



Good Thinking, Good Future

*FASTUS is a product brand of Optex FA.

General-purpose amplifier unit
CDA series

User's manual

Compatible sensor

- Small displacement sensor with digital display CD22 series

OPTEX FA CO., LTD.

Thank you for purchasing the CDA series general-purpose amplifier unit. The CDA series is a general-purpose amplifier unit that can connect to up to two sensors. You can change the settings of the connected sensors from the CDA. You can also perform level difference and thickness measurements with minimal settings by using the CDA in combination with two displacement sensors.

This manual contains the information necessary for using the CDA series and the CD22 series small displacement sensor with digital display connected to the CDA.

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.

Safety Precautions

In order to use this product safely, be sure to follow the safety precautions included in the instruction manual included with each device.

Related Manuals

The related manuals are shown below. Read the related manuals together with this one.

Manual name	Document number	Details
General-purpose amplifier unit CDA series Instruction manual	0800230	This is the instruction manual included with the general-purpose amplifier unit CDA series.
Small displacement sensor with digital display CD22 series Instruction manual	0568212	This is the instruction manual included with the small displacement sensor with digital display CD22 series (the model that supports RS-485 communication). Read this manual when connecting the CDA series to the CD22 series.
CC-Link through unit UC1-CL11 User's manual	UC1-CL11_UM-00■*1	This is the user's manual for the CC-Link through unit UC1-CL11. Read this manual when using the CDA as a relay to connect the compatible sensor to the UC1-CL11 and performing operations over a CC-Link network.

*1 The mark "■" indicates the revision number of the user's manual.

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

Abbreviations

Unless otherwise specified, the abbreviations shown below have the following meanings in this manual.

Abbreviation	Details
CDA	This indicates the general-purpose amplifier unit CDA series (CDA-□: "□" is "M" or "S").
CD22	This indicates the small displacement sensor with digital display CD22 series (CD22-□□□-485M12: "□□□" is "15," "35," or "100").
Compatible sensor	This indicates a sensor (such as the CD22) that supports connections with the CDA.



Manual Composition

This manual is composed of the following details.

1. Connection and Basic Operations	This chapter explains how to connect the CDA to the compatible sensor. It also explains how to configure the settings of the CDA and the compatible sensor from the CDA's operation interface.
2. CDA Settings	This chapter explains the CDA settings such as thickness measurements and level difference measurements.
3. Compatible Sensor Settings	This chapter explains teaching and other ways to configure the settings of the compatible sensor from the CDA.
4. Appendix	The appendix contains information, such as troubleshooting, that is useful to know during operation.

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1

Connection and Basic Operations

This chapter explains how to connect the CDA to the compatible sensor. It also explains how to configure the settings of the CDA and the compatible sensor from the CDA's operation interface.

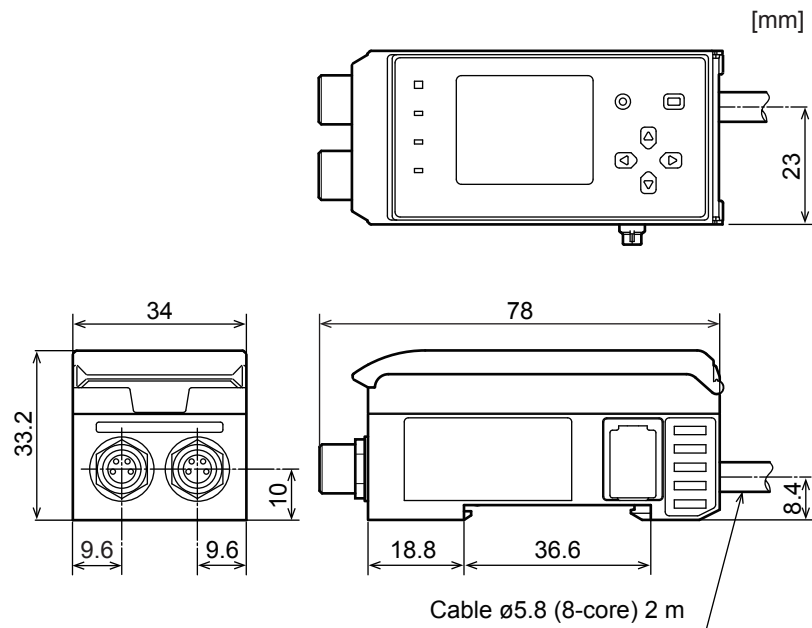
1-1 Specifications

1-1-1 Specifications

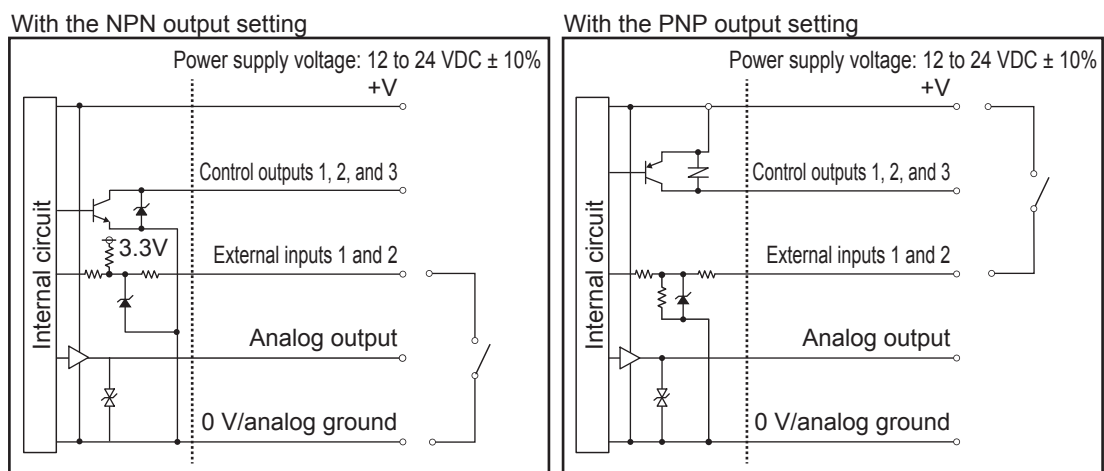
The CDA specifications are shown below. For the specifications of the compatible sensor, see its instruction manual.

Model		CDA-M (master)	CDA-S (slave)
Mounting method		DIN rail installation	
Sensor head	Max. number of connections	2	
	Connector	M8, 4-pin connector	
Display	Display panel	128 × 96 pixels	
	Indicators	Power indicator (red/green), output indicator: orange	
Analog current output		4 to 20 mA, max. load resistance: 300 Ω	
I/O	Inputs	2	
	Outputs	NPN/PNP open collector, 3 24 VDC, 100 mA or less (residual voltage: 1.8 V or less)	
Rating	Power supply voltage	12 to 24 VDC including 10% ripple (p-p)	Supplied from the master
	Current consumption	100 mA or less (at 12 V)	
Environmental resistance	Protection circuit	Reverse connection protection	
	Protection category	IEC standard, IP50	
	Operating temperature/humidity	-20 to +50°C (no freezing)/35 to 85%RH (no condensation)	
	Storage temperature/humidity	-20 to +60°C (no freezing)/35 to 85%RH (no condensation)	
	Vibration resistance	10 to 55 Hz; amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions	
	Shock resistance	500 m/s; 3 times in each of the X, Y, and Z directions	
Material		PC	

1-1-2 Dimensions



1-1-3 I/O Circuit Diagrams



1-1-4 Cable

One of the following cables (sold separately) is required to connect the CDA to the compatible sensor.

Compatible sensor	Model	Specifications
CD22	DSL-1204-G02M	M12 to M8 cable (2 m)
	DSL-0804-G02M	M8 to M8 extension cable (2 m)
	DSL-0804-G05M	M8 to M8 extension cable (5 m)

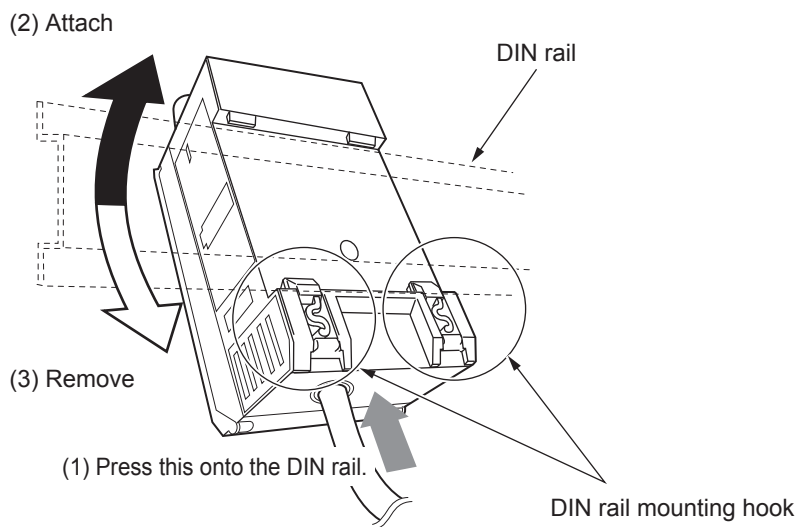
1-2 Installation and Linking

Install the CDA on a DIN rail. This section also explains how to link multiple CDAs together.

MEMO

- Ensure that the CDA is not connected to a power supply or to the compatible sensor before installing the CDA on or removing the CDA from a DIN rail.
- By linking a CDA with a UC1-CL11 on a DIN rail, you can operate the CDA and the compatible sensor that is connected to it over a CC-Link network. For details, see the UC1-CL11 user's manual.

- 1** Align the DIN rail mounting hooks at the bottom on the rear of the CDA with the bottom side of the DIN rail. While pushing the CDA in the direction of (1) to press it onto the DIN rail, push the top of the CDA onto the DIN rail in the direction of (2).

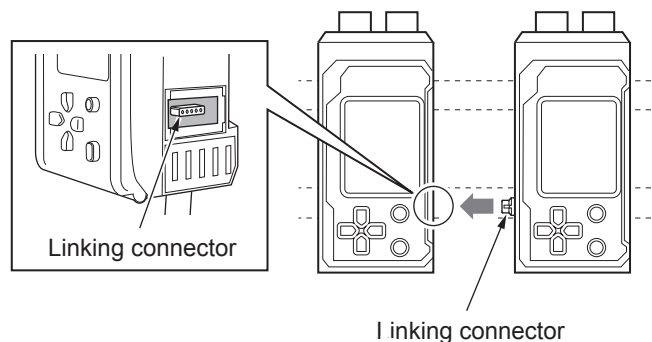


Check that the DIN rail mounting hooks are firmly locked and that the CDA is securely mounted on the DIN rail.

MEMO

To remove the CDA from the DIN rail, push the CDA in the direction of (1), and then push the top of the CDA off of the DIN rail in the direction of (3).

- 2** When linking together multiple CDAs, do so with them mounted on the DIN rail.



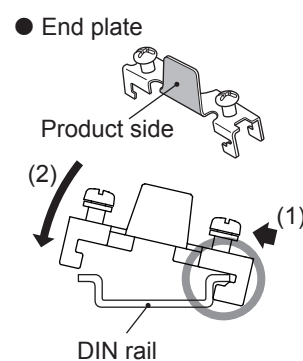
Caution

When linking the CDA with another unit (such as another CDA or a UC1-CL11) on a DIN rail, use the linking connectors to link the units together securely. If a linking connector is at an angle or is not firmly inserted all the way, the CDA or the other linked device may be damaged when the power is turned on.

3 To fix the units in place securely on the DIN rail, attach end plates (sold separately) to the DIN rail so that they surround the linked devices and fix the end plates in place with screws.

Orient the end plates on each end of the linked devices so that the product side of each end plates faces the units, which means the right and left end plates face the opposite direction. Catch the notch of the end plate onto the DIN rail in order to attach the end plate.

The tightening torque for the screws is 0.9 N•m or less.



1-3 Connecting the CDA and the Compatible Sensor

This section explains the procedure for connecting the CDA and the compatible sensor. The CD22 is used as an example in this section.

Caution

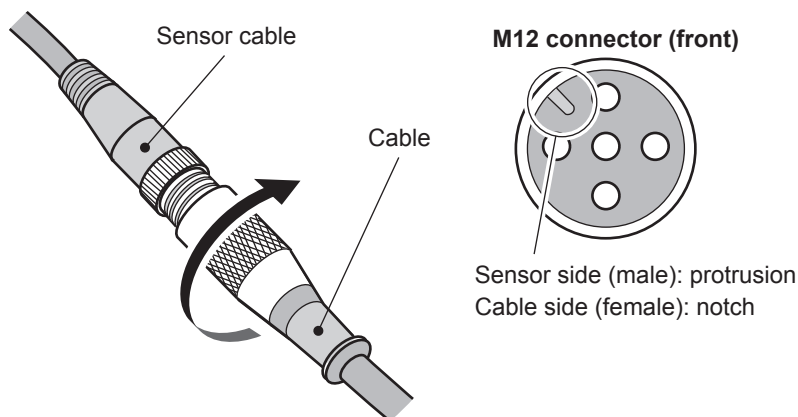
Do not connect/disconnect the CDA and the compatible sensor when a power supply is connected. Connecting/disconnecting the devices while the power is on may lead to malfunctions.

MEMO

If you need to extend the cable, connect an extension cable (2 m or 5 m type) between the cable and the CDA head connector.

Follow the procedure shown below to connect the devices.

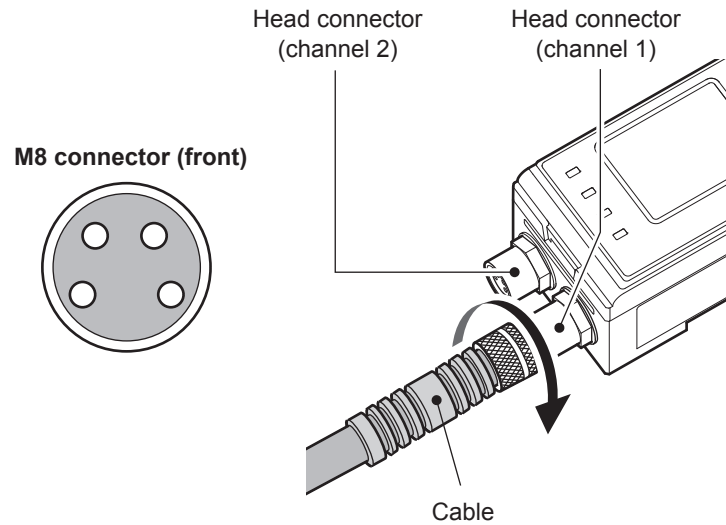
- 1** Connect the cable to the CD22, and then turn the connector on the cable side to lock it in place.



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

2 Connect the other connector (M8) of the cable connected to the CD22 to the CDA head connector, and then turn the connector on the cable side to lock it in place.

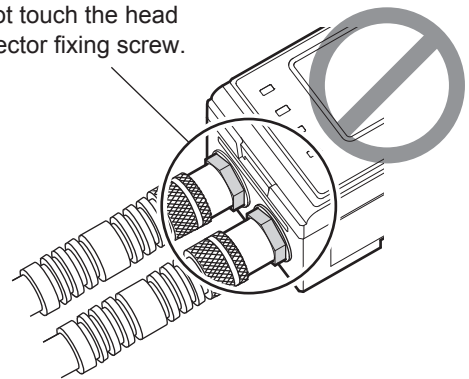
Check the orientation of the pins of the head connector of the channel that you are connecting to and of the M8 connector of the cable before establishing the connection.



Caution

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

Do not touch the head connector fixing screw.



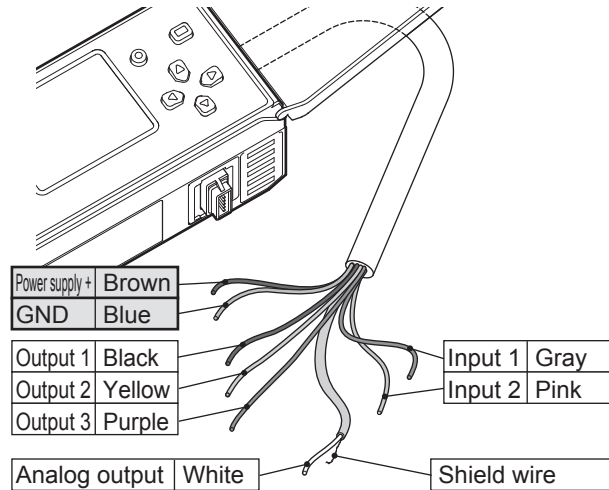
1-4 Wiring

1-4-1 Connecting the Power Supply

Connect the power supply to the CDA.

When you connect the power supply to the CDA, power is supplied to the sensor by way of the head connector.

- 1** Connect the specified power supply to the brown (power supply +) and blue (GND) wires.



Caution

- Before turning on the power, check that all the connections are complete. Also, turn the power supply off before performing wiring work such as switching and removing wires.
- When linking together multiple CDAs, you have to connect a power supply to each CDA as outlined above in order to supply power to the compatible sensors.

1-4-2 I/O Wiring

Connect the wires for external I/O to the CDA.

- 1 See "1-4-1 Connecting the Power Supply" (page 1-8) and connect the wires for external input.

Wire color	Details	Setting item
Gray	Input 1 (channel 1 external input)	[External Input Selection] under [AMP I/O Settings]
Pink	Input 2 (channel 2 external input)	
Black	Output 1	[OUT1 Source] under [AMP I/O Settings]
Yellow	Output 2	[OUT2 Source] under [AMP I/O Settings]
Brown	Output 3	[OUT3 Source] under [AMP I/O Settings]
White	Analog output	[Analog Output Source] under [AMP I/O Settings]

MEMO

- The function assigned to external input is common to channel 1 and channel 2. You cannot assign a different function to each channel.
- For the external I/O settings, see "2-1-2 I/O Settings" (page 2-4).

1-5 Operation Interface and Screen Composition

1-5-1 Settings the First Time the CDA Starts

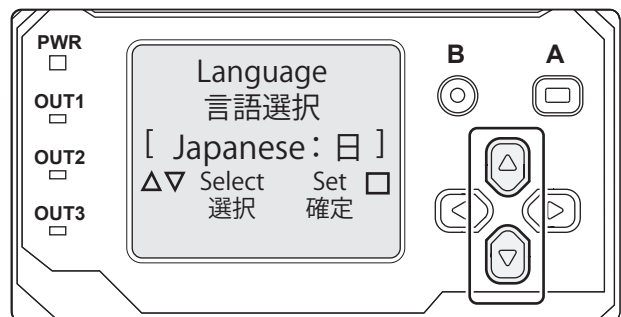
The first time that you turn on the CDA after you purchase it, a screen for setting the display language is displayed.

Follow the procedure shown here to set the display language.

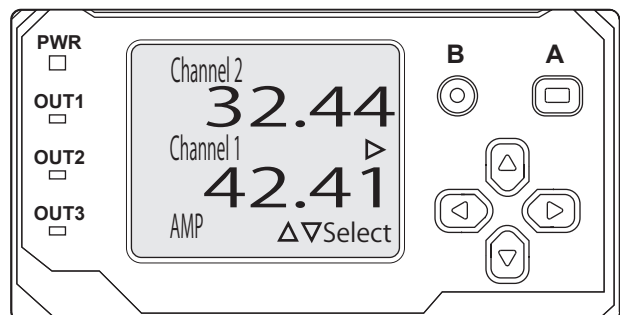
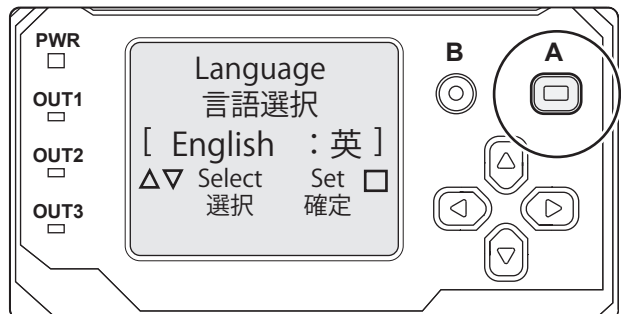
MEMO

You can change the display language later from the CDA's [AMP EXP Settings] menu.

