OMRON

ZP Series

Laser Displacement Sensor

User's Manual

ZP-L

Laser Displacement Sensor

Z495-E1-01

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Introduction

Thank you for purchasing a ZP-L Laser Displacement Sensor Sensor Head/Amplifier Unit.
This manual contains information that is necessary to use the ZP-L Laser Displacement Sensor Sensor Head/Amplifier Unit. Please read this manual and make sure you understand the functionality and performance of the product before you attempt to build a system.
Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and maintaining FA systems.
- Personnel in charge of managing FA systems and facilities.

Applicable Products

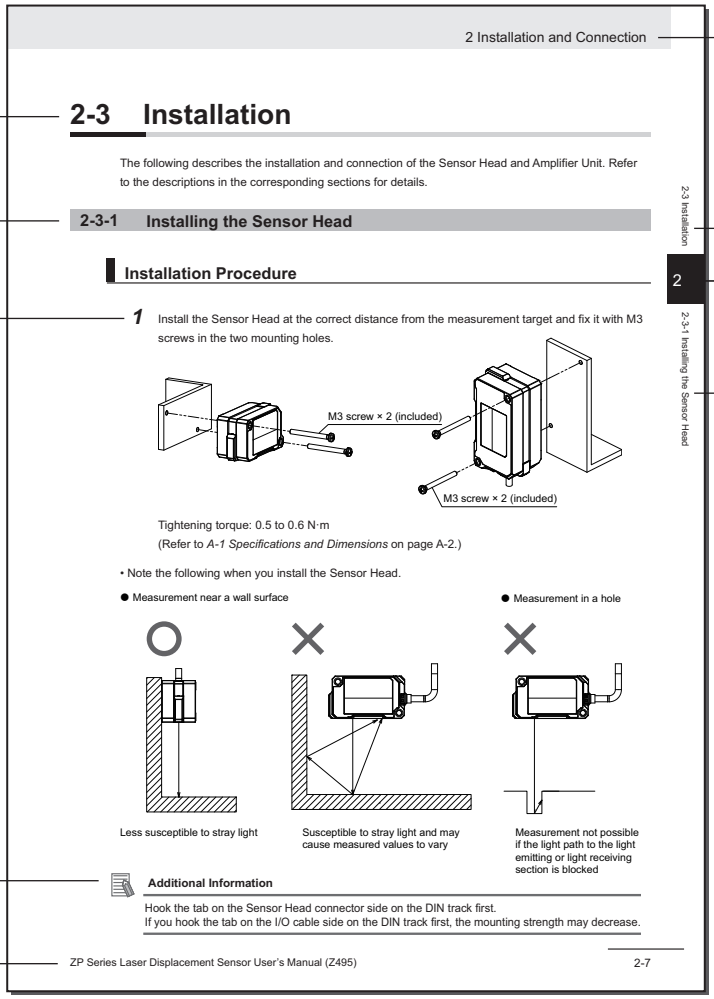
This manual covers the following product.

- ZP-L Laser Displacement Sensor
  ZP-L

Manual Structure

Page Structure

The following page structure is used in this manual.



This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:

Important

This summarizes particularly important points about its performance, including the things to be observed during operation and the advice on usage.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Version Information

Information on differences in specifications and functionality for products with different unit versions and for different versions of the Support Software is given.

Sections in this Manual

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Section 3 Amplifier Unit Operations

Section 4 Troubleshooting

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Terms and Conditions Agreement

Warranty, Limitations of Liability

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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may

be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

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It shall be the users sole responsibility to determine and use adequate measures and checkpoints to satisfy the users particular requirements for (i) antivirus protection, (ii) data input and output, (iii) maintaining a means for reconstruction of lost data, (iv) preventing Omron Products and/or software installed thereon from being infected with computer viruses and (v) protecting Omron Products from unauthorized access.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the ZP-L Laser Displacement Sensor Sensor Head/Amplifier Unit.
The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.
The following notation is used.

⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

Symbols

	The ○ with slash symbol indicates operations that you must not do. The specific operation is shown in the ○ and explained in text. This example indicates a prohibition of disassembly.
	The △ symbol indicates a caution (including warning). The specific operation is shown in the △ and explained in text. This example indicates a caution for laser beam exposure.
	The ○ with slash symbol indicates operations that you must not do. The specific operation is shown in the ○ and explained in text. This example indicates a general prohibition for something that you must not do.
	The ● symbol indicates operations that you must do. The specific operation is shown in the ● and explained in text. This example shows a general precaution for something that you must do.

Warning

⚠ WARNING

Virus protection
Install and maintain the latest commercially available antivirus software on computers connected to control systems.

Prevention of unauthorized access
To prevent unauthorized access to OMRON products, implement the following measures.

- Introduction of physical controls that allow only authorized users to access control systems and equipment
- Prevention of access from untrusted devices by minimizing network connections to control systems and equipment
- Separation from IT networks through introduction of firewalls (blocking unused communications ports, restricting communications hosts)
- Use of virtual private networks (VPNs) when remote access to control systems and equipment is necessary
- Introduction of multi-factor authentication for remote access to control systems and equipment
- Use and frequent change of strong passwords
- Preliminary virus scanning for use of external storage devices such as USB memory sticks in control systems and equipment

Protection of I/O data
Confirm the validity of backup, range check, etc. in case of unintended modification of I/O data to control systems and equipment.

- Data range check
- Validation and preparation of backup and restore processes in case of data tampering or errors
- Safety design such as emergency stop and fallback operation in anticipation of data tampering and errors

Restoration of lost data
Periodically back up and maintain setting data as a measure against data loss.

When an intranet environment is used via a global address, connecting to an unauthorized terminal or server, such as SCADA or HMI, may result in network security issues such as spoofing or tampering. Take adequate measures on your own, such as restricting access to terminals, using terminals with secure functions, and locking the installation area.

When building an intranet, communications problems may occur due to cable disconnection or unauthorized network equipment.
Take adequate measures to restrict physical access to network equipment, for example, by locking the installation area.

Equipment with SD Memory Card functionality poses a security risk that a third party may remove or illegally unmount removable media to illegally acquire, tamper with, or replace files and data contained in them.
Take adequate measures on your own to restrict physical access to the Controller, for example, by locking the installation area, controlling entry to the room, or taking appropriate control measures for the removable media.

This product is not intended for applications that directly or indirectly measure the human body for the purpose of ensuring safety. Do not use the product for measurement systems for human body protection.

To safely use laser products

⚠ WARNING

- Class 2 laser product
  Do not directly look into the laser. Be careful not allow reflected laser beams to enter your eyes. Laser beams emitted from the laser have a high power density and can cause blindness if they enter the eyes.
- Class 1 laser product
  Do not directly look into the laser. Be careful not allow reflected laser beams to enter your eyes. Staring at laser beams emitted from the laser may cause damage to your eyes.

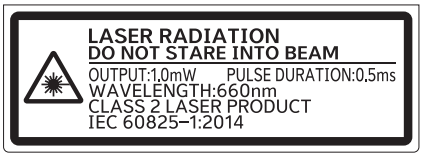
Note Use of control and adjustment procedures other than those specified herein may result in hazardous exposure to laser radiation.

Do not disassemble this product.
There is a risk of leakage of laser beams, which may cause visual impairment.

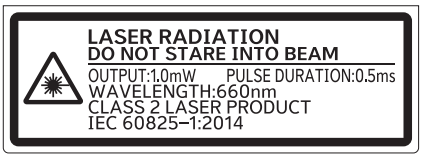
Laser safety measures for laser equipment are stipulated by the country of use.
Follow the instructions described below categorized in six cases.

1. Sensor Head
   ZP-LS025□, ZP-LS050□, ZP-LS100□, ZP-LS300□, ZP-LS600□: Class 2
   - Usage in Japan
     The JIS C6802:2018 standard stipulates the safety precautions that users must take according to the class of the laser product.
     This product is classified into class 2 defined by this standard. A JIS C 6802:2018 warning label is attached to the side of this product.

   - Usage in U.S.
     This product is subjected to the U.S. FDA (Food and Drug Administration) laser regulations. This product is classified into Class 2 by the IEC 60825-1:2014 standard according to the regulations of Laser Notice No.56 of the FDA standard. This product is already reported to CDRH (Center for Devices and Radiological Health).
     Accession Number: 2420972-000
     When using a device equipped with the product in the U.S., attach an FDA certification label and a Warning label near the sensor mounted on customer equipment.

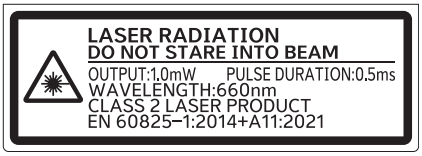


- Usage in Canada
  This product is classified into Class 2 by the IEC60825-1:2014 standard.
  When using a device equipped with the product in Canada, attach Warning labels near the sensor mounted on customer equipment.

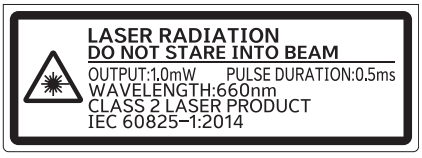


- Usage in China
  This product is classified into Class 2 by the GB7247.1:2012 (IEC60825-1:2007) standard.
  When using a device equipped with the product in China, attach a Warning label near the sensor mounted on customer equipment.

- Usage in Europe
  This product is classified into Class 2 by the EN60825-1:2014+A11:2021 standard.
  When using a device equipped with the product in these countries, attach a Warning label near the sensor mounted on customer equipment.



- Usage in countries other than U.S., Canada, China and Europe
  This product is classified into Class 2 by the IEC60825-1:2014 standard. When using a device equipped with the product in these countries, attach a Warning label near the sensor mounted on customer equipment.



2. Sensor Head
   ZP-LS025□C, ZP-LS050□C, ZP-LS100□C, ZP-LS300□C, ZP-LS600□C: Class 1

A JIS C 6802:2018 or IEC 60825-1:2014 laser notice label is attached to the side of this product.

- Usage in Japan
  The JIS C6802:2018 standard stipulates the safety precautions that users must take according to the class of the laser product.
  This product is classified into class 1 defined by this standard.
- Usage in U.S.
  This product is subjected to the U.S. FDA (Food and Drug Administration) laser regulations. This product is classified into Class 1 by the IEC 60825-1:2014 standard according to the regulations of Laser Notice No.56 of the FDA standard. This product is already reported to CDRH (Center for Devices and Radiological Health).
  Accession Number: 2420973-000
  When using a device equipped with the product in the U.S., attach an FDA certification label and a Warning label near the sensor mounted on customer equipment.

- Usage in Canada
  This product is classified into Class 1 by the IEC60825-1:2014 standard.
- Usage in China
  This product is classified into Class 1 by the GB7247.1:2012 (IEC60825-1:2007) standard.
- Usage in Europe
  This product is classified into Class 1 by the EN60825-1:2014+A11:2021 standard.
- Usage in countries other than U.S., Canada, China and Europe
  This product is classified into Class 1 by the IEC60825-1:2014 standard.

Precautions for Safe Use

- Never use this product with AC power supply. Otherwise it may explode.
- Before turning on the product's power, make sure that the supply voltage does not exceed the maximum power supply voltage.
- Unnecessary input/output wires should be securely insulated one by one to prevent short-circuiting.
- When attaching or detaching the sensor head, amplifier slave unit, or Communication Unit, be sure to turn off the power to the amplifier master unit. If you do this while the power is on, it may cause a malfunction.
- Do not connect to any amplifier unit other than the dedicated Amplifier Unit ZP-L3□□□.
- Do not connect products other than Sensor Head ZP-LS□□.
- Do not use the product if the case is damaged.
- When using the amplifier unit without connecting side, do not remove the connector cover on the side of the case.
- If you notice an abnormal condition such as a strange odor, extreme heating of the unit, or smoke, immediately stop using the product, turn off the power, and consult your dealer.
- Always turn off the power of the unit before connecting or disconnecting cables.
- Burn injury may occur. The product surface temperature rises depending on application conditions, such as the ambient temperature and the power supply voltage. Attention must be paid during operation or cleaning.

Precautions for Correct Use

- Do not install in the following locations:
  Locations where the ambient temperature exceeds the rated temperature range.
  Locations subject to sudden temperature changes (where condensation will form).
  Locations where the relative humidity is below or above 35% to 85%.
  Locations where there are corrosive or flammable gases.
  Locations where there is dust, salt, or iron powder.
  Locations where there is strong scattered light (laser light, arc welding light, ultraviolet light, etc.)
  Locations where the device will be subject to direct vibration or shock.
  Locations exposed to direct sunlight or next to a heater.
  Locations where there is splashing or spraying of water, oil, or chemicals.
  Locations where there is a strong electrical or magnetic field.
- Be sure to mount the unit to the DIN track until it *clicks*. Always use optional two end plates to keep certainly connection side by side.
- Do not pull the cord too hard.
- Tightening torque for the mounting hole is 0.5 N·m (M3 screw).
- Do not attempt to disassemble, deform by pressure, incinerate, repair, or modify this product.
- After wiring and before turning on the power, check whether the power supply is correct, whether there are any incorrect connections such as load short circuits, and whether the load current is appropriate. There is a risk of malfunction due to incorrect wiring, etc.
- When changing settings, please check safety by stopping the device, etc.
- The total length of the pull-out cable for the amplifier unit should be less than 30 m. Please use the same type of shield cord for wiring.
- To extend the cable from the sensor head, an optional extension cable (XS3W-M4□-R/XS3W-M4□-PR) must be used. It is not allowed to connect more than one extension cable.
- After turning on the power supply, allow to stand for at least 10 minutes before use. The internal temperature are unstable immediately after the power supply is turned on and attempting measurement may result in inconsistent measurement values.
- Do not use organic solvents (e.g. paint thinner and alcohol) for cleaning. Otherwise optical properties and protective structure may deteriorate.
- Do not exceed 100,000 writing operations of the EEPROM (non-volatile memory). Setting information is written to the EEPROM when a threshold value change, teaching, or zero reset is executed.
-  Dispose in accordance with applicable regulations.

Regulations and Standards

Conformance to EU Directives

This sensor complies with the following EN standards.

- EN61326-1
- Electromagnetic environment: Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
- While under electro-magnetic interference, the voltage and current outputs may fluctuate within ±3% F.S.

Important

The ZP-series products comply with EU Directives. To ensure that the machine or device in which the ZP-series products are used complies with EU Directives, the following precautions must be observed.

- You must use SELV power supply for the DC power supplies that are connected as the Unit/input power supplies and output power supplies for the ZP-series products.
  We recommend that you use the OMRON S8VK-S/S8VK-G-series Power Supplies. EMC standard compliance was confirmed for the recommended Power Supplies.
- ZP-series products that comply with EU Directives also conform to the Common Emission Standard. Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment in which the ZP-series products are used complies with EU Directives.
- You must use power supplies with an output hold time of 10 ms or longer for the DC power supplies that are connected as the Unit/input power supplies and output power supplies for the ZP-series products.
- This is a Class A product (for industrial environments). In a residential environment, it may cause radio interference. If radio interference occurs, the user may be required to take appropriate measures.
- Conformance to EU Directives was confirmed using power supply cables and I/O cables with a cable length of shorter than 30 m.

Conformance to UL and CSA Standards

Some ZP-series products comply with UL and CSA standards.
If you use a product that complies with UL or CSA standards and must apply those standards to your machinery or devices, pay attention to the following requirements during use.

- Installation environment
  Ambient operating temperature: -10 to 50°C
  Ambient humidity range: 35% to 85% (with no condensation)
  For indoor use only
  Altitude: 2,000 m max.
  Pollution degree: 3
- Use a Class 2 power supply with 10 to 30 VDC.

Related Manuals

The following table shows related manuals. Use these manuals for reference.

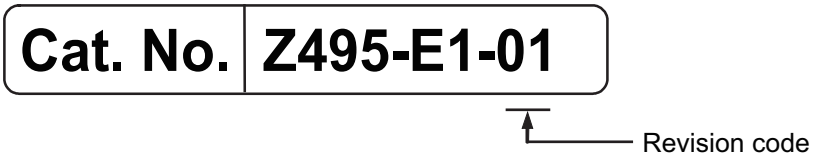
Manual name	Cat. No.	Models	Application	Contents
ZP-series EtherNet/IP™ Communication Unit User's Manual	Z496	ZP-EIP	Learning how to use a ZP-series EtherNet/IP Communication Unit.	The hardware, setup methods, and functions of the ZP-series EtherNet/IP Communication Unit are described.

Terminology

Term	Abbre-viation	Description
Measured value	MV	As opposed to RV, MV refers to the measured value after calculation, hold, differential, zero reset, and keep processing.
PLC	---	PLC (Programmable Logic Controller) is a computer used for automation control in factories and plants. It processes inputs from sensors, gives instructions to actuators, and controls machines and processes based on a program. It features high environmental resistance, flexible programming, and real-time control.
Real value	RV	RV refers to the measured value after averaging, measurement direction processing, and scaling.
Wave Inspire ZP	---	Configuration Support Software for the ZP-EIP. It enables the user to configure the Amplifier Unit adjacent to the Communication Unit, monitor measured values, and display and save time-series data.
Amplifier Unit	---	A ZP-series Amplifier Unit.
Controller	---	An OMRON CPU Unit or a Controller from another company connected to the Communication Unit through EtherNet/IP.
Ethernet switch	---	A device that efficiently transfers data between devices in a network. It sends data only to specific destinations, thus improving the network's performance.
Communication Unit	---	A ZP-series Communication Unit. In this manual, it refers to the ZP-EIP.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.



Revision code	Date	Revised content
01	December 2024	Original production

1

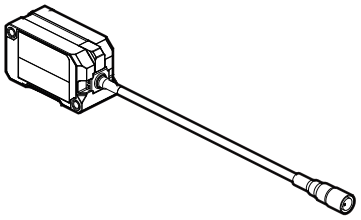
Basic Configuration

This section describes the features and system configuration of ZP-L Laser Displacement Sensor Sensor Head/Amplifier Units.

1-1 What Is the ZP-L?

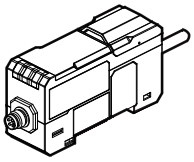
The ZP-L is an optical reflective displacement sensor.
It consists of a Sensor Head, an Amplifier Unit, a Communication Unit, and a dedicated configuration support software on a computer that the user operates for configuration and monitoring.

Sensor Head



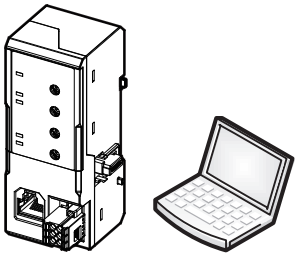
Measures the measurement targets.

Amplifier Unit



Performs measurement and outputs the results.

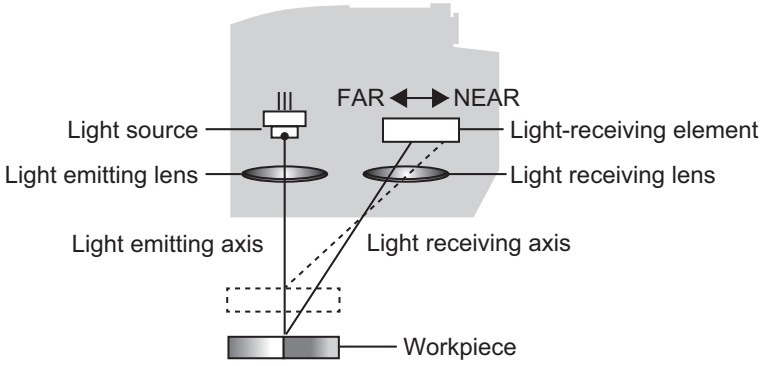
Communication Unit and Support Software



Communicates measurement results and setting data to external devices.

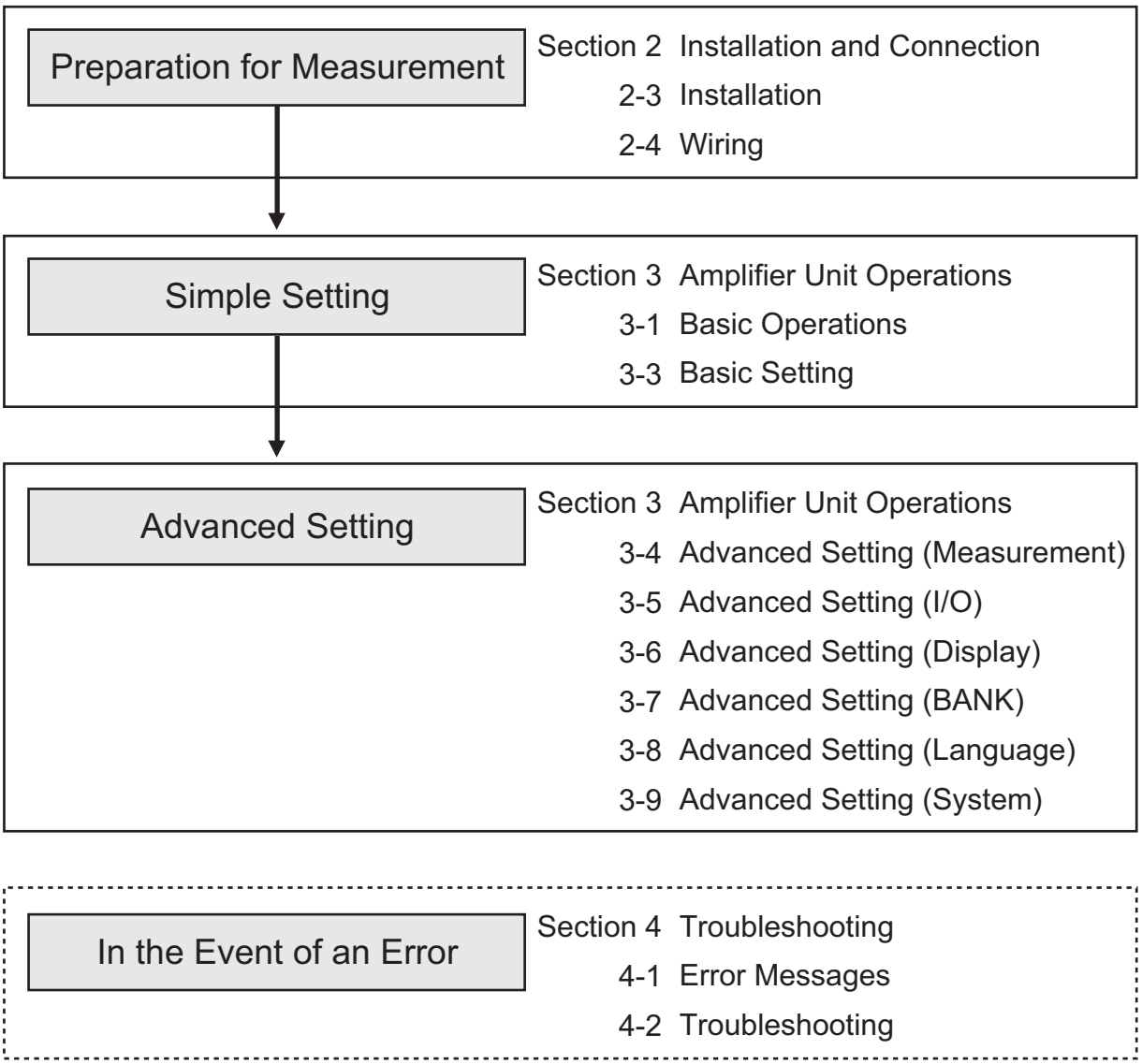
1-1-1 Measurement Principle of the ZP-L

The ZP-L measures the change in position (i.e., distance) to a workpiece based on the principle of triangular distance measurement. Laser light emitted from the light source is reflected by the workpiece and focused as a spot on the light-receiving element. When the position of the workpiece changes, the position of the spot on the light-receiving element changes accordingly. Thus, by measuring the position of the spot, it is possible to determine the change in position to the workpiece.



Note The light-receiving element is a device that recognizes light (laser beam) as a signal. The ZP-L uses a CMOS (Complementary Metal Oxide Semiconductor) image sensor.

1-2 Basic Flow of Operations



2

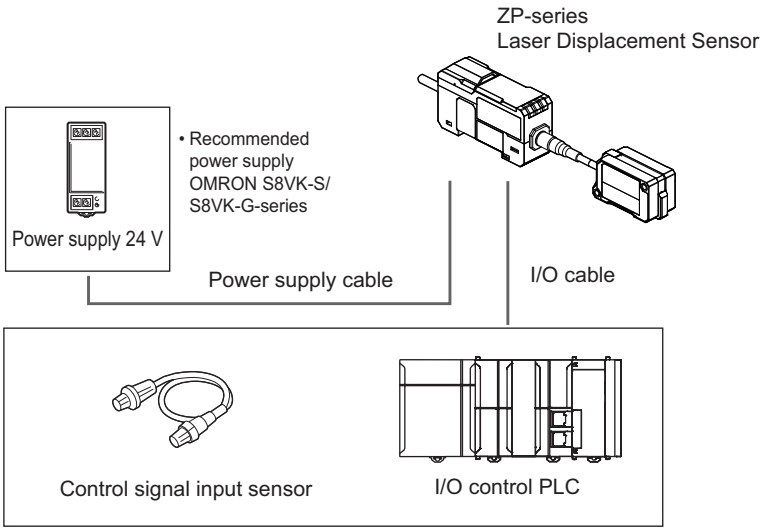
Installation and Connection

This section describes the installation and connection procedures for the Amplifier Unit.

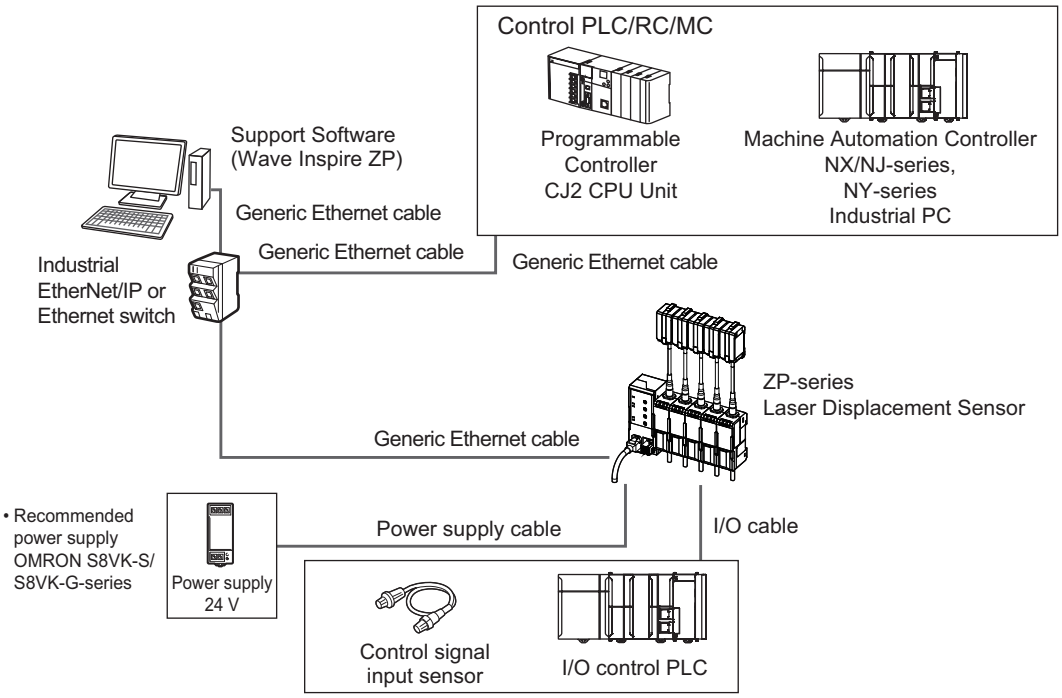
2-1 System Configuration

2-1-1 System Configuration Examples

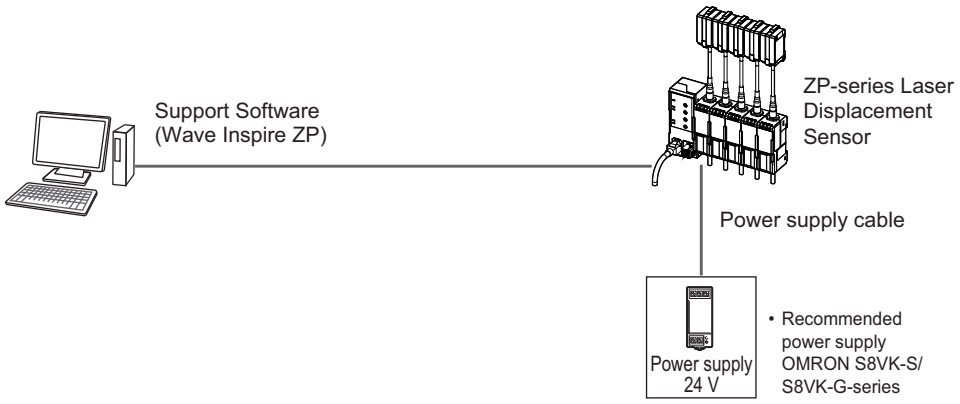
● Configuration for Using Analog Output and Control I/O



● Configuration for Connecting Devices via EtherNet/IP and Ethernet (No-protocol)



● Minimum Connection Configuration with a Computer with Wave Inspire ZP Installed

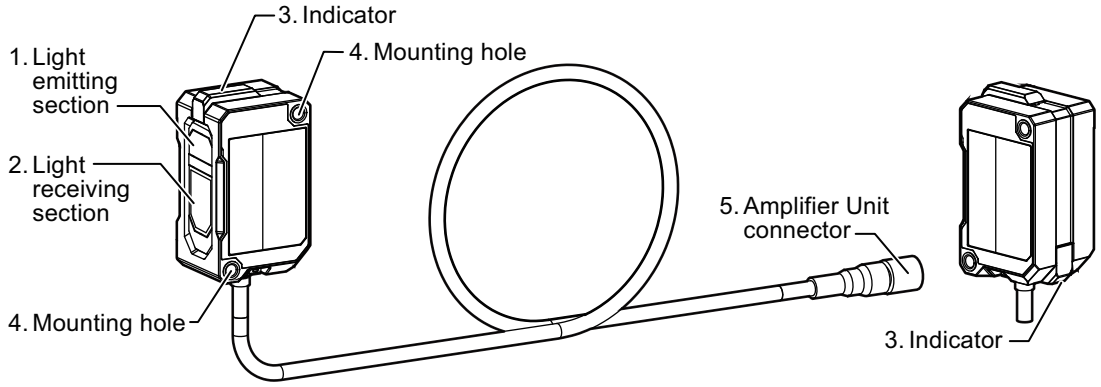


2-2 Part Names and Functions

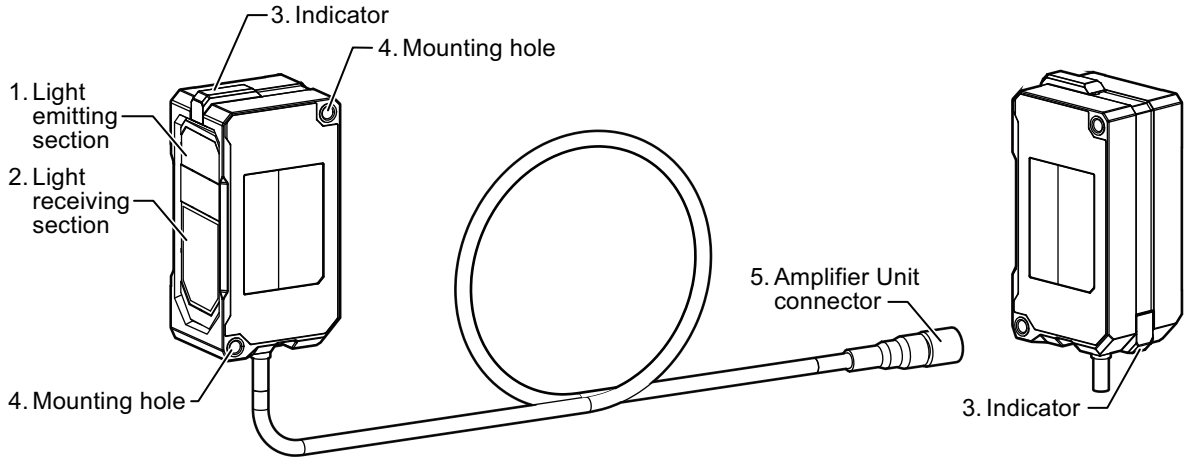
The following describes the name and function of each part of the Sensor Head and Amplifier Unit.

