



Good Thinking, Good Future

*FASTUS is a product brand of Optex FA.

High-Accuracy Laser Displacement Sensor CDX Series

User's Manual

Before using this product, please read this manual carefully.

Keep this manual at hand so that it can be used whenever necessary.

Store the manual in a safe location.



OPTEX FA CO., LTD.

Introduction



Thank you for purchasing the **CDX Series High-Accuracy Laser Displacement Sensor**. This manual contains the information necessary for using the **CDX Series High-Accuracy Laser Displacement Sensor**. Read this manual thoroughly before using the product to ensure correct product use with full understanding of the functions and performance of the product. Also, after you have finished reading this manual, store it safely for future reference.

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- The copyright of this user's manual is owned by Optex FA Co., Ltd. All the contents contained herein are protected by copyright law. Unauthorized copying of this manual is strictly prohibited.



Safety Precautions

This manual uses the following symbols to display safety precautions for ensuring safe operation of the CDX Series high-accuracy laser displacement sensor.











Precautions listed here describe important information about safety. Make sure to follow them accordingly.

■ Safety Symbols



The safety symbols and their meanings are as follows.

 Warning	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
 Caution	Indicates that any improper operation or handling may sometimes result in moderate or minor injury or property damage.













■ Notes

 Warning	
	This product cannot be used as protective equipment for the purpose of protecting the human body.
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	Do not use this product in water or in a location where it may be exposed to water. Do not use this product if wet. Doing so may cause a fire or damage the product.
 	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
 	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not install this product or its cables in any of the following locations. Doing so may cause a fire, damage, or a malfunction. <ol style="list-style-type: none"> 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where water, oil, or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct light.
	Do not use the product at voltages or with AC power supplies that exceed the rated voltage. Doing so may cause a fire or damage the product.

⚠ Warning

	<p>What to do in the event of a malfunction such as smoke being emitted from the product</p> <p>If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the body becoming very hot, immediately stop operating the product and turn off the power. Doing so may cause a fire.</p> <p>Repairing the product is dangerous and should in no way be performed by the customer. Contact an Optex FA sales representative for repairs.</p>
	<p>What to do if water enters the product</p> <p>If water or any other liquid enters the product or the cable, immediately stop operating the product and turn off the power. Using the product in this condition may cause a fire.</p>

⚠ Caution

	Do not touch the product or the cable with wet hands. Doing so may damage the product.
	Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. Incorrect wiring can damage the product or the controller, or cause a malfunction.
	Use the dedicated cable for connecting the product. Use of anything other than the dedicated cable may cause a malfunction or damage the product.
	Route wiring separately from high-voltage circuits and power circuits. If the wires are routed together, induction may occur, which can cause a malfunction or damage the product. If this is unavoidable, use a conductive object such as a properly grounded conduit as a shield.
	Install this product as far away from high-voltage equipment, power equipment, equipment that generates large switching surges, welders, inverter motors, or any equipment that can be a source of noise.
	Install the product and the dedicated controller securely. Ensure that any lock mechanisms available have been locked before use. Failure to ensure secure installation can result in the product falling and becoming damaged.
	Tighten mounting screws to the torque specified in this manual.
	Do not twist or apply stress to the cable. Doing so may damage the cable or the connector. In addition, install the cable while ensuring that the minimum bend radius or more is secured.
	Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
	During operation, this product becomes very hot. Do not touch it for long periods of time. Doing so may cause a low-temperature burn.
	Use the product and dedicated controller within the rated ranges.
	Make sure to turn the power off before connecting or disconnecting the cable. Connecting or disconnecting while energized may damage the product.

Caution



When connecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.



When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.

■ Handling Precautions

1. After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
2. Due to advances in technology, published content, including the hardware, software, and system information published in this user's manual are subject to change without notice.
3. When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
4. This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
5. This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
6. Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
7. For more details on conformity to the Restriction of Hazardous Substances Directive for this product, please contact an Optex FA sales representative.
Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations.
Optex FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.

■ Precautions for Laser Use

Caution

- This product emits a Class 1 visible laser beam that is compliant with JIS C6802 / IEC60825-1 laser safety standards.
- If this product will be exported to the United States, approval must first be obtained from the FDA (Food and Drug Administration), the laser regulating body of the United States.
- A report for this product has been submitted to the CDRH (Center for Devices and Radiological Health).
- Do not look directly at the laser beam or intentionally shine the laser beam in another person's eyes. Doing so may have adverse effects on the eyes, including temporary blindness.
- If installing this product in your own equipment, ensure that the product is properly handled according to the laws and regulations of the relevant country or region.
- This product does not have a function that stops the emission of light from the laser during disassembly. Do not disassemble the product.

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Expressions Used in This Manual

This section explains the expressions used in this manual.

Caution	Indicates an item that requires special attention during operation
MEMO	Indicates information that is useful to know during operation

■ Included Screens

Screens included in this manual are subject to change without prior notice for product improvement purposes.

We appreciate your understanding.



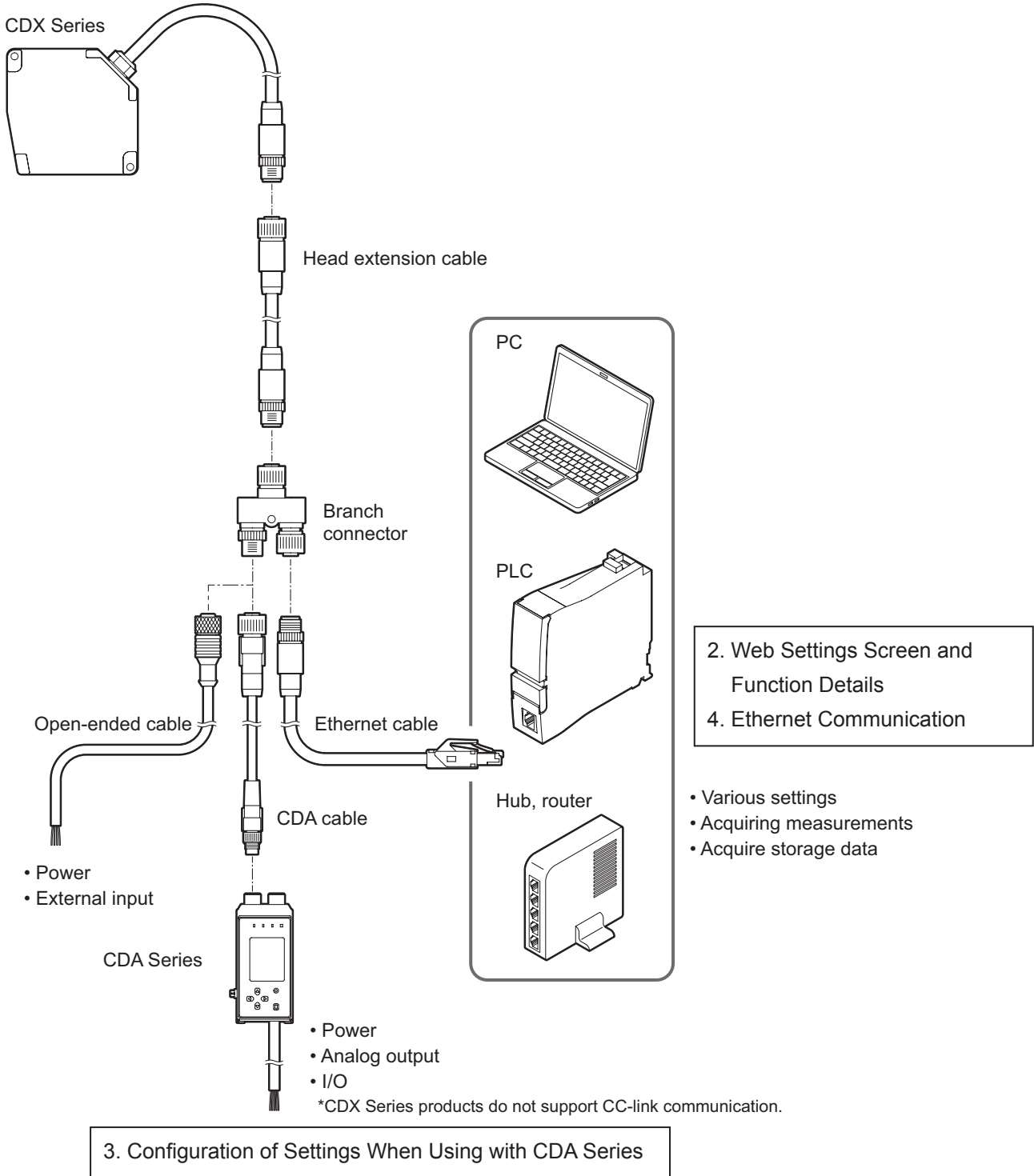
Product Overview

This section explains precautions regarding the configuration of the CDX Series and usage as well as preparations that must be performed before use.

Be sure to read this section thoroughly before using the product.

1-1 System Configuration

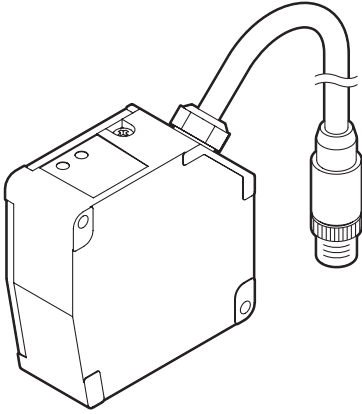
In addition to being usable as a standalone device, the product can be used connected to a CDA Series displacement sensor control unit.



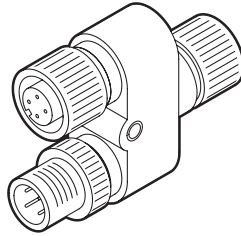
1-2 Included Items

Before using this product, confirm that the following items are contained in the package.

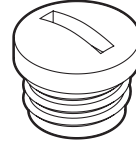
Sensor ×1



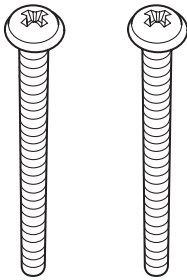
Branch connector ×1



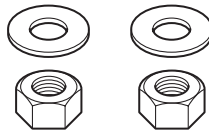
Connector cap ×1
(attached to the connector)



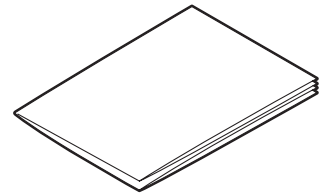
M4×50 mm mounting screws ×2



Washer, M4 nut ×2

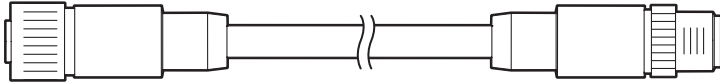


Instruction Manual ×1



1-3 Cables

● Head extension cable (green M12-8 pole connector on both ends)

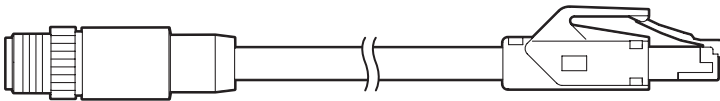


- DSC-1208-G02MA (2 m)
- DSC-1208-G05MA (5 m)
- DSC-1208-G10MA (10 m)

Caution

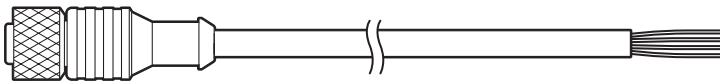
Up to two extension cables can be connected to each other for use.
When connecting CDA Series products, the maximum extension length is 10 m (including the head extension cable plus the CDA cable).

● Ethernet cable (Black 4-pole M12 connector — RJ45 plug)



- SSL-2J04-G02MER (2 m)
- SSL-2J04-G05MER (5 m)
- SSL-2J04-G10MER (10 m)

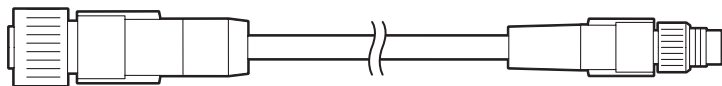
● Open-ended cable (Orange 4-pole M12 connector — Open-ended)



- DOL-1204-G02M (2 m)
- DOL-1204-G05M (5 m)

No.	Color	Description
1	Black	External input (PNP)
2	Blue	GND
3	Brown	24 VDC
4	White	External input (NPN)

● CDA cable (Green 4-pole M12 connector — Green 4-pole M8 connector)



DSL-1204-G02M Cable length: 2 m *Robot cable specification

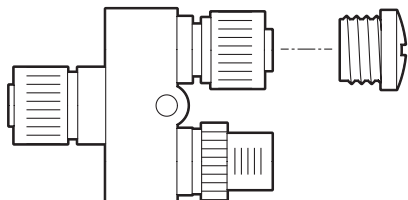
DSL-0804-G02M Extension cable length: 2 m *Robot cable specification

DSL-0804-G05M Extension cable length: 5 m *Robot cable specification

Caution

The maximum length for the head extension cable plus the CDA cable is 10 m.

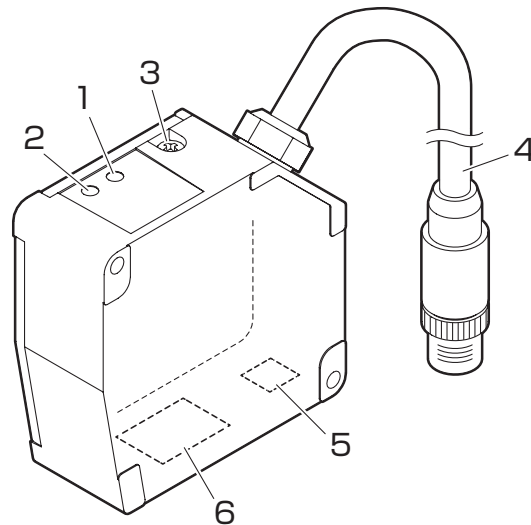
● Branch connector (with cap)



SYL-1208-G0M

*Identical to connector shipped with the product.

1-4 Names and Functions of Parts



Number	Name	Function																				
1	Status LED	Lights up or flashes according to the operation status of the sensor. Laser OFF: Flashes blue Alarm status: Flashes red (when reception of light cannot be confirmed) *When measuring a transparent target, the LED will flash twice if there is no specified surface. Control output: Lights up orange (when any output is ON) Lights up green (when any output is OFF)																				
2	Communication LED	Flashes green during Ethernet communication.																				
3	Initialization button	Remove the screws to access the initialization button. Press and hold the button with a miniature screwdriver or other object to reset all settings. <table border="1" data-bbox="450 1254 1425 1630"> <thead> <tr> <th>Length of time the button is pushed</th> <th>Action</th> <th>Status LED operation</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Less than 1 sec</td> <td>(None)</td> <td>(No change)</td> <td>The change may not be applied if the button is not pressed long enough.</td> </tr> <tr> <td>1 to less than 5 seconds</td> <td>IP address initialization (static IP)</td> <td>Flashes orange (slow)</td> <td>The IP address will be changed to "192.168.0.10."</td> </tr> <tr> <td>5 to less than 10 seconds</td> <td>IP address change (DHCP)</td> <td>Flashes green (slow)</td> <td>Set the IP address to DHCP and acquire the IP address.</td> </tr> <tr> <td>10 seconds or more</td> <td>Initialize all settings</td> <td>Flashes green (fast)</td> <td>All settings are returned to their factory default settings.</td> </tr> </tbody> </table>	Length of time the button is pushed	Action	Status LED operation	Description	Less than 1 sec	(None)	(No change)	The change may not be applied if the button is not pressed long enough.	1 to less than 5 seconds	IP address initialization (static IP)	Flashes orange (slow)	The IP address will be changed to "192.168.0.10."	5 to less than 10 seconds	IP address change (DHCP)	Flashes green (slow)	Set the IP address to DHCP and acquire the IP address.	10 seconds or more	Initialize all settings	Flashes green (fast)	All settings are returned to their factory default settings.
Length of time the button is pushed	Action	Status LED operation	Description																			
Less than 1 sec	(None)	(No change)	The change may not be applied if the button is not pressed long enough.																			
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10 seconds or more	Initialize all settings	Flashes green (fast)	All settings are returned to their factory default settings.																			
4	Cable	Connects to the head extension cable or the branch connector.																				
5	Laser exposure window	The light from the laser is emitted here. Absolutely do not look into this window.																				
6	Laser light reception window	The reflected laser light enters this window. During measurement, ensure that this window is not blocked.																				

Caution

When using the sensor, never look into the laser exposure window (5). Doing so may have adverse effects on the eyes, including temporary blindness.

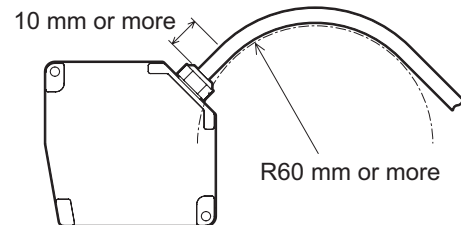
1-5 Mounting the Head

⚠ Caution

Please note the following when handling the sensor head cable or extension cable. Subjecting the cable to excessive stress may cause the cable to break.

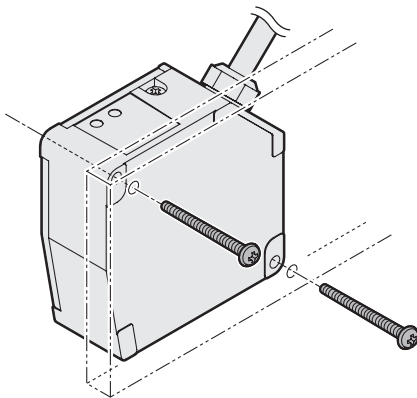
- Do not pull on the cable with forces of 30 N or more.
- Do not bend the cable at radiuses of 60 mm or more.
- Ensure that the cable is not bent at any position less than 10 mm from the sensor head.
- Tighten the sensor head mounting screws (included screws or the like) with a tightening torque of no more than 0.8 N·m.

