

DL950
ScopeCorder

U S E R ' S M A N U A L

Thank you for purchasing the DL950 ScopeCorder. This User's Manual explains how to use the instrument. To ensure correct use, please read this manual thoroughly before operation. After reading this manual, keep it in a safe place. The manuals for this instrument are listed on page iii. Please read all manuals.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document No.	Description
PIM 113-01Z2	List of worldwide contacts

Notes

- The contents of this manual are subject to change without prior notice as a result of improvements to the product's performance and functionality. Refer to our website to view our latest manuals.
- The figures given in this manual may differ from those that actually appear on your screen.
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- 4th Edition: January 2023
- 5th Edition: November 2023
- 6th Edition: April 2024

Manuals

The following manuals, including this one, are provided as manuals for this instrument. Please read all manuals.

Manuals Included with the Product

Manual Title	Manual No.	Description
DL950 ScopeCorder Getting Started Guide	IM DL950-03EN	This guide explains the handling precautions, common operations, troubleshooting measures, and specifications of this instrument.
DL950 ScopeCorder Request to Download Manuals	IM DL950-73Z2	Describes the manuals provided on the website.
Precautions Concerning the Modules	IM 701250-04E	The manual explains the precautions concerning the modules. This manual is included if you ordered modules.
DL950 ScopeCorder	IM DL950-92Z1	Document for China.
Safety Instruction Manual	IM 00C01C01-01Z1	Safety manual (European languages)

Manuals Provided on the Website

Download the following manuals from the YOKOGAWA website.

Manual Title	Manual No.	Description
DL950 ScopeCorder Features Guide	IM DL950-01EN	This manual explains all the instrument's features other than the communication interface features.
DL950 ScopeCorder User's Manual	IM DL950-02EN	This document. The manual explains how to operate this instrument.
DL950 ScopeCorder Communication Interface User's Manual	IM DL950-17EN	The manual explains the functions of this instrument's communication interface, how to configure it, and the commands used to control this instrument from a PC through the interface.

For details on downloading manuals, see Request to Download Manuals (IM DL950-73Z2). To view the PDF data, you need Adobe Acrobat Reader or a software application that can open PDF data.

The "EN", "E", "Z1", and "Z2" in the manual numbers are the language codes.

Online Help

Contents similar to those in the Features Guide, IM DL950-01EN, are included in this instrument as a help file (some the content may be omitted). For instructions on how to use the help, see section 4.11 in the *Getting Started Guide*, IM DL950-03EN.

Conventions Used in This Manual

Notes and Cautions

The notes and cautions in this manual are categorized using the following symbols.



Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING

Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION

Calls attention to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

Note

Calls attention to information that is important for the proper operation of the instrument.

French



Une manipulation ou une utilisation incorrectes risquent de blesser l'utilisateur ou d'endommager l'instrument. Ce symbole apparaît sur l'instrument pour indiquer à l'utilisateur qu'il doit se reporter au manuel de l'utilisateur afin d'y lire les instructions spécifiques correspondantes. Ce même symbole apparaît à la section correspondante du manuel de l'utilisateur pour signaler lesdites instructions. Dans le manuel de l'utilisateur, ce symbole est accompagné des termes AVERTISSEMENT et ATTENTION.

AVERTISSEMENT

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures graves (voire mortelles), et sur les précautions de sécurité pouvant prévenir de tels accidents.

ATTENTION

Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

Prefixes k and K

This manual distinguishes prefixes k and K used before units as follows:

k: Denotes 1000. Example: 100 kS/s (sample rate)

K: Denotes 1024. Example: 720 KB (file size)

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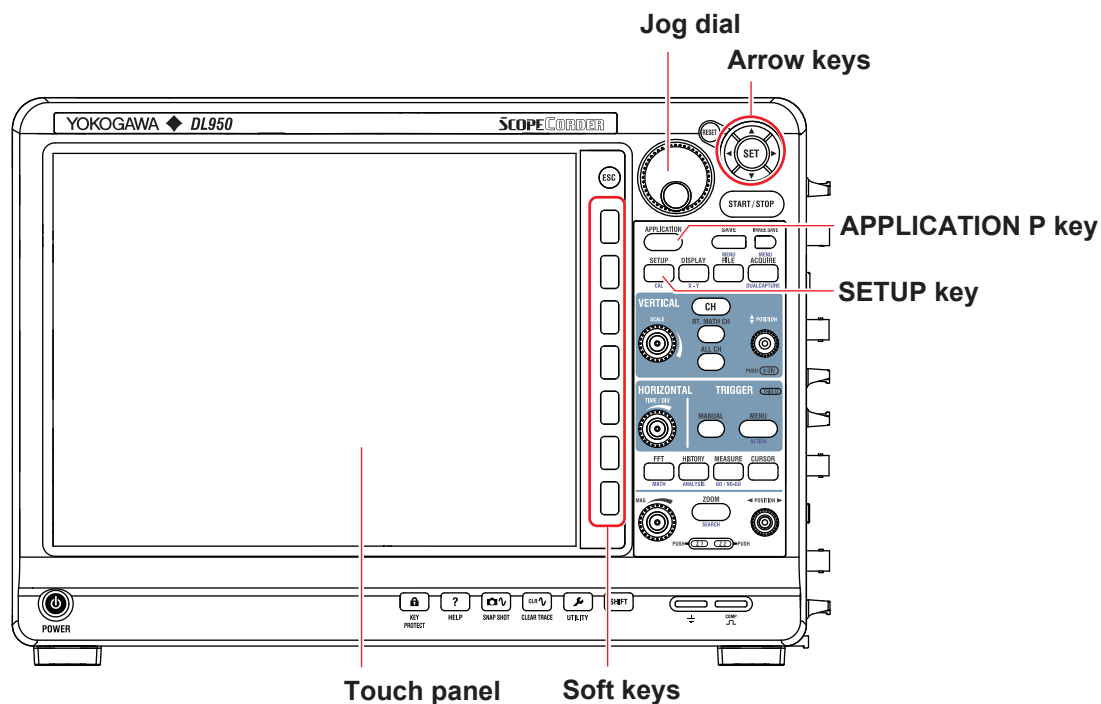
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Chapter 1

Setup

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
1.1 Setting the Operation Mode	✓	✓
1.2 Initializing the Settings	✓	✓
1.3 Performing Auto Setup	✓	✓
1.4 Configuring with the Application Menu	✓	✓

* The settings may vary depending on the operation mode.

1.1 Setting the Operation Mode

This section explains how to set the operation mode.

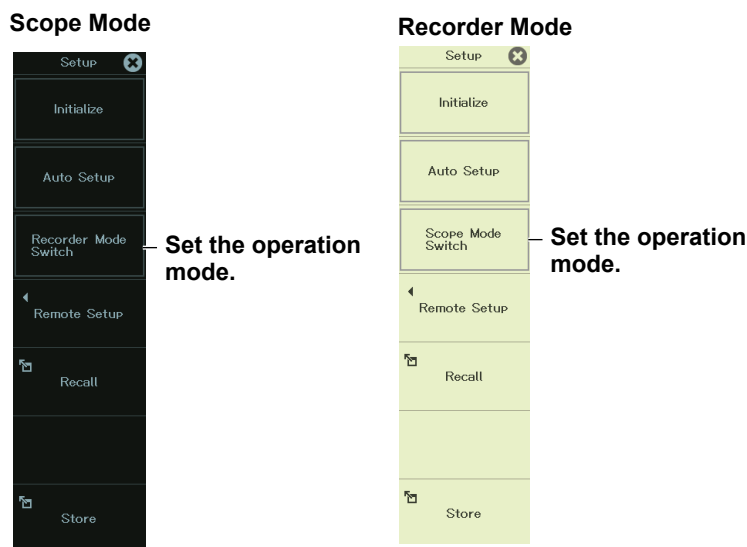
Items Common to Scope Mode and Recorder Mode

Setting the Operation Mode

- ▶ “Operation Mode (Recorder Mode Switch/Scope Mode Switch)” in the Features Guide

SETUP Screen

1. On the waveform screen’s **MENU**, tap **SETUP** > **SETUP**, or press **SETUP**.



2. To switch from Scope mode to Recorder mode, tap **Recorder Mode Switch**. To switch from Recorder mode to Scope mode, tap **Scope Mode Switch**, or press the corresponding soft key. A confirmation message appears.
3. Tap **OK**, or select **OK** using the arrow keys, and press **SET**.

Scope Mode (Scope Mode)

Scope mode is used to set the time axis using Time/Div and record length. This is the typical time scale setting method for oscilloscopes. The default screen background color (section 5.4) is black.

Recorder Mode

Recorder mode is used to set the time axis using the measurement time and sampling interval. This is the typical time scale setting method for recorders. The default screen background color (section 5.4) is white.

1.2 Initializing the Settings

This section explains how to initialize the settings to their factory default values.

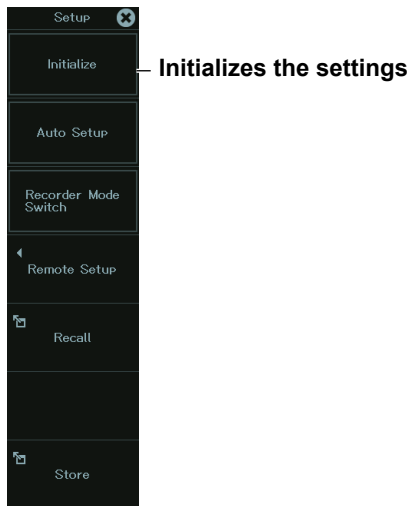
Items Common to Scope Mode and Recorder Mode

Initializing Settings

► [“Initializing Settings to Default \(Initialize\)” in the Features Guide](#)

SETUP Screen

1. On the waveform screen's **MENU**, tap **SETUP** > **SETUP**, or press **SETUP**.



2. Tap **Initialize**, or press the soft key. A confirmation message appears.
3. Tap **OK**, or select **OK** using the arrow keys, and press **SET**. Initialization is executed.

Settings That Cannot Be Reset to Their Factory Default Values

- Date and time settings
- Communication settings
- Language settings
- Operation mode
- Network settings
- Startup state (Standby Startup, Immediate Startup)

1.3 Performing Auto Setup

This section explains how to perform auto setup, which automatically sets the instrument's settings to the values that are most suitable for the input signals.

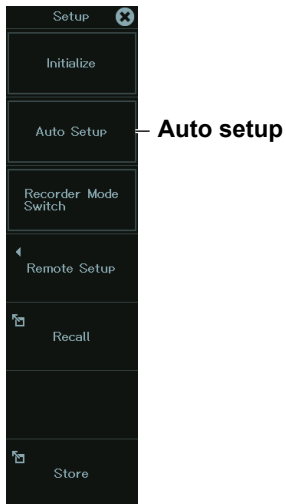
Items Common to Scope Mode and Recorder Mode

Executing Auto Setup

► [“Auto Setup \(Auto Setup\)” in the Features Guide](#)

SETUP Screen

1. On the waveform screen's **MENU**, tap **SETUP** > **SETUP**, or press **SETUP**.



2. Tap **Auto Setup**, or press the soft key. A confirmation message appears.
3. Tap **OK**, or select **OK** using the arrow keys, and press **SET**. Auto setup is executed.

1.4 Configuring with the Application Menu

This section explains how to easily configure the instrument using the measurement applications registered in advance.

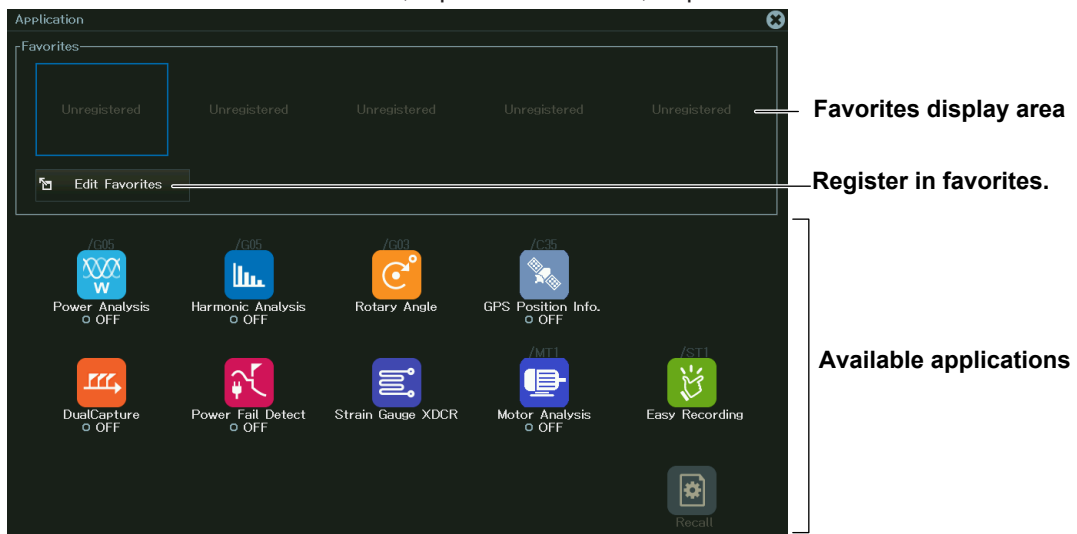
Items Common to Scope Mode and Recorder Mode

Configuration on the Application Menu

► “Application (APPLICATION)” in the Features Guide

APPLICATION Menu

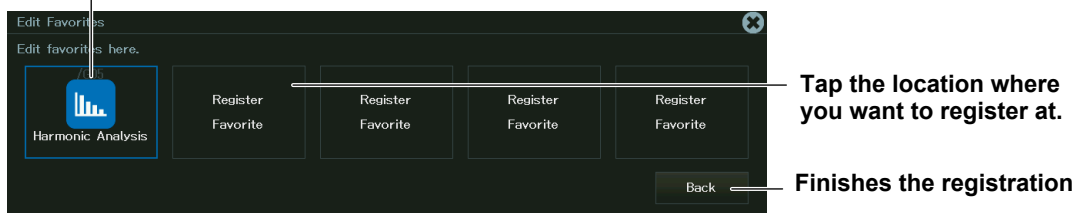
1. On the waveform screen's **MENU**, tap **APPLICATION**, or press **APPLICATION**.



Editing Favorites

2. Tap **Edit Favorites**, or select **Edit Favorites** using the jog dial or arrow keys, and press **SET**. The favorites display area becomes editable.

Registered application

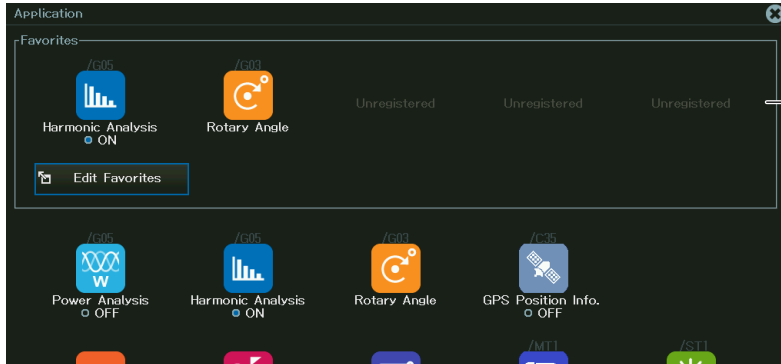


3. Tap a location to register an application to, or select it using the jog dial or arrow keys, and press **SET**. A list of applications appears.
To change an application that is already registered, tap the location where the application is registered, or select it using the jog dial or arrow keys, and press **SET**.
4. Tap the application you want to register, or select it using the jog dial or arrow keys, and press **SET**. The application is registered in favorites.

1.4 Configuring with the Application Menu

5. Tap **Back**, or select **Back** using the jog dial or arrow keys, and press **SET**.

The screen shown in step 1 appears.

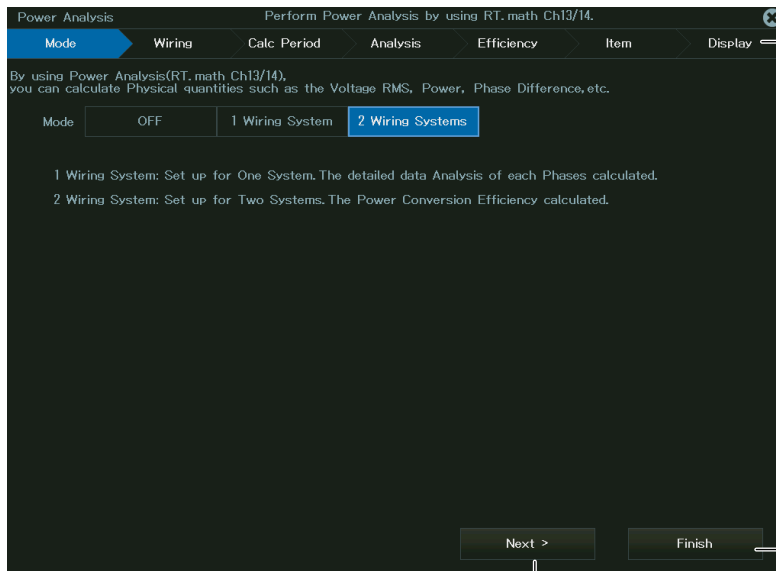


Example in which harmonic analysis and angle-of-rotation calculation applications are registered

How to Use Applications

This section explains how to use typical applications.

2. On the application list or favorites, tap the application you want to edit, or select it using the jog dial or arrow keys, and press **SET**. An application setup screen appears.



Setup steps
Set from left to right.
You can also tap a step you want to set directly.

Setup menu

Finishes the setup

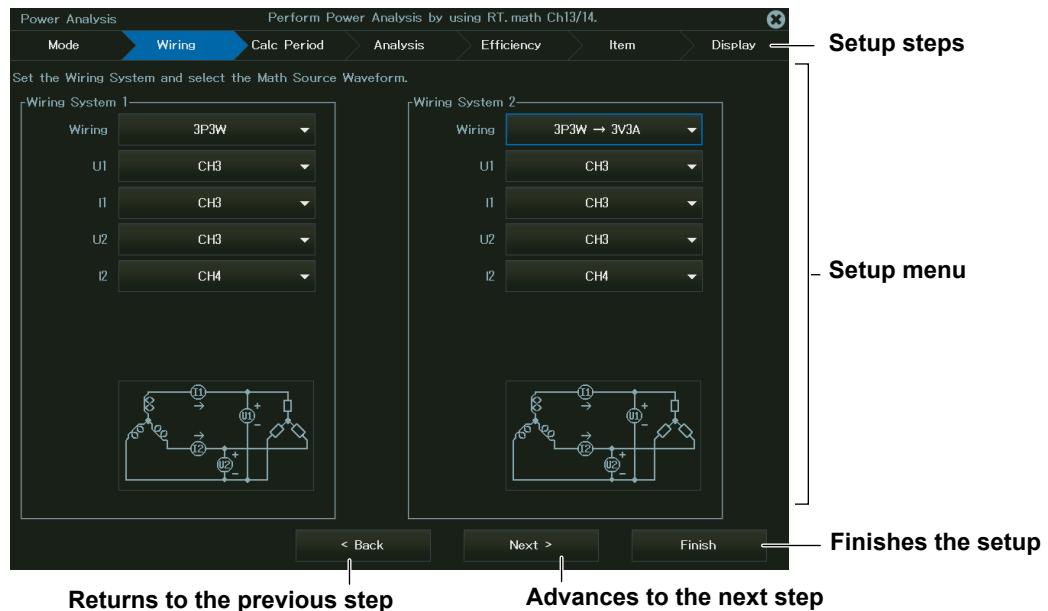
Advances to the next step

Note

Depending on the setup conditions, setup steps that do not need to be configured appear dark and are skipped. Even if you tap a setup step that appears dark, a setup screen will not appear.

- After entering the displayed setting, to move to the next step, tap **Next**, or select **Next** using the jog dial or arrow keys, and press **SET**.

You can also select a specific setup step by tapping the step you want to set or by selecting the step using the jog dial or arrow keys and pressing **SET**.



- After setting the last step, tap **Finish**, or select **Finish** using the jog dial or arrow keys, and press **SET**. The setup is complete.

Setup Details

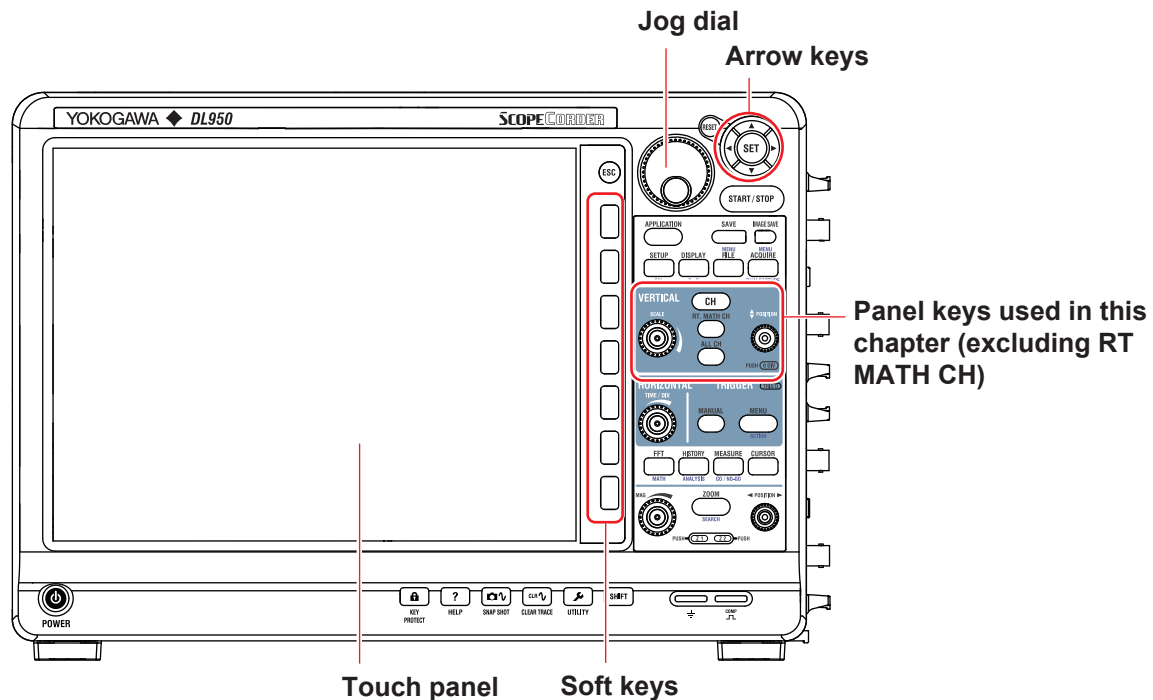
For details on the settings of each application, see the chapter or section explaining the applicable setup procedure.

Chapter 2

Channel Setup

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
2.1 Configuring Voltage Measurements (on modules other than 16-CH temperature/voltage input modules)	✓	✓
2.2 Configuring Voltage Measurements (on 16-CH temperature/voltage input modules)	✓	✓
2.3 Configuring Temperature Measurements (on modules other than 16-CH temperature/voltage input modules)	✓	✓
2.4 Configuring Temperature Measurements (For 16-CH temperature/voltage input modules)	✓	✓
2.5 Configuring Strain Measurements	✓	✓
2.6 Configuring Acceleration Measurements	✓	✓
2.7 Configuring Frequency, Revolution, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity Measurements	✓	✓
2.8 Configuring Logic Signal Measurements	✓	✓
2.9 Configuring the Monitoring of CAN and CAN FD Bus Signals (/VCE option)	✓	✓
2.10 Configuring the Monitoring of LIN Bus Signals (/VCE option)	✓	✓
2.11 Configuring the Monitoring of SENT Signals (/VCE option)	✓	✓
2.12 Displaying the All Channel Setup Menu	✓	✓
2.13 Setting the Digital Filter (/G03, /G05, /MT1 option)	✓	✓

* The settings may vary depending on the operation mode.

2.1 Configuring Voltage Measurements (on modules other than 16-CH temperature/voltage input modules)

This section explains the following settings for voltage measurements:

Scope Mode

- Turning waveform input on and off
- Display label
- Input coupling
- Probe attenuation and current-to-voltage conversion ratio
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Zoom method (DIV/SPAN) switching
- Vertical zoom (vertical zoom, offset), upper and lower display range limits
- Adjustment (DC offset cancellation, gain adjustment)
- Turning the inverted waveform display on and off
- Sample rate
- Linear scaling
- Vertical scale (V/div)
- Vertical position

Recorder Mode

- Turning waveform input on and off
- Display label
- Input coupling
- Probe attenuation and current-to-voltage conversion ratio
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Upper and lower limits of the display range
- Adjustment (DC offset cancellation, gain adjustment)
- Turning the inverted waveform display on and off
- Sample interval
- Linear scaling
- Measurement range
- Vertical Position
- Horizontal Position

► [“Voltage Measurement” in the Features Guide](#)

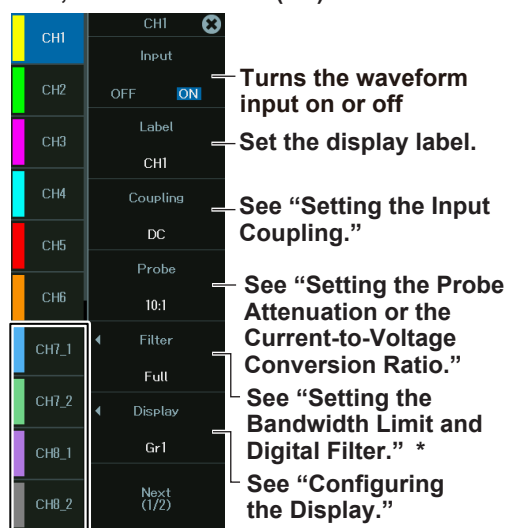
Channel Setup Menu

1. On the waveform screen's **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
You can also tap the channel information display area at the top of the screen to display the channel setup menu.
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys. When the waveform is displayed on the screen, you can also tap the waveform to select the channel you want to configure.

For a 4-CH module (720254 (4CH 1M16) or 720256 (4CH 10M16)), select a sub channel (a channel number followed by an underscore and a number as in CH3_1 if the display label is set to default).

Scope Mode

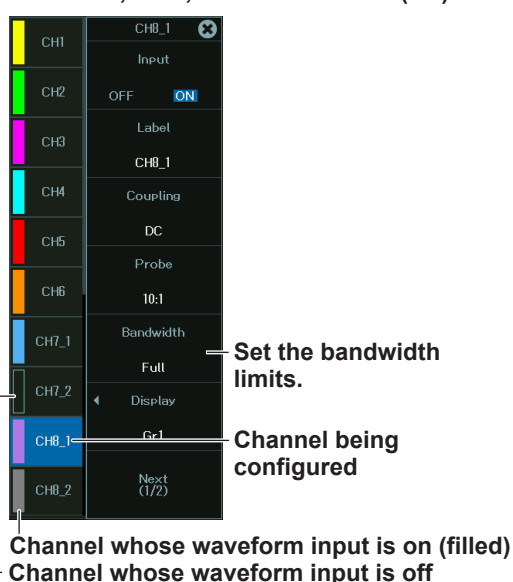
Channel Setup Menu on /G03, /G05, and /MT1 models (1/2)



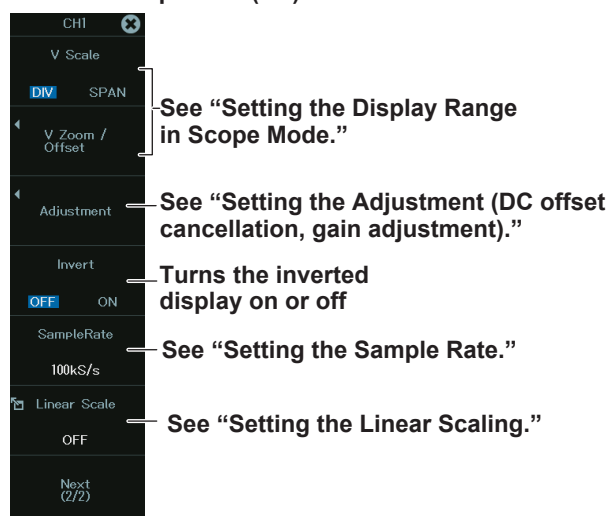
4-CH module display

* Bandwidth limit only on 4-CH modules (720254, 720256)

Channel Setup Menu on models other than /G03, /G05, and /MT1 models (1/2)



Channel setup menu (2/2)



2.1 Configuring Voltage Measurements (on modules other than 16-CH temperature/voltage input modules)

Recorder Mode

Channel Setup Menu on /G03, /G05, and /MT1 models (1/2)

CHI	CHI	✕
CH1	Input	
CH2	OFF	ON
CH3	Label	CHI
CH4	Coupling	
CH5	DC	
CH6	Probe	10:1
CH7_1	Filter	Full
CH7_2	Display	Gr1
CH8_1	Gr1	
CH8_2	Next (1/2)	

Turns the waveform input on or off

Set the display label.

See "Setting the Input Coupling."

See "Setting the Probe Attenuation or the Current-to-Voltage Conversion Ratio."

See "Setting the Bandwidth Limit and Digital Filter." *

See "Configuring the Display."

Channel Setup Menu on models other than /G03, /G05, and /MT1 models (1/2)

CH1	CH8_1	✕
CH2	Input	
CH3	OFF	ON
CH4	Label	CH8_1
CH5	Coupling	
CH6	DC	
CH7_1	Probe	10:1
CH7_2	Bandwidth	Full
CH8_1	Display	Gr1
CH8_2	Gr1	
	Next (1/2)	

Set the bandwidth limits.

* Bandwidth limit only on 4-CH modules (720254, 720256)

Channel setup menu (2/2)

CHI	✕
Upper/Lower	250.0V -250.0V
Adjustment	
Invert	OFF ON
Sample Interval	10us
Linear Scale	OFF
Next (2/2)	

See "Setting the Display Range in Recorder Mode."

See "Setting the Adjustment (DC offset cancellation, gain adjustment)."

Turns the inverted display on or off

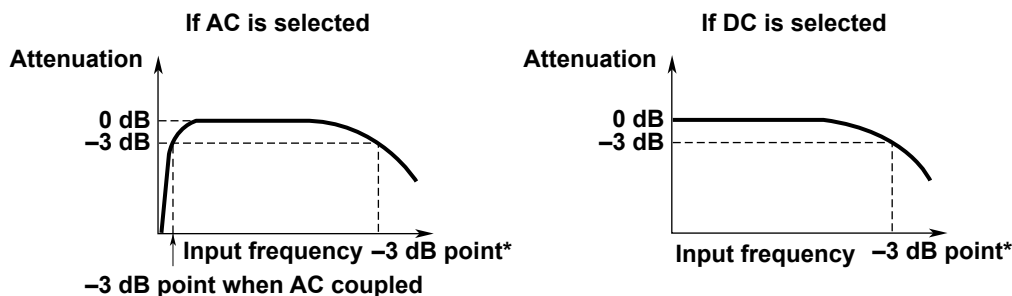
See "Setting the Sample Interval."

See "Setting the Linear Scaling."

Setting the Input Coupling

The following figure shows the frequency characteristics when the input coupling is set to AC or DC.

Please note that when set to AC, the instrument does not acquire low frequency signals or low frequency components, as seen in the following figure.



* This value differs depending on the input module.
For details, section 7.15, "Module Specifications," in the Getting Started Guide (IM DL950-03EN).



CAUTION

If the input coupling is AC, in accordance with the frequency response, the input signal is attenuated more in lower frequencies. As a result, even when a high voltage signal is actually applied, it may not be measured as a high voltage signal. Furthermore, the over-range indicator may not be displayed on the instrument screen. As necessary, switch the input coupling to DC to check the input signal voltage.

Applying an input signal whose voltage exceeds the maximum input voltage of the input module may damage the input section.

French



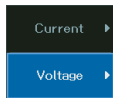
ATTENTION

Si le courant du couplage d'entrée est alternatif (CA), conforme à la réponse en fréquence, le signal d'entrée est davantage atténué aux fréquences plus basses. Par conséquent, même si vous appliquez un signal de tension élevée, ce dernier risque de ne pas être mesuré comme tel. De plus, le voyant de dépassement de plage risque de ne pas s'afficher à l'écran. Le cas échéant, basculez le couplage d'entrée sur CC (courant continu) afin de vérifier la tension du signal d'entrée.

Si la tension du signal d'entrée dépasse la tension d'entrée maximale du module d'entrée, la section d'entrée risque d'être endommagée.

Setting the Probe Attenuation or the Current-to-Voltage Conversion Ratio (Probe)

- After step 2 on page 2-3, tap **Probe**, or press the soft key. The following setup menu appears.



- Select **Voltage** or **Current**, and select a value from the displayed menu.

Voltage Probe's Attenuation Ratio

1: 1, 2: 1, 5: 1, 10: 1, 20: 1, 50: 1, 100: 1, 200: 1, 500: 1, 1000: 1, 2000: 1, 5000: 1, 10 k: 1, 20 k: 1, 50 k: 1

Current Probe's Current-to-Voltage Conversion Ratio

0.1A:1V (10V/A), 0.2A:1V (5V/A), 0.5A:1V (2V/A), 1A:1V (1V/A), 2A:1V (0.5V/A), 5A:1V (0.2V/A), 10A:1V (0.1V/A), 20A:1V (0.05V/A), 50A:1V (0.02V/A), 100A:1V (0.01V/A), 200A:1V (0.005V/A), 250A:1V (0.004V/A), 400A:1V (0.0025V/A), 500A:1V (0.002V/A), 1kA:1V (1mV/A), 2kA:1V (0.5mV/A), 5kA:1V (0.2mV/A), 10kA:1V (0.1mV/A), 20kA:1V (0.05mV/A), 50kA:1V (0.02mV/A)

Note

If the probe attenuation or current-to-voltage conversion ratio is not set correctly, the voltage and scale values of the input signals will not be displayed correctly. For example, if you use a 10:1 voltage probe but set the probe type to 1:1, the automatically measured amplitude of the waveform will be 1/10 the real value.

Setting the Bandwidth Limit and Digital Filter (Filter /G03, /G05, /MT1 option)

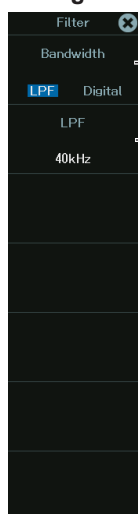
You only need to set the bandwidth limit on channels in which 720254 or 720256 input modules are installed.

- After step 2 on page 2-3, tap **Filter**, or press the soft key. A filter setup menu appears.

Note

For channels in which a 720254 or 720256 is installed, tap **Bandwidth**, or press the soft key to set the bandwidth limit.

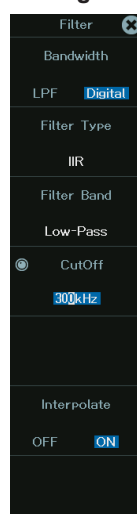
Setting the low-pass filter (LPF)



Set the bandwidth limit to LPF.

Set the bandwidth. (The available bandwidths vary depending on the module.)

Setting the digital filter (Digital)



Set the bandwidth limit to Digital.

Set the filter type. (Gauss/Sharp/IIR/Mean/IIR-Lowpass)

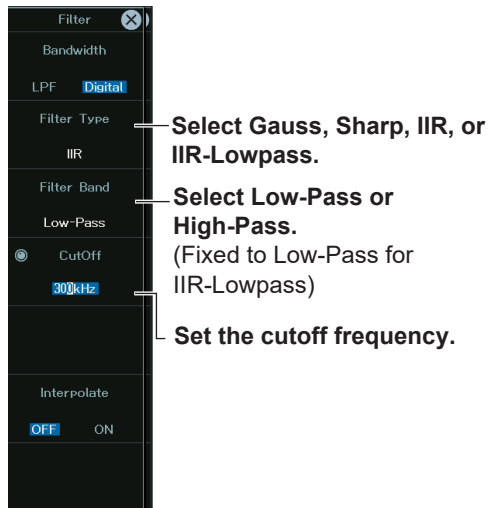
Turns interpolation on or off

Setting the Filter Type (Filter Type)

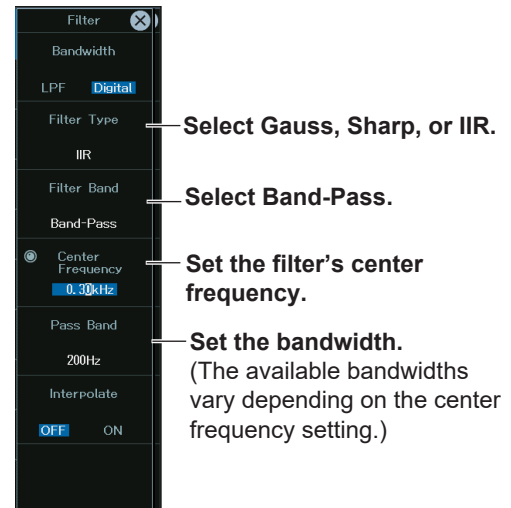
Setting the Gauss, Sharp, IIR, or IIR-Lowpass Filter

4. Set **Bandwidth** to **Digital**.
5. Tap **Filter Type**, or press the soft key. A Filter Type setup menu appears.

When Filter Band is set to Low-Pass or High-Pass



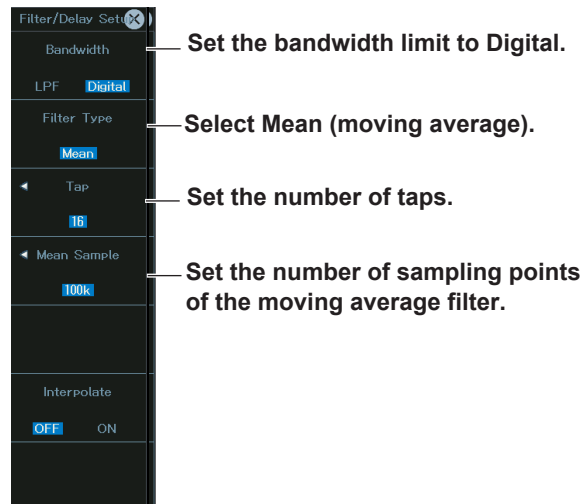
When Filter Band is set to Band-Pass



For Band-Pass, set the center frequency and the bandwidth, the frequencies before and after the center frequency.

Setting the Moving Average (Mean)

4. Set **Filter Type** to **Mean**.



Configuring the Display (Display)

- After step 2 on page 2-3, tap **Display**, or press the soft key. A display setup menu appears.



Set the display group in which the channel you are setting is to be registered.

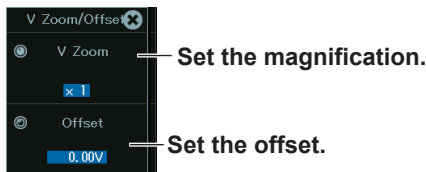
You can register a channel in multiple display groups.

For details on configuring display groups, see chapter 5, "Display."

Setting the Display Range and Scope Mode (V Scale, V Zoom/Offset, Upper/ Lower)

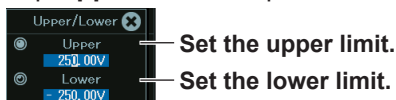
Using DIV

- After step 2 on page 2-3, set **V SCALE** to **DIV**.
- Tap **V Zoom/Offset**, or press the soft key.



Using Span

- After step 2 on page 2-3, set **V SCALE** to **SPAN**.
- Tap **Upper/Lower**, or press the soft key.



For the upper and lower limits, if you tap the jog dial mark several times or press SET to select both Upper and Lower marks to be changed with the jog dial, you can change the upper in the lower limits while keeping the interval between them constant.

Note

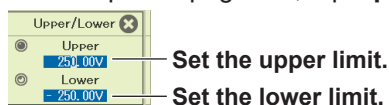
- The display range V/div is displayed above the measurement range V/div. This is not displayed when the V Scale is set to DIV and the magnification is x1 because the display range is the same as the measurement range.



- When V Scale is set to DIV, the display range is set in integer multiples of V/div. Therefore, the display range changes according to the changes in V/div.
- When V Scale is set to SPAN, the display range is fixed. Therefore, the display range does not change even if V/div is changed.

Setting the Display Range in Recorder Mode (Upper/Lower)

3. After step 2 on page 2-3, tap **Upper/Lower**, or press the soft key.



Set the upper limit.

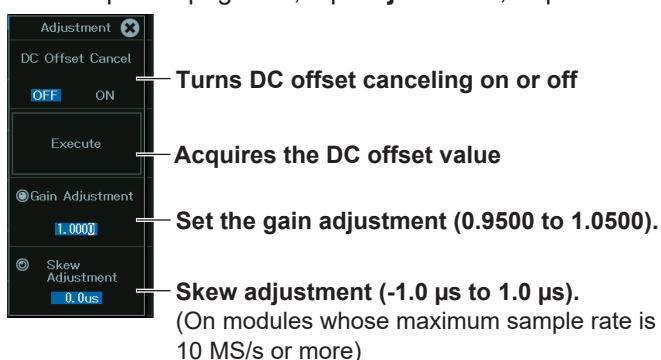
Set the lower limit.

Note

The upper and lower limits cannot exceed 10 times the measurement range. If changing the measurement range causes the upper and lower limits to exceed 10 times the measurement range, the upper and lower limits are automatically adjusted.

Setting the Adjustment (DC offset cancellation, gain adjustment)

3. After step 2 on page 2-3, tap **Adjustment**, or press the soft key.



Turns DC offset canceling on or off

Acquires the DC offset value

Set the gain adjustment (0.9500 to 1.0500).

Skew adjustment (-1.0 μ s to 1.0 μ s).

(On modules whose maximum sample rate is 10 MS/s or more)

Note

- When DC offset canceling is set to ON, you cannot adjust the gain.
- When gain adjustment is enabled, DC offset canceling cannot be set to ON. If you acquire the DC offset value when gain adjustment is enabled, gain adjustment will be disabled, and DC offset canceling will be set to ON.

Setting the Sample Rate (SampleRate, Scope mode)

In Scope mode, you can set the sample rate for each channel.

You can set the sample rate as high as the sample rate determined by the display record length and T/div settings in the waveform acquisition conditions.

If the sample rate determined by the display record length and T/div settings exceeds the maximum sample rate of a module, you can set the sample rate as high as the maximum sample rate of that module.

For example, if modules with sample rates at 10 MS/s or higher are installed and the sample rate determined by the display record length and T/div settings exceeds the maximum sample rate of a module, you can set the sample rate as high 10 MS/s.

This is useful when you do not want to acquire unneeded data.

Setting the Sample Interval (Sample Interval, Recorder mode)

In Recorder mode, you can set the sample interval for each channel.

You can set the sample interval as high as the sample interval set on the Acquire menu.

This is useful when you do not want to acquire unneeded data.

Setting the Linear Scaling (Linear Scale)

- After step 2 on page 2-3, tap **Linear Scale**, or press the soft key.

When setting the slope and offset of the equation (AX+B)

The screenshot shows the 'Linear Scale' menu with the following settings and annotations:

- Scaling Mode:** OFF, **AX+B** (selected), P1-P2. Annotation: **Select AX+B.**
- A:** 25.000. Annotation: **Set the scaling coefficient.**
- B:** -25.000. Annotation: **Set the offset.**
- Unit:** [Empty field]. Annotation: **Set the unit.**
- Display Type Mode:** Exponent, Floating. Annotation: **Set the numeric display format (Exponent).**

A second screenshot shows the 'Display Type' sub-menu with the following settings and annotations:

- Mode:** Exponent, **Floating**. Annotation: **Set the numeric display format (Floating).**
- Decimal Number:** Auto. Annotation: **Set the number of decimal places.**
- Sub Unit:** Auto. Annotation: **Set the unit prefix.**

When setting two points (P1-P2)

The screenshot shows the 'Linear Scale' menu with the following settings and annotations:

- Scaling Mode:** OFF, AX+B, **P1-P2** (selected). Annotation: **Select P1-P2.**
- P1[X]:** 1.0000. Annotation: **Measurement values** (pointing to the input field) and **Set the P1 X value to the current measured value.** (pointing to the 'Get Value' button).
- P1[Y]:** 0.0000. Annotation: **Scale value of measurement P1**
- P2[X]:** 5.0000. Annotation: **Set the P2 X value to the current measured value.** (pointing to the 'Get Value' button).
- P2[Y]:** 100.00. Annotation: **Scale value of measurement P2**
- Unit:** [Empty field]
- Display Type Mode:** Exponent, Floating. Annotation: **Set the numeric display format.**

Setting the Vertical Scale (SCALE knob) (Scope mode)

- After step 2 on page 2-3, select a channel, and then turn the SCALE knob to set the vertical scale.

If you turn the SCALE knob while the acquisition is stopped, the new vertical scale is applied the next time you start waveform acquisition.

Setting the Measurement Range (SCALE knob) (Recorder mode)

- After step 2 on page 2-3, select a channel, and then turn the SCALE knob to set the measurement range.

If you turn the SCALE knob while the acquisition is stopped, the new vertical scale is applied the next time you start waveform acquisition.

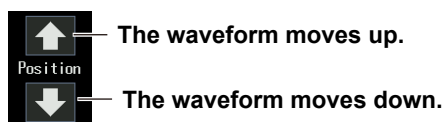
Note

If changing the measurement range causes the upper and lower limits to exceed 10 times the measurement range, the upper and lower limits are automatically adjusted so that 10 times the measurement range is not exceeded.

Setting the Vertical and Horizontal Positions of Waveforms (moving displayed waveforms)

Scope Mode

- After step 2 on page 2-3, select a channel, and then vertically drag near the center of the screen displaying the waveform of the selected channel to display up and down arrows. Tap the arrows to move the waveform. The arrows disappear after a given time period.



When V SCALE is set to DIV in Scope mode, select a channel, and then turn the vertical POSITION knob to set the vertical position.

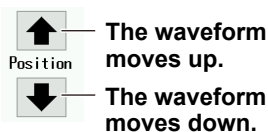
Recorder Mode

- After step 2 on page 2-3, select a channel, and then vertically drag near the center of the screen displaying the waveform of the selected channel to display up and down arrows or drag horizontally to display left and right arrows. You can move the vertical or horizontal position by performing the following operation while the arrows are displayed.

Drag the screen to display:

Drag vertically.

Up and down arrows



Drag horizontally.

Left and right arrows



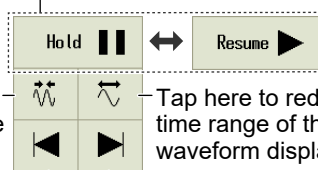
The waveform moves to the left. The waveform moves to the right.

Hold your finger on the screen to display:

Holds or resumes the waveform display
Displayed only when you touch and hold the screen during waveform acquisition

Tap here to expand the time range of the waveform display.

Displays the waveform at the left edge of the acquisition time or record time bar



Tap here to reduce the time range of the waveform display.

Displays the waveform at the right edge of the acquisition time or record time bar

2.2 Configuring Voltage Measurements (on 16-CH temperature/voltage input modules)

This section explains the following voltage measurement settings for the 16-CH temperature/voltage input module:

Scope Mode

- Turning waveform input on and off
- Display update rate
- All sub channel settings
(Display label, input coupling, zoom method (DIV/SPAN) switching, vertical zoom (vertical zoom, offset), upper and lower display range limits, linear scaling)
- Display setup (display group)
- Zoom method (DIV/SPAN) switching
- Vertical zoom (vertical zoom, offset), upper and lower display range limits
- Turning the inverted waveform display on and off
- Sample rate
- Linear scaling
- Vertical scale (V/div)
- Vertical position

Recorder Mode

- Turning waveform input on and off
- Display update rate
- All sub channel settings
(Display label, input coupling, measurement range, upper and lower display range limits, linear scaling)
- Display setup (display group)
- Upper and lower limits of the display range
- Turning the inverted waveform display on and off
- Sample interval
- Linear scaling
- Measurement range

► [“Voltage Measurement” in the Features Guide](#)

Channel Setup Menu

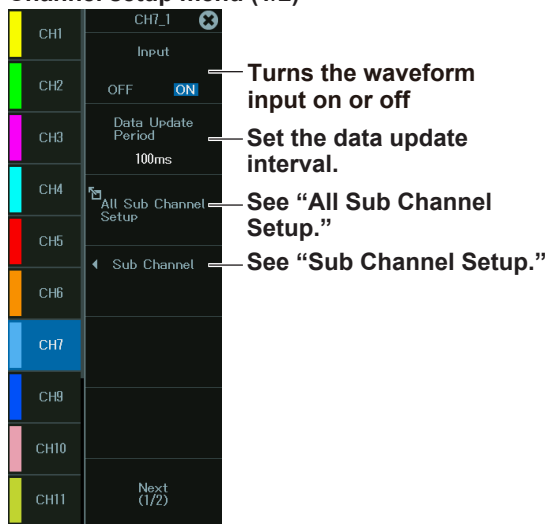
1. On the waveform screen's **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.

(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)

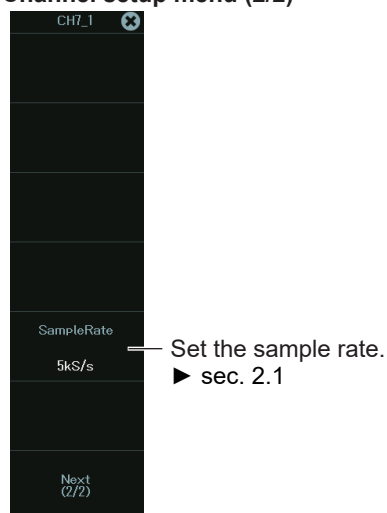
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Scope Mode

Channel setup menu (1/2)

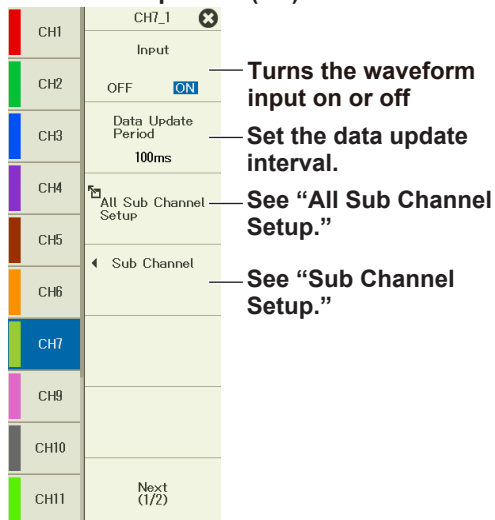


Channel setup menu (2/2)

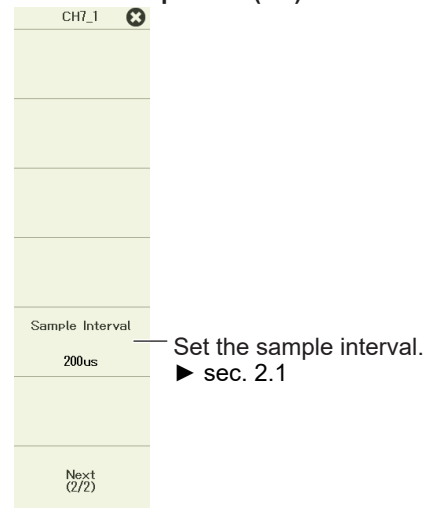


Recorder Mode

Channel setup menu (1/2)



Channel setup menu (2/2)



All Sub Channel Setup (All Sub Channel Setup)

3. Tap **All Sub Channel Setup**, or press the soft key. An All Sub Channel Setup screen appears.
4. Tap **Setup**, or press the soft key.

When measuring voltage, set the input coupling to DC or GND.

Scope Mode

Input coupling
Vertical scale
Vertical scale or temperature unit
Set the zoom offset.
Display label
Vertical position
Set the zoom magnification.

	Label	Coupling	V Scale	DIV/Scale	Offset	Position	V Zoom
All		DC	200mV	SPAN	20000.0mV	-20000.0mV	
1	CH3_1	DC	200mV	DIV	0.0mV	0.00div	× 1
2	CH3_2	DC	200mV	SPAN	20000.0mV	-20000.0mV	
3	CH3_3	DC	50mV	DIV	0.00mV	0.00div	× 2
4	CH3_4	TC	K	°C	1300.0C	-200.0C	ON OFF
5	CH3_5	DC	200mV	DIV	0.0mV	0.00div	× 1
6	CH3_6					0.00div	× 1
7	CH3_7					0.00div	× 1
8	CH3_8	DC	200mV	DIV	0.0mV	0.00div	× 1
9	CH3_9	DC	200mV	DIV	0.0mV	0.00div	× 1

The displayed items vary depending on the input coupling and vertical scale settings of the selected sub channel.

See “Setting the Linear Scaling.”
 To set all the sub channels to the same setting, change the settings in the All row.

Scroll bar

See “Copying Channels.”

Slide to display channels that do not fit in the screen.

When the vertical scale is set to SPAN, the settings for Offset, Position, V and Zoom change to Upper and Lower.

Recorder Mode

Input coupling
Measurement range
Upper limit of display range
Lower limit of display range
Display label

	Label	Coupling	V Scale	Upper	Lower
All		DC	2V	20.0V	-20.0V
1	CH5_1	DC	2V	20000.0mV	-20000.0mV
2	CH5_2	DC	2V	20000.0mV	-20000.0mV
3	CH5_3	DC	2V	20000.0mV	-20000.0mV
4	CH5_4	DC	2V	20000.0mV	-20000.0mV
5	CH5_5				
6	CH5_6				
7	CH5_7	DC	2V	20000.0mV	-20000.0mV
8	CH5_8	DC	2V	20000.0mV	-20000.0mV
9	CH5_9	DC	2V	20000.0mV	-20000.0mV

The displayed items vary depending on the input coupling settings of the selected sub channel.

See “Setting the Linear Scaling.”
 To set all the sub channels to the same setting, change the settings in the All row.

Scroll bar

See “Copying Channels.”

Slide to display channels that do not fit in the screen.

Setting the Linear Scaling (Linear Scale)

5. Tap **Linear Scale**, or press the soft key. A linear scaling setup screen appears. For details on the settings, see “Setting the Linear Scaling” in section 2.1.
6. Tap the items of each sub channel. Use the displayed list (options) or input box to set the items.

Linear scaling mode

Scaling coefficient A or measured value at point P1
 Offset value B or scaled value of point P1
 Measurement value of point P2
 Scaled value of point P2
 Unit
 Display mode
 Number of decimal places
 Unit prefix

Linear Scale	AX+B: A P1-P2	AX+B: B P1×P1-P2	P1-Y P1-Y	P2×P1-P2 P2-Y	Unit	Disp Type	Decim Num	Sub Unit
All	OFF							
1	AX+B	25.000	-25.000			Float	Auto	Auto
2	AX+B	25.000	-25.000			Exp		
3	P1-P2	1.0000	0.0000	5.0000	100.00	Float	Auto	Auto
4	P1-P2	1.0000	0.0000	5.0000	100.00	mm/s	Exp	
5	OFF							
6	OFF							
7	OFF							
8	OFF							
9	OFF							

Slide to display channels that do not fit in the screen.

To set all the sub channels to the same setting, change the settings in the All row.

See “Copying Channels.”

Copying Channels (Copy to)

7. Tap **Copy to**, or press the soft key. The following screen appears.

Copy to

Source Sub Channel: CH3_1

Destination Sub Channel: All ON | All OFF

1 ✓ 2 ✓ 3 ✓ 4 ✓
 5 ✓ 6 ✓ 7 ✓ 8 ✓
 9 ✓ 10 ✓ 11 ✓ 12 ✓
 13 ✓ 14 ✓ 15 ✓ 16 ✓

Execute

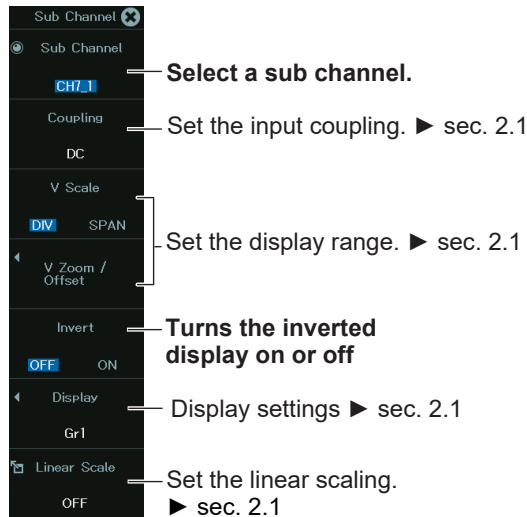
Select the source sub channel.
 Press to select all sub channels.
 Press to clear all sub channels.
 Select the sub channels that you want to copy to.
 Starts copying

The setup and linear scale settings are copied.

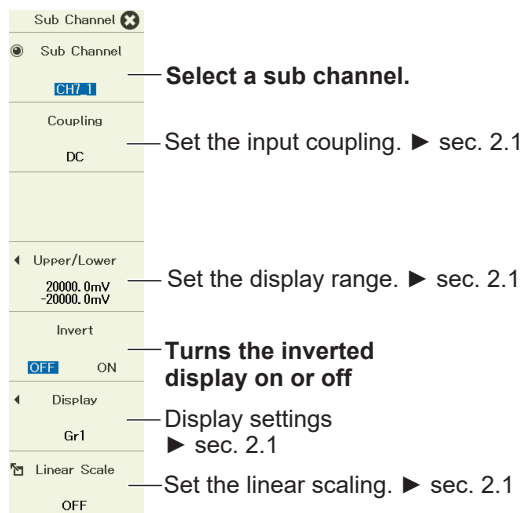
Sub Channel Setup (Sub Channel)

3. Tap **Sub Channel**, or press the soft key. A sub channel setup screen appears.

Scope Mode



Recorder Mode



Setting the Vertical Scale (SCALE knob) (when V SCALE is set to DIV in Scope mode)

▶ section 2.1

Setting the Measurement Range (SCALE knob) (Recorder mode, when V SCALE (vertical scale) is set to SPAN in Scope mode)

▶ section 2.1

Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

▶ section 2.1

2.3 Configuring Temperature Measurements (on modules other than 16-CH temperature/voltage input modules)

This section explains the following settings for temperature measurements:

Items Common to Scope Mode and Recorder Mode

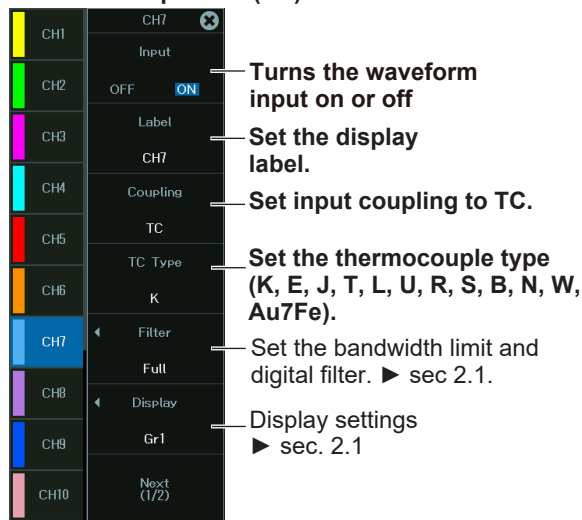
- Turning waveform input on or off
- Display label
- Input coupling
- Thermocouple type
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Upper and lower limits of the display range
- Temperature unit
- Sample Rate and Sample Interval
- Temperature settings (RJC, burnout on/off, Bmode, attenuator settings)

► [“Temperature Measurement” in the Features Guide](#)

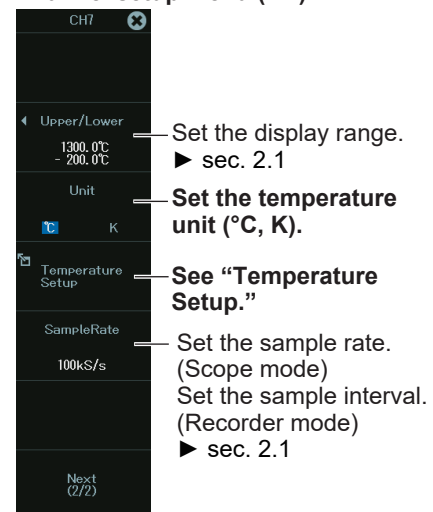
Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Channel setup menu (1/2)

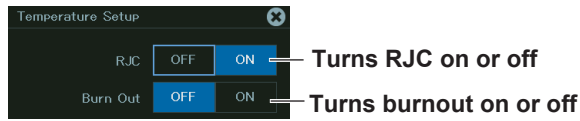


Channel setup menu (2/2)



Temperature Setup (Temperature Setup) (RJC, burnout on/off)

1. Tap **Temperature Setup**, or press the soft key. The following screen appears.



Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

- section 2.1

2.4 Configuring Temperature Measurements (For 16-CH temperature/voltage input modules)

This section explains the following temperature measurement settings for the 16-CH temperature/voltage input module:

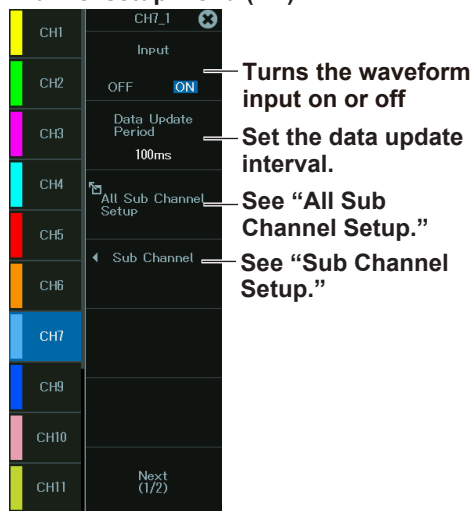
Items Common to Scope Mode and Recorder Mode

- Turning waveform input on or off
- Data update interval
- All sub channel settings
(Display label, input coupling, thermocouple type, unit, upper and lower display range limits, RJC, burnout)
- Display setup (display group)
- Upper and lower limits of the display range
- Unit
- Temperature Setup (RJC, burnout)
- Sample Rate and Sample Interval
 - ▶ [“Temperature Measurement \(For the 16-CH Temperature/Voltage Input Module\)” in the Features Guide](#)

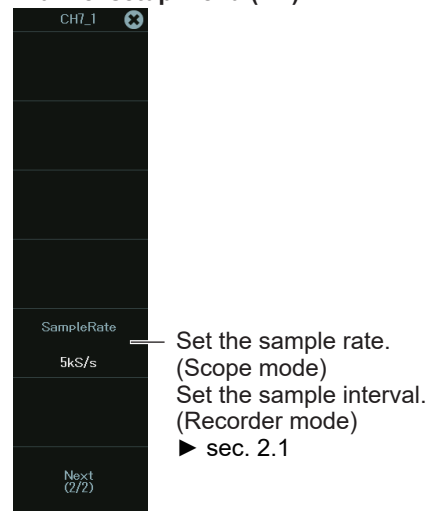
Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Channel setup menu (1/2)



Channel setup menu (2/2)



All Sub Channel Setup (All Sub Channel Setup)

3. Tap **All Sub Channel Setup**, or press the soft key. An All Sub Channel Setup screen appears.

Annotations for the All Sub Channel Setup screen:

- Display label**: Points to the 'Label' column header.
- Set input coupling to TC**: Points to the 'Coupling' column header.
- Thermocouple type**: Points to the 'Type' column header.
- Unit (°C, K)**: Points to the 'Unit' column header.
- Set the upper limit**: Points to the 'Upper' column header.
- Set the lower limit**: Points to the 'Lower' column header.
- Turns RJC on or off**: Points to the 'RJC' column header.
- Turns burnout on or off**: Points to the 'Burn' column header.
- Slide to display channels that do not fit in the screen**: Points to a vertical scroll bar on the left side of the table.
- The displayed items vary depending on the input coupling and vertical scale settings of the selected sub channel**: Points to the 'Setup' button on the right.
- Sub channels of temperature measurement are not applicable**: Points to the 'Linear Scale' button on the right.
- To set all the sub channels to the same setting, change the settings in the All row**: Points to the 'All' row in the table.
- See "Copying Channels."**: Points to the 'Copy to' button on the right.

	Label	Coupling	Type	Unit	Upper	Lower	RJC	Burn
All		TC	K	°C	1300	- 200.0C	OFF	ON
1	CH3_1	TC	K	°C	1300.0C	- 200.0C	OFF	ON
2	CH3_2	TC	T	°C	400.0C	- 250.0C	ON	OFF
3	CH3_3	TC	K	°C	1300.0C	- 200.0C	ON	OFF
4	CH3_4	TC	R	°C	1700.0C	0.0C	ON	OFF
5	CH3_5	DC	200mV	DIV	0.0mV	0.00div	× 1	
6	CH3_6					00div	× 1	
7	CH3_7					00div	× 1	
8	CH3_8	TC	K	°C	1300.0C	- 200.0C	ON	OFF
9	CH3_9	TC	K	°C	1300.0C	- 200.0C	ON	OFF

Copying Channels (Copy to)

4. Tap **Copy to**, or press the soft key. The following screen appears.

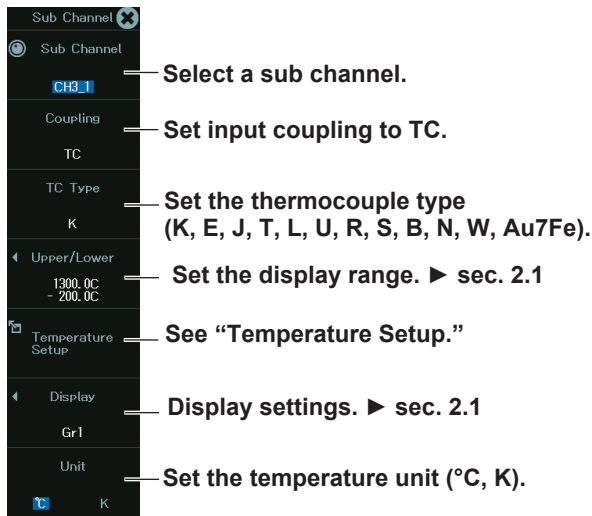
Annotations for the Copy to screen:

- Select the source sub channel**: Points to the 'Source Sub Channel' dropdown menu.
- Press to select all sub channels**: Points to the 'All ON' button.
- Press to clear all sub channels**: Points to the 'All OFF' button.
- Select the sub channels that you want to copy to**: Points to the grid of sub channel selection checkboxes.
- Starts copying**: Points to the 'Execute' button.

The setup and linear scale settings are copied.

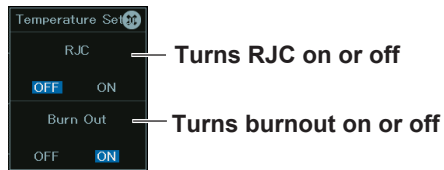
Sub Channel Setup (Sub Channel)

3. Tap **Sub Channel**, or press the soft key. An Sub Channel screen appears.



Temperature Setup (Temperature Setup) (RJC, burnout on/off)

4. Tap **Temperature Setup**, or press the soft key. The following screen appears.



Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

- section 2.1

2.5 Configuring Strain Measurements

This section explains the following settings for strain measurements:

Items Common to Scope Mode and Recorder Mode

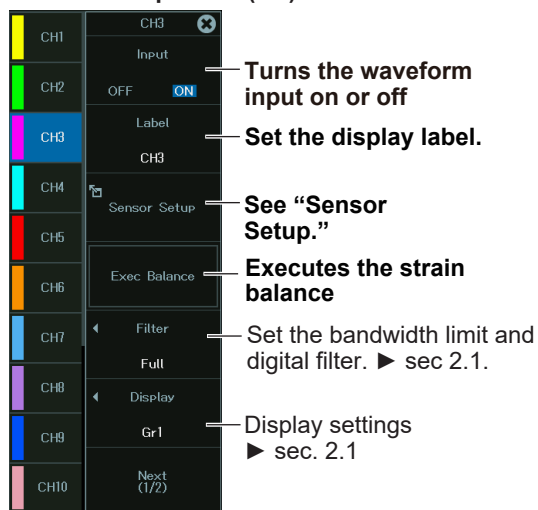
- Turning waveform input on or off
- Display label
- Sensor
- Executes strain balancing
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Display range settings
- Range unit
- Inverted waveform display
- Sample rate and sample interval settings
- Linear scaling
- Measurement range

► “Strain Measurement” in the Features Guide

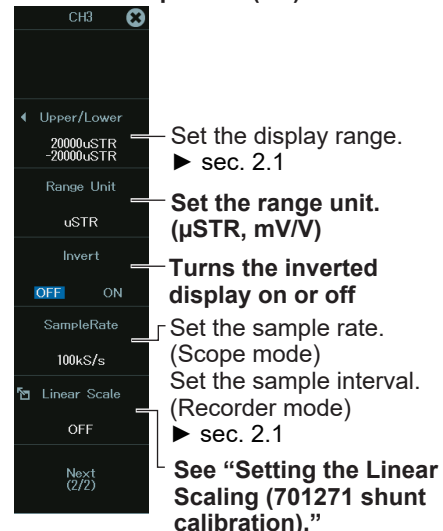
Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Channel setup menu (1/2)

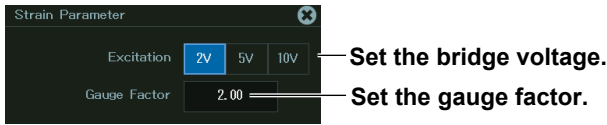


Channel setup menu (2/2)



Sensor Setup (Sensor Setup)

3. Tap **Sensor Setup**, or press the soft key. The following screen appears.



Setting the Range Unit (Range Unit)

μ STR: Units of strain ($\times 10^{-6}$ strain)

mV/V: Units of strain-gauge-transducer output

The mV/V range is calculated from the following equation.

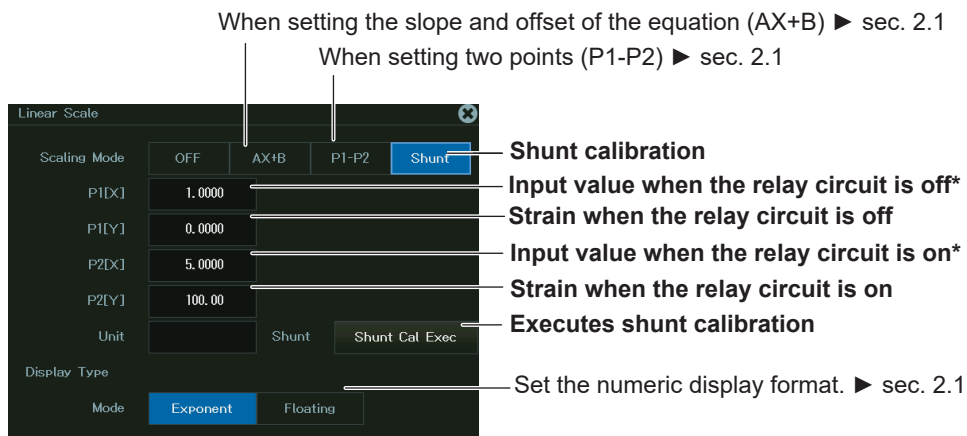
$$\text{mV/V} = 0.5 \times (\mu\text{STR}/1000)$$

Setting the Linear Scaling (Linear Scale) (shunt calibration)

3. Tap **Linear Scale**, or press the soft key.

For the 701270 strain module, see “Setting the Linear Scaling” in section 2.1.

For the 701271 strain module, the following screen appears.



* When shunt calibration is executed, the values are entered.

Setting the Measurement Range (SCALE knob)

3. After selecting a channel, turn the SCALE knob to set the measurement range.

If you turn the SCALE knob while the acquisition is stopped, the new measurement range is applied the next time you start waveform acquisition.

Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

► section 2.1

2.6 Configuring Acceleration Measurements

This section explains the following settings for acceleration measurements:

Scope Mode

- Turning waveform input on and off
- Display label
- Input coupling
- Turning the bias current supply to the acceleration sensor on and off
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Zoom method (DIV/SPAN) switching
- Vertical zoom (vertical zoom, offset), upper and lower display range limits
- Gain
- Acceleration sensor sensitivity
- Sample rate
- Acceleration unit
- Vertical position

Recorder Mode

- Turning waveform input on and off
- Display label
- Input coupling
- Turning the bias current supply to the acceleration sensor on and off
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Upper and lower limits of the display range
- Gain
- Acceleration sensor sensitivity
- Sample interval
- Acceleration unit
- Vertical position

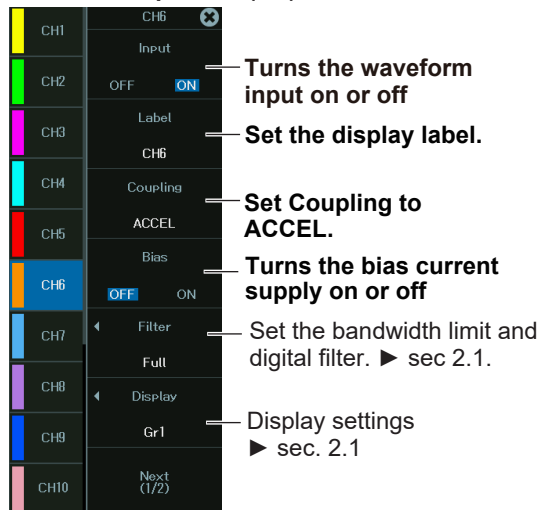
► [“Acceleration Measurement” in the Features Guide](#)

Channel Setup Menu

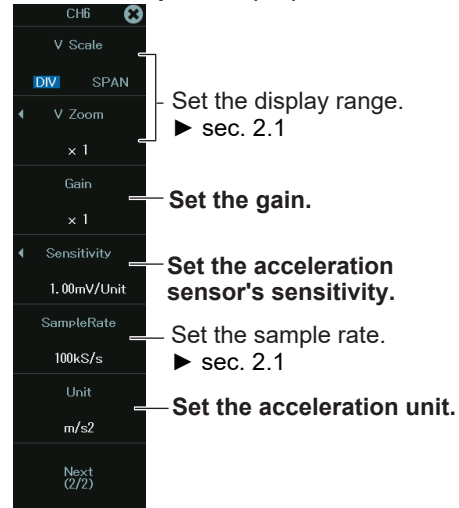
1. On the waveform screen's **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Scope Mode

Channel setup menu (1/2)

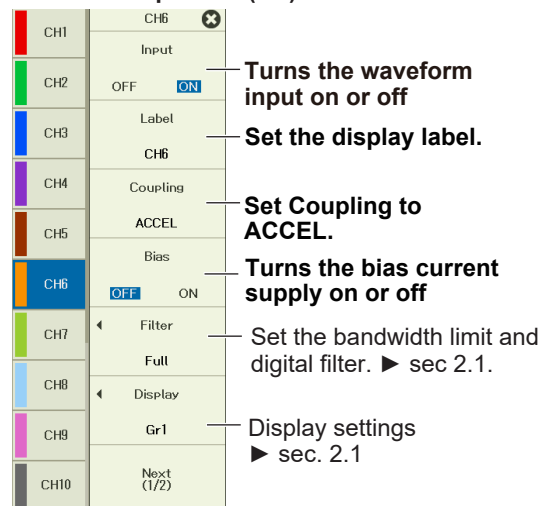


Channel setup menu (2/2)

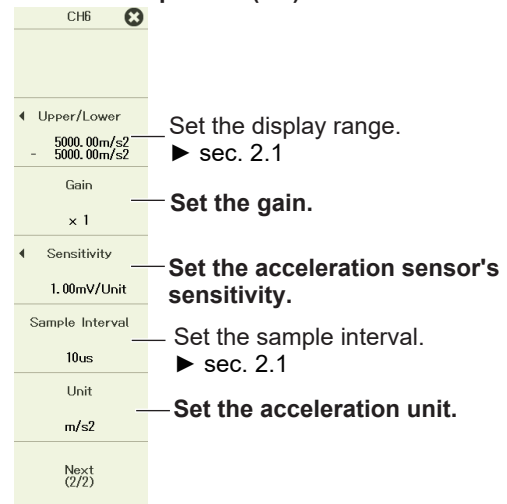


Recorder Mode

Channel setup menu (1/2)



Channel setup menu (2/2)



Setting the Input Coupling (Coupling)

To measure acceleration, set the input coupling to ACCEL.

To measure voltage, set the input coupling to an appropriate voltage measurement setting. ►
section 2.1

Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

► section 2.1

2.7 Configuring Frequency, Revolution, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity Measurements

This section explains the following settings for frequency, revolution, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity measurements:

Scope Mode

- Turning waveform input or and off
- Display label
- FV setup (measurement items)
- Input condition
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Zoom method (DIV/SPAN) switching
- Vertical zoom (vertical zoom, offset), upper and lower display range limits
- Sample rate
- Linear scaling
- Vertical scale
- Vertical position

Recorder Mode

- Turning waveform input or and off
- Display label
- FV setup (measurement items)
- Input condition
- Filter (bandwidth limit, digital filter)
- Display setup (display group)
- Upper and lower limits of the display range
- Sample interval
- Linear scaling
- Vertical scale
- Vertical position

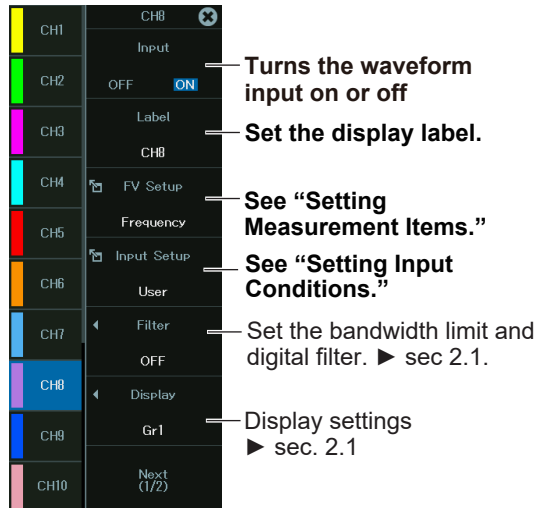
► [“Frequency Measurement” in the Features Guide](#)

Channel Setup Menu

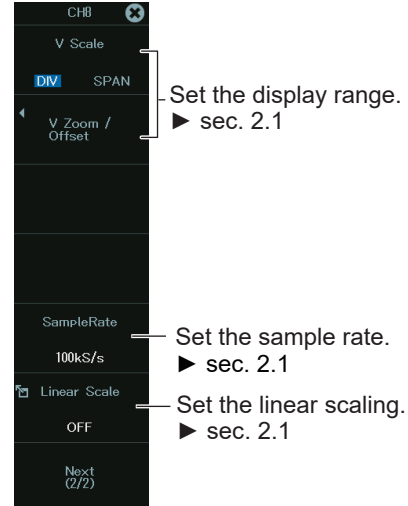
- On the waveform screen's **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
- Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Scope Mode

Channel setup menu (1/2)

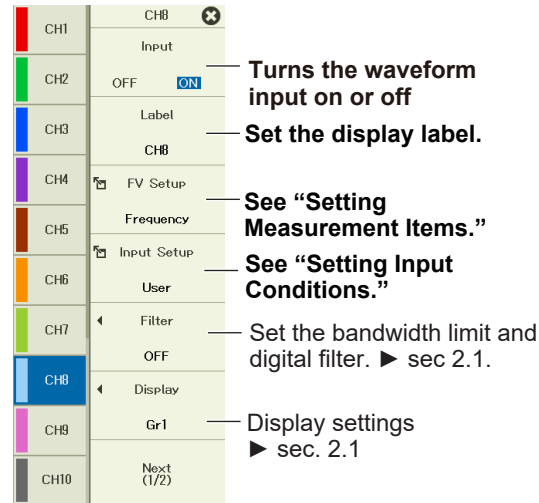


Channel setup menu (2/2)

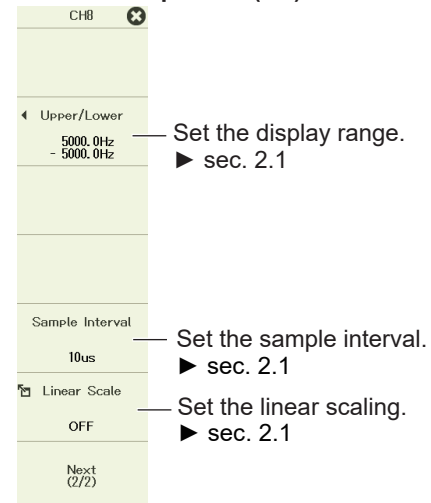


Recorder Mode

Channel setup menu (1/2)



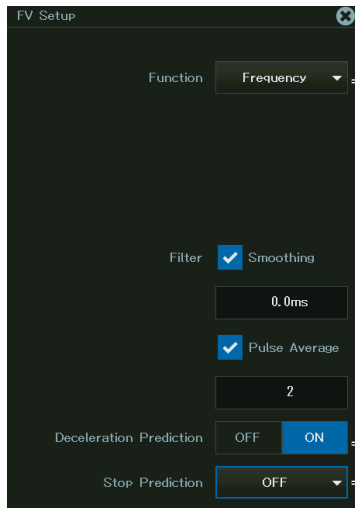
Channel setup menu (2/2)



Setting Measurement Items (FV Setup)

3. Tap **FV Setup**, or press the soft key. The following screen appears.

When Performing Frequency or Period Measurements



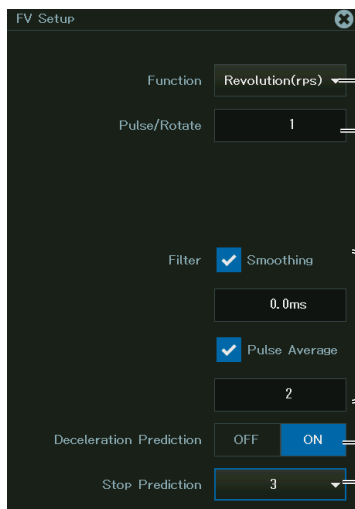
The screenshot shows the 'FV Setup' screen with the following settings:

- Function: Frequency
- Filter: Smoothing, 0.0ms
- Filter: Pulse Average, 2
- Deceleration Prediction: OFF ON
- Stop Prediction: OFF

Annotations:

- Set Function to Frequency or Period.
- Set the filter (Smoothing, PulseAverage).
- Turns decelerating prediction on or off
- Set the stop prediction (OFF, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10).

When Performing Revolution Measurements



The screenshot shows the 'FV Setup' screen with the following settings:

- Function: Revolution(rps)
- Pulse/Rotate: 1
- Filter: Smoothing, 0.0ms
- Filter: Pulse Average, 2
- Deceleration Prediction: OFF ON
- Stop Prediction: 3

Annotations:

- Set Function to Revolution(rpm) or Revolution(rps).
- Set the pulse and rotate values.
- Set the filter (Smoothing, PulseAverage).
- Turns decelerating prediction on or off
- Set the stop prediction (OFF, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10).

When Performing Duty Cycle or Pulse Width Measurements

The screenshot shows the 'FV Setup' dialog with the following settings and annotations:

- Function:** Set to 'Duty'. Annotation: **Select Duty or Pulse Width.**
- Measure Pulse:** Set to 'Positive'. Annotation: **Set the pulse to measure (Positive, Negative).**
- Filter:** 'Smoothing' is checked. Below it, a value of '0.0ms' is entered. Annotation: **Set the filter (Smoothing).**
- Time Out:** Set to '10.00100s'. Annotation: **Set Time Out. (For the 720281)**

When Performing Power Supply Frequency Measurements

The screenshot shows the 'FV Setup' dialog with the following settings and annotations:

- Function:** Set to 'Power Freq'. Annotation: **Set Function to Power Freq.**
- Center Freq:** Set to '50Hz'. Annotation: **Set the center frequency (50Hz, 60Hz, 400Hz).**
- Filter:** 'Smoothing' and 'Pulse Average' are checked. Below 'Smoothing', a value of '0.0ms' is entered. Below 'Pulse Average', a value of '2' is entered. Annotation: **Set the filter (Smoothing, PulseAverage).**

When Performing Pulse Integration Measurements

The screenshot shows the 'FV Setup' dialog with the following settings and annotations:

- Function:** Set to 'Pulse Integ'. Annotation: **Select Pulse Integ.**
- Unit/Pulse:** Set to '1.0000'. Annotation: **Set the unit and pulse.**
- Unit:** (Empty field). Annotation: **Set the unit.**
- Filter:** 'Smoothing' and 'Pulse Average' are checked. Below 'Smoothing', a value of '0.0ms' is entered. Below 'Pulse Average', a value of '2' is entered. Annotation: **Set the filter (Smoothing, PulseAverage).**
- Over Limit Reset:** Set to 'OFF'. Annotation: **Turns over-limit reset on or off**
- Reset:** 'Execute' button. Annotation: **Executes the manual reset of the pulse count**

When Performing Velocity Measurements

The screenshot shows the 'FV Setup' dialog box with the following settings and annotations:

- Function:** Velocity (dropdown) — Select Velocity.
- Distance/Pulse:** 1.0000 (text input) — Set the distance and pulse.
- Time Unit:** Second (dropdown) — Set the time unit (Hour, Minute, Second).
- Unit:** m/s (dropdown) — Set the unit.
- Filter:** Smoothing (checkbox checked) and Pulse Average (checkbox checked) — Set the filter (Smoothing, PulseAverage).
- Filter Value:** 0.0ms (text input) — Set the filter (Smoothing, PulseAverage).
- Deceleration Prediction:** ON (radio button selected) — Turns decelerating prediction on or off
- Stop Prediction:** OFF (dropdown) — Set the stop prediction (OFF, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10).

Setting Input Conditions (Input Setup)

3. Tap **Input Setup**, or press the soft key. The following screen appears.

The screenshot shows the 'Input Setup' dialog box with the following settings and annotations:

- Preset:** User (dropdown) — Set the preset.
- V Range:** ±10V (dropdown) — Set the voltage range.
- Coupling:** DC (dropdown) — Set the input coupling.
- Probe:** 1:1 (dropdown) — Set the probe type.
- Bandwidth:** Full (dropdown) — Set the bandwidth limits.
- Threshold:** 0.0V (text input) — Set the threshold level.
- Hysteresis:** \neq (radio button selected) — Set the hysteresis (\neq , \neq , \neq).
- Slope:** \uparrow (radio button selected) — Set the slope (\uparrow , \downarrow).
- Chatter Elimination:** 0ms (text input) — Set the chatter elimination.

When Preset is set to Pull-up 5V

Pull Up: OFF (radio button selected) — Turns pull-up on or off

Setting the Preset

You can set the preset to one of the following 10 options: Logic 5V, Logic 3V, Logic 12V, Logic 24V, Pull-up 5V, ZeroCross, AC100V, AC200V, EM Pickup, or User (user-defined).

The settable input items differ depending on the preset that you set. You can only turn pull-up on and off when the preset is set to Pull-up 5V.

Setting the Vertical Scale (SCALE knob)

▶ section 2.1

Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

▶ section 2.1

2.8 Configuring Logic Signal Measurements

This section explains the following settings for logic measurements:

Items Common to Scope Mode and Recorder Mode

- Turning waveform input on or off
- Display label
- Logic settings
- Deskewing
- Sample Rate and Sample Interval
- Set the zoom percentage
- Display setup (display group)
- Vertical position

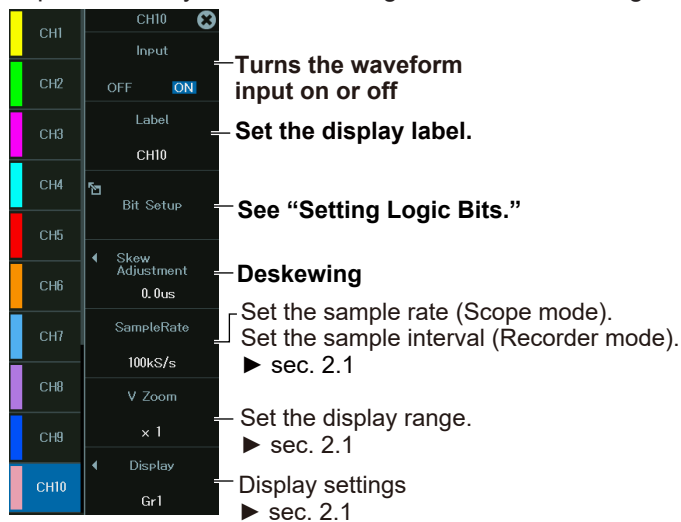
► [“Logic Measurement” in the Features Guide](#)

Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **VERTICAL > CH**, or press **CH**. A channel setup menu appears.

(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)

2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

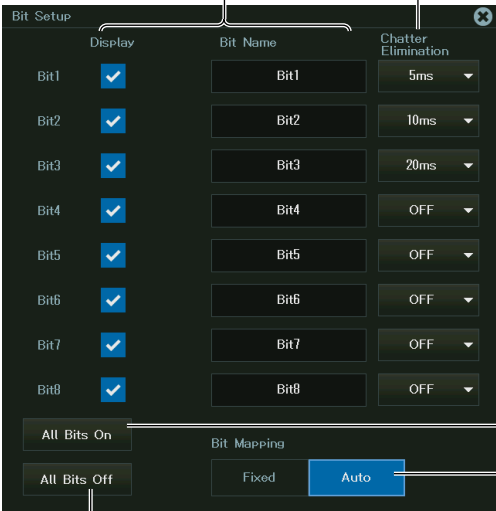


Setting Logic Bits (Logic Setup)

3. Tap **Logic Setup**, or press the soft key. The following screen appears.

Use the check boxes to turn the display on or off for each bit and press the buttons to set the label for each bit.

Set the chatter elimination.



Turns the display on for all bits

Turns the display on or off for all bits

Bit mapping
 Fixed (Fixed): The display position is fixed regardless of the bit settings.
 Auto (Auto): The display position is set automatically according to the bit settings.

Bit	Display	Bit Name	Chatter Elimination
Bit1	<input checked="" type="checkbox"/>	Bit1	5ms
Bit2	<input checked="" type="checkbox"/>	Bit2	10ms
Bit3	<input checked="" type="checkbox"/>	Bit3	20ms
Bit4	<input checked="" type="checkbox"/>	Bit4	OFF
Bit5	<input checked="" type="checkbox"/>	Bit5	OFF
Bit6	<input checked="" type="checkbox"/>	Bit6	OFF
Bit7	<input checked="" type="checkbox"/>	Bit7	OFF
Bit8	<input checked="" type="checkbox"/>	Bit8	OFF

Setting the Vertical Scale (SCALE knob)

- section 2.1

Setting the Waveform Vertical and Horizontal Positions (Sliding the waveform screen)

- section 2.1

2.9 Configuring the Monitoring of CAN and CAN FD Bus Signals (/VCE option)

This section explains the following settings for monitoring CAN and CAN FD bus signals.

Items Common to Scope Mode and Recorder Mode

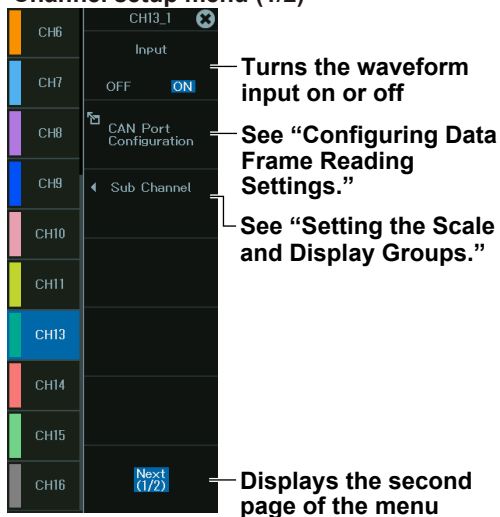
- Turning waveform input on or off
- Data frame reading settings (all sub channel settings, factor and offset settings of all sub channels, port settings, definition file loading)
- Individual sub channel scales
- Display group
- Setting and executing one-shot output
- Scaling of all sub channels
- Sample rate and sample interval settings
- Preferences

► [“CAN and CAN FD Bus Signal Monitoring \(/VCE option\)” in the Features Guide](#)

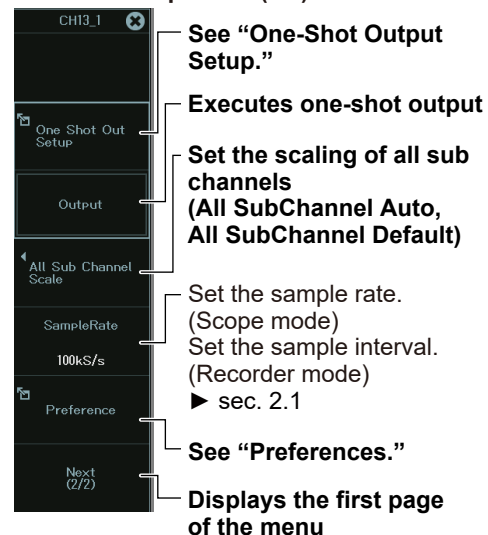
Channel Setup Menu

1. On the waveform screen's **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.
CAN Bus Monitor Module(720240), CAN & LIN Bus Monitor Module(720241), and CAN/ CAN FD Monitor Module(720242)

Channel setup menu (1/2)



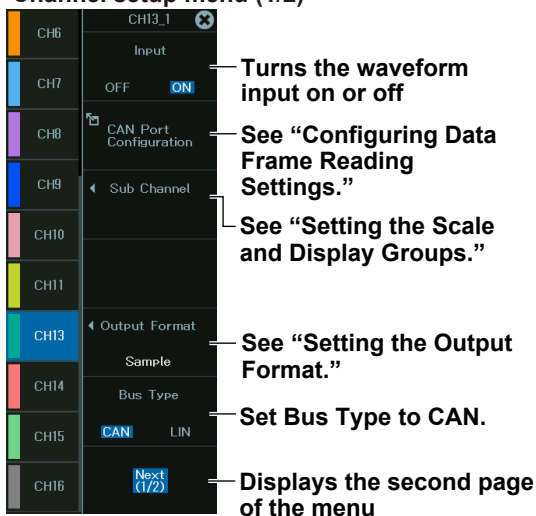
Channel setup menu (2/2)



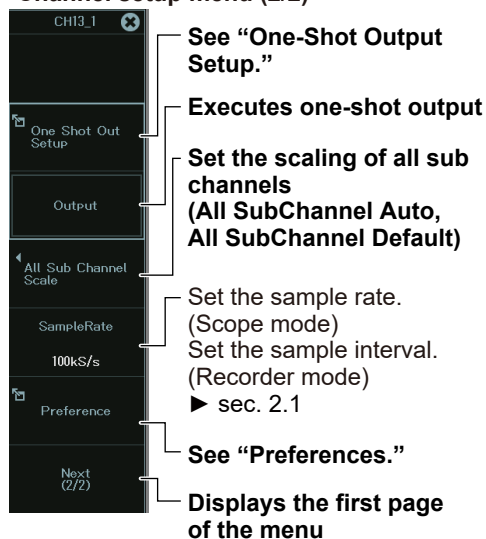
CAN FD/LIN Monitor Module (720245)

If you are using a 720245, first set Bus Type to CAN.

