8860-50
8861-50
8860-51
8861-51

HIOKI

3

Instruction Manual

MEMORY HiCORDER

EN

Dec. 2016 Revised edition 8
8860B983-08 16-12H

6001930 38

Contents

Usage Index

Product Description

Instrument Operations

Analyzing Data

Viewing Measurement Values	"8.8 Cursor Values" (p. 202)
Saving and Loading Data	"Chapter 11 Saving/Loading Data & Managing Files" (p. 261)
Printing Data	"Chapter 12 Printing" (p. 313)
Communicating with this Instrument from a Personal Computer	"Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*

Introduction

In this manual, “the instrument” means the Model 8860-50, the 8861-50, the 8860-51 or the 8861-51 Memory HiCorder.

* Unless otherwise noted in this manual, information provided for the 8860-50 also applies to the 8860-51, and information provided for the 8861-50 also applies to the 8861-51.
* The 8860-51 and 8861-51 do not have a PC CARD slot.

The following documents are provided with this instrument. Refer to them as appropriate for your application.

Document	Description
1 **Quick Start Manual**	**Read this first.** It describes preparations for use, basic operating procedures and usage methods.
2 **Input Module Guide**	**To connect input modules and measurement cables, and when making input channel settings;** this Guide describes the optional input modules, related cable connection procedures, and their settings and specifications.
3 **Instruction Manual** (This document)	**To obtain setting details;** this Manual describes details of the functions and operations of the instrument, and its specifications.
4 **Analysis and Communication Supplement**	**To analyze measurement data using the calculation functions, and to communicate with the instrument;** this supplement describes the procedures for analyzing data using numerical calculations, waveform calculations and FFT functions, and how to communicate with the instrument using a computer.

Before Use

Be sure to read the safety precautions in the *Quick Start Manual.*
Also read the precautions regarding input modules and connection cables in the chapter about connections in the *Input Module Guide*.

Symbols and Indicators in This Manual

The following symbols in this manual indicate the relative importance of cautions and warnings.

⚠DANGER	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
⚠WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
⚠CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.
NOTE	Indicates advisory items related to performance or correct operation of the instrument.

Other Indicators

	Indicates a prohibited action.
(p.)	Indicates the location of reference information.
	Indicates quick references for operation and remedies for trouble-shooting.
*	Indicates that descriptive information is provided below.
MEM	Indicates Memory function support.
REC	Indicates Recorder function support.
REC&MEM	Indicates REC&MEM function support.
FFT	Indicates FFT function support.
REALTIME	Indicates Real-time saving function support.
A→B	Indicates an operation sequence.
[ ]	Screen labels such as menu items, page titles, setting items, dialog titles and buttons are indicated by square brackets [ ].
CURSOR (Bold characters)	Bold characters within the text indicate operating key labels.

Unless otherwise specified, “Windows” represents Windows 95, 98, Me, Widows NT4.0, Windows 2000, Windows XP, or Windows Vista.

Mouse Operation Terminology

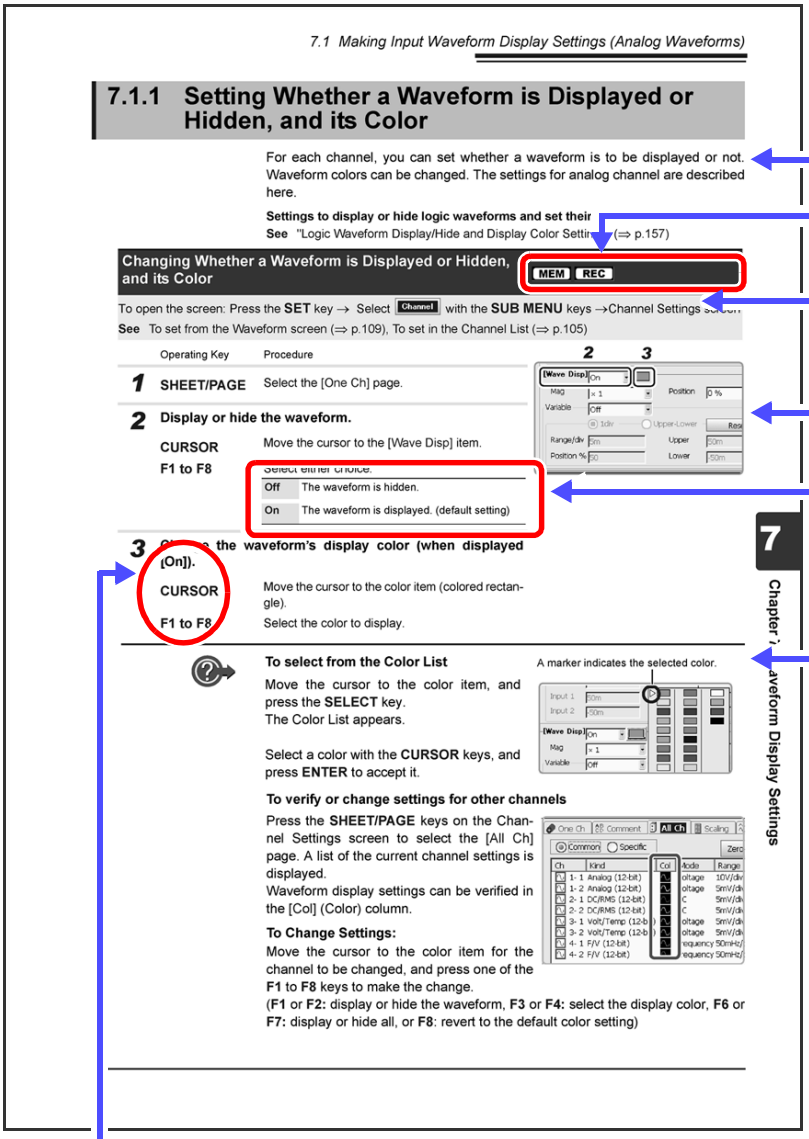
Click	Press and quickly release the left button of the mouse.
Right-click	Press and quickly release the right button of the mouse.
Double click	Quickly click the left button of the mouse twice.
Drag	While holding down the left button of the mouse, move the mouse and then release the left button to deposit the chosen item in the desired position.
Activate	Click on a window on the screen to activate that window.

Accuracy

We define measurement tolerances in terms of f.s. (full scale) values, with the following meanings:
f.s. : maximum display value or scale length
In this instrument, the maximum displayable value is the range (V/div) times the number of divisions (20) on the vertical axis.
Example: For the 1 V/div range, f.s. = 20 V

Reading this Manual

Operating Procedure Description



Setting procedure overview

Selectable functions

Screen opening procedure
See "2.2 Screen Organization" (p. 17)

Settings screen

Selection choices
F keys (F1 to F8) selections

Helpful suggestions, setting details and precautions

Operating keys
Although the instrument can be operated with a mouse, most of the operating descriptions in this manual involve only the operating keys.

Chapter 1 Overview

1.1 Product Overview

The instruments are data recorders that provide a broad range of measurements for observing both high-speed waveforms and low-speed signals.
Various measurements including voltage, current, temperature and frequency are available using connection cables or sensors with optional input modules. Up to four input modules can be installed in the Model 8860-50, and up to eight in the 8861-50.
Also, optional storage memory can be installed to enable long-term recording with high-speed sampling.
With the LAN interface installed as a standard feature, remote control and data transfer to personal computers can be performed simply over a network.
By installing the optional thermal printer, waveforms and screen image copies can be printed at large sizes.
For easy operation, a mouse and keyboard can also be used.

1.2 Features

Various waveform collecting capabilities and a full selection of input modes support a broad range of measurement applications

In addition to pre-existing input modules (Models 8936 to 8947), the following new input modules support recording of many types of parameters:

- Model 8956 Analog Unit: Provides 20 MS/s waveform recording with 12-bit resolution
- Model 8957 High Resolution Unit: Provides 2 MS/s waveform recording with 16-bit resolution
- Model 8958 16-Ch Scanner Unit: Provides temperature and voltage measurement on multiple channels with 50 ms recording interval
- Model 8959 DC/RMS Unit: Provides RMS waveform recording
- Model 8960 Strain Unit: Provides 200 kS/s distortion measurement with 16 bit resolution.
- Model 8961 High Voltage Unit: Provides direct measurements on high voltage power lines at 2 MS/s, with 16-bit resolution.

See "Chapter 1 Overview" in the *Input Module Guide*

Floating analog input components enable inputs to be connected to points with different potentials.
Analog signals from input modules and logic signals from logic probes can be recorded simultaneously.

Easy-To-See High Resolution LCD

The high resolution (800 × 600) 10.4-inch TFT color LCD ensures clear visibility.

Measurement functions corresponding to measurement application

Memory Function:
Provides a sampling period as fast as 50 ns, suitable for observing instantaneous waveforms and transient phenomena.

Recorder Function:
Suitable for slow phenomena and observational recording.

REC&MEM Function:
For long-term monitoring; sudden or intermittent signal waveforms can be, at least partially, recorded.

Real-Time Saving Function*:*
Suitable for storing long-term measurement data. While measuring, data is saved directly onto recording media.

FFT Function:
Provides frequency analysis.

See "4.1 Selecting the Function" (p. 81)
About FFT Function: *Analysis and Communication Supplement*

High capacity memory choices

8860-50: Choose from 32 to 128 MWords, 512 MWords or 1 GWord.

8861-50: Choose from 64 to 256 MWords, or 1 or 2 GWords.

Plenty of trigger functions

Digital triggering circuitry is employed.
Control measurements by combined trigger criteria including level, window, period, glitch, slope, voltage sag, logic (pattern) and timer triggers.

See "Chapter 6 Trigger Settings" (p. 135)

Scaling function enables reading any measured values directly

By setting the measurement unit name and physical value per volt of input signal, measurements are converted and displayed as the specified measurement units.

See "5.4 Converting Input Values (Scaling Function)" (p. 123)

Various observation and analysis functions

- Without interrupting ongoing measurements, you can scroll back to view recorded waveforms that have scrolled off the screen.

See "8.1 Scrolling Waveforms" (p. 192)

- Numerical values and gauges can be displayed with waveforms, simplifying on-screen verification of measured values.

See "8.5 Applying Gauges" (p. 198)

- Trace cursors enable viewing times and numerical values on all channels.

See "8.8 Cursor Values" (p. 202)

- Various numerical calculations and waveform calculations are available.

See *Analysis and Communication Supplement*

Search function

You can find various characteristics in any measured data by specifying search criteria.

See "8.14 Searching a Waveform" (p. 222)

Enhanced operability provided by GUI and support for a mouse or keyboard

Operable using a commonly available mouse or keyboard.
GUI screen displays are optimized to simplify both key operations and settings.

See "3.3 Common Operations" (p. 63)

Optional thermal printer

A thermosensitive recording printer with thermal line head can be installed in the instrument.
Specify and print sections of waveforms as occasion demands.
You can also print captured screen images, numerical value data and reports.

See "Chapter 12 Printing" (p. 313)

Support for a variety of recording media and external storage systems (optional hard disk drive)

Measurement data, settings and images can be recorded to PC Cards (optional Flash ATA Cards), hard disks and and USB memory device.
Two PC Card slots are provided, so an interface card and a Flash ATA card can be used at the same time.

See "11.1 Storage Media" (p. 262)

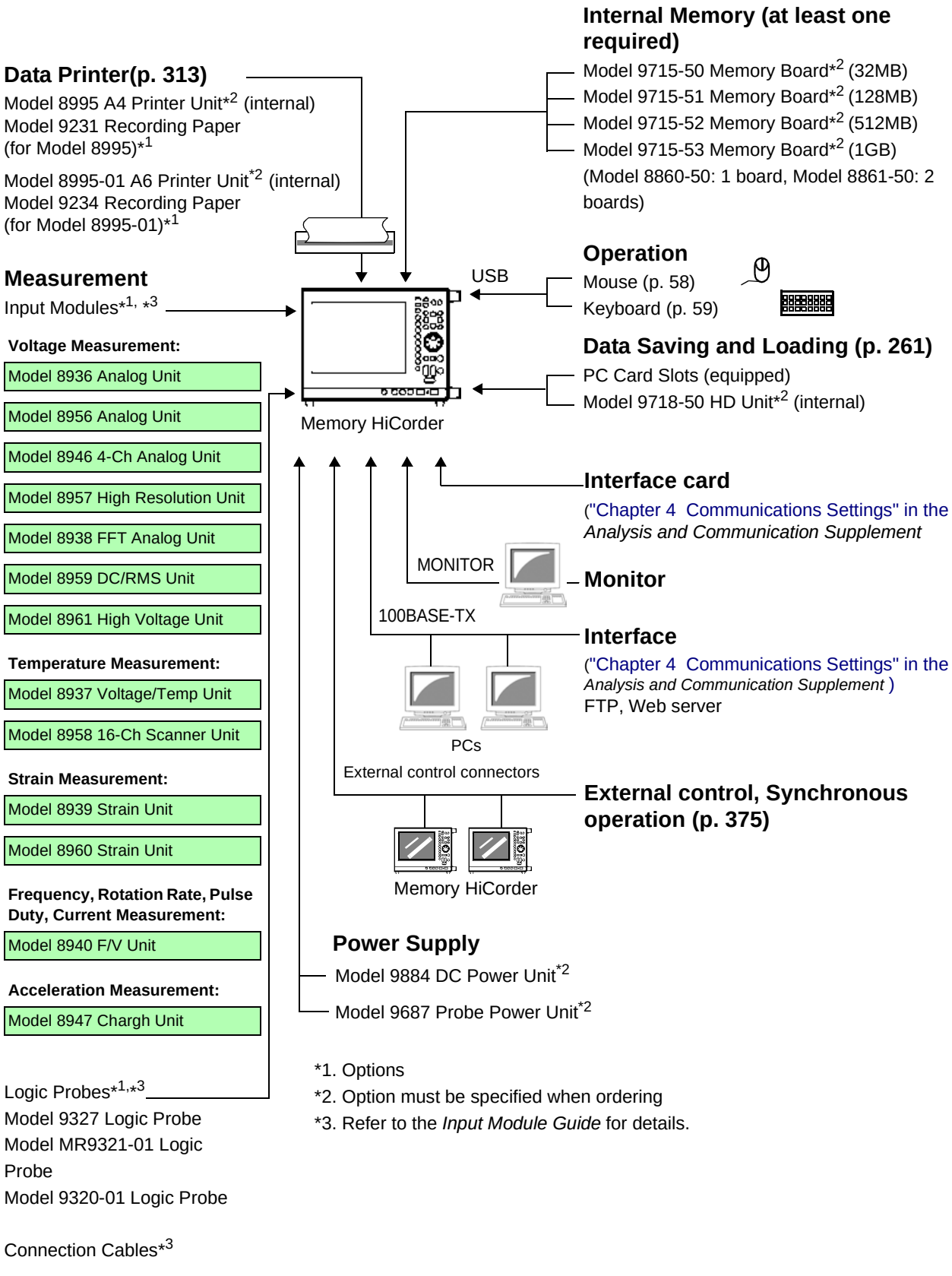
Built-in LAN interface (100Base-TX)

An HTTP server is installed. There is no need to install special applications on a PC: instrument settings and screen monitoring can be performed on a PC running Internet Explorer.
By connecting to a shared folder, measurement data from the instrument can be saved on a PC.

See "Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*
"11.1.4 Using a Network Shared Folder" (p. 264) in this Manual

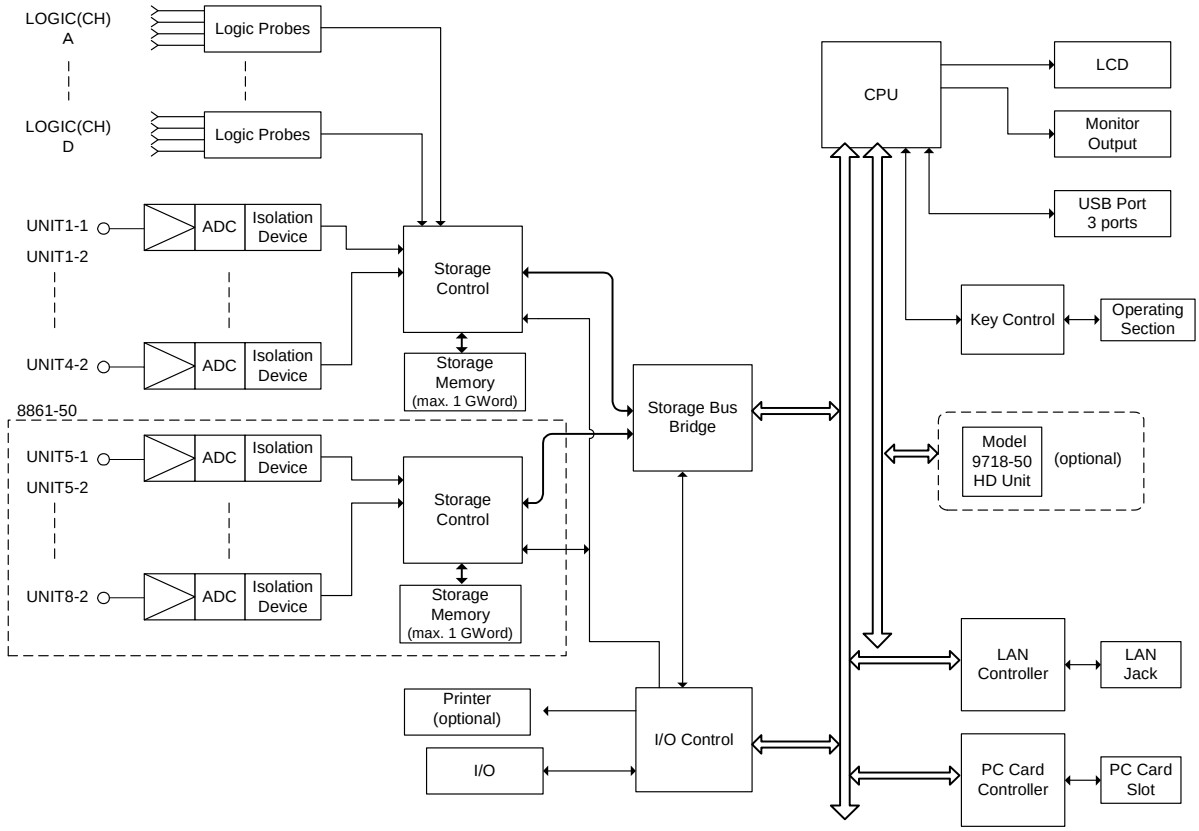
1.3 Interconnection and Block Diagrams

Interconnection Diagram



*1. Options
*2. Option must be specified when ordering
*3. Refer to the *Input Module Guide* for details.

Internal Block Diagram



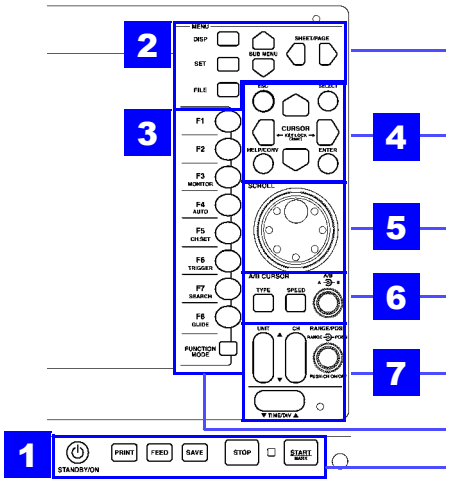
System Circuit Description

All subsystems in the instrument are microprocessor (CPU) controlled.
Each input module contains an A/D converter that connects to the instrument through an isolation device. (The isolation devices are in the input modules.)
In addition, separate power supplies are provided for each channel, electrically isolating them from the instrument.
After processing by the CPU, measurement data is stored in memory for display on the LCD or output to the printer. Data can be saved to and reloaded from a PC Card or other external storage media.

1.3 Interconnection and Block Diagrams

Operating Keys and Screen Contents Chapter 2

2.1 Operating Keys



2 Selects screens (p. 14)

3 **4** Selects setting choices and character entry (p. 15)

5 Scrolls waveforms (p. 15)

6 Sets A/B cursors (p. 15)
(To specify a waveform range, and read values at cursors)

7 Makes input waveform-related settings (p. 16) (select modules and channels, timebase, measurement range and set zero position)

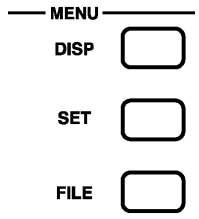
Selects setting choices or functions (p. 14)

1 Control instrument operations such as measurement start/stop and manual save/print

1 (Start/Stop Measurement, Manual Save, Printing Control)

STANDBY/ON key	Activates the Standby state.(The Standby state minimizes the startup time required when turning the instrument on by the **POWER** switch) Lights red: Power-On state Flashes red: Standby state **To cancel Standby state:** Press the **STANDBY/ON** key again. **See** "3.6 Turning the Power On and Off" in the *Quick Start Manual*
PRINT key	Prints measurement data stored in the instrument's internal memory. **See** "12.4 Making Manual Print (PRINT Key Output) Settings" (p. 319)
FEED key	Pressing the **FEED** key feeds paper for as long as you press it. (when the optional printer is installed)
SAVE key	Saves data to storage media. **See** "11.3.5 Setting Manual Save (SAVE Key Output)" (p. 278)
STOP key	Stops measurements. Press twice to force measurement to halt immediately. **See** "3.3.6 Starting and Stopping Measurement" (p. 76)
START/MARK key	Starts measurement. The green LED at the left is lit during measurement. If you have set trigger criteria, the awaiting-trigger state activates. **See** "3.3.6 Starting and Stopping Measurement" (p. 76) While recording, pressing this key inserts a mark on the waveform (event mark). **See** "8.15 Inserting and Searching for Event Marks on a Waveform" (p. 231)

2 MENU (Screen Select)



DISP key

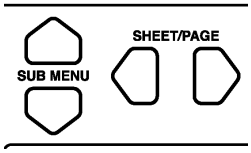
Displays the Waveform screen showing recorded data.
(Setting choices can also be changed from the Waveform screen)
See "2.4 Waveform Screen" (p. 19)
When using A/B cursors or calculation functions, waveforms and numerical values can be displayed on the same screen.
See "8.8 Cursor Values" (p. 202)

SET key

Displays the Settings screens, where you can change various settings such as measurement configuration and trigger criteria.
See "2.5 Settings Screen" (p. 27)
Hold this key to display the System screen.
See "2.7 System Screen" (p. 45)

FILE key

Displays the File screen where you can load settings and measurement data, and manage files.
See "2.6 File Screen" (p. 42)



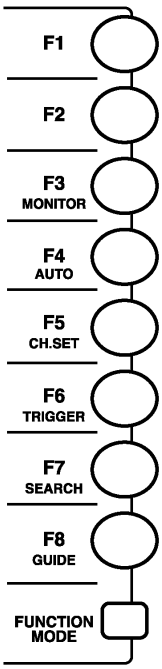
SUB MENU keys

Selects among setting items on the Waveform screen, or among the Settings menu items on the Settings or System screen.
(Which Settings menu items are available depends on the currently enabled operating function)

SHEET/PAGE keys

Switches the sheet displayed on the Waveform screen.
When using the Memory Division function, each block can be switched on the Waveform screen.
See "13.2.6 Specifying SHEET/PAGE Key Operations" (p. 357)
Switches the page displayed on the Settings screen.
Switches between the folder tree and file list on the File screen.

3 F keys (Select setting contents or function)



(*F1) to (*F8):
From the Waveform screen, press the FUNCTION MODE key to change to the FN mode, then press one of the F1 to F8 keys. To revert to the original functions, press the FUNCTION MODE key again.

F1 to F8 keys

These keys correspond to the setting choices displayed in the GUI area at the right side of the screen (GUI = Graphical User Interface).
Press a key to select its corresponding choice.
“F keys” indicates all of the **F1** to **F8** keys collectively.
See "3.3.2 To Change a Setting" (p. 63)

FUNCTION MODE key

Alters the functional mode of the **F1** to **F8** keys.
Available functions depend on the type of display screen.
[SET] (selection choice at screen cursor location) → **[FN]** (function displayed for F1 to F8) → **[MACRO]** (simple operations)
See Waveform Screen: "Function Modes and Settings" (p. 26),
File Screen: "Function Modes and Settings" (p. 43)

(*F1)

Displays information such as the measurement values and numerical calculation results.
See "8.4 Displaying Measured Values and Information" (p. 196)

(*F2)

Displays a gauge at the left side of the screen.
See "8.5 Applying Gauges" (p. 198)

MONITOR (*F3)

Displays input levels for monitoring.
See "8.6 Monitoring Input Levels (Level Monitor)" (p. 199)

AUTO (*F4)

Automatically sets the timebase and voltage axis range for the input waveform (Auto-Ranging Function).
See "3.3.5 Automatic Range Setting (Auto-Ranging Function)" (p. 74)

CH.SET (*F5)

Displays the CH ALL SET dialog.
Channel settings can be verified and changed.
See "5.7 Setting Input Channels from the Waveform Screen" (p. 134)

TRIGGER (*F6)

Applies an unconditional (manual) trigger.
See "6.10 Triggering Manually (Manual Trigger)" (p. 165)

SEARCH (*F7)

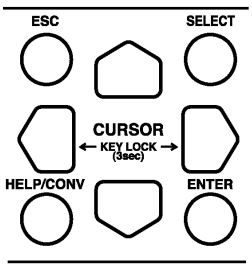
Displays the SEARCH dialog. Any desired waveform can be searched.
See "8.14 Searching a Waveform" (p. 222)

GUIDE (*F8)

(Support planned in later version upgrade)

4 Setting and Selecting (Selecting setting choices and entering characters)

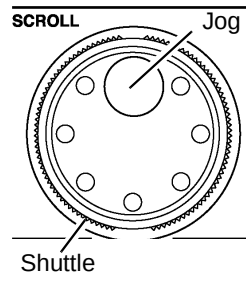
See "3.3.3 Entering Text and Numbers" (p. 65)



ESC key	Removes the displayed dialog or virtual keyboard.
SELECT key	When the cursor is on a setting item: opens a pull-down menu. When the cursor is on a character entry item: opens the virtual keyboard for character entry. When using the virtual keyboard: enters the character selected by the cursor.
HELP/CONV key	(Support planned in later version upgrade)
ENTER key	Accepts the setting choice selected on the pull-down menu or in the dialog. **Using the virtual keyboard:** when finished with your entry, accepts the entry and closes the virtual keyboard.
CURSOR keys	Moves the cursor up, down, left and right on the screen. (In this document, "CURSOR keys" indicates all of the CURSOR keys, while "△▽◁▷" indicates a specific CURSOR key or keys.)
KEY LOCK (3sec)	Press and hold the ◁ ▷ CURSOR keys for three seconds to disable key operations (Key-Lock function). **To cancel key-lock**, hold the keys again for three seconds. See "3.3.7 Disabling Key Operations (Key-Lock Function)" (p. 78)

5 SCROLL controls (waveform scrolling)

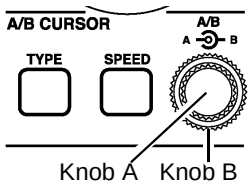
See "8.1 Scrolling Waveforms" (p. 192)



Jog	Scrolls waveforms left and right.
Shuttle	Scroll speed is determined by the rotation angle of the Shuttle knob. **To scroll waveforms automatically (Auto Scroll)** Turn the knob in the direction to scroll the waveform and hold it until "Auto-Scroll" appears, then release it. The waveform scrolls automatically. **To cancel:** press any operating key.

6 A/B CURSOR (setting the A/B cursors)

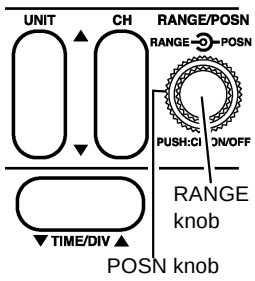
See "8.8 Cursor Values" (p. 202)



TYPE key	Sets the A/B cursor type. Press the key to display the settings dialog (Vertical, Horizontal or Trace cursors).
SPEED key	Sets the speed of A/B cursor motion. Press this key to display the currently set cursor speed at the bottom of the screen (Fast, Medium or Slow).
A/B knobs	These knobs move the A/B cursors. A ⊙ B **To move cursor A:** turn inner knob A. **To move cursor B:** turn outer knob B. Press knob A to display the settings dialog.

7 Input Waveform Settings

See "5.7 Setting Input Channels from the Waveform Screen" (p. 134)
"5.1 Analog Channel Settings" (p. 116)



UNIT key

Selects a Unit (module) (Waveform or Channel Settings screen).

CH key

Select a channel (Waveform or Channel Settings screen).

RANGE/POSN knobs

Sets the measurement range of the input channels, waveform display position (zero position of the vertical axis), and whether or not they are displayed (available on the Waveform and Channel Settings screens).

RANGE POSN

To set the measurement range: turn the inner **RANGE** knob.

To change the waveform display position (zero position): turn the outer **POSN** knob.

PUSH:CH ON/OFF

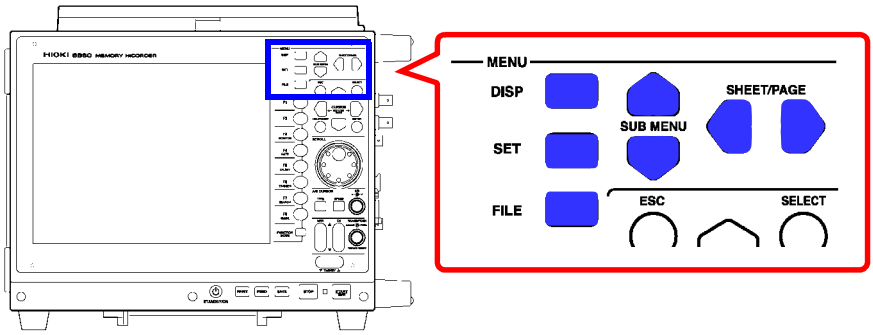
To turn a waveform display on or off: press the inner **RANGE** knob.

TIME/DIV key

Sets the acquisition speed (timebase) for the input waveform (Waveform and Status Settings screens).

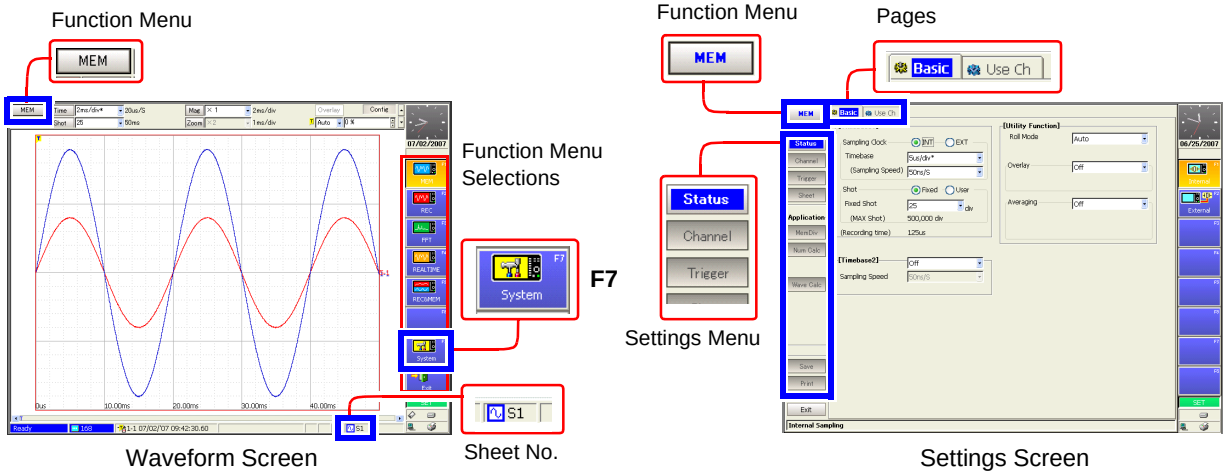
See "4.4 Setting Measurement Configuration on the Waveform Screen" (p. 114)
"4.2 Setting Measurement Configuration (Status Settings Screen)" (p. 86)

2.2 Screen Organization



There are five general screen types.
Press the operating keys shown at the right to select a screen.

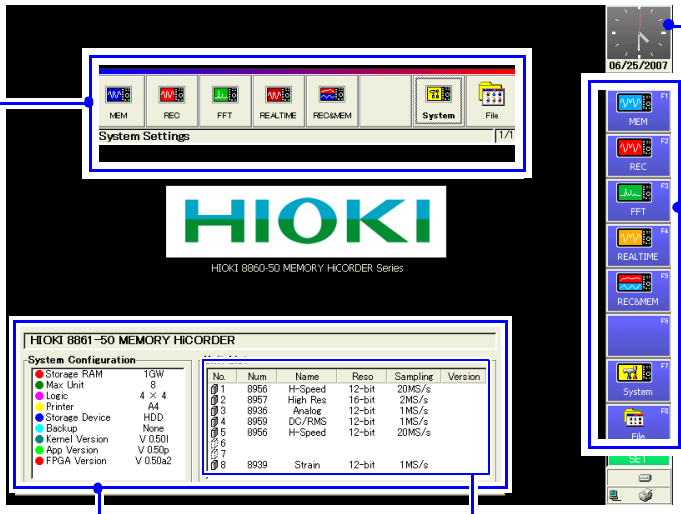
Screen	Operating Key	Screen Contents
Opening Screen (p. 18)		This screen appears first after power on. When you turn the power off with the Waveform screen displayed, it reappears after this screen is displayed briefly.
Waveform Screen (p. 19)	**DISP**	Displays measurement data as waveforms or numerical values. **See** "7.2.3 Setting the Display Type" (p. 177)
To change sheets	**SHEET/PAGE**	Switches the display between multiple "sheets" of waveform data. **See** "7.2.1 Assigning Display Data to Sheets" (p. 175) "13.2.6 Specifying SHEET/PAGE Key Operations" (p. 357)
Settings Screen (p. 27)	**SET**	Displays the setting screen for measurement data, for making settings relating to the display of measurement configuration, Waveform screen and calculation results.
To change setting menus	**SUB MENU**	Selects among setting screens in the Settings menu.
To change pages	**SHEET/PAGE**	Switches pages on the Settings screen.
File Screen (p. 42)	**FILE**	Displays the screen for loading measurement data and managing files.
System Screen (p. 45)	**F7** [System] (or hold **SET**)	(select from the Opening screen or the Function menu on the Waveform or Settings screen) Displays various system environment setting screens.
To change setting menus	**SUB MENU**	Selects among setting screens in the Settings menu.
To change pages	**SHEET/PAGE**	Switches pages on the Settings screen.



2.3 Opening Screen

This screen appears first after power on. (When you turn the power off with the Waveform screen displayed, it reappears after this screen.) The boot process takes about 40 seconds.

Select a function with the F keys (**F1** to **F8**). The Waveform screen appears when you select the function.



Function Menu

Select a function before measuring. Functions can be changed from the Waveform or Settings screens.

"4.1 Selecting the Function" (p. 81)

To return to the Opening screen:

Exit or close all screens to return to the Opening screen.

Clock

Shows the current time.

"13.3.1 Setting the Date and Time" (p. 364)

Selections

Select a function with the F keys (F1 to F8).

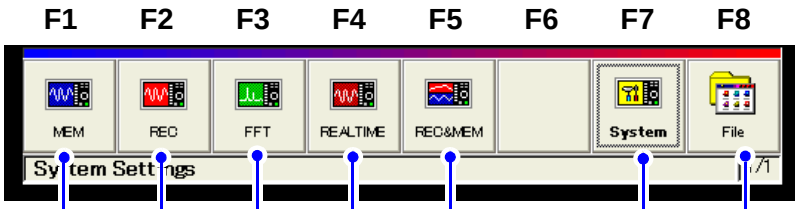
System Configuration List

This can be verified on the System screen (p. 52).

A list of the currently connected input modules appears.

Function Menu

Details:"Choosing the Appropriate Function" (p. 82)



Memory Function

Recommended for measuring instantaneous waveforms.

Use to record relatively fast signals with periods from µs to minutes.

Recorder Function

Recommended for long-term measurements.

Records waveforms at slow speeds.

Use to record relatively slow signals with periods from ms to hours.

FFT Function

Recommended for performing frequency analysis of rotating objects, vibrations, sounds and etc.

Spectral analysis and transfer functions are available.

Real-Time Saving Function

Recommended for long-term recording instead of a data recorder. Measurement data is saved to the recording media in real time.

REC&MEM Function

Recommended for recording transient signal waveforms during long-term monitoring. Long-term recordings are displayed as Recorder waveforms, and instantaneous recordings are displayed as Memory waveforms.

System Settings

Displays the System screen. Use this screen to make system environment-related settings. Select this to set the clock.

File Operations

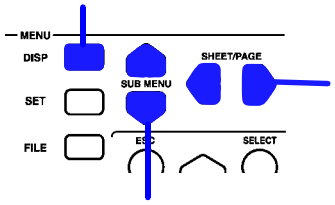
Displays the File screen.
Use this screen to load previously saved files and to otherwise manage files.

2.4 Waveform Screen

Parts of the displayed screen depend on the selected operating function.
Refer to the *Analysis and Communication Supplement* for details of the FFT function.

To open the Waveform screen

Press the DISP key
(The Waveform screen appears)



Press the SHEET/PAGE keys
(To change sheets)
This is valid only when measurement data has been assigned to multiple sheets.

Press the SUB MENU keys
(To change choices of setting items)
See "Setting Items and Choices" (p. 21)

Displays acquired data as waveforms or numerical values.

To change the display type (Waveform, numerical values or X-Y Composite):
See "7.2.3 Setting the Display Type" (p. 177)

To display any combination of recorded data:
See "7.2.1 Assigning Display Data to Sheets" (p. 175)

(Example: Memory Function Waveform Screen)

Function Menu
Select a function before measuring.
To change functions:(p. 81)

On-screen changes can be made by clicking the mouse. (p. 69)

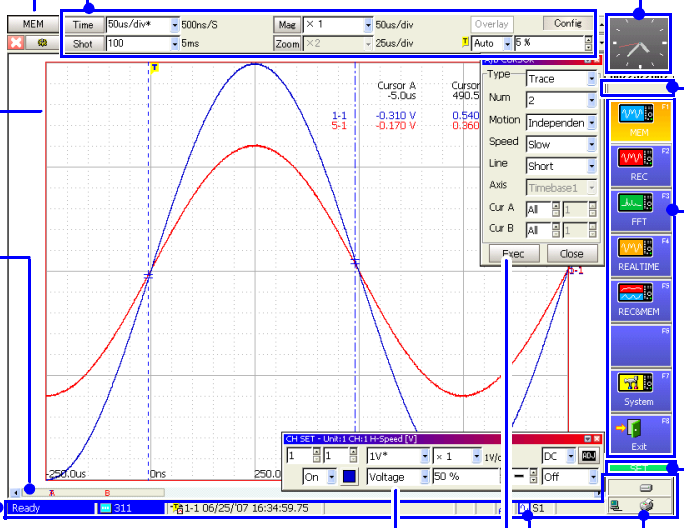
Recorded Data
Shows data acquired with this instrument. (p. 20)

Scroll Bar (p. 192)
Scrolls waveforms.
The width of the scroll bar indicates the displayed area within the overall recorded waveform. You can use the mouse to scroll.

Status Bar (p. 24)
This bar indicates the current states of data acquisition, internal processing, settings and display information.

Setting Items and Choices (p. 21)
Measurement configuration and trigger criteria settings can be changed. These can be changed while measuring.
Press the **SUB MENU** keys to select the items to change.

Clock
Shows the current time. You can change the display appearance.
Clock setting procedure (p. 364)



Input Channel Settings Dialog
Input channel settings can be changed. (p. 134)
(Appears when you press the **UNIT** or **CH** keys, or press or turn the **RANGE** knob)

A/B Cursor Settings Dialog
Select the type of cursors. (p. 202)
(Appears when you press the **TYPE** key or knob **A**)

Press the ESC key to remove the dialog.

"Key Lock" appears when the key-lock state is enabled.

Setting Choices (GUI area)
The cursor indicates the current setting choice.
Select with F keys (F1 to F8).
Press the **FUNCTION MODE** key to change the F key functions. (p. 26)

F-Key Function Status (p. 26)
Shows the current F key status.

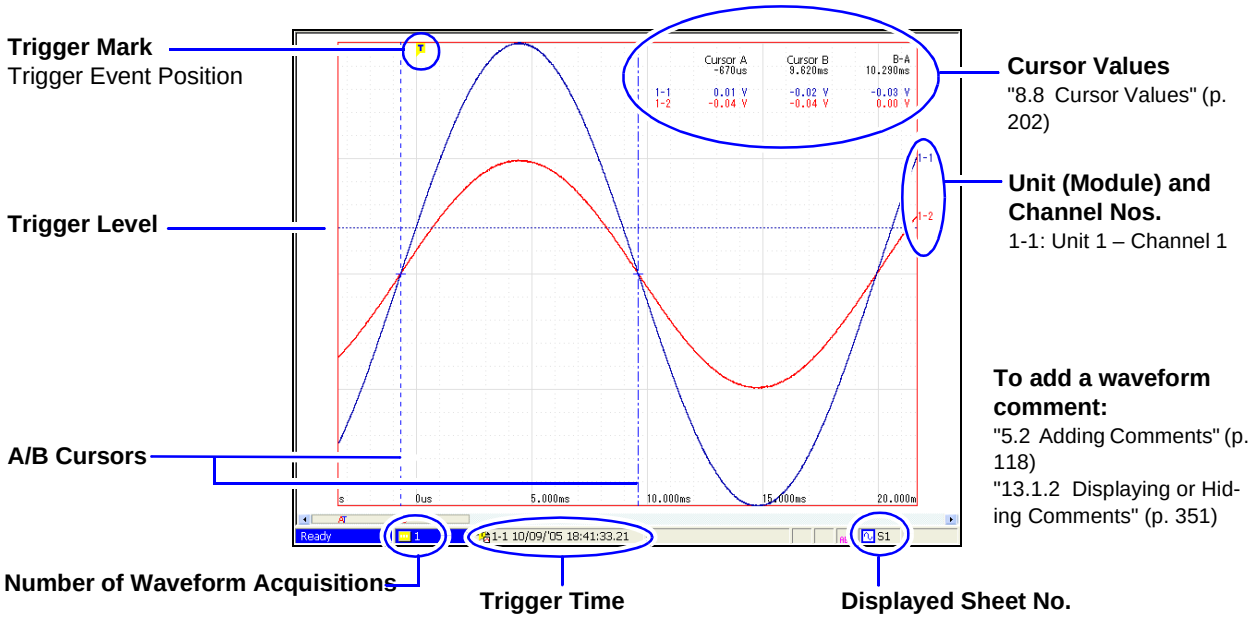
Internal and External Connection Status

Sheet No.

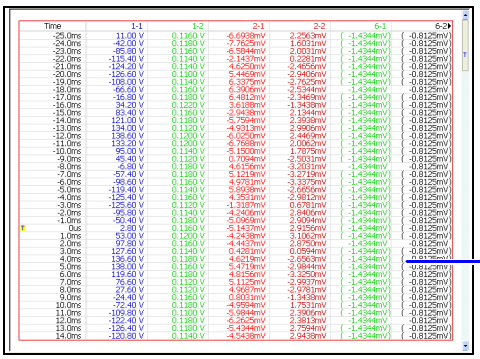
Viewing Recording Data

Data acquired by the instrument is displayed as waveforms or numerical values.

Waveform Display



Numerical Values Display

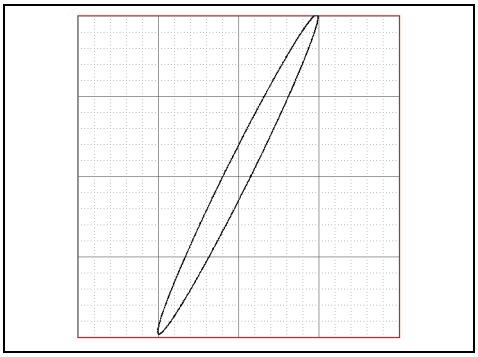


Numerical values of measurement data for each channels

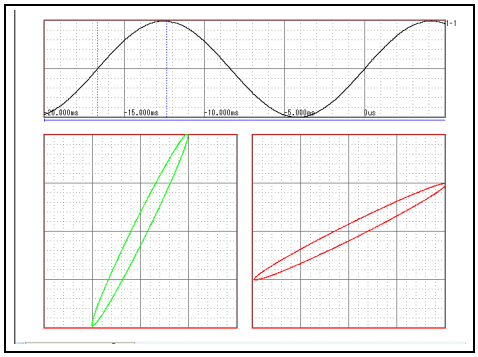
To change the display type:
See "7.2.3 Setting the Display Type" (p. 177)

X-Y Composite:
See "7.4 Composite Waveforms (X-Y Waveforms)" (p. 187)

X-Y Composite Display



X-Y Composite and Waveform Display



Setting Items and Choices

Current setting choices are displayed.

To change a setting:

Use the **CURSOR** keys to move the cursor to the setting item, and select your choice by the corresponding F key.

See "3.3.2 To Change a Setting" (p. 63)

To switch displayed setting items:

Press the **SUB MENU** keys to switch which setting items are displayed. (Some items are function-dependent)

Function		Setting items
Memory Function	MEM	**[Config]** ↔ **[Trigger]** ↔ **[Num Calc]** ↔ **[Mem Div]**
Recorder Function	REC	**[Config]** ↔ **[Trigger]**
REC&MEM Function	REC&MEM	**[Config]** ↔ **[Display]**↔ **[Trigger]** ↔ **[Mem Div]**
Real-Time Saving Function	REALTIME	**[Config]** ↔ **[Information]**
FFT Function	FFT	**[FFT(1/2)]** ↔ **[FFT(2/2)]** ↔ **[Trigger]**

Measurement Configuration & Trigger Criteria Settings [Config]

MEM REC REC&MEM

See "4.4 Setting Measurement Configuration on the Waveform Screen" (p. 114), "6.12 Making Trigger Settings on the Waveform Screen" (p. 167)

With the Memory Function

Timebase

Indicates the timebase (time per division on the horizontal axis) and sampling rate (sampling interval). This setting can also be made on the Status Settings screen.

Sampling Rate

Magnification (p. 211)

Sets time (horizontal) axis magnification/compression of the whole waveform.
You can select [Mag] to display the whole waveform on one screen.

Selectable when the Overlay function is enabled. (p. 104)

Pre-Trigger Setting (p. 140)

Set this to record data prior to a trigger event, or for a specified period afterwards.

Setting Item Category

Recording Length

Shows the recording length and time. The recording length (duration) for each data acquisition is set as a number of divisions. This setting can also be made on the Status Settings screen.

Recording Duration

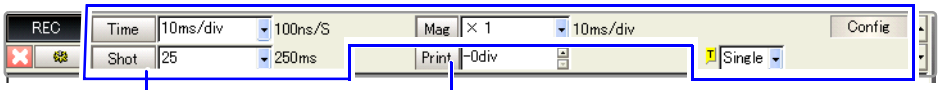
Zoom (p. 213)

Sets the time (horizontal) axis magnification ratio of the selected section of the waveform.

Trigger Mode Setting (p. 138)

Sets subsequent triggering criteria after a measurement operation is finished.
(These settings are made on the Trigger Settings screen.)

With the Recorder Function



The setting procedure is the same as that for the Memory Function. Selection items are different.

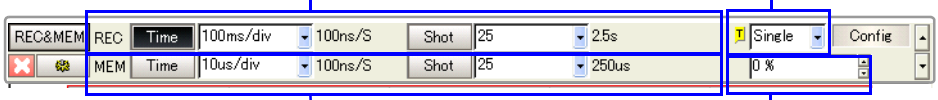
To view waveforms during real-time printing, stop and then restart printing. (p. 318)

With the REC&MEM Function

Trigger Mode Setting (p. 138)

Sets subsequent triggering criteria after a measurement operation is finished.
(These settings are made on the Status Settings screen.)

Timebase and recording length settings for the Recorder waveform



Timebase and recording length settings for the Memory waveform

Pre-Trigger Setting (p. 140)

Set this to record data prior to a trigger event, or for a specified period afterwards.

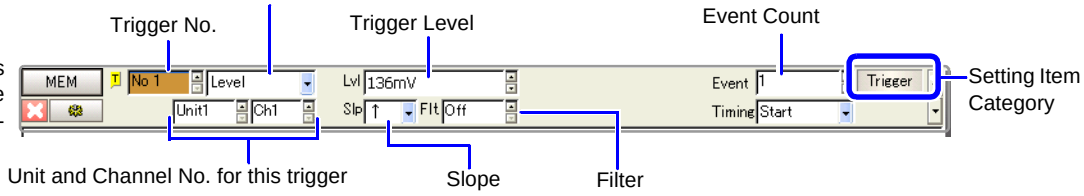
Analog Trigger Settings [Trigger]

MEM REC REC&MEM FFT

See "6.7 Triggering by Analog Signals" (p. 146)

(When using Level Triggering) **Type of Analog Trigger**

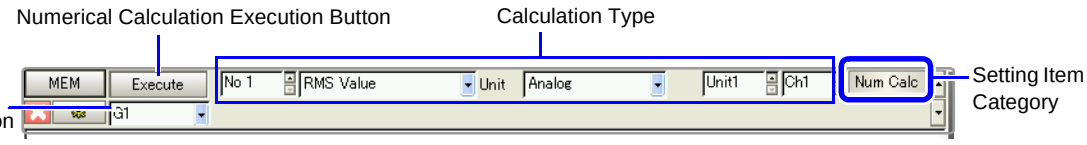
The display differs according to the type of analog triggering.



Numerical Calculation Settings [Num Calc]

MEM

See "Chapter 1 Numerical Calculation Functions" in the *Analysis and Communication Supplement*
(Changes do not affect the measurement currently in progress)

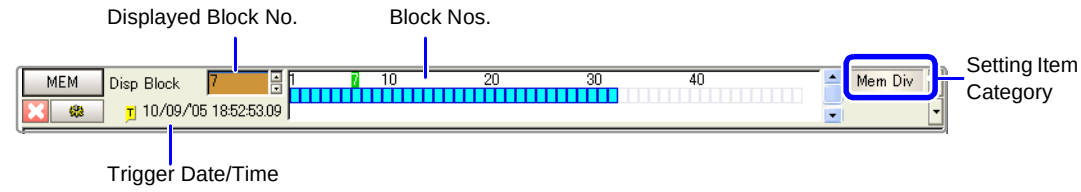


Memory Division Settings [Mem Div]

MEM REC

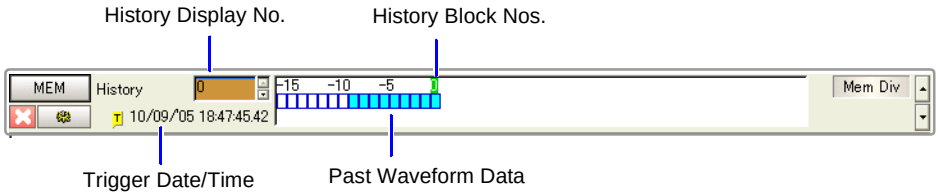
When Memory Division is enabled

See "4.3.4 Dividing Memory" (p. 109), "8.12 Viewing Waveforms in Every Display Block (Memory Division)" (p. 220)



When Memory Division is disabled

See "8.11 Viewing Past Waveforms" (p. 219)



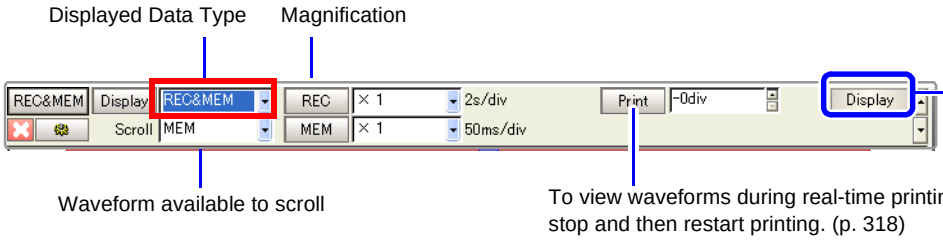
Display Settings [Display](REC&MEM)/ [Config] (REALTIME)

REC&MEM REALTIME

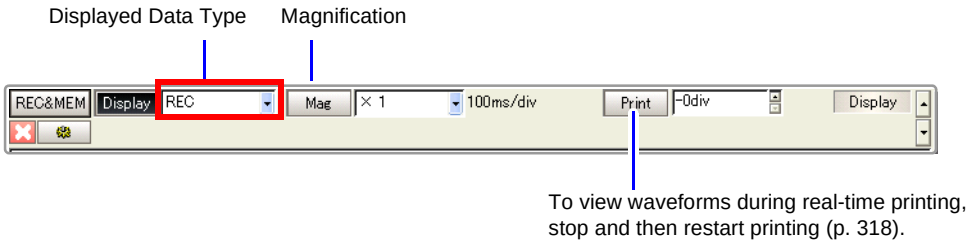
With the REC&MEM Function

See "Chapter 10 Long-Term Monitoring and Instantaneous Recording" (p. 253)

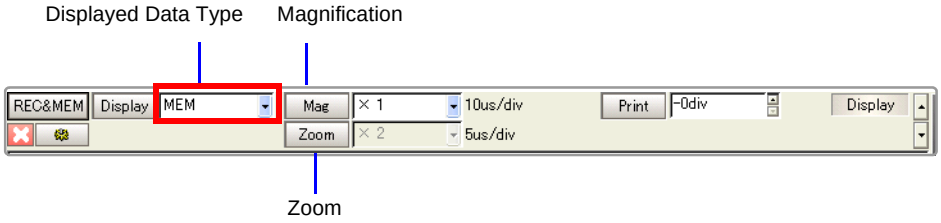
REC&MEM display



REC display

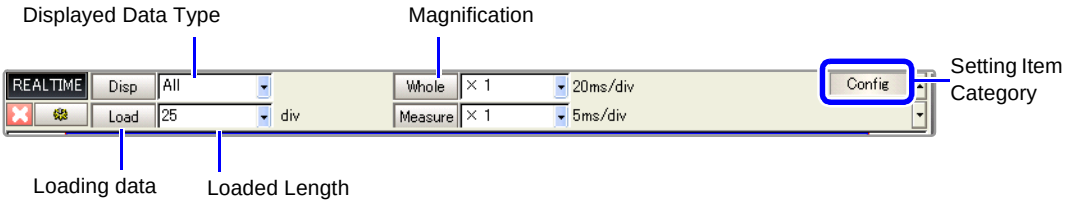


MEM display



With the Real-Time Saving Function

See "Chapter 9 Measuring with Real-Time Saving" (p. 235)



Status Bar

Shows the processing status and various information about the current status of the instrument.

1 Internal Processing State

3 Trigger Info

5 Setting Info
Appears when setting Auto Save, Auto Print and A/B Cursors.

6 Display Sheet
Indicates the type and number of the displayed Sheet.

2 Number of Storage Events

4 Sub Message

7 Displayed Information
(When Memory Division enabled) Shows the block number of the displayed waveform.
(With FFT function) Shows the calculation data type.

8 Internal and External Connection Status (p. 25)
Appears when peripheral devices are connected or installed.

1 Internal Processing State

Pre-Trig Wait	Before acquiring data Appears only when pre-trigger recording is enabled.
Trigger Wait	Trigger wait state
Timer Trigger Wait	Timer trigger wait state
Scanner Wait	Scanner module preparation state
Storing	Data acquisition in progress
Storing Done	Finished acquiring data
MEM End	End of Memory waveform acquisition (REC&MEM function)
Waveform	Waveform generation in progress
Calculating (n/m)	Numerical value calculation in progress
Calculating (Zn)	Waveform calculation in progress
FFT (n/m)	FFT calculation in progress
Calculating Average	Calculating average
Stopped	Operation stopped
Preparing	Preparation in progress
Ready	Idle state
Printing	Printing in progress
Saving	Saving in progress
Auto-Ranging	Automatic range selection in progress
Complete	Finished automatic range selection
(File Name)*	Name of loaded file

* Disappears upon start.

2 Storage Events (Trigger Mode)

(Count)	Number of data acquisition events

3 Trigger Info

1-1 10/11/'05 12:09:19.	Trigger factors (triggered unit/module and channel, timer or external trigger), date and time

4 Sub Message

(Time to Finish)
Projected time to finish storing (appears when recording duration is ten seconds or more)

Count to be Averaged (n/m)

Simple Averaging (Time axis)	Simple Averaging (Frequency)
Exponential Averaging (Time axis)	Exponential Averaging (Frequency)
	Peak hold (Frequency)

5 Setting Info

- Auto Save (Waveforms)
- Auto Save (Calculations)
- Auto Save (Waveforms & Calculations)
- Auto Save (Screen images)
- Auto Save (Waveforms & Screen images)
- Auto Save (Calculations & Screen images)
- Auto Save (Waveforms & Calculations & Screen images)
- Auto Print
- Auto Print (External Printer)
- Vertical Cursors
- Horizontal Cursors
- Trace Cursors

Indicates current settings.

6 Display Sheet

Waveform	FFT
X-Y Composite	Nyquist
Numerical Values	FFT+Nyquist
Waveform & X-Y Composite	Waveform + FFT
	Waveform + Nyquist

Sheet Selection: **SHEET/PAGE** keys

7 Display Information

- Block number when measuring with Memory Division enabled
- Displayed block number for Memory Division
- New — (FFT function) Use newly acquired data for calculations.
- MEM — (FFT function) Use pre-existing data for calculations.

Block Selection: **SHEET/PAGE** keys

See "13.2.6 Specifying SHEET/PAGE Key Operations" (p. 357)

8 Internal and External Connection Status

Appears at the lower right when a peripheral device is connected or installed.

PC card (Slot 1)	**PC card** (Slot 2)	**Internal Storage Media** (when internal drive Model 9718-50 HD Unit installed)	**FD Drive**
LAN	**Power Supply** (AC/DC)	**Internal Printer** (when Model 8995 A4 Printer Unit or 8995-01 A6 Printer Unit is installed)	**Battery Charge** (when Model 9719-50 Memory Backup Unit is installed)

PC Card

(Blank)	No PC Card
	PC Card present
	GP-IB Card present

Appears when a PC Card is inserted in PC Card Slot 1 or 2.

Internal Storage Media

	Hard drive installed

LAN

	Connection Status
(Blank)	Disconnected State

("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

Power Supply

(Blank)	AC power supply
	DC power supply

Internal Printer

(Blank)	Printer not installed
	Printer Installed
	Head-raised error *1
	Out-of-Paper error *1

Battery Charge

(Blank)	Disconnected
	Rapid charging
	Rapid charging finished

Charging finishes about two hours after power on.

"3.2.4 If the Model 9719-50 Memory Backup Unit is Installed" (p. 60)

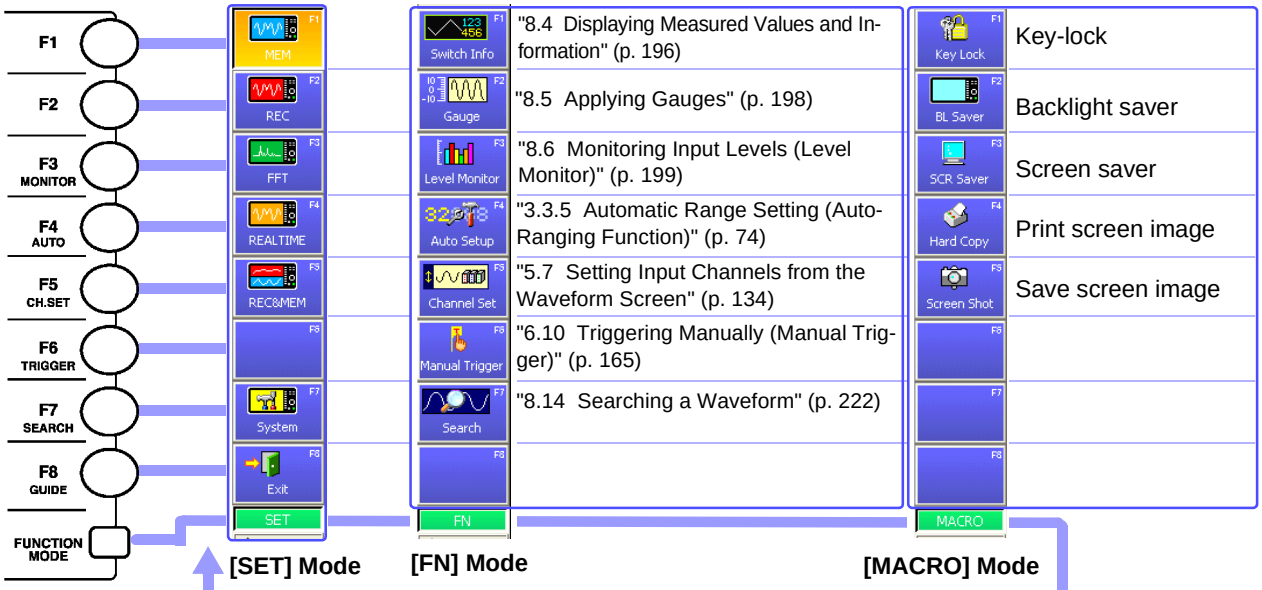
***1. Remedial Actions**

Display	Remedy
Printer lever is raised.	Check the position the head-raising lever.
Out of paper.	Load recording paper.

See "3.3 Loading Recording Paper (With a Printer Module Installed)" in the *Quick Start Manual*

Function Modes and Settings

Pressing the **FUNCTION MODE** key alters the functions of the F keys.



Shows setting choices corresponding to the cursor location.
(This is the same as on the Settings screen)

Displays the settings for each F-key function.
(On the Settings screen, the menu name is displayed)

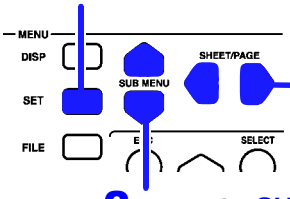
Simple Operations
(This is the same as the Settings screen)

2.5 Settings Screen

Parts of the displayed screen depend on the selected operating function. Refer to the *Analysis and Communication Supplement* for details of the FFT function, calculation function and communication.

To open the Settings screen

1 Press the SET key. (The Settings screen appears.)



3 Press the SHEET/PAGE keys to select a page.

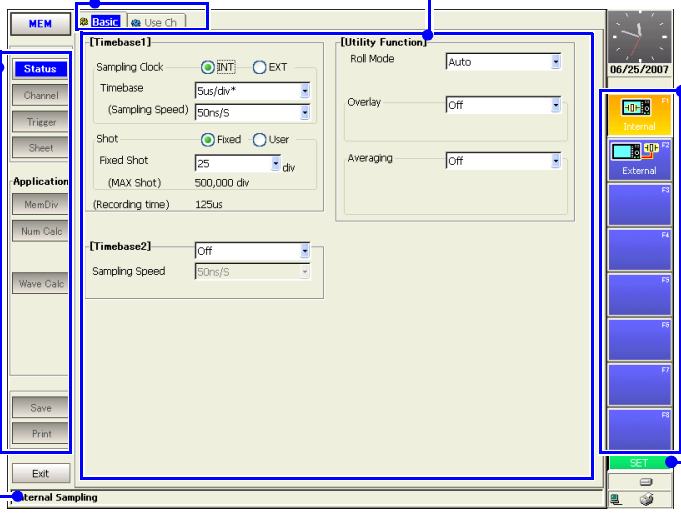
2 Press the SUB MENU keys to select from the Settings menu.

Setting items differ according to the operating function.

Example: Memory Function

Page
Indicates the displayed page.

Setting Items



Settings Menu
Indicates each Settings screen.

Setting Choices
Shows setting choices corresponding to the cursor location.
Press an F key (F1 to F8) to change the setting.

When the [FN] mode is activated by pressing the **FUNCTION MODE** key, the settings menu is displayed at F1 to F8.
About [MACRO] mode: (p. 26)

Help
Shows a description of the setting choices.

Settings Menu

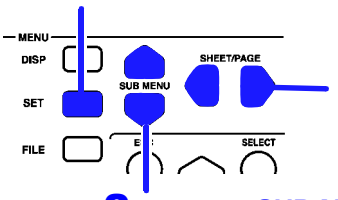
Menu items differ according to the operating function.

Menu	Name on Instrument Screen	Ref.	Description	Supporting Function				
				MEM	REC	REC&MEM	FFT	REALTIME
Status	Status Settings Screen	(p. 28)	Measurement configuration settings.	●	●	●	●	●
Channel	Channel Settings Screen	(p. 32)	Input channel-related settings.	●	●	●	●	●
Trigger	Trigger Settings Screen	(p. 35)	Trigger criteria settings.	●	●	●	●	–
Sheet	Sheet Settings Screen	(p. 36)	Waveform screen display-related settings.	●	●	●	●	●
MemDiv	Memory Division (Mem Div) Settings Screen	(p. 37)	Memory Division-related settings.	●	–	●	–	–
Num Calc	Numerical Calculation (Num Calc) Settings Screen	(p. 38)	Display-related settings for numerical calculations.	●	–	–	–	–
Wave Calc	Waveform Calculation (Wave Calc) Settings Screen	(p. 39)	Display-related settings for waveform calculations.	●	–	–	–	–
Save	Save Settings Screen	(p. 40)	Select the data saving method.	●	●	●	●	●
Print	Print Settings Screen	(p. 41)	Select the data printing method.	●	●	●	●	●

2.5.1 Status Settings Screen

To open the Status Settings screen

1 **Press the SET key.** (The Settings screen appears.)



(When using the Memory Function)

3 **Press the SHEET/PAGE keys to select a page.**
Basic Settings: [Basic] page
Settings for Used Channels: [Use Ch] page

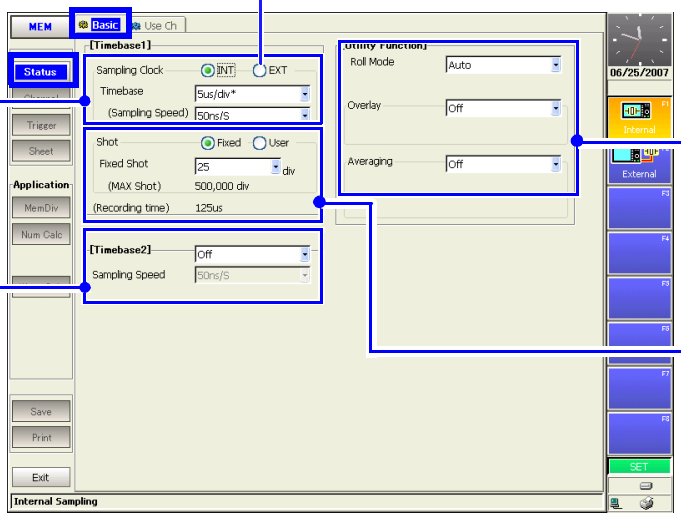
2 **Press the SUB MENU keys to select the** Status **menu item.**

Status (Memory Function) [Basic] Page

Set the timebase (horizontal axis) and recording length (recording duration).

Timebase or Sampling Rate Setting (p. 90)
Set the timebase of the horizontal axis (time per division). The sampling rate changes accordingly.

Timebase 2 Settings (p. 94)
Make these settings to measure with two sampling rates, or when using the Model 8958 16-Ch Scanner Unit together with another input module. (Memory Function only)



External Sampling Setting (p. 382)
Select this to control sampling by means of an external signal input.

Function Application Settings
Set as occasion demands.
- Roll Mode (p. 102)
- Overlay (p. 104)
- Averaging (p. 106)

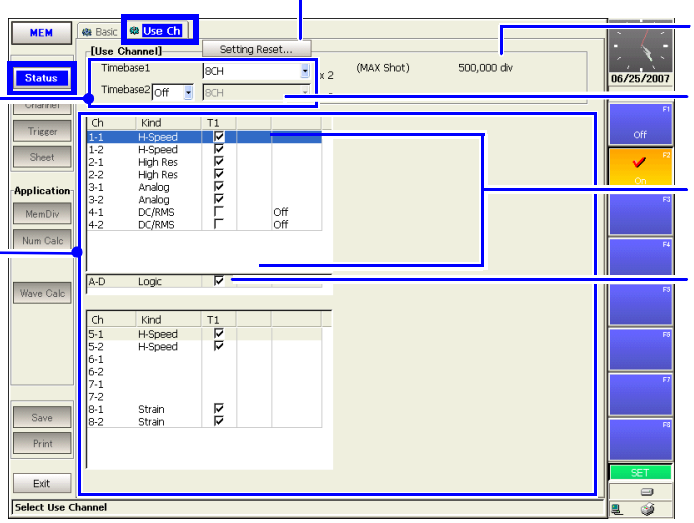
Recording Length Settings (p. 97)
Set the length (recording duration) to record each time data is acquired.

Status (Memory Function) [Use Ch] Page

Select the channel or channel numbers to use.

Setting Channel Nos to use (p. 86)
Select which channel numbers to use.

Measurement Channel Settings
Select the analog and logic channels to use for measuring.



Settings can be reset.

The maximum recording length is displayed.

Set when using Timeaxis 2 (p. 95).

Select analog channels to use for measuring (p. 86).

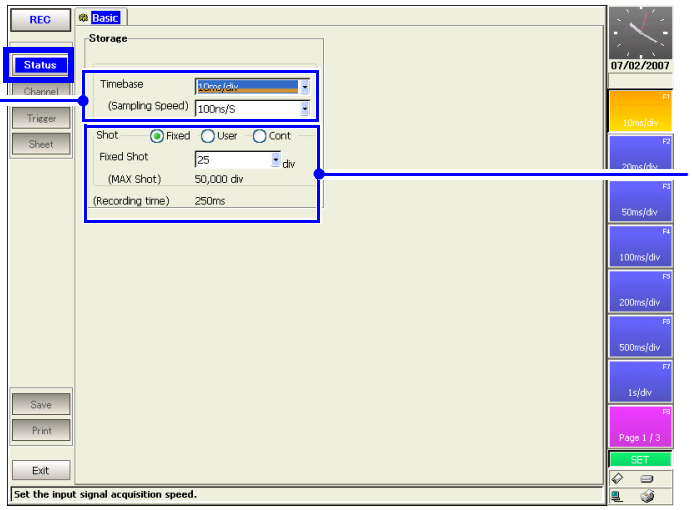
Select logic channels to use for measuring (p. 86).

Status (Recorder Function) [Basic] Page

Set the timebase (horizontal axis) and recording length (recording duration).

Timebase and Sampling Rate Settings

Set the timebase (horizontal axis) and sampling rate (p. 90).



Recording Length Settings

Set the recording length (p. 97).

Status (REC&MEM Function) [Basic] Page

Set the timebase (horizontal axis) and recording length (recording duration).

Recorder Functin Settings Memory Functin Settings

Timebase Settings

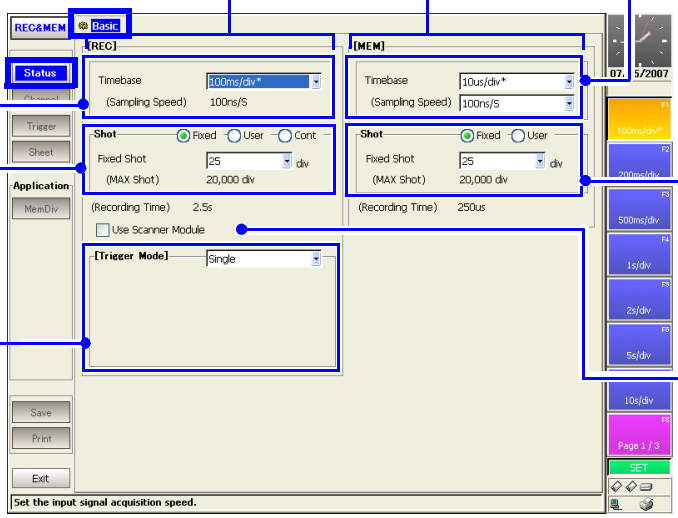
Set the timebase (horizontal axis) (p. 90).

Recording Length Settings

Set the recording length (p. 97).

Trigger Mode Setting (p. 138)

Sets trigger activation criteria.



Timebase or Sampling Rate Setting for Memory waveform (p. 90)

Set the timebase of the horizontal axis (time per division). The sampling rate changes accordingly.

Recording Length Settings (p. 97)

Set the length (recording duration) to record each time data is acquired.

Scanner Module Setting

Select whether to use the Model 8958 16-Ch Scanner Unit.

Status (Real-Time Saving Function) [Basic] Page

Set real-time recording conditions such as the timebase (horizontal axis), recording length (recording duration) and save destination.

See "Chapter 9 Measuring with Real-Time Saving" (p. 235)

Settings for Saving Waveforms

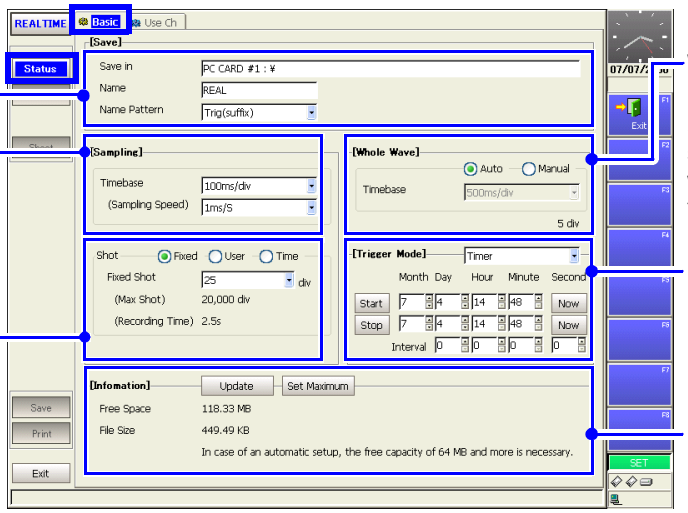
Set the save destination and save name.

Timebase or Sampling Rate Setting

Set the timebase of the horizontal axis (time per division). The sampling rate changes accordingly.

Recording Length Settings

Set the length (recording duration) to record each time data is acquired or set the recording time.



Whole Waveform Timebase

Set the timebase (time per division) for the whole measured waveform (for envelope waveforms).

Recording Condition Settings

Select the method of data acquisition: one-shot (single), continuous or timer.

Save Destination Info

Usable settings are limited by the available space on the save destination.

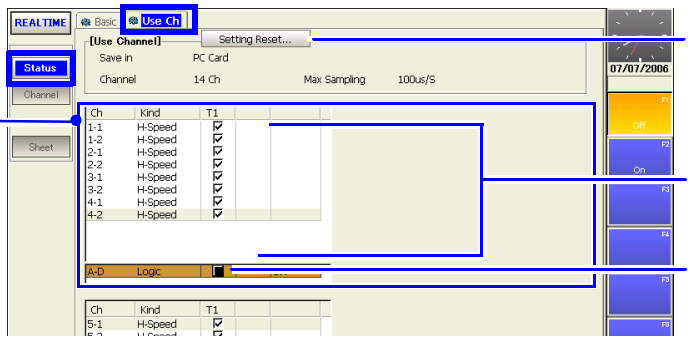
Status (Real-Time Saving Function) [Use Ch] Page

Select the channel or channel numbers to use.

See "Chapter 9 Measuring with Real-Time Saving" (p. 235)

Measurement Channel Settings

Select the analog and logic channels to use for measuring. The 8958 16-Ch Scanner Unit cannot be selected.



Settings can be reset.

Select analog channels to use for measuring.

Select logic channels to use for measuring.

Status (FFT Function) [Basic] Page

Make settings here for FFT analysis.

Input Data Selection

Select whether FFT analysis is to be applied to newly acquired data, or to a pre-existing waveform (Memory waveform).

Frequency Range and Number of Calculation Points

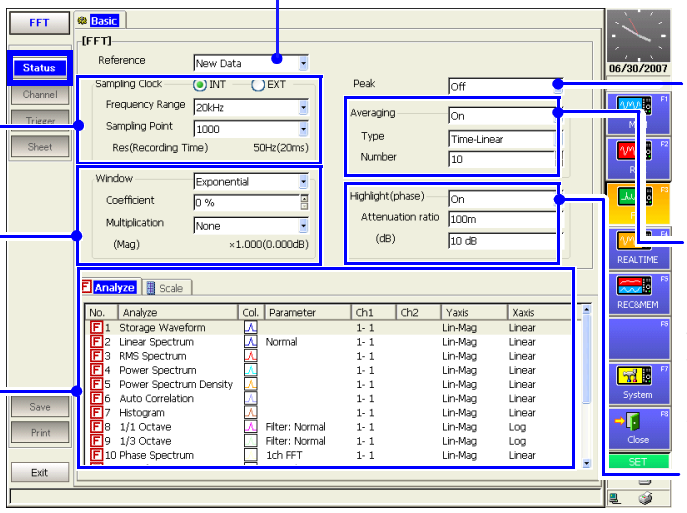
More calculation points provide greater frequency resolution.

Window Function Settings

Selects a window function and correction for acquiring input signals.

FFT Analysis Settings

Selects the analysis mode, analysis channels, x and y axes and display parameters.



Peak Value Display Setting

Selects whether to display the peaks (local or global maxima) of analysis results.

Averaging Settings

Noisy or unstable values can be averaged to clarify the waveform display.
When averaging is enabled, select the method and count for averaging.

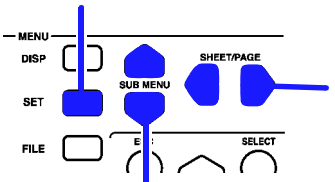
Phase Spectra Highlighting

For the maximum value of a power spectrum or cross-power spectrum, data exceeding the specified ratio can be displayed with emphasis (highlighted).

2.5.2 Channel Settings Screen

To open the Channel Settings screen

1 **Press the SET key.** (The Settings screen appears.)



3 **Press the SHEET/PAGE keys to select a page.**
Analog Channel Settings: [One Ch] page
Logic Channel Settings: [Logic] page (p. 34)

2 **Press the SUB MENU keys to select the** Channel **menu item.**

To make various settings with the All Channels list:
Comment settings: [Comment] page (p. 33)
Input Channel settings: [All Ch] page (p. 33)
Scaling settings: [Scaling] page (p. 33)
Variable Function settings: [Variable] page (p. 34)

Channel [One Ch] Page

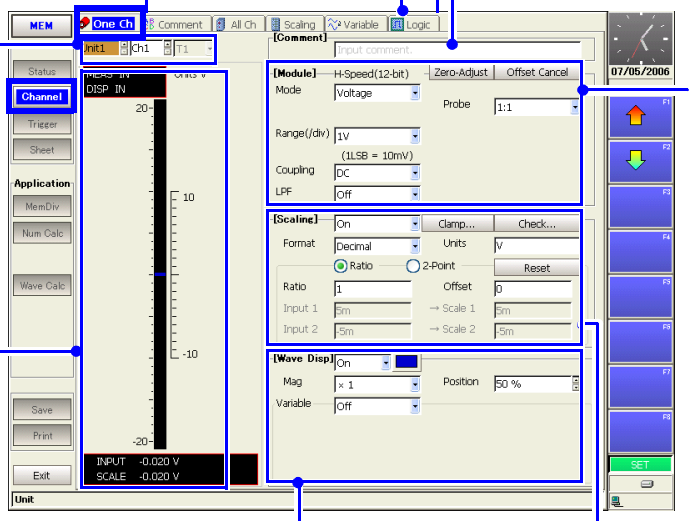
Set analog channels.

Logic Input Settings (p. 183)
Make these settings when using a logic probe.
See "Chapter 3 Input Channel Settings" in the *Input Module Guide*.

All Channel Settings List (p. 129)

Setting Unit (Module) and Channel Nos.

Level Monitor
Indicates the value and range of input relative to the area displayed on the waveform screen for verification. (p. 122)



Comment Setting (p. 118)
Make this setting to enter channel-specific comments. This setting is also available on the [Comment] page (p. 33).
Comments can be displayed on the Waveform screen. See "13.1.2 Displaying or Hiding Comments" (p. 351).

Input Module Settings (p. 116)
Set the input channels for the installed input modules.
See "Chapter 3 Input Channel Settings" in the *Input Module Guide*.
These settings are also available on the [All Ch] page (p. 33).

Input Waveform Settings (p. 170)
Set the waveform display color, zero position, vertical axis magnification and display area. These settings are also available on the [All Ch] page (p. 33).
Variable settings can be made on the [Variable] page (p. 34).
Logic waveform settings can be made on the [Logic] page (p. 184).

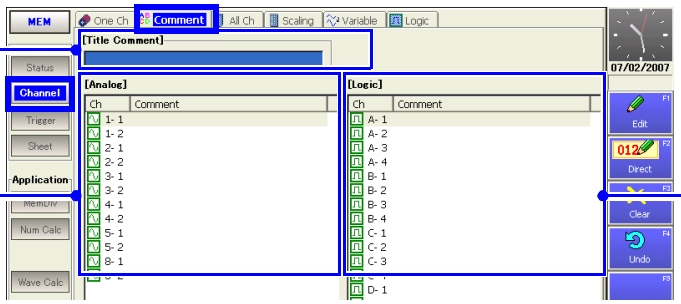
Scaling Settings (p. 123)
Make these settings to convert measurement units for display as physical values when using a clamp or external sensor. These settings are also available on the [Scaling] page (p. 33).

Channel [Comment] Page

Displays a list of comments. Settings can be changed and copied between channels.

Title
The title can be included on printouts. (p. 118)

Analog Channel Comments (p. 119)



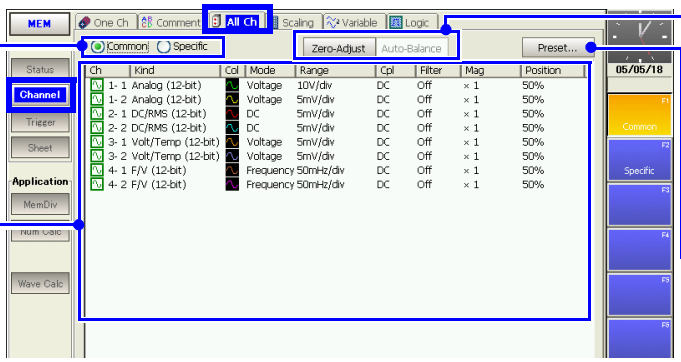
Logic Channel Comments (p. 119)

Channel [All Ch] Page

Shows the list of settings for analog channels. Settings can be changed and copied between channels.

Switch Displayed Items
Switches between display of common settings and channel-specific setting items.

Input Channel Settings List
Setting Procedures (p. 130)
Setting Contents (p. 116)



Execute Zero Adjust and Auto Balance
Executes for all channels at once.
Details: *Input Module Guide*

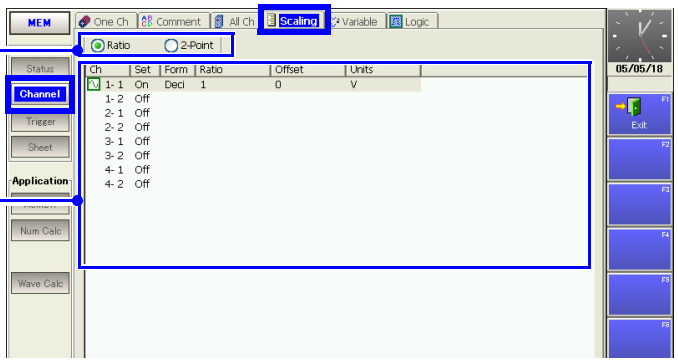
Adjusts the zero positions of all channels at once. (p. 131)

Channel [Scaling] Page

Shows the list of scaling settings for analog channels. Settings can be changed and copied between channels.

Scaling Conversion Method (p. 123)

Scaling Settings List
Setting Procedures (p. 131)
Setting Contents (p. 123)

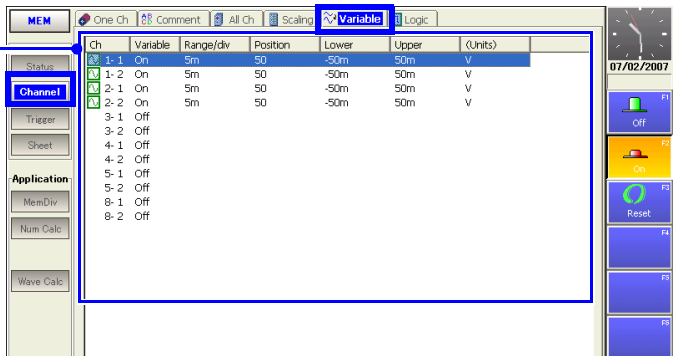


Channel [Variable] Page

Shows the list of variable function settings for analog channels. Entries can be changed, and copied from one channel to another.

Variable Function Settings List

Waveform position and magnification on the vertical axis can be freely set. The variable function can be set on or off for each channel.
Setting Procedures (p. 132)
Setting Contents (p. 215)

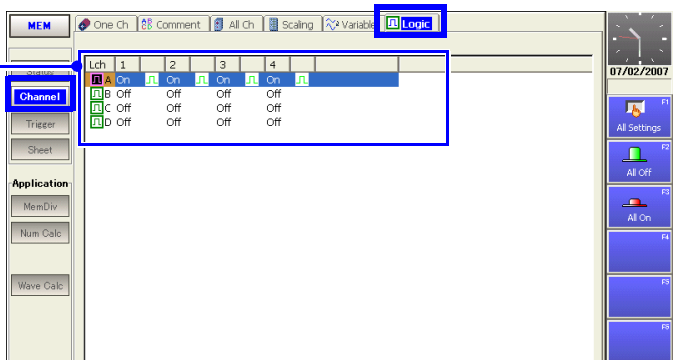


Channel [Logic] Page

Input enable/disable and waveform display color for logic waveforms can be set for each channel.

Logic Channel Settings List

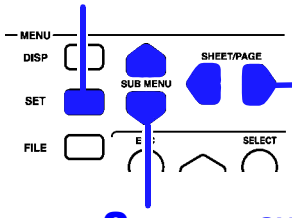
Input enable/disable and waveform display color for logic waveforms can be set for each channel. (p. 184)



2.5.3 Trigger Settings Screen

To open the Trigger Settings screen

1 **Press the SET key.** (The Settings screen appears.)



3 **Press the SHEET/PAGE keys to select a page.**
Analog waveform trigger settings: [Analog] page*
Logic waveform trigger settings: [Logic] page
(*[Analog 1 - 4] with Model 8860-50, or [Analog 1 - 4] and [Analog 5 - 8] with Model 8861-50)

2 **Press the SUB MENU keys to select the** Trigger **menu item.**

Trigger (Memory Function)

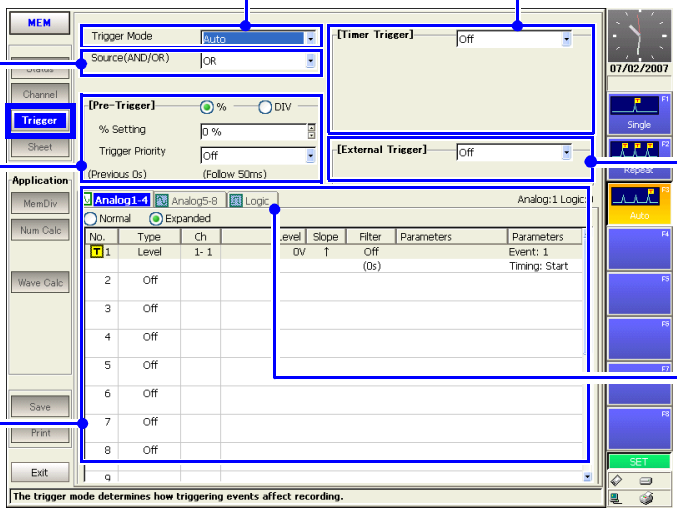
Set trigger criteria for the Memory Function.

Trigger Mode Setting (p. 138)
Sets trigger activation criteria.

Combining Method (AND/OR) for Multiple Trigger Sources (p. 139)

Pre-Trigger Settings (p. 140)
Make these settings to record prior to triggering. When Trigger Priority is On, triggering is allowed during the Pre-Trig Wait.

Analog Trigger Settings (p. 146)



Timer Trigger Settings (p. 162)
Set recording start and end times, and set timing when desired to apply a trigger within a specified period.

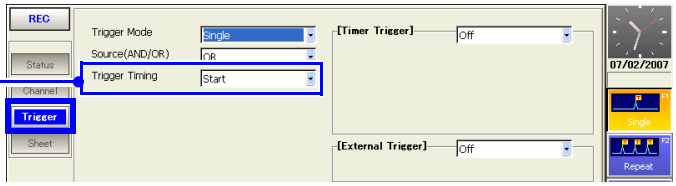
External Trigger Settings (p. 166)
Set this to accept triggering from a signal input on the External Trigger terminal.

Logic Trigger Settings (p. 159)

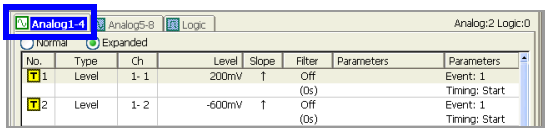
Trigger (Recorder Function)

Set trigger criteria for the Recorder Function. Except for the following, settings are the same as for the Memory Function.

Trigger Timing Setting (p. 144)

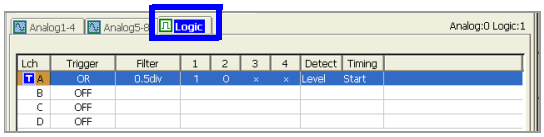


[Analog] Page



Set analog waveform triggers (p. 146).

[Logic] Page



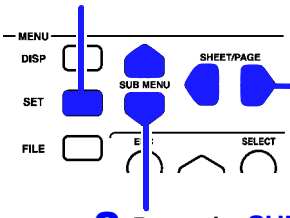
Set logic waveform triggers (p. 159).

2.5.4 Sheet Settings Screen

To open the Sheet Settings screen

Displayed page contents depend on the selected function.

1 **Press the SET key.** (The Settings screen appears.)



2 **Press the SUB MENU keys to select the** Sheet **menu item.**

3 **Press the SHEET/PAGE keys to select a page.**
Analog waveform display settings: [Analog] page
Logic waveform display settings: [Logic] page
X-Y waveform display settings: [XY Comp] page
Waveform calculation display settings: [Wcal] page

Set the display method for the Waveform screen.

Screen Layout Setting (p. 174)

Set the data type and display arrangement for each sheet to be displayed.

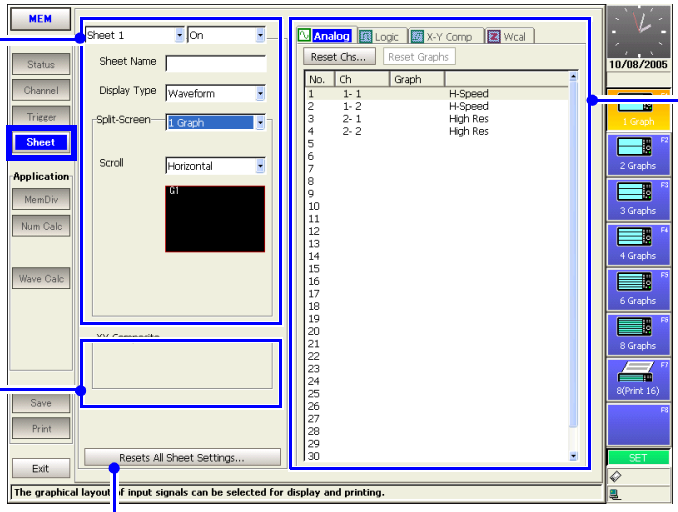
- Sheet Name setting (p. 177)
- Display type (p. 177)
- Waveform scrolling direction (p. 180)
- Split screen and display pattern (p. 178) (function-dependent)

X-Y composite settings (p. 187)

Set for composite waveforms.

- Composing range
- Line interpolation

(function-dependent)

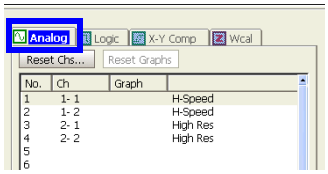


Assigning Channels to Sheets (p. 174)

Assign which channel is to be displayed on each sheet, and waveform display position.

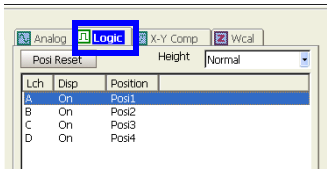
Resets all sheet settings

[Analog] Page



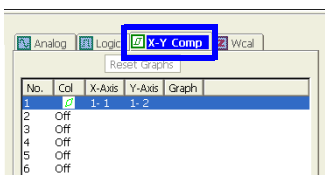
Assign analog channels and set graph arrangement for split-screen display (p. 181).

[Logic] Page



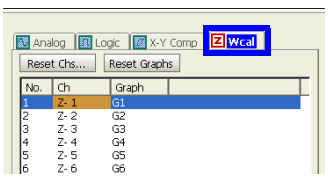
Assign logic channels and set display height and positions of waveform display (p. 185).

[XY Comp] Page



Assign display color of X-Y waveforms and set graph arrangement for split-screen display (p. 187).

[Wcal] Page

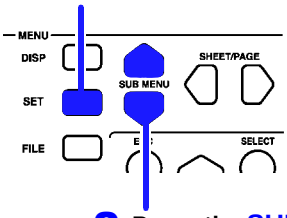


Arrange waveform calculation results and graphs for split-screen display.
(*Analysis and Communication Supplement*)

2.5.5 Memory Division Settings Screen

To open the Mem Div Settings screen **(Memory Function and REC&MEM Function only)**

1 **Press the SET key.** (The Settings screen appears.)



2 **Press the SUB MENU keys to select the** MemDiv **menu item.**

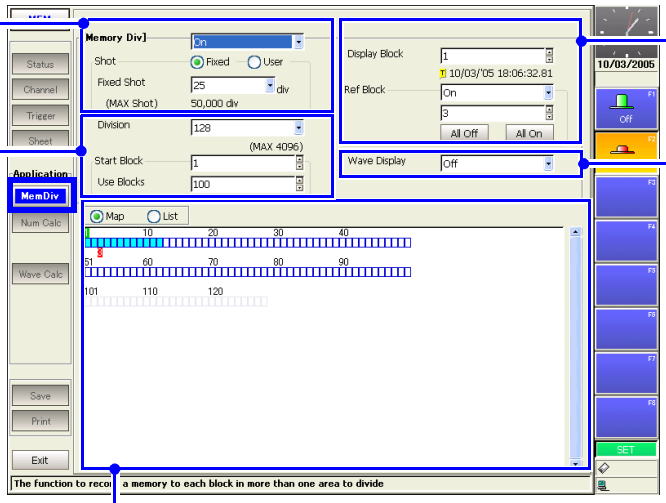
Partitions internal memory space into multiple blocks.

Recording Length Setting

Set the length (recording duration) to record each time a block is acquired.
This is linked to the Recording Length setting on the Status Settings screen. (p. 97)

Memory Division Number and Used Block Settings (p. 110)

Select whether to divide memory into multiple blocks and specify how many and which blocks to use for recording.



Display Block and Reference Block Settings (p. 111)

Select blocks for display and reference on the Waveform screen.

Setting of Waveform Display of Every Block (p. 111)

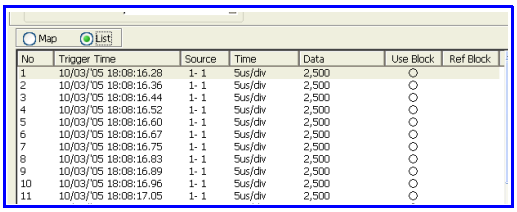
Enable (On) to display the waveform each time a block is acquired.

Memory Division Map

This map shows memory block numbers and the current position. This display can be switched to a list.

Memory Division List

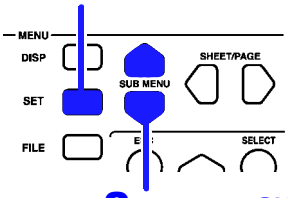
The trigger time, timebase and value of each data point can be verified.



2.5.6 Numerical Calculation (Num Calc) Settings Screen

To open the Num Calc Settings screen (Memory Function only)

1 Press the SET key. (The Settings screen appears.)



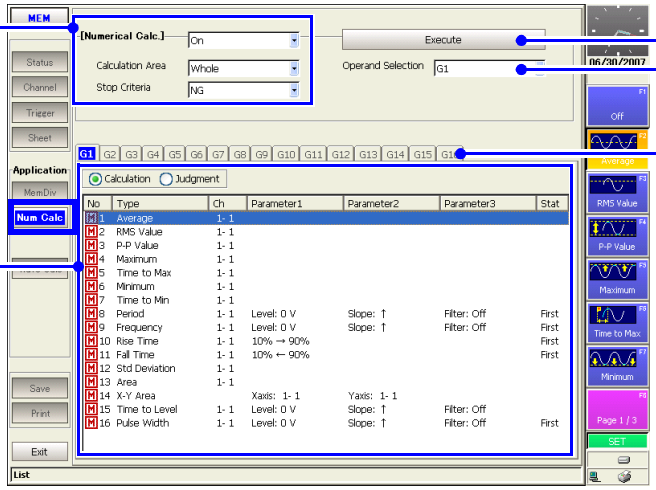
2 Press the SUB MENU keys to select the Num Calc menu item.

Refer to the *Analysis and Communication Supplement* for details of the Numerical calculation.

Set up numerical calculations using acquired waveform data. The calculation results are displayed on the Waveform screen.
The factory default setting for numerical calculations is [Off] (no calculations).

Numerical Calculation Method Setting
Set the calculation area (range) and stop conditions.

Numerical Calculation Type Setting
Set the calculation type and judgment conditions.



Calculate execution Button
Execution is also available from the Waveform screen.

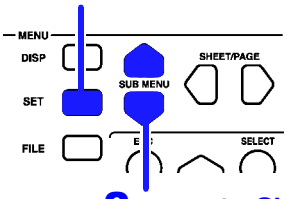
Operand Selection
Select from preset calculation types G1 to G16

Calculation Setting Groups

2.5.7 Waveform Calculation (Wave Calc) Settings Screen

To open the Wave Calc Settings screen **(Memory Function only)**

1 **Press the SET key.** (The Settings screen appears.)



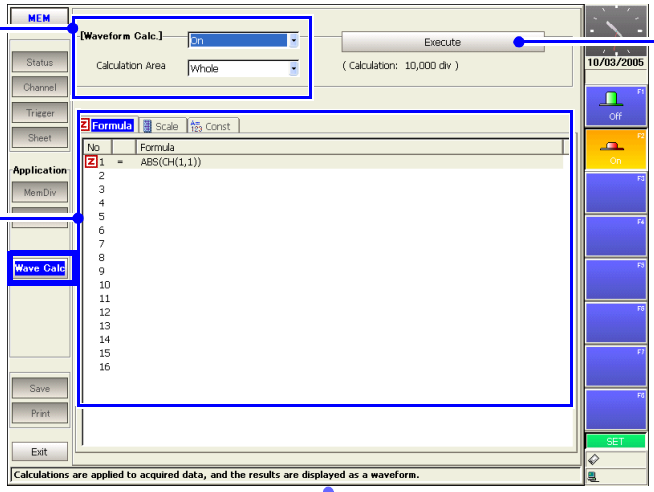
2 **Press the SUB MENU keys to select the Wave Calc menu item.**

Refer to the *Analysis and Communication Supplement* for details of the Waveform calculation.

Set up waveform calculations using acquired waveform data. The calculation results are displayed on the Waveform screen.
The factory default setting for waveform calculations is [Off] (no calculations).

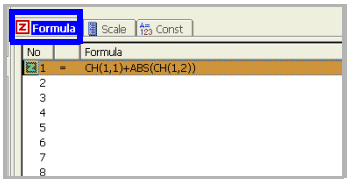
Waveform Calculation Method Setting
Set the calculation area (range).

Waveform Calculation Type Setting
Make settings related to calculation equations and waveform display.



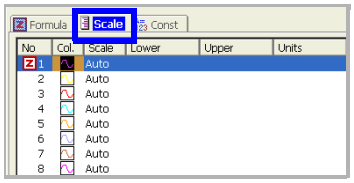
Calculate execution Button

[Formula] Page



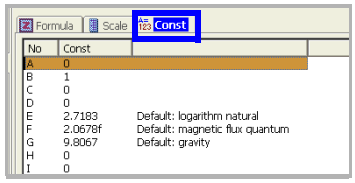
Select a calculation equation. Up to sixteen can be available.

[Scale] Page



Select automatic or manually specified calculation display area. Also select the display color for calculation waveforms.

[Const] Page

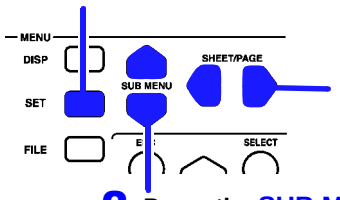


Select constants for calculation equations.

2.5.8 Save Settings Screen

To open the Save Settings screen

1 **Press the SET key.** (The Settings screen appears.)



3 **Press the SHEET/PAGE keys to select a page.**
Automatic saving: [Auto Save] page
Manual saving: [SAVE Key] page

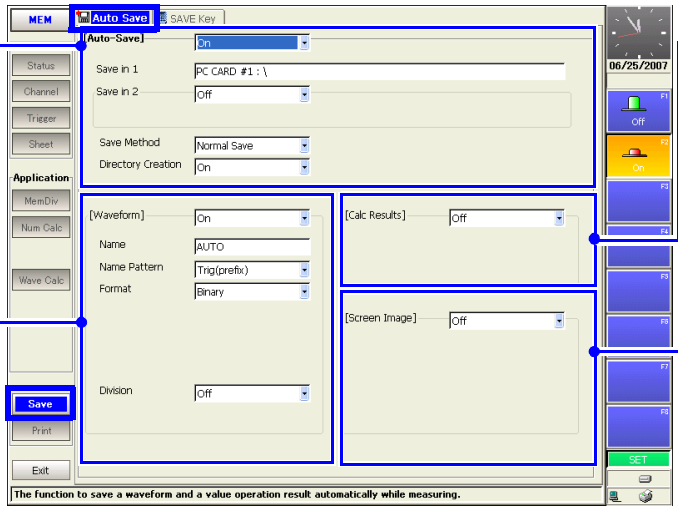
2 **Press the SUB MENU keys to select the Save menu item.**

Save [Auto Save] Page

Make these settings to specify automatic saving.
The factory default setting for auto save is [Off].

Auto-Save Settings (p. 276)
Select the action to take when the save destination or storage media becomes full during automatic saving, such as whether to create new directories. (Default setting: [Off])

Settings for Saving Waveform Data (p. 282)
Select the saving format, area to save and related settings for automatic saving.



Settings for Saving Numerical Calculation Results
(*Analysis and Communication Supplement*)
Make these setting to automatically save numerical calculation results. Select the calculation method on the Numerical Calculation screen.

Settings for Saving Screen Images (p. 287)
Make these setting to automatically save Waveform screens.

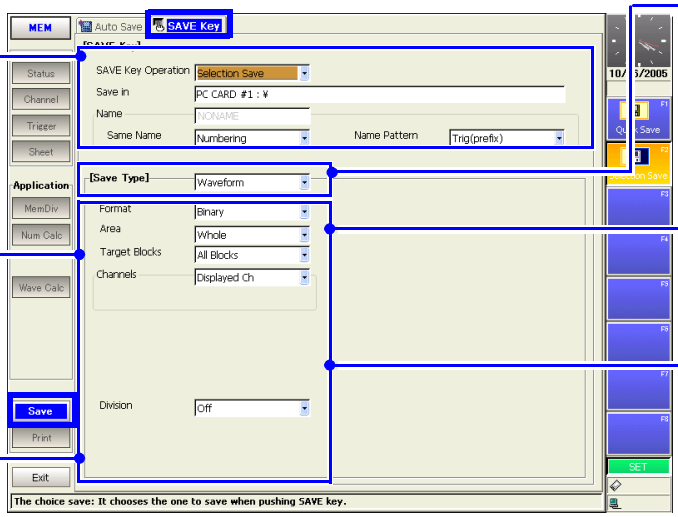
Save [SAVE Key] Page

These settings determine the operation of the **SAVE** key.

Manual Save Settings (Saving by SAVE key) (p. 278)
Set the save destination, file name and related settings for saving with the **SAVE** key.

Settings for Saving Waveform Data (p. 285)
Select the saving format, area to save and related settings for waveform saving.

Settings for Saving Settings Data (p. 280)



Save Type Settings
Select what to save with the **SAVE** key.
Display contents depend on the selections.

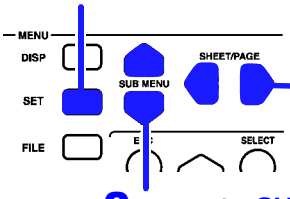
Settings for Saving Screen Images (p. 289)
Make these settings to save images of displayed screens.

Settings for Saving Numerical Calculation Results
(*Analysis and Communication Supplement*)
Select the calculation method on the Numerical Calculation screen.

2.5.9 Print Settings Screen

To open the Print Settings screen

1 **Press the SET key.** (The Settings screen appears.)



3 **Press the SHEET/PAGE keys to select a page.**
Printing method and printer settings: [Printer] page
Printout contents selection: [Print Items] page

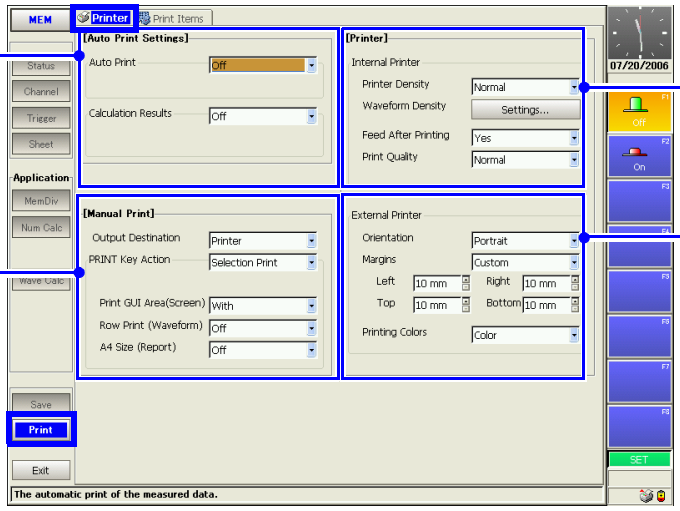
2 **Press the SUB MENU keys to select the** Print **menu item.**

Print [Printer] Page

Select the printing method and printer for automatic or manual printing.
The factory default setting for auto print is [Off].

Auto Print Settings (p. 317)
Make these setting to print automatically.
Numerical calculation results can also printed automatically.

Manual Print Settings (p. 319)
Set the printing method (Quick or Selection Print) and items you want to print when pressing the **PRINT** key.



Internal Printer Settings (p. 323)
Set the printer's print density and quality.

External Printer Settings (p. 325)
Set the paper orientation and margins.

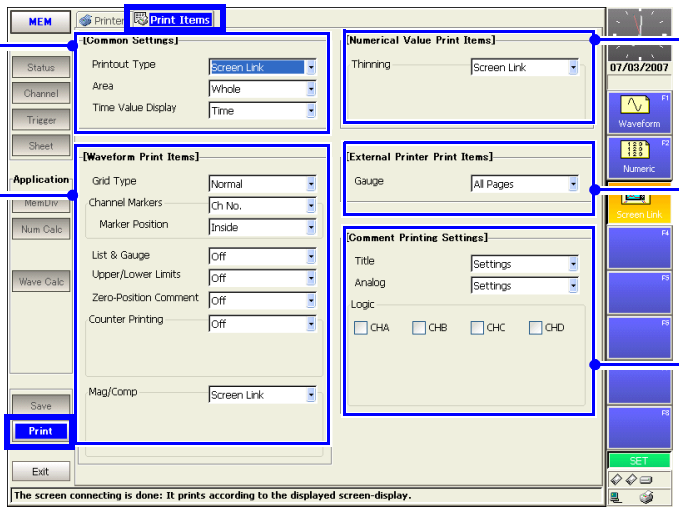
Print [Print Items] Page

Select the items to be printed (printout contents).

Print Item Common Settings (p. 327)
Select the printout type, print area and horizontal axis display value.

Waveform Printing Settings (p. 329)
Select the items to print when printing waveforms.

- Grid Type (p. 329)
- Channel Markers (p. 330)
- List & Gauge (p. 330)
- Print Upper and Lower Limits (p. 331)
- Print Zero-Position Comments (p. 331)
- Print Counter (p. 332)
- Time-Axis Magnification and Compression (p. 333)



Numerical Printing Settings (p. 334)
Select the thinning method for numerical data.

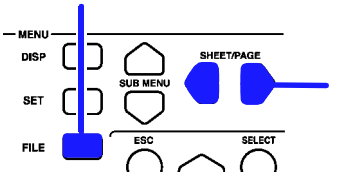
Gauge Printing Setting (p. 336)
(When using an external printer)

Printing Settings for Comments, Title and Settings Data (p. 337)

2.6 File Screen

To open the File screen

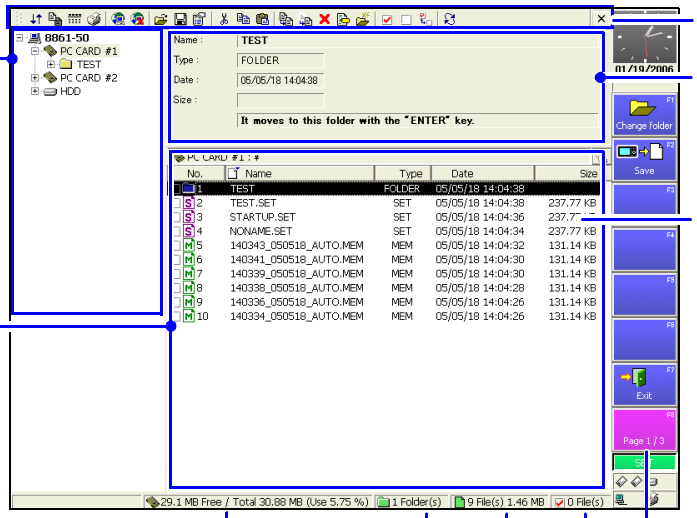
1 Press the FILE key. (the File screen appears)



2 Press the SHEET/PAGE keys to select a page.

Move the cursor to the folder tree or file list.

Load or manage the files.



Folder Tree
Shows the folders on the storage media or hard disk.

File List
Shows a list of storage media, and the files and folders on the media.

Operable with a mouse.

File Info
Shows information about the selected file in the list.

Files and folders are displayed.
The icons indicate the type of file contents.
About File Contents (p. 267)

Available file space and total storage capacity

Number of folders in the File List

Number of files in the File List

Number of files selected in the File List

File Operations
The File Operations page changes each time you press the **F8** key (p. 43).
Press the **FUNCTION MODE** key to enable the [FN] mode and make screen operations available (p. 44).

Operations in the Folder Tree

Open folder	**ENTER** or ▷ **CURSOR** key
Close folder	**ESC** or ◁ **CURSOR** key

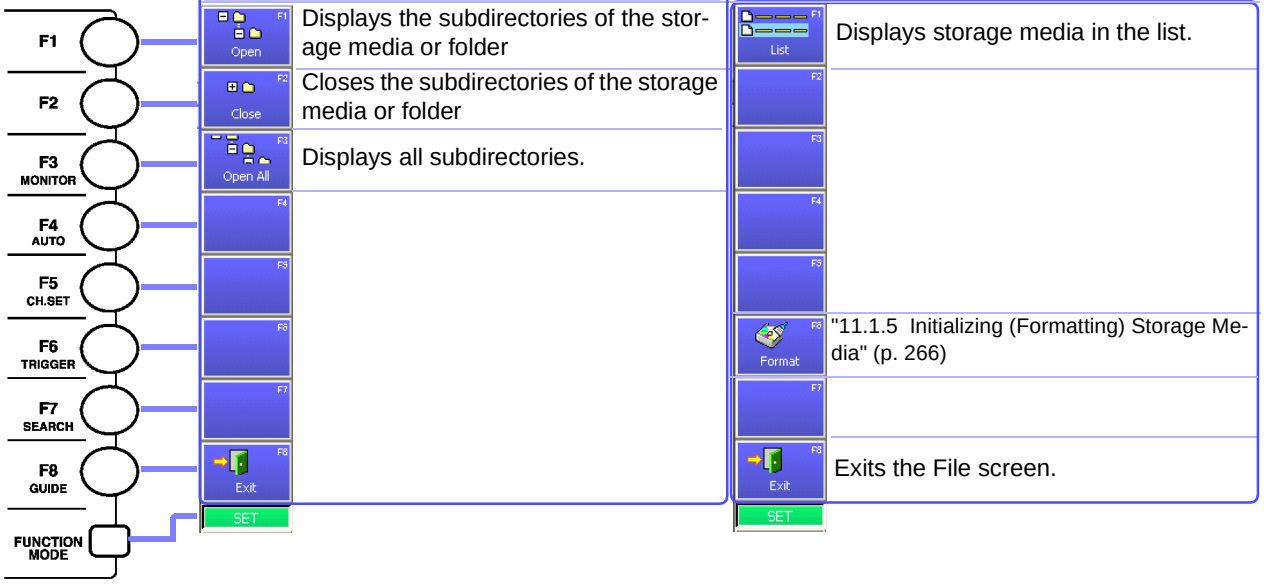
Operations in the File List

To select a file or folder	△ ▽ **CURSOR** keys or **SCROLL** controls (Jog)
To scroll the file list items left and right	◁ ▷ **CURSOR** keys
To display the Media List in the File List	**ESC** key

Function Modes and Settings

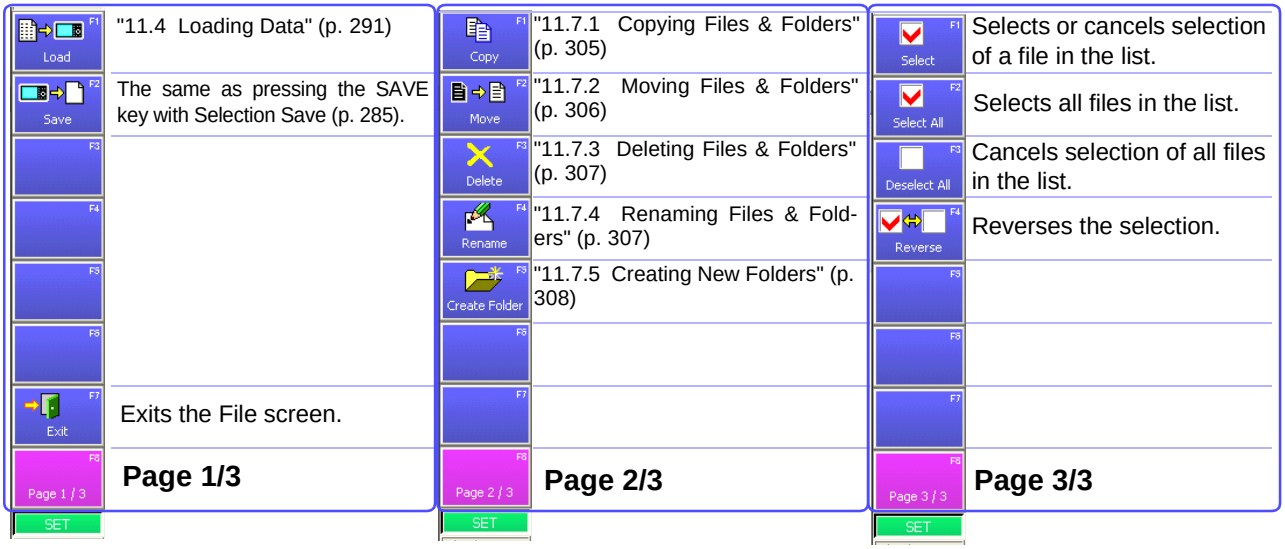
The display changes according to the position of the cursor on the File screen.
Pressing the **FUNCTION MODE** key changes the **F1** to **F8** functions.

[SET] Mode



When the cursor is in the Media Tree	When the cursor is in the File List When storage media is displayed Media List
Displays the subdirectories of the storage media or folder	Displays storage media in the list.
Closes the subdirectories of the storage media or folder	
Displays all subdirectories.	
	"11.1.5 Initializing (Formatting) Storage Media" (p. 266)
	Exits the File screen.

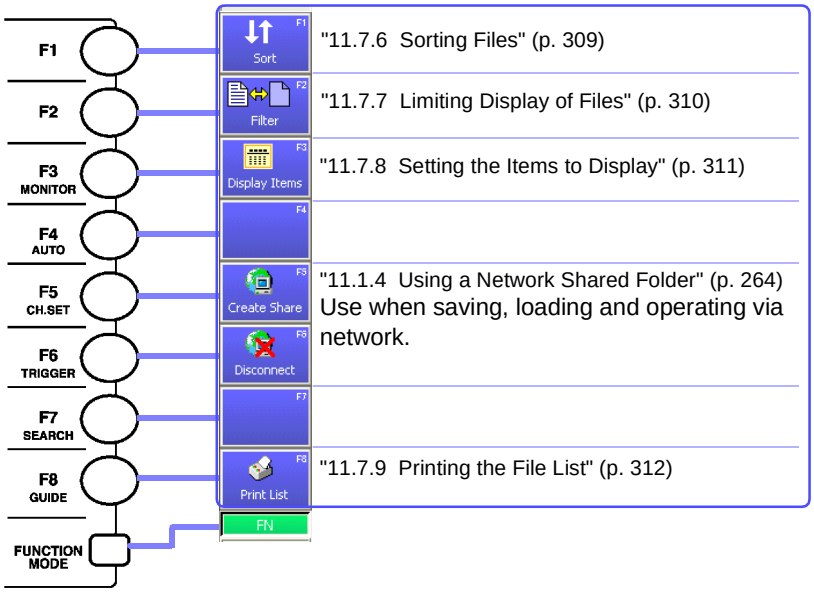
The File Operations page can be changed each time you press the **F8** key.



	When files or folders are displayed	
"11.4 Loading Data" (p. 291)	"11.7.1 Copying Files & Folders" (p. 305)	Selects or cancels selection of a file in the list.
The same as pressing the SAVE key with Selection Save (p. 285).	"11.7.2 Moving Files & Folders" (p. 306)	Selects all files in the list.
	"11.7.3 Deleting Files & Folders" (p. 307)	Cancels selection of all files in the list.
	"11.7.4 Renaming Files & Folders" (p. 307)	Reverses the selection.
	"11.7.5 Creating New Folders" (p. 308)	
Exits the File screen.		
Page 1/3	**Page 2/3**	**Page 3/3**

[FN] Mode

(Common to the Folder Tree and File List)



"11.7.6 Sorting Files" (p. 309)

"11.7.7 Limiting Display of Files" (p. 310)

"11.7.8 Setting the Items to Display" (p. 311)

"11.1.4 Using a Network Shared Folder" (p. 264)
Use when saving, loading and operating via network.

"11.7.9 Printing the File List" (p. 312)

2.7 System Screen

Settings Menu List

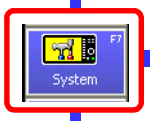
Settings Menu	Screen Name on This Instrument	Ref.	Description
Env	Environment (Env) Settings Screen	(p. 45)	Use this screen to configure the system environment, Waveform screen layout and operating key functions.
Comm	Communication (Comm) Settings Screen	(p. 46)	Make communication-related settings.
Ext Term	External Terminals (Ext Term) Settings Screen	(p. 49)	Set the external control terminals.
Setting	Setting Configuration (Setting) Screen	(p. 50)	Make settings to save or reload an instrument setting configuration, and to automatically reload settings at power on.
Init	Initialization (Init) Settings Screen	(p. 51)	Set the clock, initialize data, run self-checks and scanner module zero-adjust.
Config	Configuration (Config) List Screen	(p. 52)	Displays the instrument's system configuration. No settings are available here.

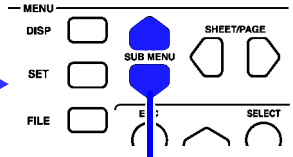
2.7.1 Environment (Env) Settings Screen

To open the Env Settings screen

To open from the Opening Screen

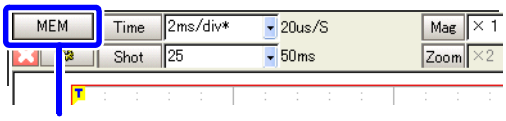
1 Press the **F7 [System]** key.





2 Press the **SUB MENU** keys to select the **Env** menu item.

To open from the Waveform or Settings screens



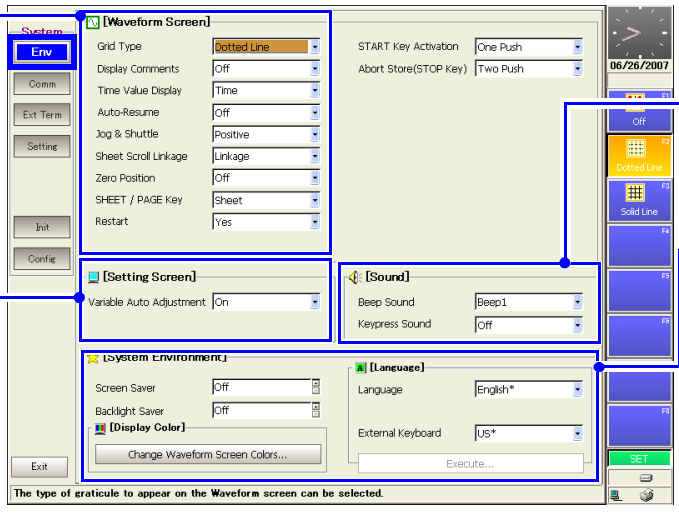
The System screen appears.
(Also appears by holding the **SET** key)

1 Use the **CURSOR** keys to move the cursor to the Function menu, and press the **F7 [System]** key.

To configure the system environment, Waveform screen layout and operating key functions.

Waveform Screen Display Settings (p. 350)
- Grid Type
- Comment Display
- Timebase Display
- Auto-resume
- Jog/Shuttle Operation
- Sheet Scrolling Linkage
- Zero-position display
- SHEET/PAGE key Operation
- Restart Permission
- START Key Acceptance Conditions
- Method for stopping measurement with the STOP key

Setting Screen Setting
- Variable Auto Correction



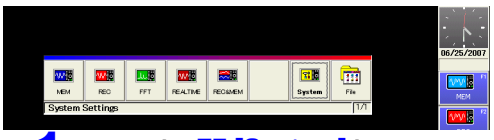
Sound Settings (p. 359)
- Beep Sound
- Key-push Sound

System Environment Settings (p. 360)
- Screen Saver
- Backlight Saver
- Screen Color Settings
- Display Language Selection
- External keyboard settings

2.7.2 Communication (Comm) Settings Screen

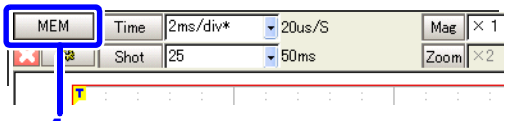
To open the Comm Settings screen

To open from the Opening Screen

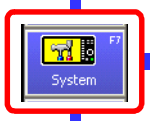


1 Press the **F7 [System]** key.

To open from the Waveform or Settings screens

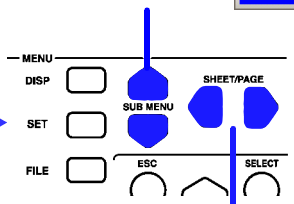


1 Use the **CURSOR** keys to move the cursor to the Function menu, and press the **F7 [System]** key.



The System screen appears.
(Also appears by holding the **SET** key)

2 Press the **SUB MENU** keys to select the **Comm** menu item.



3 Press the **SHEET/PAGE** keys to select a page.

LAN settings: [Communication] page
FTP settings: [File] page
Web Server settings: [Web] page
E-Mail settings: [Mail] page
Communication command settings: [Command] page

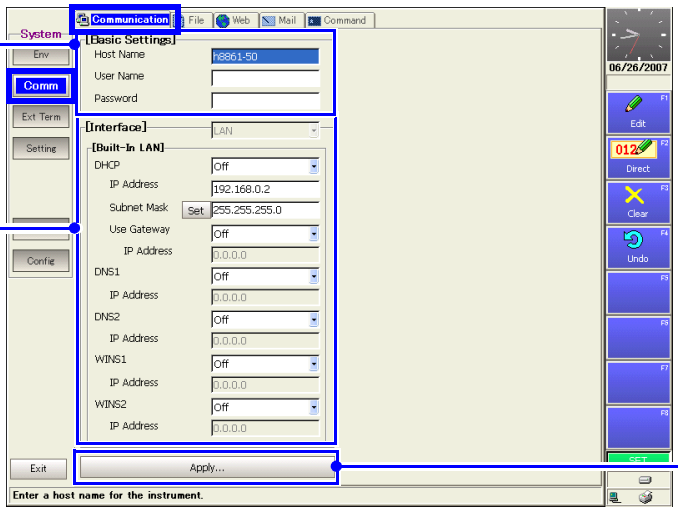
Refer to the *Analysis and Communication Supplement* for details of the settings.

Comm [Communication] Page

Configures the interface for communication with this instrument from a PC.
("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

Basic Settings
- Host name
- Authorization User Name
- Authorization Password

Interface Settings
- LAN
- DHCP Setting
- IP Address
- Subnet Mask
- Gateway
- DNS and WINS Settings



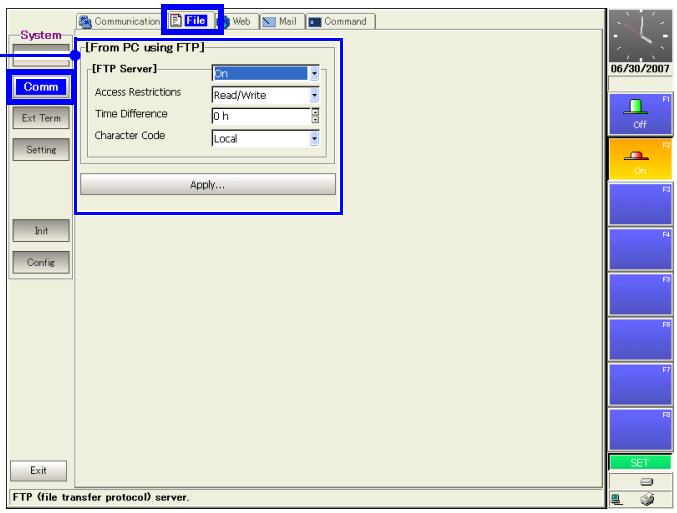
Applies changed settings.

Comm [File] Page

The FTP settings enable access to files on the instrument from a PC.
("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

FTP Settings

Perform these settings to access files on the instrument from a PC using FTP.

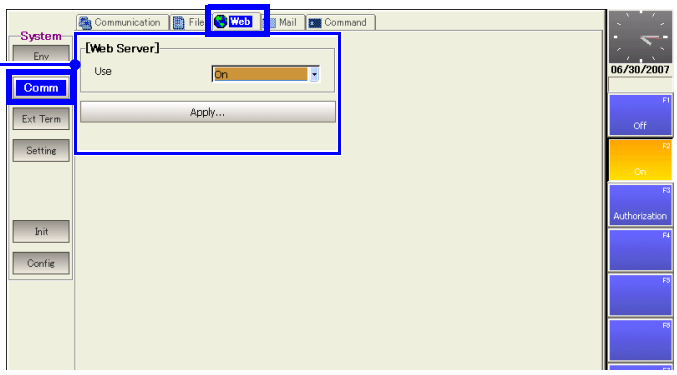


Comm [Web] Page

The Web Server settings enable control the instrument from a browser on a PC.
("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

Web Server setting

Set authorization.

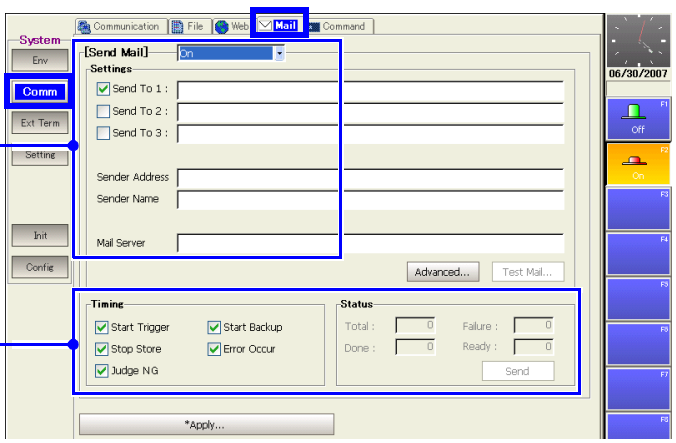


Comm [Mail] Page

When a particular event occurs while measuring, the instrument can send e-mail notifications over a network SMTP mail server to remote computers or portable telephones that support e-mail.
("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

Mail Sending Settings

Sending condition settings



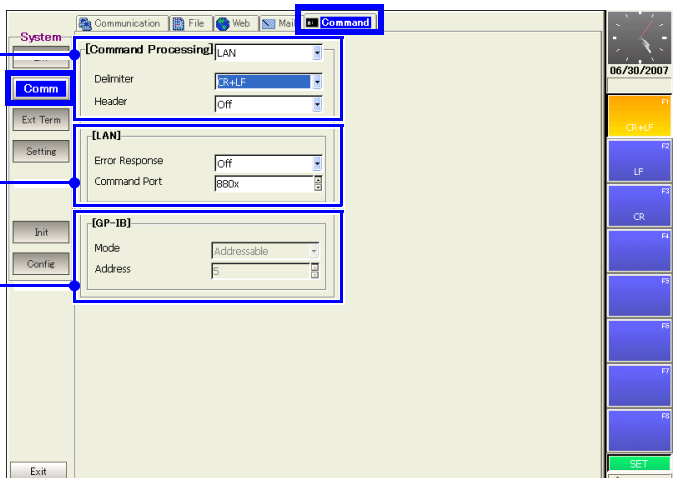
Comm [Command] Page

These settings enable communication with the instrument using command codes.
Refer to the Operating Manual on the supplied CD for operating procedures.
("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

Communication Command Settings

LAN Settings

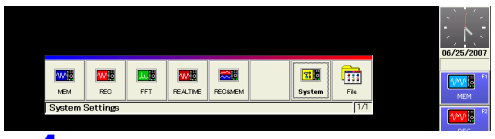
GP-IB Settings



2.7.3 External Terminals (Ext Term) Settings Screen

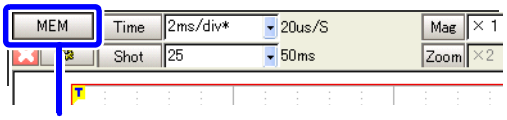
To open the Ext Term Settings screen

To open from the Opening Screen

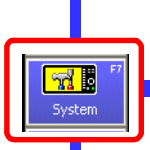


1 Press the F7 [System] key.

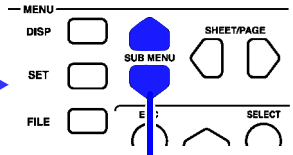
To open from the Waveform or Settings screens



1 Use the CURSOR keys to move the cursor to the Function menu, and press the F7 [System] key.



The System screen appears.
(Also appears by holding the SET key)

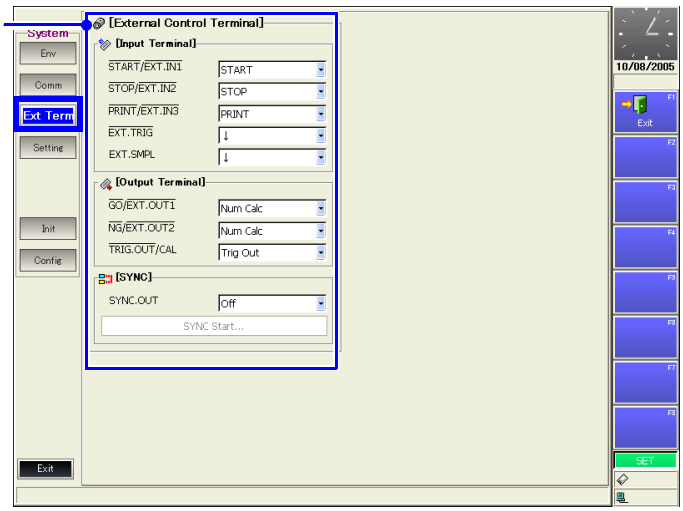


2 Press the SUB MENU keys to select the Ext Term menu item.

Set the external control terminals.

External control terminals Settings (p. 375)

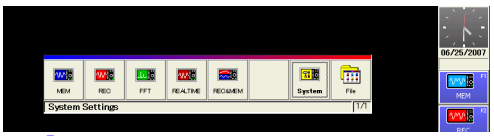
- Input terminals
- Output terminals



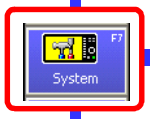
2.7.4 Setting Configuration (Setting) Screen

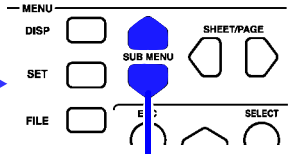
To open the Setting screen

To open from the Opening Screen



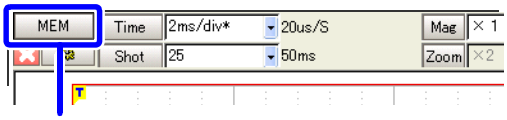
1 Press the F7 [System] key.





2 Press the SUB MENU keys to select the Setting menu item.

To open from the Waveform or Settings screens



The System screen appears.
(Also appears by holding the SET key)

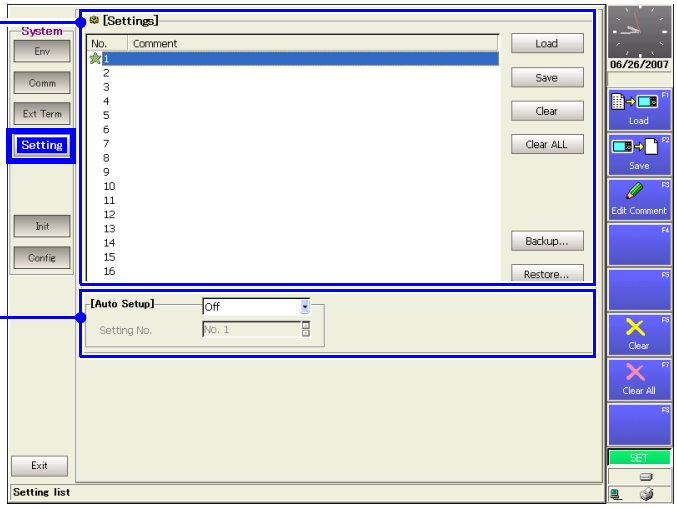
1 Use the CURSOR keys to move the cursor to the Function menu, and press the F7 [System] key.

Instrument setting states can be internally saved (as “Settings Data”). Saved setting states can then be selected and reloaded.

Saving and Reloading Setting States (p. 280)

Auto Setup of Settings Data (p. 294)

A setting state can be automatically loaded when turning power on.



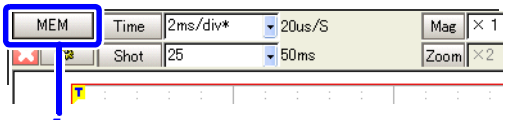
2.7.5 Initialization (Init) Settings Screen

To open the Init Settings screen

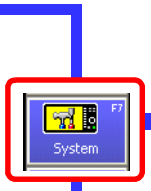
To open from the Opening Screen

1 Press the **F7 [System]** key.

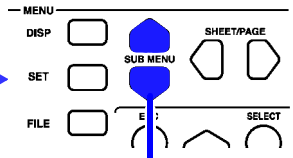
To open from the Waveform or Settings screens



1 Use the **CURSOR** keys to move the cursor to the Function menu, and press the **F7 [System]** key.



The System screen appears.
(Also appears by holding the **SET** key)

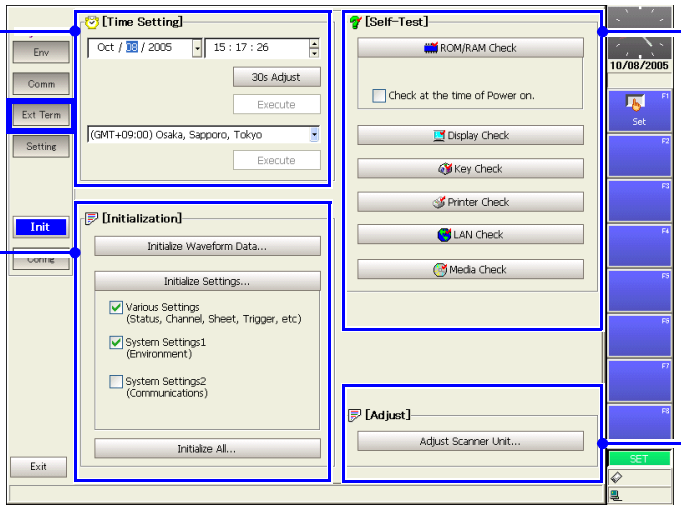


2 Press the **SUB MENU** keys to select the **Init** menu item.

Set the clock, initialize data, run self-checks and set scanner module zero-adjust.

Time Setting (p. 364)

Initialization
- Initializing Waveform Data (p. 365)
- Initializing Settings (p. 366)
- Initializing All



Self-Test (p. 367)
- ROM/RAM Check
- Display Check
- Key Check
- Printer Check
- LAN Check
- Media Check

Scanner Module Zero-Adjustment (p. 373)

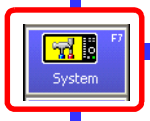
Execute zero-adjustment when the 8958 16-Ch Scanner Unit is installed.

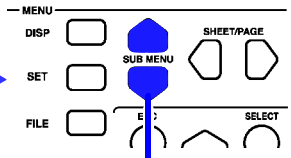
2.7.6 Configuration List (Config) Screen

To open the Configuration List screen

To open from the Opening Screen

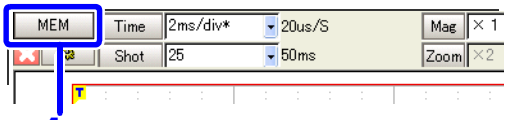
1 Press the F7 [System] key.





2 Press the SUB MENU keys to select the Config menu item.

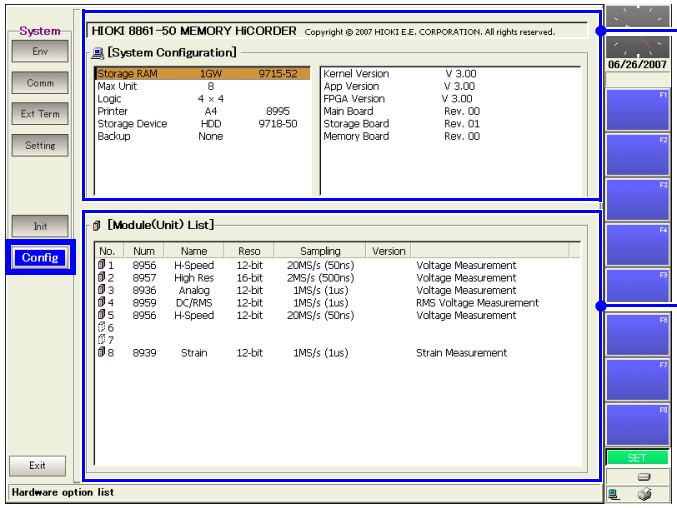
To open from the Waveform or Settings screens



The System screen appears.
(Also appears by holding the SET key)

1 Use the CURSOR keys to move the cursor to the Function menu, and press the F7 [System] key.

Displays the instrument's system configuration. Settings cannot be changed here.
Display contents are the same as the System Configuration List displayed on the Opening screen.



System Configuration (p. 374)

Module (Unit) List
Shows information about installed input modules.