Excessive tightening torque may damage the sensor head.



■ Mounting method

Use the included screws and other components to mount the head to the wall or to a bracket.



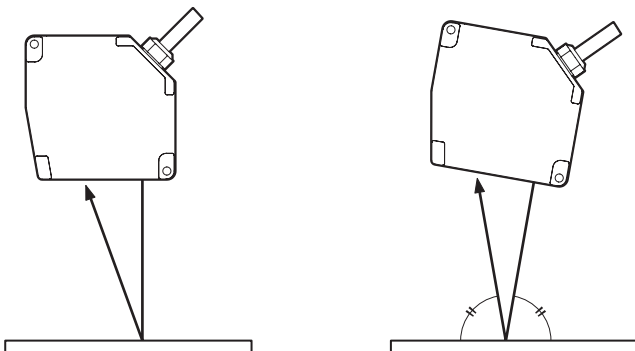
Installation typically consists of either “diffuse reflection installations” or “specular reflection installations,” which are used for measuring transparent glass, mirror surfaces, or the like.

Select the installation method according to the workpiece that will be measured.

Make sure to change the “Installation” setting of the sensor according to the installation details. (“2-7-1 Mounting” (Page 2-24))

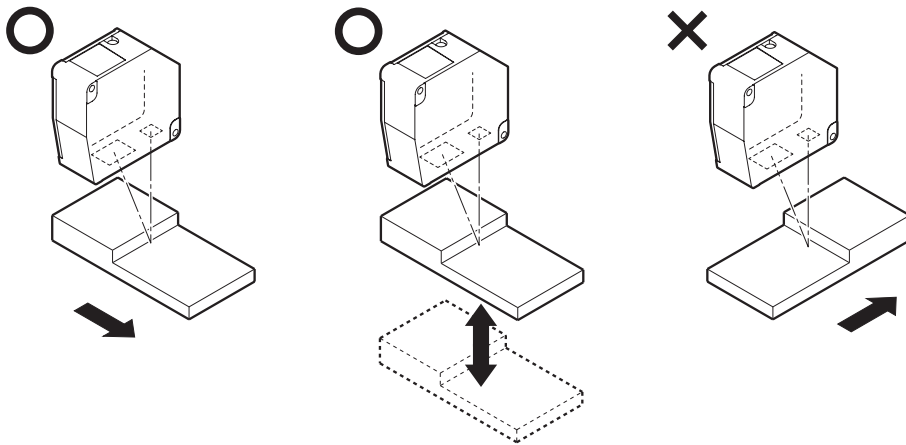
■ Measurement range

- Diffuse reflection installation
- Specular reflection installation

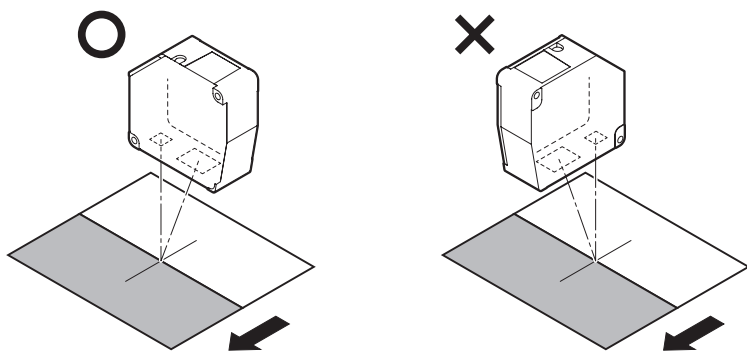


In order to enable highly accurate and stable detections, mount the sensor as follows for the appropriate targets.

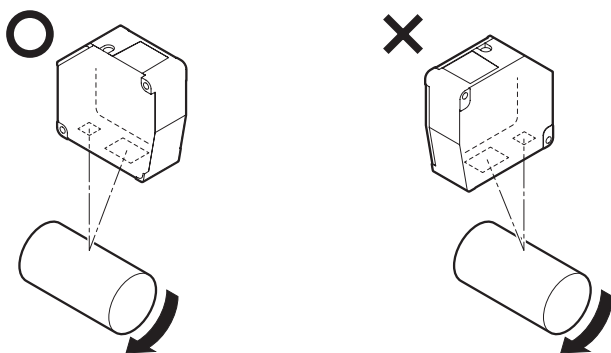
● **With height differences**



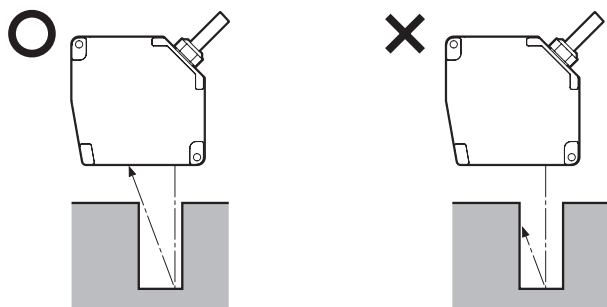
● **With material/color differences**



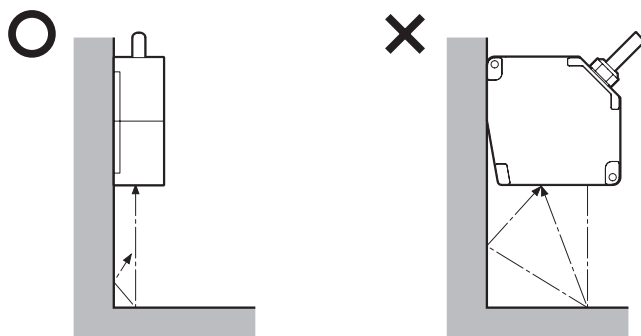
● **With rotating measurement targets**



● With holes or recesses



● When mounted on a wall



Attach the sensor head so that the window (emitting/receiving surfaces) is parallel to the detection target. Adjust the target so that the spot aligns with the detection position, and check whether the status LED lights up orange or green.

⚠ Caution

■ Warmup

Wait approx. 30 minutes after turning the power ON before using the product. Measurements performed directly after turning ON the power will gradually drift (change) over time.

■ Effects of Ambient Temperature

Changes in ambient temperature can cause measurement errors. Ensure a constant ambient temperature at all times. If the ambient temperature changes abruptly, approx. 60 minutes is required for the temperature inside the device to become uniform.

■ Effects of Dirt and Dust

Measurement errors may occur due to dirt or dust as well as water or oil.

- Should the glass cover or the surface of the measurement target become dirty, clean it by blowing it with clean air.
- If the glass cover becomes excessively dirty, wipe with a soft cloth.



2

Web Settings Screen and Function Details

The CDX Series of products includes a Web server function that allows settings to be viewed and configured using a Web browser.

This section explains how to configure the settings and explains in detail more about each function.

2-1 Checking the IP Address on CDX Series Products

CDX Series products are set to DHCP (Dynamic Host Configuration Protocol) by default, meaning the IP address is obtained automatically when the network is configured.

To learn the IP address, contact your network administrator.

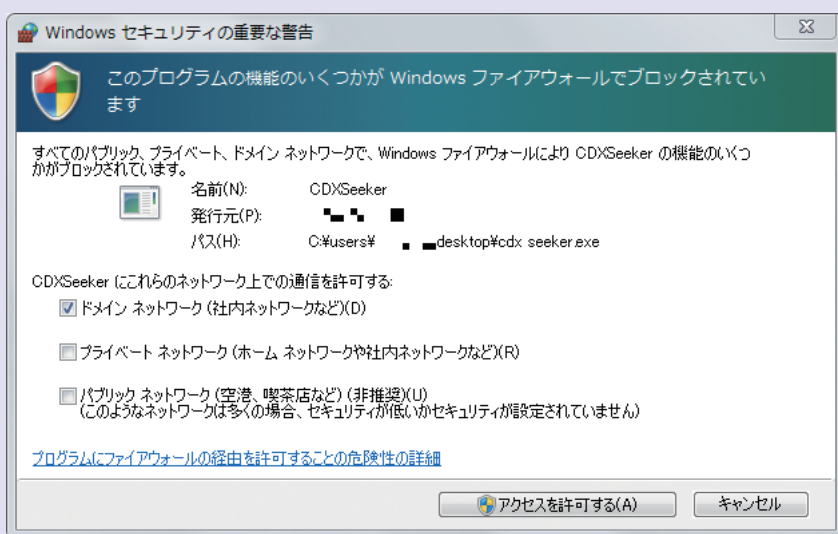
The IP address can also be checked/configured using the dedicated tool (CDX Seeker).

2-1-1 Using CDX Seeker

CDX Seeker is a dedicated tool for searching for CDX Series products within a network and verifying/configuring the IP address settings of any products found. Access the Optex FA website to download the software for free.

Optex FA website: <http://www.optex-fa.com/>

Caution

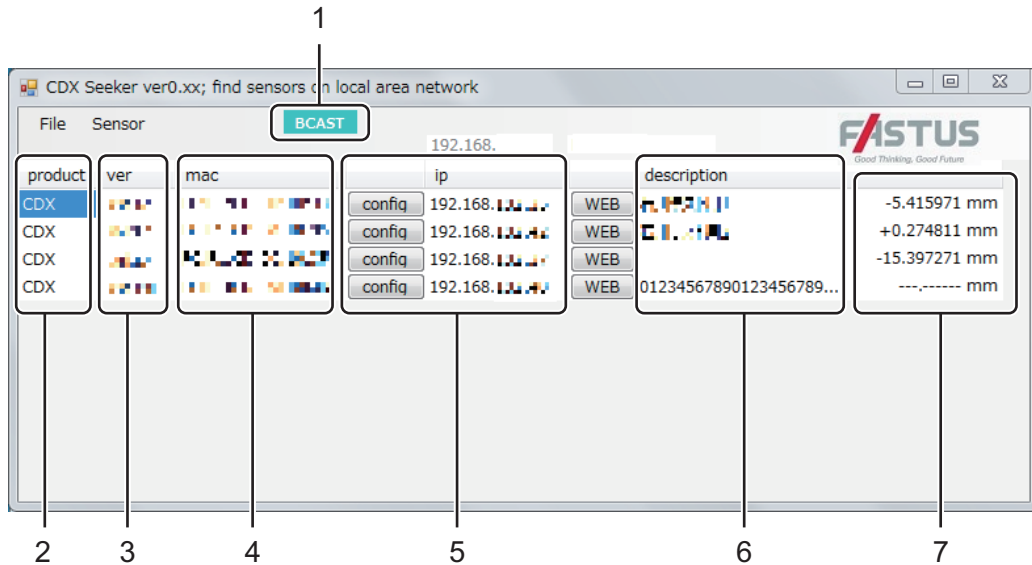


When first launching CDX Seeker, the “Security Alert” may be displayed.
To use the software, click “Allow access.”

MEMO

CDX Seeker will search for CDX Series products physically connected to the same network segment.

Once the software is launched, a search for all CDX Series products on the network will begin automatically.



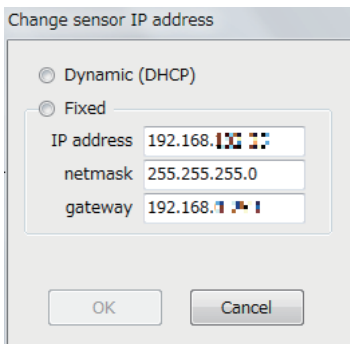
Number	Item	Description
1	Broadcast display	When operation is being carried out correctly, "BCAST" will flash.
2	Product	Displays the CDX Series product model.
3	Version	Displays the CDX Series firmware version
4	Mac address	Displays the Mac address of the CDX Series product.
5	IP address	Displays the IP address of the CDX Series product. Press "Setting" to display the menu for changing network settings.
6	Description	Use this function to provide any additional notes. Double-click to edit.
7	Measured value	The current measurement results will be displayed.

Opening the CDX Settings screen

To view the settings and actions of a CDX Series product, click the "WEB" button for the in the list to display the measurement screen for that CDX Series product.

Changing the IP address

Press the "Setting" button from the menu to bring up the IP address update menu for the sensor. Change the address and press "OK" to change the communication settings immediately. There is no need to restart the CDX Series product.



2-2 Connection Using a Web Browser

All of the following Web browsers can be used for the CDX Series Web settings screen.

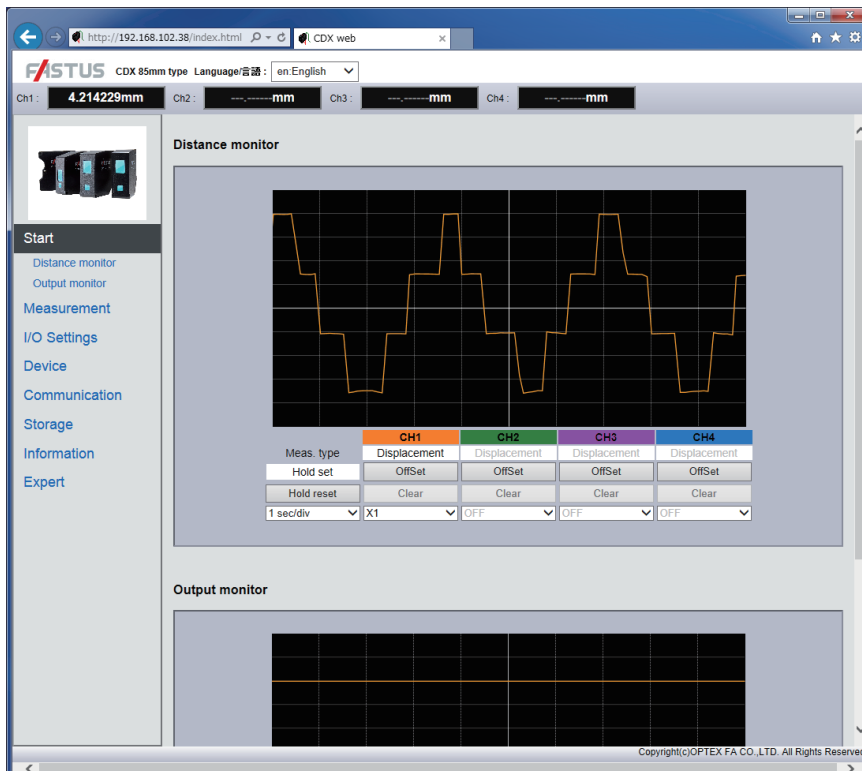
Supported Web browsers

Browser name	Version
Internet Explorer	Version 11 or higher
Google Chrome	Chrome 49 or newer

Launch the browser and enter the verified or configured IP address in the address bar.

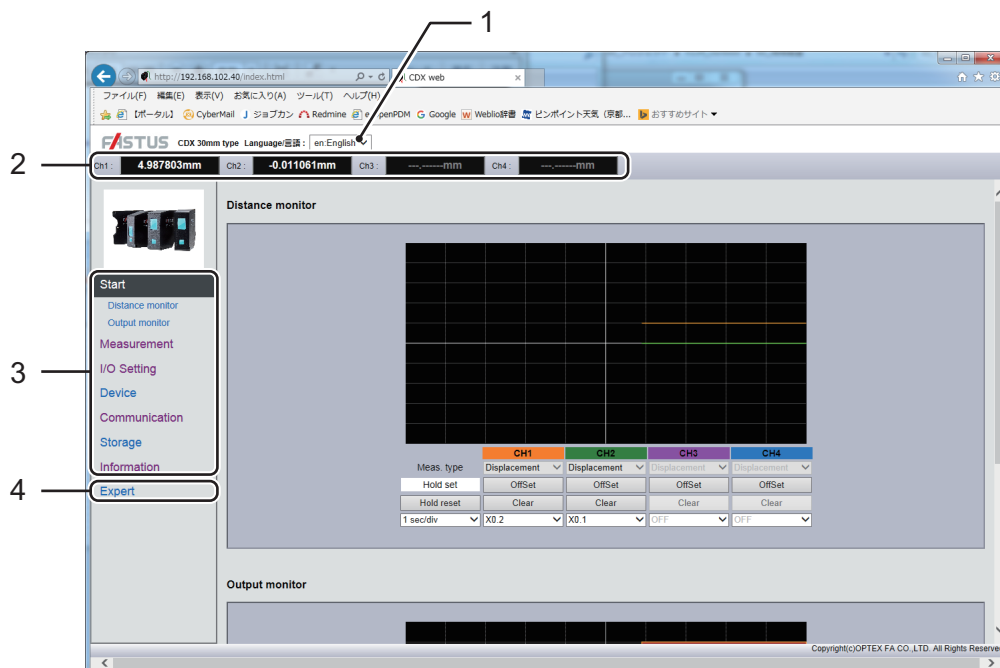


Displays the settings screen for the CDX.



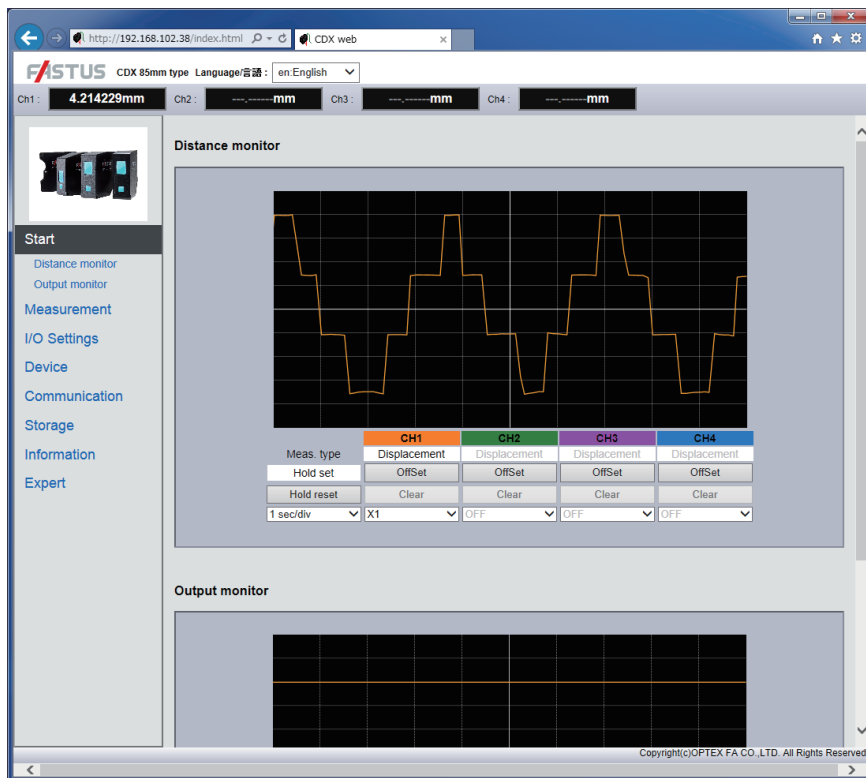
2-3 Screen Flow Chart

This section provides a rough screen configuration and the switching method.