Channel setup menu (1/2)



Channel setup menu (2/2)



Configuring Data Frame Reading Settings (CAN Port Configuration)

3. Tap **CAN Port Configuration**, or press the soft key.

All Sub Channel Setup (All SubChannel Setup - CAN or CAN FD Data Extraction Conditions)

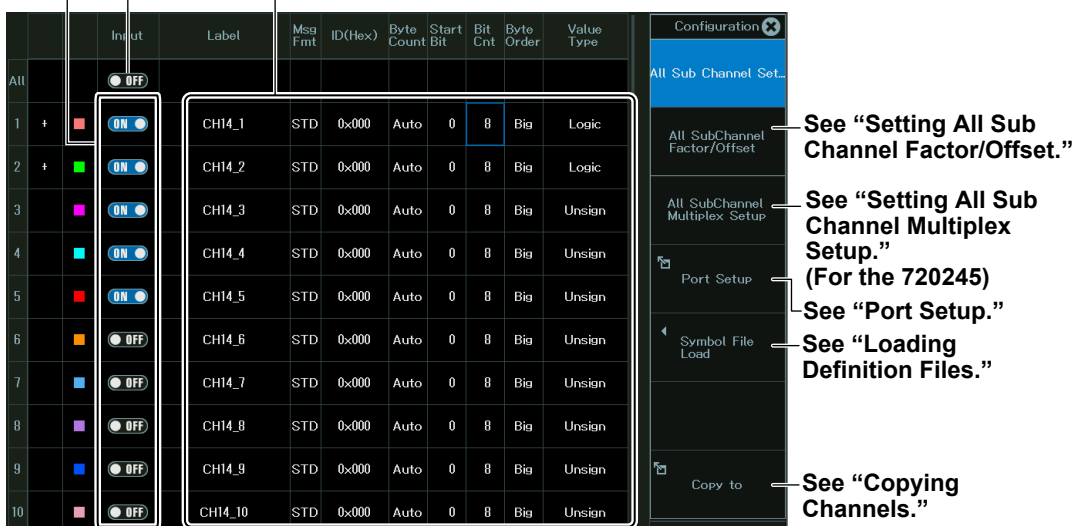
4. Tap **All SubChannel Setup**, or press the soft key. The following screen appears.

Turns sub channels on or off

Set each sub channel’s input to on or off.

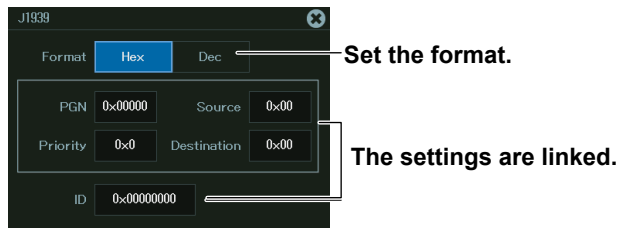
Turns all sub channel on or off

CAN or CAN FD data extraction conditions



2.9 Configuring the Monitoring of CAN and CAN FD Bus Signals (VCE option)

5. Tap each item. Use the displayed list (options) or input box to set the items.
In Port Setup of the CAN FD/LIN monitor module (720245), when you set J1939 to ON, the ID is set according to J1939. When you tap ID, the following menu appears.



In addition, if you set J1939 to ON, Msg Fmt of each sub channel is fixed to XTD and Byte Order to Little.

Setting All Sub Channel Factor/Offset (All SubChannel Factor/Offset - CAN or CAN FD Data Conversion Condition)

4. Tap **All SubChannel Factor/Offset**, or press the soft key. The following screen appears.

CAN or CAN FD data conversion conditions

	Input	Label	Factor	Offset	Unit
All	<input type="radio"/> OFF				
1	<input checked="" type="radio"/> ON	CH14_1			
2	<input checked="" type="radio"/> ON	CH14_2			
3	<input checked="" type="radio"/> ON	CH14_3	1.0000	0.0000	
4	<input checked="" type="radio"/> ON	CH14_4	1.0000	0.0000	
5	<input checked="" type="radio"/> ON	CH14_5	1.0000	0.0000	
6	<input type="radio"/> OFF	CH14_6	1.0000	0.0000	
7	<input type="radio"/> OFF	CH14_7	1.0000	0.0000	
8	<input type="radio"/> OFF	CH14_8	1.0000	0.0000	
9	<input type="radio"/> OFF	CH14_9	1.0000	0.0000	
10	<input type="radio"/> OFF	CH14_10	1.0000	0.0000	

The table is part of a configuration screen. On the right side, there is a 'Configuration' menu with options: 'All Sub Channel Set...', 'All SubChannel Factor/Offset' (highlighted in blue), 'Port Setup', and 'Symbol File Load'.

5. Tap each item. Use the displayed input box to set the items.

Setting All Sub Channel Multiplex Setup (All SubChannel Multiplex Setup) (CAN FD/LIN Monitor Module(720245))

- Tap All SubChannel Multiplex Setup, or press the soft key. The following screen appears.

Set the label, message format, and ID of CAN or CAN FD data.
(Shared with the settings of All SubChannel Setup)

Set Multiplexor (select from a list).

Set the multiplex value.

	Input	Label	Msg Tmt	ID(Hex)	Multiplexor	Multiplex Value
All	<input checked="" type="checkbox"/>					
1	<input checked="" type="checkbox"/>	CH14_1	STD	0x000	CH14_2	0x0000
2	<input type="checkbox"/>	CH14_2	STD	0x008	-	0x0000
3	<input type="checkbox"/>	CH14_3	STD	0x008	CH14_2	0x0000
4	<input type="checkbox"/>	CH14_4	STD	0x008	CH14_2	0x0000
5	<input type="checkbox"/>	CH14_5	STD	0x000	CH14_7	0x0000
6	<input type="checkbox"/>	CH14_6	STD	0x000	-	0x0000
7	<input type="checkbox"/>	CH14_7	STD	0x000	-	0x0000
8	<input type="checkbox"/>	CH14_8	STD	0x000	-	0x0000
9	<input type="checkbox"/>	CH14_9	STD	0x000	-	0x0000
10	<input type="checkbox"/>	CH14_10	STD	0x000	-	0x0000

- Tap each item. Use the displayed input box to set the items.
When you tap Multiplexor, the available sub channels are listed.

Multiplexor Setup

When you tap Multiplexor, the available sub channels are listed. If there are no available sub channels, the following window appears.

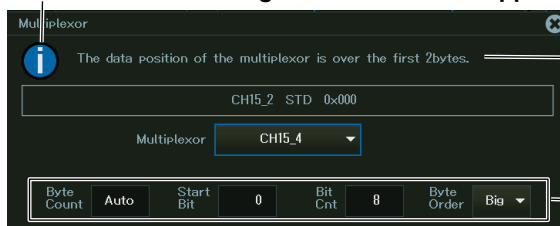


Sub channel currently being configured
Select a sub channel to designate as Multiplexor from the displayed list.

The reason why the sub channel setting selected for Multiplexor does not meet the Multiplexor conditions and the related settings are displayed.

Settings will not be displayed if a sub channel that cannot be designated as Multiplexor is selected. Select a different sub channel, or close the window and check the settings of the selected sub channel.

The icon changes to when the Multiplexor conditions are met, and the reason for not meeting the conditions disappears.



Displays the reason why the selected sub channel does not meet the Multiplexor conditions

Settings related to the Multiplexor conditions that are not met

When you change the settings and the conditions are met, the reason for not meeting the conditions disappears. When you close the setting window, Multiplexor will be set.

2.9 Configuring the Monitoring of CAN and CAN FD Bus Signals (VCE option)

If a sub channel designated as Multiplexor does not meet the Multiplexor conditions, “i” is displayed in the Multiplexor setup column as an indication. In such a case, configure Multiplexor again.

	Input	Label	Msg Fmt	ID(Hex)	Multiplexor	Multiplex Value
All	<input checked="" type="checkbox"/>					
1	<input checked="" type="checkbox"/>	CH15_1	STD	0x000	CH15_4	0x0000
2	<input checked="" type="checkbox"/>	CH15_2	STD	0x001	i CH15_4	0x0000
3	<input type="checkbox"/>	CH15_3	STD	0x000	-	0x0000

Indication that conditions are not met

Port Setup (Port Setup)

4. Tap **Port Setup**, or press the soft key. The following screen appears.

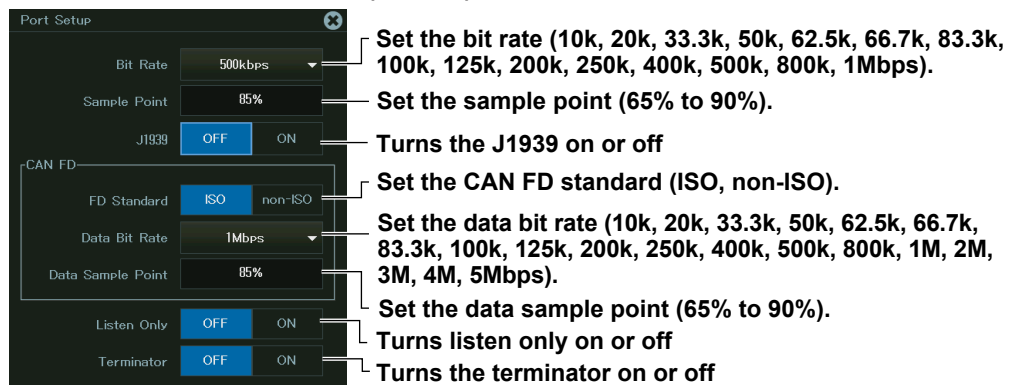
CAN Bus Monitor Module (720240) and CAN & LIN Bus Monitor Module (720241)

Bit Rate: 500Kbps — Set the bit rate (10k, 20k, 33.3k, 50k, 62.5k, 66.7k, 83.3k, 100k, 125k, 200k, 250k, 400k, 500k, 800k, 1Mbps).
 Sample Point: 85% — Set the sample point (71%, 78%, 85%).
 Sync Jump Width: 2 — Set the sync jump width (1 to 4).
 Bit Sample Num: 1 — Set the number of sample points (1, 3).
 Listen Only: OFF — Turns listen only on or off
 Terminator: OFF — Turns the terminator on or off

CAN/CAN FD Monitor Module (720242)

Bit Rate: 500Kbps — Set the bit rate (10k, 20k, 33.3k, 50k, 62.5k, 66.7k, 83.3k, 100k, 125k, 200k, 250k, 400k, 500k, 800k, 1Mbps).
 Sample Point: 85% — Set the sample point (65% to 90%).
 CAN FD
 FD Standard: ISO — Set the CAN FD standard (ISO, non-ISO).
 Data Bit Rate: 1Mbps — Set the data bit rate (10k, 20k, 33.3k, 50k, 62.5k, 66.7k, 83.3k, 100k, 125k, 200k, 250k, 400k, 500k, 800k, 1M, 2M, 3M, 4M, 5Mbps).
 Data Sample Point: 85% — Set the data sample point (65% to 90%).
 Listen Only: OFF — Turns listen only on or off
 Terminator: OFF — Turns the terminator on or off

CAN FD/LIN Monitor Module (720245)



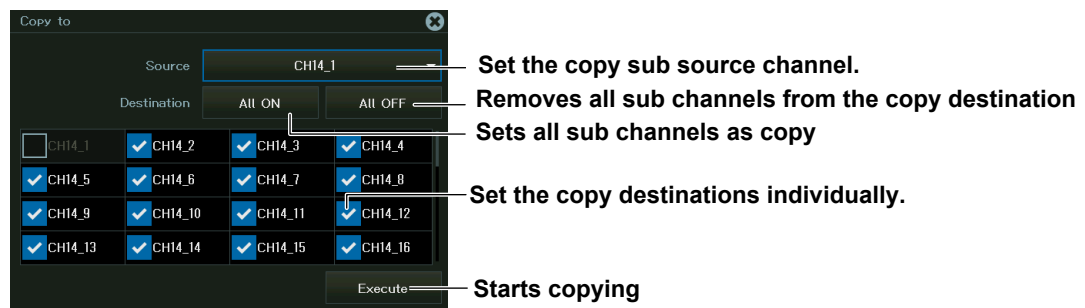
If you set J1939 to ON, Msg Fmt of each sub channel is fixed to XTD and Byte Order to Little.

Loading Definition Files (Symbol File Load)

4. Tap **Symbol File Load**, or press the soft key. A file list appears.
5. On the file list, tap a symbol file (SBL file).
For details on file list operations, see section 19.10.
6. Tap **Load**. A confirmation message appears.
7. Tap **OK**. The symbol file is loaded.

Copying Channels (Copy to)

4. Tap **Copy to**, or press the soft key. The following screen appears.

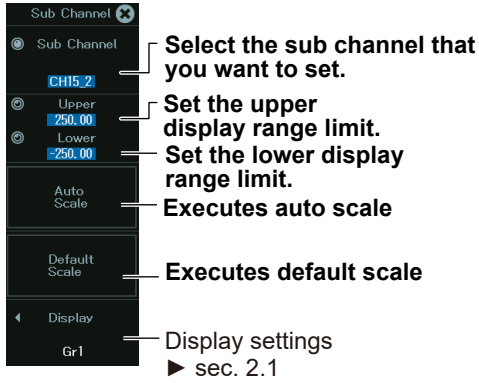


5. Set the copy source and copy destinations.
6. Tap **Execute**. Copying is executed.

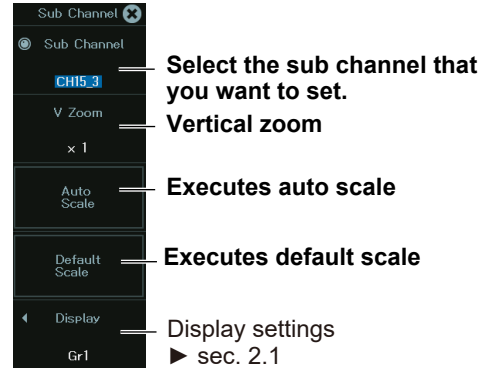
Setting the Scale and Display Groups (Sub Channel)

3. Tap **Sub Channel**, or press the soft key.

When the Data Type (Value Type) Is Unsigned, Signed, or Float



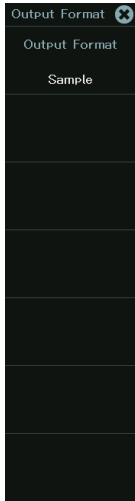
When the Data Type (Value Type) is Logic



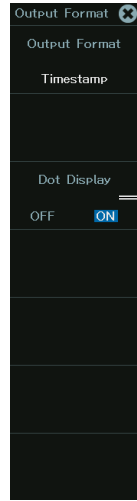
Setting the Output Format (Output Format, CAN FD/LIN Monitor Module(720245))

3. Tap **Output Format**, or press the soft key.

When Sample is selected



When Timestamp is selected



Turns the dot display on and off

4. Tap **Output Format** to select Sample or Timestamp.

Sample: Data is acquired according to the data update rate, P-P compression or pulse interpolation is applied, and the result is displayed on the screen (the same display method as other serial bus monitor modules).

Timestamp: Time information and data are acquired only when the specified ID signal is acquired, and the result is displayed on the screen.

5. When Timestamp is selected, turn the dot display on or off.

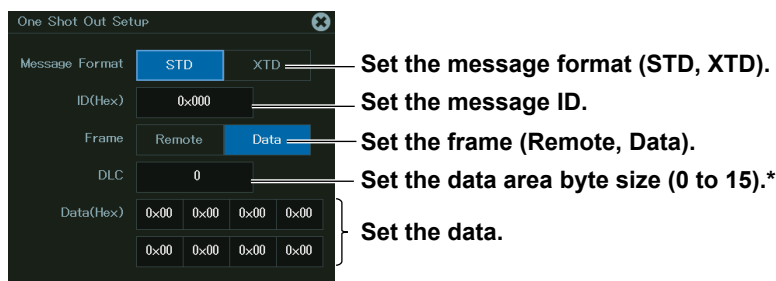
ON: Dot display when the display range is 2000 points or less. Pulse interpolation display when 2000 is exceeded.

OFF: Pulse interpolation display

One-Shot Output Setup (One shot out Setup)

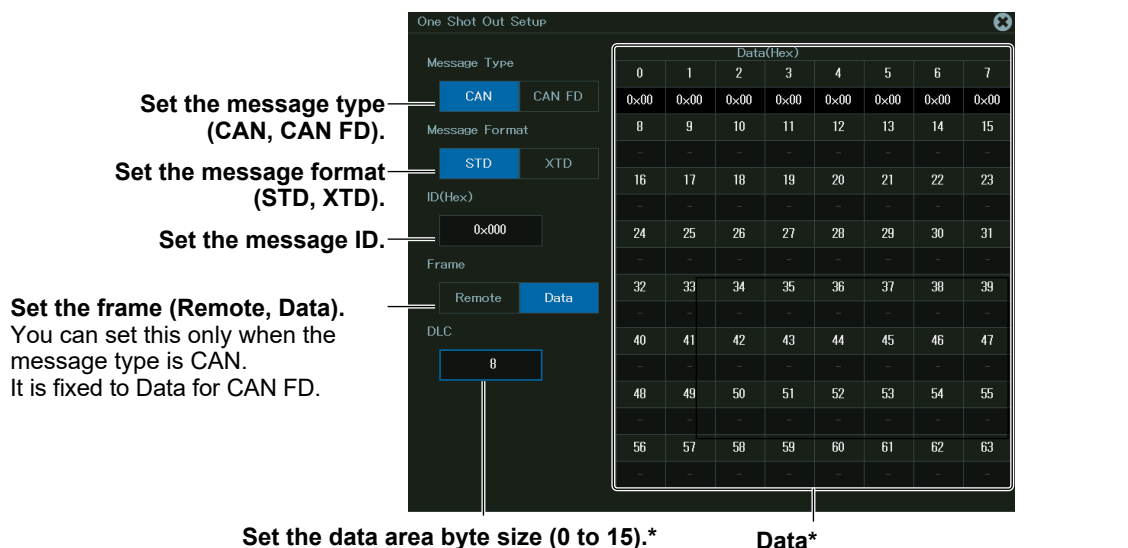
3. Tap **One Shot Out Setup**, or press the soft key. The following screen appears.

CAN Frame One-Shot Output (CAN Bus Monitor Module (720240), CAN & LIN Bus Monitor Module (720241))



* Can only be set when Frame is set to Data.

CAN or CAN FD Frame One-Shot Output (CAN/CAN FD Monitor Module (720242), CAN FD/LIN Monitor Module (720245))



Data*
The number of transmission data bytes that can be set varies depending on the message type and DLC settings.

* Can only be set when Frame is set to Data.

▶ Next page

DLC Value and the Number of Transmission Data Bytes

When DLC = 0 to 8

DLC	Number of Data Bytes		DLC	Number of Data Bytes		DLC	Number of Data Bytes																																																	
	CAN	CAN FD		CAN	CAN FD		CAN	CAN FD																																																
0	0	0	1	1	1	2	2	2																																																
<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> </table>			0	1	2	3	4	5	6	7	-	-	-	-	-	-	-	-	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>0x00</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> </table>			0	1	2	3	4	5	6	7	0x00	-	-	-	-	-	-	-	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>0x00</td><td>0x00</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr> </table>			0	1	2	3	4	5	6	7	0x00	0x00	-	-	-	-	-	-
0	1	2	3	4	5	6	7																																																	
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0	1	2	3	4	5	6	7																																																	
0x00	0x00	0x00	-	-	-	-	-																																																	
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<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>-</td><td>-</td></tr> </table>			0	1	2	3	4	5	6	7	0x00	0x00	0x00	0x00	0x00	0x00	-	-	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>-</td></tr> </table>			0	1	2	3	4	5	6	7	0x00	0x00	0x00	0x00	0x00	0x00	0x00	-	<table border="1"> <tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td><td>0x00</td></tr> </table>			0	1	2	3	4	5	6	7	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0	1	2	3	4	5	6	7																																																	
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0	1	2	3	4	5	6	7																																																	
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0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																																																	

2.9 Configuring the Monitoring of CAN and CAN FD Bus Signals (VCE option)

When DLC ≥ 9

When the message type is CAN

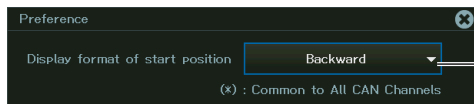
DLC	Number of Data Bytes
9 to 15	8

When the message type is CAN FD

DLC	Number of Data Bytes	DLC	Number of Data Bytes	DLC	Number of Data Bytes																		
9	12	10	16	11	20																		
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
8	9	10	11	12	13	14	15	8	9	10	11	12	13	14	15	8	9	10	11	12	13	14	15
0x00	0x00	0x00	0x00	-	-	-	-	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
16	17	18	19	20	21	22	23	16	17	18	19	20	21	22	23	16	17	18	19	20	21	22	23
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0x00	0x00	0x00	0x00	-	-	-	-
12	24	13	32	14	48																		
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
8	9	10	11	12	13	14	15	8	9	10	11	12	13	14	15	8	9	10	11	12	13	14	15
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
16	17	18	19	20	21	22	23	16	17	18	19	20	21	22	23	16	17	18	19	20	21	22	23
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
24	25	26	27	28	29	30	31	24	25	26	27	28	29	30	31	24	25	26	27	28	29	30	31
-	-	-	-	-	-	-	-	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
32	33	34	35	36	37	38	39	32	33	34	35	36	37	38	39	32	33	34	35	36	37	38	39
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
40	41	42	43	44	45	46	47	40	41	42	43	44	45	46	47	40	41	42	43	44	45	46	47
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
15	64																						
0	1	2	3	4	5	6	7																
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																
8	9	10	11	12	13	14	15																
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																
16	17	18	19	20	21	22	23																
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																
24	25	26	27	28	29	30	31																
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																
32	33	34	35	36	37	38	39																
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40	41	42	43	44	45	46	47																
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48	49	50	51	52	53	54	55																
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																
56	57	58	59	60	61	62	63																
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00																

Preferences (Preference)

- Tap **Preference**, or press the soft key. The following screen appears.



Start bit display format (Backward, Forward LSB, Forward MSB)

2.10 Configuring the Monitoring of LIN Bus Signals (/VCE option)

This section explains the following settings for monitoring LIN bus signals.

Items Common to Scope Mode and Recorder Mode

- Turning waveform input on or off
- LIN frame reading settings (all sub channel settings, factor and offset settings of all sub channels, frame settings, port settings, definition file loading)
- Individual sub channel scales
- Display group
- Scaling of all sub channels
- Sample rate and sample interval settings

► “LIN Bus Signal Monitoring (/VCE option)” in the Features Guide

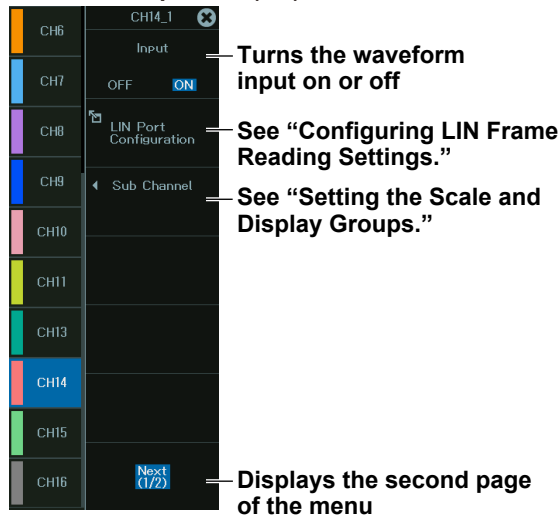
Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.

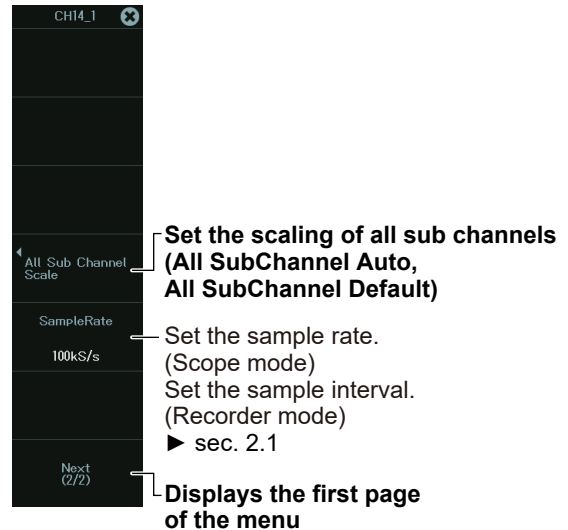
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)

2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.
CAN & LIN Bus Monitor Module (720241)

Channel setup menu (1/2)



Channel setup menu (2/2)



2.10 Configuring the Monitoring of LIN Bus Signals (/VCE option)

CAN FD/LIN Monitor Module (720245)

If you are using a 720245, first set Bus Type to LIN.

Channel setup menu (1/2)

CH14_I

- Input — Turns the waveform input on or off
- OFF ON
- LIN Port Configuration — See “Configuring Data Frame Reading Settings.”
- Sub Channel — See “Setting the Scale and Display Groups.”
- Output Format — See “Setting the Output Format.”
- Sample
- Bus Type — Set Bus Type to LIN.
- CAN LIN
- Next (1/2) — Displays the second page of the menu

Channel setup menu (2/2)

CH14_I

- All Sub Channel Scale — Set the scaling of all sub channels (All SubChannel Auto, All SubChannel Default)
- SampleRate — Set the sample rate. (Scope mode)
Set the sample interval. (Recorder mode)
► sec. 2.1
- Next (2/2) — Displays the first page of the menu

Configuring LIN Frame Reading Settings (LIN Port Configuration)

- 3 Tap **LIN Port Configuration**, or press the soft key.

All Sub Channel Setup (All SubChannel Setup - LIN Data Extraction Conditions)

4. Tap **All SubChannel Setup**, or press the soft key. The following screen appears.

Turns sub channels on or off

Set each sub channel's input to on or off.

Turns all sub channel on or off

LIN data extraction conditions

	Input	Label	ID(Hex)	Start Bit	Bit Cnt	Byte Order	Value Type
All	<input checked="" type="checkbox"/>						
1	<input checked="" type="checkbox"/>	CHI4_1	0x00	0	8	Little	Sign
2	<input checked="" type="checkbox"/>	CHI4_2	0x00	0	8	Little	Sign
3	<input checked="" type="checkbox"/>	CHI4_3	0x00	0	8	Little	Logic
4	<input checked="" type="checkbox"/>	CHI4_4	0x00	0	8	Little	Logic
5	<input checked="" type="checkbox"/>	CHI4_5	0x00	0	8	Little	Unsign
6	<input checked="" type="checkbox"/>	CHI4_6	0x00	0	8	Little	Unsign
7	<input checked="" type="checkbox"/>	CHI4_7	0x00	0	8	Little	Unsign
8	<input checked="" type="checkbox"/>	CHI4_8	0x00	0	8	Little	Unsign
9	<input checked="" type="checkbox"/>	CHI4_9	0x00	0	8	Little	Unsign
10	<input checked="" type="checkbox"/>	CHI4_10	0x00	0	8	Little	Unsign

Configuration

- All Sub Channel Set...
- All SubChannel Factor/Offset
- Port Setup
- Frame Setup
- Symbol File Load
- Copy to

See "Setting All Sub Channel Factor/Offset."

See "Port Setup."

See "Frame Setup."

See "Loading Definition Files."

See "Copying Channels."

Setting All Sub Channel Factor/Offset (All SubChannel Factor/Offset - LIN Data Conversion Condition)

4. Tap **All SubChannel Factor/Offset**, or press the soft key. The following screen appears.

LIN data conversion conditions

	Input	Label	Factor	Offset	Unit
All	<input checked="" type="checkbox"/>				
1	<input checked="" type="checkbox"/>	CHI4_1	1.0000	0.0000	
2	<input checked="" type="checkbox"/>	CHI4_2	1.0000	0.0000	
3	<input checked="" type="checkbox"/>	CHI4_3			
4	<input checked="" type="checkbox"/>	CHI4_4			
5	<input checked="" type="checkbox"/>	CHI4_5	1.0000	0.0000	
6	<input checked="" type="checkbox"/>	CHI4_6	1.0000	0.0000	
7	<input checked="" type="checkbox"/>	CHI4_7	1.0000	0.0000	
8	<input checked="" type="checkbox"/>	CHI4_8	1.0000	0.0000	
9	<input checked="" type="checkbox"/>	CHI4_9	1.0000	0.0000	
10	<input checked="" type="checkbox"/>	CHI4_10	1.0000	0.0000	

Configuration

- All Sub Channel Set...
- All SubChannel Factor/Offset
- Port Setup
- Frame Setup
- Symbol File Load
- Copy to

You cannot set Factor, Offset, or Unit when the data type (Value Type) is set to Logic.

Port Setup (Port Setup)

4. Tap **Port Setup**, or press the soft key. The following screen appears.



Frame Setup (Frame Setup)

4. Tap **Frame Setup**, or press the soft key. The following screen appears.

To set frames 0 to 59 to the same setting at once, change the settings in the All row.*

Set the data length.
Select the checksum method (Classic, Enhanced).

ID	Data Length	Checksum	ID	Data Length	Checksum	ID	Data Length	Checksum
All	Auto	Classic	-	-	-	-	-	-
0x00(0)	1	Classic	0x01(1)	1	Classic	0x02(2)	1	Classic
0x03(3)	1	Classic	0x04(4)	1	Classic	0x05(5)	1	Classic
0x06(6)	1	Classic	0x07(7)	1	Classic	0x08(8)	1	Classic
0x09(9)	1	Classic	0x0a(10)	1	Classic	0x0b(11)	1	Classic
0x0c(12)	1	Classic	0x0d(13)	1	Classic	0x0e(14)	1	Classic
0x0f(15)	1	Classic	0x10(16)	1	Classic	0x11(17)	1	Classic
0x12(18)	1	Classic	0x13(19)	1	Classic	0x14(20)	1	Classic
0x15(21)	1	Classic	0x16(22)	1	Classic	0x17(23)	1	Classic
0x18(24)	1	Classic	0x19(25)	1	Classic	0x1a(26)	1	Classic
0x1b(27)	1	Classic	0x1c(28)	1	Classic	0x1d(29)	1	Classic
0x1e(30)	1	Classic	0x1f(31)	1	Classic	0x20(32)	1	Classic

5. Tap each item. Use the displayed list (options) or input box to set the items.

Note

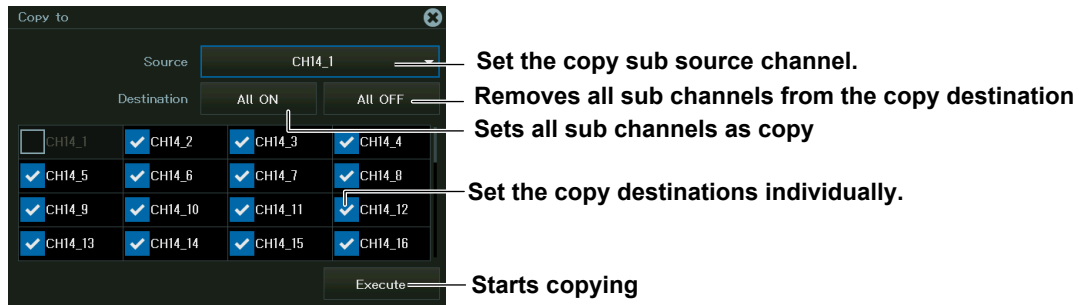
All IDs are displayed. Only the settings for the frames that have IDs that data will be read for will be enabled. The settings for frames that have other IDs will be ignored.

Loading Definition Files (Symbol File Load)

4. Tap **Symbol File Load**, or press the soft key. A file list appears.
5. On the file list, tap a symbol file (SBL file).
For details on file list operations, see section 19.10.
6. Tap **Load**. A confirmation message appears.
7. Tap **OK**. The symbol file is loaded.

Copying Channels (Copy to)

4. Tap **Copy to**, or press the soft key.

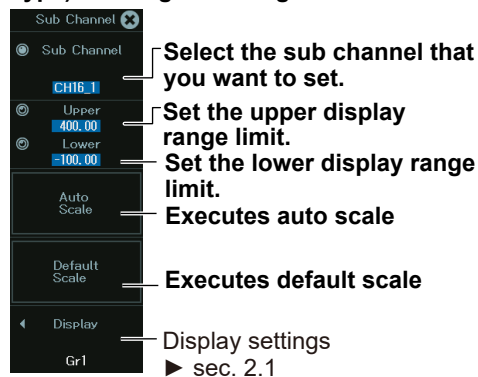


5. Set the copy source and copy destinations.
6. Tap **Execute**. Copying is executed.

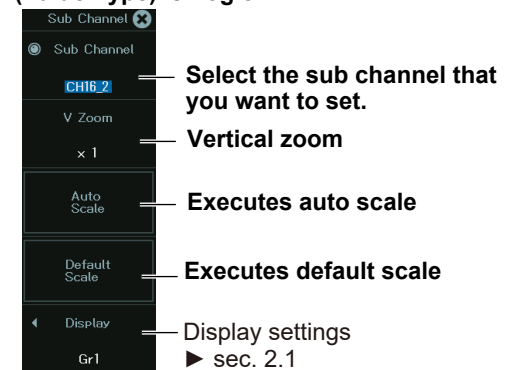
Setting the Scale and Display Groups (Sub Channel)

3. After step 2 on page 2-42, tap **Sub Channel**, or press the soft key. The following screen appears.

When the Data Type (Value Type) is Unsigned or Signed



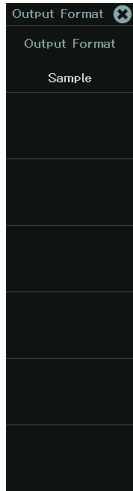
When the Data Type (Value Type) is Logic



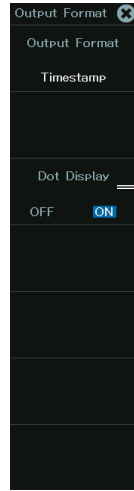
Setting the Output Format (Output Format, CAN FD/LIN Monitor Module(720245))

3. Tap **Output Format**, or press the soft key.

When Sample is selected



When Timestamp is selected



Turns the dot display on and off

4. Tap **Output Format** to select Sample or Timestamp.

Sample: Data is acquired according to the data update rate, P-P compression or pulse interpolation is applied, and the result is displayed on the screen (the same display method as other serial bus monitor modules).

Timestamp: Time information and data are acquired only when the specified ID signal is acquired, and the result is displayed on the screen.

5. When Timestamp is selected, turn the dot display on or off.

ON: Dot display when the display range is 2000 points or less. Pulse interpolation display when 2000 is exceeded.

OFF: Pulse interpolation display

2.11 Configuring the Monitoring of SENT Signals (/VCE option)

This section explains the following settings for monitoring SENT signals.

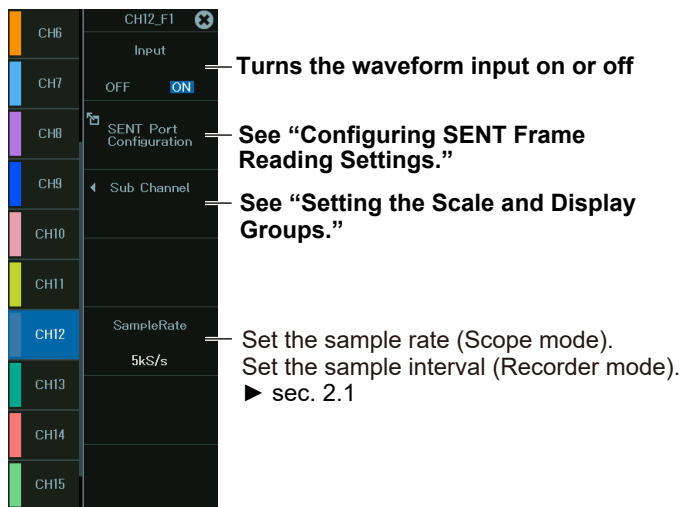
Items Common to Scope Mode and Recorder Mode

- Turning waveform input on or off
- SENT frame reading settings (all sub channel settings, factor and offset settings of all sub channels, SENT format, error channel, input settings)
- Scale
- Display group
- Sample rate and sample interval settings

► [“SENT Signal Monitoring \(/VCE option\)” in the Features Guide](#)

Channel Setup Menu

1. On the waveform screen's **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.



Configuring SENT Frame Reading Settings (SENT Port Configuration)

3 Tap **SENT Port Configuration**, or press the soft key.

All Sub Channel Setup (All SubChannel Setup - SENT Data Extraction Conditions)

4. Tap **All SubChannel Setup**, or press the soft key. The following screen appears.

Turns sub channels on or off
Set each sub channel's input to on or off.
If the data type is S&C, turn the display on or off for each bit.

SENT data extraction conditions

		Data Type	Input	Label	ID	Endian	Start Bit	Bit Size	Value Type
1		FastCH	ON	CH16_F1		Big	0	12	Unsign
2		FastCH	ON	CH16_F2		Big	12	12	Unsign
3		FastCH	ON	CH16_F3		Big	0	12	Unsign
4		S&C	ON	CH16_SC					
	_1		ON	Bit0					
	_2		ON	Bit1					
	_3		ON	Bit2					
	_4		ON	Bit3					
5		SlowCH	ON	CH16_S1	0x00		0	12	Unsign
6		SlowCH	ON	CH16_S2	0x00		0	12	Unsign
7		SlowCH	ON	CH16_S3	0x00		0	12	Unsign
8		SlowCH	ON	CH16_S4	0x00		0	12	Unsign
9		SlowCH	ON	CH16_S5	0x00		0	12	Unsign
10		Error Trigger	ON	CH16_ET					
11		Error Count	ON	CH16_EC					

Configuration

- All Sub Channel Setup
- All SubChannel Factor/Offset
- SENT Format Setup
- Error Channel Setup
- Input Setup

See "Setting All Sub Channel Factor/Offset."
See "Setting the SENT Format."
See "Setting Error Channels."
See "Input Setup."

Setting All Sub Channel Factor/Offset (All SubChannel Factor/Offset - SENT Data Conversion Condition)

4. Tap **All SubChannel Factor/Offset**, or press the soft key. The following screen appears.

SENT data conversion conditions

		Data	Input	Label	Factor	Offset	Unit
1		FastCH	ON	CH16_F1	1.0000	0.0000	
2		FastCH	ON	CH16_F2	1.0000	0.0000	
3		FastCH	ON	CH16_F3	1.0000	0.0000	
4		S&C	ON	CH16_SC			
	_1		ON	Bit0			
	_2		ON	Bit1			
	_3		ON	Bit2			
	_4		ON	Bit3			
5		SlowCH	ON	CH16_S1	1.0000	0.0000	
6		SlowCH	ON	CH16_S2	1.0000	0.0000	
7		SlowCH	ON	CH16_S3	1.0000	0.0000	
8		SlowCH	ON	CH16_S4	1.0000	0.0000	
9		SlowCH	ON	CH16_S5	1.0000	0.0000	
10		Error Trigger	ON	CH16_ET			
11		Error Count	ON	CH16_EC			

Setting the SENT Format (SENT Format Setup)

4. Tap **SENT Format Setup**, or press the soft key. The following screen appears.

SENT Format Setup

Clock Tick	3.00us	Set the clock tick (1.00 to 100.00 μ s).
Data Nibble Number	6	Set the number of data nibbles of Fast CH messages (1 to 8*).
Pause Pulse	OFF ON	Set whether to include pause pulses in Fast CH messages (ON or OFF).
CRC Type	Legacy Recommended	Set the CRC method (Legacy, Recommended).
SlowCH Type	Enhanced(ID 8bit + Data 12bit)	Set the Slow CH message format. (Short(ID 4bit + Data 8bit), Enhanced(ID 8bit + Data 12bit), Enhanced(ID 4bit + Data 16bit))
High Speed 12bit	OFF ON	Set High Speed 12bit (ON or OFF).
Fast Channel Multiplexing	OFF ON	Turns Fast Channel Multiplexing on or off You can set this when the SENT monitor module version is 0x07 or later.

* The number of data nibbles is fixed to 4 when High Speed 12bit in set to ON.

Setting Error Channels (Error Channel Setup)

4. Tap **Error Channel Setup**, or press the soft key. The following screen appears.

Turns error detection on or off (Successive Calibration Pulses (Option2) only)
Error detection (Detect) is always on for Fast Channel CRC, Slow Channel CRC, Nibble Value, and Pulse Number.

Turns error trigger display on or off

Turns error count integration on or off

Error Channel Setup

	Detect	Error Trigger	Error Count
Fast Channel CRC	ON	ON	ON
Slow Channel CRC	ON	ON	ON
Nibble Value	ON	ON	ON
Successive Calibration Puls...	OFF	ON	ON
Pulse Number	ON	ON	ON

Error Count Reset on Start: OFF ON

Error Count Reset: Execute

Turns error count reset on start on or off

Executes the manual resetting of the error count

Input Setup (Input Setup)

4. Tap **Input Setup**, or press the soft key. The following screen appears.

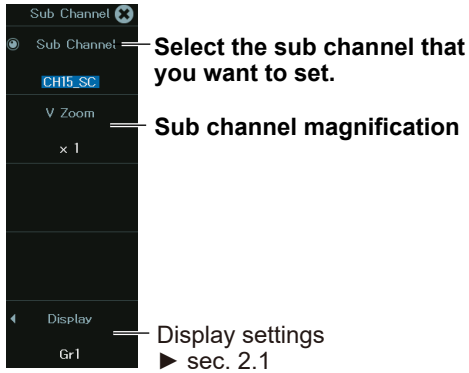
Input Setup

Probe	1:1 10:1	Set the probe (1:1, 10:1).
Threshold H	3.5V	Upper threshold (fixed)
Threshold L	1.5V	Lower threshold (fixed)
Time Out	2000.0ms	Set the timeout value (0.1 to 2000.0ms).

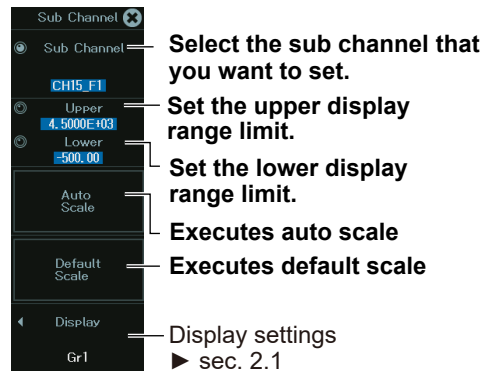
Setting the Scale and Display Groups

3. Tap **Sub Channel**, or press the soft key. The following screen appears.

When the sub channel is SC or ET



When the sub channel is F1 to F3, S1 to S5, or EC



The types of data acquired in sub channels are as follows.

Sub Channel	Data Type	
1 F1	FastCH	
2 F2		
3 F3		
4 SC	S&C (Stauts & Communication)	
When Fast Channel Multiplexing is on*		
5 S1	S1	
6 S2	S2	
7 S3	SlowCH	S3 SlowCH or FastCH
8 S4		S4
9 S5		S5
10 ET	Error Trigger	
11 EC	Error Count	

* For details on Fast Channel Multiplexing, see "Setting the SENT Format (SENT Format Setup)."

2.12 Displaying the All Channel Setup Menu

This section explains the following settings for configuring all channels:

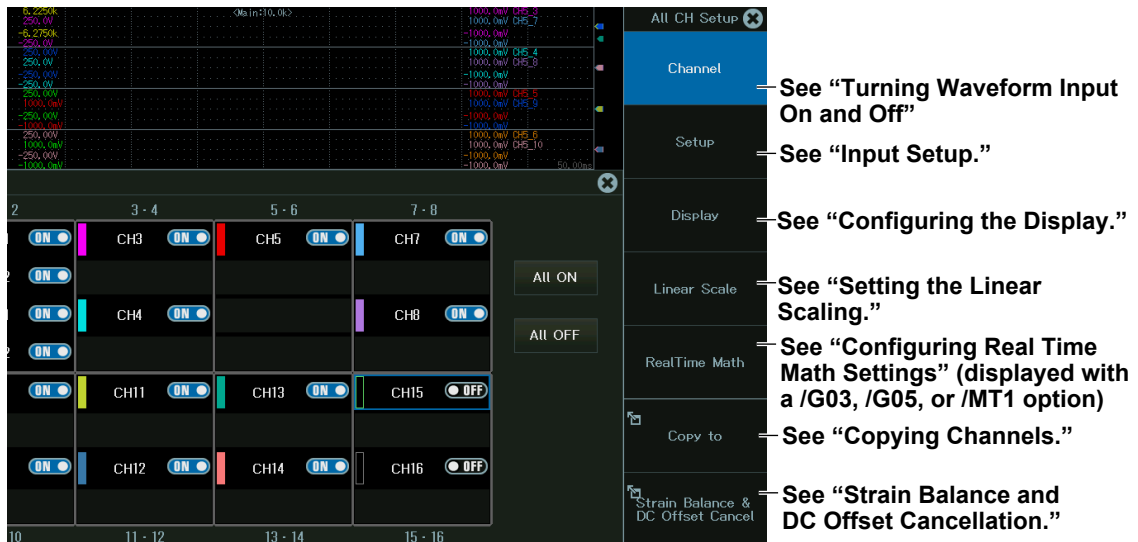
Items Common to Scope Mode and Recorder Mode

- Turning waveform input on and off
- Input settings
- Linear scaling
- Real time math channels (/G03, /G05, /MT1 option)
- Copying channels
- Strain balancing (strain module) and DC offset cancellation

► “Displaying the Menu for Configuring All Channels (ALL CH)” in the Features Guide

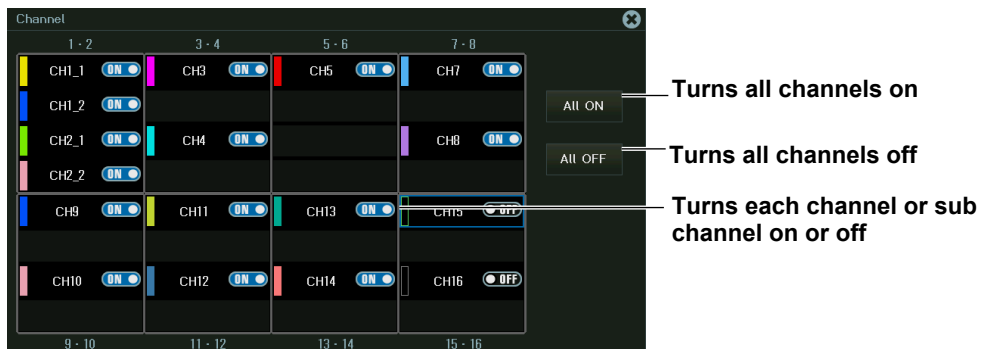
All channel setup menu

- On the waveform screen’s **MENU**, tap **VERTICAL** > **All CH**, or press **ALL CH**. An all channel setup menu appears.



Turning Waveform Input On and OFF

- Tap **Channel**, or press the soft key.



Input Setup (Setup)

2. Tap **Setup**, or press the soft key. The following screen appears.
The items on the input setting screen vary depending on the installed modules and measurement items. For details on the settings, see the explanation of the measurement items in section 2.1 and later.
3. Tap the items of each channel. Use the displayed list (options) or input box to set the items.

Turns waveform input on for all channels

Turns the waveform input on or off

Turns waveform input off for all channels

Display label

Input coupling

Vertical scale

Bandwidth limit

Probe attenuation, current-to-voltage conversion ratio, or bridge voltage (for strain measurement)

Gauge factor (for strain measurement)

	Input	Label	Coupling	V Scale	Band Width	Probe
1	■ ON	CH1_1	DC	50V/div	Full	10:1
2	■ ON	CH1_2	DC	50V/div	Full	10:1
2	■ ON	CH2_1	DC	50V/div	Full	10:1
2	■ ON	CH2_2				
3	■ ON	CH3				
4	■ ON	CH4	DC	50V/div	Full	10:1
5	■ ON					

Scroll to display channels that do not fit in the screen.

Configuring the Display (Display)

2. Tap **Display**, or press the soft key. The following screen appears.
For details on the settings, see the explanation of the measurement items in section 2.1 and later.
3. Tap the items of each channel. Use the displayed list (options) or input box to set the items.

Scope Mode

Turns waveform input on for all channels

Turns the waveform input on or off

Turns waveform input off for all channels

Display label

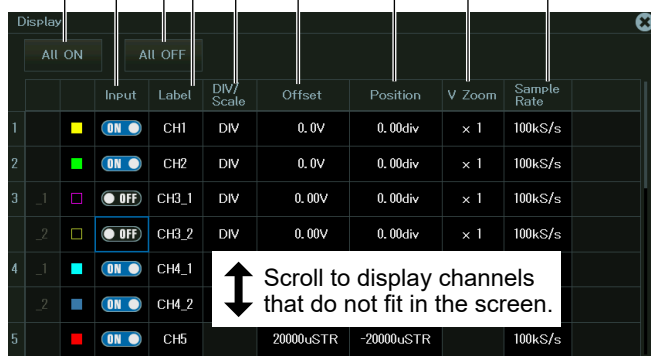
Vertical scale

Offset

Vertical position

Set the zoom magnification.

Sample rate



Recorder Mode

Turns waveform input on for all channels

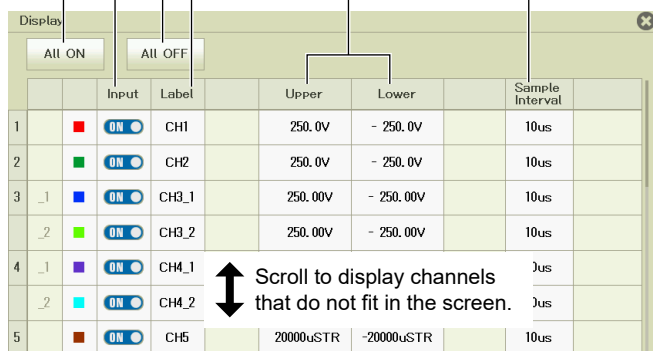
Turns the waveform input on or off

Turns waveform input off for all channels

Display label

Upper and lower limits of the display range

Sample interval



Setting the Linear Scaling (Linear Scale)

2. Tap **Linear Scale**, or press the soft key. The following screen appears.
For details on the settings, see the explanation of the measurement items in section 2.1 and later.
3. Tap the items of each channel. Use the displayed list (options) or input box to set the items.

Linear scaling mode

Scaling coefficient A or measured value at point P1

Offset value B or scaled value of point P1

Measurement value of point P2

Scaled value of point P2

Display mode

Unit

Number of decimal places

Unit prefix

Setup	Linear Scale	AX+B: A P1-P2	AX+B: B P1XP1-P2 P1:Y	P1-P2	P2XP1-P2 P2:Y	Unit	Disp Type	Decim Num	Sub Unit
1	AX+B	25.000	-25.000				Exp		
2	P1-P2	1.0000	0.0000	5.0000	100.00		Exp		
3	_1	OFF							
	_2	OFF							
4	_1	OFF							
	_2	OFF							
5	_1	OFF							
	_2	OFF							

Slide to display channels that do not fit in the screen.

Configuring Real Time Math Settings (RealTime Math) (/G03, /G05, /MT1 option)

2. Tap **RealTime Math**, or press the soft key. The following screen appears.
3. Tap the items of each channel. Use the displayed list (options) or input box to set the items.
For details on real time math, see chapter 16.

Turns real time math on or off

Display label

Equation

Source channels

Constants

Setup	RMath	Label	Operation	Source1	Source2	A	B
1	<input checked="" type="checkbox"/>	RTmath1	A(S1)+B(S2)+C	CH1	CH2	1.0000	1.0000
2	<input checked="" type="checkbox"/>	RTmath2	A(S1)+B(S2)+C	CH1	CH2	1.0000	1.0000
3	<input checked="" type="checkbox"/>	RTmath3	A(S1)+B(S2)+C	CH1	CH2	1.0000	1.0000
4	<input checked="" type="checkbox"/>	RTmath4	A(S1)+B(S2)+C	CH1	CH2	1.0000	1.0000
5	<input checked="" type="checkbox"/>	RTmath5	A(S1)+B(S2)+C	CH1	CH2	1.0000	1.0000
6	<input checked="" type="checkbox"/>	RTmath6					1.0000
7	<input type="checkbox"/>	RTmath7					
8	<input type="checkbox"/>	RTmath8					

Slide to display channels that do not fit in the screen.

Copying Channels (Copy to)

- Tap **Copy to**, or press the soft key. The following screen appears.

When the copy source is CH1 to CH16

Select the copy source channel.

Sets all copyable channels to ON

Unselects all channels

Select the channels that you want to copy to.

Starts copying

When the copy source is RTmath1 to RTmath16

Strain Balance and DC Offset Cancellation (Balance & DC Offset Cancel)

- Tap **Strain Balance & DC Offset Cancel**, or press the soft key. The following screen appears.

Select the check boxes for the channels you want to perform strain balancing and DC offset cancellation on.

Executes strain balancing and DC offset cancellation

2.13 Setting the Digital Filter (/G03, /G05, /MT1 option)

On models with the /G03, /G05, or /MT1 option, in addition to the bandwidth limit, you can set a digital filter (some input modules do not support the digital filter).

Items Common to Scope Mode and Recorder Mode

Digital filter settings

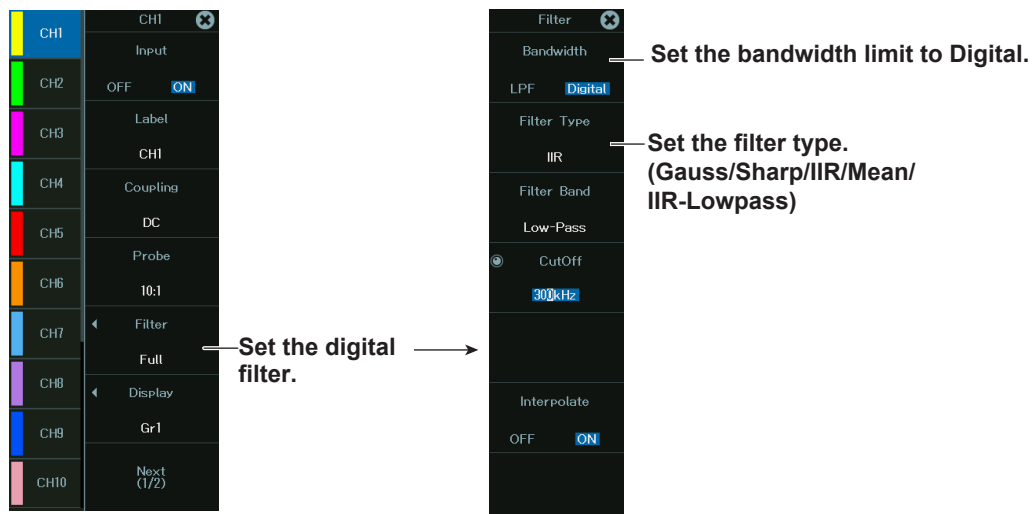
► “Digital Filter (Filter) (/G03, /G05, /MT1 option)” in the Features Guide

Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **VERTICAL** > **CH**, or press **CH**. A channel setup menu appears.
(You can also tap the channel information display area at the top of the screen to display the channel setup menu.)
2. Tap a channel you want to configure, or select it using the jog dial or up and down arrow keys.

Digital filter settings

3. Tap **Filter**, or press the soft key. A filter setup menu appears.
“Filter” does not appear for channels without digital filters. Either “Bandwidth Limit” is displayed, or nothing is displayed.



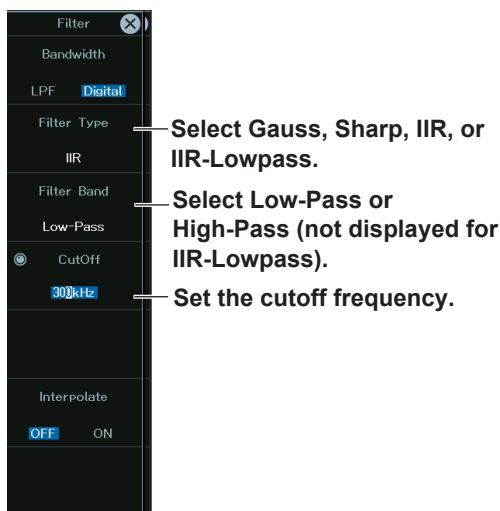
4. Set **Bandwidth** to **Digital**.

Set the filter type.

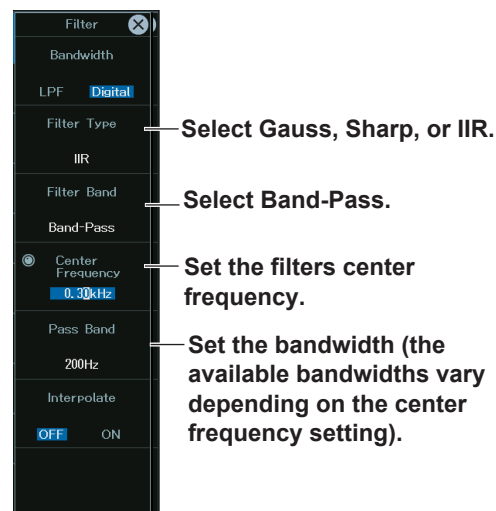
Setting the Gauss, Sharp, IIR, or IIR-Lowpass Filter

5. Tap **Filter Type**, or press the soft key. A Filter Type setup menu appears.

When Filter Band is set to Low-Pass or High-Pass



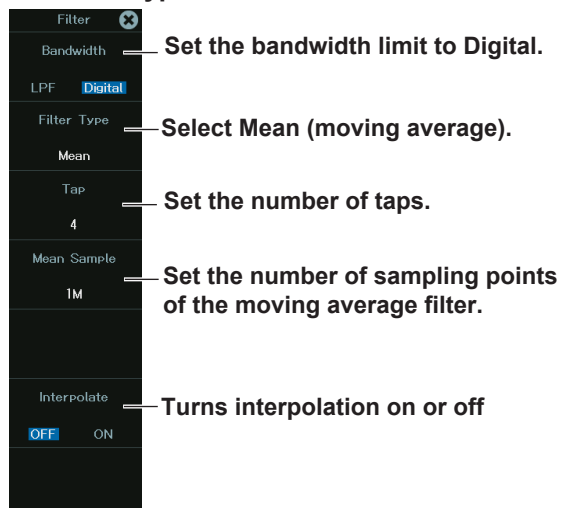
When Filter Band is set to Band-Pass



For Band-Pass, set the center frequency and the bandwidth, the frequencies before and after the center frequency.

Setting the Moving Average (Mean)

5. Set **Filter Type** to **Mean**.

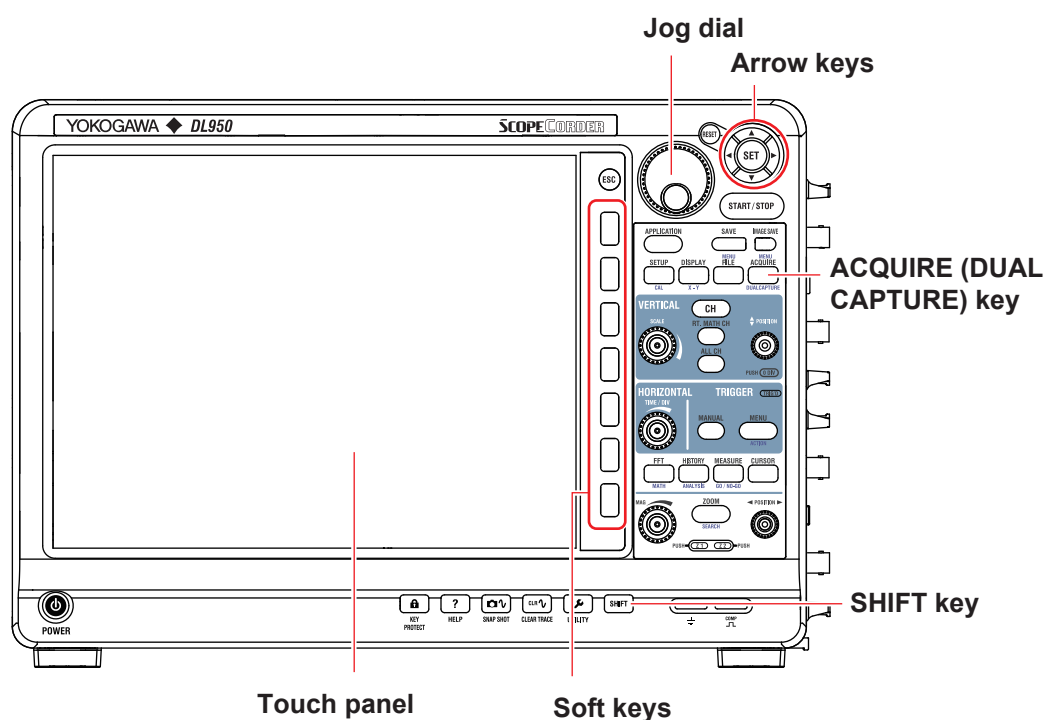


Chapter 3

Waveform Acquisition

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
3.1 Setting Conditions for Waveform Acquisition (Scope mode)	✓	-
3.2 Setting Conditions for Waveform Acquisition (Recorder mode)	-	✓
3.3 Starting and Stopping Waveform Acquisition	✓	✓
3.4 Using the Dual Capture Feature (Scope mode only)	✓	-
3.5 Performing SSD Recording (/ST1, /ST2 option)	✓	✓
3.6 Recording Using Flash Acquisition (/ST2 option)	✓	✓

* The settings may vary depending on the operation mode.

3.1 Setting Conditions for Waveform Acquisition (Scope mode)

This section explains the following settings for acquiring waveforms in Scope mode:

Applicable in Scope Mode (dual capture mode off)

- Record length
- Acquisition mode
- Trigger mode
- Waveform acquisition count
- Time base
- Time scale setting

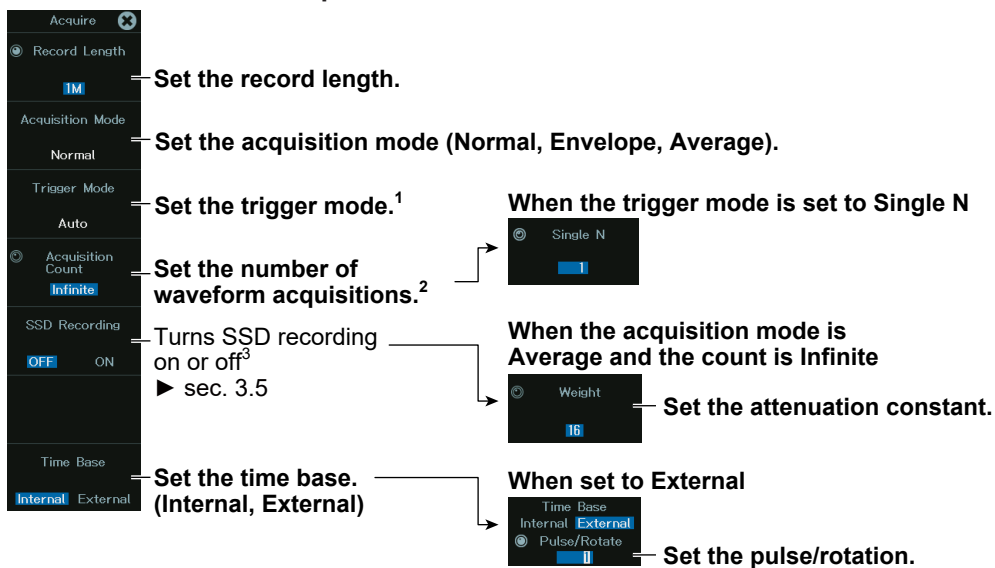
► [“Waveform Acquisition” in the Features Guide](#)

ACQUIRE menu

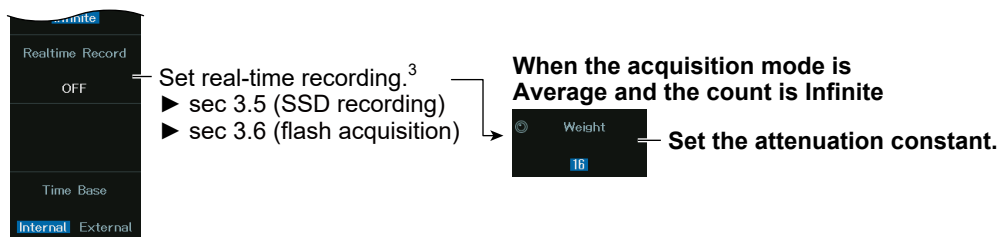
1. On the waveform screen’s **MENU**, tap **ACQUIRE > ACQUIRE**, or press **ACQUIRE**. The ACQUIRE menu appears.

When the dual capture mode is on, the dual capture menu appears. See section 3.4, “Using the Dual Capture Feature (Scope mode only).”

On a Model with the /ST1 Option



On a Model with the /ST2 Option



- 1 Fix to On Start when SSD recording or flash acquisition is enabled
- 2 When the trigger mode is set to Auto, AutoLevel, Normal
- 3 When the acquisition mode is not set to average

Setting the Acquisition Mode (Acquisition Mode)

Normal: Displays waveforms without processing the sampled data. Set the waveform acquisition count.

Envelope: Displays waveforms in envelope mode. Set the waveform acquisition count.

Average: Displays averaged waveforms. Set the attenuation constant or average count (= waveform acquisition count).

When the acquisition method is set to Average, the trigger mode cannot be set to Single, Single N, or On Start.

Also, SSD recording and flash acquisition cannot be used.

Setting the Trigger Mode (Trigger Mode)

The trigger mode determines the conditions for updating the displayed waveforms. The operation is the same as for Trigger Mode of the MENU key for trigger.

► sec 4.1 for trigger)

You can select from the following options.

Auto, AutoLevel, Normal, Single, Single N, On Start

Setting the Time Base (Time Base)

Internal: The internal clock signal is used for the time base (the TIME/DIV setting is valid).

External: An external clock signal is used for the time base (the TIME/DIV setting is invalid).

Specify a pulse count that corresponds to one rotation (or one cycle) of mechanical movement (Pulse/Rotate).

Setting the Time Scale

Turn the TIME/DIV knob. The new TIME/DIV will be applied the next time waveform acquisition is started.

3.2 Setting Conditions for Waveform Acquisition (Recorder mode)

This section explains the following settings for acquiring waveforms in Recorder mode:

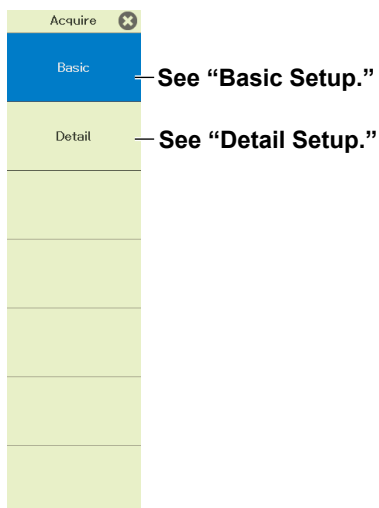
Applicable in Recorder Mode

- Recording time
- Sample interval
- Acquisition method
- Acquisition mode
- Time base

► [“Waveform Acquisition” in the Features Guide](#)

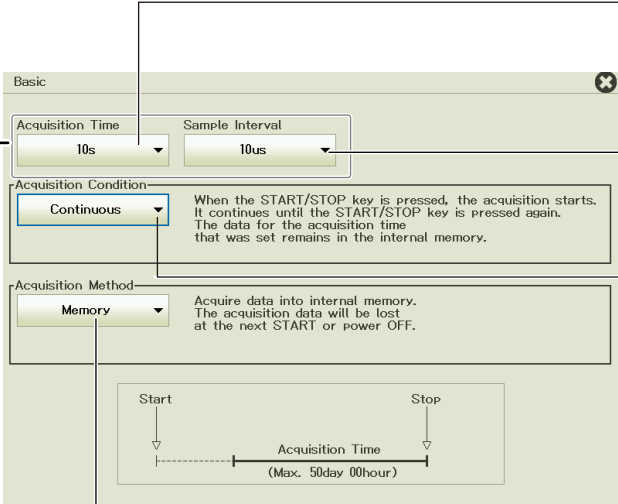
ACQUIRE menu

1. On the waveform screen’s **MENU**, tap **ACQUIRE > ACQUIRE**, or press **ACQUIRE**. The **ACQUIRE** menu appears.



Basic Setup (Basic)

2. Tap **Basic**, or press the soft key. The following screen appears.



The screenshot shows the 'Basic' setup screen with the following settings:

- Acquisition Time:** 10s
- Sample Interval:** 10us
- Acquisition Condition:** Continuous
- Acquisition Method:** Memory

Below the settings is a diagram showing a waveform acquisition window. The window starts at 'Start' and ends at 'Stop'. The duration is labeled 'Acquisition Time (Max. 50day 00hour)'. A dashed line indicates the internal memory storage period.

Acquisition time or record time
Acquisition time is a setting for memory recording. Record time is a setting for SSD recording and flash acquisition.

Sample interval
Slide to display sample intervals that do not fit in the screen.

Acquisition conditions
Select from the following three options.

- Acquisition Time (specified acquisition time)
- Continuous (continuous acquisition)
- Capture on Trigger (triggered acquisition)

When the acquisition method is set to SSD Recording or Flash Acquisition, this is fixed to Acquisition Time.

Acquisition method
Select from the following four methods.

- Memory
- Memory + Save on Stop
- SSD Recording
- Flash Acquisition

With the time base in detail setup (Detail) is set to external clock signal.

Record Length
10M

Record length
Scroll to display record lengths that do not fit in the screen.

Setting the Acquisition Conditions

Set when to start or stop waveform acquisition when the START/STOP button is pressed.

Acquisition Time: Waveform acquisition starts when you press the START/STOP button. When the waveforms over the specified time are acquired, waveform acquisition stops automatically.

Continuous: Waveform acquisition starts when the START/STOP button is pressed. When the button is pressed again, acquisition stops.

Capture on Trigger: Waveform acquisition for the pre-trigger section starts when you press the START/STOP button. When the acquisition is completed, the instrument enters the trigger-wait state. Waveform acquisition for the post-trigger section starts when a trigger occurs. When the waveforms over the specified time required, waveform acquisition stops automatically. Specify this when you want to start waveform acquisitions with triggers.

3.2 Setting Conditions for Waveform Acquisition (Recorder mode)

Setting the Acquisition Method

Set the waveform data acquisition method.

Memory: Waveform data is saved in the internal memory. The data is cleared when waveform data acquisition starts again or when the power is turned off.

Memory + Save on Stop: Waveform data is saved in the internal memory. After acquisition stops, the data is saved in the internal storage (SSD) or USB memory.

The data saved in the internal memory is cleared when waveform data acquisition starts again or when the power is turned off.

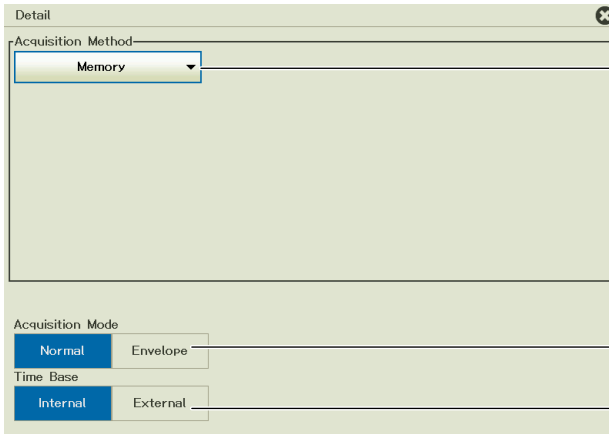
SSD Recording: Waveform data is saved in the internal storage (SSD). This is valid on models with the /ST1 or /ST2 option.

Flash Acquisition: Waveform data is saved in the dedicated flash memory (flash acquisition). This command is valid on models with the /ST2 option.

Detail Setup (Detail)

2. Tap **Detail**, or press the soft key. The following screen appears.

When Acquisition Method Is Set to Memory

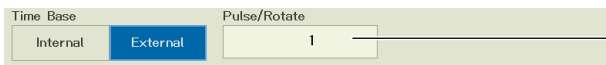


Set the acquisition method.
Select Memory.

Set the acquisition mode.
▶ sec. 3.1

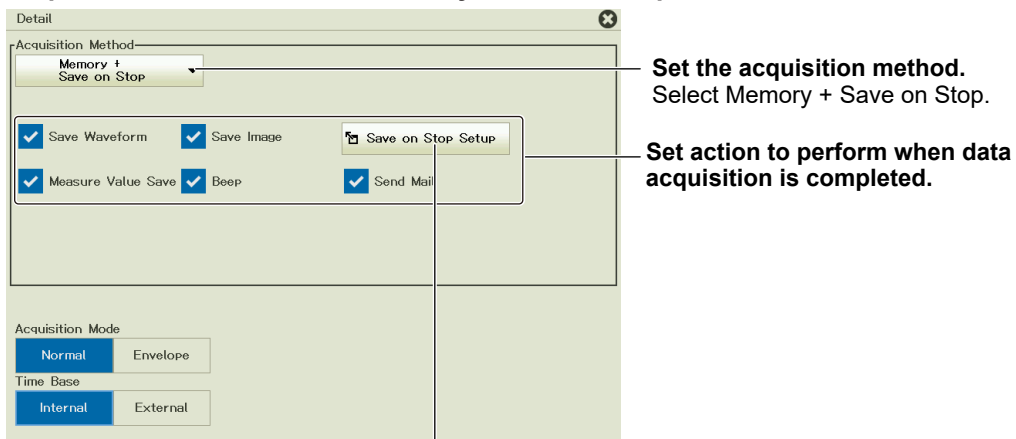
Set the time base.

When the time base is External



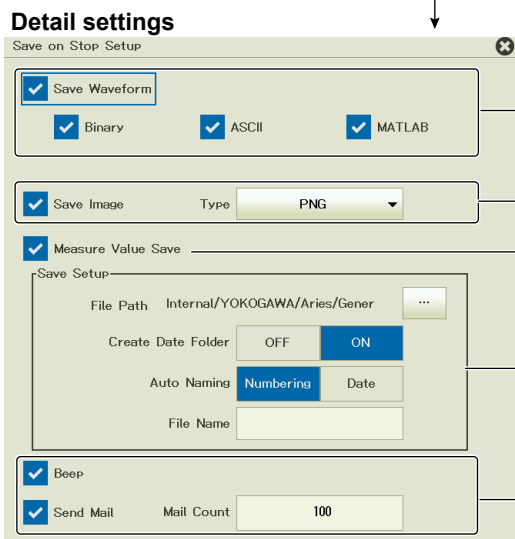
Set the pulse count or rotation count.

When Acquisition Method Is Set to Memory + Save on Stop



Set the acquisition method. Select Memory + Save on Stop.

Set action to perform when data acquisition is completed.



Turn waveform data saving on or off, and set the data format.

Turn image data saving on or off, and set the data format.

Turns waveform parameters saving on or off

Set the save destination and file name.

Turns beep sound and mail transmission on or off

Data Saved When Data Acquisition Is Complete and the Operation Performed

- Binary: Waveform data is saved in WDF format.
- ASCII: Waveform data is saved in ASCII format.
- MATLAB: Waveform data is saved in MATLAB format.
- Save Image: Screen capture data is saved (PNG, BMP, JPEG).
- Measure Value Save: Waveform parameter measurement values are saved.
- Beep: A beep sound is generated.
- Send Mail: A mail message is sent.

When Acquisition Method Is Set to SSD Recording (/ST1, /ST2 option)

See the description of recorder mode in section 3.5.

When the Acquisition Method is Flash Acquisition (/ST2 option)

See the description of recorder mode in section 3.6.

3.3 Starting and Stopping Waveform Acquisition

Items Common to Scope Mode and Recorder Mode

Start/Stop mode

▶ [“Waveform Acquisition \(START/STOP\)” in the Features Guide](#)

Waveform Acquisition (START and STOP)

1. On the waveform screen’s **MENU**, tap **START/STOP**, or press **START/STOP**. The instrument starts or stops waveform acquisition.

The key is illuminated while the instrument is acquiring waveforms.

3.4 Using the Dual Capture Feature (Scope mode only)

This section explains the following settings when acquiring waveforms with the dual capture feature.

Applicable in Scope Mode

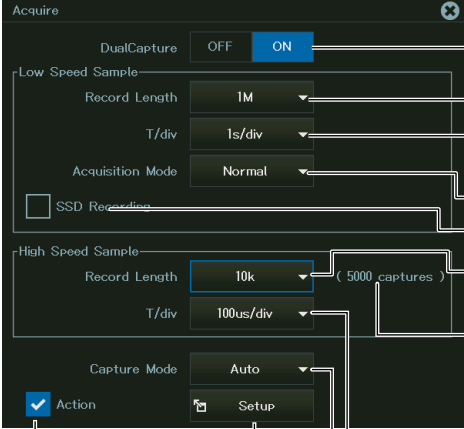
- Low-speed sampling waveform settings (horizontal scale, record length, acquisition mode, SSD recording)
- High-speed sampling waveform settings (horizontal scale, record length)
- Action to perform after waveforms are acquired
- Display format
- Percentage of the screen that the main waveform occupies
- Zoom factor
- List display

► “Dual Capture (DUAL CAPTURE, Scope mode only)” in the Features Guide

DUAL CAPTURE Menu

1. On the waveform screen’s **MENU**, tap **ACQUIRE > DUALCAPTURE**, or press **SHIFT+ACQUIRE(DUAL CAPTURE)**. A dual capture menu appears.

When dual capture is on, you can also display the dual capture menu by tapping **ACQUIRE > Acquire** on the waveform screen’s **MENU**, or pressing **ACQUIRE**.



The screenshot shows the 'Acquire' menu with the following settings and callouts:

- DualCapture**: OFF (highlighted) ON
- Low Speed Sample**:
 - Record Length**: 1M
 - T/div**: 1s/div
 - Acquisition Mode**: Normal
 - SSD Recording**:
- High Speed Sample**:
 - Record Length**: 10k (5000 captures)
 - T/div**: 100us/div
 - Capture Mode**: Auto
- Action**: Action
- Setup**: Setup

Callouts from the right side of the menu:

- Set the dual capture feature to ON.
- Set the horizontal scale for low-speed sampling waveforms.
- Set the record length for low-speed sampling waveforms.
- Set the acquisition mode (Normal, Envelope).
- Turns SSD recording on or off ► sec. 3.5
- Set the record length for high-speed sampling waveforms.
- High-speed sampling waveform acquisition count
- Varies depending on the record length and the number of used channels for high-speed sampling
- Set the horizontal scale for high-speed sampling waveforms.
- Set the capture mode (Auto, On Start).
- Set the action. ► sec. 15.1
- Turns actions on or off

Note

When dual capture is on, the acquisition mode cannot be set to Average.

Note that the acquisition mode set here is applied to the settings in section 3.1.

Capture Mode (Capture Mode)

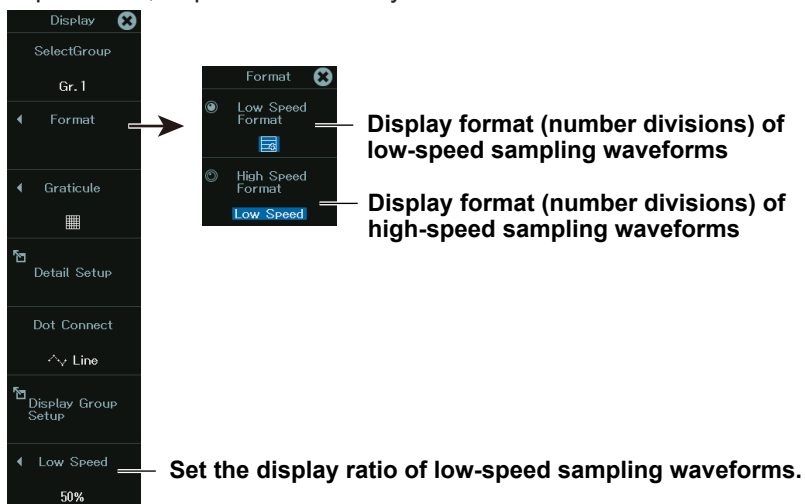
Set when to start or stop waveform acquisition when the START/STOP button is pressed. There are two capture modes: Auto and On Start.

Auto (Auto): Low-speed sampling and high-speed sampling waveforms are acquired from when acquisition is started until it is stopped. In high-speed sampling, when the acquirable history waveform data is acquired, old history waveforms are overwritten in order.

On Start (On Start): In low-speed sampling, when the specified record length of data or 10 divisions of data is acquired after starting waveform acquisition, waveform acquisition stops. In high-speed sampling, when the acquirable history waveform data is acquired, waveform acquisition stops.

Display Format (Format)

1. With dual capture turned on, on the waveform screen's MENU, tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.
2. Tap **Format**, or press the soft key.



3. Set the display format (number divisions) for low-speed sampling and high-speed sampling. For details on the display format and other settings, see chapter 5, "Display."

Configuring the Waveform Display Area

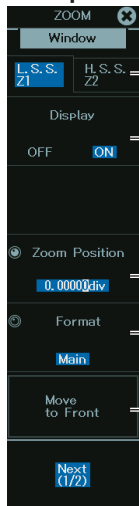
2. Tap **Low Speed**, or press the soft key.
3. Set the percentage of the entire waveform display area that the low-speed sampling waveform will occupy.

ZOOM

For details on zoom, see chapter 7, “Zooming In on or Out of Waveforms.”

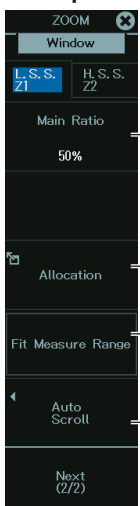
1. With dual capture turned on, on the waveform screen’s MENU, tap **ZOOM**, or press **ZOOM**. The Zoom menu appears.

Low-speed sampling ZOOM menu (1/2)



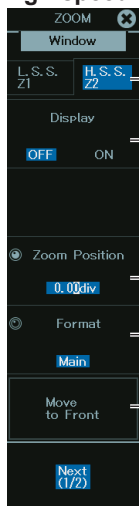
- Selects low-speed or high-speed
- Turns zoom waveform display on or off
- Set the zoom position.
- Set the display format.
- Moves the zoom position to the most recent data position

Low-speed sampling ZOOM menu (2/2)



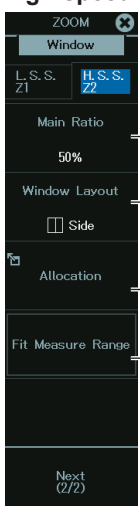
- Set the main window’s display ratio.
- Set the zoom source waveforms.
- Set the waveform parameter measurement range to the zoom area.
- Automatically scrolls the zoom position of low-speed sampling

High-speed sampling ZOOM menu (1/2)



- Selects low-speed or high-speed
- Turns zoom waveform display on or off
- Set the zoom position.
- Set the display format.
- Moves the zoom position to the most recent data position

High-speed sampling ZOOM menu (2/2)

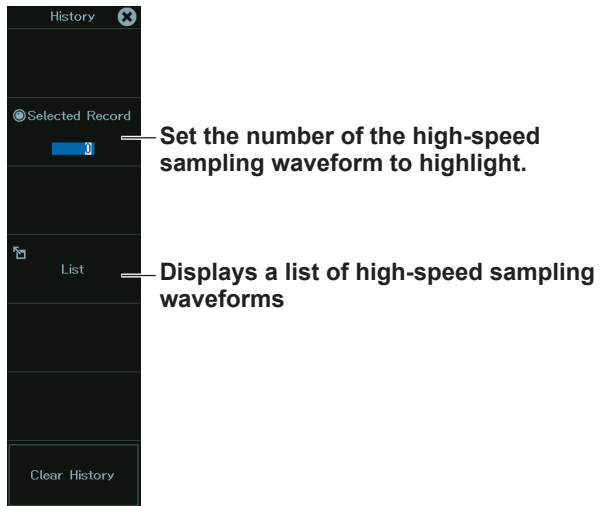


- Set the main window’s display ratio.
- Set the arrangement of the main window and zoom window (Side, Vertical).
- Set the zoom source waveforms.
- Set the waveform parameter measurement range to the zoom area.

2. Set the zoom waveforms for low-speed sampling and high-speed sampling.

List Display

1. With dual capture turned on, on the waveform screen's **MENU**, tap **ANALYSIS > HISTORY**, or press **HISTORY**. The History menu appears.



3.5 Performing SSD Recording (/ST1, /ST2 option)

This section explains the following settings when acquiring waveforms with the SSD recording feature.

Items Common to Scope Mode and Recorder Mode

- Turning SSD recording on and off
- Save destination and file name for recorded data
- File division
- Usage status of the internal storage (SSD)
 - ▶ **“Waveform Acquisition,” “SSD Recording (SSD Recording, /ST1 option),” and “Real-time Recording (Realtime recording, /ST2 option)” in the Features Guide**

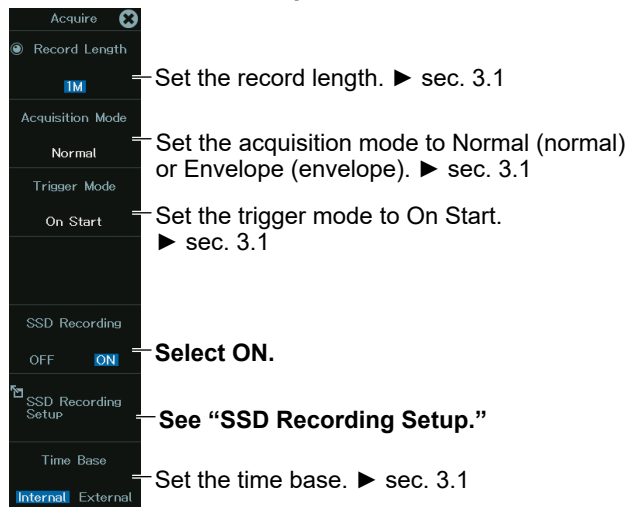
Scope Mode

ACQUIRE Menu (when dual capture is off)

1. On the waveform screen’s MENU, tap **ACQUIRE > ACQUIRE**, or press **ACQUIRE**. The ACQUIRE menu appears.

When the dual capture mode is on, the dual capture menu appears. See section 3.4, “Using the Dual Capture Feature (Scope mode only).”

On a Model with the /ST1 Option



On a Model with the /ST2 Option



SSD Recording Setup (SSD Recording Setup)

2. Press the **SSD Recording Setup** soft key. The following menu appears.

The screenshot shows the 'SSD Recording Setup' menu with the following settings and callouts:

- Auto Naming:** 'Numbering' and 'Date' tabs. Callout: **Set Auto Name (auto naming) (Numbering, Date).**
- File Name:** Text input field. Callout: **Set the file name.**
- Comment:** Text input field. Callout: **Set a comment.**
- File Divide:**
 - Mode:** 'OFF' and 'ON' buttons. Callout: **Turns file division on or off**
 - Number:** Dropdown menu set to '10'. Callout: **Set the number of divisions (10, 20, 50, 100).**
- T/div:** Dropdown menu set to '2hour/div'. Callout: **Set the time scale.**
- Record Length:** Dropdown menu set to '50G'. Callout: **Set the record length.**
- SSD Usage:** A bar chart showing 'Require(271.2 GBytes)' and 'Free(671.4 GBytes)'. Callout: **Usage status of the internal storage (SSD)**
 - Filled in blue: Recorded area
 - Shaded blue: Area used when recording with the current settings (displayed in red when there is not enough space)

ACQUIRE Menu (when dual capture is on)

1. On the waveform screen's MENU, tap **ACQUIRE > DUALCAPTURE**, or press **SHIFT+ACQUIRE(DUAL CAPTURE)**. A dual capture menu appears.

You can also display the dual capture menu by tapping **ACQUIRE > ACQUIRE** on the waveform screen's MENU, or pressing **ACQUIRE**.

The screenshot shows the 'Acquire' menu with the following settings and callouts:

- DualCapture:** 'OFF' and 'ON' buttons. Callout: **Turns SSD recording on or off**
- Low Speed Sample:**
 - Record Length:** Dropdown menu set to '1M'
 - T/div:** Dropdown menu set to '1s/div'
 - Acquisition Mode:** Dropdown menu set to 'Normal'
 - SSD Recording:** Checkmark icon. Callout: **See "SSD Recording Setup."**
 - Setup:** Gear icon
- High Speed Sample:**
 - Record Length:** Dropdown menu set to '10k' (1791 capture)
 - T/div:** Dropdown menu set to '100us/div'
- Capture Mode:** Dropdown menu set to 'On Start'. Callout: **To perform SSD recording, set the capture mode to On Start.**
- Action:** Checkmark icon. Callout: **To perform SSD recording, set action to OFF.**

The file name and file division settings when dual capture is off are valid.

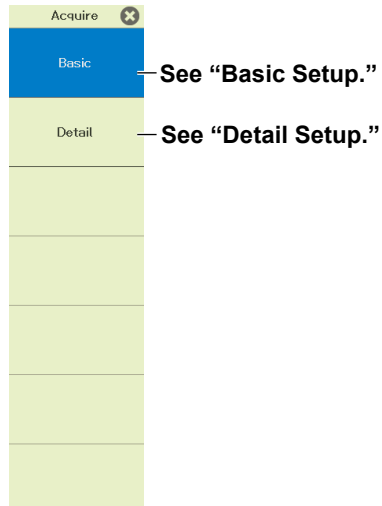
Note

SSD recording can be performed only on the low-speed sampling waveform when dual capture is on.

Recorder Mode

ACQUIRE menu

1. On the waveform screen's MENU, tap **ACQUIRE > ACQUIRE**, or press **ACQUIRE**. The ACQUIRE menu appears.



Basic Setup (Basic)

2. Tap **Basic**, or press the soft key. The following screen appears.

Recording time

Sample interval
Slide to display sample intervals that do not fit in the screen.

Usage status of the internal storage (SSD)

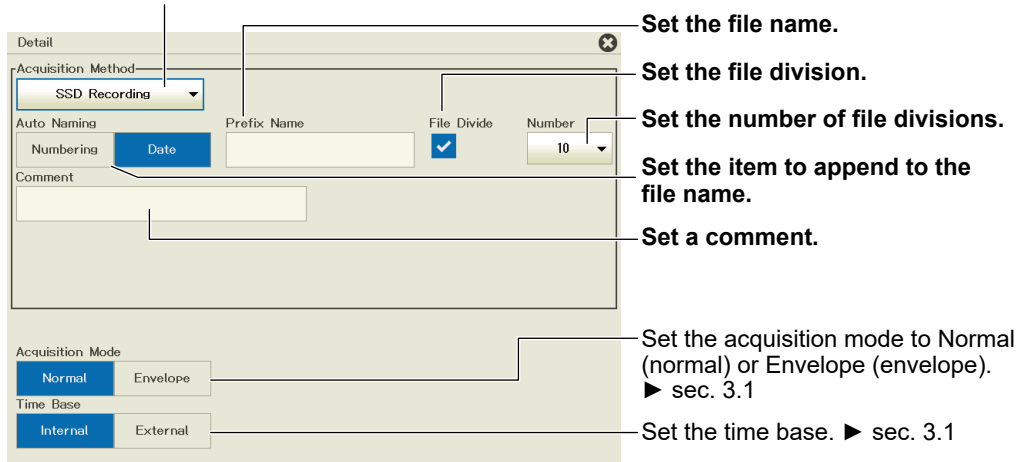
- Filled in blue: Recorded area
- Shaded blue: Area used when recording with the current settings (displayed in red when there is not enough space)

Set the acquisition method to SSD Recording.

Detail Setup (Detail)

3. Tap **Detail**, or press the soft key. The following screen appears.

Set the acquisition method.
Select SSD Recording.




SSD Recording (START/STOP)

Press **START/STOP**. Waveform acquisition starts, and data is recorded in the date folder that is automatically created in the internal storage (SSD). Press **START/STOP** again to stop waveform acquisition. Even if the set recording time has not been exceeded, SSD recording will stop.




CAUTION

- If the power supply is interrupted during SSD recording, the SSD may be damaged. If this occurs, make a backup of any important data that is stored on the SSD, and then format it.
 - During SSD recording, do not apply vibration to the instrument. Doing so may damage the SSD or may cause errors in SSD recording.
 - During SSD recording, the  icon blinks in the center of the screen. While this icon is blinking, do not insert a USB storage device into the USB port for connecting peripheral devices. Doing so may cause the instrument to malfunction or may corrupt the data that is being recorded to the SSD.
-

French



ATTENTION

- Si l'alimentation est coupée pendant l'enregistrement du SSD, ce dernier risque d'être endommagé. Dans ce cas, effectuez une sauvegarde des données importantes stockées sur le SSD, puis formatez ce dernier.
 - Pendant l'enregistrement du SSD, n'appliquez aucune vibration au DL950. Vous risqueriez d'endommager le SSD ou de créer des erreurs lors de l'enregistrement de ce dernier.
 - Pendant l'enregistrement du SSD, l'icône clignote au centre de l'écran. Lorsque cette  icône clignote, ne connectez pas le support de stockage USB aux ports USB prévus à cet effet. Vous risqueriez de causer un dysfonctionnement du DL950 ou d'endommager les données en cours d'enregistrement sur le SSD.
-

Note

For details on internal storage (SSD), see chapter 19.