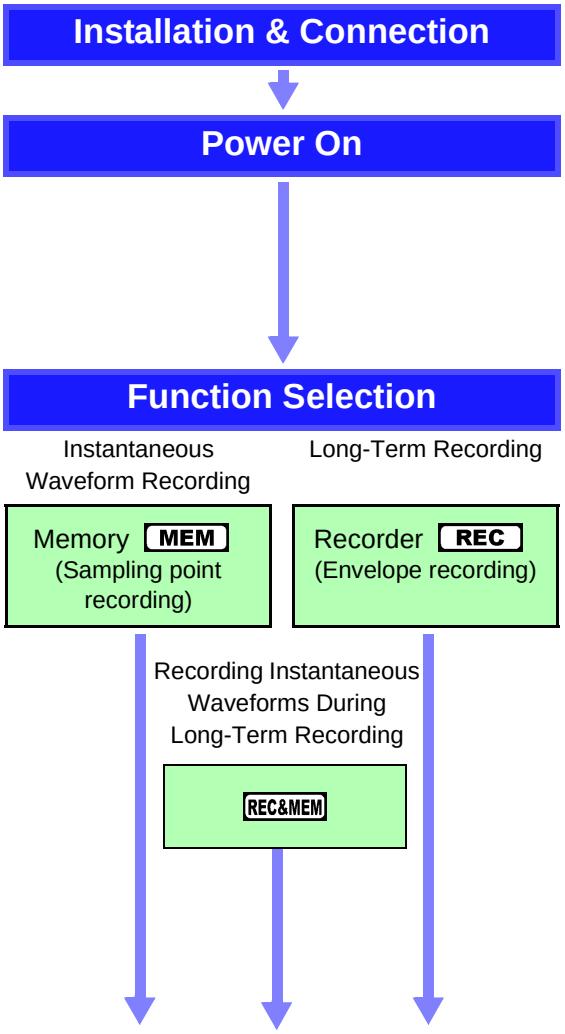
Operation Overview Chapter 3

3.1 Measurement Workflow

3.1.1 Analog Waveform Recording

Refer to "Appendix 2.1 List of Default Settings" (p. A9) for default settings.
The default setting for Auto Save and Auto Print is Off (disabled).
Set the items indicated by white text within the boxes as needed. To simultaneously record logic waveforms, also read "3.1.2 Logic Waveform Recording" (p. 57).

Procedure (asterisks (*) indicate settings that can be changed while measuring)



Overview and references

Install the input modules and cables required for measurement.

See "Chapter 3 Measurement Preparations" in the *Quick Start Manual*
"Chapter 2 Connections" in the *Input Module Guide*

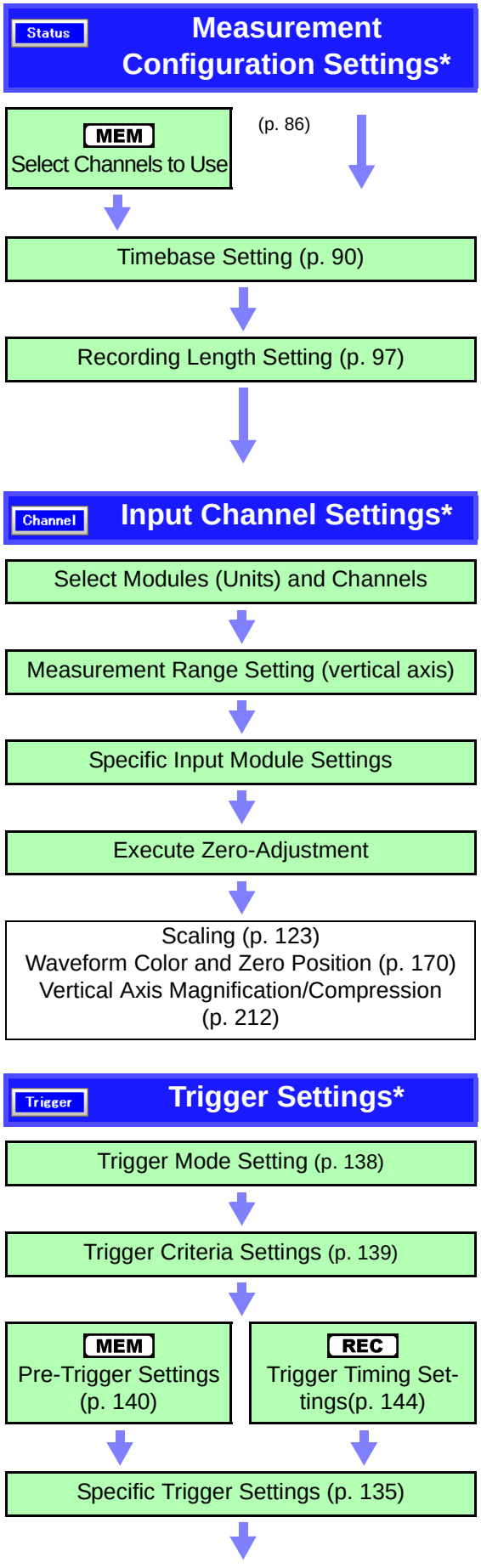
Zero-Adjustment is required if the 8958 16-Ch Scanner Unit is installed (p. 373).

See "2.2.7 Connecting to the Model 8958 16-Ch Scanner Unit" in the *Input Module Guide*

Select the appropriate function.

See "Choosing the Appropriate Function" (p. 82)

- MEM **Memory Function**
  Records relatively fast signals from µs to minutes
- REC **Recorder Function**
  Record relatively slow signals at low speeds from ms to hours
- REC&MEM **REC&MEM Function**
  By enabling a trigger with the Memory function, transient phenomena can be recorded during monitoring and long-term recording with the Recorder function.
- REALTIME **Real-Time Saving Function**
  Long-term measurement data can be saved to storage media in real time (p. 235).
- FFT **FFT Function**
  Using frequency analysis, spectral analysis and transfer functions can be performed. Analysis is applied to data measured with the Memory function.
  (Refer to the *Analysis and Communication Supplement* for details of the FFT function)



Make settings on the Status Settings screen. (p. 79)

See

- Memory capacity and recording time (p. A35)
- To measure with two sampling rates (p. 94)
- To use the Model 8958 16-Ch Scanner Unit together with other input modules (p. 96)
- If the input signal range is unknown (Auto setting) (p. 74) (Memory function only)

Practical Applications

(Memory Function)

- To view waveforms while recording (Roll Mode) (p. 102)
- To view waveforms overlaid (p. 104)
- To average data (Averaging)(p. 106)

Set on the Channel Settings screen (p. 115).

Set each channel.

See

- Input channel settings (depending on input modules): "Chapter 3 Input Channel Settings" in the *Input Module Guide*
- To adjust input module zero position (Zero Adjust): "3.11.17 Executing Zero Adjustment" in the *Input Module Guide*
- To adjust input signal offset, such as for certain sensors (Offset Cancel): "3.11.18 Executing Offset Cancellation" in the *Input Module Guide*

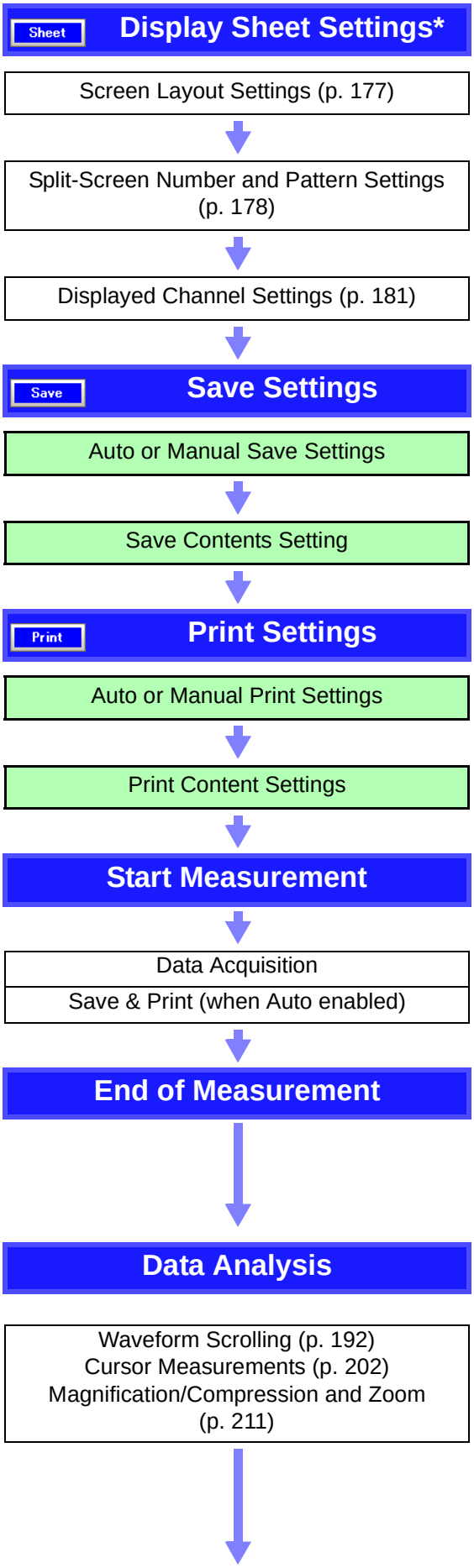
- To display measurement values converted to physical units (Scaling Function) (p. 123)
- To optionally set the displayed waveform height on the vertical axis (Variable Function) (p. 215)

Set on the Trigger Settings screen (p. 135).

(Make these settings to record a specific waveform, such as an anomaly: enable triggering)

See

- To see the waveform prior to trigger occurrence (Pre-Trigger) (p. 140)
- To enable triggering based on an analog input signal (p. 146)
- To enable triggering based on a logic input signal (p. 159)
- To enable triggering based on external control terminal signal input (p. 166)
- To enable triggering at a specified time (Timer) (p. 162)
- To trigger manually (Manual Trigger) (p. 165)



Set on the Sheet Settings screen (p. 174).

(Make these settings to change the Waveform screen layout)

See

- To optionally assign measurement data to Sheets (p. 175)
- To change Sheet names (p. 177)
- For X-Y composite measurements (p. 187)

Set on the Save Settings screen (p. 261).

(Make these settings to save data)

To save automatically while measuring, be sure to make these settings before starting.

See

- About saving methods (p. 267)

Set on the Print Settings screen (p. 313).

(Make these settings when you want to print data.)

To print automatically while measuring, be sure to make these settings before starting.

See

Using an external printer (p. 315)

Press the START key (p. 76).

Press the STOP key to stop (p. 76).

If [Single] trigger mode is selected, recording stops automatically after acquiring the specified data length. Press twice to stop immediately.

Analysis on the waveform screen (p. 191).

See

(Memory Function)

- To calculate numerical values (Analysis and Communication Supplement)
- To calculate waveform data (*Analysis and Communication Supplement*)
- For X-Y composite (p. 187)
- To search waveform data (p. 222)
- To perform FFT calculation (*Analysis and Communication Supplement*)

Optionally Save and Print

Press the SAVE key to save (Manual save).

Press the PRINT key to print (Manual print).

Power Off

Remove the cables from the measurement object, and turn the power off.

Waveform data is erased when power is turned off. However, measurement settings are retained.
The optional Model 9719-50 Memory Backup Unit is required to retain waveform data with power off.

3.1.2 Logic Waveform Recording

To simultaneously record logic waveforms, see also "3.1.1 Analog Waveform Recording" (p. 53).

Procedure (asterisks (*) indicate settings that can be changed while measuring)	Overview and references
Installation & Connection	**Connect the logic probes.** **See** "2.6 Connecting Logic Probes" in the *Input Module Guide*
Power On	
Status **Measurement Configuration Settings***	**Set on the Status Settings screen.**
Timebase Setting (p. 90)	
Recording Length Setting (p. 97)	
Set Channels to Use (p. 86)	Enable (turn on) the channels to use (With Memory function).
Channel **Input Channel Settings***	**Set on the [Logic] page of the Channel Settings screen.**
Set Waveform Display On/Off (p. 184)	Set waveform display for each channel probe on or off. (Default setting: Off)
Set Waveform Display Color (p. 184)	Set as occasion demands.
Trigger **Trigger Settings***	**Set on the [Logic] page of the Trigger Settings screen (p. 135).**
Trigger Mode Setting (p. 138)	
Trigger Criteria Settings (p. 139)	(Make these settings to record a specific waveform, such as an anomaly: enable triggering)
Logic Trigger Settings (p. 159)	
Sheet **Display Sheet Settings***	**Set on the [Logic] page of the Sheet Settings screen.**
Set Display or Non-Display (p. 184)	Enable (set On) the channels to be displayed. (Default setting: On)
Set Display Positions (p. 185)	Set for each channel as occasion demands. (Default settings: Position 1, 2, … beginning with Lch A)
Set Display Height (vertically) (p. 186)	Set as occasion demands. (Default setting: Normal)

From here, proceed the same as for analog channels. Refer to "Save Settings" (p. 55).

3.2 Before Operating

3.2.1 Preliminary Settings and Verification

Setting the Clock

Verify that the instrument's clock is set correctly, as it is required when applying timer triggers (p. 162) and when you need to know when a trigger was applied (p. 352).
Set the clock if the time is incorrect.

See "13.3.1 Setting the Date and Time" (p. 364)

Factory Shipping and Default Settings

When resetting measurement data and settings, you can select which items are to be reinitialized.

See "13.3.2 Initializing Waveform Data" (p. 365)
"13.3.3 Initializing System Settings (System Reset)" (p. 366)
"Appendix 2.1 List of Default Settings" (p. A9)

3.2.2 Using a Mouse

You can connect a commonly available mouse to the instrument to perform the same operations as the keys.

Mouse operating procedures:

See "3.3.4 Mouse Operations" (p. 69)

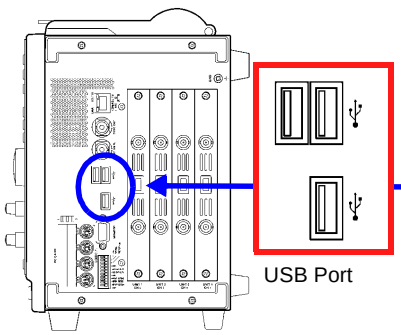
NOTE

Use the mouse only on an insulated surface. When used on a metal surface in some measurement environments, a commonly available mouse can emit electrical noise that can interfere with instrument operation.

Connection

Connect a mouse to either connector.

Right Side



USB Port

Connect a USB mouse.

A mouse pointer ( ) appears on the screen when a mouse is connected.

3.2.3 Using a Keyboard

You can connect a commonly available keyboard to the instrument to enter characters directly.

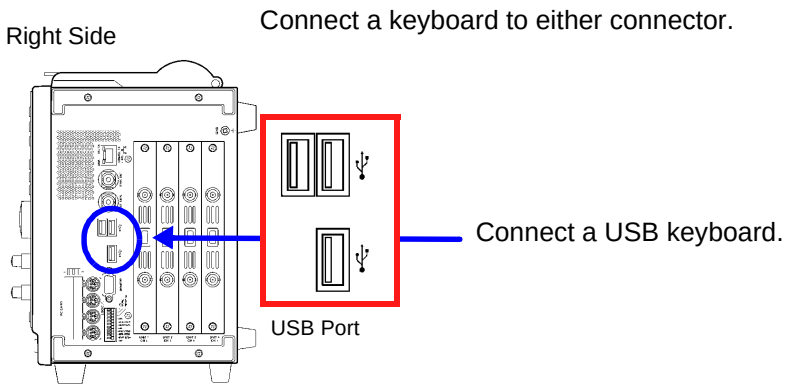
Entry methods:

See "Using a Keyboard" (p. 64)

NOTE

When used on a metal surface in some measurement environments, a commonly available keyboard can emit electrical noise that can interfere with instrument operation.

Connection



3.2.4 If the Model 9719-50 Memory Backup Unit is Installed

Measured waveforms can be backed up.
The quantity of backup memory affects how long data can be retained (backup time).
FFT spectra cannot be backed up.

Typical Backup Times

(Beginning at least two hours after power-on)

Memory Capacity	Backup Time (@25ºC)	
	8860-50	8861-50
With Model 9715-53 Memory Board (Model 8860-50: 1 board, Model 8861-50: 2 boards)	At least 10 hours	At least 5 hours

Smaller memory capacity permits longer backup time.

Charging State

An indicator shows the charging state at the lower right of the screen.

Display	Charging State
	Rapid charging
	Rapid charging finished

NOTE

Backup waveform data is cleared in the following cases:
- When an input module is replaced
- After power-on, if power is cut before the Opening screen appears

- Waveform data may not be backed up if the instrument is turned off during internal processing (such as waveform compression).
- The NiMH battery on the backup unit has a self-discharge characteristic. If the instrument is not used for a long time, turn the power on to charge the battery at least once every two months.
- Charge at an ambient temperature between 10 and 40ºC. Charging outside of this range may result in insufficient charging, and battery capacity may be reduced or battery life shortened prematurely.
- The NiMH battery gradually degrades over repeated charge/discharge cycles, which results in the back-up time becoming shorter. When the back-up time becomes very short, the battery should be replaced. In this case, contact your Hioki agent to arrange for replacement.

3.2.5 If the Model 9684 DC Power Unit is Installed

The Model 9684 enables the instrument to be operated from a DC power source such as a battery.
When both AC power and the Model 9684 DC Power Unit are connected to the instrument, the AC power source has priority. However, when the instrument is operating from AC power and the power switch of the Model 9684 is on, the 9684 is in standby state, and some power is still consumed from the DC source. We therefore recommend turning the Model 9684 off when it is not being used.

The input voltage range of Model 9684 is 10 V DC to 16 V DC. (Voltage fluctuations of ±10% from the supply voltage are taken into account.)

⚠WARNING

- **Before connecting to a battery, confirm that the power switch on the Power Unit is turned off. Connecting to a battery while the Power Unit is turned on may produce sparks and could damage the instrument.**
- **Make sure that the Power Unit's ventilation holes are not obstructed. Otherwise, the instrument could be damaged or a fire could result.**

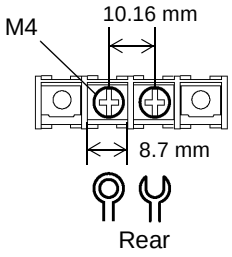
⚠CAUTION

Whenever making DC power connections to the Power Unit, observe polarity carefully, and make connections securely. Reversed-polarity connections may damage the Power Unit.

9684 DC Power Unit Specifications

See 15.1 General Specifications (8) Power Supply Options "9684 DC Power Unit (specify option when ordering)" (p. 399)

Connection Procedure



Required items: Cable to connect the DC source to the Model 9684 DC Power Unit

Recommended cable rating: at least 25 A current capacity

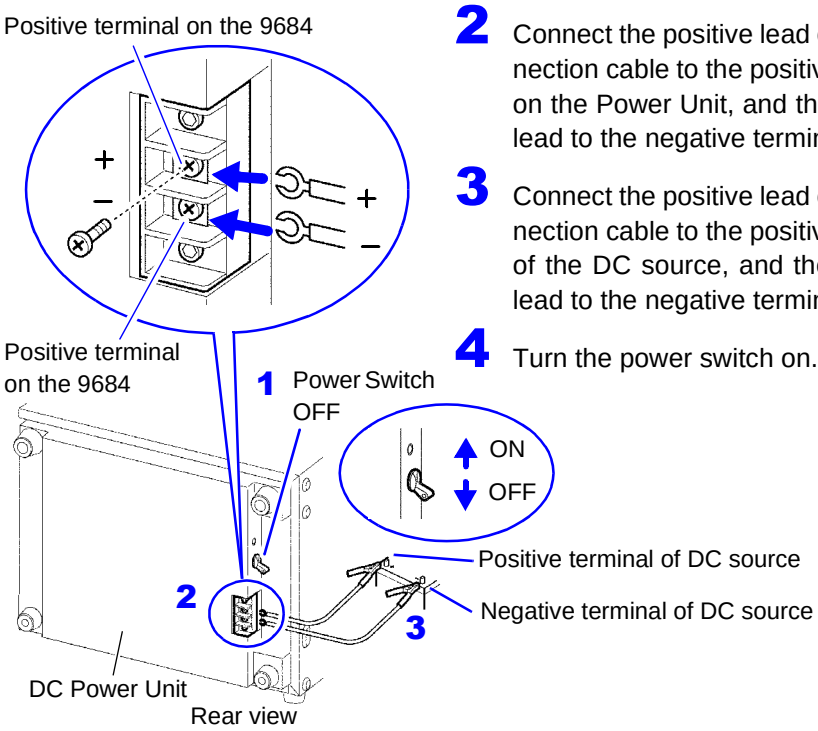
Cable terminations: compatible with the terminal block shown at the left

1 Verify that the power switch on the Power Unit is turned off.

2 Connect the positive lead of the connection cable to the positive terminal on the Power Unit, and the negative lead to the negative terminal.

3 Connect the positive lead of the connection cable to the positive terminal of the DC source, and the negative lead to the negative terminal.

4 Turn the power switch on.



NOTE

- The Power Unit has no external battery charging function.
- When using batteries, be careful to avoid overdischarging.
- The Power Unit shuts off output if it detects overcurrent or overvoltage. If this occurs, turn the switch on the Power Unit off for about one minute, and then back on.

Battery Operating Time

(Nominal values at normal room temperature)
Battery used: 12 V, 38 Ah, fully charged

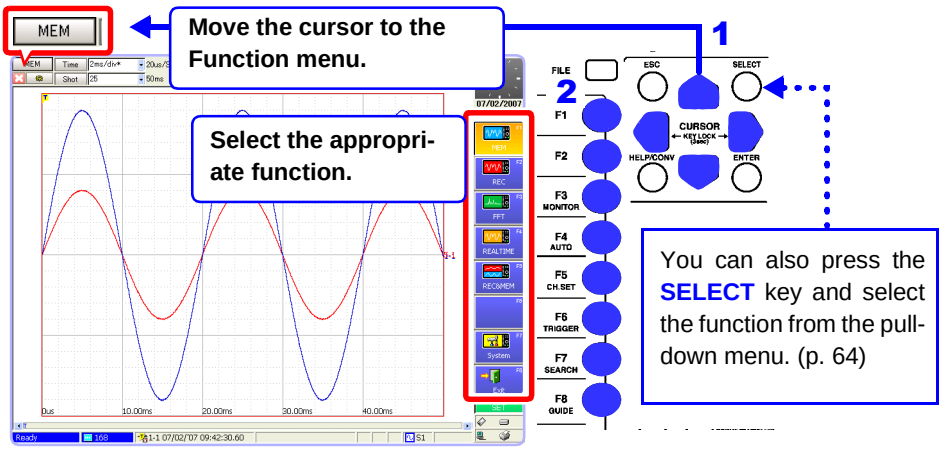
	8860-50		8861-50	
	Model 8936 full installation	Model 8956 full installation	Model 8936 full installation	Model 8956 full installation
Printer not printing (awaiting trigger state, etc.)	Approx. 5 h, 50 min	Approx. 5 h, 30 min	Approx. 3 h, 50 min	Approx. 3 h, 30 min
Printer printing (Recorder Function, 500 ms/div, all black)	Approx. 3 h, 50 min	Approx. 3 h, 40 min	Approx. 2 h, 40 min	Approx. 2 h, 30 min

The above times are affected by battery age and state of charge, ambient temperature and other factors.
Even when operating from AC power, some power is consumed from the DC source if the DC Power Unit is in the standby state (the power switch is on). In this state, battery operating time is about 320 hours.

3.3 Common Operations

3.3.1 Select a Function

The function can be selected on the Waveform or Settings screen.



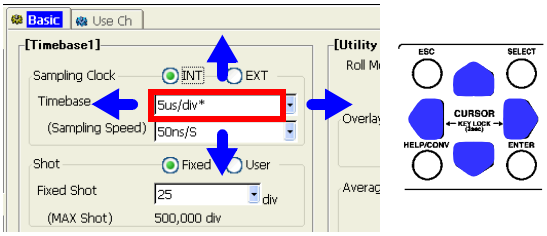
3.3.2 To Change a Setting

A displayed setting can be changed by operating keys, mouse or keyboard.

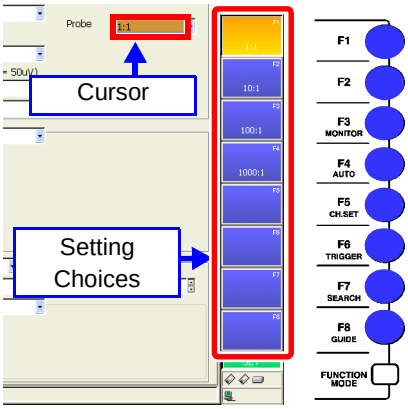
Using the Operating Keys

Use the **CURSOR** keys to move the cursor to the setting item, and select your choice from the F keys or pull-down menu.
Most of the procedures in this manual describe selection using the F keys.

Moving to a setting item



Selecting with the F keys



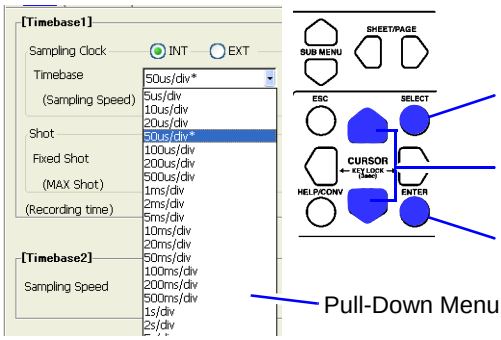
F Keys

Setting choices appear at the right side of the screen (GUI area).

Select by pressing the corresponding F key (**F1** to **F8**).

Additional choices are indicated by [Page */*] appearing at **F8**.
Press the **F8** key to display the additional selections.

Selecting from a pull-down menu



Move the cursor to the setting item, and set as follows:

SELECT key — Opens the pull-down menu.

↓

CURSOR keys — Select the desired setting choice.

↓

ENTER key — Accepts the new setting. (The SELECT key also accepts the setting)

Using a Mouse

See "3.3.4 Mouse Operations" (p. 69)

When ▼ appears to the right of the setting item

1. Click the mouse on the item to be set.
   A pull-down menu appears.
2. Click your setting choice in the pull-down menu.
   You can also click the setting choices at **F1** to **F8**.

When ▼ does not appear to the right of the setting item (for text and numeric entries)

1. Double click on the item to be set.
   The virtual keyboard appears. (p. 65)
2. Click the letters or numbers you want to enter on the virtual keyboard.
   You can also click the setting choices at **F1** to **F8**.

Using a Keyboard

See "Appendix 2.8 Keyboard Assignment Table" (p. A44)

When ▼ appears to the right of the setting item

1. Use the cursor keys (↑ , ↓ , ← and →) on the keyboard to select the item to be set, and press the Space key.
   A pull-down menu appears.
2. Select your choice with the cursor keys (↑ and ↓), and press **Enter** to accept the selection.
   The same **F1** to **F8** setting choices are available with the F keys on the keyboard.

When ▼ does not appear to the right of the setting item (for text and numeric entries)

1. Use the cursor keys (↑, ↓, ← and →) on the keyboard to select the item to be set, and press the Space key.
   The virtual keyboard appears. (p. 65)
   (When **F2** [Direct] is displayed in the setting choices, pressing **F2** on the keyboard enables direct entry using the keyboard)
2. Direct entry from the keyboard corresponds to the virtual keyboard.
   After entering, press the **Enter** key to accept the entry.
   (When using the buttons on the virtual keyboard, press the Space key)

3.3.3 Entering Text and Numbers

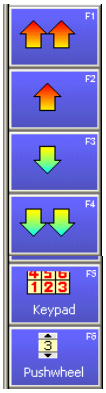
Move the cursor to the setting item for which to enter text or numbers, and press the F keys to select your setting choice.

Entering Numbers

1 Use the **CURSOR** keys to move the cursor to the setting item.
(When using a mouse, double click on a setting item to display the virtual keypad.)

2 Select an input method from the F key choices.

(Depending on the setting item, some choices are not displayed)



↑↑	Increment numerical value.*
↑	Increment numerical value by one.
↓	Decrement numerical value by one.
↓↓	Decrement numerical value.*
Keypad	The virtual keypad is displayed for entry. Settings can be made with either operating keys or a mouse.
Pushwheel	The virtual pushwheel switches are displayed for numeric entry. Numbers are set one digit at a time.

Set the numerical value directly.

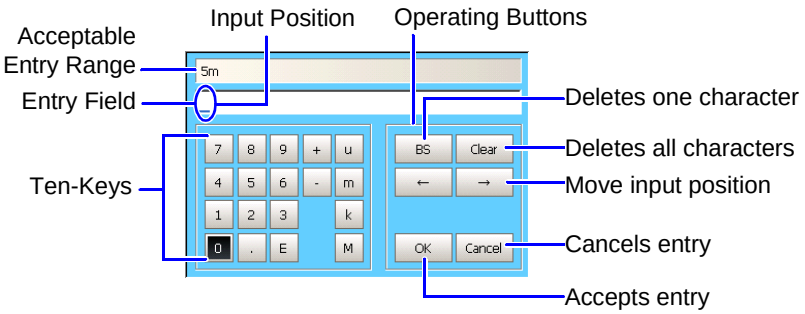
* The increment and decrement step size depends on the particular setting item.

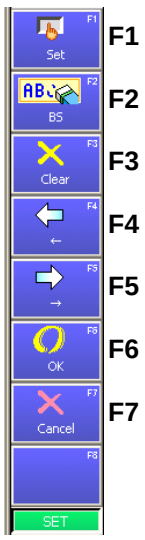
Entry by [↑↑], [↓↓], [↑] and [↓]

Set the desired numerical value by pressing the corresponding F keys.

Entry by [Keypad]

Enter a numerical value using the virtual keypad.
Use the **CURSOR** keys to move to each character, and set using the F keys or virtual keypad buttons.





1 Select numbers ..... **CURSOR** keys

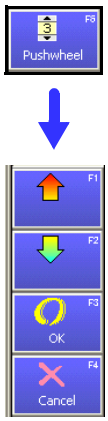
2 Accept ..... **F1** [Set] or **SELECT** key
The accepted number is displayed in the entry field.

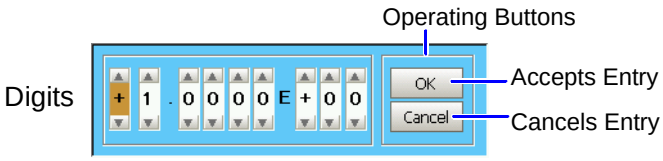
When the entry is complete

3 Accept the entry ..... **F6** [OK] or **ENTER** key
Cancel the entry ..... **F7** [Cancel] or **ESC** key
(Move the cursor to the [OK] or [Cancel] button, and press the **SELECT** key)

Entry by [Pushwheel] (To Set Each Digit)

Enter a numerical value using the virtual pushwheel switches. Press the ◁ ▷ **CURSOR** keys to move among digits, and press the △ ▽ **CURSOR** keys to set the numerical value.





1 Move to a digit to be entered ..... ◁ ▷**CURSOR** keys

2 Select a number..... △ ▽ **CURSOR** or **F1**/**F2** keys

After entering all numbers

3 Accept the entry ..... **F3** [OK] or **ENTER** key
Cancel the entry..... **F4** [Cancel] or **ESC** key

Entering Text and Comments

1 Use the **CURSOR** keys to move the cursor to the setting item.

2 Select an input method from the F key choices.

(When using a mouse, double click on a setting item to display the virtual keyboard for character entry)

Edit	The virtual keyboard is displayed for text entry. Settings can be made with either operating keys or a mouse. (p. 67)
Direct	You can enter text directly by connecting a keyboard. (p. 68)
Clear	Deletes entries.
Undo	Undoes the last operation.

NOTE

When entering a file name (for files to be loaded on a PC)

Windows 2000 and XP cannot handle file names containing the following characters, so they should not be used:

- ASCII: + = [ ] \ / | : * ? " < > ; ,
- Blank

Do not use .(period) for a file name because the characters after the period are identified as the extension.

When entering units and symbols

In some cases, characters entered on the instrument differ from those saved or printed:

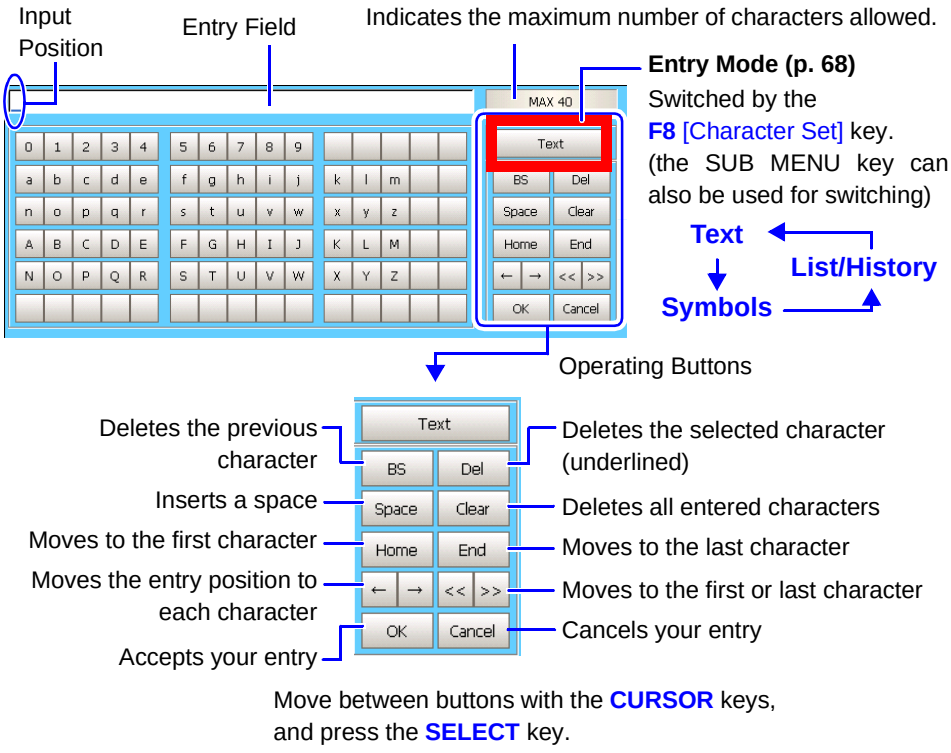
- Printing ("12.7 Print Examples" (p. 339))
  ^{2} → 2, ^{3} → 3, ^{n} → n
- Saving (when saving numerical calculation results or in text format)
  ("11.6.1 Example of Saving Data" (p. 298))
  ^{2} → ^2, ^{3} → ^3, ^{n} → ^n, μ → ~u, Ω → ~o, ε→ ~e, °→ ~c ,
  ± → ~+, με (display only) → uE, °C (display only) → C

Using [Edit] for Entry

See "Comment Entry Example" (p. 120)

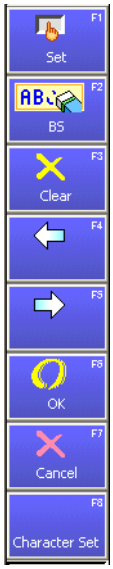
Enter text using the virtual keyboard for character entry.
You can switch between character sets by switching the entry mode.
To enter using a mouse, click a character to select it, or click an operating button. You can select a character position by clicking the entry field.

Use the **CURSOR** keys to move to each character, and set using the F keys or virtual keyboard buttons.



1 Move to a character to be entered ..... **CURSOR** keys

2 Accept ..... **F1** [Set] or **SELECT** key
The accepted characters are displayed in the entry field.



F1
F2
F3
F4
F5
F6
F7
F8

In case of an entry mistake

Delete the previous character ..... **F2** [BS](Backspace)
Delete all ..... **F3** [Clear]
Move entry position ..... **F4** [←], **F5** [→]

When the entry is complete

3 Accept the entry ..... **F6** [OK] or **ENTER** key
Cancel the entry ..... **F7** [Cancel] or **ESC** key
(Move the cursor to the [OK] or [Cancel] button, and press the **SELECT** key)

The virtual keyboard disappears.

Virtual Keyboard Entry Modes

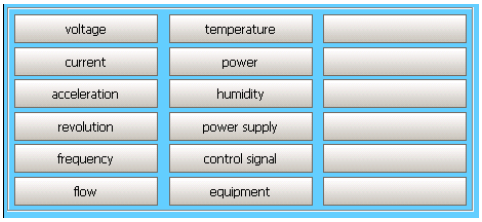
Parts of the display differ according to entry position.

[Text]

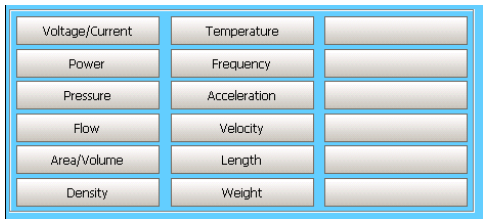
[Symbols]

[List/History]

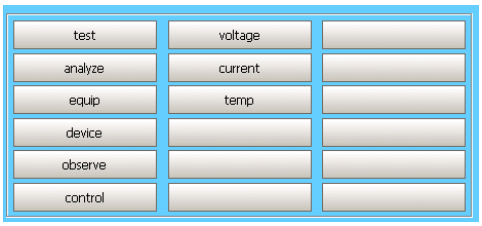
Previously entered comments and lists of measurement units are displayed.
The display depends on the current entry position. New entries appear in empty rows as they are added to the history, and when all rows are full, the oldest entry is overwritten.



(Example 1: Analog Comment Entry)

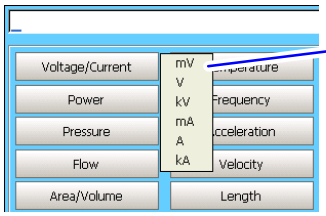


(Example 2: Scaling Unit Entry)



(Example 3: Sheet Name Entry)

F1 [SET]



Select the desired units from the pull-down menu.

CURSOR
(Select Units)
↓
ENTER
(Apply)
ESC
(Cancel)

Direct Entry

You can make entries using a keyboard.
Press the **F2** [Direct] key or the F2 key on a connected keyboard to make entries from the keyboard.
After entering, press the Enter key on the keyboard to accept.

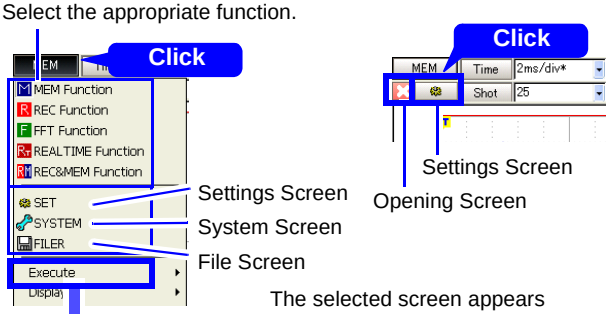
NOTE Pressing **F2** [Direct] when no keyboard is connected has no effect, and text cannot be entered. In this case, press the **ESC** key to revert to the previous state.

3.3.4 Mouse Operations

Operations on the Waveform Screen

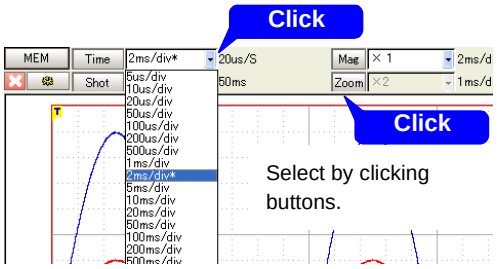
Switching Functions and Screens

Select the appropriate function.



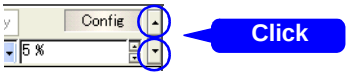
The selected screen appears

Changing Settings

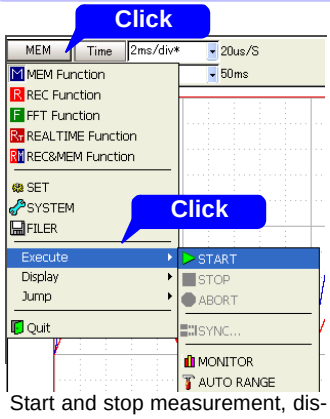


Select by clicking buttons.

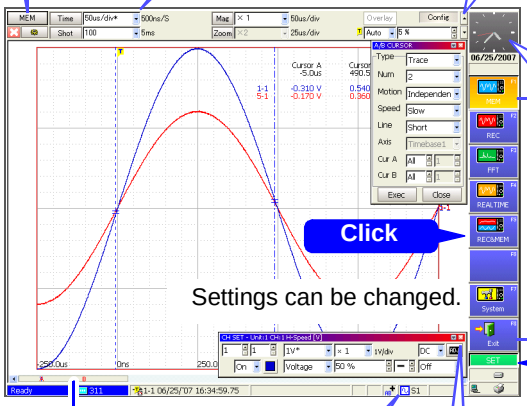
Changing Setting Items



Controlling the Instrument



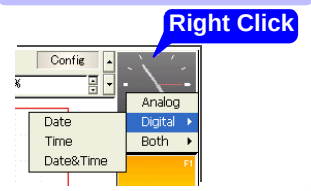
Start and stop measurement, display the level monitor and execute auto setting, manual triggering and numerical calculations.



Settings can be changed.

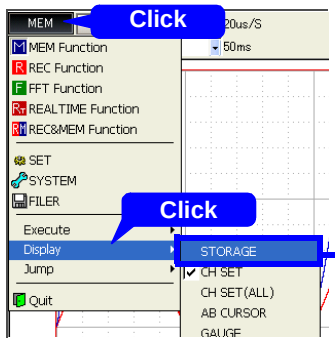
Scrolling is available.

Changing the clock display



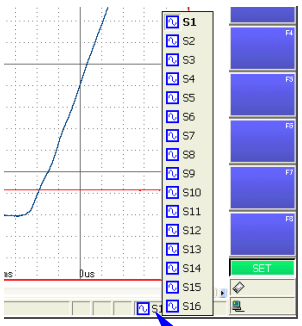
Modes can be selected.

Setting Displays

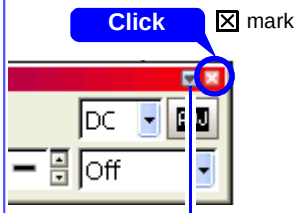


Display input channel and A/B cursor setting dialogs, and numerical values and gauges.

Changing Sheets



Closing Dialogs



Minimize view

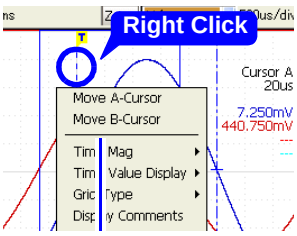
Displays only the title bar when you don't need to see the whole dialog.

You can control the instrument by measurement dialogs. The dialog type can be changed with **F8** [Change]. (Four patterns are available)

Example:

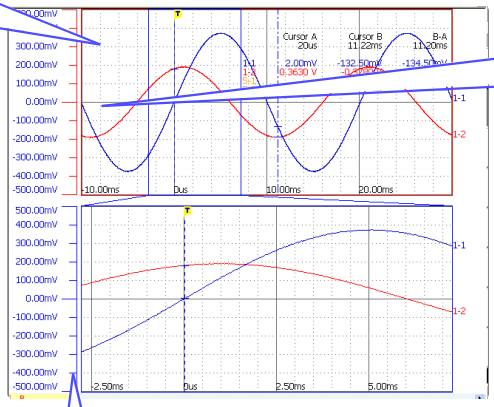
Operations on Waveform Data

Moving the A/B cursors

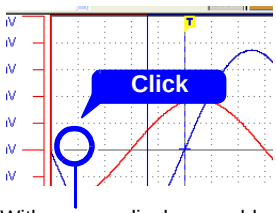


Right click at the point where you want to move the cursor, then select.

The A/B cursors can be moved by dragging them.

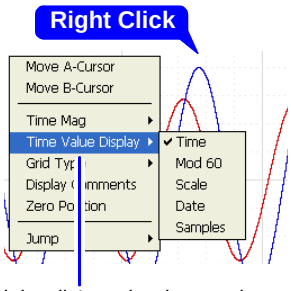


Select the area to zoom



With zoom display enabled, clicking on a location causes it to appear zoomed in the lower half of the display.

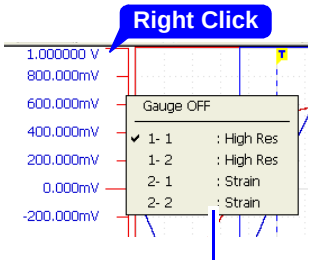
Changing display items



Right click and select an item to change the display of time values, grid, comment display and zero position display. Setting contents are the same as on the System Settings screen.

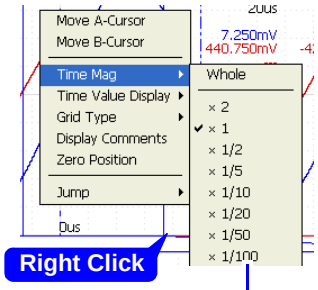
See:"13.1 Making Waveform Screen Display Settings" (p. 350)

Switching Gauges



Select the gauge to display.

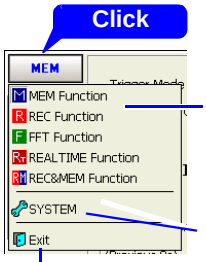
Changing time axis magnification



Select a magnification ratio.

Operations on the Settings Screens

Switching Functions

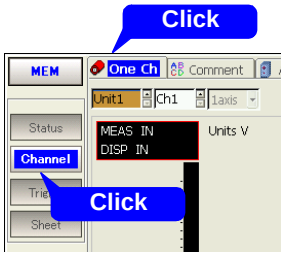


Select the appropriate function.

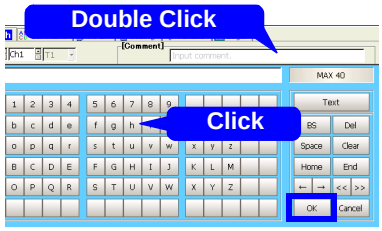
Displays the System screen.

Displays the Waveform screen.

Switching Screens and Pages

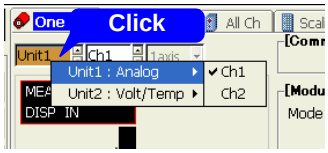


Entering Text

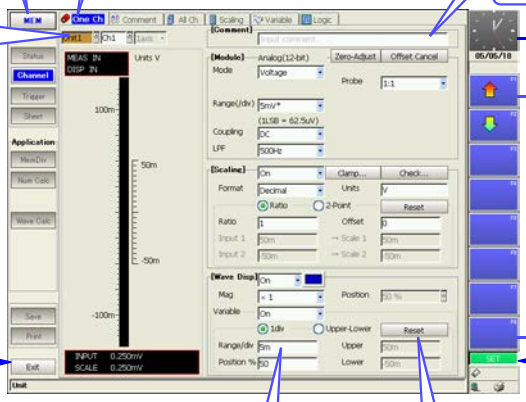


Select and enter characters by clicking buttons on the virtual keyboard.
After entering, click the [OK] button.
"Using [Edit] for Entry" (p. 67)

Selecting Channels



Select unit (module) and channel numbers.
(Channel Settings Screen)



Clock setting is the same as on the Waveform screen. (p. 69)

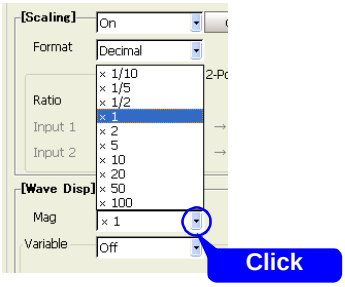
Click
Settings can be changed.

Click
To display the Waveform screen.

Click
Modes can be selected.

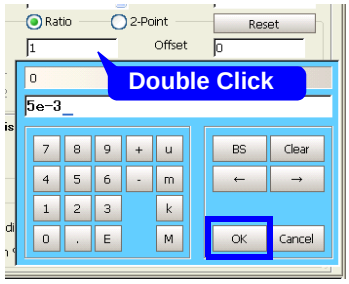
Changing Settings

Items with the ▼ mark at the right



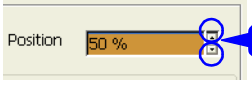
Select from the pull-down menu.

Items without a ▼ mark at the right



Entries can be made by virtual keyboard.
After entering, click the [OK] button.
"Entry by [Keypad]" (p. 65)

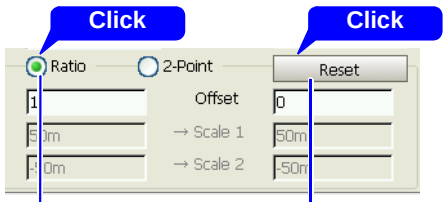
Items with the ▲▼ mark at the right



You can also double click to open the virtual keyboard and make entries.

The numerical value increments with each click.
Hold the mouse button to change the value continuously.

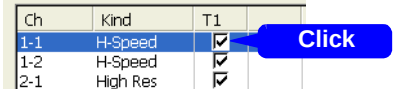
Operating Buttons



Radio buttons
Selecting one button deselects the others.

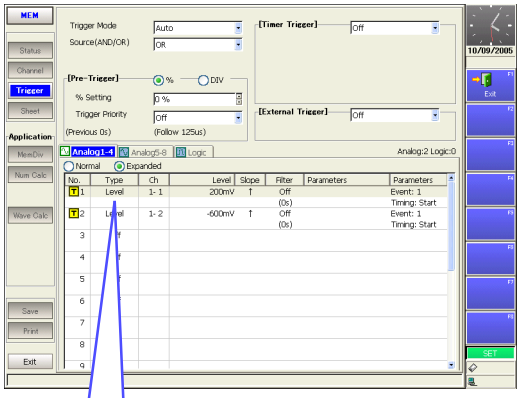
Executing buttons
Selecting this button executes this operation.
If "…" is appended, a dialog appears.

[Use Ch] page on the Status Settings screen (Memory Function)

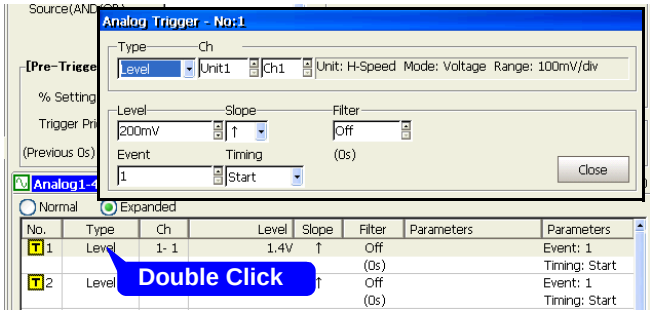


Check boxes
Toggles on (☑) and off (☐) with each click.

Pages within the Settings Screen



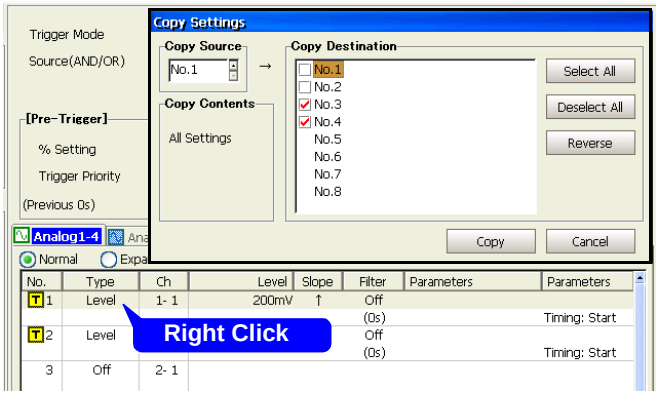
Making Dialog Settings



Settings Pages

- All except the [One Ch] page on the Channel Settings screen
- Trigger Settings screen
- Sheet Settings screen
- Numerical Calculation Settings screen

Making Copy Settings

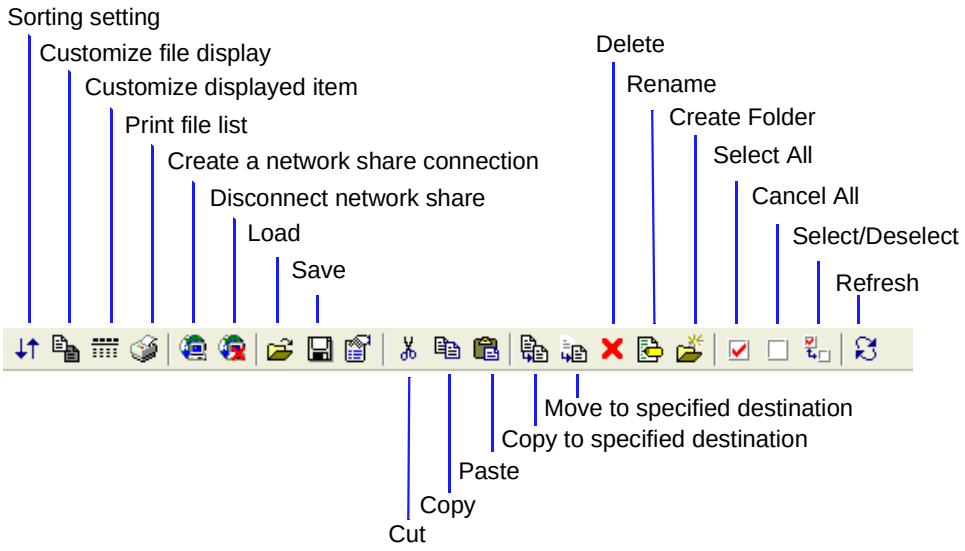


Settings Pages

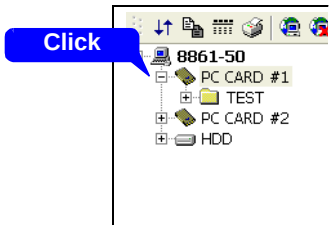
- All except the [One Ch] page on the Channel Settings screen
- Trigger Settings screen
- Numerical Calculation Settings screen

Operations on the File Screen

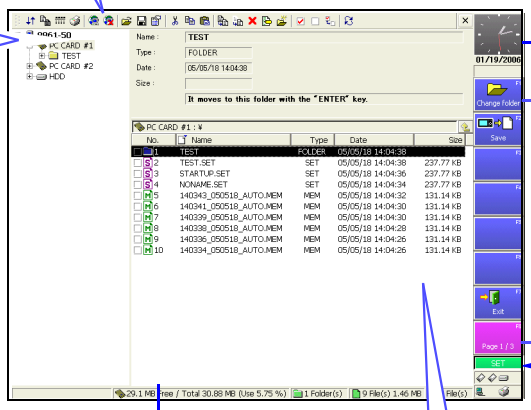
Icon Operations



Switching Levels



Levels can be displayed or not.



Clock setting is the same as on the Waveform screen. (p. 69)

Click

Settings can be changed.

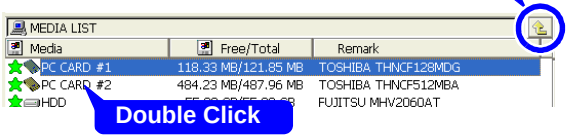
Click

Modes can be selected.

Scrolling is available.

Selecting a Display List

Displays the next higher level. Click



Displays the next lower level.

3.3.5 Automatic Range Setting (Auto-Ranging Function)

Auto setup works only with the Memory function.
By applying an input signal, the timebase, measurement range and zero position of the input waveform are set automatically. The range is determined for each channel that has its waveform enabled [On] for measuring. The timebase is automatically set so that 1 to 2.5 cycles are recorded within 25 divisions on the lowest-numbered channel being used.

Auto setup is not available with some input modules and measurement modes.

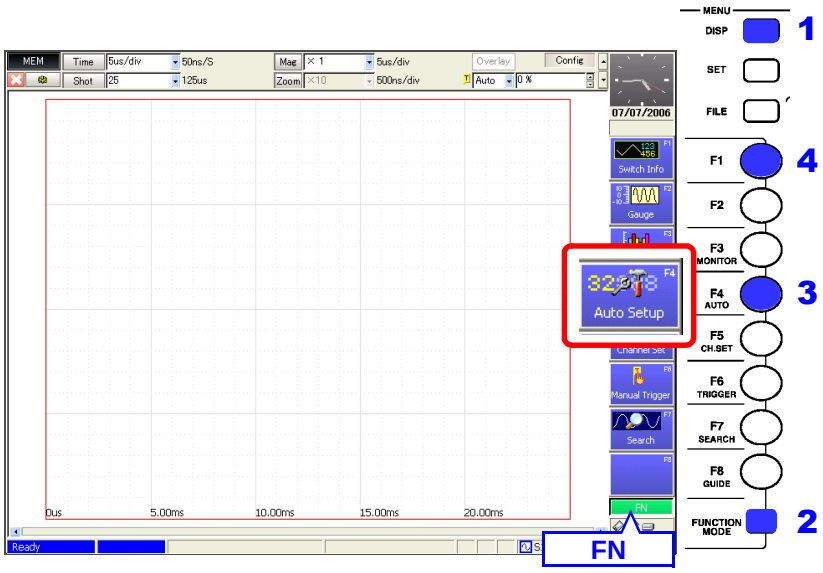
NOTE

Input modules and measurement modes not supported by auto setup:

- The [Temp] mode of the Model 8937 Voltage/Temp Unit
- Model 8939 Strain Unit
- Model 8960 Strain Unit
- [Count], [Duty] and [50/60 Hz] (mains frequency measurement) modes of the Model 8940 F/V Unit
- [Charge] and [Preamp] modes of the Model 8947 Charge Unit
- Model 8958 16-Ch Scanner Unit
- Auto setup does not work correctly with signal frequencies below 3 Hz, so manual setting is necessary.

Before performing auto setup

- Before auto setup, establish the actual measurement situation (with the signal applied to the instrument), such as by connecting to the measurement object.
- During auto setup, a trigger signal is output from the TRIG OUT/CAL external I/O terminal. Keep this in mind if using this terminal during auto setup.



1 Press the **DISP** key to display the Waveform screen.

2 Press the **FUNCTION MODE** key to enable the FN mode.

3 Press the **F4** [Auto Setup] key. A confirmation dialog appears.

4 Press the **F1** [OK] key.
Perform auto setup with the existing input signal, and start waveform recording.
Recording continues until you press the **STOP** key.

When measuring using the auto-ranging function, only the following items are changed.

Basic Setting Conditions (Status Settings screen)

Setting Choice	Auto Setup
Timebase*	Auto setting value (x 1 time axis magnification)

If the input signal frequency is below 3 Hz, the timebase cannot be set automatically.

* Among the channels with waveforms enabled, if the measurement range of the lowest-number channel is 5 mV/div (the highest sensitivity range), or if the difference between the maximum and minimum value of the input signal is eight divisions or less, the timebase is set according to the second lowest-numbered channel.

Input-Module-Related Conditions (all channels)

Setting Choice	Auto Setup
Voltage-axis range and zero position	Auto setup value
Low-pass filter, input coupling	Off, DC

Trigger Criteria (one channel only)

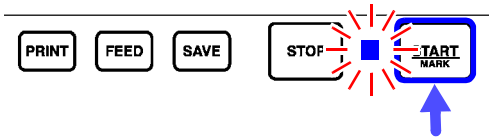
Setting Choice	Auto Setup
Trigger mode	Auto
Trigger source AND/OR	OR
Pre-Trigger	20%
Analog Trigger (Only Level Trigger No. 1 can be set. Others are all Off.)	Only the lowest-numbered channel is set. (However, if the difference between the maximum and minimum values of the input signal is eight divisions or less, the trigger is set for the second-lowest-numbered channel.) [Expanded] setting, Trigger No. 1 Level Trigger, Slope: ↑ (Rising) Trigger Level: Auto setup value Filter: Off

If the "Auto-ranging failed" warning message appears when you attempt auto-ranging

This message is displayed when the range could not be determined from those channels having waveforms set for display ([On]), and measurement is stopped. Make the settings manually while verifying the input signal with the Level Monitor (p. 122).

3.3.6 Starting and Stopping Measurement

Starting Measurement



Start Measurement

Press the **START/MARK** key.
The green LED at the left lights.

When measuring using the trigger functions, the timing of starting measurement is different than that of starting recording (data acquisition).

See "Measurement and Internal Operations" (p. 77)

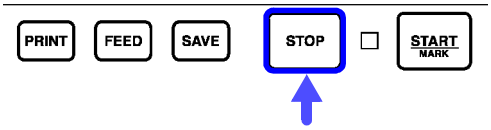
To avoid operating mistakes when starting measurement, the behavior of the **START** key can be modified. At factory shipping, the **START** key is set to start measurement when it is pressed once.

See "13.2.1 Specifying Activation Conditions for the START Key" (p. 353)

While measuring, event marks can be inserted in recorded waveforms. Event marks can then be searched after measurement.

See "8.15 Inserting and Searching for Event Marks on a Waveform" (p. 231)

Stopping Measurement



Stop Measurement

Press the **STOP** key.

Press once: recording stops at the end of the specified recording length.
Press twice: recording stops immediately. (Abort)

When Aborting

- **Aborting while auto-saving**
  Data up to the moment of aborting is automatically saved.
- **Aborting while awaiting a trigger**
  If at least one trigger event has occurred since starting, the last measured waveform is displayed. However, if longer than one half of the maximum settable recording length, no waveform is displayed.
- **Aborting while storing**
  Waveforms up to the moment of aborting are displayed.

An instrument setting can be changed to force measurements to be stopped by a single press of the STOP key.

See "13.2.2 Setting the Method for Stopping Measurement with the STOP Key" (p. 354)

Measurement and Internal Operations

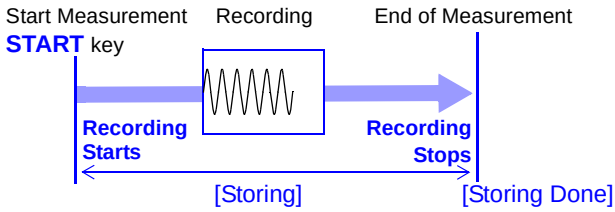
Measurement methods are normal measurement (start recording when measurement starts) and trigger measurement (start recording when trigger criteria are satisfied).
In this manual, “Measurement start” means the instant when you press the **START** key, and “Recording start” means the instant when recording begins on the waveform screen.

Trigger settings: "Chapter 6 Trigger Settings" (p. 135)

- Select the Trigger mode to record upon either single or repeating trigger events. (p. 138)
- Enable pre-triggering if you want to capture data measured prior to trigger events. (p. 140)

Normal Measurement

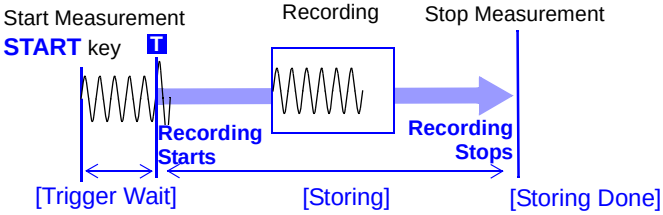
Without triggering



Trigger Measurement

Single triggering

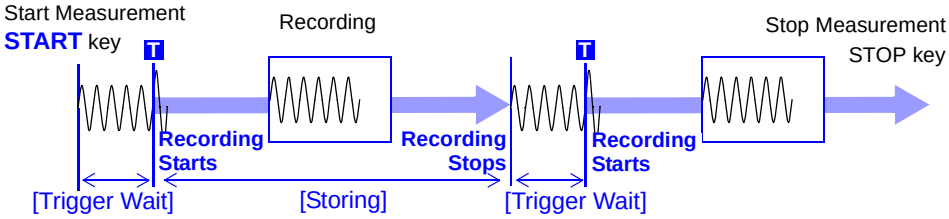
Trigger mode: [Single]
Pre-triggering not enabled



Recording starts when a trigger event occurs and continues for the specified recording length.

Repeated triggering

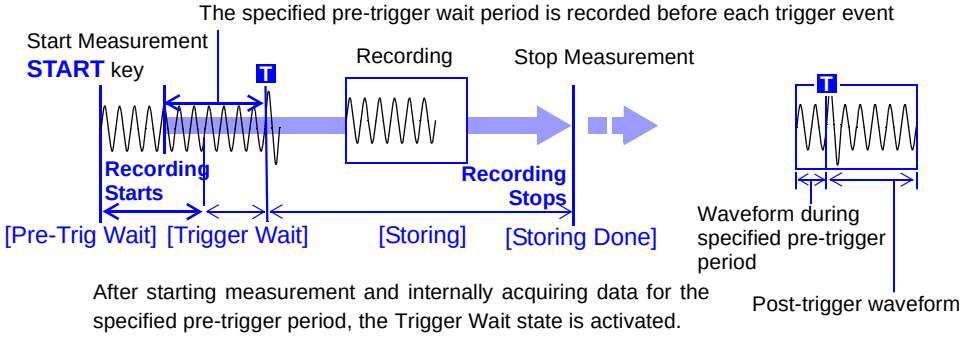
Trigger mode: [Repeat]
Pre-triggering not enabled



Recording starts when a trigger event occurs, continues for the specified recording length, and returns to the Trigger Wait state.

Repeated triggering and recording of phenomena before each event

Trigger mode: [Repeat]
Pre-triggering enabled

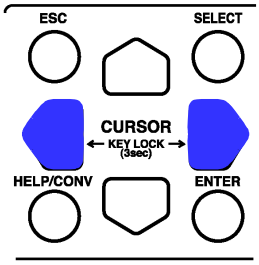


After starting measurement and internally acquiring data for the specified pre-trigger period, the Trigger Wait state is activated.

The data before a trigger event (for the pre-trigger period) is recorded.

3.3.7 Disabling Key Operations (Key-Lock Function)

All operating keys on the front panel are disabled. This can prevent unintended operations during measurement.
The External I/O terminals are unaffected by the key-lock state.



Disabling key operation

Hold both ◁ ▷ **CURSOR** keys simultaneously for three seconds.
The key-lock state is enabled.
(“Key Lock” is displayed at the upper right.)

Canceling

Again hold both ◁ ▷ **CURSOR** keys simultaneously for three seconds.

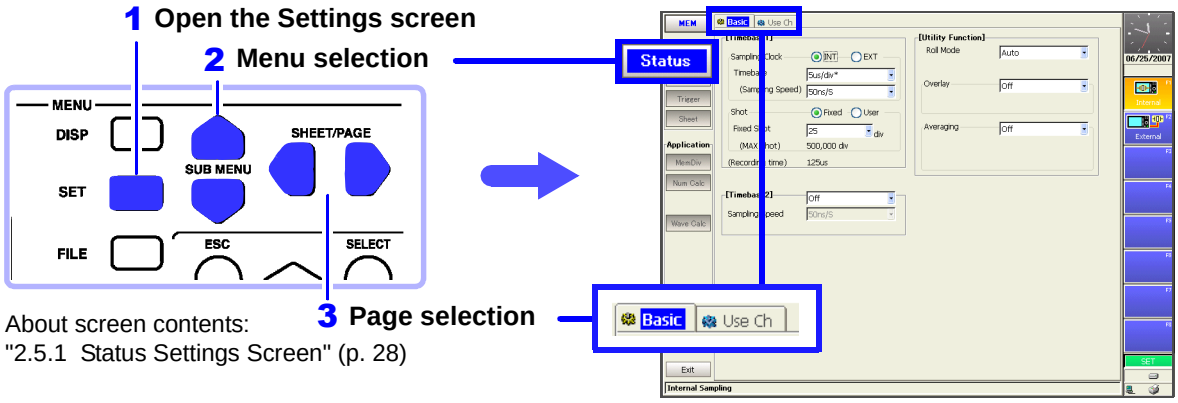
NOTE

- If the backlight has been turned off by the backlight saver function (p. 361), pressing any key still turns the backlight on. However, other key operations remain disabled.
- If a USB mouse is connected, mouse operations are not disabled. To disable the mouse, unplug it.

Measurement Configuration Settings

Chapter 4

Basic measurement configuration settings are performed on the Status Settings screen. Measurement configuration can be performed from the Waveform screen (p. 114).



About screen contents:
"2.5.1 Status Settings Screen" (p. 28)

Function Selection (p. 81)

- Memory Function
- Recorder Function
- REC&MEM Function
- Real-Time Saving Function (p. 235)
- FFT Function (*Analysis and Communication Supplement*)

Memory Function

Measurement Configuration Settings

- Timebase or Sampling Rate setting (p. 90)
- Recording Length setting (p. 97)

To measure using different sampling rates

- Timebase 1 and Timebase 2 sampling rate settings (p. 94)

To control sampling by an external signal input

- External Sampling setting (p. 382)

Set Channels to Use

- Setting the number of channel to use (p. 86)
- Setting different sampling rates (p. 95)
- Setting which channels to use (p. 86)

Utility Function Settings

- View waveforms while acquiring data (Roll Mode) (p. 102)
- Waveform Overlay (p. 104)
- The number of acquired waveforms and averaging progress (Averaging function) (p. 106)
- Record by memory divisions (p. 109) (set on the Memory Division Setting screen)

Recorder Function

Measurement Configuration Settings

- Timebase setting (p. 90)
- Sampling Rate setting (p. 90)
- Recording Length setting (p. 97)

REC&MEM Function

Measurement Configuration Settings

Recorder waveform settings

- Timebase setting (p. 90)
- Sampling Rate setting (p. 90)
- Recording Length setting (p. 97)
- Trigger mode setting

Memory waveform settings

- Timebase or Sampling Rate setting (p. 90)
- Recording Length setting (p. 97)

4.1 Selecting the Function

Select the function appropriate for your recording purpose.
Function selection can be made from the Opening, Waveform or Settings screens.

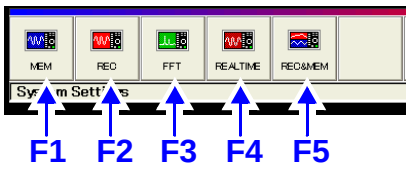
See "Choosing the Appropriate Function" (p. 82)

Function Selection: Opening Screen

MEM REC REC&MEM FFT REALTIME

	Operating Key	Procedure
1	CURSOR	Move to the desired function.
2	F1 to F8	Select the appropriate function.

Opening Screen



Function Selection: Waveform or Settings Screen

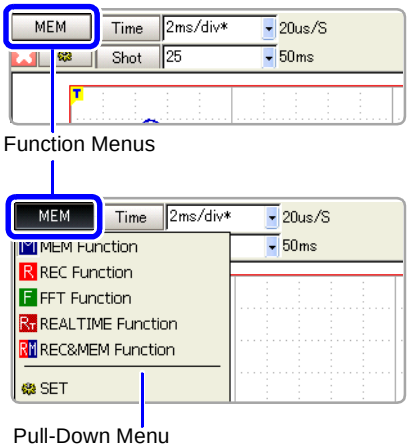
MEM REC REC&MEM FFT REALTIME

	Operating Key	Procedure
1	CURSOR	Move to the function menu (at the top left).
2	F1 to F8	Select the appropriate function.

(Select from the pull-down menu)

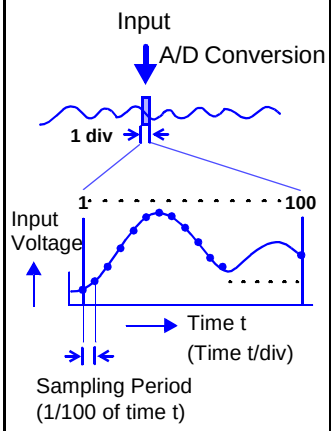
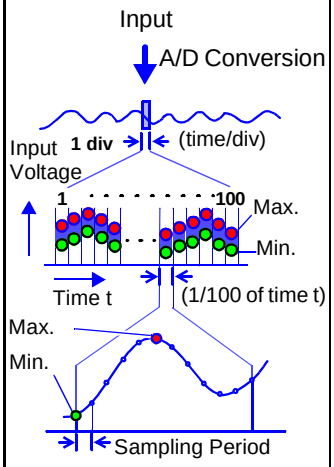
SELECT	The pull-down menu appears.
CURSOR	Select the appropriate function.
ENTER	Accepts the setting.

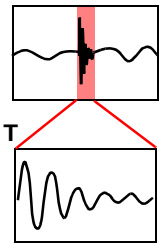
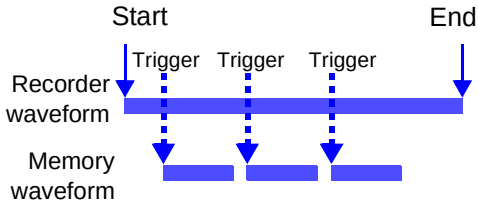
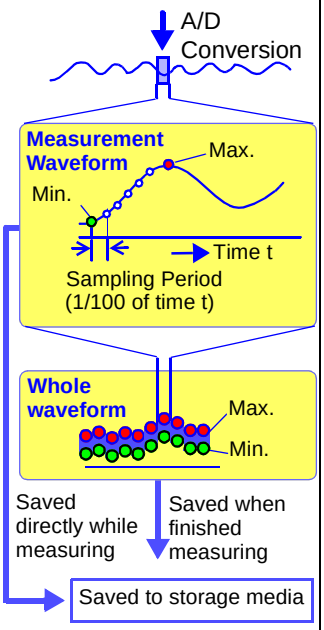
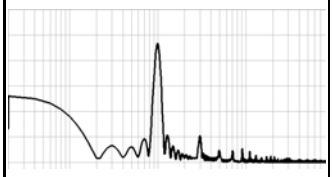
Waveform Screen



Choosing the Appropriate Function

The acquisition procedure and setting choices for measurement data and available operations depend on the selected operating function.

Function	Description
Memory Function (Sampling point recording) 	This function is most suitable for oscilloscope-type measurements, such as instantaneous waveforms and transient phenomena. Use to record relatively fast signals with periods from µs to minutes. Data is recorded at a rate of 100 samples per division. The sampling rate changes whenever the timebase (time per division) is changed. Therefore, setting a slow timebase for long-term recording simply increases the sampling interval. **Features:** • Data can be displayed, saved and printed each time an amount equal to the recording length is acquired. (When Roll Mode is enabled, data is displayed simultaneously as it is acquired. However, depending on settings, there are some cases in which this is not possible.) (p. 102) • Range and other settings can be made automatically (p. 74). • Calculations can be applied to measurement data (*Analysis and Communication Supplement*). • Waveforms can be overlaid and compared (p. 104). • Dead time (intervals of no measurement) during continuous recording can be minimized by using Memory Division (p. 109). • You can search measurement data after setting the desired search criteria (p. 222). • Averaging can be employed to remove noise components from recordings (p. 106).
Recorder Function (Envelope recording) 	This function is suitable for use instead of pen recorders and pen oscilloscopes, to record long-term fluctuations and create records for observing slow phenomena. Use to record relatively slow signals with periods from ms to hours. Data is recorded at a rate of 100 samples per division, with a maximum and minimum value included in each sample. The timebase and sampling rate can each be set separately. With the Recorder function, changing the timebase does not affect the sampling rate, so the peaks of quickly changing signals can be recorded when measuring with a slow timebase. Measured data is displayed simultaneously as it is acquired regardless of recording length. **Features:** • No recording length has to be set, as measurement continues until manually stopped (p. 101). • Printing (real-time printing) can be paused and resumed while measuring (When using the internal printer).

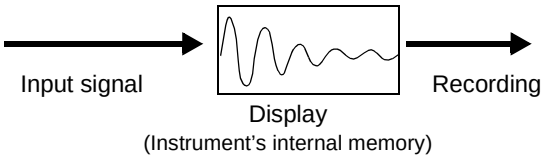
Function	Description
REC&MEM Function Input A/D Conversion Recorder waveform (Low-Speed Recording)  T Memory waveform (High-Speed Recording)	(Recorder and Memory Waveform Recording) This function is recommended for recording transient signal waveforms during long-term monitoring. While continually recording the overall signal as a Recorder waveform, abnormal phenomena can be captured by triggering, which are simultaneously recorded as Memory waveforms using high-speed sampling. This function enables viewing not only the abnormal phenomena, but the normal monitor recording as well. 
Real-Time Saving Function Input A/D Conversion  	Recommended for long-term measurements such as those that exceed the instrument's internal storage capacity. Measurements are recorded directly onto storage media as a data recorder. One hundred data samples per division are stored directly to the internal hard drive or PC Card while measuring. When finished measurement, the whole waveform is compressed and saved as well. Because the timebase is limited by the selected recording media, we recommend having the optional Model 9718-50 HD Unit installed when the fastest timebase is needed. **Features:** • Long-term recording independent of memory capacity • The whole waveform (compressed data) is saved, so you can quickly search for any desired portion within a large quantity of recorded data.
FFT Function Input A/D Conversion FFT Calculation  Frequency	Recommended for performing frequency analysis of rotating objects, vibrations, sounds and etc. Spectral analysis and transfer functions are available. Input signal data is subjected to FFT calculation and frequency analysis. An input module equipped with anti-aliasing filtering (AAF) should be used when acquiring data for FFT analysis, to suppress the effects of aliasing distortion while sampling. Refer to the *Analysis and Communication Supplement* for FFT function details.

Function Comparison Table

Items	Function				
	MEM	REC	REALTIME	FFT	REC&MEM
Timebase	5 µs/div to 5 min/div Sampling rate: 1/100 of the timebase Two simultaneous sampling rates are available (p. 94)	10 ms/div to 1 hour/div Sampling rate: 100 ns to 1 s Select a period that is 1/100 of the timebase or less	100 µs/div to 5 min/div (Limited by the save destination and number of channels used)	–	Recorder waveform 100 ms/div to 1hour/div Memory waveform 10 µs/div to 5 min/div
Auto Setup	● (p. 74)	–	–	–	–
Continuous Recording	(Reports can be issued repeatedly after each specified recording length)	● (p. 101)	● (p. 235)	–	● (Recorder waveform)
Overlay	● (p. 104)	–	–	–	–
Averaging	● (p. 106)	–	–	–	–
X-Y Waveforms	● (possible during and after measurement) (p. 187)	–	● (Available after measuring with the Memory function)	–	● (Available after measuring with the Memory waveform)
Numerical Calculations	● (*Analysis and Communication Supplement*)	–	● (Available after measuring with the Memory function)	–	● (Available after measuring with the Memory waveform)
Waveform Calculations	● (*Analysis and Communication Supplement*)	–	● (Available after measuring with the Memory function)	● (*Analysis and Communication Supplement*)	● (Available after measuring with the Memory waveform)
Memory Division	● (p. 109)	–	–	–	● (p. 109)

Function-Related Recording Capabilities

Memory function , Recorder function, REC&MEM function, FFT function



Storage Media

PC HDD USB NETWORK

Waveform files

xxxx.MEM (Memory function waveform data)
xxxx.REC (Recorder function waveform data)
xxxx.FFT (FFT function data)

Text file

xxxx.TXT (Text data)

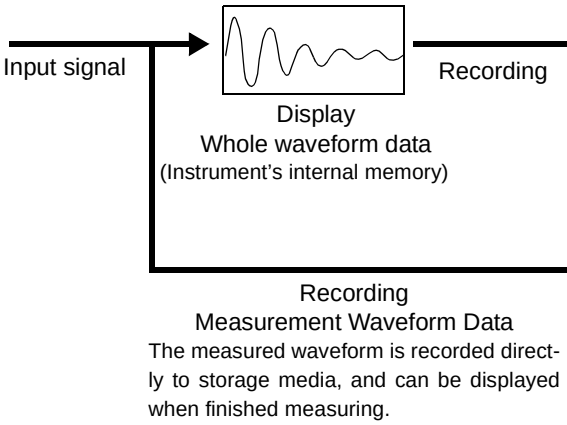
Index file

xxxx.IDX (Index data for divided saving)
xxxx.SEQ (Index data for memory division in Memory function)
xxxx.R_M (Index data for REC&MEM function)

Image file

xxxx.BMP/ xxxx.PNG (Image data)

Real-Time Saving Function



Storage Media

PC HDD NETWORK

Waveform file

xxxx.RSR (Whole waveform data)

Index file

xxxx.RSI (Index data)

Waveform file

xxxx.RSM (Sampled waveform data)

4.2 Setting Measurement Configuration (Status Settings Screen)

Make basic settings for measurement such as timebase and recording length on the Status Settings screen. These settings can also be made on the Waveform screen (p. 114).
Choices of setting items are function-dependent.
Refer to the *Analysis and Communication Supplement* for FFT function setting details.

4.2.1 Selecting Channels to Use

This applies to the Memory function and the Real-time saving function only.
Select the analog and logic channels to use.
When an input module is installed, the maximum number of usable channels (“Usable Channels” value) is automatically updated. The number of usable channels consists of the total of all analog and all logic input channels.
Refer to "Chapter 9 Measuring with Real-Time Saving" (p. 235) for settings related to real-time saving.

The following apply to the Memory function only.

To set the recording length as long as possible
Maximum recording length is available when the fewest necessary channels are enabled for use. Minimizing the number of channels in use by turning off those that are not needed allows memory to be reallocated to those channels being used.

To perform simultaneous measurements with different sampling rates
By setting different sampling rates to “Timebase 1” and “Timebase 2”, recording with either sampling rate can be selected for each channel.

See "Setting Timebase 1 and 2: Using input modules other than the Model 8958 16-Ch Scanner Unit" (p. 95)

Using the Model 8958 16-Ch Scanner Unit

- Recording with the Model 8958 16-Ch Scanner Unit is not available with the Real-Time Saving function.
- When only the Model 8958 is installed in the instrument, set the used channels to Timebase 1.

See "Setting Channels to Use: When using only the Model 8958 16-Ch Scanner Unit" (p. 89)

- When another module is also installed, Timebase 2 can only be set for the Model 8958. Timebase 2 cannot be set for the other input module(s).

See "Setting Timebase 1 and 2: When using the Model 8958 16-Ch Scanner Unit together with other input modules" (p. 96)

When measuring using external sampling
Only Timebase 1 can be set for such channels.

See "14.2.3 External Sampling (EXT.SMPL)" (p. 382)

Setting Channels to Use: Using input modules other than the Model 8958 16-Ch Scanner Unit

MEM

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Use Ch] page.

2 Select the number of channels to use.

CURSOR Move the cursor to the [Timebase1] item.

F1 to F8 Select the number of channels to use.

1CH, 2CH, 4CH, 8CH (default setting) or 16CH (The default setting depends on installed input modules.)	

When using logic channels:

LOGIC terminals CH A through CH D are represented as one channel.

For the Model 8861-50 case:

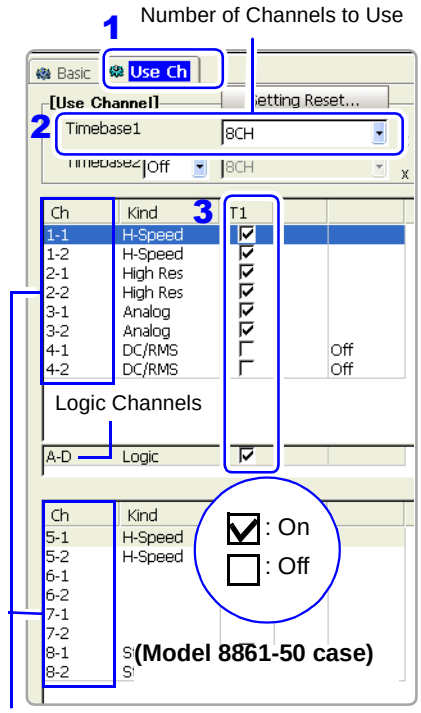
The total number of usable channels is twice the number of selected channels. However, the number of channels enabled for use in the upper tier (Units 1 to 4+ and Logic A to D) and lower tier (Units 5 to 8) cannot exceed the specified number of channels.

3 Select the channels for measurement (analog/logic inputs).

CURSOR Move the highlight cursor to a channel to be set.

F1 to F8 Select either choice.

Off	No measurement
On	Use for measurement (default setting)



About the Number of Channels

When [8CH] is selected with Model 8861-50: Up to eight channels can be used in each of the upper and lower tiers. (Total number of usable channels (8CH × 2 = 16 channels)

NOTE

When using logic channels

The default setting is [On], but if insufficient space is available for the specified number of channels to be used, some channels are set [Off]. In this case, set unneeded channels [Off] or increase the set number of channels to use, and then set the needed logic channels [On].

Decreasing the number of channels to be used below the number of channels set [On]

Channels are automatically set to [Off], starting with the lowest channel.

Using the Model 8946 4-Ch Analog Unit and logic channels

Maximum recording length is limited in the following conditions.

No. of Chs to Use	Used Channels		Max. Rec. Length*
	Model 8946 4-Ch Analog Units	Logic channels	
8860-50 16 Chs	All four Units [On]	[On]	10,000
8861-50 16 Chs x 2	All eight Units [On]	[On]	10,000

* Model 8860-50: 32 MWords, Model 8861-50: 64 MWords memory installed

If “Too many measurement channels” appears

You have tried to use more channels than the number enabled for use. Either increase the number of channels to use, or turn unneeded channels [Off].

Setting Channels to Use: When using only the Model 8958 16-Ch Scanner Unit

MEM

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28) , To set from the Waveform screen (p. 114)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Use Ch] page.

2 Select the number of channels to use.

CURSOR Move the cursor to the [Timebase 1] item.

F1 to F8 Select the number of channels to use.

1 × 8CH, 2 × 8CH, 4 × 8CH, 8 × 8CH (default setting) or 8 × 8CH + L (see Note)

For the purpose of selecting channels to use, Model 8958 channel groups 1 to 8 and 9 to 16, as well as logic channels A to D, are each treated as single channels (1 x 8CH).

For the Model 8861-50 case:

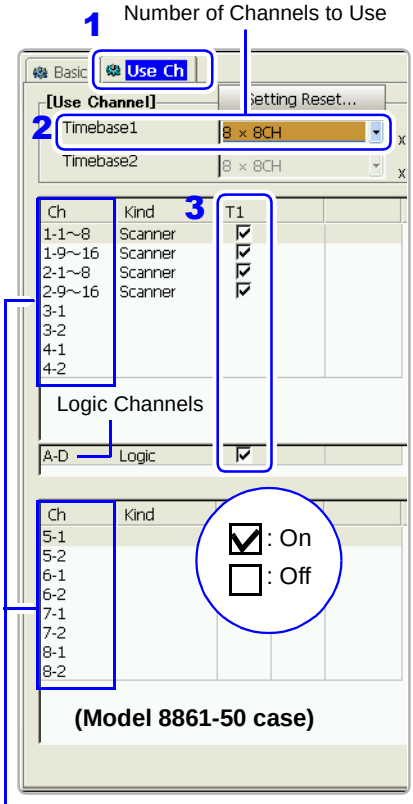
The total number of usable channels is twice the number of selected channels. However, the number of channels enabled for use in the upper tier (Units 1 to 4+ and Logic A to D) and lower tier (Units 5 to 8) cannot exceed the specified number of channels.

3 Select the channels for measurement (analog/logic inputs).

CURSOR Move the highlight cursor to a channel to be set.

F1 to F8 Select either choice.

Off	No measurement
On	Use for measurement (default setting)



Input Module and channel numbers for the Model 8958 16-Ch Scanner Unit

1-1 to 8: CH1 to 8 of UNIT 1
1-9 to 16: CH9 to 16 of UNIT 1

About the Number of Channels

When [8 × 8CH] is selected with Model 8861-50: Up to 64 channels each can be used in the upper and lower tiers (total number of usable channels [(8 × 8CH) × 2] = 128 channels).

NOTE

Decreasing the number of channels to be used below the number of channels set [On]

Channels are automatically set to [Off], starting with the lowest channel.

When also using logic channels:

Select [8 × 8CH + L] to use the maximum number of Model 8958 16-Ch Scanner Unit channels (four 8958s in the Model 8860-50, or eight in the 8861-50). In this case, the maximum recording length is halved.

If "Too many measurement channels" appears

You have tried to use more channels than the number enabled for use. Either increase the number of channels to use, or turn unneeded channels [Off].

4.2.2 Setting the Timebase (Horizontal Axis) and Sampling Rate

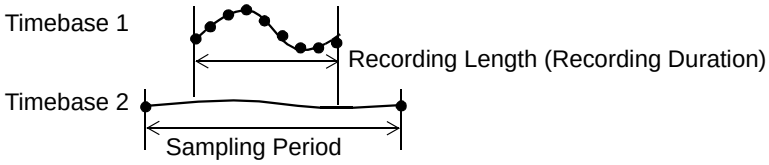
About timebase and sampling setting

The timebase setting establishes the rate of input signal waveform acquisition, specified as time-per-division on the horizontal axis (time/div).
The sampling setting specifies the interval from one sample to the next. For details about sampling, refer to "Appendix 4.1 Sampling" (p. A48).

Function	Explanation
Memory Function	• **The timebase and sampling rate settings are interdependent.** Changing the timebase causes the sampling rate to be changed. The number of samples per division is fixed at 100. Therefore, the sampling period is 1/100th of the timebase setting. • **If the appropriate timebase setting for the input signal is unknown:** Set the timebase automatically. **See**"3.3.5 Automatic Range Setting (Auto-Ranging Function)" (p. 74) • **To acquire waveforms with different sampling rates for each channel:** Set different sampling rates for Timebase 1 and Timebase 2. Set Timebase 2 to the slower sampling rate. **See**"Setting Different Sampling Rates" (p. 94) • **Using the Model 8958 16-Ch Scanner Unit:** If other input modules are installed together with the Model 8958, the other modules are set to Timebase 1, and the 8958 to Timebase 2. **See**"Setting Timebase 1 and 2: When using the Model 8958 16-Ch Scanner Unit together with other input modules" (p. 96) If only the Model 8958 is installed, it is set to Timebase 1. **See**"Setting Channels to Use: When using only the Model 8958 16-Ch Scanner Unit" (p. 89) • **Setting the sampling period according to an external signal: (External Sampling)** **See**"14.2.3 External Sampling (EXT.SMPL)" (p. 382)
Recorder Function	The timebase and sampling rate can be set independently. The sampling rate (from 100 ns/S to 1 s/S) is selected depending on the timebase setting. **See** "Appendix 4.4 Recorder Function Values" (p. A50)
REC&MEM Function	• Memory Waveform: The timebase and sampling rate settings are linked. • Recorder Waveform: The timebase and sampling rate settings can be set independently. However, this sampling rate and that of the Memory Waveform are one and the same.
Real-Time Saving Function	• The timebase and sampling rate settings are interdependent. Changing the timebase causes the sampling rate to be changed. The number of samples per division is fixed at 100. Therefore, the sampling period is 1/100th of the timebase setting. • The timebase for the whole waveform can be set automatically. This selects the most suitable timebase according to the measurement waveform timebase set for real-time data and the selected save destination. When set manually, the timebase can be selected from 10 ms/div to 1 hour/div. **See**"9.3 Pre-Measurement Settings" (p. 242)

NOTE

The data refresh rate is not allowed to exceed the maximum sampling rate of the input module.
Example: Using an input module with maximum sampling rate of 1 MS/s (up to 1M samples per second). 1 MS/s = 1 µs/S (1 µs sampling period)
When the [Sampling Speed] is set to [50 ns/S], data is refreshed once each µs.
The maximum sampling rate of the input module being used can be verified on the Config (Configuration) screen ("13.3.6 System Configuration List" (p. 374)).
Also, when sampling at different rates, if the recording time determined by the specified recording length is shorter than the Timebase 2 sampling rate, no data is sampled on Timebase 2.



The following two setting methods are available:

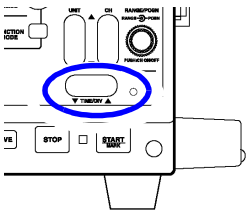
- Using the operating keys
- Using the **TIME/DIV** key (settable regardless of cursor position)

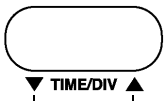
Timebase Setting: Using the TIME/DIV Key

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

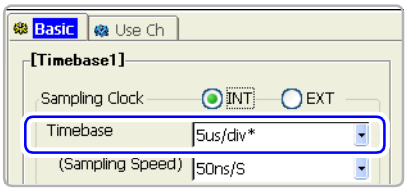




Select slower timebase

Select faster timebase

The value changes with each key press.



Timebase and Sampling Rate Settings: Using the Operating Keys

MEM REC REC&MEM

To open the screen: Press the **SET** key → Select [Status] with the **SUB MENU** keys →Status Settings screen

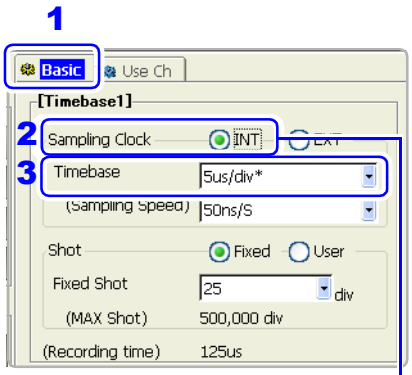
See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

Memory Function case:

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Basic] page.
2	**Select the sampling clock.**	
	CURSOR	Move the cursor to the [Sampling Clock] item.
	F1	Select [INT] (Internal). (default setting)
3	**Select the timebase.**	
	CURSOR	Move the cursor to the [Timebase] item.
	F1 to F8 (Switch Display: F8)	Set the time per division (timebase) on the horizontal axis.

5 (default setting), 10, 20, 50, 100, 200, 500 µs/div
1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5 min/div

The sampling rate changes accordingly. (you can change it by the [Sampling Speed] setting)



Normally, select [INT].
"Appendix 4.1 Sampling" (p. A48)

To control sampling by an external signal, select [EXT] (p. 382).

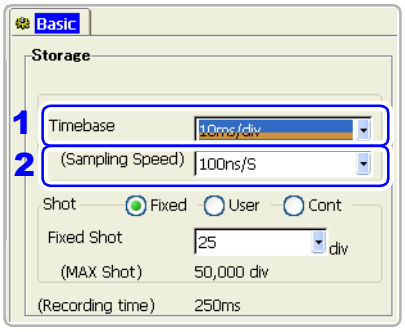
Recorder Function case

	Operating Key	Procedure
1	**Select the timebase.**	
	CURSOR	Move the cursor to the [Timebase] item.
	F1 to F8 (Switch Display: F8)	Set the time per division (timebase) on the horizontal axis.

10(default setting), 20, 50, 100, 200, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5, 10, 30 min/div, 1 h/div
(With Model 8958 installed: 50 ms/div to 1 h/div)

2	**Set the sampling rate.**	
	CURSOR	Move the cursor to the [Sampling Speed] item.
	F1 to F8 (Switch Display: F8)	Set the sampling rate. The range of choices depends on the selected timebase.

100 ns, 1 ms, 10 ms, 100 ms, 1 ms, 10 ms, 100 ms, 1s /S (Select a period that is 1/100 of the timebase or less)



About sampling period:
"Appendix 4.4 Recorder Function Values" (p. A50)

Description

Measuring with the Recorder Function

- When the following timebase values are selected, displayed waveforms are compressed in the horizontal (time axis) direction as shown.
  50 ms/div → x1, 20 ms/div → x1/2, 10 ms/div → x1/5
- When the recording length [Shot] is to set [Cont] (Continuous), the timebase must be set to at least 20 ms/div. Faster timebase settings are not available.
- When the Model 8958 16-Ch Scanner Unit is installed, the timebase can be set between 50 ms/div and 1 h/div.
- If the sampling rate is set too fast, when the input waveform amplitude is small, the difference between maximum and minimum values may become quite large as a result of sudden impulses such as noise. To prevent such phenomena, select a slower sampling rate or enable the input module's low-pass filter (p. 117).

See"Appendix 4.4 Recorder Function Values" (p. A50)

REC&MEM Function case

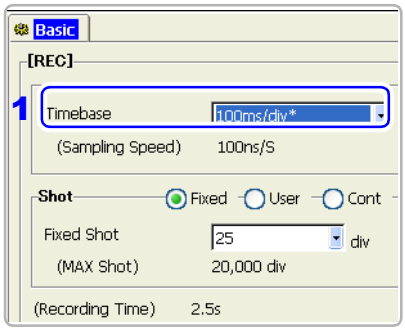
Operating Key | Procedure

1 Set the timebase of the Recorder waveform

CURSOR — Move the cursor to the [Timebase] item.

F1 to F8 (Switch Display: F8) — Set the time per division (timebase) on the horizontal axis.

100 (default setting), 200, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5, 10, 30 min/div, 1 h/div



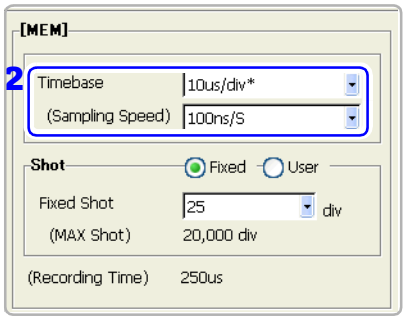
2 Set the timebase of the Memory waveform

CURSOR — Move the cursor to the [Timebase] item.

F1 to F8 (Switch Display: F8) — Set the time per division (timebase) on the horizontal axis.

10 (default setting), 20, 50, 100, 200, 500 µs/div
1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5 min/div

The sampling rate becomes linked (so it changes with the Sampling Speed setting).



With the REC&MEM function, allowable timebase combinations for Memory and Recorder waveforms are limited.

Memory waveform	Recorder waveform															
	100 ms	200 ms	500 ms	1 s	2 s	5 s	10 s	30 s	50 s	60 s	100 s	120 s	300 s	600 s	1800 s	3600 s
10 µs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
20 µs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
50 µs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
100 µs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
200 µs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
500 µs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1 ms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2 ms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
5 ms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
10 ms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
20 ms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
50 ms	×	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
100 ms	×	×	●	●	●	●	●	●	●	●	●	●	●	●	●	●
200 ms	×	×	×	●	●	●	●	●	●	●	●	●	●	●	●	●
500 ms	×	×	×	×	●	●	●	●	●	●	●	●	●	●	●	●
1 s	×	×	×	×	×	●	●	●	●	●	●	●	●	●	●	●
2 s	×	×	×	×	×	×	●	●	●	●	●	●	●	●	●	●
5 s	×	×	×	×	×	×	×	●	●	●	●	●	●	●	●	●
10 s	×	×	×	×	×	×	×	×	●	●	●	●	●	●	●	●
30 s	×	×	×	×	×	×	×	×	×	●	×	●	●	●	●	●
50 s	×	×	×	×	×	×	×	×	×	×	●	×	●	●	●	●
60 s	×	×	×	×	×	×	×	×	×	×	×	●	●	●	●	●
100 s	×	×	×	×	×	×	×	×	×	×	×	×	●	●	●	●
120 s	×	×	×	×	×	×	×	×	×	×	×	×	×	●	●	●
300 s	×	×	×	×	×	×	×	×	×	×	×	×	×	×	●	●

4.2.3 Setting Different Sampling Rates

This applies to the Memory function only.
Different sampling rates can be set for Timebase 1 and Timebase 2. The following channels can be set to Timebase 2.

- Channels on which you want to measure with a slower sampling rate than that of Timebase 1 (p. 95).
- Channels on the Model 8958 16-Ch Scanner Unit when used together with another input module (Timebase 2 is then set exclusively for the 8958) (p. 96).

NOTE Setting a slow sampling rate for Timebase 2 results in longer preparation time prior to the start of storage.

Setting Timebase 1 and 2: Using input modules other than the Model 8958 16-Ch Scanner Unit

MEM

To open the screen: Press the **SET** key → Select [Status] with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Use Ch] page.

2 Select the number of channels to use.

(The settings of the numbers of channels for Timebase 1 and Timebase 2 are interdependent)

CURSOR	Move the cursor to the [Timebase 2] item.
F2	Select [On].
CURSOR	Move the cursor to the setting items for the numbers of channels for Timebase 1 and Timebase 2.
F1 to F8	Select the number of channels to use.

1CH, 2CH, 4CH, 8CH, 16CH
(Only Timebase 1 can be set to 16CH)

When using logic channels:

Logic channels CH A through CH D are represented as one channel.

For the Model 8861-50 case (p. 87):

The total number of usable channels is twice the number of selected channels. However, the number of channels enabled for use in the upper tier (Units 1 to 4+ and Logic A to D) and lower tier (Units 5 to 8) cannot exceed the specified number of channels.

3 Select the channels for measurement. (analog/logic inputs)

CURSOR	Move the highlight cursor to a channel to be set.
F1 to F8	Select either choice.

Off	No measurement.
Timebase 1	Measure with the sampling rate of Timebase 1.
Timebase 2	Measure with the sampling rate of Timebase 2.

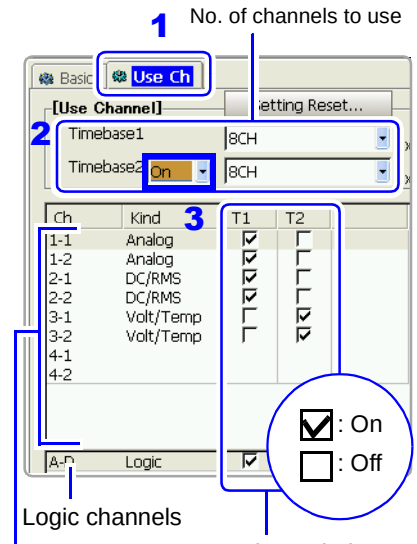
4	**SHEET/PAGE**	Select the [Basic] page.

5 Set the Timebase 1 (or sampling rate).

CURSOR	Move the cursor to the [Timebase] or [(Sampling Speed)] item.
F1 to F8 (Switch Display: F8)	About setting ranges: "Timebase Setting: Using the TIME/DIV Key" (p. 91)

6 Set the Timebase 2 sampling rate.

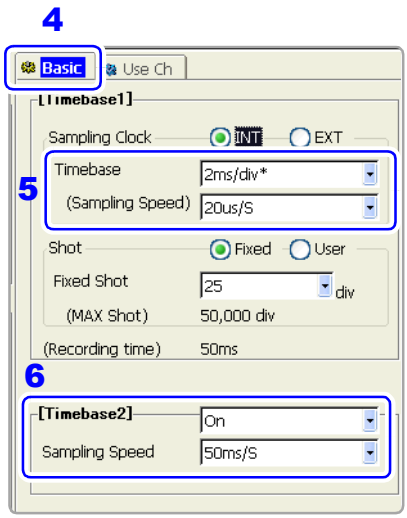
CURSOR	Move the cursor to the [Sampling Speed] item of [Timebase 2].
F1 to F8 (Switch Display: F8)	Set the sampling rate. The sampling rate cannot be set faster than that of Timebase 1.



About the Number of Channels

When [8CH] is selected with Model 8861-50: Up to eight channels each can be used in the upper and lower tiers. (Total number of usable channels (8CH × 2 = 16 channels)

When the Model 8946 Analog Unit is installed as UNIT 4, Channel 4-4 and logic channels cannot be used simultaneously with Timebase 1.



The timebase setting for Timebase 1 determines what sampling rate settings are available for Timebase 2.

Setting Timebase 1 and 2: When using the Model 8958 16-Ch Scanner Unit together with other input modules MEM

To open the screen: Press the **SET** key → Select [Status] with the **SUB MENU** keys →Status Settings screen

See Screen Layout(p. 28), To set from the Waveform screen (p. 114)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Use Ch] page.

2 Select the number of channels to use.

(The settings of the numbers of channels for Timebase 1 and Timebase 2 are interdependent)

Timebase 1 (Channels other than those on the 8958)

CURSOR Move the cursor to the [Timebase 1] item.

F1 to F8 Select the number of channels to use.

1CH, 2CH, 4CH, 8CH or 16CH

When using logic channels:
Logic channels CH A through CH D are represented as one channel.

Timebase 2 (exclusive for channels on the 8958)

CURSOR Move the cursor to the [Timebase 2] item.

F1 to F8 Select the number of channels to use.

1 × 8CH, 2 × 8CH, 4 × 8CH, 8 × 8CH (default setting)

Ch 1 to 8 and Ch 9 to 16 groups are each represented as one channel [1× 8CH]

3 Select the channels for measurement (analog/logic inputs).

CURSOR Move the highlight cursor to a channel to use for measurement.

F1 to F8 Select either choice.

Off	No measurement.
On	Use for measurement.

4	**SHEET/PAGE**	Select the [Basic] page.

5 Set the Timebase 1 (or sampling rate).

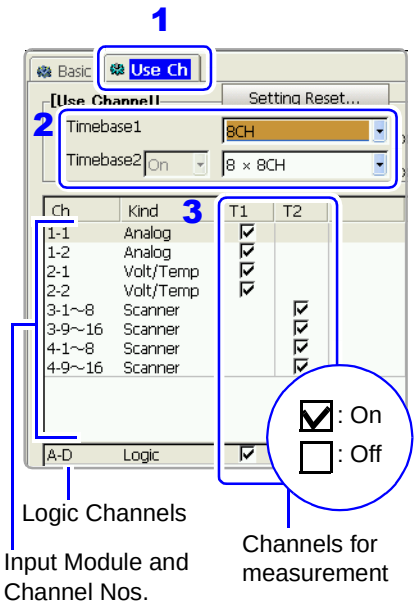
CURSOR Move the cursor to the [Timebase] or [Sampling Speed] item.

F1 to F8 (Switch Display: F8) About setting ranges: "Timebase Setting: Using the TIME/DIV Key" (p. 91)

6 Set the Timebase 2 sampling rate.

CURSOR Move the cursor to the Timebase 2 [Sampling Speed] item.

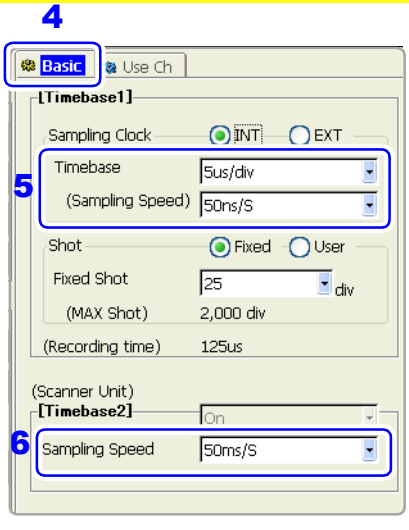
F1 to F8 (Switch Display: F8) Set the sampling rate.
The sampling rate cannot be set faster than that of Timebase 1.



About the Number of Channels

For the Model 8861-50 case:
The total number of usable channels is twice the number of selected channels. However, the number of channels enabled for use in the upper tier (Units 1 to 4+ and Logic A to D) and lower tier (Units 5 to 8) cannot exceed the specified number of channels (p. 89).

When [8CH] (Timebase 1) / [8 × 8CH] (Timebase 2) is selected with the Model 8861-50: up to eight channels (Timebase 1) / 64 channels (Timebase 2) can be used on both the upper and lower tiers. (The total number of usable channels is 16 on Timebase 1 plus 128 on Timebase 2.)



4.2.4 Setting the Recording Length (number of divisions)

Set the length (number of divisions) to record each time data is acquired.
The following methods and settings are available:

- **Fixed recording length [Fixed]:** select from the fixed recording lengths (p. 97).
- **Set arbitrary recording length [User]:** set an arbitrary recording length in units of divisions (p. 99).
- **Continuous [Cont]:** records continuously (Recorder Function only) (p. 101).

Recording Length and Data Samples

- Memory Function and memory waveforms with the REC&MEM function.
  Each division of the recording length consists of 100 data samples. The total number of data samples for a specified recording length = set recording length (divisions) × 100 + 1.
- Recorder Function and recorder waveforms with the REC&MEM function.
  Each recording length division = 100 pairs of data points, with each pair composed of two samples: the maximum and minimum measured values within each sampling period.

See "Appendix 4.4 Recorder Function Values" (p. A50)

To change recording length while measuring

Recording length can be changed on the Waveform or Settings screens. The recording length becomes effective at the time the setting is changed.

See Modifying the Waveform screen view: "4.4 Setting Measurement Configuration on the Waveform Screen" (p. 114)

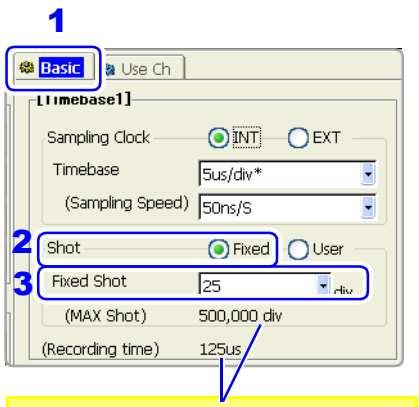
Setting a Fixed Recording Length (Fixed Shot)

MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

	Operating Key	Procedure
1	(with the Memory function)	
	SHEET/PAGE	Select the [Basic] page.
2	**Select the setting method for recording length.**	
	CURSOR	Move the cursor to the [Shot] item.
	F1	Select [Fixed].
3	**Set the recording length.**	
	CURSOR	Move the cursor to the [Fixed Shot] (Fixed recording length) item.
	F1 to F8 (Switch Display: F8)	Select the length of waveform to be acquired (recording length).



Displayed recording time and maximum recording length are linked to the recording length setting.

(Memory Function case)

Description

Setting Range of Recording Length

Memory Function

25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000, 200000, 500000, 1000000, 2000000, 5000000, 10000000
The setting range depends on the capacity of installed memory and the number of channels enabled for use.

Maximum Recording Length [Divisions]

Installed Memory (Words)		No. of Chs Used				
8860-50		16	8	4	2	1
	8861-50	32	16	8	4	2
32M	64M	20,000	20,000	50,000	100,000	200,000
128M	256M	50,000	100,000	200,000	500,000	1,000,000
512M	1G	200,000	500,000	1,000,000	2,000,000	5,000,000
1G	2G	500,000	1,000,000	2,000,000	5,000,000	10,000,000

Recorder Function

25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000
The setting range depends on the capacity of installed memory.

Maximum Recording Length [Divisions]

Installed Memory (Words)		Other than the Model 8958 16-Ch Scanner Unit	Model 8958 16-Ch Scanner Unit
8860-50	**8861-50**		
32M	64M	5,000	1,000
128M	256M	20,000	5,000
512M	1G	50,000	20,000
1G	2G	100,000	20,000

See "Appendix 2.4 Memory Capacity and Maximum Recording Length" (p. A35)
"Appendix 2.3 Timebase and Maximum Recordable Time" (p. A30)

REC&MEM Function

Memory waveform: 25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000
Recorder waveform: 25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000

The setting range depends on the installed memory, whether memory division is enabled, and whether the Model 8958 16-Ch Scanner Unit is installed.

Maximum Recording Length (Memory waveform) [Divisions]
The maximum number of memory divisions is 1,024.

Number of divisions	Installed Memory Storage Capacity			
	32M	128M	512M	1G
OFF	5,000	20,000	50,000	100,000
2	2,000	10,000	20,000	50,000
4	1,000	5,000	20,000	20,000
8	500	2,000	10,000	20,000
16	200	1,000	5,000	10,000
32	100	500	2,000	5,000
64	50	200	1,000	2,000
128	25	100	500	1,000
256		50	200	500
512		25	100	200
1024			50	100

Maximum Recording Length (Recorder waveform) [Divisions]

8958 16-Ch Scanner Unit	Installed Memory Storage Capacity			
	32M	128M	512M	1G
Not installed	2,000	10,000	20,000	50,000
Installed	500	2,000	10,000	20,000

Set Arbitrary Recording Length (User Shot)

MEM REC REC&MEM

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

Operating Key Procedure

1 (With Memory function)

SHEET/PAGE Select the [Basic] page.

2 **Select the setting method for recording length.**

CURSOR Move the cursor to the [Shot] item.

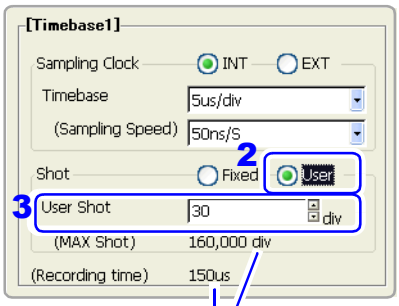
F2 Select [User] (Arbitrary).

3 **Set the recording length.**

CURSOR Move the cursor to the [User Shot] (Arbitrary recording length) item.

F1 to F8 Specify a recording length.
[↑↑], [↓↓]: Increments and decrements the value by 10 steps

See"Entering Numbers" (p. 65)



Displayed recording time and maximum recording length are linked to the recording length setting.

(Memory Function case)

Description

Setting Range of Recording Length

Memory Function

1 to 10,240,000 (divisions)
The setting range depends on the capacity of installed memory and the number of channels in use.

Maximum Recording Length [Divisions]

Installed Memory (Words)		No. of Chs Used				
8860-50		16	8	4	2	1
	8861-50	32	16	8	4	2
32M	64M	20,000	40,000	80,000	160,000	320,000
128M	256M	80,000	160,000	320,000	640,000	1,280,000
512M	1G	320,000	640,000	1,280,000	2,560,000	5,120,000
1G	2G	640,000	1,280,000	2,560,000	5,120,000	10,240,000

Recorder Function

1 to 160,000 (divisions)
The setting range depends on the capacity of installed memory.

Maximum Recording Length [Divisions]

Installed Memory (Words)		Other than the Model 8958 16-Ch Scanner Unit	Model 8958 16-Ch Scanner Unit
8860-50	**8861-50**		
32M	64M	5,000	1,000
128M	256M	20,000	5,000
512M	1G	80,000	20,000
1G	2G	160,000	40,000

See "Appendix 2.4 Memory Capacity and Maximum Recording Length" (p. A35)
"Appendix 2.3 Timebase and Maximum Recordable Time" (p. A30)

REC&MEM Function

Memory waveform: 1 to 10000000
Recorder waveform: 1 to 100000
The setting range depends on the installed memory, whether memory division is enabled, and whether the Model 8958 16-Ch Scanner Unit is installed.

Maximum Recording Length (Memory waveform) [Divisions]
The maximum number of memory divisions is 1,024.

Number of divisions	Installed Memory Storage Capacity			
	32M	128M	512M	1G
OFF	5,000	20,000	80,000	160,000
2	2,500	10,000	40,000	80,000
4	1,250	5,000	20,000	40,000
8	620	2,500	10,000	20,000
16	300	1,250	5,000	10,000
32	140	620	2,500	5,000
64	60	300	1,250	2,500
128	30	140	620	1,250
256	15	60	300	620
512	7	30	140	300
1024	3	15	60	140

Maximum Recording Length (Recorder waveform) [Divisions]

8958 16-Ch Scanner Unit	Installed Memory Storage Capacity			
	32M	128M	512M	1G
Not installed	2,000	10,000	40,000	80,000
Installed	500	2,000	10,000	20,000

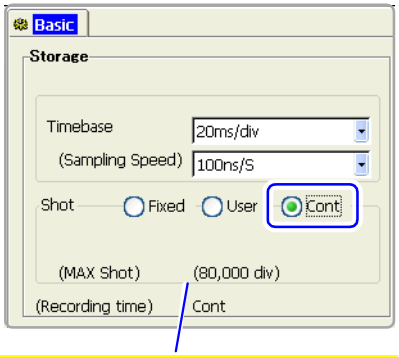
Setting Continuous Recording (Cont)

REC REC&MEM

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

See Screen Layout (p. 28), To set from the Waveform screen (p. 114)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Shot] item.
2	**F3**	Select [Cont] (Continuous).



Indicates the maximum number of divisions remaining in internal memory that can be retraced after recording has stopped.

(Recorder function case)

See "Appendix 2.4 Memory Capacity and Maximum Recording Length" (p. A35)
"Appendix 2.3 Timebase and Maximum Recordable Time" (p. A30)

NOTE

Real-time printing

- Real-time printing is not available when the timebase is 20 to 200 ms/div, even if Auto Print (real-time printing (p. 317)) is [On]. Of course printing can still be performed manually after finished measuring (p. 319).
  Up to 5,000 divisions of data can be internally recorded by the instrument (with the Model 9715-50 Memory Board installed).
- Data is not saved internally during measurement. Data remaining in memory is saved when measurement is manually aborted.
- When using the Model 9684 DC Powr Unit, or when using the Model 8995-01 A6 Printer Unit to print numerical values, real-time printing is not available at timebase settings of 500 ms/div or 1 s/div.

Measuring beyond the maximum recording length

When [Cont] recording is selected and measurement continues beyond the recording length, the remaining recording time displayed on the Waveform screen becomes negative after the end of the recording time (zero). (except when display of both date and time is enabled) (p. 352)

Timebase setting with [Cont] recording

The timebase can be set to any value from 20 ms/div when the recording length is set to [Cont]. If the timebase has been set to 10 ms/div, selecting [Cont] recording length forces it to 20 ms/div.

4.3 Acquiring Waveforms Using the Utility Functions

Several utility functions can be applied when acquiring data. Make these settings before measuring.

Utility Function		Ref.	Operating Function
Roll Mode *1	Displays a waveform as its data is being acquired	(p. 102)	MEM
Overlay *1	Retains displayed waveforms on-screen by overlaying with the new waveform.	(p. 104)	MEM
Memory Division *2	Memory space can be divided into multiple blocks for recording waveforms.	(p. 109)	MEM REC&MEM
Averaging *1	Acquired data is averaged.	(p. 106)	MEM

1*. Select from the [Utility Function] setting column on the Status Settings screen.
2*. Make a setting on the Memory Division Settings Screen.

4.3.1 Displaying Waveforms During Recording (Roll Mode)

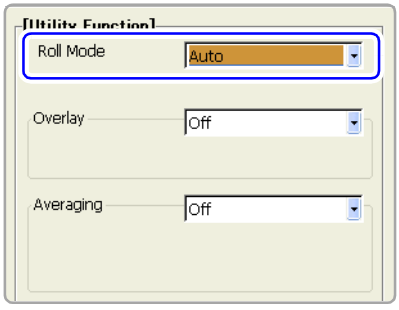
This applies to the Memory function only.
When measuring at slow sampling rates with the Memory function, you normally have to wait for recording to finish the specified recording length before viewing the waveform. However, by using the Roll Mode, you can view the waveform as the data is acquired. The new waveform scrolls automatically.

Roll Mode MEM

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen
See Screen Layout (p. 28)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Basic] page.
2	**CURSOR**	Move the cursor to the [Roll Mode] item.
	F1 to F8	Enable or disable the function.

Off	Normal recording. Data is displayed only after acquiring the specified recording length.
On	Waveforms are displayed while recording (with 1-ms and slower settings). When the timebase is set to 500 µs/div or faster, waveforms are not displayed until after acquisition has finished.
Auto	Regardless of the timebase setting, whether or not the waveform is displayed depends on the waveform display magnification settings while the data is being recorded. However, if the waveform display is set for a faster timebase than 20 ms/div, it is only displayed after acquisition has finished.



When [Auto] is selected

Example: When the timebase setting is 1 ms/div
If display magnification = [x 1], displays after the waveform has been recorded.
If display magnification = [x 1/100], displays while recording because the display is 100 ms/div.

Description

When the Roll Mode is enabled ([On] or [Auto])

- The Roll Mode, Overlay (p. 104) and Averaging (p. 106) functions cannot both be enabled at the same time. When the Roll Mode is enabled, the Overlay function and Averaging function are automatically set [Off]. And setting Overlay and Averaging function [On] automatically turns the Roll Mode [Off].
- When Auto Print (p. 317) is enabled, printing is available simultaneously with waveform display (if the internal printer is installed). However, for X-Y waveforms, all data must be acquired before printing.

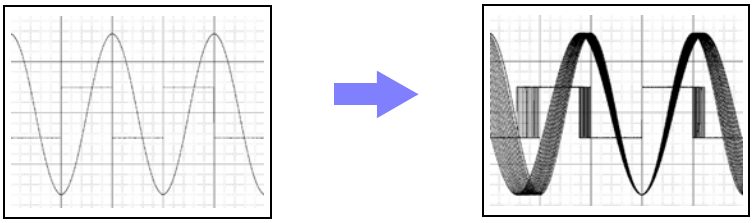
When the Roll Mode function is disabled ([Off])

Waveforms are displayed after the data has been acquired for the entire recording length, so with slow sampling there may be a long wait after starting measurement before the waveform is displayed.

4.3.2 Overlaying Waveforms

This applies to the Memory function only.
Displayed waveforms are retained on-screen and overlaid with new waveforms. Use this to compare new waveforms with those recorded immediately before. (When the trigger mode is [Repeat] or [Auto])
Methods are available to automatically overlay waveforms while measuring, and to overlay waveforms manually without limit.

Normal Display **Waveforms with the Overlay Function**



Overlay MEM

To open the screen: Press the **SET** key → Select [Status] with the **SUB MENU** keys →Status Settings screen
See Screen Layout (p. 28)

Operating Key Procedure

1 Enable/disable the Overlay function.

CURSOR Move the cursor to the [Overlay] item.

F1 to F8 Select either choice.

Off	Overlay disabled (default setting).
On	Overlay enabled.

2 When [On] is selected: Choose the overlay method.

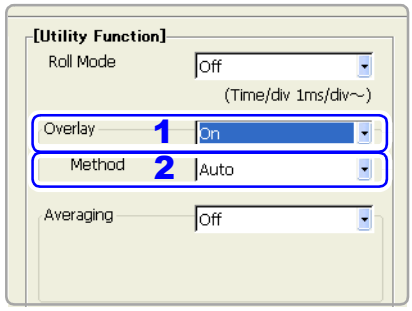
CURSOR Move the cursor to the [Method] item.

F1 to F8 Select either choice.

Auto	Normal overlay enabled. When the trigger mode is [Repeat] or [Auto], waveforms are overlaid from starting until measurement stops.
Manual	Waveforms are manually overlaid on the screen. Waveforms remain on-screen regardless of the trigger mode.

Measurement (Waveform Acquisition)

When [Manual] is selected: to overlay manually (p. 105)



This mode cannot be used simultaneously with the Roll Mode.
"When the Overlay function is enabled ([On])." (p. 105)

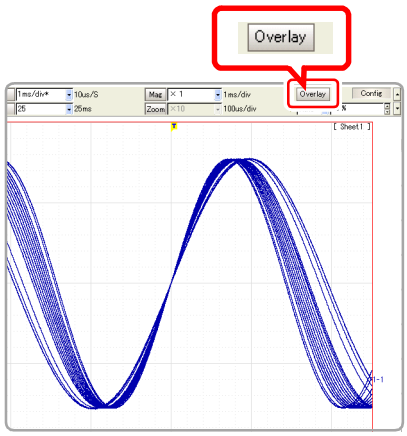
Manual Overlay (Any waveform can be retained on-screen)

MEM

To open the screen: Press the **DISP** key→Waveform screen

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Overlay] button.
2	**F1 to F8**	Select either choice.

Overlay	Acquired waveforms remain on-screen. Waveforms continue to be overlaid on-screen until cleared.
Clear	Clears the screen of all overlaid waveforms.



Description

When the Overlay function is enabled ([On]).

- The Roll Mode function (p. 102), Overlay (p. 104) and Averaging (p. 106) functions cannot both be enabled at the same time. When the Roll Mode is enabled ([On] or [Auto]), the Overlay and Averaging functions are automatically set [Off]. And setting Overlay and Averaging function [On] automatically turns the Roll Mode [Off].
- Printing and A/B Cursor tracing apply only to the last-acquired waveform.

When automatically overlaying (Overlay: [On], Method: [Auto])

The following operations are not available on the Waveform screen.

- Waveform scrolling
- Zoom function On/Off
- Changing time axis magnification/compression
- Changing zero position

In the following cases, overlaid waveforms are cleared and only the most recent waveform is displayed.

- When the split-screen settings are changed on the Sheet Settings screen
- When the [X-Y Comp] settings are changed on the Sheet Settings screen
- When settings in the [Wave Disp] item column are changed on the [One Ch] page of the Channel Setting screen.
  (Display magnification, zero position, variable, display on/off, waveform color)
- When searching a waveform

When manually overlaying (Overlay: [On], Method: [Manual])

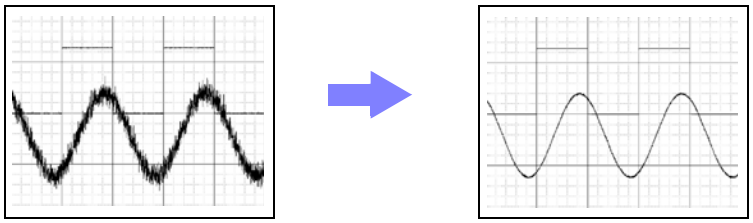
In the following cases, overlaid waveforms are displayed in different formats.

- When the split-screen settings are changed on the Sheet Settings screen.
- When the Zoom or Variable functions are switched On/Off.

4.3.3 Averaging Waveforms

This applies to the Memory function only.
The specified number of waveform samples is acquired and average values are calculated to obtain the data to be displayed.
Use this function to suppress superimposed noise and instabilities from cyclic waveforms. Increasing the number of waveform samples specified for averaging generally enhances noise suppression.

Normal Display **Waveforms with the Averaging Function**



Averaging Function MEM

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen
See Screen Layout (p. 28)

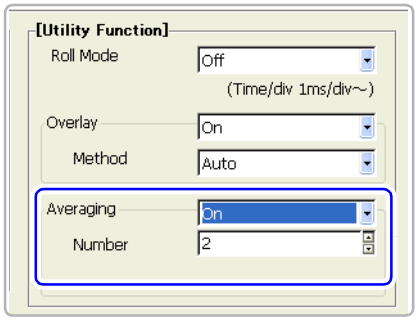
Operating Key Procedure

1 Enable the Averaging function

CURSOR Move the cursor to the [Averaging] item.

F1 to F8 Enable or disable the function.

Off	No averaging is performed.(default setting)
On	(Simple Averaging): Averages the specified number of waveform samples
On (Exponent)	(Exponential Averaging): Applies the specified weighting to the most recent data and averages with less weighting applied (exponentially) to earlier data.



2 With Averaging enabled [On]

CURSOR Move the cursor to the [Number] item.

F1 to F8 Set the number of waveform samples to be averaged.

With Exponential Averaging enabled [On (Exponent)]

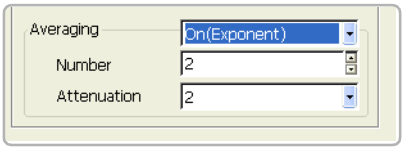
CURSOR Move the cursor to the [Number] item.

F1 to F8 Set the number of waveform samples to be averaged.

CURSOR Move the cursor to the [Attenuation] item.

F1 to F8 Set the weighting ratio (attenuation constant).

2, 4, 8, 16, 32, 64, 128, 256



Once measurement starts, the number of waveform samples specified to be averaged and the number of samples currently acquired are displayed.

Description

When Averaging is enabled:

- The Roll Mode (p. 102) and Averaging cannot be used simultaneously. Enabling the Roll Mode (by selecting [ON] or [AUTO]) automatically turns Averaging off. Also, enabling Averaging (or the Overlay function) automatically turns the Roll Mode off.
- Maximum recording length is one fourth the non-averaging length.
- Logic waveforms cannot be displayed.
- Averaging is not available when using the Model 8958 16-Ch Scanner Unit.
- Averaging and Timebase 2 (Sampling 2) cannot be used simultaneously.

When using the Memory Division function:

- Averaging cannot be enabled.
- Trigger Priority and Stop Triggering are not available.

About Averaging Calculations

Simple Averaging

Waveform samples are sequentially summed until the *N*th measurement is completed, at which time the sum is divided by *N* to obtain the average value.

$$A = \frac{1}{N}\sum_{i=1}^{N} X_i$$

A: Averaging value,
X_i: Value measured at time i,
N: Number of samples to average

Exponential Averaging

The specified weighting (attenuation constant *k*) is applied to the most recent data, and the average value is obtained by applying less weighting to earlier measurement data as the number of measurements is summed.

$$A_1 = X_1$$

A_1: Average value after first measurement,
X_1: Value of the first measurement

$$A_n = \frac{1}{k}((k-1)A_{n-1} + X_n)$$

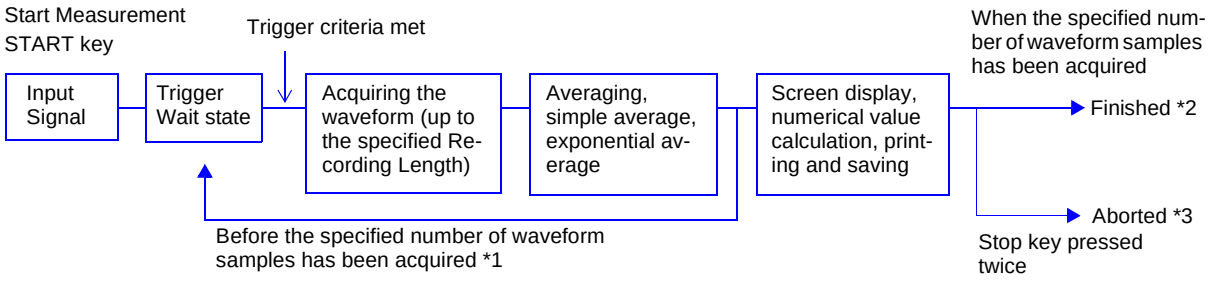
n: No. of waveform samples (2 to N),
k: Attenuation constant
A_n: Average of n samples,
X_n: Value of the n^{th} waveform sample

Relationship Between Trigger Mode and Averaging

See Trigger mode settings: "6.3 Setting the Trigger Mode" (p. 138)

Trigger Mode: [Single]

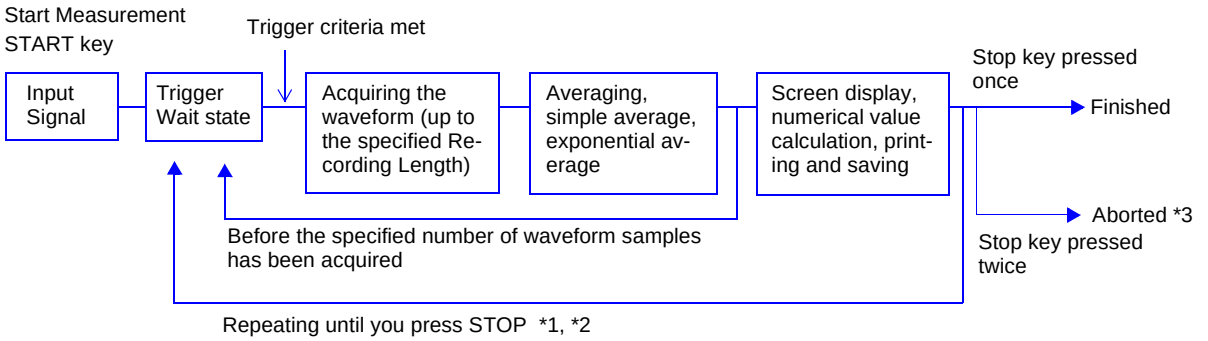
When the Trigger Mode is [Single], measurement continues until the specified number of waveform samples is acquired.



*1. Awaiting a trigger until the specified number of samples is acquired.
*2. Measurement finishes automatically when the specified number of samples is acquired.
*3. If you press the STOP key twice to abort before the specified number of waveform samples is acquired, no waveform data is retained.

Trigger Mode: [Continuous]

When the Trigger Mode setting is [Continuous], measurement continues for the specified number of waveform samples to be averaged, after which operations such as on-screen display and measurement repeat until you press the STOP key.



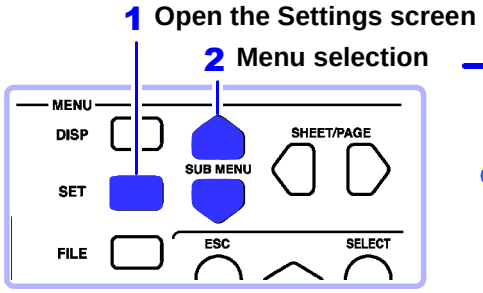
*1. With simple averaging, a new average value is calculated each time the specified number of samples is acquired.
*2. With exponential averaging, the previous average value is applied to the next measurement series when the next average is calculated.
*3. If you press the STOP key twice to abort measurement before the specified number of waveform samples is acquired, no waveform data is retained. To retain waveform data, press the STOP key once and wait until measurement finishes.

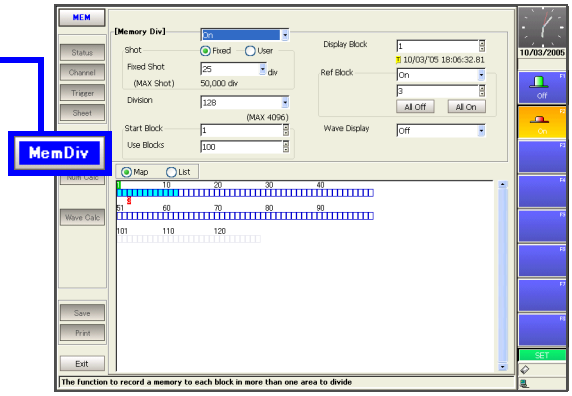
Trigger Mode: [Auto]

When the Trigger Mode setting is [Auto] after you press the START key, data is acquired after a fixed time even if no trigger criteria are met. In this case, because the signal is asynchronous, averaging data has no meaning.

4.3.4 Dividing Memory

Settings are made on the Memory Division Settings screen. Blocks to be displayed can also be selected on the Waveform screen (p. 220).
This applies to the Memory function and REC&MEM function only.



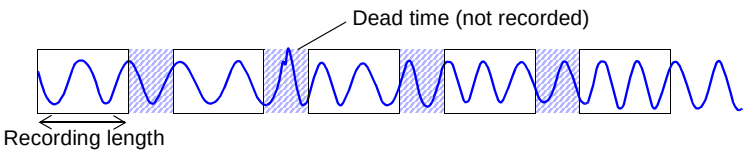


About screen contents:
"2.5.5 Memory Division Settings Screen" (p. 37)

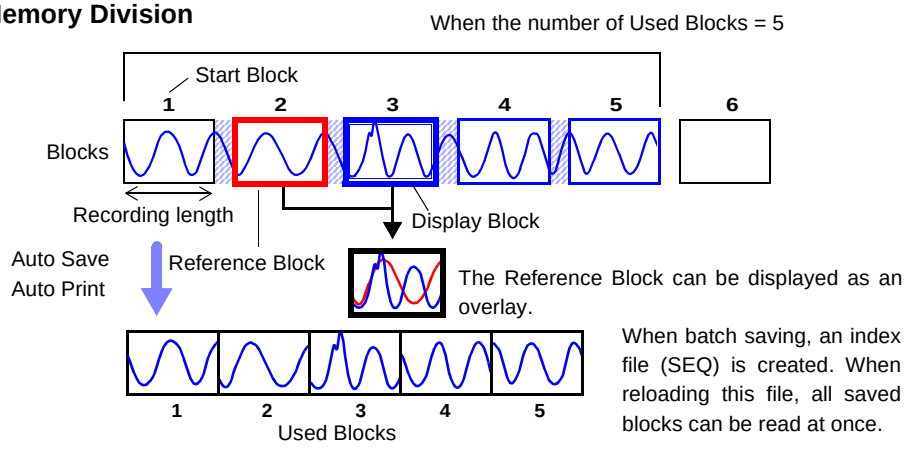
Waveforms can be recorded into individual blocks by dividing memory space into multiple blocks. You can record waveforms beginning at any block (Start Block), choose which blocks to display (Display Block), or display multiple overlaid blocks (Reference Block).
The maximum number of blocks for memory division depends on the installed memory board and recording length (up to 4096 divisions, for REC&MEM up to 1024 divisions).
In addition, triggered waveform data can be acquired continuously and recorded sequentially in specified blocks (at the Start Block, for the specified Used Blocks). Dead time while displaying or printing (during which triggers are ignored) can be minimized.
Even if the Memory Division function is not used, up to 16 blocks of data (depending on the specified recording length) can be saved to each block, so that previously recorded data can be selected for display on the Waveform Screen.

See "8.11 Viewing Past Waveforms" (p. 219)

Normal



Memory Division



When saving manually, select whether to save all used blocks, or just the displayed block. (p. 285)

Memory Division: Recording Settings

MEM REC&MEM

To open the screen: Press the **SET** key → Select MemDiv with the **SUB MENU** keys →Mem Div Settings screen

See Screen Layout (p. 37)

Operating Key Procedure

1 Enable the Memory Division function.

CURSOR Move the cursor to the [Memory Div] item.

F2 Select [On].

Off	Memory Division is disabled.(default setting)
On	Memory Division is enabled.

2 Set the recording length.

(This is linked to the recording length setting on the Status Settings screen.)

CURSOR Move the cursor to the [Shot] item.

F1 to F8 Set the recording length.
The maximum recording length and number of divisions are determined automatically according to memory capacity and the number of channels used.
Setting range: "Appendix 2.5 Recording Length and Maximum Number of Divisions (Memory Division function)" (p. A38)

3 Set the number of divisions.

CURSOR Move the cursor to the [Division] item.

F1 to F8 Set the number of blocks for division.
Default setting: 2
Changing the recording length on the Status Settings screen changes the number of divisions.

4 Set the start block.

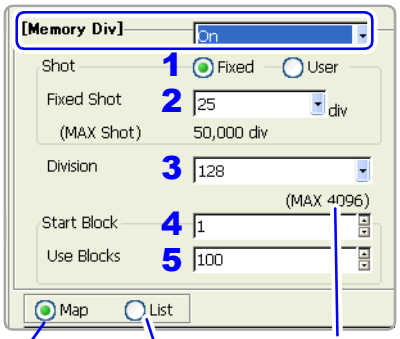
CURSOR Move the cursor to the [Start Block] item.

F1 to F8 Set the block number at which to start recording.
Default setting: 1

5 Set the Used Block number.

CURSOR Move the cursor to the [Use Blocks] item.

F1 to F8 Set the number of blocks to use.
Default setting: 1



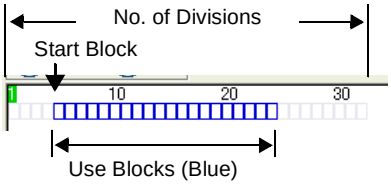
Map
Allows confirming block usage status.

Maximum number of divisions

List
Allows confirming information such as the trigger time of each block.(p. 112)

Memory Division and Waveform Calculation cannot be enabled at the same time.

When the number of divisions is 32, the Start Block is 5 and the Used Block number (number of blocks to use) is 20



About Recording
When a fast timebase is selected, displaying, printing and saving operation are not available while measuring.
Selecting the display screen for auto saving lengthens dead time.

To display any block on the waveform screen when finished measuring:
Set the number of blocks to display. (This can also be set on the Waveform screen.(p. 220))

To display overlaid waveforms:
Set the number of blocks for reference. (p. 111)

Memory Division: Display Settings MEM

To open the screen: Press the **SET** key → Select MemDiv with the **SUB MENU** keys →Mem Div Settings screen

See Screen Layout (p. 37), To set from the Waveform screen (p. 220)

Operating Key Procedure

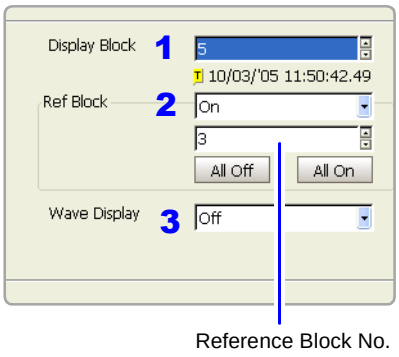
1 To display any block on the Waveform screen

Set the display blocks

(This can also be set on the Waveform screen.(p. 220))

CURSOR Move the cursor to the [Display Block].

F1 to F8 Set the number of blocks to display on the Waveform screen after measurement.



Reference Block No.

2 To display multiple blocks as overlaid waveforms

Enable the Reference Block function

CURSOR Move the cursor to the [Ref Block].

F2 Select [On].

Off	Reference Blocks are not displayed (default setting)
On	Reference Blocks overlay Display blocks on the display.

(When Reference Blocks are enabled [On])
Select whether to reference every block

CURSOR Move the cursor to the row number of the Reference Block to select its block number.

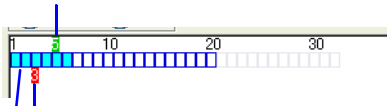
F7 or **F8** Enables (On) or disabled (Off) Reference Blocks. When enabled, the frame of the selected block is red.

F1 to F8 To overlay all waveforms, select the [All On] button.

All Off	Disables all block references.
All On	Enables all block references.

When the Display Block is 5 and the Reference Block is 3

Display Block (Green)



Reference Block (Red)

Measurement data is recorded at the colored positions.

Reference Block Selection

Reference Blocks can also be selected and deselected in the [Reference Block] item on the [List] display.

See: "Getting Details on Each Block" (p. 112)

3 To display every block as its waveform is acquired

Enable the Trace Waveform display

CURSOR Move the cursor to the [Wave Display].

F2 Select [On].

Off	The waveform of the specified Display Block is displayed after recording the specified number of Used Blocks. (default setting)
On	Waveforms are displayed one block at a time as they are acquired at each trigger event.

Enabling the Trace Waveform display lengthens dead time.

About Dead Time:

See: "Difference Between Dead Times During Normal and Memory Division Recording" (p. 112)

When Using Auto Save

When disabled, displayed images are not saved.

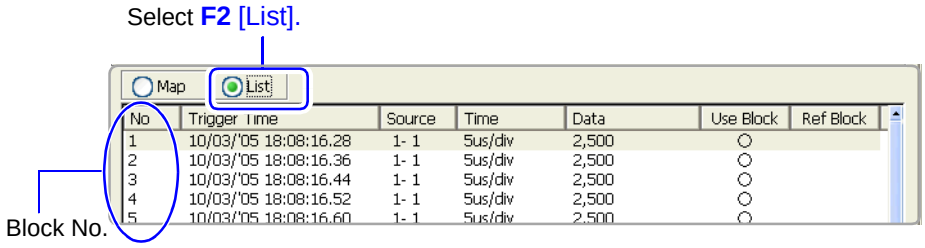
Even if the Roll Mode is enabled (other than Off), it is not usable when the Trace Waveform display is disabled.

