HIOKI

Measurement Guide

MR8875

MEMORY HiCORDER

HIOKI E. E. CORPORATION

March 2014 Revised edition 2 MR8875A983-02 14-03H

600361382

Introduction

Thank you for purchasing the HIOKI Model MR8875 Memory HiCorder. This Measurement Guide includes basic examples of how the instrument is used. Please read it carefully before using the instrument.

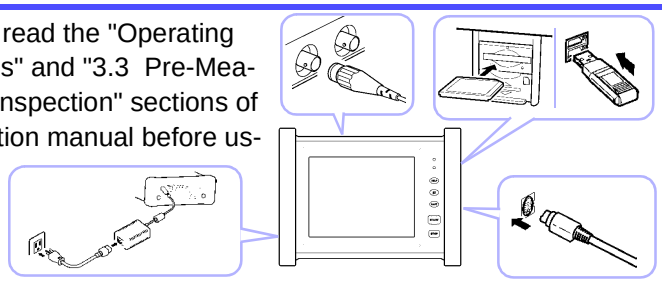
Screen Organization and Operational Overview (p.2)

The Waveform screen allows you to view measurement data, while the Settings screen allows you to configure various instrument settings.

Basic settings can also be configured on the Waveform screen's settings windows. (This manual covers the settings that can be configured on the Waveform screen in its description of how to operate the Waveform screen.)

Measurement Preparations (p.5)

Be sure to read the "Operating Precautions" and "3.3 Pre-Measurement Inspection" sections of the instruction manual before using the instrument.



Configuring Settings before Measurement (p.7)

Configure measurement conditions.

▼

Configure input channels.

▼

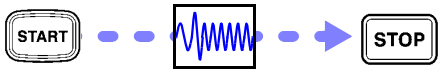
Configure triggers (identification conditions).

▼

Configure data saving, calculations, and other settings as necessary.

If you wish to save data or perform calculations automatically after starting measurement, these settings must be configured before measurement. Data can be saved in a variety of formats, and calculations can be performed after measurement.

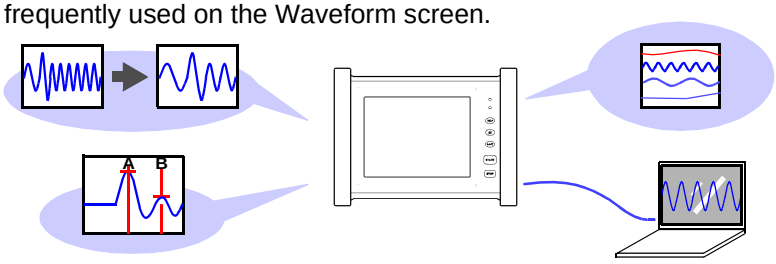
Performing Measurement (p.11)



Alternately, recording stops when the set conditions are satisfied.

Analyzing Measurement Results (p.12)

This section describes operations and analytical methods that are frequently used on the Waveform screen.

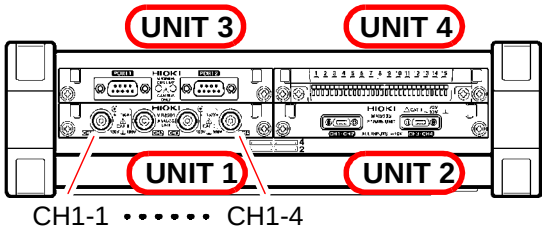


Convenient functions (p.18), measurement examples (p.19), and reference information (p.21)

Screen Organization and Operational Overview

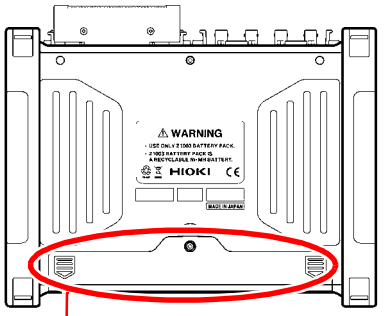
Part names

Input modules
(up to 4 can be installed)



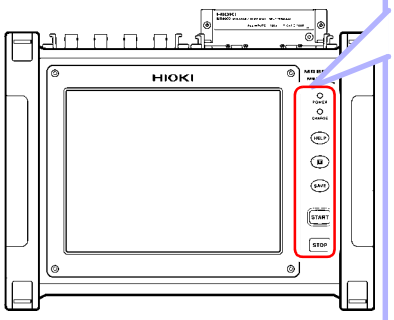
Top

Analog input terminals (BNC terminals)
Connect optional connection cords, clamps, and other input sources here.



Back

Battery compartment cover
Install the Z1003 Battery Pack here.



Front

POWER (LED)
Turns green when the power is on.

CHARGE (LED)
Turns orange when the instrument is charging.

HELP key
Displays an explanation of the screen display.

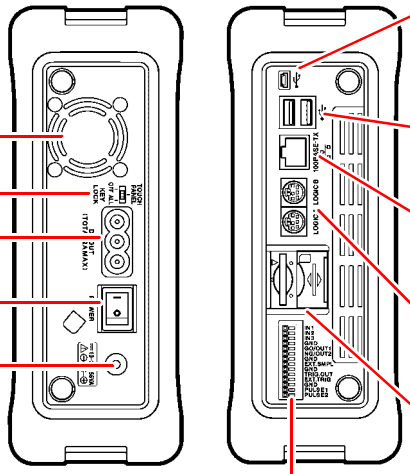
(forced trigger) key
Applies a user-specified trigger.

SAVE key
Saves data manually.

START key
Starts measurement. The key turns green while measurement is in progress.

STOP key
Stops measurement.

Left side **Right side**



Ventilation holes
(Do not block.)

KEYLOCK switch

External power supply terminals

POWER switch

AC adapter socket

USB cable slot
Connect the included USB cable when connecting the instrument to a PC.

USB flash drive slot
Connect a USB flash drive here.

100BASE-TX connector
Connect a LAN cable here.

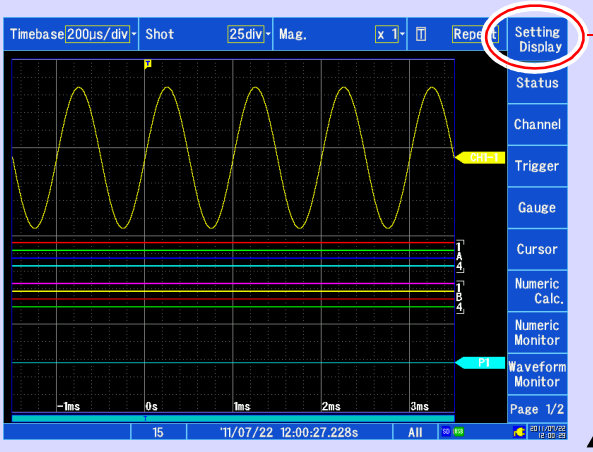
LOGIC terminals
Connect optional logic probes.

SD memory card slot
Insert an SD memory card.

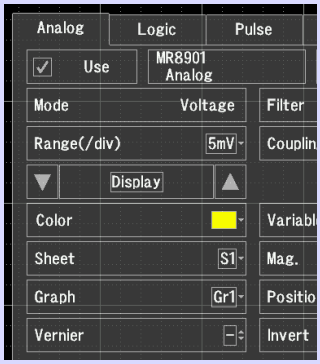
External control terminals

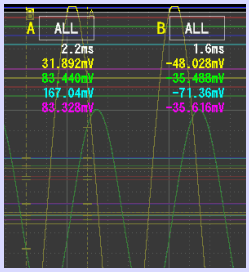
Screen organization

Waveform screen



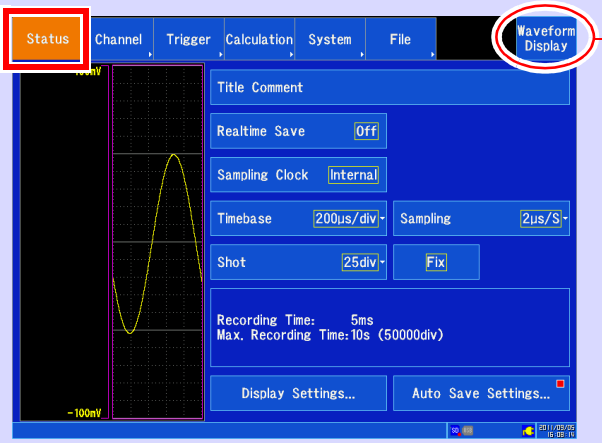
You can change various settings on the Waveform screen's settings windows.





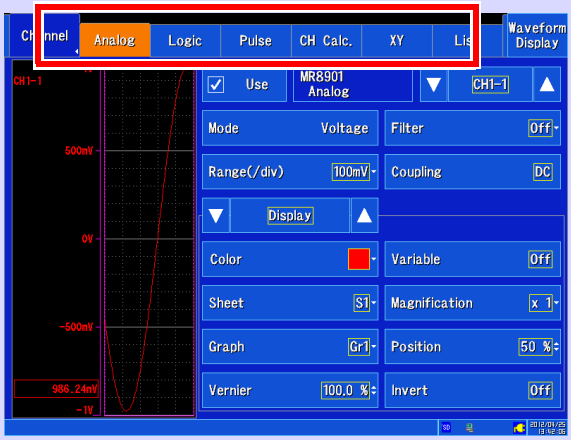
Switches between the Waveform screen and the Settings screen.