2-2-1 Sensor Head

- ZP-LS025□/ZP-LS050□/ZP-LS100□



- ZP-LS300□/ZP-LS600□



No.	Name	Function
1	Light emitting section	Emits a laser beam.
2	Light receiving section	Receives reflected light from the measurement target.
3	Indicator	Lights in orange, green, blue, white, and red in conjunction with the Amplifier Unit. (Refer to *2-2-3 Functions of Indicators* on page 2-6 for details.)
4	Mounting hole	Fixes the mounting bracket, etc. with screws.
5	Amplifier Unit connector	Connects to the Amplifier Unit (ZP-L3□□□) or Extension Cable (XS3W-M42□).

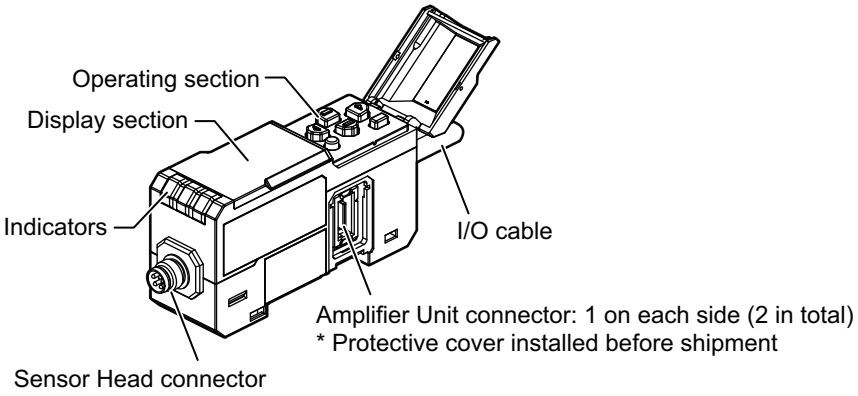
Additional Information

- Available extension cable lengths are 1 m, 2 m, 3 m, 5 m, 10 m, and 20 m.
- For extension cable connectors, straight and L-shaped types are available for use in different installation environments.
- For extension cables, robot cables are also available (XS3W-M42□-40□-PR).
- The pull-out cable of the Sensor Head is a standard cable. When the cable needs to be bent, connect a robot cable as an extension cable and then bend the extension cable. For the Sensor Head, it is convenient to use one with a pull-out cable length of 0.2 m.

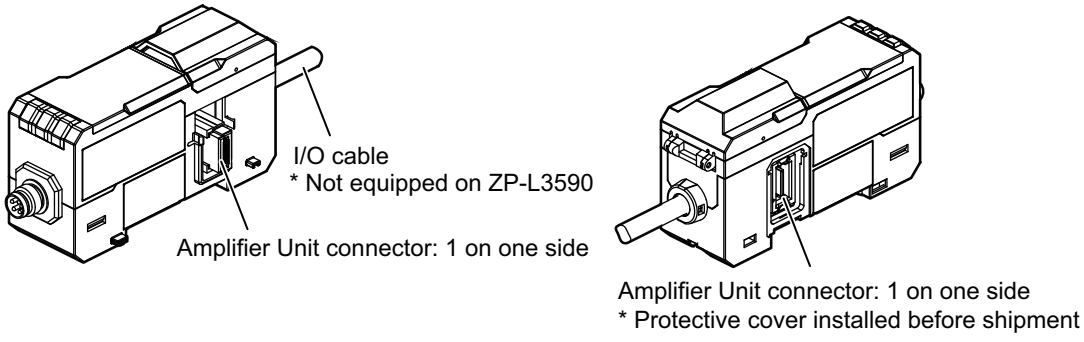
2-2-2 Amplifier Unit

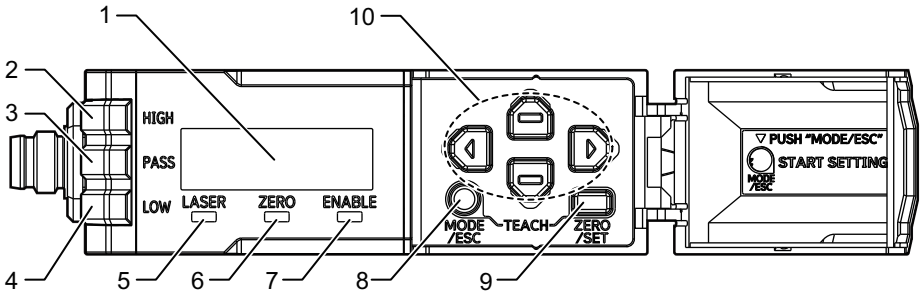
This Amplifier Unit offers master and slave models, which differ in terms of power supply, control I/O, and analog output availability. Refer to *2-4-1 Wiring I/O Lines* on page 2-14 for differences between master and slave units.

- ZP-L30□0 (Master unit)



- ZP-L35□0 (Slave unit)





No.	Name	Function
1	Display section	Displays the measured value, function name, auxiliary information, and set value during measurement.
2	HIGH indicator (orange/ red)	• Lights orange when the judgment result is HIGH. • Flashes red when an error is output.
3	PASS indicator (green/ red)	• Lights green when the judgment result is PASS. • Flashes red when an error is output.
4	LOW indicator (orange/ red)	• Lights orange when the judgment result is LOW. • Flashes red when an error is output.
5	LASER indicator (green)	Lights when the Sensor Head is emitting a laser beam.
6	Zero reset indicator (green)	Lights when the zero reset function is enabled.
7	ENABLE indicator (green)	Lights while the Sensor Head is ready for measurement. It goes out when measurement is not possible (e.g. when the amount of received light is excessive or insufficient, when the measurement range is exceeded, or when the Sensor Head is not connected).
8	MODE/ESC button	Starts/ends the setting, moves between items, etc. in various settings.
9	ZERO/SET button	In the RUN mode: Sets the zero reset display value in *3-4-2 Setting the Zero Reset Display Value* on page 3-27. In the SETTING mode: Determines each setting.
10	Cursor buttons	Switch the display or set measurement conditions.

Additional Information

- For standalone use, use the master unit.
- When installing additional Amplifier Units, add slave units to the master unit.
- Use an extension cable with an L-shape connector on the Amplifier Unit side to secure space for pulling out the cable from the Amplifier Unit.

2-2-3 Functions of Indicators

The indicator on the Sensor Head and the HIGH/PASS/LOW indicators on the Amplifier Unit are interlocked and change their color depending on the status.

Status			Sensor Head Indicator*1	Amplifier Unit		
				HIGH indicator	PASS indicator	LOW indicator
In RUN mode	Judgment status	HIGH	Orange	Orange	Not lit	Not lit
		PASS	Green	Not lit	Green	Not lit
		LOW	Orange	Not lit	Not lit	Orange
		Measured Value Undetermined*2	White	Not lit	Not lit	Not lit
	Laser emission OFF*3		Not lit	Not lit	Not lit	Not lit
In SETTING mode			Blue (Flashing)	Not lit	Not lit	Not lit

Status	Sensor Head Indicator*1	Amplifier Unit		
		HIGH indicator	PASS indicator	LOW indicator
In case of error	---*4	Red (Flashing)	Red (Flashing)	Red (Flashing)

*1. The indicators on both Units light, flash, and go out in conjunction with each other. When the Head Disp setting is OFF, the Sensor Head indicator will be always unlit at all times, in the RUN mode, in the SETTING mode, or in the event of an error.

*2. This indicates that the measured value is not determined due to no workpiece measured, averaging in progress, etc.

*3. This indicates that the laser emission is OFF due to LD-OFF input, etc.

*4. The indicator status is unstable when a communications error occurs between the Sensor Head and the Amplifier Unit.

Additional Information

The Find-me function is always enabled in the SETTING mode. The Sensor Head indicator flashes in blue, so you can recognize at a glance which Sensor Head is connected.

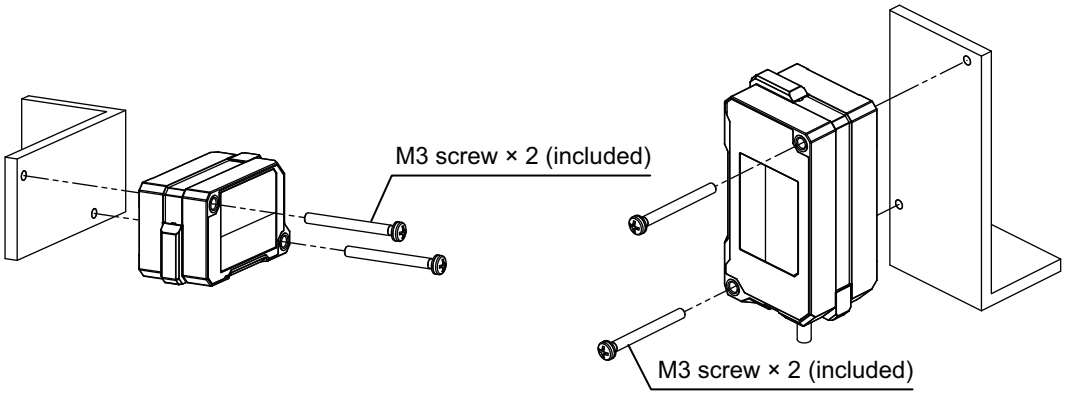
2-3 Installation

The following describes the installation and connection of the Sensor Head and Amplifier Unit. Refer to the descriptions in the corresponding sections for details.

2-3-1 Installing the Sensor Head

Installation Procedure

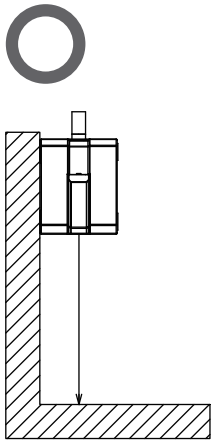
1 Install the Sensor Head at the correct distance from the measurement target and fix it with M3 screws in the two mounting holes.



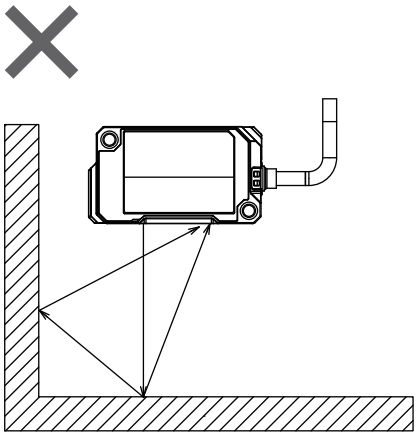
Tightening torque: 0.5 to 0.6 N·m
(Refer to *A-1 Specifications and Dimensions* on page A-2.)

- Note the following when you install the Sensor Head.

● Measurement near a wall surface

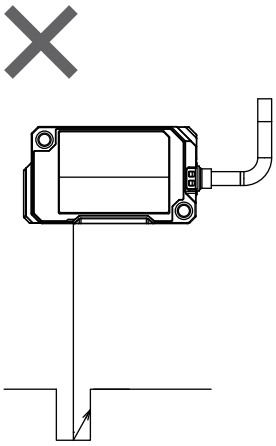


Less susceptible to stray light



Susceptible to stray light and may cause measured values to vary

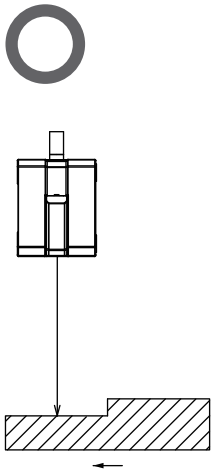
● Measurement in a hole



Measurement not possible if the light path to the light emitting or light receiving section is blocked

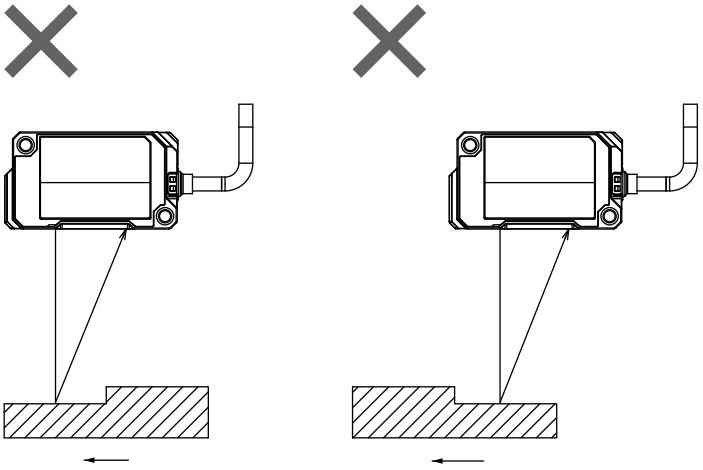
○: Measurement possible/×: Measurement not possible

● Measurement of workpieces with steps



Stable measurement is possible even at a step.

* Measurement will be unstable if the measurement spot spans a step.

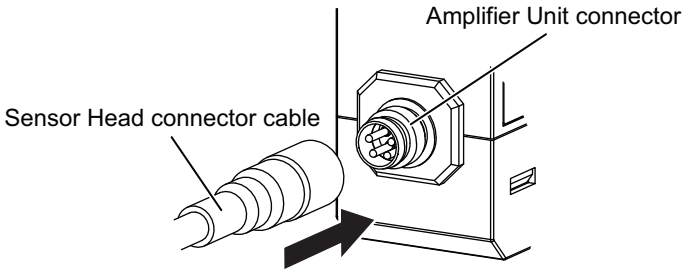


Abnormal values may be measured at steps.

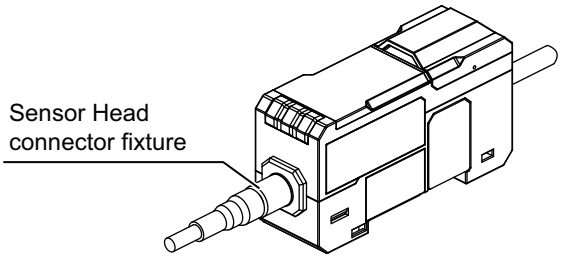
○: Measurement possible/×: Measurement not possible

2-3-2 Connecting the Amplifier Unit and Sensor Head

1 Align the connector holes of the Sensor Head connector cable with the Amplifier Unit connector pins, and insert the Sensor Head connector cable all the way into the Amplifier Unit connector.



2 Tighten the Sensor Head connector fixture by holding it by hand.



The appropriate tightening torque is 0.2 N·m.
Insufficient tightening may result in inability to maintain the protective structure or loosening due to vibration.

Important

- Be sure to turn OFF the power before inserting and removing the connector.
- Always hold the connector when inserting or removing a connector. Do not pull it out by grasping the cable.
- Do not touch the joint surface with wet hands. When inserting or removing the connector, wipe off any moisture on the connector or its surrounding area. The moisture may cause a short-circuit inside the connector and insulation failure.
- Make sure that no metal pieces or powder are caught in the joint.
- When tightening or loosening the fixture, hold the fixture only. Holding the cover or cable may cause excessive rotational force to be applied to the connector, resulting in damage to the connector.

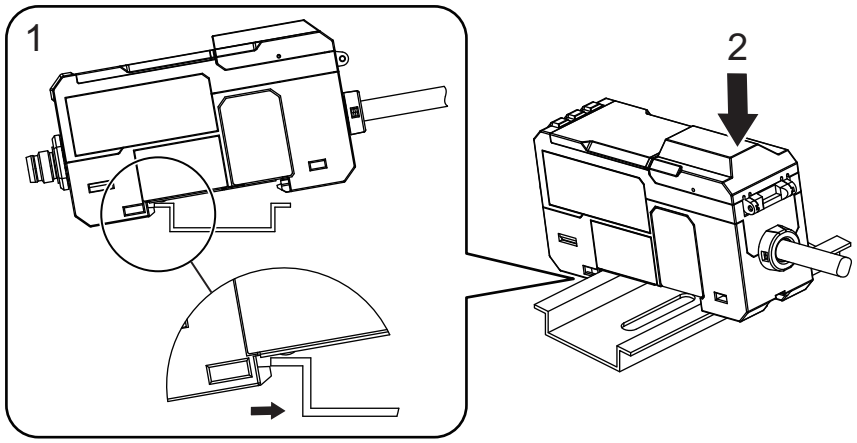
2-3-3 Installing the Amplifier Unit

You can quickly install the Amplifier Unit on a 35 mm DIN track.

Master Unit

● Installation Procedure

1 Hook the tab on the Sensor Head connector side on the DIN track and push the Amplifier Unit in until it is locked in place.



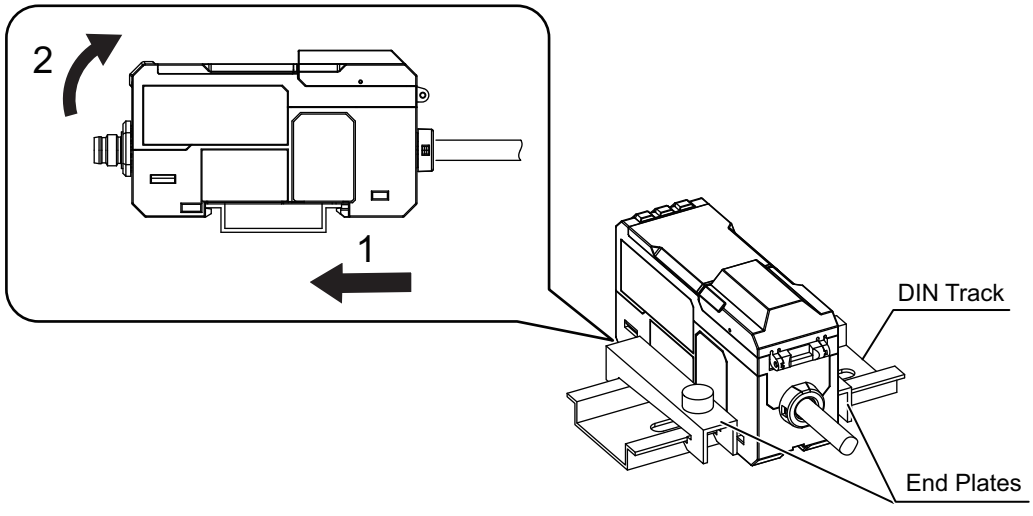
If necessary, use optional End Plates (PFP-M) to fix the Amplifier Unit in place.

Additional Information

Hook the tab on the Sensor Head connector side on the DIN track first.
If you hook the tab on the I/O cable side on the DIN track first, the mounting strength may decrease.

● Removal Procedure

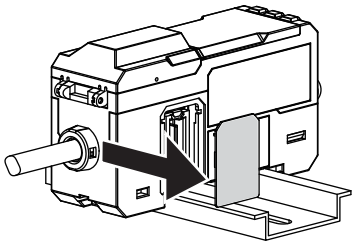
1 Raise the Amplifier Unit in the direction of arrow 2 while pushing it in the direction of arrow 1.



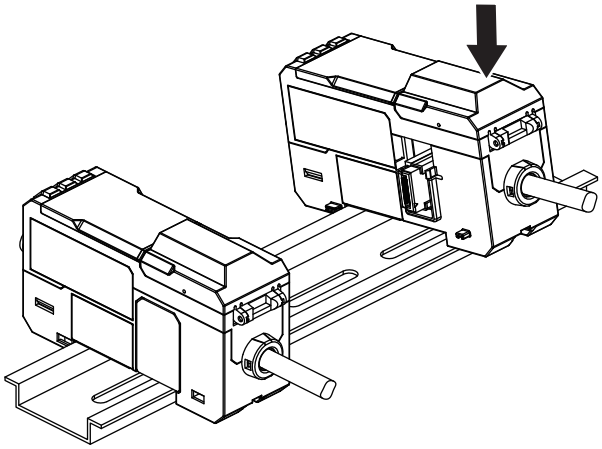
Slave Unit

● Installation Procedure

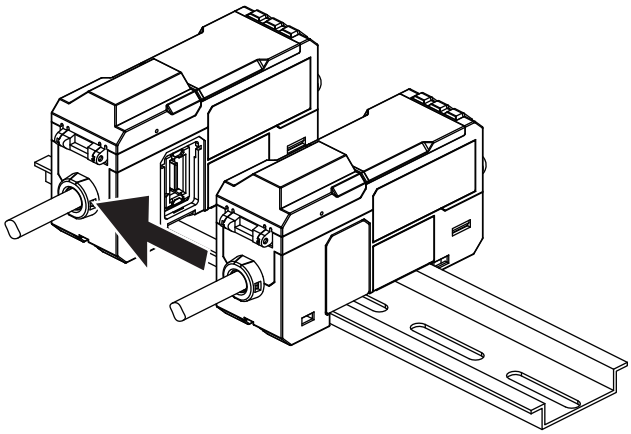
1 Remove the connector cover from the Amplifier Unit (master unit).



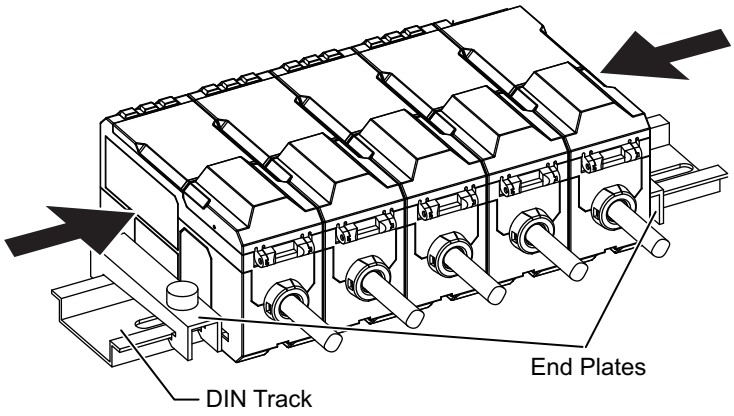
2 Hook the tab on the Sensor Head connector side on the DIN track and push the Amplifier Unit in until it is locked in place.



3 Slide the Amplifier Unit (slave unit) into the connector of the master unit until it *clicks* into place.

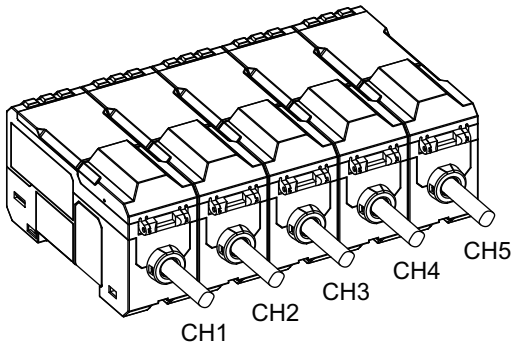


4 Place the optional End Plates (PFP-M) on both ends of the Amplifier Units (master unit and slave units to added) and fix them by tightening the screws on the End Plates (two End Plates per location).



Additional Information

- To remove the slave units, follow the above procedure in the reverse order.
- When multiple Amplifier Units are connected together, the channel numbers are as shown below.
  CH1: Master unit, CH2 to CH5: Slave units

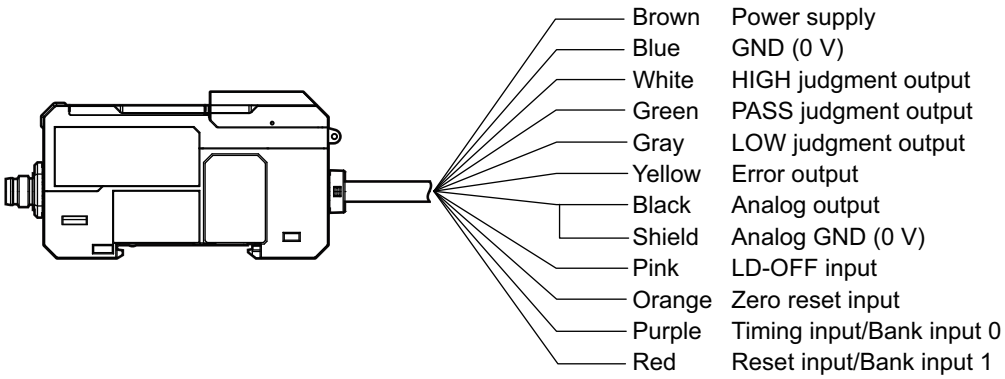


2-4 Wiring

This section describes the wiring of the Amplifier Unit and the function of each line.

2-4-1 Wiring I/O Lines

The I/O cable consists of lines as described below.



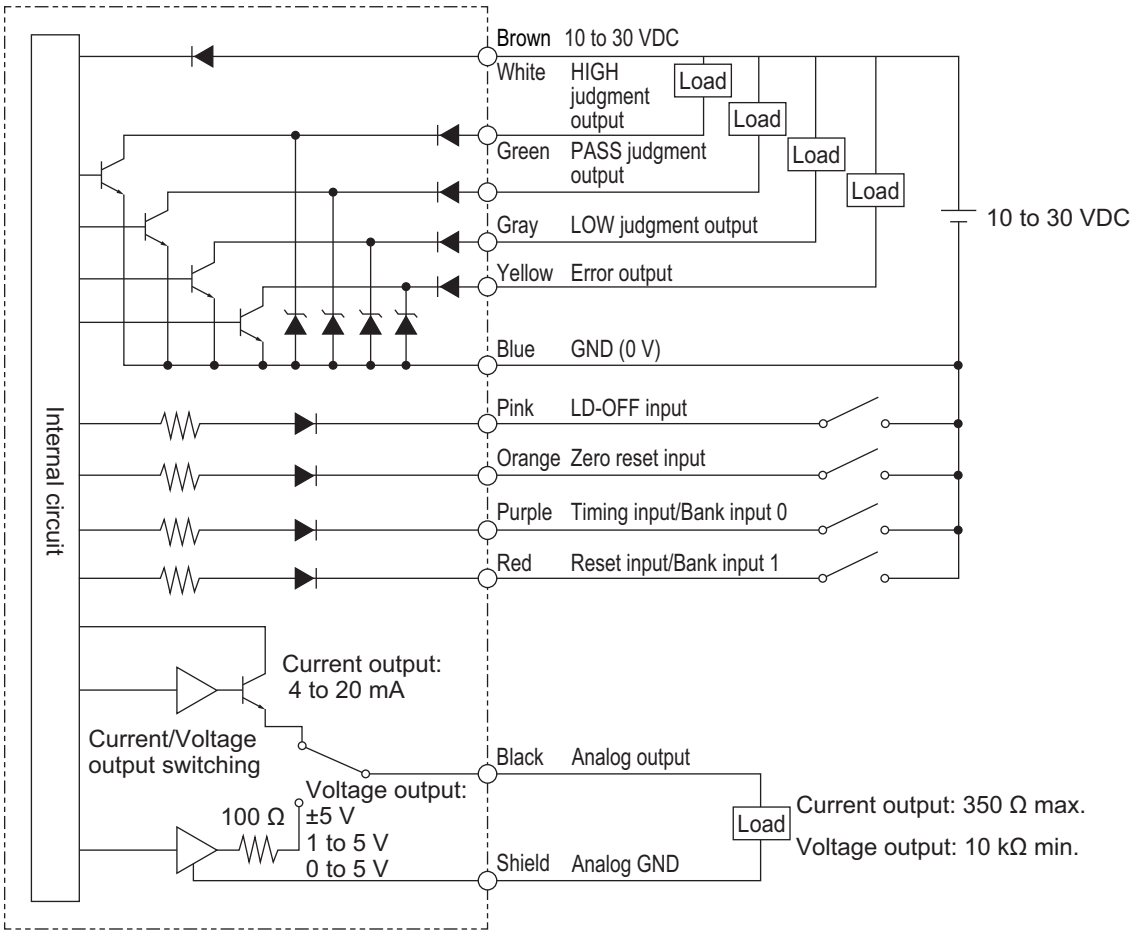
○: Supported/×: Not supported

Supported model				Wire color	Name	Function
Master unit			Slave unit			
L3050 L3000	L3060 L3010	L3560 L3510	L3590			
○	○	×	×	Brown	Power supply	Connects a power supply of 10 to 30 VDC (including 10% ripple (p-p)). For PNP type Amplifier Units, the power supply terminal is the common I/O terminal for all I/Os except for analog output.
○	○	×	×	Blue	GND (0 V)	Connects the power supply to 0 V. For NPN Type Amplifier Units, the GND (0 V) terminal is the common I/O terminal for all I/Os except for analog output.
○	○	○	×	White	HIGH judgment output	Outputs the judgment result (HIGH).
○	○	○	×	Green	PASS judgment output	Outputs the judgment result (PASS).
○	○	○	×	Gray	LOW judgment output	Outputs the judgment result (LOW).
○	○	○	×	Yellow	Error output	Turns OFF if a system error is detected. (Refer to *4-1-1 Errors Common to All Communications States* on page 4-2 for details on error messages.)
○	×	×	×	Black	Analog output	Outputs a current or voltage according to the measurement result. (Refer to *3-3-4 Setting the Analog Output* on page 3-26 for the setting procedure.)
○	×	×	×	Shield	Analog output (0 V)	Connects the power output to 0 V. **Note 1.** Use the shield line for analog output separately from the blue line (0 V) for power supply. **Note 2.** When analog output is not used, be sure to connect this line to the blue line (0 V).
○	○	○	×	Pink	LD-OFF input	Stops the laser emission if the LD-OFF input signal is turned ON, causing a light amount error. In this state, the analog output, judgment output, and judgment output indicator signals are output according to the non-measurement setting. The Laser ON indicator goes out and the display shows *Laser OFF* in the measured value display area. (Refer to *3-5-8 Setting the Initial Output* on page 3-42 for details on non-measurement output.)