Viewing Memory Division waveforms on the Waveform screen

See "8.12 Viewing Waveforms in Every Display Block (Memory Division)" (p. 220)

Getting Details on Each Block

The trigger time and measurement status of each block can be viewed on the [List] screen.



A block can be selected by the ⌂▽**CURSOR** keys or the **F5** to **F8** keys. You can move the cursor to the Reference Block column to set a block's on/off state as a Reference Block.

To switch block waveforms on the Waveform screen

You can use the **SHEET/PAGE** keys to select blocks to be displayed.

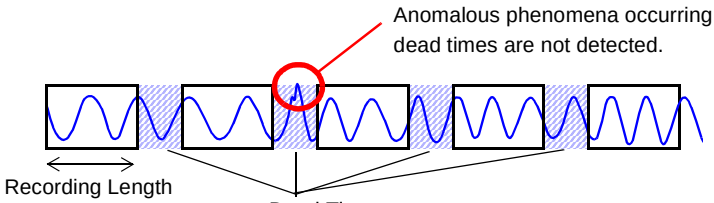
In the default state, the **SHEET/PAGE** keys switch Display Sheets. You can change the function of the **SHEET/PAGE** keys to [Block Switching] on the System - Environment Setting Screen.

See "13.2.6 Specifying SHEET/PAGE Key Operations" (p. 357)

Description

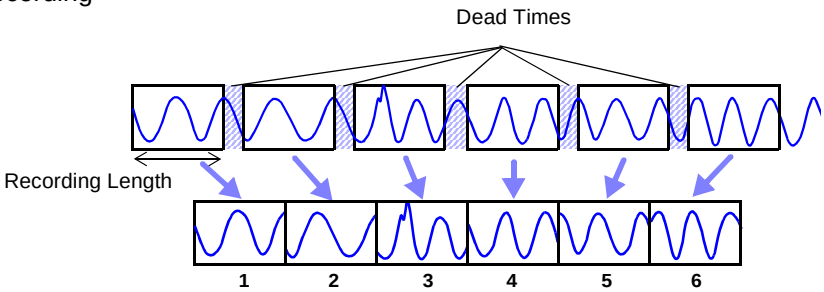
Difference Between Dead Times During Normal and Memory Division Recording

When both printer recording (Auto Print) and Auto Save are set for continuous triggering [Cont]



Times during which sampling is inhibited due to internal processing, printing or saving

When the Trace Waveform Display is disabled (Off) during Memory Division recording



The waveform data of each recording length is recorded in one block.

When recording with Memory Division, dead time is shorter than with normal recording. When Trace Waveform Display is enabled, dead time is longer.

NOTE

- The times during which sampling is inhibited (dead time) due to display and recording processing after each block of data has been acquired are about 8 ms.
- When measuring a parameter other than voltage or current with the Model 8940 F/V Unit, dead time is about 230 ms.
- When using the Model 8958 16-Ch Scanner Unit or Timebase 2 sampling, dead time may be longer, depending on the Timebase 2 sampling speed setting.
- When the Trace Waveform display is disabled, even if the Roll Mode is enabled (other than Off), the Roll Mode function is unusable.
- The Averaging function is not available when Memory Division is enabled.
- When triggering occurs very often, pressing the STOP key may not stop measurement until enough data has been acquired to fill the blocks specified for use.

4.4 Setting Measurement Configuration on the Waveform Screen

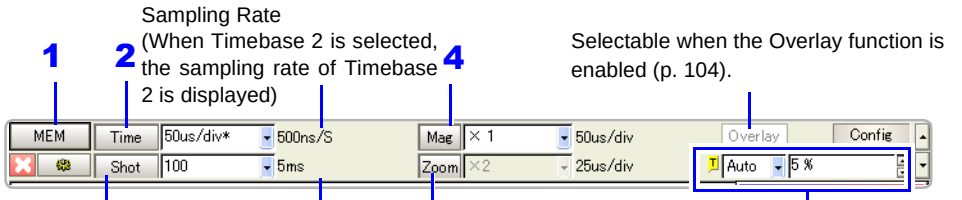
The following measurement configuration settings can be made on the Waveform screen. These can be changed while measuring.

Setting choices depend on the operating function. Refer to each setting on the Status Setting screen for details of setting choices.

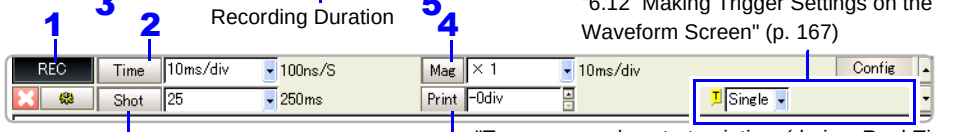
Also refer to "Chapter 9 Measuring with Real-Time Saving" (p. 235) for details about the function.
Refer to the *Analysis and Communication Supplement* for FFT function details.

Use the **CURSOR** keys to move the cursor to each setting item, and select your choice with the F keys.
Press the **SUB MENU** keys to change available setting items (p. 21).

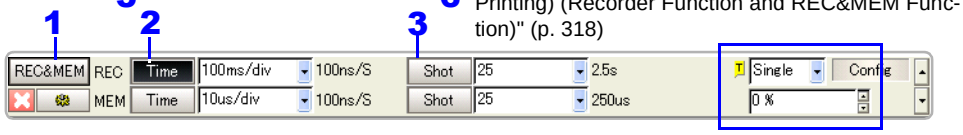
Memory Function



Recorder Function



REC&MEM Function



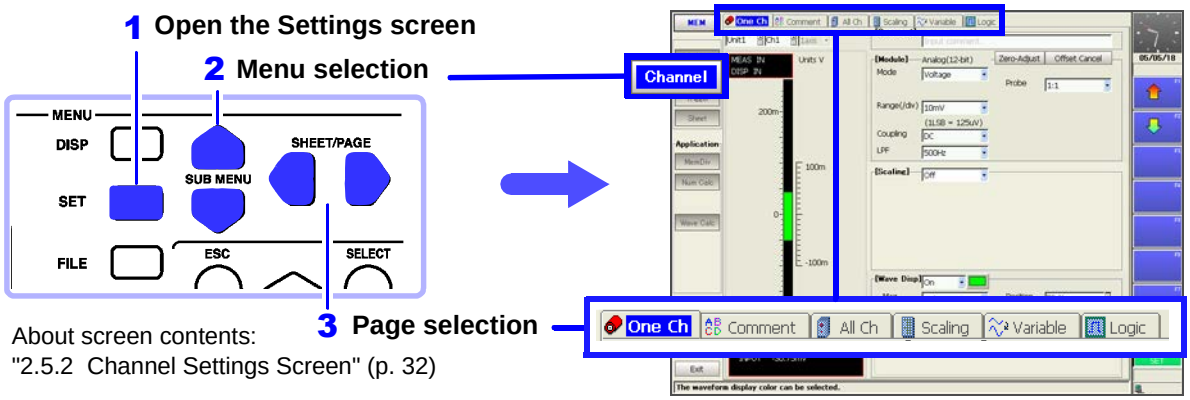
	Setting Items		Description	Selection Choices		
1	Function			Memory Function	Recorder Function	REC&MEM Function
2	Time (Timebase) (p. 90)	(Button)	Selects the sampling clock.	Internal (INT) or External (EXT)	(cannot be selected)	(cannot be selected)
		(Setting column)	Sets the input signal acquisition rate. The setting value is time per division.	(p. 92)	(p. 92)	(p. 92)
3	Shot (Recording Length) (p. 97)	(Button)	Specifies the recording length setting method.	Fixed or User	Fixed, User, or Cont	Fixed, User, or Cont (Recorder waveform only)
		(Setting column)	Sets the recording length (number of divisions) for each acquisition operation.	(p. 97)	(p. 97)	(p. 97)
4	Mag (Magnification) (p. 211)	(Button)	Selects viewing the waveform of the entire recording length on one screen.	Whole Wave	Whole Wave	Memory Waveform, Recorder Waveform Each can be set independently
		(Setting column)	Selects magnification on the horizontal axis (time axis). Overall fluctuations can be quickly seen by compressing	21 steps from x 10 to 1/500,000 (Magnification/Compression)	16 steps from x 4 to 1/20,000 * (Magnification/Compression)	
5	Zoom (p. 213)	(Button)	Magnifies a section of a waveform. Turn [On] when you want to zoom.	On or Off	————	Setting is possible only when a Memory Waveform is displayed.
		(Setting column)	Set the magnification ratio.	x 10 to 1/200,000	————	
6	Print (p. 318)	(Button)	Stops or resumes real-time printing.	————	Pause Print/ Restart Print	A setting item is can be selected if its [Display] is enabled.
		(Setting column)	When resuming printing, set how many divisions to retrace for printing.	————	-15 to 0 div	

*. with timebase settings between 10 and 50 ms/div, the measured waveform is displayed as compressed regardless of the magnification setting

Input Channel Settings

Chapter 5

Set the measurement range, scaling and input waveforms for input channels on the Channel Settings screen. Input channel settings can also be made on the Waveform screen. (p. 134)



About screen contents:
"2.5.2 Channel Settings Screen" (p. 32)

The setting choices for input channels depends on the type of input module. Refer to the *Input Module Guide* for details. If the measurement range is unknown, it can be set automatically.

See "3.3.5 Automatic Range Setting (Auto-Ranging Function)" (p. 74)

Input Module (Analog Channel) Settings (p. 116)

[One Ch] Page

- Selection of channel(s) to set
- Measurement range setting
- Measurement mode, input coupling, low-pass filter and probe attenuation*1 settings
- Channel comment*2 settings (p. 118)

*1. Setting choices depend on the type of input module. These settings are also available on the [All Ch] page. (p. 130)

*2. This setting is also available on the [Comment] page. (p. 129)

Logic Channel Settings

[Logic] Page

- Waveform color settings (p. 184)

[Comment] Page

- Channel comment settings (p. 129)

Scaling Settings (p. 123)

[One Ch] Page

When using a clamp or external sensor, set to convert measurement units for display.
These settings are also available on the [Scaling] page. (p. 131)

Input Waveform Settings

[One Ch] Page

- Enable/disable waveform display, set display color (p. 171)
- Zero position setting (p. 172)
- Vertical magnification and arbitrary display range (Variable function) settings*(p. 215)

* These settings are also available on the [Variable] page.(p. 132)

Other Settings

- Monitoring the input level (p. 122)
- Making copy settings (p. 133)
- Adding titles*(p. 118)

* Titles can be included on printouts.

5.1 Analog Channel Settings

Setting choices depend on the type of input module. This section describes channel settings using the Model 8936 Analog Unit.
The same setting choices are available with the following input modules:

- Model 8936 Analog Unit
- Model 8956 Analog Unit
- Model 8946 4-Ch Analog Unit

Refer to the *Input Module Guide* for settings specific to each input module.
Settings can be made on either the [One Ch] page or the [All Ch] page(p. 130) of the Channel Settings screen.

Channel Settings (Example: 8936 Analog Unit)

MEM REC REC&MEM FFT REALTIME

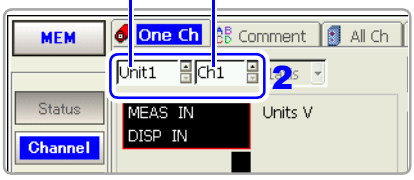
To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen

See Screen Layout (p. 32), To set from the Waveform screen (p. 134)

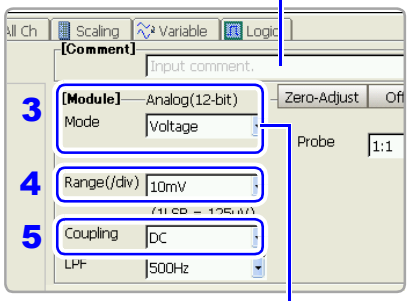
	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [One Ch] page.
2	**Select the module (Unit) and channel number to be set.**	
	CURSOR	Move the cursor to each [Unit (no.)] and [Ch (no.)].
	F1 to F8	Select the module (Unit) number (Unit 1, 2, …) and channel. (The type of the selected module is indicated beside the [Unit].)
3	**Verify the module type and measurement mode to be set.**	
		Verify that the [Mode] is set to [Voltage].
4	**Set the measurement range.**	
	CURSOR	Move the cursor to the [Range (/div)] item.
	F1 to F8	Set the vertical axis (voltage axis range).
		5 m, 10 m, 20 m, 50 m, 100 m, 200 m, 500 mV/div, 1, 2, 5, 10, 20 V/div
		The setting is the amplitude per division on the vertical axis. This setting can also be made with the **RANGE/POSN** knobs.(p. 117)
5	**Select the input signal coupling method (as occasion demands).**	
	CURSOR	Move the cursor to the [Coupling] item.
	F1 to F8	Select either choice.

DC	DC Coupling Select this to acquire both DC and AC components of an input signal.
AC	Select this to eliminate any DC component from an input signal. Use this to measure only the ripple component superimposed on pulsating current.
GND	The input signal is disconnected. Zero position can be confirmed.

Module (Unit) No. Channel No.



Comments can be entered for each channel. (p. 118)



Measurement Mode
When using an input module that can provide multiple types of measurement, such as voltage and temperature, select the type of measurement to be performed.

See "3.11.2 Setting Input Coupling" in the *Input Module Guide*

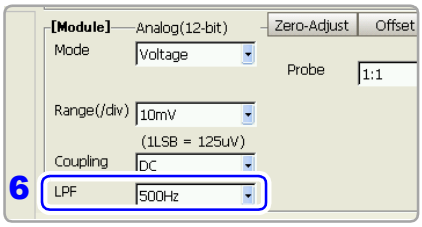
Operating Key Procedure

6 Set low-pass filtering (as occasion demands)

CURSOR Move the cursor to the [LPF] item.

F1 to F8 Set the low-pass filter in the input module.

(For Model 8936) Off, 5Hz, 500Hz, 5kHz, 100kHz

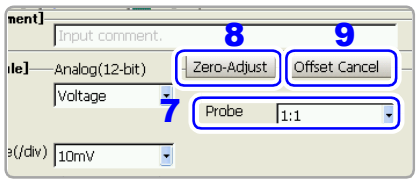


7 Select the probe attenuation.

CURSOR Move the cursor to the [Probe] item.

F1 to F8 Select according to the connection cables being used.

1:1	Select when measuring using Model L9197, 9197, L9198 or L9217 Connection Cords.
10:1	Select when measuring using the Model 9665 10:1 Probe.
100:1	Select when measuring using the Model 9666 100:1 Probe.
1000:1	Select when measuring using the Model 9322 Differential Probe.



8 Perform zero adjustment (after warm-up).

CURSOR Move the cursor to the [Zero-Adjust] button.

F1 Select [Execute].
When executed, all channels are zero adjusted (except in the Model 8958 16-Ch Scanner Unit).

9 Perform Offset Cancel (as occasion demands).

CURSOR Move the cursor to the [Offset Cancel] button.

F1 Select [Execute].
When executed, only the selected channel is corrected.

About low-pass filtering

See "3.11.3 Low-Pass Filter (LPF) Settings" in the *Input Module Guide*

About probe attenuation

Matching the probe attenuation setting to that of the input channel's probe enables automatic conversion of voltage axis range measurements for direct reading of numerical values.

See "3.11.15 Probe Attenuation Selection" in the *Input Module Guide*

About zero adjustment

Adjusts the zero position of an input module. Warm-up time depends on the type of input module.

See "3.11.17 Executing Zero Adjustment" in the *Input Module Guide*

About offset canceling

Executing Offset Cancel when using a sensor corrects for external signal bias.

See "3.11.18 Executing Offset Cancellation" in the *Input Module Guide*

To display converted units when using a clamp or sensor

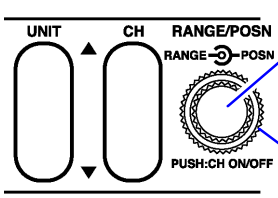
Set scaling.

See "5.4 Converting Input Values (Scaling Function)" (p. 123)

To change the input waveform color, zero position and magnification on the vertical axis

See "7.1 Making Input Waveform Display Settings (Analog Waveforms)" (p. 170)
"8.9 Magnifying and Compressing Waveforms" (p. 211)

To set the measurement range or zero position by the RANGE/POSN knobs



To set the measurement range: turn the inner **RANGE** knob.

Select a lower sensitivity range

Select a higher sensitivity range

To set the zero position: turn the outer **POSN** knob.

Lower position

Higher position

5.2 Adding Comments

5.2.1 Adding a Title Comment

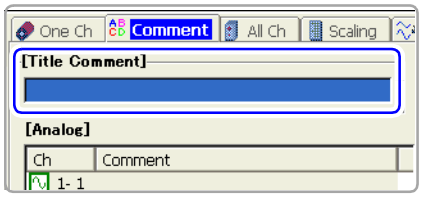
Title comments can be printed on the recording paper.
Allowed number of characters: up to 40

To print, enable the setting on the Print Settings screen.
See "12.6.5 Printing Comments and Setting Data" (p. 337)

Title Comment (for printing) MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen
See Screen Layout (p. 33)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Comment] page.
2	**CURSOR**	Move the cursor to the [Title Comment] item.
3	**F1 to F8**	Enter comment text. **See** "Entering Text and Comments" (p. 66) "Comment Entry Example" (p. 120)



5.2.2 Adding Channel Comments

Comments added for each channel can be displayed on-screen. Comments can also be printed on recording paper.
Allowed number of characters: up to 40
Make settings on either the [One Ch] page or the [Comment] page.

To display comments on the Waveform screen:

Enable comment display from the Environment (Env) Settings screen (Default setting: Off).

See "13.1.2 Displaying or Hiding Comments" (p. 351)

To print comments with measurement data:

Set on the Print Settings screen.

See "12.6.5 Printing Comments and Setting Data" (p. 337)

Channel Comments

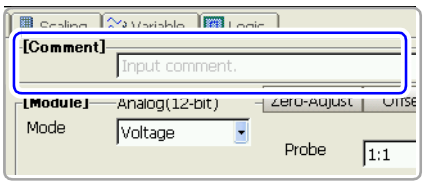
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen

See Screen Layout (p. 33)

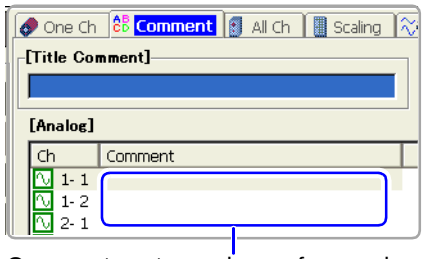
To set on the [One Ch] page (only analog channel comments)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [One Ch] page.
2	**CURSOR**	Move the cursor to the [Comment] item.
3	**F1 to F8**	Enter comment text. See "Entering Text and Comments" (p. 66) "Comment Entry Example" (p. 120)

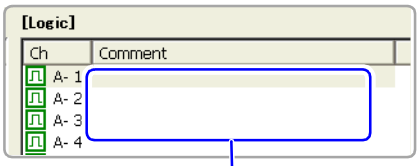


To enable on the [Comment] page (both analog and logic channel comments)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Comment] page.
2	**CURSOR**	Move the cursor to the [Comment] entry column for [Analog] or [Logic] channels.
3	**F1**	Enter comment text. See "Entering Text and Comments" (p. 66) "Comment Entry Example" (p. 120)



Comment entry column for analog channels



Comment entry column for logic channels

Displaying comments on the Waveform screen

Set the [Display Comments] setting [On] on the Env Settings screen. (p. 351)

Copy a comment from one channel to another?

Comments can be copied on the [Comment] page.

See "Copying Comments" (p. 121)

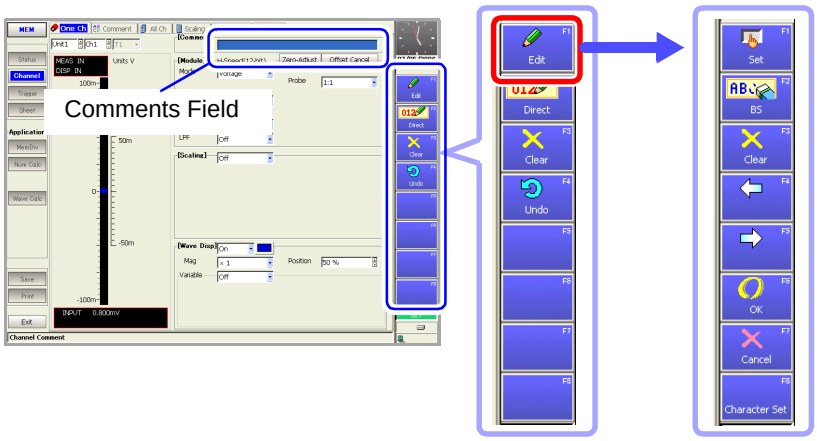
Comment Entry Example

The virtual keyboard is used to enter comments with the operating keys or a mouse.

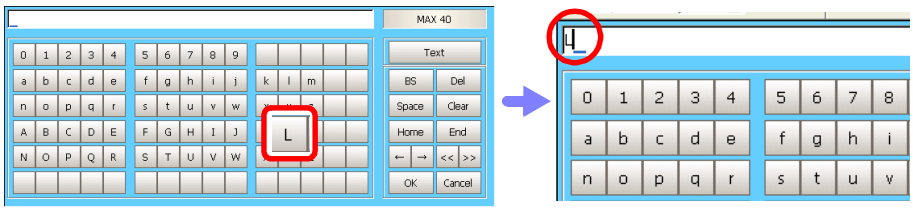
See "Using [Edit] for Entry" (p. 67)

In this example, we enter the comment “LINE-1” in the Comments field on the [One Ch] page.

1 Use the **CURSOR** keys to move the cursor to the Comments field, and press the **F1** [Edit] key.
The virtual keyboard appears.

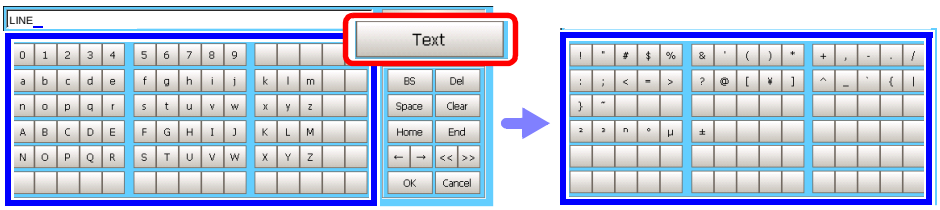


2 Use the **CURSOR** keys to move the cursor to “L”, and press the **F1** [Set] key.
The letter “L” appears in the entry field.



3 Continue entering the same way.

- To change character sets, press the **F8** [Character set] key to switch the entry mode (Virtual Keyboard Entry Modes) (p. 68)).



- To insert a character between existing characters: Use the **F4** and **F5** keys to move the cursor to the entry point, and enter a character as in Step 2.
- To delete a character: Use the **F4** and **F5** keys to move the cursor (underline) to the character following the one you want to delete in the entry field, and press the **F2** [BS](Backspace) key.
- To delete all entered characters: Press the **F3** [Clear] key.

4 When finished entering, press the **F6** [OK] or the **ENTER** key.
The characters are accepted and the virtual keyboard is closed.
To revert to the previous field contents, press the **F7** [Cancel] key.

Copying Comments

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen→ Select the [Comment] page with the **SHEET/PAGE** keys

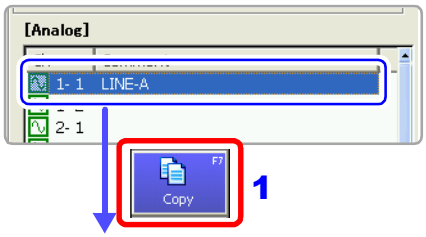
See Screen Layout (p. 33)

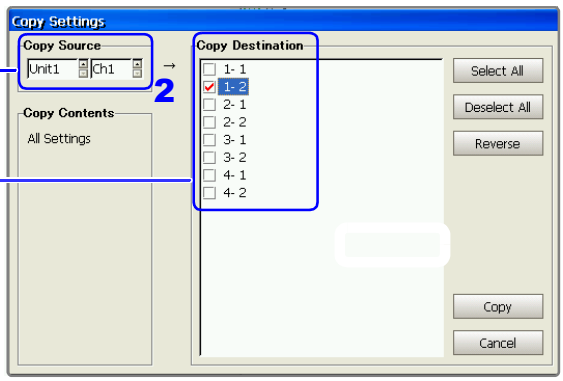
Operating Key Procedure

1 Open the dialog.

CURSOR Move the cursor to the channel with the comment you want to copy in the [Analog] or [Logic] entry column.

F7 Select [Copy].
The [Copy Settings] dialog appears.





Unit and channel number of copy source

Unit-channel number(s) of copy destination(s)

2 Select the copy source and destination(s).

CURSOR Move the cursor to the [Copy Source] item.

F1 to F8 Select the unit and channel number of the copy source.

CURSOR Move the cursor to the [Copy Destination] item.

F1 to F8 Select the unit-channel number(s) of the copy destination(s).

3 Execute copy.

F7 Select [Copy].
The selected content is copied.

Selections can be made using the buttons in the dialog.
Move the cursor to a button, and press the F1 key.

- Select All
  Selects all channels as copy destinations.
- Deselect All
  Deselects all copy destinations.
- Reverse
  Reverses selected and deselected settings.
- Copy
  Executes the copy process.
- Cancel
  Cancels the copy process.

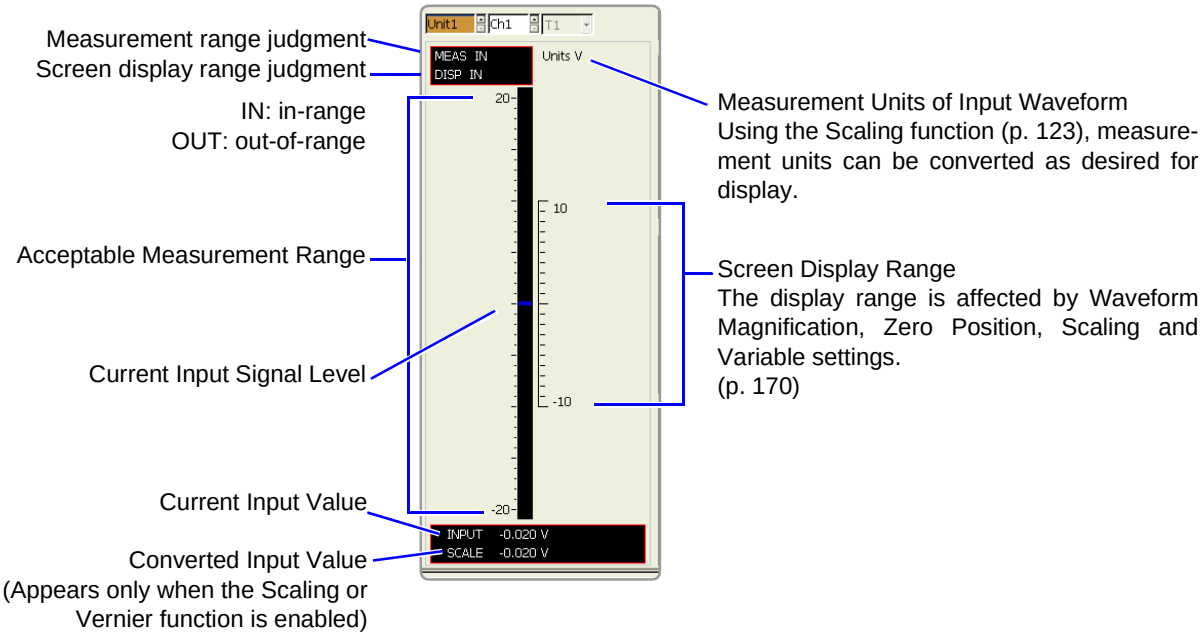
5.3 Monitoring Input Status

5.3.1 Verifying the Input Level (Level Monitor)

You can verify the input status and display range while making settings on the Channel Settings screen.
This is not available while measuring.

Interpreting the Display

[One Ch] Page of Channel Setting Screen

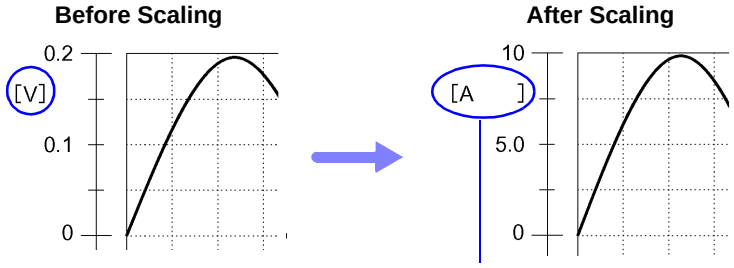


5.4 Converting Input Values (Scaling Function)

About the Scaling Function

Use the scaling function to convert the measured voltage units output from a sensor to the physical units of the parameter being measurement.
Hereafter, “scaling” refers to the process of numerical value conversion using the Scaling function.

Gauge scales, scale values (upper and lower limits of the vertical axis) and A/B cursor measurement values can be displayed in scaled units. Scaling is available for each channel.



When scaling is enabled, the space between the brackets [ ] is widened.

Scaling Setting Example

See When using a clamp sensor (p. 126) (Example: Converting [V] →[A])
When using the Strain Unit (p. 127) (Example: Converting [με] ⟶ [G])

Scaling Methods

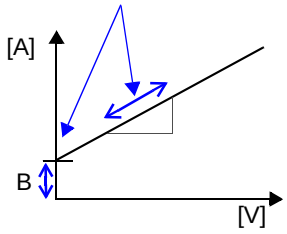
Two scaling methods are available:

(Example: Converting [V]→ [A])

Conversion Ratio Setting

Set the physical value per volt (conversion ratio: eu/V) of the input signal, an offset value and measurement unit name (eu: engineering units) for conversion, so measurement values acquired as voltage are converted to the specified units.
Example:
Conversion ratio: A value per volt,
Offset value: B, Unit name: A

Convert from slope (conversion ratio) and offset value



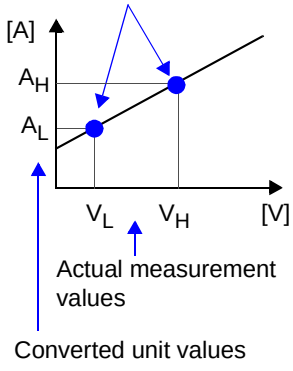
Two-Point Setting

Set the voltage values of two points of the input signal, the converted unit value of these two points and the name of the converted measurement units, so measurement values acquired as voltage are converted to the specified units.
Example:

Voltage value at 2 points	Voltage of units to convert
V_H: Higher potential point	A_H:Value for higher potential point
V_L: Lower potential point	A_L:Value for lower potential point

Unit name: A

Conversion ratio and offset value are calculated from the two points and converted



Setting Scaling

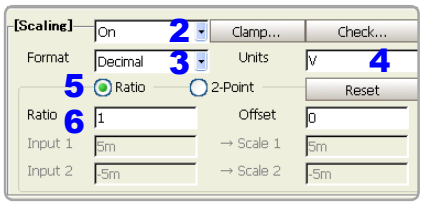
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Channel] with the **SUB MENU** keys →Channel Settings screen

See Screen Layout (p. 32)

	Operating Key	Procedure

1 **SHEET/PAGE** Select the [One Ch] page.
(Setting can also be done on the [Scaling] page.)
(p. 131)



2 **Enable the Scaling function.**

CURSOR Move the cursor to the [Scaling] item.

F2 Select [On] (Default setting: Off).

3 **Set the display format for numerical values.**

CURSOR Move the cursor to the [Format] item.

F1 to F8 Select either choice.

Decimal	Displays decimal values.
Exponential	Displays exponents in multiples of 3.

Example:
Decimal format ..... 1.2345 mV
Exponential format ..... 1.2345E-03 V

4 **Specify the physical units.**

CURSOR Move the cursor to the [Units] item.

F1 to F8 Enter the physical unit name.
(Up to 7 characters)

See "Entering Text and Comments" (p. 66)

When saving text or numerical calculation results
In certain cases, entered characters may be changed when data is saved.
(p. 298)

5 **Select the scaling conversion method.**

CURSOR Move the cursor [Ratio] or [2-Point] (item currently selected).

F1 to F8 Select either choice.

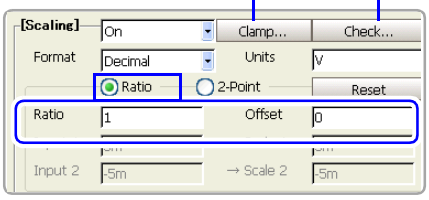
Ratio	Specify by conversion ratio.
2-Point	Specify by two points.

"Scaling Methods" (p. 123)

When setting by two points
The point values can be set to the current input values displayed on the monitor.

You can check that the conversion setting values are correct. (p. 125)

When using a clamp, scaling can be performed automatically. (p. 126)



[Ratio] Setting

6 **Enter the numerical values for conversion.**

When you have selected [Ratio] (set conversion ratio and offset)

CURSOR Move the cursor to each of the [Ratio] and [Offset] items.

F1 to F8 Enter numerical values in each field.

-9.9999E+9 to 9.9999E+9

See "Entering Numbers" (p. 65)

When you have selected [2-Point] (set input values for two points and the values after conversion)

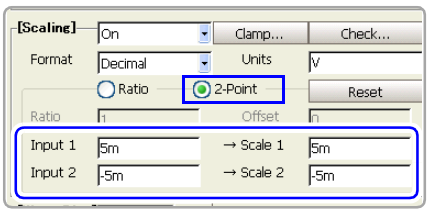
CURSOR Move the cursor to the [Input 1], [Scale 1], [Input 2] and [Scale 2] items.

F1 to F8 Enter numerical values in each field.

-9.9999E+29 to 9.9999E+29

See "Entering Numbers" (p. 65)

When entered, converted values are displayed in the specified physical units on the level meter. You can check that the setting values are correct (p. 125).

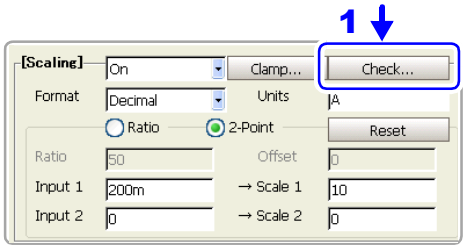


[2-Point] Setting

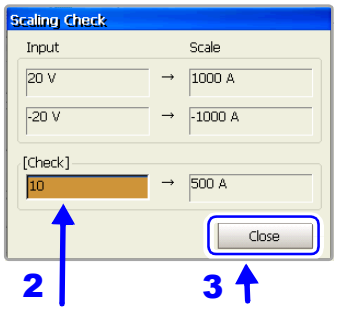
If you want to enter the current input value as it is to Inputs 1 and 2, select F7 [Monitor Value].

To verify correct scaling settings: Scaling Check

Select the **[Check]** button.



The [Scaling Check] dialog appears.

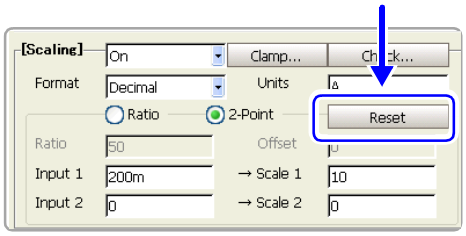


When appropriate numerical values have been entered, the converted physical value is displayed. Verify that it is converted correctly.

Select the [Close] button to close the dialog.

To reset Scaling settings

Select the **[Reset]** button.



Scaling settings are reset.

Using the Scaling and Variable functions (p. 215) in combination

The full span of output from a sensor can be displayed. (p. 217)

NOTE

At factory shipping, automatic correction of the variable function (p. 358) is set to [On].
At this time, the Variable setting is altered so that it is linked to (dependent upon) the measurement range and Scaling settings. If you want the Variable function setting to take priority, use either of the following procedures:

- Set Scaling first, and then set the Variable function
- Set a Variable value before Scaling, and then set Scaling.

When automatic correction of the Variable function (Variable Auto Adjustment) is disabled (Off), the Scaling and Variable settings are unlinked (independent of one another).

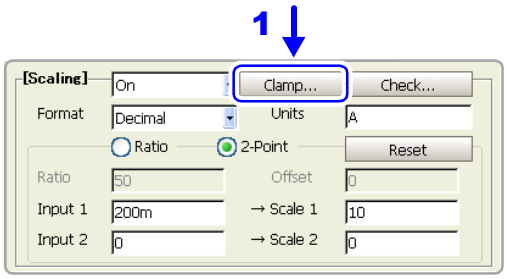
Scaling Setting Examples

Using a Clamp-On Probe

Example 1. **Measure with the 10A range of the Model 9018-50 Clamp-On Probe and display the measured data in units of [A] (Amperes)**

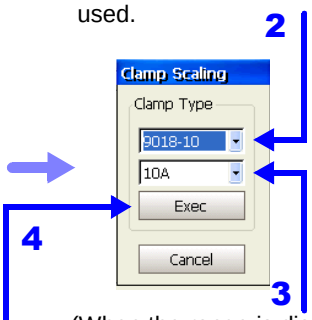
To set automatically

Select the **F1** [Clamp] button.



The Clamp Scaling dialog appears.

Select the clamp type to be used.

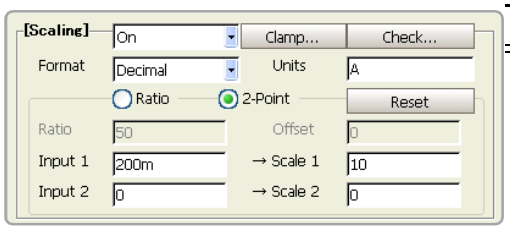


(When the range is displayed)
Select the same range as that set with the clamp.

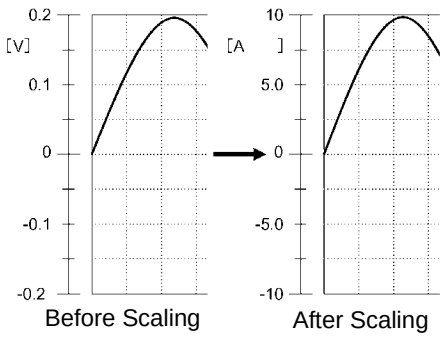
Select the [Exec] button.
Scaling is performed automatically to suit the selected clamp.

To set manually (enter two-point numerical values)

The 9018-50 Clamp-On Probe provides 0.2 V output when measuring 10 A. So Scaling should be set to display 10 A with 0.2 V input (and 0 A with 0 V input). However, you may need to switch the vertical axis (voltage range) to suit actual input values.
For example, to display ±0.2 V at full scale, set the vertical display to 20 mV per division (the instrument's 20 mV/div range)



Setting Items	Setting Choice
Scaling	On
Format	Decimal
Units	A
(Scaling Method)	2-Point
Input 1→Scale 1	0.2→10 (0.2:displays as 200m)
Input 2→Scale 2	0→0



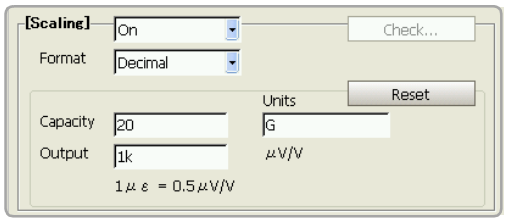
Inputs 1 and 2: [V] value
Physical values 1 and 2: [A] value (value of displayed measurement units)
With scaling, signals from the sensor are acquired as current values.
A/B cursors and gauges are displayed and printed with current (Ampere) values.

See "Applying Gauges" (p. 198)
"List and Gauge Settings" (p. 330)

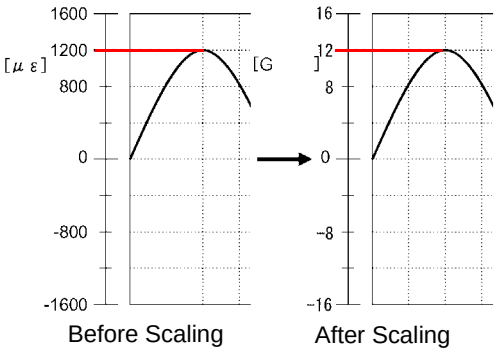
Using the Model 8939 or 8960 Strain Unit

Example 2. **Using the 20 G rated capacity and a sensor with 1000 µV/V rated output, display measured data in units of [G]**

For the rated capacity and rated output, consult the calibration record of the sensor to be used. Set as follows:



Setting Items	Setting Choice
Scaling	On
Format	Decimal
Units	G
Capacity	20 [G]
Output	1000 [µV/V] (displays as 1k)



By using the Scaling function, signals from the sensor are acquired as physical values.
A/B cursors and gauges are displayed and printed as physical (G) values.

See "Applying Gauges" (p. 198)
"List and Gauge Settings" (p. 330)

When a calibration factor is stated in the sensor's inspection records

It can be incorporated in the conversion ratio setting on the [Scaling] page (p. 131) of the Channel Settings screen.

Example 3. **Measure using a sensor with a calibration factor of 0.001442 G / 1 × 10^{-6} strain*, and display the measured data in [G] units.**

The value of the calibration factor (0.001442 [G]) is set as the conversion ratio. (* 10^{-6} strain = με)

1 Press the **SHEET/PAGE** keys to select the [Scaling] page.

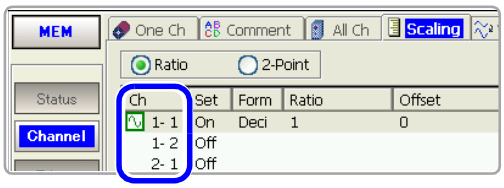
2 Move the cursor to the [Ch] column of the channel to be set, and select **F1** [All Settings].
The [Scaling] dialog appears.

3 Set as follows:

Setting Items	Setting Choice
Scaling	On
Format	Decimal
Units	G
(Scaling Method)	Ratio
Ratio (Conversion ratio)	0.001442 [G] (displays as 1.442 m)

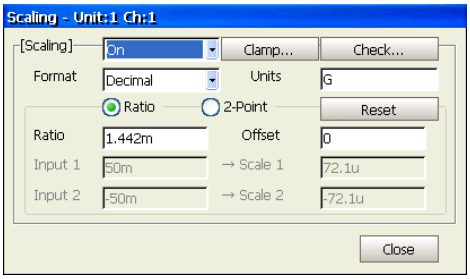
4 Press the **ENTER** key or move the cursor to the [Close] button and press the **F1** key.
The settings are accepted.

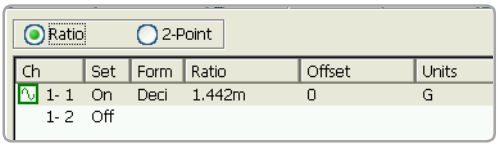
[Scaling] Page on Channel Settings Screen



[Ch] Column

[Scaling] Dialog





Using a strain gauge with a Gauge Factor other than 2.0

When using a strain gauge, the Gauge Factor needs to be set as the conversion ratio. For example, if the Gauge Factor is 2.1, the conversion ratio is 0.952 (2÷ 2.1).

Example 4. **Measure using a strain gauge (2.1 Gauge Factor), and display the measured data in [G] units.**

The scaling (conversion ratio) needs to be calculated to include both Gauge Factor and physical value conversions. In this case, the conversion ratio setting is the product of the conversion ratios of the Gauge Factor and measurement unit scaling.

The Gauge Factor component of the conversion ratio is 0.952, and the physical value component is 0.001442*
Conversion Ratio = 0.952 × 0.001442 = 0.0013728

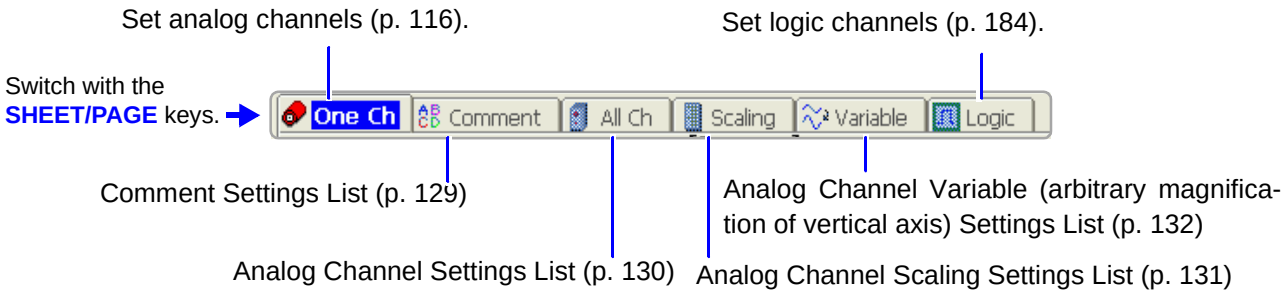
As in Example 3, enter [0.0013728] as the conversion ratio in the [Scaling] dialog on the [Scaling] page.

* To convert measurement values to physical values when using a strain gauge, calculate using the Young's modulus or Poisson's ratio of the measurement object. The conversion method depends on the conditions in which the strain gauge is used.

See "Appendix 2.7 Scaling Method When Using Strain Gauges" (p. A43)

5.5 Verifying and Setting All Channels from a List

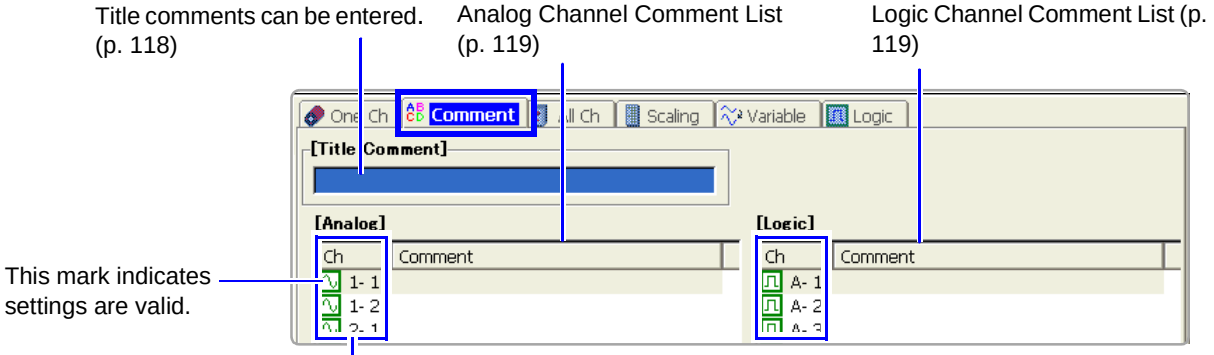
All channel settings can be verified and changed on the following Channel screen pages.
In addition, settings can be copied between channels. (p. 133)



Comment Settings List: [Comment] Page

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key→ Select Channel with the **SUB MENU** keys →Select the [Comment] page with the **SHEET/PAGE** keys



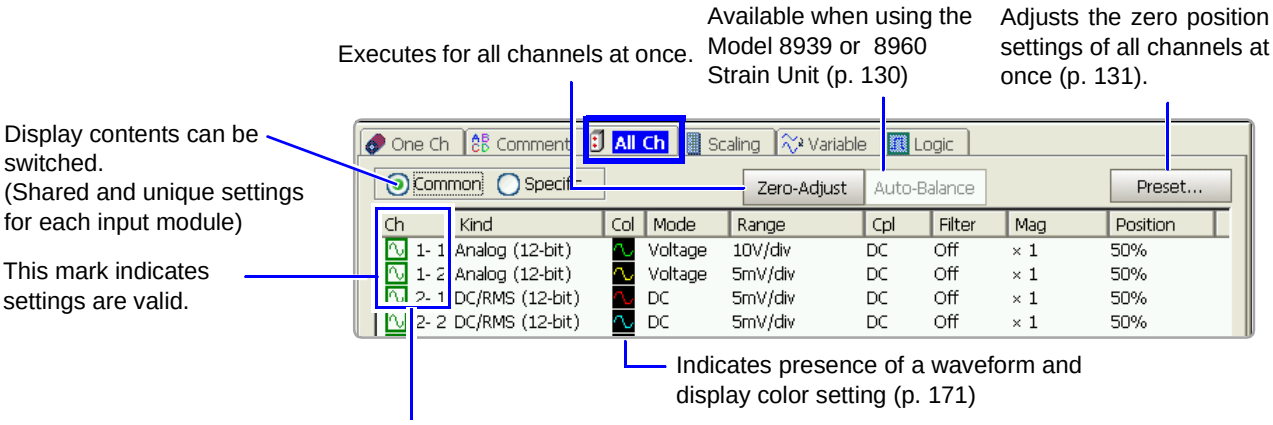
Using the **CURSOR** keys, move the cursor to the [Ch] column.

- **To enter a title or comment:**
  Select **F1** [Edit] to enter characters from the virtual keyboard.
  See"Entering Text and Comments" (p. 66), "Comment Entry Example" (p. 120)
  (If a keyboard is connected, you can press the **F2** [Direct] key and enter from the keyboard directly.)
- **To copy settings from one channel to another:**
  Select **F7** [Copy].

Input Channel Settings List: [All Ch] Page

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Select the [All Ch] page with the **SHEET/PAGE** keys



Using the **CURSOR** keys, move the cursor to the [Ch] column.

- **To set each channel:**
  Select **F1** [All Settings] and set from the dialog. (Each setting can be made when the cursor is moved to the setting item.) Setting choices are the same as on the [One Ch] page. Range and zero position can be set by the **RANGE/POSN** knobs. (Zero position can also be set by Jog and Shuttle.)
  See"5.1 Analog Channel Settings" (p. 116)
- **To copy settings from one channel to another:**
  Select **F2** [Copy].

To execute zero adjustment

To simultaneous zero-adjust all input modules

To correct internal bias of an input module in order to set the reference potential of the instrument to zero volts.

Move the cursor to the [Zero-Adjust] button, and select **F1** [Execute].

See "3.11.17 Executing Zero Adjustment" in the *Input Module Guide*

Zero adjustment is executed on all channels except as follows.

Measurement modes for which zero adjustment does not apply

- The [Temp] mode of the Model 8937 Voltage/Temp Unit
- Model 8939 Strain Unit
- Model 8960 Strain Unit
- Modes other than [Voltage] and [Current] of the Model 8940 F/V Unit
- Model 8958 16-Ch Scanner Unit

To execute auto balance (Model 8939 Strain Unit only)

Move the cursor to the [Auto-Balance] button, and select **F1**.

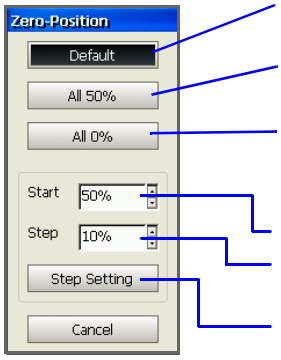
Only channels in the 8939 Strain Unit are affected.

See "3.11.19 Executing Auto-Balance" in the *Input Module Guide*

To set the zero position of all channels at once: execute Preset

Move the cursor to the [Preset] button, and select **F1** [Preset].
The [Zero-Position] dialog appears.

The setting changes when you select any button.



Reset the zero positions of all channels to the default value.

Set the zero positions of all channels to 50%.

Set the zero positions of all channels to 0%.

To make more detailed settings:

1. Set the reference position.
2. Set the number of steps from the set reference position as a percentage (%).
3. The zero position is set to the specified step.

Details of zero position:
"7.1.2 Setting the Waveform Display Position (Zero Position)" (p. 172)

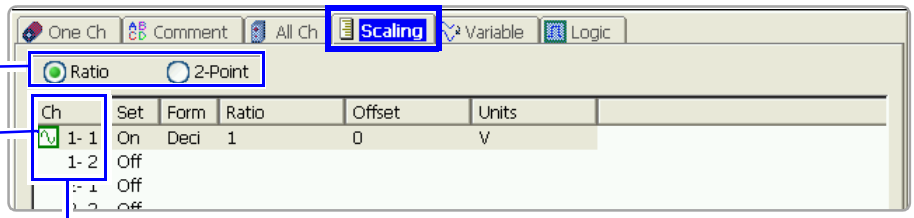
Scaling Settings List: [Scaling] Page

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Select the [Scaling] page with the **SHEET/PAGE** keys

Select the Scaling method.

This mark indicates settings are valid.



Using the **CURSOR** keys, move the cursor to the [Ch] column.

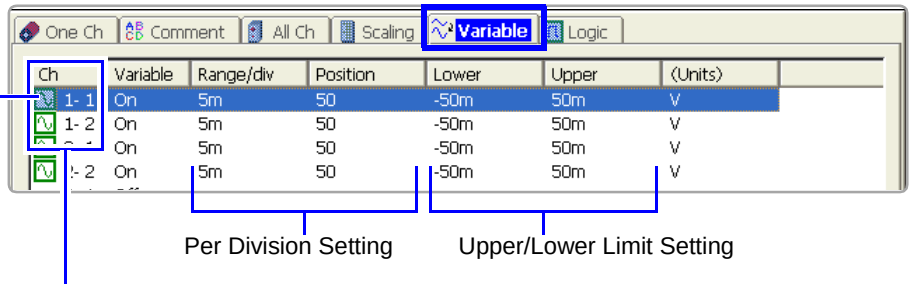
- **To set Scaling:**
  Select **F1** [All Settings] and set from the dialog. (Each setting can be made when the cursor is moved to the setting item.) Setting choices are the same as on the [One Ch] page.
  See"5.4 Converting Input Values (Scaling Function)" (p. 123)
- **To copy settings from one channel to another:**
  Select **F2** [Copy].

Variable Settings List: [Variable] Page

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Select the [Variable] page with the **SHEET/PAGE** keys

This mark indicates settings are valid.



Using the **CURSOR** keys, move the cursor to the [Ch] column.

- **To set the Variable function:**
  Select **F1** [All Settings] and set from the dialog.
  (Each setting can be made when the cursor is moved to the setting item.)
  Setting choices are the same as on the [One Ch] page.
  See"8.9.4 Setting Arbitrary Waveform Height and Position on the Vertical (Voltage) Axis (Variable Function)" (p. 215)
- **To copy settings from one channel to another:**
  Select **F2** [Copy].

5.6 Copying Settings Between Channels

Copying Channel Settings

MEM REC REC&MEM FFT REALTIME

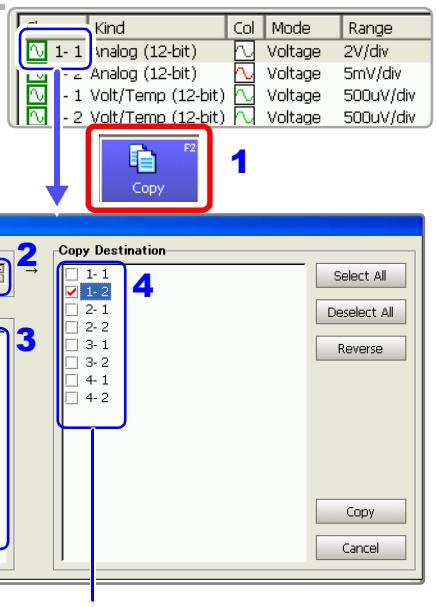
Settings can be made on the [Comment], [All Ch], [Scaling] and [Variable] pages of the Channel Setting screen.

Operating Key Procedure

1 Open the dialog.

CURSOR Move the cursor to the source unit (module) and channel.

F2 Select [Copy].
The [Copy Settings] dialog appears.



2 Select the copy source channel.

CURSOR Move the cursor to the [Copy Source] item.

F1 to F8 Select the unit and channel number of the copy source.

3 Select the contents to copy.

CURSOR Move the cursor to the [Copy Contents] item.

F1 to F8 Select the contents to copy.
Contents differs according to the page.

4 Select the copy destination channel(s).

CURSOR Move the cursor to the [Copy Destination] item.

F1 to F8 Select the unit and channel number(s) of the copy destination.

5 Execute the copy.

F7 Select [Copy].
The selected contents are copied.

Selections can be made using the buttons in the dialog.
Move the cursor to a button, and press the **F1** key.

- Select All
  Selects all channels as copy destinations.
- Deselect All
  Deselects all copy destinations.
- Reverse
  Reverses selected and deselected settings.
- Copy
  Executes the copy process.
- Cancel
  Cancels the copy process.

5.7 Setting Input Channels from the Waveform Screen

Input channel and Waveform display settings can be made from a channel's setting dialog.
Setting choices are the same as on the [One Ch] page of the Channel Settings screen.

About analog channel settings:

See "5.1 Analog Channel Settings" (p. 116)

About setting choices for each input module:

See "Chapter 3 Input Channel Settings" in the *Input Module Guide*

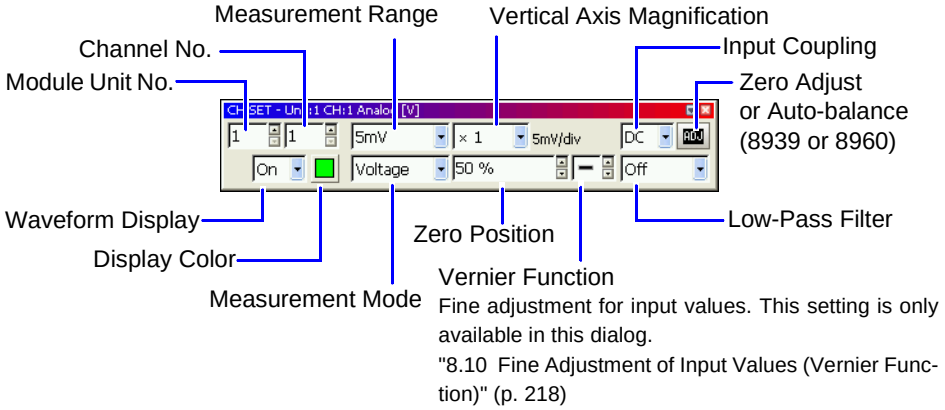
Two setting methods are available from the Waveform screen, as follows:

- Set individual channels
- Set from the All Channels List (Channel Settings)

Move the cursor to an item to be set within the dialog, and select with the F keys. Measurement range and zero position can be set by turning the **RANGE/POSN** knobs, regardless of cursor location. (p. 117)

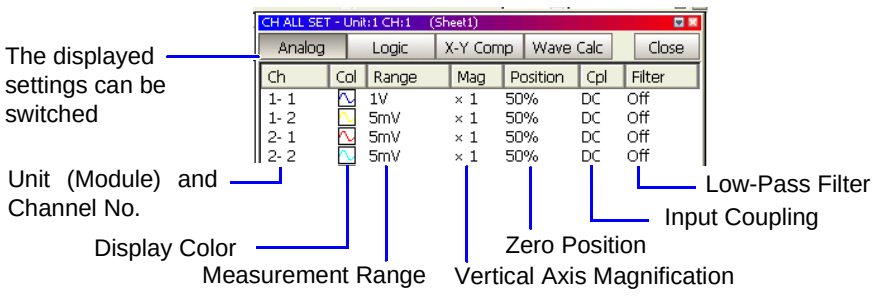
Setting Individual Channels ([CH SET] dialog)

Press the **RANGE/POSN** knobs. The [CH SET] dialog appears.
Display appearance depends on the particular input module.



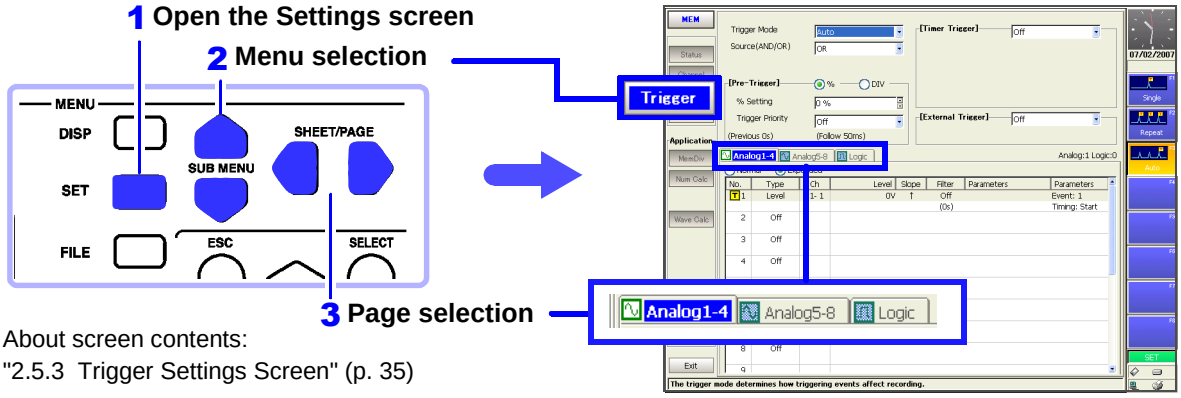
Setting from the All Channels List (Channel Settings) ([CH ALL SET] dialog)

Press the **FUNCTION MODE** key, then press the **F5** [Channel Set] key.
The [CH ALL SET] dialog appears. Current input channel settings can be verified in the list.



Trigger Settings Chapter 6

Make trigger settings on the Trigger Settings screen. You can also make them on the Waveform screen (p. 167). Setting choices are function-dependent.



About screen contents:
"2.5.3 Trigger Settings Screen" (p. 35)

Trigger Settings

- Trigger mode setting (p. 138)
- Combining logic (AND/OR) for multiple trigger sources (p. 139)
- Pre-trigger settings (p. 140)
  (Memory function, FFT function, REC&MEM function)
- Trigger timing settings (p. 144)
- Trigger source settings

Trigger Source

Analog Trigger Settings*1(p. 146)

[Analog] page

- Level trigger(p. 150)
- Window trigger (In-Window trigger, Out-of-Window trigger) (p. 152)
- Period trigger (In-Period, Out-of-Period)(p. 153)
- Glitch trigger*2(p. 155)
- Slope trigger*2(p. 156)
- Voltage sag trigger*2(p. 158)
- Trigger filter*3
- Event count*4

*1. Setting choices depend on the type of analog triggering.
*2. Memory function and FFT function only
*3. Can be set for each analog trigger selection (except for Slope and Glitch triggers).
*4. [Expanded] setting only

Timer Trigger Settings (p. 162)

- Setting recording start and stop times
- Setting a recording interval

External Trigger Settings (p. 166)

- External control terminal connections and settings (p. 375)

Manual Trigger Settings (p. 165)

Logic Trigger Settings (p. 159)

[Logic] page

- Setting combining logic for logic triggers
- Trigger filter settings
- Trigger pattern settings

Trigger Output (p. 380)

Trigger Search (p. 223)

6.1 About Triggering

What is triggering?

Triggering is the process of controlling the start and stop of recording by specific signals or conditions (criteria). When recording is started or stopped by a specific signal, we say the trigger is “applied” or “triggering occurs”.
In this manual, T indicates a “trigger point”, as the time at which a trigger is applied.

About measurement operations when triggering occurs:

See "Measurement and Internal Operations" (p. 77)

Signals that can be used for triggering (trigger sources) are as follows.

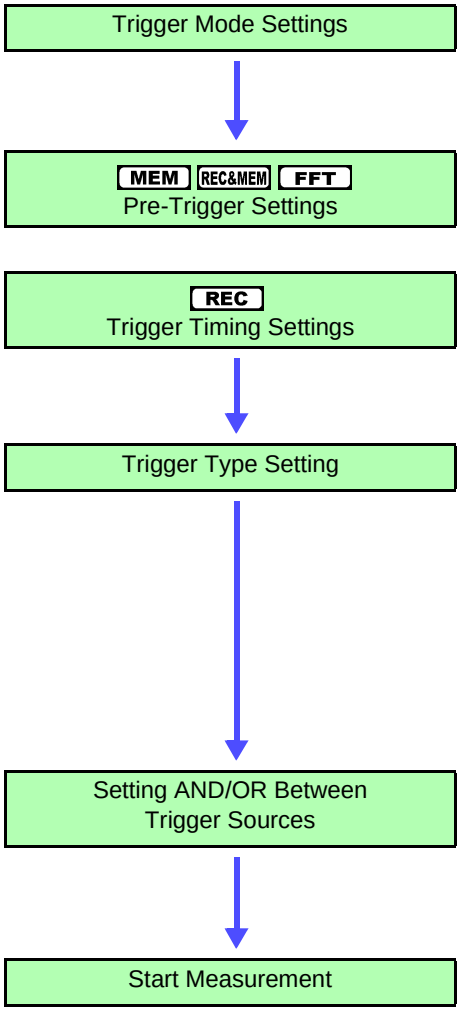
Trigger Source	Description
Analog Trigger (p. 146)	Applies a trigger according to a signal input on an analog channel. (Level, In-Window, Out-of-Window, Period, Glitch, Slope or Voltage Sag trigger) Trigger filtering (p. 149) and event counts (p. 149) can be set.
Logic Trigger (p. 159)	Applies a trigger according to signals input on logic channels (Ch A to Ch D).
External Trigger (p. 166)	Applies a trigger according to an input signal at the EXT TRIG terminal (External Trigger Input)
Timer Trigger (p. 162)	Applies triggers at specific intervals between start and stop times
Manual Trigger (p. 165)	Applies a trigger by pressing an operating key (FUNCTION MODE → F6 key).

- A trigger can be applied by combining (AND/OR) criteria from multiple trigger sources (except manual triggering) (p. 139).
- When Restart Permission is set to [Yes] (on the Environment Settings screen (p. 358)), if trigger criteria (trigger source settings or pre-trigger) are changed during recording, measurement is reset and starts again according to the new trigger criteria.
- Searching is performed by applying search criteria to measured data just like trigger criteria.

See "8.14.1 Searching by Trigger Criteria" (p. 223)

6.2 Setting Workflow

Trigger settings can be made on the Trigger Settings or Waveform screen.
Settings choices for each item are function-dependent.



Set whether to continue to accept triggers after measuring.
(function-dependent)
[Single], [Repeat], [Auto], or [Timer]

Set the amount to record before and after a trigger point.
- [% Setting] or [DIV Setting]
- Trigger priority

Set the start and stop timing for recording by triggers.
[Start], [Stop] or [Start & Stop]

Make trigger source-related settings.
- Analog trigger (p. 146)
  (Level, In-Window, Out-of-Window, Period, Glitch, Slope or Voltage Sag trigger)
- Logic trigger (p. 159)
- Timer trigger (p. 162)
- Manual trigger (p. 165)
- External trigger (p. 166)

Select AND/OR logical combination of analog, logic, external and timer triggers to be applied.
[AND] or [OR]

Press the START key to start measuring.
The green LED lights.
(However, operation differs according to the setting for START key behavior (p. 353).)
Data acquisition starts when trigger criteria are met.

To stop measurement: press the STOP key.
Press once: recording stops at the end of the specified recording length.
Press twice: recording stops immediately.

6.3 Setting the Trigger Mode

Set whether to continue to accept triggers after measuring.
If all trigger sources are disabled (Off, with no trigger setting), measurement starts immediately (free-running).
These settings can also be made on the Waveform screen.

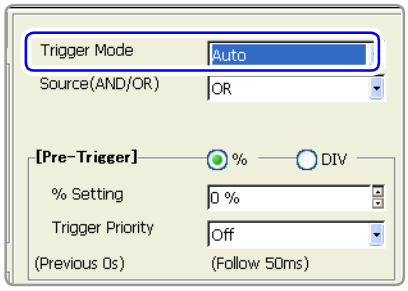
Trigger Mode Setting

MEM REC REC&MEM FFT

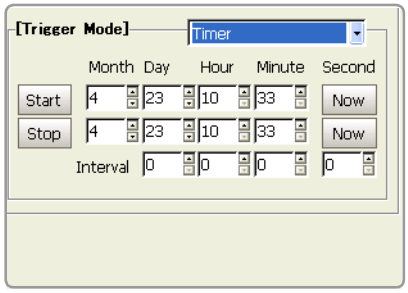
To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen
See Screen Layout (p. 35), To set from the Waveform screen (p. 167)
When using the REC&MEM function:
To open the screen: Press the **SET** key → Select [Status] with the **SUB MENU** keys →Status Settings screen

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Trigger Mode] item.
2	**F1 to F8**	Select the trigger mode.

Single	MEM REC REC&MEM FFT Only one trigger is recognized. After pressing the START key, once a trigger is applied, a waveform is recorded for the specified recording length, and measurement then stops.
Repeat	MEM REC REC&MEM FFT Triggers are accepted continuously. When no trigger is applied, the instrument enters the Trigger Wait state. Press the STOP key to stop measuring. (See below)
Auto	MEM FFT Triggers are accepted continuously. If no trigger is applied within about one second, a waveform of the specified recording length is automatically recorded. Press the STOP key to stop measuring.
Timer	REC&MEM Triggering occurs at the specified interval from the specified Start time until the Stop time. (Recorder waveform only) "6.9 Trigger by Timer or Time Intervals (Timer Trigger)" (p. 162)



(Memory Function case)



(REC&MEM Function case)
Status Setting screen

Description

To Stop Measuring

Press the **STOP** key.
Press once: recording stops at the end of the specified recording length.
Press twice: recording stops immediately.
You can change how measurement is stopped by the STOP key.
See "13.2.2 Setting the Method for Stopping Measurement with the STOP Key" (p. 354)

When the trigger mode is set to [Repeat]

When the trigger mode is set to [Repeat], triggering is disabled during the end of recording processing (auto save, auto print, waveform display processing and calculation) before going to the next trigger standby status. Therefore, it is not triggered if the trigger condition occurs during this processing period.

6.4 Setting Combining Logic (AND/OR) for Multiple Trigger Sources

Analog, logic, external and timer trigger criteria can be combined by AND/OR logic to define complex trigger criteria.

Trigger Source (AND/OR) Setting

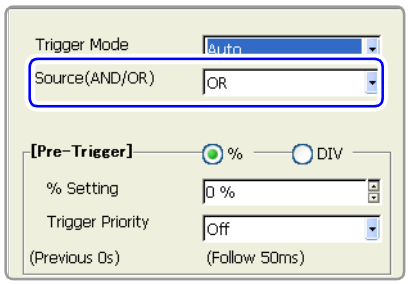
MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Source (AND/OR)] item.
2	**F1 to F8**	Select the combining logic for trigger criteria.

OR	Triggering occurs when any one of the specified trigger source criteria is met. (default setting)
AND	Triggering occurs only when all of the specified trigger source criteria are met.



(Memory Function case)

Description

When the trigger combining logic (Source (AND/OR)) is set to [AND]

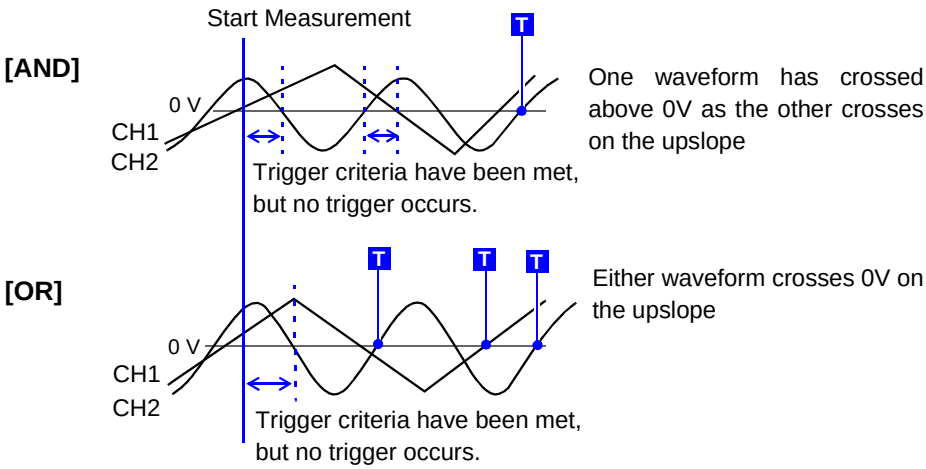
If trigger criteria are already met when you press the **START** key, no triggering occurs. Triggering occurs only after all trigger sources have ceased to meet the criteria at once, and are subsequently met again.

Setting Example

To apply a trigger when the upslope (↑) of the waveform crosses zero volts

Triggering occurs as follows in the AND and OR cases.

Channel	Trigger	Trigger Level	Slope	Filter
CH1, CH2	Level	0.00 V	↑	Off



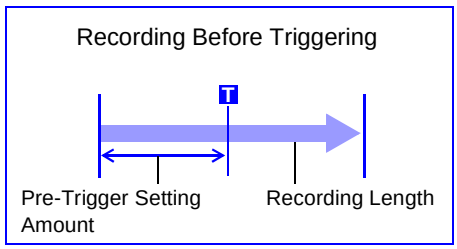
If both [Start] and [Stop] trigger timing criteria are combined, the simultaneous trigger sources are logically ANDed.

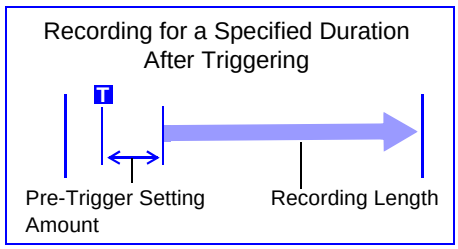
6.5 Pre-Trigger Settings

This applies to the Memory function and FFT function only.

What is pre-triggering?

By setting a portion (number of divisions or percentage) of the recording length to occur before triggering, the waveform is recorded before as well as after the trigger point.
You can also set the duration of a waveform to be recorded after a trigger point.





NOTE

When all trigger sources (analog, timer trigger, etc.) are disabled (Off), pre-trigger settings are ignored.

6.5.1 Setting the Trigger Start Point (Pre-Trigger)

Set the position of the trigger point relative to the specified recording length. Two setting methods are available:

- **Setting by Percentage (%)** [% Setting]
  Treating the recording start point as 0% and the recording end point as 100%, set the trigger point position as a percentage of the recording length.
- **Setting by Recording Length (Divisions)** [DIV Setting]
  Specify as the number of divisions of recording length relative to the trigger point.

With either method, you can specify a negative value to start recording only after the specified time has elapsed following a trigger occurrence.

Pre-Trigger Settings

MEM REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)

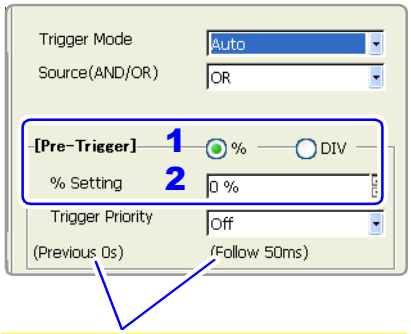
Operating Key Procedure

1 Select the setting method (% or div) for pre-triggering.

CURSOR Move the cursor to the [Pre-Trigger] item.

F1 to F8 Select either choice.

%	Set as a percentage. (default setting)
DIV	Set as a number of divisions. When using external sampling, set as a number of samples.



Pre- and post-trigger recording times are displayed in accordance with the setting

2 Specify the numerical value.

CURSOR Move the cursor to the [% Setting] or [DIV Setting] item.

F1 to F8 Enter the numerical value.
Setting Range:
% Setting from –100 to 100%
DIV Setting from –(recording length) to (recording length) divisions

Description

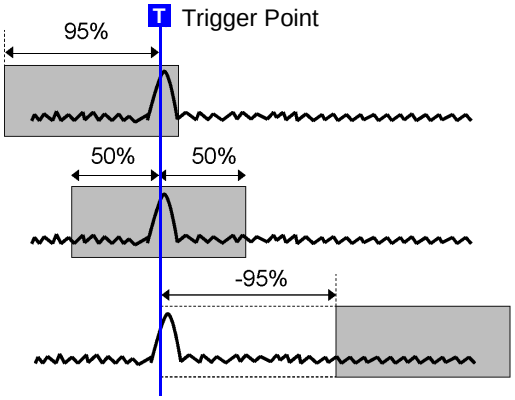
About pre-triggering and the recording period (recording length)

Pre-Trigger setting examples

95% 95% of the recording length is recorded before the trigger point

50% 50% of the recording length is recorded before and 50% after the trigger point

-95% 95% of the recording length is recorded after the trigger point



Trigger events during the specified pre-trigger recording period are ignored.
To enable recognition of such triggers, set Trigger Priority to [On].

See "6.5.2 Setting Trigger Acceptance (Trigger Priority)" (p. 143)

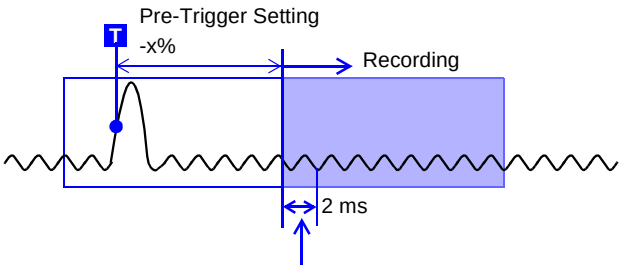
Difference between [Pre-Trig Wait] and [Trigger Wait]

When measurement is started, the specified pre-trigger length is recorded. This period is indicated as the [Pre-Trig Wait].
After the specified pre-trigger length has been recorded, the period indicated as [Trigger Wait] continues until a trigger occurs.

See "Measurement and Internal Operations" (p. 77)

When using a [Stop] trigger at the same time

When you want to record data from a specified moment sometime after a trigger event (that is, with a negative pre-trigger value specified), if a stop trigger event occurs after the pre-trigger period has passed but within 2 ms after recording starts, no waveform data is stored.



Stop trigger
If a Stop trigger event occurs during this interval, no waveform data is stored.

6.5.2 Setting Trigger Acceptance (Trigger Priority)

When pre-triggering is enabled, trigger events are normally ignored for a certain period after measurement starts (while recording the specified pre-trigger period). This period is indicated on the Status bar as [Pre-Trig Wait].
You can set whether a trigger is recognized (accepted) if trigger criteria are met during this period.

Trigger Priority Setting

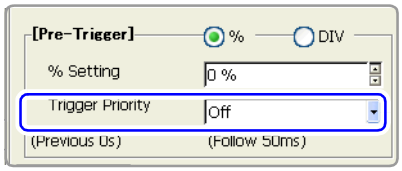
MEM REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Trigger Priority] item.
2	**F1 to F8**	Select the priority of trigger events.

Off	Trigger events are ignored during [Pre-Trig Wait] (default setting)
On	Trigger events are recognized (accepted) during [Pre-Trig Wait].

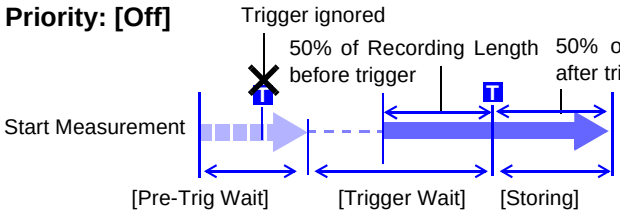


Description

When trigger criteria are met during [Pre-Trig Wait]

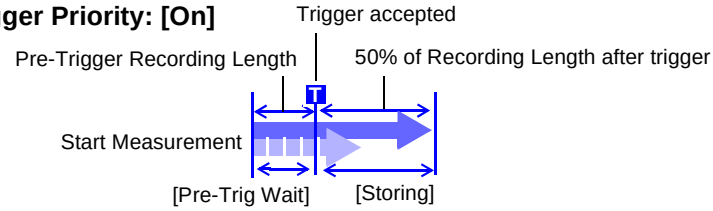
Example: When the pre-trigger period is set to 50%

Trigger Priority: [Off]



(After 50% of the Recording Length is recorded internally, the [Trigger Wait] state begins)

Trigger Priority: [On]



(A trigger event occurs while 50% of the Recording Length is being recorded internally)

When a trigger event occurs during pre-trigger recording, the data actually recorded may be shorter than the specified recording length. (In this case, the pre-trigger recording length is shortened. The recording length after the trigger event is the specified recording length minus the specified pre-trigger period.

6.6 Setting Trigger Timing

Set waveform recording operation when a trigger event occurs.
Timing for the Recorder function is set as follows.
Timing for the Memory function can be selected by various trigger settings.

Trigger Timing Setting

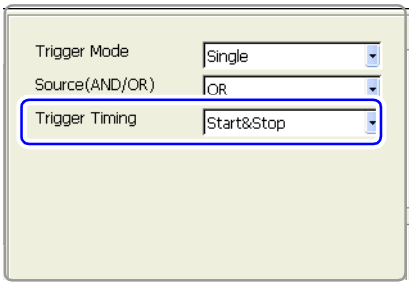
REC

To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Trigger Timing] item.
2	**F1 to F8**	Select either choice.

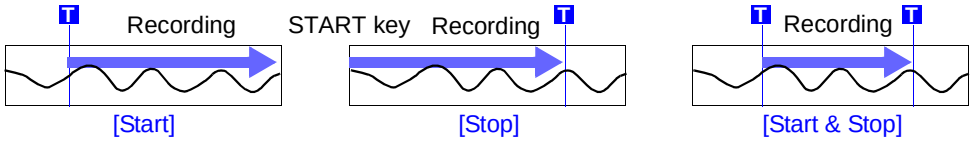
Start	Start recording when a trigger event occurs, and stop after the specified recording length.(default setting)
Stop	Start recording when the START key is pressed, and stop when a trigger event occurs.
Start & Stop	Record the interval from one trigger event until the next trigger event. (Select either Start or Stop triggering for each channel on the Analog and Logic pages.)



Description

About trigger timing

The selected trigger mode determines how recording stops.



Recording Starts	Recording starts when a trigger event occurs	Recording starts when you press the START key	Recording starts when a Start trigger event occurs
Recording Stops			
With [Single] trigger mode	Recording stops after data has been acquired for the specified recording length	Recording stops when a trigger event occurs	Recording stops when a Stop trigger event occurs

If no trigger event occurs before the specified recording length elapses:

[Start], [Stop] or [Start & Stop]: Recording stops after data has been acquired for the specified recording length

With [Repeat] trigger mode	The Trigger Wait state begins after data has been acquired for the specified recording length When another trigger event occurs, data is again acquired for the specified recording length, then Trigger Wait resumes (repeats)	When a trigger event occurs, recording stops and then starts again (repeats)	When a trigger event occurs, recording stops and the Trigger Wait state resumes When another trigger event occurs, recording continues until the next trigger occurs (repeats)

If no trigger event occurs before the specified recording length elapses:

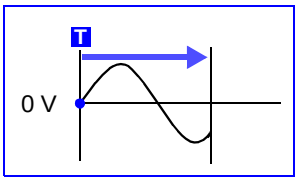
[Stop]: After data is acquired for the specified recording length, recording restarts. This repeats until a trigger event occurs.

[Start & Stop]: The Trigger Wait state begins after data has been acquired for the specified recording length (Start Trigger)

Example: When the trigger type is Level Trigger, Level = 0.000 V, and Slope = ↑(rising)

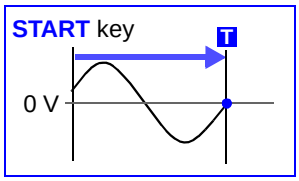
Trigger timing

[Start]



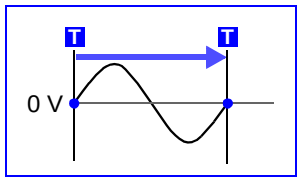
Records for specified recording length

[Stop]



Press START key to record
Records until a trigger occurs

[Start & Stop]

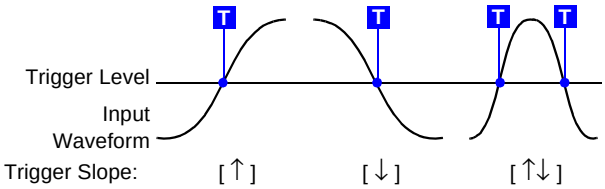
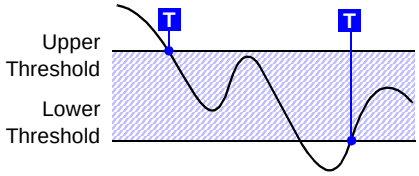
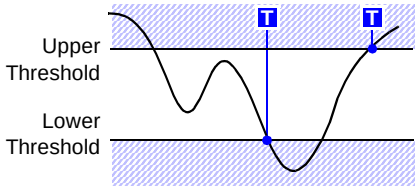
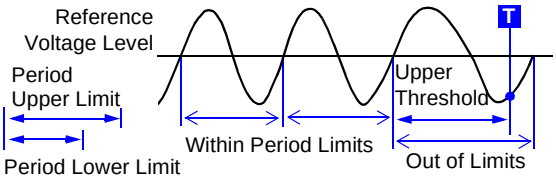
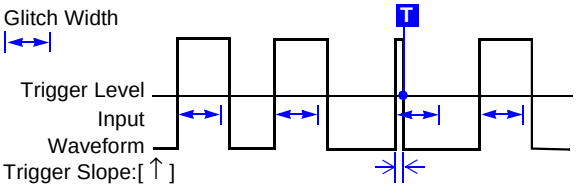
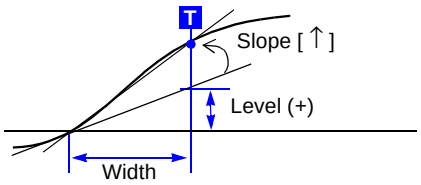
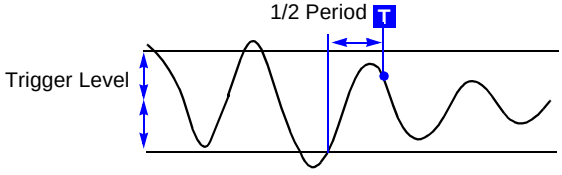


Recording starts when a Start trigger event occurs
Records until a Stop trigger occurs

The above sequences repeat when the trigger mode is [Repeat].

6.7 Triggering by Analog Signals

6.7.1 About Analog Trigger Types and Settings

Type of Analog Trigger [ ]: Displayed on screen	Trigger Example	Description
Level Trigger **[Level]** (p. 150)		A trigger is applied when an input signal crosses the specified trigger level (threshold voltage). MEM REC REC&MEM FFT
In-Window Trigger **[Win-In]** (p. 152)		A trigger is applied when the input signal enters a range defined by upper and lower thresholds. MEM REC REC&MEM FFT
Out-of-Window Trigger **[Win-Out]** (p. 152)		A trigger is applied when the input signal exits a range defined by upper and lower thresholds. MEM REC REC&MEM FFT
Period Trigger **[Peri-In]** **[Peri-Out]** (p. 153)		A trigger is applied when the period of the input signal becomes longer (Out-of-Period) or shorter (In-Period) than the period defined by the limits at the specified reference voltage. MEM REC REC&MEM FFT
Glitch Trigger **[Glitch]** (p. 155)		A trigger is applied when the input signal pulse width becomes shorter than the specified Glitch Width. MEM REC&MEM FFT
Slope Trigger **[Slope]** (p. 156)		A trigger is applied when the input signal level matches the specified trigger level in the specified slope direction (rising or falling). MEM REC&MEM FFT
Voltage Sag Trigger **[Drop]** (p. 158)		A trigger is applied when the amplitude of the input signal (at commercial mains frequency) sags below the specified trigger level. MEM REC&MEM FFT

In addition to the above, the following criteria can be set:

- Trigger width setting (Trigger Filter) (p. 149)
- Setting the event count per trigger (Events) (p. 149)

Before Setting an Analog Trigger

Analog triggers are set on the [Analog] page of the Trigger Settings screen. (These settings can also be made on the Waveform screen (p. 167).)
[Normal] and [Expanded] settings are available for analog triggers.

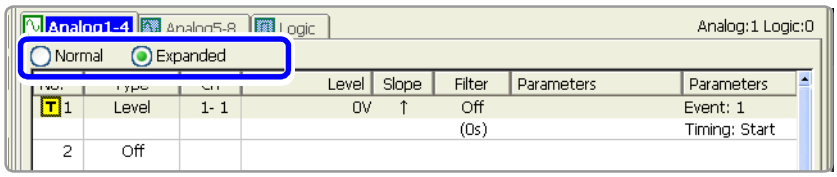
Setting	Description	Applicable Trigger Types
Normal	One trigger applies to one channel. (Not available for event count triggering) Model 8860-50: Up to 16, Model 8861-50: Up to 32 (when used with the Model 8946)	• Level Trigger • In-Window Trigger • Out-of-Window Trigger • Voltage Sag Trigger
Expanded	Multiple triggers can apply to one channel. Model 8860-50: Up to 8, Model 8861-50: Up to 8 for Unit 1 to 4, and up to 8 for Unit 5 to 8	All analog triggers

NOTE

- Triggers can be enabled for channels that are not currently selected for use (Off).
- With the Model 8958 16-Ch Scanner Unit, the [Normal] setting is only applicable to channels 1 and 9. To set triggers for the other channels, the [Expanded] setting is necessary.

Selection Procedure

Use the **CURSOR** keys to move the cursor to [Normal] or [Expanded], and select by the corresponding F key.



Analog trigger setting methods

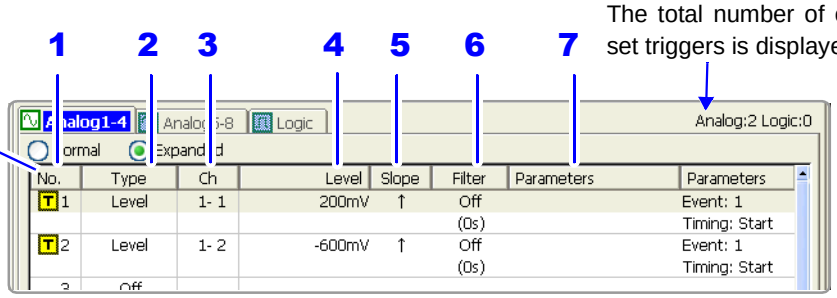
Analog trigger can be set by two methods:

- Set individual items
- Set by dialog (p. 148)

The operating procedure descriptions use the method of setting individual items.

Setting Individual Items

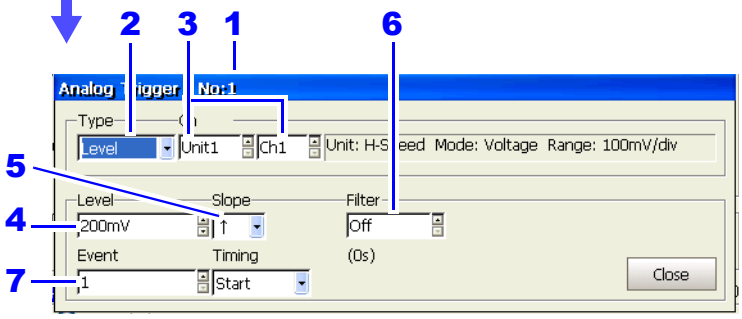
Move the cursor to each item, and make the setting.



Settings can be copied between trigger numbers. (The setting procedure is the same as "5.6 Copying Settings Between Channels" (p. 133).)

Setting by Dialog ([Analog Trigger] dialog)

F1 Move the cursor to a trigger to set in the [No.] column, and select **F1** [All Settings] to open the dialog.



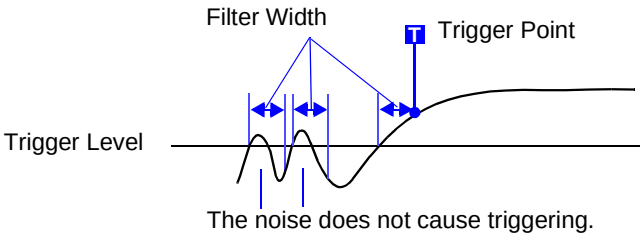
Move the cursor to each item, and make the setting.
After making settings, select the [Close] button to accept the changes.

	Setting Items	Setting Description
1	No.	Trigger No.
2	Type	Select the trigger type (p. 146).
3	Ch	(only with the [Expanded] setting) Select the module (Unit) and Channel No. to which this trigger applies. (1-1 = Unit 1, Channel 1)
4	Level	Set the signal level (threshold voltage) for triggering. A trigger is applied when the signal crosses this level.
5	Slope	Select the slope (input signal rising ↑ or falling ↓) for triggering.
6	Filter	Set the filter width (trigger filter) for triggering. Prevents noise from causing false triggers (p. 149).
7	Parameters (Event, Timing)	Make other settings. Specify the event count (only with the [Expanded] setting) for triggering (p. 149). When [Start & Stop] is selected for trigger timing (p. 144) with the Recorder function, select which triggers to use to start and stop recording.

When Using Noisy Signals for Triggering

Enable the trigger filter (p. 151)

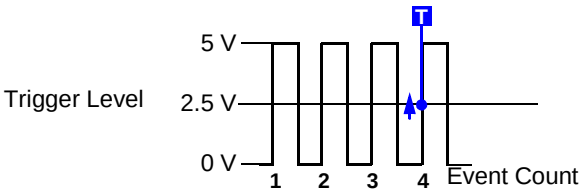
By setting the filter width to prevent triggering on noise, triggering occurs only when the trigger criteria continue to be met for at least the specified width (interval).



Setting an Event Count (p. 151) (only with the [Expanded] setting)

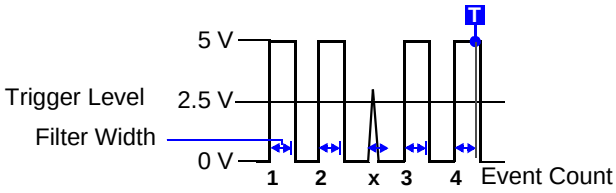
If triggering occurs too frequently, an event count can be specified so that a trigger is accepted only after the specified number of trigger events has occurred.

Example: When the event count is set to [4] (Slope: ↑)



Suppressing Noise Effects

Noise near the trigger level can erroneously increment the event count. Set the trigger filter to avoid such effects.



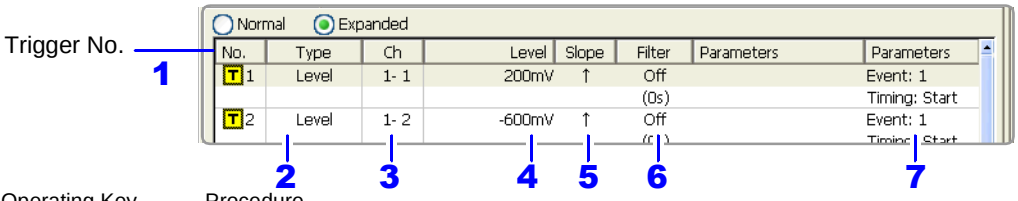
6.7.2 Triggering When Crossing a Voltage Threshold (Level Trigger)

A trigger can be applied when the input signal crosses a specified trigger level (voltage threshold). The direction in which the signal crosses the threshold is specified by the trigger slope setting (rising ↑, falling ↓ or both ↑↓).

Level Trigger ([Normal]/[Expanded] Setting) MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)



Operating Key	Procedure
1 **CURSOR**	Move the highlight cursor to a trigger number to be set. For the [Normal] setting, match the number of the channel to which the trigger applies.
2 **Select the trigger type.**	
CURSOR	Move the cursor to the [Type] item.
F1 to F8	Select [Level] (Level Trigger).
3 **Select a channel (only with the [Expanded] setting).**	
CURSOR	Move the cursor to the [Ch] item.
F1 to F8	Select a channel to which the trigger applies.
4 **Select the trigger level.**	
CURSOR	Move the cursor to the [Level] item.
F1 to F8 or **SCROLL**	Specify the trigger threshold voltage.
5 **Select the trigger slope.**	
CURSOR	Move the cursor to the [Slope] item.
F1 to F8	Select either choice.

↑	A trigger occurs when the signal crosses the threshold on the upslope (rising edge ↑). (default setting)
↓	A trigger occurs when the signal crosses the threshold on the downslope (falling edge ↓).
↑↓	A trigger occurs when the signal crosses the threshold on either the upslope or downslope (↑↓). Note: The trigger point occurs one sample after the criterion is met. Timebase 2 sampling data is also one sample later than that of Timebase 1.

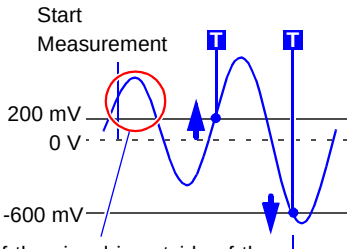
Setting Example

Apply a trigger when the input signal exceeds 200 mV or falls below –600 mV.

Trigger Source: OR
[Expanded] setting (Apply multiple triggers to one channel)

No.1
Type..... Level (Level Trigger)
Ch ..... 1-1 (Unit 1 – Channel 1)
Level ..... 200 mV
Slope..... ↑ (rising)

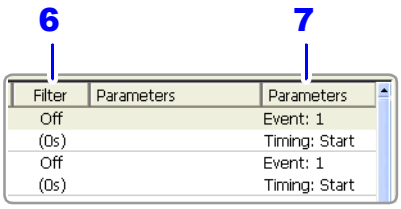
No.2
Type..... Level (Level Trigger)
Ch ..... 1-1 (Unit 1 – Channel 1)
Level ..... –600 mV
Slope..... ↓ (falling)



If the signal is outside of the specified threshold levels at the start of measurement, no triggering occurs.

Triggering occurs when the signal crosses the threshold.

Operating Key Procedure



6 Set the trigger filter (as occasion demands) (p. 149).

CURSOR Move the cursor to the [Filter] item.

F1 to F8 Set the filter width.

MEM REC&MEM FFT

Off	Trigger filtering is disabled. (default setting)
0.1 to 10	Trigger filtering is enabled. The filter width is set as a number of divisions.

REC

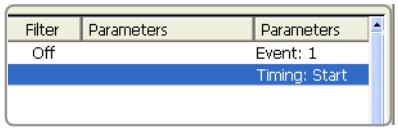
Off	Trigger filtering is disabled. (default setting)
On	Trigger filtering is enabled. Filter width is 10 ms. (or 5 ms when the sampling rate is 100 ns/S)

7 Set the event count (as occasion demands)(p. 149). (only with the [Expanded] setting)

When set to [1], a trigger is applied the first time trigger criteria are met.

CURSOR Move the cursor to the [Event] item.

F1 to F8 or **SCROLL** Setting the event count (Default setting: 1).
Setting range: 1 to 4,000



8 When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

Set the trigger to Start or Stop.

CURSOR Move the cursor to the [Timing] item.

F1 to F8 Select either choice.

Start	Set the trigger to start recording.
Stop	Set the trigger to stop recording.

Selecting [Stop] triggering causes Pre-Trigger settings to be ignored. (p. 142)

When the trigger mode is [Single]:

Recording ceases when a trigger event occurs.

When the trigger mode is [Cont] or [Auto]:

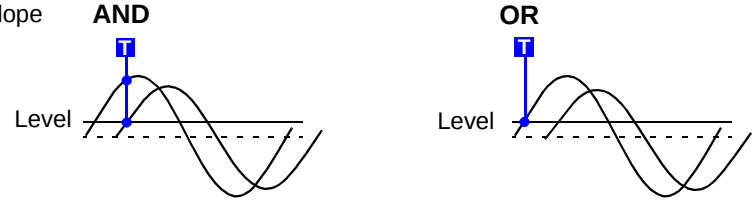
The instrument enters the Awaiting Trigger state.

Description

When a trigger source is set to [AND]

A trigger is applied only after the signals on all trigger sources have crossed their rising or falling thresholds, not necessarily at the time the specified trigger level is crossed.

With ↑ (rising) slope



6.7.3 Triggering with Upper and Lower Thresholds (Window Trigger)

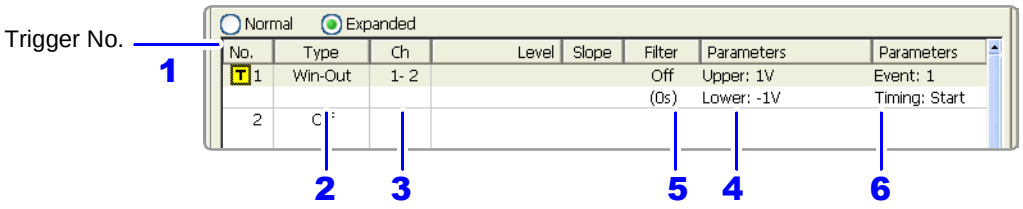
Two types of window trigger are available:

- In-Window Trigger [Win-In]
  Set upper and lower trigger thresholds so that triggering occurs when an input signal enters the defined range.
- Out-of-Window Trigger [Win-Out]
  Set upper and lower trigger thresholds so that triggering occurs when an input signal exits the defined range.

Window Trigger ([Normal]/[Expanded] Setting) MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)



	Operating Key	Procedure
1	**CURSOR**	Move the highlight cursor to a trigger number to be set. For the [Normal] setting, match the number of the channel to which the trigger applies.
2	**Select the trigger type.**	
	CURSOR	Move the cursor to the [Type] item.
	F1 to F8	Select [Win-In] or [Win-Out]
3	**Select a channel (only with the [Expanded] setting).**	
	CURSOR	Move the cursor to the [Ch] item.
	F1 to F8	Select a channel to which the trigger applies.
4	**Set the upper and lower threshold values.**	
	CURSOR	Move the cursor to the [Upper] and [Lower] items.
	F1 to F8 or **SCROLL**	Set the upper and lower threshold values.
5	**Set the trigger filter (as occasion demands) (p. 149).**	
6	**Set the event count (as occasion demands) (p. 149). (only with the [Expanded] setting)**	

When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

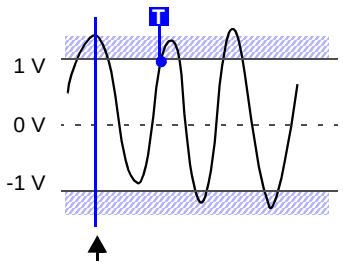
Set the trigger to Start or Stop (p. 151).

Setting Example

Apply a trigger when the input signal is outside of the range ±1 V

No.1
Type .....Win-Out
(Out-Window Trigger)
Ch..... 1-1(Unit 1-Channel 1)
Parameters
Upper .....1 V
Lower .....-1 V

Start Measurement



If the signal is outside of the threshold window when measurement starts, no triggering occurs.

6.7.4 Triggering by Period Variance (Period Trigger)

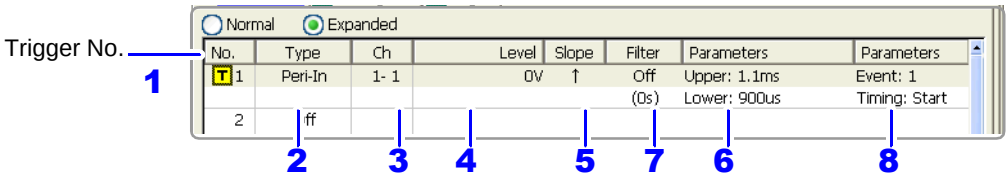
Two types of period triggering are available:

- In-Period Trigger [Peri-In]
  By measuring the rising and falling period at a reference voltage, apply a trigger when the input signal enters specified period limits.
- Out-of-Period Trigger [Peri-Out]
  By measuring the rising and falling period at a reference voltage, apply a trigger when the input signal exits specified period limits.

Period Trigger (only with the [Expanded] setting) MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)

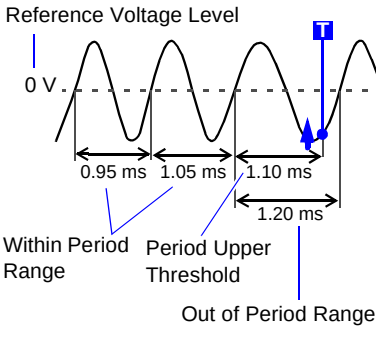


	Operating Key	Procedure
1	**CURSOR**	Move the highlight cursor to a trigger number to be set.
2	**Select the trigger type.**	
	CURSOR	Move the cursor to the [Type] item.
	F1 to F8	Select [Peri-In] or [Peri-Out].
3	**Select a channel.**	
	CURSOR	Move the cursor to the [Ch] item.
	F1 to F8	Select a channel to which the trigger applies.
4	**Specify the reference voltage.**	
	CURSOR	Move the cursor to the [Level] item.
	F1 to F8 or **SCROLL**	Set the reference voltage at which to measure the period.
5	**Select the trigger slope.**	
	CURSOR	Move the cursor to the [Slope] item.
	F1 to F8	Select either choice.
	↑	Measure the threshold period at the rising (↑) trigger slope.
	↓	Measure the threshold period at the falling (↓) trigger slope.
6	**Set the period range (upper and lower threshold values).**	
	CURSOR	Move the cursor to the [Upper] or [Lower] item.
	F1 to F8 or **SCROLL**	Set the upper and lower threshold values.

Setting Example

Apply a trigger when the input signal is outside of the range 0.9 to 1.1 ms

No.1
Type ..... Peri-Out
Ch..... 1-1 (Unit 1-Channel 1)
Level..... 0 V
Slope ..... ↑
Parameters
Upper ..... 1.1 ms
Lower ..... 900 µs



About the Trigger Point
The trigger point occurs one sample after the criterion is met. Timebase 2 sampling data is also one sample later than that of Timebase 1.

About period range settings (p. 154)

Using In-Period Triggering
When [Peri-In] triggering is enabled for multiple channels with the AND trigger criterion setting, a trigger event occurs only when all input signals cross the specified level at the same time.

Operating Key	Procedure
7	**Set the trigger filter (as occasion demands) (p. 149).**
8	**Set the event count (as occasion demands) (p. 149).**
	When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]
	Set the trigger to Start or Stop (p. 151).

Description

About period range settings

The period range settings for period triggering depend on the sampling period (sampling rate). (Changing the timebase also changes the period setting range.)
The sampling rate setting can be verified on the Status Settings screen.
The upper threshold of the period range cannot be set below the lower threshold, and vice-versa.
Lower threshold: can be set either to zero, or to at least five times the sampling period.
Upper threshold: can be set to no more than 2,000 times the sampling period.

To apply a trigger when the frequency increases (shorter period) above the upper threshold:

Set the period trigger type to [Peri-In], and the lower threshold to [0].
The lower threshold is ignored, and triggering occurs when the frequency exceeds that corresponding to the upper threshold.

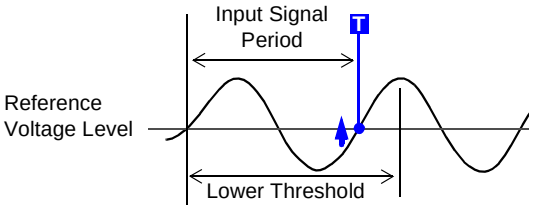
To apply a trigger when the frequency decreases (longer period) below the upper threshold:

Set the period trigger type to [Peri-Out], and the lower threshold to [0].
The lower threshold is ignored, and triggering occurs when the frequency drops below that corresponding to the upper threshold.

About the trigger point of the Out-of-Period trigger

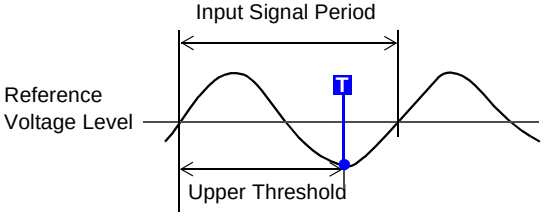
Triggering occurs when the period of sequential crossings of the specified reference voltage exceeds the period range.
The point at which triggering occurs depends on the specified period range and the period of the measured signal.

When the input signal period is shorter than the specified lower threshold (Trigger Slope: ↑)



Triggering occurs when the rising edge (↑ trigger slope) of the input signal crosses the reference voltage level, before reaching the lower period threshold.

When the input signal period is longer than the specified upper threshold (Trigger Slope: ↑)



Triggering occurs when the upper threshold period is reached, before the rising edge (↑ trigger slope) of the input signal crosses the reference voltage level.
Therefore, the trigger point is determined by the upper threshold of the period range.

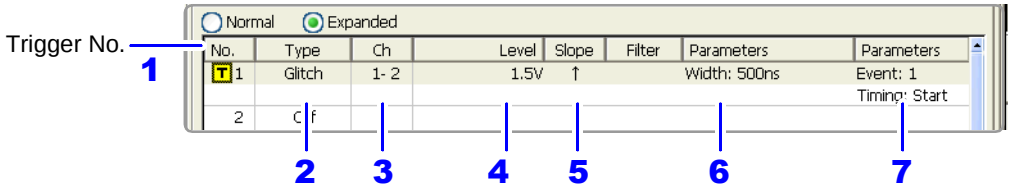
6.7.5 Triggering by Pulse Width (Glitch Trigger)

Triggering occurs when the input signal crosses the trigger level (threshold voltage) if its pulse width is shorter than the specified width.
Rising (↑) or falling (↓) edge pulse width can be selected by Trigger Slope setting.

Glitch Trigger (only with the [Expanded] setting) MEM REC&MEM FFT

To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)

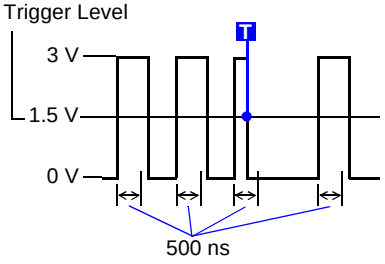


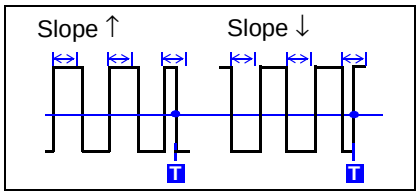
	Operating Key	Procedure
1	**CURSOR**	Move the highlight cursor to a trigger number to be set.
2	**Select the trigger type.**	
	CURSOR	Move the cursor to the [Type] item.
	F1 to F8	Select [Glitch].
3	**Select a channel.**	
	CURSOR	Move the cursor to the [Ch] item.
	F1 to F8	Select a channel to which the trigger applies.
4	**Select the trigger level.**	
	CURSOR	Move the cursor to the [Level] item.
	F1 to F8 or **SCROLL**	Specify the trigger threshold voltage.
5	**Select the trigger slope.**	
	CURSOR	Move the cursor to the [Slope] item.
	F1 to F8	Select either choice.
	↑	Glitch width is determined from rising (↑) trigger slope.
	↓	Glitch width is determined from falling (↓) trigger slope.
6	**Set the glitch width.**	
	CURSOR	Move the cursor to the [Width] item.
	F1 to F8 or **SCROLL**	Set the glitch width (in seconds).
7	**Set the event count (as occasion demands)(p. 149).**	
	When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]	
	Set the trigger to Start or Stop (p. 151).	

Setting Example

Apply a trigger when the input signal pulse width is less than 500 ns (glitch width)
No.1
Type ..... Glitch
Ch..... 1-1(Unit 1-Channel 1)
Level..... 1.5 V
Slope ..... ↑
Parameters
Width ..... 500 ns

Trigger Level





About the Trigger Point
The trigger point occurs one sample after the criterion is met. Timebase 2 sampling data is also one sample later than that of Timebase 1.

About glitch width
The valid range for glitch width setting depends on the sampling period.
Setting Range:
Minimum width setting: At least twice the sampling period
Maximum width setting: No more than 4,000 times the sampling period

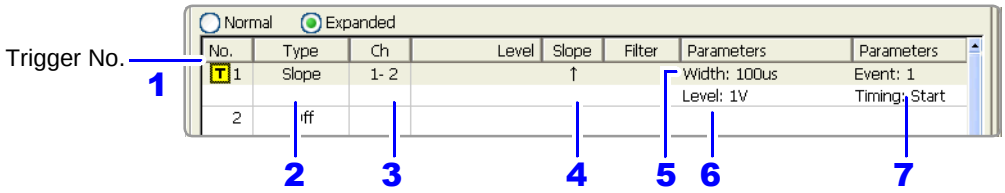
6.7.6 Triggering by a Variance within a Specified Interval (Slope Trigger)

A trigger is applied when a specified variance (slope amount) occurs within a specified time. The slope is specified by a width (time) and level (amount of change). Select the Trigger Slope (↑ or ↓) for the direction of change to be observed.

Slope Trigger (only with the [Expanded] setting) MEM REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)

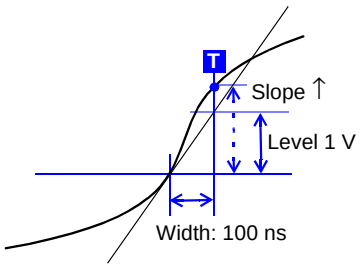


	Operating Key	Procedure
1	**CURSOR**	Move the highlight cursor to a trigger number to be set.
2	**Select the trigger type.**	
	CURSOR	Move the cursor to the [Type] item.
	F1 to F8	Select [Slope].
3	**Select a channel.**	
	CURSOR	Move the cursor to the [Ch] item.
	F1 to F8	Select a channel to which the trigger applies.
4	**Select the trigger slope.**	
	CURSOR	Move the cursor to the [Slope] item.
	F1 to F8	Select the trigger slope.(p. 157)
	↑	Apply a trigger when the amount of change exceeds the specified slope.
	↓	Apply a trigger when the amount of change drops below the specified slope.
5	**Set the width (interval) in which to judge the amount of change.**	
	CURSOR	Move the cursor to the [Width] item.
	F1 to F8 or **SCROLL**	Set the judgment interval.
6	**Set the amount of change (Level).**	
	CURSOR	Move the cursor to the [Level] item.
	F1 to F8 or **SCROLL**	Set the amount of change.
7	**Set the event count (as occasion demands)(p. 149).**	
	When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]	
	Set the trigger to Start or Stop (p. 151).	

Setting Example

Apply a trigger when the input signal changes by at least 1 V within 100 ns.

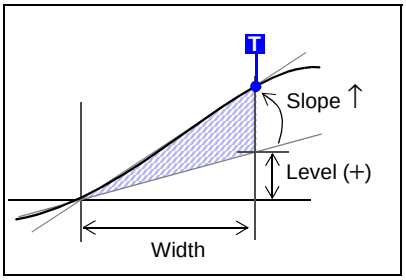
No.1
Type ..... Slope
Ch..... 1-1(Unit 1-Channel 1)
Slope .....↑
Parameters
Width ..... 100 ns
Level..... 1 V
Event 1

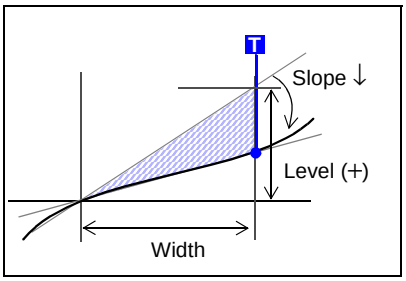


Width setting range:
Minimum width setting: At least twice the sampling period
Maximum width setting: No more than 250 times the sampling period

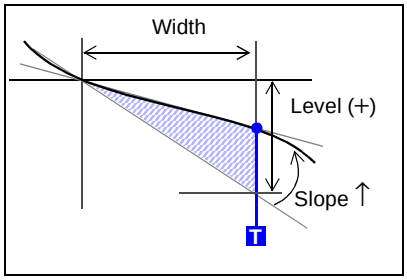
Description About the relationship between slope and trigger

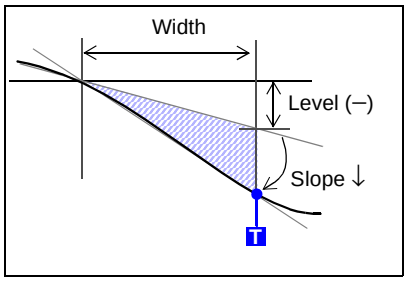
When the specified slope is positive (+)





When the specified slope is negative (–)





NOTE Slope triggering requires that enough data be acquired to determine the slope, so the trigger point is one sample later.

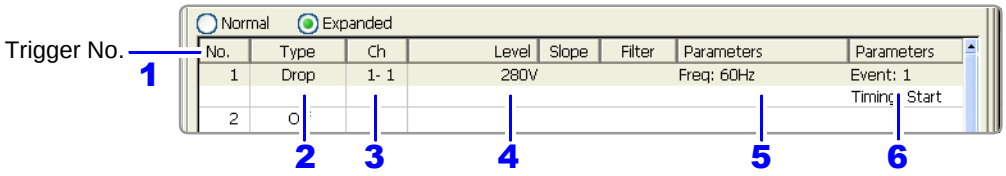
6.7.7 Triggering upon Instantaneous Voltage Sag at Commercial Mains Frequency (50/60 Hz) (Voltage Sag Trigger)

Applicable timebase range is from 20 µs to 50 ms/division.
Triggering occurs when peak voltage drops below the specified level for more than one-half cycle. Voltage sag triggering is not available with the Model 8958 16-Ch Scanner Unit.

Voltage Sag Trigger ([Normal]/[Expanded] Setting) MEM REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35), To set from the Waveform screen (p. 167)

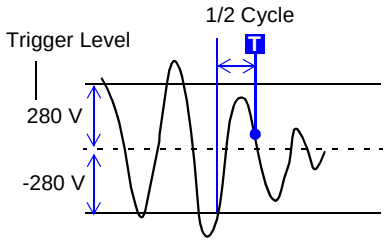


	Operating Key	Procedure
1	**CURSOR**	Move the highlight cursor to a trigger number to be set. For the [Normal] setting, match the number of the channel to which the trigger applies.
2	**Select the trigger type.**	
	CURSOR	Move the cursor to the [Type] item.
	F1 to F8	Select [Drop] (Voltage sag).
3	**Select a channel (only with the [Expanded] setting).**	
	CURSOR	Move the cursor to the [Ch] item.
	F1 to F8	Select a channel to which the trigger applies.
4	**Select the trigger level.**	
	CURSOR	Move the cursor to the [Level] item.
	F1 to F8 or **SCROLL**	Specify the trigger threshold voltage (instantaneous value).
5	**Set the mains frequency to be measured.**	
	CURSOR	Move the cursor to the [Freq] item.
	F1 to F8	Select either choice. **50Hz** 50-Hz mains frequency **60Hz** 60-Hz mains frequency
6	**Set the event count (as occasion demands) (p. 149). (only with the [Expanded] setting)**	
	When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]	
	Set the trigger to Start or Stop (p. 151).	

Setting Example

Apply a trigger if a 60-Hz mains frequency input signal, nominally about 240 Vrms (340 Vpeak), drops below 198 Vrms (280 Vpeak)

No.1
Type ..... Drop
Ch..... 1-1(Unit 1-Channel 1)
Level..... 280 V
Parameters
Freq..... 60Hz
Event 1



NOTE If trigger criteria are already met when you press the **START** key, no triggering occurs. After the criteria have ceased to be met, triggering occurs when the criteria are again met.

6.8 Triggering by Logic Signals (Logic Trigger)

Input signals on logic channels serve as the trigger source. Triggering occurs when the specified trigger pattern and logical probe combining criteria (AND/OR) are met.
The trigger detection method can be selected according to whether a trigger is applied or not when the criteria are already met at the start of measurement.
By using the trigger filter, triggering can be limited so as to occur only when trigger criteria are met for at least the specified filter width.

Logic Trigger Setting Methods

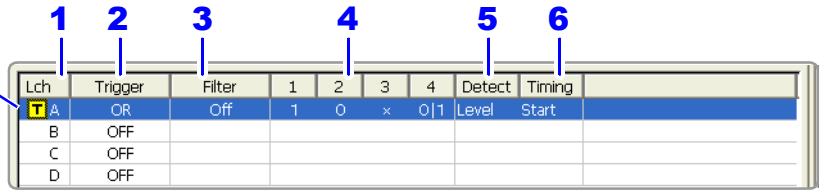
Set on the [Logic] page of the Channel Settings screen. Settings can be made in the following two ways:

- Set individual items
- Set by dialog

Setting Individual Items

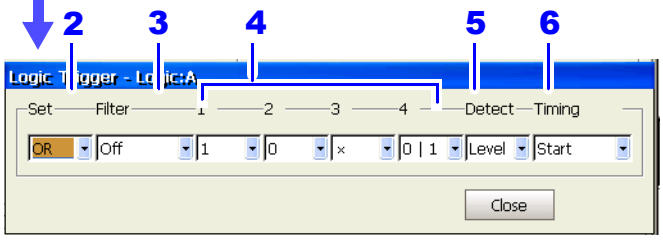
Move the cursor to each item, and make the setting.

Trigger Mark
This mark appears when the trigger setting is enabled.



Setting by Dialog ([Logic Trigger] dialog)

Move the cursor to the trigger to set in the [Lch] column, and select **F1** [All Settings] to open the dialog.



Move the cursor to each item, and make the setting. After making settings, select the [Close] button to accept them.

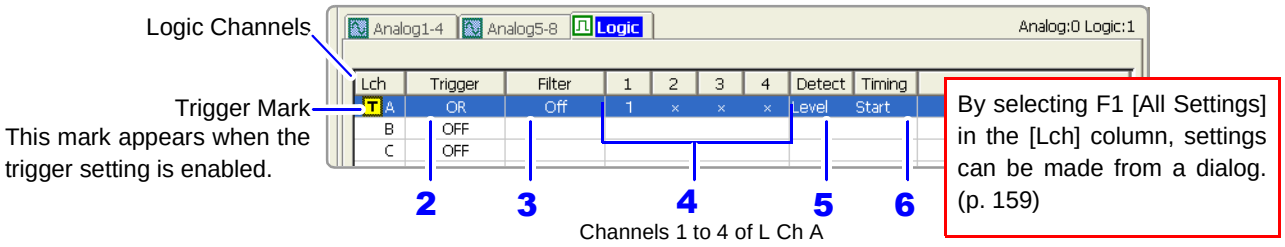
	Setting Items	Setting Choice
1	L ch A,B,..	Logic Channels
2	Trigger	Sets the trigger probe combining logic (AND/OR).
3	Filter	Sets the filter width (trigger filter) for triggering. Suppresses triggering from noise.(p. 149)
4	1, 2, 3, 4	Selects the trigger pattern.
5	Detect	Set the trigger detection method (level or edge).
6	Timing	When [Start & Stop] trigger timing is selected, choose which triggers start and stop measurement. (p. 144)

Logic Trigger

MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35)



By selecting F1 [All Settings] in the [Lch] column, settings can be made from a dialog. (p. 159)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Logic] page.
	CURSOR	Move the highlight cursor to a trigger number to be set.

2 Set the AND/OR (trigger combinatorial logic) for logic triggering.

CURSOR Move the cursor to the [Trigger] item.

F1 to F8 Select either choice.

OFF	Logic triggering is disabled. (default setting)
OR	Triggering occurs when input signal logic matches any setting in the trigger pattern.
AND	Triggering occurs only when input signal logic matches all settings in the trigger pattern.

3 Set the trigger filter (as occasion demands) (p. 149).

CURSOR Move the cursor to the [Filter] item.

F1 to F8 Set the filter width.

MEM REC&MEM FFT

Off	Trigger filtering is disabled. (default setting)
0.1 to 10	Trigger filtering is enabled. The filter width is set as a number of divisions.

REC

Off	Trigger filtering is disabled. (default setting)
On	Trigger filtering is enabled. Filter width is 10 ms (or 5 ms when the sampling rate is 100 ns/S)

4 Set the trigger pattern.

CURSOR Move the cursor to the [1] to [4] item.

F1 to F8 Select either choice.

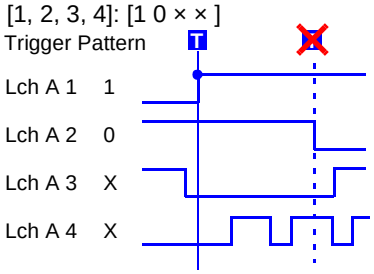
×	Ignore signal(default setting)
0	Trigger at LOW signal level.
1	Trigger at HIGH signal level.
0|1	Trigger when the signal level changes after starting measurement (trigger criteria met just once after starting measurement)

Setting Example

Example 1

Trigger when the input signal matches any of the following criteria:
Channel 1 (L Ch A1): HIGH level
Channel 2 (L Ch A2): LOW level

Lch A
Trigger..... OR
[1, 2, 3, 4]: [1 0 × ×]

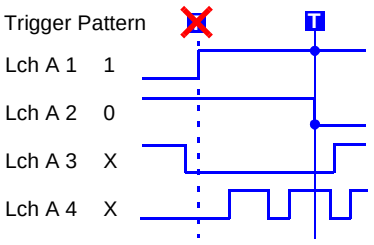


Although L Ch A2 criteria are met, L Ch A1 criteria are met first, so the trigger occurs when L Ch A1 criteria are met.

Example 2

Triggering occurs when the input signal matches both of the following criteria:
Channel 1 (L Ch A1): HIGH level
Channel 2 (L Ch A2): LOW level
Lch A

Trigger..... AND
[1, 2, 3, 4]: [1 0 × ×]



Operating Key Procedure

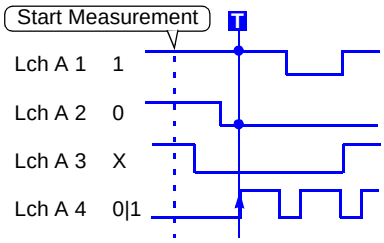
5 Select the trigger detection method.

CURSOR Move the cursor to the [Detect] item.

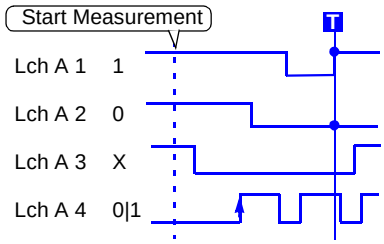
F1 to F8 Select either choice.

Level	Triggering occurs when the criteria are met. If the criteria are already met when measurement starts, the trigger is applied.(default setting)(See Note)
Edge	Triggering occurs when the specified criteria are met (after not being met). If the criteria are already met when measurement starts, no trigger is applied until after the criteria cease to be met and are then met again.

[Level] (Trigger source: when [AND])



[Edge] (Trigger source: when [AND])



6 When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

Set the triggers to start or stop recording.

CURSOR Move the cursor to the [Timing] item.

F1 to F8 Select either choice.

Start	Set the trigger to start recording. (default setting)
Stop	Set the trigger to stop recording.

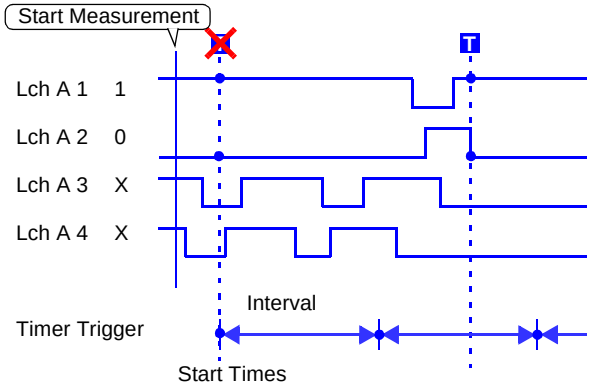
"About trigger timing" (p. 144)

NOTE

Setting external and timer triggers with the [AND] trigger source setting

In the following cases, triggering occurs in the same way as with the [Edge] setting even when [Level] trigger detection is selected.
If logic trigger criteria have been met before an external or timer trigger is applied, no triggering occurs. When external and timer trigger criteria have been applied, and after they have been subsequently released, triggering occurs once all trigger criteria are met again.

(Example: when logic and timer triggers have been set)
Trigger Detection [Detect]: Level
Trigger Source [Trigger]: AND



6.9 Trigger by Timer or Time Intervals (Timer Trigger)

Set this to record at fixed times.
Triggering occurs at the specified interval from the specified Start time until the Stop time. Before setting, verify that the clock is set to the correct time. If not, set the clock on the Environment (Env) Settings screen (p. 364).

Timer Trigger

MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select [Trigger] with the **SUB MENU** keys →Trigger Settings screen
See Screen Layout (p. 35)
When using the REC&MEM function:
To open the screen: Press the **SET** key → Select [Status] with the **SUB MENU** keys →Status Settings screen

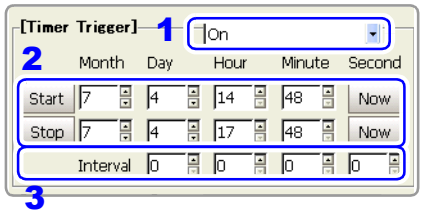
Operating Key Procedure

1 Enable or disable the timer trigger.

CURSOR Move the cursor to the [Timer Trigger] item.

F1 to F8 Enable or disable the timer trigger.

Off	Timer triggering is disabled.
On	Timer triggering is enabled.



2 Set Start and Stop times (when [On] is selected).

CURSOR Move to cursor to the [Month], [Day], [Hour] and [Minute] items to set recording Start and Stop times.

F1 to F8 Set the date and time.

To set the current date and time:
Move the cursor to the [Now] button, and select **F1**.

To set only Start or Stop time:
Move the cursor to the [Start] or [Stop] button of the setting you want to disable, and select **F1** (p. 163).

3 Set the Interval.

(To apply a trigger through the specified interval, from Start to Stop)

CURSOR Move to cursor to the [Day], [Hour], [Minute] and [Second] items of [Interval].

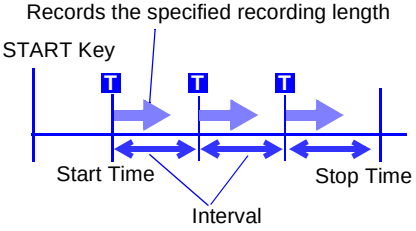
F1 to F8 Set the recording interval.

After pressing the **START** key, recording starts at the specified Start time.

To stop recording early:

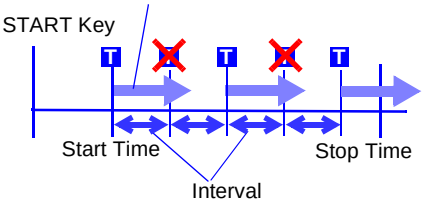
Press the **STOP** key.

Records the specified recording length



When the specified interval is shorter than the specified recording length:

Records the specified recording length



When the recording length exceeds the specified interval
The next trigger is not applied until the data for the specified recording length has been acquired.

When the recording length exceeds the stop time
Recording time depends on the operating function.
"About Stop Time and Recording Length" (p. 163)

When the interval is set to zero
If the [Repeat] trigger mode is selected, or REC&MEM function is used, measurement is repeated from Start to Stop times.

Description

About start and stop times

- Start and Stop times should be set as times elapsed since the START key was pressed.
- When the trigger mode is [Single] and the timer trigger is [On], only one timer trigger specified as the Start trigger is recognized. Interval and Stop time triggers are ignored.

Controlling Recording Start and Stop Arbitrarily

To start recording manually (by pressing the START key) and set a timer to stop

Move the cursor to the [Start] button, and select **F1** [Off].
This disables the Start timer. Set only the Stop time.
Recording (or Trigger Wait) begins when you press the **START** key, and ends at the specified Stop time.

To start recording by a timer and stop manually (by pressing the STOP key)

Move the cursor to the [Stop] button, and select **F1** [Off].
This disables the Stop timer. Set only the Start time. Recording (or Trigger Wait) begins at the specified Start time, and ends when you press the **STOP** key.
However, if the [Single] trigger mode is selected, recording stops automatically after acquiring the specified data length.

To start and stop recording manually

Select **F1** [Off] to disable timers for both [Start] and [Stop] buttons.
Recording (or Trigger Wait) begins when you press the **START** key, and ends when you press the **STOP** key.

To record an interval with specified Start and Stop times

Set the trigger mode to [Repeat], and set all other trigger sources [Off].
However, triggering is disabled during processing (auto save, auto print, waveform display processing and calculation) from the end of recording to the next Trigger Wait state, so depending on measurement settings, recording may not occur within the specified interval.

When the interval is set shorter than the recording length (recording duration)

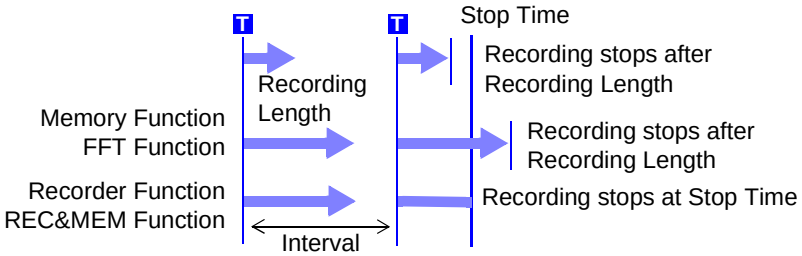
Triggers applied during recording are ignored.

About Stop Time and Recording Length

The stop time is function-dependent:

- Memory function and FFT function: Measurement data is acquired for the specified recording length, then recording stops.
- Recorder function and REC&MEM function (both Recorder waveform and Memory waveform): Measurement data continues to be acquired until the specified Stop time.

Relationship Between Last Recording Length and Stop Time



When a trigger is applied from a trigger source other than a timer trigger

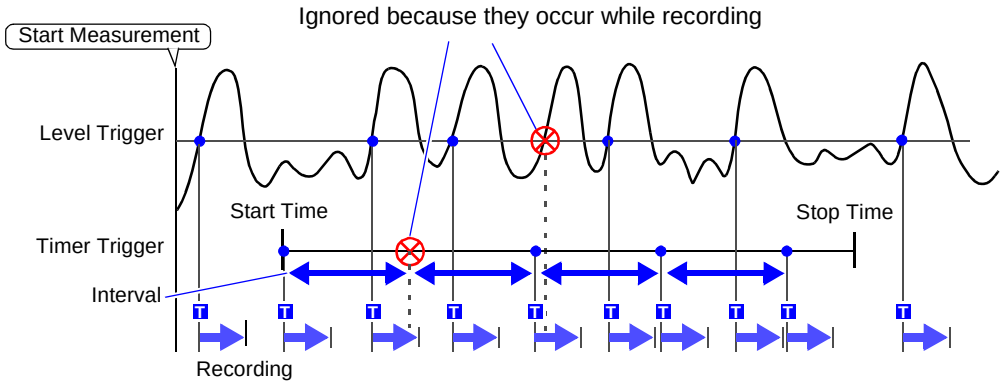
Trigger sources set to On are all enabled.
However, trigger timing depends on the trigger source settings.

- When trigger criteria are ORed together (Trigger Source: OR)
  Depending on the other trigger sources, triggering can occur before the specified trigger Start time, after the specified Stop time, or outside of the specified Interval.

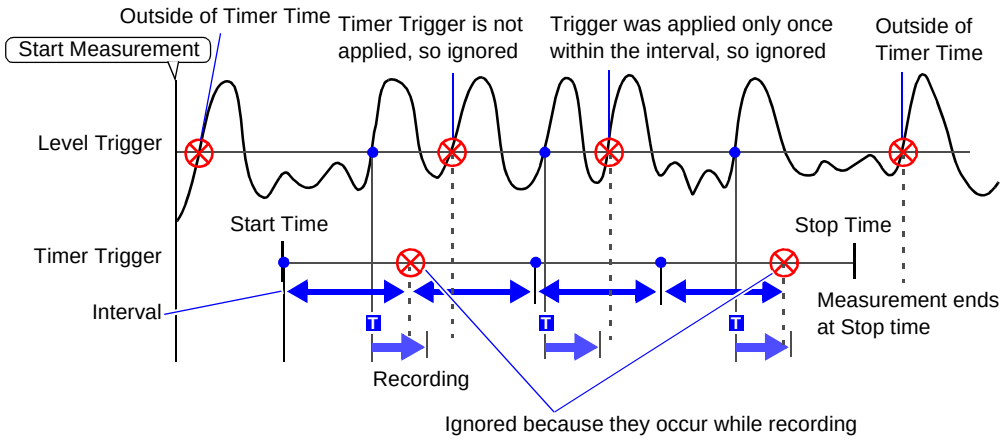
- When trigger criteria are ANDed together (Trigger Source: AND)
  Triggering occurs between the specified Start and Stop times when criteria for all trigger sources set within the specified interval are satisfied.
  If the interval is set to zero, triggering occurs when criteria for all trigger sources set between specified Start and Stop times are satisfied.

Example: measuring when both timer trigger and level triggers (Slope: ↑) are enabled.

When trigger criteria are ORed together (Trigger Source: OR)



When trigger criteria are ANDed together (Trigger Source: AND)



6.10 Triggering Manually (Manual Trigger)

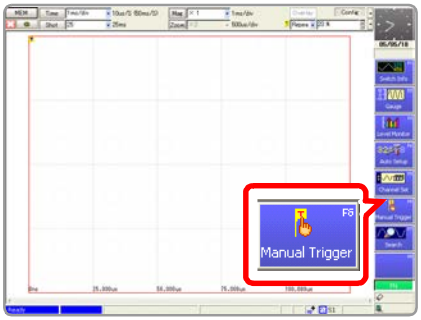
Triggers can be applied manually. Manual triggering takes priority over all other trigger sources, regardless of settings.

Manual Trigger

MEM REC REC&MEM FFT

To open the screen: Press the **DISP** key →Waveform screen

	Operating Key	Procedure
1	**DISP**	Displays the Waveform screen.
2	**FUNCTION MODE** **F6**	To apply a trigger during the Trigger Wait state, select [Manual Trigger]. Triggering occurs when you press the key.



To stop recording:

Press the **STOP** key.
The resulting action differs according to the operating function and the trigger mode (p. 138).

6.11 Applying an External Trigger (External Trigger)

An external signal applied to the External Control terminal can serve as a trigger source. It can also be used to synchronously drive parallel triggering of multiple instruments.

Triggering occurs by shorting the EXT TRIG terminal to the GND terminal, or by an input signal falling from HIGH (3.0 to 5.0 V) to LOW (0 to 0.8 V) level. (Triggering can also be set to occur by the input signal rising from LOW to HIGH level.)

See Connecting method of the External Control terminal: "14.1 Connecting External Control Terminals" (p. 376), "14.2.1 External Trigger Input (EXT TRIG)" (p. 378)

External Trigger

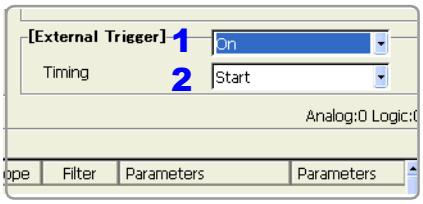
MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select Trigger with the **SUB MENU** keys →Trigger Settings screen

See Screen Layout (p. 35)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [External Trigger] item.
	F1 to F8	Enable or disable external triggering.

Off	Enable or disable external triggering. (default setting)
On	Enables external triggering.



2 When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

Set the external trigger to start or stop recording.

CURSOR	Move the cursor to the [Timing] item.
F1 to F8	Select either choice.

Start	Set the trigger to start recording. (default setting)
Stop	Set the trigger to stop recording.

3 Apply the input signal to the external trigger (EXT. TRIG) terminal.

See "14.2.1 External Trigger Input (EXT TRIG)" (p. 378)

6.12 Making Trigger Settings on the Waveform Screen

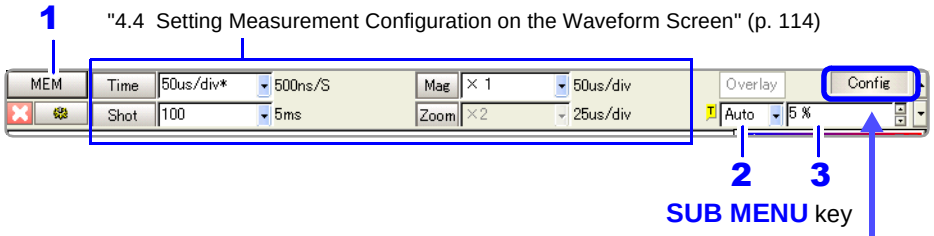
The following trigger criteria settings can be made on the Waveform screen. Press the **SUB MENU** keys to select available setting items.

- Trigger Mode
- Pre-Trigger (Memory function and FFT function only)
- Analog Trigger (settings depend on the trigger type)

Use the **CURSOR** keys to move the cursor to each setting item, and select your choice with the F keys.