- 1 Use **(A)** or **(V)** to select [Japanese: 日] or [English: 英].

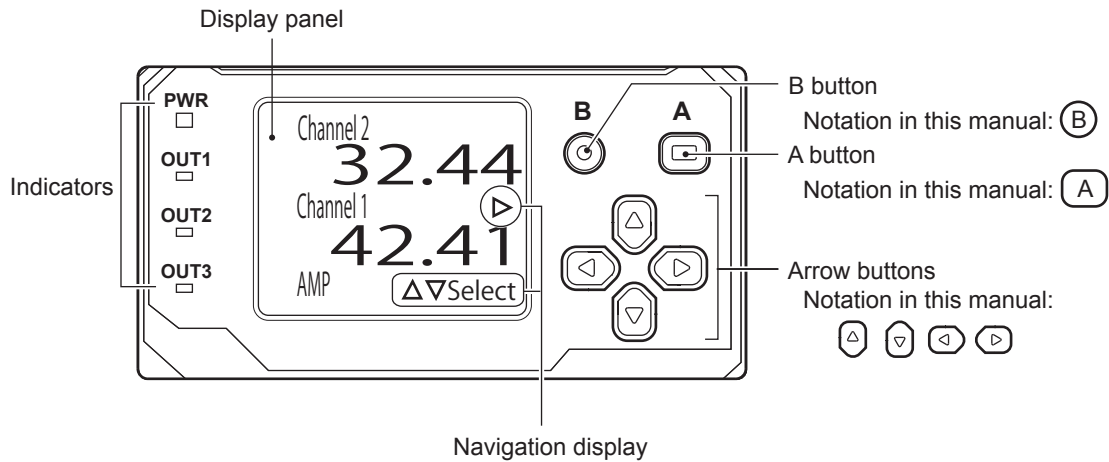


- 2 Press **(A)**.
The display language setting is confirmed and the basic screen is displayed.



1-5-2 Operation Interface

The CDA operation interface is shown below.



Indicators	These display the status of the CDA's power supply and output. For details, see the CDA's instruction manual or "4-1 Troubleshooting" (page 4-2).	
Display panel	This is used to set the CDA and the connected sensor. The display panel also displays the measurement and calculation results.	
Navigation display		Displays the details of the operation that can be performed with the arrow buttons.
		Displays the details of the operation that can be performed with the A button.
		Displays the details of the operation that can be performed by holding down the A button.
		Displays the details of the operation that can be performed with the B button.
	Operation buttons	A button
	B button	This is mainly used to return to the previous screen.
	Arrow buttons	These are used to select items, switch between screens, and increase/decrease numeric values.

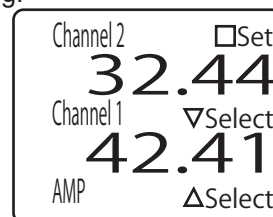
MEMO

- In actuality, the display panel is black and the characters and figures are displayed in white on it. For example, "□" in the navigation display is actually a square drawn in white and "■" is actually a square that is filled in white.
- If no operations are performed for approximately 10 minutes, the CDA's power-saving function turns the screen display off. The [PWR] LED flashes in green. In this situation, press an operation button to display the basic screen (if the basic screen or a setting menu had been displayed) or the calculation screen (if the calculation screen had been displayed).

1-5-3 Basic Screen

The basic screen is the CDA's start screen after you make the initial language setting.

- If a sensor is connected to channel 1 or channel 2, the current measurement value is displayed.
- By switching between menus, you can switch the display between the settings of the connected sensor and CDA and the calculation.

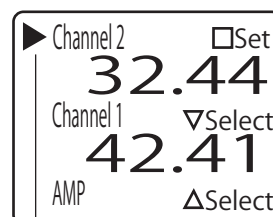


Switching to the sensor settings menu/amp settings menu

Follow the procedure shown below to switch the display between the screens used to set the CDA and the connected sensor.

1 On the basic screen, press Δ or ∇ .

The cursor (\blacktriangleright) will be displayed on the left side of the basic screen, and the navigation display will be switched.



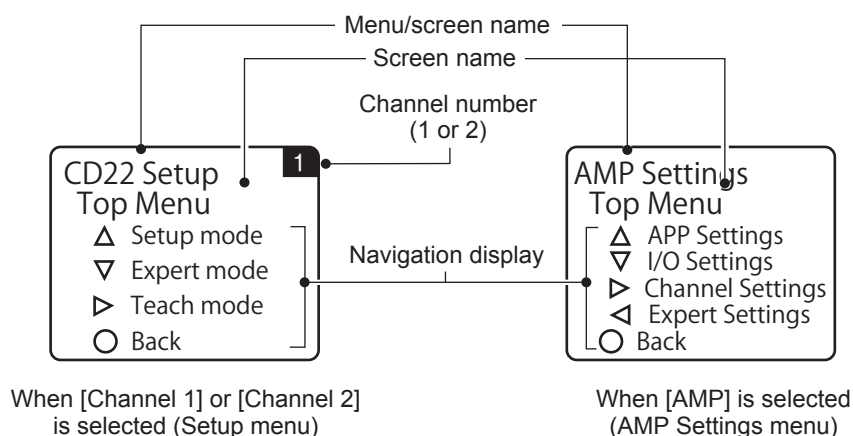
Cursor

2 Use Δ or ∇ to move the cursor and switch the target that you want to set.

Channel 2	Set the sensor connected to CDA channel 2 separately.
Channel 1	Set the sensor connected to CDA channel 1 separately.
AMP	Set the amplifier.

3 Press A .

The display switches to the [Top Menu] screen of the selected setting target.

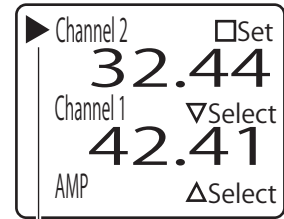


Press B on the Top Menu screen to return to the basic screen.

MEMO

- When you perform the operation to return to the basic screen from a channel 1 or channel 2 setting screen, the display returns to the basic screen with the cursor shown at the channel that you were setting. When you perform the operation to return to the basic screen from an amplifier settings screen, the cursor is not shown when the display returns to the basic screen.

When you return to the basic screen from a channel 2 setting screen



Cursor

Switching to a calculation

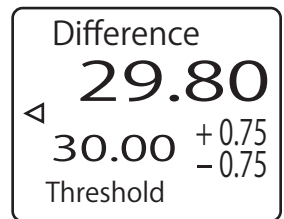
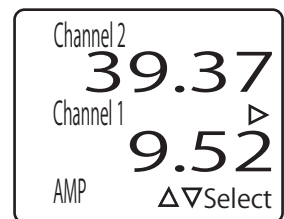
You can switch from the basic screen to the calculation screen.

1

On the basic screen, press \triangleright .

The display switches to the calculation screen.

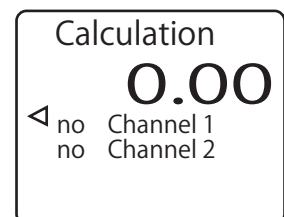
Press \triangleleft or \textcircled{B} on the calculation screen to return to the basic screen.



Display of the calculated value when measuring the level difference

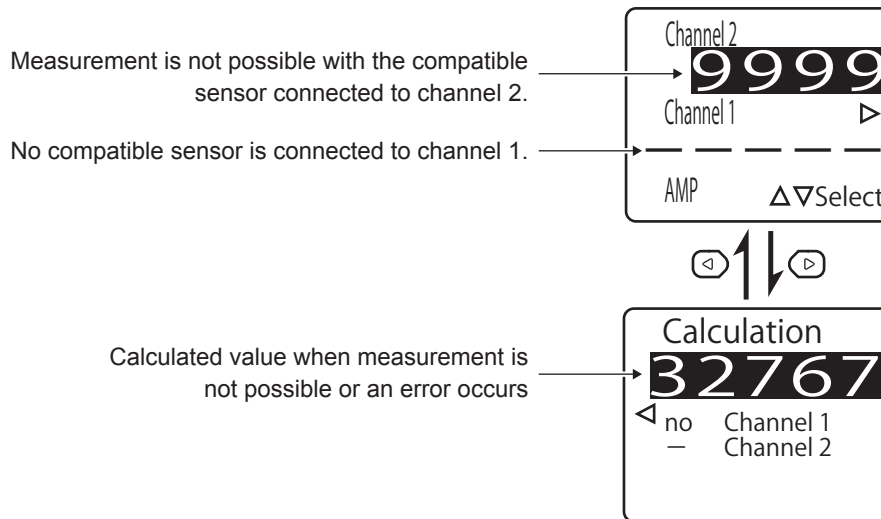
MEMO

- The display of the calculation screen varies depending on the CDA's [APP Settings]. In the example shown above, [APP Settings] is set to [Difference].
- If you set the CDA's app settings to [Not use] and each channel's calculation setting to [Not use], the calculation screen will appear as shown in the figure on the right.



■ Display when measurement is not possible and when no sensor is connected

When no compatible sensor is connected to the CDA's head connector, the display for the corresponding channel is "----." You cannot use the cursor to select a channel to which a compatible sensor is not connected. Also, if the measurement value of a compatible sensor connected to the CDA is outside of the measurement range, "9999" is displayed with the character and background colors inverted. In the same way, if a calculation result exceeds the displayable range, "32767" is displayed with the character and background colors inverted.



■ Locking the CDA operation buttons

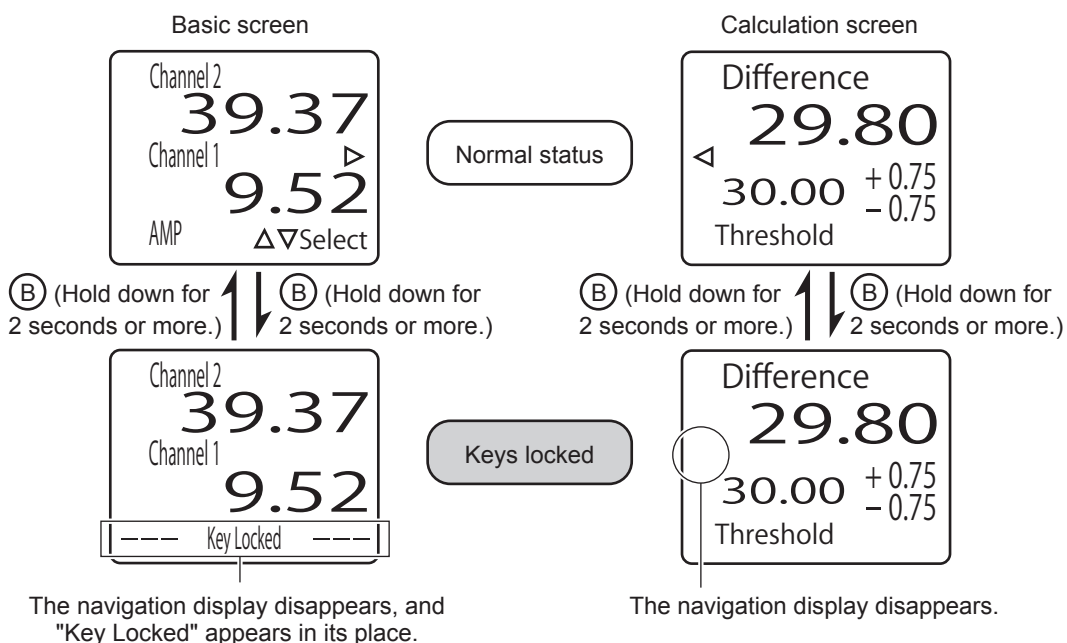
You can lock the CDA operation buttons to prevent the settings from being changed by mistake.

1 Display the basic screen or the calculation screen.

2 Hold down **(B)** (for 2 seconds or more).

The keys are locked. On the basic screen, "Key Locked" is displayed at the bottom of the screen and the navigation display disappears. On the calculation screen, the navigation display disappears.

To release the key lock, hold down **(B)** (for 2 seconds or more) again.



1-6 Basic Setting Operations

1-6-1 Setting Screen Menu Hierarchy

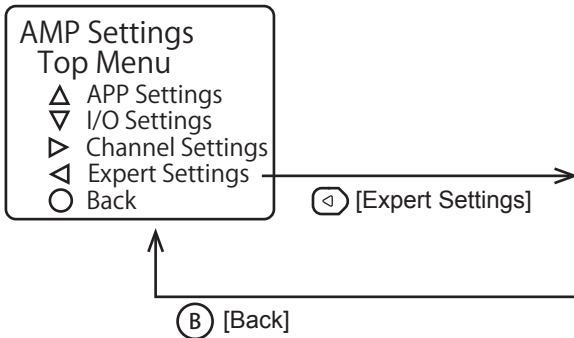
From the CDA AMP Settings and CD22 Setup [Top Menu] screen, you can select a menu by pressing \triangle , ∇ , \triangleleft , or \triangleright as shown in the navigation.

If [\triangleleft Prev] or [Next \triangleright] is displayed on the setting screen, you can press \triangleleft or \triangleright to switch between different screens within the menu.

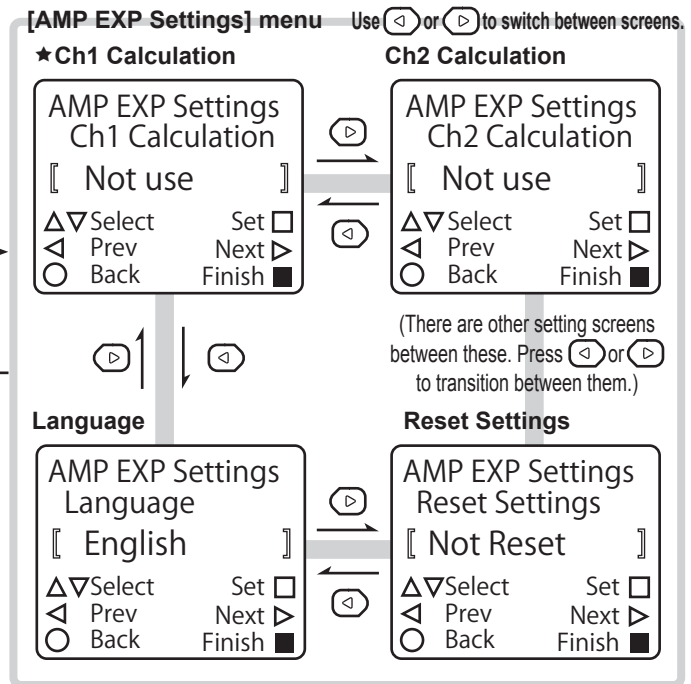
As an example of the setting screen menu hierarchy and of transitions between screens, the [AMP EXP Settings] menu is shown below.

AMP Settings Top Menu

Press a button to select a menu.



*: While the power is on, the screen on which you pressed \textcircled{B} will be the initial screen displayed the next time you press \triangleleft .



★: Immediately after the power is turned on, this is the first screen displayed for the expert settings.

MEMO

For details on the transitions between all the setting screens, see the references shown below.

- Amplifier settings menu screen transitions: "2-1 Setting Items and Screen Transitions" (page 2-2)
- Sensor settings menu screen transitions: "3-1-1 Setting Items and Screen Transitions" (page 3-2)

1-6-2 Changing Settings

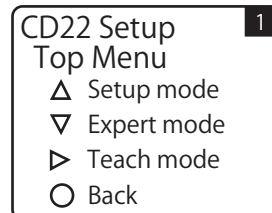
Regarding operations for configuring settings from the CDA, you can use the arrow keys to change the selected item and you can use the arrow keys to change the setting's numeric value.

■ Changing the selected item

In this section, the teaching mode of the CD22 connected to the CDA will be changed as an example for explaining how to change the selected item.

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

The Setup Top Menu for the selected channel is displayed.



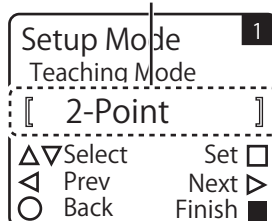
- 2** Press Δ .

The display switches to the [Setup Mode] menu.

- 3** Use \leftarrow or \rightarrow to switch to the [Teaching Mode] screen.

The default value for the CD22 teaching mode is [2-Point]. The setting has been confirmed with these details, so the setting item is displayed with double brackets (〔 〕) to indicate this, as shown in the figure.

The double brackets (〔 〕) indicate that the selected item has been confirmed.

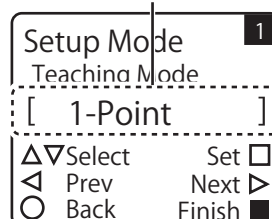


- 4** Use Δ or ∇ to switch the setting item.

For the CD22, you can select the teaching mode from [2-Point], [1-Point], and [FGS2 Distance].

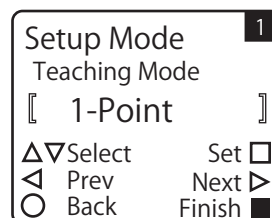
Just selecting an option does not confirm the setting. The setting item is displayed with brackets (〔 〕) to indicate that it has not been confirmed, as shown in the figure.

The brackets (〔 〕) indicate that the selected item has not been confirmed.



- 5** Press A .

The changed setting is confirmed, and the setting item is displayed with double brackets (〔 〕) again to indicate this.



●●● MEMO ●●●

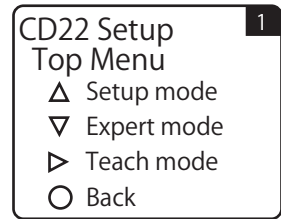
- Hold down A on any menu to return to the basic screen.
- On the setting screen where you are changing the selected item, if you press a different button before pressing A to confirm the changed setting, you will return to the Top Menu with the setting details from before the change you made.

■ Changing a setting's numeric value

In this section, the far end distance of the CD22-100□□ will be changed as an example for explaining how to change a setting's numeric value.

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

The Setup Top Menu for the selected channel is displayed.

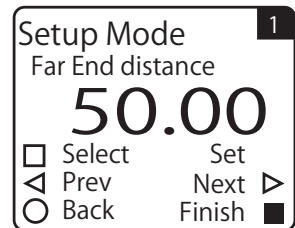


- 2** Press .

The display switches to the [Setup Mode] menu.

- 3** Use  or  to switch to the [Far End distance] screen.



The default value for the CD22-100□□ far end distance is 50.00.

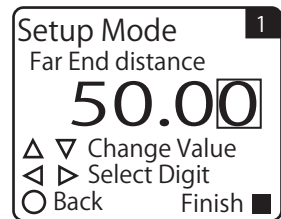


- 4** Press .

You can now change the numeric value.

The navigation display switches, and the right-most digit of the displayed numeric value is enclosed in a frame.

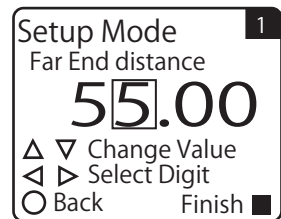
- 5** Use  or  to move the frame to the digit whose value you want to change.