Number	Name	Part
1	Change language	Switches the language used onscreen. (Initially set to "English.")
2	Measurement results	Displays the measurement results for each channel.
3	Tab	Shows the settings in a list. Click an item to move to the screen for setting or checking that item.
4	Expert window	This screen is designed specifically for service engineers. It is not to be used by the user.

2-4 Start Screen



Displays the operating status.

This screen also allows users to check measurement results, judgment results, and trend graphs.

Some settings, such as applying/releasing a hold and changing thresholds, can be changed from this screen.

2-4-1 Offset input

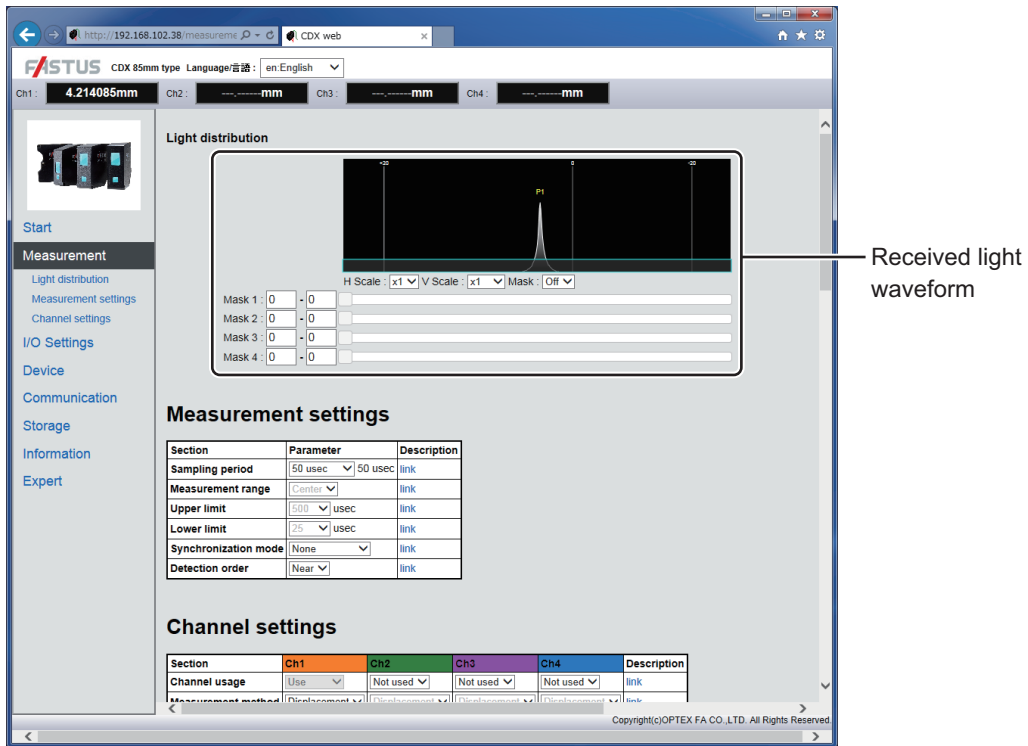
By setting a reference dimension as the offset value and then using the offset function while measuring a reference workpiece, users are able to set the current measured value as an offset value (reference value). When turning offset ON, move to the position of the displayed value or measure a reference workpiece.

- ON: The offset operation will be performed. The measured value will become the offset value.

2-4-2 Clear

The offset will be cleared.

2-5 Measurement Screen

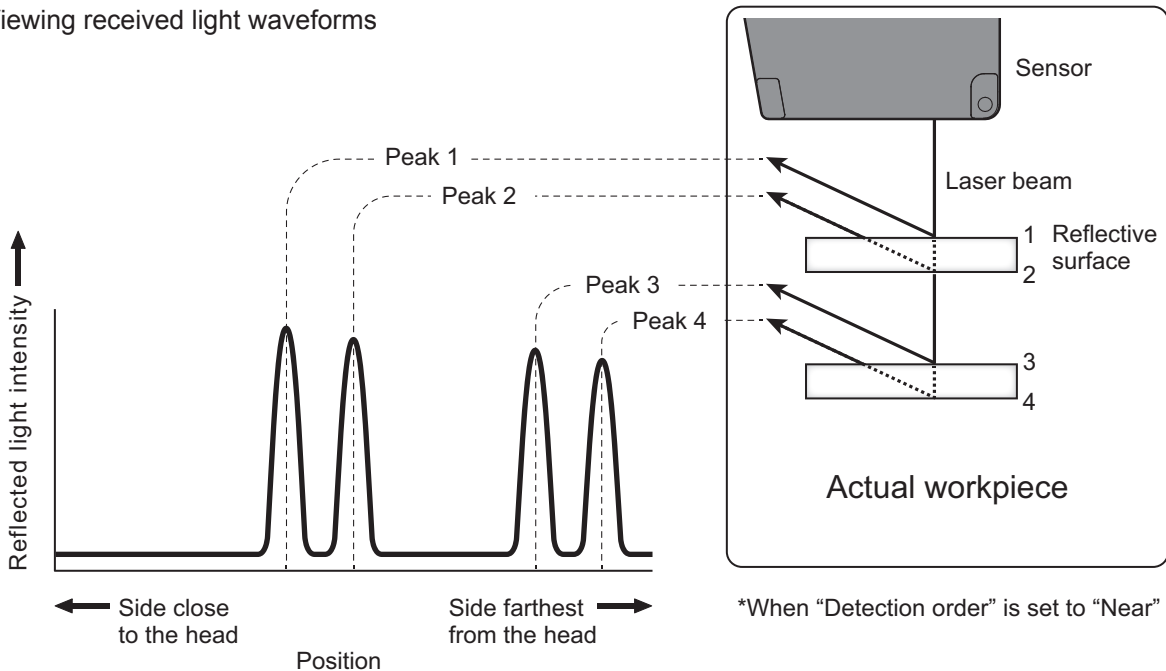


Configures the basic settings for measurement.

The CDX Series receives the reflected light of the laser it emits and uses that reception position to measure the distance to the workpiece. This screen allows users to check the received light waveform that represents the receiving status of the sensor. (See the previous figure.)

The peak positions of the received light waveform represent the distance to the applicable target. Peaks recognized by the CDX sensor will be displayed on the received light waveform such as by "P1."

Viewing received light waveforms



*When "Detection order" is set to "Near"

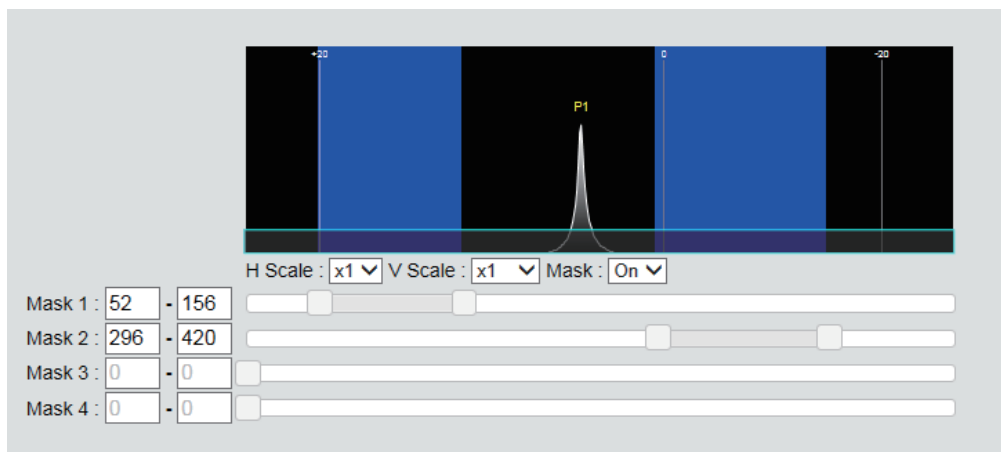
2-5-1 Mask

Sets a mask range on the light-receiving waveform inside the measurement range where measurement should not be performed.

Use the mask to exclude ambient noise or workpieces that should not be measured.

Areas covered by the mask are displayed in blue. Measurement is not performed for these areas.

The mask can be set in up to four locations. (See the following figure.)



- ON/OFF
- Default value: OFF

Caution

Checking the received light waveform and checking/configuring the mask cannot be done with CDA series products.

[Measurement]

2-5-2 Sampling period

Sets the time one measurement should take (sampling time). Setting a shorter time will result in faster measurement, but because the amount of reflected light is reduced, measurement may not be possible in the dark or with tilted objects.

The amount of reflected light can be checked from the received light waveform screen.

- 12.5/25/50/100/200/500/1000 [μ sec]
- AUTO: Adjusts the sampling period for the fastest measurement according to the target.
- Default value: 50

2-5-3 Measurement range (at 12.5 μ s)

*[CDA menu: Crop (12.5 μ s)]

When the sampling period is set to the fastest setting of 12.5 μ s, the measurement range will become narrower. Select the measurement range at this time.

	Measurement range	
	CDX-85 [W]	CDX-150 [W]
Near	65.0 to 77.7 mm 71.5 to 74.3 mm (with specular reflection installation)	110.0 to 134.4 mm
Center (Initial value)	73.5 to 90.8 mm 70.6 to 86.9 mm (with specular reflection installation)	124.8 to 166.3 mm
Far	84.8 to 105.0 mm 81.0 to 91.5 mm (with specular reflection installation)	150.2 to 190.0 mm

2-5-4 Upper Limit/Lower Limit

Select "Auto" for the sampling period to set the maximum and minimum sampling periods to adjust. The actual sampling period will be automatically adjusted within this set range.

▼ Upper Limit

- 25/50/100/200/500/1000 [μ sec]
- Default value: 500

▼ Lower Limit

- 25/50/100/200/500/1000 [μ sec]
- Default value: 25

2-5-5 Synchronization mode

Sets the measurement function used to synchronize two sensor heads for measurement.

- None: This function will not be used.
- Synchronous: Synchronize multiple sensors for measurement.
- Anti interfere1/2: Alternates between two sensors for measurement. Use this setting when the second laser is installed in an interference position. Set the first sensor head to "Anti interfere1" and the second to "Anti interfere2" to measure by alternating the laser emission. The measurement time for one measurement will need to be twice the set sampling period.
- Default value: None

Caution

- To use this function, the following settings must be configured in advance.
 - * Set the sampling period for each sensor head to an identical value of 100 μ sec or more.
 - * Set one sensor head as the "Master" and the other as the "Slave" using the setting explained in "2.8.7 High-Accuracy Time Synchronization (page 2-8-6 Precision Timesync (Page 2-28))."
- This setting cannot be configured with CDA Series products.

2-5-6 Detection order

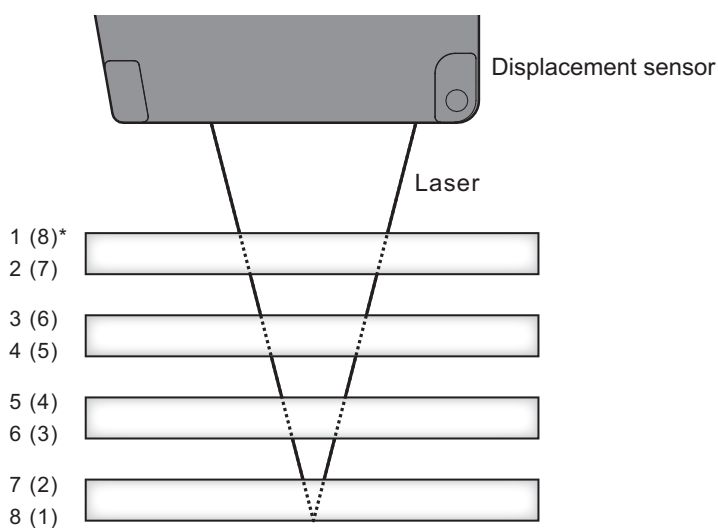
Reflected light may be received from multiple locations, such as from front and rear surfaces, when measuring certain targets (for example, transparent glass plates). The CDX Series assigns numbers in order (1, 2, etc.) to each reflective surface.

Set whether such cases should be ordered beginning with the side closest to the sensor head or farthest away from the sensor head.

Specifying this number allows any peak number surface to be measured.

If the specified surface (peak) does not exist, measurement will not be possible.

- Near: Assign numbers from the side closest to the head.
- Far: Assign numbers from the side farthest from the head.
- Default value: Near



For details, see "Viewing received light waveforms (Page 2-7)."

Caution

This setting cannot be configured with CDA Series products.

[Channel setting]

With the CDX Series, up to four channels (Ch 1 through Ch 4) can be set within the sensor, with each channel capable of independently configured measurement operations and output judgment.

The following items can be configured independently using Ch 1 through Ch 4.

MEMO

When using a CDA Series shared displacement sensor amplifier, only Ch 1 on the CDX Series will be configurable. There is no relation between “Channel 1/2” of CDA Series and “Channel setting” of CDX Series.

2-5-7 Channel On/Off

Set this channel or another channel for use.

Channel 1 is usually ON.

- OFF: Not used
- ON: Use
- Default value: ON

Caution

This setting cannot be configured with CDA Series products.

2-5-8 Measurement type

Sets the functions for measurement to use for the channel.

- Displacement: Measures the distance between the sensor and a specified point. [Unit: μm]
- Thickness: Measures the distance between two points on a target with multiple reflective surfaces, such as a plane of glass. [Unit: μm]
- Velocity: Measures the velocity. [Unit: m/s]
- Default value: Displacement

2-5-9 Peak number

*[CDA menu: Peak No.]

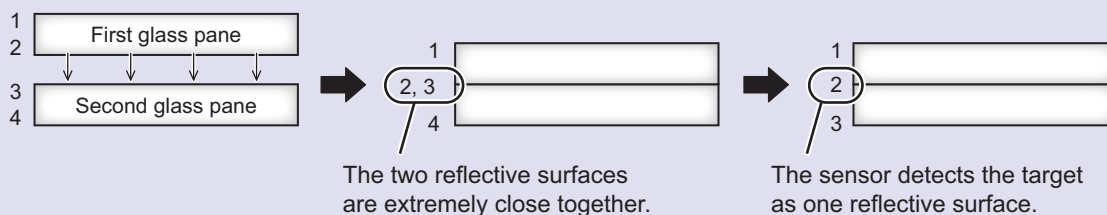
Specifies which surface (peak number) of a target to measure.

- No. 1 to No. 8: Specify each peak.
- Default value: 1

Caution

For example, when measuring two overlapping panes of glass, if the back of the first pane of glass (second reflective surface) and the front of the second pane of glass (third reflective surface) are close together, the sensor will not be able to recognize the surface and instead recognize the entire target as one reflective surface.

To see how the sensor recognizes the reflective surfaces, check the light-receiving waveform.



2-5-10 Peak number(Thickness)

*[CDA menu: Thickness Peak No.]

Measures the distance (thickness) between the surface specified in "Peak number" and the surface specified here when "Thickness" is selected as the measurement function.

If the specified surface (peak number) does not exist, measurement will not be possible.

If the specified surface is the same as that specified in "Peak number," the measured value will be shown as "0."

- No. 1 to No. 8: Specifies each peak.
- Default value: 2

2-5-11 Median filter

*[CDA menu: Median]

Applies a median filter to prevent variation by cutting sudden changes in the measured value.

- OFF: No median filter is used.
- 7/15/31: Applies the median filter the specified number of times.
- Default value: 31

Ex.: With a 7-point median filter:

Number of measurements	1	2	3	4	5	6	7	8	9	10	
Measured value	1.9	1.8	2.0	2.1	2.0	2.2	2.5	2.0	1.8	2.1	
1st filter range and results	← 2.0 →										
2nd filter range and results		← 2.0 →									
3rd filter range and results			← 2.0 →								

For example, when the measured values for the first filter range are sorted in ascending order, the values will be as follows.

In this case, the central (No. 4) value (2.0) will be output as the measured value.

Before sorting	1.9	1.8	2.0	2.1	2.0	2.2	2.5
After sorting	1.8	1.9	2.0	2.0	2.1	2.2	2.5

2-5-12 Moving average

Averaging is performed the number of times for the measured value.

This process is applied after multiplying by the median filter.

Although the measured values are changed gradually, a higher averaging count will take longer for the measured value to be produced.

- 1/2/4/8/16/32/64/128/256/512/1024/2048/4096/8192/16384/
32768/65536 [Unit: Count]
- Default value: 256

Ex.: With an averaging count of 4:

The measurement results for the specified count will be averaged and output as the measured value, as shown in the following figure.

Number of measurements	1	2	3	4	5	6	7	8
Measured value	1.9	1.8	2.0	2.1	2.0	2.2	2.5	2.0
1st filter range and results	← 1.95 →							
2nd filter range and results		← 1.975 →						
3rd filter range and results			← 2.075 →					
4th filter range and results				← 2.2 →				
5th filter range and results					← 2.175 →			

2-5-13 Edge measurement

Compares the currently measured value with the measured value prior to the specified sampling count. This allows gradual changes to be ignored for detection while measuring extreme height differences. This function will not be used when set to "0."