Measurement Configuration and Trigger Settings

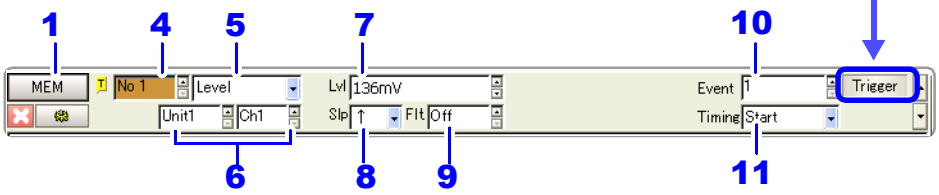
Memory Function



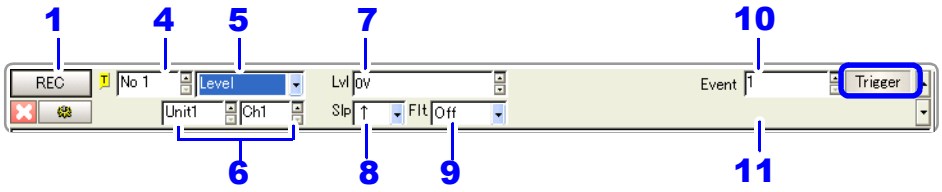
Analog Trigger Settings

Memory Function

REC&MEM Function



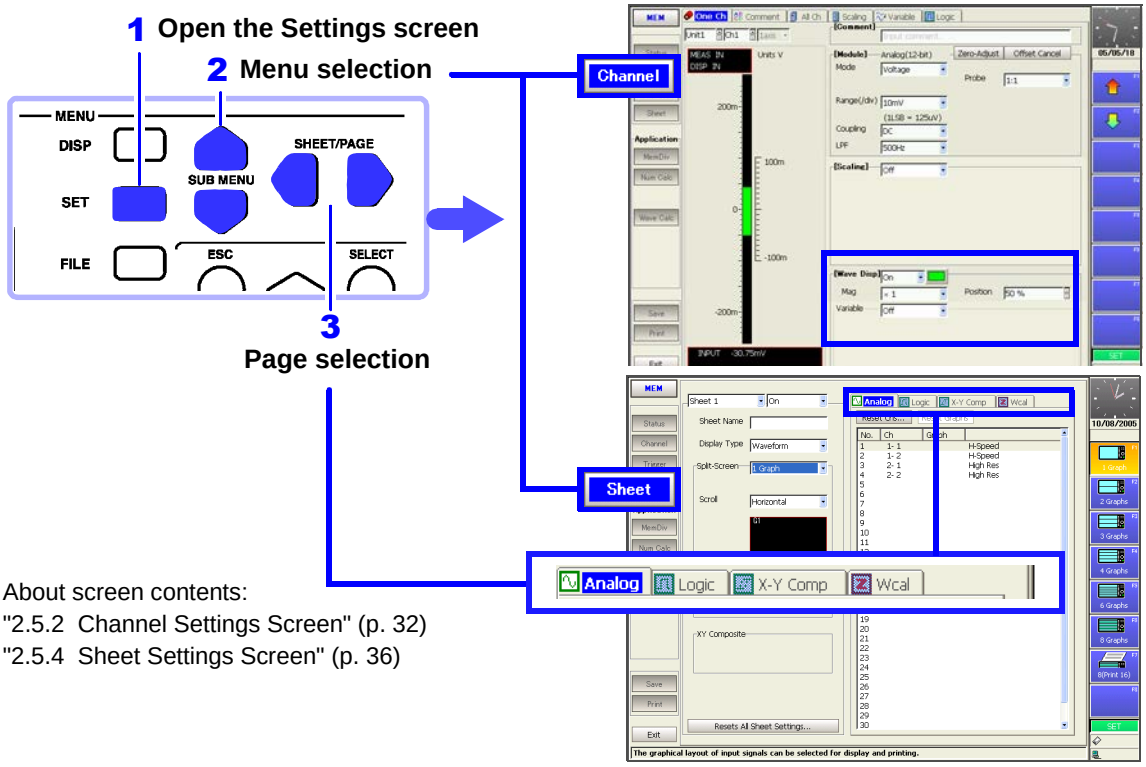
Recorder Function



	Setting Items	Description				
1	Function		MEM	REC	REC&MEM	FFT
2	Trigger Mode (p. 138)	Sets the trigger mode.	Single, Repeat or Auto	Single or Repeat	Single, Repeat or Timer	Single, Repeat or Auto
3	Pre-Trigger (p. 140)	Sets pre-triggering.	-100 to 100% (In steps of 1%, or divisions)	(None)	-100 to 100% (In steps of 1%, or divisions)	-100 to 100% (In steps of 1%, or divisions)
4	Analog Trigger No.	Selects the trigger number.				
5	Analog Trigger Type (p. 146)	Selects the analog trigger type.				
6	Unit and Channel No.	Selectable only when [Expanded] is selected.				
7	Trigger Level	Set the signal level (threshold voltage) for triggering.				
8	Trigger Slope	Select the slope (input signal rising ↑, falling ↓ or both rising and falling ↑↓) for triggering.				
9	Trigger Filter (p. 149)	Sets the filter width (trigger filter) for triggering.				
10	Events (p. 149)	Sets the event count for triggering. (only with the [Expanded] setting)				
11	Timing (p. 144)	Set the timing for triggered recording. For Recorder function, set this when trigger timing is set to [Start & Stop].				_____

Waveform Display Settings Chapter 7

Waveform display, display colors and other input channel settings are made on the Channel Settings screen. The screen layout of each sheet on the Waveform screen is set on the Sheet Settings screen.



About screen contents:
"2.5.2 Channel Settings Screen" (p. 32)
"2.5.4 Sheet Settings Screen" (p. 36)

Input Waveform Display Settings Channel

Analog waveforms (p. 170)

- Display/hide waveforms (p. 171)
- Waveform display colors (p. 171)
- Waveform zero position (p. 172)
- Vertical axis display magnification (p. 212)
- Vertical axis display range (p. 215)

Logic waveforms (p. 183)

- Display/hide setting (p. 184)
- Setting waveform display colors (p. 184)

Refer to "Chapter 8 Waveform Screen Monitoring and Analysis" (p. 191) for gauge display and split-screen display of numerical values and waveforms.

Screen Layout Settings on the Waveform Screen Sheet

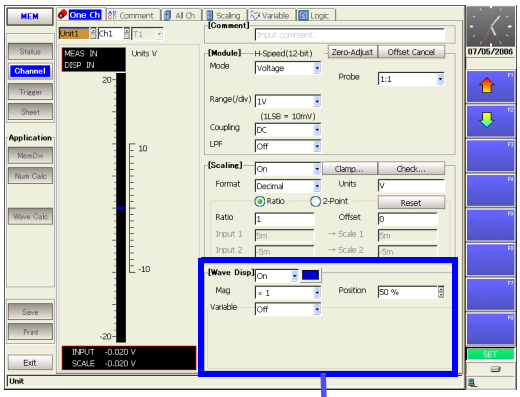
- Assign waveforms to sheets (p. 175)
- Change sheet names (p. 177)
- Types of display data (waveform/ numerical values/ X-Y composite (p. 177)
- Split-screen number and display pattern (p. 178)
- Data scrolling direction (p. 180)

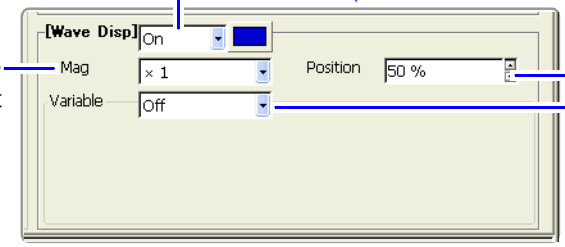
Sheet Assignment

- Analog waveforms (p. 181).....[Analog] page
- Logic waveforms (p. 183) ..... [Logic] page
- X-Y waveforms (p. 184)..... [X-Y Comp] page
- Calculation waveforms (*Analysis and Communication Supplement*) ..... [Wcal] page

7.1 Making Input Waveform Display Settings (Analog Waveforms)

Make settings for display of input channel waveforms in the [Wave Disp] (Waveform Display) settings on the Channel Settings screen.





About Logic Waveforms

See "7.3 Displaying Logic Waveforms" (p. 183)

Set whether to display or hide waveforms, and their display colors (p. 171).

Set display magnification of the vertical axis (measurement range) (p. 212).

Set zero levels of waveforms to position them on the vertical axis (measurement range). (p. 172)

When [On], the value per division on the vertical axis, upper and lower limits of the screen display, and zero position can be set arbitrarily. (Variable function)(p. 215)

7.1.1 Setting Whether a Waveform is Displayed or Hidden, and its Color

For each channel, you can set whether a waveform is to be displayed or not. Waveform colors can be changed. The settings for analog channel are described here.

Settings to display or hide logic waveforms and set their colors are described at:
See "Logic Waveform Display/Hide and Display Color Settings" (p. 184)

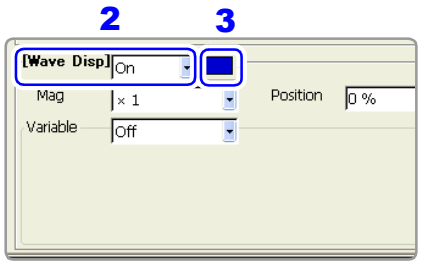
Changing Whether a Waveform is Displayed or Hidden, and its Color

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Channel] with the **SUB MENU** keys →Channel Settings screen

See To set from the Waveform screen (p. 134), To set in the Channel List (p. 130)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [One Ch] page.
2	**Display or hide the waveform.**	
	CURSOR	Move the cursor to the [Wave Disp] item.
	F1 to F8	Select either choice.
	Off	The waveform is hidden.
	On	The waveform is displayed. (default setting)
3	**Change the waveform's display color (when displayed [On]).**	
	CURSOR	Move the cursor to the color item (colored rectangle).
	F1 to F8	Select the color to display.



Select the channels to be displayed on the Waveform screen from each page of the Sheet Settings screen. Unless a display channel is specified, it is not displayed on the Waveform screen.

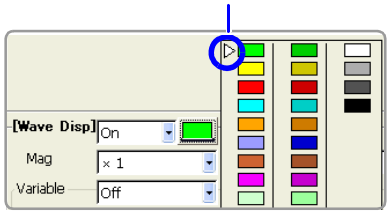
See "7.2.1 Assigning Display Data to Sheets" (p. 175)

To select from the Color List

Move the cursor to the color item, and press the **SELECT** key.
The Color List appears.

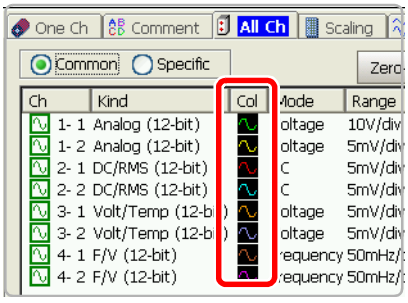
Select a color with the **CURSOR** keys, and press **ENTER** to accept it.

A marker indicates the selected color.



To verify or change settings for other channels

Press the **SHEET/PAGE** keys on the Channel Settings screen to select the [All Ch] page. A list of the current channel settings is displayed.
Waveform display settings can be verified in the [Col] (Color) column.

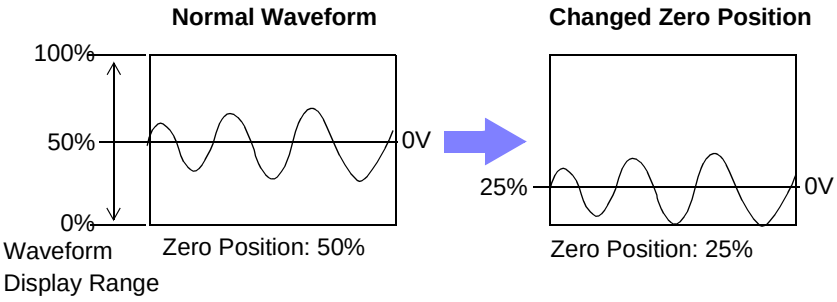


To Change Settings:

Move the cursor to the color item for the channel to be changed, and press one of the **F1** to **F8** keys to make the change.
(**F1** or **F2:** display or hide the waveform, **F3** or **F4:** select the display color, **F6** or **F7:** display or hide all, or **F8**: revert to the default color setting)

7.1.2 Setting the Waveform Display Position (Zero Position)

Set the waveform zero position (in this example, zero volts) for display on the vertical axis.
The waveform display range can be verified on the Level Monitor.



The following two setting methods are available:

- Using the operating keys
- Using the **RANGE/POSN** knobs (settable regardless of cursor position)

Setting the Zero Position

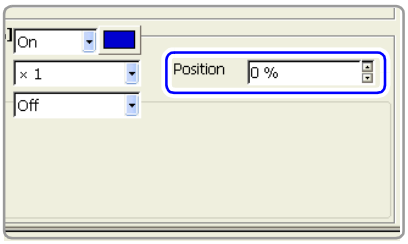
MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen

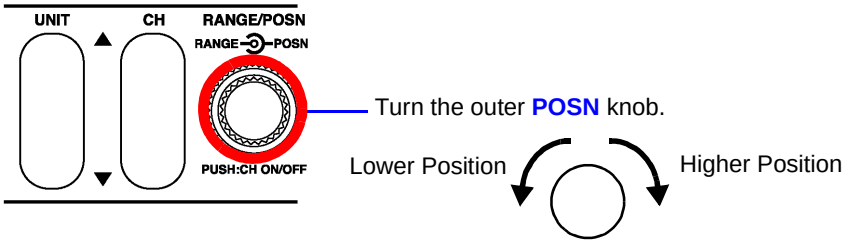
See To set from the Waveform screen (p. 134), To set in the Channel List (p. 130)

Using the Operating Keys

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [One Ch] page.
2	**CURSOR**	Move the cursor to the [Position] item.
3	**F1 to F8**	Set the zero position. The valid setting range depends on display magnification. With x 1 magnification: –100 to 150% **See** "Entering Numbers" (p. 65)

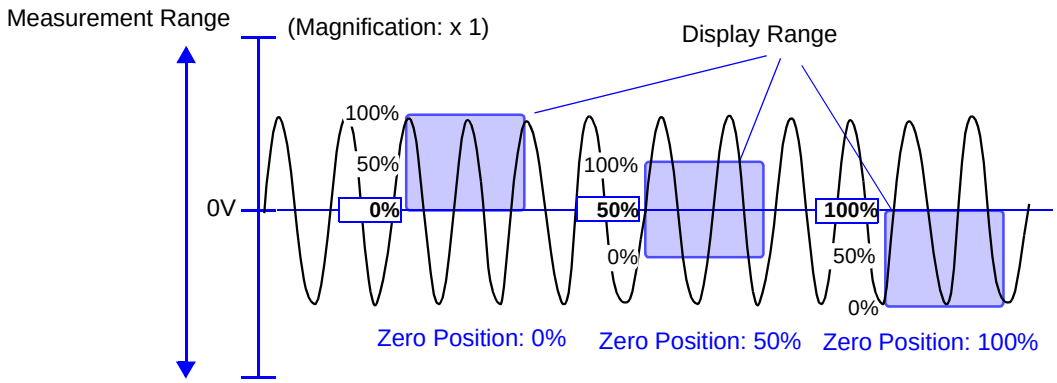


Using the RANGE/POSN Knobs



Description

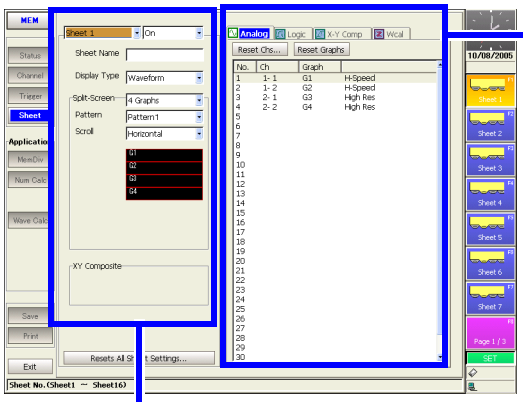
Magnification and compression (p. 212) in the voltage axis direction is based on the zero position.
Although the range of voltage that can be displayed on the Waveform screen depends on the zero position and magnification/compression of the voltage axis, the measurement range is unaffected.



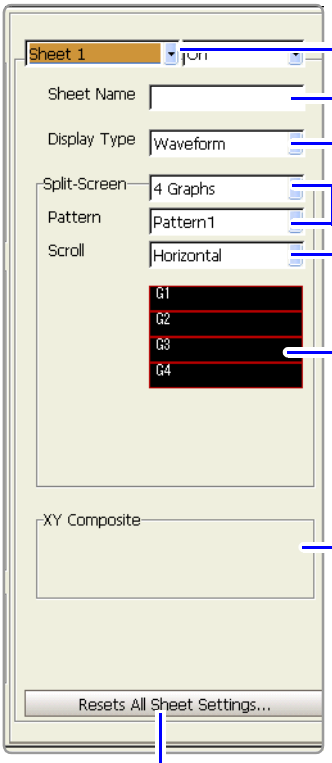
7.2 Setting the Screen Layout of the Waveform Screen (Sheet Settings Screen)

Set on the Sheet Settings screen. Setting choices are function-dependent.
Refer to the *Analysis and Communication Supplement* for FFT function setting details.

Select channels according to the types of waveforms to be displayed.

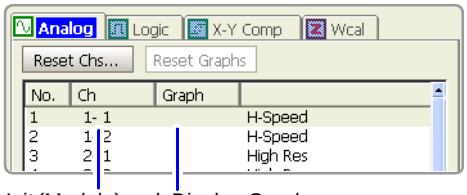


Select the format for displaying recorded data on each Sheet on the Waveform screen.



- Sheet No. (p. 175)
- Sheet Name (p. 177)
  You can change the Sheet name.
- Display Type of Recorded Data (Waveform, numerical values, or X-Y Composite)(p. 177)
- Split-Screen number (graphs) and Display Pattern (p. 178)
- Waveform Scrolling Direction (p. 180)
- Sample Display of Split Screen (Graphs) and Display Pattern
- Set this when the [X-Y Comp] or [Wave & X-Y] display type is selected (p. 187).
- All sheet settings can be reset.

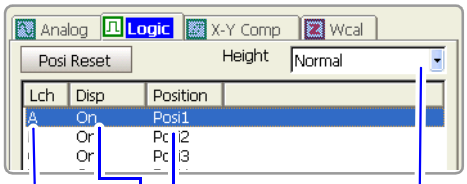
[Analog] Page (p. 181)



Unit (Module) and Channel Nos.
Display Graph (Set for split-screen display)

Switch with the **SHEET/PAGE** keys.

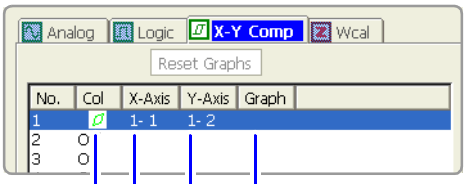
[Logic] Page (p. 183)



Logic Channel
Display/Hide Each Channel (p. 184)
Display Position(p. 185)
Waveform Height Adjustment (p. 186)

Switch with the **SHEET/PAGE** keys.

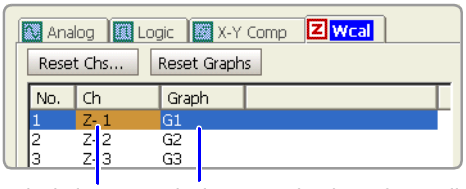
[X-Y Comp] Page (p. 187) *



Waveform Color
Channel to Display on X-Axis
Display Graph (Set for split-screen display)
Channel to Display on Y-Axis

Switch with the **SHEET/PAGE** keys.

[Wcal] Page *(*Analysis and Communication Supplement*)



Calculation Equation No.
Display Graph (set for split-screen display)

* Memory function only

7.2.1 Assigning Display Data to Sheets

Measurement data can be split and displayed on up to 16 sheets on the Waveform screen.
Each sheet can be assigned analog, logic, X-Y, analog & logic, analog & X-Y waveforms and numerical values.
The default setting is to display up to 32 analog waveform channels and 8 logic waveform channels on one sheet, in sequential order beginning with module Unit 1.
Settings are not retained when an input module is added or replaced. If more than 32 channels are selected, they are assigned to another sheet.

See Logic waveform display settings: "7.3 Displaying Logic Waveforms" (p. 183)
X-Y waveform display settings: "7.4 Composite Waveforms (X-Y Waveforms)" (p. 187)

Sheet Assignment

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

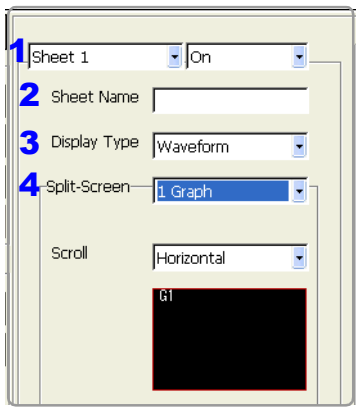
See Screen Layout (p. 174)

Operating Key Procedure

1 Sheet Assignment.

CURSOR Move the cursor to the [Sheet 1] item.
F1 to F8 Select the number of the Sheet to set.
CURSOR Move the cursor to the [On] or [Off] item.
F1 to F8 Select whether to display the selected sheet on the Waveform screen.

Off	The selected sheet is not displayed.
On	The selected sheet is displayed.



2 Enter a Sheet Name (if you want to change it (p. 177).

3 Select the Display Type (p. 177).

(Default setting: Waveform)

4 ([Waveform], [X-Y Comp], or [Wave&X-Y] is selected)
Select the number of split-screen divisions and display pattern (as occasion demands) (p. 178).

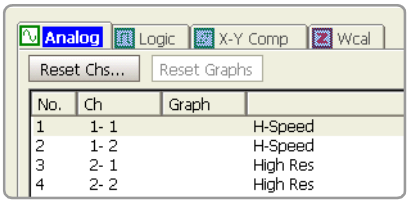
When the [Waveform] display type is selected, you can select the scrolling direction. (p. 180) (Default setting: Horizontal)

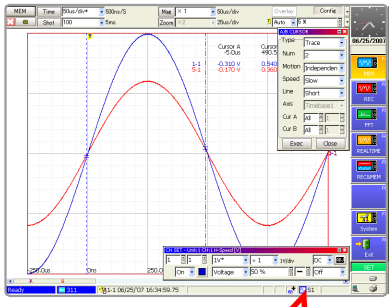
5 Select the channels to display on the sheet.

SHEET/PAGE
To display analog waveforms:
Select the [Analog] page (p. 181).
To display logic waveforms:
Select the [Logic] page (p. 183).
To display X-Y composite waveforms:
Select the [X-Y Comp] page (p. 187).
To display calculation waveforms:
Select the [Wcal] page (*Analysis and Communication Supplement*).

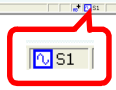
Set other sheets in the same way.

5





Waveform Screen



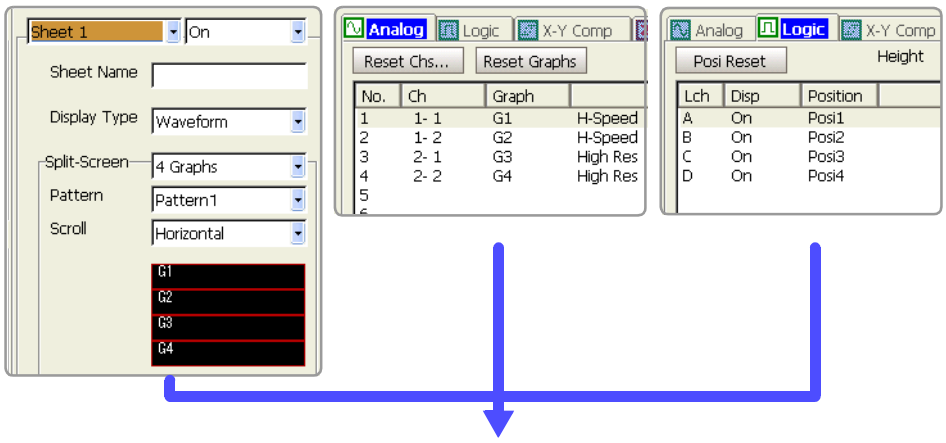
The Sheet Number appears.

Press the DISP key to display the Waveform screen.
The displayed sheet changes each time you press the SHEET/PAGE key.

Sheet Setting Example

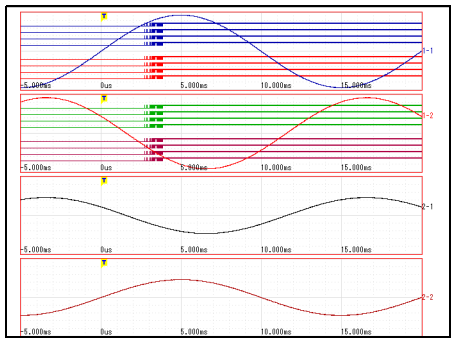
Assign four analog waveform channels and one logic waveform channel (four probes) to graphs on Sheet 1.

Sheet Settings Screen **[Analog] Page** **[Logic] Page**



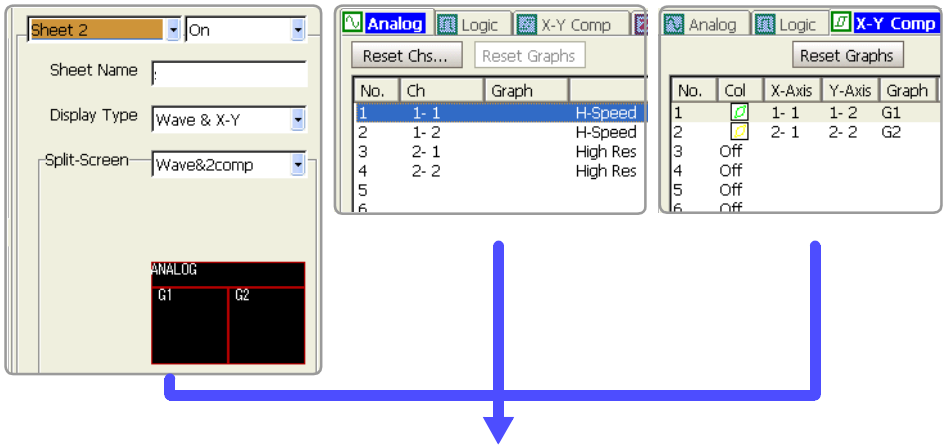
Waveform Screen

Press the **SHEET/PAGE** keys to select S1 (Sheet 1)



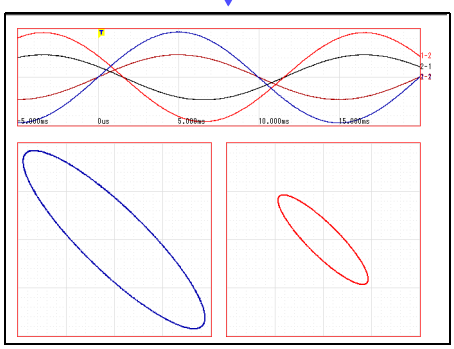
Assign four analog waveform channels and their X-Y composite waveforms to Sheet 2

Sheet Settings Screen **[Analog] Page** **[X-Y Comp] Page**



Waveform Screen

Press the **SHEET/PAGE** keys to select S2 (Sheet 2)



7.2.2 Assigning a Sheet Name

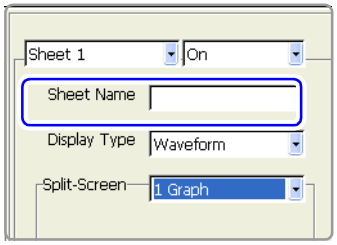
A name can be assigned to each sheet. The sheet name appears on the status bar of the Waveform screen.
To switch sheets on the Waveform screen, press the **SHEET/PAGE** keys.

Sheet Name Setting

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen
See Screen Layout (p. 174)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Sheet Name] item.
2	**F1 to F8**	Enter a name (p. 66). (up to 8 characters) (When you enter a sheet name other than the default, it is displayed to the right of the waveform.)



7.2.3 Setting the Display Type

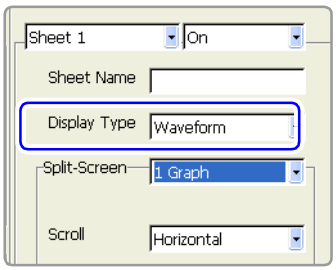
Measurement data can be displayed as waveforms, numerical values, or X-Y composites on the Waveform screen.
Select the type of display for the Waveform screen.

Display Type Setting

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen
See Screen Layout (p. 174)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Display Type] item.
2	**F1 to F8**	Select the type of data to be displayed.



MEM

Waveform	Displays waveforms.
Numeric	Displays numerical values.
X-Y Comp	Displays X-Y composite waveforms.
Wave & X-Y	Displays both waveforms and X-Y composite waveforms.

REC **REC&MEM** **REALTIME**

Waveform	Displays waveforms.
Numeric	Displays numerical values.

Waveform screen display example (p. 20)
Numerical values display "8.13 Viewing Waveform Data as Numerical Values" (p. 221)

7.2.4 Splitting the Display Screen (Split-Screen)

The screen can be split into multiple regions (graphs). You can specify the position of each channel's graph. (p. 181)
This setting is available when any display type other than [Numeric] is selected.
By splitting the screen, viewing of multiple input waveforms with similar amplitudes becomes easier.

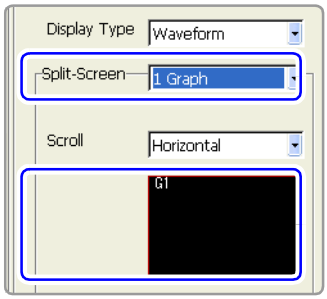
Split-Screen Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

See Screen Layout (p. 174)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Split Screen] item.
2	**F1 to F8**	Select the number of graphs into which to split the screen. Split-screen contents depend on the selected display types. A sample of the current split-screen setting is displayed below the display pattern setting.



When the [Waveform] display type is selected

1 Graph	Display and print a single graph.
2, 3, 4, 6 or 8 Graphs	Displays and prints the selected number of graphs.
8 (Print 16)	Prints 16 graphs (although upto 8 are displayed) When using the Model 8995-01 A6 Printer Unit, prints upto 8 graphs.

Select the waveform display pattern as occasion demands (p. 179)
On the [Analog] page, assign a channel to each graph.
When the waveform scrolling direction is set to [Cont] (p. 180), printing is always of a single graph.

When the [X-Y Comp] display type is selected (Memory function only)

1 Graph, 2 Graphs or 4 Graphs	X-Y waveforms are displayed on Graphs 1 to 8 and recorded with the specified graph number.

Assign channels to each graph from the [X-Y Comp] page (p. 187).

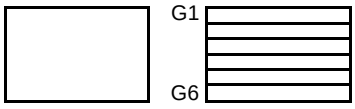
When the [Wave & X-Y] display type is selected (Memory function only)

Wave & 1 Comp	An analog waveform and an X-Y waveform are displayed and printed on each graph.
Wave & 2 Comp	Analog waveform is displayed and printed on one graph, and X-Y composite waveforms are displayed and printed on two graphs.

When printing, waveforms are printed before X-Y composites.

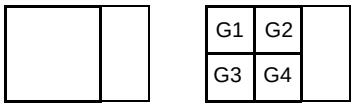
Setting Example

Display Type: [Waveform] case



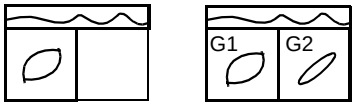
1 Graph　6 Graphs

Display Type: [X-Y Comp] case



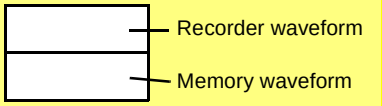
1 Graph　4 Graphs

Display Type: [Wave & X-Y] case



Wave & 1 Comp　Wave & 2 Comp

With the REC&MEM function, when both Memory and Recorder waveforms are displayed, the display appears as follows without any split-screen settings.



Pattern Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

See Screen Layout (p. 174)

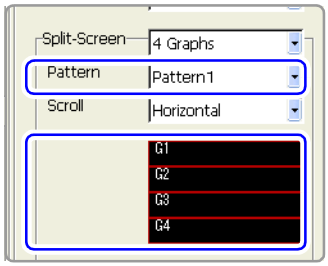
Operating Key Procedure

When the [Waveform] display type is selected and Split-Screen is set to [2 Graphs] or more, set the split-screen display method.

1 **CURSOR** Move the cursor to the [Pattern] item.

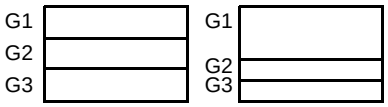
2 **F1 to F8** Select the display pattern.
A display sample appears below the setting item.

Pattern 1	Split into same-size portions.
Pattern 2	(valid for 3, 4 or 6 graphs) Graph 1 is displayed larger than the remaining graphs, displayed at the same (smaller) size. With a 6-graph split, Graphs 1 and 2 are large and the other graphs are displayed at the same (smaller) size.



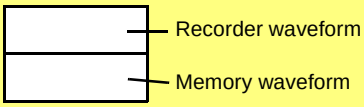
Setting Example

Split Screen: [3 Graphs] case



Pattern 1 Pattern 2

With the REC&MEM function, when both Memory and Recorder waveforms are displayed, the display appears as follows without any split-screen settings.



7.2.5 Setting Waveform Scrolling Orientation

You can change the waveform display orientation. This setting is available only when the [Waveform] display type is selected.

Scrolling Orientation Setting

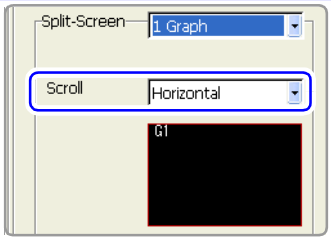
MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

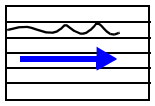
See Screen Layout (p. 174)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Scroll] item.
2	**F1 to F8**	Select the type of data to be displayed.

Horizontal	Draw waveforms horizontally (left-to-right) on the screen. (default setting)
Vertical	Draw waveforms vertically (top-to-bottom) on the screen.
Cont (Continuous)	Draws waveforms sequentially from one graph to the next, starting at the top (when Split-Screen is set to other than [1 Graph]).

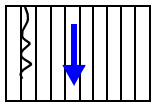


Setting Example



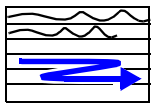
Horizontal

The timebase can be set very long.



Vertical

Minimizes overlap when viewing many waveforms.



Cont

Trends over the whole waveform can be viewed.

7.2.6 Assigning Display Channels to Graphs (Analog Channels)

The default setting assigns channels in the order of input module installation. However, with the Memory function or Real-time saving function, only those channels enabled for use [On] can be assigned.

See "4.2.1 Selecting Channels to Use" (p. 86)

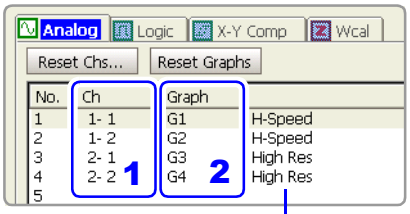
Analog Channel Assignment

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

See Screen Layout (p. 174)

	Operating Key	Procedure
1		**Select the channels to display on the Sheet.**
	SHEET/PAGE	Select the [Analog] page.
	CURSOR	Move the highlight cursor to the No. to set, and then to the [Ch] column.
	F1 to F8	Select the channel number of the unit (module) to display on the Sheet. To not display the channel, select **F3** [Off].
2		**Select the display graph (when Split-Screen is set to [2 Graphs] or more).**
	CURSOR	Move the cursor to the [Graph] column.
	F1 to F8	Select the graph number in which to display. Verify the pattern display for the graph number.



Setting from a dialog

Move the cursor to the [No.] column of the channel to be set, and select **F1** [All Settings]. A dialog appears. Set each item, then select the [Close] button.

If “Storage Off” appears

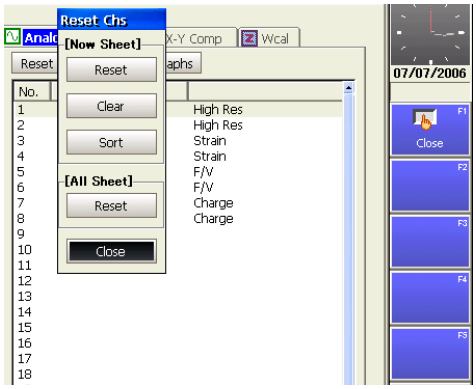
A selected channel is disabled ([Off]) on the [Use Ch] page of the Status Settings screen. To display, set the channel to [On] and measure again.

If “Display Off” appears

Waveform display setting on the Channel Settings screen is disabled ([Off]). To display the waveform on the Waveform screen, set it to [On].

To reset, clear or re-order assignments

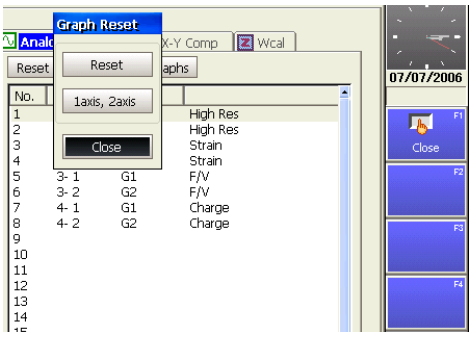
Move the cursor to the [Reset Chs] button, and select an item with the **F** keys.



F1	**Reset**	Channels assigned to current displayed Sheet numbers are reassigned beginning with No. 1 in order of input module installation.
F2	**Clear**	Erases the settings.
F3	**Sort**	Re-sort channels to be displayed in order from the top. Disable (set to [Off]) channels to be hidden, then select this button.
F5	**Reset all sheets**	Resets all sheet settings and reassigns them beginning with No. 1 on Sheet 1 in order of input module installation.

To reset graphs (when Split-Screen is enabled with [2 Graphs] or more)

Move the cursor to the [Reset Graphs] button, and select **F1** [Reset Graphs].
A dialog appears.
Select an item with the **CURSOR** keys, and press the **F1** key.



F1	**Reset**	Graph numbers are assigned sequentially depending on the number of split-screen graphs. After disabling (set to [Off]) channels to be hidden, resetting sequentially reassigns the remaining (enabled) channels.
F2	**1axis, 2axis**	This is selectable only when using Timebase 1 and Timebase 2. Timebase 1 is assigned to G1, and Timebase 2 is assigned to G2.

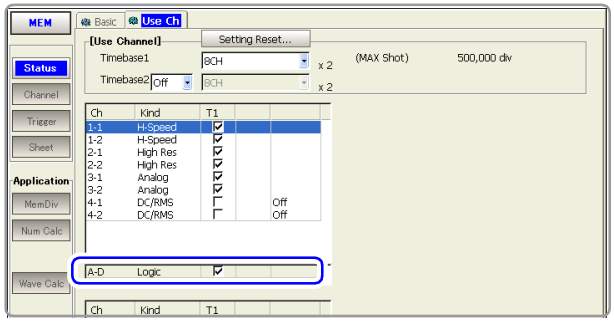
7.3 Displaying Logic Waveforms

Settings such as those for measurement configuration are the same as for analog waveforms.

Logic Waveform Display Setting Workflow

Select a measurement channel (Memory function and Real-time saving function only)

[Use Ch] page on the Status Settings screen

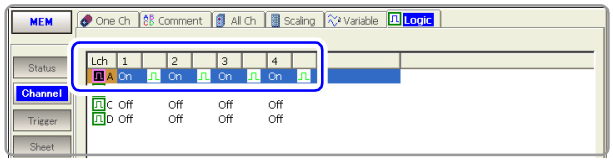


- Enable the channels to use (p. 86)

Select which logic probes to display or hide, and their display colors

[Logic] page on the Channel Settings screen

(Default setting: Off)

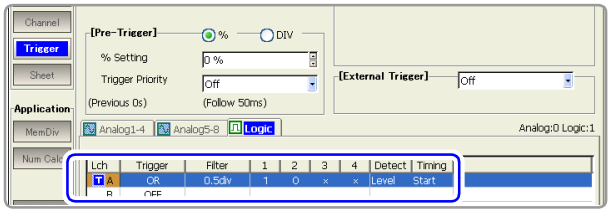


- Display/hide setting (p. 184)
- Waveform display color setting (p. 184)

Set logic triggers (if triggers are to be applied)

[Logic] page on the Trigger Settings screen

(Default setting: Off)

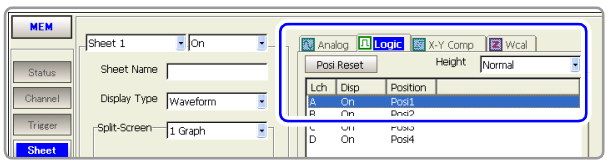


- Logic Trigger settings (p. 159)

Set whether to display or hide logic channels, and the display position and display height for each

[Logic] page on the Sheet Settings screen

(Default setting: On)



- Sheet Assignments (p. 184)
- Display Position setting (p. 185)
- Display Height setting (p. 186)

7.3.1 Setting the Waveform Display

Set whether to display or hide the waveform for each logic channel probe.

Logic Waveform Display/Hide and Display Color Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Channel] with the **SUB MENU** keys →Channel Settings screen

Operating Key Procedure

1 Set whether to display or hide the waveform.

SHEET/PAGE Select the [Logic] page.

CURSOR Move to each probe ([1] to [4]) of the logic channel to set.

F1 to F8 Select either choice.

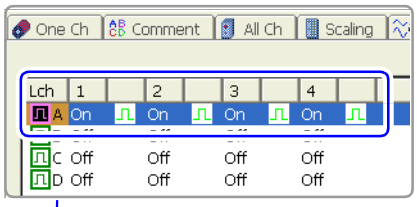
Off	The waveform hidden.(default setting)
On	The waveform is displayed.

(To set whether to display or hide a group of channels (L Ch))

CURSOR Move the cursor to the [Lch] column.

F1 to F8 Select either choice.

All Off	The waveforms are not displayed.
All On	The waveforms are displayed.



Logic Channels
(Probe channels 1 to 4 of Logic Channel A (L Ch A) of the LOGIC terminals)
Settings are also available from the dialog displayed by selecting **F1** [All Settings].

2 Change the waveform display color (when set [On]).

CURSOR Move to the color column for each probe ([1] to [4]) of the logic channel to set.

F1 to F8 Select the color to display.

Sheet Assignments (Logic Channels)

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

Operating Key Procedure

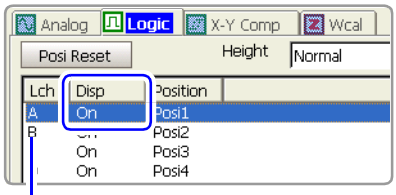
1 Select the channels to display on the sheet.

SHEET/PAGE Select the [Logic] page.

CURSOR Move the highlight cursor to the logic channel (L Ch A, B, …) to be displayed, then move the cursor to the [Disp] column.

F1 to F8 Set whether to display or hide the waveforms.

Off	The waveforms are not displayed.
On	The waveforms are displayed. (default setting)



Logic Channels
(Probe channels 1 to 4 of Logic Channel A (L Ch A) of the LOGIC terminals)

2 Set the display position (p. 185).

3 Set the display height (p. 186).

7.3.2 Setting the Display Position

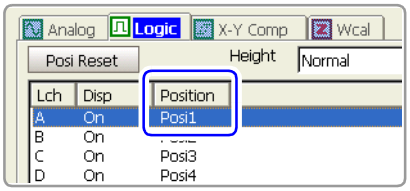
The logic waveform display position can be set for each channel.
When recording a mix of analog and logic waveforms, overlapping of waveforms on the display can be minimized by setting the display position and height.

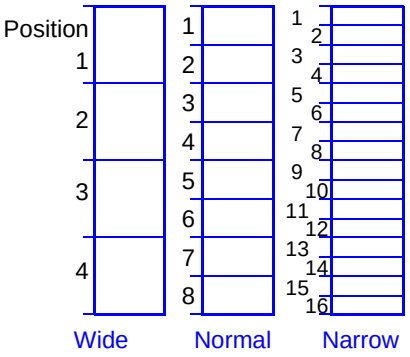
Logic Waveform Display Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Logic] page.
2	**CURSOR**	Move the cursor to the [Position] column.
3	**F1 to F8**	Set the display position numbers of the waveforms. Setting the display height affects the range that can displayed. (p. 186) • When the display height is set to [Wide]: The highest number position that can be displayed is [Pos 4]. • When the display height is set to [Narrow]: The highest number position that can be displayed is [Pos 16].
4	**F3**	Select [Set]. When a position number is duplicated by two channels: The position number of the duplicated channel is automatically changed to another number.

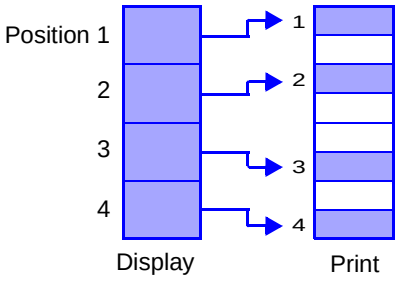




Display Height

Printing Position

When [Normal] or [Narrow] is selected, waveforms print at the same relative positions as on the display. When [Wide] is selected, printing positions are as follows.

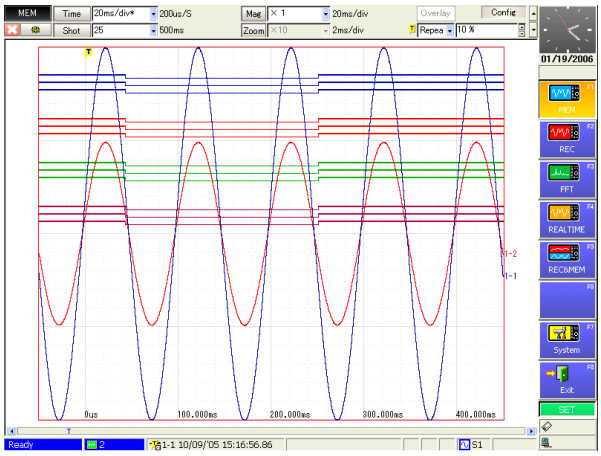


Numbering changes when changing the display position

If a duplicate position number is accepted for a channel, or if another screen is displayed without accepting assignments, the position number of the duplicated channel is automatically changed.

- When priority is given to the position number of the changed channel
  Place the cursor on the position number of the channel to be given priority, and select [Set]. The other (duplicated) channel is assigned the next available higher number.
- When the position number is duplicated and another screen is displayed without selecting [Set], or when [Set] is selected while the cursor is placed on a non-duplicated channel.
  The duplicated position number is reassigned the next available higher (L Ch A) number.

Display Position Setting Example when Recording Mixed Analog and Logic Waveforms



[Normal] Case

7.3.3 Setting the Display Height

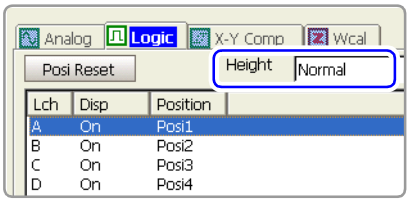
The display height of logic waveforms can be modified.
Viewing is improved by setting a narrow display height when many waveforms are displayed.

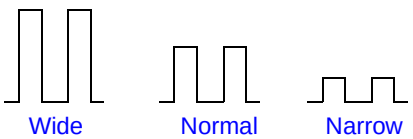
Logic Waveform Display Height MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select Sheet with the **SUB MENU** keys →Sheet Settings screen

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Logic] page.
2	**CURSOR**	Move the cursor to the [Height] item.
3	**F1 to F8**	Set the display height of the waveforms.

Wide	Wide display height.
Normal	Normal display height. (default setting)
Narrow	Narrow display height.





7.4 Composite Waveforms (X-Y Waveforms)

This applies to the Memory function only.
Any channels can be displayed as a composite during or after measurement. To make a composite while measuring, measurement configuration settings and X-Y composite have to be set before starting measurement. Refer to the appropriate chapters for measurement configuration settings. This section describes the composite waveform settings.

X-Y Waveforms

MEM

To open the screen: Press the **SET** key → Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

See Screen Layout (p. 174)

Composite setting is available both before and after measurement.

Operating Key Procedure

1 Set the Display Type.

CURSOR Move the cursor to the [Display Type] item.

F1 to F8 Select either choice.

X-Y Comp	Displays X-Y waveforms.
Wave & X-Y	Displays both X-Y composite and analog waveforms.

2 Set Split-Screen display (p. 178).

CURSOR Move the cursor to the [Split-Screen] item.

F1 to F8 Select the number of Graphs. (Available choices depend on the Display Type setting.)

3 Set the Composite Area.

CURSOR Move the cursor to the [Area] X-Y Composite item.

F1 to F8 Select either choice.

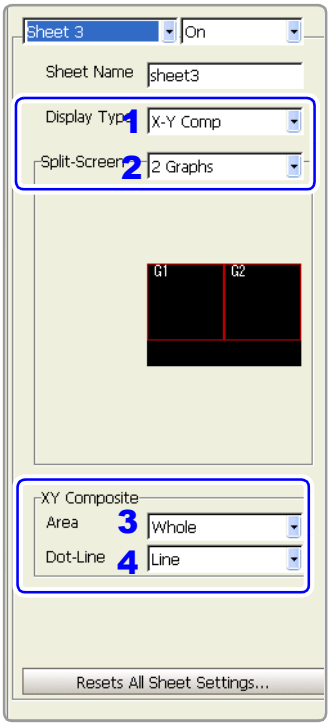
Whole	Use the whole range for the composite waveform. (default setting) (default setting)
A-B	Use the range specified by the cursors. Procedure to specify a range with A/B cursors:(p. 200)

4 Set line interpolation (as occasion demands).

CURSOR Move the cursor to the [Dot-Line] item.

F1 to F8 Select either choice.

Dots	Do not interpolate straight lines. Input signals (sampling data) are displayed and recorded as is.
Line	Interpolate straight lines. This can improve display visibility, although the display speed is slower than Dots display. (default setting)



"Making Partial Composites" (p. 189)
To make a partial composite while measuring, first acquire waveforms and specify the waveform range with A/B cursors.

Operating Key Procedure

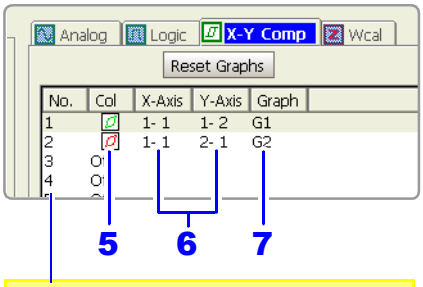
5 Set whether to display or hide composite waveforms, and display color.

SHEET/PAGE Select the [X-Y Comp] page.

CURSOR Move the cursor to the [Col] (Color) column for the No. to be displayed.

F1 to F8 Select [On] to display the waveform.

Off	The composite waveform is not displayed. (default setting)
On	The composite waveform is displayed.



By selecting **F1** [All Settings] in the [No.] column, these settings can be made from a dialog. (p. 189)

When [On] is selected:

F1 to F8 Select the color to display.

6 Assign channels to the X and Y axes.

CURSOR Move the cursor to the [X-Axis] and [Y-Axis] columns.

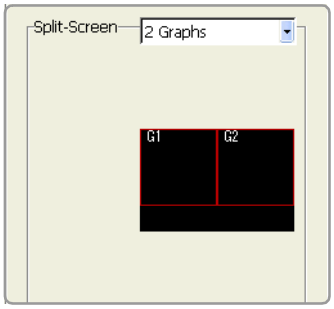
F1 to F8 Select the channels to display on the X and Y axes.

7 Select the Graph for display.

(When Split-Screen is enabled for [2 Graphs] or more, or [Wave & 2 Comp] is selected)

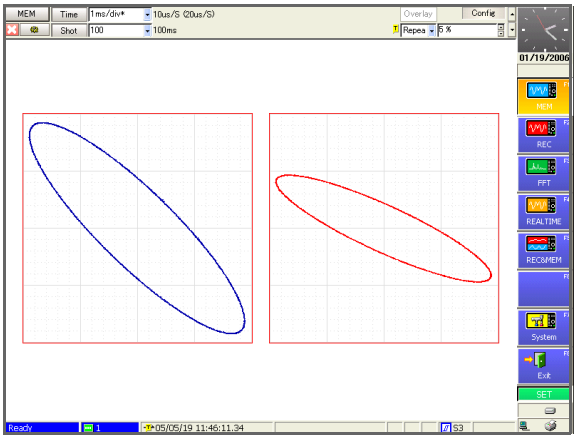
CURSOR Move the cursor to the [Graph] column.

F1 to F8 Select the graph number for display.
A sample of the Graph number (G1, G2, ...) is displayed at the left side of the screen.



8 Verify the composite waveform on the Waveform screen.

DISP The Waveform screen appears.



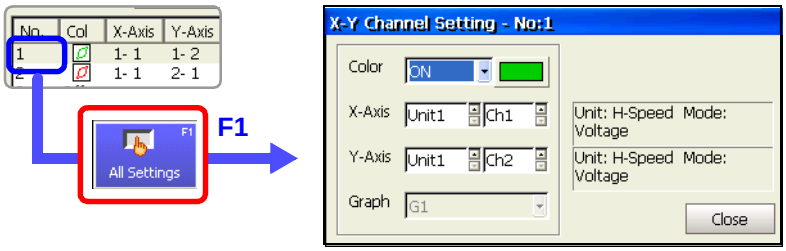
[2 Graphs] Case

To display a gauge

Press the **FUNCTION MODE** key to enable the FN mode, then press **F2** [Gauge].

Making X-Y composite settings from a dialog

Move the cursor to the [No.] column to be set, and select **F1** [All Settings].
A dialog appears. Move the cursor to each item and select with the F keys.



To reset graph settings

Move the cursor to the [Reset Graphs] button, and select **F1** [Reset Graphs].
Graph numbers are reassigned sequentially from the top of the setting column.

Making Partial Composites

Make a partial composite after specifying the composite range within normal waveforms using the A/B cursors.

See "8.7 Specifying a Waveform Range" (p. 200), "8.8 Cursor Values" (p. 202)

NOTE

- Horizontal cursors cannot be used to specify the range for partial composites.
- When one cursor is used, the X-Y composite range is from the cursor to the end of the waveform.

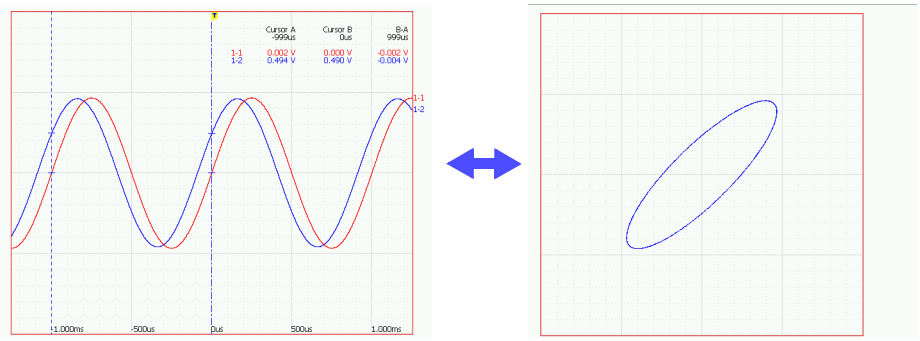
Method 1

View the normal waveform display and the partial composite waveform on a separate sheet

Set the Sheet Settings screen as follows:

- Sheet 1 (S1)
  Display Type: [Waveform]
- Sheet 2 (S2)
  Display Type: [X-Y Comp] or [Wave & X-Y]
  Composite Area: [A-B]
  Also make the required settings for the X-Y composite such as composite channel selections.

Display Sheet 1 (S1) on the Waveform screen, and specify the waveform range for the composite using the [Vertical] or [Trace] mode of the A/B cursors. The sheet displayed on the Waveform screen can be switched by the **SHEET/PAGE** keys.



Sheet 1 (S1)
Normal Waveform

Sheet 2 (S2)
Partial Composite Waveform

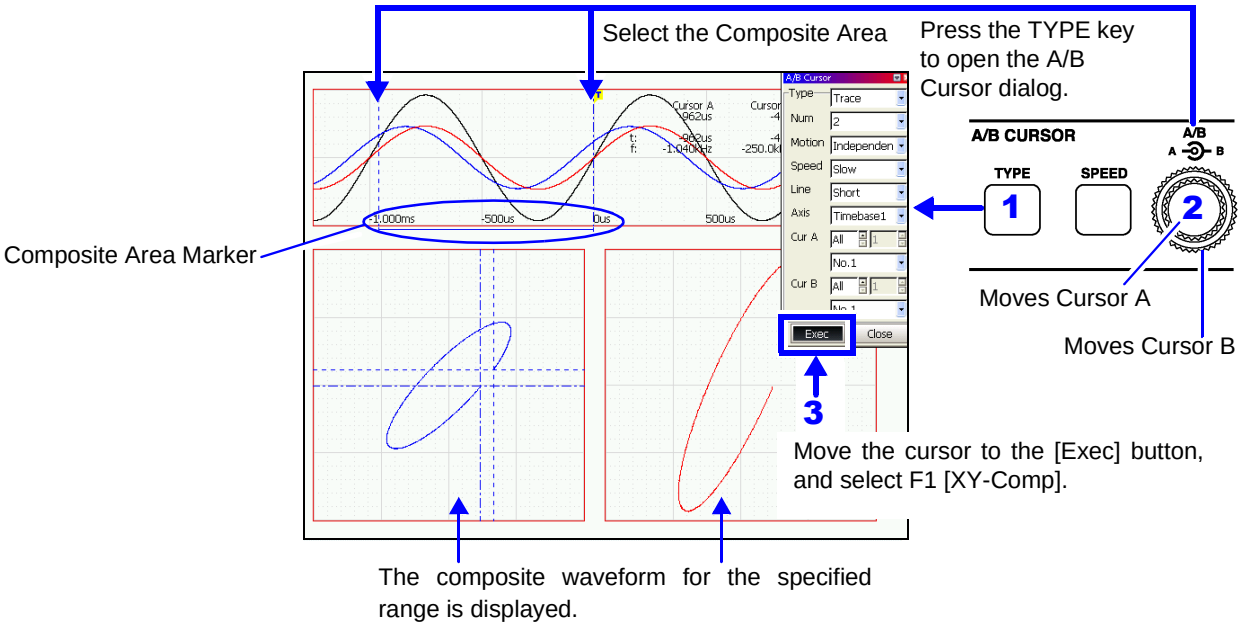
The composite range can be changed from Sheet 1.

Method 2

View the normal waveform display together with the partial composite waveform

Set the Display Type on the Sheet Settings screen to [Wave & X-Y], and set the Composite Area to [A-B]. Also make the required settings for the X-Y composite such as composite channel selections.
Specify the waveform range for the composite on the waveform graph of the Waveform screen using the [Vertical] or [Trace] mode of the A/B cursors.

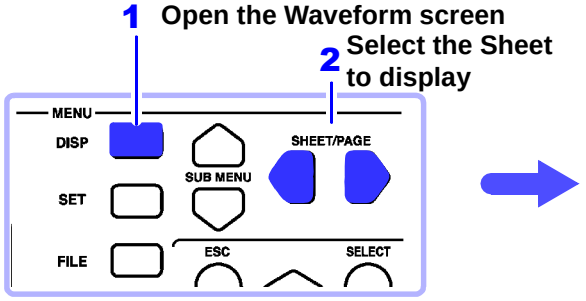
When F1 [XY-Comp] is selected by the [Exec] button in the A/B Cursor dialog, the composite waveform of the specified range is displayed on the composite waveform graph.

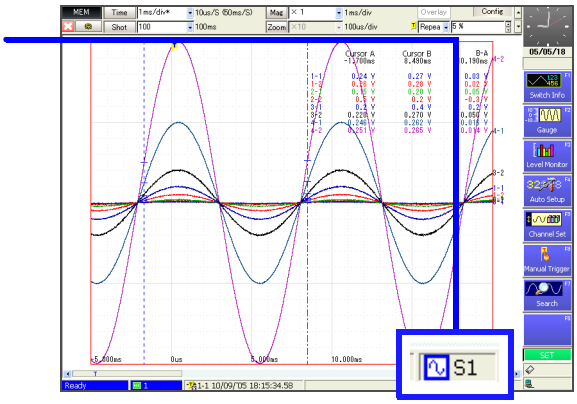


Markers indicate where the X-Y composite is executed. After the composite is displayed, you can move the A/B cursors to verify the composite range.

Waveform Screen Monitoring and Analysis Chapter 8

Analytical operations such as display magnification, compression, and search are available on the Waveform screen. Measurement configuration and related settings can also be changed.





About screen contents:
"2.4 Waveform Screen" (p. 19)

Waveform Scrolling (p. 192)

Display Switching

- Waveform display (Normal)
- Sheet switching (p. 175)
- Input level display (p. 199)
- Gauge display (p. 198)
- Info display of measured values, calculation results and etc.(p. 196)
- Numerical values display (p. 221)

Changing Settings on the Waveform Screen

- Measurement configuration settings (timebase, recording length, etc.)*1 (p. 114)
- Input channel settings*2(p. 134)
- Trigger criteria settings*1(p. 167)

*1. Make settings at upper part of screen.
*2. Set in a dialog.

Searching Waveforms

- Trigger Search (p. 223)
- Time Search (p. 228)
- Maximum/Minimum Value Search (p. 229)
- Moving Cursor to Search Location (p. 195)
- Event Mark Search (p. 231)

Waveform Magnification/Compression

- Horizontal axis magnification/compression (p. 211)
- Vertical axis magnification/compression (p. 212)
- Magnification of partial data (Zoom) (p. 213)
- Arbitrary setting of vertical display range and position (Variable function) (p. 215)

Cursor Measurements

- Specifying A/B cursors (p. 200)
- Time and frequency (vertical cursors) (p. 204)
- Voltage (horizontal cursors) (p. 206)
- Time and voltage (trace cursors) (p. 207)

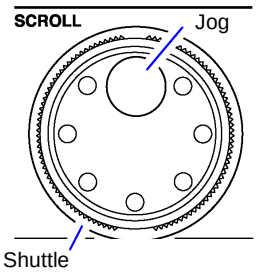
Memory Block Display

- Viewing waveforms in every block (p. 220)
- Overlaying reference waveforms (p. 111)

Displaying a Specified Location (Jump Function) (p. 195)

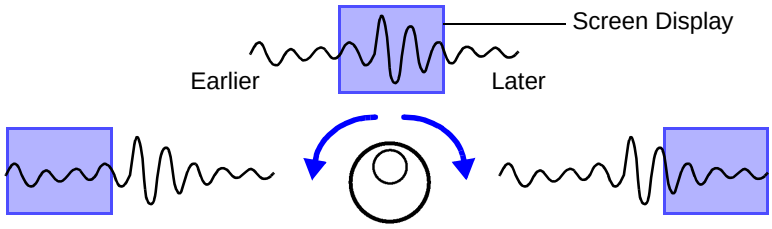
- Moving to a Trigger Location
- Moving to a Searched Location
- Moving to a Cursor Location
- Moving to a Specified Location

8.1 Scrolling Waveforms



When measuring or displaying an existing waveform, use the Jog and Shuttle (SCROLL) knobs to scroll.
The scrolling speed is controlled by the rotation angle of the Shuttle knob.

Scroll Direction



Turn CCW
Scrolls earlier on the waveform from the current point.

Turn CW
Scrolls later on the waveform from the current point.

A setting is provided to reverse Jog and Shuttle scroll directions.
See "13.2.4 Specifying Jog & Shuttle Scroll Operations" (p. 356)

To view the whole waveform
Move the cursor to the [Mag] (Magnification) button at the top of the Waveform screen, and press **F1** [Whole] (Whole waveform) key to display the overall recording length of the waveform on one screen.
See "8.9.1 Magnifying and Compressing Horizontally (Time Axis)" (p. 211)

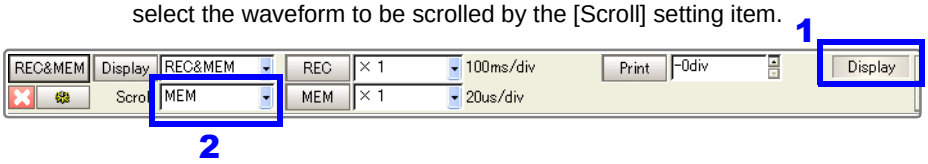
To scroll waveforms automatically (Auto Scroll)
Turn the outer Shuttle knob in the direction desired to scroll the waveform, hold it until "Auto-Scroll" appears on the screen, then release it. The waveform scrolls automatically. Turning the knob more increases the scrolling speed.

To cancel Auto Scroll
Press any operating key to cancel Auto Scroll.

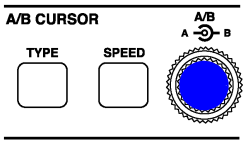
To view part of the waveform that has scrolled off the screen
Acquired parts of the waveform can be displayed. Turning the Jog and Shuttle causes "Scroll Trace" to appear.
To return the display to the currently recording part of the waveform, press the **F1** [Scroll Trace] key.

With the REC&MEM function, when both Memory and Recorder waveforms are displayed simultaneously, use either method to select which waveform will be scrolled.

Method 1 Press the SUB MENU key to display [Diplay] for the Waveform screen, and select the waveform to be scrolled by the [Scroll] setting item.



Method 2

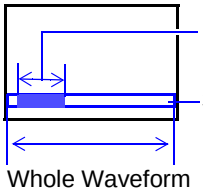


Switch by pressing Knob A of the A/B cursor controls.

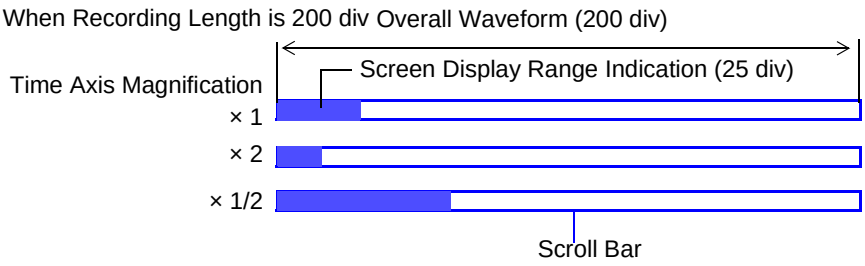
8.2 Verifying Waveform Display Position

From the scroll bar you can verify the relative position and size of the displayed portion of a waveform within the overall recorded waveform.
Trigger time, trigger position and A/B cursor positions (when using vertical or trace cursors) are also displayed.

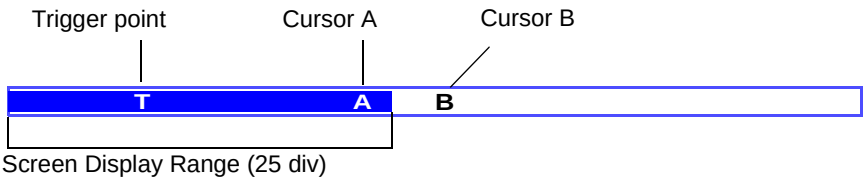
Verifying the Display Range on the Scroll Bar



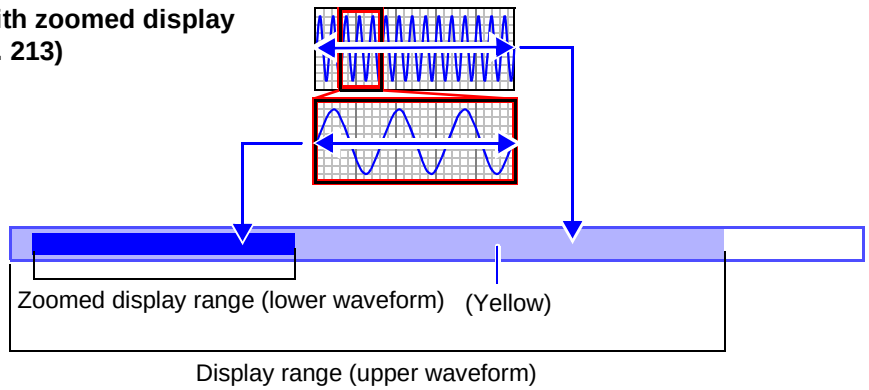
Even for identical recording lengths, the width of the screen display range indication in the scroll bar depends on the specified magnification/compression (p. 211) of the time axis.



Verifying the Trigger Point and Cursor Positions on the Scroll Bar



With zoomed display (p. 213)



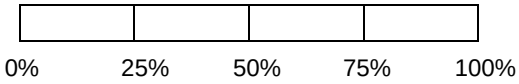
8.3 Specifying a Display Location (Jump Function)

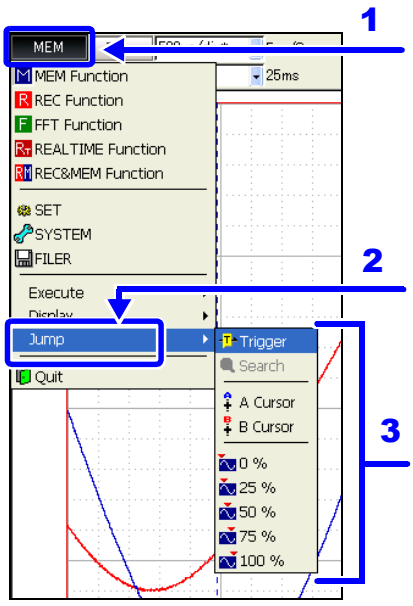
When the recording length of a waveform is long or when the desired portion is off-screen, you can specify the portion to be displayed immediately. This operation is available with the following functions:

- Memory Function
- Recorder Function
- REC&MEM Function
- Real-Time Saving Function

Display location can be specified as follows:

- Trigger point
- A/B cursor location
- Location found by search function (only with Memory and Real-Time Saving functions)
- Specified location (from the beginning [0%] to the end [100%] of the waveform)





1 Use the CURSOR keys to move the cursor to the function menu, and press the SELECT key.
A pull-down menu appears.

2 Use the ▽ CURSOR key to move the cursor to [Jump], and press the ▷ CURSOR key.

3 Use the △ and ▽ CURSOR keys to select the item to display, and press the ENTER key.
The waveform at the selected display location appears.

Trigger	Displays the location of a trigger event.
Search	Displays the location found by the last search operation.*1
A Cursor	Displays the location of cursor A.*2
B Cursor	Displays the location of cursor B.*2
0% to 100%	Displays the specified location.

*1. Perform a search using the search function beforehand (p. 222).
*2. Selectable only when the A/B cursors are enabled.

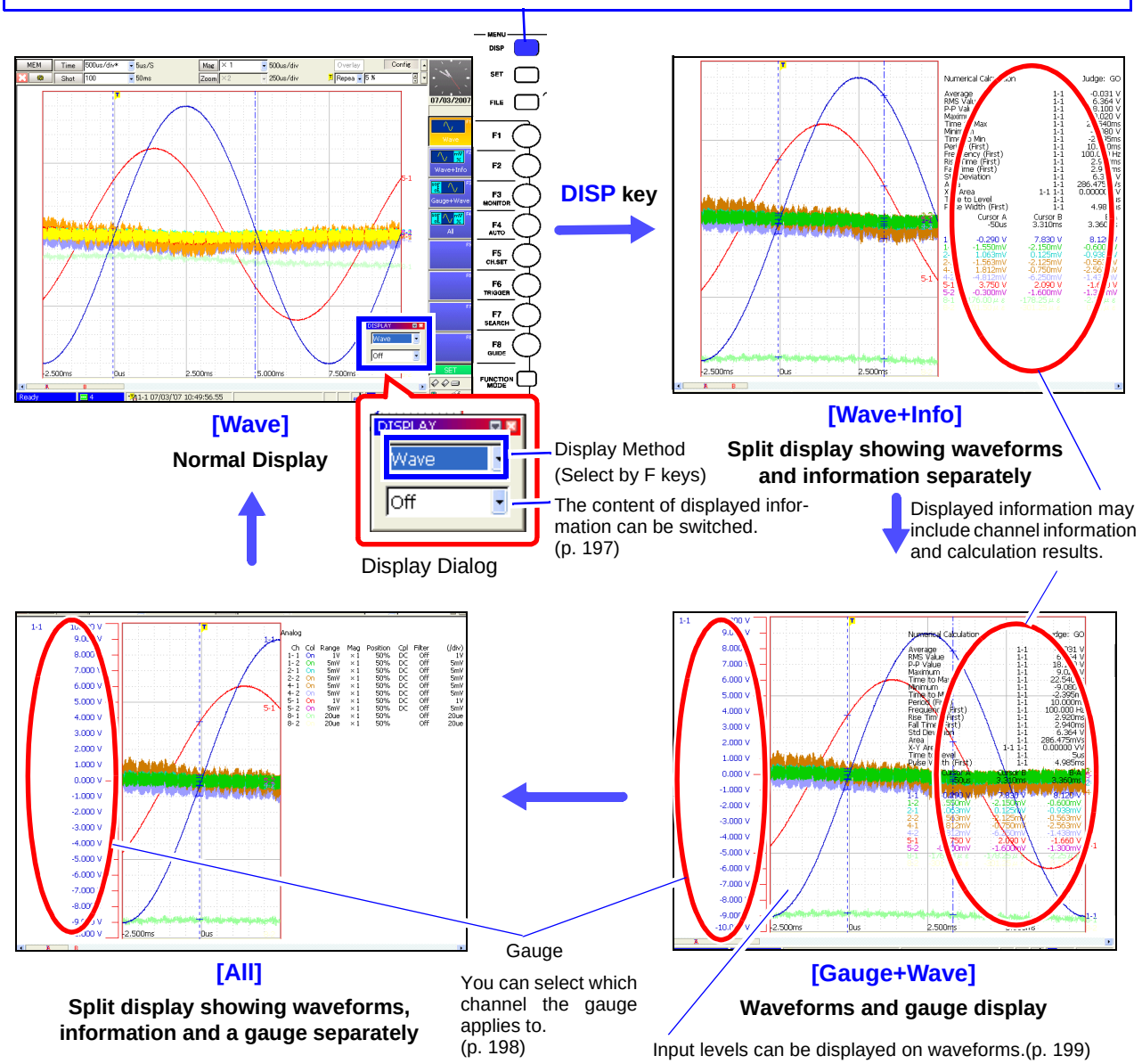
8.4 Displaying Measured Values and Information

You can select the type of information (A/B cursor values, channel setting values) and the gauge display method to be displayed with waveforms. If the information is obscured by overlapping waveforms, it can be displayed in a separate screen region. However, these functions are available only when the Display Type is set to [Waveform] and the scrolling direction (Scroll) is [Horizontal].

See "7.2.3 Setting the Display Type" (p. 177),
"7.2.5 Setting Waveform Scrolling Orientation" (p. 180)

Display Method Switching (Displaying Waveforms, Information and Gauges Separately)

Press the **DISP** key repeatedly to change the display method.
Pressing the **DISP** key opens the Display dialog in which to select a display method. Selections in this dialog are available using the F keys.
Press the **ESC** key or an F key to close the dialog.



Switching Information Contents

Displayable Contents (display details depend on operating state)

Information Item	AB Cursor *1	Ch Info		Num Calc *4	Monitor	
Details	• Analog1 • Analog2 *2 • Logic • Wave Calc*3	• Analog • Logic • XY-Comp • Wave Calc*3	• A-Comment • L-Comment • W-Comment	(no selection)	(no selection)	Off (no info display)

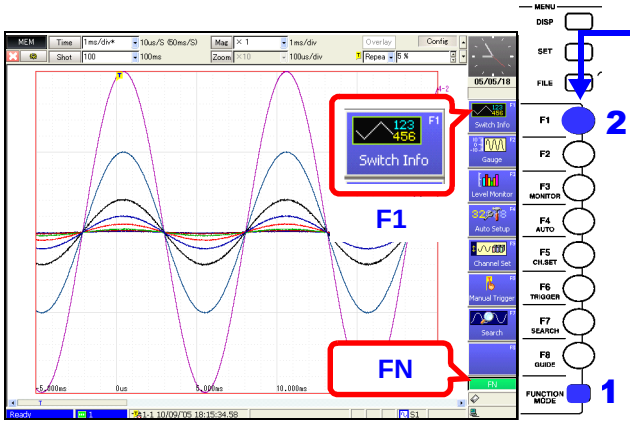
Contents such as waveforms and comments for A/B cursor values are displayed independently from those for channel information.

*1 When numerical calculation results are enabled (On), they are displayed with the A/B cursor values.

*2 Items that cannot be displayed with [Analog1] are displayed with [Analog2].

*3 Appears only when waveform calculation is enabled (On).

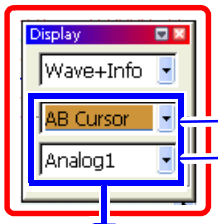
*4 Appears only when numerical calculation is enabled (On).



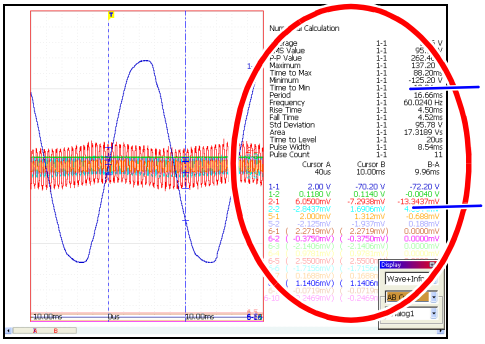
(FN: FUNCTION MODE)

Normal Display

Press the **FUNCTION MODE** key to enable the FN mode, then press F1 [Switch Info].
The Display dialog appears.
Press the F key corresponding to the desired display contents.
Press the **ESC** key to close the dialog.



Display Dialog
(Move the cursor to the desired item and select with the F keys.)
Information Item
Information Detail



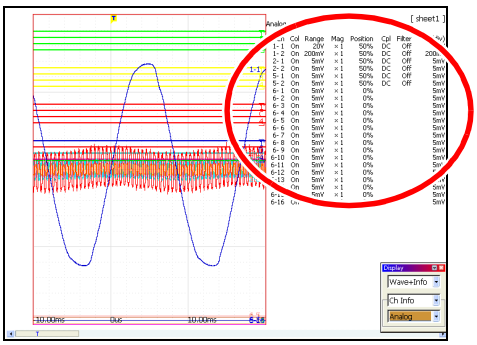
(when Numerical Calculation is enabled)
Numerical Calculation Results
A/B Cursor Values

[AB Cursor]

A/B cursor display contents are selectable.

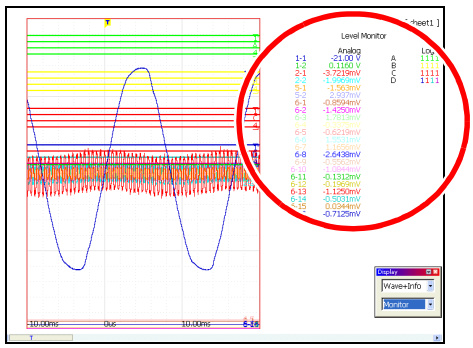
[Num Calc]

Numerical calculation results are displayed when the Numerical Calculation function is enabled (On).



[Ch Info]

Channel information and comment display contents are selectable.



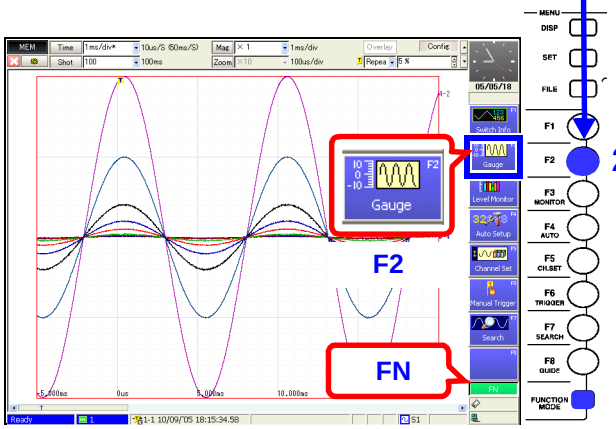
[Monitor]

The Level Monitor value of each waveform is displayed. Levels can be displayed.(p. 199)

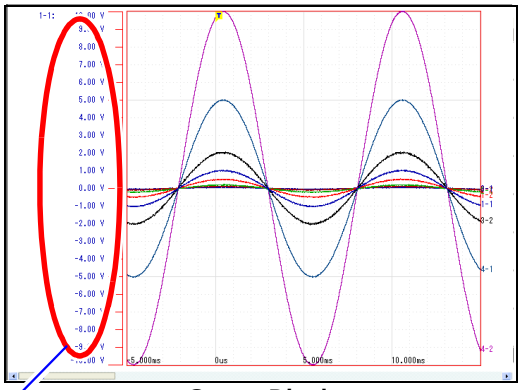
8.5 Applying Gauges

Gauges corresponding to the measurement range of each channel can be displayed at the left side of the screen. Measurement values can be verified on the gauges.

Press the **FUNCTION MODE** key to enable the FN mode, then press **F2** [Gauge].
The Gauge dialog appears. Gauges to be displayed can be selected as occasion demands.



Normal Display

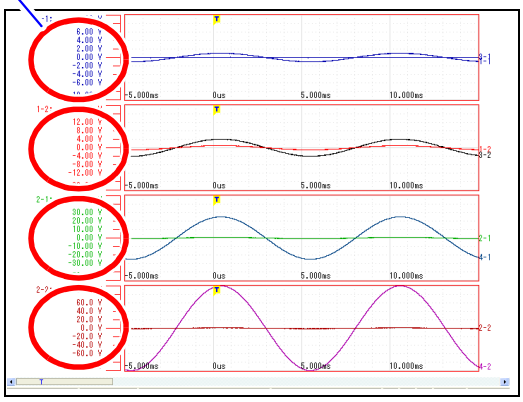


Gauge Display

Gauge display colors match their corresponding waveforms.

Gauge

Press the **ESC** key or the **F8** [Close] key to close the dialog.
Gauges can also be displayed by pressing the **DISP** key.(p. 196)



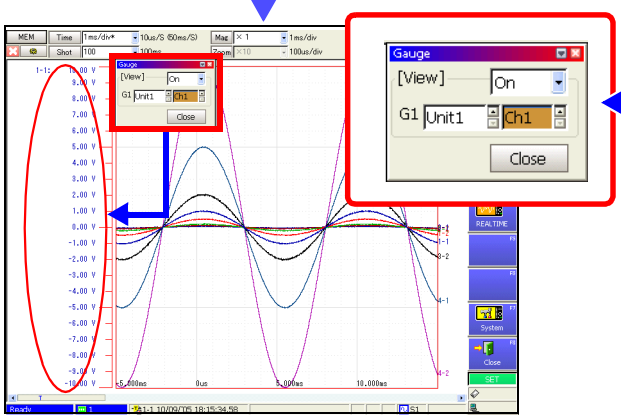
(Split-Screen Graph Displays (p. 178))
A gauge is displayed for each graph.

To hide gauges:
Set the display item to [Off].

Numerical values (p. 196) and the level monitor (p. 199) can be displayed together with gauges.

To choose which gauges to display: select channels in the dialog

F2 Key

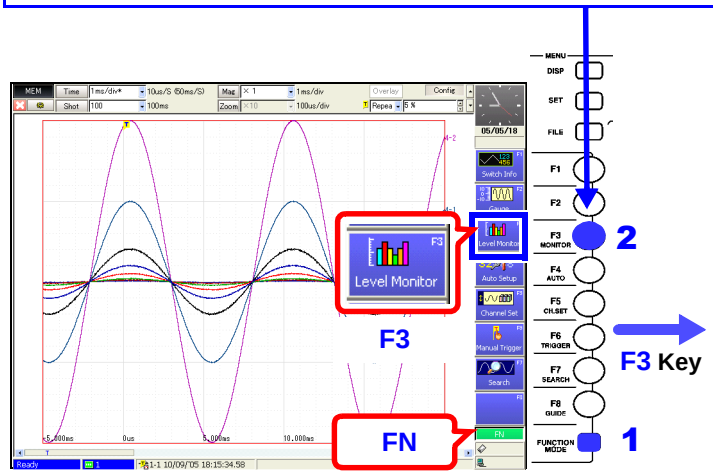


Using the **CURSOR** keys, move the cursor into the dialog and select the channels for which to display a gauge.
For XY-composite waveforms, select a waveform (No.) that has been enabled on the [X-Y Comp] page of the Sheet Settings screen.

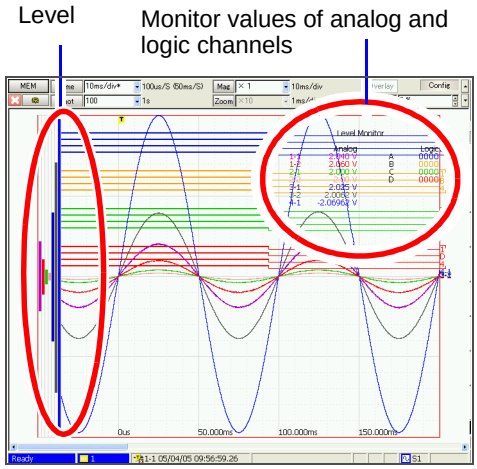
8.6 Monitoring Input Levels (Level Monitor)

All input waveform levels can be monitored in real time.
Analog channels 1 to 8 and logic channels A to D can be displayed at the same time.

Enable the FN mode by pressing the **FUNCTION MODE** key, then the **F3** [Level Monitor] key.



Normal Display



Analog and Logic Channels

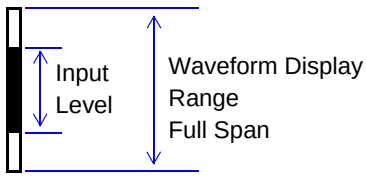
To hide the level monitor:
Press the **F3** [Level Monitor] key again.

Gauges can be displayed along with cursor values and calculation results.

When split-screen display is enabled (p. 178), level monitors are displayed for each graph.

How to View a Level Monitor

Level display of an analog channel



Monitor values of logic channels

- **1** — steady High level
- ***** — rapid fluctuation between High and Low
- **0** — steady Low level
- **–** — display disabled (Off)

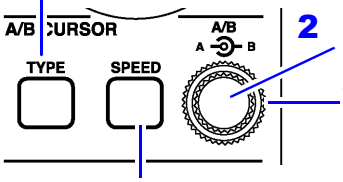
NOTE Input levels are not displayed for channels having no corresponding input module installed.

8.7 Specifying a Waveform Range

You can specify a waveform range using the A/B cursors to verify measurement values between the cursors, save and print the range, or apply it to a partial composite waveform.

Specifying a range with the A/B cursors

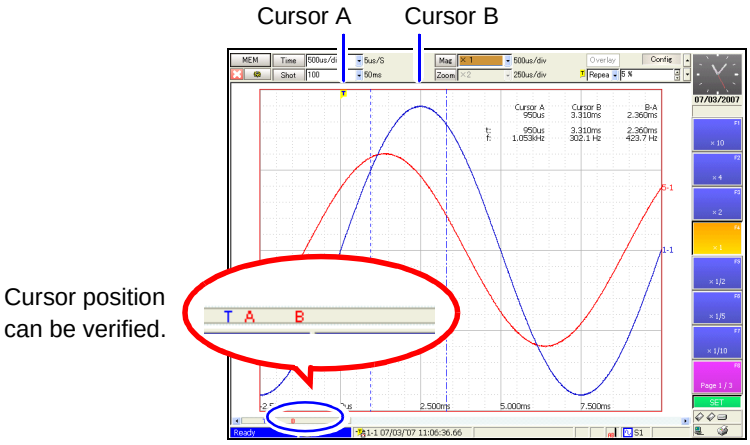
1 Select the cursor type (Vertical, Horizontal, Trace, or Off).
The [A/B Cursor] dialog appears.
See "8.8.1 About Cursor Types and Values" (p. 202)



2 Turn knob A to move cursor A.

Turn knob B to move cursor B.

Pressing this key repeatedly changes the speed of A/B cursor motion (Slow, Medium or Fast).



To specify a waveform range for purposes such as partial saving, printing, or forming a composite waveform, select [Vertical] or [Trace].
Partial composition or calculation can be selected by the [Exec] button in the A/B Cursor dialog.

Refer to the following for details:

- **About reading measurement values and cursor types:**
  See "8.8 Cursor Values" (p. 202)
  "8.8.1 About Cursor Types and Values" (p. 202)
- **To save a specified waveform range (Partial Save):**
  Select [A-B] as the Save Area setting.
  See "11.3.7 Automatically Saving Waveforms" (p. 282)
  "11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (p. 285)
- **To print a specified waveform range (Partial Print):**
  Select [A-B] as the Print Area setting.
  See "Print Area Settings" (p. 328)
  For manual printing, select [A-B Wave] as the Print Type.
  See "Manual Print [Quick Print]" (p. 321)

The range that can be specified by A/B cursors depends on the function.

See "Appendix 2.4 Memory Capacity and Maximum Recording Length" (p. A35)

- With the Memory function:
  The range must be within the data recorded by one measurement
- With the Recorder function:
  The range can be within the data recorded by one measurement, or within the internally recorded data that can be retraced from the end of measurement. (see Table below)

(with [x 1] magnification) [Divisions]

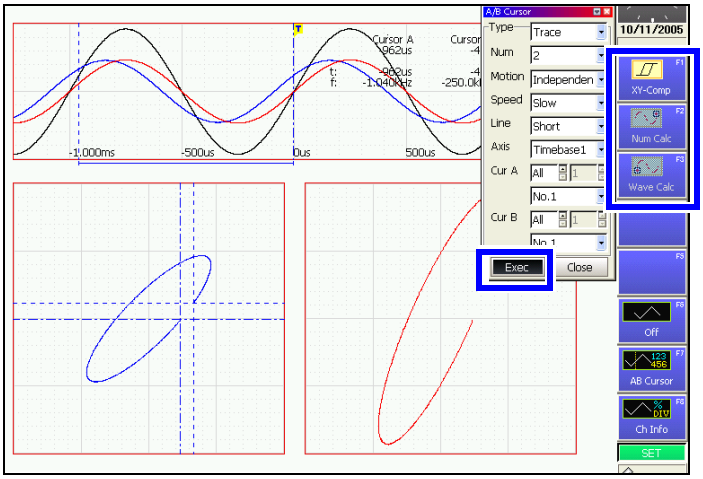
Installed Memory (Words)		8958 16-Ch Scanner Unit	
8860-50	8861-50	When Uninstalled	When Installed
32M	64M	5,000	1,000
128M	256M	20,000	5,000
512M	1G	80,000	20,000
1G	2G	160,000	40,000

If the cursors do not appear on screen when the cursor type is selected

Turn the A/B knobs to display the cursors.

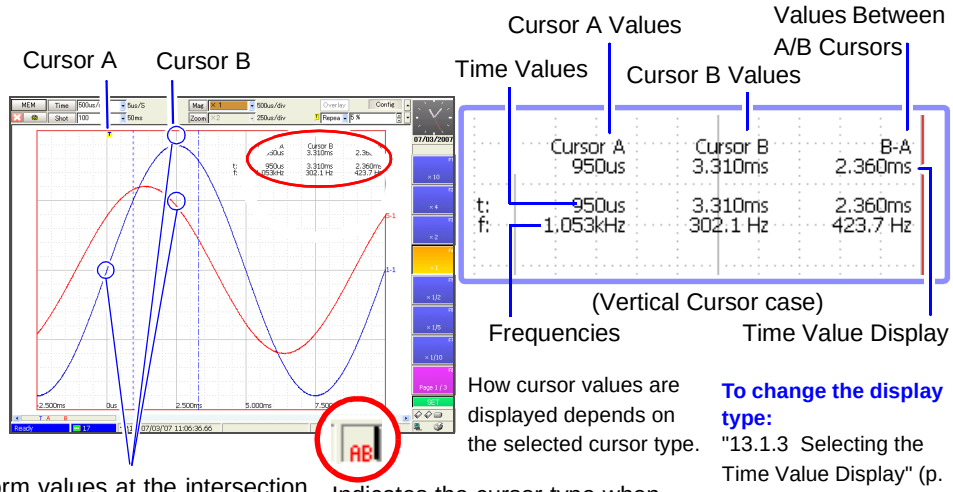
To compose or calculate waveforms within a specified range

After specifying the range, place the cursor on the [Exec] button and select the type of execution by the F keys.



8.8 Cursor Values

Time difference, frequency and potential difference (and when scaling is enabled, scaling values) can be read as numerical values using the A/B cursors on the Waveform screen. Refer to "8.8.5 Reading Cursor Values of X-Y Waveforms" (p. 209) for X-Y composite cursor values.
Waveforms and cursor values can be displayed separately by pressing the **DISP** key. (p. 196)



Waveform values at the intersection with each cursor are displayed.

Indicates the cursor type when using A/B cursors.

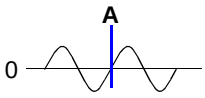
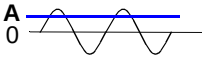
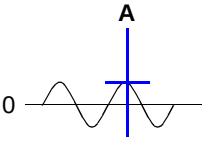
How cursor values are displayed depends on the selected cursor type.

To change the display type:
"13.1.3 Selecting the Time Value Display" (p. 352)

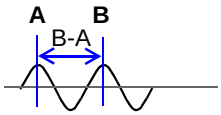
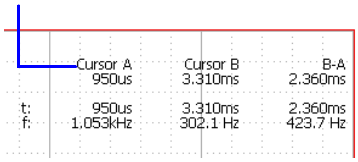
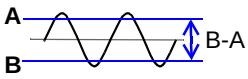
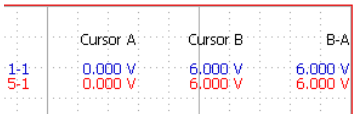
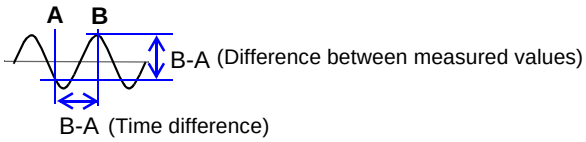
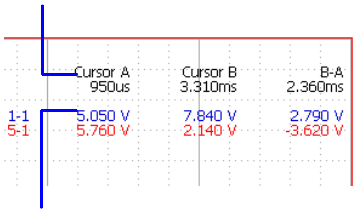
8.8.1 About Cursor Types and Values

Cursor Types

Three types of cursor are available.
The cursor type is set in the setting dialog for A/B Cursors.

Cursor Type	Description	Example
Vertical Cursors	Displays the time and frequency values at the A/B cursors, or the time and frequency differences between the A/B cursors. Time value (t): the time from the trigger point or recording start Frequency (f): the frequency having period t	
Horizontal Cursors	Displays the measurement values at the A and B cursors for the selected channel(s), or the difference between A/B cursor values. A/B cursors can be enabled on any channel.	
Trace Cursors	Displays the time and measurement values at the A/B cursors, or the time and measurement differences between the A/B cursors. **Memory Function:** Displays the intersections (trace points) of cursors and waveforms. (the intersections of waveform traces of selected channels) **Recorder Function:** The cursor intersection with the waveform is applied at the maximum and minimum values.	

About Cursor Values

Cursor Type	Cursor Value	Cursor Value Display Example (with two cursors)
Vertical Cursors **(Time Value and Frequency)**	t: A Cursor value, B Cursor value: Time from trigger point or recording start B–A value: Time difference between A/B cursors f: frequency having period t 	Time from trigger point or recording start 
Horizontal Cursors **(Measurement Values)**	A Cursor value, B Cursor value: Measured value of channel B–A value: Difference between measured values at A/B cursors 	
Trace Cursors **(Time and Measurement Values)**	**Time Values** A Cursor value, B Cursor value: Time from trigger point or recording start B–A value: Time difference between A/B cursors **Measurement Values** A Cursor value, B Cursor value: (Memory function) measurement value (Recorder function) maximum, minimum values B–A value: Difference between measured values at A/B cursors 	Time Values  Measurement Values

NOTE

When Using External Sampling

Value t is the number of samples.

If numerical values are hard to read:

Press the **DISP** key to display the waveform and measurement values separately. The display switches each time you press the **DISP** key.

See "8.4 Displaying Measured Values and Information" (p. 196)

If the A/B cursors do not appear on screen when enabled:

The A/B cursor positions can be verified on the scroll bar. (p. 194)
Turn the A/B knobs as needed to display each cursor.
If the cursor type is Vertical or Trace Cursors, cursor measurements can be made even if the A or B cursor is off-screen.

To view the waveform before or after the A/B cursors when off the screen

When using the A/B cursors, the waveform at an off-screen cursor location can be displayed using the Jump function.

See "8.3 Specifying a Display Location (Jump Function)" (p. 195)

8.8.2 Reading Time and Frequency (Vertical Cursors)

Displays the time and frequency values at the A/B cursors, or the difference in times and frequencies between the A/B cursors.

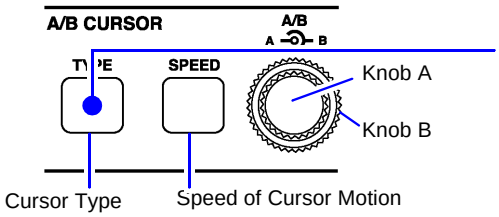
About cursor values:

See "8.8.1 About Cursor Types and Values" (p. 202)

Vertical Cursor Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen



Display the dialog

Press the **TYPE** key.
The [A/B Cursor] dialog appears.
(It also appears by pressing Knob A)

The **TYPE** and **SPEED** keys can be used regardless of cursor position.

Operating Key Procedure

1 Select the Cursor Type.

CURSOR **F2**

Move the cursor to the [Type] item.
Select [Vertical].
(The selection can also be made by pressing the **TYPE** key)

2 Select the number of cursors to enable.

CURSOR **F1 to F8**

Move the cursor to the [Num] item.
Select either choice.

1	Enable only cursor A. (skip to Step 4)
2	Enable both A/B cursors. (continue to Step 3)

3 (When 2 cursors are enabled) Select the cursor motion method.

CURSOR **F1 to F8**

Move the cursor to the [Motion] item.
Select either choice.

Independent	The A/B cursors move independently.
Together	The A/B cursors move together.

4 Select the cursor speed.

CURSOR **F1 to F8**

Move the cursor to the [Speed] item.
Select either choice.

Fast, Medium or Slow

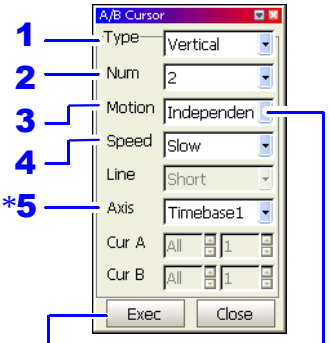
(The selection can also be made by pressing the **SPEED** key)

5 (Only when using the Timebase 2 with the Memory function) Select the Axis to serve as the origin of cursor movement.

CURSOR **F1 to F8**

Move the cursor to the [Axis] item.
Select either choice.

Timebase 1 or Timebase 2



Set this only when the number of cursors (Num) is set to [2].

To perform partial composition or calculation, specify the desired range.
- XY composition ("Making Partial Composites" (p. 189))
- Numerical value calculations (p. 200)
- Waveform calculations (p. 200)

Calculation settings: *Analysis and Communication Supplement*

*. **When using the REC&MEM function:**
With the REC&MEM function, the [Axis] setting item shown above is displayed as [Region].

Operating Key	Procedure

(with the REC&MEM function)

Select to display cursors on the Memory or Recorder waveform.

CURSOR
F1 to F8

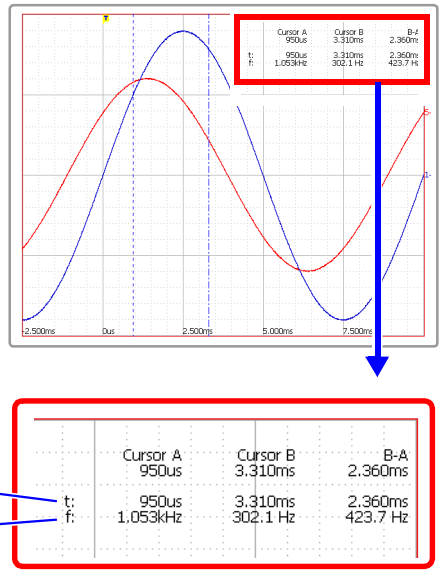
Move the cursor to the [Region] item.
Select either choice.

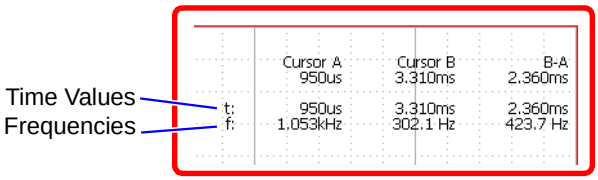
REC	Displays cursors on the Recorder waveform
MEM	Displays cursors on the Memory waveform

6 Move the A/B cursors and read the cursor values.

A/B knobs

Turn (inner) Knob A and (outer) Knob B to move the A/B cursors.





Time Values
Frequencies

"About Cursor Values" (p. 203)

If cursors are not visible on-screen even when enabled by the A/B Cursor settings

Cursor measurements are available even when the A/B cursors are off-screen. Turn Knob A or B as needed to move each cursor on-screen.

To view the waveform before or after the A/B cursors when off the screen

When using the A/B cursors, the waveform at an off-screen cursor location can be displayed using the Jump function.

See "8.3 Specifying a Display Location (Jump Function)" (p. 195)

8.8.3 Reading Voltage Values (Horizontal Cursors)

Displays the voltage values at the A and B cursors for the selected channel(s), or the voltage between A/B cursors.

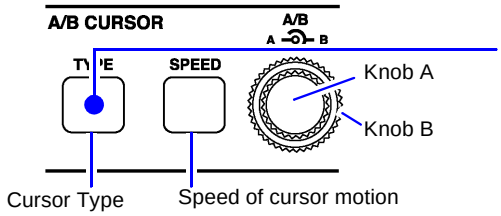
About cursor values:

See "8.8.1 About Cursor Types and Values" (p. 202)

Horizontal Cursor Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen



Display the dialog

Press the **TYPE** key.
The [A/B Cursor] dialog appears.
(It also appears by pressing Knob A)

The **TYPE** and **SPEED** keys can be used regardless of cursor position.

Operating Key | Procedure

1 Select the Cursor Type.

CURSOR **F3**

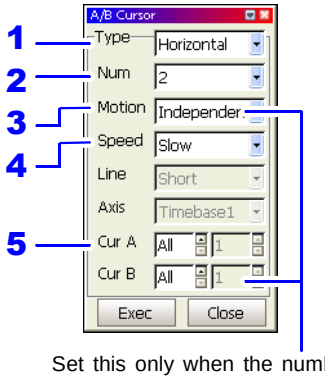
Move the cursor to the [Type] item.
Select [Horizontal].
(The selection can also be made by pressing the **TYPE** key)

2 Select the number of cursors to enable.

CURSOR **F1 to F8**

Move the cursor to the [Num] item.
Select either choice.

1	Enable only cursor A. (skip to Step 4)
2	Enable both A/B cursors. (continue to Step 3)



Set this only when the number of cursors (Num) is set to [2].

3 (When 2 cursors are enabled) Select the cursor motion method.

CURSOR **F1 to F8**

Move the cursor to the [Motion] item.
Select either choice.

Independent	The A/B cursors move independently.
Together	The A/B cursors move together.

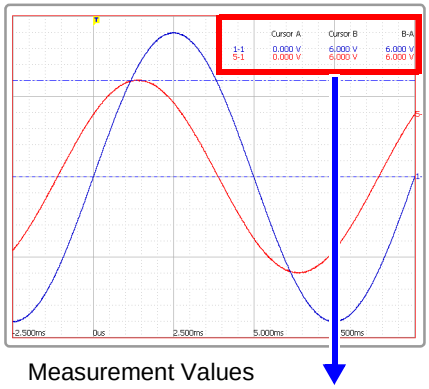
4 Select the cursor speed.

CURSOR **F1 to F8**

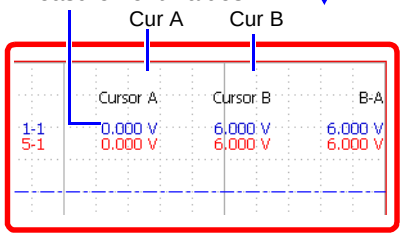
Move the cursor to the [Speed] item.
Select either choice.

Fast, Medium or Slow

(The selection can also be made by pressing the **SPEED** key)



Measurement Values



5 Select the channels for which to display cursor values.

CURSOR **F1 to F8**

Move the cursor to the [Cur A] or [Cur B] item.
Select either choice.

All, or channel numbers for which to display cursor values

6 Move the A/B cursors and read the cursor values.

A/B knobs

Turn (inner) Knob A and (outer) Knob B to move the A/B cursors.

"About Cursor Values" (p. 203)

8.8.4 Reading Time and Voltage Values (Trace Cursor)

Displays the data values at the intersections (trace points) of cursors and waveforms.

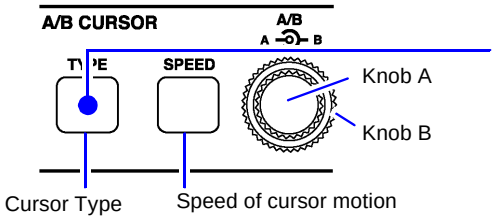
About cursor values:

See "8.8.1 About Cursor Types and Values" (p. 202)

Trace Cursor Setting

MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen

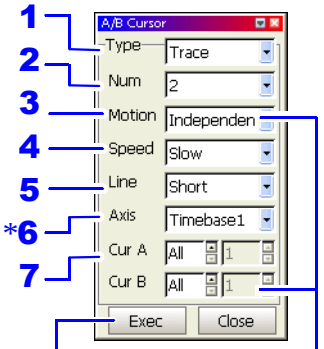


Display the dialog

Press the **TYPE** key.
The [A/B Cursor] dialog appears.
(It also appears by pressing Knob A)

The **TYPE** and **SPEED** keys can be used regardless of cursor position.

	Operating Key	Procedure
1		**Select the Cursor Type.**
	CURSOR **F4**	Move the cursor to the [Type] item. Select [Trace]. (The selection can also be made by pressing the **TYPE** key)
2		**Select the number of cursors to enable.**
	CURSOR **F1 to F8**	Move the cursor to the [Num] item. Select either choice. **1** Enable only cursor A. (skip to Step 4) **2** Enable both A/B cursors. (continue to Step 3)
3		**(When 2 cursors are enabled) Select the cursor motion method.**
	CURSOR **F1 to F8**	Move the cursor to the [Motion] item. Select either choice. **Independent** The A/B cursors move independently. **Together** The A/B cursors move together.
4		**Select the cursor speed.**
	CURSOR **F1 to F8**	Move the cursor to the [Speed] item. Select either choice. **Fast, Medium or Slow** (The selection can also be made by pressing the **SPEED** key)
5		**Select the cursor (horizontal) length.**
	CURSOR **F1 to F8**	Move the cursor to the [Line] item. Select either choice. **Short or Long**



Set this only when the number of cursors (Num) is set to [2].

To perform partial composition or calculation, specify the desired range.
- XY composition ("Making Partial Composites" (p. 189))
- Numerical value calculations (p. 200)
- Waveform calculations (p. 200)

Calculation settings: *Analysis and Communication Supplement*

*. **When using the REC&MEM function:**
With the REC&MEM function, the [Axis] setting item shown above is displayed as [Region].

Operating Key Procedure

6 **(Only when using the Timebase 2 with the Memory function)**
Select the axis to serve as the origin of cursor movement.

CURSOR
F1 to F8

Move the cursor to the [Axis] item.
Select either choice.

Timebase 1 or Timebase 2

(with the REC&MEM function)
Select to display cursors on the Memory or Recorder waveform.

CURSOR
F1 to F8

Move the cursor to the [Region] item.
Select either choice.

REC	Displays cursors on the Recorder waveform
MEM	Displays cursors on the Memory waveform

7 **Select the channels for which to display cursor values.**

CURSOR
F1 to F8

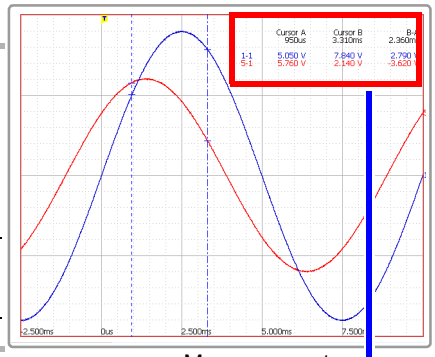
Move the cursor to the [Cur A] or [Cur B] item.
Select channel(s) for display.

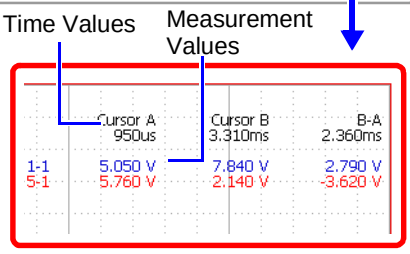
All, or channel numbers for which to display cursor values

8 **Move the A/B cursors and read the cursor values.**

A/B knobs

Turn (inner) Knob A and (outer) Knob B to move the A/B cursors.





"About Cursor Values" (p. 203)

If cursors are not visible on-screen even when enabled by the A/B Cursor settings

Cursor measurements are available even when the A or B cursor of off-screen. Turn Knob A or B as needed to move each cursor on-screen.

To view the waveform before or after the A/B cursors when off the screen

When using the A/B cursors, the waveform at an off-screen cursor location can be displayed using the Jump function.

See "8.3 Specifying a Display Location (Jump Function)" (p. 195)

When specifying channels on which you choose to display cursor values (Cur A and Cur B)

Even when cursors A and B are each assigned to different channels, the potential difference between A and B can be obtained.

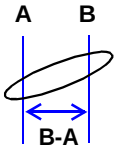
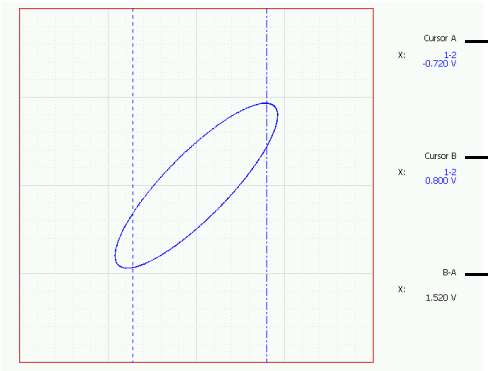
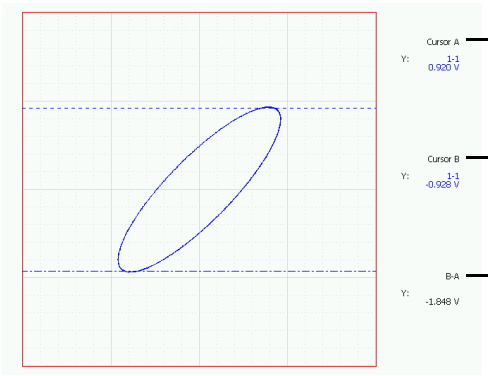
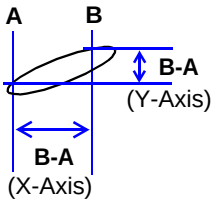
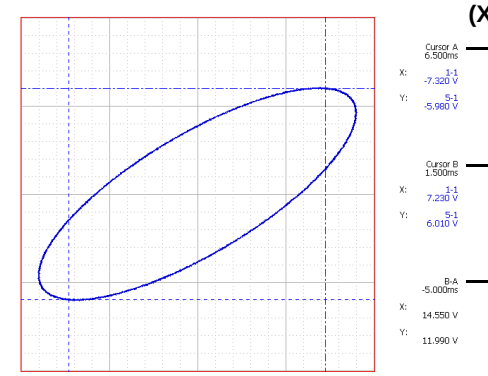
8.8.5 Reading Cursor Values of X-Y Waveforms

This applies to the Memory function only.

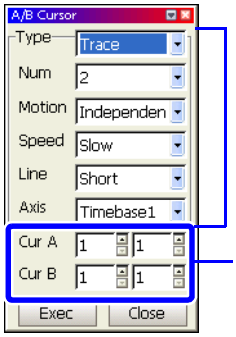
The A/B cursors can be used to read measurement values on X-Y waveforms. With split-screen display, even when the A/B cursors are set to different graphs, the potential difference between A and B can be obtained. Partial X-Y composite waveforms can also be defined using the A/B cursors.

See "Making Partial Composites" (p. 189)

About Cursor Values of X-Y Composite Waveforms

Cursor Type	Cursor Values	Cursor Value Display Example (with two cursors)
Vertical Cursors (Measurement Value of X-Axis)		 **(X-Axis Channel)** Measurement Value at Cursor A Measurement Value at Cursor B Difference between measured values at A/B cursors
Horizontal Cursors (Measurement Value of Y-Axis)		 **(Y-Axis Channel)** Measurement Value at Cursor A Measurement Value at Cursor B Difference between measured values at A/B cursors
Trace Cursors (Time and Measurement Values of X and Y Axes)		 **(X- and Y-Axis Channels)** Time and measurement value at Cursor A Time and measurement value at Cursor B Differences between time and measurement values at A/B cursors

Press the **TYPE** key to open the [A/B Cursor] dialog.
Select the cursor type and required items.

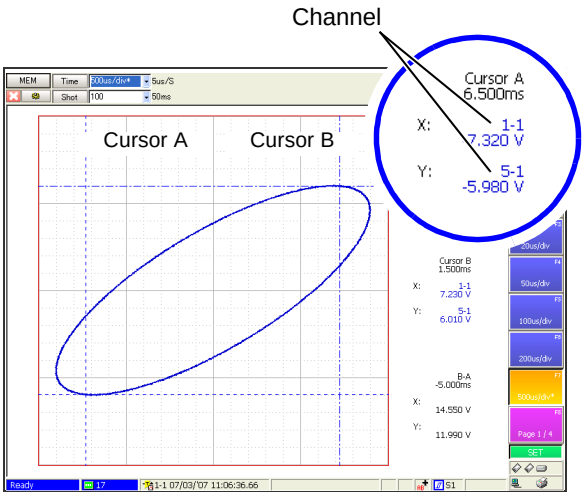


The setting procedure is the same as for normal waveforms.

See "8.8.4 Reading Time and Voltage Values (Trace Cursor)" (p. 207)

Select the cursor value to be displayed from the No. set on the [X-Y Comp] page of the Sheet Settings screen.

(When 1-2 is assigned to the X-axis, 1-1 to the Y-axis, and the Trace cursor selected)



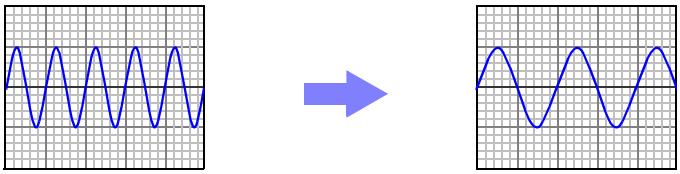
When the Sheet Settings screen is set to [X-Y Comp]

8.9 Magnifying and Compressing Waveforms

8.9.1 Magnifying and Compressing Horizontally (Time Axis)

Data details can be observed by magnifying the waveform along the time axis. Also, by compressing the time axis, overall waveform fluctuations can be readily seen.
On-screen magnification and compression is based on the left edge of the screen, regardless of whether A/B cursors are present.
The amount of magnification/compression can be changed after measurement.

Normal Display **Magnified Display (× 2)**

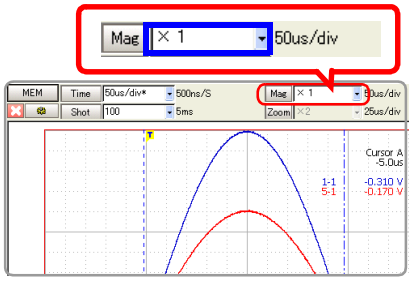


Horizontal Axis Magnification/Compression

MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Mag] (Magnification) item.
2	**F1 to F8**	Select display magnification of the horizontal axis. MEM REALTIME (Sampled waveform data) REC&MEM (Memory waveform data) **× 10, × 4, × 2, × 1, × 1/2, × 1/5, × 1/10, × 1/20, × 1/50, × 1/100, × 1/200, × 1/500, × 1/1000, × 1/2000, × 1/5000, × 1/10000, × 1/20000, × 1/50000, × 1/100000, × 1/200000, × 1/500000** REC REALTIME (Whole waveform data) REC&MEM (Recorder waveform data) **× 4, × 2, × 1, × 1/2, × 1/5, × 1/10, × 1/20, × 1/50, × 1/100, × 1/200, × 1/500, × 1/1000, × 1/2000, × 1/5000, × 1/10000, × 1/20000**

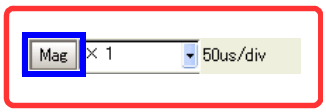


NOTE

With the Recorder function, display magnifications of × 4 and × 2 are available only for on-screen display. For printing, each data point corresponds to one pixel when magnification is × 1, so the resolution is the same as displaying at × 4.

To view the overall waveform

Move the cursor to the [Mag] (Magnification) button, and press the **F1** [Whole Wave] (Whole Waveform) key. The full recording length of waveform is displayed.



Printing with different magnification of the horizontal axis

Set the magnification on the Print Settings screen.

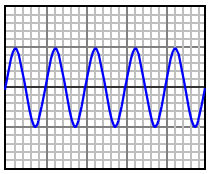
See "Time Axis Magnification and Compression Settings" (p. 333)

When displaying a highly compressed waveform loaded from storage media, there may be considerable delay before the waveform appears.

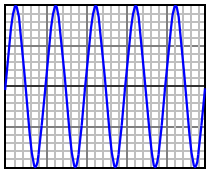
8.9.2 Magnifying and Compressing Vertically (Voltage Axis)

Waveforms on each channel can be magnified or compressed along the voltage axis for display or printing.
Magnification and compression based on zero position (p. 172).

Normal Display



Magnified Display (× 2)



Vertical Axis Magnification/Compression

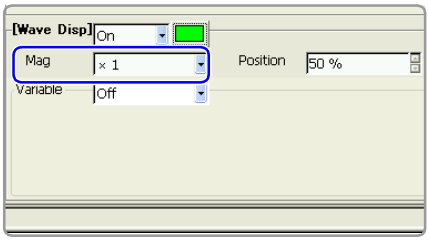
MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen

See To set from the Waveform screen (p. 134)

Using the Operating Keys

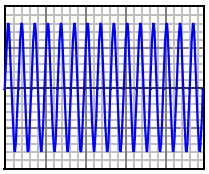
	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Mag] (Magnification) item.
2	**F1 to F8**	Change magnification of the vertical axis. **× 100, × 50, × 20, × 10, × 5, × 2, × 1, × 1/2, × 1/5, × 1/10**



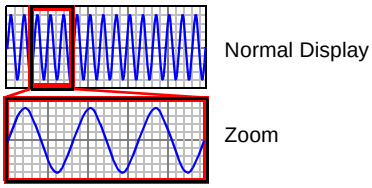
8.9.3 Magnifying a Section of the Horizontal Axis (Time Axis – Zoom Function)

This applies to the Memory function, REC&MEM function (when the memory waveform is displayed) and Real-time saving function only.
A magnified section of a waveform can be displayed together with the unmagnified view by splitting the screen horizontally.
With the waveform displayed normally on the upper half of the screen, a section magnified along the time axis can be displayed on the lower half.

Normal Display



Zoomed Display



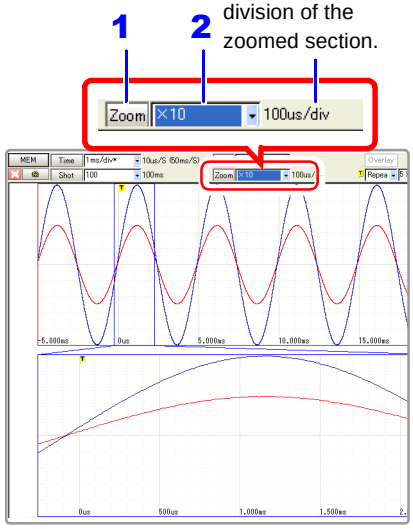
Zooming a Waveform

MEM REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen

	Operating Key	Procedure
1	**CURSOR** **F2**	Move the cursor to the [Zoom] button. Select [On]. The Zoom function is enabled and the screen is split into upper and lower halves. (Upper: waveform to be magnified, Lower: magnified (zoomed) section of waveform)
2	**CURSOR** **F1 to F8**	Move into the setting items. Select display magnification for the zoomed waveform section. The zoomed waveform section at the lower half of the screen is magnified.
3	**SCROLL**	Scrolls the zoomed section of the waveform. **To cancel Zoom** Move the cursor to the [Zoom] button, and press **F1** [Off].

Shows the time per division of the zoomed section.



About Zoom Magnification
If the [Zoom] magnification is set to the same or lower value than the [Mag] (Magnification) setting, the [Mag] setting is automatically changed to be one step higher than the [Zoom] magnification.

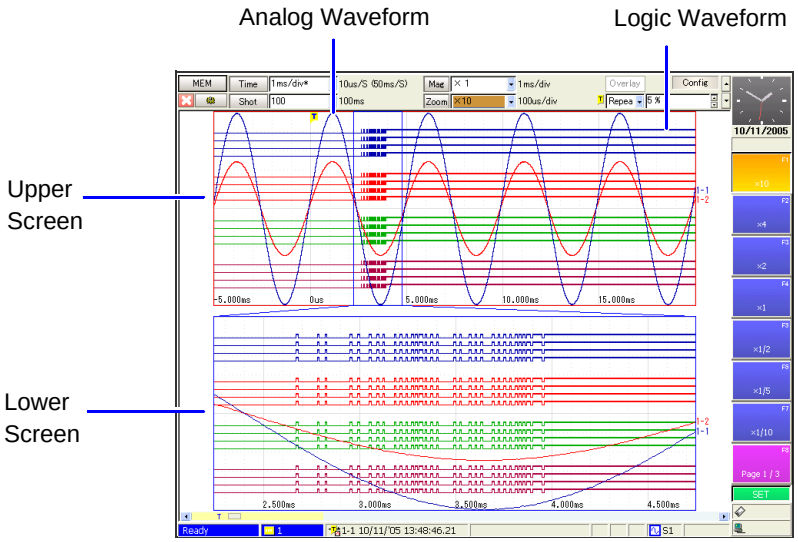
Description

Printing with the Zoom function

When you press the **PRINT** key while using the Zoom function, only the waveform on the upper half of the screen is printed.

About logic waveform display

Depending on display position (p. 185) and height (p. 186) settings for logic waveforms, some waveforms may not be displayed.
When the Display Height is set to [Wide]: waveforms up to Display Position 2 are displayed
When the Display Height is set to [Normal]: waveforms up to Display Position 4 are displayed
When the Display Height is set to [Narrow]: waveforms up to Display Position 8 are displayed



When Viewing Analog and Logic Channels with [Normal] Display Height

8.9.4 Setting Arbitrary Waveform Height and Position on the Vertical (Voltage) Axis (Variable Function)

The waveform height and display position can be arbitrarily set along the vertical axis.

NOTE

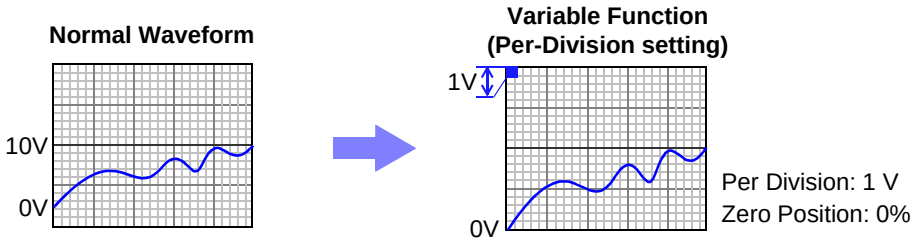
Precautions for using the Variable Function

- Verify that the measurement range (voltage axis range) is set properly for the input signal.
- The measurement range is unaffected by changes to the upper and lower limits made by the Variable setting.

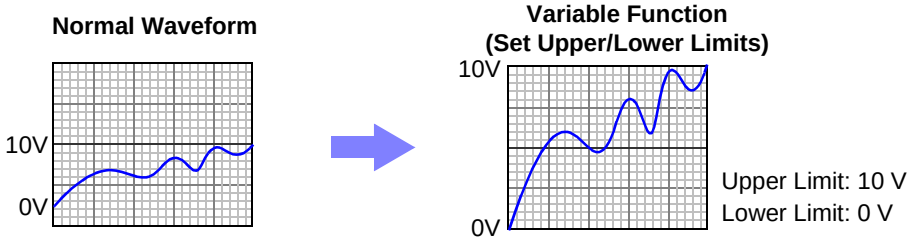
The Variable function can be set on or off for each channel.
By using the Scaling and Variable functions together, the full span of a sensor's output can be displayed. (p. 217)

The following two setting methods are available:

- **Set the displayed amplitude per division (1div setting)**
  Set the amplitude to be displayed per vertical division and the zero position of the waveform on the vertical axis.



- **Set the Upper and Lower Limits (Upper-Lower setting)**
  The upper and lower limits on the vertical axis can be set to display the waveform amplitude full-screen.



Variable function settings can be made for each channel independently on the [One Ch] page, or for all channels on the [Variable] page (All-Channel Display) (p. 129).

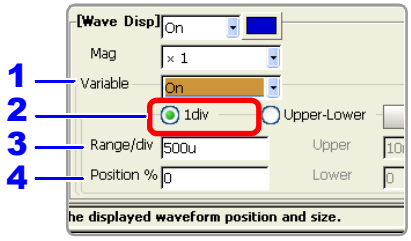
Variable Function (Per-Division Setting)

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen

See To set from the Variable List (p. 132)

	Operating Key	Procedure
1		**Enable the Variable function.**
	CURSOR	Move the cursor to the [Variable] item.
	F2	Select [On].
2		**Enable the 1div (per- division) setting.**
	CURSOR	Move the cursor to the [1div] item (if the [Upper-Lower] is currently selected).
	F2	Select [1div].
3		**Set the range of values to display per division.**
	CURSOR	Move the cursor to the [Range/div] item.
	F1 to F8	Enter a numerical value. (Measurement units depend on the measurement mode of the input module.)
		See "Entering Numbers" (p. 65)
4		**Set the waveform zero position to display on the vertical axis.**
	CURSOR	Move the cursor to the [Position (%)] item.
	F1 to F8	Enter a numerical [%] value.
		See "Entering Numbers" (p. 65)



When Scaling is enabled, values are displayed in scaling units.
When these settings are changed, the numerical values indicating the display range on the level monitor are changed accordingly.

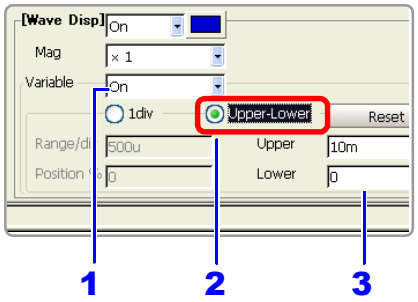
Variable Function (Upper/Lower Limits Setting)

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Channel with the **SUB MENU** keys →Channel Settings screen

See To set from the Variable List (p. 132)

	Operating Key	Procedure
1		**Enable the Variable function.**
	CURSOR	Move the cursor to the [Variable] item.
	F2	Select [On].
2		**Enable the Upper-Lower (Upper/Lower limits) Setting.**
	CURSOR	Move the cursor to the [Upper-Lower] item (if the [1div] is currently selected).
	F2	Select [Upper-Lower].
3		**Set the upper and lower limits.**
	CURSOR	Move the cursor to the [Upper] item.
	F1 to F8	Enter the numerical value.
		See "Entering Numbers" (p. 65)
	CURSOR	Move the cursor to the [Lower] item.
	F1 to F8	Set in the same way.



Description

When setting combined use of the Scaling and Variable functions

When Auto-Correction of the Variable function is enabled (On, default setting) (p. 358)

The Variable function settings change according to Scaling and voltage axis range settings. Set Scaling before setting the Variable function.
If you change Scaling settings after enabling the Variable function, the Variable setting voltage is automatically corrected so that the displayed size of waveforms is unchanged.

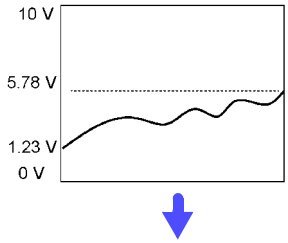
When Auto-Correction of the Variable function is disabled (Off)

Set the Variable function after setting Scaling.
If setting the Variable function first, enter post-scaling values (converted physical values).

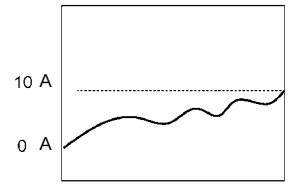
To display the full span of output from a sensor

By using the Scaling function in combination, voltage from a sensor can be converted to the physical units of the measurement object.

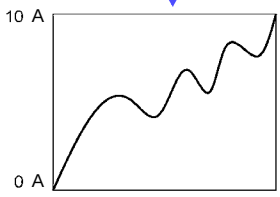
Example. Set Scaling as follows:
Scaling: On, Two-Point Setting
Units: A
Sensor Output
(Input 1): 1.23 [V] ⟶ (Scale 1): 0 [A]
(Input 2): 5.78 [V] ⟶ (Scale 2): 10 [A]



(with Variable function Off)
Voltage from the sensor is displayed as voltage.
It is displayed with the voltage axis range and at the zero position set on the Channel Settings screen.

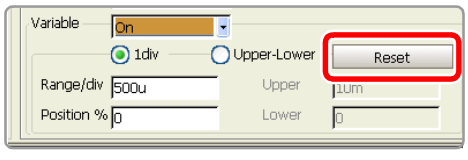


The Variable function is set as follows:
Variable: On, Set Upper/Lower Limits
Lower Limit: 0 [A] Upper Limit: 10 [A]
The full span of output from the sensor is displayed.



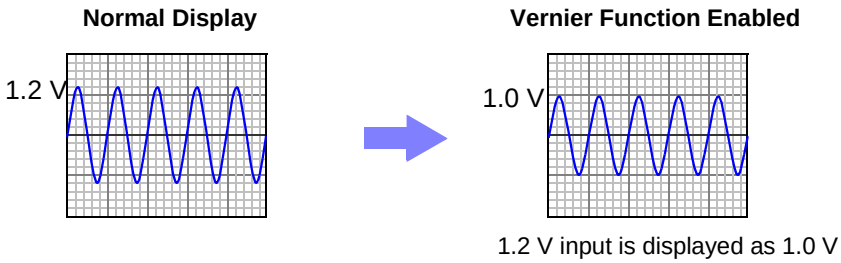
To reset the settings

Select the [Reset] button.
Settings return to their defaults.



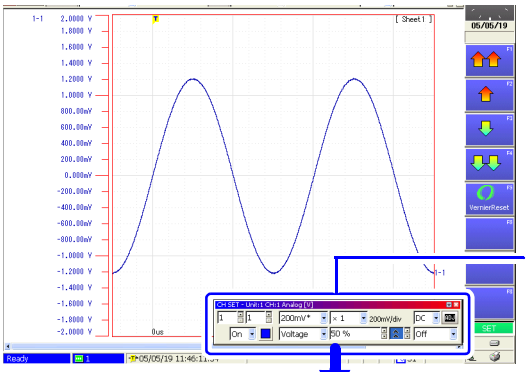
8.10 Fine Adjustment of Input Values (Vernier Function)

Fine adjustment of input voltage can be performed arbitrarily on the Waveform screen. When recording physical values such as noise, temperature and acceleration using sensors, amplitude can be adjusted to facilitate calibration.

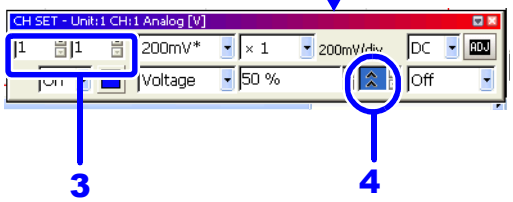


1.2 V input is displayed as 1.0 V

1 Press the DISP key to display the Waveform screen.



2 Press the RANGE/POSN knob to display the [CH SET] dialog.



Using the CURSOR keys, move the cursor to an item in the dialog, and press the F keys to select it.

3 Select the channel to adjust.

4 Adjust while viewing the waveform.

Adjustment Range: between 50 and 200% of original waveform (magnification/compression ratio not displayed)

⌃⌃ : Magnify waveform
⌄⌄ : Compress waveform

NOTE

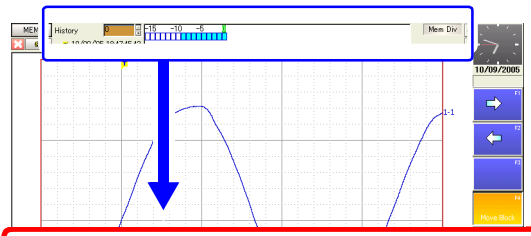
- The Vernier function cannot be applied to the calculation waveforms.
- Vernier adjustments cannot be verified on printed waveforms or lists.
- When modulated by the vernier function, a marker (⌃ or ⌄) will be added to the channel settings, CH information, and the channel number on the level monitor.

8.11 Viewing Past Waveforms

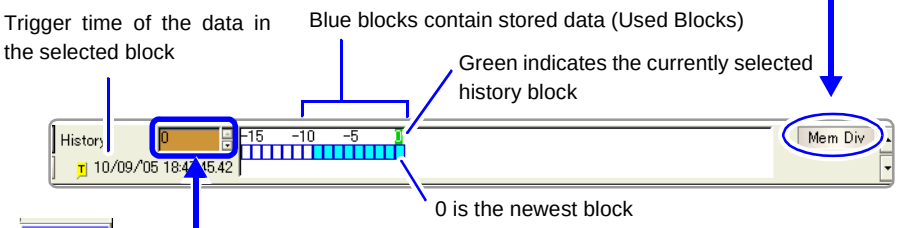
This operation is available when the Memory Division function is disabled. (Memory function only)
The instrument stores in internal memory up to 16 waveform measurements (16 blocks)*2 that were measured with the same setting configuration*1 (subsequently, the data acquired during each measurement will be referred to as a "block").
As a result, you can view some waveforms measured in the past.

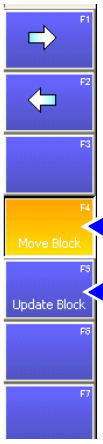
*1 Past waveform data is deleted when you start measuring again after changing the configuration (recording length and channels used).
*2 Although the maximum number of such blocks is 16, the number of blocks is reduced if the recording length is long. When all blocks are filled, the oldest waveform (block) is overwritten.

1 Press the DISP key to display the Waveform screen.



2 Press the SUB MENU key to display the [Mem Div] setting items.





3 Move the cursor to the [History] item using the CURSOR keys, and select the block to display by the F1 or F2 keys.
(0 = newest, to block -15)

4 Press F4 [Move Block].
The data in the selected history block is displayed.
(The number of the currently displayed block appears in the status bar at the lower right.)
[Move Block] remains active until you press it again. While it is active, the display refreshes each time you select a block.

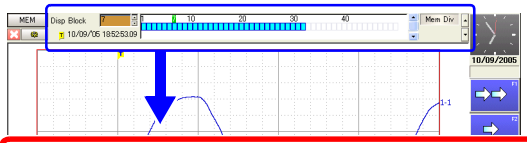
To view the block usage status while measuring
Press **F5** [Update Block] to verify block usage while measuring (used blocks are blue). [Update Block] remains active until you press it again. When deactivated, block usage is not updated until finished measuring.

8.12 Viewing Waveforms in Every Display Block (Memory Division)

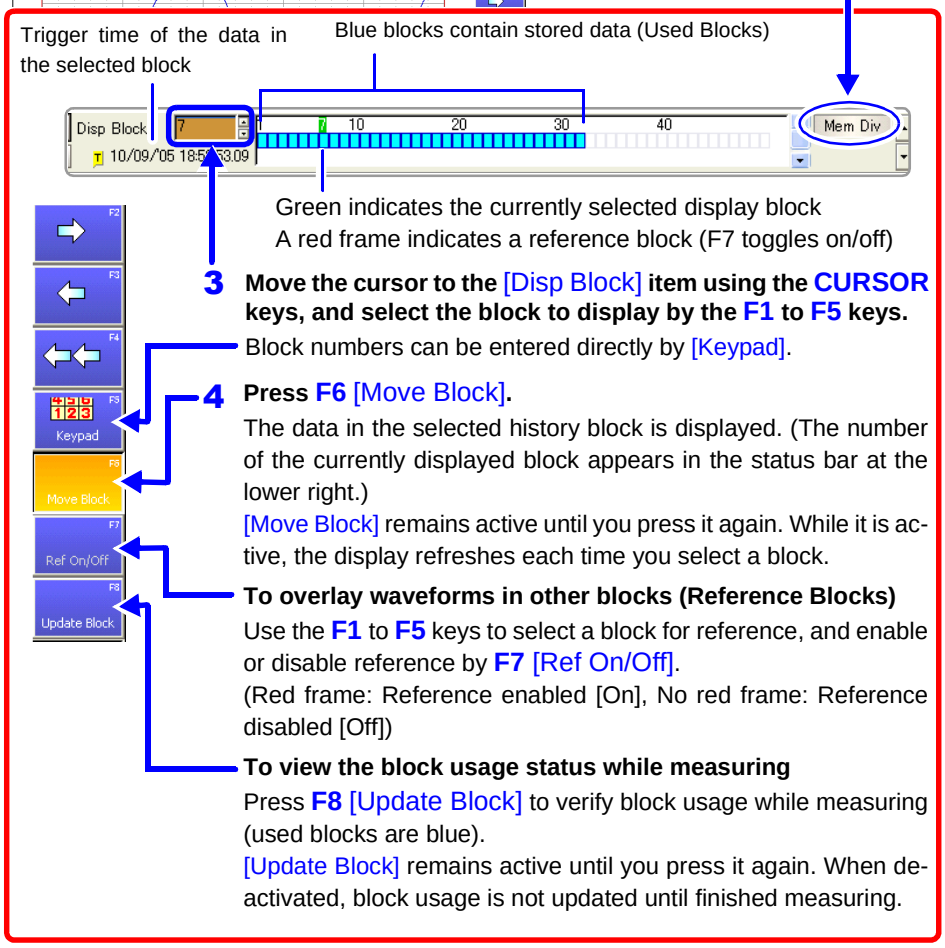
This operation is available when the Memory Division function (p. 109) is enabled. (Memory function and REC&MEM function only)
Block usage status can be verified during Memory Division recording. In addition, the waveform recorded in any block can be displayed.
When Memory Division is disabled, previously recorded waveforms in up to the last 16 blocks (depending on recording length) can be referenced.

See "8.11 Viewing Past Waveforms" (p. 219)

1 Press the DISP key to display the Waveform screen.



2 Press the SUB MENU key to display the [Mem Div] setting items.



3 Move the cursor to the [Disp Block] item using the CURSOR keys, and select the block to display by the F1 to F5 keys.

Block numbers can be entered directly by [Keypad].

4 Press F6 [Move Block].

The data in the selected history block is displayed. (The number of the currently displayed block appears in the status bar at the lower right.)
[Move Block] remains active until you press it again. While it is active, the display refreshes each time you select a block.

To overlay waveforms in other blocks (Reference Blocks)

Use the F1 to F5 keys to select a block for reference, and enable or disable reference by F7 [Ref On/Off].
(Red frame: Reference enabled [On], No red frame: Reference disabled [Off])

To view the block usage status while measuring

Press F8 [Update Block] to verify block usage while measuring (used blocks are blue).
[Update Block] remains active until you press it again. When deactivated, block usage is not updated until finished measuring.

To overlay a block with other blocks (Reference Blocks)

Set the Reference Block setting to [On] on the Memory Division Settings screen.

See Settings Screen Settings: "Memory Division: Display Settings" (p. 111)

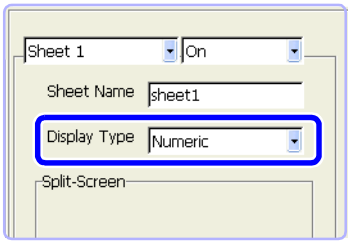
To switch the waveform in a block

Select the block to display with the SHEET/PAGE keys.
In the default state, the SHEET/PAGE keys switch Sheets. You can change the function of these keys by selecting [Blocks] on the Environment Setting Screen.

See "Specifying SHEET/PAGE Key Operations" (p. 357)

8.13 Viewing Waveform Data as Numerical Values

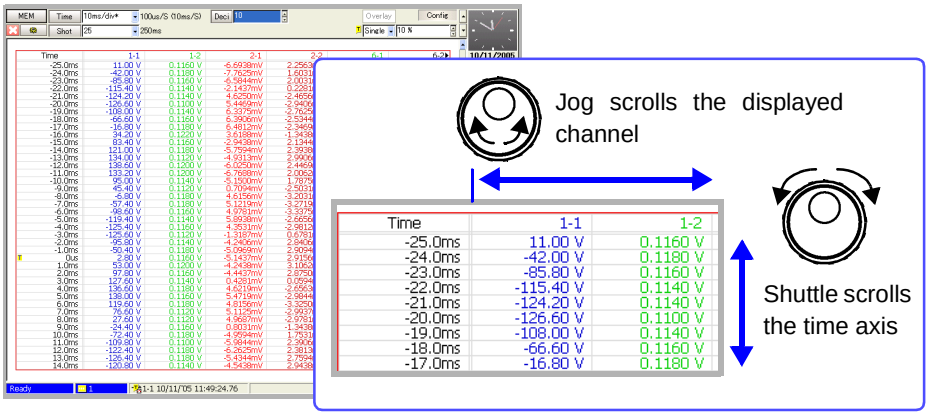
To display numerical values



Set the Display Type on the Sheet Settings screen to [Numeric].