- 6** Use  or  to change the numeric value.

: Increase the numeric value.

: Decrease the numeric value.



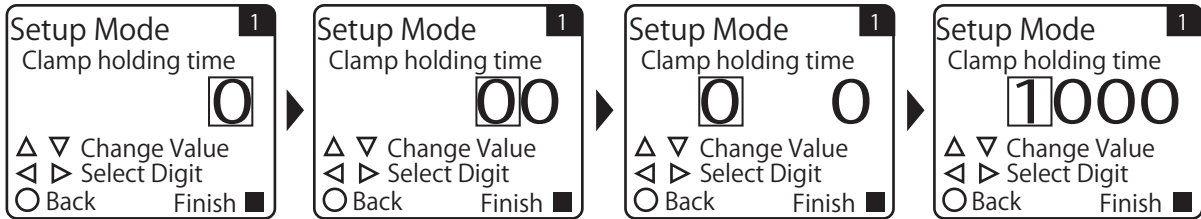
- 7** When you are finished changing the numeric value, press .

The changed numeric value is confirmed, and the frame disappears.

MEMO

- As shown in the following operation example, you may be able to move the frame to a digit that is not displayed.

■ Example: Setting "Clamp holding time" to a four-digit numeric value



As shown in the above figure, this item's default value is "0."

When you press once, the frame moves to the digit on the left, and "0" is displayed.

When you press two more times, the frame moves to the thousands position. The digits between the ones position and the thousands position are not displayed.

When you press to change the thousands position to a numeric value other than "0," the intermediate digits are displayed as "0."

- If you press before pressing to confirm the changed numeric value that you are setting, the change will be canceled and you will return to the setting screen.
-



2

CDA Settings

This chapter explains the CDA settings such as thickness measurements and level difference measurements.

2-1 Setting Items and Screen Transitions

2-1-1 APP Settings

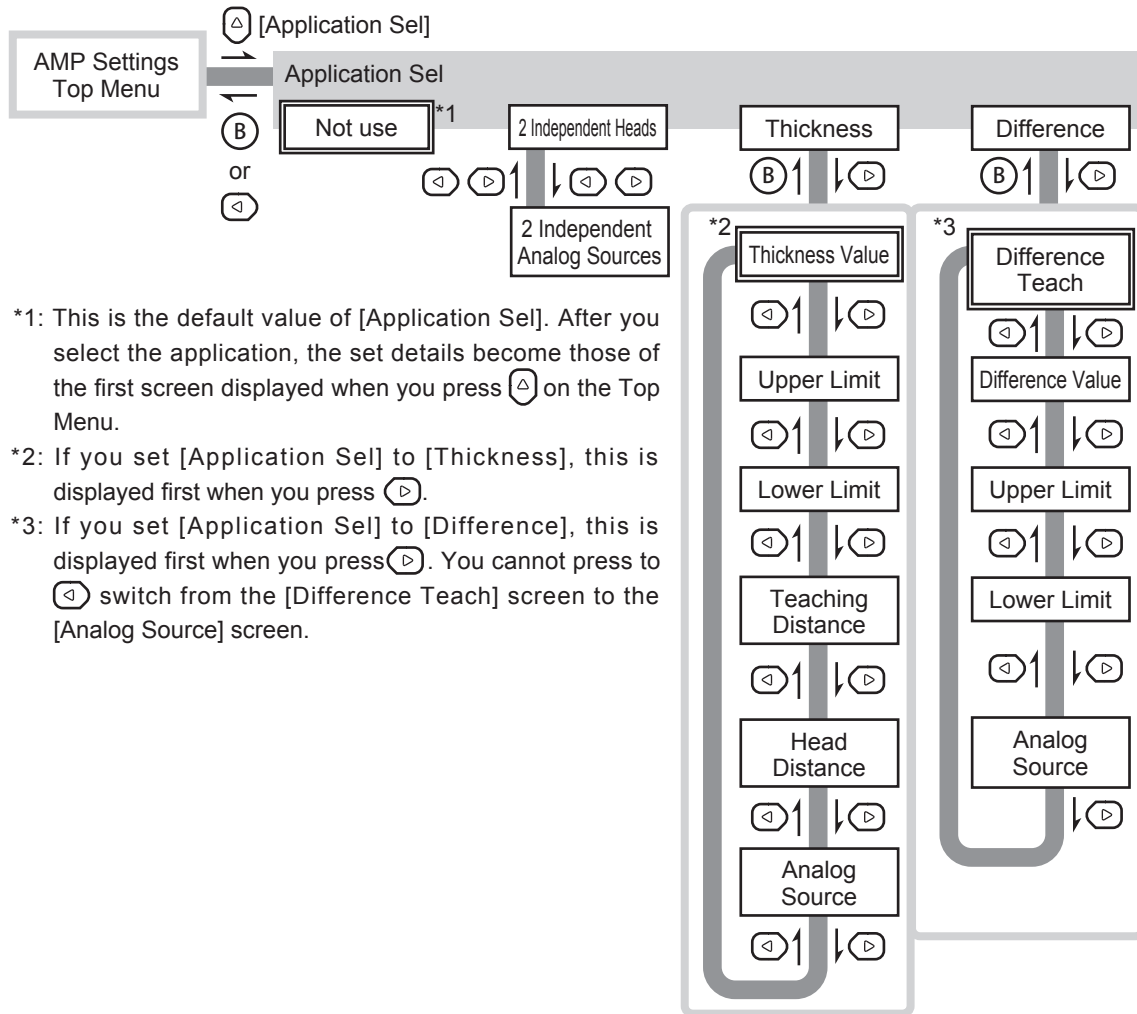
■ Setting items

Screen name	Explanation and settable values/options
Application Sel	<p>Set the application of the sensor connected to the CDA.</p> <p>Not use: Use this when you are using a calculation for the measurement value of each of the two channels.</p> <p>Difference: Measure the workpiece's level difference from the measurement values of the two channels. See "2-3 Difference" (page 2-16).</p> <p>Thickness: Measure the workpiece's thickness from the measurement values of the two channels. See "2-2 Thickness" (page 2-10).</p> <p>2 Independent Heads: The two channels are measured independently and no calculation is performed between them. The [I/O Settings] are changed automatically to the following values (which can be changed).</p> <ul style="list-style-type: none"> • [OUT1 Source]: [Go Ch1 Result] • [OUT2 Source]: [Go Ch2 Result]
2 Independent Analog Sources	Set the analog output assignment when [Application Sel] is set to [2 Independent Heads]. Not use/Ch1 Measurement Value/Ch2 Measurement Value
Thickness Value	Enter the judgment reference (the target thickness). 0 to 100.00
Upper Limit	Enter the error value to use as the upper limit of the allowable thickness. -327.68 to 0.50 or higher (327.67 - Thickness Value)
Lower Limit	Enter the error value to use as the lower limit of the allowable thickness. -327.68 to -0.50 or higher (327.67 - Thickness Value)
Teaching Distance	See "2-2 Thickness" (page 2-10).
Head Distance* ¹	Enter the distance between two sensors that are installed facing each other.
Analog Source	Set the analog output assignment when [Application Sel] is set to [Thickness]. When you select [Active], the calculated thickness value is output. Not use/Active
Difference Teach	See "2-3 Difference" (page 2-16).
Difference Value	Enter the judgment reference (the target level difference). -100.00 to 0.00 to 100.00
Upper Limit	Enter the upper limit of the allowable level difference error. -327.68 to 0.50 or higher (327.67 - Difference Value)
Lower Limit	Enter the lower limit of the allowable level difference error. -327.68 to -0.50 or higher (327.67 - Difference Value)
Analog Source	Set the analog output assignment when [Application Sel] is set to [Difference]. When you select [Active], the calculated level difference value is output. Not use/Active

* The default values are shown in bold.

*1 The decimal position in the setting value varies depending on the compatible sensor that is connected.

Screen transitions



- *1: This is the default value of [Application Sel]. After you select the application, the set details become those of the first screen displayed when you press \triangleleft on the Top Menu.
- *2: If you set [Application Sel] to [Thickness], this is displayed first when you press \triangleright .
- *3: If you set [Application Sel] to [Difference], this is displayed first when you press \triangleright . You cannot press to \triangleleft switch from the [Difference Teach] screen to the [Analog Source] screen.

MEMO

After you confirm the selected application on the [Application Sel] screen, press \triangleright to switch to the menu for the confirmed application. If a non-confirmed application is displayed, pressing this button will have no effect.

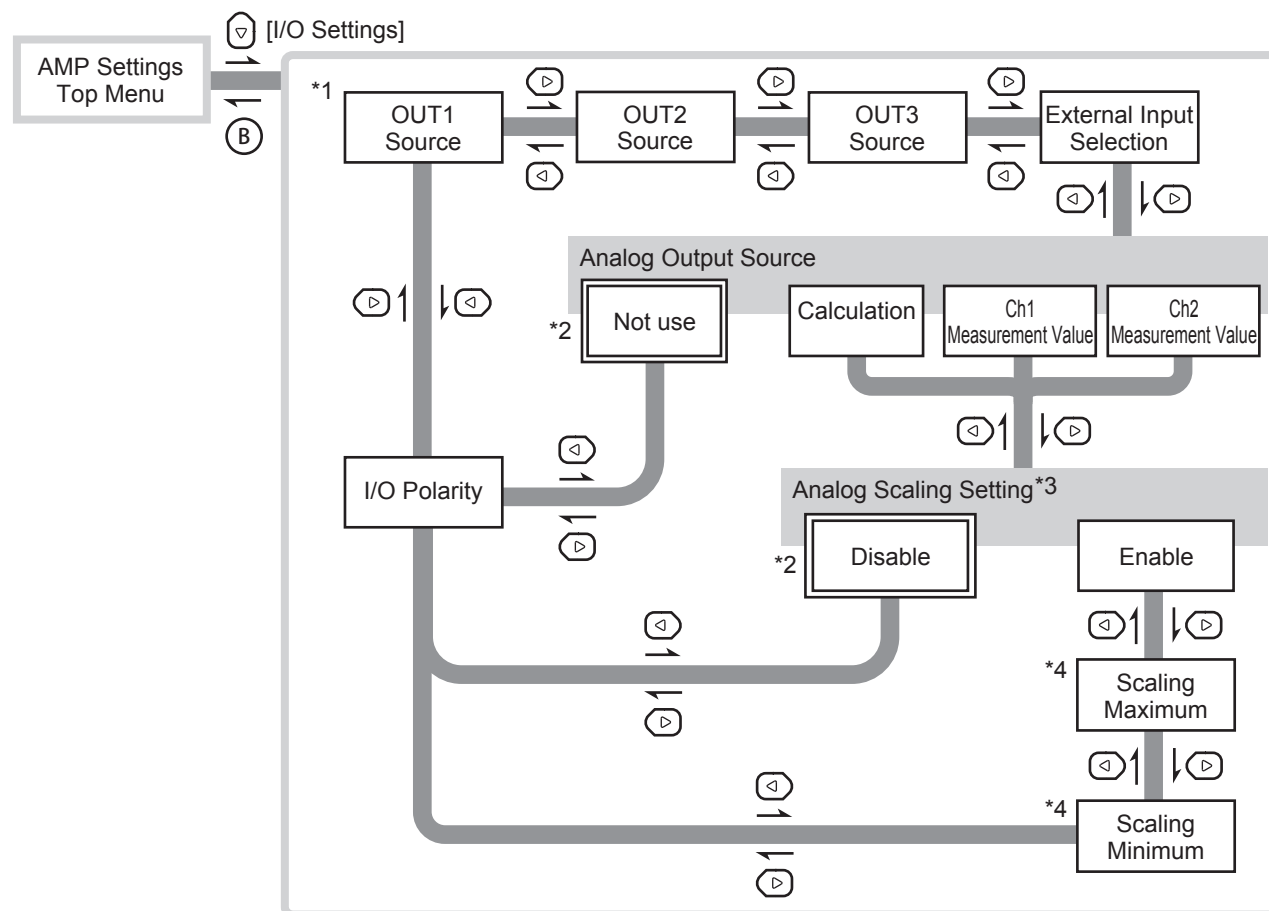
2-1-2 I/O Settings

■ Setting items

Screen name	Explanation and setting items
OUT1 Source	Set the assignments for each of the three control outputs.
OUT2 Source	Not use /Go Calculated Val/Lo Calculated Val/Hi Calculated Val/Go Ch1 Result/Lo Ch1 Result/Hi Ch1 Result/Go Ch2 Result/Lo Ch2 Result/Hi Ch2 Result
OUT3 Source	
External Input Selection	Set the external input device. Not use /Teach mode/BGS/FGS Distance/Execute Offset/Stop Laser
Analog Output Source	Set the details to assign to analog output. Not use /Calculated Val/Ch1 Measurement Value/Ch2 Measurement Value
Analog Scaling Setting	Set whether to apply the scaling settings to the analog output when performing analog output with [Analog Output Source] set to a value other than [Not use]. Enable/ Disable
Scaling Maximum	Set the value during 20 mA output when [Analog Scaling Setting] is set to [Enable]. -32768 to 10000 to 32767
Scaling Minimum	Set the value during 4 mA output when [Analog Scaling Setting] is set to [Enable]. -32768 to -10000 to 32767
I/O Polarity	Set the I/O polarity (the indicators light when the I/O polarity is on). NPN (N.O.) /PNP (N.C.)/NPN (N.C.)/PNP (N.O.)

* The default values are shown in bold.

■ Screen transitions



- *1: This is the first screen displayed for the [AMP I/O Settings] menu immediately after the power is turned on or after you initialize the settings. Thereafter, the last menu that you used is displayed.
- *2: Items indicated with are the default values for their respective settings.
- *3: This is only displayed when you set [Analog Output Source] to a value other than [Not use].
- *4: This is only displayed when you set [Analog Scaling Setting] to [Enable].

2-1-3 Channel Settings

■ Setting items

The settings are independent for each channel.

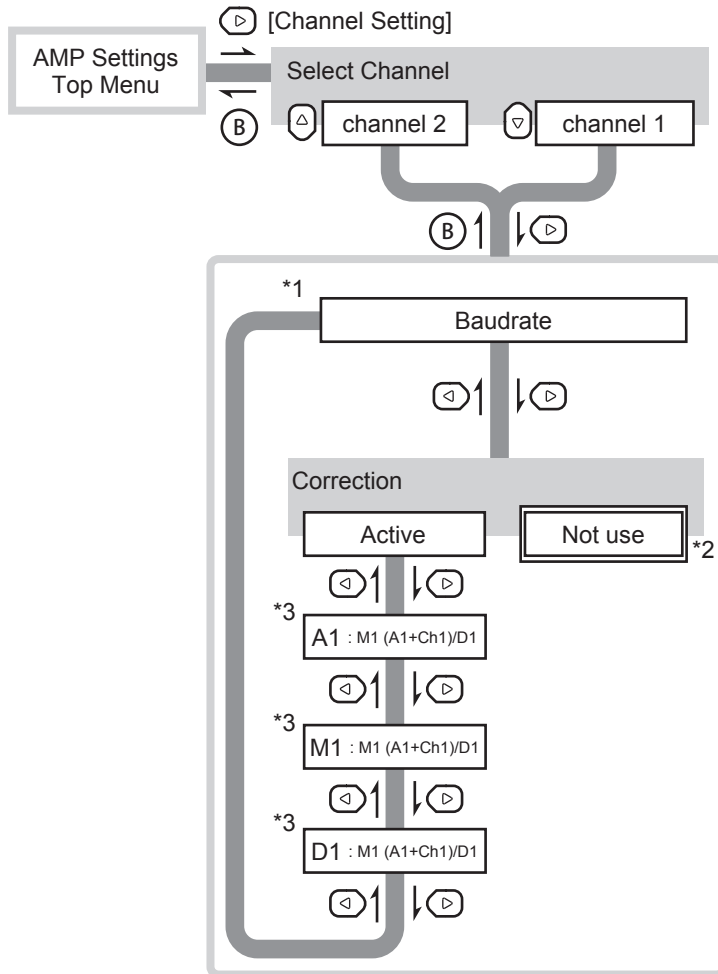
Screen name	Explanation and setting items
Select Channel	Select the channel to set. Channel 2/Channel 1
Baudrate	Set the communication speed between the CDA and the sensor. Not use/9.6 kbps/19.2 kbps/38.4 kbps/57.6 kbps/115.2 kbps/230.4 kbps/312.4 kbps/468.8 kbps/500.0 kbps/ 625.0 kbps /833.3 kbps/937.5 kbps/1250 kbps
Correction	Set whether to correct the input from the sensor. Not use /APPLY
A1: M1 (A1 + Ch1)/D1	Set correction parameter A (the addition coefficient) of channel 1. -10000 to 0 to 10000
M1: M1 (A1 + Ch1)/D1	Set correction parameter M (the multiplication coefficient) of channel 1. -10000 to 1 to 10000
D1: M1 (A1 + Ch1)/D1	Set correction parameter D (the division coefficient) of channel 1. 1 to 32767
A2: M2 (A2 + Ch2)/D2	Set correction parameter A (the addition coefficient) of channel 2. -10000 to 0 to 10000
M2: M2 (A2 + Ch2)/D2	Set correction parameter M (the multiplication coefficient) of channel 2. -10000 to 1 to 10000
D2: M2 (A2 + Ch2)/D2	Set correction parameter D (the division coefficient) of channel 2. 1 to 32767

* The default values are shown in bold.

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- If no sensors are connected to the channels, the CDA will be "unconnected" and its POW LED will light in red to indicate an error. If a sensor is not connected to a channel, you can prevent the unconnected channel error by setting the channel's [Baudrate] to [Not use].
- For details on the correction setting and the correction parameters, see "2-5-4 Correction Value Settings" (page 2-31).

Screen transitions



*1: This is the first screen displayed for the [Channel Setting] menu immediately after the power is turned on or after you initialize the settings. Thereafter, the last menu that you used is displayed.

*2: This is the default value of [Correction]. When [Not Use] is selected, you can use the \leftarrow key or the \rightarrow key to switch to the [Baudrate] screen and [Correction] screen.

*3: This is only displayed when [APPLY] is selected for [Correction].

The correction values here are displayed for channel 1. For channel 2, these are A2, M2, and D2.

