SUNX

LED Type Optical Displacement Sensor

Sensor head	**LH-50** series
High-functionality controller	
1-head type	**LH-CS6 (P)**
2-head type	**LH-CD6 (P)**

User's Manual

First Edition

03/2003

Contents

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1. INTRODUCTION

Thank you very much for buying our LED Type Optical Displacement Sensor, 'sensor head **LH-50** series / high functionality controller **LH-CS6 (P)** and **LH-CD6(P)**. Please read this User's Manual carefully and thoroughly to make the most of this product's excellent performance capabilities and to use it safely and correctly.
This system has been strictly checked and tested prior to its delivery. However, before use, make sure that there is no abnormality caused by transportation and also perform an operation check. If the system is damaged in transit or does not perform as per the specifications, please contact our office.

■ Notes

1. There may be cases that the illustrations of the product shown in this manual differ slightly from the actual product.
2. The contents of this manual may be subject to change without any prior notice. Further, any reproduction or modification of all or a part of this manual without permission is prohibited.
3. Full care has been taken to prepare the contents of this manual. However, should there be any unclear point, error, etc., which you become aware of, please feel free to contact us.
4. We shall not be responsible for any adverse consequences of operation, regardless of item 3 mentioned above.

Warranty

1) Warranty period

SUNX warrants this product for a period of one year from the date of purchase or delivery to the purchaser's appointed warehouse.

2) Scope of warranty

During the above mentioned period, if a failure of the product occurs under normal use and operation, and if it is found by SUNX that it is responsible for the failure, it shall remedy the defect or tender substitution for exchange at its cost and expense. However, in no event shall SUNX be liable for the failure, damage or loss stipulated below:

① Failure caused by instructions, standards, or handling specified by the customer
② Failure caused by modifications done in the structure, capabilities, specifications, etc., without consulting SUNX, after the purchase or the delivery of the product
③ Failure caused by a development which could not be foreseen based upon the technology in practice at the time of purchase or contract
④ Failure caused by use which deviates from the conditions/environment given in the product catalog or specifications
⑤ In case this product is used by being incorporated in the customer's machine, failure which could be avoided if the customer's machine had functions and structure commonly accepted in the industry
⑥ Failure due to happening of Force Majeure

Further, the warranty given here is limited only to this product which has been purchased or delivered. SUNX shall not be responsible for any consequential damage or loss arising out of the failure of this product.

Explanation on Used Symbols

This manual uses a variety of symbols to ensure safe operation.
Before reading this manual, fully understand the meaning of these symbols.

WARNING

This symbol indicates a warning against things, places or states which may pose a risk or danger to the human body.

CAUTION

This symbol indicates caution against possibilities which may lead to product damage.

NOTE

This symbol indicates a possibility of wrong operation.

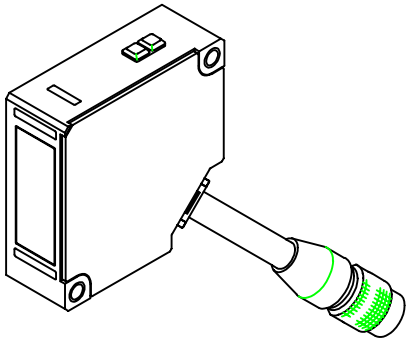
REFERENCE

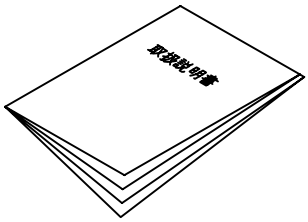
This symbol indicates matters which are convenient if remembered, or it provides reference for detailed descriptions of the concerned item.

2. CHECKING PACKED ITEMS

Before use, check to see that the following items are present in the package.

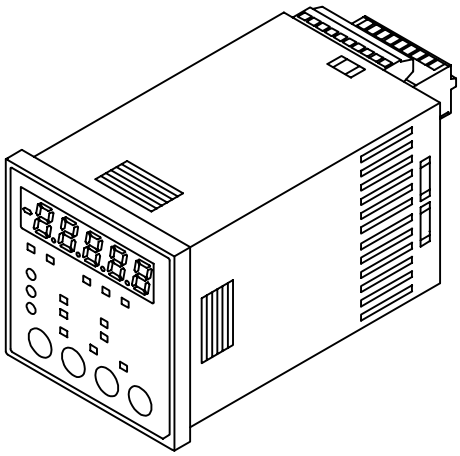
LH-54, LH-58, LH-512

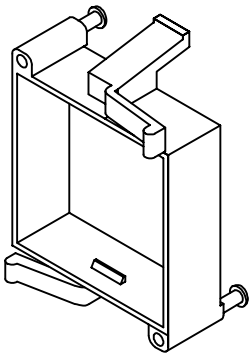


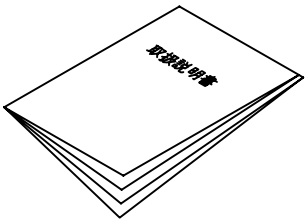


- ☐ **LH-54, LH-58, LH-512** Sensor head 1 No.
- ☐ Instruction manual 1 No.

LH-CS6 (P), LH-CD6 (P)







- ☐ **LH-CS6 (P), LH-CD6(P)** Controller 1 No.
- ☐ Instruction manual 1 No.
- ☐ Controller mounting frame (**ATA4811**) 1 No.

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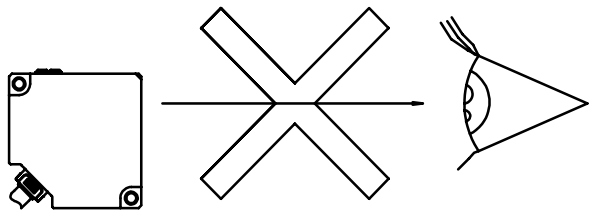
CHAPTER 1

CAUTIONS IN HANDLING

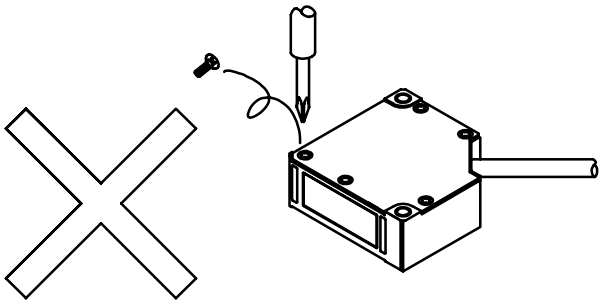
1-1 Working environment

WARNING

1. Although this sensor uses a red LED as the beam source, do not directly see the beam emitted from the sensor head, since it has been focused and has high optical intensity.



2. Never disassemble the products.



3. Make sure to carry out the wiring in the power supply OFF condition.

CAUTION

4. Operate the products within an ambient temperature of 0 to +45℃ (sensor head), 0 to +50℃ (controller). Storage can be at an ambient temperature of -20 to +60℃.

5. Operate the products within 35 to 85% RH humidity. Further, do not use the product under conditions where condensation may occur due to drastic temperature variation.

CAUTION

6. Ambient illuminance with incandescent light should be 3,000lx or less for **LH-54, LH-58** and 2,500lx or less for **LH-512**.

7. Do not allow any water, oil, fingerprints etc., which may refract light, or dust dirt, etc., which may block light, to stick to the emitting/receiving surfaces of the sensor head. In case they are present, wipe them with a clean, soft cloth or lens paper.

8. Take care that extraneous light, such as sunlight or light having the same wavelength, does not fall on the receiving part of the sensor head. Especially for accurate measurements, install a shield, etc., to block extraneous light.

9. Take care that in case the measured object has a highly reflective surface or is transparent, accurate measurement may not be possible.

10. Although the sensor has IP67 protection, measurement in water or rain is not possible. Further, the connector part is not water-proof.

11. Avoid dust, dirt, and steam. Besides, avoid use at places subject to intense vibrations or shock.

12. Take care that the sensor head does not come in direct contact with water, oil, grease, or organic solvents, such as thinner, etc.

13. Verify that the power supply voltage variation is within the rating.

14. If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.

15. If the controller is used for a long time, although it becomes hot, this does not indicate any abnormality. However, if the controller is used by being enclosed in a control box, make sure to provide proper ventilation.

1-2 Wiring and noise countermeasures

CAUTION

1 . In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.

2. The analog output and alarm output are not incorporated with a short-circuit protection circuit. Do not connect them directly to a power supply or a capacitive load**.**

3. Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.

1-3 Warming-up

NOTE

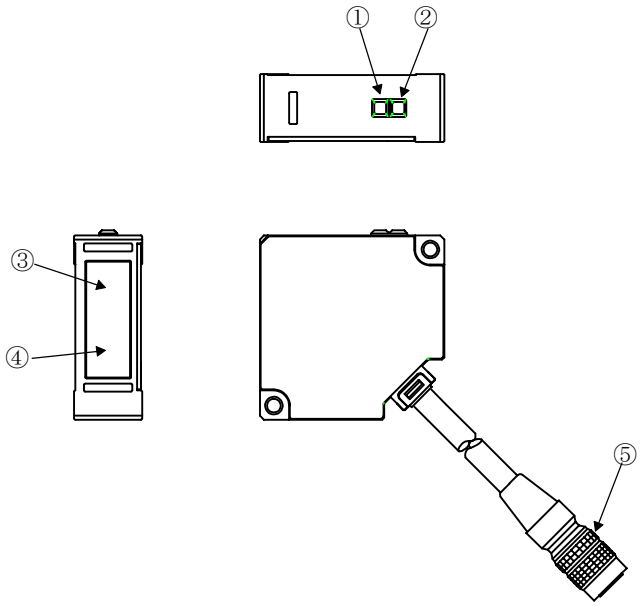
1. Take care that after switching on the power supply, there is a muting time of 5 sec.

2. Use this product 30 min. after the power is supplied. Immediately on supply of power, the electrical circuit is yet to stabilize, which may cause variation in measurements.

CHAPTER 2

FUNCTIONAL DESCRIPTION

2-1 Sensor head ［LH-54, LH-58, LH-512］



① Emitting indicator (Yellow)

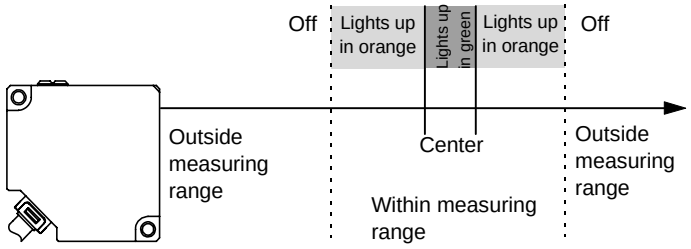
Lights up during emission.

② Operation indicator

Green: Lights up when the object is at center measuring distance.

Orange: Lights up when the object is within measuring range.

Turns off when the object is outside the measuring range.



③ Emitting part

Emits the LED beam.

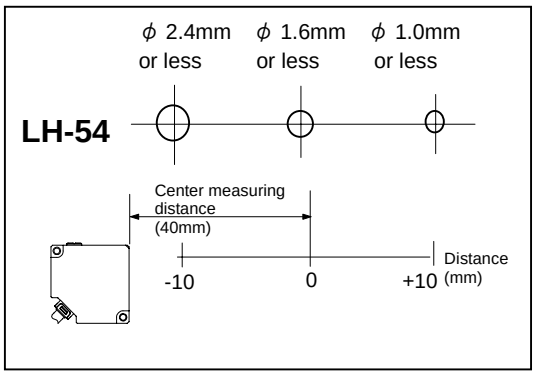
④ Receiving part

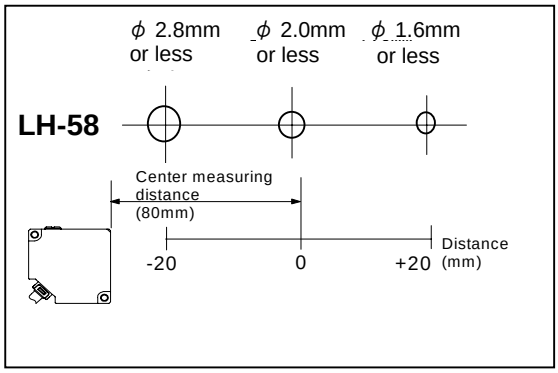
Receives the reflected beam.

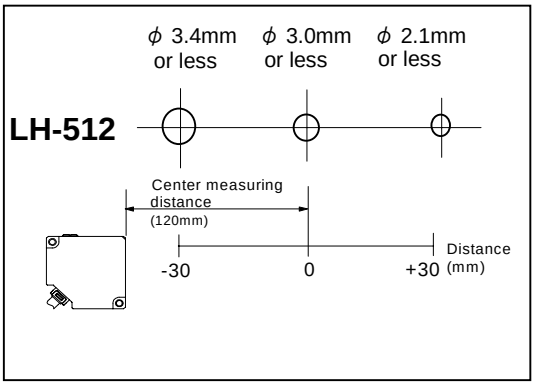
⑤ Connector for controller

It connects to the controller or the extension cable.

■ Spot diameter

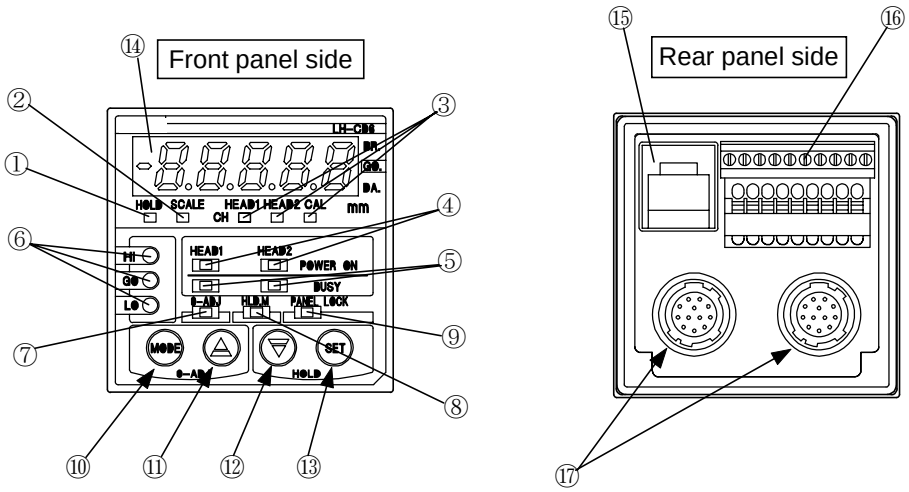






CAUTION The spot diameter is based on the definition of $1/e^2$ (13.5%) of the beam axis light intensity. Take care that some amount of light spreads out of the specified spot diameter and, depending on the conditions around the measured object, may affect the measurement accuracy.

2-2 Controller ［LH-CS6(P), LH-CD6(P)］



	Description	Function
①	Display hold indicator (Orange)	Lights up during display hold operation.
②	Display scale indicator (Orange)	Lights up during display offset operation.
③	Selected channel indicators (Orange)	Light up on display channel selection.
④	Emission indicators (Yellow)	Light up during emission.
⑤	BUSY indicators (Green)	Light up on BUSY input application.
⑥	Comparative output indicators (Hi and LO: Orange, Go: Green)	Light up when the comparative output is ON.
⑦	0-ADJ indicator (Green)	Lights up on 0-ADJ operation.
⑧	Analog output hold mode indicator (Orange)	Lights up when analog output hold mode is set.
⑨	Panel lock indicator (Orange)	Lights up when panel lock is set.
⑩	MODE key	Used to call memory and store settings.
⑪	UP key	Used to change contents of setting items or setting conditions.
⑫	DOWN key	
⑬	SET key	Used to change and confirm setting conditions.
⑭	5 digit LED indicator (Red)	Displays measurement value, setting items and settings.
⑮	RS-232C modular connector	Connected when RS-232C is used.
⑯	Terminal block	————
⑰	Connectors for sensor head connection	Connectors for connection to sensor heads [In **LH-CS6**(**P**), there is one connector for sensor head connection.]

CHAPTER 3

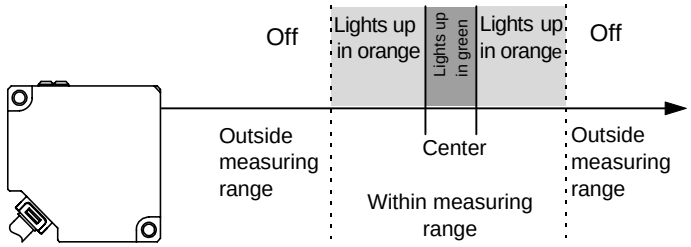
MOUNTING AND CONNECTION

3-1 Mounting

3-1-1 Sensor head

■ Setting method

1. Adjust the distance between the sensor head and the measured object to be within the measuring range, by checking the operation indicator. Further, adjusting the reference position (center of displacement) of the measured object near the center measuring distance (**LH-54**: 40mm, **LH-58**: 80mm, **LH-512**: 120mm) results in stable measurement.



2. Install the sensor head, such that the surface of the measured object is parallel to the sensing face of the sensor head. Use the two mounting holes and fix the sensor head firmly. However, note that the tightening torque should be 0.5N・m or less.

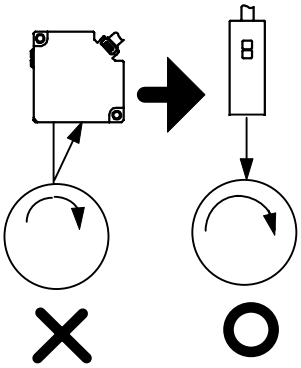
3. Since the emitting/receiving surfaces of the sensor head use glass, take care that they are not subject to direct shock. Further, do not allow any water, oil, fingerprints, etc., which may refract light, or dust, dirt, etc., which may block light, to stick to the emitting/receiving surfaces of the sensor head. In case they are present, wipe them with a clean, soft cloth or lens paper.

4. If the light reflected from the measured object is reflected once again from the surrounding objects and is received by the sensor head, the measurement is affected. Install the sensor head away from such objects or color them with non-glossy black paint so that reflected light is not received from the surroundings.

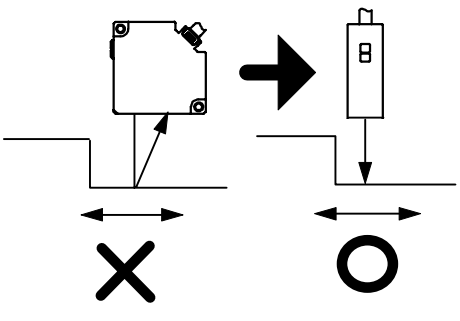
■ Direction of mounting

In case the measured object is moving as shown below, take care of the mounting direction of the sensor head, as an error may be generated depending on the mounting direction.

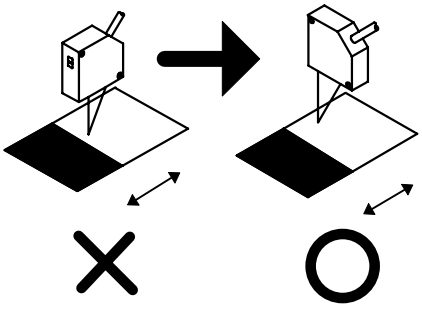
◆ **Eccentricity measurement**



◆ **Level difference measurement**

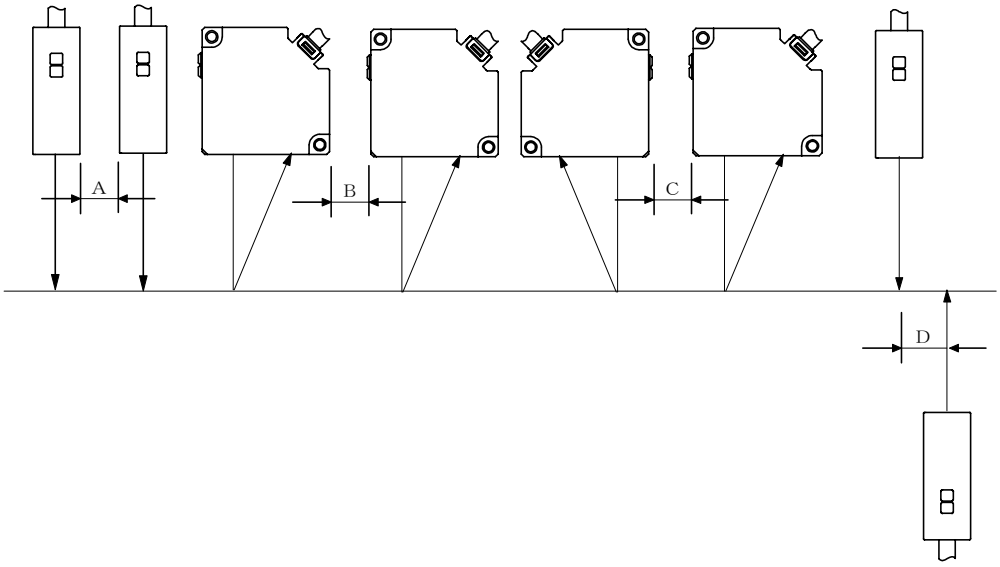


◆ **In case of extreme change in color or material at a boundary**



■ Mounting of several sensor heads

In case several sensor heads are arranged in a row, mount them by keeping the minimum distance given below.



- **When interference prevention function is used**

	A	B	C	D
LH-54	0mm	0mm	10mm	17mm
LH-58	0mm	0mm	10mm	17mm
LH-512	0mm	0mm	30mm	17mm

- **When interference prevention function is not used**

	A	B	C	D
LH-54	20mm	40mm	90mm	20mm
LH-58	40mm	100mm	100mm	20mm
LH-512	70mm	150mm	210mm	20mm

NOTE

- Regarding the interference prevention function, please refer to page 3-12 '■**Interference prevention function**'.
- If light from the opposite side sensor is not received, even D=0 is OK.

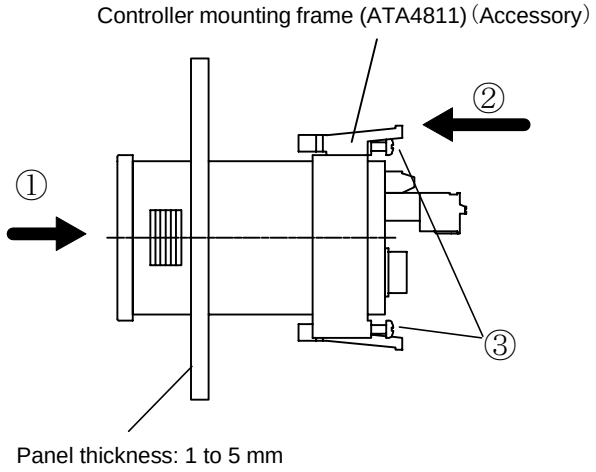
3-1-2 Controller

■ How to mount the controller

① Insert the controller, from its rear position, into the cut-out of the panel.

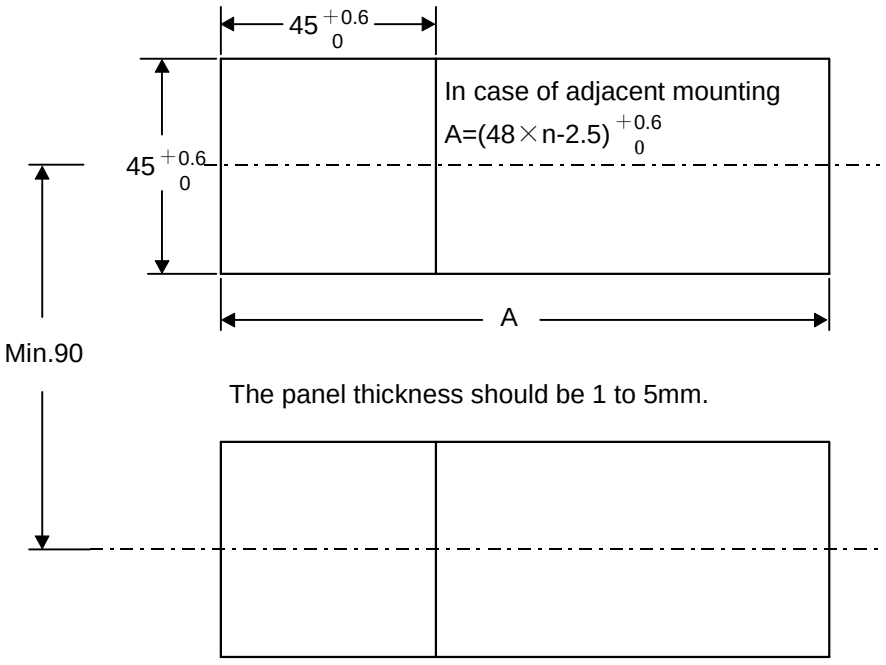
② Insert the enclosed controller mounting frame (ATA4811) from the rear side of the controller and push it until the end.

③ Tighten the controller mounting frame uniformly, using the mounting screws (2 Nos.) enclosed with it. After mounting on the panel, make sure to confirm that the controller is firmly mounted and does not shake.



CAUTION If the mounting screws are tightened excessively, the controller mounting frame gets displaced. In case this happens, loosen the screws once, push in the controller mounting frame and then tighten the mounting screws.

■ Panel cut-out dimensions



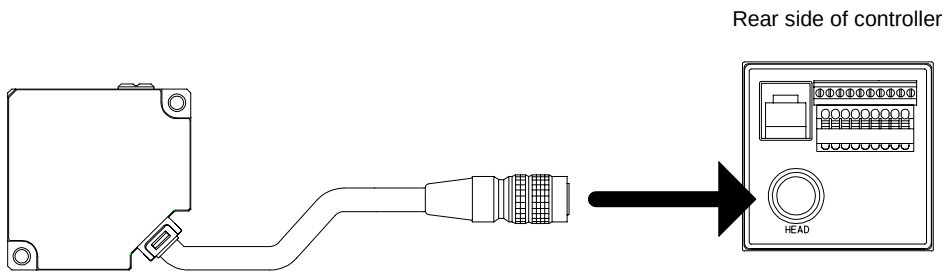
3-2 Connection

3-2-1 Connection of sensor head to controller

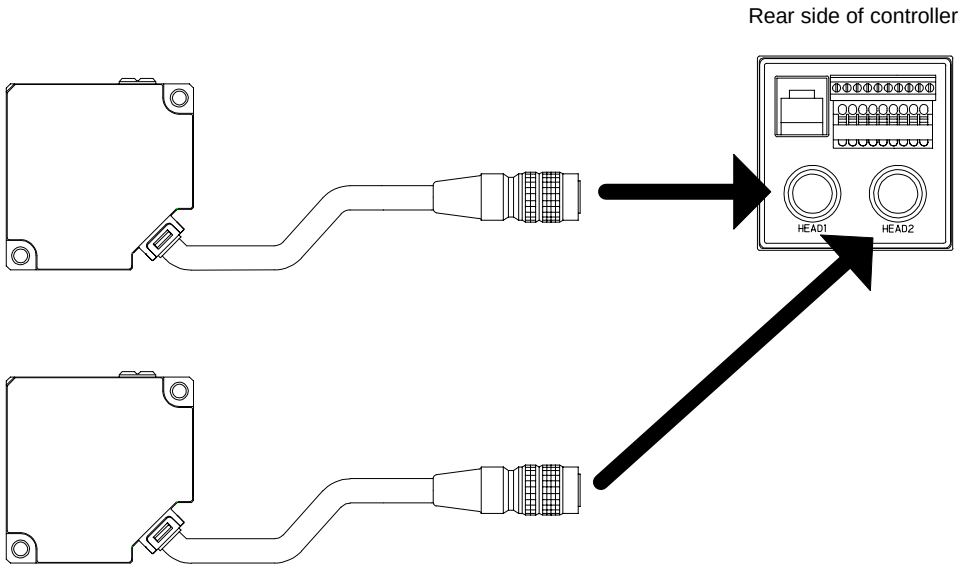
1. Hold the sensor head's connector and insert it into the connector provided on the controller for sensor head connection, till its outer ring locks.

2. To remove the sensor head, hold its connector by the outer ring and pull it straight out. While removing the connector from the controller, take care not to touch the terminals inside the connector.

・LH-CS6(P)



・LH-CD6(P)

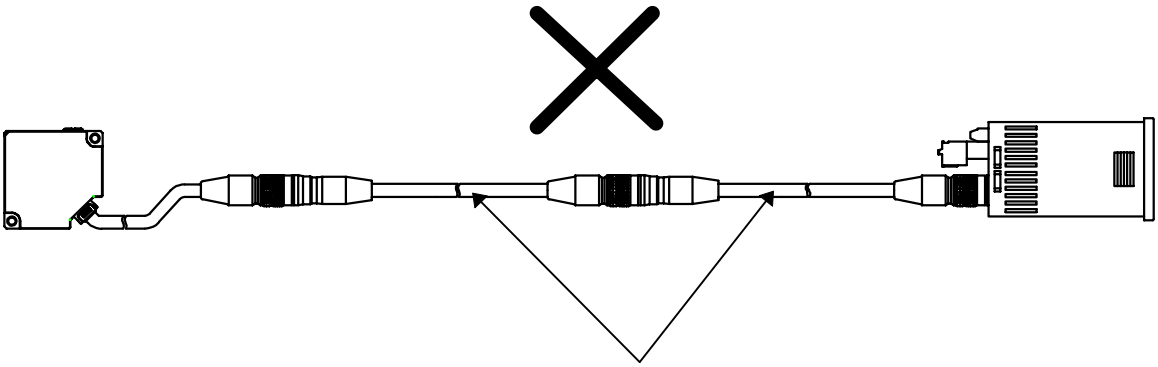


CAUTION

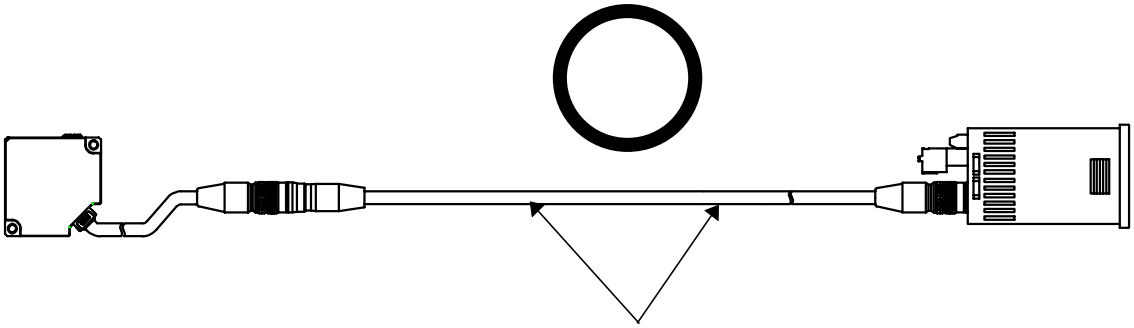
- Make sure to connect or disconnect the connector to the controller in the power supply off condition.
- Do not pull by holding the cable, as this can result in cable disconnection.

3-2-2 Cable extension

To extend the connection cable between the sensor head and the controller, use the optional exclusive cable. Three types of cable, 2m type (**LH-CCJ2**), 5m type (**LH-CCJ5**) and 10m type (**LH-CCJ10**), are available. Note that although the cable can be extended up to 10m, do not connect together two or more 2m type cables or two 5m type cables.



LH-CCJ2 (2m)
LH-CCJ5 (5m)



LH-CCJ2 (2m)
LH-CCJ5 (5m)
LH-CCJ10 (10m)

3-2-3 Terminal connection

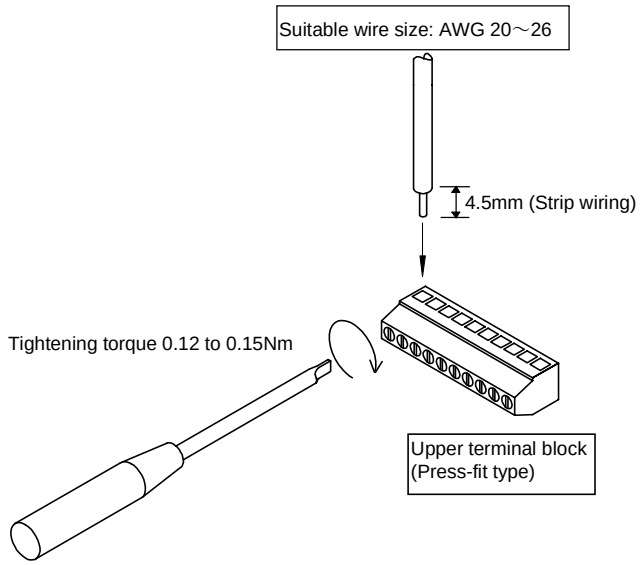
■ Procedure for connection to terminal block

- **For upper terminal block (press-fit type)**

  ① Loosen the screw of the terminal block by a screwdriver.

  ② Insert the wire to be connected into the terminal block as shown in the diagram below and then tighten the screws using a screwdriver with a tightening torque of 0.12 to 0.15N･m.

  Suitable wire size: AWG 20～26 Stripped wire length: 4.5mm

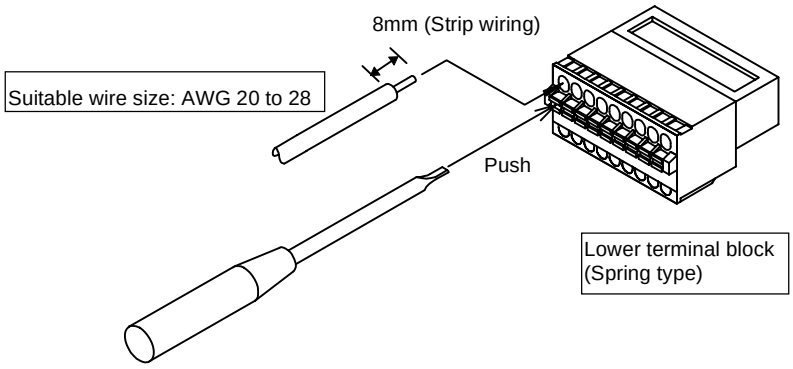


- **For lower terminal block (spring connection type)**

  ① Keep the lever of the terminal block pressed with a screwdriver.

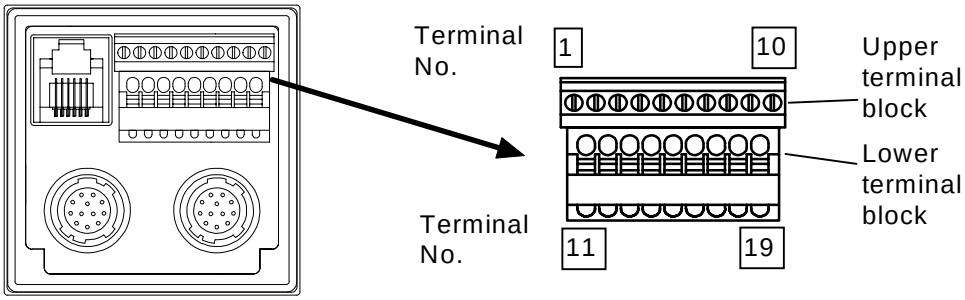
  ②Insert the wire to be connected into the terminal block as shown in the diagram below and then release the lever.

  Suitable wire size: AWG 20 to 28 Stripped wire length: 8.0mm



CAUTION Make sure to connect or disconnect the connector from the controller in the power supply off condition.

■ Terminal arrangement

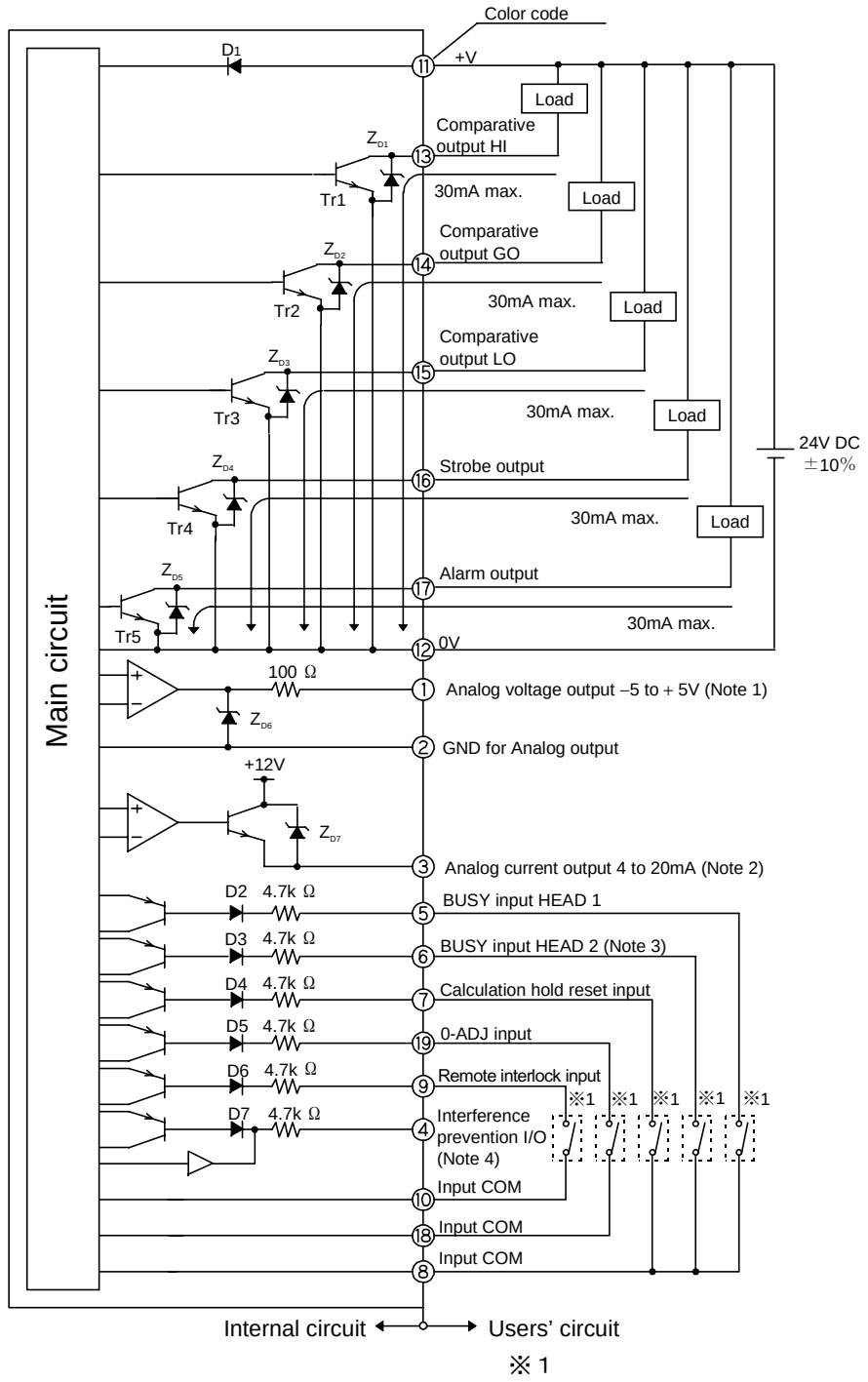


Terminal	Terminal No.	Description	Symbol	I/O	Function
Upper terminal block	①	Analog voltage output	−5 to+5V	O	Analog voltage output ±5V F.S.
	②	GND for analog output	ANALOG_GND	COM	Analog ground
	③	Analog current output	4 to 20mA	O	Analog current output 4 to 20mA
	④	Interference prevention I/O	IF.P I/O	I/O	Interference prevention I/O
	⑤	BUSY input Sensor head 1	BUSY HEAD1	I	**LH-CS6** **LH-CD6** **LH-CS6P** **LH-CD6P** Low (0 to 1V) Measurement stops / High (+V) Measurement stops
	⑥	BUSY input Sensor head 2 (Note)	BUSY HEAD2	I	**LH-CD6** / **LH-CD6P** Low (0 to 1V) Measurement stops / High (+V) Measurement stops
	⑦	Calculation hold reset input	HOLD RESET	I	**LH-CS6** **LH-CD6** **LH-CS6P** **LH-CD6P** Low (0 to1V) Calculation result is reset / High (+V) Calculation result is reset
	⑧	Input COM	IN. COM	COM	COM for input **LH-CS6** **LH-CD6** **LH-CS6P** **LH-CD6P** 0V / +V
	⑨	Remote interlock input	INTERLOCK	I	Emission when short-circuited with IL.COM
	⑩	Input COM	IL. COM	COM	COM for remote interlock
Lower terminal block	⑪	+V	+V	—	Power supply +24V
	⑫	0 V	0V	—	Power supply 0 V
	⑬	Comparative output HI	HI	O	ON when effective
	⑭	Comparative output GO	GO	O	ON when effective
	⑮	Comparative output LO	LO	O	ON when effective
	⑯	Strobe output	STRB	O	ON when effective
	⑰	Alarm output	ALARM	O	ON when normal, OFF during alarm
	⑱	Input COM	IN.COM	COM	COM for input **LH-CS6** **LH-CD6** **LH-CS6P** **LH-CD6P** 0V / +V
	⑲	0-ADJ input	0-ADJ	I	**LH-CS6** **LH-CD6** **LH-CS6P** **LH-CD6P** Low (0 to 1V) 0-ADJ operation / High (+V) 0-ADJ operation

Note: In case of **LH-CS6(P)**, terminal No.⑥ is not used.

3-2-4 I/O circuit diagram

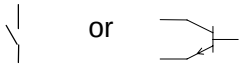
・LH-CS6, LH-CD6/NPN output type



※1

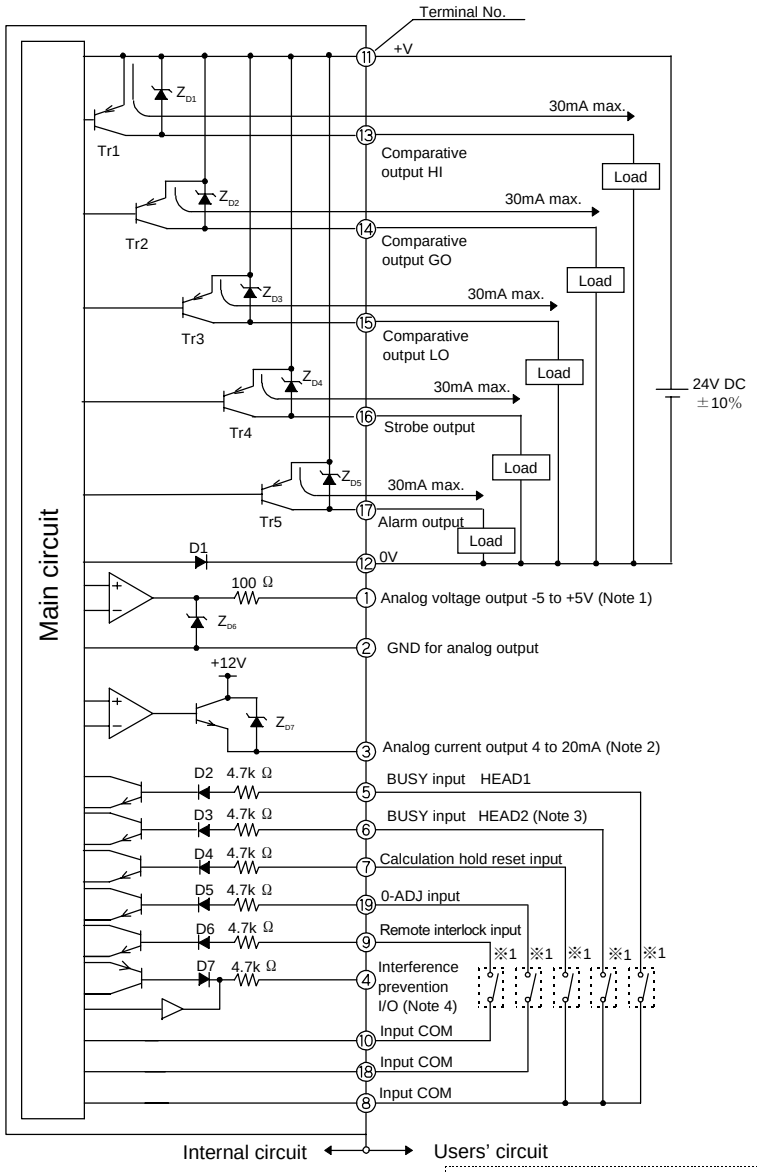
Symbols.... D_1 : Reverse supply polarity protection diode
D_2 to D_7 : Input protection diode
Z_{D1} to Z_{D5} : Surge absorption zener diode
Tr1 to Tr5 : NPN output transistor

Non-voltage contact or NPN open-collector transistor



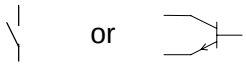
- **0-ADJ input, BUSY input**
  Calculation hold reset input
  Low (0 to 1V): Effective
  High (+V or open): Ineffective
- **Remote interlock input**
  Low (0 to 1V): Emission
  High (+V or open): Emission stopped

・LH-CS6P, LH-CD6P/PNP output type



Symbols...D_1 : Reverse supply polarity protection diode
D_2 to D_7 : Input protection diode
Z_{D1} to Z_{D7} : Surge absorption zener diode
Tr1 to Tr5 : PNP output transistor

※1 Non-voltage contact or PNP open-collector transistor



- **0-ADJ input, BUSY input**
  Calculation hold reset input
  Low (0 to 1V, or open): Ineffective
  High (+V): Effective
- **Remote interlock input**
  Low(0 to 1V, or open): Emission stopped
  High (+V): Emission

Notes: 1) The device connected to analog output voltage should have an input impedance of 1M Ω or more.
2) The device connected to the analog current output should have a load resistance of 300 Ω or more.

CAUTION
3) In case of **LH-CS6(P)**, terminal No.⑥ is not used.
4) Do not connect an interference prevention I/O wire other than that of **LH-CS6(P)** or **LH-CD6(P)** to the interference prevention I/O. Further, do not connect together two controllers which have both been set as masters during interference prevention setting, as this will cause a fault.
5) The analog output and the alarm output are not incorporated with a short-circuit protection circuit. Do not connect them directly to a power supply or a capacitive load.

3-2-5 Input/Output

■ Power supply input [⑪ - ⑫]

Input 24V DC±10% (Ripple P-P 10% or less). If a power supply transformer is used, make sure to use an isolation transformer.

■ Comparative judgement output HI/GO/LO [⑬/⑭/⑮]

Based on the set comparative values, the result of comparison is output by an NPN or PNP open-collector transistor.

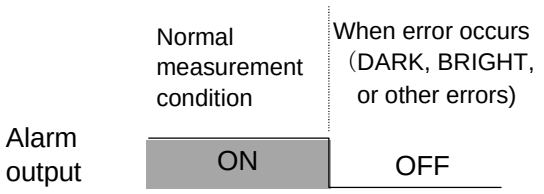
■ Strobe output [⑯]

This output lets you know that the measurement value has been finalized.
When starting a measurement after the power supply is switched on or when restarting a measurement from BUSY condition when the BUSY input is used, strobe output turns ON at the time when the measurement value is finalized according to the set response time.
Using the strobe output in combination with the BUSY input makes external control of measurement and use of the comparative judgment result easy.

REFERENCE Please refer to page 3-14 '■**Timing of BUSY input/Strobe output/ Comparative output**'.

■ Alarm output [⑰]

This is output when an error, such as, no object in the measuring range, (NEAR, FAR error), insufficient light (DARK) or too much light (BRIGHT), occurs.



NOTE Alarm output is effective only in the measurement mode. Alarm output on setting remains in a normal measurement condition.

REFERENCE Please refer to page 9-1 '■**Error indication**' for NEAR or FAR, DARK, BRIGHT and other errors, and to page 3-11 '■**Analog displacement output diagrams**' for the alarm output.

CAUTION The analog output and the alarm output are not incorporated with a short-circuit protection circuit. Do not connect them directly to a power supply or a capacitive load.

■ Analog voltage output [① - ②]

Within the measurement range, an analog voltage corresponding to the displacement is output. Please refer to analog displacement output diagrams below.

CAUTION

- The device connected to the analog voltage output should have an input impedance of 1M Ω or more.
- The analog output and the alarm output are not incorporated with a short-circuit protection circuit. Do not connect them directly to a power supply or a capacitive load.

■ Analog current output [② - ③]

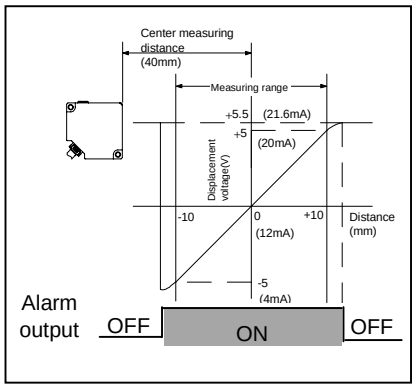
Within the measurement range, an analog current corresponding to the displacement is output. Please refer to analog displacement output diagrams below.

