# HIOKI

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**INSTRUCTION MANUAL** 

# 8860 8861 MEMORY HICORDER

This manual describes the instrument's functions and operations in detail, and its specifications.

HIOKI E.E. CORPORATION

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# Introduction

In this manual, "the instrument" means the Model 8860 or 8861 Memory HiCorder. 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 Supplement	The supplement describes usage of the calculation functions to analyze measurement data.	

## **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*.

## Registered trademarks

Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.

# Symbols and Indicators in This Manual

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

Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.

Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.

Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.

Indicates advisory items related to performance or correct operation of the instrument.

#### Other Indicators

Indicates the prohibited action. Indicates the location of reference information. (⇒ p.) Indicates quick references for operation and remedies for troubleshooting. Indicates that descriptive information is provided below. Indicates Memory function support. MEM Indicates Recorder function support. REC Indicates FFT function support. FFT REALTIME Indicates Real-time saving function support.  $A \rightarrow B$ 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 Bold characters within the text indicate operating key labels. characters)

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

## **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:

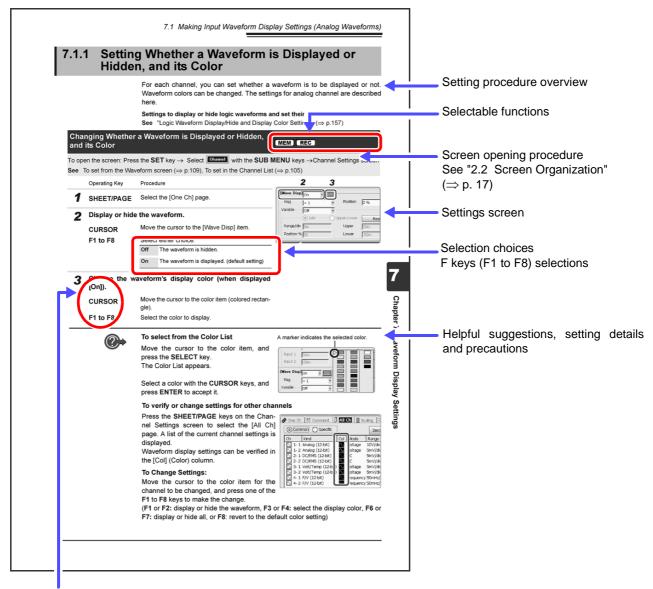
f.s.: maximum display value or scale length

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**



Operating keys

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

# **Overview**

# **Chapter 1**

# 1.1 Product Overview

The Model 8860 and 8861 Memory HiCorders 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, and up to eight in the 8861.

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.

#### 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  $\times$  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.

#### 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. 80)
About FFT Function: *Analysis Supplement* 

# High capacity memory choices

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

8861: 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. 129)

# 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. 117)

# 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. 186)
```

Numerical values and gauges can be displayed with waveforms, simplifying onscreen verification of measured values.

```
See "8.5 Applying Gauges" (⇒ p. 191)
```

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

```
See "8.8 Cursor Values" (⇒ p. 195)
```

Various numerical calculations and waveform calculations are available.

See Analysis Supplement

# Search function

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

See "8.14 Searching a Waveform" (⇒ p. 215)

# 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. 62)

# 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 11 Printing" (⇒ p. 297)

# Support for a variety of recording media and external storage systems (optional MO, hard disk and floppy disk drives)

Measurement data, settings and images can be recorded to PC Cards (optional Flash ATA Cards), floppy disks, MO and hard disks.

Either the Model 9717 MO Unit or 9718 HD Unit optional drive can be installed. The Model 9716 FD Drive (floppy drive) can be connected to the instrument's USB port.

Two PC Card slots are provided, so an interface card and a Flash ATA card can be used at the same time.

See "10.1 Storage Media" (⇒ p. 244)

# Built-in LAN interface (100Base-TX)

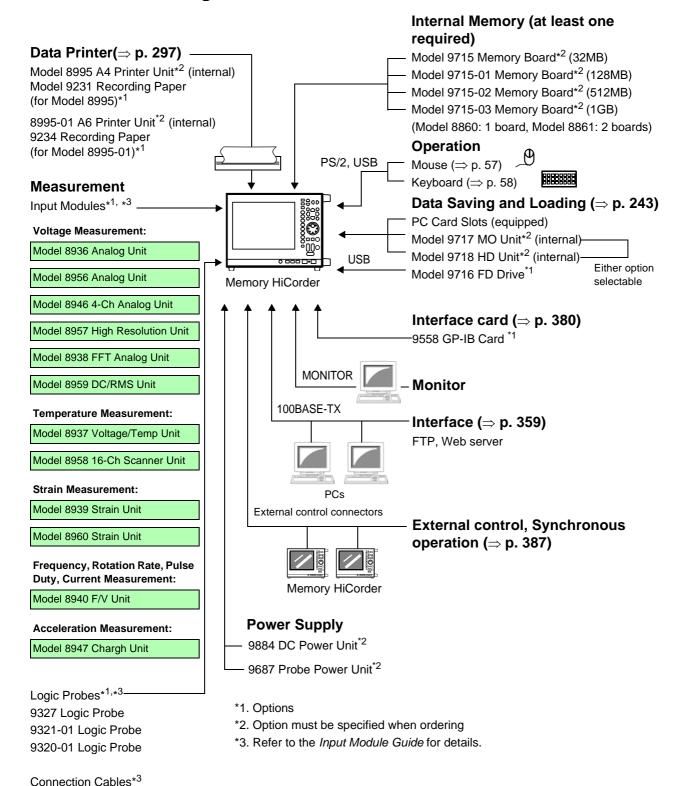
An HTTP server is installed. There is no need to install special applications on a PC: instrument settings and screen monitoring can be performed on a PC running Internet Explorer.

By connecting to a shared folder, measurement data from the instrument can be saved on a PC.

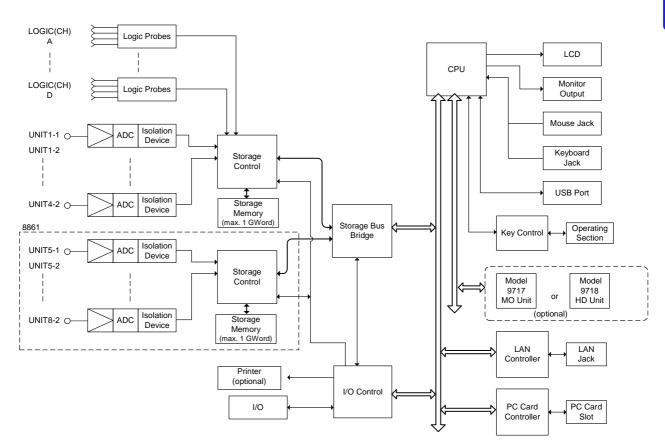
See "Chapter 13 Communications Settings" ( $\Rightarrow$  p. 359) "10.1.6 Using a Network Shared Folder" ( $\Rightarrow$  p. 249)

# 1.3 Interconnection and Block Diagrams

# **Interconnection Diagram**



# **Internal Block Diagram**



## **System Circuit Description**

All subsystems in the instrument are microprocessor (CPU) controlled.

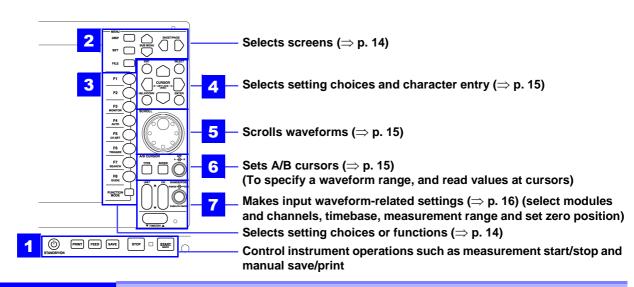
Each input module contains an A/D converter that connects to the instrument through an isolation device. (The isolation devices are in the input modules.) In addition, separate power supplies are provided for each channel, electrically isolating them from the instrument.

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, MO disk or other external storage media.



# **Operating Keys and Screen** Chapter 2 Contents

# **Operating Keys**



# (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 "11.4 Making Manual Print (PRINT Key Output) Settings" (⇒ p.

303)

Pressing the **FEED** key feeds paper for as long as you press it.

**FEED key** (when the optional printer is installed)

SAVE key Saves data to storage media.

See "10.3.5 Setting Manual Save (SAVE Key Output)" (⇒ p. 263)

STOP key Stops measurements.

Press twice to force measurement to halt immediately.

See "3.3.6 Starting and Stopping Measurement" (⇒ p. 75)

Starts measurement. The green LED at the left is lit during measure-START/MARK key

If you have set trigger criteria, the awaiting-trigger state activates.

See "3.3.6 Starting and Stopping Measurement" (⇒ p. 75)

2	MENU (Scr	een Sel	ect)
DISP SET	_ DISP key ) )		Displays the Waveform screen showing recorded data. (Setting choices can also be changed from the Waveform screen) See "2.4 Waveform Screen" ( $\Rightarrow$ 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" ( $\Rightarrow$ p. 195)
FILE	SET key		Displays the Settings screens, where you can change various settings such as measurement configuration and trigger criteria. See "2.5 Settings Screen" ( $\Rightarrow$ p. 26) Hold this key to display the System screen. See "2.7 System Screen" ( $\Rightarrow$ p. 43)
	FILE key		Displays the File screen where you can load settings and measurement data, and manage files. See "2.6 File Screen" ( $\Rightarrow$ p. 40)
SUB MENU SHEET/PAGE	SUB MENU	J 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 "12.2.5 Specifying SHEET/PAGE Key Operations" ( $\Rightarrow$ p. 340) 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 F2	F1 to F8 ke	eys	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" ( $\Rightarrow$ p. 62)
F3 MONITOR  F4 AUTO	FUNCTION key	MODE	Alters the functional mode of the <b>F1</b> to <b>F8</b> keys. Available functions depend on the type of display screen. [SET] (selection choice at screen cursor location) $\rightarrow$ [FN] (function displayed for F1 to F8) $\rightarrow$ [MACRO] (simple operations)  See Waveform Screen: "Function Modes and Settings" ( $\Rightarrow$ p. 25), File Screen: "Function Modes and Settings" ( $\Rightarrow$ p. 41)
F5 CH.SET		(*F1)	Displays information such as the measurement values and numerical calculation results.  See "8.4 Displaying Measured Values and Information" (⇒ p. 189)
TRIGGER F7		(*F2)	Displays a gauge at the left side of the screen.  See "8.5 Applying Gauges" (⇒ p. 191)
F8 F8	MONITOR	(*F3)	Displays input levels for monitoring.  See "8.6 Monitoring Input Levels (Level Monitor)" (⇒ p. 192)
FUNCTION MODE	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)" ( $\Rightarrow$ p. 73)
(*F1) to (*F8): From the Waveform screen, press the FUNC-TION MODE key to	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. 128)
change to the FN mode, then press one of the F1 to F8 keys. To revert to	TRIGGER	(*F6)	Applies an unconditional (manual) trigger.  See "6.10 Triggering Manually (Manual Trigger)" (⇒ p. 159)
the original functions, press the FUNCTION MODE key again.	SEARCH	(*F7)	Displays the SEARCH dialog. Any desired waveform can be searched. See "8.14 Searching a Waveform" ( $\Rightarrow$ p. 215)
	GUIDE	(*F8)	(Support planned in later version upgrade)

# ESC SELECT CURSOR KEYLOCK → HELP/CONV ENTER

4

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

See "3.3.3 Entering Text and Numbers" (⇒ p. 64)

**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 key-

board for character entry.

When using the virtual keyboard: enters the character selected by the

curso

**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** 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. 77)

5

## SCROLL controls (waveform scrolling)

See "8.1 Scrolling Waveforms" (⇒ p. 186)

SCROLL Jog

Shuttle

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)

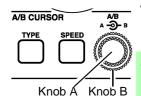
Turn the knob in the direction to scroll the waveform and hold it until "Auto-Scroll" appears, then release it. The waveform scrolls automatically.

To cancel: press any operating key.

6

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

See "8.8 Cursor Values" (⇒ p. 195)



**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.

**а —Э**— в

**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

UNIT CH RANGE/POSN
RANGE-9-POSN
PUSH:CI JNV0FF
RANGE
knob
POSN knob

#### **Input Waveform Settings**

See "5.7 Setting Input Channels from the Waveform Screen" ( $\Rightarrow$  p. 128) "5.1 Analog Channel Settings" ( $\Rightarrow$  p. 110)

**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-O-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.

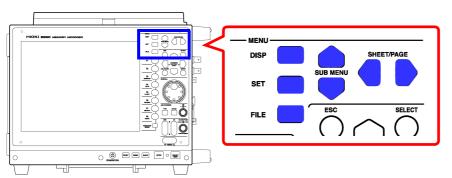
TIME/DIV key

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. 108)

"4.2 Setting Measurement Configuration (Status Settings Screen)" (⇒ p. 85)

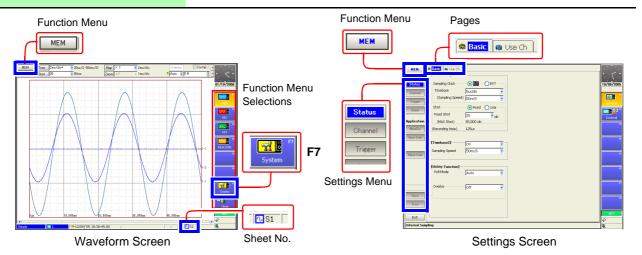
# **Screen Organization**



There are five general screen

Press the operating keys shown at the right to select a screen.

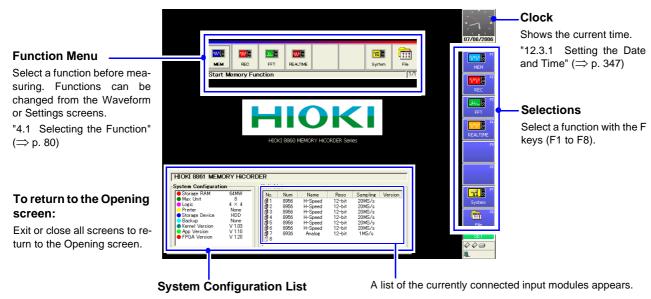
Screen	Operating Key	Screen Contents
Opening Screen (⇒ p. 18)		This screen appears first after power on. When you turn the power off with the Waveform screen displayed, it reappears after this screen is displayed briefly.
Waveform Screen (⇒ p. 19)	DISP	Displays measurement data as waveforms or numerical values. See "7.2.3 Setting the Display Type" ( $\Rightarrow$ p. 171)
To change sheets	SHEET/PAGE	Switches the display between multiple "sheets" of waveform data.  See "7.2.1 Assigning Display Data to Sheets" (⇒ p. 169)  "12.2.5 Specifying SHEET/PAGE Key Operations" (⇒ p. 340)
Settings Screen (⇒ p. 26)	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. 40)	FILE	Displays the screen for loading measurement data and managing files.
System Screen (⇒ p. 43)	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 Sv		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.

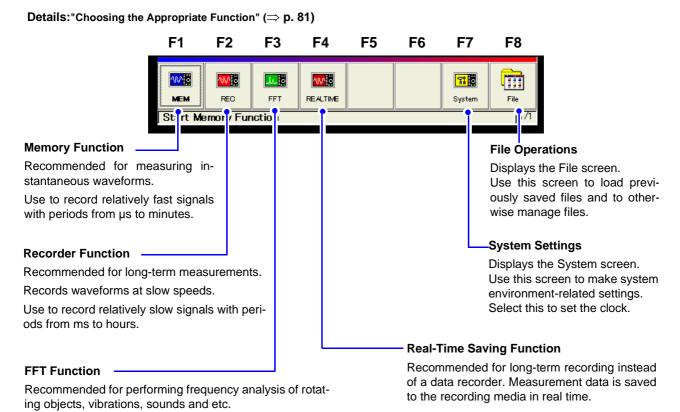
Select a function with the F keys (F1 to F8). The Waveform screen appears when you select the function.



This can be verified on the System screen ( $\Rightarrow$  p. 49).

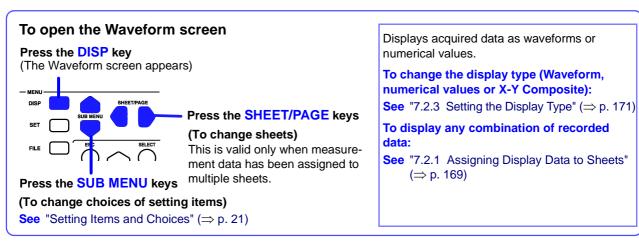
#### **Function Menu**

Spectral analysis and transfer functions are available.



# 2.4 Waveform Screen

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



(Example: Memory Function Waveform Screen) Setting Items and Choices (⇒ p. 21) Clock **Function Menu** Measurement configuration and trigger criteria set-Shows the current time. You can Select a function before measurtings can be changed. These can be changed while change the display appearance. measuring. ina. Clock setting procedure (⇒ p. 347) To change functions:(⇒ p. 80) Press the SUB MENU keys to select the items to change. On-screen changes can be made by clicking the mouse. Mag (⇒ p. 68) Cursor A -260us Cursor 9,940 "Key Lock" appears when Num t: -260us 211.0 Hz 9.940 66.93 the key-lock state is en-**Recorded Data** Motion T abled. Speed Gr Shows data acquired with this Line instrument. (⇒ p. 20) **Setting Choices** Cur A Al B 1 Al 🔡 1 (GUI area) **Scroll Bar (⇒ p. 186)** The cursor indicates the Scrolls waveforms. current setting choice. The width of the scroll bar indi-Select with F keys (F1 to cates the displayed area within the overall recorded waveform. Press the **FUNCTION** nd E You can use the mouse to MODE key to change the scroll. F key functions. ( $\Rightarrow$  p. 25) F-Key Function On Voltage ■ 🖁 Off **Status (**⇒ **p. 25)** Status Bar (⇒ p. 23) Shows the current F key This bar indicates the current status states of data acquisition, inter-**Input Channel Settings Dialog** nal processing, settings and Input channel settings can be changed. (⇒ p. 128) display information. Internal and External (Appears when you press the UNIT or CH keys, or **Connection Status** press or turn the **RANGE** knob) Sheet No. A/B Cursor Settings Dialog Press the ESC key to Select the type of cursors. (⇒ p. 195) remove the dialog. (Appears when you press the TYPE key or knob A)

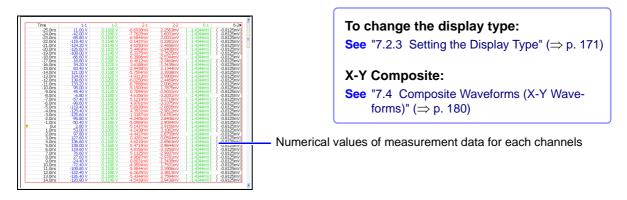
# **Viewing Recording Data**

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

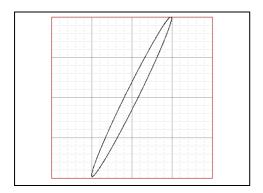
#### **Waveform Display** Trigger Mark Cursor A -670us Cursor B 8.620ms **Cursor Values Trigger Event Position** "8.8 Cursor Values" 0.01 V -0.04 V -0.03 \ 0.00 \ -0.02 V -0.04 V (⇒ p. 195) Unit (Module) and **Channel Nos. Trigger Level** 1-1: Unit 1 - Channel 1 To add a waveform comment: "5.2 Adding Comments" A/B Cursors (⇒ p. 112) "12.1.2 Displaying or Hid-5.000ms ing Comments" (⇒ p. 335) **1-1 10/09/'05 18:41:33.21** Number of Waveform Acquisitions

**Trigger Time** 

## Numerical Values Display¶

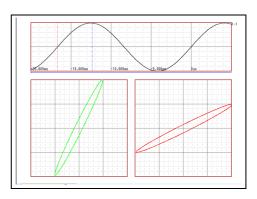


## X-Y Composite Display



# X-Y Composite and Waveform Display

Displayed Sheet No.



# **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.

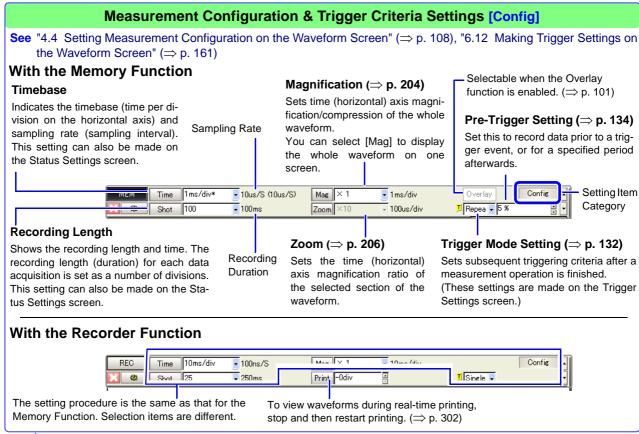
See "3.3.2 To Change a Setting" (⇒ p. 62)

#### To switch displayed setting items:

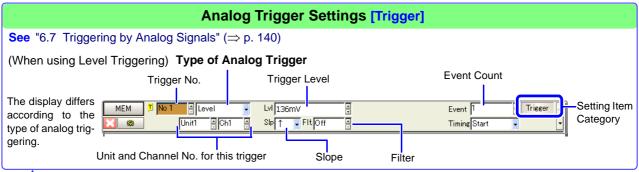
Press the SUB MENU keys to switch which setting items are displayed. (Some items are function-dependent)

- Memory Function and Recorder Function
  - $[\mathsf{Config}] \longleftrightarrow [\mathsf{Trigger}] \longleftrightarrow [\mathsf{Num}\;\mathsf{Calc}]^* \longleftrightarrow [\mathsf{Mem}\;\mathsf{Div}]^*$
  - \* Only with Memory Function
- Real-Time Saving Function
   [Config]
- FFT Function

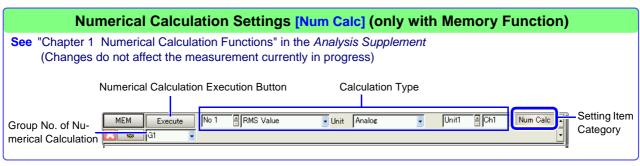
 $[FFT(1/2)] \leftrightarrow [FFT(2/2)] \leftrightarrow [Trigger]$ 



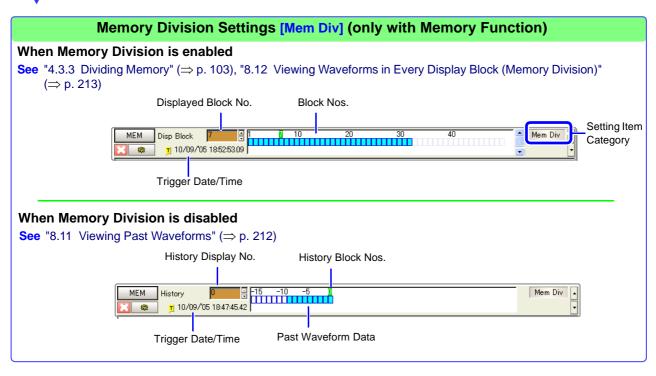


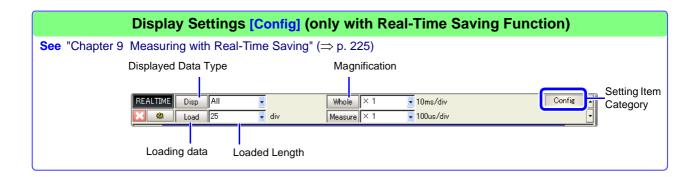


Switch with the SUB MENU keys



Switch with the SUB MENU keys



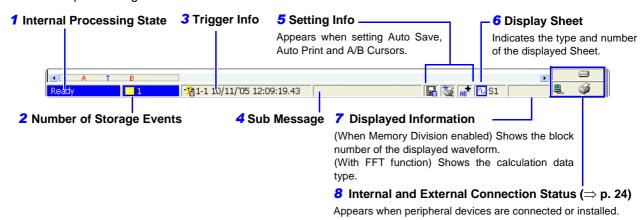


Block Selection: SHEET/PAGE keys

See "12.2.5 Specifying SHEET/PAGE Key Operations" (⇒ p. 340)

# **Status Bar**

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

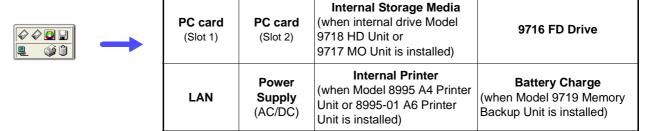


1 Internal Pro	ocessing State	4 Sub Message	
Pre-Trig Wait	Before acquiring data Appears only when pre-trigger re- cording is enabled.	(Time to Finish) Projected time to finish storing (appears when recording duration is ten seconds or more)	
Trigger Wait	Trigger wait state	Count to be Averaged (n/m)	
Scanner Wait	Scanner module preparation state	Simple Averaging	Simple Averaging
Storing	Data acquisition in progress	(Time axis)	(Frequency)
Storing Done	Finished acquiring data	Exponential Averaging (Time axis)	Exponential Averaging (Frequency)
Waveform	Waveform generation in progress		Peak hold (Frequency)
Calculating (n/m)	Numerical value calculation in progress		- Li reaktion (Frequency)
Calculating (Zn)	Waveform calculation in progress	5 Setting Info	Display Sheet
FFT (n/m)	FFT calculation in progress	Auto Save (Waveforms)	Waveform
Stopped	Operation stopped		X-Y // Nyquist
Preparing	Preparation in progress	Auto Save (Calculations)	Composite
Ready	Idle state	Auto Save (Waveforms & Calculations)	Numerical FFT+Nyquist
Printing	Printing in progress	Auto Cours (Consentinger	·
Saving	Saving in progress	es)	Waveform & FFT
Auto-Ranging	Automatic range selection in progress	Auto Save (Waveforms & Screen images)	X-Y Compos- ite Waveform + Nyquist
Complete	Finished automatic range selection	Auto Save (Calculations & Screen images)	Sheet Selection: SHEET/PAGE keys
(File Name)*	Name of loaded file		7 Diamer Information
* Disappears upon s	start.	Auto Save (Waveforms & Calculations & Screen	
2 Storage Ev	ents (Trigger Mode)	images)	Block number when measuring with Memory Division enabled
	per of data acquisition events	Muto Print	Displayed block number for Mer
(Count) Numb	er or data acquisition events	Auto Print (External Printer)	— Oly Division
3 Trigger Info		AB Vertical Cursors	(FFT function)  New Use newly acquired data for cal culations.
- 12:0/11/05 12:0/11/05 12:0/	9:19. Trigger factors (triggered unit/module and channel, timer or external trigger), date and time	AB Horizontal Cursors	(FFT function) MEM Use pre-existing data for calculations
	35-7, 22-2 31-3 11-10	RB Trace Cursors	tions.

Indicates current settings.

# 8 Internal and External Connection Status

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



MO drive installed\*

\* Appears when an MO disk is inserted.

# Model 9716 FD Drive (Floppy drive)

(Blank) No floppy disk



Floppy disk present

Appears when a floppy disk is inserted in the Model 9716 FD Drive.

#### LAN



Connection Status

(Blank) Disconnected State

"Chapter 13 Communications Settings" (⇒ p. 359)

## **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 Memory Backup Unit is Installed" (⇒ p. 59)

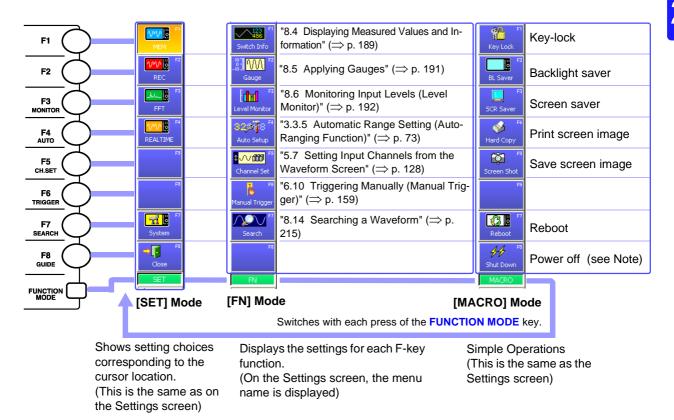
#### \*1. Remedial Actions

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.



### NOTE

Normally, you do not have to press the F8 [Shut Down] key to turn the instrument off. Just press the POWER switch.

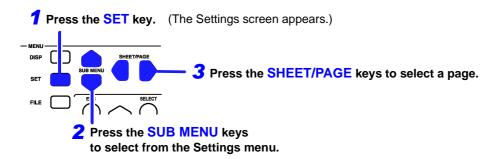
Pressing the F8 [Shut Down] key terminates all processes, but you still have to turn the POWER switch off to shut off the instrument.

### 2.5 Settings Screen

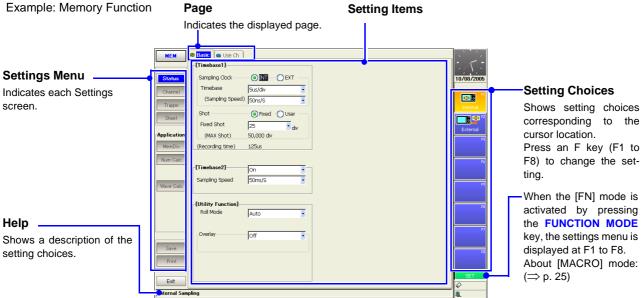
Parts of the displayed screen depend on the selected operating function.

Refer to the *Analysis Supplement* for details of the FFT function and calculation function.

### To open the Settings screen



Setting items differ according to the operating function.

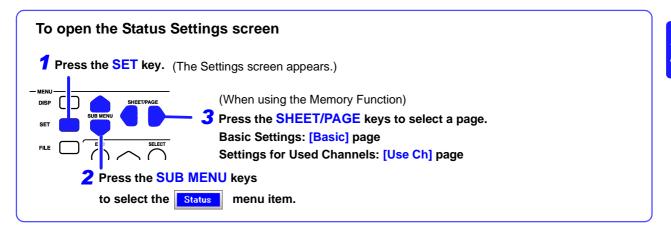


#### **Settings Menu**

Menu items differ according to the operating function.

Menu	Name on Instrument Screen	Ref.	Description	Supporting Function			
				MEM	REC	FFT	REALTIME
Status	Status Settings Screen	(⇒ p. 27)	Measurement configuration settings.	0	0	0	0
Channel	Channel Settings Screen	(⇒ p. 30)	Input channel-related settings.	0	0	0	0
Trigger	Trigger Settings Screen	(⇒ p. 33)	Trigger criteria settings.	0	0	0	-
Sheet	Sheet Settings Screen	(⇒ p. 34)	Waveform screen display-related settings.	0	0	0	0
MemDiv	Memory Division (Mem Div) Settings Screen		Memory Division-related settings.	0	-	-	_
Num Calc	Numerical Calculation (Num Calc) Settings Screen	(⇒ p. 36)	Display-related settings for numerical calculations.	0	_	_	_
Wave Cald	Waveform Calculation (Wave Calc) Settings Screen	(⇒ p. 37)	Display-related settings for wave- form calculations.	0	_	_	_
Save	Save Settings Screen	(⇒ p. 38)	Select the data saving method.	0	0	0	0
Print	Print Settings Screen	(⇒ p. 39)	Select the data printing method.	0	0	0	0

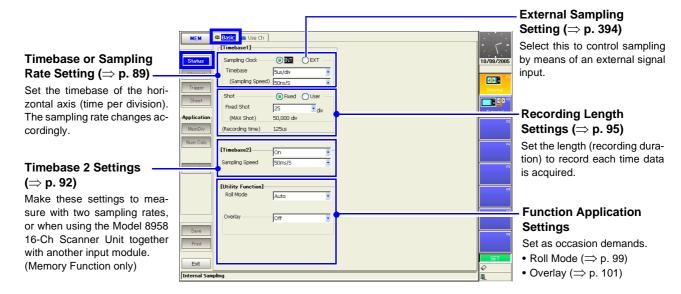
### 2.5.1 Status Settings Screen

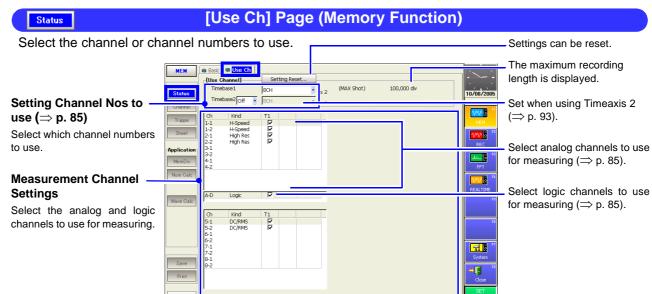


#### Status

### [Basic] Page (Memory Function)

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





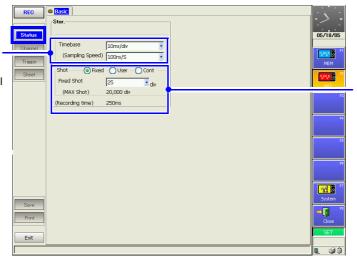
Status

### [Basic] Page (Recorder Function)

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

### Timebase and Sampling Rate Settings

Set the timebase (horizontal axis) and sampling rate  $(\Rightarrow p. 89)$ .



#### Recording Length Settings

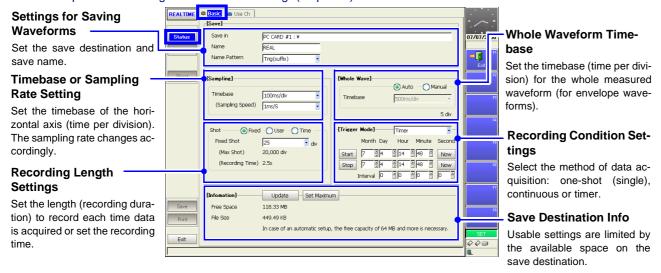
Set the recording length (⇒ p. 95).

Status

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

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. 225)

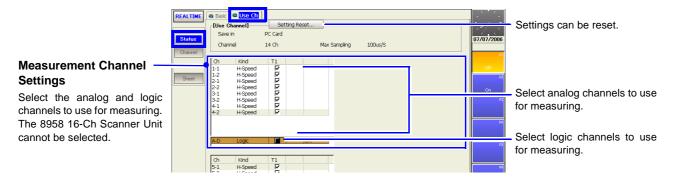


Status

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

Select the channel or channel numbers to use.

See "Chapter 9 Measuring with Real-Time Saving" (⇒ p. 225)

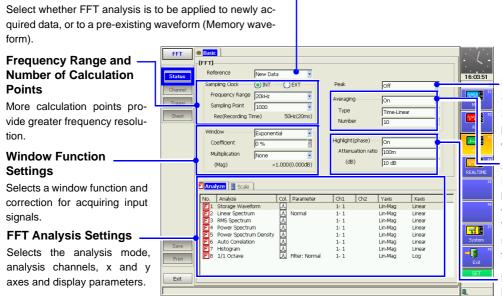


Status

**Input Data Selection** 

### [Basic] Page (FFT Function)

Make settings here for FFT analysis.



### Peak Value Display Setting

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

#### **Averaging Settings**

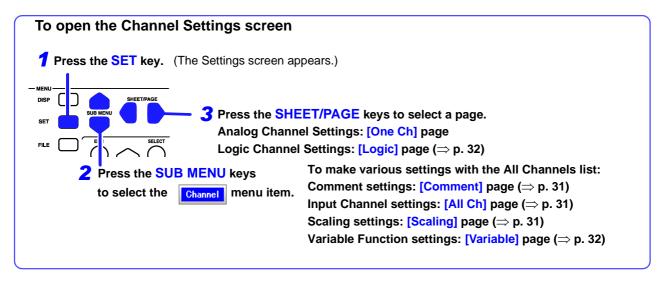
Noisy or unstable values can be averaged to clarify the waveform display.

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).

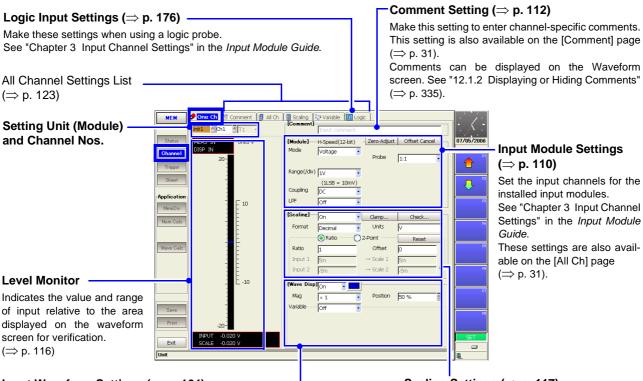
### 2.5.2 Channel Settings Screen





### [One Ch] Page

Set analog channels.



Input Waveform Settings (⇒ p. 164) - Set the waveform display color, zero position

Set the waveform display color, zero position, vertical axis magnification and display area. These settings are also available on the [All Ch] page ( $\Rightarrow$  p. 31). Variable settings can be made on the [Variable] page ( $\Rightarrow$  p. 32). Logic waveform settings can be made on the [Logic] page ( $\Rightarrow$  p. 177).

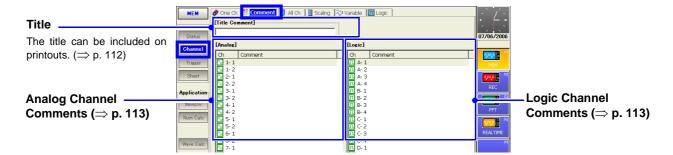
Scaling Settings (⇒ p. 117)

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. 31).

#### Channel

### [Comment] Page

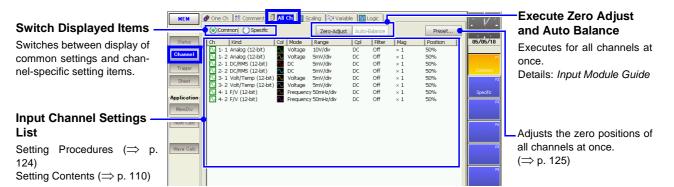
Displays a list of comments. Settings can be changed and copied between channels.



### Channel

### [All Ch] Page

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



#### Channel

### [Scaling] Page

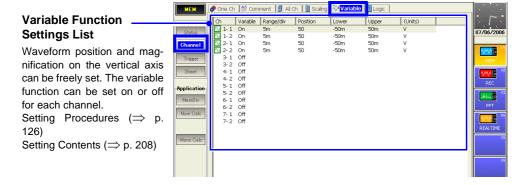
Shows the list of scaling settings for analog channels. Settings can be changed and copied between channels.



### Channel

### [Variable] Page

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



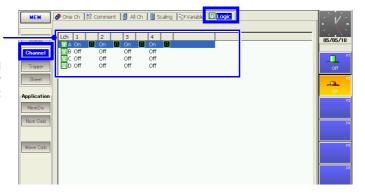
### Channel

### [Logic] Page

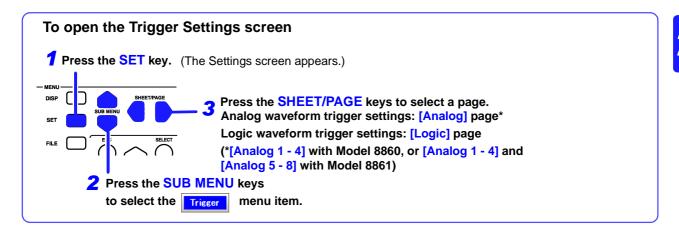
Input enable/disable and waveform display color for logic waveforms can be set for each channel.

### **Logic Channel Settings List**

Input enable/disable and waveform display color for logic waveforms can be set for each channel. (⇒ p. 177)



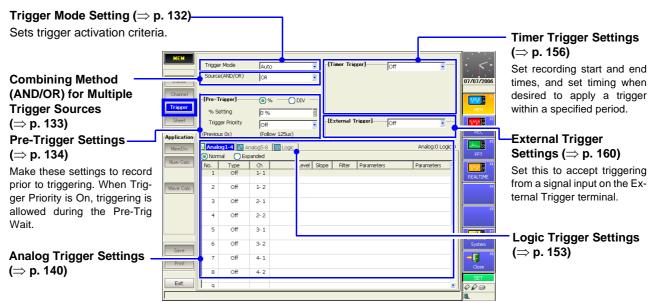
### 2.5.3 Trigger Settings Screen



#### Trigger

### (Memory Function)

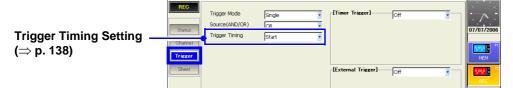
Set trigger criteria for the Memory Function.

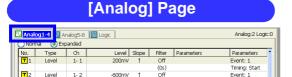


#### Trigger

#### (Recorder Function)

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



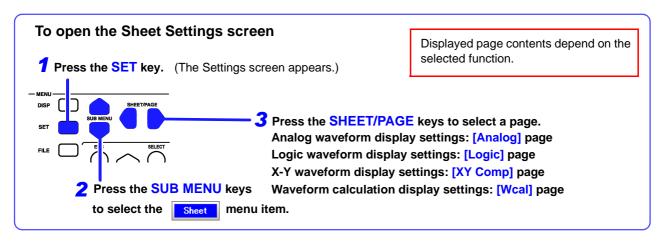


Set analog waveform triggers (⇒ p. 140).

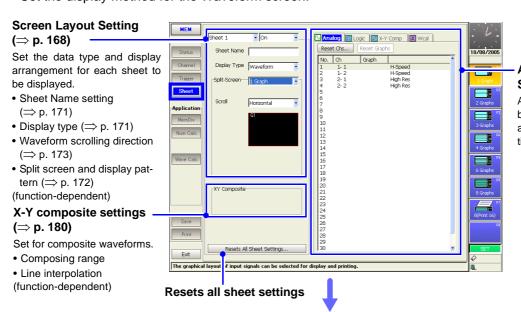
### 

Set logic waveform triggers (⇒ p. 153).

### 2.5.4 Sheet Settings Screen



Set the display method for the Waveform screen.



### Assigning Channels to Sheets (⇒ p. 168)

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

#### [Analog] Page



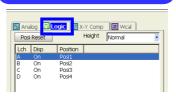
Assign analog channels and set graph arrangement for split-screen display (⇒ p. 174).





Assign display color of X-Y waveforms and set graph arrangement for split-screen display ( $\Rightarrow$  p. 180).

#### [Logic] Page



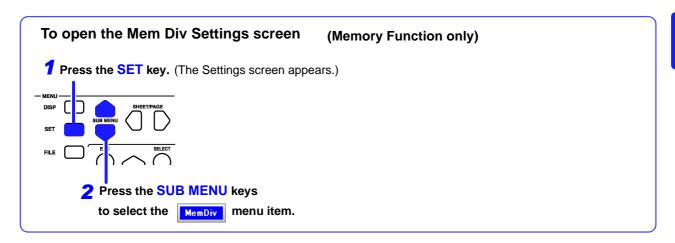
Assign logic channels and set display height and positions of waveform display ( $\Rightarrow$  p. 178).

### [Wcal] Page

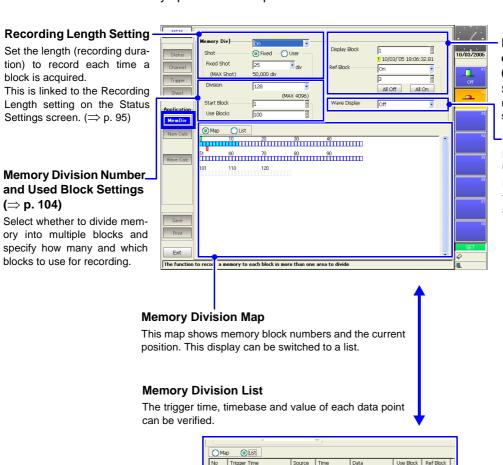


Arrange waveform calculation results and graphs for split-screen display. (Analysis Supplement)

### 2.5.5 Memory Division Settings Screen



Partitions internal memory space into multiple blocks.



# Display Block and Reference Block Settings (⇒ p. 105)

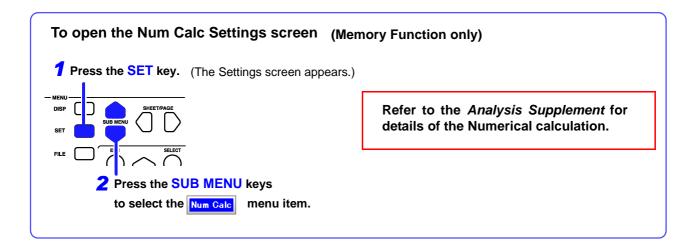
Select blocks for display and reference on the Waveform screen.

# Setting of Waveform Display of Every Block (⇒ p. 105)

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

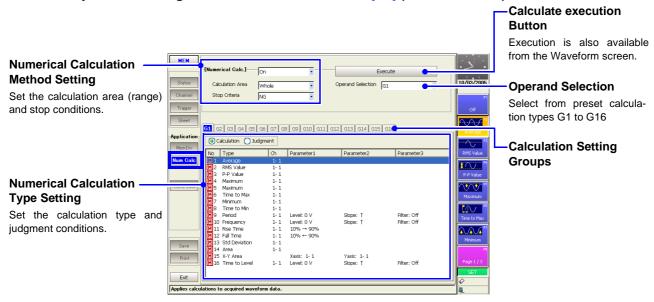


# 2.5.6 Numerical Calculation (Num Calc) Settings Screen

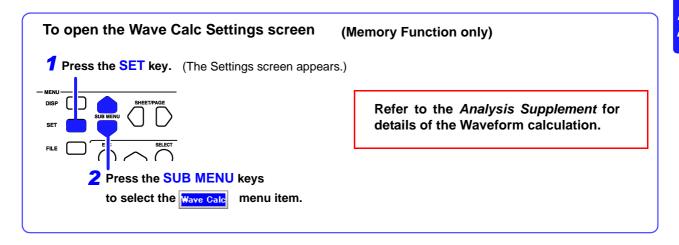


Set up numerical calculations using acquired waveform data. The calculation results are displayed on the Waveform screen.

The factory default setting for numerical calculations is [Off] (no calculations).

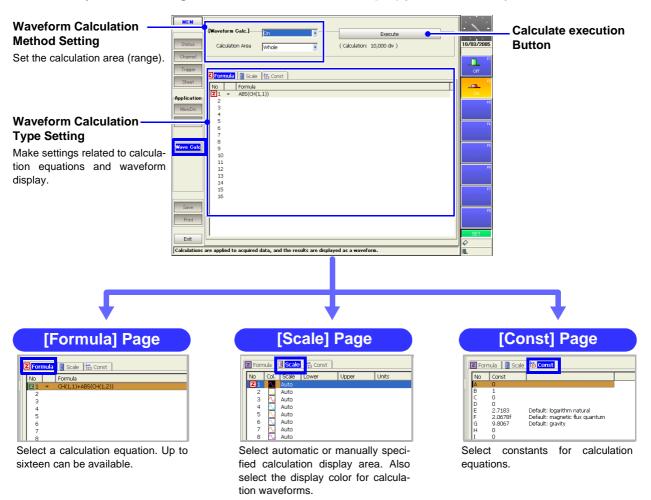


# 2.5.7 Waveform Calculation (Wave Calc) Settings Screen

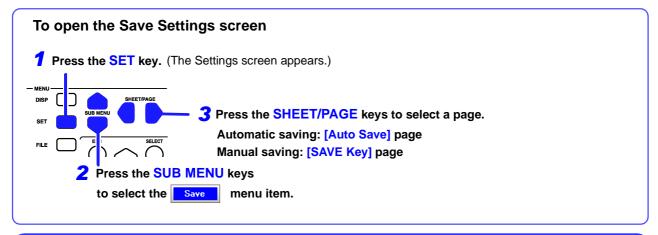


Set up waveform calculations using acquired waveform data. The calculation results are displayed on the Waveform screen.

The factory default setting for waveform calculations is [Off] (no calculations).



### 2.5.8 Save Settings Screen

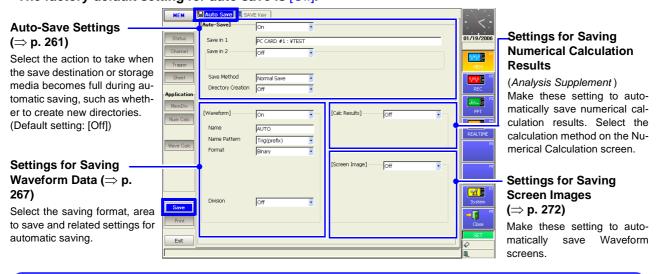


Save

### [Auto Save] Page

Make these settings to specify automatic saving.

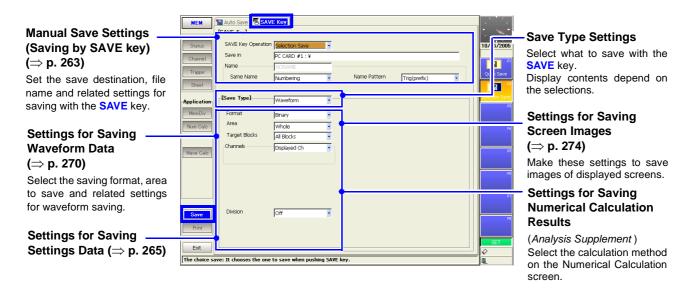
The factory default setting for auto save is [Off].



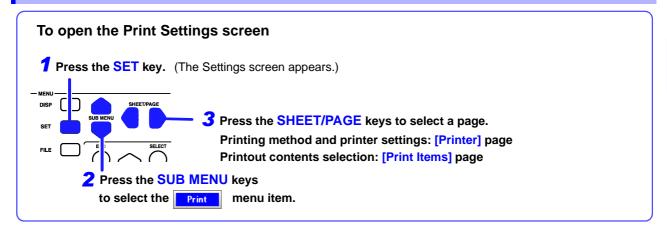
Save

### [SAVE Key] Page

These settings determine the operation of the SAVE key.



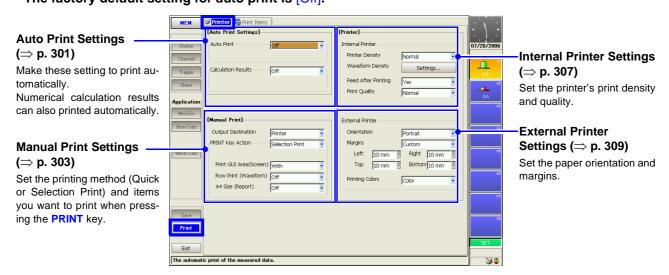
### 2.5.9 Print Settings Screen



#### Print

### [Printer] Page

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

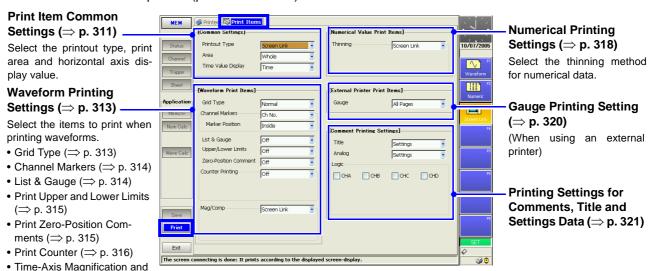


#### Print

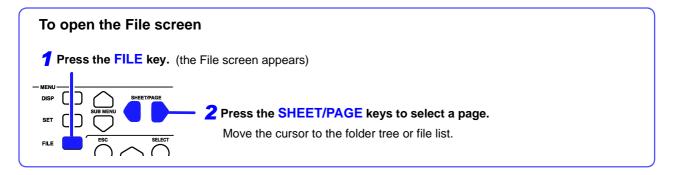
Compression (⇒ p. 317)

### [Print Items] Page

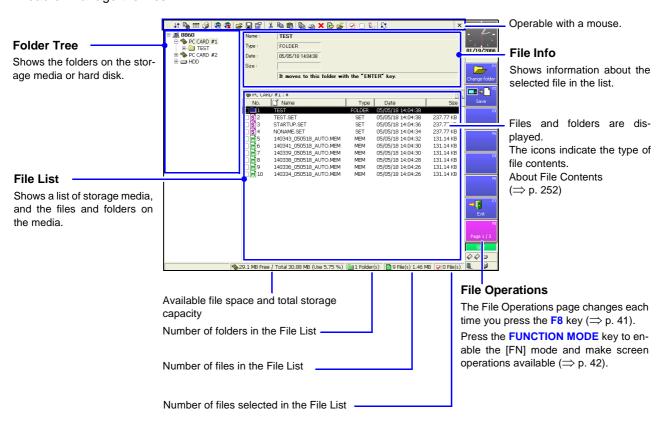
Select the items to be printed (printout contents).

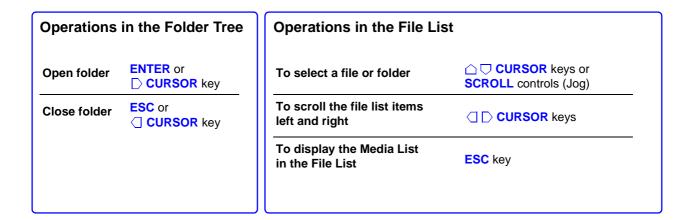


### 2.6 File Screen



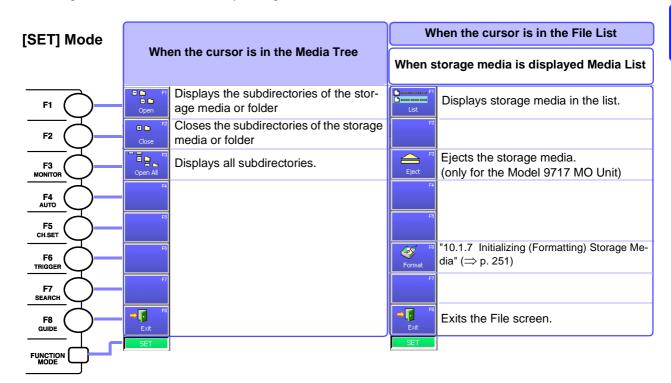
Load or manage the files.





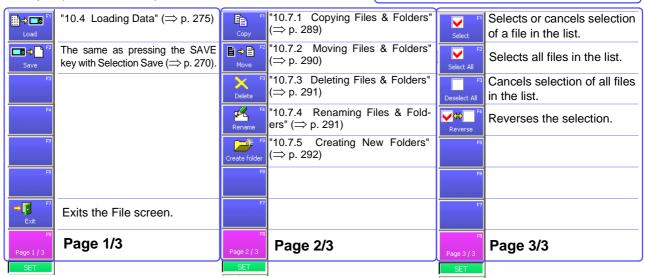
### **Function Modes and Settings**

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.



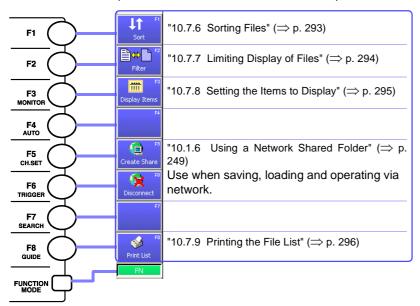
The File Operations page can be changed each time you press the F8 key.

### When files or folders are displayed



### [FN] Mode

(Common to the Folder Tree and File List)



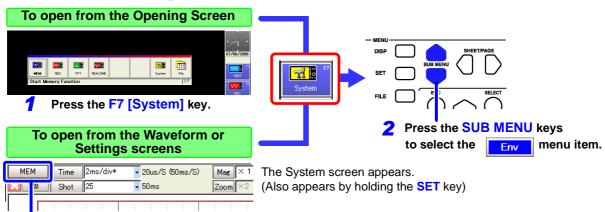
### 2.7 System Screen

### **Settings Menu List**

Settings Menu	Screen Name on This Instrument	Ref.	Description
Env	Environment (Env) Settings Screen	ı (⇒ p. 43)	Use this screen to configure the system environment, Waveform screen layout and operating key functions.
Comm	Communication (Comm) Settings Screen	(⇒ p. 44)	Make communication-related settings.
Ext Term	External Terminals (Ext Term) Settings Screen	(⇒ p. 46)	Set the external control terminals.
Setting	Setting Configuration (Setting) Screen	(⇒ p. 47)	Make settings to save or reload an instrument setting configuration, and to automatically reload settings at power on.
Init	Initialization (Init) Settings Screen	(⇒ p. 48)	Set the clock, initialize data, run self-checks and scanner module zero-adjust.
Config	Configuration (Config) List Screen	(⇒ p. 49)	Displays the instrument's system configuration. No settings are available here.

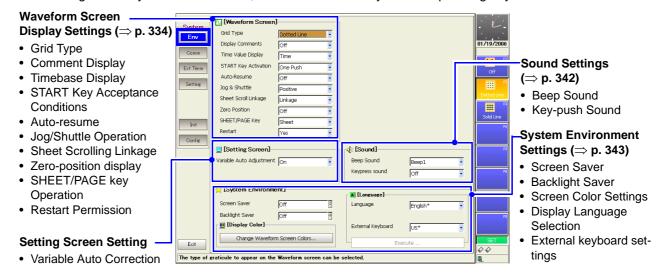
### 2.7.1 Environment (Env) Settings Screen

To open the Env Settings screen

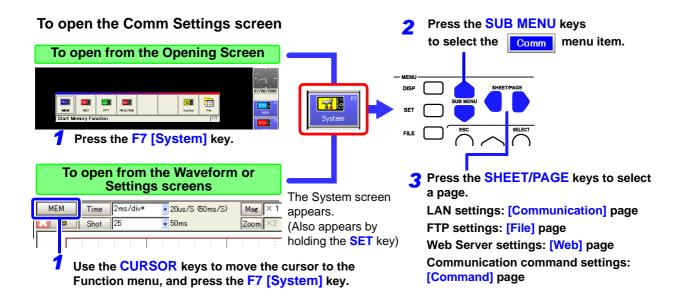


1 Use the CURSOR keys to move the cursor to the Function menu, and press the F7 [System] key.

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



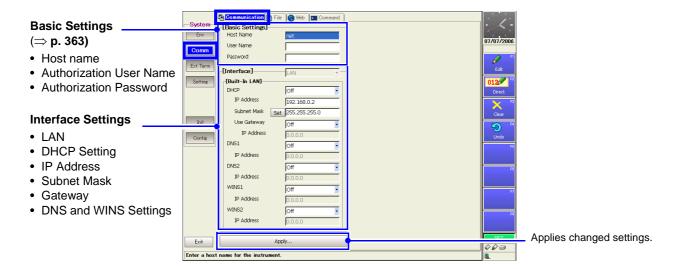
### 2.7.2 Communication (Comm) Settings Screen



Comm

### [Communication] Page

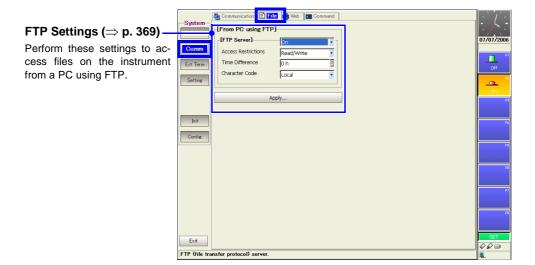
Configures the interface for communication with this instrument from a PC ( $\Rightarrow$  p. 362).



### Comm

### [File] Page

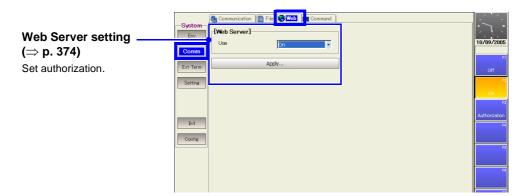
The FTP settings enable access to files on the instrument from a PC.



### Comm

### [Web] Page

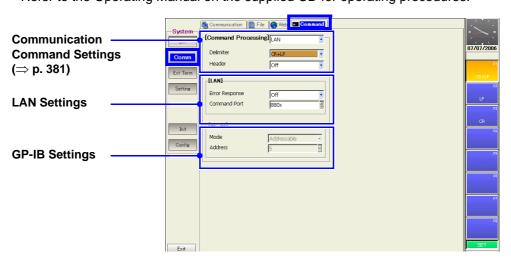
The Web Server settings enable control the instrument from a browser on a PC.



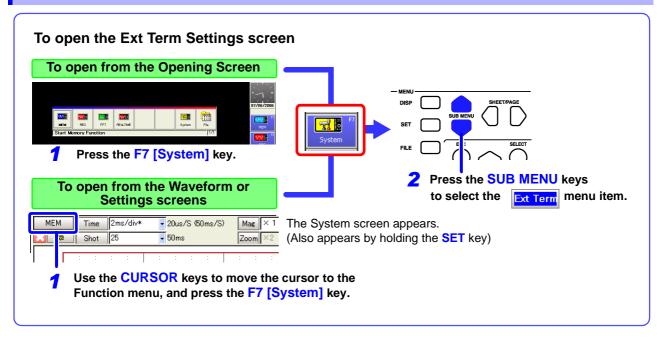
#### Comm

### [Command] Page

These settings enable communication with the instrument using command codes. Refer to the Operating Manual on the supplied CD for operating procedures.



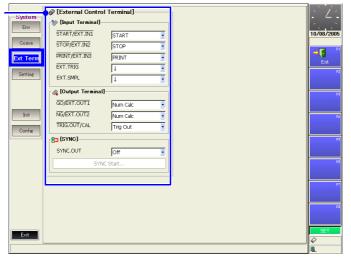
### 2.7.3 External Terminals (Ext Term) Settings Screen



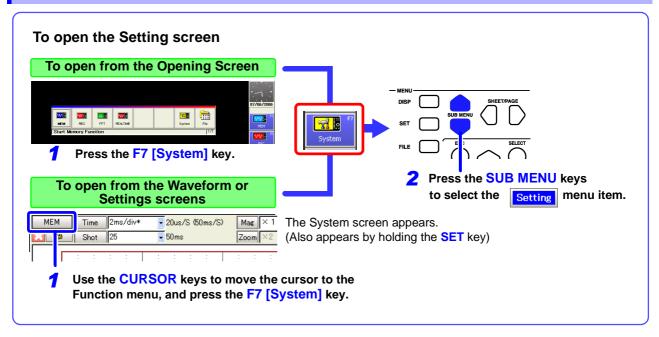
Set the external control terminals.

### External control terminals Settings (⇒ p. 387)

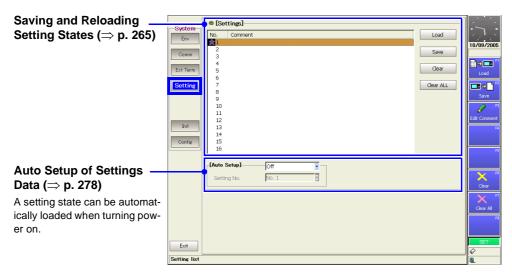
- · Input terminals
- · Output terminals



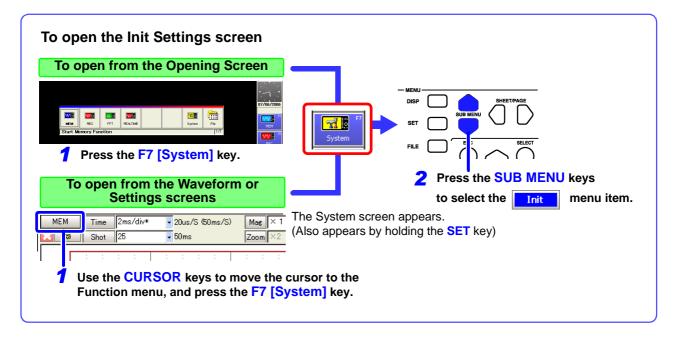
#### 2.7.4 **Setting Configuration (Setting) Screen**



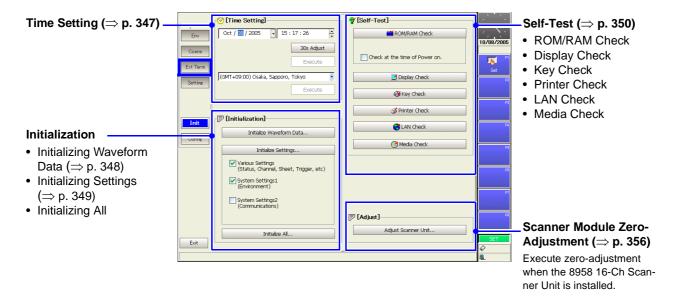
Instrument setting states can be internally saved (as "Settings Data"). Saved setting states can then be selected and reloaded.



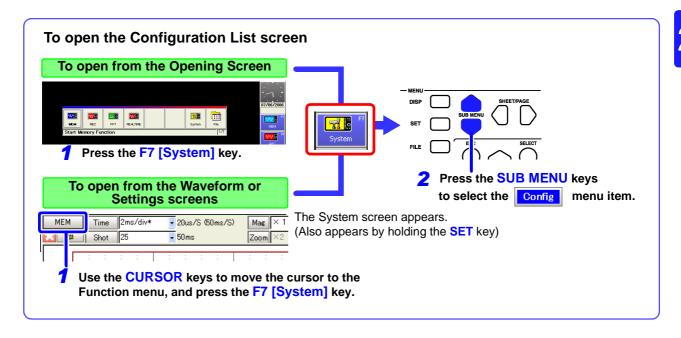
### 2.7.5 Initialization (Init) Settings Screen



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

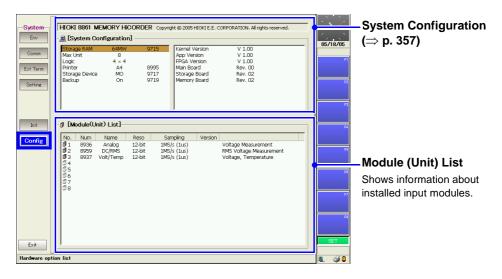


### 2.7.6 Configuration List (Config) Screen



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.



# **Operation Overview**

# **Chapter 3**

### 3.1 Measurement Workflow

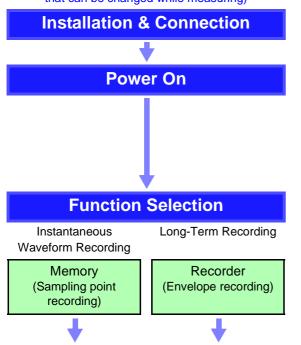
### 3.1.1 Analog Waveform Recording

Refer to "Appendix 2.1 List of Default Settings" (⇒ p. A8) 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" ( $\Rightarrow$  p. 55).

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 ( $\Rightarrow$  p. 356).

**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. 81)

#### Memory Function

Records relatively fast signals from µs to minutes

#### • Recorder Function

Record relatively slow signals at low speeds from ms to hours

#### • Real-Time Saving Function

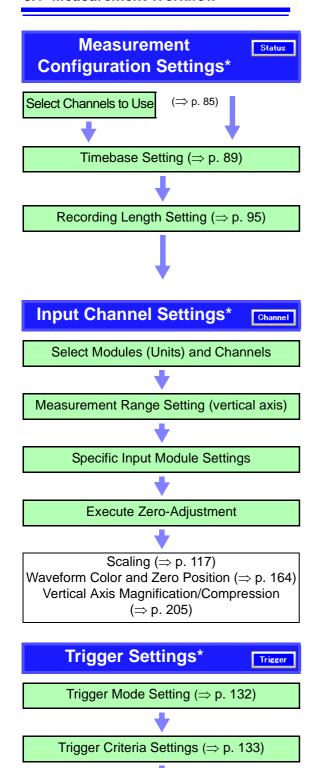
Long-term measurement data can be saved to storage media in real time ( $\Rightarrow$  p. 225).

#### 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 Supplement* for details of the FFT function)

#### 3.1 Measurement Workflow



(Memory)

**Pre-Trigger Settings** 

(⇒ p. 134)

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

#### See

- Memory capacity and recording time (⇒ p. A37)
- To measure with two sampling rates (⇒ p. 92)
- To use the Model 8958 16-Ch Scanner Unit together with other input modules (⇒ p. 94)
- If the input signal range is unknown (Auto setting) (⇒ p. 73) (Memory function only)

### **Practical Applications**

(Memory Function)

- To view waveforms while recording (Roll Mode) (⇒ p. 99)
- To view waveforms overlaid (⇒ p. 101)

### Set on the Channel Settings screen (⇒ p. 109).

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):
   "3.10.17 Executing Zero Adjustment" in the *Input Module Guide*
- To adjust input signal offset, such as for certain sensors (Offset Cancel): "3.10.18 Executing Offset Cancellation" in the Input Module Guide
- To display measurement values converted to physical units (Scaling Function) (⇒ p. 117)
- To optionally set the displayed waveform height on the vertical axis (Variable Function) (⇒ p. 208)

### Set on the Trigger Settings screen ( $\Rightarrow$ p. 129).

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

#### See

(Recorder)

Trigger Timing Set-

tings( $\Rightarrow$  p. 138)

Specific Trigger Settings (⇒ p. 129)

- To see the waveform prior to trigger occurrence (Pre-Trigger) (⇒ p. 134)
- To enable triggering based on an analog input signal (⇒ p. 140)
- To enable triggering based on a logic input signal (⇒ p. 153)
- To enable triggering based on external control terminal signal input (⇒ p. 160)
- To enable triggering at a specified time (Timer) (⇒ p. 156)
- To trigger manually (Manual Trigger) (⇒ p. 159)

# **Display Sheet Settings\*** Screen Layout Settings (⇒ p. 171) Split-Screen Number and Pattern Settings (⇒ p. 172) Displayed Channel Settings (⇒ p. 174) **Save Settings** Auto or Manual Save Settings Save Contents Setting **Print Settings** Auto or Manual Print Settings **Print Content Settings Start Measurement Data Acquisition** Save & Print (when Auto enabled)

### Set on the Sheet Settings screen (⇒ p. 168).

(Make these settings to change the Waveform screen layout)

#### See

- To optionally assign measurement data to Sheets (⇒ p. 169)
- To change Sheet names (⇒ p. 171)
- For X-Y composite measurements (⇒ p. 180)

#### Set on the Save Settings screen ( $\Rightarrow$ p. 243).

(Make these settings to save data)

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

#### Sec

• About saving methods (⇒ p. 252)

### Set on the Print Settings screen ( $\Rightarrow$ p. 297).

(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. 299)

Press the START key ( $\Rightarrow$  p. 75).

### Press the STOP key to stop ( $\Rightarrow$ p. 75).

Press twice to stop immediately.

If [Single] trigger mode is selected, recording stops automatically after acquiring the specified data length.

#### Analysis on the waveform screen ( $\Rightarrow$ p. 185).

#### See

(Memory Function)

- To calculate numerical values (Analysis Supplement)
- For X-Y composite (⇒ p. 180)
- To search waveform data (⇒ p. 215)
- To calculate waveform data (Analysis Supplement)
- To perform FFT calculation (Analysis Supplement)

### Data Analysis

**End of Measurement** 

Waveform Scrolling ( $\Rightarrow$  p. 186) Cursor Measurements ( $\Rightarrow$  p. 195) Magnification/Compression and Zoom ( $\Rightarrow$  p. 204)



**Optionally Save and Print** 

4

**Power Off** 

Press the SAVE key to save (Manual save).

Press the PRINT key to print (Manual print).

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 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. 51).

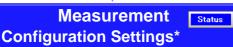
Procedure (asterisks (\*) indicate settings that can be changed while measuring)

Overview and references

# Installation & Connection **Power On**

Connect the logic probes.

See "2.6 Connecting Logic Probes" in the Input Module Guide



Set on the Status Settings screen.

Recording Length Setting (⇒ p. 95)

Timebase Setting (⇒ p. 89)

Set Channels to Use (⇒ p. 85)

Enable (turn on) the channels to use (With Memory function).

### **Input Channel** Settings\*

Set on the [Logic] page of the Channel Settings screen.

Set Waveform Display On/Off (⇒ p. 177)

Set waveform display for each channel probe on or off. (Default setting: Off)

Set Waveform Display Color (⇒ p. 177)

Set as occasion demands.

### Trigger Settings\*

Trigger

Trigger Mode Setting ( $\Rightarrow$  p. 132)

Set on the [Logic] page of the Trigger Settings screen (⇒ p. 129).

Trigger Criteria Settings (⇒ p. 133)

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

Logic Trigger Settings (⇒ p. 153)

### **Display Sheet Settings\***

Set on the [Logic] page of the Sheet Settings screen.

Set Display or Non-Display (⇒ p. 177)

Enable (set On) the channels to be displayed. (Default setting: On)

Set Display Positions (⇒ p. 178)

Set for each channel as occasion demands.

(Default settings: Position 1, 2, ... beginning with Lch A)

Set Display Height (vertically) (⇒ p. 179)

Set as occasion demands. (Default setting: Normal)

From here, proceed the same as for analog channels. Refer to "Save Settings" (⇒ p. 53).

### 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 ( $\Rightarrow$  p. 156) and when you need to know when a trigger was applied ( $\Rightarrow$  p. 336).

Set the clock if the time is incorrect.

See "12.3.1 Setting the Date and Time" (⇒ p. 347)

### **Factory Shipping and Default Settings**

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