[Status] screen



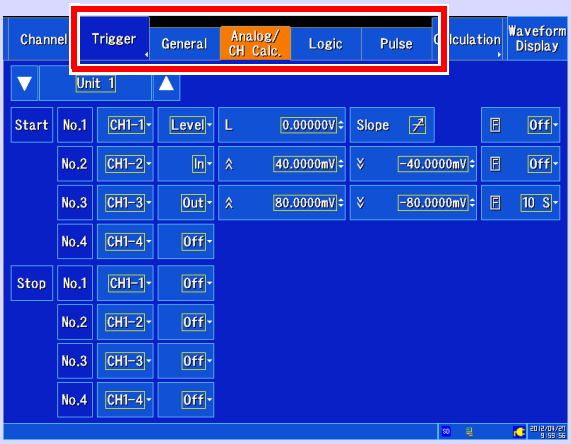
Configures the measurement method. You can also configure the waveform display, auto save, and other settings.

[Channel] screen



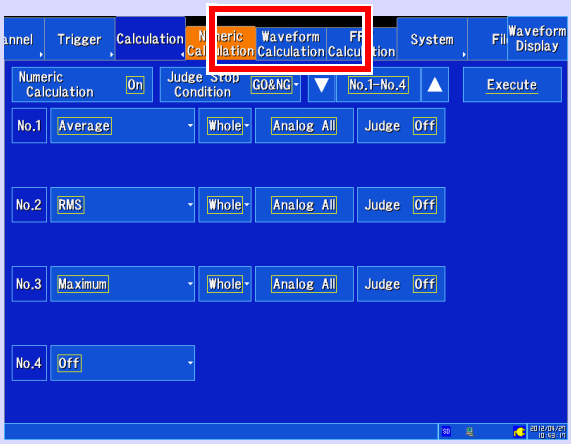
Configures input channels. You can also configure the channel display and other functions.

[Trigger] screen



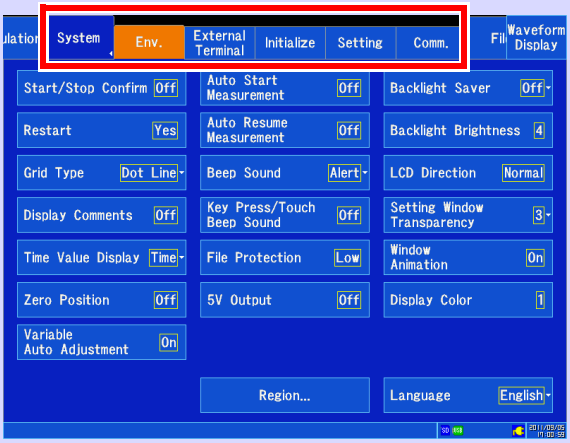
Configure when you want to start and stop recording based on a specific signal.

[Calculation] screen



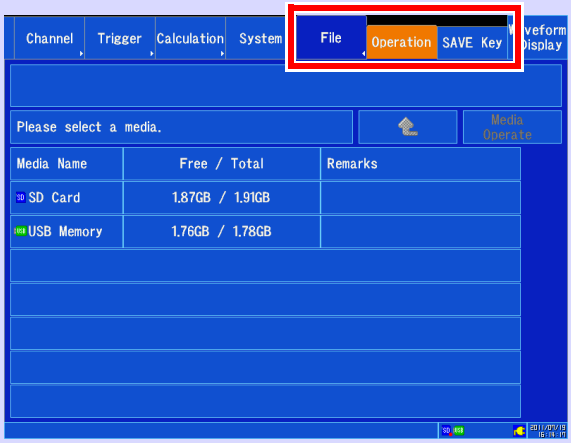
Configures settings related to waveform value calculations.

[System] screen



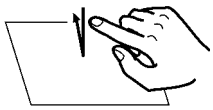
Configures the system environment, external I/O, and communications.

[File] screen



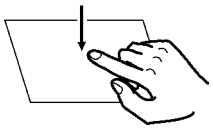
Displays files on media and configures settings such as the method used to save data.

Screen operation



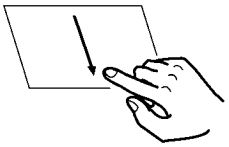
Tap

Touch the screen with your finger and then remove your finger.



Touch

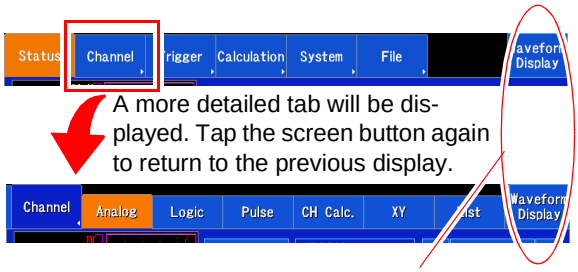
Touch the screen with your finger for a longer amount of time.



Drag

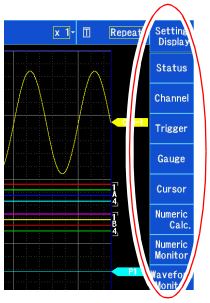
Move your finger while touching the screen.

Switching screens



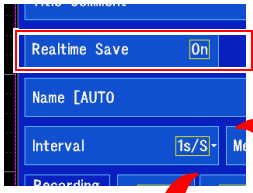
A more detailed tab will be displayed. Tap the screen button again to return to the previous display.

You can switch between the Waveform screen and the Settings screen.



You can display various settings windows on the Waveform screen and use instrument functions. You can also switch pages.

Changing settings



The setting will change each time you tap the screen.

You can change the value from the value input panel.

Example:

▼ ▲ Increases or decreases the value by 1.

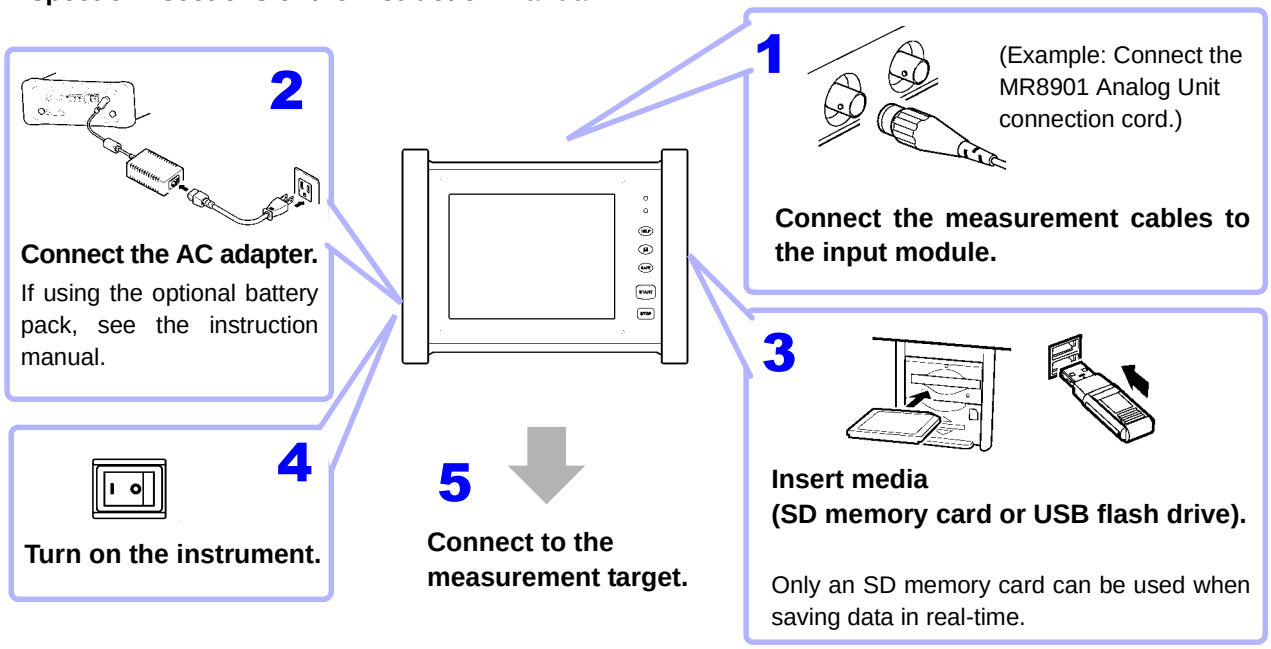
⏬ ⏫ Increases or decreases the value.

Select from a list

1. Measurement Preparations

Connecting the instrument

Before using the instrument, be sure to read the "Operating Precautions" and "Pre-Measurement Inspection" sections of the instruction manual.