When using this function, median filters and the count for performing moving average are ignored.

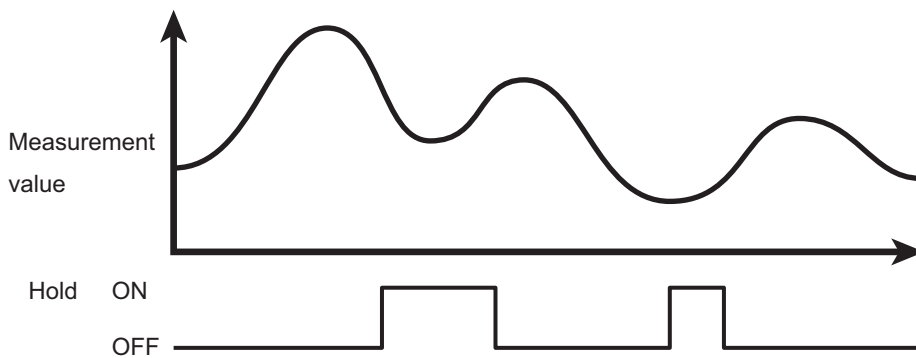
- Input range: 0 to 100,000
- Default value: 0 (Sampling)

2-5-14 Hold

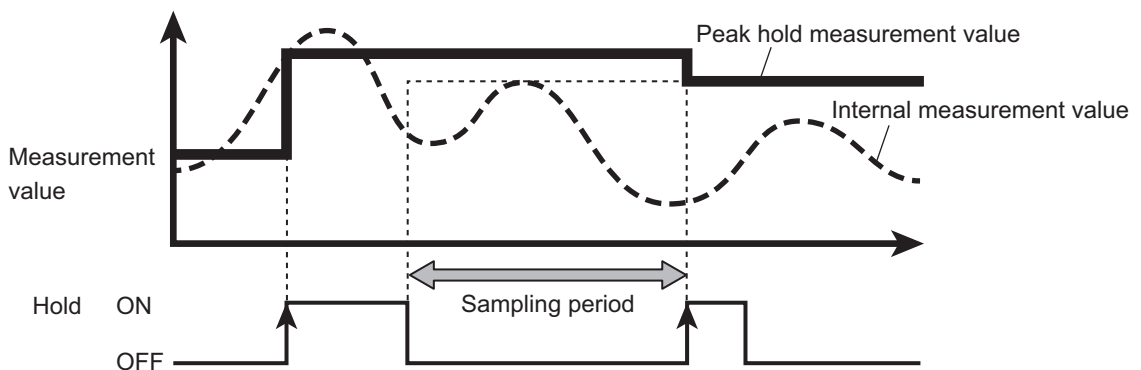
Extracts the specified value such as the maximum or minimum within a set period.

The value used for "Hold set" is used as the hold period. Use this function after inputting the hold reset when using auto peak or auto bottom.

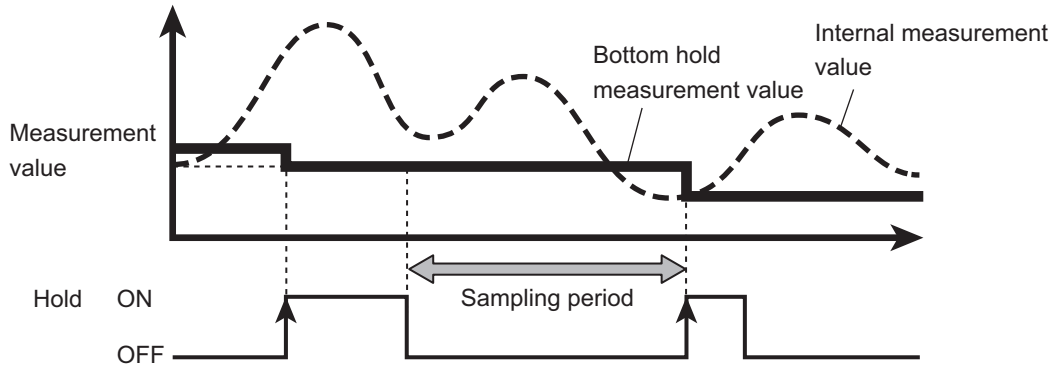
- OFF: When the hold function is "OFF," the measurement result is output as is and hold input is ignored.



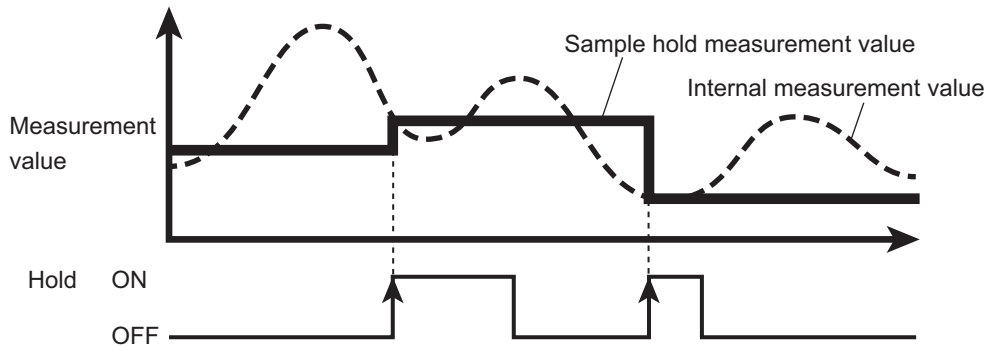
- Peak: The maximum value during the sampling period (see figure below) will be output.



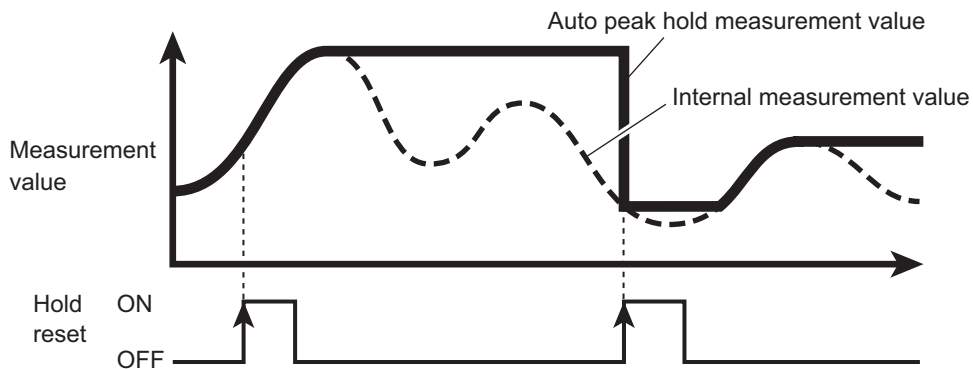
- Bottom: The minimum value during the sampling period (see figure below) will be output.



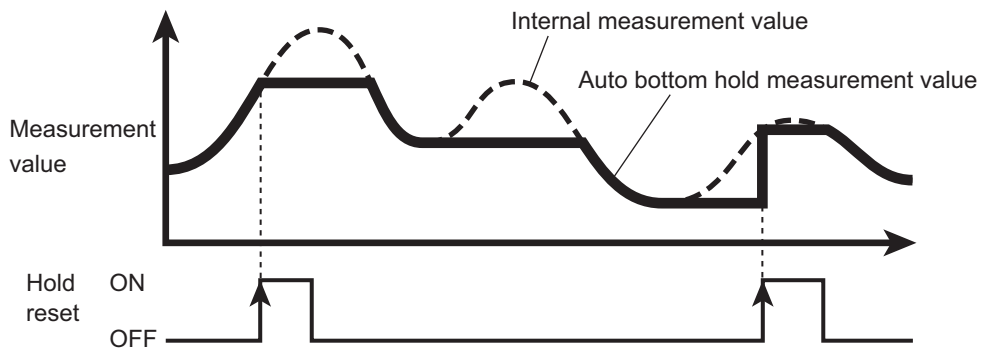
- Sample Hold The measured value during hold input will be output.



- Auto Peak: The maximum value from when the hold reset input is detected until the present will be output.

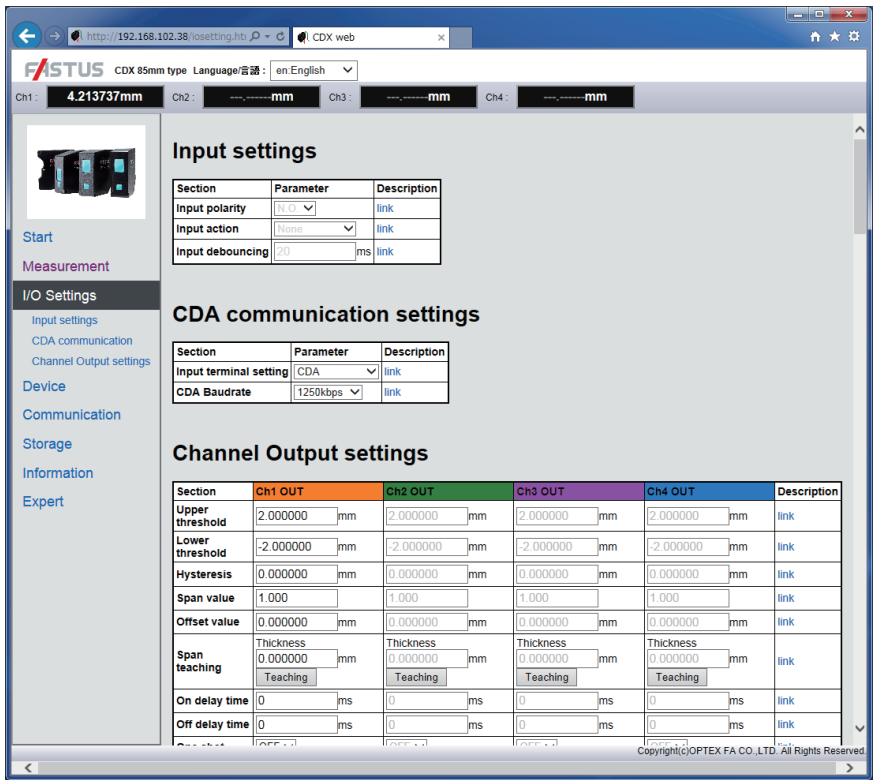


- Auto Bottom: The minimum value from when the hold reset input is detected until the present will be output.



- Default value: OFF

2-6 I/O Setting Screen



Configure the settings related to input/output.

Judgment settings can be configured for channels 1 through 4 with the CDX Series.

Because CDX Series products do not have an output signal line, judgment results are obtained via Ethernet or through a CDA Series product.

[Input setting]

This section provides information on input terminal settings.

Input terminals cannot be used when a CDA Series product is connected. As such, these settings cannot be configured with CDA Series products.

2-6-1 Polarity

Select the polarity of the external input terminals.

- N.O.: Turns ON when an input is detected.
- N.C.: Turns OFF when an input is detected.
- Default value: N.O.

2-6-2 Action

Select the operation of the external input terminals.

- None: The input terminal will not be used. (Input will be ignored.)
- Laser Off: Laser emission is stopped during input.
- Hold/Reset: Used as hold set/hold reset input when hold operation is in use.
 - At peak/bottom/sample hold: Hold set
 - At auto peak, auto bottom: Hold reset
- Storage Start: Used as the storage function input.

Storage operation will be performed while ON. When the specified number of saved data entries is reached, storage operation will end and a file will be created.

Setting the input to OFF while storage operation is in progress will pause the storage operation and create a file using the data saved up to that point.
- Offset: Used as the offset or as the offset release input.
 - Less than 1 sec: Offset
 - 1 sec or more: Clearing offset
- Default value: None

2-6-3 Debouncing

Sets the delay time from when the external input is turned ON until actual operation begins in order to prevent the external input from turning ON or OFF suddenly.

- Input range: 0 to 32.767[msec]
- Default value: 20

[Channel Output setting]

This section explains the output operation settings.

With a CDX Series product, output for channels 1 through 4 are available, and the settings can be configured for each channel.

MEMO

When using a CDA Series shared displacement sensor amplifier, only Ch 1 output will be configurable.

2-6-4 Upper Limit/Lower Limit

Sets the judgment threshold for turning the output ON or OFF.

GO output will be turned ON between the upper and lower thresholds.

▼ Upper Limit

- Input range: ± 2000.000 (mm)
- Default value: [+2.0] (85 mm type)
[+4.0] (150 mm type)

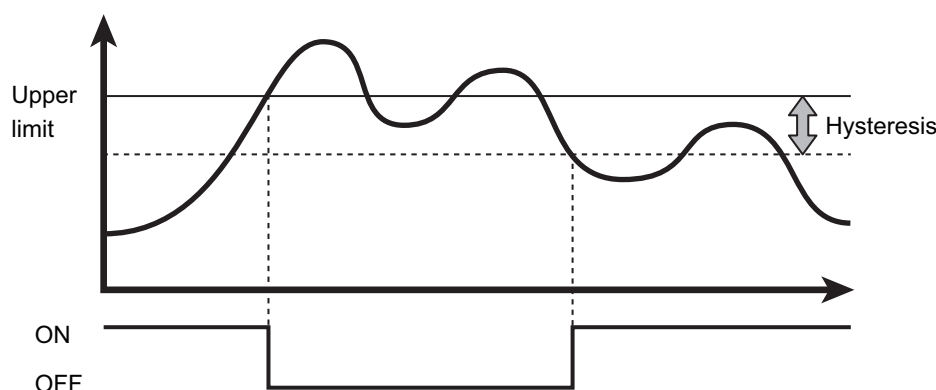
▼ Lower Limit

- Input range: ± 2000.000 (mm)
- Default value: [-2.0] (85 mm type)
[-4.0] (150 mm type)

2-6-5 Hysteresis

If the measured value is slightly above or below the threshold, control input/output may turn ON and OFF repeatedly (chattering). This state can be prevented by padding the value from when the threshold is exceeded and the output goes from ON to OFF. This padding is called “hysteresis”. (See the following figure.)

- Input range: ± 2000.000 [mm]
- Default value: [0.000]



2-6-6 Span

Multiplies the measured value by the specified value.

This function is used, for example, to correct measured values when installing at an incline or to correct the refractive index when measuring transparent objects such as glass.

- Input range: -2.000 to +2.000
- Default value: +1.000

2-6-7 Offset

Adds to (or subtracts from) the value obtained through multiplication by the span value.

When offset input is received, the addition or subtraction is performed internally so that the measured value becomes the value set here.

- Input range: -2000.000 to +2000.000 [Unit: mm]
- Default value: 0.00000

2-6-8 Span teaching

The span value can be set based on the actual measured value.

To determine the span value, perform teaching using an actual workpiece with known dimensions.

Use this function to correct errors and other factors caused by refraction of a transparent object such as glass with a known thickness.

Enter the actual dimension in the input area, and press “Teaching” during measurement to set the span value.

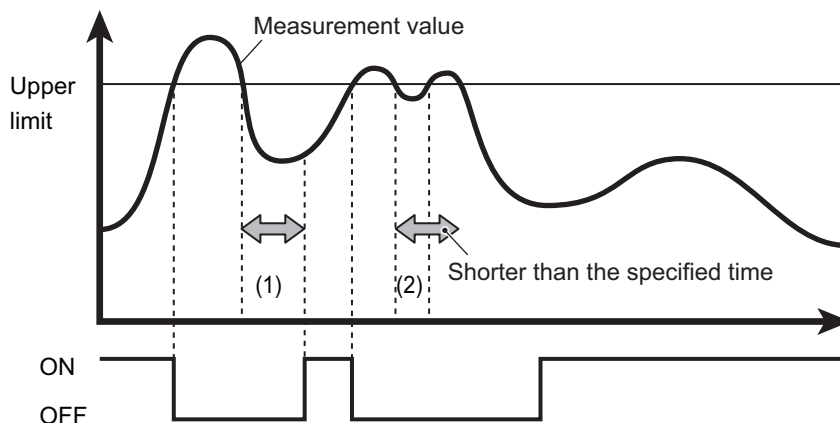
- Input range: -2000.000 to +2000.000 [Unit: mm]
- Default value: 0.00000

2-6-9 On delay

Sets the time from when the measured value exceeds the threshold until the output actually turns ON.

Cancelling output until this time has elapsed prevents the control input/output from turning ON/OFF repeatedly in a short time (chattering).

Example:



(1) When the measured value remains below the threshold from when the measured value falls below the threshold until after the On delay time has elapsed

⇒ Output turns ON.

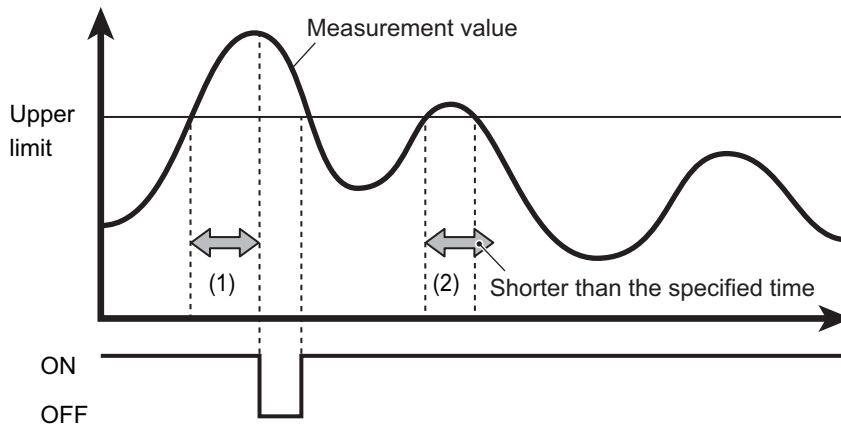
(2) When the measured value is equal to or more than the threshold from when the measured value falls below the threshold until after the On delay time has elapsed

⇒ Output remains OFF. (The output does not turn ON.)