```
See "12.3.2 Initializing Waveform Data" (⇒ p. 348)
"12.3.3 Initializing System Settings (System Reset)" (⇒ p. 349)
"Appendix 2.1 List of Default Settings" (⇒ p. A8)
```

To automatically save, print or calculate during measurement, you need to enable them as needed because the factory shipping default for these operations is disabled (Off).

### 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. 68)

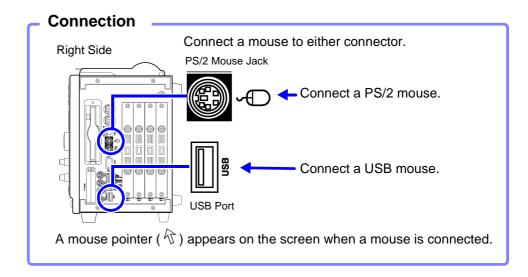
### **Compatible Mouse Types**

- USB Mouse
- PS/2 Mouse

### **Before Connecting to the Instrument**

NOTE

- Do not connect any device other than a mouse to the PS/2 mouse jack.
- To use a PS/2 mouse, connect it before turning power on. The mouse will not be recognized if connected after turning power on.
- Do not disconnect a PS/2 mouse from the instrument while power is on.
- Do not connect one mouse to the PS/2 jack and another to the USB port.
- 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.



### 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. 63)

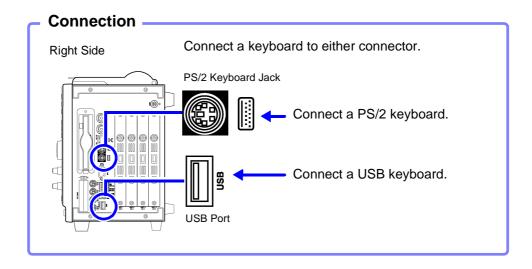
### **Compatible Keyboard Types**

- · USB Keyboard
- PS/2 Keyboard

#### **Before Connecting to the Instrument**



- Do not connect any device other than a keyboard to the PS/2 keyboard jack.
- Do not connect one keyboard to the PS/2 jack and another to the USB port. Use the keyboard only on an insulated surface.
- When used on a metal surface in some measurement environments, a commonly available keyboard can emit electrical noise that can interfere with instrument operation.



#### If the Model 9719 Memory Backup Unit is 3.2.4 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 (@25°C)		
метногу Сараску	8860	8861	
With Model 9715-03 Memory Board (Model 8860: 1 board, Model 8861: 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
<b>=</b>	Rapid charging
Û	Rapid charging finished



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 40°C. Charging outside of this range may result in insufficient charging, and battery capacity may be reduced or battery life shortened prematurely.

### 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  $\pm 10\%$  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.

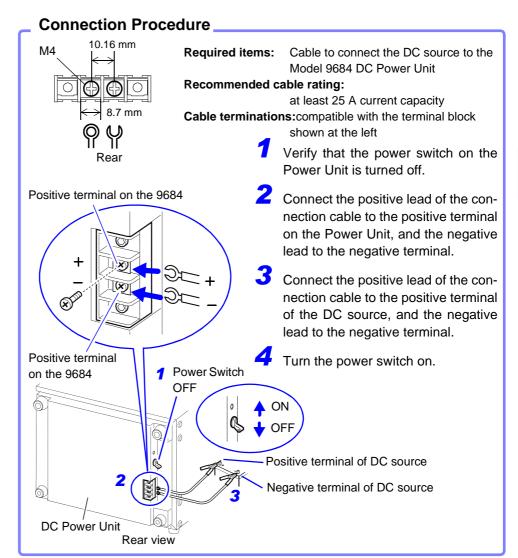
### **ACAUTION**

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

Accuracy is specified at 23±5°C 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	0 to 40°C (32 to 104°F), 20% to 85% RH (non-condensating)
Storage temperature and humidity	-10 to 50°C (14 to 122°F), 20% to 90% RH (non-condensating)
Operating environment	Compatible with Models 8860/8861
Withstand voltage	700 V DC for 1 min. (between input and output, and between input and instrument chassis) $$
Isolation voltage	$100~\text{M}\Omega$ or more @ 500 V DC (between input and output, and between input and instrument chassis)
Dimensions	Adds approx. 29 mm (D) (1.14"D) to dimensions of Models $8860/8861$
Mass	Adds approx. 1.25 kg (44.1 oz.) to the weight of Models $8860/8861$
Supported Models	Model 8860 Serial Nos. 051040422 and above Model 8861 Serial Nos. 051040432 and above



## 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

	88	60	8861		
	Model 8936	Model 8956	Model 8936	Model 8956	
	full installation	full installation	full installation	full installation	
Printer not printing (awaiting trigger state, etc.)	Approx. 5 h,	Approx. 5 h,	Approx. 3 h,	Approx. 3 h,	
	50 min	30 min	50 min	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	

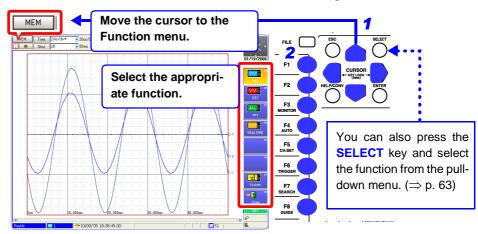
The above times are affected by battery age and state of charge, ambient temperature and other factors.

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**

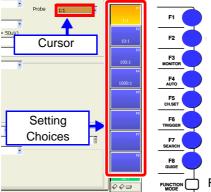
Use the **CURSOR** keys to move the cursor to the setting item, and select your choice from the F keys or pull-down menu.

Most of the procedures in this manual describe selection using the F keys.

#### Moving to a setting item



#### Selecting with the F keys



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

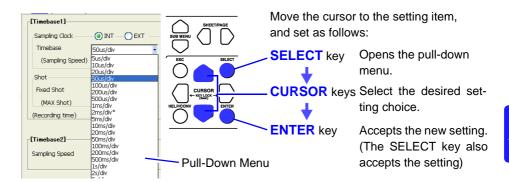
Select by pressing the corresponding F key (F1 to F8).

Additional choices are indicated by [Page \*/\*] appearing at **F8**.

Press the **F8** key to display the additional selections.

F Keys

#### Selecting from a pull-down menu



#### **Using a Mouse**

See "3.3.4 Mouse Operations" (⇒ p. 68)

#### When ▼ appears to the right of the setting item

- Click the mouse on the item to be set. A pull-down menu appears.
- 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)

- Double click on the item to be set.

  The virtual keyboard appears. (⇒ p. 64)
- 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. A45)

#### When ▼ appears to the right of the setting item

- 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)

- Use the cursor keys  $(\uparrow, \downarrow, \leftarrow$  and  $\rightarrow)$  on the keyboard to select the item to be set, and press the Space key.
  - The virtual keyboard appears. ( $\Rightarrow$  p. 64)
  - (When **F2** [Direct] is displayed in the setting choices, pressing **F2** on the keyboard enables direct entry using the keyboard)
- Direct entry from the keyboard corresponds to the virtual keyboard.

  After entering, press the Enter key to accept the entry.

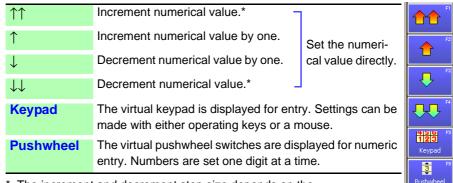
  (When using the buttons on the virtual keyboard, press the Space key)

## 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**

- 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.)
- Select an input method from the F key choices.



<sup>\*</sup> The increment and decrement step size depends on the particular setting item.

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

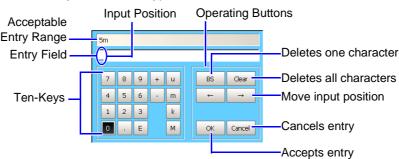
#### Entry by $[\uparrow\uparrow]$ , $[\downarrow\downarrow]$ , $[\uparrow]$ and $[\downarrow]$

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.

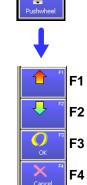
#### When the entry is complete

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  $\bigcirc \square$  CURSOR keys to move among digits, and press the  $\bigcirc \square$  CURSOR keys to set the numerical value.



- Operating Buttons

  Digits

  OK Accepts Entry

  Cancel Cancels Entry
- **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. 66)
Direct	You can enter text directly by connecting a keyboard. $(\Rightarrow$ p. 67)
Clear	Deletes entries.
Undo	Undoes the last operation.



## 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: + = [ ] \ / | : \* ? " < > ; ,
- · White space characters

#### When entering units and symbols

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

- Printing ("11.7 Print Examples" ( $\Rightarrow$  p. 323))  $^2 \rightarrow$  2,  $^3 \rightarrow$  3,  $^n \rightarrow$  n
- Saving (when saving numerical calculation results or in text format) ("10.6.1 Example of Saving Data" ( $\Rightarrow$  p. 282))  $^2 \rightarrow$  ^2,  $^3 \rightarrow$  ^3,  $^n \rightarrow$  ^n,  $\mu \rightarrow$  ~u,  $\Omega \rightarrow$  ~o,  $\epsilon \rightarrow$  ~e,  $^\circ \rightarrow$  ~c,  $\pm \rightarrow$  ~+,  $\mu \epsilon$  (display only)  $\rightarrow$  uE,  $^\circ C$  (display only)  $\rightarrow$  C

#### **Using [Edit] for Entry**

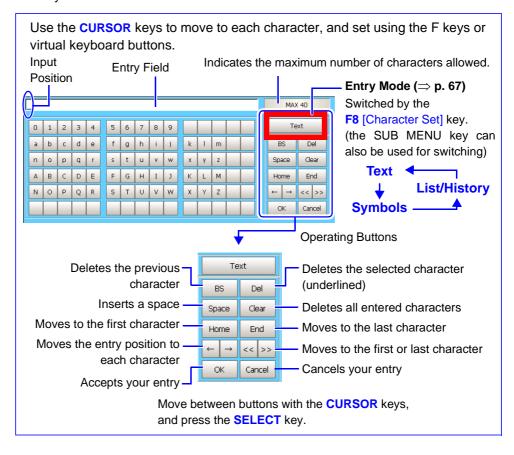
#### See "Comment Entry Example" (⇒ p. 114)

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.



- 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.

#### In case of an entry mistake

Delete the previous character.......F2 [BS](Backspace)

Delete all......F3 [Clear]

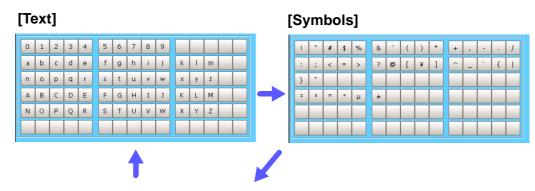
Move entry position ..........F4  $[\leftarrow]$ , F5  $[\rightarrow]$ 

#### When the entry is complete

The virtual keyboard disappears.

#### **Virtual Keyboard Entry Modes**

Parts of the display differ according to entry position.



#### [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)

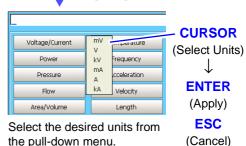


Voltage/Current

the pull-down menu.



(Example 3: Sheet Name Entry)



Temperature

#### **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.



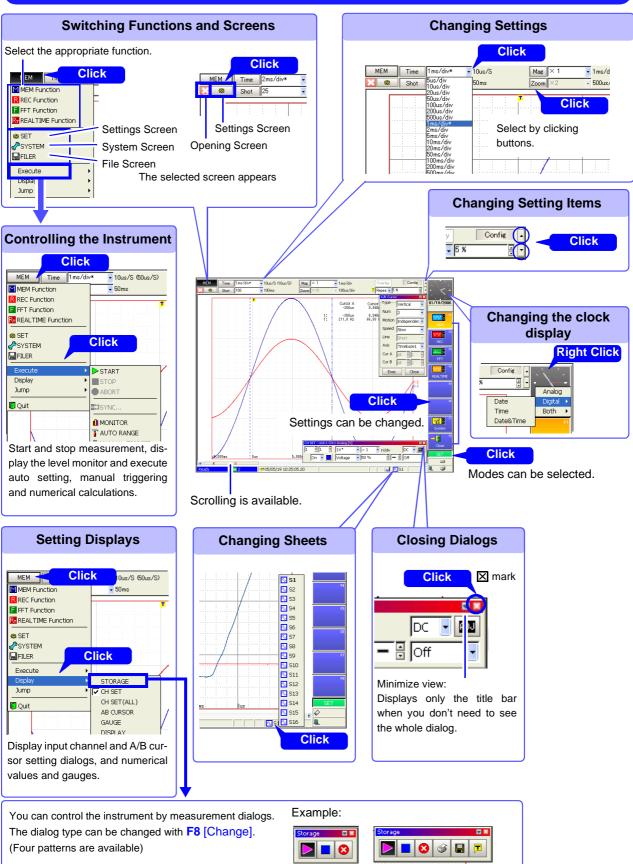
After entering, press the Enter key on the keyboard to accept.



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





Select the area to

#### **Operations on Waveform Data**



Right click at the point where you want to move the cursor, then se-

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

#### zoom Cursor A 20us Cursor B 11 22ms Click 300.00m) With zoom display enabled, clicking on a location causes it 200.00mV to appear zoomed in the lower half of the display. 0.00ml -200.00mV 300.00ml -400.00m\ -500.00m\

#### Changing display items

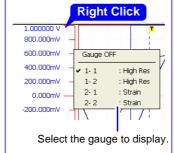
#### Right Click



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: "12.1 Making Waveform Screen Display Settings" (⇒ p. 334)

#### **Switching Gauges**



#### Changing time axis magnification Move A-Cursor 7.250mV 440.750mV Move B-Cursor

Time Value Display 🕨

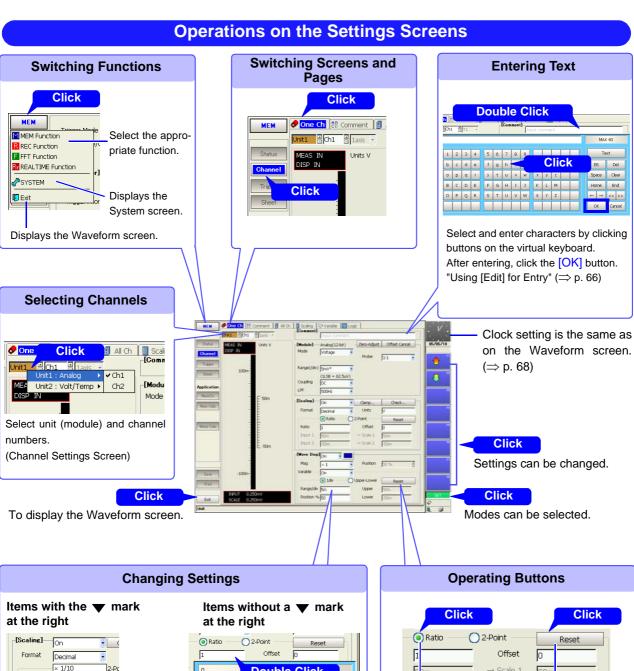
Display Comments

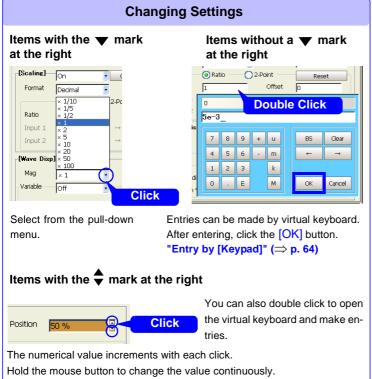
Grid Type

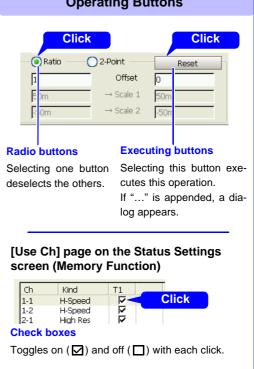
Whole

× 1/2

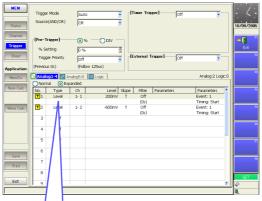
Zero Position × 1/5 Jump × 1/10 × 1/20 Dus × 1/50 × 1/100 **Right Click** Select a magnification ratio.

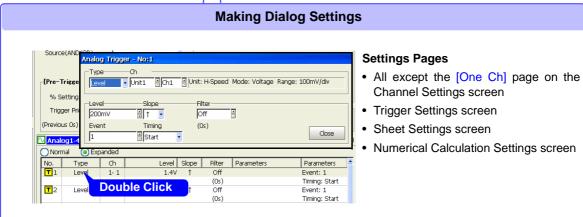


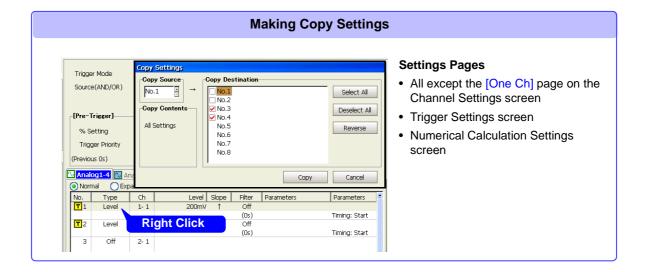




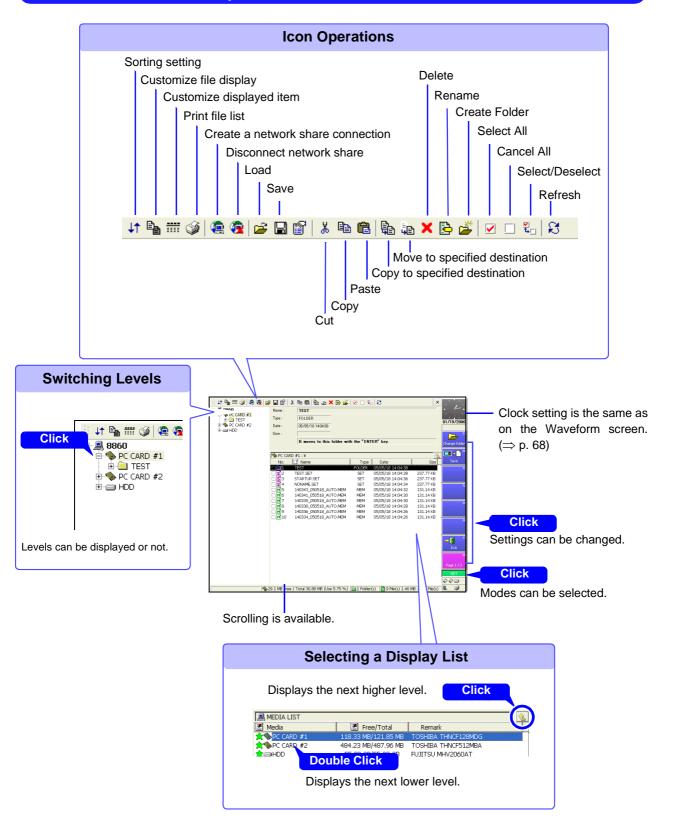
#### **Pages within the Settings Screen**







#### **Operations on the File Screen**



## **Automatic Range Setting (Auto-Ranging Func**tion)

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.

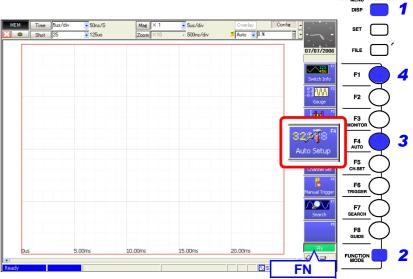
#### NOTE

#### 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.



- Press the **DISP** key to display the Waveform screen.
- Press the **FUNCTION MODE** key to enable the FN mode.
- Press the **F4** [Auto Setup] key. A confirmation dialog appears.
- 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 lowestnumber 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



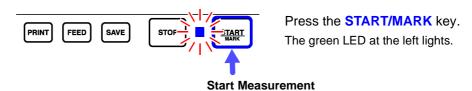
## If the "Auto-ranging failed" warning message appears when you attempt auto-ranging

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 ( $\Rightarrow$  p. 116).

# Chapter 3 Operation Overview

#### 3.3.6 **Starting and Stopping Measurement**

#### **Starting Measurement**



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. 76)

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 "12.2.1 Specifying Activation Conditions for the START Key" (⇒ p. 337)

#### **Stopping Measurement**



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.

#### **Measurement and Internal Operations**

Measurement methods are normal measurement (start recording when measurement starts) and trigger measurement (start recording when trigger criteria are satisfied).

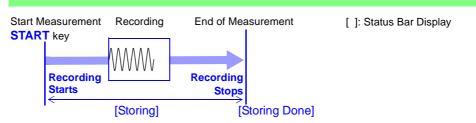
In this manual, "Measurement start" means the instant when you press the **START** key, and "Recording start" means the instant when recording begins on the waveform screen.

Trigger settings: "Chapter 6 Trigger Settings" (⇒ p. 129)

- Select the Trigger mode to record upon either single or repeating trigger events. (⇒ p. 132)
- Enable pre-triggering if you want to capture data measured prior to trigger events. (⇒ p. 134)

#### Normal Measurement

#### Without triggering

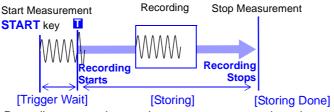


#### Trigger Measurement

#### Single triggering

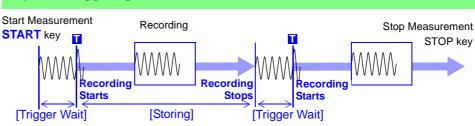
Repeated triggering

Trigger mode: [Single]
Pre-triggering not
enabled



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

# Trigger mode: [Repeat] Pre-triggering not enabled

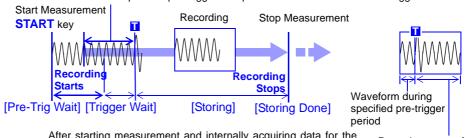


Recording starts when a trigger event occurs, continues for the specified recording length, and returns to the Trigger Wait state.

#### Repeated triggering and recording of phenomena before each event

The specified pre-trigger wait period is recorded before each trigger 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.

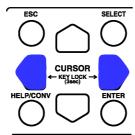
Post-trigger waveform

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  $\bigcirc$  CURSOR keys simultaneously for three seconds.

The key-lock state is enabled. ("Key Lock" is displayed at the upper right.)

#### Canceling

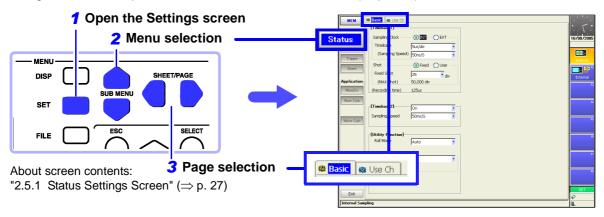
Again hold both  $\bigcirc \square$  CURSOR keys simultaneously for three seconds.

#### NOTE

- If the backlight has been turned off by the backlight saver function (⇒ p. 344), 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 ( $\Rightarrow$  p. 108).



#### Measurement Configuration Settings Available on the Status Setting Screen

#### Function Selection (⇒ p. 80)

- Memory Function
- Recorder Function
- Real-Time Saving Function (⇒ p. 225)
- FFT Function (Analysis Supplement)

#### **Memory Function**

#### **Measurement Configuration Settings**

- Timebase or Sampling Rate setting (⇒ p. 89)
- Recording Length setting (⇒ p. 95)

#### To measure using different sampling rates

 Timebase 1 and Timebase 2 sampling rate settings (⇒ p. 92)

## To control sampling by an external signal input

External Sampling setting (⇒ p. 394)

#### Set Channels to Use

- Setting the number of channel to use (⇒ p. 85)
- Setting different sampling rates (⇒ p. 93)
- Setting which channels to use (⇒ p. 85)

#### **Utility Function Settings**

- View waveforms while acquiring data (Roll Mode) (⇒ p. 99)
- Waveform Overlay (⇒ p. 101)
- Record by memory divisions (⇒ p. 103) (set on the Memory Division Setting screen)

#### **Recorder Function**

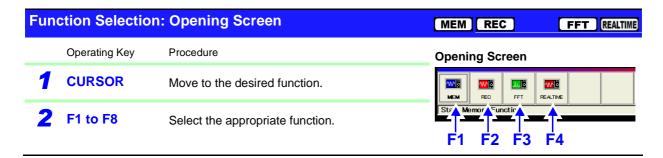
#### **Measurement Configuration Settings**

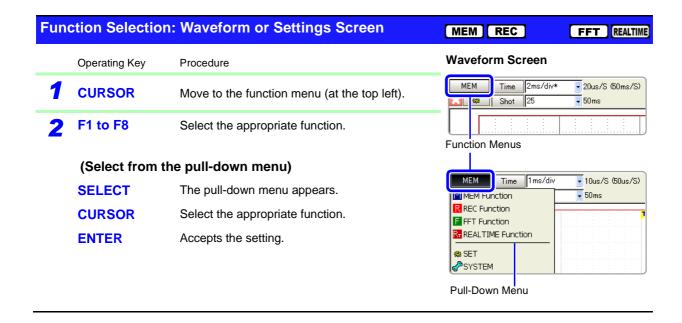
- Timebase setting (⇒ p. 89)
- Sampling Rate setting (⇒ p. 89)
- Recording Length setting (⇒ p. 95)

## 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

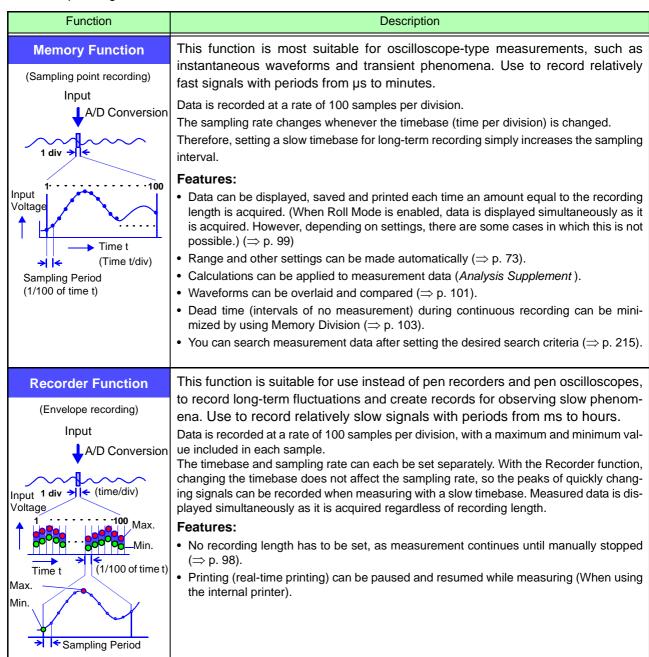
**See** "Choosing the Appropriate Function" (⇒ p. 81)



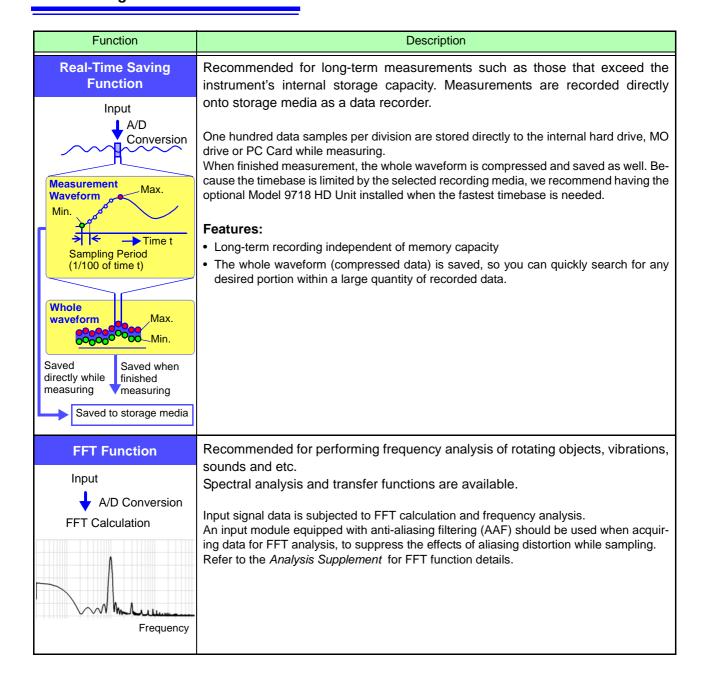


#### **Choosing the Appropriate Function**

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



#### 4.1 Selecting the Function

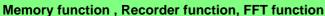


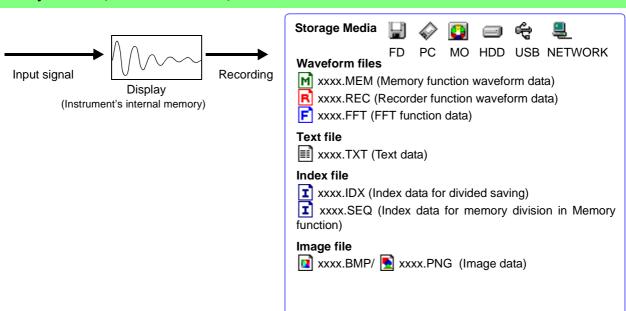
## **Function Comparison Table**

●: Available, –: Not available

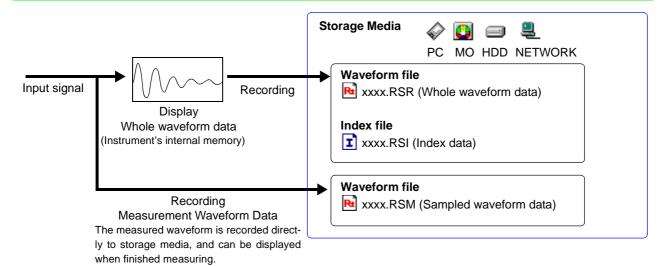
Items	Function					
items	MEM	REC	REALTIME	FFT		
Timebase	5 μs/div to 5 min/div Sampling rate: 1/100 of the timebase Two simultaneous sampling rates are available (⇒ p. 92)	10 ms/div to 1 hour/div Sampling rate: 100 ns to 1 s Select a period that is 1/100 of the timebase or less	100 μs/div to 5 min/div (Limited by the save desti- nation and number of chan- nels used)	-		
Auto Setup	● (⇒ p. 73)	_	_	_		
Continuous Recording	(Reports can be issued re- peatedly after each speci- fied recording length)	● (⇒ p. 98)	● (⇒ p. 225)	-		
Overlay	● (⇒ p. 101)	_	_			
X-Y Waveforms	(possible during and after measurement) (⇒ p. 180)	_	(Available after measuring with the Memory function)	-		
Numerical Calculations	(Analysis Supplement)	_	(Available after measuring with the Memory function)	-		
Waveform Calculations	(Analysis Supplement)	-	(Available after measuring with the Memory function)	● (Analysis Supplement)		
Memory Division	● (⇒ p. 103)	_	-	-		

#### **Function-Related Recording Capabilities**





#### **Real-Time Saving Function**



# 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. 108).

Choices of setting items are function-dependent.

Refer to the Analysis 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. 225) 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" ( $\Rightarrow$  p. 93)



#### 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"  $(\Rightarrow p. 88)$ 

• 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).

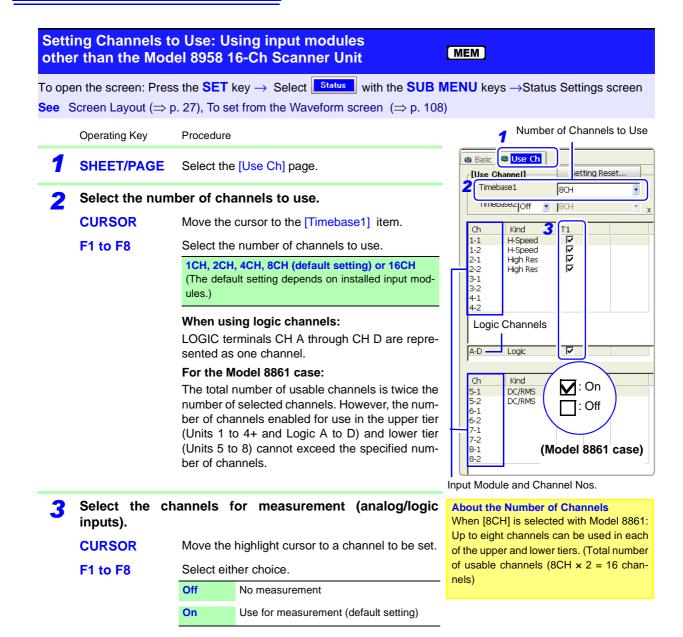
See "Setting Timebase 1 and 2: When using the Model 8958 16-Ch Scanner Unit together with other input modules" (⇒ p. 94)



#### When measuring using external sampling

Only Timebase 1 can be set for such channels.

See "14.2.3 External Sampling (EXT.SMPL)" (⇒ p. 394)



### 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.

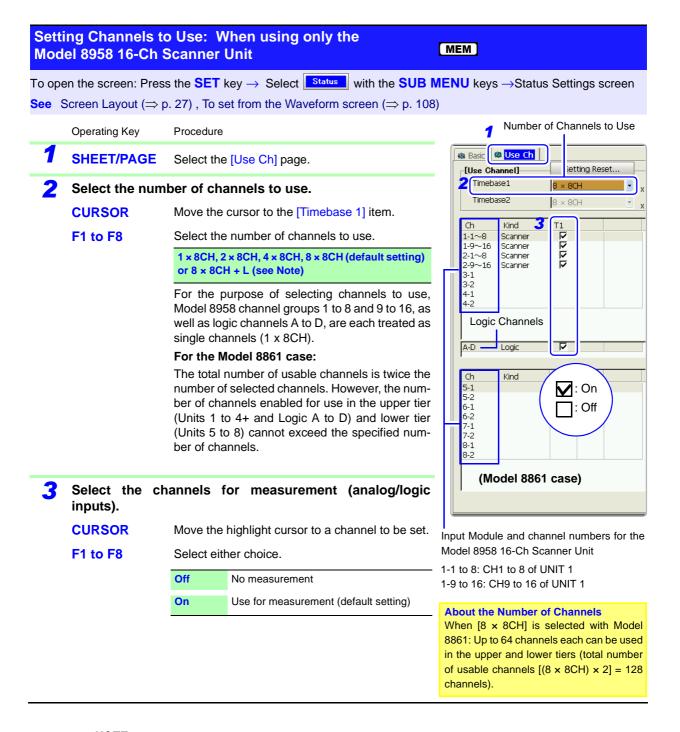
No. of	Chs to Use	Used Chann	Max. Rec.	
INO. OI	Clis to Ose	Model 8946 4-Ch Analog Units	Logic channels	Length*
8860	16 Chs	All four Units [On]	[On]	10,000
8861	16 Chs x 2	All eight Units [On]	[On]	10,000

<sup>\*</sup> Model 8860: 32 MWords, Model 8861: 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].



## 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  $[8 \times 8CH + L]$  to use the maximum number of Model 8958 16-Ch Scanner Unit channels (four 8958s in the Model 8860, or eight in the 8861). 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" ( $\Rightarrow$  p. A49).

#### **Memory Function case:**

- 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 1/100<sup>th</sup> 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. 73)

 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. 92)

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. 94)

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. 88)

 Setting the sampling period according to an external signal: (External Sampling)

See"14.2.3 External Sampling (EXT.SMPL)" (⇒ p. 394)

#### **Recorder Function case:**

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 time-base setting.

See "Appendix 4.4 Recorder Function Values" (⇒ p. A51)

#### **Real-Time Saving Function case:**

- 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 1/100<sup>th</sup> 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. 232)

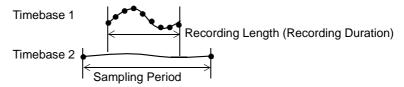
#### 4.2 Setting Measurement Configuration (Status Settings Screen)

## NOTE

The data refresh rate is not allowed to exceed the maximum sampling rate of the input module.

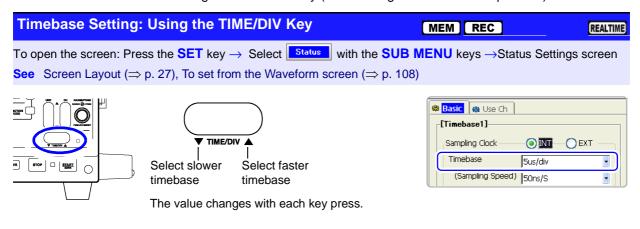
Example: Using an input module with maximum sampling rate of 1 MS/s (up to 1M samples per second). 1 MS/s = 1  $\mu$ s/S (1  $\mu$ s sampling period)

When the [Sampling Speed] is set to [50 ns/S], data is refreshed once each  $\mu$ s. The maximum sampling rate of the input module being used can be verified on the Config (Configuration) screen ("12.3.6 System Configuration List" ( $\Rightarrow$  p. 357)). 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)

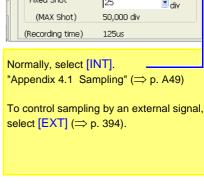


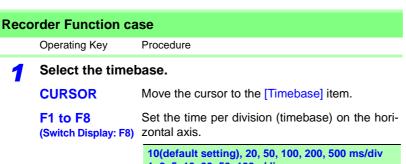
#### Timebase and Sampling Rate Settings: Using the MEM REC **Operating Keys** To open the screen: Press the SET key → Select Status with the SUB MENU keys →Status Settings screen **See** Screen Layout ( $\Rightarrow$ p. 27), To set from the Waveform screen ( $\Rightarrow$ p. 108) **Memory Function case:** Operating Key Procedure **®** Basic 🐉 Use Ch SHEET/PAGE Select the [Basic] page. [Timebase1] 2 Sampling Clock NII Select the sampling clock. Timebase 5us/div (Sampling Speed) |50ns/S **CURSOR** Move the cursor to the [Sampling Clock] item. Shot Fixed User **F1** Select [INT] (Internal). (default setting) Fixed Shot 25 div (MAX Shot) 50,000 div Select the timebase.

Move the cursor to the [Timebase] item.

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

Set the time per division (timebase) on the hori-









Set the sampling rate.

**CURSOR** 

F1 to F8

**CURSOR** Move the cursor to the [Sampling Speed] item.

F1 to F8 Set the sampling rate. (Switch Display: F8) The range of choices

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. A51)

#### **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 → x1/2, 20 ms/div → x1/5, 10 ms/div → x1/10
- 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 lowpass filter (⇒ p. 111).

See"Appendix 4.4 Recorder Function Values" (⇒ p. A51)

## 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. 93).
- 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. 94).

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  $\rightarrow$  Select sign with the **SUB MENU** keys  $\rightarrow$ Status Settings screen See Screen Layout ( $\Rightarrow$  p. 27), To set from the Waveform screen ( $\Rightarrow$  p. 108)

1 SHEET/PAGE Select the [Use Ch] page.

Procedure

Operating Key

#### 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 num-

bers of channels for Timebase 1 and Timebase 2.

F1 to F8 Select the number of channels to use.

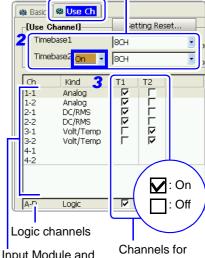
1CH, 2CH, 4CH, 8CH, 16CH (Only Timebase 1 can be set to 16CH)

#### When using logic channels:

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

For the Model 8861 case ( $\Rightarrow$  p. 86):

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.



Input Module and Channel Nos.

Channels for measurement

No. of channels to use

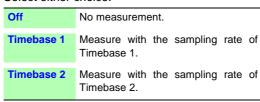
#### **About the Number of Channels**

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



- SHEET/PAGE Select the [Basic] page.
- Set the Timebase 1 (or sampling rate).

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

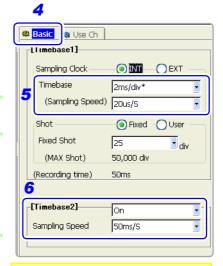
**F1 to F8** About setting ranges: "Timebase Setting: Using (Switch Display: F8) the TIME/DIV Key" (⇒ p. 90)

Set the Timebase 2 sampling rate.

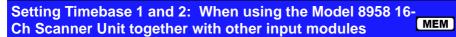
CURSOR Move the cursor to the [Sampling Speed] item of [Timebase 2].

F1 to F8 Set the sampling rate. The sampling rate cannot

(Switch Display: F8) be set faster than that of Timebase 1.



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



To open the screen: Press the **SET** key  $\rightarrow$  Select sites with the **SUB MENU** keys  $\rightarrow$ Status Settings screen **See** Screen Layout( $\Rightarrow$  p. 27), To set from the Waveform screen ( $\Rightarrow$  p. 108)

Operating Key Procedure

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

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 x 8CH, 2 x 8CH, 4 x 8CH, 8 x 8CH (default setting)

Ch 1 to 8 and Ch 9 to 16 groups are each represented as one channel [1x 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.

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

Set the Timebase 1 (or sampling rate).

**CURSOR** Move the cursor to the [Timebase] or [Sampling

Speed] item.

F1 to F8 About setting ranges: "Timebase Setting: Using (Switch Display: F8) the TIME/DIV Key" (⇒ p. 90)

Set the Timebase 2 sampling rate.

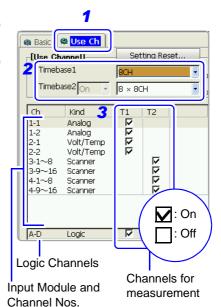
CURSOR Move the cursor to the Timebase 2 [Sampling

Speed] item.

F1 to F8 Set the sampling rate.

(Switch Display: F8) The sampling rate cannot be set faster than that

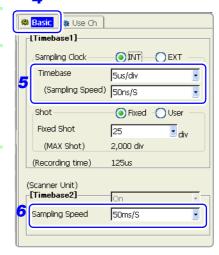
of Timebase 1.



## **About the Number of Channels**For the Model 8861 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 ( $\Rightarrow$  p. 88).

When [8CH] (Timebase 1) / [8  $\times$  8CH] (Timebase 2) is selected with the Model 8861: 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. 95).
- Set arbitrary recording length [User]: set an arbitrary recording length in units of divisions (⇒ p. 97).
- Continuous [Cont]: records continuously (Recorder Function only) (⇒ p. 98).

#### **Recording Length and Data Samples**

Memory 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)  $\times$  100 + 1.

Recorder 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. A51)



#### 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. 108)



#### Description

## Setting Range of Recording Length (Memory Function)

25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000, 200000, 500000, 1000000, 2000000, 10000000

The setting range depends on the capacity of installed memory and the number of channels enabled for use.

#### Maximum Recording Length

[Divisions]

	Memory ords)	No. of Chs Used				
0000		16	8	4	2	1
8860	8861	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.

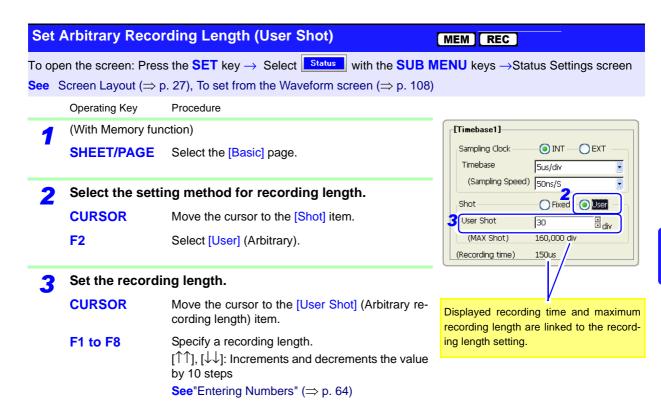
#### Maximum Recording Length

[Divisions]

		-		
Installed Memory (Words)		Other than the Model 8958 16-Ch	Model 8958 16-Ch Scanner Unit	
8860	8861	Scanner Unit		
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. A37) "Appendix 2.3 Timebase and Maximum Recordable Time" (⇒ p. A32)

#### 4.2 Setting Measurement Configuration (Status Settings Screen)



#### **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]

	Memory ords)	No. of Chs Used				
9960		16	8	4	2	1
8860	8861	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)

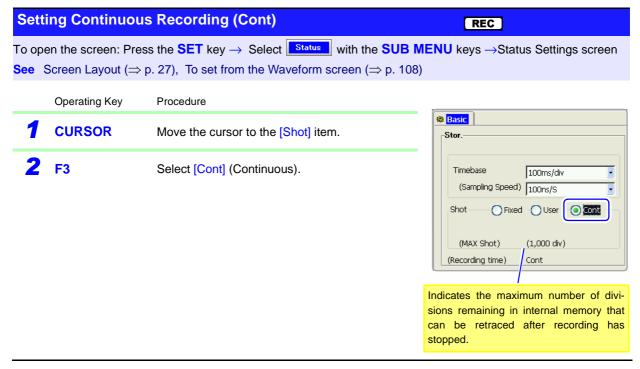
The setting range depends on the capacity of installed memory.

Maximum Recording Length

[Divisions]

maximi		ing Longin		
Installed Memory (Words)		Other than the Model 8958 16-Ch	Model 8958 16-Ch Scanner Unit	
8860	8861	Scanner Unit		
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. A37) "Appendix 2.3 Timebase and Maximum Recordable Time" (⇒ p. A32)



See "Appendix 2.4 Memory Capacity and Maximum Recording Length" (⇒ p. A37) "Appendix 2.3 Timebase and Maximum Recordable Time" (⇒ p. A32)

#### 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 (\$\Rightarrow\$ p. 301)) is [On]. Of course printing can still be performed manually after finished measuring (\$\Rightarrow\$ p. 303).
   Up to 5,000 divisions of data can be internally recorded by the instrument (with the Model 9715 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) ( $\Rightarrow$  p. 336)

#### 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. Select from the [Utility Function] setting column on the Status Settings screen. Make these settings before measuring.

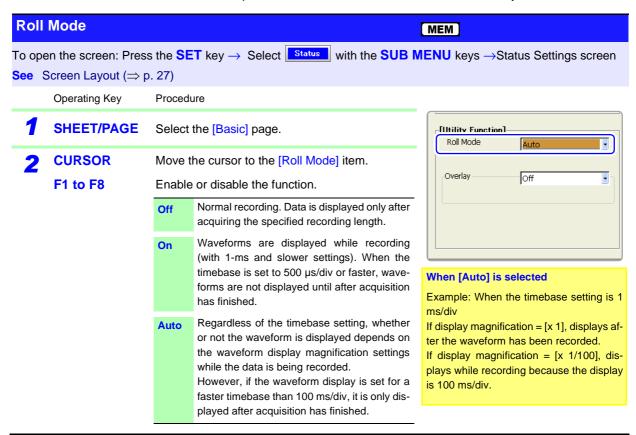
Operating Function	Utility Function		Ref.
Memory Function	Roll Mode *1	Displays a waveform as its data is being acquired	(⇒ p. 99)
	Overlay *1	Retains displayed waveforms on-screen by overlaying with the new waveform.	(⇒ p. 101)
	Memory Division *2	Memory space can be divided into multiple blocks for recording waveforms.	(⇒ p. 103)

- \*1. Set in the [Utility Function] setting column on the Status Settings screen.
- \*2. Set on the Memory Division (Mem Div) 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.



#### 4.3 Acquiring Waveforms Using the Utility Functions

#### **Description**

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

- The Roll Mode and Overlay (⇒ p. 101) functions cannot both be enabled at the same time. When the Roll Mode is enabled, the Overlay function is automatically set [Off]. And setting Overlay [On] automatically turns the Roll Mode [Off].
- When Auto Print (⇒ p. 301) 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

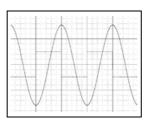
This applies to the Memory function only.

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])

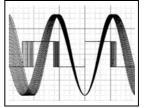
Methods are available to automatically overlay waveforms while measuring, and to overlay waveforms manually without limit.

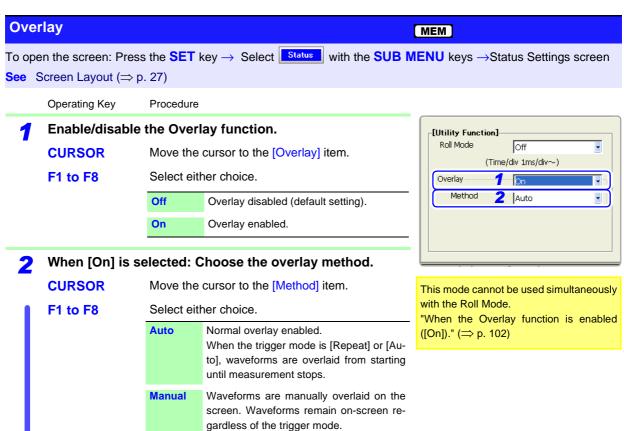
#### **Normal Display**

### Waveforms with the Overlay Function



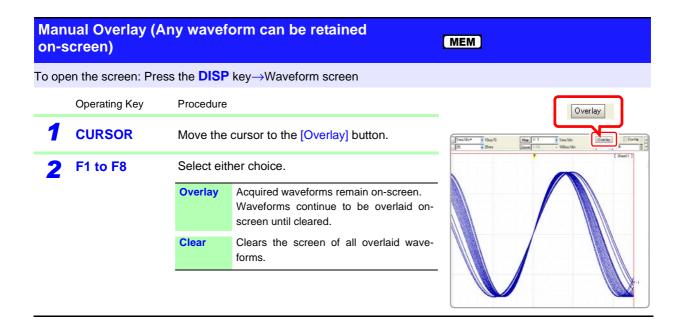






**Measurement (Waveform Acquisition)** 

When [Manual] is selected: to overlay manually ( $\Rightarrow$  p. 102)



#### **Description** When the Overlay

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

- The Roll Mode (⇒ p. 99) and Overlay (⇒ p. 101) functions cannot both be enabled at the same time. When the Roll Mode is enabled ([On] or [Auto]), the Overlay function is automatically set [Off].
  - And setting Overlay [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])

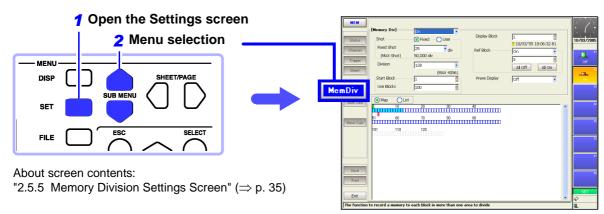
In the following cases, overlaid waveforms are displayed in different formats.

- 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 Dividing Memory

Settings are made on the Memory Division Settings screen. Blocks to be displayed can also be selected on the Waveform screen ( $\Rightarrow$  p. 213).

This applies to the Memory function only.



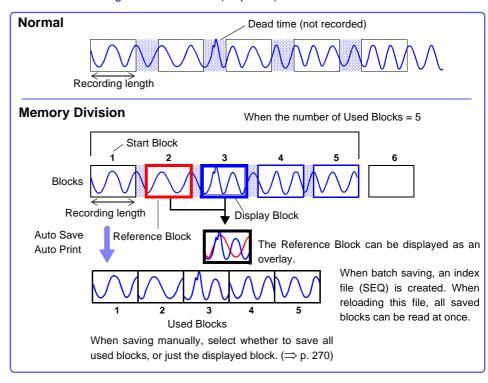
Waveforms can be recorded into individual blocks by dividing memory space into multiple blocks. You can record waveforms beginning at any block (Start Block), choose which blocks to display (Display Block), or display multiple overlaid blocks (Reference Block).