CAUTION

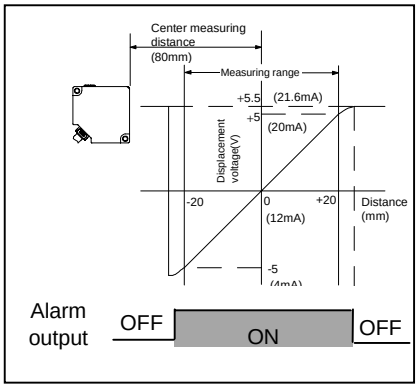
- The device connected to the analog current output (white) should have a load resistance of 300 Ω or more.
- The analog output and the alarm output are not incorporated with a short-circuit protection circuit. Do not connect them directly to a power supply or a capacitive load.

Analog displacement output diagram

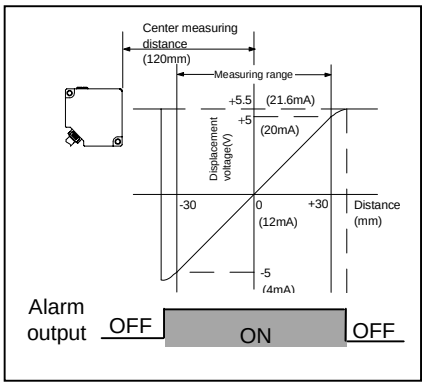
LH-54



LH-58

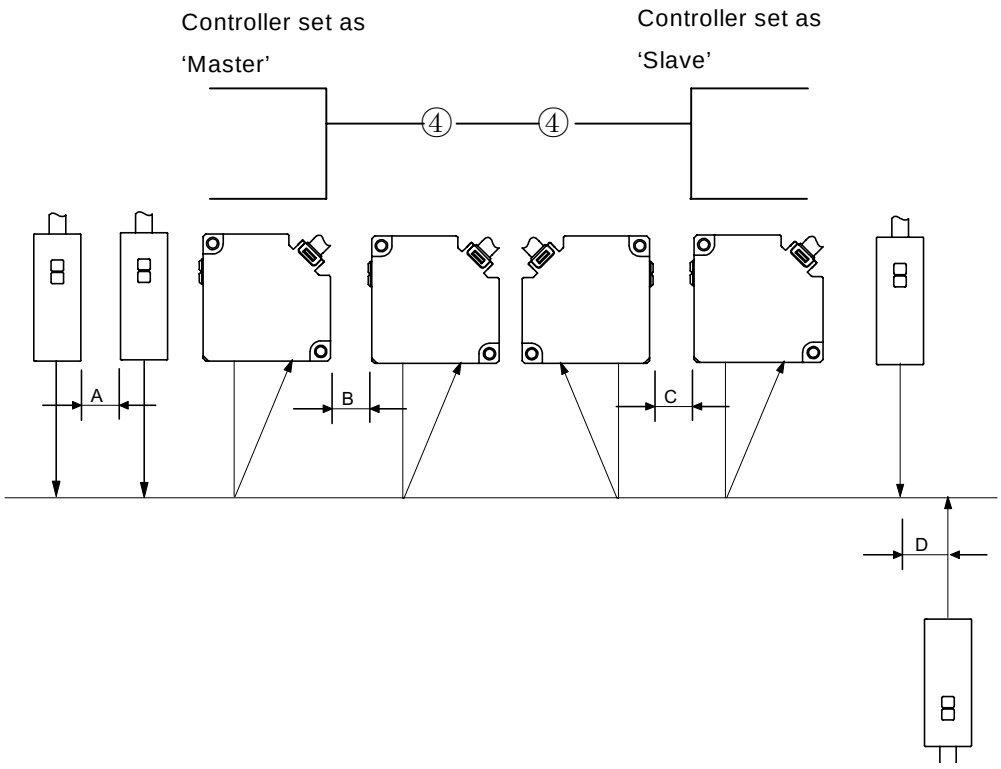


LH-512



■ Interference prevention function [④]

When 2 sensor heads or more are installed close to each other, a malfunction may occur due to interference of LED lights. In this case, use the interference prevention function.
In case 2 sensor heads are connected to one controller, when the calculation mode is set, the sensor is put into the interference prevention mode automatically. Further, 2 sensor heads can be connected to 2 controllers each, and a total of 4 sensor heads can be installed close to each other. In this case, for the 2 controllers, connecting the respective I/O terminal ④ together, and setting one controller to 'Master' and the other controller to 'Slave' puts the sensor in the interference prevention function mode. Since the emission beam frequency of 4 sensors is mutually different, reliable measurements, without any mutual interference of the emitted beams, are possible. In case a number of sensor heads are used closely, take care of the interference range given in the table below, during installation.



	A	B	C	D
LH-54	0mm	0mm	10mm	17mm
LH-58	0mm	0mm	10mm	17mm
LH-512	0mm	0mm	30mm	17mm

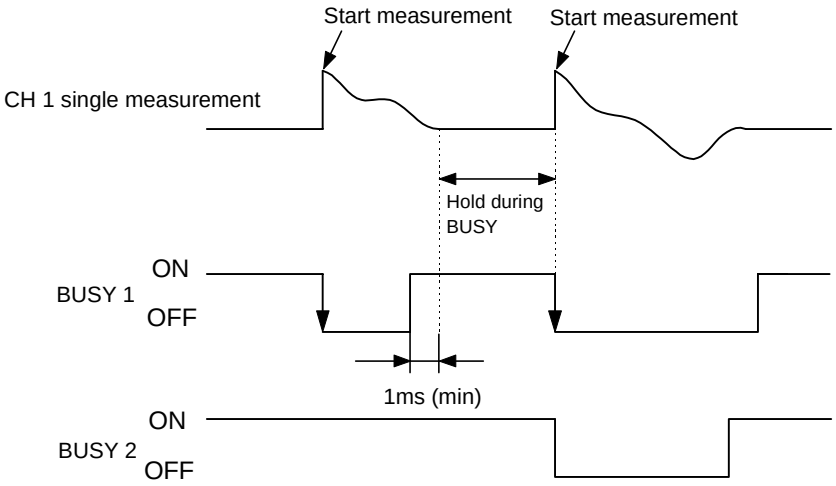
REFERENCE Please refer to page 6-99 '■ **Interference prevention setting**' for details of setting.

CAUTION

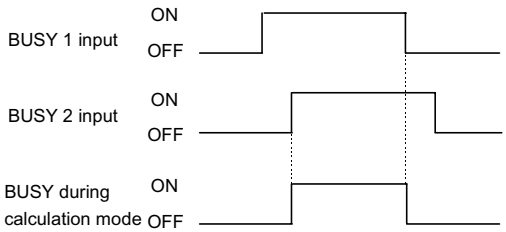
- When this function is used, the linearity, resolution, and response time may deteriorate.
- Do not connect an interference prevention I/O wire other than that of **LH-CS6(P)** / **LH-CD6(P)** to the interference prevention I/O terminal No. ④. Further, do not connect together two controllers which have both been set as masters during interference prevention setting, as this will cause a fault.
- If light from the opposite side sensor is not received, even D=0 is OK.

■ BUSY input HEAD1/HEAD2 [⑤ - ⑧, ⑩, ⑱/⑥ - ⑧, ⑩, ⑱]

Short-circuiting BUSY input (⑤, ⑥) to Input COM (⑧, ⑩, ⑱) makes the BUSY input effective and puts the sensor in the BUSY condition. In the BUSY condition, the measurement is temporarily stopped and the measurement value, the comparative judgement output and the analog output are put on hold. BUSY input enables you to control the start /stop of measurement externally.



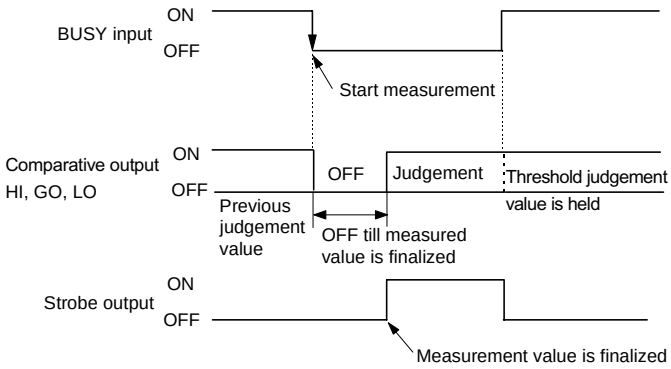
- **Features of BUSY input**
  - The measurement is put on hold when the BUSY input is ON.
  - The measurement starts when BUSY input condition turns OFF from ON.
    Value just after the measurement starts: Measured value ＋F.S.
    Comparative output OFF
    Analog output +5.5V (21.6mA)
  - For **LH-CD6(P)** in CH1 single measurement mode, BUSY 1 is effective and BUSY 2 is ignored. Similarly, BUSY 2 is effective in CH2 single measurement mode and BUSY 1 is ignored.
  - For **LH-CD6 (P)** in the calculation mode, setting BUSY 1 and BUSY 2 to ON or OFF simultaneously makes the BUSY input effective or ineffective. (See the diagram below.)
  - BUSY input becomes effective by short-circuiting with input COM.
  - BUSY input is effective when it is ON for 1ms or more.



NOTE In case of **LH-CS6(P)**, the terminal No.⑥ is not used.

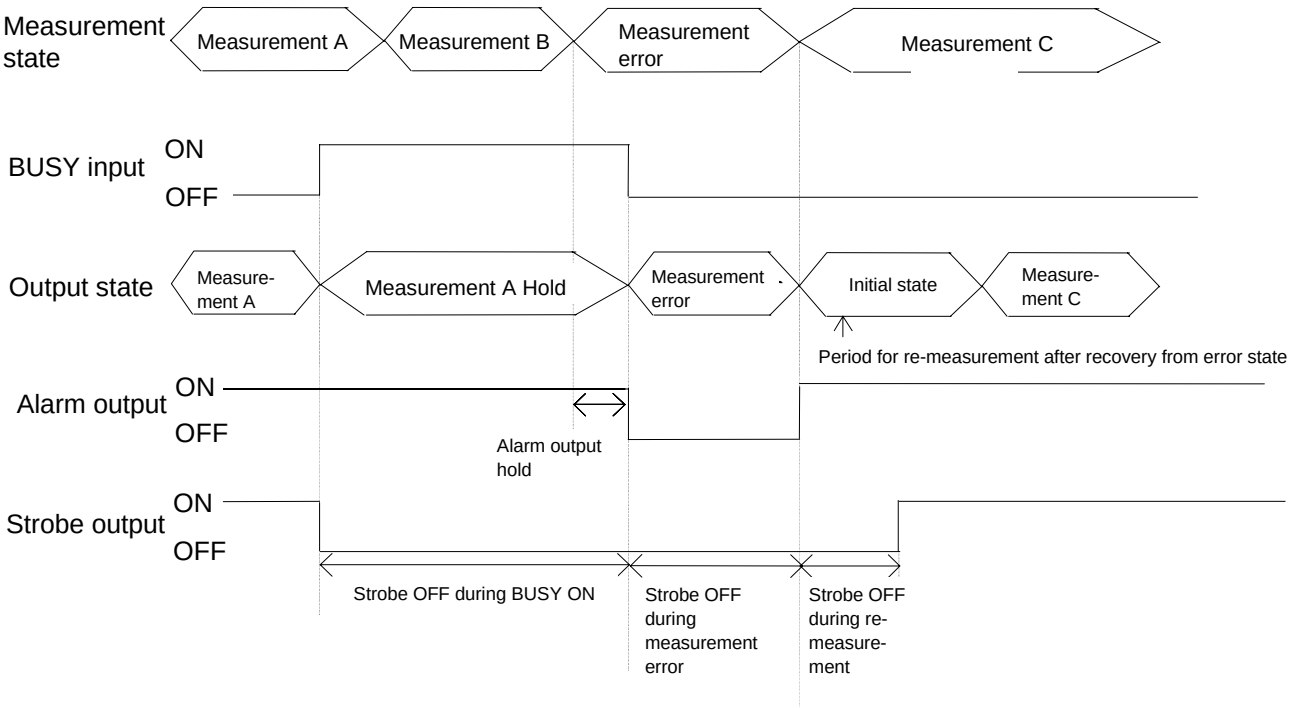
REFERENCE Please refer to page 3-14 '■ **Timing of BUSY input/Strobe output/ Comparative output**'.

■ Timing of BUSY input/Strobe output/Comparative output



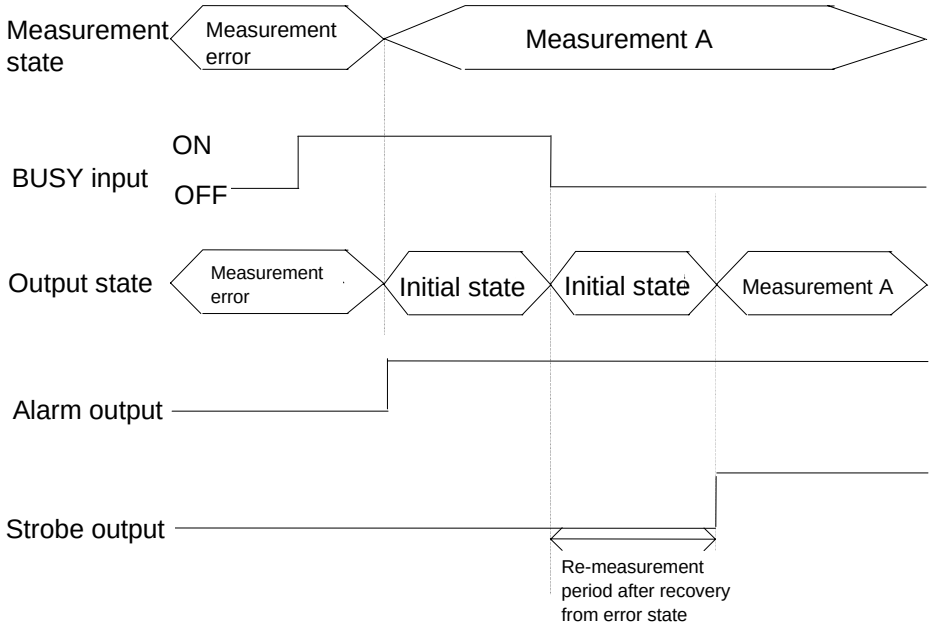
- **Features**
  - When the BUSY input is ON, the sensor is in BUSY condition and the comparative output is held.
  - The measurement starts when BUSY input turns OFF from ON and the comparative output turns OFF until the measurement has been finalized according to the set response time.
  - When the measurement is finalized, the comparative output gives judgement and the strobe output is turned ON.

REFERENCE Even if a measurement error occurs during BUSY input is in the ON state, the measurement output state held by BUSY is maintained.



Note 1: In case BUSY is turned ON when measurement error

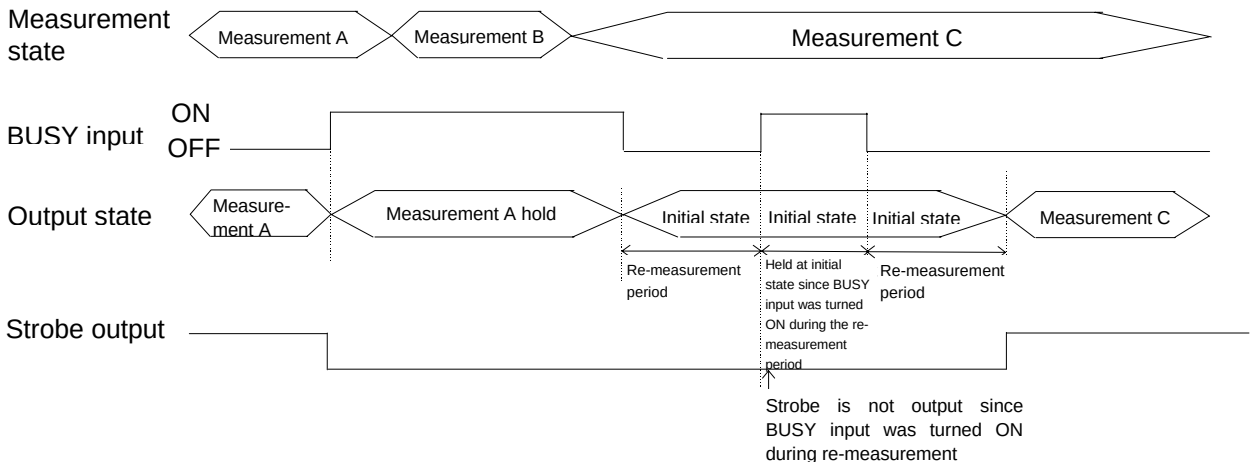
If BUSY input is ON during measurement error state, error is output on during measurement error. If the sensor is recovered from the measurement error state in the BUSY ON state, the initial state is output. In order to get back to the normal output state from the Initial state, turn OFF the BUSY input once.



Initial state:
Comparative output OFF
Strobe OFF
Alarm OFF
Analog output +5.5

Note 2: In case BUSY is canceled, or BUSY input is turned ON during the re-measurement period after recovery from the measurement error state

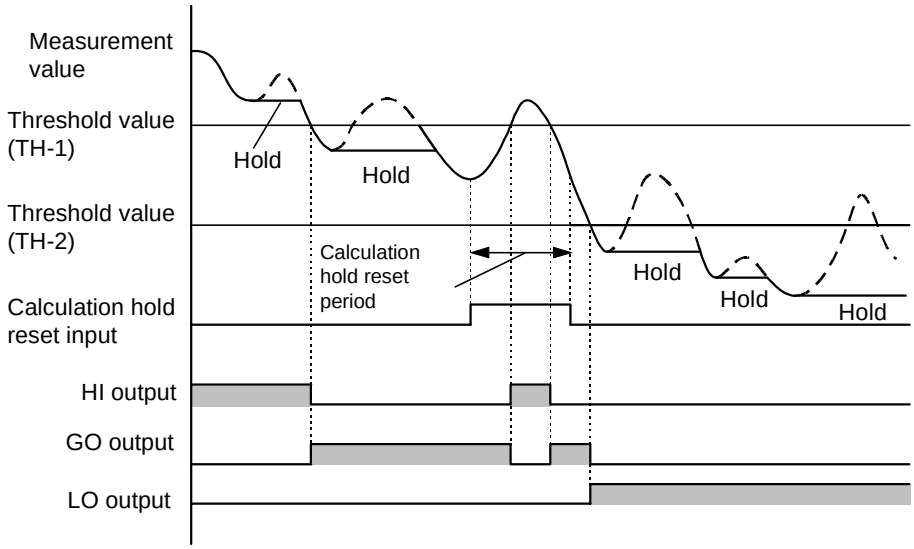
The re-measurement is carried out when BUSY is canceled, or after the sensor returns from the measurement error state. However, if BUSY is input when the re-measurement period (the period till the strobe input is turned ON), the initial state will be held.



■ Calculation hold reset input [⑦ - ⑧, ⑩, ⑱]

In the calculation mode, when peak-peak, bottom hold or peak hold is selected, the held value can be reset by inputting the calculation hold reset.

〈Example〉 In case of bottom hold



- **Features of calculation hold reset input**
  - The hold value is reset by the calculation hold reset input.
  - During the calculation hold, normal measurement is carried out.
  - In case of simple average, the calculation hold reset input is invalid.
  - Calculation reset hold input becomes effective by short-circuiting with input COM.
  - Calculation hold reset input becomes effective when it is ON for 1 ms or more.

REFERENCE

Please refer to page 6-63 '■**Calculation mode setting**' for calculation mode.

■ Remote interlock input [⑨ - ⑧, ⑩, ⑱]

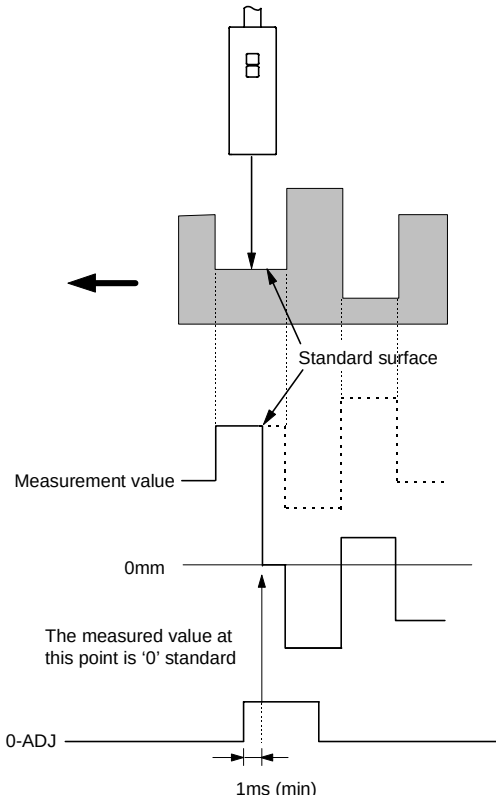
ON/OFF of LED emission can be externally controlled by short-circuiting the remote interlock input to the input COM terminal Nos.⑧, ⑩, ⑱ or keeping it open.

NOTE

A short-circuit bar has been inserted between terminal Nos.⑨ and ⑧ when shipped from factory.

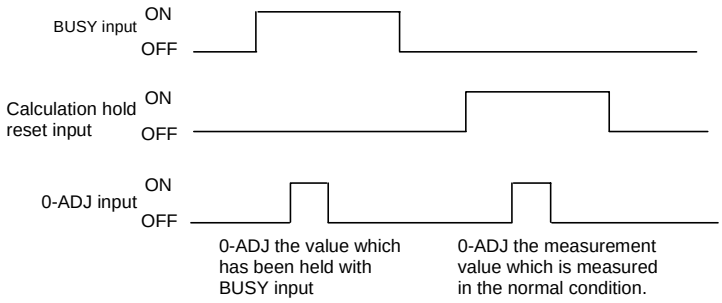
■ 0-ADJ input [⑲ - ⑧, ⑩, ⑱]

・Short-circuiting the 0-ADJ input to input COM terminal (⑧, ⑩, ⑱) adjusts the measurement value and the analog output to '0' and the value at this time is taken as the standard '0' for measurements.



- **Features of 0-ADJ input**
  - ・0-ADJ input makes the measurement value standard '0' at the instant it is turned ON.
  - ・0-ADJ becomes effective by short-circuiting with input COM.
  - ・0-ADJ input becomes effective when it is ON for 1 ms or more.

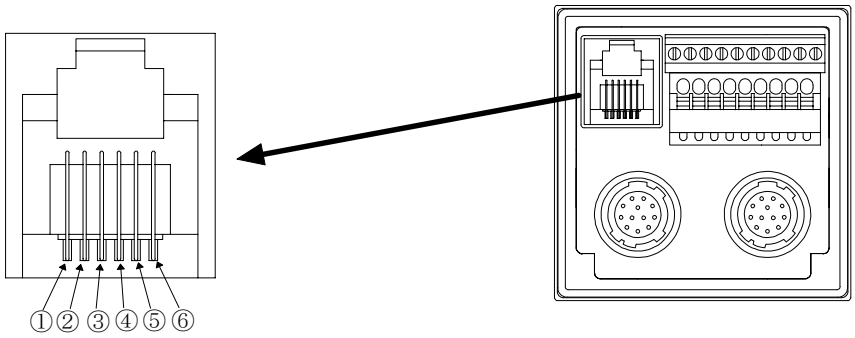
- **0-ADJ during BUSY input and calculation hold reset input**



REFERENCE Please refer to page 6-112 '■**0-ADJ**' for the details of setting and functions.

3-2-6 Serial I/O

RS-232C modular connector pin position



Pin No.	Signal	Description	I/O
①	—	NC	—
②	—	NC	—
③	RD (RXD)	Data input from external device	Input
④	SG (SG)	Signal ground	—
⑤	SD (TXD)	Command output to external device	Output
⑥	—	N C	—

＜Recommended connector＞

Modular plug MOD-P66 manufactured by Honda Tsushin Kogyo Co., Ltd.

REFERENCE Please refer to Chapter 7 '**RS-232C CONTROL**' for RS-232C transmission.

CHAPTER 4

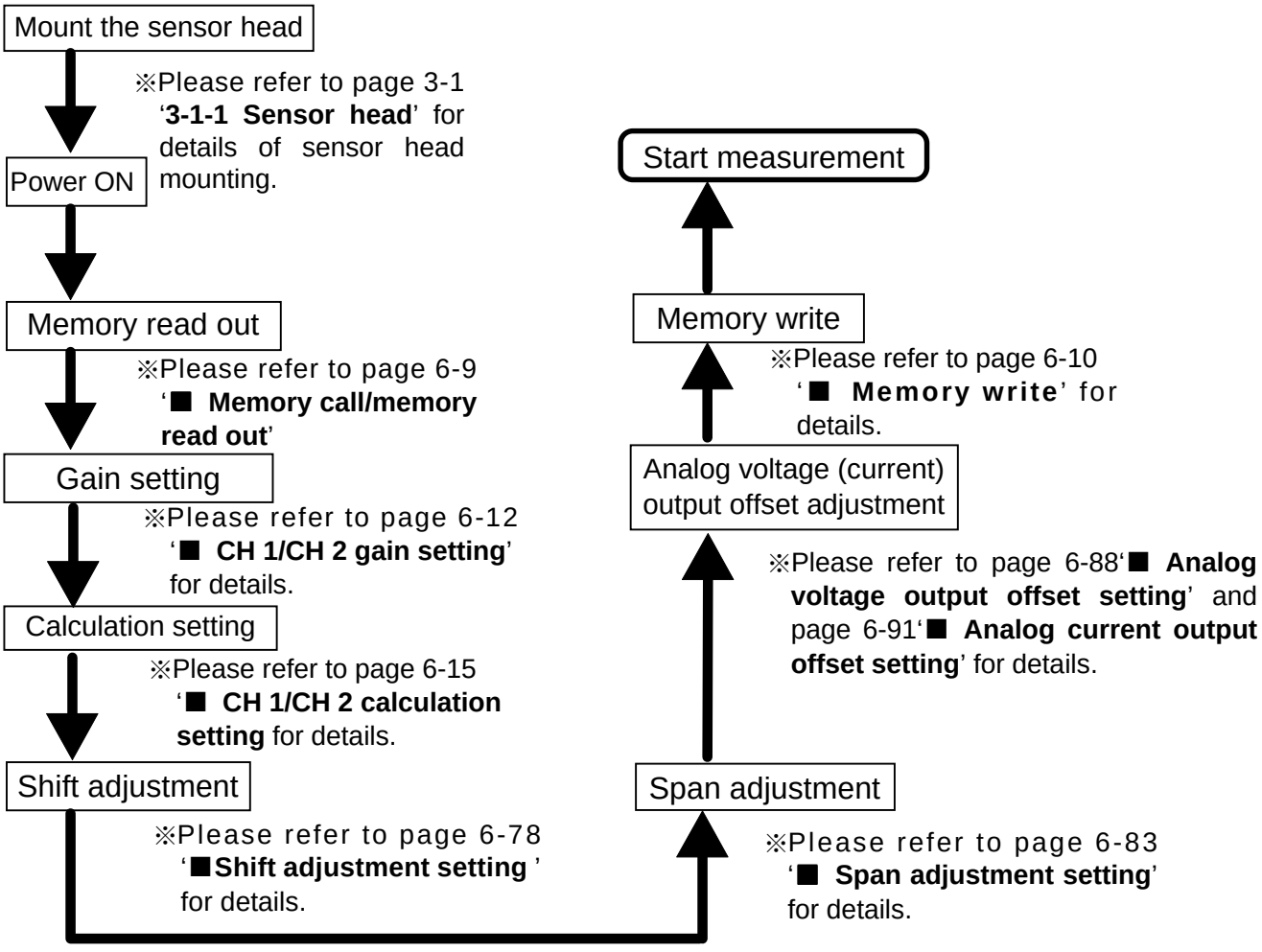
FOR OPTIMUM MEASUREMENT

4-1 Setting flow for optimum measurement

■ Setting flow for the sensor head and the exclusive controller

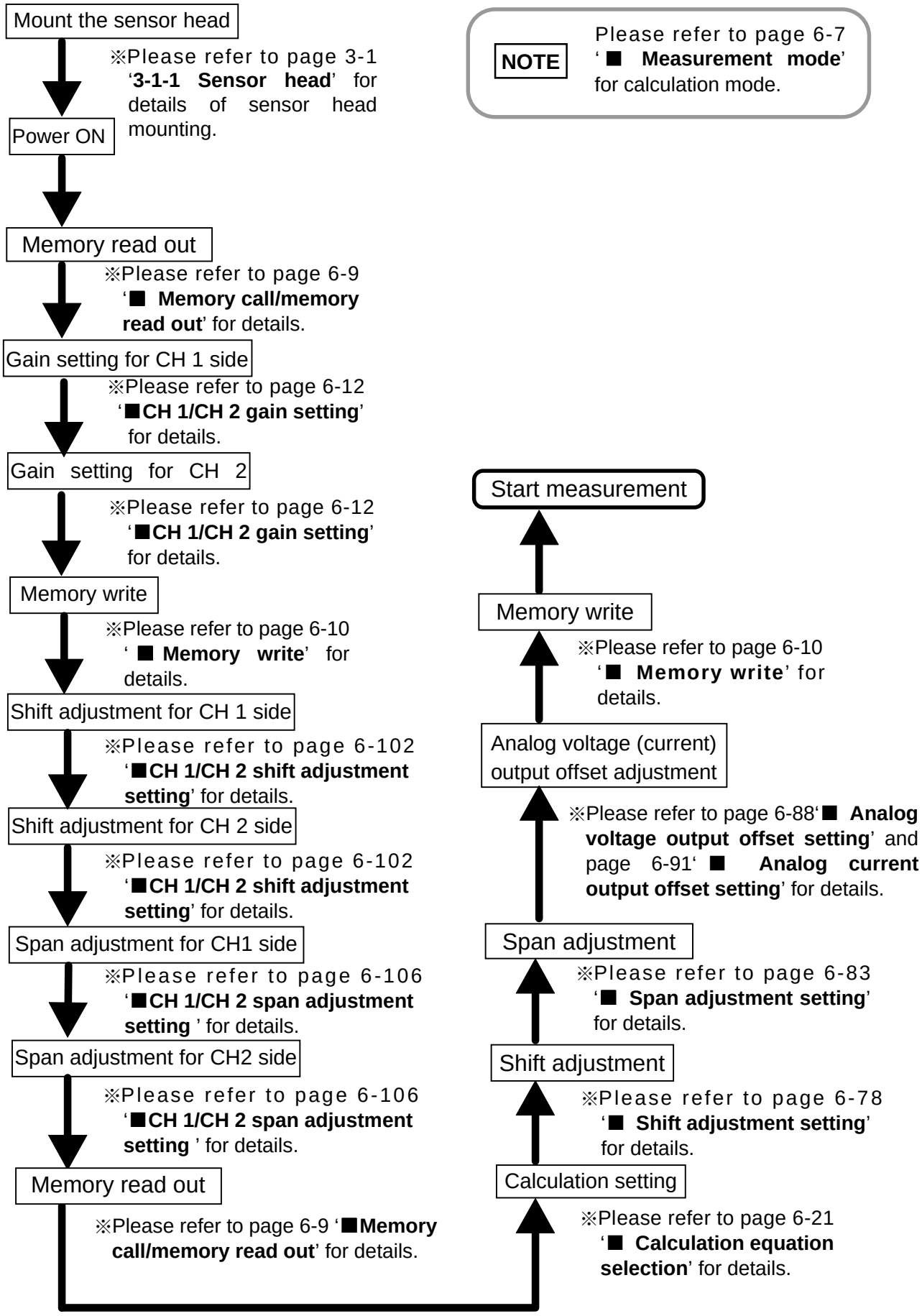
In this product, the sensor heads and the exclusive controllers can be used in any combination.
Before commencing the measurement, follow the setting flow shown below in order to make the most of this product's excellent performance capability.

- **In case of using single measurement mode (with one sensor head) (Note)**



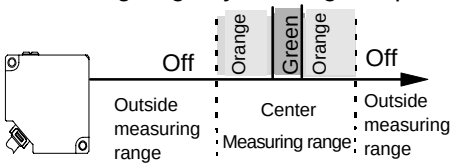
NOTE Please refer to page 6-7 '■ **Measurement mode**' for single measurement mode.

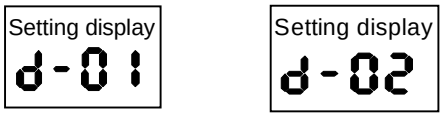
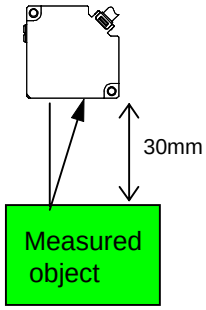
- **In case of using calculation mode (with two sensor heads) (Note)**

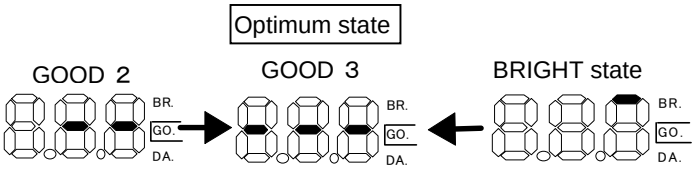


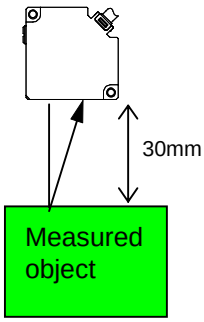
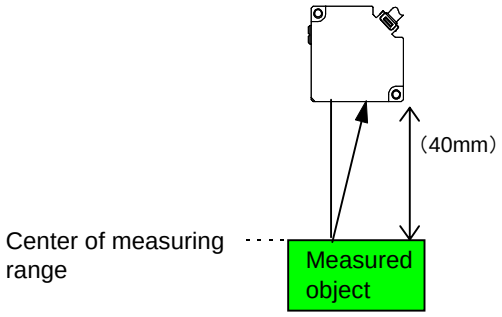
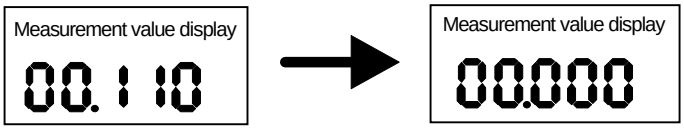
4-2 Optimum setting method

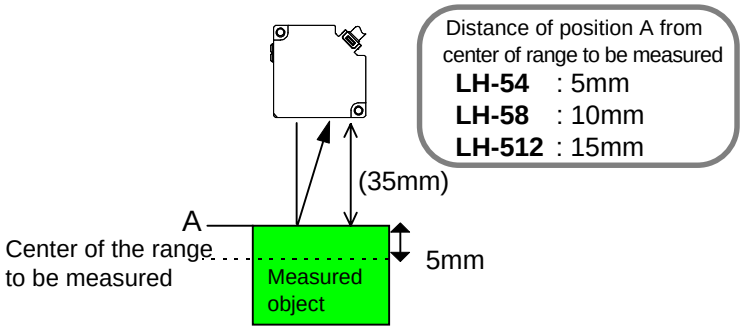
■ In case of using single measurement mode (with one sensor head)

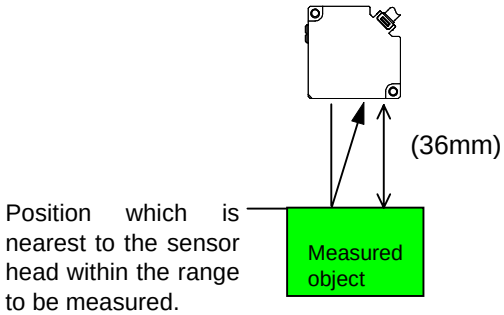
<table>
<tr><th>Step</th><th colspan="2">Setting method</th><th>Details</th></tr>
<tr><td>Mount the sensor head</td><td colspan="2">Adjust the distance between the sensor head and the measured object to be within the measuring range, by checking the operation indicator.
 
</td><td>Page 3-1
3-1-1 Sensor head</td></tr>
<tr><td>Power ON</td><td colspan="2">——</td><td>——</td></tr>
<tr><td>Memory read out</td><td colspan="2">In the initial condition.
In case of LH-CS6(P), select ‘d-01’.
 

In case of LH-CD6(P), ‘d-01’ (for connection to HEAD 1) , ‘d-02’ (for connection to HEAD 2) is displayed.
 
</td><td>Page 6-9
■ Memory call / memory read out</td></tr>
<tr><td>Gain setting</td><td>When the measured object color does not change</td><td>Set the object to be measured within the measuring range and at the closest position from the sensor head.
Example: In case of measuring at 30 to 50mm with LH-54.
 

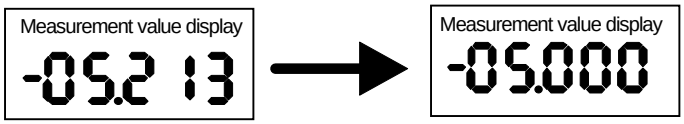
In SELECT setting, carry out the gain setting to display GOOD 3.
• Depending on the reflection ratio or gloss of the measured object, it is possible that GOOD 3 state does not change even if the gain is changed. In that case, set the gain at one level lower than the highest gain for GOOD 3.
• Because of the same reason mentioned above, it is possible that GOOD 3 does not light up. In that case, set the gain at the highest gain for GOOD 2.
 
</td><td>Page 6-12
■ CH 1/CH 2 gain setting</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Setting method</th><th>Details</th></tr>
<tr><td rowspan="2">Gain setting</td><td rowspan="2">When the measured object color changes frequently</td><td>Set the object to be measured within the measuring range.
Example: In case of measuring at 30 to 50mm with LH-54.
 
</td><td rowspan="2">Page 6-12
■ CH 1/CH 2 gain setting</td></tr>
<tr><td>Set the gain setting to AUTO.
 
</td></tr>
<tr><td>Calculation setting</td><td colspan="2">Carry out calculation selection.
Example: In case normal measurement is selected.
 
</td><td>Page 6-15
■ CH 1/CH 2 calculation selection</td></tr>
<tr><td rowspan="2">Shift adjustment</td><td colspan="2">Set the object to be measured at the center of the measuring range.
Example: In case of measuring at 30 to 50mm with LH-54.
 
</td><td rowspan="2">Page 6-78
■ Shift adjustment setting</td></tr>
<tr><td colspan="2">Carry out shift adjustment to display the desired measurement value.
 
</td></tr>
</table>

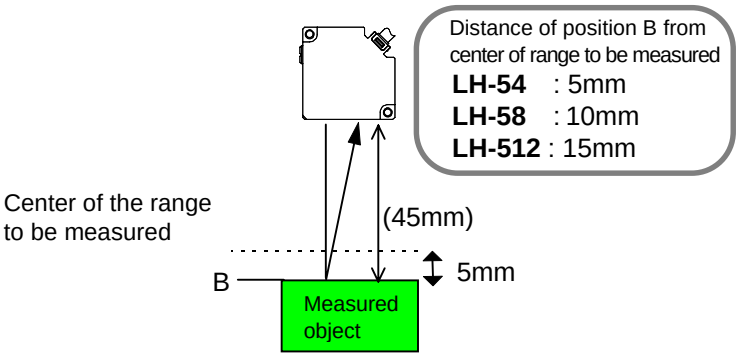
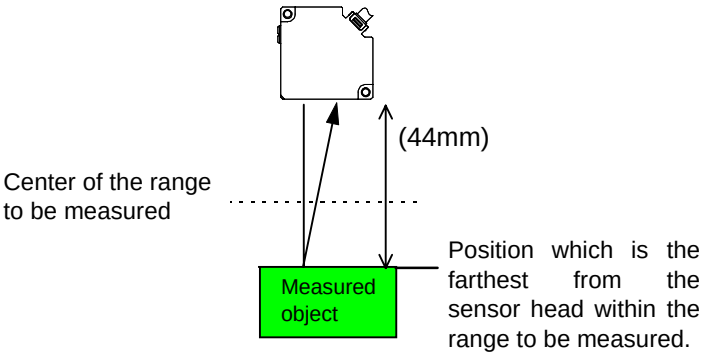
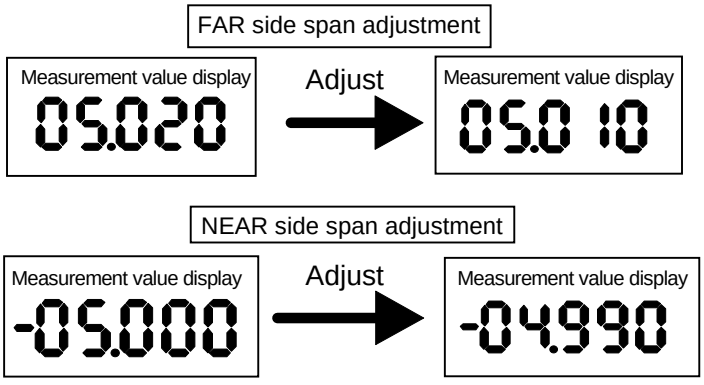
<table>
<tr><th>Step</th><th>Setting method</th><th>Details</th></tr>
<tr><td>Span adjustment (NEAR side)</td><td>
＜In case the range to be measured is 50% or more of full-scale＞
As shown in the figure below, set the object to be measured at position A, which is at the distance given below from the center of the range to be measured, towards the sensor head side (NEAR side).
Example: In case of measuring at 30 to 50mm with LH-54.


＜In case the range to be measured is less than 50% of full-scale＞
Set the object to be measured within the range to be measured at the position which is nearest (NEAR side) to the sensor head.
Example: In case of measuring at 36 to 44mm with LH-54.


</td><td rowspan="2">Page 6-83
■ Span adjustment setting</td></tr>
<tr><td>
Carry out span adjustment to display the desired measurement value.

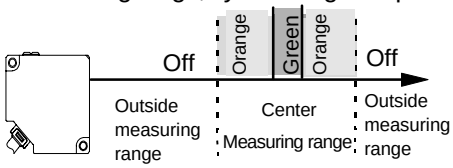
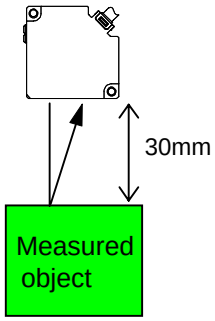
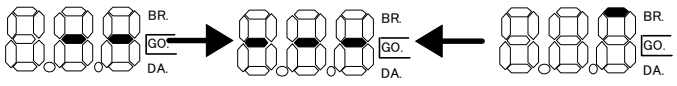
Example: In case the measurement value is to be 30 to 50mm with LH-54.


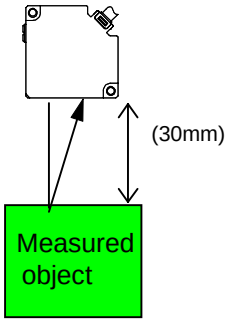
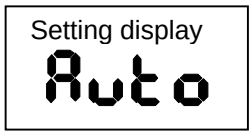
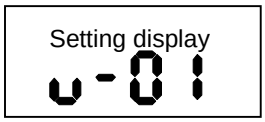
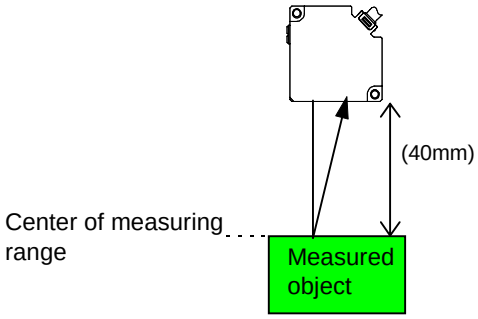
</td></tr>
</table>

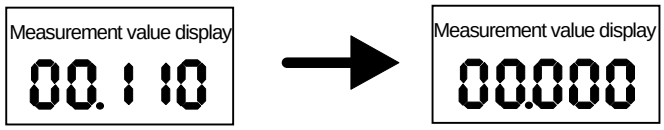
Step	Setting method	Details
Span adjustment (FAR side)	**<In case the range to be measured is 50% or more of full-scale>** As shown in the figure below, set the object to be measured at position B, which is at the distance given below from the center of the range to be measured, away from the sensor head side (FAR side). Example: In case of measuring at 30 to 50mm with **LH-54**.  **<In case the range to be measured is less than 50% of full-scale>** Set the object to be measured within the range to be measured at the position which is farthest (FAR side) from the sensor head. Example: In case of measuring at 36 to 44mm with **LH-54**.  	Page 6-83 ■ **Span adjustment setting**
	If the measurement value is different, adjust the span of FAR side and the NEAR side to balance them. Example: In case of measuring at 30 to 50mm with **LH-54**.  	

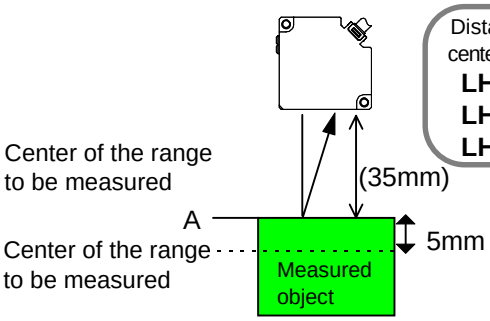
Step	Setting method	Details
Analog voltage (current) output offset adjustment	Fine adjust the output value of digital panel meter, etc. (In offset adjustment of analog voltage (current) output, only the analog output changes, the measurement value display does not change. If it is desired to offset only the measurement value display, refer to page 6-54■ **Display offset setting**.)	Page 6-88 ■ **Analog voltage output offset setting** Page 6-91 ■ **Analog current output offset setting**
Memory write	Store the setting in the memory to be written. Example: In case of storing in u-01 Setting display 	Page 6-10 ■ **Memory write**
Start measurement		

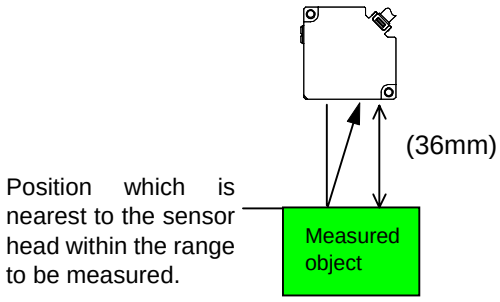
■ In case of using calculation mode (with two sensor heads)

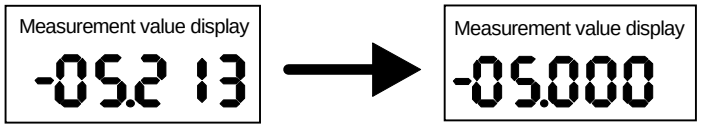
<table>
<tr><th>Step</th><th colspan="2">Setting method</th><th>Details</th></tr>
<tr><td>Mount the sensor head</td><td colspan="2">Adjust the distance between the sensor head and the measured object to be within the measuring range, by checking the operation indicator.
 
</td><td>Page 3-1
3-1-1 Sensor head</td></tr>
<tr><td>Power ON</td><td colspan="2"></td><td></td></tr>
<tr><td>Memory read out</td><td colspan="2">In the initial condition, select the following.
‘d-03’ level difference measurement
[When A - B calculation is selected]
Setting display d-03
‘d-04’ thickness measurement
[When L - (A + B) calculation is selected]
Setting display d-04</td><td>Page 6-9
■ Memory call/ memory read out</td></tr>
<tr><td>Gain setting for CH1 side</td><td rowspan="2">When the measured object color does not change</td><td>Set the object to be measured within the measuring range and at the closest position from the sensor head.
Example: In case of measuring at 30 to 50mm with LH-54.
 
</td><td rowspan="2">Page 6-12
■ CH1/CH2 gain setting</td></tr>
<tr><td>In SELECT setting, carry out the gain setting to display GOOD 3.
• Depending on the reflection ratio or gloss of the measured object, it is possible that GOOD 3 state does not change even if the gain is changed. In that case, set the gain at one level lower than the highest gain for GOOD 3.
• Because of the same reason mentioned above, it is possible that GOOD 3 does not light up. In that case, set the gain at the highest gain for GOOD 2.
Optimum state
GOOD 2 GOOD 3 BRIGHT state
 
</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Setting method</th><th>Details</th></tr>
<tr><td>Gain setting for CH 1 side</td><td rowspan="2">When the measured object color changes frequently</td><td>Set the object to be measured within the measuring range.
Example: In case of measuring at 30 to 50mm with LH-54.
 
</td><td rowspan="2">Page 6-12
■ CH 1/CH 2 gain setting</td></tr>
<tr><td>Set the gain setting to AUTO.
 
</td></tr>
<tr><td>Gain setting for CH 2 side</td><td colspan="2">Set the gain in a manner similar to that for CH 1.</td><td>Page 6-12
■ CH 1/CH 2 gain setting</td></tr>
<tr><td>Memory write</td><td colspan="2">The setting conditions are stored in the memory number to be written in.
Example: In case of storing in u-01
 
</td><td>Page 6-10
■ Memory write</td></tr>
<tr><td>Shift adjustment for CH 1 side</td><td colspan="2">Set the object to be measured on CH 1 side at the center of the measuring range.
Example: In case of measuring at 30 to 50mm with LH-54.
 