2

Connect the AC adapter.

If using the optional battery pack, see the instruction manual.

1

(Example: Connect the MR8901 Analog Unit connection cord.)

Connect the measurement cables to the input module.

3

Insert media (SD memory card or USB flash drive).

Only an SD memory card can be used when saving data in real-time.

4

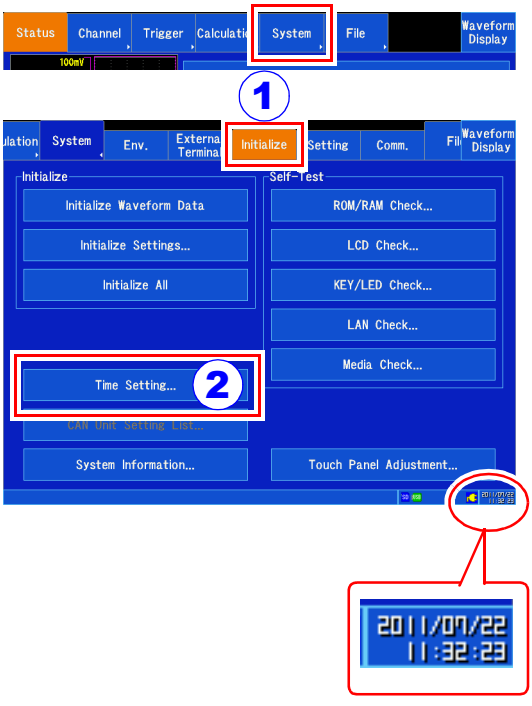
Turn on the instrument.

5

Connect to the measurement target.

Setting the clock

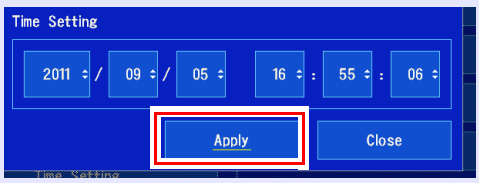
The time is displayed on the bottom right of the screen. Change the time if it is not correct.



1 **Open the screen.**
[Setting Display] ▶ [System] ▶ [Initialize]

2 **Tap [Time Setting].**
The Settings window will open.

Tap the field you wish to change and set the desired value.



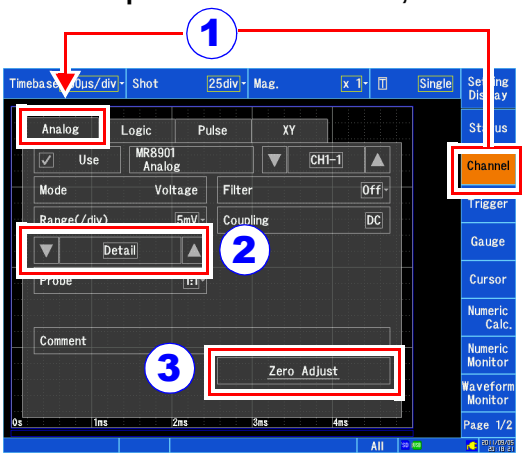
Tap [Apply] to accept the settings.

To return to the previous screen without changing the time, tap **[Close]**.

Performing zero adjustment

This procedure compensates for input module differences and sets the instrument's reference potential to 0 V. (MR8901, MR8902 and MR8905 only) Zero adjustment can be performed for all input modules at once.

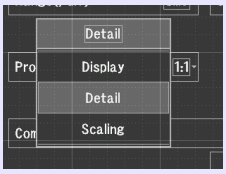
For more precise measurement, allow a warm-up period of about 30 minutes to elapse after turn-



When using the MR8903 Strain Unit
Zero adjustment cannot be performed for the MR8903. Instead, perform **[Auto Balance]**. For more information, see the instruction manual.

1 **Open the screen.**
[Waveform Display] / **[Setting Display]** ▶ **[Channel]** ▶ **[Analog]**

2 **Set the display to [Detail].**



3 **[Zero Adjust]** ▶ **[Yes]**
Perform zero adjustment.

2. Configuring Settings before Measurement

Before starting measurement, it is necessary to configure measurement conditions, input channels, triggers, and other settings. To save data automatically after starting measurement, it is necessary to configure data save settings before measurement.

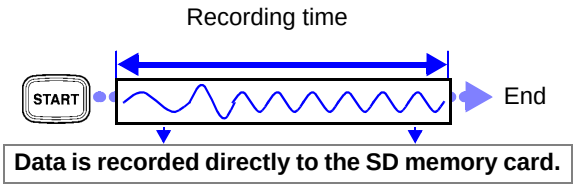
Measurement and save methods

There are two methods for saving data, as explained below: you can save data automatically after starting measurement, or you can save data manually (with the SAVE key) after measurement is complete. This manual describes how to save waveforms automatically while performing measurement using the MR8901 Analog Unit. For other more detailed information, see the instruction manual.

Performing measurement while saving data automatically

Real-time save

- The recording interval, recording time, and other recording conditions are set before starting measurement. (Unlike when using auto save, you will not be able to select high-speed sampling.)
- Data is recorded directly to the SD memory card while measurement is performed.
- Since data is recorded directly to the SD memory card, it is possible to record data in excess of the internal memory capacity.

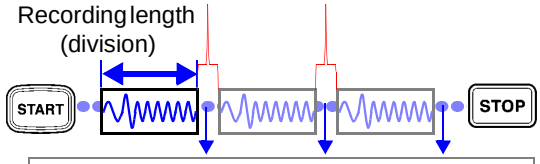


Data is recorded directly to the SD memory card.

Auto save

- The sampling speed (or time axis), recording length, and other recording conditions are set before starting measurement. Measurement can be performed using high-speed sampling.
- Data equivalent to the set recording length is acquired in the instrument's internal memory and then saved to the storage destination. Data can be saved to an SD memory card or USB flash drive or sent by e-mail or FTP.
- Since data is saved to the instrument's internal memory, it is not possible to record data in excess of the internal memory capacity.

Dead time: Data is not recorded if the trigger is applied during this interval.



Data is saved after being acquired to the internal memory.

Saving data by pressing the SAVE key at any time after measurement

Quick save

The data to be saved is set in advance. Then you can save that data immediately at any time by pressing the **SAVE** key.

Set data to be saved. ▶ SAVE ▶ Save data.

Selection save

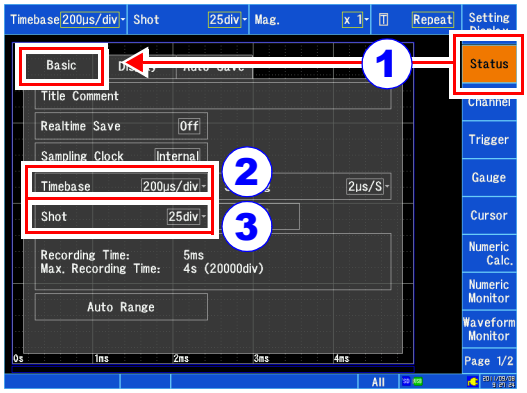
The data to be saved is set after you press the **SAVE** key. Then the data is saved.

SAVE ▶ Set the data to be saved and save the data.

Setting measurement conditions

Settings can be configured on setting windows on the Waveform screen or on the Settings screen.

Waveform screen ([Status] window)



1 Open the screen.
[Waveform Display] ▶ [Status] ▶ [Basic]
or [Setting Display] ▶ [Status]

2 Select the desired setting from the [Timebase] list.

Set the time per division on the horizontal axis. Sampling is fixed to 100 samples per division. If you do not wish to change the setting, tap the current setting to re-select it.

To keep the current setting, tap the setting again.

Timebase	
200µs/div	50ms/div
500µs/div	100ms/div
1ms/div	200ms/div
2ms/div	500ms/div
5ms/div	1s/div

3 Select the desired setting from the [Shot] list.

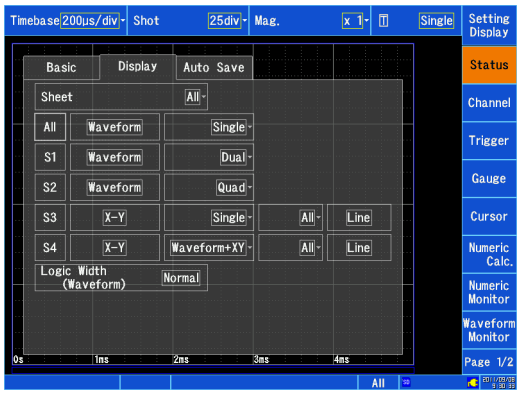
Set the length (number of divisions) to record each time data is acquired. If you do not wish to change the setting, tap the current setting to re-select it.