The maximum number of blocks for memory division depends on the installed memory board and recording length (up to 4096 divisions).

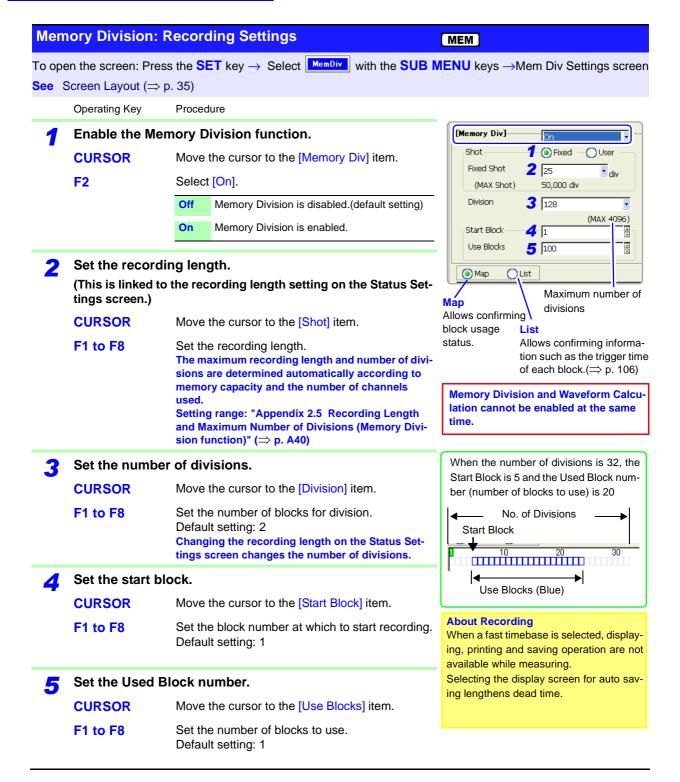
In addition, triggered waveform data can be acquired continuously and recorded sequentially in specified blocks (at the Start Block, for the specified Used Blocks). Dead time while displaying or printing (during which triggers are ignored) can be minimized.

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. 212)



#### 4.3 Acquiring Waveforms Using the Utility Functions



#### 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. 213))

#### To display overlaid waveforms:

Set the number of blocks for reference. ( $\Rightarrow$  p. 105)

#### **Memory Division: Display Settings**

MEM

Display Block

To open the screen: Press the **SET** key  $\rightarrow$  Select MemDiv with the **SUB MENU** keys  $\rightarrow$ Mem Div Settings screen **See** Screen Layout ( $\Rightarrow$  p. 35), To set from the Waveform screen ( $\Rightarrow$  p. 213)

Operating Key Procedure

#### To display any block on the Waveform screen

#### Set the display blocks

(This can also be set on the Waveform screen.(⇒ p. 213))

**CURSOR** Move the cursor to the [Display Block].

F1 to F8 Set the number of blocks to display on the Wave-

form screen after measurement.

#### 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 Refer-

ence 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] but-

ton.

All Off
Disables all block references.

All On
Enables all block references.

### **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

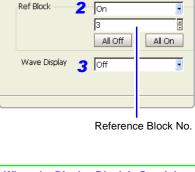
The waveform of the specified Display Block is displayed after recording the specified number of Used Blocks. (default setting)

On

Waveforms are displayed one block at a time as they are acquired at each trigger event.

#### Viewing Memory Division waveforms on the Waveform screen

See "8.12 Viewing Waveforms in Every Display Block (Memory Division)" (⇒ p. 213)



T 10/03/'05 11:50:42.49



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. 106)

## **Enabling the Trace Waveform display lengthens dead time.**

#### About Dead Time:

See: "Difference Between Dead Times During Normal and Memory Division Recording" (⇒ p. 106)

#### When Using Auto Save

When disabled, displayed images are not saved.

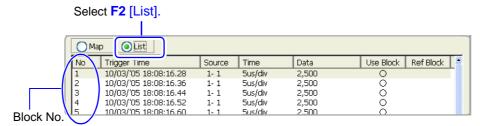
Even if the Roll Mode is enabled (other than Off), it is not usable when the Trace Waveform display is disabled.

#### 4.3 Acquiring Waveforms Using the Utility Functions



#### **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.

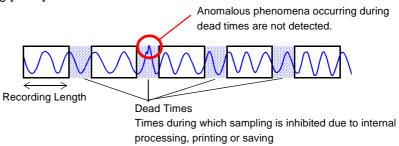
In the default state, the **SHEET/PAGE** keys switch Display Sheets. You can change the function of the **SHEET/PAGE** keys to [Block Switching] on the System - Environment Setting Screen.

See "12.2.5 Specifying SHEET/PAGE Key Operations" (⇒ p. 340)

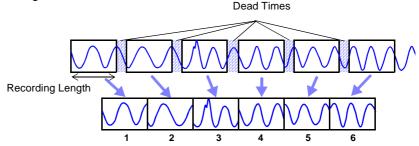
#### **Description**

# 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]



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.
- 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.

- Timebase and recording length of the Status Settings screen
- Time axis display magnification
- Waveform zoom
- Trigger criteria
   ("6.12 Making Trigger Settings on the Waveform Screen" (⇒ p. 161))

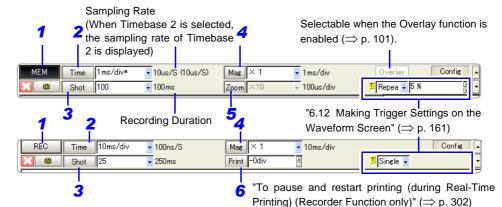
Setting choices depend on the operating function. Refer to each setting on the Status Setting screen for details of setting choices.

Also refer to "Chapter 9 Measuring with Real-Time Saving" ( $\Rightarrow$  p. 225) for details about the function.

Refer to the Analysis 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 ( $\Rightarrow$  p. 21).



**Memory Function** 

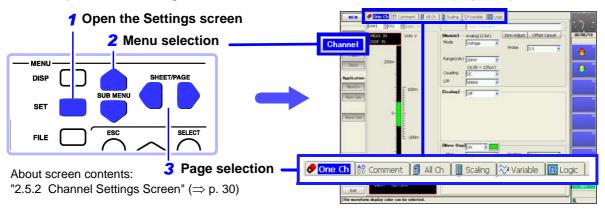
**Recorder Function** 

	Setting Items		Description	Selection Choices	
1	Function			Memory Function	Recorder Function
2	Time (Timehaaa)	(Button)	Selects the sampling clock.	Internal (INT) or External (EXT)	(cannot be selected)
_	(Timebase) (⇒ p. 89)	(Setting column)	Sets the input signal acquisition rate. The setting value is time per division.	(⇒ p. 90)	(⇒ p. 90)
3	Shot (Recording	(Button)	Specifies the recording length setting method.	Fixed or User	Fixed, User, or Cont
3	Length) (⇒ p. 95)	(Setting column)	Sets the recording length (number of divisions) for each acquisition operation.	(⇒ p. 95)	(⇒ p. 95)
		(Button)	Selects viewing the waveform of the entire recording length on one screen.	Whole Wave	Whole Wave
4	Mag (Magnification) (⇒ p. 204)	(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/Com- pression)	16 steps from x 4 to 1/20,000 (Compression Only) (with timebase settings between 10 and 50 ms/div, the measured waveform is displayed as compressed regardless of the magnification setting)
5	Zoom	(Button)	Magnifies a section of a waveform. Turn [On] when you want to zoom.	On or Off	
3	(⇒ p. 206)	(Setting column)	Set the magnification ratio.	x 10 to 1/200,000	
	Print (⇒ p. 302)	(Button)	Stops or resumes real-time printing.		Pause Print/ Restart Print
6		(Setting column)	When resuming printing, set how many divisions to retrace for printing.		-15 to 0 div

# 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. 128)



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. 73)

#### Input Channel Settings on the Channel Settings Screen

#### Input Module (Analog Channel) Settings Scaling Settings (⇒ p. 117) (⇒ p. 110) [One Ch] Page [One Ch] Page When using a clamp or external sensor, set to · Selection of channel(s) to set · Measurement range setting (⇒ p. 125) · Measurement mode, input coupling, low-pass filter and probe attenuation\*1 settings • Channel comment\*2 settings (⇒ p. 112) **Input Waveform Settings** \*1. Setting choices depend on the type of input module. These settings are also available on the [All Ch] [One Ch] Page page. (⇒ p. 124) • Enable/disable waveform display, set display \*2. This setting is also available on the [Comment] page. color (⇒ p. 165) (⇒ p. 123) Zero position setting (⇒ p. 166) These settings are also available on the [Variable]

#### **Logic Channel Settings**

#### [Logic] Page

Waveform color settings (⇒ p. 177)

#### [Comment] Page

• Channel comment settings (⇒ p. 123)

convert measurement units for display.

These settings are also available on the [Scaling] page.

- Vertical magnification and arbitrary display range (Variable function) settings\*(⇒ p. 208)
- page.(⇒ p. 126)

#### **Other Settings**

- Monitoring the input level (⇒ p. 116)
- Making copy settings (⇒ p. 127)
- Adding titles\*(⇒ p. 112)
- Titles can be included on printouts.

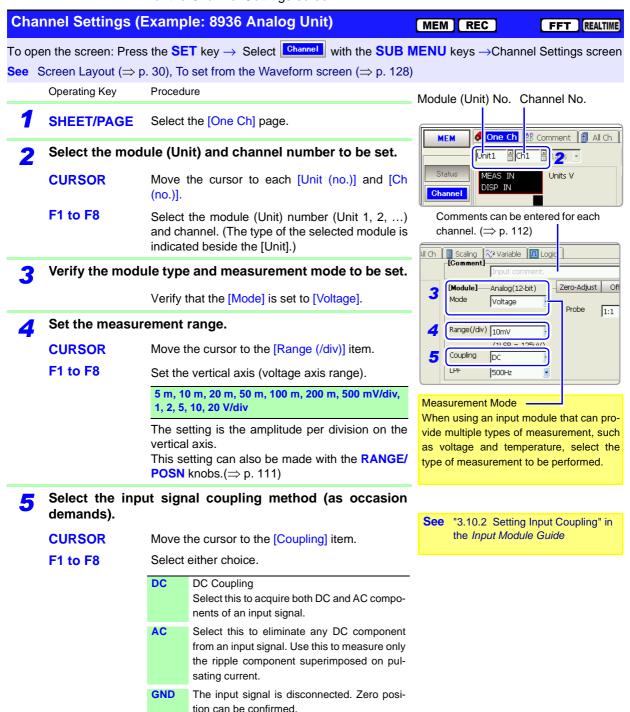
# 5.1 Analog Channel Settings

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. 124) of the Channel Settings screen.



### Set low-pass filtering (as occasion demands)

Procedure

**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



#### Select the probe attenuation.

**CURSOR** 

Operating Key

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 9197, 9198 or 9217 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.

#### 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).

#### 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 "3.10.3 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 "3.10.15 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** "3.10.17 Executing Zero Adjustment" in the *Input Module Guide* 

#### **About offset canceling**

Executing Offset Cancel when using a sensor corrects for external signal bias.

See "3.10.18 Executing Offset Cancellation" in the *Input Module Guide* 



#### To display converted units when using a clamp or sensor

Set scaling.

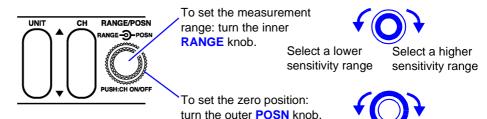
See "5.4 Converting Input Values (Scaling Function)" (⇒ p. 117)

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. 164)

"8.9 Magnifying and Compressing Waveforms" (⇒ p. 204)

To set the measurement range or zero position by the RANGE/POSN knobs



Lower position Higher position

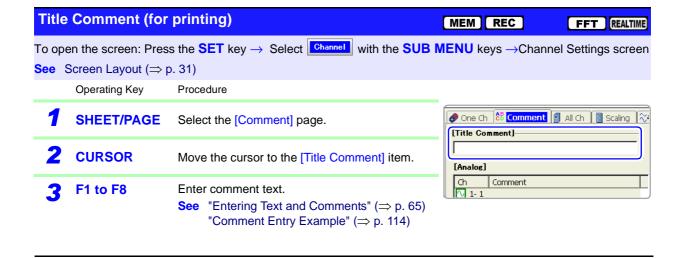
# 5.2 Adding Comments

## 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 "11.6.5 Printing Comments and Setting Data" (⇒ p. 321)



## **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.

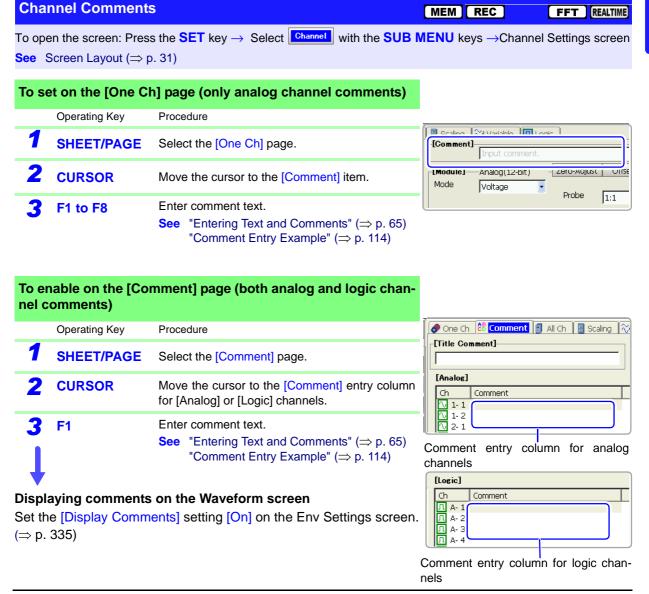
#### To display comments on the Waveform screen:

Enable comment display from the Environment (Env) Settings screen (Default setting: Off). **See** "12.1.2 Displaying or Hiding Comments" ( $\Rightarrow$  p. 335)

#### To print comments with measurement data:

Set on the Print Settings screen.

See "11.6.5 Printing Comments and Setting Data" (⇒ p. 321)





#### Copy a comment from one channel to another?

Comments can be copied on the [Comment] page.

See "Copying Comments" (⇒ p. 115)

#### **Comment Entry Example**

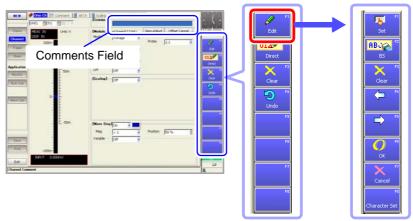
The virtual keyboard is used to enter comments with the operating keys or a mouse.

See "Using [Edit] for Entry" (⇒ p. 66)

In this example, we enter the comment "LINE-1" in the Comments field on the [One Ch] page.

Use the CURSOR keys to move the cursor to the Comments field, and press the F1 [Edit] key.

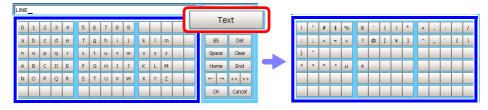
The virtual keyboard appears.



Use the CURSOR keys to move the cursor to "L", and press the F1 [Set] key. The letter "L" appears in the entry field.



- 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. 67)).



- 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.
- 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.

Сору Cancel

#### **Copying Comments**

MEM REC 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. 31)

Operating Key Procedure

Open the dialog.

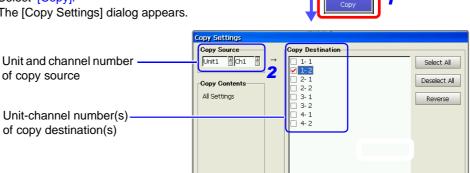
**CURSOR** Move the cursor to the channel with the comment

you want to copy in the [Analog] or [Logic] entry

column.

Select [Copy]. **F7** 

The [Copy Settings] dialog appears.



[Analog]

1- 1

2-1

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.

Move the cursor to the [Copy Destination] item. **CURSOR** 

F1 to F8 Select the unit-channel number(s) of the copy

destination(s).

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

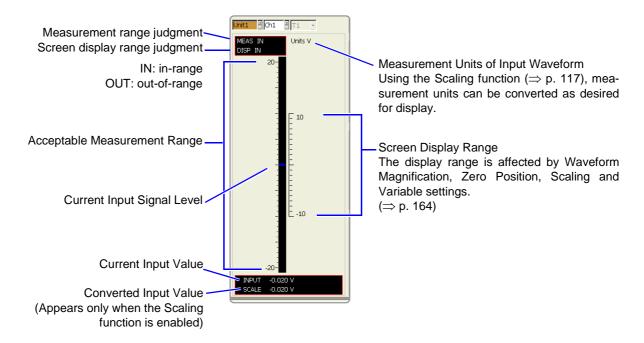
# **5.3.1 Verifying the Input Level (Level Monitor)**

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)

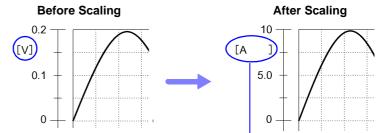
# About the Scaling Function

**Scaling Methods** 

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 ( $\Rightarrow$  p. 120) (Example: Converting [ V ]  $\rightarrow$  [ A ] ) When using the Strain Unit ( $\Rightarrow$  p. 121) (Example: Converting [  $\mu\epsilon$  ]  $\rightarrow$  [ G ])

Two scaling methods are available:

- Conversion ratio setting method
- · Two-point setting method

#### **Conversion Ratio Setting**

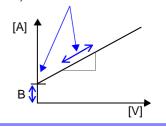
Set the physical value per volt (conversion ratio: eu/V) of the input signal, an offset value and measurement unit name (eu: engineering units) for conversion, so measurement values acquired as voltage are converted to the specified units.

Example:

Conversion ratio: A value per volt, Offset value: B, Unit name: A

Convert from slope (conversion ratio) and offset value

(Example: Converting  $[V] \rightarrow [A]$ )



#### **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:

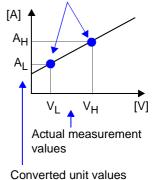
Voltage value at 2 points Voltage of units to convert

V<sub>H</sub>: Higher potential point A<sub>H</sub>:Value for higher potential point

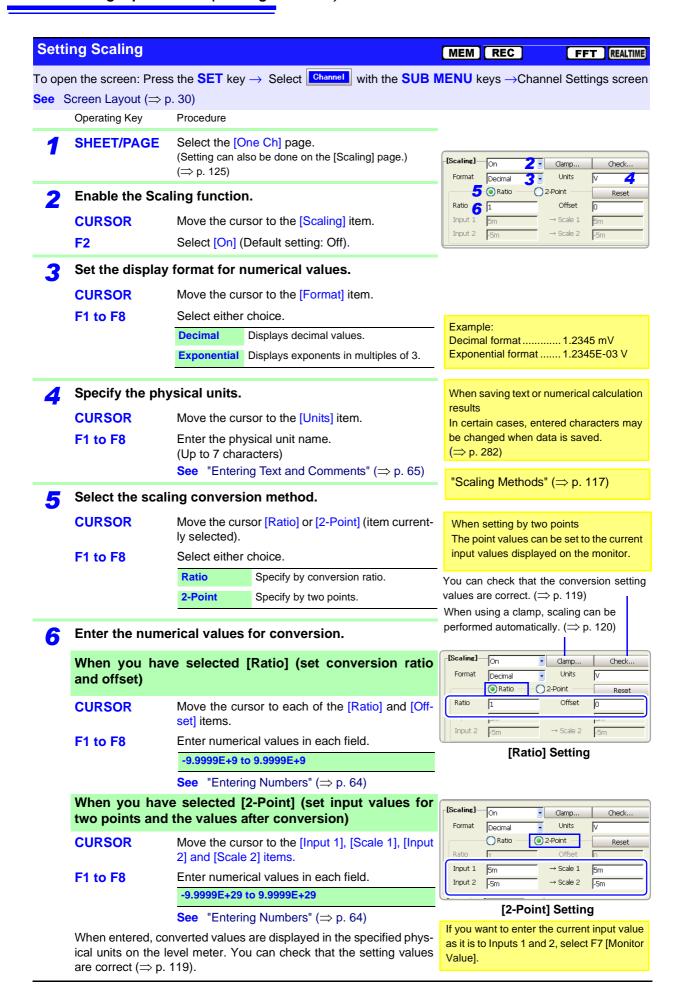
V<sub>L</sub>: Lower potential point A<sub>L</sub>: Value for lower potential point

Unit name: A

Conversion ratio and offset value are calculated from the two points and converted



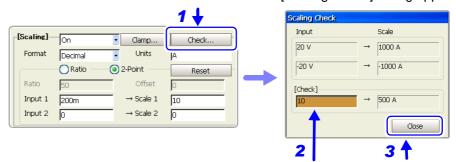
#### 5.4 Converting Input Values (Scaling Function)





#### To verify correct scaling settings: Scaling Check

Select the [Check] button. The [Scaling Check] dialog appears.



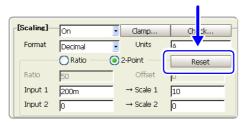
When appropriate numerical values have been entered, the converted physical value is displayed. Verify that it is converted correctly.

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. 208) in combination

The full span of output from a sensor can be displayed. (⇒ p. 210)



At factory shipping, automatic correction of the variable function ( $\Rightarrow$  p. 341) 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:

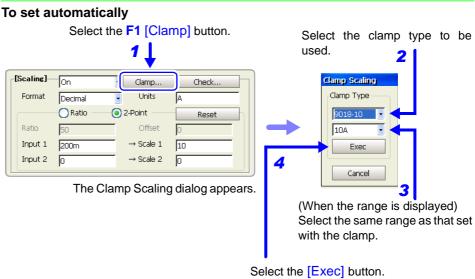
- · Set Scaling first, and then set the Variable function
- Set a Variable value before Scaling, and then set Scaling.

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 9018-10 Clamp-On Probe and display the measured data in units of [A] (Amperes)

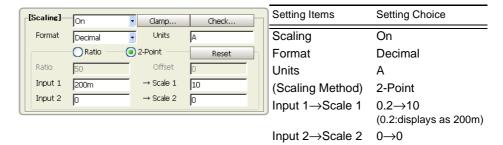


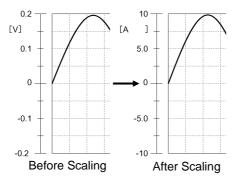
Scaling is performed automatically to suit the selected clamp.

#### To set manually (enter two-point numerical values)

The 9018-10 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)





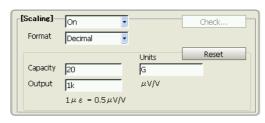
Inputs 1 and 2: [V] value
Physical values 1 and 2: [A] value (value of displayed measurement units)
With scaling, signals from the sensor are acquired as current values.
A/B cursors and gauges are displayed and printed with current (Ampere) val-

See "Applying Gauges" ( $\Rightarrow$  p. 191) "List and Gauge Settings" ( $\Rightarrow$  p. 314)

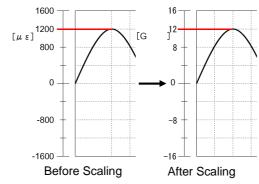
#### Using the Model 8939 or 8960 Strain Unit

# 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" ( $\Rightarrow$  p. 191)

"List and Gauge Settings" ( $\Rightarrow$  p. 314)

#### 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 ( $\Rightarrow$  p. 125) of the Channel Settings screen.

#### Example 3.

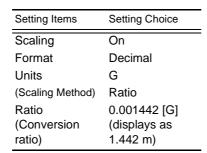
Measure using a sensor with a calibration factor of 0.001442 G /  $1 \times 10^{-6}$  strain\*, and display the measured data in [G] units.

The value of the calibration factor (0.001442 [G]) is set as the conversion ratio. (\*  $10^{-6}$  strain =  $\mu$ E)

- **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.

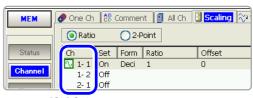
3 Set as follows:



Press the ENTER key or move the cursor to the [Close] button and press the F1 key.

The settings are accepted.

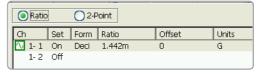
[Scaling] Page on Channel Settings Screen



[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 ( $2 \div 2.1$ ).

#### 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 =  $0.952 \times 0.001442 = 0.0013728$ 

As in Example 3, enter [0.0013728] as the conversion ratio in the [Scaling] dialog on the [Scaling] page.

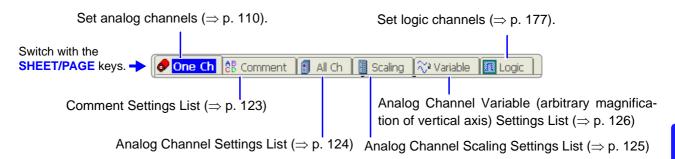
\* To convert measurement values to physical values when using a strain gauge, calculate using the Young's modulus or Poisson's ratio of the measurement object. The conversion method depends on the conditions in which the strain gauge is used.

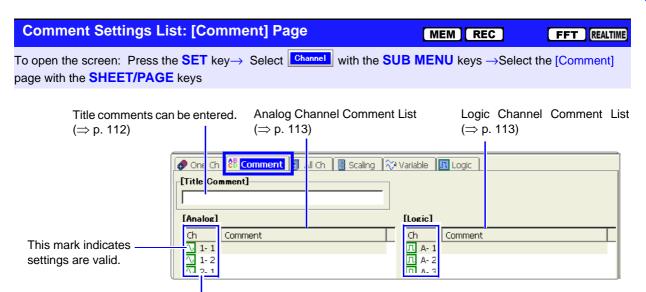
See "Appendix 2.7 Scaling Method When Using Strain Gauges" (⇒ p. A44)

# 5.5 Verifying and Setting All Channels from a List

All channel settings can be verified and changed on the following Channel screen pages.

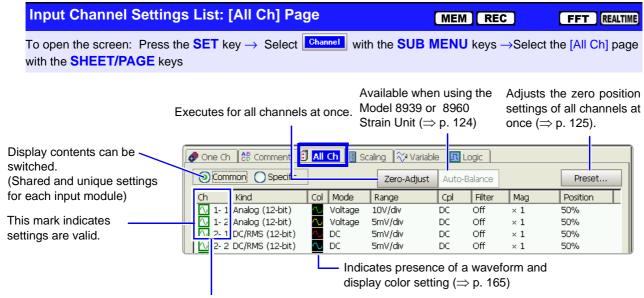
In addition, settings can be copied between channels. (⇒ p. 127)





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. 65), "Comment Entry Example" (⇒ p. 114) (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].



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" ( $\Rightarrow$  p. 110)

 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 "3.10.17 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.

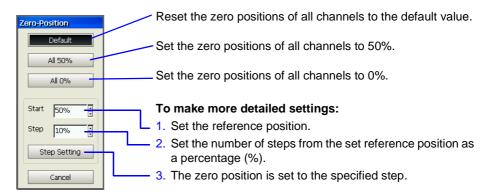
See "3.10.19 Executing Auto-Balance" in the Input Module Guide



#### To set the zero position of all channels at once: execute Preset

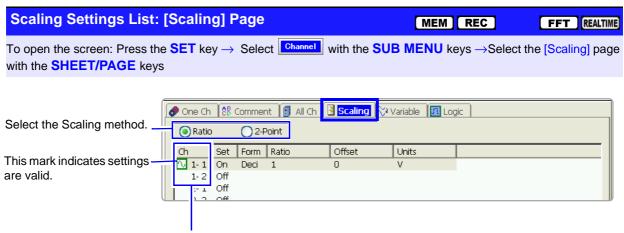
Move the cursor to the [Preset] button, and select **F1** [Preset]. The [Zero-Position] dialog appears.

The setting changes when you select any button.



Details of zero position:

"7.1.2 Setting the Waveform Display Position (Zero Position)" ( $\Rightarrow$  p. 166)



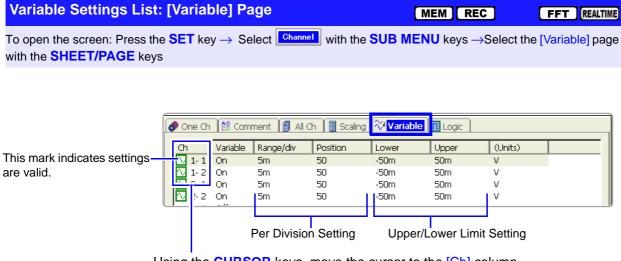
Using the **CURSOR** keys, move the cursor to the [Ch] column.

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. 117)

• To copy settings from one channel to another: Select F2 [Copy].



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. 208)

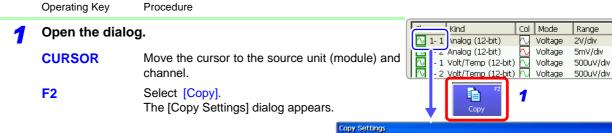
 To copy settings from one channel to another: Select F2 [Copy].

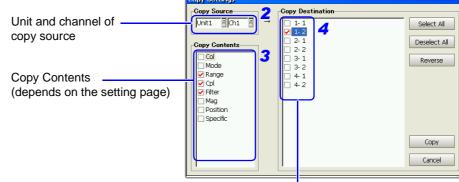
## 5.6 Copying Settings Between Channels

#### **Copying Channel Settings**

MEM REC FFT REALTIME

Settings can be made on the [Comment], [All Ch], [Scaling] and [Variable] pages of the Channel Setting screen.





Unit and channel of copy destination

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.

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.

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.

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. 110)

About setting choices for each input module:

See "Chapter 3 Input Channel Settings" in the Input Module Guide

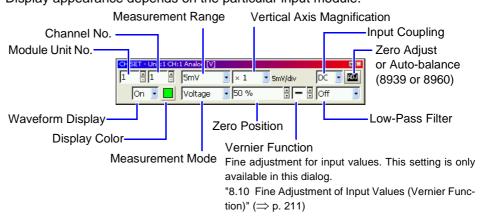
Two setting methods are available from the Waveform screen, as follows:

- · 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. ( $\Rightarrow$  p. 111)

#### Setting Individual Channels ([CH SET] dialog)

Press the **RANGE/POSN** knobs. The [CH SET] dialog appears. Display appearance depends on the particular input module.



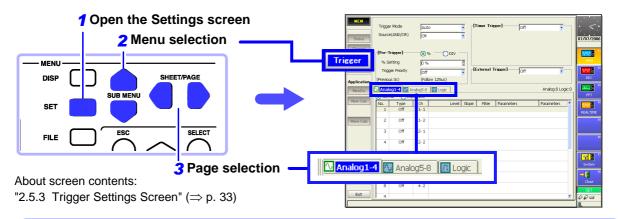
# Setting from the All Channels List (Channel Settings) ([CH ALL SET] dialog)

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  $(\Rightarrow p. 161)$ . Setting choices are function-dependent.



#### **Trigger Settings Available on the Trigger Settings Screen**

#### **Trigger Settings**

- Trigger mode setting (⇒ p. 132)
- Combining logic (AND/OR) for multiple trigger sources (⇒ p. 133)
- Pre-trigger settings (Memory function and FFT function only)
   (⇒ p. 134)
- Trigger timing settings (⇒ p. 138)
- Trigger source settings

#### Timer Trigger Settings (⇒ p. 156)

- Setting recording start and stop times
- · Setting a recording interval

#### External Trigger Settings (⇒ p. 160)

 External control terminal connections and settings (⇒ p. 387)

Manual Trigger Settings (⇒ p. 159)

#### **Trigger Source**

#### Analog Trigger Settings\*1(⇒ p. 140)

#### [Analog] page

- Level trigger(⇒ p. 144)
- Window trigger (In-Window trigger, Out-of-Window trigger) (⇒ p. 146)
- Period trigger (In-Period, Out-of-Period)(⇒ p. 147)
- Glitch trigger\*<sup>2</sup>(⇒ p. 149)
- Slope trigger\*<sup>2</sup>(⇒ p. 150)
- Voltage sag trigger\*<sup>2</sup>(⇒ p. 152)
- Trigger filter\*3
- Event count\*<sup>4</sup>
- \*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

#### **Logic Trigger Settings (⇒ p. 153)**

#### [Logic] page

- Setting combining logic for logic triggers
- Trigger filter settings
- Trigger pattern settings

#### Trigger Output (⇒ p. 392)

Trigger Search (⇒ p. 216)

# 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, 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. 76)

Signals that can be used for triggering (trigger sources) are as follows.

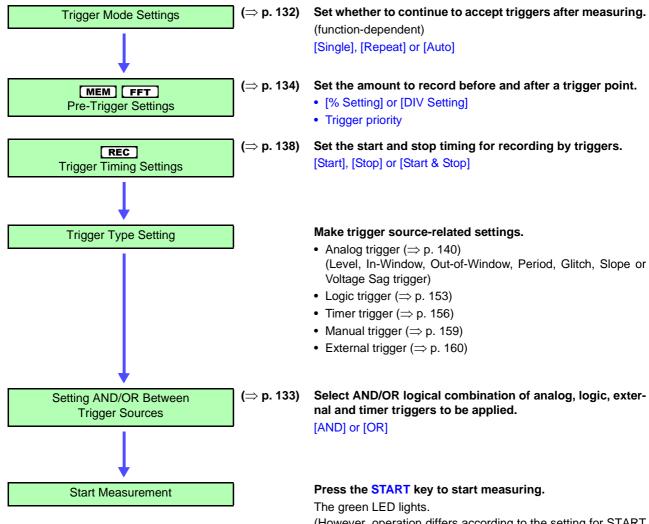
Trigger Source	Description
Analog Trigger (⇒ p. 140)	Applies a trigger according to a signal input on an analog channel.  (Level, In-Window, Out-of-Window, Period, Glitch, Slope or Voltage Sag trigger)  Trigger filtering (⇒ p. 143) and event counts (⇒ p. 143) can be set.
Logic Trigger (⇒ p. 153)	Applies a trigger according to signals input on logic channels (Ch A to Ch D).
External Trigger (⇒ p. 160)	Applies a trigger according to an input signal at the EXT TRIG terminal (External Trigger Input)
Timer Trigger (⇒ p. 156)	Applies triggers at specific intervals between start and stop times
Manual Trigger (⇒ p. 159)	Applies a trigger by pressing an operating key (FUNCTION MODE $\rightarrow$ F6 key).

- A trigger can be applied by combining (AND/OR) criteria from multiple trigger sources (except manual triggering) (⇒ p. 133).
- When Restart Permission is set to [Yes] (on the Environment Settings screen (\$\Rightarrow\$ p. 341)), 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. 216)

# 6.2 Setting Workflow

Trigger settings can be made on the Trigger Settings or Waveform screen. Settings choices for each item are function-dependent.



(However, operation differs according to the setting for START key behavior ( $\Rightarrow$  p. 337).)

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.

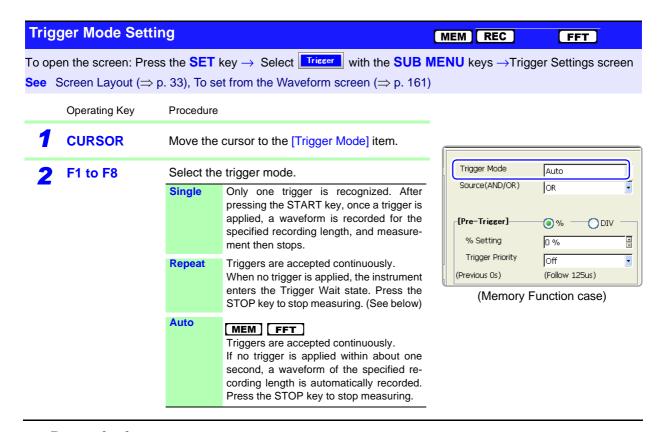
Press twice: recording stops immediately.

# 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.



### Description

Selection choices depend on the operating function.

Trianna Mada	Operating Function	
Trigger Mode	MEM FFT	REC
Single	0	O (default setting)
Repeat	0	0
Auto	O (default setting)	×

#### **To Stop Measuring**

Press the **STOP** key.

Press once: recording stops at the end of the specified recording length.

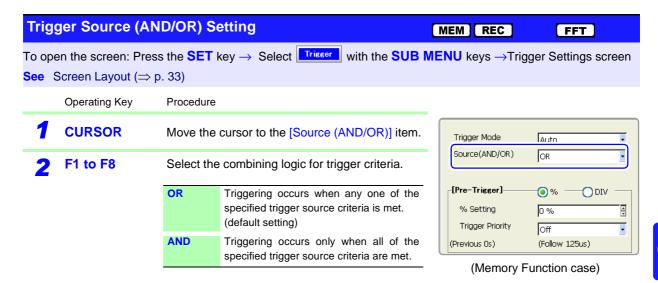
Press twice: recording stops immediately.

#### 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.



#### **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**

CH2

Trigger

Channel

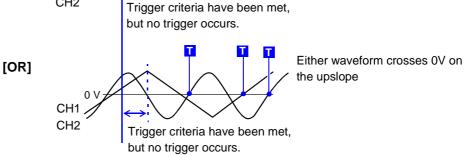
To apply a trigger when the upslope (1) of the waveform crosses zero volts Triggering occurs as follows in the AND and OR cases.

Slope

Filter

CH1, C	H2	Level	0.00 V	$\uparrow$	Off	
[AND]	0 V CH1	Start Measure	ement		waveform has e 0V as the othe e upslope	

Trigger Level



If both [Start] and [Stop] trigger timing criteria are combined, the simultaneous trigger sources are logically ANDed.

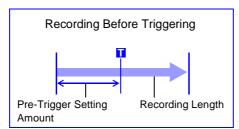
## 6.5 Pre-Trigger Settings

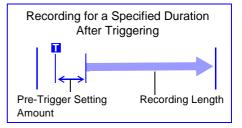
This applies to the Memory function and FFT function only.

#### 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.

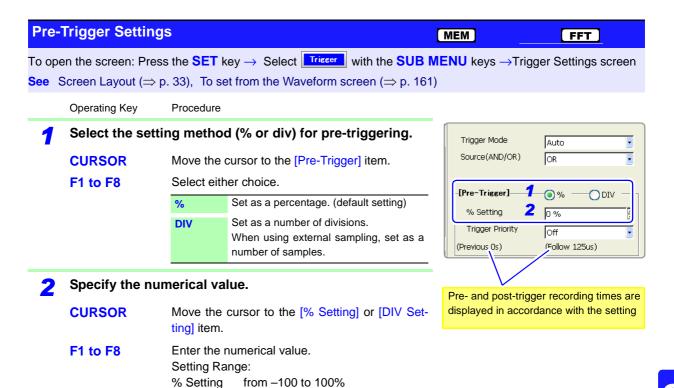
## 6.5.1 Setting the Trigger Start Point (Pre-Trigger)

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.

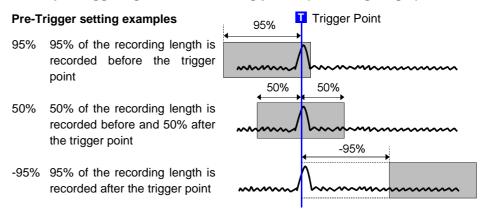


#### **Description** About pre-triggering and the recording period (recording length)

ing length) divisions

from -(recording length) to (record-

**DIV Setting** 



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. 137)

#### Difference between [Pre-Trig Wait] and [Trigger Wait]

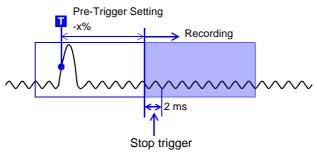
When measurement is started, the specified pre-trigger length is recorded. This period is indicated as the [Pre-Trig Wait].

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. 76)

#### 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.

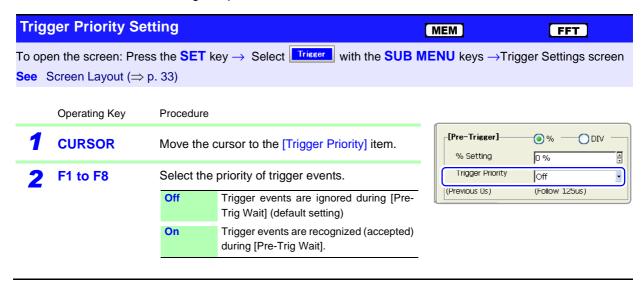


If a Stop trigger event occurs during this interval, no waveform data is stored.

## 6.5.2 Setting Trigger Acceptance (Trigger Priority)

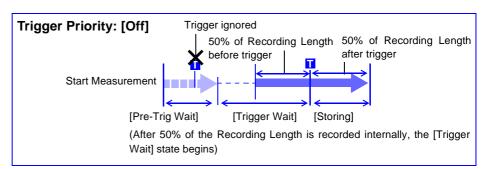
When pre-triggering is enabled, trigger events are normally ignored for a certain period after measurement starts (while recording the specified pre-trigger period). This period is indicated on the Status bar as [Pre-Trig Wait].

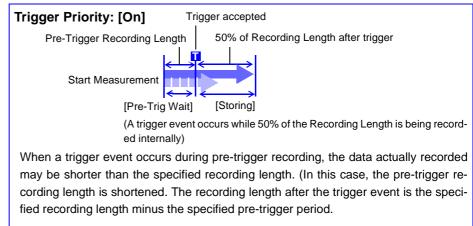
You can set whether a trigger is recognized (accepted) if trigger criteria are met during this period.



#### **Description**

When trigger criteria are met during [Pre-Trig Wait] Example: When the pre-trigger period is set to 50%



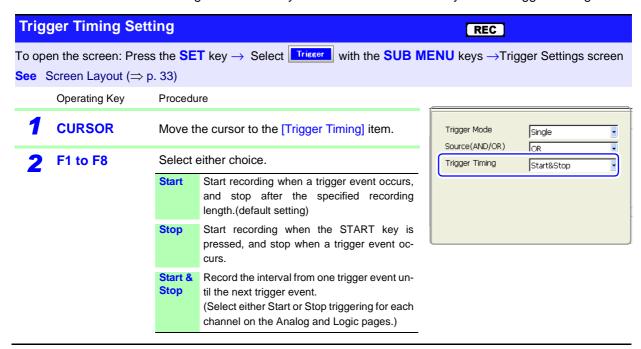


#### **Setting Trigger Timing** 6.6

Set waveform recording operation when a trigger event occurs.

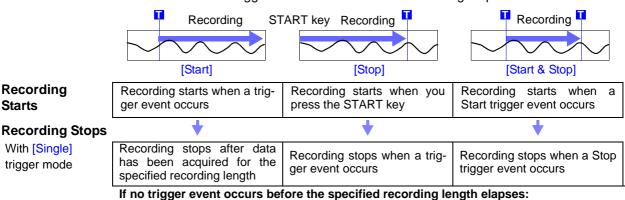
Timing for the Recorder function is set as follows.

Timing for the Memory function can be selected by various trigger settings.



#### Description **About trigger timing**

The selected trigger mode determines how recording stops.



With [Repeat] trigger mode

**Starts** 

[Start], [Stop] or [Start & Stop]: Recording stops after data has been acquired for the specified recording length

The Trigger Wait state begins after data has been acquired When a trigger event occurs, for the specified recording recording stops and the Triglength When a trigger event occurs, ger Wait state resumes When another trigger event recording stops and then When another trigger event occurs, recording continues starts again (repeats) occurs, data is again acquired for the specified recording until the next trigger occurs length, then Trigger Wait re-(repeats) sumes (repeats)

#### If no trigger event occurs before the specified recording length elapses:

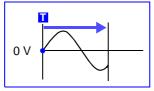
[Stop]: After data is acquired for the specified recording length, recording restarts. This repeats until a trigger event occurs.

[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)

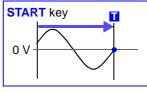
Trigger timing

[Start]



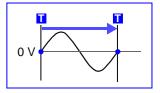
Records for specified recording length

[Stop]



Press START key to record Records until a trigger occurs

[Start & Stop]

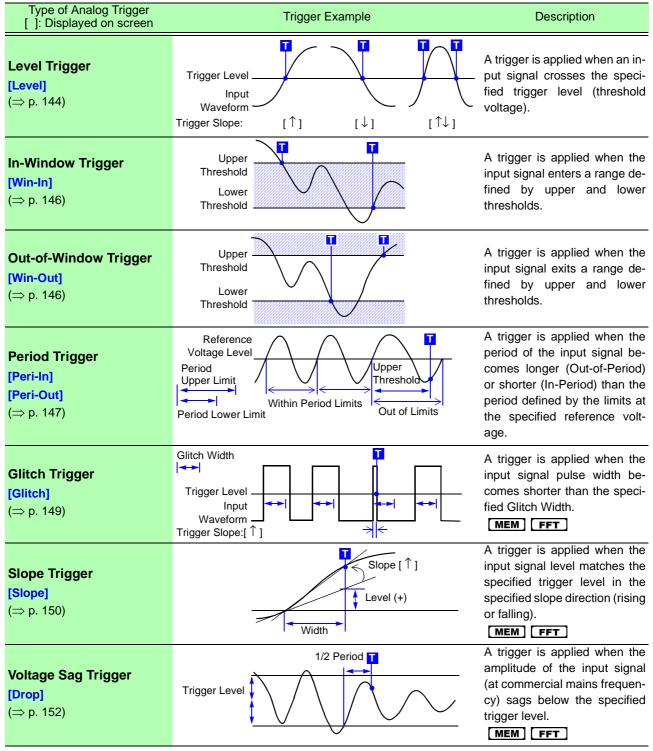


Recording starts when a Start trigger event occurs Records until a Stop trigger occurs

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



In addition to the above, the following criteria can be set:

- Trigger width setting (Trigger Filter) (⇒ p. 143)
- Setting the event count per trigger (Events) (⇒ p. 143)

#### **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. 161).) [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: Up to 16, Model 8861: Up to 32 (when used with the Model 8946)	<ul><li>Level Trigger</li><li>In-Window Trigger</li><li>Out-of-Window Trigger</li><li>Voltage Sag Trigger</li></ul>
Expanded	Multiple triggers can apply to one channel. Model 8860: Up to 8, Model 8861: 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

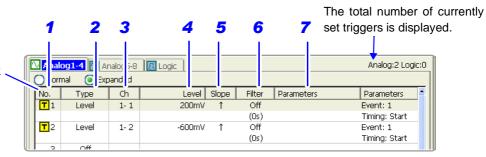
Analog trigger can be set by two methods:

- · Set individual items
- Set by dialog (⇒ p. 142)

The operating procedure descriptions use the method of setting individual items.

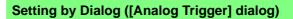
#### **Setting Individual Items**

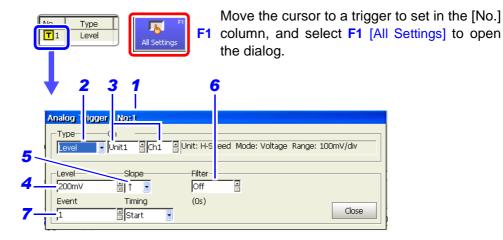
Move the cursor to each item, and make the setting.



Trigger Mark
This mark appears
when the trigger
setting is enabled.

Settings can be copied between trigger numbers. (The setting procedure is the same as "5.6 Copying Settings Between Channels" ( $\Rightarrow$  p. 127).)





Move the cursor to each item, and make the setting. After making settings, select the [Close] button to accept the changes.

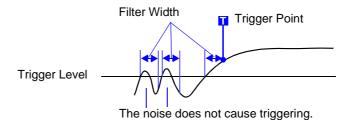
	Setting Items	Setting Description
1	No.	Trigger No.
2	Туре	Select the trigger type (⇒ p. 140).
3	Ch	(only with the [Expanded] setting) Select the module (Unit) and Channel No. to which this trigger applies. (1-1 = Unit 1, Channel 1)
4	Level	Set the signal level (threshold voltage) for triggering. A trigger is applied when the signal crosses this level.
5	Slope	Select the slope (input signal rising $\uparrow$ or falling $\downarrow$ ) for triggering.
6	Filter	Set the filter width (trigger filter) for triggering. Prevents noise from causing false triggers (⇒ p. 143).
7	Parameters (Event, Timing)	Make other settings. Specify the event count (only with the [Expanded] setting) for triggering ( $\Rightarrow$ p. 143). When [Start & Stop] is selected for trigger timing ( $\Rightarrow$ p. 138) 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. 145)

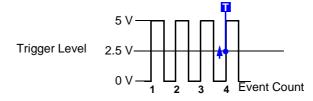
By setting the filter width to prevent triggering on noise, triggering occurs only when the trigger criteria continue to be met for at least the specified width (interval).



#### Setting an Event Count (⇒ p. 145) (only with the [Expanded] setting)

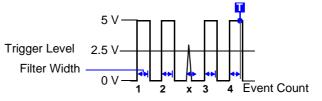
If triggering occurs too frequently, an event count can be specified so that a trigger is accepted only after the specified number of trigger events has occurred.

Example: When the event count is set to [4] (Slope: 1)



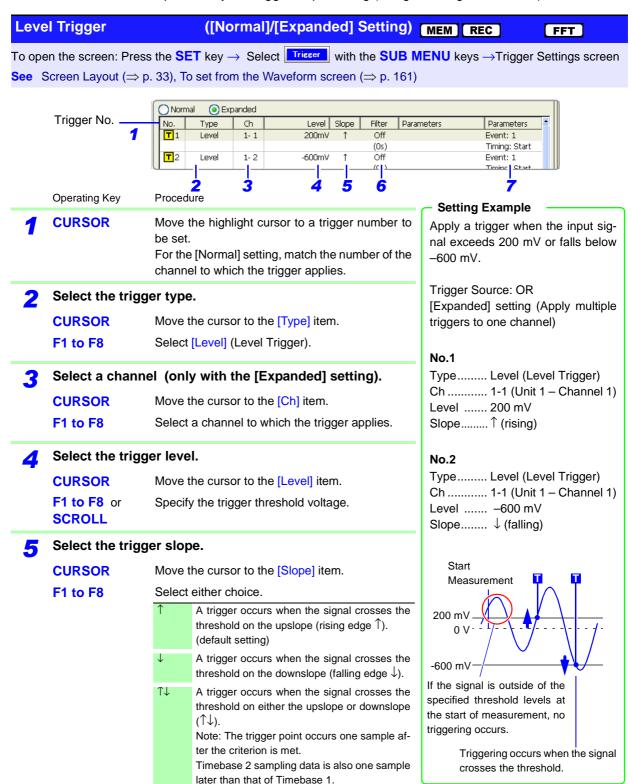
#### **Suppressing Noise Effects**

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  $\uparrow$ , falling  $\downarrow$  or both  $\uparrow\downarrow$ ).