2-1-4 AMP EXP Settings

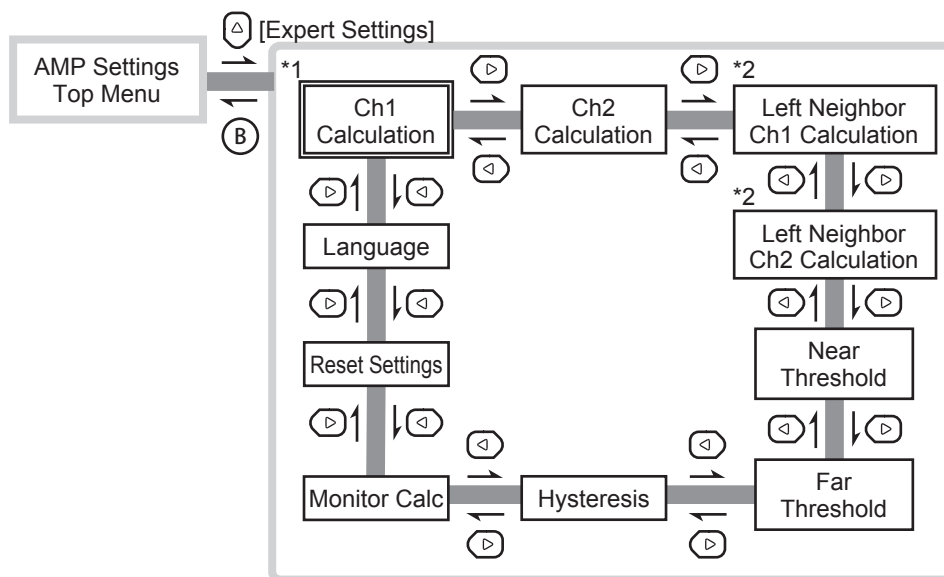
■ Setting items

Screen name	Explanation and setting items
Ch1 Calculation	See "2-4 Calculation Settings" (page 2-22).
Ch2 Calculation	Not use /+ Addition/- Subtraction/- Abso Sub
Left Neighbor Ch1 Calculation	When the CDA is linked with other units, you can use the measurement values of the channels of the neighboring CDA on the left as references in the calculations.
Left Neighbor Ch2 Calculation	Not use /+ Addition/- Subtraction/- Abso Sub
Near Threshold	Set the lower limit that is used when controlling judgment output. -32768 to -50 to 32767
Far Threshold	Set the upper limit that is used when controlling judgment output. -32768 to 50 to 32767
Hysteresis	Set the hysteresis that is used when controlling judgment output. 0 to 10 to 32767
Monitor Calc* ¹	Assign the calculated value's output source. Not Assigned/Calculated Val
Reset Settings	Reset all the CDA settings to their default values. Not Reset /Execute by <input type="checkbox"/>
Language	Select the display language. Japanese/English

* The default values are shown in bold.

*¹ When you are referencing calculated values over CC-Link, select [Calculated Val]. However, this will make channel 2 handle calculated values, so you will not be able to directly reference the measurement values of channel 2.

■ Screen transitions



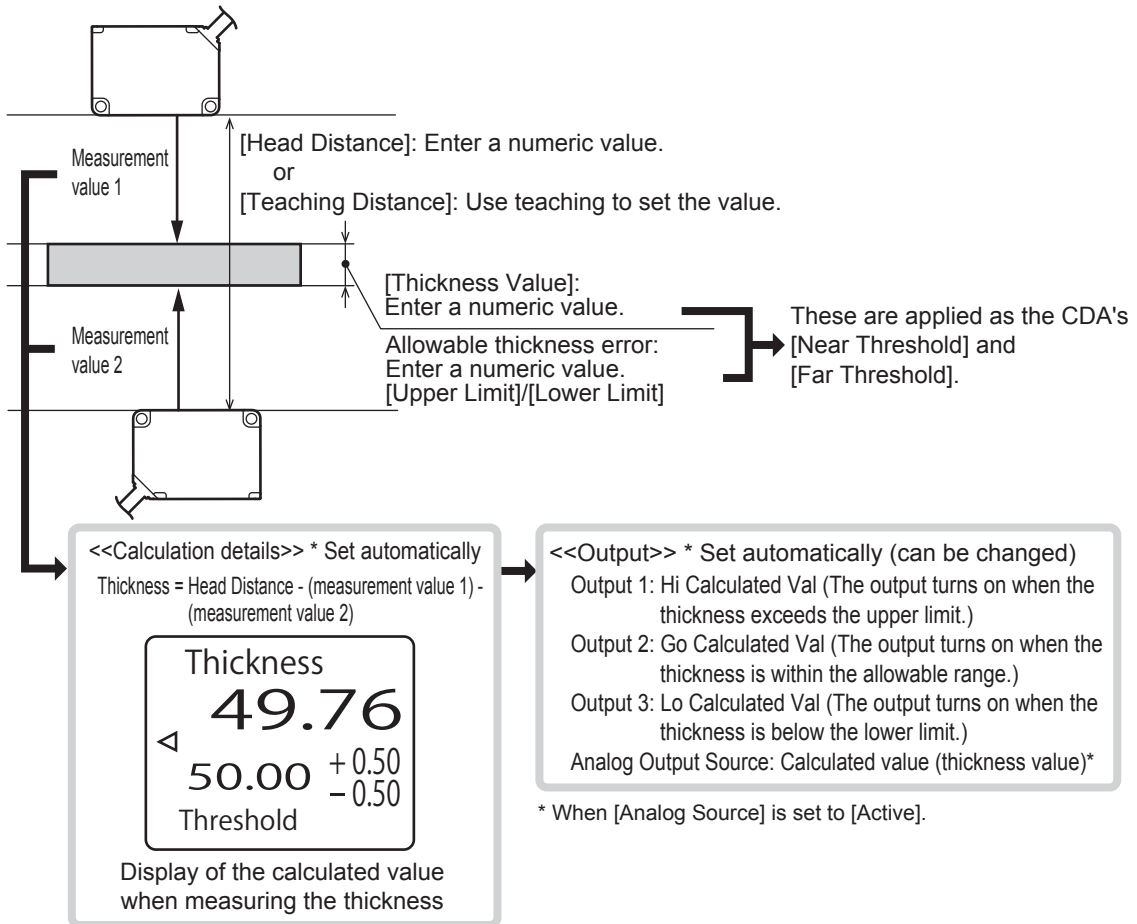
*1: Immediately after the power is turned on, this is the first screen displayed for the [AMP EXP Settings] menu. Thereafter, the last menu that you used is displayed.

*2: This is only displayed when a CDA is linked on the left side of the unit.

2-2 Thickness

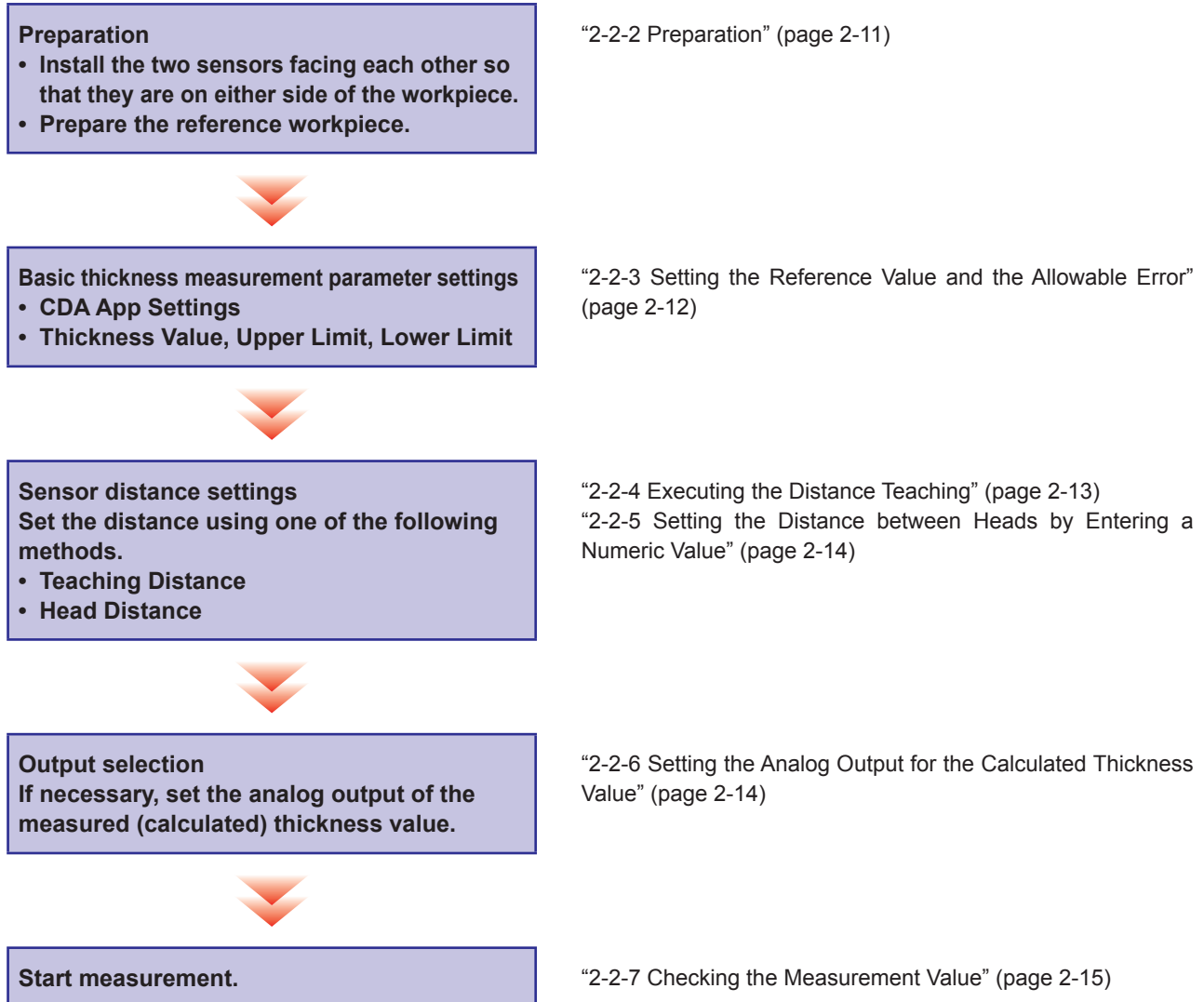
Generally speaking, in order to perform a thickness measurement, position two displacement sensors so that they are on either sides of the workpiece to measure. Then, calculate or observe the workpiece thickness from the obtained measurement values.

You can easily switch to the measurement by setting the CDA's application setting to [Thickness] and setting the minimal parameters.



2-2-1 Thickness Measurement Procedure

You can follow the procedure shown below to perform a thickness measurement using the CDA and two displacement sensors.



2-2-2 Preparation

- 1** To perform thickness measurements, install two compatible sensors so that they face each other and are on either side of the workpiece.
 Install the sensors so that their laser light axes are perpendicular to the workpiece.
- 2** When you are setting the head distance from the actual value measured by distance teaching, prepare a workpiece that will be the reference for the thickness, and then place the workpiece in the same manner as the actual measurement.

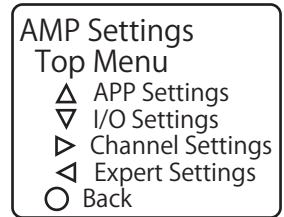
MEMO

To transition smoothly to the measurement, if there are any settings on the sensors that are necessary, configure these settings before switching to the amplifier settings. (See "Chapter 3 Compatible Sensor Settings.")

2-2-3 Setting the Reference Value and the Allowable Error

- 1** On the basic screen, press or to select [AMP], and then press .

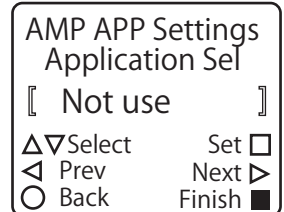
The AMP Settings Top Menu is displayed.



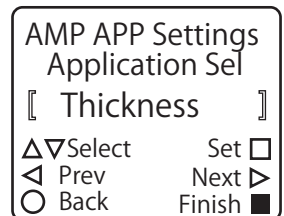
- 2** Press .

The display switches to the [AMP APP Settings] menu.

The [Application Sel] screen is always displayed first on this menu.



- 3** On the [Application Sel] screen, select [Thickness].

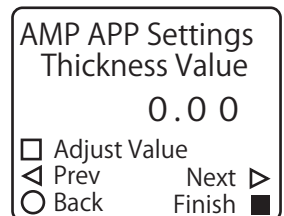


MEMO

When you set [Application Sel] to [Thickness], the calculation settings of the measurement value between the two sensors that is required for the thickness measurement and the judgment output assignment are set automatically. If you want to change the judgment output assignment, see "■ Assigning the output sources for the calculated value" (2-27).

- 4** Press .

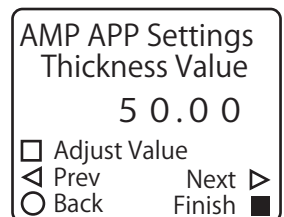
The [Thickness Value] screen is displayed.



- 5** Enter the numeric value of the thickness that will be the judgment reference.

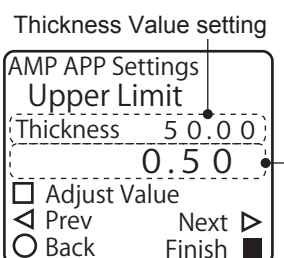
Thickness Value	Enter the judgment reference (the target thickness) in units of millimeters. 0.00 to 100.00
------------------------	---

* The default value is shown in bold.



- 6** Press .

The [Upper Limit] screen is displayed.

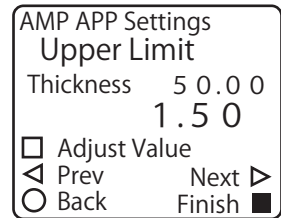


Thickness Upper Limit setting

7 Enter the thickness upper limit.

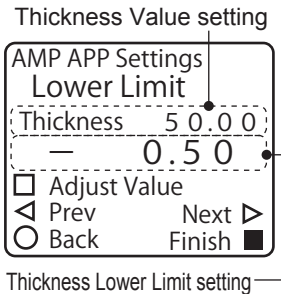
Upper Limit	Enter the value to use as the upper limit of the allowable thickness. -327.68 to 0.50 or higher (327.67 - Thickness Value)
--------------------	--

* The default value is shown in bold.



8 Press .

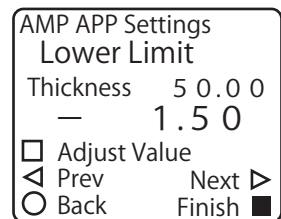
The [Lower Limit] screen is displayed.



9 Set the thickness lower limit.

Lower Limit	Enter the value to use as the lower limit of the allowable thickness. 327.68 to 0.50 or higher (327.67 - Thickness Value)
--------------------	---

* The default value is shown in bold.



Continue by using teaching or entering the numeric value to set the distance between the two sensors that are installed facing each other.

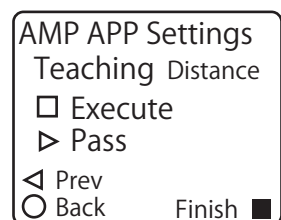
- If you are using a workpiece as the thickness reference and are performing teaching to set the distance between the sensors, proceed to the next section.
- If you are entering the numeric value directly to set the distance between the sensors, proceed to “2-2-5 Setting the Distance between Heads by Entering a Numeric Value” (page 2-14).

2-2-4 Executing the Distance Teaching

1 When you are finished setting the [Lower Limit], press .

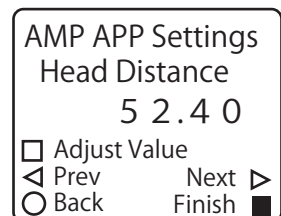
The [Teaching Distance] screen is displayed.

Check that the workpiece to use as the thickness reference is positioned in the same manner as for normal measurements, and then proceed to the next step.



2 Press .

Distance teaching is executed from the current measurement values of the sensors, and then the display switches to the [Head Distance] screen. The distance between the sensors is calculated and is displayed as the setting value of [Head Distance].



The thickness is calculated from the measurement values of the two sensors. If analog output is necessary, continue to “2-2-6 Setting the Analog Output for the Calculated Thickness Value” (page 2-14).

If analog output is not necessary, this completes the setting of the thickness measurement.

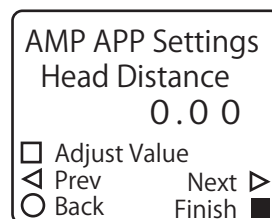
2-2-5 Setting the Distance between Heads by Entering a Numeric Value

Instead of executing teaching, you can directly enter a numeric value for the distance between the heads. You can also use this to perform corrections after executing [Teaching Distance].

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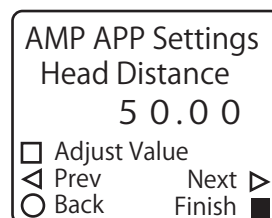
The distance between the heads that you set here is not the actual distance between the sensors. It is the value defined by the following calculation.
 Distance between heads = actual distance between sensors - center of measurement range of the channel 1 sensor - center of measurement range of the channel 2 sensor

- 1 When you are finished setting the [Lower Limit], press twice. The display switches to the [Head Distance] screen.



- 2 Enter the distance between the heads.

Head Distance	Enter the distance between two sensors that are installed facing each other. -100.00 to 0.00 to 100.00
----------------------	--



* The default value is shown in bold.

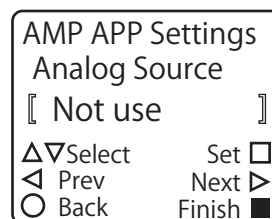
The thickness is calculated from the measurement values of the two sensors. If analog output is necessary, continue to “2-2-6 Setting the Analog Output for the Calculated Thickness Value” (page 2-14).

If analog output is not necessary, this completes the setting of the thickness measurement.

2-2-6 Setting the Analog Output for the Calculated Thickness Value

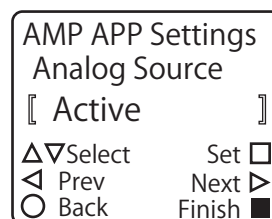
You can not only output the judgment performed in relation to the reference value but also output an analog signal of the calculated thickness value.

- 1 When you are finished executing [Teaching Distance] or setting the [Head Distance], press . The [Analog Source] screen is displayed.



- 2 Change [Analog Source] to [Active].

Analog Source	Set the analog output assignment when [Application Sel] is set to [Thickness]. When you select [Active], the calculated thickness value is output. Not use/Active
----------------------	--



* The default value is shown in bold.

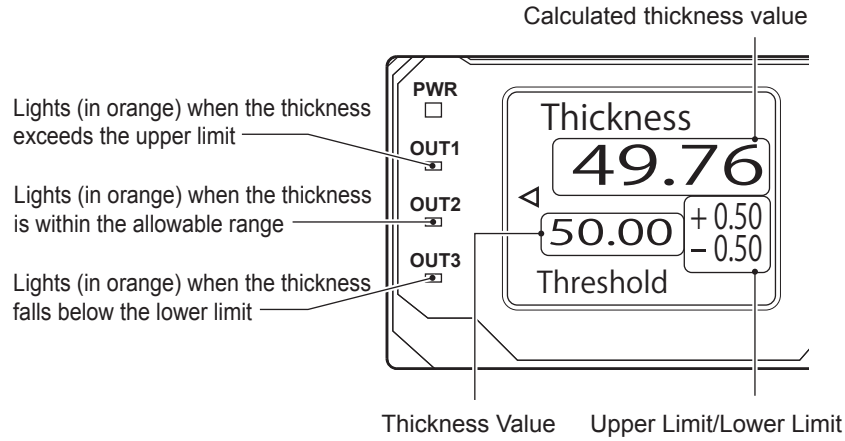
This completes the setting of the thickness measurement.

2-2-7 Checking the Measurement Value

Start the line moving, and then begin measurements.

Press \blacktriangleright on the basic screen to switch to the [Thickness] screen.

On the display panel, you can check the calculated thickness value as well as the set thickness value, upper limit, and lower limit. You can also use the lighting of the indicators to check the judgment result.