Shot	
25div	1000div
50div	2000div
100div	5000div
200div	10000div
500div	20000div

"Configuring input channels" (p.9)

■ Arranging measurement results

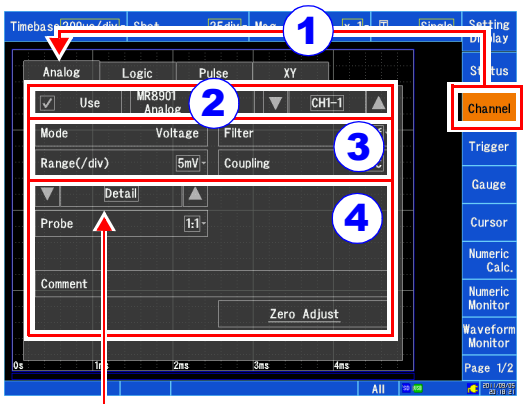
The method used to display measurement data on the Waveform screen can be changed to allow a maximum of four sheets, with up to four segments per screen.
Related settings are configured on the **[Display]** window.



Configuring input channels

This explanation applies when using the MR8901 Analog Unit.

Waveform screen (**[Channel]** window)



Setting to **[Display]** allows the Waveform screen display to be changed. The screen can also be changed after measurement.

Configure these settings as necessary:

[Filter]

You can set the frequency band to cut (filter band) if you wish to cut excessive high-frequency components, for example when input signal noise is a concern.

[Coupling]

The instrument is normally used in DC coupling mode. The zero position can be checked by setting the instrument to GND mode.

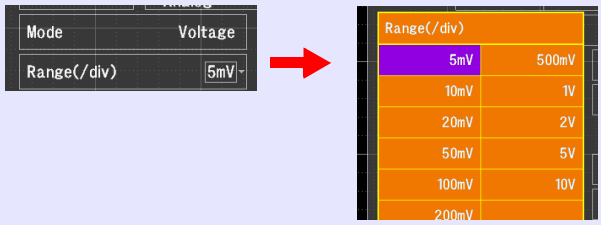
1 Open the screen.

[Waveform Display] / [Setting Display] ▶ [Channel]

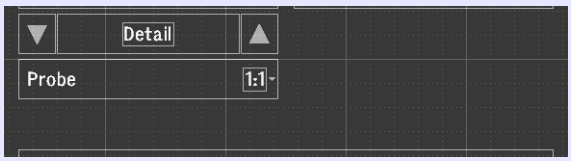
2 [Analog] ▶ Select the channel to configure.

3 Set the [Range(/div)].

(Configure other settings as necessary.)



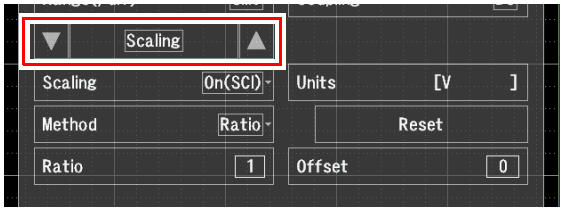
4 Display [Detail] and configure input module-specific settings as necessary.



"Configuring triggers (to assign specific conditions for recording)" (p.10)

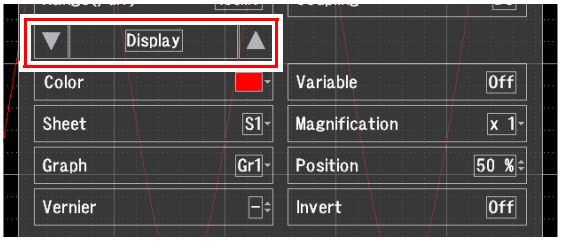
■ To calculate and display input values

Set the display to **[Scaling]** and set the calculation method. This functionality allows you to check converted measured values. It can also be changed after measurement.



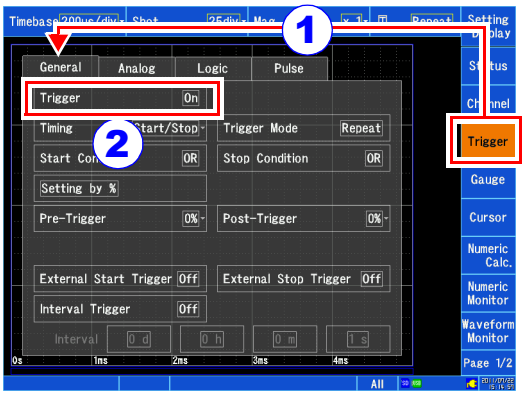
■ To change the waveform color or screen display

Set the display to **[Display]** to change the waveform color, display position, graph settings, display magnification, or other settings. These settings can also be changed after measurement.



Configuring triggers (to assign specific conditions for recording)

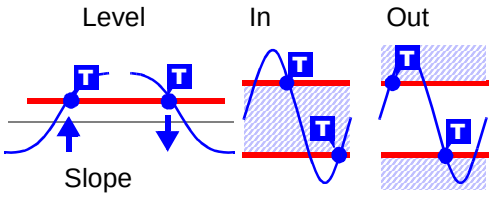
Waveform screen ([Trigger] window)



[Trigger Mode]

- Single
  Data is recorded once when the trigger conditions are satisfied.
- Repeat
  Data is recorded repeatedly when the trigger conditions are satisfied.

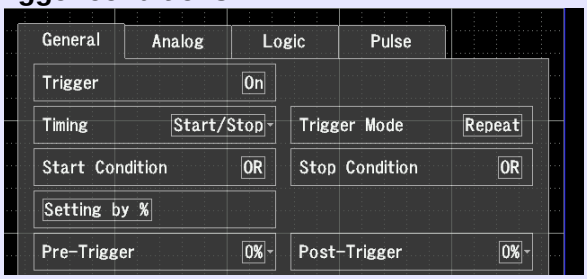
Trigger types



1 Open the screen

[Waveform Display] / [Setting Display] ▶ [Trigger]

2 [General] ▶ Set [Trigger] to [On] and set the trigger conditions.

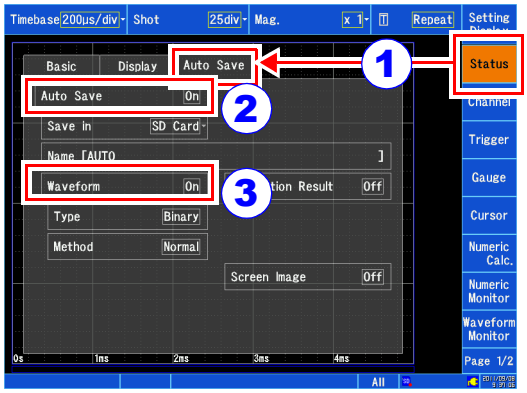


3 Select [Analog] and set the trigger conditions for each channel.

Channel — Trigger type — Level value at which to apply trigger

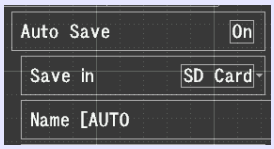
Configuring auto save

Waveform screen ([Status] window)

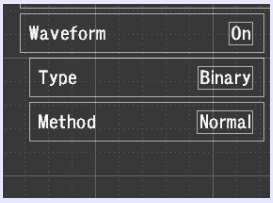


1 **Open the screen**
[Waveform Display] ▶ [Status] ▶ [Auto Save] Or [Setting Display] ▶ [Status] ▶ [Auto Save Settings]

2 **Set [Auto Save] to [On] and set the media and filename.**



3 **Set [Waveform] to [On].**
Tapping the setting toggles it on and off.



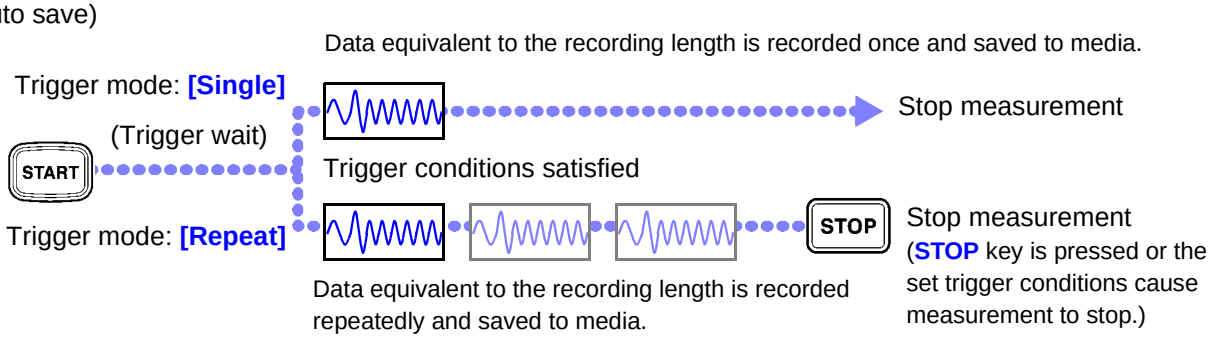
Configure settings as necessary. For more information, see the instruction manual.

[Type]
- Binary
  Saves waveform data in a binary format.
- Text
  Saves waveform data in a text format.

[Method]
- Normal
  Stops auto save operation when the media becomes full. Save operation will stop, but measurement will continue.
- Delete
  Old files are deleted so that data can continue to be saved when the media becomes full.