Parameters

Timing: Start

Event: 1

Event: 1 Timing: Start

6

Filter

Off

(0s)

Off

(Os)

Parameters

# Set the trigger filter (as occasion demands) ( $\Rightarrow$ p. 143).

CURSOR

Operating Key

Move the cursor to the [Filter] item.

F1 to F8

Set the filter width.

Procedure

MEM F	FT ]
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)
	(deradit setting)
On	Trigger filtering is enabled. Filter width is 10 ms. (or 5 ms when the sampling rate is 100 ns/S)

When set to [1], a trigger is applied the first time trigger criteria are met.

7 Set the event count (as occasion demands)(⇒ p. 143). (only with the [Expanded] setting)

**CURSOR** Move the cursor to the [Event] item.

**F1 to F8** or Setting the event count (Default setting: 1).

**SCROLL** Setting range: 1 to 4,000

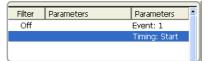
When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

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. 136) When the trigger mode is [Single]:

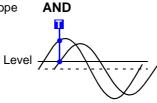
Recording ceases when a trigger event occurs.

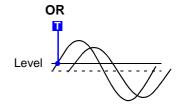
When the trigger mode is [Cont] or [Auto]: The instrument enters the Awaiting Trigger state.

#### **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





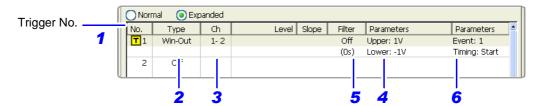
## **Triggering with Upper and Lower Thresholds** (Window Trigger)

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.



**See** Screen Layout ( $\Rightarrow$  p. 33), To set from the Waveform screen ( $\Rightarrow$  p. 161)



Operating Key Procedure

**CURSOR** 

Move the highlight cursor to a trigger number to

For the [Normal] setting, match the number of the channel to which the trigger applies.

Select the trigger type.

**CURSOR** Move the cursor to the [Type] item.

F1 to F8 Select [Win-In] or [Win-Out]

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.

Set the upper and lower threshold values.

**CURSOR** Move the cursor to the [Upper] and [Lower] items.

F1 to F8 or **SCROLL** 

Set the trigger filter (as occasion demands) ( $\Rightarrow$  p. 143).

Set the upper and lower threshold values.

Set the event count (as occasion demands) ( $\Rightarrow$  p. 143). (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 ( $\Rightarrow$  p. 145).

#### **Setting Example**

Apply a trigger when the input signal is outside of the range ±1 V

No.1

Type ......... Win-Out

(Out-Window Trigger)

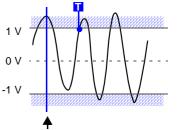
Ch...... 1-1(Unit 1-Channel 1)

**Parameters** 

Upper ...... 1 V

Lower ......-1 V





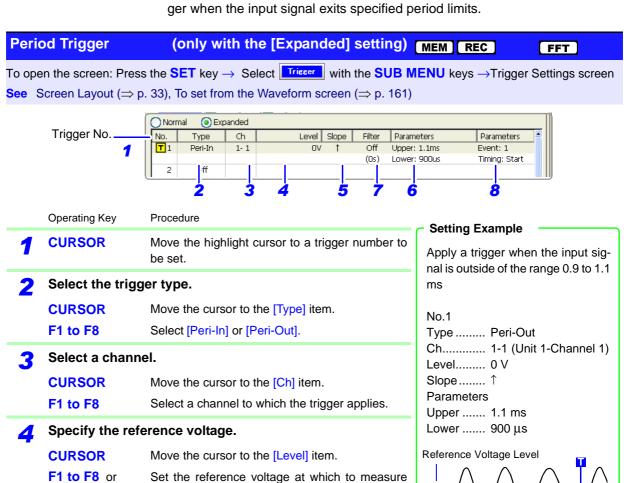
If the signal is outside of the threshold window when measurement starts, no

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.



#### Select the trigger slope.

CURSOR

**SCROLL** 

Move the cursor to the [Slope] item.

F1 to F8

Select either choice.

the period.

Measure the threshold period at the rising (1) trigger slope.

Measure the threshold period at the falling  $(\downarrow)$  trigger slope.

### 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.

## Out of Period Range

#### **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. 148)

Operating Key

Procedure

- **7** Set the trigger filter (as occasion demands) (⇒ p. 143).
- Set the event count (as occasion demands) (⇒ p. 143).

When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

Set the trigger to Start or Stop ( $\Rightarrow$  p. 145).

#### **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:

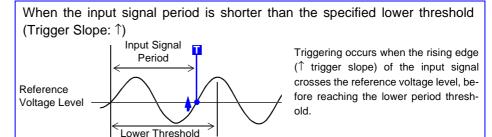
Set the period trigger type to [Peri-Out], and the lower threshold to [0].

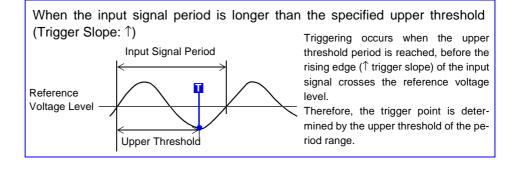
The lower threshold is ignored, and triggering occurs when the frequency drops below that corresponding to the upper threshold.

#### 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.





## **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  $(\uparrow)$  or falling  $(\downarrow)$  edge pulse width can be selected by Trigger Slope setting.



O Normal Expanded Trigger No. Туре Level Slope Parameters Parameters Width: 500ns Event: 1 Timing: Start 2 3

Operating Key

Procedure

**CURSOR** Move the highlight cursor to a trigger number to be set.

Select the trigger type.

Move the cursor to the [Type] item. **CURSOR** 

F1 to F8 Select [Glitch].

Select a channel.

**CURSOR** Move the cursor to the [Ch] item.

Select a channel to which the trigger applies. F1 to F8

Select the trigger level.

**CURSOR** Move the cursor to the [Level] item.

F1 to F8 or Specify the trigger threshold voltage.

**SCROLL** 

Select the trigger slope.

**CURSOR** Move the cursor to the [Slope] item.

F1 to F8 Select either choice.

> Glitch width is determined from rising (1) trigger slope. Glitch width is determined from falling (↓)

trigger slope.

Set the glitch width.

**SCROLL** 

**CURSOR** Move the cursor to the [Width] item. F1 to F8 or Set the glitch width (in seconds).

Set the event count (as occasion demands)( $\Rightarrow$  p. 143).

When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

Set the trigger to Start or Stop ( $\Rightarrow$  p. 145).

#### **Setting Example**

Apply a trigger when the input signal pulse width is less than 500 ns (glitch width)

No.1

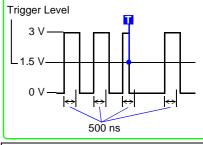
6

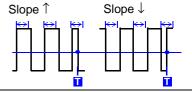
Type ...... Glitch

Ch..... 1-1(Unit 1-Channel 1)

Level...... 1.5 V Slope ...... ↑ **Parameters** 

Width ...... 500 ns





#### **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:

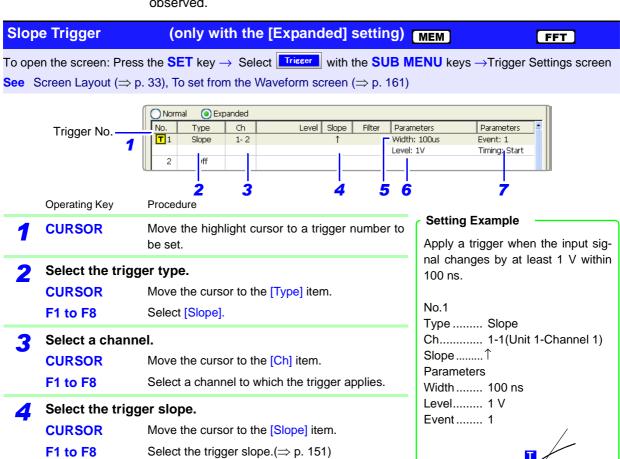
Minimum width setting: At least twice the

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 ( $\uparrow$  or  $\downarrow$ ) for the direction of change to be observed.



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.

Set the width (interval) in which to judge the amount of change.

**CURSOR** Move the cursor to the [Width] item.

**F1 to F8** or Set the judgment interval.

**SCROLL** 

Set the amount of change (Level).

**CURSOR** Move the cursor to the [Level] item.

**F1 to F8** or Set the amount of change.

**SCROLL** 

**The second of the second of** 

When using the Memory function, or when using the Recorder function with [Timing] set to [Start & Stop]

Set the trigger to Start or Stop ( $\Rightarrow$  p. 145).

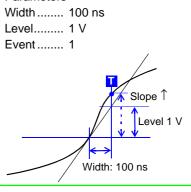
Minimum width setting: At least twice the

sampling period

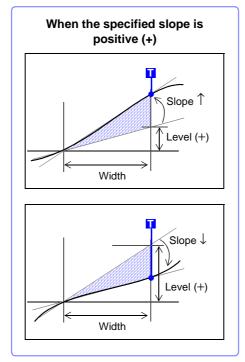
Width setting range:

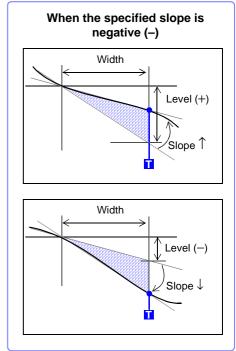
Maximum width setting: No more than 250

times the sampling period



#### **Description** About the relationship between slope and trigger





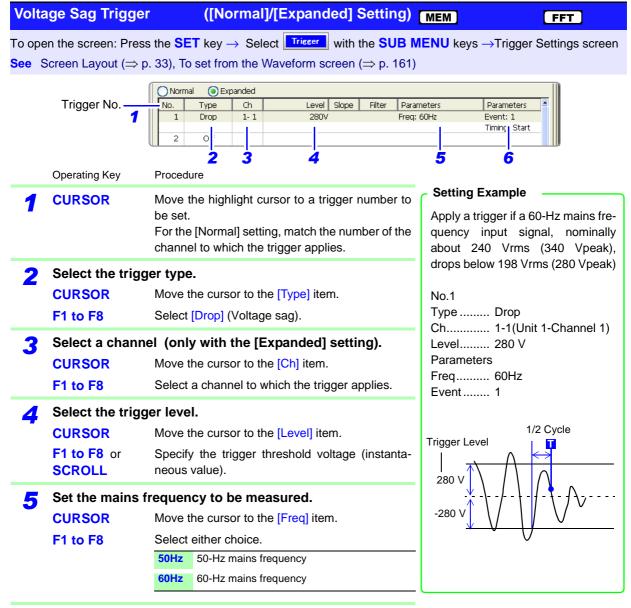
NOTE

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.



Set the event count (as occasion demands) (⇒ p. 143). (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 ( $\Rightarrow$  p. 145).

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.

# **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)

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**

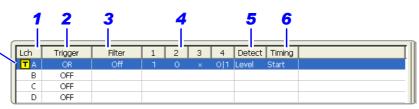
Set on the [Logic] page of the Channel Settings screen. Settings can be made in the following two ways:

- · Set individual items
- · Set by dialog

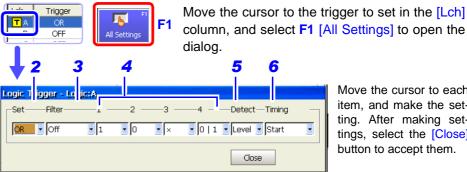
#### **Setting Individual Items**

Move the cursor to each item, and make the setting.

Trigger Mark This mark appears when the trigger setting is enabled.



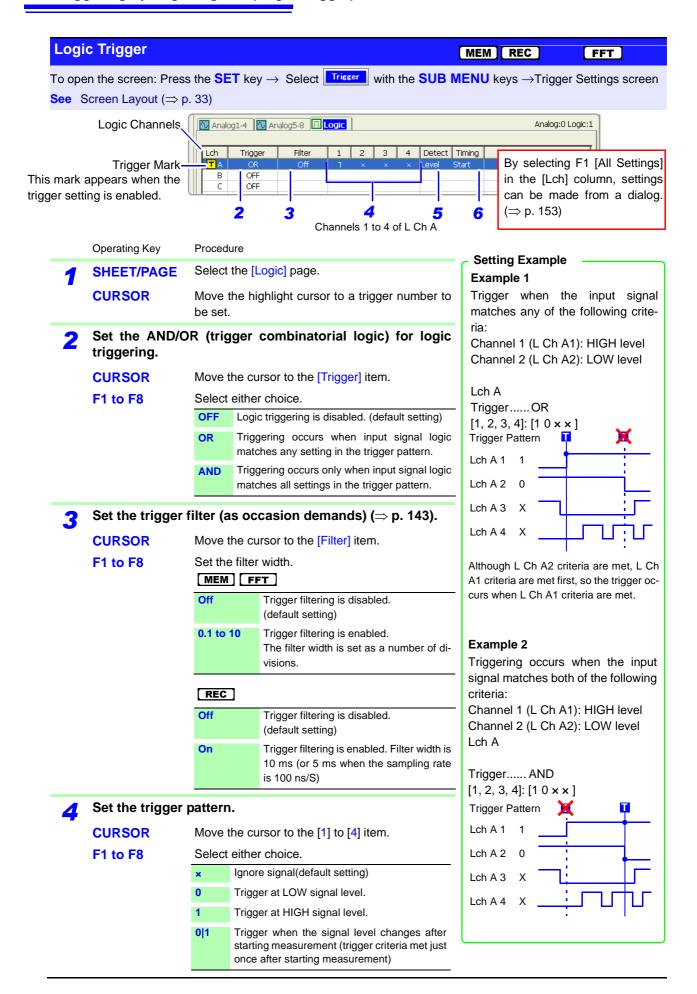
#### Setting by Dialog ([Logic Trigger] dialog)

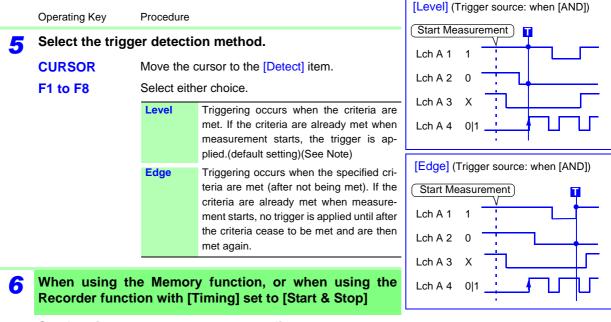


Move the cursor to each item, and make the setting. After making settings, select the [Close] button to accept them.

	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. 143)
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. ( $\Rightarrow$ p. 138)

#### 6.8 Triggering by Logic Signals (Logic Trigger)





#### 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. 138)

#### NOTE

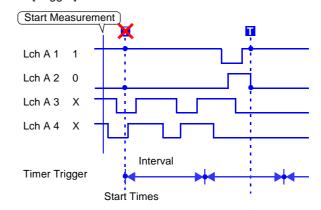
#### Setting external and timer triggers with the [AND] trigger source setting

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

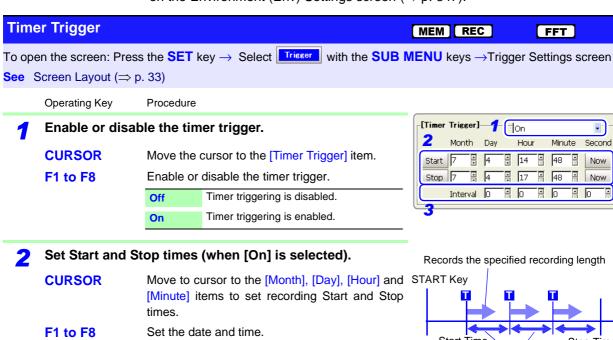


#### 6.9 **Trigger by Timer or Time Intervals (Timer Trigger)**

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 ( $\Rightarrow$  p. 347).



#### To set the current date and time:

Move the cursor to the [Now] button, and select

#### 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. 157).

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

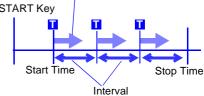
[Second] items of [Interval].

F1 to F8 Set the recording interval.

After pressing the **START** key, recording starts at the specified Start time.

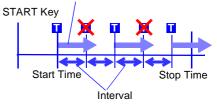
#### To stop recording early:

Press the **STOP** key.



When the specified interval is shorter than the specified recording length:

Records the specified recording length



## When the recording length exceeds the

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. 157)

#### When the interval is set to zero

If the [Repeat] trigger mode is selected, 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)

STOP 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



STOP 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.

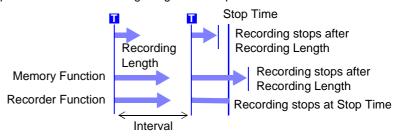
#### **About Stop Time and Recording Length**

The stop time is function-dependent:

Memory function: Measurement data is acquired for the specified recording length, then recording stops.

Recorder function: Measurement data continues to be acquired until the specified Stop time.

Relationship Between Last Recording Length and Stop Time



# 6

#### When a trigger is applied from a trigger source other than a timer trigger

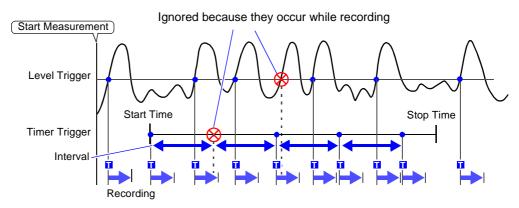
Trigger sources set to On are all enabled.

However, trigger timing depends on the trigger source settings.

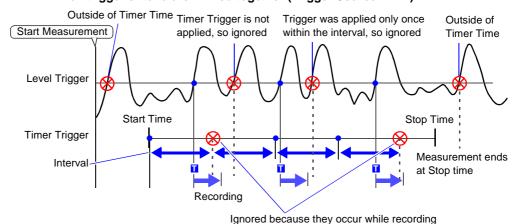
- When trigger criteria are ORed together (Trigger Source: OR)
   Depending on the other trigger sources, triggering can occur before the specified trigger Start time, after the specified Stop time, or outside of the specified Interval.
- When trigger criteria are ANDed together (Trigger Source: AND)
   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: 1) are enabled.

When trigger criteria are ORed together (Trigger Source: OR)

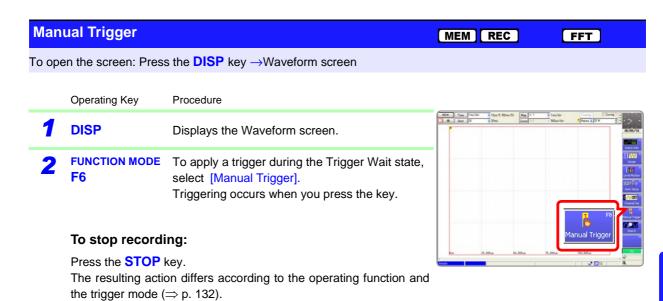


#### When trigger criteria are ANDed together (Trigger Source: AND)



# 6.10 Triggering Manually (Manual Trigger)

Triggers can be applied manually. Manual triggering takes priority over all other trigger sources, regardless of settings.

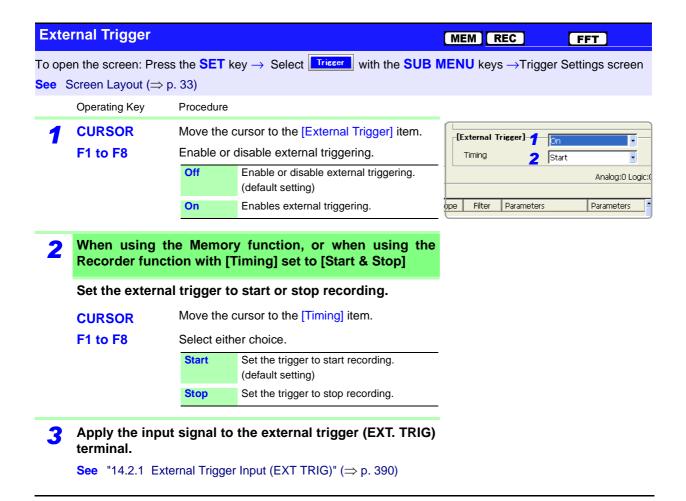


# 6.11 Applying an External Trigger (External Trigger)

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. 388), "14.2.1 External Trigger Input (EXT TRIG)" (⇒ p. 390)



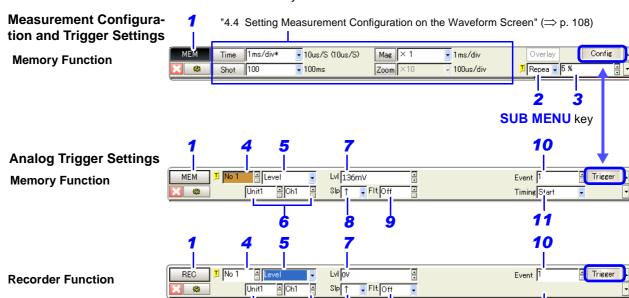
11

# 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.

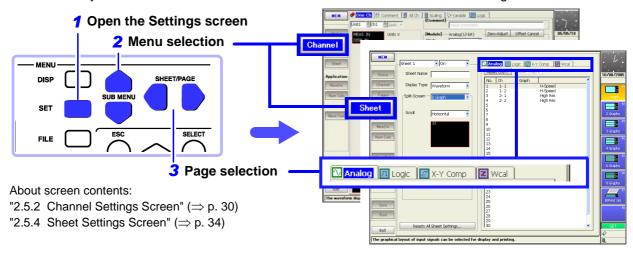


	Setting Items	Description			
1	Function		MEM	REC	FFT
2	Trigger Mode (⇒ p. 132)	Sets the trigger mode.	Single, Repeat or Auto	Single or Repeat	Single, Repeat or Auto
3	Pre-Trigger (⇒ p. 134)	Sets pre-triggering.	-100 to 100% (In steps of 1%, or divisions)	(None)	-100 to 100% (In steps of 1%, or divisions)
4	Analog Trigger No.	Selects the trigger numb	er.		
5	Analog Trigger Type (⇒ p. 140)	Selects the analog trigge	er type.		
6	Unit and Channel No.	Selectable only when [E.	xpanded] is selected.		
7	Trigger Level	Set the signal level (thre	shold voltage) for trig	gering.	
8	Trigger Slope	Select the slope (input si	gnal rising $\uparrow$ , falling $\downarrow$	or both rising and fall	ing ↑↓) for triggering.
9	Trigger Filter (⇒ p. 143)	Sets the filter width (trigg	ger filter) for triggering	J.	
10	Events (⇒ p. 143)	Sets the event count for	triggering. (only with	the [Expanded] setting	g)
11	Timing (⇒ p. 138)	Set the timing for trigger For Recorder function, s Stop].	_	ming is set to [Start &	

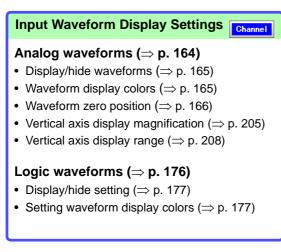
# Waveform Display Settings Chapter 7

Waveform display, display colors and other input channel settings are made on the Channel Settings screen.

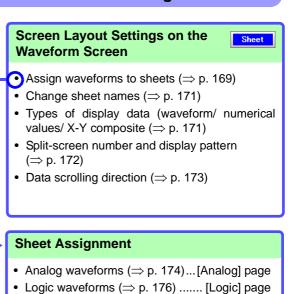
The screen layout of each sheet on the Waveform screen is set on the Sheet Settings screen.



#### **Waveform Display Settings on the Channel and Sheet Settings Screens**



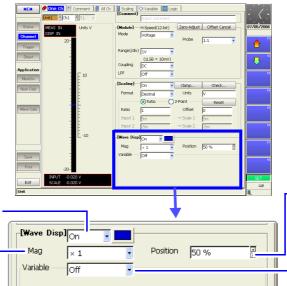
Refer to "Chapter 8 Waveform Screen Monitoring and Analysis" ( $\Rightarrow$  p. 185) for gauge display and split-screen display of numerical values and waveforms.



X-Y waveforms (⇒ p. 177).. [X-Y Comp] page
 Calculation waveforms (Analysis 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. 176)

Set whether to display or hide waveforms, and their display colors ( $\Rightarrow$  p. 165).

Set display magnification of thevertical axis (measurement range) ( $\Rightarrow$  p. 205).

-Set zero levels of waveforms to position them on the vertical axis (measurement range). (⇒ p. 166)

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.

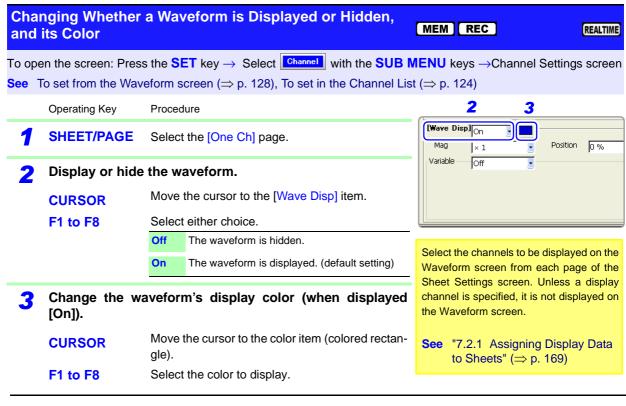
(Variable function)(⇒ p. 208)

## 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. 177)





#### 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.

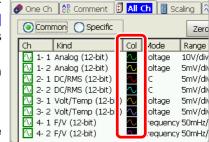
Waveform display settings can be verified in the [Col] (Color) column.

#### **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.

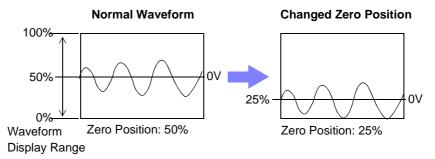
(F1 or F2: display or hide the waveform, F3 or F4: select the display color, F6 or F7: display or hide all, or F8: revert to the default color setting)



# 7.1.2 Setting the Waveform Display Position (Zero Position)

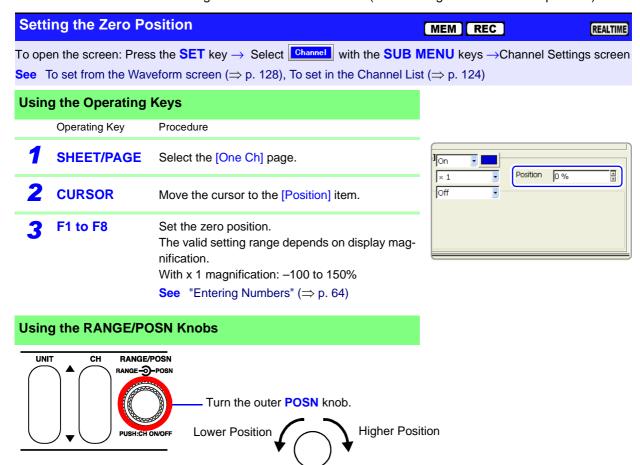
Set the waveform zero position (in this example, zero volts) for display on the vertical axis.

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)



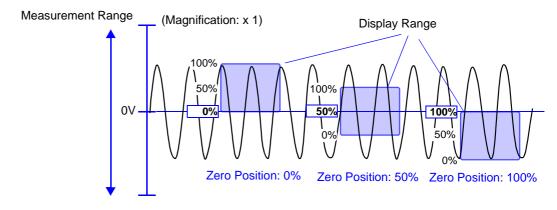
# Chapter 7 Waveform Display Settings

#### 7.1 Making Input Waveform Display Settings (Analog Waveforms)

#### **Description**

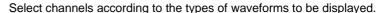
Magnification and compression ( $\Rightarrow$  p. 205) in the voltage axis direction is based on the zero position.

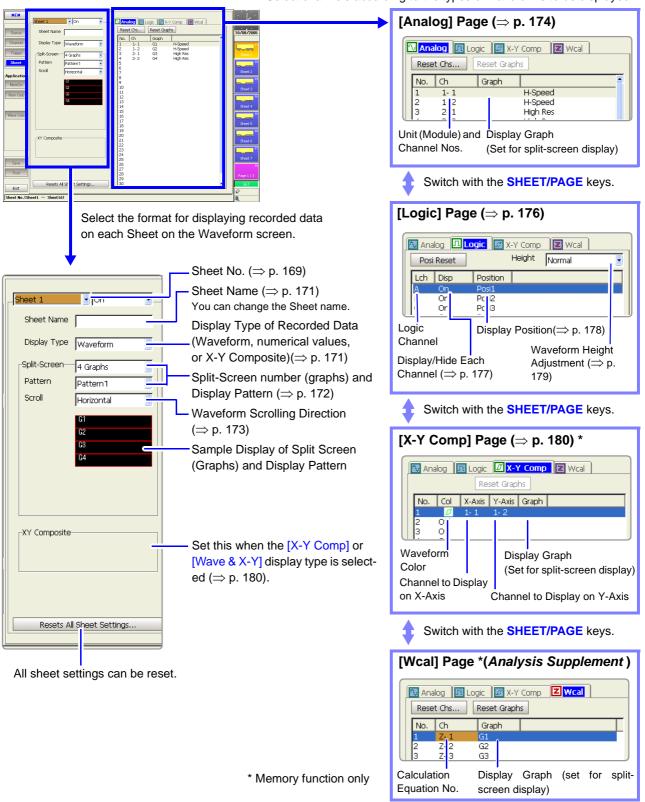
Although the range of voltage that can be displayed on the Waveform screen depends on the zero position and magnification/compression of the voltage axis, the measurement range is unaffected.



# 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 Supplement* for FFT function setting details.





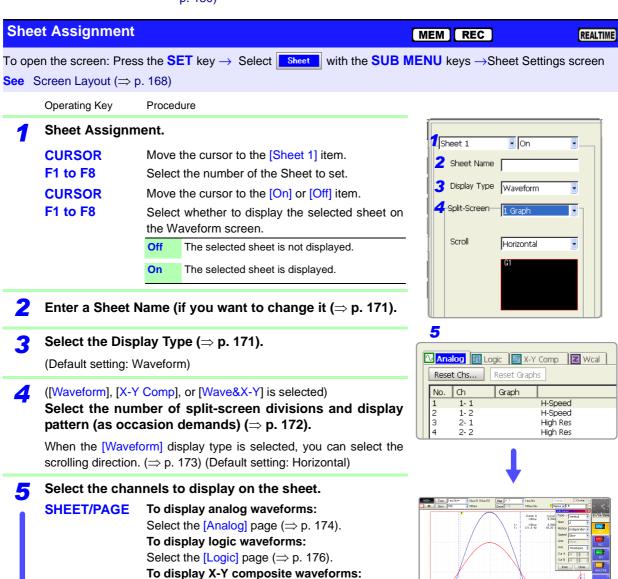
## 7.2.1 Assigning Display Data to Sheets

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. 176) X-Y waveform display settings: "7.4 Composite Waveforms (X-Y Waveforms)" (⇒ p. 180)



Press the DISP key to display the Waveform screen.

Set other sheets in the same way.

The displayed sheet changes each time you press the SHEET/PAGE key.

Select the [X-Y Comp] page ( $\Rightarrow$  p. 180). To display calculation waveforms:

Select the [Wcal] page (Analysis Supplement).

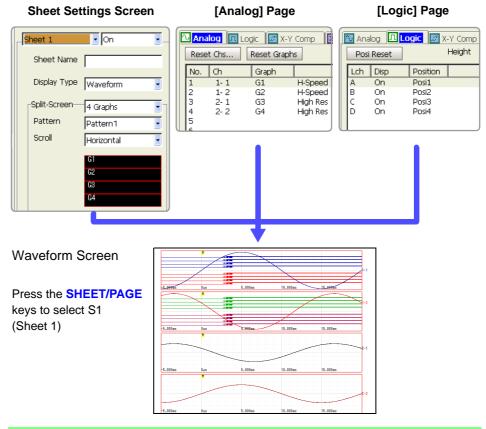
The Sheet Number appears.

**∿** S1

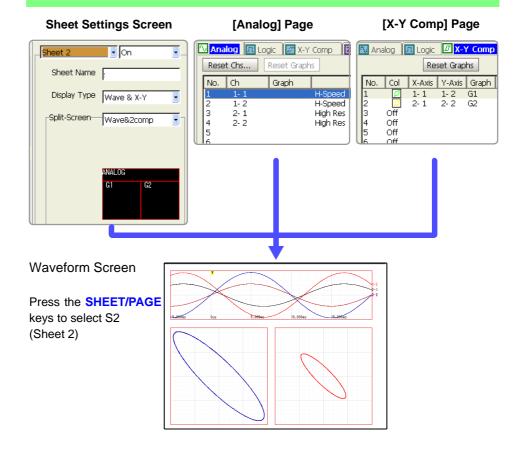
Waveform Screen

## Sheet Setting Example

Assign four analog waveform channels and one logic waveform channel (four probes) to graphs on Sheet 1.



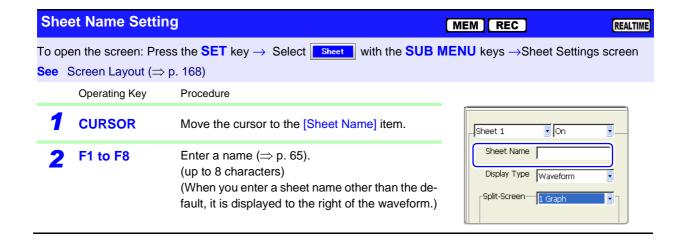
Assign four analog waveform channels and their X-Y composite waveforms to Sheet 2



## 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.

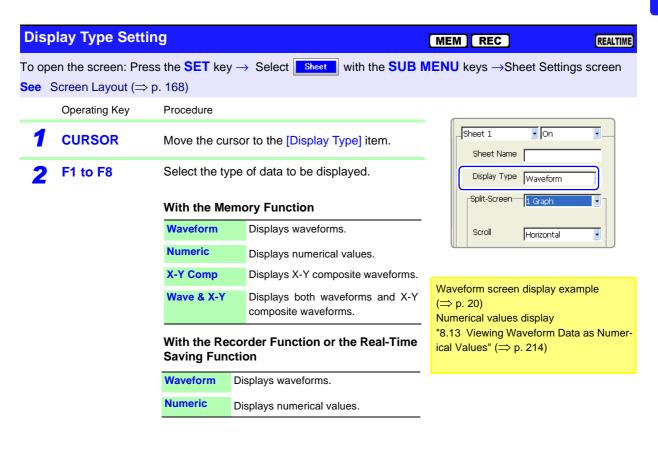
To switch sheets on the Waveform screen, press the **SHEET/PAGE** keys.



## 7.2.3 Setting the Display Type

Measurement data can be displayed as waveforms, numerical values, or X-Y composites on the Waveform screen.

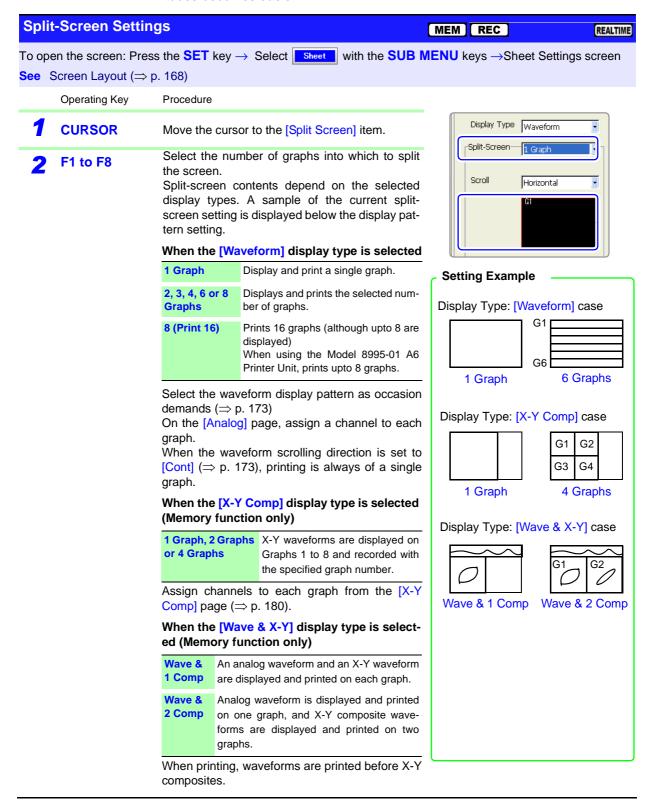
Select the type of display for the Waveform screen.

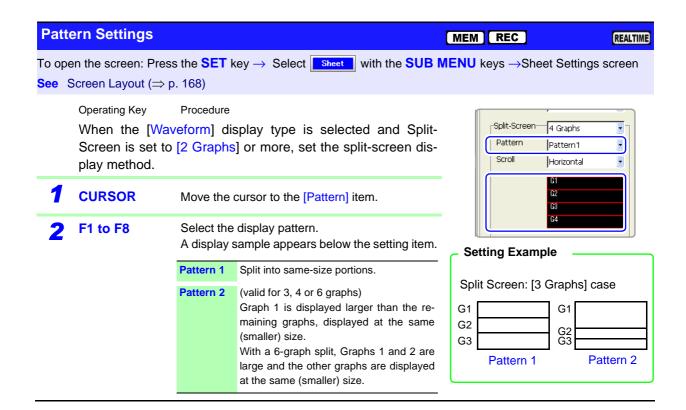


## 7.2.4 Splitting the Display Screen (Split-Screen)

The screen can be split into multiple regions (graphs). You can specify the position of each channel's graph. ( $\Rightarrow$  p. 174)

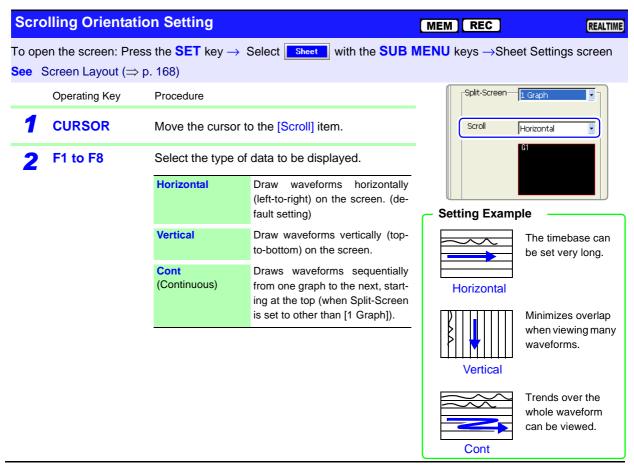
This setting is available when any display type other than [Numeric] is selected. By splitting the screen, viewing of multiple input waveforms with similar amplitudes becomes easier.





## 7.2.5 Setting Waveform Scrolling Orientation

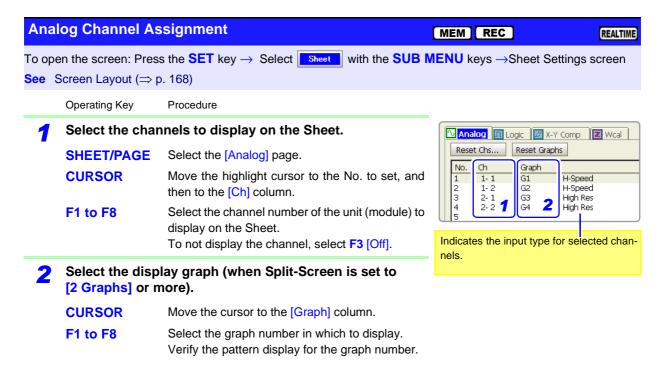
You can change the waveform display orientation. This setting is available only when the [Waveform] display type is selected.



# 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. 85)





#### 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

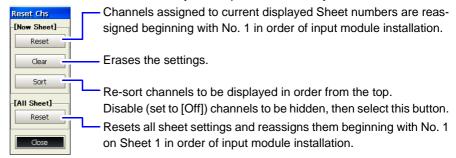
Waveform display setting on the Channel Settings screen is disabled ([Off]). To display the waveform on the Waveform screen, set it to [On].

#### 7.2 Setting the Screen Layout of the Waveform Screen (Sheet Settings Screen)

#### To reset, clear or re-order assignments

Move the cursor to the [Reset Chs] button, and select F1 [Reset Chs]. A dialog appears.

Select an item with the CURSOR keys, and press the F1 key.

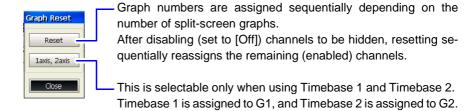




#### To reset graphs (when Split-Screen is enabled with [2 Graphs] or more)

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.



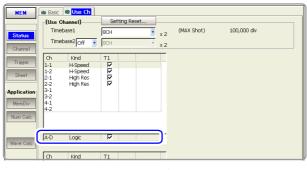
## 7.3 Displaying Logic Waveforms

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. 85)

1

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. 177)
- Waveform display color setting (⇒ p. 177)



Set logic triggers (if triggers are to be applied)

[Logic] page on the Trigger Settings screen

(Default setting: Off)



Logic Trigger settings
 (⇒ p. 153)

Set whether to display or hide logic channels, and the display position and display height for each

[Logic] page on the Sheet Settings screen

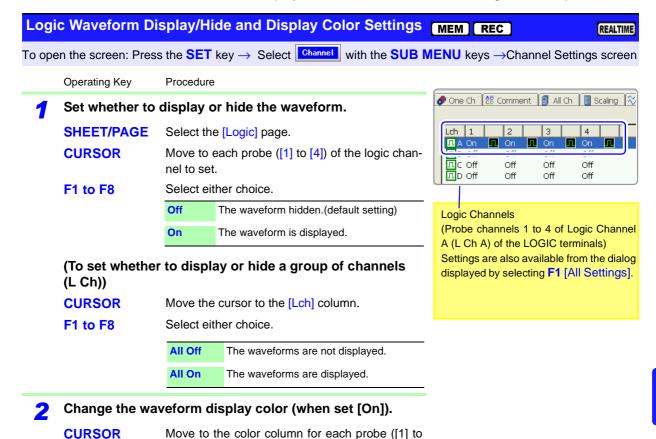
(Default setting: On)

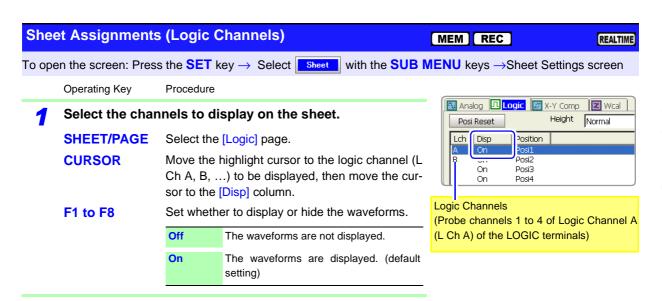


- Sheet Assignments
   (⇒ p. 177)
- Display Position setting (⇒ p. 178)
- Display Height setting (⇒ p. 179)

## 7.3.1 Setting the Waveform Display

Set whether to display or hide the waveform for each logic channel probe.





[4]) of the logic channel to set.

Select the color to display.

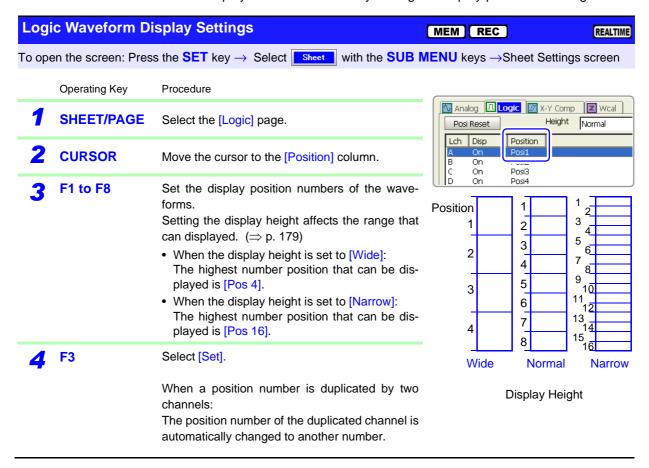
Set the display position ( $\Rightarrow$  p. 178).

Set the display height ( $\Rightarrow$  p. 179).

F1 to F8

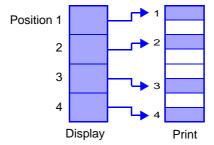
## 7.3.2 Setting the Display Position

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.



#### **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.





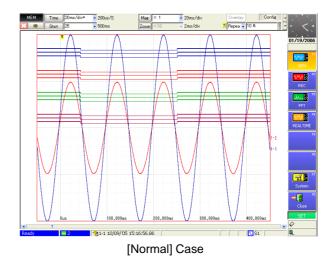
#### Numbering changes when changing the display position

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.

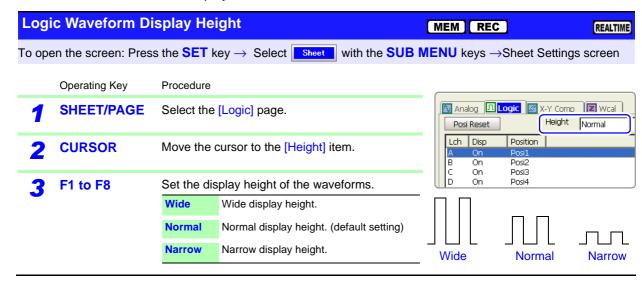
## Display Position Setting Example when Recording Mixed Analog and Logic Waveforms



## 7.3.3 Setting the Display Height

The display height of logic waveforms can be modified.

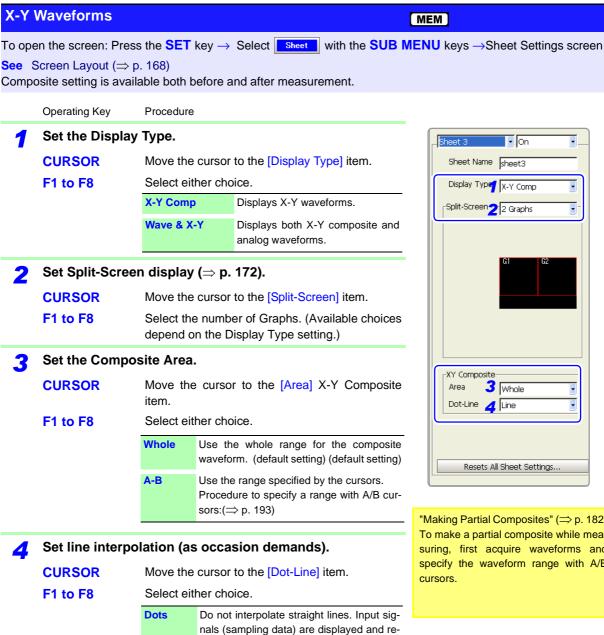
Viewing is improved by setting a narrow display height when many waveforms are displayed.



## **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.

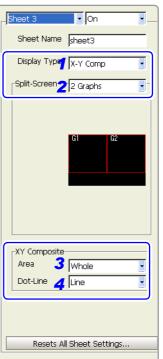


corded as is.

(default setting)

Interpolate straight lines. This can improve display visibility, although the display speed is slower than Dots display.

Line



"Making Partial Composites" (⇒ p. 182) To make a partial composite while measuring, first acquire waveforms and specify the waveform range with A/B

Set whether to display or hide composite waveforms, and display color.

SHEET/PAGE Select the [X-Y Comp] page.

Procedure

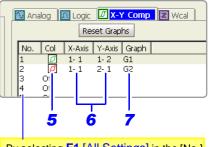
Move the cursor to the [Col] (Color) column for **CURSOR** 

the No. to be displayed.

F1 to F8 Select [On] to display the waveform.

> 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. 182)

#### When [On] is selected:

Operating Key

F1 to F8 Select the color to display.

Assign channels to the X and Y axes.

**CURSOR** Move the cursor to the [X-Axis] and [Y-Axis] col-

umns.

F1 to F8 Select the channels to display on the X and Y ax-

Select the Graph for display.

(When Split-Screen is enabled for [2 Graphs] or more, or [Wave & 2 Comp] is selected)

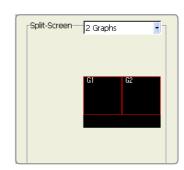
**CURSOR** Move the cursor to the [Graph] column. F1 to F8

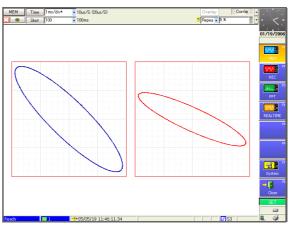
Select the graph number for display.

A sample of the Graph number (G1, G2, ...) is displayed at the left side of the screen.

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].

#### 7.4 Composite Waveforms (X-Y Waveforms)



#### 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. 193), "8.8 Cursor Values" (⇒ p. 195)

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]

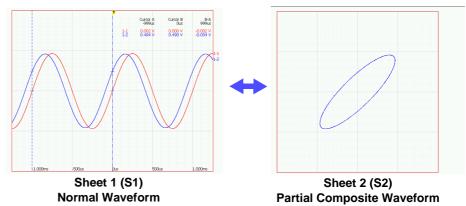
Sheet 2 (S2)

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.



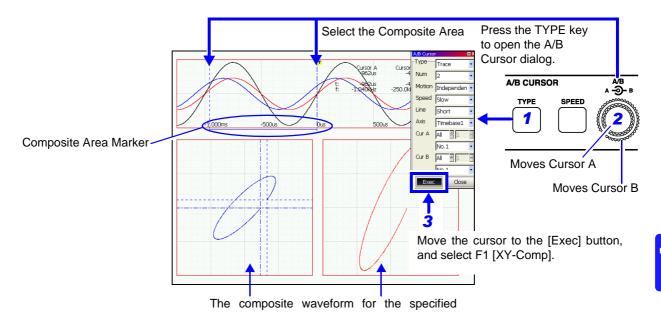
The composite range can be changed from Sheet 1.

## 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.

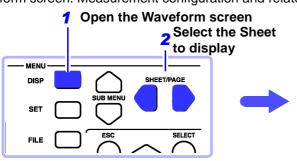


range is displayed.

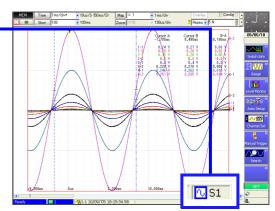
Markers indicate where the X-Y composite is executed. After the composite is displayed, you can move the A/B cursors to verify the composite range.

## **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:



#### Items Available for Waveform Setting and Analysis (Waveform Screen)

#### Waveform Scrolling (⇒ p. 186)

"2.4 Waveform Screen" (⇒ p. 19)

#### **Display Switching**

- · Waveform display (Normal)
- Sheet switching (⇒ p. 169)
- Input level display (⇒ p. 192)
- Gauge display (⇒ p. 191)
- Info display of measured values, calculation results and etc.(⇒ p. 189)
- Numerical values display (⇒ p. 214)

#### Changing Settings on the Waveform Screen

- Measurement configuration settings (timebase, recording length, etc.)\*1 ( $\Rightarrow$  p. 108)
- Input channel settings\*<sup>2</sup>(⇒ p. 128)
- Trigger criteria settings\*¹(⇒ p. 161)
- \*1. Make settings at upper part of screen.
- \*2. Set in a dialog.

#### **Searching Waveforms**

- Trigger Search (⇒ p. 216)
- Time Search (⇒ p. 221)
- Maximum/Minimum Value Search (⇒ p. 222)
- Moving Cursor to Search Location(⇒ p. 188)

#### **Waveform Magnification/Compression**

- Horizontal axis magnification/compression (⇒ p. 204)
- Vertical axis magnification/compression (⇒ p. 205)
- Magnification of partial data (Zoom) (⇒ p. 206)
- Arbitrary setting of vertical display range and position (Variable function) (⇒ p. 208)

#### **Cursor Measurements**

- Specifying A/B cursors (⇒ p. 193)
- Time and frequency (vertical cursors) (⇒ p. 197)
- Voltage (horizontal cursors) (⇒ p. 199)
- Time and voltage (trace cursors) (⇒ p. 200)

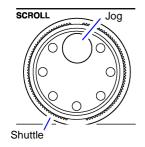
#### **Memory Block Display**

- Viewing waveforms in every block (⇒ p. 213)
- Overlaying reference waveforms (⇒ p. 105)

#### **Displaying a Specified Location** (Jump Function) (⇒ p. 188)

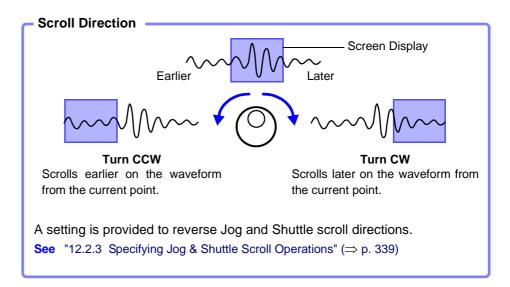
- Moving to a Trigger Location
- · Moving to a Searched Location
- · Moving to a Cursor Location
- Moving to a Specified Location

## 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.





#### 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. 204)



#### 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

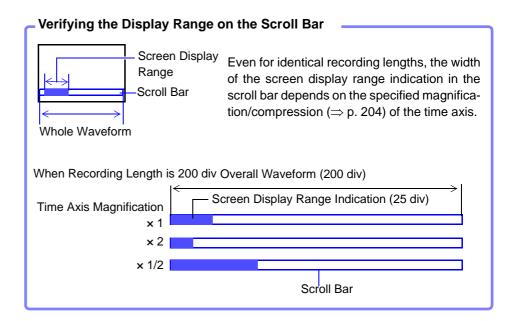
Acquired parts of the waveform can be displayed. Turning the Jog and Shuttle causes "Scroll Trace" to appear.

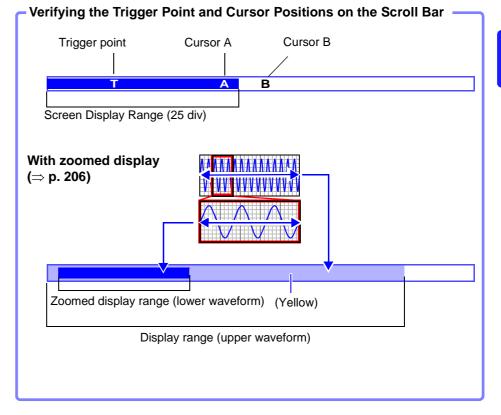
To return the display to the currently recording part of the waveform, press the **F1** [Scroll Trace] key.

## **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.





# 8.3 Specifying a Display Location (Jump Function)

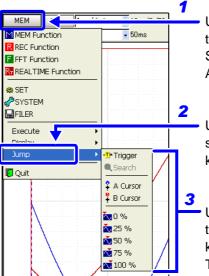
When the recording length of a waveform is long or when the desired portion is off-screen, you can specify the portion to be displayed immediately. This operation is available with the following functions:

- · Memory Function
- Recorder Function
- · 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)





Use the CURSOR keys to move the cursor to the function menu, and press the SELECT key.

A pull-down menu appears.

Use the  $\bigcirc$  CURSOR key to move the cursor to [Jump], and press the  $\bigcirc$  CURSOR key.

Use the  $\triangle$  and  $\nabla$  CURSOR keys to select the item to display, and press the ENTER key.

The waveform at the selected display location appears.

Trig	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.	

<sup>\*1.</sup> Perform a search using the search function beforehand (⇒ p. 215).

<sup>\*2.</sup> 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].

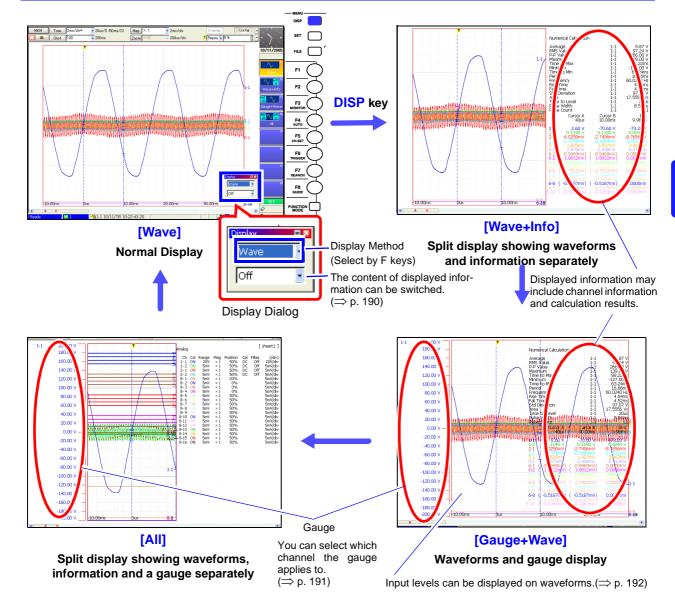
See "7.2.3 Setting the Display Type" (⇒ p. 171), "7.2.5 Setting Waveform Scrolling Orientation" (⇒ p. 173)

## 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.



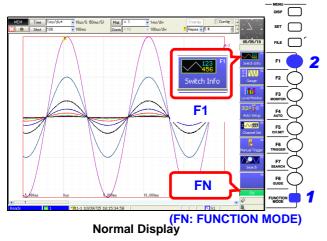
### **Switching Information Contents**

#### Displayable Contents (display details depend on operating state)

Informa- tion Item	AB Cursor *1	Ch Info		Num Calc *4	Monitor	
Details	<ul> <li>Analog1</li> <li>Analog2 *<sup>2</sup></li> <li>Logic</li> <li>Wave Calc*<sup>3</sup></li> </ul>	<ul> <li>Analog</li> <li>Logic</li> <li>XY-Comp</li> <li>Wave Calc*3</li> </ul>	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.

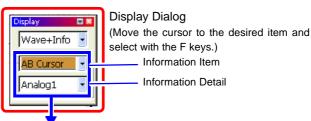
- \*1 When numerical calculation results are enabled (On), they are displayed with the A/B cursor values.
- \*2 Items that cannot be displayed with [Analog1] are displayed with [Analog2].
- \*3 Appears only when waveform calculation is enabled (On).
- \*4 Appears only when numerical calculation is enabled (On).



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.

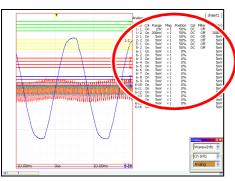
Press the **ESC** key to close the dialog.



(when Numerical Calculation is enabled) **Numerical Calculation** Results A/B Cursor Values

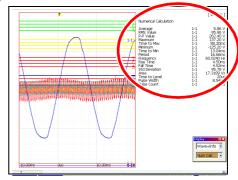
[AB Cursor]

A/B cursor display contents are selectable.



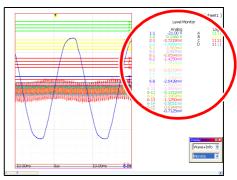
[Ch Info]

Channel information and comment display contents are selectable.



[Num Calc]

Numerical calculation results are displayed when the Numerical Calculation function is enabled (On).



#### [Monitor]

The Level Monitor value of each waveform is displayed. Levels can be displayed.(⇒ p. 192)

## 8.5 Applying Gauges

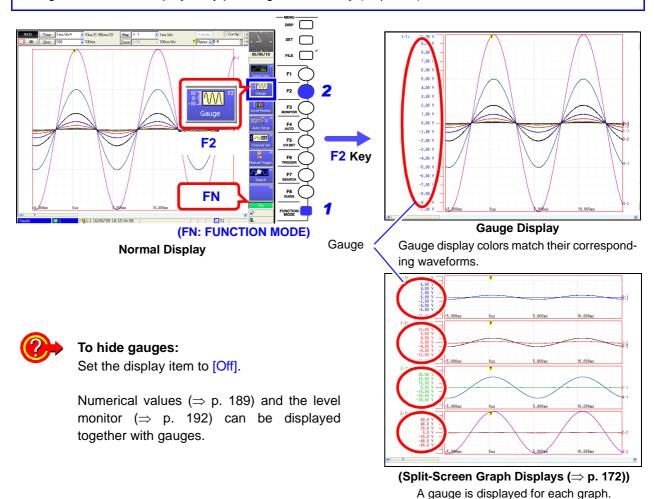
Gauges corresponding to the measurement range of each channel can be displayed at the left side of the screen. Measurement values can be verified on the gauges.

Press the **FUNCTION MODE** key to enable the FN mode, then press **F2** [Gauge].

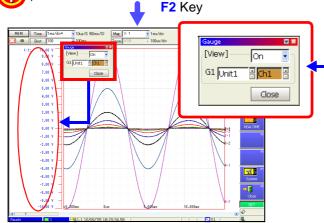
The Gauge dialog appears. Gauges to be displayed can be selected as occasion demands.

Press the **ESC** key or the **F8** [Close] key to close the dialog.

Gauges can also be displayed by pressing the DISP key.(⇒ p. 189)



To choose which gauges to display: select channels in the dialog



Using the **CURSOR** keys, move the cursor into the dialog and select the channels for which to display a gauge.

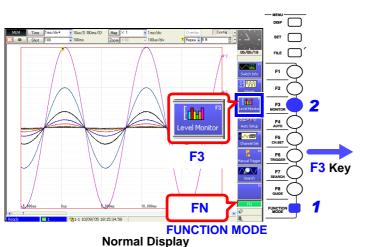
For XY-composite waveforms, select a waveform (No.) that has been enabled on the [X-Y Comp] page of the Sheet Settings screen.

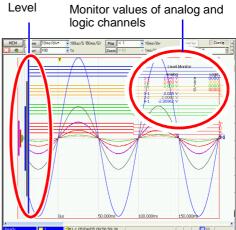
## 8.6 Monitoring Input Levels (Level Monitor)

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.





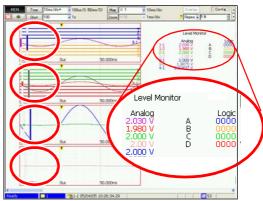
**Analog and Logic Channels** 



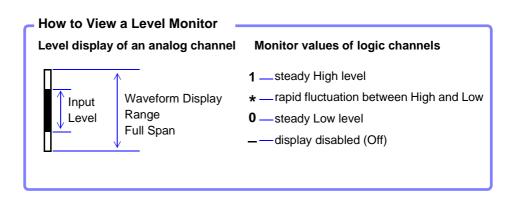
#### To hide the level monitor:

Press the F3 [Level Monitor] key again.

Gauges can be displayed along with cursor values and calculation results.



When split-screen display is enabled ( $\Rightarrow$  **p. 172)**, level monitors are displayed for each graph.

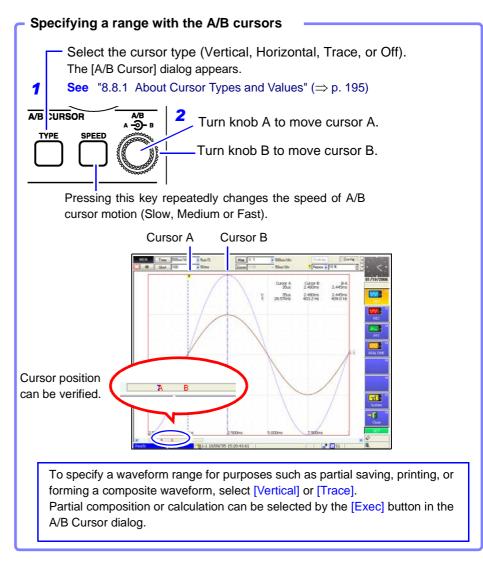


<u>NOTE</u>

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.



Refer to the following for details:

About reading measurement values and cursor types:

```
See "8.8 Cursor Values" (⇒ p. 195)

"8.8.1 About Cursor Types and Values" (⇒ p. 195)
```

To save a specified waveform range (Partial Save):

Select [A-B] as the Save Area setting.

```
See "10.3.7 Automatically Saving Waveforms" (⇒ p. 267)
"10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (⇒ p. 270)
```

• To print a specified waveform range (Partial Print):

```
Select [A-B] as the Print Area setting.
```

See "Print Area Settings" (⇒ p. 312)

For manual printing, select [A-B Wave] as the Print Type.

See "Manual Print [Quick Print]" (⇒ p. 305)

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. A37)

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]

- 1					
	Installed Memory (Words)		8958 16-Ch Scanner Unit		
	8860	8861	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	

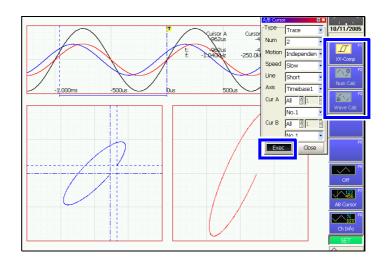


If the cursors do not appear on screen when the cursor type is selected Turn the A/B knobs to display the cursors.



#### To compose or calculate waveforms within a specified range

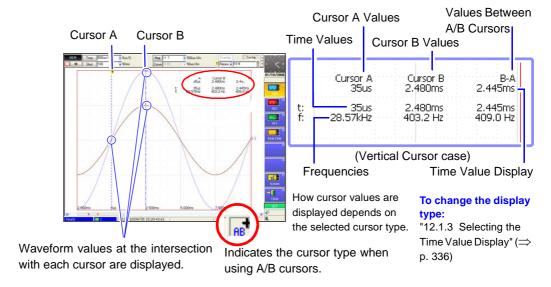
After specifying the range, place the cursor on the [Exec] button and select the type of execution by the F keys.



### 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. 202) for X-Y composite cursor values.

Waveforms and cursor values can be displayed separately by pressing the **DISP** key. ( $\Rightarrow$  p. 189)



## 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	0
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.	<b>A</b> 0
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 any	0
	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  Cursor A Cursor B B-A 35us 2.480ms 2.445ms t: 35us 2.480ms 2.445ms f: 28.57kHz 403.2 Hz 409.0 Hz
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  A B-A	Cursor A Cursor B B-A 1-1 0.00 V 4.92 V 4.92 V 1-2 0.00 V 9.84 V 9.84 V
Trace Cursors (Time and Mea- surement 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  A B B-A (Difference between measured values) B-A (Time difference)	Cursor A Cursor B 5.180 ms 1-1 -0.18 V 9.88 V 10.08 V 9.70 V 9.80 V  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. 189)



#### If the A/B cursors do not appear on screen when enabled:

The A/B cursor positions can be verified on the scroll bar. ( $\Rightarrow$  p. 187)

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)" ( $\Rightarrow$  p. 188)

REALTIME

## 8.8.2 Reading Time and Frequency (Vertical Cursors)

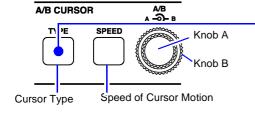
Displays the time and frequency values at the A/B cursors, or the difference in times and frequencies between the A/B cursors.

#### About cursor values:

See "8.8.1 About Cursor Types and Values" (⇒ p. 195)



To open the screen: Press the **DISP** key  $\rightarrow$  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.

Select the Cursor Type.

Operating Key

CURSOR Move the cursor to the [Type] item.

F2 Select [Vertical].

(The selection can also be made by pressing the

TYPE key)

Procedure

Select the number of cursors to enable.

CURSOR Move the cursor to the [Num] item.

F1 to F8 Select either choice.

Enable only cursor A. (skip to Step 4)Enable both A/B cursors. (continue to Step 3)

(When 2 cursors are enabled)
Select the cursor motion method.

CURSOR Move the cursor to the [Motion] item.
F1 to F8 Select either choice.

Independent The A/B cursors move independently.

Together The A/B cursors move together.

Select the cursor speed.

CURSOR Move the cursor to the [Speed] item.

F1 to F8 Select either choice.

Fast, Medium or Slow

(The selection can also be made by pressing the **SPEED** key)

Avis to serve as the origin of cursor move-

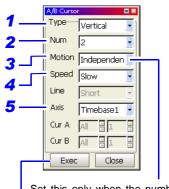
Select the Axis to serve as the origin of cursor movement.

(Only when using the Timebase 2 with the Memory function)

**CURSOR** Move the cursor to the [Axis] item.

F1 to F8 Select either choice.

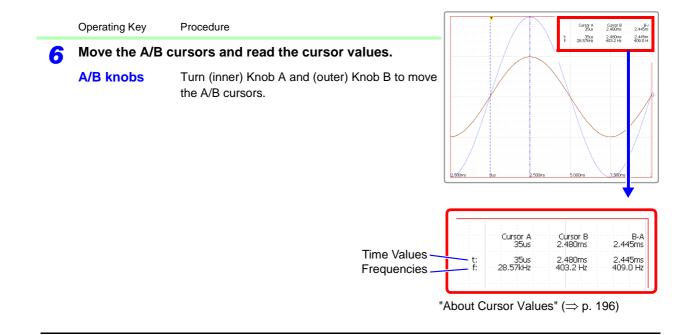
Timebase 1 or Timebase 2



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. 182))
- Numerical value calculations
   (⇒ p. 193)
- Waveform calculations (⇒ p. 193)
   Calculation settings: Analysis Supplement





## 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.

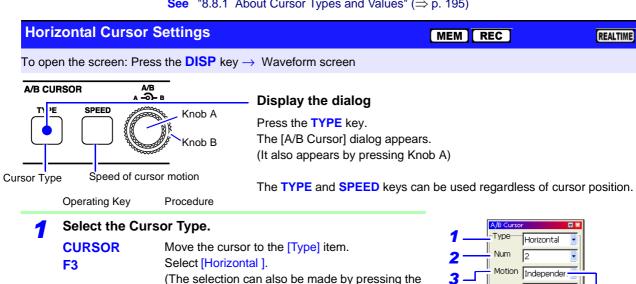
See "8.3 Specifying a Display Location (Jump Function)" (⇒ p. 188)

## **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. 195)



Select the number of cursors to enable.

TYPE key)

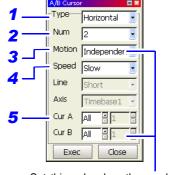
**CURSOR** F1 to F8

Move the cursor to the [Num] item.

Select either choice.

Enable only cursor A. (skip to Step 4)

Enable both A/B cursors. (continue to Step 3)



Set this only when the number of cursors (Num) is set to [2].

(When 2 cursors are enabled) Select the cursor motion method.

**CURSOR** 

Move the cursor to the [Motion] item.

Select either choice. F1 to F8

Independent The A/B cursors move independently. **Together** The A/B cursors move together.

Select the cursor speed.

**CURSOR** Move the cursor to the [Speed] item.

Select either choice. F1 to F8

Fast, Medium or Slow

(The selection can also be made by pressing the **SPEED** key)

Select the channels for which to display cursor values.

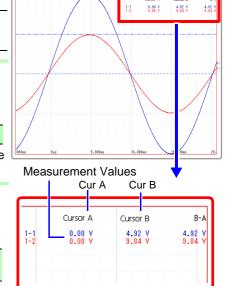
**CURSOR** Move the cursor to the [Cur A] or [Cur B] item. Select either choice. F1 to F8

> All, or channel numbers for which to display cursor values

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.



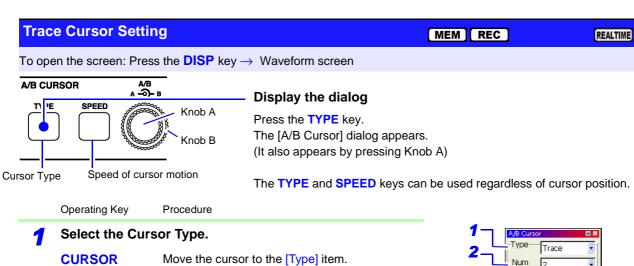
"About Cursor Values" (⇒ p. 196)

## **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. 195)



TYPE key)

**CURSOR** F1 to F8

F4

Move the cursor to the [Num] item.

Select either choice.

Select the number of cursors to enable.

Select [Trace].

Enable only cursor A. (skip to Step 4)

Enable both A/B cursors. (continue to Step 3)

(The selection can also be made by pressing the

(When 2 cursors are enabled) Select the cursor motion method.

**CURSOR** 

Move the cursor to the [Motion] item.

Select either choice. F1 to F8

Independent The A/B cursors move independently. The A/B cursors move together. **Together** 

Select the cursor speed.

Move the cursor to the [Speed] item. **CURSOR** 

Select either choice. F1 to F8

Fast, Medium or Slow

(The selection can also be made by pressing the

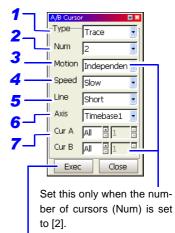
SPEED key)

Select the cursor (horizontal) length.

**CURSOR** Move the cursor to the [Line] item.

F1 to F8 Select either choice.

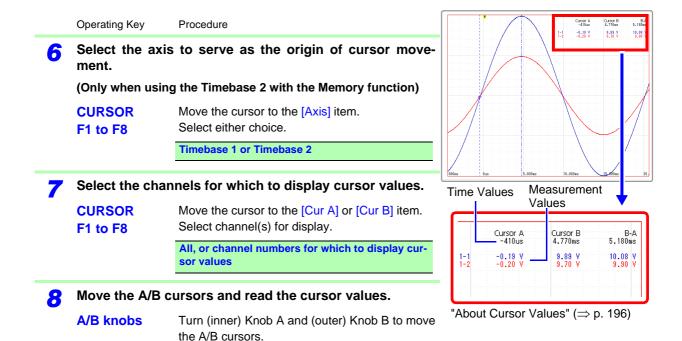
**Short or Long** 



To perform partial composition or calculation, specify the desired range.

- XY composition ("Making Partial Composites" (⇒ p. 182))
- Numerical value calculations (⇒ p. 193)

 Waveform calculations (⇒ p. 193) Calculation settings: Analysis Supplement





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. 188)



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.

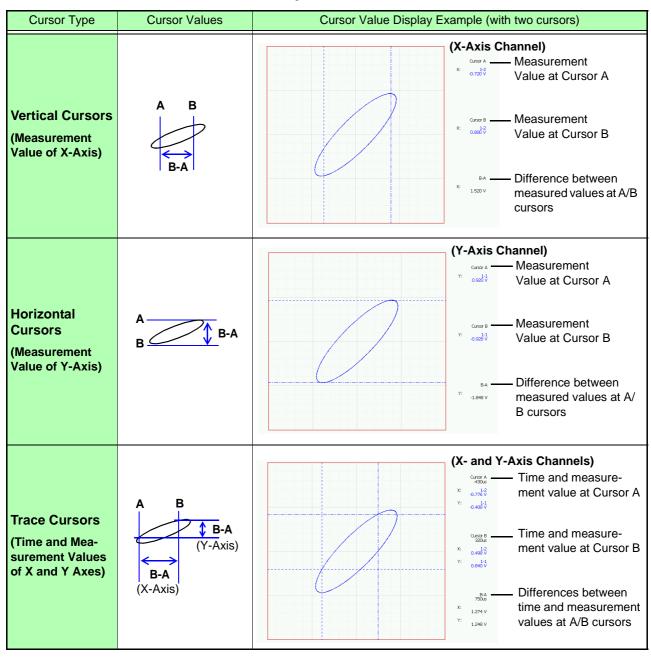
## 8.8.5 Reading Cursor Values of X-Y Waveforms

#### This applies to the Memory function only.

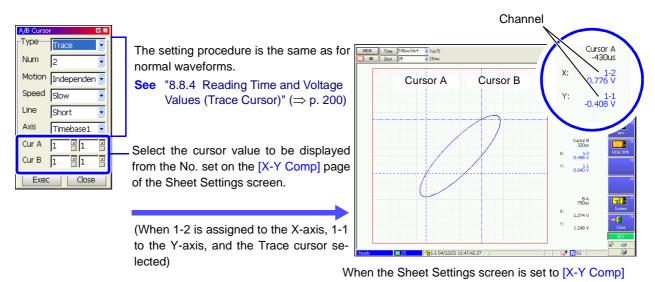
The A/B cursors can be used to read measurement values on X-Y waveforms. With split-screen display, even when the A/B cursors are set to different graphs, the potential difference between A and B can be obtained. Partial X-Y composite waveforms can also be defined using the A/B cursors.

See "Making Partial Composites" (⇒ p. 182)

#### **About Cursor Values of X-Y Composite Waveforms**



Press the **TYPE** key to open the [A/B Cursor] dialog. Select the cursor type and required items.



## 8.9 Magnifying and Compressing Waveforms

# 8.9.1 Magnifying and Compressing Horizontally (Time Axis)

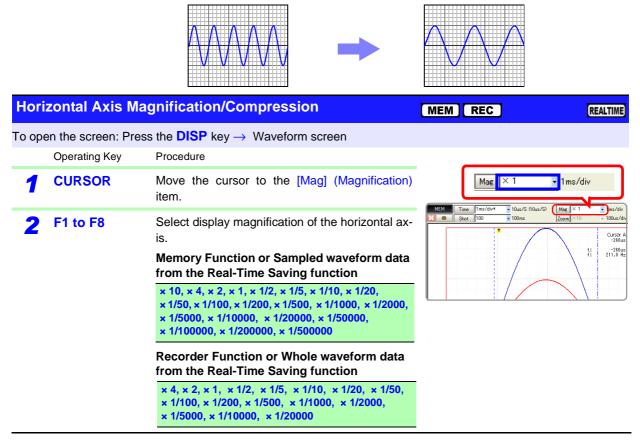
**Normal Display** 

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.

Magnified Display (x 2)

The amount of magnification/compression can be changed after measurement.



### NOTE

With the Recorder function, display magnifications of  $\times$  4 and  $\times$  2 are available only for on-screen display. For printing, each data point corresponds to one pixel when magnification is  $\times$  1, so the resolution is the same as displaying at  $\times$  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.

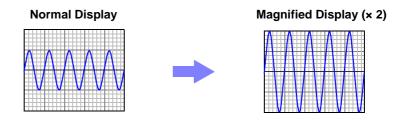
See "Time Axis Magnification and Compression Settings" (⇒ p. 317)

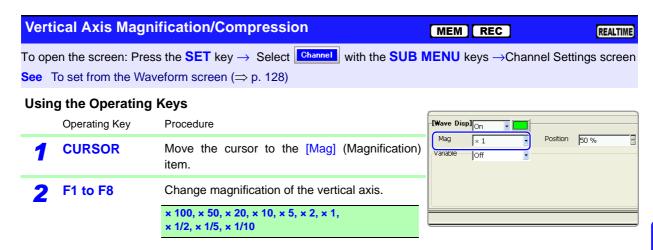
When displaying a highly compressed waveform loaded from storage media, there may be considerable delay before the waveform appears.

# 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 ( $\Rightarrow$  p. 166).



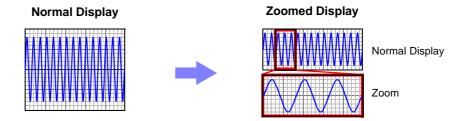


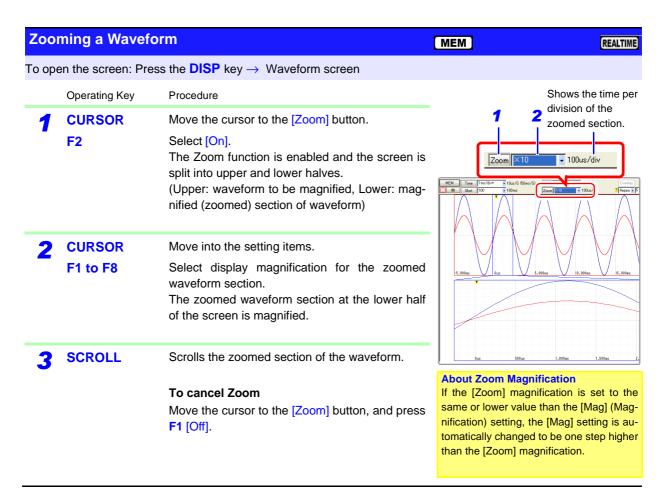
# 8.9.3 Magnifying a Section of the Horizontal Axis (Time Axis – Zoom Function)

This applies to the Memory function 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.





#### **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.

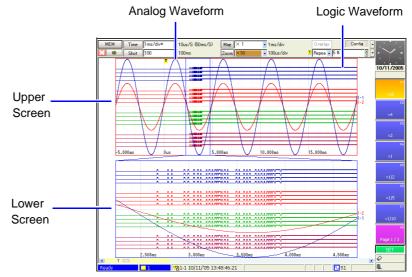
#### About logic waveform display

Depending on display position (⇒ p. 178) and height (⇒ p. 179) 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.

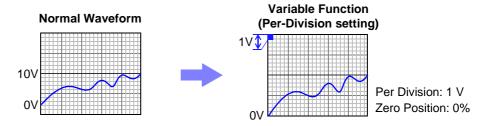
The Variable function can be set on or off for each channel.

By using the Scaling and Variable functions together, the full span of a sensor's output can be displayed. ( $\Rightarrow$  p. 210)

The following two setting methods are available:

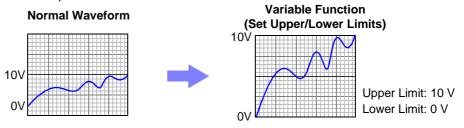
#### • Set the displayed amplitude per division (1div setting)

Set the amplitude to be displayed per vertical division and the zero position of the waveform on the vertical axis.

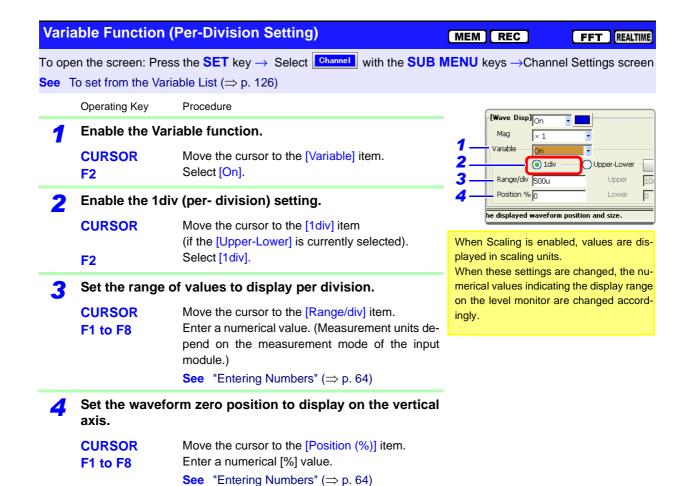


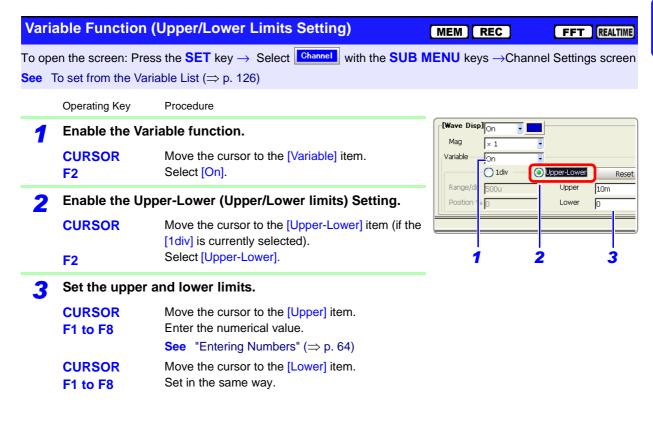
#### Set the Upper and Lower Limits (Upper-Lower setting)

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) ( $\Rightarrow$  p. 123).





#### **Description**

#### When setting combined use of the Scaling and Variable functions

# When Auto-Correction of the Variable function is enabled (On, default setting) ( $\Rightarrow$ p. 341)

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]  $\rightarrow$  (Scale 1): 0 [A]

(Input 2): 5.78 [V]  $\rightarrow$  (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.

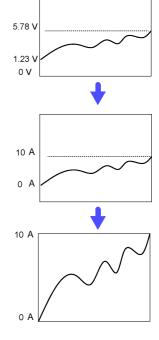
The Variable function is set as follows:

Variable: On, Set Upper/Lower Limits

Lower Limit: 0 [A] Upper Limit: 10 [A]

The full append of output from the capacitic display.

The full span of output from the sensor is displayed.



10 V



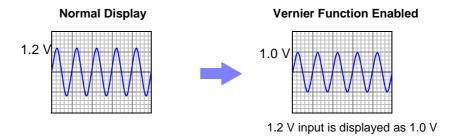
#### To reset the settings

Select the [Reset] button. Settings return to their defaults.

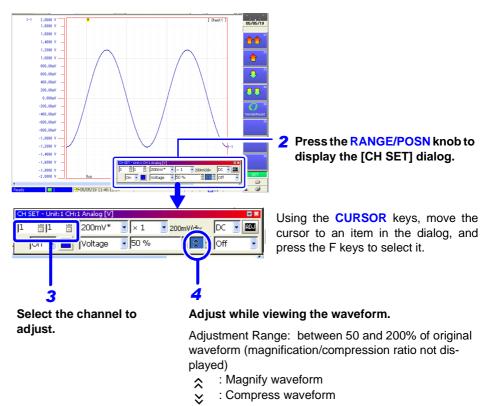
Variable On	•	
<b>●</b> 10	liv Opper-Lowe	r Reset
Range/div 500u	Upper	jium
Position % 0	Lower	0

# 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 Press the DISP key to display the Waveform screen.



NOTE

- The Vernier function cannot be applied to the calculation waveforms.
- Vernier adjustments cannot be verified on printed waveforms or lists.

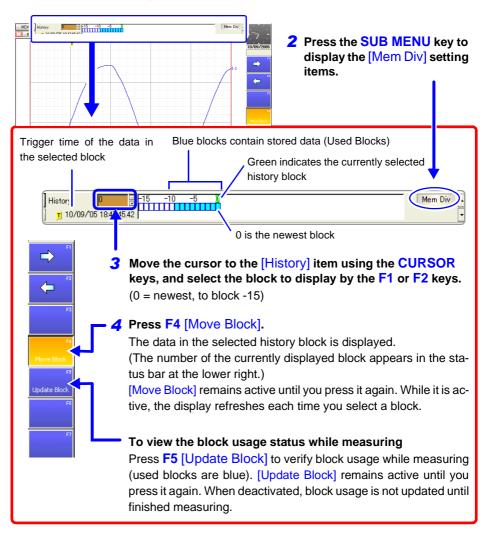
## 8.11 Viewing Past Waveforms

This operation is available when the Memory Division function is disabled.

The instrument stores in internal memory up to 16 waveform measurements (16 blocks)<sup>\*2</sup> that were measured with the same setting configuration<sup>\*1</sup> (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.



# 8.12 Viewing Waveforms in Every Display Block (Memory Division)

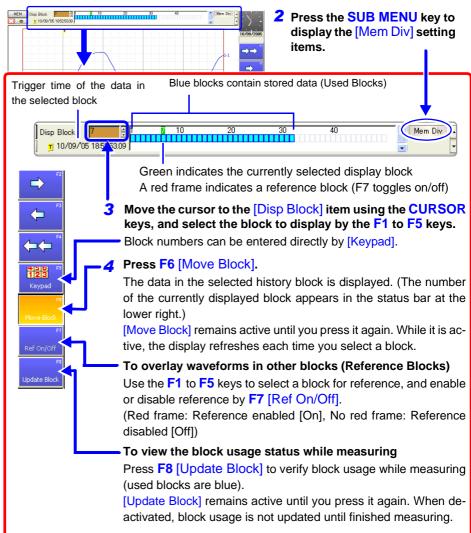
This operation is available when the Memory Division function ( $\Rightarrow$  p. 103) is enabled.

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. 212)

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





#### 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. 105)



#### To switch the waveform in a block

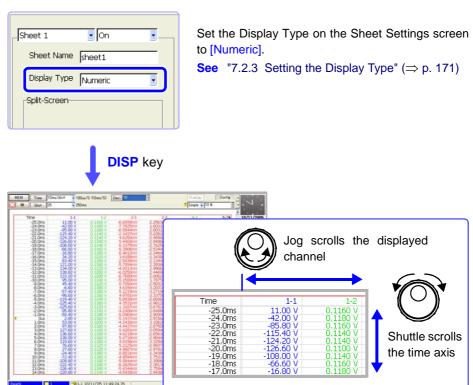
Select the block to display with the **SHEET/PAGE** keys.

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. 340)

# 8.13 Viewing Waveform Data as Numerical Values

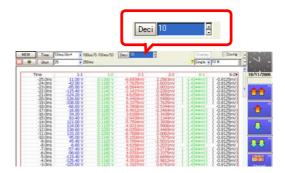
#### To display numerical values





#### 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.

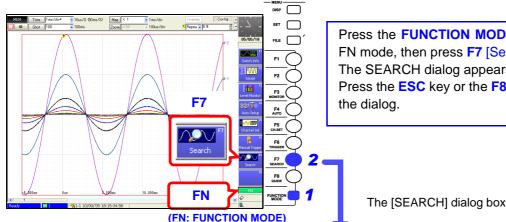
- When [2] is selected:
   Every other sample is thinned out (hidden). Numerical values are displayed for every other sample.
- When [10] is selected:
   Nine out of every ten samples is thinned out (hidden). Numerical values are displayed for one out of every ten samples.

# 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. These are available only with the Memory and Real-Time Saving functions.

- Trigger Search (⇒ p. 216) Specify trigger criteria to find locations that meet those criteria.
- Peak Search (⇒ p. 222) Select the maximum, minimum, local maximum or local minimum location to find.
- Time Search (⇒ p. 221) Specify any time to locate on the waveform.

Search markers are placed wherever search criteria are satisfied. Also, A/B cursors can be moved to the search marker locations.



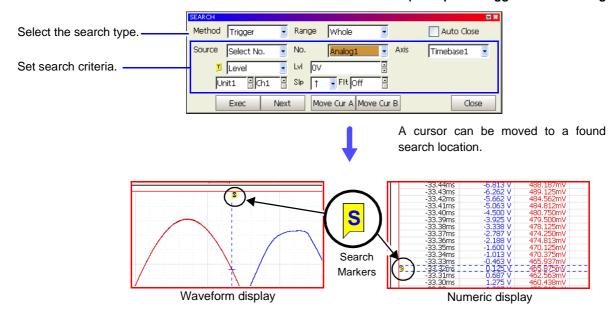
Press the **FUNCTION MODE** key to enable the FN mode, then press **F7** [Search].

The SEARCH dialog appears.

Press the **ESC** key or the **F8** [Close] key to close

The [SEARCH] dialog box appears.

#### (Example of Trigger Search settings)



# 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
Level	S	Level (LvI), Slope (Slp), Filter (Flt)
Win-In	S	Upper limit (Up), Lower limit (Low), Filter (Flt)
Win-Out	S	Upper limit (Up), Lower limit (Low), Filter (Flt)
Logic		Filter, Trigger pattern (1 to 4)

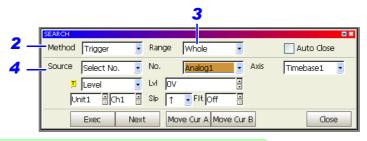


To open the screen: Press the **DISP** key → Waveform screen

Operating Key Procedure

**FUNCTION MODE** Display [FN] mode. Select [Search].

The [SEARCH] dialog box appears.



Select the contents to find.

**CURSOR** Move the cursor to the [Method] item.

**F1** Select [Trigger].

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.

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]

See "Select which timebase to search (if measured using two timebases)." (⇒ p. 218)

#### 8.14 Searching a Waveform

Operating Key Procedure

#### **Setting Analog Channel Search Criteria**

Displayed items depend on the trigger type.

When the trigger type is [Level]



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.

Select which timebase to search (if measured using two timebases). [MEM]

CURSOR F1 to F8 Move the cursor to the [Axis] item.

Select either choice.

Timebase 1 Searches a Timebase 1 channel (default setting).

Timebase 2 Searches a Timebase 2 channel.

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)

Select the type of trigger criteria to use for searching.

CURSOR F1 to F8 Move the cursor to the [Unit], [Ch] item and select

the channel to be searched.

Only those channels that were recorded using

the [Axis] can be selected.

Select the search criteria.

CURSOR F1 to F8 Select the trigger search criteria.

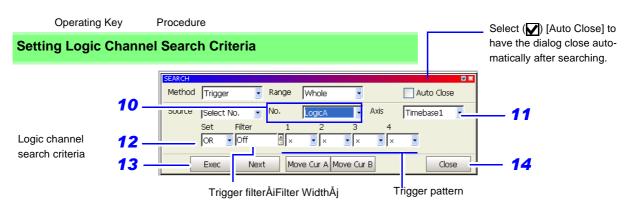
Available selections depend on the search type.

Lvi (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 $\uparrow$ or falling $\downarrow$ ) for search.
Flt (Filter)	Set the filter width (trigger filter) for search. Prevents noise from causing false triggers ( $\Rightarrow$ p. 143).
Up (upper limit) Low (lower limit)	Select whether to search for upper or lower limit values.

To combine different search criteria with logical [AND] or [OR], repeat steps 5 to 9 to specify all necessary criteria.

Trigger search criteria settings are the same as the pre-measurement trigger criteria settings.

See "6.7 Triggering by Analog Signals" (⇒ p. 140)



Select the criteria number to use.

**CURSOR** Move the cursor to the [No.] item.

Select a number for this set of search criteria, F1 to F8

from Analog 1 to Analog 8.

Select the timebase to search (if measured using two timebases). MEM

**CURSOR** Move the cursor to the [Axis] item.

Select either choice. F1 to F8

> Timebase 1 Searches a Timebase 1 channel (default setting).

Timebase 2 Searches a Timebase 2 channel.

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 premeasurement trigger criteria settings. See "6.8 Triggering by Logic Signals (Logic Trigger)" (⇒ p. 153)

#### Search

**CURSOR** 

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 ( 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].

Close the search function.

F8 Select [Close].

#### **Description**

#### If search results differ from expectations

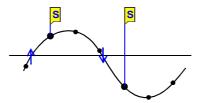
Undesired search results may occur as a result of noise on the acquired waveform. In such cases, enable the trigger filter.

See "6.7 Triggering by Analog Signals" (⇒ p. 140)

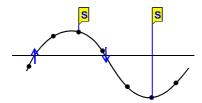
When the slope (Slp) setting is  $[\uparrow\downarrow]$ , the search result location is one sample late.

#### **Level Trigger Search**

When the slope (Slp) setting is  $[\uparrow]$ ,  $[\downarrow]$ 



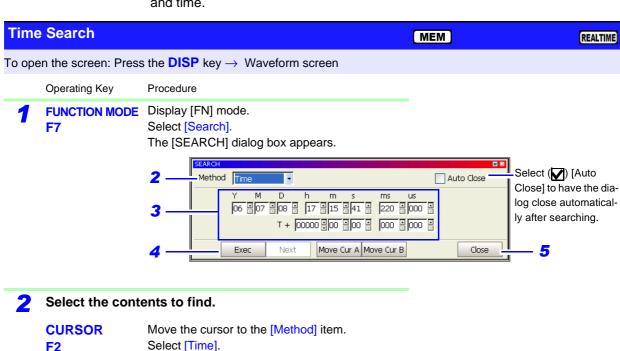
When the slope (Slp) setting is  $[\uparrow\downarrow]$ 



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.



Specify the time to find

**CURSOR** F1 to F8

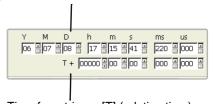
Move to the date field (to specify an absolute time) or time from trigger [T] (relative time), and set the time to find.

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.

Date field (to specify an absolute time)



Time from trigger [T] (relative time) (T+: time after a trigger event, T-: time before a trigger event)

#### Search

**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

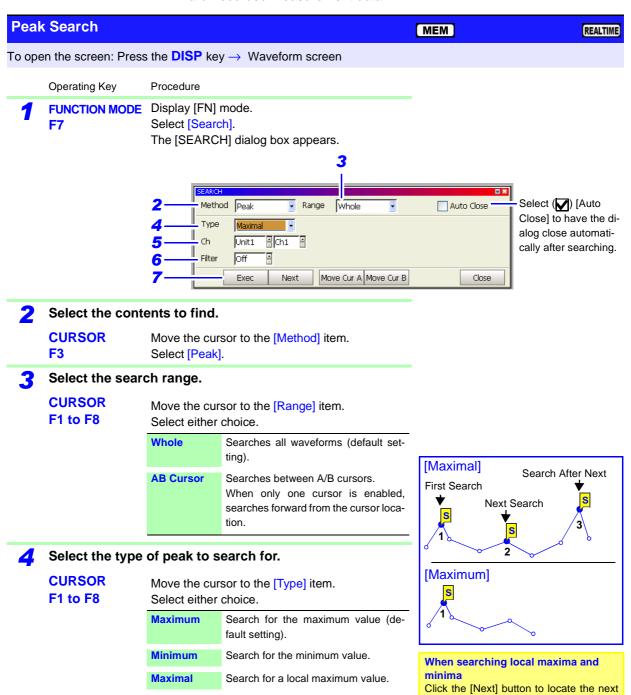
F4 or F5 Select [Move Cur A] or [Move Cur B].

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.



Search for a local minimum value.

local maximum or minimum after the cur-

rent location.

Select the channel to be searched.

**CURSOR** Move the cursor to the [Ch] item.

**Minimal** 

F1 to F8 Select the input module (Unit) and channel num-

ber data to be searched.



Operating Key

Procedure

(If searching for local maxima or minima)

Set the criteria for the local maximum or minimum value (Filter).

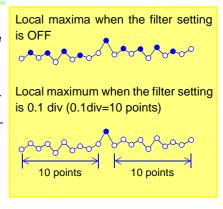
CURSOR F1 to F8 Move the cursor to the [Filter] item.

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).



#### 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 ( significant elecations 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].

Close the search function.

F8 Select [Close].

# 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 HD Unit, 9717 MO 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** "10.4 Loading Data" (⇒ p. 275)

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.

#### 9.1 Overview of the Real-Time Saving Function

#### 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).

# Chapter 9 Measuring with Real-Time Saving

# **Setting and Analysis Workflow**

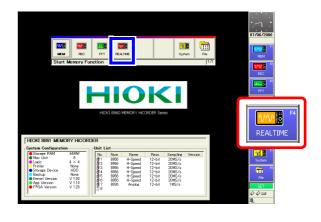
#### **Function Selection**

#### Select the Real-Time Saving function.

See: "Choosing the Appropriate Function" (⇒ p. 81)

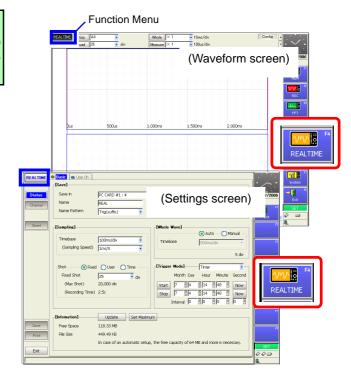
#### From the Initial screen:

Press the F4 [REALTIME] key.



#### 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

#### 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

#### 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.

#### 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.

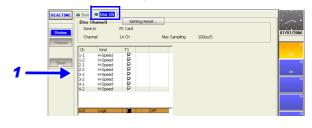
#### Make whole waveform settings

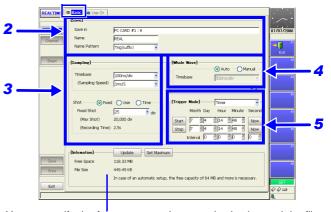
The timebase can be set automatically or manually.

Set the trigger mode (recording method)
Select single (one-shot), continuous or timer.

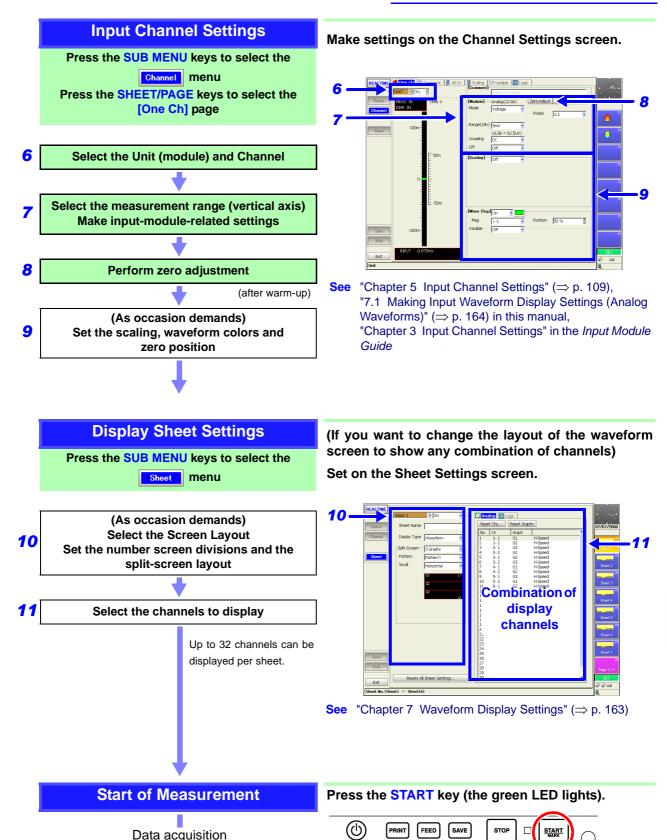
#### Make settings on the Status Settings screen.

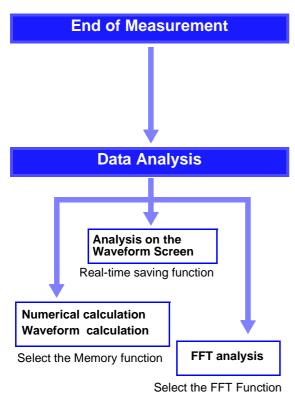
Measurement using different sampling rates is not available with the Real-Time Saving function.





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.





#### Press the STOP key.

Recording stops after acquiring the specified length (the green LED goes off).



Press twice to stop immediately.

#### Analysis on the waveform screen.

See "Chapter 8 Waveform Screen Monitoring and Analysis" (⇒ p. 185)

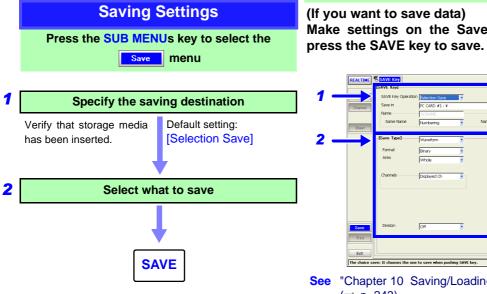
#### Loading files

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.

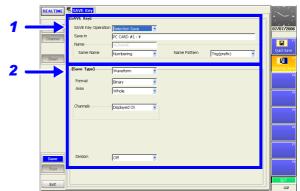
To display a measurement waveform, specify its location within the whole waveform.

- 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.

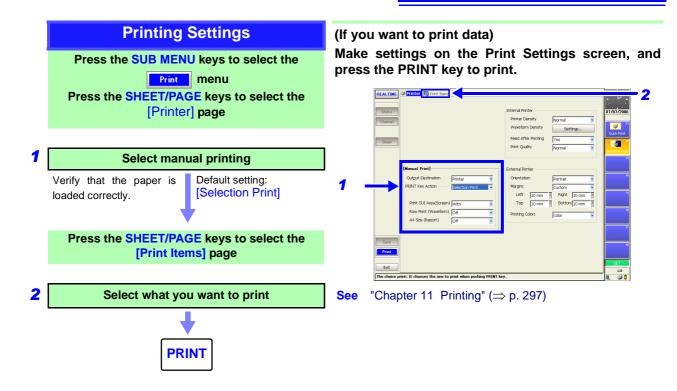


(If you want to save data) Make settings on the Save Settings screen, and



See "Chapter 10 Saving/Loading Data & Managing Files" (⇒ p. 243)

Measurement data stored in memory by the Real-Time Saving function is saved as Memory function data (.MEM).



# 9.3 Pre-Measurement Settings

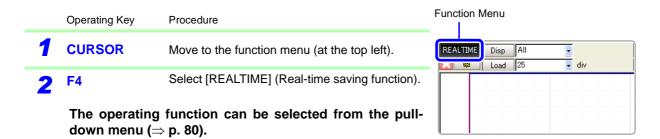
Make the settings required for measurement, such as the save destination and channels to use.

#### 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)**







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).

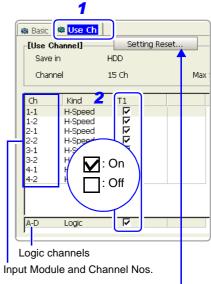
CURSOR Move the highlight cursor to a channel to be set.
F1 to F8 Select either choice.

Off No measurement

Use for measurement (default setting)

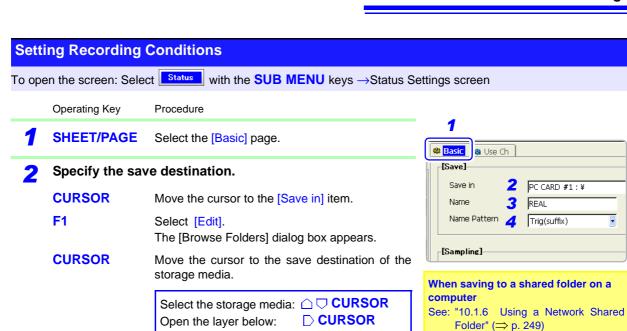
With the Real-Time Saving function, all enabled channels (those with 'On' checked) are saved, regardless of whether their waveforms are dis-

played. See: "Chapter 7 Waveform Display Settings" (⇒ p. 163)



Enables (sets 'On') all channels.





Set the save name (if you want to change the name).

The dialog box closes.

Select [OK].

CURSOR Move the cursor to the [Name] item.

F1 to F8 Enter the save name (default setting)

Enter the save name.(default setting: REAL)

See "Entering Text and Comments" (⇒ p. 65)

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)

F1

Set the time per division (timebase) on the horizontal axis for recording the measurement waveform.

100, 200, 500  $\mu$ s/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.)



The available space on the selected stor-

age media is displayed by selecting the [Update] button at the bottom of the

storage media
Measurement is disabled if the available
space at the save destination is less than

#### Saved files

screen.

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. 237)

For an example of file names created by the [Name Pattern] setting: (⇒ p. 256)



The available timebase settings may be limited by the save destination and the number of channels used ( $\Rightarrow$  p. 237)

## When the timebase is 100 $\mu s/div$ or 200 $\mu s/div$

The waveform is not displayed while measuring.

#### 9.3 Pre-Measurement Settings

Operating Key Procedure

Setting a Recording Length

CURSOR Move the cursor to the [Shot] item.

F1 to F8 Select the setting method for recording length.

(Switch Display: F8) Fixed (Fixed recording length)

Select from the fixed recording lengths(decording lengths)

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.

#### When selecting [Fixed] or [User]

CURSOR Move the cursor to the [Fixed] or [User] item.

**F1 to F8** Select the length of waveform to be acquired (re-(Switch Display: F8) cording length).

#### When selecting [Time]

CURSOR Move the cursor to the [Day] (or Hour, Minute,

Second) item.

**F1 to F8** Select the amount for recording waveforms. (Switch Display: F8)

\_\_\_\_

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.

#### When selecting [Manual]

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

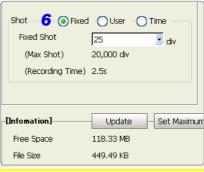
F1 to F8 Set the time per division (timebase) of the hori-

zontal axis.

#### 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 (9715) with 32 MW internal memory: at least 32 MB available space
- Model 8861 (9715) with 64 MW internal memory: at least 64 MB available space
- Models 8860 and 8861 other than the above: at least 128 MB available space



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.



Shot: When [Time] is selected



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  $\mu$ s/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.



Operating Key Procedure

Select the recording method

CURSOR Move the cursor to the [Trigger mode] item.

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 speci-

fied 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. 156)



#### Select each channel

F1 to F8

To open the screen: Select with the SUB MENU keys → Channel Settings screen

See "Chapter 5 Input Channel Settings" (⇒ p. 109) 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. 163)

- 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.

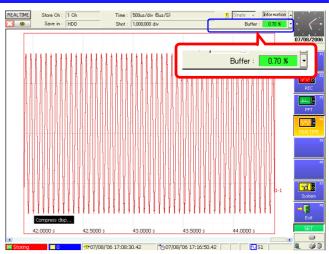
The green LED lights as measurement starts.

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 "10.3.5 Setting Manual Save (SAVE Key Output)" ( $\Rightarrow$  p. 263) "11.4 Making Manual Print (PRINT Key Output) Settings" ( $\Rightarrow$  p. 303)

# 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.

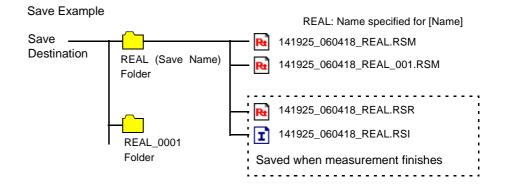
Timebase	HDD	PC Card, LAN (shared folder) or MO
100 μs *	1	
200 μs *	1	
500 μs	2	1
1 ms	4	2
2 ms	10	4
5 ms	24	8
10 ms	33	20
20 ms or more	33	33

- \*. 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 "10.1.7 Initializing (Formatting) Storage Media" (⇒ p. 251)

 Depending on the disc type and usage conditions when saving to MO, measurement during real-time processing may be aborted. Specifically, writing to 128 MB and 2.3 GB media may be too slow to satisfy the specification of the above table. Therefore, we recommend testing whether measurement can be performed when using the intended MO media before attempting critical recording. Alternatively, select a slow timebase setting.

#### 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]

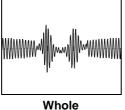
Whole Waveform (the waveform recorded with the [Whole Wave] timebase set on the Status Settings screen)

#### • [Measurement]

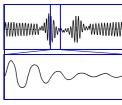
Measurement Waveform (the waveform recorded with the [Sampling] timebase set on the Status Settings screen)

#### • [AII]

Whole Waveform and Measurement Waveform (upper and lower traces, respectively). When printing, the measurement waveform is printed.



Die Measurement



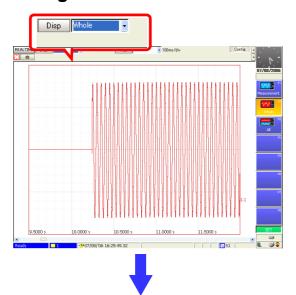
All

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.

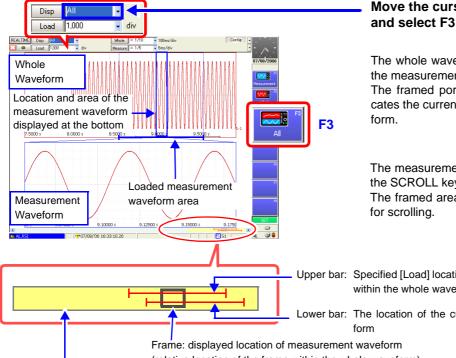
To view previously saved data, load the index file (.RSI) with the Real-Time Saving function ( $\Rightarrow$  p. 241).

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 wave-

The measurement waveform can be scrolled with the SCROLL keys.

The framed area of the whole waveform is linked

Upper bar: Specified [Load] location (relative location of the dotted line within the whole waveform)

Lower bar: The location of the currently loaded measurement wave-

(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. 214)

#### Changing and loading the location of the displayed measurement waveform



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.



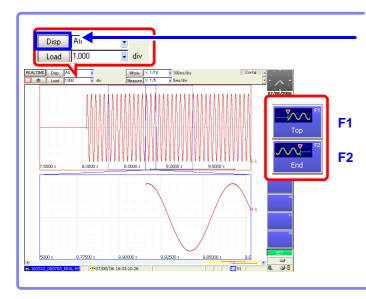
#### To display a waveform that is off-screen.

Move the cursor to the [Disp] button, and select the F1 [Top] or F2 [End] key.

The measurement waveform is displayed at the bottom.

Displays the start position for loading the measurement waveform.

Displays the end position for loading the measurement waveform.





# 

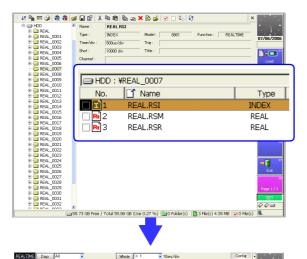
Move the cursor to the [Load] button and select F1 [Load].

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.

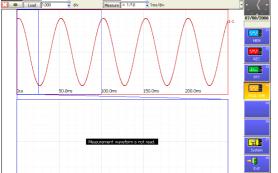
#### **Viewing Saved Waveform Data**



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:  $\bigcirc \bigcirc \bigcirc \text{CURSOR}$  keys Loading: F1 [Load] key (Page 1/3) $\rightarrow$ F1 [Execute] key

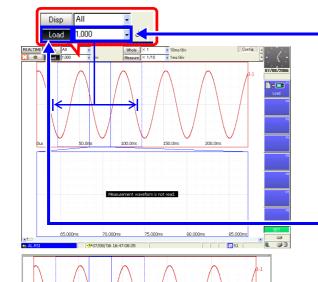
See "10.4.3 Loading Waveform Data" (⇒ p. 279)



€ S1

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.



75.000ms

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 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.

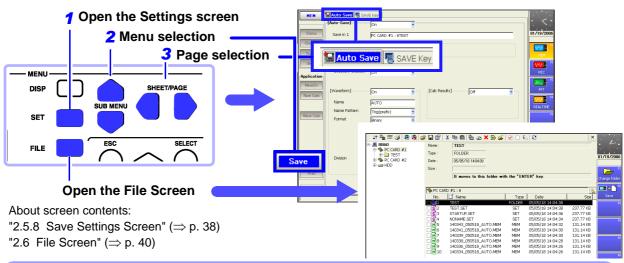
See "3.4 Setting FFT Analysis Conditions" in the Analysis Supplement

# Saving/Loading Data & Managing Files Chapter 10

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.



#### Capabilities for Saving/Loading Data & Managing Files

#### **Supported Storage Media**

- PC card (⇒ p. 244)\*1
- MO disk (⇒ p. 245)\*<sup>2</sup>
- Floppy disk (⇒ p. 247)\*<sup>2</sup>
- Hard disk ( $\Rightarrow$  p. 248)\*<sup>2</sup>
- USB disk (⇒ p. 248)(⇒ p. 254)
- Shared folder on a network (⇒ p. 249) \*3
- \*1. For details on handling, refer to the Quick Start Manual.
- \*2. Optional drives are available.
- \*3. Requires configuration of the communication settings. (⇒ p. 359)

#### Loading Data & Managing Files (File Screen)

- Initializing storage media (⇒ p. 251)
- Loading (⇒ p. 275)
- Copying (⇒ p. 289), moving (⇒ p. 290), and deleting (⇒ p. 291)
- Renaming (⇒ p. 291)
- Creating new folders (⇒ p. 292)
- Sorting files (⇒ p. 293)
- Setting the files (⇒ p. 294) and items to display (⇒ p. 294)

#### Save Method ( $\Rightarrow$ p. 258)

- 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**



#### Settings Data ( $\Rightarrow$ p. 265)

#### **Waveform Data**

- Saving data automatically during measurement (⇒ p. 267)
- Selecting waveforms, then saving (SAVE key)
   (⇒ p. 270)

#### **Display Screens (Screen Image)**

- Saving data automatically during measurement (⇒ p. 272)
- Selecting screens, then saving (SAVE key) (⇒ p. 274)

#### Numerical Calculation Results

- Saving data automatically during measurement
- Calculating and saving after measurement (SAVE kev)
- "1.4 Saving Numerical Calculation Results" in the Analysis Supplement

File types ( $\Rightarrow$  p. 252)

## 10.1 Storage Media

## 10.1.1 Using a PC Card

For details on handling PC cards, refer to "5.2 Using PC Cards" in the *Quick Start Manual*.

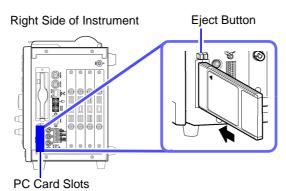
Before saving or loading data to/from a PC card, insert the PC card in the PC card slot on the right side of the instrument. (Two slots are available.)

#### **Supported PC Cards**

Hioki options PC cards (includes adapter)

- 9626 PC Card 32M
- 9627 PC Card 64M
- 9726 PC Card 128M
- 9727 PC Card 256M
- 9728 PC Card 512M
- 9729 PC Card 1G

#### **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. 254)

To use the Model 9558 GP-IB Card interface card, insert it into the PC CARD slot.

See "13.5 Using an Interface Card" (⇒ p. 380)

## 10.1.2 Using an MO Disk

An optional 9717 MO Unit (optional built-in unit installed prior to shipment) is required to save or load data to/from an MO disk.

#### **Supported MO Disks**

3.5 inch MO disk 128 MB, 230 MB, 540 MB, 640 MB, 1.3 GB, 2.3 GB

#### **Handling MO Disks**

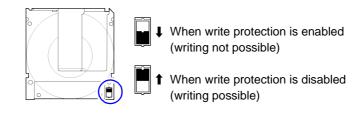
## **ACAUTION**

- Inserting a MO disk upside down, backwards or in the wrong direction may damage the instrument.
- Do not remove the MO disk or turn off the power while the LED of the MO unit is lit. Doing so may damage data on the MO disk.
- Do not use the MO unit while the instrument is tilted. The unit may not work properly.
- Do not subject the MO unit to excessive shock or vibration. Doing so may damage the MO unit.
- To avoid damage to the MO Unit, be sure to remove the MO disk before shipping.
- Use an MO disk in an environment with a temperature of 5 to 35°C.

## NOTE

- Initialize (format) unformatted MO disks before use.
  - See When using the instrument to initialize an MO disk "10.1.7 Initializing (Formatting) Storage Media" (⇒ p. 251)
- Disable write protection before inserting an MO disk. Saving and initializing cannot be performed while write protection is enabled.
- After an MO disk is inserted, it cannot be accessed until the LED light of the 9717 MO Unit goes out (approximately ten seconds).
- The number of bytes available differs depends on the MO disk type.

#### **Enabling & Disabling Write Protection**



#### **MO Disk Insertion & Removal**

Right Side of Instrument

Eject Button & LED

MO Disk Slot

Model 9717 MO Unit
(Option)

Manual Eject Hole

#### Inserting an MO Disk

With the label on the eject button side, fully insert the MO disk in the direction of the arrow.

#### Removing an MO Disk

Press the eject button. (An MO disk can also be ejected by performing an operation from the File screen. See below.)

#### When Pressing the Eject Button Does Not Eject the MO Disk

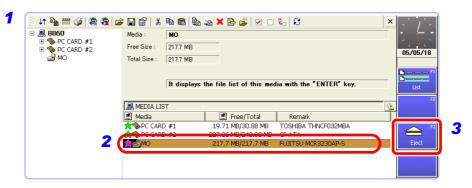
Follow one of the procedures below to remove the disk.

- Procedure 1
  Turn on the POWER switch while pressing the eject button of the MO drive.
- Procedure 2
   Turn off the POWER switch and insert the supplied eject pin or a pin with a diameter of 1 mm into the manual eject hole of the MO drive. The disk is ejected.

When a MO disk is inserted, the name of the storage media appears on the File screen.

See "Storage Media Names" (⇒ p. 254)

#### **Ejecting an MO Disk from the File Screen**



- 1 Press the FILE key to display the File screen.
- Use the CURSOR keys to select [MO] in the media list.
- Press the F3 [Eject] key.
  A confirmation dialog box appears.
- 4 Press the F1 [Execute] key. The MO disk is ejected from the MO unit.

To cancel ejecting, press the F2 [Cancel] key.

## 10.1.3 Using a Floppy Disk

An optional 9716 FD Drive drive is required to save or load data to/from a floppy disk.

#### **Supported Floppy Disks**

3.5 inch 2HD or 2DD Floppy disks formatted to 720 KB or 1.44 MB

#### **Handling Floppy Disks**

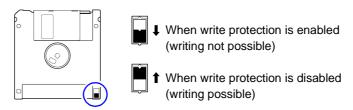
## **ACAUTION**

- Inserting a floppy disk upside down, backwards or in the wrong direction may damage the device.
- Do not remove the floppy disk or disconnect the USB cable while the LED of the floppy disk drive is lit. Doing so may damage data on the floppy disk.
- To avoid damage to the floppy disk drive, be sure to remove the floppy disk before shipping.
- Place the floppy disk drive on a flat surface where it will not be subject to vibration.
- Use a floppy disk in an environment with a temperature of 5 to 40°C.

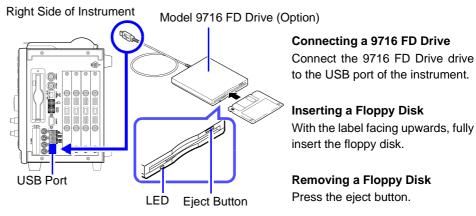
### NOTE

- A 2DD (640 KB) or 2HD (1.2 MB) floppy disk that was formatted on a PC-9801 cannot be used.
- The number of bytes available depends on the floppy disk type.
- Disable write protection before inserting a floppy disk. Saving cannot be performed while write protected is enabled.

#### **Enabling & Disabling Write Protection**



#### Connecting a 9716 FD Drive & Inserting/Removing a Floppy Disk



When a floppy disk is inserted, the name of the storage media appears on the File screen.

See "Storage Media Names" (⇒ p. 254)

## 10.1.4 Using a Hard Disk

An optional 9718 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 60 GB. (1 GB = 1,000,000,000 bytes) The hard disk is initialized prior to shipment.

## **<u>ACAUTION</u>**

- 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.

## 10.1.5 Using USB Memory Devices

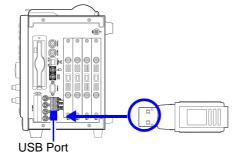
Data can be read and written to a USB memory device connected to the USB port.



- 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.

#### **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. 254)

## 10.1.6 Using a Network Shared Folder

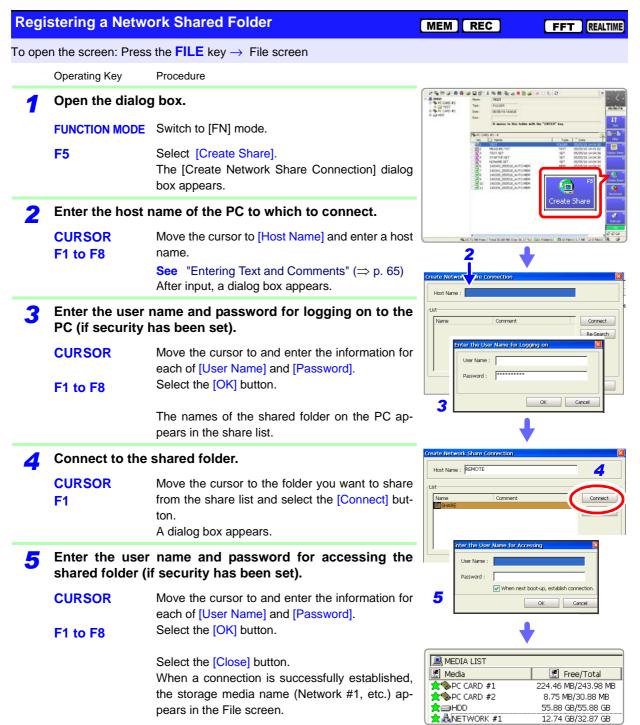
If a shared folder of a PC connected to the network is registered on the File screen, data can be saved and loaded to/from the folder. Furthermore, you can perform file operations in the same way as if the files were on the instrument.

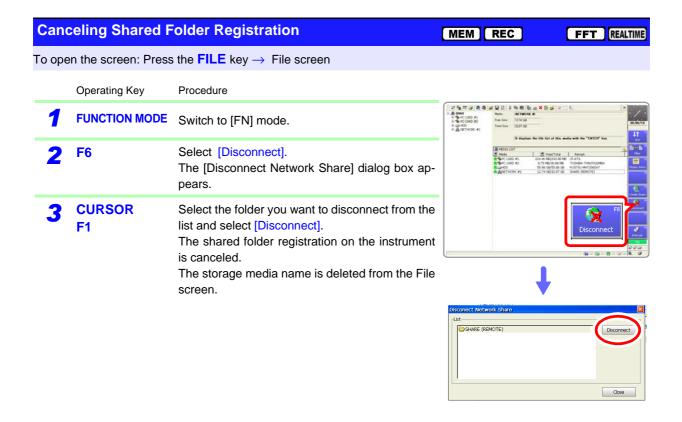
NOTE

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 "13.1 Connection Configurations" (⇒ p. 360)

"13.2 Controlling the Instrument over the LAN Interface" (⇒ p. 362)





### 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 ( $\Rightarrow$  p. 261). (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"Interface Communication Settings: Network Connections" (⇒ p. 366)

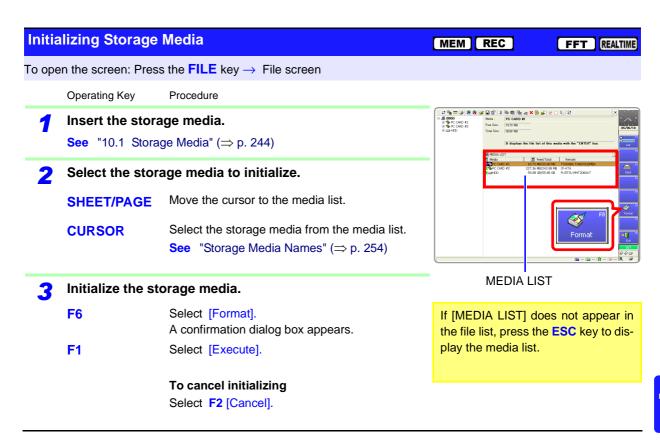
## 10.1.7 Initializing (Formatting) Storage Media

#### Storage Media the Instrument is Capable of Initializing and Formats

Storage Media	Format
Floppy Disk	MS-DOS Format (FAT) When formatted normally: 2HD (1.44 MB), 2DD (720 KB)
PC Card	MS-DOS Format
MO Disk	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.



## 10.2 Data Capable of Being Saved & Loaded

#### Data the Instrument Can Save & Load

"O" = Possible, "-" = Not Possible

	File Ir	Indica-	File Extension & Description		Save			PC
File Type	Format	tion			Auto	Manu- al	Load	Read- able
Settings Data*1	Binary	S	SET	Settings Data (Measurement Configuration)	_	0	0	<b>-</b> *5
		M	MEM	Memory Function Waveform Data	0	0	0	-*5,*6
Waveform Data* <sup>2</sup>		R	REC	Recorder Function Waveform Data	0	0	0	-*5,*6
Whole of the waveform acquired by the instrument or	Binary	Re .	RSM	Sampled waveform data from the Real-Time Saving function	0	-	0	_
a section of the waveform specified with the A and B cursors.			RSR	Whole waveform data from the Real-Time Saving function	0	-	0	_
		F	FFT	FFT Function data	0	0	0	-*5
	Text		ТХТ	Text Data	0	0	-	0
Waveform Manage-	(Index file)		IND	Index data for divided saving	0	0	0	-*5
ment Data (Memory Division*3, Divided Saving, and when Real-Time Saving is selected)		Ī	SEQ	Index data for memory division (created automatically for batch saving)	0	0	0	-*5
			RSI	Index data for the Real-Time Saving Function	0	-	0	_
Numerical Calculation Results	Text		TXT	Text Data	0	0	-	0
Captured Screen Image* <sup>4</sup>	ВМР		ВМР	Image Data	0	0	_	0
	PNG	<u>•</u>	PNG	Image Data	0	0	-	0

<sup>\*1.</sup> Settings data can be loaded automatically at power-on (Auto Setup function) (⇒ p. 281).

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. 195).

\*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.

\*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).

<sup>\*2.</sup> When the data is to be reloaded on the instrument, save it in binary format. Waveforms and some measurement settings are saved.

## **ACAUTION**

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." ( $\Rightarrow$  p. 261)

#### 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
Floppy Disk	14 KB/s
MO Disk (Built-in)	300 KB/s
Hard Disk (Built-in)	1.2 MB/s

Storage Media	Saving Rate
PC Card	450 KB/s
LAN (Transfer to Shared Folder)	630 KB/s

#### File Sizes

Data Type	Size
Settings Data	386 KB
Measurement Data	See "Appendix 2.2 Waveform File Sizes" (⇒ p. A19)
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.

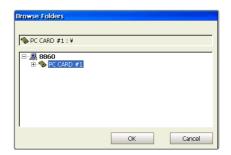
### Specifying Storage Media & Files \_

#### **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.

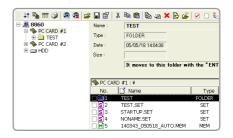
See "10.3.3 Specifying the Save Destination" (⇒ p. 260)



#### 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 "10.4 Loading Data" (⇒ p. 275)



#### **Storage Media Names**

Storage Media	Storage Media Name Displayed on the Instrument
Hard Disk (Built-in)	HDD
MO Disk *1 (Built-in 9717 MO Unit)	MO
PC Card (PC Card Slot) *1	PC CARD #1, PC CARD #2
Floppy Disk (9716 FD Drive) *1,*2	FDD #1, FDD #2, FDD #5
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. 249)

## 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

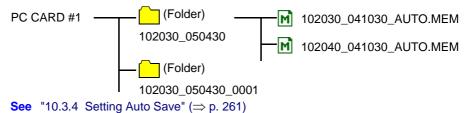
(when the save name is [TEST])

Data Type	Auto Save	Manual Save		
	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)	[Off] (serial numbers are appended when the [Same Name] (duplicate file name handling) setting is [Numbering])		
Waveform	TEST.MEM, TEST0001.MEM, TEST0002,	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 Calcula- tions	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 wave- forms same as for numerical calculations			