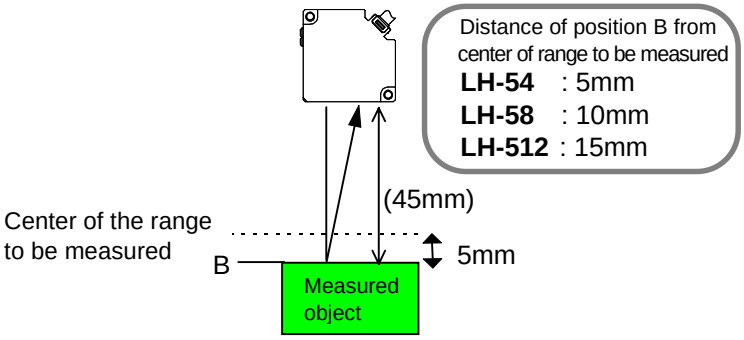
Carry out shift adjustment to display the desired measurement value.
 
</td><td>Page 6-102
■ CH 1/CH 2 shift adjustment</td></tr>
<tr><td>Shift adjustment for CH 2 side</td><td colspan="2">Set in a manner similar to that for CH 1.</td><td>Page 6-102
■ CH 1/CH 2 shift adjustment setting</td></tr>
</table>

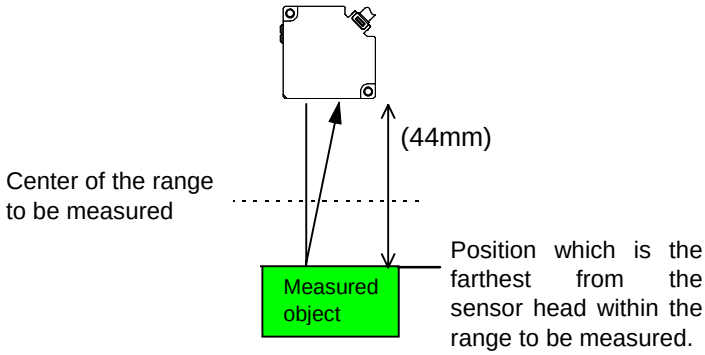
<table>
<tr><th>Step</th><th>Setting method</th><th>Details</th></tr>
<tr><td>Span adjustment for CH 1 side (NEAR side)</td><td>
＜In case the range to be measured is 50% or more of full-scale＞
Set the object to be measured on CH 1 side at position A, which is at the distance given below from the center of the range to be measured, towards the sensor head side (NEAR side).
Example: In case of measuring at 30 to 50mm with LH-54.


＜In case the range to be measured is less than 50% of full-scale＞
Set the object to be measured within the range to be measured at the position which is nearest (NEAR side) to the sensor head.
Example: In case of measuring at 36 to 44mm with LH-54.


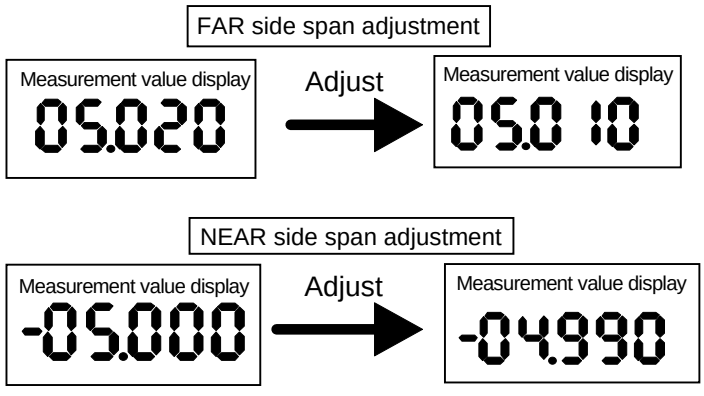
Carry out span adjustment to display the desired measurement value.
Example: In case the 30 to 50mm with LH-54.


</td><td>Page 6-106
■ CH 1/CH 2 span adjustment</td></tr>
</table>

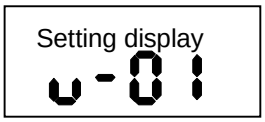
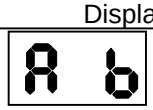
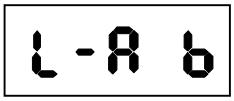
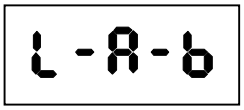
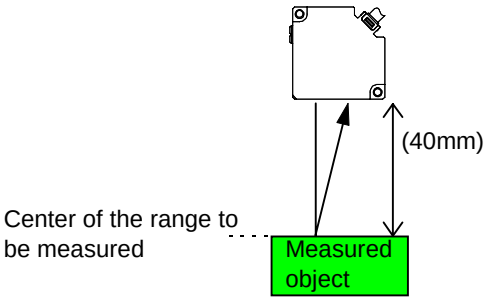
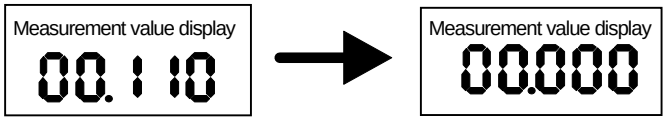
<table>
<tr><th>Step</th><th>Setting method</th><th>Details</th></tr>
<tr><td>Span adjustment for CH 1 side (FAR side)</td><td>
＜In case the range to be measured is 50% or more of full-scale＞
Set the object to be measured at position B, which is at the distance given below from the center of the range to be measured, away from the sensor head side (FAR side).
Example: In case of measuring at 30 to 50mm with LH-54.


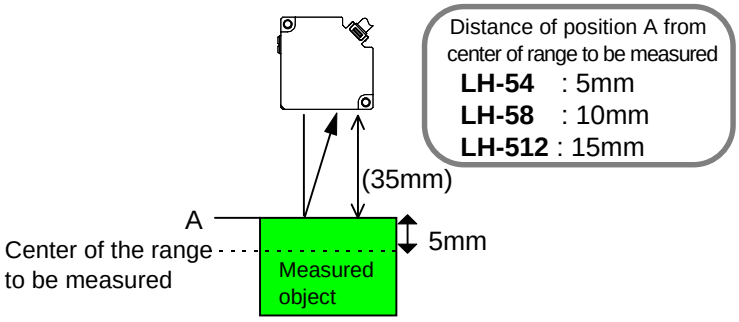
＜In case the range to be measured is less than 50% of full-scale＞
Set the object to be measured within the range to be measured at the position which is farthest (FAR side) from the sensor head.
Example: In case of measuring at 36 to 44mm with LH-54.


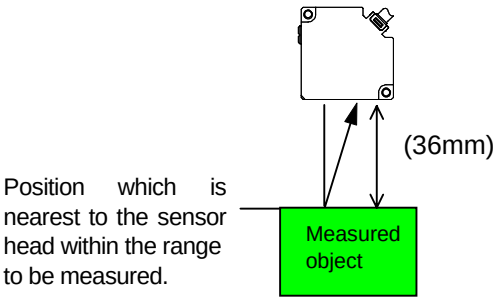
</td><td rowspan="2">Page 6-106
■ CH 1/CH 2 span adjustment setting</td></tr>
<tr><td>
If the measurement value is different, adjust the span of FAR side and the NEAR side to balance them.

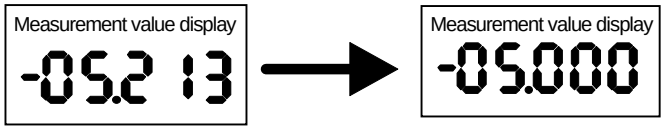
Example: In case of measuring at 30 to 50mm with LH-54.


</td></tr>
<tr><td>Span adjustment for CH 2 side (NEAR side)</td><td>Set the span in a manner similar to that for CH 1.</td><td>Page 6-106
■ CH 1/CH 2 span adjustment setting</td></tr>
</table>

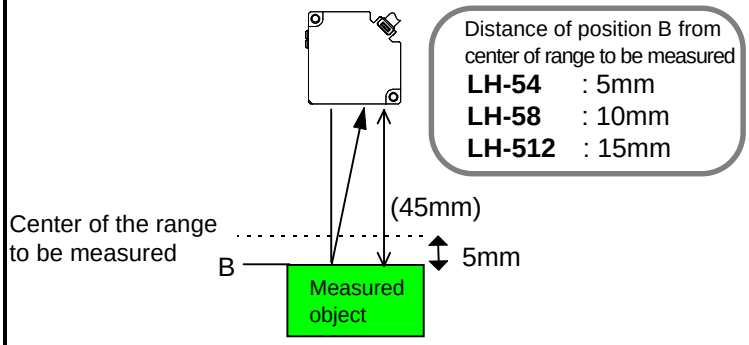
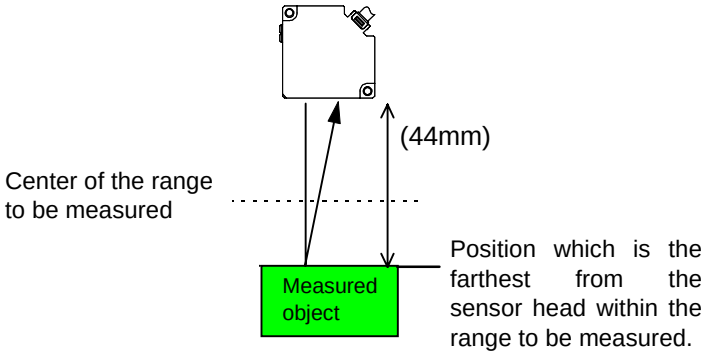
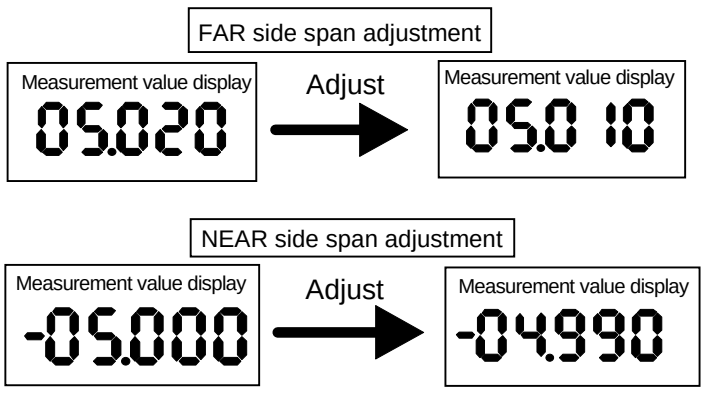
<table>
<tr><th>Step</th><th>Setting method</th><th>Details</th></tr>
<tr><td>Span adjustment for CH 2 side (FAR side)</td><td>Set the span in a manner similar to that for CH 1.</td><td>Page 6-106
■ CH 1/CH 2 span adjustment setting</td></tr>
<tr><td>Memory read out</td><td>Call the user memory which was previously written in after the gain setting.
Example: In case u-01 was stored in
Setting display
 
‘u-01’ should be selected.</td><td>Page 6-9
■ Memory call /memory read out</td></tr>
<tr><td>Calculation setting</td><td>Carry out the calculation setting.
① Switch the items of calculation equation.
Initial setting: CH 1= A, CH 2 = B
② Select the calculation equation.
<table><tr><th>Equation</th><th>Display</th></tr><tr><td>(1) A + B</td><td>  </td></tr><tr><td>(2)A – B</td><td>  </td></tr><tr><td>(3)(A – B) / 2</td><td>  </td></tr><tr><td>(4)L – (A + B)
L: Constant</td><td>  </td></tr><tr><td>(5)L – (A – B)
L: Constant</td><td>  </td></tr></table></td><td>Page 6-21
■Calculation equation selection</td></tr>
<tr><td>Shift adjustment</td><td>Set the object to be measured at the center of the measuring range.
Example: In case of measuring at 30 to 50mm with LH-54.
 
</td><td>Page 6-78
■Shift adjustment setting</td></tr>
<tr><td></td><td>Carry out shift adjustment to display the desired measurement value.
 
</td><td></td></tr>
</table>

<table>
<tr><th>Step</th><th>Setting method</th><th>Details</th></tr>
<tr><td>Span adjustment (NEAR side)</td><td>
＜In case the range to be measured is 50% or more of full-scale＞
Set the object to be measured at position A, which is at the distance given below from the center of the range to be measured, towards the sensor head side (NEAR side).
Example: In case of measuring at 30 to 50mm with LH-54.


＜In case the range to be measured is less than 50% of full-scale＞
Set the object to be measured within the range to be measured at the position which is nearest (NEAR side) to the sensor head.
Example: In case of measuring at 36 to 44mm with LH-54.


Carry out span adjustment to display the desired measurement value.
Example: In case the measurement value is to be 30 to 50mm with LH-54.


</td><td>Page 6-83
■Span adjustment setting</td></tr>
</table>

Step	Setting method	Details
Span adjustment (FAR side)	**<In case the range to be measured is 50% or more of full-scale>** Set the object to be measured at position B, which is at the distance given below from the center of the range to be measured, away from the sensor head side (FAR side). Example: In case of measuring at 30 to 50mm with **LH-54**.  **<In case the range to be measured is less than 50% of full-scale>** Set the object to be measured within the range to be measured at the position which is farthest (FAR side) from the sensor head. Example: In case of measuring at 36 to 44mm with **LH-54**.  	Page 6-83 ■**Span adjustment setting**
	If the measurement value is different, adjust the span of FAR side and the NEAR side to balance them. Example: In case of measuring at 30 to 50mm with **LH-54**.  	

Step	Setting method	Details
Analog voltage (current) output offset adjustment	Fine adjust the output value of digital panel meter, etc. In offset adjustment of analog voltage (current) output, only the analog output changes, the measurement value display does not change. If it is desired to offset only the measurement value display, refer to page 6-54■ **Display offset setting**.	Page 6-88 ■ **Analog voltage output offset setting** Page 6-91 ■ **Analog current output offset setting**
Memory write	Store the setting in the memory to be written. Example: In case of storing in u-01 Setting display 	Page 6-10 ■ **Memory write**
Start measurement		

CHAPTER 5

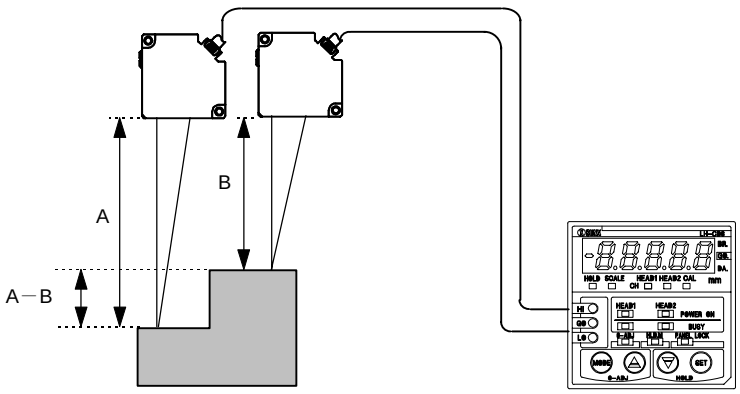
APPLICATION EXAMPLES AND USEFUL FUNCTIONS

Use of functions incorporated in this displacement sensor enables various measurements besides a simple displacement measurement. Some examples are given below.

5-1 Level difference measurement of objects by A - B

In order to judge the height with respect to a reference plane, measure the level difference with two sensors.

Example: Level difference is measured by using the calculation equation A – B.



NOTE The diagram above is the case when distance monitor is selected in the display setting. In case of displacement monitor, the reference position is the measuring center. Please refer to page 6-45 '■**Display contents selection**' for details.

■ Setting details

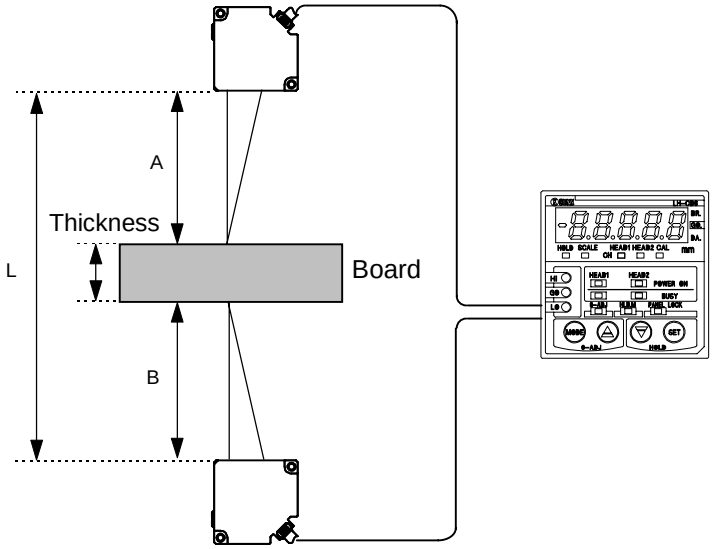
Setting item		Contents	Details
Memory read out		d-03	Page 6-9
Calculation setting	Item change	A=CH 1 or A=CH 2	Page 6-19
	Calculation equation selection	A – B (Note)	Page 6-21
Comparative output setting	Threshold level setting	Threshold value TH-1 or TH-2 is set	Page 6-33
Display setting selection	Display contents selection	Displacement monitor or Distance monitor	Page 6-45

NOTE If 'default memory d-03' is selected, the calculation equation is automatically set to A – B.

5-2 Object thickness measurement by L - (A + B)

The thickness of the board is measured with two sensor heads and the thickness is judged with respect to the standard thickness.

Example: The board thickness is measured by using the calculation equation L – (A + B)



NOTE The diagram above is the case when distance monitor is selected in the display setting. In case of displacement monitor, the reference position is the measuring center. Please refer to page 6-45 '■**Display contents selection**' for details.

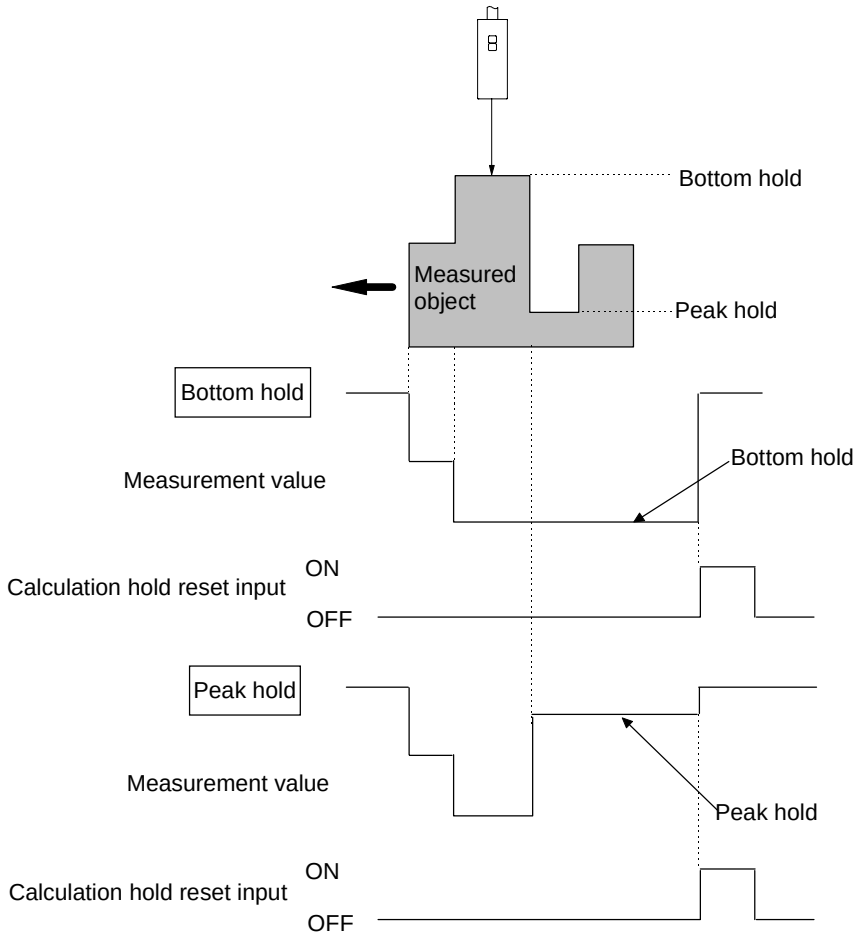
■ Setting details

Setting item		Contents	Details
Memory read out		d-04	Page 6-9
Calculation setting	Item change	A=CH 1 or A=CH 2	Page 6-19
	Calculation equation selection	L – (A ＋ B) (Note)	Page 6-21
Comparative output setting	Threshold level setting	Threshold value TH-1 or TH-2 is set	Page 6-33
Display setting selection	Display contents selection	Displacement monitor or Distance monitor	Page 6-45

NOTE If 'default memory d-04' is selected, the calculation equation is automatically set to L – (A + B).

5-3 Extreme point measurement by peak hold / bottom hold function

The highest level or the lowest level of the object is measured by using with peak hold / bottom hold function.
Further, the hold states can be reset with the calculation reset input.

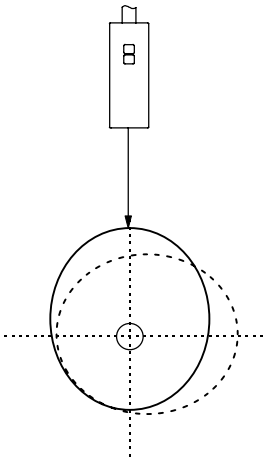


■ Setting details

Setting item		Contents	Details
Other settings	Calculation mode setting	Peak hold or bottom hold	Page 6-63

5-4 Measurement of roller eccentricity by peak-peak function

The change in the height of the roller caused by the eccentricity is measured by using the peak-peak function, and the amount of the eccentricity is output.



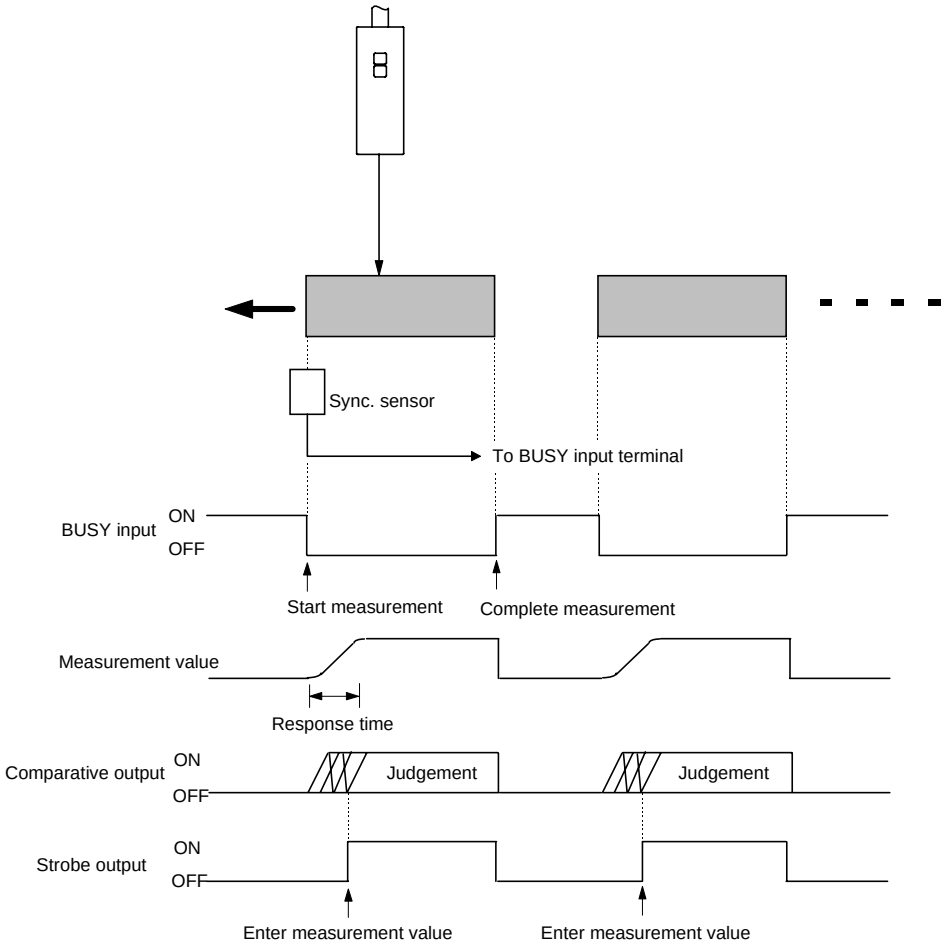
■ Setting details

Setting item		Contents	Details
Other settings	Calculation mode setting	Peak-peak	Page 6-63

5-5 BUSY input + Strobe output

By using a combination of BUSY input and Strobe output, the timing of comparative output can be controlled.

Example: When comparative output is taken at the time when the strobe output turns ON, the measurement value at that time becomes the entered judgement value.

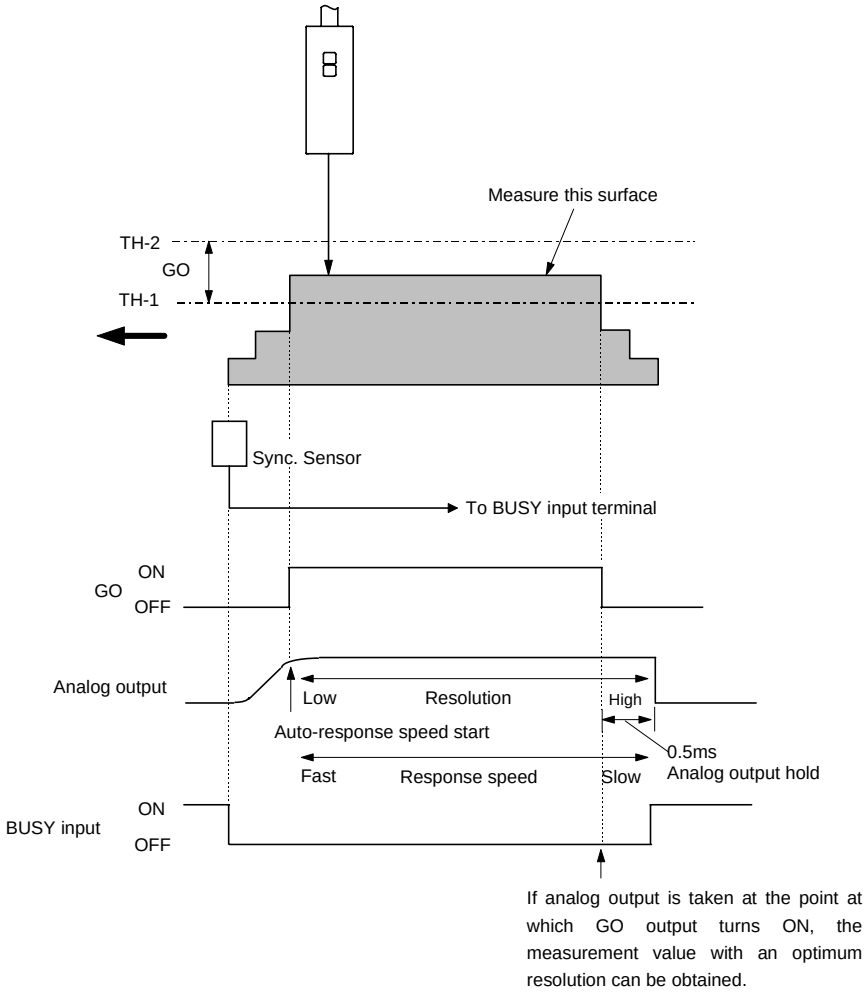


REFERENCE

Please refer to page 3-8, 9 '**3-2-4 I/O circuit diagram**' for the connection.

5-6 Auto-response speed

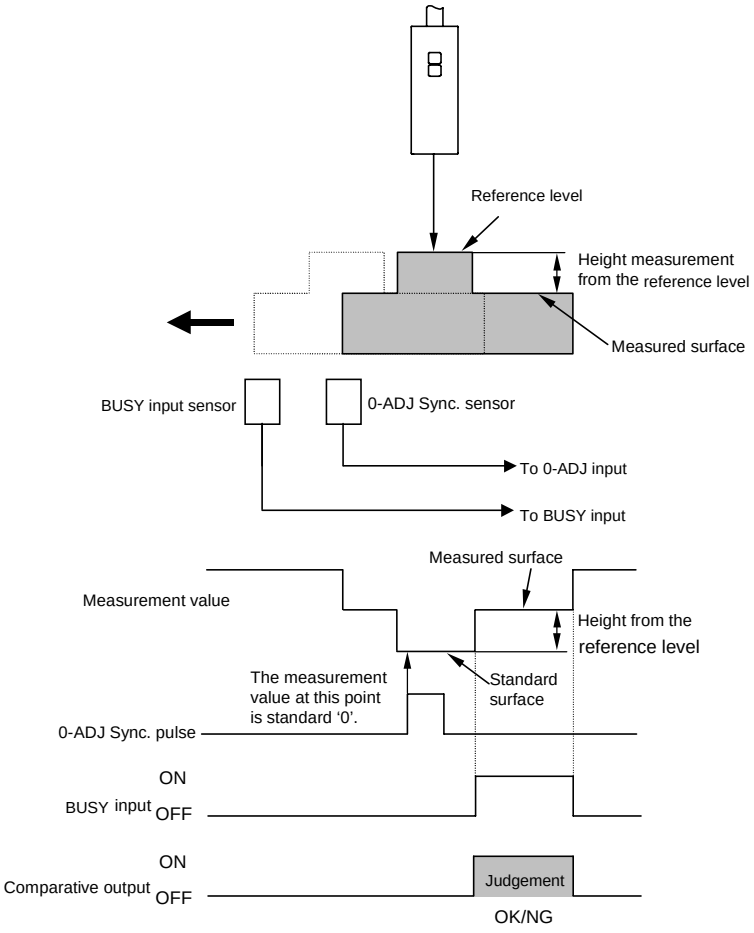
If 'AUTO' is set in the response time setting, the response speed changes corresponding to the line speed and the analog output can be measured with an optimum resolution.



REFERENCE Please refer to page 6-59 '■**Response time setting**' for setting details.

5-7 Height measurement by 0-ADJ function

By using the 0-ADJ input, the height of a moving object can be measured with respect to a reference level to judge if it is OK or not.



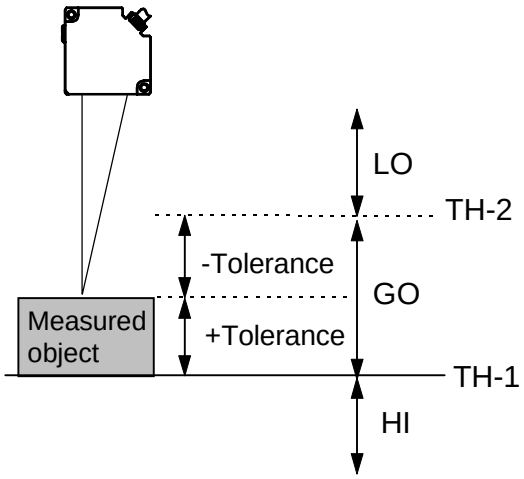
REFERENCE

- Please refer to page 3-8, 9 '**3-2-4 I/O circuit diagram**' for the connection and page 3-18 '■ **0-ADJ input**' for the operation chart.
- Also, please refer to page 6-112 '■ **0-ADJ**' for setting details.

5-8 1-level teaching function

In case of measuring height (thickness) of an object to inspect and decide if the measured object is within the specifications, the threshold value of the comparative output can be automatically set by simple operation, by teaching with the actual object.
In 1-level teaching function, performing 1-level teaching on the object and inputting the tolerance value can set the threshold values (TH-1, TH-2).

Example:

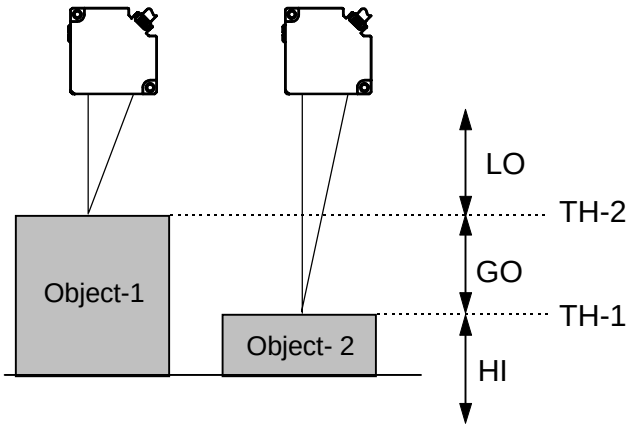


REFERENCE Please refer to page 6-27 '■ **1-level teaching**' for setting details.

5-9 2-level teaching function

In case of measuring height (thickness) of an object to inspect and decide if the measured object is within the specifications, the threshold value of the comparative output can be automatically set by simple operation, by teaching with the actual objects.
In 2-level teaching function, performing 2-level teaching on the objects can set the threshold values (TH-1, TH-2).

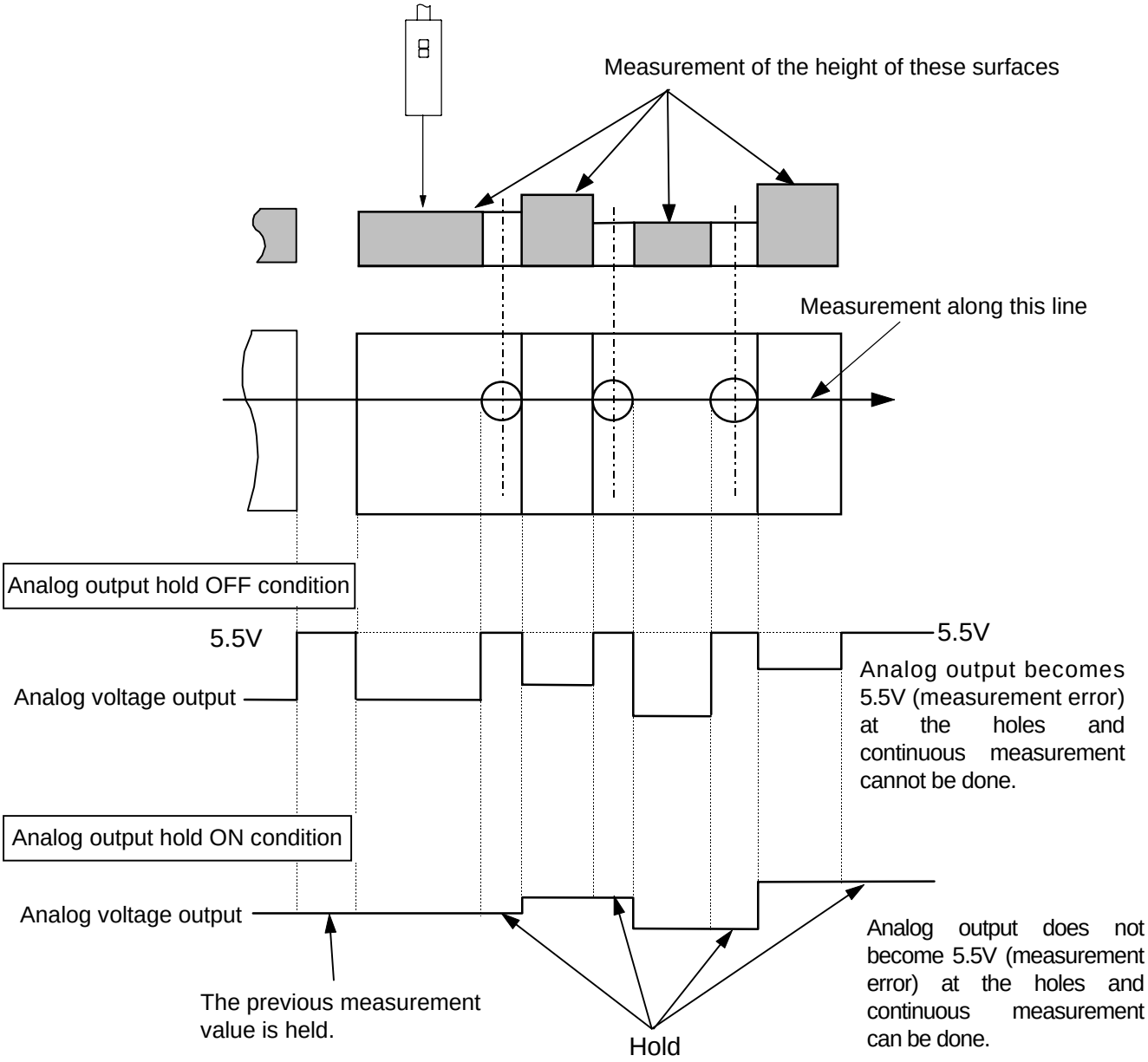
Example:



REFERENCE Please refer to page 6-30 '■ **2-level teaching**' for setting details.

5-10 Analog output hold function

Continuous analog output data can be obtained even if there are extreme changes (e.g. holes etc.), that can cause an error, on the measured surface of the object.



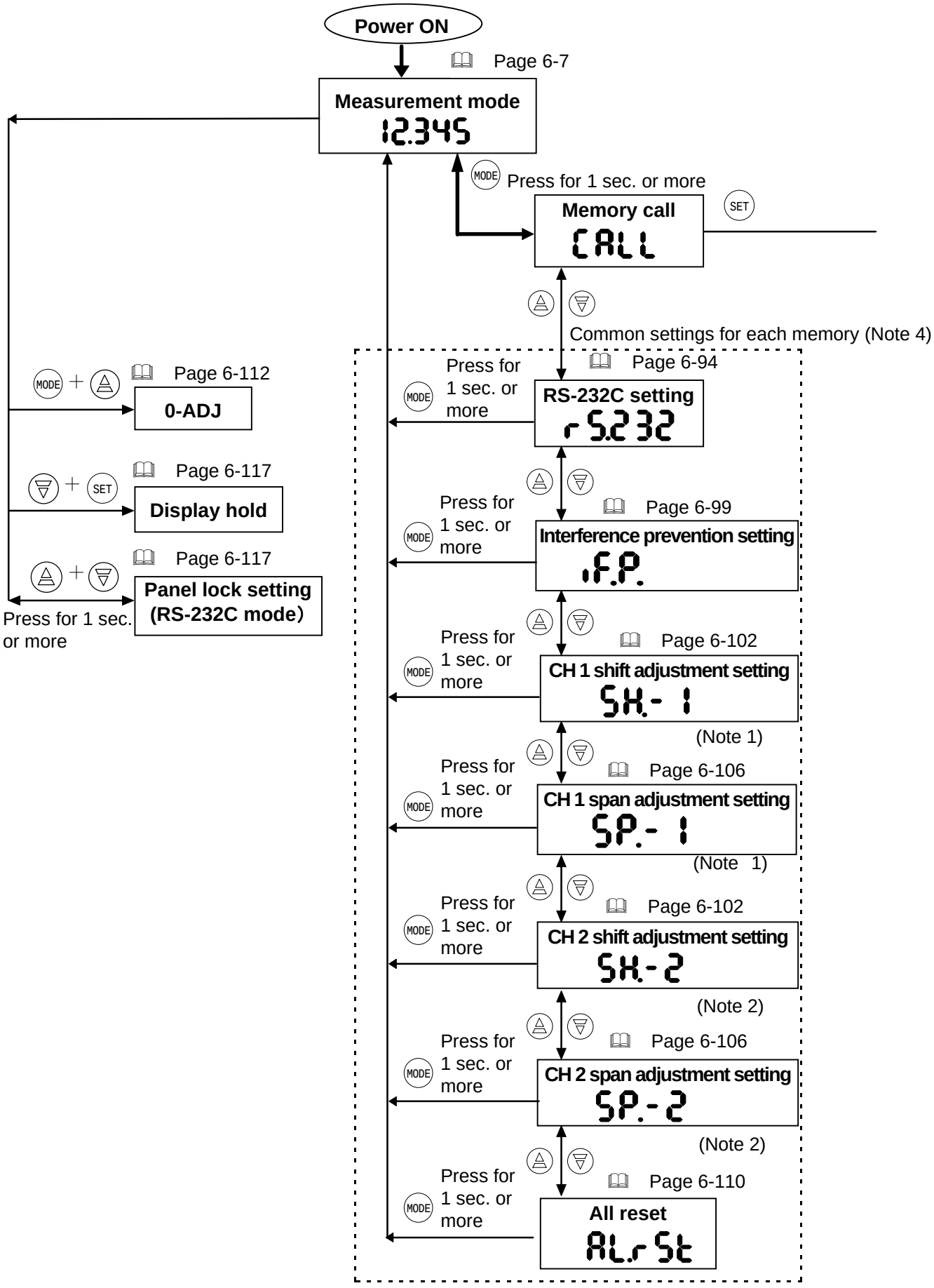
REFERENCE Please refer to page 6-71 '■**Analog output hold setting**' for setting details.

— MEMO —

CHAPTER 6

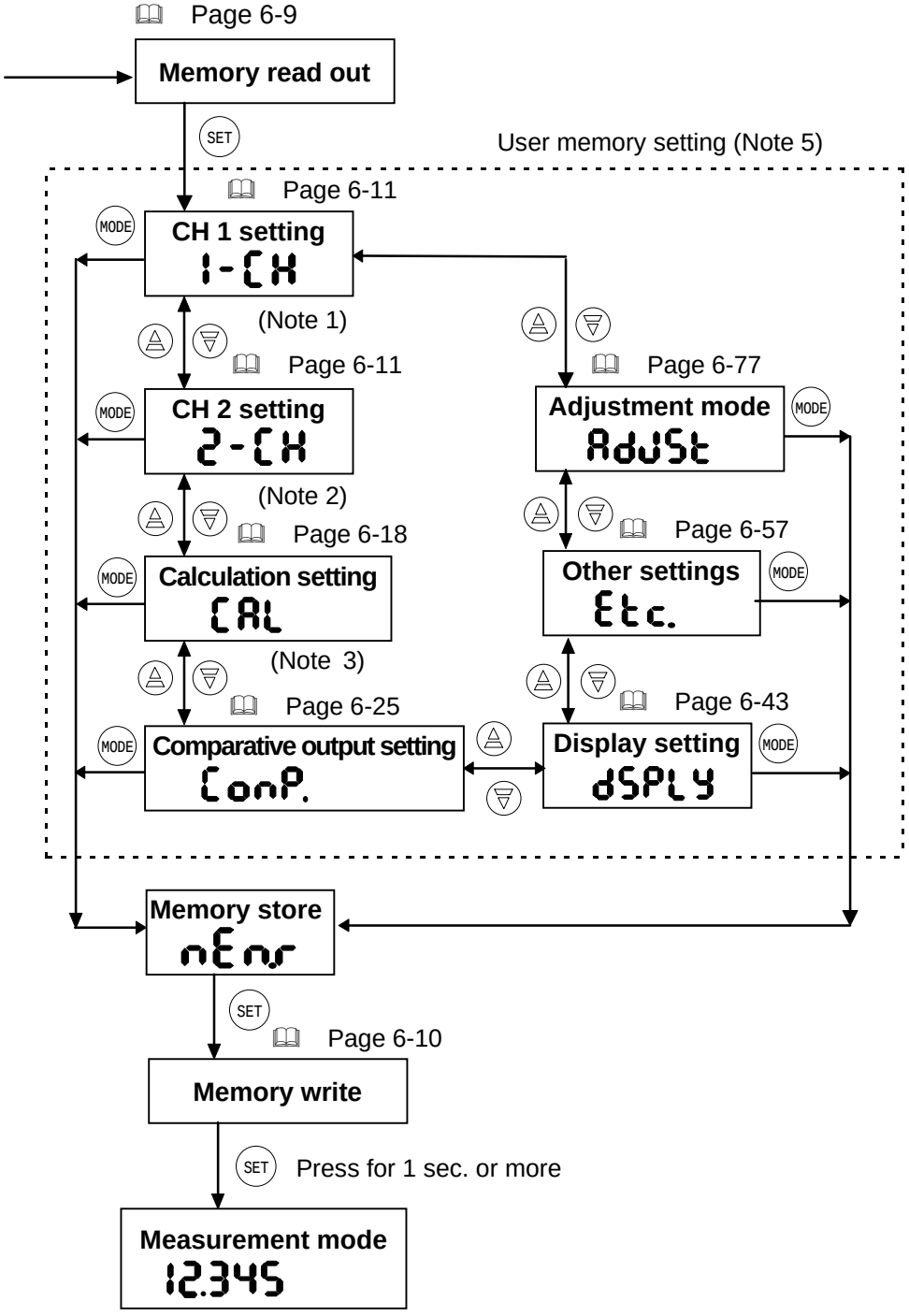
SETTING • OPERATION

6-1 Overall configuration



NOTE

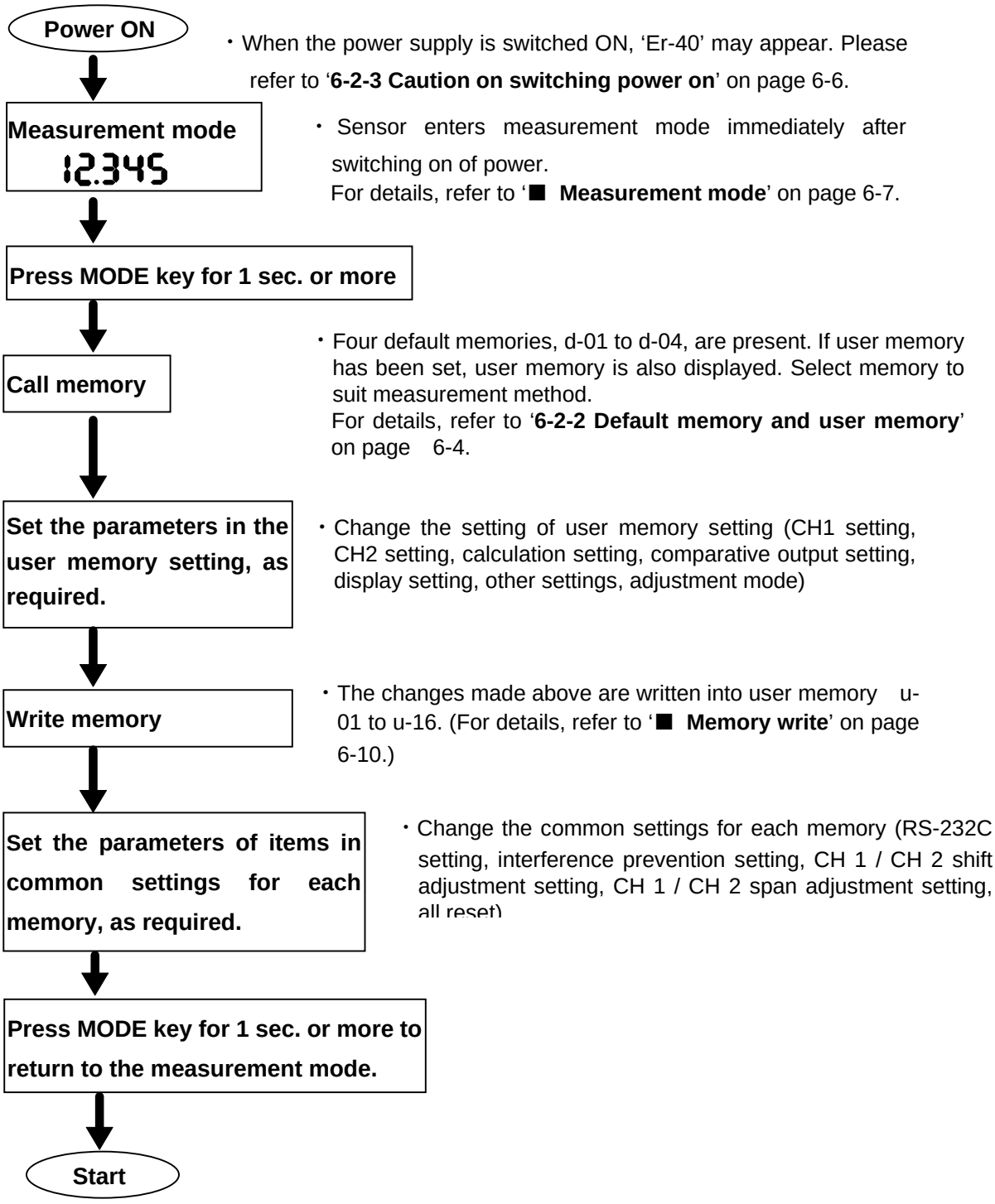
1) Displayed when sensor head is connected to **LH-CS6(P)** or HEAD 1 side of **LH-CD6(P)**.
2) Displayed when sensor head is connected to HEAD 2 side of **LH-CD6(P)**.
3) Displayed when sensor heads are connected to both HEAD 1 side and HEAD 2 side of **LH-CD6(P)**.
4) The settings in 'Common settings for each memory' are common for user's memory (u-01 to u-16).
5) The settings in 'User memory settings' can be stored in 16 memories (u-01 to u-16).



6-2 Prior to operation

6-2-1 Setting flow

Here, the flow of setting is explained in a simplified manner for proper understanding.