Supported model				Wire color	Name	Function	
Master unit			Slave unit				
L3050	L3000 L3060 L3010	L3560	L3510 L3590				
○	○	○	×	Orange	Zero reset input	Executes or cancels zero reset. (Refer to *3-4-2 Setting the Zero Reset Display Value* on page 3-27 for details.)	
○	○	○	×	Purple	Timing input/Bank input 0 (switched by External Input setting)	Timing input	Inputs a timing signal for the hold function. While timing input is being executed with the hold function set to other than OFF, the display shows the icon. Refer to *3-5-2 Setting the Hold Trigger Level* on page 3-32 for details on the hold function.
						Bank input 0	Inputs the bank change signal. You can change the bank according to the combination of the Input Select and the External Input settings. (Refer to *3-7 Advanced Setting (BANK)* on page 3-47 for details on bank change input.)
○	○	○	×	Red	Reset input/Bank input 1 (switched by External Input setting)	Reset input	While reset input is in progress, the display shows ---.--- in the measured value display area.
						Bank input 1	Inputs the bank change signal. You can change the bank according to the combination of the Input Select and the External Input settings. (Refer to *3-7 Advanced Setting (BANK)* on page 3-47 for details on bank change input.)

2-4-2 I/O Circuit Diagrams

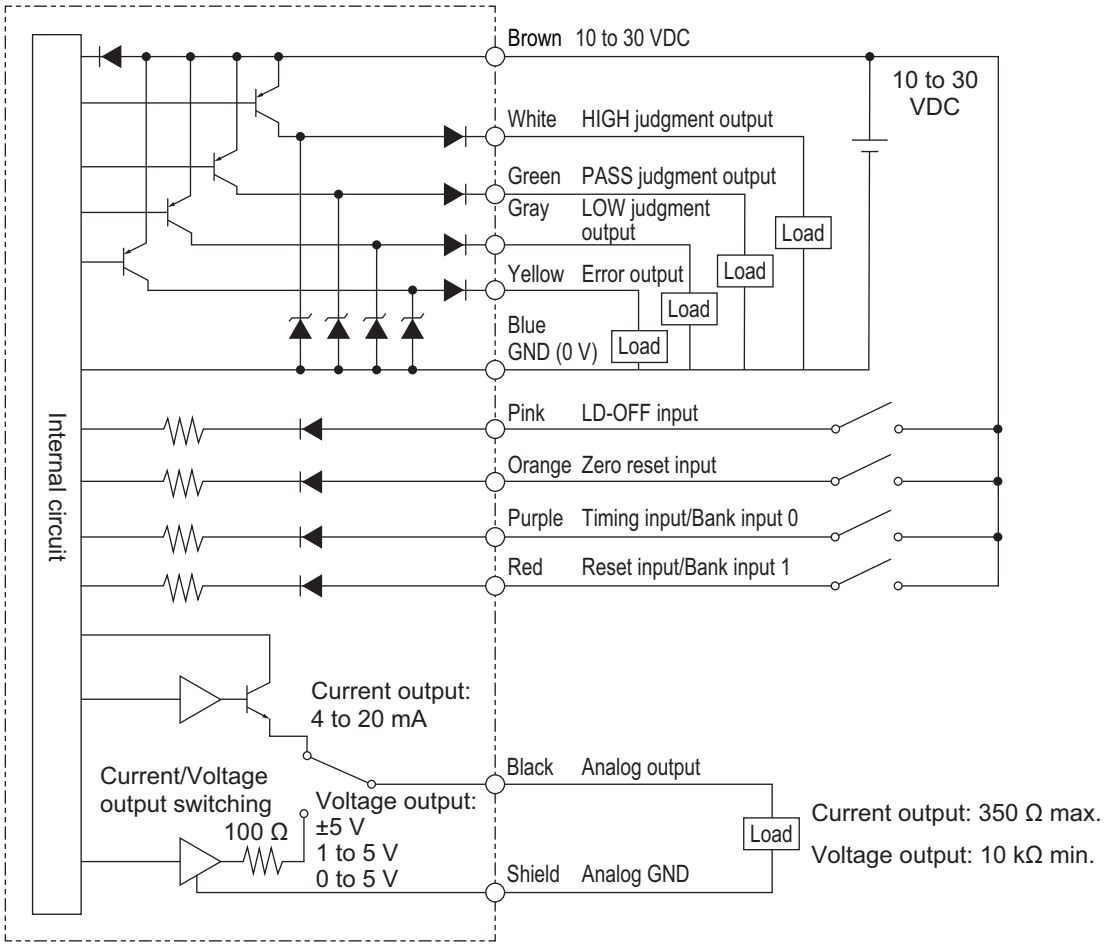
ZP-L3000/ZP-L3010/ZP-L3510 (NPN Type)



Item	ZP-L3000	ZP-L3010/ZP-L3510
Power consumption*1	2,300 mW max.	2,000 mW max.
Control output	Open collector output: 30 VDC, 50 mA max. (20 mA per channel when 5 or more additional slave units are installed) Residual voltage: 2 V max.	
External input	When ON: 0 V short-circuit or 1.2 V max. When OFF: Open (Leakage current: 0.1 mA max.)	
Analog output	Current output: 4 to 20 mA (Maximum load resistance: 350 Ω) Voltage output: 5 V, 1 to 5 V, 0 to 5 V (Output impedance: 100 Ω)	No analog output

*1. This includes the power consumption of the Sensor Head. It does not include the load current of each output. The power consumption of the ZP-L3590 is 2,000 mW max.

ZP-L3050/ZP-L3060/ZP-L3560 (PNP Type)



Item	ZP-L3050	ZP-L3060/ZP-L3560
Power consumption*1	2,300 mW max.	2,000 mW max.
Control output	Open collector output: 30 VDC, 50 mA max. (20 mA per channel when 5 or more additional slave units are installed) Residual voltage: 2 V max.	
External input	When ON: Power supply voltage short-circuit or within -1.2 V of power supply voltage When OFF: Open (Leakage current: 0.1 mA max.)	
Analog output	Current output: 4 to 20 mA (Maximum load resistance: 350 Ω) Voltage output: 5 V, 1 to 5 V, 0 to 5 V (Output impedance: 100 Ω)	No analog output

*1. This includes the power consumption of the Sensor Head. It does not include the load current of each output. The power consumption of the ZP-L3590 is 2,000 mW max.

3

Amplifier Unit Operations

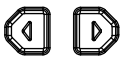
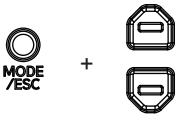
This section describes the operations of the Amplifier Unit.

3-1 Basic Operations

The main unit of ZP-series Amplifier Unit has two operating modes: RUN mode and SETTING mode. The RUN mode is used for normal operations. The SETTING mode is used for setting and adjusting various functions of the main unit.

To switch between the operating modes, use the MODE /ESC button on the Amplifier Unit. You can also check the present operating mode with the Sensor Head indicator. Refer to *2-2-3 Functions of Indicators* on page 2-6 for details.

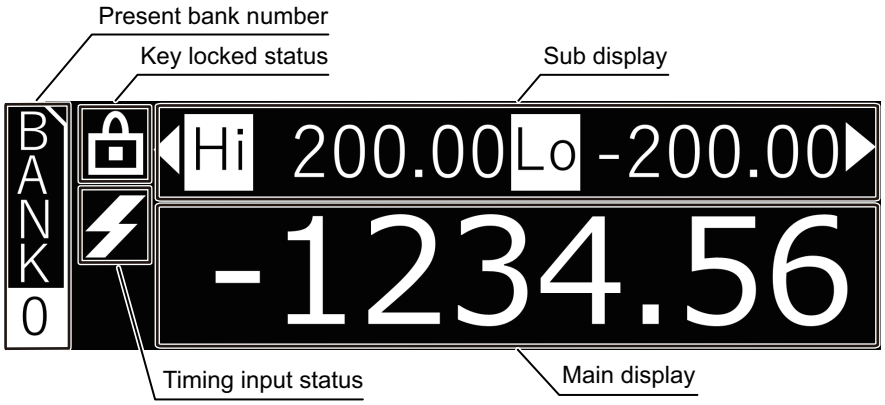
3-1-1 Functions of Operation Buttons

Name		Function	
		RUN mode (Shortcut operation)	SETTING mode
LEFT button RIGHT button		Switches the display in the RUN mode.	The function changes depending on the present display. • Switches the selection menu. • Changes the set value. • Selects digits of numerical values.
UP button DOWN button		Switches to the Threshold setting display. **Note** The key can be used only in the High threshold display or Low threshold display.	The function changes depending on the present display. • Switches the selection menu. • Change numerical values.
MODE/ESC button		Shifts to the SETTING mode.	The function changes depending on the present display. • Switches between the RUN mode and the SETTING mode. • Switches to the upper-level menu. • Cancels the selected condition or numerical value.
ZERO/SET button		• Executes zero reset. • Cancels zero reset when held down for 2 seconds or more.	The function changes depending on the present display. • Switches to the Advanced Setting mode. • Determines the setting category. • Determines the selected condition or numerical value.
LEFT button + RIGHT button		Enables the key lock function when held down for 2 seconds or more. **Note** Disables the key lock function when held down for 2 seconds or more in the key locked state.	---
UP button + DOWN button		Executes timing input. **Note** The function is enabled when Hold Function is set to Peak, Bottom, Sample, or Peak to Peak	---
MODE/ESC button + UP button DOWN button		Shifts to the BANK Change display and executes BANK Change.	---

Name		Function	
		RUN mode (Shortcut operation)	SETTING mode
MODE/ESC button + ZERO/SET button		Shifts to the Threshold teaching display.	---

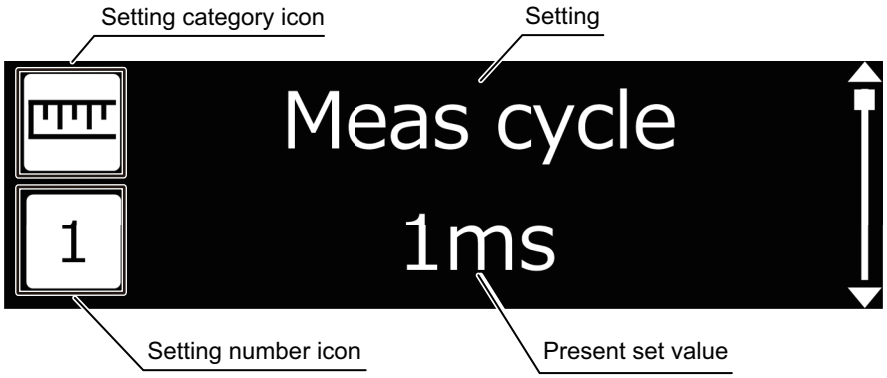
3-1-2 Functions of Displays

● Configuration of the Operation Display



Configuration element	Description
Main display	This area shows the measured value (MV value). It may show the following information instead of the measured value. • *Light Shortage*: The light amount is insufficient. Or the workpiece is located outside of the measurement range. • *Light Excess*: The light receiving section is exposed to strong external light such as laser beams. • ---.---: The measured value is not determined because timing input is not turned ON when the hold function is set, or measurement for the number of samples to average set in Average Rate is not completed. • *Laser OFF*: Laser emission is turned OFF by an external input or command. Refer to *4-2 Troubleshooting* on page 4-5 for the countermeasure.
Sub display	The information shown in this area is changed by LEFT/RIGHT button operation. Refer to *Transition Diagram of the Operation Display and Simple Settings* on page 3-7 for details.
Present bank number	This is the bank number presently in use.
Key locked status	This area shows an icon that indicates whether the keys are locked. The icon appears when the keys are locked.
Timing input status	This area shows an icon that indicates whether timing input is ON. The icon appears when timing input is ON.

● Configuration of the Setting Display

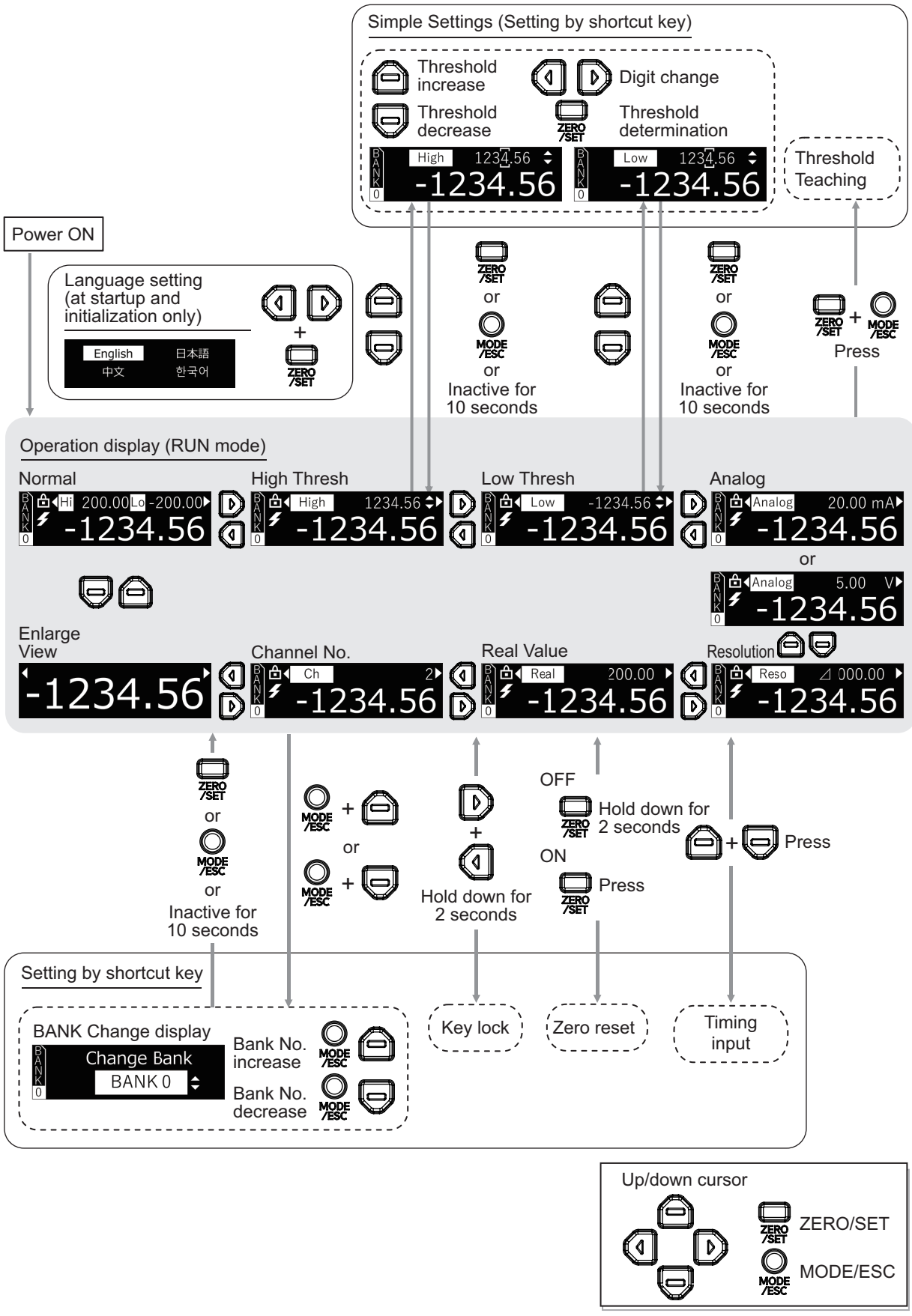


Configuration element	Description
Setting category icon	This area shows an icon that indicates the setting category.
Setting number icon	This area shows an icon that indicates the setting number.
Setting	The area shows the setting name.
Present set value	This area shows the present set value.

● Setting Category Icons

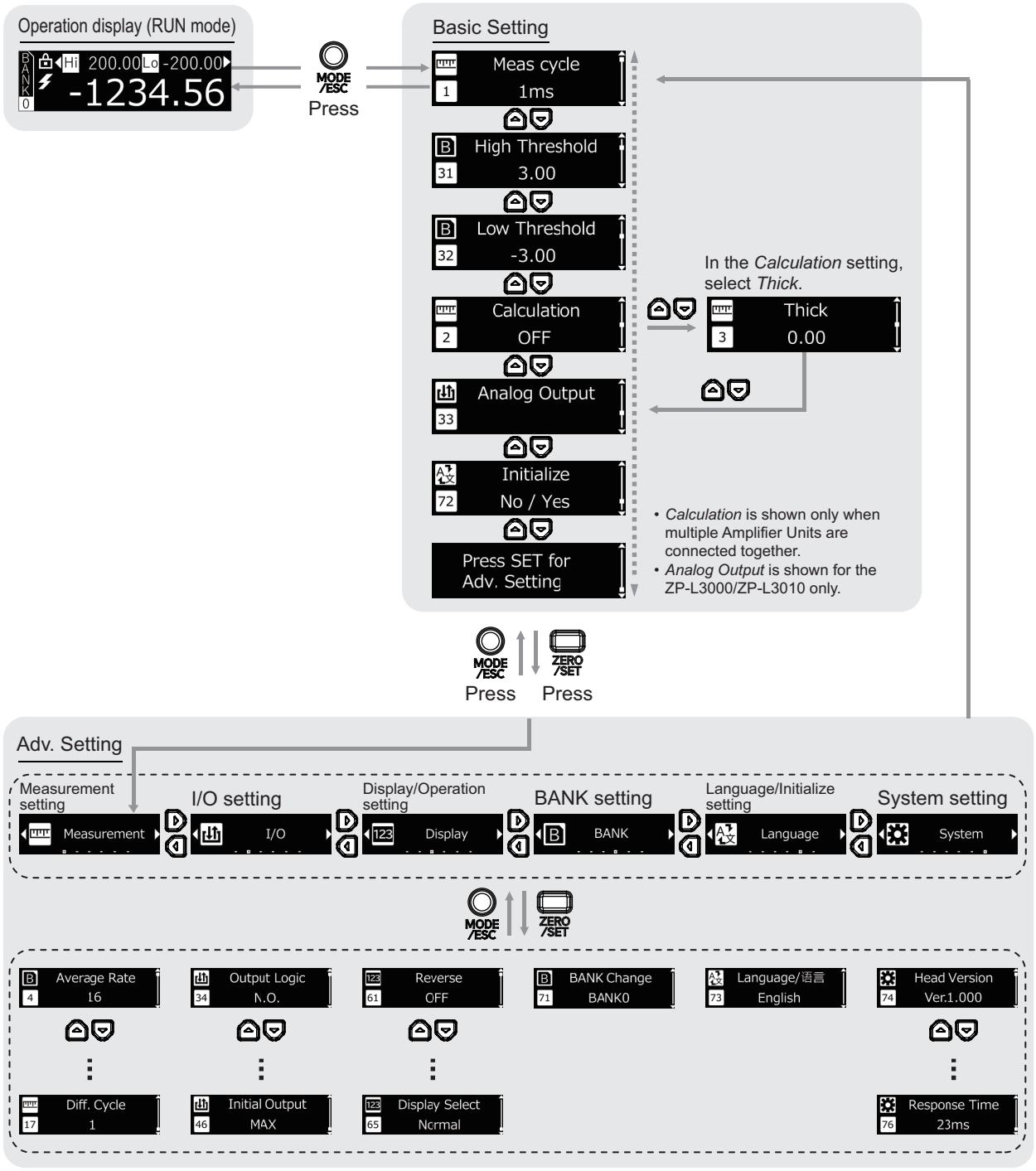
Setting category icon	Icon name	Description
	Measurement setting icon	This icon represents a measurement-related setting.
	I/O setting icon	This icon represents an I/O related setting.
	Display setting icon	This icon represents a display-related setting.
	Bank setting icon	This icon represents the BANK Change setting, or a bank change target setting. Settings with this icon at the lower left are bank change targets.
	Language setting icon	This icon represents a Language/Initialize setting.
	System setting icon	This icon represents a system setting.

● Transition Diagram of the Operation Display and Simple Settings



Note The measured value will not be updated on the simple settings displays.

● Transition Diagram of the Setting Display

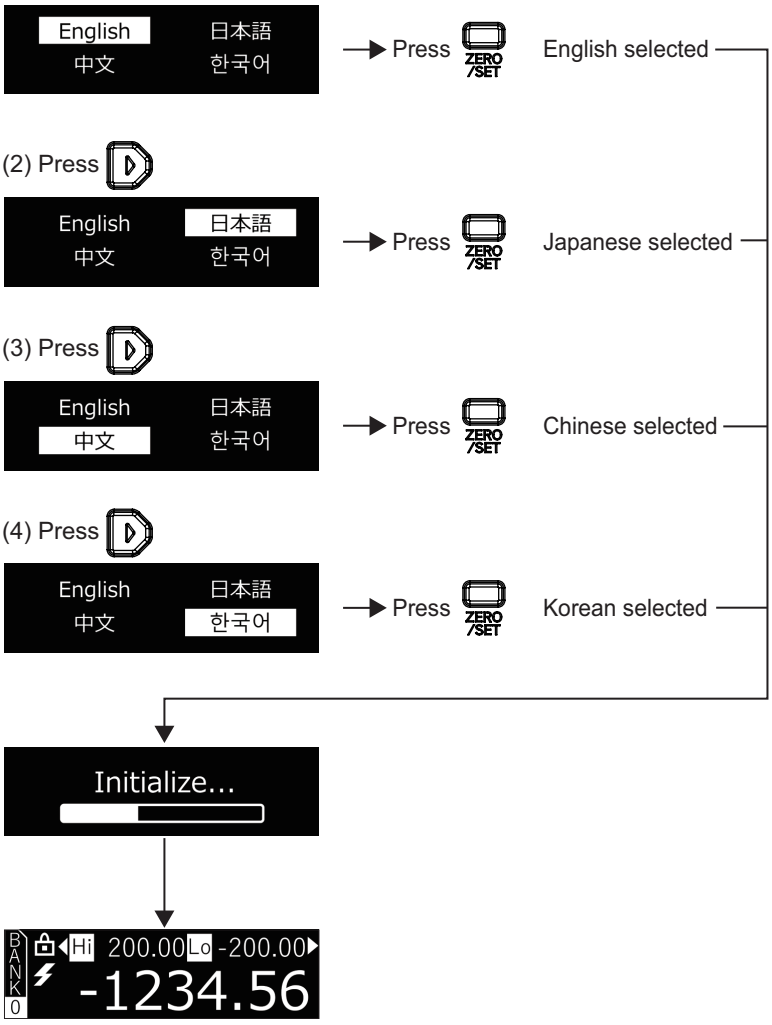


Note Refer to *3-2 Hierarchy of the Setting Display* on page 3-15 for the structure of the entire advanced setting display.

3-1-3 Operation at the First Power ON

When you turn ON the power for the first time after the equipment is shipped from the factory or initialized, perform the following operation.

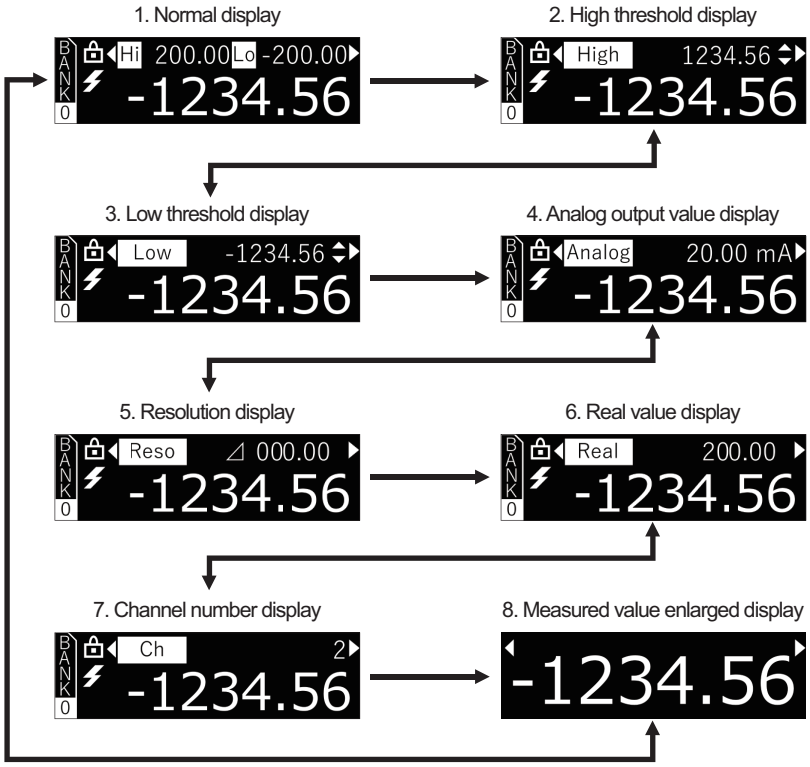
(1) Display at first startup



3-1-4 Operations in the Operation Display

In the RUN mode, press the / button to switch the display.

You can check the threshold values, analog output value, etc. while displaying the measured value.



Display		Description
1	Normal display	This display appears during startup. It shows both the High and Low threshold values.
2	High threshold display	This display shows the High threshold value. You can also press the / button to change the High threshold value.
3	Low threshold display	This display shows the Low threshold value. You can also press the / button to change the Low threshold value.
4	Analog output value display	This display shows the analog voltage value (unit: V) or current value (unit: mA) being output. **Note** Displayed only for the master unit with analog output.
5	Resolution display	This display shows the width of fluctuation of the measured value in one second (*Peak to Peak*).
6	Real value display	This display shows the present value, to which only the measurement direction and scaling have been applied.
7	Channel number display	This display shows the channel number of the Amplifier Unit in use.
8	Measured value enlarged display	This display shows only the measured value in an enlarged view.

Measured Value Indication

The default setting for the measurement value is as follows.
(Refer to *3-4-6 Setting the Measurement Increase/Decrease Direction* on page 3-30 for details.)

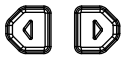
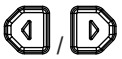
- Reference value *0*: Reference distance
- +: NEAR side
- -: FAR side

However, the measured value will not be displayed in the following cases.

- *Light Shortage* will be displayed if the amount of light received is insufficient. *Light Excess* is shown if the amount of received light is saturated.
- --- will be displayed if the measured value is undetermined. The conditions under which the measured value is undetermined are as follows.
  a) When the hold function is set, the hold value does not meet the conditions to be determined.
  b) When the average rate is set, the number of measurements does not meet the average rate.
  c) When the differential function is set, the number of measurements does not meet the differential rate.

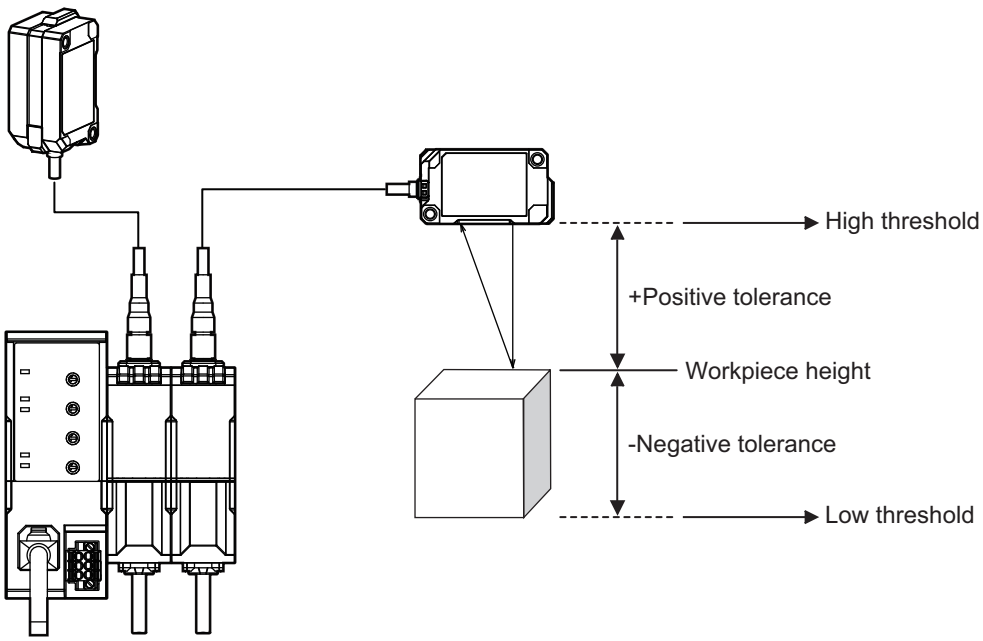
Changing the Thresholds

When the High threshold display or the Low threshold display is displayed, you can change the threshold value.

Step	Button operation	Display	Description of operation
1			In the Operation display, press the  button several times to display the High threshold display.
2			Press the  button to select the digit of the High threshold value to adjust.
			You can press the  button to select the number of digits of the set value. You can toggle between positive and negative by selecting the leftmost digit.
3			Press the  button to determine the set value and return to the RUN mode.

Teaching the Thresholds

Follow the procedure below to automatically calculate threshold values based on the measured value and the set tolerance.



● Setting Procedure

Step	Button operation	Display	Description of operation
1	ZERO /SET + MODE /ESC	BANK 0 High 3.00 0.56 Threshold Teach...	With the measured value displayed on the Operation display, simultaneously press the ZERO /SET and MODE /ESC buttons to start threshold teaching. Attempting to execute threshold teaching under a non-measurement condition such as Light Shortage results in transition to the Failure display. (Refer to the Failure display in Step 3.)
2	▲ / ▼	BANK 0 Tolerance: 3.00 0.56	Press the ▲ / ▼ button to select the digit of the set tolerance to adjust.
	◀ / ▶		You can press the ◀ / ▶ button to select the number of digits of the set value.
3	ZERO /SET	Success display Success ✓ Failure display Failure ✗	Pressing the ZERO /SET button determines the set tolerance and automatically returns to the Operation display. If “measured value shown ± set tolerance” is within the measurement range, the Success screen appears and the threshold value is reset to the calculated value. If “measured value shown ± set tolerance” is not within the measurement range, the Failure screen appears and the threshold value remains unchanged.