- Input range: 0 to 4000[msec]
- Default value: 0

2-6-10 Off delay

Sets the time from when the output turns ON until the output turns OFF when the measured value falls below the threshold. Ensuring that the output always lasts the same length of time will prevent problems resulting from situations where detection is impossible because the ON time is too short.



- (1) When the measured value remains outside the range from when the measured value exceeds the threshold until after the Off delay time has elapsed
 - ⇒ Output is turned OFF.
- (2) When the measured value remains within the range from when the measured value falls outside the range until after the Off delay time has elapsed
 - ⇒ Output is not turned OFF.
 - Input range: 0 to 4000[msec]
 - Default value: 0

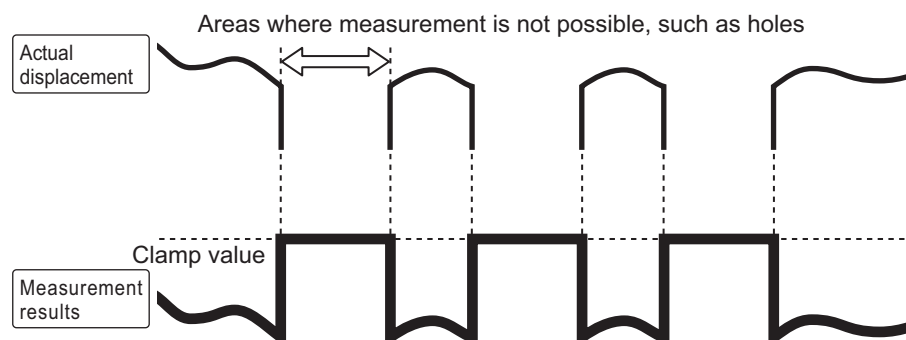
2-6-11 One shot

When this setting is turned ON, output will be set to ON only for the designated time once the conditions for turning output ON are met, and then turn OFF afterward. Output time will be set by the “Off delay” time.

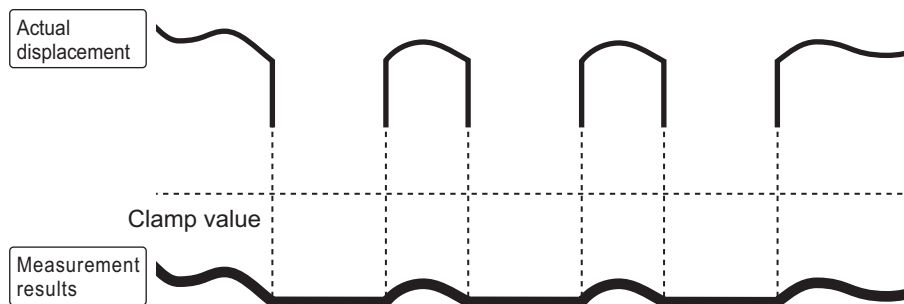
2-6-12 Alarm

Specifies how the measured value should be displayed when measurement is not possible.

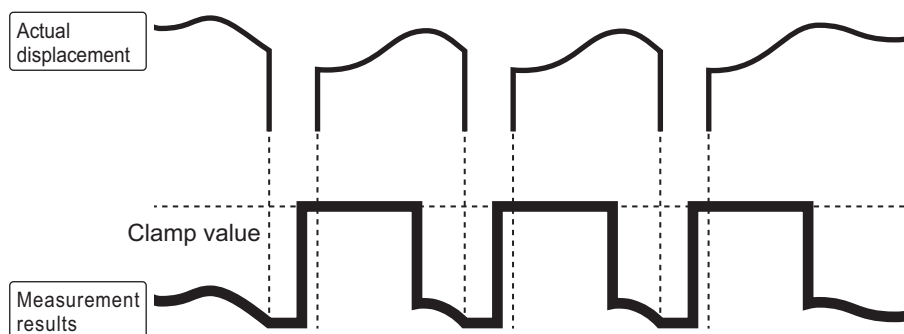
- Clamp: Shows a specified value.



- Hold: Maintains the value from directly before the alarm occurred.



- Delay Clamp: Enforces the “Clamp” operation for the specified time during the “Hold” operation.



- Default value: Clamp

2-6-13 Clamp value

Sets the value to display when an alarm occurs if “Clamp” or “Delay Clamp” is set under “Alarm.”

- Input range: -2000.000 to +2000.000[mm]
- Default value: 1000.000000

Caution

When “CDA” is selected for “Input terminal setting” under “Communication”, the clamp values will be changed to the following values.

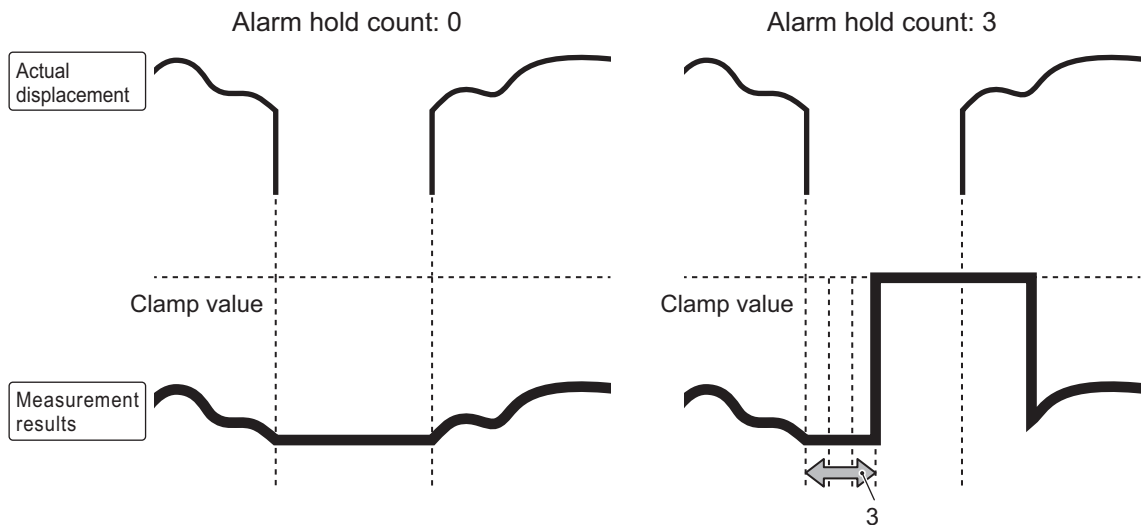
Do not change this value when using a connected CDA Series product.

CDX-85 [W]/CDX-150 [W]: 209.7152 mm

For details, see “2-8-1 Input terminal setting (Page 2-27).”

2-6-14 Alarm delay

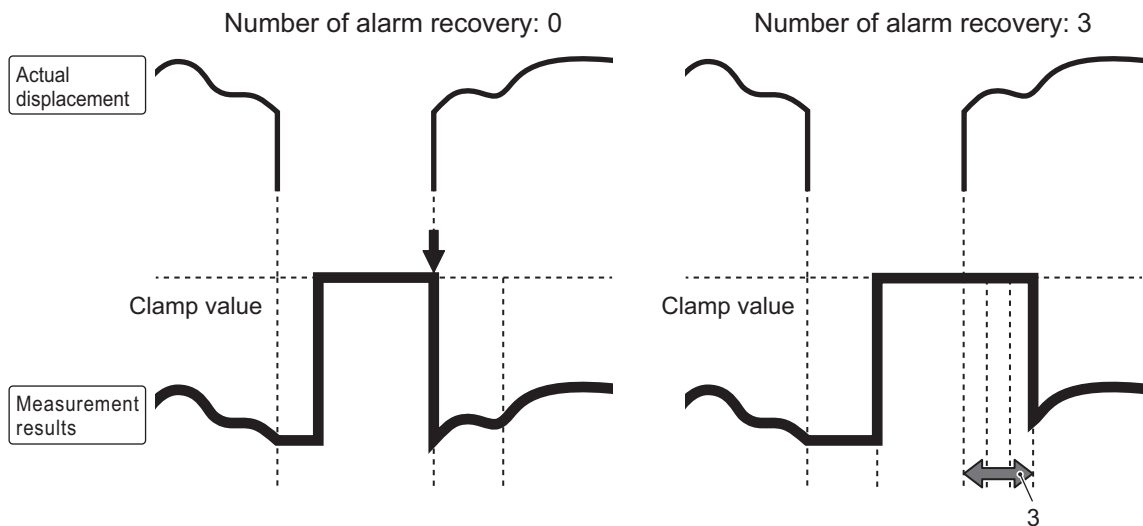
When “Delay Clamp” is set under “Alarm,” the “Hold” period is set by the number of samplings.



- Input range: 0 to 4095
- Default value: 0

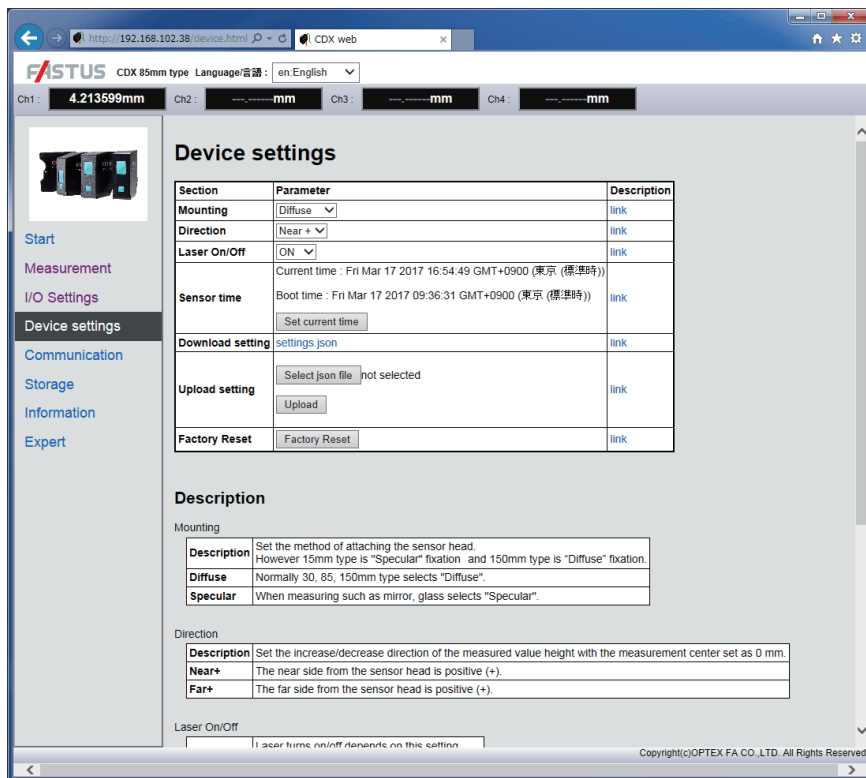
2-6-15 Alarm recovery

When “Delay Clamp” is set under “Alarm,” the period from the “Alarm” state until the status returns to a measurable state is set by the number of samplings.



- Input range: 0 to 4095
- Default value: 0

2-7 Device Screen



Configure the common device settings.

Select "Factory Reset" on this screen to return the settings to their factory defaults.

In addition, setting data for device can be saved as a file and written to other CDX Series products.

2-7-1 Mounting

Selects the installation method for the sensor head.

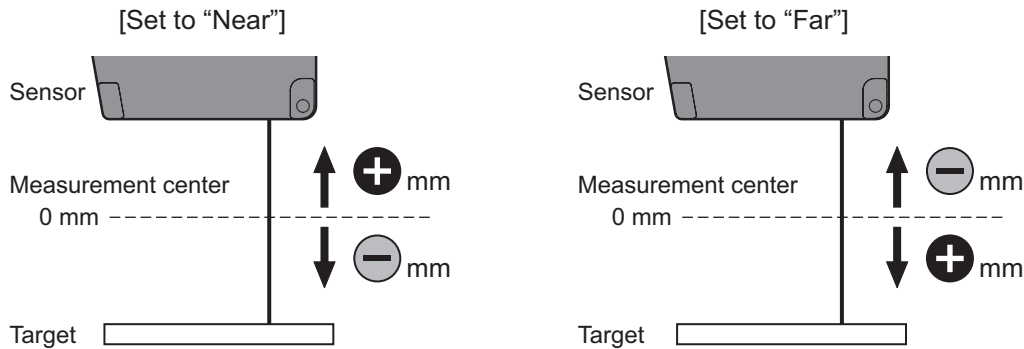
Selection is only possible for sensor heads that allow selection of the installation method.

- Diffuse: Use this normally.
- Specular: Measurement is performed with the device installed at a specular reflection angle. Used when measuring targets with no diffuse reflection, such as mirror surfaces and glass.
- Default value: Diffuse

2-7-2 Direction

Select the increase/decrease direction of the measured value with the measurement as 0.

- Near: The closer the sensor and the target are to each other, the higher the measured value will be.
- Far: The farther the sensor and the target are from each other, the higher the measured value will be.
- Default value: Near



2-7-3 Laser On/Off

Laser emission is stopped when set to OFF.

Measurement is also stopped when set to OFF. Set to ON under normal circumstances.

- ON: Turns the laser ON and perform measurements.
- OFF: Turns the laser OFF and stops measurement.
- Default value: ON

2-7-4 Sensor time

Displays the current time and the run time for the sensor.

When "Sensor time" is clicked, the time for the sensor will be adjusted to match the time for the device being used (for example, the PC being used).

2-7-5 Setting data storage

Download and save setting files to the PC.

2-7-6 Setting data writing

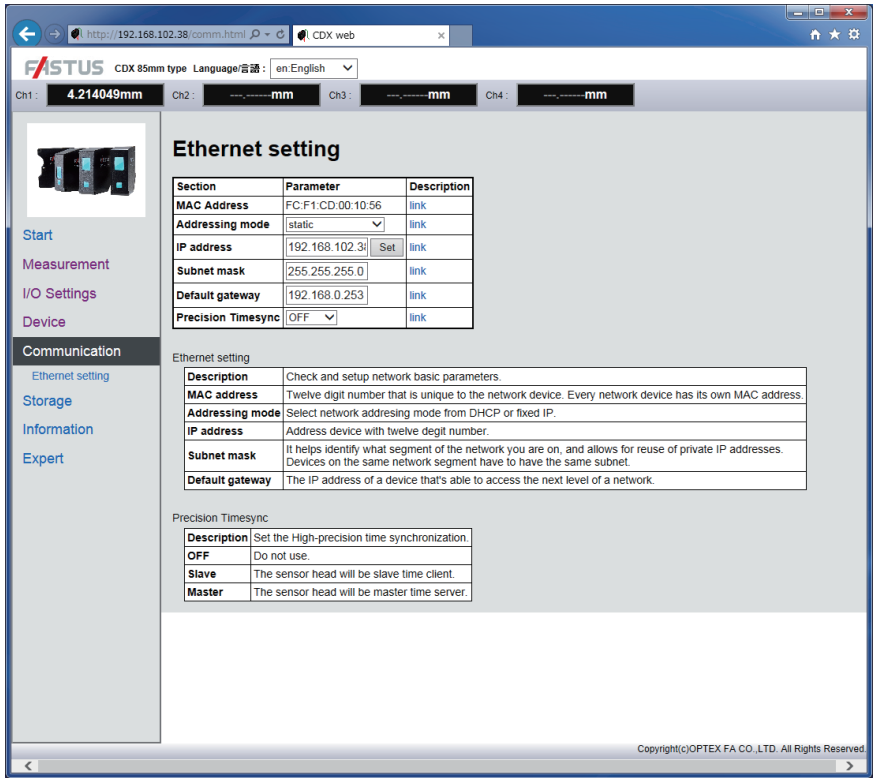
Select the data saved by selecting "Setting data storage" under "Select File" to write saved setting data to the sensor.

This function can be used for writing settings to multiple sensors or to back up data if a malfunction occurs.

2-7-7 Factory Reset

Press this button to reset all of the settings on the unit to the initial settings.

2-8 Communication Screen



Configures the settings related to communication.

Caution
These settings cannot be configured with CDA Series products.

2-8-1 Input terminal setting

Set the operation of the external input terminals according to the object being connected.

- External Input: Used for external input. Not used to connect to CDA Series.
- CDA Used to connect to a CDA Series product.

2-8-2 CDA Baudrate

Sets the communication speed when connected to a CDA Series product.

CDA Series products are normally detected and configured automatically, so there is no need to configure the settings. If the connection cannot be easily established, set to the same setting as the CDA communication speed.

- 9.6/19.2/38.2/57.6/115.2/230.4/312.4/468.8/500.0/625.0/833.3/937.5/1250 [Unit: kbps]
- Default value: 1250

[Ethernet setting]

2-8-3 IP address

Sets the IP address of the CDX Series product.

- Default value: 192.168.0.10

2-8-4 Subnet mask

Sets the subnet mask for the CDX Series product.

- Default value: 255.255.255.0

2-8-5 Default gateway

Sets the default gateway for the CDX Series product.

- Default value: 0.0.0.0

2-8-6 Precision Timesync

Sets one CDX Series products among multiple products as a time server to allow for high-accuracy synchronization of the internal clocks across all sensors.

Synchronization is required when using the “Synchronous” or “Anti interfere” exposure mode.

When this function is used, one of the CDX Series products on the network must be selected as the “Master” and the others as “Slave.”

The number of slave devices is unlimited.