3. Starting and Stopping Measurement

(Auto save)

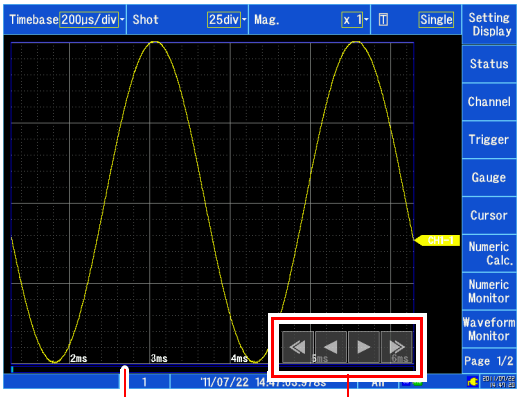


4. Analyzing Measurement Results

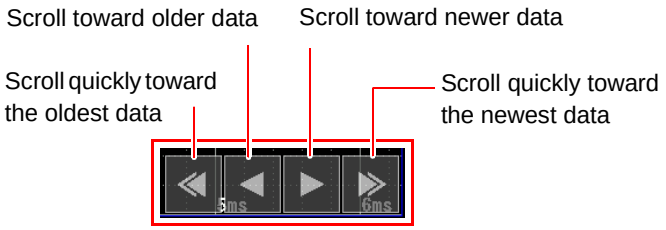
This section provides a basic example of how measurement results are analyzed. For more information, see the instrument's instruction manual.

Scrolling waveforms

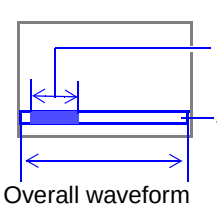
Waveforms can be scrolled by either using the Arrow window or tapping the scroll bar.



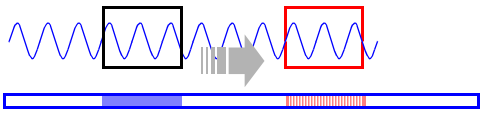
Scrolling with the Arrow window



The waveform is scrolled each time you tap the window. Tapping harder* causes the waveform to scroll faster. Tapping continuously causes the waveform to scroll continuously.
*Hard taps made with a touch pen cannot be detected.

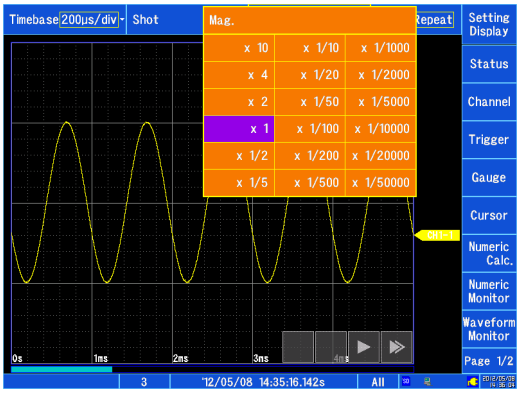


Displaying the desired location with the scroll bar

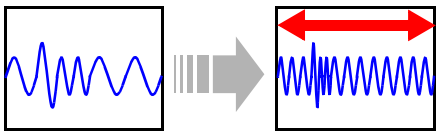


Tap the desired location on the scroll bar.

Magnifying and compressing waveforms

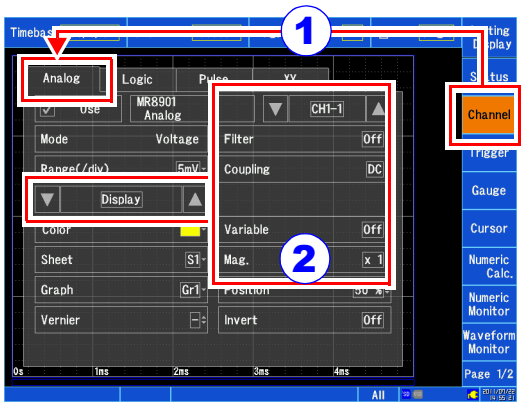


Magnifying and compressing the horizontal axis (time axis)

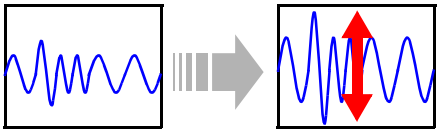


Selecting from the Waveform screen's [Mag.] list
Waveforms for all channels are magnified and compressed along the horizontal axis using the left edge of the screen as the reference. When cursors are being shown on the screen, waveforms are magnified and compressed using the cursor as the reference.

Waveform screen ([Channel] window)



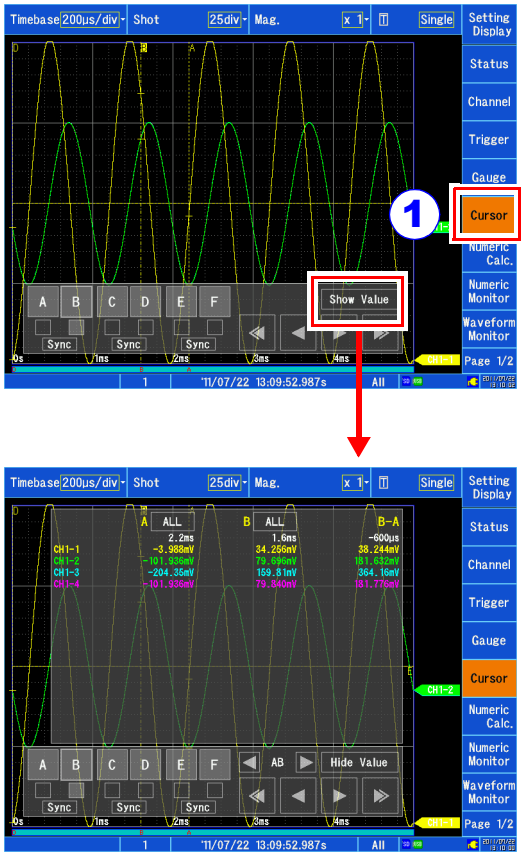
Magnifying and compressing the vertical axis (voltage axis)



1 **Open the screen**
[Waveform Display] / [Setting Display] ▶ [Channel]

2 **[Analog] ▶ [Display] ▶ [Mag.] ▶ Select from the list.**

Viewing the value at the cursor and selecting a range

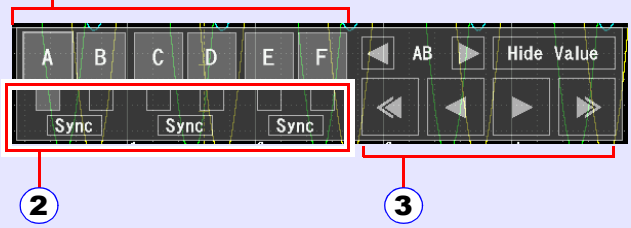


Tapping toggles between **[Show Value]** and **[Hide Value]**.
Setting to **[Show Value]** causes the Measured Value window to be displayed.
To hide the Measured Value window, tap **[Hide Value]**.

1 **Open the screen.**
[Waveform Display] ▶ [Cursor]

2

1 **Select the cursor you wish to display.**
A to D: Trace cursor
E, F: Horizontal cursor



2 **Select the cursor to move.**

To move at the same time, select **[Sync]**.

3 **Move the cursor(s).**

▲▼ ◀ ▶ :
Light tap Moves 1 data point at a time.
Hard tap* Moves 5 data points at a time.

⏫ ⏬ ⏪ ⏩ :
Light tap Moves 1 division at a time.
Hard tap* Moves 5 divisions at a time.

Touching continuously causes the waveform to scroll continuously.

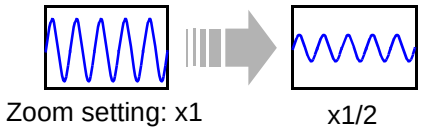
*Hard taps made with a touch pen cannot be detected.

To specify a range, select A-B or C-D.

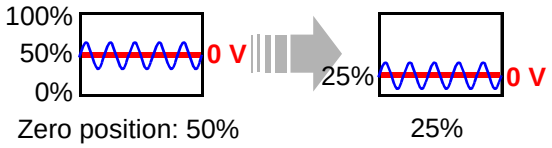
If the display is hard to decipher due to overlapping waveforms

You can either change the waveform zoom setting and zero position or assign waveforms to sheets or graphs. This section describes how to improve waveform visibility by changing the waveform zoom setting and zero position.