Key Lock Function

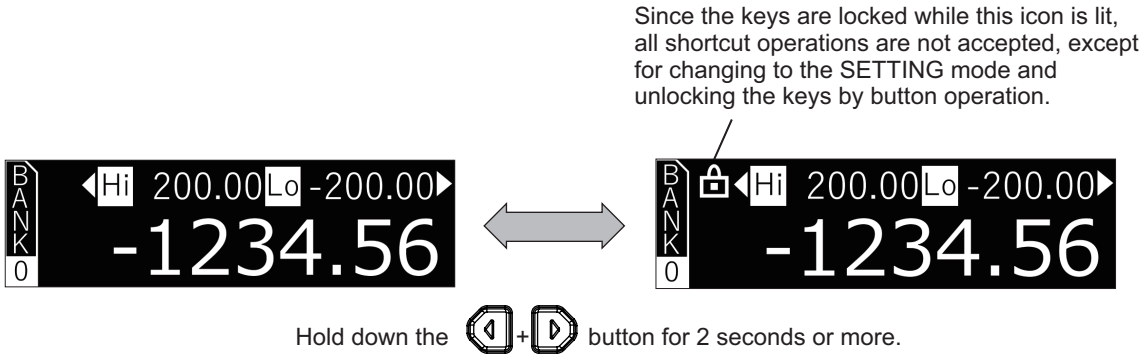
The key lock function prevents accidental button operation on the measured value.
While the key lock function is enabled, all shortcut operations are disabled, except for switching to the SETTING mode and unlocking the keys. However, you can change settings by executing commands via the Communication Unit.

● Enabling and Disabling the Key Lock Function

In a basic setting display, hold down the and buttons simultaneously for 2 seconds or more.

The icon lights at the upper left of the Operation display to indicate that the keys are locked.

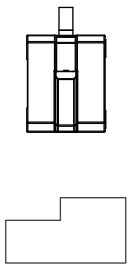
While the icon is lit, hold down the and buttons simultaneously for 2 seconds or more on the basic setting display to disable (unlock) the key lock function.



Executing Zero Reset

By executing zero reset, you can set the measured value to *0* in any timing during measurement in the RUN mode.

1 Set the measurement target to use as the reference.



2 Press the ZERO /SET button.

The *ZERO* indicator lights and the present measured value is registered as *0*.

To cancel the zero reset status, hold down the ZERO /SET button for 2 seconds.

Additional Information

- For the analog output range, the analog value corresponding to the *Zero Display* value will be output at the distance point where the zero reset is executed (e.g., 3 V for 1 to 5 V, 0 V for -5 to 5 V, and 12 mA for 4 to 20 mA when Zero Display is 0 mm and Meas. Scaling is OFF).
- You can also execute zero reset through external input lines. Refer to *3-5-4 Setting the Input Selection and External Inputs* on page 3-35 for details.
- You can also use the Zero Display function to set the reference value to a value other than *0*. Refer to *3-4-2 Setting the Zero Reset Display Value* on page 3-27 for details.

3-2 Hierarchy of the Setting Display

3-2-1 Basic Setting Mode

Setting number	Setting Default value	Options or setting range	Reference
1	Meas cycle 1 ms	125 µs/250 µs/500 µs/1 ms/2 ms/4 ms/20 ms/50 ms/100 ms/Auto	page 3-21
31	High threshold 3.00*2	-9999.99 to 9999.99 [mm]*1	page 3-22
32	Low threshold -3.00*2	-9999.99 to 9999.99 [mm]*1	page 3-22
2	Calculation*3 OFF	OFF/Thick/Step	page 3-23
3	Thick*4 0.00	0.00 to 9999.99 [mm]*1	page 3-23
33	Analog Output*5 4 to 20 mA	-5 to 5 V/1 to 5 V/4 to 20 mA/0 to 5 V/OFF	page 3-26
72	Initialize No	Yes/No	page 3-26
Adv. Setting			

*3. This can be set only for the master unit connected to at least one slave unit (2CH).

*4. This can be set only when Calculation is set to *Thickness*.

*5. This is displayed only for the master unit with analog output.

*1. The number of digits that can be set varies depending on the connected Sensor Head. Refer to *3-6-3 Setting the Number of Digits* on page 3-44 for details.

*2. The default value varies depending on the connected Sensor Head. Refer to *Setting Method* on page 3-22 for details.

3-2-2 Advanced Setting Mode

	Options or setting range	Reference
4 Average Rate (Upper line: Setting) 16 (Lower line: Default value)	1/2/4/8/16/32/64/128/256/512/1,024/2,048/4,096	page 3-27
5 Zero Display 0.00	-9999.99 to 9999.99 [mm]*1	page 3-27
6 Analog Scaling OFF	OFF/ON	page 3-27
7 Analog Scaling High *2	-9999.99 to 9999.99 [mm]*1	page 3-27
8 Analog Scaling Low *2	-9999.99 to 9999.99 [mm]*1	page 3-27
9 Meas. Scaling OFF	OFF/ON	page 3-29

*1. The number of digits that can be set varies depending on the connected Sensor Head. Refer to *3-6-3 Setting the Number of Digits* on page 3-44 for details.

*2. The default value varies depending on the connected Sensor Head. Refer to *3-4-3 Setting the Analog Output Scaling* on page 3-27 for details.

		Options or setting range	Refer-ence
10	Scale1 Before[*1] (Upper line: Setting) [*3] (Lower line: Default value)	-9999.99 to 9999.99 [mm][*2]	page 3-29
11	Scale1 After[*1] [*3]	-9999.99 to 9999.99 [mm][*2]	page 3-29
12	Scale2 Before[*1] [*3]	-9999.99 to 9999.99 [mm][*2]	page 3-29
13	Scale2 After[*1] [*3]	-9999.99 to 9999.99 [mm][*2]	page 3-29
14	Detection Select MAX	MAX/NEAR/FAR	page 3-30
15	Meas. Direction NEAR plus	NEAR plus/FAR plus	page 3-30
16	Diff. Calculation OFF	OFF/ON	page 3-30
17	Diff. Cycle[*4] 1	1 to 8,000	page 3-30

4. This can be set only when Diff. Calculation is set to ON.

*1. This can be set only when Meas. Scaling is set to ON.

*2. The number of digits that can be set varies depending on the connected Sensor Head. Refer to *3-6-3 Setting the Number of Digits* on page 3-44 for details.

*3. The default value varies depending on the connected Sensor Head. Refer to *3-4-4 Setting the Scaling* on page 3-29 for details.

	Options or setting range	Reference
34 Output Logic (Upper line: Setting) N.O. (Lower line: Default value)	N.O./N.C.	page 3-32
35 Hold Function OFF	OFF/Peak/Bottom/Sample/Peak to Peak/Auto Peak/Auto Bottom	page 3-32
36 Trigger Level*2 0.00	-9999.99 to 9999.99 [mm]*1	page 3-32
37 Timer Mode OFF	OFF/On Delay/Off Delay/One Shot	page 3-34
38 Timer Time*3 1 ms	1 to 9,999 [ms]	page 3-34
39 Hysteresis 0.00	0.00 to 9999.99 [mm]*1	page 3-34
40 Input Select Button	Button/External Input	page 3-35
41 External Input Timing	Timing/BANK	page 3-35
42 Zero Memory (Upper line: Setting) OFF (Lower line: Default value)	OFF/ON	page 3-40

*1. The number of digits that can be set varies depending on the connected Sensor Head. Refer to *3-6-3 Setting the Number of Digits* on page 3-44 for details.

*2. This can be set when Hold Function is set to *Auto Peak* or *Auto Bottom*.

*3. This can be set only when Timer Mode is set to other than OFF.

		Options or setting range	Reference
43	Synchronization Timing A	Timing A/Timing B	page 3-40
44	Keep Function OFF	OFF/ON	page 3-41
45	Keep Count*1 0	0 to 1,000 [times]	page 3-41
46	Initial Output MAX	4 mA/5 mA/6 mA/7 mA/8 mA/9 mA/10 mA/11 mA/12 mA/13 mA/14 mA/15 mA/16 mA/17 mA/18 mA/19 mA/20 mA/MAX*2	page 3-42

*1. Can be set only when Keep Function is set to ON

*2. When Analog Output is set to 4 to 20 mA

123 Display		Options or setting range	Reference
61	Reverse (Upper line: Setting) OFF (Lower line: Default value)	OFF/ON	page 3-44
62	Brightness Normal	Normal/OFF	page 3-44
63	Digits *1	0.001/0.01/0.1/1	page 3-44
64	Head Disp ON	ON/OFF	page 3-45
65	Display Select Normal	Normal/High Thresh/Low Thresh/Analog*2/Resolution/Real Value/Channel No./Enlarge View	page 3-45

*1. Refer to *3-6-3 Setting the Number of Digits* on page 3-44 for the default value.

*2. *Analog* is displayed only for the master unit with analog output.

		Options or setting range	Reference
71	BANK Change (Upper line: Setting) BANK0 (Lower line: Default value)	BANK0/BANK1/BANK2/BANK3	page 3-47

		Options or setting range	Reference
73	Language/言語 (Upper line: Setting) 日本語 (Lower line: Default value)	English/日本語/中文/한국어	page 3-50

		Options or setting range	Reference
74	Head Version (Upper line: Setting) Ver. XXXX (Lower line: Default value)	Sensor Head version shown	page 3-51
75	Amp Version Ver. XXXX	Amplifier Unit version shown	page 3-51
76	Response Time 22 ms	System response time is shown	page 3-51

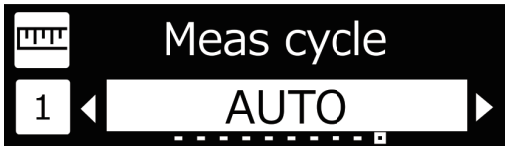
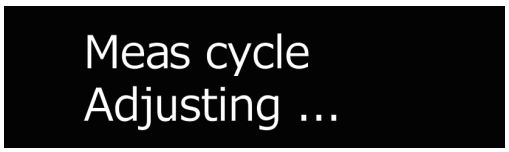
3-3 Basic Setting

3-3-1 Setting the Measurement Cycle

Set the measurement cycle. Setting a longer measurement cycle allows for measurement of targets with lower reflectance.
Select *AUTO* to automatically set the measurement cycle that provides the most stable measurement of the target currently being measured.

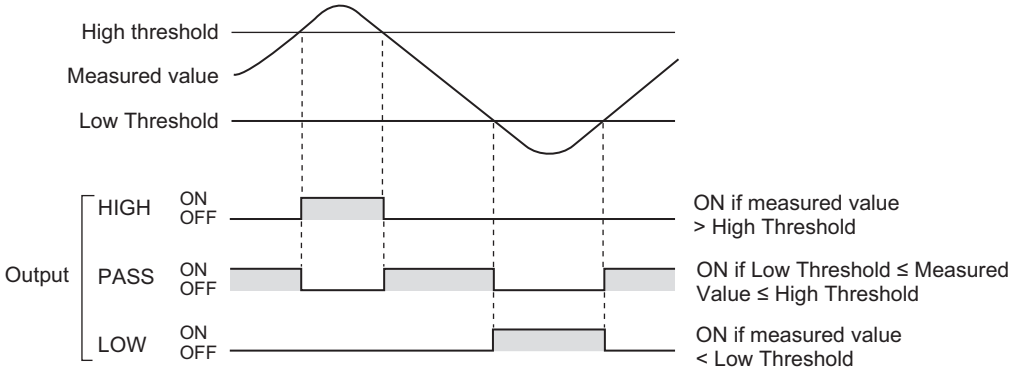
Setting	Setting value	Description
Meas cycle	125 µs/250 µs/500 µs/1 ms/2 ms/4 ms/20 ms/50 ms/100 ms/Auto	Set the measurement cycle.

Setting the Measurement Cycle to *AUTO*

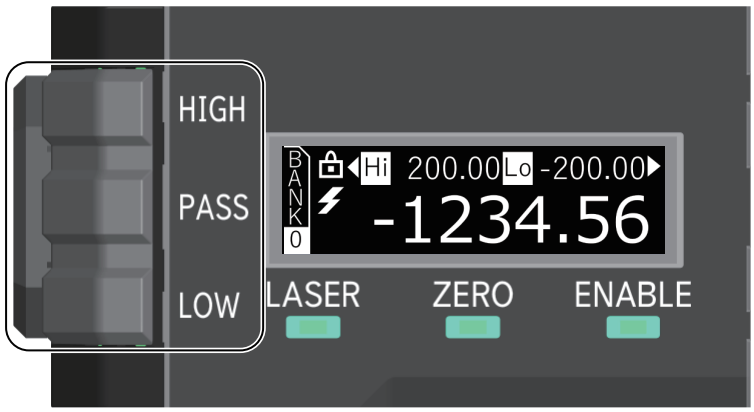
Step	Display	Description of operation
1		Press the MODE/ESC button to switch to the SETTING mode.
2		Make sure that the Sensor Head is in the measurement range of the measurement target, and set Meas cycle to *AUTO*.
3		The Amplifier Unit shifts to the measurement cycle adjusting state.
4	When successful (set to 100 ms)  When failed 	The measurement cycle is automatically set according to the amount of light received by the Sensor Head. The following cases can be considered when the adjustment fails. • The workpiece is out of the measurement range. • The reflectance of the workpiece is too low. • The angle between the workpiece and the Sensor Head is too large.
5		Press the MODE/ESC button to switch to RUN mode.

3-3-2 Setting the Thresholds

Set the range of measured values to be judged as PASS.
Set the two thresholds: High Threshold and Low Threshold.
As a judgment result, *HIGH*, *PASS*, or *LOW* will be output.



The judgment result is displayed on the Sensor Controller as shown below.



- When the judgment result is *HIGH*: The HIGH indicator lights.
- When the judgment result is *PASS*: The PASS indicator lights.
- When the judgment result is *LOW*: The LOW indicator lights.

Setting	Setting value	Description
Low Threshold	-9999.99 to 9999.99 [mm]	Set the Low threshold.
High Threshold	-9999.99 to 9999.99 [mm]	Set the High threshold.

The default values of the thresholds depend on the model of the connected Sensor Head.

Model of Sensor Head	Default value [mm]	
	High Threshold	Low Threshold
ZP-LS025□	1.0	-1.0
ZP-LS050□	2.0	-2.0
ZP-LS100□	7.0	-7.0
ZP-LS300□	30.0	-30.0
ZP-LS600□	80.0	-80.0

● Setting Method

1 Enter the thresholds in *Low Threshold* and *High Threshold*.

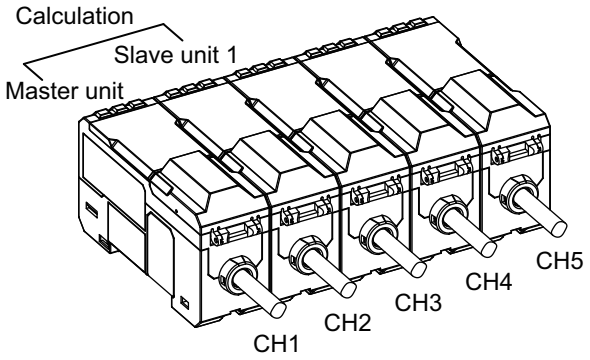
Threshold setting method	
RUN mode	Setting from Threshold display
	Command (via Communication Unit)
SETTING mode	Threshold setting

Additional Information

If High Threshold is set to less than Low Threshold, the High and Low thresholds will operate independently.
Example: When High Threshold is -1.0 mm and Low Threshold is 1.0 mm
- If the measured value is -2, only LOW output is ON and HIGH and PASS outputs are OFF.
- If the measured value is 0, LOW and HIGH outputs are ON and PASS output is OFF.

3-3-3 Setting the Calculation

You can perform calculations (addition or subtraction) on the real values (RV values) of the *master unit* and a *slave unit mounted next to the master unit (called "slave unit 1")*.
When there are two or more Amplifier Units connected, the calculation function can be used only between the *master unit* and *slave unit 1*.



The calculation function has the following two calculation modes.
- Thickness mode (for addition)
- Step mode (for subtraction)

Additional Information

When the mutual interference prevention function is turned ON, the update timing of the internal data does not match between the master unit and the slave unit. As a result, when using the Calculation mode to measure a moving measurement target, the measured value may deviate from the actual value.

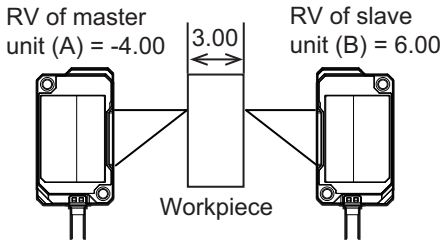
Thickness Mode

In the Thickness mode, the value obtained by adding the real value (RV value) of the master unit (A), the RV value of slave unit 1 (B), and the calculation reference value is used as the measured value (MV value) of the master unit.

Measured value (MV value) = (RV value of A) + (RV value of B) + Calculation reference value

This allows for measuring the outside diameter and width of large measurement targets that cannot be measured within the measurement range of a single Sensor Head.

Setting Example



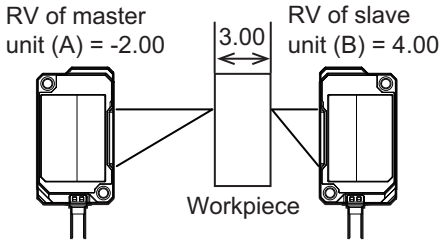
(1) Assuming that (RV value of A) = -4.00 and (RV value of B) = 6.00 in the installation condition, enter 3.00 for the set value of Thick.

(2) The master unit internally determines the thickness reference value.
Calculation reference value = (Set value of Thick) - (RV value of A) - (RV value of B)
= 1.00

(3) After completion of the setting, the master unit calculates the measured value (MV value) as follows.
Measured value (MV value) = (RV value of A) + (RV value of B) + Calculation reference value
= 3.00

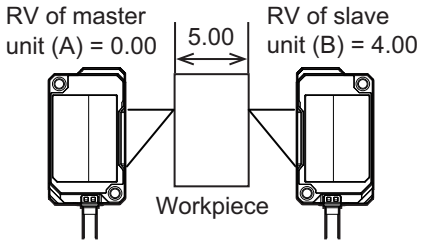
Cases of Operation

- Case where the workpiece moved horizontally



Assuming that RV of master unit (A) = -2.00 and RV of slave unit (B) = 4.00,
(RV value of A) + (RV value of B) + Calculation reference value
= -2.00 + 4.00 + 1.00
= 3.00

- Case where the workpiece thickness changed



Assuming that RV of master unit (A) = 0.00 and RV of slave unit (B) = 4.00,
(RV value of A) + (RV value of B) + Calculation reference value
=0.00 + 4.00 + 1.00
= 5.00

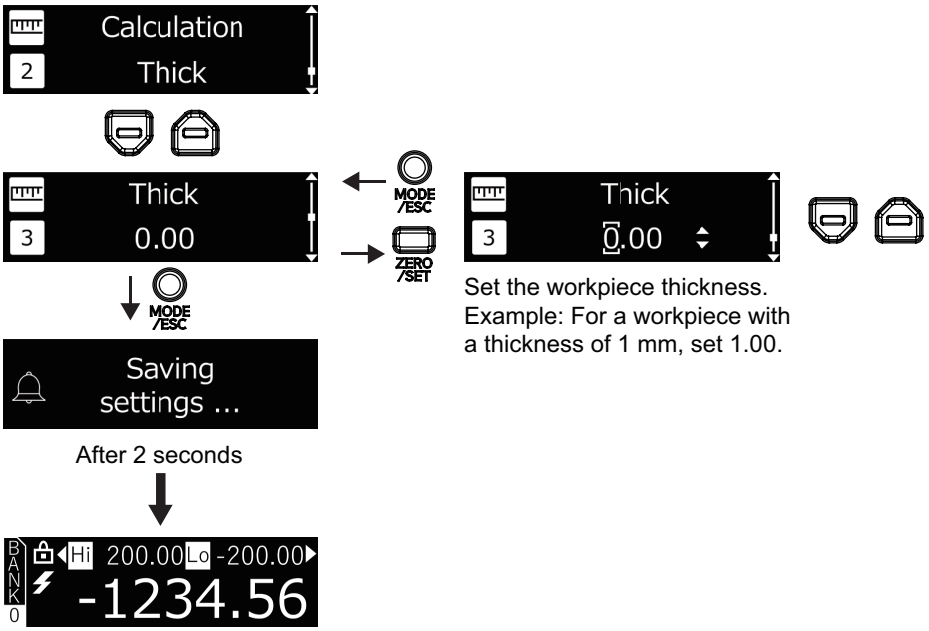
● Measurement Thickness Setting

After changing the *Calculation* setting to *Thick*, press the button to go to the *Thick* display.

In the *Thick* display, press the ZERO /SET button, change the target thickness using the / button, and then press the ZERO /SET button to complete the setting.

After completion of the setting, the calculation reference value is internally determined so that the measured value is the set value of Thick.

Note If you do not select **Thick** in **Calculation**, **Thick** will not be shown in the basic setting display.



Set the workpiece thickness.
Example: For a workpiece with a thickness of 1 mm, set 1.00.

The display returns to the operation display. The measured value varies depending on the setting.

● Setting the Thickness

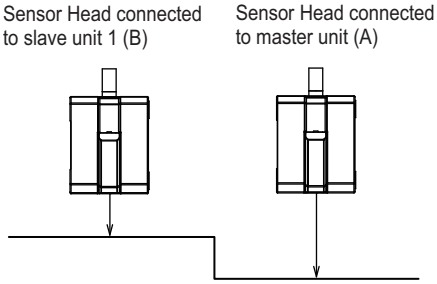
Setting value	Description
0.00 to 9999.99 [mm]	Corrects the calculated value so that it is the set value of Thick after completion of the setting.

Step Mode

In the Step mode, the value obtained by subtracting the real value (RV value) of slave unit 1 (B) from the real value (RV value) of the master unit (A) is used as the measured value (MV value) of the master unit.

Measured value (MV value) = (RV value of A) - (RV value of B)

Setting Example 1



● Mutual Interference Prevention Setting

You can prevent mutual interference between two sensors by switching the laser emission timing of each sensor. Refer to *Mutual Interference Prevention Function* on page 3-41 for details.

3-3-4 Setting the Analog Output

Set how to convert the measured value (MV value) into an analog output value for output.

Setting value	Setting description
-5 to 5 V	Converts the measured value (MV value) to -5 to 5 V for analog output.
1 to 5 V	Converts the measured value (MV value) to 1 to 5 V for analog output.
4 to 20 mA	Converts the measured value (MV value) to 4 to 20 mA for analog output.
0 to 5 V	Converts the measured value (MV value) to 0 to 5 V for analog output.
OFF	No output

Additional Information

The setting is possible only for the master unit with analog output.

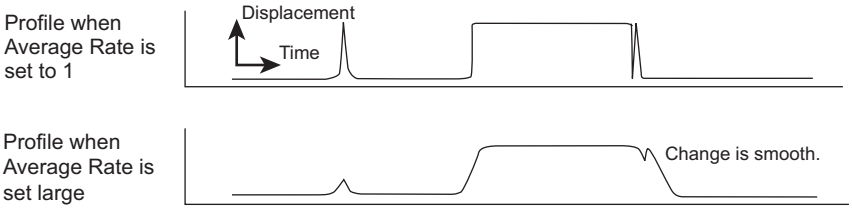
3-3-5 Initializing the Settings

Initialize the settings and return to the factory defaults. Executing Initialize by button operation brings up the same display as when you turned ON the power for the first time. (Refer to *3-1-3 Operation at the First Power ON* on page 3-9.)

3-4 Advanced Setting (Measurement)

3-4-1 Setting the Average Rate

The average rate function outputs the measured data as the average of a set number of measurements.
Set this function to reduce variation in measured values and improve static resolution.



Setting value	Description
1/2/4/8/16/32/64/128/256/512/1,024/2,048/4,096	The average rate can be changed.

3-4-2 Setting the Zero Reset Display Value

By setting Zero Display, you can set the display value when zero reset is executed to a value other than *0*.

Setting value	Description
-9999.99 to 9999.99	The display value when zero reset is executed can be specified.

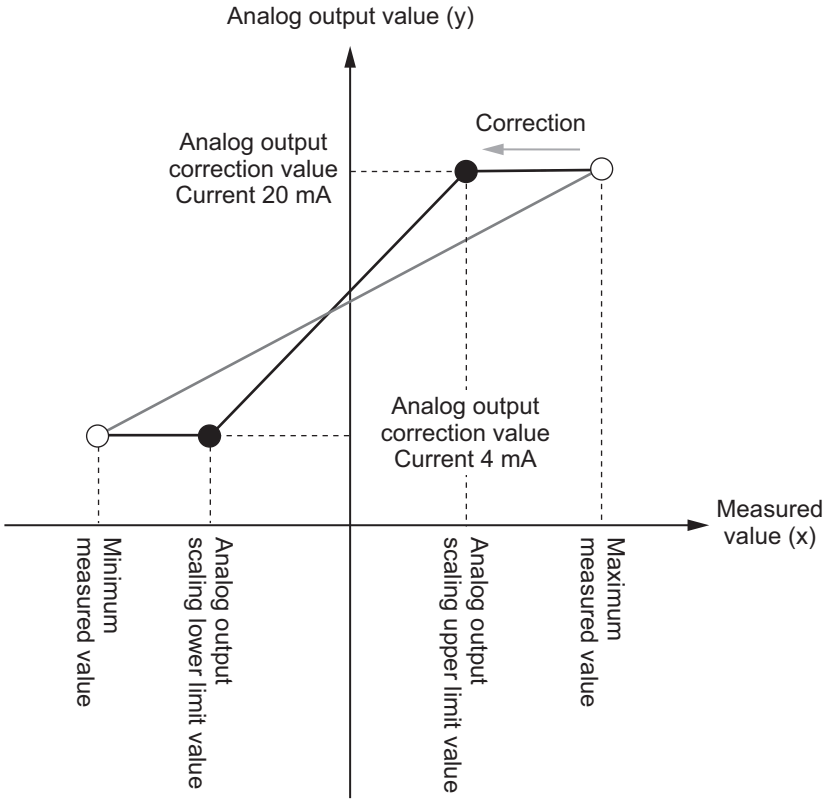
Additional Information

- The number of digits that can be set varies depending on the connected Sensor Head. Refer to *3-6-3 Setting the Number of Digits* on page 3-44 for details.
- If you execute zero reset with the Zero Display value of 0.00 (default), the present measured value will be 0.00.
  If you execute zero reset with the Zero Display value set to 10.00, the present measured value will be 10.00.

3-4-3 Setting the Analog Output Scaling

Analog output scaling is the processing to correct the analog output value with respect to two points: slope (span) and intercept (offset).
Enter the following two points.

- Measured value for the maximum current/voltage value (upper limit of analog output scaling)
- Measured value for the minimum current/voltage value (lower limit of analog output scaling)



Additional Information

- If the measured value is less than the maximum measurement value and greater than the upper limit of analog output scaling, the analog output value at the maximum measurement value will be output.
  If the measured value is greater than the minimum measurement value and less than the lower limit of analog output scaling, the analog output value at the minimum measurement value will be output.

-

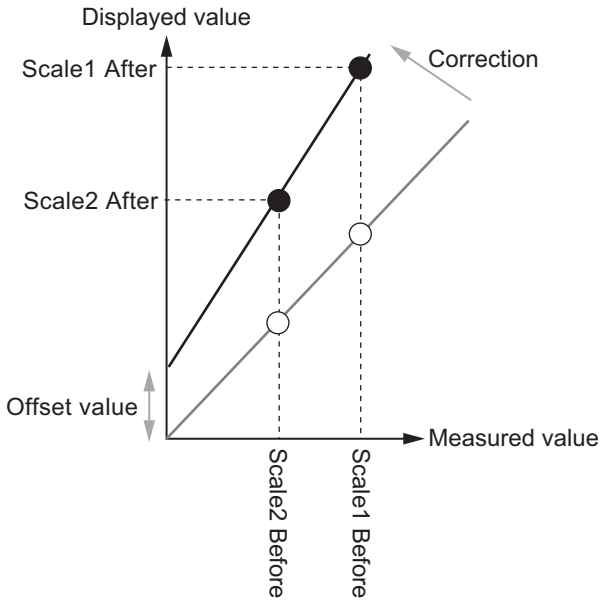
Setting	Setting value	Description
Analog Scaling	ON/OFF	Turn ON/OFF the Analog Scaling function.
Analog Scaling High	-9999.99 to 9999.99 [mm]	Set the upper limit of analog output scaling used for analog output correction.
Analog Scaling Low	-9999.99 to 9999.99 [mm]	Set the lower limit of analog output scaling used for analog output correction.

The default values of the upper and lower limits of analog output scaling depend on the model of the connected Sensor Head.

Model of Sensor Head	Default value [mm]	
	Analog Scaling High	Analog Scaling Low
ZP-LS025□	5.0	-5.0
ZP-LS050□	10.0	-10.0
ZP-LS100□	35.0	-35.0
ZP-LS300□	150.0	-150.0
ZP-LS600□	400.0	-400.0

3-4-4 Setting the Scaling

Use the scaling function to display the measured value after correcting an error caused by the installation condition of the Sensor Head.
Enter the present measured value (Scale Before value) and the measured value after correction (Scale After value) for two points.



Setting	Setting value	Description
Meas. Scaling	OFF/ON	Turn ON/OFF the scaling function.
Scale1 Before	-9999.99 to 9999.99 [mm]	Set the measured value for the first point.
Scale1 After	-9999.99 to 9999.99 [mm]	Set the measured value after correction for the first point.
Scale2 Before	-9999.99 to 9999.99 [mm]	Set the measured value for the second point.
Scale2 After	-9999.99 to 9999.99 [mm]	Set the measured value after correction for the second point.

The default values of the Scale After and Scale Before settings depend on the model of the connected Sensor Head.

Additional Information

- This can be set only when Meas. Scaling is set to ON.
- The number of digits that can be set varies depending on the connected Sensor Head.
- The default values of the Scale After and Scale Before settings depend on the model of the connected Sensor Head.

Model of Sensor Head	Default value [mm]	
	Scale1 Before Scale1 After	Scale2 Before Scale2 After
ZP-LS025□	5.0	-5.0
ZP-LS050□	10.0	-10.0
ZP-LS100□	35.0	-35.0
ZP-LS300□	150.0	-150.0
ZP-LS600□	400.0	-400.0

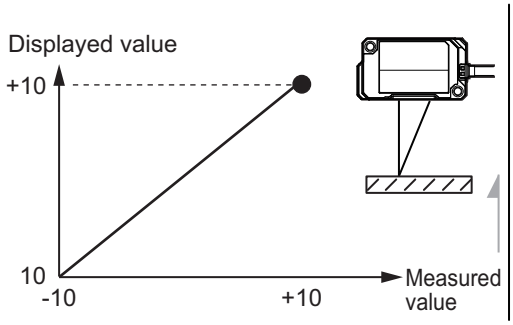
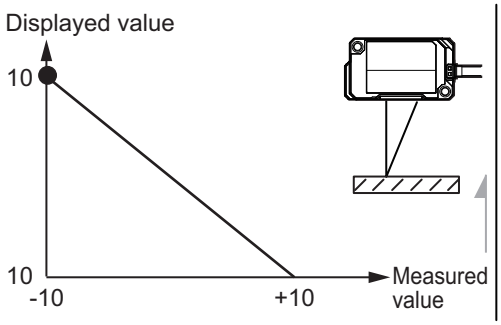
3-4-5 Setting the Measurement Surface Selection

When the measured value is unstable, setting the position of the measurement target may help stabilize the measurement.
For example, measurement through a view port may be unstable due to light reflected from the view port.
In this case, changing the setting of Detection Select from "MAX" (default) to "FAR" to select the far side of the measurement target may result in more stable measurement.