- OFF: This function will not be used.
- Master: The sensor will be used as the master.
- Slave: The sensor will be used as the slave.
- Default value: OFF

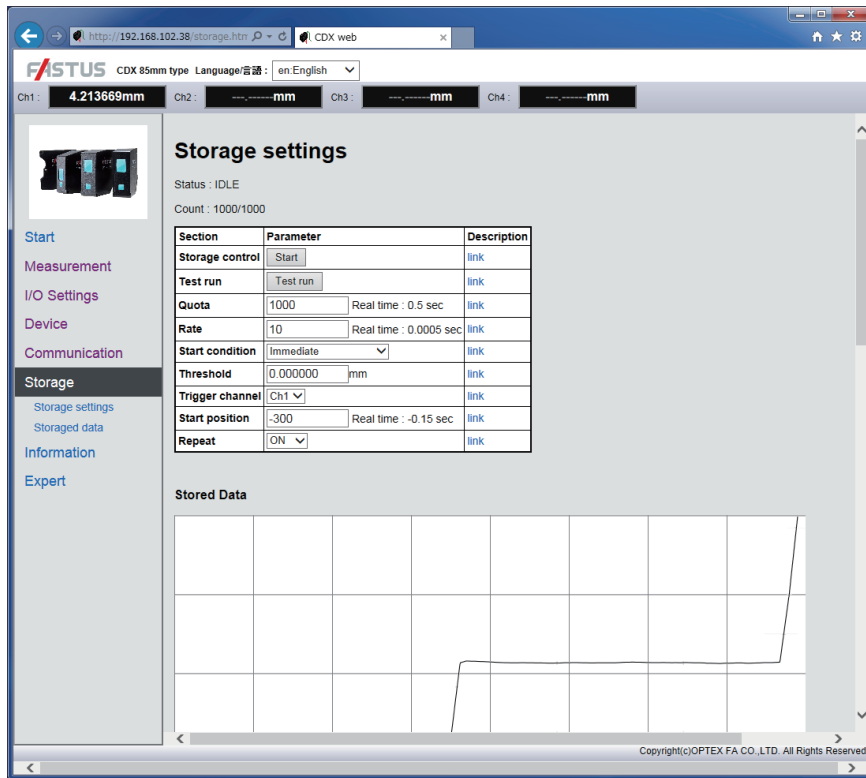
Caution

If a time server already exists on the network the CDX Series product is connected to, synchronization of the CDX Series “Master” may not occur properly.

In such cases, use the time server currently on the network as the master.

Set all CDX Series products as “Slave.”

2-9 Storage Screen



Sets the “Storage function” operation for saving results of measurement with the CDX Series.

Saved values are saved within the CDX Series as CSV data.

Saved data will be listed on this screen, and the data can be downloaded to the PC by clicking each file name.

Caution

These settings and functions cannot be configured or used with CDA Series products.

2-9-1 Status

Sets the storage function operation status.

- IDLE: The storage function is stopped.
- WAIT: Storage start trigger standby
- BUSY: The storage function is operating.
- Default value: Stopped

2-9-2 Start storage

Starts the storage operation.

2-9-3 Test run

The storage operation is performed once only after the button is pressed and only for the “Quota” amount before stopping.

This makes it easy to obtain data on the spot.

2-9-4 Quota

This is the number of data entries to save until the storage function is stopped when the storage function is in use.

- Input range: 1 to 100,000
- Default value: 1000

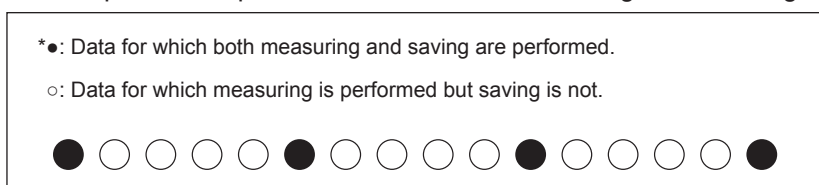
2-9-5 Rate

Sets the interval during which data should be saved for all measured data.

Not all measurement data is saved. Saving is done intermittently to reduce the amount of data stored and to facilitate processing.

- “0”:
All obtained data is stored.
- Number (positive values only):
For each data entry stored, a single measurement value is saved for each specified sampling.
- Input range:
0 to 100,000
- Default value:
10

Ex.: For example, if 5 is specified as the intermittent setting, the following operation will be performed.



2-9-6 Start condition

Sets the “Start trigger” conditions used as the basis for starting storage.

- Immediate: Storage starts immediately.
- Alarm Off edge: Storage starts from the instant measurement becomes possible.
- Alarm On edge: Storage starts from the instant measurement becomes impossible.
- Threshold Up edge: Storage starts when the measured value exceeds the set threshold.
- Threshold Down edge: Storage starts when the measured value falls below the set threshold.
- Threshold Both edge: Storage starts when the measured value exceeds or falls below the set threshold.
- Default value: Immediate

2-9-7 Threshold

When “Start condition” is “Threshold Up edge,” “Threshold Down edge,” or “Threshold Both edge,” this setting specifies the threshold to be used as the reference for the start condition.

- Input range: ± 2000.000 (mm)
- Default value: 0

2-9-8 Trigger channel

Sets the target output when the trigger for starting storage is set.

Storage starts once the selected output meets the necessary conditions.

- Options: Ch1 / Ch2 / Ch3 / Ch4
- Default value: Ch1

2-9-9 Start position

Specifies by how much the start of storage should be shifted when the start condition is satisfied.

The unit is the number of samplings.

- Positive value: Delays by the specified number of samplings and then starts storage. (Delay trigger)
- “0”: Starts storage the instant the condition is satisfied.
- Negative value: Backs up by the specified number of samplings and then starts storage. (Pre-trigger)
- Input range: ± 50000
- Default value: -300

2-9-10 Repeat

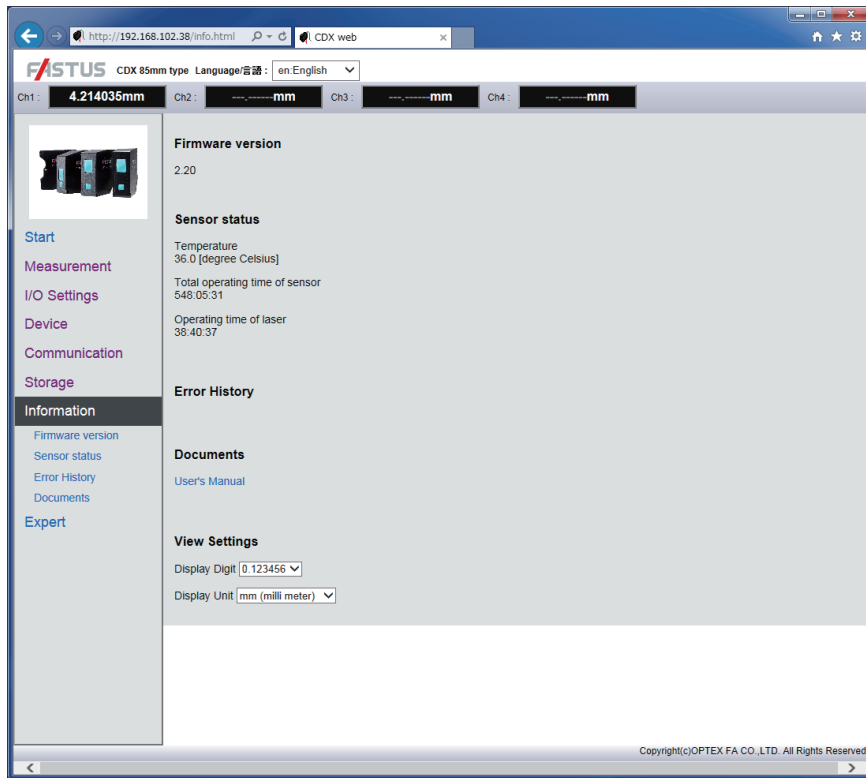
Sets the operation to perform after the storage operation has been performed for the number of data items set under “Quota.”

- OFF: Sets “Status” to “Stopped” after the storage operation completes.
- ON: Sets “Status” to “Trigger standby” after the storage operation completes.

MEMO

When “Repeat” is set to ON, the CDX Series will resume storage operation immediately if the trigger conditions are met after the storage operation has finished.

2-10 Information Screen



This screen allows the sensor head status to be checked.
The following items cannot be written.

2-10-1 Sensor information

Displays the sensor head status.

- **Firmware version:** Displays the version of the unit firmware.
- **Temperature:** Displays the internal temperature of the sensor head. [Unit: °C]
- **Sensor operating time:** Displays the total run time since the sensor was powered on. [Unit: Hour: Minute: Sec]
- **Laser operating time:** Displays the total ON time since the sensor was powered on. (Because the laser uses pulse illumination, the laser ON time will differ from the sensor run time.) [Unit: Hour: Minute: Sec]

2-10-2 Documents

Manuals and other material that can be used as references when using the sensor are available for download.

2-10-3 Error History

Saves and displays any abnormal sensor status including high temperatures outside specified range.

2-10-4 Display Settings

Allows display settings for measured values to be changed.

- No. of display digits: Sets the number of digits to display.
- Display unit: Selects the display unit for numbers from “mm” and “nm.”



3

Configuration of Settings When Using with CDA Series

The CDX Series can be connected to CDA Series displacement sensor amplifier units.

For details on CDA Series products, see the CDA Series user's manual.

This section explains CDX Series settings related to use of the CDA Series.

3-1 Connecting

Caution

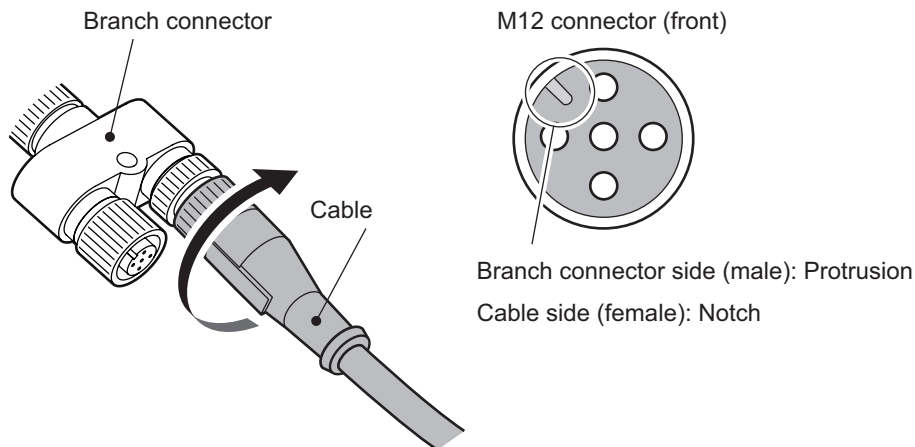
- CDX Series products do not support CC-link communication.
- Do not connect/disconnect CDA Series or CDX Series products when a power supply is connected. Connecting/disconnecting the device while the power is on may lead to malfunctions.

MEMO

To extend the cable, connect an extension cable (2 m type) between the cable and the CDA Series head connector.

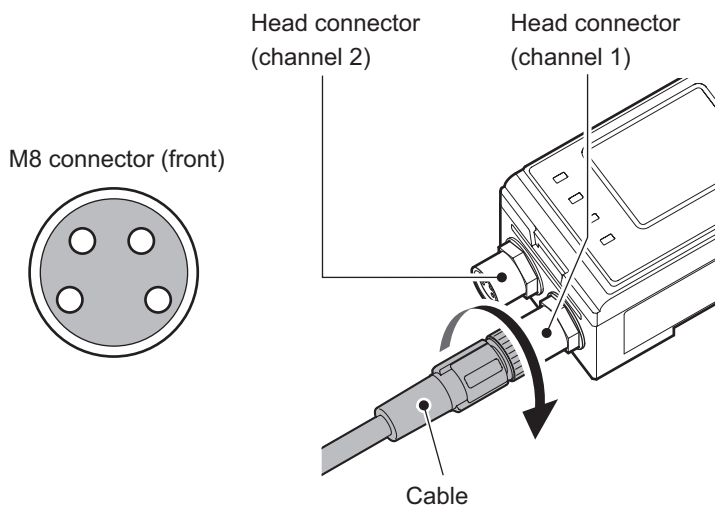
Follow the procedure shown below to connect the devices.

- 1** Connect the cable to the CDX Series branch connector, and then turn the connector to lock it in place.



Align the protrusion on the M12 connector with the notch to connect the cable.

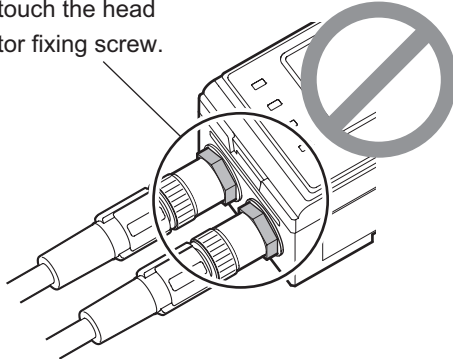
- 2** Connect the M8 connector of the cable to the CDA head connector, and then turn the connector to lock it in place.



Caution

- When connecting or removing, do not use tools to turn the CDA Series head's connector fixing screw. If this screw is removed, the CDA will need to be repaired.
- Avoid installing the CDA Series on a DIN rail while the CDA is connected to a cable. Doing so may apply unnecessary force to the cable.

Do not touch the head
connector fixing screw.



- 3** When power is supplied to the CDA Series, power is also supplied to the CDX Series. For details on wiring, please see the CDA Series user's manual.

3-2 List of Setting Items

Caution

CDX Series products do not support CC-link communication.

3-2-1 Measurement settings

The settings and parameters are listed here.

For details on individual settings, see "2 Web Settings Screen and Function Details" (Page 2-1).

Caution

- When using with a CDA Series device, some CDX Series settings cannot be checked/changed.
- Configurable/usable outputs are limited to Ch 1 in CDX Series products.

● Setting items

Item name	Selection / Input item
Sampling period	[12.5 μ s] [25 μ s] [50 μs] [100 μ s] [200 μ s] [500 μ s] [1000 μ s] [Auto]
Sampling — Crop (12.5 μ s)	[Near] [Center] [Far]
Sampling — Upper Limit	[25 μ s] [50 μ s] [100 μ s] [200 μ s] [500 μ s] [1000 μs]
Sampling — Lower Limit	[25 μs] [50 μ s] [100 μ s] [200 μ s] [500 μ s] [1000 μ s]
Process — Measure	[Displacement] [Thickness] [Velocity]
Process — Peak Numbering	[from Near] [from Far]
Process — Peak No.	[Peak 1] [Peak 2] [Peak 3] [Peak 4] [Peak 5] [Peak 6] [Peak 7] [Peak 8]
Process — Thickness — Peak No.	[Peak 1] [Peak 2] [Peak 3] [Peak 4] [Peak 5] [Peak 6] [Peak 7] [Peak 8]
Process — Median	[Off] [7] [15] [31]
Process — Moving Average	[1] [2] [4] [8] [16] [32] [64] [128] [256] [512] [1024] [2048] [4096] [8192] [16384] [32768] [65536]
Process — Edge Measureing	[0000] (0000 to 100,000)
Process — Hold	[Off] [Peak] [Bottom] [Sample Hold] [Auto Peak] [Auto Bottom]

* The default value is shown in bold.

● Output

Item name	Selection / Input item
Output — Upper Limit	[+2.00] (85 mm type) [+4.00] (150 mm type) (–99.99 to +99.99) [mm]
Output — Lower Limit	[–2.00] (85 mm type) [–4.00] (150 mm type) (–99.99 to +99.99) [mm]
Output — Span value	[+1.000] (–2.000 to +2.000)
Output — Offset value	[0.000 μm] (–2147483.647 to +2147483.647)
Output — Hysteresis	[+0.000] (–2000 to +2000) [mm]
Output — ON Delay	[0] (0 to 9999) [ms]
Output — OFF Delay	[0] (0 to 9999) [ms]
Output — One shot	[Off] [On]
Alarm — Direction	[Clamp] [Hold] [Delayed Clamp]
Alarm — Alarm Delay	[0] (0 to 4095)
Alarm — Alarm Recovery	[0] (0 to 4095)

* The default value is shown in bold.

● Device

Item name	Selection / Input item
Device — Mounting	[Diffuse] [Specular]
Device — Direction	[Near+] [Far+]
Device — Factory Reset	[Cancel] [Execute]
Device — External Input	[Laser Off] [Offset] [Hold] [Storage]
Device — Laser	[Enable] [Disabled]

* The default value is shown in bold.

Caution

When using the external input terminal, set [External Input Selection] under [Amplifier Settings] → [I/O Settings] to [Laser Off].

3-2-2 Initializing settings

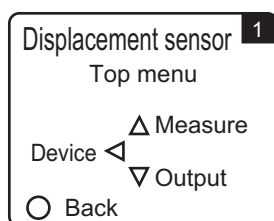
Follow the procedure shown below to initialize the CDX Series settings with CDA Series operations. When performing initialization, all the CDX Series settings are returned to their default values.

MEMO

- There is no message or other confirmation when you execute the initialization. Exercise caution when initializing the settings.
- All of the settings—including those not accessible/configurable with the CDA Series—are initialized.

- 1 On the basic screen, press [△] or [▽] to select [Channel 1] or [Channel 2], and then press [A].**

The sensor settings top menu for the selected channel is displayed.



- 2 Press [◀].**

The display switches to the [Device Settings] menu.

- 3 Use [◀] or [▶] to switch to the [Factory Reset] screen.**



- 4 Use [△] or [▽] to select [◻INIT].**

To initialize the settings, press [A] while [◻INIT] is displayed.

Press (B) to cancel the initialization and return to the sensor settings top menu.



4

Ethernet Communication

Using Ethernet communication, CDX Series products allow users to obtain measurements and to check or change settings.

This section explains the communication specifications and the details for various commands.

4-1 Communication Specifications



This section explains the specifications for Ethernet communication performed through commands.

Protocol	TCP/UDP (multicast, broadcast)
Port number	5011
Byte order	Big endian



4-2 List of Commands for Reading/Writing Settings/Measured Values

Reading of measured values and reading/writing of various settings are performed in the following format.