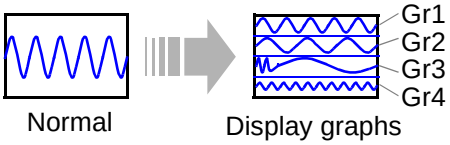
Changing the waveform zoom setting (vertical axis)



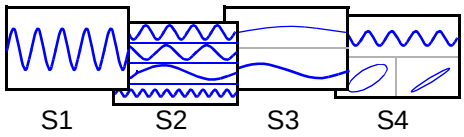
Changing the waveform zero position



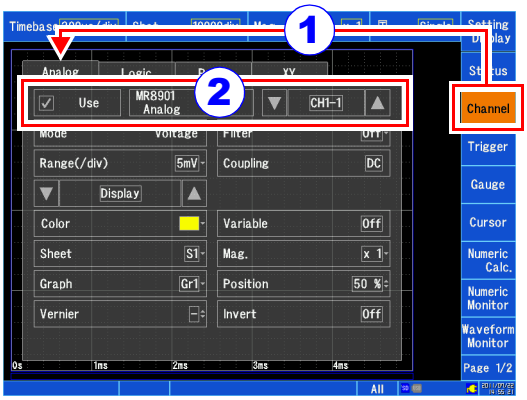
Assigning waveforms to graphs

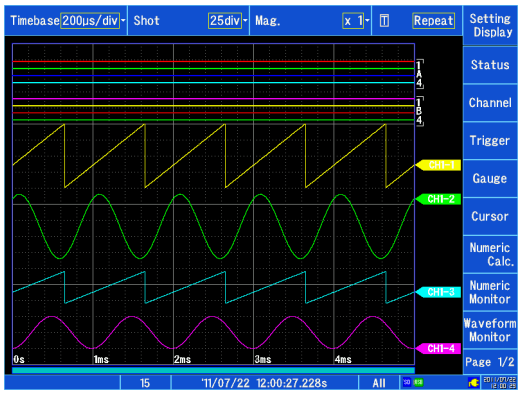


Assigning waveforms to sheets



Waveform screen ([Channel] window)





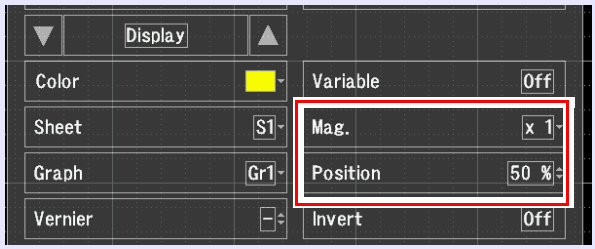
(Example settings)

1 **Open the screen.**
[Waveform Display] / [Setting Display] ▶ [Channel]

2 **[Analog] ▶ Select the channel to configure.**

3 **Set the display to [Display] and change the settings.**

- Change the zoom: **[Mag.]** ▶ Select from the list.
- Change the zero position: **[Position]** ▶ Change the value.



- These settings can be changed during measurement.
- You can also select the logic waveform position.
- When the waveform includes a DC component, changing the zoom setting has the effect of making the waveform appear to fluctuate significantly. This is due to the fact that the zoom setting also affects the DC component.

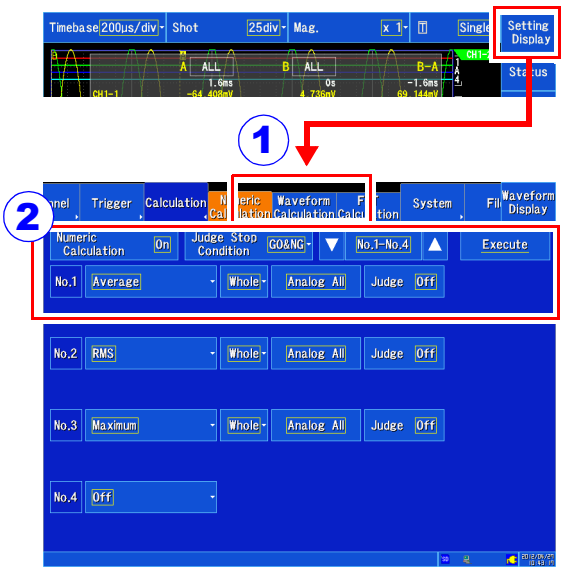
Performing calculations

There are 24 types of numerical calculations available, up to 8 of which can be performed at the same time. There are two methods for performing calculations:

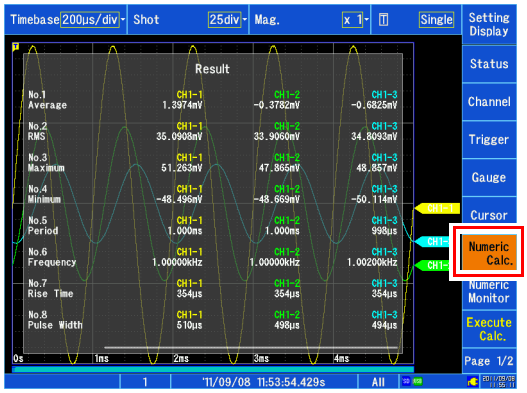
- Calculating while measuring (The numerical calculation must be configured before measurement.)
- Calculating using existing data (Calculations can be performed using data that has already been acquired and data stored on media.)

This section describes how to perform calculations while measuring.

Setting screen (**[Numeric Calculation]** window)



Waveform screen (**[Numeric Calc.]** window)

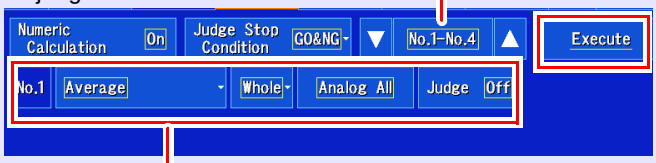


1 **Open the screen.**
[Setting Display] ▶ [Calculation] ▶ [Numeric Calculation]

2 **Set [Numeric Calculation] to [On] and configure the calculation.**

You can configure calculation operation based on judgment results.

You can switch the calculation configuration list.



You can set the calculation type, calculation range, calculation target channel, and whether there is a judgment result.

The calculation will be performed automatically once measurement starts. To perform a calculation using existing data, select **[Execute]**.

3 **[Waveform Display] ▶ Open the [Numeric Calc.] window and view the calculation results.**

Available calculations

- Average
- RMS (Root-Mean-Square)
- P-P
- Maximum
- Time to Maximum
- Minimum
- Time to Minimum
- Period
- Frequency
- Rise Time
- Fall Time
- Standard Deviation
- Area
- X-Y Area
- Time to Level
- Level at Time
- Pulse Width
- Duty Ratio
- Pulse Count
- Arithmetic Operation
- Time Difference
- Phase Contrast
- High Level
- Low Level

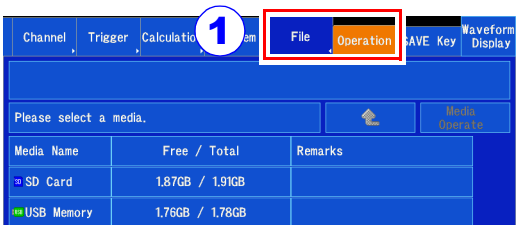
(Total of 24 types)

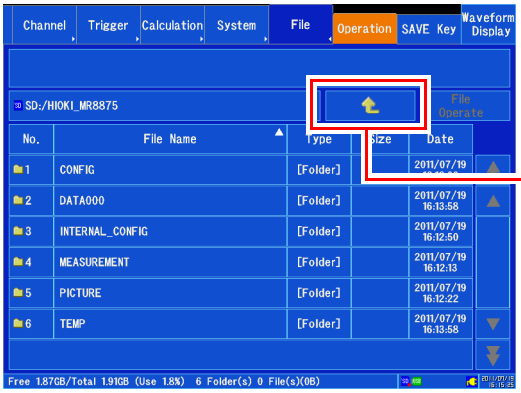
- Specified calculation between cursors
  Waveform calculations can be limited to data within the range specified by A/B cursors and C/D cursors.

For more information about calculation equations and operators, see the instruction manual.

Viewing the Contents of Media

You can check data that has been saved with the instrument using the File screen.





1 **Open the screen.**
[Setting Display] ▶ [File] ▶ [Operation]

2 **Tap the media you wish to view to select it.**
(The selected media will be displayed in reverse video.)

3 **Tap the media again.**
The data stored on the media will be displayed.

Tap here to move up a level.