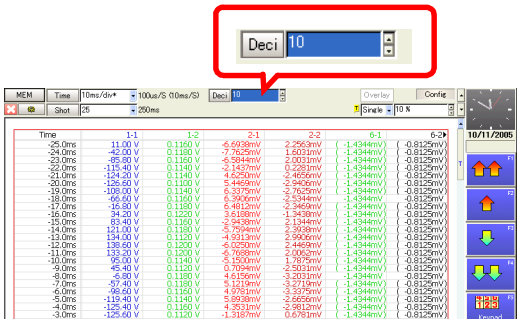
See "7.2.3 Setting the Display Type" (p. 177)

DISP key



To display data with thinning applied

Numerical data can be thinned for display.



Move the cursor to [Thinning], and select a thinning factor with the F keys.

- When [2] is selected:
  Every other sample is thinned out (hidden). Numerical values are displayed for every other sample.
- When [10] is selected:
  Nine out of every ten samples is thinned out (hidden). Numerical values are displayed for one out of every ten samples.

8.14 Searching a Waveform

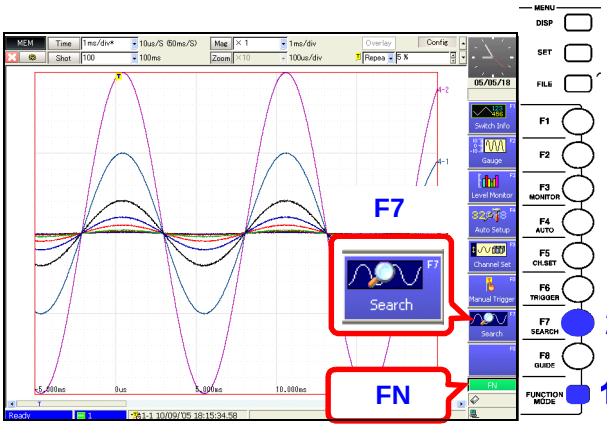
Any location within measured waveform data that satisfies the search criteria can be found and displayed. Search criteria can be specified as trigger criteria, peaks and times.

	MEM	REC	REC&MEM	REALTIME	FFT
Trigger Search(p. 223) Specify trigger criteria to find locations that meet those criteria.	●	–	● *1	● *2	–
Peak Search (p. 229) Select the maximum, minimum, local maximum or local minimum location to find.	●	–	● *1	● *2	–
Time Search (p. 228) Specify any time to locate on the waveform.	●	●	●	●	–

*1. Memory waveform only

*2. Measurement waveform only

Search markers are placed wherever search criteria are satisfied. Also, A/B cursors can be moved to the location of a search mark, and any other mark (e.g., event marks, (p. 231)) can be inserted.



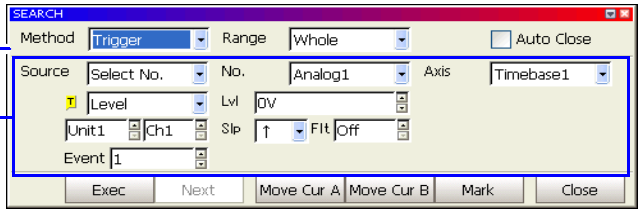
(FN: FUNCTION MODE)

Press the **FUNCTION MODE** key to enable the FN mode, then press **F7** [Search].
The SEARCH dialog appears.
Press the **ESC** key or the **F8** [Close] key to close the dialog.

The [SEARCH] dialog box appears.

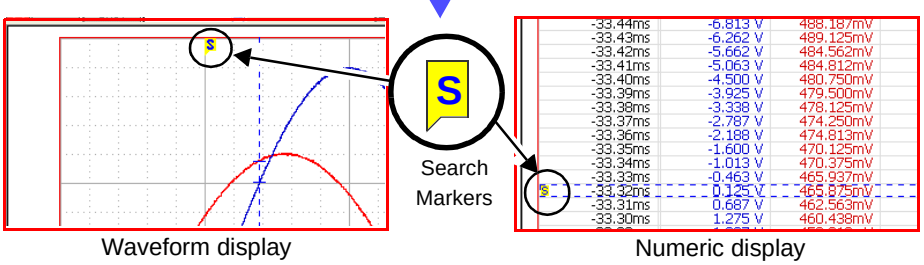
Select the search type.

Set search criteria.



(Example of Trigger Search settings)

A cursor can be moved to a found search location.

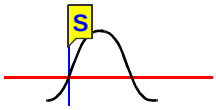
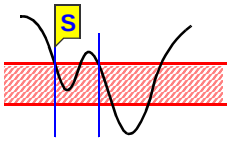
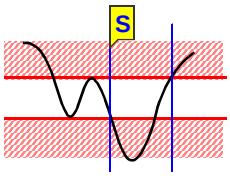
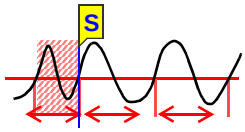
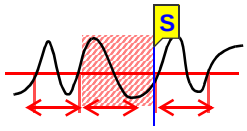
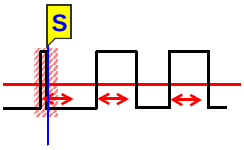
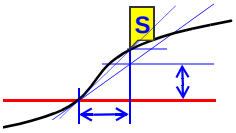
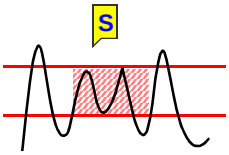
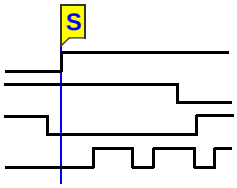


Waveform display

Numeric display

8.14.1 Searching by Trigger Criteria

Measured data can be searched using the following trigger criteria.

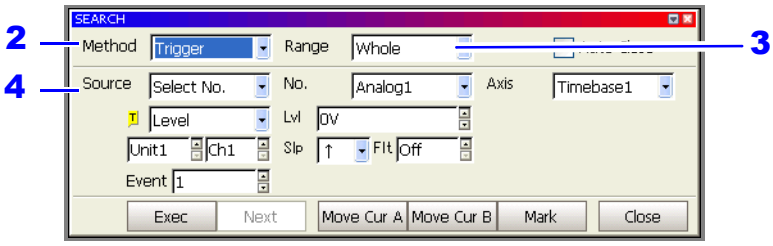
Trigger Criteria Search	Example	Waveform content specifiable with this search criteria	Reference
Level		Level (Lvl), Slope (Slp), Filter (Flt), Event	"6.7.2 Triggering When Crossing a Voltage Threshold (Level Trigger)" (p. 150)
Win-In		Upper limit (Up), Lower limit (Low), Filter (Flt), Event	"6.7.3 Triggering with Upper and Lower Thresholds (Window Trigger)" (p. 152)
Win-Out		Upper limit (Up), Lower limit (Low), Filter (Flt)	"6.7.3 Triggering with Upper and Lower Thresholds (Window Trigger)" (p. 152)
In-Period Trigger (Peri-In)		Level (Lvl), Slope (Slp), Filter (Flt), Lower, Upper, Event	"6.7.4 Triggering by Period Variance (Period Trigger)" (p. 153)
Out-of-Period Trigger (Peri-Out)		Level (Lvl), Slope (Slp), Filter (Flt), Lower, Upper, Event	"6.7.4 Triggering by Period Variance (Period Trigger)" (p. 153)
Glitch		Level (Lvl), Slope (Slp), Width, Event	"6.7.5 Triggering by Pulse Width (Glitch Trigger)" (p. 155)
Slope		Level (Lvl), Slope (Slp), Width, Event	"6.7.6 Triggering by a Variance within a Specified Interval (Slope Trigger)" (p. 156)
Voltage Sag (Drop)		Level (Lvl), Frequency (Freq), Event	"6.7.7 Triggering upon Instantaneous Voltage Sag at Commercial Mains Frequency (50/60 Hz) (Voltage Sag Trigger)" (p. 158)
Logic		Filter, Trigger pattern (1 to 4)	"6.8 Triggering by Logic Signals (Logic Trigger)" (p. 159)

Trigger Criteria Search

MEM REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen

	Operating Key	Procedure
1	**FUNCTION MODE** **F7**	Display [FN] mode. Select [Search]. The [SEARCH] dialog box appears.



2 Select the contents to find.

CURSOR **F1**	Move the cursor to the [Method] item. Select [Trigger].

3 Select the search range.

CURSOR **F1 to F8**	Move the cursor to the [Range] item. Select either choice.

Whole	Searches all waveforms (default setting).
Block	(only for the Real-Time Saving function) Searches the currently loaded measurement waveform block.
AB Cursor	Searches between A/B cursors. When only one cursor is enabled, searches forward from the cursor location.

When recording with Memory Division (Memory function and REC&MEM function)

Display Block	Searches within a currently displayed block. (default setting)
Display Block AB	Searches between AB cursors in a currently displayed block.
All Blocks	Searches all measured blocks.
All Blocks AB	Searches between AB cursors in all measured blocks.

4 Select the trigger search criteria.

(Trigger criteria settings for Analog No. 1 to No. 8, or Logic No. 1 to No. 4)

CURSOR **F1 to F8**	Move the cursor to the [Source] item. Select either choice.

AND	Searches for the condition in which all trigger criteria are met.
OR	Searches for the condition in which any of the trigger criteria is met.
Select No.	Searches only using the currently displayed search criteria (default setting).

Because searching is timebase-dependent, waveforms measured with different timebases must be searched separately. Select the timebase to search as the [Axis] setting.

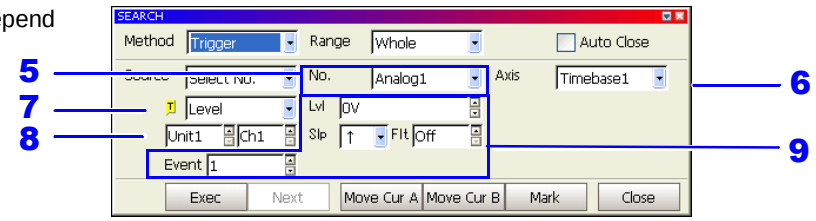
See "Select which timebase to search (if measured using two timebases)." (p. 225)

Operating Key Procedure

Setting Analog Channel Search Criteria

Displayed items depend on the trigger type.

When the trigger type is [Level]



5 Select the criteria number to use.

CURSOR Move the cursor to the [No.] item.
F1 to F8 Select a number for this set of search criteria, from Analog 1 to Analog 8.

6 Select which timebase to search (if measured using two timebases). MEM

CURSOR Move the cursor to the [Axis] item.
F1 to F8 Select either choice.

Timebase 1	Searches a Timebase 1 channel (default setting).
Timebase 2	Searches a Timebase 2 channel.

7 Select the trigger search type

CURSOR Move the cursor to the [T] item.
F1 to F8 Select the type of trigger criteria to use for searching.

Level, Win-In, Win-Out, Off (default setting)

8 Select the type of trigger criteria to use for searching.

CURSOR Move the cursor to the [Unit], [Ch] item and select the channel to be searched.
F1 to F8 Only those channels that were recorded using the [Axis] can be selected.

9 Select the search criteria.

CURSOR Select the trigger search criteria.
F1 to F8 Available selections depend on the search type.

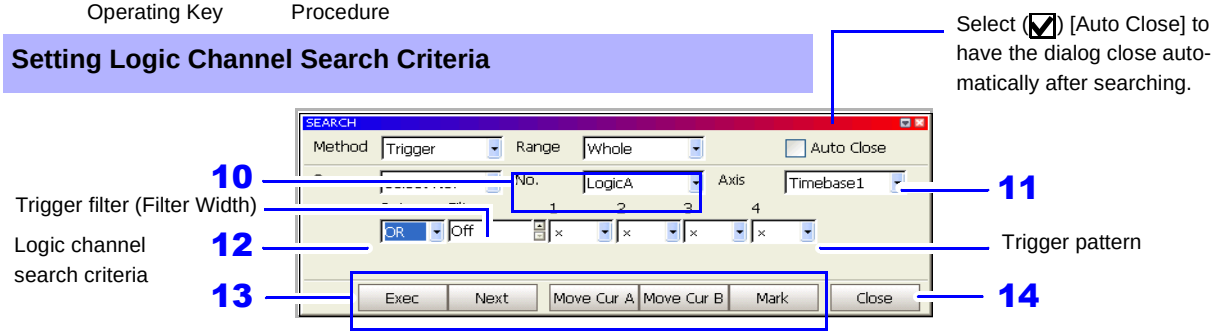
Lvl (Level)	Set the signal level (threshold voltage) for search. Searching is applied when the signal crosses this level.
Slp (Slope)	Select the slope (input signal rising ↑ or falling ↓) for search.
Flt (Filter)	Set the filter width (trigger filter) for search. Prevents noise from causing false triggers (p. 149).
Up (upper limit) **Low** (lower limit)	Select whether to search for upper or lower limit values.
Event	Set the event count for triggering.

Trigger search criteria settings are the same as the pre-measurement trigger criteria settings.
See "6.7 Triggering by Analog Signals" (p. 146)

To combine different search criteria with logical [AND] or [OR], repeat steps 5 to 9 to specify all necessary criteria.

Operating Key Procedure

Setting Logic Channel Search Criteria



10 Select the criteria number to use.

CURSOR Move the cursor to the [No.] item.
F1 to F8 Select a number for this set of search criteria, from Analog 1 to Analog 8.

11 Select the timebase to search (if measured using two timebases). MEM

CURSOR Move the cursor to the [Axis] item.
F1 to F8 Select either choice.

Timebase 1	Searches a Timebase 1 channel (default setting).
Timebase 2	Searches a Timebase 2 channel.

12 Select the trigger search criteria for logic channels

Set the trigger search criteria for each channel.

To combine different search criteria with logical [AND] or [OR], repeat steps 10 to 12 to specify all necessary criteria.

Trigger search criteria settings are made using the same procedures as the pre-measurement trigger criteria settings.
See "6.8 Triggering by Logic Signals (Logic Trigger)" (p. 159)

Search

13 CURSOR F1

Move the cursor to the [Exec] button.
Starts searching.
[Searching] appears on the Status bar, and the locations where search criteria are satisfied are displayed.
Search markers (S) indicate locations where search criteria are met.

To search for more instances

F2 Select [Next].

To move a cursor to a found location

F4 or **F5** Select [Move Cur A] or [Move Cur B].

To insert an event mark at a location where search criteria are met.

CURSOR Move the cursor to the [Mark] button.
F6 Select [Mark].

14 Close the search function.

F8 Select [Close].

Description

If search results differ from expectations

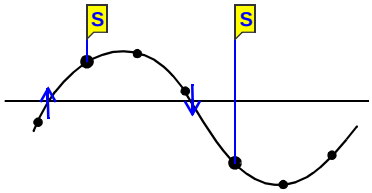
Undesired search results may occur as a result of noise on the acquired waveform. In such cases, enable the trigger filter.

See "6.7 Triggering by Analog Signals" (p. 146)

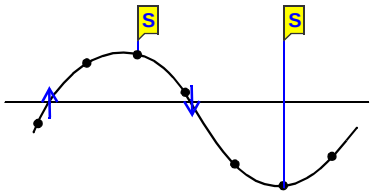
When the slope (Slp) setting is [↑↓], the search result location is one sample late.

Level Trigger Search

When the slope (Slp) setting is [↑], [↓]



When the slope (Slp) setting is [↑↓]



When searching with logic trigger criteria, if the criteria are already satisfied when starting the search, searching proceeds past the point where the criteria are no longer satisfied to the next location where the criteria are again satisfied.

8.14.2 Searching by Time

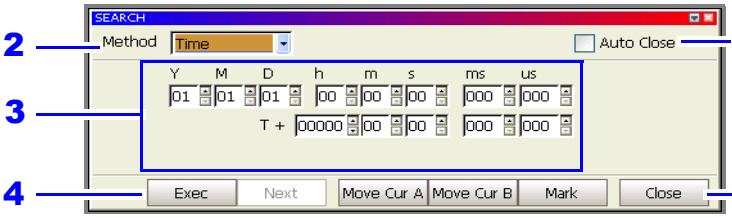
You can search recorded data for a specific time. The time to search for can be specified as relative time elapsed after a trigger event, or as an absolute date and time.

Time Search

MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen

	Operating Key	Procedure
1	**FUNCTION MODE** **F7**	Display [FN] mode. Select [Search]. The [SEARCH] dialog box appears.



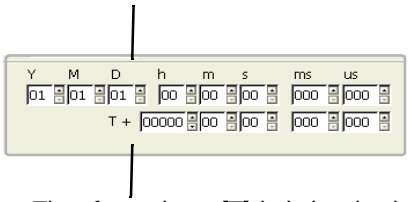
Select (☑) [Auto Close] to have the dialog close automatically after searching.

2 Select the contents to find.

CURSOR **F2**	Move the cursor to the [Method] item. Select [Time].

3 Specify the time to find

CURSOR **F1 to F8**	Move to the date field (to specify an absolute time) or time from trigger [T] (relative time), and set the time to find. • To set by date Set the recording date. • Set the time from the trigger event. When pre-triggering was enabled for recording, you can specify time before the trigger event.



Search

4

CURSOR **F1**	Move the cursor to the [Exec] button. Starts searching. [Searching] appears on the Status bar, and the locations where search criteria are satisfied are displayed. Search markers (S) indicate locations where search criteria are met.

To move a cursor to a found location

F4 or **F5**	Select [Move Cur A] or [Move Cur B].

To insert an event mark at a location where search criteria are met.

CURSOR **F6**	Move the cursor to the [Mark] button. Select [Mark].

5 Close the search function.

F8	Select [Close].

8.14.3 Searching for Peaks

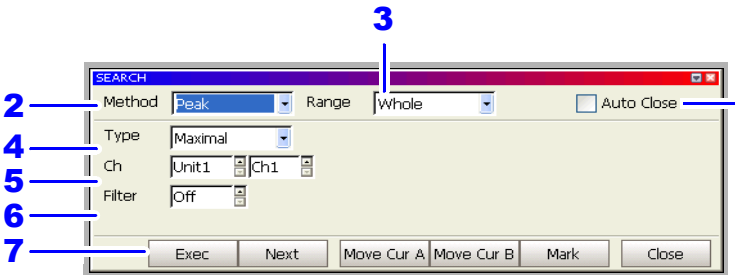
You can select to search for the maximum, minimum, local maxima and local minima of recorded measurement data.

Peak Search

MEM REC&MEM REALTIME

To open the screen: Press the **DISP** key → Waveform screen

	Operating Key	Procedure
1	**FUNCTION MODE** **F7**	Display [FN] mode. Select [Search]. The [SEARCH] dialog box appears.



Select (☑) [Auto Close] to have the dialog close automatically after searching.

2 Select the contents to find.

CURSOR
F3

Move the cursor to the [Method] item.
Select [Peak].

3 Select the search range.

CURSOR
F1 to F8

Move the cursor to the [Range] item.
Select either choice.

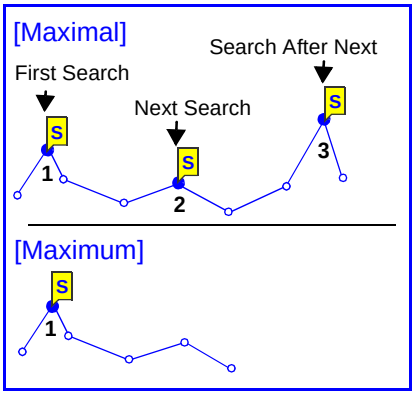
Whole	Searches all waveforms (default setting).
AB Cursor	Searches between A/B cursors. When only one cursor is enabled, searches forward from the cursor location.

4 Select the type of peak to search for.

CURSOR
F1 to F8

Move the cursor to the [Type] item.
Select either choice.

Maximum	Search for the maximum value (default setting).
Minimum	Search for the minimum value.
Maximal	Search for a local maximum value.
Minimal	Search for a local minimum value.



5 Select the channel to be searched.

CURSOR
F1 to F8

Move the cursor to the [Ch] item.
Select the input module (Unit) and channel number data to be searched.

When searching local maxima and minima
Click the [Next] button to locate the next local maximum or minimum after the current location.

Operating Key | Procedure

6 **(If searching for local maxima or minima)**

Set the criteria for the local maximum or minimum value (Filter).

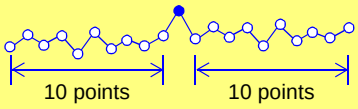
CURSOR **F1 to F8**

Move the cursor to the [Filter] item.
Set the criteria for the local maximum or minimum value. (1div = 100 points)

Off	When a value is larger (or smaller) than the value of the data points immediately before and after it, that value is considered to be a local maximum (or minimum) (default setting).
0.1 to 10.0 div	When a value is larger (or smaller) than the values of all of the data points within the specified range before and after it, that value is considered to be a local maximum (or minimum).

Local maxima when the filter setting is Off

Local maximum when the filter setting is 0.1 div (0.1div=10 points)



Search

7 **CURSOR** **F1**

Move the cursor to the [Exec] button.
Starts searching.
[Searching] appears on the Status bar, and the locations where search criteria are satisfied are displayed.
Search markers (S) indicate locations where search criteria are met.

To search for more instances (local maximum or minimum values only)

F2 Select [Next].

To move a cursor to a found location

F4 or **F5** Select [Move Cur A] or [Move Cur B].

To insert an event mark at a location where search criteria are met.

CURSOR **F6**

Move the cursor to the [Mark] button.
Select [Mark].

8 **Close the search function.**

F8 Select [Close].

8.15 Inserting and Searching for Event Marks on a Waveform

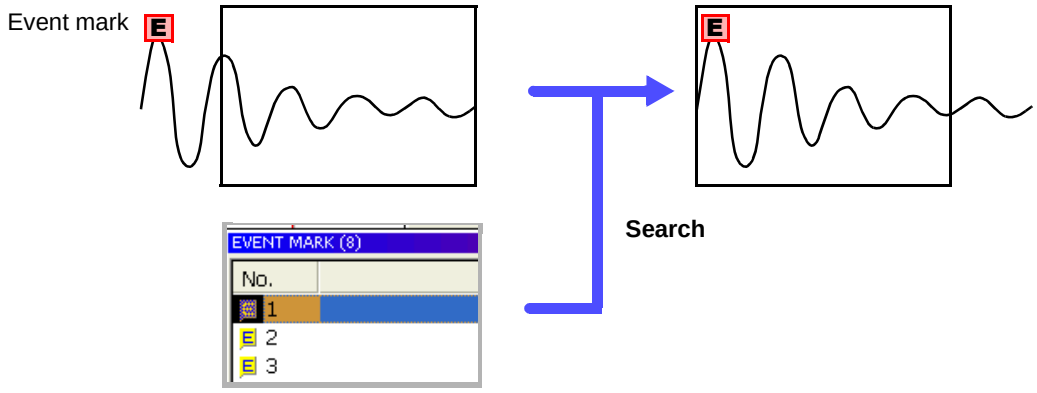
You can search for any marks (event marks) inserted on waveforms during and after measurement.

Supporting Function

MEM	REC	REC&MEM	REALTIME	FFT
● (Only when Memory division is disabled)	● *	● *	●	–

* Event marks inserted on a Recorder waveform

You can insert up to 1,000 event marks of 16 types, which can be edited and assigned comments. A list of event marks can be printed (p. 348).



Event mark information list
(EVENT MARK dialog)

8.15.1 Inserting Event Marks

An event mark is inserted on the waveform every time you press the START key during measurement.
Event marks can also be inserted by signals at the external Start terminal input.
In addition, event marks can be inserted at locations searched with the Search dialog.

- When using the Memory Division function in the Memory function, event marks cannot be inserted.
  In the REC&MEM function, event marks can be inserted on a Recorder waveform.
- To confirm the location of event marks, they can be searched for in the Event Mark List.

See "8.15.2 Event Mark Searching" (p. 232)

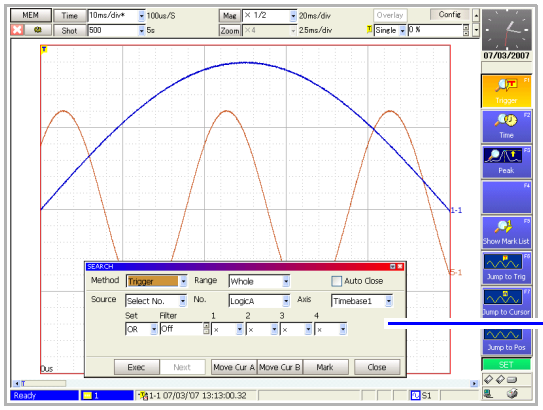
- Event marks can be repositioned, added, deleted and edited after measurement.

See "8.15.3 Event Mark Editing" (p. 233)

- Event marks cannot be inserted after pressing the STOP key once while measuring (and “Push again to stop measurement” is displayed).

8.15.2 Event Mark Searching

An event mark can be searched for by selecting it in the Event Mark List (accessible from the EVENT MARK dialog).

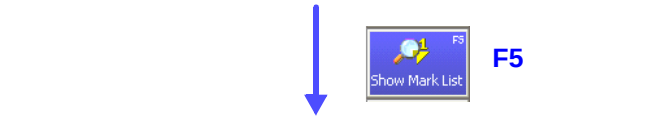


SEARCH dialog

1 Press the **FUNCTION MODE** key to enable the FN mode, then press **F7** [Search]. The Search dialog appears.

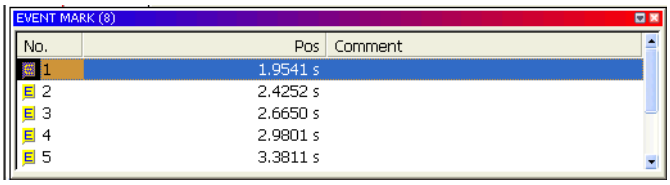
2 Using the **CURSOR** keys, move the cursor to the [Method] item in the dialog, and press the **F5** [Show Mark List] key.

The Event Mark dialog appears.



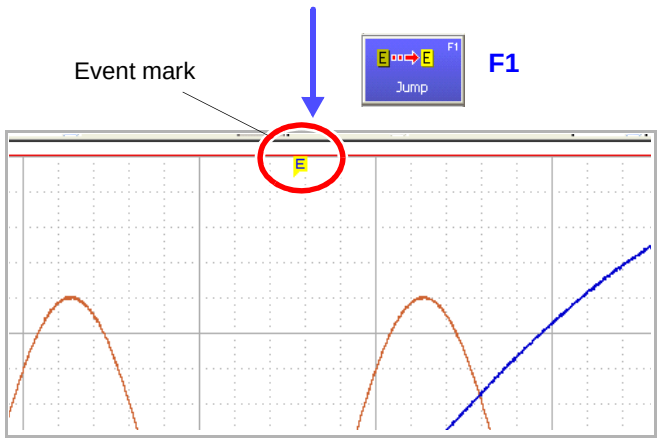
F5

Event marks are listed in the order they were inserted.



EVENT MARK dialog

3 Select the number of the event mark to search for, and press the F1 [Jump] key.

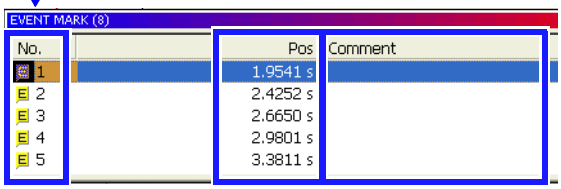


F1

8.15.3 Event Mark Editing

Place the cursor on the row of the event number to edit, and press one of the F1 to F8 keys.

Cursor movement



To change the type or location, and to add or delete an event mark

Displays the location of the event mark

Changes the event mark type (from 16 available types)

Adds an event mark (1,000 maximum)

Deletes the event mark

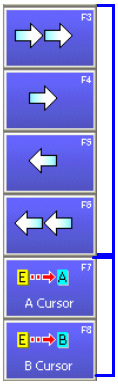
Deletes all event marks

Adding a comment to an event mark

Enter a comment.
The entry method is the same as for channel comments.

See "3.3.3 Entering Text and Numbers" (p. 65)

Repositioning an event mark



Move the event mark (the displayed value is the same as that on the time axis).

The event mark moves to the cursor position.

Measuring with Real-Time Saving Chapter 9

9.1 Overview of the Real-Time Saving Function

The Real-Time Saving function saves data to a specified save destination while measuring. Long-term measurement is available regardless of the installed memory capacity of the instrument.
Storage media that can be specified:
Model 9718-50 HD Unit, PC Card or a shared network folder
In addition, while recording measurement data directly to storage media, an overview of measurement data (the whole waveform) is recorded to instrument memory. The whole waveform is then saved to the storage media when measurement finishes.
To perform analysis, specify the portion of data within the whole waveform to be loaded and analyzed. The Memory function is activated for loaded measurement waveforms so that waveform and numerical calculations can be performed, as well as FFT analysis using the FFT function.

Maximum Recording Time

The maximum recording time for the Real-Time Saving function is determined by the available space on the storage media specified as the save destination. The instrument is able to record unattended for up to one year (365 days, 23 hours, 59 minutes and 59 seconds).
Before measuring, the save destination and file name (which can be set to be assigned automatically) must be set. The timebase is limited by the storage media and the number of measurement channels to be recorded. The maximum recording length can also be set according to the available space at the save destination.

Measurement Data

When recording with the Real-Time Saving function, measurement waveform data (.RSM) is saved directly to the specified save destination. Data is apportioned into files of up to 100 MB each during saving.
When measurement is finished, the whole waveform file (.RSR) and an index file (.RSI, for data management) are also saved. The index file is used to load the data files for analysis.

See "11.4 Loading Data" (p. 291)

Loading the index file displays the whole waveform. Measurement waveform data can then be loaded by specifying the loading position within the whole waveform. Display of the whole waveform, measurement waveform, or both together can be selected.

NOTE

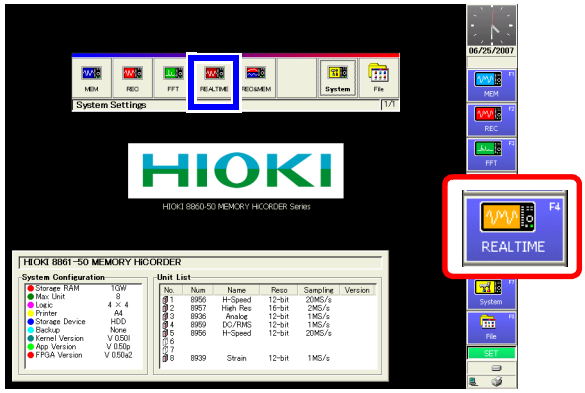
- To use the Real-Time Saving function, at least 3 MB of free space must be available on the storage media.
- Measurement using different sampling rates is not available with the Real-Time Saving function.
- The Model 8958 16-Ch Scanner Unit cannot be used.
- Only data for those channels selected for use ([Use Ch] setting enabled on the Status screen) is measured and saved. However, when a channel is selected for use, its data is saved even if display of that channel's waveform is disabled (off).
- The whole waveform data is recorded in instrument memory. Depending on the setting of the whole waveform's timebase (when fast), even if there is sufficient available space on the save destination, only the recording length (duration) required for the whole waveform is stored. When automatic timebase setting of the whole waveform is selected (default setting), the timebase of the whole waveform is set according to the recording length (time).

9.2 Setting and Analysis Workflow

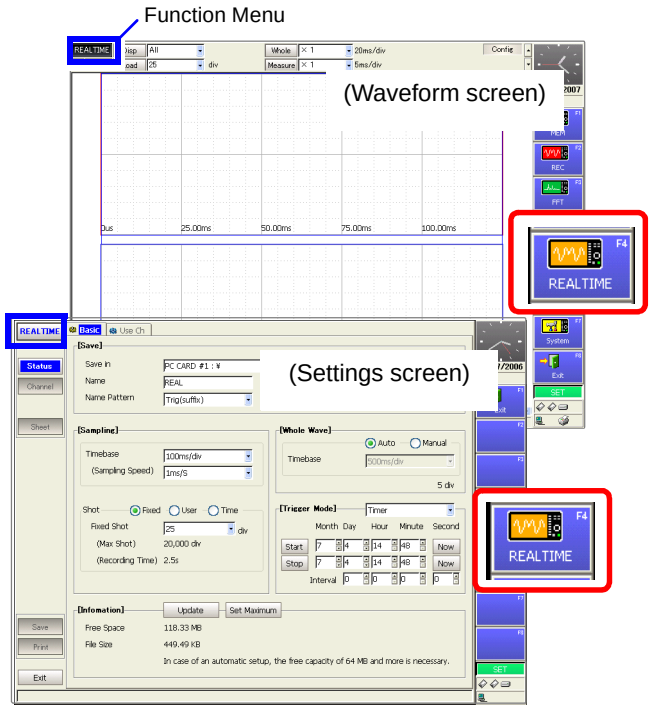
Function Selection

From the Initial screen:
Press the **F4 [REALTIME]** key.

Select the Real-Time Saving function.
See: "Choosing the Appropriate Function" (p. 82)



From the Waveform or Settings screen:
Use the CURSOR keys to move the cursor to the function menu, and press the **F4 [REAL-TIME]** key.



Measurement Configuration Settings

Press the SET key to open the Settings screen
Press the SUB MENU keys to select the Status menu

Press the SHEET/PAGE keys to select the [Use Ch] page

1

Selecting channels to use

With the Real-Time Saving function, measurement using different sampling rates simultaneously is not available. Also, the Model 8958 16-Ch Scanner Unit cannot be used.

Press the SHEET/PAGE keys to select the [Basic] page

2

Making settings for saving data

Set the save destination and file name.
Verify that there is adequate space available at the save destination, and that the media is installed or inserted properly.

3

Make measurement waveform settings

Select the timebase (sampling rate) and recording length (duration).
The data acquisition interval on the time axis is set by the timebase or sampling rate setting. Recording length can be set as a number of divisions or recording duration.

4

Make whole waveform settings

The timebase can be set automatically or manually.

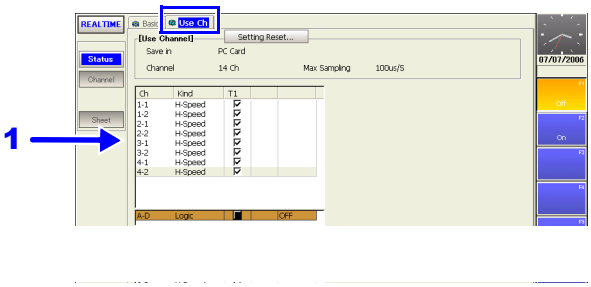
5

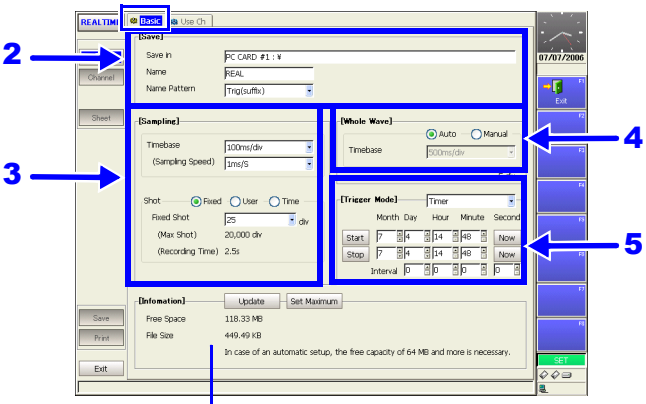
Set the trigger mode (recording method)

Select single (one-shot), continuous or timer.

Make settings on the Status Settings screen.

Measurement using different sampling rates is not available with the Real-Time Saving function.





You can verify the free space on the save destination and the file size to be saved using the current settings. Also, the maximum recording length can be set to match the free space on the save destination storage media.

Input Channel Settings

Press the SUB MENU keys to select the **Channel** menu
Press the SHEET/PAGE keys to select the [One Ch] page

6 Select the Unit (module) and Channel

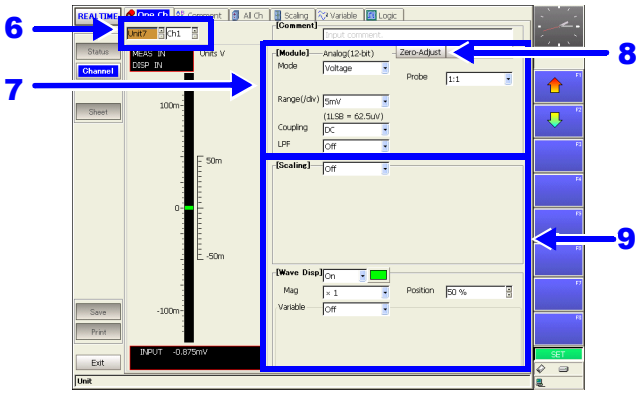
7 Select the measurement range (vertical axis)
Make input-module-related settings

8 Perform zero adjustment

(after warm-up)

9 (As occasion demands)
Set the scaling, waveform colors and zero position

Make settings on the Channel Settings screen.



See "Chapter 5 Input Channel Settings" (p. 115),
"7.1 Making Input Waveform Display Settings (Analog Waveforms)" (p. 170) in this manual,
"Chapter 3 Input Channel Settings" in the *Input Module Guide*

Display Sheet Settings

Press the SUB MENU keys to select the **Sheet** menu

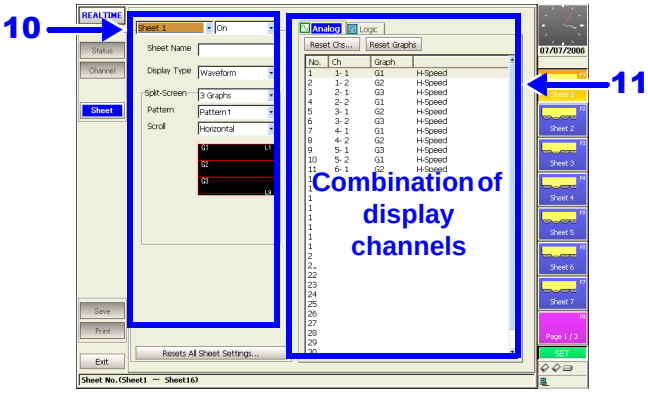
10 (As occasion demands)
Select the Screen Layout
Set the number screen divisions and the split-screen layout

11 Select the channels to display

Up to 32 channels can be displayed per sheet.

(If you want to change the layout of the waveform screen to show any combination of channels)

Set on the Sheet Settings screen.



See "Chapter 7 Waveform Display Settings" (p. 169)

Start of Measurement

Data acquisition

Press the START key (the green LED lights).

End of Measurement

Press the STOP key.
Recording stops after acquiring the specified length (the green LED goes off).

Press twice to stop immediately.

Data Analysis

Analysis on the Waveform Screen
Real-time saving function

Numerical calculation
Waveform calculation
Select the Memory function

FFT analysis
Select the FFT Function

Analysis on the waveform screen.
See "Chapter 8 Waveform Screen Monitoring and Analysis" (p. 191)

Loading files
When measurement is finished, data remains in instrument memory. To display other data, load the index (RSI) file from the Real-Time Saving function. The whole waveform is displayed.

To display a measurement waveform, specify its location within the whole waveform.

- To perform numerical or waveform calculations, switch to the Memory function.
- To perform FFT analysis, switch to the FFT function.

Executing a waveform calculation clears the waveform acquired by the Real-Time Saving function.

Saving Settings

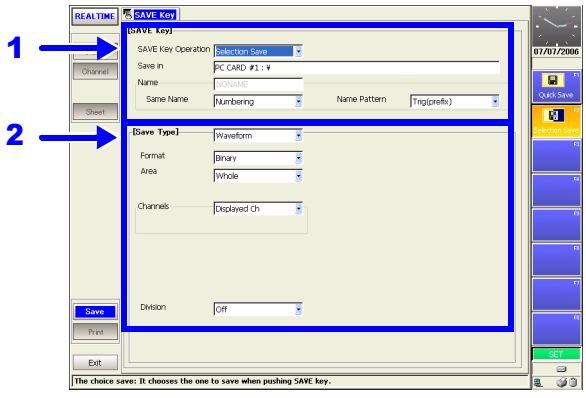
Press the SUB MENUs key to select the Save menu

1 Specify the saving destination
Verify that storage media has been inserted.
Default setting: [Selection Save]

2 Select what to save

SAVE

(If you want to save data)
Make settings on the Save Settings screen, and press the SAVE key to save.



See "Chapter 11 Saving/Loading Data & Managing Files" (p. 261)

Measurement data stored in memory by the Real-Time Saving function is saved as Memory function data (.MEM).

Printing Settings

Press the SUB MENU keys to select the Print **menu**

Press the SHEET/PAGE keys to select the [Printer] page

1 Select manual printing

Verify that the paper is loaded correctly.

Default setting: [Selection Print]

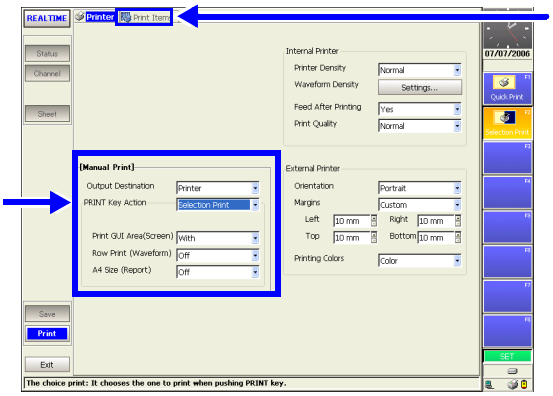
Press the SHEET/PAGE keys to select the [Print Items] page

2 Select what you want to print

PRINT

(If you want to print data)

Make settings on the Print Settings screen, and press the PRINT key to print.



See "Chapter 12 Printing" (p. 313)

9.3 Pre-Measurement Settings

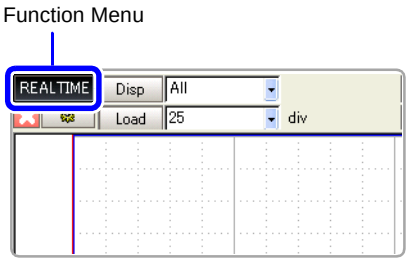
Make the settings required for measurement, such as the save destination and channels to use.

Settings required before measurement:
Save destination and channel(s) to use
Because the timebase and recording length may be limited by the save destination and number of channels used, always check these settings before measuring.

Function Selection (Waveform or Settings Screen)

	Operating Key	Procedure
1	**CURSOR**	Move to the function menu (at the top left).
2	**F4**	Select [REALTIME] (Real-time saving function).

The operating function can be selected from the pull-down menu (p. 81).



Setting Channels to Use

To open the screen: Press the **SET** key → Select Status with the **SUB MENU** keys →Status Settings screen

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Use Ch] page.

2 Select the channels for measurement (analog/logic inputs).

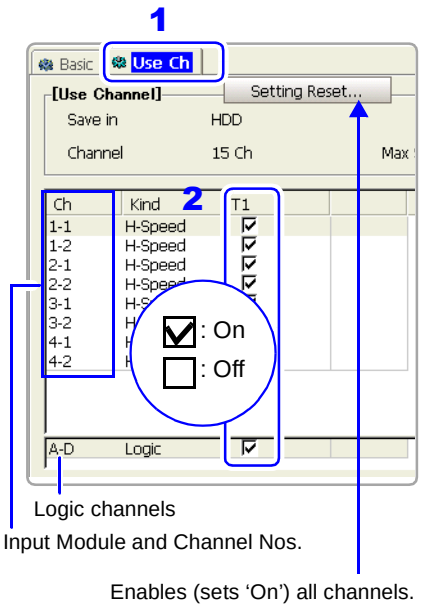
CURSOR Move the highlight cursor to a channel to be set.

F1 to F8 Select either choice.

Off	No measurement
On	Use for measurement (default setting)

With the Real-Time Saving function, all enabled channels (those with 'On' checked) are saved, regardless of whether their waveforms are displayed.

See: "Chapter 7 Waveform Display Settings" (p. 169)



Setting Recording Conditions

To open the screen: Select [Status] with the **SUB MENU** keys →Status Settings screen

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Basic] page.

2 Specify the save destination.

Operating Key	Procedure
CURSOR	Move the cursor to the [Save in] item.
F1	Select [Edit]. The [Browse Folders] dialog box appears.
CURSOR	Move the cursor to the save destination of the storage media.

Select the storage media: ↑↓ **CURSOR**
Open the layer below: → **CURSOR**

F1	Select [OK]. The dialog box closes.

3 Set the save name (if you want to change the name).

CURSOR	Move the cursor to the [Name] item.
F1 to F8	Enter the save name.(default setting: REAL) **See** "Entering Text and Comments" (p. 66)

4 Select the contents (Name Pattern) to be automatically added to the save name

CURSOR	Move the cursor to the [Name Pattern] item.
F1 to F8	Select the contents to be automatically added to the save name

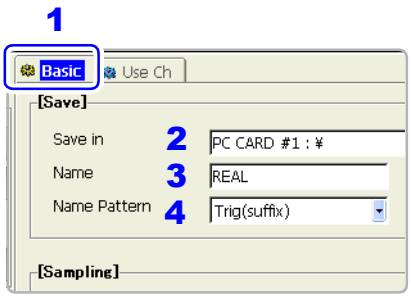
Numbering	Appends serial numbers beginning with 0001 as a suffix to the save name.
Trig (suffix)	Appends the trigger date and time as a suffix to the save name.
Trig (prefix)	Appends the trigger date and time as a prefix to the save name (default setting).

5 Set the timebase [Sampling] of the measurement waveform.

CURSOR	Move the cursor to the [Timebase] item.
F1 to F8 (Switch Display: F8)	Set the time per division (timebase) on the horizontal axis for recording the measurement waveform.

100, 200, 500 µs/div,
1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5 min/div

The (linked) sampling rate is changed accordingly. (The sampling rate can also be set directly.)



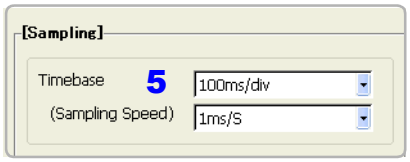
When saving to a shared folder on a computer
See: "11.1.4 Using a Network Shared Folder" (p. 264)

The available space on the selected storage media is displayed by selecting the [Update] button at the bottom of the screen.

Available space on save destination storage media
Measurement is disabled if the available space at the save destination is less than 3 MB.

Saved files
A folder is created with the save name, and each file is saved in this folder. If a folder with the same name already exists, a four-digit serial number is appended to the save name (for example, REAL_0001).
See: "File/Folder Organization for Real-Time Saving" (p. 247)

For an example of file names created by the [Name Pattern] setting: (p. 271)



The available timebase settings may be limited by the save destination and the number of channels used (p. 247)

When the timebase is 100 µs/div or 200 µs/div
The waveform is not displayed while measuring.

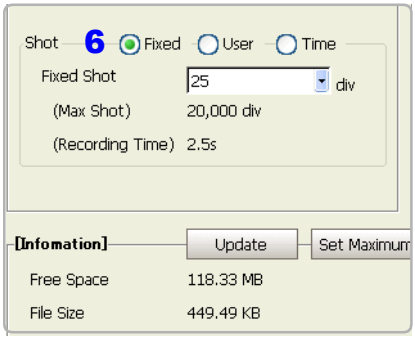
Operating Key Procedure

6 Setting a Recording Length

CURSOR Move the cursor to the [Shot] item.

F1 to F8 (Switch Display: F8) Select the setting method for recording length.

Fixed	(Fixed recording length) Select from the fixed recording lengths(default setting)
User	(Arbitrary) Set an arbitrary recording length in units of divisions
Time	Specify the amount of time to record.



The displayed recording time and maximum recording length are linked to the set recording length.
Recording length may be limited by the available space at the save destination, the number of channels used, and the timebase of the whole waveform (when manually set).

To set the maximum recording length for the available space at the save destination

Click the [Set Maximum] button to set the recording length to suit available storage space.

When selecting [Fixed] or [User]

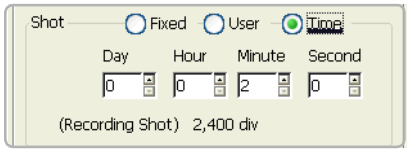
CURSOR Move the cursor to the [Fixed] or [User] item.

F1 to F8 (Switch Display: F8) Select the length of waveform to be acquired (recording length).

When selecting [Time]

CURSOR Move the cursor to the [Day] (or Hour, Minute, Second) item.

F1 to F8 (Switch Display: F8) Select the amount for recording waveforms.

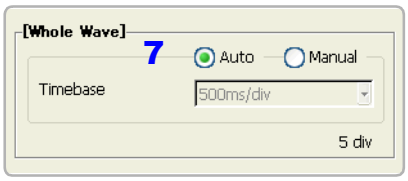


Shot: When [Time] is selected

7 Set the timebase for the whole waveform

CURSOR Move the cursor to the [Auto] or [Manual] item.

F1 to F8 Select whether the timebase should be automatically set to suit measurement waveform settings.



If the timebase of the whole waveform is set extremely slow (such as 1 hour/div) and the timebase of the measurement waveform is set fast (such as 100 µs/div), a whole measurement cannot be recorded if the recording (time) is set too short.
Be especially careful when manually setting the timebase for the whole waveform.

When selecting [Manual]

CURSOR Move the cursor to the [Timebase] item.

F1 to F8 Set the time per division (timebase) of the horizontal axis.

10, 20, 50, 100, 200, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5, 10, 30 min/div
1 h/div

When selecting [Auto]

The timebase for the whole waveform is set according to the timebase and recording length settings of the measurement waveform, and the amount of space available on the storage media. The minimum amount of space required on the save destination storage media is as follows. Measurement with the [Auto] setting is disabled if insufficient storage space is available. In this case, choose [Manual] and set the timebase for the whole waveform manually.

- Model 8860-50 (9715-50) with 32 MW internal memory: at least 32 MB available space
- Model 8861-50 (9715-50) with 64 MW internal memory: at least 64 MB available space
- Models 8860-50 and 8861-50 other than the above: at least 128 MB available space

Operating Key Procedure

8 **Select the recording method**

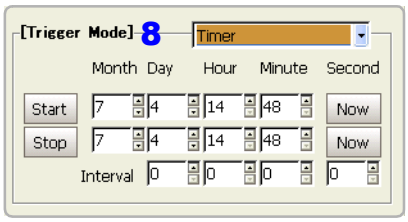
CURSOR

Move the cursor to the [Trigger mode] item.

F1 to F8

Select the setting method for the recording length.

Single	Record only once (default setting).
Repeat	Until you press the STOP key, recording repeats at intervals of the set recording length.
Timer	Recording begins and ends at the specified recording start and stop times.



Timer settings
The setting procedure is the same as for the timer trigger.
See: "6.9 Trigger by Timer or Time Intervals (Timer Trigger)" (p. 162)

Select each channel

To open the screen: Select [Channel] with the **SUB MENU** keys →Channel Settings screen

See "Chapter 5 Input Channel Settings" (p. 115) and *Input Module Guide*

Set the waveform display

To open the screen: Select [Sheet] with the **SUB MENU** keys →Sheet Settings screen

See "Chapter 7 Waveform Display Settings" (p. 169)

- When measuring with the Real-Time Saving function, Display sheet settings set with the Memory function are applied to the Real-Time Saving function.
- Sheet settings for the Model 8958 16-Ch Scanner Unit are canceled, so to measure with the Memory function after measuring with the Real-Time Saving function, first reset the Sheet settings as occasion demands.

Starting and Ending Recording

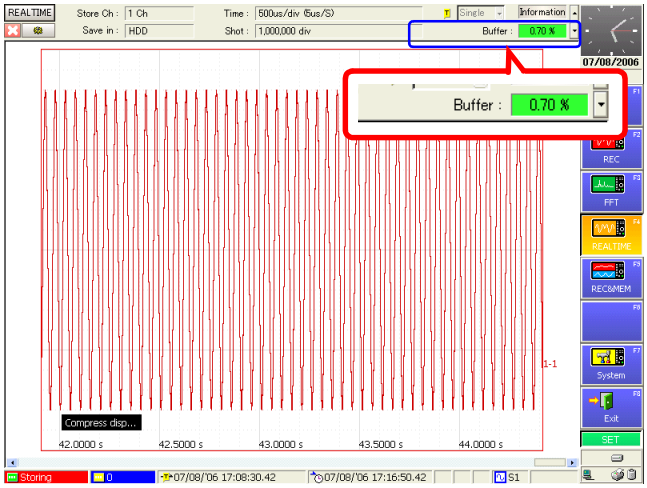
Press the START key.

The green LED lights as measurement starts.

After recording for the set recording length, data for the whole waveform is displayed. Measurement waveform data is saved directly to the save destination.

If the trigger mode is [Single], measurement stops.
If the trigger mode is [Repeat], measurement restarts.

During measurement, if the [Buffer (buffer usage status)], which is the memory used for temporary storage, exceeds 30%, waveform drawing is suspended to yield precedence to the saving process. Waveform drawing resumes when buffer usage subsequently drops below 5%.



Screen While Measuring

When measurement ends, the waveform is displayed normally.

To stop measurement

Press the STOP key.

Pressing the STOP key once causes recording to stop after the set recording length has been acquired.
Pressing the STOP key twice stops recording immediately.

Depending on the timebase and recording length, maximum and minimum values at the end of the whole waveform may not be recorded. Also, when recording is interrupted, whole waveform data does not include the last maximum and minimum value data. Such cases can be confirmed by loading the measurement waveform.

To save and print when finished measuring

See "11.3.5 Setting Manual Save (SAVE Key Output)" (p. 278)
"12.4 Making Manual Print (PRINT Key Output) Settings" (p. 319)

Relationship Between the Number of Channels Used and Timebase (Real-Time Saving Function)

Timebase setting may be limited by the save destination and the number of channels used.
The maximum number of channels usable with each timebase setting and type of save destination is as follows.

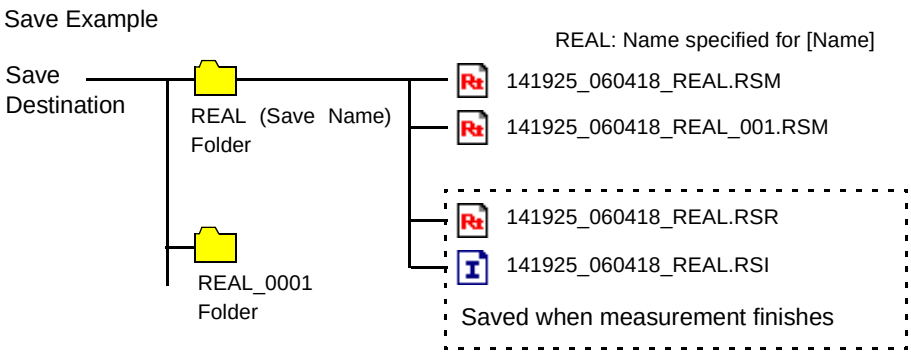
Timebase (/div)	HDD	PC Card or LAN (shared folder)
100 µs *	1	–––
200 µs *	1	–––
500 µs	2	1
1 ms	4	2
2 ms	10	4
5 ms	24	8
10 ms	33	20
20 ms or more	33	33

*. Waveform drawing is not performed during measurement.

- The table above indicates the optimum timing.
- Logic channels A through D are considered collectively as one channel.
- Depending on network traffic, saving to LAN (shared folder) may be too slow for Real-Time Saving. In this case, measurement is aborted.
- Depending on the operating condition (fragmentation), some hard disk drives may not meet the above specifications. In particular, after repeated saving and deleting, the real-time saving process may be delayed enough to interrupt measurements. In this case, reformat the hard disk before measuring.

See "11.1.5 Initializing (Formatting) Storage Media" (p. 266)

File/Folder Organization for Real-Time Saving

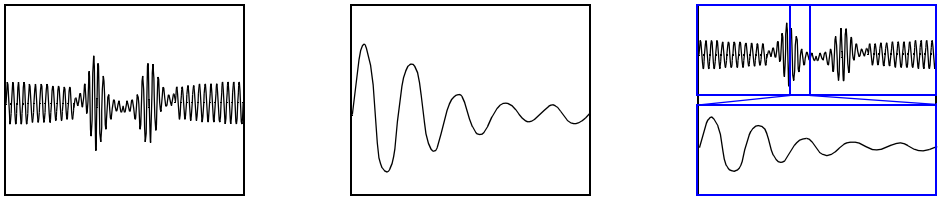


9.4 Analyzing Data

9.4.1 Waveform Viewing

Three types of waveform display are available with the Real-Time Saving function.

- **[Whole]**
  Whole Waveform (the waveform recorded with the [Whole Wave] timebase set on the Status Settings screen)
- **[Measurement]**
  Measurement Waveform (the waveform recorded with the [Sampling] timebase set on the Status Settings screen)
- **[All]**
  Whole Waveform and Measurement Waveform (upper and lower traces, respectively). When printing, the measurement waveform is printed.

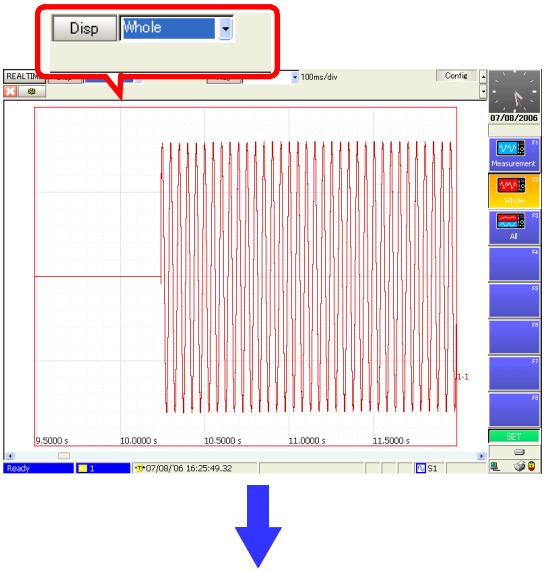


Whole **Measurement** **All**

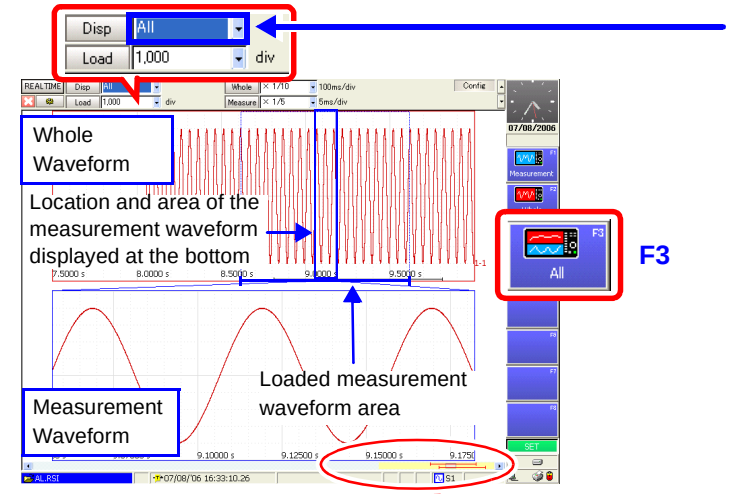
While recording, the whole waveform is displayed. When finished measuring, data remains in the instrument's memory, and you can select among the above three types of waveform display.
To view previously saved data, load the index file (.RSI) with the Real-Time Saving function (p. 251).

Waveforms can be scrolled by the SCROLL keys, and can be magnified, compressed and measured with the A/B cursors.

Viewing Waveforms After Measurement Stops



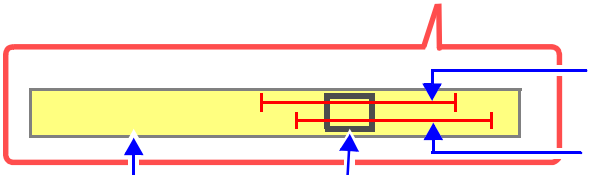
[Whole] is displayed when measurement finishes.



Move the cursor to the [Disp] setting item and select F3 [All].

The whole waveform is displayed at the top, and the measurement waveform at the bottom.
The framed portion of the whole waveform indicates the currently displayed measurement waveform.

The measurement waveform can be scrolled with the SCROLL keys.
The framed area of the whole waveform is linked for scrolling.



Upper bar: Specified [Load] location (relative location of the dotted line within the whole waveform)

Lower bar: The location of the currently loaded measurement waveform

Frame: displayed location of measurement waveform
(relative location of the frame within the whole waveform)

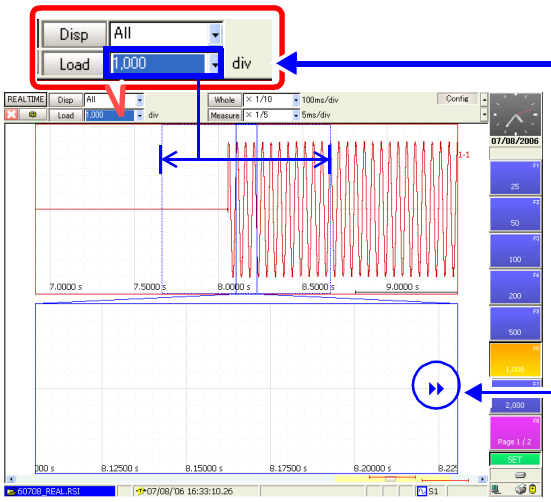
Yellow area: displayed whole waveform

To view waveform data as numerical values

Waveform data can be displayed as numerical values. When the [Disp] setting item is set to [All], the numerical values is displayed instead of the measurement waveform.

See: "8.13 Viewing Waveform Data as Numerical Values" (p. 221)

Changing and loading the location of the displayed measurement waveform



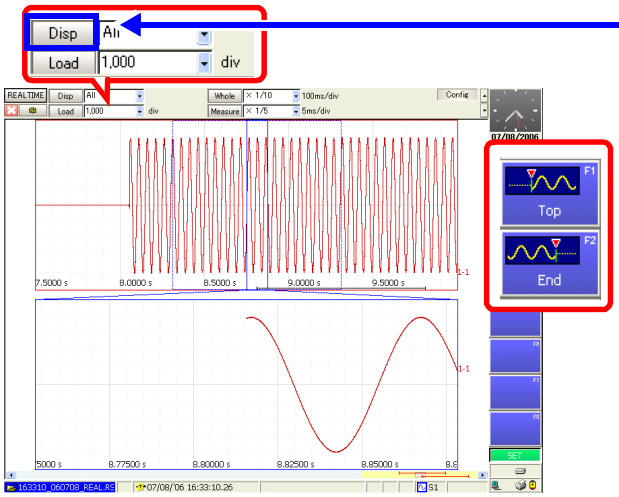
1 Move the cursor to the [Load] setting item, and select the location (division number) of the measurement waveform to display.

The (linked) dotted-line frame in the whole waveform changes.

2 With the SCROLL keys, select the loading location from the whole waveform at the top.

If the currently loading waveform is off-screen, the direction of the waveform is indicated by a marker.

To display a waveform that is off-screen.

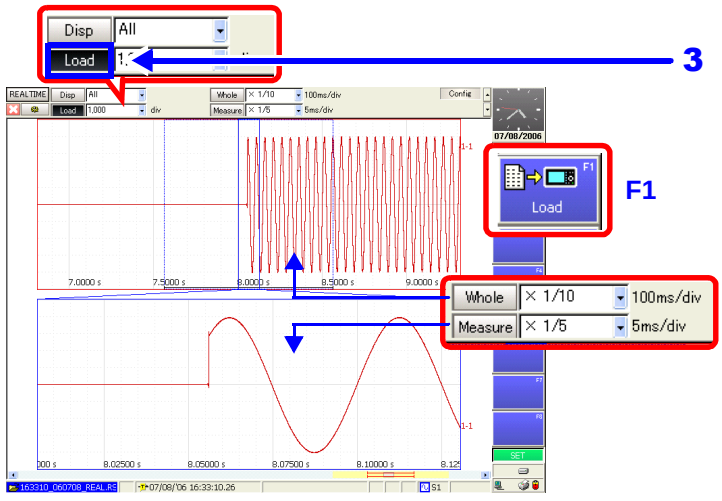


Move the cursor to the [Disp] button, and select the F1 [Top] or F2 [End] key.

The measurement waveform is displayed at the bottom.

F1 Displays the start position for loading the measurement waveform.

F2 Displays the end position for loading the measurement waveform.



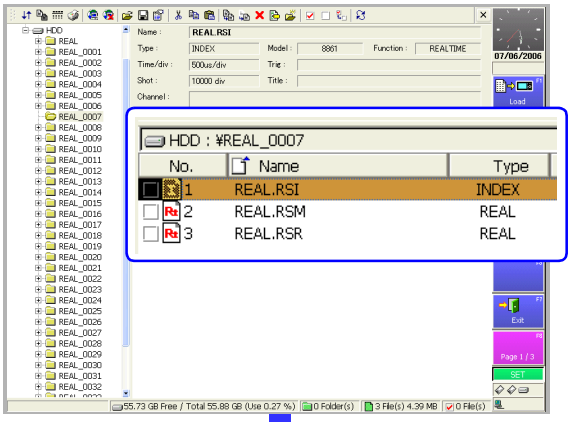
3 Move the cursor to the [Load] button and select F1 [Load].

The number of specified divisions of the measurement waveform is loaded.

To change waveform magnification

Move the cursor to the [Whole] (Whole waveform) or [Measure] (Measurement waveform) setting item, and select the display magnification. The waveform is magnified or reduced by the specified magnification.

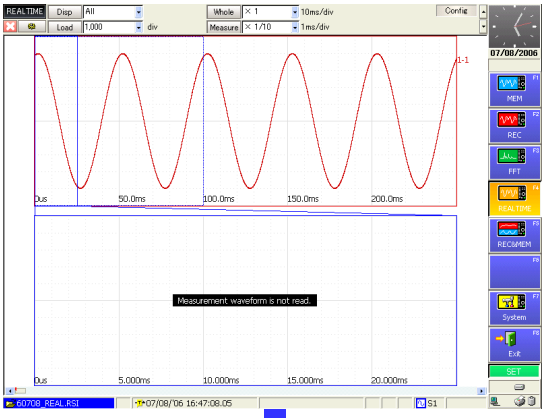
Viewing Saved Waveform Data



1 Press the FILE key to display the File screen. Select and load an index file (.RSI) created by the Real-Time Saving function.

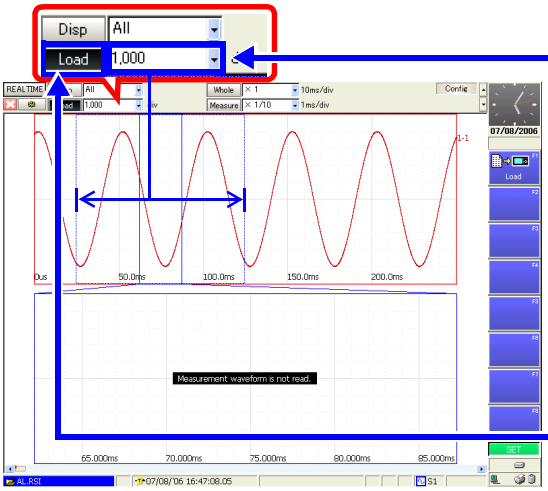
File Selection: ⌂ ▽ **CURSOR** keys
Loading: **F1** [Load] key (Page 1/3)→**F1** [Execute] key

See "11.4.3 Loading Waveform Data" (p. 295)



The selected file is loaded and the display shows the [All] setting display on the Waveform screen.

When first loaded, no measurement waveform is displayed at the bottom.

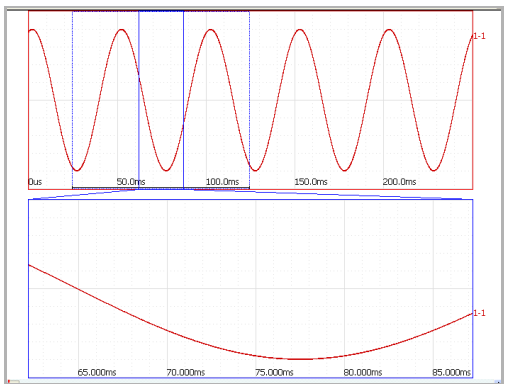


2 Move the cursor to the [Load] setting item, and set the number of divisions to load for the measurement waveform.

The (linked) dotted-line frame in the whole waveform changes.

3 With the SCROLL keys, select the loading location from the whole waveform at the top.

4 Move the cursor to the [Load] button and select F1 [Load].



The number of specified divisions of the measurement waveform is loaded.

9.4.2 Calculating

Data recorded with the Real-Time Saving function can be subjected to numerical value calculations, waveform calculations and FFT analysis. In all cases, load the index file (.RSI) created by the Real-Time Saving function, display (load) the measurement waveform area to be used for calculation, and select the desired function.

Performing numerical value and waveform calculations

1. With the Real-Time Saving function selected, load the measurement waveform area to be used for calculation from the whole waveform.
2. Switch to the Memory function.
3. Make the required calculation settings with the Memory function, and execute calculation.

See "Chapter 1 Numerical Calculation Functions", "Chapter 2 Waveform Calculation Functions" in the *Analysis and Communication Supplement*

NOTE

- When a calculation is executed, waveform data from the Real-Time Saving function is cleared, and data can be displayed only with the Memory function.
- Waveform calculations cannot be performed if the loaded recording length is greater than the maximum recording length allowed for calculation. Shorten the [Load] length setting, reload the data, and try calculating again.

Performing FFT waveform analysis

1. With the Real-Time Saving function selected, load the measurement waveform area to be used for calculation from the whole waveform.
2. Switch to the FFT function.
3. Set the [Reference] (source) data input selection to [From Mem], Make the required calculation settings, and execute FFT analysis.

See "3.4 Setting FFT Analysis Conditions" in the *Analysis and Communication Supplement*

Long-Term Monitoring and Instantaneous Recording Chapter 10

10.1 Overview of the REC&MEM Function

Using the REC&MEM function, during continuous recording at a normal (Recorder function) rate, anomalous phenomena can be captured by triggering and recorded with high-speed sampling (Memory function). Multiple anomalies can be recorded using the Memory Division function.
By switching to the Memory function after REC&MEM measurement is finished, numerical and waveform calculations can be applied to Memory waveforms.
Also, FFT analysis can be performed using the FFT function.

- Pressing the START key with the REC&MEM function selected causes Recorder waveform recording to start immediately, while Memory waveform recording occurs only when trigger criteria are satisfied.
- The Model 8958 16-Ch Scanner Unit is only usable for recording Recorder waveforms.

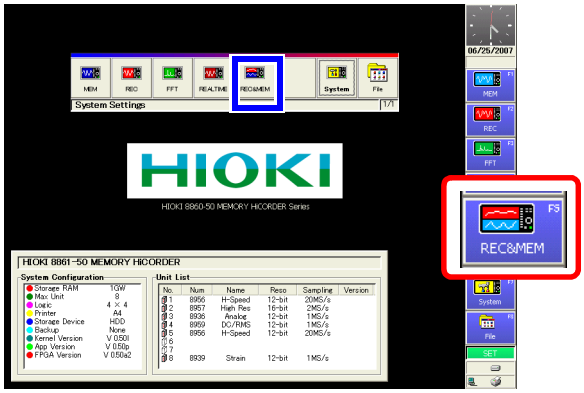
10.2 Setting and Analysis Workflow

Function Selection

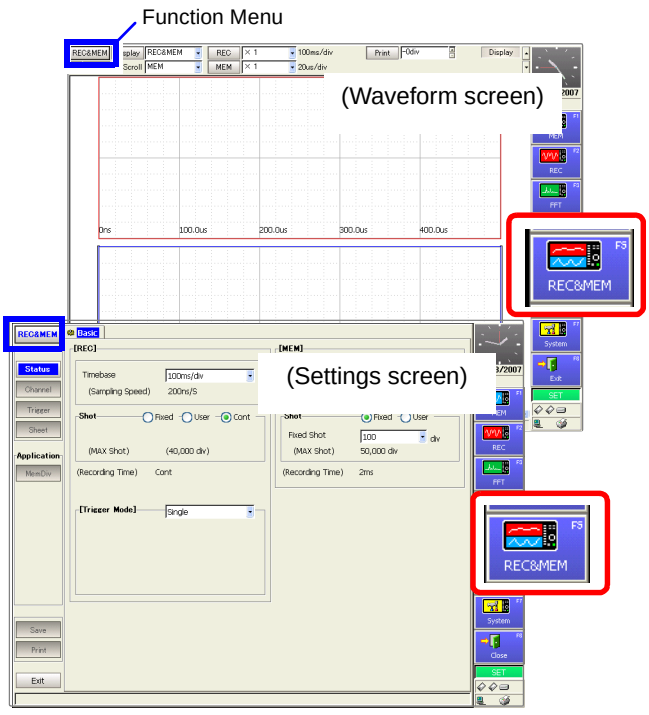
From the Initial screen:
Press the **F5 [REC&MEM]** key.

Select the REC&MEM function.

See: "Choosing the Appropriate Function" (p. 82)



From the Waveform or Settings screen:
Use the CURSOR keys to move the cursor to the function menu, and press the **F5 [REC&MEM]** key.



Measurement Configuration Settings

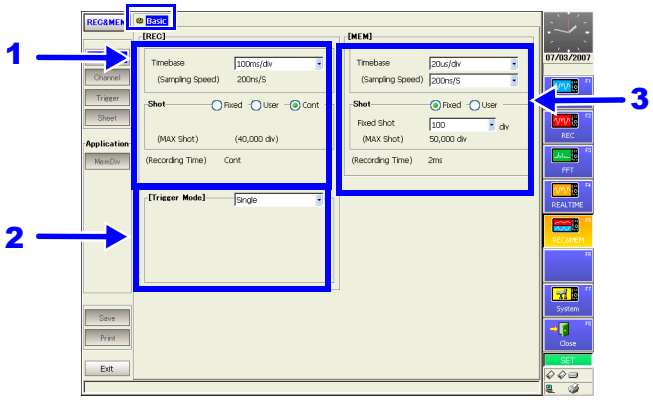
Press the SET key to open the Settings screen
Press the SUB MENU keys to select the Status menu

1 Recorder waveform settings
Set the timebase and recording length.

2 Trigger mode (recording criteria) setting
Select Simple, Continuous or Timer

3 Memory waveform settings
Set the timebase (sampling rate) and recording length.
The sampling rate is 1/100th of the timebase setting. The Recorder waveform sampling rate becomes the same.

Make settings on the Status Settings screen.



Input Channel Settings

Press the SUB MENU keys to select the Channel menu
Press the **SHEET/PAGE** keys to select the [One Ch] page

4 Select the Unit (module) and Channel

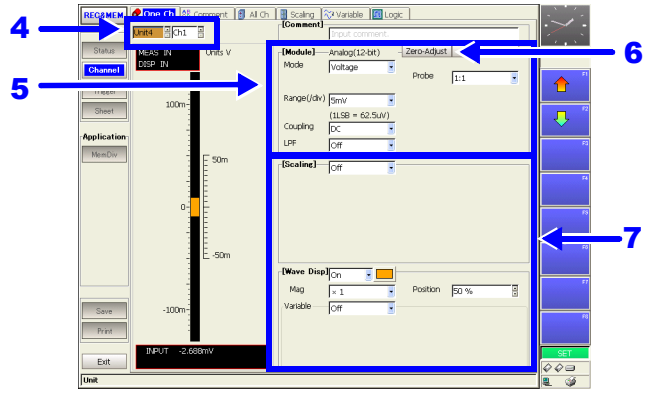
5 Select the measurement range (vertical axis) Make input-module-related settings

6 Perform zero adjustment

(after warm-up)

7 (As occasion demands) Set the scaling, waveform colors and zero position

Make settings on the Channel Settings screen.



See "Chapter 5 Input Channel Settings" (p. 115),
"7.1 Making Input Waveform Display Settings (Analog Waveforms)" (p. 170),
"Chapter 3 Input Channel Settings" in the Input Module Guide

Display Sheet Settings

Press the SUB MENU keys to select the [Sheet] menu

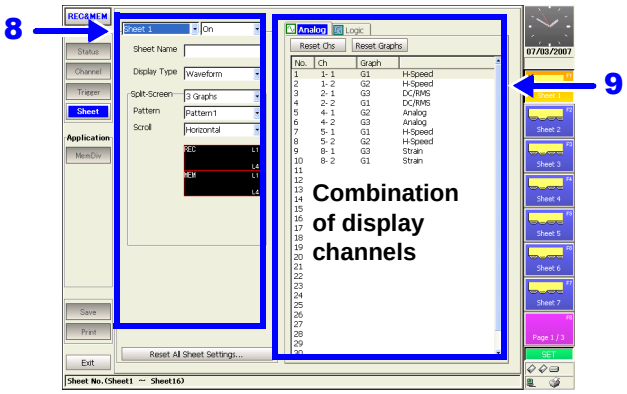
8 (As occasion demands)
Select the Screen Layout
Set the number screen divisions and the split-screen layout

9 Select the channels to display

Up to 32 channels can be displayed per sheet.

(If you want to change the layout of the waveform screen to show any combination of channels)

Set on the Sheet Settings screen.



See "Chapter 7 Waveform Display Settings" (p. 169)

Memory Division Settings
(As occasion demands)

Press the SUB MENU keys to select the [MemDiv] menu

See "4.3.4 Dividing Memory" (p. 109)

Saving Settings

Press the SUB MENUs key to select the [Save] menu

10 Select automatic or manual saving
Specify the saving destination

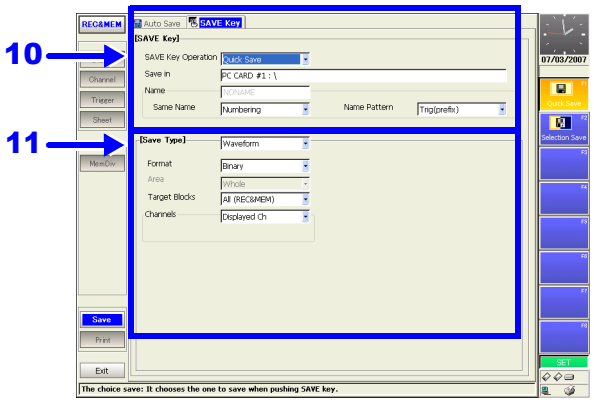
Verify that storage media has been inserted.
When saving manually, settings can be changed after measurement.

Default setting:
Auto Save [Off],
Manual Save [Selection Save]

11 Select what to save

(If you want to save data)

Set on the Save Settings screen.



See "Chapter 11 Saving/Loading Data & Managing Files" (p. 261)

Printing Settings

Press the SUB MENU keys to select the Print menu

Press the SHEET/PAGE keys to select the [Printer] page

12 Set manual printing

Verify that the paper is loaded correctly.

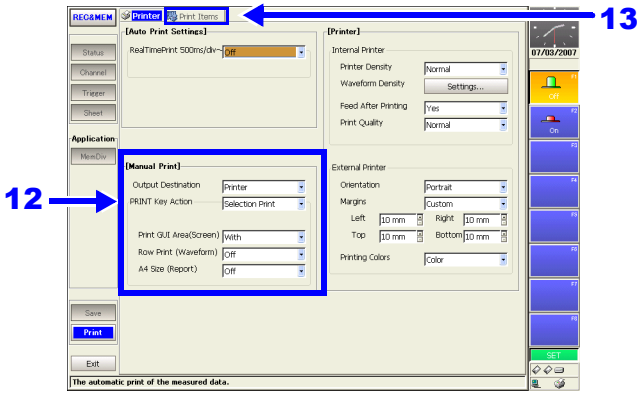
Default setting: Manual Print [Selection Print]

Press the SHEET/PAGE keys to select the [Print Items] page

13 Select what you want to print

(If you want to print data)

Set on the Print Settings screen.

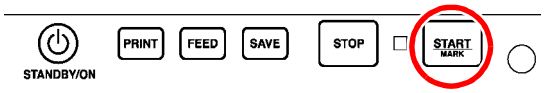


See "Chapter 12 Printing" (p. 313)

Start of Measurement

Data acquisition

Press the START key (the green LED lights).



End of Measurement

Press the STOP key.

Recording stops after acquiring the specified length (the green LED goes off)

Press twice to stop immediately.

When Memory waveform recording is in progress at the moment that Recorder waveform recording is stopped, it also stops.

Data Analysis

Analysis on the Waveform Screen

REC&MEM function

Analysis on the waveform screen.

See "Chapter 8 Waveform Screen Monitoring and Analysis" (p. 191)

Numerical calculation
Waveform calculation

Select the Memory function

FFT analysis

Select the FFT Function

Loading files

When measurement is finished, data remains in instrument memory. To display other data, load the index (R_M) file from the REC&MEM function.

- To perform numerical or waveform calculations, switch to the Memory function.
- To perform FFT analysis, switch to the FFT function.

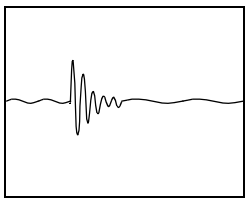
Executing a waveform calculation clears the waveform acquired by the REC&MEM function.

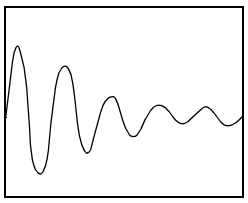
10.3 Analyzing Data

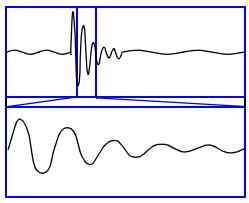
10.3.1 Waveform Viewing

Three types of waveform display are available with the REC&MEM function.

- Recorder waveform (the waveform recorded with the [REC] timebase set on the Status Settings screen)
- Memory waveform (the waveform recorded with the [MEM] timebase set on the Status Settings screen)
- REC&MEM waveform (the Recorder waveform is displayed at the top, and the Memory waveform at the bottom). When printing, the Memory waveform is printed.

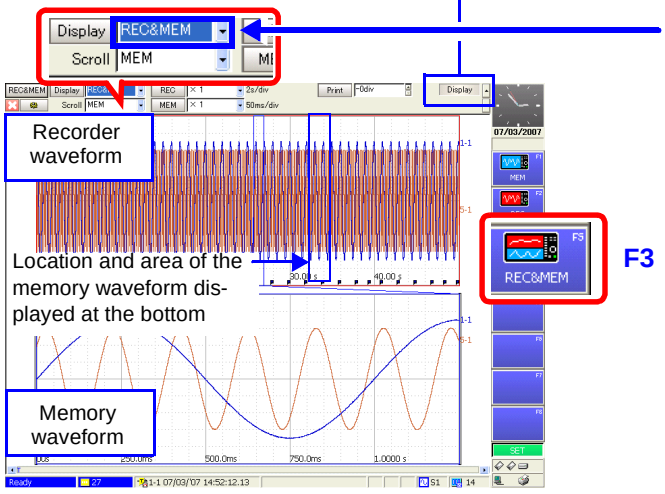

Recorder waveform


Memory waveform


REC&MEM waveform

To view previously saved data, load the index file (R_M) with the REC&MEM function.
Waveforms can be scrolled by the SCROLL keys, and can be magnified, compressed and measured with the A/B cursors.

Viewing waveforms during and after measurement



Using the SUB MENU key, select the [Display] setting item.

Move the cursor to the [Display] setting item and select F3 [REC&MEM].

The Recorder waveform is displayed at the top, and the Memory waveform at the bottom.

The measurement waveform can be scrolled with the SCROLL keys.

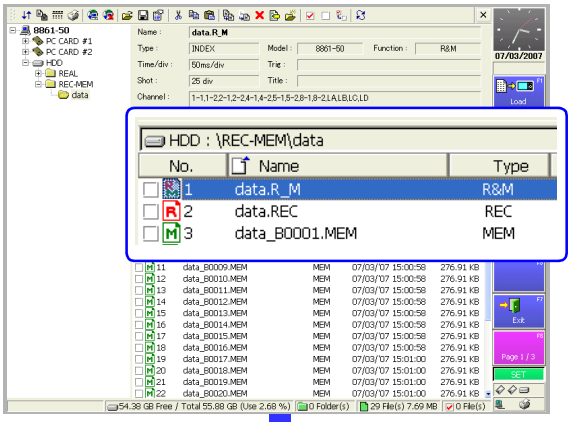
The waveform (Recorder or Memory) selected with the Scroll setting is scrolled.
Pressing Knob A of the A/B cursor control simultaneously switches the A/B cursors and the waveform scrolling selection between the displayed Recorder and Memory waveforms.

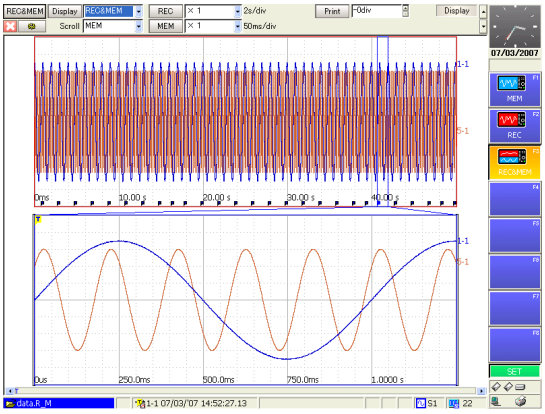
To view waveform data as numerical values

Waveform data can be displayed as numerical values. When the [Display] setting item is set to [REC&MEM], the numerical values is displayed instead of the measurement waveform.

See: "8.13 Viewing Waveform Data as Numerical Values" (p. 221)

Viewing Saved Waveform Data





1 **Press the FILE key to display the File screen.**

2 **Select and load an index file (.R_M) created by the REC&MEM function.**

File Selection: △▽ **CURSOR** keys
Loading: **F1** [Load] key (Page 1/3)→**F1** [Execute] key
See "11.4.3 Loading Waveform Data" (p. 295)

The selected file is loaded and the display shows the [REC&MEM] setting display on the Waveform screen.

10.3.2 Calculating

Data recorded with the REC&MEM function can be subjected to numerical value calculations, waveform calculations and FFT analysis. In all cases, load the index file (.R_M) created by the REC&MEM function, and select the desired function.

When Memory Division is enabled and multiple Memory waveforms are measured, the waveform to be subject to calculation is displayed before the function is switched.

Performing numerical value and waveform calculations

1. With the REC&MEM function selected, display the memory waveform to be used for calculation.
2. Switch to the Memory function.
3. Make the required calculation settings with the Memory function, and execute calculation.

See "Chapter 1 Numerical Calculation Functions", "Chapter 2 Waveform Calculation Functions" in the *Analysis and Communication Supplement*

NOTE When a calculation is executed, waveform data from the REC&MEM function is cleared, and data can be displayed only with the Memory function.

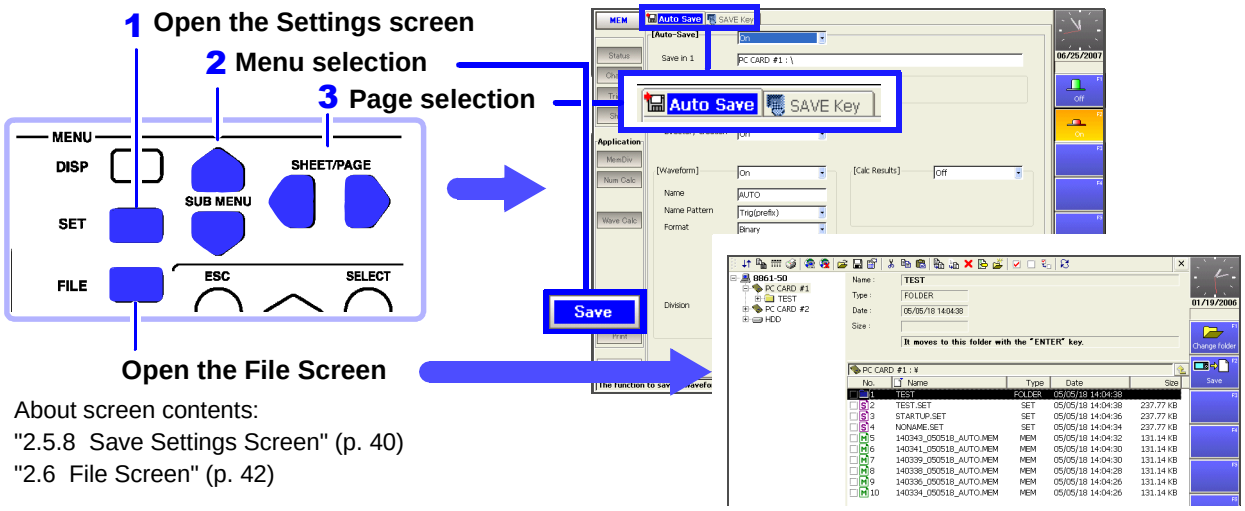
Performing FFT waveform analysis

1. With the REC&MEM function selected, display the memory waveform to be used for calculation.
2. Switch to the FFT function.
3. Set the [Reference] (source) data input selection to [From Mem], Make the required calculation settings, and execute FFT analysis.

See "3.4 Setting FFT Analysis Conditions" in the *Analysis and Communication Supplement*

Saving/Loading Data & Managing Files Chapter 11

Data can be saved and loaded and files can be managed.
Before saving data, configure the save settings on the Save Settings screen.
Load data and manage files from the File screen.



About screen contents:
"2.5.8 Save Settings Screen" (p. 40)
"2.6 File Screen" (p. 42)

Supported Storage Media

- PC card (p. 262)*1
- Hard disk (p. 263)*2
- USB disk (p. 263)(p. 269)
- Shared folder on a network (p. 264) *3

*1. For details on handling, refer to the *Quick Start Manual*.

*2. Optional drives are available.

*3. Requires configuration of the communication settings. ("Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*)

Loading Data & Managing Files (File Screen)

- Initializing storage media (p. 266)
- Loading (p. 291)
- Copying (p. 305), moving (p. 306), and deleting (p. 307)
- Renaming (p. 307)
- Creating new folders (p. 308)
- Sorting files (p. 309)
- Setting the files (p. 310) and items to display (p. 310)

Save Method (p. 273)

- Auto Save (saving during measurement)
- Selection Save (pressing the SAVE key after measurement, selecting the data to save, then saving)
- Quick Save (presetting the data to save enables saving upon pressing of the SAVE key)

Save Types

Save

Settings Data (p. 280)

Waveform Data

- Saving data automatically during measurement (p. 282)
- Selecting waveforms, then saving (SAVE key) (p. 285)

Display Screens (Screen Image)

- Saving data automatically during measurement (p. 287)
- Selecting screens, then saving (SAVE key) (p. 289)

Numerical Calculation Results

- Saving data automatically during measurement
- Calculating and saving after measurement (SAVE key)

"1.4 Saving Numerical Calculation Results" in the *Analysis and Communication Supplement*
File types (p. 267)

11.1 Storage Media

11.1.1 Using a PC Card

For details on handling PC cards, refer to "5.2 Using PC Cards" in the *Quick Start Manual*.

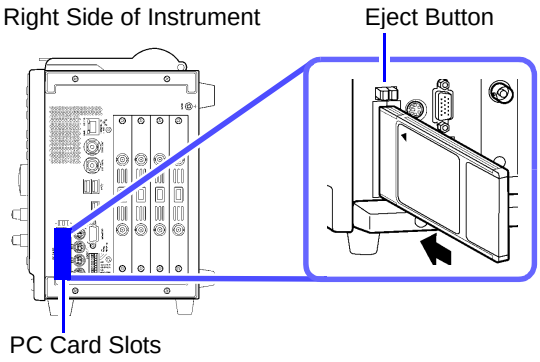
Before saving or loading data to/from a PC card, insert the PC card in the PC card slot on the right side of the instrument. (Two slots are available.)

Supported PC Cards

Hioki options PC cards (includes adapter)

- 9726 PC Card 128M
- 9727 PC Card 256M
- 9728 PC Card 512M
- 9729 PC Card 1G
- 9830 PC Card 2G

PC Card Insertion & Removal



Inserting a PC Card

With the surface with the arrow mark (▲) facing toward the front, fully insert the PC card in the direction of the arrow.

Removing a PC Card

Press the eject button. When the button pops out, press it again and remove the PC Card.

When a PC card is inserted, the name of the storage media appears on the File screen.

See "Storage Media Names" (p. 269)

To use the interface card, insert it into the PC CARD slot.

See "4.6 Using an Interface Card" in the *Analysis and Communication Supplement*

11.1.2 Using a Hard Disk

An optional 9718-50 HD Unit (optional built-in unit installed prior to shipment) is required to save or load data to/from a hard disk.

The capacity of the hard disk is 80GB. (1GB = 1,000,000,000 bytes)
The hard disk is initialized prior to shipment.

⚠CAUTION

- Do not turn the power off during hard disk operation (saving or loading). The data being saved or loaded may be damaged.
- Do not subject the hard disk to extreme shock or vibration. Doing so may damage the hard disk.
- Use the hard disk in an environment with a temperature of 5°C or above.
- Do not operate the instrument at a slanted angle. It may not work properly.

11.1.3 Using USB Memory Devices

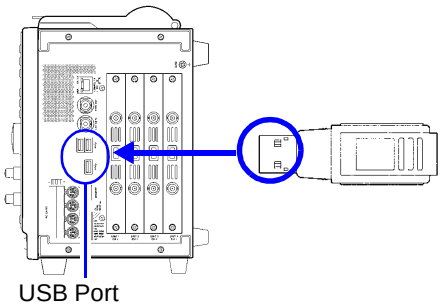
Data can be read and written to a USB memory device connected to the USB port.

⚠CAUTION

- After confirming proper connector orientation, connect it to the USB port. Attempting to force a connector with the wrong orientation may cause damage.
- Do not remove the USB memory device while it is in use. Data may become corrupted.
- Do not transport the instrument while a USB memory device is connected. Damage could result.
- Not all commonly available USB memory devices are supported.
- Some USB memory devices are sensitive to static electricity. Handle such devices carefully to minimize the possibility of device malfunction or damage due to electrostatic potential.
- Some USB memory devices, when installed, may prevent the instrument from turning on. In this case, insert the USB memory device only after turning the instrument on. Also, we recommend testing a memory device to verify that it can record waveforms before performing critical measurements.

USB Memory Device Insertion & Removal

Right Side of Instrument



Inserting a USB memory device
Confirm that the connector of the USB memory device is aligned with the USB port, and insert it all the way in.

Removing a USB memory device
Confirm that the instrument is not accessing (reading or writing) the USB memory device, then remove it.
(No particular instrument operation is required to remove a USB memory device.)

When a USB memory device is inserted, the name of the storage media appears on the File screen.

See "Storage Media Names" (p. 269)

11.1.4 Using a Network Shared Folder

If a shared folder of a PC connected to the network is registered on the File screen, data can be saved and loaded to/from the folder. Furthermore, you can perform file operations in the same way as if the files were on the instrument.

NOTE

The communication settings need to be configured to access a shared folder on a PC. Before configuring settings on the File screen, connect to the PC to be used.

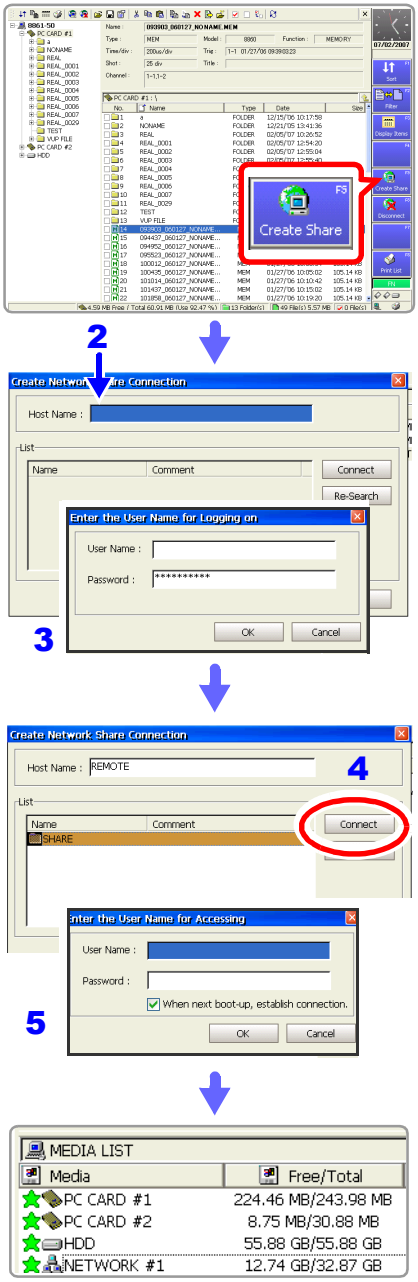
See "4.1 Connection Configurations" and "4.2 Controlling the Instrument over the LAN Interface" in the *Analysis and Communication Supplement*

Registering a Network Shared Folder

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

	Operating Key	Procedure
1		**Open the dialog box.**
	FUNCTION MODE	Switch to [FN] mode.
	F5	Select [Create Share]. The [Create Network Share Connection] dialog box appears.
2		**Enter the computer name of the PC to which to connect.**
	CURSOR F1 to F8	Move the cursor to [Host Name] and enter a computer name of PC. **When OS of the computer to share is Windows7 or later.** Move the cursor to [Host Name] and enter { \\ [computer name of PC] \ [shared folder name] } e.g. computer name of PC is "AAAA" and shared folder name is "share". [Host Name]: \\AAAA\share See "Entering Text and Comments" (p. 66) After input, a dialog box appears.
3		**Enter the user name and password for logging on to the PC (if security has been set).**
	CURSOR	Move the cursor to and enter the information for each of [User Name] and [Password].
	F1 to F8	Select the [OK] button. The names of the shared folder on the PC appears in the share list.
4		**Connect to the shared folder.**
	CURSOR F1	Move the cursor to the folder you want to share from the share list and select the [Connect] button. A dialog box appears.
5		**Enter the user name and password for accessing the shared folder (if security has been set).**
	CURSOR	Move the cursor to and enter the information for each of [User Name] and [Password].
	F1 to F8	Select the [OK] button. Select the [Close] button. When a connection is successfully established, the storage media name (Network #1, etc.) appears in the File screen.

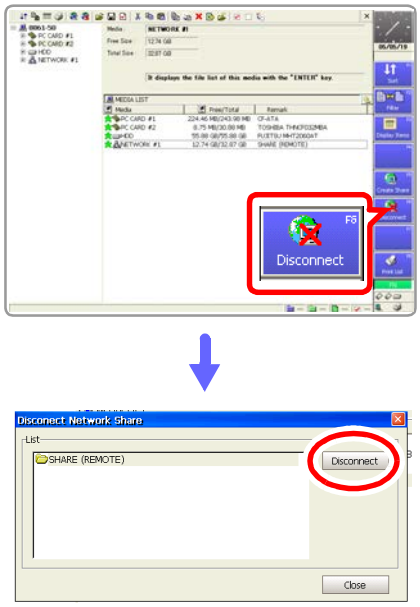


Canceling Shared Folder Registration

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

	Operating Key	Procedure
1	**FUNCTION MODE**	Switch to [FN] mode.
2	**F6**	Select [Disconnect]. The [Disconnect Network Share] dialog box appears.
3	**CURSOR** **F1**	Select the folder you want to disconnect from the list and select [Disconnect]. The shared folder registration on the instrument is canceled. The storage media name is deleted from the File screen.



NOTE

The PC for Sharing Folders with the Instrument

- Folder space information (free space and total space) cannot be obtained from some operating systems. (Windows 95, 98, ME, etc.)
  If this information cannot be obtained, data can not be saved when the amount of free space of the save destination becomes low even if [Delete Save] is set as the save method and automatic saving is performed (p. 276). (An error is displayed.)
  With the Real-Time Saving function, if the amount of free space in a shared folder cannot be acquired, that folder cannot be specified as a save destination.
- [Enable NetBIOS over TCP/IP] of [Network Connections] needs to be selected on the PC that will share the folder. For details, contact your network administrator.
- If the PC sharing the folder is on a different network from that of the instrument (in a location on the other side of a gateway), set the WINS setting to [On] and specify the IP address of the WINS server in the communication settings.

  See "4.2.2 Making Settings on the Instrument" in the *Analysis and Communication Supplement*

11.1.5 Initializing (Formatting) Storage Media

Storage Media the Instrument is Capable of Initializing and Formats

Storage Media	Format
PC Card	MS-DOS Format
Hard Disk	MS-DOS Format (FAT32)

NOTE

- Write protected storage media cannot be initialized.
- Note that initializing used storage media deletes all the information on the storage media and that deleted information is unrecoverable.

Initializing Storage Media

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

Operating Key Procedure

1 Insert the storage media.

See "11.1 Storage Media" (p. 262)

2 Select the storage media to initialize.

SHEET/PAGE Move the cursor to the media list.

CURSOR Select the storage media from the media list.

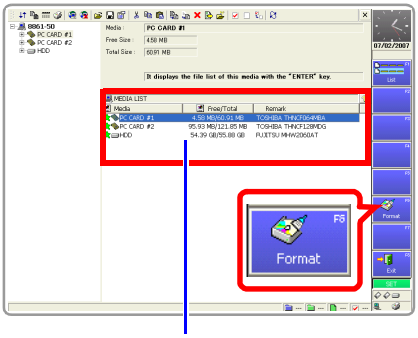
See "Storage Media Names" (p. 269)

3 Initialize the storage media.

F6 Select [Format].
A confirmation dialog box appears.

F1 Select [Execute].

To cancel initializing
Select **F2** [Cancel].



MEDIA LIST

If [MEDIA LIST] does not appear in the file list, press the **ESC** key to display the media list.

11.2 Data Capable of Being Saved & Loaded

Data the Instrument Can Save & Load

"O" = Possible, "–" = Not Possible

File Type	File Format	Indication	File Extension & Description		Save		Load	PC Readable
					Auto	Manual		
Settings Data*1	Binary		SET	Settings data (Measurement Configuration)	–	O	O	–*5
Waveform Data*2 Whole of the waveform acquired by the instrument or a section of the waveform specified with the A and B cursors.	Binary		MEM	Memory Function waveform data and Memory waveform data acquired with the REC&MEM Function	O	O	O	–*5,*6
			REC	Recorder Function Waveform Data and Recorder waveform data acquired with the REC&MEM Function	O	O	O	–*5,*6
			RSM	Sampled waveform data from the Real-Time Saving function	O	–	O	–
			RSR	Whole waveform data from the Real-Time Saving function	O	–	O	–
			FFT	FFT Function data	O	O	O	–*5
	Text		TXT	Text Data	O	O	–	O
Waveform Management Data (Memory Division*3, Divided Saving, and when Real-Time Saving is selected)	(Index file)		IND	Index data for divided saving	O	O	O	–*5
			SEQ	Index data for memory division (created automatically for batch saving)	O	O	O	–*5
			RSI	Index data for the Real-Time Saving Function	O	–	O	–
			R_M	Index data for the REC&MEM function	O	O	O	–
Numerical Calculation Results	Text		TXT	Text Data	O	O	–	O
Captured Screen Image*4	BMP		BMP	Image Data	O	O	–	O
	PNG		PNG	Image Data	O	O	–	O
Event Mark List	Text		TXT	Text Data	–	O	–	O

*1. Settings data can be loaded automatically at power-on (Auto Setup function) (p. 296).

*2. **When the data is to be reloaded on the instrument**, save it in binary format. Waveforms and some measurement settings are saved.
When the data is to be loaded on a PC, save it in text format.
When saving a section of a waveform, use the A and B cursors to set the section (p. 202).

*3. **To load all blocks at once when memory division is enabled**:
Save using the [All Blocks] selection. A directory is created automatically, and files for the waveform data of each block and the SEQ index file are created. This index file is used for reloading.
To reload waveform data saved with the Divided Saving function, load the IDX index file.
To load measurement data created by the Real-Time Saving function: Load the RSI index file.
To load measurement data created by the REC&MEM function: Load the R_M index file.

*4. **BMP Format**: This is a standard Windows graphics format. File in this format can be handled by many graphics programs.
PNG Format: This image file format has been internationally standardized as ISO/IEC15948.

*5. Loading is possible when using the optional Model 9725 Memory HiViewer.

*6. Loading is possible with the Waveform Viewer (Wv).

CAUTION

If a warning message appears during saving because of insufficient space on the storage media, be sure to press the STOP key to stop measurement before replacing the storage media. If the storage media is removed during measurement, the data may be damaged.

(If the storage media specified for **[Save in 1]** becomes full during automatic saving, the instrument can continue saving data to the storage media selected for **[Save in 2]**.)

See "Set the save method for the secondary save destination." (p. 276)

Data Saving Rate

The saving rate varies depending on factors such as the communication conditions.

Saving Rate for Binary Format (Reference Value)

Storage Media	Saving Rate
Hard Disk (Built-in)	1.2 MB/s
PC Card	550 KB/s
LAN (Transfer to Shared Folder)	900 KB/s

File Sizes

Data Type	Size
Settings Data	386 KB
Measurement Data	**See** "Appendix 2.2 Waveform File Sizes" (p. A22)
Screen Image Data	BMP Color: Approximately 938 KB, BMP Compressed Color: Approximately 100 KB, BMP Grayscale: Approximately 100 KB, PNG: Approximately 50 KB

NOTE

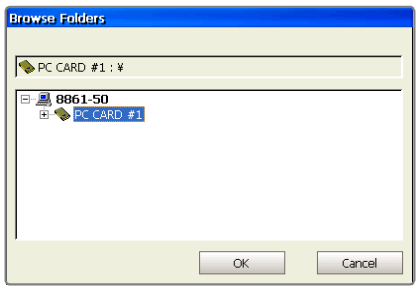
- Files larger than 2 GB cannot be saved. In this case, specify a range to save using the A/B cursors, and perform a partial save or divided save so that the file size is smaller than 2 GB.
- The file sizes of BMP compressed color and PNG formats may vary greatly depending on the images.
- The size of setting data files may be subject to change by version updates.

Specifying Storage Media & Files

Specifying the Save Destination

Specify the save destination in the [Browse Folders] dialog box.
This dialog box is displayed by selecting **F1** [Edit] from the item for specifying the [Save in] on the Save Settings screen, etc.

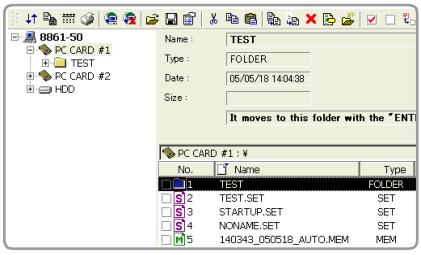
See "11.3.3 Specifying the Save Destination" (p. 275)



Loading Data or Managing Files of Storage Media

Press the **FILE** key and select a storage media or file from the list on the File screen.

See "11.4 Loading Data" (p. 291)



Storage Media Names

Storage Media	Storage Media Name Displayed on the Instrument
Hard Disk (Built-in)	HDD
PC Card (PC Card Slot) *1	PC CARD #1, PC CARD #2
USB Disk *1,*2	USB DISK #1, USB DISK #2, ... USB DISK #5
Network Share *3	NETWORK #1, NETWORK #2, ... NETWORK #10

*1. Displayed when a storage media is inserted.

*2. When multiple USB disks are used via a hub connected to the USB port, a number is added to each name to indicate the order in which the storage media was inserted.
Be careful when saving data because the number may change if storage media is removed or the power is turned off and then on during saving.
When using a USB memory device, no particular instrument operation is required for removal.

*3. Displayed when connected to a shared folder of a PC on the network. Be careful when saving data because the number may change if the power is turned off and then on.

See"Using a Network Shared Folder" (p. 264)

File Names

Up to 5,000 files can be saved to one folder.
Up to 40 characters can be used for the save name.

When automatically saving waveforms and displayed images, serial numbers or trigger date and time can be appended to the saved file names ([Name Pattern] setting).

Auto Save File Names

The default save names are set according to save types such as waveforms (Auto), numerical calculations (MEAS) and images (IMAGE). A save name can be changed to any name.

Manual Save File Names

Any name can be entered for a save name. If the data is saved without entering a name, it is saved automatically under the file name “NONAME.”

If the [Same Name] setting for save names is [Numbering] (the default setting), then when a duplicate file name exists, a serial number is automatically added to the save name. When [Overwrite] is enabled, the existing file is overwritten.
In addition, if the last character of the saved file name is a number, serial numbering begins from that number.

Batch saving Memory Division data (Auto and Manual save)

When waveform data in multiple blocks is saved as a batch using the Memory Division function, block numbers of the form "_B0001" are added to each file name.

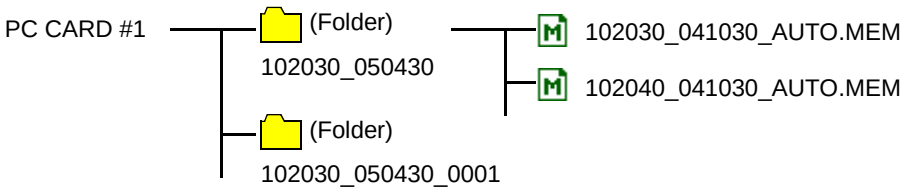
Data types and file naming

(when the save name is [TEST])

Data Type	Auto Save	Manual Save
Waveform	According to the [Name Pattern] setting, a serial number or trigger date and time are automatically added to the save name.	
	[Numbering] (save name + four-digit serial number) TEST.MEM, TEST0001.MEM, TEST0002, ...	[Off] (serial numbers are appended when the [Same Name] (duplicate file name handling) setting is [Numbering]) TEST.MEM, TEST0001.MEM, TEST0002, ...
	[Trig (prefix)] (Time_Date_Save Name) 102030_041030_TEST.MEM [Trig (suffix)] (Save Name_Date_Time) TEST_102030_041030.MEM (shown for a file containing data from a trigger event that occurred at 10:20:30 on October 30, 2004)	
Numerical Calculations	Serial numbers beginning with "0001" are appended at the end of the file name. When the save file name ends with a number, sequential numbers are appended by incrementing that number. (save name+0001, 0002,... four-digit serial number) TEST, TEST00001, TEST0002,... (when the save name ends with a number) TEST1, TEST2, TEST3,...	
Screens	same as for Auto Save of waveforms	same as for numerical calculations
Settings	_____	same as for numerical calculations

Folder Names for Auto Save

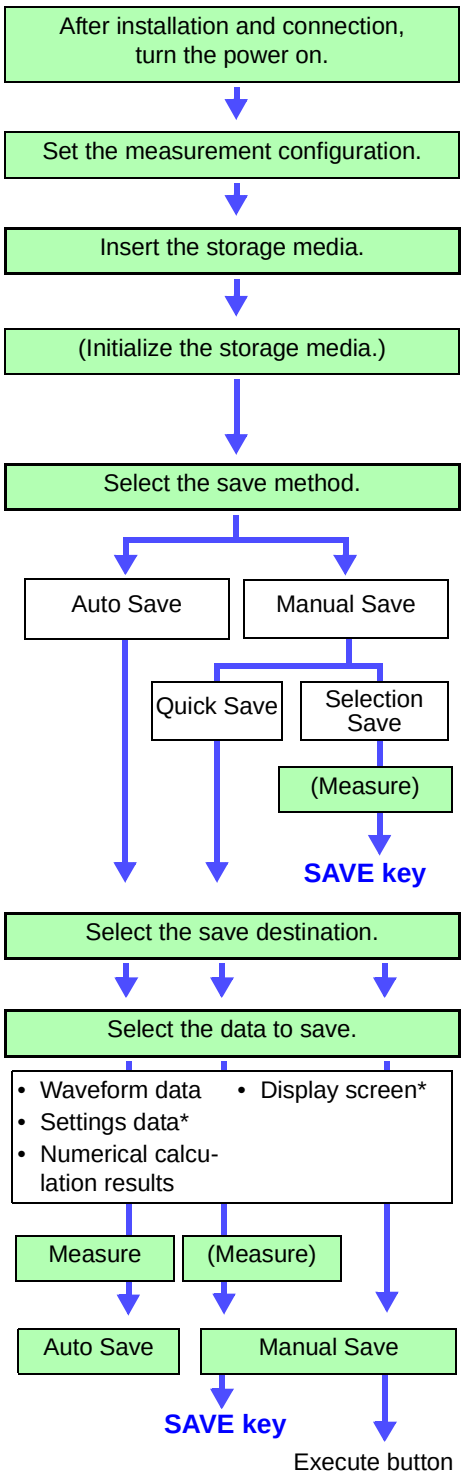
The total number of folders and files that can be stored in one folder is 5,000. When this number is exceeded, a new folder is created automatically.
The time and date (Time_Date) when the folder was created is set automatically as the folder name. However, a folder is not created when the [Directory Creation] setting is set to [Off] while saving data to the topmost directory (root directory) of the storage media.



See "11.3.4 Setting Auto Save" (p. 276)

11.3 Saving Data

11.3.1 Save Sequence



Measurement Preparations

See "Chapter 3 Measurement Preparations" in the *Quick Start Manual*

Set the measurement configuration on each settings screen ([Status], [Channel], [Trigger] menu).

Before inserting the storage media, make sure write protection is disabled.

See "11.1 Storage Media" (p. 262)

When using unformatted storage media, initialize the storage media from the File screen.

See "11.1.5 Initializing (Formatting) Storage Media" (p. 266)

Configure the settings on the Save Settings screen ([Save] menu).

See "11.3.2 Save Methods" (p. 273)

Select whether to save data automatically during measurement or set the data to save and perform manual saving (SAVE key) after measurement.

- When saving automatically: [Auto Save] page (p. 276)
- When saving manually: [SAVE key] page (p. 278)
  With [Selection Save], the data is saved after selecting the save destination and the data to save in the dialog box that appears upon pressing the **SAVE** key.
  With [Quick Save], the data is saved upon pressing the **SAVE** key if the data to save is preset in the Settings screen.
  Settings data can be saved regardless of whether measurement has not begun or has ended.

Make sure the storage media has been inserted in the instrument.

Select the storage media and save destination in the dialog box. (p. 275)

Set the data to save such as waveforms, numerical calculations, and screens.

The data that can be saved differs depending on whether automatic saving or manual saving is performed.

See "Data Capable of Being Saved" (p. 273))

(*: Manual saving only)

For auto save, make sure the auto save setting is set to On before beginning measurement.

Auto Save

The data is saved before and after measurement.

To stop saving, press the **STOP** key. Measurement also ends at the same time.

Manual Save

Quick Save:The data is saved upon pressing the **SAVE** key.

Selection Save:The data is saved after setting the data to save and performing the save operation in the dialog box that appears upon pressing the **SAVE** key.

11.3.2 Save Methods

Save Methods

Methods for saving data can be roughly divided into two.

Auto Save **(p. 276)**	Saves the data automatically to the storage media after acquiring measurement data for the specified recording length. Various types of data can be saved simultaneously. Before measurement, set the save destination and the data to save.
Manual Save (Saving with the SAVE key) **(p. 278)**	Press the **SAVE** key and save specified data. There are two save method types. • **Quick Save** Before pressing the **SAVE** key, preset the data to save. The data is saved upon pressing the **SAVE** key. This allows you to save specific data quickly whenever you want. • **Selection Save** After you press the **SAVE** key, set the data to save in the dialog box and then save the data. Different data can be selected and saved each time.

NOTE

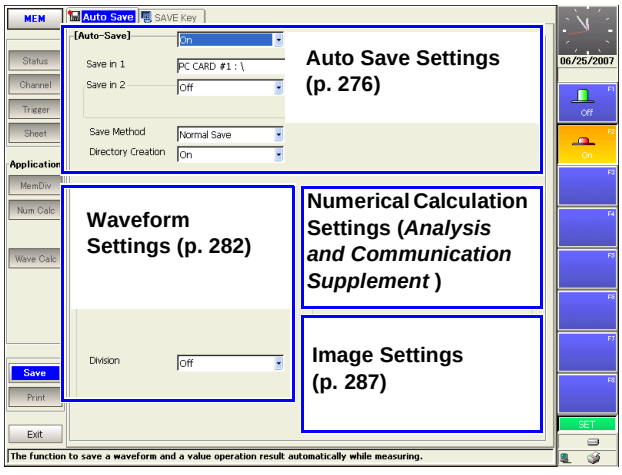
Files larger than 2 GB cannot be saved. In this case, specify a range to save using the A/B cursors, and perform a partial save or divided save so that the file size is smaller than 2 GB.

Data Capable of Being Saved

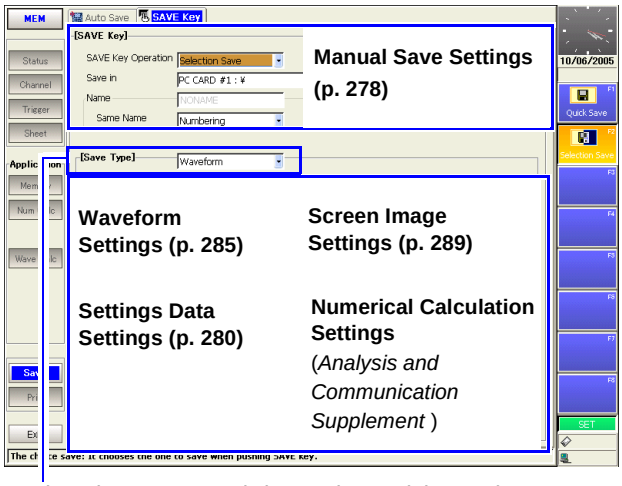
Save Data		Auto Save	Manual Save
Waveform Data	Save waveform data. (whole of waveform, section of waveform)	(p. 282)	(p. 285)
Settings Data	Save measurement configurations and other settings made on the Settings screen.	_____	(p. 280)
Numerical Calculation Results	Saves numerical calculation results.	"1.4 Saving Numerical Calculation Results" in the *Analysis and Communication Supplement*	
Screen Image	Save a copy of the screen.	(p. 287)	(p. 289)

Set the save method on the Save Settings screen.

Auto Save: [Auto Save] page



Manual Save: [SAVE Key] page



Select the save type (when using Quick Save)

To divide waveform data for saving: Divided Save

(valid only for saving in binary format)
When the file size is likely to be large such as when the recording length is long, dividing the data into multiple files can facilitate later searching through waveforms.
The data is divided and saved after each specified recording length. The recording length for saving by Auto Save or by the SAVE key is set by the [Division] item on the Settings screen.

See "11.3.7 Automatically Saving Waveforms" (p. 282),
"11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (p. 285)

When using Divided Save, a new directory is created for the waveform data and index file (IDX). The index file enables batch loading of the data. (p. 295)

When manual saving with Memory Division enabled, and the [Target Blocks] setting is [All Blocks], Divided Save is not available.

To save selected memory blocks from a recorded waveform

(only when manual saving using Memory Division)
When the Memory Division function (p. 109) is enabled and waveforms are recorded to individual blocks, you can select whether to save only displayed blocks or all used blocks.

See "11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (p. 285)

11.3.3 Specifying the Save Destination

Set the save destination in the [Save in] item on each page of the Save Settings screen.

NOTE

Before Specifying the Save Destination

Make sure the storage media has been inserted.
If the storage media has not been inserted, its name does not appear in the save destination list.

Save Destination Settings

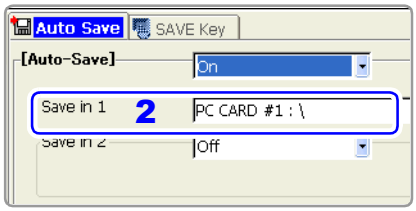
MEM REC REC&MEM FFT

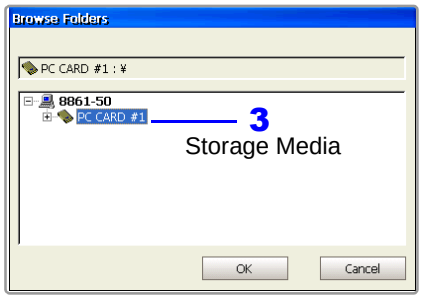
To open the screen: Press the **SET** key → Select Save with the **SUB MENU** keys →Save Settings screen

See Screen Layout (p. 40)

	Operating Key	Procedure
1		**Select the save method.**
	SHEET/PAGE	Select the [Auto Save] or [SAVE Key] page.
2		**Open the dialog box for specifying the save destination.**
	CURSOR	Move the cursor to the [Save in] item.
	F1	Select [Edit]. The [Browse Folders] dialog box appears.
3		**Specify the save destination.**
	CURSOR	Move the cursor to the save destination of the storage media. Select the storage media: ⌂ ▽ **CURSOR** Open the layer below: ▷ **CURSOR**
	F1	Select [OK].
		To cancel setting Select **F2** [Cancel]. The dialog box closes.

(When [Auto Save] page)





See "Storage Media Names" (p. 269)

NOTE

When using storage media formatted in FAT16:

There is a limit to the number of files that can be saved to the root directory (the topmost directory). Although the maximum number of files is 512, the number of files that can actually be saved differs depending on the storage media and the length of each file name. When saving many files, create a folder and save the files in the folder.

See "11.7.5 Creating New Folders" (p. 308)

When saving automatically, folders can be created automatically if [Directory Creation] is set to [On].

See "11.3.4 Setting Auto Save" (p. 276)

11.3.4 Setting Auto Save

This setting enables waveforms, numerical calculation results and screen images to be saved automatically during measurement. Both can be saved simultaneously.

Auto Save Settings

MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select Save with the **SUB MENU** keys →Save Settings screen

See Screen Layout (p. 40)

Operating Key Procedure

1 Enable auto save.

SHEET/PAGE Select the [Auto Save] page.

CURSOR Move the cursor to the [Auto Save] item.

F2 Select [On]. Default setting: Off (automatic saving is not performed)

2 Set the save destination.

CURSOR Move the cursor to the [Save in 1] item.

F1 Select the save destination (p. 275).

3 Set the save method for the secondary save destination.

CURSOR Move the cursor to the [Save in 2] item.

F1 to F8 Select either choice.

Off	The data is not saved.
Save on Error	The data is saved to the secondary save destination when saving to the primary save destination is unsuccessful because of an error.
Always Save	The same data is also saved to the secondary save destination.

When other than OFF is selected, select a save destination (p. 275).

4 Set the save method for when the storage media runs out of space.

CURSOR Move the cursor to the [Save Method] item.

F1 to F8 Select either choice.

Normal Save	Automatic saving stops when the storage media becomes full.
Delete Save	Old files are deleted and automatic saving is performed when the storage media becomes full. (Waveform files only.) The [Directory Creation] setting is set automatically to [On].

5 Set whether to create directories (folders).

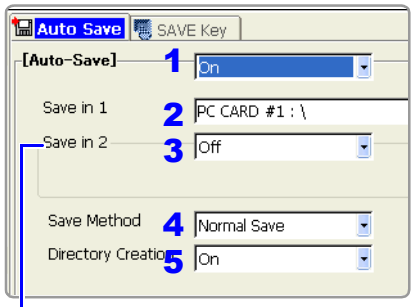
CURSOR Move the cursor to the [Directory Creation] item.

F1 to F8 Select either choice.

Off	A folder is not created when measurement starts.
On	A folder is created automatically when measurement starts and files are saved in the folder.

6 Set the data to save.

Saving waveforms (p. 282), Saving numerical calculation results (*Analysis and Communication Supplement*), Saving screen images (p. 287)



If for some reason data cannot be saved to the save destination specified for [Save in 1], the data can be saved to the save destination specified for [Save in 2].

Set the following when you want data to be saved to the secondary save destination if the primary save destination becomes full or when you want to save data for a long period of time.

Specify save destinations for [Save in 1] and [Save in 2].
Save in 2: [Save on Error]
Save method: [Normal Save]
Directory Creation: [On]
Configuring the settings as shown above enables saving without having to stop for reasons such as insufficient file capacity.

For examples of operation during saving (p. 277)

Maximum number of files that can be saved to a directory

Up to 5,000 files can be saved to one folder (directory).
"When the maximum number of files that can be saved is exceeded:" (p. 277)

When [Directory Creation] is set to [On], a folder cannot be created in the following cases.

- When saving only numerical calculation results
- When saving one file with the [Single] trigger mode
- When saving numerical calculation results and one other file with the [Single] trigger mode

For details on folder names

"Folder Names for Auto Save" (p. 271)

Description

When the maximum number of files that can be saved is exceeded:

Maximum number of files

- When saving to folders, up to 5,000 files can be saved in one folder.
- When saving to the topmost directory (root directory) of the storage media, up to 512 files can normally be saved if the storage media (PC card) is formatted in FAT16 and up to 5,000 files can normally be saved if the storage media (hard disk drive or large capacity PC card) is formatted in FAT32.

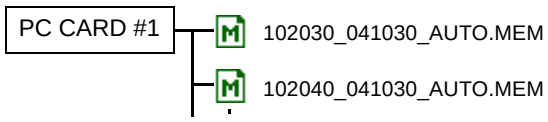
The save operation differs depending on the [Directory Creation] settings.

- When [Directory Creation] is set to [On] and the number of files exceeds 5,000, a new folder is created and files are stored in that folder.
- When [Directory Creation] is set to [Off], a folder was specified for the save destination, and the number of files exceeds 5,000, a new folder is created. However, if only the storage media name was specified for the save destination (when saving to the root directory, the topmost directory), a folder is not created.

Auto Save Operations

Example 1: Saving Files to the Topmost Directory of the Storage Media

Save in: PC Card #1
Save method: Normal Save
Directory Creation: Off



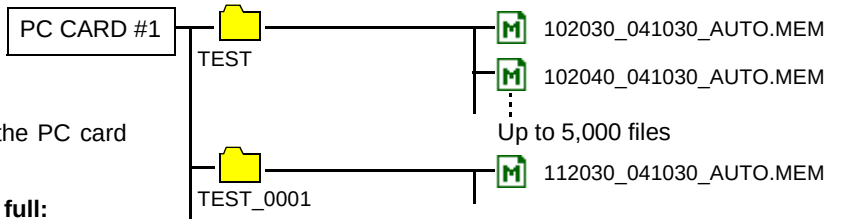
Up to 512 files or 5,000 files (refer to the section above on the maximum number of files)

When the storage media becomes full:
Automatic saving stops.

When the maximum number of files that can be saved in PC Card #1 is reached, an error is generated and automatic saving stops even if there is still available space remaining on the storage media. Measurement continues.

Example 2: Saving Files to a Folder on Storage Media

Save in: PC Card #1 \TEST
Save method: Normal Save
Directory Creation: Off
(Create a folder named “TEST” on the PC card beforehand.)

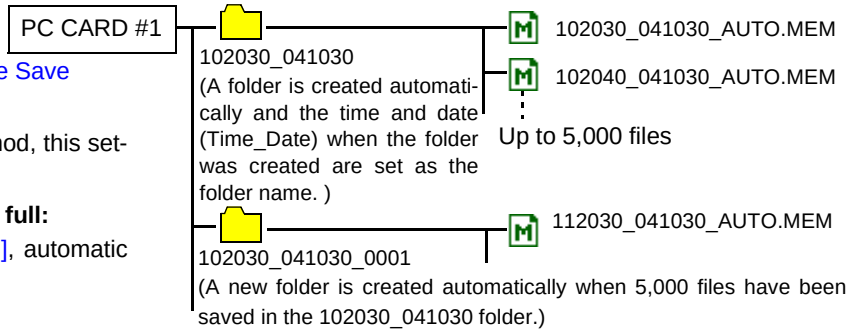


(A new folder is created automatically when 5,000 files have been saved in the TEST folder.)

When the storage media becomes full:
Automatic saving stops.

Example 3: Automatically Creating a Folder on Storage Media & Saving Files

Save in: PC Card #1
Save method: Normal Save or Delete Save
Directory Creation: On
(When Delete Save is the save method, this setting is set automatically to On)



(A new folder is created automatically when 5,000 files have been saved in the 102030_041030 folder.)

When the storage media becomes full:
If the save method is [Normal Save], automatic saving stops.

If the save method is [Delete Save], files in the 102030_041030 folder are deleted in order from the oldest to create free space on the storage media while new files are being saved. Once all the files in the 102030_041030 folder have been deleted, files in the 102030_041030_0001 folder, the next oldest folder, are deleted in order.

11.3.5 Setting Manual Save (SAVE Key Output)

Enables data acquired during measurement and existing data to be saved by pressing the **SAVE** key. Any of the following data can be saved.
Settings data, waveform data, numerical calculation results, and display screens

Manual Save Settings

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Save] with the **SUB MENU** keys →Save Settings screen

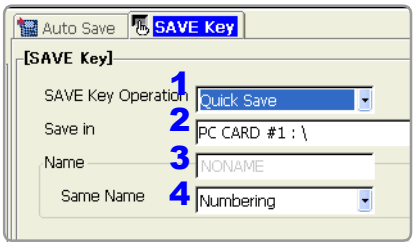
See Screen Layout (p. 40)

Operating Key Procedure

1 Set the save method for when the SAVE key is pressed.

SHEET/PAGE Select the [SAVE Key] page.
CURSOR Move the cursor to the [SAVE Key Operation] item.
F1 to F8 Select either choice.

Quick Save	The preset data is saved upon pressing the SAVE key.
Selection Save	After pressing the SAVE key, set the data to save in the dialog box, then save the data (default setting).



When [Selection Save] is set, the settings can be configured in the [Save] dialog box that appears upon pressing the SAVE key.

2 Set the save destination.

CURSOR Move the cursor to the [Save in] item.
F1 Select the save destination (p. 275).

3 Set the save name.

CURSOR Move the cursor to the [Name] item.
F1 to F8 Enter the save name.
See "Entering Text and Comments" (p. 66)

The maximum number of characters for the save name is 40.
When saving a file in text format, note that a PC will not be able to handle the following characters if they are used.

- ASCII:
  + = [ ] \ / | : * ? " < > ; ,
- White space characters

4 Select the save method for files with the same name.

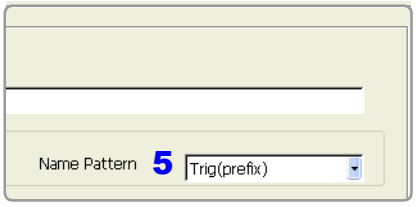
CURSOR Move the cursor to the [Same Name] item.
F1 to F8 Select either choice.

Numbering	1 The save name is used as the file name when the SAVE key is first pressed. 2 Subsequently, numbers are appended automatically to the save name to prevent the duplication of file names. (Single-byte number up to four digits long)
Overwrite	Existing duplicate file names are overwritten.

Suffix Auto-Numbering
Up to 5,000 files can be saved to one folder.
If the last character of the file name is a single-byte numerical character, files are saved with sequential numbers starting from that numerical character.
"Manual Save File Names" (p. 270)

Operating Key Procedure

5 Select the contents (Name Pattern) to be automatically added to the save name
(only when saving waveform data)



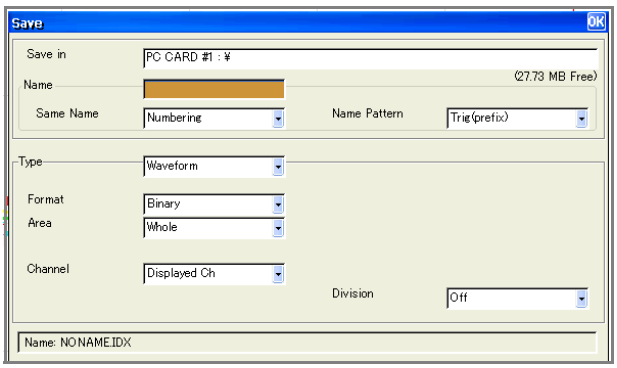
CURSOR Move the cursor to the [Name Pattern] item.

F1 to F8 Select the contents to be automatically added to the save name.

Numbering	Appends serial numbers beginning with 0001 as a suffix to the save name.
Trig (suffix)	Appends the trigger date and time as a suffix to the save name.
Trig (prefix)	Appends the trigger date and time as a prefix to the save name. (default setting)

6 Set the data to save.

Saving waveform data (p. 285)
Saving settings data (p. 280)
Saving display screens (p. 289)
Saving numerical calculation results (*Analysis and Communication Supplement*)



When the SAVE key is set to [Selection Save]
Dialog displayed when the SAVE key is pressed

11.3.6 Saving Settings Data

Settings such as measurement configurations can be saved to storage media by pressing the **SAVE** key.
In addition, multiple instrument setting states ("settings data") can be stored in internal instrument memory and reloaded.
Settings data can be loaded automatically at power-on (Auto Setup function) (p. 296).

Saving Settings Data: Saving to Storage Media

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Save] with the **SUB MENU** keys →Save Settings screen

See Screen Layout (p. 40)

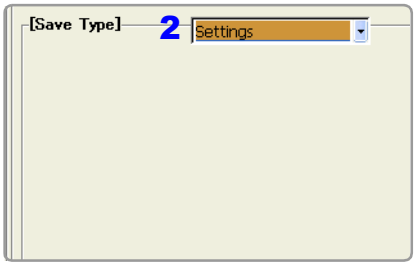
	Operating Key	Procedure
1		**Set manual save (p. 278).** Set the save destination.
2		**Select the save type.**
↓	**CURSOR**	Move the cursor to the [Save Type] item.
↓	**F1**	Select [Settings].

Press the SAVE key after setting the measurement configuration to save.

The settings data that was set is saved to the specified storage media upon pressing the key.

See "11.6 Examples of Saving Data: Reading Data on a PC" (p. 298)

[SAVE Key] Page



The data of all settings configured in the Settings screen can be saved.
(However, the communication settings cannot be read. If the communication settings are required, save or print the display screen.)

See
"11.3.10 Optionally Selecting Display Screens & Saving (SAVE Key)" (p. 289)
"12.4 Making Manual Print (PRINT Key Output) Settings" (p. 319)

When you want to load the settings data automatically at power-on (Auto Setup function):

If you create a STARTUP.SET file for auto setup, the settings data can be loaded automatically from the storage media at power-on.

See "11.5 Saving & Loading Auto Settings File (Auto Setup Function)" (p. 296)

In addition, previously saved settings data can be reloaded when the instrument is turned on.

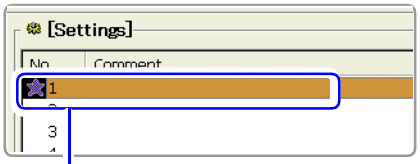
See "Saving Settings Data: Internal Saving" (p. 281)
"Select the data to load: Loading from the instrument" (p. 294)

Saving Settings Data: Internal Saving

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Setting with the **SUB MENU** keys → Setting Configuration screen

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the Setting No. to be saved.
2	**F2**	Select [Save]. A confirmation dialog box appears.
3	**F1**	Select [Execute]. The currently setting state is stored as the selected Setting No. To cancel saving Select **F2** [Cancel].



Setting Number
A mark beside the No. indicates that the setting state is stored.

To add a comment to saved settings data

Adding a comment to settings data can help with later identification.
Press **F3** [Edit comment] to enter a comment.

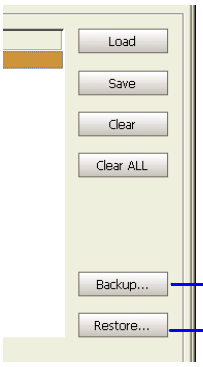
See "Entering Text and Comments" (p. 66)

To reload setting data

See "Select the data to load: Loading from the instrument" (p. 294)

To back up settings data saved in the instrument to other storage media

All saved settings data (up to 16 items) is saved to the other media at once.
Settings data saved to other storage media can be reloaded into the instrument.



To save settings data to other storage media
Select [Backup]. The storage media selection screen appears.
Select the destination storage media, and select [OK] to save.

To reload settings data from other storage media
Select [Restore]. The storage media selection screen appears.
Select the source storage media containing the backup settings data, and select [OK] to reload.

11.3.7 Automatically Saving Waveforms

Save waveforms automatically during measurement. Set auto save before beginning measurement. Waveforms can be saved in binary or text format.
The channels of all sheets for which waveform display is set to [On] are saved.

⚠CAUTION When using auto save during measurement, do not remove the storage media specified as the save destination until the measurement operation is completely finished. Data on the storage media may be damaged.

NOTE If the file size would exceed 2 GB, save using Divided Save or Thinning Save (text format only).

See "Appendix 2.2 Waveform File Sizes" (p. A22)

Automatically Saving Waveforms

MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select [Save] with the **SUB MENU** keys →Save Settings screen

See Screen Layout (p. 40)

Operating Key Procedure

1 Set auto save (p. 276).

Set the save destination.

2 Enable the saving of waveforms.

CURSOR Move the cursor to the [Waveform] item.
F2 Select [On] (default setting).

3 Enter a save name (if you want to use a different name).

CURSOR Move the cursor to the [Name] item.
F1 to F8 Enter the save name (Default setting: AUTO).

See "Entering Text and Comments" (p. 66)

4 Select the contents (Name Pattern) to be automatically added to the save name

CURSOR Move the cursor to the [Name Pattern] item.
F1 to F8 Select the contents to be automatically added to the save name

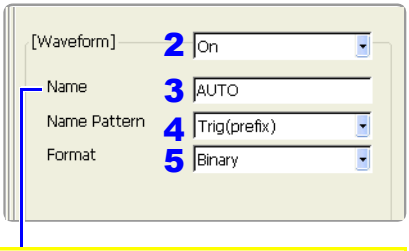
Numbering	Appends serial numbers beginning with 0001 as a suffix to the save name.
Trig (suffix)	Appends the trigger date and time as a suffix to the save name.
Trig (prefix)	Appends the trigger date and time as a prefix to the save name.(default setting)

5 Set the save format.

CURSOR Move the cursor to the [Format] item.
F1 to F8 Select the save format.

Binary	Select this format if waveforms are to be reloaded on the instrument.
Text	Select this format if waveforms are to be read on a PC. "11.6.1 Example of Saving Data" (p. 298) (Proceed to the next step.)

[Auto Save] Page



Save Name
Up to 40 characters (single byte and double byte) can be used for the save name. "File Names" (p. 270)

If the data is saved in text format,
it cannot be reloaded on the instrument. When a file is saved in text format, some characters may differ from those used on the instrument. (p. 298)

When saving a file in text format, note that a PC will not be able to handle the following characters if they are used.

- ASCII:
  + = [ ] \ / | : * ? " < > ; ,
- White space characters

Operating Key Procedure

6 MEM REC

When [Text] is selected as the save format

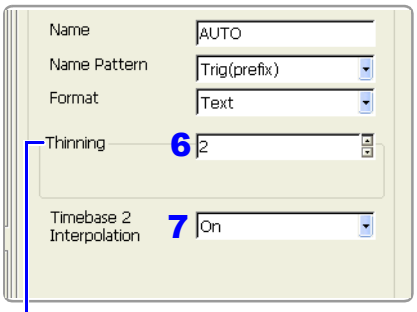
Set the data thinning number.

CURSOR Move the cursor to the [Thinning] item.

F1 to F8 For no data thinning, select [Off].
For data thinning, set the thinning number (out of how many data items to leave one data item remaining).

Off, 2 to 1000

See "Entering Numbers" (p. 65)



Thinning
A large amount of space is required for saving files in text format. Data thinning enables a reduction in file size.
- When [2] is set, every second data item is saved. The number of data items is reduced to a 1/2.
- When [10] is set, every tenth data item is saved. The number of data items is reduced to a 1/10.

(p. 221)

7 MEM

When using Timebase 2 and [Text] is selected as the save format

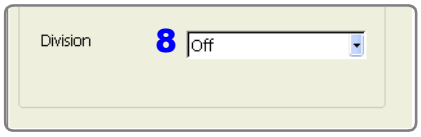
Select whether to interpolate data.

CURSOR Move the cursor to the [Timebase 2 Interpolation] item.

F1 to F8 Select either choice.

On	Use the same data as the previous data for interpolation. "Example 3 of Saving Waveform Data as Text" (p. 300)
Off	No interpolation is performed. "Example 2 of Saving Waveform Data as Text" (p. 299)

Format: [Binary]



8 MEM REC

When [Binary] is the selected save type (Format)

Select whether to save divided files

CURSOR Move the cursor to the [Division]

F1 to F8 Select either choice.

Off	Files are not divided when saved. If a file is too large, it cannot be saved.
2,500 to 1,000,000 div	Select the recording length for divided save.

About divided file saving
Large quantities of waveform data can be divided and saved as multiple files.
Saving divided data creates one or more waveform files and an index (IDX) file. Then by loading the IDX file, the data in the waveform file(s) is loaded as a batch.

See: "11.4.3 Loading Waveform Data" (p. 295)

When using the Memory Division function
When Auto-saving, divided save is not available.

Confirm the measurement configuration and other settings, then start measurement (START key).