Setting value	Description
MAX/NEAR/FAR	Set which measurement surface to use for measurement.

3-4-6 Setting the Measurement Increase/Decrease Direction

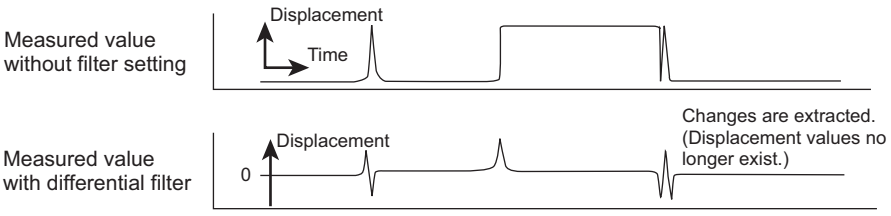
Set the direction to increase the display value, i.e., as the measurement target comes closer to (default setting) or goes away from the Sensor Head.

Meas. Direction	Description	Default value
NEAR plus	The measured value increases as the measurement target comes closer to the Sensor Head. • For ZP-LS050 	✓
FAR plus	The measured value decreases as the measurement target comes closer to the Sensor Head. 	

3-4-7 Setting the Differential Calculation

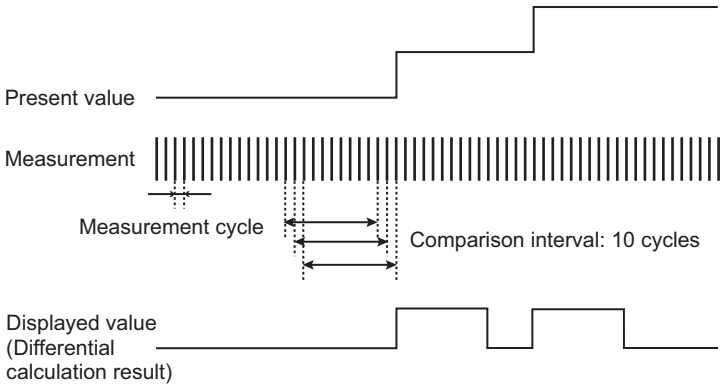
To extract the change amount of rapid changes in a measured value that occur within a very short period of time, set the differential function.

The differential filter compares the present value with the measured value before the set number of measurements (comparison internal) and outputs the difference.



Setting value	Description
Diff. Calculation	Turn ON/OFF the differential calculation.

You can adjust the comparison interval in the Diff. Cycle setting.



Setting value	Description
1 to 8,000	Set the interval to compare the present value with the measured value (before the number of measurements).

3-5 Advanced Setting (I/O)

3-5-1 Setting the Output Logic

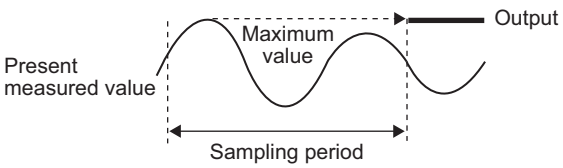
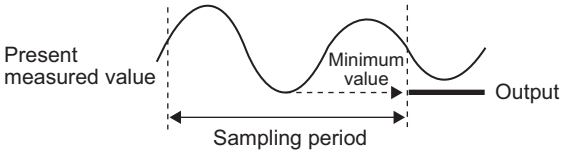
You can set Output Logic to N.O. (Normally Open) or N.C. (Normally Close).
Setting either of these values switches the output status at the time of each judgment. If the judgment is turned ON when this setting is N.O., the output is ON. If the judgment is turned ON when it is N.C., the output is OFF.
The judgment output will be turned ON/OFF according to the Output Logic setting as shown below.

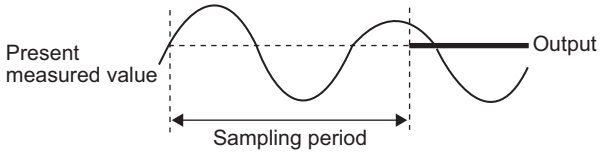
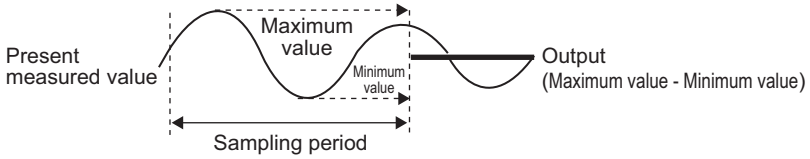
Output Logic setting		N.O.					N.C.				
	Judgment status	HIGH	PASS	LOW	Non-measurement state	System error state	HIGH	PASS	LOW	Non-measurement state	System error state
Judgment output	HIGH	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF
	PASS	OFF	ON	OFF	OFF	OFF	ON	OFF	ON	ON	OFF
	LOW	OFF	OFF	ON	OFF	OFF	ON	ON	OFF	ON	OFF
	ERROR	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF

3-5-2 Setting the Hold Trigger Level

Set the processing to hold the measured value. Select one hold type from Peak, Bottom, Sample, Peak to Peak, Auto Peak, and Auto Bottom.

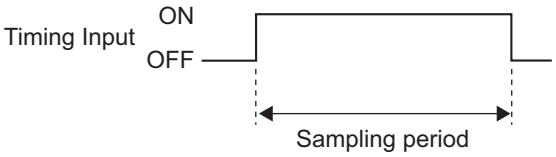
Hold Output Result Specifications

Setting value	Description of processing
Peak Auto Peak	Holds the *maximum value* within the sampling period. After sampling is completed, the held value is output. 
Bottom Auto Bottom	Holds the *minimum value* within the sampling period. After sampling is completed, the held value is output. 

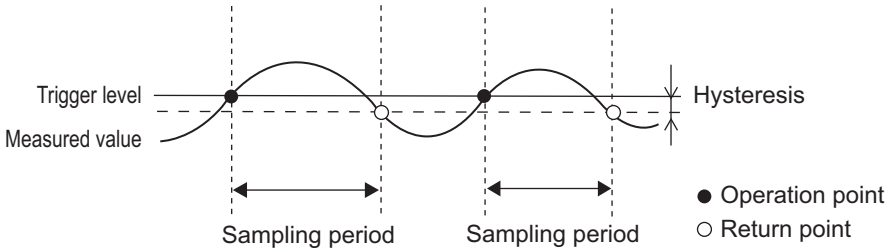
Setting value	Description of processing
Sample	Holds the measured value at the moment of entry into the sampling time. After sampling is completed, the held value is output. If the measured value at the moment of entry into sampling time is Light Excess (0x7FFF FFFD), Light Shortage (0x7FFF FFFE), or Measured Value Undetermined (0x7FFF FFFF), Measured Value Undetermined (0x7FFF FFFF) is held. 
Peak to Peak	Holds the *difference between the maximum and minimum values* within the sampling period. After sampling is completed, the held value is output. 

Sampling Time

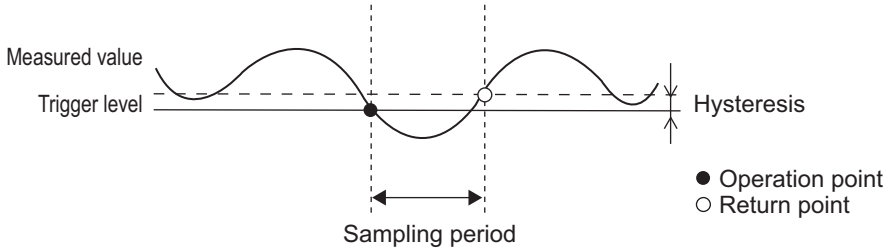
- When the hold function set to *Peak*, *Bottom*, *Sample*, or *Peak to Peak*
  The sampling time is the period during which the timing input is ON. When sampling is completed, the held value is determined and output.



- When the hold function set to *Auto Peak*
  Sampling starts when the measured value rises above the set trigger level and ends when it falls below the trigger level.
  After sampling is completed, the held value is determined and output. Whether the timing input is ON or OFF does not affect sampling.



- When the hold function set to *Auto Bottom*
  Sampling starts when the measured value falls below the set trigger level and ends when it rises above the trigger level.
  After sampling is completed, the held value is determined and output. Whether the timing input is ON or OFF does not affect sampling.



3-5-3 Setting the Timer Hysteresis

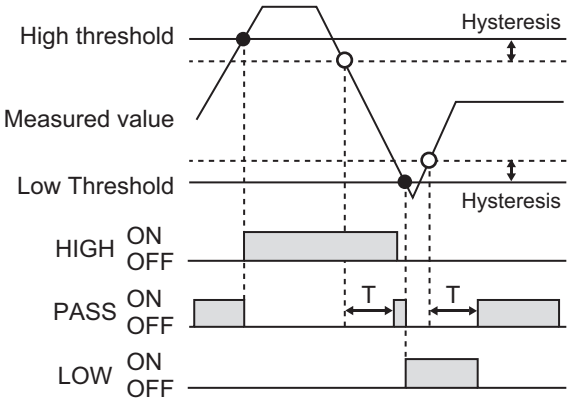
Timer processing adjusts the output timing of the judgment output. Three types of timers are available: *ON-delay timer*, *OFF-delay timer*, and *One-shot timer*. Timer processing is reflected in control output signals, output indicators, and output data to the Communication Unit. In the default setting, timer processing is OFF (timer OFF).

You can specify a hysteresis width to prevent the judgment value from fluctuating and the judgment output from repeatedly turning ON and OFF when the measurement target vibrates, for example.
If the PASS judgment repeatedly turns ON and OFF, increasing the hysteresis value will stabilize it at ON or OFF.

● ON-delay Timer

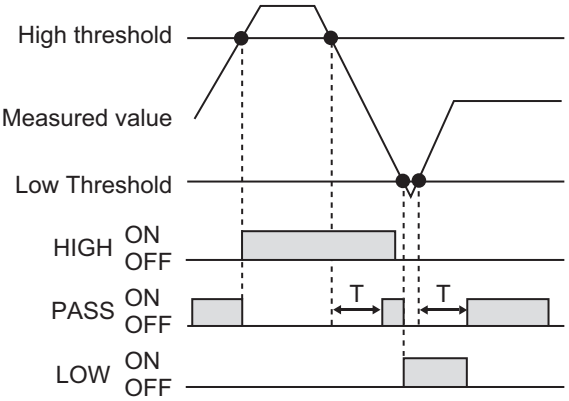
The ON-delay timer delays (slows down) the rise of the PASS judgment output from OFF to ON for the specified timer time.
It also delays (slows down) the fall of the HIGH and LOW judgment outputs from ON to OFF. The timing chart for the ON-delay timer operation is shown below.

When the hold function is OFF



● Greater than or less than
○ Greater than or equal to or less than or equal to

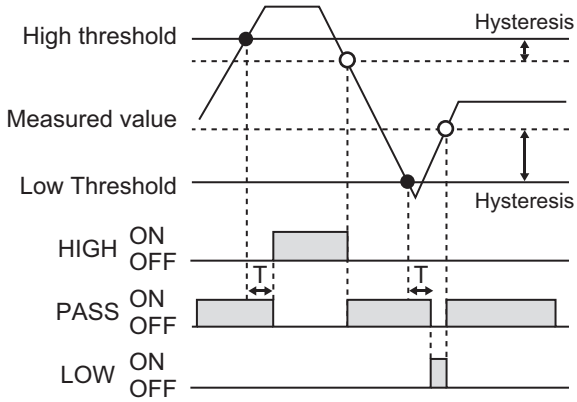
When the hold function is ON



● OFF-delay Timer

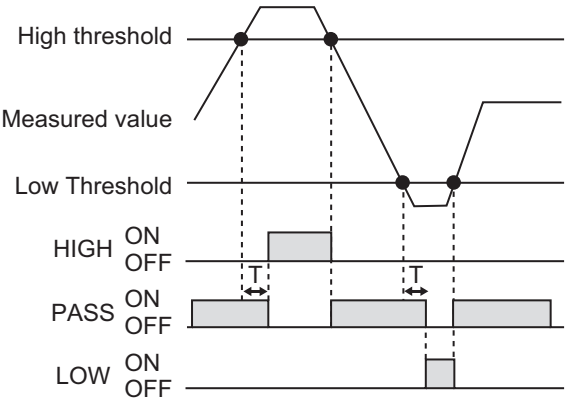
The OFF-delay timer delays (slows down) the fall of the PASS judgment output from ON to OFF for the specified timer time.
It also delays (slows down) the rise of the HIGH and LOW judgment outputs from OFF to ON. The timing chart for the OFF-delay timer operation is shown below.

When the hold function is OFF



● Greater than or less than
○ Greater than or equal to or less than or equal to

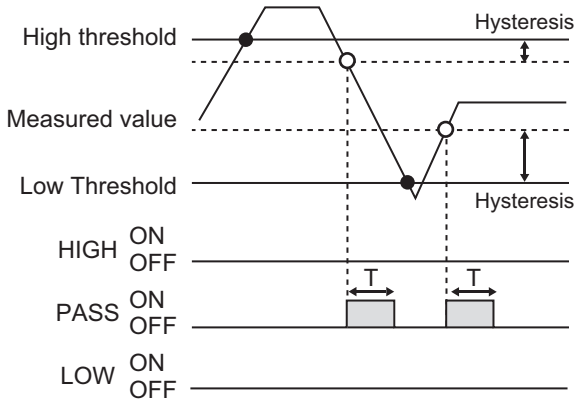
When the hold function is ON



● One-shot Timer

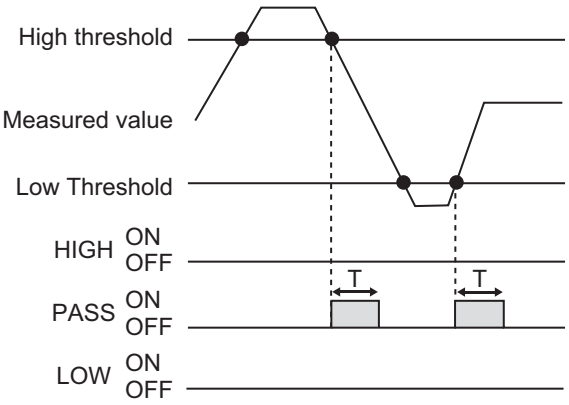
The one-shot timer forcibly turns OFF the judgment output when the specified timer time has elapsed since the PASS judgment output was turned ON.
The HIGH and LOW judgment outputs are not turned ON. The timing chart for the one-shot timer operation is shown below.

When the hold function is OFF



● Greater than or less than
○ Greater than or equal to or less than or equal to

When the hold function is ON



Note If the hysteresis width is in the same range as the PASS region, the PASS judgment will not be output.

3-5-4 Setting the Input Selection and External Inputs

Input selection method is a function that selects whether the control input to the Amplifier Unit is provided by a button or external input line.
In *External Input*, among the external input lines, select the functions of External inputs 3 and 4 from either Timing or BANK. The functions of external inputs 1 and 2 are fixed to Laser OFF and Zero Reset, respectively.

Input line name	Input terminal	External input function
Input 1	Pink wire	LD-OFF
Input 2	Orange wire	Zero Reset
Input 3	Purple wire	Timing input*1

Input line name	Input terminal	External input function
Input 4	Red wire	Reset input*2

*1. When BANK is set, this functions as *BANK A*.
*2. When BANK is set, this functions as *BANK B*.

The control input methods used for the Amplifier Unit are divided into three types: *external input*[*3] , *button*, and *control command*.
The table below shows whether operation is enabled or disabled for each combination of the *input selection method* and *external input setting*.
*3. The external input request function of the Communication Unit also operates in the same way.

		Setting result of *input selection method*					
		Button			External Input		
Setting result of *external input setting*	**Timing**	Timing	External input	Disabled	Timing	External input	Enabled
			Button	Enabled		Button	Disabled
			Control command	Enabled		Control command	Disabled
		Reset	External input	Disabled	Reset	External input	Enabled
			Button	---		Button	---
			Control command	Enabled		Control command	Disabled
		BANK	External input	Disabled	BANK	External input	Disabled
			Button	Enabled		Button	Enabled
			Control command	Enabled		Control command	Enabled
	BANK	Timing	External input	Disabled	Timing	External input	Disabled
			Button	Enabled		Button	Enabled
			Control command	Enabled		Control command	Enabled
		Reset	External input	Disabled	Reset	External input	Disabled
			Button	---		Button	---
			Control command	Enabled		Control command	Enabled
		BANK	External input	Disabled	BANK	External input	Enabled
			Button	Enabled		Button	Disabled
			Control command	Enabled		Control command	Disabled

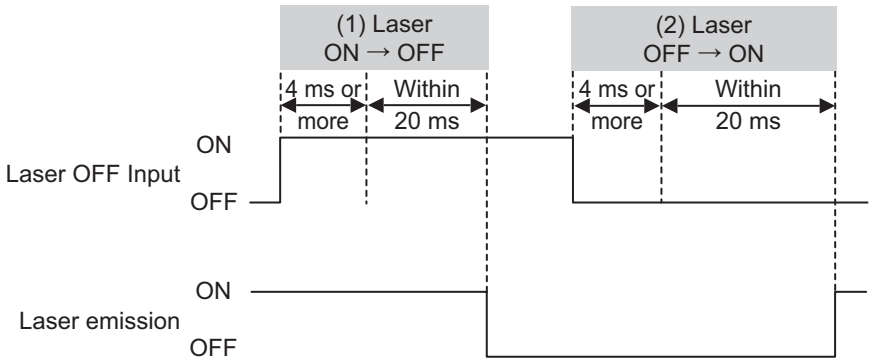
Timing Charts When External Input Is Enabled

The timing charts below show the cases where the external input is enabled according to the combination of the input selection and external input settings.

● Laser OFF Input

While the Laser OFF input is ON, laser emission is stopped. While the laser emission is stopped, the LASER indicator light on the Amplifier Unit is not lit. Refer to *2-2-2 Amplifier Unit* on page 2-5 for details.

Note Measurement is disabled while laser emission is stopped.



(1)	Laser ON → OFF	If the laser OFF input is ON for 4 ms or more, the signal is accepted and the laser emission is turned OFF within 20 ms.
(2)	Laser OFF → ON	If the laser OFF input is OFF for 4 ms or more, the signal is accepted and the laser emission is turned ON within 20 ms.

Note When mutual interference prevention is turned ON, the above time is 150 ms or less.

Minimum Input Time

ON time: 4 ms

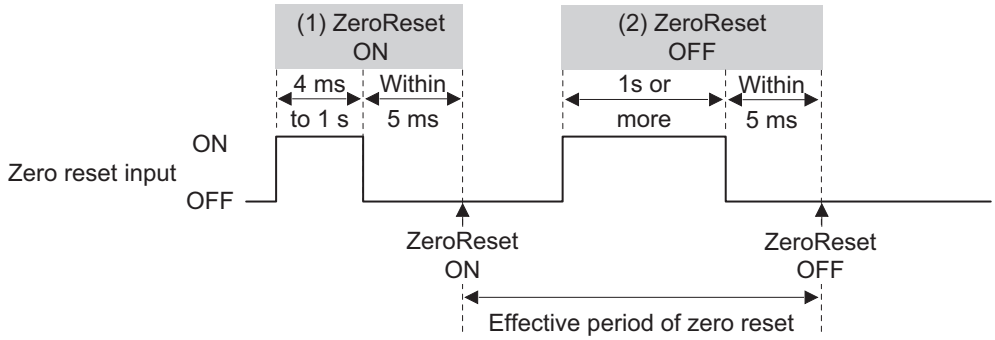
OFF time: 4 ms

● Zero Reset Input

When the zero reset input is turned ON, the measured value (MV value) is set to 0 or the set value of Zero Display. Refer to *3-4-2 Setting the Zero Reset Display Value* on page 3-27 for details.

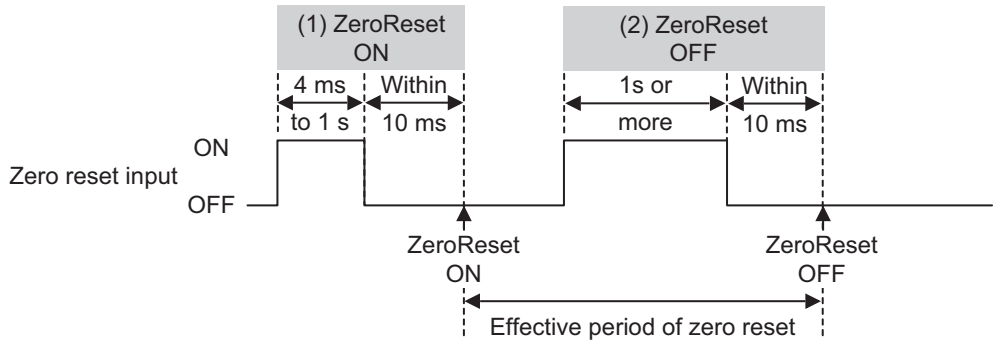
Timing Chart

- When Zero Memory is set to OFF



(1)	ZeroReset ON	Turn ON the zero reset input for 4 ms to 1 s, and then turn it OFF. Zero reset is executed and the measurement is resumed within 5 ms.
(2)	ZeroReset OFF	Turn ON the zero reset input for 1 s or more, and then turn it OFF. Zero reset is canceled and the measurement is resumed within 5 ms.

- When Zero Memory is set to ON



(1)	ZeroReset ON	Turn ON the zero reset input for 4 ms to 1 s, and then turn it OFF. Zero reset is executed and the measurement is resumed within 10 ms. Obtain the measurement result after the set response time has elapsed.
(2)	ZeroReset OFF	Turn ON the zero reset input for 1 s or more, and then turn it OFF. Zero reset is canceled and the measurement is resumed within 10 ms. Obtain the measurement result after the set response time has elapsed.

Minimum Input Time

ON time: 4 ms

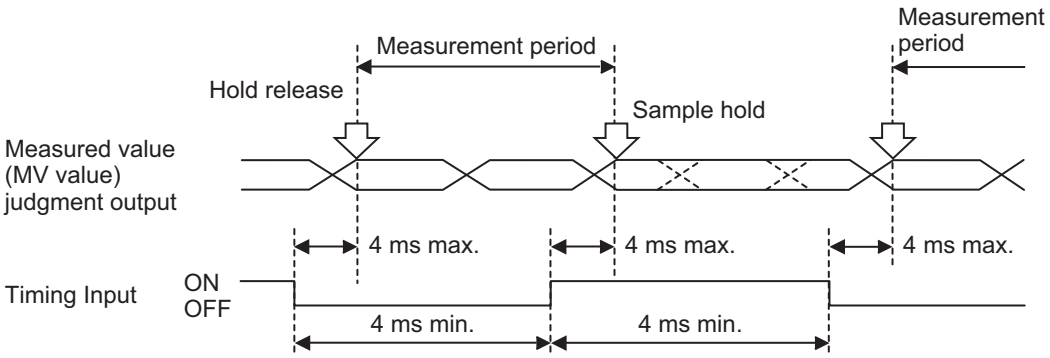
OFF time: 4 ms

● Timing Input

When the timing input is turned ON while the hold function is enabled, the measured value (MV value) is held. Refer to *3-5-2 Setting the Hold Trigger Level* on page 3-32 for details.

Timing Chart

- For Sample hold



Minimum Input Time

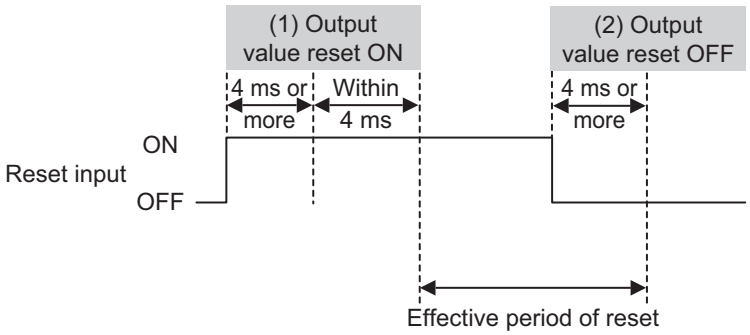
ON time: 4 ms

OFF time: 4 ms

● Reset Input

The reset input function is enabled when Timing Reset is set for Input 4. When the reset input is turned ON, the hold state is released.

Timing Chart



(1)	Output value reset ON	If the reset input is ON for 4 ms or more, the signal is accepted and the output is reset within 4 ms.
(2)	Output value reset OFF	If the reset input is OFF for 4 ms or more, the measurement is resumed. Obtain the measurement result after the set response time has elapsed.

Note • When the hold function is not used
Holds the output according to the settings in the Keep Function settings.
• When the hold function is used
Restores the hold undetermined state when a reset signal is input. Refer to *3-5-2 Setting the Hold Trigger Level* on page 3-32 for the hold function. Refer to *3-5-8 Setting the Initial Output* on page 3-42 for the non-measurement output.

Minimum Input Time

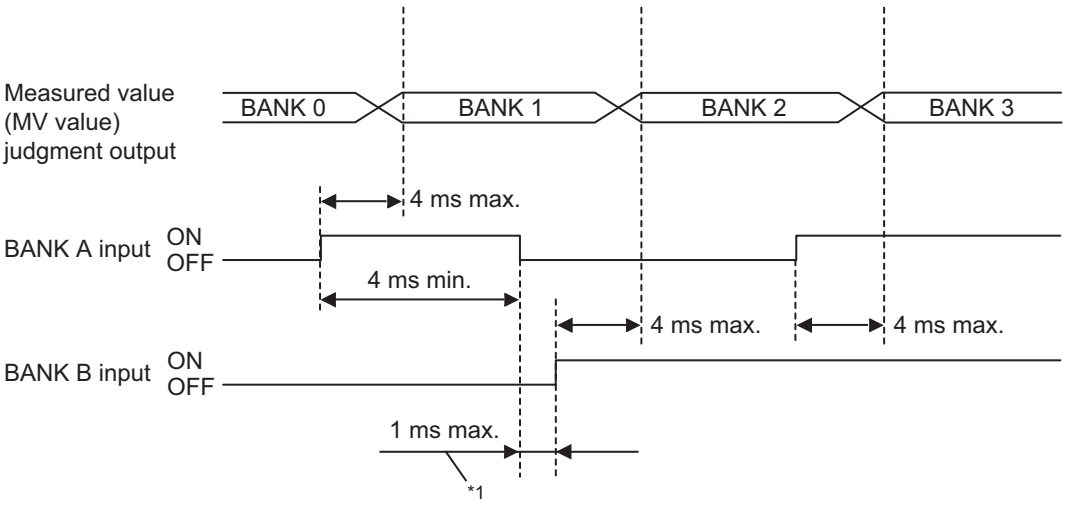
ON time: 4 ms

OFF time: 4 ms

● BANK A Input and BANK B Input

You can set bank input for Input 3 and Input 4. The bank is changed according to the ON/OFF combination of BANK A input and BANK B input. Refer to *3-7-1 Changing the Bank* on page 3-47 for details on how to change the bank input.

Timing Chart



*1. In this example, when 1 ms elapses, both BANK A input and BANK B input may be judged as OFF, resulting in a period of operation in BANK 0.

Note When a measured value (MV value) is held by the hold function, the measured value (MV value) is held as it is even if the BANK A input or BANK B input is turned ON/OFF. However, the judgment output will change according to the tolerance settings registered in the new bank.

Minimum Input Time
ON time: 4 ms
OFF time: 4 ms

3-5-5 Setting the Zero Memory

Setting Zero Memory to ON allows the Amplifier Unit to retain the result of the zero reset even after the power is turned OFF after execution of zero reset by an external input or command.
For button operations, the result is retained regardless of the Zero Memory setting.

3-5-6 Setting the Synchronization

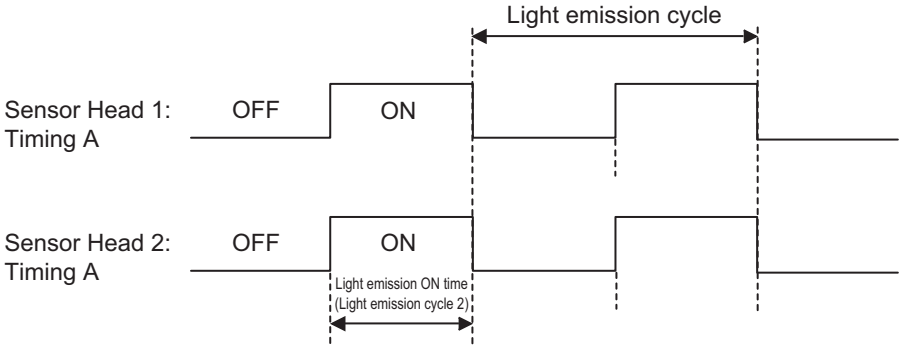
When using two or more Sensor Heads, setting different light emission timings, Timing A and Timing B, for them enables synchronous measurement and mutual interference prevention.

- **Values That Can Be Set**

Setting value	Description
Timing A	Emits light at the emission timing shown as Timing A.
Timing B	Emits light at the light emission timing shown as Timing B, which is shifted from Timing A by one-half of the measurement cycle.

Synchronous Measurement Function

This function allows measurement by matching the start timing of laser emission from two or more Sensor Heads.
You can perform synchronous measurement with two or more sensors by setting the light emission timing of the Amplifier Units connected together to match either *Timing A* or *Timing B* so that the laser emission starts simultaneously.



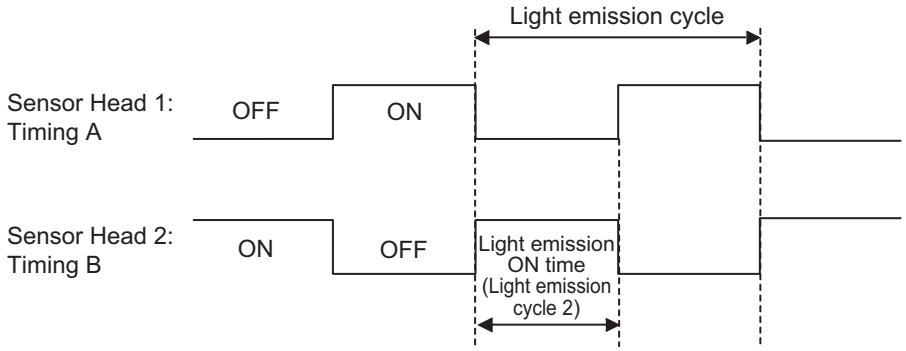
Synchronous measurement is enabled only when the same measurement cycle of 1 ms or less is set.