Data that can be saved and loaded by the instrument

●: Available / –: Not Available

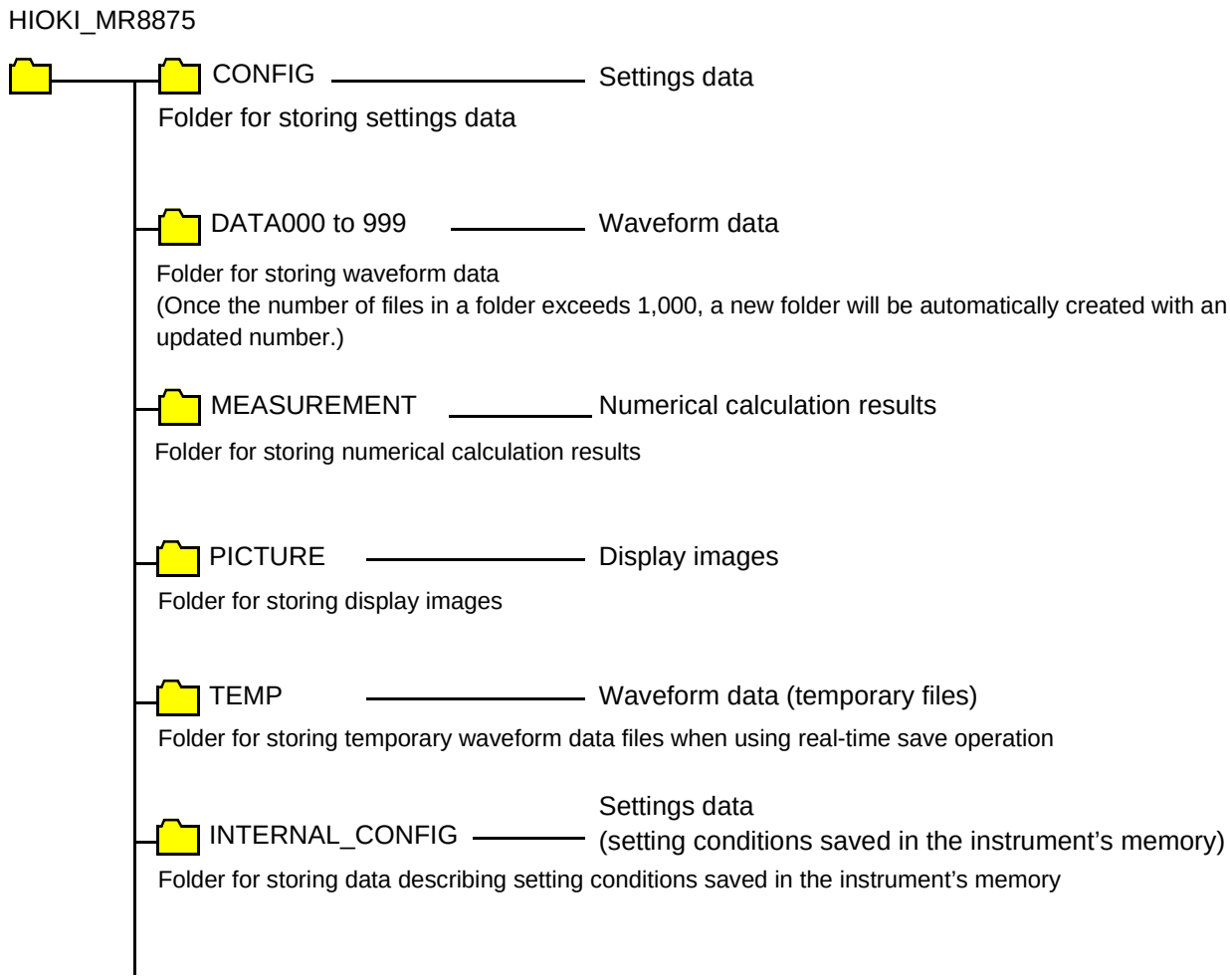
File type	File format	Icon	File extension	Saving			Loading	
				Auto	Real-time	Manual	Instrument	PC
Settings data*1	Binary		SET	–	–	●	●	–
Waveform data*2	Binary		MEM	●	●	●	●	– *5
	Text*3		CSV TXT	●	–	●	–	●
Numerical calculation results	Text*3		CSV TXT	●	–	●	–	●
Display images	BMP*4		BMP	●	–	●	–	●

*1: You can load settings data automatically when the instrument is turned on (auto setup function).
*2: Save data you wish to load later using the instrument in binary format. Waveform data will be saved along with some of the settings data that was in effect at the time of measurement. To load data for later viewing on a PC, save it in text format. To save a partial waveform, set the desired range with the A/B and C/D cursors. (p.13)
*3: When **[Separator]** is set to a value other than a comma, the file will have the .TXT extension.
*4: BMP is a standard Windows graphic format that can be opened and processed using many graphic applications.
*5: This format can be loaded using the Waveform Viewer (Wv).

For more information, see the instrument manual.

Folder and file structure

When data is saved, the folder “HIOKI_MR8875” will be created on the media, and folders will be saved inside that folder.



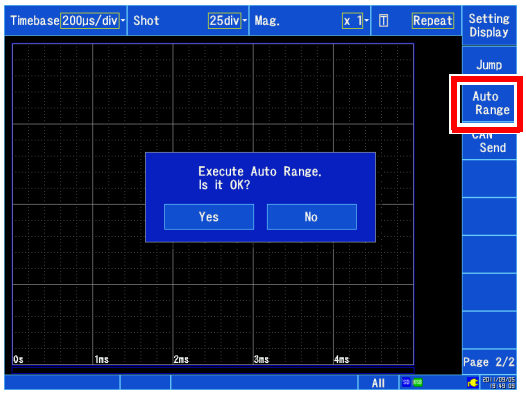
For more information about filenames, see the instruction manual.

Convenient Functionality

When you don't know the time axis or range "Auto-ranging"

Automatically sets the time axis range, voltage axis range, and zero position.

[Waveform Display (page2/2)] ▶ [Auto Range] ▶ [Yes]



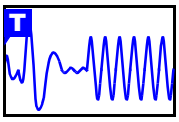
When you wish to record evidence or passage of abnormal phenomena "Pre-trigger" and "Post-trigger"

Allows you to record the waveform prior to the trigger point or conditions after the trigger point. This functionality is useful when you wish to assess trends such as abnormal phenomena.

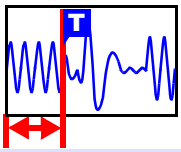
[Waveform Display] / [Setting Display] ▶ [Trigger] ▶ [General] ▶ [Pre-Trigger] / [Post-Trigger]

Display items vary with the trigger timing, percent setting, and division setting.

Without pre-trigger setting



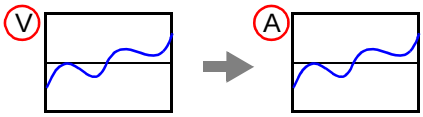
With pre-trigger setting



When you wish to convert readings to strain, temperature, or other values "Scaling"

[Waveform Display] / [Setting Display] ▶ [Channel] ▶ [Analog] ▶ [Scaling]

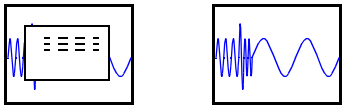
Sets the conversion method.



When you wish to monitor waveforms "Numeric monitor" and "Waveform monitor"

[Waveform Display] ▶ [Numeric Monitor] / [Waveform Monitor]

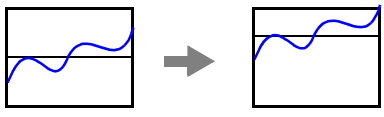
Allows you to monitor current waveform and value input.



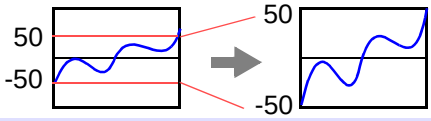
When you wish to change the waveform position or display range

[Waveform Display]/[Setting Display] ▶ [Channel] ▶ [Display] ▶ [Position]/[Variable]

"Position"
(specify the waveform zero position)

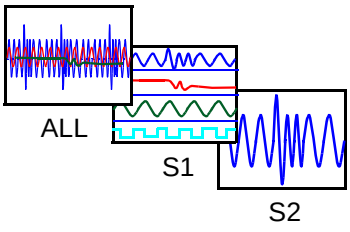


"Variable"
(specify with upper and lower limits)



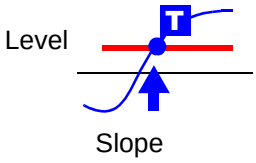
When you wish to assign measurement results to display sheets and graphs

[Waveform Display]/[Setting Display] ▶ [Channel] ▶ [Analog] ▶ [Display] ▶ [Sheet]/ [Graph]



Example Measurement: Measuring a Sine Wave

This section describes how to record a sine wave 1 Vp-p (500 Hz, 0 V offset) voltage waveform. It also describes how to save the data after measurement. In this example, measurement is performed using a level trigger. When measuring a repeating waveform such as a sine wave, the waveform can be made easier to observe by using the level trigger's level as the measurement start point.