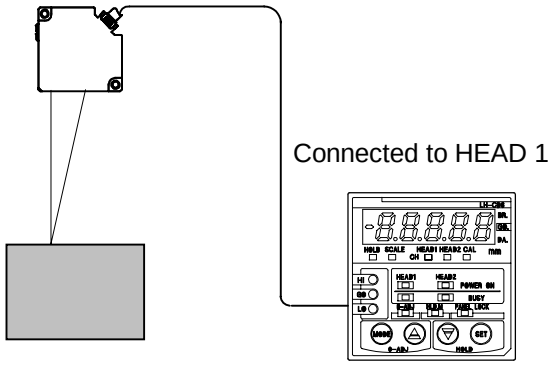
6-2-2 Default memory and user memory

■ Default memory

The settings for four different applications in which this sensor is likely to be frequently used have been registered in the default memories d-01 to d-04.

- **d-01 (CH1 independent measurement)**

  This default memory is selected when only one sensor head is used and the used sensor head is connected to the HEAD 1 side of the controller.

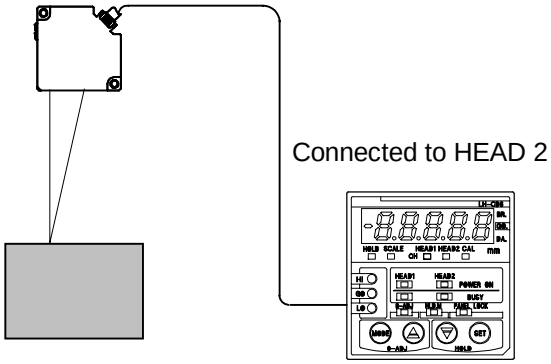


NOTE

- In case of **LH-CS6(P)**, default memories other than d-01 cannot be selected.
- d-01 can be selected even if two sensor heads are connected. In this case only the sensor head connected to HEAD 1 side operates.

- **d-02 (CH2 independent measurement)**

  This default memory is selected when only one sensor head is used and the used sensor head is connected to the HEAD 2 side of the controller.



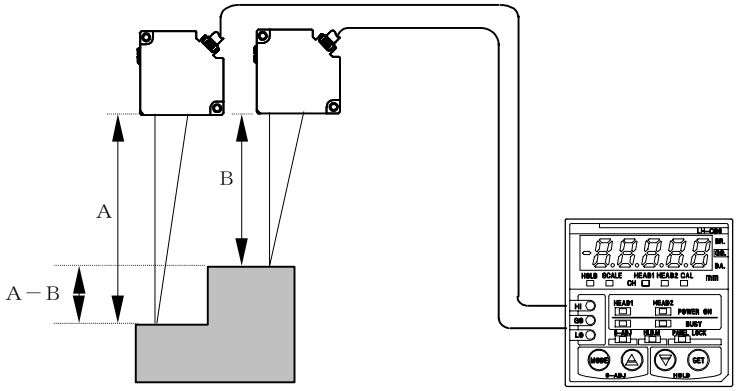
NOTE

- d-02 can be selected even if two sensor heads are connected. In this case only the sensor head connected to HEAD 2 side operates.

- **d-03 (level difference measurement)**

  This default memory is selected when two sensor heads are used to measure level difference.

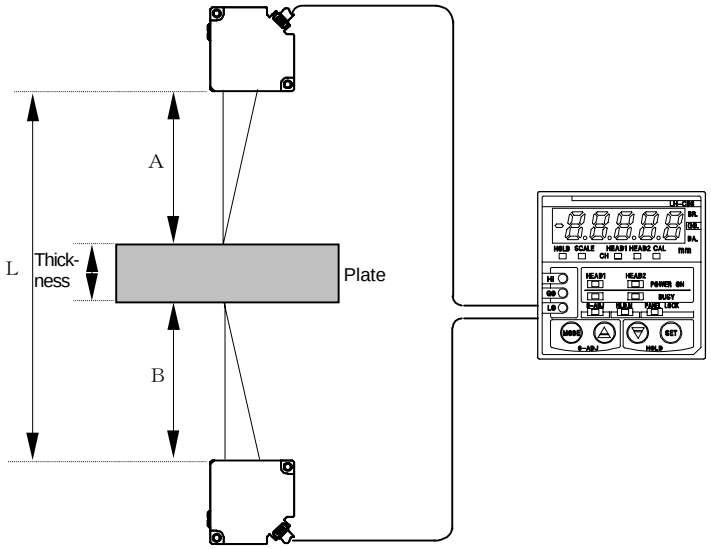
  When d-03 is selected, calculation equation A – B is set in the calculation setting of user memory setting. (Refer to page 6-21.)



- **d-04 (thickness measurement)**

  This default memory is selected when two sensor heads are used to measure thickness.

  When d-04 is selected, calculation equation L – (A + B) is set in the calculation setting of user memory setting, and L input display appears. For the setting procedure after this, refer to ‘Setting procedure’ on page 6-22.



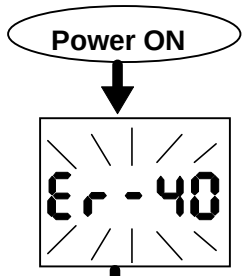
■ User memory

In the factory shipment condition, even when memory call is carried out only the above mentioned four default memories are available. (Refer to page 6-9 ■ **Memory call / memory read out**.) In case the sensor is to be used in a different application, first choose from one the four default memories d-01 to d-04 and change each setting (CH1 setting, CH2 setting, calculation setting, comparative output setting, display setting, other settings, adjustment mode) of the user memory setting to suit the application. After that, store these settings in user memory (u-01 to u-16). (Refer to page 6-10 ■ **Memory write**.) A user memory which has once been written in and stored can be called by memory read out.

6-2-3 Caution on switching power on

When the power is switched on, the memory which has been last set when the sensor was previously used is called. At this time, if the sensor head connection information (Note 1) is different from that stored the last time the sensor was used, an error indication appears.

For example, if the sensor was previously used by connecting 2 Nos. of sensor heads **LH-54** and now the power supply is switched on with 2 Nos. of sensor heads **LH-512** connected, Er-40 error appears. In this case, after pressing some key, select the memory number and correct the settings.



・In case the present head connection information is different from that stored the last time the sensor was used.

Select from either the four default memories d-01 to d-04 or the already registered user memories. (Note 2)
For details, refer to page 6-9 '■ **Memory call / memory read out**'.

・For the procedure after this, refer to the setting flow on page 6-3.

NOTE

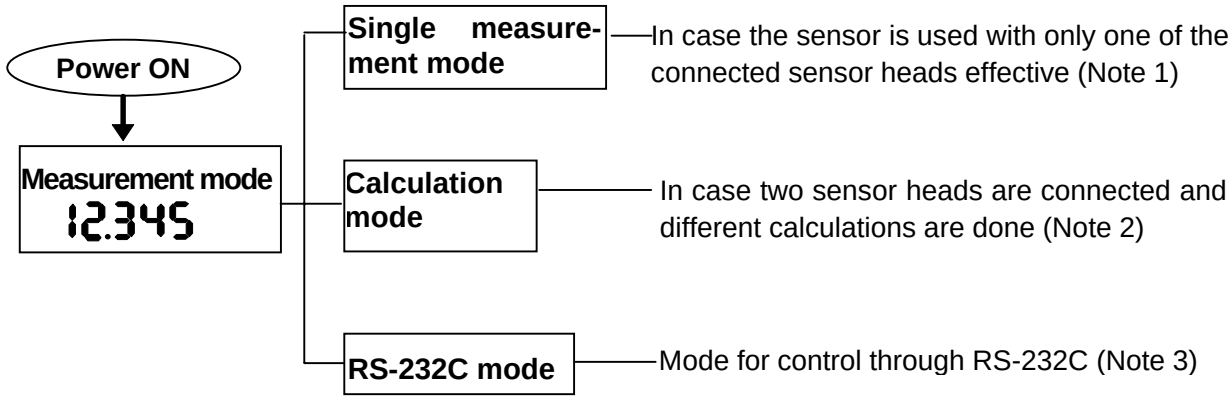
1) Sensor head connection information is the information on the model Nos. of the sensor heads connected to the HEAD 1 side and the HEAD 2 side and their combination.
2) Even though a registered memory No. already exists, if the present sensor head connection information and the sensor head connection information at the time of memory registration is different, the registered memory No. is not displayed.
For instance, in the above example, even if memory No. u-01 is registered previously when using 2 Nos. **LH-54**, since the present sensor head connection information is 2 Nos. of **LH-512**, u-01 is not displayed.

6-3 Functions and setting procedure

■ Measurement mode

When the power is switched on, the sensor is in measurement mode.

The measurement mode can be further classified as follows.



NOTE

1) This is the normal mode in case of **LH-CS6(P)**. Further, in case of **LH-CD6(P)**, it is not possible to use the two sensor heads independently.
2) This mode is not available with **LH-CS6(P)**.
3) Refer to page 6-117 '■ **Panel lock setting**' for changing to RS-232C mode.

■ Measurement value display

- **With sensor head emission ON**

  The present measurement value is displayed. The measurement value can be displayed in terms of displacement monitor or distance monitor.

(Display example)

REFERENCE

Refer to page 6-43 '■ **Display contents selection**' for setting of displacement monitor or distance monitor.

- **With sensor head emission OFF**

  If the LED does not emit due to the setting of remote interlock, the display shown at the right appears.

REFERENCE

Refer to page 3-17 '■ **Remote interlock input**' for emission ON/ OFF.

- **In case of outside measurement range, insufficient light or excess light**

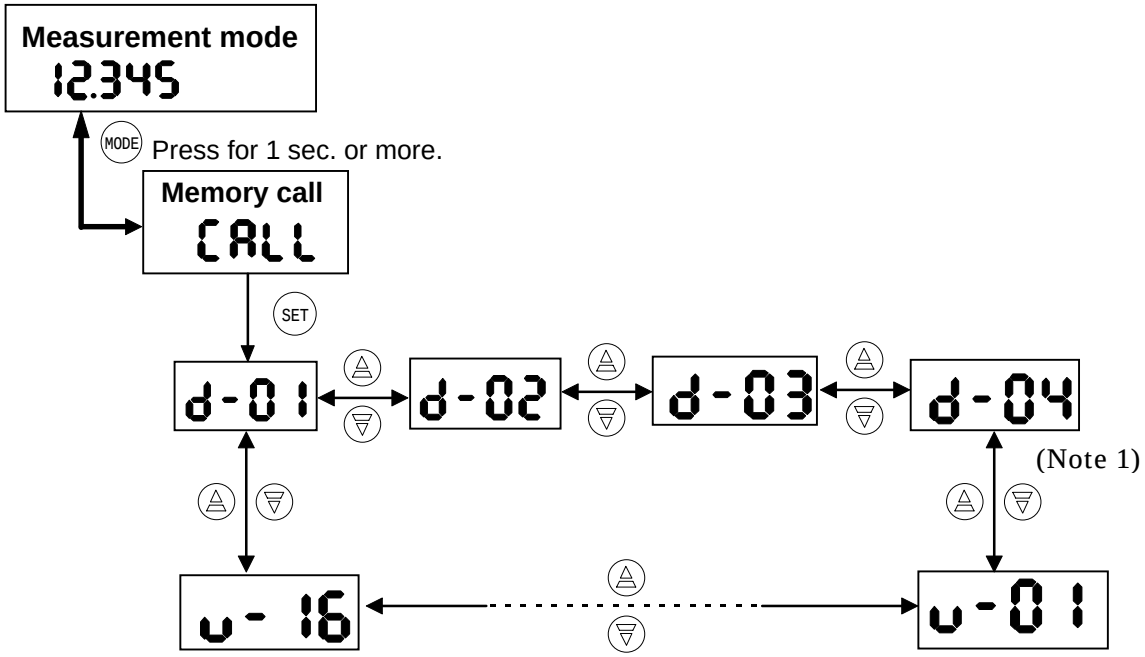
Description	Display	
	HEAD 1 side	HEAD 2 side
The measured object is outside the measuring range (near side)		
The measured object is outside the measuring range (far side)		
Incident light intensity is insufficient		
Incident light intensity is excessive		

NOTE

- Please refer to page 9-1 '**9-1 Error indication**' for other error indications.
- In case the measured object is outside the measuring range and is very close to the sensor head, the measurement value may be displayed, instead of NEAR or BRIGHT indication. Please ensure to set the object to be measured within the measuring range.
- Measurement value may be unstable near the boundaries of the measuring range. Please ensure to correctly set the object to be measured within the measuring range.

■ Memory call / memory read out

In the factory shipment condition, memory call can be for d-01 to d-04. U-01 to u-16 are not displayed. (For details refer to page 6-4 '■ **Default memory and user memory**'.)



Select the memory and press (SET).

Default memory (d-01 to d-04) is limited depending on the type of controller and the sensor head connection condition as given in the table below. Further, regarding u-01 to u-16, only the memory Nos. which have been once stored by memory write (page 6-10) are displayed. (Note 2)

Memory No.	**LH-CS6(P)**	**LH-CD6(P)**		
		Connection to HEAD 1 side	Connection to HEAD 2 side	Connection to both HEAD 1 and HEAD 2 sides
d-01	Displayed	Displayed	Not displayed	Displayed
d-02	Not displayed	Not displayed	Displayed	Displayed
d-03	Not displayed	Not displayed	Not displayed	Displayed
d-04	Not displayed	Not displayed	Not displayed	Displayed

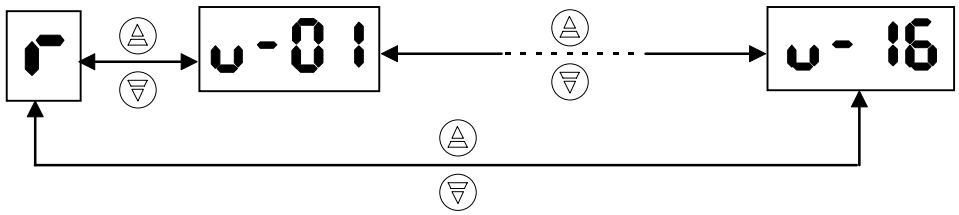
NOTE

1) When d-04 is selected, since the value of L is to be first input, L input display of calculation setting appears. For the setting procedure after this, refer to page 6-23 Step ⑥ onwards.
2) Further, the present sensor head connection information (Note 3) and the sensor head connection information at the time of registration can display only the same memory numbers.
3) Sensor head connection information is the information on the model Nos. of the sensor heads connected to the HEAD 1 side and the HEAD 2 side and their combination.

■ Memory write

Select the memory number to be written into by using the UP and DOWN keys, and then press the SET key.

Once a user memory has been stored into by using memory write, it can then be called by memory read out (refer to page 6-9).



Select memory and press (SET) .

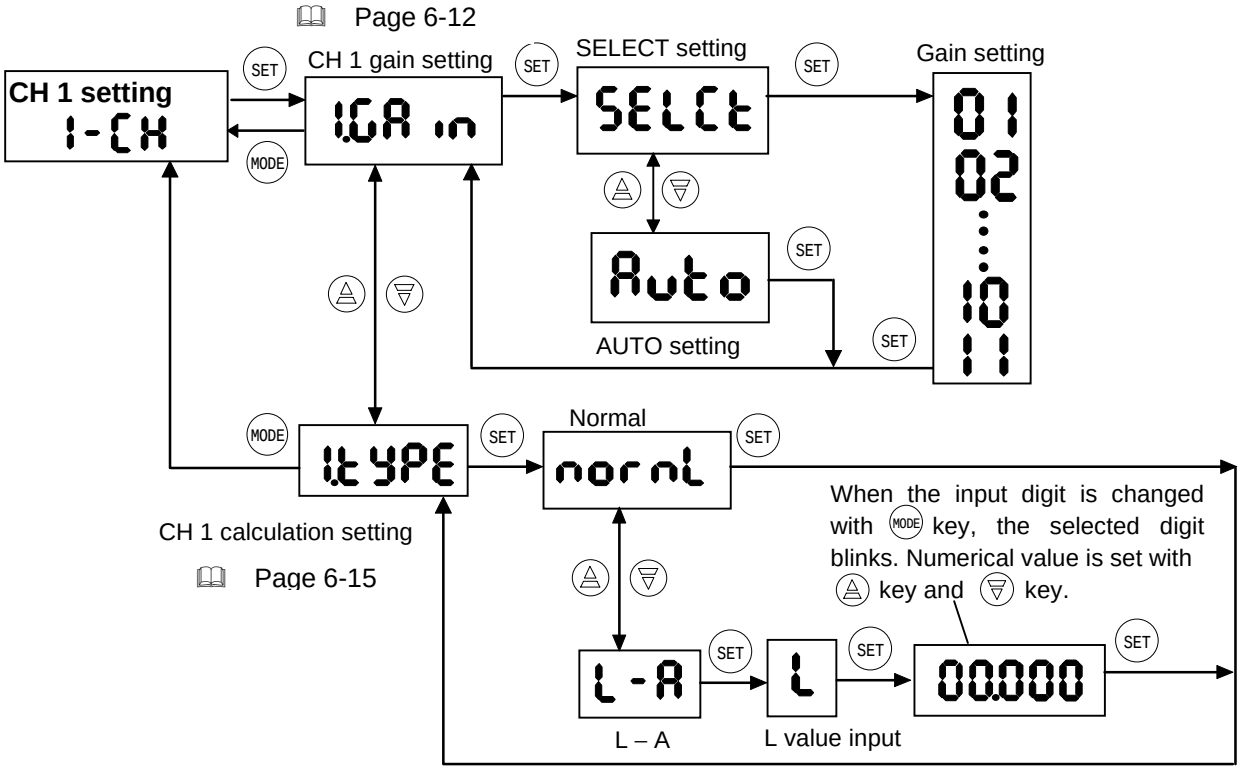
NOTE

If u-01 to u-16 is selected, the contents are written into an EEPROM and stored. However, if r is selected, the contents are not written into the EEPROM and are not stored. In this case, when the power supply is switched off, or when another user memory is read out, the contents which have been set are lost.

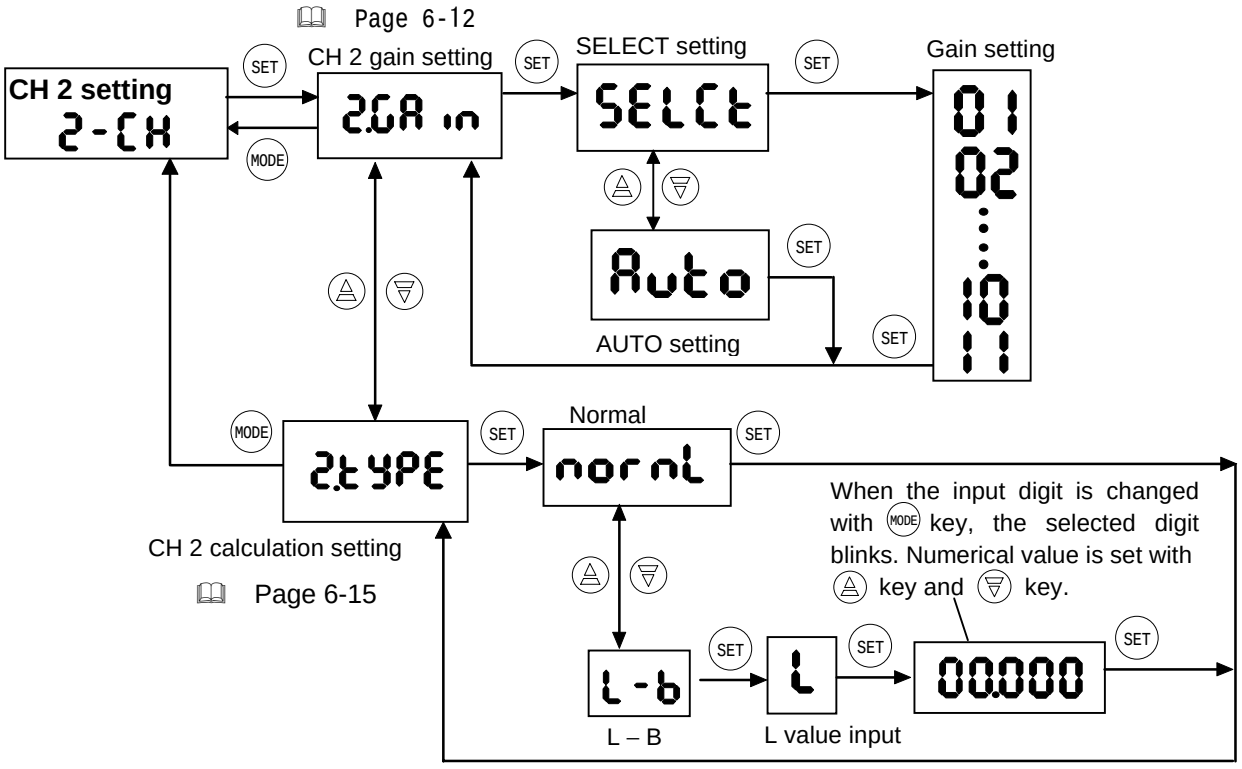
■ CH 1 / CH 2 setting

- **CH 1 / CH 2 setting configuration**

CH 1 setting [Displayed when sensor head is connected to **LH-CS6(P)** or HEAD 1 side of **LH-CD6(P)**].



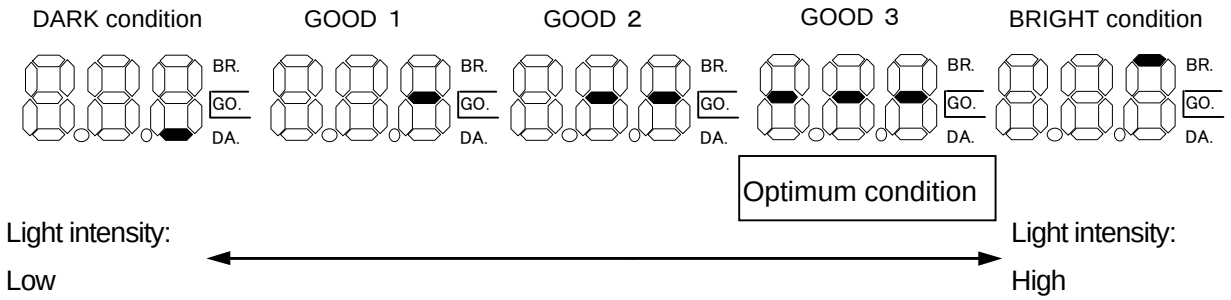
CH 2 setting [Displayed when sensor head is connected to HEAD 2 side of **LH-CD6(P)**.]



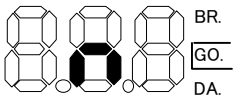
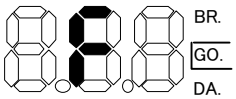
■ CH 1 / CH 2 gain setting

Gain setting is the setting of the sensitivity of the sensor head connected to CH 1 or CH 2. This sensor calculates the measurement value based on the light reflected from the object. Hence, it is necessary to optimally set the sensitivity of the sensor head with respect to the change in the received light depending on the reflectivity of the object surface. The gain setting can be selected from AUTO setting and SELECT setting, separately for sensor heads of CH 1 and CH 2.

- AUTO : The gain is automatically varied according to the change in the reflectivity (amount of light received) of the measured object. (Note 1)
- SELECT: The sensitivity can be set with respect to the measured object in 11 steps. Further, since the setting can be done while seeing the 'BRIGHT', 'GOOD' and 'DARK' LEDs, the optimum gain can be verified (Refer to the figure below.). Set the gain so that GOOD 3 is displayed. (Note 2, 3 and 4)



In SELECT setting, if the object is outside the measuring range, the following is displayed. In this case, return the object to within the measuring range.

When the object is outside the near side of the measuring range (NEAR)	
When the object is outside the far side of the measuring range (FAR)	

Initial setting: SELECT setting———04

NOTE

1) In the auto setting, the linearity and resolution may deteriorate.
2) Depending on the reflection ratio or gloss of the measured object, it is possible that GOOD 3 state does not change even if the gain is changed. In that case, set the gain at one level lower than the highest gain for GOOD 3.
   Because of the same reason mentioned above, it is possible that GOOD 3 does not light up. In that case, set the gain at the highest gain for GOOD 2.
3) Especially, in case of an object having a high reflectivity which should normally result in BRIGHT being displayed, if a high gain is set, the measured value may be displayed in the measurement mode, without the BRIGHT error being displayed. In this case, note that the measured value is highly inaccurate.
4) Do not move the object during gain setting. It will not be possible to set the optimum gain.

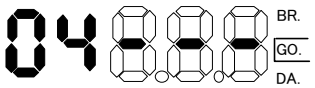
Setting procedure | Key operation from measurement mode is explained.

Step	Key	Operation	Display/Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or U-01 ~ U-16 (Note 1)
③	SET	Press the set key.	1-CH 2-CH
	▲ ▼	Select either CH 1 setting or CH 2 setting by using the UP key or the DOWN key.	CH 1 setting (Note 2) CH 2 setting (Note 3)
④	SET	Press the set key.	1GA in 2GA in
	▲ ▼	Select either CH 1 gain setting or CH 2 gain setting by using the UP key or the DOWN key.	CH 1 gain setting (Note 2) CH 2 gain setting (Note 3)
⑤	SET	Press the set key.	SELCt Auto
	▲ ▼	Select either AUTO setting or SELECT setting by using the UP key or the DOWN key.	SELECT setting AUTO setting
In case AUTO setting is selected: Go to Step ⑥ In case SELECT setting is selected: Go to Step ⑧			

• In case of AUTO setting

Step	Key	Operation	Display
⑥	SET	Press the set key.	AUTO setting is set and the display returns to CH 1 gain setting or CH 2 gain setting. 1GA in 2GA in CH 1 gain setting CH 2 gain setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
To Step ⑪			

・In case of SELECT setting

Step	Key	Operation	Display/Result
⑧	SET	Press the set key.	Gain selection display appears. Gain appears on the left side and Bright, DARK, GOOD on the right side. 
	▲ ▼	Select the optimum gain using the UP key or DOWN key.	
⑨	SET	Press the set key.	The selected gain is set.
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
To step ⑪			

・Memory write

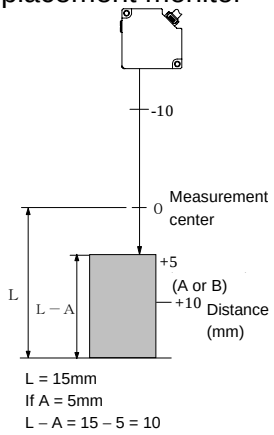
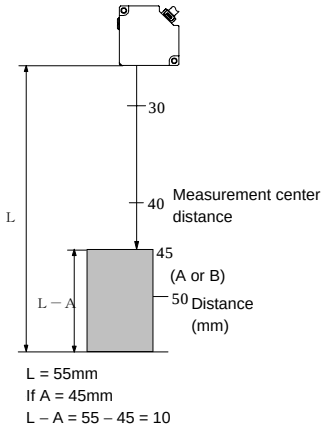
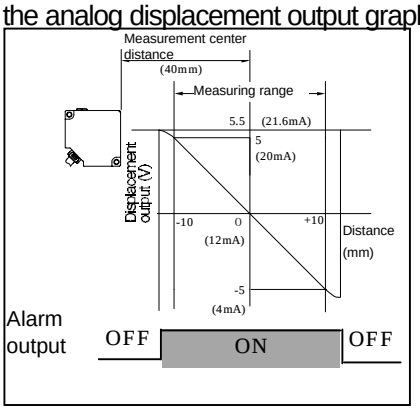
Step	Key	Operation	Display/Result
⑪	SET	Press the set key.	Memory selection display appears.  or  (Note 4)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Return to measurement mode  (Note 5)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) Displayed when sensor head is connected to **LH-CS6(P)** or HEAD 1 side of **LH-CD6(P)**.
3) Displayed when sensor head is connected to HEAD 2 side of **LH-CD6(P)**.
4) For details, refer to page 6-10 '■ **Memory write**'.
5) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ CH 1 / CH 2 calculation setting

In case of single measurement mode, the calculation equation for the sensor head connected to HEAD 1 or HEAD 2 is selected.

Cal. equation	Description	Display
Normal	Normal measurement is done.	nor nL
L – A (CH 1) L – B (CH 2)	・It is selected when the measurement value A (CH 1) or B (CH 2) is to be deducted from a constant L. ・L can be set arbitrarily. (Input up to ±5,000mm is possible.) ・It is convenient for object height measurement, etc. ・The reference position for L differs depending on whether displacement monitor or distance monitor is selected during display setting. Displacement monitor: L is distance from measurement center Distance monitor: L is distance from sensor head. Ex.: **LH-54** Displacement monitor  L = 15mm If A = 5mm L – A = 15 – 5 = 10 Ex.: **LH-54** Distance monitor  L = 55mm If A = 45mm L – A = 55 – 45 = 10 ・For example, when L=0 is set, the analog displacement output graph is as given below. Ex.: **LH-54**  	L-A or L-b

Initial setting: Normal L = 0mm

NOTE
- When 'Normal' is selected, the display offset returns to the initial value.
- L value is common for CH 1 and CH 2.Further, the L value set here is linked to the L value input at page 6-21 '■ **Calculation equation selection**', and at page 6-54 '■ **Display offset setting**'.

REFERENCE
Refer to page 6-45 '■ **Display contents selection**' for displacement monitor and distance monitor.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display/Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
③	SET	Press the set key.	1-CH 2-CH CH 1 setting (Note 2) CH 2 setting (Note 3)
	▲ ▼	Select either CH 1 setting or CH 2 setting by using the UP key or DOWN key.	
④	SET	Press the set key.	1.tYPE 2.tYPE CH 1 calculation setting (Note 2) CH 2 calculation setting (Note 3)
	▲ ▼	Select either CH 1 calculation setting or CH 2 calculation setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	norml or L-A or L-b CH 1 CH 2
	▲ ▼	Select normal, L-A (CH 1), or L-B (CH 2) by using the UP key or DOWN key.	
		In case normal is selected: Go to step ⑥ In case L-A (CH 1) or L-B (CH 2) is selected: Go to ⑧	

・In case of normal setting

Step	Key	Operation	Display/Result
⑥	SET	Press the set key.	Normal is set and the display returns to CH 1 calculation setting or CH 2 calculation setting 1.tYPE 2.tYPE CH 1 calculation setting (Note 2) CH 2 calculation setting (Note 3)
⑦	MODE MODE	Press the mode key twice.	Memory store display appears nEnr Memory store
		To step ⑫	

・In case of L – A or L – B

Step	Key	Operation	Display/Result
⑧	SET	Press the set key.	L value input display appears 
⑨	SET	Press the set key	L value is input
	MODE △ ▽	Input the L value by using the mode key, Up key and DOWN key.	When the input digit is shifted by the mode key, the selected digit blinks. Input the numerical value by using the UP key or DOWN key.
⑩	SET	Press the set key.	The input L value is set and the display returns to CH 1 calculation setting or CH 2 calculation setting  CH 1 calculation setting (Note 2) CH 2 calculation setting (Note 3)
⑪	MODE MODE	Press the mode key twice.	Memory store display appears  Memory store
To step ⑫			

・Memory write

Step	Key	Operation	Display/Result
⑫	SET	Press the set key.	Memory selection display appears.  or  (Note 4)
	△ ▽	Select the memory No. by using the UP key or DOWN key.	
⑬	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 5)

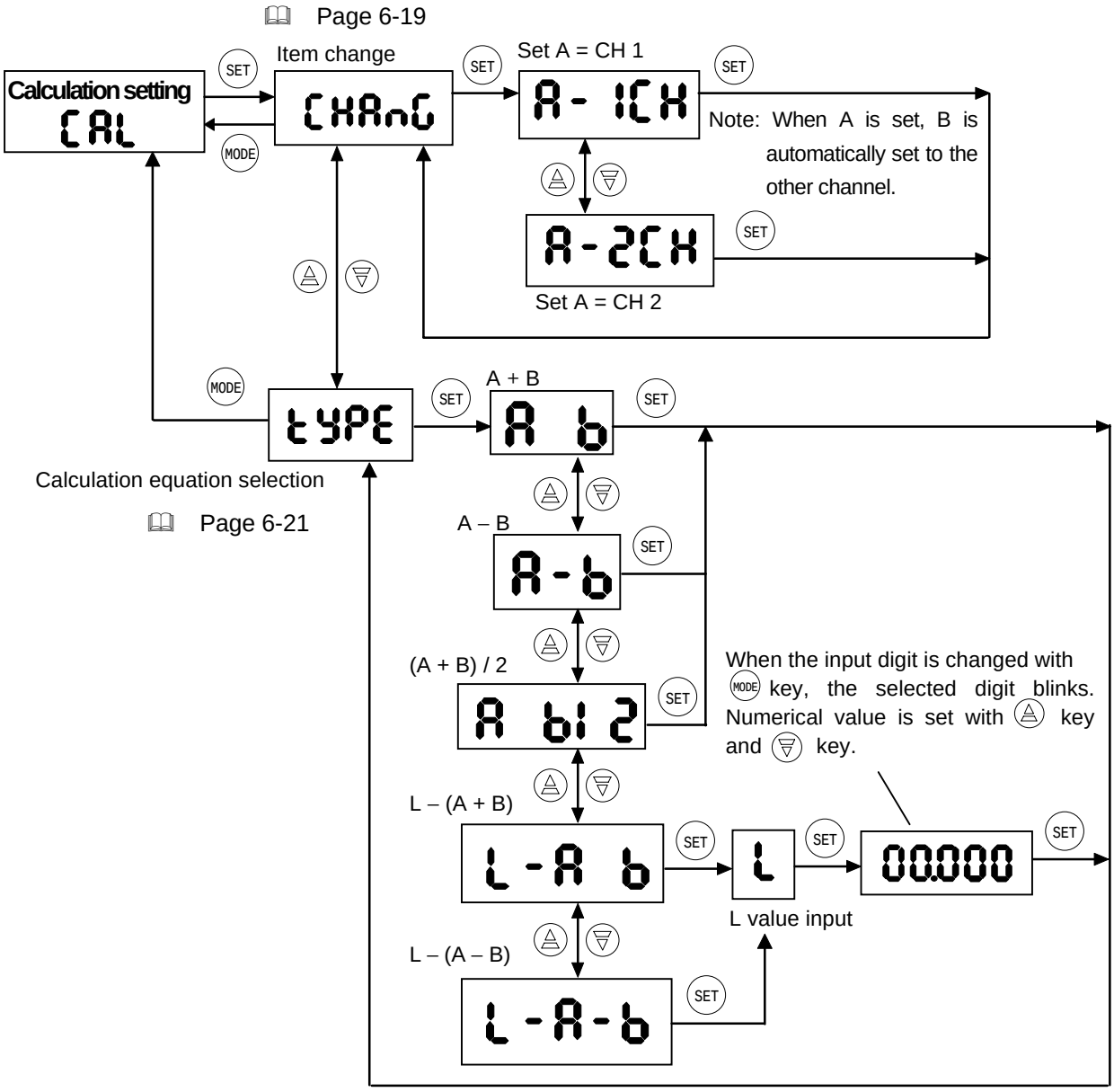
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) Displayed when sensor head is connected to **LH-CS6(P)** or HEAD 1 side of **LH-CD6(P)**.
3) Displayed when sensor head is connected to HEAD 2 side of **LH-CD6(P)**.
4) For details, refer to page 6-10 '■ **Memory write**'.
5) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Calculation setting

Settings regarding each calculation of the calculation mode are done.

- **Configuration for calculation setting**



■ Item change

Set A of calculation equation to CH 1 or CH 2. When A is set, B is automatically set to the other channel.

Initial setting CH 1 (HEAD 1 side) = A
CH 2 (HEAD 2 side) = B

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears. d-03 ~ d-04 u-01 ~ u-16 (Note 1)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
③	SET	Press the set key.	CAL Calculation setting
	▲ ▼	Select calculation setting by using the UP key or DOWN key.	
④	SET	Press the set key.	CHANG Item change
	▲ ▼	Select item change by using the UP key or DOWN key.	
⑤	SET	Press the set key.	A-1CH A = CH 1 A-2CH A = CH 2
	▲ ▼	Select either A=CH 1 or A=CH 2 by using the UP key or DOWN key.	
⑥	SET	Press the set key.	CH for A is set and the display returns to item change. CHANG Item change
⑦	MODE MODE	Press the mode key twice.	Memory store display appears nEnr Memory store
To step ⑧			

・Memory write

Step	Key	Operation	Display/Result
⑧	SET	Press the set key.	Memory selection display appears.
	△ ▽	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

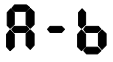
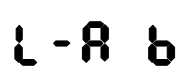
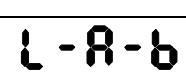
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Calculation equation selection

This function performs calculation on the CH 1 and CH 2 measurement values.

The following types of calculations are available.

Equation	Description	Display
A + B	Measurement values A and B are added.	
A – B	Measurement value B is subtracted from measurement value A.	
(A + B) / 2	Average of measurement values A and B is taken.	
L – (A + B)	Sum of measurement values A and B is subtracted from constant L.	
L – (A – B)	Difference of A and B is subtracted from constant L.	


REFERENCE

Regarding interchange of CH 1 and CH 2 (CH 1 = B, CH 2 = A), refer to page 6-19 '■ **Item change**'.

NOTE

In memory read out, if d-03 is selected, A – B is automatically set. If d-04 is selected, L – (A + B) is automatically set.

- **Analog displacement output diagram in case of calculation**

In case two sensor heads are connected and an equation given above is selected, or when two different types of sensor heads are connected and calculation is performed, the relation between the analog output and the displacement is different from that when measurement is done with only one sensor head. The full scale distance becomes the sum of the full scale distances of the two sensor heads. Depending upon the combination, the full scale distance is as shown in the table below and the analog displacement output diagrams are as shown on the next page.

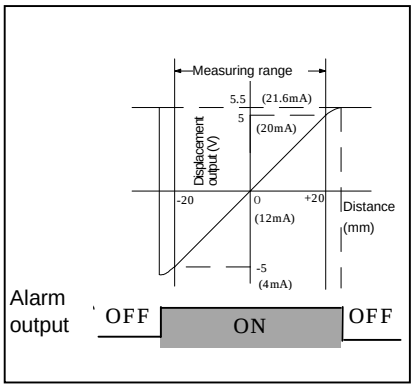
		HEAD 2 side		
		LH-54	**LH-58**	**LH-512**
HEAD 1 side	**LH-54**	40mm (±20mm)	60mm (±30mm)	80mm (±40mm)
	LH-58	60mm (±30mm)	80mm (±40mm)	100mm (±50mm)
	LH-512	80mm (±40mm)	100mm (±50mm)	120mm (±60mm)


REFERENCE

In case of measurement with one sensor head, refer to page 3-11 '**Analog displacement output diagram**'.

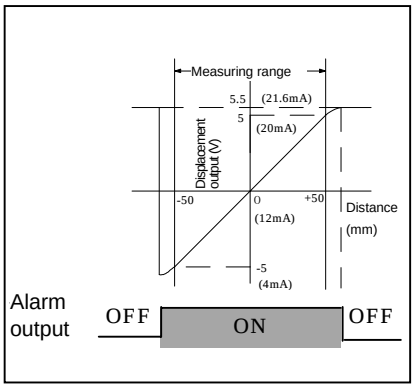
Ex. 1: In case of calculation with 2 Nos. of **LH-54**

Since the full scale distance of **LH-54** is 20mm (±10mm), when calculation is done with two sensor heads, the full scale distance becomes 40mm (±20mm), and the analog displacement output diagram is as shown in the figure below.



Ex. 2: In case of calculation with **LH-58** and **LH-512**

Since the full scale distance of **LH-58** is 40mm (±20mm), and that of **LH-512** is 60mm (±30mm), when they are used in combination, the full scale distance becomes 100mm (±50mm), and the analog displacement output diagram is as shown in the figure below.



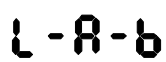
- **Analog output when L – (A + B) or L – (A – B) is selected**

  In Example 1, with two **LH-54** sensor heads connected, if A + B is selected and A + B = 20mm, the measurement value display is 20mm, and the analog output voltage is +5V. If in this condition, L – (A + B) is selected, and L = 0mm, the measurement value display becomes –20mm and the analog output voltage becomes –5V, i.e., + changes to –.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display/Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-03 ~ d-04 or U-01 ~ U-16 (Note 1)
③	SET	Press the set key.	CAL Calculation setting
	▲ ▼	Select the calculation setting by using the UP key or DOWN key.	

④	SET	Press the set key.	 Calculation equation selection
	▲ ▼	Select the calculation equation selection by using the UP key or DOWN key.	
⑤	SET	Press the set key.	 A +B  A – B  (A + B) / 2  L – (A + B)  L – (A – B)
	▲ ▼	Select the calculation equation by using the UP key or DOWN key.	
To step ⑥ in case L – (A + B) or L – (A – B) is selected To step ⑩ in case other equations are selected			

・In case L – (A + B) or L – (A – B) is selected.

Step	Key	Operation	Display/Result
⑥	SET	Press the set key.	L value input display appears. 
⑦	SET	Press the set key.	L value is input.
	MODE ▲ ▼	Input L value by using the mode key, UP key and DOWN key.	When the input digit is shifted by the mode key, the selected digit blinks. Input the numerical value by using the UP key or DOWN key.
⑧	SET	Press the set key.	Input L value is set, and the display returns to calculation equation setting  Calculation equation setting
⑨	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
To step ⑫			

・In case other equations are selected

Step	Key	Operation	Display/Result
⑩	SET	Press the set key.	Selected calculation equation is set and the display returns to calculation equation selection tYPE Calculation equation selection
⑪	MODE MODE	Press the mode key twice.	Memory store display appears nEnr Memory store
To step ⑬			

・Memory write

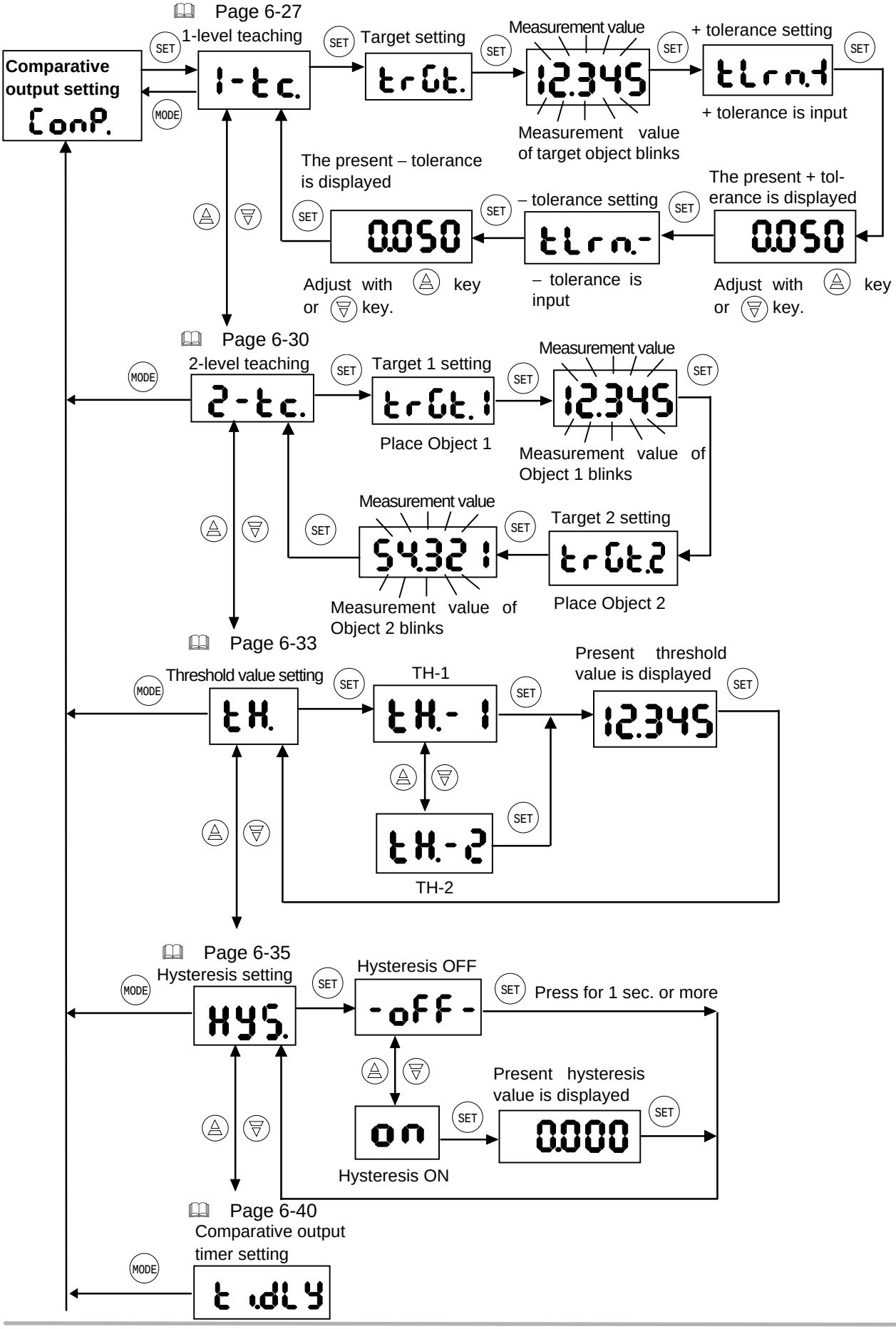
Step	Key	Operation	Display/Result
⑫	SET	Press the set key.	Memory selection display appears. u-01 ~ u-16 or r (Note 2)
	△ ▽	Select the memory No. by using the UP key or DOWN key.	
⑬	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

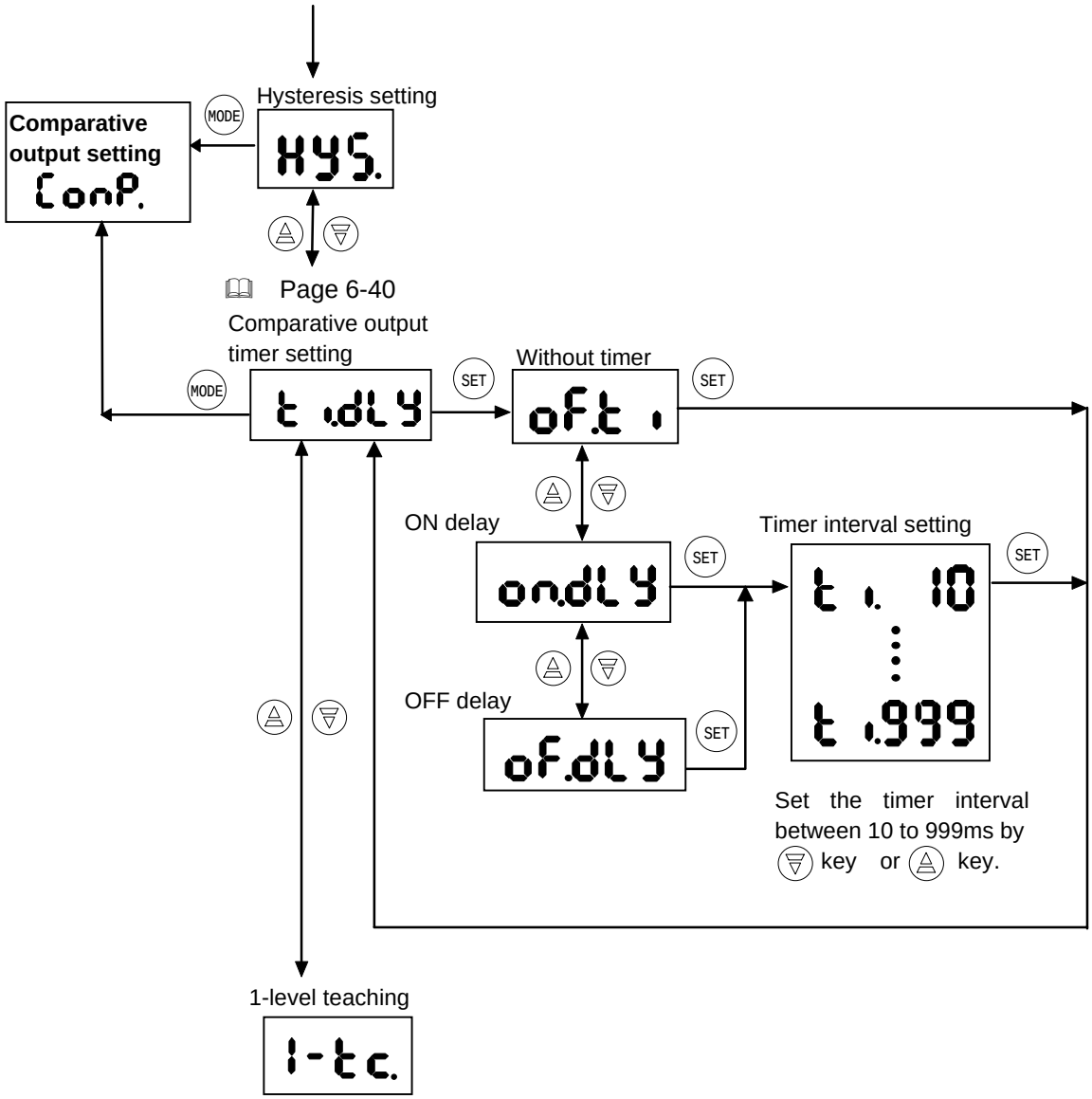
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Comparative output setting

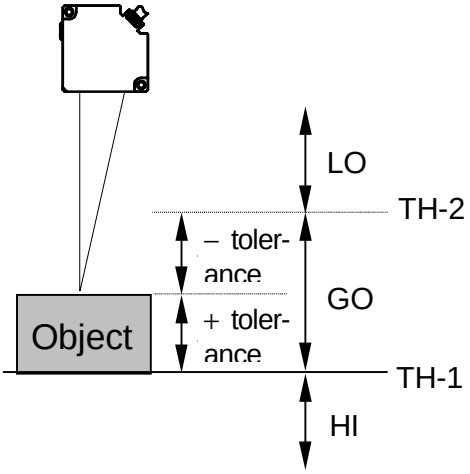
● Comparative output configuration




Hysteresis setting
MODE
Comparative output setting
ConP.
HYS.
Page 6-40
Comparative output timer setting
MODE
t.dLY
SET
Without timer
oFt.
SET
ON delay
ondLY
SET
Timer interval setting
t. 10
t.999
SET
OFF delay
ofdLY
SET
Set the timer interval between 10 to 999ms by key or key.
1-level teaching
1-tc.