Additional Information

Image synchronization is possible when the measurement cycle is 1 ms or less. When synchronous measurement is enabled, the lag time in measurement timing between the Sensor Heads is 3 µs or less. Note that the measurement is asynchronous when the measurement cycle is set to 2 ms or more.

Mutual Interference Prevention Function

This function prevents mutual interference that occurs when light emitted from one Sensor Head is reflected and received by another Sensor Head.
Set the timing of laser emission on each of the connected Amplifier Units to different timing from *Timing A* and *Timing B*. This enables control of the light emission times so that they do not overlap, thus preventing mutual interference.



Mutual interference prevention is enabled for measurement only when the same measurement cycle is set.

Additional Information

- Immediately after the power is turned ON, or when the setting is switched between Timing A and Timing B, it takes 10 ms to complete the adjustment of the light emission timing. When the mutual interference prevention function is turned ON, the update timing of the internal data does not match between the master unit and the slave unit. Attention must be paid during measurement of moving objects.
- Although synchronous measurement is disabled when the measurement cycle exceeds 1 ms, mutual interference prevention is enabled.

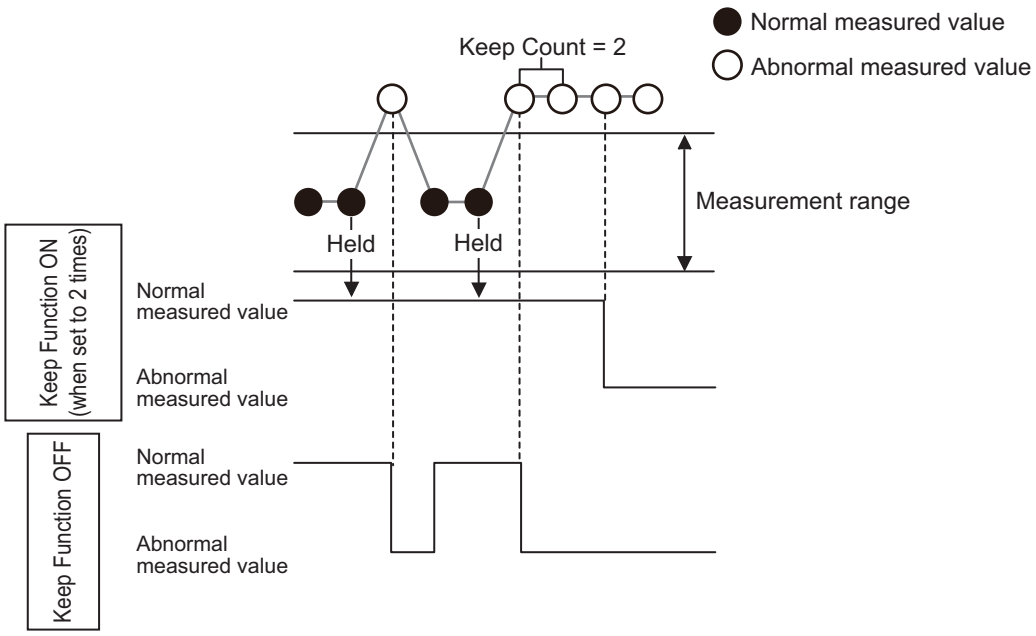
3-5-7 Setting the Keep Function and Keep Count

You can set the keep count to output an abnormal measured value either after keeping the previous normal measured value or without keeping it if the sensor enters a non-measurement state.

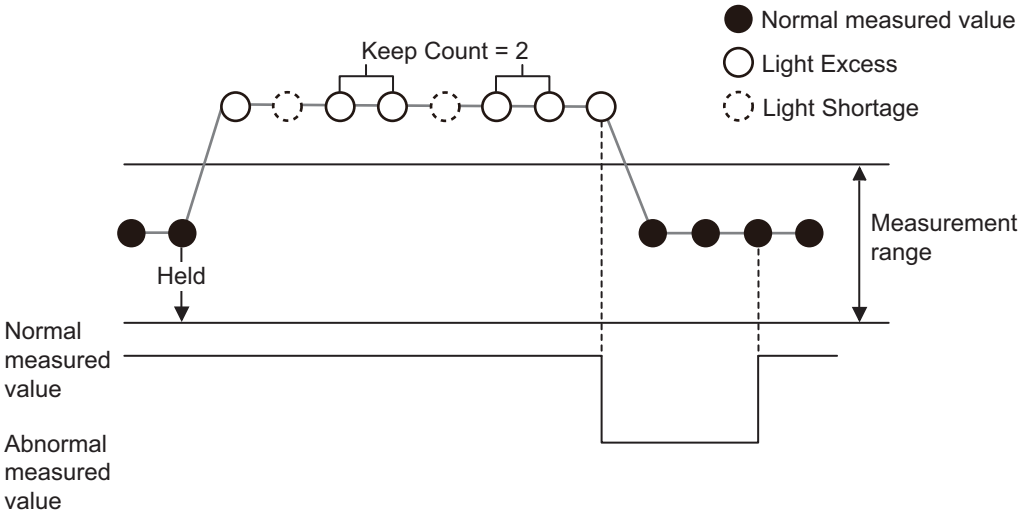
The keep time is set as follows.

Keep time = Keep Count × Measurement cycle*1

*1. When the Keep Count is set to *0*, there is no limit to the keep count, and the keep state is always held until a normal measured value is obtained.



If another non-measurement condition (e.g., Light Shortage) occurs while a non-measurement condition (e.g., Light Excess) has been occurring continuously, the occurrence count of the non-measurement condition will be reset.



- **Setting Value Range**

Setting value	Description
Keep Function	ON/OFF
Keep Count	0 to 1000

3-5-8 Setting the Initial Output

Determine the analog value to be output from the analog output line when the measured value (MV value) is a non-measurement value.
The range of values that can be set differs depending on the Analog Output setting.

Analog Output value	Initial Output setting range
-5 to 5 V	-5/-4/-3/-2/-1/0/1/2/3/4/5/MAX*1

Analog Output value	Initial Output setting range
1 to 5 V	1/2/3/4/5/MAX*1
4 to 20 mA	4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/MAX*1
0 to 5 V	0/1/2/3/4/5/MAX*1
OFF	Setting not possible

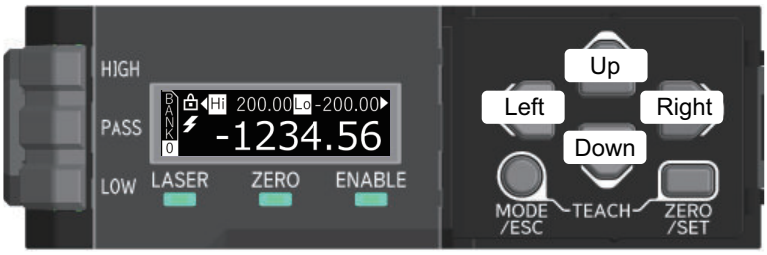
*1. MAX is 5.5 V when Analog Output is set to *-5 to 5 V*, *1 to 5 V*, or *0 to 5 V*.
MAX is 22 mA when Analog Output is set to *4 to 20 mA*.
If the present Analog Output setting is voltage (-5 to 5 V, 1 to 5 V, or 0 to 5 V), 5.5 V will be output in the event of a system error.
If the present Analog Output setting is current (4 to 20 mA), 3 mA will be output in the event of a system error.

3-6 Advanced Setting (Display)

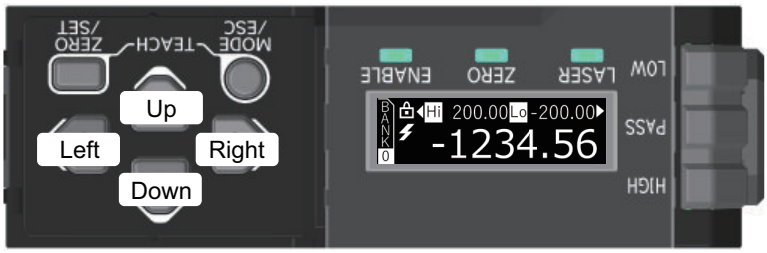
3-6-1 Setting the Reverse Display

This function reverses the display upside down.
When the display is reversed, the functions of the UP/DOWN, and LEFT/RIGHT cursor buttons are reversed, but the functions of MODE /ESC and ZERO /SET buttons are not reversed.

REVERSE OFF (Default)



REVERSE ON



3-6-2 Setting the Brightness

The Amplifier Unit automatically dims the brightness of its display after a certain period of inactivity. For the dimming operation, you can specify whether to completely turn OFF the display or reduce the brightness.

Setting value	Operation
Normal	Reduces the display brightness by 50% after 60 seconds of inactivity.
OFF	Reduces the display brightness by 50% after 5 seconds of inactivity, and then turns OFF the display after 15 seconds of inactivity.

3-6-3 Setting the Number of Digits

In Digits, specify the number of digits (decimal point position) that will be displayed in the Operation display.

Setting value	Displayable values [mm]
0.001	-999.999 to 999.999
0.01	-9999.99 to 9999.99
0.1	-9999.9 to 9999.9
1	-9999 to 9999

Additional Information

- If the internal measured value exceeds the range of the displayable value, the display value is clamped to the upper or lower limit of the displayable values.
  There may be a discrepancy between the internally held value and the displayed value since the internally held value is in the range of -9,999.99999 to 9,999.99999 [mm].
- The default value of Digits varies depending on the model of the connected Sensor Head.

Setting of Digits	Type of Sensor Head
0.001	No corresponding Sensor Head
0.01	ZP-LS025□, ZP-LS050□, ZP-LS100□
0.1	ZP-LS300□, ZP-LS600□
1	No corresponding Sensor Head

- In the SETTING mode and in the sub displays of the operation display, the number of display digits is clamped to the default value of Digits.

3-6-4 Setting the Sensor Head Indicator

Specify whether the indicator on the Sensor Head is to be normally lit or unlit.

When Head Disp is ON		When Head Disp is OFF
Lit during PASS judgment	Lit during High/Low threshold judgment	Always OFF
		

Additional Information

- When the Head display mode is OFF, the indicator on the Sensor Head is always unlit. The indicator is always unlit also in the SETTING mode (where Find-me is enabled) and in the event of a system error.
- Refer to *2-2-3 Functions of Indicators* on page 2-6 for information on whether the indicator is lit in each status.

3-6-5 Setting the Startup Operation Display (Display Select)

Specify the Operation display that will be displayed immediately after startup.

Setting value	Display at next startup after setting
Normal	

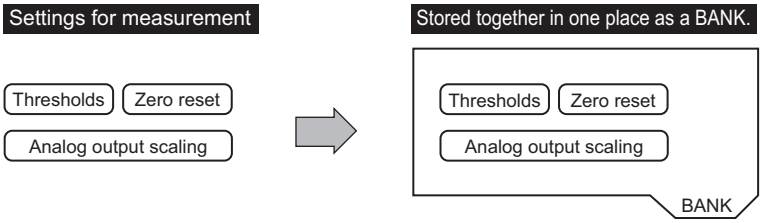
Setting value	Display at next startup after setting
High Threshold	
Low Threshold	
Analog	For current setting  For voltage setting  **Note** Displayed only for the master unit with analog output.
Resolution	
Real Value	
Channel No.	
Enlarge View	

3-7 Advanced Setting (BANK)

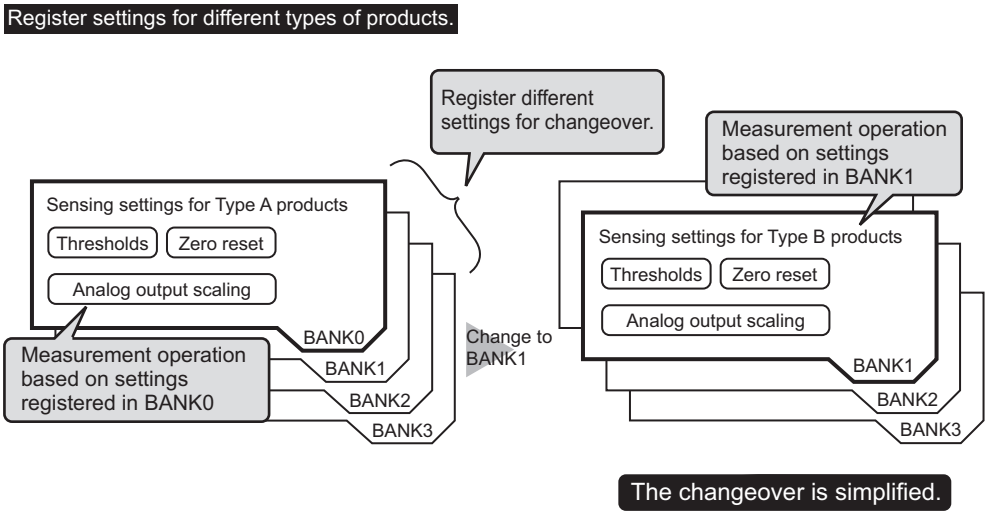
3-7-1 Changing the Bank

The Amplifier Unit can hold up to four banks of settings. You can change among the banks by shortcut key operation, BANK Change in advanced settings, or external input.

What is a Bank?



Example of Changing between Banks of Settings



● Bank Change Target Settings

Bank change target setting
High Threshold
Low Threshold
Zero Display
Analog Scaling
Analog Scaling High
Analog Scaling Low

● Bank Change Methods

Bank change method	
RUN mode	Shortcut key
	Command (via Communication Unit)
	External input

Bank change method	
SETTING mode	BANK setting

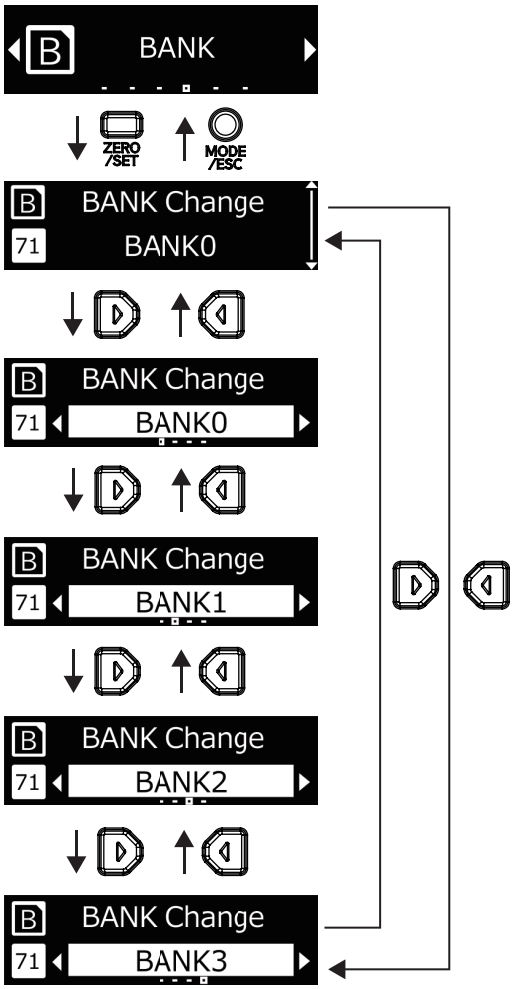
Bank Change by Shortcut Keys

Refer to the “Setting by shortcut key” in *3-1 Basic Operations* on page 3-3.

Bank Change from the Advanced Setting Display

Press the ZERO /SET button in the *BANK* setting in the Advanced Setting mode.

In the advanced setting display, press the ◀ or ▶ button several times to change the bank.



Additional Information

When *Input Select* is set to *External Input* and *External Input* is set to BANK in the function settings, the *BANK* setting is not displayed in the SETTING mode.

Bank Change by External Input

You can change the bank by external input by setting Input Select to External Input and External Input to BANK A or BANK B.

1 The bank is changed according to the ON/OFF combination of BANK A and BANK B input settings.

- Refer to *3-5-4 Setting the Input Selection and External Inputs* on page 3-35 for the input timing of bank input.
- The combinations of BANK A input and BANK B input are shown in the table below.

Bank	BANK A input	BANK B input
BANK 0	OFF	OFF
BANK 1	ON	OFF
BANK 2	OFF	ON
BANK 3	ON	ON

ON: short-circuited, OFF: open

Additional Information

If External Input is not set to BANK A input or BANK B input, it is regarded as OFF.
Example: When using only BANK A input for External Input, you can only change between two patterns, BANK 0 and BANK 1, by external input. When using only the BANK B input, you can only change between two patterns, BANK 0 and BANK 2.

2 Change the Input Select setting from Button to External Input for BANK Change.
Refer to *3-5-4 Setting the Input Selection and External Inputs* on page 3-35 for details.

3-8 Advanced Setting (Language)

3-8-1 Setting the Language

You can select the text displayed on the Amplifier Unit from *Japanese*, *English*, *Simplified Chinese*, or *Korean*.
The text on both the Operation display and the settings displays will be changed.

3-9 Advanced Setting (System)

3-9-1 Checking the Sensor Head and Amplifier Unit Versions

You can check the software versions of the Amplifier Unit and the connected Sensor Head.

3-9-2 Checking the Response Time

Display the response time until a change in the target is reflected in the output after it is measured.

The tables below show the response time displayed on the Amplifier Unit.

[ms]

Meas cycle	Average Rate						
	1	2	4	8	16 (Default value)	32	64
125 µs	1	1	2	2	3	5	9
250 µs	2	2	3	4	6	10	18
500 µs	4	4	5	7	11	19	35
1 ms (default)	7	8	10	14	22	38	70
2 ms	14	16	20	28	44	76	140
4 ms	16	20	28	44	76	140	268
20 ms	40	60	100	180	340	660	1300
50 ms	100	150	250	450	850	1650	3250
100 ms	200	300	500	900	1700	3300	6500

Meas cycle	Average Rate					
	128	256	512	1,024	2,048	4,096
125 µs	17	33	65	129	257	513
250 µs	34	66	130	258	514	1026
500 µs	67	131	259	515	1027	2051
1 ms (default)	134	262	518	1030	2054	4102
2 ms	268	524	1036	2060	4108	8204
4 ms	524	1036	2060	4108	8204	16396
20 ms	2580	5140	10260	20500	40980	81940
50 ms	6450	12850	25650	51250	102450	204850
100 ms	12900	25700	51300	102500	204900	409700

Additional Information

If the Calculation setting is enabled and the measurement cycles of channel 1 and channel 2 are the same, the response time is the above response time plus 1 ms.

4

Troubleshooting

This section describes measures to be taken in the event of trouble.

4-1 Error Messages

4-1-1 Errors Common to All Communications States

If an error occurs in the Amplifier Unit, the error code is displayed on the display.
From the Communication Unit, an MV value corresponding to the error code is output. You can check the MV value on the host system to identify the error type.

Error code	Amplifier Unit display		MV value	Contents	Cause	Correction
	Black display	White display				
Error-01	Error - 01 Amp hard fail	Refer to the manual	0x7FFF FF00	Hardware failure	Hardware failure	Restart the Amplifier Unit (cycle the power supply). If the error still occurs, replace the Amplifier Unit.
Error-02	Error - 02 Amp hard fail	Refer to the manual	0x7FFF FF10	Hardware failure	Hardware failure	Restart the Amplifier Unit (cycle the power supply). If the error still occurs, replace the Amplifier Unit.
Error-03	Error - 03 Amp hard fail	Refer to the manual	0x7FFF FF20	Hardware failure	Hardware failure	Restart the Amplifier Unit (cycle the power supply). If the error still occurs, replace the Amplifier Unit.
Error-04	Error - 04 Amp com err	Verify amp connection	0x7FFF FF40	Communications error between Amplifier Units	• Connection between Amplifier Units was lost. • Excessive noise was applied between Amplifier Units.	• Check the connection of the Amplifier Units. • Check to see if excessive noise is applied to the power supply or cables.
Error-05	Error - 05 Head com err	Check head connection	0x7FFF FF50	Communications error between Sensor Head and Amplifier Unit	The communications cable between the Sensor Head and Amplifier Unit was broken.	Check to see if the communications cable between the Sensor Head and Amplifier Unit is broken.
Error-06	Error - 06 Head com err	Refer to the manual	0x7FFF FF60	Communications error between Sensor Head and Amplifier Unit	Excessive noise was applied between the Sensor Head and Amplifier Unit.	Check to see if excessive noise is applied between the Sensor Head and Amplifier Unit.
Error-07	Error - 07 Head failure	Refer to the manual	0x7FFF FF70	Sensor Head internal failure.	An internal part of the Sensor Head is damaged.	Replace the Sensor Head.

Error code	Amplifier Unit display		MV value	Contents	Cause	Correction
	Black display	White display				
Error-08	Error - 08 Saved data err	Push MODE 3sec for Init	0x7FFF F000	Error in data stored in Amplifier Unit	The power was cut off while setting data was being saved to the Amplifier Unit.	• Initialize the settings according to the instructions on the display. • Execute the initialization command to restore the factory defaults via the Communication Unit.
Error-09	Error - 09 Head type err	Refer to the manual	0x7FFF F200	Unsupported Sensor Head connection	A model or version of the Sensor Head that cannot be connected to the Amplifier Unit due to the specifications was connected.	Connect a model or version of the Sensor Head that can be connected to the Amplifier Unit according to the specifications.
Error-10	Error - 10 Calc set err	Push MODE 3sec for Init	0x7FFF F300	Calculation setting error	• The master unit was started alone although it is set to calculate the internal measured value of the adjacent slave unit. • The connection between the master unit and the slave unit was lost after the calculation setting was made.	• Initialize the settings according to the instructions on the display. • Execute the initialization command to restore the factory defaults.
Error-11	Error - 11 Amp short err	Review wiring status	0x7FFF F400	Load short-circuit error	The external output line was short-circuited.	Check the wiring condition of the external output line and remove the short-circuit of the external output line.
None	Push MODE 3sec for Init	Different HEAD is connected	0x7FFF F100	Startup with different Sensor Head from the previous startup connected	The Amplifier Unit was started up with a Sensor Head different from that used at the previous start-up.	• Initialize the settings according to the instructions on the display. • Execute the initialization command to restore the factory defaults.

Error code	Amplifier Unit display		MV value	Contents	Cause	Correction
	Black display	White display				
None		---	0x7FFF FFFE	Light Shortage	Refer to *4-2-1 Frequently Asked Questions* on page 4-5.	
None		---	0x7FFF FFFD	Light Excess		
None		---	0x7FFF FFFF	Non-measurement state		

4-2 Troubleshooting

This section describes measures to be taken in the event of trouble.

4-2-1 Frequently Asked Questions

Symptom	Inspection	Countermeasure	Reference
Nothing is displayed on the display section of the Amplifier Unit.	Is the power supply correctly connected?	Connect the power supply correctly.	*2-4 Wiring* on page 2-14
	Is it displayed on Amplifier slave Units? If not, are the Amplifier Units connected correctly?	Connect them correctly.	*2-3 Installation* on page 2-8
The indicator and/or laser emitting section of the Sensor Head do not light.	Is an error indication displayed on the Amplifier Unit?	Take countermeasures according to the error indication.	*4-1 Error Messages* on page 4-2
The Amplifier Unit restarts during operation.	Is the power supply wiring unstable?	Connect the power supply correctly.	*2-4 Wiring* on page 2-14
	Is the power supply capacity insufficient?	Check if the power supply capacity meets the specification, especially if multiple Amplifier Units are connected together or if the power supply is shared with other devices.	---
No measured value is displayed. (*Light Shortage* is displayed.)	Is the measurement target within the measurement range?	Place the measurement target correctly within the measurement range.	---
	Is there any obstacle within the measuring range?	Remove the obstacle.	---
	Are objects with low reflectance (black or transparent) being measured?	Increase the measurement cycle to ensure the required light-receiving amount for measurement. Set an appropriate measurement cycle by selecting Auto in Meas cycle.	*3-3-1 Setting the Measurement Cycle* on page 3-21
	Are shiny objects being measured in a tilted position?		
	Is the sensor measuring the bottom of slots or holes?	Measurement is not possible if the light path from the light emitting section to the light receiving section is blocked. Make sure that the light path is not blocked.	*2-3-1 Installing the Sensor Head* on page 2-8
No measured value is displayed. (*Light Excess* is displayed.)	Is the Sensor Head exposed to strong external light?	Provide shielding to prevent the entry of external strong light.	---
	Is the light receiving section exposed to reflected light from the workpiece that is shiny?	Tilt the Sensor Head or the workpiece to prevent reception of the mirror reflection light.	---
No measured value is displayed. (---.--- is displayed.)	Is the hold function enabled?	Check the setting of the hold function. Turn ON the timing input according to the setting.	*3-5-2 Setting the Hold Trigger Level* on page 3-32
	Is the reset input short-circuited?	Check the reset input wiring.	*2-4 Wiring* on page 2-14
	Are the Meas cycle and Average Rate settings unintentionally set to large values?	The measured value will not be displayed until it is determined. Review the set values.	*3-3-1 Setting the Measurement Cycle* on page 3-21 *3-4-1 Setting the Average Rate* on page 3-27

Symptom	Inspection	Countermeasure	Reference
No measured value is displayed. (An error indication is displayed.)	Is an error indication displayed on the Amplifier Unit?	Take countermeasures according to the error indication.	*4-1-1 Errors Common to All Communications States* on page 4-2
Measured values are not stable.	Is the Average Rate setting too low?	Set a higher average rate.	*3-4-1 Setting the Average Rate* on page 3-27
	Are objects with low reflectance (black or transparent) being measured?	Increase the measurement cycle to ensure the required light-receiving amount for measurement. Set an appropriate measurement cycle by selecting Auto in Meas cycle.	*3-3-1 Setting the Measurement Cycle* on page 3-21
	Are shiny objects being measured in a tilted position?		
	Is the laser beam spot hitting the targeted position on the measurement target?	Install the Sensor Head correctly so that the laser beam hits the target position.	*2-3 Installation* on page 2-8
	Is the measurement target or Sensor Head vibrating?	Take measures to prevent vibration.	---
	Is there any strong ambient light, such as light from image sensors or inverter fluorescent lamps?	Provide shielding to prevent the ambient light from entering the light receiving section of the Sensor Head.	---
	Is there any mutual interference?	Provide shielding to prevent laser beams from other photoelectric sensors, etc., from hitting the measurement target.	---
		Provide shielding to prevent laser beams from other photoelectric sensors, etc from entering the light receiving section of the Sensor Head.	---
		Use the mutual interference prevention function when using multiple Sensor Heads in close proximity.	*Mutual Interference Prevention Function* on page 3-41
	Is there any dust or dirt on the light emitting/receiving section of the Sensor Head?	Remove any dust or dirt.	---
	Are there any dust, dirt, water droplets, oil droplets, etc. on the measurement target?	Remove any dust, dirt, water droplets, or oil droplets.	---
	Are there any dust, water droplets, or oil droplets in the operating atmosphere?	Remove dust and droplets by air purging,	---
	Is the sensor installed near a wall?	The sensor may be affected by stray light due to reflection of the light on the wall surface. Install the sensor so that it is less susceptible to stray light.	*2-3-1 Installing the Sensor Head* on page 2-8
	Is the measurement target moving rapidly?	When the target is rapidly moving, the number of measurement points may not be sufficient depending on the response time. Set the measurement cycle and average rate so that the expected number of measurement points can be obtained.	*3-3-1 Setting the Measurement Cycle* on page 3-21 *3-4-1 Setting the Average Rate* on page 3-27 *3-9-2 Checking the Response Time* on page 3-51
	Is the sensor measuring steps on the measurement target that is moving?	Install the Sensor Head in an orientation that does not block the light path at steps.	*2-3-1 Installing the Sensor Head* on page 2-8

Symptom	Inspection	Countermeasure	Reference
	Is the sensor receiving reflected light from something other than the measurement target, for example, when measuring through a view port?	Set the position of the measurement target in Detection Select.	*3-4-5 Setting the Measurement Surface Selection* on page 3-30

Symptom	Inspection	Countermeasure	Reference
Measured value deviates from actual distance.	Is zero reset unintentionally executed?	Cancel the zero reset by button operation.	*Zero Reset Input* on page 3-37
		Connect the zero reset input line correctly.	*2-4 Wiring* on page 2-14
	Are the scaling settings correct?	Review the scaling settings.	*3-4-4 Setting the Scaling* on page 3-29
	Is the sensor measuring the deviation in absolute distance?	This Displacement Sensor measures the amount of displacement from the reference position, not the absolute distance from the Sensor Head to the measurement target. Execute zero reset at the reference position to correct the symptom.	---
Measured values change gradually.	Is the Sensor Head securely fixed?	Install it in the correct position.	*2-3 Installation* on page 2-8
	Is the warm-up operation after power ON insufficient?	After turning ON the power, wait for at least 10 minutes before using the product.	---
	Is there a significant temperature change in the operating atmosphere?	Review the environment to ensure that the change in ambient operating temperature is as small as possible.	---
		Periodically execute zero reset on the reference target to correct the symptom.	*Zero Reset Input* on page 3-37
Button operation is disabled.	Is the key lock function enabled?	Disable the key lock function.	*Key Lock Function* on page 3-13
No input signal is accepted.	Is it wired correctly?	Wire it correctly.	*2-4-1 Wiring I/O Lines* on page 2-14
	Is the signal line broken?	Check the wiring.	---
	Does the NPN/PNP connection method match the Amplifier Unit model?	Use a connection method that matches the Amplifier Unit model.	*2-4-2 I/O Circuit Diagrams* on page 2-16
	Is bank change operation not accepted? If so, is the external input setting correct?	When the External Input setting is the default value, the bank change function does not work. Check the External Input setting.	*3-7-1 Changing the Bank* on page 3-47
Judgment result is not output correctly.	Is it wired correctly?	Wire it correctly.	*2-4-1 Wiring I/O Lines* on page 2-14
	Is the signal line broken?	Check the wiring.	---
	Does the NPN/PNP connection method match the Amplifier Unit model?	Use a connection method that matches the Amplifier Unit model.	*2-4-2 I/O Circuit Diagrams* on page 2-16
	Are the High and Low thresholds set correctly?	Check the set values.	*Changing the Thresholds* on page 3-11
	Is the Output Logic (N.O/N.C.) setting correct?	Set the output logic.	*3-5-1 Setting the Output Logic* on page 3-32
Analog output does not work correctly.	Is the wiring correct for the analog output type (voltage/current)?	Wire it correctly and set the analog output type.	*3-3-4 Setting the Analog Output* on page 3-26
	Are the analog output scaling settings correct?	Check the analog output scaling settings.	*3-4-3 Setting the Analog Output Scaling* on page 3-27

A

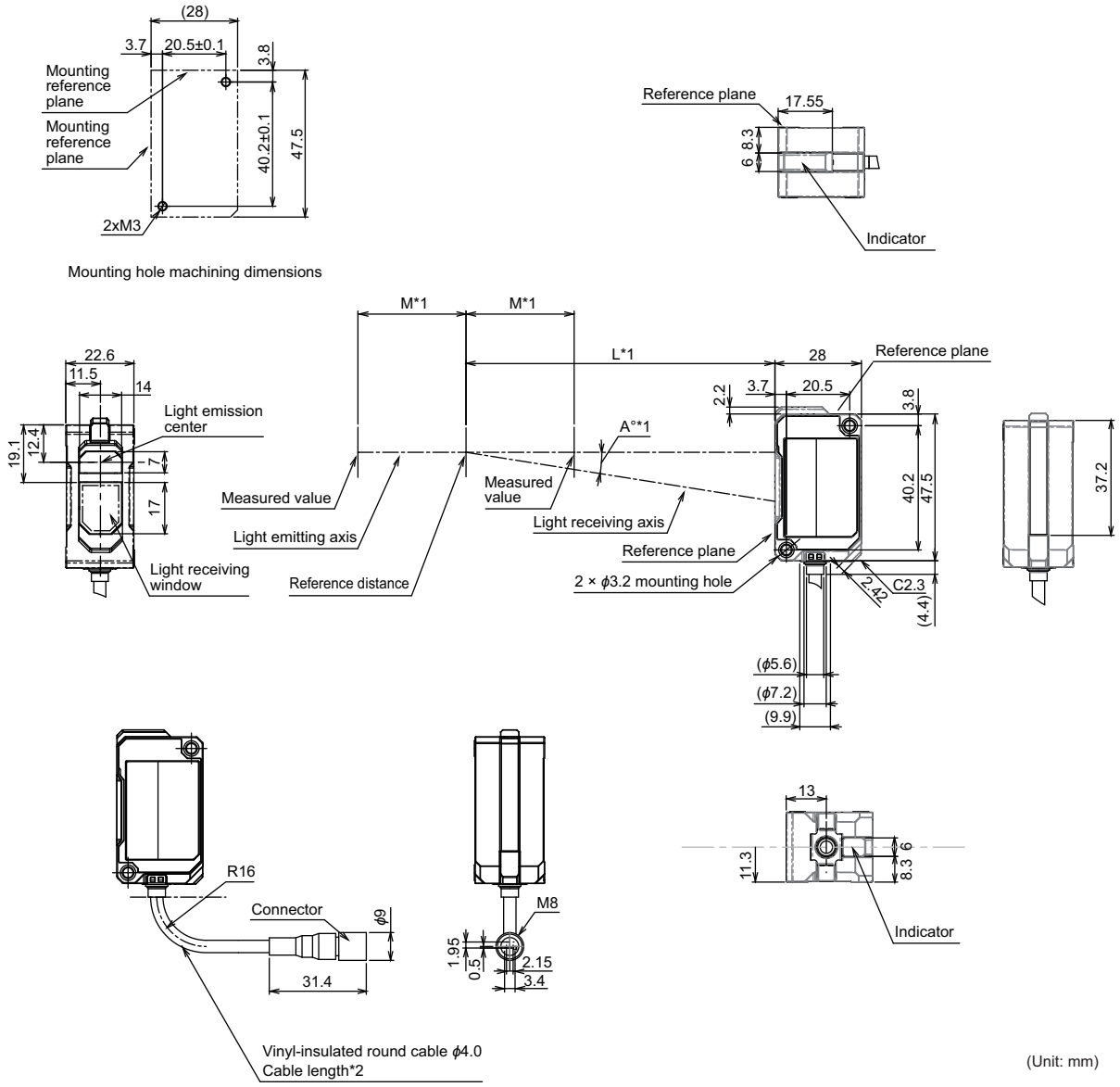
Appendices

This section provides information that supplements the main body of this manual, including the product specifications and dimensions, laser safety, version information, etc.