3.6 Recording Using Flash Acquisition (/ST2 option)

This section explains the following settings when acquiring waveforms with the flash acquisition feature.

Items Common to Scope Mode and Recorder Mode

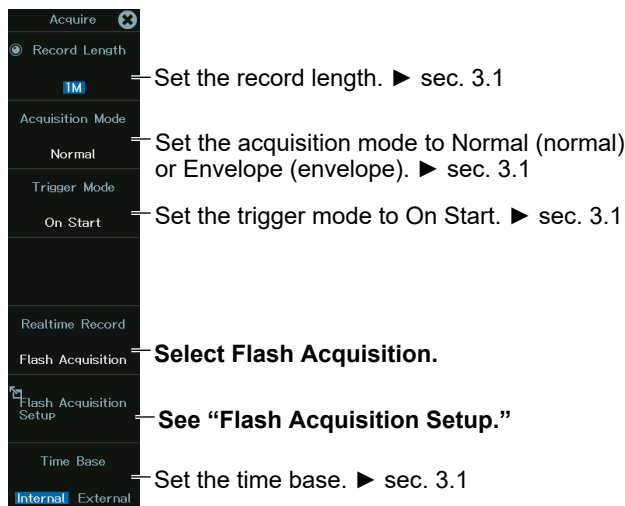
- Turning flash acquisition on and off
- Comment
- Usage status of the dedicated flash memory (flash acquisition)
 - ▶ “Waveform Acquisition” and “Real-time Recording (Realtime recording, /ST2 option)” in the Features Guide

Scope Mode

ACQUIRE Menu

1. On the waveform screen’s MENU, tap ACQUIRE > ACQUIRE, or press ACQUIRE. The ACQUIRE menu appears.

When dual capture mode is ON, flash acquisition cannot be used.



Flash Acquisition Setup (Flash Acquisition Setup)

- Press the **Flash Acquisition Setup** soft key. The following menu appears.

Flash Acquisition Setup

Comment

Data List

Record Area
All Data Delete

T/div 1hour/div

Record Length 2G

Flash Acquisition

Require(36%) Free(64%)

Set a comment.

Displays a list of recorded waveform data

Deletes all recorded waveform data

Set the record length.

Set the time scale.

Usage status of the dedicated flash memory (flash acquisition)

Confirm to Execute

Deletes all Flash Acquisition data.
Is it OK?

OK Cancel

- Filled in blue: Recorded area
- Shaded blue: Area used when recording with the current settings (displayed in red when there is not enough space)

Recorder Mode

ACQUIRE Menu

- On the waveform screen's MENU, tap **ACQUIRE > ACQUIRE**, or press **ACQUIRE**. The ACQUIRE menu appears.

Acquire

Basic

Detail

See "Basic Setup (Basic)."

See "Detail Setup (Detail)."

Basic Setup (Basic)

2. Tap **Basic**, or press the soft key. The following screen appears.

Record time

Sample interval
Slide to display sample intervals that do not fit in the screen.

Usage status of the dedicated flash memory (flash acquisition)

- Filled in blue: Recorded area
- Shaded blue: Area used when recording with the current settings (displayed in red when there is not enough space)

Set the acquisition method to Flash Acquisition.

Detail Setup (Detail)

3. Tap **Detail**, or press the soft key. The following screen appears.

Set the acquisition method. Select Flash Acquisition.

Displays a list of recorded waveform data

Set a comment.

Deletes all recorded waveform data

Set the acquisition mode to Normal (normal) or Envelope (envelope). ▶ sec. 3.1

Set the time base. ▶ sec. 3.1

Starting and Stopping Flash Acquisition (START/STOP)

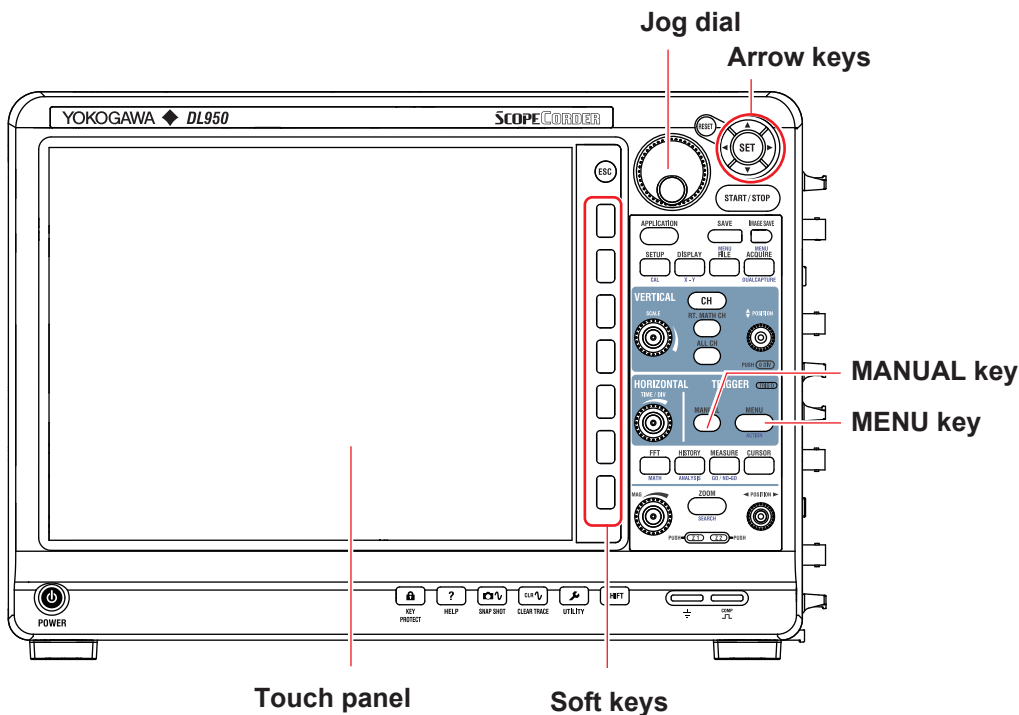
Press **START/STOP**. Waveform acquisition starts, and data is recorded to the dedicated flash memory (flash acquisition). Press **START/STOP** again to stop waveform acquisition. Even if the set recording time has not been exceeded, flash acquisition will stop.

Chapter 4

Triggering

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
4.1 Setting the Trigger Mode	✓	-
4.2 Setting the Trigger Position, Trigger Delay, and Hold-off	✓	-
4.3 Triggering on an Edge Trigger (Simple) in Scope Mode	✓	-
4.4 Triggering on an Time Trigger (Simple) in Scope Mode	✓	-
4.5 Triggering on an External Trigger (Simple)	✓	-
4.6 Triggering on a Power Line Signal (Simple)	✓	-
4.7 Triggering on a Logic Trigger (Simple)	✓	-
4.8 Triggering on an A to B(N) Trigger (Enhanced)	✓	-
4.9 Triggering on an A Delay B Trigger (Enhanced)	✓	-
4.10 Triggering on an Edge On A Trigger (Enhanced)	✓	-
4.11 Triggering on an OR or AND Trigger (Enhanced) in Scope Mode	✓	-
4.12 Triggering on a Period Trigger (Enhanced)	✓	-
4.13 Triggering on a Pulse Width Trigger (Enhanced)	✓	-
4.14 Triggering on a Wave Window Trigger (Enhanced)	✓	-
4.15 Triggering on an Edge Trigger in Recorder Mode	-	✓
4.16 Triggering on a Time Trigger in Recorder Mode	-	✓
4.17 Triggering on an OR or AND Trigger in Recorder Mode	-	✓
4.18 Triggering the Instrument Manually (Manual Trigger)	✓	✓

* The settings may vary depending on the operation mode.

4.1 Setting the Trigger Mode

This section explains the following trigger settings:

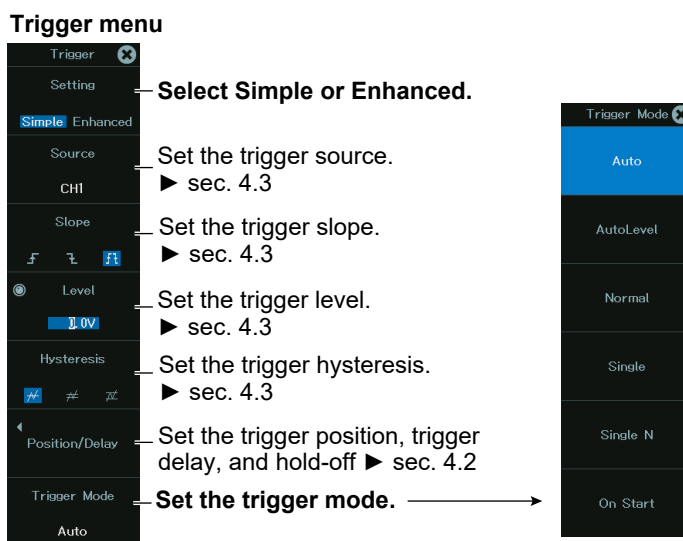
Applicable in Scope Mode

- Trigger mode

► “Trigger Mode (Trigger Mode)” in the Features Guide

Trigger Mode Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.
2. Tap **Trigger Mode**, or press the soft key. The trigger mode options are displayed.



Setting the Trigger Mode (Trigger Mode)

3. Tap the trigger mode you want to use, or press the soft key.
 - Auto:** If the trigger conditions are met within a 50-ms timeout period, the instrument updates the displayed waveforms on each trigger occurrence. If not, this instrument automatically updates the displayed waveforms. If the time axis is set to a value that would cause the display to switch to roll mode, roll mode display will be enabled.
 - Auto Level:** If a trigger occurs before a timeout (which is approximately 1 second), the instrument updates the waveform in the same way that it does in Auto mode. If a trigger does not occur before a timeout, the instrument automatically changes the trigger level to the center value of the trigger source amplitude, triggers on that value, and updates the displayed waveform.
 - Normal:** The instrument updates the waveform display only when the trigger conditions are met.
 - Single:** When the trigger conditions are met, the instrument updates the displayed waveform once and stops signal acquisition. If the time axis is set to a range that causes the display to switch to roll mode, the roll mode display will be enabled. When the instrument triggers, it begins recording data. When data has been acquired up to the amount specified by the set record length, the waveform display stops.

- SingleN: The instrument acquires signals each time the trigger conditions are met until a specified number of signals have been acquired, stops acquisition, and displays all of the acquired signals. If no triggers occur, the display is not updated.
- On Start: Regardless of the trigger settings, when you press the START key, the instrument updates the displayed waveforms once and stops signal acquisition. If the time axis is set to a value that would cause the display to switch to roll mode, roll mode display will be enabled. When data has been acquired up to the amount specified by the set record length, the waveform display stops.

4.2 Setting the Trigger Position, Trigger Delay, and Hold-off

This section explains the following trigger settings:

Applicable in Scope Mode

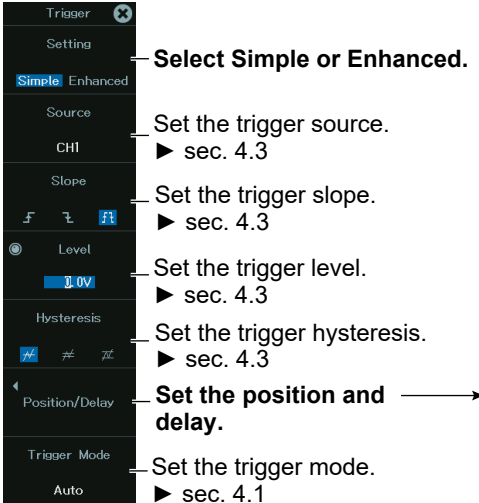
- Trigger position
- Trigger delay
- Hold-off

► “Trigger Position (Position),” “Trigger Delay (Delay Time),” and “Trigger Hold-off (Hold Off)” in the Features Guide

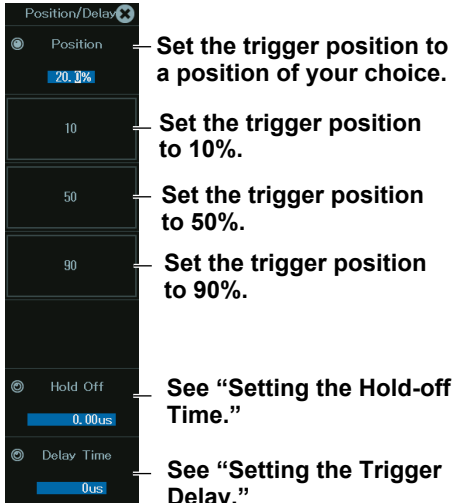
POSITION/DELAY Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.
2. Tap **Position/Delay**, or press the soft key. The following menu appears.

Trigger menu



Position/Delay menu



The image shows two screenshots of the oscilloscope's trigger menu. The left screenshot is the main 'Trigger' menu, and the right screenshot is the 'Position/Delay' sub-menu. Annotations with arrows point from text descriptions to specific menu items in both screenshots.

Menu Item	Description
Simple / Enhanced	Select Simple or Enhanced.
Source	Set the trigger source. ► sec. 4.3
Slope	Set the trigger slope. ► sec. 4.3
Level	Set the trigger level. ► sec. 4.3
Hysteresis	Set the trigger hysteresis. ► sec. 4.3
Position/Delay	Set the position and delay. →
Trigger Mode	Set the trigger mode. ► sec. 4.1
Position	Set the trigger position to a position of your choice.
10	Set the trigger position to 10%.
50	Set the trigger position to 50%.
90	Set the trigger position to 90%.
Hold Off	See “Setting the Hold-off Time.”
Delay Time	See “Setting the Trigger Delay.”

Setting the Hold-off Time (Hold Off)

The trigger hold-off feature temporarily stops the detection of the next trigger once a trigger has occurred.

Setting the Trigger Delay (Delay Time)

The trigger delay is the delay from the trigger point until waveforms are displayed.

Note

You cannot specify a trigger delay when an external clock is being used as the time base.

4.3 Triggering on an Edge Trigger (Simple) in Scope Mode

This section explains the settings for triggering on the edges of an analog-signal trigger source in Scope mode: To use a logic signal for the trigger source, see section 4.7.

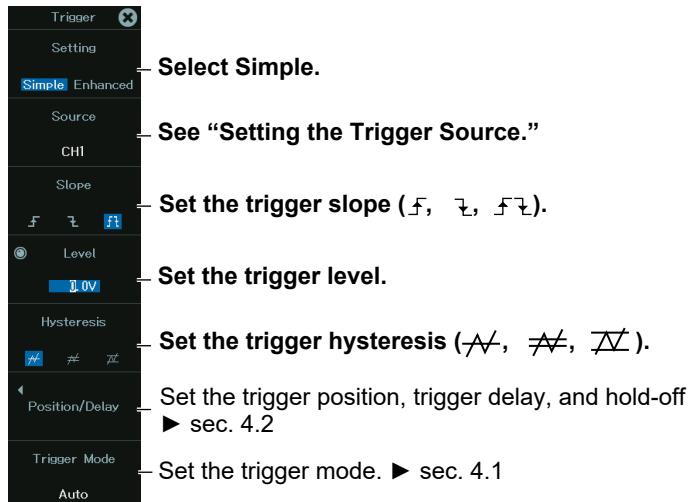
Applicable in Scope Mode

- Trigger source
- Trigger slope
- Trigger level
- Trigger hysteresis

► “Simple Trigger (Simple),” “Trigger Source (Source),” “Trigger Slope (Slope),” “Trigger Level (Level),” and “Trigger Hysteresis (Hysteresis)” in the Features Guide

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.

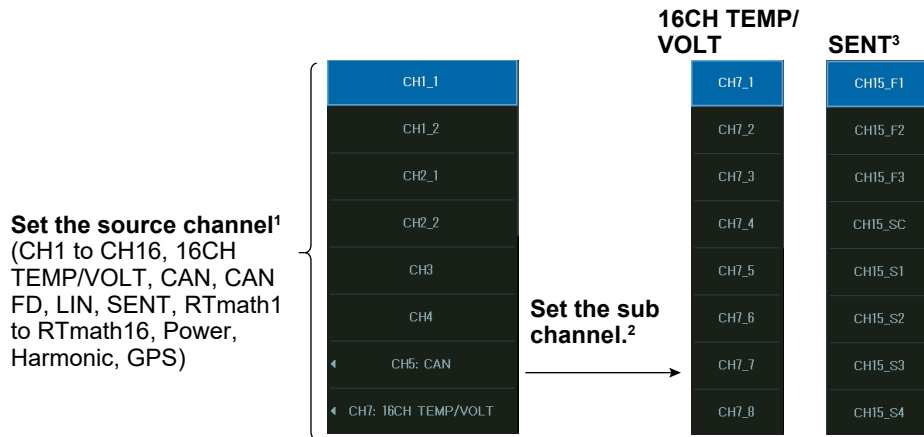


Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

Setting the Trigger Source (Source)

2. Press the **Source** soft key. The following menu appears.



- 1 For details on Time, External, Line, and logic signal, see section 4.4, 4.5, 4.6, and 4.7, respectively.
- 2 For 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Power, Harmonic, and GPS, set also the sub channel. However, if input (Input), coupling (for 16CH TEMP/VOLT), or analysis item (for Power, Harmonic) is set to OFF, you cannot set the sub channel.
- 3 For SENT SC and ET, set also the source bit or error item.

4.4 Triggering on an Time Trigger (Simple) in Scope Mode

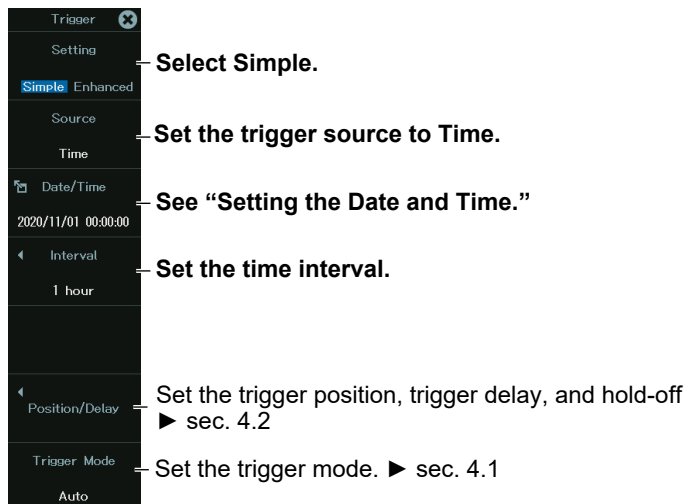
This section explains the settings that are used when triggering on a specific date and time in Scope mode.

Applicable in Scope Mode

- Trigger source
 - Date and time
 - Time interval
- ▶ “Simple Trigger (Simple)” and “Trigger Source (Source)” in the Features Guide

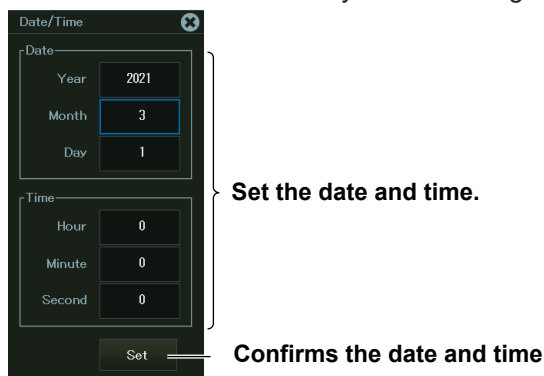
Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the Date and Time (Date/Time Setting)

2. Press the **Date/Time** soft key. The following screen appears.



4.5 Triggering on an External Trigger (Simple)

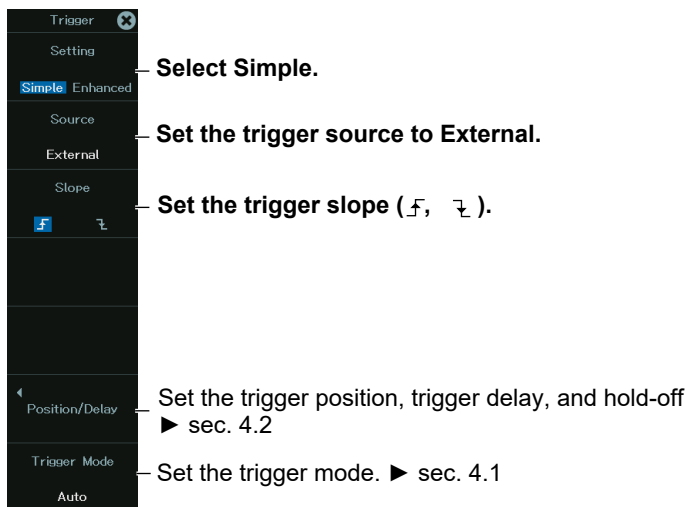
This section explains the settings that are used when triggering on an external signal.

Applicable in Scope Mode

- Trigger source
 - Trigger slope
- “Simple Trigger (Simple)” and “Trigger Source (Source)” in the Features Guide

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



4.6 Triggering on a Power Line Signal (Simple)

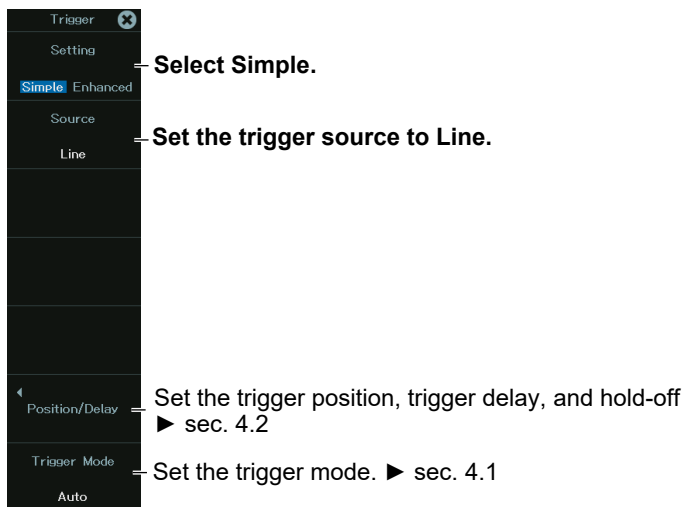
This section explains the settings that are used when triggering on a power line signal.

Applicable in Scope Mode

- Trigger source
 - ▶ “Simple Trigger (Simple)” and “Trigger Source (Source)” in the Features Guide

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



4.7 Triggering on a Logic Trigger (Simple)

This section explains the following settings for triggering on the edges of a logic-signal trigger source:

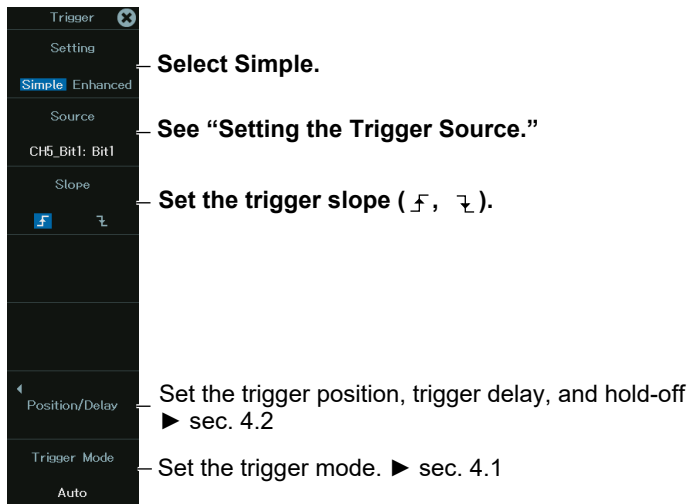
Applicable in Scope Mode

- Trigger source
- Source bit
- Trigger slope

► “Simple Trigger (Simple)” and “Trigger Source (Source)” in the Features Guide

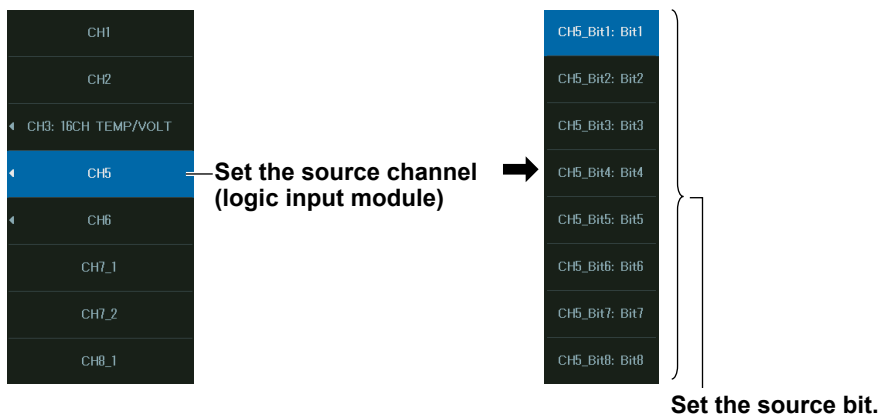
Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the Trigger Source (Source)

2. Press the **Source** soft key. The following menu appears.



4.8 Triggering on an A to B(N) Trigger (Enhanced)

This section explains the following settings for triggering on an A to B(N) trigger:

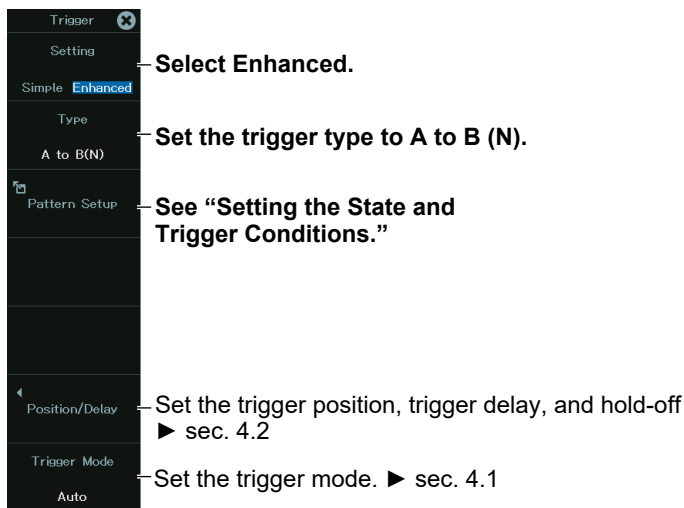
Applicable in Scope Mode

- Trigger source
- State condition
- State condition achievement condition
- Number of times state condition B must be met
- Trigger conditions (trigger level, hysteresis)

► [“A to B\(N\) Trigger \(Enhanced\)” in the Features Guide](#)

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the trigger level.

Set the hysteresis (\overline{A} , \overline{A} , \overline{A}).

A	Delay	B	A State	B State	Level	Hys
CH1			H	H	0.0V	\overline{A}
CH2			X	X	0.0V	\overline{A}
CH3: 16CH TEMP/VOL						
CH4						
CH5						
CH6						
CH7_1			X	X	0.0V	\overline{A}
CH7_2			X	X	0.0V	\overline{A}
CH8_1			X	X	0.0V	\overline{A}
CH8_2			X	X	0.0V	\overline{A}

A Condition

B Condition

Delay Time
 0.00us

Set the state condition achievement conditions (Enter, Exit).

Set the number of times state condition B must be met.
 On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

4.9 Triggering on an A Delay B Trigger (Enhanced)

This section explains the following settings for triggering on an A Delay B trigger:

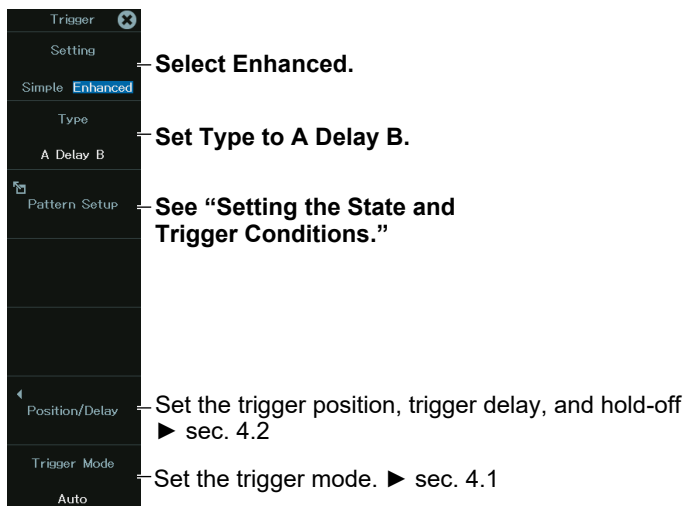
Applicable in Scope Mode

- Trigger source
- State condition
- State condition achievement condition
- Delay time
- Trigger conditions (trigger level, hysteresis)

► [“A Delay B Trigger \(Enhanced\)” in the Features Guide](#)

Trigger Menu

1. On the waveform screen's **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the trigger level.

Set the hysteresis (\overline{A} , \overline{B} , $\overline{A\&B}$).

	A State	B State	Level	Hys
CH1	H	H	1.0V	\neq
CH2	H	L	0.0V	\neq
CH3: 16CH TEMP/VOLT				
CH4				
CH5				
CH6				
CH7_1	X	X	0.0V	\neq
CH7_2	X	X	0.0V	\neq
CH8_1	X	X	0.0V	\neq
CH8_2	X	X	0.0V	\neq

A Condition
Enter Exit

B Condition
Enter Exit

Delay Time
0.00us

Set the state condition achievement conditions (Enter, Exit)

Set the delay time.

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

4.10 Triggering on an Edge On A Trigger (Enhanced)

This section explains the following settings for triggering on an Edge On A trigger:

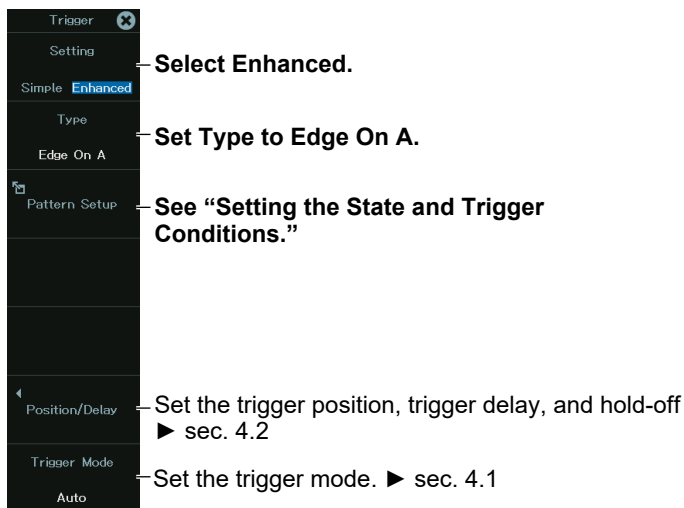
Applicable in Scope Mode

- Trigger source
- State condition
- State condition achievement condition
- Edge detection condition
- Trigger conditions (trigger level, hysteresis)

► [“Edge On A Trigger \(Enhanced\)” in the Features Guide](#)

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the edge detection condition (F, \bar{F} , -).

Set the trigger level.

Set the hysteresis ($\bar{\Delta}$, Δ , $\bar{\Delta}$).

Channel	A State	Edge	Level	Hys	Condition
CH1	H	-	0.0V	\neq	True
CH2	X	F	0.0V	\neq	
CH3: 16CH TEMP/VOLT					
CH4					
CH5					
CH6					
CH7	X	F	0uSTR	\neq	
CH8	X	-	0uSTR	\neq	
CH9	X	-	0.00V	\neq	
CH10	X	-	0.00V	\neq	

Set the state condition achievement conditions (True, False)

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

4.11 Triggering on an OR or AND Trigger (Enhanced) in Scope Mode

This section explains the following settings for triggering on an OR or AND trigger:

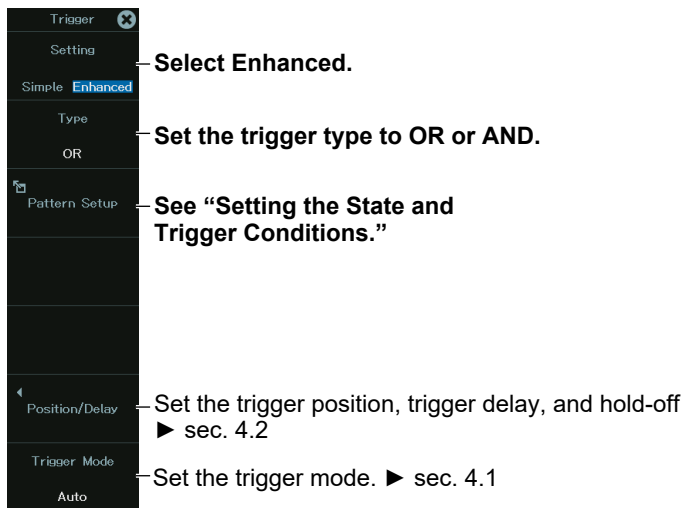
Applicable in Scope Mode

- Trigger source
- Edge detection condition (OR trigger)
- Achievement condition (AND trigger)
- Trigger conditions (trigger level, hysteresis)

► “OR Trigger (Enhanced)” and “AND Trigger (Enhanced)” in the Features Guide

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

OR trigger

Set the edge detection condition (\uparrow , \downarrow , IN, OUT, —).

Set the trigger level.

Set the level width (when the edge detection condition is set to IN or OUT).

Set the hysteresis. ($\overline{\Delta}$, $\overline{\neq}$, $\overline{\Delta}$)

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

	Edge	Level	Width	Hys
CH1_1	\uparrow	2.0V	5.0V	$\overline{\neq}$
CH1_2	IN	0.0V	5.0V	$\overline{\neq}$
CH2_1	\downarrow	3.0V	5.0V	$\overline{\neq}$
CH2_2	OUT	0.0V	5.0V	$\overline{\neq}$
CH3	—	0.0V	5.0V	$\overline{\neq}$
CH4	—	0.0V	5.0V	$\overline{\neq}$
CH5: CAN	+			
CH6: LIN	+			
CH7: 16CH TEMP/VOLT	+			
CH8				

AND Trigger

Set the achievement condition (H, L, IN, OUT, —).

Set the trigger level.

Set the level width (when the edge detection condition is set to IN or OUT).

Set the hysteresis. ($\overline{\Delta}$, $\overline{\neq}$, $\overline{\Delta}$)

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

	Condition	Level	Width	Hys
CH1_1	H	2.0V	5.0V	$\overline{\neq}$
CH1_2	L	0.0V	5.0V	$\overline{\neq}$
CH2_1	IN	3.0V	5.0V	$\overline{\neq}$
CH2_2	OUT	0.0V	5.0V	$\overline{\neq}$
CH3	—	0.0V	5.0V	$\overline{\neq}$
CH4	—	0.0V	5.0V	$\overline{\neq}$
CH5: CAN	+			
CH6: LIN	+			
CH7: 16CH TEMP/VOLT	+			
CH8				

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

4.12 Triggering on a Period Trigger (Enhanced)

This section explains the following settings for triggering on a period trigger:

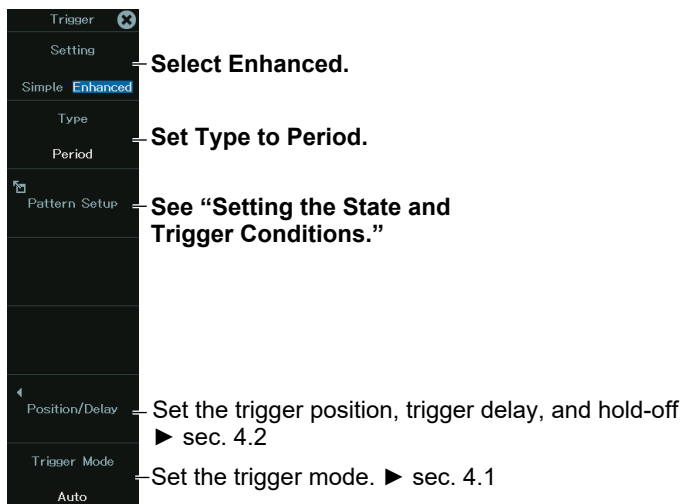
Applicable in Scope Mode

- Trigger source
- State condition
- Determination mode
- Reference time
- Trigger conditions (trigger level, hysteresis)

► [“Period Trigger \(Enhanced\)” in the Features Guide](#)

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the trigger level.

Set the hysteresis (\overline{A} , $\overline{A\overline{B}}$, $\overline{A\overline{B}}$).

Period	B State	Level	Hys
CH1	H	0.0V	\overline{A}
CH2	X	0.0V	\overline{A}
CH3: 16CH TEMP/VOLT			
CH4			
CH5			
CH6			
CH7	X	0uSTR	\overline{A}
CH8	X	0uSTR	\overline{A}
CH9	X	0.00V	\overline{A}
CH10	X	0.00V	\overline{A}

Mode: T < Time

Time: 0.02us

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

* Set T1 and T2 when the determination mode is T1 < T < T2 or T <T1, T2 < T.
Set Time when the determination mode is T < Time or T >Time.

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

Setting the Determination Mode (Mode)

Set what kind of relationship must be established between period T and the specified reference times (Time or T1 and T2) for the instrument to trigger.

T < Time	Period T must be shorter than the reference time (Time).
T > Time	Period T must be longer than the reference time (Time).
T1 < T < T2	Period T must be longer than reference time T1 and shorter than reference time T2.
T < T1, T2 < T	Period T must be shorter than reference time T1 or longer than reference time T2.

4.13 Triggering on a Pulse Width Trigger (Enhanced)

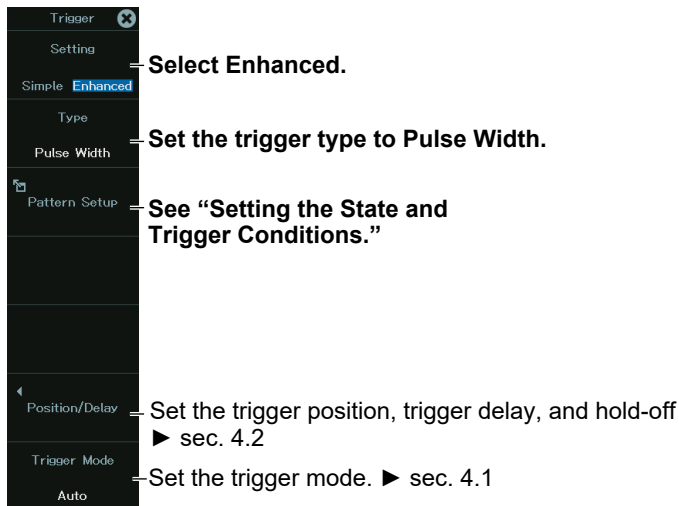
This section explains the following settings for triggering on a pulse width trigger:

- Trigger source
- State condition
- Determination mode
- Reference time
- Trigger conditions (trigger level, hysteresis)

► [“Pulse Width Trigger \(Enhanced\)” in the Features Guide](#)

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

Set the state condition (H, L, or X (do not use as a trigger source)).

Set the trigger level.

Set the hysteresis (\overline{A} , $\overline{A\overline{B}}$, $\overline{A\overline{B}}$).

Channel	B State	Level	Hys
CH1	H	0.0V	\overline{A}
CH2	X	0.0V	\overline{A}
CH3: 16CH TEMP/VOLT			
CH4			
CH5			
CH6			
CH7	X	0uSTR	\overline{A}
CH8	X	0uSTR	\overline{A}
CH9	X	0.00V	\overline{A}
CH10	X	0.00V	\overline{A}

Mode: B < Time

Time: 0.02us

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

* Set T1 and T2 when the determination mode is B Between.
Set Time when the determination mode is B < Time, B >Time, or B TimeOut.

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

Setting the Determination Mode (Mode)

Set what kind of relationship must be established between the state condition B achievement time and the specified reference times (Time or T1 and T2) for the instrument to trigger.

B < Time	The instrument triggers when the achievement time is shorter than the reference time (Time), and the state condition changes from being met to not being met.
B > Time	The instrument triggers when the achievement time is longer than the reference time (Time), and the state condition changes from being met to not being met.
B TimeOut	The instrument triggers when the achievement time is longer than the reference time (Time).
B Between	The instrument triggers when the achievement time is longer than reference time T1 and shorter than reference time T2, and the state condition changes from being met to not being met.

4.14 Triggering on a Wave Window Trigger (Enhanced)

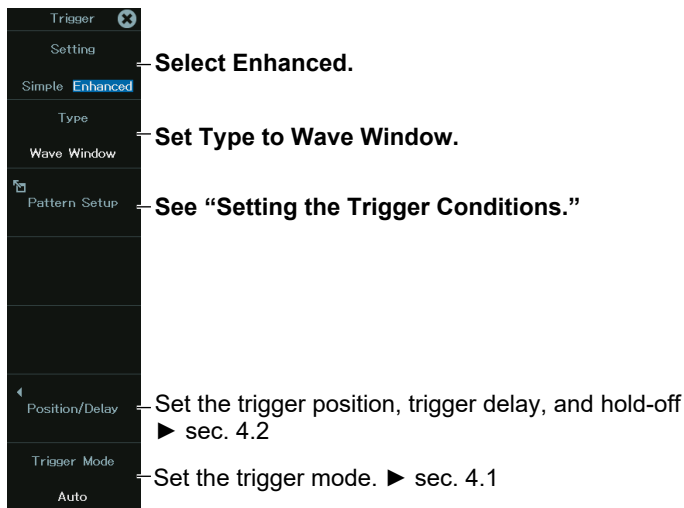
This section explains the following settings for triggering on a wave window trigger:

- Source channels
- Tolerance width, cycle frequency, and reference cycle
- Synchronization channel
- Level for detecting the start and end points
- Hysteresis

► “Wave Window Trigger (Enhanced)” in the Features Guide

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the Trigger Conditions (Pattern Setup)

2. Tap **Pattern Setup**, or press the soft key. The following menu appears.

Set the source channel (ON, OFF).
Set the tolerance width.

Wave Window	Condition	Width	
CH1	ON	0.5V	
CH2	ON	0.5V	
CH3: 16CH TEMP/VOLT			
CH4			
CH5			
CH6			
CH7	OFF	1uSTR	
CH8	OFF	1uSTR	
CH9	OFF	0.05V	
CH10	OFF	0.05V	

Cycle Frequency
50Hz — Set the cycle frequency.

Reference Cycle
1 2 4 — Set the reference cycle.

Sync. Ch
CH2 — Set the synchronization channel (Auto, CH1 to CH16).

Level
0.0V — Set the level for detecting the start and end points.*+

Hysteresis
≠ — Set the hysteresis (≠, ≠, ≠).*

* Not required when the synchronization channel is Auto

4.15 Triggering on an Edge Trigger in Recorder Mode

This section explains the settings that are used when triggering on a specific edge in Recorder mode.

Applicable in Recorder Mode

- Trigger source
- Trigger slope
- Trigger level
- Trigger hysteresis
- Pre-trigger

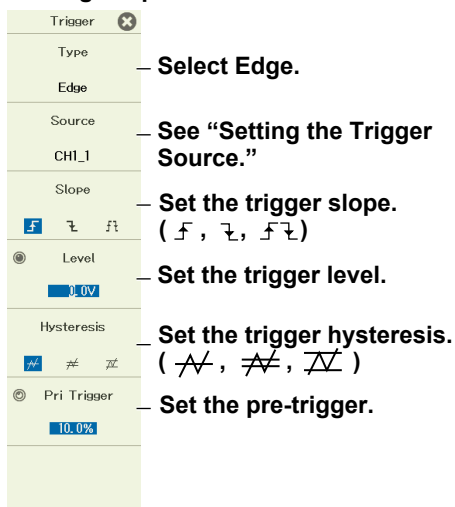
► “Trigger Source (Source),” “Trigger Slope (Slope),” “Trigger Level (Level),” “Trigger Hysteresis (Hysteresis),” “Pre-Trigger (Pre Trigger)” and “Edge Trigger(Edge)” in the Features Guide

Trigger Menu

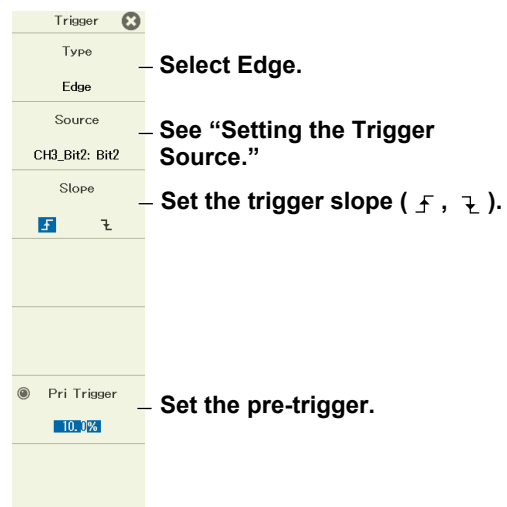
1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.

The Trigger menu appears only when Acquisition Condition in the waveform acquisition conditions is set to Capture On Trigger.

Not logic input/external



Logic input/external

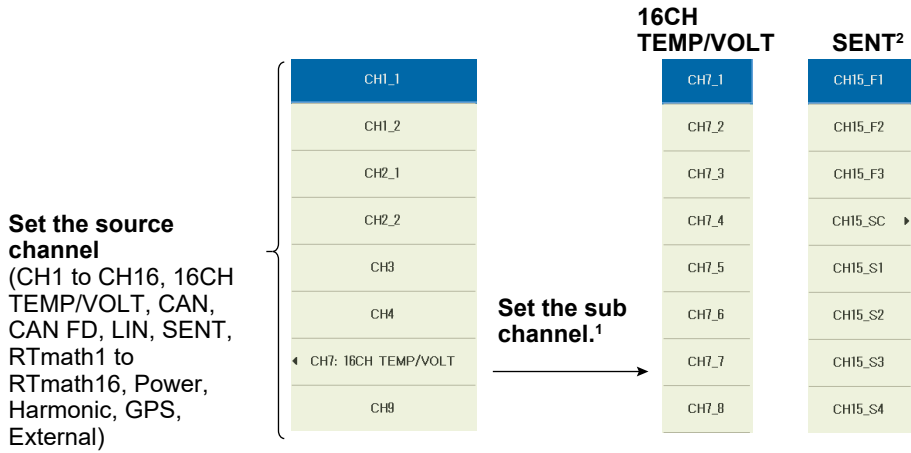


Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

Setting the Trigger Source (Source)

2. Press the **Source** soft key. The following menu appears.



- 1 For 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Power, Harmonic, and GPS, set also the sub channel. However, if input (Input), coupling (for 16CH TEMP/VOLT), or analysis item (for Power, Harmonic) is set to OFF, you cannot set the sub channel.
- 2 For SENT SC and ET, set also the source bit or error item.

Logic waveform

CH3_Bit1: Bit1
CH3_Bit2: Bit2
CH3_Bit3: Bit3
CH3_Bit4: Bit4
CH3_Bit5: Bit5
CH3_Bit6: Bit6
CH3_Bit7: Bit7
CH3_Bit8: Bit8

4.16 Triggering on a Time Trigger in Recorder Mode

This section explains the settings that are used when triggering on a specific date and time in Recorder mode.

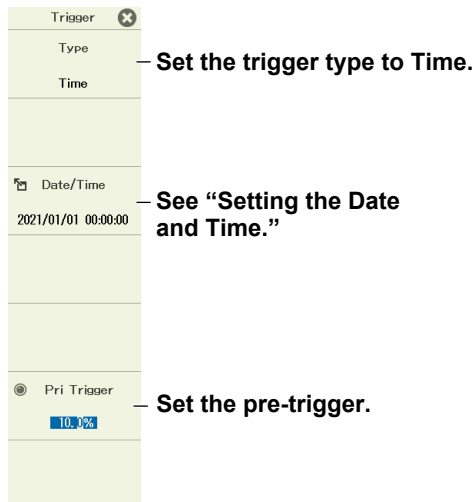
Applicable in Recorder Mode

- Trigger source
- Date and time
- Pre-trigger

► “Pre-Trigger (Pre Trigger)” and “Time Trigger (Time)” in the Features Guide

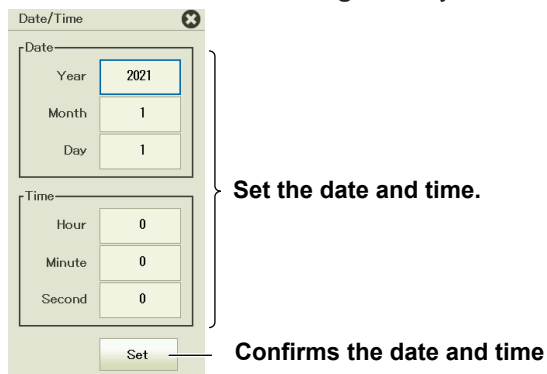
Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the Date and Time (Date/Time Setting)

2. Press the **Date/Time Setting** soft key. The following screen appears.



4.17 Triggering on an OR or AND Trigger in Recorder Mode

This section explains the following settings for triggering on an OR or AND trigger in Recorder mode:

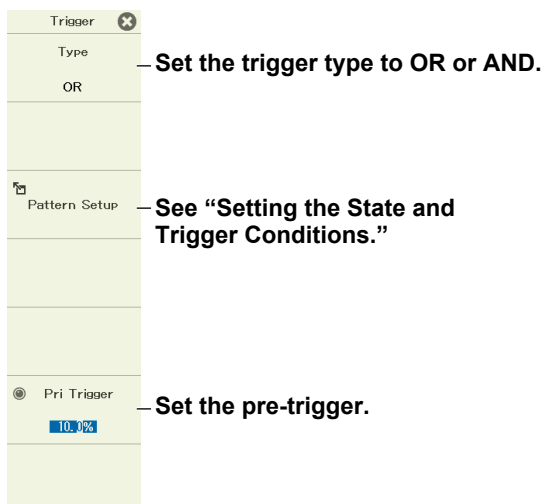
Applicable in Recorder Mode

- Trigger source
- Edge detection condition (OR trigger)
- Achievement condition (AND trigger)
- Trigger conditions
- Pre-trigger

► “Pre-Trigger (Pre Trigger),” “OR Trigger (Enhanced),” and “AND Trigger (Enhanced)” in the Features Guide

Trigger Menu

1. On the waveform screen’s **MENU**, tap **TRIGGER > MENU**, or press **TRIG.MENU**. A trigger menu appears.



Setting the State and Trigger Conditions (Pattern Setup)

2. Tap **Setup**, or press the soft key. The following menu appears.

OR trigger

Set the edge detection condition (F, \bar{F} , IN, OUT, -).

Set the trigger level.

Set the level width (when the edge detection condition is set to IN or OUT).

Set the hysteresis. (~~AV~~, ~~AV~~, ~~AV~~)

	Edge	Level	Width	Hys
CH1	F	0.0V	5.0V	AV
CH2	\bar{F}	0.0V	5.0V	AV
CH3: 16CH TEMP/VOLT	+			
CH4				
CH5	+			
CH6	+			
CH7	IN	0.0Hz	100.0Hz	AV
CH8	OUT	0.0Hz	100.0Hz	AV
CH9	-	0.00V	0.50V	AV
CH10	-	0.00V	0.50V	AV

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

AND Trigger

Set the achievement condition (H, L, IN, OUT, —).

Set the trigger level.

Set the level width (when the edge detection condition is set to IN or OUT).

Set the hysteresis. (~~AV~~, ~~AV~~, ~~AV~~)

	Condition	Level	Width	Hys
CH1	IN	0.0V	5.0V	AV
CH2	OUT	0.0V	5.0V	AV
CH3: 16CH TEMP/VOLT	+			
CH4				
CH5	+			
CH6	+			
CH7	H	0.0Hz	100.0Hz	AV
CH8	L	0.0Hz	100.0Hz	AV
CH9	-	0.00V	0.50V	AV
CH10	-	0.00V	0.50V	AV

On a module with logic inputs or sub channels, expand the menu, and set each bit or sub channel.

Note

If linear scaling is applied to the trigger source, set the trigger level using a linearly scaled value.

4.18 Triggering the Instrument Manually (Manual Trigger)

Items Common to Scope Mode and Recorder Mode

▶ [“Trigger Settings \(Setting\)”](#) and [“Trigger Types \(Type\)”](#) in the [Features Guide](#)

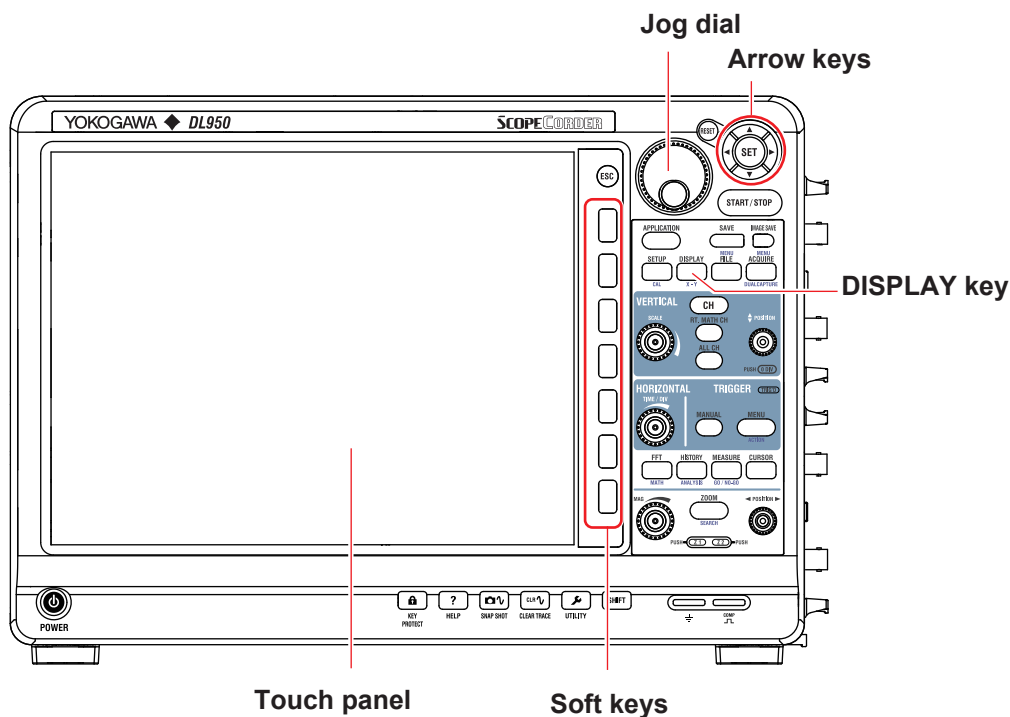
1. On the waveform screen’s **MENU**, tap **TRIGGER > MANUAL**, or press **MANUAL**.
The instrument triggers, and waveform acquisition starts.

Chapter 5

Display

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
5.1 Setting Display Groups and Display Format	✓	✓
5.2 Setting the Waveform Arrangement, Color, and Grouping	✓	✓
5.3 Setting the Grid and Interpolation Method	✓	✓
5.4 Configuring the Detailed Display Settings	✓	✓
5.5 Using the Accumulate Feature (Scope mode)	✓	-
5.6 Holding the Waveform Display (Recorder mode)	-	✓
5.7 Using the Snapshot and Clear Trace Features	✓	✓

* The settings may vary depending on the operation mode.

5.1 Setting Display Groups and Display Format

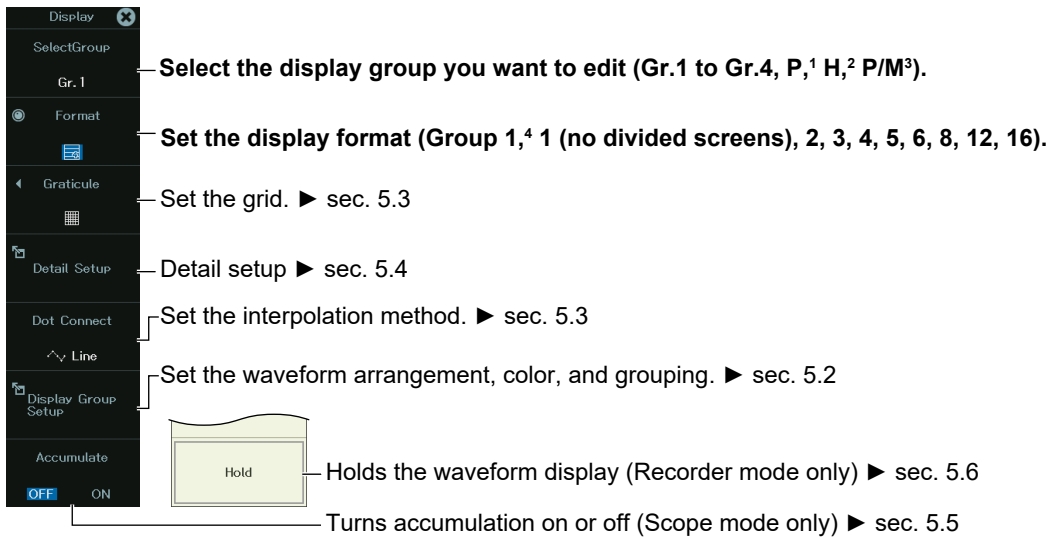
This section explains the following settings for displaying waveforms:

Items Common to Scope Mode and Recorder Mode

- Display group, display format (number of divided screens)
 - ▶ “Group Selection (Select Group)” and “Display Format (Format)” in the Features Guide

Display Menu

1. On the waveform screen’s MENU tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.



- 1 Available on models with the /G05 option
- 2 Available on models with the /G05, /MT1 option
- 3 Available on models with the /MT1 option
- 4 The Group 1 option appears when display groups 2 to 4, P, H, or P/M is selected.

Changing the Display Group Shown on the Screen

2. You can also tap Gr1 to Gr4, GrP (power analysis), GrH (harmonic analysis), or GrP/M (power analysis/motor dq analysis) at the bottom of the screen to change the display group.



Tap the display group to show on the screen.
 GrP (power analysis), GrH (harmonic analysis), and GrP/M (power and motor dq analysis) are available only when their analysis modes are not set to OFF.

5.2 Setting the Waveform Arrangement, Color, and Grouping

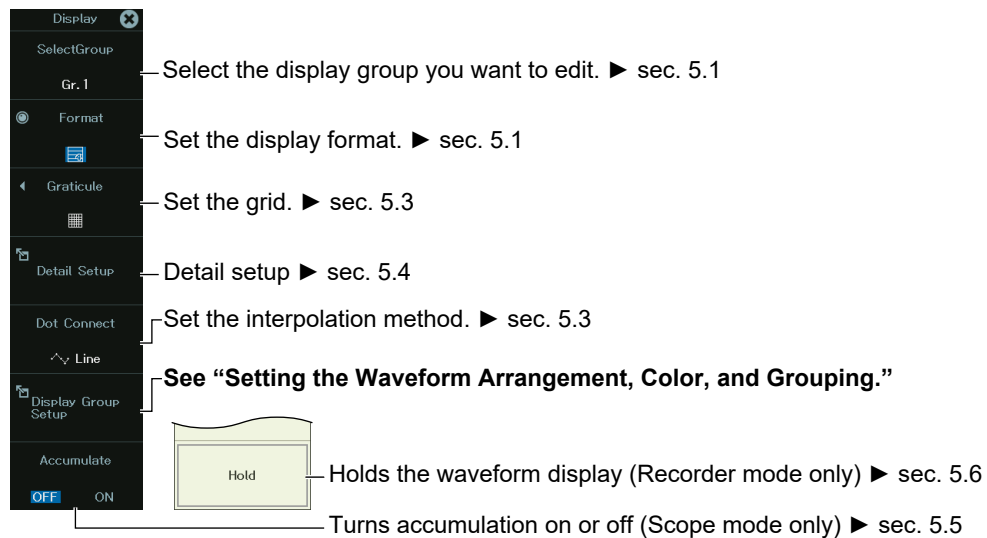
This section explains the following settings for displaying waveforms:

Items Common to Scope Mode and Recorder Mode

- Waveform arrangement, color, and grouping
 - ▶ “Display Group Setup (Display Group Setup)” in the Features Guide

Display Menu

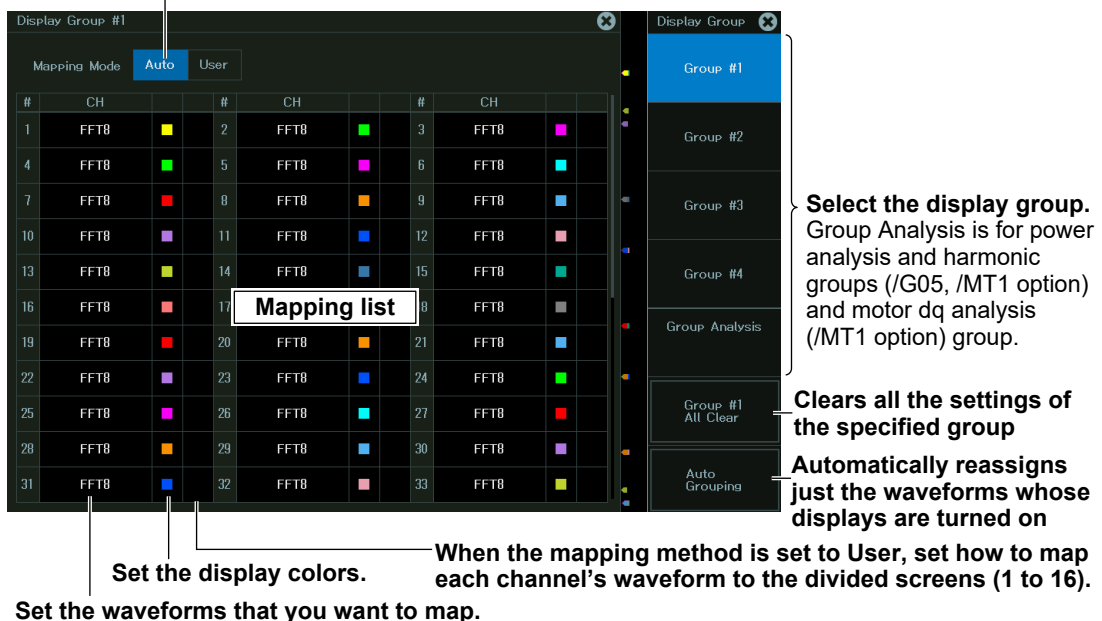
1. On the waveform screen’s **MENU** tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.



Setting the Waveform Arrangement, Color, and Grouping (Display Group Setup)

2. Tap **Display Group Setup**, or press the soft key. The following screen appears.

Set the mapping mode (Auto, User).



5.3 Setting the Grid and Interpolation Method

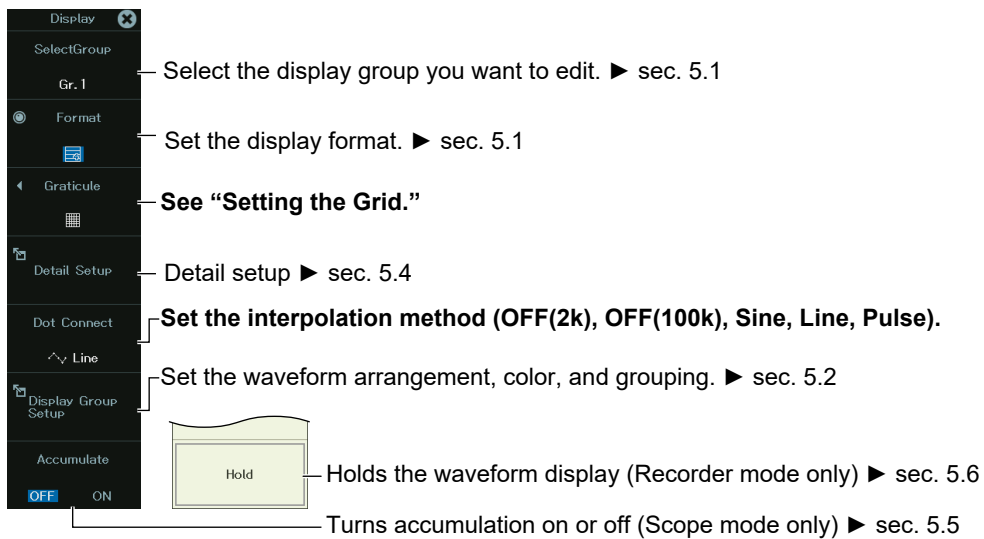
This section explains the waveform information and preference settings for displaying waveforms.

Items Common to Scope Mode and Recorder Mode

- Grid
- Interpolation method
 - ▶ **“Grid (Graticule)” and “Interpolation Method (Dot Connect)” in the Features Guide**

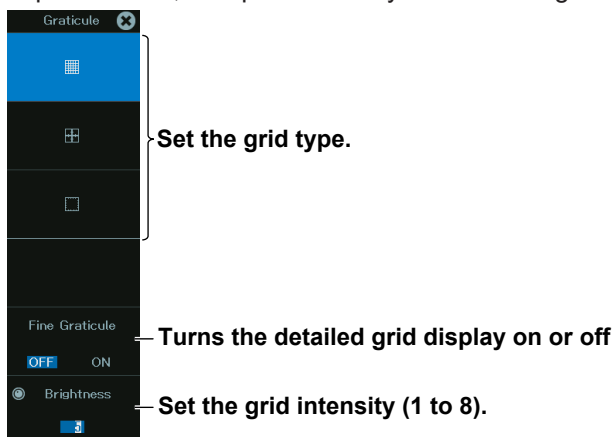
Display Menu

1. On the waveform screen’s **MENU** tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.



Setting the Grid (Graticule)

2. Tap **Graticule**, or tap the soft key. The following window appears.



Interpolation method

You can select the interpolation method from the following:

- OFF(2k): Interpolation is not performed. If outside the interpolation area and the display record length exceeds 2 kpoint, the data is decimated down to 2 kpoint and displayed. If the display record length is less than or equal to 2 kpoint, all the points are displayed.
- OFF(100k): Interpolation is not performed. If outside the interpolation area and 100 kpoint is exceeded, the data is decimated down to 100 kpoint and displayed. If the display record length is less than or equal to 100 kpoint, all the points are displayed.
- Sine: Sampling data is interpolated with a sine curve.
- Line: Sampling data is interpolated linearly.
- Pulse: Sampling data is interpolated stepwise.

5.4 Configuring the Detailed Display Settings

This section explains detailed display settings such as scale display and font size.

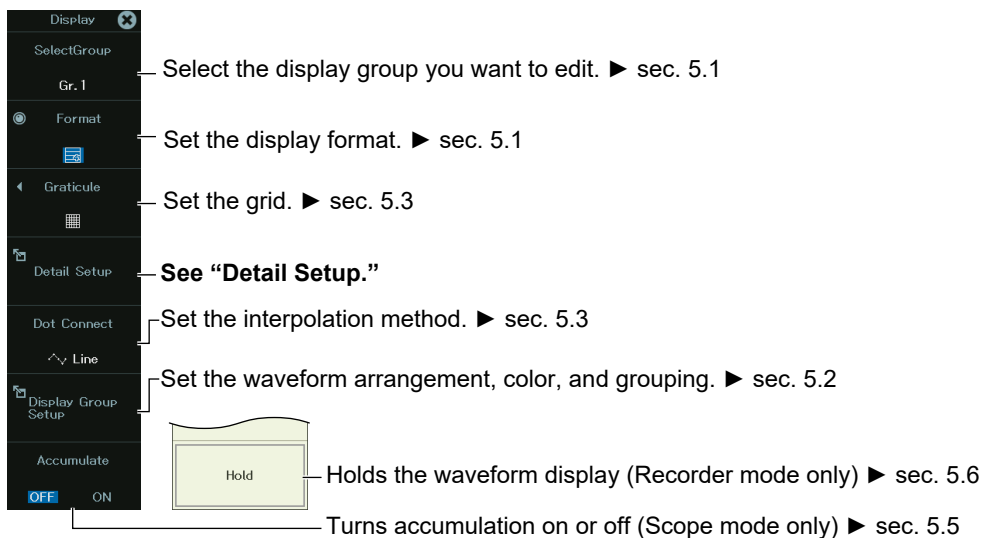
Items Common to Scope Mode and Recorder Mode

- Scale value's display item
- Scale font size
- Horizontal axis display mode
- Turning the extra window on and off
- Number of displayed digits for analysis results (1 to 20)
- Font size for displaying analysis results
- Menu font size
- Screen background color
- Turning the trace label display on and off
- Turning the level indicator on and off
- Channel information
- Channel information display range
- Turning the manual event display on and off

► [“Detail Setup \(Detail Setup\)” in the Features Guide](#)

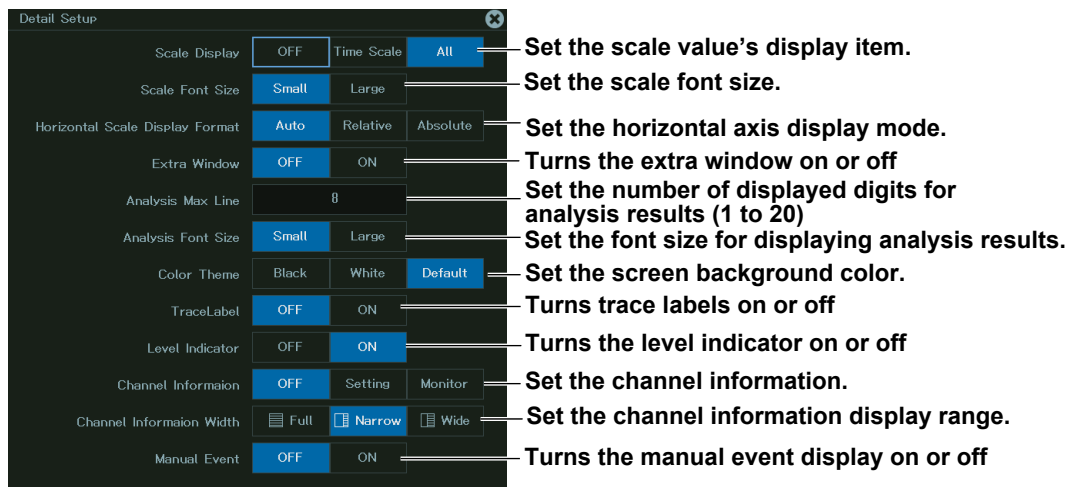
Display Menu

1. On the waveform screen's **MENU** tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.



Detail Setup (Detail Setup)

2. Tap **Detail Setup**, or press the soft key. The following screen appears.



Scale Value's Display Item

Select from the following items:

- OFF: Scale values are not displayed.
- All : All scale values are displayed.
- Time Scale : Only time scale values are displayed.

Horizontal Axis Display Mode

Select from the following items:

- Relative time: Relative time from the start of measurement
- Absolute time: Absolute time of measurement (not selectable when the measurement time is 1 second or less)
- Auto: Automatically set according to the horizontal scale (TIME DIV) at the time of measurement

Channel Information

Set the contents to display as channel information.

- OFF: Not displayed
- Setting: Setup parameters
- Monitor: Measured values

Channel Information Display Range

Set the channel information display range.

- Full: Channel information is displayed in full screen.
- Narrow: Channel information is displayed with the same width as the setup menu.
- Wide: Channel information is displayed with the same width as the setup menu in two columns.

5.4 Configuring the Detailed Display Settings

Channel Information Display Method

With the setup menu not shown on the screen, tap the channel information icon at the lower right of the screen.

The icon varies depending on the channel information display range setting.

When the setup menu is not displayed, you can press ESC to switch between setup information display, measured value display, and hidden.

When the channel information display is on, the icon background is displayed in blue.

Waveform display
Setup information and measurement

Measurement display (monitor)

Setup information display

Set the channel information display range.

Channel information icon

- When the channel information display range is set to Full
- When the channel information display range is set to Wide
- When the channel information display range is set to Narrow

5.5 Using the Accumulate Feature (Scope mode)

This section explains the following accumulation settings:

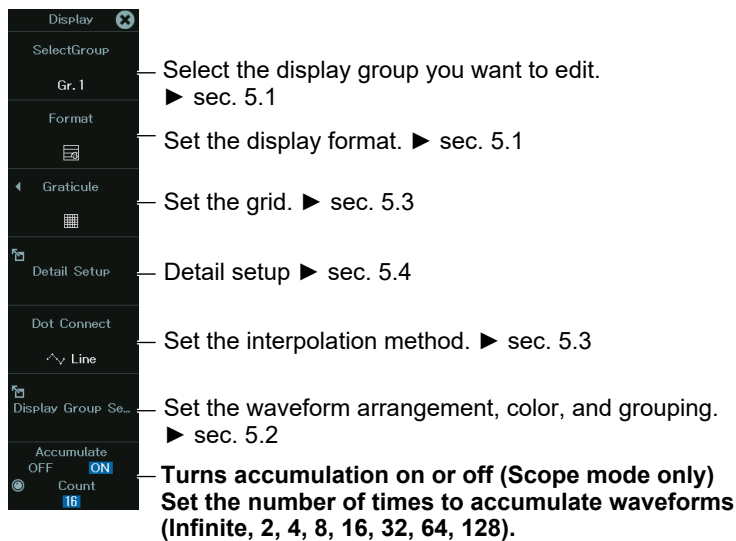
Applicable in Scope Mode

- Turning accumulation on and off
- Number of times to accumulate waveforms

► “Accumulation (Accumulate)” in the Features Guide

Display Menu

1. On the waveform screen’s **MENU** tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.



Setting Accumulation (Accumulate)

2. Tap **Accumulate**, or tap the soft key. If you set this to ON, the accumulation count appears.
3. Set the accumulation count by tapping the displayed accumulation count or by using the jog dial or up and down keys. If you set this to Infinite, accumulation will continue until acquisition is complete.

5.6 Holding the Waveform Display (Recorder mode)

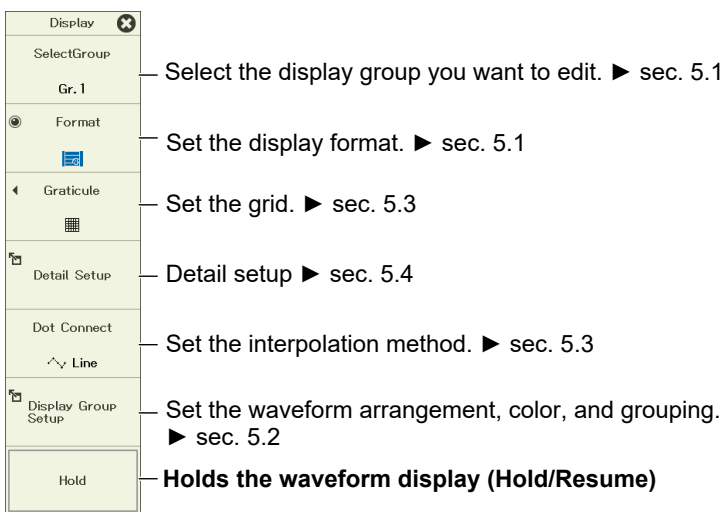
This section explains a feature for holding the waveform display during waveform acquisition in Recorder mode.

Applicable in Recorder Mode

- Holding the waveform display
 - ▶ “Holding the Waveform Display (Hold/Resume)” in the Features Guide

Display Menu

1. During waveform acquisition, on the waveform screen’s **MENU**, tap **DISPLAY > DISPLAY**, or press **DISPLAY**. The Display menu appears.



Holding the Waveform Display (Hold)

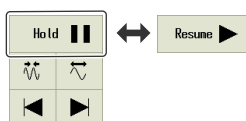
2. Tap **Hold**, or press the soft key.
 - The waveform display is held while waveform acquisition continues.
 - The menu item changes to Resume.

Resuming (Resume)

3. Tap **Resume**, or press the soft key.
 - The waveform display is resumed, and the waveform display is updated to the latest state.
 - The menu item changes to Hold.

Note

- Waveform display holding is disabled when waveform acquisition is stopped.
- When hold down the waveform display area during waveform acquisition, the following pop-up menu appears, and you can execute Hold or Resume.



5.7 Using the Snapshot and Clear Trace Features

Items Common to Scope Mode and Recorder Mode

- Taking a snapshot
- Clearing the snapshot waveform
 - ▶ [“Snapshot \(SNAPSHOT\)” and “Clear Trace \(CLEAR TRACE\)” in the Features Guide](#)

Snapshot

1. On the waveform screen’s **MENU**, tap **OTHERS > SNAPSHOT**, or press **SNAPSHOT**. The currently displayed waveform is retained on the screen as a snapshot displayed in white. Snapshot waveforms remain on the screen until you execute a clear trace operation.

Clear Trace

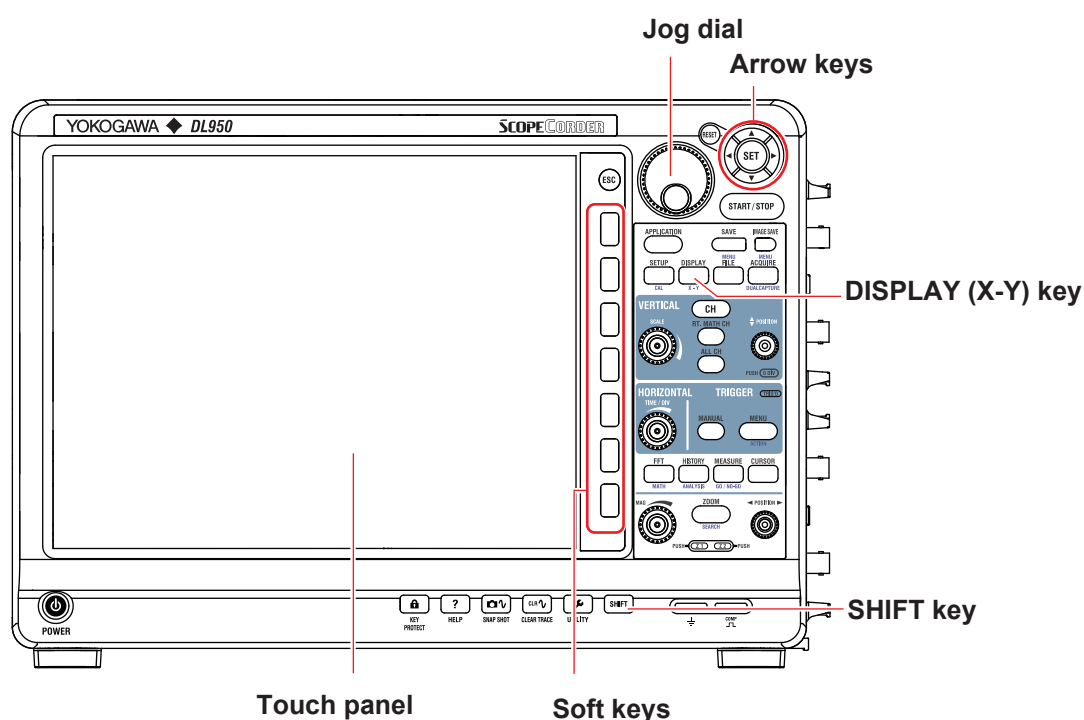
1. On the waveform screen’s **MENU**, tap **OTHERS > CLEAR TRACE**, or press **CLEAR TRACE**. All waveforms on the screen are cleared.

Chapter 6

X-Y display

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
6.1 Setting the X-Y Waveform Trace	✓	✓
6.2 Setting the Display Conditions for X-Y Waveforms	✓	✓
6.3 Measuring X-Y Waveforms with Cursors	✓	✓

* The settings may vary depending on the operation mode.

6.1 Setting the X-Y Waveform Trace

This section explains the following settings for displaying X-Y waveforms:

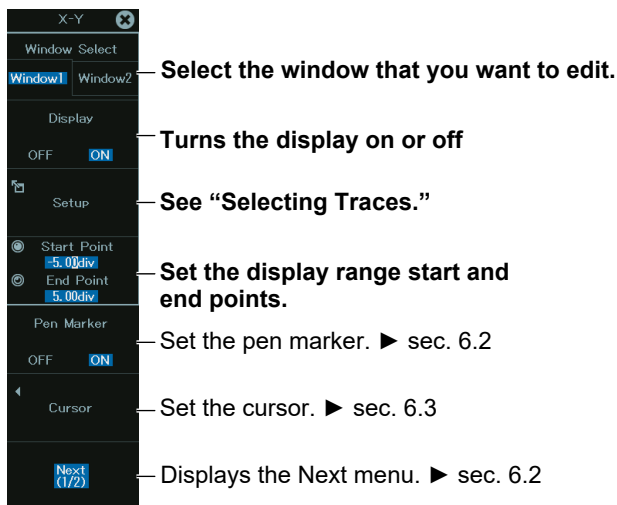
Items Common to Scope Mode and Recorder Mode

- Turning X-Y waveform display on and off, source waveform (X axis, Y axis)
- Start and end points of display range

► “X-Y Waveform Setup (Setup)” in the Features Guide

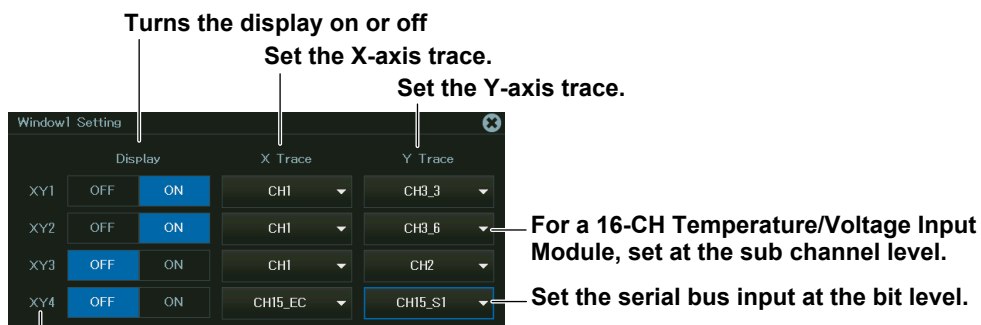
X-Y menu

1. On the waveform screen’s **MENU**, tap **DISPLAY > X-Y**, or press **SHIFT+DISPLAY(X-Y)**. The X-Y menu appears.



Selecting Traces

2. Tap **Setup**, or press the soft key. The following menu appears.



Set XY1 to XY4 on Window1 and XY5 to XY8 on Window2.

6.2 Setting the Display Conditions for X-Y Waveforms

This section explains the following settings for the display conditions of X-Y waveforms:

Items Common to Scope Mode and Recorder Mode

- Display range
- Turning pen markers on and off
- Main window's display ratio
- Window layout
- Turning combine display on and off
- Interpolation
- The number of data points that are used to display waveforms
- Turning trace-clear-on-start on and off

► [“X-Y Waveform Display” in the Features Guide](#)

X-Y menu

1. On the waveform screen's **MENU**, tap **DISPLAY > X-Y**, or press **SHIFT+DISPLAY(X-Y)**. The X-Y menu appears.

X-Y menu (1/2)

Set the trace. ► sec. 6.1

Set the pen marker.

Set the cursor. ► sec. 6.3

Displays the second page of the menu

X-Y menu (2/2)

Set the main window's display ratio. (50%, 20%, 0%)

Set the window layout (Side, Vertical).

Select whether to superimpose Window1 and Window2 (ON/OFF).

Set the display interpolation (OFF, Line).

Set the number of data points that are used to display waveforms (2k, 100k).

Set whether to clear waveforms at the start of acquisition (ON/OFF).

Displays the first page of the menu

6.3 Measuring X-Y Waveforms with Cursors

This section explains the following settings for measuring X-Y waveforms with cursors for each cursor type:

Items Common to Scope Mode and Recorder Mode

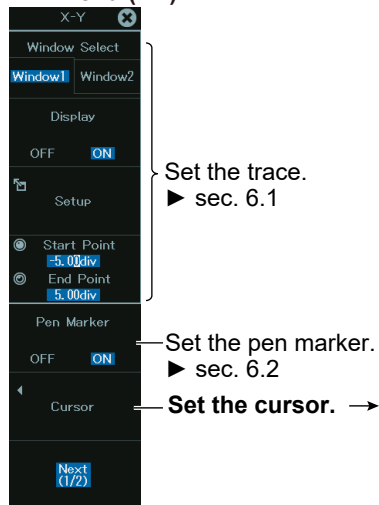
- Turning cursor measurement on and off
- Cursor type
- Source waveform
- Moving cursors
- Measurement items
- Marker assignment
- Marker position

► “X-Y Waveform Cursor Measurement (Cursor)” in the Features Guide

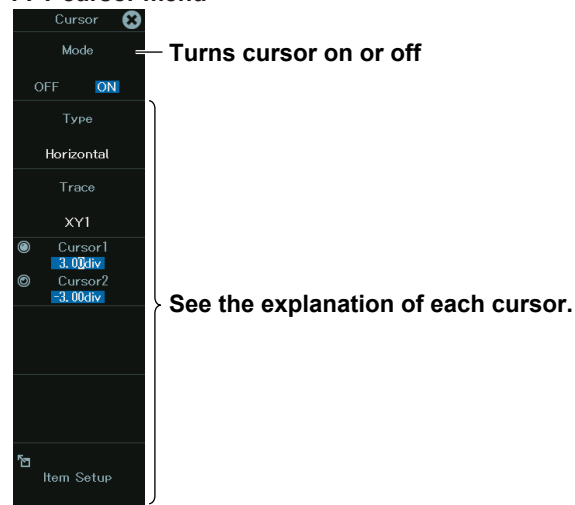
X-Y Cursor Menu

1. On the waveform screen’s **MENU**, tap **DISPLAY > X-Y**, or press **SHIFT+DISPLAY(X-Y)**. The X-Y menu appears.
2. Tap **Cursor**, or tap the soft key.

X-Y menu (1/2)

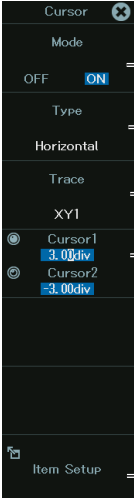


FFT cursor menu



Measuring X-Y Waveforms with Horizontal Cursors (Horizontal)


3. Tap **Type**, or press the soft key to select **Horizontal**.



The screenshot shows the 'Cursor' menu with the following settings and annotations:

- Mode:** OFF **ON** — **Set Mode to ON.**
- Type:** Horizontal — **Set the cursor type to Horizontal (horizontal).**
- Trace:** XY1 — **Select the trace to measure with cursors (XY1 to XY8).**
- Cursor1:** 3.00div — **Set the cursor positions (Cursor1: Y1, Cursor2: Y2).**
- Cursor2:** -3.00div — **Set the cursor positions (Cursor1: Y1, Cursor2: Y2).**

You can also drag the cursors on the X-Y screen. Tap the cursor and then tap the arrow that appears (shown in the figure below) to adjust the cursor position in fine increments.

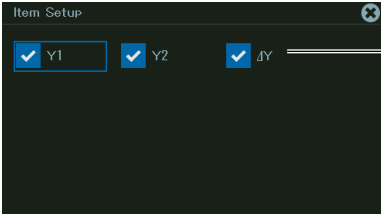


The icon shows a vertical double-headed arrow with the text 'Cursor Position' in the center.

Item Setup — **See “Setting Measurement Items.”**

Setting Measurement Items (Item Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.



The screenshot shows the 'Item Setup' screen with the following settings:

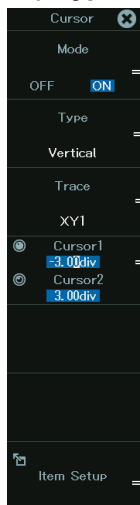
- Y1
- Y2
- ΔY

Select the measurement items that you want to use.

- Y1: Vertical (Y axis) value at Cursor1
- Y2: Vertical (Y axis) value at Cursor2
- ΔY: Difference between the vertical (Y axis) values of Cursor1 and Cursor2

Measuring X-Y Waveforms with Vertical Cursors (Vertical)

3. Tap **Type**, or press the soft key to select **Vertical**.

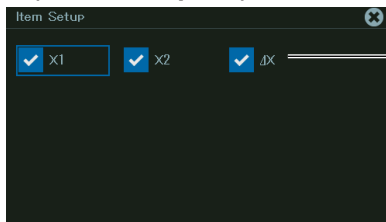


The screenshot shows the 'Cursor' menu with the following options and annotations:

- Mode**: OFF and ON. Annotation: **Set Mode to ON.**
- Type**: Vertical. Annotation: **Set the cursor type to Vertical (vertical).**
- Trace**: XY1. Annotation: **Select the trace to measure with cursors (XY1 to XY8).**
- Cursor1**: 3.00div. Annotation: **Set the cursor positions (Cursor1: X1, Cursor2: X2).**
- Cursor2**: 3.00div.
- Cursor Position**: A button with left and right arrows. Annotation: **You can also drag the cursors on the X-Y screen. Tap the cursor and then tap the arrow that appears (shown in the figure below) to adjust the cursor position in fine increments.**
- Item Setup**. Annotation: **See "Setting Measurement Items."**

Setting Measurement Items (Item Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.



The screenshot shows the 'Item Setup' screen with the following options and annotations:

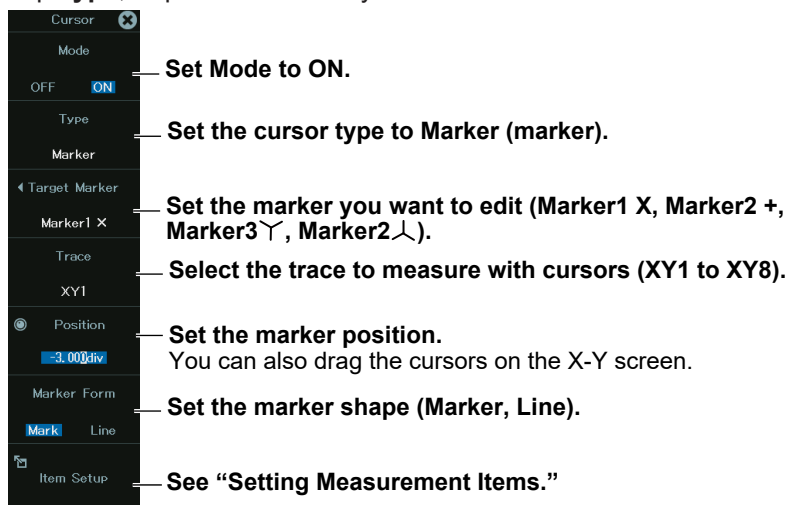
- X1
- X2
- ΔX

Select the measurement items that you want to use.

- X1: Time (X axis) value at Cursor1
- X2: Time (X axis) value at Cursor2
- ΔX: Difference between the time (X axis) values of Cursor1 and Cursor2

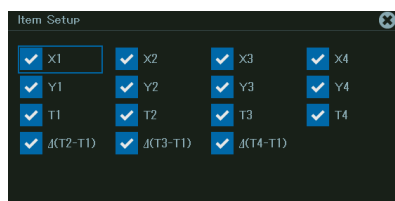
Measuring X-Y Waveforms with Marker Cursors (Marker)

3. Tap **Type**, or press the soft key to select **Marker**.



Setting Measurement Items (Item Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.

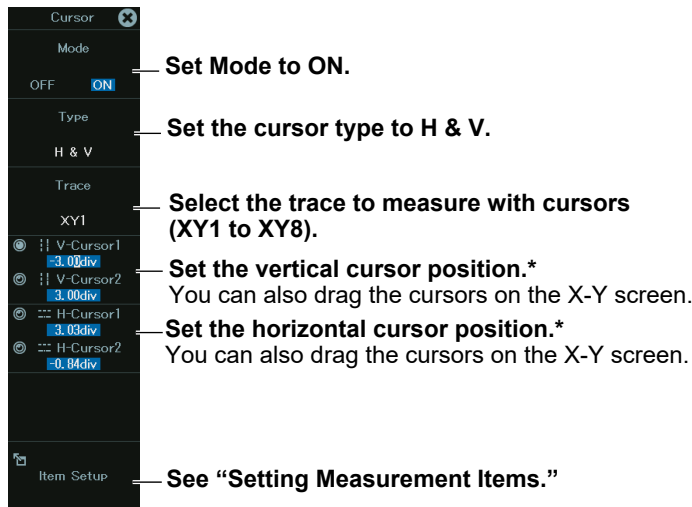


Select the measurement items that you want to use.

- X1: Horizontal (X axis) value at Marker1
- X2: Horizontal (X axis) value at Marker2
- X3: Horizontal (X axis) value at Marker3
- X4: Horizontal (X axis) value at Marker4
- Y1: Vertical (Y axis) value at Marker1
- Y2: Vertical (Y axis) value at Marker2
- Y3: Vertical (Y axis) value at Marker3
- Y4: Vertical (Y axis) value at Marker4
- T1: Time from the trigger position at Marker1
- T2: Time from the trigger position at Marker2
- T3: Time from the trigger position at Marker3
- T4: Time from the trigger position at Marker4
- $\Delta(T2-T1)$: Time difference between Marker1 and Marker2
- $\Delta(T3-T1)$: Time difference between Marker1 and Marker3
- $\Delta(T4-T1)$: Time difference between Marker1 and Marker4

Measuring X-Y Waveforms with Horizontal and Vertical Cursors (H & V)

3. Tap **Type**, or press the soft key to select **H & V**.

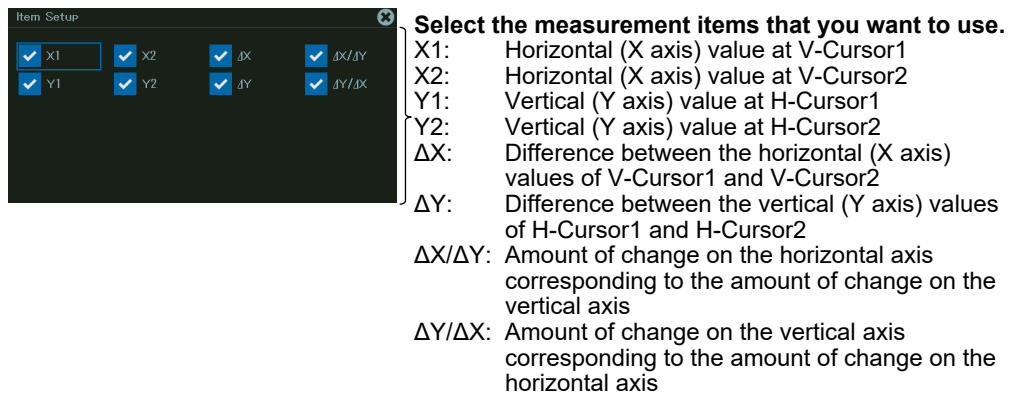


* Tap the cursor and then tap the arrow that appears (shown in the figure below) to adjust the cursor position in fine increments.