■ 1-level teaching

This function is used to automatically determine the threshold value for HI, GO and LO of comparative output by teaching with actual measured objects, etc. The threshold values (TH-1, TH-2) are set by performing 1-level teaching on the desired object and inputting the tolerance values with respect to the measured value.



Initial values TH-1: +15% of full scale from the center measuring distance
TH-2: –15% of full scale from the center measuring distance
+ tolerance: 0
– tolerance: 0

NOTE

- The threshold value set here is linked to page 6-30 '■ **2-level teaching**' and page 6-33 '■ **Threshold value setting**'.
- If fine adjustment of the threshold value is required after the teaching, do it according to page 6-33 '■ **Threshold value setting**'.
- + tolerance or – tolerance can be set. However, the higher value is set to the HI side (TH-1).
- Teaching cannot be done in the BUSY state with the BUSY input ON. The teaching data becomes the upper limit of + F.S.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display/Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL Memory call
②	SET	Press the set key.	Memory selection display appears d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
③	SET	Press the set key.	ConP. Comparative output setting
	▲ ▼	Select comparative output setting by using the UP key or DOWN key.	
④	SET	Press the set key.	1-tc. 1-level teaching
	▲ ▼	Select 1-level teaching by using the UP key or DOWN key.	
⑤	SET	Press the set key.	Target setting display appears. Place the object for teaching. trGt. Target setting
⑥	SET	Press the set key.	Measurement value of object is displayed. 12.345 (Note 2)
⑦	SET	Press the set key.	+ tolerance setting display appears. tLrn.1 + tolerance setting
⑧	SET	Press the set key.	Adjust + tolerance. 00.001
	▲ ▼	Adjust the + tolerance by using the UP key or DOWN key.	
⑨	SET	Press the set key.	– tolerance setting display appears. tLrn.- – tolerance setting
⑩	SET	Press the set key.	Adjust – tolerance. -00.001
	▲ ▼	Adjust the – tolerance by using the UP key or DOWN key.	

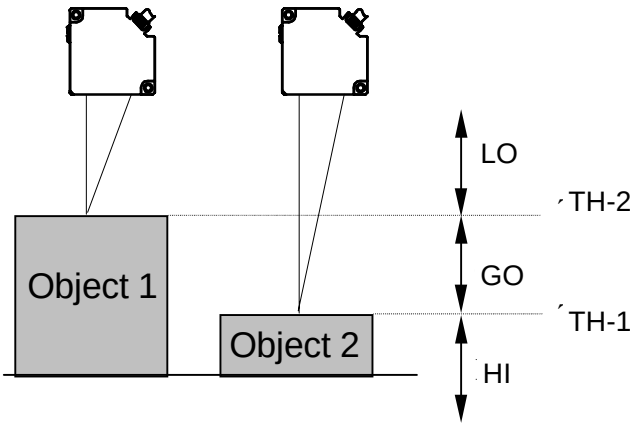
⑪	SET	Press the set key.	Threshold level and tolerance is set and display returns to 1-level teaching  1-level teaching
⑫	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
⑬	SET	Press the set key.	Memory selection display appears.  or  (Note 3)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
⑭	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 5)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) If the display is set to comparative decision monitor, HI, GO or LO is displayed. In case it is desired to display the present measurement value, change the setting to either displacement monitor or distance monitor. (For details of the setting, refer to page 6-45 '■**Display contents selection**'.)
3) For details, refer to page 6-10 '■ **Memory write**'.
4) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ 2-level teaching

This function is used to automatically determine the threshold value for HI, GO and LO of comparative output by teaching with actual measured objects, etc. The threshold values (TH-1, TH-2) are set by performing 2-level teaching on the desired object.



Initial set value TH-1: +15% of F. S. from center measuring distance
TH-2: –15% of F. S. from center measuring distance

NOTE

- The threshold value set here is linked to page 6-27 '■ **1-level teaching**' and page 6-33 '■ **Threshold value setting**'.
- If fine adjustment of the threshold value is required after the teaching, do it according to page 6-33 '■ **Threshold value setting**'.
- Threshold values TH-1 and TH-2 can be set as TH-1 > TH-2 or TH-1<TH-2. However, the higher value is set to the HI side.
- Teaching cannot be done in the BUSY state with the BUSY input ON. The teaching data becomes the upper limit of + F.S.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display/Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	ConP. Comparative output setting.
	▲ ▼	Select the comparative output setting by using the UP key or DOWN key.	
④	SET	Press the set key.	2-tc. 2-level teaching
	▲ ▼	Select 2-level teaching by using the UP key or DOWN key.	
⑤	SET	Press the set key.	Target 1 setting display appears. Object 1 to be used in teaching is placed. trGt.1 Target 1 setting
⑥	SET	Press the set key.	The measurement value of Object 1 is displayed. 12.345 (Note 2)
⑦	SET	Press the set key.	Target 2 setting display appears. Object 2 to be used in teaching is placed. trGt2 Target 2 setting
⑧	SET	Press the set key.	The measurement value of Object 2 is displayed. 54.321 (Note 2)
⑨	SET	Press the set key.	The threshold value is displayed and the display returns to the 2-level teaching display. 2-tc. 2-level teaching

Step	Key	Operation	Display / Result
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
⑪	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	 or  (Note 3)
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 4)

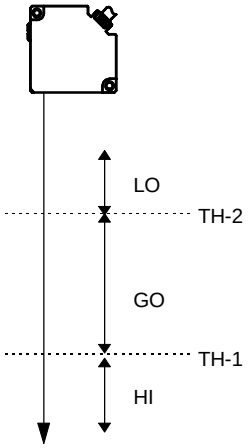
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) If the display is set to comparative decision monitor, HI, GO or LO is displayed. In case it is desired to display the present measurement value, change the setting to either displacement monitor or distance monitor. (For details of the setting, refer to page 6-45 '■ **Display contents selection**'.)
3) For details, refer to page 6-10 '■ **Memory write**'.
4) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Threshold value setting

The comparative results are output based on the set threshold values. This device is equipped with three independent outputs (HI, GO, LO).

The threshold value is set for two places, and depending on the measurement value, one of the outputs, either HI, GO or LO, turns ON.



Initial setting

TH-1: +15% of full scale from the measurement center

TH-2: –15% of full scale from the measurement center

HI	TH-1 ≤ Measurement value
GO	TH-2 < Measurement value < TH-1
LO	TH-2 ³ Measurement value

NOTE

- Threshold values TH-1 and TH-2 can be set as TH-1 > TH-2 or TH-1<TH-2. However, the higher value is set to the HI side.
- The threshold value set here is linked to page 6-27 '■ **1-level teaching**' and page 6-30 '■ **2-level teaching**'.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL L Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u- 16 (Note 1)

③	SET	Press the set key.	ConP. Comparative output setting.
	▲ ▼	Select the comparative output setting by using the UP key or DOWN key.	
④	SET	Press the set key.	tH. Threshold value setting
	▲ ▼	Select the threshold value setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	tH.-1 or tH.-2
	▲ ▼	Select the TH-1 or TH-2 threshold value setting by using the UP key or DOWN key.	
⑥	SET	Press the set key.	The current threshold value is displayed. 12.345 (Note 2)
	▲ ▼	Adjust the threshold value by using the UP key or DOWN key.	
⑦	SET	Press the set key.	The threshold value is set and the display returns to the threshold value setting display. tH. Threshold value
⑧	MODE MODE	Press the mode key twice.	Memory store display appears. mEnr Memory store
⑨	SET	Press the set key.	Memory selection display appears. u-01 ~ u-16 or r (Note 3)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
⑩	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 4)

NOTE

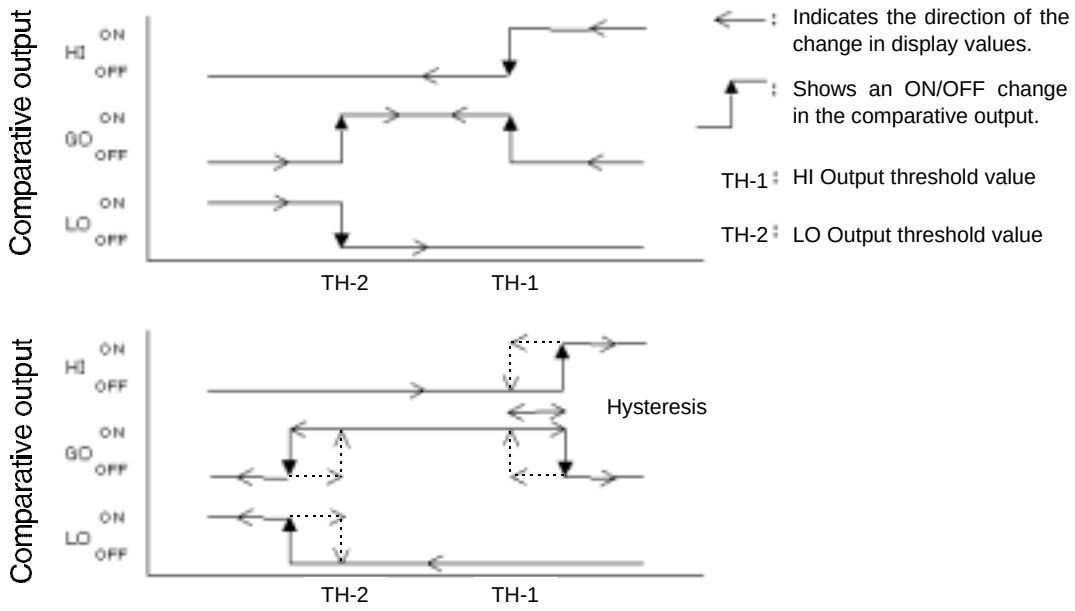
1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) If the display is set to comparative decision monitor, HI, GO or LO is displayed. In case it is desired to display the present measurement value, change the setting to either displacement monitor or distance monitor. (For details of the setting, refer to page 6-45 '■ **Display contents selection**'.)
3) For details, refer to page 6-10 '■ **Memory write**'.
4) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Hysteresis setting

This is a function that sets the display value range when the comparative output GO is ON (when HI and LO are OFF). It is effective in preventing chattering of the comparative output.

If the Hysteresis setting is OFF

- If the hysteresis setting is set on OFF, hysteresis exists when the GO output changes from ON to OFF, and when the HI output or LO output changes from OFF to ON.
- The size of hysteresis is fixed at 0.15% of the setting range full scale.



NOTE

- The threshold values TH-1 and TH-2 cannot be set individually for each device.

If the Hysteresis Setting is ON

If the hysteresis setting is set to ON, the size of the hysteresis and its direction can be set.

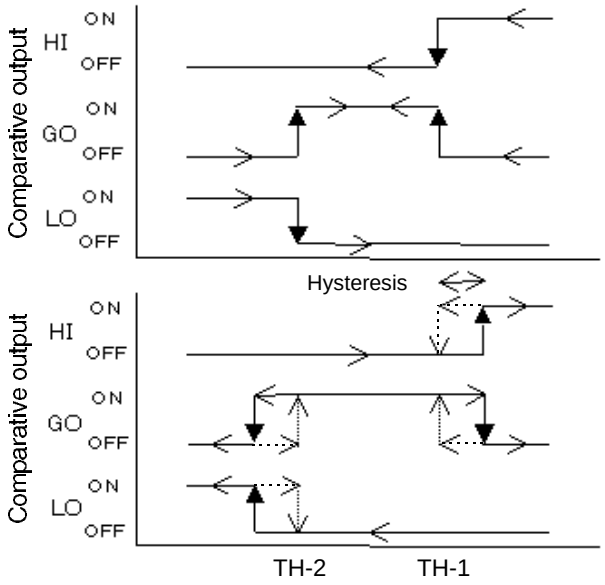
(Size of Hysteresis)

Hysteresis can be set within a range of 0 to ±5% F.S.

<Hysteresis Direction>

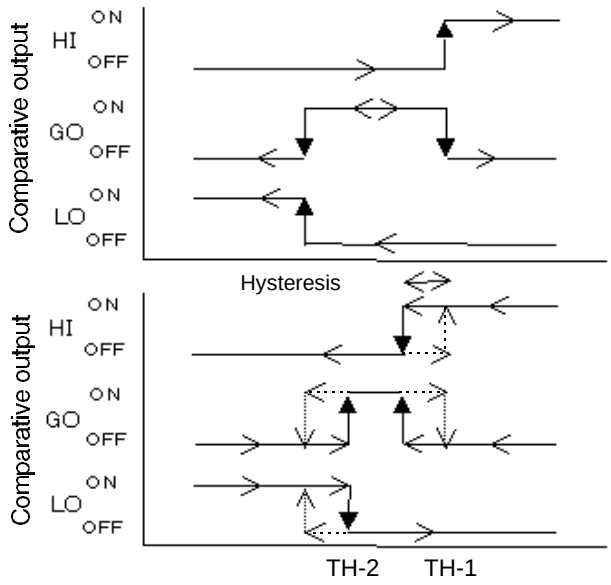
If the hysteresis value is '+'

Hysteresis exists when the GO output changes from ON to OFF, and when the HI output and LO output change from OFF to ON.



If the Hysteresis value is '–'

Hysteresis exists when the GO output changes from OFF to ON and when the HI output and LO output change from ON to OFF.



NOTE The threshold values TH-1 and TH-2 cannot be set individually for each device.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for one sec. or more.	CALL Memory call.
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	ConP. Comparative output setting.
	▲ ▼	Select the comparative output setting by using the UP key or DOWN key.	
④	SET	Press the set key.	HYS. Hysteresis setting
	▲ ▼	Select the hysteresis setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	on or -oFF-
	▲ ▼	Select the hysteresis setting ON or OFF by using the UP key or DOWN key.	
If ON is selected, go to step ⑥. If OFF is selected, go to step ⑨.			

・ If ON is selected

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	The current hysteresis value is displayed.
	▲ ▼	Adjust the hysteresis value by using the UP key or DOWN key.	0.000
⑦	SET	Press the set key.	The hysteresis value is set and the display returns to the hysteresis setting display. HYS. Hysteresis setting
⑧	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
Go to Step ⑪.			

・ If OFF is selected

Step	Key	Operation	Display / Result
⑨	SET 1 sec. or more	Press the set key.	The hysteresis setting is set to OFF and the display returns to hysteresis setting. HYS. Hysteresis setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
Go to Step ⑪.			

・ Memory write

Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

NOTE

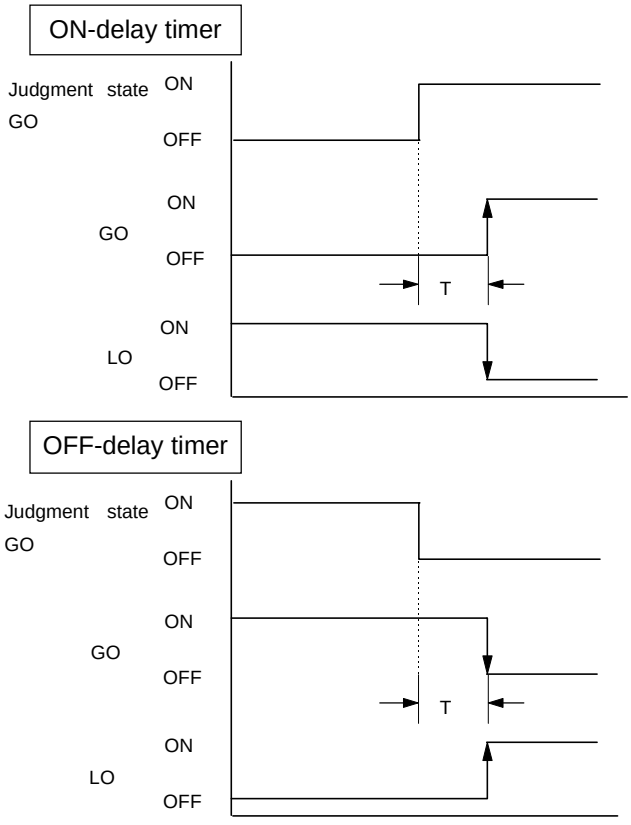
1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Comparative output timer setting

This is a function which applies a delay to the comparative output (GO) and the alarm output. This device is equipped with an ON-delay timer, which is convenient for detecting objects that take a long time to pass, as well as an OFF-delay timer, which is convenient for connected devices that have a slow response time. The timer can be selected from 19 different settings between 10 to 1,000ms (at 10ms intervals up to 100ms, and 100ms intervals between 100 to 1,000ms).

- On-delay timer: Neglects short detection signals.
- Off-delay timer: Extends output for a fixed period of time.
- Off timer: Timer is not used.

Initial setting: Off Timer



NOTE

- The ON-delay timer is set when turning ON of Comparative Output GO is to be delayed and the OFF-delay timer is set when turning OFF of Comparative Output GO is to be delayed.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for one sec. or more.	CAL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 (Note 1) u-01 ~ u-16
③	SET	Press the set key.	CONP. Comparative output setting.
	▲ ▼	Select the comparative output setting by using the UP key or DOWN key.	
④	SET	Press the set key.	t.dLY Comparative output timer setting
	▲ ▼	Select the comparative output timer setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	oFt : Off-timer onDLY ON-delay oFDLY OFF-delay
	▲ ▼	Select the OFF-timer, ON-delay or OFF-delay settings by using the UP key or DOWN key.	
If OFF-timer is selected, go to Step ⑥. If ON-delay or OFF-delay is selected, go to Step ⑧.			

・ If OFF is selected.

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	OFF-timer is set, and the display returns to the comparative output timer setting display. t.dLY Comparative Output Timer Setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
Go to Step ⑪.			

・ If ON-delay or OFF-delay is selected.

Step	Key	Operation	Display / Result
⑧	SET	Press the set key.	
	▲ ▼	Select the desired timer time setting by using the UP or DOWN key.	
⑨	SET	Press the set key.	The selected timer time is set and the display returns to the comparative output timer setting display.  Comparative output timer setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

・ Writing to Memory

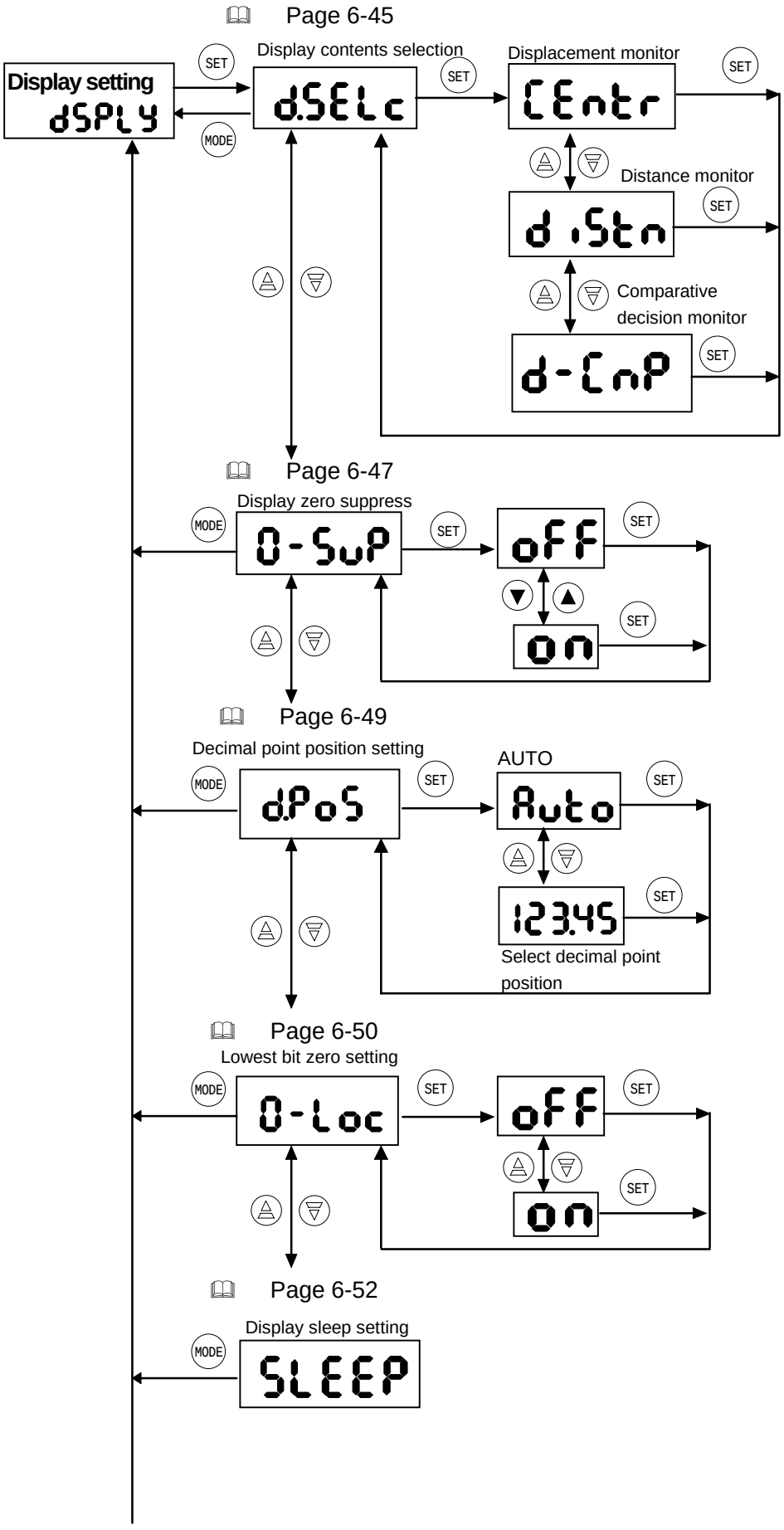
Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP or DOWN key.	 or  (Note 2)
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 3)

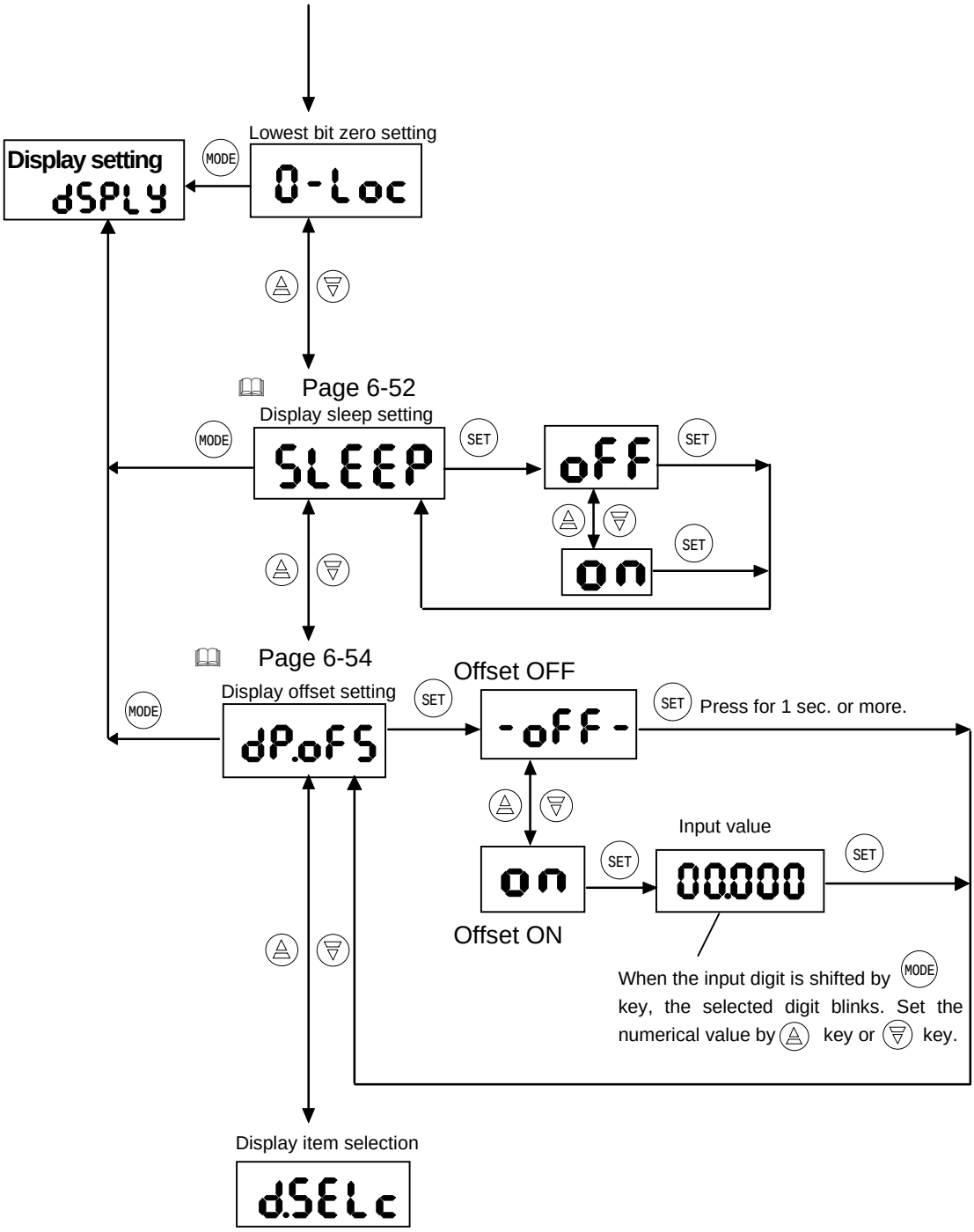
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Display setting selection

● Display setting configuration




Lowest bit zero setting
Display setting
dSPLY
MODE
0-Loc
Page 6-52
Display sleep setting
MODE
SLEEP
SET
oFF
SET
SET
on
SET
Page 6-54
Offset OFF
Display offset setting
MODE
dP.oFS
SET
-oFF-
SET
Press for 1 sec. or more.
Input value
on
SET
00.000
SET
Offset ON
When the input digit is shifted by MODE key, the selected digit blinks. Set the numerical value by key or key.
Display item selection
d.SELc

■ Display contents selection

This function switches the use of the measurement value display to displacement monitor, distance monitor or comparative decision monitor.

Displacement Monitor:

This displays the measurement center as '0.' The NEAR side is the – side and the FAR side is the + side.

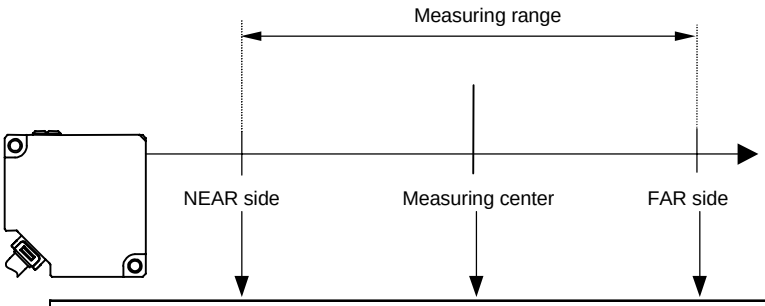
Distance Monitor:

This displays the distance from the sensor head to the measured object.

Comparative Decision Monitor:

This displays the current comparative decision output result, either HI, GO or LO.

Initial setting: Displacement Monitor



Displacement monitor			
	NEAR side	Measuring center	FAR side
LH-54	–10.000	00.000	10.000
LH-58	–20.000	00.000	20.000
LH-512	–30.000	00.000	30.000

Distance monitor			
	NEAR side	Measuring center	FAR side
LH-54	30.000	40.000	50.000
LH-58	60.000	80.000	99.999
LH-512	90.000	120.00	150.00

Comparative decision monitor	
Comparative decision output	Display
HI	
GO	
LO	

NOTE

- If the comparative decision monitor is set, HI, GO, or LO are shown in the display instead of the measurement values in case of '■ **1-level teaching**', page 6-27, '■ **2-level teaching**', page 6-30 and '■ **Threshold value setting**', page 6-33.
- If '■ **0-ADJ**', page 6-112, is executed, the measurement value becomes '0' and the display is automatically set to displacement monitor.

Setting procedure

Key operation from the measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	dSPLY Display setting
	▲ ▼	Select the display setting by using the UP key or DOWN key.	
④	SET	Press the set key.	d.SELc Display contents selection
	▲ ▼	Select the display contents selection by using the UP key or DOWN key.	
⑤	SET	Press the set key.	CEntr Displacement monitor d.Stn Distance monitor d-CnP Comparative decision monitor
	▲ ▼	Select either displacement, distance or comparative decision monitor by using the UP key or DOWN key.	
⑥	SET	Press the set key..	The selected monitor is set, and the display returns to the display contents selection display d.SELc Display contents selection
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Display zero suppress

This function clears the '0' in the higher order digit and displays numerical values without it.

This function sets the zero suppress ON/OFF.

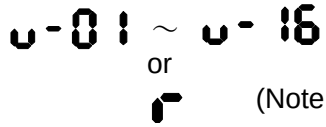
<Example>

Zero suppress OFF		Zero suppress ON
01.234	→	1.234
001.23	→	1.23

Initial setting: OFF

Setting Procedure Key operation from the measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL L Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	dSPLY Display setting
	▲ ▼	Select the display setting by using the UP key or DOWN key.	
④	SET	Press the set key.	0-SuP Display zero suppress
	▲ ▼	Select display zero suppress by using the UP key or DOWN key.	
⑤	SET	Press the set key.	on or oFF
	▲ ▼	Select ON or OFF by using the UP key or DOWN key.	
⑥	SET	Press the set key.	ON or OFF state is set, and the display returns to the display zero suppress display. 0-SuP Display zero suppress
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store

⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	 (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Decimal point position setting

This function enables the decimal point position of the measurement value to be set.
In the AUTO setting, the decimal point is shifted automatically so that the value of the higher order digit is displayed.

Initial setting: AUTO

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	dSPLY Display setting
	▲ ▼	Select the display setting by using the UP key or DOWN key.	
④	SET	Press the set key.	d.PoS Decimal point position shift setting
	▲ ▼	Select the decimal point position shift setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	Auto or 123.45 etc.
	▲ ▼	Select AUTO or the desired decimal point position by using the UP key or DOWN key.	
⑥	SET	Press the set key.	AUTO or the desired decimal point position is set, and the display returns to the decimal point position shift setting display. d.PoS Decimal point position shift setting.
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store

⑧	(SET)	Press the set key.	Memory selection display appears.
	(▲) (▽)	Select the memory No. by using the UP or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑨	(SET) 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 123.45 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Lowest bit zero setting

This is a function that fixes the display of the lowest bit to '0.'

<Example>

12.345 → 12.340

123.45 → 123.40

Initial setting: OFF

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	(MODE) 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	(SET)	Press the set key.	Memory selection display appears.
	(▲) (▽)	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	(SET)	Press the set key.	dSPLY Display setting
	(▲) (▽)	Select the display setting by using the UP key or DOWN key.	

④	SET	Press the set key.	0-Loc Lowest bit zero setting
	▲ ▼	Select the lowest bit zero setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	on or oFF
	▲ ▼	Select either ON or OFF by using the UP key or DOWN key.	
⑥	SET	Press the set key.	ON or OFF state is set and the display returns to the lowest bit zero setting display. 0-Loc Lowest bit zero setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.340 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Display sleep setting

This function enables the display contents in the measurement value display to be turned off. When the display sleep ON setting is selected, press the set key for 1 sec. or more if you desire to see the measurement value. The measurement value is displayed temporarily.

Initial setting: OFF

NOTE

- The display sleep setting is preserved even when the power is turned OFF.
- The display sleep operation is enabled only in the measurement mode.
- Temporary cancellation of display sleep is enabled only in the measurement mode.

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL L Memory call
②	SET	Press the set key.	Memory selection display appears.
	△ ▽	Select the memory No. by using the UP key or DOWN key.	d-01 ～ d-04 or U-01 ～ U- 16 (Note 1)
③	SET	Press the set key.	dSPLY Display setting
	△ ▽	Select the display setting by using the UP key or DOWN key.	
④	SET	Press the set key.	SLEEP Display sleep setting
	△ ▽	Select the display sleep setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	on or oFF
	△ ▽	Select either ON or OFF by using the UP key or DOWN key.	
⑥	SET	Press the set key.	ON or OFF state is set and the display returns to the display sleep setting display. SLEEP Display sleep setting

⑦	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	 or  (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode, and the display is put off. (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Display offset setting

This function changes the display value, for a given measurement value, to the desired value.

Input the desired offset amount. L can be set as desired. (Any value up to ± 5,000 mm can be input.)

Display value =

Measurement value + Offset amount (L)

<Example>

Current measurement value: 5.000

If we input 15 as the Offset L value:

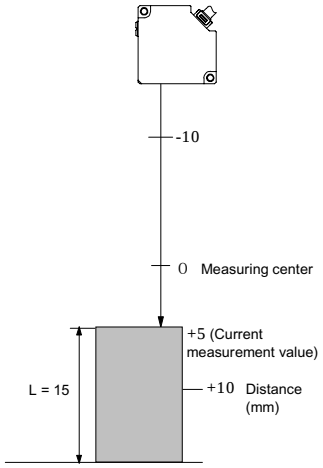
The display value becomes 20.000.

Initial setting: OFF

L = 0 mm

LH-54

(In case of displacement monitor)



NOTE

- The offset amount input here is linked to the constant L value input in '■ **CH1 / CH2 calculation setting**', page 6-15, and '■ **Calculation equation selection**', page 6-21.
- If this function is set to the OFF state, the display offset returns to the initial setting value.

REFERENCE

Refer to page 6-45, '■ **Display contents selection**', for details of the displacement monitor.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	dSPLY Display setting
	▲ ▼	Select the display setting by using the UP key or DOWN key.	
④	SET	Press the set key.	dP.oFS Display offset setting
	▲ ▼	Select the display offset setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	on or -oFF-
	▲ ▼	Select either ON or OFF by using the UP key or DOWN key.	
		If OFF is selected, go to Step ⑥. If ON is selected, go to Step ⑧.	

・ If OFF is selected.

Step	Key	Operation	Display / Result
⑥	SET 1 sec. or more.	Press the set key.	ON or OFF state is set and the display returns to the display offset setting screen. dP.oFS Display offset setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
		Go to Step ⑪.	

・ If ON is selected

Step	Key	Operation	Display / Result
⑧	SET	Press the set key.	If the input digit is shifted using the mode key, the selected digit blinks in the display. Set the numerical value using the UP or DOWN key.
	MODE △ ▽	Select the amount of offset by using the UP or DOWN key.	
⑨	SET	Press the set key.	The input offset amount is set and the display returns to the display offset setting display. dP.oFS Display offset setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
Step ⑪.			

・ Writing to Memory

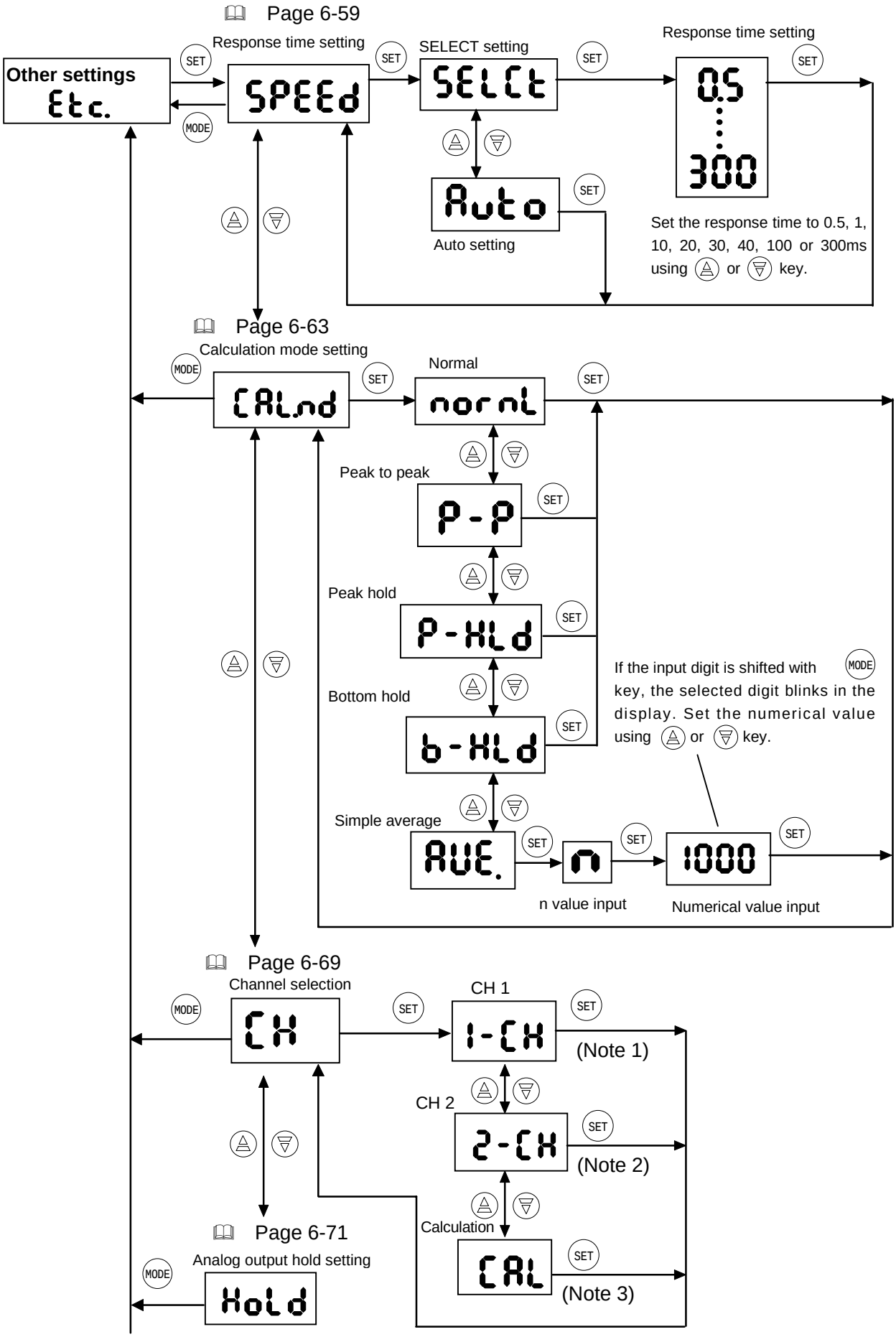
Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears. u-01 ～ u-16 or r (Note 2)
	△ ▽	Select the memory No. by using the UP or DOWN key.	
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

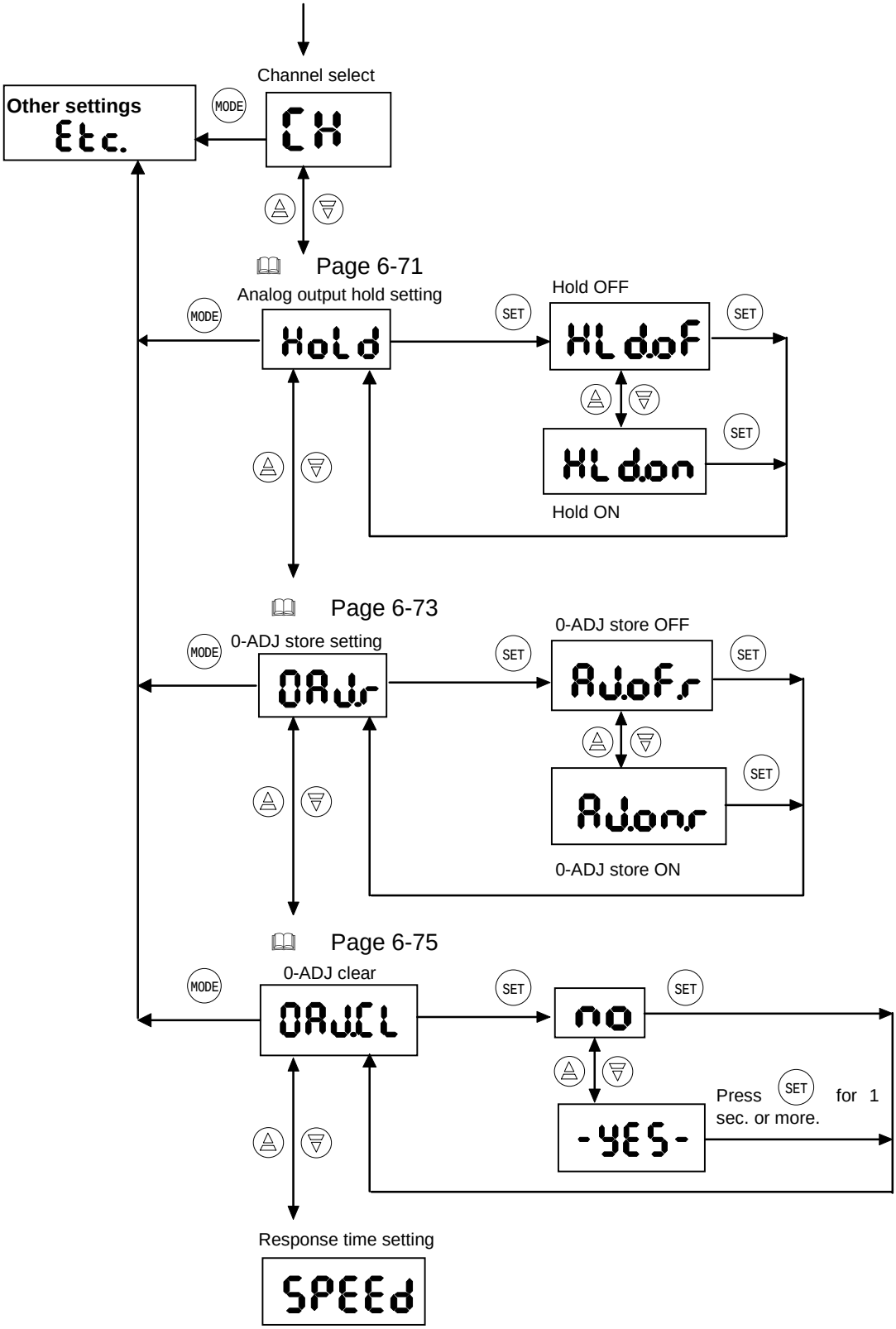
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Other settings

● Configuration of other settings





NOTE

1) Displayed if the sensor head is connected to **LH-CS6 (P)** or the HEAD 1 side of **LH-CD6 (P)**.
2) Displayed if the sensor head is connected to the HEAD 2 side of **LH-CD6 (P)**.
3) Displayed if the sensor heads are connected to both the HEAD 1 side and HEAD 2 side of **LH-CD6 (P)**.

■ Response time setting

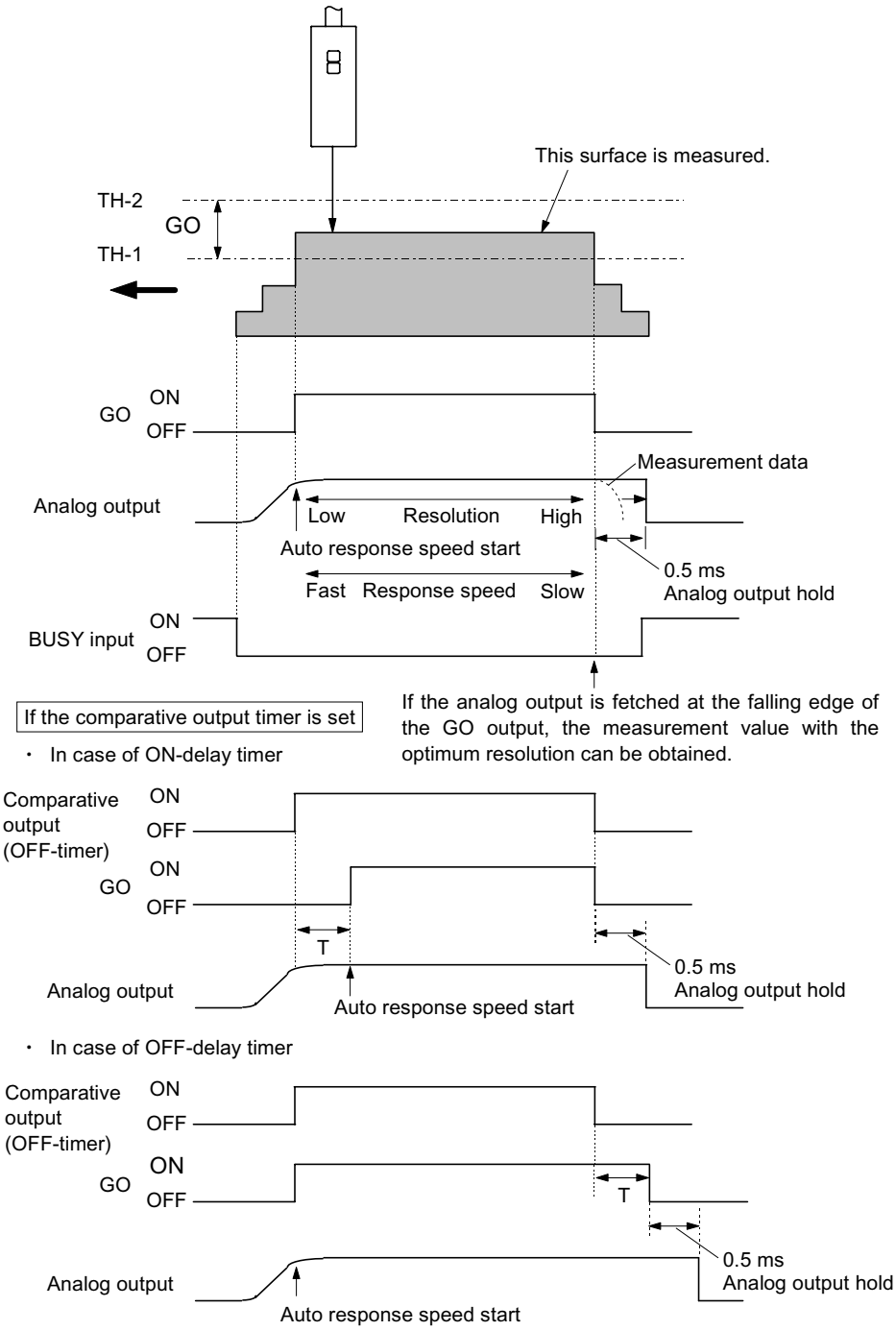
This function selects the response time.

In the SELECT setting, the response time can be selected from 8 different steps, 0.5, 1, 10, 20, 30, 40, 100 or 300ms. The resolution changes depending on the selected response time. Set the response time in consideration of the necessary response speed and resolution.

Also, if the AUTO setting is selected, the response time is selected in accordance with the measured object.

- For measuring the displacement accurately:
  Set to slow response time. (High resolution)
- For fast response
  Set to fast response time. (Low resolution)

Initial Setting: SELECT 300ms



NOTE

- For **LH-CD6 (P)**, this is the response time for CH 1 or CH 2 setting. The response time for calculation setting is twice the selected time. Also, take care that when the response time is set to AUTO, the linearity, resolution and the response time would vary.
- If set on AUTO, only Normal can be selected in '■ **Calculation mode setting**', page 6-63. Also, if a mode other than Normal is selected in the calculation mode setting, AUTO cannot be set.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	Etc. Other settings
	▲ ▼	Select 'Other settings' by using the UP key or DOWN key.	
④	SET	Press the set key.	SPEEd Response time setting
	▲ ▼	Select the response time setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	SELCt SELECT setting / Auto AUTO setting
	▲ ▼	Select either AUTO or SELECT setting by using the UP key or DOWN key.	
		If AUTO is selected, go to Step ⑥. If SELECT is selected, go to Step ⑧.	