Settings	same as for numerical calculations			

#### **Folder Names for Auto Save**

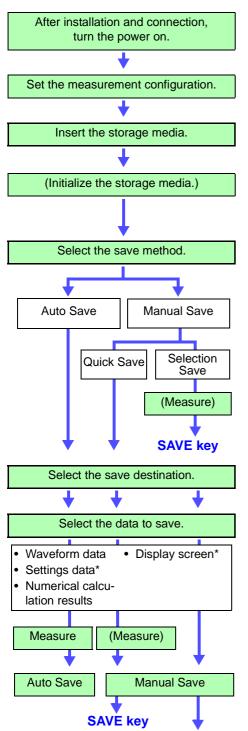
The total number of folders and files that can be stored in one folder is 5,000. When this number is exceeded, a new folder is created automatically.

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.



## 10.3 Saving Data

## 10.3.1 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** "10.1 Storage Media" (⇒ p. 244)

When using unformatted storage media, initialize the storage media from the File screen.

See "10.1.7 Initializing (Formatting) Storage Media" (⇒ p. 251)

Configure the settings on the Save Settings screen ([Save] menu).

**See** "10.3.2 Save Methods" (⇒ p. 258)

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. 261)
- When saving manually: [SAVE key] page (⇒ p. 263)
   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. ( $\Rightarrow$  p. 260)

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. 258))

(\*: 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**

Execute button

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.

## 10.3.2 Save Methods

#### **Save Methods**

Methods for saving data can be roughly divided into two.

Auto Save (⇒ p. 261)	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. 263)	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.

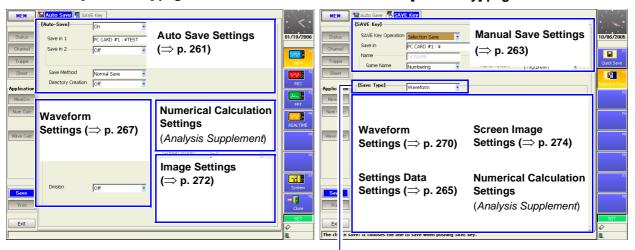
## Data Capable of Being Saved

Save Data		Auto Save	Manual Save
Waveform Data	Save waveform data. (whole of waveform, section of waveform)	(⇒ p. 267)	(⇒ p. 270)
Settings Data	Save measurement configurations and other settings made on the Settings screen.		(⇒ p. 265)
Numerical Calculation Results	Saves numerical calculation results.	"1.4 Saving culation Resu	
Screen Image	Save a copy of the screen.	(⇒ p. 272)	(⇒ p. 274)

Set the save method on the Save Settings screen.

Auto Save: [Auto Save] 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 "10.3.7 Automatically Saving Waveforms" (⇒ p. 267), "10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (⇒ p. 270)

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. ( $\Rightarrow$  p. 279)

Divided Save is not available in the following cases:

- When saving to a floppy diskette
- When manual saving with Memory Division enabled, and the [Target Blocks] setting is [All Blocks].



#### To save selected memory blocks from a recorded waveform

(only when manual saving using Memory Division)

When the Memory Division function ( $\Rightarrow$  p. 103) is enabled and waveforms are recorded to individual blocks, you can select whether to save only displayed blocks or all used blocks.

See "10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" ( $\Rightarrow$  p. 270)

## 10.3.3 Specifying the Save Destination

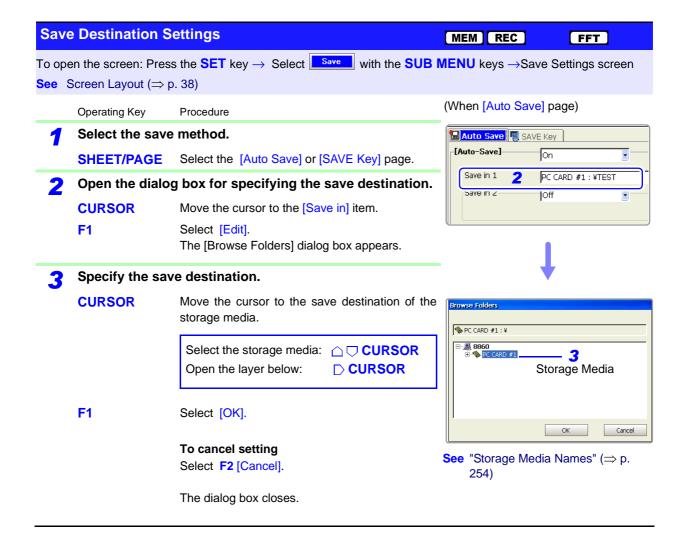
Set the save destination in the [Save in] item on each page of the Save Settings screen.

#### 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.



## 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.

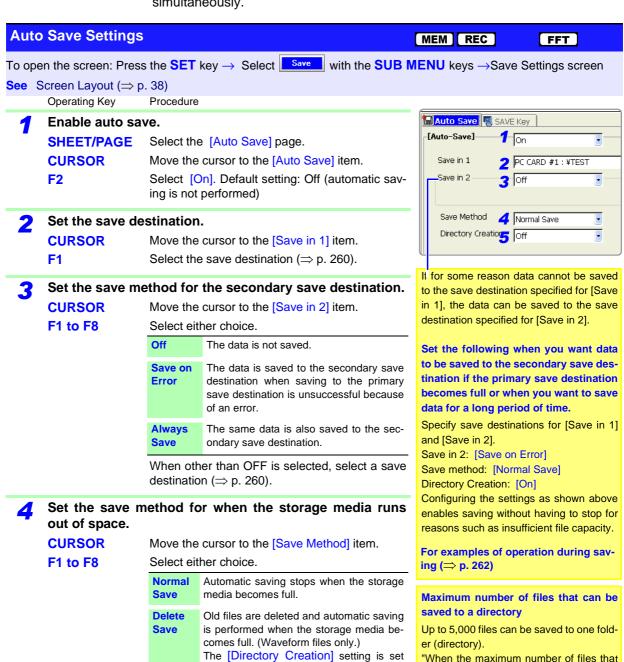
See "10.7.5 Creating New Folders" (⇒ p. 292)

When saving automatically, folders can be created automatically if [Directory Creation] is set to [On].

See "10.3.4 Setting Auto Save" (⇒ p. 261)

## 10.3.4 Setting Auto Save

This setting enables waveforms, numerical calculation results and screen images to be saved automatically during measurement. Both can be saved simultaneously.



Set whether to create directories (folders).

**CURSOR** F1 to F8

Move the cursor to the [Directory Creation] item. Select either choice.

automatically to [On].

A folder is not created when measurement starts.

On A folder is created automatically when measurement starts and files are saved in the folder.

Set the data to save.

Saving waveforms (⇒ p. 267), Saving numerical calculation results (Analysis Supplement), Saving screen images (⇒ p. 272)

"When the maximum number of files that can be saved is exceeded:" (\$\Rightarrow\$ p. 262)

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. 256)

#### **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 (MO disk or 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

PC CARD #1

102030\_041030\_AUTO.MEM

102040\_041030\_AUTO.MEM

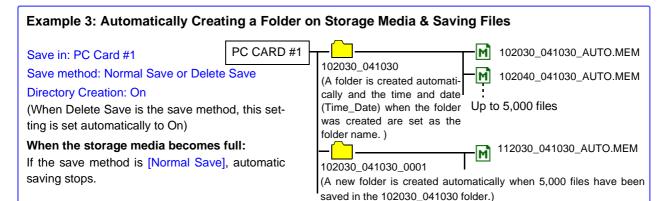
When the storage media becomes full:

Automatic saving stops.

Up to 512 files or 5,000 files (refer to the section above on the maximum number of files)

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.

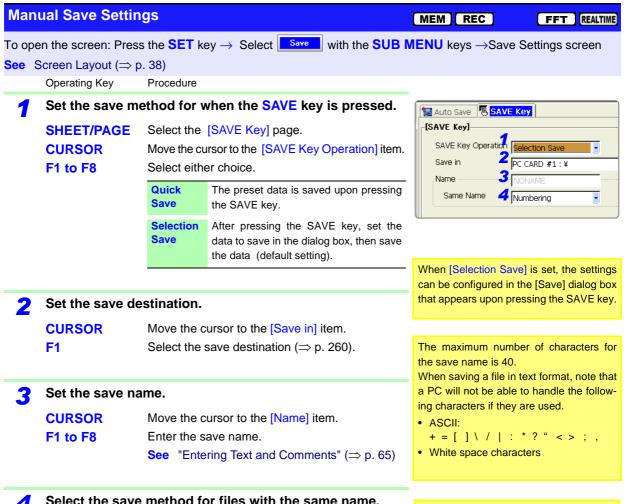
#### **Example 2: Saving Files to a Folder on Storage Media** Save in: PC Card #1 \TEST PC CARD #1 102030\_041030\_AUTO.MEM Save method: Normal Save TEST 102040\_041030\_AUTO.MEM **Directory Creation: Off** (Create a folder named "TEST" on the PC card Up to 5.000 files beforehand.) 112030\_041030\_AUTO.MEM TEST\_0001 When the storage media becomes full: (A new folder is created automatically when 5,000 files have been Automatic saving stops. saved in the TEST folder.)



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.

## 10.3.5 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



#### Select the save method for files with the same name.

**CURSOR** F1 to F8

Move the cursor to the [Same Name] item. Select either choice.

Numbering	<ol> <li>The save name is used as the file name when the SAVE key is first pressed.</li> <li>Subsequently, numbers are ap- pended automatically to the save name to prevent the duplication of file names. (Single-byte number up to four digits long)</li> </ol>
Overwrite	Existing duplicate file names are overwritten.

#### **Suffix Auto-Numbering**

Up to 5,000 files can be saved to one fold-

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. 255)

#### 10.3 Saving Data

Operating Key Procedure

Select the contents (Name Pattern) to be automatically added to the save name

(only when saving waveform data)

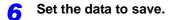
CURSOR F1 to F8 Move the cursor to the [Name Pattern] item.

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)

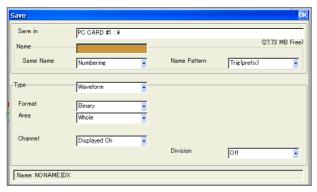


Saving waveform data (⇒ p. 270)

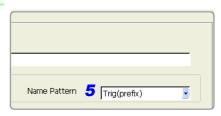
Saving settings data (⇒ p. 265)

Saving display screens (⇒ p. 274)

Saving numerical calculation results (Analysis Supplement)



When the SAVE key is set to [Selection Save] Dialog displayed when the SAVE key is pressed

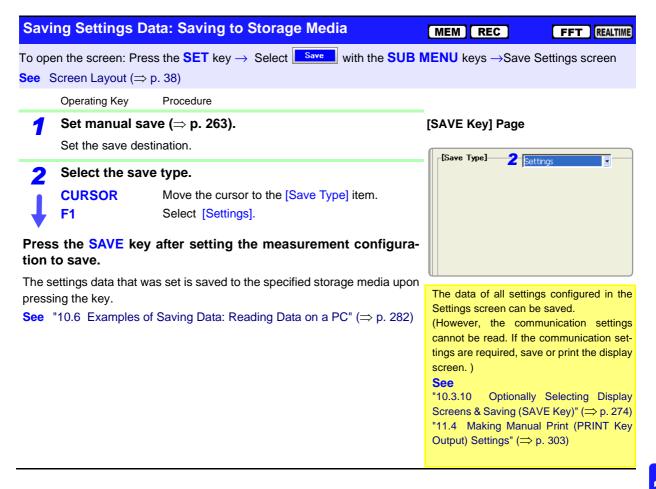


## 10.3.6 Saving Settings Data

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) ( $\Rightarrow$  p. 281).





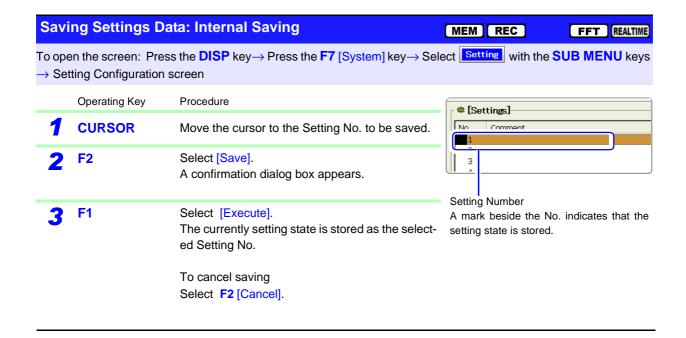
When you want to load the settings data automatically at power-on (Auto Setup function):

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 "10.5 Saving & Loading Auto Settings File (Auto Setup Function)" (⇒ p. 280)

In addition, previously saved settings data can be reloaded when the instrument is turned on.

See "Saving Settings Data: Internal Saving" (⇒ p. 266)
"Select the data to load: Loading from the instrument" (⇒ p. 278)





#### 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. 65)



#### To reload setting data

**See** "Select the data to load: Loading from the instrument" ( $\Rightarrow$  p. 278)

## 10.3.7 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.

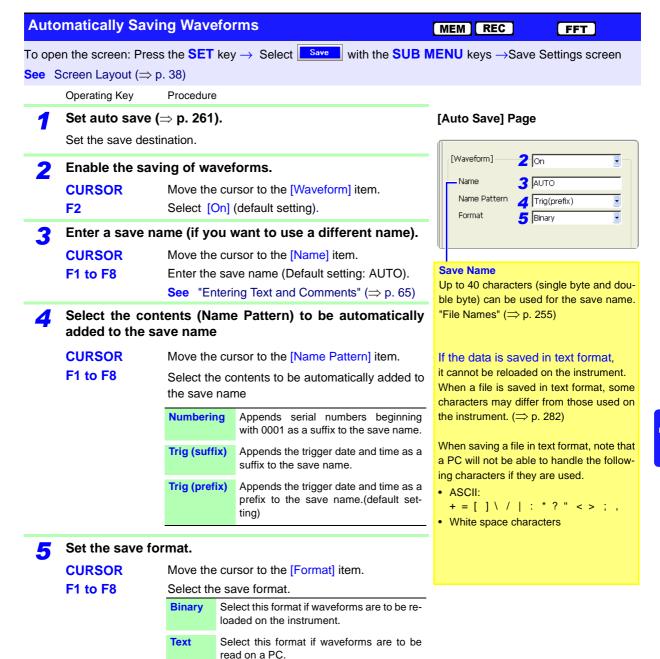
## 

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. A19)



"10.6.1 Example of Saving Data" (⇒ p.

(Proceed to the next step.)

282)

Operating Key

Procedure



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. 64)



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. 284)
Off	No interpolation is performed. "Example 2 of Saving Waveform Data



MEM REC

When [Binary] is the selected save type (Format)

Select whether to save divided files

CURSOR F1 to F8 Move the cursor to the [Division]

8 Select either choice.

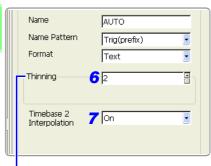
Off	Files are not divided when saved. If a file is too large, it cannot be saved.
2,500 to	Select the recording length for divided

## 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 "10.6.1 Example of Saving Data" (⇒ p. 282)

"10.6.2 Reading Waveform Data on a PC" (⇒ p. 286)



#### 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. 214)

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: "10.4.3 Loading Waveform Data"

( $\Rightarrow$  p. 279)

#### When using the Memory Division function

When Auto-saving, divided save is not available.



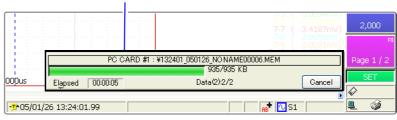
#### When you want to close or move the save progress dialog box:

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

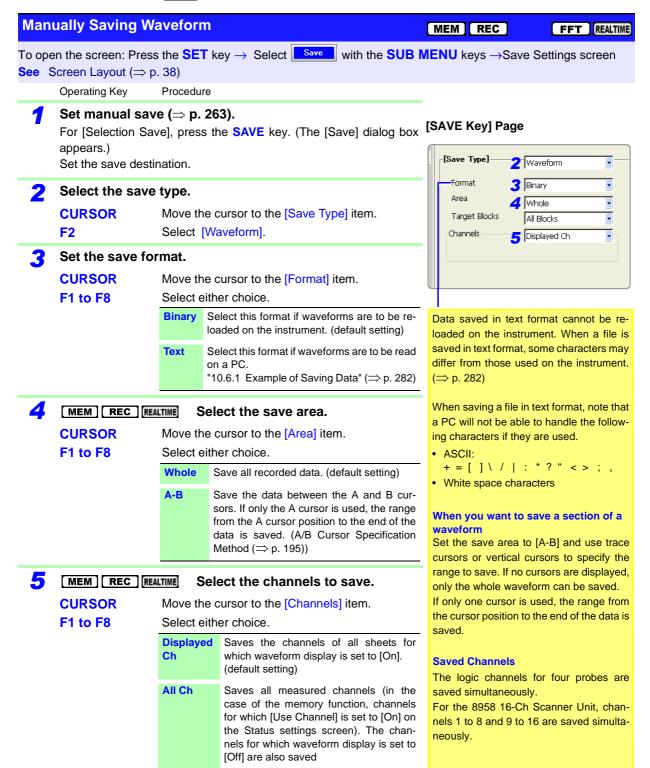


## 10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)

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).



## Operating Key Procedure [MEM] REC | 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. 64)

## 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. 284)

Off No interpolation is performed.

"Example 2 of Saving Waveform Data as Text" (⇒ p. 283)

### 8 MEM REC 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.

## MEM When using the 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.

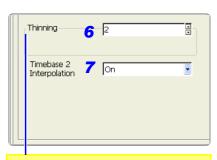
#### For [Selection Save]:

#### Select the [OK] button.

The waveform data is saved to the specified storage media upon selecting the button.

See "10.6.1 Example of Saving Data" (⇒ p. 282), "10.6.2 Reading Waveform Data on a PC" (⇒ p. 286)

#### 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. 214)

## 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]

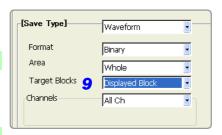


#### About divided file saving

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: "10.4.3 Loading Waveform Data" (\$\Rightarrow\$ p. 279)

#### 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.

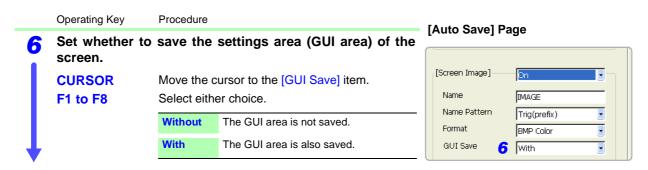
See: "To save selected memory blocks from a recorded waveform" (⇒ p.

## 10.3.9 Automatically Saving Display Images

After acquiring data, the waveform screen is automatically saved as an image file (BMP or PNG format).







#### 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.

## 10.3.10 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.



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.

## 10.4 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. 281), the settings data can be loaded automatically from the storage media at power-on.

See "Creating a Settings File for Auto Setup" (⇒ p. 281)

"Automatically Loading Settings Data (Auto Setup)" (⇒ p. 281)

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. 278)

#### **Data Not Loadable on the Instrument**

- · Data saved in text, BMP, or PNG format.
- Data saved on devices other than the 8860 and 8861.
- 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 "10.2 Data Capable of Being Saved & Loaded" (⇒ p. 252)

#### To load waveform data in a batch (⇒ p. 279)

An index file is necessary to read files as a batch. Load any of the following types of index files.

File Extensio	n
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.

The index file is required to load files saved as a batch.



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.



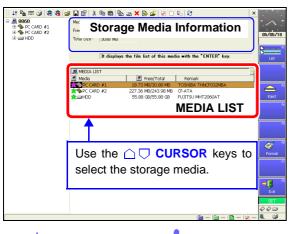
#### If the "Cannot load this file" message appears:

Check the format of the selected file. The instrument can load waveforms and settings data saved in binary format.

## 10.4.1 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.

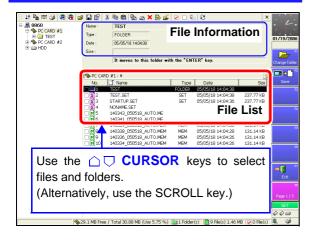
#### **Selecting the Storage Media**



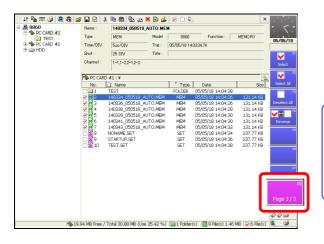




#### **Selecting Files & Folders**



#### **Selecting Multiple Files**



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. 251)
- Removing an MO disk [F3: Eject] (⇒ p. 246)

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. 275)
- Copying, moving, deleting, and renaming files and creating folders (Page 2/3) (⇒ p. 288)
- Sorting files, selecting the files and items to display, and printing the file list (FN mode) (⇒ p. 288)

#### File Types:

**See** "10.2 Data Capable of Being Saved & Loaded" ( $\Rightarrow$  p. 252)

#### Press the F8 key to switch to [Page 3/3].

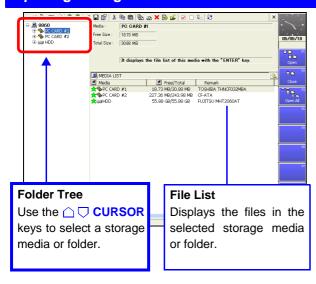
When copying ( $\Rightarrow$  p. 289), deleting ( $\Rightarrow$  p. 291), and moving ( $\Rightarrow$  p. 290) files or folders in the storage media, multiple files can be selected.

The "\( \sigma\)" 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**



Press the **SHEET/PAGE** key and move the cursor to the folder tree. The available storage media appears.

See "Storage Media Names" (⇒ p. 254)

## To show or hide the directories of storage media in the folder tree:

F1 [Open] Displays the subdirectories of the stor-

age media or folder of "±."

F2 [Close] Closes the subdirectories of the storage

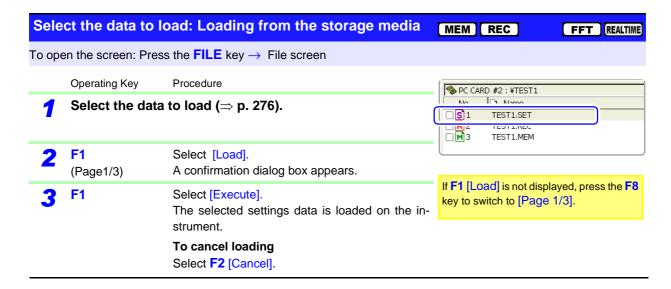
media or folder of " $\square$ ."

F3 [Open All] Displays all subdirectories.

The **SELECT** key can also be used to show or hide directories.

## 10.4.2 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

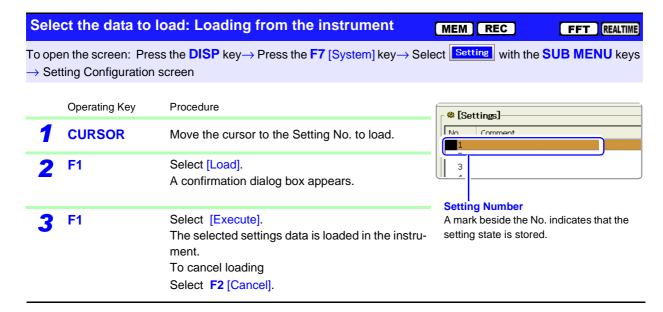




#### To load settings data automatically:

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 "10.5 Saving & Loading Auto Settings File (Auto Setup Function)" (⇒ p. 280)

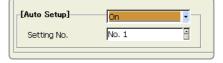




#### Loading stored settings data automatically

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.

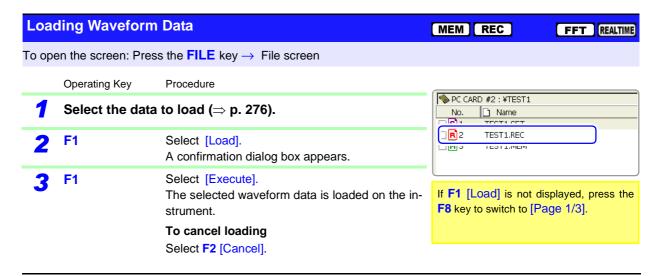


## 10.4.3 Loading Waveform Data

Loadable settings data file:

"file name".MEM, REC, FFT, SEQ\* (when memory division is enabled), IDX\* (with the Divided Saving function), RSI\* (with the Real-Time Saving function)
\*. Index file

By loading an index file, data files are loaded as a batch.



### 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 "10.3.7 Automatically Saving Waveforms" (\$\Rightarrow\$ p. 267)  "10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (\$\Rightarrow\$ p. 270)
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 "10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" (⇒ p. 270)
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. 225)

# 10.5 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.

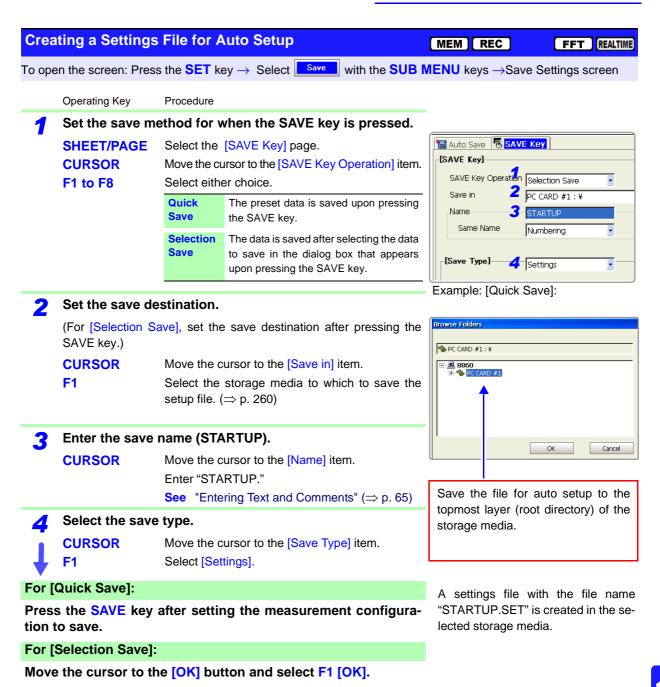
#### Loadable Storage Media & Priority Order

(When more than one storage media contains a settings files for auto setup.)

- 1. PC Card
- 2. Floppy Disk
- 3. MO Disk or Hard Disk

Refer to "Select the data to load: Loading from the instrument" ( $\Rightarrow$  p. 278) 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. 281)

#### Automatically loading a setup file saved in the instrument (Auto Setup)

See "Loading stored settings data automatically" (⇒ p. 278)

# 10.6 Examples of Saving Data: Reading Data on a PC

### 10.6.1 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  $\rightarrow$  Saved characters)

$$^2$$
  $\rightarrow$  ^2,  $^3$   $\rightarrow$  ^3,  $^n$   $\rightarrow$  ^n,  $\mu$   $\rightarrow$  ~u,  $\Omega$   $\rightarrow$  ~o,  $\epsilon$   $\rightarrow$  ~e,  $^\circ$   $\rightarrow$  ~c,  $\pm$   $\rightarrow$  ~+,  $\mu\epsilon$  (display only)  $\rightarrow$  uE,  $^\circ$ C (display only)  $\rightarrow$  C

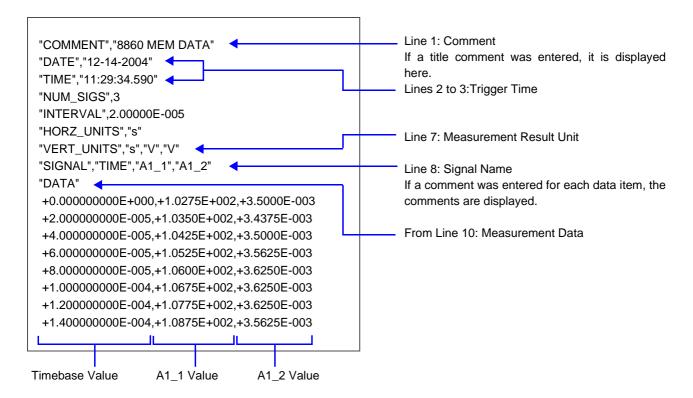
Refer to the *Analysis Supplement* for examples of text saved with the FFT function and numerical calculation results.

### 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)



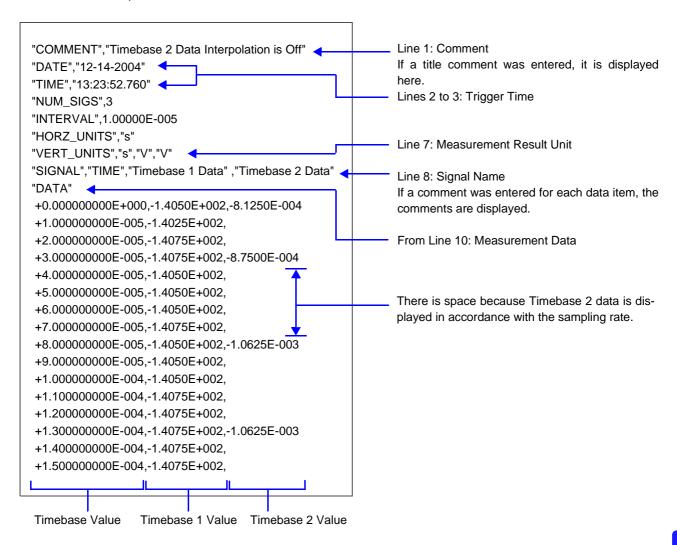
### Example 2 of Saving Waveform Data as Text \_

## 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  $\mu$ s/S)

2: 50 μs/S



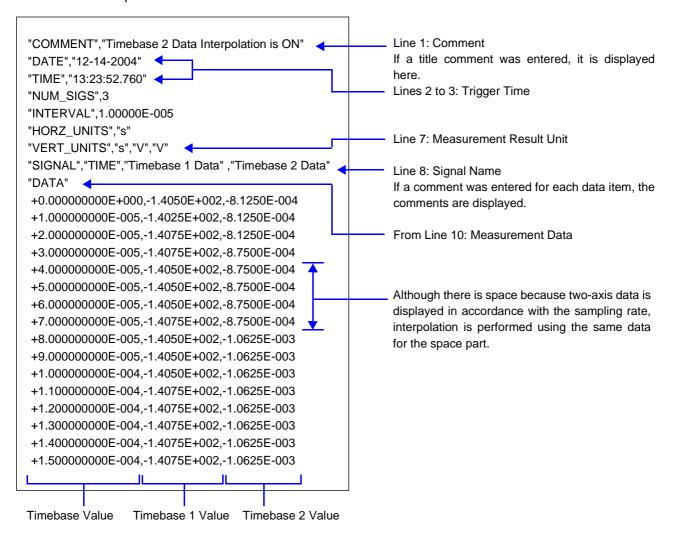
### **Example 3 of Saving Waveform Data as Text**

## 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  $\mu$ s/S)

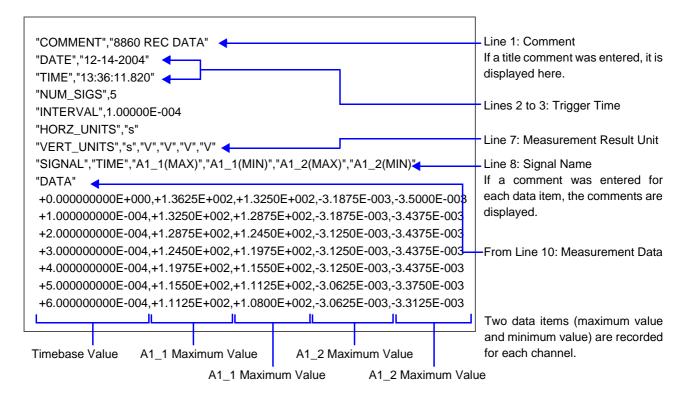
 $2:50 \mu s/S$ 



### 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)



## 10.6.2 Reading Waveform Data on a PC

The following explains how to import data into Excel on Windows.

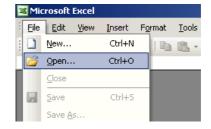
The capacity of Excel to import data from a text file is limited to 256 columns and 65,536 rows.

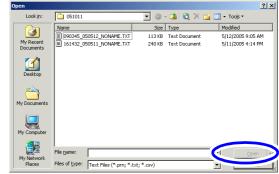
Text files containing data that exceeds these limits cannot be imported into Excel. To avoid exceeding these limits when saving text data, select [Displayed Ch] as the channels to save, or specify the saving range as that between A/B cursors.

**1** Start Excel and click [Open] from the [File] menu.

The [Open] dialog box appears.

Select the file to import and click [Open].



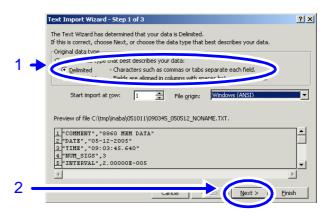


The Text Import Wizard appears.

3 Select the text processing method.

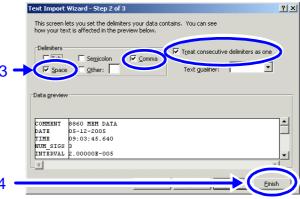
#### [Text Import Wizard Step 1 of 3]

- 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

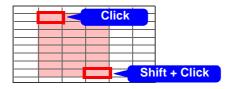
#### Example:

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)

## 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.

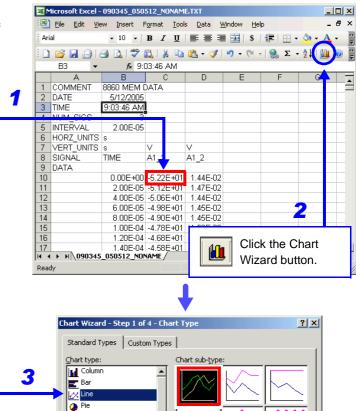
For details on how to configure graph settings, refer to the Help function of Excel.

## 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

"10.3.7 Automatically Saving Waveforms" ( $\Rightarrow$  p. 267) "10.3.8 Optionally Selecting Waveforms & Saving (SAVE Key)" ( $\Rightarrow$  p. 270)



XY (Scatter)
Area
Doughnut
Radar
Surface
Bubble

Cancel

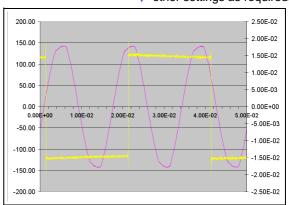
4 Set the display method and other settings as required.

Einish

Press and Hold to View Sample

Next :

Line. Displays trend over time or



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.

## 10.7 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" ( $\Rightarrow$  p. 40), "Function Modes and Settings" ( $\Rightarrow$  p. 41)



- 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 "10.4.1 Selecting Files & Folders on Storage Media" (⇒ p. 276)

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	F1 List	Displays files on the selected storage media.				
the file list)		See "10.4.1 Selecting Files & Folders on Storage Media" (⇒ p. 276)				
[MEDIA LIST]	F3 Eject	Enables you to eject an MO by performing a screen operation if there is a built-				
When storage me-		in Model 9717 MO Unit.				
dia is displayed		<b>See</b> "10.1.2 Using an MO Disk" (⇒ p. 245)				
	F6 Format	See "10.1.7 Initializing (Formatting) Storage Media" (⇒ p. 251)				
	F8 Exit	Closes the File screen and returns to the screen displayed previously.				
(When the cursor is in the file list)  Page 1/3 (F8)						
,	F1 Load	See "10.4 Loading Data" (⇒ p. 275)				
When a folder or	F2 Save	Enables you to select the save type and save the data.				
file is displayed	F7 Exit	Closes the File screen and returns to the screen displayed previously.				
	Page 2/3 (F8)					
	F1 Copy	See "10.7.1 Copying Files & Folders" (⇒ p. 289)				
	F2 Move	See "10.7.2 Moving Files & Folders" (⇒ p. 290)				
	F3 Delete	See "10.7.3 Deleting Files & Folders" (⇒ p. 291)				
	F4 Rename	See "10.7.4 Renaming Files & Folders" (⇒ p. 291)				
	F5 Create Folder	See "10.7.5 Creating New Folders" (⇒ p. 292)				

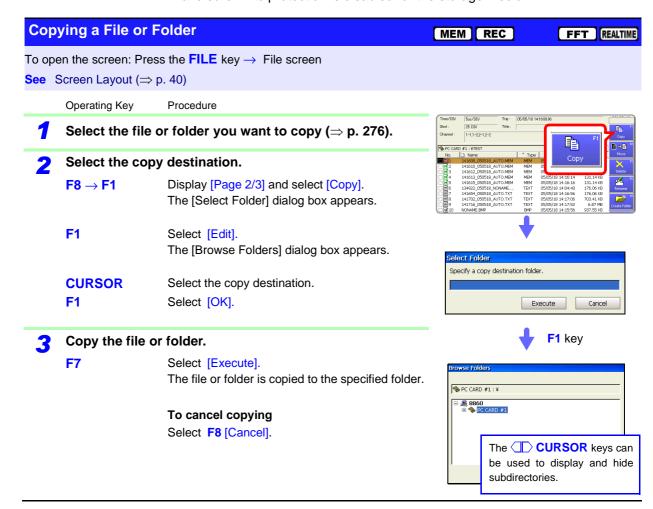
### **List of File Operations**

File Screen	File Operation	Description or Reference Section			
(When the cursor is in the file list)	Page 3/3 (F8) (Oper Files)	Page 3/3 (F8) (Operations for Selecting Multiple Files when Copying, Moving, & Deleting Files)			
When a folder or	F1 Select	Selects or deselects a file.			
file is displayed	F2 Select All	Selects all files.			
	F3 Deselect All	Deselects all files.			
	F4 Reverse	Reverses which files are selected and which files are deselected.			
FN Mode	F1 Sort	See "10.7.6 Sorting Files" (⇒ p. 293)			
(Press the FUNC-	F2 Filter	See "10.7.7 Limiting Display of Files" (⇒ p. 294)			
TION MODE key)	F3 Display Items	See "10.7.8 Setting the Items to Display" (⇒ p. 295)			
F5 Create Share Enables you to co		Enables you to configure settings for using a shared folder on a PC connected			
	F6 Disconnect	to the network.			
		See "10.1.6 Using a Network Shared Folder" (⇒ p. 249)			
	F8 Print List	See "10.7.9 Printing the File List" (⇒ p. 296)			

## 10.7.1 Copying Files & Folders

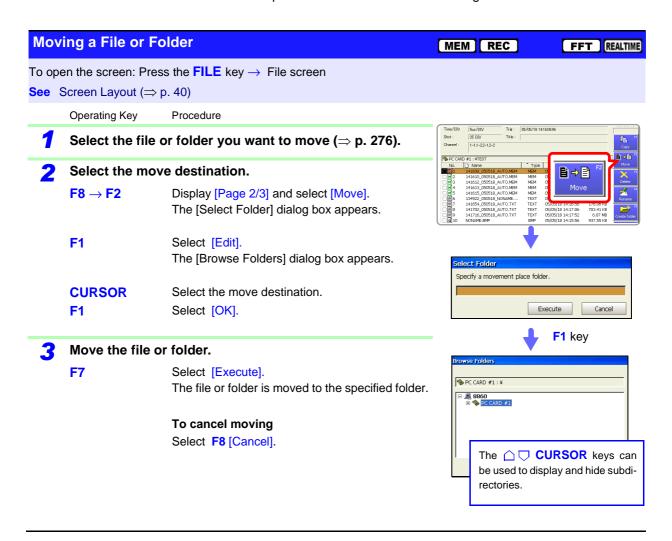
Copy a file or folder to a specified folder.

Make sure write protection is disabled for the storage media.



## 10.7.2 Moving Files & Folders

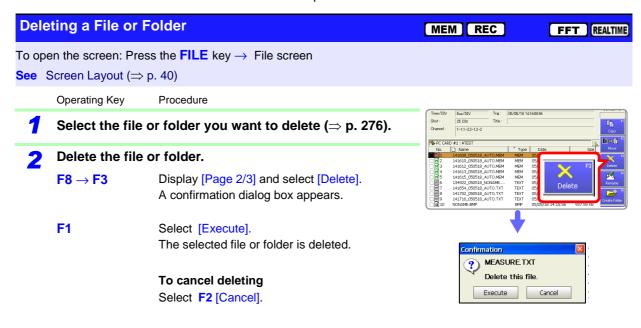
Move a file or folder to a specified folder. Make sure write protection is disabled for the storage media.



## 10.7.3 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.



## 10.7.4 Renaming Files & Folders

Rename a file or folder.

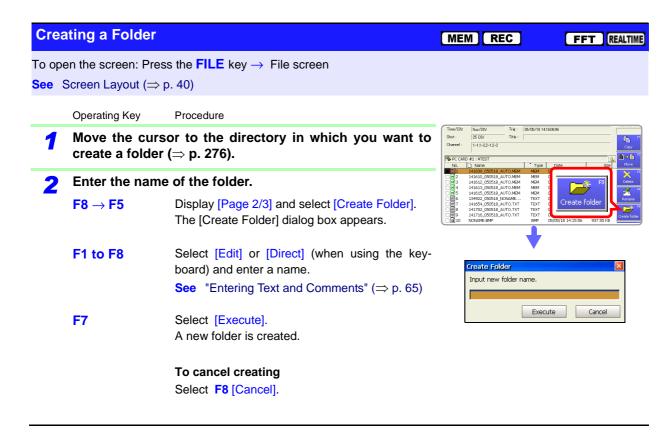
Make sure write protection is disabled for the storage media.



## 10.7.5 Creating New Folders

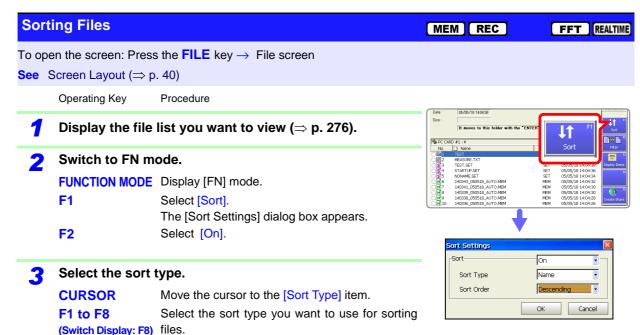
Create a folder.

Make sure write protection is disabled for the storage media.



## 10.7.6 Sorting Files

Sort files in the file list into a specified order.



Name	Sorts files by file name characters.
Туре	Sorts files by type (file for- mat) 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* <sup>2</sup>	Sorts files by saved channel.
Trig CH* <sup>2</sup>	Sorts files by triggered channel.

- Sorts waveform files and settings files.
- \*2. Sorts waveform files only.

#### Select the sort order.

**CURSOR** F1 to F8

Move the cursor to the [Sort Order] item.

Select the file sort order.

 $A \rightarrow Z$ , New  $\rightarrow$  Old, Small  $\rightarrow$  Large **Ascending Descending** Reverses the order.

:ST¥170416_050518		
)	Type	te
050518_AUTO.MEM	MEM	05/05/18 17:04:20
.050518_AUTO.MEM	MEM	05/05/18 17:04:26
050518_AUTO.MEM	MEM	05/05/18 17:04:32
.050518_AUTO.MEM	MEM	05/05/18 17:04:38
050518_AUTO.MEM	MEM	05/05/18 17:04:44
050518_AUTO.MEM	MEM	05/05/18 17:04:50

#### Apply sorting.

**CURSOR** F1

Move the cursor to the [OK] button.

Select [Execute].

The files appear in the order of the specified type.

#### To cancel sorting

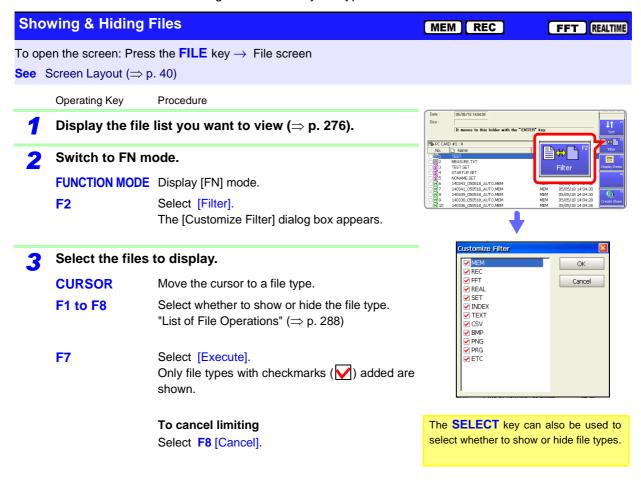
Select F8 [Cancel]

The "A" 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.

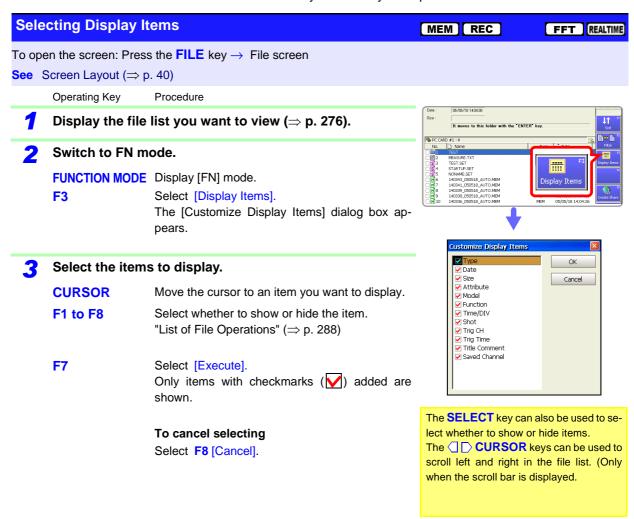
## 10.7.7 Limiting Display of Files

The hiding of unnecessary file types in the file list can be set.



## 10.7.8 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.

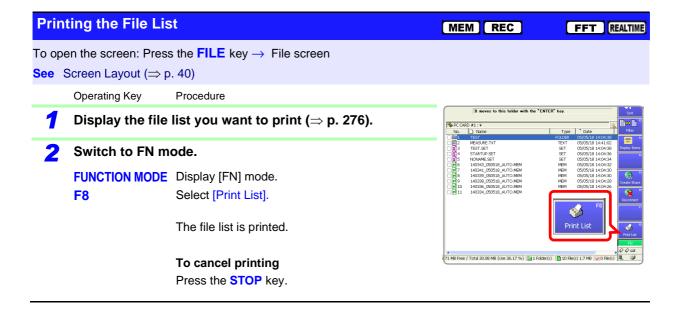


## 10.7.9 Printing the File List

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.

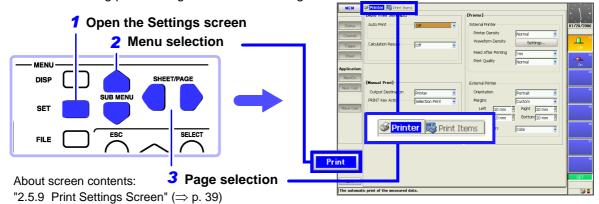


### **Example of File List Printout**

# **Printing**

# **Chapter 11**

Print after making print settings in the Print Settings screen.



### Things you can do with printing

#### Selecting the print method [Printer] page

"11.2 Print Methods and Print Items" (⇒ p. 299)

#### **Auto Print**

#### (Auto Print/Real-Time Printing)

- Auto Print waveforms (⇒ p. 301)
- Auto Print numerical calculation results (⇒ p. 301)

#### **Manual Printing (PRINT key)**

- Quick Print (⇒ p. 305)
- Selection Print (⇒ p. 303)

### Selecting items to print [Print Items] page

#### **Waveform printing**

- Grid Types (⇒ p. 313)
- Channel Marker (⇒ p. 314)
- List & Gauge (⇒ p. 314)
- Upper and Lower Limits (⇒ p. 315)
- Zero-Position Comments (⇒ p. 315)
- Counter Printing (⇒ p. 316)
- Time Axis Magnification and Compression (⇒ p. 317)
- Gauge (⇒ p. 320) (when using external printer)
- Row Print (⇒ p. 301), (⇒ p. 303)

#### **Numerical Printing**

Thinned numerical value data (⇒ p. 318)

#### Comments and settings data

- Print comments (analog, logic)
- · Print titles
- · Settings data

#### Selecting the printing type [Printer] page

- · Whole Waveform
- A-B Waveform
- Pre- and Post-Trigger Waveforms
- Report
- Lists
- Calculation Results
- Screen

Depending on the print method or function, some items cannot be printed. "Available Printing types" ( $\Rightarrow$  p. 300)

You can also print waveforms or settings data according to the type of screen (Screen Link).

#### Selecting items to print [Print Items] page

- Printout Type (recording format:Waveform, Numeric)
   (⇒ p. 311)
- Print Area (⇒ p. 312)
- Display value of horizontal axis (Time Value Display)
   (⇒ p. 312)

#### Making printer settings [Printer] page

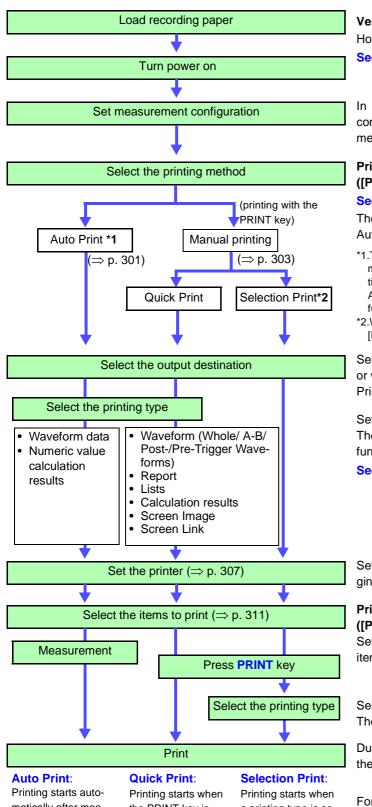
#### Internal Printer (Output Destination: [Printer])

- Print Density (⇒ p. 307)
- Paper Feed (⇒ p. 308)
- Print Quality (⇒ p. 309)

#### External Printer \*(Output Destination: [USB])

- Paper Orientation (⇒ p. 309)
- Margins (⇒ p. 310)
- Printing Colors (⇒ p. 310)
- \* "External printers" (⇒ p. 299)

## 11.1 Printing Workflow



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. 299)

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. 300)

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 ( $\Rightarrow$  p. 302).

For printing examples:

See "11.7 Print Examples" (⇒ p. 323)

matically after measurement starts.

Printing starts whe the PRINT key is pressed

Printing starts when a printing type is selected in the [Print] dialog.

## 11.2 Print Methods and Print Items

#### **Print Methods**

There are two main print methods.

Auto Print (⇒ p. 301)	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. 303)	<ul> <li>Press the PRINT key at any time to start printing.</li> <li>There are two print methods.</li> <li>Selection Print (⇒ p. 303)(default setting) Start printing after selecting items in the dialog which appears when you press the PRINT key.</li> <li>Quick Print (⇒ p. 305) Start printing pre-selected items as soon as you press the PRINT key.</li> </ul>

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 timebase 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. 99): [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.

#### **External printers**

### NOTE

Printer confirmed to operate normally: HP Deskjet 5551, HP Deskjet 5740, HP Deskjet 450 (Hewlett Packard)

- · Printers other than HP printers are not supported.
- 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.

### **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	Content	Auto Print (⇒ p. 301)	Manual Print (⇒ p. 303)	Print Examples	Functions			
(Print Example)					MEM	REC	FFT	REALTIME
Whole Wave *1 (Whole Waveform)	Print the entire range of data acquired by the instrument.	O *3	0	(⇒ p. 323)	0	0	0	0
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	0	(⇒ p. 328)	0	0	-	0
Trig Wave*1 (Pre- and Post- Trigger Wave- forms)	Print 10 divisions of the data before and after a trigger event.	_	0	(⇒ p. 329)	0	0	_	_
Report	Prints the waveform data of the dis- played area on the waveform screen, upper and lower limits and analog chan- nel settings.	_	0	(⇒ p. 329)	0	0	0	0
List	Print a list of settings made in the settings screens.	_	0	(⇒ p. 330)	0	0	0	0
Calc Results Calculation results	Print numerical calculation results. Calculation settings are necessary.  See Analysis Supplement	0	0	(⇒ p. 331)	0	_	_	_
Screen Image	Print the currently displayed screen.	_	0	(⇒ p. 331)	0	0	0	0
(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.)		0		0	0	0	0

<sup>\*1.</sup> Waveforms or numerical values can be printed (Default setting: Waveform).

See "Recording Type Settings" (⇒ p. 311), Numerical Data Printing Examples (⇒ p. 327)

Waveforms can be printed with the addition of settings data, comments, gauges, and so on.

See"11.6.5 Printing Comments and Setting Data" (⇒ p. 321)

\*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].

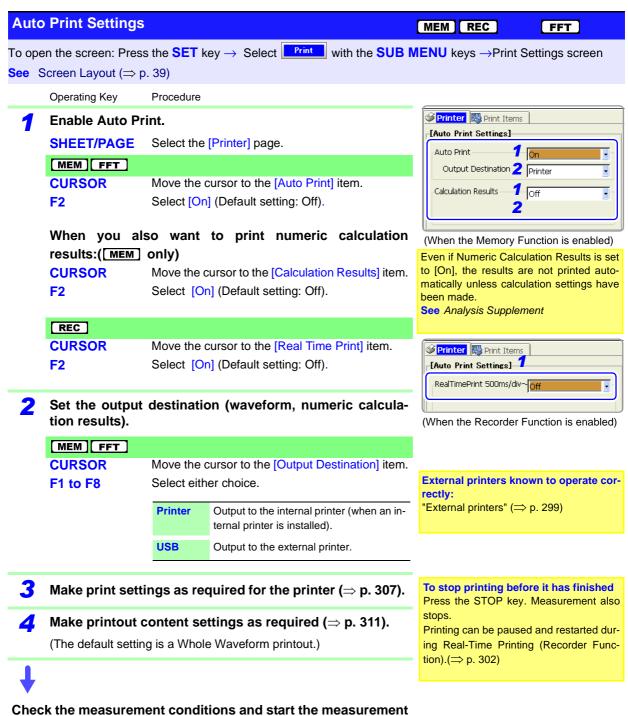
See"Print Area Settings" (⇒ p. 312)

\*3: Cannot be executed with the Real-Time Saving function enabled.

## 11.3 Making Auto Print Settings

(START key).

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.



### **Description** Print Order

During Auto Printing of waveforms and numeric calculation results (both are set to [On]), numeric calculation results are printed after waveforms.



#### To print at the same time as waveform display (internal printer only)

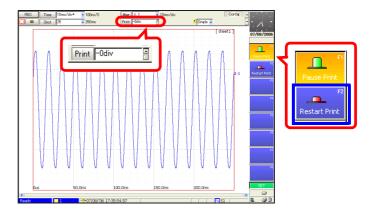
When the Memory Function is enabled, Roll Mode ( $\Rightarrow$  p. 99) allows you to print at the same time that waveforms are displayed.

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 only)

Move the cursor to the [Print] setting item, and press the **F1** [Pause Print] key or the **F2** [Restart Print] key.

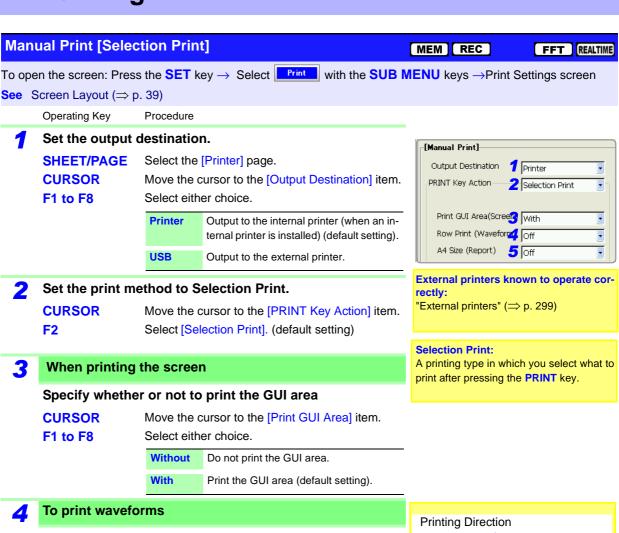


When printing resumes, a divider line is printed before the waveform.

#### 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.

# 11.4 Making Manual Print (PRINT Key Output) Settings



#### 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,
Prints 25 divisions of the horizontal axis at a

1/2, 1/3, 1/4, 1/6, 1/8, 1/16
1/8, 1/16
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### 5 To print a report

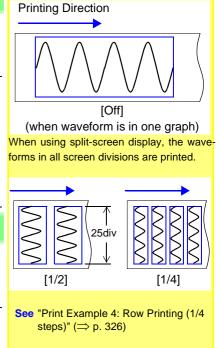
F1 to F8

#### Set the print size

CURSOR Move the cu

Move the cursor to the [A4 Size] item. Select either choice.

Off	Print without condensing (default setting).
On	Print waveforms or text condensed horizontally to fit on A4-size paper.



#### 11.4 Making Manual Print (PRINT Key Output) Settings

Operating Key Procedure

6 Make print settings as required for the printer (⇒ p. 307).

7 Make printout content settings as required (⇒ p. 311).

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

- \*1. Memory Function, Recorder Function, and Real-Time Saving Function only
- \*2. Memory Function only

#### To cancel printing

Select [Cancel].

For more information about printing types  $(\Rightarrow p. 300)$ For print examples  $(\Rightarrow p. 323)$ 

To stop printing before it finishes

Press the **STOP** key.

#### Before pressing the PRINT key

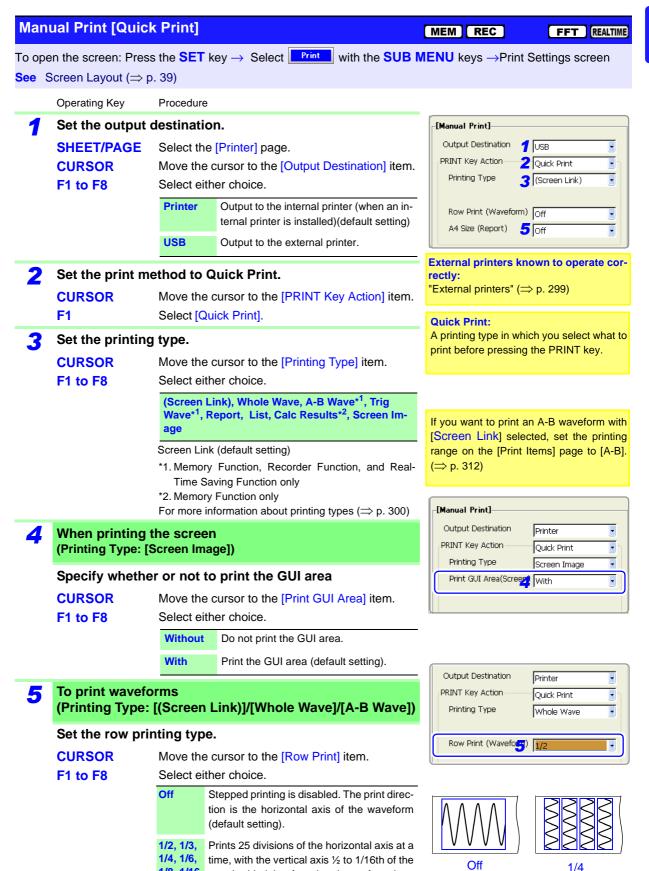
**If you want to print the display screen** Display the screen that you want to print.

If you want to print an A-B waveform Set the A-B range on the waveform screen. ( $\Rightarrow$  p. 306)



[Print] dialog

Chapter 11 Printing

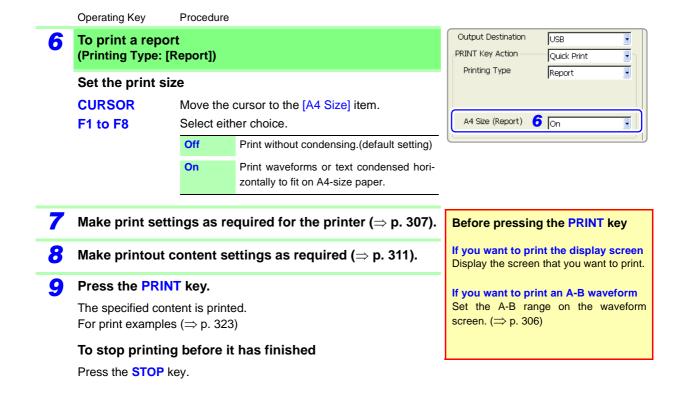


standard height of a printed waveform (one graph). The print direction is the vertical axis

of the waveform.

1/8, 1/16

#### 11.4 Making Manual Print (PRINT Key Output) Settings



### 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. 193)

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.

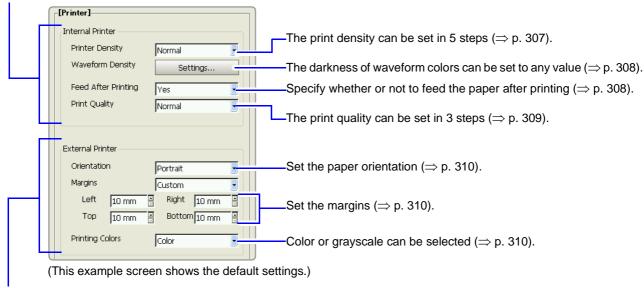
## 11.5 Making Printer Settings

Use the [Printer] page of the printer settings screen to make settings related to printers.

**See** About the printer settings screen: "2.5.9 Print Settings Screen" (⇒ p. 39)

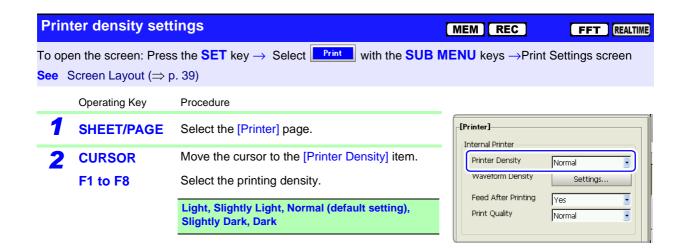
[Printer] page of the printer settings screen

Set these items when you are using the internal printer (option).



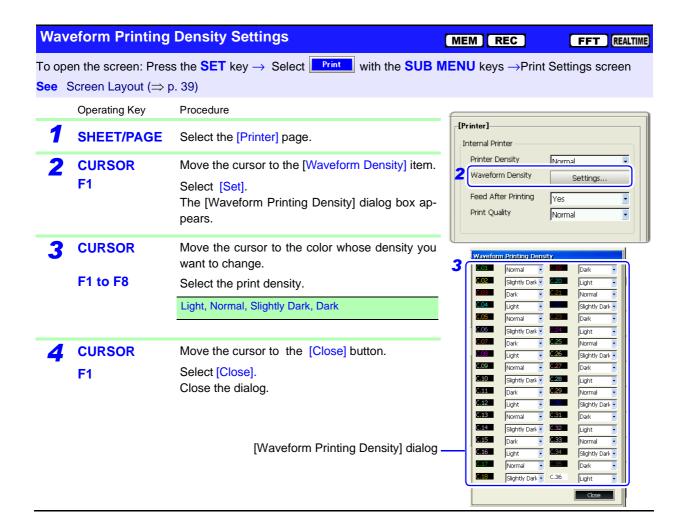
Set these items when you are using an external printer ( $\Rightarrow$  p. 309).

## 11.5.1 Internal Printer Settings



NOTE

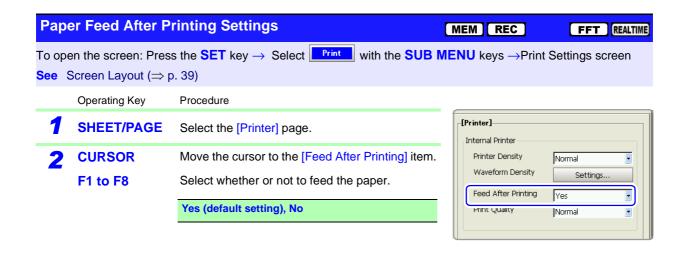
When using the Model 9684 DC Power Unit Some content may print a little lighter.

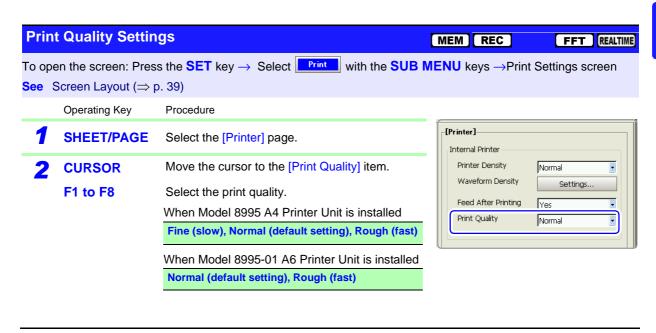


### NOTE

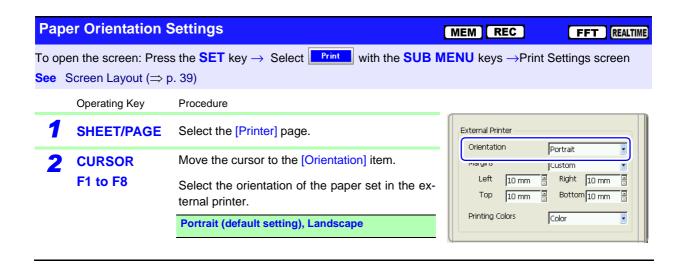
#### When the Recorder Function is enabled and Real-Time Print is [On]

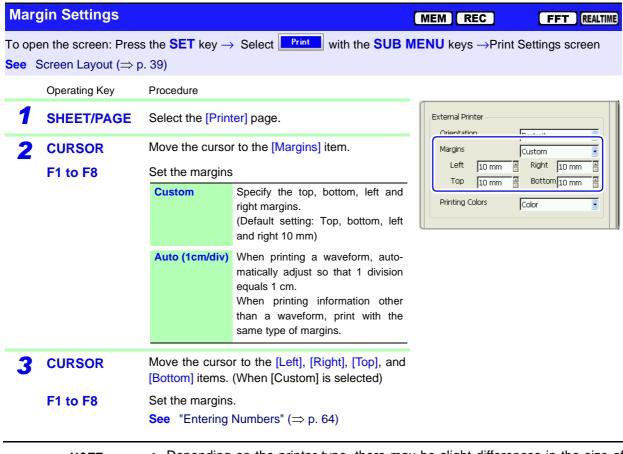
If the timebase is in a range faster than 1s/div, the printing may be light even if the printing density is set to [Dark].





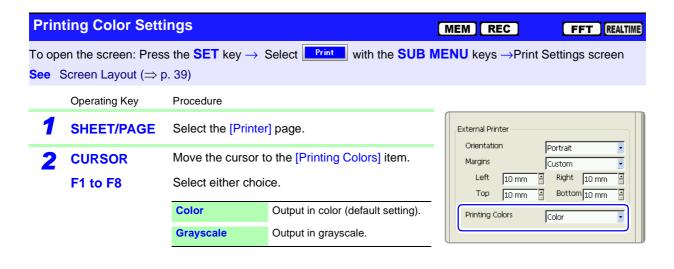
### 11.5.2 External Printer Settings





### 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.



**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. 165)

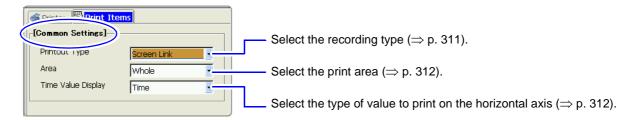
## 11.6 Setting the Print Content

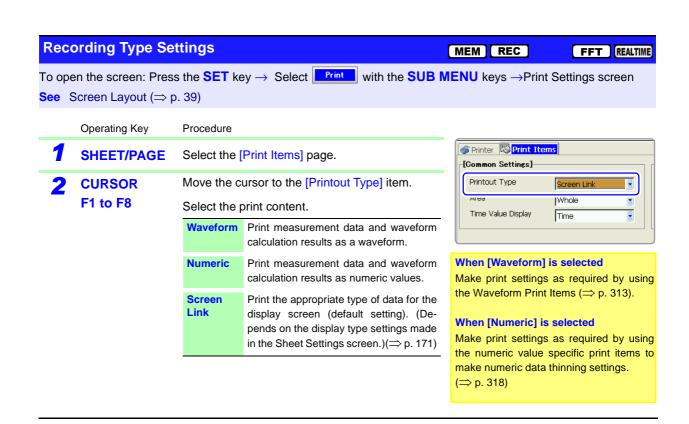
### 11.6.1 Common Settings

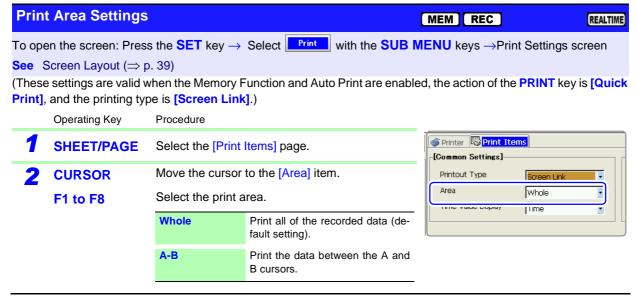
Press the **SUB MENU** key and select the [Print] menu.

Press the **SHEET/PAGE** key and select the [Print Items] page.

[Common Settings] fields in the [Print Items] page of the Print Settings screen.



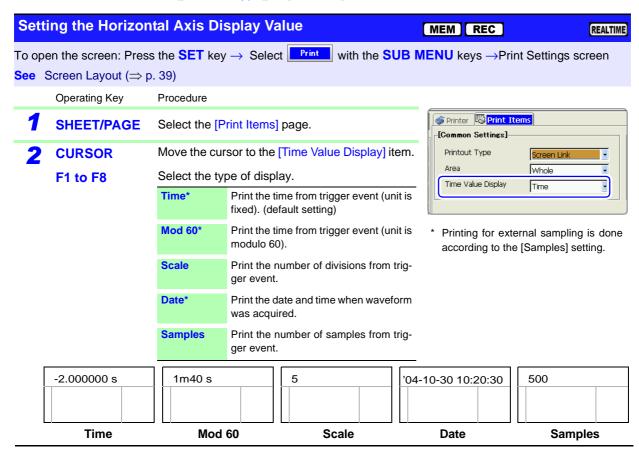




### NOTE

#### 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].

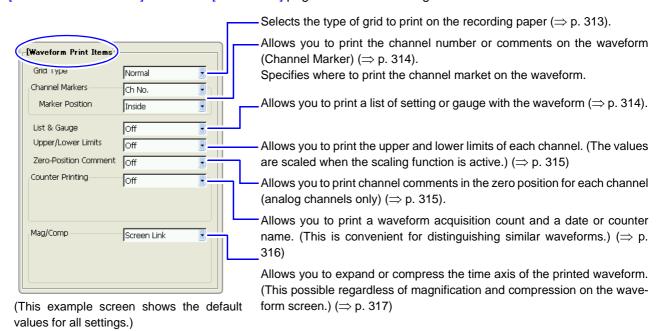


### 11.6.2 Printing Waveforms

#### Make the following settings as required.

Press the **SUB MENU** key and select the [Print] menu. Press the **SHEET/PAGE** key and select the [Print Items] page.

[Waveform Print Items] field in the [Print Items] page of the Print Settings screen



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.).

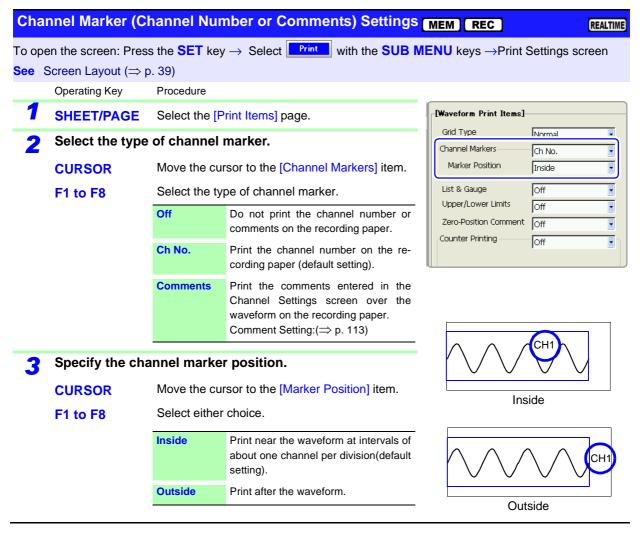
#### Row printing:

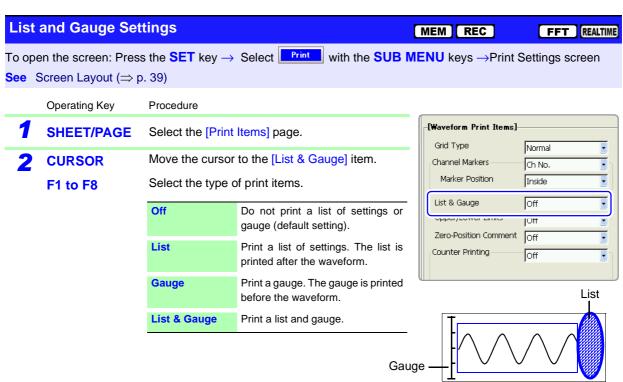
See "11.3 Making Auto Print Settings" (⇒ p. 301), "11.4 Making Manual Print (PRINT Key Output) Settings" (⇒ p. 303), "Print Example 4: Row Printing (1/4 steps)" (⇒ p. 326)

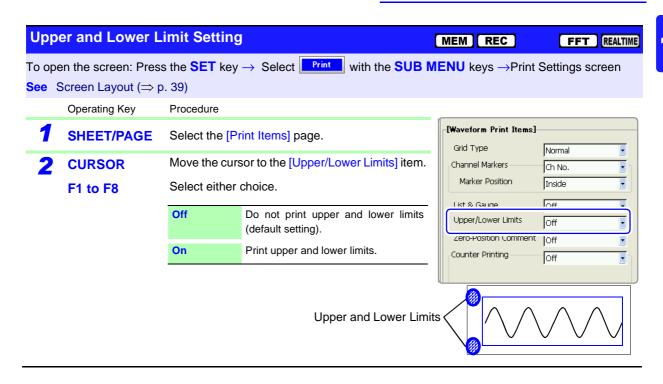


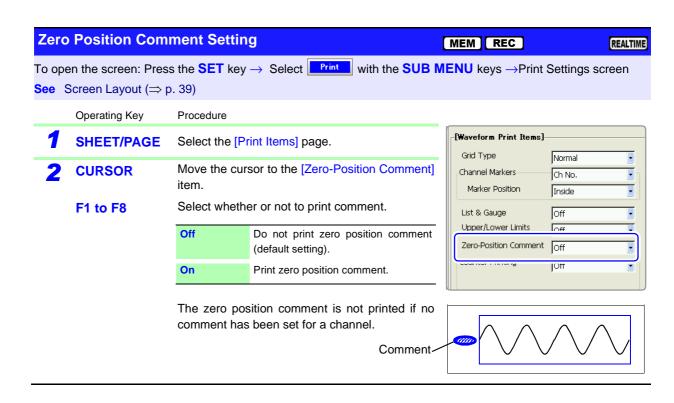
<u>NOTE</u>

Grids displayed on the screen are not reflected in the printout.

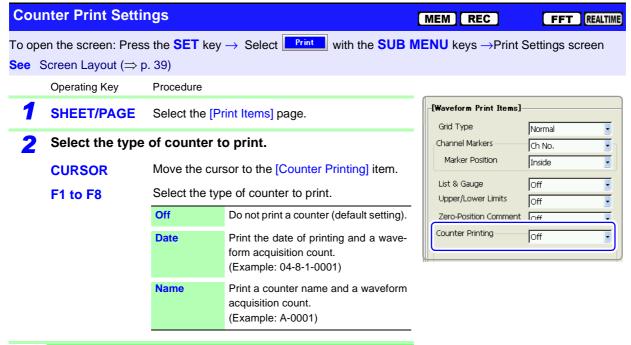








#### 11.6 Setting the Print Content



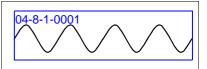
#### When [Date] is selected

#### 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

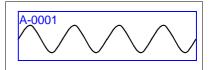
Enter a counter name (up to 10 characters)

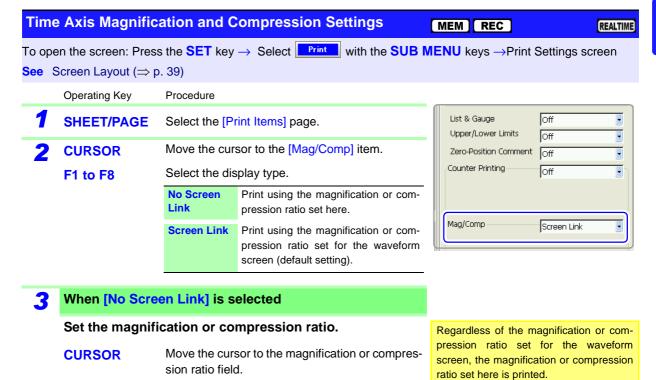
See "Entering Text and Comments" (⇒ p. 65)

**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)





Set the magnification or compression ratio for the

(Memory Function or Sampled waveform data from the Real-Time Saving function is enabled)

(Recorder Function or Whole waveform data from the Real-Time Saving function is enabled)

#### NOTE

F1 to F8

timebase.

x 10 to x 1/50000

x 1 to x 1/20000

- 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.

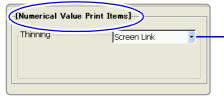
## 11.6.3 Printing Numerical Value Displays

#### Make the following settings as required.

Press the **SUB MENU** key to display the [Print] menu.

Press the **SHEET/PAGE** key to display the [Print Items] page.

[Numerical Value Print Items] field in the [Print Items] page of the Print Settings screen.

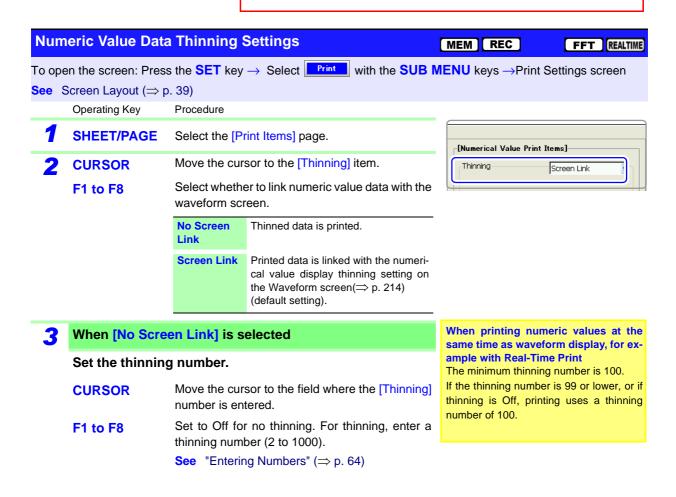


Numeric values can be thinned before printing. Select whether or not to link the printing to the display of numeric values on the waveform screen. Thinning is convenient when there are a large number of data points with little variation in value.

(This example screen shows the default values for all settings.)

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. 311)



#### 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.

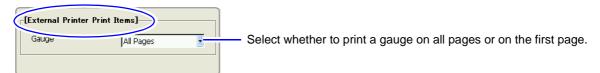
See "Print Example 2: Measurement with Timebase 1 and Timebase 2, with Timebase 1 thinned" (⇒ p. 327)

## 11.6.4 Making Gauge Settings (When Using External Printer)

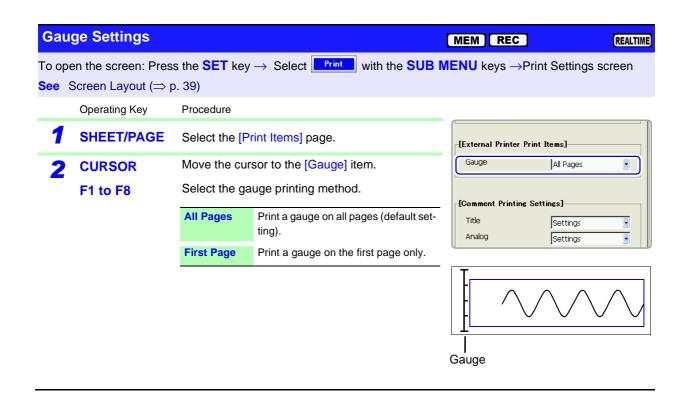
#### Make the following settings as required.

Press the **SUB MENU** key and select the [Print] menu. Press the **SHEET/PAGE** key and select the [Print Items] page.

[External Printer Print Items] field in the [Print Items] page of the Print Settings screen.



(This example screen shows the default value.)



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.

## 11.6.5 Printing Comments and Setting Data

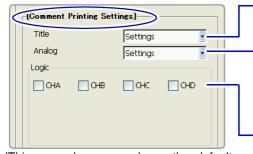
Select whether to print titles ( $\Rightarrow$  p. 112) and channel comments ( $\Rightarrow$  p. 113) that you have set in the Channel Settings screen, and settings data for the instrument.

#### Make the following settings as required.

Press the **SUB MENU** key to display the [Print] menu.

Press the **SHEET/PAGE** key to display the [Print Items] page.

[Comment Printing Settings] field in the [Print Items] page of the Print Settings screen.

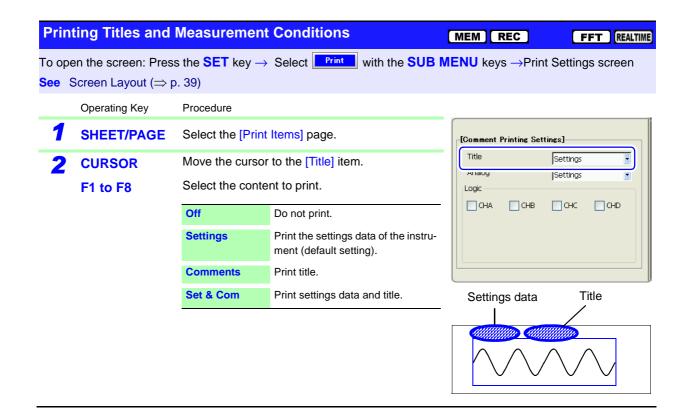


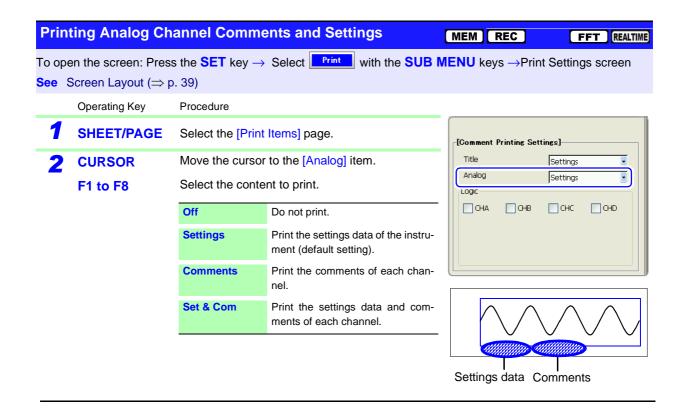
Select whether to print titles and settings data (function, timebase, time axis magnification or compression ratio, trigger times).

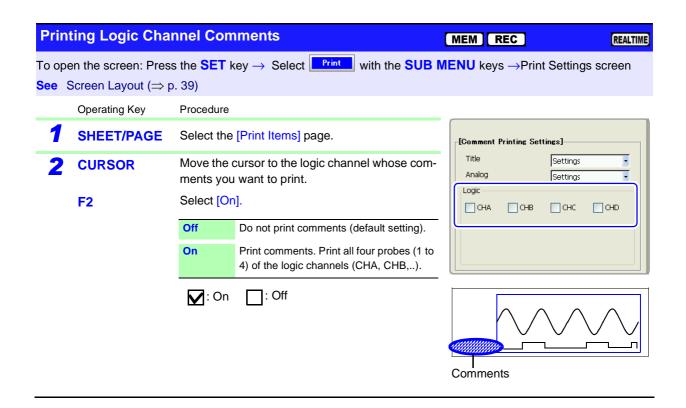
Select whether to print analog channel comments and channel settings (measurement range, vertical-axis magnification and compression ratios, zero position, low-pass filter, full-scale value of range (upper and lower limits when scaling or Variable is enabled).

Select whether to print comments for each logic channel.

(This example screen shows the default values for all settings.)







## 11.7 Print Examples

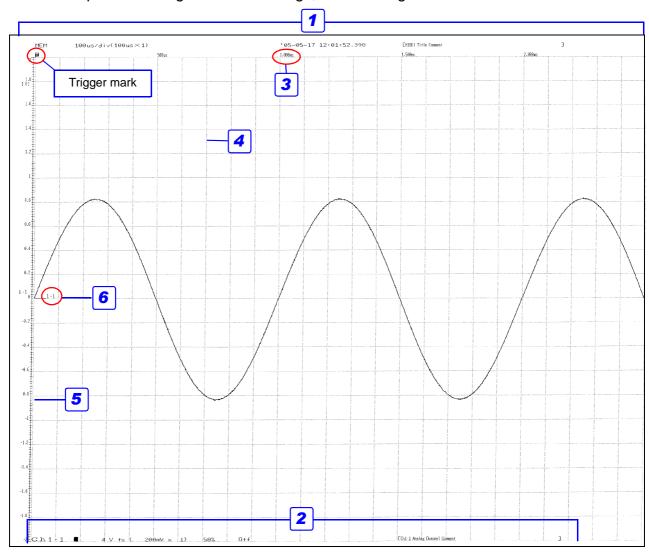
## NOTE

In the following cases, the characters used by the instrument differ from printed characters. (Instrument characters  $\to$  Printed characters )

$$^2 \rightarrow 2$$
,  $^3 \rightarrow 3$ ,  $^n \rightarrow n$ 

#### Whole Waveform

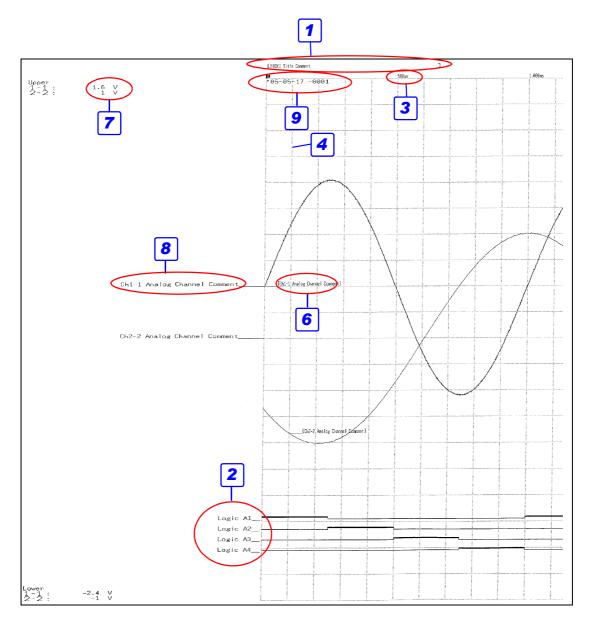
Print Example 1: Printing Title and Settings, with a Gauge



#### Settings for this print example

	Setting Item	Setting	Reference for Setting	Setting Field or Page	
1	Title	[Set & Com]	(⇒ p. 321)	[Comment Printing Settings] field in the [Print Items] page	
2	Analog	[Set & Com]	(⇒ p. 322)		
3	Time Value Display	[Time]	(⇒ p. 312)	Common Print Items field	
4	Grid Type	[Normal]	(⇒ p. 313)	Waveform Print Items field	
5	List & Gauge	[Gauge]	(⇒ p. 314)		
6	Channel Markers	[Ch No.]	(⇒ p. 314)		
7	Printer Density	[Dark]	(⇒ p. 307)	[Printer] page	

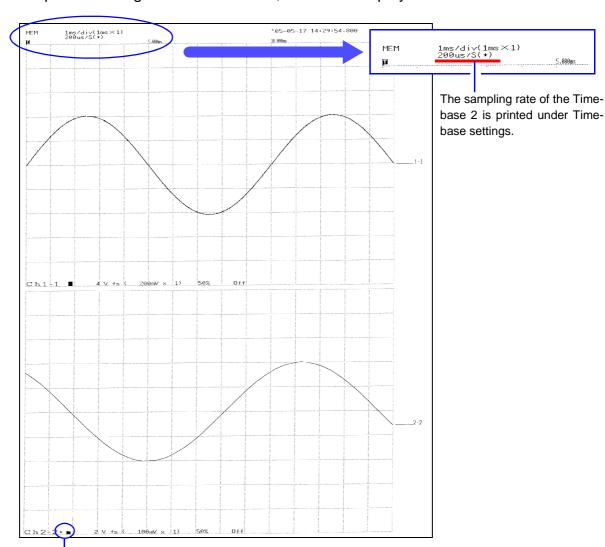
### Print Example 2: Printing Title with Channel Comments



#### Settings for this print example

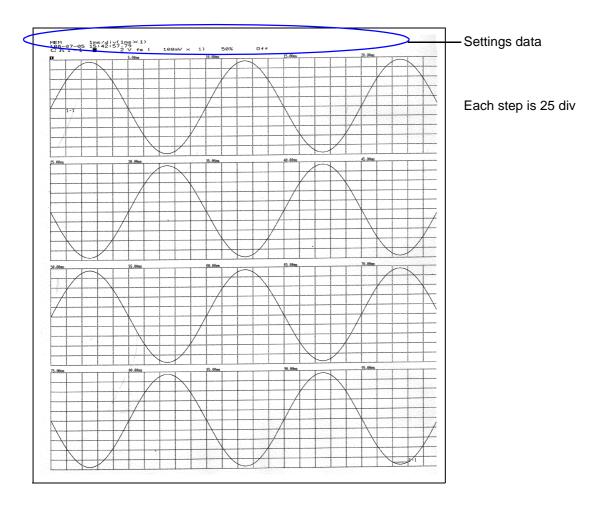
	Setting Item	Setting	Reference for Setting	Setting Field or Page	
1	Title	[Comments]	(⇒ p. 321)	[Comment Printing Settings] field in the	
2	Logic	[On]	(⇒ p. 322)	[Print Items] page	
3	Time Value Display	[Time]	(⇒ p. 312)	Common Print Items	
4	Grid Type	[Normal]	(⇒ p. 313)	_	
5	List & Gauge	[Off]	(⇒ p. 314)		
6	Channel Markers	[Comments],[Inside]	(⇒ p. 314)	– – Waveform Print Items field	
7	Upper/Lower Limits	[On]	(⇒ p. 315)	- wavelomi Film nems nem	
8	Zero-Position Comment	[On]	(⇒ p. 315)	_	
9	Counter Printing	[Date]	(⇒ p. 316)	_	
10	Printer Density	[Dark]	(⇒ p. 307)	[Printer] page	

#### Print Example 3: Printing of Timebase 1 & 2, 2-Screen Display



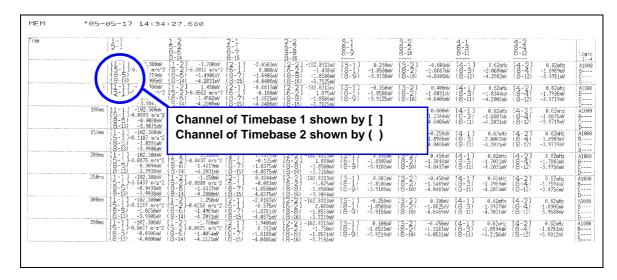
The channel of Timebase 2 is marked by an asterisk (\*).

Print Example 4: Row Printing (1/4 steps)

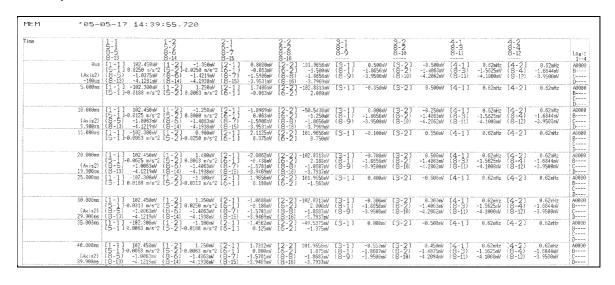


#### **Numerical Value Data**

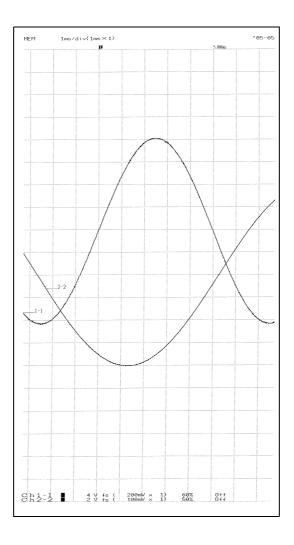
#### Print Example 1: Measurement with Timebase 2



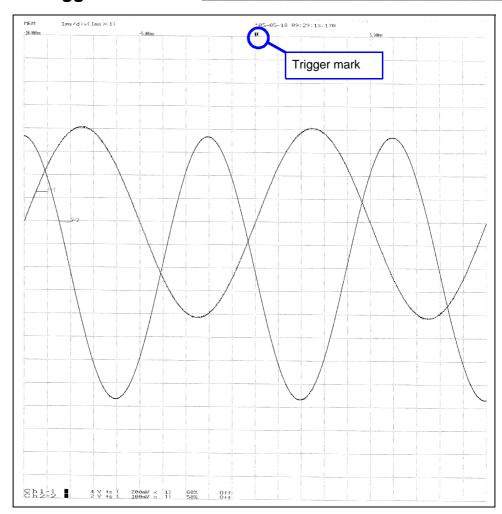
#### Print Example 2: Measurement with Timebase 1 and Timebase 2, with Timebase 1 thinned



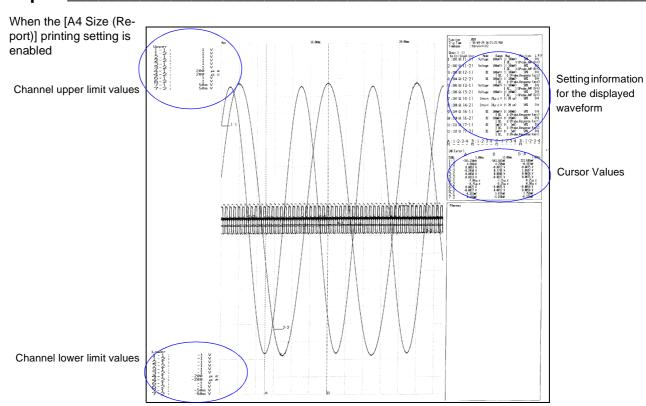
### A-B Waveform\_\_\_\_\_



### **Pre- and Post-Trigger Waveform**



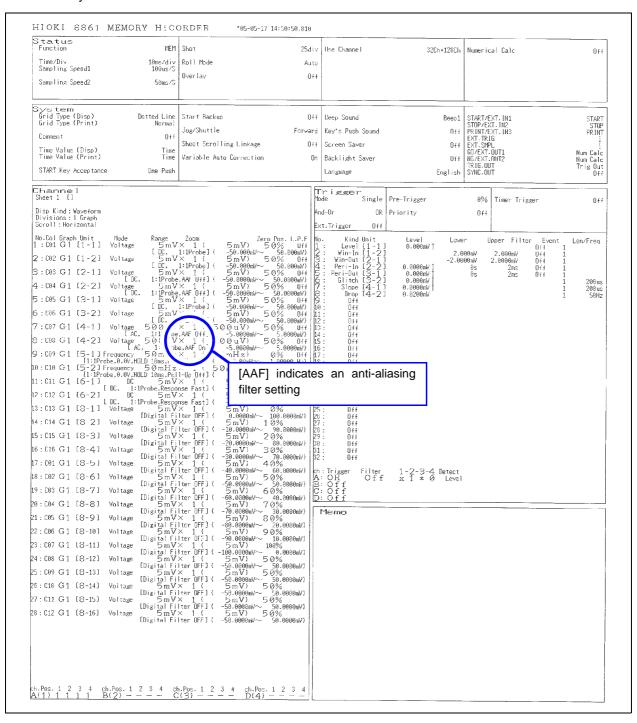
#### Report\_



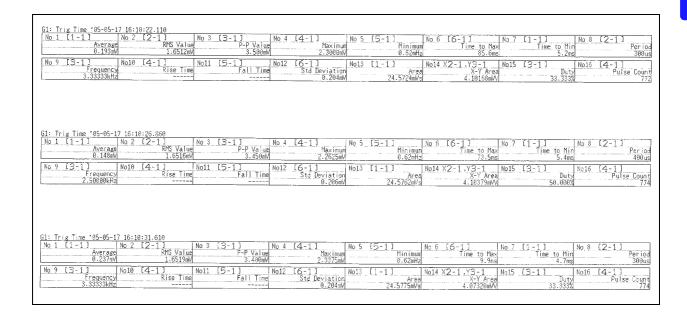
#### 11.7 Print Examples

#### List

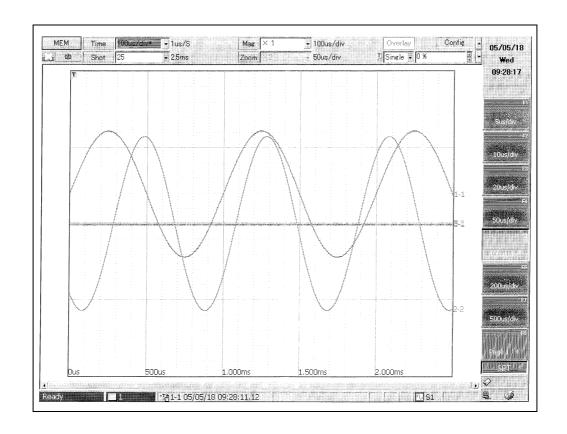
#### With Memory Function Enabled



#### Calculation Results

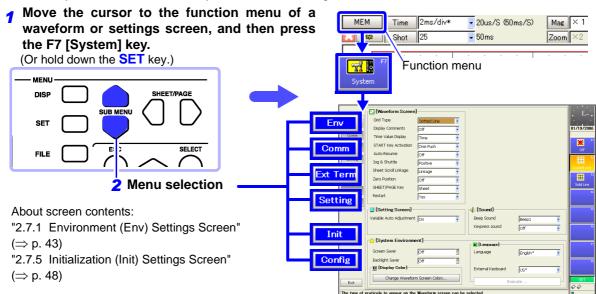


#### Screen \_

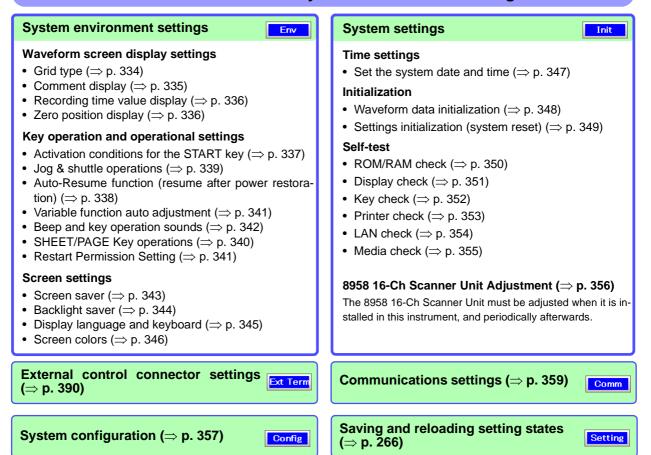


# System Environment Settings Chapter 12

Use the System screen to make system-related settings.



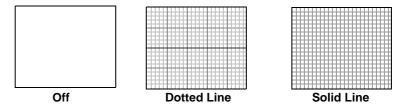
#### What You Can Set with System Environment Settings



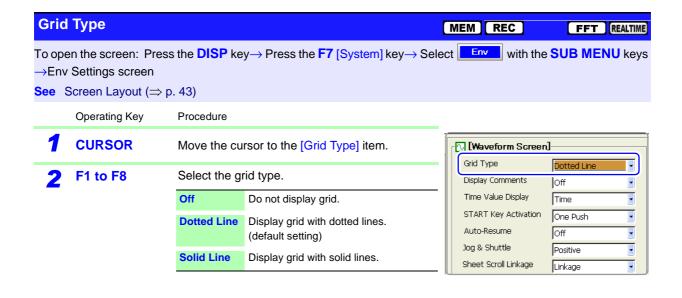
## 12.1 Making Waveform Screen Display Settings

## 12.1.1 Selecting the Grid Type

Select whether to display dotted lines or solid lines in the grids shown on waveform screens.

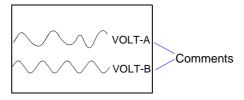


This setting is not reflected in printing. Use the Print Settings screen if you want to change how grids are printed ( $\Rightarrow$  p. 313).



## 12.1.2 Displaying or Hiding Comments

You can display the comments for each channel on waveform screens.



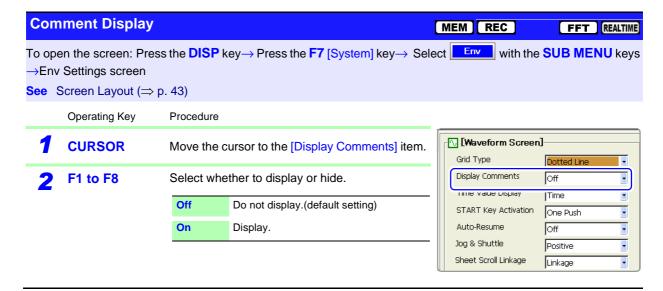
Use the Channel Settings screen to set channel comments.