Setting Measurement Items (Item Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.

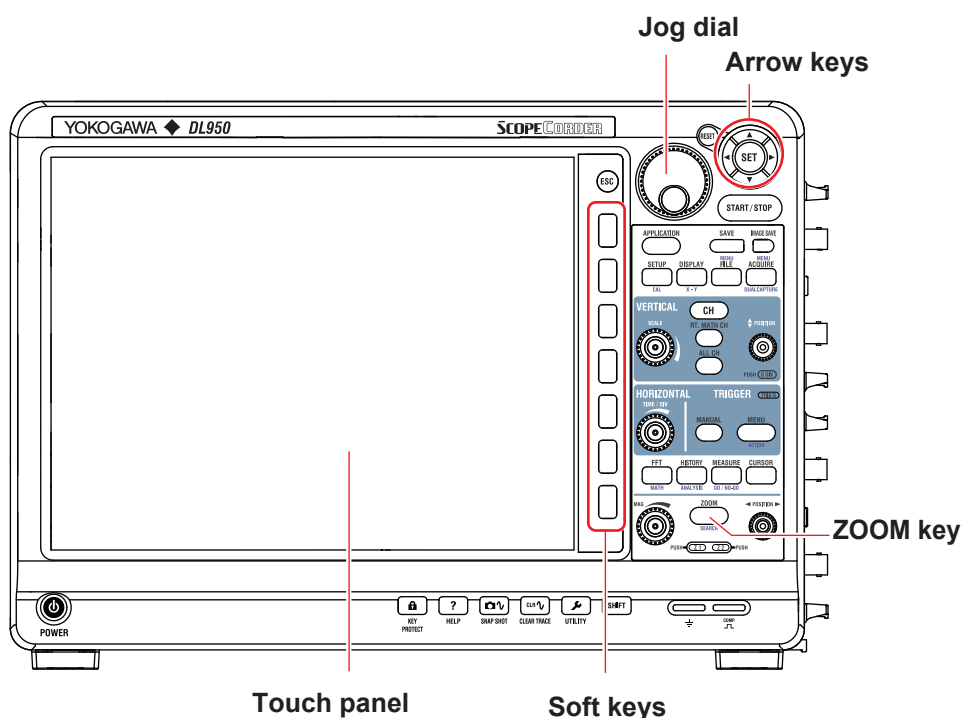


Chapter 7

Zooming In on or Out of Waveforms

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
7.1 Zooming In on or Out of Waveforms (Scope mode)	✓	-
7.2 Zooming In on or Out of Waveforms (Recorder mode)	-	✓

* The settings may vary depending on the operation mode.

7.1 Zooming In on or Out of Waveforms (Scope mode)

This section explains the following settings for zooming in or out of waveforms in Scope mode:

Applicable to Scope Mode

- Setting the target (Zoom1, Zoom2)
- Turning zoom on and off
- Zoom source window (for Zoom2)
- Zoom position
- Display format
- Main window's display ratio
- Window layout
- Auto scroll
- Zoom source waveform
- Changing the range for performing automated measurement of waveform parameters
- Zoom factor

► [“Zooming In on or Out of Waveforms” in the Features Guide](#)

ZOOM Menu

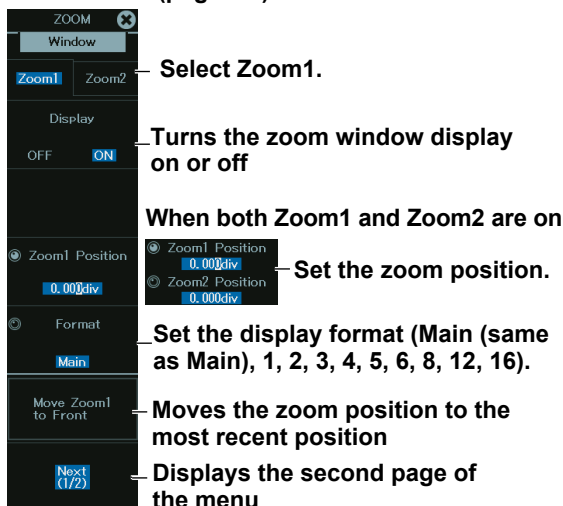
1. On the waveform screen's **MENU**, tap **ZOOM**, or press **ZOOM**. The ZOOM menu appears.

If a zoom window is not displayed on the screen, zoom box 1 (Zoom1) is automatically turned on, and a zoom window appears.

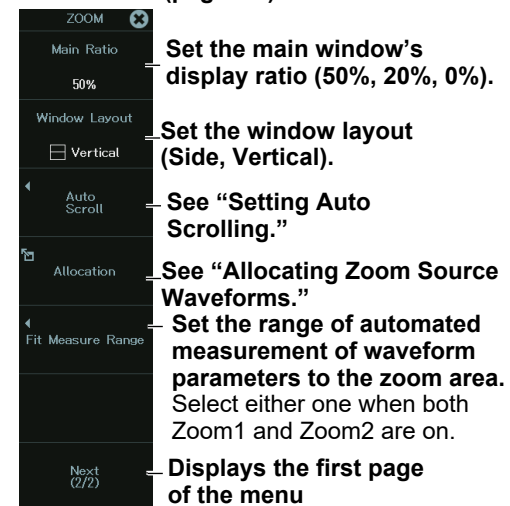
To switch between Zoom1 and Zoom2, tap the **Zoom1** or **Zoom2** tab, or press the zoom **POSITION** or **MAG** knob.

Configuring Zoom1

ZOOM menu (page 1/2)

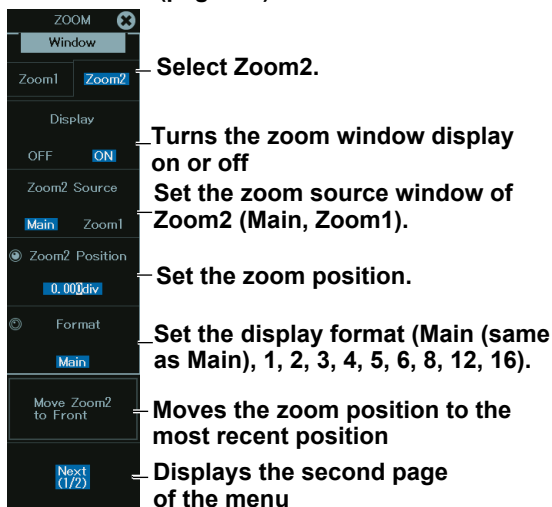


ZOOM menu (page 2/2)

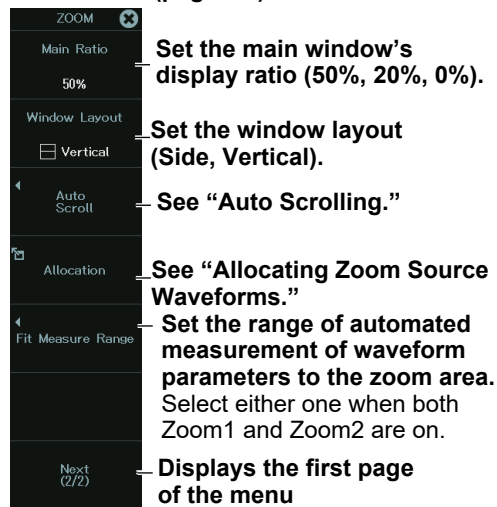


Configuring Zoom2

ZOOM menu (page 1/2)



ZOOM menu (page 2/2)

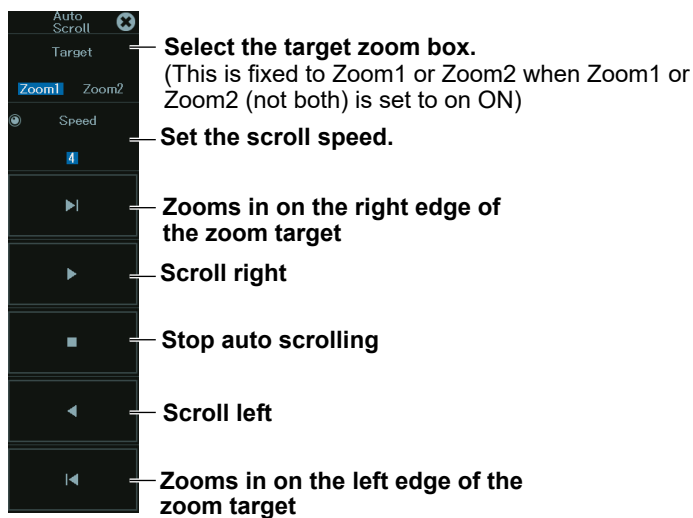


Note

For the ZOOM menu when dual capture is on, see section 3.4.

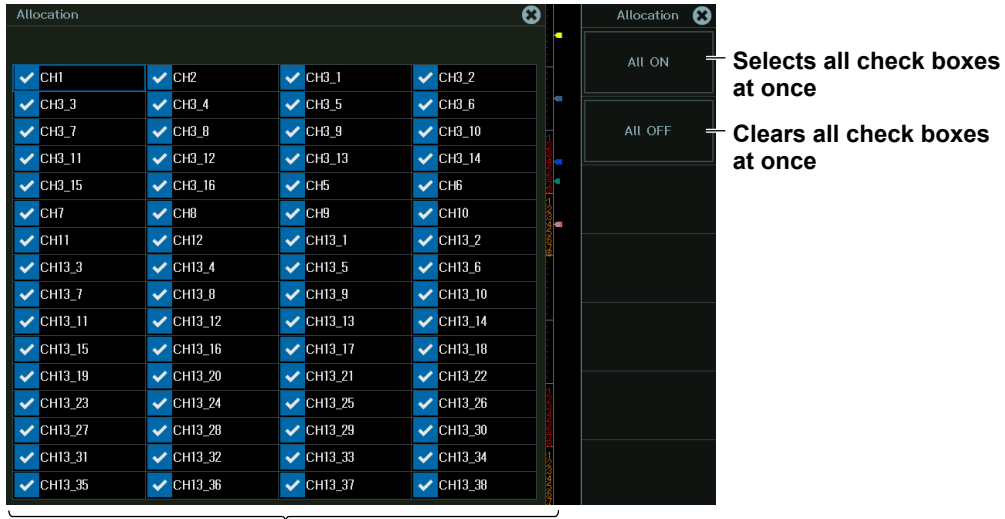
Setting Auto Scrolling (Auto Scroll)

2. Tap **Auto Scroll**, or press the soft key. The following menu appears.



Allocating Zoom Source Waveforms (Allocation)

3. Tap **Allocation**, or press the soft key. The following screen appears.



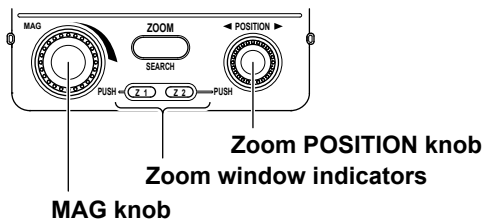
Select the zoom source waveforms (the waveforms that can be selected are displayed).

Zoom Factor (MAG knob)

Use the **MAG** knob to set the zoom factor.

The **MAG** knob controls the waveforms in the window whose corresponding indicator, Z1 or Z2, is illuminated.

The **MAG** knob has a push switch. Push the knob to illuminate the Z1 indicator, Z2 indicator, or both indicators. Then, you can set the zoom factor. When both the Z1 and Z2 indicators are illuminated, you can set both zoom windows to the same zoom factor at the same time.



Setting the Zoom Position (Zoom POSITION knob)

Use the **zoom POSITION** knob to set the zoom position.

The zoom **POSITION** knob controls the waveforms in the window whose corresponding indicator, Z1 or Z2, is illuminated.

The zoom **POSITION** knob has a push switch. Push the knob to illuminate the Z1 indicator, Z2 indicator, or both indicators. Then, you can set the zoom position. When both the Z1 and Z2 indicators are illuminated, you can set the zoom positions of both windows at the same time while retaining the positional relationship between the two.

7.2 Zooming In on or Out of Waveforms (Recorder mode)

This section explains the following settings for zooming in or out of waveforms in Recorder mode:

Applicable in Recorder Mode

- Turning zoom on and off
- Zoom position
- Display range (zoom factor)
- Display format
- Main window's display ratio
- Window layout
- Auto scroll
- Zoom source waveform
- Changing the range for performing automated measurement of waveform parameters

► [“Zooming in on or Out of Waveforms” in the Features Guide](#)

ZOOM Menu

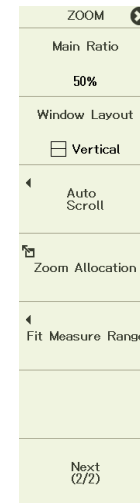
1. On the waveform screen's **MENU**, tap **ZOOM**, or press **ZOOM**. The ZOOM menu appears.

ZOOM menu (page 1/2)



See “Switching between the Main Window and Zoom Window.”

ZOOM menu (page 2/2)



Set the main window's display ratio (50%, 20%, 0%).

Set the window layout (Side, Vertical).

See “Setting Auto Scrolling.”


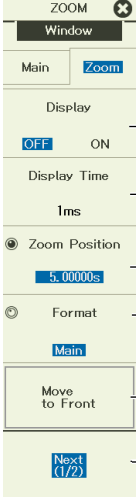
See “Allocating Zoom Source Waveforms.”

Set the range of automated measurement of waveform parameters to the zoom area.

Displays the first page of the menu


Switching between the Main Window and Zoom Window

2. Tap the Main or Zoom tab, or press the zoom POSITION knob. The selected tab switches.

Main window menu	Zoom window menu
	
<p>Window</p> <p>Main Zoom</p> <p>Display Time 10s</p> <p>Position 5.00000s</p> <p>Move to Front</p> <p>Next (1/2)</p>	<p>Window</p> <p>Main Zoom</p> <p>Display OFF ON</p> <p>Display Time 1ms</p> <p>Zoom Position 5.00000s</p> <p>Format Main</p> <p>Move to Front</p> <p>Next (1/2)</p>
<p>Set the main window's display time period.</p> <p>Set the center position of the main window.</p> <p>Moves to the beginning of the waveform</p> <p>Displays the second page of the menu</p>	<p>Turns the zoom window on or off</p> <p>Set the zoom window's display time period.</p> <p>Set the center position of the zoom window.</p> <p>Set the display format (Main (same as Main), 1, 2, 3, 4, 5, 6, 8, 12, 16).</p> <p>Moves to the beginning of the waveform</p> <p>Displays the second page of the menu</p>

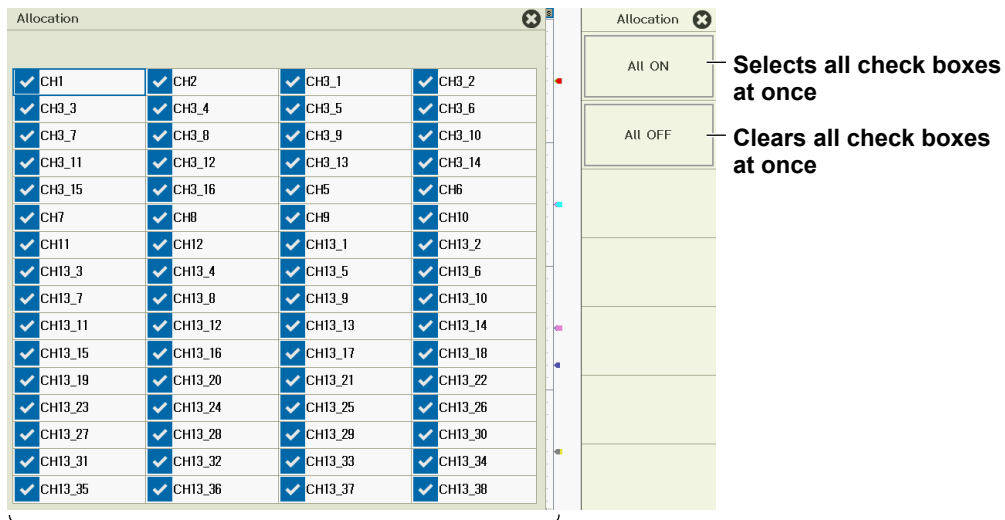
Setting Auto Scrolling (Auto Scroll)

2. Press the **Auto Scroll** soft key. The following menu appears.

	<p>Auto Scroll</p> <p>Target</p> <p>Main Zoom</p> <p>Speed 4</p> <p>▶</p> <p>▶</p> <p>■</p> <p>◀</p> <p>◀</p>	<p>Select the target zoom box. (This is fixed to Main when Zoom is set to OFF.)</p> <p>Set the scroll speed.</p> <p>Zooms in on the right edge of the zoom target</p> <p>Scroll right</p> <p>Stop auto scrolling</p> <p>Scroll left</p> <p>Zooms in on the left edge of the zoom target</p>
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Allocating Zoom Source Waveforms (Allocation)

- Press the **Allocation** soft key. The following screen appears.



Selects all check boxes at once
Clears all check boxes at once

Select the zoom source waveforms (the waveforms that can be selected are displayed).

The selected waveforms are displayed in the zoom window.

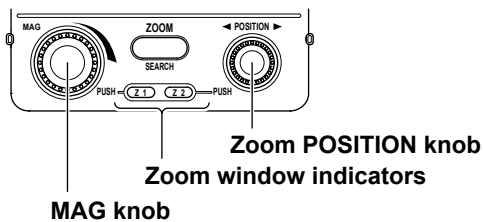
Setting the Display Range with the MAG Knob

You can also set the display range with the **MAG** knob.

The MAG knob controls the waveforms in the window whose corresponding indicator, Z1 or Z2, is illuminated. In Recorder mode, the MAG knob controls the main window when Z1 is illuminated and the zoom window when Z2 is illuminated.

The **MAG** knob has a push switch. Push the knob to illuminate the Z1 indicator, Z2 indicator, or both indicators. Then, you can set the zoom factor. When both the Z1 and Z2 indicators are illuminated, you can set both the main window and zoom window at the same time.

When the zoom window display is off, only Z1 illuminates.



Setting the Window's Center Position with the Zoom POSITION Knob

You can also set the window's center position with the zoom POSITION knob.

The zoom POSITION knob controls the waveforms in the window whose corresponding indicator, Z1 or Z2, is illuminated.

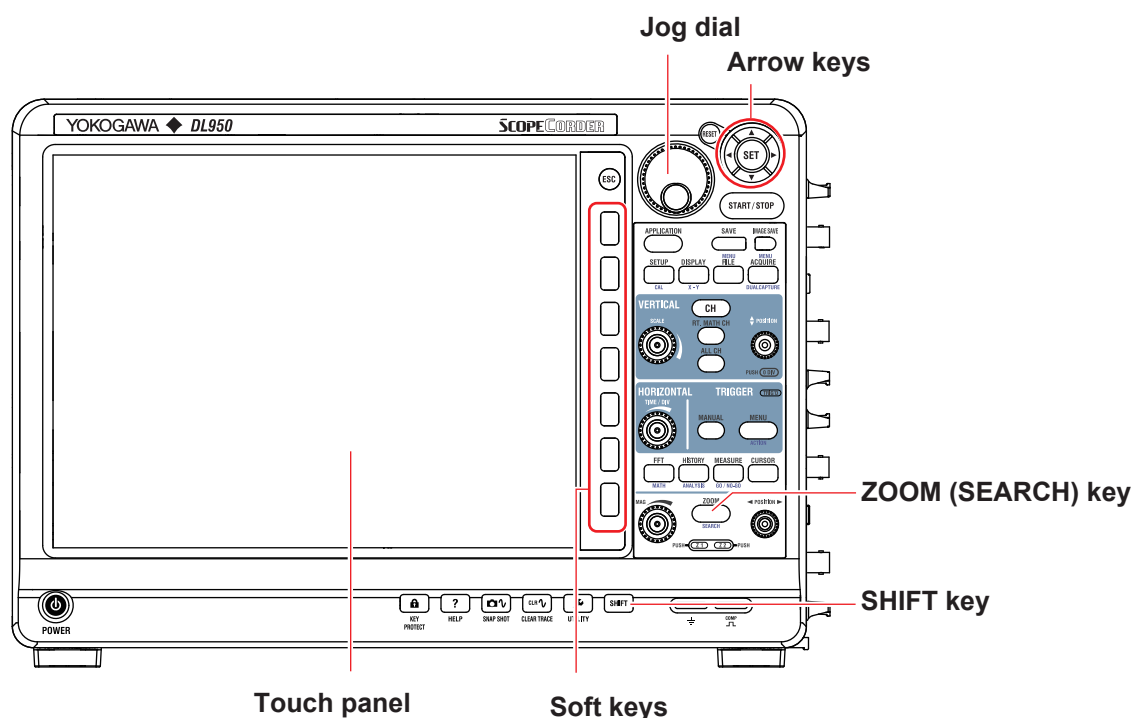
The zoom POSITION knob has a push switch. Push the knob to illuminate the Z1 indicator, Z2 indicator, or both indicators. Then, you can set the window's center position. When both the Z1 and Z2 indicators are illuminated, you can set both the main window and zoom window at the same time. When the zoom window display is off, only Z1 illuminates.

Chapter 8

Searching Waveforms

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
8.1 Searching for Edges	✓	✓
8.2 Searching for Events	✓	✓
8.3 Searching for Logic Patterns	✓	✓
8.4 Searching for a Specific Date and Time	✓	✓

* The settings may vary depending on the operation mode.

8.1 Searching for Edges

This section explains the following settings for searching for edges:

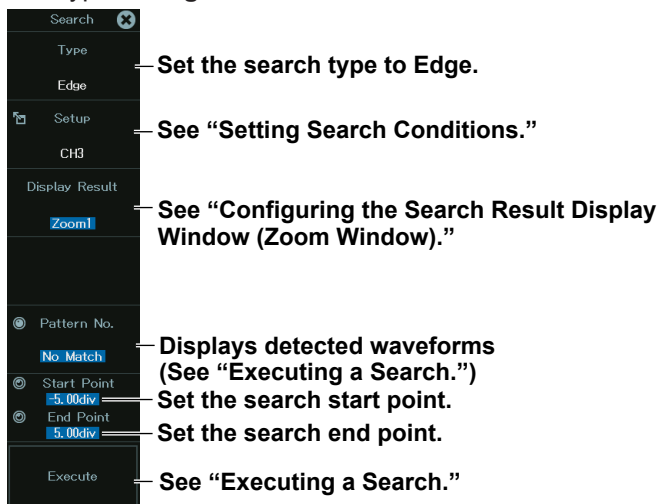
Items Common to Scope Mode and Recorder Mode

- Search type
- Search conditions (source waveform, level for determining the state of the source waveform, edge polarity, hysteresis, and the number of times to detect the conditions)
- Detected waveform display window (Scope mode)
- Detected point number
- Search range
- Executing searches

► [“Edge Search \(Edge\)” in the Features Guide](#)

SEARCH Edge Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > SEARCH**, or press **SHIFT+ZOOM (SEARCH)**.
2. Set Type to **Edge**.



Setting Search Conditions (Setup)

3. Press the **Setup** soft key. A menu appears according to the waveform to be searched you specified.

When the waveform to search is set to CH1 to CH16, 16CH TEMP/VOLT, CAN,* CAN FD,* LIN,* SENT,* RTmath1 to RTmath16, Power, Harmonic, GPS

Setup

Trace: CH1

Level: 0.0V

Polarity: F

Hysteresis: H

Count: 1

Set the waveform to search (CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, RTmath1 to RTmath16, Power, Harmonic, GPS).

Set the level.

Set the edge polarity (F, L, FL).

Set the hysteresis (H, A, V).

Set the number of times to detect the conditions.

* Use this menu for waveforms whose sub channel Value Type on the CAN bus monitor, CAN/CAN FD monitor, or CAN & LIN bus monitor is Unsigned, Signed, or Float and waveforms whose sub channel on the SENT monitor is FastCH, SlowCH, or Error Count.

If the Waveform to Search Is Set to a Logic Channel

- Waveforms of logic input modules
- Waveforms whose sub channel Value Type on the CAN bus monitor, CAN/CAN FD monitor, or CAN & LIN bus monitor is Logic
- Waveforms whose sub channel on the SENT monitor is S&C or Error Trigger

Setup

Trace: CH6

BitSetting:

Bit1: F

Bit2: L

Bit3: FL

Bit4: F

Bit5: L

Bit6: FL

Bit7: -

Bit8: -

Count: 1

Set the search source waveform (a logic channel).

Set the polarity of each bit (F, L, FL, - (don't use as a search condition)).

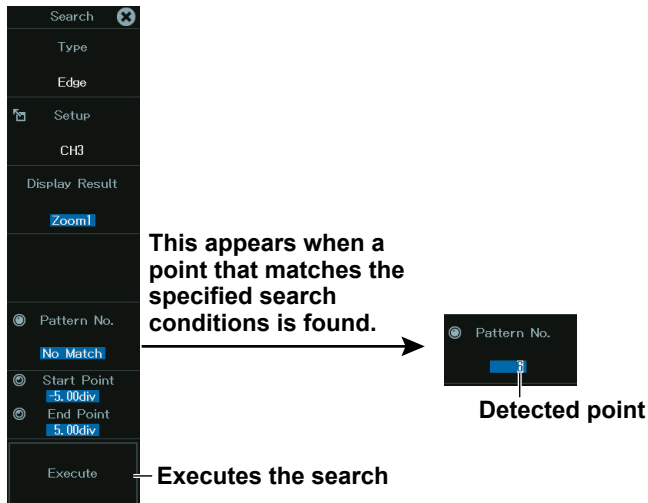
Set the number of times to detect the conditions.

Configuring the Search Result Display Window (Zoom Window) (Display Result) (Scope mode)

Set which zoom window, Z1 or Z2, to display the found waveform in. You can configure zoom windows Z1 and Z2 when they are displayed. If both Z1 and Z2 are not displayed, Z1 will be displayed when you press **SHIFT+ZOOM** (SEARCH) to display the SEARCH menu.

Executing a Search (Execute)

4. Tap **Execute**, or press the soft key. The instrument executes the search.



Executing and Aborting a Search

After setting the search conditions, tap **Execute**, or press the soft key. The search is executed, and the soft key changes to Abort. If the instrument finds points that match the search conditions (detected points), it shows numbers (0, 1, 2, etc.) from the left of the waveform display in the order that the points were detected.

To abort a search, tap **Abort**, or press the soft key.

Setting the Detected Point Numbers

You can set the detected point number and display the waveform with the detected point in the center of the zoom window.

8.2 Searching for Events

This section explains the following settings for searching for events):

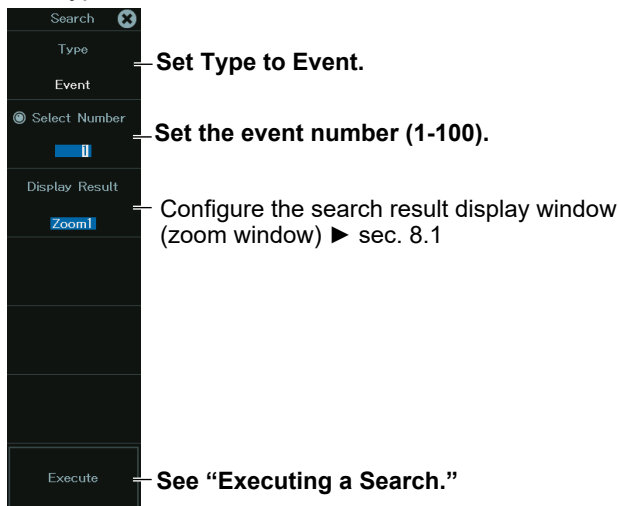
Items Common to Scope Mode and Recorder Mode

- Search type
- Search source
- Event number

► “Event Search (Event)” in the Features Guide

SEARCH Event Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > SEARCH**, or press **SHIFT+ZOOM (SEARCH)**.
2. Set Type to **Event**.



Executing a Search (Execute)

3. Tap **Execute**, or press the soft key. The instrument executes the search.

8.3 Searching for Logic Patterns

This section explains the following settings for searching for logic patterns:

Items Common to Scope Mode and Recorder Mode

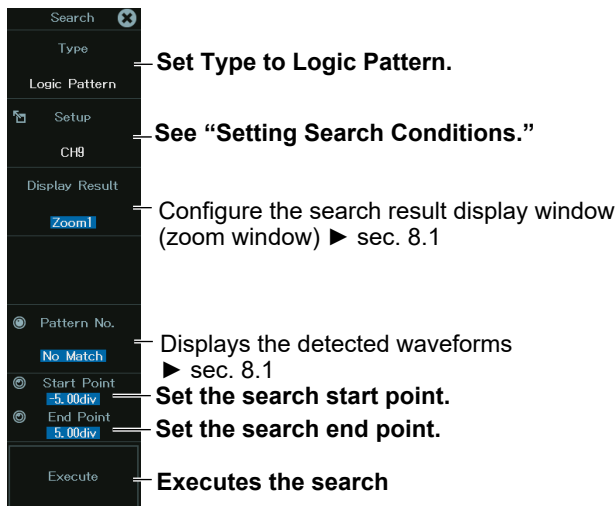
- Search type
- Search conditions

Source waveform, source bits, and the number of times to detect the conditions

► [“Logic Pattern Search \(Logic Pattern\)” in the Features Guide](#)

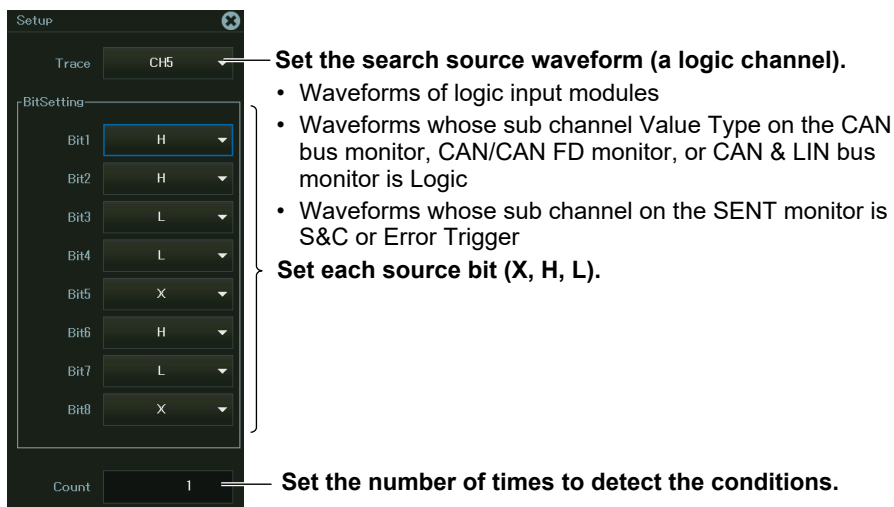
SEARCH Logic Pattern Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > SEARCH**, or press **SHIFT+ZOOM (SEARCH)**.
2. Set Type to **Logic Pattern**. If a logic module is not installed, you cannot select Logic Pattern.



Setting Search Conditions (Setup)

3. Tap **Setup**, or press the soft key. The following screen appears.



Executing a Search (Execute)

4. Tap **Execute**, or press the soft key. The instrument executes the search.

8.4 Searching for a Specific Date and Time

This section explains the following settings for searching for a specific date and time:

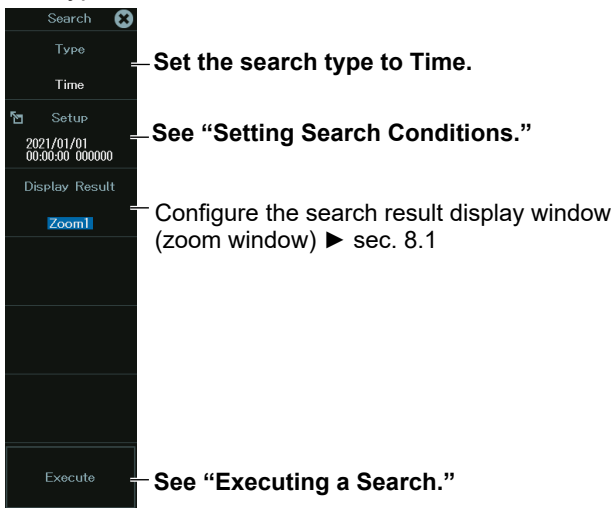
Items Common to Scope Mode and Recorder Mode

- Search type
- Date and time

► [“Time Search \(Time\)” in the Features Guide](#)

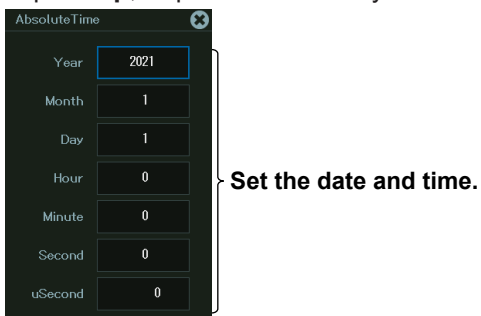
SEARCH Time menu

1. On the waveform screen’s MENU, tap **ANALYSIS > SEARCH**, or press **SHIFT+ZOOM (SEARCH)**.
2. Set Type to Time.



Setting Search Conditions (Setup)

3. Tap **Setup**, or press the soft key. The following screen appears.



Executing a Search (Execute)

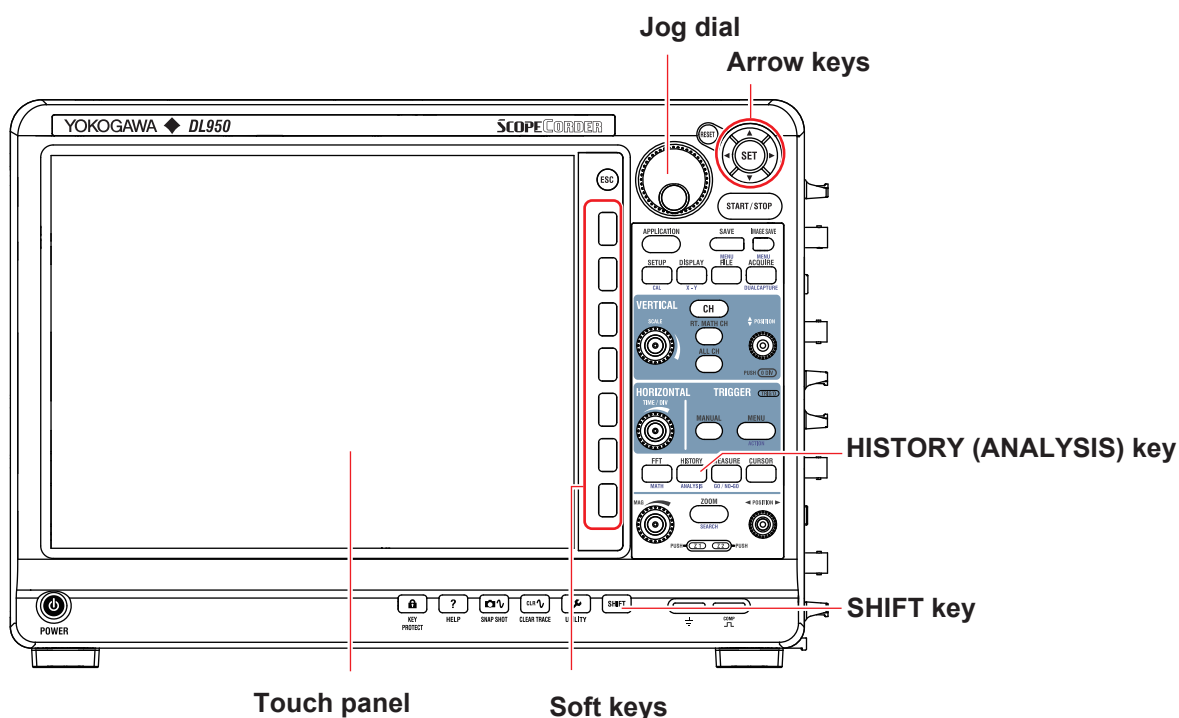
4. Tap **Execute**, or press the soft key. The instrument executes the search.

Chapter 9

History Waveform Display/Search (Scope mode only)

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section		Scope Mode	Recorder Mode
9.1	Displaying History Waveforms	✓	-
9.2	Searching History Waveforms	✓	-

* The settings may vary depending on the operation mode.

9.1 Displaying History Waveforms

This section explains the following settings for displaying history waveforms, which are waveforms that were previously saved to acquisition memory:

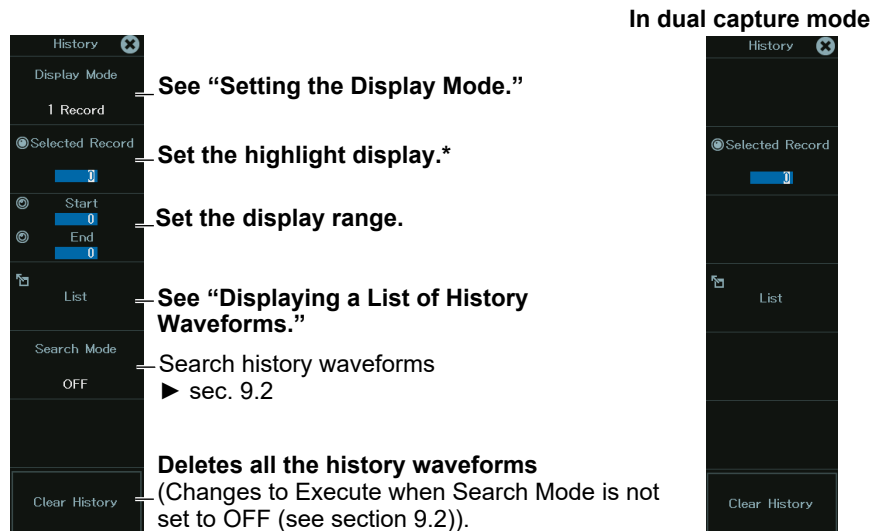
Applicable to Scope Mode

- Display mode
- Highlighting the selected record number
- Display range (start and end record numbers)
- Showing a list of timestamps
- Clearing all history waveforms

► “History Waveform Display/Search (Scope mode only)” in the Features Guide

HISTORY menu

1. On the waveform screen’s MENU, tap **ANALYSIS > HISTORY**, or press **HISTORY (ANALYSIS)**.



* This setting only appears when Display Mode is set to 1 Record or All Record.

Setting the Display Mode (Display Mode)

2. Tap **Display Mode**, or press the soft key.

From the menu that appears, select the display mode.

1 Record: Only the waveform corresponding to the selected record number is displayed.¹

All Record: All selected waveforms are superimposed on each other.²

All other waveforms¹ are displayed with an intermediate color.

Average Record: Computes the linear average of all the selected waveforms² and displays the result.

1 Specify the highlighted waveform with Selected Record.

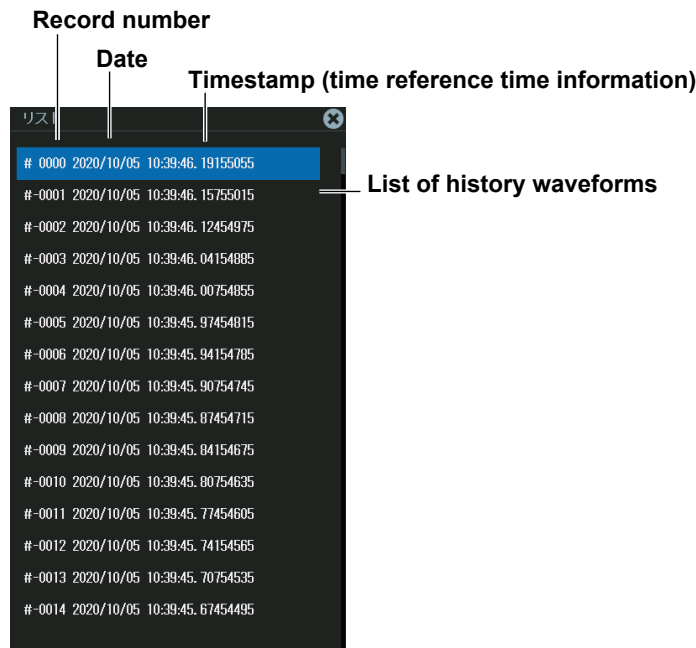
2 Specify with Start Record and End Record.

Note

- After you execute a search on the history waveforms, the only waveforms that are displayed are those that meet the search conditions. To display all the history waveforms in acquisition memory again, turn the history waveform search feature off.
- The averaging feature requires a certain amount of acquisition memory. If this is not available, you will not be able to display the Average Record.

Displaying a List of History Waveforms (List)

2. Tap **List**, or press the soft key. A list of history waveforms appears.

**Note****Notes on Using the History Feature**

- When the acquisition mode is set to Average, you cannot use the history feature.
- If you stop waveform acquisition, even if one complete screen's worth of waveform data has not been acquired, the waveform at which the trigger occurred is displayed as a single history waveform.
- You can start waveform acquisition when the History menu is displayed. However, you cannot change the history feature settings while waveform acquisition is in progress.
- The settings are restricted so that the following relationship is retained: Last record (End Record) \leq Selected Record \leq first record (Start Record).
- When you load waveform data from the specified storage device, history waveforms up to that point are cleared. The loaded waveform data is placed in record number zero. If you load a file containing multiple history waveforms, the latest waveform is placed in zero, and earlier waveforms are placed in order to record numbers -1 , -2 , and so on.
- Computation and automated measurement of waveform parameters are performed on the waveform of the record number specified by Selected Record. You can analyze old data as long as you do not overwrite the acquisition memory contents by restarting waveform acquisition. If Display Mode is set to Average Record, analysis is performed on the averaged waveform.
- History waveforms are cleared when you turn the power off. On models with the /ST2 option, history waveforms can be backed up at power-off (see section 24.6).

9.2 Searching History Waveforms

This section explains the following settings for searching history waveforms:

Applicable to Scope Mode

- Search mode
- Executing searches

Zone

- Target zone (Zone1 to Zone4)
- Search conditions
- Search window (upper and lower limits, left and right boundary values)
- Search logic

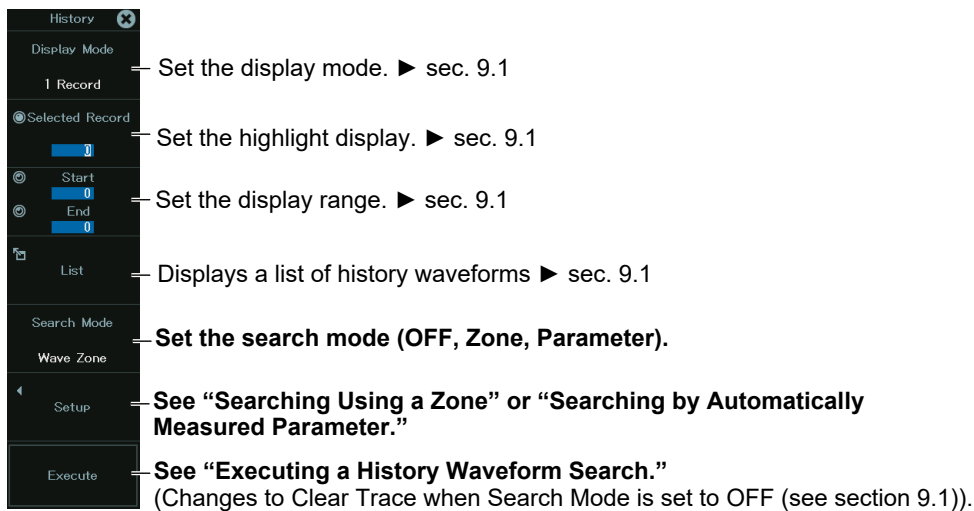
Parameter

- Target parameter (Param1 to Param4)
- Search conditions
- Source waveform and parameter
- Reference range (upper and lower limits)
- Search logic
- Parameter measurement range

► [“History Waveform Display/Search \(Scope mode only\)” in the Features Guide](#)

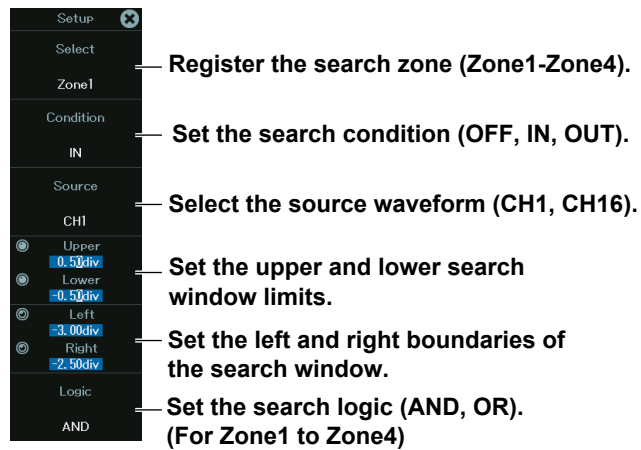
HISTORY menu

1. On the waveform screen’s MENU, tap **ANALYSIS > HISTORY**, or press **HISTORY (ANALYSIS)**.



Searching Using a Zone

2. Tap **Search Mode**, or press the soft key. On the menu that appears, set Search Mode to **Wave Zone**.
3. Tap **Search Setup**, or press the soft key. The following screen appears.



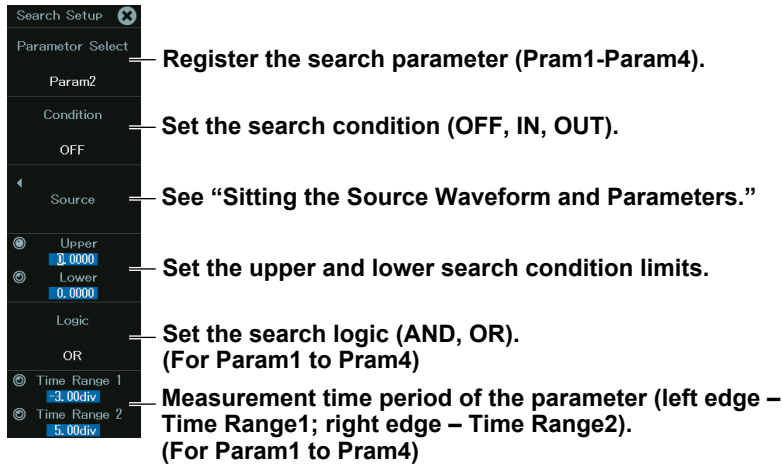
For items other than Logic, set for each zone.

Executing a History Waveform Search

4. After you set all the search conditions, close the menu to return to the HISTORY menu.
5. Tap **Execute**, or press the soft key. The instrument searches for the search conditions. The soft key changes to **Abort**.
To abort a search, tap **Abort**, or press the soft key.

Searching by Automatically Measured Parameter (Search Setup)

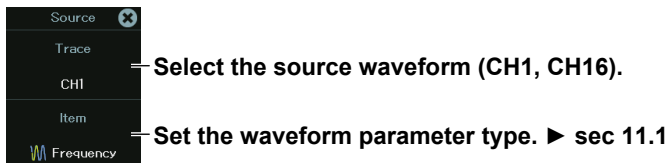
2. Tap **Search Mode**, or press the soft key. On the menu that appears, Search Mode to **Parameter**.
3. Tap **Search Setup**, or press the soft key. The following screen appears.



For all items other than Logic and Time Range 1, 2, set for each Param.

Sitting the Source Waveform and Parameters (Source)

4. Press the **Source** soft key. The following menu appears.



Executing a History Waveform Search

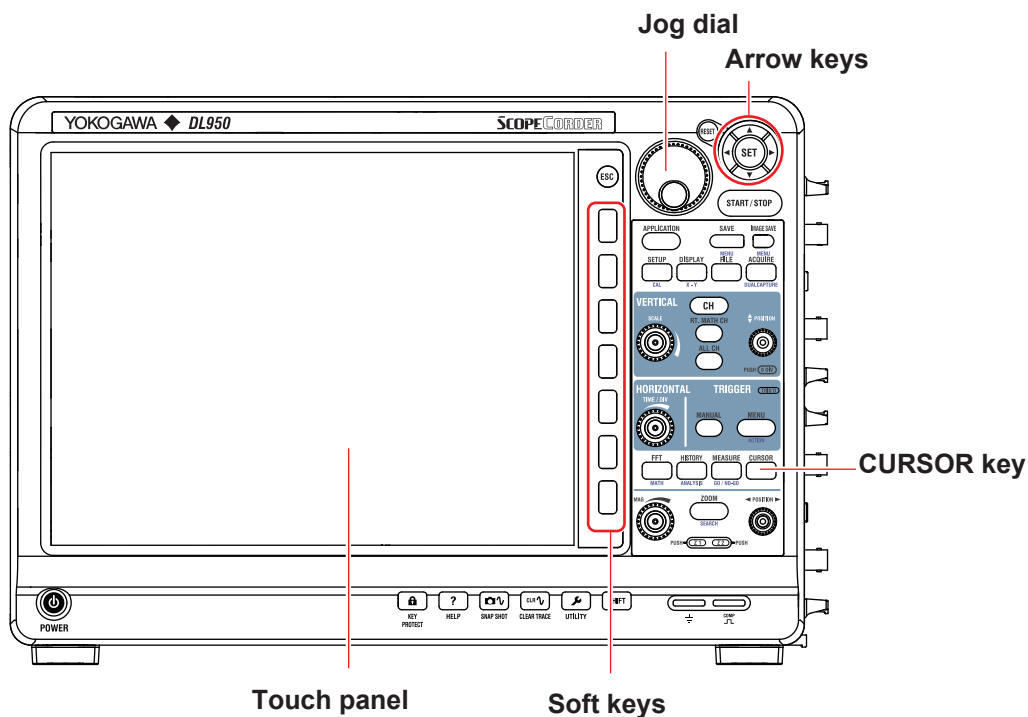
5. After you set all the search conditions, close the menu to return to the HISTORY menu.
6. Tap **Execute**, or press the soft key. The instrument searches for the search conditions. The soft key changes to **Abort**.
To abort a search, tap **Abort**, or press the soft key.

Chapter 10

Cursor Measurement

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
10.1 Measuring with Horizontal Cursors	✓	✓
10.2 Measuring with Vertical Cursors	✓	✓
10.3 Measuring with Marker Cursors (Marker)	✓	✓
10.4 Measuring with Angle Cursors (Degree)	✓	✓
10.5 Measuring with Horizontal and Vertical Cursors (H & V)	✓	✓

* The settings may vary depending on the operation mode.

10.1 Measuring with Horizontal Cursors

This section explains the following settings for measuring T-Y waveforms with horizontal cursors:
For information on cursor measurement on X-Y waveforms, see chapter 6.3.

Items Common to Scope Mode and Recorder Mode

- Turning the cursors on and off
- Cursor type
- Source waveform
- Cursor position
- Measurement items
- Cursor intensity

► “Horizontal Cursors (Horizontal)” in the Features Guide

CURSOR Horizontal menu

1. On the waveform screen’s MENU, tap **ANALYSIS** > **CURSOR**, or press **CURSOR**.
2. Tap **Mode**, or press the soft key to select **ON**.
3. Tap **Type**, or press the soft key to select **Horizontal**.

The image shows two screenshots from a device. The left screenshot is the 'Cursor' menu with the following options and annotations:

- Mode**: OFF, ON (ON is selected). Annotation: Turns cursor measurement on or off.
- Type**: Horizontal (selected). Annotation: Set Type to Horizontal.
- Trace**: CH1. Annotation: Set the measurement source waveform (CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Math1 to Math8, RTmath1 to RTmath16, Power, Harmonic, GPS).
- Cursor1**: 3.00div. Annotation: Set the cursor positions.
- Cursor2**: -3.00div. Annotation: Set the cursor positions.
- Item Setup**: Annotation: See “Setting Measurement Items.”
- Other Setup**: Annotation: Other settings.

The right screenshot is the 'Other Setup' menu with the following options and annotations:

- Target**: High Speed. Annotation: Select the cursor measurement target (high-speed, low-speed)*.
- Brightness**: 8. Annotation: Set the cursor display intensity.

* Set this when dual capture is on.

Setting Measurement Items (Item Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.

The image shows the 'Item Setup' screen with the following options and annotations:

- Y1**: . Annotation: Select the measurement items that you want to use.
- Y2**: . Annotation: Y1: Vertical value at Cursor1
- ΔY**: . Annotation: Y2: Vertical value at Cursor2

ΔY: Difference between the vertical values of Cursor1 and Cursor2

10.2 Measuring with Vertical Cursors

This section explains the following settings for measuring T-Y waveforms with vertical cursors:
For information on cursor measurement on X-Y waveforms, see chapter 6.3.

Items Common to Scope Mode and Recorder Mode

- Turning the cursors on and off
- Cursor type
- Source waveform
- Cursor position
- Cursor jump
- Measurement items
- Cursor value read mode
- Cursor intensity

► “Vertical Cursors (Vertical)” in the Features Guide

CURSOR Vertical menu

1. On the waveform screen’s MENU, tap **ANALYSIS > CURSOR**, or press **CURSOR**.
2. Tap **Mode**, or press the soft key to select **ON**.
3. Tap **Type**, or press the soft key to select **Vertical**.

The image shows two screenshots of the CURSOR Vertical menu. The left screenshot is the main menu, and the right screenshot is the Item Setup/Other Setup sub-menu. Arrows point from text labels to specific menu items in both screenshots.

Cursor (Close)

- Mode** — Turns cursor measurement on or off
 - OFF
 - ON**
- Type** — Set Type to Vertical.
 - Vertical**
- Trace** — Set the measurement source waveform (ALL, CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Math1 to Math8, RTmath1 to RTmath16, Power, Harmonic, GPS).
 - CH1**
- Cursor1** — Set the cursor positions.
 - 4.000div
- Cursor2** — Set the cursor positions.
 - 4.000div
- Cursor Jump** — See “Cursor Jump.”
- Item Setup/Other Setup** — Set measurement and other items.

Item Setup/Other Setup (Close)

- Item Setup** — See “Setting Measurement Items.”
- Target** — Select the cursor measurement target (high-speed, low-speed)*
 - High Speed
- Cursor Read Mode** — See “Cursor Value Read Mode.”
 - Display**
 - ACQ
- Brightness** — Set the cursor display intensity.
 - Brightness

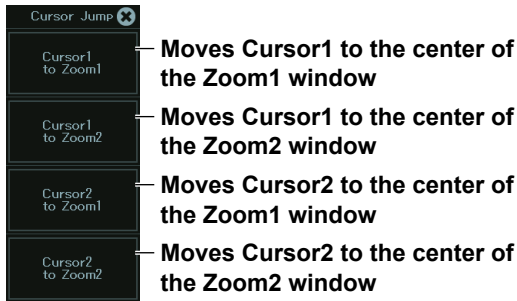
* Set this when dual capture is on.

Cursor Jump (Cursor Jump)

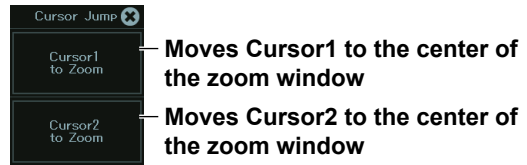
4. Tap **Cursor Jump**, or press the soft key. The following window appears.

Scope Mode

When Dual Capture Mode Is Off

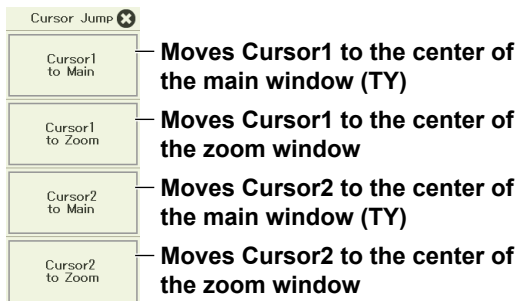


When dual capture mode is on*



* You can use this feature on the cursor measurement target waveform on either the high-speed sampling waveform or low-speed sampling waveform.

Recorder Mode



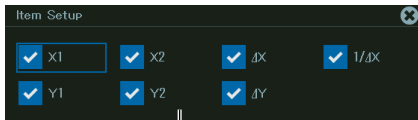
Note

You can configure the cursor jump feature when the target zoom window is turned on.

Setting Measurement Items (Item Setup)

4. Tap **Item Setup/Other Setup**, or press the soft key.

5. Tap **Item Setup**, or press the soft key. The following screen appears.



Select the measurement items that you want to use.

X1: Time value at Cursor1

X2: Time value at Cursor2

ΔX : Difference between the time values of Cursor1 and Cursor2

$1/\Delta X$: Reciprocal of the difference between the time values of Cursor1 and Cursor2

Y1: Vertical value at the intersection of Cursor1 and the waveform

Y2: Vertical value at the intersection of Cursor2 and the waveform

ΔY : Difference in the vertical values at the intersection of Cursor1/Cursor2 and the waveform

Cursor Value Read Mode

4. Tap **Item Setup/Other Setup**, or press the soft key.
5. Tap **Cursor Read Mode**, or press the soft key to set the cursor value read mode.
The two modes available for reading Y1 and Y2 measurements are Display (display data) or ACQ (acquisition data).
 - Display: The screen is divided into 1001 parts, and the maximum and minimum values displayed on those rasters are read.
 - ACQ: Measurement data acquired at the sample rate of each waveform is read. When all traces are selected, measurement data acquired at the sample rate calculated from T/div and record length is read.

10.3 Measuring with Marker Cursors (Marker)

This section explains the following settings for measuring T-Y waveforms with marker cursors:
For information on cursor measurement on X-Y waveforms, see chapter 6.3.

Items Common to Scope Mode and Recorder Mode

- Turning the cursors on and off
- Cursor type
- Marker type
- Measurement source waveform
- Cursor position
- Cursor jump
- Measurement items
- Marker form
- Cursor value read mode
- Cursor intensity

► [“Marker Cursors \(Marker\)” in the Features Guide](#)

CURSOR Marker menu

1. On the waveform screen’s MENU, tap **ANALYSIS** > **CURSOR**, or press **CURSOR**.
2. Tap **Mode**, or press the soft key to select **ON**.
3. Tap **Type**, or press the soft key to select **Marker**.

The image shows two screenshots of the CURSOR Marker menu. The left screenshot shows the main menu with the following items and annotations:

- Mode**: Turns cursor measurement on or off (ON is selected).
- Type**: Set the cursor type to Marker.
- Marker**: Set the marker you want to edit (Marker1 X, Marker2 +, Marker3 Y, Marker2 ^).
- Marker1 X**: Set the measurement source waveform (OFF, CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Math1 to Math8, RTmath1 to RTmath16, Power, Harmonic, GPS).
- Trace**: Set the marker position.
- CHI**: Set measurement and other items.
- Position**: Set measurement and other items.
- Cursor Jump**: See “Cursor Jump.”
- Item Setup/Other Setup**: Set measurement and other items.

The right screenshot shows the sub-menu for Item Setup/Other Setup with the following items and annotations:

- Item Setup**: See “Setting Measurement Items.”
- Target**: Select the cursor measurement target (high-speed, low-speed)*
- High Speed**: Select the cursor measurement target (high-speed, low-speed)*
- Marker Form**: Set the marker shape (Marker, Line).
- Marker Form**: Set the marker shape (Marker, Line).
- Cursor Read Mode**: See “Cursor Value Read Mode.”
- Brightness**: Set the cursor display intensity.

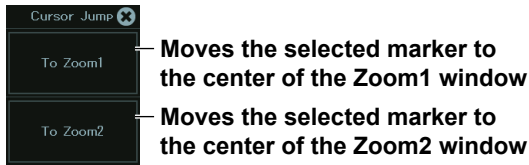
* Set this when dual capture is on.

Cursor Jump (Cursor Jump)

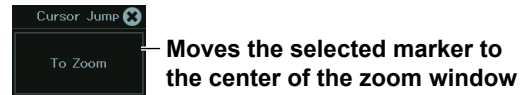
4. Tap **Cursor Jump**, or press the soft key. The following window appears.

Scope Mode

When Dual Capture Mode Is Off

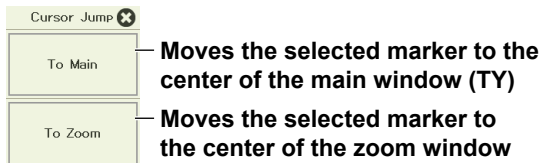


When dual capture mode is on*



* You can use this feature on the cursor measurement target waveform on either the high-speed sampling waveform or low-speed sampling waveform.

Recorder Mode

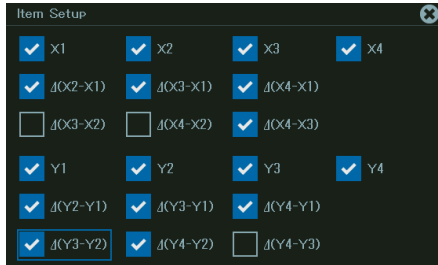


Note

You can configure the cursor jump feature when the target zoom window is turned on.

Setting Measurement Items (Item Setup)

4. Tap **Item Setup/Other Setup**, or press the soft key.
5. Tap **Item Setup**, or press the soft key. The following screen appears.



Select the measurement items that you want to use.

- X1 Time value at Marker1
- X2 Time value at Marker2
- X3 Time value at Marker3
- X4 Time value at Marker4
- Δ(X2-X1) Difference between the time values of Marker1 and Marker2
- Δ(X3-X1) Difference between the time values of Marker1 and Marker3
- Δ(X4-X1) Difference between the time values of Marker1 and Marker4
- Δ(X3-X2) Difference between the time values of Marker2 and Marker3
- Δ(X4-X2) Difference between the time values of Marker2 and Marker4
- Δ(X4-X3) Difference between the time values of Marker3 and Marker4
- Y1 Vertical value at Marker1
- Y2 Vertical value at Marker2
- Y3 Vertical value at Marker3
- Y4 Vertical value at Marker4
- Δ(Y2-Y1) Difference between the vertical values of Marker1 and Marker2
- Δ(Y3-Y1) Difference between the vertical values of Marker1 and Marker3
- Δ(Y4-Y1) Difference between the vertical values of Marker1 and Marker4
- Δ(Y3-Y2) Difference between the vertical values of Marker2 and Marker3
- Δ(Y4-Y2) Difference between the vertical values of Marker2 and Marker4
- Δ(Y4-Y3) Difference between the vertical values of Marker3 and Marker4

Cursor Value Read Mode

► section 10.2

10.4 Measuring with Angle Cursors (Degree)

This section explains the following settings for measuring T-Y waveforms with angle cursors:

Items Common to Scope Mode and Recorder Mode

- Turning the cursors on and off
- Cursor type
- Source waveform
- Cursor position
- Reference cursor position
- Cursor jump
- Measurement items
- Reference angle
- Cursor value read mode
- Cursor intensity

► [“Angle Cursors \(Degree\)” in the Features Guide](#)

CURSOR Degree menu

1. On the waveform screen’s MENU, tap **ANALYSIS** > **CURSOR**, or press **CURSOR**.
2. Tap **Mode**, or press the soft key to select **ON**.
3. Tap **Type**, or press the soft key to select **Degree**.

The image shows two screenshots of the CURSOR Degree menu. The left screenshot is the main menu, and the right screenshot is the 'Item Setup/Other Setup' sub-menu. Annotations with lines pointing to specific menu items provide instructions for each.

Cursor (Close icon)

- Mode** — Turns cursor measurement on or off (OFF, ON)
- Type** — Set the cursor type to Degree. (Degree)
- Trace** — Set the measurement source waveform (ALL, CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Math1 to Math8, RTmath1 to RTmath16, Power, Harmonic, GPS). (CH1)
- Cursor1** — Set the cursor positions. (4.000div)
- Cursor2** — Set the cursor positions. (4.000div)
- Reference1** — Set the reference cursor position. (2.000div)
- Reference2** — Set the reference cursor position. (2.000div)
- Cursor Jump** — See “Cursor Jump.”
- Item Setup/Other Setup** — Set measurement and other items.

Item Setup/Other Setup (Close icon)

- Item Setup** — See “Setting Measurement Items.”
- Target** — Select the cursor measurement target (high-speed, low-speed)*
- High Speed** — Select the cursor measurement target (high-speed, low-speed)*
- RefValue** — Set the reference angle (1-720). (Angle between the reference cursors (R1, R2)) (360)
- Cursor Read Mode** — See “Cursor Value Read Mode.” (Display, ACQ)
- Brightness** — Set the cursor display intensity. (0)

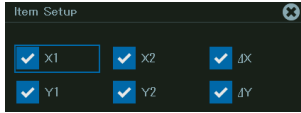
* Set this when dual capture is on.

Cursor Jump (Cursor Jump)

► section 10.2

Setting Measurement Items (Item Setup)

4. Tap **Item Setup/Other Setup**, or press the soft key.
5. Tap **Item Setup**, or press the soft key. The following screen appears.



Select the measurement items that you want to use.

X1: Time value at Cursor1

X2: Time value at Cursor2

Δ X: Difference between the time values of Cursor1 and Cursor2

Y1: Vertical value at the intersection of Cursor1 and the waveform

Y2: Vertical value at the intersection of Cursor2 and the waveform

Δ Y: Difference in the vertical values at the intersection of
Cursor1/Cursor2 and the waveform

Cursor Value Read Mode

► section 10.2

10.5 Measuring with Horizontal and Vertical Cursors (H & V)

This section explains the following settings for measuring T-Y waveforms with horizontal and vertical cursors:

For information on cursor measurement on X-Y waveforms, see chapter 6.3.

Items Common to Scope Mode and Recorder Mode

- Turning the cursors on and off
- Cursor type
- Source waveform
- Vertical cursor position
- Horizontal cursor position
- Cursor jump
- Measurement items
- Measurement source window

► [“Horizontal and Vertical Cursors \(H & V\)” in the Features Guide](#)

CURSOR H & V menu

1. On the waveform screen’s MENU, tap **ANALYSIS > CURSOR**, or press **CURSOR**.
2. Tap **Mode**, or press the soft key to select **ON**.
3. Tap **Type**, or press the soft key to select **H & V**.

The image shows two screenshots of the CURSOR H & V menu. The left screenshot shows the main menu with the following options and descriptions:

- Mode** — Turns cursor measurement on or off (OFF, ON)
- Type** — Set the cursor type to H&V (H & V)
- Trace** — Set the measurement source waveform (CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Math1 to Math8, RTmath1 to RTmath16, Power, Harmonic, GPS) (CH1)
- H-Cursor1** — Set the horizontal cursor positions (3.00div)
- H-Cursor2** — Set the horizontal cursor positions (3.00div)
- V-Cursor1** — Set the vertical cursor positions (0.000div)
- V-Cursor2** — Set the vertical cursor positions (4.000div)
- Cursor Jump** — See “Cursor Jump.”
- Item Setup/Other Setup** — Set measurement and other items.

The right screenshot shows the **Item Setup/Other Setup** sub-menu with the following options and descriptions:

- Item Setup** — See “Setting Measurement Items.”
- Target** — Select the cursor measurement target (High Speed) (High Speed)
- Cursor Read Mode** — See “Cursor Value Read Mode.” (Display, ACQ)
- Brightness** — Set the cursor display intensity (8)

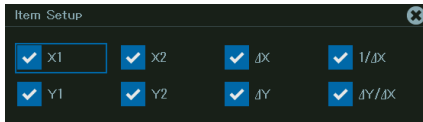
* Set this when dual capture is on.

Cursor Jump (Cursor Jump)

► section 10.2

Setting Measurement Items (Item Setup)

4. Tap **Item Setup/Other Setup**, or press the soft key.
5. Tap **Item Setup**, or press the soft key. The following screen appears.



Select the measurement items that you want to use.

- X1: Time value at V-Cursor1
- X2: Time value at V-Cursor2
- ΔX: Difference between the time values of V-Cursor1 and V-Cursor2
- 1/ΔX: Reciprocal of the difference between the time values of V-Cursor1 and V-Cursor2
- Y1: Vertical value of H-Cursor1
- Y2: Vertical value of H-Cursor2
- ΔY: Difference between the vertical values of H-Cursor1 and H-Cursor2
- ΔY/ΔX: The amount of change in the vertical value per unit time in the cursor range

Cursor Value Read Mode

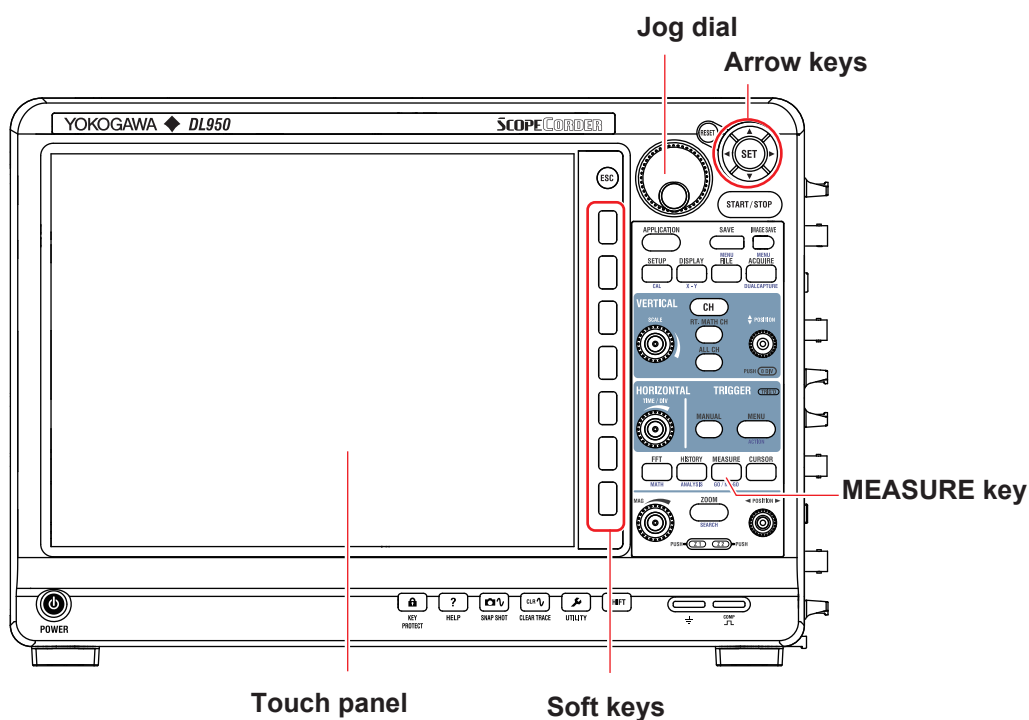
► section 10.2

Chapter 11

Automated Measurement of Waveform Parameters

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
11.1 Automatically Measuring Waveform Parameters	✓	✓
11.2 Performing Continuous Statistical Processing	✓	-
11.3 Performing Cyclic Statistical Processing	✓	✓
11.4 Performing Statistical Processing on History Waveforms (Scope mode)	✓	-

* The settings may vary depending on the operation mode.

11.1 Automatically Measuring Waveform Parameters

This section explains the following settings for automatically measuring waveform parameters:

Items Common to Scope Mode and Recorder Mode

- Turning automated measurement on and off
- Source waveform and measurement items
- Delay settings
- Turning period measurement on and off
- Time measurement reference level
- Measurement window and measurement time period

▶ [“Automated Measurement of Waveform Parameters” in the Features Guide](#)

MEASURE Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > MEASURE**, or press **MEASURE**.

When Dual Capture Mode Is Off

— Turns automated measurement on or off

— See [“Setting the Source Waveform and Measurement Items.”](#)

— Set the measurement time period.

— See [“Setting the Time Measurement Reference Level and 1-Cycle Mode.”](#)

— Set statistical processing to OFF.
Continuous ▶ sec.11.2. Cycle ▶ sec. 11.3. History ▶ sec. 11.4.

— See [“Setting the Indicator.”](#)

— See [“Setting Measurement Time Period 2.”](#)

When Dual Capture Mode Is On

— See [“During Dual Capture.”](#)

Setting the Source Waveform and Measurement Items (Measure Setup)

2. Tap **Measure Setup**, or press the soft key. The following menu appears.

When the source waveform is other than logic or XY

Set the source waveform.*
(Slide to display waveforms that do not fit in the screen.)

Unselects all measurement items
See “Copying to Specified Channels.”

Set measurement items.

Set the source waveform.*
(Slide to display waveforms that do not fit in the screen.)

See “Setting the Delay.”

Clears the settings of all waveforms

When the source waveform is logic

When the source waveform is XY (XY1 to XY8)

* Depending on the channel you select, you need to select sub channels and bits.

Copying to Specified Channels (Copy to)

3. Tap **Copy to**, or select **Copy to** using the jog dial or arrow keys, and press **SET**. The following screen appears.

Copying is not possible when the copy source waveform is an XY waveform.

Copy source channel

Select the channels that you want to copy to.
(Slide to display waveforms that do not fit in the screen.)

Clears all selected channels

Selects all channels

Starts copying

Setting the Delay

3. Tap **Delay**, or select **Delay** using the jog dial or arrow keys, and press **SET**. The following screen appears.

Set the delay value unit (Time, Degree¹).

Set the slope of the edge to be detected.

Set which counted edge to use as a detected point.

Set the delay measurement reference.¹

Set the reference waveform conditions. (only when Reference is set to Trace)

Set the reference waveform.²
(Slide to display waveforms that do not fit in the screen.)

Set the slope of the edge to be detected.

Set which counted edge to use as a detected point.

1 You cannot set Degree of Mode and Trigger of Reference Trace at the same time.
 2 Depending on the channel you select, you need to select sub channels and bits.

Setting the Measurement Time Period (Time Range1/Time Range2)

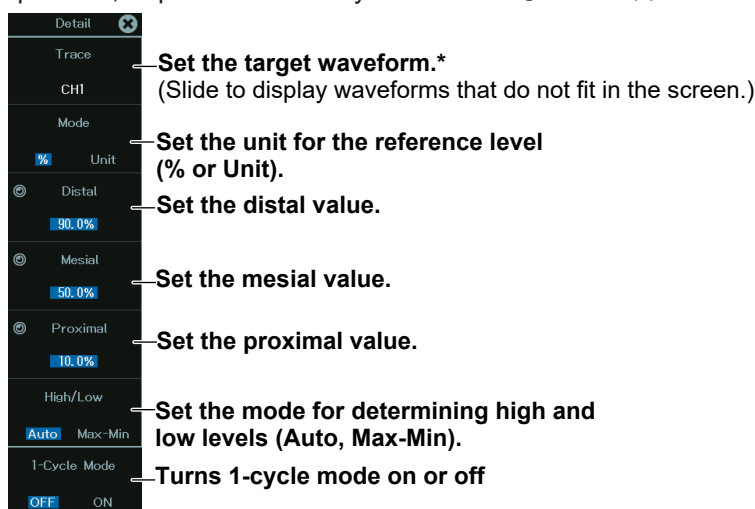
The specified parameters are measured in the range between the measurement start point (Time Range1) and measurement end point (Time Range2).

Note

For SSD recording waveforms, up to 100 Mpoint from the measurement start point (Time Range1) are measured.

Setting the Time Measurement Reference Level and 1-Cycle Mode (Detail)

2. Tap **Detail**, or press the soft key. The following menu appears.



* Depending on the channel you select, you need to select sub channels and bits.

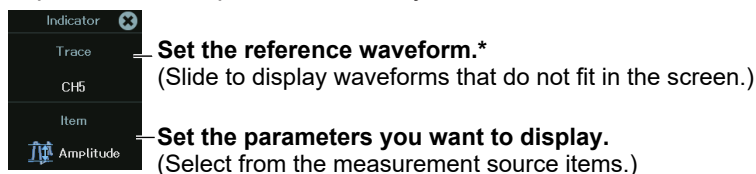
Note

When 1-cycle mode is on, if the interval between Time Range1 and Time Range2 is less than 1 cycle, the measured value will be "*****."

Setting the Indicator (Indicator)

The measurement area of the specified item is displayed with cursors.

2. Tap **Indicator**, or press the soft key. The following menu appears.



* Depending on the channel you select, you need to select sub channels and bits.

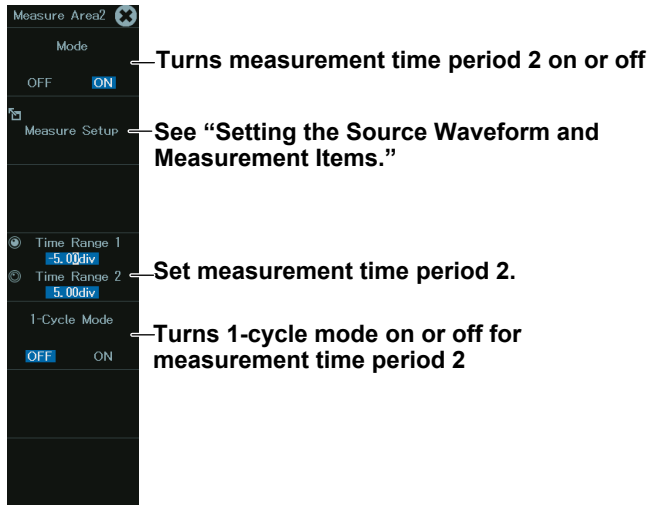
The measurement areas of the following items can be indicated.

Peak to Peak, Amplitude, Maximum, Minimum, High, Low, Average, Middle, RMS, Std, Deviation, +Overshoot, -Overshoot, Rise, Fall, Frequency, Period, +Width, -Width, Duty, Burst1, Burst2, Avg Frequency, Avg Period, Integ1TY+, Integ2TY, Delay

Setting Measurement Time Period 2 (Area2 Mode)

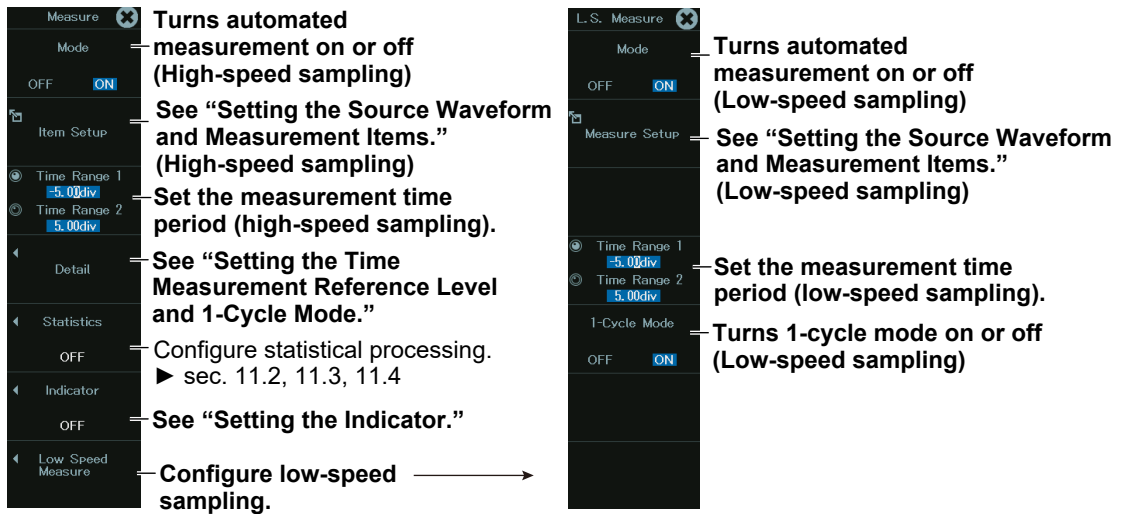
Set this to simultaneously measure parameters in two areas.

2. Tap **Area2 Mode**, or press the soft key. The following menu appears.



During Dual Capture

When measuring in dual capture mode, set the measurement time period, measurement items, and 1-cycle mode separately for high-speed sampling and low-speed sampling.



11.2 Performing Continuous Statistical Processing

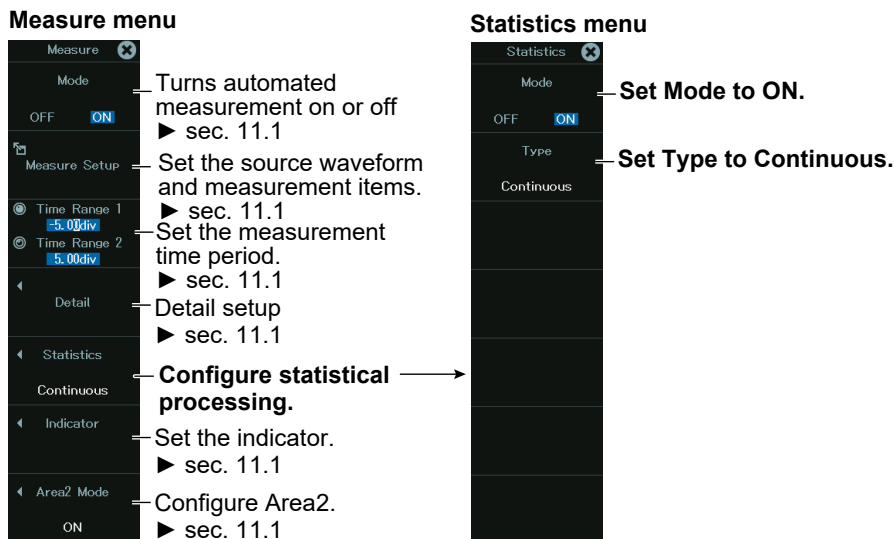
This section explains the following setting for performing continuous statistical processing on the displayed waveforms:

Items Common to Scope Mode and Recorder Mode

- Turning statistical processing on
 - ▶ [“Continuous Statistical Processing \(Continuous\)” in the Features Guide](#)

MEASURE Statistics Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > MEASURE**, or press **MEASURE**.
2. Tap **Statistics**, or press the soft key. The following screen appears.



11.3 Performing Cyclic Statistical Processing

This section explains the following settings for performing cycle statistic processing on the displayed waveforms):

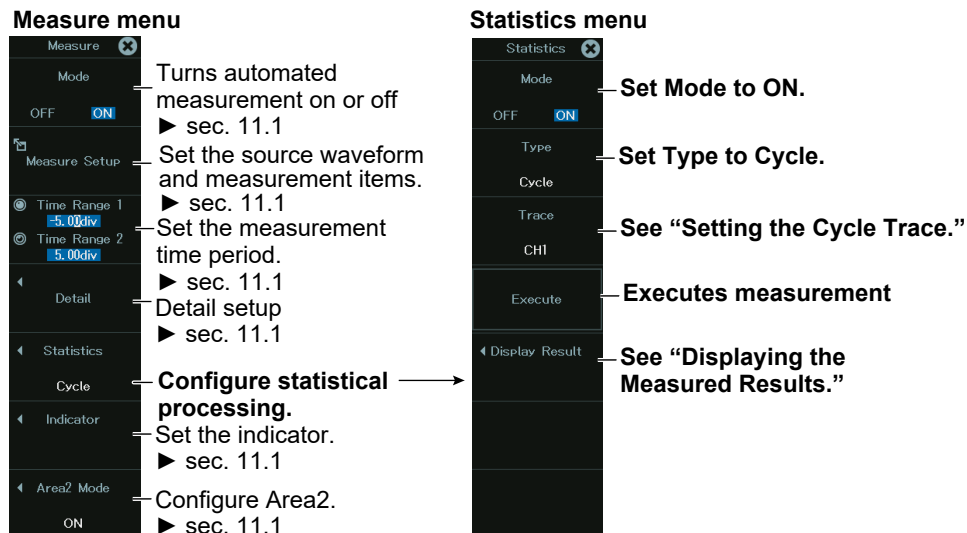
Items Common to Scope Mode and Recorder Mode

- Turning cycle statistics on
- Source waveform used to determine the cycle
- Displaying results

► [“Cyclic Statistical Processing \(Cycle\)” in the Features Guide](#)

MEASURE Statistics Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > MEASURE**, or press **MEASURE**.
2. Tap **Statistics**, or press the soft key. The following screen appears.



Setting the Cycle Trace (Trace)

3. Tap **Trace**, or press the soft key. Select the cycle trace from the following. Depending on the channel you select, you need to select sub channels and bits.

- Own:

The instrument determines the period of each source waveform. It then automatically measures the waveform parameters and performs statistical processing once per period. However, if signals that have different periods are applied to multiple channels, the number of iterations of automated measurement and statistical processing for each signal is equal to the number of periods in the slowest signal.

- CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, Math1 to Math8, FFT1 to FFT8, RTmath1 to RTmath16, Power, Harmonic, GPS:

The instrument automatically measures the waveform parameters of all the source waveforms and performs statistical processing on the measured values for each cycle of the specified channel.

Displaying the Measured Results (Display Result)

3. Tap **Display Result**, or press the soft key. The following screen appears.

↑: Displayed next to the maximum value of each measurement item.
 ↓: Displayed next to the minimum value of each measurement item.

	P-P(CH1)	Amp(CH1)	High(CH1)	Low(CH1)
1	xxxxx	xxxxx	xxxxx	xxxxx
2	xxxxx	xxxxx	xxxxx	xxxxx
3	xxxxx	xxxxx	xxxxx	xxxxx
4	xxxxx	xxxxx	xxxxx	xxxxx
5	xxxxx	xxxxx	xxxxx	xxxxx
6	xxxxx	xxxxx	xxxxx	xxxxx
7	xxxxx	xxxxx	xxxxx	xxxxx
8	xxxxx	xxxxx	xxxxx	xxxxx
9	xxxxx	xxxxx	xxxxx	xxxxx
10	xxxxx	xxxxx	xxxxx	xxxxx
11	xxxxx	xxxxx	xxxxx	xxxxx
12	xxxxx	xxxxx	xxxxx	xxxxx
13	xxxxx	xxxxx	xxxxx	xxxxx
14	xxxxx	xxxxx	xxxxx	xxxxx

Sort
 Forward
 Sorts the display (Forward, Reverse)

Statistics Max
 Displays the maximum value

Statistics Min
 Displays the minimum value

When this scroll bar is displayed, you can drag the screen or use the left and right arrow keys to scroll the display.

11.4 Performing Statistical Processing on History Waveforms (Scope mode)

This section explains the following settings for performing statistical processing on history waveforms:

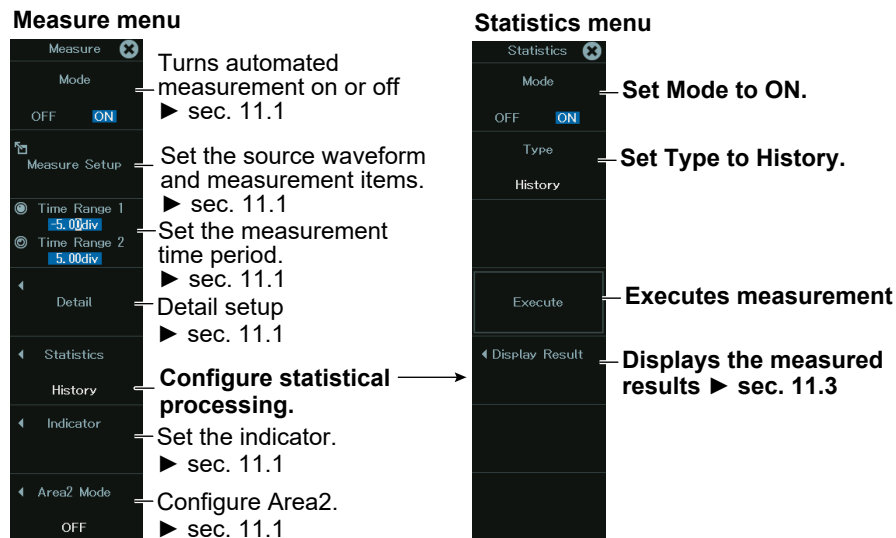
Scope Mode

- Turning history waveform statistics on
- Displaying results

► [“Statistical Processing of History Waveforms \(History\)” in the Features Guide](#)

MEASURE Statistics Menu

1. On the waveform screen's MENU, tap **ANALYSIS > MEASURE**, or press **Measure**.
2. Tap **Statistics**, or press the soft key. The following screen appears.

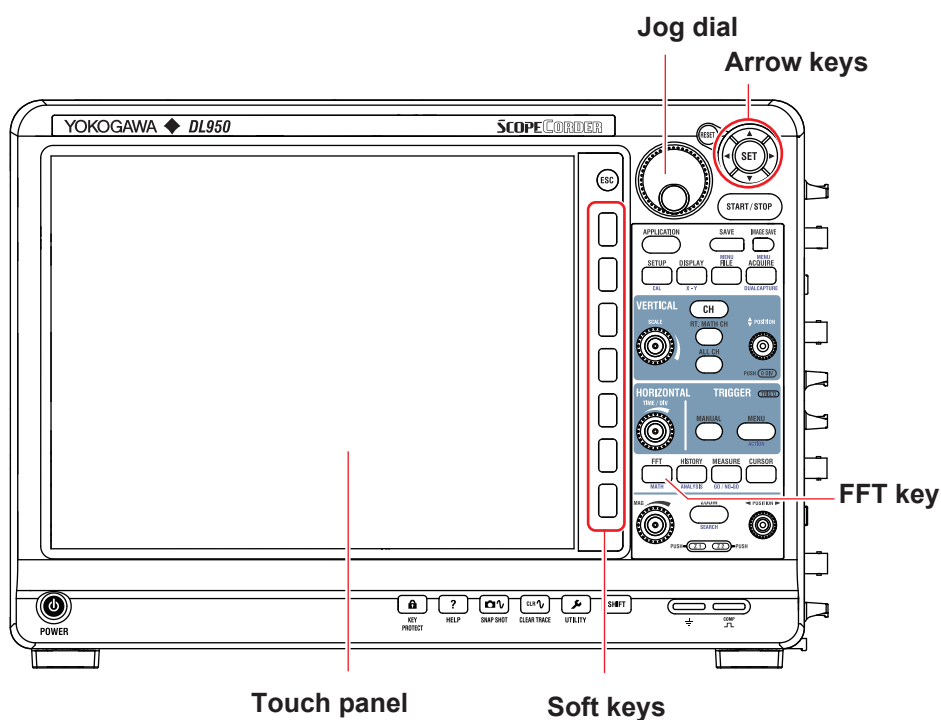


Chapter 12

FFT

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
12.1 Displaying FFT Waveforms	✓	✓
12.2 Setting the Details of the FFT	✓	✓
12.3 Measuring FFT Waveforms with Cursors	✓	✓

* The settings may vary depending on the operation mode.

12.1 Displaying FFT Waveforms

This section explains the following FFT waveform display settings:

Items Common to Scope Mode and Recorder Mode

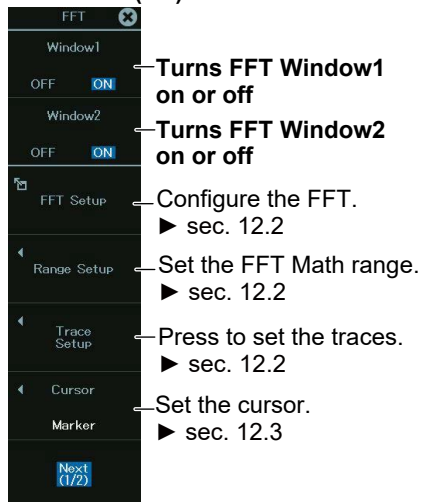
- Turning the window for displaying FFT waveforms on and off
- Main waveform display area ratio
- FFT window layout
- Turning FFT window linking on and off
- Window1 and Window2 display settings

- ▶ “Display Ratio of the Main Window (Main Ratio),”
“Window Layout (Window Layout),”
“Combine Display (Combine Display),” and
“Window Display Setup (Window Display Setup)” in the Features Guide

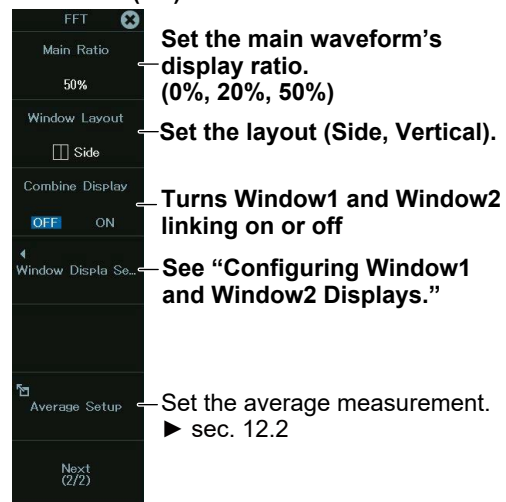
FFT Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > FFT**, or press **FFT**. The following screen appears.