・ If AUTO is set

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	AUTO setting is set and the display returns to the response time setting display. SPEEd (Note 2) Response time setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store
		Go to Step ⑪.	

・ If SELECT is set

Step	Key	Operation	Display / Result
⑧	SET	Press the set key.	Response time selection display appears. 
	▲ ▼	Select the optimum response time by using the UP key or DOWN key.	
⑨	SET	Press the set key.	The selected response time is set.
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

・ Memory write

Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears.  or (Note 3)
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 4)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) If this function is set to AUTO, it becomes impossible to select any calculation mode settings (p. 6-63) except Normal. Also, if a mode other than Normal is selected in the calculation mode setting, it cannot be set on AUTO.
3) For details, refer to page 6-10 '■ **Memory write**'.
4) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

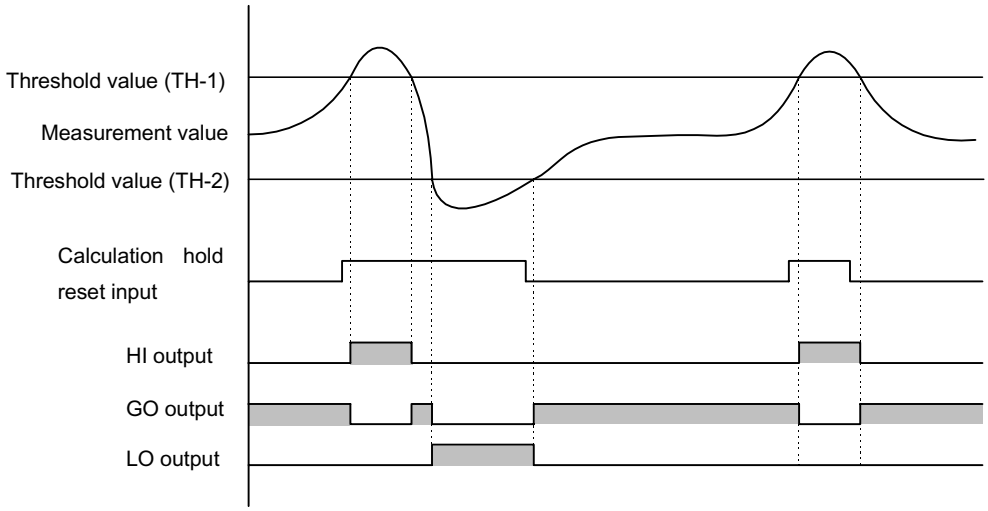
■ Calculation mode setting

This device is equipped with 5 types of calculation modes. Various measurements are possible through a combination of the three input signals: strobe output, BUSY input and calculation hold reset input.

Initial setting: Normal

- **Normal**

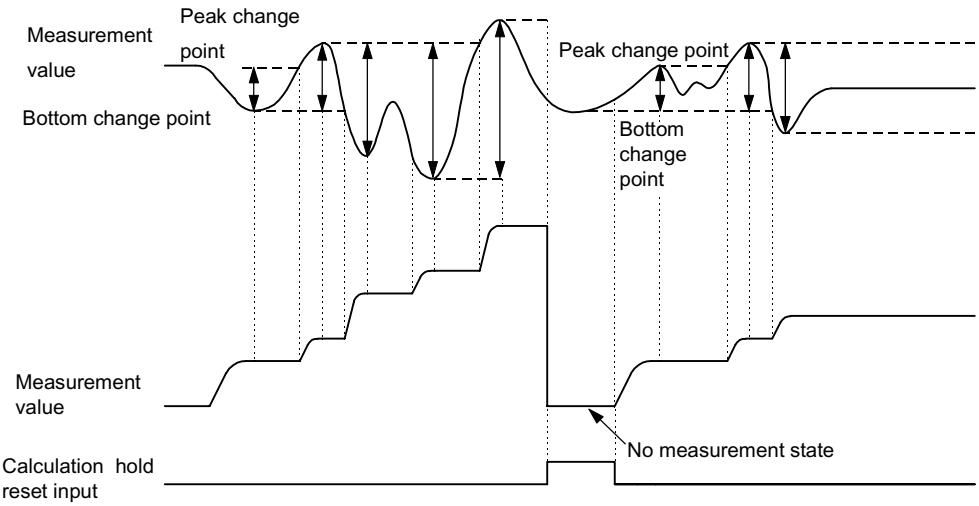
Measurement is performed continuously, and the display value and comparative output are updated at all times.



NOTE The calculation hold reset input is disabled.

- **Peak to Peak**

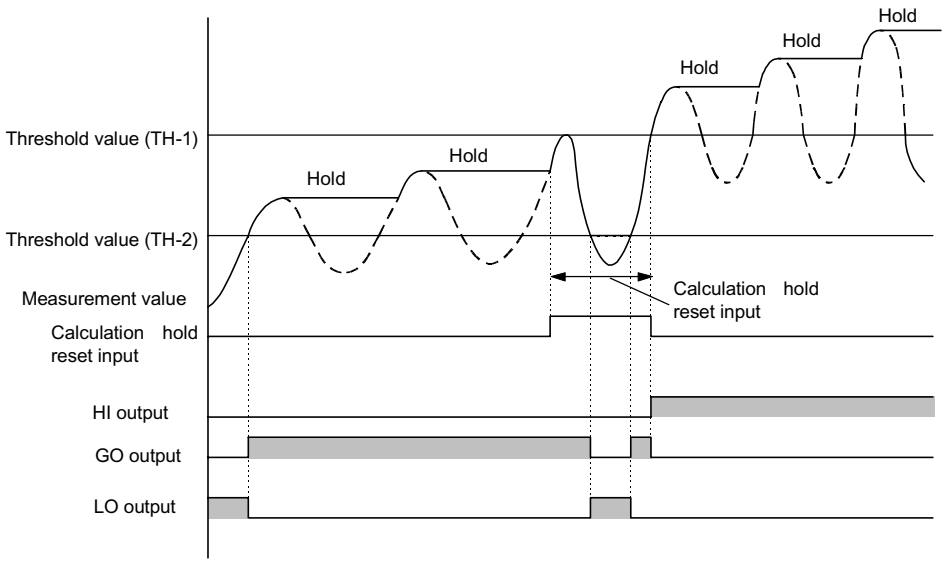
The difference between the maximum value and the minimum value in the data during the measuring period is updated.



NOTE No measurement is done during the calculation hold reset input interval.

- **Peak Hold**

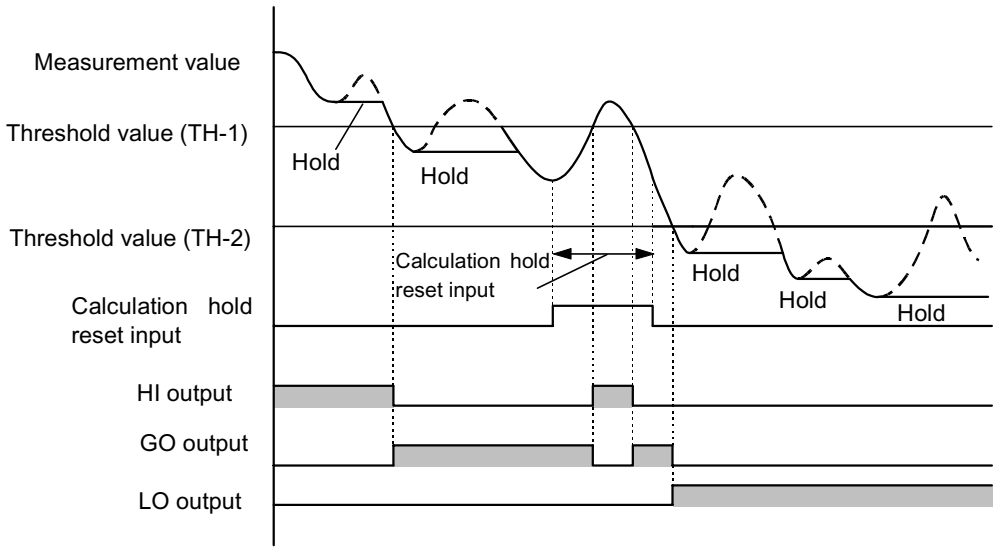
  Holds the maximum value of the data during the measuring period.



NOTE During the calculation hold reset period, normal measurement is done.

- **Bottom Hold**

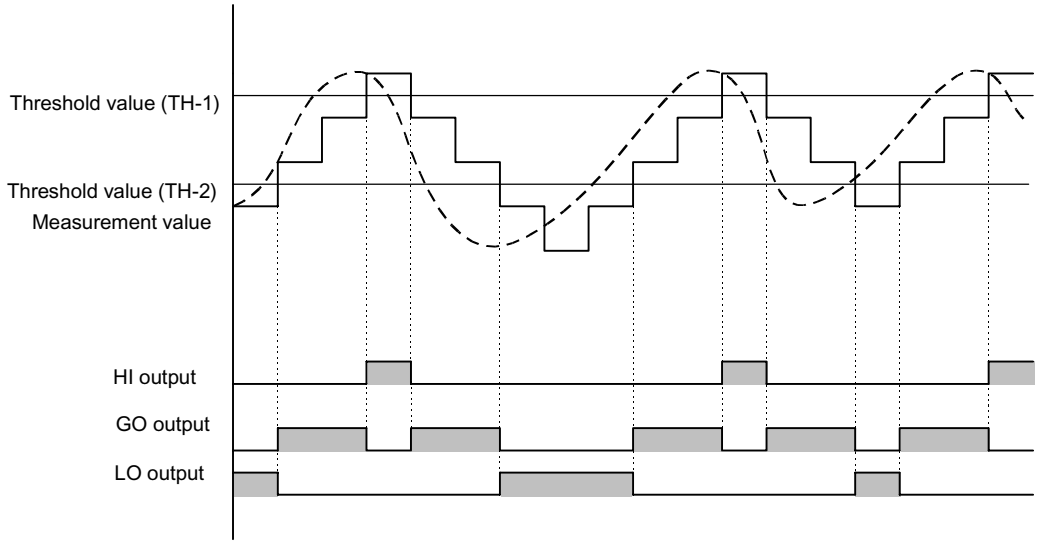
  Holds the minimum value in the data during the measuring period.



NOTE During the calculation hold reset period, normal measurement is done.

- **Simple average**

  This is the simple average over the number of times the data is set during the measuring period. The upper limit for the number of settings is 1,024 times.



NOTE

・Do not input the calculation hold reset input. If this is input, the measurement value will be fixed on the + side's full scale value, the comparative output will be HI and the analog output will be +5.5 V.

NOTE

・If AUTO is set at '■ **Response time setting**', page 6-59, only Normal can be selected. Also, if a mode other than Normal is selected, AUTO cannot be set in response time setting.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or U-01 ~ U-16 (Note 1)
③	SET	Press the set key.	Etc. Other settings
	▲ ▼	Select 'Other settings' by using the UP key or DOWN key.	
④	SET	Press the set key.	CALmd Calculation mode setting
	▲ ▼	Select the measurement mode by using the UP key or DOWN key.	
⑤	SET	Press the set key.	nornL Normal P-P Peak to peak P-HLd Peak hold b-HLd Bottom Hold AVE. Simple average (Note 2)
	▲ ▼	Select the measurement mode by using the UP key or DOWN key.	
		If a setting other than simple average is selected: Go to Step ⑥. If simple average is selected: Go to Step ⑧.	

・ If a setting other than simple average is selected.

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	The selected calculation mode is set and the display returns to the calculation mode setting.  Calculation mode setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑫.			

・ If simple average is selected

Step	Key	Operation	Display / Result
⑧	SET	Press the set key.	The display changes to the n (number of average times) input display. 
⑨	SET	Press the set key.	Input n.
	MODE △ ▽	Press the mode key, then input the L value by using the UP key or DOWN key.	If the input digit is shifted using the mode key, the digit that is selected will blink in the display. Fix the numerical value using the UP key or DOWN key.
⑩	SET	Press the set key.	n is set, and the display returns to the calculation mode setting display.  Calculation mode setting
⑪	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑫.			

・ Memory write

Step	Key	Operation	Display / Result
⑫	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP or DOWN key.	u-01 ～ u-16 or r (Note 3)
⑬	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 4)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) If this function is set to AUTO, it becomes impossible to select any calculation mode settings (p. 6-63) except Normal. Also, if a mode other than Normal is selected in the calculation mode setting, it cannot be set on AUTO.
3) For details, refer to page 6-10 '■ **Memory write**'.
4) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Channel selection

This selects the channels which are used for measurement value display and for analog output.

1 - CH : Select when using the single measurement mode on CH 1 side.

2 - CH : Select when using the single measurement mode on CH 2 side.

CAL : Select when using the calculation mode.

Setting procedure

Key operation from the measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	△ ▽	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	Etc. Other settings
	△ ▽	Select 'Other settings' by using the UP key or DOWN key.	
④	SET	Press the set key.	CH Channel selection
	△ ▽	Select channel selection by using the UP key or DOWN key.	
⑤	SET	Press the set key.	1-CH CH 1 (Note 2) 2-CH CH 2 (Note 3) CAL Calculation mode (Note 4)
	△ ▽	Select 1-CH, 2-CH or CAL by using the UP key or DOWN key.	
⑥	SET	Press the set key.	The selected channel is set, and the display returns to the channel selection display. CH Channel selection
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory store

⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	 or  (Note 5)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 6)

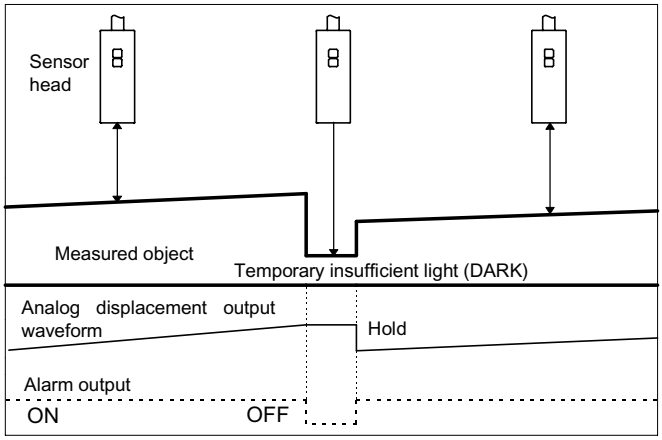
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) Displayed if a sensor head is connected to the HEAD 1 side of **LH-CS6 (P)** or **LH-CD6 (P)**.
3) Displayed if a sensor head is connected to the HEAD 2 side of **LH-CD6 (P)**.
4) Displayed if sensor heads are connected to both the HEAD 1 side and HEAD 2 side of **LH-CD6 (P)**.
5) For details, refer to page 6-10 '■ **Memory write**'.
6) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Analog output hold setting

When this function is used, even if insufficient light (DARK) condition or excessive light (BRIGHT) condition occurs temporarily, the value just before this error occurs is held. Hence, this enables continuous measurements without any break of analog output.

NOTE Only analog output is held. Measurement display, comparative output and alarm output are not held.



Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	Etc. Other settings
	▲ ▼	Select 'Other settings' by using the UP key or DOWN key.	
④	SET	Press the set key.	HoLd Analog output hold setting
	▲ ▼	Select the analog output hold setting by using the UP key or DOWN key.	

⑤	SET	Press the set key.	HLdon or HLdoF
	▲ ▼	Select ON or OFF by using the UP key or DOWN key.	
⑥	SET	Press the set key.	ON or OFF is set and the display returns to the analog output hold setting display. HoLd Analog Output Hold Setting
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. nEnr Memory Store
⑧	SET	Press the set key.	Memory selection display appears. u-01 ~ u-16 or r (Note 2)
	▲ ▼	Select the memory No. by using the UP or DOWN key.	
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12345 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ 0-ADJ store setting

The 0-ADJ function forcibly sets the measurement value and the analog output to '0' and makes the value at that time the reference value ('0') for measuring.

If 0-ADJ store is set to the ON state, it is recorded in the sensor so that even if the power is turned OFF, the sensor operates with the recorded zero value when the power is turned ON again.

NOTE

- If 0-ADJ is performed with 0-ADJ store in the OFF state, 0-ADJ will be disabled when the memory is called. First set 0-ADJ store to the ON state, then carry out 0-ADJ after performing memory write.
- If r is selected in '■ **Memory write**', page 6-10, even if 0-ADJ store is turned ON, the value is not written into the EEPROM and is not recorded. When the power is turned OFF or a different address in memory is called, 0-ADJ is cleared.
- If 0-ADJ store is set to ON, the settings are stored in an EEPROM. However, the EEPROM has a lifetime and the settings cannot be done for more than 100,000 times.

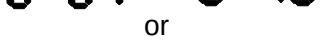
REFERENCE

Refer to page 6-112 '■ **0-ADJ**' for details of the 0-ADJ function.

Setting procedure

Key operation from the measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	Etc. Other settings
	▲ ▼	Select 'Other settings' by using the UP key or DOWN key.	
④	SET	Press the set key.	0Adj 0-ADJ store setting
	▲ ▼	Select 0-ADJ store setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	Adjonr or AdjofF
	▲ ▼	Select ON or OFF by using the UP key or DOWN key.	

⑥	SET	Press the set key.	ON or OFF is set, and the display returns to the 0-ADJ store setting display.  0-ADJ store setting
⑦	MODE MODE	Press the MODE key twice.	Memory store display appears.  Memory store
⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	 or (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ 0-ADJ clear

This function clears the 0-ADJ value once it has been set. This condition is the factory setting (0V, 12mA at the measuring center). Also, 0-ADJ cannot be cleared from an external terminal.

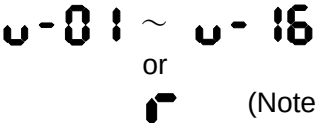

REFERENCE

Refer to page 6-112, '■ **0-ADJ**' for details of the 0-ADJ function.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL L Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or U-01 ~ U- 16 (Note 1)
③	SET	Press the set key.	Etc. Other settings
	▲ ▼	Select 'Other settings' by using the UP key or DOWN key.	
④	SET	Press the set key.	0AJ.CL 0-ADJ clear
	▲ ▼	Select the 0-ADJ clear setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	no Do not clear 0-ADJ. or -YES- Clear 0-ADJ.
	▲ ▼	Select NO or YES by using the UP key or DOWN key.	
⑥	SET 1 sec. or more	Press the set key. (In case of YES, press it for 1 sec. or more.)	The selected contents are set and the display returns to the 0-ADJ clear setting display. 0AJ.CL 0-ADJ clear
⑦	MODE MODE	Press the MODE key twice.	Memory store display appears. nEnr Memory store

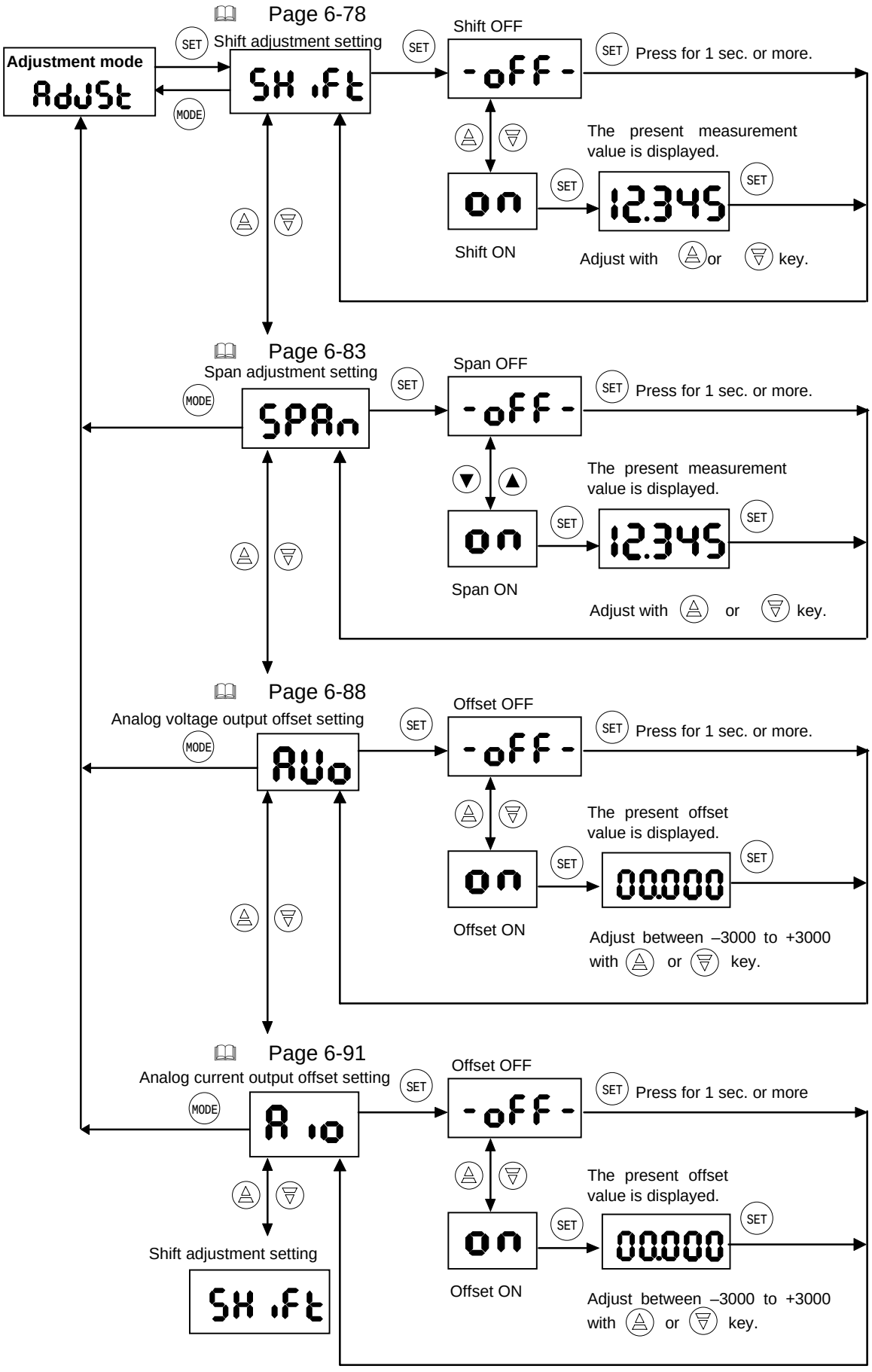
⑧	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	 or (Note 2)
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Adjustment mode

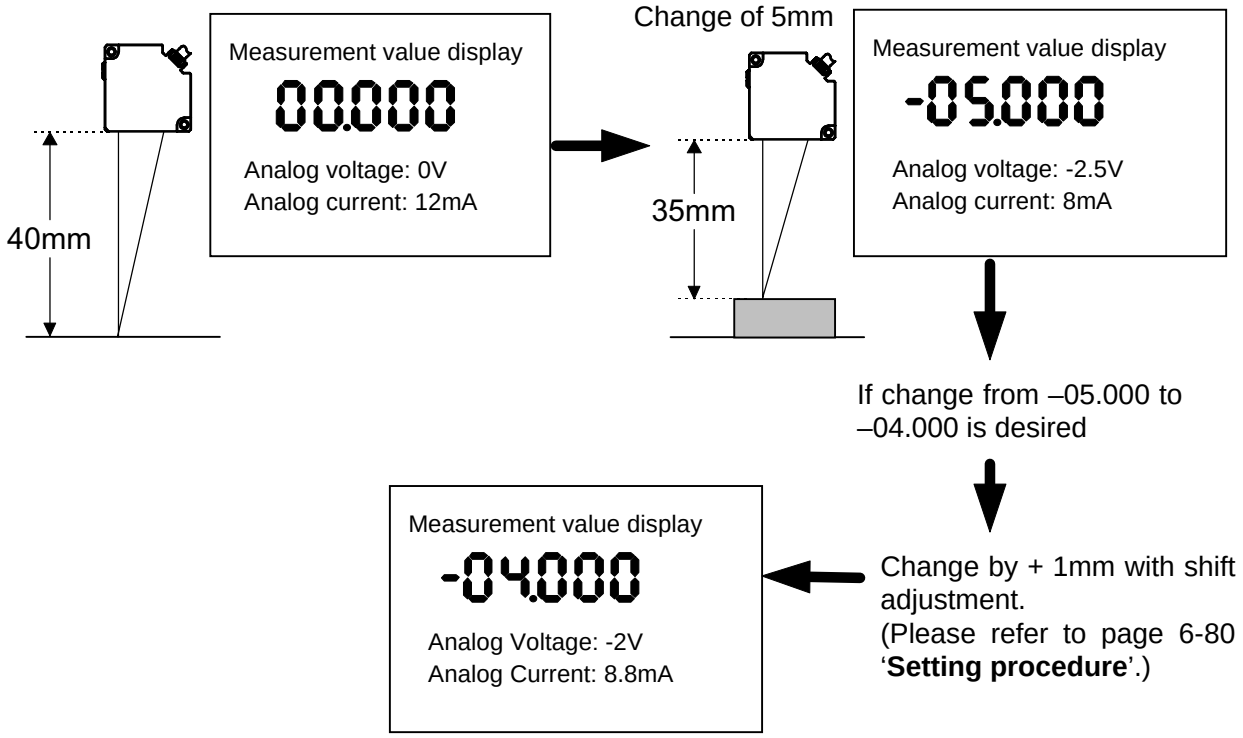
● Adjustment mode configuration



■ Shift adjustment setting

In case the relation between displacement amount and output is desired to be calibrated, shift adjustment is possible. By shift adjustment, the relation between the distance from the sensor head to the measured object and the measured value or the analog output value can be shifted within ±30% of full scale.

- **Example LH-54**



- **Features of shift adjustment setting**
  - ① Relation between displacement amount and output can be adjusted within ±30% of full scale (±3.0V approx. for analog voltage output and ±4.8mA approx. for analog current output).
  - ② Analog output shift adjustment is for, both, current output and voltage output.
  - ③ This setting acts on, both, measurement value display and analog output.
  - ④ If sensor heads are connected to, both, HEAD 1 and HEAD 2 sides, the setting applies to both of them.
  - ⑤ If the set values exceed the upper/lower limit of the analog output, they are held at the upper/lower limit of full scale. Further, the measurement value display is also held at the upper or lower limit of full scale.
  - ⑥ Setting is possible for each memory No. (u-01 to u-16).

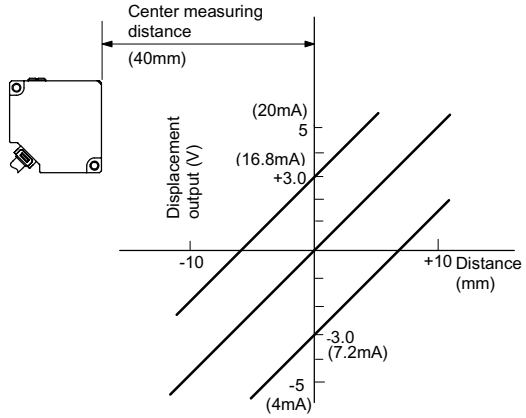
Initial setting: OFF (zero shift)

REFERENCE

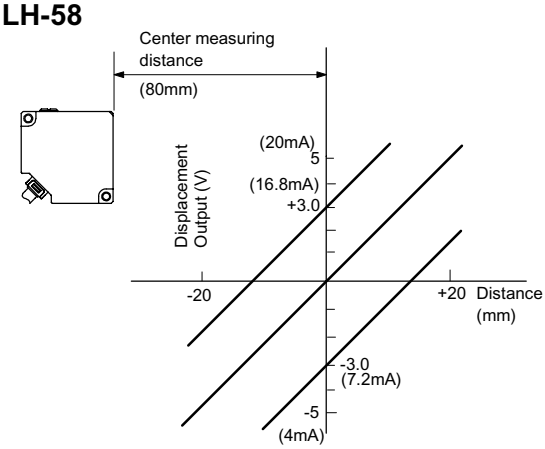
- This function can be used together with 0-ADJ setting. Please refer to page 6-112 '■ **0-ADJ**' for details.
- In case setting is to be done individually for the sensor heads connected to HEAD 1 and HEAD 2, refer to page 6-102 '■ **CH1 / CH2 shift adjustment setting**'.

- **Analog displacement output diagram**

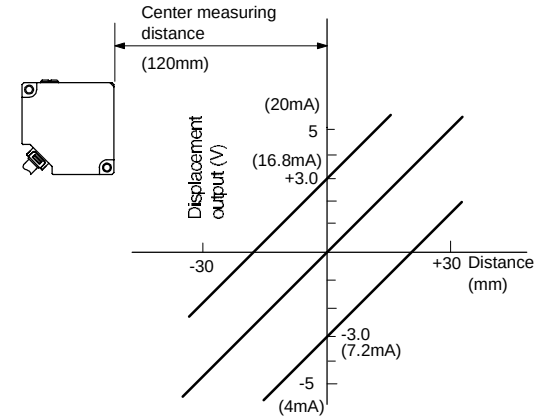
LH-54



LH-58



LH-512



NOTE After shift adjustment, the set values that exceed the upper/lower limit of the measurement value or analog output, are held at the upper/lower limit of full scale.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	AdJSt Adjustment mode
	▲ ▼	Select the adjustment mode by using the UP key or DOWN key.	
④	SET	Press the set key.	SH.Ft Shift adjustment setting
	▲ ▼	Select the shift adjustment setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	-oFF- or on
	▲ ▼	Select OFF or ON by using the UP key or DOWN key.	
		If ON is selected, go to Step ⑥. If OFF is selected, go to Step ⑨.	

・ If ON is selected

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	The present measurement value is displayed. 
	△ ▽	Adjust the amount of shift by using the UP key or DOWN key.	
⑦	SET	Press the set key.	The shift amount is set, and the display returns to the shift adjustment setting display.  Shift adjustment setting
⑧	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

・ If OFF is selected

Step	Key	Operation	Display / Result
⑨	SET 1 sec. or more.	Press the set key.	The shift adjustment setting is set to the OFF state, and the display returns to the shift adjustment setting display.  Shift adjustment setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

・ Memory write

Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears.
	△ ▽	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

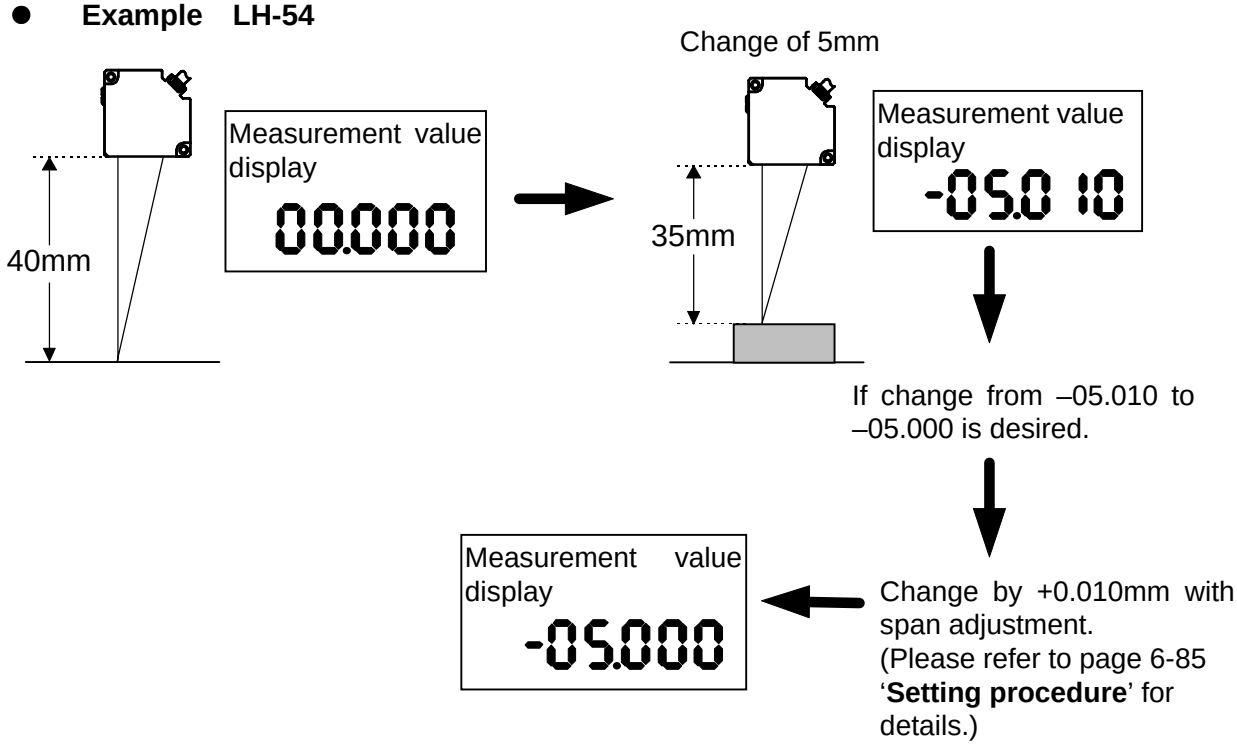
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Span adjustment setting

In case the relation between displacement amount and output is desired to be calibrated, span adjustment is possible. By span adjustment, the output span (slope) of the measurement value, or analog output, versus the distance from the sensor head to the measured object can be adjusted within ±30% of full scale.

● **Example LH-54**



● **Features of span adjustment setting**

① The span (slope) of the output versus the displacement can be adjusted within ±30% of full scale (±3.0V approx. for analog voltage output and ±4.8mA approx. for analog current output).
② Analog output span adjustment is for, both, current output and voltage output.
③ This setting acts on, both, measurement value display and analog output.
④ If sensor heads are connected to, both, HEAD 1 and HEAD 2 sides, the setting applies to both of them.
⑤ If the set values exceed the upper/lower limit of the analog output, they are held at the upper/lower limit of full scale. Further, the measurement value display is also held at the upper or lower limit of full scale.
⑥ Setting is possible for each memory No. (u-01 to u-16).

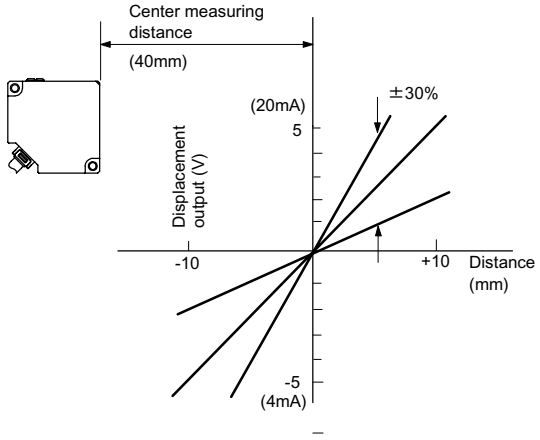
Initial setting: OFF (Span amount 1)

REFERENCE

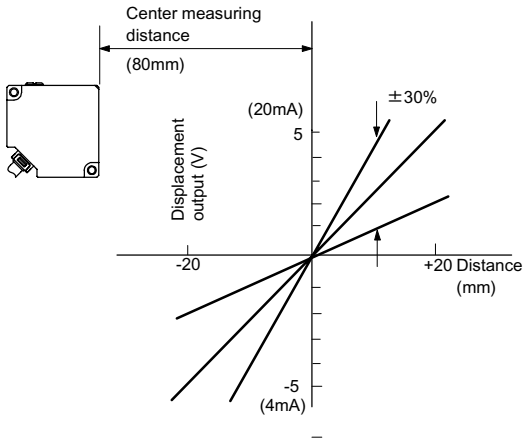
- This function can be used together with 0-ADJ setting. Please refer to page 6-112 '■ **0-ADJ**' for details.
- In case setting is to be done individually for the sensor heads connected to HEAD 1 and HEAD 2, refer to page 6-106 '■ **CH1 / CH2 span adjustment setting**'.

- **Analog displacement output diagram**

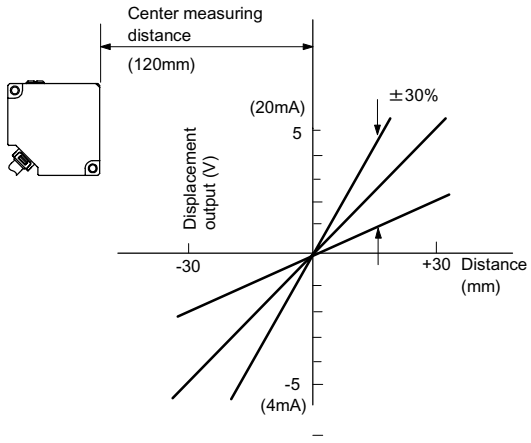
LH-54



LH-58



LH-512



NOTE

After span adjustment, the set values that exceed the upper/lower limit of the measurement value or analog output, are held at the upper/lower limit of full scale.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CALL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	AdJSt Adjustment mode
	▲ ▼	Select the adjustment mode by using the UP key or DOWN key.	
④	SET	Press the set key.	SPAn Span adjustment setting
	▲ ▼	Select the span adjustment setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	-oFF- or on
	▲ ▼	Select OFF or ON by using the UP key or DOWN key.	
		If ON is selected, go to Step ⑥. If OFF is selected, go to Step ⑨.	

・ If ON is selected

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	The present measurement value is displayed. 
	▲ ▼	Adjust the amount of span by using the UP key or DOWN key.	
⑦	SET	Press the set key.	The span amount is set, and the display returns to the span adjustment setting display.  Span adjustment setting
⑧	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

・ If OFF is selected

Step	Key	Operation	Display / Result
⑨	SET 1 sec. or more	Press the set key.	The span adjustment setting is set to the OFF state, and the display returns to the span adjustment setting display.  Span adjustment setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

▪ Memory write

Step	Key	Operation	Display / Result
⑪	(SET)	Press the set key.	Memory selection display appears.
	(△) (▽)	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or (Note 2)
⑫	(SET) 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Analog voltage output offset setting

This function adjusts the offset of analog voltage output within ±10% approx.(±1V approx.) of full scale. It adjusts only the analog voltage output value, not the measurement value display. To set the offset, select analog voltage output offset ON and set the amount of offset. Offset can be fine adjusted in ±3,000 steps. To cancel offset adjustment, set to analog current output offset OFF.

Initial setting: OFF

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	AdJSt Adjustment mode
	▲ ▼	Select the adjustment mode by using the UP key or DOWN key.	
④	SET	Press the set key.	AUo Analog voltage output offset setting
	▲ ▼	Select the analog voltage output offset setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	-oFF- or on
	▲ ▼	Select OFF or ON by using the UP key or DOWN key.	
If ON is selected, go to Step ⑥. If OFF is selected, go to Step ⑨.			

- If ON is selected

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	The present offset value is displayed. 
	▲ ▼	Adjust the offset value by using the UP key or DOWN key. (within ± 3000)	
⑦	SET	Press the set key.	The offset value is set, and the display returns to the analog voltage output offset setting display.  Analog voltage output offset setting
⑧	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

- If OFF is selected

Step	Key	Operation	Display / Result
⑨	SET 1 sec. or more	Press the set key.	The analog voltage output offset setting is set to the OFF state, and the display returns to the analog voltage output offset setting display.  Analog voltage output offset setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

- Memory write

Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Analog current output offset setting

This function adjusts the offset of analog current output within ±10% approx.(±1.6mA approx.) of full scale. It adjusts only the analog current output value, not the measurement value display. To set the offset, select analog current output offset ON and set the amount of offset. Offset can be fine adjusted in ±3,000 steps. To cancel offset adjustment, set to analog current output offset OFF.

Initial setting: OFF

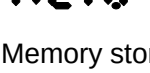
Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	CAL Memory call
②	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
③	SET	Press the set key.	AdJSt Adjustment mode
	▲ ▼	Select the Adjustment Mode by using the UP key or DOWN key.	
④	SET	Press the set key.	A io Analog current output offset setting
	▲ ▼	Select the analog current output offset setting by using the UP key or DOWN key.	
⑤	SET	Press the set key.	-oFF- or on
	▲ ▼	Select OFF or ON by using the UP key or DOWN key.	
		If ON is selected, go to Step ⑥. If OFF is selected, go to Step ⑨.	

・ If ON is selected

Step	Key	Operation	Display / Result
⑥	SET	Press the set key.	The present offset value is displayed. 
	▲ ▼	Adjust the offset value by using the UP key or DOWN key. (within ±3,000)	
⑦	SET	Press the set key.	The offset value is set, and the display returns to the analog current output offset setting display.  Analog current output offset setting
⑧	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

・ If OFF is selected

Step	Key	Operation	Display / Result
⑨	SET 1 sec. or more	Press the set key.	The analog current output offset setting is set to the OFF state, and the display returns to the analog current output offset setting display.  Analog current output offset setting
⑩	MODE MODE	Press the mode key twice.	Memory store display appears.  Memory store
Go to Step ⑪.			

▪ Memory write

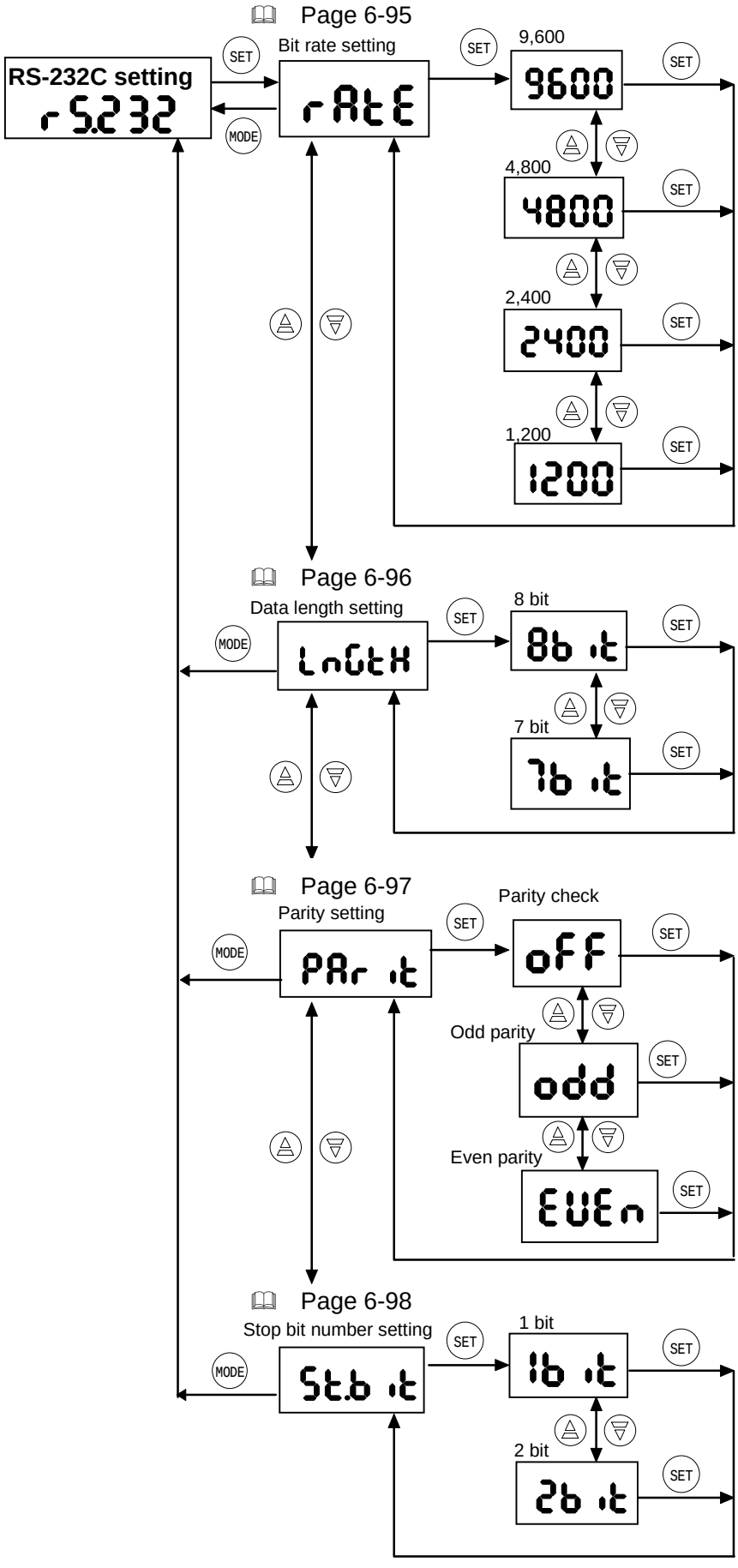
Step	Key	Operation	Display / Result
⑪	SET	Press the set key.	Memory selection display appears.
	▲ ▼	Select the memory No. by using the UP key or DOWN key.	u-01 ~ u-16 or r (Note 2)
⑫	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) When the set key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ RS-232C setting

● Configuration of the RS-232C setting



■ Bit rate setting

Initial setting: 9,600 bps

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	
	▲ ▼	Select the RS-232C setting by using the UP key or DOWN key.	RS-232C setting.
②	SET	Press the set key.	
	▲ ▼	Select bit rate setting by using the UP key or DOWN key.	Bit rate setting
③	SET	Press the set key.	
	▲ ▼	Select 9,600, 4,800, 2,400 or 1,200 by using the UP key or DOWN key.	
④	SET	Press the set key.	The selected bit rate is set, and the display returns to the bit rate setting display.  Bit rate setting
⑤	MODE	Press the mode key once.	The display returns to the RS-232C setting display.  RS-232C setting
⑥	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 1)

NOTE When the mode key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ Data length setting

Initial setting: 8 bits

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	 RS-232C setting.
	▲ ▼	Select the RS-232C setting by using the UP key or DOWN key.	
②	SET	Press the set key.	 Data length setting
	▲ ▼	Select data length setting by using the UP key or DOWN key.	
③	SET	Press the set key.	
	▲ ▼	Select 8 bit or 7 bit by using the UP key or DOWN key.	
④	SET	Press the set key.	The selected data length is set, and the display returns to the data length setting display.  Data length setting
⑤	MODE	Press the mode key once.	The display returns to the RS-232C setting display.  RS-232C setting
⑥	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 1)

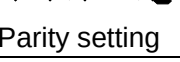
NOTE

When the mode key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Parity setting

Initial setting: OFF

Setting procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	 RS-232C setting.
	▲ ▼	Select RS-232C setting by using the UP key or DOWN key.	
②	SET	Press the set key.	 Parity setting
	▲ ▼	Select parity setting by using the UP key or DOWN key.	
③	SET	Press the set key.	 OFF  Odd parity  Even parity
	▲ ▼	Select OFF, even parity or odd parity using the UP key or DOWN key.	
④	SET	Press the set key.	The selected parity is set, and the display returns to the parity setting display.  Parity setting
⑤	MODE	Press the mode key once.	The display returns to the RS-232C setting display.  RS-232C setting
⑥	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 1)

NOTE

When the mode key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Stop bit number setting

Initial Setting: 1 bit

Setting procedure

Key operation from measurement mode is explained.

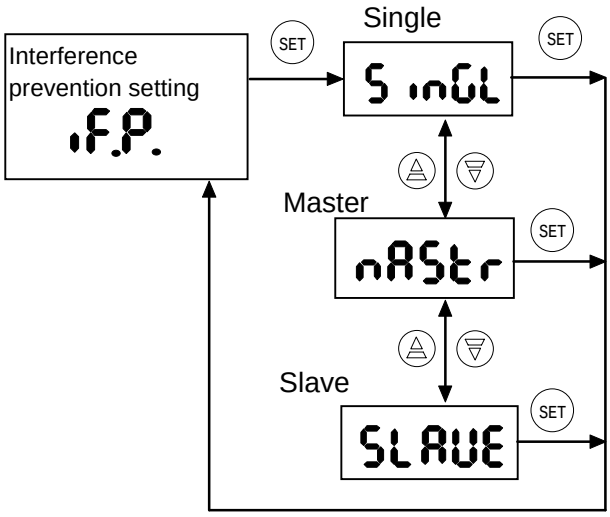
Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	 RS-232C setting.
	▲ ▼	Select the RS-232C setting by using the UP key or DOWN key.	
②	SET	Press the set key.	 Stop bit number setting
	▲ ▼	Select stop bit number setting by using the UP key or DOWN key.	
③	SET	Press the set key.	 or 
	▲ ▼	Select 1 bit or 2 bit by using the UP key or DOWN key.	
④	SET	Press the set key.	The selected stop bit number is set, and the display returns to the stop bit number setting display.  Stop bit number setting
⑤	MODE	Press the mode key once.	The display returns to the RS-232C setting display.  RS-232C setting
⑥	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 1)

NOTE

When the mode key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to the measurement mode.