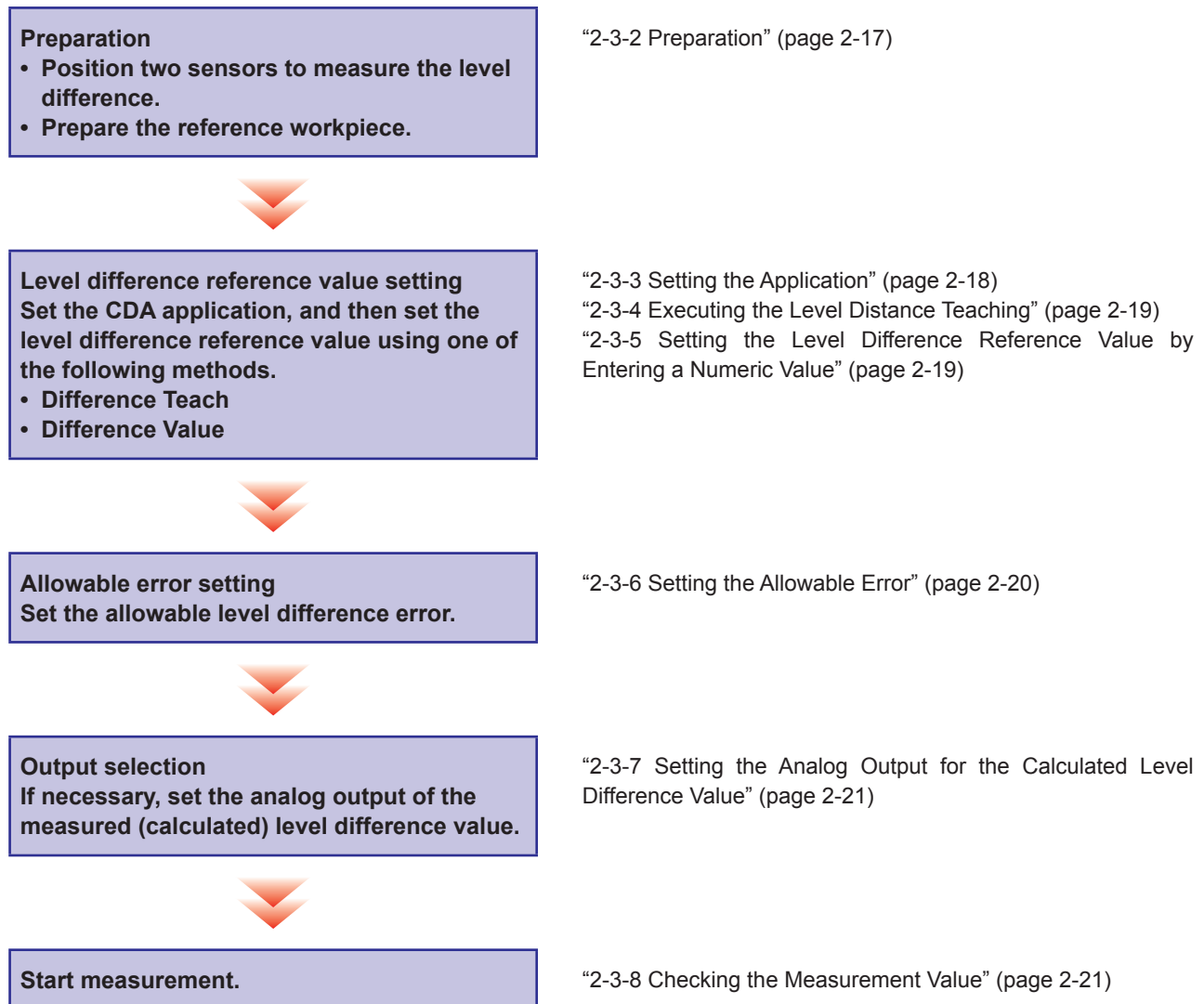


MEMO

The LED display shown above is an example from the case in which no changes have been made to the judgment output assignment that has been set automatically.

2-3-1 Level Difference Measurement Procedure

You can follow the procedure shown below to perform a level difference measurement using the CDA and two displacement sensors.





2-3-2 Preparation

- 1** Install two compatible sensors so that they can measure two locations on a workpiece that has a level difference.
- 2** When you are setting the level difference reference value from the actual value measured by level difference teaching, prepare a workpiece that will be the reference for the level difference, and then place the workpiece in the same manner as the actual measurement.

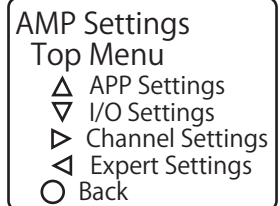
MEMO

To transition smoothly to the measurement, if there are any settings on the sensors that are necessary, configure these settings before switching to the amplifier settings.

2-3-3 Setting the Application

- 1** On the basic screen, press  or  to select [AMP], and then press .

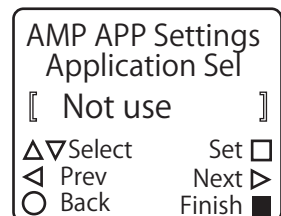
The AMP Settings Top Menu is displayed.



- 2** Press .

The display switches to the [AMP APP Settings] menu.

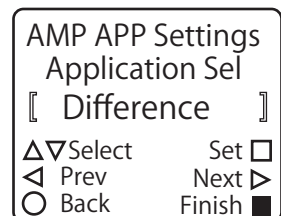
The [Application Sel] screen is always displayed first on this menu.



- 3** On the [Application Sel] screen, select [Difference].

Continue by setting the numeric value that will be the reference for the level difference.

- If you are using a workpiece as the level difference reference and are performing teaching to set the reference value, proceed to the next section.
- If you are entering the numeric value directly to set the level difference, proceed to “2-3-5 Setting the Level Difference Reference Value by Entering a Numeric Value” (page 2-19).



MEMO

When you set [Application Sel] to [Difference], the calculation settings of the measurement value between the two sensors that is required for the level difference measurement and the judgment output assignment are set automatically. If you want to change the judgment output assignment, see "■ Assigning the output sources for the calculated value" (2-27).

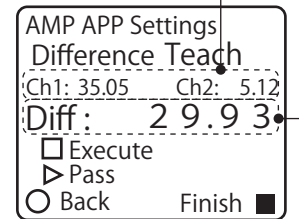
2-3-4 Executing the Level Distance Teaching

1 Set [Application Sel] to [Difference], and then press \odot .

The [Difference Teach] screen is displayed.

Check that the workpiece to use as the level difference reference is positioned in the same manner as for normal measurements, and then proceed to the next step.

Current measurement value
for each channel



Current level difference

2 Press \odot .

Level difference teaching is executed, and then the display switches to the [Difference Value] screen.

The level difference is calculated from the measurement values of the sensors and is displayed as the setting value of [Difference Value].

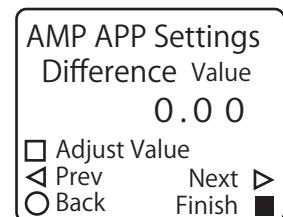
Continue by setting the allowable error from the level difference reference value. Proceed to "2-3-6 Setting the Allowable Error" (page 2-20).

2-3-5 Setting the Level Difference Reference Value by Entering a Numeric Value

Instead of executing teaching, you can directly enter a numeric value for the level difference reference value. You can also use this to perform corrections after executing [Difference Teach].

1 Set [Application Sel] to [Difference], and then press \odot twice.

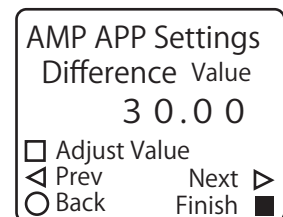
The display switches to the [Difference Value] screen.



2 Enter the level difference reference value.

Difference Value	Enter the judgment reference (the target level difference) in units of millimeters. -100.00 to 0.00 to 100.00
-------------------------	---

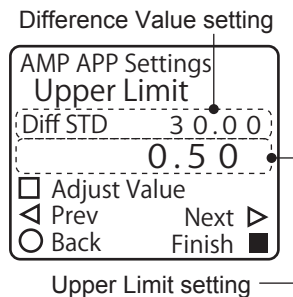
* The default value is shown in bold.



Continue by setting the allowable error from the level difference reference value.

2-3-6 Setting the Allowable Error

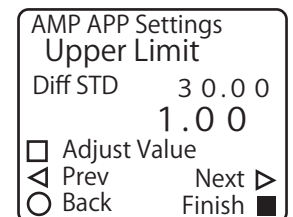
- 1 When you are finished executing [Difference Teach] or setting the [Difference Value], press . The [Upper Limit] screen is displayed.



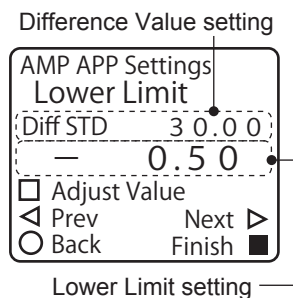
- 2 Enter the level difference upper limit.

Upper Limit	Enter the value to use as the upper limit of the allowable level difference. -327.68 to 0.50 or higher (327.67 - Difference Value)
--------------------	--

* The default value is shown in bold.



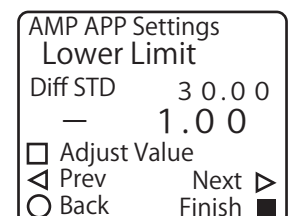
- 3 Press . The [Lower Limit] screen is displayed.



- 4 Set the level difference lower limit.

Lower Limit	Enter the value to use as the lower limit of the allowable level difference. 327.68 to -0.50 or higher (327.67 - Difference Value)
--------------------	--

* The default value is shown in bold.



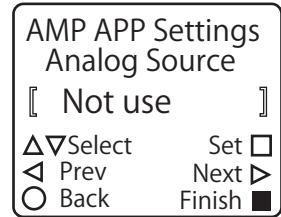
The level difference is calculated from the measurement values of the two sensors. If analog output is necessary, continue to “2-3-7 Setting the Analog Output for the Calculated Level Difference Value” (page 2-21).

If analog output is not necessary, this completes the setting of the level difference measurement.

2-3-7 Setting the Analog Output for the Calculated Level Difference Value

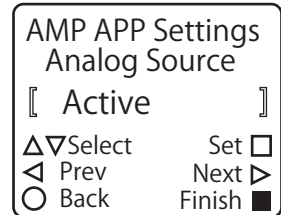
You can not only output the judgment performed in relation to the reference value but also output an analog signal of the calculated level difference value.

- 1 When you are finished setting the [Lower Limit], press . The [Analog Source] screen is displayed.



- 2 Change [Analog Source] to [Active].

Analog Source	Set the analog output assignment when [Application Sel] is set to [Difference]. When you select [Active], the calculated level difference value is output. Not use/Active
----------------------	---



* The default value is shown in bold.

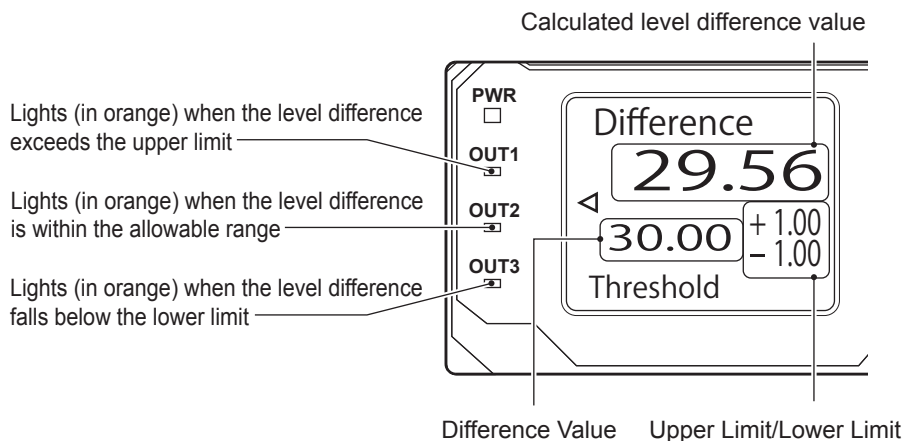
This completes the setting of the level difference measurement.

2-3-8 Checking the Measurement Value

Start the line moving, and then begin measurements.

Press on the basic screen to switch to the [Difference] screen.

On the display panel, you can check the calculated level difference value as well as the set level difference value, upper limit, and lower limit. You can also use the lighting of the indicators to check the judgment result.



MEMO

The LED display shown above is an example from the case in which no changes have been made to the judgment output assignment that has been set automatically.

2-4 Calculation Settings

Calculations are set automatically for the measurement values of each channel to correspond to the application specified with [APP Settings] under AMP Settings. You can also add calculation settings for the measurement values of each channel on the CDA.

You can add the following three types of calculation settings for each channel on the CDA.

Calculation setting	Details
Not use	The measurement value of the set channel will not be calculated. Channels for which no calculation settings have been added are not related to the calculated value.
+ Addition	The measurement value of the set channel will be added.
- Subtraction	The measurement value of the set channel will be subtracted.
- Abso Sub	The absolute value of the measurement value of the set channel will be subtracted.

Example 1: Calculated values from the various calculation settings when channel 1 = 10 and channel 2 = 15

Channel	Calculation setting
1	+ Addition
2	+ Addition
Calculated value	$(10) + (15) = 25$

Channel	Calculation setting
1	- Subtraction
2	- Subtraction
Calculated value	$-(10) - (15) = -25$

Channel	Calculation setting
1	+ Addition
2	- Subtraction
Calculated value	$(10) - (15) = -5$

Channel	Calculation setting
1	- Subtraction
2	+ Addition
Calculated value	$-(10) + (15) = 5$

Channel	Calculation setting
1	+ Addition
2	- Abso Sub
Calculated value	$(10) - (15) = -5$

Channel	Calculation setting
1	- Abso Sub
2	+ Addition
Calculated value	$-(10) + (15) = 5$

Channel	Calculation setting
1	- Subtraction
2	- Abso Sub
Calculated value	$-(10) - (15) = -25$

Channel	Calculation setting
1	- Abso Sub
2	- Subtraction
Calculated value	$-(10) - (15) = -25$

Channel	Calculation setting
1	- Abso Sub
2	- Abso Sub
Calculated value	$-(10) - (15) = -25$

Channel	Calculation setting
1	Not use
2	+ Addition
Calculated value	$+ (15) = 15$

Channel	Calculation setting
1	Not use
2	- Subtraction
Calculated value	$-(15) = -15$

Channel	Calculation setting
1	Not use
2	- Abso Sub
Calculated value	$-(15) = -15$

Example 2: Calculated values from the various calculation settings when channel 1 = -10 and channel 2 = -15

Channel	Calculation setting
1	+ Addition
2	+ Addition
Calculated value	$(-10) + (-15) = -25$

Channel	Calculation setting
1	- Subtraction
2	- Subtraction
Calculated value	$-(-10) - (-15) = 25$

Channel	Calculation setting
1	+ Addition
2	- Subtraction
Calculated value	$(-10) - (-15) = 5$

Channel	Calculation setting
1	- Subtraction
2	+ Addition
Calculated value	$-(-10) + (-15) = -5$

Channel	Calculation setting
1	+ Addition
2	- Abso Sub
Calculated value	$(-10) - (15) = -25$

Channel	Calculation setting
1	- Abso Sub
2	+ Addition
Calculated value	$(-10) + (-15) = -25$

Channel	Calculation setting
1	- Subtraction
2	- Abso Sub
Calculated value	$-(-10) - (15) = -5$

Channel	Calculation setting
1	- Abso Sub
2	- Subtraction
Calculated value	$(-10) - (-15) = 5$

Channel	Calculation setting
1	- Abso Sub
2	- Abso Sub
Calculated value	$(-10) - (15) = -25$

Channel	Calculation setting
1	Not use
2	+ Addition
Calculated value	$+ (-15) = -15$

Channel	Calculation setting
1	Not use
2	- Subtraction
Calculated value	$- (-15) = 15$

Channel	Calculation setting
1	Not use
2	- Abso Sub
Calculated value	$-(15) = -15$

2-4-1 Setting the Calculation

This section explains the procedure for setting channel 1 to absolute value subtraction and channel 2 to subtraction.

- 1** On the basic screen, press Δ or ∇ to select [AMP], and then press A .

The AMP Settings Top Menu is displayed.

AMP Settings
Top Menu
 Δ APP Settings
 ∇ I/O Settings
 \triangleright Channel Settings
 \triangleleft Expert Settings
 O Back

- 2** Press \triangleleft .

The display switches to the [AMP EXP Settings] menu.

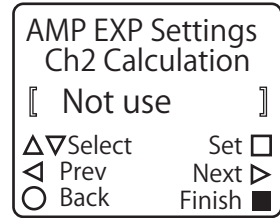
- 3** Use \triangleleft or \triangleright to switch to the [Ch1 Calculation] screen.

AMP EXP Settings
Ch1 Calculation
[Not use]
 $\Delta\nabla$ Select Set \square
 \triangleleft Prev Next \triangleright
 O Back Finish \blacksquare

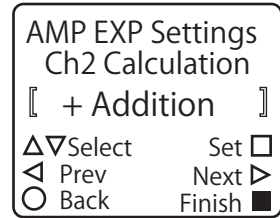
- 4** Use Δ or ∇ to select [-|| Abso Sub], and then confirm your selection with A .

AMP EXP Settings
Ch1 Calculation
[-|| Abso Sub]
 $\Delta\nabla$ Select Set \square
 \triangleleft Prev Next \triangleright
 O Back Finish \blacksquare

5 Press .
The display switches to the [Ch2 Calculation] screen.

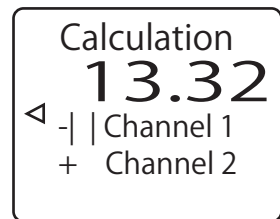


6 Use or to select [+ Addition], and then confirm your selection with .



MEMO

When you set the calculation, the calculation setting added to each channel is displayed on the Calculation screen.



2-4-2 Setting the Calculated Value Judgment

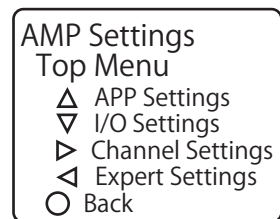
Follow the procedure in this section to apply the calculated value judgment to the control output.

■ Setting the calculated value judgment references

Set the numeric values that are required for performing judgment on the calculated value.

1 On the basic screen, press or to select [AMP], and then press .

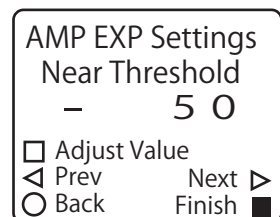
The AMP Settings Top Menu is displayed.



2 Press .

The display switches to the [AMP EXP Settings] menu.

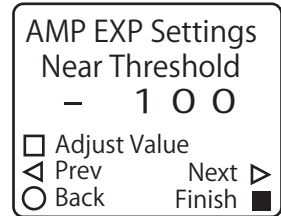
3 Use or to switch to the [Near Threshold] screen.



4 Change the [Near Threshold] value.

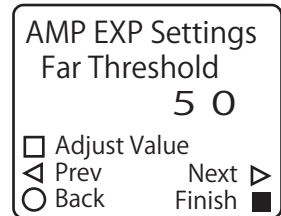
Near Threshold	Set the numeric value of the lower limit to use when performing judgment. -32768 to -50 to 32767
-----------------------	--

* The default value is shown in bold.



5 Press .

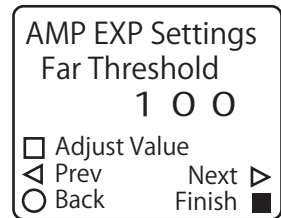
The display switches to the [Far Threshold] screen.



6 Change the [Far Threshold] value.

Far Threshold	Set the numeric value of the upper limit to use when performing judgment. -32768 to 50 to 32767
----------------------	---

* The default value is shown in bold.

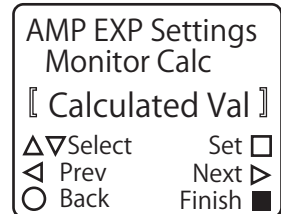


Continue by assigning the output sources.

MEMO

When you are referencing calculated values over CC-Link, you have to assign the calculated values to channel 2 of the CDA.