FFT menu (1/2)



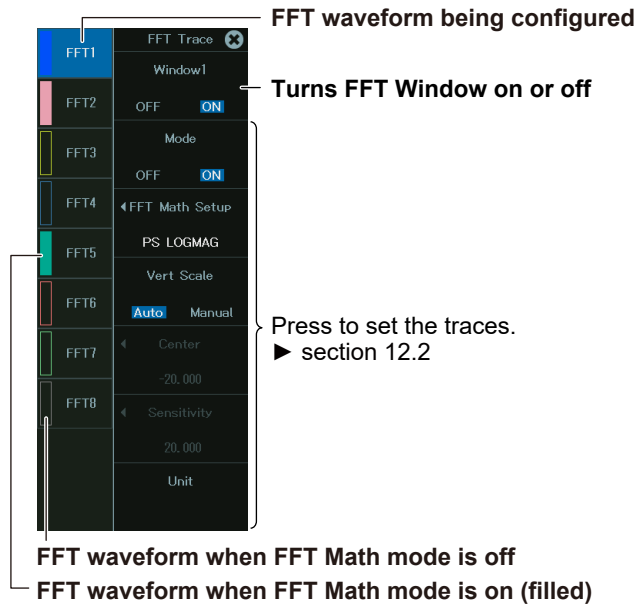
FFT menu (2/2)



Note

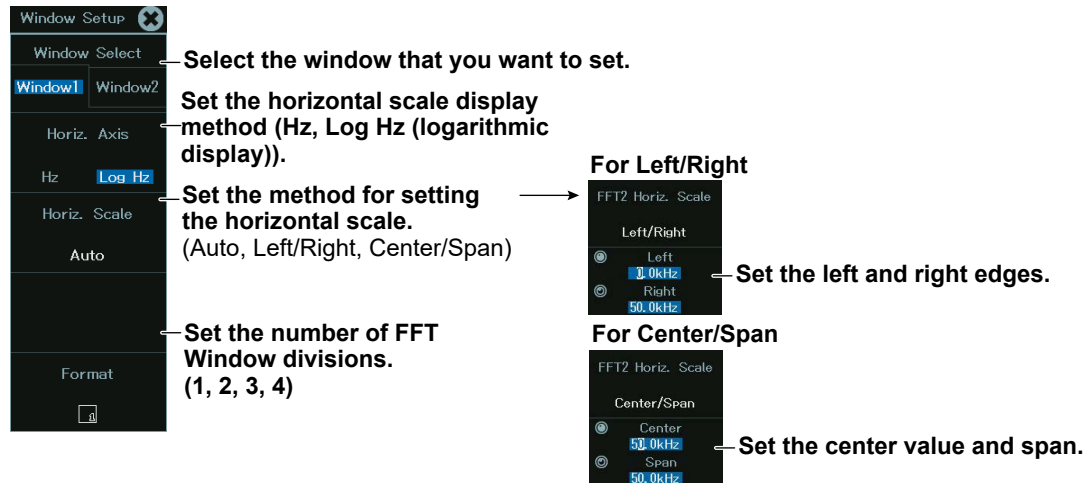
Selecting FFT waveforms

When the channel setup menu (CH key) or RealTime Math Menu (RT.MATH CH key) is displayed, if you tap an FFT waveform displayed on the screen, that waveform becomes configurable, and the following window appears.



Configuring Window1 and Window2 Displays

- On the FFT menu (2/2), tap **Window Display Setup**, or press the soft key. The following screen appears.



Waveforms Displayed in Window1 and Window2

Window1 displays the waveforms that are turned on from FFT1 to FFT4, and Window2 displays the waveforms that are turned on from FFT5 to FFT8.

When the window is divided, FFT waveforms are assigned in ascending order by number from the top area. When a waveform is assigned to the bottom area, subsequent waveforms are assigned again in order from the top area.

For the FFT1 to FFT8 settings, see section 12.2.

12.2 Setting the Details of the FFT

This section explains the detail settings of FFT waveforms.

Items Common to Scope Mode and Recorder Mode

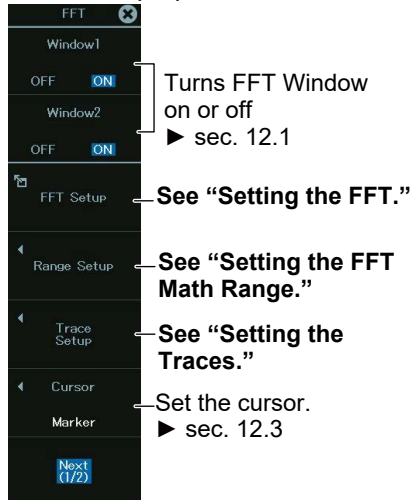
- FFT start point and number of FFT points
- Window function
- Spectrum type and sub type
- Source waveform
- Setting the vertical scale (center value, minimum unit)
- Setting the average measurement

► “All FFT Computation Setup (FFT Setup),”
“FFT Computation Range Setup (Range Setup),”
“FFT Trace Setup (Trace Setup),”
“FFT Math Setup (FFT Math Setup),” and
“Average Setup (Average Setup)/(G02 option)” in the Features Guide

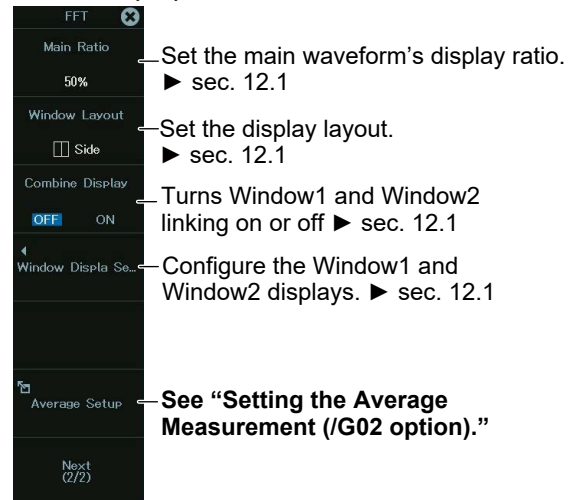
FFT Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > FFT**, or press **FFT**. The following screen appears.

FFT menu (1/2)



FFT menu (2/2)



Setting the FFT (FFT Setup)

2. On the FFT menu (1/2), tap **FFT Setup**, or press the soft key. The following screen appears.

Configure FFT Window1. **Configure FFT Window2.**

Turns FFT Window1 and 2 on or off¹
 FFT start point²
 Number of FFT points² (1k, 2k, 5k, 10k, 20k, 50k, 100k)
 Set the window function.³ (Rect, Hanning, FlatTop, Hamming, Exponential)

Set source waveform 2.⁴ (Needs to be set depending on the spectrum type)
 Set the source waveform.⁴
 Set the spectrum sub type⁴ (REAL, IMAG, MAG, LOGMAG, PHASE).
 Set the spectrum type⁴ (LS, RS, PS, PSD, CS, TF, or CH).

Turns FFT on or off.⁴

- 1: Same as the Window1 and Window2 on/off setting in section 12.1
- 2: Same as the FFT Math range setting
- 3: Same as the window function setting of average measurement
- 4: Same as the trace setting

Note

If the number of points is set to 50 k, you cannot display FFT1, FFT2, FFT5, or FFT6.
 If the number of points is set to 100 k, you can only display FFT1 and FFT5.

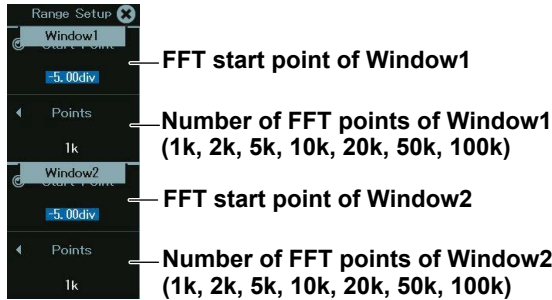
Setting the Exponential Window Function (/G02 option)

When the window function is set to Exponential, use the Setup button to set the damping rate and measurement time period.

Set the damping rate.
 Set the math range.

Setting the FFT Math Range (Range Setup)

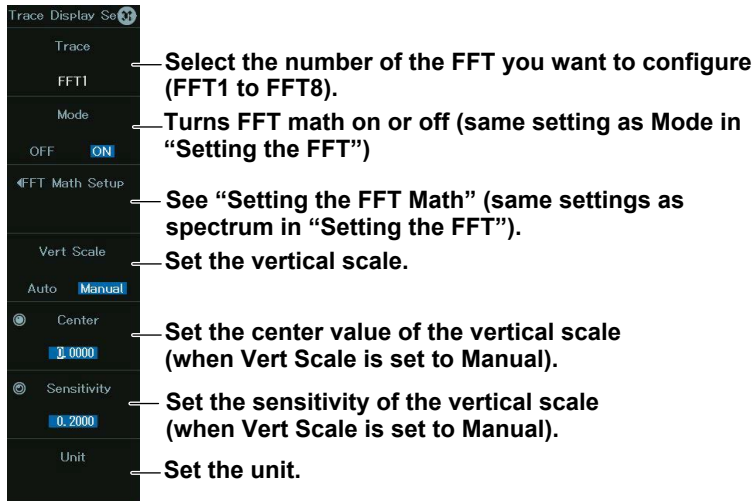
- On the FFT menu (1/2), tap **Range Setup**, or press the soft key. The following screen appears.



The FFT start point and the number of FFT points are the same as those explained in “Setting the FFT.”

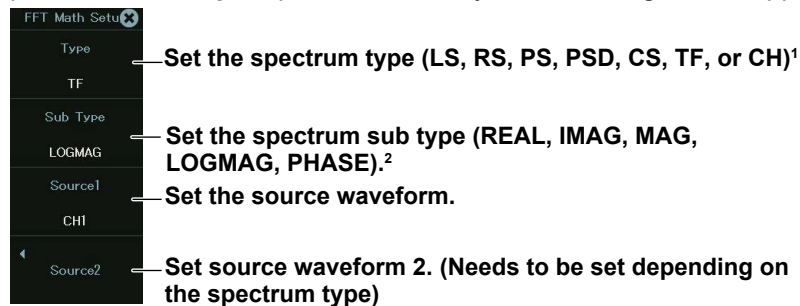
Setting the Traces (Trace Setup)

- On the FFT menu (1/2), tap **Trace Setup**, or press the soft key. The following screen appears.



Setting the FFT Math (FFT Math Setup)

- Tap **FFT Math Setup**, or press the soft key. The following screen appears.



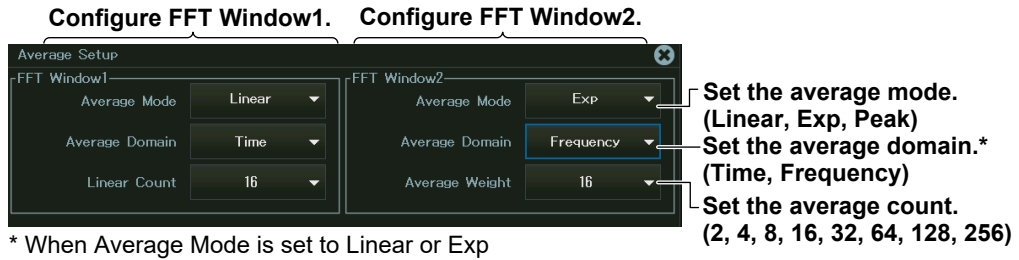
1: Fixed to PS when the /G02 option is not installed.

2: Fixed to LOGMAG when the /G02 option is not installed.

The FFT math settings are the same as the spectrum type, sub type, and source waveform settings explained in “Setting the FFT.”

Setting the Average Measurement (Average Setup) (/G02 option)

2. On the FFT menu (2/2), tap **Average Setup**, or press the soft key. The following screen appears.



12.3 Measuring FFT Waveforms with Cursors

This section explains cursor measurements of FFT waveforms.

Items Common to Scope Mode and Recorder Mode

- Turning the cursors on and off
- Cursor type

Marker cursor

- Source waveform
- Marker position
- Marker form
- Measurement items

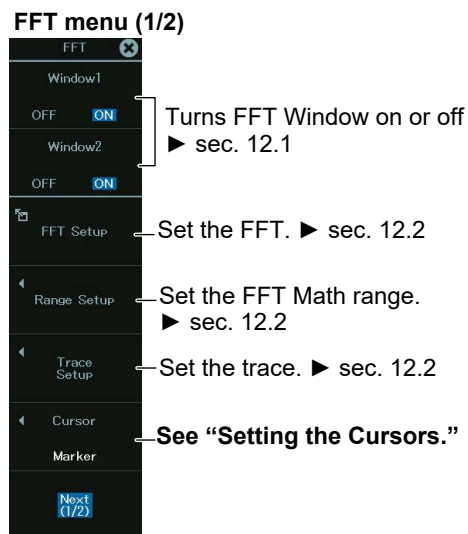
Peak cursor

- Measurement time period
- Measurement items

► “Maker Cursor (Maker)”, “Peak Cursor (Peak)”, and “Peak List (Peak List)” in the Features Guide

FFT Menu

1. On the waveform screen’s MENU, tap **ANALYSIS** > **FFT**, or press **FFT**. The following screen appears.

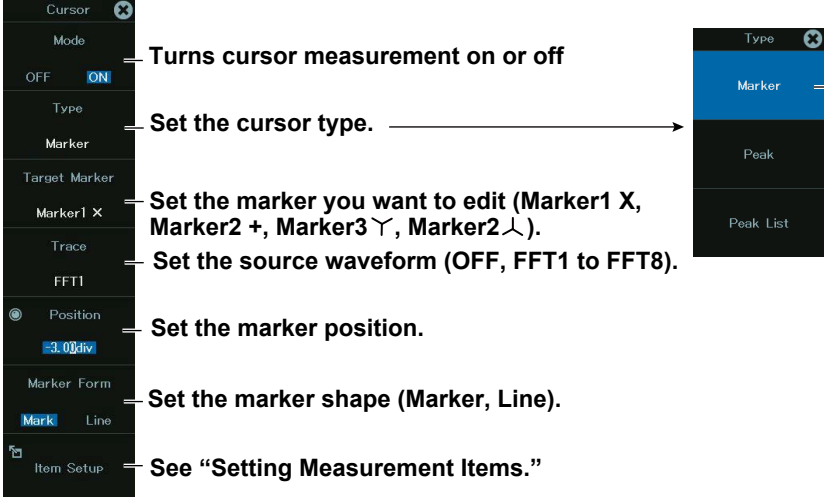


Setting the Cursors (Cursor)

2. On the FFT menu (1/2), tap **Cursor**, or press the soft key.

Measuring with Marker Cursors (Marker)

3. Tap **Type**, or press the soft key, and select **Marker** on the screen that appears.

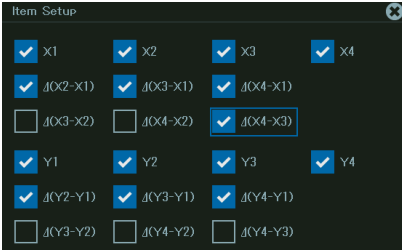


The image shows two screenshots from a software interface. The left screenshot is the 'Cursor' menu, and the right screenshot is the 'Type' sub-menu.

- Cursor Menu:**
 - Mode:** OFF, ON (ON is selected) — Turns cursor measurement on or off
 - Type:** Marker — Set the cursor type.
 - Target Marker:** Marker1 X — Set the marker you want to edit (Marker1 X, Marker2 +, Marker3 Y, Marker2 ^).
 - Trace:** FFT1 — Set the source waveform (OFF, FFT1 to FFT8).
 - Position:** 3.00div — Set the marker position.
 - Marker Form:** Mark, Line — Set the marker shape (Marker, Line).
 - Item Setup:** — See "Setting Measurement Items."
- Type Menu:**
 - Marker:** — Set the cursor type to Marker.
 - Peak:**
 - Peak List:**

Setting Measurement Items (Item Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.



The image shows the 'Item Setup' menu with various measurement items and their checkboxes.

- X1
- X2
- X3
- X4
- Δ(X2-X1)
- Δ(X3-X1)
- Δ(X4-X1)
- Δ(X3-X2)
- Δ(X4-X2)
- Δ(X4-X3)
- Y1
- Y2
- Y3
- Y4
- Δ(Y2-Y1)
- Δ(Y3-Y1)
- Δ(Y4-Y1)
- Δ(Y3-Y2)
- Δ(Y4-Y2)
- Δ(Y4-Y3)

Select the measurement items that you want to use.

X1	Frequency of Marker1
X2	Frequency of Marker2
X3	Frequency of Marker3
X4	Frequency of Marker4
Δ(X2-X1)	Frequency difference between Marker1 and Marker2
Δ(X3-X1)	Frequency difference between Marker1 and Marker3
Δ(X4-X1)	Frequency difference between Marker1 and Marker4
Δ(X3-X2)	Frequency difference between Marker2 and Marker3
Δ(X4-X2)	Frequency difference between Marker2 and Marker4
Δ(X4-X3)	Frequency difference between Marker3 and Marker4
Y1	Vertical value at Marker1
Y2	Vertical value at Marker2
Y3	Vertical value at Marker3
Y4	Vertical value at Marker4
Δ(Y2-Y1)	Difference between the vertical values of Marker1 and Marker2
Δ(Y3-Y1)	Difference between the vertical values of Marker1 and Marker3
Δ(Y4-Y1)	Difference between the vertical values of Marker1 and Marker4
Δ(Y3-Y2)	Difference between the vertical values of Marker2 and Marker3
Δ(Y4-Y2)	Difference between the vertical values of Marker2 and Marker4
Δ(Y4-Y3)	Difference between the vertical values of Marker3 and Marker4

Measuring with Peak Cursors (Peak)

3. Tap **Type**, or press the soft key, and select **Peak** on the screen that appears.

Annotations for the **Cursor** menu:

- Mode**: Turns cursor measurement on or off (ON is selected).
- Type**: Set the cursor type. (An arrow points to the **Type** menu shown to the right).
- Peak**: Set the cursor type to Peak. (An arrow points to the **Peak** option in the **Type** menu).
- Window1 Range1**: Set the measurement time period of Window1. (Value: 5.00div)
- Window1 Range2**: Set the measurement time period of Window2. (Value: 5.00div)
- Window2 Range1**: Set the measurement time period of Window2. (Value: 5.00div)
- Window2 Range2**: Set the measurement time period of Window2. (Value: 5.00div)
- Item Setup**: See "Setting Measurement Items."

Annotations for the **Type** menu:

- Peak**: Set the cursor type to Peak.

Setting Measurement Items (Setup)

4. Tap **Item Setup**, or press the soft key. The following screen appears.

Annotations for the **Item Setup** menu:

- F1 to F8**: Select the measurement items that you want to use. (All checkboxes are checked).
 F1 to F8 The peak value frequencies of FFT1 to FFT8
 Y1 to Y8 Peak values of FFT1 to FFT8

Measuring with Peak List Cursors (Peak List)

3. Tap **Type**, or press the soft key to select **Peak** on the screen that appears.

Annotations for the **Cursor** menu:

- Mode**: Turns cursor measurement on or off (ON is selected).
- Type**: Set the cursor type. (An arrow points to the **Type** menu shown to the right).
- Peak List**: Set the cursor type to Peak List. (An arrow points to the **Peak List** option in the **Type** menu).
- Trace**: Set the measurement time period of Window1 when the source trace is FFT1 to FFT4 and that of Window2 when the source trace is FFT5 to FFT8.
- Window1 Range1**: Set the measurement time period of Window1 when the source trace is FFT1 to FFT4. (Value: 5.00div)
- Window1 Range2**: Set the measurement time period of Window2 when the source trace is FFT5 to FFT8. (Value: 5.00div)
- Threshold**: Set the threshold. (Value: 40.000)
- Excursion**: Set the difference between peak and bottom. (Value: 20.000)
- List**: Shows a list (An arrow points to the **Peak List** menu shown below).
- List No.**: Set the list number to display in the FFT Window. (Value: 1)

Annotations for the **Type** menu:

- Peak List**: Set the cursor type to Peak List.

Annotations for the **Peak List** menu:

- Frequency**: Frequency
- Peak**: Peak Value
- Peak specified by the list number**: Points to the peak value in the list.
- List number**: Points to the list number in the list.

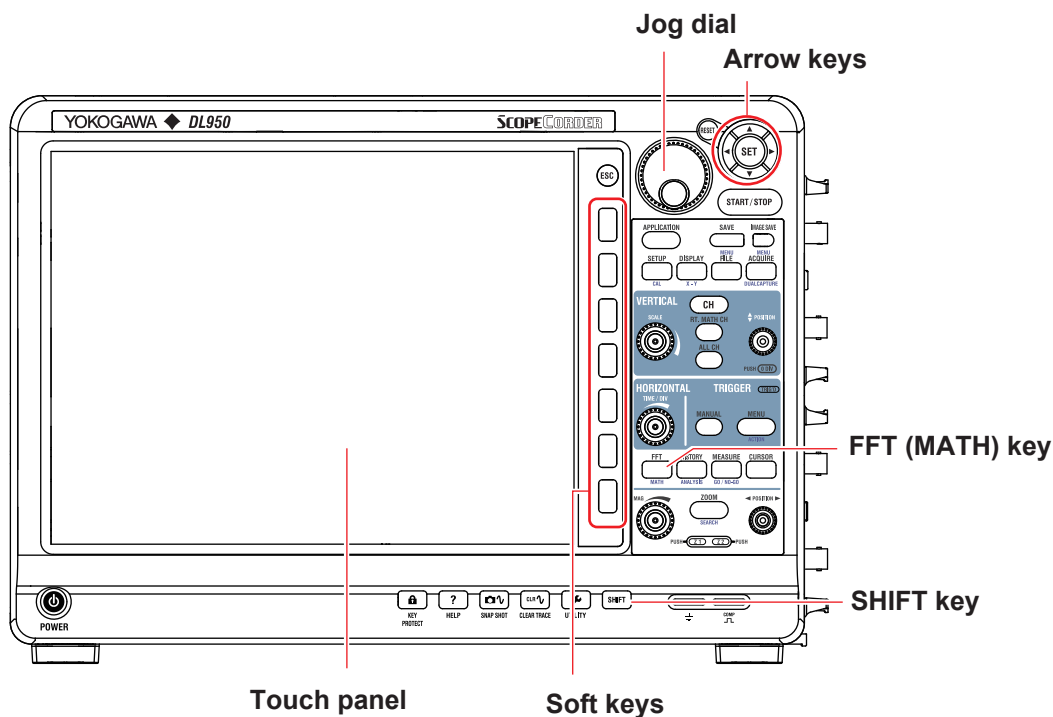
List number	Frequency	Peak
1	400Hz	-7.2375E+00
2	1.00kHz	-5.1083E+00 †
3	1.70kHz	-6.0042E+00
4	-	-
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-

Chapter 13

Math

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
13.1 Setting Expressions and Computation Ranges	✓	✓
13.2 Setting the Math Waveform Scaling	✓	✓
13.3 Setting Averaging (/G02 Option)	✓	✓
13.4 Performing User-Defined Math (/G02 option)	✓	✓

* The settings may vary depending on the operation mode.

13.1 Setting Expressions and Computation Ranges

This section explains the following settings for setting expressions:

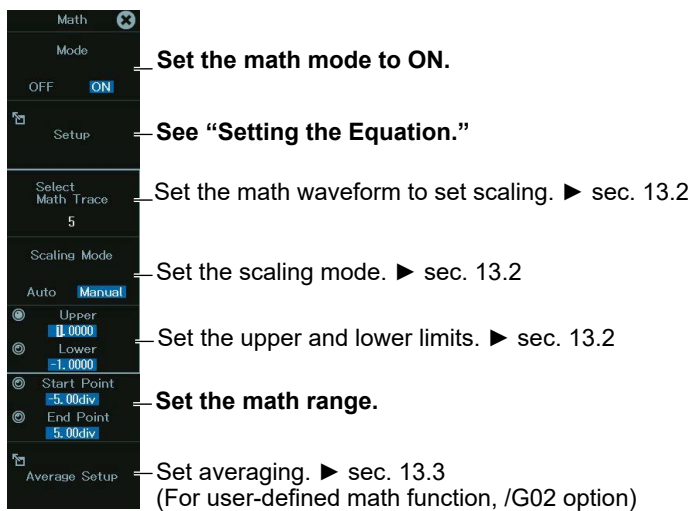
Items Common to Scope Mode and Recorder Mode

- Math waveform to edit
- Turning computation on and off
- Setting expressions (operator, function, computation source waveform, unit, label, settings for specific operators and functions)
- Setting the computation range

► [“Math” in the Features Guide](#)

Math Menu

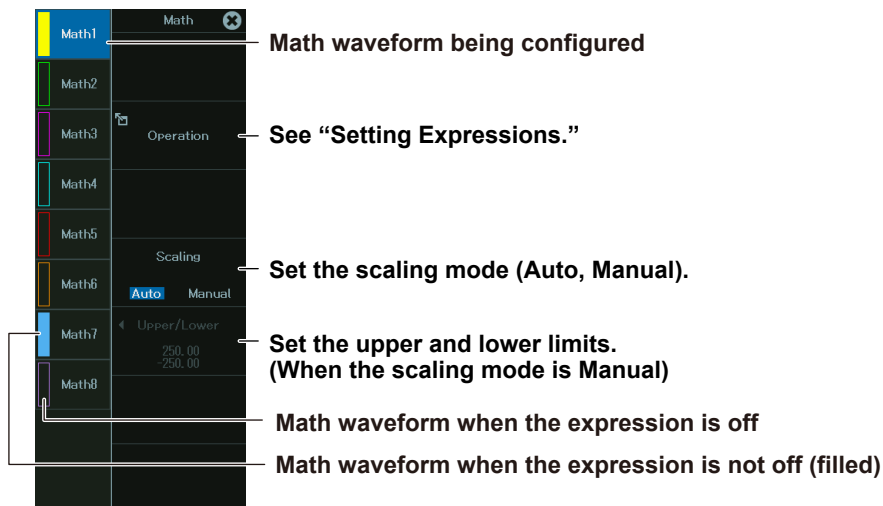
1. On the waveform screen’s MENU, tap **ANALYSIS > MATH**, or press **SHIFT+FFT (MATH)**. The Math menu appears.



Note

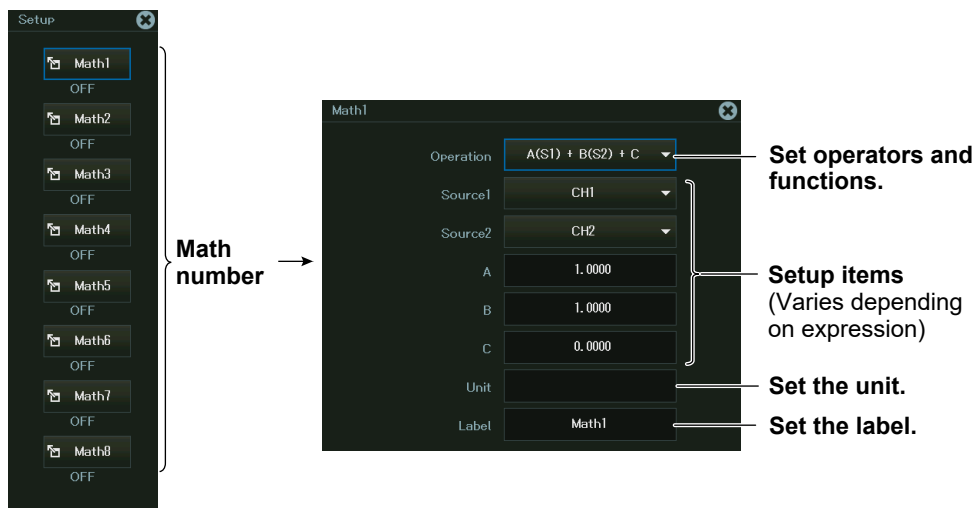
Selecting a Math waveform

When the channel setup menu (CH key) or RealTime Math Menu (RT.MATH CH key) is displayed, if you tap a math waveform displayed on the screen, that waveform becomes configurable, and the following window appears.



Setting the Expression (Setup)

2. Tap **Setup**, or press the soft key.
3. Tap the math number that you want to assign an expression to, or use a jog dial and arrow keys to select the math number, and press **SET**. The following screen appears.



Note

On models with the/G02 option, User Define (user define) is displayed in the expression list. For details on user-defined computation, see section 13.4.

Basic Arithmetic with Coefficients

The screenshot shows the configuration for Math1. The Operation dropdown is set to $A(S1) + B(S2) + C$. Source1 is CH1 and Source2 is CH2. Coefficients A, B, and C are set to 1.0000, 1.0000, and 0.0000 respectively. The Unit and Label fields are empty.

- Operation:** Select $A(S1)+B(S2)+C$, $A(S1)-B(S2)+C$, $A(S1)*B(S2)+C$, or $A(S1)/B(S2)+C$.
- Math source waveform:** CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, RTmath1 to RTmath16, Math1 to Math7 (math channel with a number smaller than the number of the math channel you are setting)
- Scale value:** A, B, C
- Offset:** C
- Set the unit.** Unit
- Set the label.** Label

Basic arithmetic without coefficients is selected when you set scale value A and B to 1 and offset value C to 0.

Binary Computation

The screenshot shows the configuration for Math2. The Operation dropdown is set to Bin(S1). Source is CH3_1. Thresholds are set to 0V for both Upper and Lower. The Unit and Label fields are empty.

- Operation:** Select Bin(S1).
- Math source waveform:** CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, RTmath1 to RTmath16, Math1 to Math7 (math channel with a number smaller than the number of the math channel you are setting)
- Upper threshold limit:** Thr. Upper
- Lower threshold limit:** Thr. Lower
- Set the unit.** Unit
- Set the label.** Label

Phase Shift

The screenshot shows the configuration for Math3. The Operation dropdown is set to Shift(S1). Source is CH1. The Shift amount is set to 0.00ms. The Unit and Label fields are empty.

- Operation:** Select Shift(S1).
- Math source waveform:** CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, RTmath1 to RTmath16, Math1 to Math7 (math channel with a number smaller than the number of the math channel you are setting)
- Phase shift amount:** Shift
- Set the unit.** Unit
- Set the label.** Label

13.2 Setting the Math Waveform Scaling

This section explains the following settings for displaying computed waveforms:

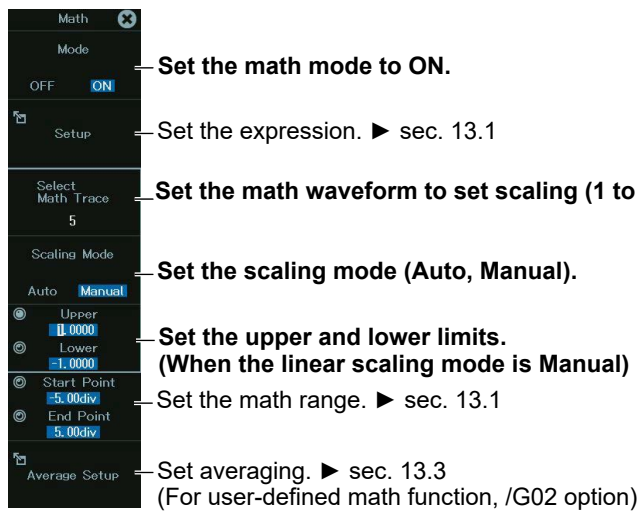
Items Common to Scope Mode and Recorder Mode

- Vertical scale

► “Scaling Mode (Scaling)” in the Features Guide

Math Menu

1. On the waveform screen’s MENU, tap **ANALYSIS > MATH**, or press **SHIFT+FFT (MATH)**. The Math menu appears.



13.3 Setting Averaging (/G02 Option)

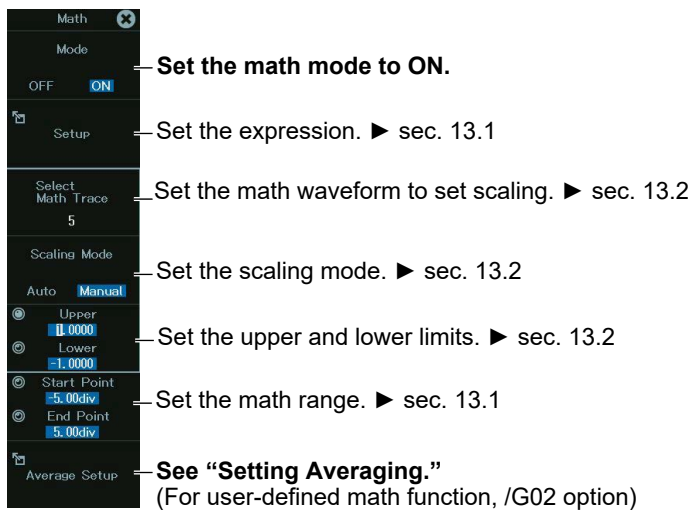
This section explains the following averaging settings:
The averaging explained here applies to math waveforms.

Items Common to Scope Mode and Recorder Mode

- Average settings (including peak computation)
 - ▶ [“Average Setup \(Average Setup\)\(/G02 option\)” in the Features Guide](#)

Math Menu

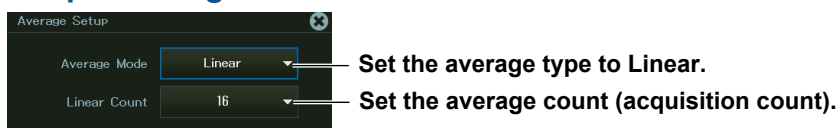
1. On the waveform screen’s MENU, tap **ANALYSIS > MATH**, or press **SHIFT+FFT (MATH)**. The Math menu appears.



Setting Averaging

2. Tap the **Average Setup** tab, or press the soft key. The following screen appears.

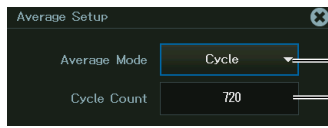
Simple average



Exponential average



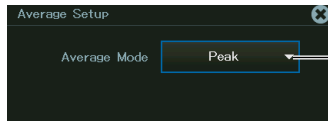
Cycle average



Set the average type to Cycle.

Set the number of data points in one cycle.

Peak computation



Set the average type to Peak.

13.4 Performing User-Defined Math (/G02 option)

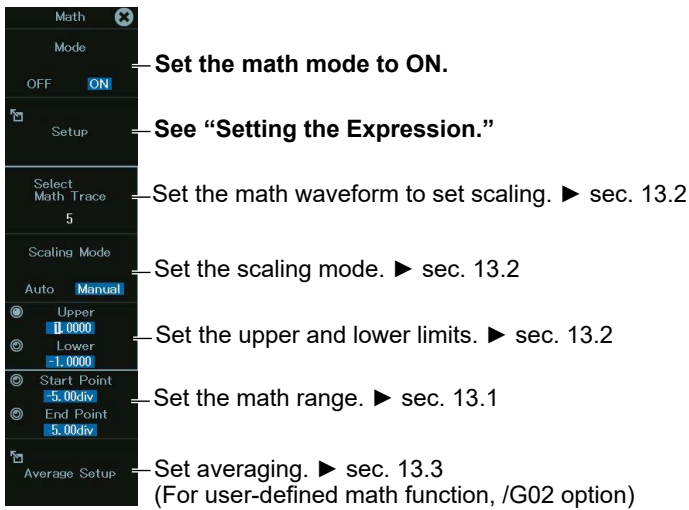
This section explains the following settings for user-defined math:

Items Common to Scope Mode and Recorder Mode

- Setting user-defined math functions
 - ▶ [“User-Defined Math Function \(User Define\)\(/G02 option\)”](#) in the Features Guide

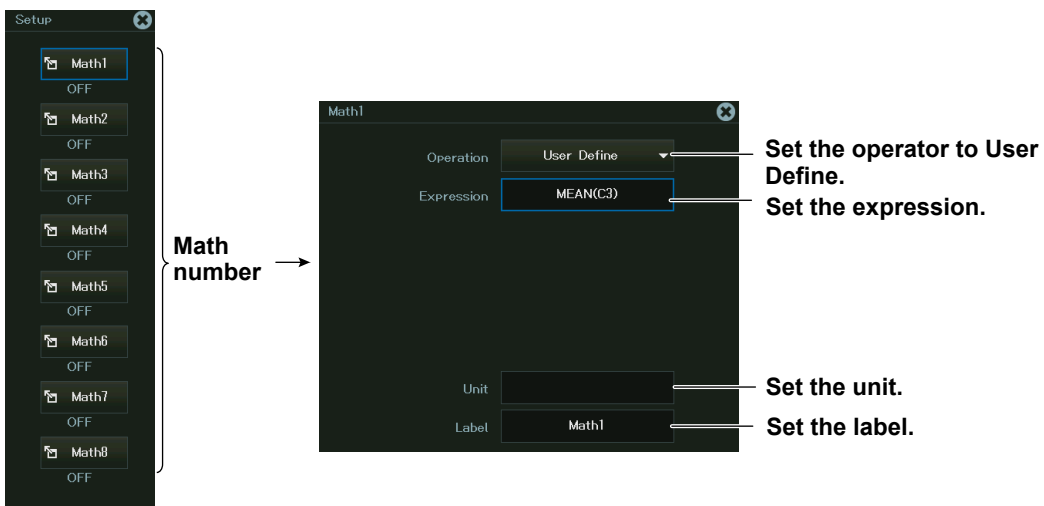
Math Menu

- On the waveform screen’s MENU, tap **ANALYSIS > MATH**, or press **SHIFT+FFT (MATH)**. The Math menu appears.



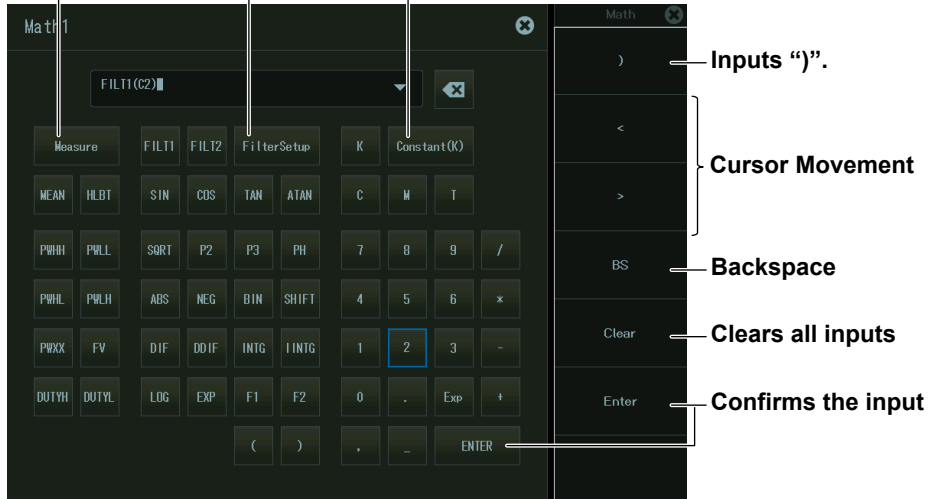
Setting the Expression (Setup)

- Tap **Setup**, or press the soft key.
- Tap the math number that you want to assign an expression to, or use a jog dial and arrow keys to select the math number, and press **SET**. The following screen appears.



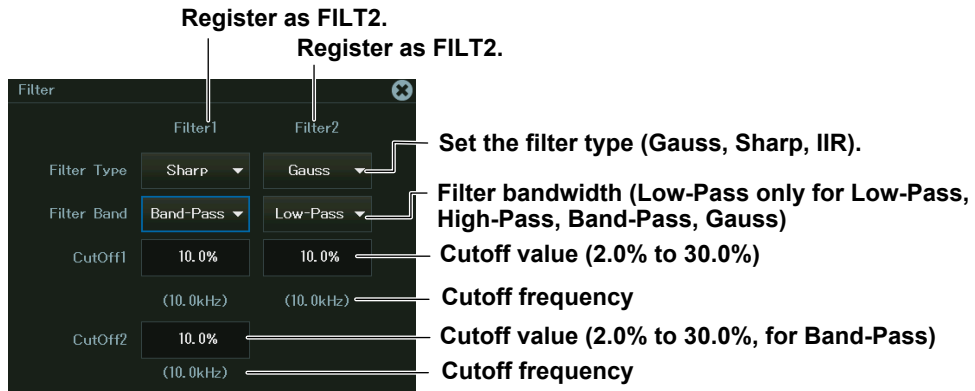
- Tap the **Expression** box, or select the Expression box using the jog dial or arrow keys, and press **SET**. The following screen appears.

Set the automated measurement values of waveform parameters to add to the expression.
 Set the filters (Filter1, Filter2).
 Set constants (K1 to K8).



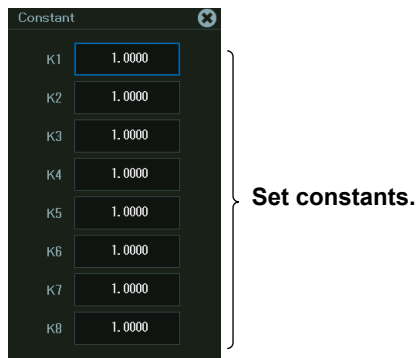
Setting a Filter (Filter Setup)

- Tap **Filter Setup**, or select **Filter Setup** using the jog dial or arrow keys, and press **SET**. The following screen appears.



Setting Constants

- Tap **Constant(K)**, or select **Constant(K)** using the jog dial, and press **SET**. The following screen appears.



Notes on Setting User-Defined Math Functions

When setting a user-defined math function, keep the following in mind.

- A math channel with a larger number cannot be used in an expression of a mass channel with a smaller number.
- An expression with only constants cannot be defined.
- An expression can only contain up to two FILT1 or FILT2 functions.
- Other computations cannot be performed on a pulse width computation.
- When performing shift computation, pulse width computation, or binary conversion, only a single operator can be used in an expression.

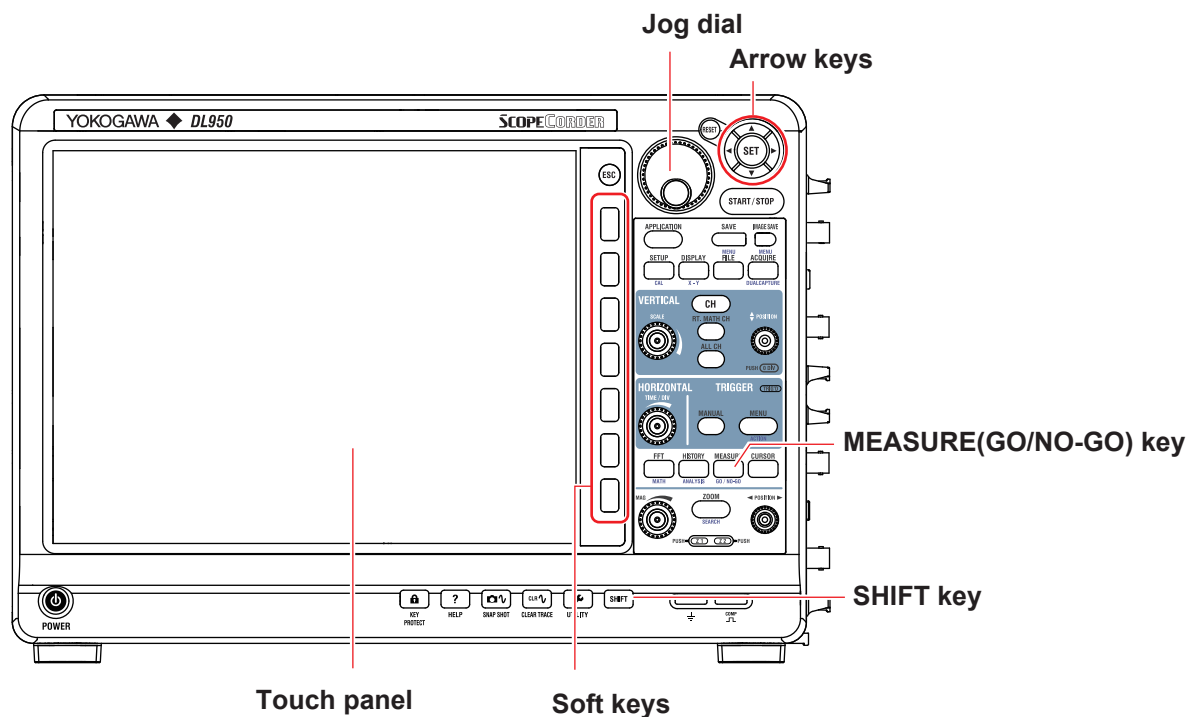
For details, see the Features Guide (IM DL950-01EN).

Chapter 14

GO/NO-GO Determination (Scope mode only)

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
14.1 Performing GO/NO-GO Determination with Waveform Zones	✓	-
14.2 Performing GO/NO-GO Determination with Waveform Parameters	✓	-

* The settings may vary depending on the operation mode.

14.1 Performing GO/NO-GO Determination with Waveform Zones

This section explains the following settings for performing GO/NO-GO determination with waveform zones:

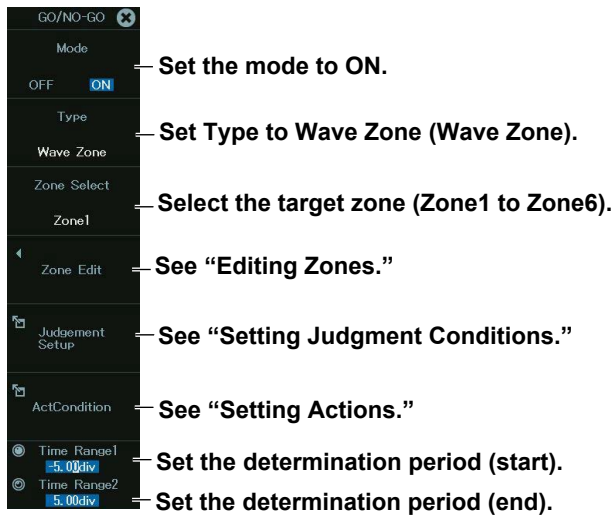
Applicable in Scope Mode

- Selecting the mode
- Creating and editing waveform zones
- Judgment conditions
- Setting actions

► [“Waveform Zone \(Wave Zone\)” in the Features Guide](#)

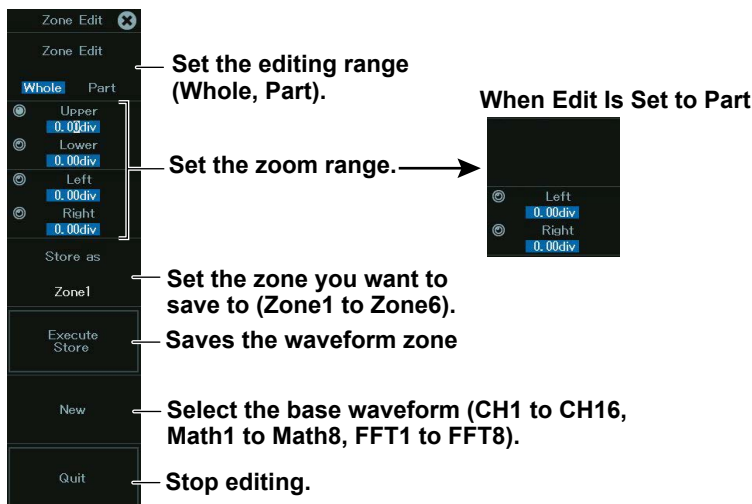
GO/NO-GO Menu

1. On the waveform screen's MENU, tap **ANALYSIS > GO/NO-GO**, or press **SHIFT+MEASURE (GO/NO-GO)**. The following screen appears.



Editing Zones (Edit Zone)

2. Tap **Edit Zone**, or press the soft key. The following screen appears.



Setting the Judgment Conditions (Judgement Setup)

2. Tap **Judgement Setup**, or press the soft key. The following screen appears.

Set the judgment criterion (X, IN, OUT).

Select the source waveform (CH1 to CH16, Math1 to Math8, FFT1 to FFT8).

Set the zone number (Zone1-Zone6).

#	Mode	Trace	Zone No.
1	IN	CH1	Zone1
2	OUT	CH2	Zone1
3	IN	CH3	Zone1
4	X	CH1	Zone1
5	X	CH1	Zone1
6	X	CH1	Zone1
7	X	CH1	Zone1
8	X	CH1	Zone1

Annotations:

- Scroll bar: Scroll to display reference conditions that do not fit in the screen.
- Logic: Set the determination logic (AND, OR).
- ActCondition: Set the action condition (Always, Fail, Success).
- Sequence: Set the sequence (Single, Continue).
- Acquisition Count: Set the number of waveforms to acquire.
- Remote: Turns external start on or off.

Determination Logic (Logic)

AND: The specified action is executed when all the specified judgment conditions are met.

OR: The specified action is executed when any of the specified judgment conditions is met.

Action Condition (Act Condition)

Always: The specified actions is always executed.

Fail: The specified action is executed when the GO conditions are not met.

Success: The specified actions is executed when the GO conditions are met.

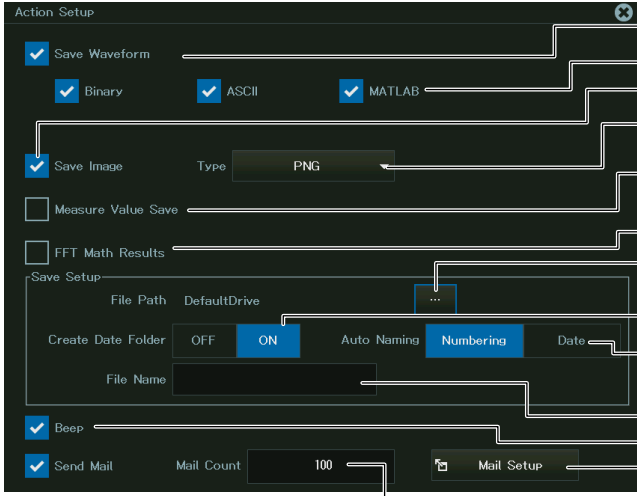
Sequence (Sequence)

Single: The specified action is executed once.

Continue: The specified action is executed repeatedly. The specified action is executed until the number of acquisitions specified by ACQ Count is reached. If ACQ Count is set to Infinite, the set actions are executed until waveform acquisition is stopped.

Setting Actions (Action Setup)

2. Tap **Action Setup**, or press the soft key. The following screen appears.



The screenshot shows the 'Action Setup' screen with the following settings and callouts:

- Save Waveform** (checked): Saves the waveform data
- Waveform data format**: Binary (checked), ASCII (checked), MATLAB (checked)
- Save Image** (checked): Saves a screen capture
- Screen capture data format (PNG, BMP, JPEG)**: Type: PNG
- Measure Value Save** (unchecked): Saves waveform parameters measured automatically
- FFT Math Results** (unchecked): Saves the FFT math results
- Save Setup**: Set the waveform parameter save destination.
- File Path**: DefaultDrive (with a selection icon)
- Set the creation of date file folders.**
- Create Date Folder**: OFF, ON (selected)
- Auto Naming**: Numbering (selected), Date
- Set the auto file naming method (Date, Numbering).**
- File Name**: (empty text field)
- Set the waveform parameter file name.**
- Beep** (checked): Set the beep sound.
- Send Mail** (checked): Mail Count: 100. Configure mail settings. ▶ sec. 20.6
- Mail Setup** (icon)
- Set mail transmission and the number of mail transmissions.**

14.2 Performing GO/NO-GO Determination with Waveform Parameters

This section explains the following settings for performing GO/NO-GO determination with waveform parameters:

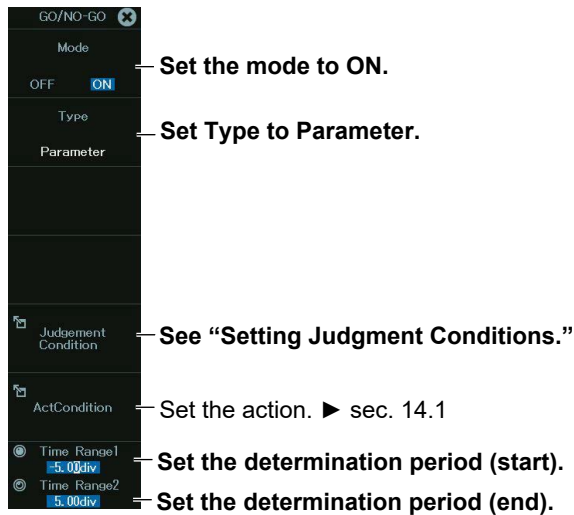
Applicable in Scope Mode

- Selecting the mode
- Judgment conditions

▶ [“Waveform Parameter \(Parameter\)”](#) and [“Automated Measurement of Waveform Parameters”](#) in the Features Guide

GO/NO-GO Menu

1. On the waveform screen's MENU, tap **ANALYSIS > GO/NO-GO**, or press **SHIFT+MEASURE (GO/NO-GO)**. The following screen appears.



Setting the Judgment Conditions (Judgement Setup)

2. Tap **Judgement Setup**, or press the soft key. The following screen appears.

Set the judgment criterion (X, IN, OUT).
 Select the source waveform (CH1 to CH16, Math1 to Math8, FFT1 to FFT8).
 Select the source parameter.
 Set the upper parameter limit.
 Set the lower parameter limit.

#	Mode	Trace	Item	Upper	Lower
1	OUT	CH1	Peak to Peak	0.0000	0.0000
2	IN	CH1	Peak to Peak	0.0000	0.0000
3	X	CH1	Peak to Peak	0.0000	0.0000
4	X	CH1	Peak to Peak	0.0000	0.0000
5	X	CH1	Peak to Peak	0.0000	0.0000
6	X	CH1	Peak to Peak	0.0000	0.0000
7	X	CH1	Peak to Peak	0.0000	0.0000
8	X	CH1	Peak to Peak	0.0000	0.0000

Logic: AND OR
 ActCondition: Always Fail Success
 Sequence: Single Continue
 Acquisition Count: Infinite
 Remote: OFF ON

Scroll bar
 Scroll to display reference conditions that do not fit in the screen.

Set the determination logic (AND, OR).
 Set the action condition (Always, Fail, Success).
 Set the sequence (Single, Continue).
 Set the number of waveforms to acquire.
 Turns external start on or off

Setting Waveform Parameters (Item)

You can use all 27 automatically measured waveform parameters as reference conditions.

You can perform GO/NO-GO determination on up to 16 parameters at the same time. ▶ sec.

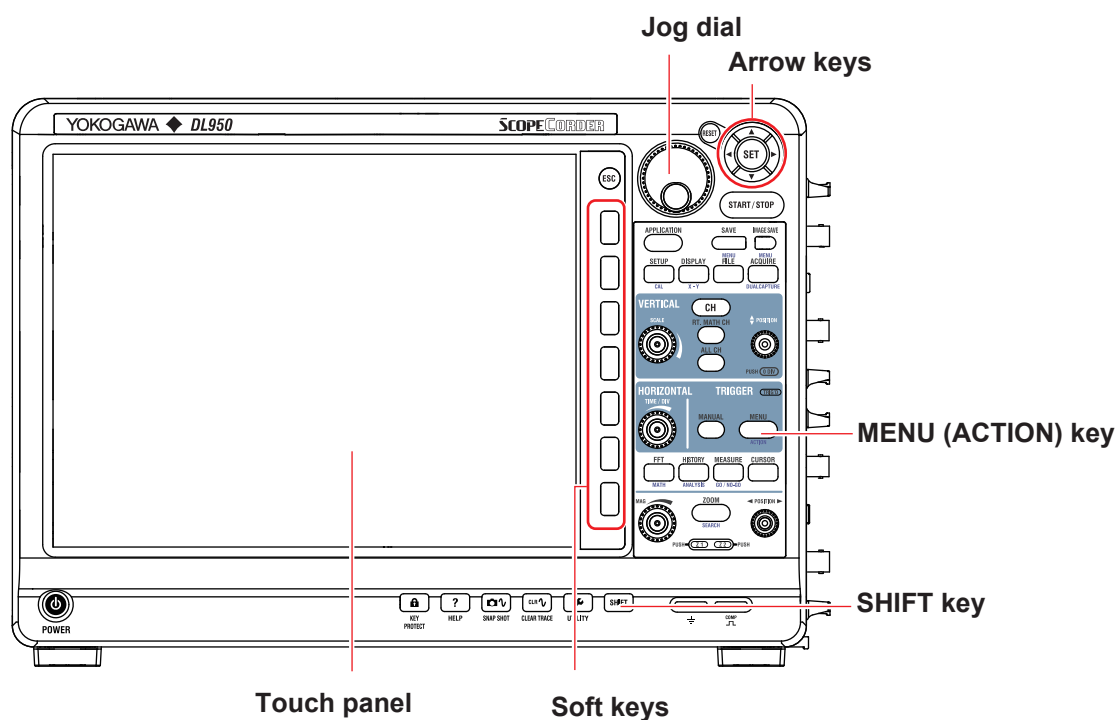
11.1

Chapter 15

Actions

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
15.1 Setting Actions	✓	✓

* The settings may vary depending on the operation mode.

15.1 Setting Actions

This section explains the following settings for executing the action function:

Applicable in Scope Mode

- Action mode
- Action to execute

Applicable in Recorder Mode

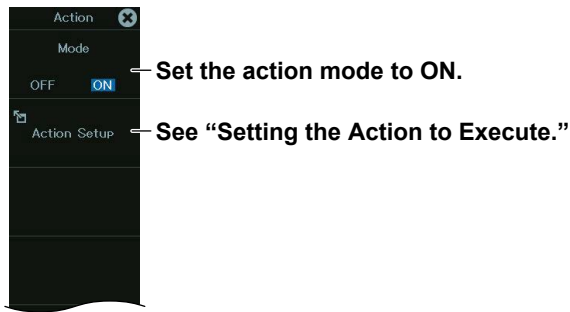
- Save on Stop
- Save on Stop Setup

► [“Actions” in the Features Guide](#)

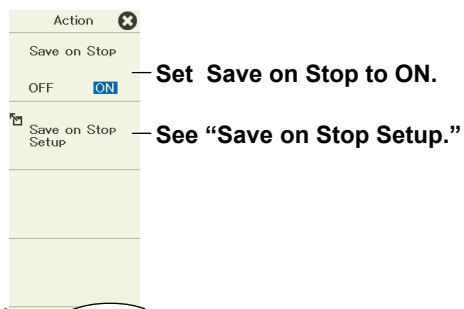
ACTION menu

1. On the waveform screen's MENU, tap **TRIGGER > ACTION**, or press **SHIFT+MENU (ACTION)**. The following screen appears.

Scope mode



Recorder mode



Note

You cannot set actions when SSD recording or flash acquisition is enabled.

Setting the Action to Execute (Action Setup)

Scope mode

2. Tap **Action Setup**, or press the soft key. The following screen appears.

When Dual Capture Mode Is Off

Saves the waveform data

Waveform data format

Saves a screen capture

Screen capture data format (PNG, BMP, JPEG)

Saves waveform parameters measured automatically

Saves the FFT math results

Set the save destination.

Set the creation of date file folders.

Set the auto file naming method (Date, Numbering).

Set the file name.

Set the beep sound.

Configure mail settings. ► sec. 20.6

Set mail transmission and the number of mail transmissions.

When Dual Capture Mode Is On

Low-speed sampling waveform data format

High-speed sampling waveform data format

Save on Stop Setup (Save on Stop Setup)

Recorder mode

2. Tap **Save on Stop Setup**, or press the soft key.

The settings are the same as those for Save on Stop of the ACQUIRE menu (when the acquisition method is Memory + Save on Stop). See section 3.2.

Executing Actions

Configure the action settings, and press **START/STOP**. The actions will be executed each time that the Instrument triggers. "ACTION" appears at the top center of the screen when an action is being executed. To stop, press **START/STOP**.

Note

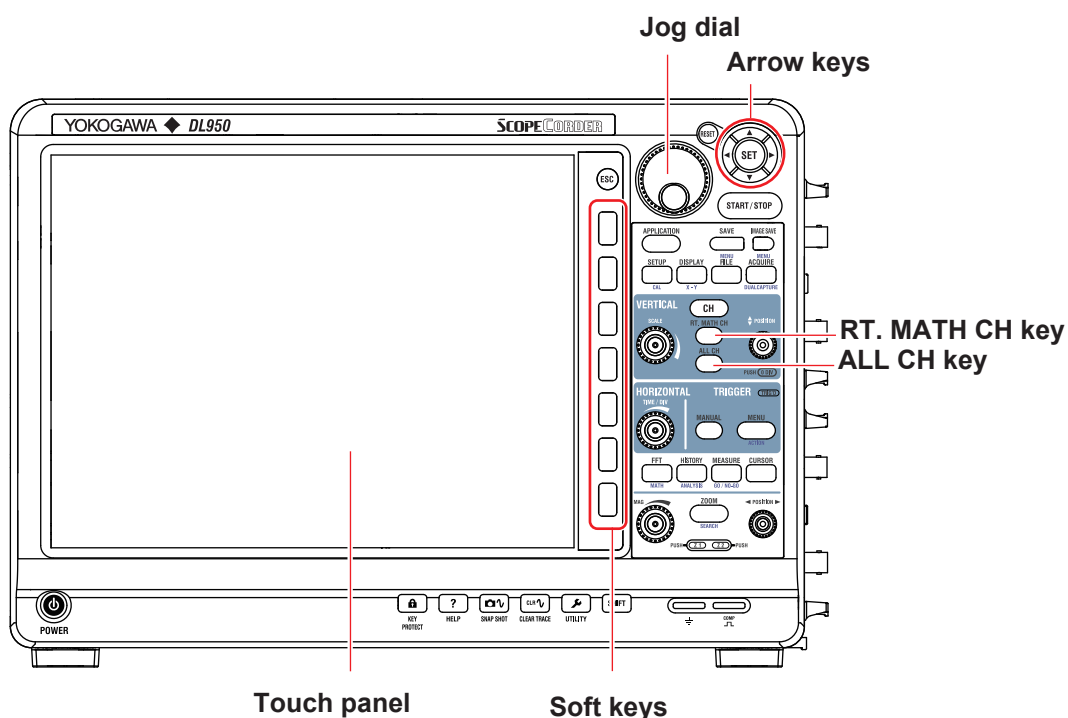
- If the action to execute is mail transmission and the specified number of mail transmissions is less than the number of specified actions, mail transmission will stop after the specified number of transmissions. If the specified number of mail transmissions is greater than the number of specified actions, mail transmission will stop after the specified number of actions.
- The settings for actions executed in Scope mode are shared with the action settings of GO/NO-GO.

Chapter 16

Real Time Math (/G03, /G05, /MT1 option)

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
16.1 Configuring Real Time Math	✓	✓
16.2 Configuring with the All Channel Setup Menu	✓	✓

* The settings may vary depending on the operation mode.

16.1 Configuring Real Time Math

This section explains the following real time math settings.

Items Common to Scope Mode and Recorder Mode

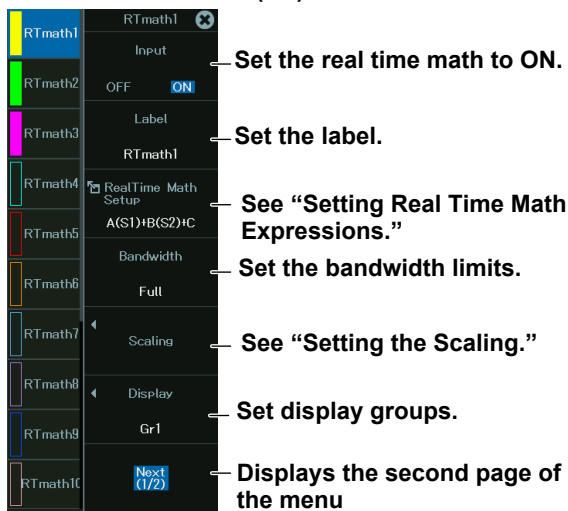
- Turning real time math on and off
- Setting real time math expressions
- Setting the scaling
- Setting the display range
- Setting the vertical position
- Setting the horizontal position (Recorder mode only)

► “Real Time Math (/G03, /G05, /MT1 option)” in the Features Guide

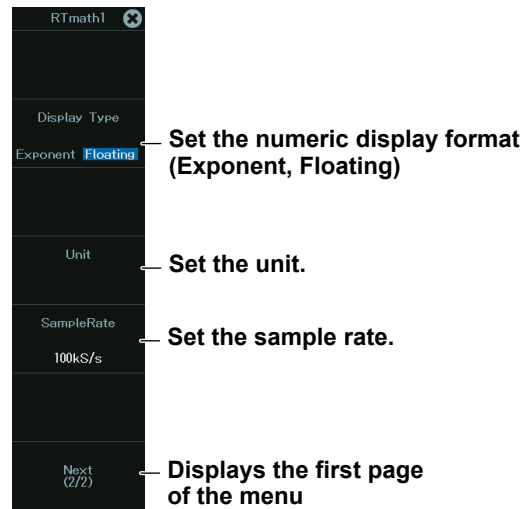
RealTime Math Menu

1. On the waveform screen’s MENU, tap **CH > RT.MATH CH**, or press **RT. MATH CH**. A real time math setup menu appears.
2. Tap a real time math channel you want to configure, or select the channel using the jog dial or up and down arrow keys. When the waveform is displayed on the screen, you can also tap waveform of the real time math channel to select the channel you want to configure.

RealTime Math menu (1/2)



RealTime Math menu (2/2)

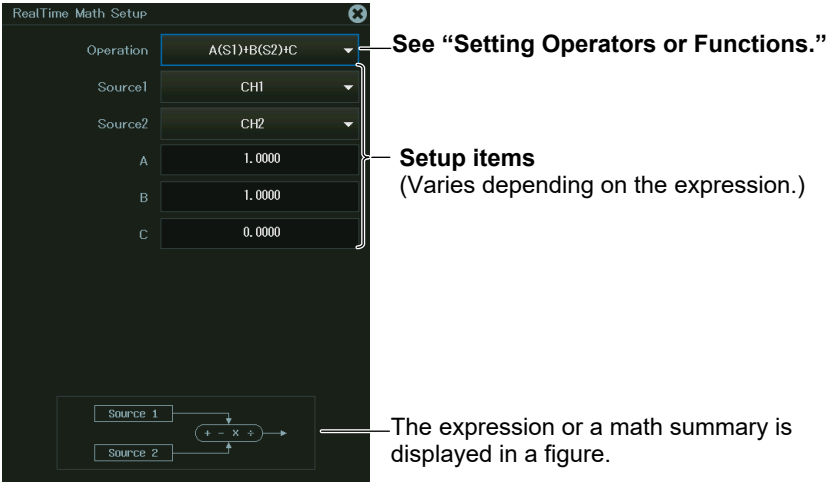


Note

- When position information acquisition (/C35 option) is enabled on the ANALYSIS menu, RTmath1 is set to GPS, and you can set the position information display (see section 22.2). The items displayed in the setup menu are different from those of the real time math menu.
- If power analysis (/G05, /MT1 option) is enabled (1 Wiring System or 2 Wiring Systems) on the ANALYSIS menu, RTmath13 and RTmath14 is set to Power, and you can set the waveform display of the power analysis results (see section 17.4). The items displayed in the setup menu are different from those of the real time math menu.
- If harmonic analysis (/G05, /MT1 option) is enabled (Line RMS or Power) on the ANALYSIS menu, RTmath15 and RTmath16 is set to Harmonics, and you can set the waveform display of the harmonic analysis results (see section 17.4). The items displayed in the setup menu are different from those of the real time math menu.
- If motor dq analysis (/MT1 option) is enabled (1 Motor System or 2 Motor Systems) on the ANALYSIS menu, RTmath13 and RTmath14 is set to Motor, and you can set the waveform display of the analysis results (see section 17.4). The items displayed in the setup menu are different from those of the real time math menu.

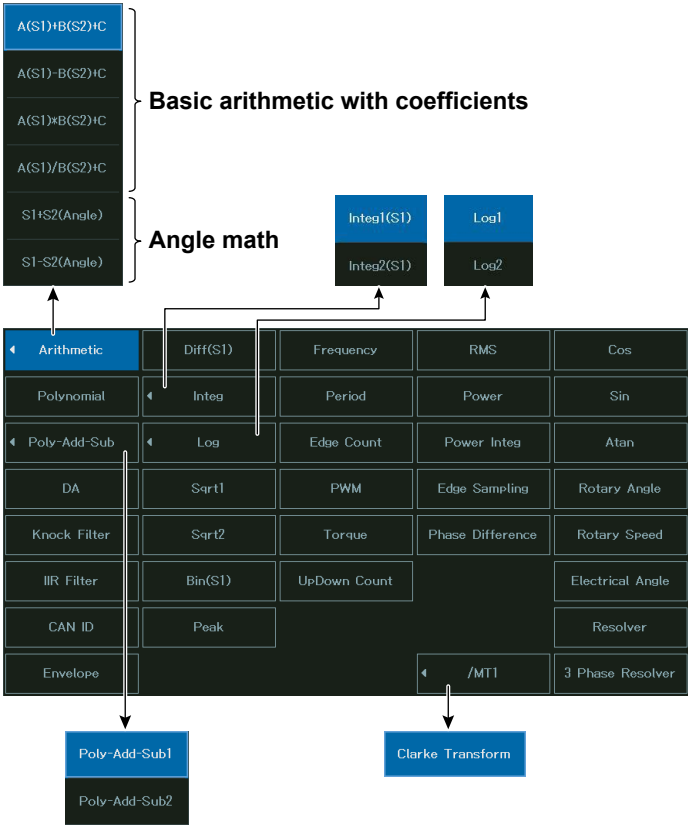
Setting Real Time Math Expressions

3. Tap **RealTime Math Setup**, or press the soft key. The following screen appears.



Setting Operators or Functions

4. Tap the **Operation** box, or select the Operation box using the jog dial or arrow keys, and press **SET**. The following screen appears.



Basic Arithmetic (Arithmetic)

Basic Arithmetic with Coefficients ($A(S1)+B(S2)+C$, $A(S1)-B(S2)+C$, $A(S1)*B(S2)+C$, and $A(S1)/B(S2)+C$)

The following screen appears when you select a basic arithmetic operation with coefficients.

RealTime Math Setup

Operation	A(S1)+B(S2)+C
Source1	CH1
Source2	CH2
A	1.0000
B	1.0000
C	0.0000

- Select $A(S1)+B(S2)+C$, $A(S1)-B(S2)+C$, $A(S1)*B(S2)+C$, or $A(S1)/B(S2)+C$.
- Select the math source waveform (channel whose acquisition is set to ON).
- Scale value (Basic arithmetic without coefficients is selected when you set scale value A and B to 1 and offset value C to 0.)

Angle Math ($S1+S2$ (Angle), $S1-S2$ (Angle))

The following screen appears when you select an angle math operator.

RealTime Math Setup

Operation	S1+S2(Angle)
Source1	CH1
Source2	CH2
Scaling	-180° ~ +180°

- Select $S1 + S2$ (Angle) or $S1 - S2$ (Angle).
- Select the math source waveform (channel whose acquisition is set to ON).
- Scale value

Quartic Polynomial (Polynomial)

The following screen appears when you select the quartic polynomial function.

RealTime Math Setup

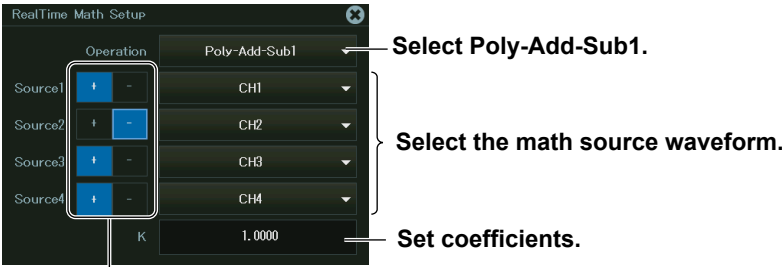
Operation	Polynomial
Source	CH1
A	1.0000
B	1.0000
C	0.0000
D	0.0000
E	0.0000

- Select Polynomial.
- Select the math source waveform.
- Set coefficients.

Polynomial (Poly-Add-Sub)

Polynomial (Poly-Add-Sub1)

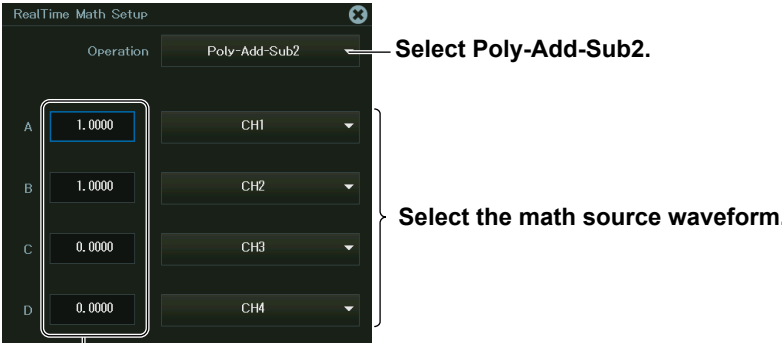
The following screen appears when you select the polynomial function (Poly-Add-Sub1).



Select the sign (+, -). Tap the polarity you want to select, or select the polarity with the jog dial, and press SET.

Polynomial with Coefficients (Poly-Add-Sub2)

The following screen appears when you select the polynomial-with-coefficients (Poly-Add-Sub2) operator.



Set the coefficients of each term.

Logic Signal and Analog Waveform Conversion (DA)

The following screen appears when you select the logic signal and analog waveform conversion function.

Select DA.

Select the math source logic signal (least significant 8 bits).
The channels of installed logic modules are displayed.

Select the math source logic signal (most significant 8 bits).
The channels of installed logic modules are displayed.

Select the conversion method (Unsigned, Signed, Offset Binary).

Set the bit length.

Set coefficients.

Knocking Filter (Knock Filter) (/VCE option)

The following screen appears when you select the knocking filter function.

Select Knock Filter.

Select the math source waveform.

Set the elimination level.

Turns differentiation on or off

IIR Filter (IIR Filter)

The following screen appears when you select the IIR filter function.

When Filter Band Is Set to Low-Pass or High-Pass

Select IIR Filter.

Select the math source waveform.

Set the filter band (Low-Pass, High-Pass).

Set the cutoff frequency.

Turns interpolation on and off

When Filter Band Is Set to Band-Pass

Select IIR Filter.

Select the math source waveform.

Set the filter band (Band-Pass).

Set the center frequency.

Set the bandwidth.

Turns interpolation on and off

CAN ID Detection (CAN ID)

The following screen appears when you select the CAN ID function.

- Set Mode to CAN ID.
- Select the detection source waveform.
- Select the bit rate (10kbps, 20kbps, 33.3kbps, 50kbps, 62.5kbps, 66.7kbps, 83.3kbps, 100kbps, 125kbps, 250kbps, 500kbps, 400k, 500k, 800kbps, 1Mbps).
- Select the message format (STD, XTD).
- Set the message ID.

Envelope Curve (Envelope)

The following screen appears when you select the envelope curve (Envelope) function.

- Select Envelope.
- Select the math source waveform.
- Set the envelope curve polarity.
- Set the bandwidth (the same as bandwidth limit of step 2).

Differentiation (Diff(S1))

The following screen appears when you select the differentiation function.

- Select RMS(S1).
- Select the math source waveform.
- calculation period

Integration (Integ1(S1) and Integ2(S1))

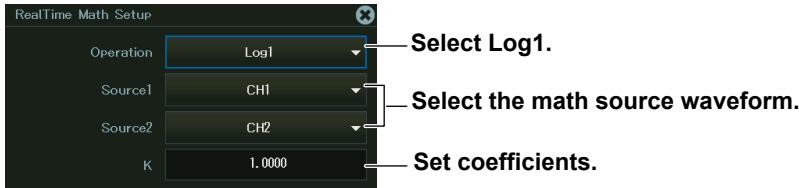
The following screen appears when you select the integration function.

- Select Integ1(S1) or Integ2(S1).
- Select the math source waveform.
- Resets the integration result when waveform acquisition starts
- Resets the integration result when the math source waveform exceeds the specified threshold
- Set the threshold.
- Resets the integration result when the math source waveform crosses zero and an edge is generated
- Set the zero-crossing edge (f, r).
- Set the zero-crossing hysteresis (f, r, z).
- Resets the integration result manually

Common Logarithm (Log1 and Log2)

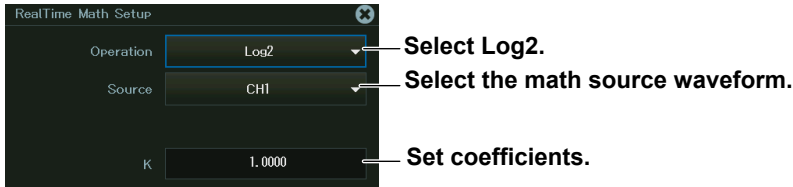
Log1

The following screen appears when you select the common logarithm function (Log1).



Log2

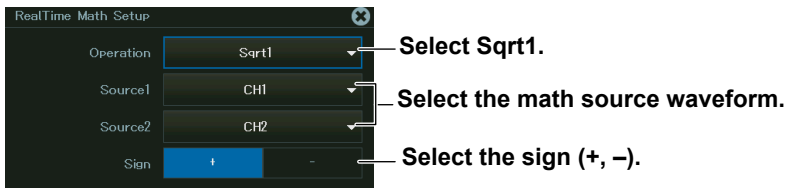
The following screen appears when you select the common logarithm function (Log2).



Square Root (Sqrt1 and Sqrt2)

Sqrt1

The following screen appears when you select the square root function (Sqrt1).



Note

When you set Sign to +, the square root of "S1*S1 + S2*S2" is calculated.
When you set Sign to -, the square root of "S1*S1 - S2*S2" is calculated.

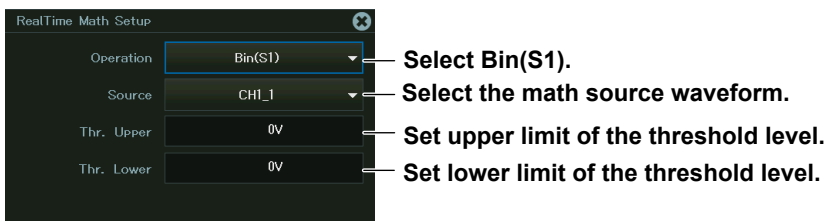
Sqrt2

The following screen appears when you select the square root function (Sqrt2).



Binary Conversion (Bin (S1))

The following screen appears when you select the binary conversion function.



Peak (Peak)

The following screen appears when you select the peak function.

If the Calculation Period Is Edge

The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Peak (Set to Peak.)
- Source:** CH1_1 (Select the math source waveform.)
- Type:** Max (Set the type (Max, Min).)
- Calc Period:** Edge (Set the calculation period to Edge.)
- Edge Source:** CH1_1 (Set the source waveform used to detect edges. (CH1 to CH16¹, RTmath1 to RTmath15²))
- Level:** 0V (Set the level.)
- Slope:** f (Set the edge detection condition (f, r, fr).)
- Hysteresis:** ~~r~~ (Set the hysteresis (~~r~~, ~~r~~, ~~r~~)).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are editing.

If the Calculation Period Is Time

The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Peak (Set to Peak.)
- Source:** CH3 (Select the math source waveform.)
- Type:** Max (Set the type (Max, Min).)
- Calc Period:** Time (Set the calculation period to Time.)
- Time:** 1.0us (Set the hours.)

Frequency (Frequency)

The following screen appears when you select the frequency function.

The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Frequency (Select Frequency.)
- Source:** CH1 (Select the math source waveform.)
- Slope:** f (Set the edge detection condition (f, r).)
- Level:** 0.0V (Set the level.)
- Hysteresis:** ~~r~~ (Set the hysteresis (~~r~~, ~~r~~, ~~r~~)).
- Scaling:** Hz (Select the scale (Hz, Rpm).)
- Deceleration Prediction:** ON (Set the number of pulses per rotation (when scale is set to Rpm).)
- Stop Prediction:** OFF (Set the deceleration prediction (OFF, ON).)

Period (Period)

The following screen appears when you select the period function.

RealTime Math Setup

- Operation: Period — Select Period.
- Source: CH1 — Select the math source waveform.
- Slope: F — Set the edge detection condition (F , \bar{F}).
- Level: 0.0V — Set the level.
- Hysteresis: A — Set the hysteresis (~~A~~, ~~A~~, ~~A~~).
- Deceleration Prediction: ON — Set the deceleration prediction (OFF, ON).
- Stop Prediction: 2 — Set the stop prediction (OFF, 2, 4, 8, 16).

Edge Count (Edge Count)

The following screen appears when you select the edge count function.

RealTime Math Setup

- Operation: Edge Count — Select Edge Count.
- Source: CH1 — Select the math source waveform.
- Slope: F — Set the edge detection condition (F , \bar{F}).
- Level: 0.0V — Set the level used to detect edges.
- Hysteresis: A — Set the hysteresis (~~A~~, ~~A~~, ~~A~~).
- Reset Condition: Start — Resets the counter when waveform acquisition starts
- Overlimit: Overlimit — Resets the counter when the specified limit value is exceeded
- OverlimitValue: 0.0000 — Set the limit value for resetting the counter.
- Manual Reset: Execute — Manually resets the counter

Demodulation of the Pulse Width Modulated Signal (PWM)

When you select the function that is used to demodulate pulse width modulated signals, the following screen appears.

RealTime Math Setup

- Operation: PWM — Select PWM.
- Source: CH1 — Select the math source waveform.
- Period: 0.1us — Set the carrier wave period.

Torque (Torque)

The following screen appears when you select the torque function.

RealTime Math Setup

- Operation: Torque — Select Torque.
- Source: CH1 — Select the math source waveform.
- Slope: F — Set the edge detection condition (F , \bar{F}).
- Level: 0.0V — Set the level.
- Hysteresis: A — Set the hysteresis (~~A~~, ~~A~~, ~~A~~).
- Deceleration Prediction: ON — Set the deceleration prediction (OFF, ON).
- Stop Prediction: 2 — Set the stop prediction (OFF, 2, 4, 8, 16).
- A: 1.0000 — Set coefficients.
- C: 0.0000 — Set coefficients.

Up Down Count (UpDown Count)

The following screen appears when you select the up down count function.

Operation UpDown Count — Select UpDown Count.

Type Incremental ABZ — Set the encode type to Incremental ABZ or Incremental AB.

Source Condition Setup — See “Setting the Source Conditions.”

Reset Condition Overlimit — Resets the counter when the specified limit value is exceeded

OverlimitValue 0 — Set the limit value for resetting the counter.

Encode Condition Setup — See “Setting the Encoding Conditions.”

Manual Reset Execute — Manually resets the counter

Setting the Source Conditions

When the logic source is ON

Logic Source OFF ON — Set the logic source to ON.

Source CH5 — Set the source channel (input channel of a logic module). (Only the channels with logic modules installed are displayed.)

Phase A Bit1 — Select the bits of logic signals of phases A, B, and Z* (Bit1 to Bit8).

Phase B Bit2

Phase Z Bit3

Phase Z Invert — Select the check box when the Z-phase input is inverted.*

When the logic source is OFF

Logic Source OFF ON — Set the logic source to OFF.

Phase A CH1 — Set the phase A signal channel.

Level 0.0V — Set the signal level to count.

Hysteresis # # # — Set the hysteresis (\overline{A} , $\overline{A}\overline{B}$, $\overline{A}\overline{B}\overline{C}$).

Phase B CH2 — Set phase B.

Level 0.0V

Hysteresis # # #

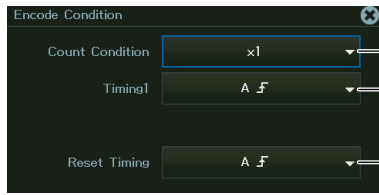
Phase Z CH3 — Set phase Z.*

Phase Z Invert — Select the check box when the Z-phase input is inverted.

* The phase Z setting does not appear when the encode type is set to Incremental AB.

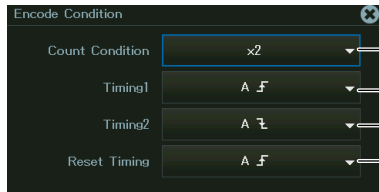
Setting the Encoding Conditions

When the count condition is x1



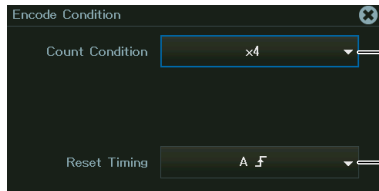
- Set the count condition to x1.
- Select the edge to count pulses on (A f, A l, B f, B l).
- Select the edge to reset the value on* (A f, A l, B f, B l, Z Level).

When the count condition is x2



- Set the count condition to x2.
- Select the edge to count pulses on (A f, A l, B f, B l).
- Select the edge to count pulses on (A f, A l, B f, B l).
- Select the edge to reset the value on* (A f, A l, B f, B l, Z Level).

When the count condition is x4



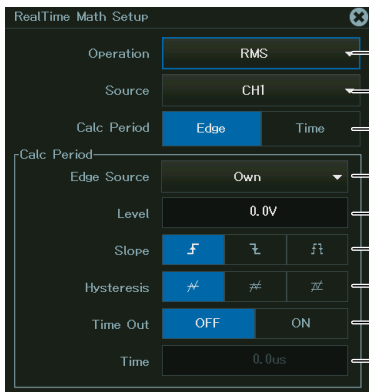
- Set the count condition to x4.
- Select the edge to reset the value on* (A f, A l, B f, B l, Z Level).

* This can be set when the Encode Type is Incremental ABZ.

RMS Value (RMS)

The following screen appears when you select the rms function.

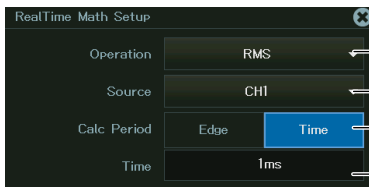
If the Calculation Period Is Edge



- Select RMS.
- Select the math source waveform.
- Set the calculation period to Edge.
- Set the source waveform used to detect edges. (Own, CH1 to CH16', RTmath1 to RTmath15')
- Set the level.
- Set the edge detection condition (f, l, fl).
- Set the hysteresis (≠, ≠, ≠).
- Set the timeout (OFF, ON).
- Set the timeout period.

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are editing.

If the Calculation Period Is Time



- Select RMS.
- Select the math source waveform.
- Set the calculation period to Time.
- Set the hours.

Effective Power (Power)

The following screen appears when you select the effective power function.

RealTime Math Setup

Operation: Power

Source1: CH1

Source2: CH2

Calc. Period

Edge Source: Source1

Level: 0.0V

Slope: f, \bar{f} , f \bar{f}

Hysteresis: \neq , \neq , \neq

Select Power.

Select the math source waveform.

Set the math range.

Set the source waveform used to detect edges (Own, CH1 to CH16,¹ RTmath1 to RTmath15²).

Set the level.

Set the edge detection condition (f, \bar{f} , f \bar{f}).

Set the hysteresis (\neq , \neq , \neq).

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are editing.

Effective Power Integration (Power Integ)

The following screen appears when you select the effective power integration function.

RealTime Math Setup

Operation: Power Integ

Source1: CH1

Source2: CH2

Reset Condition: Start, Overlimit

OverlimitValue: 0.0000

Manual Reset: Execute

Scaling: Second, Hour

Select Power Integ.

Select the math source waveform.

Resets the integration result when waveform acquisition starts

Resets the integration result when the specified limit value is exceeded

Limit value used to reset the integration result

Resets the integration result manually

Select the scale (Second, Hour).

Edge Sampling (Edge Sampling)

The following screen appears when you select the edge sampling function.

RealTime Math Setup

Operation: Edge Sampling

Target: CH1

Edge

Source: CH1

Level: 0V

Slope: f, \bar{f} , f \bar{f}

Hysteresis: \neq , \neq , \neq

Delay Time: 0.0us

Select Edge Sampling.

Select the target waveform.

Set the source waveform used to detect edges. (CH1 to CH16¹, RTmath1 to RTmath15²)

Set the level.

Set the edge detection condition (f, \bar{f} , f \bar{f}).

Set the hysteresis (\neq , \neq , \neq).

Set the delay time for the sampling timing.

- 1 You can select channels in which input modules that support basic arithmetic are installed.
- 2 You can select channels whose numbers are smaller than the channel you are editing.

Phase Difference (Phase Difference)

The following screen appears when you select the phase difference function.

RealTime Math Setup

Operation: Phase Difference

Angle: CH1

Average: 1

Edge		CH	Level	Hys	Slope
Source1	CH2	0.0V	#	F	
Source2	CH3	0.0V	#	F	

Update condition: 0.0000

- Select Phase Difference.
- Select the waveform for phase angle measurement.
- Set the number of values to average.
- Set the edge detection condition (F, \bar{F}).
- Set the hysteresis (\bar{A} , \bar{A} , $\bar{\Delta}$).
- Set the level.
- Set the timing for calculating and outputting the phase difference using the angle of the waveform for phase angle measurement.
- Set the two source waveform for finding the phase difference.

Cosine (Cos) and Sine (Sin)

The following screen appears when you select the cosine or sine function.

When the Encode Type Is Set to Incremental ABZ, Incremental AZ, Incremental AB, or Incremental A

RealTime Math Setup

- Operation: Cos
- Type: Incremental ABZ
- Source Condition: Setup
- Encode Condition: Setup
- Manual Reset
- Execute

Annotations:

- Select Cos or Sin.
- Set the encode type to Incremental ABZ, Incremental AZ, Incremental AB, or Incremental A.
- See "Setting the Source Conditions."
- See "Setting the Encoding Conditions."
- Resets the math result manually

Setting the Source Conditions

When the logic source is ON

Source Condition

- Logic Source: ON
- Source: CH5
- Phase A: Bit1
- Phase B: Bit2
- Phase Z: Bit3
- Phase Z Invert:

Annotations:

- Set the logic source to ON.
- Set the source channel (input channel of a logic module). (Only the channels with logic modules installed are displayed.)
- Select the bits of logic signals of phases A, B,* and Z * (Bit1 to Bit8).
- Select the check box when the Z-phase input is inverted.*

When the logic source is OFF

Source Condition

- Logic Source: OFF
- Phase A: CH1, Level: 0.0V, Hysteresis:
- Phase B: CH2, Level: 0.0V, Hysteresis:
- Phase Z: CH3_1, Level: 0V, Hysteresis: Phase Z Invert

Annotations:

- Set the logic source to OFF.
- Set the phase A signal channel.
- Set the signal level to count.
- Set the hysteresis (, ,).
- Set phase B.*
- Select the check box when the Z-phase input is inverted.
- Set phase Z.*

* Phase B and phase Z settings are not displayed depending on the encode type.

Setting the Encoding Conditions

When the count condition is x1

Encode Condition

- Pulse/Rotate: 180 → Set the number of pulses per rotation.
- Count Condition: x1 → Set the count condition to x1.
- Count/Rotate: 180 → Number of counts per rotation
- Timing1: A \downarrow → Select the edge to count pulses on (A \downarrow , A \uparrow , B \downarrow ,¹ B \uparrow).
- Multiplication factor: 1 → Set the multiplication factor.
- Reset Timing: A \downarrow → Select the edge to reset the value on (A \downarrow , A \uparrow , B \downarrow ,¹ B \uparrow ,¹ Z Level²).
- Reverse: OFF → Turns rotation direction inversion on or off
- Offset(*): 0.00 → Set the initial phase of the rotation angle.

When the encoding type is Incremental ABZ or Incremental AB and the count condition is x2

Encode Condition

- Pulse/Rotate: 180 → Set the number of pulses per rotation.
- Count Condition: x2 → Set the count condition to x2.
- Count/Rotate: 360 → Number of counts per rotation
- Timing1: A \downarrow → Select the edge to count pulses on (A \downarrow , A \uparrow , B \downarrow , B \uparrow)
- Timing2: A \uparrow → Select the edge to count pulses on (A \downarrow , A \uparrow , B \downarrow , B \uparrow)
- Multiplication factor: 1 → Set the multiplication factor.
- Reset Timing: A \downarrow → Select the edge to reset the value on (A \downarrow , A \uparrow , B \downarrow , B \uparrow , Z Level²)
- Reverse: OFF → Turns rotation direction inversion on or off
- Offset(*): 0.00 → Set the initial phase of the rotation angle.

When the encoding type is Incremental ABZ or Incremental AB and the count condition is x4
When the encoding type is Incremental AZ or Incremental A and the count condition is x2

Encode Condition

- Pulse/Rotate: 180 → Set the number of pulses per rotation.
- Count Condition: x4 → Set the count condition to x2 or x4.
- Count/Rotate: 720 → Number of counts per rotation
- Multiplication factor: 1 → Set the multiplication factor.
- Reset Timing: A \downarrow → Select the edge to reset the value on (A \downarrow , A \uparrow , B \downarrow ,¹ B \uparrow ,¹ Z Level²).
- Reverse: OFF → Turns rotation direction inversion on or off
- Offset(*): 0.00 → Set the initial phase of the rotation angle.

- 1: Can be set when the Encoding Type is Incremental ABZ or Incremental AB
- 2: Can be set when the Encoding Type is Incremental ABZ or Incremental AZ

When the Encode Type Is Set to Absolute 8bit, Absolute 16bit, or Gray Code

When Absolute 8bit or Absolute 16bit is selected

The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Cos (Annotation: Select Cos or Sin.)
- Type:** Absolute 16bit (Annotation: Set the encode type to Absolute 8bit or Absolute 16bit.)
- Source Condition:** Setup (Annotation: See "Setting the Source Conditions.")
- Pulse/Rotate:** 180 (Annotation: Set the number of pulses per rotation.)
- Negative Logic:** OFF (Annotation: Turns negative logic on or off)

For Gray Code

The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Cos (Annotation: Set the encode type to Gray Code.)
- Type:** Gray Code (Annotation: Set the encode type to Gray Code.)
- Source Condition:** Setup
- Bit Length:** 16 (Annotation: Set the bit length.)
- Negative Logic:** OFF

Setting the Source Conditions

The screenshot shows the 'Source Condition' dialog with the following settings and annotations:

- Logic Source:** ON (Annotation: Set the logic source to ON.)
- Source1:** CH5 (Annotation: Set the source channel* (input channel of a logic module). (Only the channels with logic modules installed are displayed.)
- Source2:** CH6 (Annotation: Set the source channel* (input channel of a logic module). (Only the channels with logic modules installed are displayed.)