See "5.2 Adding Comments" (⇒ p. 112)

Title comments are printed but do not appear on waveform screens.

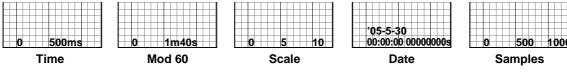
Comments do not appear on printouts automatically, even if they are displayed on waveform screens. Use the Print Settings screen if you want to print comments.

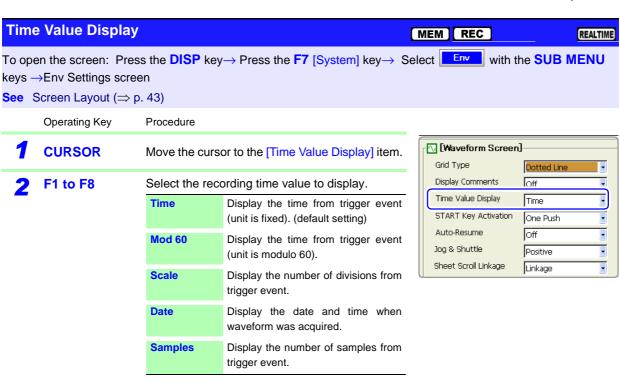
See "11.6.5 Printing Comments and Setting Data" (⇒ p. 321)



## 12.1.3 Selecting the Time Value Display

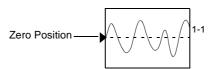
Select the waveform recording time value to display (horizontal axis) on waveform screens.

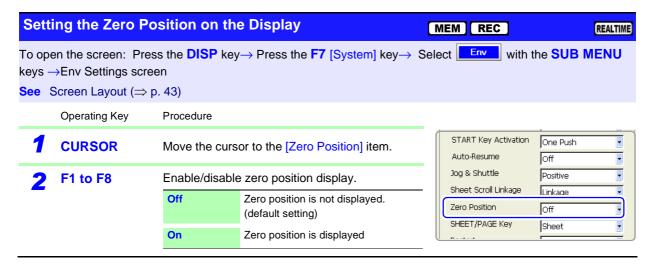




## 12.1.4 Displaying Zero Position

The zero position of a measurement waveform can be displayed.





## 12.2 Making Key Operation and Operational Settings

## 12.2.1 Specifying Activation Conditions for the START Key

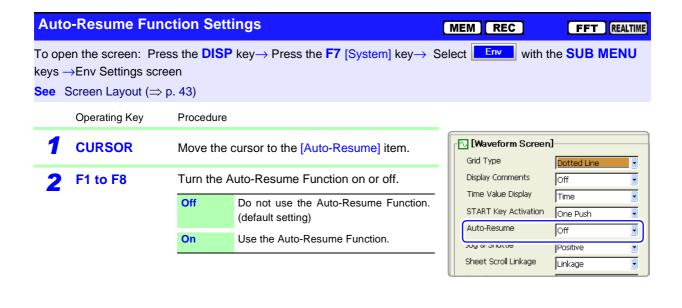
Normally measurement starts when you press the **START** key one time. To prevent measurement from starting by misoperations, you can set the **START** key activation conditions.





## 12.2.2 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.



## 12.2.3 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)

Display earlier waveforms Display the most recent waveforms





Move the display position to the left

Waveforms earlier than the current point appear.

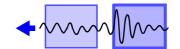
Move the display position

Move the display position to the right

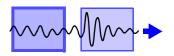
Waveforms later than the current point appear.

#### **Negative direction**

Display the most recent waveforms Display earlier waveforms





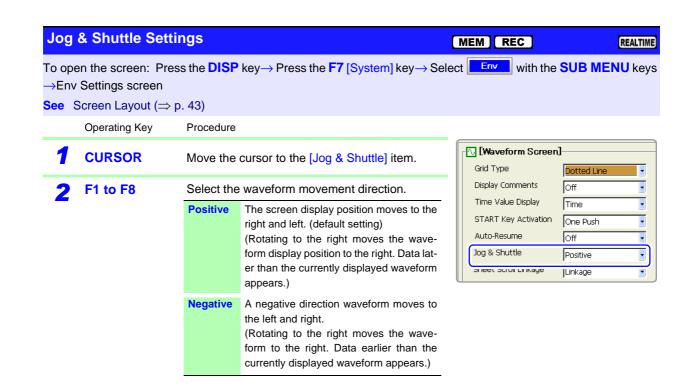


Move the waveform to the left

Waveforms later than the current point appear.

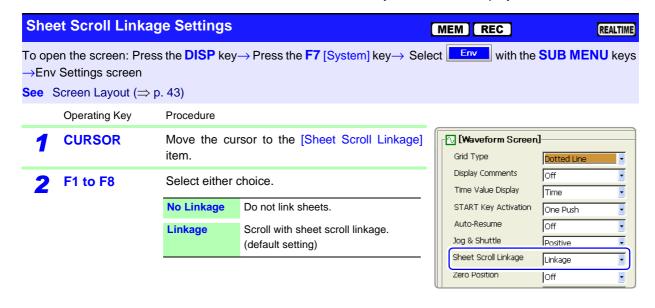
Move the waveform

Move the waveform to the right Waveforms earlier than the current point appear.



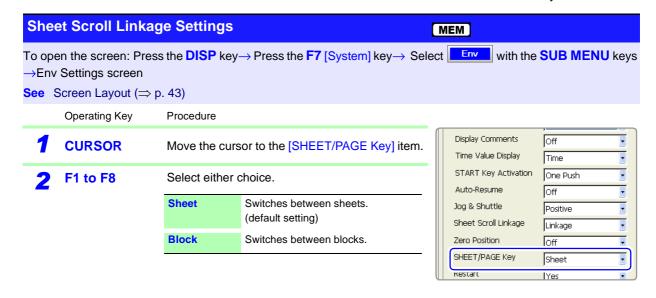
## 12.2.4 Using Sheet Scroll Linkage

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.



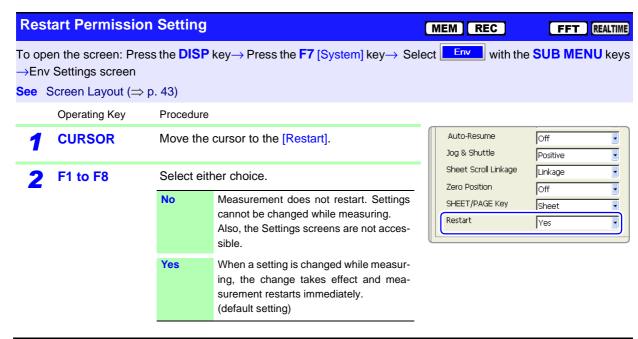
## 12.2.5 Specifying SHEET/PAGE Key Operations

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.



## 12.2.6 Selecting How Settings Affect Measurement (Restart Permission)

You can select whether measurement restarts immediately after changing measurement-related settings.

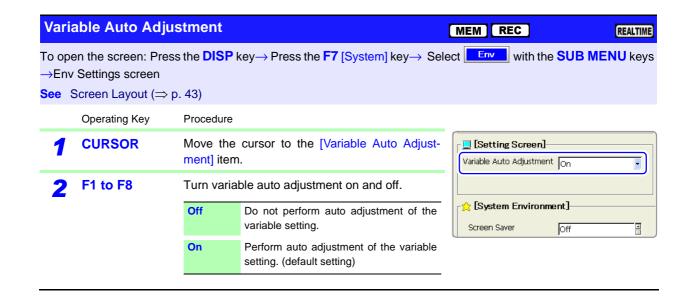


## 12.2.7 Performing Variable Function Auto Adjustment

When variable auto adjustment is enabled, the variable setting becomes linked to changes in scaling and voltage range settings.

Variable function settings:

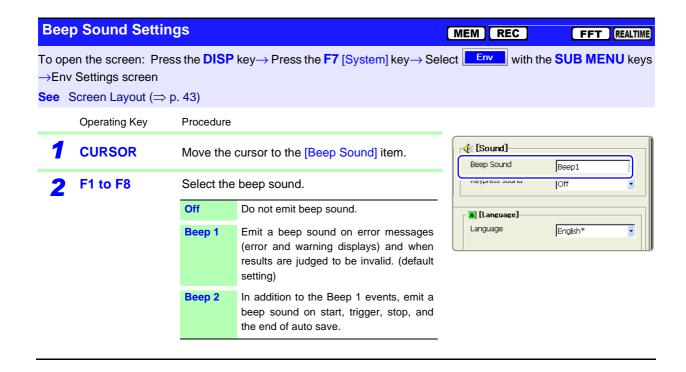
See "8.9.4 Setting Arbitrary Waveform Height and Position on the Vertical (Voltage) Axis (Variable Function)" ( $\Rightarrow$  p. 208)

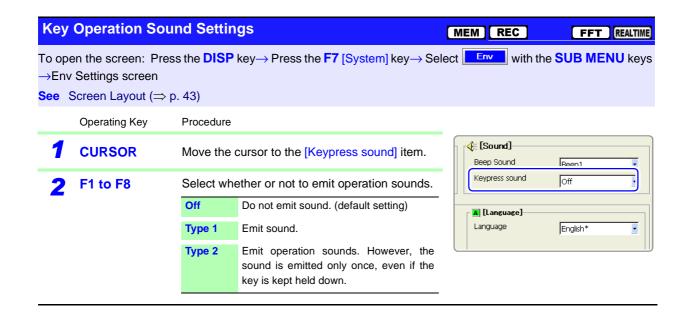


## 12.2.8 Specifying Beep and Operation Sounds

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.



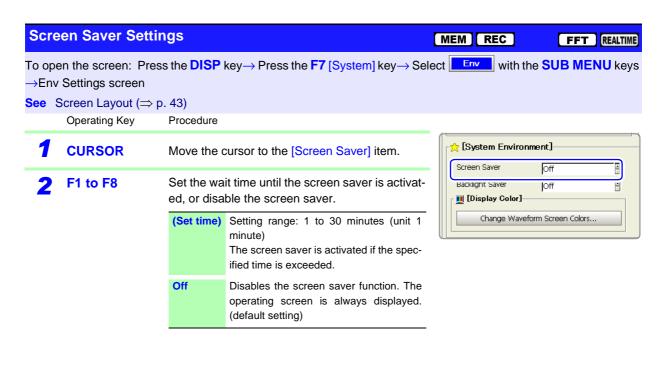


## 12.2.9 Making Screen Saver Settings

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.

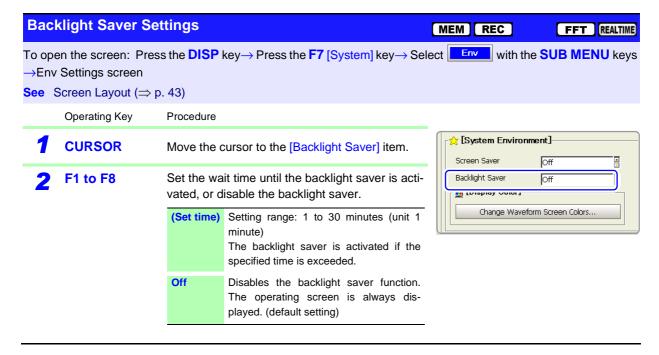


## 12.2.10 Making Backlight Saver Settings

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.

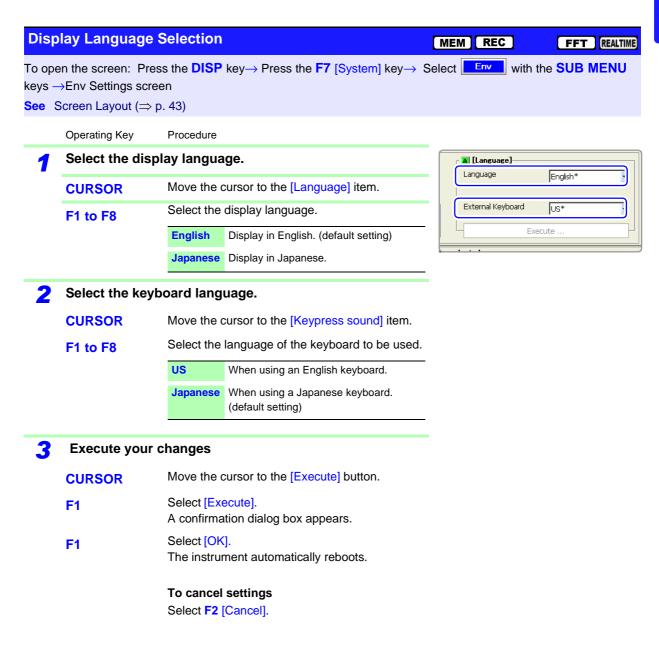
#### To deactivate the backlight saver

Press any key. The operating screen appears again.



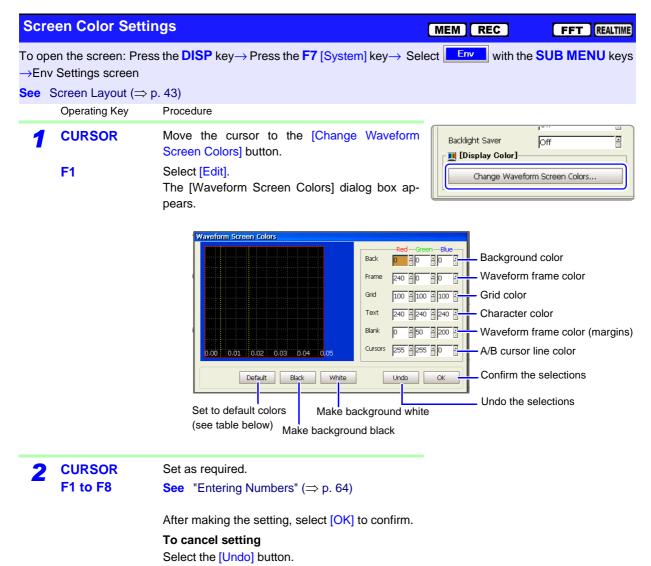
## 12.2.11 Selecting the Display Language

You can select the screen display language. After selecting a language, reboot the instrument to enable the selection.



## 12.2.12 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.



#### **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

## 12.3 Making System Settings

## 12.3.1 Setting the Date and Time

You can set the date and time zone.

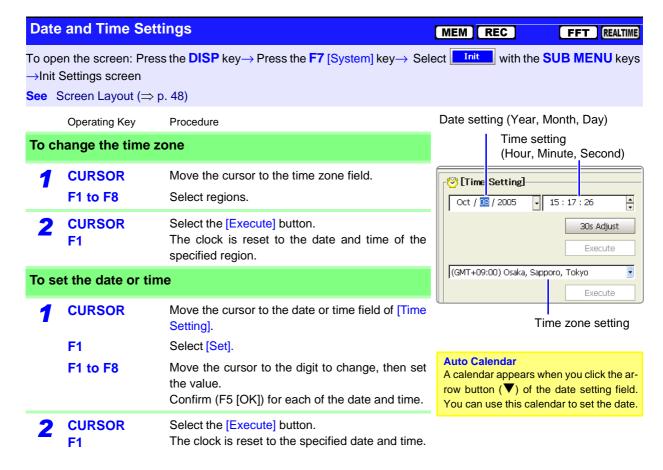
The instrument is equipped with an auto-recorder, automatic leap year detection, and a 24-hour clock.

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

<u>Note</u>

If you need to change both the time zone and the date and time, change the time zone first.





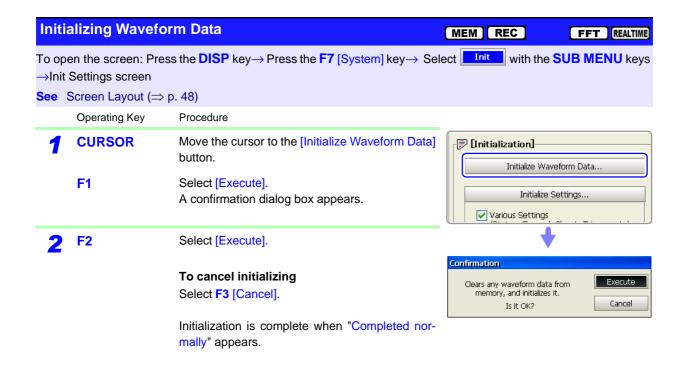
#### To adjust the current time by less than 1 minute in 30-second intervals

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.

## 12.3.2 Initializing Waveform Data

Discard the waveform data saved in memory and initialize the data.



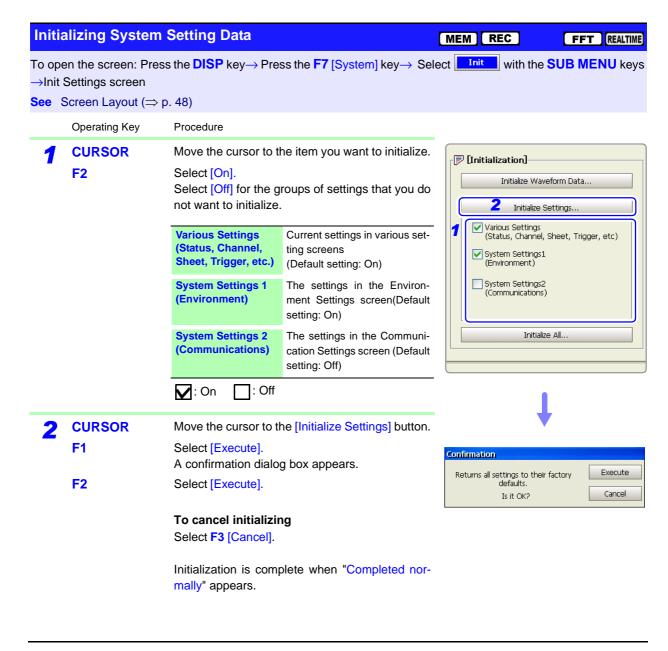
## 12.3.3 Initializing System Settings (System Reset)

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. A8)

By default, the Various Settings and System Settings 1 (Environment) setting groups are selected for initialization in this screen.



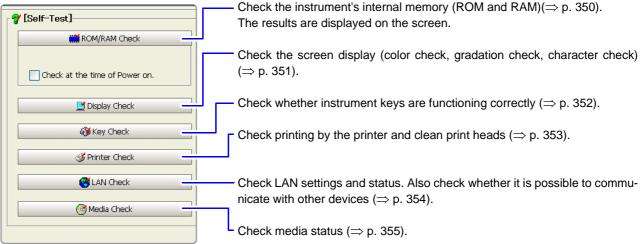


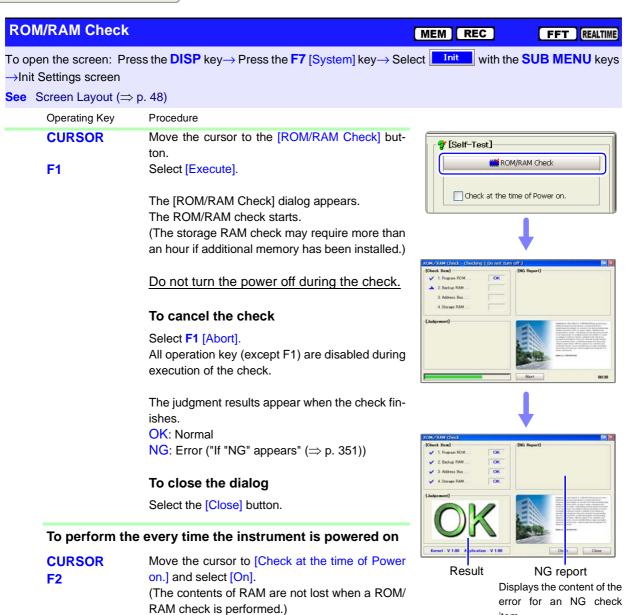
#### To initialize all settings

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.

## 12.3.4 Self-Test (Self Diagnostics)

The following self-test checks are available.







#### If "NG" appears

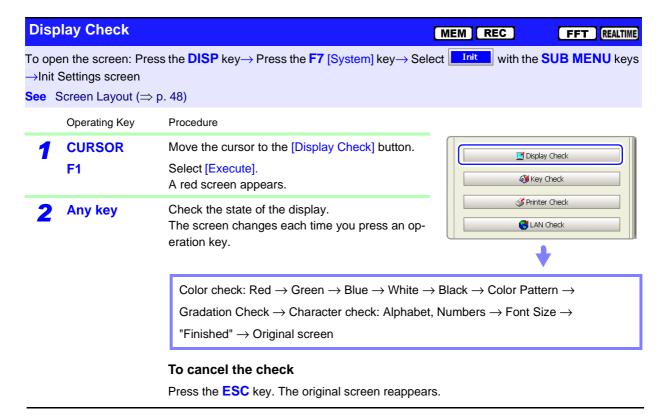
Select the [Detail] button to check the results.

To save the NG results report, select the [Save] button, and to print the results select the [Print] button.



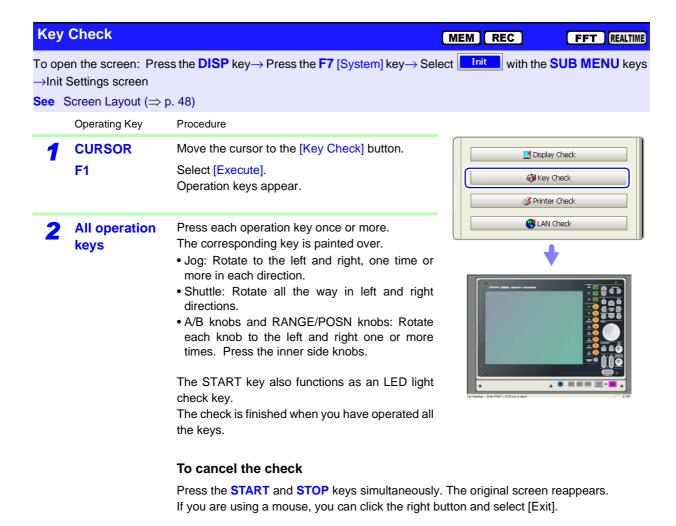
NOTE

If "NG" appears, request repairs.



NOTE

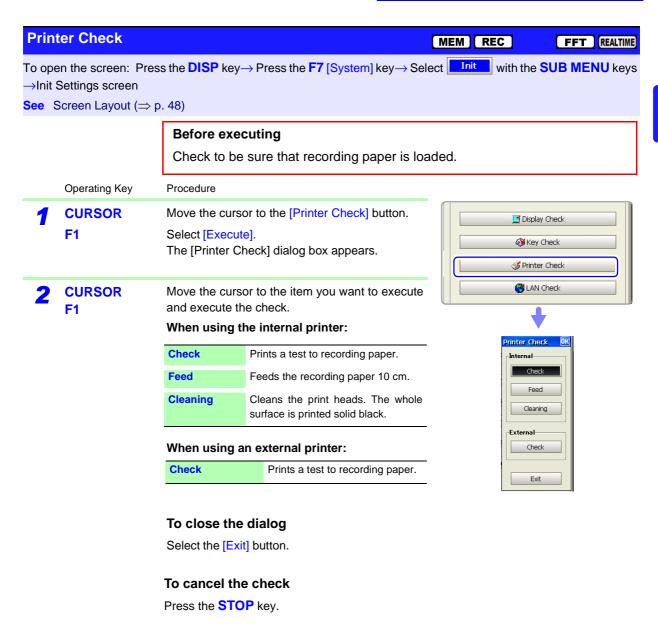
If the display screen seems abnormal, request repairs.



## NOTE

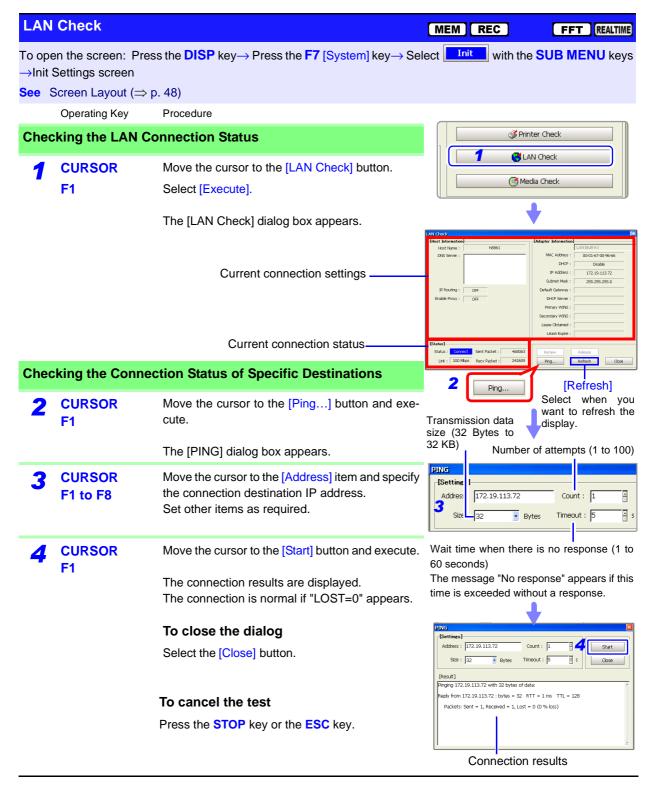
The key check does not finish if there is a problem that prevents even one of the keys from being recognized. If this occurs, press the **START** and **STOP** keys simultaneously to display the original screen.

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.



## 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.





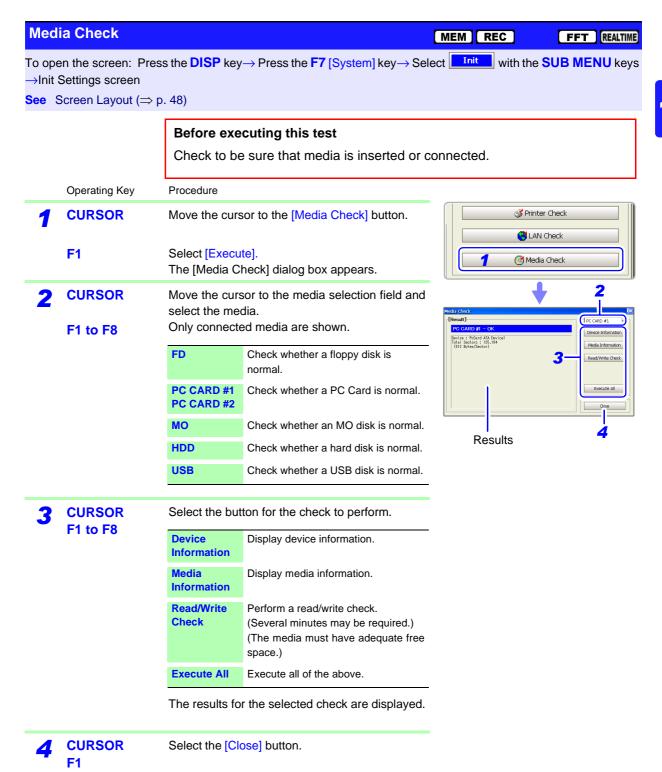
#### If "No response" appears

- Check to be sure that the LAN cable is connected correctly.
- Check the communications connections settings and try the LAN check again.
   See"13.2 Controlling the Instrument over the LAN Interface" (⇒ p. 362)
- 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.



## **<u>ACAUTION</u>**

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.

## 12.3.5 Adjusting the 8958 16-Ch Scanner Unit

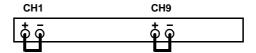
Zero-position adjustment of the 8958 16-Ch Scanner Unit with this instrument is necessary in the following cases. Adjust one hour after powering on.

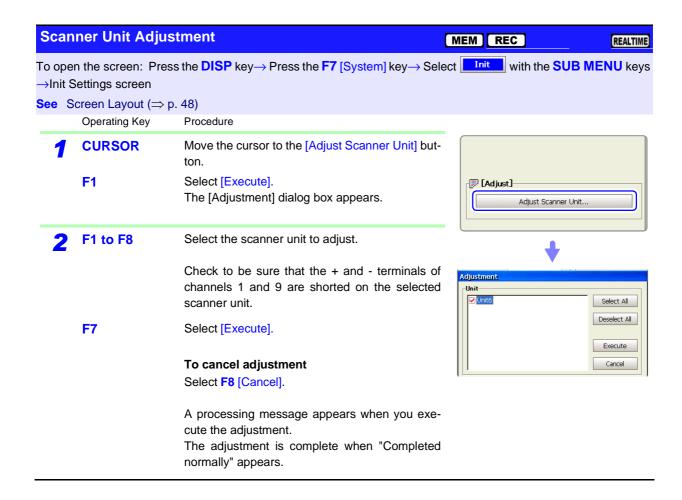
- When the 8958 16-Ch Scanner Unit is installed in this instrument (A message appears when this instrument boots, prompting you to perform the adjustment.)
- When the zero position has gotten out of alignment due to the passage of time or changes in the environment

#### 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*.

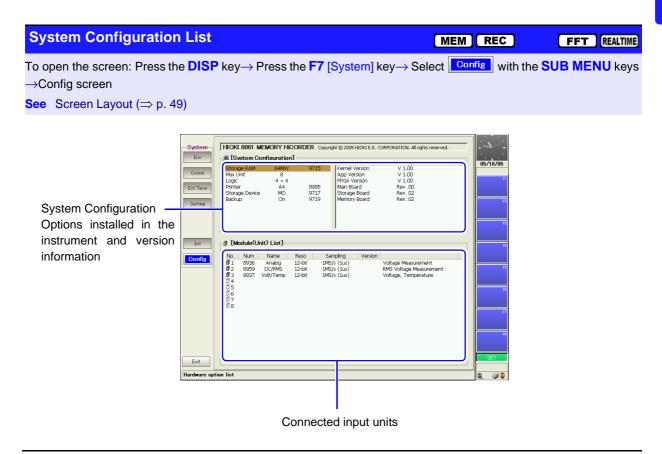
#### Short the + and - terminals of channels 1 and 9





## 12.3.6 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.



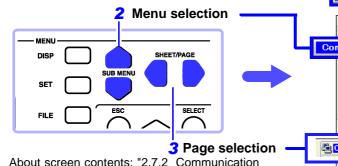
# Communications Settings Chapter 13

This instrument is equipped with an Ethernet 100BASE-TX interface for LAN communications. You can control the instrument from PCs and other devices by connecting it to a network with 10BASE-T or 100BASE-TX cable (maximum length 100 m).

Use the Communications Settings screen to make communications 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.)





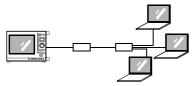
About screen contents: "2.7.2 Communication (Comm) Settings Screen" (⇒ p. 44)

## What You Can Do with Communications

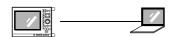
#### LAN connections and settings

#### Connections ( $\Rightarrow$ p. 360)

Connecting the instrument and a PC over a network



Connecting the instrument and a PC with a 1:1 connection



LAN settings on the instrument ( $\Rightarrow$  p. 362)

#### LAN Check (⇒ p. 354)

#### Accessing shared folders on PCs

You can connect to shared folders on Windows PCs, read files in the folders, and save files in the folders. Make shared folder settings in the File screen.

"10.1.6 Using a Network Shared Folder" (⇒ p. 249)

## Accessing the instrument by FTP (⇒ p. 369)

Web Command

#### [File] page

The instrument is equipped with an FTP (File Transfer Protocol, compliant with RFC959) server. You can use a PC FTP client to transfer files to instrument media and perform other file operations.

## Performing remote operations with an Internet browser ( $\Rightarrow$ p. 374)

#### [Web] page

You can control the instrument from a PC Internet browser.

## Controlling the instrument by command communications (⇒ p. 381)

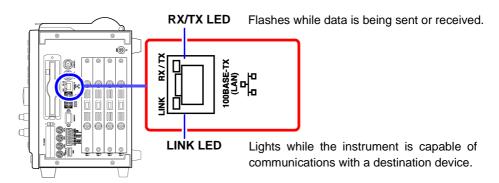
#### [Command] page

You can control the instrument by creating programs and connecting to the command communications port by TCP. The instrument can also be controlled using a GP-IB interface card.

For more information about commands, refer to the communications operation manual on the supplied application disk.

## 13.1 Connection Configurations

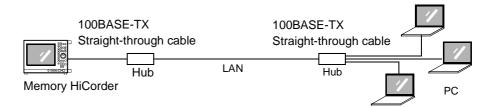
Connect the LAN cable to the 100BASE-TX connector on the right panel of the instrument.



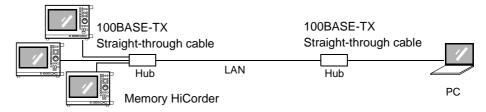
#### Connecting the Instrument to a Network

(Connecting the Instrument to a Hub)

You can monitor and control the instrument from a PC by connecting the instrument to a hub with LAN cable (100BASE-TX cable).

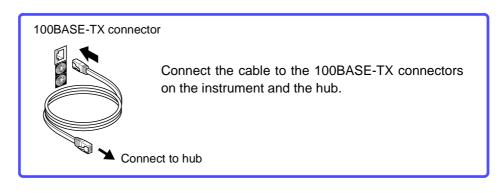


Connecting several instruments to one PC



Connection cable: Use one of the following.

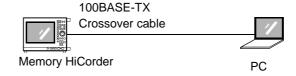
- 100BASE-TX straight-through cable (maximum length 100 m, commercially available)
   (10BASE-T cable may also be used for 10BASE communications)
- 9642 LAN Cable (option)



#### Making 1:1 Connections Between the Instrument and a PC

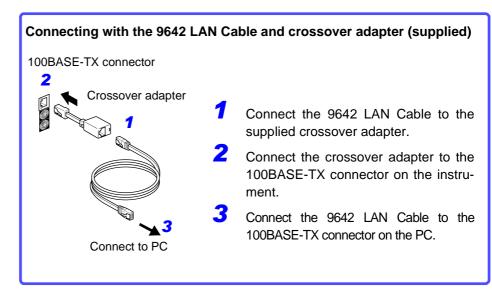
(Connecting the Instrument to a PC)

You can monitor and control the instrument from a PC by connecting the instrument to the PC with LAN cable (100BASE-TX cable)



Connection cable: Use one of the following.

- 100BASE-TX crossover cable (maximum length 100 m)
- 100BASE-TX straight-through cable with crossover adapter (maximum length 100 m)
- 9642 LAN Cable (option, supplied with crossover adapter)



## 13.2 Controlling the Instrument over the LAN Interface

## 13.2.1 Settings and Connection Procedure

### NOTE

Always make LAN settings before connecting to the network. If you change settings while connected to the network, IP addresses may overlap or invalid address data may flow over the network.

1 Make settings on the instrument.

Make LAN settings in the Communications (Comm) Settings screen. Move the cursor to the [Apply] button and select **F1** [Apply]. (The settings are not reflected to the currently active LAN if the button's function is not executed.)

2 Connect the instrument to the network.

Connect the LAN cable. (⇒ p. 360)

**3** Connect the PC.

See "13.3 Using FTP to Access Instrument Files (FTP Server)" (⇒ p. 369),
 "13.4 Performing Remote Operations on the Instrument from an Internet Browser (Web Server)" (⇒ p. 374)

## 13.2.2 Making Settings on the Instrument

## **Things to Check Before Making Settings**

#### When Connecting to an Existing Network

The following items must be assigned in advance by your network administrator. Be sure that there is no conflict with other devices.

Whether to use DHCP:	Yes/No
The host name and address of the Host name (up to 15 characters):     IP address:     Subnet mask:     (When DHCP is used, the IP address)	
DNS settings     Whether to use DNS:Y IP address (when used):Y	/es/No (up to 2 addresses)
WINS settings     Whether to use WINS: IP address (when used):	Yes/No (up to 2 addresses)
Gateway     Whether to use a gateway:  IP address (when used): (When DHCP is used, the gateway does not need to be specified here	
• The TCP/IP port number to use:X (default 880x) (Specify the most significant 3 digits of the 4-digit number. The least significant digit (0 to 9) is reserved for use by the instrument.  Specify when the default 8800 to 8809 cannot be used.)	

#### When Configuring a New Network with a PC and This Instrument

(Using as Local Network Without External Connections)

If there is not administrator for your network, or if you have been entrusted with settings, the following addresses are recommended.

(Settings example)		
IP address		
PC: 192.168.0.1		
First recorder: 192.168.0.2		
Second recorder: 192.168.0.3		
Third recorder: 192.168.0.4 and so on, in sequence.		
$\downarrow$ $\downarrow$		
Host name Any name (However, must be unique)		
Subnet mask		
Gateway Off		
DNS Off		
DHCP Off		
WINS Off		
Port number 880X		

## **Setting Items**

<b>DHCP</b> (Dynamic Host Configuration Protocol)	DHCP is a protocol that allows devices to automatically obtain and set their own IP addresses.  If you enable DHCP and there is a DHCP server operating in the same network, the instrument's IP address, subnet mask, and gateway can be obtained and set automatically. If there is no DHCP server operating, a default IP address is assigned.
Host Name	This is a name that identifies the instrument on the network. Assign a host name that is different from the names of all other devices. This instrument does not support dynamic DNS, the name that you set is not registered with a DNS server. PCs on the same network can refer to the instrument by its host name by using the NetBIOS over TCP/IP protocol.
IP Address	This is an address that identifies an individual device on a network.  Assign an address that is different from the addresses of all other devices. If DHCP is enabled, the address is assigned automatically by the DHCP server.
Subnet Mask	This is a setting used to divide an IP address shown to the network into a network address and a host address. Use the same subnet mask for all devices in the same network. If DHCP is enabled, the subnet mask is assigned automatically by the DHCP server.
DNS (Domain Name System)	DNS allows network devices to be specified by their names instead of by their IP addresses. (An IP address is simply a string of numbers, which it is hard to remember. Device addresses are easier to understand if they can be specified with names instead of IP addresses.)
WINS (Windows Internet Naming Service)	DNS allows network devices to be specified by their names instead of by their IP addresses. If there is a WINS server in the network, a name can be obtained by querying that server.
Gateway IP address	For network connections:  When your PC (or the communicating device) is on another network than this instrument, set this to [On] and specify the gateway device.  When the PC is on the same network, this is usually set to the same address as the default gateway in the PC communications settings.  For 1:1 connections between the instrument and a PC:  This setting is not required when the instrument and the PC are connected to the same hub. Set it to [Off].  If DHCP is enabled, the gateway address is obtained from the DHCP server.
Command Port (Port number)	The instrument uses the TCP/IP protocol for communications. TCP/IP allows communicating devices to establish multiple connections, which are distinguished by port numbers. By default the instrument uses port numbers 8800 to 8809.  • 8800 to 8801 reserved  • 8802 (instrument is server): For communications command control  • 8803 to 8809 reserved  Normally these ports do not need to be changed. You can change them if certain ports cannot be used for security reasons, or if certain ports are not available on the communicating PC. Set only the most significant three digits. The least significant digit (0 to 9) is used by the instrument, or reserved for use by the instrument.
Header (On/Off)	Use for control of communications commands.  The Header item specifies whether to prefix headers to command response messages.  For more information about commands, refer to the Communications operation manual on the supplied CD.
Delimiter	The Delimiter item specifies LF, CR, or CR/LF as the newline delimiter in command response messages. The instrument understands all three settings: LF, CR, and CR/LF.

#### **Authorization User Name and Password**

These are used when you login to the instrument by FTP, or use a PC browser (with the authorization setting set to on).

When authorization is enabled, login is not possible unless a correct user name and password are entered. This setting is recommended if you wish to restrict the users who can access the instrument.

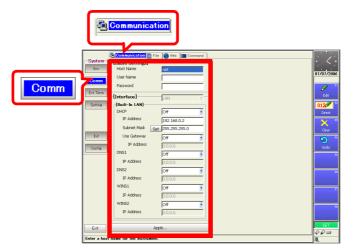
The "Password" item is displayed as "\*\*\*\*\*\*\*\*".

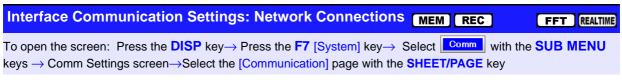
Valid characters: Alphabetic characters and symbols (however, ":" (colon) cannot be used)

If you want to allow anyone to access, or you wish to login as "anonymous" with a FTP client, leave the user name and password fields blank.

## **Making Communications Settings on the Instrument**

Make communications settings in the [Basic Settings] and [Interface] section of the [Communication] page of the Communications (Comm) Settings screen.





Operating Key Procedure

## Set the host name, authorization user name, and password.

CURSOR F1 to F8 Move the cursor to the various [Basic Settings]

fields.

Enter the host name, authorization user name,

and authorization password.See About Host Names

"Authorization User Name and Password"

(⇒ p. 365)

#### To obtain the IP address automatically

#### **Enable DHCP.**

**CURSOR** Move the cursor to the [DHCP] item.

F2 Select [On].

#### To set the IP address to any address

#### Set the IP address and subnet mask.

CURSOR Move the cursor to the [DHCP] item.
F1 Select [Off]. (default setting)

CURSOR Move the cursor to the [IP Address] or [Subnet

Mask] item.

F1 to F8 Enter the IP address and subnet mask of the in-

strument.

If you want to set the subnet mask automatically:

Press the [Set] button.

## To use a gateway

#### Enable the gateway and set the IP address.

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

F2 Select [On].

CURSOR Move the cursor to the [IP Address] item.

F1 to F8 Enter the IP address.

## 1 To use DNS

#### Enable DNS and set the IP address.

**CURSOR** Move the cursor to the [DNS1] item.

F2 Select [On].

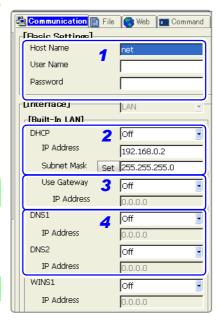
If you wish to use 2 DNS servers, also set

[DNS2].

#### (When [On] is selected for DNS1 and DNS2)

**CURSOR** Move the cursor to the [IP Address] item.

F1 to F8 Enter the IP address.



#### **About subnet masks**

Although the subnet mask can be set automatically, you should still check to be sure that it is set correctly. It should match the subnet mask of the network to which you are connecting.

#### **Using gateways**

If you will be using a PC on a different network from the instrument, set [Use Gateway] to [On], and specify the address of the device that serves as the gateway for that network.

#### **Explanations of terms**

"Setting Items" (⇒ p. 364)

- To make FTP connections (⇒ p. 369)
- To connect with an Internet browser (⇒ p. 374)
- To perform command communications(⇒ p. 381)

Operating Key Procedure

#### To use WINS

#### Enable WINS and set the IP address.

**CURSOR** Move the cursor to the [WINS1] item.

F2 Select [On].

If you wish to use 2 WNS servers, also set

[WINS2].

#### (When [On] is selected for WINS1 and WINS2)

**CURSOR** Move the cursor to the [IP Address] item.

F1 to F8 Enter the IP address.

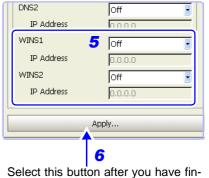
#### **6** To apply communications settings

**CURSOR** Move the cursor to the [Apply] button.

F1 Select [Apply].

A dialog appears.

F2 Select [Execute].



Select this button after you have finished making settings.

After applying the settings, connect the LAN cable.

### NOTE About Host Names

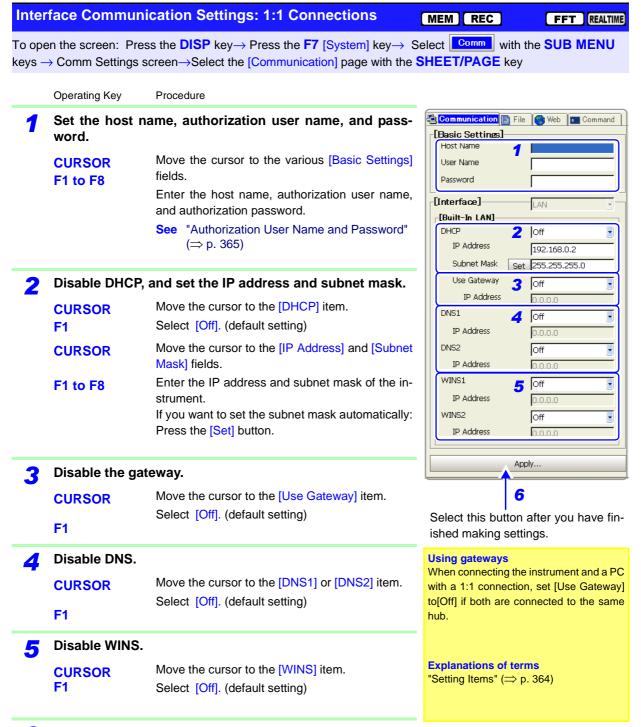
Valid characters:

Alphabetic characters (uppercase and lowercase), numbers, symbols (only hyphen (-) and underscore (\_))

Characters other than those listed above cannot be used.

Host names cannot begin with a number or symbol, and cannot end with a symbol

Contact your network administrator for more information about IP addresses and the other settings required by your network.



6 Apply the settings.

CURSOR Move the cursor to the [Apply] button.

F1 Select [Apply].
A dialog appears.
Select [Execute].

## 13.3 Using FTP to Access Instrument Files (FTP Server)

This instrument is equipped with an FTP (File-Transfer-Protocol, RFC959 compliant) server.

By using a PC FTP client, you can transfer files from the instrument's media to the PC and perform other file operations.

You can use IE (Internet Explorer) or other popular FTP clients.

#### For more information about LAN connections and settings:

See "13.2 Controlling the Instrument over the LAN Interface" (⇒ p. 362)

## NOTE

Be careful when moving files by FTP, as some FTP client/browser programs may delete all selected files or folders from the source if you cancel a transfer before completion. Rather than moving files in one step, we recommend copying (downloading) and then manually deleting from the source.

## 1 Make settings on the instrument.

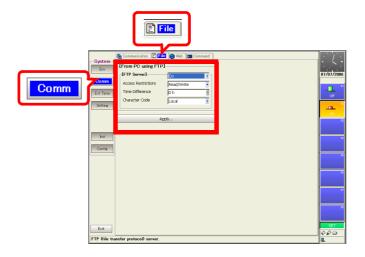
- Make LAN settings in the Communications (Comm) Settings screen.
   (⇒ p. 363)
  - (Set the host name, authorization user name, and authorization password in the [Basic Settings] section of the [Communication] page of the Comm Settings screen.)
- Make FTP settings in the [FTP Server] section of the [File] page of the Comm Settings screen. (⇒ p. 369)

## 2 Operate on the PC.

Connect to the instrument from the PC, and carry out file operations. ( $\Rightarrow$  p. 371)

## 13.3.1 Making Settings on the Instrument

Make FTP settings in the [FTP Server] section of the [File] page of the Comm Settings screen.

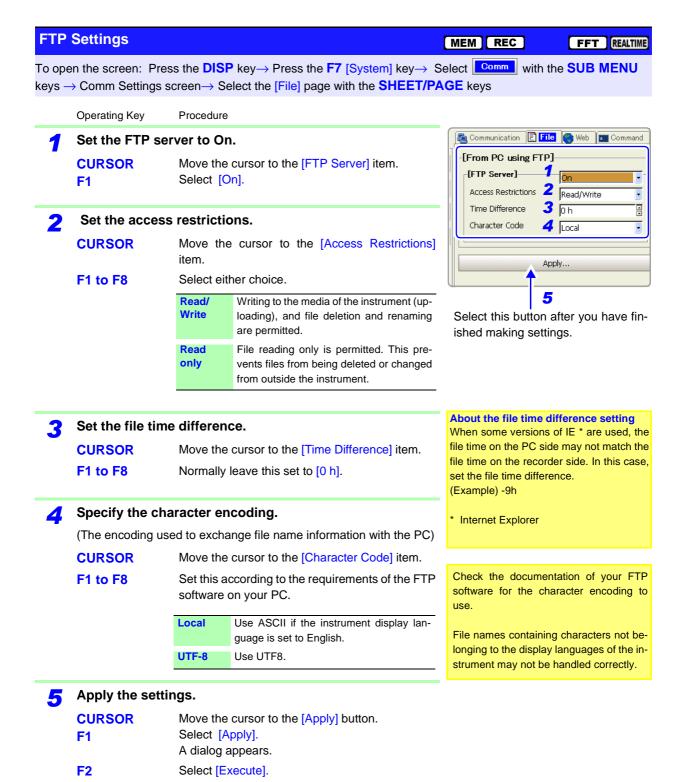


NOTE

LAN settings are required to use FTP.

See "Interface Communication Settings: Network Connections" (⇒ p. 366) "Interface Communication Settings: 1:1 Connections" (⇒ p. 368)

#### 13.3 Using FTP to Access Instrument Files (FTP Server)



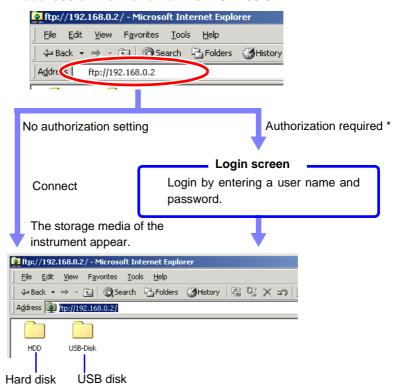
## 13.3.2 Operate on the PC

#### Connecting

The following example shows how to use the IE (Internet Explorer) browser on Windows XP.

Launch IE on the PC and enter "ftp://" plus the IP address of the instrument in the address bar.

#### If the IP address of the instrument is "192.168.0.2":



Click to display the file stored on the media.

\*: An authorization user name and password have been set in the [Communication] page of the instrument's Communications (Comm) Settings screen.

You can also enter the user name and password, delimited by ':' and '@', in front of the normal IP address.

#### [ftp:// Username:Password@ instrument IP address]

Example: When the user name is "hioki" and the password is "1234": Enter [ftp://hioki:1234@192.168.0.2].



#### If the connection fails

Check the communications settings of the instrument.

See "13.2 Controlling the Instrument over the LAN Interface" (⇒ p. 362)

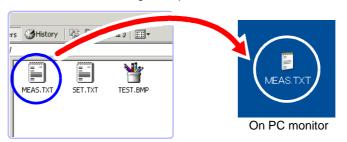
#### **Operations**

#### **Downloading Files**

Select the file to download from the folder list and drag and drop\* it on the download destination (the desktop or a folder outside the IE window).

\*: Click the file and hold the button down. Move the mouse pointer to the target destination, and then release the button

Drag & Drop



Minutes and seconds may not be reflected on the file stamp (date) of the file.

#### **Uploading Files**

Select a file on the PC desktop or in folder, and drag and drop it on a folder in the FTP folder list. This updates the FTP folder.

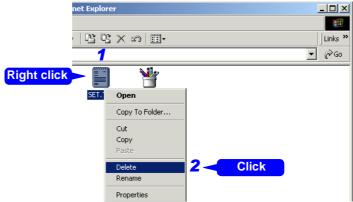
Drag & Drop



The file's time stamp becomes the time when you uploaded the file.

#### **Deleting and Renaming Files**

Right click a file in the FTP folder list, and select [Delete] or [Rename] from the pull-down menu.



Files cannot be moved.

## **Relationship Between Storage Media and Directories**

Each of the various types of storage media appears as a directory on the FTP

/FDD	Floppy disk
/PC-Card1	PC Card
/PC-Card2	PC Card
/MO	Internal MO drive
/HDD	Hard disk
/USB-Disk	USB memory

## NOTE

- · In general, only one FTP user (1 connection) is allowed to log on to the FTP server at one time. For this reason, avoid the use of high-speed download tools which open multiple connections.
- Because FTP does not define a specific format for exchanging information about files, file information may not display correctly on some FTP clients. The server supports only generally used FTP commands. You may not be able to use FTP clients which rely on other commands.

## 13.4 Performing Remote Operations on the Instrument from an Internet Browser (Web Server)

You can perform remote operations on the instrument from a PC by using an Internet browser.

Microsoft Internet Explorer Version 5 or later is recommended as the browser. The Web server uses JavaScript, so enable Active Script in the Security tab of the Internet Options dialog of IE.

#### For more information about LAN connections and settings:

See "13.2 Controlling the Instrument over the LAN Interface" (⇒ p. 362)

## 1 Make settings on the instrument.

Make the following web server authorization setting in the [Web] page of the Communications (Comm) Settings screen. ( $\Rightarrow$  p. 375)

#### If you want to restrict access to the instrument:

Set the Web server [Use] to F3 [Authorization].

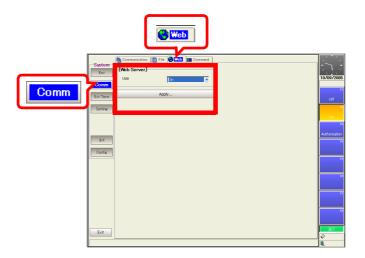
(You can restrict access by setting an authorization user name and password in the [Basic Settings] section of the [Communication] page of the Comm Settings screen.)

## Operate on the PC.

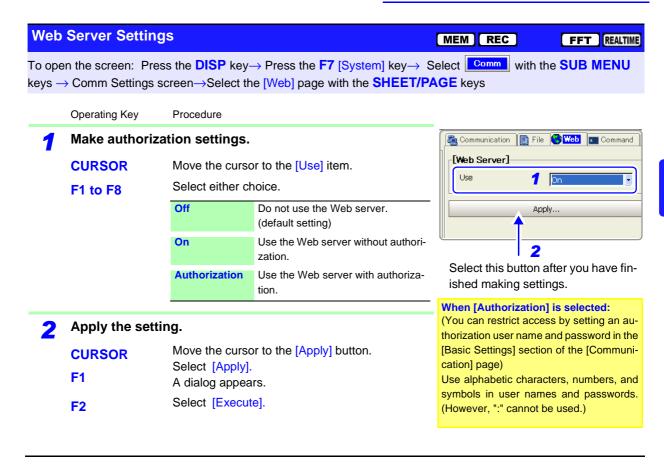
Connect to the instrument from the PC, and carry out remote operations. ( $\Rightarrow$  p. 376)

## 13.4.1 Making Settings on the Instrument

Make Web settings in the [Web Server] section of the [Web] page of the Comm Settings screen.



#### 13.4 Performing Remote Operations on the Instrument from an Internet Browser (Web Server)



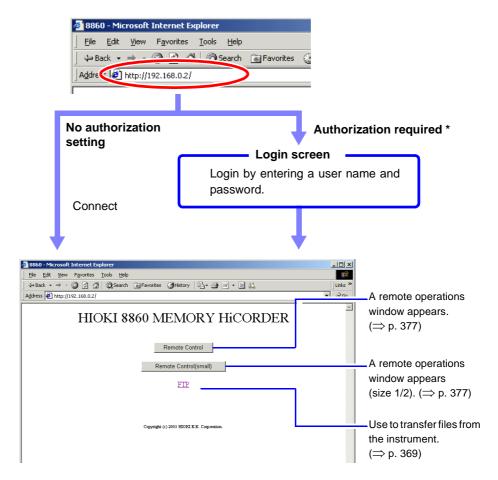
## 13.4.2 Operate on the PC

#### Connecting

The following example shows how to use the IE (Internet Explorer) browser on Windows XP.

Launch IE on the PC and enter "http://" plus the IP address of the instrument in the address bar.

#### If the IP address of the instrument is "192.168.0.2":



\* An authorization user name and password have been set in the [Communication] page of the instrument's Communications (Comm) Settings screen.

As shown below, you can also enter the user name and password as part of the address.

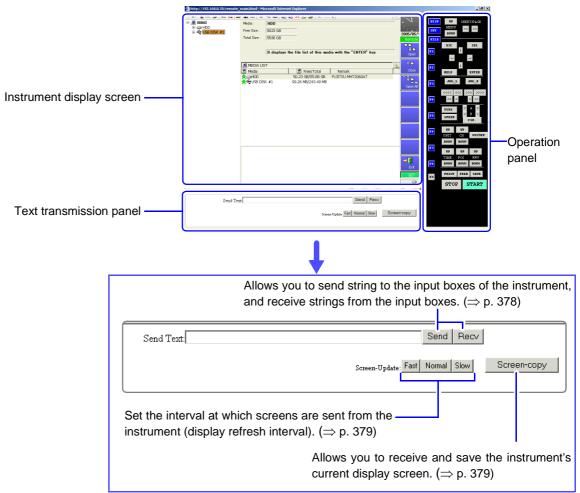
[http:// Username:Password@ instrument IP address]

(The user name and password delimited by ':' and '@', are entered in front of the normal IP address.)

Operations

#### About the remote operation window

The remote operation window is divided into 3 sections: the instrument display screen, the operation panel, and the text transmission panel.

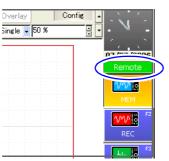


The screen is sent from the instrument periodically, so that it is always up to date. You can specify the display refresh interval.

See "Changing the Display Interval" (⇒ p. 379)

The instrument enters remote mode when you operate in the remote operation window.

(Remote display)



All of the operation keys on the instrument are disabled, with the exception of the **SET** key.

When you want to operate on the instrument Press the **SET** key to exit remote mode.

#### **Basic Operations**

#### To use the operation panel:

Click one of the buttons on the operation panel. The buttons can be used in the same way as the operation keys on the instrument. However, it is not possible to press two buttons at the same time.

If you are performing a key check in the initialization settings screen of the System menu and want to exit the key check screen, right click on the screen and select [Exit] from the pull-down menu. This exits from the key check screen.

#### To operate with the mouse on the display screen:

Click the display screen. Mouse operations on the display screen work in the same way as mouse operations on the instrument. However, dragging is not possible.

#### To operate with the keyboard on the display screen:

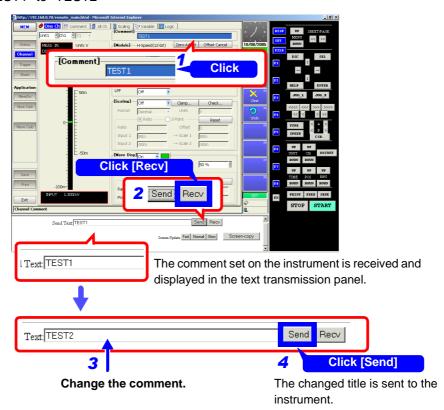
Press a key. Keyboard input for the display screen works in the same way as keyboard input for the instrument. However, the Alt key and function keys may be assigned to browser operations.

(Keyboard input is possible with IE Version 5 and later. Depending on the browser used, some entered characters may display differently from those on the pressed keys. This also occurs when the instrument's display language setting is different from the language of the keyboard.)

#### **Sending and Receiving Text**

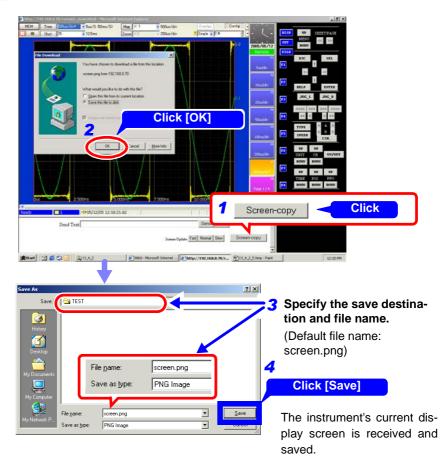
You can send text to the input boxes of the instrument, and receive text from the input boxes.

Example: Changing the comment set for a channel on the instrument from "TEST1" to "TEST2"



#### **Saving Screens**

Screens received from the instrument can be saved. The data is saved in PNG format.



#### **Changing the Display Interval**

Click [Fast], [Normal], or [Slow] in the text transmission panel to change the screen transmission interval.

The [Slow] setting is recommended for use with slow networks.

The [Fast] setting puts a greater burden on the instrument, so operations may become slower. (The operations are performed correctly, but calculations take longer.)

#### **Quitting Remote Operation**

Click the  $\boxtimes$  (Close) button in the upper right corner of the browser. The browser closes.

## 13.5 Using an Interface Card

The instrument can be controlled using an interface card (Model 9558 GP-IB Card). To prepare for communications, insert the interface card and configure the interface settings on the Communications Settings screen.

See "13.6 Controlling the Instrument with Command Communications" (⇒ p. 381)

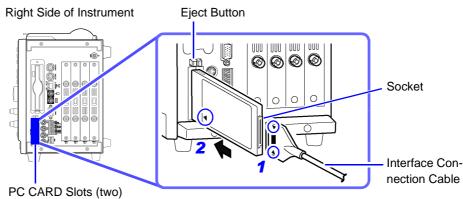
Refer to the Instruction Manual for the Model 9558 GP-IB Card for details.

## **<u>ACAUTION</u>**

Observe the following precautions to avoid damage or disruption to the connections of the interface card and the instrument's card slot.

- Do not insert or remove the interface card by holding the connection cable, and avoid pulling the cable forcefully.
- Do not attempt to force the card into the slot when it is upside down or not facing in the proper insertion direction.
- Do not move the instrument while the cable is connected to the interface card.

#### **Interface Card Insertion & Removal**



The interface card is keyed to prevent improper insertion, so forcing it in the wrong way may damage the PC CARD slot or the card.

#### Inserting an Interface Card

- 1 Align the ▲ marks on the plug of the interface connection cable with the socket on the interface card as shown in the drawing, and insert the plug.
- 2 With the ▲ mark on the interface card facing toward the front and pointing in the insertion direction (arrow), insert it into the PC CARD slot as far as it will go.

#### Removing an Interface Card

Press the Eject button. When the button pops out, press it again to eject the Interface Card.

After the interface card is automatically recognized, the settings can be made.

#### **GP-IB**

Mode	Addressable / Disable
Address	0 to 30

Configure the communications settings on the [Command] page before establishing communications.

See "13.6.1 Making Settings on the Instrument" (⇒ p. 381)

## 13.6 Controlling the Instrument with Command **Communications**

You can control the instrument remotely over the communications interface.

#### For more information about LAN connections and settings:

See "13.2 Controlling the Instrument over the LAN Interface" (⇒ p. 362)

#### Interface card connections

See "13.5 Using an Interface Card" (⇒ p. 380)

## Make settings on the instrument.

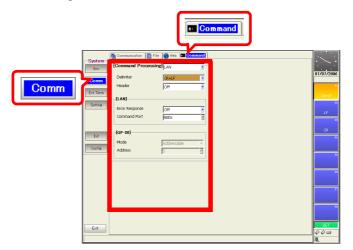
Set communications commands on the [Command] page of the Communications (Comm) Settings screen.

## Operate on the PC.

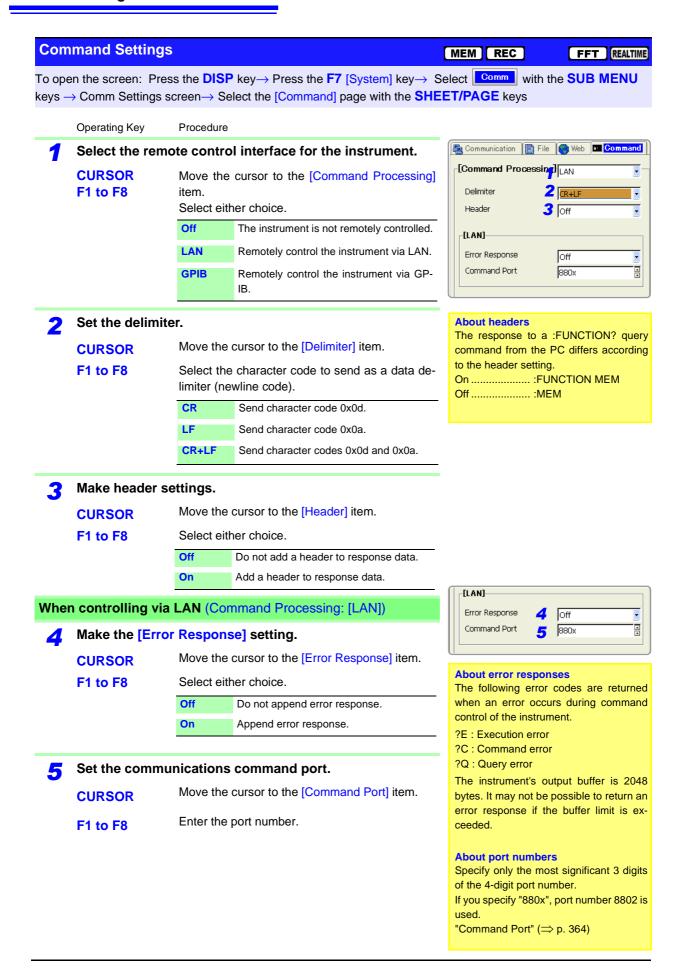
Connect the PC to the instrument (\$\Rightarrow\$ p. 384), launch a communications program, and issue commands to control the instrument. For details, refer to the Communications operation manual on the supplied CD.

## 13.6.1 Making Settings on the Instrument

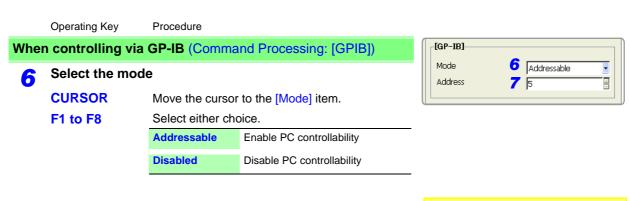
Set the items in the [Command Processing] section of the [Command] page of the Comm Settings screen.



#### 13.6 Controlling the Instrument with Command Communications



#### 13.6 Controlling the Instrument with Command Communications



#### 7 Assign an address

**CURSOR** Move the cursor to the [Address] item.

F1 to F8 Select from 0 to 30.

#### **About the Address**

GP-IB requires that each device connected to the GP-IB have a unique address.

## 13.6.2 Operate on the PC

The following example shows how to make a connection using the telnet software (HyperTerminal) supplied with Windows XP.

#### Launch HyperTeminal.

Click [Start], [Programs] - [Accessories] - [Communications] - [HyperTerminal], and then click [HyperTerminal].

The HyperTerminal screen appears.

Specify a connection name.

Enter a name in the [Name] field and click the [OK] button.

(You can enter any name.)

A [Connect To] dialog appears.

#### Make the connection settings.

- 1. In [Connect using] select [TCP/IP (Winsock)].
- 2. In [Host address], enter the IP address of the instrument.
- 3. In [Port number], enter the port number specified in the [Command] page.

#### **About port numbers**

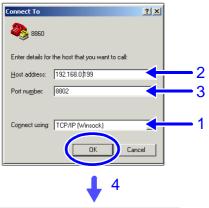
On the instrument, only the most significant 3 digits of the 4-digit instrument port number are specified ( $\Rightarrow$  p. 382). If you specified "880x" on the instrument, enter "8802" here. "Command Port" ( $\Rightarrow$  p. 364)

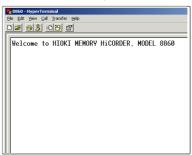
4. Click the [OK] button.

The connection is made.



NetMee Click
Network and Dial-up Connect





HyperTerminal screen

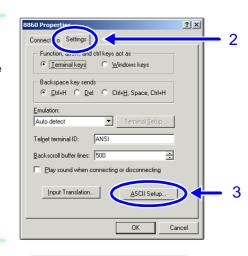
#### Make detailed connection settings.

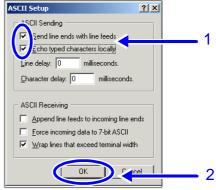
- Select [Properties] in the [File] menu.
   The Properties dialog for the specified connection name appears.
- 2. Click the [Settings] tab.
- 3. Click the [ASCII Setup...] button.

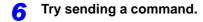
The [ASCII Setup] dialog appears.

#### Make detailed settings

- 1. Check the [Send line ends with line feeds] and [Echo typed characters locally] check boxes.
- 2. Click the [OK] button to return to the Properties dialog.
- Click the [OK] button to return to the HyperTerminal window.

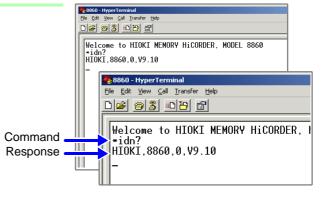






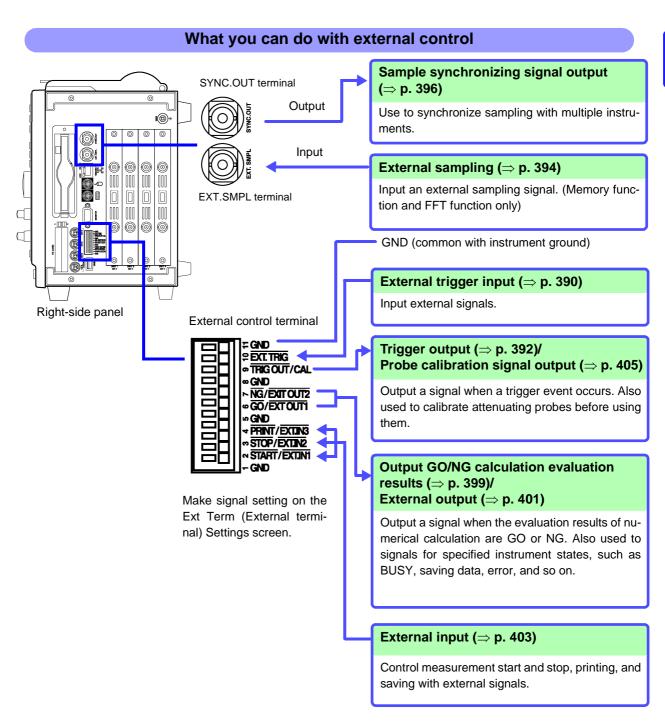
Enter "\*IDN?" and press the Enter key.

A response is returned from the instrument.



# **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.



## 14.1 Connecting External Control Terminals

### **A** 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
	EXT.SMPL		BNC
Input	EXT.TRIG		
	PRINT/EXT.IN3	-2 to 7 V DC	Terminal block
	STOP/EXT.IN2		
	START/EXT.IN1		
	TRIG OUT/CAL	001.001/.00	Terminal block
Output	NG/EXT OUT2	-20 to 30 V DC 500 mA max, 200 mW max	
	GO/EXT OUT1	·	

### **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.

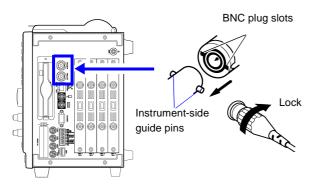
### **<u>ACAUTION</u>**

- 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)



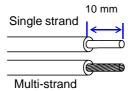
Connect the BNC plug of the connection cord to the BNC jack on the instrument side.

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.

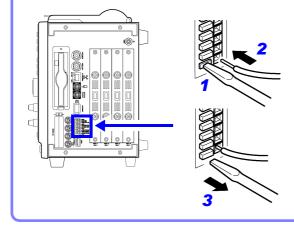
Disconnecting BNC connectors
Twist the BNC plug counterclockwise and pull it out.

#### Connecting External I/O Terminals (Connector Blocks)

#### **Cables to connect**



#### **Connection procedure**



- Recommended cables: single strand diameter 1.0 mm (AWG18), multi-strand 0.75 mm<sup>2</sup> (AWG20)
- Usable cables:
   Single strand diameter 0.4 to 1.0 mm (AWG26 to 18),
   Multi-strand 0.3 to 0.75 mm<sup>2</sup> (AWG22 to 20)
   Strand diameter 0.18 mm or greater (per wire)
- Standard insulation stripping length:10 mm
- Button operation specified tool: Flat-blade screwdriver (tip width 2.6 mm)
- Push in the button on the connector with a flatblade screwdriver or other tool.
- With the button held in, insert the cable into the cable connection hole.
- 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  $(\Rightarrow p. 391)$ .

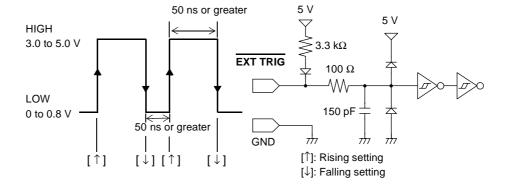


#### **Trigger Input Signals**

Voltage range HIGH level: 3.0 to 5.0 V, LOW level: 0 to 0.8 V

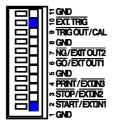
Pulse width HIGH level: 50 ns or greater, LOW level: 50 ns or greater

Maximum input voltage -2 to 7 V



#### **Signal Input Procedure**

Connect the cables for the corresponding external input signals to the EXT TRIG and GND terminals.

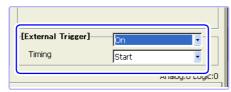


GND is common. It can be connected to any ground.

#### Connection procedure:

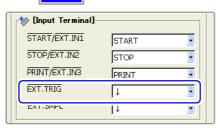
"14.1 Connecting External Control Terminals" (⇒ p. 388)

In the Trigger Settings screen, set External trigger to [On].  $(\Rightarrow$  p. 160)

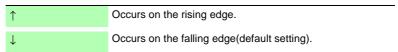


In the Ext Term (external terminal) Settings screen, select a setting for the [EXT.TRIG] terminal.

(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

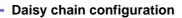


Short-circuit the EXT TRIG terminal and GND, or leave the terminals open-circuited, and input a HIGH level (3.0 to 5.0 V) or LOW level (0 to 0.8 V) pulse wave or rectangular wave to the EXT TRIG terminal.

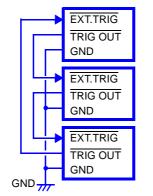
A trigger event occurs on the rising or falling edge of the input waveform.

#### **Parallel Trigger Synchronization**

#### **Connection examples**



Set all instruments to master.



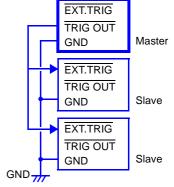
When a trigger event occurs on any of the connected instruments, it also occurs on the others.

As more instruments are connected, the difference between trigger timing on different instruments becomes larg-

Set external trigger to [On] for all instruments.

#### Parallel synchronization

Set 1 instrument to master, and set the others to slave.



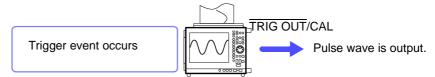
Use 1 instrument as the master (monitor triggers). Start measurement simultaneously on the other instruments when a trigger event occurs.

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. 391)

NOTE

The  $\overline{\text{TRIG OUT}}/\text{CAL}$  terminal can be used as a trigger output terminal (TRIG OUT) or as a probe calibration output signal terminal (CAL) ( $\Rightarrow$  p. 405). It cannot be used for both functions at the same time.

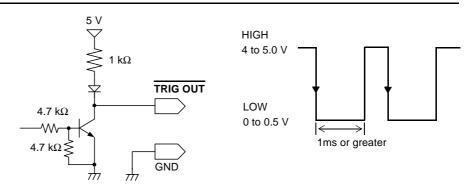
#### **Trigger Output Signals**

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 500 mA max 200 mW max

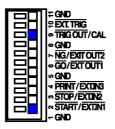


NOTE

Trigger events occur and signals are output when the auto-ranging function (FUNCTION MODE  $\rightarrow$  F4 [Auto Setting]) ( $\Rightarrow$  p. 73) 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**

Connect the cables for the corresponding external input signals to the TRIG OUT/CAL and GND terminals.



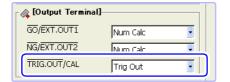
GND is common. It can be connected to any ground.

#### Connection procedure:

"14.1 Connecting External Control Terminals" (⇒ p. 388)

In the Ext Term (external terminal) Settings screen, select a setting for the <a href=[TRIG.OUT/CAL] terminal.</a>

(To open the screen: Press the **DISP** key $\rightarrow$  Press the **F7** [System] key $\rightarrow$  Select **Ext Term** with the **SUB MENU** keys  $\rightarrow$ 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  $\overline{\text{TRIG OUT}}/\text{CAL}$  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 signal input