1 Preparing for measurement

You will need:

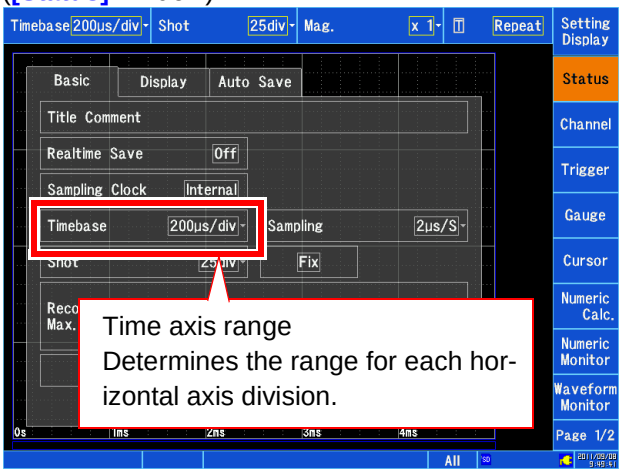
- MR8875 Memory HiCorder
- MR8901 Analog Unit
- Oscillator
- L9217 Connection Cord
- SD memory card

"Measurement Preparations" (p.5)

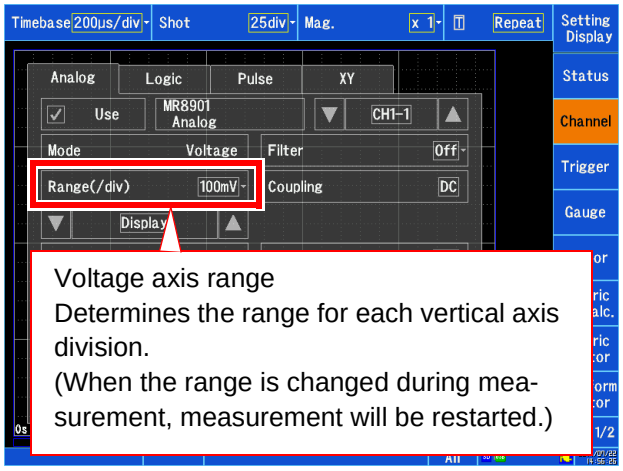
2 Setting measurement and trigger conditions

Set the measurement and trigger conditions as shown below on the Waveform screen:

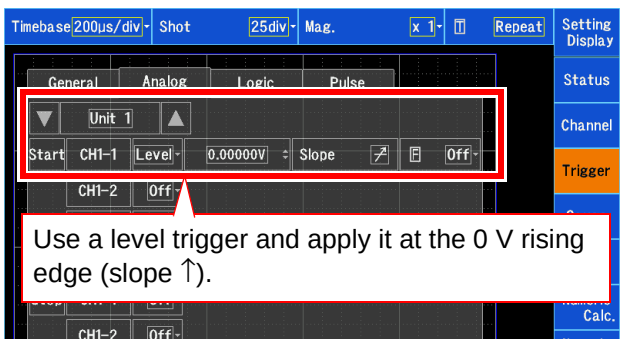
Setting measurement conditions (**[Status]** window)



Configuring input channels (**[Channel]** window)



Setting trigger conditions (**[Trigger]** window)



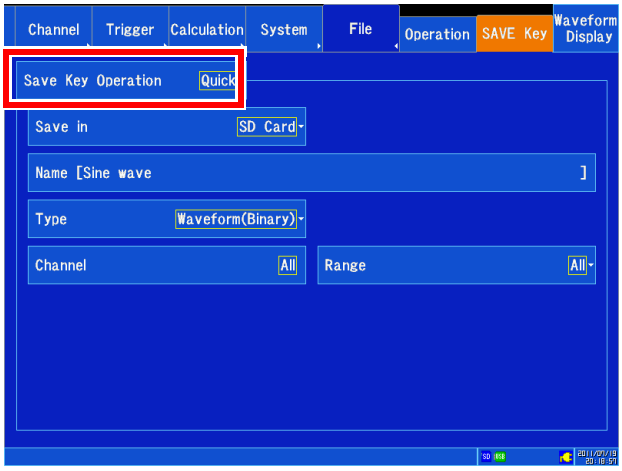
Determining the time axis range

The time axis range is calculated from the frequency and period.
f [Hz] = 1/t [s] (f: frequency; t: period)

Example: For a measurement frequency of 50 Hz
1 period = t = 1/50 [s], or 20 ms
Setting the time axis to 20 ms/div causes exactly 1 period to be displayed for 1 division (1 frame).

3 Setting the save conditions

[Setting Display] ▶ **[File]** ▶ Configure the settings as shown below under **[SAVE Key]**.
This section describes how to configure the instrument when setting **SAVE** key operation to **[Quick]**.

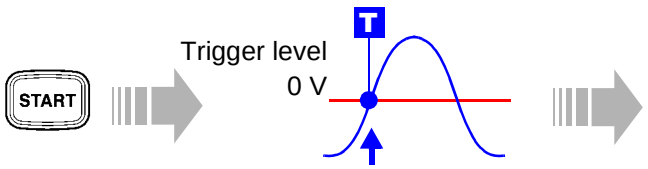


When the **SAVE** key is pressed, data will be saved immediately in accordance with the save conditions.

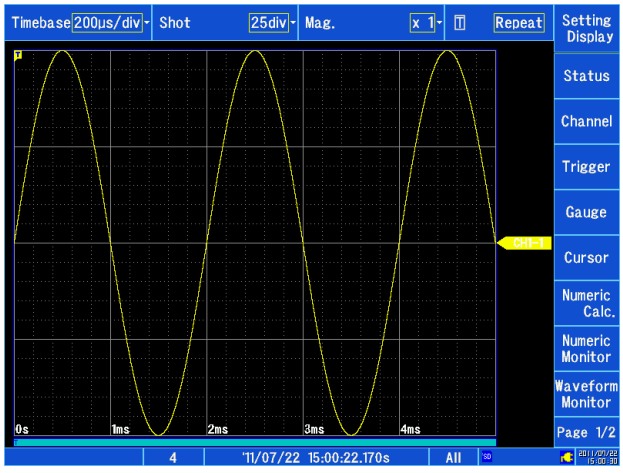
Save conditions (example)
- Save destination (Save in): SD Card
- Data filename (Name): Sine wave
- Save type (Type): Waveform(Binary)
- Channels to save (Channel): All
- Save range (Range): All

- If you wish to specify the save conditions each time the **SAVE** key is pressed, set **[Save Key Operation]** to **[Select]**.
- If you wish to view the waveform using the instrument, set the **[Type]** setting to **[Waveform(Binary)]**. If you wish to view the waveform with spreadsheet software, set to **[Waveform(Text)]**. Data saved as text cannot be loaded by the MR8875.

4 Starting and stopping measurement



Press the **START** key.
When the trigger conditions are satisfied, the trigger will be applied, and a waveform of the set recording length will be recorded.



The instrument will record measurement data until the **STOP** key is pressed.

5 Save the data

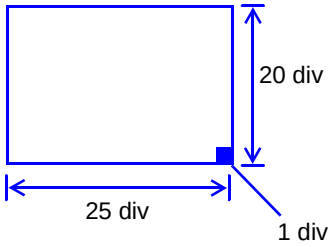
Pressing the SAVE key causes data to be saved immediately in accordance with the configured save conditions. The saved data can be checked with [Setting Display] ▶ [File] ▶ [Operation]. For more information about how to analyze data, see "Analyzing Measurement Results" (p.12).

Reference

Screen

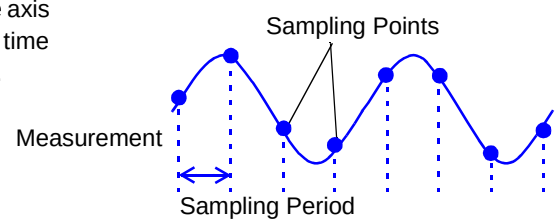
The MR8875 uses an SVGA (800 x 600) LCD. The waveform display area uses 625 horizontal dots and 500 vertical dots of the screen.

The waveform display range is 25 horizontal divisions by 20 vertical divisions, with each frame (division) taking up 25 horizontal dots and 25 vertical dots on the display. Each data frame (division) consists of 100 samples horizontally and 1250LSB vertically (the exact number varies with the input module). The size of each data frame (division) varies with the time axis magnification and compression ratios and the voltage axis magnification and compression ratios.



Time and sampling

The sampling period is 1/100 of the time axis. When the time axis range is 100 ms/div, the sampling period is 1 ms. When the time axis range is set, the sampling period changes accordingly.



Measurement length setting

The measurement length sets the length (in divisions) to record during each data acquisition event. A recording length of 1 division consists of 100 data points.
Total data points in recording length = Set recording length (in divisions) 100 data points + 1
Example: For a set recording length of 50 divisions, 50 div x 100 data points + 1 = 5,001 data points

Voltage axis and resolution

The instrument's resolution varies with the input module. The following table lists the full-scale resolution for each unit. The maximum resolution can be calculated from the screen's full-scale value and the full-scale resolution given in the following table.

Example: For measurements made using the MR8901 Analog Unit
Power supply voltage is measured using a vertical axis of 20 V/div and a vertical zoom of 1x. The maximum resolution under these conditions is calculated as follows:
Screen full-scale: 1 V/div x 20 div = 20 V
Full-scale resolution for vertical axis of 1x: 25,000
20 / 25,000 = 0.8 mV

Full-scale resolution (LSB) for input modules by vertical axis zoom setting

Input module	Magnification/compression ratio									
	×1/10	×1/5	×1/2	×1	×2	×5	×10	×20	×50	×100
MR8901 MR8903 MR8905	250000 (50000)	125000 (50000)	50000	25000	12500	5000	2500	1250	500	250
MR8902*	200000 (40000)	100000 (40000)	40000	20000	10000	4000	2000	1000	400	200

( ): Indicates the effective data range.
*: The effective range for the MR8902 Voltage/TEMP Unit varies with the thermocouple. For more information about

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