- * Source2 can be set when the encode type is set to Absolute 16bit or Gray Code. Set the logic channel for the least significant digits to Source1 and the logic channel for the most significant digits to Source2.

When the Encode Type Is Set to Resolver Ch

You can set this when Resolver or 3 Phase Resolver is set to a real time math channel with a smaller number than the real time math channel that you are currently setting.

The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Cos (Annotation: Select Cos or Sin.)
- Type:** Resolver Ch (Annotation: Set the encode type to Resolver Ch.)
- Resolver Ch:** RTmath1 (Annotation: Set the resolver channel.*)

- * Select from RTmath1 to RTmath15 (a real time math channel with a smaller number than the real time math channel that you are currently setting) set to Resolver or 3 Phase Resolver.

When the Encode Type Is Set to Rotary Angle (Z Pulse)

These settings are available when Rotary Angle is set to a real time math channel with a smaller number than the real time math channel that you are currently setting and the encode type is set to Z Pulse.

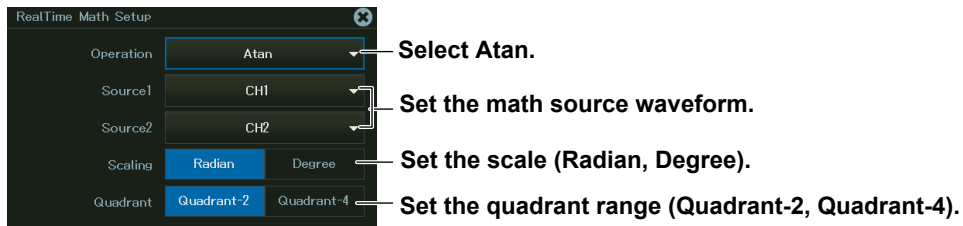
The screenshot shows the 'RealTime Math Setup' dialog with the following settings and annotations:

- Operation:** Cos (Annotation: Select Cos or Sin.)
- Type:** Rotary Angle(Z Pulse) (Annotation: Set the encode type to Rotary Angle(Z Pulse).)
- Z Pulse Ch:** RTmath1 (Annotation: Set the Z Pulse channel.*)

- * Select from RTmath1 to RTmath15 (only the real time math channels with a smaller number than the real time math channel that you are currently setting) whose operator is set to Rotary Angle and the encode type is set to Z Pulse.

Arc Tangent (Atan)

The following screen appears when you select the arc tangent function.

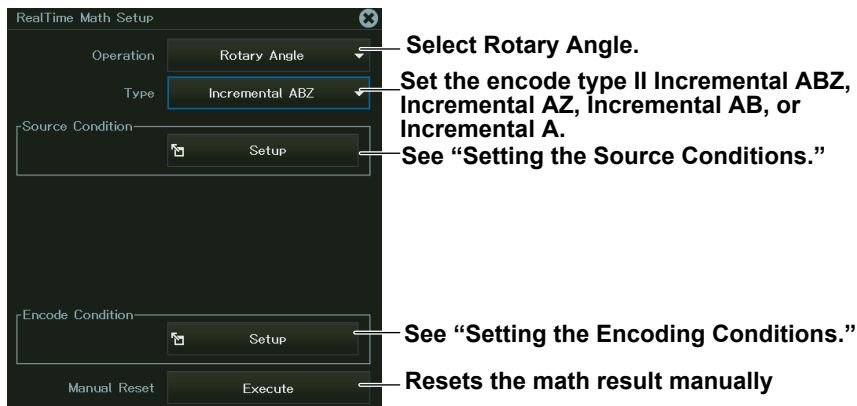


- Select Atan.
- Set the math source waveform.
- Set the scale (Radian, Degree).
- Set the quadrant range (Quadrant-2, Quadrant-4).

Rotation Angle (Rotary Angle)

The following screen appears when you select the rotary angle function.

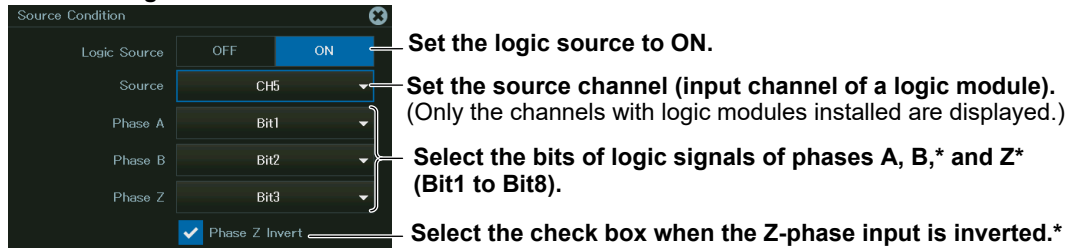
When the Encode Type Is Set to Incremental ABZ, Incremental AZ, Incremental AB, or Incremental A



- Select Rotary Angle.
- Set the encode type II Incremental ABZ, Incremental AZ, Incremental AB, or Incremental A.
- See "Setting the Source Conditions."
- See "Setting the Encoding Conditions."
- Resets the math result manually

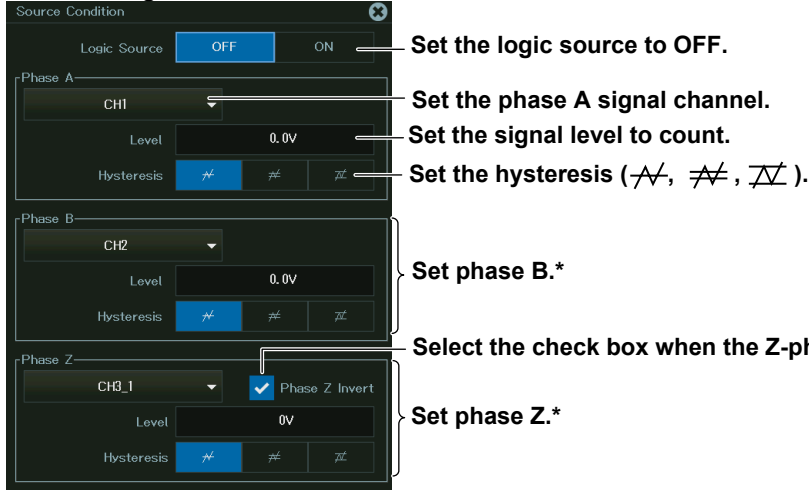
Setting the Source Conditions

When the logic source is ON



- Set the logic source to ON.
- Set the source channel (input channel of a logic module). (Only the channels with logic modules installed are displayed.)
- Select the bits of logic signals of phases A, B,* and Z* (Bit1 to Bit8).
- Select the check box when the Z-phase input is inverted.*

When the logic source is OFF



- Set the logic source to OFF.
- Set the phase A signal channel.
- Set the signal level to count.
- Set the hysteresis (\overline{A} , \overline{B} , \overline{Z}).
- Set phase B.*
- Select the check box when the Z-phase input is inverted.
- Set phase Z.*

* Phase B and phase Z settings are not displayed depending on the encode type.

Setting the Encoding Conditions

When the count condition is x1

The screenshot shows the 'Encode Condition' dialog box with the following settings:

- Pulse/Rotate: 180
- Scaling: 0 ~ 2 π
- Count Condition: x1
- Count/Rotate: 180
- Timing1: A \uparrow
- Multiplication factor: 1
- Reset Timing: A \uparrow
- Reverse: OFF
- Offset(*): 0.00

Annotations on the right side of the dialog box:

- Set the number of pulses per rotation.
- Set the scaling (-360° to +360°, -180° to +180°, 0° to 360°, -2 π to +2 π , - π to + π , 0 to 2 π , User Define¹).
- Set the count condition to x1.
- Number of counts per rotation
- Select the edge to count pulses on (A \uparrow , A \downarrow , B \uparrow ,² B \downarrow).
- Set the multiplication factor.³
- Select the edge to reset the value on (A \uparrow , A \downarrow , B \uparrow ,² B \downarrow ,² Z Level⁴)
- Turns rotation direction inversion on or off
- Set the initial phase of the rotation angle.³

When the encoding type is Incremental ABZ or Incremental AB and the count condition is x2

The screenshot shows the 'Encode Condition' dialog box with the following settings:

- Pulse/Rotate: 180
- Scaling: 0 ~ 2 π
- Count Condition: x2
- Count/Rotate: 360
- Timing1: A \uparrow
- Timing2: A \downarrow
- Multiplication factor: 1
- Reset Timing: A \uparrow
- Reverse: OFF
- Offset(*): 0.00

Annotations on the right side of the dialog box:

- Set the number of pulses per rotation.
- Set the scaling (-360° to +360°, -180° to +180°, 0° to 360°, -2 π to +2 π , - π to + π , 0 to 2 π , User Define¹).
- Set the count condition to x2.
- Number of counts per rotation
- Select the edge to count pulses on (A \uparrow , A \downarrow , B \uparrow , B \downarrow).
- Select the edge to count pulses on (A \uparrow , A \downarrow , B \uparrow , B \downarrow).
- Set the multiplication factor.³
- Select the edge to reset the value on (A \uparrow , A \downarrow , B \uparrow ,¹ B \downarrow ,¹ Z Level⁴).
- Turns rotation direction inversion on or off
- Set the initial phase of the rotation angle.³

When the encoding type is Incremental ABZ or Incremental AB and the count condition is x4 When the encoding type is Incremental AZ or Incremental A and the count condition is x2

The screenshot shows the 'Encode Condition' dialog box with the following settings:

- Pulse/Rotate: 180
- Scaling: 0 ~ 2 π
- Count Condition: x4
- Count/Rotate: 720
- Multiplication factor: 1
- Reset Timing: A \uparrow
- Reverse: OFF
- Offset(*): 0.00

Annotations on the right side of the dialog box:

- Set the number of pulses per rotation.
- Set the scaling (-360° to +360°, -180° to +180°, 0° to 360°, -2 π to +2 π , - π to + π , 0 to 2 π , User Define¹).
- Set the count condition to x2 or x4.
- Number of counts per rotation
- Set the multiplication factor.³
- Select the edge to reset the value on (A \uparrow , A \downarrow , B \uparrow ,² B \downarrow ,² Z Level⁴)
- Turns rotation direction inversion on or off
- Set the initial phase of the rotation angle.³

- 1: When User Define is selected, set the scaling coefficient.

The screenshot shows the 'Scaling' dialog box with 'User Define' selected in the dropdown menu and 'K' set to 1.0000.

Annotations on the right side:

- Set the scaling factor.

- 2: This can be set when the Encoding Type is Incremental ABZ or Incremental AB
 3: This can be set when scaling is set to -180° to +180°, 0° to 360°, - π to + π , or 0 to 2 π .
 4: This can be set when the Encoding Type is Incremental ABZ or Incremental AZ

When the Encode Type Is Set to Absolute 8bit, Absolute 16bit, or Gray Code

When Absolute 8bit or Absolute 16bit is selected

The screenshot shows the 'RealTime Math Setup' dialog box with the following settings and annotations:

- Operation:** Rotary Angle (Annotation: Select Rotary Angle.)
- Type:** Absolute 8bit (Annotation: Set the encode type to Absolute 8bit or Absolute 16bit.)
- Source Condition:** Setup (Annotation: See "Setting the Source Conditions.")
- Pulse/Rotate:** 180 (Annotation: Set the number of pulses per rotation.)
- Scaling:** 0 ~ 2π (Annotation: Set the scaling (-360° to +360°, -180° to +180°, 0° to 360°, -2 π to +2 π, - π to + π, 0 to 2 π, User Define*).
- Negative Logic:** OFF (Annotation: Turns negative logic on or off)

* When User Define is selected, set the scaling coefficient.

The screenshot shows the 'Scaling' dialog box with the following settings and annotation:

- Scaling:** User Define (Annotation: Set the scaling factor.)
- K:** 1.0000

For Gray Code

The screenshot shows the 'RealTime Math Setup' dialog box with the following settings and annotations:

- Operation:** Rotary Angle
- Type:** Gray Code (Annotation: Set the encode type to Gray Code.)
- Source Condition:** Setup
- Bit Length:** 16 (Annotation: Set the bit length.)
- Scaling:** 0 ~ 2π
- Negative Logic:** OFF

Setting the Source Conditions

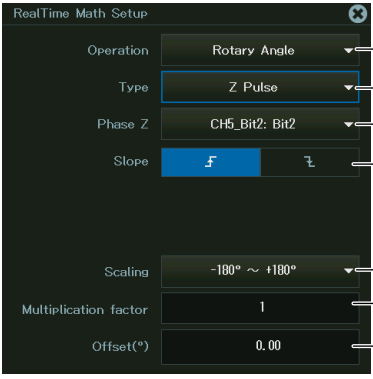
The screenshot shows the 'Source Condition' dialog box with the following settings and annotations:

- Logic Source:** ON (Annotation: Set the logic source to ON.)
- Source1:** CH6 (Annotation: Set the source channel* (input channel of a logic module). (Only the channels with logic modules installed are displayed.)
- Source2:** CH5

* Source2 can be set when the encode type is set to Absolute 16bit or Gray Code.

When the Encode Type Is Set to Z Pulse

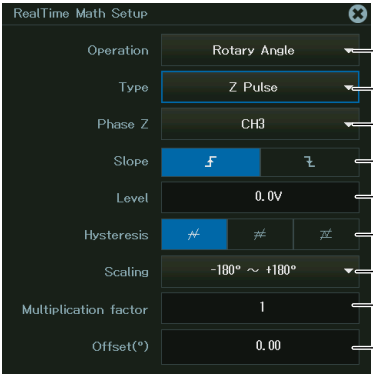
When the phase Z signal channel is a logic module



The screenshot shows the 'RealTime Math Setup' interface with the following settings and annotations:

- Operation:** Rotary Angle. **Select Rotary Angle.**
- Type:** Z Pulse. **Set the encode type to Z Pulse.**
- Phase Z:** CH5_Bit2: Bit2. **Set the phase Z signal channel. Select a logic module input channel and then the logic signal bit (Bit1 to Bit8).**
- Slope:** F (selected), F. **Set the edge detection condition (F , F).**
- Scaling:** -180° ~ +180°. **Select the scale (-180° to +180°, 0° to 360°, -π to +π, 0 to 2π).**
- Multiplication factor:** 1. **Set the multiplication factor.**
- Offset(*):** 0.00. **Set the offset.**

When the phase Z signal channel is an analog waveform module



The screenshot shows the 'RealTime Math Setup' interface with the following settings and annotations:

- Operation:** Rotary Angle. **Select Rotary Angle.**
- Type:** Z Pulse. **Set the encode type to Z Pulse.**
- Phase Z:** CH3. **Set the phase Z signal channel. Select the input channel of the analog waveform module.**
- Slope:** F (selected), F. **Set the edge detection condition (F , F).**
- Level:** 0.0V. **Set the level.**
- Hysteresis:** # (selected), #, #. **Set the hysteresis (~~#~~ , ~~#~~ , ~~#~~).**
- Scaling:** -180° ~ +180°. **Select the scale (-180° to +180°, 0° to 360°, -π to +π, 0 to 2π).**
- Multiplication factor:** 1. **Set the multiplication factor.**
- Offset(*):** 0.00. **Set the offset.**

Rotary Speed (Rotary Speed)

The following screen appears when you select the rotary speed function.

RealTime Math Setup

- Operation:** Rotary Speed. **Select Rotary Speed.**
- Type:** Incremental AB. **The encoding type is fixed to Incremental AB.**
- Source Condition:** Setup. **See "Setting the Source Conditions."**
- Scaling:** Rpm. **Set the scaling (Hz, Rpm, or User Define(K × Hz)).**
 - When User Define(K × Hz) is selected:**
Set the scaling factor.
- Pulse/Rotate:** 1. **Set the number of pulses per rotation. (When scaling is Rpm)**
- Encode Condition:** Setup. **See "Setting the Encoding Conditions."**
- Deceleration Prediction:** OFF ON. **Turns decelerating prediction on or off**
- Stop Prediction:** OFF. **Set the stop prediction (OFF, 2, 4, 8, 16).**

Setting the Source Conditions

When the logic source is ON

Source Condition

- Logic Source:** OFF ON. **Set the logic source to ON.**
- Source:** CH7. **Set the source channel (input channel of a logic module). (Only the channels with logic modules installed are displayed.)**
- Phase A:** Bit1. **Select the bits of logic signals of phases A and B (Bit1 to Bit8).**
- Phase B:** Bit2.

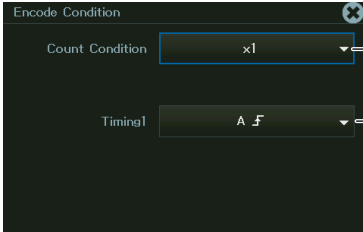
When the logic source is OFF

Source Condition

- Logic Source:** OFF ON. **Set the logic source to OFF.**
- Phase A:**
 - CH3:** **Set the phase A signal channel.**
 - Level:** 0.0V. **Set the signal level to count.**
 - Hysteresis:** . **Set the hysteresis (, ,).**
- Phase B:**
 - CH3:** **Set phase B.**
 - Level:** 0.0V
 - Hysteresis:**

Setting the Encoding Conditions

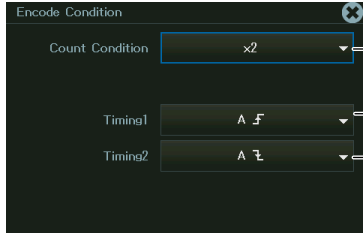
When the count condition is x1



Set the count condition to x1.

Select the edge to count pulses on¹
(A \bar{f} , A \bar{t} , B \bar{f} , B \bar{t})

When the count condition is x2

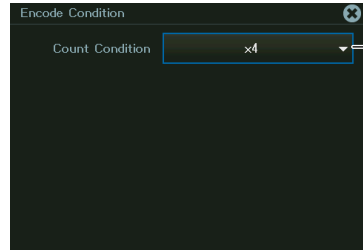


Set the count condition to x2.

Select the edge to count pulses on
(A \bar{f} , A \bar{t} , B \bar{f} , B \bar{t})

Select the edge to count pulses on
(A \bar{f} , A \bar{t} , B \bar{f} , B \bar{t})

When the count condition is x4

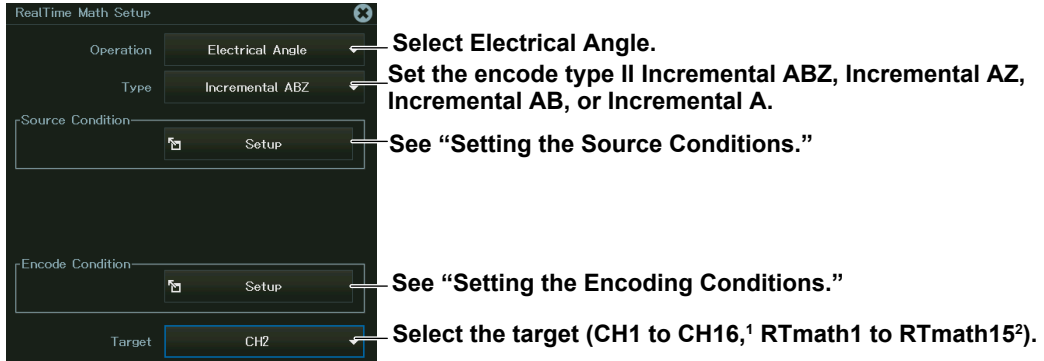


Set the count condition to x4.

Electrical Angle (Electrical Angle)

The following screen appears when you select the electrical angle function.

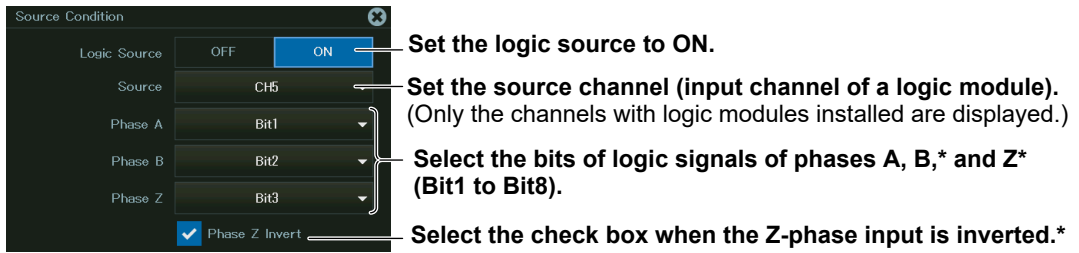
When the Encode Type Is Set to Incremental ABZ, Incremental AZ, Incremental AB, or Incremental A



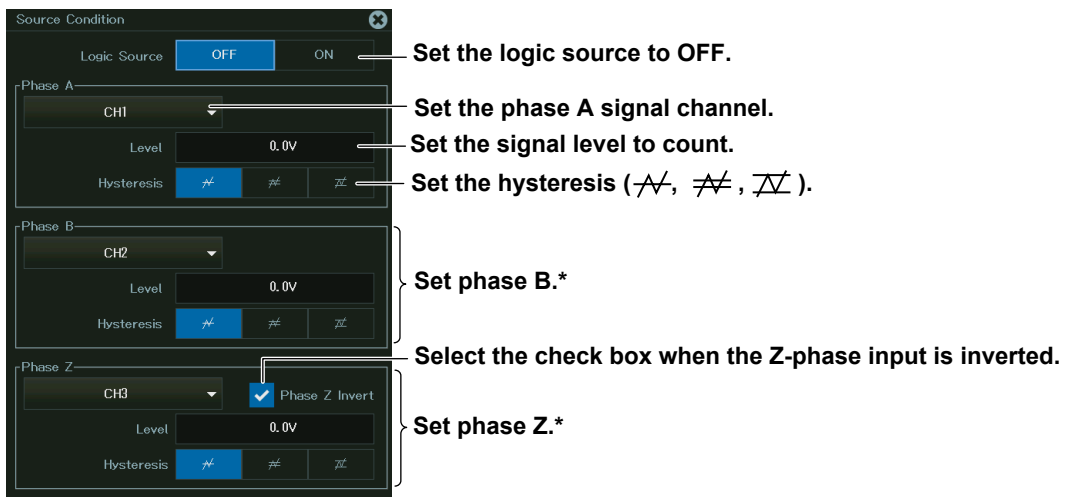
- 1: You can select channels in which input modules that support basic arithmetic are installed.
- 2: You can select channels whose numbers are smaller than the channel you are editing.

Setting the Source Conditions

When the logic source is ON



When the logic source is OFF



* Phase B and phase Z settings are not displayed depending on the encode type.

Setting the Encoding Conditions

When the count condition is x1

Pulse/Rotate: 180
 Scaling: -180° ~ +180°
 Count Condition: x1
 Count/Rotate: 180
 Timing1: A F
 Multiplication factor: 1
 Reset Timing: A F
 Reverse: OFF ON
 Offset(*): 0.00

- Set the number of pulses per rotation.
- Set the scaling (-180° to $+180^\circ$, $-\pi$ to $+\pi$).
- Set the count condition to x1.
- Number of counts per rotation
- Select the edge to count pulses on (A^F , A^L , B^F , B^L).
- Set the multiplication factor.
- Select the edge to reset the value on (A^F , A^L , B^F , B^L , Z Level²)
- Turns rotation direction inversion on or off
- Set the initial phase of the rotation angle.

When the encoding type is Incremental ABZ or Incremental AB and the count condition is x2

Pulse/Rotate: 180
 Scaling: -180° ~ +180°
 Count Condition: x2
 Count/Rotate: 360
 Timing1: A F
 Timing2: A L
 Multiplication factor: 1
 Reset Timing: A F
 Reverse: OFF ON
 Offset(*): 0.00

- Set the number of pulses per rotation.
- Set the scaling (-180° to $+180^\circ$, $-\pi$ to $+\pi$).
- Set the count condition to x2.
- Number of counts per rotation
- Select the edge to count pulses on (A^F , A^L , B^F , B^L).
- Select the edge to count pulses on (A^F , A^L , B^F , B^L).
- Set the multiplication factor.
- Select the edge to reset the value on (A^F , A^L , B^F , B^L , Z Level²)
- Turns rotation direction inversion on or off
- Set the initial phase of the rotation angle.

When the encoding type is Incremental ABZ or Incremental AB and the count condition is x4 When the encoding type is Incremental AZ or Incremental A and the count condition is x2

Pulse/Rotate: 180
 Scaling: -180° ~ +180°
 Count Condition: x4
 Count/Rotate: 720
 Multiplication factor: 1
 Reset Timing: A F
 Reverse: OFF ON
 Offset(*): 0.00

- Set the number of pulses per rotation.
- Set the scaling (-180° to $+180^\circ$, $-\pi$ to $+\pi$).
- Set the count condition to x2 or x4.
- Number of counts per rotation
- Set the multiplication factor.
- Select the edge to reset the value on (A^F , A^L , B^F , B^L , Z Level²)
- Turns rotation direction inversion on or off
- Set the initial phase of the rotation angle.

- 1: Can be set when the Encoding Type is Incremental ABZ or Incremental AB
- 2: Can be set when the Encoding Type is Incremental ABZ or Incremental AZ

When the Encode Type Is Set to Absolute 8bit, Absolute 16bit, or Gray Code

When Absolute 8bit or Absolute 16bit is selected

The screenshot shows the 'RealTime Math Setup' window with the following settings and annotations:

- Operation:** Electrical Angle (Annotation: Select Electrical Angle.)
- Type:** Absolute 8bit (Annotation: Set the encode type to Absolute 8bit or Absolute 16bit.)
- Source Condition:** Setup (Annotation: See "Setting the Source Conditions.")
- Pulse/Rotate:** 180 (Annotation: Set the number of pulses per rotation.)
- Scaling:** -180° ~ +180° (Annotation: Set the scaling (-180° to +180°, -π to +π).)
- Negative Logic:** OFF (Annotation: Turns negative logic on or off)
- Target:** CH3 (Annotation: Set the target.)

For Gray Code

The screenshot shows the 'RealTime Math Setup' window with the following settings and annotations:

- Operation:** Electrical Angle (Annotation: Select Electrical Angle.)
- Type:** Gray Code (Annotation: Set the encode type to Gray Code.)
- Source Condition:** Setup (Annotation: See "Setting the Source Conditions.")
- Bit Length:** 16 (Annotation: Set the bit length.)
- Scaling:** -180° ~ +180° (Annotation: Set the scaling (-180° to +180°, -π to +π).)
- Negative Logic:** OFF (Annotation: Turns negative logic on or off)
- Target:** CH3 (Annotation: Set the target.)

Setting the Source Conditions

The screenshot shows the 'Source Condition' window with the following settings and annotations:

- Logic Source:** ON (Annotation: The logic source is fixed to ON.)
- Source1:** CH6 (Annotation: Set the source channel* (input channel of a logic module). (Only the channels with logic modules installed are displayed.)
- Source2:** CH5 (Annotation: Set the source channel* (input channel of a logic module). (Only the channels with logic modules installed are displayed.)

* Source2 can be set when the encode type is set to Absolute 16bit or Gray Code. Set the logic channel for the least significant digits to Source1 and the logic channel for the most significant digits to Source2.

When the Encode Type Is Set to Resolver Ch

You can set this when Resolver or 3 Phase Resolver is set to a real time math channel with a smaller number than the real time math channel that you are currently setting.

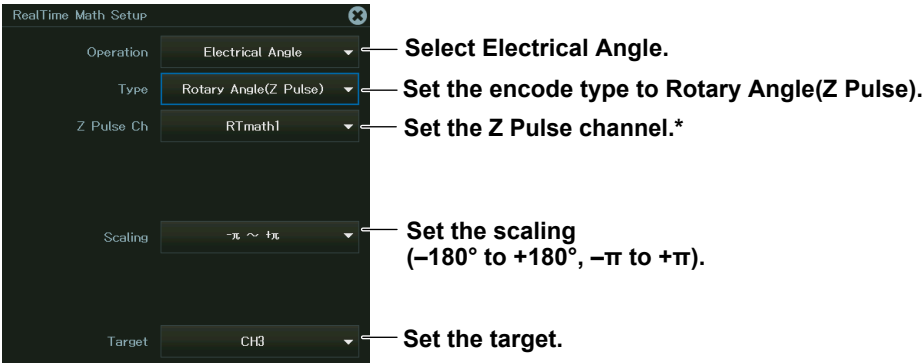
The screenshot shows the 'RealTime Math Setup' window with the following settings and annotations:

- Operation:** Electrical Angle (Annotation: Select Electrical Angle.)
- Type:** Resolver Ch (Annotation: Set the encode type to Resolver Ch.)
- Resolver Ch:** RTmath1 (Annotation: Set the resolver channel.*)
- Scaling:** -180° ~ +180° (Annotation: Set the scaling (-180° to +180°, -π to +π).)
- Target:** CH3 (Annotation: Set the target.)

* Select from RTmath1 to RTmath15 (a real time math channel with a smaller number than the real time math channel that you are currently setting) set to Resolver or 3 Phase Resolver.

When the Encode Type Is Set to Rotary Angle(Z Pulse)

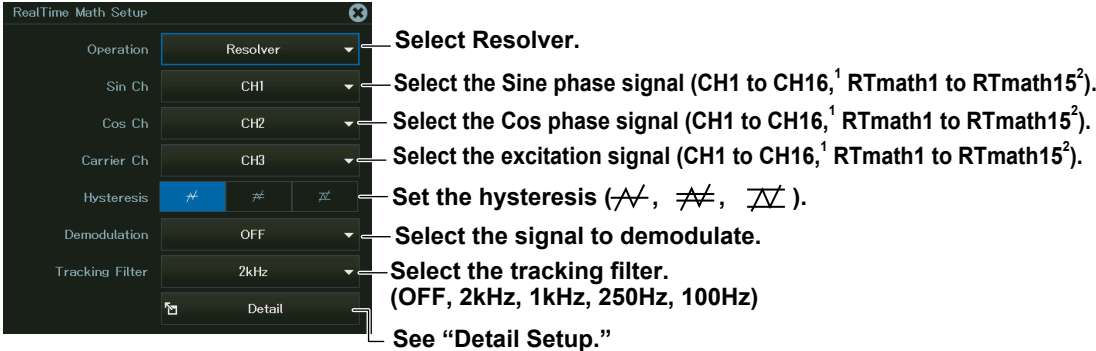
These settings are available when Rotary Angle is set to a real time math channel with a smaller number than the real time math channel that you are currently setting and the encode type is set to Z Pulse.



* Select from RTmath1 to RTmath15 (only the real time math channels with a smaller number than the real time math channel that you are currently setting) whose operator is set to Rotary Angle and the encode type is set to Z Pulse.

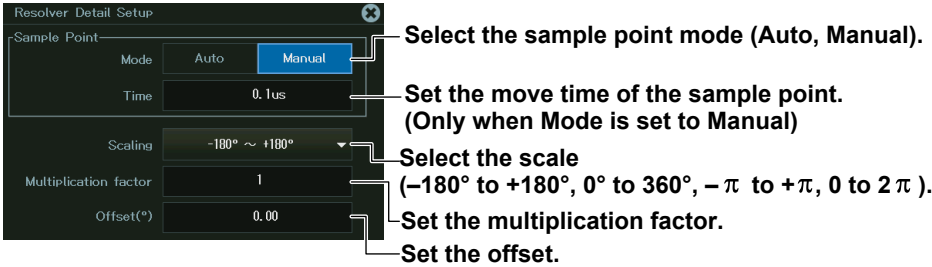
Resolver (Resolver)

The following screen appears when you select the resolver function.



1 : You can select channels in which input modules that support basic arithmetic are installed.
 2 : You can select channels whose numbers are smaller than the channel you are editing.

Detail Setup



3 Phase Resolver(3 Phase Resolver)

The following screen appears when you select the 3 phase resolver function.

Operation 3 Phase Resolver → Select 3 Phase Resolver.
Phase 0° - 120° → Set the phase of the Sin signal. (0° to 120°, 0° to 240°, 120° to 240°)
Sin0° Ch CH1 → Set the Sin signal (CH1 to CH16,¹ RTmath1 to RTmath15²).
Sin120° Ch CH2 → Set the Sin signal (CH1 to CH16,¹ RTmath1 to RTmath15²).
Carrier Ch CH3 → Set the excitation signal (CH1 to CH16,¹ RTmath1 to RTmath15²).
Hysteresis ≠ → Set the hysteresis (\sphericalangle , \neq , \sphericalangle).
Demodulation OFF → Select the signal to demodulate.
Tracking Filter 2kHz → Set the tracking filter. (OFF, 2kHz, 1kHz, 250Hz, 100Hz)
Detail → See "Detail Setup."

- 1 : You can select channels in which input modules that support basic arithmetic are installed.
- 2 : You can select channels whose numbers are smaller than the channel you are editing.

Detail Setup

Sample Point
 Mode: Auto Manual → Select the sample point mode (Auto, Manual).
 Time: 0.1us → Set the move time of the sample point. (Only when Mode is set to Manual)
Scaling -180° ~ +180° → Select the scale (-180° to +180°, 0° to 360°, $-\pi$ to $+\pi$, 0 to 2π).
Multiplication factor 1 → Set the multiplication factor.
Offset(°) 0.00 → Set the offset.

Motor dq Analysis Computation (/MT1)

This function can be used on models with the /MT1 option.

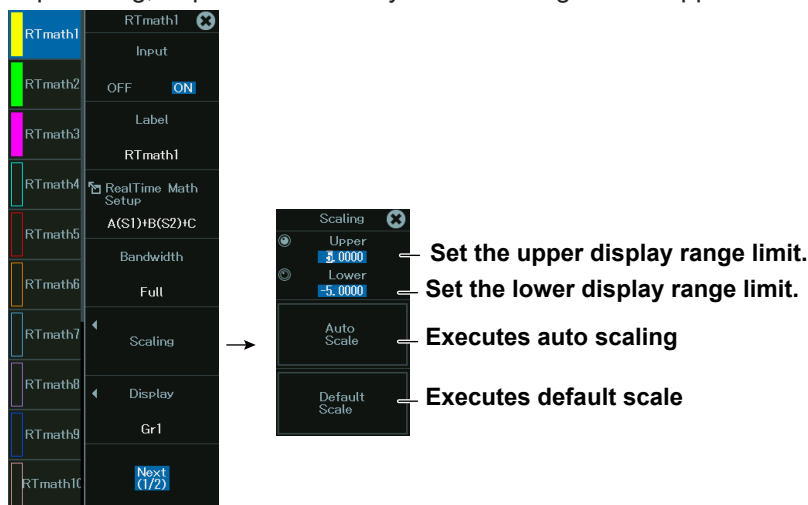
Clarke Transform (Clarke Transform)

The following screen appears when you select the Clarke transform operator.

Operation Clarke Transform → Select Clarke Transform.
Axis α β 0 → Select the phase to output.
 Power invariant → Set the transformation type.
Source1 CH3 → Set the math source waveform.
Source2 CH2 → Set the math source waveform.
Source3 CH1 → Set the math source waveform.

Setting the Scaling

3. Tap Scaling, or press the soft key. The following screen appears.



Auto Scale: The scale is set automatically according to the real time math waveform.

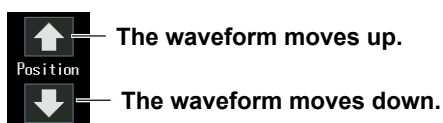
Default Scale: Sets a display range deemed appropriate from the setting range and expression of the math source waveform.

Setting the Display Range (SCALE knob)

3. After step 2 on page 16-2, select a channel, and then turn the SCALE knob to set the display range.

Setting the Vertical and Horizontal Positions of Waveforms (moving displayed waveforms)

3. After step 2 on page 16-2, select a channel, and then vertically drag near the center of the screen displaying the waveform of the selected channel to display up and down arrows. Tap the arrows to move the waveform. The arrows disappear after a given time period.



After selecting a channel, turn the vertical POSITION knob to set the vertical position.

In Recorder mode, you can move the horizontal position using the following methods.

Drag the screen horizontally

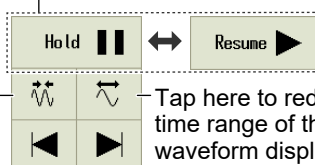


The waveform moves to the right.
The waveform moves to the left.

Hold your finger on the screen to display:

Holds or resumes the waveform display
Displayed only when you touch and hold the screen during waveform acquisition

Tap here to expand the time range of the waveform display.



Tap here to reduce the time range of the waveform display.

Displays the waveform at the left edge of the acquisition time or record time bar

Displays the waveform at the right edge of the acquisition time or record time bar

16.2 Configuring with the All Channel Setup Menu

This section explains how to set the real time math source waveform settings on all channels.

Items Common to Scope Mode and Recorder Mode

- Turning real time math on and off
- Label
- Real time math expression
- Math source waveforms, coefficients

► “Real Time Math (/G03, /G05, /MT1 option),” and
“Displaying the Menu for Configuring All Channels (ALL CH)” in the Features Guide

All Channel Setup Menu

1. On the waveform screen’s **MENU**, tap **CH > All CH**, or press **ALL CH**. An all channel setup menu appears.
2. Tap **RealTime Math**, or press the soft key. The following screen appears.

Turning real time math on or off

Set the label.

Set the expression.

Set the math source waveform and coefficients.
(The settings vary depending on the expression.)

	Input	Label	Operation	Sin Ch	Cos Ch	Carrier Ch	
1	<input checked="" type="checkbox"/> ON	RTmath1	Resolver	CH3_1	CH6	CH1	
2	<input checked="" type="checkbox"/> ON	RTmath2	Rotary Angle	CH7	CH7		
3	<input checked="" type="checkbox"/> ON	RTmath3	Knock Filter	CH1			
4	<input checked="" type="checkbox"/> ON	RTmath4	RMS	CH1			
5	<input checked="" type="checkbox"/> ON	RTmath5	$A(S1)+B(S2)+C$	CH1	CH2	1.0000	1.0000
6	<input checked="" type="checkbox"/> ON	RTmath6	Rotary Angle	CH7			
7	<input type="checkbox"/> OFF	RTmath7					
8	<input type="checkbox"/> OFF	RTmath8					

Note

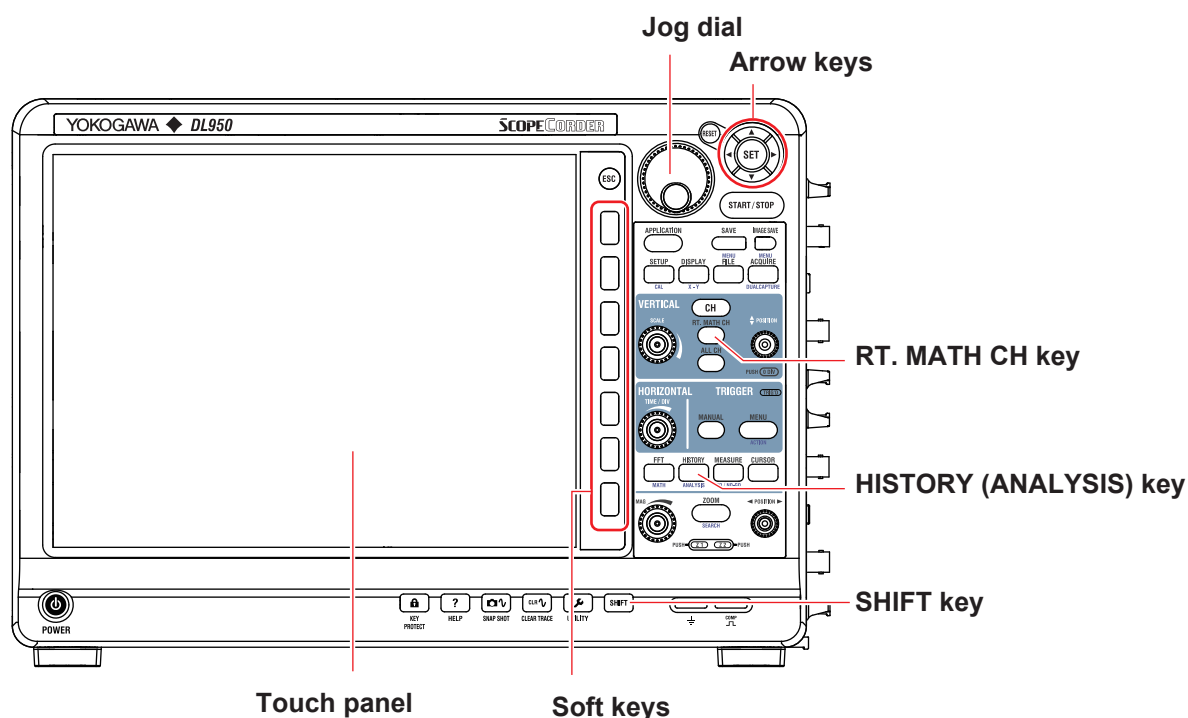
Not all real time math items can be set on the all channel setup menu. For items that cannot be set, use the real time math menu.

Chapter 17

Power Math (/G05, /MT1 Option), Motor dq Analysis (/MT1 Option)

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
17.1 Power Analysis (Power)	✓	✓
17.2 Harmonic Analysis (Harmonics)	✓	✓
17.3 Motor dq Analysis Function (Motor)	✓	✓
17.4 Configuring the Power Math and Motor dq Analysis Waveform Display	✓	✓

* The settings may vary depending on the operation mode.

17.1 Power Analysis (Power)

This section explains the following settings for performing power analysis:

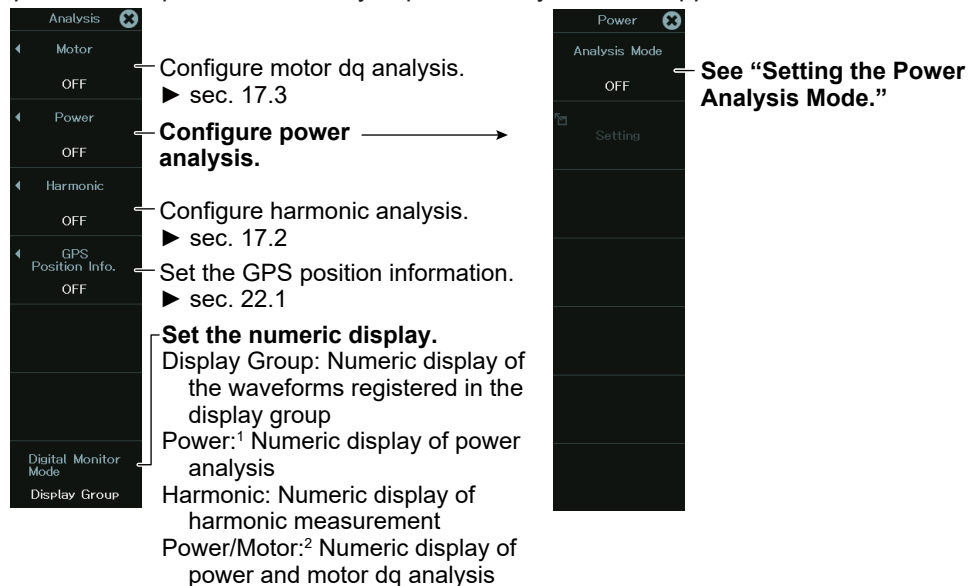
Items Common to Scope Mode and Recorder Mode

- Power analysis mode
- Selecting power analysis items
- Power analysis reset

▶ “Power Math (/G05, /MT1 Option), Motor dq Analysis (/MT1 Option)” in the Features Guide

Power Analysis Menu (Power)

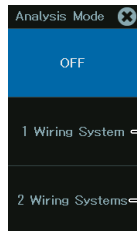
1. On the waveform screen’s **MENU**, tap **ANALYSIS** > **ANALYSIS**, or press **SHIFT+HISTORY (ANALYSIS)**.
2. Tap **Power**, or press the soft key. A power analysis menu appears.



- 1 /G05 option
- 2 /MT1 option

Setting the Power Analysis Mode (Analysis Mode)

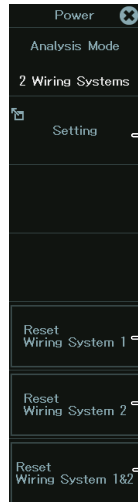
3. Tap **Analysis Mode**, or press the soft key. The following screen appears.
Set the analysis mode.



Set one analysis source.

Set two analysis sources.

Menu when the analysis mode is set to 2 Wiring Systems



See "Setting the Power Analysis Source."

Resets the integrated value of Wiring System1

Resets the integrated value of Wiring System2 (Appears when the analysis mode is set to 2Wiring)

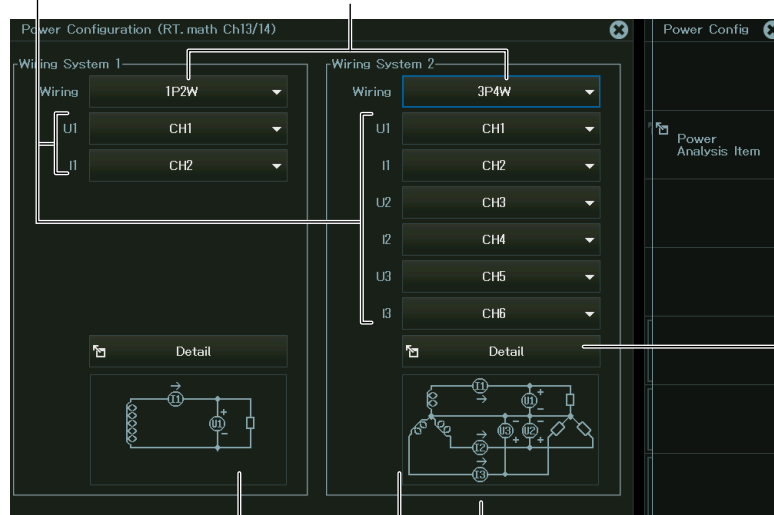
Resets the integrated value of Wiring System1 and 2 (Appears when the analysis mode is set to 2Wiring)

Setting the Power Analysis Source

4. Tap **Setting**, or press the soft key. The following screen appears.

Select the math source waveform.

Set the wiring system (1P2W, 1P3W, 3P3W, 3V3A, 3P4W, 3P3W→3V3A, 3V3A→3P4W, 3P4W→3V3A, 3V3AR, 3P3W→3P4W, 3V3AR→3P4W, 3V3AS→3P4W).



See "Selecting Power Analysis Items."

See "Detail Setup."

Wiring diagram

Wiring System 2 is displayed when the analysis mode is 2 Wiring System.

Detail Setup (Detail)

5. Tap **Detail**, or select **Detail** using the jog dial or arrow keys, and press **SET**. The following screen appears.

When the Calculation Period Type Is Set to Edge

Wiring System 1 Detail Setup

Calc Period

Type: Edge

Edge Source: UI

Slope: f, r, ft

Hysteresis: A, A#, A#

Edge Source Filter: OFF

Analysis Setting

Efficiency Setting

Δ-Y Waveform Display Setting

- Set the calculation period type to Edge.
- Set the edge detection source. (U1 to U3¹, I1 to I3¹, Other Channel, RTmath1 to RTmath16²)
- Set the slope (f, r, ft).
- Set the hysteresis (A, A#, A#).
- Set the edge source filter.³ (OFF, 128kHz, 64kHz, 32kHz, 16kHz, 8kHz, 4kHz, 2kHz, 1kHz, 500Hz, 250Hz, 125Hz, 62.5Hz)
- See "Analysis Setting."
- See "Efficiency Setting."
- See "Δ-Y Waveform Display Setting."⁴

- Items vary depending on the wiring system settings.
- You can set RTmath1 to RTmath16 when there are real time math channels set to Rotary Angle (excluding the case when the encoding condition's scaling is set to user-defined) or Resolver.
- This is not displayed when the edge detection source is set to RTmath.
- You can set this when the wiring system is 3V3A→3P4W, 3P3W→3P4W, 3V3AR→3P4W, or 3V3AS→3P4W.

Other Channel

Edge Source: Other Channel

Channel: CHI

Slope: f, r, ft

Hysteresis: A, A#, A#

Select channels from any of the voltage modules (except 16-CH temperature/voltage input modules).

RTmath1 to RTmath16

Edge Source: RTmath1

Threshold(*): 0.00

Slope: f, r, ft

Hysteresis: A, A#, A#

Set the threshold level.

When the Calculation Period Type Is Set to Timer

Wiring System 1 Detail Setup

Calc Period

Type: Timer

Auto Timer: 20.000ms

Analysis Setting

Efficiency Setting

Δ-Y Waveform Display Setting

- Set the calculation period type to Timer.
- Set the update time
- See "Analysis Setting."
- See "Efficiency Setting."
- See "Δ-Y Waveform Display Setting."^{*}

* You can set this when the wiring system is 3V3A→3P4W, 3P3W→3P4W, 3V3AR→3P4W, or 3V3AS→3P4W.

When the Calculation Period Type Is Set to Transient

Wiring System 1 Detail Setup

- Calc Period Type: Transient
- Edge Source: U1
- Slope: f, \bar{f} , $f\bar{f}$
- Hysteresis: \neq , \neq , \neq
- Edge Source Filter: OFF
- Stop Prediction: 2
- Output after Stop Prediction: OFF
- Auto Timer: 20.0000ms
- Analysis Setting
- Efficiency Setting
- Δ -Y Waveform Display Setting

Set the calculation period type to Transient.

Set the edge detection source. (U1 to U3¹, I1 to I3¹, Other Channel, RTmath1 to RTmath16²)

Set the slope (f, \bar{f} , $f\bar{f}$).

Set the hysteresis (\neq , \neq , \neq).

Set the edge source filter.³ (OFF, 128kHz, 64kHz, 32kHz, 16kHz, 8kHz, 4kHz, 2kHz, 1kHz, 500Hz, 250Hz, 125Hz, 62.5Hz)

Set the stop prediction (2, 4, 8, 16).

Set whether to output a zero after a stop prediction.

Set the update time

See "Analysis Setting."

See "Efficiency Setting."

See " Δ -Y Waveform Display Setting."⁴

- 1 Items vary depending on the wiring system settings.
- 2 You can set RTmath1 to RTmath16 when there are real time math channels set to Rotary Angle (excluding the case when the encoding condition's scaling is set to user-defined) or Resolver.
- 3 This is not displayed when the edge detection source is set to RTmath.
- 4 You can set this when the wiring system is 3V3A→3P4W, 3P3W→3P4W, 3V3AR→3P4W, or 3V3AS→3P4W.

Other Channel

Edge Source: Other Channel

Channel: CH1

Slope: f, \bar{f} , $f\bar{f}$

Hysteresis: \neq , \neq , \neq

Select channels from any of the voltage modules (except 16-CH temperature/voltage input modules).

RTmath1 to RTmath16

Edge Source: RTmath1

Threshold(°): 0.00

Slope: f, \bar{f} , $f\bar{f}$

Hysteresis: \neq , \neq , \neq

Set the threshold level.

Analysis Setting (Analysis Setting)

6. Tap **Analysis Setting**, or select **Analysis Setting** using the jog dial or arrow keys, and press **SET**. The following window appears.

Wiring System 1 Analysis Setup

- RMS Type: True RMS, Rect. Mean
- Φ Scale (°): Radian, Degree
- Load Circuit Connection Type: Series, Parallel
- Q Formula Type: Type1, Type2
- Integration Setup:
 - Condition: All Times, In Acquisition
 - Reset on Start: OFF, ON
 - Scaling: Second, Hour

Select the RMS type (True RMS, Rect. Mean).

Select the ϕ scale (Radian, Degree).

Set the load circuit connection type (Series, Parallel).

Set the reactive power math type (Type1, Type2).

Set the integration condition (All times, In Acquisition).

Set reset-at-start (OFF, ON).

Set the scaling (Second, Hour).

Efficiency Setting (Efficiency Setting)

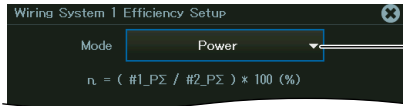
6. Tap **Efficiency Setting**, or select **Efficiency Setting** using the jog dial or arrow keys, and press **SET**. The following window appears.



Select the efficiency mode (OFF, Power,* Motor).

* You can select this when analysis mode is 2 Wiring System.

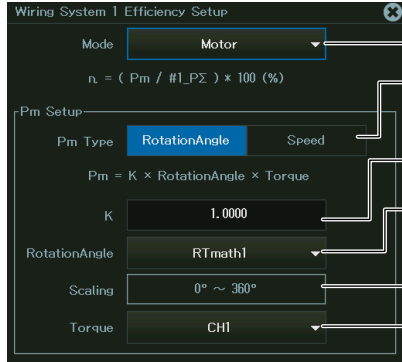
When the Efficiency Mode Is Set to Power



Select Power.

When the Efficiency Mode Is Set to Motor

When the Pm type is RotationAngle



Select Motor.

Set the Pm type (rotating speed type) to RotationAngle.

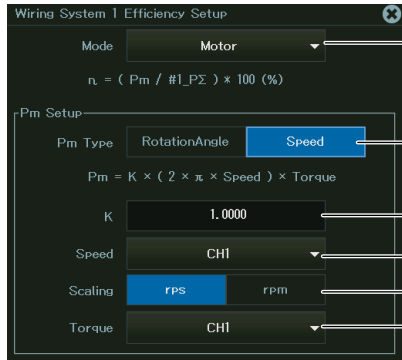
Set coefficient K.

Set the channel used to derive the rotation angle. (Select from the RTmath channels set to Rotary Angle.)

Scaling (fixed to 0° to 360°)

Set the channel used to derive the torque.

When the Pm type is Speed



Select Motor.

Set the Pm type (rotating speed type) to Speed.

Set coefficient K.

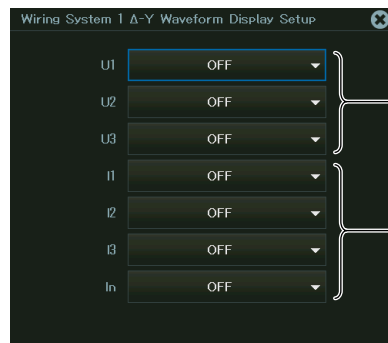
Set the channel used to derive the rotating speed.

Set the scaling (rps, rpm).

Set the channel used to derive the torque.

Δ -Y Waveform Display Setting (Δ -Y Waveform Display Setting)

6. Tap **Δ -Y Waveform Display Setting**, or select **Δ -Y Waveform Display Setting** using the jog dial or arrow keys, and press **SET**. The following screen appears.



Set the output destination for the voltage waveform obtained after delta-star transformation.
(OFF, RTmath1¹ to RTmath12, RTmath15,² RTmath16²)

Set the output destination for the current waveform obtained after delta-star transformation.
(OFF, RTmath1¹ to RTmath12, RTmath15,² RTmath16²)

- 1 When GPS position information (/C35 option) is on, RTmath1 cannot be selected.
- 2 When harmonic analysis is on, RTmath15 and RTmath16 cannot be selected.

Note

- No more than a single waveform can be assigned to a real time math (RTmath) channel. If several waveforms are assigned to a single RTmath channel, the last waveform takes precedence, and other waveforms are turned off.
- If a waveform is assigned to an RTmath channel being used for real time math, the real time math function of that channel is disabled. When the assignment is cleared, the real time math function is resumed.
- The waveform display and other settings of RTmath channels that waveforms are assigned to can be configured using the real time math menu (RT.MATH CH key). However, real time math setup (RealTime Math Setup) is not available.

Selecting Power Analysis Items (Power Analysis Item)

5. Tap **Power Analysis Item**, or press the soft key. The following screen appears. Display example when the analysis mode is set to 1 Wiring Systems and the wiring system is set to 1P2W

Output items

<input checked="" type="checkbox"/> Urms1	<input checked="" type="checkbox"/> Irms1	<input checked="" type="checkbox"/> Udc1	<input checked="" type="checkbox"/> Idc1
<input checked="" type="checkbox"/> Uac1	<input checked="" type="checkbox"/> Iac1	<input checked="" type="checkbox"/> P1	<input checked="" type="checkbox"/> S1
<input checked="" type="checkbox"/> Q1	<input checked="" type="checkbox"/> λ1	<input checked="" type="checkbox"/> φ1	<input checked="" type="checkbox"/> fU1
<input checked="" type="checkbox"/> fI1	<input checked="" type="checkbox"/> U _{pk1}	<input checked="" type="checkbox"/> U _{-pk1}	<input type="checkbox"/> I _{pk1}
<input checked="" type="checkbox"/> I _{-pk1}	<input checked="" type="checkbox"/> P _{pk1}	<input checked="" type="checkbox"/> P _{-pk1}	<input checked="" type="checkbox"/> WP1
<input checked="" type="checkbox"/> WP+1	<input checked="" type="checkbox"/> WP-1	<input checked="" type="checkbox"/> q1	<input type="checkbox"/> q+1
<input checked="" type="checkbox"/> q-1	<input checked="" type="checkbox"/> WS1	<input checked="" type="checkbox"/> WQ1	<input checked="" type="checkbox"/> Z1
<input checked="" type="checkbox"/> R1	<input checked="" type="checkbox"/> X1	<input type="checkbox"/> P _m	<input type="checkbox"/> n
<input checked="" type="checkbox"/> Time			

Set all output items to OFF (clear the check boxes).
 Set all output items to ON (select the check boxes).

See "Setting All Output Items."

- Display example when the analysis mode is set to 2 Wiring Systems and the wiring system is set to 1P2W

Output items

<input checked="" type="checkbox"/> Urms1	<input checked="" type="checkbox"/> Irms1	<input checked="" type="checkbox"/> Udc1	<input checked="" type="checkbox"/> Idc1
<input checked="" type="checkbox"/> Uac1	<input checked="" type="checkbox"/> Iac1	<input checked="" type="checkbox"/> P1	<input checked="" type="checkbox"/> S1
<input checked="" type="checkbox"/> Q1	<input checked="" type="checkbox"/> λ1	<input checked="" type="checkbox"/> φ1	<input checked="" type="checkbox"/> fU1
<input checked="" type="checkbox"/> fI1	<input checked="" type="checkbox"/> U _{pk1}	<input checked="" type="checkbox"/> U _{-pk1}	<input type="checkbox"/> I _{pk1}

Set all output items to OFF (clear the check boxes).
 Set all output items to ON (select the check boxes).

See "Setting All Output Items."

Setting All Output Items (All Items Output Setup)

Analysis items (scroll to display hidden items)

	Color	Label	Upper limit	Lower limit
1	Urms1	#1_Urms1	5.0000V	-5.0000V
2	Irms1	#1_Irms1	5.0000A	-5.0000A
3	Udc1	#1_Udc1	5.0000V	-5.0000V
4	Idc1	#1_Idc1	250.00A	-250.00A
5	Uac1	#1_Uac1	250.00V	-250.00V
6	Iac1	#1_Iac1	250.00A	-250.00A
7	P1	#1_P1	25.000kW	-25.000kW
8	S1	#1_S1	25.000kVA	-25.000kVA
9	Q1	#1_Q1	25.000kvar	-25.000kvar
10	λ 1	#1_λ1	0.001k	-1.0000
11	φ1	#1_φ1	0.180kdeg	-180.00deg

Setup

- Wiring System 1 (Selected) - Switches the displayed wiring system*
- Wiring System 2
- All AutoScale - Sets all upper limits and lower limits using auto scale.
- All DefaultScale - Sets all upper limits and lower limits using default scale.

* This is fixed to Wiring System 1 when the analysis mode is 1 Wiring System.

17.2 Harmonic Analysis (Harmonics)

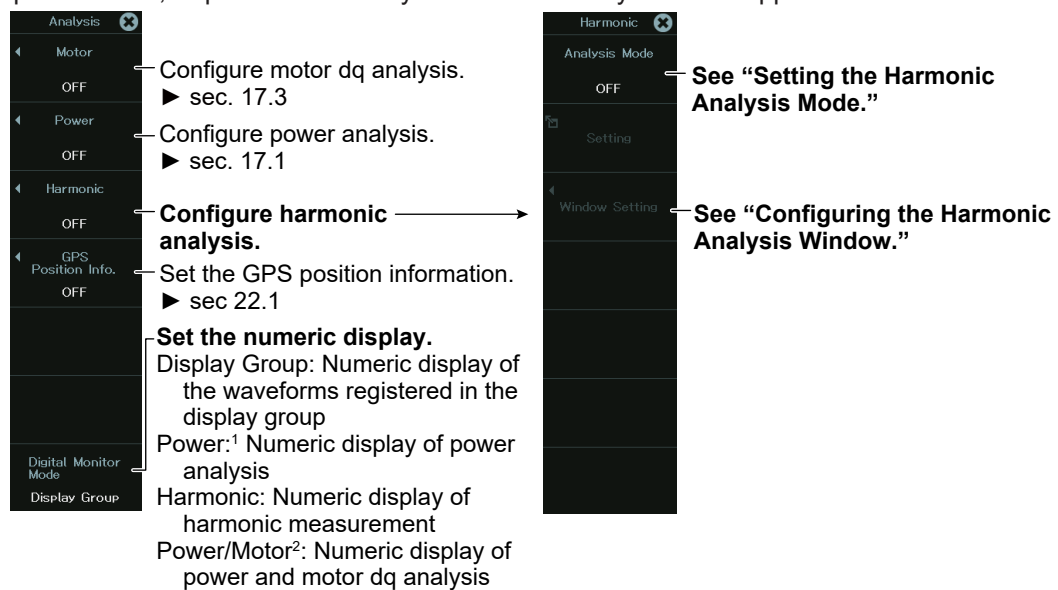
This section explains the following settings for performing harmonic analysis:

- Harmonic analysis mode
- Selecting harmonic analysis items
- Harmonic analysis window

► “Power Math (/G05, /MT1 Option), Motor dq Analysis (/MT1 Option)” in the Features Guide

Harmonic Analysis Menu (Harmonic)

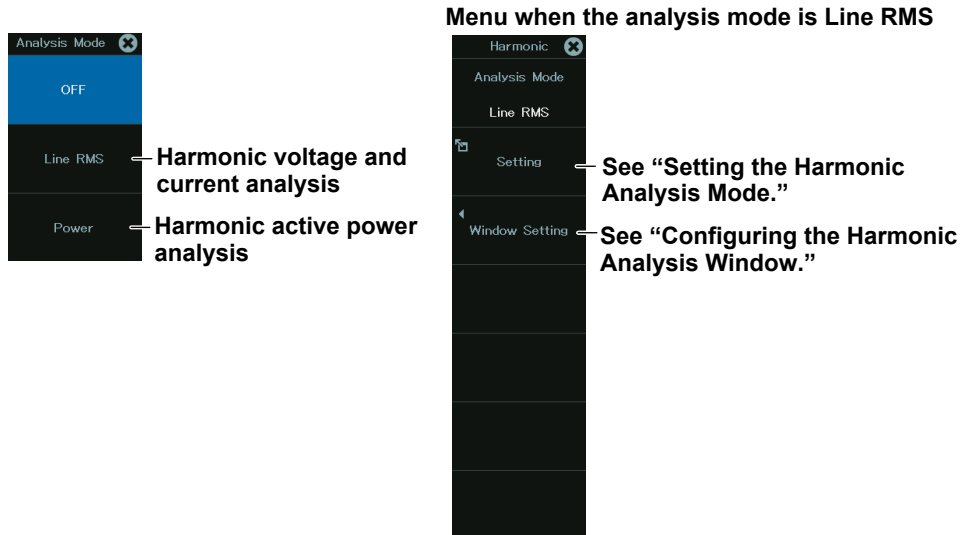
1. On the waveform screen’s **MENU**, tap **ANALYSIS** > **ANALYSIS**, or press **SHIFT+HISTORY (ANALYSIS)**. The following menu appears.
2. Tap **Harmonic**, or press the soft key. A harmonic analysis menu appears.



- 1 /G05 option
- 2 /MT1 option

Setting the Harmonic Analysis Mode (Analysis Mode)

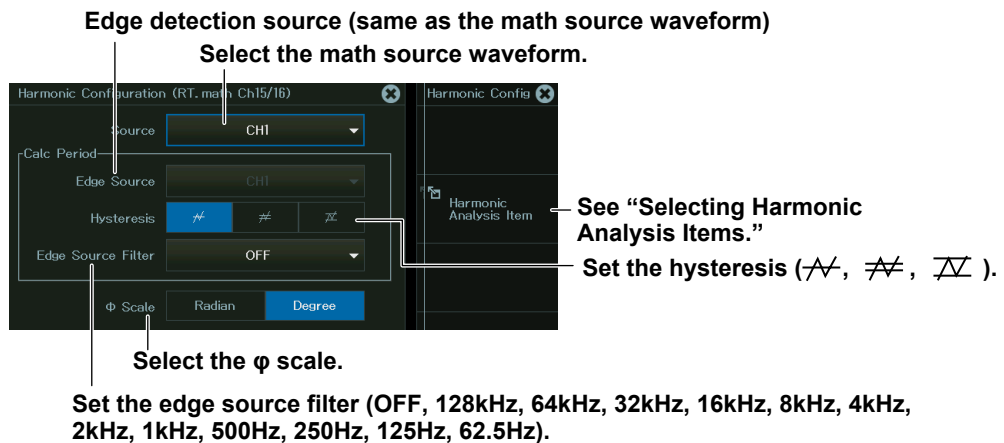
3. Tap **Analysis Mode**, or press the soft key. The following screen appears.
Set the analysis mode.



When Analysis Mode is set to Line RMS (voltage/current harmonic analysis)

Setting the Harmonic Analysis Mode (Setting)

4. Tap **Setting**, or press the soft key. The following screen appears.



Selecting Harmonic Analysis Items

5. Tap **Harmonic Analysis Item**, or press the soft key. The following screen appears.

Output items

Harmonic Analysis Item Analysis Item

<input checked="" type="checkbox"/> RMS(1)	<input type="checkbox"/> RMS(2)	<input checked="" type="checkbox"/> RMS(3)	<input type="checkbox"/> RMS(4)	<input checked="" type="checkbox"/> RMS(5)	<input type="checkbox"/> RMS(6)
<input checked="" type="checkbox"/> RMS(7)	<input type="checkbox"/> RMS(8)	<input checked="" type="checkbox"/> RMS(9)	<input type="checkbox"/> RMS(10)	<input checked="" type="checkbox"/> RMS(11)	<input type="checkbox"/> RMS(12)
<input checked="" type="checkbox"/> RMS(13)	<input type="checkbox"/> RMS(14)	<input checked="" type="checkbox"/> RMS(15)	<input type="checkbox"/> RMS(16)	<input checked="" type="checkbox"/> RMS(17)	<input type="checkbox"/> RMS(18)
<input checked="" type="checkbox"/> RMS(19)	<input type="checkbox"/> RMS(20)	<input checked="" type="checkbox"/> RMS(21)	<input type="checkbox"/> RMS(22)	<input checked="" type="checkbox"/> RMS(23)	<input type="checkbox"/> RMS(24)
<input checked="" type="checkbox"/> RMS(25)	<input type="checkbox"/> RMS(26)	<input checked="" type="checkbox"/> RMS(27)	<input type="checkbox"/> RMS(28)	<input checked="" type="checkbox"/> RMS(29)	<input type="checkbox"/> RMS(30)
<input checked="" type="checkbox"/> RMS(31)	<input type="checkbox"/> RMS(32)	<input checked="" type="checkbox"/> RMS(33)	<input type="checkbox"/> RMS(34)	<input checked="" type="checkbox"/> RMS(35)	<input type="checkbox"/> RMS(36)
<input checked="" type="checkbox"/> RMS(37)	<input type="checkbox"/> RMS(38)	<input checked="" type="checkbox"/> RMS(39)	<input type="checkbox"/> RMS(40)	<input type="checkbox"/> Rhdf(1)	<input type="checkbox"/> Rhdf(2)
<input type="checkbox"/> Rhdf(3)	<input type="checkbox"/> Rhdf(4)	<input type="checkbox"/> Rhdf(5)	<input type="checkbox"/> Rhdf(6)	<input type="checkbox"/> Rhdf(7)	<input type="checkbox"/> Rhdf(8)
<input type="checkbox"/> Rhdf(9)	<input type="checkbox"/> Rhdf(10)	<input type="checkbox"/> Rhdf(11)	<input type="checkbox"/> Rhdf(12)	<input type="checkbox"/> Rhdf(13)	<input type="checkbox"/> Rhdf(14)
<input type="checkbox"/> Rhdf(15)	<input type="checkbox"/> Rhdf(16)	<input type="checkbox"/> Rhdf(17)	<input type="checkbox"/> Rhdf(18)	<input type="checkbox"/> Rhdf(19)	<input type="checkbox"/> Rhdf(20)
<input type="checkbox"/> Rhdf(21)	<input type="checkbox"/> Rhdf(22)	<input type="checkbox"/> Rhdf(23)	<input type="checkbox"/> Rhdf(24)	<input type="checkbox"/> Rhdf(25)	<input type="checkbox"/> Rhdf(26)

All Items Output Setup See "Setting All Output Items."

Sets all output items to on (selects the check boxes) or off (clears the check boxes)

Resets settings to their defaults.

Collectively sets ϕ(1 to 35) to on or off
 Collectively sets Rhdf(1 to 35) to on or off
 Collectively sets Rms(1 to 35) to on or off

Setting All Output Items (All Items Output Setup)

Analysis items (scroll to display hidden items)

	Color	Label	Upper limit	Lower limit
1	-	RMS(x)	0.0000	0.0000
2	■	RMS(1)	5.0000	-5.0000
3	■	RMS(2)	5.0000	-5.0000
4	■	RMS(3)	5.0000	-5.0000
5	■	RMS(4)	5.0000	-5.0000
6	+	Rhdf(x)	0.0000	0.0000
7	+	Φ(x)	0.0000	0.0000
8	■	RMS	5.0000	-5.0000
9	■	THDIEC	5.0000	-5.0000
10	■	THDCSA	5.0000	-5.0000

All Items Output Setup Analysis Item

Tap "+" or move the cursor to "+" and press SET to display the items that have been set to ON when harmonic analysis items were selected. "+" changes to "-".

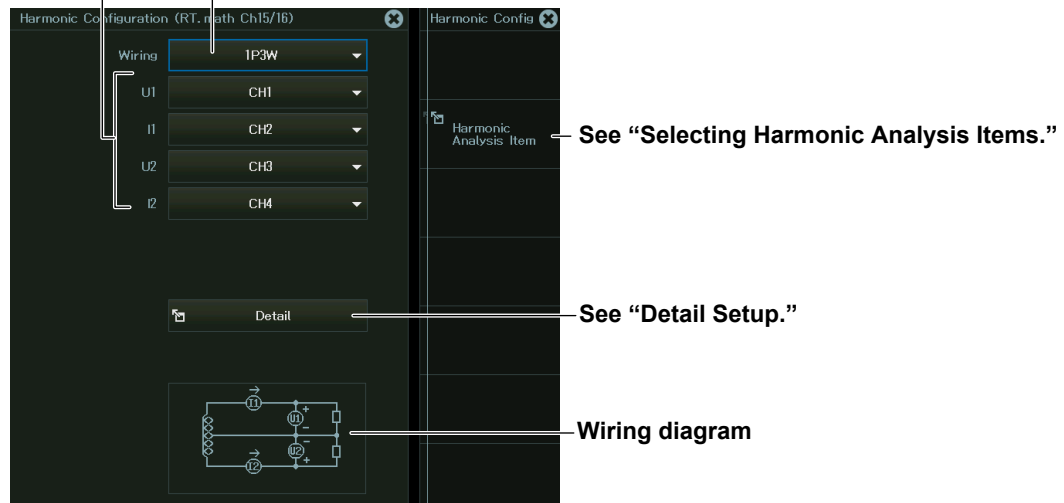
When Analysis Mode is set to Power

Setting the Harmonic Analysis Mode (Setting)

4. Tap **Setting**, or press the soft key. The following screen appears.

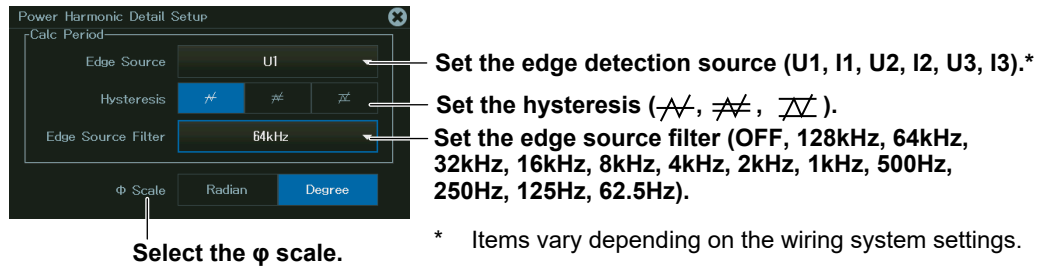
Select the math source waveform (the items vary depending on the wiring system).

Set the wiring system (1P2W, 1P3W, 3P3W, 3V3A, 3P4W, 3P3W→3V3A, 3V3A→3P4W, 3P4W→3V3A, 3V3AR, 3P3W→3P4W, 3V3AR→3P4W, 3V3AS→3P4W).



Detail Setup (Detail)

5. Select **Detail** to display the following screen.



Selecting Harmonic Analysis Items (Harmonic Analysis Item)

6. Tap **Harmonic Analysis Item**, or press the soft key. The following screen appears.

Output items

See "Setting All Output Items."

Sets all output items to on (selects the check boxes) or off (clears the check boxes)

Resets settings to their defaults.

Collectively sets $\phi(1$ to $35)$ to on or off

Collectively sets Phdf(1 to 35) to on or off

Collectively sets P(1 to 35) to on or off

Setting All Output Items (All Output Items Setup)

7. Tap **All Output Items Setup**, or press the soft key. The following screen appears.

Analysis items (scroll to display hidden items)

	Color	Label	Upper limit	Lower limit
1	-	P(x)	0.0000	0.0000
2	■	P(1)	5.0000	-5.0000
3	■	P(2)	5.0000	-5.0000
4	■	P(3)	5.0000	-5.0000
5	■	P(4)	5.0000	-5.0000
6	■	P(5)	5.0000	-5.0000
7	+	Phdf(x)	0.0000	0.0000
8	+	$\phi(x)$	0.0000	0.0000
9	■	P	5.0000	-5.0000
10	■	S	5.0000	-5.0000
11	■	Q	5.0000	-5.0000

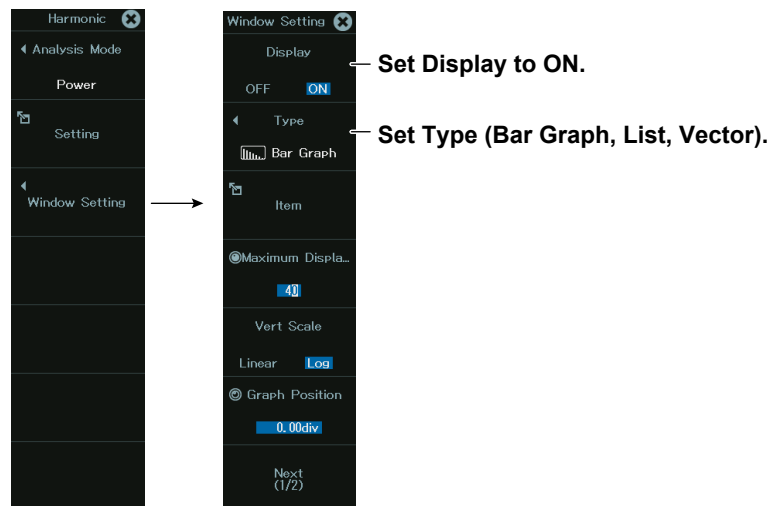
Tap "+" or move the cursor to "+" and press SET to display the items that have been set to ON when harmonic analysis items were selected. "+" changes to "-".

Configuring the Harmonic Analysis Window (Harmonic Window Setup)

Setting the Display Type (Type)

3. Tap **Window Setting**, or press the soft key.
4. Tap **Type**, or press the soft key.

From the menu that appears, select the display type.

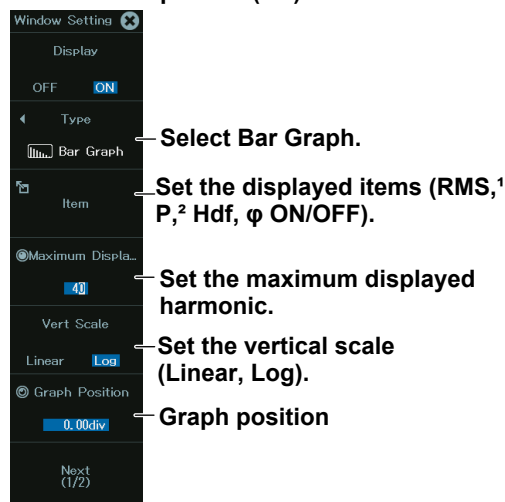


There are three methods to display the harmonic analysis results.

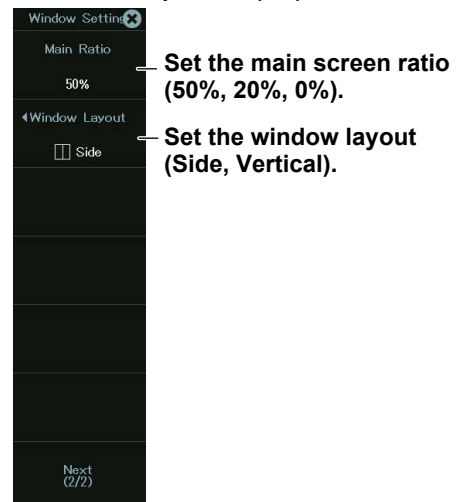
- Bar graph (Bar): A bar graph is displayed for the calculated harmonic value of each harmonic up to the 40th harmonic.
- List (List): A numerical list is displayed for the calculated harmonic value of each harmonic up to the 40th harmonic.
- Vector (Vector): The relationship of the phase difference and size (rms value) between the fundamental waves U(1) and I(1) of the element is displayed with vectors.

Configuring the Bar Graph (Bar Graph)

Window setup menu (1/2)



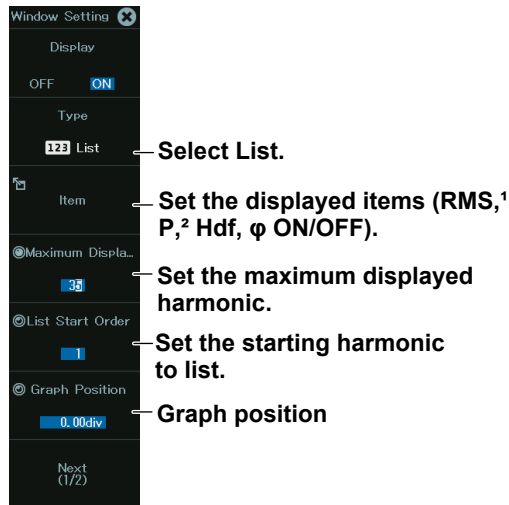
Window setup menu (2/2)



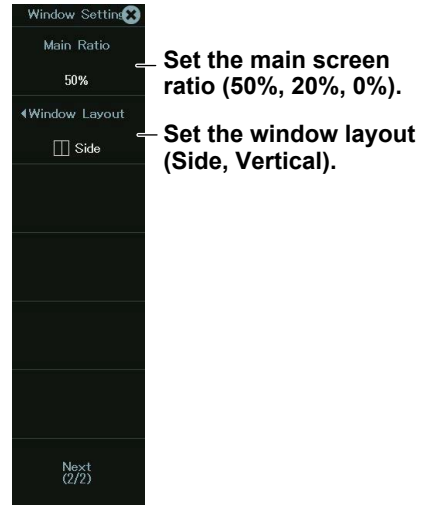
- 1: When the analysis mode is Line RMS
- 2: When the Analysis Mode is Power

Configuring the List (List)

Window setup menu (1/2)



Window setup menu (2/2)

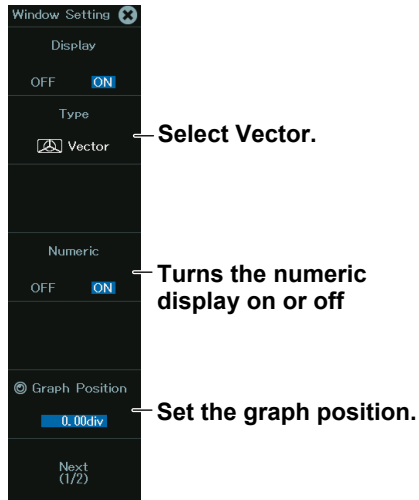


- 1: When the analysis mode is Line RMS
- 2: When the Analysis Mode is Power

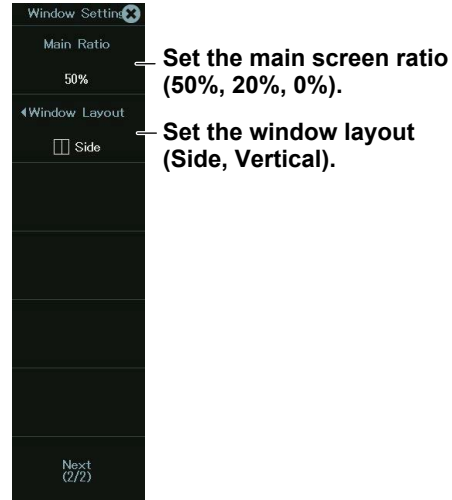
Configuring the Vector (Vector)

You can configure this when Analysis Mode is set to Power.

Window setup menu (1/2)



Window setup menu (2/2)



17.3 Motor dq Analysis Function (Motor)

This section explains the following settings for performing motor dq analysis.

Items Common to Scope Mode and Recorder Mode

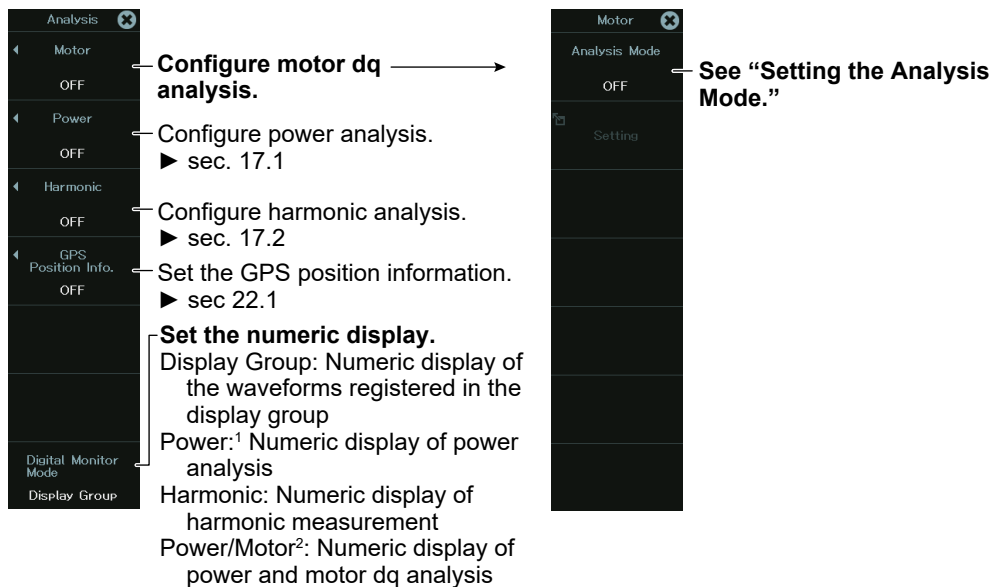
- Analysis method
- Selecting analysis items
- Analysis reset

▶ “Power Math (/G05, /MT1 Option), Motor dq Analysis (/MT1 Option)” in the Features Guide

Motor dq Analysis Menu (Motor)

1. On the waveform screen’s **MENU**, tap **ANALYSIS > ANALYSIS**, or press **SHIFT+HISTORY**.
2. Tap **Motor**, or press the soft key.

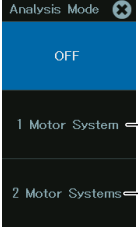
A motor dq analysis menu appears.



- 1 /G05 option
- 2 /MT1 option

Setting the Analysis Mode (Analysis Mode)

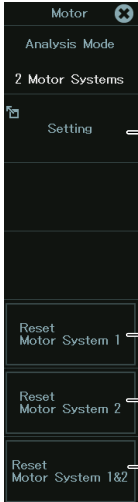
3. Tap **Analysis Mode**, or press the soft key. The following screen appears.
Set the analysis mode.



1 Motor System — Set one analysis source.

2 Motor Systems — Set two analysis sources.

Menu when the analysis mode is set to 2 Motor Systems



Setting — See “Setting the Analysis Source.”

Reset Motor System 1 — Resets the integrated value of Motor System1

Reset Motor System 2 — Resets the integrated value of Motor System2 (Appears when the analysis mode is set to 2 Motor)


Reset Motor System 1&2 — Resets the integrated value of Motor System1 and 2 (Appears when the analysis mode is set to 2 Motor)

Setting the Analysis Source

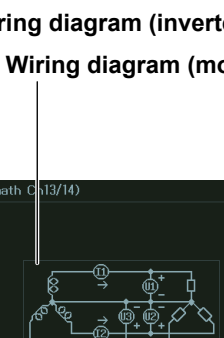
4. Tap **Setting**, or press the soft key. The following screen appears.

Select the item (system) to configure (available when 2 Motor Systems is selected)

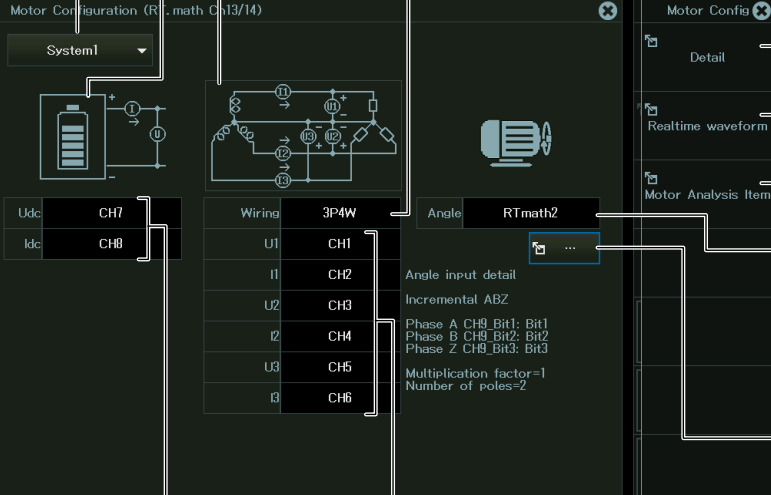
Wiring diagram (inverter input power (DC power))



Wiring diagram (motor input power)



Set the wiring system.
(3P4W, 3V3A→3P4W, 3P3W→3P4W, 3V3AR→3P4W, 3V3AS→3P4W)



Detail — See “Detail Setup.”

Realtime waveform — See “Setting the Realtime Waveform.”

Motor Analysis Item — See “Setting the Motor dq Analysis Items.”

Set the motor rotation angle.
Select a real time math channel set to Rotary Angle, Resolver, or 3 phase Resolver.*

Configure real time math settings.
Change the settings of a real time math channel set to Angle. ► sec. 16.1

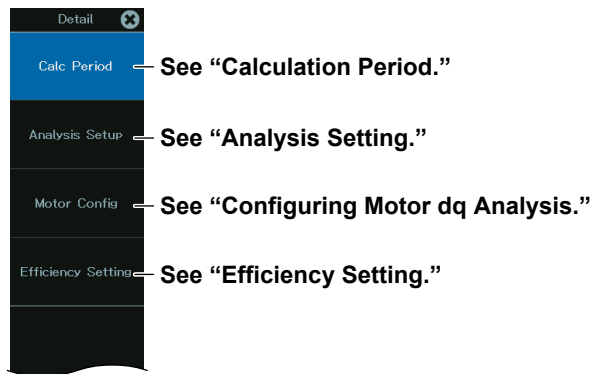
Select the math source waveform (motor input power).

Select the math source waveform (inverter input power (DC power)).

* The scaling of the selected real time math must be set to -180° to $+180^\circ$ or $-\pi$ to $+\pi$.

Detail Setup (Detail)

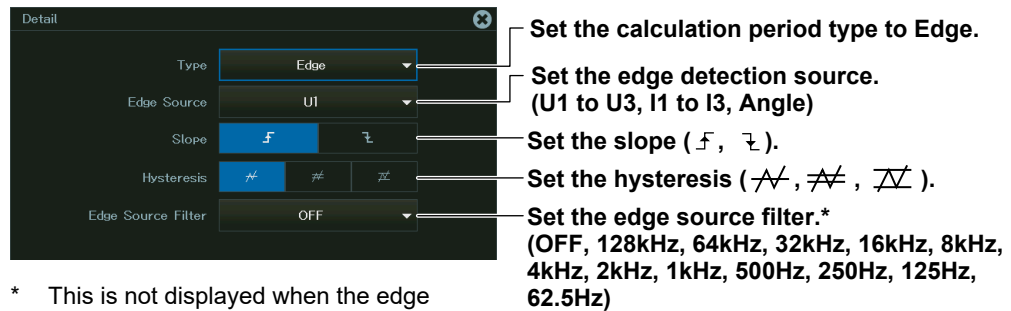
5. Tap **Detail**, or press the soft key. The following screen appears.



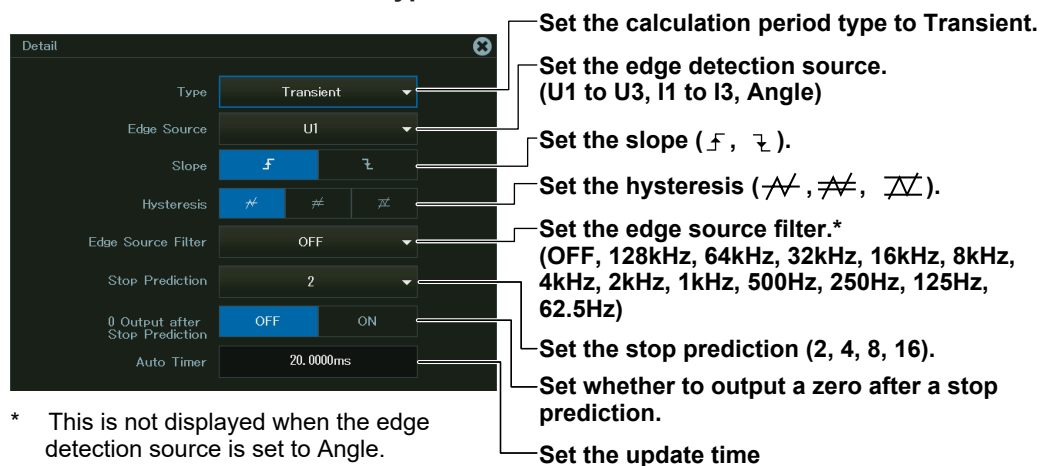
Calculation Period (Calc Period)

6. Tap **Calc Period**, or press the soft key. The following screen appears.

When the calculation period type is set to Edge



When the Calculation Period Type Is Set to Transient



Analysis Setup (Analysis Setup)

6. Tap **Analysis Setup**, or press the soft key. The following screen appears.

The screenshot shows the 'Detail' screen for Analysis Setup. It includes the following settings and callouts:

- RMS Type:** True RMS (selected), Rect. Mean. Callout: **Select the RMS type (True RMS, Rect. Mean).**
- Φ Scale (*):** Radian, Degree (selected). Callout: **Select the φ scale (Radian, Degree).**
- Q Formula Type:** Type1, Type2 (selected). Callout: **Set the reactive power math type (Type1, Type2).**
- Integration Setup:**
 - Condition:** All Times (selected), In Acquisition. Callout: **Set the integration condition (All times, In Acquisition).**
 - Reset on Start:** OFF, ON (selected). Callout: **Set reset-at-start (OFF, ON).**
 - Scaling:** Second, Hour (selected). Callout: **Set the scaling (Second, Hour).**

Configuring Motor dq Analysis (Motor Config)

6. Tap **Motor Config**, or press the soft key. The following screen appears.

The screenshot shows the 'Detail' screen for Motor Config. It includes the following settings and callouts:

- DQ transformation:**
 - Fundamental analysis:** (checked). Callout: **Set the math type. Select this check box to perform fundamental waveform analysis during dq transformation.**
 - Power invariant:** (unchecked). Callout: **Set the transformation type. Select this check box to perform absolute dq transformation.**
- Number of poles:** 2. Callout: **Set the number of poles.**
- Armature flux linkage:** 100.00mWb. Callout: **Set the armature flux linkage.**
- Winding resistance:** 1.0000ohm. Callout: **Set the winding resistance.**
- Θe Offset(*):** 0.0000. Callout: **Set the electrical angle offset.**
- Rotational speed unit:** Hz (selected), rpm. Callout: **Set the unit of rotation frequency (Hz, rpm). Set the unit of rotation frequency (fm) of the motor dq analysis item.**

Efficiency Setting (Efficiency Setting)

6. Tap **Efficiency Setting**, or press the soft key. The following screen appears.

The screenshot shows the 'Detail' screen for Efficiency Setting. It includes the following settings and callouts:

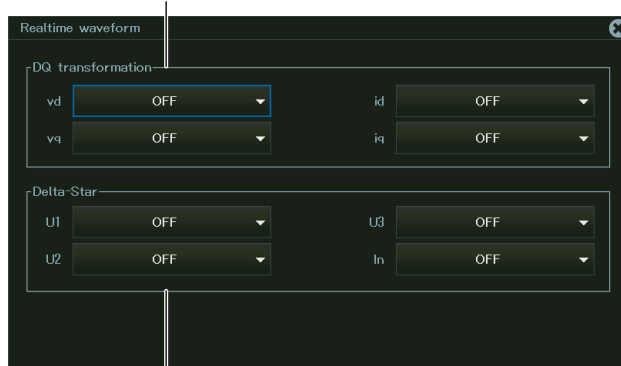
- Efficiency 1:**
 - Denominator: #1_Pm
 - Numerator: #1_PS
 - Callout: **Set the denominator and numerator of the equation for deriving efficiency 1.¹ (#1_Pdc, #1_PS, #1_Pm, #2_Pdc², #2_PS², #2_Pm²)**
- Efficiency 2:**
 - Denominator: #1_Pm
 - Numerator: #1_Pdc
 - Callout: **Set the denominator and numerator of the equation for deriving efficiency 2.¹ (#1_Pdc, #1_PS, #1_Pm, #2_Pdc², #2_PS², #2_Pm²)**
- Pm Setup:**
 - Equation: $P_m = \text{Torque} \times 2\pi \times f_m(\text{Hz})$
 - Torque: CH1 (selected)
 - Callout: **Set the channel used to derive the torque. Used to derive Pm (motor drive efficiency)**

1 Can be set by combining Pdc (inverter input power (DC power)), PS (motor input power), Pm (motor drive efficiency) of System1(#1_) and System2(#2_).
 2 System2(#2_) is displayed when the analysis mode is 2 Motor Systems.