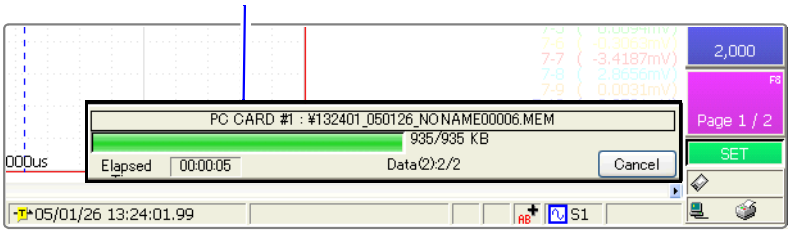
After the data is acquired, the waveform data is saved automatically to the specified storage media.

See "11.6.1 Example of Saving Data" (p. 298)
"11.6.2 Reading Waveform Data on a PC" (p. 302)

When you want to close or move the save progress dialog box:

To close the dialog box, press the **FUNCTION MODE** key while pressing the **SAVE** key when the dialog box is displayed.
To redisplay the dialog box, press the **FUNCTION MODE** key while pressing the **SAVE** key.
To move the dialog box, press the cursor keys while pressing the **SAVE** key when the dialog box is displayed.

Save Progress Dialog Box



11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)

Optionally select an acquired waveform and press the **SAVE** key to save the waveform. Waveforms can be saved in binary or text format.
Set the data to save before pressing the **SAVE** key for [Quick Save] and set the data to save after pressing the **SAVE** key for [Selection Save].
With the Real-Time Saving function, only the measurement waveform in the instrument's internal memory is saved as a MEM file (.MEM file name extension).

Manually Saving Waveform

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Save] with the **SUB MENU** keys →Save Settings screen
See Screen Layout (p. 40)

Operating Key Procedure

1 Set manual save (p. 278).
For [Selection Save], press the **SAVE** key. (The [Save] dialog box appears.)
Set the save destination.

2 Select the save type.

CURSOR Move the cursor to the [Save Type] item.
F2 Select [Waveform].

3 Set the save format.

CURSOR Move the cursor to the [Format] item.
F1 to F8 Select either choice.

Binary	Select this format if waveforms are to be reloaded on the instrument. (default setting)
Text	Select this format if waveforms are to be read on a PC. "11.6.1 Example of Saving Data" (p. 298)

4 MEM REC REC&MEM REALTIME Select the save area.

CURSOR Move the cursor to the [Area] item.
F1 to F8 Select either choice.

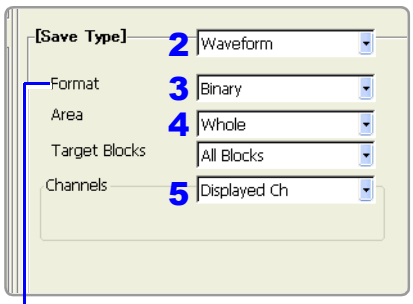
Whole	Save all recorded data. (default setting)
A-B	Save the data between the A and B cursors. If only the A cursor is used, the range from the A cursor position to the end of the data is saved. (A/B Cursor Specification Method (p. 202))

5 MEM REC REC&MEM REALTIME Select the channels to save.

CURSOR Move the cursor to the [Channels] item.
F1 to F8 Select either choice.

Displayed Ch	Saves the channels of all sheets for which waveform display is set to [On]. (default setting)
All Ch	Saves all measured channels (in the case of the memory function, channels for which [Use Channel] is set to [On] on the Status settings screen). The channels for which waveform display is set to [Off] are also saved

[SAVE Key] Page



Data saved in text format cannot be reloaded on the instrument. When a file is saved in text format, some characters may differ from those used on the instrument. (p. 298)

When saving a file in text format, note that a PC will not be able to handle the following characters if they are used.

- ASCII:
  + = [ ] \ / | : * ? " < > ; ,
- White space characters

When you want to save a section of a waveform
Set the save area to [A-B] and use trace cursors or vertical cursors to specify the range to save. If no cursors are displayed, only the whole waveform can be saved.
If only one cursor is used, the range from the cursor position to the end of the data is saved.

Saved Channels
The logic channels for four probes are saved simultaneously.
For the 8958 16-Ch Scanner Unit, channels 1 to 8 and 9 to 16 are saved simultaneously.

Operating Key Procedure

6 MEM REC REC&MEM REALTIME
When [Text] is selected as the save format

Set the data thinning number.

CURSOR Move the cursor to the [Thinning] item.

F1 to F8 For no data thinning, select [Off].
For data thinning, set the thinning number (out of how many data items to leave one data item remaining).

Off, 2 to 1000

See "Entering Numbers" (p. 65)

7 MEM
When using Timebase 2 and [Text] is selected as the save format

Select whether to interpolate data.

CURSOR Move the cursor to the [Timebase 2 Interpolation] item.

F1 to F8 Select either choice.

On	Use the same data as the previous data for interpolation. "Example 3 of Saving Waveform Data as Text" (p. 300)
Off	No interpolation is performed. "Example 2 of Saving Waveform Data as Text" (p. 299)

8 MEM REC REC&MEM REALTIME
When [Binary] is the selected save type (Format)

Select whether to save divided files

CURSOR Move the cursor to the [Division].

F1 to F8 Select either choice.

Off	Files are not divided when saved.
2,500 to 1,000,000 div	Select the file size for Divided Save.

9 MEM REC&MEM
When using the Memory Division function

Select the blocks to save

CURSOR Move the cursor to the [Target Blocks].

F1 to F8 Select either choice.

Displayed Block	Saves only the selected display blocks.
All Blocks	Saves all used blocks as a batch.

For [Quick Save]:

Press the SAVE key.

The waveform data is saved to the specified storage media upon pressing the key.

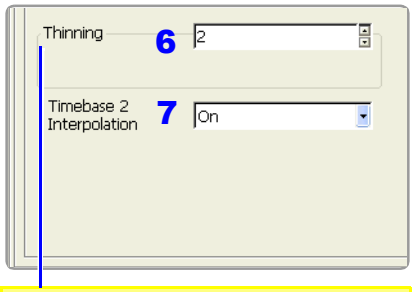
For [Selection Save]:

Select the [OK] button.

The waveform data is saved to the specified storage media upon selecting the button.

See "11.6.1 Example of Saving Data" (p. 298), "11.6.2 Reading Waveform Data on a PC" (p. 302)

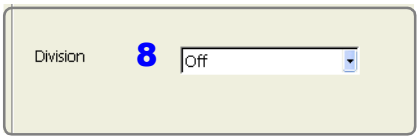
When the save format is [Text]



Thinning Data
A large amount of space is required for saving files in text format. Data thinning enables a reduction in file size.
- When [2] is set, every second data item is saved. The number of data items is reduced to a 1/2.
- When [10] is set, every tenth data item is saved. The number of data items is reduced to a 1/10. (p. 221)

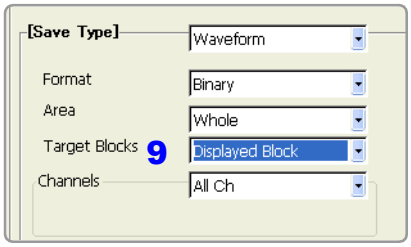
Creating Graphs from Text Data on a PC
When you want to use Excel to create a graph from Timebase 1 and 2 data, set **[Timebase 2 Interpolation]** to [On].

Format: [Binary]



About divided file saving
Large quantities of waveform data can be divided and saved as multiple files.
Saving divided data creates one or more waveform files and an index (IDX) file. Then by loading the IDX file, the data in the waveform file(s) is loaded as a batch.
See: "11.4.3 Loading Waveform Data" (p. 295)

When using the Memory Division function



Selecting the blocks to save
When [All Blocks] is selected for the Target Blocks, divided save is not available.
See: "To save selected memory blocks from a recorded waveform" (p. 274)

11.3.9 Automatically Saving Display Images

After acquiring data, the waveform screen is automatically saved as an image file (BMP or PNG format).

Screen Auto Save

MEM REC FFT

To open the screen: Press the **SET** key → Select [Save] with the **SUB MENU** keys →Save Settings screen

Screen Layout (p. 40)

Operating Key Procedure

1 Set auto save (p. 276).

Set the save destination.

2 Enable display image saving.

CURSOR Move the cursor to the [Screen Image] item.

F2 Select [On] (default setting).

3 Enter a save name (if you want to use a different name).

CURSOR Move the cursor to the [Name] item.

F1 to F8 Enter the save name (Default setting: IMAGE).

See "Entering Text and Comments" (p. 66)

4 Select the contents (Name Pattern) to be automatically added to the save name

CURSOR Move the cursor to the [Name Pattern] item.

F1 to F8 Select the contents to be automatically added to the save name

Numbering	Appends serial numbers beginning with 0001 as a suffix to the save name.
Trig (suffix)	Appends the trigger date and time as a suffix to the save name.
Trig (prefix)	Appends the trigger date and time as a prefix to the save name.(default setting)

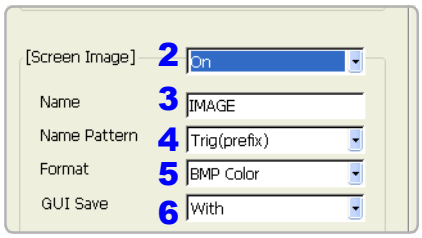
5 Select the save format type.

CURSOR Move the cursor to the [Format] item.

F1 to F8 Select either choice.

BMP Color	Saves a color BMP format file.
Comp BMP	Saves a compressed color BMP format file.
BMP Gray	Saves a grayscale BMP format file.
PNG	Saves a PNG format file.

[Auto Save] Page



Save Name

Up to 40 characters (single byte and double byte) can be used for the save name.

See "File Names" (p. 270)

Operating Key Procedure

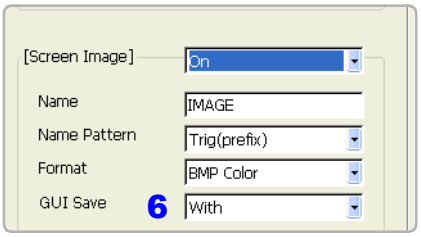
6 **Set whether to save the settings area (GUI area) of the screen.**

CURSOR Move the cursor to the [GUI Save] item.

F1 to F8 Select either choice.

Without	The GUI area is not saved.
With	The GUI area is also saved.

[Auto Save] Page



Confirm the measurement configuration and other settings, then start measurement (START key).

After the data is acquired, the screen image is saved automatically to the specified storage media. The saved image is that of the screen after data has been acquired.

NOTE When using the Memory Division function, if [Wave Display] is disabled (Off), screen images are not saved.

11.3.10 Optionally Selecting Display Screens & Saving (SAVE Key)

Optionally select the screen you want to save and press the **SAVE** key to save the screen as an image (BMP or PNG format). Display screens can also be saved during measurement.

Manually Saving Screens

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Save with the **SUB MENU** keys → Save Settings screen

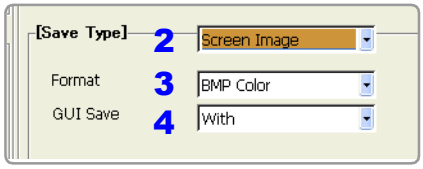
See Screen Layout (p. 40)

Operating Key Procedure

1 **Set manual save (p. 278).**

For [Selection Save], press the **SAVE** key after displaying the screen you want to save.
(The [Save] dialog box appears.)
Set the save destination.

[SAVE Key] Page



2 **Select the save type.**

CURSOR	Move the cursor to the [Save Type] item.
F3	Select [Screen Image].

3 **Select the save format type.**

CURSOR	Move the cursor to the [Format] item.
F1 to F8	Select either choice.

BMP Color	Saves a color BMP format file.
Comp BMP	Saves a compressed color BMP format file.
BMP Gray	Saves a grayscale BMP format file.
PNG	Saves a PNG format file.

4 **Set whether to save the settings area (GUI area) of the screen.**

CURSOR	Move the cursor to the [GUI Save] item.
F1 to F8	Select either choice.

Without	The GUI area is not saved.
With	The GUI area is also saved.

For [Quick Save]:

Display the screen you want to save and press the SAVE key.

The image data is saved to the specified storage media upon pressing the key.

For [Selection Save]:

Select the [OK] button.

The image data is saved to the specified storage media upon selecting the button.

11.3.11 Saving an Event Mark List

Event mark information can be saved only in text format. Measurement values at event mark locations can be saved.

Manually saving Event Marks

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Save] with the **SUB MENU** keys → Save Settings screen

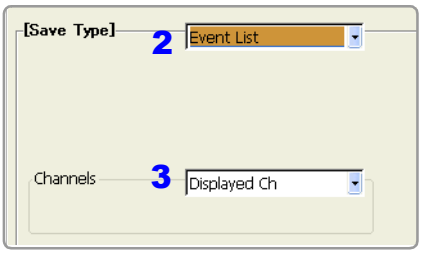
See Screen Layout (p. 40)

Operating Key Procedure

1 **Set manual save (p. 278).**

For [Selection Save], press the **SAVE** key.
(The [Save] dialog box appears.)
Set the save destination.

[SAVE Key] Page



2 **Select the save type.**

CURSOR Move the cursor to the [Save Type] item.

F4 Select [Event List].

3 MEM REC REC&MEM REALTIME **Select the channels to save.**

CURSOR Move the cursor to the [Channels] item.

F1 to F8 To save the measured value at an event mark location, select the channel of the value to be saved.

Displayed Ch	Saves the channels of all sheets for which waveform display is set to [On]. (default setting)
All Ch	Saves all measured channels (in the case of the memory function, channels for which [Use Channel] is set to [On] on the Status settings screen). The channels for which waveform display is set to [Off] are also saved

For [Quick Save]:

Press the SAVE key.

The event list is saved to the specified storage media upon pressing the key.

For [Selection Save]:

Select the [OK] button.

The event list is saved to the specified storage media upon selecting the button.

Example

```
"COMMENT","8861-50 MEM DATA(EventMark)"
"DATE","05-14-2007"
"TIME","09:49:58.150"
"NUM_SIGS",6
"SIGNAL","No.","Type","Position","Comment","A1_1","A1_2"
"VERT_UNITS","","","s","","V","V"
"DATA"
 1,2, +2.450582000E+000,"Test",-1.25000E-003,-4.37500E-003
 2,3, +3.622628000E+000,"start",+7.50000E-004,-2.25000E-003
 3,4, +4.869508000E+000,"Signal input",+1.25000E-004,-1.25000E-004
 4,16, +5.715336000E+000,"",+1.25000E-003,-2.50000E-004
 5,6, +6.482090000E+000,"",+1.25000E-004,+1.25000E-003
 6,1, +8.667364000E+000,"",+1.25000E-003,-8.75000E-004
 7,1, +8.673658000E+000,"",+1.75000E-003,+0.00000E+000
 8,1, +1.006509600E+001,"",+0.00000E+000,+6.25000E-004
 9,1, +1.312489200E+001,"",-1.25000E-004,+2.50000E-004
 10,1, +1.390065800E+001,"",-3.75000E-004,-3.75000E-004
```

11.4 Loading Data

Waveform data or settings data saved to storage media can be loaded on the instrument.
Furthermore, if you create a STARTUP.SET file for auto setup (p. 297), the settings data can be loaded automatically from the storage media at power-on.

See "Creating a Settings File for Auto Setup" (p. 297)
"Automatically Loading Settings Data (Auto Setup)" (p. 296)

Multiple setting states can be stored in the instrument and later reloaded. In the same way, settings can also be automatically reloaded when power is turned on.

See "Select the data to load: Loading from the instrument" (p. 294)

Data Not Loadable on the Instrument

- Data saved in text, BMP, or PNG format.
- Data saved on devices other than the 8860-50 and 8861-50.
- When the data is loaded, the file name appears on the bottom left of the waveform screen. The file name is displayed until the START key is pressed.

File Types

See "11.2 Data Capable of Being Saved & Loaded" (p. 267)

To load waveform data in a batch (p. 295)

An index file is necessary to read files as a batch.
Load any of the following types of index files.

File Extension	
IDX	Loads all saved files that were divided at a specified recording length.
SEQ	(Memory function only) Loads all saved files that were saved as individual blocks by Memory Division.
RSI	(Real-Time Saving Function only) Loads files saved using the Real-Time Saving function.
R_M	(REC&MEM Function only) Loads files saved using the REC&MEM function.

NOTE

- When the data is loaded from the storage media:
  The storage media needs to be inserted before it can be selected.
  If the data on the storage media is to be modified, make sure write protection is disabled before you insert the storage media.
- When loading waveform data that was stored with a different input module configuration, the input module setting status of the loaded waveform data is displayed on the Channel setting screen. To revert to the settings of the currently installed input modules for subsequent measurements, press the START key to measure once, or initialize the waveform data (p. 365).

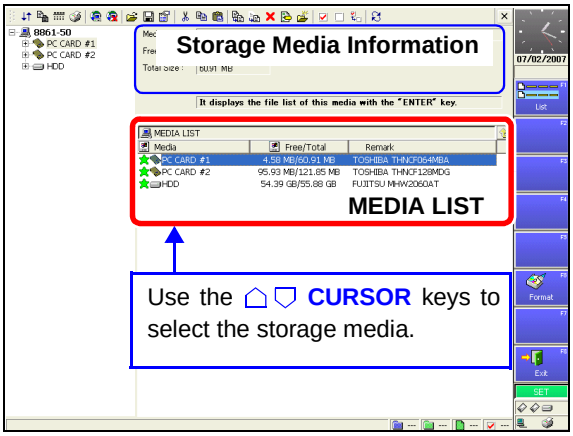
If the “Cannot load this file” message appears:

Check the format of the selected file. The instrument can load waveforms and settings data saved in binary format.

11.4.1 Selecting Files & Folders on Storage Media

Storage media does not appear in the File screen unless it is inserted. Make sure the storage media is inserted properly. Press the **FILE** key to display the File screen.

Selecting the Storage Media



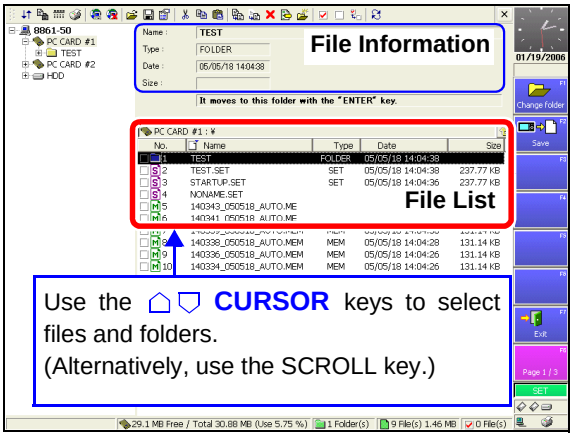
A list of storage media ([MEDIA LIST]) appears in the file list.
If the list does not appear, press the **ESC** key until [MEDIA LIST] appears.

To display files and folders on the storage media:
Select the storage media and press the **F1** [List] key.
The files and folders on the selected storage media appear in the file list.
To return to the previous screen, press the **ESC** key.

Operations Possible from Screen:

- Initializing storage media [**F6**: Format] (p. 266)

Selecting Files & Folders



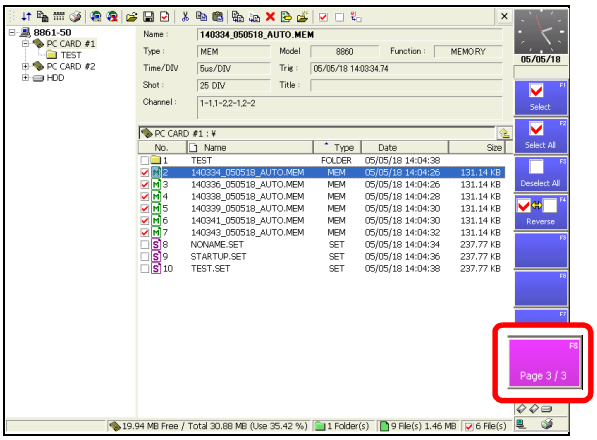
Press the **ESC** key to display the next level up.
Press the **ENTER** key to display the next level down.

Operations Possible from Screen:
The **F8** key can be used to display [Page 1/3] to [Page 3/3] for performing file operations.

- Loading a file by pressing the **F1** key (Page 1/3) (p. 291)
- Copying, moving, deleting, and renaming files and creating folders (Page 2/3) (p. 304)
- Sorting files, selecting the files and items to display, and printing the file list (FN mode) (p. 304)

File Types:
See "11.2 Data Capable of Being Saved & Loaded" (p. 267)

Selecting Multiple Files



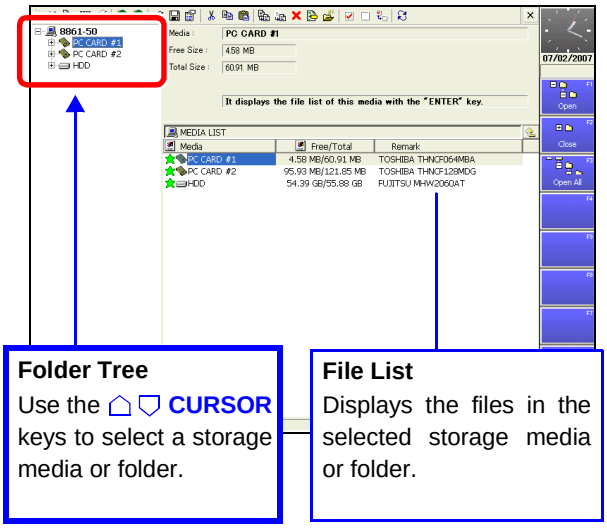
Press the F8 key to switch to [Page 3/3].

When copying (p. 305), deleting (p. 307), and moving (p. 306) files or folders in the storage media, multiple files can be selected.
The "☑" mark appears beside the file number when the file is selected.

F1	[Select]	Selects files individually.
F2	[Select All]	Selects all files.
F3	[Deselect All]	Deselects all files.
F4	[Reverse]	Reverses which files are selected and which files are Deselected.

The **SELECT** key can also be used to select and deselect files.

Opening Storage Media and Folders from the Folder Tree



Folder Tree
Use the ⌂ ⛉ **CURSOR** keys to select a storage media or folder.

File List
Displays the files in the selected storage media or folder.

Press the **SHEET/PAGE** key and move the cursor to the folder tree. The available storage media appears.

See "Storage Media Names" (p. 269)

To show or hide the directories of storage media in the folder tree:

F1	[Open]	Displays the subdirectories of the storage media or folder of "⊞."
F2	[Close]	Closes the subdirectories of the storage media or folder of "⊟."
F3	[Open All]	Displays all subdirectories.

The **SELECT** key can also be used to show or hide directories.

11.4.2 Loading Settings Data

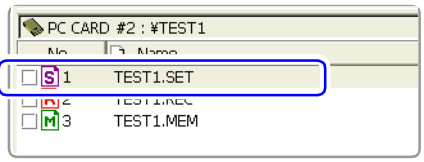
Previously saved settings data can be loaded from storage media (File screen) or from internal memory (System Settings Status screen).
Loadable settings data file: “file name”.SET

Select the data to load: Loading from the storage media

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

	Operating Key	Procedure
1	**Select the data to load (p. 292).**	
2	**F1** (Page1/3)	Select [Load]. A confirmation dialog box appears.
3	**F1**	Select [Execute]. The selected settings data is loaded on the instrument. **To cancel loading** Select **F2** [Cancel].



If **F1** [Load] is not displayed, press the **F8** key to switch to [Page 1/3].

To load settings data automatically:

If you create a STARTUP.SET file for auto setup, the settings data can be loaded automatically from the storage media at power-on.

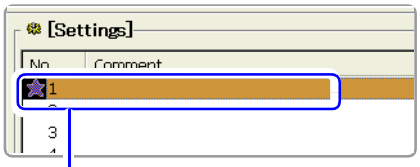
See "11.5 Saving & Loading Auto Settings File (Auto Setup Function)" (p. 296)

Select the data to load: Loading from the instrument

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Setting with the **SUB MENU** keys → Setting Configuration screen

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the Setting No. to load.
2	**F1**	Select [Load]. A confirmation dialog box appears.
3	**F1**	Select [Execute]. The selected settings data is loaded in the instrument. To cancel loading Select **F2** [Cancel].

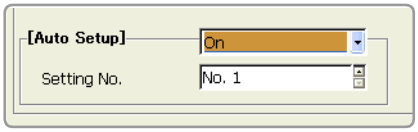


Setting Number
A mark beside the No. indicates that the setting state is stored.

Loading stored settings data automatically

A setting state can be automatically loaded when turning power on.

Enable [Auto Setup] (set to On), and set the Setting No. to the number of the settings data to be automatically loaded.



11.4.3 Loading Waveform Data

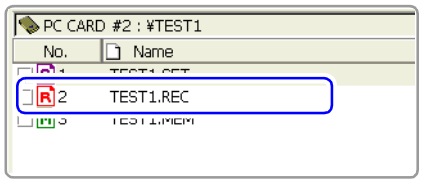
Loadable settings data file:
See "11.2 Data Capable of Being Saved & Loaded" (p. 267)
By loading an index file, data files are loaded as a batch.

Loading Waveform Data

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

	Operating Key	Procedure
1	**Select the data to load (p. 292).**	
2	**F1**	Select [Load]. A confirmation dialog box appears.
3	**F1**	Select [Execute]. The selected waveform data is loaded on the instrument. **To cancel loading** Select **F2** [Cancel].



If **F1** [Load] is not displayed, press the **F8** key to switch to [Page 1/3].

NOTE

When the waveform data is loaded, the waveform displayed currently on the instrument is deleted. The loaded waveform and settings appear.

To load waveform data in a batch

When waveform data is saved by Memory Division or in recording length divisions, an index file is created along with the waveform data files.
By loading this index file, the waveform data files are loaded as a batch.

Index File Extension	Description
IDX	The divided data files are loaded all at once. This index is created when saving data after setting the recording length for [Division] on the Save Settings screen (unless [All Blocks] is selected for Memory Division, in which case no IDX file is created). See "11.3.7 Automatically Saving Waveforms" (p. 282) "11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (p. 285)
SEQ	(When using Memory Division with the Memory function) **To create an index file:** Enable Memory Division (set it to [ON]), set the target blocks on the Save Settings screen to [All Blocks], and save. See "11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (p. 285)
RSI	(Real-Time Saving Function only) Loads data measured with the Real-Time Saving function **To create an index file:** It is automatically created when measuring with the Real-Time Saving function. See "Chapter 9 Measuring with Real-Time Saving" (p. 235)
R_M	(REC&MEM Function only) Loads data measured with the REC&MEM function When measured with Memory Division enabled, all waveform data blocks are loaded at once. **Index file creation:** The file is created automatically when saved with the REC&MEM function enabled.

11.5 Saving & Loading Auto Settings File (Auto Setup Function)

If you save a STARTUP.SET file for auto setup to the root directory of the storage media (topmost level in the storage media), the settings data can be loaded automatically from the storage media at power-on.

Loadable Storage Media & Priority Order

(When more than one storage media contains a settings files for auto setup.)

1. PC Card
2. Hard Disk

Refer to "Select the data to load: Loading from the instrument" (p. 294) for the procedure to load automatically stored settings data into the instrument.

When auto setup is enabled and if the file selected for auto setup is saved to storage media, the settings data file on the storage media has priority.

Automatically Loading Settings Data (Auto Setup)

Loading an auto setup file (STARTUP.SET) from storage media

Insert the storage media to which the file for auto setup was saved and turn on the power. The settings file is automatically loaded on the instrument.

File Creation Method:

See "Creating a Settings File for Auto Setup" (p. 297)

Automatically loading a setup file saved in the instrument (Auto Setup)

See "Loading stored settings data automatically" (p. 294)

Creating a Settings File for Auto Setup

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Save with the **SUB MENU** keys →Save Settings screen

Operating Key Procedure

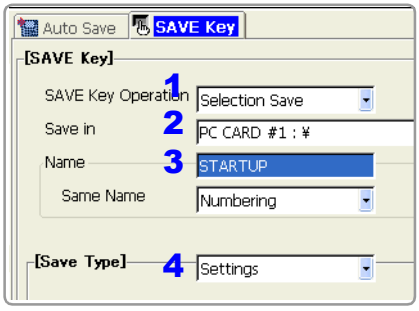
1 Set the save method for when the SAVE key is pressed.

SHEET/PAGE Select the [SAVE Key] page.

CURSOR Move the cursor to the [SAVE Key Operation] item.

F1 to F8 Select either choice.

Quick Save	The preset data is saved upon pressing the SAVE key.
Selection Save	The data is saved after selecting the data to save in the dialog box that appears upon pressing the SAVE key.



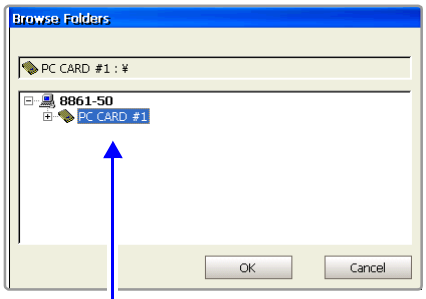
Example: [Quick Save]:

2 Set the save destination.

(For [Selection Save], set the save destination after pressing the SAVE key.)

CURSOR Move the cursor to the [Save in] item.

F1 Select the storage media to which to save the setup file. (p. 275)



Save the file for auto setup to the topmost layer (root directory) of the storage media.

3 Enter the save name (STARTUP).

CURSOR Move the cursor to the [Name] item.

Enter "STARTUP."

See "Entering Text and Comments" (p. 66)

4 Select the save type.

CURSOR Move the cursor to the [Save Type] item.

F1 Select [Settings].

A settings file with the file name "STARTUP.SET" is created in the selected storage media.

For [Quick Save]:

Press the SAVE key after setting the measurement configuration to save.

For [Selection Save]:

Move the cursor to the [OK] button and select F1 [OK].

11.6 Examples of Saving Data: Reading Data on a PC

11.6.1 Example of Saving Data

NOTE

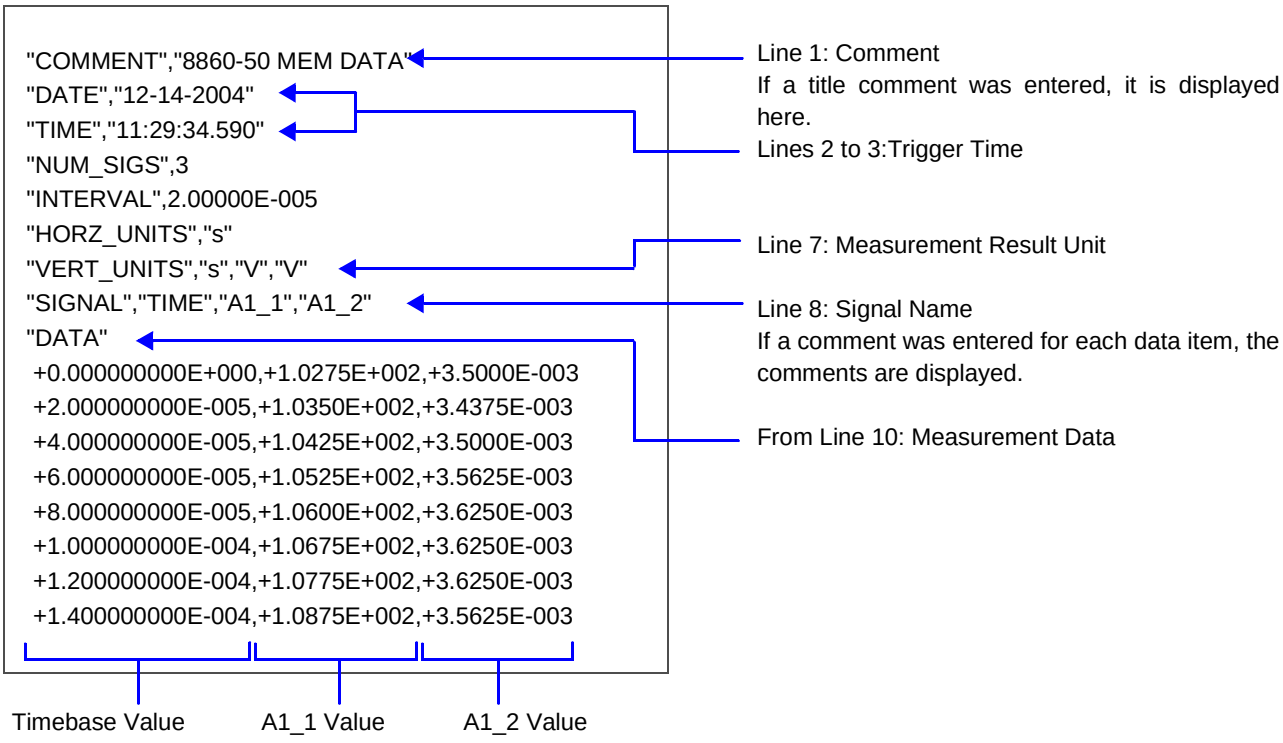
If you save numerical calculation results or data in text format, characters or display items used on the instrument are converted as shown below.
(Characters used on the instrument → Saved characters)
^{2} → ^2, ^{3} → ^3 , ^{n} → ^n, μ→ ~u, Ω→ ~o, ε → ~e, ° → ~c ,
±→ ~+, με (display only) → uE, °C (display only)→ C

Refer to the *Analysis and Communication Supplement* for examples of text saved with the FFT function and numerical calculation results.

Example 1 of Saving Waveform Data as Text

Using Timebase 1 Only with the Memory Function

When Analog Channel 1-1 and 1-2 was Saved:
Timebase: 2 ms/div (20 μs/S)

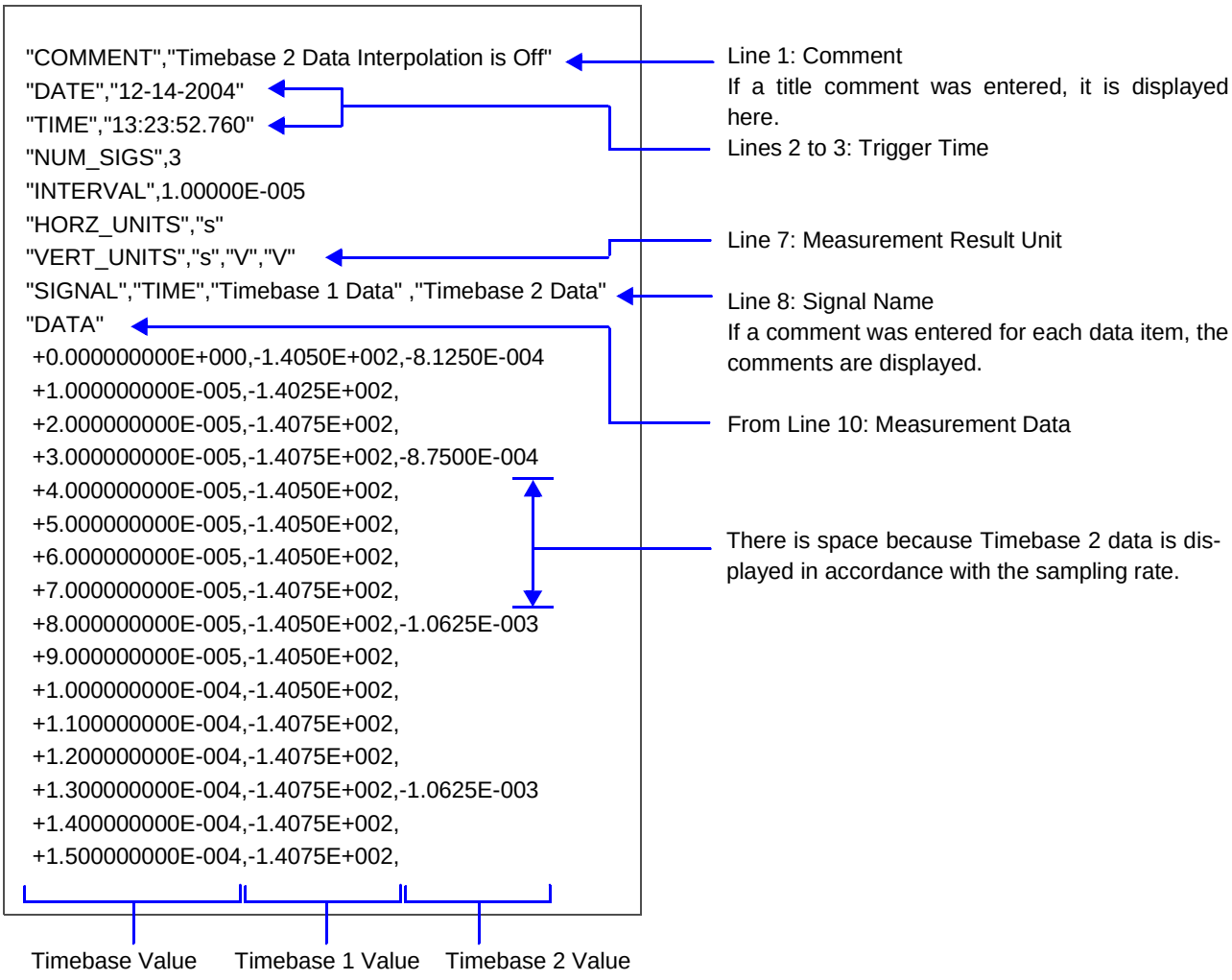


Example 2 of Saving Waveform Data as Text

Using Timebase 1 & Timebase 2 with the Memory Function when Timebase 2 Interpolation is Set to [Off]

When Analog Channel 1-1 (Timebase 1) and 1-2 (Timebase 2) was Saved:

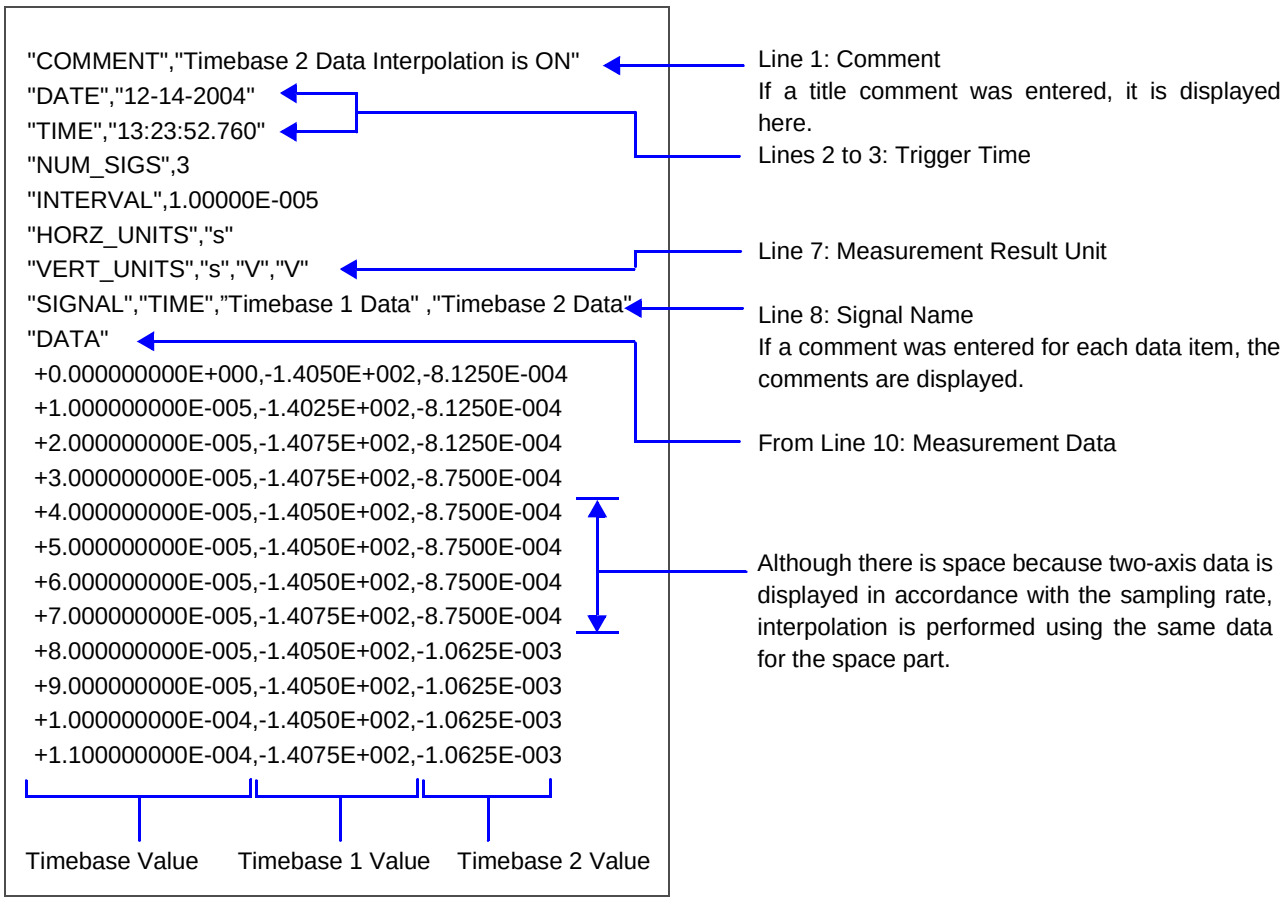
Timebase 1: 1 ms/div (10 µs/S)
2: 50 µs/S



Example 3 of Saving Waveform Data as Text

Using Timebase 1 & Timebase 2 with the Memory Function when Timebase 2 Interpolation is Set to [On]

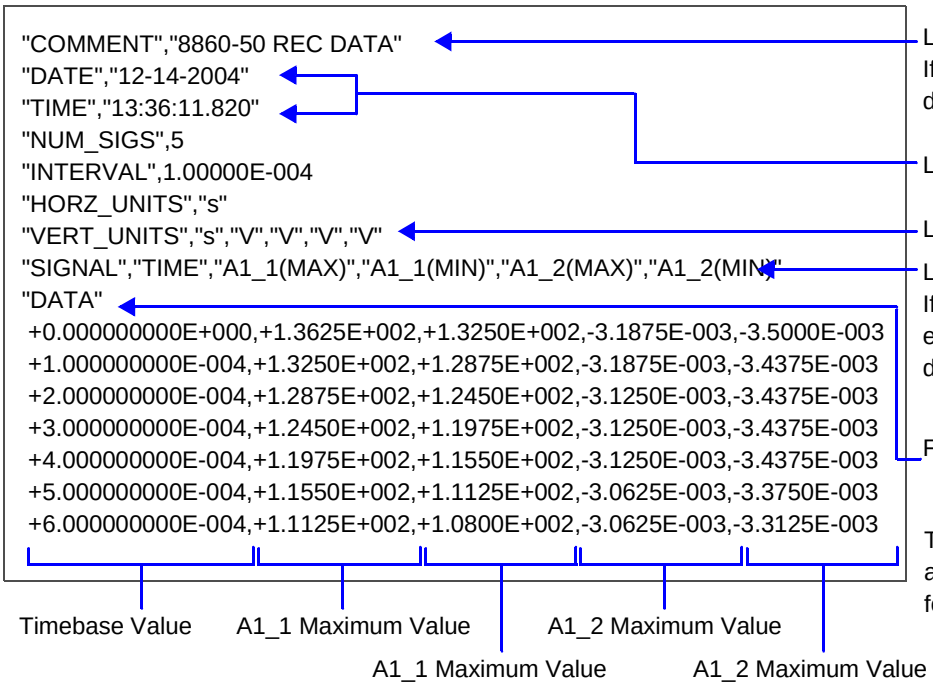
When Analog Channel 1-1 (Timebase 1) and 1-2 (Timebase 2) was Saved:
Timebase 1: 1 ms/div (10 µs/S)
2: 50 µs/S



Example 4 of Saving Waveform Data as Text

Recorder Function

When Analog Channel 1-1 and 1-2 was Saved:
Timebase 10 ms/div (100 ns/S)



Line 1: Comment
If a title comment was entered, it is displayed here.

Lines 2 to 3: Trigger Time

Line 7: Measurement Result Unit

Line 8: Signal Name
If a comment was entered for each data item, the comments are displayed.

From Line 10: Measurement Data

Two data items (maximum value and minimum value) are recorded for each channel.

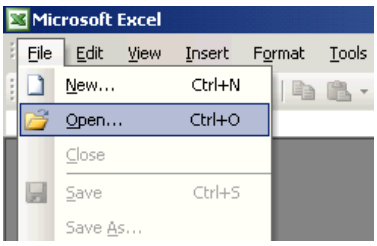
11.6.2 Reading Waveform Data on a PC

The following explains how to import data into Excel on Windows.

The capacity of Excel to import data from a text file is limited to 256 columns and 65,536 rows.

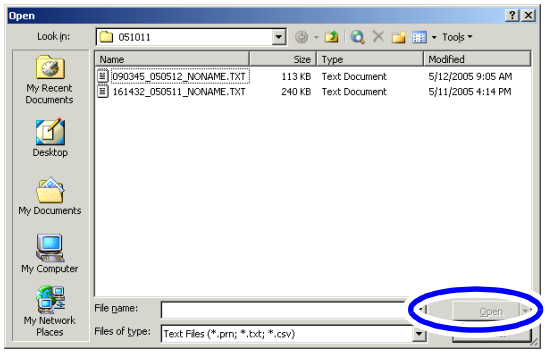
Text files containing data that exceeds these limits cannot be imported into Excel. To avoid exceeding these limits when saving text data, select [Displayed Ch] as the channels to save, or specify the saving range as that between A/B cursors.

1 Start Excel and click [Open] from the [File] menu.



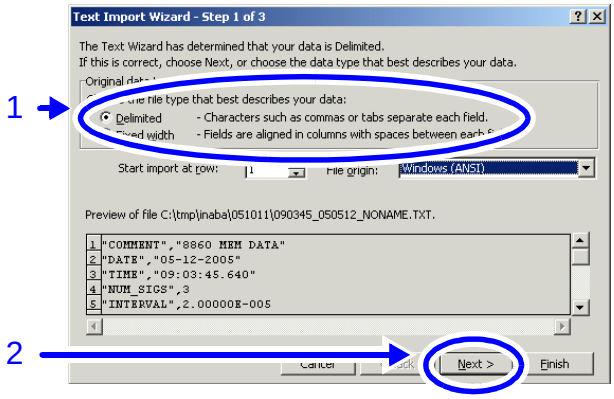
The [Open] dialog box appears.

2 Select the file to import and click [Open].



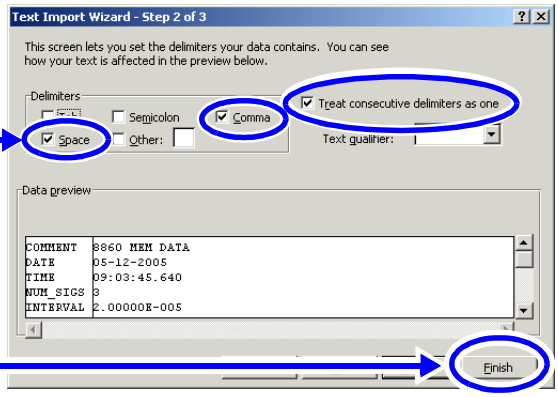
The Text Import Wizard appears.

3 Select the text processing method.



[Text Import Wizard Step 1 of 3]

1. Select [Characters such as commas or tabs separate each field].
2. Click [Next].



[Text Import Wizard Step 2 of 3]

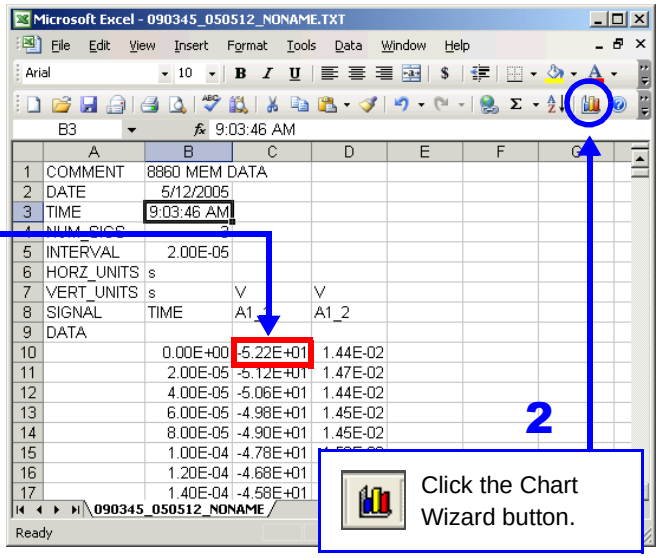
3. Select [Comma] and [Space] for the delimiters and select [Treat consecutive delimiters as one].
4. Click [Finish].

Creating a Graph from Waveform Data Imported into Excel

Example:
Creating a graph for the voltage values of channels A1_1 and A1_2.

Click inside the cell containing the first data item for the graph and press the Shift+Ctrl+End keys. (All data up until the last data item is selected)

1

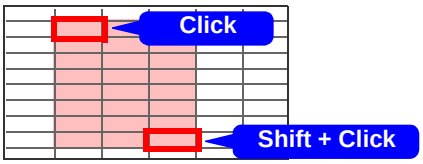


2

Click the Chart Wizard button.

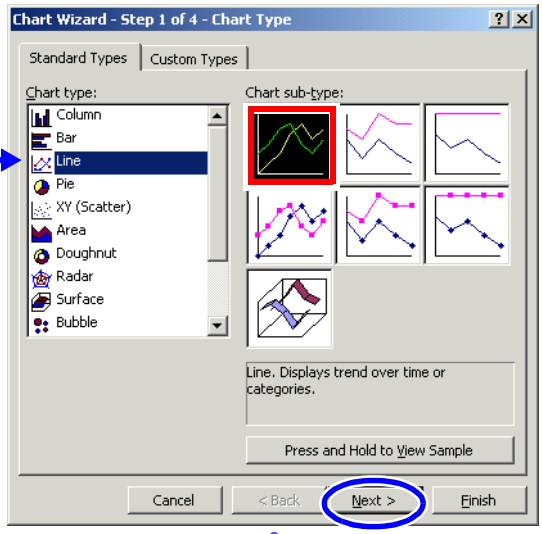
When you want to specify a range and then create a graph:

Click inside the cell containing the first data item for the graph and then click the cell containing the last data item while pressing the Shift key.



Select the “Line” chart type.

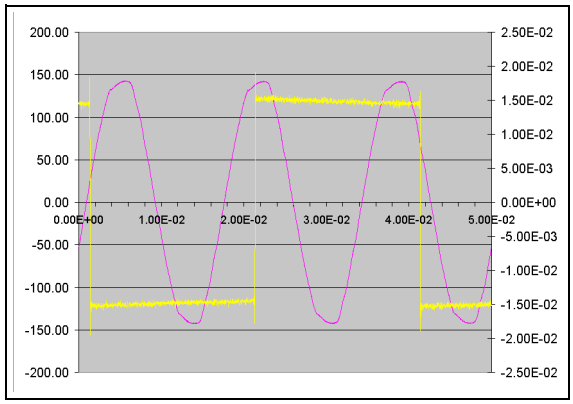
3



4

Set the display method and other settings as required.

For details on how to configure graph settings, refer to the Help function of Excel.



In this example, A1-1 data is assigned to the left vertical axis, A1-2 data is assigned to the right vertical axis, and time data is assigned to the horizontal axis.

When different sampling rates were used for measurement:

When a graph is to be created from data measured using the Timebase 2, set the [Timebase 2 Interpolation] setting on the Save Settings screen to [On] and then save the data.

See
"11.3.7 Automatically Saving Waveforms" (p. 282)
"11.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (p. 285)

11.7 Managing Files

Press the **FILE** key to display the File screen. Data saved to storage media can be managed on the File screen.

The file operations that are available differ depending on the cursor position in the File screen (folder tree or file list) and the FUNCTION MODE display.

Screen & File Operation Display

See "2.6 File Screen" (p. 42), "Function Modes and Settings" (p. 43)

NOTE

- Before performing an operation, insert the storage media (except for the optional hard disk). When no storage media is inserted, “No media” appears in the file list of the File screen.
- If the data on the storage media is to be modified, make sure write protection is disabled before you insert the storage media.

Selecting Data on Storage Media

See "11.4.1 Selecting Files & Folders on Storage Media" (p. 292)

If you press the F key for the file operation you want to perform, the corresponding dialog box appears.
Select an item in the dialog box and perform the operation.

List of File Operations

File Screen	File Operation	Description or Reference Section
(When the cursor is in the file list) **[MEDIA LIST]** When storage media is displayed	**F1 List**	Displays files on the selected storage media. **See** "11.4.1 Selecting Files & Folders on Storage Media" (p. 292)
	F6 Format	**See** "11.1.5 Initializing (Formatting) Storage Media" (p. 266)
	F8 Exit	Closes the File screen and returns to the screen displayed previously.
(When the cursor is in the file list) **When a folder or file is displayed**	**Page 1/3 (F8)**	
	F1 Load	**See** "11.4 Loading Data" (p. 291)
	F2 Save	Enables you to select the save type and save the data.
	F7 Exit	Closes the File screen and returns to the screen displayed previously.
	Page 2/3 (F8)	
	F1 Copy	**See** "11.7.1 Copying Files & Folders" (p. 305)
	F2 Move	**See** "11.7.2 Moving Files & Folders" (p. 306)
	F3 Delete	**See** "11.7.3 Deleting Files & Folders" (p. 307)
	F4 Rename	**See** "11.7.4 Renaming Files & Folders" (p. 307)
	F5 Create Folder	**See** "11.7.5 Creating New Folders" (p. 308)
	Page 3/3 (F8) (Operations for Selecting Multiple Files when Copying, Moving, & Deleting Files)	
	F1 Select	Selects or deselects a file.
	F2 Select All	Selects all files.
	F3 Deselect All	Deselects all files.
	F4 Reverse	Reverses which files are selected and which files are deselected.

List of File Operations

File Screen	File Operation	Description or Reference Section
FN Mode (Press the **FUNCTION MODE** key)	**F1 Sort**	**See** "11.7.6 Sorting Files" (p. 309)
	F2 Filter	**See** "11.7.7 Limiting Display of Files" (p. 310)
	F3 Display Items	**See** "11.7.8 Setting the Items to Display" (p. 311)
	F5 Create Share	Enables you to configure settings for using a shared folder on a PC connected to the network. **See** "11.1.4 Using a Network Shared Folder" (p. 264)
	F6 Disconnect	
	F8 Print List	**See** "11.7.9 Printing the File List" (p. 312)

11.7.1 Copying Files & Folders

Copy a file or folder to a specified folder.
Make sure write protection is disabled for the storage media.

Copying a File or Folder

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen
See Screen Layout (p. 42)

Operating Key Procedure

1 Select the file or folder you want to copy (p. 292).

2 Select the copy destination.

F8 → F1 Display [Page 2/3] and select [Copy].
The [Select Folder] dialog box appears.

F1 Select [Edit].
The [Browse Folders] dialog box appears.

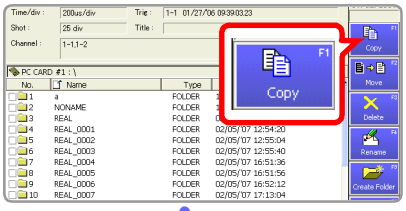
CURSOR Select the copy destination.

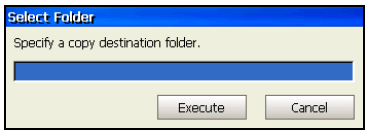
F1 Select [OK].

3 Copy the file or folder.

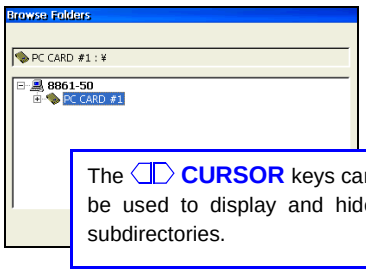
F7 Select [Execute].
The file or folder is copied to the specified folder.

To cancel copying
Select **F8** [Cancel].





F1 key



The ◁▷ **CURSOR** keys can be used to display and hide subdirectories.

11.7.2 Moving Files & Folders

Move a file or folder to a specified folder.
Make sure write protection is disabled for the storage media.

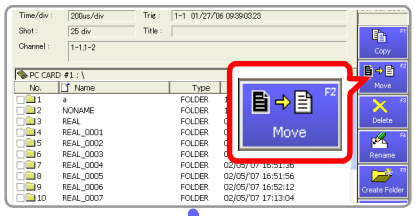
Moving a File or Folder

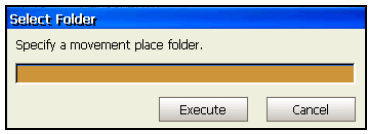
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

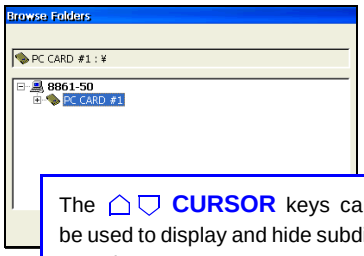
See Screen Layout (p. 42)

	Operating Key	Procedure
1		**Select the file or folder you want to move (p. 292).**
2		**Select the move destination.**
	F8 → **F2**	Display [Page 2/3] and select [Move]. The [Select Folder] dialog box appears.
	F1	Select [Edit]. The [Browse Folders] dialog box appears.
	CURSOR	Select the move destination.
	F1	Select [OK].
3		**Move the file or folder.**
	F7	Select [Execute]. The file or folder is moved to the specified folder.
		To cancel moving Select **F8** [Cancel].





F1 key



The ⌂ ⛉ **CURSOR** keys can be used to display and hide subdirectories.

11.7.3 Deleting Files & Folders

Delete a file or folder.
Make sure write protection is disabled for the storage media. Files and folders cannot be deleted if write protection is enabled.

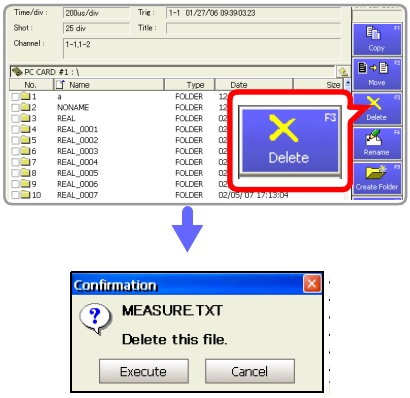
Deleting a File or Folder

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

	Operating Key	Procedure
1		**Select the file or folder you want to delete (p. 292).**
2		**Delete the file or folder.**
	F8 → **F3**	Display [Page 2/3] and select [Delete]. A confirmation dialog box appears.
	F1	Select [Execute]. The selected file or folder is deleted.
		To cancel deleting Select **F2** [Cancel].



11.7.4 Renaming Files & Folders

Rename a file or folder.
Make sure write protection is disabled for the storage media.

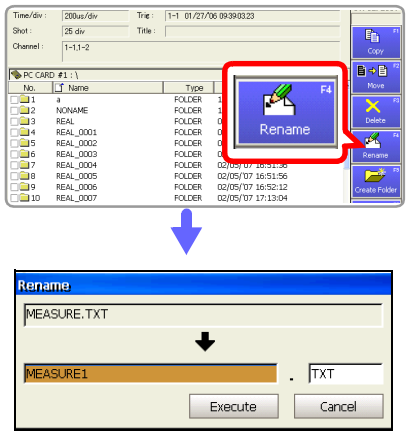
Renaming a File or Folder

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

	Operating Key	Procedure
1		**Select the file or folder you want to rename (p. 292).**
2		**Rename the file or folder.**
	F8 → **F4**	Display [Page 2/3] and select [Rename]. The [Rename] dialog box appears.
	F1 to F8	Select [Edit] or [Direct] (when using the keyboard) and enter a name. **See** "Entering Text and Comments" (p. 66)
	F7	Select [Execute]. The file or folder is renamed.
		To cancel renaming Select **F8** [Cancel].



11.7.5 Creating New Folders

Create a folder.
Make sure write protection is disabled for the storage media.

Creating a Folder

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

Operating Key Procedure

1 **Move the cursor to the directory in which you want to create a folder (p. 292).**

2 **Enter the name of the folder.**

F8 → F5 Display [Page 2/3] and select [Create Folder]. The [Create Folder] dialog box appears.

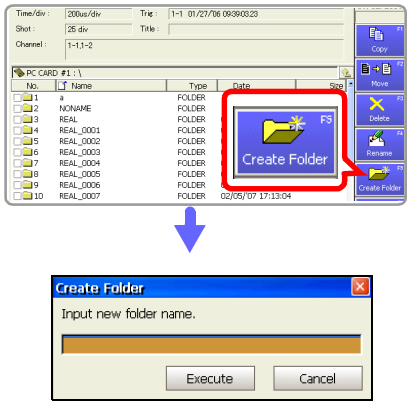
F1 to F8 Select [Edit] or [Direct] (when using the keyboard) and enter a name.

See "Entering Text and Comments" (p. 66)

F7 Select [Execute]. A new folder is created.

To cancel creating

Select **F8** [Cancel].



11.7.6 Sorting Files

Sort files in the file list into a specified order.

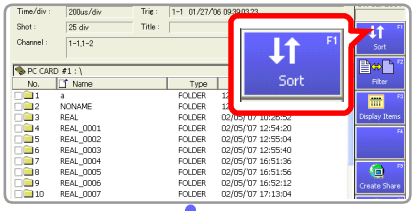
Sorting Files

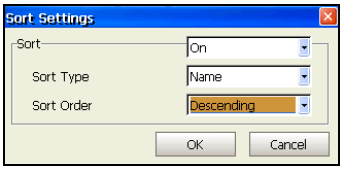
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

Operating Key Procedure





1 Display the file list you want to view (p. 292).

2 Switch to FN mode.

FUNCTION MODE Display [FN] mode.

F1 Select [Sort].
The [Sort Settings] dialog box appears.

F2 Select [On].

3 Select the sort type.

CURSOR Move the cursor to the [Sort Type] item.

F1 to F8 (Switch Display: F8) Select the sort type you want to use for sorting files.

Name	Sorts files by file name characters.
Type	Sorts files by type (file format) of data (settings, MEM waveforms, etc.)
Date	Sorts files by time and date of creation.
Size	Sorts files by size.
Attribute	Sorts files by attribute.
Model*1	Sorts files by product number.
Function*1	Sorts files by function.

Time/DIV*1	Sorts files by timebase.
Trig Time *2	Sorts files by trigger time.
Shot*1	Sorts files by recording length.
Title Comment*1	Sorts files by title comment characters.
Saved Channel*2	Sorts files by saved channel.
Trig CH*2	Sorts files by triggered channel.

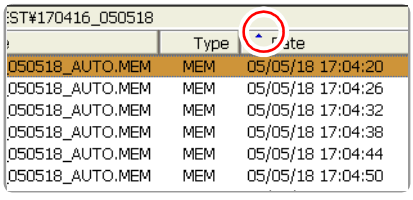
*1. Sorts waveform files and settings files.
*2. Sorts waveform files only.

4 Select the sort order.

CURSOR Move the cursor to the [Sort Order] item.

F1 to F8 Select the file sort order.

Ascending	A → Z, New → Old, Small → Large
Descending	Reverses the order.



5 Apply sorting.

CURSOR Move the cursor to the [OK] button.

F1 Select [Execute].
The files appear in the order of the specified type.

To cancel sorting
Select **F8** [Cancel]

The "▲" mark is displayed for item selected for the sort type.
If there is a combination of files and folders in the file list, folders appear above files.
If you are using a mouse, you can click a display item to sort the files in the order of that item.

11.7.7 Limiting Display of Files

The hiding of unnecessary file types in the file list can be set.

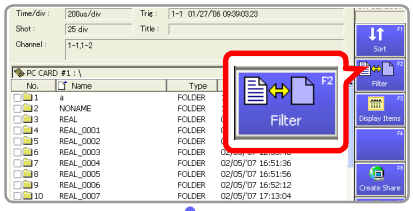
Showing & Hiding Files

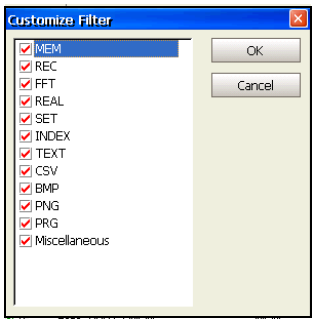
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

	Operating Key	Procedure
1		**Display the file list you want to view (p. 292).**
2		**Switch to FN mode.**
	FUNCTION MODE	Display [FN] mode.
	F2	Select [Filter]. The [Customize Filter] dialog box appears.
3		**Select the files to display.**
	CURSOR	Move the cursor to a file type.
	F1 to F8	Select whether to show or hide the file type. "List of File Operations" (p. 304)
	F7	Select [Execute]. Only file types with checkmarks (☑) added are shown.
		To cancel limiting Select **F8** [Cancel].





The **SELECT** key can also be used to select whether to show or hide file types.

11.7.8 Setting the Items to Display

You can add items to the file list to display details for those items. You can also set the file list to show only the items you require.

Selecting Display Items

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

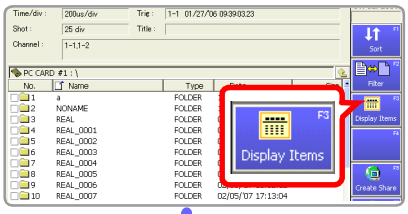
Operating Key Procedure

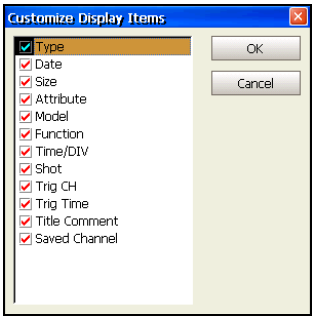
1 **Display the file list you want to view (p. 292).**

2 **Switch to FN mode.**

FUNCTION MODE Display [FN] mode.

F3 Select [Display Items].
The [Customize Display Items] dialog box appears.





3 **Select the items to display.**

CURSOR Move the cursor to an item you want to display.

F1 to F8 Select whether to show or hide the item.
"List of File Operations" (p. 304)

F7 Select [Execute].
Only items with checkmarks (☑) added are shown.

To cancel selecting
Select **F8** [Cancel].

The **SELECT** key can also be used to select whether to show or hide items.
The ◁ ▷ **CURSOR** keys can be used to scroll left and right in the file list. (Only when the scroll bar is displayed.

11.7.9 Printing the File List

The file list of the File screen can be printed. Details for all display items in the file list are printed.
Only folder names are printed for folders. Information on the contents of folders is not printed.

Before printing, make sure the recording paper is loaded correctly.

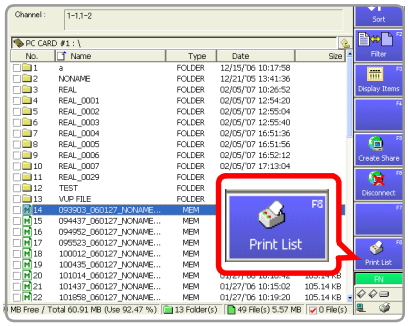
Printing the File List

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **FILE** key → File screen

See Screen Layout (p. 42)

	Operating Key	Procedure
1		**Display the file list you want to print (p. 292).**
2		**Switch to FN mode.**
	FUNCTION MODE	Display [FN] mode.
	F8	Select [Print List].
		The file list is printed.



To cancel printing
Press the **STOP** key.

Example of File List Printout

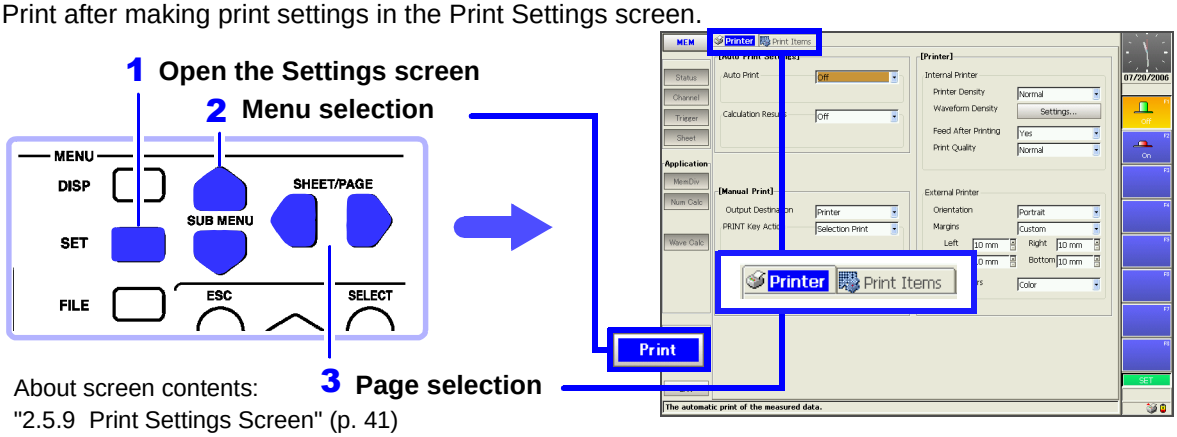
[PC CARD #1 : ¥MeasData]

	Name	Type	Date	Size	Model	Function	Time/DIV	Shot	Trig CH	Trig Time	Title Comment
1	092307_050518_AUTO.MEM	MEM	05/05/18 09:23:03	168.78 KB	8861	MEM	100µs/DIV	25 DIV	1-1	05/05/18 09:23:07.46	
2	092309_050518_AUTO.MEM	MEM	05/05/18 09:23:10	168.78 KB	8861	MEM	100µs/DIV	25 DIV	1-1	05/05/18 09:23:09.10	
3	092310_050518_AUTO.MEM	MEM	05/05/18 09:23:10	168.78 KB	8861	MEM	100µs/DIV	25 DIV	1-1	05/05/18 09:23:10.55	
4	092314_050518_NONAME.TXT	TEXT	05/05/18 09:23:44	376.4 KB							
5	092355_050518_AUTO.MEM	MEM	05/05/18 09:23:56	168.78 KB	8861	MEM	100µs/DIV	25 DIV	1-1	05/05/18 09:23:55.71	
6	092357_050518_AUTO.MEM	MEM	05/05/18 09:23:58	168.78 KB	8861	MEM	100µs/DIV	25 DIV	1-1	05/05/18 09:23:57.19	
7	092417_050518_AUTO.REC	REC	05/05/18 09:24:18	228.77 KB	8861	REC	10ms/DIV	25 DIV		05/05/18 09:24:17.27	
8	092514_050518_AUTO.MEM	MEM	05/05/18 09:25:16	168.78 KB	8861	MEM	100µs/DIV	25 DIV	1-1	05/05/18 09:25:14.52	
9	MEAS.TXT	TEXT	05/05/18 09:25:16	78 B							
10	NONAME.PNG	PNG	05/05/18 09:24:10	45.63 KB							
11	NONAME.SET	SET	05/05/18 09:24:36	237.77 KB	8861	REC	10ms/DIV	25 DIV			

Folder : 0 File : 11 1.86 MB

Printing Chapter 12

Print after making print settings in the Print Settings screen.



About screen contents:
"2.5.9 Print Settings Screen" (p. 41)

Selecting the print method [Printer] page

"12.2 Print Methods and Print Items" (p. 315)

Auto Print
(Auto Print/Real-Time Printing)

- Auto Print waveforms (p. 317)
- Auto Print numerical calculation results (p. 317)

Manual Printing (PRINT key)

- Quick Print (p. 321)
- Selection Print (p. 319)

Selecting the printing type [Printer] page

- Whole Waveform
- A-B Waveform
- Pre- and Post-Trigger Waveforms
- Report
- Lists
- Calculation Results
- Screen
- Event

Depending on the print method or function, some items cannot be printed. "Available Printing types" (p. 316)
You can also print waveforms or settings data according to the type of screen (Screen Link).

Selecting items to print [Print Items] page

Waveform printing

- Grid Types (p. 329)
- Channel Marker (p. 330)
- List & Gauge (p. 330)
- Upper and Lower Limits (p. 331)
- Zero-Position Comments (p. 331)
- Counter Printing (p. 332)
- Time Axis Magnification and Compression (p. 333)
- Gauge (p. 336) (when using external printer)
- Row Print (p. 317), (p. 319)

Numerical Printing

- Thinned numerical value data (p. 334)

Comments and settings data

- Print comments (analog, logic)
- Print titles
- Settings data

Selecting items to print [Print Items] page

- Printout Type (recording format:Waveform, Numeric) (p. 327)
- Print Area (p. 328)
- Display value of horizontal axis (Time Value Display) (p. 328)

Making printer settings [Printer] page

Internal Printer (Output Destination: [Printer])

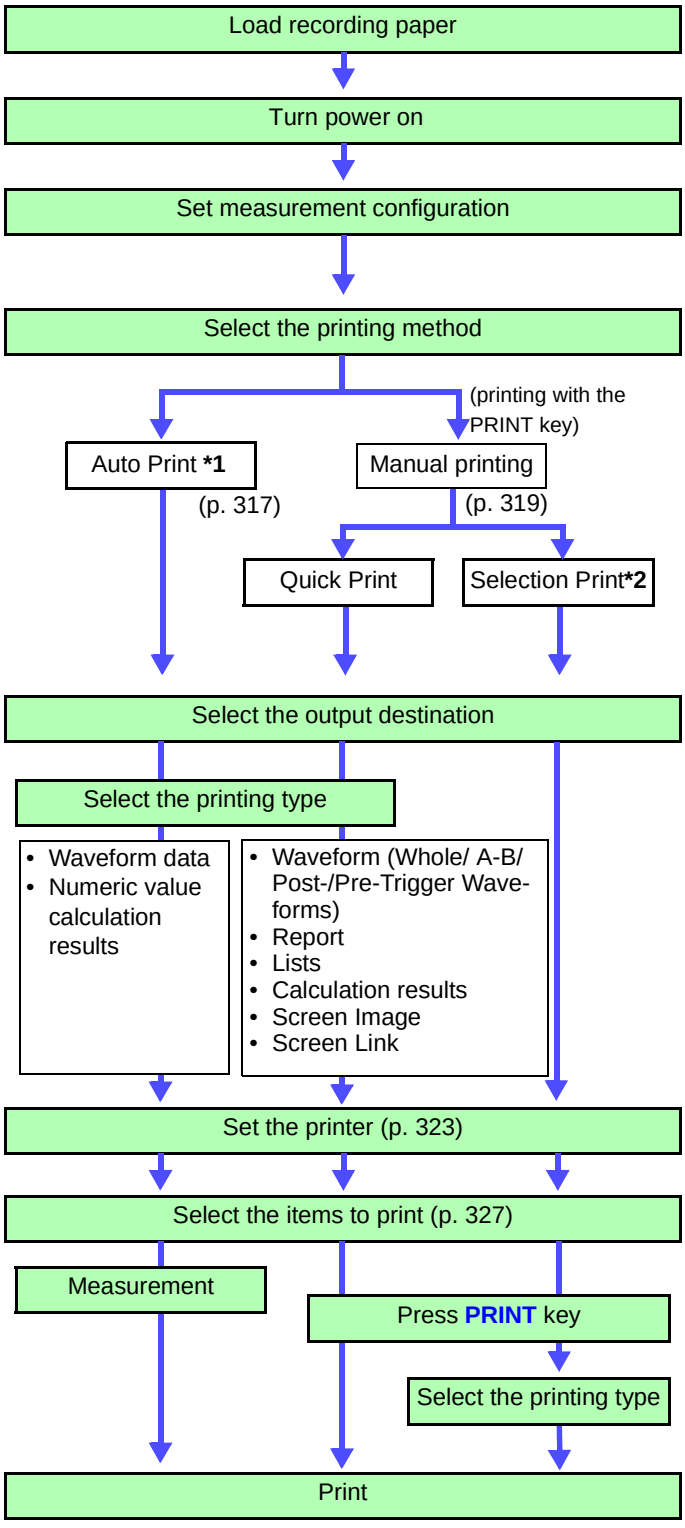
- Print Density (p. 323)
- Paper Feed (p. 324)
- Print Quality (p. 325)

External Printer *(Output Destination: [USB])

- Paper Orientation (p. 325)
- Margins (p. 326)
- Printing Colors (p. 326)

* "" (p. 315)

12.1 Printing Workflow



Auto Print:
Printing starts automatically after measurement starts.

Quick Print:
Printing starts when the PRINT key is pressed

Selection Print:
Printing starts when a printing type is selected in the [Print] dialog.

Verify that the recording paper is loaded correctly.
How to load recording paper:

See "3.3 Loading Recording Paper (With a Printer Module Installed)" in the *Quick Start Manual*

In the various setting screens, set the measurement conditions with the [Status], [Channel], and [Trigger] menus.

Print Settings screen
([Printer] page of the [Print] menu)

See "Print Methods and Print Items" (p. 315)

The factory default settings are as follows.
Auto Print: [Off], Manual Print: [Selection Print]

*1.The Memory Function and FFT Function are printed after measurement. The Recorder Function is printed at the same time as measurement (Real-Time Print).
Auto Print is not available with the Real-Time Saving function.
*2.When you press the PRINT key, set the printing type in the [Print] dialog.

Select whether to print with the optional internal printer or with an external (USB) printer. (However, Real-Time Print is available only with the internal printer.)

Set the printing type.
The items which can be printed vary depending on the function and whether Auto or Manual Print is selected.

See "Available Printing types" (p. 316)

Set the print density and quality (internal printer) or margins and print colors (external printer) as required.

Print Settings screen
([Print Items] page of the [Print] menu)
Set the recording format (Printout Type), grid, and other items to print.

Select the printing type in the [Print] dialog.
The items print are the same as for Quick Print.

During Real-Time Printing, you can pause and restart the printing (p. 318).

For printing examples:

See "12.7 Print Examples" (p. 339)

12.2 Print Methods and Print Items

Print Methods

There are two main print methods.

Auto Print (p. 317)	Printing starts automatically when measurement starts. Printing operation varies depending on the selected function. * • Auto Print (Memory Function and FFT Function) • Real-Time Print (Recorder Function)
Manual Print (PRINT key output) (p. 319)	Press the PRINT key at any time to start printing. There are two print methods. • Selection Print (p. 319)(default setting) Start printing after selecting items in the dialog which appears when you press the PRINT key. • Quick Print (p. 321) Start printing pre-selected items as soon as you press the PRINT key.

Press the **FEED** key on the front panel if you are using the internal printer and want to feed the paper.

***. Differences in printing operation according to function:**

Memory Function

The time when printing starts after data acquisition differs according to the time-base setting.
Printing starts at the same time as waveform display if Roll Mode is enabled and you are using the internal printer.
(Settings: Roll Mode(p. 102): [On] or [Auto], Output Destination: [Printer])

Recorder Function

Printing starts at the same time as waveform display (Real-Time Print).
However, in the following cases, printing lags data acquisition.

- When the timebase is set faster than 500 ms/div (or faster than 2 s/div with numerical printing on the Model 8995-01 A6 Printer Unit)
- When the timebase is set faster than 2 s/div while using the Model 9684 DC Power Unit

Printing is not available when [Cont] is selected for the recording length in the above cases.

FFT Function

Printing is possible when FFT calculations are finished. However, when averaging is enabled, printing is possible only after the specified count to be averaged has been measured.

NOTE

External printers

Please make sure that you read the "Appendix 2.6 Compatible External Printers" (p. A42).

Available Printing types

The following printing types are available.
Use the Print Settings screen ([Printer] page of the [Print] menu) to select the content to print.

Type (Print Example)	Content	Auto Print (p. 317)	Manual Print (p. 319)	Print Examples	Functions				
					MEM	REC	REC&MEM	FFT	REALTIME
Whole Wave *1 (Whole Waveform)	Print the entire range of data acquired by the instrument.	O *3	O	(p. 339)	O	O	O	O	O
A-B Wave[*1] A-B Waveform	From the data acquired by the instrument, print the data between the A and B cursors.	Δ[*2]	O	(p. 344)	O	O	O	–	O
Trig Wave[*1] (Pre- and Post-Trigger Waveforms)	Print 10 divisions of the data before and after a trigger event.	–	O	(p. 345)	O	O	O	–	–
Report	Prints the waveform data of the displayed area on the waveform screen, upper and lower limits and analog channel settings.	–	O	(p. 345)	O	O	O	O	O
List	Print a list of settings made in the settings screens.	–	O	(p. 346)	O	O	O	O	O
Calc Results Calculation results	Print numerical calculation results. Calculation settings are necessary. **See** *Analysis and Communication Supplement*	O	O	(p. 347)	O	–	–	–	–
Screen Image	Print the currently displayed screen.	–	O	(p. 347)	O	O	O	O	O
(Screen Link)	Print the appropriate type of data for the display screen. (Print a waveform when a waveform is displayed, and print a list when something other than a waveform is displayed.)	–	O		O	O	O	O	O
Event	The contents of all currently set event marks are printed.	–	O	(p. 348)	O	O	O	–	O

*1. Waveforms or numerical values can be printed (Default setting: Waveform).
See "Recording Type Settings" (p. 327), Numerical Data Printing Examples (p. 343)
Waveforms can be printed with the addition of settings data, comments, gauges, and so on.
See"12.6.5 Printing Comments and Setting Data" (p. 337)

*2. With the Memory Function, printing is possible only when Roll Mode is disabled [Off]. First acquire the data, then specify a range with the A and B cursors and set the print area to [A-B].
See"Print Area Settings" (p. 328)

*3: Cannot be executed with the Real-Time Saving function enabled.

12.3 Making Auto Print Settings

Make these settings before measurement. Check to be sure that recording paper is loaded correctly. Measurement data is printed automatically when you press the **START** key to start measurement.

Auto Print Settings

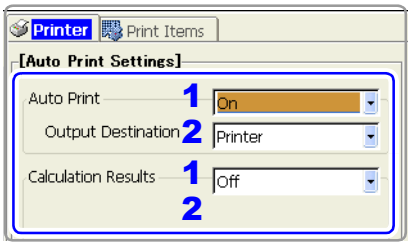
MEM REC REC&MEM FFT

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**Enable Auto Print.**	
	SHEET/PAGE	Select the [Printer] page.
	MEM FFT	
	CURSOR	Move the cursor to the [Auto Print] item.
	F2	Select [On] (Default setting: Off).
	When you also want to print numeric calculation results:(MEM only)	
	CURSOR	Move the cursor to the [Calculation Results] item.
	F2	Select [On] (Default setting: Off).
	REC REC&MEM	
	CURSOR	Move the cursor to the [Real Time Print] item.
	F2	Select [On] (Default setting: Off).
2	**Set the output destination (waveform, numeric calculation results).**	
	MEM FFT	
	CURSOR	Move the cursor to the [Output Destination] item.
	F1 to F8	Select either choice.

Printer	Output to the internal printer (when an internal printer is installed).
USB	Output to the external printer.

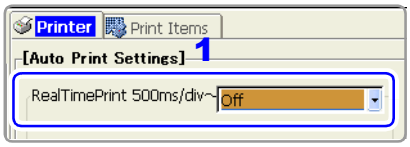


(When the Memory Function is enabled)

Even if Numeric Calculation Results is set to [On], the results are not printed automatically unless calculation settings have been made.

See *Analysis and Communication Supplement*

During Auto Printing of waveforms and numeric calculation results (both are set to [On]), numeric calculation results are printed after waveforms.



(When the Recorder Function is enabled)

External printers known to operate correctly:

"" (p. 315)

3	**Make print settings as required for the printer (p. 323).**	
4	**Make printout content settings as required (p. 327).**	(The default setting is a Whole Waveform printout.)

Check the measurement conditions and start the measurement (START key).

To stop printing before it has finished

Press the STOP key. Measurement also stops.

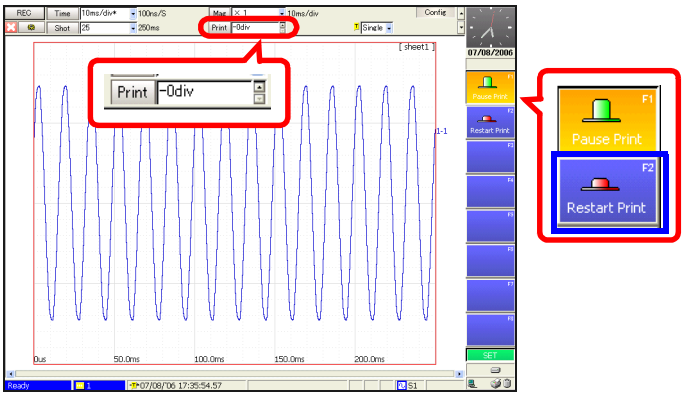
Printing can be paused and restarted during Real-Time Printing (Recorder Function).(p. 318)

To print at the same time as waveform display (internal printer only)

When the Memory Function is enabled, Roll Mode (p. 102) allows you to print at the same time that waveforms are displayed.
When the Recorder Function is enabled, printing is always done at the same time as waveform display (Real-Time Print).

To pause and restart printing (during Real-Time Printing)
(Recorder Function and REC&MEM Function)

Move the cursor to the [Print] setting item, and press the **F1** [Pause Print] key or the **F2** [Restart Print] key.



When printing resumes, a divider line is printed before the waveform.

To print data prior to the current point:

Use the [Print] setting item to specify how many divisions prior the current point to record. When you restart printing, the printout will begin with the specified number of recorded divisions.

12.4 Making Manual Print (PRINT Key Output) Settings

Manual Print [Selection Print]

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

Operating Key Procedure

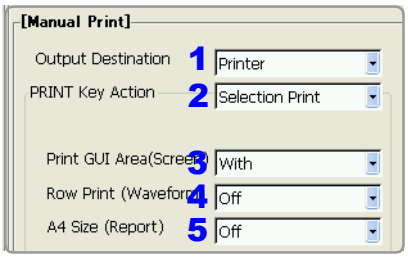
1 Set the output destination.

SHEET/PAGE Select the [Printer] page.

CURSOR Move the cursor to the [Output Destination] item.

F1 to F8 Select either choice.

Printer	Output to the internal printer (when an internal printer is installed) (default setting).
USB	Output to the external printer.



External printers known to operate correctly:
"" (p. 315)

2 Set the print method to Selection Print.

CURSOR Move the cursor to the [PRINT Key Action] item.

F2 Select [Selection Print]. (default setting)

Selection Print:
A printing type in which you select what to print after pressing the **PRINT** key.

3 When printing the screen

Specify whether or not to print the GUI area

CURSOR Move the cursor to the [Print GUI Area] item.

F1 to F8 Select either choice.

Without	Do not print the GUI area.
With	Print the GUI area (default setting).

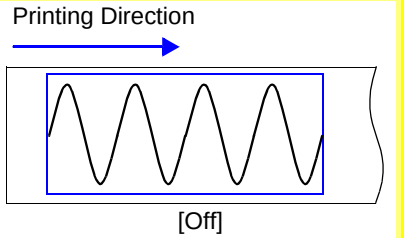
4 To print waveforms

Set the row printing type.

CURSOR Move the cursor to the [Row Print] item.

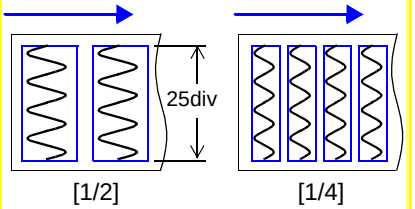
F1 to F8 Select either choice.

Off	Stepped printing is disabled. The print direction is the horizontal axis of the waveform (default setting).
1/2, 1/3, 1/4, 1/6, 1/8, 1/16	Prints 25 divisions of the horizontal axis at a time, with the vertical axis ½ to 1/16th of the standard height of a printed waveform (one graph). The print direction is the vertical axis of the waveform.



[Off]
(when waveform is in one graph)

When using split-screen display, the waveforms in all screen divisions are printed.



See "Print Example 4: Row Printing (1/4 steps)" (p. 342)

5 To print a report

Set the print size

CURSOR Move the cursor to the [A4 Size] item.

F1 to F8 Select either choice.

Off	Print without condensing (default setting).
On	Print waveforms or text condensed horizontally to fit on A4-size paper.

Operating Key Procedure

6 **Make print settings as required for the printer (p. 323) .**

7 **Make printout content settings as required (p. 327).**

8 **Press the PRINT key.**

9 **Select the printing type in the [Print] dialog.**

F1 to F8 Select the item to print.

Whole Wave, A-B Wave*1, Trig Wave*1, Report, List, Calc Results*2, Screen Image, Event*1

*1. For all except the FFT function
*2. Memory Function only

To cancel printing

Select [Cancel].

For more information about printing types (p. 316)
For print examples (p. 339)

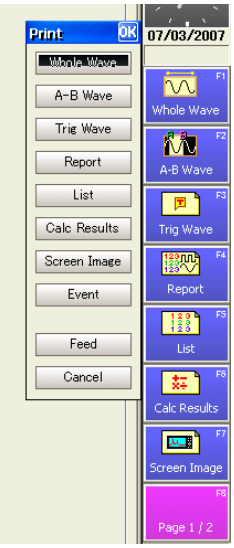
To stop printing before it finishes

Press the **STOP** key.

Before pressing the PRINT key

If you want to print the display screen
Display the screen that you want to print.

If you want to print an A-B waveform
Set the A-B range on the waveform screen. (p. 322)



[Print] dialog

Manual Print [Quick Print]

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

Operating Key Procedure

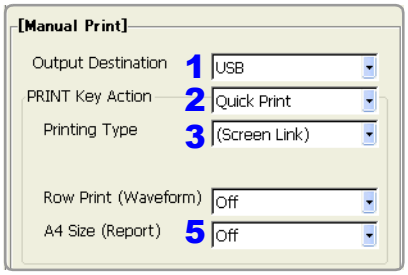
1 Set the output destination.

SHEET/PAGE Select the [Printer] page.

CURSOR Move the cursor to the [Output Destination] item.

F1 to F8 Select either choice.

Printer	Output to the internal printer (when an internal printer is installed)(default setting)
USB	Output to the external printer.



External printers known to operate correctly:
"" (p. 315)

2 Set the print method to Quick Print.

CURSOR Move the cursor to the [PRINT Key Action] item.

F1 Select [Quick Print].

Quick Print:
A printing type in which you select what to print before pressing the PRINT key.

3 Set the printing type.

CURSOR Move the cursor to the [Printing Type] item.

F1 to F8 Select either choice.

(Screen Link), Whole Wave, A-B Wave*1, Trig Wave*1, Report, List, Calc Results*2, Screen Image, Event*1

Screen Link (default setting)

*1. Memory Function, Recorder Function, and Real-Time Saving Function only

*2. Memory Function only

For more information about printing types (p. 316)

If you want to print an A-B waveform with [Screen Link] selected, set the printing range on the [Print Items] page to [A-B]. (p. 328)

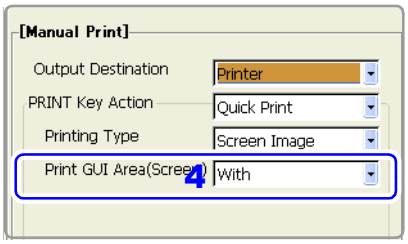
4 When printing the screen (Printing Type: [Screen Image])

Specify whether or not to print the GUI area

CURSOR Move the cursor to the [Print GUI Area] item.

F1 to F8 Select either choice.

Without	Do not print the GUI area.
With	Print the GUI area (default setting).



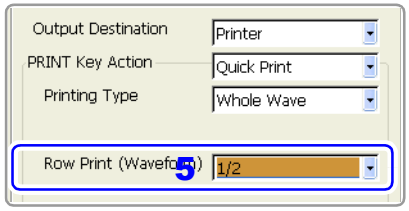
5 To print waveforms (Printing Type: [(Screen Link)]/[Whole Wave]/[A-B Wave])

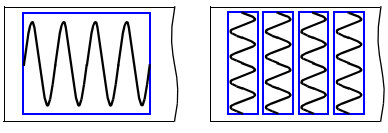
Set the row printing type.

CURSOR Move the cursor to the [Row Print] item.

F1 to F8 Select either choice.

Off	Stepped printing is disabled. The print direction is the horizontal axis of the waveform (default setting).
1/2, 1/3, 1/4, 1/6, 1/8, 1/16	Prints 25 divisions of the horizontal axis at a time, with the vertical axis ½ to 1/16th of the standard height of a printed waveform (one graph). The print direction is the vertical axis of the waveform.





Off 1/4

Operating Key Procedure

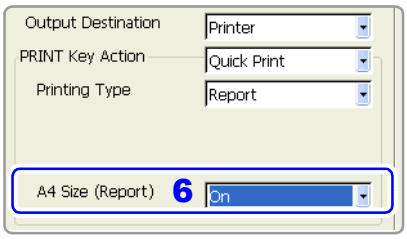
6 **To print a report (Printing Type: [Report])**

Set the print size

CURSOR Move the cursor to the [A4 Size] item.

F1 to F8 Select either choice.

Off	Print without condensing.(default setting)
On	Print waveforms or text condensed horizontally to fit on A4-size paper.



7 **Make print settings as required for the printer (p. 323).**

8 **Make printout content settings as required (p. 327).**

9 **Press the PRINT key.**

The specified content is printed.
For print examples (p. 339)

To stop printing before it has finished

Press the **STOP** key.

Before pressing the PRINT key

If you want to print the display screen
Display the screen that you want to print.

If you want to print an A-B waveform
Set the A-B range on the waveform screen. (p. 322)

NOTE

When [A-B Wave] is selected as the printing type

Set the start point and end point on the waveform screen with the A and B cursors.

See "8.7 Specifying a Waveform Range" (p. 200)

A Whole Waveform is printed when no range has been set with the A and B cursors, and when the A and B cursors are not displayed on the waveform screen. Specified ranges of X-Y waveforms cannot be printed, even if you specify a range with the A and B cursors.

12.5 Making Printer Settings

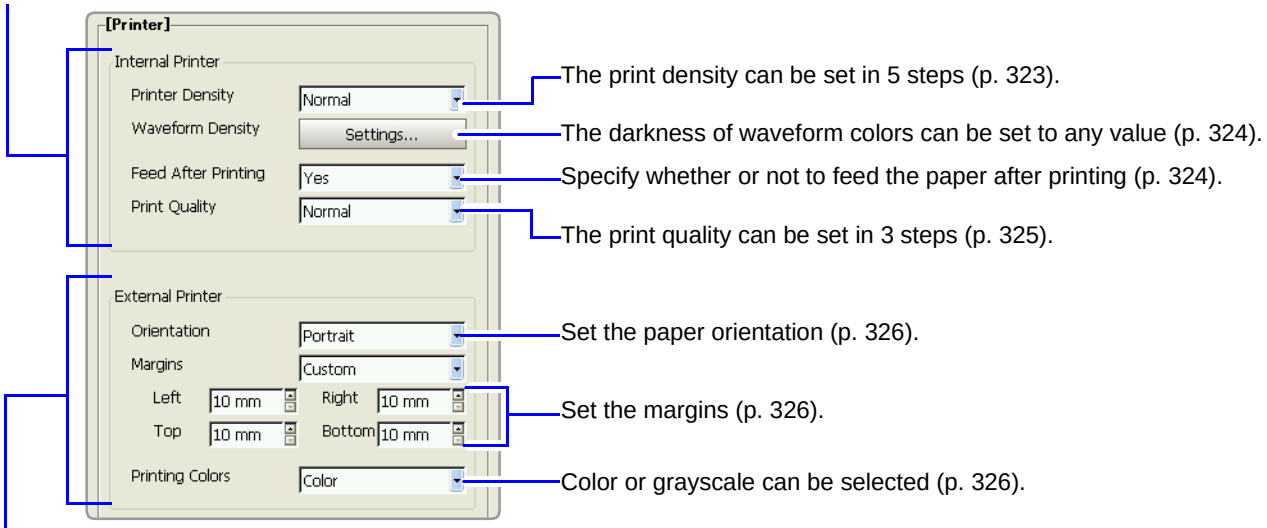
Make settings on the [Printer] page of the Print Settings screen

1. Press the **SUB MENU** key and select the [Print] menu.
2. Press the **SHEET/PAGE** key and select the [Printer] page.

See About the printer settings screen:"2.5.9 Print Settings Screen" (p. 41)

[Printer] page of the printer settings screen

Set these items when you are using the internal printer (option).



(This example screen shows the default settings.)

Set these items when you are using an external printer (p. 325).

12.5.1 Internal Printer Settings

Printer density settings

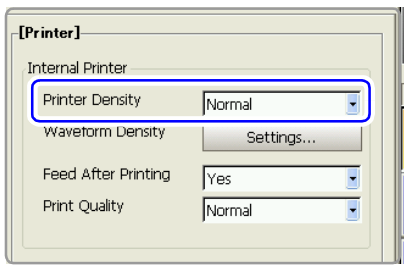
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR**	Move the cursor to the [Printer Density] item.
	F1 to F8	Select the printing density.

Light, Slightly Light, Normal (default setting), Slightly Dark, Dark



NOTE When using the Model 9684 DC Power Unit
Some content may print a little lighter.

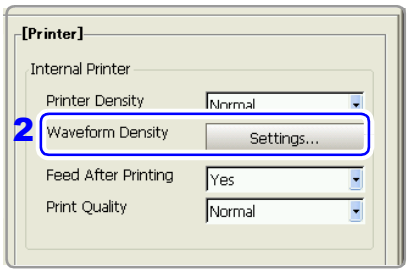
Waveform Printing Density Settings

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR** **F1**	Move the cursor to the [Waveform Density] item. Select [Set]. The [Waveform Printing Density] dialog box appears.
3	**CURSOR** **F1 to F8**	Move the cursor to the color whose density you want to change. Select the print density. Light, Normal, Slightly Dark, Dark
4	**CURSOR** **F1**	Move the cursor to the [Close] button. Select [Close]. Close the dialog.



[Waveform Printing Density] dialog

NOTE

When the Recorder Function is enabled and Real-Time Print is [On]

If the timebase is in a range faster than 1s/div, the printing may be light even if the printing density is set to [Dark].

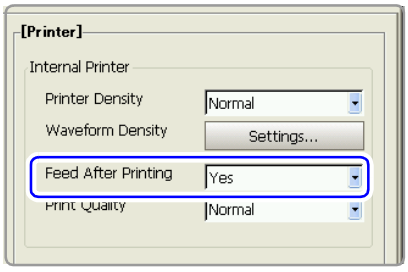
Paper Feed After Printing Settings

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR** **F1 to F8**	Move the cursor to the [Feed After Printing] item. Select whether or not to feed the paper. **Yes (default setting), No**



Print Quality Settings

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

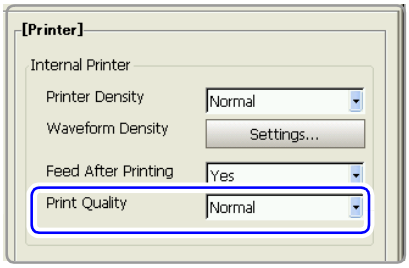
	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR**	Move the cursor to the [Print Quality] item.
	F1 to F8	Select the print quality.

When Model 8995 A4 Printer Unit is installed

Fine (slow), Normal (default setting), Rough (fast)

When Model 8995-01 A6 Printer Unit is installed

Normal (default setting), Rough (fast)



12.5.2 External Printer Settings

Paper Orientation Settings

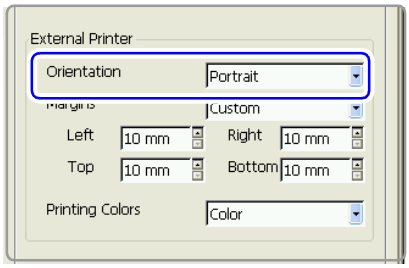
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR**	Move the cursor to the [Orientation] item.
	F1 to F8	Select the orientation of the paper set in the external printer.

Portrait (default setting), Landscape



Margin Settings

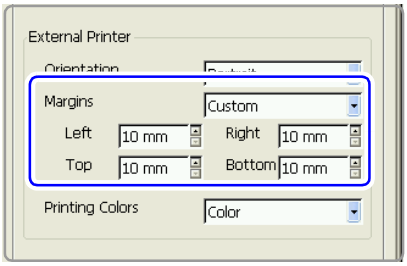
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR**	Move the cursor to the [Margins] item.
	F1 to F8	Set the margins

Custom	Specify the top, bottom, left and right margins. (Default setting: Top, bottom, left and right 10 mm)
Auto (1cm/div)	When printing a waveform, automatically adjust so that 1 division equals 1 cm. When printing information other than a waveform, print with the same type of margins.



3	**CURSOR**	Move the cursor to the [Left], [Right], [Top], and [Bottom] items. (When [Custom] is selected)
	F1 to F8	Set the margins. **See** "Entering Numbers" (p. 65)

NOTE

- Depending on the printer type, there may be slight differences in the size of the actually printed margins.
- Depending on the printed content, margins may be larger than the specified values.
- When printing a report, if the A4-Size (Report) setting is enabled, it has priority. In that case, printing may not occur with the specified margins.

Printing Color Settings

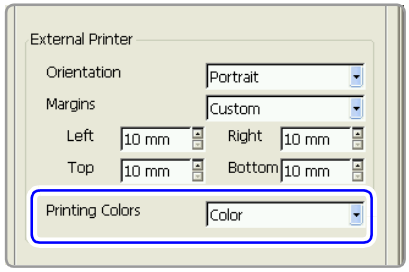
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Printer] page.
2	**CURSOR**	Move the cursor to the [Printing Colors] item.
	F1 to F8	Select either choice.

Color	Output in color (default setting).
Grayscale	Output in grayscale.



NOTE

Straight lines may be indistinct for some waveform display colors. To make straight lines easier to recognize, you should select colors close to primary colors.

See "7.1.1 Setting Whether a Waveform is Displayed or Hidden, and its Color" (p. 171)

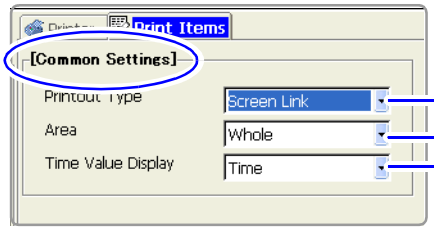
12.6 Setting the Print Content

12.6.1 Common Settings

Make settings on the **[Print Items] page of the Print Settings screen**

1. Press the **SUB MENU** key and select the [Print] menu.
2. Press the **SHEET/PAGE** key and select the [Print Items] page.

[Common Settings] fields



Select the recording type (p. 327).

Select the print area (p. 328).

Select the type of value to print on the horizontal axis (p. 328).

Recording Type Settings

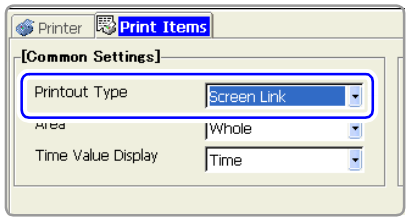
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR** **F1 to F8**	Move the cursor to the [Printout Type] item. Select the print content.

Waveform	Print measurement data and waveform calculation results as a waveform.
Numeric	Print measurement data and waveform calculation results as numeric values.
Screen Link	Print the appropriate type of data for the display screen (default setting). (Depends on the display type settings made in the Sheet Settings screen.)(p. 177)



When [Waveform] is selected

Make print settings as required by using the Waveform Print Items (p. 329).

When [Numeric] is selected

Make print settings as required by using the numeric value specific print items to make numeric data thinning settings. (p. 334)

Print Area Settings

MEM REC REC&MEM REALTIME

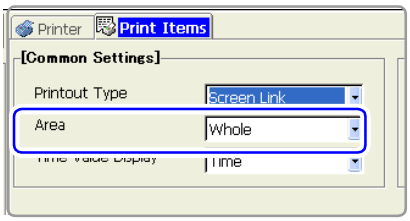
To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

(These settings are valid when the Memory Function and Auto Print are enabled, the action of the **PRINT** key is **[Quick Print]**, and the printing type is **[Screen Link]**.)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Area] item.
	F1 to F8	Select the print area.

Whole	Print all of the recorded data (default setting).
A-B	Print the data between the A and B cursors.



NOTE

Printing specified ranges (when [A-B] is selected)

- Real-time auto printing of specified ranges is not possible when the Recorder Function is enabled. When the Memory Function is enabled, specified ranges can be printed automatically by setting Auto Print to [On] and Roll Mode to [Off].
- The waveform range specified with the A and B cursors (Vertical or Trace cursors) is printed. Printing is possible even if one of the A and B cursors is outside the screen.
- If only one cursor is used, the range from the cursor to the end of the waveform is printed.
- Printed of specified ranges is also possible when the printer recording format ([Printout Type]) is [Numeric].

Setting the Horizontal Axis Display Value

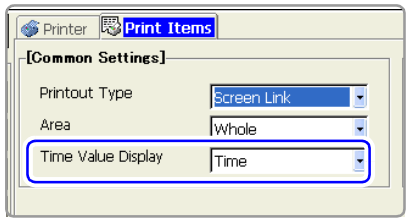
MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Time Value Display] item.
	F1 to F8	Select the type of display.

Time*	Print the time from trigger event (unit is fixed). (default setting)
Mod 60*	Print the time from trigger event (unit is modulo 60).
Scale	Print the number of divisions from trigger event.
Date*	Print the date and time when waveform was acquired.
Samples	Print the number of samples from trigger event.



* Printing for external sampling is done according to the [Samples] setting.

Time	Mod 60	Scale	Date	Samples
-2.000000 s	1m40 s	5	'04-10-30 10:20:30	500

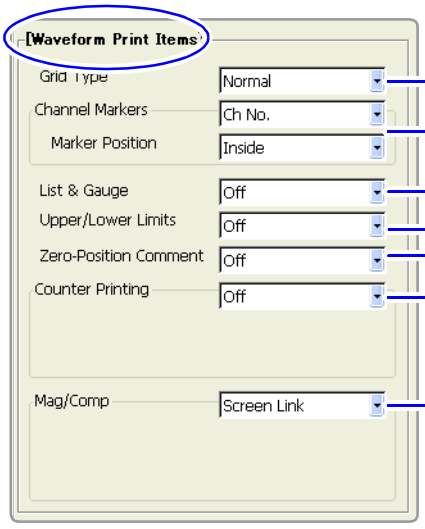
12.6.2 Printing Waveforms

Make the following settings as required.

Make settings on the **[Print Items] page of the Print Settings screen**

1. Press the **SUB MENU** key and select the [Print] menu.
2. Press the **SHEET/PAGE** key and select the [Print Items] page.

[Waveform Print Items] field



(This example screen shows the default values for all settings.)

Selects the type of grid to print on the recording paper (p. 329).

Allows you to print the channel number or comments on the waveform (Channel Marker) (p. 330).
Specifies where to print the channel market on the waveform.

Allows you to print a list of setting or gauge with the waveform (p. 330).

Allows you to print the upper and lower limits of each channel. (The values are scaled when the scaling function is active.) (p. 331)

Allows you to print channel comments in the zero position for each channel (analog channels only) (p. 331).

Allows you to print a waveform acquisition count and a date or counter name. (This is convenient for distinguishing similar waveforms.) (p. 332)

Allows you to expand or compress the time axis of the printed waveform. (This possible regardless of magnification and compression on the waveform screen.) (p. 333)

NOTE

For the row printing, waveforms are printed separately from other information (settings and comments, gauges, upper and lower thresholds, zero position comments and etc.).

Row printing:

See "12.3 Making Auto Print Settings" (p. 317),
"12.4 Making Manual Print (PRINT Key Output) Settings" (p. 319),
"Print Example 4: Row Printing (1/4 steps)" (p. 342)

Setting the Grid Type

MEM REC REC&MEM FFT REALTIME

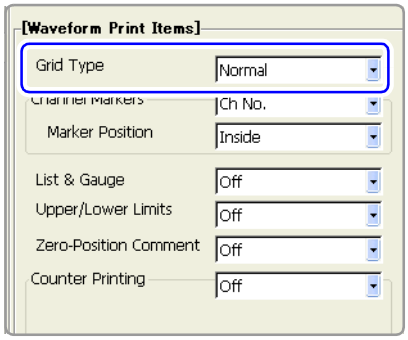
To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Grid Type] item.
	F1 to F8	Select the grid type.

Off, Normal (default setting), Fine, Normal (Dark), Fine (Dark), Time Axis, or T-Axis (Dark)

(For the time axis, only the time axis is printed.)



NOTE

Grids displayed on the screen are not reflected in the printout.

Channel Marker (Channel Number or Comments) Settings

MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

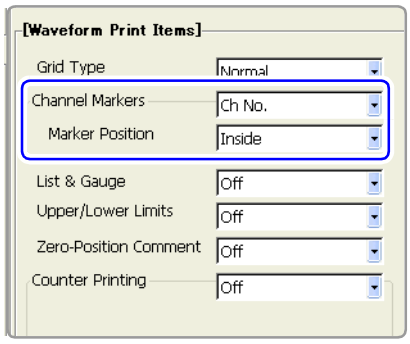
	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.

2 Select the type of channel marker.

CURSOR Move the cursor to the [Channel Markers] item.

F1 to F8 Select the type of channel marker.

Off	Do not print the channel number or comments on the recording paper.
Ch No.	Print the channel number on the recording paper (default setting).
Comments	Print the comments entered in the Channel Settings screen over the waveform on the recording paper. Comment Setting:(p. 119)

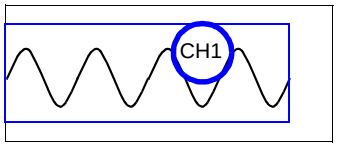


3 Specify the channel marker position.

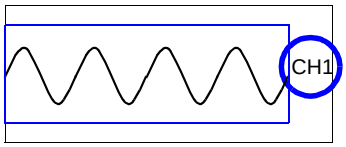
CURSOR Move the cursor to the [Marker Position] item.

F1 to F8 Select either choice.

Inside	Print near the waveform at intervals of about one channel per division(default setting).
Outside	Print after the waveform.



Inside



Outside

List and Gauge Settings

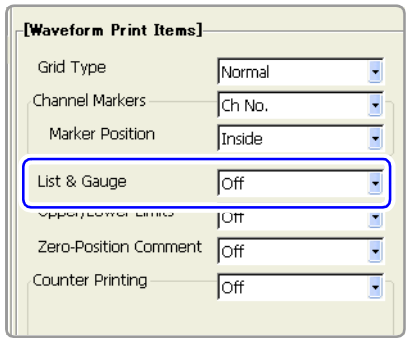
MEM REC REC&MEM FFT REALTIME

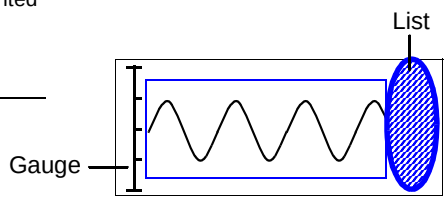
To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [List & Gauge] item.
	F1 to F8	Select the type of print items.

Off	Do not print a list of settings or gauge (default setting).
List	Print a list of settings. The list is printed after the waveform.
Gauge	Print a gauge. The gauge is printed before the waveform.
List & Gauge	Print a list and gauge.





Upper and Lower Limit Setting

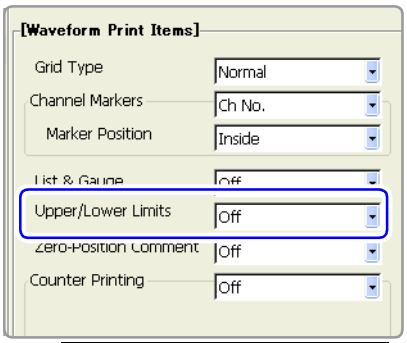
MEM REC REC&MEM FFT REALTIME

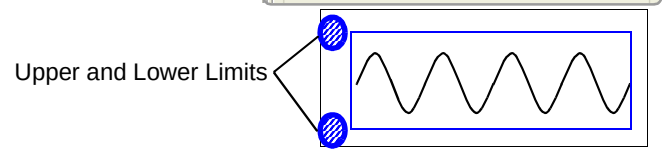
To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Upper/Lower Limits] item.
	F1 to F8	Select either choice.

Off	Do not print upper and lower limits (default setting).
On	Print upper and lower limits.





Zero Position Comment Setting

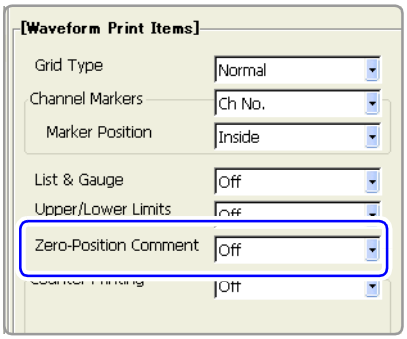
MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

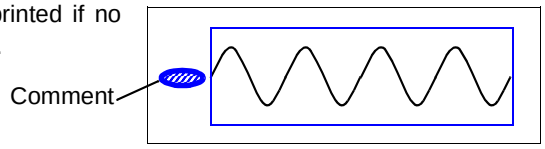
See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Zero-Position Comment] item.
	F1 to F8	Select whether or not to print comment.

Off	Do not print zero position comment (default setting).
On	Print zero position comment.



The zero position comment is not printed if no comment has been set for a channel.



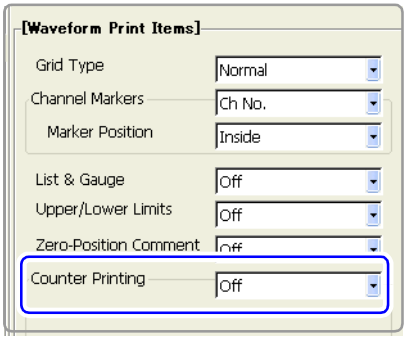
Counter Print Settings

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.



2 Select the type of counter to print.

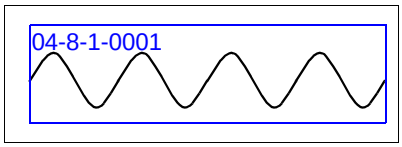
CURSOR Move the cursor to the [Counter Printing] item.

F1 to F8 Select the type of counter to print.

Off	Do not print a counter (default setting).
Date	Print the date of printing and a waveform acquisition count. (Example: 04-8-1-0001)
Name	Print a counter name and a waveform acquisition count. (Example: A-0001)

3 When [Date] is selected

If you want to begin from an arbitrary count

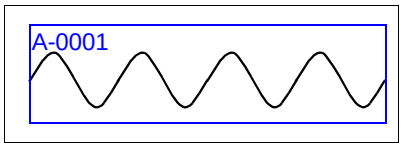


CURSOR Move the cursor to the [Count] item.

F1 to F8 Set an arbitrary count. The count is automatically cleared to zero when the instrument is powered on. The count is incremented by 1 each time a waveform is acquired. (Maximum count 999)

When [Name] is selected

Enter a counter name.



CURSOR Move the cursor to the [Counter Name] item.

F1 to F8 Enter a counter name (up to 10 characters)

See "Entering Text and Comments" (p. 66)

CURSOR Move the cursor to the [Count] item.

F1 to F8 Set an arbitrary count. The count is automatically cleared to zero when the instrument is powered on. The count is incremented by 1 each time a waveform is acquired. (Maximum count 999)

Time Axis Magnification and Compression Settings

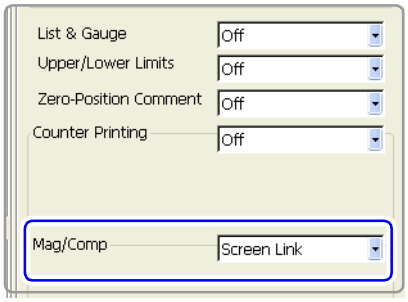
MEM REC REC&MEM REALTIME

To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Mag/Comp] item.
	F1 to F8	Select the display type.

No Screen Link	Print using the magnification or compression ratio set here.
Screen Link	Print using the magnification or compression ratio set for the waveform screen (default setting).



3 When [No Screen Link] is selected

Set the magnification or compression ratio.

CURSOR	Move the cursor to the magnification or compression ratio field.
F1 to F8	Set the magnification or compression ratio for the timebase.

Regardless of the magnification or compression ratio set for the waveform screen, the magnification or compression ratio set here is printed.

(Memory Function or Memory waveform data from the REC&MEM function is enabled)
x 10 to x 1/50000

(Recorder Function or Recorder waveform data from the REC&MEM function is enabled)
x 1 to x 1/20000

With the REC&MEM function, settings for the Recorder and Memory waveforms can be made independently.

NOTE

- The Recorder Function display magnification ratios x 4 and x 2 are valid only for screen display. When printing waveforms, the magnification ratio x 1 gives 1 pixel per data point, which is the same resolution as the screen when viewed at x 4.
- During external sampling, depending on the timebase magnification ratio, the number of data points per division may be a number with a decimal fraction. When the waveform is printed, the decimal fraction is discarded, so that the number of data points per division is an integral number.

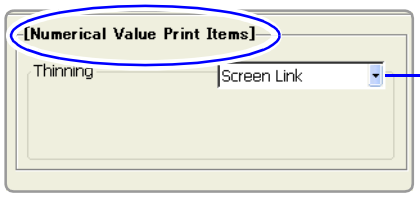
12.6.3 Printing Numerical Value Displays

Make the following settings as required.

Make settings on the **[Print Items] page of the Print Settings screen**

1. Press the **SUB MENU** key and select the [Print] menu.
2. Press the **SHEET/PAGE** key and select the [Print Items] page.

[Numerical Value Print Items] field



(This example screen shows the default values for all settings.)

Numeric values can be thinned before printing. Select whether or not to link the printing to the display of numeric values on the waveform screen. Thinning is convenient when there are a large number of data points with little variation in value.

To print numeric value data, set the Printout Type to [Numeric] or set the Printout Type to [Screen Link] and Display Type of the Sheet setting screen to [Numeric].

See "Recording Type Settings" (p. 327)

Numeric Value Data Thinning Settings

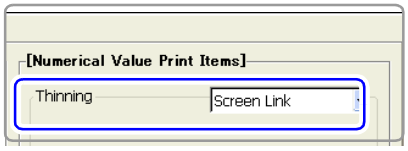
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Thinning] item.
	F1 to F8	Select whether to link numeric value data with the waveform screen.

No Screen Link	Thinned data is printed.
Screen Link	Printed data is linked with the numerical value display thinning setting on the Waveform screen(p. 221) (default setting).



With the REC&MEM function, settings for the Recorder and Memory waveforms can be made independently.

3 When [No Screen Link] is selected

Set the thinning number.

CURSOR	Move the cursor to the field where the [Thinning] number is entered.
F1 to F8	Set to Off for no thinning. For thinning, enter a thinning number (2 to 1000).

See "Entering Numbers" (p. 65)

When printing numeric values at the same time as waveform display, for example with Real-Time Print

The minimum thinning number is 100.

If the thinning number is 99 or lower, or if thinning is Off, printing uses a thinning number of 100.

NOTE

When the printing interval is longer than the record data

Data from the first sample only is printed.

- When there is data for a recording length of one division (= 100 samples) and numerical value thinning is set to [2]:
  The data is printed after thinning to every other sample.
- When there is data for a recording length of one division (= 100 samples) and numerical value thinning is set to [1000]:
  Only the first sample is printed.

When the Memory Function is enabled and Timebase 2 sampling is used

The data of Timebase 1 and Timebase 2 is printed. The data of Timebase 1 only is thinned before printing. The data of Timebase 2 is printed in the field which are closes to the timebase of Timebase 1.

See "Print Example 2: Measurement with Timebase 1 and Timebase 2, with Timebase 1 thinned" (p. 343)

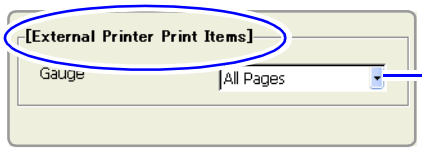
12.6.4 Making Gauge Settings (When Using External Printer)

Make the following settings as required.

Make settings on the **[Print Items] page of the Print Settings screen**

1. Press the **SUB MENU** key and select the [Print] menu.
2. Press the **SHEET/PAGE** key and select the [Print Items] page.

[External Printer Print Items] field



Select whether to print a gauge on all pages or on the first page.

(This example screen shows the default value.)

Gauge Settings

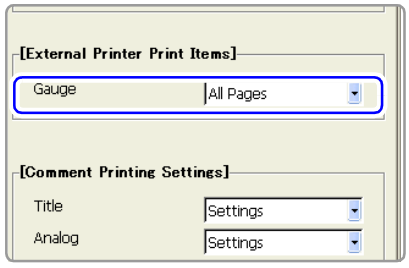
MEM REC REC&MEM REALTIME

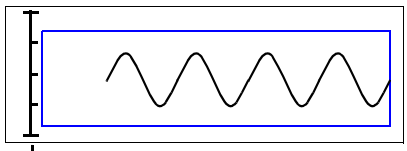
To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Gauge] item.
	F1 to F8	Select the gauge printing method.

All Pages	Print a gauge on all pages (default setting).
First Page	Print a gauge on the first page only.





Gauge

NOTE

- If the gauge alone is large enough to occupy half or more of the page, only the scale of the gauge is printed on the second and following pages.
- With stepped printing, gauges only print on the first page, regardless of this setting.

12.6.5 Printing Comments and Setting Data

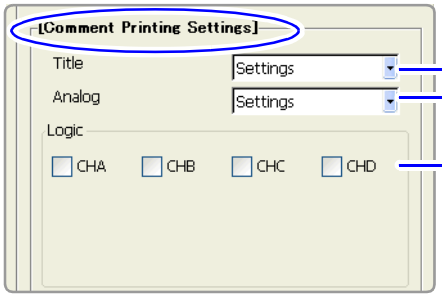
Select whether to print titles (p. 118) and channel comments (p. 119) that you have set in the Channel Settings screen, and settings data for the instrument.

Make the following settings as required.

Make settings on the **[Print Items] page of the Print Settings screen**

1. Press the **SUB MENU** key and select the [Print] menu.
2. Press the **SHEET/PAGE** key and select the [Print Items] page.

[Comment Printing Settings] field



(This example screen shows the default values for all settings.)

Select whether to print titles and settings data (function, timebase, time axis magnification or compression ratio, trigger times).

Select whether to print analog channel comments and channel settings (measurement range, vertical-axis magnification and compression ratios, zero position, low-pass filter, full-scale value of range (upper and lower limits when scaling or Variable is enabled).

Select whether to print comments for each logic channel.

Printing Titles and Measurement Conditions

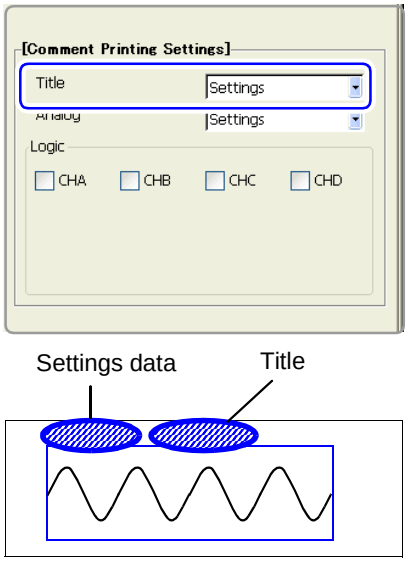
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **SET** key → Select Print with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Title] item.
	F1 to F8	Select the content to print.

Off	Do not print.
Settings	Print the settings data of the instrument (default setting).
Comments	Print title.
Set & Com	Print settings data and title.



Printing Analog Channel Comments and Settings

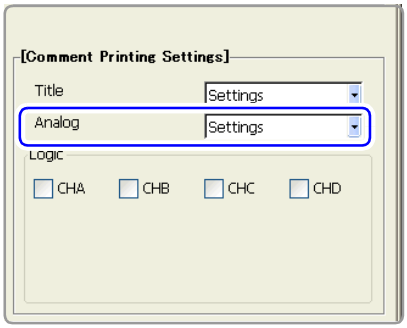
MEM REC REC&MEM FFT REALTIME

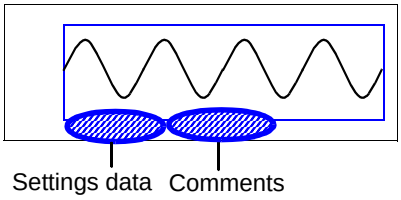
To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the [Analog] item.
	F1 to F8	Select the content to print.

Off	Do not print.
Settings	Print the settings data of the instrument (default setting).
Comments	Print the comments of each channel.
Set & Com	Print the settings data and comments of each channel.





Printing Logic Channel Comments

MEM REC REC&MEM REALTIME

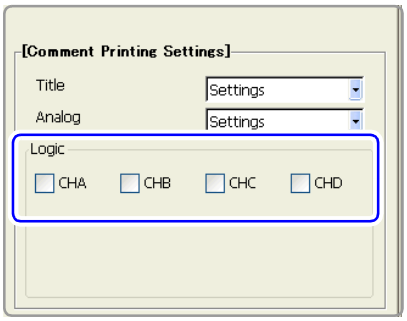
To open the screen: Press the **SET** key → Select [Print] with the **SUB MENU** keys →Print Settings screen

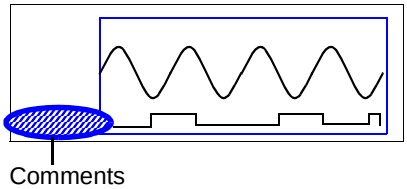
See Screen Layout (p. 41)

	Operating Key	Procedure
1	**SHEET/PAGE**	Select the [Print Items] page.
2	**CURSOR**	Move the cursor to the logic channel whose comments you want to print.
	F2	Select [On].

Off	Do not print comments (default setting).
On	Print comments. Print all four probes (1 to 4) of the logic channels (CHA, CHB,..).

☑: On ☐: Off



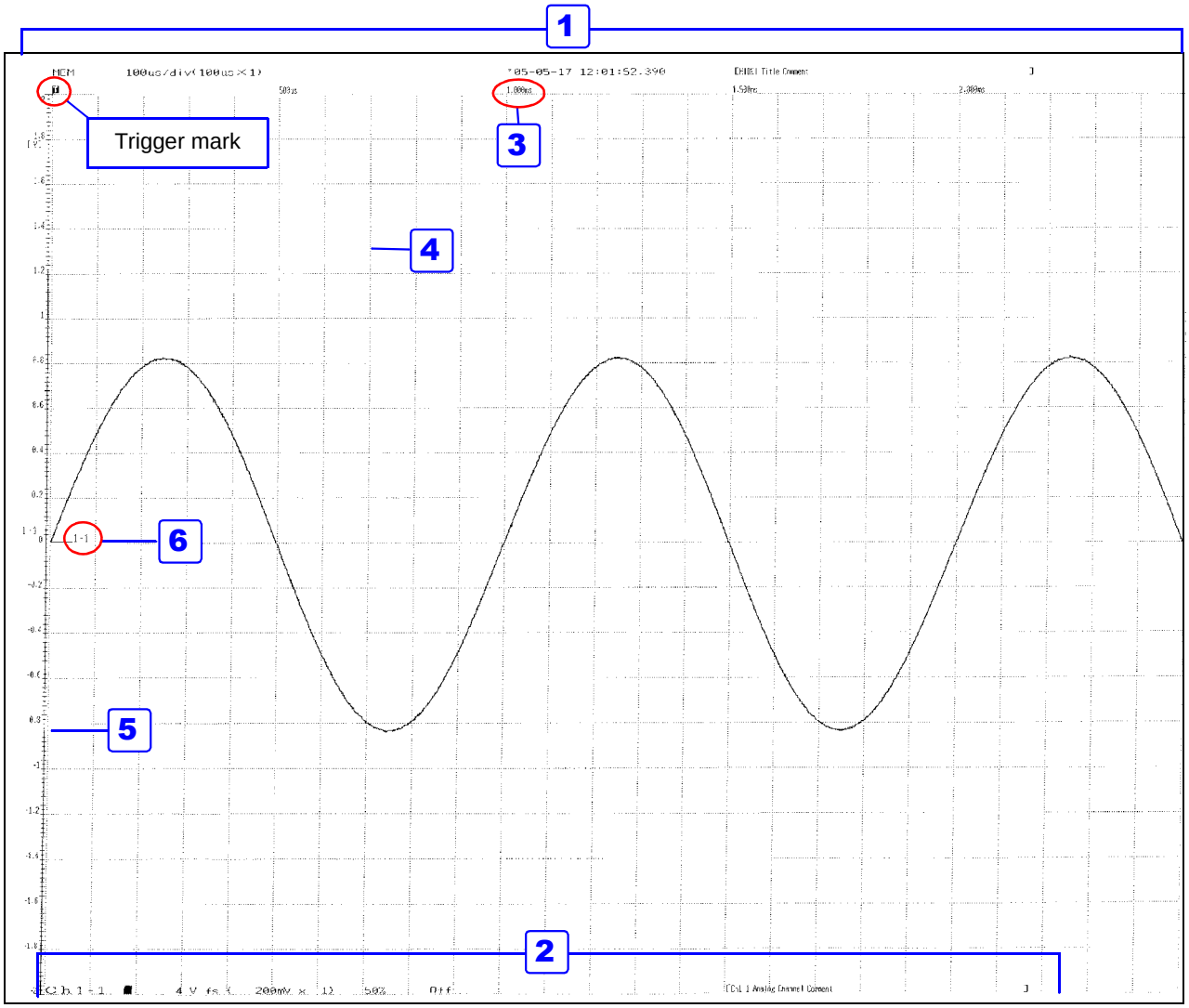


12.7 Print Examples

NOTE In the following cases, the characters used by the instrument differ from printed characters. (Instrument characters → Printed characters)
^{2} → 2, ^{3} → 3, ^{n} → n

Whole Waveform

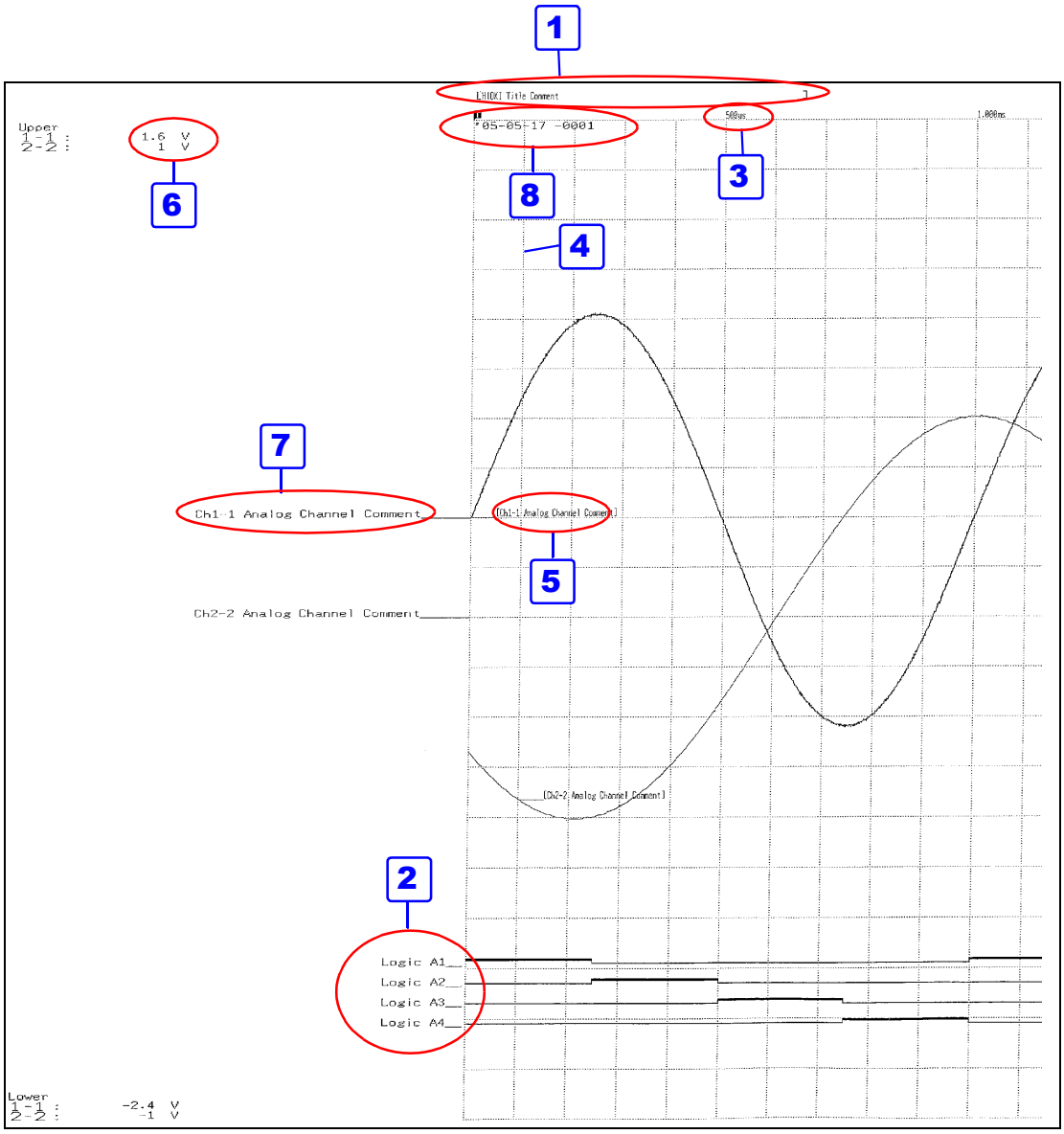
Print Example 1: Printing Title and Settings, with a Gauge



Settings for this print example

	Setting Item	Setting	Reference for Setting	Setting Field or Page
1	Title	[Set & Com]	(p. 337)	[Comment Printing Settings] field in the [Print Items] page
2	Analog	[Set & Com]	(p. 338)	
3	Time Value Display	[Time]	(p. 328)	Common Print Items field
4	Grid Type	[Normal]	(p. 329)	Waveform Print Items field
5	List & Gauge	[Gauge]	(p. 330)	
6	Channel Markers	[Ch No.]	(p. 330)	
	Printer Density	[Dark]	(p. 323)	[Printer] page

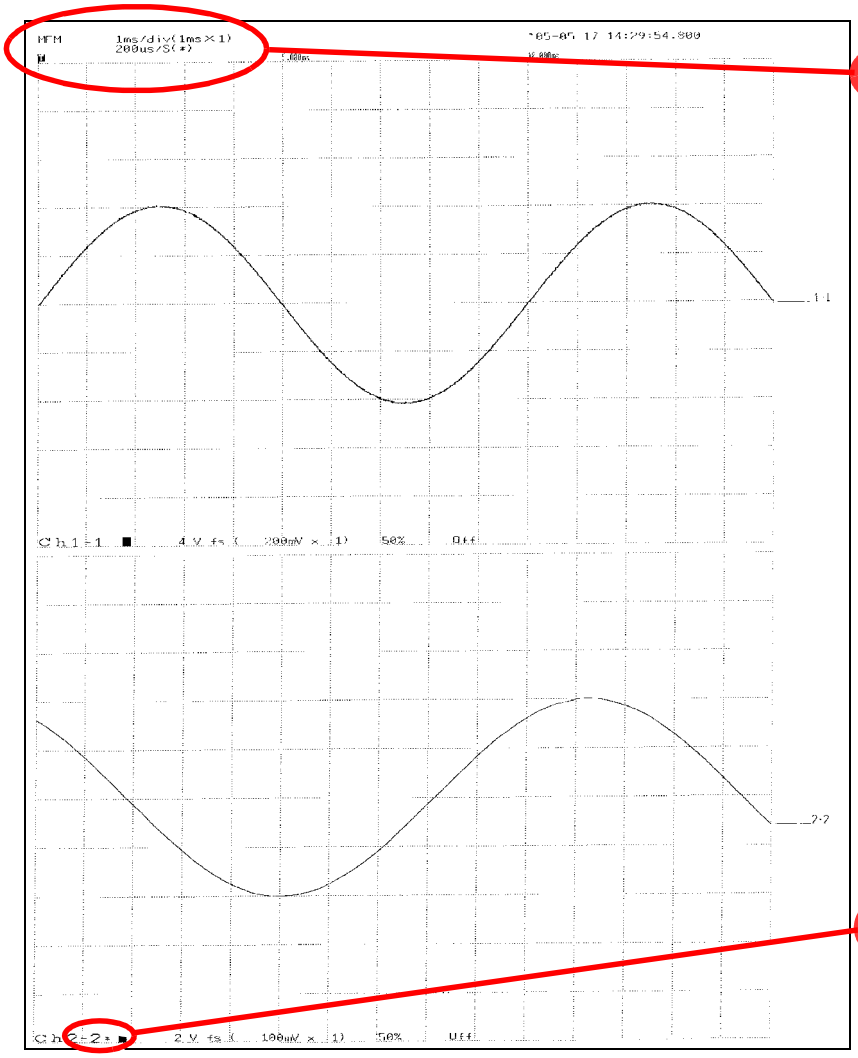
Print Example 2: Printing Title with Channel Comments

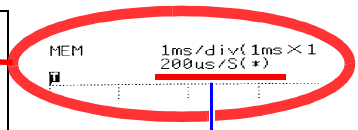


Settings for this print example

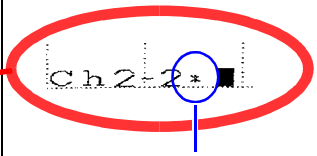
	Setting Item	Setting	Reference for Setting	Setting Field or Page
1	Title	[Comments]	(p. 337)	[Comment Printing Settings] field in the [Print Items] page
2	Logic	[On]	(p. 338)	
3	Time Value Display	[Time]	(p. 328)	Common Print Items
4	Grid Type	[Normal]	(p. 329)	Waveform Print Items field
5	Channel Markers	[Comments],[Inside]	(p. 330)	
6	Upper/Lower Limits	[On]	(p. 331)	
7	Zero-Position Comment	[On]	(p. 331)	
8	Counter Printing	[Date]	(p. 332)	
	List & Gauge	[Off]	(p. 330)	
	Printer Density	[Dark]	(p. 323)	[Printer] page

Print Example 3: Printing of Timebase 1 & 2, 2-Screen Display



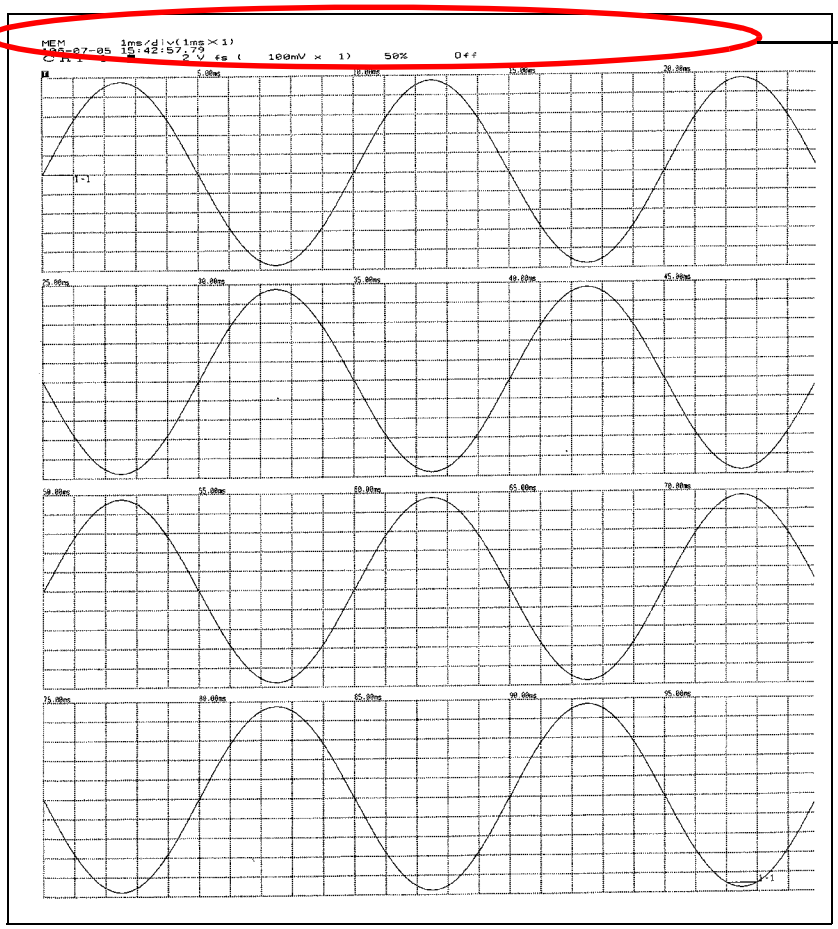


The sampling rate of the Timebase 2 is printed under Timebase settings.