On the [AMP EXP Settings] menu, change to the [Monitor Calc] screen, and then select [Calculated Val].

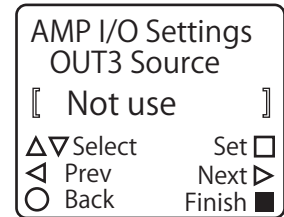


■ Assigning the output sources for the calculated value

- 1** Press **(B)** to return to the **AMP Settings Top Menu**, and then press **(V)**.
The display switches to the [AMP I/O Settings] menu.

- 2** Use **(←)** or **(→)** to switch to the **[OUT1 Source]**, **[OUT2 Source]**, or **[OUT3 Source]** screen.

OUT1 Source	Select the details to assign to output 1.
OUT2 Source	Select the details to assign to output 2.
OUT3 Source	Select the details to assign to output 3.



In this example, we have switched to the [OUT3 Source] screen.

- 3** **Set the calculated value's output.**

Go Calculated Val	Assign the calculated value's Go output. This output will turn on when the calculated value is within the range specified by Near Threshold and Far Threshold.
Hi Calculated Val	Assign the calculated value's Hi output. This output will turn on when the calculated value exceeds the value specified by Far Threshold.
Lo Calculated Val	Assign the calculated value's Lo output. This output will turn on when the calculated value falls below the value specified by Near Threshold.

* You can select the Hi, Go, or Lo judgment for both channel 1 and channel 2.

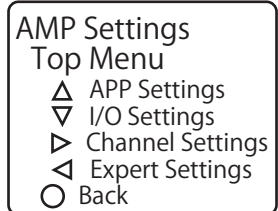
2-5 Other Settings

2-5-1 Setting the I/O Polarity

Follow the procedure shown below to set the CDA I/O polarity. You can select from four types of polarities made of combinations of NPN/PNP and N.O. (normally open)/N.C. (normally closed).

1 On the basic screen, press or to select [AMP], and then press .

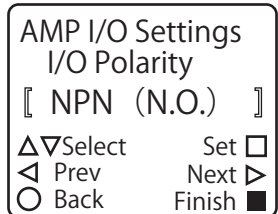
The AMP Settings Top Menu is displayed.



2 Press .

The [I/O Settings] menu is displayed.

3 Use or to switch to the [I/O Polarity] screen.



4 Select the target I/O polarity.

I/O Polarity	Set the I/O polarity. NPN (N.O.) /PNP (N.C.)/NPN (N.C.)/PNP (N.O.)
---------------------	--

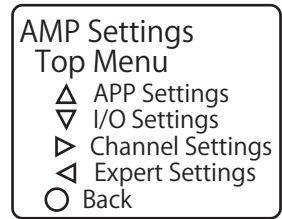
* The default value is shown in bold.

2-5-2 Changing the Display Language

You can select [Japanese] or [English] for the CDA's display language.

- 1** On the basic screen, press or to select [AMP], and then press .

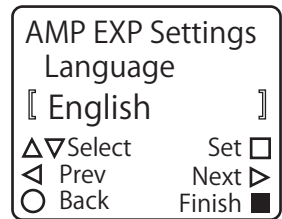
The AMP Settings Top Menu is displayed.



- 2** Press .

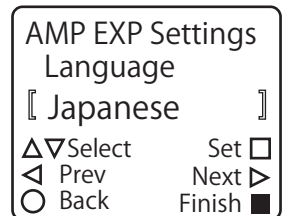
The display switches to the [AMP EXP Settings] menu.

- 3** Use or to switch to the [Language] screen.



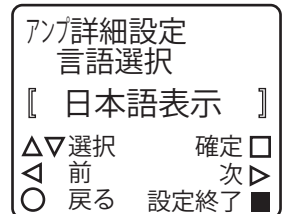
- 4** Change the display language.

Language	Select the display language. [Japanese]/[English] * When you switch the display language to Japanese [日本語表示]/[英語表示]
-----------------	--



MEMO

If you set the language to [Japanese] and press to confirm your entry, the display will switch to Japanese. To return the language to English, select [英語表示] on the screen shown in the figure on the right.



2-5-3 Initializing Settings

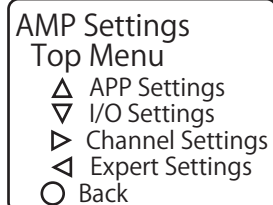
Follow the procedure shown below to initialize the CDA settings. When you perform this operation, all setting details except for [Language] will return to the default values.

MEMO

There is no message or other confirmation when you execute the initialization. Exercise caution when initializing the settings.

- 1** On the basic screen, press Δ or ∇ to select [AMP], and then press A .

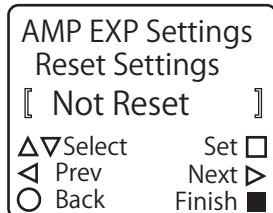
The AMP Settings Top Menu is displayed.



- 2** Press \triangleleft .

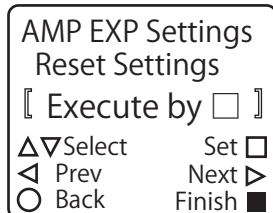
The display switches to the [AMP EXP Settings] menu.

- 3** Use \triangleleft or \triangleright to switch to the [Reset Settings] screen.



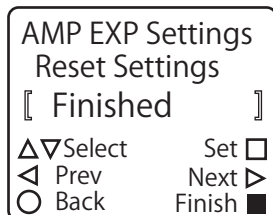
- 4** Use Δ or ∇ to display [Execute by \square].

To initialize the settings, press A while [Execute by \square] is displayed. Press B to cancel the initialization and return to the AMP Settings Top Menu.



MEMO

When you execute the initialization, [Finished] is displayed on the screen as shown in the figure on the right.



2-5-4 Correction Value Settings

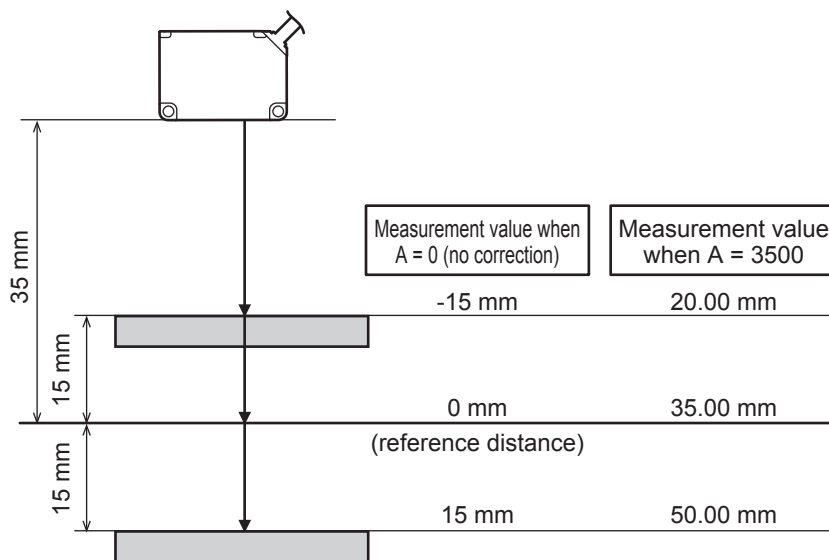
You can correct the sensor's measurement values by setting correction values on the amplifier side. Also, the measurement values of a displacement sensor are normally positive or negative values from the measurement center, but you can also change the reference distance used in actual measurement on the amplifier side.

■ Changing the reference distance




Use the correction parameter A_n to change the way that the sensor's center of measurement range (the reference distance) is displayed.

With a displacement sensor, the center of measurement range is normally set as 0 and the measurement value is displayed as a positive or negative value. If you set A_n to the value of the center of measurement range defined in the specifications, the measurement value from the displacement sensor will become the actual distance from the sensor to the workpiece.

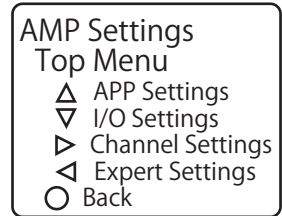
● Example: CD22-35



In this section, we will explain the setup procedure for displaying the CD22-35 measurement value as the actual distance from the sensor to the workpiece as an example.

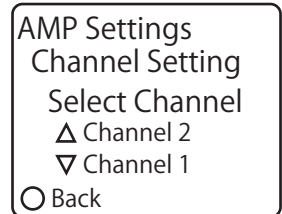
1 On the basic screen, press  or  to select [AMP], and then press .

The AMP Settings Top Menu is displayed.



2 Press .

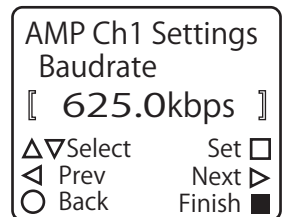
The [Channel Setting] screen is displayed.



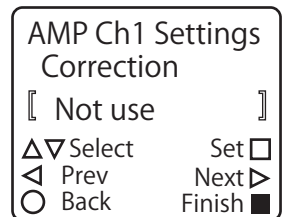
3 Press  or  to select the channel to correct.

Here, we will press  to select channel 1.

The display switches to the [AMP Ch1 Settings] menu.



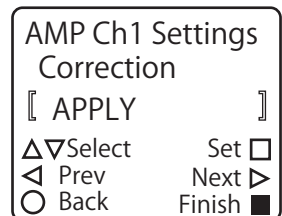
4 Use  or  to switch to the [Correction] screen.



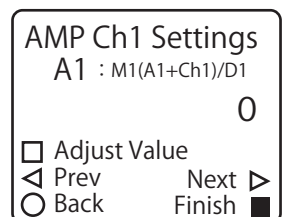
5 Change [Correction] to [APPLY].

Correction	Set whether to correct the input from the sensor. This can be set separately for each channel. Not use/APPLY
-------------------	---

* The default value is shown in bold.



6 Press  to switch to the [A1: M1 (A1 + Ch1)/D1] screen.



7 Set "3500" as the A1 value.

A1	Set A1 (correction parameter A for channel 1). -10000 to 0 to 10000
----	---

* The default value is shown in bold.

AMP Ch1 Settings
A1 : M1(A1+Ch1)/D1
3 5 0 0

Adjust Value
◀ Prev Next ▶
○ Cancel Finish ■

The channel 1 output is corrected according to the set A1 value.

MEMO

- Correction parameters are only displayed and can only be changed when you set [Correction] to [APPLY].
- If you set [Correction] to [Not use] after setting correction parameters, the correction will no longer be applied. However, the set correction parameter values will be retained.

Aligning the measurement range between channels

As an example, consider the CD22-15 and the CD22-35/CD22-100; the digits of the measurement ranges are different. To use these measurement values in a calculation, it may be necessary to match the digits. In situations such as this, you can use the CDA's Mn and Dn correction parameters to correct the measurement values. As an example, this section explains the procedure for matching the digits of a CD22-15 connected to channel 1 with the digits of a CD22-35 connected to channel 2.

1 On the basic screen, press or to select [AMP], and then press .

The AMP Settings Top Menu is displayed.

AMP Settings
Top Menu

▲ APP Settings
▼ I/O Settings
▶ Channel Settings
◀ Expert Settings
○ Back

2 Press .

The [Channel Setting] screen is displayed.

AMP Settings
Channel Setting

Select Channel

▲ Channel 2
▼ Channel 1
○ Back

3 Press to select [Channel 1].

The display switches to the [AMP Ch1 Settings] menu.

AMP Ch1 Settings
Baudrate

[625.0kbps]

▲▼Select Set
◀ Prev Next ▶
○ Back Finish ■

4 Use or to switch to the [Correction] screen.

AMP Ch1 Settings
Correction

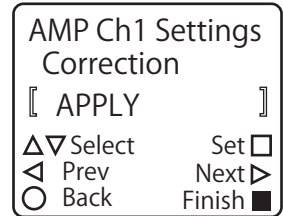
[Not use]

▲▼Select Set
◀ Prev Next ▶
○ Back Finish ■

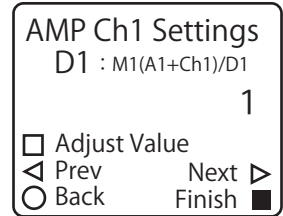
5 Change [Correction] to [APPLY].

Correction	Select whether to correct the output value from the amplifier. This can be set separately for each channel. Not use/APPLY
-------------------	---

* The default value is shown in bold.



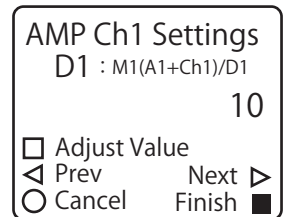
6 Press \odot three times to switch to the [D1: M1 (A1 + Ch1)/D1] screen.



7 Set "10" as the D1 value.

D1	Set D1 (correction parameter D for channel 1). 1 to 32767
-----------	---

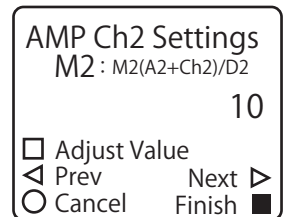
* The default value is shown in bold.



The channel 1 output is corrected according to the set D1 value.

MEMO

- You can perform correction in the same manner by pressing \odot in step 3 to select [Channel 2], enabling the channel 2 correction settings, and then setting the M2 value to "10."
- Correction parameters are only displayed and can only be changed when you set [Correction] to [APPLY].
- If you set [Correction] to [Not use] after setting correction parameters, the correction will no longer be applied. However, the set correction parameter values will be retained.





3

Compatible Sensor Settings

This chapter explains teaching and other ways to configure the settings of the compatible sensor from the CDA.

3-1 CD22 Settings

MEMO

The CDA only supports the CD22 series model that supports RS-485 communication.

3-1-1 Setting Items and Screen Transitions

■ Setup mode

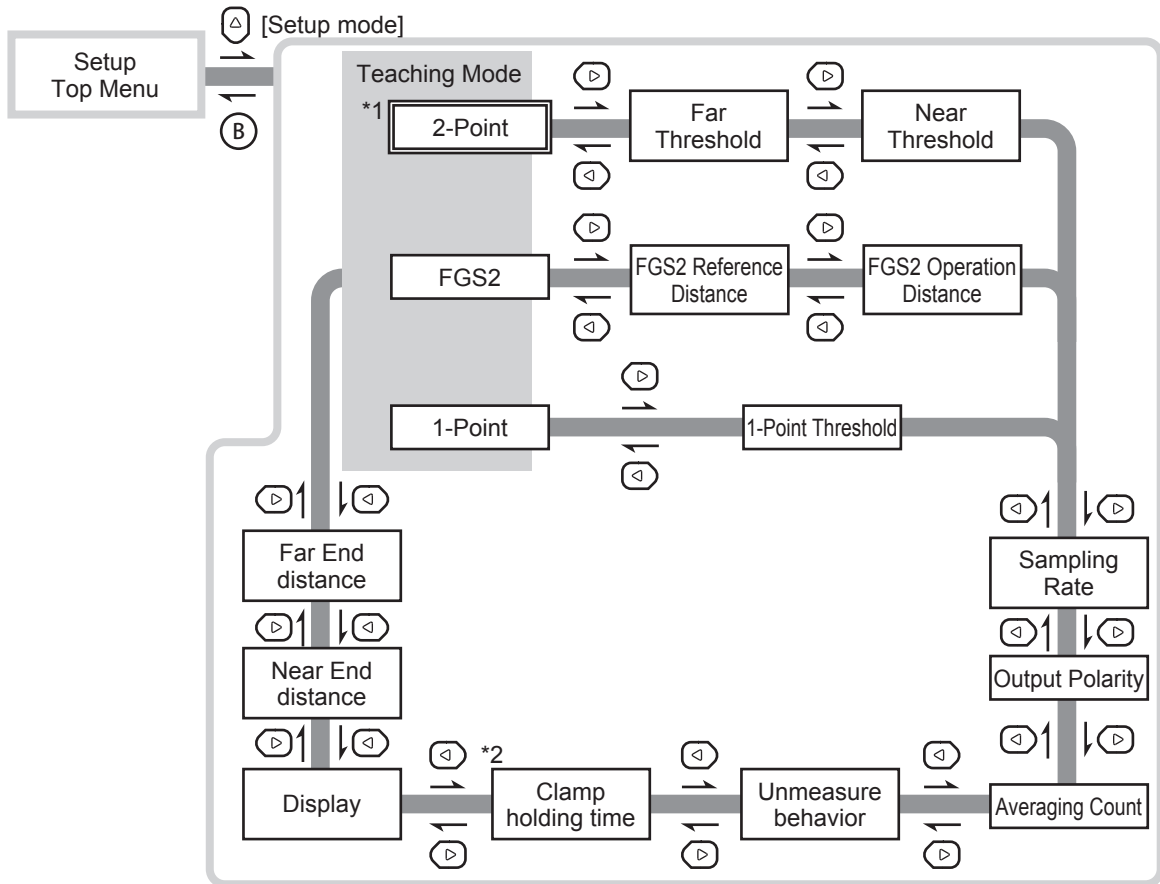
● Setting items

Screen name	Explanation and settable values/options	
Teaching Mode	Set the CD22's teaching method. 2-Point/FGS2/1-Point	
Near Threshold	Check or change the currently set threshold on the near side for 2-point teaching.	
	CD22-15	-7.499 to -1.000 to 7.499
	CD22-35	-22.49 to -3.00 to 22.49
Far Threshold	Check or change the currently set threshold on the far side for 2-point teaching.	
	CD22-15	-7.499 to 1.000 to 7.499
	CD22-35	-22.49 to 3.00 to 22.49
FGS2 Reference Distance	Check or change the currently set FGS2 reference distance.	
	CD22-15	-7.499 to 0.000 to 7.499
	CD22-35	-22.49 to 0.00 to 22.49
FGS2 Operation Distance	Check or change the currently set FGS2 operation distance.	
	CD22-15	0.000 to 1.000 to 7.499
	CD22-35	0.00 to 3.00 to 22.49
1-Point Threshold	Check or change the currently set 1-point teaching threshold.	
	CD22-15	-7.499 to -1.000 to 7.499
	CD22-35	-22.49 to -3.00 to 22.49
CD22-100	-74.99 to -10.00 to 74.99	
	0.00 to 10.00 to 74.99	
	0.00 to 3.00 to 22.49	
Sampling Rate	Set the measurement period. Setting a large sampling rate makes the response speed slower but makes it possible to detect workpieces with poor reflectance such as black workpieces. 500/1000/2000/4000 (μs)/Automatic	
Output Polarity	Select whether to generate output when light is received or when light is not received. Light On/Dark On	

Screen name	Explanation and settable values/options	
Averaging Count	Select the number of times to average the sampled measurement values. Increasing the averaging count improves the detection accuracy but makes the response slower. 1/8/ 64 /512	
Unmeasure behavior	Set the operation to perform when measurement is not possible. Clamp/ Hold	
Clamp holding time	Set the number of samples over which to maintain the previous measurement value when measurement is not possible. 0 to 9999	
Display	Set the behavior of the CD22 display when CD22 key operations are disabled. Display When Locked/ Off When Locked	
Near End distance	Check or change the near-end distance correction value used when correcting the tilt of the sensor's light axis.	
	CD22-15	-7.499 to -5.000 to 7.499
	CD22-35	-22.49 to -50.00 to 22.49
	CD22-100	-74.99 to -50.00 to 74.99
Far End distance	Check or change the far-end distance correction value used when correcting the tilt of the sensor's light axis.	
	CD22-15	-7.499 to 5.000 to 7.499
	CD22-35	-22.49 to 50.00 to 22.49
	CD22-100	-74.99 to 50.00 to 74.99

* The default values are shown in bold.