Setting the Realtime Waveform (Realtime waveform)

7. Tap **Realtime waveform**, or press the soft key. The following screen appears.

**Set the output destination for real-time dq math waveforms.¹
(OFF, RTmath1² to RTmath12, RTmath15,³ RTmath16³)**



**Set the output destination for the voltage/current waveform
obtained after delta-star transformation.⁴
(OFF, RTmath1² to RTmath12, RTmath15,³ RTmath16³)**

- 1 Voltage and current waveforms after transforming to the rotational coordinate system (dq) but before averaging.
- 2 When GPS position information (/C35 option) is on, RTmath1 cannot be selected.
- 3 When harmonic analysis is on, RTmath15 and RTmath16 cannot be selected.
- 4 You can set this when the wiring system is 3V3A→3P4W, 3P3W→3P4W, 3V3AR→3P4W, or 3V3AS→3P4W.

Note

- A real time math (RTmath) channel cannot be assigned to multiple output destinations. If a real time math (RTmath) channel is assigned to multiple channels, the last output destination takes precedence, and other channels are turned off.
- If a waveform is assigned to an RTmath channel being used for real time math, the real time math function of that channel is disabled. When the assignment is cleared, the real time math function is resumed.
- The waveform display and other settings of RTmath channels that waveforms are assigned to can be configured using the real time math menu (RT.MATH CH key). However, real time math setup (RealTime Math Setup) is not available.

Setting the Motor dq Analysis Items (Motor Analysis Item)

7. Tap **Motor Analysis Item**, or press the soft key. The following screen appears.

Turns waveform display on or off

Color
Label
Upper limit
Lower limit

	Display	Color	Label	Upper	Lower
1. UrmsΣ	<input checked="" type="checkbox"/>	■	#1_UrmsS	5.0000 V	-5.0000 V
2. Urms1	<input checked="" type="checkbox"/>	■	#1_Urms1	5.0000 V	-5.0000 V
3. Urms2	<input checked="" type="checkbox"/>	■	#1_Urms2	5.0000 V	-5.0000 V
4. Urms3	<input checked="" type="checkbox"/>	■	#1_Urms3	5.0000 V	-5.0000 V
5. IrmsΣ	<input checked="" type="checkbox"/>	■	#1_IrmsS	5.0000 A	-5.0000 A
6. Irms1	<input checked="" type="checkbox"/>	■	#1_Irms1	5.0000 A	-5.0000 A
7. Irms2	<input checked="" type="checkbox"/>	■	#1_Irms2	5.0000 A	-5.0000 A
8. Irms3	<input checked="" type="checkbox"/>	■	#1_Irms3	5.0000 A	-5.0000 A

All ON
All OFF

Analysis items (scroll to display hidden items)

Set all display items to ON (select the check boxes).

Set all display items to OFF (clear the check boxes).

17.4 Configuring the Power Math and Motor dq Analysis Waveform Display

This section explains the following settings for displaying power math and motor dq analysis waveforms.

Items Common to Scope Mode and Recorder Mode

- Selecting the sub channels (measurement functions)
- Upper and lower limits of the display range
- Auto scale or default scale
- Display groups
- Setting the display range
- Vertical position and horizontal position

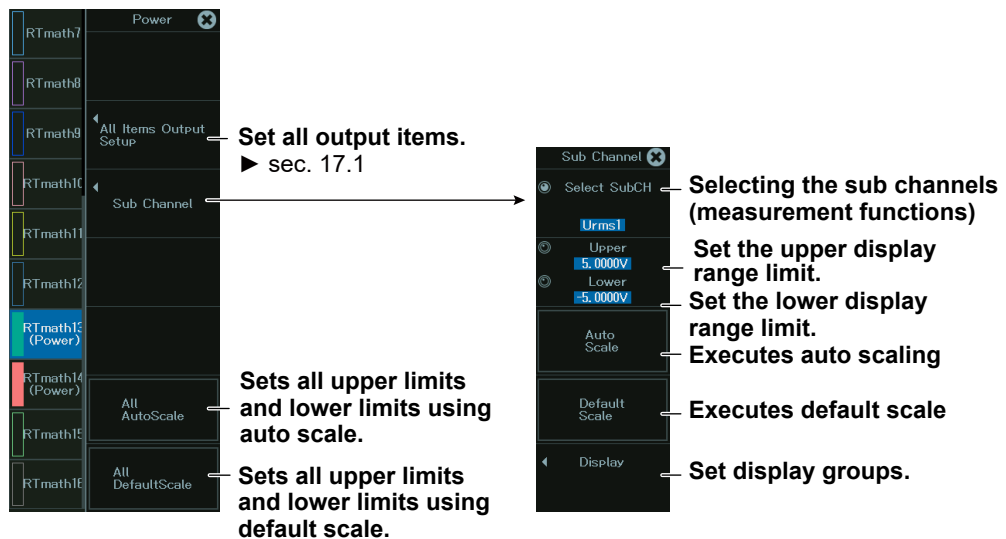
► “Power Math (/G05, /MT1 Option), Motor dq Analysis (/MT1 Option)” in the Features Guide

RealTime Math Menu

Power Analysis (RTmath13 (Power), RTmath14 (Power))

Power analysis results are output to the sub channels of RTmath13 and RTmath14.

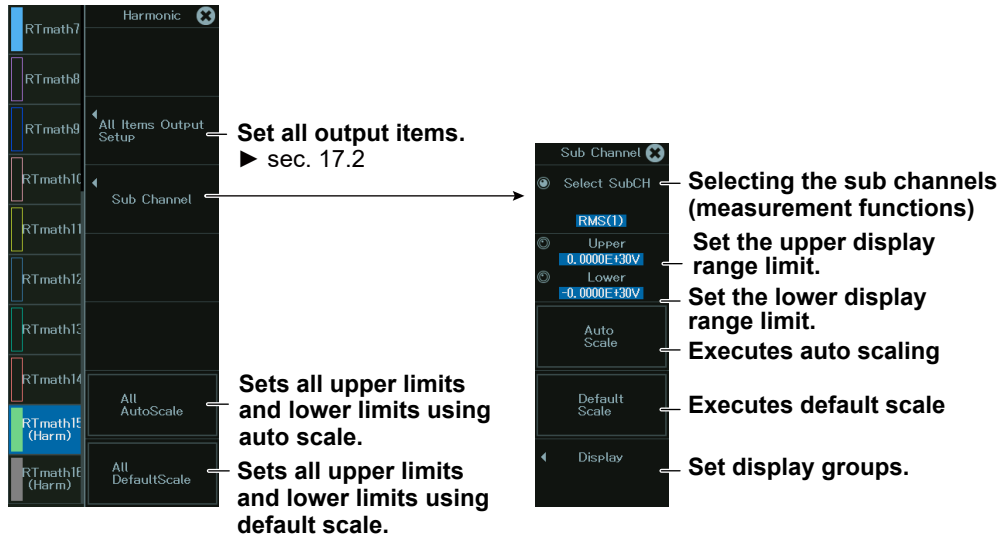
1. Set the power analysis mode to 1 Wiring System or 2 Wiring Systems. For the procedure, see section 17.1.
2. On the waveform screen’s **MENU**, tap **CH > RT.MATH CH**, or press **RT. MATH CH**. A real time math setup menu appears.
3. Tap **RTmath13 (Power)** or **RTmath14 (Power)**, or select it using the jog dial or up and down arrow keys. A power analysis setup menu appears.



Harmonic Analysis (RTmath15 (Harm), RTmath16 (Harm))

Harmonic analysis results are output to the sub channels of RTmath15 and RTmath16.

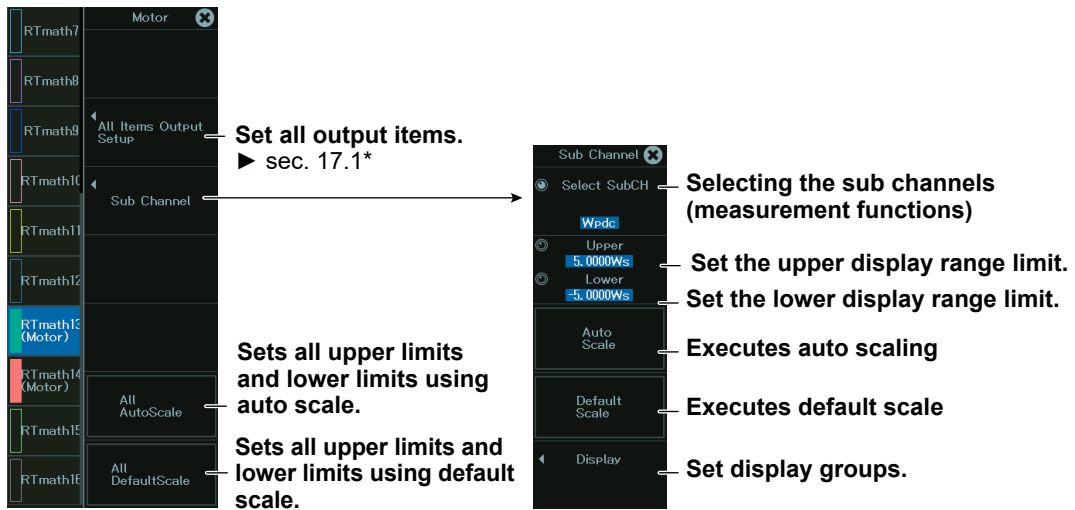
1. Set the harmonic analysis mode to Line RMS or Power. For the procedure, see section 17.2.
2. On the waveform screen's **MENU**, tap **CH > RT.MATH CH**, or press **RT. MATH CH**. A real time math setup menu appears.
3. Tap **RTmath15 (Harm)** or **RTmath16 (Harm)**, or select it using the jog dial or up and down arrow keys. A harmonic measurement setup menu appears.



Motor dq Analysis (RTmath13 (Motor), RTmath14 (Motor))

Motor dq analysis results are output to the sub channels of RTmath13 and RTmath14.

1. Set the analysis mode to 1 Motor System or 2 Motor Systems. For the procedure, see section 17.3.
2. On the waveform screen's **MENU**, tap **CH > RT.MATH CH**, or press **RT. MATH CH**. A real time math setup menu appears.
3. Tap **RTmath13 (Motor)** or **RTmath14 (Motor)**, or select it using the jog dial or up and down arrow keys. A motor dq analysis setup menu appears.



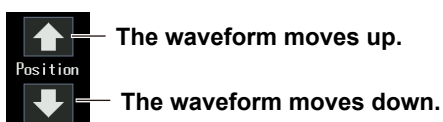
* The same as power analysis. The exception is that the switching of Wiring System 1/Wiring System 2 will be the switching of System1/System2. Also, when the analysis mode is 1 Motor System, the wiring system is fixed to System1.

Setting the Display Range (SCALE knob)

4. Select the measurement function (sub channel) you want to set, and turn the SCALE knob to set the display range.

Setting the Vertical and Horizontal Positions of Waveforms (moving displayed waveforms)

4. Select the measurement function (sub channel) you want to set, and then vertically drag near the center of the screen displaying the waveform of the selected channel to display up and down arrows. Tap the arrows to move the waveform. The arrows disappear after a given time period.



After selecting a channel, turn the vertical POSITION knob to set the vertical position.

In Recorder mode, you can move the horizontal position using the following methods.

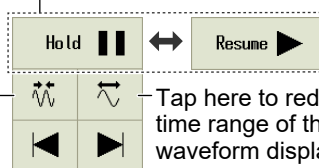
Drag the screen horizontally



The waveform moves to the right.
The waveform moves to the left.

Hold your finger on the screen to display:

Holds or resumes the waveform display
Displayed only when you touch and hold the screen during waveform acquisition



Tap here to expand the time range of the waveform display.

Tap here to reduce the time range of the waveform display.

Displays the waveform at the left edge of the acquisition time or record time bar

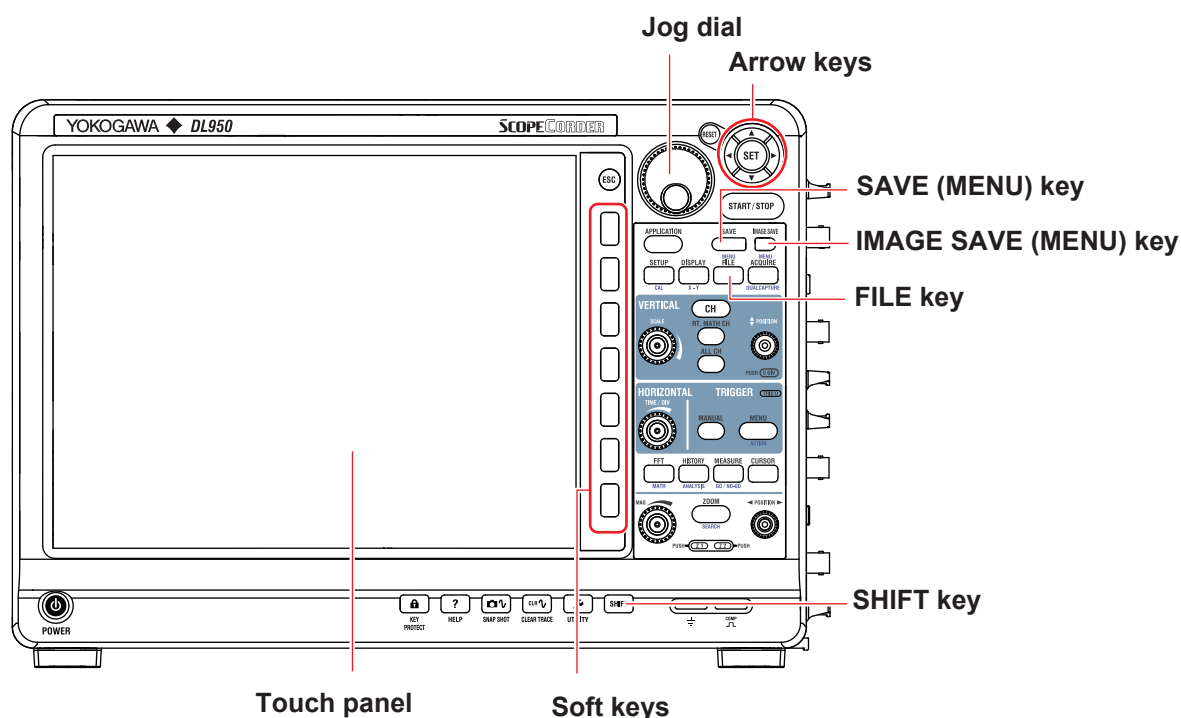
Displays the waveform at the right edge of the acquisition time or record time bar

Chapter 18

Printing and Saving Screen Captures

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
18.1 Printing on a Network Printer	✓	✓
18.2 Printing on a USB Printer	✓	✓
18.3 Saving Screen Captures to Files	✓	✓

* The settings may vary depending on the operation mode.

18.1 Printing on a Network Printer

This section explains the following settings for printing images displayed on the instrument on a network printer:

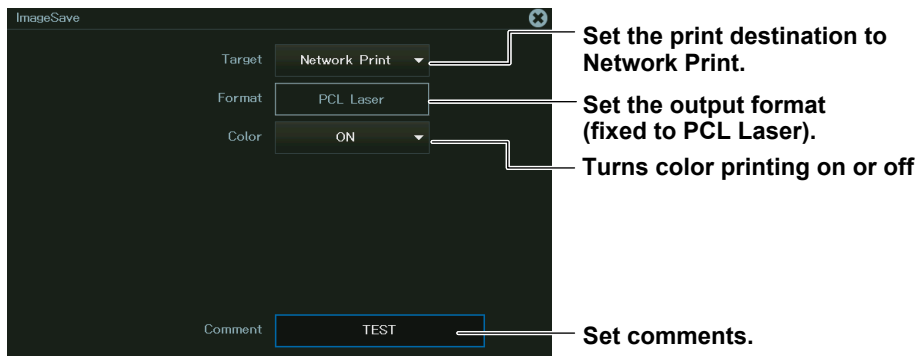
Items Common to Scope Mode and Recorder Mode

- Print destination
- Printer type
- Color
- Comment

► “Printing on a Network Printer (Network Print)” and “Printing and Saving Screen Captures (IMAGE SAVE key)” in the Features Guide

IMAGE SAVE Menu

1. On the waveform screen’s **MENU**, tap **FILE > IMAGE SAVE MENU**, or press **SHIFT+IMAGE SAVE (MENU)**. The following screen appears.



Note

You must configure the network printer in advance by following the instructions in section 20.8.

Printing

2. Press **IMAGE SAVE** to print the image that is displayed on the screen using a network printer.

18.2 Printing on a USB Printer

This section explains the following settings for printing images displayed on the instrument on a USB printer:

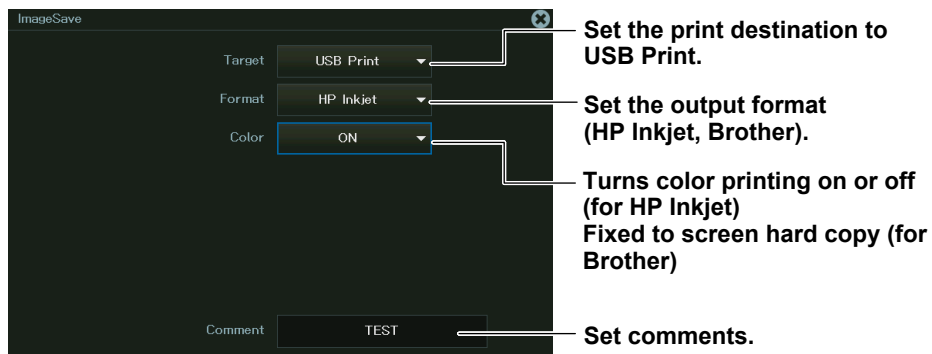
Items Common to Scope Mode and Recorder Mode

- Print destination
- Printer type
- Color
- Comment

► “Printing on a USB Printer (USB Print)” and
“Printing and Saving Screen Captures (IMAGE SAVE key)” in the Features Guide

IMAGE SAVE menu

1. On the waveform screen’s **MENU**, tap **FILE > IMAGE SAVE MENU**, or press **SHIFT+IMAGE SAVE (MENU)**. The following screen appears.



Printing

2. Press **IMAGE SAVE** to print the image that is displayed on the screen using a USB printer.

18.3 Saving Screen Captures to Files

This section explains the following settings for saving screen captures to files:

You can save screen captures to files in one of three ways: using the IMAGE SAVE menu, using the SAVE menu, or using the FILE menu.

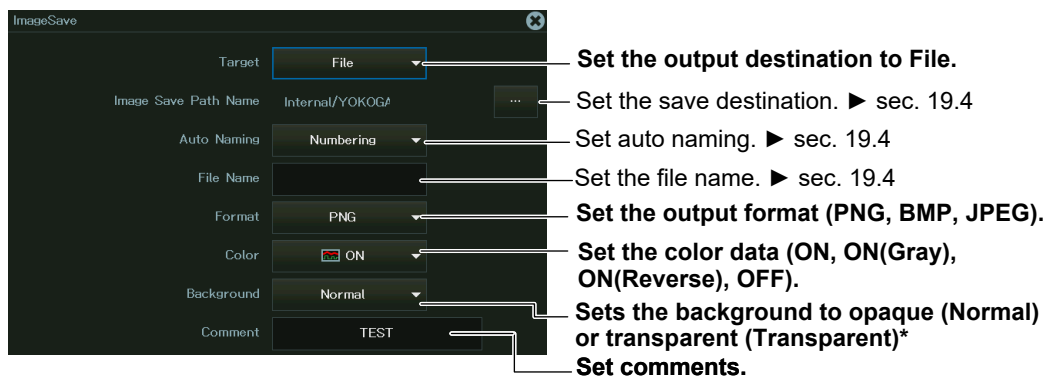
Items Common to Scope Mode and Recorder Mode

- Print destination
- Data format
- Color data
- Background transparent or opaque
- Save destination and file name

► “Saving Screen Captures to Files (File),”
“Printing and Saving Screen Captures (IMAGE SAVE key),”
“Saving Other Types of Data (Others),”
and “Saving Data (SAVE key)” in the Features Guide

Using the IMAGE SAVE Menu

1. On the waveform screen’s **MENU**, tap **FILE > IMAGE SAVE MENU**, or press **SHIFT+IMAGE SAVE (MENU)**. The following screen appears.



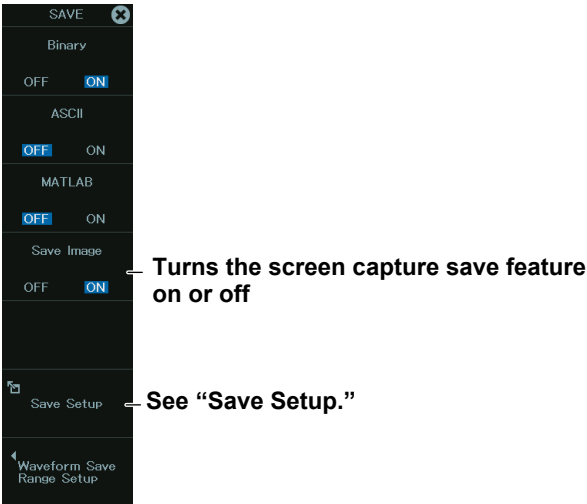
* This appears when the data format is set to PNG.

Saving

2. Press **IMAGE SAVE** to save the screen capture file to the specified folder.

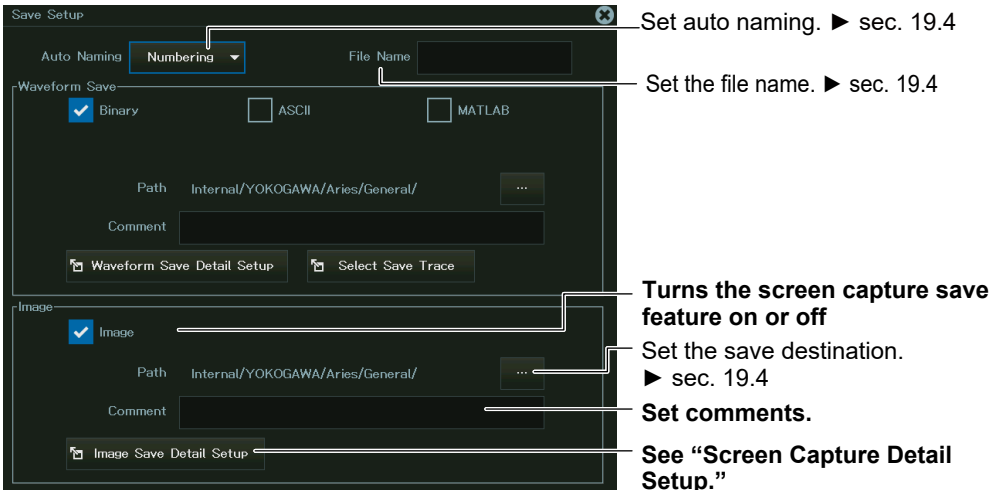
Using the SAVE Menu

- 1. On the waveform screen's **MENU**, tap **FILE > SAVE MENU**, or press **SHIFT+SAVE (MENU)**. The following screen appears.



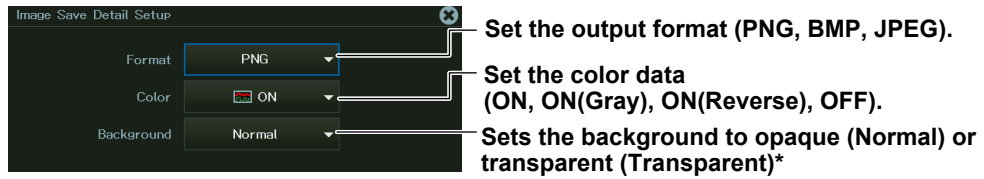
Save Setup (Save Setup)

- 2. Tap **Save Setup**, or press the soft key. The following screen appears.



Screen Capture Detail Setup

3. Tap **Image Save Detail**, or select **Image Save Detail** using the jog dial or arrow keys, and press **SET**.



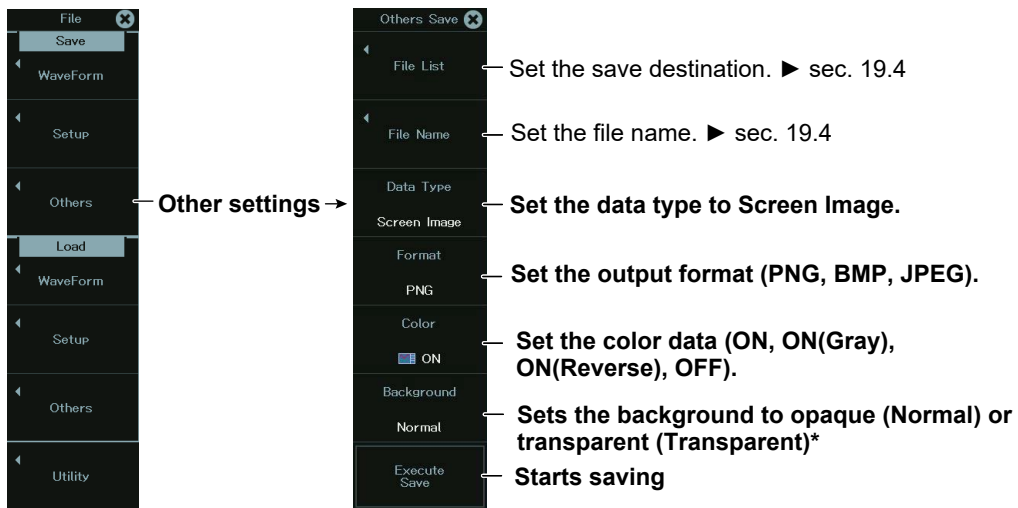
* This appears when the data format is set to PNG.

Saving

4. Press **SAVE** to save the screen capture file to the specified folder.
If Waveform Save on the SAVE menu is set to ON, the waveform data is also saved.

Using the FILE Menu

1. On the waveform screen's MENU, tap **FILE > FILE**, or press **FILE**. The following screen appears.



* This appears when the data format is set to PNG.

Saving

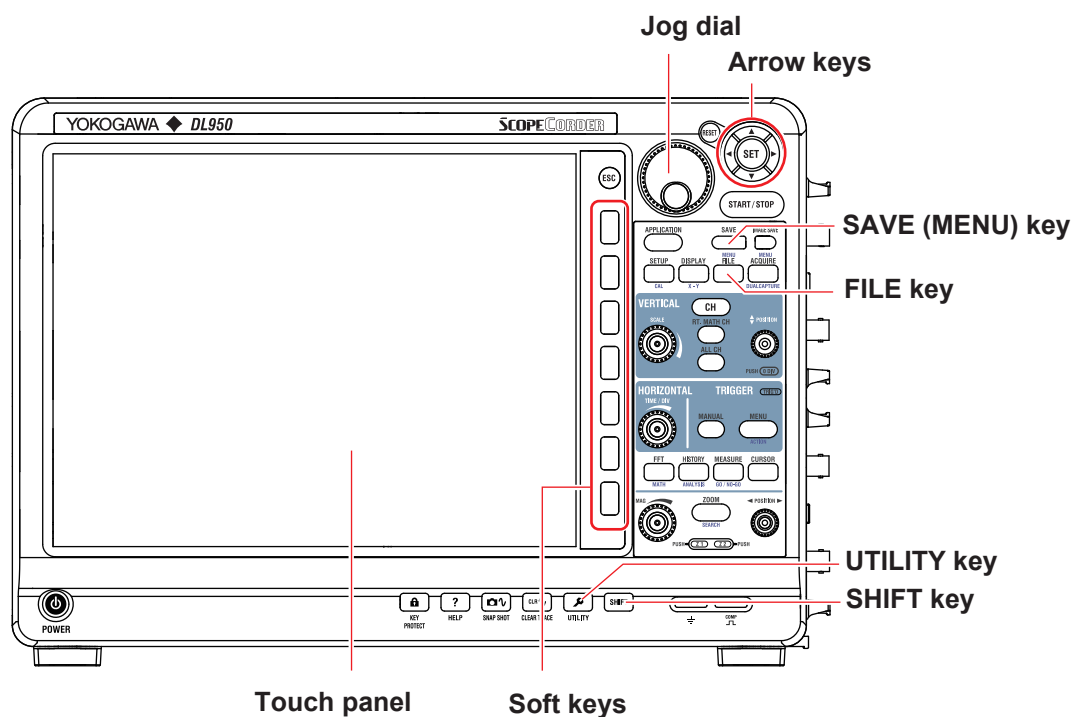
2. Tap **Execute Save**, or press the soft key.

Chapter 19

Saving and Loading Data

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
19.1 Connecting a Storage Device	✓	✓
19.2 Internal Storage (SSD) (/ST1, /ST2 option)	✓	✓
19.3 Formatting a Storage Device	✓	✓
19.4 Saving Waveform Data	✓	✓
19.5 Saving Setup Data	✓	✓
19.6 Saving Other Types of Data	✓	✓
19.7 Loading Waveform Data	✓	✓
19.8 Loading Setup Data	✓	✓
19.9 Loading Other Types of Data	✓	✓
19.10 Performing File Operations	✓	✓

* The settings may vary depending on the operation mode.

19.1 Connecting a Storage Device


This section explains how to connect the following storage device for saving and loading data to the Instrument:

- SD memory card
- USB storage device

SD memory card




CAUTION

- Do not insert the SD memory card in the wrong direction. Doing so may damage the SD memory card and the instrument.
- Inserting and removing the SD memory card quickly (within the span of a second) may damage the instrument.
- Removing the SD memory card from the instrument while the card is being accessed may corrupt the data on the SD memory card.
- An icon  appears at the top center of the screen when the SD memory card is being accessed.

French



ATTENTION

- Ne placez pas la carte mémoire SD dans le mauvais sens et ne l'insérez pas en forçant dans le DL950. Vous risqueriez d'endommager la carte mémoire SD et le DL950.
- Le fait d'insérer et de retirer la carte mémoire SD rapidement (en une seconde) peut endommager le DL950.
- Le fait de retirer la carte mémoire SD du DL950 pendant que le dispositif accède à cette carte risque d'endommager les données qu'elle contient.
- Une icône() au centre de la partie supérieure de l'écran indique que le dispositif est en train d'accéder à la carte mémoire SD.

SD Memory Cards That Can Be Used

You can use memory cards that conform to the SD, SDHC, or SDXC standard with the instrument. For details, contact your nearest YOKOGAWA dealer.

Note

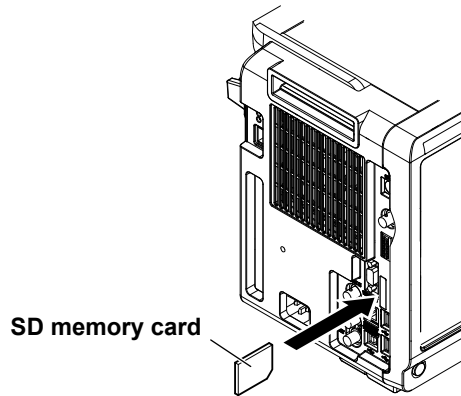
When using an SD memory card with a PC, make sure that the PC is compatible with the SD memory card. Also, depending on the type of PC, some of the SD cards listed above may not function properly. Check it in advance.

Inserting an SD Memory Card

Insert the SD memory card into the slot with the front of the card facing the front panel.

The SD memory card slot is on the left side panel of the instrument.

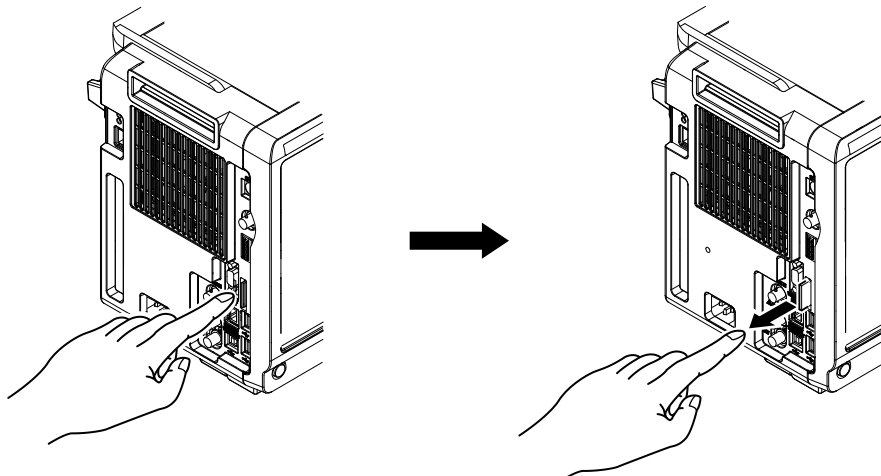
If you are using an SD memory card that has a write-protection feature and you want to save data to or format the card, disable the write-protection feature before you insert the SD memory card into the instrument.



Removing the SD Memory Card

Press the edge of the SD memory card with your finger. Release the SD memory card to eject.

Remove the SD memory card.



Push the card in.



Release the SD memory card to eject.

General SD Memory Card Handling Precautions

Follow the general handling precautions that are provided with your SD memory card.



USB storage device

CAUTION

- During SSD recording, the  icon blinks in the center of the screen. While this icon is blinking, do not insert a USB storage device into the USB port for connecting peripheral devices. Doing so may cause the instrument to malfunction or may corrupt the data that is being recorded to the SSD.
 - Do not remove the USB storage device or turn off the power when the medium is being accessed. If you do so, the data on the USB storage device may be corrupted.
 - An icon  appears at the top center of the screen when the USB storage device is being accessed.
-

French

ATTENTION

- Pendant l'enregistrement du SSD, l'icône clignote au centre de l'écran. Lorsque cette  icône clignote, ne connectez pas le support de stockage USB aux ports USB prévus à cet effet. Vous risqueriez de causer un dysfonctionnement du DL950 ou d'endommager les données en cours d'enregistrement sur le SSD.
 - Pendant que le dispositif accède au support de stockage USB, ne retirez pas ce dernier et ne mettez pas l'alimentation hors tension. Vous risqueriez d'endommager les données sur le support de stockage USB.
 - Une icône () au centre de la partie supérieure de l'écran indique que le dispositif est en train d'accéder au support de stockage USB.
-

Compatible USB Storage Devices

You can use USB storage devices that are compatible with USB Mass Storage Class version 1.1.

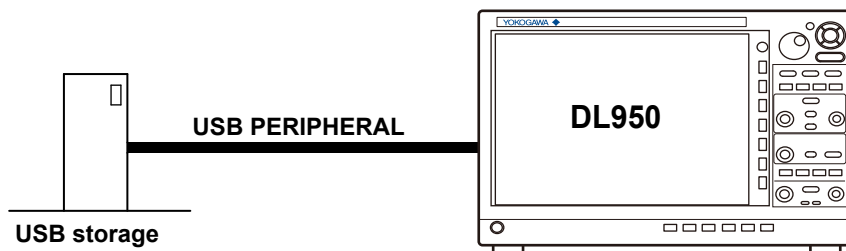
Note

- Only connect a USB keyboard, mouse, printer, or storage device to the USB port for peripherals.
 - The instrument can handle up to four storage devices. If the connected device is partitioned, the instrument treats each partition as a separate storage device.
 - Connect USB storage devices directly, not through a USB hub.
 - Do not connect and disconnect the two USB devices repetitively. Provide at least a 10-second interval between removal and connection.
-

How to Connect a USB Storage Device

When connecting a USB storage device to the instrument's USB port, connect the USB cable directly as shown in the figure below. You can connect/disconnect a USB cable at any time regardless of whether the instrument is on or off (hot-plugging is supported). Connect the type A connector of the USB cable to the instrument, and connect the type B connector to the USB storage device. If you connect a USB storage device when the power switch is on, the device becomes available for use after the instrument identifies it.

The instrument has two USB ports: USB-0 and USB-1. The port numbers are not fixed. The port where the first detected USB storage device is connected to becomes USB-0. The second detected USB storage device becomes USB-1.



General USB Storage Device Handling Precautions

Follow the general handling precautions that are provided with your USB storage device.

19.2 Internal Storage (SSD) (/ST1, /ST2 option)

This section explains the handling of the internal storage.



CAUTION

Do not store more than 513 files in the root directory of the internal storage. Doing so will slow the file access operations to all files. In addition, we cannot guarantee the operation of the storage device when the instrument is in this condition.

French



ATTENTION

Ne pas stocker plus de 512 fichiers dans le répertoire racine du SSD interne. Ceci ralentit les opérations d'accès à tous les fichiers. En outre, nous ne pouvons pas garantir le fonctionnement de la fonction d'enregistrement sur SSD lorsque le DL950 est dans cet état.

19.3 Formatting a Storage Device

This section explains how to format storage device.

- Storage management
- Formatting the storage device

► [“Formatting Storage Device \(Storage Manager\)” in the Features Guide](#)

CAUTION

- When you format a storage device, all the data on it is deleted.
- If a formatted storage device cannot be detected by the instrument, use the instrument to format the storage device again.

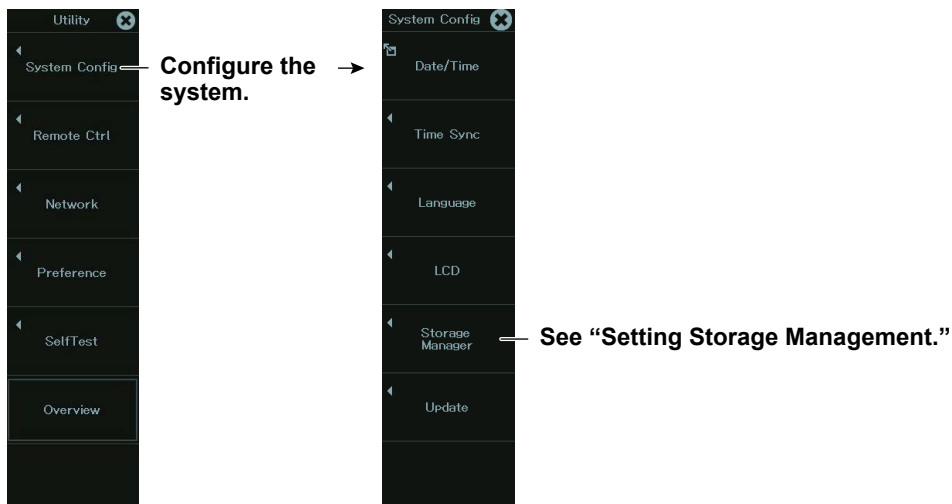
French

ATTENTION

- Lorsque vous formatez un support de stockage, toutes les données qu’il contient sont supprimées.
- Si le DL950 ne détecte pas un support de stockage formaté, utilisez le DL950 pour formater de nouveau le support de stockage.

System Config Menu

1. On the waveform screen’s **MENU**, tap **OTHERS > UTILITY**, or press **UTILITY**.
2. Tap **System Config**, or press the soft key. The following menu appears.



Setting Storage Management (Storage Manager)

3. Tap **Storage Manager**, or press the soft key. The following menu appears.



— Set the storage device to format (SSD, SD).

— Confirm that you want to format internal memory.

4. Tap **Execute Format**, or press the soft key. A format confirmation message appears. Selecting **OK** executes the format.

Storage Device That Will Be Formatted (Media)

SSD: Internal SSD

SD: SD memory card

19.4 Saving Waveform Data

This section explains the following settings for saving waveform data):

There are two methods to save files: using the FILE Waveform (Save) menu or using the SAVE menu.

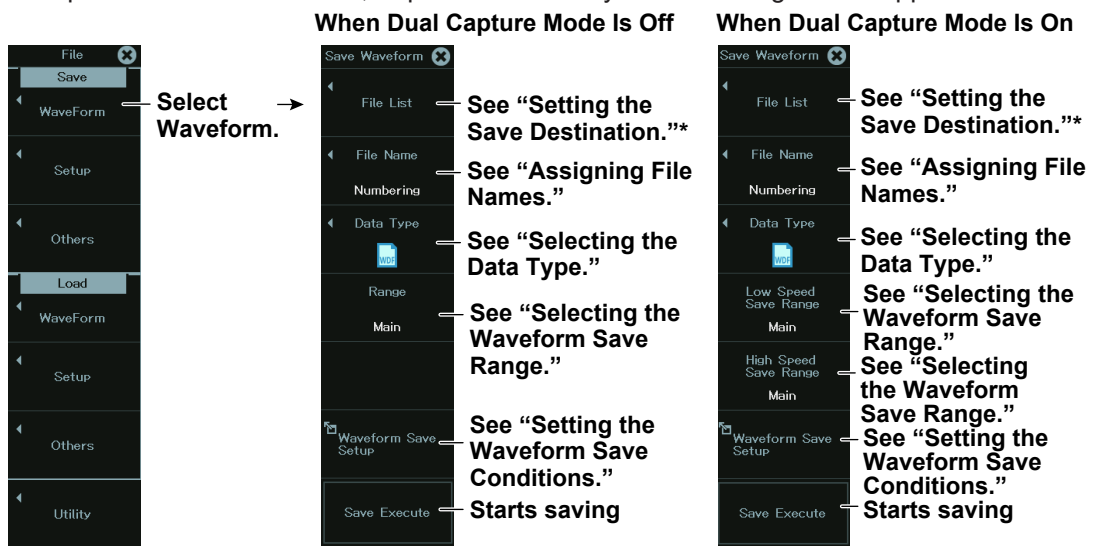
Items Common to Scope Mode and Recorder Mode

- Save destination
- File name
- Data format
- Save range
- Waveform to save
- Saving waveform data

► [“Saving Waveform Data \(Waveform\)” in the Features Guide](#)

FILE Waveform (Save) Menu

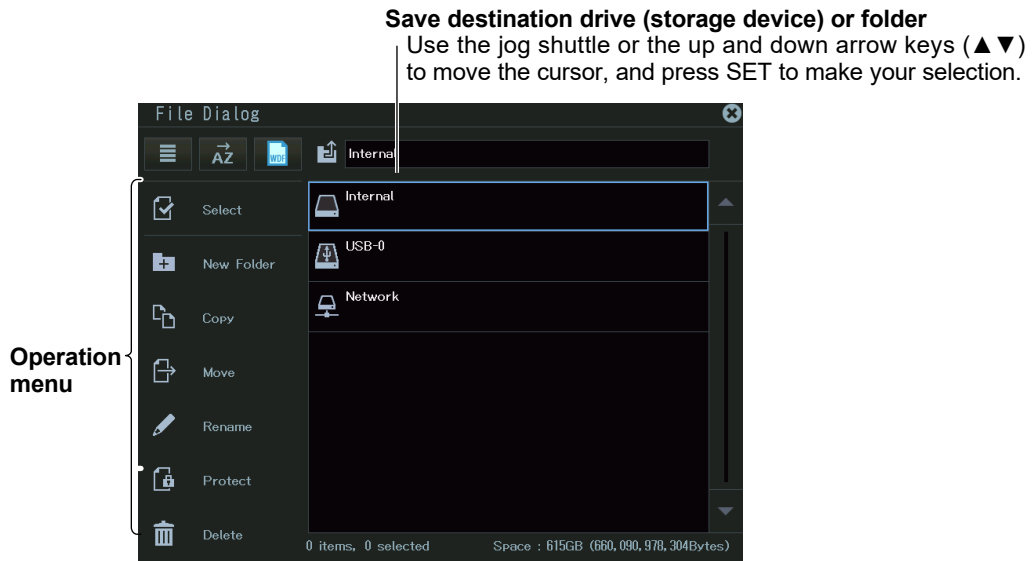
1. On the waveform screen’s **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Waveform** under Save, or press the soft key. The following screen appears.



* If synchronous operation is in progress in multi-unit synchronization mode (/C50 option), the menu displays Destination (Destination).

Setting the Save Destination (File List)

3. Tap **File List**, or press the soft key. The following screen appears.

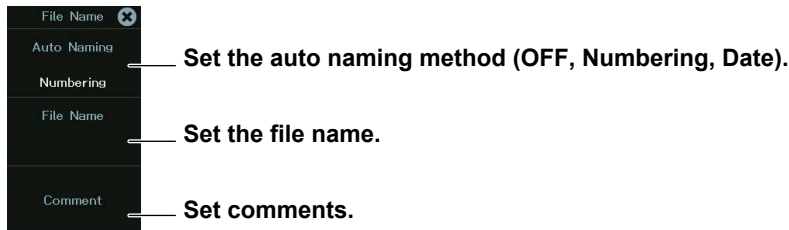


Note

- For more information on file operations, see section 19.10.
- If synchronous operation is in progress in multi-unit synchronization mode (/C50 option), you can only select the save destination device. You cannot specify a sub folder in a storage device.

Assigning File Names (File Name)

3. Tap **File Name**, or press the soft key. The following screen appears.



Note

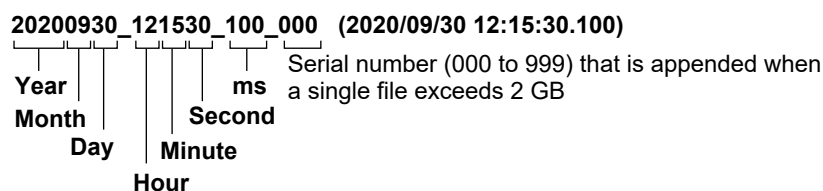
When dual capture is on, “_HS” is appended to the file names of high-speed sampling and “_LS” to the file names of low-speed sampling.

Setting Auto Naming (Auto Naming)

OFF: The auto naming feature is disabled. The file name specified using the File Name setting is used. If there is a file with the same name in the save destination folder, you cannot save the data.

Numbering: A 4-digit serial number (0000 to 9999) is automatically appended to the common name (up to 32 characters) specified with the File Name setting.

Date: The file name is the date and time (down to ms) when the file is saved. The file name specified with the File Name setting is not used.



Regardless of whether the auto naming feature is set to OFF, Numbering, or Date, if the data size of a single file exceeds 2 GB, an underscore and a three-digit sequence number (000 to 999) is appended to the file name. The sequence number is incremented by one each time a file is added. This is appended only if the file exceeds 2 GB.

Setting a Comment (Comment)

You can add a comment that consists of up to 120 characters when you save a file. You do not have to enter a comment. All characters, including spaces, can be used in comments.

Selecting the Data Type (Data Type)

3. Tap **Data Type**, or press the soft key. The following screen appears.

When Dual Capture Mode Is Off	When Dual Capture Mode Is On
<p>Binary — Saves in binary format</p> <p>ASCII — Saves in ASCII format</p> <p>MATLAB — Saves in MATLAB format</p>	<p>All Data Binary — Saves low-speed sampling and high-speed sampling waveform data to a file in binary format</p> <p>Low Speed Data — Saves low-speed sampling waveform data in ASCII format</p> <p>MATLAB — Saves low-speed sampling waveform data in MATLAB format</p> <p>High Speed Data — Saves high-speed sampling waveform data in binary format</p> <p>Binary — Saves high-speed sampling waveform data in binary format</p> <p>ASCII — Saves high-speed sampling waveform data in ASCII format</p> <p>MATLAB — Saves high-speed sampling waveform data in MATLAB format</p>

You can save the sampling data stored in the acquisition memory in the following data formats.

Data format	Extension	
Binary	.WDF	Data is saved in binary format. You can load this type of data into the instrument. ► sec. 19.7 Data can be saved in compressed form. For details, see Page 19-13.
ASCII	.CSV	Data is scaled using the specified range and saved to a file in ASCII format. You cannot load this type of data into the instrument.
MATLAB	.MAT	Data is saved in MATLAB format. You cannot load this type of data into the instrument.

Note

If the data format is ASCII or MATLAB and the combination of the record length and the number of channels causes the file size to exceed 2 GB, the file cannot be saved.

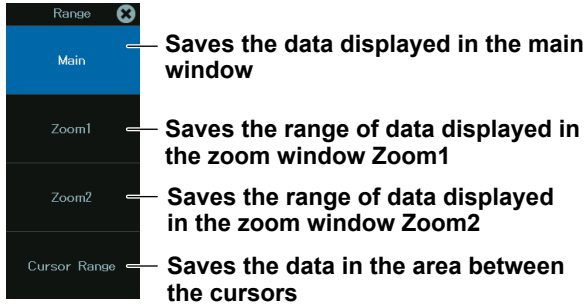
Selecting the Waveform Save Range (Range)

3. Tap **Range**, or press the soft key.

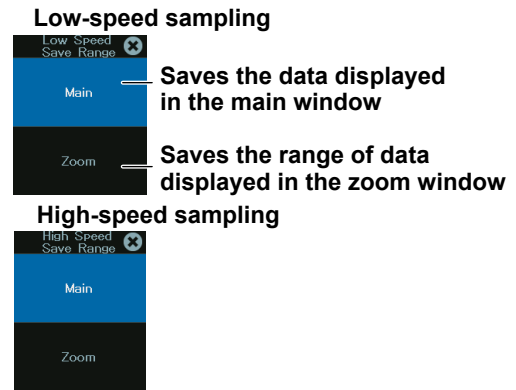
When dual capture is on, tap **Low Speed Save Range** or **High Speed Save Range**, or press the soft key. The following screen appears.

Scope Mode

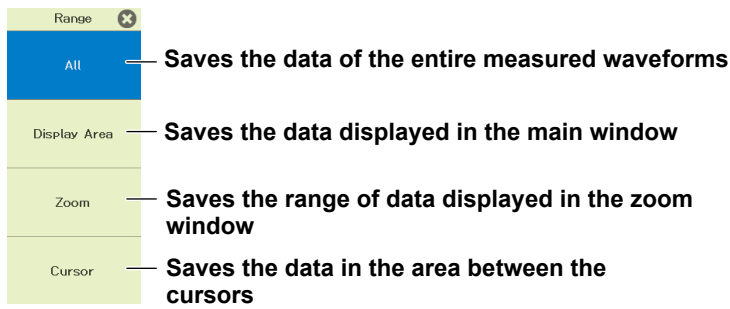
When Dual Capture Mode Is Off



When Dual Capture Mode Is On

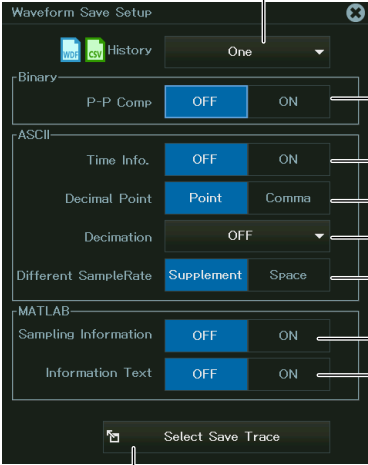


Recorder Mode



Setting the Waveform Save Conditions (Waveform Save Setup)

3. Tap **Waveform Save Setup**, or press the soft key. The following screen appears.



Set how much history data to save (One, All, Average Record*). (Scope mode)

Binary format
Set whether to compress data before saving (ON, OFF).

ASCII format
Whether to save time information (ON, OFF)

Whether to save time information (ON, OFF)

Select the decimal point display (Point, Comma).

Data decimation interval (OFF, Per5, Per10, Per20, Per50, Per100, Per200, Per500, Per1000, Per2000, Per5000)

Select the interpolation method to apply to waveform data acquired at a slow sample rate. (Supplement, Space)

MATLAB format
Whether to include sampling information (ON, OFF).
Whether to include text format information (ON, OFF).

* Average Record cannot be specified when dual capture is on.

Set the waveform to save.



Saving History Data (History)

- One:** The one waveform that is selected with Select Record on the HISTORY menu will be saved.
- All:** All waveforms within the range bounded by Start Record and End Record on the HISTORY menu will be saved. If you search for history waveforms, and then select All, only the detected waveforms will be saved.
- Average Record:** All history waveforms within the range bounded by Start Record and End Record on the HISTORY menu will be saved. You can select this only when Display Mode is set to Average Record on the HISTORY menu.

Note

- In the following cases, even when History is set to All, only the single waveform selected with Selected Record on the HISTORY menu is saved.
 - When saving a waveform in MATLAB format
 - When saving dual capture high-speed sampling waveforms in binary format
- When waveforms are saved using All Data Binary (a setting available when dual capture is on), all high-speed sampling waveforms and low-speed sampling waveforms are saved, regardless of the History settings.

Compressing and Saving Data (P-P Comp; when the data type is Binary)

- If you set P-P Comp to ON, and then save data, the Instrument saves just the maximum and minimum values from the multiple measured data points on the same time axis. This decreases the size of the saved file.
- You cannot perform P-P compression when saving power-spectrum computed data.
- If you set P-P Comp to ON, you cannot use Range to select the save range.

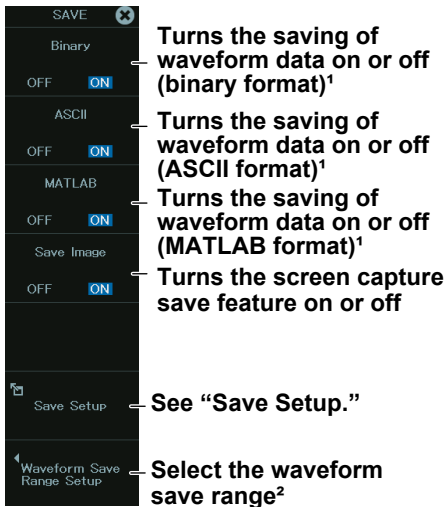
Selecting the Waveform to Save (Select Save Trace)

- You can select CH1 to CH16, 16CH TEMP/VOLT, CAN, CAN FD, LIN, SENT, or Math. The waveforms that are displayed are saved.
- If you set History to All, the Math waveforms will not be saved. If you want to save the Math data, set History to One.
- If you set History to All, all history waveforms within the range bounded by Start Record and End Record on the HISTORY menu will be saved. If you want to select which waveform will be saved, do not select All.

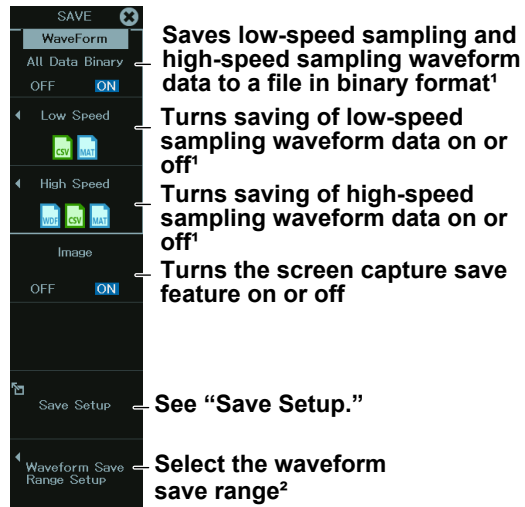
SAVE Menu

1. On the waveform screen’s **MENU**, tap **FILE > SAVE MENU**, or press **SHIFT+SAVE (MENU)**. The following screen appears.

When Dual Capture Mode Is Off



When Dual Capture Mode Is On

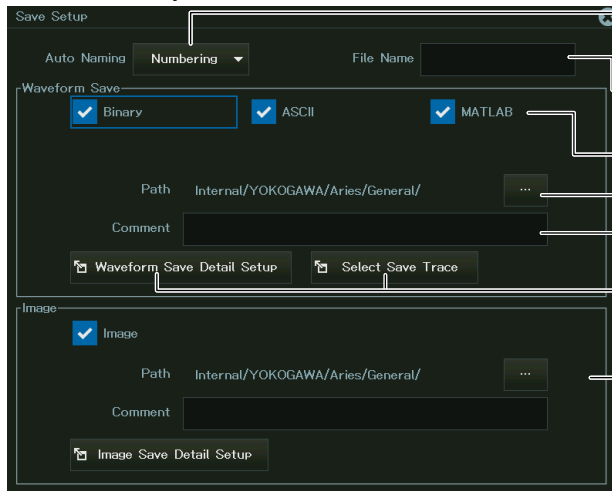


1: This is the same as “Selecting a Data Type” of the FILE Menu.
 2: This is the same as “Selecting the Waveform Save Range” of the FILE Menu.

Save Setup (Save Setup)

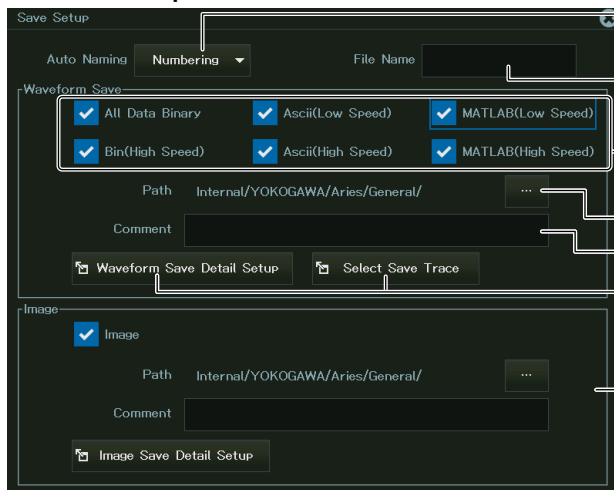
2. Tap **Save Setup**, or press the soft key. The following screen appears.

When Dual Capture Mode Is Off



- Set auto naming.
(This is the same as the setting on the FILE menu.)
- Set the file name.
(This is the same as the setting on the FILE menu.)
- Set the format to save the data in.
- Set the save destination.
- Set comments.
- Set the waveform save conditions.
(This is the same as the setting on the FILE menu.)
- Saves screen capture data
▶ sec. 18.3

When Dual Capture Mode Is On



- Set auto naming.
(This is the same as the setting on the FILE menu.)
- Set the file name.
(This is the same as the setting on the FILE menu.)
- Set the format to save the data in.
- Set the save destination.
- Set comments.
- Set the waveform save conditions.
(This is the same as the setting on the FILE menu.)
- Saves screen capture data
▶ sec. 18.3

Saving

3. Press **SAVE**. When the saving is complete, a message appears.

Tap **Close**, or press **SET**.

The waveform data file is saved in the specified folder. If Image Save on the SAVE menu is set to ON, the screen capture data is also saved.

Save Destination for Action Execution

In the specified drive, a folder is automatically created with the date (year, month, and day) as its name, and data is saved to files in that folder using names that are specified by the auto naming feature.

If the number of files in the save destination folder exceeds 1000, a new folder is automatically created with the date and an incremented sequence number (000 to 999) as its name, and the data continues to be saved in the new folder. You can configure the instrument so that data is saved to the specified folder when an action is executed, not to the folder that is automatically created with the date. For details on the action feature, see section 15.1.

19.5 Saving Setup Data

This section explains the following settings for saving setup data: You can save setup data to a file.

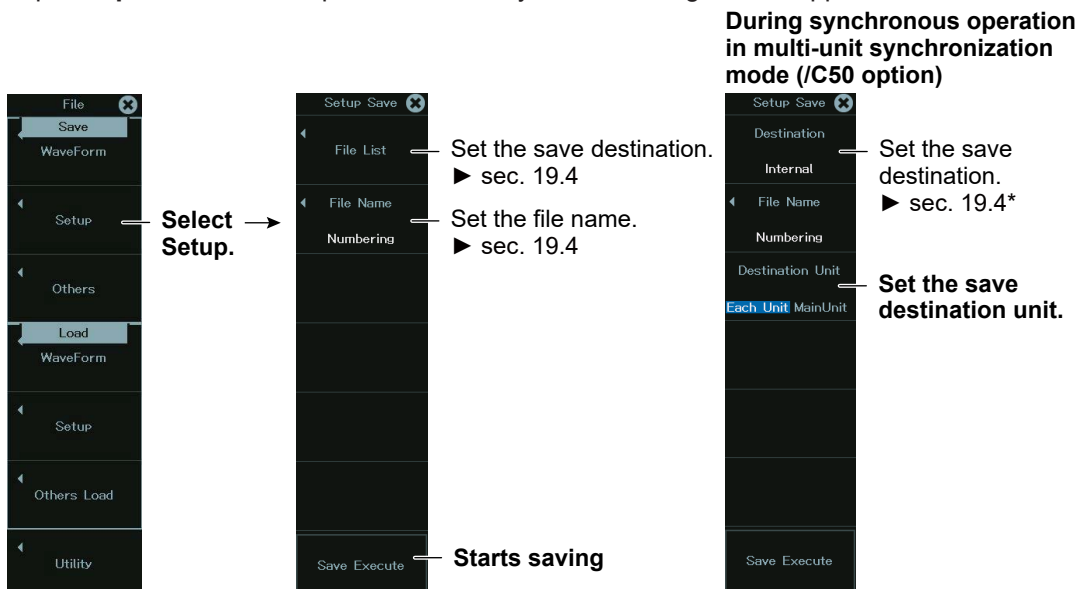
Items Common to Scope Mode and Recorder Mode

- Save destination
- File name
- Saving setup data
- Setting the save destination unit

► “Saving Setup Data (setup)” in the Features Guide

FILE Setup (Save) Menu

1. On the waveform screen’s **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Setup** under Save, or press the soft key. The following screen appears.



* If synchronous operation is in progress in multi-unit synchronization mode (/C50 option), the menu displays Destination (Destination).

Saving Setup Data (Save Execute)

- You can save the setup data (the setup information of each key at the time that the file is saved) to a file. The extension is .SET.
- The date, time, and communication setup parameters are not saved.
- You cannot save setup data during waveform acquisition. Press START/STOP to stop the waveform acquisition.

Setting the Destination Unit (Destination Unit) (/C50 option)

Set the save destination unit for setup data. You can set this when synchronous operation is in progress in multi-unit synchronization mode.

Each Unit: The setup data of each unit is saved to the save destination of each unit.

MainUnit: The setup data of each unit is saved collectively in a single file at the save destination of the main unit.

19.6 Saving Other Types of Data

This section explains the following settings for saving screen captures, snapshot waveform data, results of automated measurement of waveform parameters, and results of FFT:

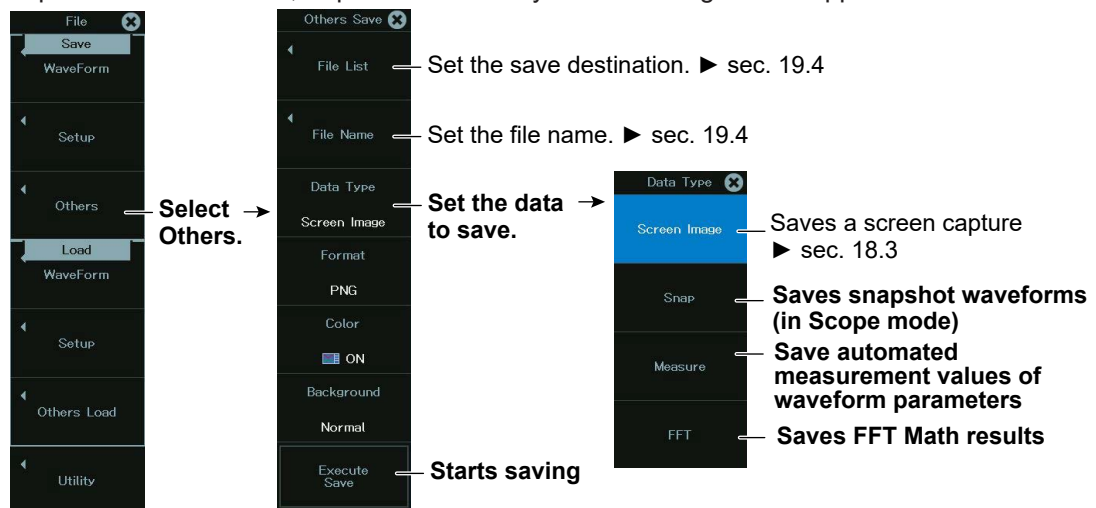
Items Common to Scope Mode and Recorder Mode

- Save destination
- File name
- Saved data
- Data type (screen captures)
- Color data (screen captures)
- Saving data

► “Saving Other Types of Data (Others)” in the Features Guide

FILE Others (Save) Menu

1. On the waveform screen's **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Others** under Save, or press the soft key. The following screen appears.



Setting the Data Type to Save (Data Type)

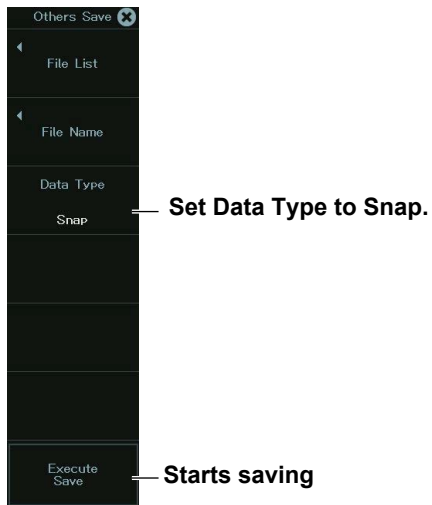
Screen Image: Save the display to a PNG, BMP, or JPEG file.

Snap: You can save the waveform data captured in a snapshot. The extension is .SNP. This is valid in Scope mode.

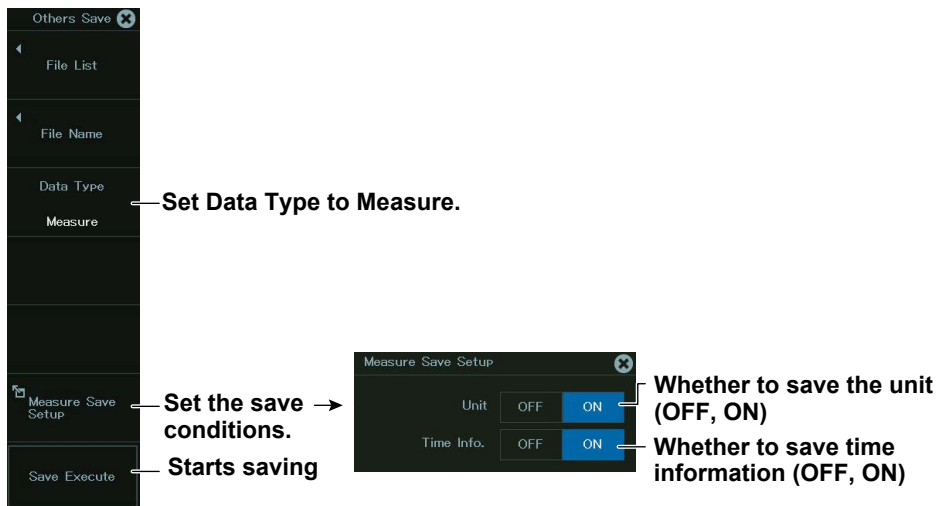
Measure: Save the results of automatic waveform parameter measurement to a file in CSV format.

FFT: You can save FFT Math results to a file in CSV format.

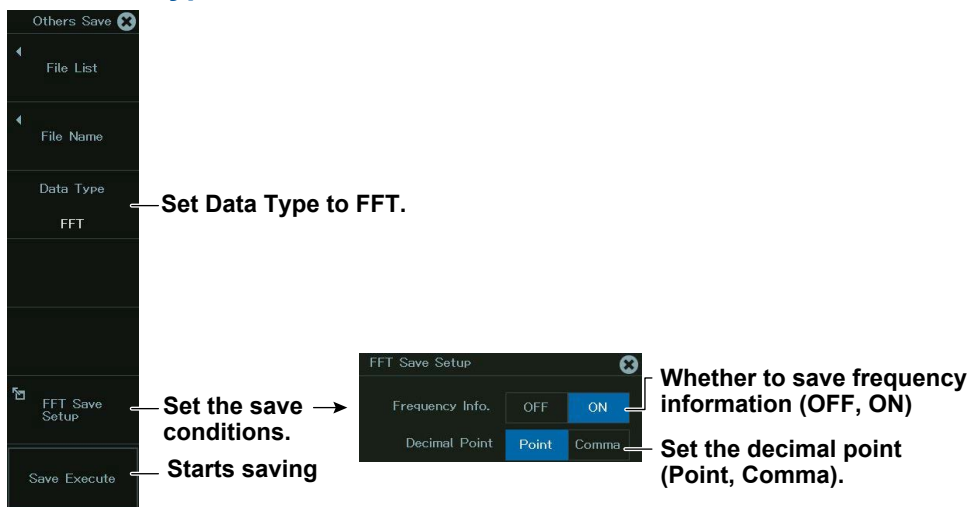
When Data Type Is Snap (Scope mode)



When Data Type Is Measure



When Data Type Is FFT



19.7 Loading Waveform Data

This section explains the following settings for loading waveform data:

Items Common to Scope Mode and Recorder Mode

- Displaying file information
- Loading into channels

► [“Loading Waveform Data \(Waveform\)” in the Features Guide](#)

FILE Waveform (Load) Menu

1. On the waveform screen’s **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Waveform** under Load, or press the soft key. The following screen appears.

Select the .WDF file that you want to load.



Selecting a File

- Select the file to load from the file list. For details on file operations, see section 19.10.
- To load waveforms recorded using flash acquisition (/ST2 option), select the dedicated flash memory (Flash Acquisition) for the drive.

Loading Waveform Data (Load)

- The selected waveform data file is loaded together with the setup file. Loaded data is cleared when you start measurement.
- The extension for waveform data is .WDF (excluding waveforms recorded using flash acquisition).
- If the module configuration when the waveform data is saved and that when the data is loaded are different, only the waveform data of modules that match is loaded. When loading is complete, a message indicating the channel numbers that were not loaded is displayed.

19.8 Loading Setup Data

This section explains the following settings for loading setup data:

Items Common to Scope Mode and Recorder Mode

- Displaying file information
- Loading setup data

► [“Loading Setup Data \(Setup\)” in the Features Guide](#)

FILE Setup (Load) Menu

1. On the waveform screen’s **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Setup** under Load, or press the soft key. The following screen appears.

Select the **.SET** file that you want to load.



Selecting a File

Select the file to load from the file list. For details on file operations, see section 19.10.

Loading Setup Data (Load)

- Select the setup data and load it. The extension is **.SET**.
- If the module configuration when the setup data is saved and that when the data is loaded are different, only the setup data of modules that match is loaded. When loading is complete, a message indicating the channel numbers that were not loaded is displayed.

19.9 Loading Other Types of Data

This section explains the following settings for loading snapshot waveforms or symbol data:

Applicable in Scope Mode

- Displaying file information
- Data to load
- Loading data

Applicable in Recorder Mode

- Displaying symbol file information
- Load destination
- Loading files

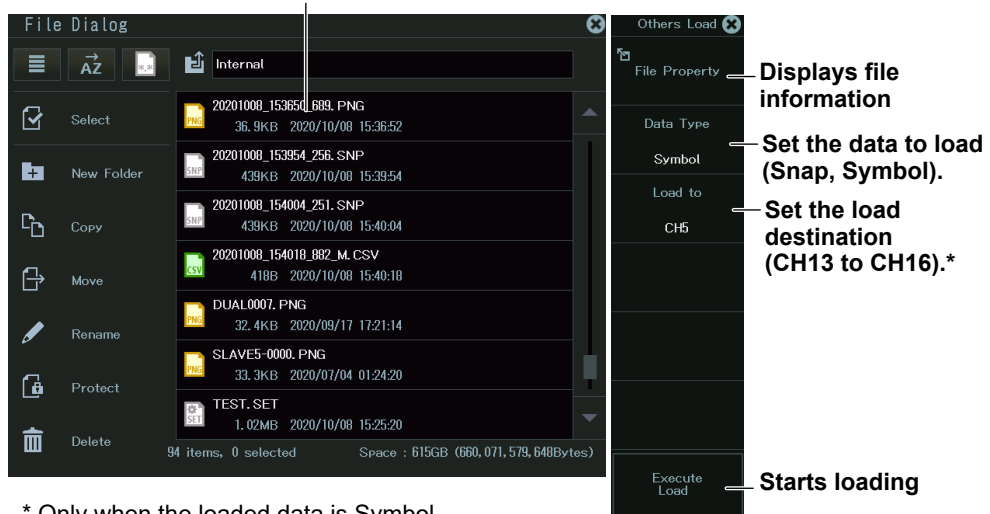
► “Loading Other Types of Data (Others),” and
“Loading Symbols (Symbol)” in the Features Guide

Scope Mode

FILE Others (Load) Menu

1. On the waveform screen’s **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Others** under Load, or press the soft key. The following screen appears.

Select the file to load.



* Only when the loaded data is Symbol

Setting the Data Type to Load (Data Type)

Snap: A saved snapshot waveform is loaded. The extension is .SNP. This is valid in Scope mode.

Symbol: A CAN or CAN FD or LIN data definition file is loaded. The extension is .SBL. This is valid when a CAN bus monitor, CAN & LIN bus monitor, CAN/CAN FD monitor, or SENT monitor is installed.

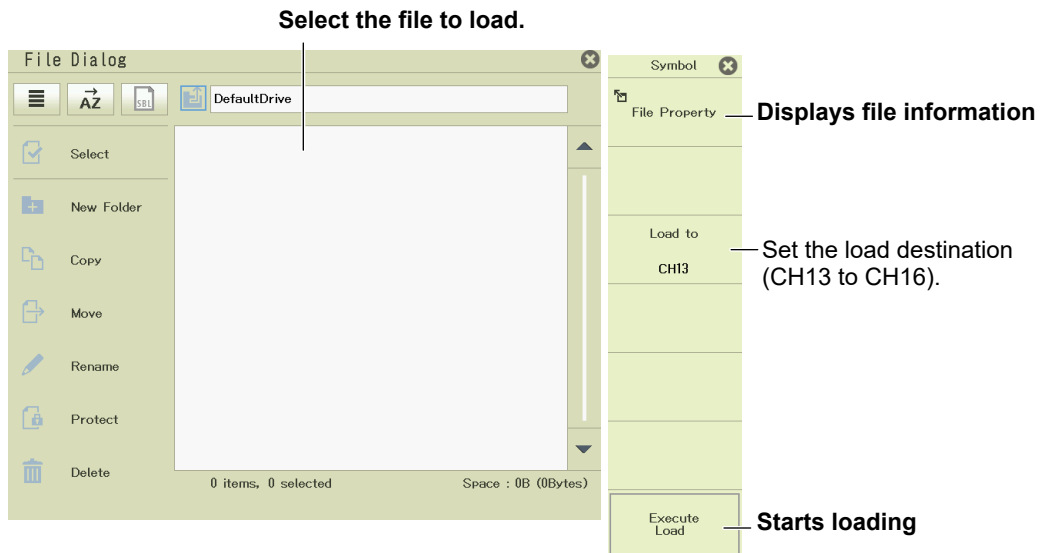
Clearing the Waveform

To clear a loaded snapshot waveform, perform clear trace or initialize.

Recorder mode

FILE Symbol (Load) Menu

1. On the waveform screen's **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Symbol** under Load, or press the soft key. The following screen appears.



19.10 Performing File Operations

This section explains how to operate the file utility and file list.

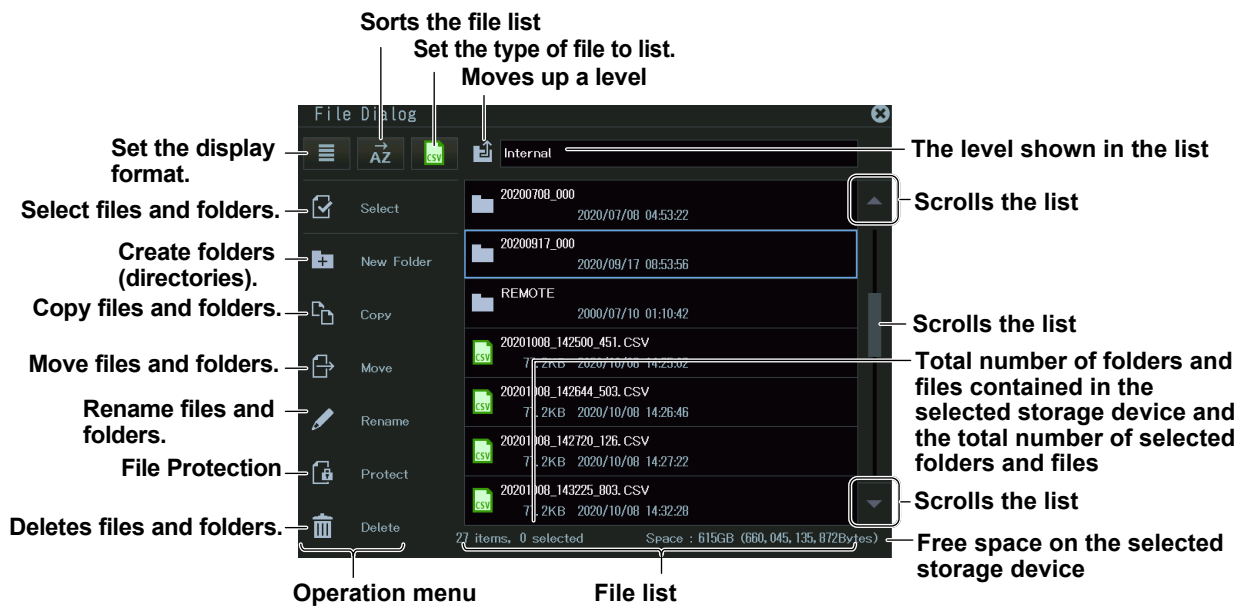
Items Common to Scope Mode and Recorder Mode

- Creating folders
- Coping files and folders
- Moving files and folders
- Renaming files and folders
- Protecting files
- Deleting files and folders

► [“File Operations \(Utility\)” in the Features Guide](#)

File Utility (Utility)

1. On the waveform screen’s **MENU**, tap **FILE > FILE**, or press **FILE**.
2. Tap **Utility**, or press the soft key. The following screen appears.

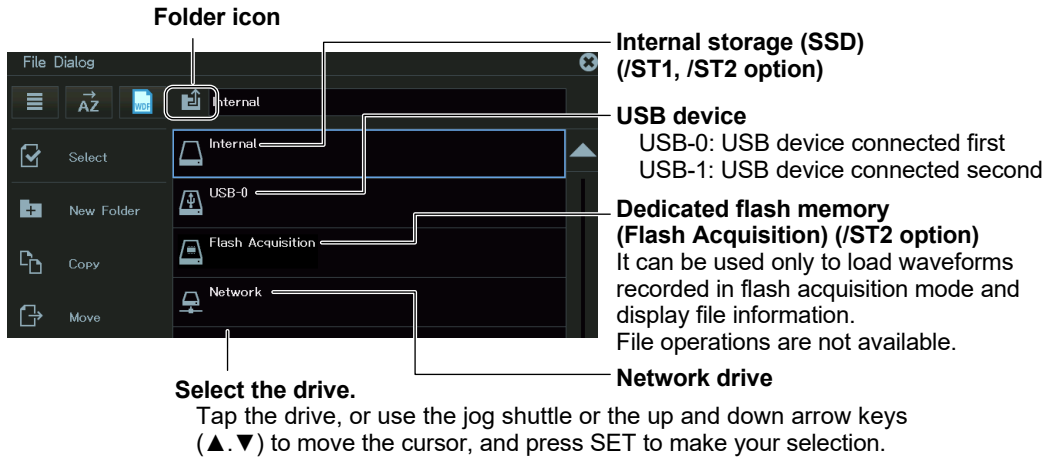


Note

The maximum number of files that can be shown in the file list is about 1000. This number varies depending on the storage device connection status and folder structure. It is possible to save files in a folder that contains more than 1000 files, but they may not appear in the file list. If this happens, delete some files or move them to another folder so that the number of files in the folder is less than about 1000 files.

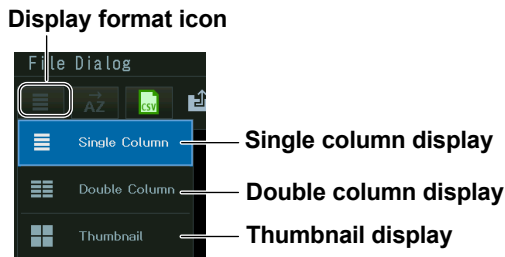
Selecting Drives

Tap the folder icon several times to move to the top level. You can also move to the top level by moving the cursor to the folder icon with the jog dial or arrow keys and pressing SET.



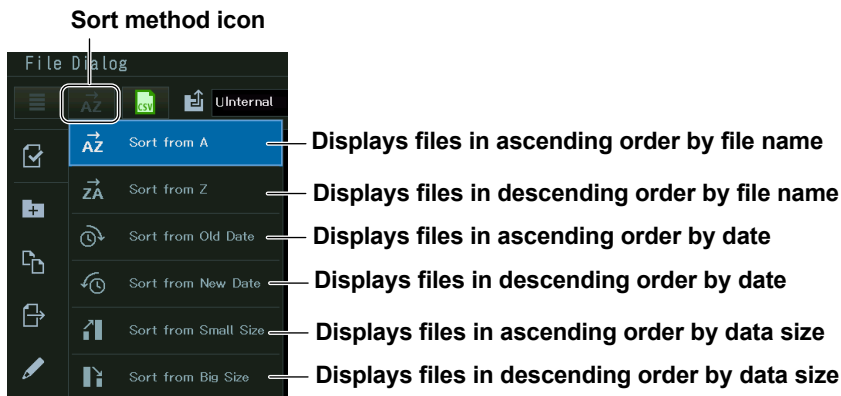
Setting the Display Format

Tap the display format icon to display the display format options. You can also display the options by moving the cursor to the display format icon with the jog dial or arrow keys and pressing SET.



Sorting the File List

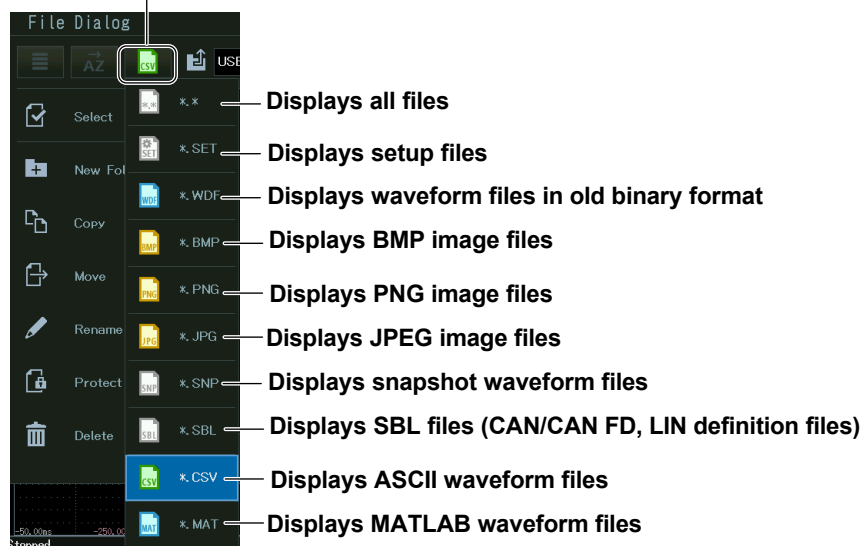
Tap the sort mode icon to display the sort mode options. You can also display the options by moving the cursor to the sort mode icon with the jog dial or arrow keys and pressing SET.



Selecting the Type of Files to List (Filter)

Tap file list type icon to display the file type list. You can also display the list by moving the cursor to the sort mode icon with the jog dial or arrow keys and pressing SET.

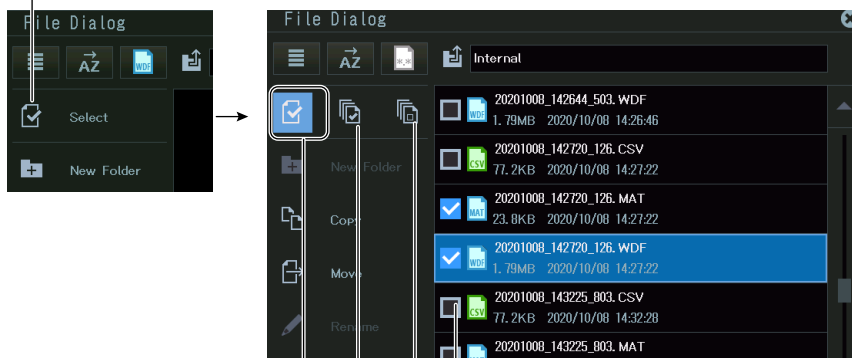
Icon of the type of files to list



Selecting Files and Folders

Tap the file and folder selection icon to display the file and folder selection modes. You can also display the modes by moving the cursor to the file and folder selection icon with the jog dial or arrow keys and pressing SET.

Icon for selecting files and folders



Check box

- Clears the check boxes from all files and folders
- Selects the check boxes of all files and folders
- Select the check boxes of files and folders one at a time.

Tap the check boxes to select files and folders. You can also select the file and folder check boxes by moving the cursor with the jog dial or arrow keys and pressing SET. File operations will be performed on the files and folders whose check boxes are selected.

Copying Files (Copy)

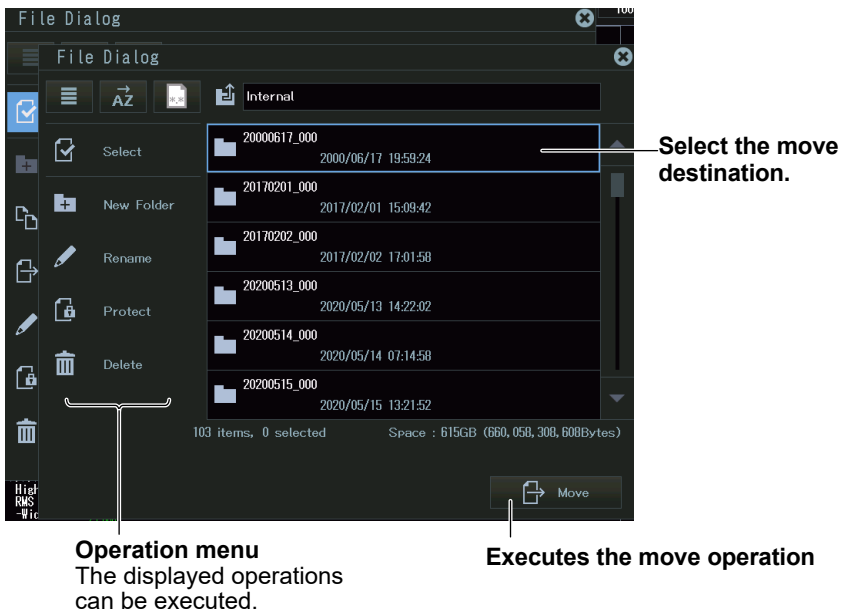
1. Select the file or folder that you want to copy from the file list.
2. On the operation menu, tap **Copy**, or move the cursor using the jog dial or arrow keys, and press **SET**. A copy destination selection screen appears.



3. Select the copy destination and tap **Copy**, or move the cursor using the jog dial or arrow keys, and press **SET**.

Moving Files (Move)

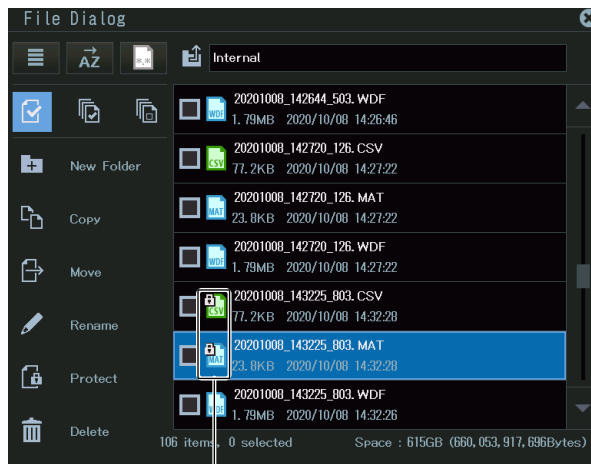
1. Select the file or folder that you want to move from the file list.
2. On the operation menu, tap **Move**, or move the cursor using the jog dial or arrow keys, and press **SET**. A move destination selection screen appears.



3. Select the move destination and tap **Move**, or move the cursor using the jog dial or arrow keys, and press **SET**.

Protecting Files

1. Select the file that you want to protect from the file list.
2. On the operation menu, tap **Protect**, or move the cursor using the jog dial or arrow keys, and press **SET**. A protection mark is added to the file icon.



Protected files

Protection	File Attribute	Description
ON	r	The selected files are protected. The file can be read from. Writing is not allowed. Deleting is also not allowed.
OFF	r/w	The selected files are not protected. The file has read and write access.

Releasing the Protection

1. Select the file that you want to release the protection of from the file list.
2. On the operation menu, tap **Protect**, or move the cursor using the jog dial or arrow keys, and press **SET**. The protection mark is disappears from the file icon.

Making Folders (New Folder)

1. Display the location to create a folder in the file list.
2. On the operation menu, tap **New Folder**, or move the cursor using the jog dial or arrow keys, and press **SET**. A keyboard appears.
3. Enter the folder name.

Deleting Files and Folders (Delete)

1. Select the file or folder that you want to delete from the file list.
2. On the operation menu, tap **Delete**, or move the cursor using the jog dial or arrow keys, and press **SET**. A confirmation screen appears.
3. Tap **OK**, or select **OK** using the arrow keys, and press **SET**. The selected files and folders will be deleted.

Note

You can abort (Abort) file deleting. However, files that are already being processed are not applicable.

Renaming Files and Folders (Rename)

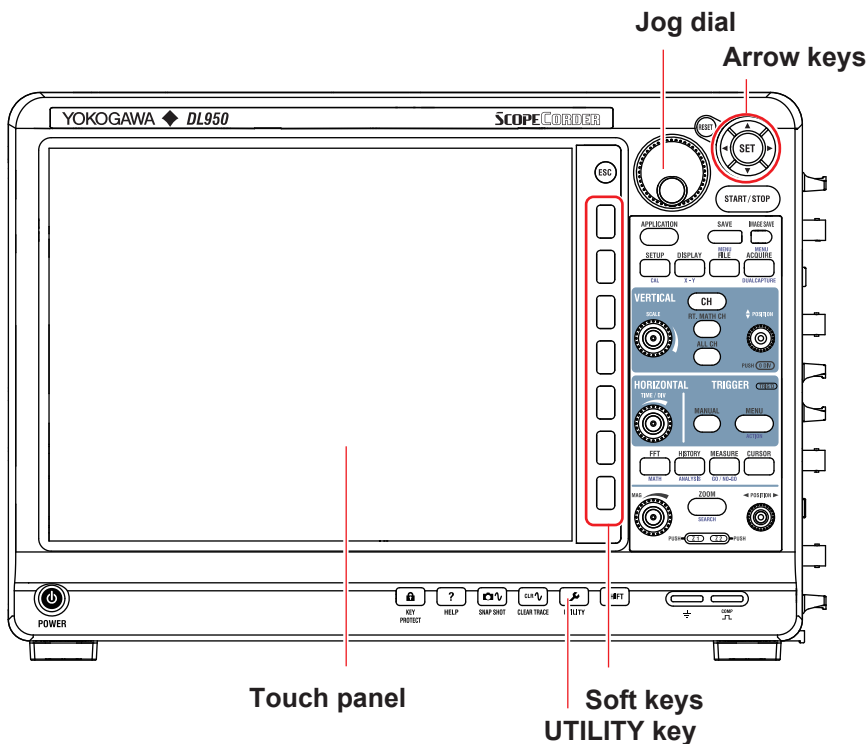
1. Select a file or folder that you want to rename from the file list.
2. On the operation menu, tap **Rename**, or move the cursor using the jog dial or arrow keys, and press **SET**. A keyboard appears.
3. Enter the new file name or folder name.

Chapter 20

Ethernet Communication

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
20.1 Connecting the Instrument to a Network	✓	✓
20.2 Configuring the TCP/IP Settings	✓	✓
20.3 Accessing the Instrument from a PC (FTP Server)	✓	✓
20.4 Monitoring the Instrument's Display from a PC (Web Server)	✓	✓
20.5 Connecting to a Network Drive	✓	✓
20.6 Configuring Mail Transmission (SMTP client function)	✓	✓
20.7 Using SNTP to Set the Date and Time	✓	✓
20.8 Configuring a Network Printer	✓	✓

* The settings may vary depending on the operation mode.

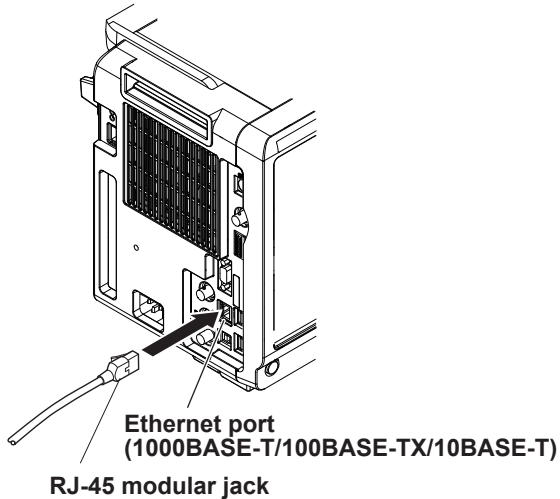
20.1 Connecting the Instrument to a Network

This section explains how to connect the instrument to a network.