■ Read

- Sent command

30	02	Command (2 bytes)
----	----	-------------------

- Reply command

B0	04	Reply (4 bytes)
----	----	-----------------

■ Writing

- Sent command

40	02	Command (2 bytes)	00	04	Write data (4 bytes)
----	----	-------------------	----	----	----------------------

- Reply command

C0	00
----	----

All data is read/write in units of 4 bytes.

Items with only 1 byte listed in the table as the selectable item will be appended with “0” in all of the higher bit positions.

Ex. 1: Acquiring measured values

- Sent command

$0x30020D60$

- Reply command

$0x0012D687 = 1234567 \rightarrow 1.234567$ [mm]

$0xFFF85EE0 = -500000 \rightarrow -0.5$ [mm]

*The unit for measured values is nm.

Ex. 2: Changing the sampling period to 100 μ s

- Sent command

$0x4000C10000400000003$

* Write data will change from $0x03$ to $0x00000003$ with “0” added as the higher bytes to form a 4-bit expression.

The same format is used for replies during reading.

- Reply command

$0xC000$

Legend table

Class	Command	Name	Parameter	Note
R/W	0x0C10	Sampling period	0x00: 12.5	Unit: μ sec

R: Read only
 R/W: Read/write possible

Command name
 Command (2 bytes, hexadecimal form)
 Individual parameters, formats, or initial values for a command
 Supplementary explanation (if applicable)

4-2-1 Acquiring measured results

■ Sensor status/measurement result

Class	Command	Name	Parameter	Note
R	0x0DA0	Channel 1 output status	*1	
R	0x0DA4	Channel 2 output status	*1	
R	0x0DA8	Channel 3 output status	*1	
R	0x0DAC	Channel 4 output status	*1	
R	0x01F4	Sensor status output	*2	

*1: Explanation of bits

32	...	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	◀ Bit
(Not used)	...	(Not used)	(Not used)	(Not used)	(Not used)	(Not used)	HI output	GO output	LO output	(Not used)	(Not used)	Hold ON	Zero set ON	(Not used)	ON when measurement is not possible	Control input/output status (ON/OFF)	Channel usage	

*2: Explanation of bits

32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	◀ Bit
(Not used)	ON when the laser is emitted	ON when storage file area is full	ON when precision timesync is in operation	On for alarm status	(Not used)	(Not used)	Input terminal status	(Not used)	(Not used)	(Not used)	(Not used)	Ch4 control input/output	Ch3 control input/output	Ch2 control input/output	Ch1 control input/output	(Not used)	(Not used)	(Not used)	(Not used)	(Not used)	Ch1 HI output	Ch1 GO output	Ch1 LO output	(Not used)	(Not used)	Ch1 hold ON	Ch1 zero set ON	(Not used)	ON when measurement for Ch1 is not possible	Ch1 control input/output status (ON/OFF) (Usually ON)		

■ Measurement value

Class	Command	Name	Parameter	Note
R	0x0D60	Channel output 1 — Measurement value		
R	0x0D64	Channel output 2 — Measurement value		
R	0x0D68	Channel output 3 — Measurement value		
R	0x0D6C	Channel output 4 — Measurement value		

4-2-2 Checking/writing settings

■ Measurement

Class	Command	Name	Parameter	Note
R/W	0x0C10	Sampling period	0x00: 12.5 0x01: 25 0x02: 50 0x03: 100 0x04: 200 0x05: 500 0x06: 1000 0x07: Auto	Unit: μ sec
R/W	0x0C28	Measurement range (with sampling at 12.5 μ s)	0x00: Near 0x01: Center 0x02: Far	
R/W	0x0C14	Upper Limit	0x01: 25 0x02: 50 0x03: 100 0x04: 200 0x05: 500 0x06: 1000	
R/W	0x0C18	Lower Limit	0x01: 25 0x02: 50 0x03: 100 0x04: 200 0x05: 500 0x06: 1000	
R/W	0x0CA8	Synchronization mode	0x00: None 0x01: Synchronous 0x02: Anti interfere1 0x03: Anti interfere2	
R/W	0x0C48	Detection order	0x00: Near 0x01: Far	

■ Light distribution and Mask settings

Class	Command	Name	Parameter	Note
R/W	0x0C44	Waveform mask ON/OFF	0x00: OFF 0x01: ON	
R	0x0D14	Peak position 1 of received light waveform	[0000000000]	Side closest to the sensor head [Received light waveform data number]
R	0x0D18	Peak position 2 of received light waveform		[Received light waveform data number]
R	0x0D1C	Peak position 3 of received light waveform		[Received light waveform data number]
R	0x0D20	Peak position 4 of received light waveform		[Received light waveform data number]
R	0x0D24	Peak position 5 of received light waveform		[Received light waveform data number]
R	0x0D28	Peak position 6 of received light waveform		[Received light waveform data number]
R	0x0D2C	Peak position 7 of received light waveform		[Received light waveform data number]
R	0x0D30	Peak position 8 of received light waveform		Side farthest away from the sensor head [Received light waveform data number]
R/W	0x0C60	Mask start position (1)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C64	Mask end position (1)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C68	Mask start position (2)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C6C	Mask end position (2)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C70	Mask start position (3)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C74	Mask end position (3)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C78	Mask start position (4)	(Numeric input)	[Received light waveform data number (1 to 511)]
R/W	0x0C7C	Mask end position (4)	(Numeric input)	[Received light waveform data number (1 to 511)]

■ Input setting

Class	Command	Name	Parameter	Note
R/W	0x0C90	Polarity	0x00: N.O. 0x01: N.C.	
R/W	0x0C98	Action	0x00: None 0x01: Laser Off 0x02: Hold/Reset 0x03: Storage Start 0x04: Offset	
R/W	0x0C94	Debouncing	[0x0000000000] (0000000.000 μsec)	Unit: μsec

■ Measurement/output settings (settings per output)

Class	Command				Name	Parameter:	Note
	Ch1	Ch2	Ch3	Ch4			
R/W	(Always ON)	0x0280	0x0300	0x0380	Channel usage	0x00: Not used 0x01: Use	
R/W	0x0204	0x0284	0x0304	0x0384	Measurement method	0x00: Distance 0x01: Thickness 0x02: Velocity	
R/W	0x0208	0x0288	0x0308	0x0388	Peak number	0x00: No. 1 peak to 0x07: No. 8 peak	
R/W	0x020C	0x028C	0x030C	0x038C	Thickness peak No.	0x00: No. 1 peak to 0x07: No. 8 peak	
R/W	0x0210	0x0290	0x0310	0x0390	Median filter	0x00: Not used 0x07: 7 0x15: 15 0x31: 31	
R/W	0x0214	0x0294	0x0314	0x0394	Moving average	[1000000]	
R/W	0x0270	0x0350	0x0370	0x0450	Edge measurement	(Numeric input)	Unit: Number
R/W	0x022C	0x030C	0x032C	0x040C	Hold mode	0x00: Normal 0x01: Peak 0x02: Bottom 0x03: Sample Hold 0x04: Auto Peak 0x05: Auto Bottom	
R/W	0x0238	0x0318	0x0338	0x0418	Hold operation	0x00: None 0x01: Hold ON 0x02: Hold OFF 0x03: Hold reset	Execute the hold operation.
R/W	0x0244	0x0324	0x0344	0x0424	Measurement value upper threshold	(Numeric input)	Unit: mm
R/W	0x0248	0x0328	0x0348	0x0428	Measurement value lower threshold	(Numeric input)	Unit: mm
R/W	0x024C	0x032C	0x034C	0x042C	Hysteresis	(Numeric input)	Unit: mm
R/W	0x0220	0x0300	0x0320	0x0400	Offset value	(Numeric input)	Unit: mm
R/W	0x0224	0x0304	0x0324	0x0404	Span value (multiplication)	(Numeric input)	
R/W	0x0228	0x0308	0x0328	0x0408	Offset value (to be added)	(Numeric input)	Unit: mm
R/W	0x0230	0x0310	0x0330	0x0410	Span teaching	(Numeric input)	Span teaching reference value Unit: mm
R/W	0x0234	0x0314	0x0334	0x0414	Executing teaching	0x00: None 0x01: Execute offset 0x02: Clear offset 0x03: Span teaching	Displays the data processing status.
R/W	0x0254	0x0334	0x0354	0x0434	One shot	0x00: OFF 0x01: ON	
R/W	0x0258	0x0338	0x0358	0x0438	ON delay time	(Numeric input)	Unit: μsec
R/W	0x025C	0x033C	0x035C	0x043C	OFF delay time	(Numeric input)	Unit: μsec

Class	Command				Name	Parameter:	Note
	Ch1	Ch2	Ch3	Ch4			
R/W	0x0260	0x0340	0x0360	0x0440	Alarm	0x00: Clamp 0x01: Hold 0x02: Delay clamp	
R/W	0x0264	0x0344	0x0364	0x0444	Clamp value at alarm detection	(Numeric input)	Unit: mm
R/W	0x0268	0x0348	0x0368	0x0448	Number of alarm delay measurements	(Numeric input)	Unit: Number of samplings
R/W	0x026C	0x034C	0x036C	0x044C	Alarm recovery	(Numeric input)	Unit: Number of samplings

■ Device settings

Class	Command	Name	Parameter	Note
R/W	0x0CA0	Mounting	0x00: Diffuse 0x01: Specular	
R/W	0x0CA4	Direction	0x00: Near+ 0x01: Far+	
R/W	0x0C40	Laser On/Off	0x00: ON 0x01: OFF	
R	0x012C	Current time	(Time)	
R	0x0100	Boot time	(Time)	
R/W	0x0030	Sensor time	(Time)	
W	0x004C	*(Changing the time setting)	0x0980	Sending this command overwrites the time in "Sensor time" with the current time.
W	0x004C	Factory Reset	0x0999	Sending this command returns all settings (excluding Ethernet communication settings) to the factory defaults.

■ Communication

Class	Command	Name	Parameter	Note
R/W	0x0CB0	Input terminal setting	0x00: External Input 0x01: CDA	
R	0x0018	MAC Address (first 6 bytes)		
R/W	0x0010	IP address		Setting the IP address to "0.0.0.0" will initiate DHCP mode and automatically acquire the IP address.
R/W	0x0020	Subnet mask		
R/W	0x0024	Default gateway		
R/W	0x0CBC	Precision Timesync	0x00: OFF 0x01: Slave 0x02: Master	

4-2-3 Storage setting

Class	Command	Name	Parameter	Note
R/W	0x0CC0	Storage control	0x00: Stop 0x01: Start 0x02: Force stop	
R/W	0x0CC4	Storage status	0x00: Stopped 0x01: Waiting 0x02: Trigger standby 0x03: Operating 0x04: Operation complete	
R/W	0x0CD0	Quota	(Number of data items)	
R/W	0x0CD4	Rate	(Number of data items)	
R/W	0x0CDC	Start condition	0x00: Immediate 0x01: Alarm Off edge 0x02: Alarm On edge 0x03: Threshold Up edge 0x04: Threshold Down edge 0x05: Threshold Both edge	
R/W	0x0CE4	Threshold	(Measured value)	Unit: μm
R/W	0x0CE0	Trigger channel	0x00: Ch1 0x01: Ch2 0x02: Ch3 0x03: Ch4	
R/W	0x0CE8	Start position	(Number of samplings)	
R/W	0x0CD8	Repeat	0x00: OFF 0x01: ON	
R	0x0110	File system free space	(Numerical value)	Unit: KB
R	0x0114	File system capacity	(Numerical value)	Unit: KB

4-2-4 Information

Class	Command	Name	Parameter	Note
R	0x0004	Firmware version		
R	0x0008	Software version		
R	0x0120	Temperature		Unit: °C
R	0x0124	Total operating time of sensor		Unit: sec
R	0x0128	Operating time of laser		

4-3 Acquiring Measured Values with Time Data

When measuring thickness, controlling feedback, or performing similar operations, the measurement results of the CDX Series are used when highly accurate time is necessary.

When this command is used, the CDX Series attaches the timestamp to the measured value and then outputs the value.

- Sent command

30	06	00	00	01	F0	00	0C
----	----	----	----	----	----	----	----

- Reply command

B0	0C	Measurement value (4 bytes)	Sensor status/measurement result (4 bytes)	Timestamp (4 bytes)
----	----	--------------------------------	---	------------------------

The sensor status and measurement formats are the same as “4-2-1 Acquiring measured results”(Page 4-4).

A value between 0 and 999999999 (nsec) is used as the timestamp, which counts down one second at a time to 0. Checking this value allows the user to understand the measurement timing and order of measurement data acquired through communication.

4-4 Obtaining Received Light Waveforms and Configuring Mask Settings

Received waveforms can be obtained with the following commands.

The data includes continuously output received light amounts from each point in order starting from close to the sensor head.

■ Read

- Sent command

30	06	00	00	04	00	04	00
----	----	----	----	----	----	----	----

- Reply command

B4	00	Received light amount 1 (2 bytes)	Received light amount 2 (2 bytes)	Received light amount 511 (2 bytes)	Received light amount 512 (2 bytes)
----	----	-----------------------------------	-----------------------------------	-------	-------------------------------------	-------------------------------------

* Received light amount data is output in order from the first point (closest to the sensor head) to the 512th point (farthest from the sensor head).

4-5 Setting/Reading Individual Sensor Descriptions

CDX Series products allow for writing and reading of individual descriptions. Descriptions are limited to 30 bytes of characters.

■ Read

- Sent command

30	06	00	00	01	60	00	1E
----	----	----	----	----	----	----	----

- Reply command

B4	00	Individual sensor description (30 bytes)					
----	----	--	--	--	--	--	--

■ Writing

- Sent command

40	02	01	60	00	1E	Write data (30 bytes)	
----	----	----	----	----	----	-----------------------	--

- Reply command

C0	00
----	----

4-6 Error Messages

The CDX will send an error in the following format when an error occurs.

- Reply command

E0	02	Error details
----	----	---------------

Error name	Error details	Details
Command error	0x00E1	A command that does not exist was specified.
Address error	0x00E2	The specified address is out of range.
Overflow	0x00E9	Reply data overflow



Specifications

The following shows the specifications, characteristics, and dimensions of CDX Series products.

5-1 Specifications

Model	CDX-85	CDX-W85	CDX-150	CDX-W150
Measurement range	With diffuse reflection installation: 85 ±20 mm With specular reflection installation: 81.5 ±10.0 mm		With diffuse reflection installation: 150 ±40 mm	
Light source	Red laser, wavelength: 655 nm, max. output: 0.39 mW			
Laser class	IEC/JIS CLASS 1			
Spot size*1	∅70 μm	70 × 2000 μm	∅120 μm	120 × 4000 μm
Linearity	Diffuse mode: [Measurement range] 65 to 85mm: ±0.018% of F.S. (±7.2μm) [Measurement range] 85 to 105 mm: ±0.03% of F.S. (±12.0 μm) Specular mode: ±0.03% of F.S. (±6.0 μm)	Diffuse mode: ±0.015% of F.S. (±6.0 μm) Specular mode: ±0.03% of F.S. (±6.0 μm)	Diffuse mode: [Measurement range] 110 to 150 mm: ±0.03% of F.S. (±24 μm) [Measurement range] 150 to 190 mm: ±0.04% of F.S. (±32 μm)	Diffuse mode: ±0.015% of F.S. (±12.0 μm)
Resolution*2	0.1 μm		0.2 μm	
Repeatability*3	0.1 μm		0.2 μm	
Sampling period	12.5 μs/25 μs/50 μs/100 μs/200 μs/500 μs/1 ms / Auto			
Temperature drift	±0.01% FS/°C (at -10 to +40°C), ±0.03% FS/°C (at +40 to +50°C)			
Indicators	Link indicator (green) / Power indicator (orange/green/blue/red)			
External input	Laser OFF, Hold/Reset, Storage start, Offset			
Communication interface	Ethernet (100BaseTX)			
Power supply voltage	12 to 24 VDC (±10%; including ripple)			
Current consumption	180 mA (with 24 V supply)			
Protection category	IP67 (incl. connector)			
Ambient temperature/ humidity	-10 to +50°C / 35 to 85% RH (no condensation or freezing)			
Storage temperature/ humidity	-20 to +60°C / 35 to 85% RH (no condensation or freezing)			
Ambient illuminance	Incandescent light: 3,000 lx or less, Fluorescent light: 10000 lx or less			
Vibration resistance	10 to 55 Hz; Double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions			
Shock resistance	50 G (500 m/s ²), 3 times in each of the X, Y, and Z directions			
Material	Main unit: Aluminum die cast, Emitting window: Glass			
Weight	Approx. 280 g			

<Measurement Conditions>

Unless specifically designated, specifications are based on the following measurement conditions.