● Screen transitions



*1: This is the default value of [Teaching Mode].

If you execute [Reset Settings], the [Teaching Mode] screen is displayed with [2-Point] specified when you select [Setup Mode] on the Top Menu.

While the power is on, the screen on which you pressed (B) to return to the Top Menu will be the initial screen displayed the next time you select [Setup Mode] from the Top Menu.

Thereafter, the last menu that you used is displayed.

*2: This is only displayed when you set [Unmeasure behavior] to [Hold].

● ● ● MEMO ● ● ●

The menus that you transition to with ◀ and ▶ vary depending on the setting that you select for [Teaching Mode].

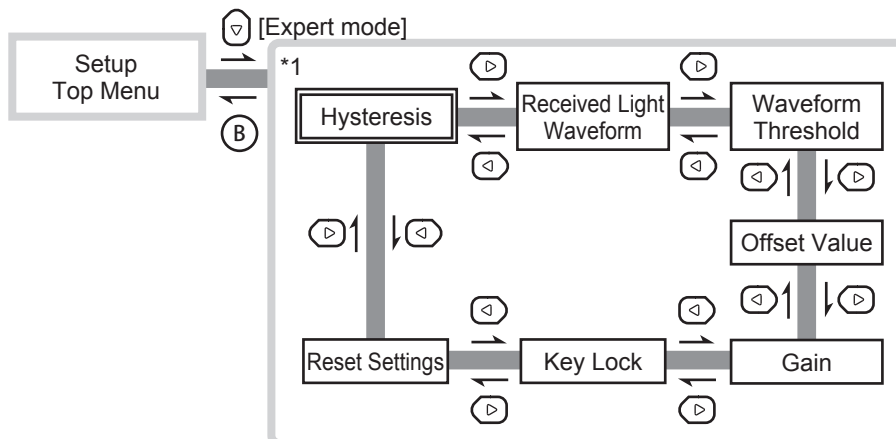
Expert Mode

Setting items

Screen name	Explanation and settable values/options	
Hysteresis	Set the hysteresis in relation to the sensor's judgment threshold to prevent chattering.	
	CD22-15	0.000 to 0.050 to 7.499
	CD22-35	0.00 to 0.15 to 22.49
	CD22-100	0.00 to 0.50 to 74.99
Received Light Waveform	Normally use [Maximum]. Maximum /Nearest Point/Point 2/Point 3/Point 4/Point 5	
Waveform Threshold	Normally use [Lowest Surface]. Use this setting to perform adjustments when detections are unstable due to the influence of noise. Lowest Surface /Low Position/Middle Position/Highest Position	
Offset Value	Check or change the currently set offset value.	
	CD22-15	-7.499 to 0.000 to 7.499
	CD22-35	-22.49 to 0.00 to 22.49
	CD22-100	-74.99 to 0.00 to 74.99
Gain	Normally use [Auto adjust]. Fixing the gain improves the detection speed but measurement may not be possible due to the influence of the workpiece's color or materials. Auto adjust /Fixed to Lowest/Fixed to #2/Fixed to #3/Fixed to #4/Fixed to #5/Fixed to Highest	
Key Lock	Enable/disable the CD22 key operations. Lock /Unlock	
Reset Settings	Initialize all the CD22 settings. Not Reset /Execute by <input type="checkbox"/>	

* The default values are shown in bold.

Screen transitions



*1: Immediately after the power is turned on, this is the first screen displayed for the [Expert Mode] menu. Thereafter, the last menu that you used is displayed.

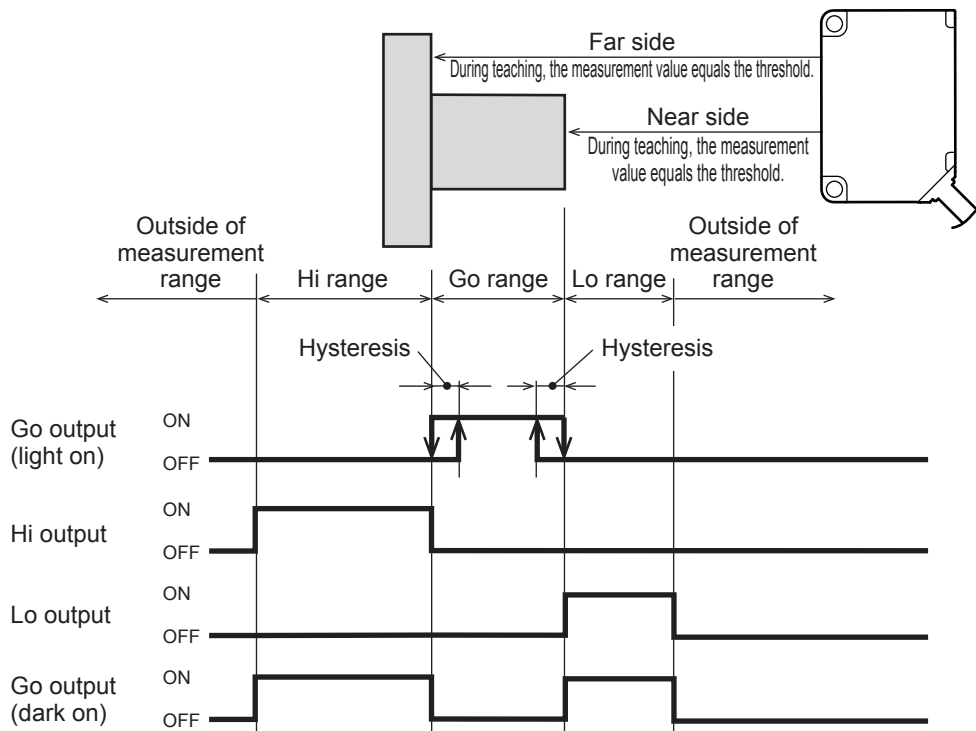
3-1-2 Teaching

With the CD22, you can perform three types of teaching: "2-point teaching," "FGS2 teaching," and "1-point teaching."

2-point teaching

Perform teaching with two points and register both points as thresholds.

The Go on/off judgment is performed according to whether the measurement value is within the two thresholds during operation.



Executing 2-point teaching

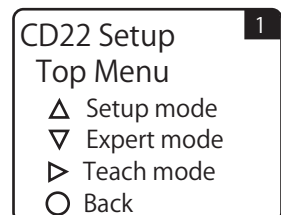
This section explains how to perform teaching from the sensor's actual measurement value. You can execute 2-point teaching from the far side or from the near side, but this explanation will perform teaching from the near side followed by teaching from the far side as an example. Prepare a workpiece in advance so that the sensor detects the near side.

MEMO

- You can enter the thresholds manually from the [Setup Mode] menu. You can also set the output polarity (light on/dark on) from the [Setup Mode] menu.
- From the [Expert Mode] menu, in addition to changing the offset value manually, you can also set the hysteresis value.
- From the [Teaching Mode] menu, you can execute and clear offsets as well as specify the near end/far end from the actual measurement value.

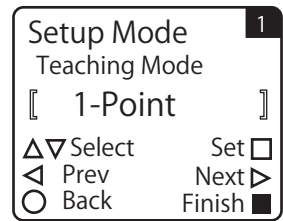
- On the basic screen, press Δ or ∇ to select [Channel 1] or [Channel 2], and then press A .

The Setup Top Menu for the selected channel is displayed.

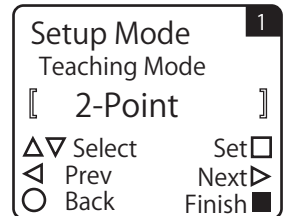


2 Press **△**.
The display switches to the [Setup Mode] menu.

3 Use **◀** or **▶** to switch to the [Teaching Mode] screen.
The default value for the teaching mode is [2-Point], but a different setting is selected here as an example.



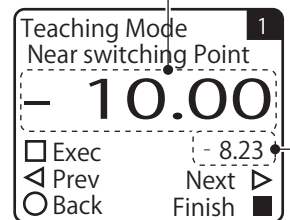
4 Use **△** or **▽** to select [2-Point], and then press **Ⓐ**.
The teaching mode is set to [2-Point].



5 Press **Ⓑ** to return to the Setup Top Menu, and then press **▶**.
The display switches to the [Teaching Mode] menu.

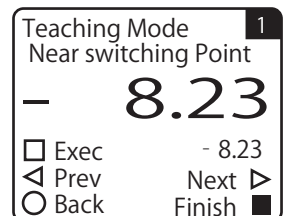
6 Use **◀** or **▶** to switch to the [Near switching Point] screen.

Currently registered
threshold on the near end



Current measurement value

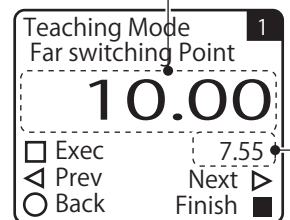
7 Press **Ⓐ** to execute the teaching on the near side.
When you execute the teaching on the near side, the near side threshold is overwritten with the current measurement value.



8 Move the workpiece so that the sensor detects the far side.

9 Press **▶**.
The display switches to the [Far switching Point] screen.

Currently registered
threshold on the far end

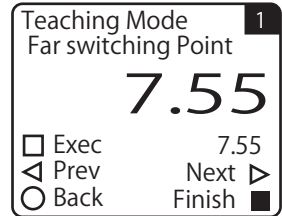


Current measurement value

10 Press (A) to execute the teaching on the far side.

When you execute the teaching on the far side, the far side threshold is overwritten with the current measurement value.

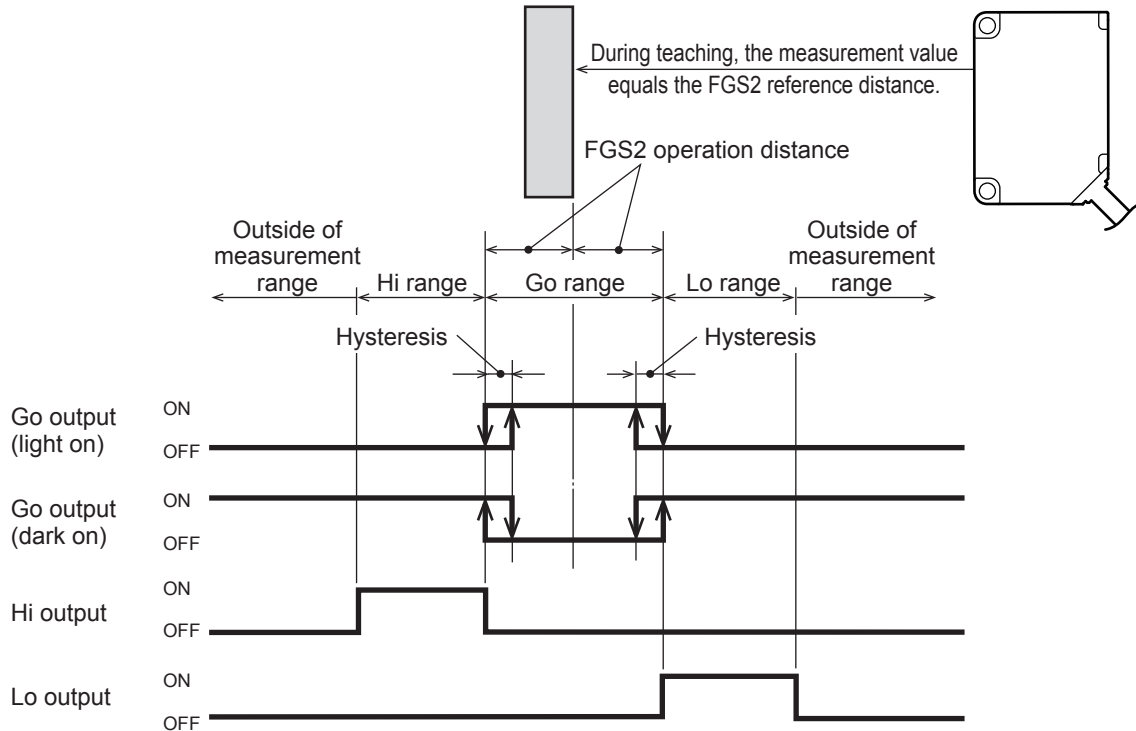
This completes the 2-point teaching procedure.



■ FGS2 teaching

Perform 1-point teaching to set the reference distance.

During operation, the Go on/off judgment is performed according to whether the measurement value is within the range of "reference distance ± operation distance" by using the operation distance set in advance.



When detecting workpieces on a belt conveyor from above, the Go output will turn on when using the dark on setting if the workpiece on the conveyor belt is outside of the detection range. For example, it is difficult to accurately detect the distance when the workpiece has a mirror surface, but by using FGS2, it is possible to judge whether the workpiece is present on the basis of the Go output being on or off regardless of whether it is possible to actually detect the workpiece. In this manner, use FGS2 with dark on operation when a reference background is present and the workpieces are closer to the sensor than the background (the reference distance) is.

MEMO

When the teaching mode is set to FGS2, Hi and Lo are judged. You can use Hi output/Lo output in the same manner as Go output.

● Executing FGS2 teaching

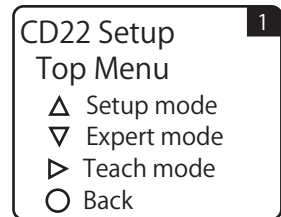
This section explains how to perform teaching from the sensor's actual measurement value. In advance, position the sensor and the reference background in the same manner as during actual operation.

●●● MEMO ●●●

- You can enter the FGS2 reference distance manually from the [Setup Mode] menu. You can also set the FGS2 operation distance and the output polarity (light on/dark on) from the [Setup Mode] menu.
- From the [Expert Mode] menu, in addition to changing the offset value manually, you can also set the hysteresis value.
- From the [Teaching Mode] menu, you can execute and clear offsets as well as specify the near end/far end from the actual measurement value.

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

The Setup Top Menu for the selected channel is displayed.

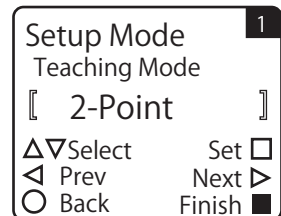


- 2** Press .

The display switches to the [Setup Mode] menu.

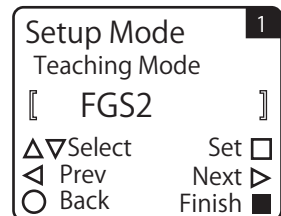
- 3** Use or to switch to the [Teaching Mode] screen.

The default value for the teaching mode is [2-Point].



- 4** Use or to select [FGS2], and then press .

The teaching mode is set to [FGS2].

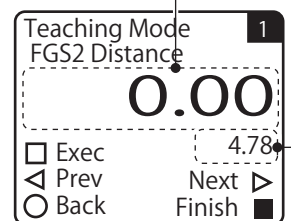


- 5** Press to return to the Setup Top Menu, and then press .

The display switches to the [Teaching Mode] menu.

- 6** Use or to switch to the [FGS2 Distance] screen.

Currently registered FGS2 reference value

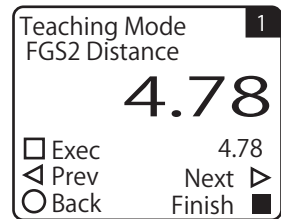


Current measurement value

7 Press **(A)** to execute the teaching.

When you execute the teaching, the FGS2 reference value is overwritten with the current measurement value.

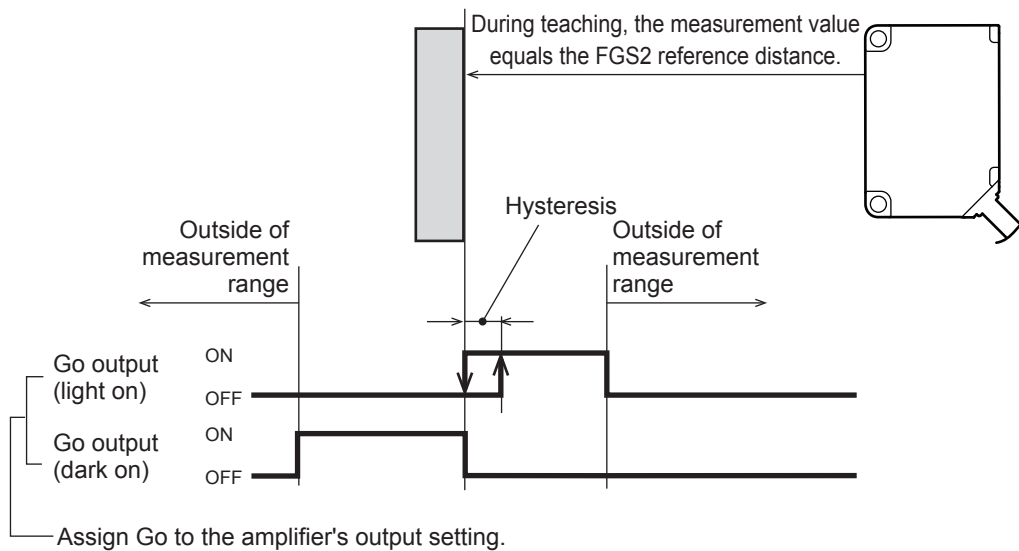
This completes the FGS2 teaching procedure.



1-point teaching

Use the measurement value during teaching as the threshold.

The Go on/off judgment is performed according to whether the measurement value reaches the threshold during operation.



● Executing 1-point teaching

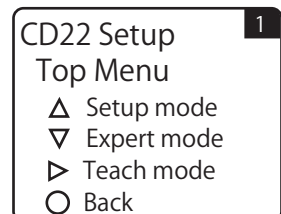
This section explains how to perform teaching from the sensor's actual measurement value. In advance, prepare a workpiece to use in teaching.

MEMO

- You can enter the threshold manually from the [Setup Mode] menu. You can also set the output polarity (light on/dark on) from the [Setup Mode] menu.
- From the [Expert Mode] menu, in addition to changing the offset value manually, you can also set the hysteresis value.
- From the [Teaching Mode] menu, you can execute and clear offsets as well as specify the near end/far end from the actual measurement value.

1 On the basic screen, press **(▲)** or **(▼)** to select [Channel 1] or [Channel 2], and then press **(A)**.

The Setup Top Menu for the selected channel is displayed.

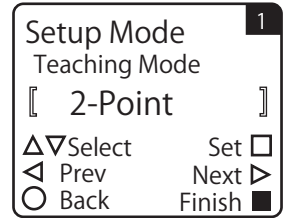


2 Press **(▲)**.

The display switches to the [Setup Mode] menu.

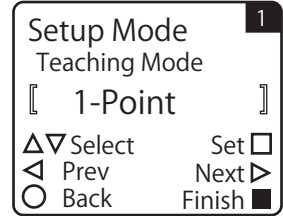
3 Use **◀** or **▶** to switch to the [Teaching Mode] screen.

The default value for the teaching mode is [2-Point].



4 Use **▲** or **▼** to select [1-Point], and then press **Ⓐ**.

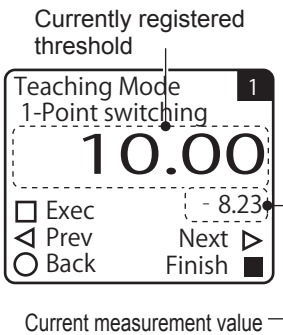
The teaching mode is set to [1-Point].



5 Press **Ⓑ** to return to the Setup Top Menu, and then press **▶**.

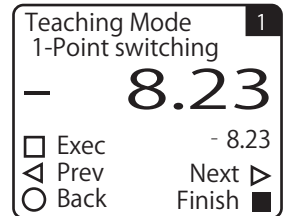
The display switches to the [Teaching Mode] menu.