A-1 Specifications and Dimensions

A-1-1 Sensor Head

ZP-LS025□/ZP-LS050□/ZP-LS100□



(Unit: mm)

*1.

Model	L	M	A
ZP-LS025□	25	5	24.2
ZP-LS050□	50	10	16.4
ZP-LS100□	100	35	9

*2.

Length specification	Standard length [mm]
0.2M	(260)
2M	(2,000)

Item		Specification					
		ZP-LS025L(C)	ZP-LS025S(C)	ZP-LS050L(C)	ZP-LS050S(C)	ZP-LS100L(C)	ZP-LS100S(C)
Reference distance		25 mm		50 mm		100 mm	
Measurement distance		20 to 30 mm		40 to 60 mm		65 to 135 mm	
Light source		Red semiconductor laser					
Wavelength		660 nm					
Laser class		ZP-LS□L, ZP-LS□S: Class 2 (JIS/IEC/EN/FDA) ZP-LS□LC, ZP-LS□SC: Class 1 (JIS/IEC/EN/FDA)					
Laser power		ZP-LS□L, ZP-LS□S: 1 mW max. ZP-LS□LC, ZP-LS□SC: 0.376 mW max.					
Spot diameter*1		Approx. 50 x 1,000 μm	Approx. ϕ50 μm	Approx. 70 × 1,600 μm	Approx. ϕ70 μm	Approx. 130 × 2,900 μm	Approx. ϕ120 μm
Linearity*2	Near side	±0.05% F.S. (±5 μm)	±0.1% F.S. (±10 μm)	±0.03% F.S. (±6 μm)	±0.075% F.S. (±15 μm)	±0.025% F.S. (±17.5 μm)	±0.07% F.S. (±49 μm)
		when used at 20 to 25 mm		when used at 40 to 50 mm		when used at 65 to 100 mm	
	Total area	±0.08% F.S. (±8 μm)	±0.125% F.S. (±12.5 μm)	±0.04% F.S. (±8 μm)	±0.1% F.S. (±20 μm)	±0.065% F.S. (±45.5 μm)	±0.085% F.S. (±59.5 μm)
		when used at 20 to 30 mm		when used at 40 to 60 mm		when used at 65 to 135 mm	
Resolution (Repeatability)*3		0.5 μm	0.6 μm	0.7 μm	0.8 μm	1.2 μm	1.3 μm
Temperature characteristics*4		0.01% F.S./°C		0.01% F.S./°C		0.01% F.S./°C	
Indicators		2 indicators (identified by color) HIGH (orange)/PASS (green)/LOW (orange), Out of range (white), Error (red), SETTING mode (blue)					
Ambient illuminance		Illuminance of light-receiving surface, Incandescent lamp: 10,000 lx max.					
Ambient temperature range		Operating: -10 to 50°C, Storage: -15 to 70°C (with no icing or condensation)					
Ambient humidity range		Operating and storage: 35% to 85% RH each (with no condensation)					
Dielectric strength		1,000 VAC 50/60 Hz for 1 min.					
Insulation resistance		20 MΩ min. (at 500 VDC)					
Vibration resistance		10 to 500 Hz, double amplitude 1.5 mm, 120 min. each in X, Y and Z directions					
Shock resistance		300 m/s^2, 3 times each in 6 directions along X, Y, and Z axes					
Degree of protection		IP67 (IEC60529)					
Connection method*5		Pre-wired Connector type (Standard cable length: 2 m/0.2 m)					
Material		Case and cover: Polybutylene terephthalate, Optical window: Glass, Threaded portion: Brass, Cable: PVC					
Weight (Main unit only)		Approx. 90 g (Cable length: 2 m), Approx. 45 g (Cable length: 0.2 m)					
Accessories		Instruction manual, compliance sheet, FDA certification label, fixing screws (M3×30 mm. 2 screws), laser warning label (ZP-LS□L and ZP-LS□S models only)					

*1. This is the value (actual value) at the standard distance, which is defined as 1/e^2 (13.5%) of the central light intensity.

*2. This shows the error of displacement output relative to the ideal line when OMRON's standard target (white diffuse object) is measured. Linearity and measured values may vary depending on the target object.
F.S. refers to the entire measuring range (70 mm for ZP-LS100L).

*3. This shows the width of the variation of measured values when OMRON's standard target (white diffuse object) is measured at a reference distance with a measurement cycle of 1 ms and an average rate of 128 times.

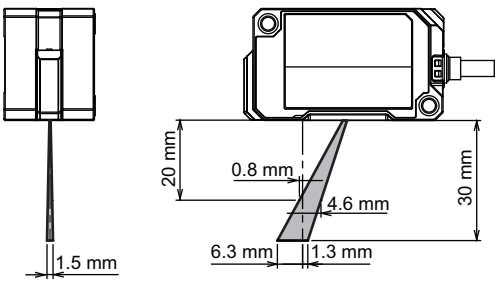
*4. This is the value (typical value) measured at the reference distance, with the Sensor Head and OMRON's standard object (white diffuse object) fixed with an aluminum jig between them.

*5. This product is powered by the Laser Displacement Sensor Amplifier Unit (ZP-L3□□□).

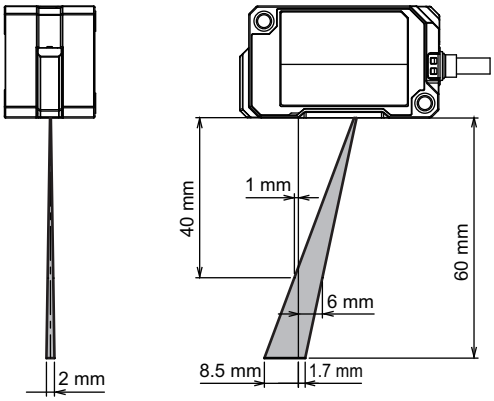
● Mutual Interference

When two or more Sensor Heads are used adjacent to each other, interference will not occur as long as the other's sensor spot is outside the shaded area shown below.

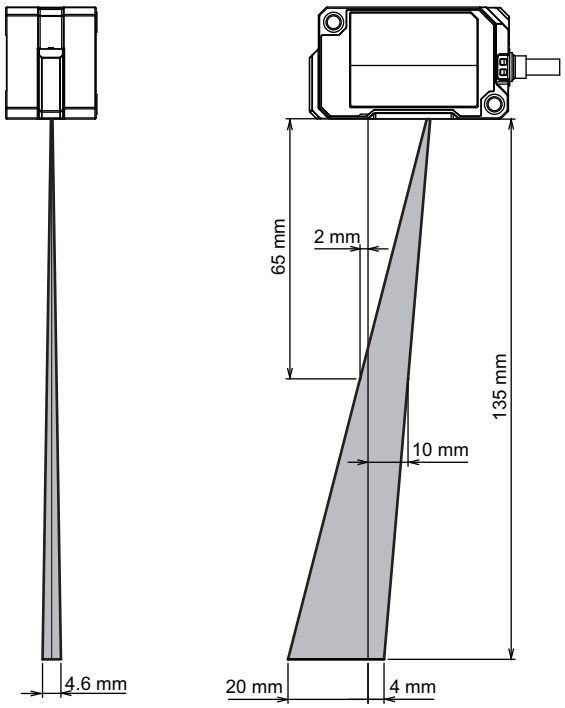
· ZP-LS025□



· ZP-LS050□

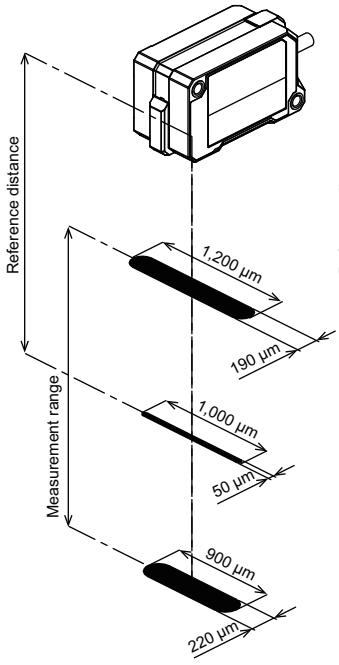


· ZP-LS100□

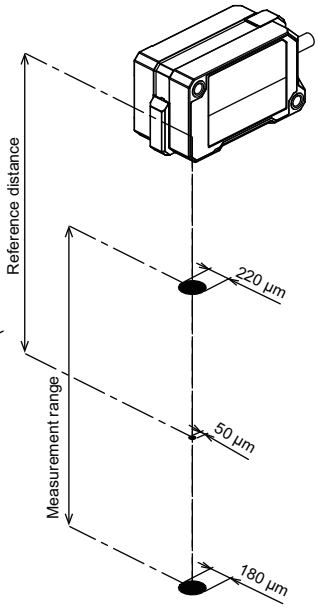


● Spot Diameter

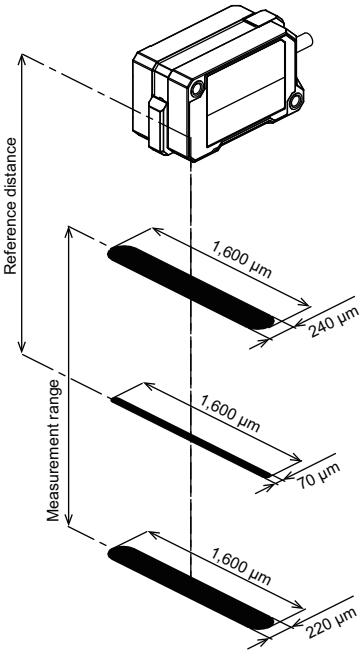
· ZP-LS025L



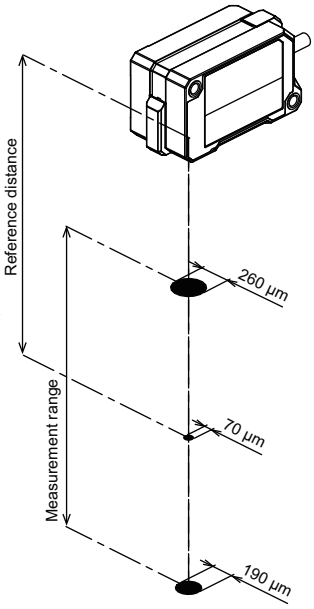
· ZP-LS025S



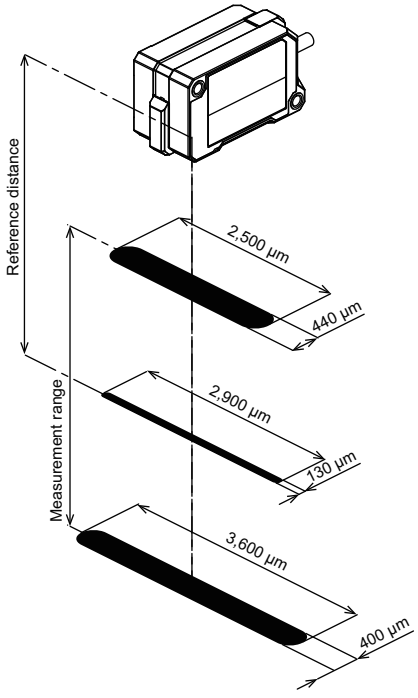
· ZP-LS050L



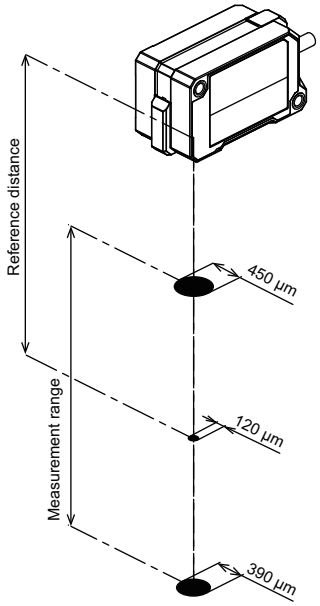
· ZP-LS050S



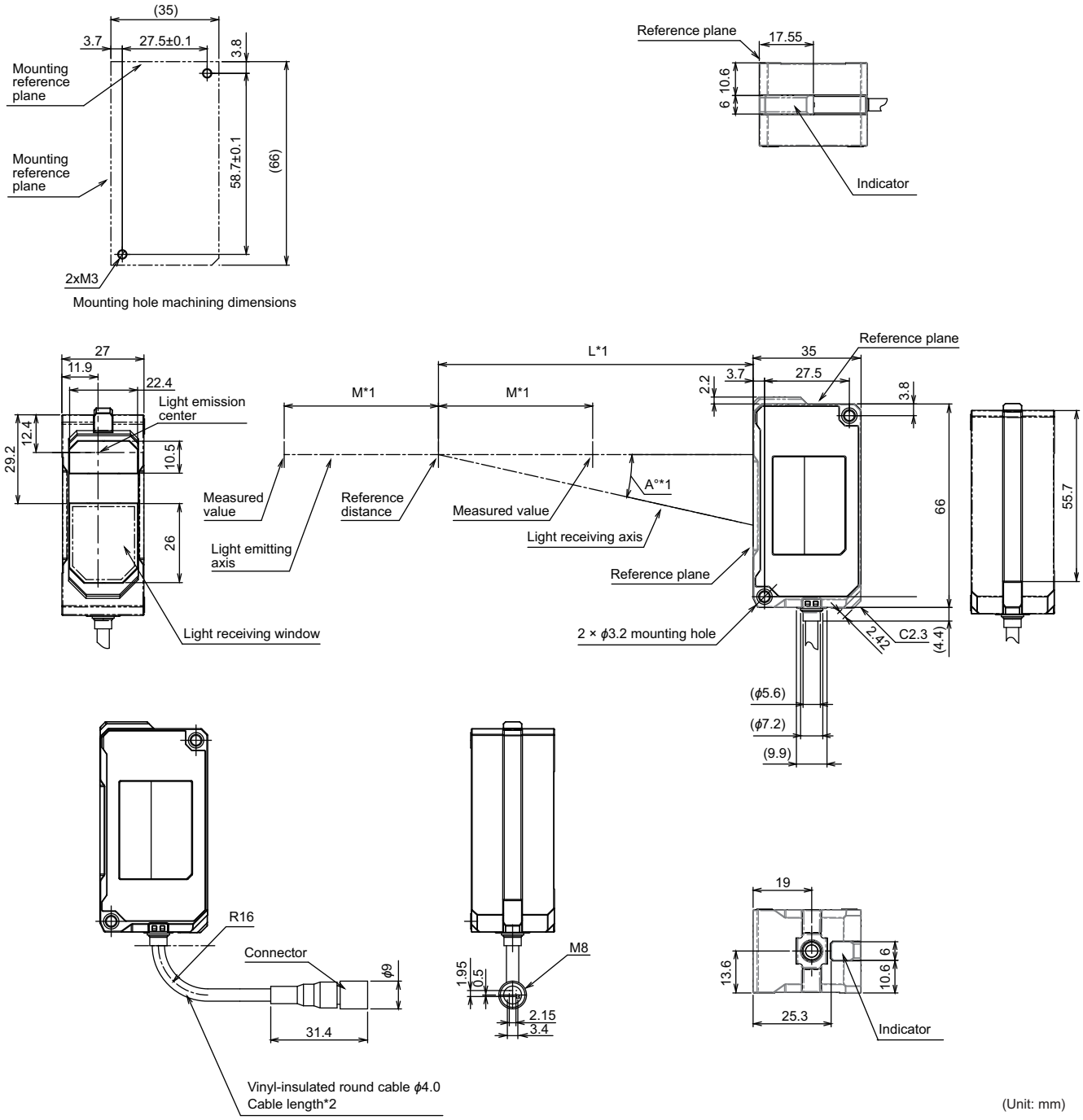
· ZP-LS100L



· ZP-LS100S



ZP-LS300□/ZP-LS600□



(Unit: mm)

*1.

Model	L	M	A
ZP-LS300□	300	150	5.91
ZP-LS600□	600	400	2.95

*2.

Length specification	Standard length [mm]
0.2M	(260)
2M	(2,000)

Item		Specification			
		ZP-LS300L(C)	ZP-LS300S(C)	ZP-LS600L(C)	ZP-LS600S(C)
Reference distance		300 mm		600 mm	
Measurement distance		150 to 450 mm		200 to 1,000 mm	
Light source		Red semiconductor laser			
Wavelength		660 nm			
Laser class		ZP-LS□L, ZP-LS□S: Class 2 (JIS/IEC/EN/FDA) ZP-LS□LC, ZP-LS□SC: Class 1 (JIS/IEC/EN/FDA)			
Laser power		ZP-LS□L, ZP-LS□S: 1 mW max. ZP-LS□LC, ZP-LS□SC: 0.376 mW max.			
Spot diameter*1		Approx. 340 × 2,800 μm	Approx. ϕ310 μm	Approx. 670 × 5,800 μm	Approx. ϕ600 μm
Linearity*2	Near side	±0.03% F.S. (±90 μm)	±0.04% F.S. (±120 μm)	±0.06% F.S. (±480 μm)	±0.075% F.S. (±600 μm)
		when used at 150 to 300 mm		when used at 200 to 600 mm	
	Total area	±0.1% F.S. (±300 μm)	±0.125% F.S. (±375 μm)	±0.15% F.S. (±1,200 μm)	±0.2% F.S. (±1,600 μm)
		when used at 150 to 450 mm		when used at 200 to 1,000 mm	
Resolution (Repeatability)*3		4 μm		14 μm	
Temperature characteristics*4		0.01% F.S./°C		0.02% F.S./°C	
Indicators		2 indicators (identified by color) HIGH (orange)/PASS (green)/LOW (orange), Out of range (white), Error (red), SETTING mode (blue)			
Ambient illuminance		Illuminance of light-receiving surface, Incandescent lamp: 5,000 lx max.			
Ambient temperature range		Operating: -10 to 50°C, Storage: -15 to 70°C (with no icing or condensation)			
Ambient humidity range		Operating and storage: 35% to 85% RH each (with no condensation)			
Dielectric strength		1,000 VAC 50/60 Hz for 1 min.			
Insulation resistance		20 MΩ min. (at 500 VDC)			
Vibration resistance		10 to 500 Hz, double amplitude 1.5 mm, 120 min. each in X, Y and Z directions			
Shock resistance		300 m/s^2, 3 times each in 6 directions along X, Y, and Z axes			
Degree of protection		IP67 (IEC60529)			
Connection method*5		Pre-wired Connector type (Standard cable length: 2 m/0.2 m)			
Material		Case and cover: Polybutylene terephthalate, Optical window: Glass, Threaded portion: Brass, Cable: PVC			
Weight (Main unit only)		Approx. 110 g (Cable length: 2 m), Approx. 70 g (Cable length: 0.2 m)			
Accessories		Instruction manual, compliance sheet, FDA certification label, fixing screws (M3×35 mm. 2 screws), laser warning label (ZP-LS□L and ZP-LS□S models only)			

*1. This is the value (actual value) at the standard distance, which is defined as 1/e^2 (13.5%) of the central light intensity.

*2. This shows the error of displacement output relative to the ideal line when OMRON's standard target (white diffuse object) is measured. Linearity and measured values may vary depending on the target object.
F.S. refers to the entire measuring range (70 mm for ZP-LS100L).

*3. This shows the width of the variation of measured values when OMRON's standard target (white diffuse object) is measured at a reference distance with a measurement cycle of 1 ms and an average rate of 128 times.

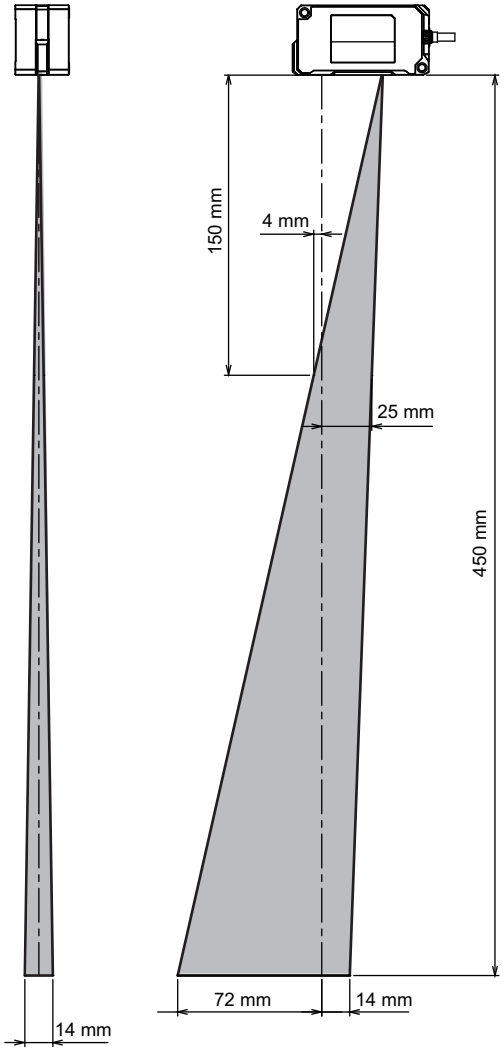
*4. This is the value (typical value) measured at the reference distance, with the Sensor Head and OMRON's standard object (white diffuse object) fixed with an aluminum jig between them.

*5. This product is powered by the Laser Displacement Sensor Amplifier Unit (ZP-L3□□□).

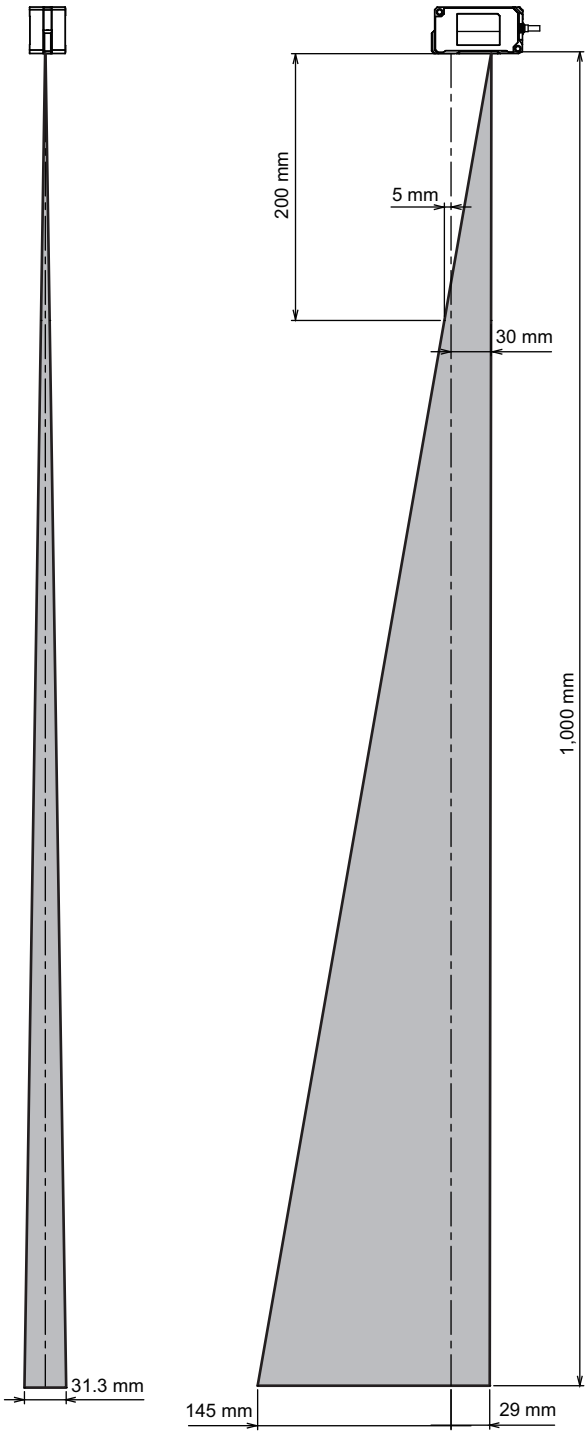
● Mutual Interference

When two or more Sensor Heads are used adjacent to each other, interference will not occur as long as the other's sensor spot is outside the shaded area shown below.