Ambient temperature: 25°C (room temperature), Power supply voltage: 24 VDC, Sampling period: 25 μs, Moving average: 256, Median filter: 31, Center of measurement range, Standard target measurement object (specular reflection: Aluminum vapor deposition mirror, Diffuse reflection: Visible light shielding ceramic)

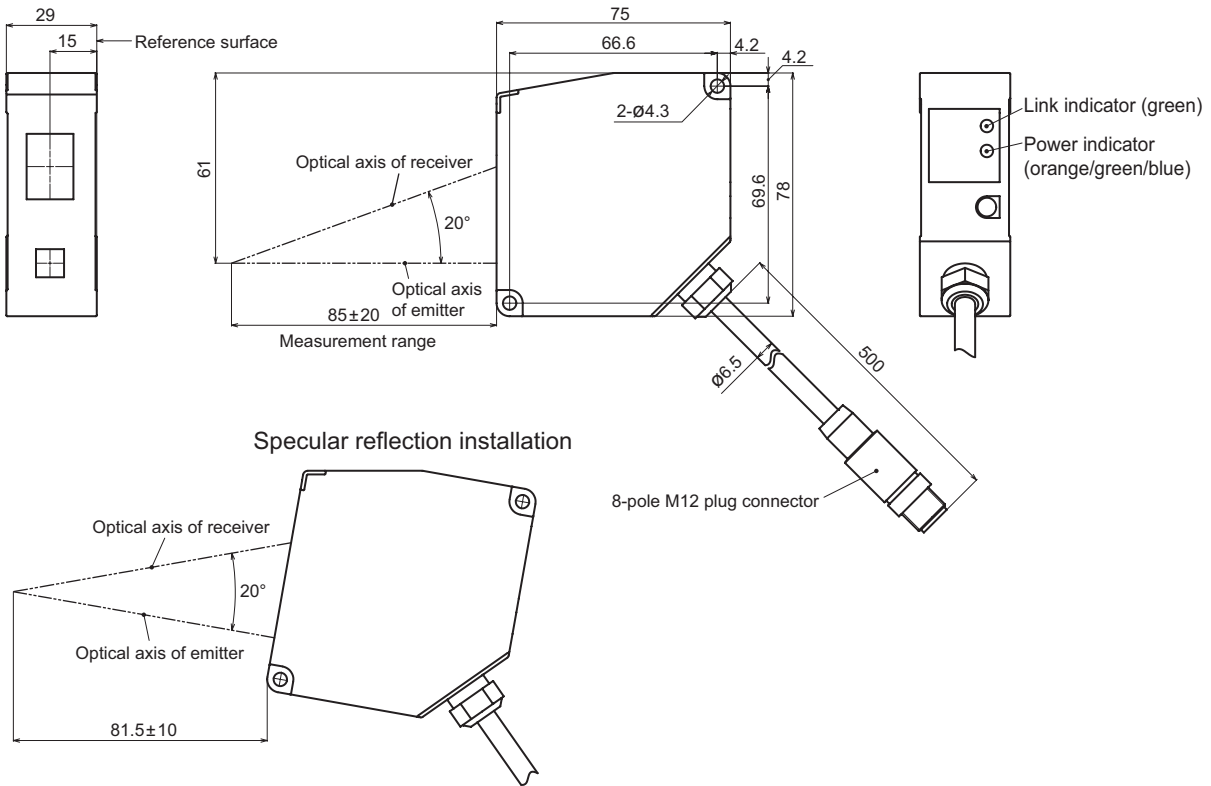
*1: Center strength of 1/e² (13.5%) at the center of measurement range. There may be leak light other than the specified spot size. The sensor may be affected when there is a highly reflective object close to the detection area.

*2: The smallest determinable step when changing the distance between the sensor and the target one step at a time (number of times to perform moving average: 65536).

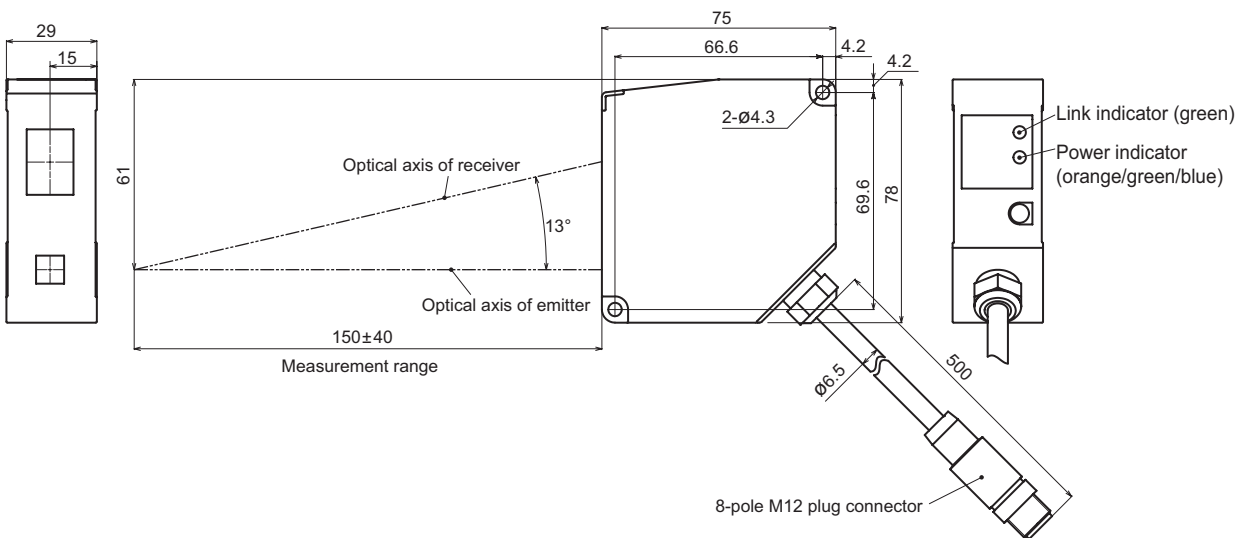
*3: Peak-to-peak value for measurements when measured while stationary (number of times to perform moving average: 65536).

5-2 Dimensions

85 mm type



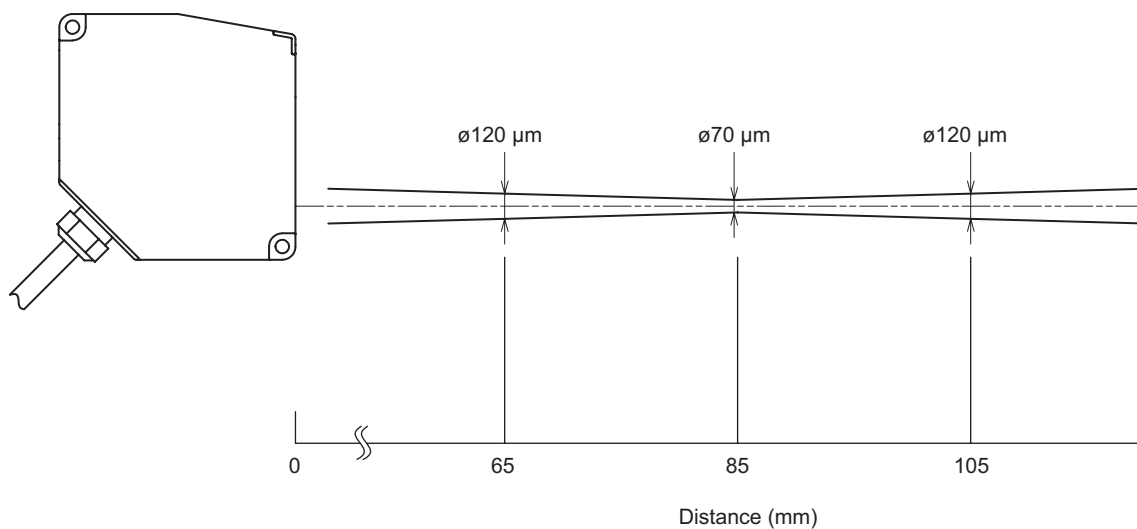
150 mm type



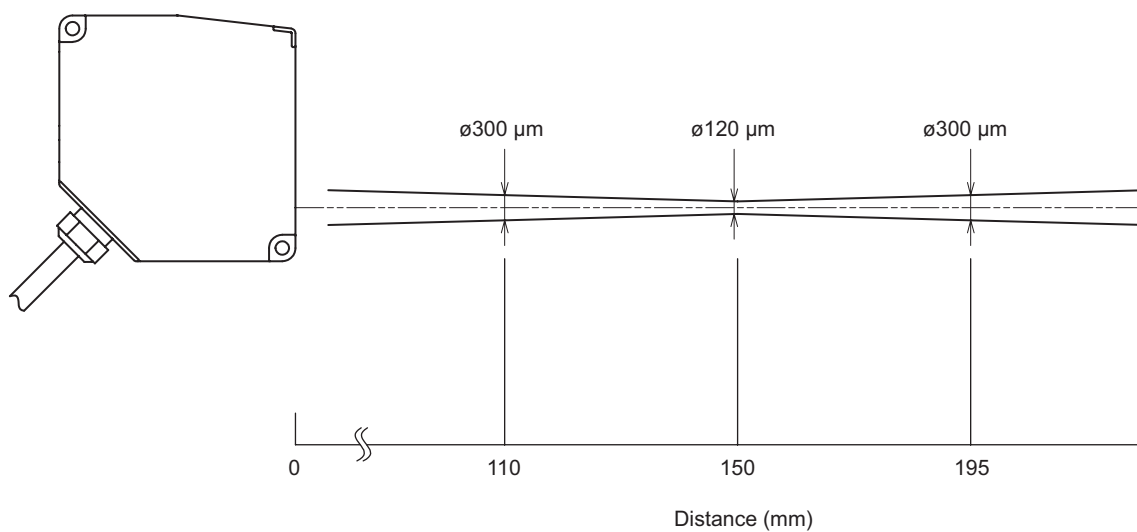
5-3 Characteristics

5-3-1 Spot size

■ 85 mm type

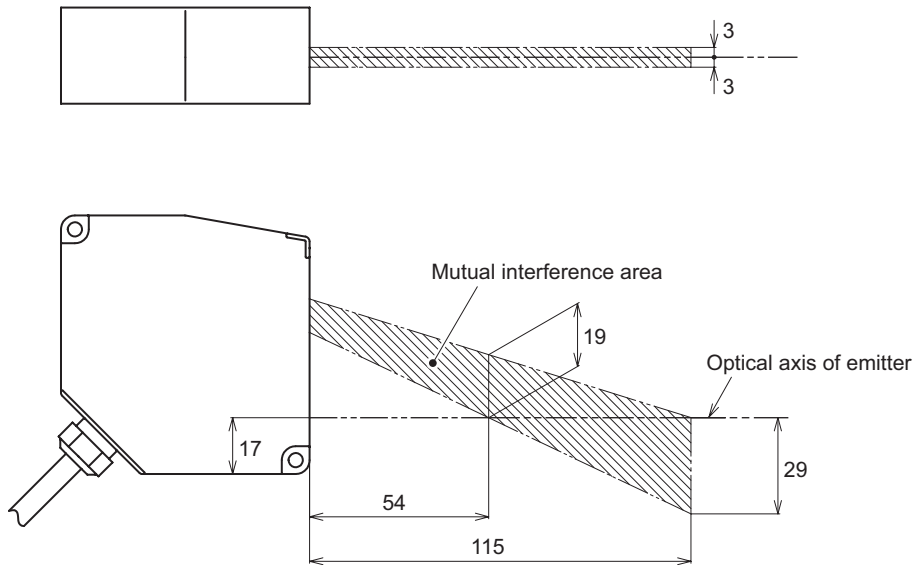


■ 150 mm type

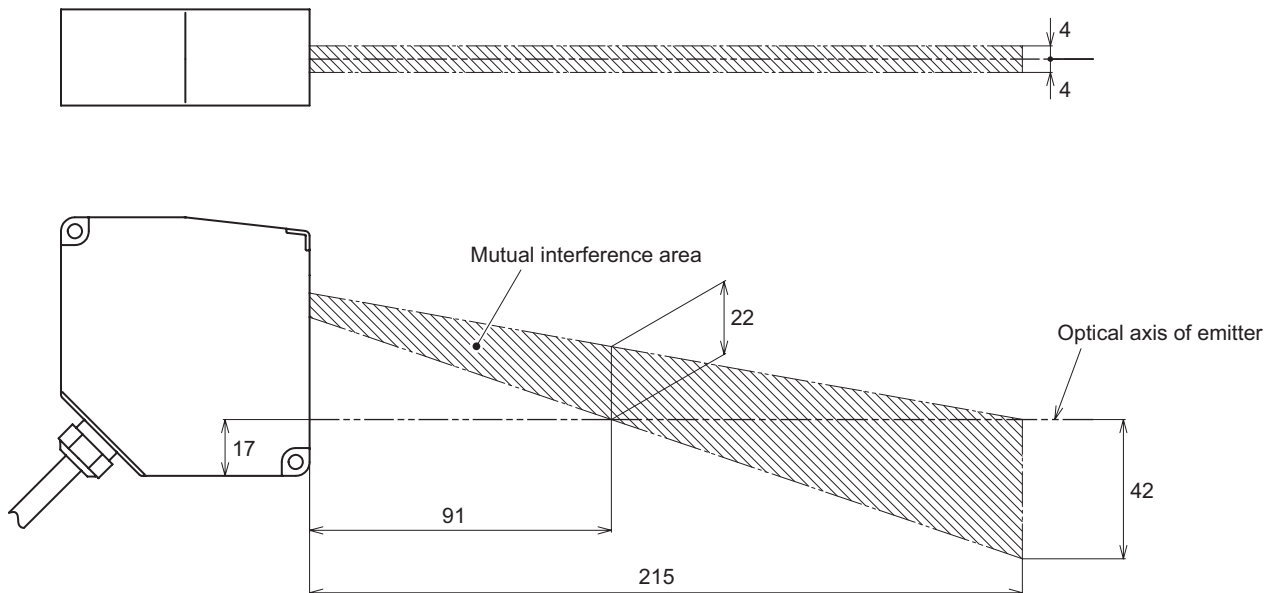


5-3-2 Mutual interference diagram

■ 85 mm type

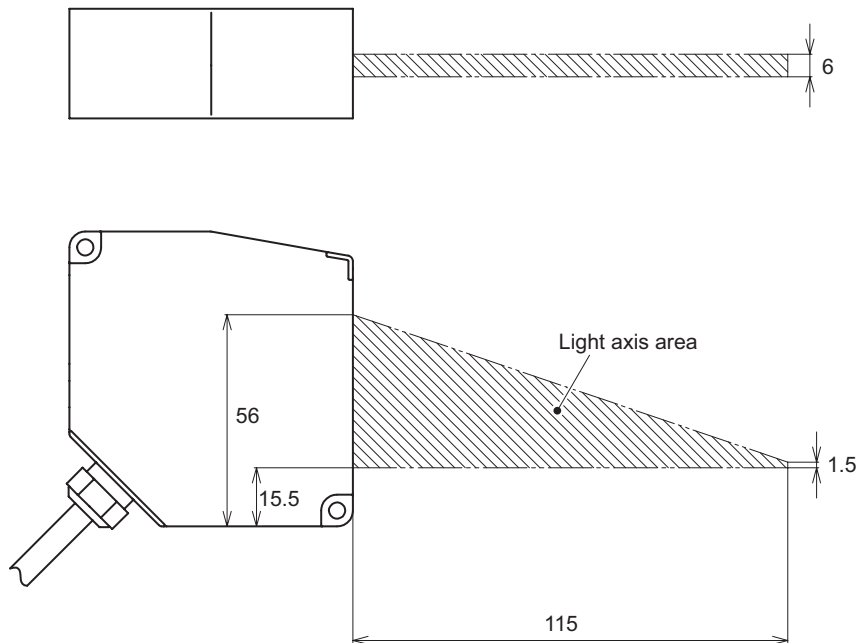


■ 150 mm type

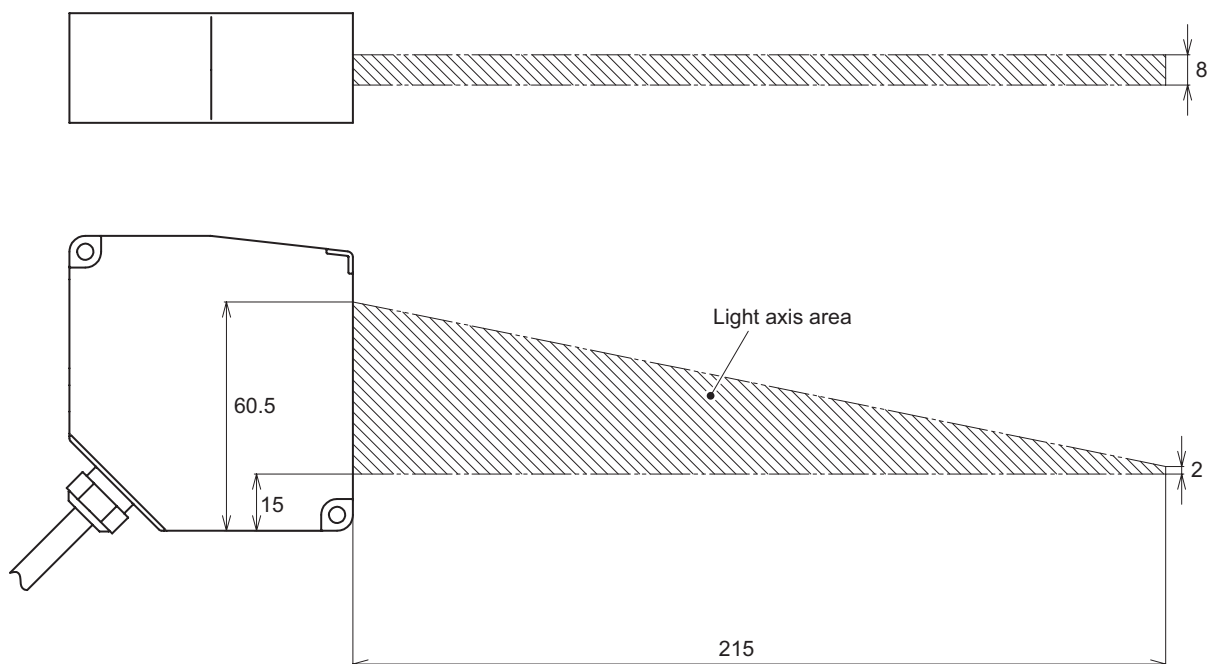


5-3-3 Light axis area

■ 85 mm type



■ 150 mm type



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Attention: Not to be Used for Personnel Protection.

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death. These sensors do not include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Please consult our distributors about safety products which meet OSHA, ANSI and IEC standards for personnel protection.

- Specifications are subject to change without prior notice.
- Specifications and technical information not mentioned here are written in Instruction Manual. Or visit our website for details.
- All the warnings and cautions to know prior to use are given in Instruction Manual.



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