Connecting to the Ethernet Port (1000BASE-T/100BASE-TX/10BASE-T)

Connect an Ethernet cable to the 1000BASE-T port on the side panel of this instrument.

Connector type: RJ-45 connector



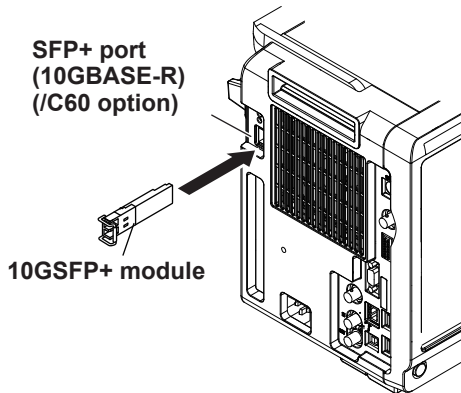
Items Required to Connect the Instrument to a Network

Cable

Use an STP (Shielded Twisted-Pair) cable that is compatible with your network environment (transmission speed).

Connecting to the SFP+ Port (10GBASE-R)/(C60 option)

Mount a 10GSFP+ module to the SFP+ port on the side panel of this instrument.
For details on mounting, see the 10GSFP+ module's user's manual.



Connect an SFP+ cable to the 10GSFP+ module.

Items Required to Connect the Instrument to a Network

10GSFP+ module

Prepare an SFP+ module that is compatible with 10 Gbit Ethernet.

Connector type: SFP+

Electrical and mechanical specifications: Complies with IEEE802.3

For detailed specifications, see the *DL950 ScopeCorder Getting Started Guide* (IM DL950-03EN).

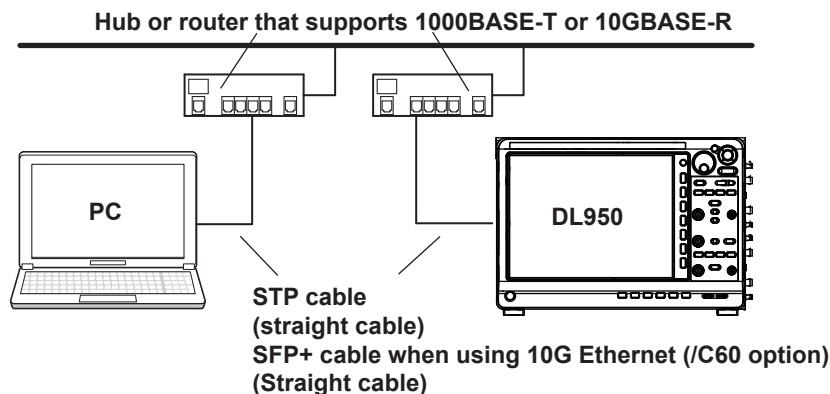
This module is not required if you are using a module-integrated cable.

SFP+ cable

Prepare a 10GBASE-R cable.

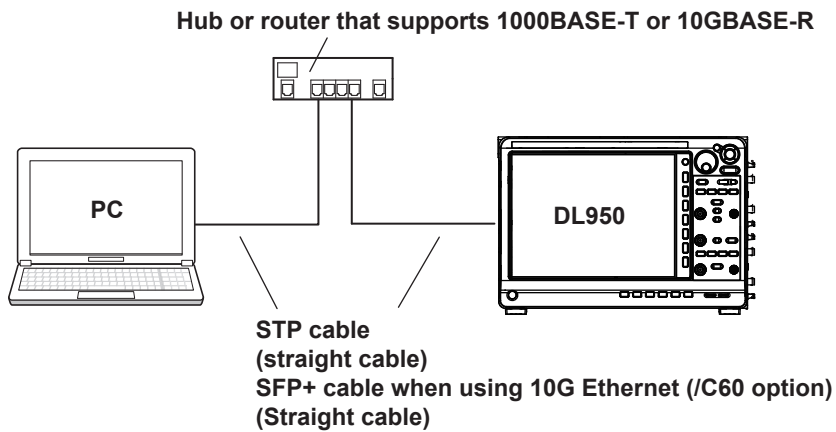
To Connect to a PC over a Network

1. Turn off the instrument.
2. Connect the connector on one end of an STP cable to the ETHERNET 1000BASE-T port on the side panel or the connector on one end of an SFP+ cable to the 10GBASE-R port on the side panel.
3. Connect the other end of the STP or SFP+ cable to a hub or router.
4. Turn on the instrument.



To Connect to a PC through a Hub or Router

1. Turn off the instrument and the PC.
2. Connect the connector on one end of an STP cable to the ETHERNET 1000BASE-T port on the side panel or the connector on one end of an SFP+ cable to the 10GBASE-R port on the side panel.
3. Connect the other end of the STP or SFP+ cable to a hub or router.
4. Connect the PC to the hub or router in the same way.
5. Turn on the instrument.



Note

- Use a hub or router that conforms to the transfer speed of your network.
 - To connect a PC to the instrument through a hub or router, the PC must be equipped with an auto 1000BASE-T/100BASE-TX/10BASE-T switching or 10GBASE-R network card.
 - Do not connect the instrument to a PC directly. Direct communication without a hub or router is not guaranteed to work.
 - If you specify a fixed IP address or network drive, be sure to use the instrument in an environment where it can be accessed. If it cannot be accessed, you may not be able to operate the instrument for the specified timeout period.
-

20.2 Configuring the TCP/IP Settings

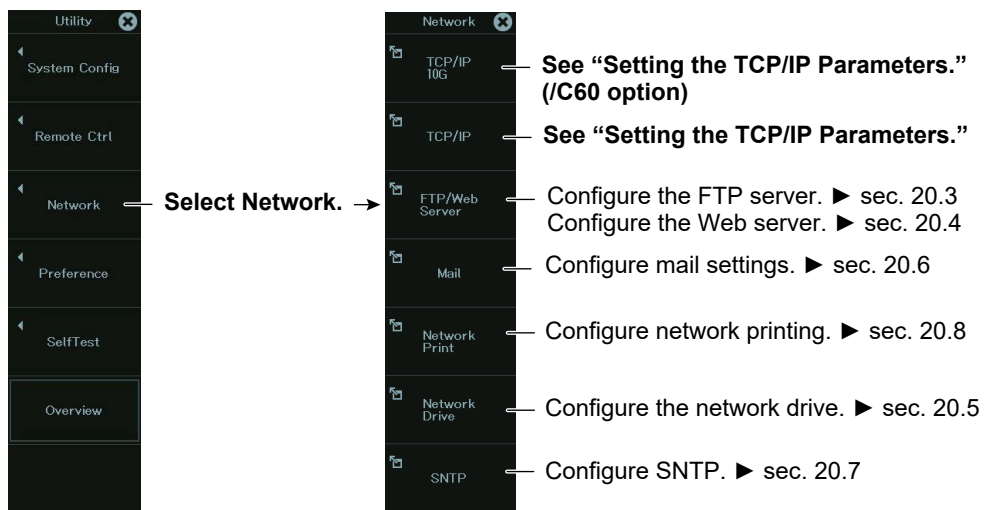
This section explains the following TCP/IP settings for connecting to a network:

Items Common to Scope Mode and Recorder Mode

- DHCP (IP address, subnet mask, and default gateway)
- DNS (domain name, DNS server IP address, and domain suffix)
 - ▶ “TCP/IP10G (TCP/IP10G), TCP/IP (TCP/IP)” in the Features guide

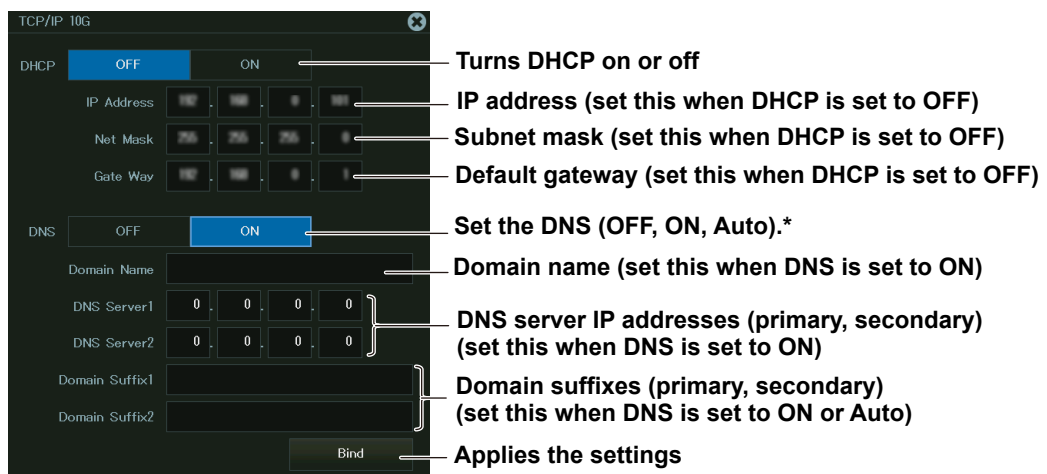
UTILITY Network Menu

1. On the waveform screen’s MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Setting the TCP/IP Parameters (TCP/IP 10G, TCP/IP)

3. Tap **TCP/IP 10G** or **TCP/IP**, or press the soft key. The following screen appears.



* Auto is displayed when DHCP is turned on.

Setting the DNS (DNS)

- OFF: Disable the DNS.
- ON: DNS is enabled. Set the domain name, and the DNS server's primary and secondary IP addresses and domain suffixes.
- Auto: DNS is enabled. Set the domain suffix. The domain name and the DNS server IP addresses are set automatically. This option can only be selected when DHCP is on.

20.3 Accessing the Instrument from a PC (FTP Server)

This section explains the following settings for accessing the instrument from a PC on a network:

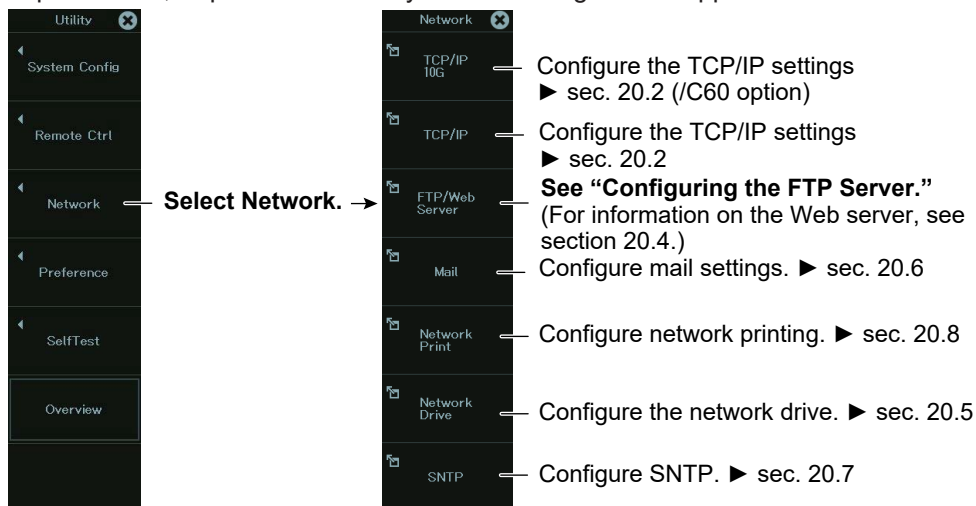
Items Common to Scope Mode and Recorder Mode

- User name
- Password
- Timeout
- Starting an FTP client

▶ “FTP Server (FTP/Web Server)” in the Features Guide

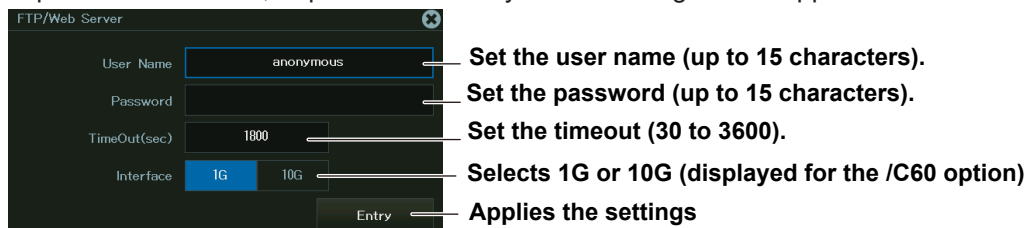
UTILITY Network Menu

1. On the waveform screen’s MENU, tap **OTHERS > UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Configuring the FTP Server (FTP/Web Server)

3. Tap **FTP/Web Server**, or press the soft key. The following screen appears.



Note

If you set the user name to “anonymous,” you can connect to the instrument without entering a password.

Starting an FTP Client

Start an FTP client on a PC. Enter the user name and password that you have set on the instrument’s FTP/Web Server screen shown above, and connect to the instrument.

20.4 Monitoring the Instrument's Display from a PC (Web Server)

This section explains the following settings for connecting to the instrument from a PC over a network to show the instrument's display on the PC and to start and stop waveform acquisition from the PC:

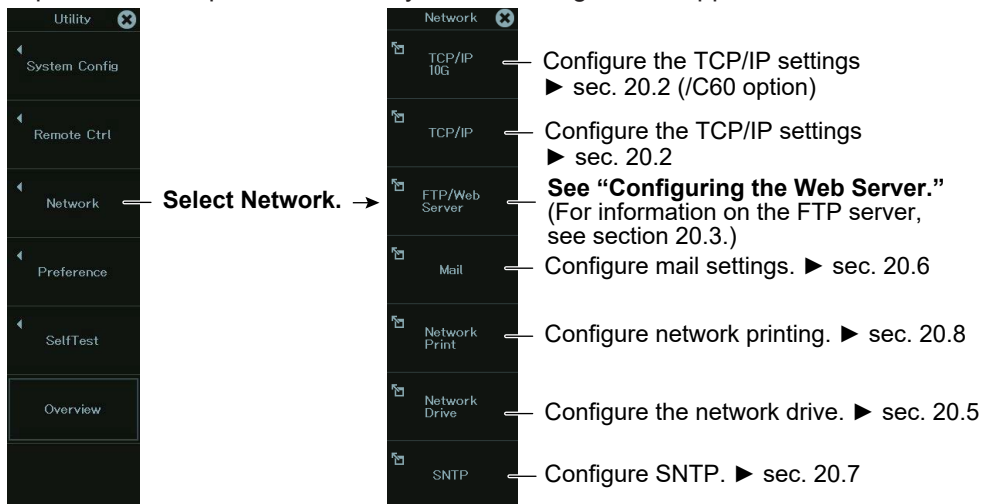
Items Common to Scope Mode and Recorder Mode

- User name
- Password
- Timeout
- Connecting to the instrument from a PC

▶ [“Web Server \(FTP/Web Server\)” in the Features Guide](#)

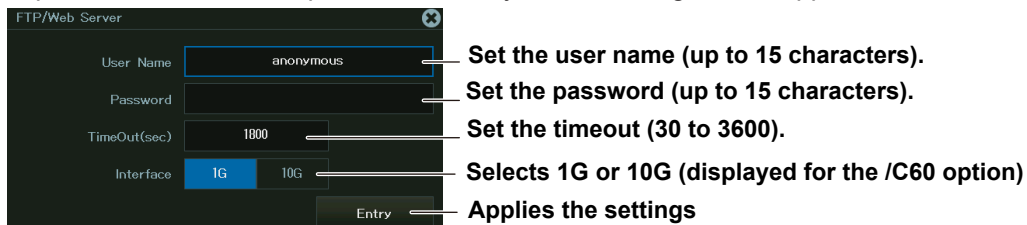
UTILITY Network Menu

1. On the waveform screen's MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Configuring the Web Server (FTP/Web Server)

3. Tap **FTP/Web Server**, or press the soft key. The following screen appears.



20.5 Connecting to a Network Drive

This section explains the following settings for accessing a network drive through an Ethernet connection to load or save various instrument's data:

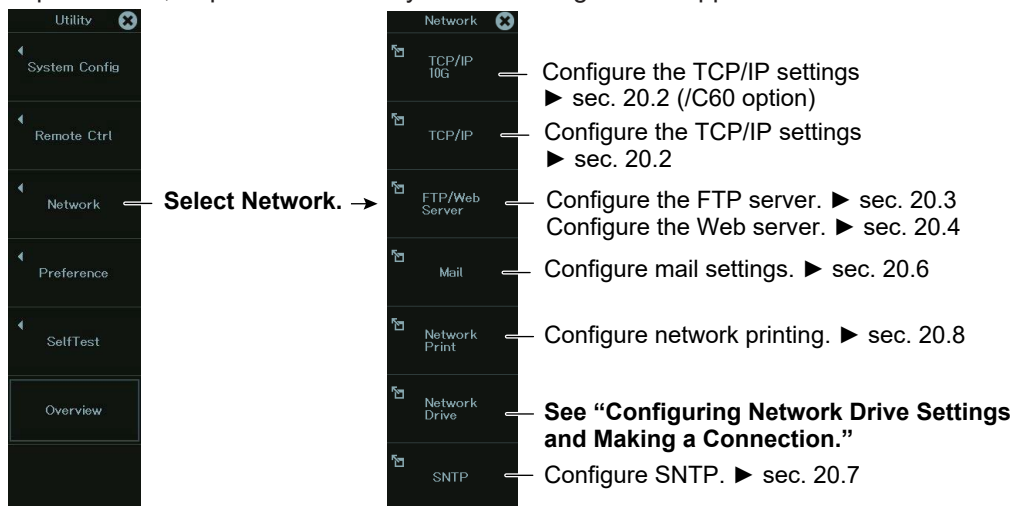
Items Common to Scope Mode and Recorder Mode

- FTP server (file server)
- Login name
- Password
- Turning FTP passive mode on and off
- Timeout
- Connecting to and disconnecting from network drives

▶ [“Network Drive \(Net Drive\)” in the Features Guide](#)

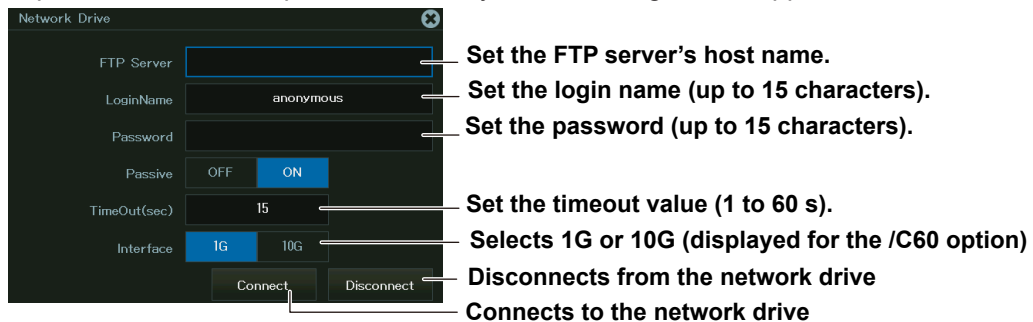
UTILITY Network Menu

1. On the waveform screen's MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Configuring Network Drive (Network Drive) Settings and Making a Connection

3. Tap **Network Drive**, or press the soft key. The following screen appears.



20.6 Configuring Mail Transmission (SMTP client function)

This section explains the following settings for transmitting mail to a specified mail address on a network:

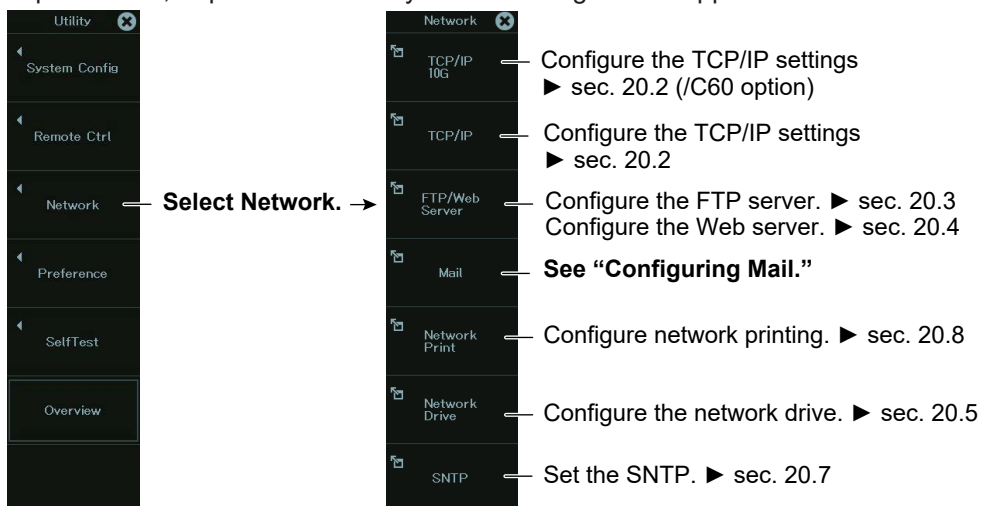
Items Common to Scope Mode and Recorder Mode

- Mail server
- Recipient mail address
- Comment
- Attaching image files
- Timeout
- Sending a test mail

▶ “Mail (Mail)” in the Features Guide

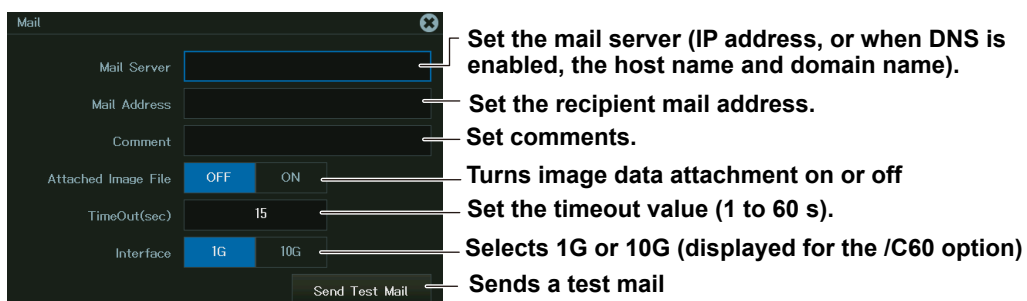
UTILITY Network Menu

1. On the waveform screen's MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Configuring Mail (Mail)

3. Tap **Mail**, or press the soft key. The following screen appears.



20.7 Using SNTP to Set the Date and Time

This section explains how to use SNTP to set the Instrument's date and time.

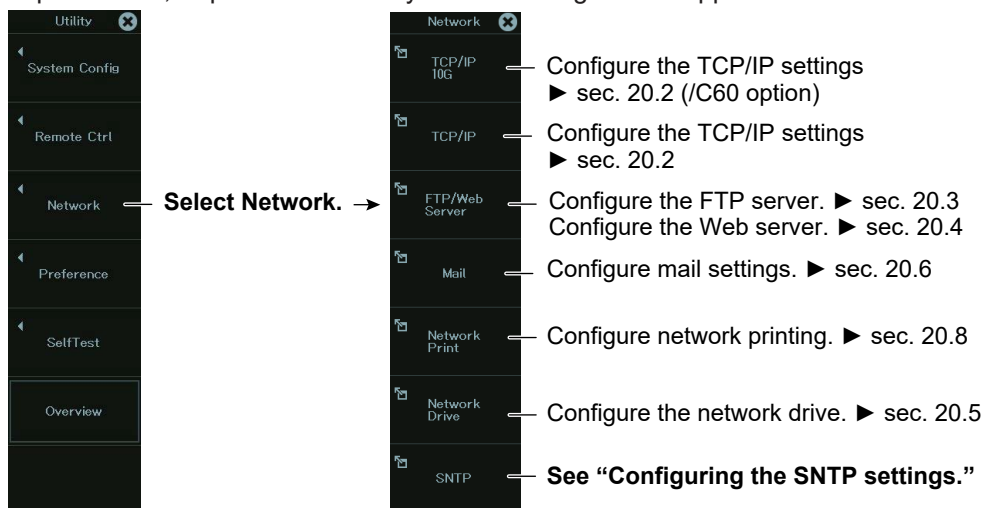
Items Common to Scope Mode and Recorder Mode

- SNTP server
- Timeout
- Executes clock adjustment
- Automatic adjustment

► “SNTP (SNTP)” in the Features Guide

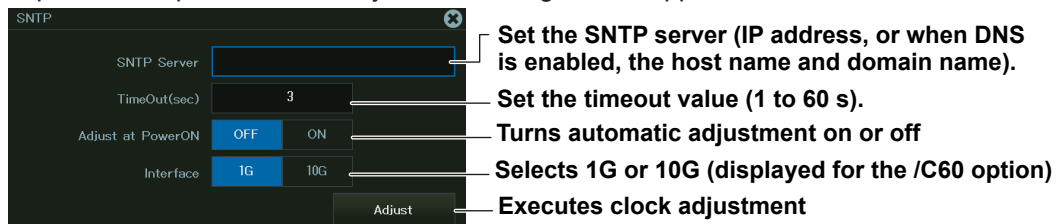
UTILITY Network Menu

1. On the waveform screen's MENU, tap **OTHERS > UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Configuring the SNTP Settings (SNTP)

3. Tap **SNTP**, or press the soft key. The following screen appears.



20.8 Configuring a Network Printer

This section explains the following settings for printing screen images to a network printer:

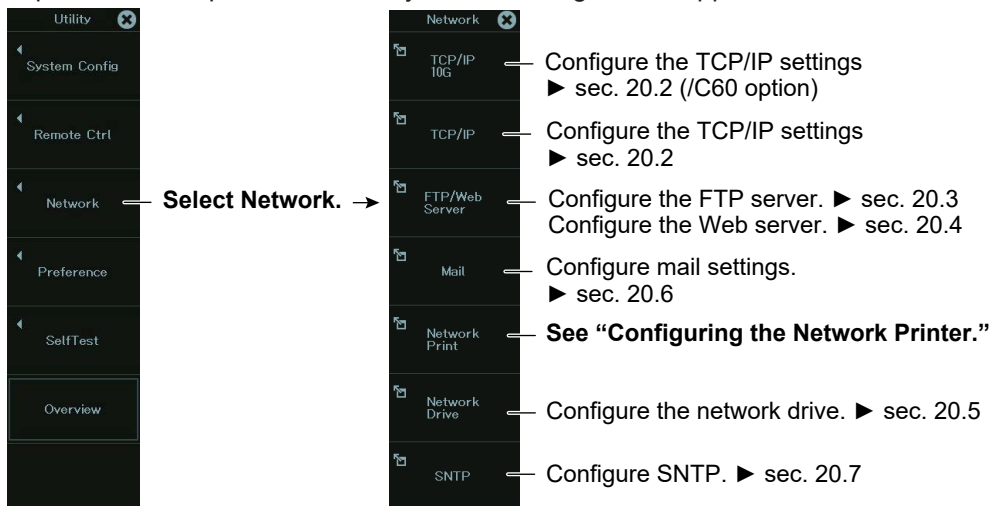
Items Common to Scope Mode and Recorder Mode

- LPR server
- LPR name
- Timeout

► “Network Printer (Net Print)” in the Features Guide

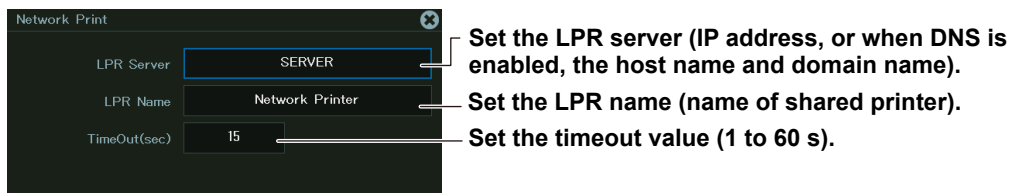
UTILITY Network Menu

1. On the waveform screen’s MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Network**, or press the soft key. The following screen appears.



Configuring the Network Printer (Network Print)

3. Tap **Network Print**, or press the soft key. The following screen appears.

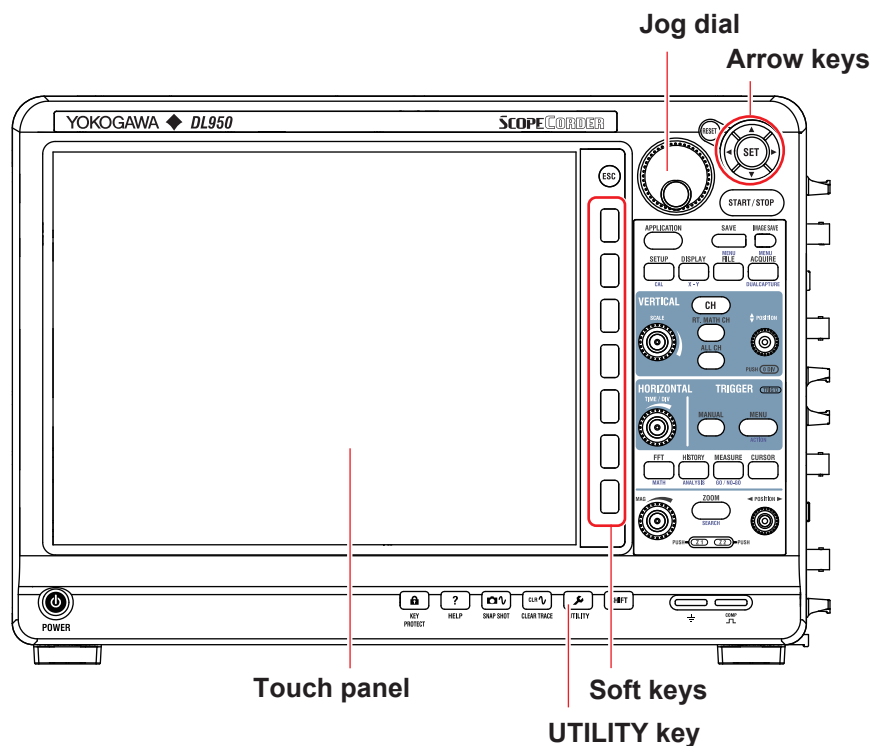


Chapter 21

Time Synchronization

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
21.1 Setting Time Synchronization Mode	✓	✓
21.2 Configuring Master Settings (/C40 option)	✓	✓

* The settings may vary depending on the operation mode.

21.1 Setting Time Synchronization Mode

This section explains the following setting for synchronizing instruments on a network.

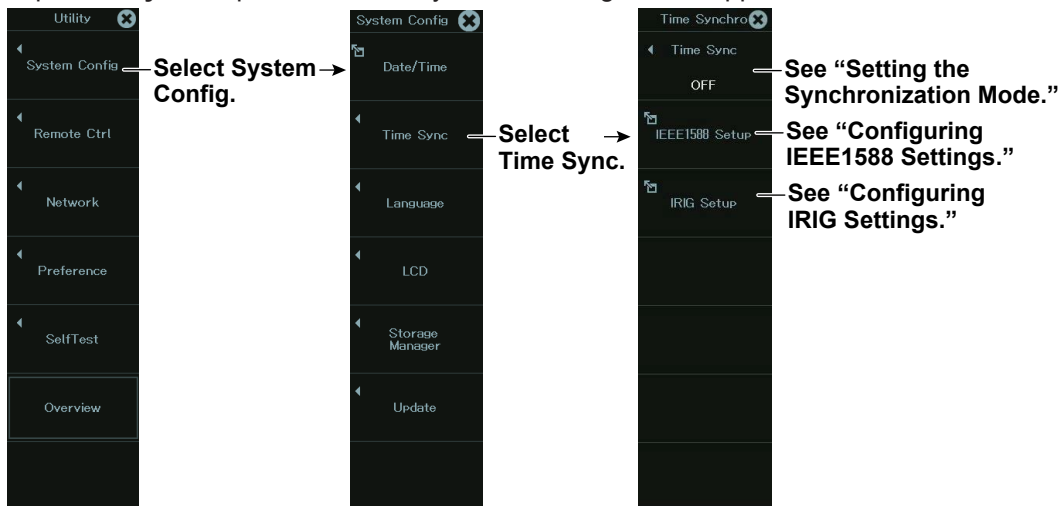
Items Common to Scope Mode and Recorder Mode

- Time synchronization mode
- Configuring IRIG settings
- Configuring IEEE1588 settings

► [“Time Synchronization” in the Features Guide](#)

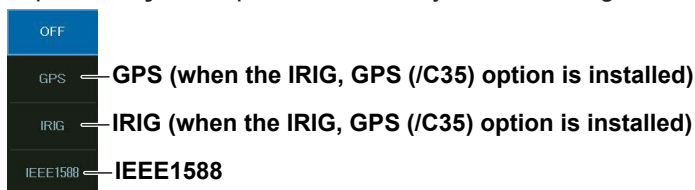
Utility System Config Time Sync Menu

1. On the waveform screen’s MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **System Config**, or press the soft key.
3. Tap **Time Sync**, or press the soft key. The following screen appears.



Setting the Synchronization Mode (Time Sync)

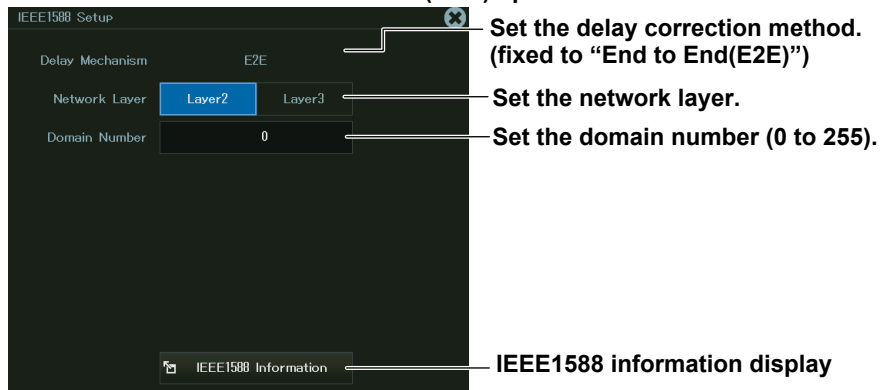
4. Tap **Time Sync**, or press the soft key. The following screen appears.



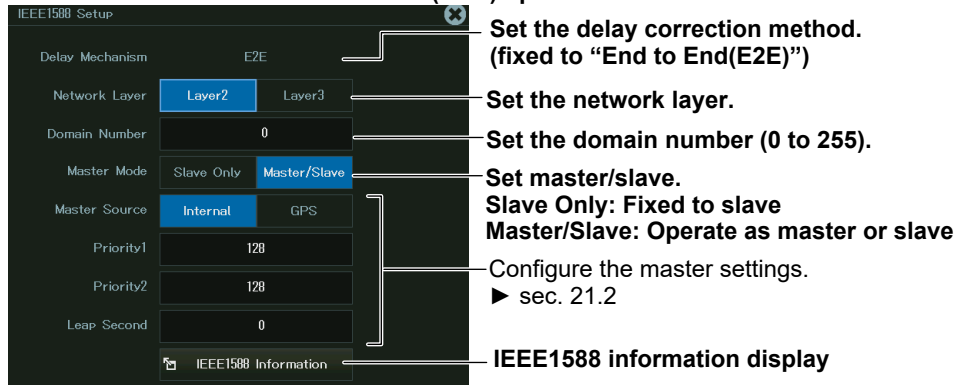
Configuring IEEE1588 Settings (IEEE1588)

4. Tap **IEEE1588**, or press the soft key. The following screen appears.

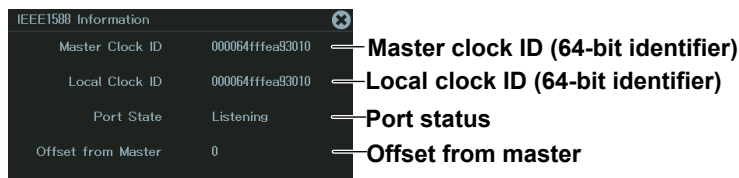
When the IEEE1588 master function (/C40) option is not installed



When the IEEE1588 master function (/C40) option is installed

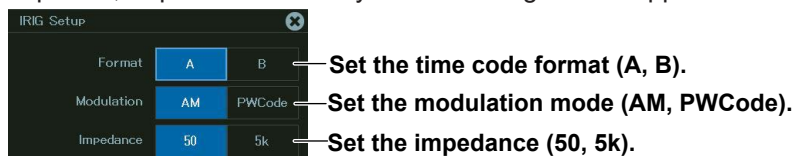


IEEE1588 Information Display



Configuring IRIG Settings (IRIG)

4. Tap **IRIG**, or press the soft key. The following screen appears.



21.2 Configuring Master Settings (/C40 option)

This section explains the following settings that are necessary for this instrument to be selected as a master unit in IEEE1588.

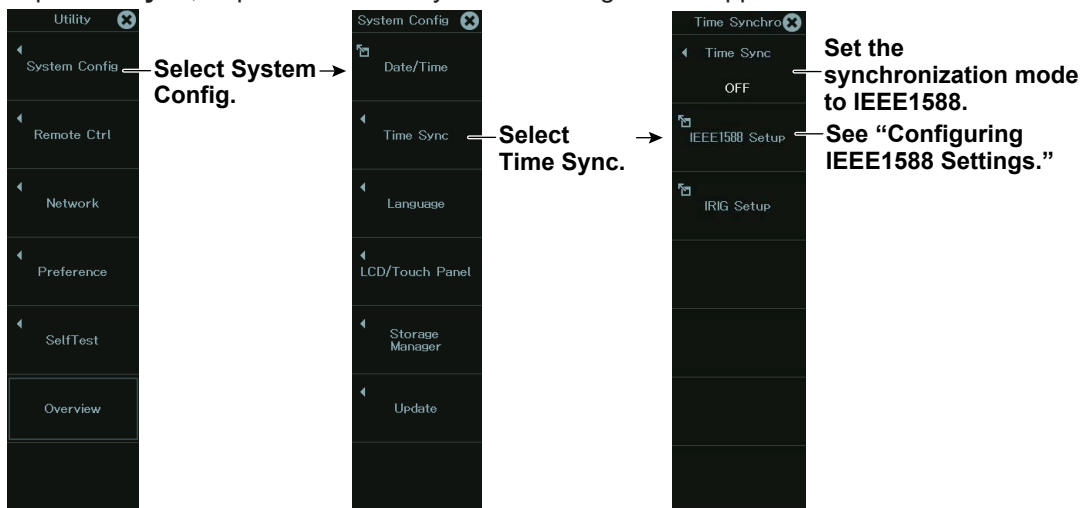
Items Common to Scope Mode and Recorder Mode

- Master mode
- Clock source
- Priority1, Priority2
- Leap second

► “IEEE1588 Setup (IEEE1588 Setup)” in the Features Guide

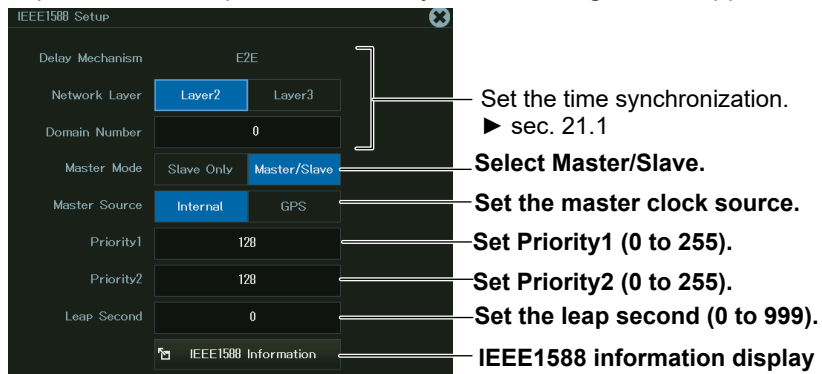
Utility System Config Time Sync Menu

1. On the waveform screen’s MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **System Config**, or press the soft key.
3. Tap **Time Sync**, or press the soft key. The following screen appears.



Configuring IEEE1588 Settings (IEEE1588)

4. Tap **IEEE1588**, or press the soft key. The following screen appears.



Master Source GPS is available on models with the IRIG/GPS option (/C35).

In IEEE1588, the master clock in the network is selected according to the rules stipulated in the IEEE1588 standard, taking into account the Priority1 and Priority2 values.

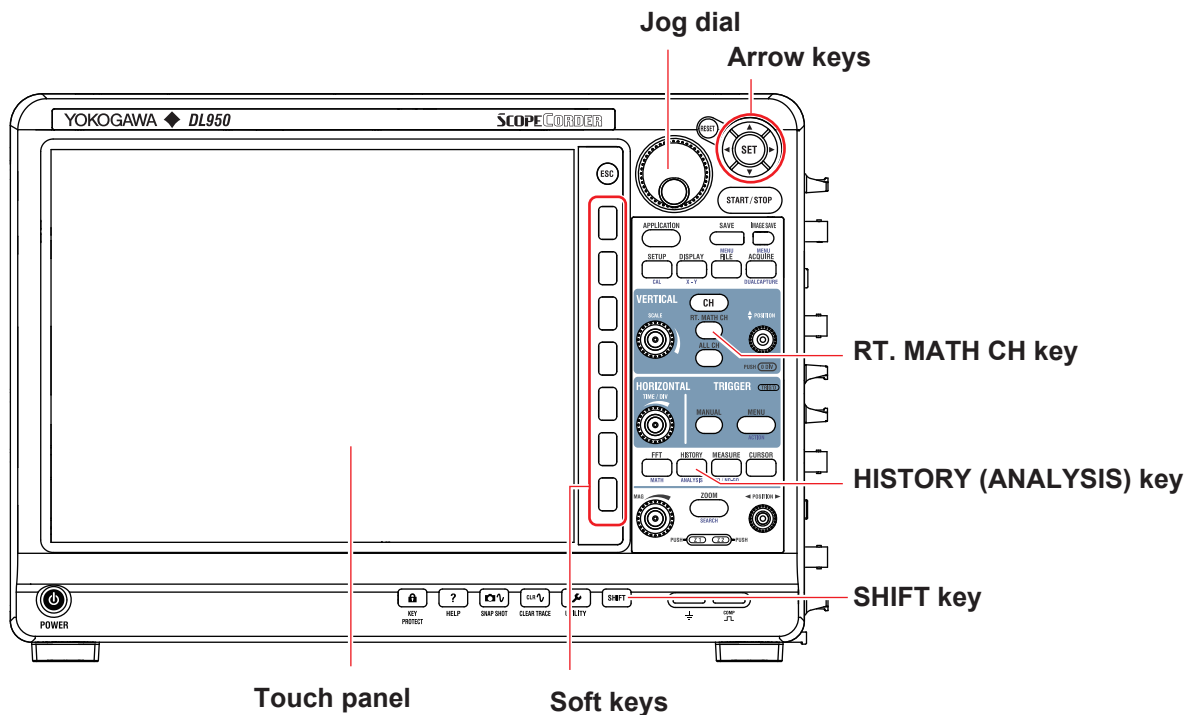
Devices with smaller Priority1 and Priority2 values have priority in selecting the master clock.

Chapter 22

Position Information (GPS) (/C35 Option)

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
22.1 Acquiring Position Information	✓	✓
22.2 Configuring the Position Information Waveform Display	✓	✓

* The settings may vary depending on the operation mode.

22.1 Acquiring Position Information

This section explains the following settings for acquiring position information with the GPS (Global Positioning System):

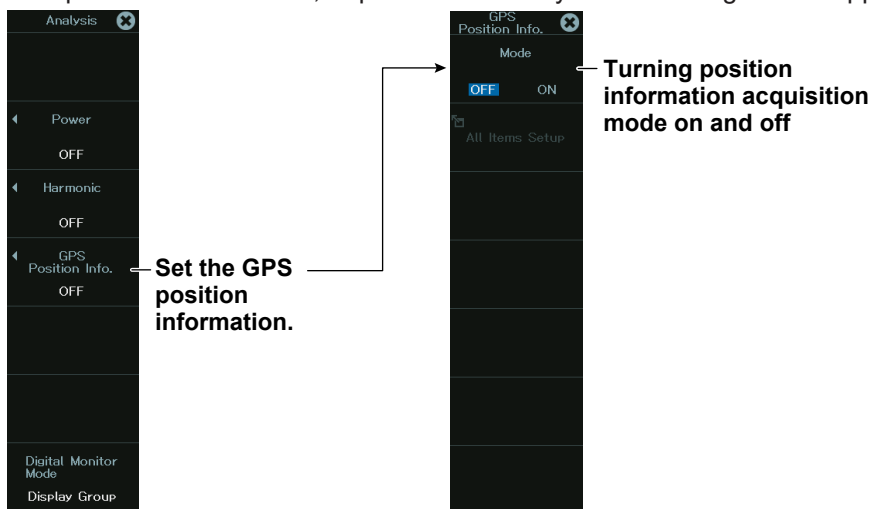
Items Common to Scope Mode and Recorder Mode

- Turning position information acquisition mode on and off
- Setting all output items

▶ [“Position information \(GPS\)/\(C35 Option\)” in the Features Guide](#)

GPS Position Information Menu (GPS Position Info.)

1. On the waveform screen’s **MENU**, tap **ANALYSIS > ANALYSIS**, or press **SHIFT+HISTORY**.
2. Tap **GPS Position Info**, or press the soft key. The following screen appears.



Turning Position information Acquisition Mode ON and OFF (Mode)

3. Tap **Mode**, or press the soft key to set the position information acquisition mode to ON.

Setting All Output Items (All Items Setup)

- 4. Tap **All Item Setup**, or press the soft key. The following screen appears.
 For each piece of position information (latitude, longitude, direction, altitude, velocity, status), you can set the color, waveform input on/off state, display label, and display range and collectively specify auto scale or default scale.

The image shows two screenshots from a device. The top-left screenshot is titled 'GPS Position Info.' and shows a 'Mode' section with 'OFF' and 'ON' options. An arrow points to the 'ON' option with the text 'Select ON.' Below it, an arrow points to the 'All Items Setup' button with the text 'Set all output items.' The bottom screenshot is titled 'All Items Setup' and contains a table with columns: Input, Label, Upper, and Lower. Each row represents a different data point (Latitude, Longitude, Altitude, Velocity, Direction, Status) with corresponding settings for color, waveform input, and display ranges. To the right of this table is a 'Setup' screen with 'All AutoScale' and 'All DefaultScale' options. Arrows point from these options to text explaining they 'Sets all upper limits and lower limits using auto scale.' and 'Sets all upper limits and lower limits using default scale.' respectively. Below the 'All Items Setup' table, several labels with arrows point to specific columns: 'Set the display colors.' points to the 'Input' column, 'Turns the waveform input on or off' points to the 'ON/OFF' toggle, 'Display label' points to the 'Label' column, 'Upper limit of display range' points to the 'Upper' column, and 'Lower limit of display range' points to the 'Lower' column.

	Input	Label	Upper	Lower
1	<input type="checkbox"/> ON	Latitude	90.000000°	- 90.000000°
2	<input type="checkbox"/> ON	Longitude	180.000000°	- 180.000000°
3	<input type="checkbox"/> ON	Altitude	100.0m	- 100.0m
4	<input type="checkbox"/> ON	Velocity	100.00km/h	0.00km/h
5	<input type="checkbox"/> ON	Direction	360.00°	0.00°
6	<input type="checkbox"/> ON	Status	4	- 1

22.2 Configuring the Position Information Waveform Display

This section explains the following settings for displaying position information acquired with the GPS (Global Positioning System):

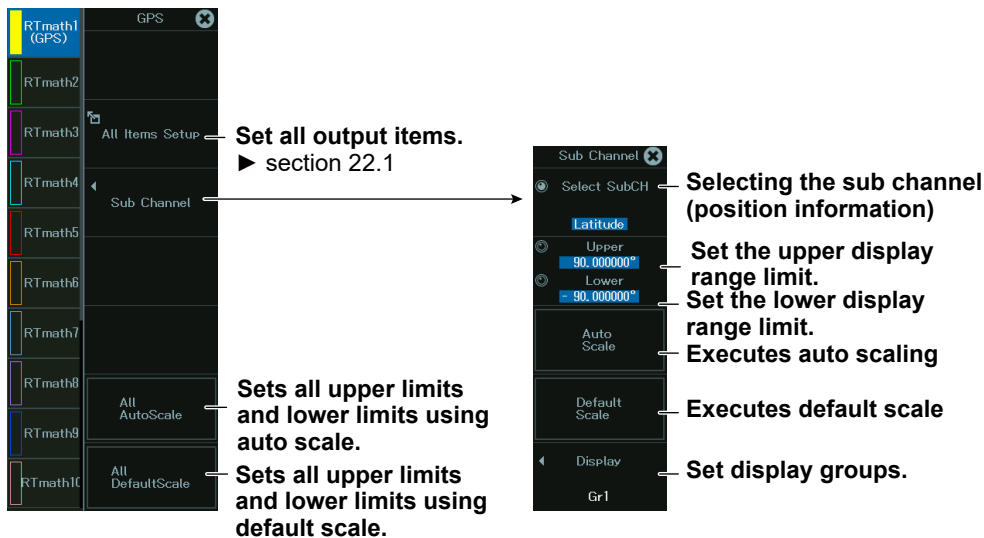
Items Common to Scope Mode and Recorder Mode

- Selecting the sub channel (position information)
- Upper and lower limits of the display range
- Auto scale or default scale
- Display groups
- Setting the display range
- Vertical position and horizontal position

► “Position information (GPS)/(C35 Option)” and “Display Settings for Position Information (RT.MATH CH)” in the Features Guide

RealTime Math Menu (RTmath1 (GPS))

1. Set position information acquisition mode to ON. For the procedure, see section 22.1.
2. On the waveform screen’s **MENU**, tap **CH > RT.MATH CH**, or press **RT. MATH CH**. A real time math setup menu appears.
3. Tap **RTmath1(GPS)**, or select it using the jog dial or up and down arrow keys. A GPS setup menu appears.

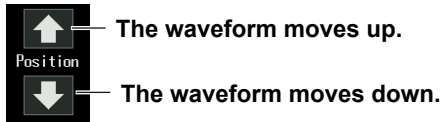


Setting the Display Range (SCALE knob)

4. Select the position information (sub channel) you want to set, and turn the SCALE knob to set the display range.

Setting the Vertical and Horizontal Positions of Waveforms (moving displayed waveforms)

4. Select the position information (sub channel) you want to set, and then vertically drag near the center of the screen displaying the waveform of the selected channel to display up and down arrows. Tap the arrows to move the waveform. The arrows disappear after a given time period.



After selecting a channel, turn the vertical POSITION knob to set the vertical position.

In Recorder mode, you can move the horizontal position using the following methods.

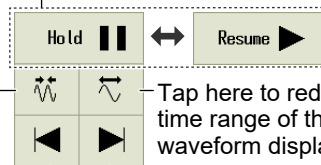
Drag the screen horizontally



The waveform moves to the right.
The waveform moves to the left.

Hold your finger on the screen to display:

Holds or resumes the waveform display
Displayed only when you touch and hold the screen during waveform acquisition



Tap here to expand the time range of the waveform display.

Tap here to reduce the time range of the waveform display.

Displays the waveform at the left edge of the acquisition time or record time bar

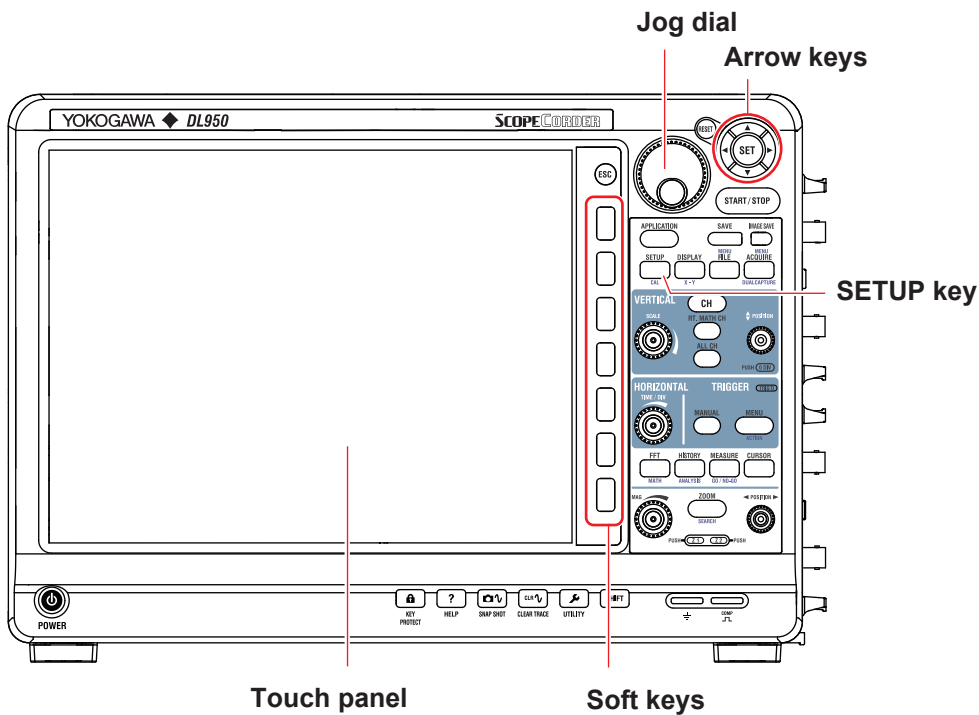
Displays the waveform at the right edge of the acquisition time or record time bar

Chapter 23

Connecting Multiple Instruments (/C50 option)

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
23.1 Connecting Multiple Instruments	✓	✓
23.2 Configuring the Multiple-Unit Connection	✓	✓
23.3 Starting and Stopping Waveform Acquisition	✓	✓

* The settings may vary depending on the operation mode.

23.1 Connecting Multiple Instruments

This section explains how to connect multiple DL950s.

Items Common to Scope Mode and Recorder Mode

- Installing SFP modules
 - Connecting optical cables
- ▶ [“Synchronizing Multiple Instruments \(/C50 option\)” in the Features Guide](#)

CAUTION

- Be extremely careful of static electricity when you install or remove SFP modules. Electrostatic discharges during the installation or removal of these modules may cause them to malfunction.
- Do not install or remove SFP modules while cables are connected to them. Doing so may damage the instrument.

French

ATTENTION

- Se méfier extrêmement de l'électricité statique lors d'installer ou retirer des modules d'émetteur-récepteur optiques. La décharge électrostatique lors de l'installation ou du retrait de ces modules pourrait causer leur dysfonctionnement.
- Ne pas installer ou ne pas retirer les modules d'émetteur-récepteur optique lorsque des cordons de fibre optique y sont connectés. Cela pourrait endommager l'instrument.

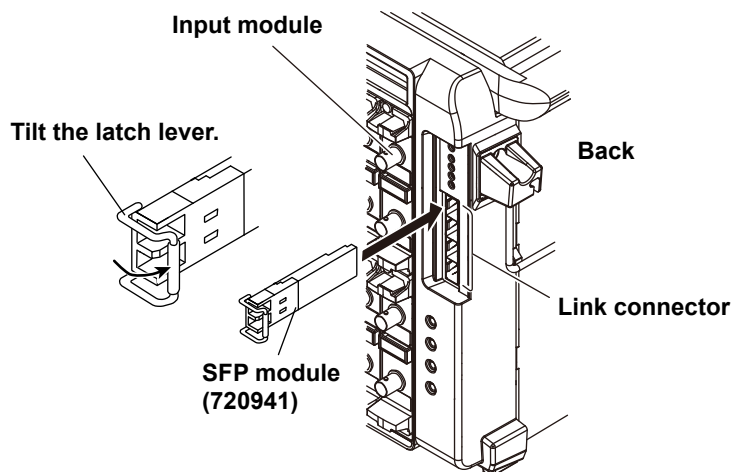
Installing SFP Modules

To connect multiple DL950s, you need 720941 SFP modules, which are optional accessories, and optical fiber cords. For optical fiber cords, use the 720942 optional accessories or use your own multi-mode optical fiber cords (LC type).

1. Turn off the instrument.
2. Insert 720941 SFP modules into the link connectors on the right side of the instrument's front panel. Tilt the latch lever on the SFP module, align the SFP module with the guide on the link connector, and slowly insert it. Push it until you hear a click.

When installing an SFP module into a sub unit, connect it to the top connector.

Install it with the latch lever tilted down. If it is installed with the latch lever raised, it cannot be installed normally.

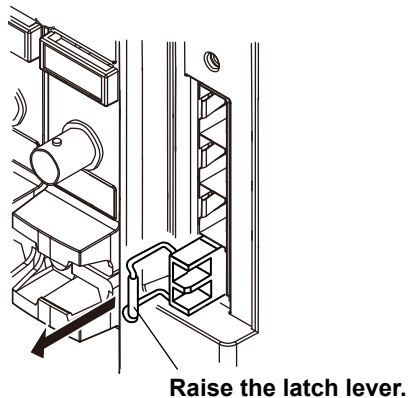


Note

- Be sure to use the 720941 optional accessory for the SFP module. If you use a different SFP module, the instrument's functions and performance are not guaranteed. In addition, a malfunction caused by using a different SFP module is not covered by warranty.
- There are connectors with the same shape as those of link connectors on the left side of the instrument's front panel, but they are 10G Ethernet connectors. You cannot use them to connect SFP modules.

Removing SFP Modules

1. Turn off the instrument.
2. Remove the optical fiber cord from the instrument.
3. Raise the latch lever on the SFP module toward you and slowly pull the module out. The connector will be disengaged, and the SFP module will come out of the link connector.



Connecting Optical Fiber Cords

CAUTION

- Insert the optical fiber cord connectors slowly and straight into the optical ports. If you shake the connector to the left and right or force it into the port, the optical connector or optical port may be damaged.
- If you use optical connectors that do not meet the specifications, the instrument's optical ports may be damaged. Use optical connectors that are approved or used by national or local telecom carriers and providers in your area.

French

ATTENTION

- Insérer lentement et droit le connecteur du cordon de fibre optique dans l'orifice optique en tenant le connecteur. Si vous secouez le connecteur vers la gauche et la droite ou si vous le forcez dans l'orifice, le connecteur ou l'orifice optique pourrait être endommagé.
- Toujours utiliser des connecteurs optiques conformes aux spécifications, à défaut de quoi les ports optiques de l'DL950 pourraient être endommagés. Utiliser des connecteurs optiques homologués ou utilisés par les entreprises et les fournisseurs de services de télécommunications de votre région.

Connect multiple DL950s using the 720942 optical fiber cord, sold separately.

If you are preparing your own optical fiber cords, use multi-mode optical fiber cords (LC type).

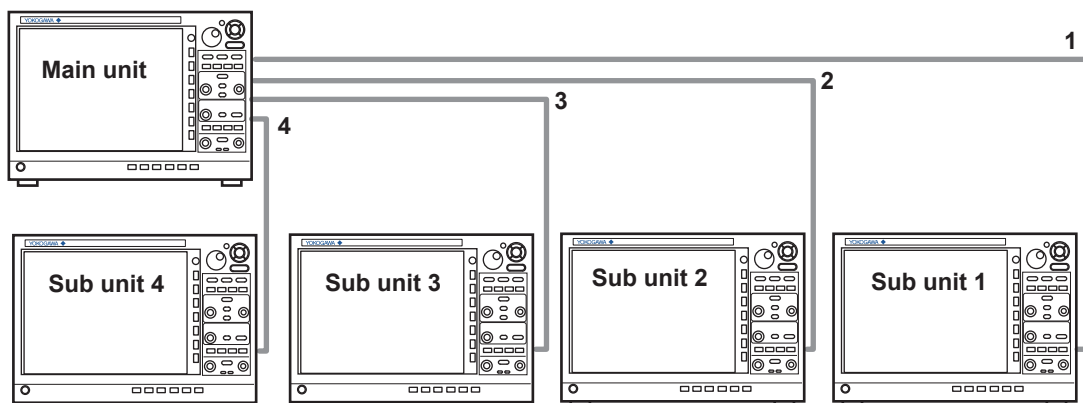
1. Properly align the optical fiber cord's connector with the SFP module's optical port, and insert the connector.

Note

Clean the connector end face of the optical fiber cord before connecting it to the instrument. If dust is adhered to the connector end face, it may damage the instrument's optical port. If this happens, the instrument will not be able to communicate.

When cleaning the end face of the connector, use a cleaner dedicated to fiber optic cords.

Connect the main unit and sub units in a star configuration as shown in the following figure.



The sub unit numbers 1 to 4 are assigned in order from the top connector of the main unit to be connected.

23.2 Configuring the Multiple-Unit Connection

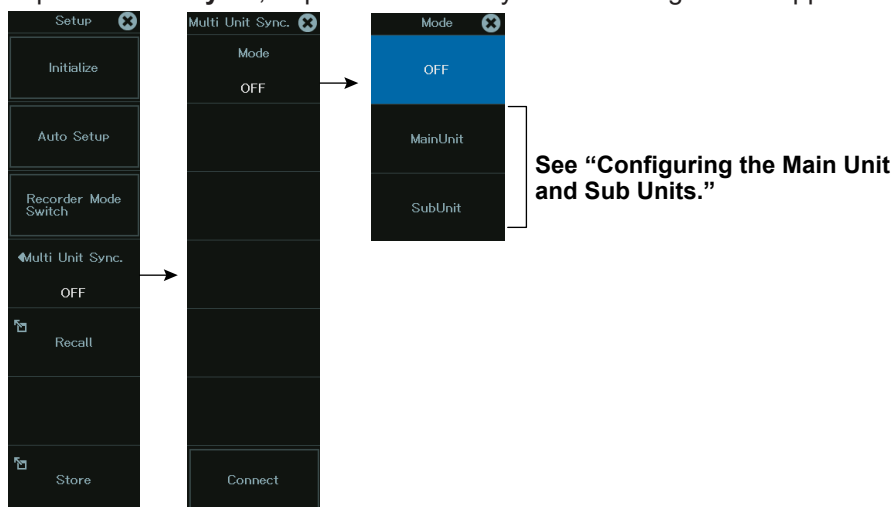
This section explains the following settings for connecting multiple DL950s.

Items Common to Scope Mode and Recorder Mode

- Configuring the main unit and sub units
- Connection and disconnection
 - ▶ “Synchronizing Multiple Instruments (/C50 option)” in the Features Guide

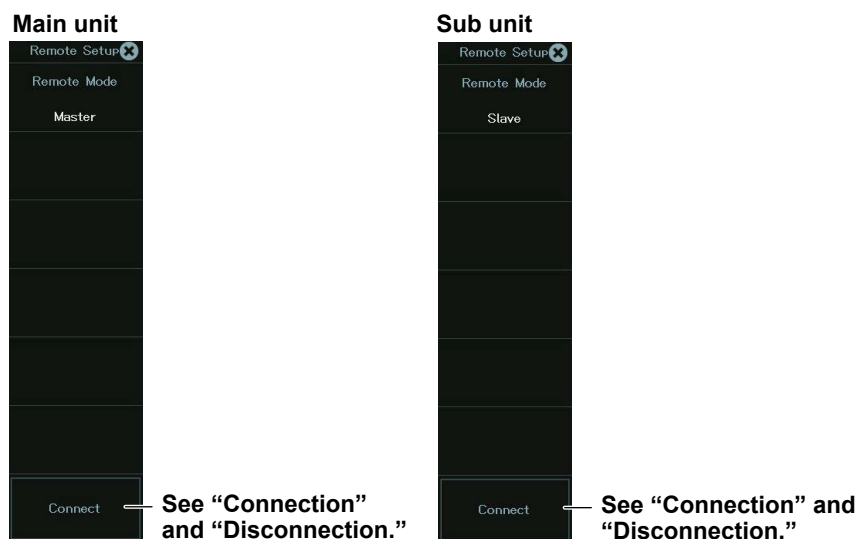
SETUP Multi Unit Sync. Menu

1. On the waveform screen's MENU, tap **SETUP** > **SETUP**, or press **SETUP**.
2. Tap **Multi Unit Sync.**, or press the soft key. The following screen appears.



Configuring the Main Unit and Sub Units

3. Tap **MainUnit** or **SubUnit**, or press the soft key. The following screen appears.



Connection

4. On the main unit menu and all sub unit menus, tap **Connect**, or press the soft key. The main unit and sub units will be connected. When the connection operation on some units is not complete, the Connect menu on units that connection operation has been completed changes to Cancel. When the connection operation on all units is complete, Cancel changes to Disconnect.

Note

The connection operation must be performed on the main unit and all the sub units connected to the main unit. The link feature will not work if the connection operation is not performed on any of the units.

Disconnection

5. While connected, tap **Disconnect**, or press the soft key on the main unit menu or a sub unit menu. The connection will be disconnected.

When the link is disconnected on a sub unit, the link feature between the main unit and all connected sub units will be disabled.
6. To reconnect, on the main unit menu and the sub unit menus, tap **Connect**, or press the soft key.

23.3 Starting and Stopping Waveform Acquisition

Items Common to Scope Mode and Recorder Mode

- Starting and stopping waveform acquisition
 - ▶ [“Synchronizing Multiple Instruments \(/C50 option\)” in the Features Guide](#)

Waveform Acquisition (START and STOP)

Perform the operation on the main unit.

1. On the main unit waveform screen's **MENU**, tap **START/STOP**, or press **START/STOP**.
Waveform acquisition starts or stops on the main unit and sub units.

Waveform acquisition is in progress when the START/STOP key is illuminated.

Setting Items That Give Priority to the Settings of the Main Unit

When multiple DL950s are connected, the following settings on the main unit take priority. The settings on the sub units are overwritten with the settings on the main unit.

- Record length
- Time base, T/Div
- Acquisition mode
- Trigger mode
- Number of measurements
- SSD recording (ST1, /ST2 option) and flash acquisition (/ST2 option) settings
- Dual capture settings
- Trigger position, trigger delay
- Hold-off time
- Action trigger settings
- Accumulation display
- Current history number
- Search feature
- Go-Nogo settings
- Save operation

The following features will not work when the units are linked.

- Averaging function
- Single-N trigger, line trigger, wave window trigger, sub units' external trigger
- Enhanced trigger other than OR
- History search
- History averaging
- All history record display
- Waveform acquisition start using power-on action
- Remotely stopping waveform acquisition

Saving Data

Waveform Data

When you execute a save operation on the main unit, the sub units will also save their waveform data in their storage areas.

“Main” is added to the normal file name on the main unit. “Sub(N)” is added on the sub units.

Setup Data

You can select whether to save the setup data of each unit separately in each unit or in a single file in the main unit. For the setup procedure, see section 19.5.

If the DL950s are connected with the same configuration as when the setup data was saved, you can perform measurements with the same conditions by loading the setup data.

If the link configuration is different from that in the setup data, the setup data cannot be loaded.

Setup data saved to each unit is loaded one each unit separately. Setup data saved in a single file in the main unit is loaded on the main unit.

Screen Capture Data

Screen captures of the main unit can be saved.

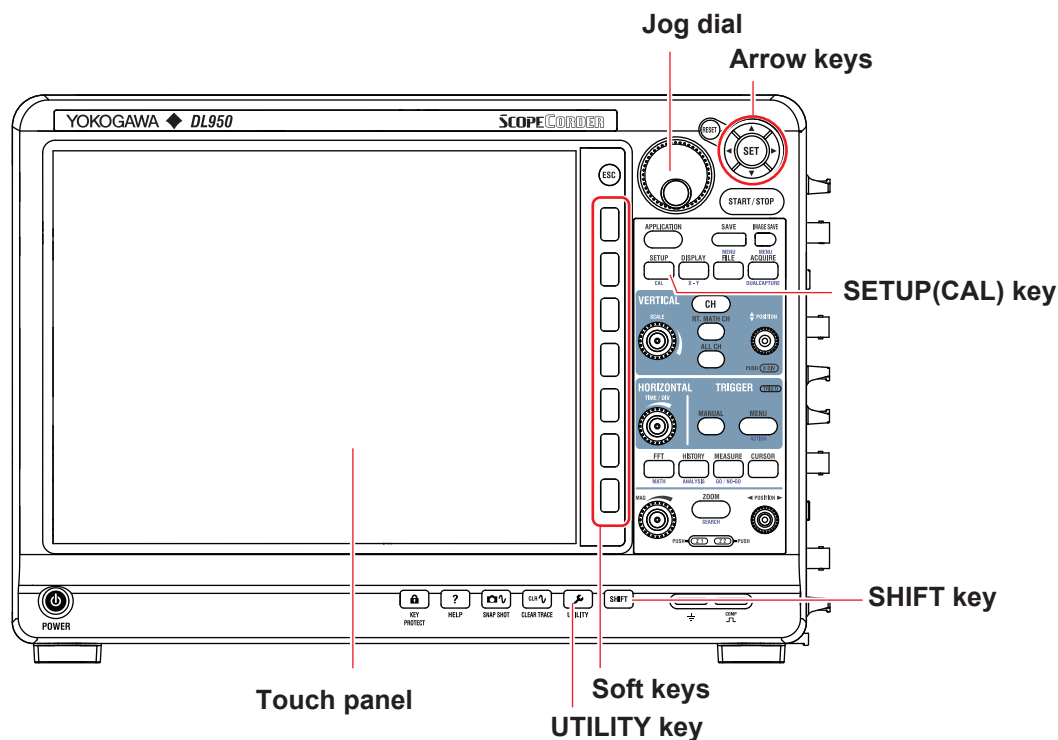
Screen captures of the sub units cannot be saved.

Chapter 24

Other Operations

Main Control Areas Used in This Chapter

You can also use the touch panel.



Operation Modes Applicable to the Sections in This Chapter

✓: Applicable, -: Not applicable

Section	Scope Mode	Recorder Mode
24.1 Storing and Recalling Setup Data	✓	✓
24.2 Calibrating the Instrument	✓	✓
24.3 Changing the Message, Menu, and USB Keyboard Languages	✓	✓
24.4 Configuring the LCD	✓	✓
24.5 Using the Instrument as a USB Storage Device	✓	✓
24.6 Configuring the Environment Settings	✓	✓
24.7 Locking the Keys	✓	✓

* The settings may vary depending on the operation mode.

24.1 Storing and Recalling Setup Data

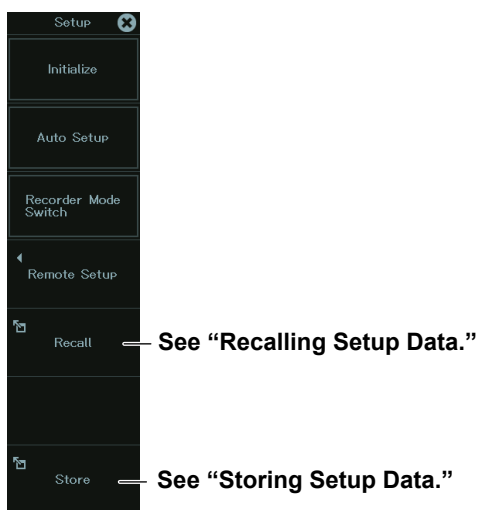
This section explains how to save the instrument settings to the internal memory and how to load settings from the internal memory.

Items Common to Scope Mode and Recorder Mode

- Storing and recalling setup data
 - ▶ [“Setup Data Store/Recall \(Store/Recall\)” in the Features Guide](#)

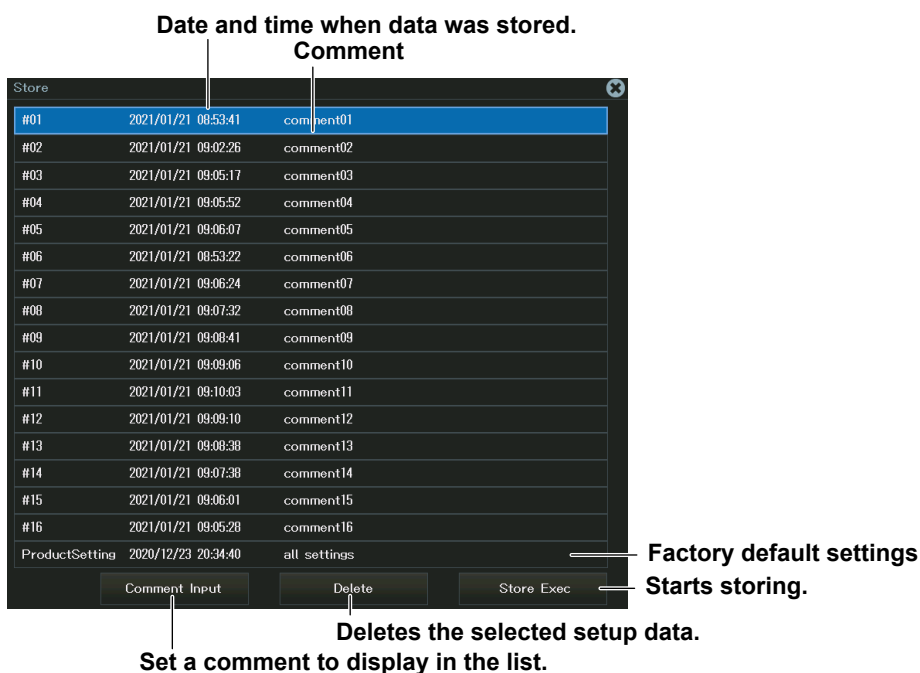
SETUP Store/Recall Menu

1. On the waveform screen’s MENU, tap **SETUP** > **SETUP**, or press **SETUP**. The following screen appears.



Storing Setup Data

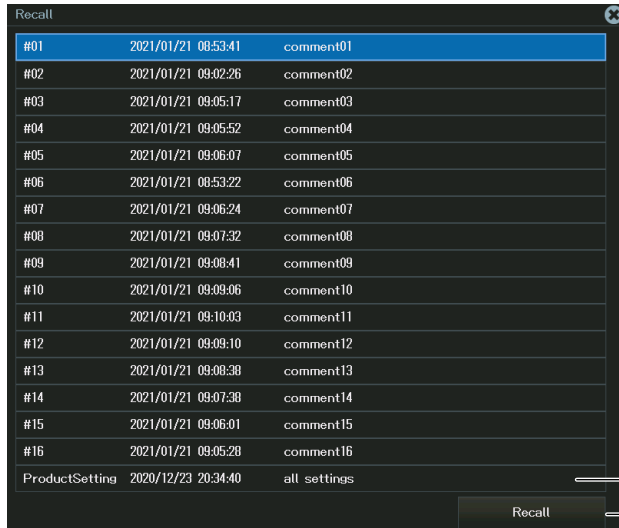
2. Tap **Store**, or press the soft key. The following screen appears.



3. Tap **Store Exec**, or select **Store Exec** using the jog dial or arrow keys, and press **SET**. The setup data is saved at the selected number. If setup data is registered at the selected number, it will be overwritten.

Recalling Setup Data

2. Tap **Recall**, or press the soft key. The following screen appears.



ID	Timestamp	Comment
#01	2021/01/21 09:53:41	comment01
#02	2021/01/21 09:02:26	comment02
#03	2021/01/21 09:05:17	comment03
#04	2021/01/21 09:05:52	comment04
#05	2021/01/21 09:06:07	comment05
#06	2021/01/21 08:53:22	comment06
#07	2021/01/21 09:06:24	comment07
#08	2021/01/21 09:07:32	comment08
#09	2021/01/21 09:08:41	comment09
#10	2021/01/21 09:09:06	comment10
#11	2021/01/21 09:10:03	comment11
#12	2021/01/21 09:09:10	comment12
#13	2021/01/21 09:08:38	comment13
#14	2021/01/21 09:07:38	comment14
#15	2021/01/21 09:06:01	comment15
#16	2021/01/21 09:05:28	comment16
ProductSetting	2020/12/23 20:34:40	all settings

Factory default settings

Recalls the setup data

24.2 Calibrating the Instrument

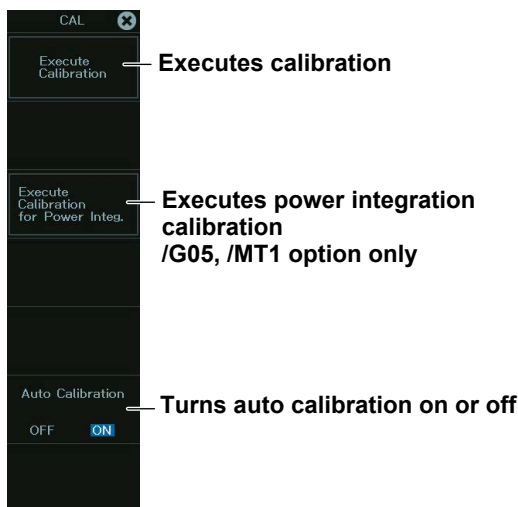
This section explains how to calibrate the instrument. Execute calibration when you want to make accurate measurements.

Items Common to Scope Mode and Recorder Mode

- Executes calibration
 - ▶ “Calibration (CAL)” and “Power Integration Calibration (/G05, /MT1 option)” in the Features Guide

CAL Menu

1. On the waveform screen’s MENU, tap **SETUP > CAL**, or press **SHIFT+SETUP (CAL)**. The following screen appears.



Resetting All Settings to Their Factory Default Values

See section 4.6 in the *DL950 Getting Started Guide* (IM DL950-03EN).

24.3 Changing the Message, Menu, and USB Keyboard Languages

This section explains the following settings:

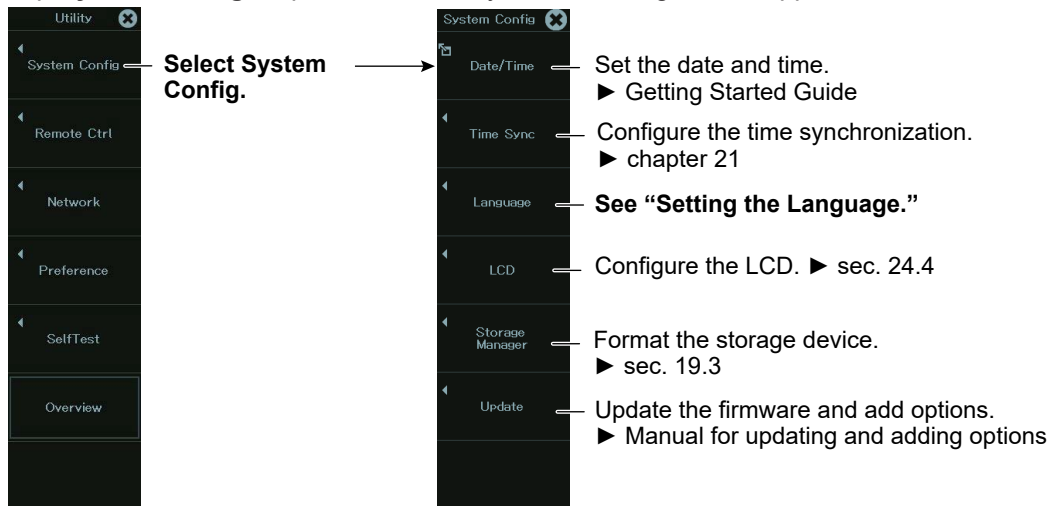
Items Common to Scope Mode and Recorder Mode

- Message language
- Menu language
- USB keyboard language
- Setting the USB Keyboard Input Method

▶ “System Configuration (System Config)” in the Features Guide

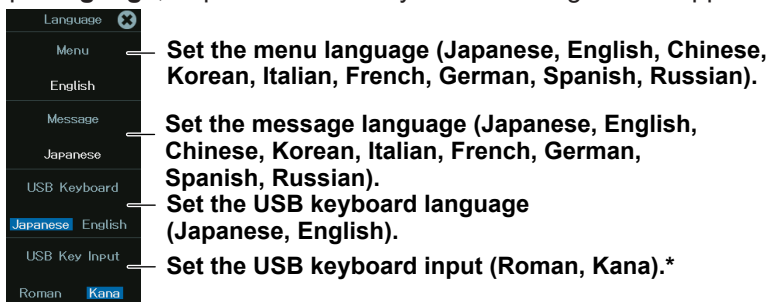
UTILITY System Config Menu

1. On the waveform screen’s MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **System Config**, or press the soft key. The following screen appears.



Setting the Language (Language)

3. Tap **Language**, or press the soft key. The following screen appears.



* You can set this when Menu or Message is set to Japanese.

Note

Some terminology is always displayed in English.

Setting the USB Keyboard Language (USB Keyboard)

You can use the following keyboards that conform to USB Human Interface Devices (HID) Class Ver. 1.1.

English: 104-key keyboards

Japanese: 109-key keyboards

For details on how the keys of this instrument are mapped to the keys on a USB keyboard, see appendix 10 in the *Getting Started Guide* (IM DL950-03EN).

24.4 Configuring the LCD

This section explains the following settings for adjusting the LCD:

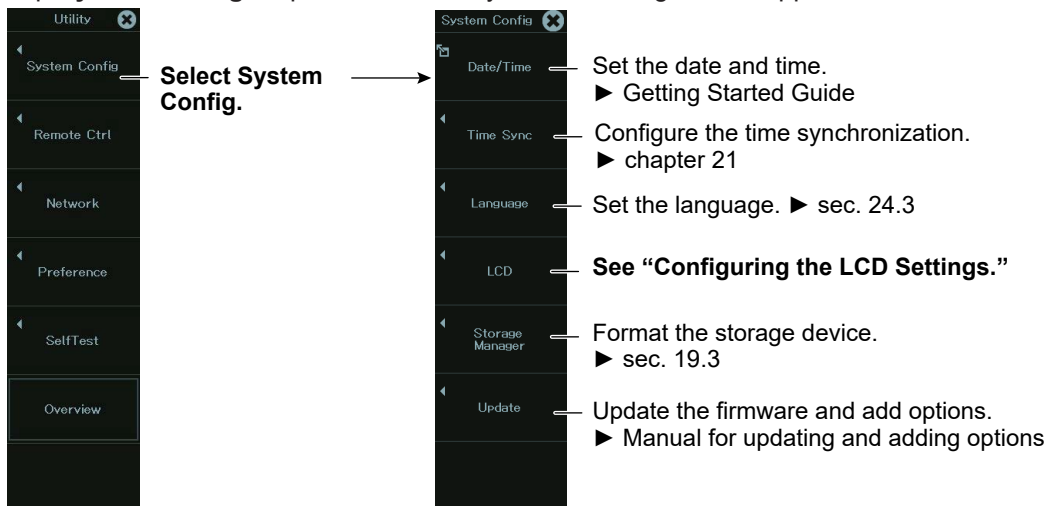
Items Common to Scope Mode and Recorder Mode

- Turning the display on and off
- Setting auto-off
- Setting the LCD brightness

► “System Configuration (System Config)” in the Features Guide

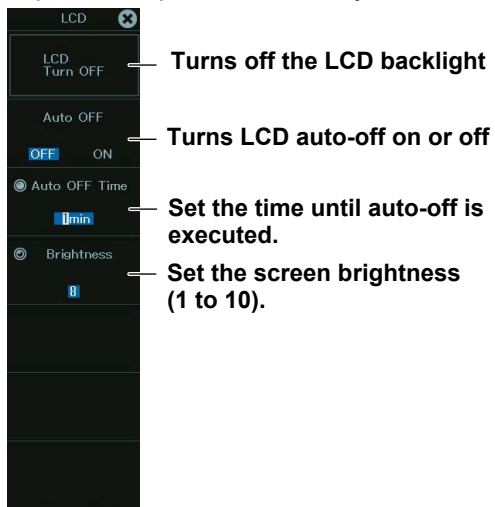
UTILITY System Config Menu

1. On the waveform screen's MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **System Config**, or press the soft key. The following screen appears.



Configuring the LCD (LCD)

3. Tap **LCD**, or press the soft key. The following screen appears.



24.5 Using the Instrument as a USB Storage Device

This section explains the setting that enables you to use the instrument as a USB storage device through a USB connection made between the USB port on the instrument's side panel and a PC.

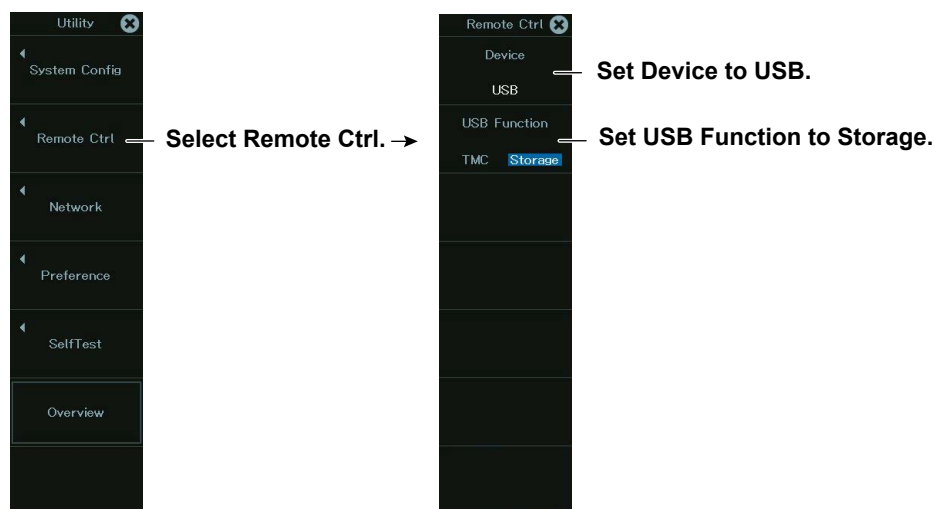
Items Common to Scope Mode and Recorder Mode

- Setting the USB function

► “Remote Control (Remote Ctrl)” in the Features Guide

UTILITY Remote Ctrl Menu

1. On the waveform screen's MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Remote Ctrl**, or press the soft key. The following screen appears.



Note

- When USB Function is set to Storage, only this instrument's internal SSD can be used as a storage device. You cannot access any other storage device that are connected to the instrument.
- When you access this instrument's internal SSD from a PC, only perform read and write operations. Otherwise, the instrument may be damaged.
- When USB Function is set to Storage and files are being accessed, do not remove the USB cable or turn off the instrument. Otherwise, the instrument may be damaged.
- When USB Function is set to Storage, do not access this instrument's internal SSD from the instrument's menu.
- When you set USB Function to TMC, you can control this instrument from a PC via USB. For details, see the *Communication Interface User's Manual*, IM DL950-17EN.

24.6 Configuring the Environment Settings

This section explains the following instrument settings:

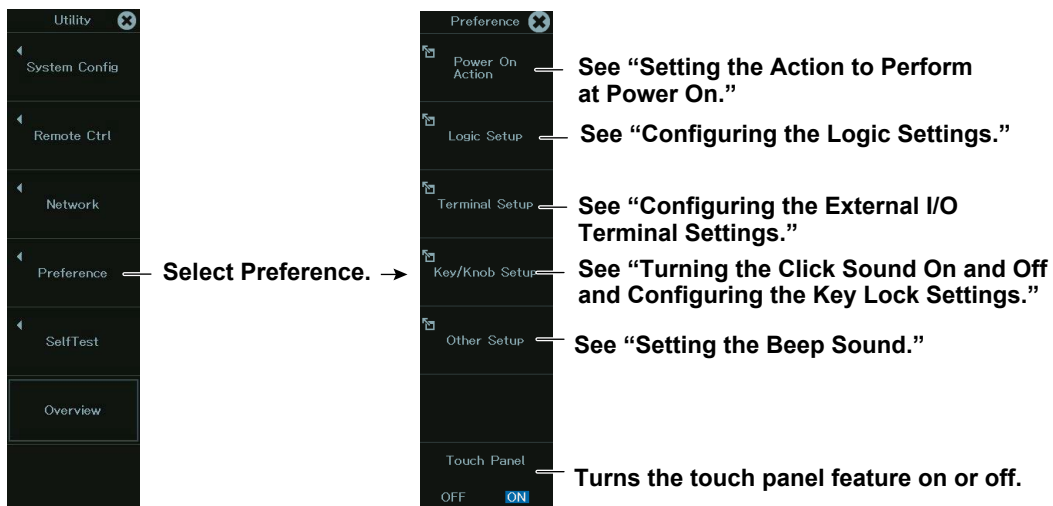
Items Common to Scope Mode and Recorder Mode

- Power-on action
- Logic
- External I/O terminal
- Click sound on/off and key lock type and release method
- Beep on errors, backup when the power is turned off
- Turning the touch panel feature on and off

► [“Environment Settings \(Preference\)” in the Features Guide](#)

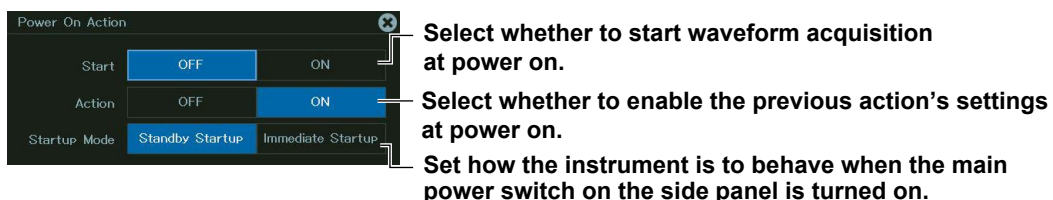
UTILITY Preference Menu (Preference)

1. On the waveform screen’s MENU, tap **OTHERS** > **UTILITY**, or press **UTILITY**.
2. Tap **Preference**, or press the soft key. The following screen appears.



Setting the Action to Perform at Power On (Power On Action)

3. Tap **Power On Action**, or press the soft key. The following screen appears.



Startup Mode

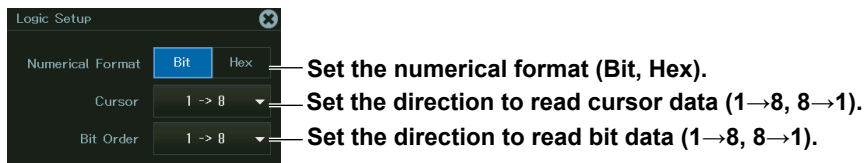
Set how the instrument is to behave when the main power switch on this instrument’s side panel is turned on.

Standby Startup: Stand by until the power switch on the front panel is turned on.

Immediate Startup: Start the instrument.

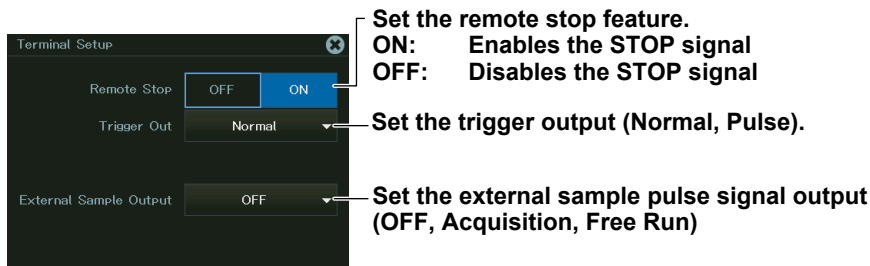
Configuring the Logic Settings (Logic Setup)

3. Tap **Logic Setup**, or press the soft key. The following screen appears.



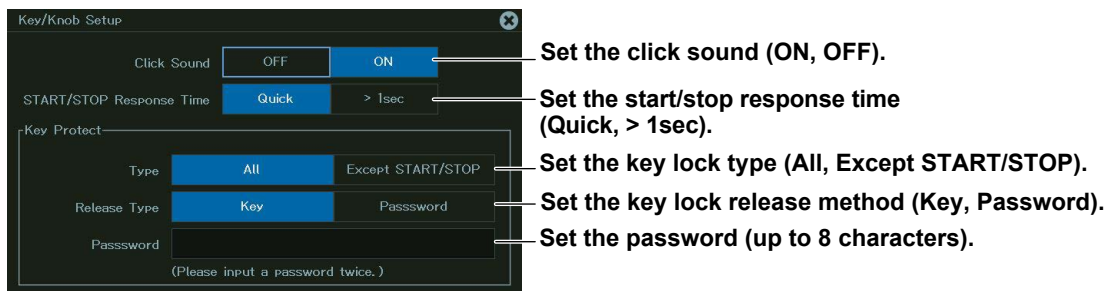
Configuring the External I/O Terminal Settings (Terminal Setup)

3. Tap **Terminal Setup**, or press the soft key. The following screen appears.



Turning the Click Sound On and Off and Configuring the Key Lock Settings (Key/Knob Setup)

3. Tap **Key/Knob Setup**, or press the soft key. The following screen appears.



Start/Stop Response Time

Quick: Waveform acquisition starts or stops as soon as the START/STOP key is pressed.

1 s: Waveform acquisition starts or stops 1 second after the START/STOP key is pressed.

Key Lock Type

All: Key lock is applied to all keys except KEY PROTECT.

Except START/STOP: Key lock is applied to all keys except KEY PROTECT and START/STOP.

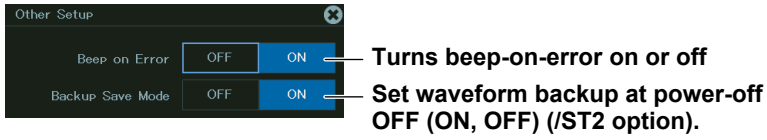
Releasing the Key Lock

Key: The key lock is released by pressing the KEY PROTECT key.

Password: The key lock is released with a password.

Other Setup (Other Setup)

3. Tap **Other Setup**, or press the soft key. The following screen appears.



24.7 Locking the Keys

This section explains how to lock the panel keys, which prevents you from unintentionally changing the current state of the instrument.

Items Common to Scope Mode and Recorder Mode

- Key lock

▶ [“Key Lock \(KEY PROTECT key\)” in the Features Guide](#)

Key Lock (KEY PROTECT)

Press **KEY PROTECT** to lock the panel keys. The KEY PROTECT key illuminates. When you lock the keys, all keys except KEY PROTECT or all keys except KEY PROTECT and START/STOP, depending on the setting in section 24.6, are disabled.

To release the key lock, press **KEY PROTECT** again to turn off the key or enter the password set in section 24.6.

Note

When the keys are locked, you cannot use a USB mouse or keyboard to operate the instrument either.

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