· ZP-LS300□

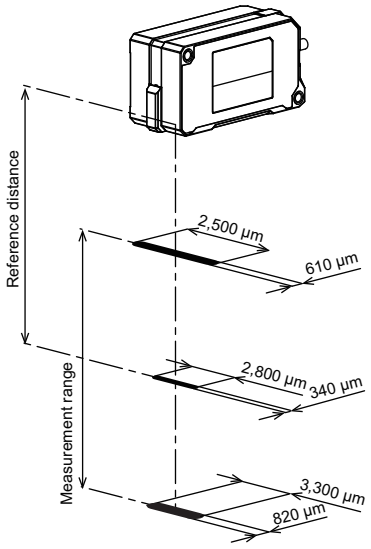


· ZP-LS600□

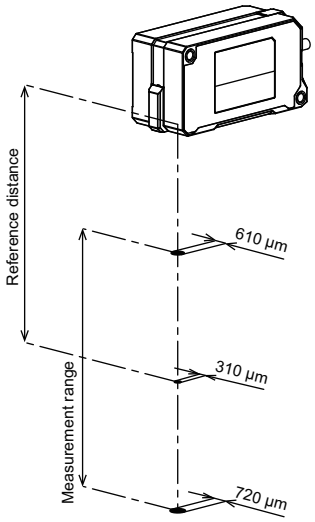


● Spot Diameter

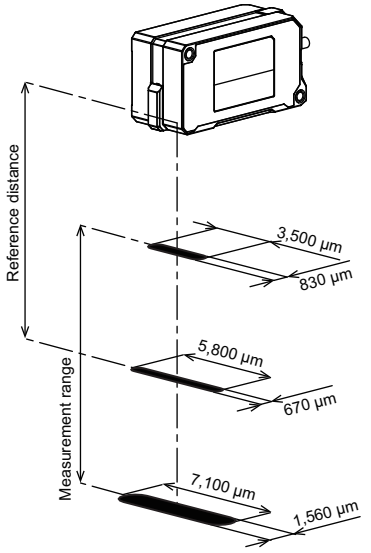
· ZP-LS300L



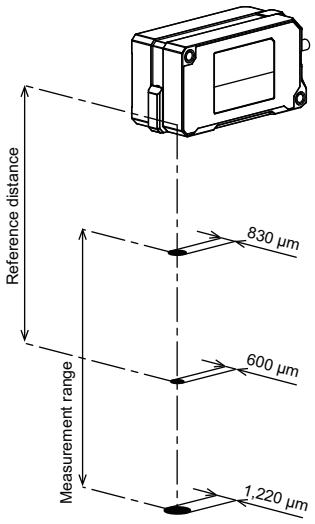
· ZP-LS300S



· ZP-LS600L

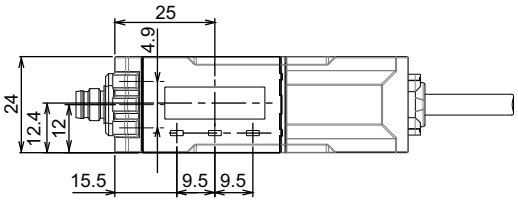


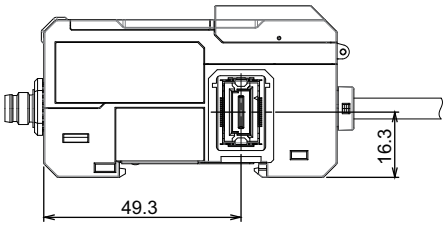
· ZP-LS600S



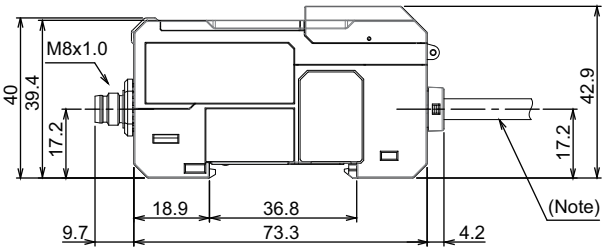
A-1-2 Amplifier Unit

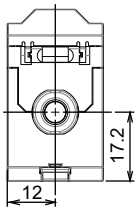
ZP-L30□0



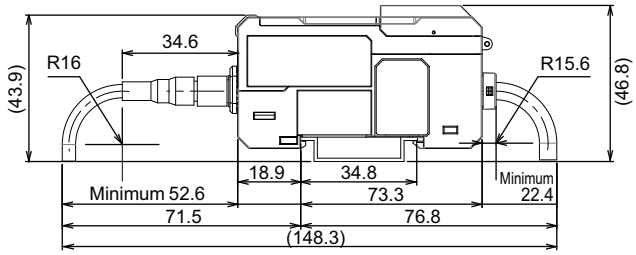


Amplifier Unit connector position



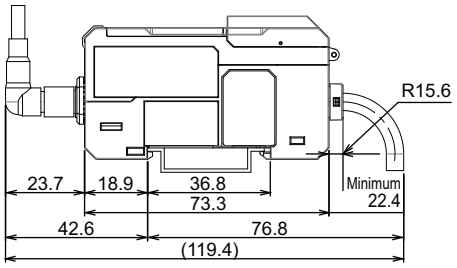


XS3W connector cable socket (straight)



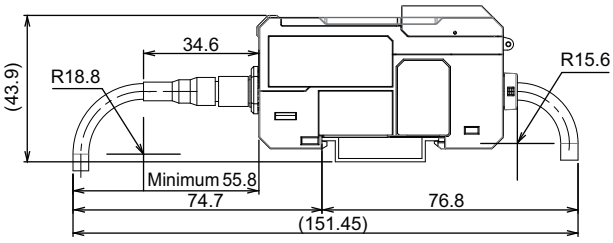
When ZP-LS□ and extension cable (XS3W-M421/M423-□-R) are connected

XS3W connector cable socket (L shape)

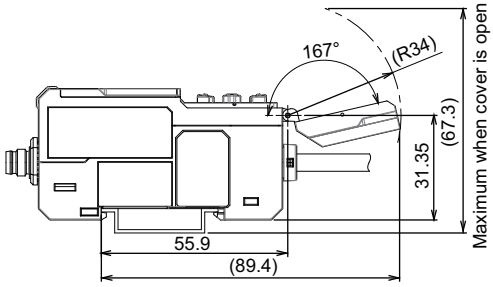


When extension cable (XS3W-M422/M424-□-□) is connected

XS3W connector cable socket (straight)



When extension cable (XS3W-M421/M423-□-PR) is connected



Cover open position (DIN Track mounting)

Note The cable specifications are as follows:

Model	Cable outside diameter	Number of conductors	Conductor cross-section [mm²]		AWG size		Cable length
			Brown/Blue/ Black	Others	Brown/ Blue/Black	Others	
ZP-L3000	Φ5.2 mm	11	0.22*1	0.09	24	28	2 m
ZP-L3010		10					
ZP-L3050		11					
ZP-L3060		10					

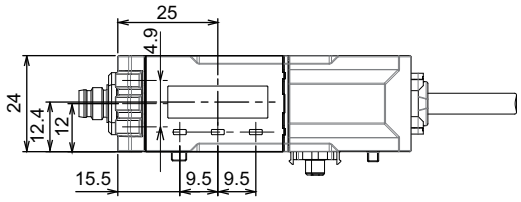
*1. Black wire not provided for ZP-L3010 and ZP-L3060

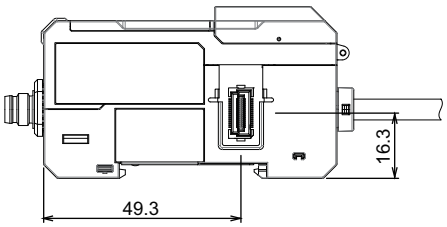
Item		Specification			
		ZP-L3000	ZP-L3010	ZP-L3050	ZP-L3060
Master/Slave unit		Master Unit			
I/O type		NPN		PNP	
Analog output*1	Current output	4 to 20 mA Maximum load resistance: 350 Ω	No analog output	4 to 20 mA Maximum load resistance: 350 Ω	No analog output
	Voltage output	±5 V, 1 to 5 V, 0 to 5 V Output impedance: 100 Ω		±5 V, 1 to 5 V, 0 to 5 V Output impedance: 100 Ω	
Control output*2		HIGH/PASS/LOW/ Error output Open collector output: 30 VDC, 50 mA max., Residual voltage: 2 V max. N.O./N.C. switchable			
External input		Zero reset, Laser OFF, Timing, Reset, BANK			
		When ON: 0 V short-circuit or 1.2 V max. When OFF: Open (Leakage current: 0.1 mA max.)		When ON: Power supply voltage short-circuit or within -1.2 V of power supply voltage When OFF: Open (Leakage current: 0.1 mA max.)	
Measurement cycle		125 µs/250 µs/500 µs/1 ms/2 ms/4 ms/20 ms/50 ms/100 ms switchable			
Maximum number of connected units		16 (15 slave units can be connected per master unit)			
Display		OLED display Judgment indicators: HIGH (orange/red), PASS (green/red), LOW (orange/red) Status indicators: LASER (green), ZERO (green), ENABLE (green)			
Power supply voltage*3		10 to 30 VDC, including 10% ripple (p-p)			
Power consumption*4		2,300 mW max.	2,000 mW max.	2,300 mW max.	2,000 mW max.
Ambient temperature range		Operating: -10 to 50°C (standalone or multi-unit connection) Storage: -15 to 70°C (with no icing or condensation)			
Ambient humidity range		Operating and storage: 35% to 85% RH each (with no condensation)			
Dielectric strength		1,000 VAC 50/60 Hz for 1 min.			
Insulation resistance		20 MΩ min. (at 500 VDC)			
Vibration resistance		10 to 150 Hz, double amplitude 0.7 mm, 80 minutes each in X, Y, and Z directions			
Shock resistance		300 m/s², 3 times each in 6 directions along X, Y, and Z axes			
Degree of protection*5		IP40 (IEC60529)			
Connection method		Cable pull-out type (Standard cable length: 2 m)			
Material		Main unit case, operating section cover: Polycarbonate Cable: PVC			
Weight (Main unit only)		Approx. 160 g	Approx. 150 g	Approx. 160 g	Approx. 150 g
Accessories		Instruction manual, compliance sheet			

*1. Select ±5 V, 1 to 5 V, 0 to 5 V, or 4 to 20 mA to use this.
*2. When six or more Amplifier Units are added including the master unit, use a load current of 20 mA/ch or less.
*3. Use a Class 2 power supply to supply power to this product. When six or more Amplifier Units are added including the master unit, use a power supply voltage of 20 to 30 V, including 10% ripple (p-p).
*4. This includes the power consumption of the Sensor Head. It does not include the load current of each output.
*5. For slave units, this indicates the degree of protection when connected.

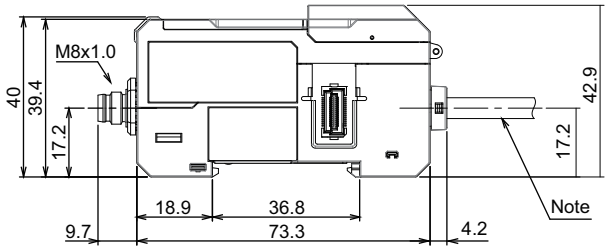
ZP-L35□0

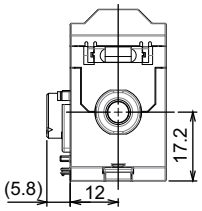
• ZP-L3510/ZP-L3560





Amplifier Unit connector position

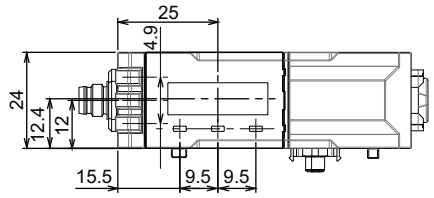


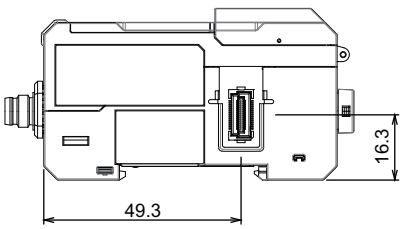


Note The cable specifications are as follows:

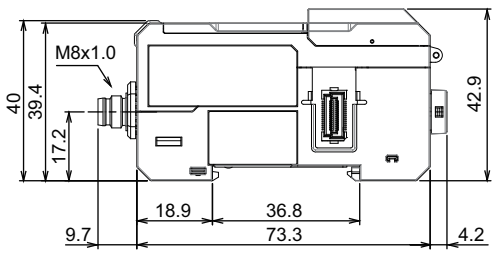
Model	Cable outside diameter	Number of conductors	Conductor cross-section [mm^2]	AWG size	Cable length
ZP-L3510	Φ5.2 mm	8	0.09	28	2 m
ZP-L3560					

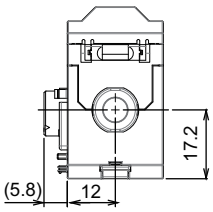
• ZP-L3590





Unit coupling connector position





Item		Specification		
		ZP-L3510	ZP-L3560	ZP-L3590
Master/Slave unit		Slave Unit		
I/O type		NPN	PNP	No I/O
Analog output*1	Current output	No analog output		
	Voltage output			
Control output*2		HIGH/PASS/LOW/ Error output Open collector output: 30 VDC, 50 mA max., Residual voltage: 2 V max. N.O./N.C. switchable		No control output
External input		Zero reset, Laser OFF, Timing, Reset, BANK		No external input
		When ON: 0 V short-circuit or 1.2 V max. When OFF: Open (Leakage current: 0.1 mA max.)	When ON: Power supply voltage short-circuit or within -1.2 V of power supply voltage When OFF: Open (Leakage current: 0.1 mA max.)	
Measurement cycle		125 µs/250 µs/500 µs/1 ms/2 ms/4 ms/20 ms/50 ms/100 ms switchable		
Maximum number of connected units		16 (15 slave units can be connected per master unit)		
Display		OLED display Judgment indicators: HIGH (orange/red), PASS (green/red), LOW (orange/red) Status indicators: LASER (Green), ZERO (Green), ENABLE (Green)		
Power supply voltage*3		Supplied by master unit		
Power consumption*4		2,000 mW max.		
Ambient temperature range		Operating: -10 to 50°C (standalone or multi-unit connection) Storage: -15 to 70°C (with no icing or condensation)		
Ambient humidity range		Operating and storage: 35% to 85% RH each (with no condensation)		
Dielectric strength		1,000 VAC 50/60 Hz for 1 min.		
Insulation resistance		20 MΩ min. (at 500 VDC)		
Vibration resistance		10 to 150 Hz, double amplitude 0.7 mm, 80 minutes each in X, Y, and Z directions		
Shock resistance		300 m/s^2, 3 times each in 6 directions along X, Y, and Z axes		
Degree of protection*5		IP40 (IEC60529)		
Connection method		Cable pull-out type (Standard cable length: 2 m)		None
Material		Main unit case, operating section cover: Polycarbonate Cable: PVC		Main unit case, operating section cover: Polycarbonate
Weight (Main unit only)		Approx. 140 g	Approx. 140 g	Approx. 70 g
Accessories		Instruction manual, compliance sheet		

*1. Select ±5 V, 1 to 5 V, 0 to 5 V, or 4 to 20 mA to use this.

*2. When six or more Amplifier Units are added including the master unit, use a load current of 20 mA/ch or less.

*3. Use a Class 2 power supply to supply power to this product. When six or more Amplifier Units are added including the master unit, use a power supply voltage of 20 to 30 V, including 10% ripple (p-p).

*4. This includes the power consumption of the Sensor Head. It does not include the load current of each output.

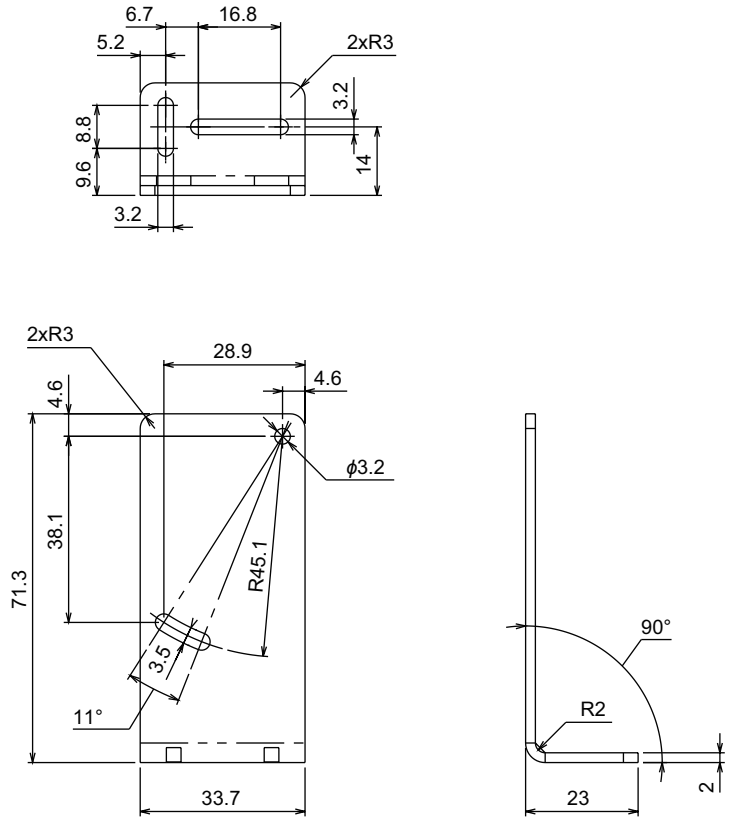
*5. This indicates the degree of protection when connected to a master unit.

A-1-3 Accessories

ZP-XL1

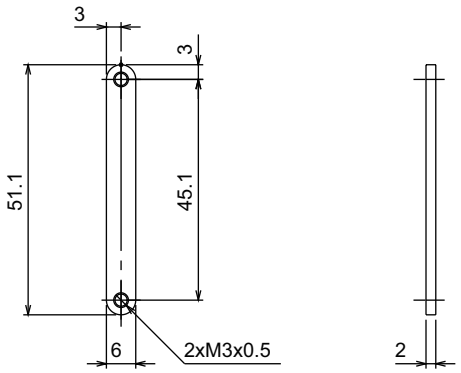
Applicable models: ZP-LS025□/ZP-LS050□/ZP-LS100□

Mounting bracket



Material: Stainless steel (SUS304)
Weight: Approx. 43 g

Fixing bracket



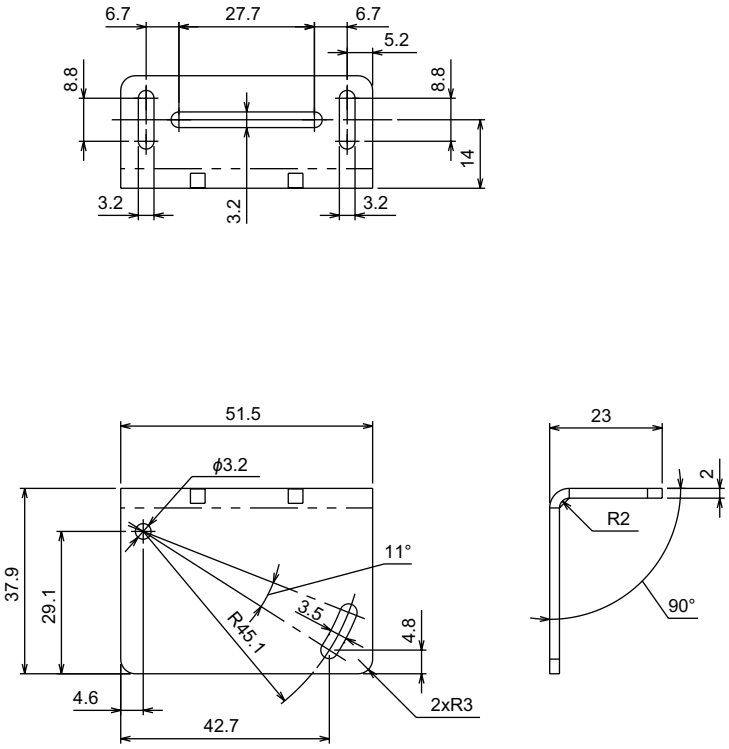
(Unit: mm)

Material: Stainless steel (SUS304)
Weight: Approx. 4 g

ZP-XL2

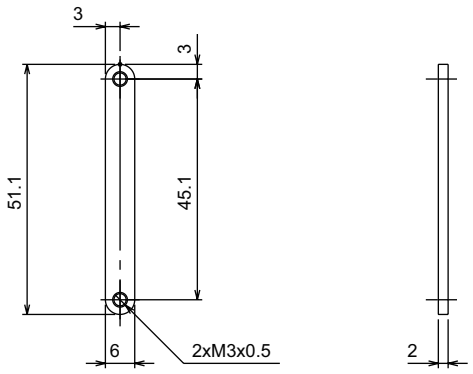
Applicable models: ZP-LS025□/ZP-LS050□/ZP-LS100□

Mounting bracket



Material: Stainless steel (SUS304)
Weight: Approx. 41 g

Fixing bracket



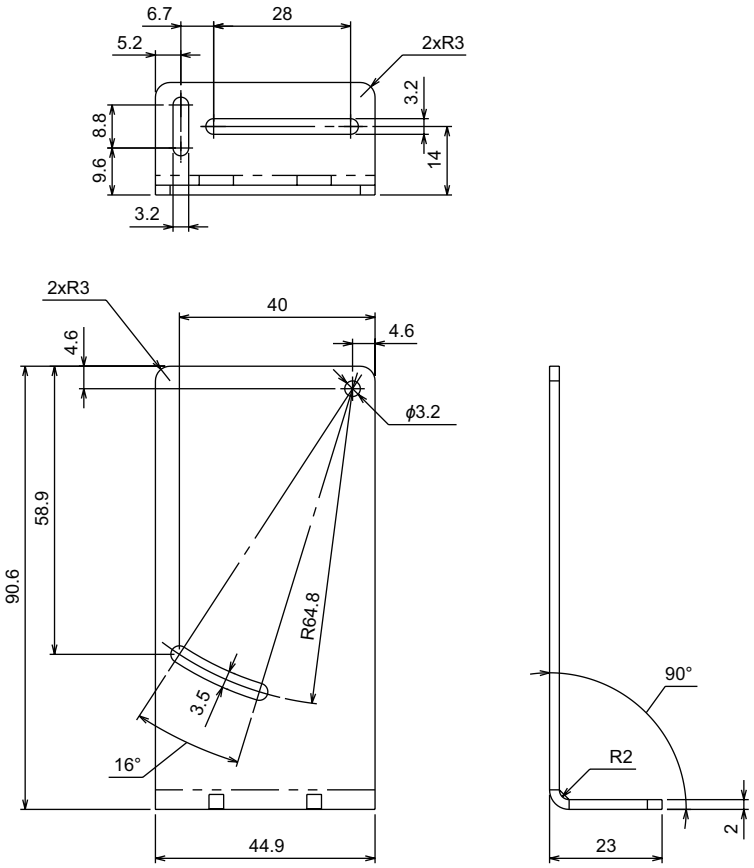
(Unit: mm)

Material: Stainless steel (SUS304)
Weight: Approx. 4 g

ZP-XL3

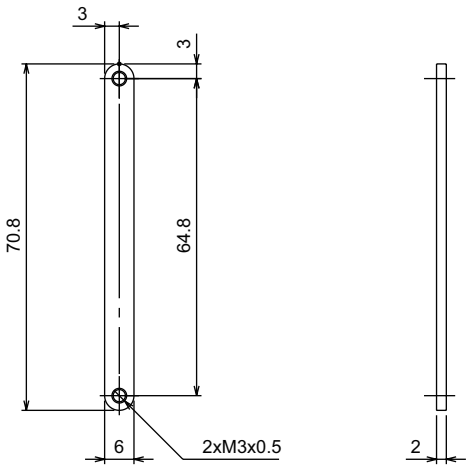
Applicable models: ZP-LS300□/ZP-LS600□

Mounting bracket



Material: Stainless steel (SUS304)
Weight: Approx. 71 g

Fixing bracket



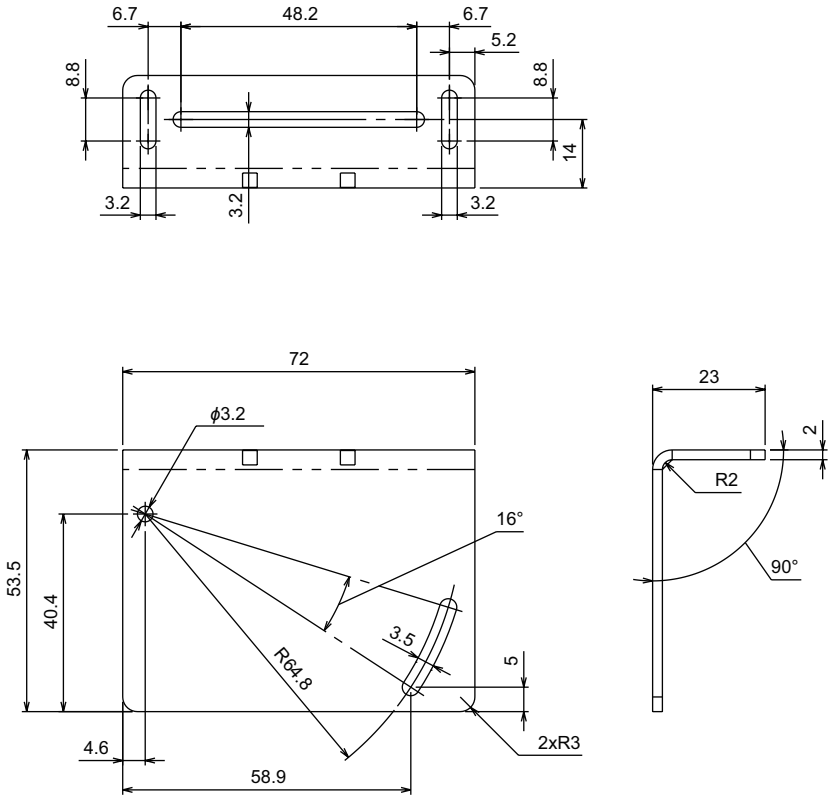
(Unit: mm)

Material: Stainless steel (SUS304)
Weight: Approx. 6 g

ZP-XL4

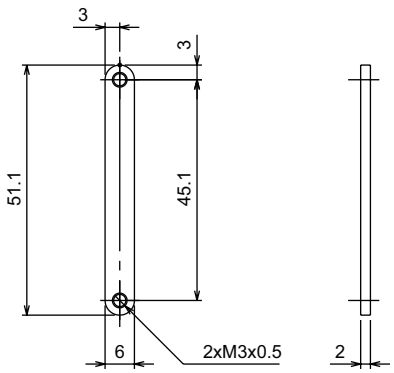
Applicable models: ZP-LS300□/ZP-LS600□

Mounting bracket



Material: Stainless steel (SUS304)
Weight: Approx. 73 g

Fixing bracket



(Unit: mm)

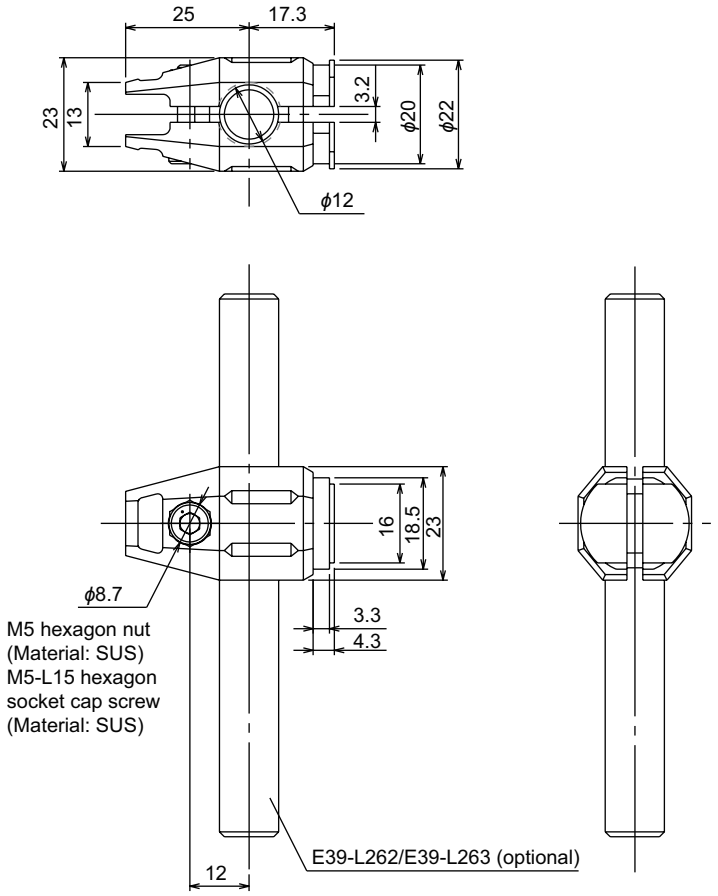
Material: Stainless steel (SUS304)
Weight: Approx. 6 g

Item	Specification			
	ZP-XL1	ZP-XL2	ZP-XL3	ZP-XL4
Applicable sensor	ZP-LS025□□, ZP-LS050□□, ZP-LS100□□		ZP-LS300□□, ZP-LS600□□	
Ambient temperature range	-10 to 50°C			
Ambient humidity range	-15 to 70°C			
Vibration resistance	10 to 150 Hz, double amplitude 0.7 mm, 80 minutes each in X, Y, and Z directions			
Shock resistance	300 m/s^2, 3 times each in X, Y, and Z directions			
Material	Stainless steel (SUS304)			

ZP-XL5

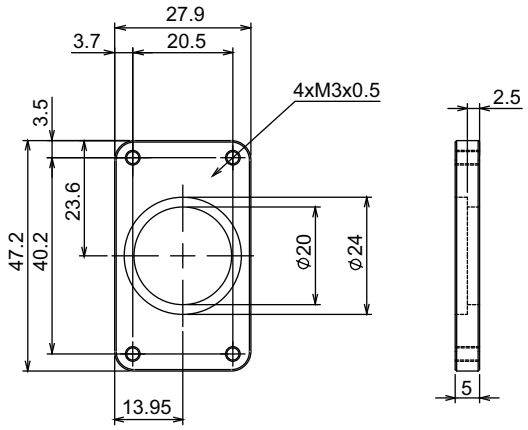
Applicable models: ZP-LS025□/ZP-LS050□/ZP-LS100□

Clamp



Material: Zinc die casting (ZDC2)
Weight: Approx. 56 g (including clamp fixing screw)

Bracket



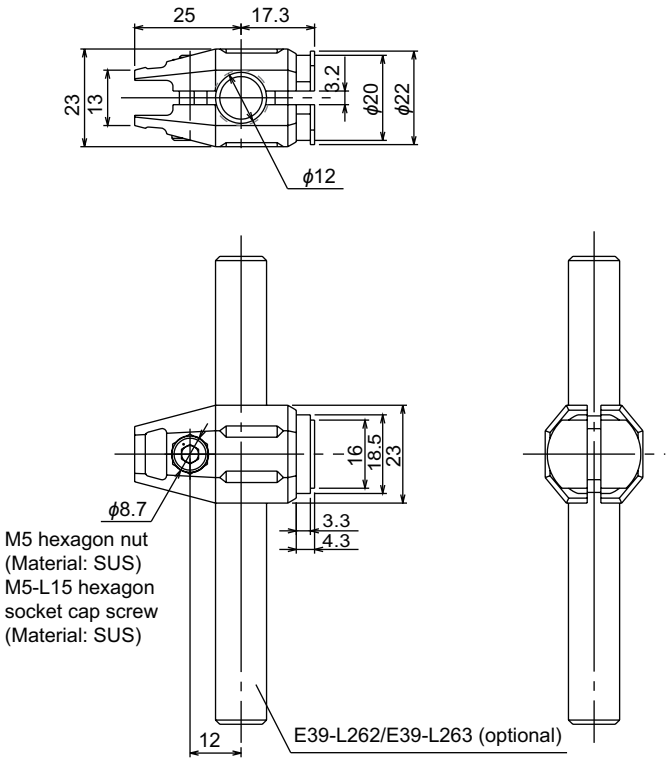
(Unit: mm)

Material: Aluminum (A5052)
Weight: Approx. 12 g

ZP-XL6

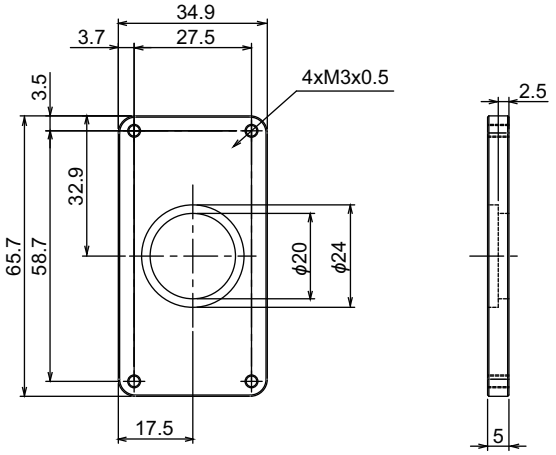
Applicable models: ZP-LS300□/ZP-LS600□

Clamp



Material: Zinc die casting (ZDC2)
Weight: Approx. 56 g (including clamp fixing screw)

Bracket



(Unit: mm)

Material: Aluminum (A5052)
Weight: Approx. 25 g

Item	Specification	
	ZP-XL5	ZP-XL6
Applicable sensor	ZP-LS025□□, ZP-LS050□□, ZP-LS100□□	ZP-LS300□□, ZP-LS600□□
Mounting angle	360° in horizontal and vertical directions	
Ambient temperature range	-10 to 50°C	
Ambient humidity range	-15 to 70°C	
Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm, 2 h each in X, Y and Z directions	
Shock resistance	300 m/s^2, 3 times each in X, Y, and Z directions	
Material	Clamp: Zinc die-cast (ZDC2 Ni plating), Bracket: Aluminum (A5052)	
Post*1	φ12	

*1. Applicable posts (E39-L262 and E39-L263) are optional.

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