6 Use **◀** or **▶** to switch to the [1-Point switching] screen.



7 Press **Ⓐ** to execute the teaching.

When you execute the teaching, the threshold is overwritten with the current measurement value. This completes the 1-point teaching procedure.



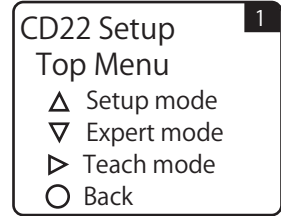
3-1-3 Setting the Operation When an Alarm Occurs (When Measurement Is Not Possible)

■ Unmeasure behavior

With the CD22, you can select from two operations when measurement is not possible: [Clamp] and [Hold]. This section explains the procedure for setting the CD22's alarm operation from the CDA.

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

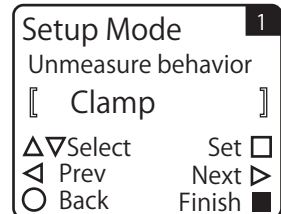
The Setup Top Menu for the selected channel is displayed.



- 2** Press Δ .

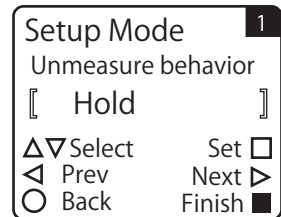
The display switches to the [Setup Mode] menu.

- 3** Use \leftarrow or \rightarrow to switch to the [Unmeasure behavior] screen.



- 4** Use Δ or ∇ to select the value for [Unmeasure behavior], and then press A .

Unmeasure behavior	
	Clamp: When measurement is not possible, the specified output is generated. In this situation, the output value is 9999.
	Hold: When measurement is not possible, the previous measurement value is maintained.

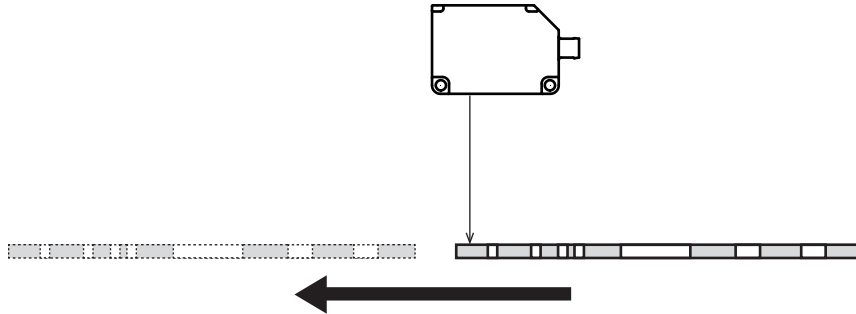


* The default value is shown in bold.

■ Clamp holding time

If you select [Hold] for [Unmeasure behavior], you can set the time for which to maintain the measurement value when measurement is not possible.

For example, when detecting a workpiece such as a printed circuit board that has multiple holes, such as that shown in the following figure, measurement is not possible at the hole positions.

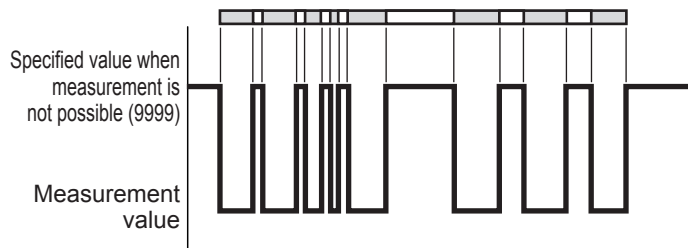


Setting [Unmeasure behavior] to [Clamp] does not suit this workpiece because it will frequently be impossible to perform measurement.

Just setting [Unmeasure behavior] to [Hold] maintains the detection status after the workpiece is first detected. This means that the presence and absence of both holes and the workpiece are ignored, which is not well-suited to the detection of the workpiece.

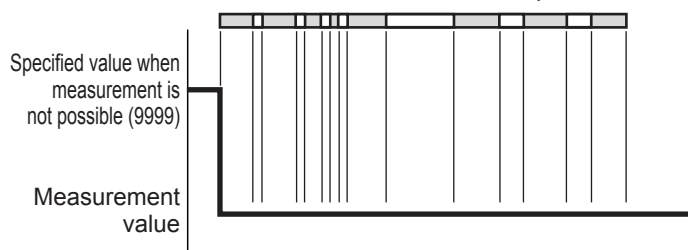
● Operation when Clamp is specified

Measurement is not possible outside of the workpiece and at the hole positions.



● Operation when only Hold is specified

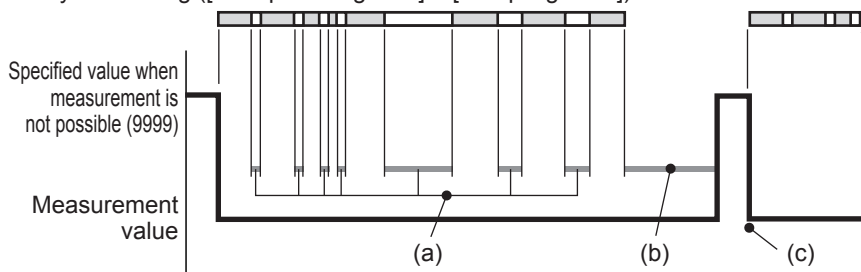
After the workpiece is first detected, the detected status (measurement value) is maintained even when measurement is not possible.



In order to accurately detect the presence and absence of a printed circuit board, it is necessary to not handle holes as impossible measurements and to set the measurement target as the case where the workpiece is present. Therefore, configure the settings to release the hold function's maintained detection status after a set length of time elapses. If you set [Clamp holding time] and [Sampling Rate], the detection status will be maintained only for the length of time specified by $[\text{Sampling Rate}] \times [\text{Clamp holding time}]$.

• **Operation when Hold is specified and Clamp holding time and Sampling Rate are set**

After the workpiece is detected, the detected status (measurement value) is maintained even when measurement is not possible due to holes in the workpiece. The held status is released if measurement is not possible for a length of time longer than that found by calculating $([\text{Clamp holding time}] \times [\text{Sampling Rate}])$.



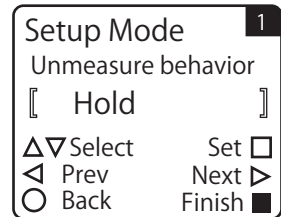
(a) The time that the detection laser passes the holes in the workpiece is less than or equal to $([\text{Clamp holding time}] \times [\text{Sampling Rate}])$ [maximum], so the measurement value is maintained.

(b) The time that the detection laser passes from one workpiece to the next one is greater than $([\text{Clamp holding time}] \times [\text{Sampling Rate}])$ [maximum], so the measurement value is released (measurement is not possible).

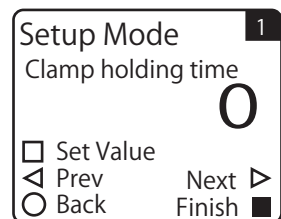
(c) The next workpiece is detected and the measurement value is acquired.

This section explains the procedure for setting the CD22's sampling rate and clamp holding time from the CDA.

- 1** Set [Unmeasure behavior] to [Hold].
See "Unmeasure behavior" (page 3-13).



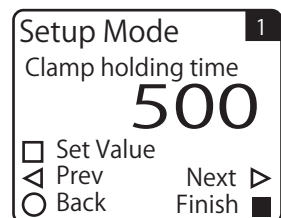
- 2** Press \triangleright .
The display switches to the [Clamp holding time] screen.



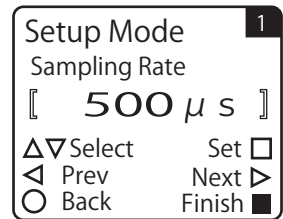
- 3** Set the clamp holding time.

Clamp holding time	Set the number of samples over which to allow measurement to continue even when measurement is not possible. 0 to 9999
---------------------------	--

* The default value is shown in bold.

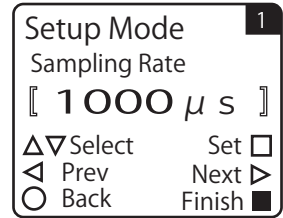


4 Use \leftarrow or \rightarrow to switch to the [Sampling Rate] screen.



5 Use \uparrow or \downarrow to select the sampling rate, and then press (A).

Sampling Rate	Select the rate at which to perform measurement from the values shown below. 500 μs , 1000, 2000, 4000, Automatic
----------------------	---

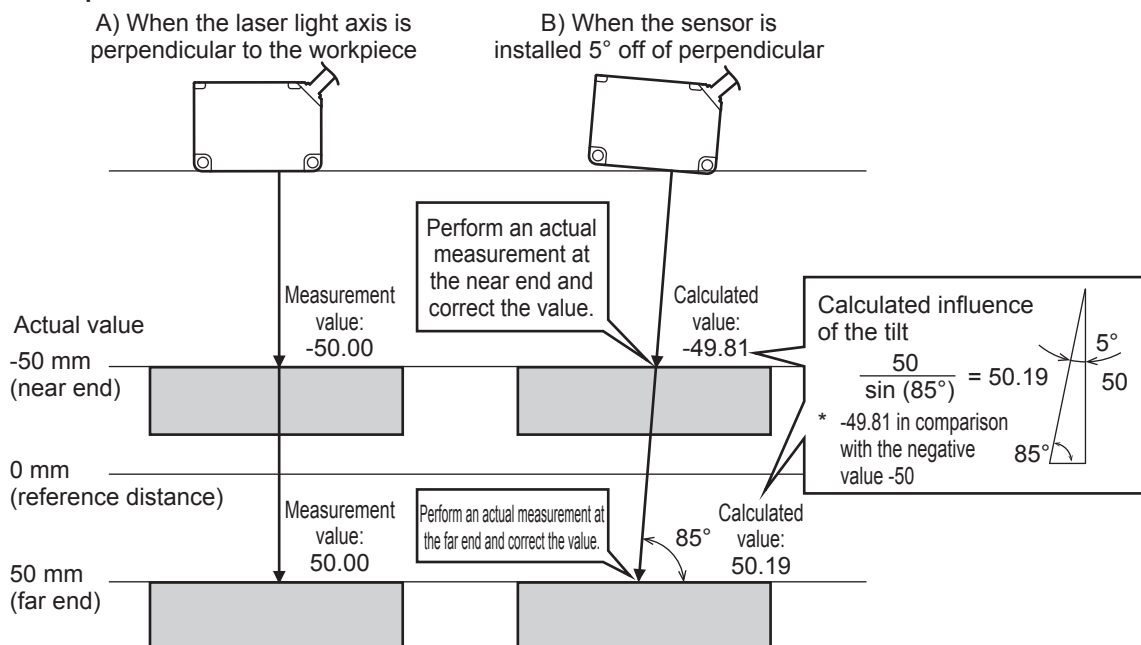


* The default value is shown in bold.

3-1-4 Correcting the Influence of Sensor Light Axis Tilt

Before it is shipped from the factory, the CD22 is calibrated to match a distance fluctuation of 90° from the laser light axis. Therefore, if the CD22 is tilted in its installation position, errors will occur in the output value. For example, the measurement range for the CD22-100 is -50 mm to +50 mm. If the sensor is installed with a tilt of 5°, an error occurs in the output as calculated according to the following figure.

• Example: CD22-100



In this situation, it is possible to correct the actual measurement value with the sensor tilted (B in the above figure) to the measurement value with the perpendicular light axis (A in the above figure).

■ Performing corrections with the actual near-end and far-end measurements

This section explains how to correct the influence of the tilt of the CD22-100 installation position with the actual near-end and far-end measurements.

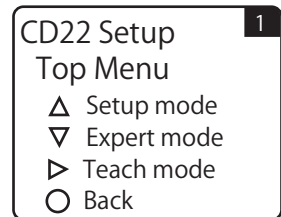
Prepare a workpiece in advance so that the measurement can be performed on the near end.

MEMO

When specifying the near end, perform the measurement at the shortest distance in the detection range wherever possible. In the same manner, when specifying the far end, perform the measurement at the longest distance in the detection range wherever possible.

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

The Setup Top Menu for the selected channel is displayed.



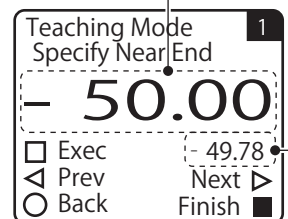
- 2 Press .

The display switches to the [Teaching Mode] menu.

- 3 Use  or  to switch to the [Specify Near End] screen.

For the CD22-100, -50.00 is registered as the default value for the near end measurement value (Near End distance).

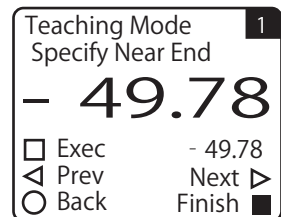
Registered actual measurement value on the near end



Current measurement value

- 4 Press  to execute the teaching of the near end specification.

When you execute the teaching of the near end specification, Near End distance is overwritten with the current measurement value.



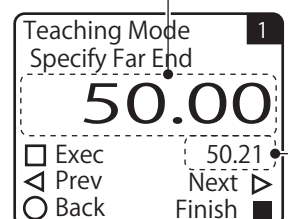
- 5 After you finish the near end teaching, prepare the workpiece so that the far end measurement can be performed.

- 6 Press .

The display switches to the [Specify Far End] screen.

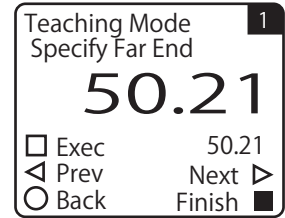
For the CD22-100, 50.00 is registered as the default value for the far end measurement value (Far End distance).

Registered actual measurement value on the far end



Current measurement value

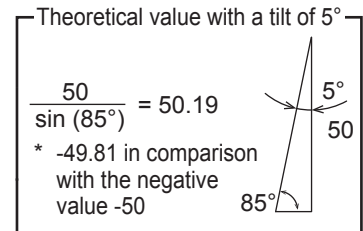
- 7** Press **(A)** to execute the teaching of the far end specification. When you execute the teaching of the far end specification, Far End distance is overwritten with the current measurement value. This completes the procedure for correcting the tilt influence by performing teaching from actual measurement values.



■ Performing corrections by entering numeric values

Calculate the influence of the tilt according to the example on 3-16. When the sensor's laser light axis is tilted by 5° (at an angle of 85° from the workpiece), the calculation becomes that shown in the figure on the right for the CD22-100.

Near End distance = -49.81
Far End distance = 50.19

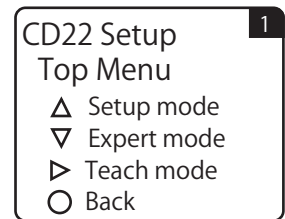


This section explains how to correct the influence of the tilt of the CD22-100 installation position by entering the numeric values calculated above.

Caution

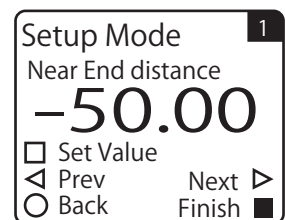
Unless you have a special reason to do otherwise, correct the influence of light axis tilt by performing actual measurements of the near and far ends. For details on correcting the sensor light axis tilt with actual measurements, see "Performing corrections with the actual near-end and far-end measurements" (page 3-17).

- 1** On the basic screen, press **(▲)** or **(▼)** to select [Channel 1] or [Channel 2], and then press **(A)**. The Setup Top Menu for the selected channel is displayed.



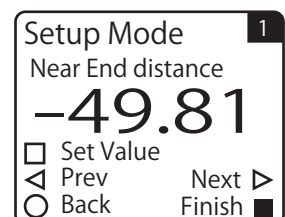
- 2** Press **(▲)**. The display switches to the [Setup Mode] menu.

- 3** Use **(◀)** or **(▶)** to switch to the [Near End distance] screen. For the CD22-100, -50.00 is registered as the default value for Near End distance.

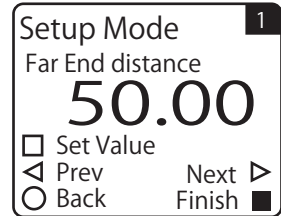


- 4** Change the near end distance to match the calculated value. The range of settings that are possible for the near end distance varies according to the sensor model (the center of measurement range).

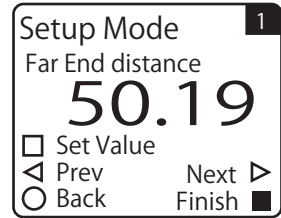
Model	Near end distance settable range
CD22-15	-7.499 to 0.000 to 7.499
CD22-35	-22.49 to 0.00 to 22.49
CD22-100	-74.99 to 0.00 to 74.99



- 5** Press .
- The display switches to the [Far End distance] screen.
For the CD22-100, 50.00 is registered as the default value for Far End distance.



- 6** Change the far end distance to match the calculated value.
This completes the procedure for correcting the tilt influence by entering calculated values.



3-1-5 Initializing Settings

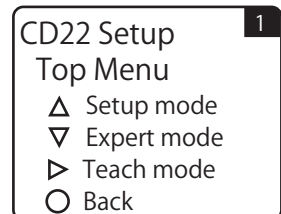
Follow the procedure shown below to initialize the CD22 settings with CDA operations. You can initialize each connected channel separately.

When you perform the initialization, all the CD22 settings—such as the changed correction of the influence of the sensor's light axis tilt, teaching method, and teaching result—are returned to their default values.

MEMO

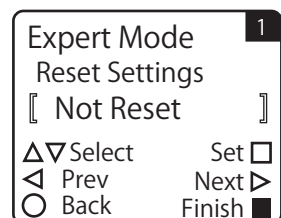
There is no message or other confirmation when you execute the initialization. Exercise caution when initializing the settings.

- 1** On the basic screen, press or to select [Channel 1] or [Channel 2], and then press (A).
The Setup Top Menu for the selected channel is displayed.

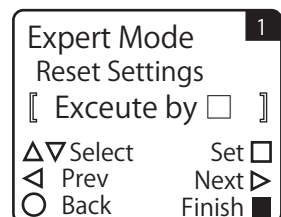


- 2** Press .
- The display switches to the [Expert Mode] menu.

- 3** Use or to switch to the [Reset Settings] screen.



- 4** Use or to select [Execute by].
To initialize the settings, press (A) while [Execute by] is displayed.
Press (B) to cancel the initialization and return to the Setup Top Menu.



 **MEMO** 

When you initialize the sensor settings, the PWR lamp will light in red for an instant due to the initialization of the CD22 communication speed setting. Different from the initialization of the amplifier settings, the screen's display does not change.



4

Appendix

The appendix contains information, such as troubleshooting, that is useful to know during operation.

4-1 Troubleshooting

This section explains how to check for problems.

4-1-1 CDA Indicator Specifications

The CDA indicators express the operation status as shown below.

■ PWR (power indicator)

LED status	CDA status	Countermeasures	Reference
Lit (green)	<ul style="list-style-type: none">• Power on• Normal operation		
Flashing	In power-saving mode	Press any key to make the display panel light.	
Lit (red)	Error	Check for an error in the connection to the power supply or to the sensor.	1-6 1-8
Off	Power off	Check the connection to the power supply.	1-8

■ OUT1/OUT2/OUT3 (control output indicators)

LED status	CDA status	Countermeasures	Reference
Lit (orange)	Assigned output on		
Off	Assigned output off		

If an unexpected operation occurs, check [I/O Settings] under [AMP Settings].



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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