■ Interference prevention setting

- **Configuration of interference prevention setting**



- **Features of interference prevention setting**

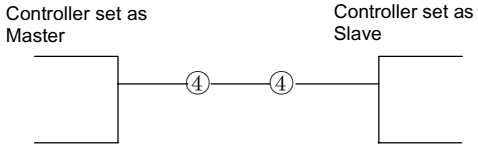
When multiple sensor heads are used in close proximity to each other, the LED light from each sensor may interfere with the other sensors and cause malfunction. In such a situation, use the interference prevention function.

If two sensor heads are connected to one controller unit, and the calculation mode is set, they enter the interference prevention mode automatically.

Also, by using two controller units, each connected with two sensor heads, a maximum of four sensor heads can be used in close proximity to each other. In this case, the input/output terminal ④ on one controller is connected to the input/output terminal ④ on the other controller, and one controller is set as the master and the other is set as the slave to set the interference prevention mode. (Note 1)

In this mode, light beam modulation is switched alternately between the four sensors, so that the sensors are not influenced by each other's beams and reliable measurement is possible. If multiple sensor heads are used, install them taking care of the interference range shown in the table on the next page.

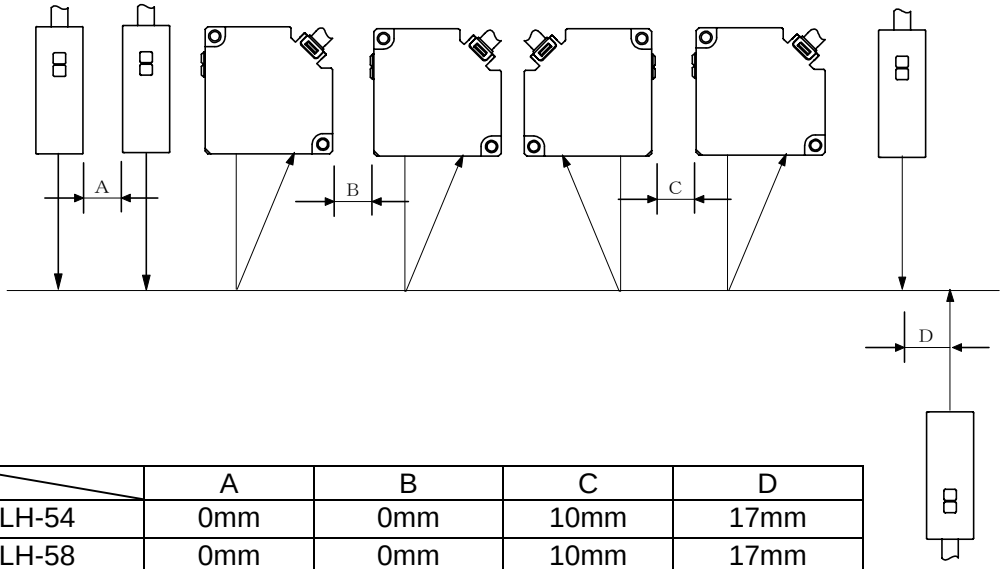
・If measurement is being done with 1 controller: Set the control on 'Single.'
・If measurement is being done with 2 controllers: Set one controller on 'Master' and the other controller on 'Slave.' (Note 1) Connect the interference prevention input/output terminal ④ on each controller together.



Initial setting: Single

NOTE

Depending on the combination of the measurement modes set on the controllers, which are set as the master and the slave, you may not be able to use the interference prevention function. See page 6-100, '• **Combination of controllers when setting interference prevention**'.



	A	B	C	D
LH-54	0mm	0mm	10mm	17mm
LH-58	0mm	0mm	10mm	17mm
LH-512	0mm	0mm	30mm	17mm

NOTE If light from the sensor on the opposite side is not received, there would be no influence even if D = 0.

NOTE
- Do not connect an interference prevention I/O other than that of **LH-CS6(P)** or **LH-CD6(P)** to the interference prevention I/O.
- Do not connect together two controllers which have been set as masters during interference prevention function setting, as this causes malfunction.

- **Combination of controllers when setting interference prevention**

  Depending on the combination of the measurement modes set on the controllers, which are set as the master and the slave, you may not be able to use the interference prevention function.

  In case of Combination 3 in the table below, the interference prevention function will not work. Change to Combination 2.

- **Response time when interference prevention is being used**

  If the interference prevention function is set, take care that the response time becomes longer compared to the case when this function is not used. The response time, as compared to the case when the interference prevention function is not used, is as shown in the following table.

	Controller set as master	Controller set as slave	Interference prevention function	Response time
1	Calculation mode	Calculation mode	OK	20 times
2	Calculation mode	Single measurement mode	OK	20 times
3	Single measurement mode	Calculation mode	NG	———
4	Single measurement mode	Single measurement mode	OK	10 times

NOTE

- If a controller is set as Slave, it cannot function by itself. In this case, the measurement value display shows an error 'SLAVE' in the measurement mode.
- When not using the interference prevention function, set the controller on Single. If it is set on Master, it will slow the response time.
- Linearity and resolution may deteriorate when this function is used.
- If a controller is set as Master, the sensor head's spot intensity will reduce, but this is not a sign of failure.

Setting procedure

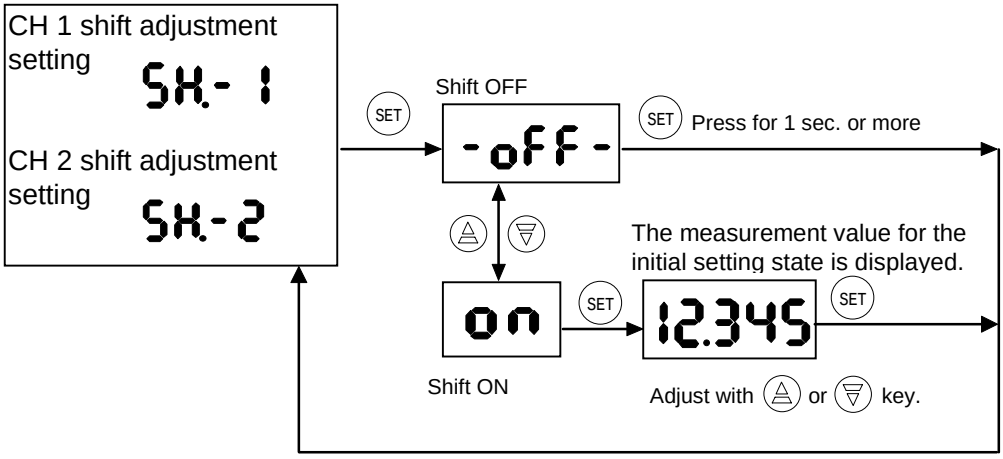
Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	 Interference prevention setting
	▲ ▼	Select the interference prevention setting by using the UP key or DOWN key.	
②	SET	Press the set key.	 Single  Master  Slave
	▲ ▼	Select single, master or slave by using the UP key or DOWN key.	
③	SET	Press the set key.	Single, master or slave is set, and the display returns to the interference prevention setting display.  Interference prevention setting
④	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode. 

■ CH 1 / CH 2 shift adjustment setting

It is possible to calibrate the relationship between the displacement and the output of sensor heads connected to CH 1 and CH 2 individually. By the CH 1 / CH 2 shift adjustment, the relation between the distance from the sensor head to the measured object and the measurement value or the analog output value can be shifted up or down within a range of ±5% of the full scale.

- **CH 1 / CH 2 shift adjustment setting configuration**



- **Features of CH 1 / CH 2 shift adjustment setting**

① Relation between displacement amount and output can be adjusted within ±5% of full scale (±0.5V approx. for analog voltage output and ±0.8mA approx. for analog current output).

② Analog output shift adjustment is for, both, current output and voltage output.

③ This setting acts on, both, measurement value display and analog output.

④ Even if sensor heads are connected to both CH 1 and CH 2, they can be adjusted individually.

⑤ If the set values exceed the upper/lower limit of the analog output, they are held at the upper/lower limit of full scale. Further, the measurement value display is also held at the upper or lower limit of full scale.

⑥ Unlike '■ **Shift adjustment setting**', page 6-78, registration cannot be done for each memory No. This is a common memory setting.

Initial setting: OFF (Zero shift)

NOTE

When this setting is done, the settings other than the gain setting become initial setting values. (As for gain, operation is at the presently set gain.) For that reason, when this setting is done, the measurement value for the initial setting state is displayed. (For example, even if you have set 0-ADJ, etc., the display in the measurement value display is as in the case when 0-ADJ is OFF.)

- **Example of use**

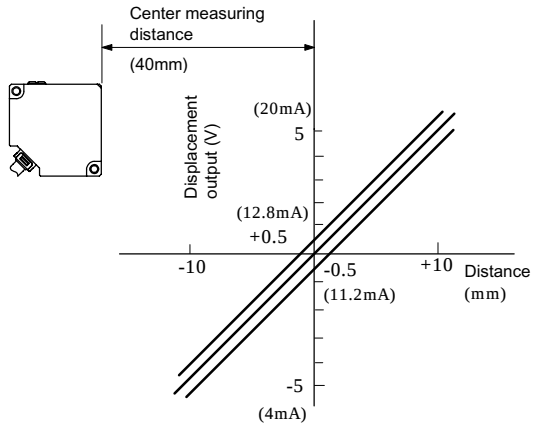
  If you are performing calculation measurement (A - B), in case the measurement value is not '0' even when a flat object is being measured, this function is convenient.

  Variations in individual heads or between objects can be canceled using this function.

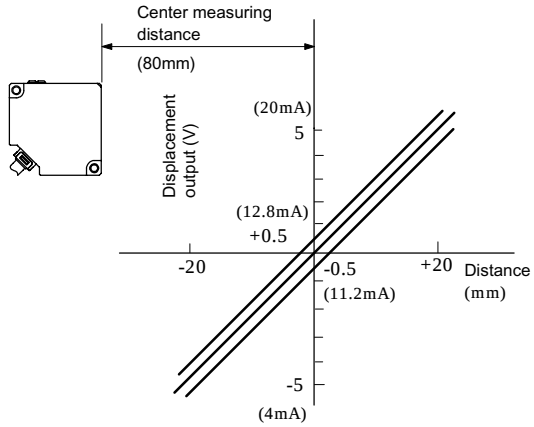
REFERENCE

- It is possible to set this in combination with the 0-ADJ setting. For details, refer to page 6-112 '■ **0-ADJ**'.
- If you desire to set this setting for each memory No., refer to page 6-78 '■ **Shift adjustment setting**'.

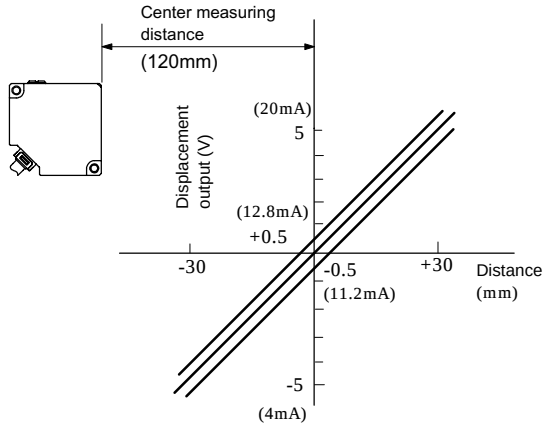
LH-54



LH-58



LH-512



NOTE

After shift adjustment, if the set values exceed the upper/lower limit for the measurement value and analog output, they are held at the upper/lower limit of full scale.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	SH-1 CH 1 shift adjustment setting (Note 1) or SH-2 CH 2 shift adjustment setting (Note 2)
	▲ ▼	Select the CH 1 or CH 2 shift adjustment setting by using the UP key or DOWN key.	
②	SET	Press the set key.	-oFF- or on
	▲ ▼	Select ON or OFF by using the UP key or DOWN key.	
If ON is selected, go to Step ③. If OFF is selected, go to Step ⑥.			

・If ON is selected.

Step	Key	Operation	Display / Result
③	SET	Press the set key.	The present measurement value is displayed. 12.345
	▲ ▼	Select shift amount by using the UP key or DOWN key.	
④	SET	Press the set key.	The shift amount is set, and the display returns to the CH 1 or CH 2 shift adjustment setting display. SH-1 CH 1 shift adjustment setting (Note 1) or SH-2 CH 2 shift adjustment setting (Note 2)
⑤	MODE 1 sec. or more.	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode. 12.345

・If OFF is selected

Step	Key	Operation	Display / Result
⑥	(SET) 1 sec. or more.	Press the set key for 1 sec. or more.	The CH 1 or CH 2 shift adjustment setting is set to the OFF state, and the display returns to the CH 1 or CH 2 shift adjustment setting display. SH.-1 CH 1 shift adjustment setting (Note 1) or SH.-2 CH 2 shift adjustment setting (Note 2)
⑦	(MODE) 1 sec. or more.	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

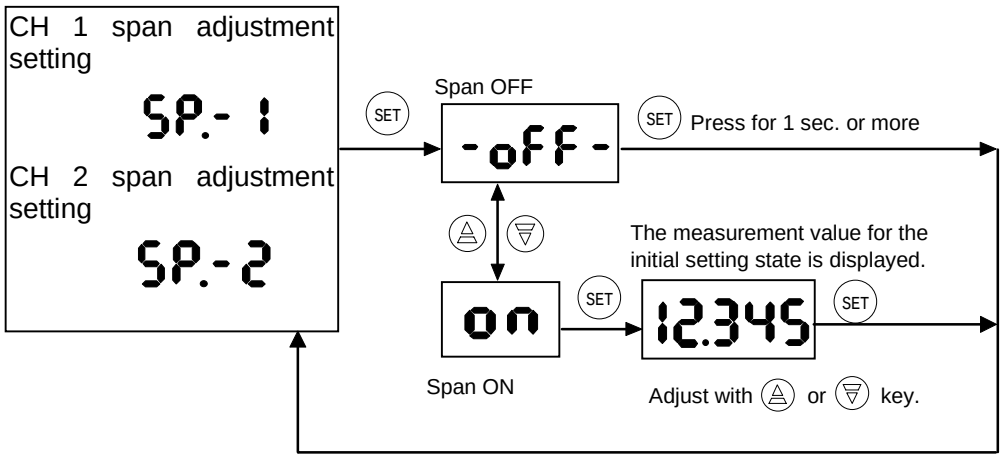
NOTE

1) Displayed if a sensor head is connected to the HEAD 1 side of **LH-CS6 (P)** or **LH-CD6 (P)**.
2) Displayed if a sensor head is connected to the HEAD 2 side of the **LH-CD6 (P)**
3) When the mode key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ CH 1 / CH 2 span adjustment setting

It is possible to calibrate the relation between the displacement and the output of sensor heads connected to CH 1 and CH 2 individually. By the CH 1 / CH 2 span adjustment, the relation between the distance from the sensor head to the measured object and the output span (slope) of the measurement value or the analog output value can be adjusted within a range of ±5% of full scale.

- **CH1 / CH2 span adjustment setting configuration**



- **Features of CH1 / CH2 span adjustment setting**

① Relation between displacement amount and output can be adjusted within ±5% of full scale (±0.5V approx. for analog voltage output and ±0.8mA approx. for analog current output).

② Analog output shift adjustment is for, both, current output and voltage output.

③ This setting acts on, both, measurement value display and analog output.

④ Even if sensor heads are connected to both CH 1 and CH 2, they can be adjusted individually.

⑤ If the set values exceed the upper/lower limit of the analog output, they are held at the upper/lower limit of full scale. Further, the measurement value display is also held at the upper or lower limit of full scale.

⑥ Unlike '■ **Span adjustment setting**', page 6-83, registration cannot be done for each memory No. This is a common memory setting.

Initial Setting: OFF (Span amount 1)

NOTE

When this setting is done, the settings other than the gain setting become initial setting values. (As for gain, operation is at the presently set gain.) For that reason, when this setting is done, the measurement value for the initial setting state is displayed. (For example, even if you have set 0-ADJ, etc., the display in the measurement value display is as in the case when 0-ADJ is OFF.)

- **Example of use**

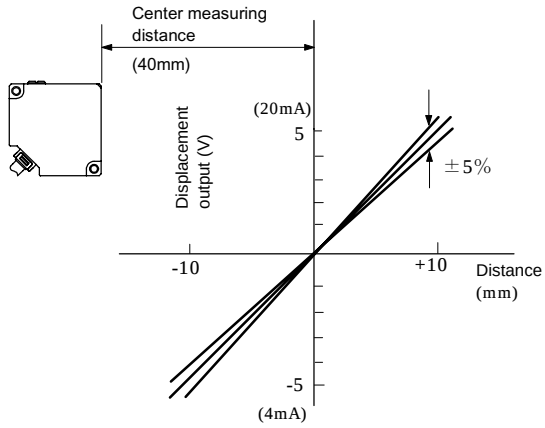
  If you are performing calculation measurement (A – B), in case the measurement value is not '0' even when a flat object is being measured, this function is convenient.

  Variations in individual heads or between objects can be canceled using this function.

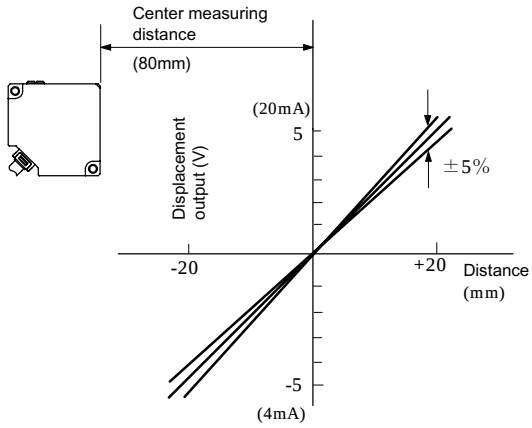
REFERENCE

- It is possible to set this in combination with the 0-ADJ setting. For details, refer to page 6-112 '■ **0-ADJ**'.
- If you desire to set this setting for each memory No., refer to page 6-83 '■ **Span adjustment setting**'.

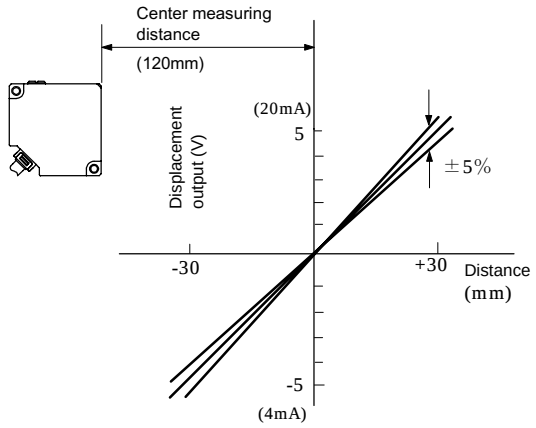
LH-54



LH-58



LH-512



NOTE

After span adjustment, if the set values exceed the upper/lower limit for the measurement value and analog output, they are held at the upper/lower limit of full scale.

Setting procedure

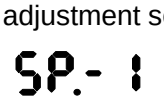
Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	SP.-1 CH 1 span adjustment setting (Note 1) or SP.-2 CH2 span adjustment setting (Note 2)
	▲ ▼	Select the CH1 or CH2 span adjustment setting by using the UP key or DOWN key.	
②	SET	Press the set key.	-oFF- or on
	▲ ▼	Select ON or OFF by using the UP key or DOWN key.	
		If ON is selected, go to Step ③. If OFF is selected, go to Step ⑥.	

・If ON is selected.

Step	Key	Operation	Display / Result
③	SET	Press the set key.	The current measurement value is displayed. 12.345
	▲ ▼	Select span amount by using the UP key or DOWN key.	
④	SET	Press the set key.	The span amount is set, and the display returns to the CH 1 or CH 2 span adjustment setting display. SP.-1 CH 1 span adjustment setting (Note 1) or SP.-2 CH 2 span adjustment setting (Note 2)
⑤	MODE 1 sec. or more.	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode. 12.345

・If OFF is selected

Step	Key	Operation	Display / Result
⑥	(SET) 1 sec. or more.	Press the set key for 1 sec. or more.	The CH 1 or CH 2 span adjustment setting is set to the OFF state, and the display returns to the CH 1 or CH 2 span adjustment setting display.  CH1 span adjustment setting (Note 1) or  CH2 span adjustment setting (Note 2)
⑦	(MODE) 1 sec. or more.	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode.  (Note 3)

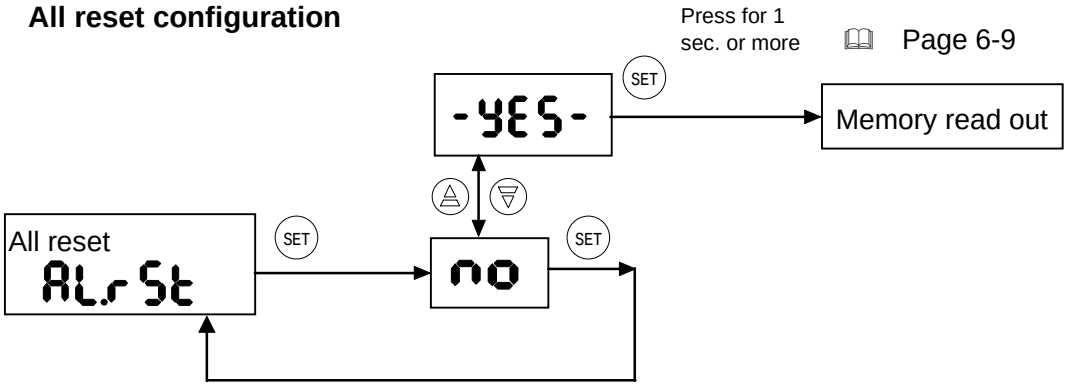
NOTE

1) Displayed if a sensor head is connected to the HEAD 1 side of **LH-CS6 (P)** or **LH-CD6 (P)**.
2) Displayed if a sensor head is connected to the HEAD 2 side of **LH-CD6 (P)**.
3) When the mode key is pressed for 1 sec. or more at the end of the setting, the settings are confirmed and stored in an EEPROM. In order to cancel before confirmation, simultaneously press UP key and DOWN key for 1 sec. or more. The sensor returns to measurement mode.

■ All reset

This function returns the settings of all the functions to their initial settings.

● **All reset configuration**



NOTE

- When all reset is executed, it becomes impossible to press the UP key and DOWN key at the same time for 1 sec. or more and cancel the settings before going to Step ⑧ on page 6-111, performing memory write and returning to measurement mode in Step ⑨.
  For example, if you have proceeded to Step ⑥, then decided to perform some other setting without proceeding to Step ⑨, the settings performed up to that point cannot be canceled in the middle of the setting procedure.

REFERENCE

Refer to page 6-118, '**List of initial settings**'.

Setting procedure

Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	AL.rSt All reset setting
	▲ ▼	Select all reset setting by using the UP key or DOWN key.	
②	SET	Press the set key.	no or -YES-
	▲ ▼	Select No or Yes using the UP key or DOWN key.	
If No is selected, go to Step ③. If Yes is selected, go to Step ⑤.			

・If No is selected

Step	Key	Operation	Display / Result
③	SET	Press the set key.	The display returns to the all reset setting display without executing all reset. AL.rSt All reset setting
④	MODE 1 sec. or more	Press the mode key for 1 sec. or more.	Sensor returns to measurement mode. 12.345

・If Yes is selected

Step	Key	Operation	Display / Result
⑤	SET 1 sec. or more	Press the set key for 1 sec. or more.	Memory selection display appears. d-01 ~ d-04 or u-01 ~ u-16 (Note 1)
	△ ▽	Select the memory No. by using the UP key or DOWN key.	
⑥	SET	Press the set key.	The display will change to the setting display for the selected memory No.
⑦	MODE MODE	Press the mode key twice.	Memory store display appears. mEnr Memory store
⑧	SET	Press the set key.	Memory write. Memory selection display appears. u-01 ~ u-16 or r (Note 2)
	△ ▽	Select the memory No. by using the UP key or DOWN key.	
⑨	SET 1 sec. or more	Press the set key for 1 sec. or more.	Sensor returns to measurement mode. 12.345 (Note 3)

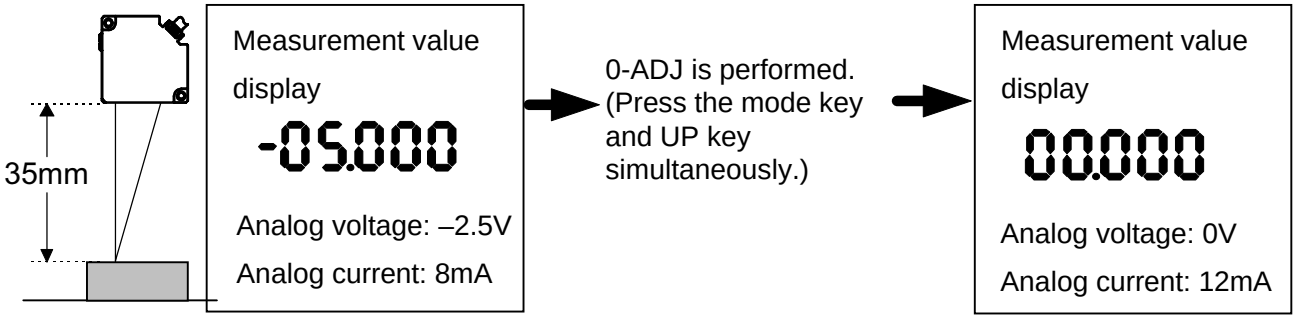
NOTE

1) For details, refer to page 6-9 '■ **Memory call / memory read out**'.
2) For details, refer to page 6-10 '■ **Memory write**'.
3) Until you return to the measurement mode, it is impossible to press the UP key and DOWN key simultaneously for 1 sec. or more and cancel the operation.

■ 0-ADJ

At the point when 0-ADJ is executed, the analog output is forcibly changed to 0V (analog voltage output) or to 12mA (analog current output) and this output is used as the reference value in measurements. The comparative output threshold value is also linked to the 0-ADJ reference. However, if a threshold value is set which exceeds the measuring range after 0-ADJ, the threshold value is held at the upper or lower limit of the measuring range.

Example: LH-54



・The contents of the measurement value display (reference value display) at the point when 0-ADJ is performed differ depending on whether the display setting selection is ‘displacement monitor’ or ‘distance monitor’.

	LH-54	**LH-58**	**LH-512**
Displacement Monitor	0mm	0mm	0mm
Distance Monitor	40mm	80mm	120mm

Also, if the calculation function is used with **LH-CD6 (P)**, the reference value display during 0-ADJ differs depending on the connected sensor head and its calculation contents.

Example: Using LH-54 and LH-58, if calculation function A - B is selected

When A = **LH-54** and B = **LH-58**, if 0-ADJ is performed, **LH-54** is set to 40mm and **LH-58** is set to 80mm. So, calculation A - B gives **–** 40mm.

- **Features of 0-ADJ function**
  - Within the measuring range, the analog output at any point can be adjusted to 0V (voltage output) or 12mA (current output).
  - The set value that exceeds the upper or lower limit of analog output is held at the upper or lower limit of full scale. Further, the measurement value display is also held at the upper or lower limit of full scale.
  - 0-ADJ is done together on the measurement value display and analog output.
  - 0-ADJ is done together on the voltage output and the current output.
  - 0-ADJ is possible for values including those set by Shift adjustment or Span adjustment.
  - At the time of factory shipment, approx. 0V and 12mA have been set for measuring center.
  - 0-ADJ can also be set from the terminal block (⑲).

NOTE

- If 0-ADJ store is set to ON, the settings are stored in an EEPROM. However, the EEPROM has a lifetime and the settings cannot be done for more than 100,000 times.

REFERENCE

- Regarding the relation between the displacement and the analog output when 0-ADJ has been done, or when 0-ADJ has been done in shift setting ON state, please refer to page 6-114 '**• Examples of analog displacement output diagrams during 0-ADJ**'.
- Concerning recording and cancellation of 0-ADJ, refer to page 6-73 '■ **0-ADJ store setting**' and page 6-75 '■ **0-ADJ clear**'.

Setting procedure

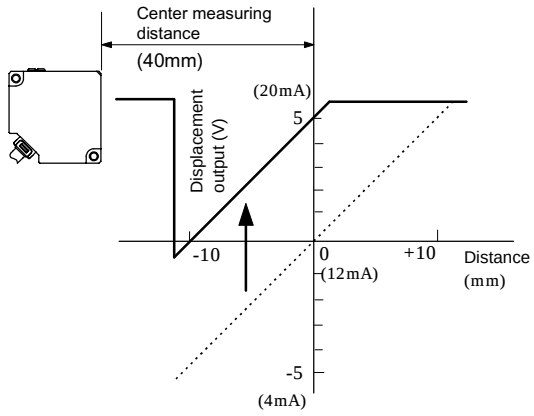
Key operation from the measurement mode is explained.

Step	Key	Operation	Display / Result
①	MODE + △	Press the mode key and UP key simultaneously.	0-ADJ is performed, the display value becomes '0' and the 0-ADJ indicator lights up. 00.000

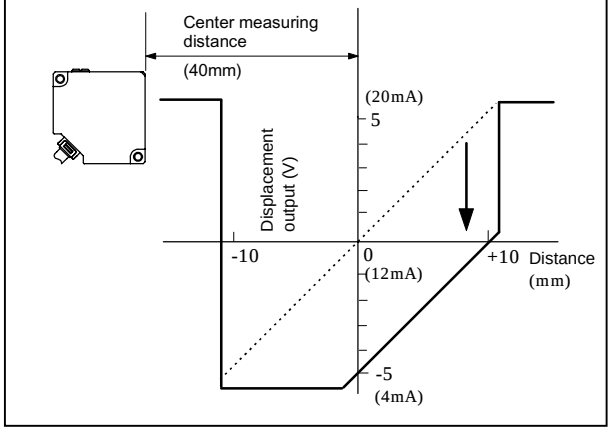
- **Examples of analog displacement output diagrams during 0-ADJ**

① In case 0-ADJ setting has been done at the NEAR side or the FAR side, the analog displacement output diagrams are as shown below.

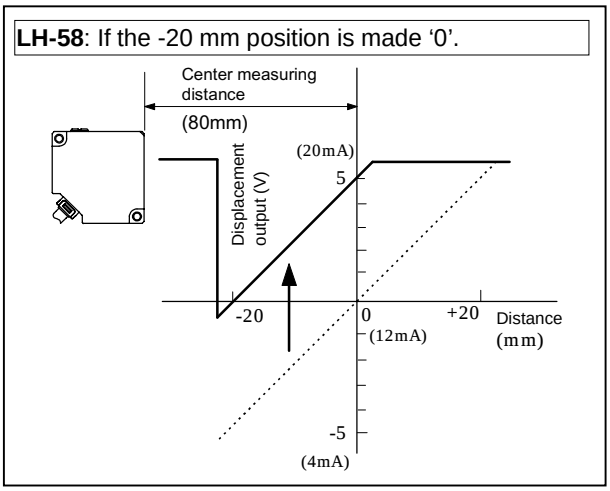
LH-54: If the -10 mm position is made '0'.



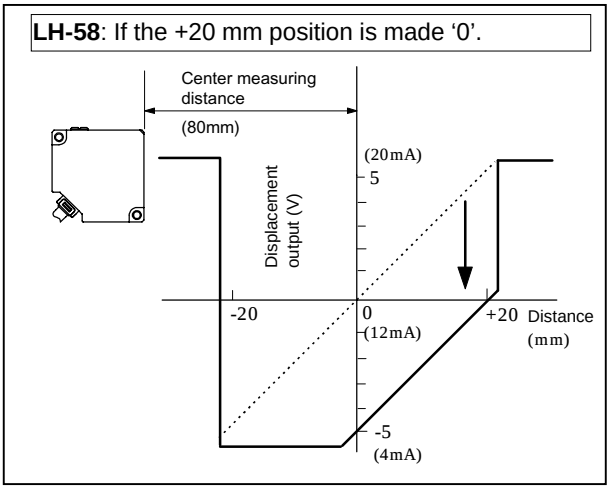
LH-54: If the +10 mm position is made '0'.



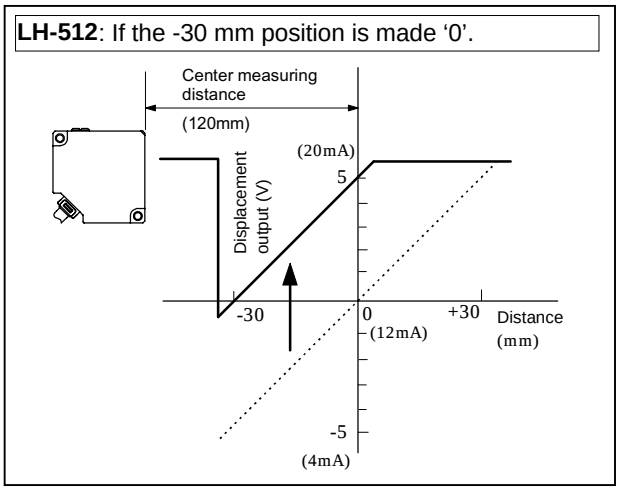
LH-58: If the -20 mm position is made '0'.



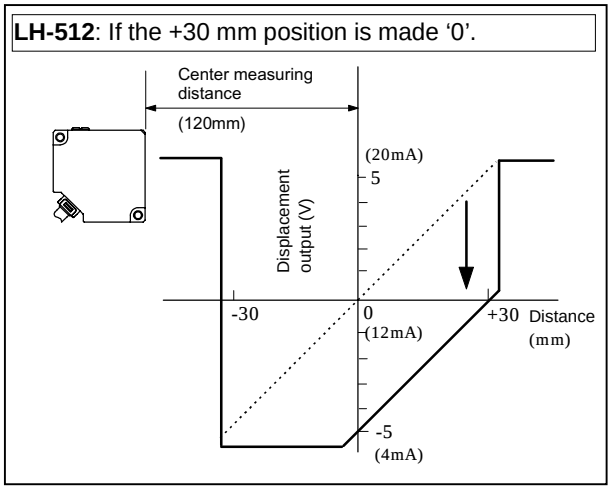
LH-58: If the +20 mm position is made '0'.



LH-512: If the -30 mm position is made '0'.



LH-512: If the +30 mm position is made '0'.

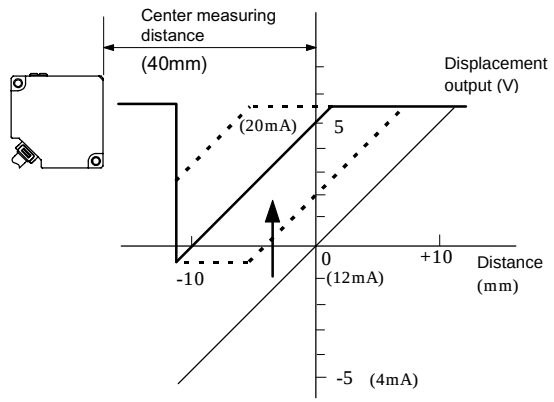


NOTE

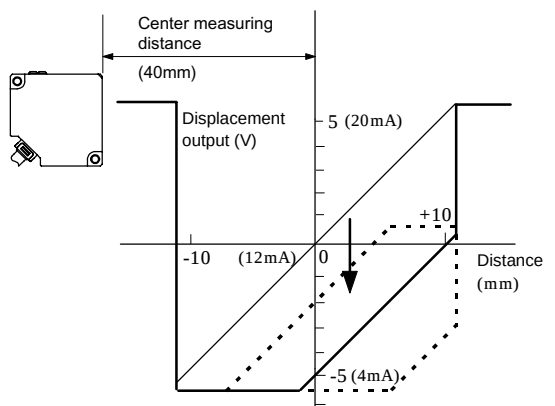
After the 0-ADJ and shift adjustments, if the set value exceeds the upper/lower limit of the measurement value or the analog output, it is held at the upper/lower limit of full scale.

② In case ■ **Shift adjustment**, page 6-78, has been done after 0-ADJ has been set at the NEAR side or the FAR side, the analog displacement output diagrams are as shown below.

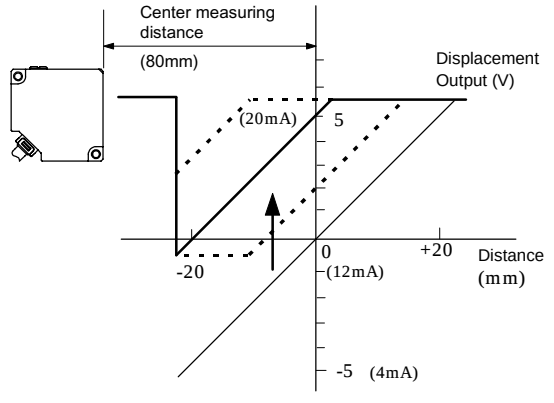
LH-54: If the -10 mm position is made '0'.



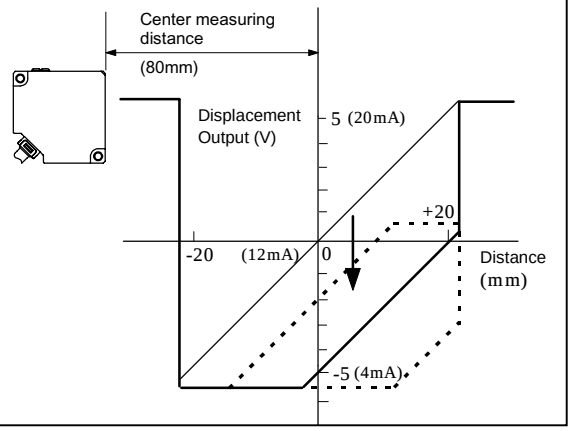
LH-54: If the +10 mm position is made '0'.



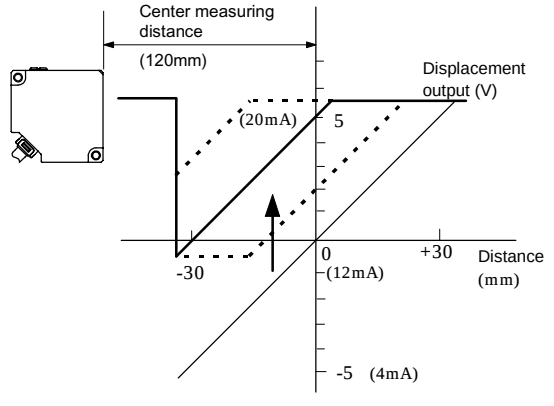
LH-58: If the -20 mm position is made '0'.



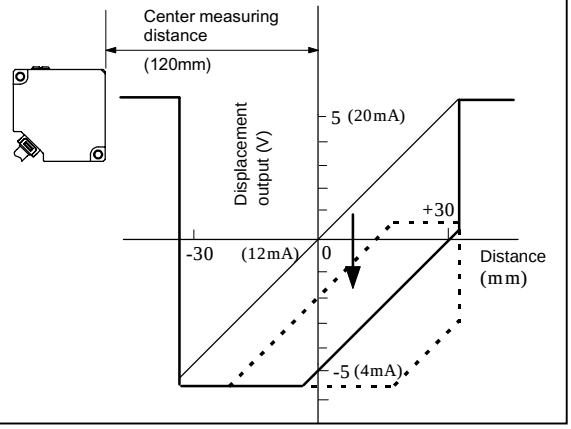
LH-58: If the +20 mm position is made '0'.



LH-512: If the -30 mm position is made '0'.



LH-512: If the +30 mm position is made '0'.

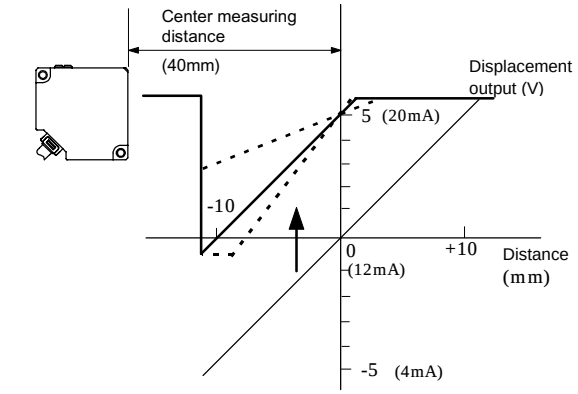


NOTE

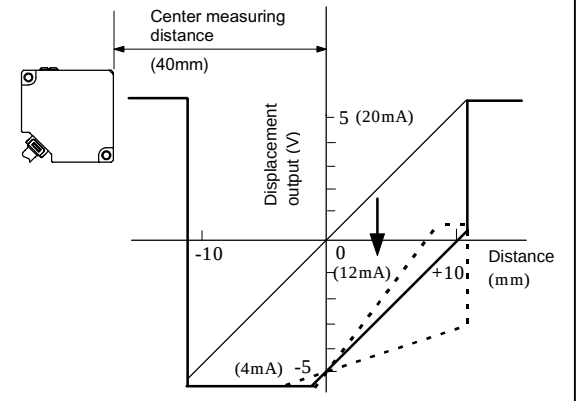
- If shift adjustment is carried out with respect to a 0-adjusted measurement value, a large shift adjustment, which when added to the data before 0-ADJ results in a value exceeding the measurement full scale, cannot be performed.
- After the 0-ADJ, if the set value exceeds the upper/lower limit of the measurement value or the analog output, it is held at the upper/lower limit of full scale.

③ In case ■ **Span adjustment setting**, page 6-83, has been done after 0-ADJ has been set at the NEAR side or the FAR side, the analog displacement output diagrams are as shown below.

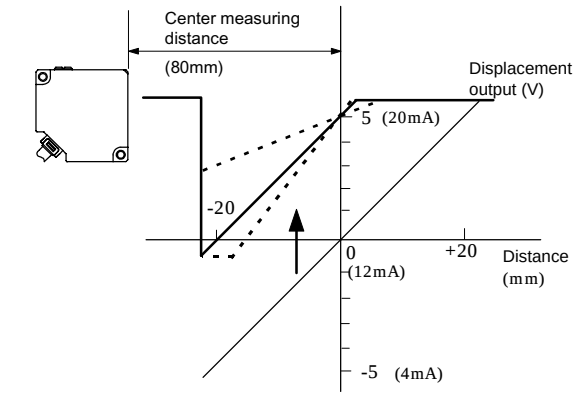
LH-54: If the -10 mm position is made '0'.



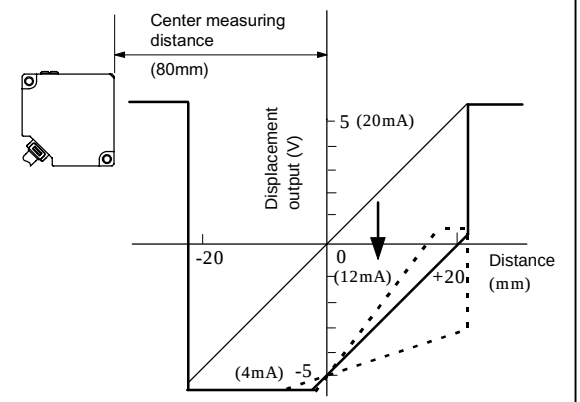
LH-54: If the +10 mm position is made '0'.



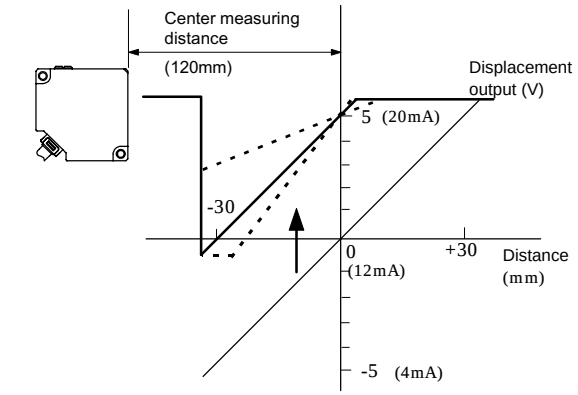
LH-58: If the -20 mm position is made '0'.



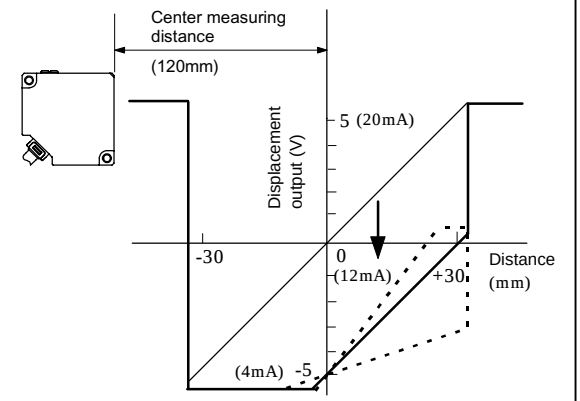
LH-58: If the +20 mm position is made '0'.



LH-512: If the -30 mm position is made '0'.



LH-512: If the +30 mm position is made '0'.



NOTE

- If span adjustment is carried out with respect to a 0-adjusted measurement value, a large span adjustment, which when added to the data before 0-ADJ results in a value exceeding the measurement full scale, cannot be performed.
- After the 0-ADJ, if the set value exceeds the upper/lower limit of the measurement value or the analog output, it is held at the upper/lower limit of full scale.

■ Display hold

The display hold function is a function that fixes the measurement value display by pressing the DOWN key and Set key simultaneously. Pressing any key cancels the function.

NOTE The display hold setting is enabled only in the measurement mode.

Setting Procedure Key operation from measurement mode is explained.

Step	Key	Operation	Display / Result
①	▽ + SET	Press the DOWN key and set key simultaneously.	The measurement value display is fixed and the display hold indicator lights up.

■ Panel lock setting

When the panel lock setting is turned ON, it makes it impossible for a key operation to be received until the setting is canceled. Also, when the panel lock setting is turned ON, RS-232C communication is enabled.

Initial setting: OFF

NOTE
- Even if the power is turned OFF, panel lock is maintained.
- Setting and canceling of panel lock are only enabled in the measurement mode.

Setting procedure Key operation from measurement mode is explained.

・Setting/cancellation method

Step	Key	Operation	Display / Result
①	△ + ▽ 1 sec. or more	Press the UP key and DOWN key simultaneously for 1 sec. or more.	・When the panel lock setting is ON, the panel lock indicator lights up.

6-4 List of initial settings

CH 1 / CH 2 gain setting	SELECT:04	
CH 1 / CH 2 calculation selection	Normal	
Item change	CH 1 = A, CH 2 = B	
Calculation equation selection	When d-03 is selected.	When d-04 is selected
	A-B	L-(A+B)
Threshold level setting	TH-1	TH-2
	+15% of F.S. from the measurement center.	-15% of F.S. from the measurement center.
Hysteresis setting	OFF	
Comparative output timer setting	OFF-timer	
Display contents selection	Displacement Monitor	
Display zero suppress	OFF	
Decimal point position setting	AUTO	
Lowest bit zero setting	OFF	
Display sleep setting	OFF	
Display offset setting	OFF	
Response time setting	300ms	
Calculation mode setting	Normal	
Analog output hold setting	OFF	
0-ADJ store setting	OFF	
Shift adjustment setting	OFF	
Span adjustment setting	OFF	
Analog voltage output offset setting	OFF	
Analog current output offset setting	OFF	
Bit rate setting	9600	
Data length setting	8bit	
Parity setting	OFF	
Stop bit number setting	1bit	
Interference prevention setting	Single	
CH 1 / CH 2 shift adjustment setting	OFF	
CH 1 / CH 2 span adjustment setting	OFF	
Panel lock setting	OFF	

— MEMO —

CHAPTER 7

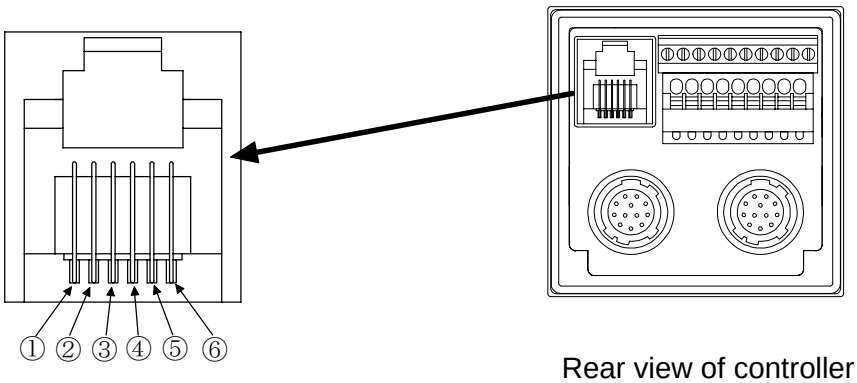
RS-232C CONTROL

7-1 Specifications

Connector	6-pin modular jack
Sync. method	Start-stop sync. system
Communication method	Non-procedural half-duplex
Stop bit	1 bit / 2 bits
Data bit	7 bits / 8 bits
Baud rate	1,200 / 2,400 / 4,800 / 9,600
Parity setting	Without parity / Even / Odd
Sending/receiving timer	With time-out monitor (10 seconds for sending, 10 seconds for receiving)

NOTE In case RS-232C transmission function is used, set to RS-232C mode by setting panel setting to ON. Please refer to page 6-117 '■ **Panel lock setting**' for setting details.