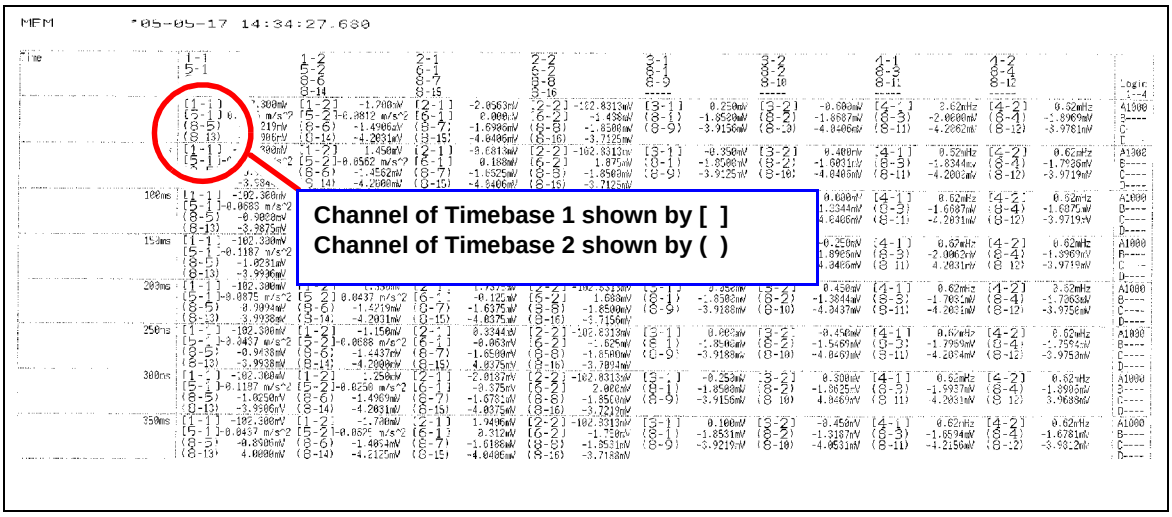
The channel of Timebase 2 is marked by an asterisk (*).

Print Example 4: Row Printing (1/4 steps)

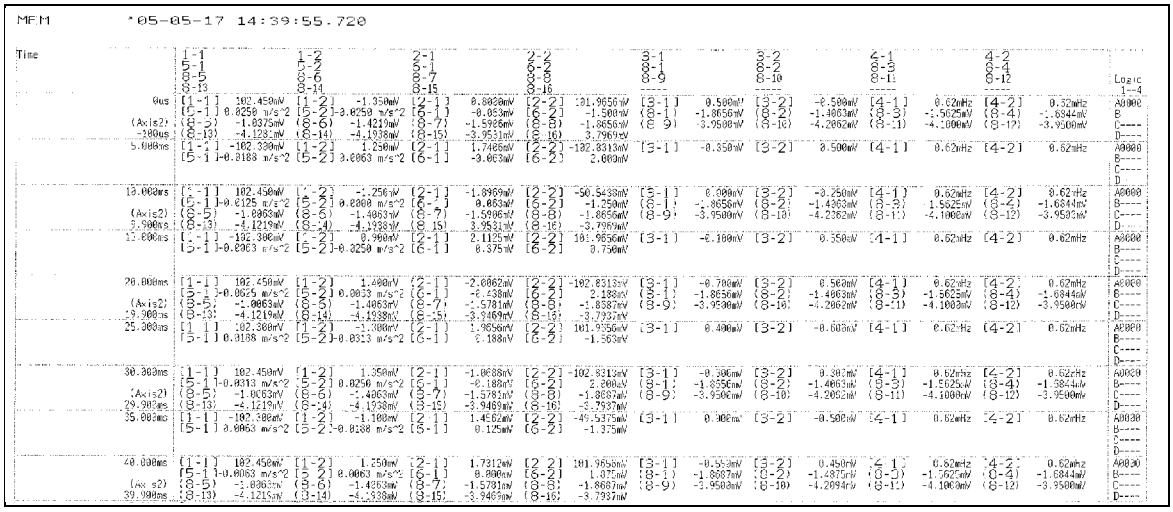


Numerical Value Data

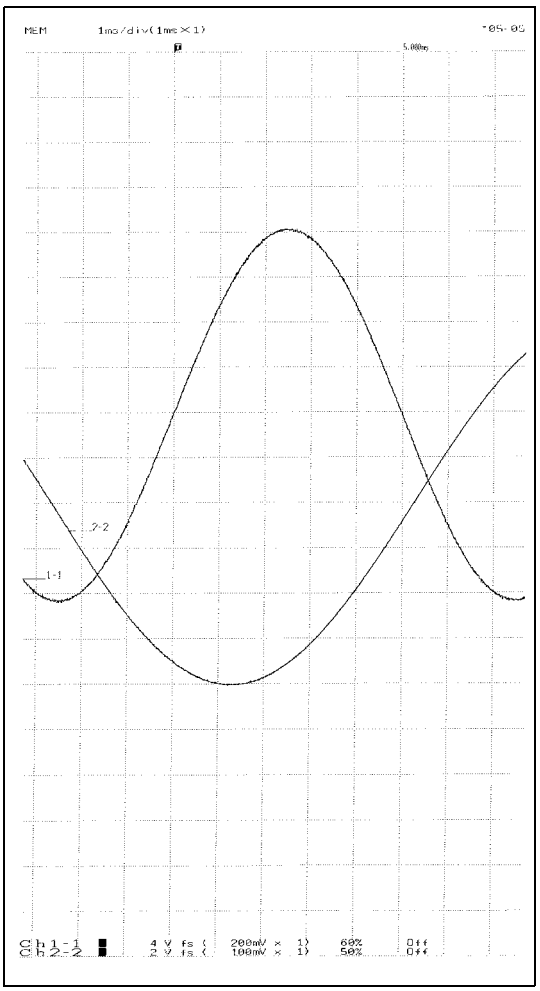
Print Example 1: Measurement with Timebase 2



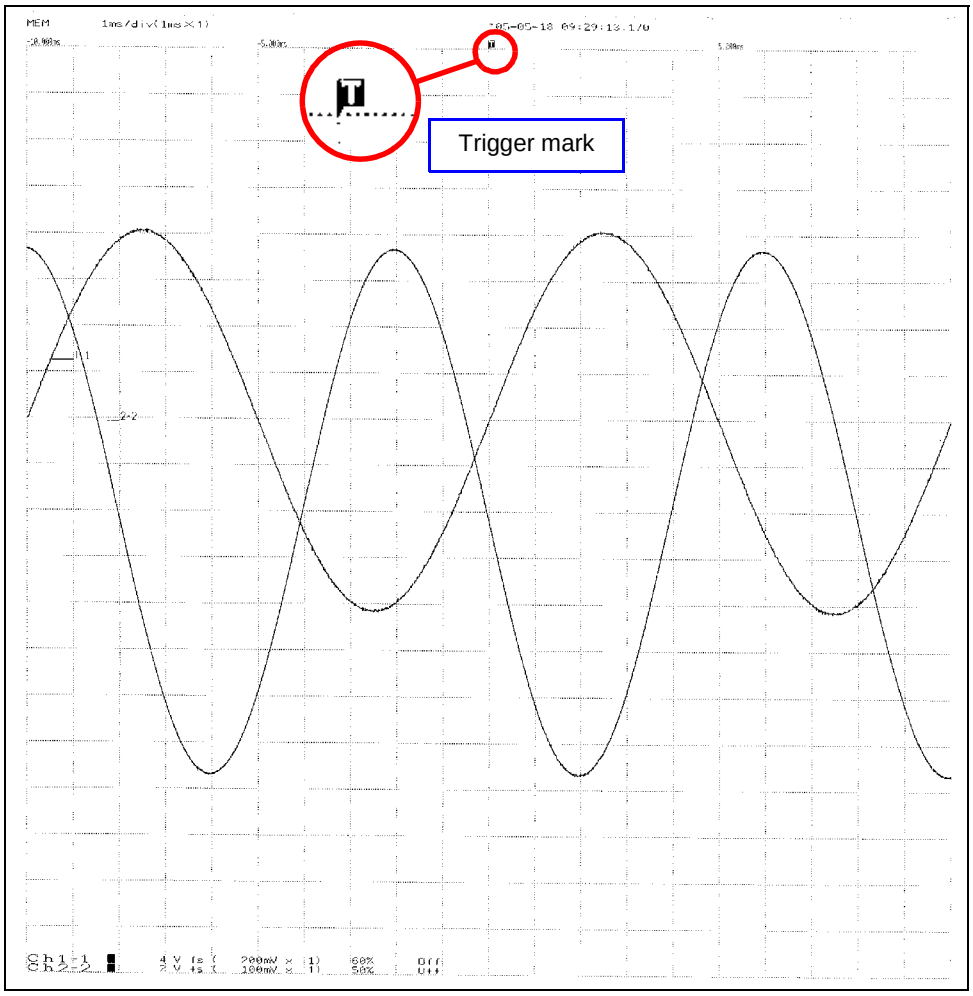
Print Example 2: Measurement with Timebase 1 and Timebase 2, with Timebase 1 thinned



A-B Waveform

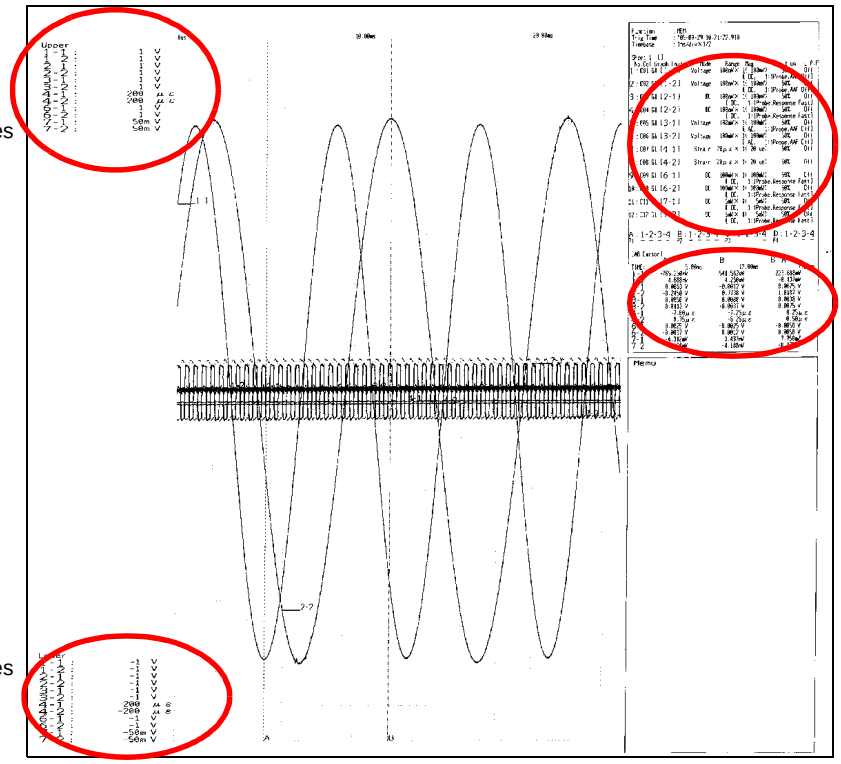

MEM
1ms/div(1ms×1)
*05-05
5.00Hz
2-2
1-1
Ch1-1
4 V fs (
200mV ×
1)
60%
Off
Ch2-2
2 V fs (
100mV ×
1)
50%
Off

Pre- and Post-Trigger Waveform



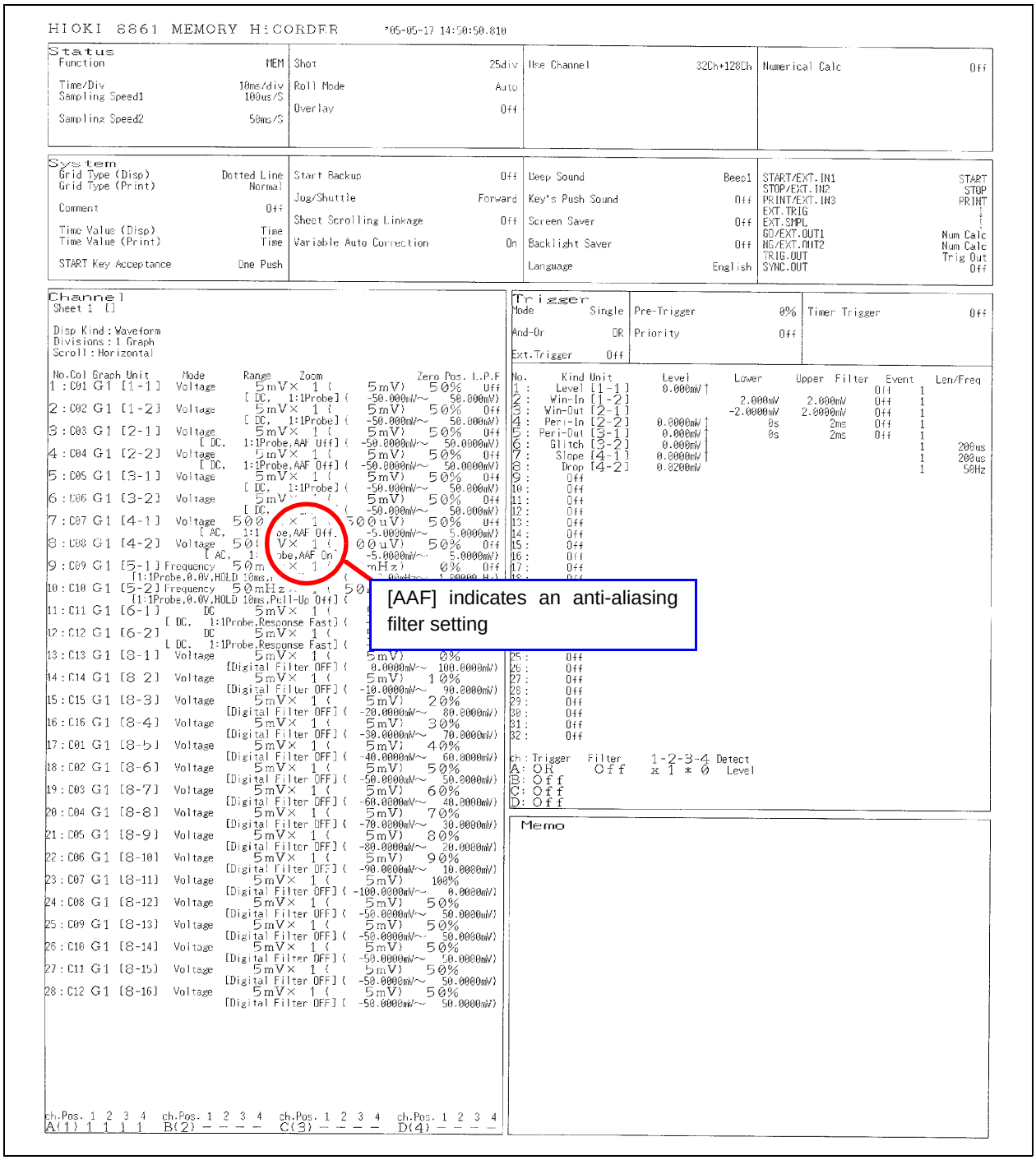
Report

When the [A4 Size (Report)] printing setting is enabled

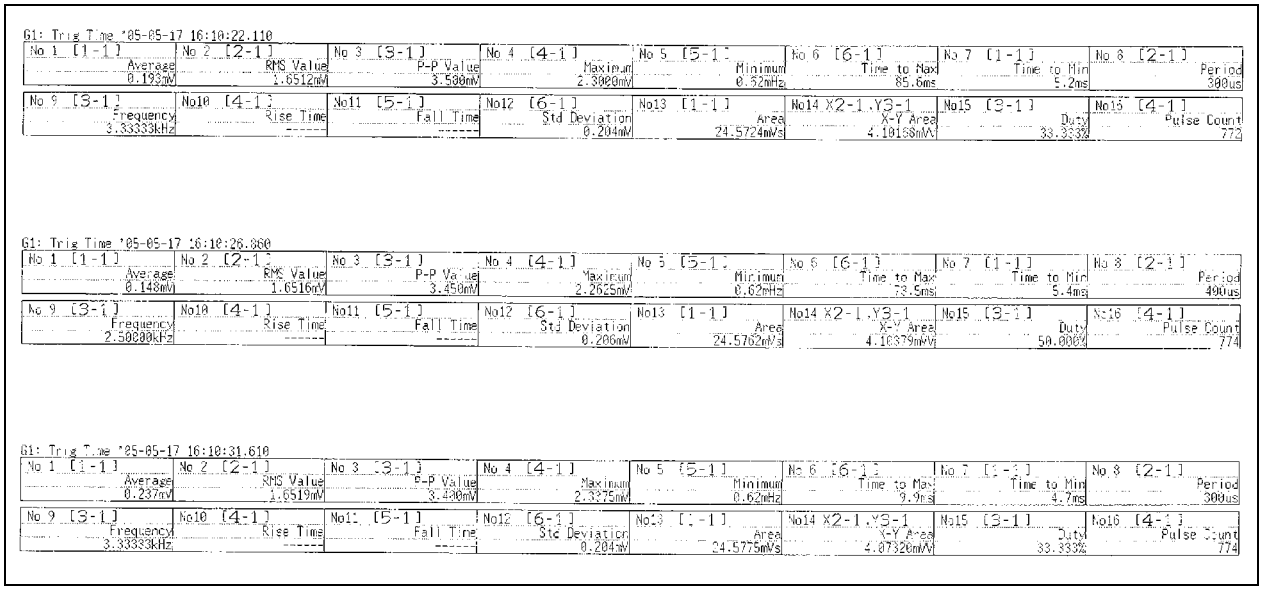


List

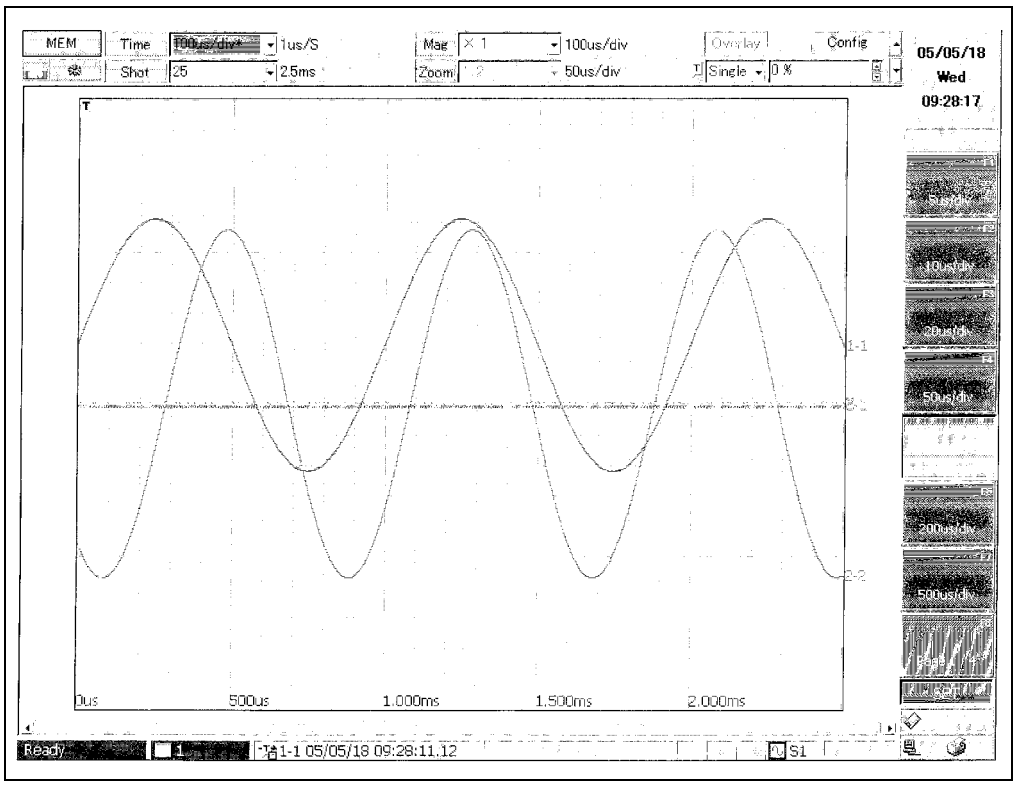
With Memory Function Enabled



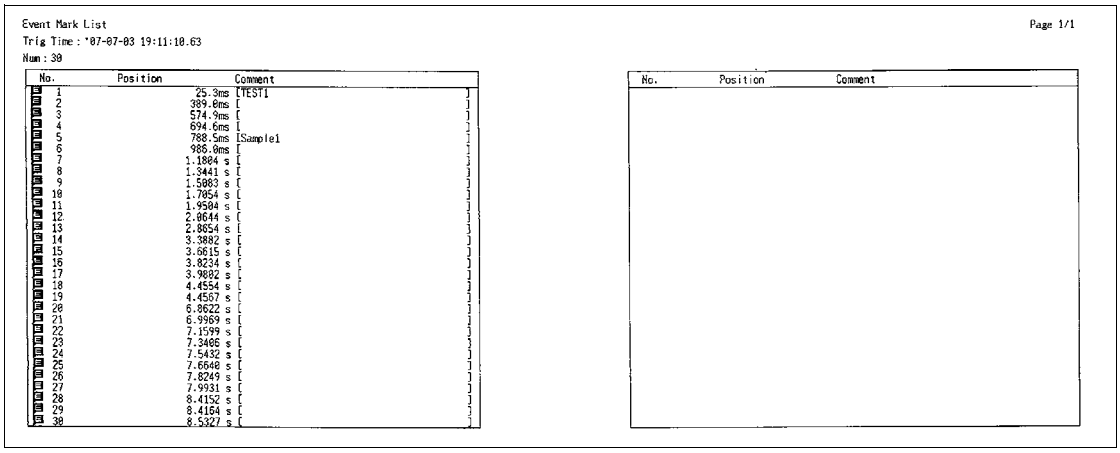
Calculation Results



Screen



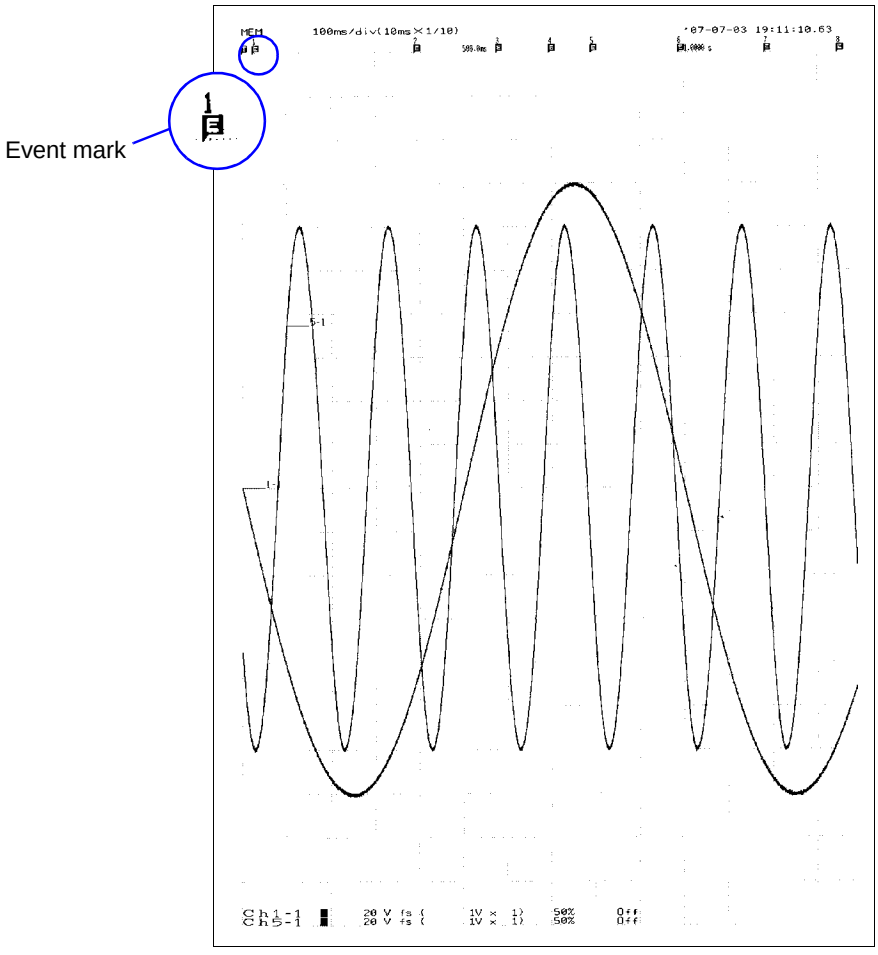
Event



Event Mark List
Page 1/1
Trig Time : '07-07-03 19:11:10.63
Num : 30

No.	Position	Comment
1	25.3ms	[TEST1]
2	389.6ms	[ ]
3	574.9ms	[ ]
4	694.6ms	[ ]
5	788.5ms	[Sample1]
6	988.0ms	[ ]
7	1.1884 s	[ ]
8	1.3441 s	[ ]
9	1.5083 s	[ ]
10	1.7054 s	[ ]
11	1.9504 s	[ ]
12	2.0644 s	[ ]
13	2.8654 s	[ ]
14	3.3882 s	[ ]
15	3.6615 s	[ ]
16	3.8234 s	[ ]
17	3.9882 s	[ ]
18	4.4554 s	[ ]
19	4.4567 s	[ ]
20	6.8622 s	[ ]
21	6.9969 s	[ ]
22	7.1599 s	[ ]
23	7.3486 s	[ ]
24	7.5432 s	[ ]
25	7.6648 s	[ ]
26	7.8249 s	[ ]
27	7.9931 s	[ ]
28	8.4152 s	[ ]
29	8.4164 s	[ ]
30	8.5327 s	[ ]

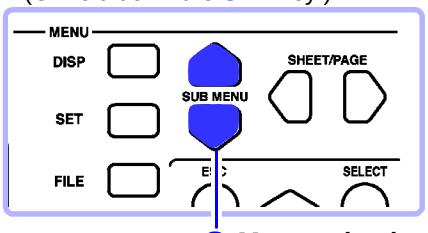
No.	Position	Comment



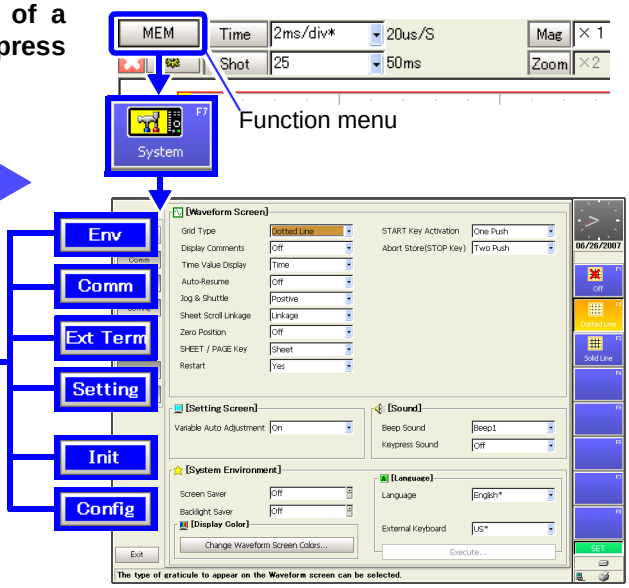
System Environment Settings Chapter 13

Use the System screen to make system-related settings.

1 Move the cursor to the function menu of a waveform or settings screen, and then press the F7 [System] key.
(Or hold down the **SET** key.)



2 Menu selection



About screen contents:
"2.7.1 Environment (Env) Settings Screen" (p. 45)
"2.7.5 Initialization (Init) Settings Screen" (p. 51)

System environment settings — Env

Waveform screen display settings
- Grid type (p. 350)
- Comment display (p. 351)
- Recording time value display (p. 352)
- Zero position display (p. 352)

Key operation and operational settings
- Activation conditions for the START key (p. 353)
- Method for stopping measurement with the STOP key (p. 354)
- Jog & shuttle operations (p. 356)
- Auto-Resume function (resume after power restoration) (p. 355)
- Variable function auto adjustment (p. 358)
- Beep and key operation sounds (p. 359)
- SHEET/PAGE Key operations (p. 357)
- Restart Permission Setting (p. 358)

Screen settings
- Screen saver (p. 360)
- Backlight saver (p. 361)
- Display language and keyboard (p. 362)
- Screen colors (p. 363)

System settings — Init

Time settings
- Set the system date and time (p. 364)

Initialization
- Waveform data initialization (p. 365)
- Settings initialization (system reset) (p. 366)

Self-test
- ROM/RAM check (p. 367)
- Display check (p. 368)
- Key check (p. 369)
- Printer check (p. 370)
- LAN check (p. 371)
- Media check (p. 372)

8958 16-Ch Scanner Unit Adjustment (p. 373)
The 8958 16-Ch Scanner Unit must be adjusted when it is installed in this instrument, and periodically afterwards.

External control connector settings (p. 378) — Ext Term

Saving and reloading setting states (p. 281) — Setting

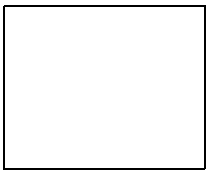
System configuration (p. 374) — Config

Communications settings — Comm
"Chapter 4 Communications Settings" in the *Analysis and Communication Supplement*

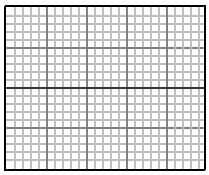
13.1 Making Waveform Screen Display Settings

13.1.1 Selecting the Grid Type

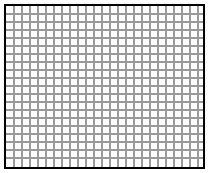
Select whether to display dotted lines or solid lines in the grids shown on waveform screens.



Off



Dotted Line



Solid Line

This setting is not reflected in printing. Use the Print Settings screen if you want to change how grids are printed (p. 329).

Grid Type

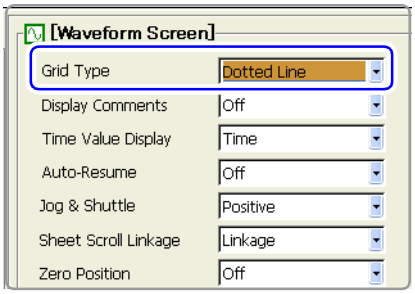
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

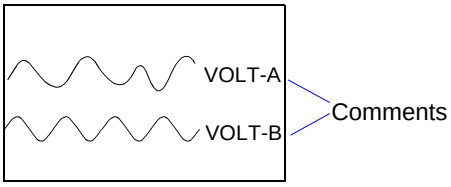
	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Grid Type] item.
2	**F1 to F8**	Select the grid type.

Off	Do not display grid.
Dotted Line	Display grid with dotted lines. (default setting)
Solid Line	Display grid with solid lines.



13.1.2 Displaying or Hiding Comments

You can display the comments for each channel on waveform screens.



Use the Channel Settings screen to set channel comments.

See "5.2 Adding Comments" (p. 118)

Title comments are printed but do not appear on waveform screens.
Comments do not appear on printouts automatically, even if they are displayed on waveform screens. Use the Print Settings screen if you want to print comments.

See "12.6.5 Printing Comments and Setting Data" (p. 337)

Comment Display

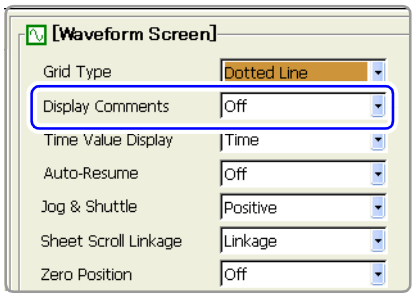
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

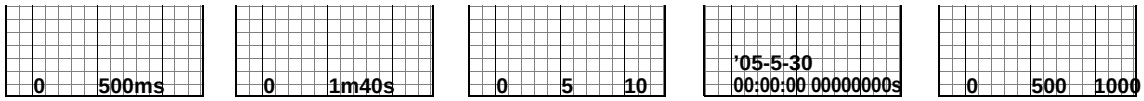
	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Display Comments] item.
2	**F1 to F8**	Select whether to display or hide.

Off	Do not display.(default setting)
On	Display.



13.1.3 Selecting the Time Value Display

Select the waveform recording time value to display (horizontal axis) on waveform screens.



Time | Mod 60 | Scale | Date | Samples

Time Value Display

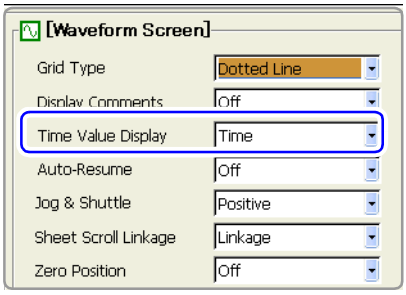
MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

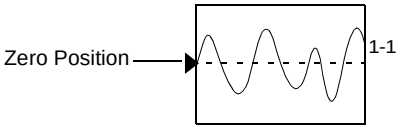
	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Time Value Display] item.
2	**F1 to F8**	Select the recording time value to display.

Time	Display the time from trigger event (unit is fixed). (default setting)
Mod 60	Display the time from trigger event (unit is modulo 60).
Scale	Display the number of divisions from trigger event.
Date	Display the date and time when waveform was acquired.
Samples	Display the number of samples from trigger event.



13.1.4 Displaying Zero Position

The zero position of a measurement waveform can be displayed.



Setting the Zero Position on the Display

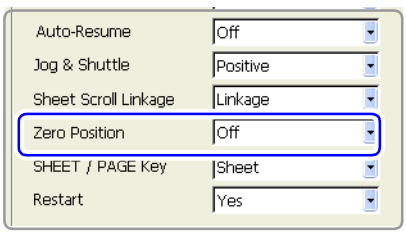
MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Zero Position] item.
2	**F1 to F8**	Enable/disable zero position display.

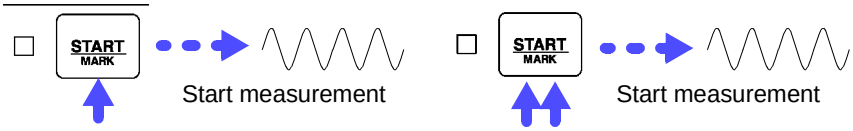
Off	Zero position is not displayed. (default setting)
On	Zero position is displayed



13.2 Making Key Operation and Operational Settings

13.2.1 Specifying Activation Conditions for the START Key

Normally measurement starts when you press the **START** key one time. To prevent measurement from starting by misoperations, you can set the **START** key activation conditions.



START Key Activation Condition Settings

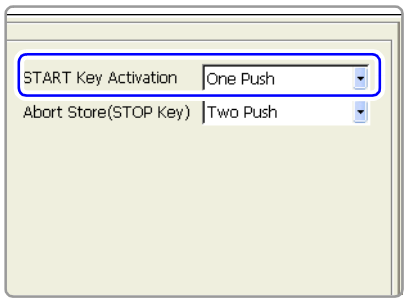
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [START Key Activation] item.
2	**F1 to F8**	Select the **START** key activation conditions.

One Push	Measurement starts when the key is pressed once. (default setting)
Two Push	Measurement starts when the key is pressed twice.
2s Push* (for 2 seconds)	Measurement starts when the key is pressed for 2 seconds.



* When **[2s Push]** is selected
When you press the START key, a message appears to inform you that measurement will start if you keep the key pressed for 2 seconds.
If you keep the key pressed for 2 seconds, the message disappears and measurement starts.

13.2.2 Setting the Method for Stopping Measurement with the STOP Key

Normally, pressing the STOP key once causes measurement to stop after the specified recording length has been recorded, and pressing it twice aborts measurement immediately. However, you can change a setting so that measurement is aborted by pressing the STOP key only once.

Setting the Method for Stopping Measurement with the STOP Key

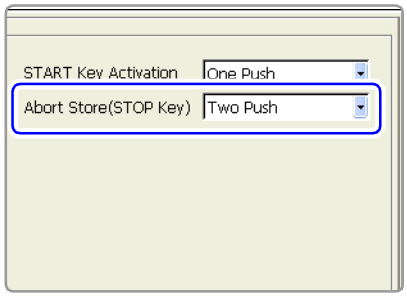
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Abort Stores (STOP key)] item.
2	**F1 to F8**	Select the method for stopping measurement with the STOP key.

Two Push	Pressing the STOP key twice aborts measurement. (default setting)
One Push	Pressing the STOP key once aborts measurement



13.2.3 Using the Auto-Resume Function (Resume After Power Restoration)

If a power outage or other power loss causes an interruption in recording (while the LED on the left side of the **START** key is lit), you can automatically resume recording when the power is restored. If you are using triggers, the triggers are restored to the Trigger Wait State.

Auto-Resume Function Settings

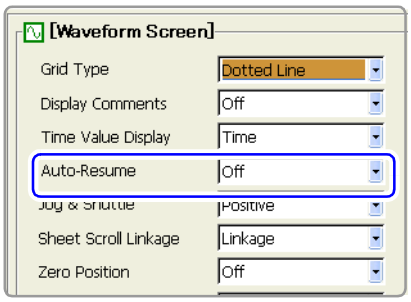
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Auto-Resume] item.
2	**F1 to F8**	Turn the Auto-Resume Function on or off.

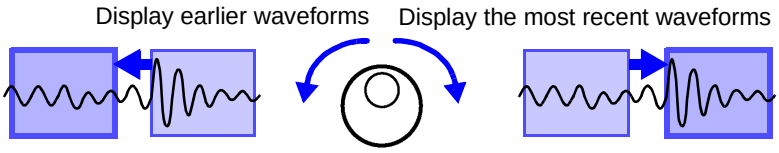
Off	Do not use the Auto-Resume Function. (default setting)
On	Use the Auto-Resume Function.



13.2.4 Specifying Jog & Shuttle Scroll Operations

You can change the direction of the waveform scrolling which occurs when you rotate the Jog and Shuttle knobs.

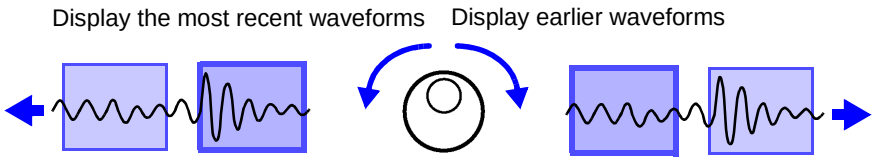
Positive direction (default setting)



Move the display position to the left
Waveforms earlier than the current point appear.

Move the display position to the right
Waveforms later than the current point appear.

Negative direction



Move the waveform to the left
Waveforms later than the current point appear.

Move the waveform to the right
Waveforms earlier than the current point appear.

Jog & Shuttle Settings

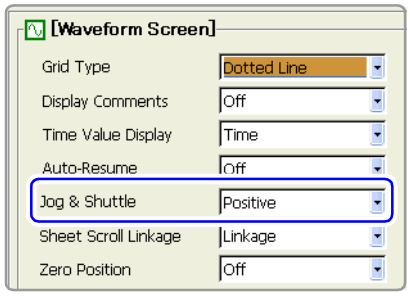
MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Jog & Shuttle] item.
2	**F1 to F8**	Select the waveform movement direction.

Positive	The screen display position moves to the right and left. (default setting) (Rotating to the right moves the waveform display position to the right. Data later than the currently displayed waveform appears.)
Negative	A negative direction waveform moves to the left and right. (Rotating to the right moves the waveform to the right. Data earlier than the currently displayed waveform appears.)



13.2.5 Using Sheet Scroll Linkage

Sheet scroll linkage allows you to scroll sheets which are not displayed when you scroll a waveform on the waveform screen. This allows you to check waveforms for the same time value when you switch the displayed sheet.

Sheet Scroll Linkage Settings

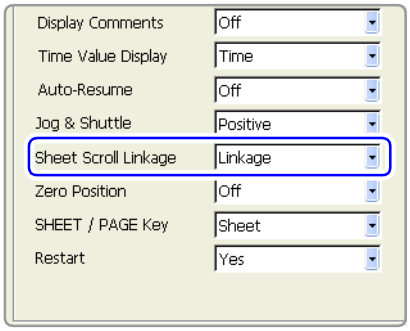
MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Sheet Scroll Linkage] item.
2	**F1 to F8**	Select either choice.

No Linkage	Do not link sheets.
Linkage	Scroll with sheet scroll linkage. (default setting)



13.2.6 Specifying SHEET/PAGE Key Operations

When scrolling waveforms on the Waveform screen, sheets not currently displayed can be scrolled as well. Then when switching to another display sheet, the same time value on the waveform can be verified immediately.

Sheet Scroll Linkage Settings

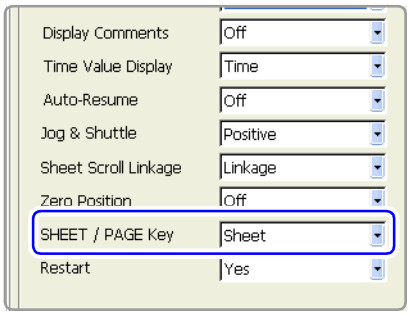
MEM REC&MEM

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [SHEET/PAGE Key] item.
2	**F1 to F8**	Select either choice.

Sheet	Switches between sheets. (default setting)
Block	Switches between blocks.



13.2.7 Selecting How Settings Affect Measurement (Restart Permission)

You can select whether measurement restarts immediately after changing measurement-related settings.

Restart Permission Setting

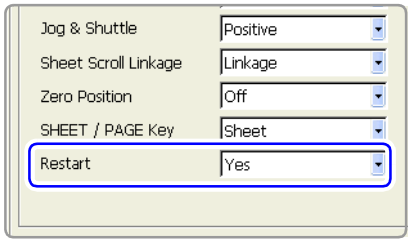
MEM REC REC&MEM FFT

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Restart].
2	**F1 to F8**	Select either choice.

No	Measurement does not restart. Settings cannot be changed while measuring. Also, the Settings screens are not accessible.
Yes	When a setting is changed while measuring, the change takes effect and measurement restarts immediately. (default setting)



13.2.8 Performing Variable Function Auto Adjustment

When variable auto adjustment is enabled, the variable setting becomes linked to changes in scaling and voltage range settings.
Variable function settings:

See "8.9.4 Setting Arbitrary Waveform Height and Position on the Vertical (Voltage) Axis (Variable Function)" (p. 215)

Variable Auto Adjustment

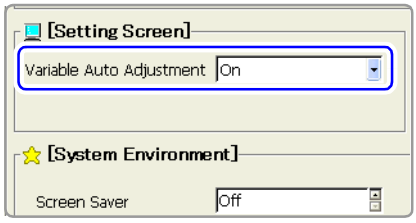
MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Variable Auto Adjustment] item.
2	**F1 to F8**	Turn variable auto adjustment on and off.

Off	Do not perform auto adjustment of the variable setting.
On	Perform auto adjustment of the variable setting. (default setting)



13.2.9 Specifying Beep and Operation Sounds

Beep sounds can be specified to alert you to operation status. They can be selected from two types.
Sounds can also be emitted for key operations.

Beep Sound Settings

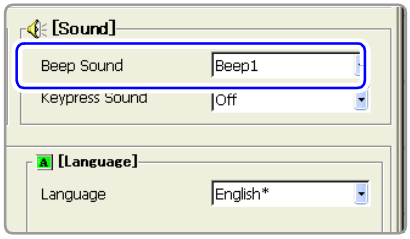
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Beep Sound] item.
2	**F1 to F8**	Select the beep sound.

Off	Do not emit beep sound.
Beep 1	Emit a beep sound on error messages (error and warning displays) and when results are judged to be invalid. (default setting)
Beep 2	In addition to the Beep 1 events, emit a beep sound on start, trigger, stop, and the end of auto save.



Key Operation Sound Settings

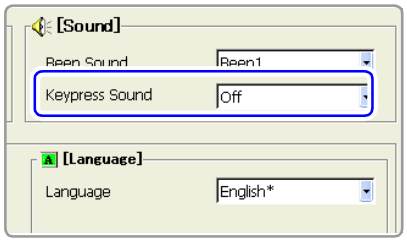
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Keypress sound] item.
2	**F1 to F8**	Select whether or not to emit operation sounds.

Off	Do not emit sound. (default setting)
Type 1	Emit sound.
Type 2	Emit operation sounds. However, the sound is emitted only once, even if the key is kept held down.



13.2.10 Making Screen Saver Settings

A screen saver can be set to appear after a specified number of minutes during which no operation key is pressed. This prevents screen burn-in. If a monitor is connected to the MONITOR jack of the instrument, the screen saver also appears on the monitor.

To exit the screen saver

Press any key. The operating screen appears again.

Screen Saver Settings

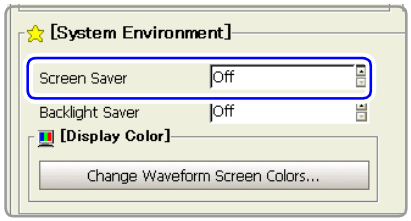
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Screen Saver] item.
2	**F1 to F8**	Set the wait time until the screen saver is activated, or disable the screen saver.

(Set time)	Setting range: 1 to 30 minutes (unit 1 minute) The screen saver is activated if the specified time is exceeded.
Off	Disables the screen saver function. The operating screen is always displayed. (default setting)



13.2.11 Making Backlight Saver Settings

A backlight saver can be activated after a specified number of minutes during which no operation key is pressed. The backlight saver turns off the backlight of the LCD, prolonging the lifetime of the backlight by turning it off when not needed.

To deactivate the backlight saver

Press any key. The operating screen appears again.

Backlight Saver Settings

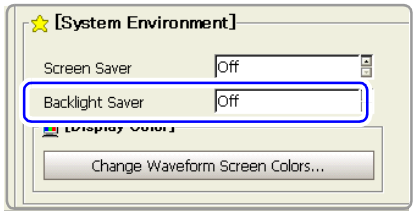
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Backlight Saver] item.
2	**F1 to F8**	Set the wait time until the backlight saver is activated, or disable the backlight saver.

(Set time)	Setting range: 1 to 30 minutes (unit 1 minute) The backlight saver is activated if the specified time is exceeded.
Off	Disables the backlight saver function. The operating screen is always displayed. (default setting)



13.2.12 Selecting the Display Language

You can select the screen display language. After selecting a language, reboot the instrument to enable the selection.
Recorded waveforms are erased when rebooting.

Display Language Selection

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

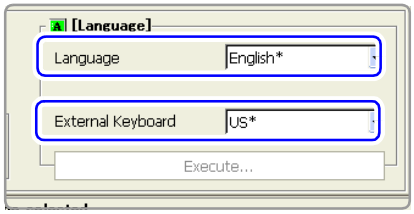
Operating Key Procedure

1 Select the display language.

CURSOR Move the cursor to the [Language] item.

F1 to F8 Select the display language.

English	Display in English. (default setting)
Japanese	Display in Japanese.
Chinese	Display in Chinese.



2 Select the keyboard language.

CURSOR Move the cursor to the [External Keyboard] item.

F1 to F8 Select the language of the keyboard to be used.

US	When using an English keyboard.
Japanese	When using a Japanese keyboard. (default setting)
French	To use a French keyboard
German	To use a German keyboard
Italian	To use an Italian keyboard
Spanish	To use an Spanish keyboard

3 Execute your changes

CURSOR Move the cursor to the [Execute] button.

F1 Select [Execute].
A confirmation dialog box appears.

F1 Select [OK].
The instrument automatically reboots.

To cancel settings
Select **F2** [Cancel].

13.2.13 Selecting Screen Colors

You can set the colors of the waveform screen background and the colors of characters and other objects on the screen. Select red, blue, and green values for the corresponding setting items. The color of the setting item changes to the selected color.

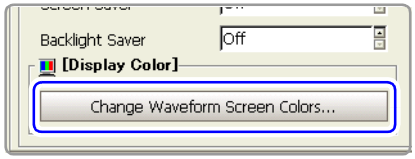
Screen Color Settings

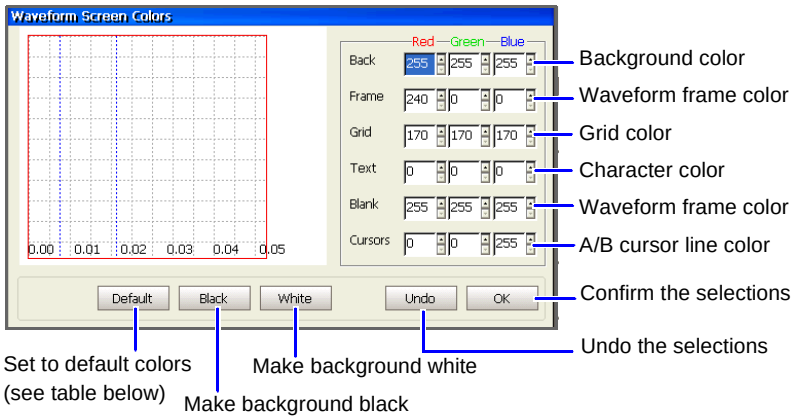
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Env with the **SUB MENU** keys →Env Settings screen

See Screen Layout (p. 45)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Change Waveform Screen Colors] button.
	F1	Select [Edit]. The [Waveform Screen Colors] dialog box appears.





2	**CURSOR** **F1 to F8**	Set as required. **See** "Entering Numbers" (p. 65)

After making the setting, select [OK] to confirm.

To cancel setting

Select the [Undo] button.

Default Colors

Setting item	Red	Green	Blue
Back	0	0	0
Frame	240	0	0
Grid	100	100	100
Text	240	240	240
Blank	0	50	200
Cursors	255	255	0

13.3 Making System Settings

13.3.1 Setting the Date and Time

You can set the date and time zone.
The instrument is equipped with an auto-recorder, automatic leap year detection, and a 24-hour clock.
The system date and time are used in the following operations. Before using the instrument, check to be sure that they are accurate.

- Measuring with timer triggers
- Printing trigger times on printouts

NOTE **If you need to change both the time zone and the date and time, change the time zone first.**

Date and Time Settings

MEM REC REC&MEM FFT REALTIME

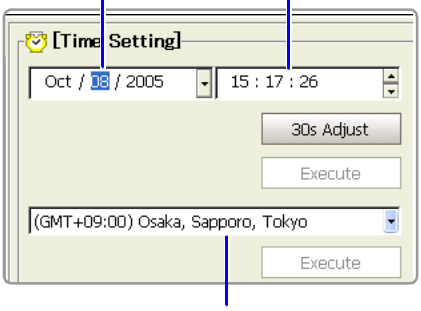
To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

	Operating Key	Procedure
To change the time zone		
1	**CURSOR**	Move the cursor to the time zone field.
	F1 to F8	Select regions.
2	**CURSOR**	Select the [Execute] button.
	F1	The clock is reset to the date and time of the specified region.
To set the date or time		
1	**CURSOR**	Move the cursor to the date or time field of [Time Setting].
	F1	Select [Set].
	F1 to F8	Move the cursor to the digit to change, then set the value. Confirm (F5 [OK]) for each of the date and time.
2	**CURSOR**	Select the [Execute] button.
	F1	The clock is reset to the specified date and time.

Date setting (Year, Month, Day)

Time setting (Hour, Minute, Second)



Time zone setting

Auto Calendar
A calendar appears when you click the arrow button (▼) of the date setting field. You can use this calendar to set the date.

To adjust the current time by less than 1 minute in 30-second intervals

Select **F2** [30s Adjust]. The time is adjusted as follows.
00 to 29 seconds: Seconds are reset to 00 without changing the minutes.
30 to 59 seconds: Seconds are reset to 00 and minutes are increased by 1.

13.3.2 Initializing Waveform Data

Discard the waveform data saved in memory and initialize the data.

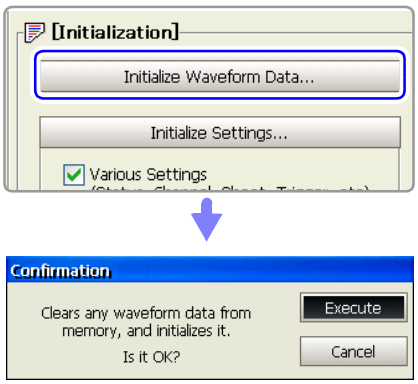
Initializing Waveform Data

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Initialize Waveform Data] button.
	F1	Select [Execute]. A confirmation dialog box appears.
2	**F2**	Select [Execute]. **To cancel initializing** Select **F3** [Cancel]. Initialization is complete when "Completed normally" appears.



13.3.3 Initializing System Settings (System Reset)

Select groups of settings currently in force on the instrument, and initialize the settings.
Initialization returns the instrument to the factory default state.
See "Appendix 2.1 List of Default Settings" (p. A9)

By default, the Various Settings and System Settings 1 (Environment) setting groups are selected for initialization in this screen.

Initializing System Setting Data

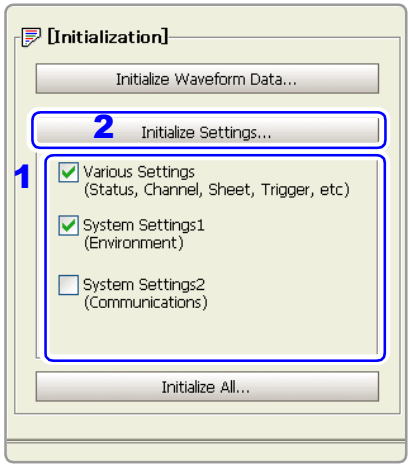
MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen
See Screen Layout (p. 51)

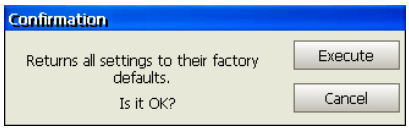
	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the item you want to initialize.
	F2	Select [On]. Select [Off] for the groups of settings that you do not want to initialize.

Various Settings (Status, Channel, Sheet, Trigger, etc.)	Current settings in various setting screens (Default setting: On)
System Settings 1 (Environment)	The settings in the Environment Settings screen(Default setting: On)
System Settings 2 (Communications)	The settings in the Communication Settings screen (Default setting: Off)

☑: On ☐: Off



2	**CURSOR**	Move the cursor to the [Initialize Settings] button.
	F1	Select [Execute]. A confirmation dialog box appears.
	F2	Select [Execute].



To cancel initializing
Select **F3** [Cancel].

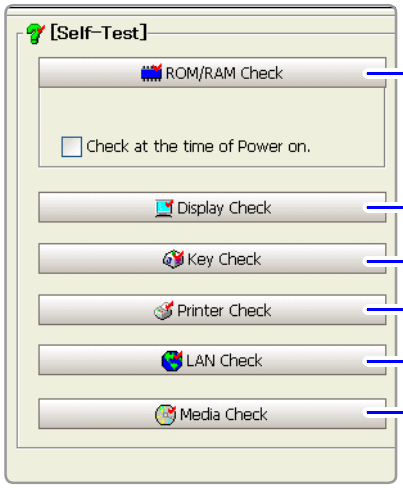
Initialization is complete when "Completed normally" appears.

To initialize all settings

Select the [Initialize All] button. All settings are initialized and the instrument reboots. The zero-adjust values of input modules and the correction value of the 8958 16-Ch Scanner Unit are not initialized.

13.3.4 Self-Test (Self Diagnostics)

The following self-test checks are available.



Check the instrument's internal memory (ROM and RAM)(p. 367). The results are displayed on the screen.

Check the screen display (color check, gradation check, character check) (p. 368).

Check whether instrument keys are functioning correctly (p. 369).

Check printing by the printer and clean print heads (p. 370).

Check LAN settings and status. Also check whether it is possible to communicate with other devices (p. 371).

Check media status (p. 372).

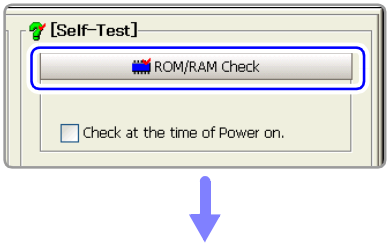
ROM/RAM Check

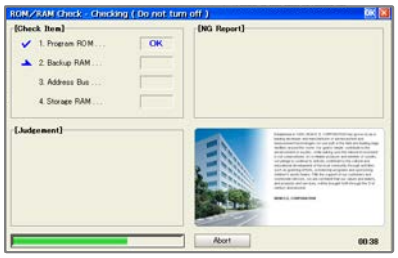
MEM REC REC&MEM FFT REALTIME

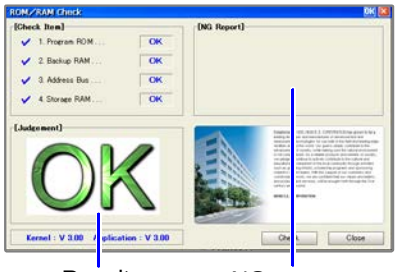
To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

Operating Key	Procedure
CURSOR	Move the cursor to the [ROM/RAM Check] button.
F1	Select [Execute].
	The [ROM/RAM Check] dialog appears. The ROM/RAM check starts. (The storage RAM check may require more than an hour if additional memory has been installed.)
	Do not turn the power off during the check.
	To cancel the check
	Select **F1** [Abort]. All operation key (except F1) are disabled during execution of the check.
	The judgment results appear when the check finishes. OK: Normal NG: Error ("If "NG" appears" (p. 368))
	To close the dialog
	Select the [Close] button.







Result

NG report

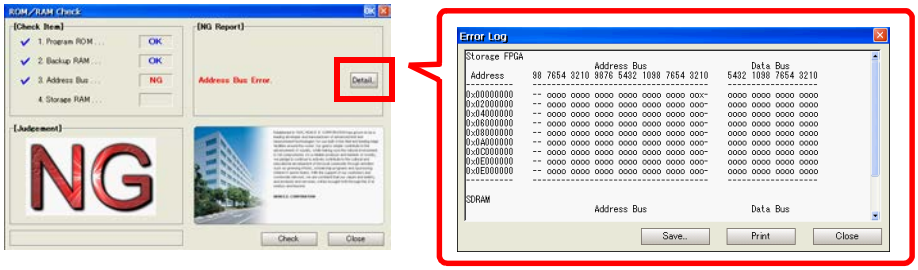
Displays the content of the error for an NG check item.

To perform the every time the instrument is powered on

CURSOR **F2**	Move the cursor to [Check at the time of Power on.] and select [On]. (The contents of RAM are not lost when a ROM/RAM check is performed.)

If "NG" appears

Select the [Detail] button to check the results.
To save the NG results report, select the [Save] button, and to print the results select the [Print] button.



NOTE If "NG" appears, request repairs.

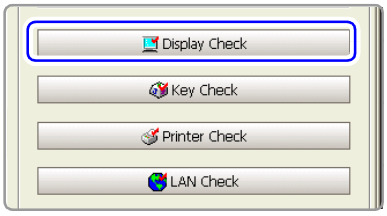
Display Check

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Display Check] button.
	F1	Select [Execute]. A red screen appears.
2	**Any key**	Check the state of the display. The screen changes each time you press an operation key.



Color check: Red → Green → Blue → White → Black → Color Pattern →
Gradation Check → Character check: Alphabet, Numbers → Font Size →
"Finished" → Original screen

To cancel the check

Press the **ESC** key. The original screen reappears.

NOTE If the display screen seems abnormal, request repairs.

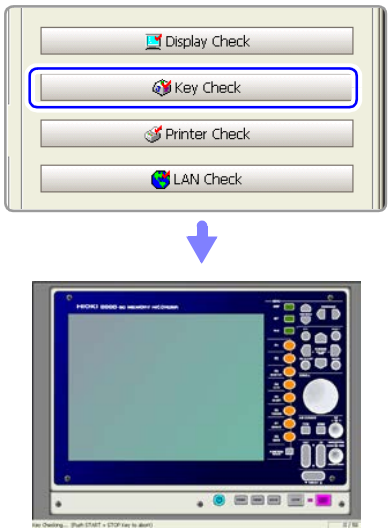
Key Check

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

	Operating Key	Procedure
1	**CURSOR** **F1**	Move the cursor to the [Key Check] button. Select [Execute]. Operation keys appear.
2	**All operation keys**	Press each operation key once or more. The corresponding key is painted over. • Jog: Rotate to the left and right, one time or more in each direction. • Shuttle: Rotate all the way in left and right directions. • A/B knobs and RANGE/POSN knobs: Rotate each knob to the left and right one or more times. Press the inner side knobs. The START key also functions as an LED light check key. The check is finished when you have operated all the keys.



To cancel the check

Press the **START** and **STOP** keys simultaneously. The original screen reappears.
If you are using a mouse, you can click the right button and select [Exit].

NOTE

The key check does not finish if there is a problem that prevents even one of the keys from being recognized. If this occurs, press the **START** and **STOP** keys simultaneously to display the original screen.
There may be a malfunction in the instrument, so request repairs. If there is a problem with the **STOP** or **START** key, you cannot return to the original screen. Power the instrument off and request repairs.

Printer Check

MEM REC REC&MEM FFT REALTIME

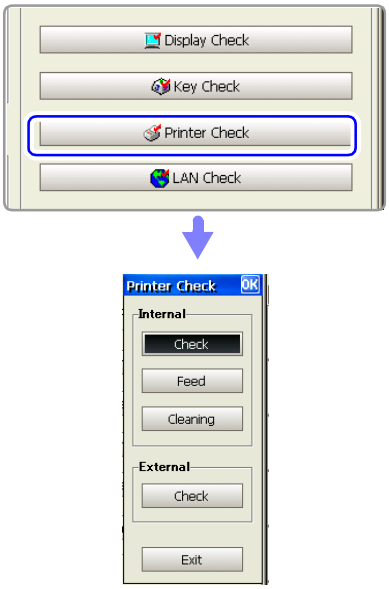
To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

Before executing

Check to be sure that recording paper is loaded.

	Operating Key	Procedure
1	**CURSOR** **F1**	Move the cursor to the [Printer Check] button. Select [Execute]. The [Printer Check] dialog box appears.
2	**CURSOR** **F1**	Move the cursor to the item you want to execute and execute the check.



When using the internal printer:

Check	Prints a test to recording paper.
Feed	Feeds the recording paper 10 cm.
Cleaning	Cleans the print heads. The whole surface is printed solid black.

When using an external printer:

Check	Prints a test to recording paper.

To close the dialog

Select the [Exit] button.

To cancel the check

Press the **STOP** key.

NOTE

Things to check for after a printer check

Check the printed recording paper for white streaks. If there are any white streaks, clean the print heads.

LAN Check

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

Operating Key Procedure

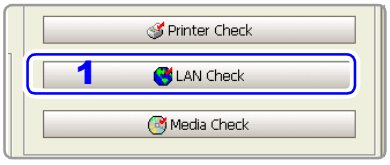
Checking the LAN Connection Status

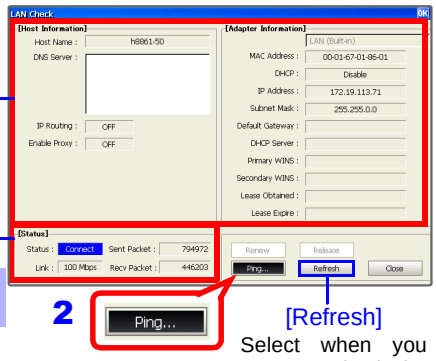
1 **CURSOR** **F1**

Move the cursor to the [LAN Check] button.

Select [Execute].

The [LAN Check] dialog box appears.





Current connection settings

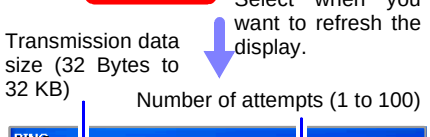
Current connection status

Checking the Connection Status of Specific Destinations

2 **CURSOR** **F1**

Move the cursor to the [Ping…] button and execute.

The [PING] dialog box appears.



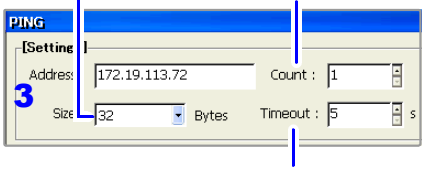
[Refresh]
Select when you want to refresh the display.

Transmission data size (32 Bytes to 32 KB)

Number of attempts (1 to 100)

3 **CURSOR** **F1 to F8**

Move the cursor to the [Address] item and specify the connection destination IP address.
Set other items as required.

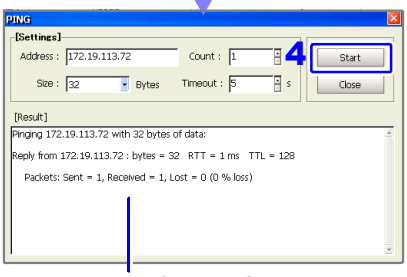


Wait time when there is no response (1 to 60 seconds)
The message "No response" appears if this time is exceeded without a response.

4 **CURSOR** **F1**

Move the cursor to the [Start] button and execute.

The connection results are displayed.
The connection is normal if "LOST=0" appears.



Connection results

To close the dialog

Select the [Close] button.

To cancel the test

Press the **STOP** key or the **ESC** key.

If "No response" appears

- Check to be sure that the LAN cable is connected correctly.
- Check the communications connections settings and try the LAN check again.
  See "4.2 Controlling the Instrument over the LAN Interface" in the *Analysis and Communication Supplement*
- There may be no response if the connection destination is behind a firewall.

To obtain a new IP address, or release an IP address

(Only when IP address is obtained automatically from a DHCP server (DHCP: [On]))
Select the [Renew] or [Release] button.

Media Check

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

Before executing this test

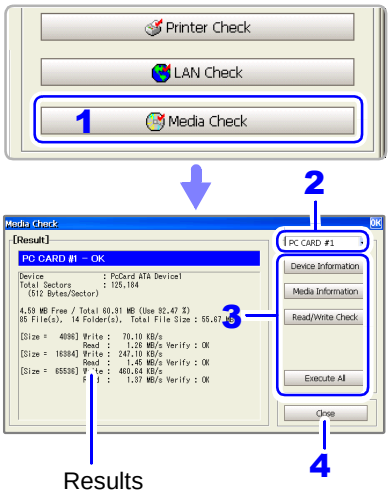
Check to be sure that media is inserted or connected.

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Media Check] button.
	F1	Select [Execute]. The [Media Check] dialog box appears.
2	**CURSOR**	Move the cursor to the media selection field and select the media. Only connected media are shown.
	F1 to F8	
3	**CURSOR** **F1 to F8**	Select the button for the check to perform.
4	**CURSOR** **F1**	Select the [Close] button.

PC CARD #1 **PC CARD #2**	Check whether a PC Card is normal.
HDD	Check whether a hard disk is normal.
USB	Check whether a USB disk is normal.

Device Information	Display device information.
Media Information	Display media information.
Read/Write Check	Perform a read/write check. (Several minutes may be required.) (The media must have adequate free space.)
Execute All	Execute all of the above.

The results for the selected check are displayed.



⚠CAUTION

In the [Read/Write Check], data is actually written to and read from the media, which may damage the media or result in the loss of recorded data. Do not perform this check using media on which important data is recorded.

13.3.5 Adjusting the 8958 16-Ch Scanner Unit

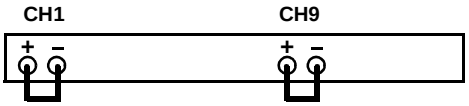
Zero-position adjustment of the 8958 16-Ch Scanner Unit with this instrument is necessary in the following cases. Adjust one hour after powering on.

- When the 8958 16-Ch Scanner Unit is installed in this instrument
  (A message appears when this instrument boots, prompting you to perform the adjustment.)
- When the zero position has gotten out of alignment due to the passage of time or changes in the environment

Before executing the adjustment

Before adjusting the scanner unit, the + and - terminals of channels 1 and 9 must be shorted. For details, refer to "Scanner Unit Zero Position Adjustment" in "2.2.7 Connecting to the Model 8958 16-Ch Scanner Unit" in the *Input Module Guide*.

Short the + and - terminals of channels 1 and 9



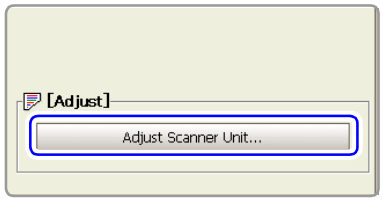
Scanner Unit Adjustment

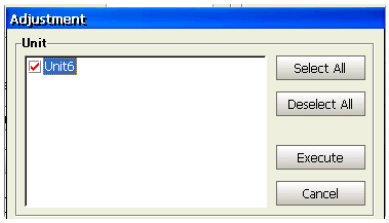
MEM REC REC&MEM REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Init with the **SUB MENU** keys →Init Settings screen

See Screen Layout (p. 51)

	Operating Key	Procedure
1	**CURSOR**	Move the cursor to the [Adjust Scanner Unit] button.
	F1	Select [Execute]. The [Adjustment] dialog box appears.
2	**F1 to F8**	Select the scanner unit to adjust. Check to be sure that the + and - terminals of channels 1 and 9 are shorted on the selected scanner unit.
	F7	Select [Execute]. **To cancel adjustment** Select **F8** [Cancel]. A processing message appears when you execute the adjustment. The adjustment is complete when "Completed normally" appears.





13.3.6 System Configuration List

This is a list of the installed options, software versions, and system configuration.
You can also check this list from the initial screen.
No settings can be changed.

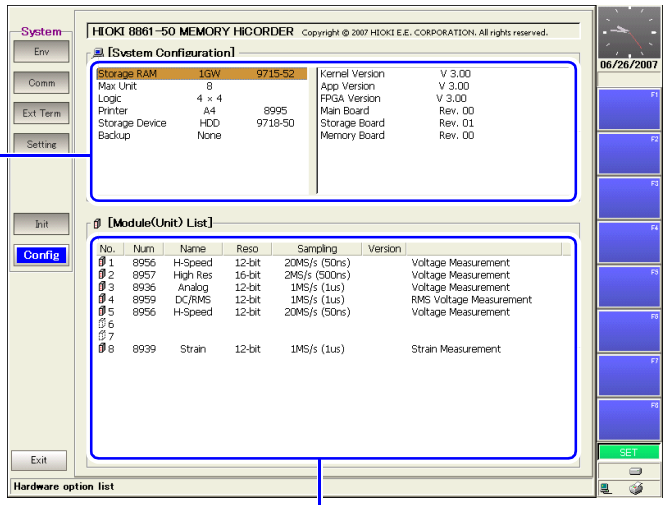
System Configuration List

MEM REC REC&MEM FFT REALTIME

To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Config with the **SUB MENU** keys →Config screen

See Screen Layout (p. 52)

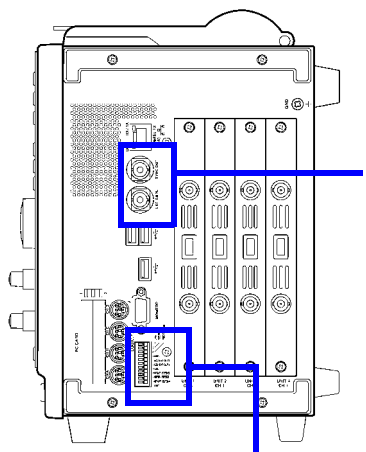
System Configuration
Options installed in the instrument and version information



Connected input units

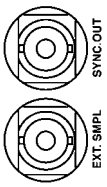
External Control Chapter 14

This section explains the terminals used for external control of the instrument. As shown below, there are two types of terminals. The general term “external control terminal” refers to both types.



Right-side panel

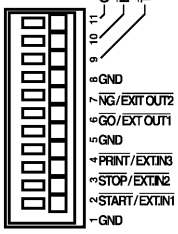
SYNC.OUT terminal



Output

Input

EXT.SMPL terminal



External control terminal

Make signal setting on the Ext Term (External terminal) Settings screen.

Sample synchronizing signal output (p. 384)

Use to synchronize sampling with multiple instruments.

External sampling (p. 382)

Input an external sampling signal. (Memory function and FFT function only)

GND (common with instrument ground)

External trigger input (p. 378)

Input external signals.

Trigger output (p. 380)/ Probe calibration signal output (p. 393)

Output a signal when a trigger event occurs. Also used to calibrate attenuating probes before using them.

Output GO/NG calculation evaluation results (p. 387)/ External output (p. 389)

Output a signal when the evaluation results of numerical calculation are GO or NG. Also used to signals for specified instrument states, such as BUSY, saving data, error, and so on.

External input (p. 391)

Control measurement start and stop, printing, and saving with external signals.

14.1 Connecting External Control Terminals

⚠DANGER

To avoid electric shock accidents and damage to the instrument, do not apply voltage over the maximum specified voltage level to the external control terminals.

	I/O terminals	Maximum input voltage	Terminal type
Input	EXT.SMPL	-2 to 7 V DC	BNC
	$\overline{\text{EXT.TRIG}}$		Terminal block
	$\overline{\text{PRINT}}$/$\overline{\text{EXT.IN3}}$		
	$\overline{\text{STOP}}$/$\overline{\text{EXT.IN2}}$		
	$\overline{\text{START}}$/$\overline{\text{EXT.IN1}}$		
Open collector output	$\overline{\text{TRIG OUT}}$/CAL	-20 to 30 V DC 50 mA max, 200 mW max	Terminal block
	$\overline{\text{NG}}$/$\overline{\text{EXT OUT2}}$		
	$\overline{\text{GO}}$/$\overline{\text{EXT OUT1}}$		
Output	SYNC.OUT	Do not apply a voltage.	BNC

⚠WARNING

To prevent electric shock accidents and damage to the equipment, always observe the following precautions when making connections to external terminal blocks and external connectors.

- **Before making connections, turn off the power on the instrument and the equipment to connect.**
- **Do not exceed the specified signal levels for signals supplied to external terminal blocks and external connectors.**
- **Ensure that devices and systems to be connected to the External Control terminals are properly isolated.**

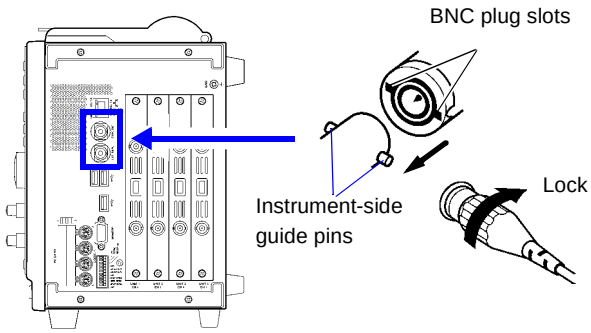
⚠CAUTION

- The ground pins of external control connectors are not isolated from the instrument's ground. Connect so that no potential difference arise between external control connector ground and the ground of the connection object. Failure to observe this precaution can result in damage to the connection object and the instrument.
- Do not short circuit the SYNC.OUT jack and the ground of the instrument, or apply external voltage. Doing so can result in damage to the instrument.

Connecting the SYNC.OUT Jack and the EXT.SMPL Jack (BNC connector)

- When disconnecting BNC connectors, be sure to release the lock before pulling the connectors apart. Forcibly pulling a connector without releasing the lock, or pulling on the cable, can damage the connector.

Connecting the SYNC.OUT Jack and the EXT.SMPL Jack (BNC connector)



Connect the BNC plug of the connection cord to the BNC jack on the instrument side.

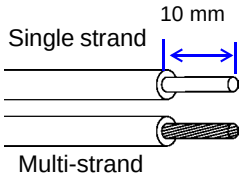
Align the slots on the BNC plug with the guide pins on the instrument-side jack, then push and twist the plug clockwise until it locks.

Disconnecting BNC connectors

Twist the BNC plug counterclockwise and pull it out.

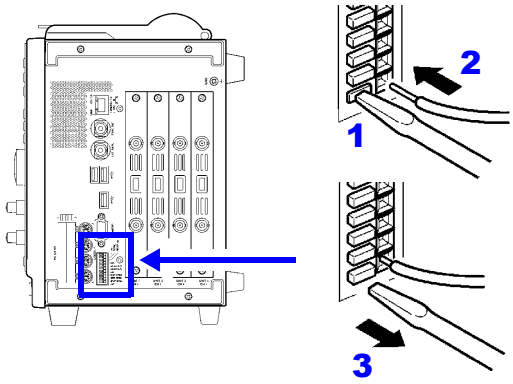
Connecting External I/O Terminals (Connector Blocks)

Cables to connect



- Recommended cables:
  single strand diameter 0.65 mm (AWG22),
  multi-strand 0.32 mm^2 (AWG22)
- Usable cables:
  Single strand diameter 0.32 to 0.65 mm (AWG28 to 22),
  Multi-strand 0.08 to 0.32 mm^2 (AWG28 to 22)
  Strand diameter 0.12 mm or greater
- Standard insulation stripping length: 9 to10 mm
- Button operation specified tool: Flat-blade screwdriver (tip width 2.6 mm)

Connection procedure



1 Push in the button on the connector with a flat-blade screwdriver or other tool.

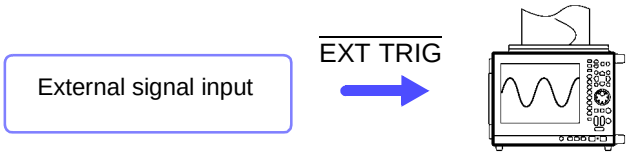
2 With the button held in, insert the cable into the cable connection hole.

3 Release the button.
The cable is locked.

14.2 External I/O

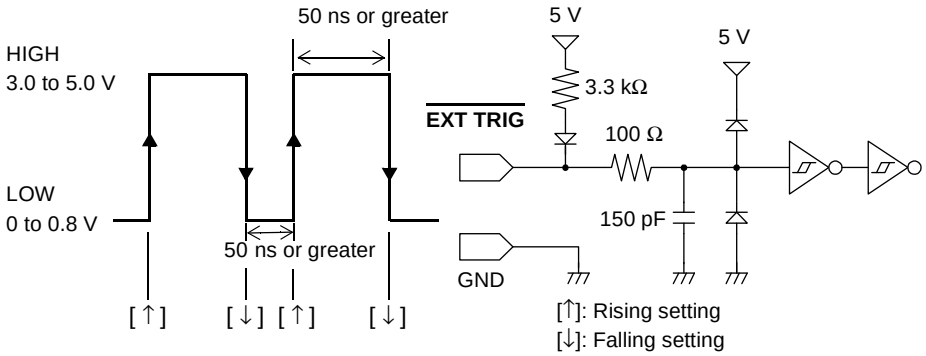
14.2.1 External Trigger Input (EXT TRIG)

You can input external signals as trigger sources.
When you are using several instruments, you can also synchronize triggers (p. 379).



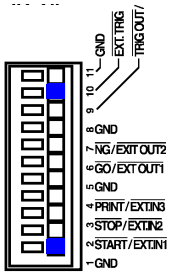
Trigger Input Signals

Voltage range	HIGH level: 3.0 to 5.0 V, LOW level: 0 to 0.8 V
Pulse width	HIGH level: 50 ns or greater, LOW level: 50 ns or greater
Maximum input voltage	-2 to 7 V



Signal Input Procedure

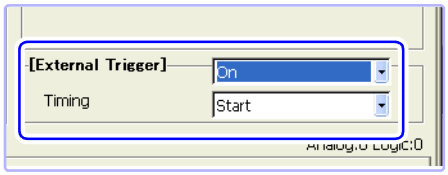
1 Connect the cables for the corresponding external input signals to the EXT TRIG and GND terminals.



GND is common. It can be connected to any ground.

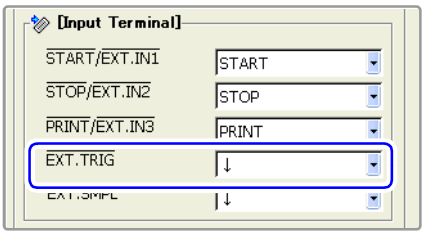
Connection procedure:
"14.1 Connecting External Control Terminals" (p. 376)

2 In the Trigger Settings screen, set External trigger to [On]. (p. 166)



3 In the Ext Term (external terminal) Settings screen, select a setting for the [EXT.TRIG] terminal.

(To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Ext Term with the **SUB MENU** keys →Ext Term Settings Screen)



Select whether the trigger event occurs on the rising edge of the waveform or the falling edge.

↑	Occurs on the rising edge.
↓	Occurs on the falling edge(default setting).

4 Short-circuit the EXT TRIG terminal and GND, or leave the terminals open-circuited, and input a HIGH level (3.0 to 5.0 V) or LOW level (0 to 0.8 V) pulse wave or rectangular wave to the EXT TRIG terminal.

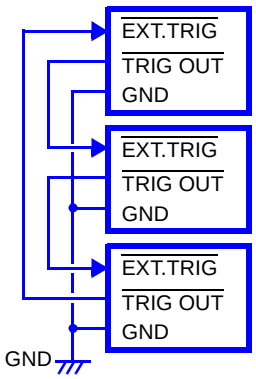
A trigger event occurs on the rising or falling edge of the input waveform.

Parallel Trigger Synchronization

Connection examples

Daisy chain configuration

Set all instruments to master.

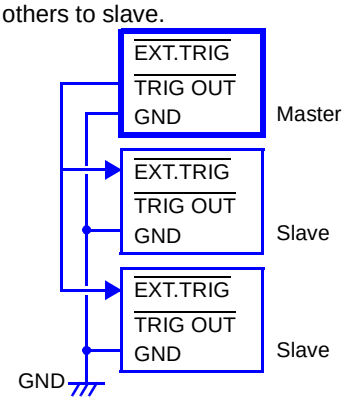


When a trigger event occurs on any of the connected instruments, it also occurs on the others.
As more instruments are connected, the difference between trigger timing on different instruments becomes larger.

Set external trigger to [On] for all instruments.

Parallel synchronization

Set 1 instrument to master, and set the others to slave.

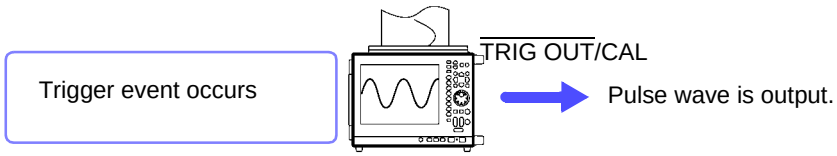


Use 1 instrument as the master (monitor triggers). Start measurement simultaneously on the other instruments when a trigger event occurs.
This gives the least difference in trigger timing between instruments.

Set external trigger to [On] for the slave instruments only.

14.2.2 Trigger Output (TRIG OUT/CAL)

You can output a signal when a trigger event occurs.



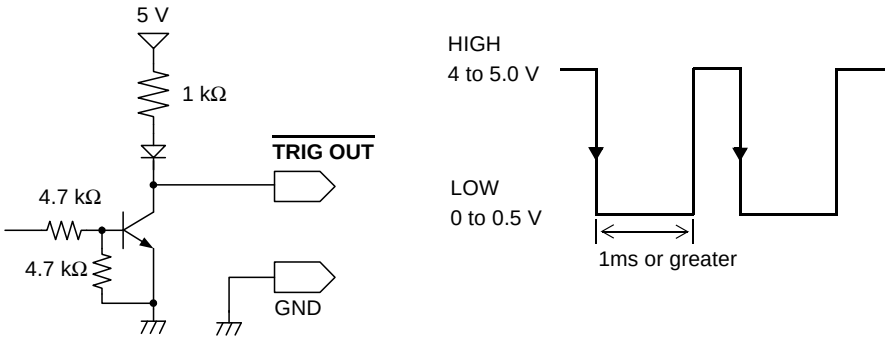
You can also connect several instruments for parallel trigger synchronized operation.

See "Parallel Trigger Synchronization" (p. 379)

NOTE The TRIG OUT/CAL terminal can be used as a trigger output terminal (TRIG OUT) or as a probe calibration output signal terminal (CAL) (p. 393). It cannot be used for both functions at the same time.

Trigger Output Signals

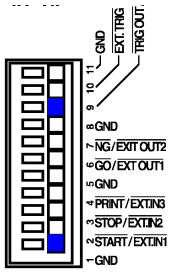
Output signal	Open collector output (with voltage output), active LOW
Output voltage range	HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Pulse width	LOW level: 1 ms or greater
Maximum input voltage	-20 to +30 V 50 mA max 200 mW max



NOTE Trigger events occur and signals are output when the auto-ranging function (**FUNCTION MODE** → **F4** [Auto Setting]) (p. 74) is used with the Memory Function. You should be aware of this if you are using the trigger output terminal together with the auto-ranging function.

Signal Output Procedure

1 Connect the cables for the corresponding external input signals to the TRIG OUT/CAL and GND terminals.

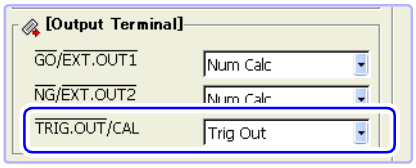


GND is common. It can be connected to any ground.

Connection procedure:
"14.1 Connecting External Control Terminals" (p. 376)

2 In the Ext Term (external terminal) Settings screen, select a setting for the [TRIG.OUT/CAL] terminal.

(To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Ext Term with the **SUB MENU** keys →Ext Term Settings Screen)

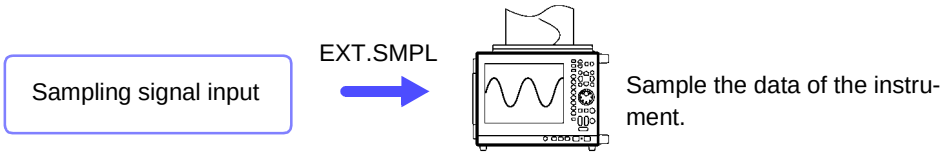


Select [Trig Out](default setting)

When a trigger event occurs, a pulse wave changing from the HIGH level (4.0 to 5.0 V) to the LOW level (0 to 0.5 V) is output from the TRIG OUT/CAL terminal.

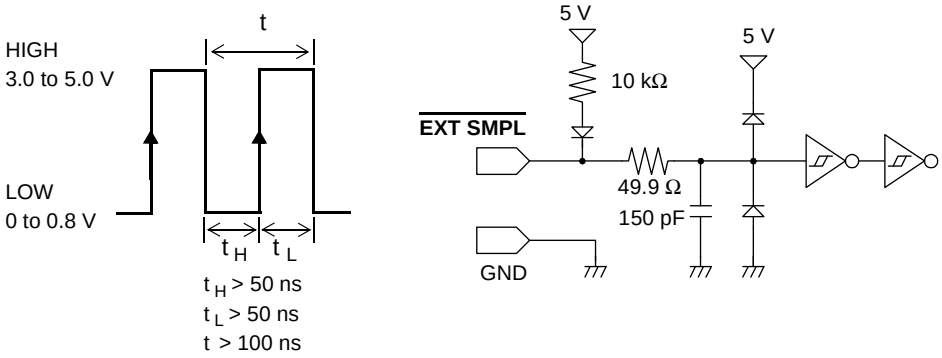
14.2.3 External Sampling (EXT.SMPL)

An external signal can be input to set the sampling frequency.
External sampling is possible only when the Memory Function or FFT function is enabled.



Sampling Input Signals

Voltage range	HIGH level: 3.0 to 5.0 V, LOW level: 0 to 0.8 V
Pulse width	HIGH, LOW level: 50 ns or greater
Response frequency	10 MHz or lower
Maximum input voltage	-2 to 7 V



NOTE

- Normal operation is not possible when the pulse width is below that shown in the following table.

Supported external sampling pulse widths

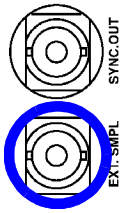
Setting (EXT.SMPL)	Pulse width					
	When 8958 is used			When other input module is used		
	t_H	t_L	t	t_H	t_L	t
↑	> 5 µs	> 5 µs	> 10 µs	> 50 ns	> 50 ns	> 100 ns
↓	> 5 µs	> 5 µs	> 10 µs	> 50 ns	> 50 ns	> 100 ns
↑&↓	> 10 µs	> 10 µs	> 20 µs	> 90 ns	> 110 ns	> 200 ns

When the Roll Mode is enabled, supported pulse widths are those shown above for the Model 8958, regardless of input modules.

- When the 8937, 8947, and 8957 are used, the anti-aliasing filter (AAF) is not available, even if it is set to [On] in the Channel Settings screen

Signal Input Procedure

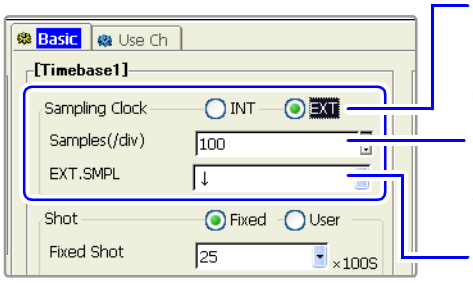
1 Connect the EXT.SMPL terminal and the sampling signal output destination with a BNC cable.



2

In the Status Settings screen (Memory Function), make the following external sampling settings.

(To open the screen: Press the **SET** key → Select Status with the **SUB MENU** key→ Status Settings screen)



Set Sampling clock to [EXT].

Set the number of data points to display per division on the horizontal axis (time axis). Input range: 10 to 1000 (Default setting: 100)

See "Entering Numbers" (p. 65)

Select the input waveform sampling method. (This can also be set in the Ext Term Settings Screen.

↑	Sample on rising edge.
↓	Sample on falling edge (default setting).
↑&↓	Sample on both rising and falling edges.

3

Input HIGH level (3.0 to 5.0 V) and LOW level (0 to 0.8 V) pulse waves or rectangular waves to the EXT.SMPL terminal.

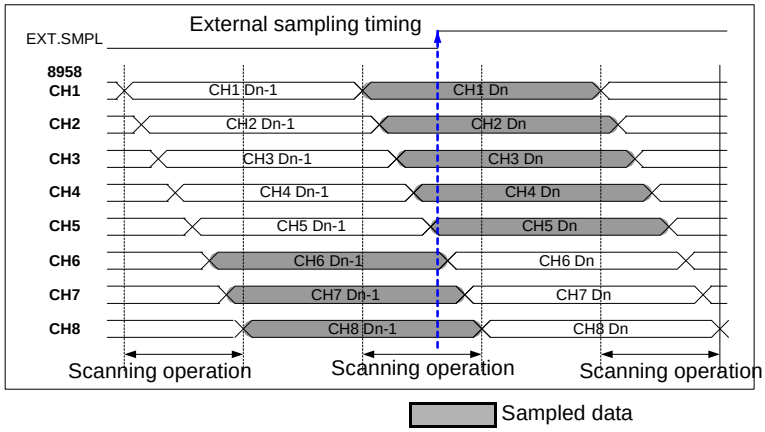
Data is sampled on the rising edge, falling edge, or both edges of the input waveform. Note that the sampling frequency is limited by the selected edge or edges. ("Supported external sampling pulse widths" (p. 382))

NOTE

- When a sampling signal of 5 MHz or greater is input, trigger points are delayed by 1 sample.
- It is recommended that the Roll Mode function be set to [On] when the external sampling input signal is 100 kHz or lower (p. 102). When the Roll Mode function is set to [Off] or [Auto], external sampling data is collected and saved in memory after external sampling signals (rising, falling, and both rising and falling) are input 32 times.

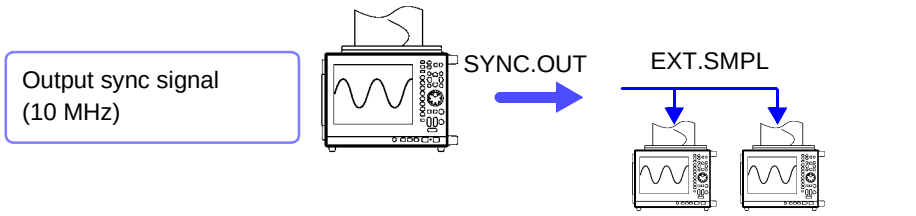
When the 8958 16-Ch Scanner Unit is installed

- Input sampling input signals of 100 kHz or lower. Signals higher than 100 kHz cannot be sampled.
- During scanning, if they overlap with the external sampling frequency, channels where scanning is finished exist at the same time as channels where scanning is not finished. Data may be sampled according to the timing shown in the figure below.



14.2.4 Synchronized Sampling Output (SYNC.OUT)

Sampling can be synchronized across multiple instruments.



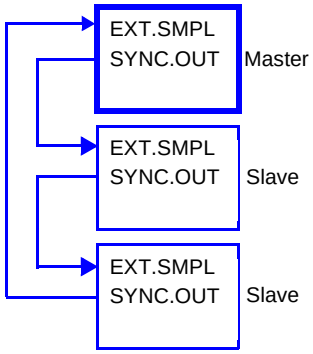
Synchronized sampling measurement

Synchronized Operation

Connection example

Daisy-chain configuration

Set 1 instrument to Master, and set the others to Slave



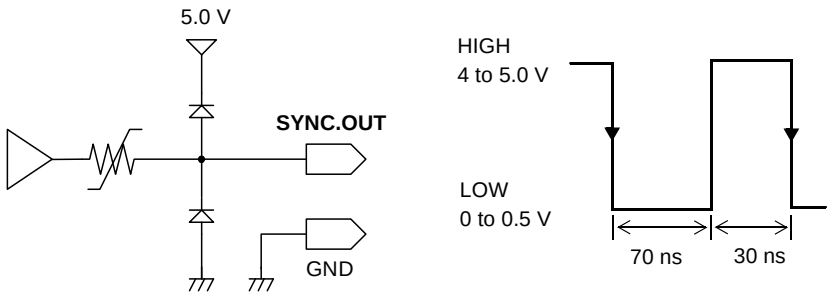
Using 1 master instrument, synchronize sampling according to the sync signal input to the EXT. SMPL terminal. (The sync signal is output by the master.)

As more instruments are connected, the difference between sampling timing on different instruments becomes larger.
(Up to 3 instruments may be connected, including the master)

With 1 instrument only, synchronized measurement is not possible and precise measurement is not possible.

Sync Signals

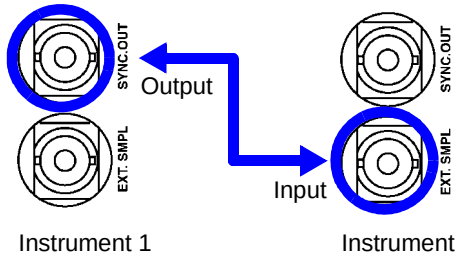
Output signal	CMOS level output (0 to 5 V)
Output voltage range	HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Output clock frequency	HIGH level: 30 ns, LOW level: 70 ns, frequency 100 ns



Signal Output Procedure

⚠CAUTION To prevent damage to the instruments, do not connect the SYNC.OUT terminals of two instruments.

1 Connect the SYNC.OUT and EXT.SMPL terminals of the instruments to be synchronized (8860-50 or 8861-50), using BNC cables (9165 Connection Cord or L9217 Connection Cord).



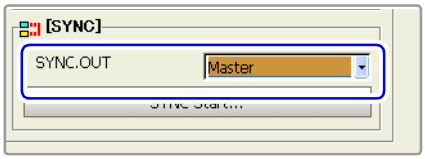
See "Synchronized Operation" (p. 384) for a connection example

Use 9165 Connection Cord or L9217 Connection Cord to make the connections

2 Set the master and slaves in the [SYNC] (Synchronization) section of the Ext Term (external terminal) Settings screen.
Make settings for all instruments to be synchronized (Default setting: [Off]).

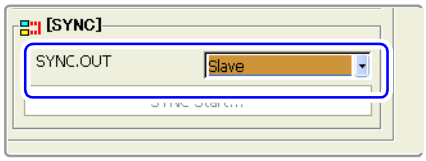
(To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Ext Term with the **SUB MENU** keys →Ext Term Settings Screen)

Master instrument



Set synchronization operation to [Master].

Salve instrument



Set synchronization operation to [Slave].

Set only 1 instrument as [Master]. Synchronization is not possible if 2 or more instruments are set to [Master].

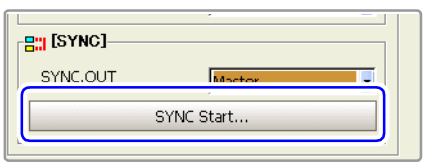
3 Set the measurement conditions in the Status Settings screen.

See "Chapter 4 Measurement Configuration Settings" (p. 79)

NOTE For synchronized sampling measurement, sampling rates must be slower than 1 µs/S.

4 Synchronized operation on the master instrument.

Master instrument



Select the [SYNC Start…] button.

Synchronized operation can be started only on the instrument specified as the master. (Output sync signal)

NOTE If you change the measurement condition settings after selecting the [SYNC Start…] button to start synchronized operation, select the [SYNC Start…] button again on the master instrument.

In the sampling timing of the following modules, there is an offset from the sync signal timing.

Input Module	Offset from sync signal
Model 8956 Analog Unit	Within -50 ns
Model 8957 High Resolution Unit	Within -500 ns

If you want to change the measurement conditions

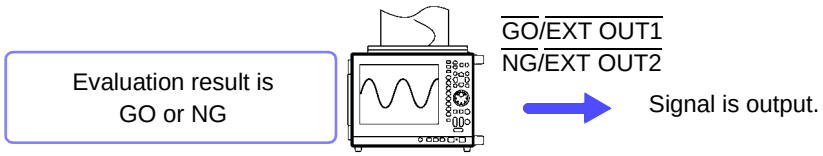
During synchronized measurement sampling, settings such as the time base and sampling rate cannot be changed.
If you need to change these settings, stop measurement by all of the connected instruments before making the changes. After making the changes, select the [SYNC Start…] button again in the Ext Term Settings Screen on the master instrument.

When power is restored after a power outage during synchronized measurement

Select the [SYNC Start…] button in the Ext Term Settings Screen on the master instrument.
Synchronized measurement does not restart if you do not select the button. Measurement restarts if the Auto-Resume function (p. 355) is on, but no synchronization is conducted with the connected instruments.

14.2.5 GO/ NG Evaluation Output ($\overline{\text{GO}}$/$\overline{\text{EXT OUT1}}$)/ ($\overline{\text{NG}}$/$\overline{\text{EXT OUT2}}$)

Signals can be output when the results of evaluation of numerical calculations are GO (pass) or NG (fail).



NOTE

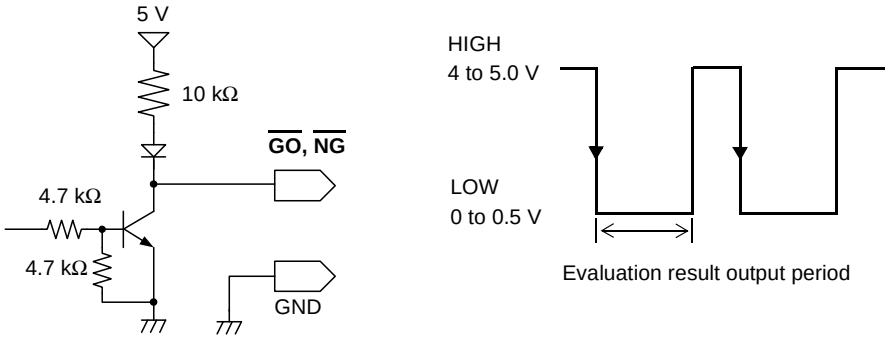
The $\overline{\text{GO}}$/$\overline{\text{EXT OUT1}}$ and $\overline{\text{NG}}$/$\overline{\text{EXT OUT2}}$ terminals can be used as GO/NG evaluation output terminals (GO, NG) or as external output terminals for specific conditions (EXT OUT1, EXT OUT2) (p. 389). They cannot be used for both functions at the same time.

The default setting (factory default) is [Num Calc].

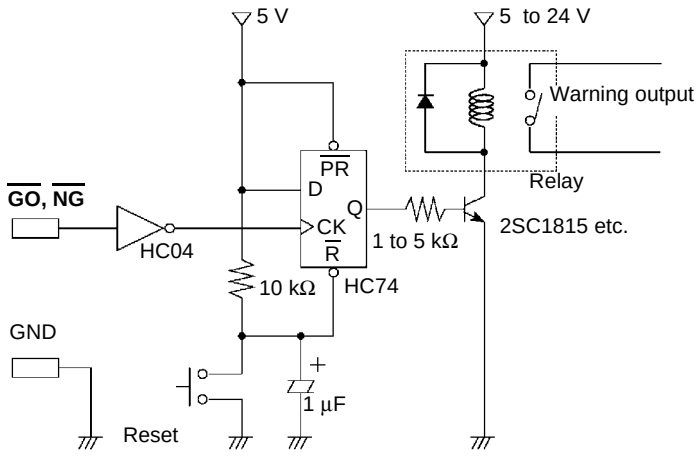
GO/ NG Evaluation Output Signals

Output signal	Open collector output (with voltage output), active LOW
Output voltage range	HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Maximum input voltage	-20 to +30 V 50 mA max 200 mW max

Evaluation result output period (for numerical calculations: 100 ms or greater
For one-shot measurements, the signal is saved. It returns to HIGH on the next start.
For continuous measurements, the signal is saved until the next trigger event occurs.

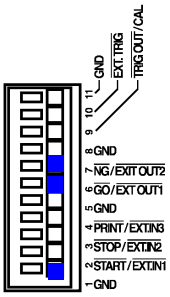


Example of a circuit for a warning device



Signal Output Procedure

1 Connect the GO/EXT OUT1 terminal, NG/EXT OUT2 terminal, and GND terminal to the controlled device.

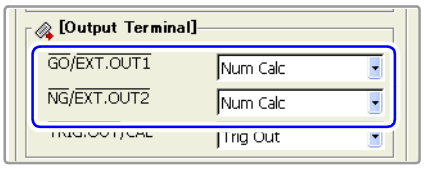


GND is common. It can be connected to any ground.

Connection procedure:
"14.1 Connecting External Control Terminals" (p. 376)

2 In the Ext Term (external terminal) Settings screen, make settings for the [GO/EXT OUT1] and [NG/EXT OUT2] external output terminals.

(To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Ext Term with the **SUB MENU** keys →Ext Term Settings Screen)



Select the conditions under which the instrument outputs a signal.

Num calc	Output the GO/NG results of numerical evaluation (default setting).

See For more information about other menu items
"14.2.6 External Output (GO/EXT OUT1)/ (NG/EXT OUT2)" (p. 389)

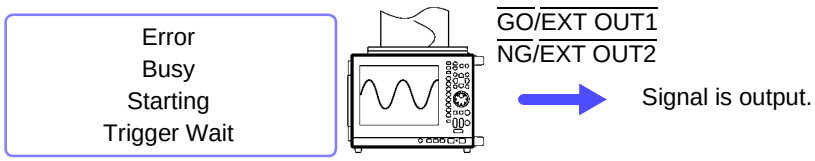
3 Evaluate the measurement data.

See For more information about calculation settings: *Analysis and Communication Supplement*

The signal for the specified evaluation result is output.

14.2.6 External Output (GO/EXT OUT1)/ (NG/EXT OUT2)

You can specify the states which cause signal output from the instrument.



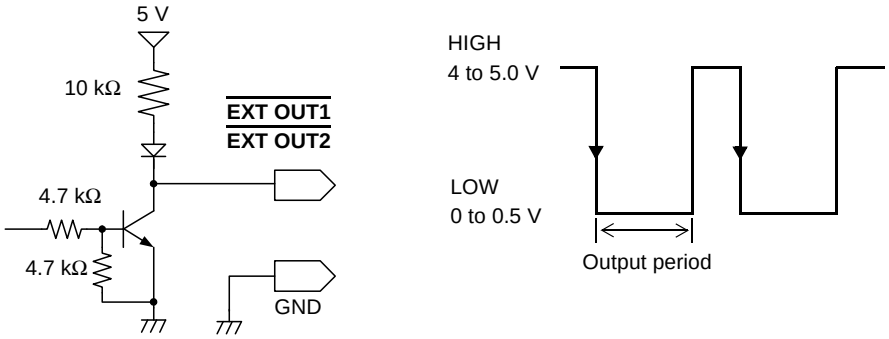
State		Output period
Error	While error message (Error or Warning display) is displayed	During error
Busy	Instrument cannot start operation	During save, printing, etc.
Start	Instrument is starting an operation	While instrument is starting
Trigger	Instrument is waiting for trigger	While instrument is waiting for trigger

NOTE

The GO/EXT OUT1 and NG/EXT OUT2 terminals can be used as external output terminals for specific conditions (EXT OUT1, EXT OUT2) or as GO/NG evaluation output terminals (GO, NG). (p. 387)
They cannot be used for both functions at the same time.

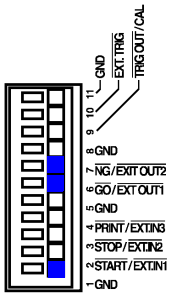
External Output Signals

Output signal	Open collector output (with voltage output), active LOW
Output voltage range	HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Maximum input voltage	-20 to +30 V 50 mA max 200 mW max



Signal Output Procedure

1 Connect the GO/EXT OUT1 terminal, NG/EXT OUT2 terminal, and GND terminal to the controlled device.



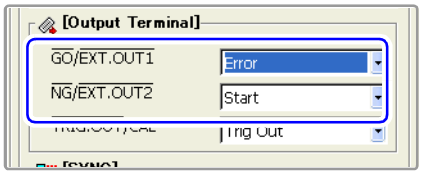
GND is common. It can be connected to any ground.

Connection procedure:
"14.1 Connecting External Control Terminals" (p. 376)

2

In the Ext Term (external terminal) screen, make settings for the [GO/EXT OUT1] and [NG/EXT OUT2] external output terminals.

(To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Ext Term with the **SUB MENU** keys →Ext Term Settings Screen)



Select the conditions under which the instrument outputs a signal.

Error	Output a LOW level signal when an error occurs.
Busy	Output a LOW level signal when the instrument cannot start an operation because it is starting another operation, saving data, printing, and so on
Start	Output a LOW level signal while instrument is starting.
Trigger	Output a LOW level signal while instrument is waiting for a trigger, and when a trigger event occurs.

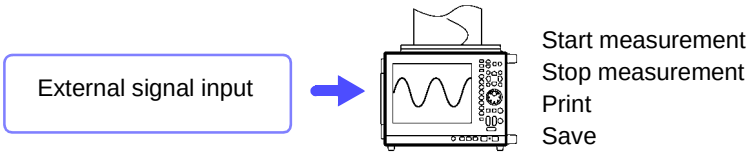
Default setting: GO/EXT.OUT1: Numerical evaluation
NG/EXT.OUT2: Numerical evaluation

See For more information about other menu items
"14.2.5 GO/ NG Evaluation Output (GO/EXT OUT1)/ (NG/EXT OUT2)" (p. 387)

The signal for the specified state is output.

14.2.7 External Input (START/EXT.IN1)/(STOP/EXT.IN2)/(PRINT/EXT.IN3)

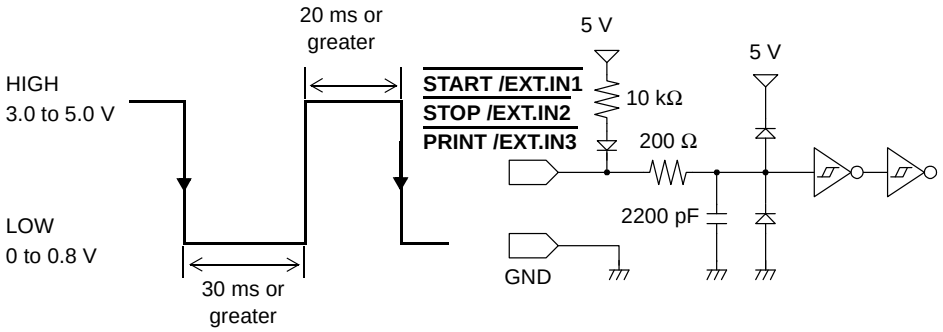
Operation start and stop, data printing, and data saving can be initiated by external signals.



The default settings (factory defaults) for each terminal are [START], [STOP], and [PRINT].

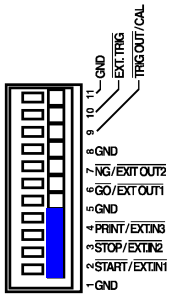
External Input Signals

Voltage range	HIGH level: 3.0 to 5.0 V, LOW level: 0 to 0.8 V
Pulse width	level: 20 ms or greater, LOW level: 30 ms or greater
Maximum input voltage	-2 to 7 V



Signal Input Procedure

1 Connect the START /EXT.IN1, STOP /EXT.IN2, and PRINT /EXT.IN3 terminals and the GND terminal to the external signal source device.



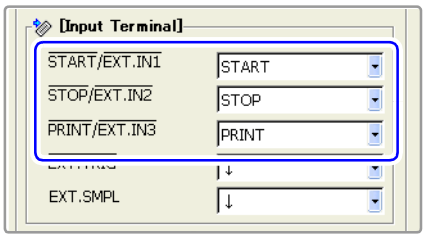
GND is common. It can be connected to any ground.

Connection procedure:

"14.1 Connecting External Control Terminals" (p. 376)

2 In the Ext Term (external terminal) Settings screen, make settings for the [START /EXT.IN1], [STOP /EXT.IN2], [PRINT /EXT.IN3] external terminals.

(To open the screen: Press the **DISP** key→ Press the **F7** [System] key→ Select Ext Term with the **SUB MENU** keys →Ext Term Settings Screen)



Select the operation performed by the instrument in response to external signal input.

START	Start measurement.
STOP	Stop measurement.
START/STOP	Start measurement on LOW level, and stop measurement on HIGH level.
PRINT	Print to the destination specified as the PRINT key output destination.
SAVE	Save to the media specified for the SAVE key, according to the specified conditions.

Default setting: START/EXT.IN1: START
STOP/EXT.IN2: STOP
PRINT/EXT.IN3: PRINT

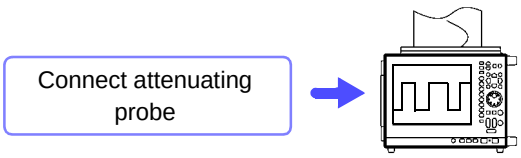
3 Short circuit the terminal and GND, or input a HIGH level (3.0 to 5.0 V) or LOW level (0 to 0.8 V) pulse wave or rectangular wave to the terminal.

Control with the LOW level of the input waveform.

14.2.8 Probe Calibration Signal Output (TRIG OUT/CAL)

Connect to calibrate the 9665 10:1 Probe or 9666 100:1 Probe.

For more information about connections and calibration procedures, refer to "Calibration" of "2.5 Connecting Attenuating Probes" in the *Input Module Guide*

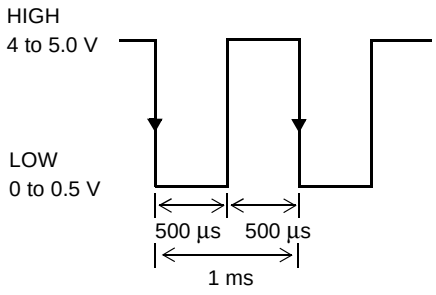


NOTE

The TRIG OUT/CAL terminal can be used as a probe calibration output signal terminal (CAL) or as a trigger output terminal (TRIG OUT) (p. 380). It cannot be used for both functions at the same time.

External Output Signals

Output signal	Open collector output (with voltage output), active LOW
Output voltage range	HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Frequency	1 kHz (square wave)



Specifications Chapter 15

* Unless otherwise noted, information provided for the 8860-50 also applies to the 8860-51, and information provided for the 8861-50 also applies to the 8861-51.
* The 8860-51 and 8861-51 do not have a PC CARD slot.

15.1 General Specifications

(1) Basic Specifications

Measurement functions	Memory Function (high-speed data saving) Recorder Function (real time recording) REC&MEM Function (Both real-time and high-speed recording) FFT Function (frequency analysis) Real-Time Saving Function
No. of input modules	Model 8860-50: 4 Modules Model 8861-50: 8 Modules
No. of channels (max.)	Model 8860-50: 8 analog channels + 16 logic channels 16 analog channels + 16 logic channels (using the Model 8946 4-Ch Analog Unit) 64 analog channels + 16 logic channels (using the Model 8958 16-Ch Scanner Unit) Model 8861-50: 16 analog channels + 16 logic channels 32 analog channels + 16 logic channels (using the Model 8946 4-Ch Analog Unit) 128 analog channels + 16 logic channels (using the Model 8958 16-Ch Scanner Unit) (Logic channels are equipped as standard. The GND terminal on this instrument is common)
Memory capacity **Models** **9715-50 Memory Board (32M)** **9715-51 Memory Board (128M)** **9715-52 Memory Board (512M)** **9715-53 Memory Board (1G)**	Model 8860-50:

Channels Used	Standard 32 MWords (Model 9715-50 Memory Board)	Expands by up to 1 GWord (Model 9715-53 Memory Board)
1	12-bit (16-bit) × 32 MWords/Ch	12-bit (16-bit) × 1G word/ch
2	12-bit (16-bit) × 16 MWords/Ch	12-bit (16-bit) × 512 MWords/Ch
4	12-bit (16-bit) × 8 MWords/Ch	12-bit (16-bit) × 256 MWords/Ch
8	12-bit (16-bit) × 4 MWords/Ch	12-bit (16-bit) × 128 MWords/Ch
16	12-bit (16-bit) × 2 MWords/Ch	12-bit (16-bit) × 64 MWords/Ch

Model 8861-50:

Channels Used	Standard 64 MWords (Model 9715-50 Memory Board × 2)	Expands by up to 2 GWords (Model 9715-53 Memory Board × 2)
2	12-bit (16-bit) × 32 MWords/Ch	12-bit (16-bit) × 1G word/ch
4	12-bit (16-bit) × 16 MWords/Ch	12-bit (16-bit) × 512 MWords/Ch
8	12-bit (16-bit) × 8 MWords/Ch	12-bit (16-bit) × 256 MWords/Ch
16	12-bit (16-bit) × 4 MWords/Ch	12-bit (16-bit) × 128 MWords/Ch
32	12-bit (16-bit) × 2 MWords/Ch	12-bit (16-bit) × 64 MWords/Ch

Maximum sampling rate	20 MS/s (All channels simultaneously) (using 8956 Analog Unit) External sampling (10 MS/s)
Timebase accuracy	±0.005% (Relative grid timing error)
Input system	Plug-in modules (units) with 2, 4 or 16 channels each
External control terminals	External Trigger, Trigger Output, GO/NG Output, Sampling Synchronization Output, External Start, External Stop, Print Input, External Sampling Input

Clock functions	Auto calendar, auto leap year judgment, 24-hour timer Accuracy With power on: ±2.5 ppm With power off: ±100 ppm (Approx. ±8.6 s/day) (typically ±50 ppm at room temperature)
Backup battery life	Approx. Ten years for clock and settings (@25°C, 77°F)
Operating temperature and humidity	Temperature 0 to 40°C (32 to 104°F), Humidity 20 to 80% RH (non-condensating)
Temperature and humidity range for guaranteed accuracy	Temperature 23±5°C (73±9°F), Humidity 20 to 80% RH (non-condensating)
Period of guaranteed accuracy	1 year
Storage temperature and humidity	Temperature -10 to 50°C (14 to 122°F), Humidity 20 to 90% RH (non-condensating)
Operating environment	Indoors, Pollution degree 2, Altitude up to 2,000 m (6,562-ft.)
Isolation resistance and withstand voltage	Chassis-to-Power Line: 1.62 kV AC for 1 minute, 100 MΩ or more @ 500 V DC DC Input Module-to-Chassis and between Modules: 3.7 kV AC for 1 minute, 100 MΩ or more @ 500 V DC
Power source	100 to 240 V AC (continuous input) @ 50/60 Hz (Voltage fluctuations of ±10% from the rated supply voltage are taken into account.) 10 to 16 V DC (when using the Model 9684 DC Power Unit) Anticipated transient overvoltage 4000 V
Maximum rated power	Model 8860-50: 220 VA (No printer, but fully loaded with Model 8956 Analog Units, Model 9715-53 Memory Board and Model 9718-50 HD Unit) 300 VA (with A4 Printer, and fully loaded with Model 8956 Analog Units, Model 9715-53 Memory Board and Model 9718-50 HD Unit) Model 8861-50: 280 VA (No printer, but fully loaded with Model 8956 Analog Units, Model 9715-53 Memory Board and Model 9718-50 HD Unit) 350 VA (with A4 Printer, and fully loaded with Model 8956 Analog Units, Model 9715-53 Memory Board and Model 9718-50 HD Unit)
Dimensions	Model 8860-50: Approx. 330W × 250H × 184.5D mm (12.99"W × 9.84"H × 7.26"D) With Model 8995 A4 Printer Unit: Approx. 330W × 272.5H × 184.5D mm (12.99"W × 10.73"H × 7.26"D) With Model 8995-01 A6 Printer Unit: Approx. 330W × 255.5H × 184.5D mm (12.99"W × 10.06"H × 7.26"D) Model 8861-50: Approx. 330W × 250H × 284.5D mm (12.99"W × 9.84"H × 11.2"D) With Model 8995 A4 Printer Unit: Approx. 330W × 272.5H × 284.5D mm (12.99"W × 10.73"H × 11.2"D) With Model 8995-01 A6 Printer Unit: Approx. 330W × 255.5H × 284.5D mm (12.99"W × 10.06"H × 11.2"D) (sans protrusions)
Mass	Model 8860-50: Approx. 8 kg (282.2 oz.) (Instrument) Approx. 9.5 kg (335.1 oz.) (With Model 8995 A4 Printer Unit) Approx. 9.0 kg (317.5 oz.) (With Model 8995-01 A6 Printer Unit) Model 8861-50: Approx. 10.5 kg (370.4 oz.) (Instrument) Approx. 12 kg (423.3 oz.) (With Model 8995 A4 Printer Unit) Approx. 11.5 kg (405.6 oz.) (With Model 8995-01 A6 Printer Unit)
Applicable Standards	Safety EN61010 EMC EN61326 Class A

Accessories **For information about options:** **"Appendix 5 Options" (p. A51)**	• 1 Quick Start Manual ..... 1 • 2 Input Module Guide ..... 1 • 3 Instruction Manual (This document) ..... 1 • 4 Analysis and Communication Supplement ..... 1 • Application CD (Wave Viewer and Communications Manual) 1 • Power Cord ..... 1 • Input Cable Labels ..... 1 • Ferrite clamp-on choke ..... 1 If a printer is installed (one roll of compatible recording paper) • Model 9231 Recording Paper (for Model 8995 A4 Printer Unit) ..... 1 roll • Model 9234 Recording Paper (for Model 8995-01 A6 Printer Unit) ..... 1 roll • Paper Roll Holders ..... 1 pair

(2) Recording Section

(Model 8995 A4 Printer Unit or 8995-01 A6 Printer Unit: option specified when ordering)

You can select an A4- or A6-size printer

Recording system	Thermosensitive recording system using thermal line head
Recording paper	• Model 9231 Recording Paper: 216 mm × 30 m (8.50” x 98.43-ft) roll-type thermosensitive paper • Model 9234 Recording Paper: 112 mm × 18 m (4.41” x 59.058-ft) roll-type thermosensitive paper
Recording width	• Model 8995 A4 Printer Unit: using Model 9231 Recording Paper Overall recording width 212 mm ±1mm (8.35”±0.04”), Waveform portion 200 mm ±1 mm (7.87”±0.04”) (20 div) • Model 8995-01 A6 Printer Unit: using Model 9234 Recording Paper Overall recording width 104 mm ±0.3 mm (4.09”±0.01”), Waveform portion 100 mm ±0.3 mm (3.94”±0.01”) (20 div)
Recording speed	Maximum 25 mm/s
Paper feeding accuracy	±1.5% (@25°C, 77°F, 60% RH)

(3) Display Section

Display character	English/ Japanese/ Chinese selectable
Display type	10.4-in TFT Color LCD (800 × 600 dots)
Display resolution	• Memory Function, Recorder Function Horizontal scrolling Waveform: 25 div (time axis) × 20 div (voltage axis) (1 div = 25 dots (time axis) × 25 dots (voltage axis)) Vertical scrolling Waveform: 20 div (time axis) × 20 div (voltage axis) (1 div = 25 dots (time axis) × 30 dots (voltage axis)) • X-Y display (1-graph display) Waveform: Horizontal 20 div × 20 div (1 div = 25 × 25 dots) • X-Y display (4-graph display) Waveform: Horizontal 20 div × 20 div (1 div = 5 × 5 dots)
Operating life (LCD module only)	LCD: MTBF Approx. 52,000 hours Backlight: Approx. 50,000 hours (continuously on)

TFT color LCDs characteristically have a few defective pixels that do not always light, or that remain lit.
We do not consider the presence of six or fewer such defects to indicate a damaged or faulty display. Please be aware of this in advance.

(4) Memory Storage (optional, must be specified when ordering)

Capacity	Model 8860-50:One of the following is required Model 8861-50:Two of the same type are required • Model 9715-50 Memory Board (32 MWord memory) • Model 9715-51 Memory Board (128 MWord memory) • Model 9715-52 Memory Board (512 MWord memory) • Model 9715-53 Memory Board (1 GWord memory)
Expansion method	Exchange installed memory boards

(5) Memory Storage Backup Function

(Model 9719-50 Memory Backup Unit: option must be specified when ordering)

Waveform backup time	Model 8860-50:Approx. 10 hours Model 8861-50:Approx. 5 hours (after full charge, @25°C, 77°F)
Waveform backup power	NiMH battery Charger built-in (charges when power on, approx. 2 hours charge time)

(6) External Storage

PC Card (Not available on the 8860-51 or 8861-51)

Slots	2 Slots, compliant with PC Card Standard specification PC Card Types I and II accepted
Card types	Flash ATA cards, Hard disk drive (HDD) cards
Data formats	FAT and FAT32 supported
Storage contents	• Setting configurations • Measurement data (binary ASCII, BMP) (data between A-B cursors can be saved) • Screen images (BMP) • Calculation results • Thinned storage (ASCII: simple thinning)

Hard Disk Drive (Model 9718-50 HD Unit: option must be specified when ordering)
(Ships standard with the 8860-51 and 8861-51)

Storage system	2.5-inch hard disk drive
Storage capacity	80 GB
Format	FAT32
Storage contents	• Setting configurations • Measurement data (binary ASCII, BMP) (data between A-B cursors can be saved) • Screen images (BMP) • Calculation results • Thinned storage (ASCII: simple thinning)

(7) External Interfaces

PC Card Slot (Not available on the 8860-51 or 8861-51)

GP-IB	Contec GP-IB card, Supports GP-IB(CB)FL Also provides remote control of the installed input modules. Complies with IEEE 488.2-1987

USB (equipped as standard)

USB Standard	USB2.0 compliant
Connector	Series-A receptacle 3 ports
Connecting devices	Keyboard, mouse, printer, hard disk drive, USB memory

LAN (equipped as standard)

Compliant standards	Ethernet 100Base-TX, 10Base-T
Connector	RJ-45
Functions	HTTP server, FTP server, file sharing, DHCP-compliant and e-mail sending

Monitor Output (equipped as standard)

Connector	15-pin D-sub
Output format	SVGA

(8) Power Supply Options

9684 DC Power Unit (specify option when ordering)

Accuracy is specified at 23±5°C (73±9°F) and 20 to 80% RH, 30 minutes after power on

Rated input voltage	12 V DC
Input voltage range	10 to 16 V DC
Maximum rated power	200 VA
Operating temperature and humidity	Accordance with the specification of the instrument in which Model 9684 is installed
Storage temperature and humidity	Accordance with the specification of the instrument in which Model 9684 is installed
Operating environment	Accordance with the specification of the instrument in which Model 9684 is installed
Breakdown voltage	700 V DC for 1 min. (between input and output, and between input and instrument chassis)
Isolation voltage	100 MΩ or more @ 500 V DC (between input and output, and between input and instrument chassis)
Dimensions	Adds approx. 29 mm (1.14”) (D) to dimensions of Models 8860-50/ 8861-50
Mass	Adds approx. 1.25 kg (42.3oz.) to the weight of Models 8860-50/ 8861-50
Applicable Standards	Safety EN61010 EMC EN61326 Class A

15.1 General Specifications

9687 Probe Power Unit (specify option when ordering)

Accuracy is specified at 23±5°C (73±9°F) and 20 to 80% RH, 30 minutes after power on

No. of powered channels	8
Compatible probes	3273-50, 3274, 3275, 3276, 9322
Rated output voltage	±12 V
Rated output current	±3 A (total for all channels)
Operating temperature and humidity	Accordance with the specification of the instrument in which Model 9687 is installed
Storage temperature and humidity	Accordance with the specification of the instrument in which Model 9687 is installed
Operating environment	Accordance with the specification of the instrument in which Model 9687 is installed
Dimensions	Adds approx. 18.2 mm (0.72”) (D) to dimensions of Models 8860-50/ 8861-50
Mass	Adds approx. 570 g (20.1oz.) to the weight of Models 8860-50/ 8861-50
Applicable Standards	Safety EN61010 EMC EN61326 Class A

15.2 Trigger Section

Trigger method	Digital comparison
Trigger modes	• Memory Function and FFT Function: Single, Repeat or Automatic • Recorder Function: Single or Repeat • REC&MEM Function: Single, Repeat, or Timer • Real-Time Saving Function: Single, Repeat, or Timer
Trigger source	Analog, logic A to D, external trigger, manual trigger, timer trigger Free-run operation occurs when all trigger types are off. • Normal Mode All analog channels can be set as trigger sources • Expanded Mode One analog channel can serve as multiple trigger sources (Up to eight trigger sources on channels in modules (Units) 1 to 4 in Models 8860-50 and 8861-50, plus an additional eight sources on channels in modules 5 to 8 in Model 8861-50.) External triggering occurs by applying a 2.5 V falling edge signal, or shorted terminals (can be set to rising edge). The sources of trigger events are displayed
Trigger criteria	AND or OR of each trigger source
Trigger types (analog)	• Level Trigger Set digitally as a voltage value below full-scale Triggering occurs when the signal rises (or falls) through a specified value. • Windows Trigger Upper and lower trigger threshold levels are specified Triggering occurs when the signal enters or exits the defined threshold range. • Period Trigger* A trigger period reference voltage level and period range are specified The period of the signal rising (or falling) through the specified level is measured, and triggering occurs when the period is outside of the specified range. • Glitch Trigger* Triggering occurs when the signal pulse width is narrower than the specified pulse width defined as rising or falling through a specified voltage level. • Slope Trigger* Triggering occurs when the signal exceeds (or does not exceed) a specified rate of change. • Voltage Sag Trigger (Drop) Triggering occurs when peak voltage falls below the specified level (for commercial power). (* Expanded setting only) Specified Event The number of times trigger criteria are met (on all trigger sources) is counted, and triggering occurs when the specified event count is reached.
Trigger types (logic)	Pattern (mask) trigger by 1, 0, 0|1 or X (0|1: triggering occurs when changing to either state, X: don't care)
Trigger filter	Off or 0.1 to 10.0 div (settable in 0.1 increments) (Memory Function and REC&MEM Function) On (10 ms), Off (Recorder Function)
Trigger level resolution	0.1% f.s. (f.s. = 20 div)
Pre-trigger	-100 to 100% (settable in 1% increments) recording time is displayed before and after triggering (Memory Function, Recorder Function and REC&MEM Function)
Trigger timing	Start, Stop and Start & Stop (Recorder Function) Start and Stop criteria can be set independently.

15.2 Trigger Section

Trigger output	Open-collector output (with 5 V output, Active Low) Pulse Width: at least 1 ms (When using Memory Division: at least 150 µs)
Trigger Input and Output Terminals	Terminal Block
Level Display Function	Displays the signal level while Trigger Wait (display can be turned off)

15.3 Memory Function

Timebase	5, 10, 20, 50, 100, 200, 500 µs/div 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div 1, 2, 5, 10, 30, 50, 100 s/div 1, 2, 5 min/div External sampling (100 S/div) allows simultaneous control of multiple instruments
Time axis resolution	100 points/div
Sampling period	1/100th of timebase, or external sampling The timebase can be set according to sampling period Two different sampling periods can be set
Recording Length	Fixed or adjustable The setting range depends on the capacity of installed memory and the number of channels enabled for use ("Appendix 2.4 Memory Capacity and Maximum Recording Length" (p. A35))

- Fixed settings
  25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000, 200000, 500000, 1000000, 2000000, 5000000, 10000000

Maximum Recording Length [Divisions]

Installed Memory (Words)		No. of Channels Used				
8860-50		16	8	4	2	1
	8861-50	32	16	8	4	2
32M	64M	20,000	20,000	50,000	100,000	200,000
128M	256M	50,000	100,000	200,000	500,000	1,000,000
512M	1G	200,000	500,000	1,000,000	2,000,000	5,000,000
1G	2G	500,000	1,000,000	2,000,000	5,000,000	10,000,000

- Adjustable settings
  1 to 10240000 (in 1-div steps)

Maximum Recording Length [Divisions]

Installed Memory (Words)		No. of Channels Used				
8860-50		16	8	4	2	1
	8861-50	32	16	8	4	2
32M	64M	20,000	40,000	80,000	160,000	320,000
128M	256M	80,000	160,000	320,000	640,000	1,280,000
512M	1G	320,000	640,000	1,280,000	2,560,000	5,120,000
1G	2G	640,000	1,280,000	2,560,000	5,120,000	10,240,000

Screen and Printing Settings	1, 2, 3, 4, 6, 8 or 16 screens (printer, excluding Model 8995-01 A6 Printer Unit) Can be displayed sequentially, or selectable layout (for three divisions or more) X-Y screens (1 or 4 screens) (X-Y and time axis screens can be combined) Sheet display (up to 32 channels displayed per sheet)
Interpolation function	Line (exc. X-Y), dot or line (with X-Y)
Recording line distinction	32 colors (four printing types)
Overlay function	Provided

Waveform compression and magnification	• Time axis × 10, × 4, × 2, × 1 × 1/2, × 1/5, × 1/10, × 1/20, × 1/50, × 1/100, × 1/200, × 1/500, × 1/1000, × 1/2000, × 1/5000, × 1/10000, × 1/20000, × 1/50000, × 1/100000, × 1/200000, × 1/500000 • Voltage axis × 100, × 50, × 20, × 10, × 5, × 2, × 1, × 1/2, × 1/5, × 1/10
Waveform scrolling	Left-right scrolling by Jog and Shuttle knobs Waveforms can be viewed and scrolled before measurement finishes (Roll Mode: restricts time axis and waveform compression) Parts of the waveform already recorded can be scrolled into view while measuring
Auto Print	On or Off: automatically prints recorded waveforms (Selectable for whole waveform, or for cursor-defined selection)
Manual Print	Available The whole waveform or cursor-defined selection can be selected for printing by PRINT key settings Printout magnification can be set independently from display magnification
Selection printing	Prints the waveform between A/B cursors (by PRINT key setting)
Smoothed printing	Setting print quality to [Fine (Slow)] doubles print density in the time axis direction, providing smooth waveform printing (Only using the Model 8995 A4 Printer Unit)
Report Print	Available
Login function	Prints and displays measurement data as numeric values
Variable display function	Provided (voltage axis) Upper and lower limits and range position can be set Variable settings can be linked to changes in voltage range settings
Zoom function	Provided (split-screen display of whole waveform and magnified section is available)
X-Y Composites	X-Axis: 16 channels, Y-Axis: 16 channels (16 composites)

15.4 Recorder Function

Time axis

10*1, 20*1, 50*1, 100*1, 200*1, 500 ms/div
1, 2, 5, 10, 30, 50, 100 s/div
1, 2, 5, 10, 30 min/div
1 h/div

*1. Real-time paper recording is not available with the faster ranges (10 ms to 200 ms/div), although waveforms can still be recorded in memory and monitored on-screen. Up to 5000 divisions (with Model 9715-50 Memory Board installed) of waveforms can be stored before measurement stops. Also, if the Recording Length is set to other than [Cont], simultaneous printing is available, so waveforms can be printed under the following conditions:

With [Cont]: Recording Length, 20 ms/div to 1 h/div

With Model 8958 16-Ch Scanner Unit installed, 50 ms/div to 1 h/div

Time axis resolution

100 points/div

Sampling period

100 ns, 1 µs, 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1s
(not more than 1/100th of the selected timebase)

Recording mode

Maximum and minimum recording values
Records data at a rate of 100 samples per division, with a maximum and minimum value included in each sample.

Recording length

Fixed, User (Adjustable) or Cont (Continuous)
(setting range depends on the capacity of installed memory)

- Fixed settings
  25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000
- Adjustable settings
  1 to 160000 (in 1-div steps)

Maximum Recording Length [Divisions]

Installed Memory (Words)		Other than the Model 8958 16-Ch Scanner Unit		Model 8958 16-Ch Scanner Unit	
8860-50	**8861-50**	Fixed	Adjustable or Continuous	Fixed	Adjustable or Continuous
32M	64M	5,000	5,000	1,000	1,000
128M	256M	20,000	20,000	5,000	5,000
512M	1G	50,000	80,000	20,000	20,000
1G	2G	100,000	160,000	20,000	40,000

Continuous setting is not available for 10 ms to 200 ms/div timebase settings when printing.
Timebase settings of 10 ms/div to 1 s/div are not available when printing numerical values on the Model 8995-01 A6 Printer Unit

Screen and printing settings

1, 2, 3, 4, 6, 8 or 16 screens (printer, except on the Model 8995-01 A6 Printer Unit), can be displayed sequentially, or selectable layout (for three divisions or more)
Sheet display (up to 32 channels displayed per sheet)

Interpolation function

Line

Recording line distinction

32 colors (four printing types)

Waveform magnification and compression

- Time axis
  × 4*, × 2*, × 1, × 1/2, × 1/5, × 1/10, × 1/20, × 1/50, × 1/100, × 1/200, × 1/500, × 1/1000, × 1/2000, × 1/5000, × 1/10000, × 1/20000
  (* Screen display only. Printing is can be x 1 or more)
- Voltage axis
  × 100, × 50, × 20, × 10, × 5, × 2, × 1, × 1/2, × 1/5, × 1/10

15.4 Recorder Function

Waveform Storage	The most recent 5,000 divisions of measurement data is retained in internal memory (when the Model 8958 16-Ch Scanner Unit is not installed) Model 8860-50 128 MWords: 20,000 div, 512 MWords: 80,000 div, 1 GWord: 160,000 div Model 8861-50 256 MWords: 20,000 div, 1 GWord: 80,000 div, 2 GWords: 160,000 div Viewing by backwards scrolling and re-printing are available
Waveform Scrolling	Parts of the waveform already recorded can be scrolled into view while measuring
Print functions	On, Off and Re-print are available Printing can be paused and restarted while measuring When printing is turned on, you can select printing of the last 0 to 15 divisions. Printout magnification can be set independently from display magnification
Report Print	Available
Logging recording	Prints and displays measurement data as numerical values
Variable display function	Provided (voltage axis) Upper and lower limits and range position can be set Linkage of Variable settings to voltage range setting changes can be selected

15.5 REC&MEM Function

Time axis

- Recorder Function
  100, 200, 500 ms/div
  1, 2, 5, 10, 30, 50, 100 s/div
  1, 2, 5, 10, 30 min/div
  1 h/div
- Memory Function
  10, 20, 50, 100, 200, 500 µs/div
  1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div
  1, 2, 5, 10, 30, 50, 100 s/div
  1, 2, 5 min/div

Depending on the timebase of the Memory and Recorder waveforms, some setting combinations are invalid (p. 94).
The 8958 16-Ch Scanner Unit supports only the Recorder function

Time axis resolution

100 points/div

Sampling period

Recorder Function: Same as the sampling rate of the Memory Function
Memory Function: 1/100th of the timebase

Recording length

- Recorder Function
  Fixed, User (Adjustable) or Cont (Continuous)
  (Setting range depends on installed memory capacity, whether Memory Division is enabled, and whether the 8958 16-Ch Scanner Unit is installed)
  Fixed settings:25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000
  Adjustable settings:25 to 100000 (in 1-div steps)
  Continuous setting is not available for 10 ms to 200 ms/div timebase settings when printing.
  Timebase settings of 10 ms/div to 1 s/div are not available when printing numerical values on the Model 8995-01 A6 Printer Unit

Maximum Recording Length

[Fixed] [div]

8958 16-Ch Scanner Unit	Memory Storage Capacity			
	32M	128M	512M	1G
Not installed	2,000	10,000	20,000	50,000
Installed	500	2,000	10,000	20,000

[User] [div]

8958 16-Ch Scanner Unit	Memory Storage Capacity			
	32M	128M	512M	1G
Not installed	2,000	10,000	40,000	80,000
Installed	500	2,000	10,000	20,000

Recording length

- Memory Function
  Fixed, User (Adjustable)
  (Setting range depends on installed memory capacity, whether Memory Division is enabled, and whether the 8958 16-Ch Scanner Unit is installed)
  Fixed settings: 25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000
  Adjustable settings: 25 to 10000000 (in 1-div steps)

Maximum Recording Length
[Fixed] [div]

Number of the Memory Division	Memory Storage Capacity			
	32M	128M	512M	1G
OFF	5,000	20,000	50,000	100,000
2	2,000	10,000	20,000	50,000
4	1,000	5,000	20,000	20,000
8	500	2,000	10,000	20,000
16	200	1,000	5,000	10,000
32	100	500	2,000	5,000
64	50	200	1,000	2,000
128	25	100	500	1,000
256		50	200	500
512		25	100	200
1024			50	100

[User] [div]

Number of the Memory Division	Memory Storage Capacity			
	32M	128M	512M	1G
OFF	5,000	20,000	80,000	160,000
2	2,500	10,000	40,000	80,000
4	1,250	5,000	20,000	40,000
8	620	2,500	10,000	20,000
16	300	1,250	5,000	10,000
32	140	620	2,500	5,000
64	60	300	1,250	2,500
128	30	140	620	1,250
256	15	60	300	620
512	7	30	140	300
1024	3	15	60	140

Screen and printing settings	1, 2, 3, 4, 6, 8 or 16 screens (printer, except on the Model 8995-01 A6 Printer Unit), can be displayed sequentially, or selectable layout (for three divisions or more) Sheet display (up to 32 channels displayed per sheet)
Recording line distinction	32 colors (four printing types)
LCD (display)	Switch between Recorder and Memory waveforms Simultaneous split-screen display of Recorder and Memory waveforms
Printer Output	When measurement starts, only the Recorder waveform can be output. When stopped, depending on the screen display, either the Recorder or Memory waveform can be printed.

Waveform Storage (Recorder Waveform)	The most recent 2,500 divisions of measurement data is retained in internal memory (when the Model 8958 16-Ch Scanner Unit is not installed) Model 8860-50 128 MWords: 10,000 div, 512 MWords: 40,000 div, 1 GWord: 80,000 div Model 8861-50 256 MWords: 10,000 div, 1 GWord: 40,000 div, 2 GWords: 80,000 div Viewing by backwards scrolling and re-printing are available
Trigger source	Timer trigger source, or OFF (Recorder Function) CH1 to CH16, Logic A to D and external trigger (Memory Function)
Zoom function	Provided (available with the Memory waveform display)
Report Print	Available
Variable display function	Provided (voltage axis) Upper and lower limits and range position can be set Linkage of Variable settings to voltage range setting changes can be selected
Logging recording	Prints and displays measurement data as numerical values

15.6 FFT Function

FFT channel mode	1ch FFT 2ch FFT
Frequency range	133 mHz to 8 MHz
Dynamic range	72dB (logical value) (with Model 8938 or 8947) 96dB (logical value) (with Model 8957 or 8960)
Number of sampling points	1000, 2000, 5000, 10000, 20000
Frequency resolution	1/400, 1/800, 1/2000, 1/4000, 1/8000
Antialiasing filter	Automatic cutoff frequency selection linked to frequency range (With Model 8957 High Resolution Unit, 8938 FFT Analog Unit, 8947 Charge Unit, 8960 Strain Unit)
Analysis channel setting	Either one or two channels can be freely specified for FFT analysis (up to 16 analyses can be specified)
Analysis data	Data to be subject to FFT analysis can be newly acquired or selected from data previously acquired with the Memory function or memory waveform from the REC&MEM function. Newly acquired: when measurement starts, the number of specified sampling points is acquired, and calculation performed. Memory waveform: applies calculations data prestored with the Memory function or memory waveform from the REC&MEM function Data to be subject to FFT analysis can be newly acquired or selected from data previously acquired with the Memory function.
FFT analysis mode setting	Storage waveform, Linear spectrum, RMS spectrum, Power spectrum, Power spectrum density, Cross-power spectrum, Auto-correlation function, Histogram, Transfer function, Cross-correlation function, Impulse response, Coherence function, Octave analysis, Phase spectrum, Power spectrum density (LPC)
Display format setting	1, 2, or 4 screen display, Nyquist display When using memory waveforms as analysis data, memory waveform + FFT1 and memory waveform + FFT2 screens can be displayed. (Calculation points can be specified by waveform scrolling.)
Windows	Rectangular, Hann, Exponential, Hamming, Blackman, Blackman-Harris, Flat top
Display scale	Linear scale, Log scale, Phase
Print function	Applicable to the Memory function
Averaging function	Timebase, simple averaging on frequency axis, exponential averaging on frequency axis, peak hold on frequency axis (settable from 2 to 10,000 counts)
Logging recording	Prints measurement data as numerical values

15.7 Real-Time Saving Function

Timebase	• Measurement waveform 100, 200, 500 µs/div 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div 1, 2, 5, 10, 30, 50, 100 s/div 1, 2, 5 min/div • Whole waveform (with auto setting function) 10, 20, 50, 100, 200, 500 ms/div 1, 2, 5, 10, 30, 50, 100 s/div 1, 2, 5, 10, 30 min/div 1 h/div May be limited by saving destination and number of channels
Time axis resolution	100 points/div
Sampling period	Measurement waveform: 1/100th of the timebase Whole waveform: same as measurement waveform
Save destinations	Hard drive (HDD), LAN or PC Card
Recording Length	Maximum recording length: determined by available space at the save destination, the file system, number of channels and whole waveform timebase Length is set in units of divisions, up to the maximum recording length
Screen and Printing Settings	1, 2, 3, 4, 6, 8 or 16 screens (printer) Can be displayed sequentially, or selectable layout (for three divisions or more) Sheet display (up to 32 channels displayed per sheet) Available when the screen display shows only the whole waveform or only the measurement waveform
Recording line distinction	32 colors (four printing types)
LCD (display)	While measuring: whole waveform After measuring: selectable from whole waveform, measurement waveform, or both whole and measurement waveforms displayed simultaneously (split-screen).
Printer Output	Output is not available while measuring. When not measuring, the whole or measurement waveform can be printed as displayed on the LCD
Zoom function	Provided (when only a measurement waveform is displayed)
Report Print	Available
Variable display function	Provided (voltage axis, timebase) Upper and lower limits and range position can be set Variable settings can be linked to changes in voltage range settings
Login function	Prints and displays measurement data as numeric values
Memory transfer function	Data can be analyzed with the Memory function and FFT function.

15.8 Functions

15.8.1 Practical Functions

Waveform Processing (Memory Function)

Numerical Calculations	Average value, RMS value, P-P value, Maximum value, Time-to-Maximum value, Minimum value, Time-to-Minimum value, Period, Frequency, Rise Time, Fall Time, Area value, X-Y Area value, Standard Deviation, Time-to-Specified Level, Pulse Width, Duty, Pulse Count, Four Arithmetic Operators Sixteen calculations are available at the same time Calculation results can be saved to external storage media and printed
Waveform Parameter Judgment	Judgment is available by setting MAX and MIN values as waveform parameter calculation results
Waveform Processing Calculations	Four arithmetic operators, absolute value, exponent, common logarithm, square root, moving average, differential calculus (first and second derivatives), integral calculus (first and second integrals), transposition on the time axis, trigonometric functions (sin, cos, tan) and inverse trigonometric functions (asin, acos, atan), up to 16 custom calculation expressions Calculated waveforms can use up to one fourth of the recording length of overall memory space
Averaging	Cumulative average, indexed average (from 2 to 10,000 waveform samples)

Memory Division function (Memory Function or REC&MEM Function)

Memory Division function	Memory space can be divided Up to 4096 divisions (for the REC& MEM function, up to 1024 divisions) Batch save to external storage media
Sequential Save function	Although display, printing and recording to external storage media are not performed, input signals are continuously acquired by triggering. Trace display and saving can be enabled and disabled Multiple waveform blocks can be overlaid
Block Search function	Applicable blocks of the waveform can be searched using the Waveform Search function

15.8.2 Miscellaneous Functions

Printing Setting Conditions	Upper Chart: Function, Trigger Time, Timebase, Divisions, etc. Lower Chart: Channels in Use, Measurement Range, Zero Position and etc., and module-related settings
Cursor Measurement functions	Potential at each cursor, time from trigger Time difference between A/B cursors, potential difference, frequency Multiple channel cursor readout
Scaling functions	Available for each channel independently Set scaling by entering a conversion ratio and input offset, or by entering two points A function is provided to acquire scaling setting values
Current Clamp settings	Probe range and scaling are automatically set just by entering the probe model number

Comment Entry	Title comment Comments for each channel Comments can be printed at the zero-position of each channel at the left side of printed waveforms Comment printing for each channel using callouts on waveforms
Screen Image Capture function	Provided (on internal printer, or save to a file)
List	On or Off Prints setting conditions following waveforms
Gauge	On or Off Prints before waveforms Available for on-screen display
Grid	Off, Normal, Fine, Normal (Dark), Fine (Dark), Time Axis, or T-Axis (Dark) (printout only)
Retain Start Condition function	Provided Retains continuity of timer trigger criteria
Auto Setup function	Automatically loads settings from external storage media when turning power on
Auto Save function	Provided While saving, the next measurement can be started (timebase and recording length are limited)
Remote control	Control terminals to Start, Stop, Print and Save Settings are provided to change operations (2.5 V threshold, Active Low or Shorted Terminals)
Auto-Ranging Function	Provided (Memory function only) Automatically select the optimum timebase and voltage axis range
View function	Indicates the relative location of the current display within the overall recording length (use the Jump function to divide the overall length into four segments, and jump to any trigger or A/B cursor position). History display (shows data from the previous 16 measurements) The usage status of each block can be displayed when Memory Division is enabled. (The Jump function can jump to a specified block.) Elapsed time from start of measurement and the measurement finishing time can be displayed.
Error Display	Displays the cause when an error occurs
Key-lock	Keys (other than KEY LOCK) can be temporarily disabled
LCD Backlight	On, Off (Auto-Off function)
Screen Saver	On, Off (Auto function)
PRINT Key setting	Provided Print contents can be selected by pressing the PRINT key (Screen linkage, whole waveform, between A/B cursors, pre- and post-trigger waveform, report, list, calculation results, screen image) With the “Screen Link” setting, waveforms on the Waveform screen are printed by pressing the PRINT key: either whole waveforms, or if the A/B cursors are enabled, just the waveforms between cursors are printed Lists (of settings) can be printed from screens other than the Waveform screen
SAVE Key settings	Provided Settings are provided to select storage media, save format, file name and saving area by pressing the SAVE key
Level Monitor function	Provided (Level bar, measurement values) Monitoring is available while measuring and awaiting triggers
Logic display	On, Off and Comments are available for each waveform Any of 16 display positions can be selected for each block of four channels (L-Chs A to D) Wide, Normal or Narrow logic waveform width (height) can be specified

Vernier function	Fine adjustment of input voltage can be made arbitrarily (from 50 to 200% of original input level)
Offset Cancel function	Executing Offset Cancel causes the measured input value to be recognized as zero
Event Marks	Up to 1,000 event marks can be inserted during and after measurement.
Waveform search functions	Search criteria can be specified as trigger criteria, specified time, event mark or peak value
TIME/DIV direct setting function	The timebase can be changed using the special TIME/DIV key
Range and Position direct setting function	The range and position settings of input modules can be adjusted using the special-purpose knobs

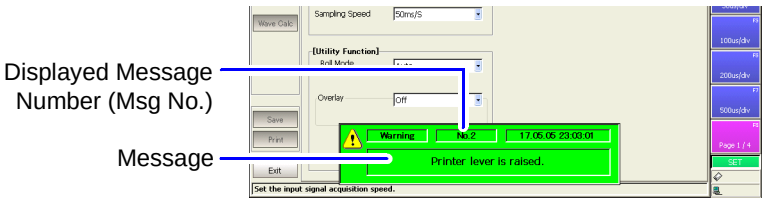
Appendix

Appendix 1 Error Messages

Error messages consist of either “Error” or “Warning” displays.
A screen message appears whenever an error occurs. In either case, take the remedial action indicated.
A beep may sound if the beeper setting on the Environment (Env) Settings screen is [Beep 1] or [Beep 2].

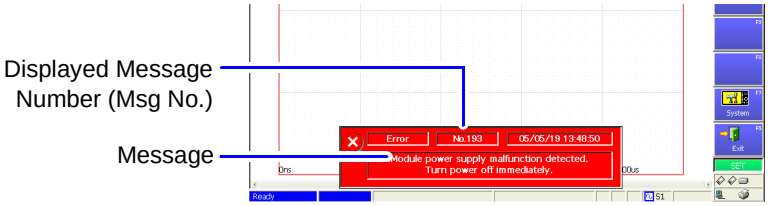
See "13.2.9 Specifying Beep and Operation Sounds" (p. 359)

Warning Display



Appears just once when an error occurs. Disappears within a few seconds.
Also disappears when any key is pressed.

Error Display (p. A7)



Remains displayed until the error is corrected, or until you press the **STOP** key.

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
1	**Out of paper.**	Load more paper.	*Quick Start Manual*: "3.3 Loading Recording Paper (With a Printer Module Installed)"
2	**Printer lever is raised.**	Lower the printer lever.	
3	**No response from printer.**	Turn the external printer on. Also verify that the external printer (if used) is working.	
4	**Printer head temperature error.**	Use in an environment with the specified operating temperature and humidity.	"Chapter 15 Specifications" (p. 395)
5	**Printer is not installed.**	Printing is not available. Either the internal printer is not installed, or no external printer is connected.	
6	**Printer internal error.**	An unexpected error occurred. Perform a system reset. If this error continues to appear, damage may have occurred requiring repairs.	"13.3.3 Initializing System Settings (System Reset)" (p. 366)

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
11	**File size exceeds 2 GB.**	Files large than 2 GB cannot be saved. Use partial or divided save to create files smaller than 2 GB.	"11.3.2 Save Methods" (p. 273)
12	**Disable write-protection.**	Write-protection is enabled on the storage media. Disable it.	"11.1 Storage Media" (p. 262)
14	**Cannot load this file.**	The selected file cannot be loaded.	
16	**The file name already exists: cannot save.**	Change the file name.	"11.7.4 Renaming Files & Folders" (p. 307)
17	**The directory name already exists.**	Change the directory name.	
18	**Could not rename file.**	A file with the same name may already exist, or the file name is invalid. Give the file a different name.	"11.7.4 Renaming Files & Folders" (p. 307)
19	**Could not copy or move file.**	Verify whether the storage media is write-protected. The file may be already in use. Try executing after processing finishes. Verify that you have access permission to the storage media. (If it is in a shared folder on a network)	"11.7.1 Copying Files & Folders" (p. 305) "11.7.2 Moving Files & Folders" (p. 306)
20	**Path name exceeds 127 characters.**	Change the path to 127 or fewer characters.	
21	**File not found.**	Verify that the names of the file saving destination and the file are correct.	
22	**No waveform data to save.**	Acquire waveform data.	
26	**Cannot access shared folder.**	The shared folder does not exists or you do not have access permission.	"11.1.4 Using a Network Shared Folder" (p. 264)
27	**Cannot find shared file.**	No shared folder can be found for connection.	
28	**File is in use.**	The file in the shared folder cannot be deleted because it is in use.	
29	**An invalid character is present.**	A character is present that is invalid for file names.	"When entering a file name (for files to be loaded on a PC)" (p. 66)
30	**Auto-ranging failed.**	Check the input signal.	"3.3.5 Automatic Range Setting (Auto-Ranging Function)" (p. 74)
31	**AB cursor positions invalid.**	The A/B cursors overlap. Check the cursor positions.	"8.7 Specifying a Waveform Range" (p. 200)
32	**Zero-adjustment needed.**	Perform zero-adjustment.	*Input Module Guide*: "3.11.17 Executing Zero Adjustment"
34	**Invalid key pressed. (Overlay)**	The key operation is prohibited because Overlay is enabled (On).	"4.3.2 Overlaying Waveforms" (p. 104)
36	**No trigger has been set.**	Set trigger criteria.	"Chapter 6 Trigger Settings" (p. 135)
37	**Invalid operation.**	The operation is not available while processing. Try again after processing finishes.	

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
38	**Invalid operation (measuring).**	The operation is not available while measuring. Try again after measuring finishes.	
39	**Invalid operation (printing).**	The operation is not available while printing. Try again after printing finishes.	
41	**Recording length is set to Continuous.**	When the Recording Length (Shot) is set to Continuous (Cont), real-time printing is not available with fast timebase settings	"12.2 Print Methods and Print Items" (p. 315)
42	**There is no calculation result.**	There is no calculation result. Print results after performing calculation.	*Analysis and Communication Supplement*
43	**Over event mark count(1000).**	Up to 1,000 event marks are supported.	
44	**No event mark.**	An event mark has not been set.	
45	**Out of range.**	Check the valid setting range, and reset.	
46	**Invalid operation(accessing file).**	The operation is not available during file processing. Try again when file processing finishes.	
50	**Roll Mode is not available.**	The Roll Mode cannot be used when Overlay is enabled.	"4.3.1 Displaying Waveforms During Recording (Roll Mode)" (p. 102)
54	**Function not available. (Averaging, Overlay,Wave Calculation)**	Averaging, Overlay and Waveform calculation functions are prohibited when the Roll Mode is set to [On] or [Auto].	"4.3.1 Displaying Waveforms During Recording (Roll Mode)" (p. 102)
56	**Real-time printing is not available.**	Recording Length is set to [Cont]. Real-time printing is not available when the time base of the Recorder function is 10 to 200 ms/div.	"Setting Continuous Recording (Cont)"(p. 101)
58	**Function not available.(Averaging)**	The Averaging function is not available when Memory Division is enabled.	
59	**Function not available. (Averaging, Wave Calculation)**	When Memory Division is enabled, Averaging and Waveform Calculation functions are not available. If enabled, these functions are turned off.	
60	**No waveform data.**	Acquire waveform data.	
61	**Function not available. (Roll Mode, Averaging, Memory Division)**	When Waveform Calculation is enabled, Roll Mode, Averaging and Memory Division functions are not available. If enabled, these functions are turned off.	
63	**Function not available.(Trigger Priority)**	Trigger priority cannot be set when Averaging is enabled.	
64	**Up to eight clamps can be used.**	Up to eight channels can be used simultaneously when clamps are connected to the Model 8940 with Model 9318 or 9319 Conversion Cables. Do not exceed this clamp limitation. When using the Model 9325 connected to the 9322, up to eight channels can be used for clamps and the Model 9322 together.	*Input Module Guide*: "3.5.5 Current Measurement"

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
67	**Too many measurement channels.**	You have tried to use more channels than the number enabled for use. Either increase the number of channels enabled for use, or turn unused channels Off.	"4.2.1 Selecting Channels to Use" (p. 86)
68	**The offset value is too large for Offset Cancel.**	Offset Cancel is not available if the input signal is more than ±10 divisions from 0 V. Change the range, and execute Channel Offset again.	*Input Module Guide*: "3.11.18 Executing Offset Cancellation"
69	**Up to six Model 9322 Differential Probes can be used (with Model 9325)**	When the Model 9322 Differential Probe is connected with the Model 9325 Power Cord, up to six channels can be used simultaneously. Do not use more Model 9322 Differential Probes than this limitation allows.	
70	**Voltage Sag triggering is disabled. (Valid time base range: 20 µs/div to 50 ms/div)**	Voltage Sag triggering can be used only when the time base is between 20 µs/div and 50 ms/div.	
71	**Voltage Sag triggering is disabled for scanner modules.**	Voltage Sag triggering cannot be used with a scanner module.	
72	**Zero-adjustment failed.**	Execute zero-adjustment again.	
73	**Offset Cancel failed.**	The input voltage is more than ±10 divisions from 0 V. Set the input signal within ±10 divisions from 0 V.	*Input Module Guide*: "3.11.18 Executing Offset Cancellation"
74	**Auto balance failed.**	Check whether a sensor is in an uncharged state, and that it is connected correctly.	*Input Module Guide*: "3.11.19 Executing Auto-Balance"
75	**Time base can be set from 20 ms/div.**	When the Recording Length is set to [Cont] with the Recorder function, the time base must be at least 20 ms/div.	
76	**Measurement is not possible with the current module configuration. (REC Function)**	(Model 8861-50 only) When four Model 8946 4-Ch Analog Units are installed in Unit locations 1 to 4 and a Model 8958 16-Ch Scanner Unit is also installed, the Recorder function cannot be used for measurement. Install no more than three Model 8946s in Unit locations 1 to 4.	
78	**No waveform, or recording length is too long.**	If no waveform is present, execute measurement. If the recording length is too long, perform a partial save, then reload and calculate.	
79	**Measurement is not possible with the current module configuration. (FFT function)**	FFT function measurements are not available when only the Model 8958 16-Ch Scanner Unit is installed.	
80	**The time base and sampling rate cannot be changed during synchronized measurement.**	During synchronized measurement sampling, the time base and sampling rate cannot be changed. Finish measuring, change the time base or sampling rate, and resume synchronized measurement sampling.	

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
81	**Perform initialization to start synchronized measurements.**	A setting was changed after starting synchronous operation. Resynchronize by pressing the [Synchronous Start] button on the System screen of the master instrument.	"14.2.4 Synchronized Sampling Output (SYNC.OUT)" (p. 384)
82	**Maximum sampling rate is limited to 1 MS/s.**	The sampling rate is limited when using synchronized sampling.	
83	**No channel selected for use.**	Select the channel(s) to use.	"4.2.1 Selecting Channels to Use" (p. 86)
84	**Measurement aborted due to save processing delay.**	With the Real-Time Saving function, measurement is aborted if the recording speed at the save destination is too slow. Select a slower timebase or reduce the number of channels used.	
85	**Invalid search condition.**	Check the search criteria settings.	"8.14 Searching a Waveform" (p. 222)
86	**Recording length is too long.**	Check the recording length.	"4.2.4 Setting the Recording Length (number of divisions)" (p. 97)
87	**Cannot load measurement waveform.**	Load an index file (.RSI) created by the Real-Time Saving function. If the RSI file cannot be loaded, a measurement waveform file (.RSM) may be damaged or missing.	
88	**Function not available. (Roll, Timebase2, Memory Division)**	The Roll Mode, Timebase 2 and Memory Division are not available when using the Averaging function.	
89	**Function not available. (Trigger Priority, Stop Trigger)**	Trigger Priority and Stop Trigger are not available when using the Averaging function.	
90	**Scanner module and Logic will not measure.**	Scanner and Logic modules are disabled available when using the Averaging function.	
91	**Wave Calculation will not automatically execute on measuring.**	Waveform calculations cannot be performed while measuring using the Averaging function. Calculations can be initiated manually when measurement is finished.	
92	**AAF is disabled.**	Anti-aliasing is not available when using the Recorder function with external sampling.	
93	**Measurement is not possible with the current module configuration. Install no more than four 8961s.**	Up to four 8961 High Voltage Units (modules) may be used. Install no more than four 8961s. (8861-50)	
175	**Internal temperature is rising. Please confirm the use temperature and the installation environment.**	Internal temperature is rising. Damage may result if this condition continues. Please confirm the use temperature and installation environments.	

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
203	**No response from server.**	Verify the network settings on the PC at the connection destination.	*Analysis and Communication Supplement* "Chapter 4 Communications Settings"
210	**Cannot connect to the mail server.**	Check the mail server settings.	
211	**Communication error with the mail server.**	Check the mail sending settings.	
212	**Fail to send mail.**	Check the mail sending settings.	
213	**Mail spool over.**	Check the mail sending settings.	
214	**POP authorization needed.**	Configure POP authentification.	
215	**Invalid POP account or password.**	Enter the correct user name and password.	
216	**Invalid mail settings.**	Check the mail sending settings.	
501	**An unknown error occurred while accessing (file name) .**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
502	**(File name) was not found.**	Verify that the file saving destination or file to load is correct. Alternatively, the free space of the directory can be insufficient. In this case, either delete files in the saving destination directory, or change to another saving destination.	"When the maximum number of files that can be saved is exceeded:"(p. 277)
503	**(File name) contains an invalid path.**	Verify that the file saving destination or file to load is correct.	"11.2 Data Capable of Being Saved & Loaded" (p. 267)
504	**(File name) could not be opened because there are too many open files.**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
505	**Access to (file name) was denied.**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
506	**An invalid file handle was associated with (file name) .**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
507	**(File name) could not be removed because it is the current directory.**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
508	**(File name) could not be created because the directory is full.**	Since the number of files in the saving destination directory is exceeding the maximum number of files, the file cannot be saved. Either delete files in the saving destination directory, or change to another saving destination.	"When the maximum number of files that can be saved is exceeded:"(p. 277)
509	**Seek failed on (file name).**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
510	**A hardware I/O error was reported while accessing (file name).**	The storage media may be corrupted. Replace with new storage media.	
511	**A sharing violation occurred while accessing (file name).**	Verify the settings (user name and password) of the shared destination.	

Displayed Warnings

Msg No.	Message	Remedial Action	Reference
512	**A locking violation occurred while accessing (file name).**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
513	**Disk full while accessing (file name).**	Saving is not possible because of insufficient space on the storage media. Delete files or replace the storage media. If measuring, stop measurement, then replace the storage media.	"11.7.3 Deleting Files & Folders" (p. 307)
514	**An attempt was made to access (file name) past its end.**	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
520	**(File name) may be corrupted.**	The file may be corrupted. This file cannot be used.	

Displayed Errors

Msg No.	Message	Remedial Action
93	**Measurement is not possible with the current module configuration. Install no more than four 8961s.**	Up to four 8961 High Voltage Units (modules) may be used. Install no more than four 8961s. (8861-50)
160	**Measurement was aborted.**	(Cause) Real-time measurement and saving operations were aborted due to an error. Remove the cause of the error.
170	**Unsupported FPGA version detected. Upgrade to a compatible FPGA.**	Upgrade to an FPGA version that is supported by the application program.
171	**Unsupported Kernel version detected. Upgrade to a compatible Kernel.**	Upgrade to a kernel version that is supported by the application program.
176	**Internal temperature is abnormal. Please turn the power off after preserving necessary data.**	Internal temperature is abnormal. Measurement has been stopped. Please turn the power off after preserving necessary data. If there is no problem with the use temperature and installation environments, then there is a possibility that the instrument may be damaged. Please send it for repair.
177	**Input unit temperature is rising. Please confirm the use temperature and the installation environment.**	Internal temperature is abnormal. Please turn the power off after preserving necessary data. If there is no problem with the use temperature and installation environments, then there is a possibility that the instrument may be damaged. Please send it for repair.
180	**USB host controller malfunction detected.**	Have the instrument repaired.
181	**Keyboard controller malfunction detected.**	Have the instrument repaired.
182	**I/O FPGA malfunction detected.**	Have the instrument repaired.
183	**Storage FPGA malfunction detected.**	Have the instrument repaired.
184	**Bus bridge malfunction detected.**	Have the instrument repaired.
190	**Module power supply malfunction detected.**	Power to the modules was momentarily interrupted. If this occurred while measuring, data may have been corrupted.

Displayed Errors

Msg No.	Message	Remedial Action
191	**Clamp power supply malfunction detected.**	Power to the clamps was momentarily interrupted. If this occurred while measuring, data may have been corrupted.
193	**Module power supply malfunction detected. Turn power off immediately.**	Power to the modules is abnormal. Turn the instrument off immediately, and have it repaired.
194	**Clamp power supply malfunction detected. Turn power off immediately.**	Power to the clamps is abnormal. Turn the instrument off immediately, and have it repaired.

Other Display Messages

These messages provide only supplemental information.

Msg No.	Message	Remedial Action	Reference
102	**Confirm sheet settings.**	Verify settings such as the channels to be displayed on sheets. Verify the settings on the Sheet Settings screen.	"7.2 Setting the Screen Layout of the Waveform Screen (Sheet Settings Screen)" (p. 174)
119	**Unit (module) configuration has changed. Verify each setting.**	When an input module has been added or replaced, verify settings on the Settings screens (Status, Channel, Trigger and Sheet). Pay particular attention to the displayed channels setting on the Sheet Settings screen.	*Input Module Guide*: "2.1 Installing Input Modules (Adding or Replacing)"

Appendix 2 Reference

Appendix 2.1 List of Default Settings

Shows the default setting contents when shipped from the factory, and after System Reset.

Reference

Setting Type	
Memory Function	(p. A9)
Recorder Function	(p. A13)
REC&MEM Function	(p. A13)
Real-Time Saving Function	(p. A18)
FFT Function	(p. A15)
Input Channel	(p. A19)
System	(p. A21)

Memory Function

Menu	Setting Items		Default Setting	Reference for Setting
Status	Basic	Sampling Clock	INIT (Internal)	4.2.2 (p. 90)
		Timebase	5 µs/div (sampling speed: 50 ns) With only Model 8958 16-Ch Scanner Unit Installed: 5s/div	
		Shot (Recording length)	Fixed	4.2.4 (p. 97)
		Fixed Shot (Fixed recording length)	25 div	
		Timebase 2	Off (On when the Model 8958 is installed)	4.2.3 (p. 94)
		Roll Mode	Auto	4.3.1 (p. 102)
		Overlay	Off	4.3.2 (p. 104)
		Averaging	Off	4.3.3 (p. 106)
	Use Ch	Timebase 1	Set to enable use of all installed modules	4.2.1 (p. 86)
		Timebase 2	Off (or On if a Scanner Module is installed)	
Channel	One Ch		Refers to the default value of each input module	(p. A19)
	Comment		All blank	5.2 (p. 118)
	Scaling		Off	5.4 (p. 123)
	Variable		Off	8.9.4 (p. 215)
	Logic		All Off	7.3 (p. 183)

Menu	Setting Items		Default Setting	Reference for Setting
Trigger	Trigger Mode		Auto	6.3 (p. 138)
	Source (AND/OR)		OR	6.4 (p. 139)
	Pre-Trigger	% Setting	0%	6.5.1 (p. 140)
		Trigger Priority	Off	6.5.2 (p. 143)
	Timer Trigger		Off	6.9 (p. 162)
	External Trigger		Off	6.11 (p. 166)
	All Trigger Sources		Off	
Sheet	Sheet display		On (Sheet 1 only)	7.2.2 (p. 177)
	Sheet Name		Blank	7.2.2 (p. 177)
	Display Type		Waveform	7.2.3 (p. 177)
	Split Screen		1 Graph	7.2.4 (p. 178)
	Pattern		Pattern 1	
	Scroll		Horizontal	7.2.5 (p. 180)
	X-Y Comp	Area (Composite area)	Whole (Whole waveform)	7.4 (p. 187)
		Dot-Line (Line interpolation)	Line	
Mem Div	Memory Div		Off	4.3.4 (p. 109)
	Division		2	
	Start Block		1	
	Use Block		1	
	Display Block		1	
	Ref Block		Off	
	Wave Display		Off	
Num Calc	Numerical Calc		Off	*Analysis and Communication Supplement*
Wave Calc	Waveform Calc		Off	*Analysis and Communication Supplement*

Menu	Setting Items			Default Setting	Reference for Setting
Save	Auto Save	Auto Save		Off	11.3.4 (p. 276)
		Save in 1		PC Card #1:\	
		Save in 2		Off	
		Save Method		Normal Save	
		Directory Creation		On	
		Waveform		On	11.3.7 (p. 282)
			Name	AUTO	
			Name Pattern	Trig (prefix)	
			Format	Binary	
			Thinning	Off	
			Timebase 2 Interpolation	On	
			Division	Off	
		Calc Results		Off	*Analysis and Communication Supplement*
			Name	MEAS	
			Save Specified File	New File	
		Screen Image		Off	11.3.9 (p. 287)
			Name	IMAGE	
			Name Pattern	Trig (prefix)	
			Format	BMP Color	
			GUI Save	With	
	SAVE Key	SAVE Key Operation		Selection Save	11.3.5 (p. 278)
		Save in		PC Card #1:\	
		Name		Blank	
		Same Name		Numbering	
		Name Pattern		Trig (prefix)	
		Save Type		Waveform	
		Waveform	Format	Binary	11.3.8 (p. 285)
			Area	Whole	
			Channels	Displayed Ch	
			Thinning	Off	
			Timebase 2 Interpolation	On	
			Division	Off	
		Screen Image	Format	BMP Color	11.3.10 (p. 289)
			GUI Save	With	
		Calc Results	Save Specified File	New File	*Analysis and Communication Supplement*

Menu	Setting Items			Default Setting	Reference for Setting
Print	Printer	Auto Print Settings	Auto Print	Off	12.3 (p. 317)
			Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	
			Calculation Results	Off	
			Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	
		Manual Print	Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	12.4 (p. 319)
			PRINT Key Action	Selection Print	
			Print GUI Area	With	
			Row Print	Off	
			A4 Size	Off	
		Internal Printer	Printer Density	Normal	12.5.1 (p. 323)
			Waveform Density	C 01, 05, 09, 13, 17, 21, 25, 29, 33: Normal	
				C 02, 06, 10, 14, 18, 22, 26, 30, 34: Slightly Dark	
				C 03, 07, 11, 15, 19, 23, 27, 31, 35: Dark	
				C 04, 08, 12, 16, 20, 24, 28, 32, 36: Light	
			Feed After Printing	Yes	
			Print Quality	Normal	
		External Printer	Orientation	Portrait	12.5.2 (p. 325)
			Margins	Custom	
			Left	10 mm	
			Right	10 mm	
			Top	10 mm	
			Bottom	10 mm	
			Printing Colors	Color	
	Print Items	Common Settings	Printout Type	Screen Link	12.6.1 (p. 327)
			Area	Whole	
			Time Value Display	TIme	
		Waveform Print Items	Grid Type	Normal	12.6.2 (p. 329)
			Channel Markers	Ch No.	
			Marker Position	Inside	
			List & Gauge	Off	
			Upper/Lower Limits	Off	
			Zero-Position Comment	Off	
			Counter Printing	Off	
			Counter Name	Blank	
			Count	0	
			Mag/Comp	Screen Link	
		Numerical Value Printing Items	Thinning	Screen Link	12.6.3 (p. 334)
		External Printer Print Items	Gauge	All Pages	12.6.4 (p. 336)
		Comment Printing Settings	Title	Settings	12.6.5 (p. 337)
			Analog	Settings	
			Logic	Off	

Recorder Function

Menu	Setting Items			Default Setting	Reference for Setting
Status	Basic	Timebase		10ms/div With Model 8958 16-Ch Scanner Unit Installed: 50 ms/div	4.2.2 (p. 90)
		Sampling Speed		100 ns/S	
		Shot (recording length)		Fixed	4.2.4 (p. 97)
		Fixed Shot		25 div	
Channel	One Ch			Refers to the default value of each input module	(p. A19)
	Comment			All blank	5.2 (p. 118)
	Scaling			Off	5.4 (p. 123)
	Variable			Off	8.9.4 (p. 215)
	Logic			All Off	7.3 (p. 183)
Trigger	Trigger Mode			Single	6.3 (p. 138)
	Source (AND/OR)			OR	6.4 (p. 139)
	Trigger Timing			Start	6.6 (p. 144)
	Timer Trigger			Off	6.9 (p. 162)
	External Trigger			Off	6.11 (p. 166)
	All Trigger Sources			Off	
Sheet	Sheet display			On (Sheet 1 only)	7.2.2 (p. 177)
	Sheet Name			Blank	7.2.2 (p. 177)
	Display Type			Waveform	7.2.3 (p. 177)
	Split Screen			1 Graph	7.2.4 (p. 178)
	Pattern			Pattern 1	
	Scroll			Horizontal	7.2.5 (p. 180)
Save	Auto Save			Off	11.3.4 (p. 276)
	Refer to Memory Function “Save” for other items				
Print	Printer	Auto-Print Settings	Real-Time Print	Off	12.3 (p. 317)
	Refer to Memory Function “Print” for other items				(p. A9)

REC&MEM Function

Menu	Setting Items			Default Setting	Reference for Setting
Status	Basic	Recorder	Timebase	100ms/div (Sampling Speed: 100ns/S)	4.2.2 (p. 90)
			Shot (recording length)	Fixed	4.2.4 (p. 97)
			Fixed Shot	25 div	
			Using the scanner module	Configure for use when the Model 8958 is installed	
			Trigger Mode	Single	
		Memory	Timebase	10 µs/div (sampling speed: 100 ns/div)	4.2.2 (p. 90)
			Shot (Recording length)	Fixed	4.2.4 (p. 97)
			Fixed Shot (Fixed recording length)	25 div	

Menu	Setting Items			Default Setting	Reference for Setting
Channel	One Ch			Refers to the default value of each input module	(p. A19)
	Comment			All blank	5.2 (p. 118)
	Scaling			Off	5.4 (p. 123)
	Variable			Off	8.9.4 (p. 215)
	Logic			All Off	7.3 (p. 183)
Trigger	Source (AND/OR)			OR	6.4 (p. 139)
	Pre-Trigger	% Setting		0%	6.5.1 (p. 140)
		Trigger Priority		Off	6.5.2 (p. 143)
	External Trigger			Off	6.11 (p. 166)
	All Trigger Sources			Off	
Sheet	Sheet display			On (Sheet 1 only)	7.2.2 (p. 177)
	Sheet Name			Blank	7.2.2 (p. 177)
	Display Type			Waveform	7.2.3 (p. 177)
	Split Screen			1 Graph	7.2.4 (p. 178)
	Scroll			Horizontal	7.2.5 (p. 180)
Mem Div	Memory Div			Off	4.3.4 (p. 109)
Save	Auto Save	Auto Save		Off	11.3.4 (p. 276)
		Save in 1		PC Card #1:\	
		Save in 2		Off	
		Save Method		Normal Save	
		Directory Creation		On	
		Waveform		On	11.3.7 (p. 282)
			Name	AUTO	
			Name Pattern	Trig (prefix)	
			Format	Binary	
	SAVE Key	SAVE Key Operation		Selection Save	11.3.5 (p. 278)
		Save in		PC Card #1:\	
		Name		Blank	
		Same Name		Numbering	
		Name Pattern		Trig (prefix)	
		Save Type		Waveform	
		Waveform	Format	Binary	11.3.8 (p. 285)
			Area	Whole	
			Target Blocks	All	
			Channels	Displayed Ch	
Print	Printer	Auto-Print Settings	Real-Time Print	Off	12.3 (p. 317)
	Refer to Memory Function “Print” for other items				(p. A9)

FFT Function

Menu	Setting Items			Default Setting	Reference for Setting
Status	Basic	Reference		New Data	*Analysis and Communication Supplement*
		Sampling Clock		INT	
		Frequency Range		8MHz	
		Sampling Point		1000	
		Window		Rectangular	
			Multiplication	None	
		Peak		Off	
		Averaging		Off	
		Highlight (phase)		Off	
		Analyze		Nos. 1 to 8 all Off	
		Scale		Nos. 1 to 8 all Auto	
Channel	One Ch			Refers to the default value of each input module	(p. A19)
	Comment			All blank	5.2 (p. 118)
	Scaling			Off	5.4 (p. 123)
	Variable			Off	8.9.4 (p. 215)
	Logic			All Off	7.3 (p. 183)
Trigger	Trigger Mode			Auto	6.3 (p. 138)
	Source (AND/OR)			OR	6.4 (p. 139)
	Pre-Trigger	% Setting		0%	6.5.1 (p. 140)
		Trigger Priority		Off	6.5.2 (p. 143)
	Timer Trigger			Off	6.9 (p. 162)
	External Trigger			Off	6.11 (p. 166)
	All Trigger Sources			Off	
Sheet	Sheet display			On (Sheet 1 only)	*Analysis and Communication Supplement*
	Sheet Name			Blank	
	Display Type			FFT	
	Split Screen			1 Graph	

Menu	Setting Items			Default Setting	Reference for Setting
Save	Auto Save	Auto Save		Off	11.3.4 (p. 276)
		Save in 1		PC Card #1:\	
		Save in 2		Off	
		Save Method		Normal Save	
		Directory Creation		On	
		Waveform		On	11.3.7 (p. 282)
			Name	AUTO	
			Name Pattern	Trig (prefix)	
			Format	Binary	
		Screen Image		Off	11.3.9 (p. 287)
			Name	IMAGE	
			Name Pattern	Trig (prefix)	
			Format	BMP Color	
			GUI Save	With	
	SAVE Key	SAVE Key Operation		Selection Save	11.3.5 (p. 278)
		Save in		PC Card #1:\	
		Name		Blank	
		Same Name		Numbering	
		Name Pattern		Trig (prefix)	
		Save Type		Waveform	
		Waveform	Format	Binary	11.3.8 (p. 285)
		Screen Image	Format	BMP Color	11.3.10 (p. 289)
			GUI Save	With	

Menu	Setting Items			Default Setting	Reference for Setting
Print	Printer	Auto Print Settings	Auto Print	Off	12.3 (p. 317)
			Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	
		Manual Print	Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	12.4 (p. 319)
			PRINT Key Action	Selection Print	
			Print GUI Area	With	
			A4 Size	Off	
		Internal Printer	Printer Density	Normal	12.5.1 (p. 323)
			Waveform Density	C 01, 05, 09, 13, 17, 21, 25, 29, 33: Normal	
				C 02, 06, 10, 14, 18, 22, 26, 30, 34: Slightly Dark	
				C 03, 07, 11, 15, 19, 23, 27, 31, 35: Dark	
				C 04, 08, 12, 16, 20, 24, 28, 32, 36: Light	
			Feed After Printing	Yes	
			Print Quality	Normal	
		External Printer	Orientation	Portrait	12.5.2 (p. 325)
			Margins	Custom	
			Left	10 mm	
			Right	10 mm	
			Top	10 mm	
			Bottom	10 mm	
			Printing Colors	Color	
	Print Items	Common Settings	Printout Type	Screen Link	12.6.1 (p. 327)
		Waveform Print Items	Grid Type	Normal	12.6.2 (p. 329)
			List & Gauge	Off	
			Upper/Lower Limits	Off	
			Counter Printing	Off	
			Counter Name	Blank	
			Count	0	
		Numerical Value Printing Items	Thinning	Screen Link	12.6.3 (p. 334)
		Comment Printing Settings	Title	Settings	12.6.5 (p. 337)
			Analog	Settings	

Real-Time Saving Function

Menu	Setting Items			Default Setting	Reference for Setting
Status	Basic	Save	Save in	HD:\ (when Model 9718-50 HD Unit is installed) PC CARD #1:\ (except the above)	Chapter 9 (p. 235)
			Same Name	REAL	
			Name Pattern	Trig (prefix)	
		Sampling	Timebase	All installed modules are set to their fastest settings.	
			Sampling Speed	1µs/S	
			Shot (Recording length)	Fixed	
			Fixed Shot (Fixed record-ing length)	25 div	
		Whole Wave	Timebase	Auto	
		Trigger Mode		Single	
	Use Ch			Set to enable use of all installed modules (excluding the Model 8958)	
Channel	One Ch			Refers to the default value of each input module	(p. A19)
	Comment			All blank	5.2 (p. 118)
	Scaling			Off	5.4 (p. 123)
	Variable			Off	8.9.4 (p. 215)
	Logic			All Off	7.3 (p. 183)
Sheet	Sheet display			On (Sheet 1 only)	7.2.2 (p. 177)
	Sheet Name			Blank	7.2.2 (p. 177)
	Display Type			Waveform	7.2.3 (p. 177)
	Split Screen			1 Graph	7.2.4 (p. 178)
	Scroll			Horizontal	7.2.5 (p. 180)
Save	SAVE Key	SAVE Key Operation		Selection Save	11.3.5 (p. 278)
		Save in		PC Card #1:\	
		Name		Blank	
		Same Name		Numbering	
		Name Pattern		Trig (prefix)	
		Save Type		Waveform	
		Waveform	Format	Binary	11.3.8 (p. 285)
			Area	Whole	
			Channels	Displayed Ch	
			Division	Off	
		Screen Image	Format	BMP Color	11.3.10 (p. 289)
			GUI Save	With	
Print	The Auto Print setting is not available with the Real-Time Saving function. Refer to Memory Function “Print” for other items				(p. A9)

Input Channel

Input Module	Setting Items	Default Setting	Reference for Setting
8936 Analog Unit	Mode	Voltage	*Input Module Guide*: "3.1 Analog Unit Settings (Models 8936, 8946 and 8956)"
	Range (/div)	5 mV	
	Coupling	DC	
	LPF	Off	
	Probe	1:1	
	Position (zero position)	50%	
8937 Voltage/Temp Unit	Mode	Voltage	*Input Module Guide*: "3.2 Model 8937 Voltage and Temperature Unit Settings"
	Range (/div)	500µV	
	Coupling	DC	
	LPF	Off	
	Position	50%	
	Probe	1:1	
	Digital F	Off	
8938 FFT Analog Unit	Mode	Voltage	*Input Module Guide*: "3.3 Model 8938 FFT Analog Unit Settings"
	Range (/div)	5mV	
	Coupling	DC	
	LPF	Off	
	Probe	1:1	
	Position (zero position)	50%	
	AAF	Off	
8939 Strain Unit	Mode	Strain	*Input Module Guide*: "3.4 Strain Unit Settings (Models 8939 and 8960)"
	Range (/div)	20µε	
	LPF	Off	
	Position (zero position)	50%	
8940 F/V Unit	Mode	Frequency	*Input Module Guide*: "3.5 Model 8940 F/V Unit Settings"
	Range (/div)	0.05Hz	
	Coupling	DC	
	LPF	Off	
	Position (zero position)	0%	
	Probe	1:1	
	Threshold	0V	
	Pull-Up	Off	
	Hold	10-ms Off	
8946 4-Ch Analog Unit	Mode	Voltage	*Input Module Guide*: "3.1 Analog Unit Settings (Models 8936, 8946 and 8956)"
	Range (/div)	10mV	
	Coupling	DC	
	LPF	Off	
	Probe	1:1	
	Position (zero position)	50%	

Input Module	Setting Items	Default Setting	Reference for Setting
8947 Charge Unit	Mode	Charge	*Input Module Guide*: "3.6 Model 8947 Charge Unit Settings"
	Range (/div)	500mm/s^2	
	Coupling	AC	
	LPF	Off	
	AAF	Off	
	Sensitivity	1pC	
	Position (zero position)	50%	
8956 Analog Unit	Mode	Voltage	*Input Module Guide*: "3.1 Analog Unit Settings (Models 8936, 8946 and 8956)"
	Range (/div)	5mV	
	Coupling	DC	
	LPF	Off	
	Probe	1:1	
	Position (zero position)	50%	
8957 High Resolution Unit	Mode	Voltage	*Input Module Guide*: "3.7 Model 8957 High Resolution Unit Settings"
	Range (/div)	5mV	
	Coupling	DC	
	LPF	Off	
	Probe	1:1	
	Position (zero position)	50%	
	AAF	Off	
8958 16-Ch Scanner Unit	Mode	Voltage	*Input Module Guide*: "3.8 Model 8958 16-Ch Scanner Unit Settings"
	Range (/div)	5mV	
	Digital F	Off	
	Position (zero position)	50%	
8959 DC/RMS Unit	Mode	DC	*Input Module Guide*: "3.9 Model 8959 DC/RMS Unit Settings"
	Range (/div)	5mV	
	Coupling	DC	
	LPF	Off	
	Probe	1:1	
	Position (zero position)	50%	
	Response	Fast	
8960 Strain Unit	Mode	Strain	*Input Module Guide*: "3.4 Strain Unit Settings (Models 8939 and 8960)"
	Range (/div)	20με	
	LPF	Off	
	Bridge	2 V	
	AAF	Off	
	Position (zero position)	50%	
8961 High Voltage Unit	Mode	DC	*Input Module Guide* "3.10 Model 8961 High Voltage Unit Settings"
	Range (/div)	1V	
	Coupling	DC	
	LPF	Off	
	Position (zero position)	50%	

System Settings

Menu	Setting Items			Default Setting	Reference for Setting
Env (Environment)	Waveform Screen	Grid Type		Dotted Line	13.1.1 (p. 350)
		Display Comments		Off	13.1.2 (p. 351)
		Time Value Display		Time	13.1.3 (p. 352)
		START Key Activation		One Push	13.2.1 (p. 353)
		Abort Stores (STOP key)		Two Push	13.2.2 (p. 354)
		Auto-Resume		Off	13.2.3 (p. 355)
		Jog & Shuttle		Positive	13.2.4 (p. 356)
		Sheet Scroll Linkage		Linkage	13.2.5 (p. 357)
		Zero Position		Off	13.1.4 (p. 352)
		SHEET/PAGE Key		Sheet	13.2.6 (p. 357)
		Restart		Yes	13.2.7 (p. 358)
	Settings Screen	Variable Auto Adjustment		On	13.2.8 (p. 358)
	Sound	Beep Sound		Beep 1	13.2.9 (p. 359)
		Keypress Sound		Off	
	System Environment	Screen Saver		Off	13.2.10 (p. 360)
		Backlight Saver		Off	13.2.11 (p. 361)
	Display Colors	Back		RGB 0, 0, 0	13.2.13 (p. 363)
		Frame		RGB 240, 0, 0	
		Grid		RGB 100, 100, 100	
		Text		RGB 240, 240, 240	
		Blank		RGB 0, 50, 200	
		Cursors		RGB 255, 255, 0	
Comm (Communication)	Communication	Basic Settings	Host Name	Blank	*Analysis and Communication Supplement* Chapter 4
			User Name	Blank	
			Password	Blank	
		Interface	DHCP	On	
	File	FTP Server		Off	
		Access Restrictions		Read/Write	
		Time Difference		0 h	
		Character Code		Local	
	Web	Web Server		Off	
	Mail	Send Mail		Off	
	Command	Command Processing		LAN	
			Delimiter	CR+LF	
			Header	Off	
		LAN	Error Response	Off	
			Command Port	880x	
		GP-IB	Mode	Addressable	
			Address	5	
Ext Term (External Terminal)	External Control Terminal	Input Terminal	START/EXT.IN1	START	14.2.7 (p. 391)
			STOP/EXT.IN2	STOP	
			PRINT/EXT.IN3	PRINT	
			EXT.TRIG	↓	14.2.1 (p. 378)
			EXT.SMPL	↓	14.2.3 (p. 382)
		Output Terminal	GO/EXT.OUT1	Num Calc	14.2.5 (p. 387)
			NG/EXT.OUT2	Num Calc	14.2.6 (p. 389)
			TRIG.OUT/CAL	Trig Out	14.2.2 (p. 380) 14.2.8 (p. 393)
		SYNC	SYNC.OUT	Off	14.2.4 (p. 384)
Setting	Settings			All settings are cleared by All Reset.	11.3.6 (p. 280)
	Auto Setup			Off	11.4.2 (p. 294)

Appendix 2.2 Waveform File Sizes

References

File Type	Operating Function	Reference
MEM File	Memory Function	(p. A22)
REC File	Recorder Function	(p. A24)
RSM Files	Real-Time Saving Function	(p. A25)
RSR Files		(p. A26)
FFT File	FFT Function	(p. A26)
TXT File	Memory Function	(p. A27)
	Recorder Function	(p. A28)
	Real-Time Saving Function	(p. A27)
	FFT Function	(p. A29)

Even for the same record length and number of channels, there are cases where file size may be different because of different Sheet settings and input module types. File size is also subject to change with functional enhancements that may be added in the future.
Refer to "File Sizes"(p. 268) for information about the sizes of files for settings and screen image files.

MEM File Size (Memory Function) 8860-50

File size (bytes) = settings size*1 + data size*2

*1 Settings size = approx. 180KB + analog channel portion + logic channel portion

Analog channel portion = approx. 1.2KB × saved analog channels
Logic channel portion = approx. 3.6KB × saved logic channels (0: none saved / 4: saved)

*2. Data size = data size of Timebase 1 + data size of Timebase 2

Data size of Timebase 1 = Samples on Timebase 1 × (2 × saved channels on Timebase 1*3)
Samples on Timebase 1 = Recording Length × 100 + 1
(Example: If the Recording Length is 25 divisions, 25 × 100 + 1 = 2501)

Data size of Timebase 2 = approx. 12KB + samples on Timebase 2 × (2 × saved channels on Timebase 2) + 1

Samples on Timebase 2 = Samples on Timebase 1 × ratio of sampling periods on the second and first Time Axes

(Example: If there are 2501 samples on Timebase 1, and if the sampling period of Timebase 1 is 1 ms/S and the sampling period of Timebase 2 is 10 ms/S, then 2501 × (1/10) + 1 = 251)

*3. Saved channels: Logic channels A to D count as one channel, regardless of the actual number of channels used. When logic channels are not used, they are counted as zero.
(Example: When analog channels Unit 1 – Ch 1, Unit 1 – Ch 2 and logic channels A and B are stored, the number of saved channels is 3)

* Refer to the Table for the data file size for Timebase 2 after acquiring Timebase 2 data quantity.
Calculating Timebase 2 data quantity:
Timebase 2 data quantity = Timebase 1 data quantity × ratio of timebases of Timebase 1 and Timebase 2
Ratio of Timebase 1 and Timebase 2: Timebase 1 / Timebase 2
Example. Recording Length = 100 div, Timebase 1 = 1 ms/div, and Timebase 2 = 100 ms/div:
Timebase 2 Data Quantity
= Timebase 1 data quantity (10000) × ratio of timebases of Timebase 1 and Timebase 2 (1 ms / 100 ms)
= 10000 × (1/100)
= 100

Memory board (8861-50: Memory board x 2) (W: words)

9715-50 (32MW) to 9715-53 (1GW)
9715-51 (128MW) to 9715-53 (1GW)
9715-52 (512MW) to 9715-53 (1GW)
9715-53 (1GW) only

Notes:
Values in parentheses ( ) in the following table exceed 2 GB, and so cannot be saved unless size is reduced by partial saving.
When saving both Timebase 1 and Timebase 2, add both file sizes.

(Reference Values)

When the Model 8958 16-Ch Scanner Unit is not installed **[Byte]**

Record-ing length (div)	Timebase 1 Data Quantity	8860-50					8861-50				
		Timebase 1 Saved Channels					Timebase 1 Saved Channels				
		1	**2**	**4**	**8**	**16**	**2**	**4**	**8**	**16**	**32**
100	10,000	192 K	213 K	254 K	337 K	502 K	213 K	254 K	337 K	502 K	832 K
1,000	100,000	368 K	565 K	958 K	1.7 M	3.2 M	565 K	958 K	1.7 M	3.2 M	6.3 M
10,000	1,000,000	2.1 M	4.0 M	7.8 M	15 M	31 M	4.0 M	7.8 M	15 M	31 M	61 M
100,000	10,000,000	19 M	38 M	76 M	153 M	**305 M**	38 M	76 M	153 M	305 M	**611 M**
1,000,000	100,000,000	191 M	**382 M**	**763 M**	**1,526 M**	———	382 M	**763 M**	**1,526 M**	**(3,052 M)**	———
10,000,000	1,000,000,000	**1,908 M**	———	———	———	———	**(3,815 M)**	———	———	———	———

Record-ing length (div)	Timebase 2 Data Quantity*	Timebase 2 Saved Channels					Timebase 2 Saved Channels				
		4	**8**	**16**	**32**	**48**	**8**	**16**	**32**	**64**	**96**
———	100	21 K	26 K	37 K	58 K	78 K	26 K	37 K	58 K	99 K	141 K
———	1,000	28 K	40 K	65 K	114 K	163 K	40 K	65 K	114 K	212 K	310 K
———	10,000	98 K	181 K	346 K	676 K	1007 K	181 K	346 K	676 K	1.3 M	2.0 M
———	100,000	801 K	2 M	3.1 M	6.2 M	9.2 M	1.5 M	3.1 M	6.2 M	12 M	18 M
———	1,000,000	7.6 M	15.3 M	31 M	61 M	92 M	15 M	31 M	61 M	122 M	183 M
———	10,000,000	76 M	153 M	305 M	610 M	916 M	153 M	305 M	610 M	1,221 M	1,831 M

With only Model 8958 16-Ch Scanner Unit Installed **[Byte]**

Recording length (div)	8860-50				8861-50			
	Saved channels				Saved channels			
	8	**16**	**32**	**64**	**16**	**32**	**64**	**128**
100	337 K	502 K	832 K	1.5 M	502 K	832 K	1.5 M	2.7 M
1,000	1.7 M	3.2 M	6.3 M	12 M	3.2 M	6.3 M	12 M	25 M
10,000	15 M	31 M	61 M	122 M	31 M	61 M	122 M	244 M
100,000	153 M	**305 M**	**611 M**	**1,221 M**	305 M	**611 M**	**1,221 M**	**(2,442 M)**
1,000,000	**1,526 M**	———	———	———	**(3,052 M)**	———	———	———

REC File Size (Recorder Function)

File size (bytes) = settings size[*1] + data size[*2]

*1. Settings size = approx. 180KB + analog channel portion + logic channel portion

Analog channel portion = approx. 1.2KB × saved analog channels
Logic channel portion = approx. 3.6KB × saved logic channels (0: none saved / 4: saved)

*2. Data size = samples × (4 × saved channels*3)

Samples = Recording Length × 100 + 1

(Example: If the Recording Length is 25 divisions, 25 × 100 + 1 = 2501)

*3. Saved channels: Logic channels A to D count as one channel, regardless of the actual number of channels used. When logic channels are not used, they are counted as zero.
(Example: When analog channels Unit 1 – Ch 1, Unit 1 – Ch 2 and logic channels A and B are stored, the number of saved channels is 3)

Memory board (8861-50: Memory board x 2) (W: words)

9715-50 (32MW) to 9715-53 (1GW)
9715-51 (128MW) to 9715-53 (1GW)
9715-52 (512MW) to 9715-53 (1GW)
9715-53 (1GW) only

(Reference Values)

When the Model 8958 16-Ch Scanner Unit is not installed **[Byte]**

Recording length (div)	8860-50					8861-50				
	Saved channels					Saved channels				
	1	2	4	8	16	2	4	8	16	32
100	228 K	268 K	348 K	509 K	830 K	268 K	348 K	509 K	830 K	1.4 M
1,000	579 K	971 K	1.7 M	3.2 M	6.3 M	971 K	1.7 M	3.2 M	6.3 M	12 M
10,000	4.0 M	7.8 M	15 M	31 M	61 M	7.8 M	15 M	31 M	61 M	122 M
100,000	**38 M**	**76 M**	**153 M**	**305 M**	**611 M**	**76 M**	**153 M**	**305 M**	**611 M**	**1,221 M**

With only Model 8958 16-Ch Scanner Unit Installed **[Byte]**

Recording length (div)	8860-50				8861-50			
	Saved channels				Saved channels			
	8	16	32	64	16	32	64	128
100	509 K	830 K	1.4 M	2.7 M	830 K	1.4 M	2.7 M	5.2 M
1,000	3.2 M	6.3 M	12 M	25 M	6.3 M	12 M	25 M	49 M
10,000	**31 M**	**61 M**	**122 M**	**244 M**	**61 M**	**122 M**	**244 M**	**489 M**
20,000	**61 M**	**122 M**	**244 M**	**489 M**	**122 M**	**244 M**	**489 M**	**977 M**

RSM File Size (Real-Time Saving Function)

File size (bytes) = settings size*1 + data size*2

*1: Settings size = approx. 108KB + analog channel portion + logic channel portion

Analog channel portion = approx. 1.1KB × saved analog channels

Logic channel portion = approx. 3.6KB × saved logic channels (0: none saved / 4: saved)

*2: Data size = samples × (2 × saved channels*3)

Samples = Recording Length × 100 + 1

(Example: If the Recording Length is 25 divisions, 25 × 100 + 1 = 2501)

*3. Saved channels: Logic channels A to D count as one channel, regardless of the actual number of channels used. When logic channels are not used, they are counted as zero.
(Example: When analog channels Unit 1 – Ch 1, Unit 1 – Ch 2 and logic channels A and B are stored, the number of saved channels is 3)

Memory board (8861-50: Memory board x 2) (W: words)

9715-50 (32MW) to 9715-53 (1GW)
9715-51 (128MW) to 9715-53 (1GW)
9715-52 (512MW) to 9715-53 (1GW)
9715-53 (1GW) only

(Reference Values)

[Byte]

Sampled waveform Recording length (div)	Saved channels					
	1	**2**	**4**	**8**	**16**	**32**
100	126 KB	147 KB	188 KB	270 KB	436 KB	766 KB
1,000	302 KB	498 KB	891 KB	1.6 MB	3.2 MB	6.2 MB
10,000	2.0 MB	3.9 MB	7.7 MB	15 MB	31 MB	61 MB
100,000	19 MB	38 MB	76 MB	153 MB	305 MB	610 MB
1,000,000	191 MB	382 MB	763 MB	1.5 MB	3.0 MB	6.0 GB
10,000,000	1.9 GB	3.7 GB	7.5 GB	15 GB	30 GB	———
20,000,000	3.7 GB	7.5 GB	15 GB	30 GB	———	———
50,000,000	9.3 GB	19 GB	37 GB	———	———	———
100,000,000	19 GB	37 GB	———	———	———	———
200,000,000	37 GB	———	———	———	———	———

RSR File Size (Real-Time Saving Function)

File size (bytes) = settings size*1 + data size*2

*1. Settings size = 111672 + analog channel portion + logic channel portion

Analog channel portion = 1104 × saved analog channels
Logic channel portion = 3584 × saved logic channels (0: none saved / 4: saved)

*2. Data size = samples × (4 × saved channels*3)

Samples = Recording Length × 100 + 1

(Example: If the Recording Length is 25 divisions, 25 × 100 + 1 = 2501)

*3. Saved channels: Logic channels A to D count as one channel, regardless of the actual number of channels used. When logic channels are not used, they are counted as zero.
(Example: When analog channels Unit 1 – Ch 1, Unit 1 – Ch 2 and logic channels A and B are stored, the number of saved channels is 3)

Memory board (8861-50: Memory board x 2) (W: words)

9715-50 (32MW) to 9715-53 (1GW)
9715-51 (128MW) to 9715-53 (1GW)
9715-52 (512MW) to 9715-53 (1GW)
9715-53 (1GW) only

(Reference Values) **[Byte]**

Whole waveform Recording length (div)	Saved channels					
	1	**2**	**4**	**8**	**16**	**32**
100	150 K	190 K	271 K	431 K	752 K	1.4 M
1,000	502 K	893 K	1.6 M	3.2 M	6.2 M	12 M
10,000	3.9 M	7.7 M	15 M	31 M	61 M	122 M
100,000	38 M	76 M	153 M	305 M	610 M	1,221 M

FFT File Size (FFT Function)

File size (bytes) = settings size + data size

File size depends on the analysis mode, calculation object (waveform processing calculation or not), averaging, Sheet numbers used, etc.

Values in the following table are approximations.

Analysis mode is fixed (cross-correlation function), waveform processing is not the object of calculation, using Sheet No. 1

Number of points	Averaging [Off]					Averaging [On]				
	No. of calculations					No. of calculations				
	1	**2**	**4**	**8**	**16**	**1**	**2**	**4**	**8**	**16**
1000	128 K	144 K	178 K	244 K	375 K	138 K	164 K	219 K	326 K	538 K
2000	143 K	175 K	240 K	369 K	625 K	163 K	215 K	320 K	529 K	945 K
5000	190 K	269 K	428 K	744 K	1.3 M	239 K	368 K	625 K	1.1 M	2.1 M
10000	268 K	425 K	740 K	1.3 M	2.6 M	366 K	621 K	1.1 M	2.1 M	4.1 M
20000	424 K	738 K	1.3 M	2.6 M	5.0 M	620 K	1.1 M	2.1 M	4.1 M	8.1 M

TXT (Text) File Size (Memory Function and Real-Time Saving Function)

File size (bytes) = header size[*1] + data size[*2]

*1. Header size = 190 + 27 × saved analog channels + 64 × saved logic channels
*2. Data size = (20 + 16 × saved analog channels + 9 × saved logic channels) × (Recording Length (div) × 100 + 1)
(Saved logic channels = 0: none saved / 4: saved)

Memory board (8861-50: Memory board x 2) (W: words)

9715-50 (32MW) to 9715-53 (1GW)
9715-51 (128MW) to 9715-53 (1GW)
9715-52 (512MW) to 9715-53 (1GW)
9715-53 (1GW) only

Note: Logic channels A to D count as one channel, regardless of the actual number of channels used.
Values in parentheses ( ) in the following table exceed 2 GB, and so cannot be saved unless size is reduced by partial saving.

(Reference Values)

When the Model 8958 16-Ch Scanner Unit is not installed (None saved logic channels) [Byte]

Recording length (div)	8860-50						8861-50					
	Saved channels						Saved channels					
	0	1	2	4	8	16	0	2	4	8	16	32
100	———	352 K	508 K	821 K	1.4 M	2.6 M	———	508 K	821 K	1.4 M	2.6 M	5.1 M
1,000	———	3.4 M	5.0 M	8.0 M	14 M	26 M	———	5.0 M	8.0 M	14 M	26 M	51 M
10,000	———	34 M	50 M	80 M	141 M	263 M	———	50 M	80 M	141 M	263 M	507 M
100,000	———	343 M	496 M	801 M	1,411 M	**(2,632 M)**	———	496 M	801 M	1,411 M	(2,632 M)	**(5,074 M)**
1,000,000	———	(3,433 M)	**(4,959 M)**	**(8,011 M)**	**(14,114 M)**	———	———	(4,959 M)	**(8,011 M)**	**(14,114 M)**	**(26,321 M)**	———
10,000,000	———	**(34,332 M)**	———	———	———	———	———	**(49,591 M)**	———	———	———	———

When the Model 8958 16-Ch Scanner Unit is not installed (All saved logic channels) [Byte]

Recording length (div)	8860-50						8861-50					
	Saved channels						Saved channels					
	0	1	2	4	8	16	0	2	4	8	16	32
100	547 K	704 K	860 K	1.1 M	1.8 M	3.0 M	547 K	860 M	1.1 M	1.8 M	3.0 M	5.4 M
1,000	5.3 M	6.9 M	8.4 M	11 M	18 M	30 M	5 M	8.4 M	11 M	18 M	30 M	54 M
10,000	53 M	69 M	84 M	114 M	175 M	298 M	53 M	84 M	114 M	175 M	298 M	542 M
100,000	534 M	687 M	839 M	1,144 M	1,755 M	**(2,975 M)**	534 M	839 M	1,144 M	1,755 M	(2,975 M)	**(5,417 M)**
1,000,000	(5,341 M)	(6,866 M)	**(8,392 M)**	**(11,444 M)**	**(17,548 M)**	———	(5,341 M)	(8,392 M)	**(11,444 M)**	**(17,548 M)**	**(29,755 M)**	———
10,000,000	**(53,406 M)**	**(68,665M)**	———	———	———	———	**(53,406 M)**	**(83,923 M)**	———	———	———	———

With only Model 8958 16-Ch Scanner Unit Installed (None saved logic channels) [Byte]

Recording length (div)	8860-50					8861-50				
	Saved channels(Analog channels)					Saved channels (Analog channels)				
	0	8	16	32	64	0	16	32	64	128
100	———	1.4 M	2.6 M	5.1 M	10.0 M	———	2.6 M	5.1 M	10.0 M	20 M
1,000	———	14 M	26 M	51 M	100 M	———	26 M	51 M	100 M	197 M
10,000	———	141 M	263 M	507 M	996 M	———	263 M	507 M	996 M	1,972 M
100,000	———	1,411 M	(2,632 M)	(5,074 M)	(9,956 M)	———	(2,632 M)	(5,074 M)	(9,956 M)	(19,722 M)
1,000,000	———	(14,114 M)	**(26,321 M)**	**(50,735 M)**	**(99,564 M)**	———	(26,321 M)	**(50,735 M)**	**(99,564 M)**	**(197,220 M)**
10,000,000	———	**(141,144 M)**	———	———	———	———	**(263,214 M)**	———	———	———

With only Model 8958 16-Ch Scanner Unit Installed (All saved logic channels) [Byte]

Recording length (div)	8860-50					8861-50				
	Saved channels(Analog channels)					Saved channels (Analog channels)				
	0	8	16	32	64	0	16	32	64	128
100	547 K	1.8 M	3.0 M	5.4 M	10.3 M	———	2.6 M	5.1 M	10.0 M	20 M
1,000	5.3 M	17.5 M	29.8 M	54 M	103 M	———	26 M	51 M	100 M	197 M
10,000	53 M	175 M	298 M	542 M	1,030 M	———	263 M	507 M	996 M	1,972 M
100,000	534 M	1,755 M	(2,975 M)	(5,417 M)	(10,300 M)	———	(2,632 M)	(5,074 M)	(9,956 M)	(19,722 M)
1,000,000	(5,341 M)	(17,548 M)	**(29,755 M)**	**(54,169 M)**	**(102,997 M)**	———	(26,321 M)	**(50,735 M)**	**(99,564 M)**	**(197,220 M)**
10,000,000	**(53,406 M)**	**(175,476 M)**	———	———	———	———	**(263,214 M)**	———	———	———

TXT (Text) File Size (Recorder Function)

File size (bytes) = header size*1 + data size*2

*1. Header size = 190 + 27 × saved analog channels + 64 × saved logic channels

*2. Data size = (20 +32 × saved analog channels +18 × saved logic channels) × (Recording Length (div) × 100 + 1)

(Saved logic channels = 0: none saved / 4: saved)

Memory board (8861-50: Memory board x 2) (W: words)

9715-50 (32MW) to 9715-53 (1GW)
9715-51 (128MW) to 9715-53 (1GW)
9715-52 (512MW) to 9715-53 (1GW)
9715-53 (1GW) only

Note: Logic channels A to D count as one channel, regardless of the actual number of channels used.
Values in parentheses ( ) in the following table exceed 2 GB, and so cannot be saved unless size is reduced by partial saving.

(Reference Values)

When the Model 8958 16-Ch Scanner Unit is not installed (None saved logic channels) [Byte]

Recording length (div)	8860-50 Saved channels						8861-50 Saved channels					
	0	1	2	4	8	16	0	2	4	8	16	32
100	———	508 K	821 M	1.4 M	2.6 M	5.1 M	———	821 K	1,446 M	2.6 M	5.1 M	10.0 M
1,000	———	5.0 M	8.0 M	14 M	26 M	51 M	———	8.0 M	14 M	26 M	51 M	100 M
10,000	———	50 M	80 M	141 M	263 M	507 M	———	80 M	141 M	263 M	507 M	996 M
100,000	———	**496 M**	**801 M**	**1,411 M**	**(2,632 M)**	**(5,074 M)**	———	**801 M**	**1,411 M**	**(2,632 M)**	**(5,074 M)**	**(9,956 M)**

When the Model 8958 16-Ch Scanner Unit is not installed (All saved logic channels) [Byte]

Recording length (div)	8860-50 Saved channels						8861-50 Saved channels					
	0	1	2	4	8	16	0	2	4	8	16	32
100	899 K	1.2 M	1.5 M	2.1 M	3.3 M	5.8 M	899 K	1.5 M	2.1 M	3.3 M	5.8 M	10.6 M
1,000	8.8 M	12 M	15 M	21 M	33 M	58 M	8.8 M	15 M	21 M	33 M	58 M	106 M
10,000	88 M	118 M	149 M	210 M	332 M	576 M	88 M	149 M	210 M	332 M	576 M	1,064 M
100,000	**877 M**	**1,183 M**	**1,488 M**	**(2,098 M)**	**(3,319 M)**	**(5,760 M)**	**877 M**	**1,488 M**	**(2,098 M)**	**(3,319 M)**	**(5,760 M)**	**(10,643 M)**

With only Model 8958 16-Ch Scanner Unit Installed (None saved logic channels) [Byte]

Recording length (div)	8860-50 Saved channels(Analog channels)					8861-50 Saved channels(Analog channels)				
	0	8	16	32	64	0	16	32	64	128
100	———	2.6 M	5.1 M	10.0 M	20 M	———	5.1 M	10.0 M	20 M	39 M
1,000	———	26 M	51 M	100 M	197 M	———	51 M	100 M	197 M	393 M
10,000	———	263 M	507 M	996 M	1,972 M	———	507 M	996 M	1,972 M	(3,925 M)
100,000	———	**(2,632 M)**	**(5,074 M)**	**(9,956 M)**	**(19,722 M)**	———	**(5,074 M)**	**(9,956 M)**	**(19,722 M)**	**(39,253 M)**

With only Model 8958 16-Ch Scanner Unit Installed (All saved logic channels) [Byte]

Recording length (div)	8860-50 Saved channels(Analog channels)					8861-50 Saved channels(Analog channels)				
	0	8	16	32	64	0	16	32	64	128
100	899 K	3.3 M	5.8 M	11 M	20 M	899 K	5.8 M	10.6 M	20 M	40 M
1,000	8.8 M	33 M	58 M	106 M	204 M	8.8 M	58 M	106 M	204 M	399 M
10,000	88 M	332 M	576 M	1,064 M	2,041 M	88 M	576 M	1,064 M	2,041 M	(3,994 M)
100,000	**877 M**	**(3,319 M)**	**(5,760 M)**	**(10,643 M)**	**(20,409 M)**	**877 M**	**(5,760 M)**	**(10,643 M)**	**(20,409 M)**	**(39,940 M)**

TXT (Text) File Size (FFT Function)

File size (bytes) = header size*1 + data size*2

*1. Header size = approx. 200 bytes (depending on comment settings)
*2. Data size

- For non-Nyquist displays

Analysis Mode	Size of Data Portion
Storage, Correlation Function, Cross-Correlation Function, Impulse Response	32 bytes × no. of calculation points
Octave Analysis	Approx. 1 KB (fixed)
Other Analysis Modes	32 bytes × no. of calculation points × (2/5)

- For Nyquist display
  34 bytes × no. of calculation points × (2/5)

(Reference Values)

Units: Bytes

Number of points	Analysis Modes			Nyquist display
	Storage Auto correlation function Cross-correlation function Impulse response	Octave analysis	Analysis modes except those at the left	
1000	32 KB	1 KB	13 KB	14 KB
2000	63 KB	1 KB	26 KB	27 KB
5000	156 KB	1 KB	63 KB	67 KB
10000	312 KB	1 KB	125 KB	133 KB
20000	625 K	1 K	250 K	266 K

Appendix 2.3 Timebase and Maximum Recordable Time

Recordable Time = Timebase × Recording Length

Recordable time can be verified on the Status Settings screen.
These tables show cases in which minimum- and maximum-capacity memory boards are installed.

NOTE

- Setting a slow timebase may result in a very long recording time (over a year) which may exceed the guarantee period or product life, in which case we cannot guarantee operation.
- The maximum recording length depends on the number of channels used.
  Refer to "Appendix 2.4 Memory Capacity and Maximum Recording Length" (p. A35).

Reference

Functions	Installed Memory	8860-50	8861-50	Fixed Recording Length (Fixed)	Arbitrary Recording Length (User)
Memory Function	9715-50 Memory Board	32 MWords	64 MWords	(p. A30)	(p. A31)
	9715-53 Memory Board	1 GWord	2 GWords	(p. A32)	(p. A33)
Recorder Function	9715-50 Memory Board	32 MWords	64 MWords	(p. A34)	
	9715-53 Memory Board	1 GWord	2 GWords	(p. A34)	

Memory Function (Using Only Timebase 1)

With Model 9715-50 Memory Board Installed
(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

Fixed Recording Length (d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling Period	Channels used and recording length ( ): 8861-50				
		16 (32)	**8 (16)**	**4 (8)**	**2 (4)**	**1 (2)**
		20,000 div	20,000 div	50,000 div	100,000 div	200,000 div
5µs	50ns	100ms	100ms	250ms	500ms	1s
10µs	100ns	200ms	200ms	500ms	1s	2s
20µs	200ns	400ms	400ms	1s	2s	4s
50µs	500ns	1s	1s	2.5s	5s	10s
100µs	1µs	2s	2s	5s	10s	20s
200µs	2µs	4s	4s	10s	20s	40s
500µs	5µs	10s	10s	25s	50s	1min 40s
1ms	10µs	20s	20s	50s	1min 40s	3min 20s
2ms	20µs	40s	40s	1min 40s	3min 20s	6min 40s
5ms	50µs	1min 40s	1min 40s	4min 10s	8min 20s	16min 40s
10ms	100µs	3min 20s	3min 20s	8min 20s	16min 40s	33min 20s
20ms	200µs	6min 40s	6min 40s	16min 40s	33min 20s	1h 06min 40s
50ms	500µs	16min 40s	16min 40s	41min 40s	1h 23min 20s	2h 46min 40s
100ms	1ms	33min 20s	33min 20s	1h 23min 20s	2h 46min 40s	5h 33min 20s
200ms	2ms	1h 06min 40s	1h 06min 40s	2h 46min 40s	5h 33min 20s	11h 06min 40s
500ms	5ms	2h 46min 40s	2h 46min 40s	6h 56min 40s	13h 53min 20s	1d 03h 46min 40s
1s	10ms	5h 33min 20s	5h 33min 20s	13h 53min 20s	1d 03h 46min 40s	2d 07h 33min 20s
2s	20ms	11h 06min 40s	11h 06min 40s	1d 03h 46min 40s	2d 07h 33min 20s	4d 15h 06min 40s
5s	50ms	1d 03h 46min 40s	1d 03h 46min 40s	2d 21h 26min 40s	5d 18h 53min 20s	11d 13h 46min 40s
10s	100ms	2d 07h 33min 20s	2d 07h 33min 20s	5d 18h 53min 20s	11d 13h 46min 40s	23d 03h 33min 20s
30s	300ms	6d 22h 40min 00s	6d 22h 40min 00s	17d 08h 40min 00s	34d 17h 20min 00s	69d 10h 40min 00s
1min	600ms	13d 21h 20min 00s	13d 21h 20min 00s	34d 17h 20min 00s	69d 10h 40min 00s	138d 21h 20min 00s
100s	1s	23d 03h 33min 20s	23d 03h 33min 20s	57d 20h 53min 20s	115d 17h 46min 40s	231d 11h 33min 20s
2min	1.2s	27d 18h 40min 00s	27d 18h 40min 00s	69d 10h 40min 00s	138d 21h 20min 00s	277d 18h 40min 00s
5min	3s	69d 10h 40min 00s	69d 10h 40min 00s	173d 14h 40min 00s	347d 05h 20min 00s	

With Model 9715-50 Memory Board Installed
(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

Arbitrary Recording Length

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling Period	Channels used and recording length				
		16 (32)	**8 (16)**	**4 (8)**	**2 (4)**	**1 (2)**
		20,000 div	40,000 div	80,000 div	160,000 div	320,000 div
5µs	50ns	100ms	200ms	400ms	800ms	1.6s
10µs	100ns	200ms	400ms	800ms	1.6s	3.2s
20µs	200ns	400ms	800ms	1.6s	3.2s	6.4s
50µs	500ns	1s	2s	4s	8s	16s
100µs	1µs	2s	4s	8s	16s	32s
200µs	2µs	4s	8s	16s	32s	1min 04s
500µs	5µs	10s	20s	40s	1min 20s	2min 40s
1ms	10µs	20s	40s	1min 20s	2min 40s	5min 20s
2ms	20µs	40s	1min 20s	2min 40s	5min 20s	10min 40s
5ms	50µs	1min 40s	3min 20s	6min 40s	13min 20s	26min 40s
10ms	100µs	3min 20s	6min 40s	13min 20s	26min 40s	53min 20s
20ms	200µs	6min 40s	13min 20s	26min 40s	53min 20s	1h 46min 40s
50ms	500µs	16min 40s	33min 20s	1h 06min 40s	2h 13min 20s	4h 26min 40s
100ms	1ms	33min 20s	1h 06min 40s	2h 13min 20s	4h 26min 40s	8h 53min 20s
200ms	2ms	1h 06min 40s	2h 13min 20s	4h 26min 40s	8h 53min 20s	17h 46min 40s
500ms	5ms	2h 46min 40s	5h 33min 20s	11h 06min 40s	22h 13min 20s	1d 20h 26min 40s
1s	10ms	5h 33min 20s	11h 06min 40s	22h 13min 20s	1d 20h 26min 40s	3d 16h 53min 20s
2s	20ms	11h 06min 40s	22h 13min 20s	1d 20h 26min 40s	3d 16h 53min 20s	7d 09h 46min 40s
5s	50ms	1d 03h 46min 40s	2d 07h 33min 20s	4d 15h 06min 40s	9d 06h 13min 20s	18d 12h 26min 40s
10s	100ms	2d 07h 33min 20s	4d 15h 06min 40s	9d 06h 13min 20s	18d 12h 26min 40s	37d 00h 53min 20s
30s	300ms	6d 22h 40min 00s	13d 21h 20min 00s	27d 18h 40min 00s	55d 13h 20min 00s	111d 02h 40min 00s
1min	600ms	13d 21h 20min 00s	27d 18h 40min 00s	55d 13h 20min 00s	111d 02h 40min 00s	222d 05h 20min 00s
100s	1s	23d 03h 33min 20s	46d 07h 06min 40s	92d 14h 13min 20s	185d 04h 26min 40s	370d 08h 53min 20s
2min	1.2s	27d 18h 40min 00s	55d 13h 20min 00s	111d 02h 40min 00s	222d 05h 20min 00s	
5min	3s	69d 10h 40min 00s	138d 21h 20min 00s	277d 18h 40min 00s		

With Model 9715-53 Memory Board Installed

(1 GWord in Model 8860-50, or 2 GWords in Model 8861-50)

Fixed Recording Length

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling period	Channels used and recording length ( ): 8861-50				
		16 (32)	**8 (16)**	**4 (8)**	**2 (4)**	**1 (2)**
		500,000 div	1,000,000 div	2,000,000 div	5,000,000 div	10,000,000 div
5µs	50ns	2.5s	5s	10s	25s	50s
10µs	100ns	5s	10s	20s	50s	1min 40s
20µs	200ns	10s	20s	40s	1min 40s	3min 20s
50µs	500ns	25s	50s	1min 40s	4min 10s	8min 20s
100µs	1µs	50s	1min 40s	3min 20s	8min 20s	16min 40s
200µs	2µs	1min 40s	3min 20s	6min 40s	16min 40s	33min 20s
500µs	5µs	4min 10s	8min 20s	16min 40s	41min 40s	1h 23min 20s
1ms	10µs	8min 20s	16min 40s	33min 20s	1h 23min 20s	2h 46min 40s
2ms	20µs	16min 40s	33min 20s	1h 6min 40s	2h 46min 40s	5h 33min 20s
5ms	50µs	41min 40s	1h 23min 20s	2h 46min 40s	6h 56min 40s	13h 53min 20s
10ms	100µs	1h 23min 20s	2h 46min 40s	5h 33min 20s	13h 53min 20s	1d 03h 46min 40s
20ms	200µs	2h 46min 40s	5h 33min 20s	11h 06min 40s	1d 03h 46min 40s	2d 07h 33min 20s
50ms	500µs	6h 56min 40s	13h 53min 20s	1d 03h 46min 40s	2d 21h 26min 40s	5d 18h 53min 20s
100ms	1ms	13h 53min 20s	1d 03h 46min 40s	2d 07h 33min 20s	5d 18h 53min 20s	11d 13h 46min 40s
200ms	2ms	1d 03h 46min 40s	2d 21h 26min 40s	4d 15h 06min 40s	11d 13h 46min 40s	23d 03h 33min 20s
500ms	5ms	2d 21h 26min 40s	5d 18h 53min 20s	11d 13h 46min 40s	28d 22h 26min 40s	57d 20h 53min 20s
1s	10ms	5d 18h 53min 20s	11d 13h 46min 40s	23d 03h 33min 20s	57d 20h 53min 20s	115d 17h 46min 40s
2s	20ms	11d 13h 46min 40s	23d 03h 33min 20s	46d 07h 06min 40s	115d 17h 46min 40s	231d 11h 33min 20s
5s	50ms	28d 22h 26min 40s	57d 20h 53min 20s	115d 17h 46min 40s	289d 08h 26min 40s	
10s	100ms	57d 20h 53min 20s	115d 17h 46min 40s	231d 17h 46min 40s		
30s	300ms	173d 14h 40min 00s	347d 05h 20min 00s			
1min	600ms	347d 05h 20min 00s				
100s	1s					
2min	1.2s					
5min	3s					

With Model 9715-53 Memory Board Installed
(1 GWord in Model 8860-50, or 2 GWords in Model 8861-50)

Arbitrary Recording Length

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling period	Channels used and recording length ( ): 8861-50				
		16 (32)	**8 (16)**	**4 (8)**	**2 (4)**	**1 (2)**
		640,000 div	1,280,000 div	2,560,000 div	5,120,000 div	10,240,000 div
5µs	50ns	3.2s	6.4s	12.8s	25.6s	51.2s
10µs	100ns	6.4s	12.8s	25.6s	51.2s	1min 42.4s
20µs	200ns	12.8s	25.6s	51.2s	1min 42.4s	3min 24.8s
50µs	500ns	32s	1min 04s	2min 08s	4min 16s	8min 32s
100µs	1µs	1min 04s	2min 08s	4min 16s	8min 32s	17min 04s
200µs	2µs	2min 08s	4min 16s	8min 32s	17min 04s	34min 08s
500µs	5µs	5min 20s	10min 40s	21min 20s	42min 40s	1h 25min 20s
1ms	10µs	10min 40s	21min 20s	42min 40s	1h 25min 20s	2h 50min 40s
2ms	20µs	21min 20s	42min 40s	1h 25min 20s	2h 50min 40s	5h 41min 20s
5ms	50µs	53min 20s	1h 46min 40s	3h 33min 20s	7h 06min 40s	14h 13min 20s
10ms	100µs	1h 46min 40s	3h 33min 20s	7h 06min 40s	14h 13min 20s	1d 04h 26min 40s
20ms	200µs	3h 33min 20s	7h 06min 40s	14h 13min 20s	1d 04h 26min 40s	2d 08h 53min 20s
50ms	500µs	8h 53min 20s	17h 46min 40s	1d 11h 33min 20s	2d 23h 06min 40s	5d 22h 13min 20s
100ms	1ms	17h 46min 40s	1d 11h 33min 20s	2d 23h 06min 40s	5d 22h 13min 20s	11d 20h 26min 40s
200ms	2ms	1d 11h 33min 20s	2d 23h 06min 40s	5d 22h 13min 20s	11d 20h 26min 40s	23d 16h 53min 20s
500ms	5ms	3d 16h 53min 20s	7d 09h 46min 40s	14d 19h 33min 20s	29d 15h 06min 40s	59d 06h 13min 20s
1s	10ms	7d 09h 46min 40s	14d 19h 33min 20s	29d 15h 06min 40s	59d 06h 13min 20s	118d 12h 26min 40s
2s	20ms	14d 19h 33min 20s	29d 15h 06min 40s	59d 06h 13min 20s	118d 12h 26min 40s	237d 00h 53min 20s
5s	50ms	37d 00h 53min 20s	74d 01h 46min 40s	148d 03h 33min 20s	296d 07h 06min 40s	
10s	100ms	74d 01h 46min 40s	148d 03h 33min 20s	296d 07h 06min 40s		
30s	300ms	222d 05h 20min 00s				
1min	600ms					
100s	1s					
2min	1.2s					
5min	3s					

Recorder Function

With Model 9715-50 Memory Board Installed

(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Fixed Recording Length		Arbitrary Recording Length	
	Model 8958 16-Ch Scanner Unit		Model 8958 16-Ch Scanner Unit	
	When Uninstalled	When Installed	When Uninstalled	When Installed
	5,000 div	1,000 div	5,000 div	1,000 div
10ms	50s	————	50s	————
20ms	1min 40s	————	1min 40s	————
50ms	4min 10s	50s	4min 10s	50s
100ms	8min 20s	1min 40s	8min 20s	1min 40s
200ms	16min 40s	3min 20s	16min 40s	3min 20s
500ms	41min 40s	8min 20s	41min 40s	8min 20s
1s	1h 23min 20s	16min 40s	1h 23min 20s	16min 40s
2s	2h 46min 40s	33min 20s	2h 46min 40s	33min 20s
5s	6h 56min 40s	1h 23min 20s	6h 56min 40s	1h 23min 20s
10s	13h 53min 20s	2h 46min 40s	13h 53min 20s	2h 46min 40s
30s	1d 17h 40min 00s	8h 20min 00s	1d 17h 40min 00s	8h 20min 00s
1min	3d 11h 20min 00s	16h 40min 00s	3d 11h 20min 00s	16h 40min 00s
100s	5d 18h 53min 20s	1d 03h 46min 40s	5d 18h 53min 20s	1d 03h 46min 40s
2min	6d 22h 40min 00s	1d 09h 20min 00s	6d 22h 40min 00s	1d 09h 20min 00s
5min	17d 08h 40min 00s	3d 11h 20min 00s	17d 08h 40min 00s	3d 11h 20min 00s
10min	34d 17h 20min 00s	6d 22h 40min 00s	34d 17h 20min 00s	6d 22h 40min 00s
30min	104d 04h 00min 00s	20d 20h 00min 00s	104d 04h 00min 00s	20d 20h 00min 00s
1h	208d 08h 00min 00s	41d 16h 00min 00s	208d 08h 00min 00s	41d 16h 00min 00s

With Model 9715-53 Memory Board Installed

(1 GWord in Model 8860-50, or 2 GWords in Model 8861-50)

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Fixed Recording Length		Arbitrary Recording Length	
	Model 8958 16-Ch Scanner Unit		Model 8958 16-Ch Scanner Unit	
	When Uninstalled	When Installed	When Uninstalled	When Installed
	100,000 div	20,000 div	160,000 div	40,000 div
10ms	16min 40s	————	26min 40s	————
20ms	33min 20s	————	53min 20s	————
50ms	1h 23min 20s	16min 40s	2h 13min 20s	33min 20s
100ms	2h 46min 40s	33min 20s	4h 26min 40s	1h 06min 40s
200ms	5h 33min 20s	1h 06min 40s	8h 53min 20s	2h 13min 20s
500ms	13h 53min 20s	2h 46min 40s	22h 13min 20s	5h 33min 20s
1s	1d 03h 46min 40s	5h 33min 20s	1d 20h 26min 40s	11h 06min 40s
2s	2d 07h 33min 20s	11h 06min 40s	3d 16h 53min 20s	22h 13min 20s
5s	5d 18h 53min 20s	1d 03h 46min 40s	9d 06h 13min 20s	2d 07h 33min 20s
10s	11d 13h 46min 40s	2d 07h 33min 20s	18d 12h 26min 40s	4d 15h 06min 40s
30s	34d 17h 20min 00s	6d 22h 40min 00s	55d 13h 20min 00s	13d 21h 20min 00s
1min	69d 10h 40min 00s	13d 21h 20min 00s	111d 02h 40min 00s	27d 18h 40min 00s
100s	115d 17h 46min 40s	23d 03h 33min 20s	185d 04h 26min 40s	46d 07h 06min 40s
2min	138d 21h 20min 00s	27d 18h 40min 00s	222d 05h 20min 00s	55d 13h 20min 00s
5min	347d 05h 20min 00s	69d 10h 40min 00s		138d 21h 20min 00s
10min		138d 21h 20min 00s		277d 18h 40min 00s
30min				
1h				

Appendix 2.4 Memory Capacity and Maximum Recording Length

Memory Function

Recording length depends on installed memory and the number of channels used.

Using Only Timebase 1

When the Model 8958 16-Ch Scanner Unit is not installed

Fixed Recording Length (Fixed) [Divisions]							
Installed Memory (Words)		No. of Chs Used					
8860-50		16 + logic	16	8	4	2	1
	8861-50	32 + logic	32	16	8	4	2
32M	64M	10,000	20,000	20,000	50,000	100,000	200,000
128M	256M	20,000	50,000	100,000	200,000	500,000	1,000,000
512M	1G	100,000	200,000	500,000	1,000,000	2,000,000	5,000,000
1G	2G	200,000	500,000	1,000,000	2,000,000	5,000,000	10,000,000

Arbitrary Recording Length (User) [Divisions]							
Installed Memory (Words)		No. of Chs Used					
8860-50		16 + logic	16	8	4	2	1
	8861-50	32 + logic	32	16	8	4	2
32M	64M	10,000	20,000	40,000	80,000	160,000	320,000
128M	256M	40,000	80,000	160,000	320,000	640,000	1,280,000
512M	1G	160,000	320,000	640,000	1,280,000	2,560,000	5,120,000
1G	2G	320,000	640,000	1,280,000	2,560,000	5,120,000	10,240,000

With only Model 8958 16-Ch Scanner Unit Installed

Fixed Recording Length (Fixed) [Divisions]						
Installed Memory (Words)		No. of Chs Used x 8 ( ): Indicated when setting				
		(8 x 8CH+L)	(8 x 8CH)	(4 x 8CH)	(2 x 8CH)	(1 x 8CH)
8860-50		8 + logic	8	4	2	1
	8861-50	16 + logic	16	8	4	2
32M	64M	2,000	5,000	10,000	20,000	20,000
128M	256M	10,000	20,000	20,000	50,000	100,000
512M	1G	20,000	50,000	100,000	200,000	500,000
1G	2G	50,000	100,000	200,000	500,000	1,000,000

Arbitrary Recording Length (User) [Divisions]						
Installed Memory (Words)		No. of Chs Used x 8 ( ): Indicated when setting				
		(8 x 8CH+L)	(8 x 8CH)	(4 x 8CH)	(2 x 8CH)	(1 x 8CH)
8860-50		16	8	4	2	1
	8861-50	32	16	8	4	2
32M	64M	2000	5000	10,000	20,000	40,000
128M	256M	10,000	20,000	40,000	80,000	160,000
512M	1G	40,000	80,000	160,000	320,000	640,000
1G	2G	80,000	160,000	320,000	640,000	1,280,000

Using Timebase 1 and 2

When the Model 8958 16-Ch Scanner Unit is not installed

Fixed Recording Length (Fixed)						**[Divisions]**
Installed Memory (Words)		Channels Using Timebase 1 / ( ):Channels Using Timebase 2				
8860-50		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)
	8861-50	32 (16)	16 (16)	8 (8)	4 (4)	2 (2)
32M	64M	10,000	20,000	20,000	50,000	100,000
128M	256M	20,000	50,000	100,000	200,000	500,000
512M	1G	100,000	200,000	500,000	1,000,000	2,000,000
1G	2G	200,000	500,000	1,000,000	2,000,000	5,000,000

Arbitrary Recording Length (User)						**[Divisions]**
Installed Memory (Words)		Channels Using Timebase 1 / ( ): Channels Using Timebase 2				
8860-50		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)
	8861-50	32 (16)	16 (16)	8 (8)	4 (4)	2 (2)
32M	64M	10,000	20,000	40,000	80,000	160,000
128M	256M	40,000	80,000	160,000	320,000	640,000
512M	1G	160,000	320,000	640,000	1,280,000	2,560,000
1G	2G	320,000	640,000	1,280,000	2,560,000	5,120,000

With Model 8958 16-Ch Scanner Unit installed

Fixed Recording Length (Fixed)						**[Divisions]**
Installed Memory (Words)		Channels Using Timebase 1 / ( ): 8 × Channels on Model 8958				
8860-50		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)
	8861-50	32 (16)	16 (16)	8 (8)	4 (4)	2 (2)
32M	64M	1,000	2000	5000	10,000	20,000
128M	256M	5,000	10,000	20,000	20,000	50,000
512M	1G	20,000	20,000	50,000	100,000	200,000
1G	2G	20,000	50,000	100,000	200,000	500,000

Arbitrary Recording Length (User)						**[Divisions]**
Installed Memory (Words)		Channels Using Timebase 1 / ( ): 8 × Channels on Model 8958				
8860-50		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)
	8861-50	32 (16)	16 (16)	8 (8)	4 (4)	2 (2)
32M	64M	1,000	2,000	5,000	10,000	20,000
128M	256M	5,000	10,000	20,000	40,000	80,000
512M	1G	20,000	40,000	80,000	160,000	320,000
1G	2G	40,000	80,000	160,000	320,000	640,000

Recorder Function

Recording length depends on installed memory and input modules.

[Divisions]

Installed Memory (Words)		**Fixed Recording Length (Fixed)**		**Arbitrary Recording Length (User)/ Continuous Recording Length (Cont)**	
		Model 8958 16-Ch Scanner Unit		Model 8958 16-Ch Scanner Unit	
8860-50	**8861-50**	When Uninstalled	When Installed	When Uninstalled	When Installed
32M	64M	5,000	1,000	5,000	1,000
128M	256M	20,000	5,000	20,000	5,000
512M	1G	50,000	20,000	80,000	20,000
1G	2G	100,000	20,000	160,000	40,000

Appendix 2.5 Recording Length and Maximum Number of Divisions (Memory Division function)

Memory Function (Using Only Timebase 1)

With Model 9715-50 Memory Board Installed

(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1 to 3	4096	4096	4096	4096	4096
4 to 7	2048	4096	4096	4096	4096
8 to 15	1024	2048	4096	4096	4096
16 to 30	512	1024	2048	4096	4096
31 to 60	256	512	1024	2048	4096
61 to 140	128	256	512	1024	2048
141 to 300	64	128	256	512	1024
301 to 620	32	64	128	256	512
621 to 1250	16	32	64	128	256
1251 to 2500	8	16	32	64	128
2501 to 5000	4	8	16	32	64
5001 to 10000	2	4	8	16	32
10001 to 20000		2	4	8	16
20001 to 40000			2	4	8
40001 to 80000				2	4
80001 to 160000					2

With Model 9715-51 Memory Board Installed

(128 MWords in Model 8860-50, or 256 MWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1 to 15	4096	4096	4096	4096	4096
16 to 30	2048	4096	4096	4096	4096
31 to 60	1024	2048	4096	4096	4096
61 to 140	512	1024	2048	4096	4096
141 to 300	256	512	1024	2048	4096
301 to 620	128	256	512	1024	2048
621 to 1250	64	128	256	512	1024
1251 to 2500	32	64	128	256	512
2501 to 5000	16	32	64	128	256
5001 to 10000	8	16	32	64	128
10001 to 20000	4	8	16	32	64
20001 to 40000	2	4	8	16	32
40001 to 80000		2	4	8	16
80001 to 160000			2	4	8
160001 to 320000				2	4
320001 to 640000					2

With Model 9715-52 Memory Board Installed

(512 MWords in Model 8860-50, or 1 GWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1 to 60	4096	4096	4096	4096	4096
61 to 140	2048	4096	4096	4096	4096
141 to 300	1024	2048	4096	4096	4096
301 to 620	512	1024	2048	4096	4096
621 to 1250	256	512	1024	2048	4096
1251 to 2500	128	256	512	1024	2048
2501 to 5000	64	128	256	512	1024
5001 to 10000	32	64	128	256	512
10001 to 20000	16	32	64	128	256
20001 to 40000	8	16	32	64	128
40001 to 80000	4	8	16	32	64
80001 to 160000	2	4	8	16	32
160001 to 320000		2	4	8	16
320001 to 640000			2	4	8
640001 to 1280000				2	4
1280001 to 2560000					2

With Model 9715-53 Memory Board Installed

(1 GWords in Model 8860-50, or 2 GWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1 to 140	4096	4096	4096	4096	4096
141 to 300	2048	4096	4096	4096	4096
301 to 620	1024	2048	4096	4096	4096
621 to 1250	512	1024	2048	4096	4096
1251 to 2500	256	512	1024	2048	4096
2501 to 5000	128	256	512	1024	2048
5001 to 10000	64	128	256	512	1024
10001 to 20000	32	64	128	256	512
20001 to 40000	16	32	64	128	256
40001 to 80000	8	16	32	64	128
80001 to 160000	4	8	16	32	64
160001 to 320000	2	4	8	16	32
320001 to 640000		2	4	8	16
640001 to 1280000			2	4	8
1280001 to 2560000				2	4
2560001 to 5120000					2

Memory Function (Using Timebase 1 and 2)

With Model 9715-50 Memory Board Installed

(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

[Blocks]

Recording length (div)			Channels used				
8860-50			16	8	4	2	1
8861-50			32	16	8	4	2
1	to	3	2048	2048	2048	2048	2048
4	to	7	1024	2048	2048	2048	2048
8	to	15	512	1024	2048	2048	2048
16	to	30	256	512	1024	2048	2048
31	to	60	128	256	512	1024	2048
61	to	140	64	128	256	512	1024
141	to	300	32	64	128	256	512
301	to	620	16	32	64	128	256
621	to	1250	8	16	32	64	128
1251	to	2500	4	8	16	32	64
2501	to	5000	2	4	8	16	32
5001	to	10000		2	4	8	16
10001	to	20000			2	4	8
20001	to	40000				2	4
40001	to	80000					2

With Model 9715-51 Memory Board Installed

(128 MWords in Model 8860-50, or 256 MWords in Model 8861-50)

[Blocks]

Recording length (div)			Channels used				
8860-50			16	8	4	2	1
8861-50			32	16	8	4	2
1	to	15	2048	2048	2048	2048	2048
16	to	30	1024	2048	2048	2048	2048
31	to	60	512	1024	2048	2048	2048
61	to	140	256	512	1024	2048	2048
141	to	300	128	256	512	1024	2048
301	to	620	64	128	256	512	1024
621	to	1250	32	64	128	256	512
1251	to	2500	16	32	64	128	256
2501	to	5000	8	16	32	64	128
5001	to	10000	4	8	16	32	64
10001	to	20000	2	4	8	16	32
20001	to	40000		2	4	8	16
40001	to	80000			2	4	8
80001	to	160000				2	4
160001	to	320000					2

With Model 9715-52 Memory Board Installed

(512 MWords in Model 8860-50, or 1 GWords in Model 8861-50)

[Blocks]

Recording length (div)			Channels used				
8860-50			16	8	4	2	1
8861-50			32	16	8	4	2
1	to	60	2048	2048	2048	2048	2048
61	to	140	1024	2048	2048	2048	2048
141	to	300	512	1024	2048	2048	2048
301	to	620	256	512	1024	2048	2048
621	to	1250	128	256	512	1024	2048
1251	to	2500	64	128	256	512	1024
2501	to	5000	32	64	128	256	512
5001	to	10000	16	32	64	128	256
10001	to	20000	8	16	32	64	128
20001	to	40000	4	8	16	32	64
40001	to	80000	2	4	8	16	32
80001	to	160000		2	4	8	16
160001	to	320000			2	4	8
320001	to	640000				2	4
640001	to	1280000					2

With Model 9715-53 Memory Board Installed

(1 GWords in Model 8860-50, or 2 GWords in Model 8861-50)

[Blocks]

Recording length (div)			Channels used				
8860-50			16	8	4	2	1
8861-50			32	16	8	4	2
1	to	140	2048	2048	2048	2048	2048
141	to	300	1024	2048	2048	2048	2048
301	to	620	512	1024	2048	2048	2048
621	to	1250	256	512	1024	2048	2048
1251	to	2500	128	256	512	1024	2048
2501	to	5000	64	128	256	512	1024
5001	to	10000	32	64	128	256	512
10001	to	20000	16	32	64	128	256
20001	to	40000	8	16	32	64	128
40001	to	80000	4	8	16	32	64
80001	to	160000	2	4	8	16	32
160001	to	320000		2	4	8	16
320001	to	640000			2	4	8
640001	to	1280000				2	4
1280001	to	2560000					2

Memory Function (With Model 8958 16-Ch Scanner Unit and Other Modules)

With Model 9715-50 Memory Board Installed

(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1	512	1024	2048	2048	2048
2 to 3	256	512	1024	2048	2048
4 to 7	128	256	512	1024	2048
8 to 15	64	128	256	512	1024
16 to 30	32	64	128	256	512
31 to 60	16	32	64	128	256
61 to 140	8	16	32	64	128
141 to 300	4	8	16	32	64
301 to 620	2	4	8	16	32
621 to 1250		2	4	8	16
1251 to 2500			2	4	8
2501 to 5000				2	4
5001 to 10000					2

With Model 9715-51 Memory Board Installed

(128 MWords in Model 8860-50, or 256 MWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1	2048	2048	2048	2048	2048
2 to 3	1024	2048	2048	2048	2048
4 to 7	512	1024	2048	2048	2048
8 to 15	256	512	1024	2048	2048
16 to 30	128	256	512	1024	2048
31 to 60	64	128	256	512	1024
61 to 140	32	64	128	256	512
141 to 300	16	32	64	128	256
301 to 620	8	16	32	64	128
621 to 1250	4	8	16	32	64
1251 to 2500	2	4	8	16	32
2501 to 5000		2	4	8	16
5001 to 10000			2	4	8
10001 to 20000				2	4
20001 to 40000					2

With Model 9715-52 Memory Board Installed

(512 MWords in Model 8860-50, or 1 GWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1 to 7	2048	2048	2048	2048	2048
8 to 15	1024	2048	2048	2048	2048
16 to 30	512	1024	2048	2048	2048
31 to 60	256	512	1024	2048	2048
61 to 140	128	256	512	1024	2048
141 to 300	64	128	256	512	1024
301 to 620	32	64	128	256	512
621 to 1250	16	32	64	128	256
1251 to 2500	8	16	32	64	128
2501 to 5000	4	8	16	32	64
5001 to 10000	2	4	8	16	32
10001 to 20000		2	4	8	16
20001 to 40000			2	4	8
40001 to 80000				2	4
80001 to 160000					2

With Model 9715-53 Memory Board Installed

(1 GWords in Model 8860-50, or 2 GWords in Model 8861-50)

[Blocks]

Recording length (div)	Channels used				
8860-50	16	8	4	2	1
8861-50	32	16	8	4	2
1 to 15	2048	2048	2048	2048	2048
16 to 30	1024	2048	2048	2048	2048
31 to 60	512	1024	2048	2048	2048
61 to 140	256	512	1024	2048	2048
141 to 300	128	256	512	1024	2048
301 to 620	64	128	256	512	1024
621 to 1250	32	64	128	256	512
1251 to 2500	16	32	64	128	256
2501 to 5000	8	16	32	64	128
5001 to 10000	4	8	16	32	64
10001 to 20000	2	4	8	16	32
20001 to 40000		2	4	8	16
40001 to 80000			2	4	8
80001 to 160000				2	4
160001 to 320000					2

Memory Function (With only Model 8958 16-Ch Scanner Unit)

With Model 9715-50 Memory Board Installed

(32 MWords in Model 8860-50, or 64 MWords in Model 8861-50)

[Blocks]

Recording length (div)		Channels used (x 8ch)				
8860-50		8+L	8	4	2	1
8861-50		16+L	16	8	4	2
	1	1024	2048	4096	4096	4096
2 to	3	512	1024	2048	4096	4096
4 to	7	256	512	1024	2048	4096
8 to	15	128	256	512	1024	2048
16 to	30	64	128	256	512	1024
31 to	60	32	64	128	256	512
61 to	140	16	32	64	128	256
141 to	300	8	16	32	64	128
301 to	620	4	8	16	32	64
621 to	1250	2	4	8	16	32
1251 to	2500		2	4	8	16
2501 to	5000			2	4	8
5001 to	10000				2	4
10001 to	20000					2

With Model 9715-51 Memory Board Installed

(128 MWords in Model 8860-50, or 256 MWords in Model 8861-50)

[Blocks]

Recording length (div)		Channels used (x 8ch)				
8860-50		8+L	8	4	2	1
8861-50		16+L	16	8	4	2
	1	4096	4096	4096	4096	4096
2 to	3	2048	4096	4096	4096	4096
4 to	7	1024	2048	4096	4096	4096
8 to	15	512	1024	2048	4096	4096
16 to	30	256	512	1024	2048	4096
31 to	60	128	256	512	1024	2048
61 to	140	64	128	256	512	1024
141 to	300	32	64	128	256	512
301 to	620	16	32	64	128	256
621 to	1250	8	16	32	64	128
1251 to	2500	4	8	16	32	64
2501 to	5000	2	4	8	16	32
5001 to	10000		2	4	8	16
10001 to	20000			2	4	8
20001 to	40000				2	4
40001 to	80000					2

With Model 9715-52 Memory Board Installed

(512 MWords in Model 8860-50, or 1 GWords in Model 8861-50)

[Blocks]

Recording length (div)		Channels used (x 8ch)				
8860-50		8+L	8	4	2	1
8861-50		16+L	16	8	4	2
1 to	7	4096	4096	4096	4096	4096
8 to	15	2048	4096	4096	4096	4096
16 to	30	1024	2048	4096	4096	4096
31 to	60	512	1024	2048	4096	4096
61 to	140	256	512	1024	2048	4096
141 to	300	128	256	512	1024	2048
301 to	620	64	128	256	512	1024
621 to	1250	32	64	128	256	512
1251 to	2500	16	32	64	128	256
2501 to	5000	8	16	32	64	128
5001 to	10000	4	8	16	32	64
10001 to	20000	2	4	8	16	32
20001 to	40000		2	4	8	16
40001 to	80000			2	4	8
80001 to	160000				2	4
160001 to	320000					2

With Model 9715-53 Memory Board Installed

(1 GWords in Model 8860-50, or 2 GWords in Model 8861-50)

[Blocks]

Recording length (div)		Channels used (x 8ch)				
8860-50		8+L	8	4	2	1
8861-50		16+L	16	8	4	2
1 to	15	4096	4096	4096	4096	4096
16 to	30	2048	4096	4096	4096	4096
31 to	60	1024	2048	4096	4096	4096
61 to	140	512	1024	2048	4096	4096
141 to	300	256	512	1024	2048	4096
301 to	620	128	256	512	1024	2048
621 to	1250	64	128	256	512	1024
1251 to	2500	32	64	128	256	512
2501 to	5000	16	32	64	128	256
5001 to	10000	8	16	32	64	128
10001 to	20000	4	8	16	32	64
20001 to	40000	2	4	8	16	32
40001 to	80000		2	4	8	16
80001 to	160000			2	4	8
160001 to	320000				2	4
320001 to	640000					2

Appendix 2.6 Compatible External Printers

Printers that can be used are compatible with HP's WindowsCE5.0 printers (USB connection).
Printers with confirmed compatibility:

- HP deskjet 5551
- HP deskjet 5740
- HP deskjet 450cbi *****

* To move the USB printer cable from the PC to the instrument, disconnect it from the PC, turn the printer off and back on, then connect it to the instrument.

NOTE

- Before printing, check to be sure that the power is on and that paper is loaded.
- Select [USB] as the printer output destination.
- Do not turn the power off or disconnect the cable during printing.
- When the USB printer cable is disconnected from a PC and connected to the USB port on this instrument, the instrument may not print. In this case, disconnect the cable from the instrument, turn the printer off and on, then reconnect the cable to the instrument.

Appendix 2.7 Scaling Method When Using Strain Gauges

This section describes how to determine the scaling conversion ratio when measuring with strain gauges and the Model 8939 Strain Unit.
The appropriate conversion formula for stress depends on how the strain gauges are used.
Three methods are available depending on whether one, two or four strain gauges are used for measurement. The two-gauge method is used for temperature compensation.

E: Young modulus, ν: Poisson ratio, ε: Distortion measurement value

Tensile and Compressive Stress Measurement: Stress (σ) = E × ε

For temperature compensation with two or four gauges, position the gauges perpendicularly.
Stress (σ) is obtained by 1 / (1 + ν) for two gauges, and by 1 / {2 (1 + ν)} for four gauges.

Bending Stress Measurement: Stress (σ) = E × ε

For temperature compensation with two or four gauges, stress (σ) is obtained as a multiple of ½ or ¼, respectively.

Torsional Stress Measurement: Stress (σ) = E / {2 (1 + ν)} × ε (two-gauge case)

For the four-gauge case, it is half of that.
Refer to the strain gauge instruction manual for combinations of strain gauges for each measurement.

Example. Measuring Compressive Stress

Using the one-gauge method for an aluminum measurement object having a Young's modulus of 73 (GPa) according to the following Table,

$\sigma = 73 \times 10^{9} \times$ Measurement Value (in με units) $\times 10^{-6}$ (in με units)
$= 73 \times$ Measurement Value (in kPa units)
$= 7.44^{*} \times$ Measurement Value (in gf/mm^2 units)
*: 1 Pa = 1.01971621$\times 10^{-7}$ kgf/mm^2

Unit: gf/mm^2, Conversion Ratio = 7.44 gf/mm^2
Enter this value as the scaling conversion ratio.

Mechanical Characteristics of Industrial Materials

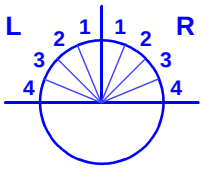
Material	Modulus of Elasticity (Young's Modulus)	Poisson's Ratio
	E(GPa)	ν
Carbon Steel (0.1 to 0.25% C)	205	0.28 to 0.3
Carbon Steel (> 0.25% C)	206	0.28 to 0.3
Spring Steel (Quenched)	206 to 211	0.28 to 0.3
Nickel Steel	205	0.28 to 0.3
Cast Iron	98	0.2 to 0.29
Brass (Cast)	78	0.34
Phosphor Bronze	118	0.38
Aluminum	73	0.34
Concrete	20 to 29	0.1

Appendix 2.8 Keyboard Assignment Table

See "2.1 Operating Keys" (p. 13)

Category	Operating Key or Operation	Keyboard Operation: Method 1	Keyboard Operation: Method 2
Menu	DISP	**Ctrl + Alt + D**	**Alt + F1**
	SET	**Ctrl + Alt + S**	**Alt + F2**
	SET (Hold)	**Ctrl + Alt + S (Hold)**	
	FILE	**Ctrl + Alt + F**	**Alt + F3**
	SUB MENU ↑	**Ctrl + Alt + ↑**	**Alt + F4**
	SUB MENU ↓	**Ctrl + Alt + ↓**	**Alt + F5**
	SHEET/PAGE ←	**Ctrl + Alt + ←**	**Alt + F6**
	SHEET/PAGE →	**Ctrl + Alt + →**	**Alt + F7**
Cursor Keys	Up	↑	
	Left	←	
	Down	↓	
	Right	→	
Operation	ESC	**Esc**	
	ENTER	**Enter**	
	SELECT	**(space)**	
	HELP/CONV	**Ctrl + Alt + H**	
Save	SAVE	**Ctrl + Alt + V**	**Alt + F11**
Printer	PRINT	**Ctrl + Alt + Q**	
	FEED	**Ctrl + Alt + W**	
Function Keys	F1	**F1**	
	F2	**F2**	
	F3	**F3**	
	F4	**F4**	
	F5	**F5**	
	F6	**F6**	
	F7	**F7**	
	F8	**F8**	
	FN	**Ctrl + Alt + F11**	**Alt + F12**
Channels	UNIT ↑	**Ctrl + Alt + U**	
	UNIT ↓	**Shift + Ctrl + Alt + U**	
	CH ↑	**Ctrl + Alt + C**	
	CH ↓	**Shift + Ctrl + Alt + C**	
	RANGE ↑	**Ctrl + Alt + R**	
	RANGE ↓	**Shift + Ctrl + Alt + R**	
	POSN ↑	**Ctrl + Alt + P**	
	POSN ↓	**Shift + Ctrl + Alt + P**	
	CH ON/Off	**Ctrl + Alt + O**	
Timebase	TIME/DIV ↑	**Ctrl + Alt + T**	
	TIME/DIV ↓	**Shift + Ctrl + Alt + T**	
	Magnify	**Ctrl + Alt + G**	
	Compress	**Shift + Ctrl + Alt + G**	
	Zoom	**Ctrl + Alt + Z**	

See "2.1 Operating Keys" (p. 13)

Category	Operating Key or Operation	Keyboard Operation: Method 1	Keyboard Operation: Method 2
AB Cursors	Move Cursor A right	**Ctrl + Alt + A**	
	Move Cursor A left	**Shift + Ctrl + Alt + A**	
	Move Cursor B right	**Ctrl + Alt + B**	
	Move Cursor B left	**Shift + Ctrl + Alt + B**	
	TYPE	**Ctrl + Alt + Y**	**Alt + F9**
	SPEED	**Ctrl + Alt + X**	**Alt + F10**
	AB CURSOR Dialog	**Ctrl + Alt + J**	
Jog	Turn Left	**Ctrl + Alt + 0**	
	Turn Right	**Ctrl + Alt + 9**	
Shuttle 	Turn Left 4	**Ctrl + Alt + 1**	
	Turn Left 3	**Ctrl + Alt + 2**	
	Turn Left 2	**Ctrl + Alt + 3**	
	Turn Left 1	**Ctrl + Alt + 4**	
	Turn Right 1	**Ctrl + Alt + 5**	
	Turn Right 2	**Ctrl + Alt + 6**	
	Turn Right 3	**Ctrl + Alt + 7**	
	Turn Right 4	**Ctrl + Alt + 8**	
Measurement	STOP	**F11**	
	START	**F12**	
Power	STANDBY ON	————————	

Appendix 3 Terminology

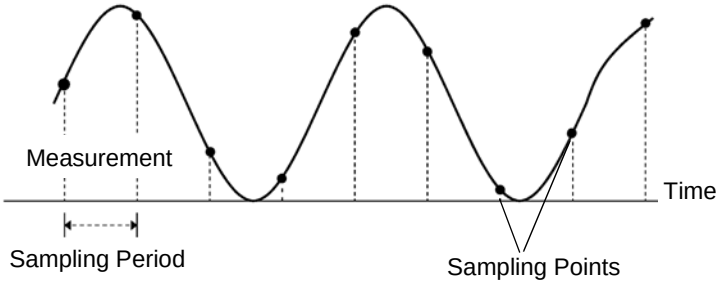
AC	Abbreviation for alternating current
A/D Conversion	Conversion of an analog quantity to a digital quantity
Active Low	An operation that occurs when signal voltage level changes from High to Low
Aliasing Errors	The phenomena that prevents proper signal waveform acquisition because of aliasing distortion (p. A48)
Analog	Continuous physical quantity such as voltage or current
Attenuator	A device that attenuates a signal to reduce its amplitude
Averaging	The sum of multiple data values divided by the number of those values to obtain the average value
Beep Sound	The audible alarm produced when an error or warning occurs
bit	The unit of minimum quantity signified by a "0" or "1" in binary notation
byte	Unit of binary notation (1 byte = 8 bits)
Channel (Ch)	The input route for a signal
Chassis	The metal frame of the instrument
Comment	A note that can be entered by the user, such as to describe measurement conditions, that can be printed on recording paper
Common Mode	The situation in which voltage is present between measurement input lines and ground
Cut-Off Frequency	The frequency at which the output amplitude of a filter becomes $1/\sqrt{2}$ (-3 dB)
dB (decibel)	Unit used to indicate attenuation or amplification of voltage, current or power
DC	Abbreviation for direct current
Digital	Discrete physical quantities
div (divisions)	A unit of linear display measurement
Dots	One pixel of the LCD display, or display of points of a waveform without interpolation
Drift	A phenomena of false output due to shift in the operating point of an op-amp. Drift results from temperature change and long-term aging that can occur years after manufacture.
Dynamic Range	The range of amplitudes that a device is able to display
FFT	Abbreviation of fast-Fourier transform
File	A collection of data preserved on storage media, conceptually similar to a paper file stored on a bookshelf
Format	The process of initializing storage media to a usable state
Function	An operational function
Gain	The numerical value of the ratio of signal output to input, in decibel units
GND (Ground)	The reference potential for voltage measurement
GP-IB	Abbreviation of general purpose interface bus, a bus standard for measurement instrument data transfers (8-bit parallel)
Interface	Devices required for data exchange between the instrument and a computer
LAN	Abbreviation of local area network
LCD	Abbreviation of liquid crystal display
LED	Light-emitting diode
Logging	Collecting sample data as numerical values
Logic	Signals displayed by dividing input signals into distinct High and Low levels according to threshold values
Low-Pass Filter	A filter that passes only low frequencies
LSB	Abbreviation of least significant bit, the minimum unit of A/D conversion
Max. Allowable Input Voltage	The maximum voltage that can be applied between input terminals of an input module
Maximum rated voltage to ground	The maximum voltage that can be applied between the instrument (GND)-to-Module (L terminals), and between one Module (L terminal) and another

Memory	Storage component. The place where digital data is stored.
Mode	A particular kind of operation, or format
Module (Unit)	A device that provides additional functionality when installed in the instrument
MS-DOS	A DOS (disk operating system) developed by Microsoft Corporation (USA), and a registered trademark of that company
Offset	The amount that a waveform is shifted on the voltage axis by waveform calculation. An additional value when scaling
Parameter	A numerical value representing a feature of a signal waveform, such as its maximum or RMS value
Peak Hold	Retaining the maximum amplitude at each frequency point
Position	The location of the zero-volt level.
Pre-Trigger	Time prior to triggering. That is, time that passes before a trigger event occurs
Probe	A signal line carrying input signals to the input circuitry.
PT	Abbreviation of potential transformer, a voltage transformer.
Recording Length	An amount signifying the total number of samples as a number of (display) divisions
RH	Abbreviation for relative humidity The amount of vapor contain in one cubic meter relative to the amount of saturated vapor at the same temperature, expressed as a percentage
Ripple Component	An AC noise component
RMS	Abbreviation of root-mean-square, which is the value of AC that performs the equivalent work as the same value of DC
Sampling	Conversion of an analog waveform to a digital numeric progression
Sampling Rate	The rate at which the sampling process repeats
Scaling	Conversion of measurement values acquired as voltage into another physical quantity
Slope	The condition of rising or falling voltage
Storage	Writing a waveform (A/D signal) to memory
TFT	Abbreviation for thin-film transistor
Thermal Head	Provides thermosensitive printing
Threshold	The values of separate High and Low boundary levels at which an analog signal is converted to a logic signal
Trigger	An event that initiates an operation. It signals measurement to begin.
Trigger Source	A signal that serves as the source required to apply a trigger.
Unbalanced Input	When one of two input terminals serves as a reference for the other, as a method for signal input
Word	A unit of data for digital display. Each sample of an input signal is converted into one word of digital data.
Zero Adjust	Making the zero position match the actual ground level

Appendix 4 Supplemental Technical Information

Appendix 4.1 Sampling

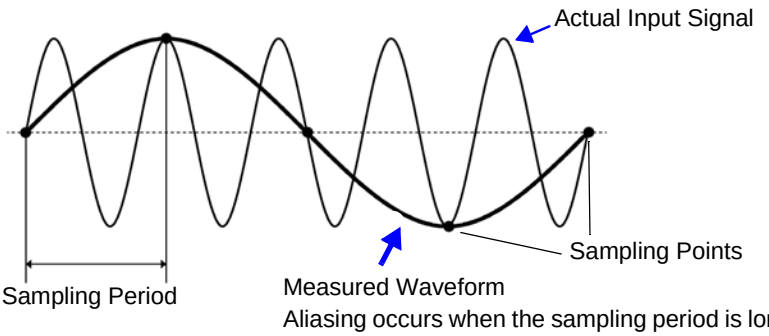
This instrument converts analog input signals into digital values which are then processed internally as digital (numerical) values. This A/D conversion process is called sampling.
Sampling repeatedly measures the size of the input signal at a specific interval (the sampling period).



The rate of measurement is called the sampling rate.
Sampling units are [S/s] (read as samples-per-second)
This is the number of samples taken each second, and is the inverse of the sampling period. (1/T)

Appendix 4.2 Aliasing

If the signal to be measured changes too fast relative to the sampling period, beginning at a certain frequency, non-existent slow signal fluctuations are recorded. This phenomena is aliasing.

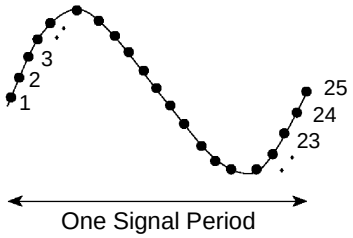


Aliasing occurs when the sampling period is longer than half of the input signal period.

With the Memory function, the sampling period can be significantly affected by the timebase setting, so care is necessary to avoid aliasing when selecting the timebase.
Because the timebase determines the measurement frequency limit, the fastest possible timebase setting should be used.
When the signal can be recorded repeatedly, the auto-ranging function (p. 74) may be used to select the optimum timebase.

Appendix 4.3 Measurement Frequency Limit

Displaying waveforms by their sampled values with adequate resolution of characteristics such as sine wave peaks requires a minimum of about 25 samples per waveform period.
The measurement frequency limit is determined by the timebase.

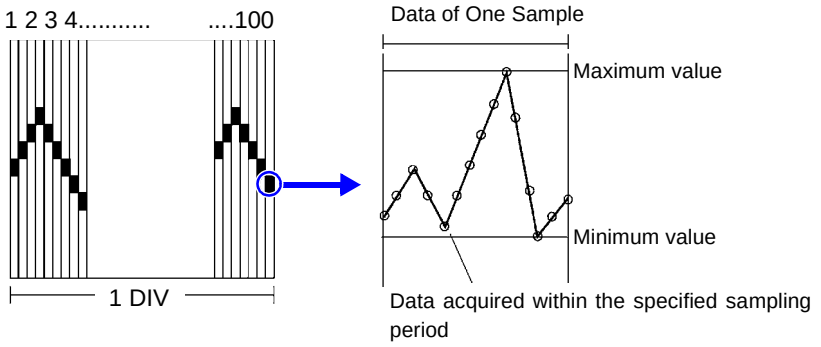


Timebase	Sampling period	Measurement limit frequency
5 µs/div	50 ns	800 kHz
10 µs/div	100 ns	400 kHz
20 µs/div	200 ns	200 kHz
50 µs/div	500 ns	80 kHz
100 µs/div	1 µs	40 kHz
200 µs/div	2 µs	20 kHz
500 µs/div	5 µs	8 kHz
1 ms/div	10 µs	4 kHz
2 ms/div	20 µs	2 kHz
5 ms/div	50 µs	800 Hz
10 ms/div	100 µs	400 Hz
20 ms/div	200 µs	200 Hz
50 ms/div	500 µs	80 Hz

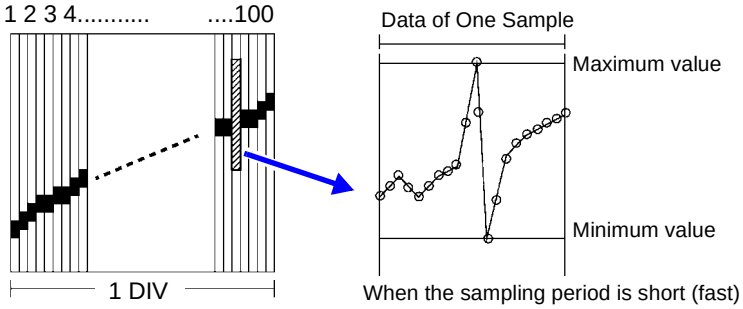
Timebase	Sampling period	Measurement limit frequency
100 ms/div	1 ms	40 Hz
200 ms/div	2 ms	20 Hz
500 ms/div	5 ms	8 Hz
1 s/div	10 ms	4 Hz
2 s/div	20 ms	2 Hz
5 s/div	50 ms	0.8 Hz
10 s/div	100 ms	0.4 Hz
30 s/div	300 ms	0.13 Hz
1 min/div	600 ms	0.067 Hz
2 min/div	1.2 s	0.033 Hz
5 min/div	3 s	0.013 Hz

Appendix 4.4 Recorder Function Values

Waveform data consists of 100 samples per division.
With the Recorder function, each data sample consists of the maximum and minimum values acquired in the specified sampling period. So each data sample has its own amplitude breadth.



When input waveform variation is slight, the difference between maximum and minimum values (breadth, or width) can be inordinately large if the sampling period is short and if severe fluctuations are present due to noise.
This phenomena may be prevented by setting a longer sampling period.



Appendix 4.5 The “Two-Point Setting Method” for Scaling

$$Y = \{ (SC_H - SC_L)/(V_H - V_L) \} X + \{ (V_H \times SC_L - V_L \times SC_H)/(V_H - V_L) \}$$

V_H : Higher potential point SC_H : Value at higher potential point
V_L : Lower potential point SC_L : Value at lower potential point

The ranges of the values enclosed in curly brackets { } are as follows:
-9.9999E+9 ≤ Value enclosed in { } ≤ -1.0000E-9
-9.9999E+9 ≤ Value enclosed in { } = 0
+1.0000E-9 ≤ Value enclosed in { } ≤ +9.9999E+9

A warning appears if a setting is outside of the above ranges, and the set value after conversion = the voltage value. (Y = X)
On channels for which waveform processing calculations have been recorded, converted measurement units are applicable only to the calculation results. (Scaling is otherwise disabled)
Scaled valued are displayed on the gauge scale, on-screen upper and lower limit values, and cursor values when using A/B cursors.

Appendix 5 Options

Refer to the *Input Module Guide* for details of cables and clamps for connecting to the input modules and the instrument.
Items indicated “specify when ordering” are not user-installable. For new purchases, contact your supplier (agent) or nearest Hioki office.

Input Modules (Measurement Amplifiers)

These are installed by insertion into the compartments on the right side of the instrument. Modules can be swapped out as needed.

		Channels	Max Sampling Rate	A/D Resolution	Maximum input voltage
Voltage Measurements	Model 8956 Analog Unit	2	20 MS/s	12-bit	400 V DC
	Model 8957 High Resolution Unit	2	2 MS/s	16-bit	400 V DC
	Model 8936 Analog Unit	2	1 MS/s	12-bit	400 V DC
	Model 8938 FFT Analog Unit	2	1 MS/s	12-bit	400 V DC
	Model 8946 4-Ch Analog Unit	4	1 MS/s	12-bit	30Vrms/60 V DC
	Model 8961 High Voltage Unit	2	2 MS/s	16-bit	1000 V DC
RMS Voltage Measurements	Model 8959 DC/RMS Unit	2	1 MS/s	12-bit	400 V DC
Voltage and Temperature (Thermometer) Measurements	Model 8937 Voltage/Temp Unit	2	1 MS/s	12-bit	30Vrms/60 V DC
	Model 8958 16-Ch Scanner Unit	16	20 S/s	16-bit	40 V DC
Voltage, Frequency, Count, Pulse Duty and Current Measurements	Model 8940 F/V Unit	2	1 MS/s	12-bit	30Vrms/60 V DC
Voltage and Acceleration (Acceleration Sensor) Measurements	Model 8947 Charge Unit	2	1 MS/s	12-bit	30Vrms/60 V DC
Strain (Strain Gauge Type Converter) Measurements	Model 8939 Strain Unit	2	1 MS/s	12-bit	10 V DC
	Model 8960 Strain Unit	2	200 kS/s	16-bit	10 V DC

Refer to the *Input Module Guide* for specifications.

Measurement Probes, Cables and Clamps

			Maximum input voltage
For Voltage Measurement	Model L9197 Connection Cord Model 9197 Connection Cord	For high voltage	500 V
	Model L9198 Connection Cord	For low voltage	300 V
	Model L9217 Connection Cord	Isolated BNC-BNC	300 V
	Model 9242 Connection Cord	For Model 8961 High Voltage Unit The Model 9243 Grabber Clip can also be connected.	1000 V DC
	Model 9322 Differential Probe	For high voltage Following item is required for connection. • Voltage measurement with an input module other than the Model 8958 16-Ch Scanner Unit requires the Model 9418-15 AC Adapter*2 or 9248 Power Cord (when using the Model 9687)*3 • Connecting the Model 8940 F/V Unit requires the Model 9325 Power Cord*1, 9418-15 AC Adapter*2, or 9248 Power Cord(when using the Model 9687)*3	(CAT II) 2000 V DC, 1000 V AC (CAT III) 600 V AC/DC
	Model 9665 10:1 Probe	Maximum rate voltage above ground is that of the input module.	1 kVrms (up to 500 kHz)
	Model 9666 100:1 Probe	Maximum rate voltage above ground is that of the input module.	5 kVpeak (up to 1 MHz)
	*1. Model 9325 Power Cord	For Model 9322, connect to the sensor terminal on the Model 8940	
	*2. Model 9418-15 AC Adapter	For Model 9322	
	*3. Model 9248 Power Cord	Supplies power from the Model 9687 to the 9322	
For Logic Signal Input	Model 9320-01 Logic Probe	Four channels, for detecting voltage and closed/open contact points	
	Model MR9321-01 Logic Probe	Four isolated channels, for detecting AC/DC voltage on/off (for small terminal types and for lines)	
	Model 9327 Logic Probe	Four channels, for detecting voltage and closed/open contact points (high-speed type)	

For current measurement AC/DC, wide range Following item (1) or (4) is required for connection.	Model 3273-50 Clamp-On Probe(1), (4)	30 A, DC to 50 MHz (up to 15 A when used with the Model 8940 F/V Unit)
	Model 3274 Clamp-On Probe(1)	150 A, DC to 10 MHz
	Model 3275 Clamp-On Probe(1)	500 A, DC to 2 MHz
	Model 3276 Clamp-On Probe(1)	30 A, DC to 100 MHz
AC/DC Following item (2) or (3) is required for connection.	Model 9277 Universal Clamp-On CT (2),(3)	20 A, DC to 100 kHz
	Model 9278 Universal Clamp-On CT (2),(3)	200 A, DC to 100 kHz
	Model 9279 Universal Clamp-On CT*(2),(3)	500 A, DC to 20 kHz
For AC Following item (2) or (3) is required for connection.	Model 9270 Clamp-On Sensor* (2),(3)	20 A, 5 Hz to 50 kHz
	Model 9271 Clamp-On Sensor* (2),(3)	200 A, 5 Hz to 50 kHz
	Model 9272 Clamp-On Sensor* (2),(3)	20/200 A, 5 Hz to 10 kHz
For AC	Model 9018-50 Clamp-On Probe	10 to 500 A, 40 Hz to 3 kHz
	Model 9132-50 Clamp-On Probe*	20 to 1000 A, 40 Hz to 1 kHz
For Leakage Current	Model 9657-10 Clamp-On Leak Sensor	1 A, 45 to 66 Hz
Miscellaneous For connecting to an input module for voltage measurement	(1) Model 3272 Power Supply or 3269 Power Supply	for Model 3273-50 to 3276
	(2) Model 9555-10 Sensor Unit	for Model 9270 to 9272, 9277 to 9279
For connecting to the Model 8940 F/V Unit	(3) Model 9318 Conversion Cable	for Model 9270 to 9272, 9277 to 9279
	(4) Model 9319 Conversion Cable	for Model 3273-50 (Rated for up to 15 Arms input)
	Model 9199 Conversion Adapter	(BNC-to-Banana) (Either Model 9018 or 9132 can be used)

* Not applicable to CE Marking
A power or conversion cable and scaling settings may be required depending on the input module and clamp to be used. Refer to "1.3 List of Input Modules, Cables, Probes and Clamp Combinations" in the *Input Module Guide* for viable combinations.

Printer, Recording Paper

Printer	Model 8995 A4 Printer Unit	specify when ordering
	Model 8995-01 A6 Printer Unit	specify when ordering
Recording Paper	Model 9231 Recording Paper	A4, one set of 6 rolls, 30 m
	Model 9234 Recording Paper	A6, one set of 10 rolls, 18 m
	Model 220H Paper Winder*	(Auto winder for recording paper)

* Not applicable to CE Marking

Storage Media

Drives	Model 9718-50 HD Unit	Internal Hard Disk Drive, specify when ordering
Memory Boards (One in the 8860-50, or Two in the 8861-50)	Model 9715-50 Memory Board	32 MWords, specify when ordering
	Model 9715-51 Memory Board	128 MWords, specify when ordering
	Model 9715-52 Memory Board	512 MWords, specify when ordering
	Model 9715-53 Memory Board	1 GWords, specify when ordering
PC Card	Model 9726 PC Card 128M	128MB, with adapter
	Model 9727 PC Card 256M	256MB, with adapter
	Model 9728 PC Card 512M	512MB, with adapter
	Model 9729 PC Card 1G	1GB, with adapter
	Model 9830 PC Card 2G	2GB, with adapter

Communication

LAN Cable	Model 9642 LAN Cable	5 m straight-through cable, plus crossover adapter

Software

Application Software	Model 9725 Memory HiViewer	

Miscellaneous

Memory Backup	Model 9719-50 Memory Backup Unit	Memory storage backup specify when ordering
Power Supply	Model 9684 DC Power Unit	Power supply for DC operation specify when ordering
	Model 9687 Probe Power Unit	Power supply for probes specify when ordering
Cases	Model 9723 Carrying Case (for 8860-50)	with casters
	Model 9724 Carrying Case (for 8861-50)	with casters
Transformer	Model 9303 PT *	

* Not applicable to CE Marking

Appendix 6 Disposing of the Instrument

Before Disposing of the Instrument

The instrument contains a lithium battery for memory backup. Remove this battery before disposing of the instrument. Also remove the optional Model 9719-50 Memory Backup Unit, if installed (p. A56).

⚠WARNING **To avoid electric shock, turn off the power switch and disconnect the power cord before removing the lithium battery and Model 9719-50 Memory Backup Unit (if the option is installed).**

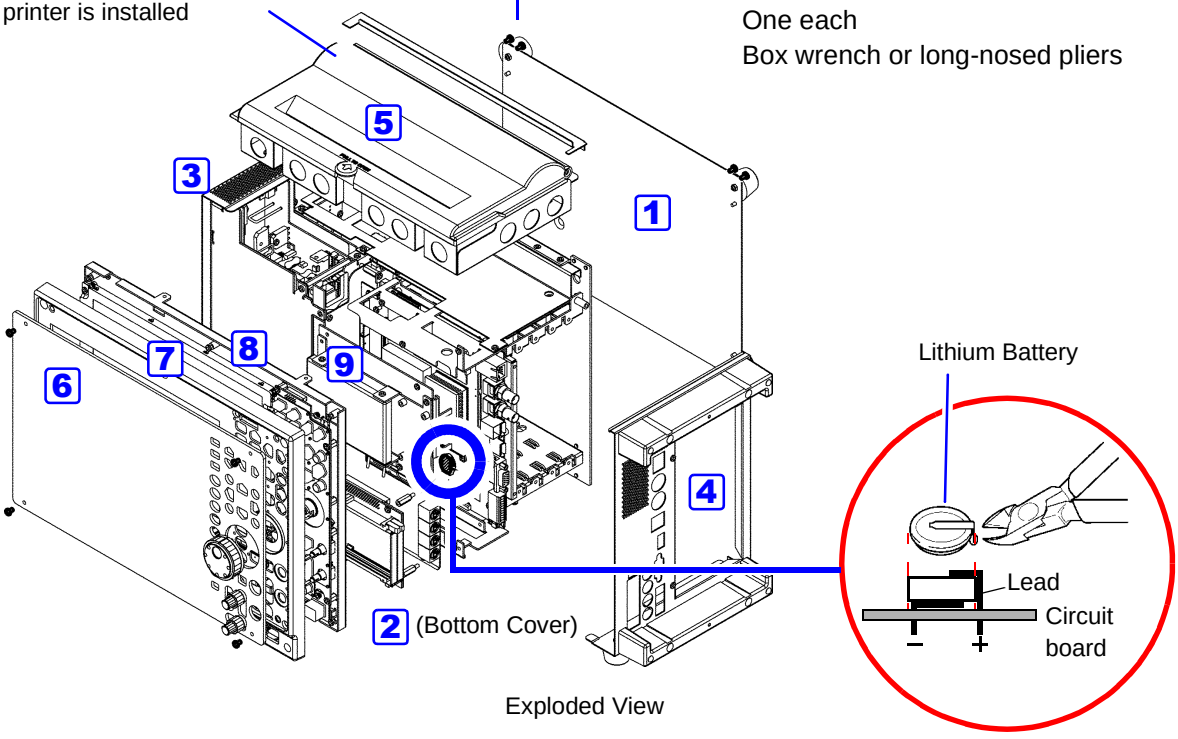
⚠CAUTION When disposing of the instrument, remove the lithium battery and Model 9719-50 Memory Backup Unit (if the option is installed) and dispose of them in accordance with local regulations.

Lithium Battery Removal

Only when the optional printer is installed

Screws

Required tools:
Phillips screwdriver, wire cutter
One each
Box wrench or long-nosed pliers



Exploded View

1 Verify that the power is off, and remove the connection cables and power cord.

2 Remove the screws and panels as indicated in the above diagram.

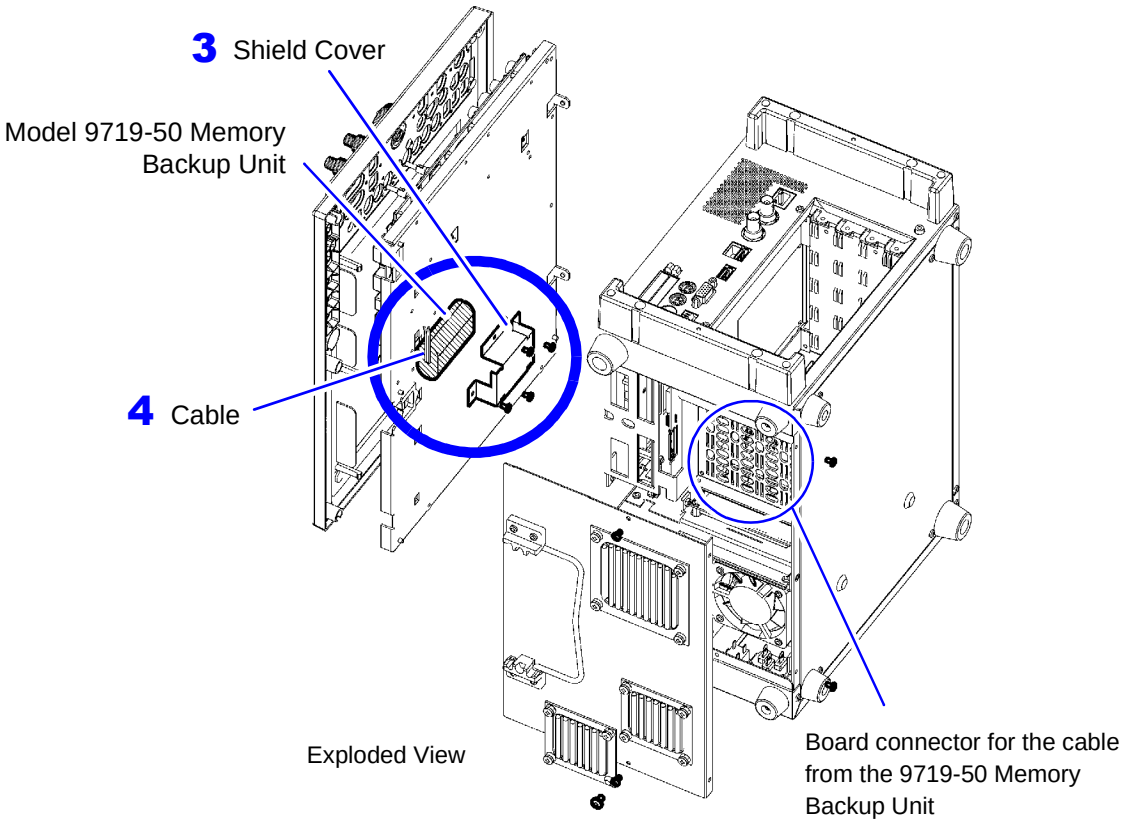
3 Pull the lithium battery up from the circuit board, and cut the two leads with a wire cutter.

4 Remove the battery from the board.

CALIFORNIA, USA ONLY
This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Removing the Model 9719-50 Memory Backup Unit

Required tools: Phillips screwdriver and wire cutter



1 Verify that the power is off, and remove the connection cables and power cord.

2 Remove the screws and panels as indicated in the above diagram.

3 Remove the screws in the shield cover over the 9719-50 Memory Backup Unit, and cut the cable tie with diagonal cutters.

4 Cut the cable of the Model 9719-50 Memory Backup Unit with diagonal cutters, or remove the cable from the board connector and the Model 9719-50 Memory Backup Unit.

Index

Numerics

A

B

C

D

Index

E

F

G

I

J

K

L

M

N

O

P

R

S

T

U

V

W

X

Z

- Please visit our website at www.hioki.com for the following:
  - ■ Regional contact information
  - ■ The latest revisions of instruction manuals and manuals in other languages.
  - ■ Declarations of Conformity for instruments that comply with CE mark requirements.
- All reasonable care has been taken in the production of this manual, but if you find any points which are unclear or in error, please contact your supplier or the International Sales and Marketing Department at Hioki headquarters.
- In the interests of product development, the contents of this manual are subject to revision without prior notice.
-

HIOKI

HEADQUARTERS
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 FAX +81-268-28-0568
os-com@hioki.co.jp
(International Sales Department)

www.hioki.com

HIOKI USA CORPORATION
hioki@hiokiusa.com www.hiokiusa.com

HIOKI (Shanghai) Sales & Trading Co.,Ltd.
info@hioki.com.cn www.hioki.cn

HIOKI SINGAPORE PTE. LTD.
info-sg@hioki.com.sg www.hioki.com

HIOKI KOREA CO., LTD.
info-kr@hioki.co.jp www.hiokikorea.com

1604EN

Edited and published by Hioki E.E. Corporation Printed in Japan