7-2 Connector pin-position and signals



Rear view of controller

Pin No.	Signal	Signal direction Controller External	Description
①	–	NC	
②	–	NC	
③	RD (RXD)	Input ← Output	Receiving
④	SG (SG)	–	Signal ground
⑤	SD (TXD)	Output → Input	Sending
⑥	–	NC	

No.③ pin: RD (RXD) signal

This is a terminal for receiving signal of controller.
Usually SD (TXD) of external device is connected.

No.④ pin: SG (SG)

Ground for signal.
Usually SG (SG) of external device is connected.

No.⑤ pin: SD (TXD)

This is a terminal for sending signal of controller.
Usually RD (RXD) of external device is connected.

<Recommended connector>
Modular plug MOD-P66□ manufactured by Honda Tsushin Kogyo Co. Ltd.

NOTE

- Make sure to connect/disconnect the connectors in the power supply off condition.
- Do not pull the cable to remove the connector, since this can result in a cable break.

7-3 Message format

The message format is shown below.
The characters to be used for the message are JIS8 (some parts are common with JIS7/ASCII) code.

■ Command message

The command is an instruction given to the controller from an external device. By the command, each setting of the controller can be changed or checked externally. In order to use the command, the message must be constructed in the defined format and must be transmitted to the controller. This message is called the command message. The format and its contents are described below.

- **Command messageformat**

Start code 1 character	Command 4 characters	Sub- command 1 character	Data Variable length of data	End code 1 character

Head ← → End

- **Description of command message**

Name	Description
Start code	STX (02h) fixed. This is a code to recognize the start of the message.
Command	This is the instruction portion. By specifying a command consisting of 4 characters, instruction for any operation can be given to the controller. Type of command that can be specified is described later.
Sub command	This is auxiliary instruction to be added for setting and reading. Either of following one character is specified. 'S'... Data write-in or operation (SET) 'R'... Data read-out (Read) Note: There are commands for which 'R' cannot be specified.
Data	This is the data to be specified for each command. The contents to specified vary from command to command. Refer to the description of each command.
End code	ETX (03h) fixed. This is a code to recognize the end of the message.


REFERENCE

Please refer to page 7-8 '**7-5 Commands description**' for the type of commands.

■ Response message

The response message is the returned message from the controller in response to the command message sent by the external device.
The response message is classified into 3 types, a normal response message, an abnormal response message, and a read-out response message, depending on a command message sent by the external device.

- **Normal response message**
  The normal response message is returned back when the contents of the command message are correct or when the instructed process is completed correctly. It can be recognized by the start code ACK (06h) at the beginning.
- **Abnormal response message**
  The abnormal response message is returned back when the contents of the command message are not correct, when the instructed process is not correctly completed or when a system error occurs, etc. It can be recognized by the start code NAK (15h) at the beginning.

The format and its contents are described below.

- **Format of normal response message**

Start code 1 character	Response code 2 characters	Data Variable length of data	End code 1 character

Head ← → End

- **Description of normal response message**

Name	Description
Start code	ACK (06h) fixed. This is a code to recognize the normal response message besides to identify the beginning of the message.
Response code	00 (3030h) fixed.
Data	When the sub-command of the command message is 'R', the read set value is stored. Refer to the description of each command, since the contents differ from command to command. If 'S' is specified for the sub-command of the command message, this item will be omitted. (O character)
End code	ETX (03h) fixed. This is a code to recognize the end of the message.

Please refer to page 7-8 '**7-5 Commands description**' for the type of commands.

- **Format of abnormal response message**

Start code 1 character	Response code 2 characters	End code 1 character

Head ← → End

- **Description of abnormal response message**

Name	Description
Start code	NAK (15h) fixed. This is a code to recognize the abnormal response message besides to identify the beginning of the message.
Response code	The cause of abnormality is informed with a 2 digit number. 10: Not ended with ETX 11: Command name is not correct. 12: Sub-command is not correct. 13: Command other than ALRM command is not accepted because of being in alarm state. 14: The data length or type of character is not correct. 15: Format of data part is not correct. 16: Specified head is not connected. 17: EEPROM access error 18: The information of the head is not identical when EEPROM is read. 19: Unregistered number is specified when EEPROM is read.
End code	EXT (03h) fixed. This is a code to recognize the end of the message.

7-4 Cautions

When using RS-232C transmission function, take care of the following.

- **Panel lock setting**
  RS-232C cannot be used unless the panel lock setting is set to ON. Please refer to page 6-117 '■ **Panel lock setting**' for setting details.

- **Hand shake**
  Do not send command messages continuously. Make sure to check the response message first, and then send the next command. After a command message is sent, the controller does not accept the next command till the response message is returned.

- **Setting change through RS-232C**
  In case each setting is changed through RS-232C (in case the message sub-command 'W' is sent), save the changed setting into the EEPROM before RS-232C mode is canceled. Otherwise, the change is not stored. (Carry out Save of 'MMRW'.)

- **Command message to specify the write-in of setting and command message to access the EEPROM**
  If the message of sub-command 'W' is sent in each command or if 'MMRW' command is sent, wait for approx. 400ms after receiving the response message before sending the next message.

- **Operation in error state**
  During 'system error' or 'RS-232C communication error (required power supply OFF error) ', no sending/receiving is possible. During 'other errors', commands other than 'ALRM' command cannot be used. However, during 'measurement error', all commands can be used as in the normal condition.

Please refer to page 9-1 '**9-1 Error indication**' for errors.

- **0-ADJ in RS-232C mode**

  Even if 0-ADJ memory is in the ON state, 0-ADJ is not stored in case the time 0-ADJ was carried out is till the setting is changed through RS-232C and the setting is stored into EEPROM. 0-ADJ memory function operates correctly till the setting is changed after entering into RS-232Cmode, or the setting is changed again after the setting is stored into EEPROM.

- **Gain setting through RS-232C**

  In case gain setting is done through RS-232C, optimum gain described on page 6-12 '■ **CH 1/CH 2 gain setting**' cannot be set. Therefore, take care of the following.

  - After gain setting, if the set gain is not optimum, BRIGHT or DARK error may occur.
  - Specifically, if a high gain level is selected for an object having high reflectance which should normally result in a BRIGHT state, the measurement value might be displayed, instead of BRIGHT state error being shown in the measurement mode. In this case, take care that the measurement value is highly inaccurate.

7-5 Commands description

■ Table of commands

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■ Description of each command

The following describes the function, command message and the format of the data part contained in the normal response message in each command.
By putting the format described for each command into the data part of the command message or the normal response message, a message format, which is communicated between the controller and the external device, is created.


REFERENCE

Please refer to page 7-3 '**7-3 Message format**' for command message and the format of normal response message.

- **TMST**

It reads out the current output terminal state.
As output terminal state cannot be controlled externally, allowable command is 'R' only.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 3 characters long

HI terminal state 1 character	GO terminal state 1 character	LO terminal state 1 character

Head ← → End

Each character from the first indicates, in order, the state of HI terminal, GO terminal and LO terminal.
Character '0' indicates OFF.
Character '1' indicates ON.

- **ALRM**

It reads out the current alarm state (error state).
As output terminal state cannot be controlled externally, allowable command is 'R' only.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 6 characters long

Major alarm state 3 characters	Minor alarm state 3 characters

Head ← → End

The first 3 characters indicate the alarm code for major alarm, and 3 characters from the 4th digit indicate the alarm code for minor alarm.
However, in case a major alarm occurs, as RS-232C mode is canceled, the major alarm cannot be actually confirmed with this command.


REFERENCE

- Please refer to 9-1 '**9-1 Error indication**' for error.
- Please refer to page 7-6 '**7-4 Cautions**' for RS-232C mode operation.

Alarm code for major alarm and its description.
(Confirming major alarm is actually impossible)

‘001’: CH1 sensor head EEPROM abnormality	(Er-01)
‘002’: CH2 sensor head EEPROM abnormality	(Er-02)
‘003’: CH1 wire-break detection	(Er-03)
‘004’: CH2 wire-break detection	(Er-04)
‘005’: Controller EEPROM abnormality	(Er-05)
‘007’: Sensor head not connected	(Er-07)
‘010’: EEPROM READ abnormality	(Er-10)
‘011’: EEPROM WRITE abnormality	(Er-11)
‘012’: Internal process 1 abnormality	(Er-12)
‘013’: Internal process 2 abnormality	(Er-13)
‘020’: Receiving time-out	(Er-20)
‘021’: Sending time-out	(Er-21)
‘022’: Parity error	(Er-22)
‘023’: Framing error	(Er-23)
‘024’: Over-run error	(Er-24)

Alarm code for minor alarm and its description

‘001’: BRIGHT CH 1	(bri1)
‘002’: BRIGHT CH 2	(bri2)
‘003’: DARK CH 1	(dAr1)
‘004’: DARK CH 2	(dAr2)
‘005’: NEAR CH 1	(nEAr1)
‘006’: NEAR CH 2	(nEAr2)
‘007’: FAR CH 1	(FAr1)
‘008’: FAR CH 2	(FAr2)
‘029’: Interlock	(-----)
‘030’: Over-current protection	(Er-30)

- **MSVL**

The measurement value displayed on the 5 digit LED display is read out.
(Even if on 'sleep', the measurement value can be read.)
As the displayed value on the 5 digit display cannot be controlled externally, allowable subcommand is 'R' only.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 7 characters long

Measurement value on 5 digit LED display 7 characters

Head ← → End

In case the display setting is 'displacement monitor' or 'distance monitor'
The first character is the sign. For minus, '-' is put, and for plus, '+' is put.
Five characters from the second digit are a number and one of them is a decimal point.
(The position of the decimal point may change depending on the setting)
In case the display setting is 'comparative decision monitor.
When HI: 'HI'
When GO: 'GO'
When LO: 'LO'
Regardless of the display setting, in case of the following alarm in minor alarm
When BRIGHT: ' BRIGHT'
When DARK: 'DARK'
When NEAR: 'NEAR'
When FAR: 'FAR'


REFERENCE

Please refer to page 6-45 '■ **Display contents selection**' for display settings.

- **DPHL**

This is for hold setting of the measurement value on 5 digit LED display and reading out the current hold setting.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Display hold instruction 1 character

Head ← → End

Hold cancel instruction with a character '0' and hold start instruction with a character '1'.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Display hold state 1 character

Head ← → End

Character '0' indicates 'no hold'.
Character '1' indicates 'on hold' .

- **MMNM**

This reads out the currently used memory No.
If it is desired to move the current memory No. to another memory No., use a command 'MMRW'. The allowable sub-command is 'R' only.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': Not possible

When sending with a sub command 'R': 2 characters long

Memory No. 2 characters

Head ← → End

It is expressed by unit of 1 within '01 to 20'.
'01' to '16': User's memory (u-01 to u-16) is indicated.
'17' to '20': Default memory is indicated.
17＝d-01, 18＝d-02, 19＝d-03, 20＝d-04


REFERENCE

Please refer to page 6-4 '**6-2-2 Default memory and user memory**' for memory No.

- **MMRW**

This stores the currently used memory into user's memory (EEPROM) (when sub command is 'W'), or reads out the memory from user's memory & default memory (when sub command is 'R').

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 2 characters long

User memory No. where stored 2 characters

Head ← → End

It is expressed by unit of 1 within '01 to 16'.
This number expresses the user's memory No. as it is.

When sending with a sub command 'R': 2 characters long

Memory No. which is read 2 characters

Head ← → End

It is expressed by unit of 1 within '01 to 20'.
'01' to '16': User's memory (u-01 to u-16) is indicated.
'17' to '20': Default memory is indicated.
17＝d-01, 18＝d-02, 19＝d-03, 20＝d-04

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 0 character long (no data part)

- **ITFS**

This sets interference prevention and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command ‘W’: 1 character long

Interference prevention instruction 1 character

Head ← → End

Single setting is indicated with a character ‘1’.
Master setting is indicated with a character ‘2’.
Slave setting is indicated with a character ‘3’.

When sending with a sub command ‘R’: 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command ‘W’: 0 character long (no data part)

When sending with a sub command ‘R’: 1 character long

Interference prevention state 1 character

Head ← → End

Character ‘1’ indicates Single setting.
Character ‘2’ indicates Master setting.
Character ‘3’ indicates Slave setting.

- **GIN1**

This sets gain setting for CH 1 side and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 3 characters long

Gain classification instruction 1 character	SELECT No. instruction 2 characters

Head ← → End

A character on the first digit is for gain classification selection.
Character '0' for SELECT
Character '1' for AUTO
2 characters from the second digit are to specify the SELECT No. for SELECT classification and the setting can be in unit of 1 within '01 to 11'. When gain classification is set to AUTO, set the SELECT No. to '00'.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 3 characters long

Gain classification state 1 character	SELECT No. state 2 characters

Head ← → End

A letter on the first digit is to select gain classification.
Character '0' indicates SELECT.
Character '1' indicates AUTO.
2 characters from the second digit specify the SELECT No. for SELECT gain classification and the setting can be in unit of 1 within '01 to 11'. When gain classification selection is set to AUTO, the SELECT No. is fixed to '00'.

- **GIN2**

This sets gain setting for CH 2 side and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 3 characters long

Gain classification instruction 1 character	SELECT No. instruction 2 characters

Head ← → End

A character on the first digit is for gain classification selection.
Character '0' for SELECT
Character '1' for AUTO
2 characters from the second digit are to specify the SELECT No. for SELECT classification and the setting can be in unit of 1 within '01 to 11'. When gain classification selection is set to AUTO, set the SELECT No. to '00'.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 3 characters long

Gain classification state 1 character	SELECT No. state 2 characters

Head ← → End

A letter on the first digit is to select gain classification.
Character '0' indicates SELECT.
Character '1' indicates AUTO.
2 characters from the second digit specify the SELECT No. for SELECT gain classification and the setting can be in unit of 1 within '01 to 11'. When gain classification selection is set to AUTO, the SELECT No. is fixed to '00'.

- **REST**

This sets the response time and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 2 characters long

Response time instruction 1 character	SELECT No. instruction 1 character

Head ← → End

A character on the first digit is for response time selection.

Character '0' for SELECT

Character '1' for AUTO.

A character on the second digit specifies the SELECT No. when SELECT in response time selection is set and the setting can be in unit of 1 within '1' to '8'.

Character	1	2	3	4	5	6	7	8
Response time (ms)	0.5	1	10	20	30	40	100	300

When response time selection is set to AUTO, set the SELECT No. to '0'.

NOTE In order to set response time selection to AUTO, the measurement function selection 'FCSL' must be set to normal.

When sending with a sub-command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 2 characters long

Response time state 1 character	SELECT No. state 1 character

Head ← → End

A character on the first digit is for response time selection.

Character '0' indicates SELECT.

Character '1' indicates AUTO.

A character on the second digit specifies SELECT No. when SELECT in response time selection is set and the setting can be in unit of 1 within '1' to '8'.

Character	1	2	3	4	5	6	7	8
Time(ms)	0.5	1	10	20	30	40	100	300

When response time selection is set to AUTO, the SELECT No. is fixed to '0'.

- **CA1C**

This sets the calculation selection for CH 1 side head in single measurement mode and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Calculation type instruction 1 character

Heard ← → End

Character '1' specifies normal calculation.
Character '2' specifies L-A calculation.

When sending with a sub-command 'R': 0 character (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Calculation type state 1 character

Head ← → End

Character '1' indicates normal calculation.
Character '2' indicates L-A calculation.

NOTE In case normal calculation is selected, the display offset 'DPOF' is set to OFF.

- **CA2C**

This sets the calculation selection for CH 2 side head in single measurement mode and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command ‘W’: 1 character long

Calculation type instruction 1 character

Head ← → End

Character ‘1’ specifies normal calculation.
Character ‘2’ specifies L-A calculation.

When sending with a sub command ‘R’: 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command ‘W’: 0 character long (no data part)

When sending with a sub command ‘R’: 1 character long

Calculation type state 1 character

Head ← → End

Character ‘1’ indicates normal calculation.
Character ‘2’ indicates L-A calculation.

NOTE In case normal calculation is selected, the display offset ‘DPOF’ is set to OFF.

- **EXHD**

This sets calculation item change and reads out the set value. It specifies the head substituted for A in the calculation formula for the calculation function in calculation mode.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Calculation head change instruction 1 character

Head ← → End

Character '1' is for A=CH 1.
Character '2' is for A=CH 2.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Calculation head change state 1 character

Head ← → End

Character '1' indicates A=CH 1.
Character '2' indicates A=CH 2.

- **CA12**

This sets calculation selection in the calculation mode and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub-command 'W': 1 character long

Calculation selection instruction 1 character

Head ← → End

Character '1' is for A + B calculation
Character '2' is for A – B calculation
Character '3' is for (A + B) / 2 calculation
Character '4' is for L – (A + B)
Character '5' is for L – (A – B) calculation

NOTE When setting '1' ,'2' or '3' is specified, the display offset 'DPOF' becomes OFF.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Calculation selection state 1 character

Head ← → End

Character '1' indicates A + B calculation.
Character '2' indicates A – B calculation.
Character '3' indicates (A + B) / 2 calculation.
Character '4' indicates L – (A + B).
Character '5' indicates L – (A – B) calculation.

- **DPSL**

This specifies the display setting on the 5 digit LED display and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

5 digit LED display setting instruction 1 character

Head ← → End

Character '0' specifies the displacement monitor display.
Character '1' specifies the distance monitor display.
Character '2' specifies the comparative decision monitor display.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

5 digit LED display setting state 1 character

Head ← → End

Character '0' indicates displacement monitor display.
Character '1' indicates distance monitor display.
Character '2' indicates comparative decision monitor display.

- **ZSPS**

This sets zero-suppress on the 5 digit LED display and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command ‘W’: 1 character long

5 digit LED display zero-suppress instruction 1 character

Head ← → End

Character ‘0’ makes zero suppress invalid.
Character ‘1’ makes zero suppress valid.

When sending with a sub command ‘R’: 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command ‘W’: 0 character long (no data part)

When sending with a sub command ‘R’: 1 character long

5 digit LED display zero suppress state 1 character

Head ← → End

Character ‘0’ indicates that the zero suppress is invalid.
Character ‘1’ indicates that the zero suppress is valid.

- **CMPS**

This sets the position of the decimal point on the 5 digit display and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Decimal point position instruction 1 character

Head ← → End

Character '0' specifies AUTO for setting the decimal point.
Character '1' specifies one digit after decimal point.
Character '2' specifies two digits after decimal point.
Character '3' specifies three digits after decimal point.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Decimal point position state 1 character

Head ← → End

Character '0' indicates AUTO for setting the decimal point.
Character '1' indicates one digit after decimal point.
Character '2' indicates two digits after decimal point.
Character '3' indicates three digits after decimal point.

- **LWZS**

This sets the lowest digit on the 5 digit LED display to zero and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command ‘W’: 1 character long

Zero-setting instruction 1 character

Head ← → End

Character ‘0’ specifies zero setting OFF.
Character ‘1’ specifies zero setting ON.

When sending with a sub command ‘R’: 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command ‘W’: 0 character long (no data part)

When sending with a sub command ‘R’: 1 character long

Zero-setting state 1 character

Head ← → End

Character ‘0’ indicates zero setting OFF.
Character ‘1’ indicates zero setting ON.

- **DPSP**

This sets 5 digit LED display sleep and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Display sleep instruction 1 character

Head ← → End

Character '0' specifies display sleep OFF.
Character '1' specifies display sleep ON.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Display sleep state 1 character

Head ← → End

Character '0' indicates display sleep OFF.
Character '1' indicates display sleep ON.

- **DPOF**

This sets display offset for 5 digit LED display and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub-command 'W': 9 characters long

Offset presence / absence instruction 1 character	Offset amount instruction 8 characters

Head ← → End

A character on the first digit specifies display offset ON/OFF.
Character '0' specifies display offset absent.
Character '1' specifies display offset present.
8 characters from the second digit specify offset amount and it can be set in unit of 1 within '–5,000,000' to '+5,000,000'.
When display offset absent is to be specified, set the offset amount to '00000000'.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 9 characters long

Offset presence / absence state 1 character	Offset amount state 8 characters

Head ← → End

A character on the first digit indicates display offset ON / OFF.
Character '0' indicates display offset absent.
Character '1' indicates display offset present.
8 characters from the second digit specify offset amount and it is indicated in unit of 1 within '–5,000,000' to '+5,000,000'.

- **FCSL**

This sets the measurement mode and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 5 characters long

Measurement mode instruction 1 character	Simple average number instruction 4 characters

Head ← → End

A character on the first digit selects the measurement mode.

Character '0' specifies normal measurement.
Character '1' specifies peak-peak measurement.
Character '2' specifies peak hold measurement.
Character '3' specifies bottom hold measurement.
Character '4' specifies simple average measurement.

4 characters from 2nd digit specify the average number in the simple average measurement and it can be set in unit of 1 within '0002 to 1024'.
When selecting measurement other than simple average measurement, set the simple average number as '0000'.

NOTE In order to set the measurement mode selection to '1', '2', '3' or '4', the response time classification 'REST' must be set to SELECT.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command ‘W’: 0 character long (no data part)

When sending with a sub command ‘R’: 5 characters long

Measurement mode state 1 character	Simple average number state 4 characters

Head ← → End

A character on the first digit shows the measurement mode selection.

Character ‘0’ indicates normal measurement.
Character ‘1’ indicates peak-peak measurement.
Character ‘2’ indicates peak hold measurement.
Character ‘3’ indicates bottom hold measurement.
Character ‘4’ indicates simple average measurement.

4 characters from 2nd digit specify the average number in simple average and it is indicated in unit of 1 within ‘0002 to 1024’.

When measurement other than simple average measurement was selected, the simple average number is fixed as ‘0000’.

- **CHSL**

This sets change of channel and reads out the set value.
Specifically, it selects single measurement mode/calculation mode and CH 1/CH 2 in case of single measurement mode.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Used head & channel instruction 1 character

Head ← → End

Character '1' specifies single measurement mode & CH 1.
Character '2' specifies single measurement mode & CH 2.
Character '3' specifies the calculation mode.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Head to use & channel state 1 character

Head ← → End

Character '1' indicates single measurement mode & CH 1.
Character '2' indicates single measurement mode & CH 2.
Character '3' indicates calculation mode.

- **ANHD**

This sets analog output hold and reads out the set value.

1) The format of the data part in the command message is as follows.

When sending with a sub command 'W': 1 character long

Analog output hold instruction 1 character

Head ← → End

Character '0' specifies hold OFF.
Character '1' specifies the hold ON.

When sending with a sub command 'R': 0 character long (no data part)

2) The format of the data part in the normal response message is as follows.

When sending with a sub command 'W': 0 character long (no data part)

When sending with a sub command 'R': 1 character long

Analog output hold state 1 character

Head ← → End

Character '0' indicates hold OFF.
Character '1' indicates hold ON.

CHAPTER 8

DESCRIPTION OF TERMS

■ Full Scale (F. S.)

In case of **LH-CS6**(**P**) and **LH-CD6**(**P**) when used in single measurement mode (measurement with one sensor head only), full scale indicates the following values:

Item \ Sensor head	**LH-54**	**LH-58**	**LH-512**
Full scale distance	20mm (±10mm)	40mm (±20mm)	60mm (±30mm)
Full scale analog voltage output	10V		
Full scale analog current output	16mA		

In case **LH-CD6**(**P**) is used in calculation mode with two sensor heads connected, full scale distance indicates the following values, depending on the sensor head combination.

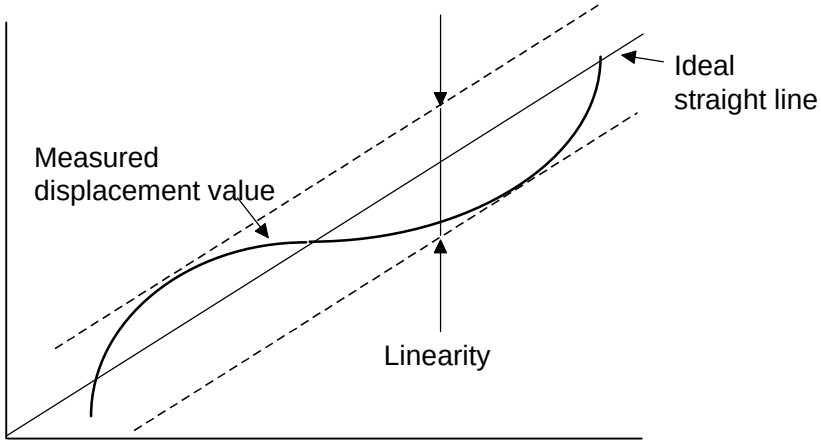
		HEAD 2 side		
		LH-54	**LH-58**	**LH-512**
HEAD 1 side	**LH-54**	40mm (±20mm)	60mm (±30mm)	80mm (±40mm)
	LH-58	60mm (±30mm)	80mm (±40mm)	100mm (±50mm)
	LH-512	80mm (±40mm)	100mm (±50mm)	120mm (±60mm)

■ Linearity

When measuring displacement, the displacement of the measured object and the measured displacement value given by the sensor should ideally match, and if a graph is drawn, it should be expressed as a straight line. However, in practice, there is a slight difference between the displacement of the measured object and the measured displacement value. The linearity gives the range of deviation of the measured displacement value from the ideal straight line. For this product, the linearity has been defined as the deviation from the ideal straight line for a white ceramic board as the measured object. The linearity may differ depending on the measured object.

The data mentioned gives the deviation from the ideal straight line expressed as a percentage of the full scale value. (% of F.S.)

Example: In case the deviation is +0.1 % of F.S. for **LH-54**
Since the full scale of **LH-54** is 20mm (±10mm), a deviation of ±0.1 % of F.S. is 20mm×0.1% = 0.02mm.

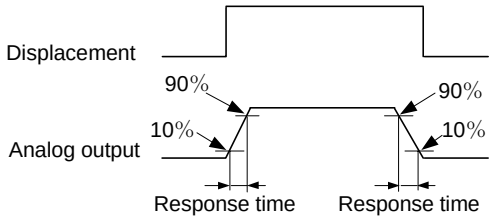


■ Resolution

When the analog output of the displacement sensor is processed by the controller, a deviation results due to the signal's S/N. The resolution is defined as twice the standard deviation of the measured value at the center measuring distance.

■ Response time

The response time is the rise time or the fall time (10 to 90%) of the analog displacement output for a step change in the displacement.



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CHAPTER 9

ERROR INDICATION AND TROUBLESHOOTING

9-1 Error indication

In case of abnormality of the sensor, or depending on the measurement conditions, an error signal appears on the display panel. The table below gives the error display, its cause and remedy.
Should there be a need to contact our office, please inform the error displayed.

9-1-1 System errors

Error display	Cause	Remedy
Er-01	An EEPROM access error occurred for the CH 1 sensor head.	After turning the power OFF once, turn it ON again. If the error occurs again, please contact our office.
Er-02	An EEPROM access error occurred for the CH 2 sensor head.	
Er-05	Access error 1 occurred in the CPU EEPROM.	
Er-10	Read error 1 occurred in the CPU EEPROM.	
Er-11	Write error 2 occurred in the CPU EEPROM.	
Er-12	A CPU internal processing (1) error occurred.	
Er-13	A CPU internal processing (2) error occurred.	
Er-07	Sensor head was not connected when the power was turned on.	After turning the power OFF once, connect the sensor head, then turn the power ON again.

9-1-2 RS-232C communication errors

Error display	Cause	Remedy
Er-20	Reception time out occurred in RS-232C.	After turning the power OFF, turn it on again. Also, reconfirm the communications command, and execute again.
Er-21	Transmission time out occurred in RS-232C.	
Er-22	Parity error occurred in RS-232C.	
Er-23	Framing error occurred in RS-232C.	
Er-24	Overrun error occurred in RS-232C.	

9-1-3 Measurement errors

Error display	Cause	Remedy	Reference page
	Light intensity received at the CH 1 sensor head has reached the saturation level.	Change the gain or other settings and eliminate the state where the sensor heads are receiving excess or insufficient light.	6-12
	Light intensity received at the CH 2 sensor head has reached the saturation level.		
	Light intensity received at the CH 1 sensor head is insufficient.		
	Light intensity received at the CH 2 sensor head is insufficient.		
	CH 1 sensor head is outside the measuring range (near side).	Set the sensor head so that it is within the measuring range.	3-1
	CH 2 sensor head is outside the measuring range (near side).		
	CH 1 sensor head is outside the measuring range (far side).		
	CH 2 sensor head is outside the measuring range (far side).		

9-1-4 Other errors

Error display	Cause	Remedy	Reference page
- - - - -	Emission is OFF due to operation of remote interlock	Short-circuit the interlock terminals.	3-8, 9, 15
Er-30	Overcurrent protection function is activated.	Remove the cause of the overcurrent state.	_____
Er-40	When the power is turned on, the sensor head connection information recorded most recently in memory differed from the previous sensor head connection information. (Note 1)	The error indication will blink, so press any key. This will result in memory read out condition, so select the memory No.	6-6
Er-50	A condition which is impossible to set was selected during setting of measurement conditions.	After blinking for approximately 2 sec., it becomes possible to select the setting again.	_____

NOTE

Sensor head connection information gives the model type of the sensor head connected to the HEAD 1 side or HEAD 2 side connector and the combination of those types.

9-2 Troubleshooting

In case there are symptoms which indicate abnormal operation, first check the following items. If the operation is still abnormal, please contact our office.

Trouble	Cause	Remedy	Reference page
Nothing is displayed in the 5 digit LED display.	Power is not ON.	Turn the power ON.	3-10
	Display sleep setting is set to the ON state.	Set the display sleep setting to the OFF state.	6-52
Emitting LED does not light up and [- - - - -] is displayed in the 5 digit LED display.	Interlock is functioning.	Short-circuit the interlock terminals (⑧ - ⑨).	3-15
"Er-40" is blinking in the 5 digit LED display.	Sensor head connection state stored most recently in memory differed from the sensor head connection state when the power was turned ON this time.	The error display will blink, so press any key. This will be result in memory read out condition, so select the memory No.	6-6
Measurement values vary (analog output, display).	Sensor head's emitter and receiver surfaces are soiled.	Remove the dirt from the sensor head's emitter and receiver surfaces.	3-1
	Sensor head or the measured object is tilted.	Check the sensor head's mounting condition and the measured object's setting condition.	3-1
	Gain setting is not correct.	Set the gain correctly.	6-12
	Set response time is too short.	Set the response time to a suitable period.	6-59
	Measured object is soiled.	Remove the dirt from the measured portion.	
	Sensor head mounting direction is not correct.	Check the sensor head mounting direction.	3-1
	Measurement value display is unstable near the boundaries of the measuring range.	Use the sensor head to measure within the measuring range.	3-1

Trouble	Cause	Remedy	Reference Page
Measurement value (analog output) differs from the display.	Analog voltage/current output offset setting is set to the ON state.	Check the analog voltage/current output offset setting value.	6-88 6-91
	Display offset is set.	Check the setting value of display offset (L value).	6-54 6-15 6-21
Measurement value is not displayed correctly.	Display contents selection is not set correctly.	Change the setting of display contents selection to the appropriate setting from among 'displacement monitor,' 'distance monitor' or 'comparative decision monitor.'	6-45
	Lowest bit zero setting is set to the ON state.	Set the lowest bit zero setting to the OFF state.	6-50
	Decimal point position setting is set.	Check the decimal point position setting.	6-49
	Calculation mode is not set correctly.	Check the calculation mode setting in the 'Other settings'.	6-63
	0-ADJ setting is done.	Clear the 0-ADJ setting or use it correctly.	6-75, 112
	Shift and span adjustments were not performed correctly.	Perform the shift and span adjustments correctly.	6-78, 83, 102, 106
	Sensor head's emitter and receiver surfaces are soiled.	Remove the dirt from the sensor head's emitter and receiver surfaces.	3-1
	Measured object is soiled.	Remove the dirt from the measured portion.	
There is no analog output corresponding to the displacement of the connected head.	Shift and span adjustments have been set.	Clear the shift and span adjustments. If necessary, set them again.	6-78, 83, 102, 106
	Calculation settings are set in **LH-CD6 (P)**.	If the calculation settings are set, the sum of the measuring ranges of the connected heads becomes the full scale of the analog output.	6-21

Trouble	Cause	Remedy	Reference page
Even if 0-ADJ is performed, once the power is turned off, the setting returns to the original setting.	0-ADJ store setting is in the OFF state.	Change the 0-ADJ store setting to the ON state.	6-73
	'r' is selected when writing to memory.	Write the data in user memory u-01 to u-16.	6-10
Display doesn't become '0' even when 0-ADJ is performed.	Display offset (L) is set.	Check the display offset (L) setting value.	6-54 6-15 6-21
Even if the UP and DOWN keys are pressed simultaneously for 1 sec. or more during setting, the setting operation is not canceled.	After all reset operation, memory write was not performed.	Carry out memory write once, then return to the measurement mode.	6-110
Only 'bri1, bri2' is displayed.	An object which reflects a lot of light is being measured.	Lower the gain. Else, increase the measurement distance.	6-12
	A mirror-like object is being measured and specularly reflected light enters the receiving section.	Tilt the sensor head.	
Only 'dar1, dar2' is displayed.	An object which reflects very little light is being measured.	Raise the gain. Also, decrease the measurement distance.	6-12
	A mirror-like object is being measured and reflected light is not entering the receiving section at all.	Tilt the sensor head.	
Only 'SLAVE' is displayed.	Interference prevention setting is set on Slave, but the controller connected to the interference prevention I/O terminal is not set as Master.	Connect a controller which is set as master.	6-99
When reading memory, memory numbers are being skipped during display. The memory number that is to be used for measurement cannot be read.	A sensor head of a model different from the type used when the memory was set is connected.	When reading memory, only those memory numbers which match the setting conditions of the connected sensor head are displayed. Either connect a sensor head which is of the same model as the type connected when the memory setting was performed or carry out memory setting once more.	6-6

Trouble	Cause	Remedy	Reference page
Communications cannot be carried out with the connected device through RS-232C.	The wiring of the pins of the modular connector is faulty.	Check the wiring of the modular connector.	7-2
	The bit rate / data length / parity / stop bit and other settings are not correct.	Set the values in the controller so that they are the same as the values set in the external device.	6-94 ~ 98
An error response message is returned by RS-232C.	The transmission command / ASCII code is not correct.	Transmit the correct command / ASCII code.	7-1 ~ Chapter 7

— MEMO —

CHAPTER 10

SPECIFICATIONS

10-1 Sensor head

Item \ Designation / Model No.			LED type optical displacement sensor		
			LH-54	**LH-58**	**LH-512**
Applicable controller			**LH-CL6 (P), LH-CS6 (P), LH-CD6 (P)**		
Center measuring distance			40mm	80mm	120mm
Measuring range			±10mm	±20mm	±30mm
Emitting element			Red LED (modulated) (Peak wavelength: 650nm)		
Spot diameter (Note 2)			φ1.6mm or less	φ2.0mm or less	φ3.0mm or less
Resolution (Note 3)	Controller response time	300ms	2 μm	4 μm	20 μm
		100ms	4 μm	8 μm	40 μm
		40ms	5 μm	14 μm	65 μm
		30ms	6 μm	16 μm	75 μm
		20ms	7 μm	28 μm	92 μm
		10ms	10 μm	40 μm	130 μm
		1ms	20 μm	120 μm	400 μm
		0.5ms	40 μm	160 μm	580 μm
Linearity (Note 4)			Within ±0.2% F.S.		
Ambient temperature			0 to +45℃ (No dew condensation) Storage: −20 to +60℃		
Ambient humidity			35 to 85% RH, Storage: 35 to 85% RH		
Ambient illuminance (Incandescent light)			3,000lx or less		2,000lx or less
Protection (Except connector part)			IP67 (IEC)		
Material			Enclosure: PEI, Enclosure cover: Aluminum		
Cable			0.22 mm^2 11-core composite cabtyre cable, 0.2m long, with a connector at the end		
Cable extension			Extension up to total 10.2m is possible with optional cable.		
Weight			70g approx. (with cable), 45g approx. (without cable)		

Notes:

1) Conditions which have not been specified are to be taken as: 24V DC power supply, 20℃ ambient temperature, SELECT gain setting, 300ms response time setting, center measuring distance, interference prevention function not used and white ceramic board object.
2) This is the value at the center measuring distance, and is based on the definition of $1/e^2$(13.5%) of the beam axis light intensity. Take care that some amount of light spreads out of the specified spot diameter and, depending on the conditions around the measured object, may affect the measurement accuracy.
3) This is the typical value at the center measuring distance for a white ceramic board object.
4) This is the value for white ceramic board object. The linearity may differ depending on the measured object. The value is for the analog output of the applicable controller.

10-2 Controller

Item	Designation	LED type optical displacement sensor General purpose controller			
	Type	NPN output type		PNP output type	
		1-head type	2-head type	1-head type	2-head type
	Model No.	**LH-CS6**	**LH-CD6**	**LH-CS6P**	**LH-CD6P**
Applicable sensor head		**LH-54, LH-58, LH-512**			
Connectable sensor heads (Max.)		1 No.	2 Nos.	1 No.	2 Nos.
Supply voltage		24V DC±10% Ripple P-P 10% or less			
Current consumption (Note 2)		300mA or less	350mA or less	300mA or less	350mA or less
Sampling frequency		5kHz approx.	CH1 or CH2 setting: 5kHz approx. Calculation setting: 2.5kHz approx.	5kHz approx.	CH1 or CH2 setting: 5kHz approx. Calculation setting: 2.5kHz approx.
Gain setting		AUTO (Note 3) / SELECT (settable in 11 steps)			
Analog output (Analog voltage output Analog current output)		Analog voltage ・Output voltage: −5 to+5V ・Output impedance: 100 Ω		Analog current ・Output current: 4 to 20mA ・Load resistance: 300 Ω less	
	Response time (Note 4)	When set to SELECT: 0.5ms/1ms/10ms/20ms/30ms/40ms/100ms/300ms selectable by key When set to AUTO: 0.5ms/1ms/10ms/20ms/30ms/40ms/100ms/300ms automatically selected depending on the measured object			
	Linearity (Note 5)	Within ±0.2% F.S.			
	Temp. characteristics	Within ±0.04% F.S./℃			
	Span adjustment	Within ±30% F.S. (Note 6)			
	Shift adjustment	Within ±30% F.S. (Note 6)			
Comparative output (HI, GO, LO)		NPN open-collector transistor ・Maximum sink current: 30mA ・Applied voltage: 30V DC or less (between comparative output and 0V) ・Residual voltage: 1.5V or less (at 30mA sink current) 0.4V or less (at 16mA sink current)		PNP open-collector transistor ・Maximum source current: 30mA ・Applied voltage: 30V DC or less (between comparative output and+V) ・Residual voltage: 1.5V or less (at 30mA source current) 0.4V or less (at 16mA source current)	
	Output operation	ON when threshold level is reached			
	Short-circuit protection	Incorporated			
Strobe output		NPN open-collector transistor ・Maximum sink current: 30mA ・Applied voltage: 30V DC or less (between strobe output and 0V) ・Residual voltage: 1.5V or less (at 30mA sink current) 0.4V or less (at 16mA sink current)		PNP open-collector transistor ・Maximum source current: 30mA ・Applied voltage: 30V DC or less (between strobe output and+V) ・Residual voltage: 1.5V or less (at 30mA source current) 0.4V or less (at 16mA source current)	
	Output operation	ON when comparative output is effective			
	Short-circuit protection	Incorporated			

Item \ Type		NPN output type		PNP output type	
		1-head type	2-head type	1-head type	2-head type
Model No.		**LH-CS6**	**LH-CD6**	**LH-CS6P**	**LH-CD6P**
Alarm output		NPN open-collector transistor ・Maximum sink current: 30mA ・Applied voltage: 30V DC or less (between alarm output and 0V) ・Residual voltage: 1.5V or less (at 30mA sink current) 0.4V or less (at 16mA sink current)		PNP open-collector transistor ・Maximum source current: 30mA ・Applied voltage: 30V DC or less (between alarm output and +V) ・Residual voltage: 1.5V or less (at 30mA source current) 0.4V or less (at 16mA source current)	
	Output operation	OFF when DARK, BRIGHT, NEAR, FAR or other error is displayed.			
	Short-circuit protection	——			
0-ADJ input		Low (0 to 1V): 0-ADJ operation ・Applied voltage: 30V DC or less		High (+V): 0-ADJ operation ・Applied voltage: 30V DC or less	
Remote interlock input		Low (0 to 1V): Emission High (+V or open): Emission stopped ・Applied voltage: 30V DC or less		High (+V): Emission Low (0 to 1V, or open): Emission stopped ・Applied voltage: 30V DC or less	
BUSY input		Low (0 to 1V): Measurement stopped ・Applied voltage: 30V DC or less		High(+V): Measurement stopped ・Applied voltage: 30V DC or less	
	No. of inputs	1 ch.	2 ch.	1 ch.	2 ch.
Calculation hold reset input		Low (0 to 1V): Calculation result reset ・Applied voltage: 30V DC or less		High(+V): Calculation result reset ・Applied voltage: 30V DC or less	
Timer function		Incorporated (operates on comparative output and alarm output)			
Interference prevention function (Note 7)		Incorporated (up to two units)			
Serial communication		Standard: RS-232C (RD/SD/SG) Connector: 6 pin modular jack Operation: user setting external switching, function detail external setting, measurement data transmission, etc.			
Display		5 digit red LED display			
Ambient temperature		0 to +50℃ (No dew condensation), Storage: −20 to +60℃			
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH			
Material		Enclosure: Polycarbonate			
Connection method		Terminal block connection			
Weight		120g approx.			
Accessories		ATA4811 (Controller mounting frame): 1 set			

Notes:

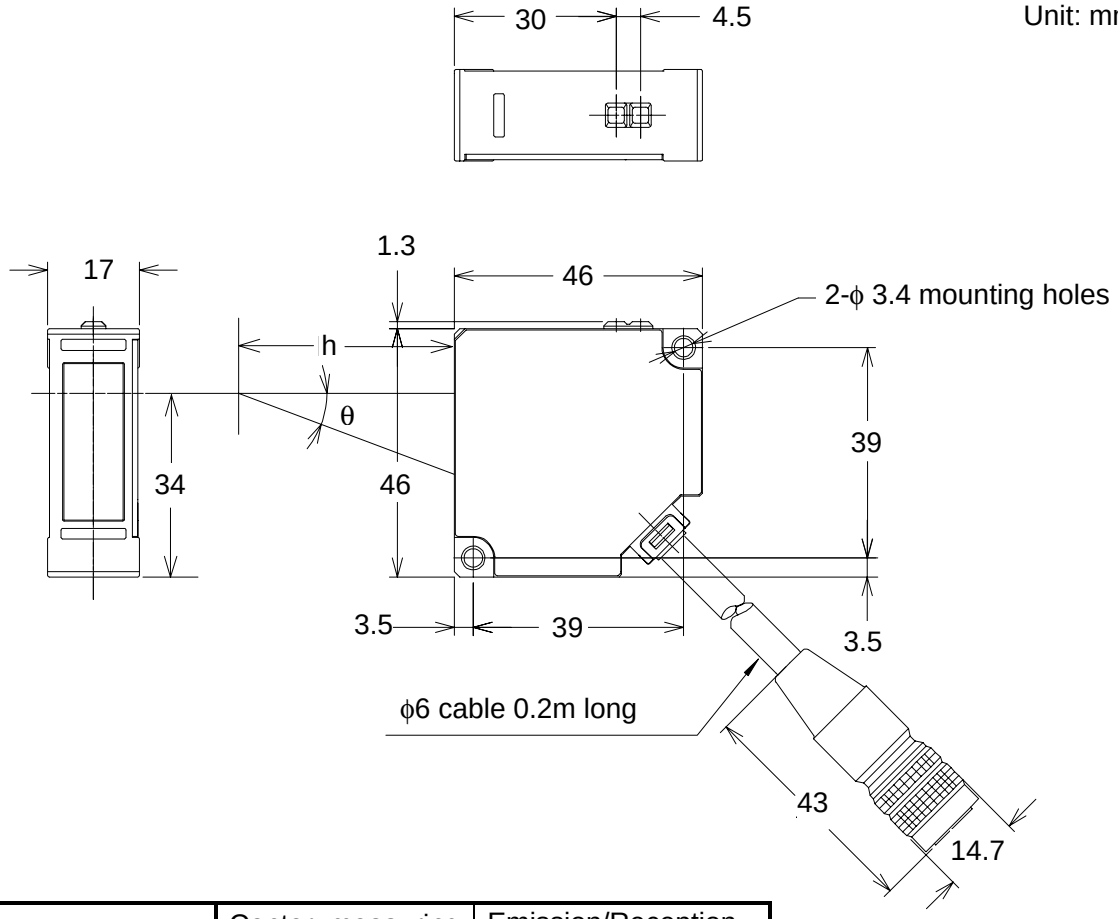
1) Conditions which have not been specified are to be taken as: 24V DC power supply, 20℃ ambient temperature, SELECT gain setting, 300ms response time setting, center measuring distance, interference prevention function not used and white ceramic board object.
2) Including the sensor head.
3) Take care that when the gain is set to AUTO, the linearity and the resolution may deteriorate.
4) For **LH-CD6** and **LH-CD6P**, this is the response time for CH 1 or CH 2 setting. The response time for Calculation setting is twice this value. Also, take care that when the response time is set to AUTO, the linearity, resolution and the response time would vary.
5) This is the value for white ceramic board object. The linearity may differ depending on the measured object. Further, in case of **LH-CD6** or **LH-CD6P**, this is the value for CH 1 or CH 2 setting. For calculation setting, the linearity is approx. twice the value given in the above table.
6) The linearity of the sensor head and the controller has been adjusted at the time of shipment. Carry out the shift adjustment and the span adjustment to suit the operating conditions.
7) Take care that the linearity, resolution and the response time may deteriorate when the interference prevention function is used.

CHAPTER 11

DIMENSIONS

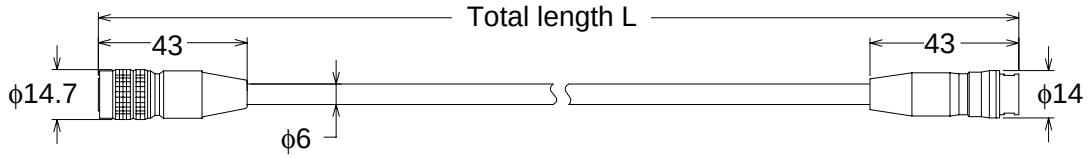
11-1 Sensor head

Unit: mm



Model No.	Center measuring distance h	Emission/Reception angle θ
LH-54	40mm	20.5°
LH-58	80mm	11.5°
LH-512	120mm	8.3°

Extension cable

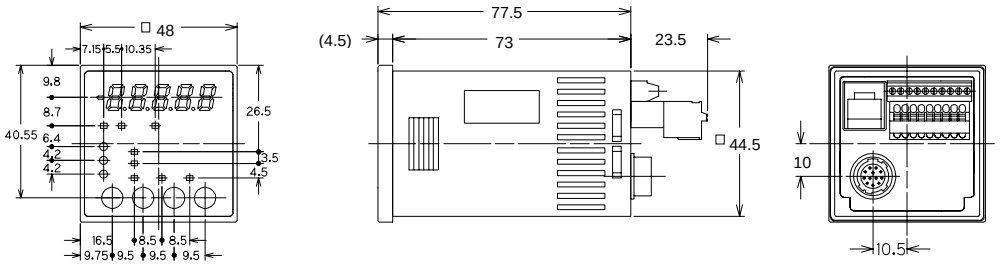


Model No.	Total length L
LH-CCJ2	2,000mm
LH-CCJ5	5,000mm
LH-CCJ10	10,000mm

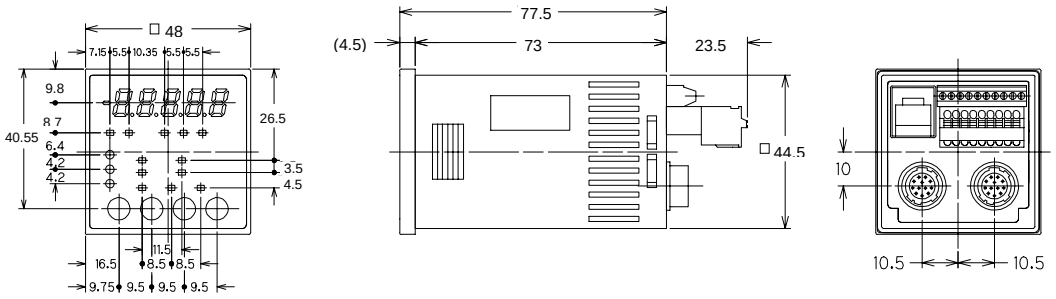
11-2 Controller

Unit: mm

- **LH-CS6 (P)**



- **LH-CD6 (P)**



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