EXT.SMPL

Sample the data of the instrument.

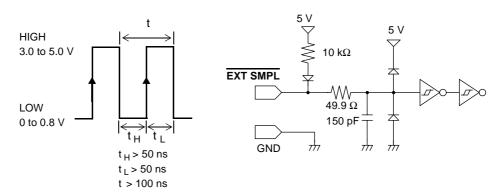
#### **Sampling Input Signals**

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	Pulse width					
(EXT.SMPL)	When 8958 is used			When other input module is used		
(=/:::0::::=)	t <sub>H</sub>	t∟	t	t <sub>H</sub>	t∟	t
1	> 5 μs > 5 μs		> 10 µs	> 50 ns	> 50 ns	> 100 ns
<del>\</del>	> 5 µs	> 5 µs	> 10 µs	> 50 ns	> 50 ns	> 100 ns
<b>↑&amp;</b> ↓	> 10 µs	> 10 µs	> 20 µs	> 100 ns	> 100 ns	> 200 ns

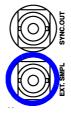
When the Roll Mode is enabled, supported pulse widths are those shown above for the Model 8958, regardless of input modules.

• 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

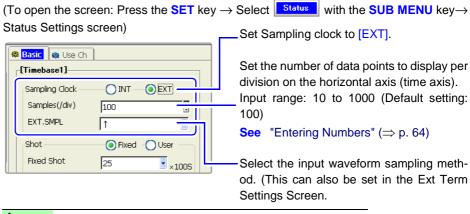
#### **Signal Input Procedure**

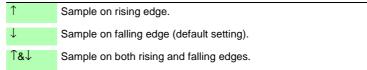
1

Connect the EXT.SMPL terminal and the sampling signal output destination with a BNC cable.



In the Status Settings screen (Memory Function), make the following external sampling settings.





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.

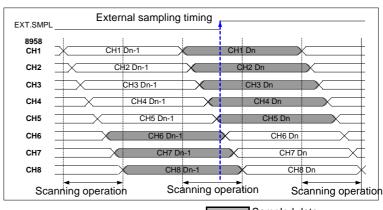
Data is sampled on the rising edge, falling edge, or both edges of the input waveform. Note that the sampling frequency is limited by the selected edge or edges. ("Supported external sampling pulse widths" ( $\Rightarrow$  p. 394))

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. 99). 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

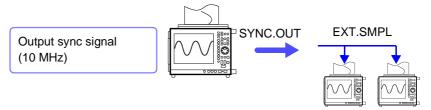
- Input sampling input signals of 100 kHz or lower. Signals higher than 100 kHz cannot be sampled.
- During scanning, if they overlap with the external sampling frequency, channels where scanning is finished exist at the same time as channels where scanning is not finished. Data may be sampled according to the timing shown in the figure below.



Sampled data

# 14.2.4 Synchronized Sampling Output (SYNC.OUT)

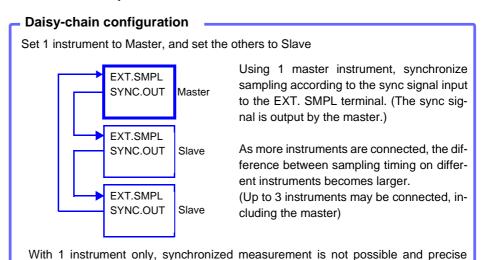
Sampling can be synchronized across multiple instruments.



Synchronized sampling measurement

#### **Synchronized Operation**

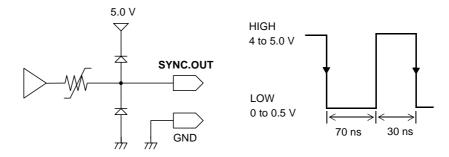
#### **Connection example**



#### **Sync Signals**

measurement is not possible.

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

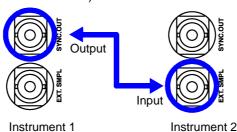


#### **Signal Output Procedure**

### ∕!\CAUTION

To prevent damage to the instruments, do not connect the SYNC.OUT terminals of two instruments.

Connect the SYNC.OUT and EXT.SMPL terminals of the instruments to be synchronized (8860 or 8861), using BNC cables (9165 Connection Cord or 9217 Connection Cord).



See "Synchronized Operation" ( $\Rightarrow$  p. 396) for a connection example

Use 9165 Connection Cord or 9217 Connection Cord to make the connec-

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  $\boxed{\text{Ext Term}}$  with the SUB MENU keys  $\rightarrow$ Ext Term Settings Screen)

#### **Master instrument**



#### Salve instrument



Set synchronization operation to [Master].

Set synchronization operation to [Slave].

Set only 1 instrument as [Master]. Synchronization is not possible if 2 or more instruments are set to [Master].

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.

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	Sampling rate	Offset from sync signal
Model 8956 Analog Unit	50 ns/S	Within -50 ns
Model 8957 High Resolution Unit	500 ns/S	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.

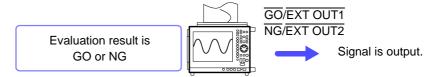
## When power is restored after a power outage during synchronized measurement

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 ( $\Rightarrow$  p. 338) is on, but no synchronization is conducted with the connected instruments.

### 14.2.5 GO/ NG Evaluation Output (GO/EXT OUT1)/ (NG/EXT OUT2)

Signals can be output when the results of evaluation of numerical calculations are GO (pass) or NG (fail).



### NOTE

The GO/EXT OUT1 and NG/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) ( $\Rightarrow$  p. 401). They cannot be used for both functions at the same time.

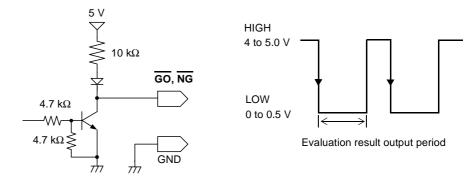
The default setting (factory default) is [Num Calc].

#### **GO/ NG Evaluation Output Signals**

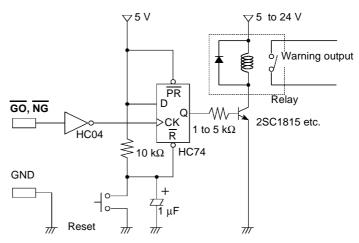
Output signal	Open collector output (with voltage output), active LOW
Output voltage range	HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Maximum input voltage	-20 to +30 V 500 mA max 200 mW max

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.



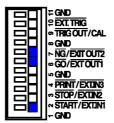
Example of a circuit for a warning device



#### **Signal Output Procedure**

1

Connect the  $\overline{\text{GO}/\text{EXT OUT1}}$  terminal,  $\overline{\text{NG}/\text{EXT OUT2}}$  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. 388)

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 $\rightarrow$  Press the **F7** [System] key $\rightarrow$  Select xit Term with the **SUB MENU** keys  $\rightarrow$ 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).
Waveform *	Output the GO/NG results of waveform evaluation.
Num   Wave	Output results when either numerical evaluation OR waveform evaluation * is GO or NG.
Num & Wave	Output results when both numerical evaluation AND waveform evaluation* are GO or NG.

(\*: Waveform evaluation will be supported in a future version.)

See For more information about other menu items "14.2.6 External Output (GO/EXT OUT1)/ (NG/EXT OUT2)" (⇒ p. 401)

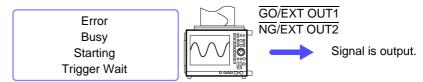
**3** Evaluate the measurement data.

See For more information about calculation settings: Analysis 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

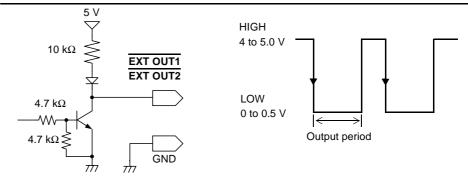
### NOTE

The  $\overline{\text{GO}/\text{EXT OUT1}}$  and  $\overline{\text{NG}/\text{EXT OUT2}}$  terminals can be used as external output terminals for specific conditions (EXT OUT1, EXT OUT2) or as GO/NG evaluation output terminals (GO, NG). ( $\Rightarrow$  p. 399)

They cannot be used for both functions at the same time.

### **External Output Signals**

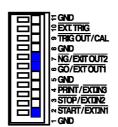
Output signal Open collector output (with voltage output), active LOW
Output voltage range HIGH level: 4.0 to 5.0 V, LOW level: 0 to 0.5 V
Maximum input voltage -20 to +30 V 500 mA max 200 mW max



#### **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. 388)

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 $\rightarrow$  Press the **F7** [System] key $\rightarrow$  Select xit Term with the **SUB MENU** keys  $\rightarrow$ 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

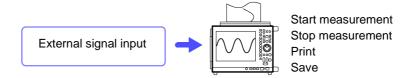
NG/EXT.OUT2: Numerical evaluation

See For more information about other menu items
"14.2.5 GO/ NG Evaluation Output (GO/EXT OUT1)/ (NG/EXT OUT2)" (⇒ p. 399)

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.



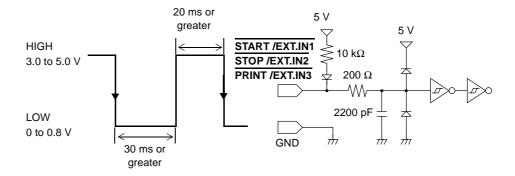
The default settings (factory defaults) for each terminal are [START], [STOP], and [PRINT].

#### **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

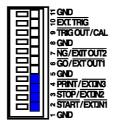
Maximum input voltage -2 to 7 V



#### **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.



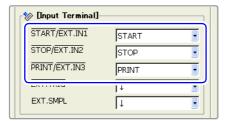
GND is common. It can be connected to any ground.

#### Connection procedure:

"14.1 Connecting External Control Terminals" (⇒ p. 388)

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 $\rightarrow$  Press the **F7** [System] key $\rightarrow$  Select Ext Term with the **SUB MENU** keys  $\rightarrow$ 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

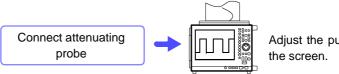
Short circuit the terminal and GND, or input a HIGH level (3.0 to 5.0 V) or LOW level (0 to 0.8 V) pulse wave or rectangular wave to the terminal.

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* 



Adjust the pulse wave while viewing the screen.

NOTE

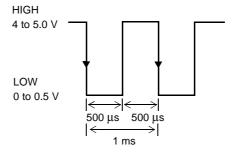
The  $\overline{\text{TRIG OUT/CAL}}$  terminal can be used as a probe calibration output signal terminal (CAL) or as a trigger output terminal (TRIG OUT) ( $\Rightarrow$  p. 392). It cannot be used for both functions at the same time.

#### **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

## 15.1 General Specifications

### (1) Basic Specifications

**Measurement functions** Memory Function (high-speed data saving)

Recorder Function (real time recording)
FFT Function (frequency analysis)
Real-Time Saving Function

No. of input modules Model 8860: 4 Modules

Model 8861: 8 Modules

No. of channels (max.) Model 8860:

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)

64 analog channels + 16 logic channels (using the Model 8958 16-Ch Scanner Un

Model 8861

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 com-

mon)

Models 9715 Memory Board (32M) 9715-01 Memory Board (128M) 9715-02 Memory Board (512M)

9715-03 Memory Board

(1G)

Memory capacity

Model 8860:

Channels Used	Standard 32 MWords (Model 9715 Memory Board)	Expands by up to 1 GWord (Model 9715-03 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) x 128 MWords/Ch
16	12-bit (16-bit) × 2 MWords/Ch	12-bit (16-bit) × 64 MWords/Ch

Model 8861:

Channels Standard 64 MWords (Model 9715 Memory Board × 2)		Expands by up to 2 GWords (Model 9715-03 Memory Board × 2)
2	12-bit (16-bit) × 32 MWords/Ch	12-bit (16-bit) × 1G word/ch
4	12-bit (16-bit) x 16 MWords/Ch	12-bit (16-bit) × 512 MWords/Ch
8	12-bit (16-bit) x 8 MWords/Ch	12-bit (16-bit) × 256 MWords/Ch
16	12-bit (16-bit) × 4 MWords/Ch	12-bit (16-bit) x 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, Ex-

ternal Start, External Stop, Print Input, External Sampling Input

# 15.1 General Specifications

Clock functions	Auto color de	ar auto loop voor judgment 24 hour timer	
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, up to	o 2000 m (6562-ft.) ASL	
Isolation resistance and withstand voltage		ower Line: 1.39 kV AC for 15 s, 100 M $\Omega$ or more @ 500 V DC dule-to-Chassis and between Modules: 3.7 kV AC for 15 s, 100 M $\Omega$ or more	
Power source	10 to 16 V D	AC (continuous input) @ 50/60 Hz C (when using the Model 9684 DC Power Unit) tuations of ±10% from the rated supply voltage are taken into account.)	
Maximum rated power		<ul> <li>140 VA (No printer, but fully loaded with Model 8936 Analog Units and 9715 Memory Board)</li> <li>300 VA (with A4 Printer, and fully loaded with Model 8956 Analog Units, Model 9715-03 Memory Board and MO Unit)</li> <li>190 VA (No printer, but fully loaded with Model 8936 Analog Units and Model 9715 Memory Board)</li> <li>350 VA (with A4 Printer, and fully loaded with Model 8956 Analog Units, Model 9715-03 Memory Board and MO Unit)</li> </ul>	
Dimensions		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) 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)	
Mana			
Mass		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) 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	Mea EMC EN6 EN6	1010 Voltage input section: Pollution degree 2, surement category II (anticipated transient overvoltage 4000 V) 1326 Class A 1000-3-2 1000-3-3	

Accessories	1 Quick Start Manual 1
	2 Input Module Guide  1
	3 Instruction Manual (This document)1
For information about	4 Analysis Supplement  1
options:	Application CD (Communications Manual)1
"Appendix 5 Options" (⇒ p.	• Power Cord1
A52)	Input Cable Labels1
	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	<ul> <li>Model 9231 Recording Paper: 216 mm x 30 m (8.50" x 98.43-ft) roll-type thermosensitive paper</li> <li>Model 9234 Recording Paper: 112 mm x 18 m (4.41" x 59.058-ft) roll-type thermosensitive paper</li> </ul>
Recording width	<ul> <li>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)</li> <li>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)</li> </ul>
Recording speed	Maximum 25 mm/s
Paper feeding accuracy	±1.5% (@25°C, 77°F, 60% RH)

### (3) Display Section

Display character	English/ Japanese selectable
Display type	10.4-in TFT Color LCD (800 × 600 dots)
Display resolution	<ul> <li>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))</li> <li>X-Y display (1-graph display) Waveform: Horizontal 20 div × 20 div (1 div = 25 × 25 dots)</li> <li>X-Y display (4-graph display) Waveform: Horizontal 20 div × 20 div (1 div = 5 × 5 dots)</li> </ul>
Operating life	LCD: Approx. 74,000 hours  Backlight: Approx. 55,000 hours (LCD module only)  (LCD operating life approximation based on 8 hours/day on, 16 hours/day off)

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: One of the following is required Model 8861: Two of the same type are required  • Model 9715 Memory Board (32 MWord memory)  • Model 9715-01 Memory Board (128 MWord memory)  • Model 9715-02 Memory Board (512 MWord memory)
	Model 9715-03 Memory Board (1 GWord memory)
Expansion method	Exchange installed memory boards

### (5) Memory Storage Backup Function

(Model 9719 Memory Backup Unit: option must be specified when ordering)

Waveform backup time	Model 8860: Approx. 10 hours Model 8861: 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**

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	<ul> <li>Setting configurations</li> <li>Measurement data (binary ASCII, BMP) (data between A-B cursors can be saved)</li> <li>Screen images (BMP)</li> <li>Calculation results</li> <li>Thinned storage (simple ASCII)</li> </ul>

#### Floppy disk drive (optional Model 9716 FD Drive)

Storage system	3.5-in. floppy disk drive (YD-8U10 Y-E Data) USB interface
Storage capacity	1.44 MB (2HD), 720 KB (2DD)
Format	FAT
Storage contents	<ul> <li>Setting configurations</li> <li>Measurement data (binary ASCII, BMP) (data between A-B cursors can be saved)</li> <li>Screen images (BMP)</li> <li>Calculation results</li> <li>Thinned storage (simple ASCII)</li> </ul>

# Magneto-Optical Disk Drive (Model 9717 MO Unit: option must be specified when ordering; select either this or the Model 9718 HD Unit)

Storage system	3.5-inch magneto-optical disk drive
Storage capacity	2.3 GB (supports 128, 230, 540 or 640 MB, or 1.3 GB)
Format	FAT or FAT32 (compatible with super-floppy format)

# Magneto-Optical Disk Drive (Model 9717 MO Unit: option must be specified when ordering; select either this or the Model 9718 HD Unit)

Storage contents	Setting configurations
	• Measurement data (binary ASCII, BMP) (data between A-B cursors can be saved)
	Screen images (BMP)
	Calculation results
	Thinned storage (simple ASCII)

# Hard Disk Drive (Model 9718 HD Unit: option must be specified when ordering; select either this or the Model 9717 MO Unit)

Storage system	2.5-inch hard disk drive
Storage capacity	60 GB
Format	FAT32
Storage contents	<ul> <li>Setting configurations</li> <li>Measurement data (binary ASCII, BMP) (data between A-B cursors can be saved)</li> <li>Screen images (BMP)</li> <li>Calculation results</li> <li>Thinned storage (simple ASCII)</li> </ul>

### (7) External Interfaces

#### **USB** (equipped as standard)

USB Standard	USB 1.1 compliant
Connector	Series-A receptacle
Connecting devices	Keyboard, mouse, printer, MO drive, 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

#### Monitor Output (equipped as standard)

Connector	15-pin D-sub
Output format	SVGA

#### Mouse Input (equipped as standard)

Connector	6-pin mini-DIN (IBM PS/2 compatible)	
	- 1	

#### Keyboard Input (equipped as standard)

Connector	6-pin mini-DIN (IBM PS/2 compatible)
•••••	5 p ( 2.1. (

#### **PC Card Slot**

GP-IB	Requires the optional Model 9558 GP-IB Card
	Also provides remote control of the installed input modules.
	Complies with IEEE 488.2-1987

### (8) Power Supply Options

# DC Power (9684 DC Power Unit: option must be specified 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	0 to 40°C (32 to 104°F), 20 to 85% RH (non-condensating)	
Storage temperature and humidity	-10 to 50°C (14 to 122°F), 20 to 90% RH (non-condensating)	
Operating environment	Compatible with Models 8860/ 8861	
Breakdown voltage	700 V DC for 1 min. (between input and output, and between input and instrument chassis)	
Isolation voltage	100 $\text{M}\Omega$ 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/ 8861	
Mass	Adds approx. 1.25 kg (42.3oz.) to the weight of Models 8860/ 8861	
Supported Models	Model 8860 Serial Nos. 051040422 and above Model 8861 Serial Nos. 051040432 and above	

#### Probe power supply (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, 3273-50, 3274, 3275, 3276, 9322	
Rated output voltage	±12 V	
Rated output current	±3 A (total for all channels)	
Operating temperature and humidity	0 to 40°C (32 to 104°F), 20 to 85% RH (non-condensating)	
Storage temperature and humidity	-10 to 50°C (14 to 122°F), 20 to 90% RH (non-condensating)	
Operating environment	Compatible with Models 8860/ 8861	
Dimensions	Adds approx. 18.2 mm (0.72") (D) to dimensions of Models 8860/8861	
Mass	Adds approx. 570 g (20.1oz.) to the weight of Models 8860/ 8861	
Supported Models	Model 8860 Serial Nos. 051040422 and above Model 8861 Serial Nos. 051040432 and above	

# 15.2 Trigger Section

Trigger method	Digital comparison
Trigger modes	<ul> <li>Memory Function and FFT Function: Single, Repeat or Automatic</li> <li>Recorder Function: Single or Repeat</li> <li>Real-Time Saving Function: Single, Repeat, or Timer</li> </ul>
Trigger source	<ul> <li>Analog, logic A to D, external trigger, manual trigger, timer trigger</li> <li>Free-run operation occurs when all trigger types are off.</li> <li>Normal Mode         <ul> <li>All analog channels can be set as trigger sources</li> </ul> </li> <li>Expanded Mode         <ul> <li>One analog channel can serve as multiple trigger sources</li> <li>(Up to eight trigger sources on channels in modules (Units) 1 to 4 in Models 8860 and 8861, plus an additional eight sources on channels in modules 5 to 8 in Model 8861.)</li> </ul> </li> <li>External triggering occurs by applying a 2.5 V falling edge signal, or shorted terminals (can be set to rising edge).</li> <li>The sources of trigger events are displayed</li> </ul>
Trigger criteria	AND or OR of each trigger source
Trigger types (analog)	<ul> <li>Level Trigger Set digitally as a voltage value below full-scale Triggering occurs when the signal rises (or falls) through a specified value.</li> <li>Windows Trigger Upper and lower trigger threshold levels are specified Triggering occurs when the signal enters or exits the defined threshold range.</li> <li>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.</li> <li>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.</li> <li>Slope Trigger* Triggering occurs when the signal exceeds (or does not exceed) a specified rate of change.</li> <li>Voltage Sag Trigger (Drop) Triggering occurs when peak voltage falls below the specified level (for commercial power).</li> <li>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.</li> <li>(* Expanded setting only)</li> </ul>
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) 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)
Trigger timing	Start, Stop and Start & Stop (Recorder Function) Start and Stop criteria can be set independently.
Trigger output	Open-collector output (with 5 V output, Active Low) Pulse Width: at least 1 ms

# 15.2 Trigger Section

Trigger Input and Output Terminals	Terminal Block
Level Display Function	Displays the signal level while Trigger Wait (display can be turned off) Waveforms can be displayed while Trigger Wait (timebase limited)

## 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. A37))

· Fixed settings

25, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000, 200000, 500000, 1000000, 2000000, 5000000, 10000000

Maximum Recording Length

[Divisions]

	Memory ords)	No. of Channels Used				
8860		16	8	4	2	1
0000	8861	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]

	Memory ords)	No. of Channels Used				
8860		16	8	4	2	1
8800	8861	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 split into selected widths (with some restrictions) 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

### 15.3 Memory Function

Waveform compression and magnification	<ul> <li>Time axis x 10, x 4, x 2, x 1 x 1/2, x 1/5, x 1/10, x 1/20, x 1/50, x 1/100, x 1/200, x 1/500, x 1/1000, x 1/2000, x 1/5000, x 1/10000, x 1/20000, x 1/50000 </li> <li>Voltage axis x 100, x 50, x 20, x 10, x 5, x 2, x 1, x 1/2, x 1/5, x 1/10 </li> </ul>	
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: 8 channels, Y-Axis: 8 channels (8 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 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  $\mu$ s, 10  $\mu$ s, 100  $\mu$ s, 1 ms, 10 ms, 100 ms, 1s (not more than 1/100th of the selected timebase)

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]

		<u> </u>			
	Memory ords)	Other than the Model 8958 16-Ch Scanner Unit		Model 8958 16-0	Ch Scanner Unit
8860	8861	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 split into specified widths (with some restrictions) 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

 $\times$  4\*,  $\times$  2\*,  $\times$  1,  $\times$  1/2,  $\times$  1/5,  $\times$  1/10,  $\times$  1/20,  $\times$  1/50,  $\times$  1/100,  $\times$  1/200,  $\times$  1/500,  $\times$  1/1000,  $\times$  1/2000,  $\times$  1/20000 (\* Screen display only. Printing is can be x 1 or more)

Voltage axis

 $\times$  100,  $\times$  50,  $\times$  20,  $\times$  10,  $\times$  5,  $\times$  2,  $\times$  1,  $\times$  1/2,  $\times$  1/5,  $\times$  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 128 MWords: 20,000 div, 512 MWords: 80,000 div, 1 GWord: 160,000 div  Model 8861 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 FFT Function

FFT channel mode		
Pynamic range   72dB (logical value) (with Model 8938 or 8947) 96dB (logical value) (with Model 8957 or 8960)	FFT channel mode	
Number of sampling points         1000, 2000, 5000, 10000           Frequency resolution         1/400, 1/800, 1/2000, 1/4000           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 eight 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. 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. 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 Linear scale, Log scale           Print function         Applicable	Frequency range	133 mHz to 8 MHz
Frequency resolution         1/400, 1/800, 1/2000, 1/4000           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 eight 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.	Dynamic range	
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 eight 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. 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.  Data to be subject to FFT analysis can be newly acquired or selected from data previously acquired with the Memory function.  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  Print function  Applicable to the Memory function  Timebase, simple averaging on frequency axis, exponential averaging on frequency axis, peak hold on frequency axis (settable from 2 to 10,000 counts)	Number of sampling points	1000, 2000, 5000, 10000
(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 eight 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. Newly acquired with the Memory 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. 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  Print function Applicable to the Memory function  Timebase, simple averaging on frequency axis, exponential averaging on frequency axis, peak hold on frequency axis (settable from 2 to 10,000 counts)	Frequency resolution	1/400, 1/800, 1/2000, 1/4000
can be specified)Analysis dataData to be subject to FFT analysis can be newly acquired or selected from data previously acquired with the Memory 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. Data to be subject to FFT analysis can be newly acquired or selected from data previously acquired with the Memory function.FFT analysis mode settingStorage 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 setting1, 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.)WindowsRectangular, Hann, Exponential, Hamming, Blackman, Blackman-Harris, Flat topDisplay scaleLinear scale, Log scalePrint functionApplicable to the Memory functionAveraging functionTimebase, simple averaging on frequency axis, exponential averaging on frequency axis, peak hold on frequency axis (settable from 2 to 10,000 counts)	Antialiasing filter	(With Model 8957 High Resolution Unit, 8938 FFT Analog Unit, 8947 Charge Unit,
ously acquired with the Memory 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. 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  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)	Analysis channel setting	
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  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)	Analysis data	ously acquired with the Memory 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.  Data to be subject to FFT analysis can be newly acquired or selected from data previ-
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  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)	FFT analysis mode setting	density, Cross-power spectrum, Auto-correlation function, Histogram, Transfer function, Cross-correlation function, Impulse response, Coherence function, Octave analy-
Display scale       Linear scale, Log scale         Print function       Applicable to the Memory function         Averaging function       Timebase, simple averaging on frequency axis, exponential averaging on frequency axis (settable from 2 to 10,000 counts)	Display format setting	When using memory waveforms as analysis data, memory waveform + FFT1 and memory waveform + FFT2 screens can be displayed.
Print function  Applicable to the Memory function  Timebase, simple averaging on frequency axis, exponential averaging on frequency axis, peak hold on frequency axis (settable from 2 to 10,000 counts)	Windows	Rectangular, Hann, Exponential, Hamming, Blackman, Blackman-Harris, Flat top
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)	Display scale	Linear scale, Log scale
is, peak hold on frequency axis (settable from 2 to 10,000 counts)	Print function	Applicable to the Memory function
Logging recording Prints measurement data as numerical values	Averaging function	is, peak hold on frequency axis
	Logging recording	Prints measurement data as numerical values

# 15.6 Real-Time Saving Function

Timebase	<ul> <li>Measurement waveform 100, 200, 500 µs/div 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/div 1, 2, 5, 10, 30 s/div 1, 2, 5 min/div</li> <li>Whole waveform (with auto setting function) 10, 20, 50, 100, 200, 500 ms/div 1, 2, 5, 10, 30, 100 s/div 1, 2, 5, 10, 30 min/div 1 h/div</li> <li>May be limited by saving destination and number of channels</li> </ul>
Time axis resolution	100 points/div
Sampling period	Measurement waveform: 1/100th of the timebase Whole waveform: same as measurement waveform
Save destinations	MO drive, hard drive (HDD), LAN, PC Card or OFF (none)
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 split into selected widths (with some restrictions) Sheet display (up to 32 channels displayed per sheet)
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	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

## 15.7 Functions

## **15.7.1 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  Calculation results can be saved to external storage media and printed Sixteen calculations are available at the same time
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

## **Memory Division function (Memory Function)**

Memory Division function	Memory space can be divided Up to 4096 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

## 15.7.2 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
<b>Cursor Measurement functions</b>	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

#### 15.7 Functions

0	Till	
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 (for printing and saving as BMP files)	
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	
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	
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	
Waveform search functions	Search criteria can be specified as trigger criteria, specified time 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**

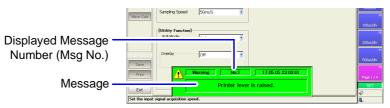
Error messages consist of either "Error" or "Warning" displays.

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 "12.2.8 Specifying Beep and Operation Sounds" (⇒ p. 342)

#### **Warning Display**



Appears just once when an error occurs. Disappears within a few seconds.

Also disappears when any key is pressed.

#### Error Display (⇒ p. A6)



Remains displayed until the error is corrected, or until you press the **STOP** key.

Msg No.	Message	Remedial Action	Reference
1	Out of paper.	Load more paper.	Quick Start Manual: "3.3 Loading Recording
2	Printer lever is raised.	Lower the printer lever.	Paper (With a Printer Module Installed)"
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. 407)
5	Printer not connected.	Printing is not available. Either the internal printer is not installed, or no external printer is connected.	

Msg No.	Message	Remedial Action	Reference
6	Printer internal error.	An unexpected error occurred. Perform a system reset. If this error continues to appear, damage may have occurred requiring repairs.	"12.3.3 Initializing System Settings (System Reset)" (⇒ p. 349)
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.	"10.3.2 Save Methods" (⇒ p. 258)
12	Disable write-protection.	Write-protection is enabled on the storage media. Disable it.	"10.1 Storage Media" (⇒ p. 244)
14	Cannot load this file.	The selected file cannot be loaded.	
16	The file name already exists: cannot save.	Change the file name.	"10.7.4 Renaming Files
17	The directory name already exists.	Change the directory name.	& Folders" (⇒ p. 291)
18	Could not rename file.	A file with the same name may already exist, or the file name is invalid. Give the file	"10.7.4 Renaming Files & Folders" (⇒ p. 291)
19	Could not copy or move file.  protected. The file may be already in use. Try exing after processing finishes. Verify you have access permission to the	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	"10.7.1 Copying Files & Folders" (⇒ p. 289)  "10.7.2 Moving Files & Folders" (⇒ p. 290)
20	Path name exceeds 127 characters.	Change the path to 127 or fewer characters.	
22	No waveform data to save.	Acquire waveform data.	
24	Cannot eject this media.	Only discs in internal MO drives can be ejected.	"Ejecting an MO Disk from the File Screen"(⇒
25	Could not eject.	The storage media cannot be ejected because it is in use.	p. 246)
26	Cannot access shared folder.	The shared folder does not exists or you do not have access permission.	
27	Cannot find shared file.	No shared folder can be found for connection.	"10.1.6 Using a Network Shared Folder" (⇒ p. 249)
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. 65)
30	Auto-ranging failed.	Check the input signal.	"3.3.5 Automatic Range Setting (Auto-Ranging Function)" (⇒ p. 73)
31	A/B cursor positions invalid.	The A/B cursors overlap. Check the cursor positions.	"8.7 Specifying a Waveform Range" (⇒ p. 193)
32	Zero-adjustment needed.	Perform zero-adjustment.	Input Module Guide: "3.10.17 Executing Zero Adjustment"

Msg No.	Message	Remedial Action	Reference
34	Invalid key pressed (Overlay)	The key operation is prohibited because Overlay is enabled (On).	"4.3.2 Overlaying Waveforms" (⇒ p. 101)
36	No trigger has been set.	Set trigger criteria.	"Chapter 6 Trigger Settings" (⇒ p. 129)
37	Invalid operation.	The operation is not available while processing. Try again after processing finishes.	
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	"11.2 Print Methods and Print Items" (⇒ p. 299)
42	There is no calculation result.	There is no calculation result. Print results after performing calculation.	Analysis Supplement
45	Out of range.	Check the valid setting range, and reset.	
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. 99)
54	Can not use (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. 99)
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. 98)
59	Can not use (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	Can not use (Roll Mode, Averaging, Memory Division).	When Waveform Calculation is enabled, Roll Mode, Averaging and Memory Divi- sion functions are not available. If en- abled, these functions are turned off.	
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 Measure- ment"
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. 85)

Msg No.	Message	Remedial Action	Reference
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: "3.10.18 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 $\mu s/div$ 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: "3.10.18 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: "3.10.19 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. (Recorder Function)	(Model 8861 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.	

Msg	Message	Remedial Action	Reference
No.	ivicooaye		Kelefelice
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. 396)
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. 85)
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. 215)
86	Recording length is too long.	Check the recording length.	"4.2.4 Setting the Recording Length (number of divisions)" (⇒ p. 95)
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 wave- form file (.RSM) may be damaged or miss- ing.	
94	No response from server.	Verify the network settings on the PC at the connection destination.	
501	An unexpected error occurred when 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.	
503	(File name) is an invalid path.	Verify that the file saving destination or file to load is correct.	"10.2 Data Capable of Being Saved & Loaded" (⇒ p. 252)
504	Too many open files. Cannot open (file name).	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
505	Access to (file name) refused.	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
506	(File name) has an invalid file handle.	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
507	The current directory (file name) cannot be deleted.	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
508	Not enough free space in the directory to create (file name).	Either delete files in the saving destination directory, or change to another saving destination.	

Msg No.	Message	Remedial Action	Reference
509	Seek for (file name) failed.	An internal fault may have occurred in the instrument. Turn the instrument off and back on.	
510	A hardware I/O error occurred 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.	
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	Not enough disk space for (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.	"10.7.3 Deleting Files & Folders" (⇒ p. 291)
514	Attempted to access past the end of (file name).	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
160	Measurement aborted (Cause)	(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.
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 oc- curred while measuring, data may have been corrupted.
191	Clamp power supply malfunction detected.	Power to the clamps was momentarily interrupted. If this occurred while measuring, data may have been corrupted.

## **Displayed Errors**

Msg No.	Message	Remedial Action
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.
195	Fan malfunction detected. Turn power off immediately.	A cooling fan has stopped. 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	Verify 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. 168)
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. A8)
Recorder Function	(⇒ p. A11)
Real-Time Saving Function	(⇒ p. A15)
FFT Function	(⇒ p. A12)
Input Channel	(⇒ p. A16)
System	(⇒ p. A18)

## **Memory Function**

Menu	Setting Item	ns	Default Setting	Reference for Setting	
		Sampling Clock	INIT (Internal)		
		Timebase	5 μs/div (sampling speed: 50 ns) With only Model 8958 16-Ch Scanner Unit Installed: 5s/div	4.2.2 (⇒ p. 89)	
	Basic	Shot (Recording length)	Fixed	4.2.4 (⇒ p. 95)	
		Fixed Shot (Fixed recording length)	25 div	4.2.4 (→ β. 95)	
Status		Timebase 2	Off (On when the Model 8958 is installed)	4.2.3 (⇒ p. 92)	
		Roll Mode	Auto	4.3.1 (⇒ p. 99)	
		Overlay	Off	4.3.2 (⇒ p. 101)	
	Use Ch	Timebase 1	Set to enable use of all installed modules	4.2.1 (⇒ p. 85)	
	Ose Ch	Timebase 2	Off (or On if a Scanner Module is installed)	- <del>1</del> .2.1 ( <i></i> γ μ. 66)	
	One Ch		Refers to the default value of each input module	(⇒ p. A16)	
	Comment		All blank	5.2 (⇒ p. 112)	
Channel	Scaling		Off	5.4 (⇒ p. 117)	
	Variable		Off	8.9.4 (⇒ p. 208)	
	Logic		All Off	7.3 (⇒ p. 176)	
	Trigger Mode	9	Auto	6.3 (⇒ p. 132)	
	Source (AND	0/OR)	OR	6.4 (⇒ p. 133)	
Trigger	Pre-Trigger	% Setting	0%	6.5.1 (⇒ p. 134)	
	1 le-frigger	Trigger Priority	Off	6.5.2 (⇒ p. 137)	
	Timer Trigge	r	Off	6.9 (⇒ p. 156)	
	External Trig	ger	Off	6.11 (⇒ p. 160)	
	All Trigger So	ources	Off		

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01			Default Setting	Setting	
Sheet display	/		On (Sheet 1 only)	7.2.2 (⇒ p. 171)	
Sheet Name			Blank	7.2.2 (⇒ p. 171)	
Display Type	!		Waveform	7.2.3 (⇒ p. 171)	
Split Screen			1 Graph	7.2.4 (⇒ p. 172)	
Pattern			Pattern 1	7.2.4 (→ p. 172)	
Scroll			Horizontal	7.2.5 (⇒ p. 173)	
V V C	Area (Composite	e area)	Whole (Whole waveform)	7.4 (-> n. 100)	
X-Y Comp	Dot-Line (Line in	terpolation)	Line	— 7.4 (⇒ p. 180)	
Memory Div	"		Off		
Division			2		
Start Block			1		
Use Block			1	4.3.3 (⇒ p. 103)	
Display Block	<b>(</b>		1	` ' '	
			Off		
	v				
			Off	Analysis Supplemer	
Waveform Ca	alc		Off	Analysis Supplemer	
	Auto Save		Off		
				10.3.4 (⇒ p. 261)	
	Directory Creation				
	Waveform			10.3.7 (⇒ p. 267)	
Auto Save					
		Division			
			Off	Analysis Supplement	
	Calc Results	Name	MEAS		
		Save Specified File	New File		
			Off		
		Name	IMAGE		
	Screen Image	Name Pattern	Trig (prefix)	10.3.9 (⇒ p. 272)	
		Format	BMP Color		
		GUI Save	With		
	SAVE Key Operation		Selection Save		
	Save in		PC Card #1:\	10.3.5 (⇒ p. 263)	
	Name		Blank		
	Same Name		Numbering		
	Name Pattern		Trig (prefix)		
	Save Type		Waveform		
		Format	Binary		
SAVE Key		Area	Whole		
		Channels			
	Waveform			— 10.3.8 (⇒ p. 270)	
	Screen Image			10.3.10 (⇒ p. 274)	
	0-1-5			Analysis Supplemen	
	Split Screen Pattern Scroll X-Y Comp  Memory Div Division Start Block Use Block Display Block Wave Displa Numerical Ca Waveform Ca  Auto Save	Split Screen Pattern Scroll X-Y Comp  Memory Div Division Start Block Use Block Display Block Ref Block Wave Display Numerical Calc  Waveform Calc  Auto Save Save in 1 Save in 2 Save Method Directory Creation  Waveform  Auto Save  Save In 1 Save In 2 Save Method Directory Creation  Screen Image  SAVE Key Oper Save in Name Same Name Name Pattern Save Type  SAVE Key  Waveform	Split Screen	Split Screen	

## Appendix 2 Reference

Menu	Setting Iter	ns		Default Setting	Reference for Setting	
			Auto Print	Off		
		Auto Print	Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	- 11.3 (⇒ p. 301)	
		Settings	Calculation Results	Off	γ. σσι)	
			Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)		
			Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)		
		Manual Print	PRINT Key Action	Selection Print	11.4 (⇒ p. 303)	
			Print GUI Area	With	, , ,	
			Row Print	Off		
			A4 Size	Off		
			Printer Density	Normal		
	Printer			C 01, 05, 09, 13, 17, 21, 25, 29, 33: Normal		
			Waveform Density	C 02, 06, 10, 14, 18, 22, 26, 30, 34: Slightly Dark	11.5.1 (⇒ p. 307)	
		Internal Printer	waveloffi Defisity	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		
Print			Orientation	Portrait	11.5.2 (⇒ p. 309)	
			Margins	Custom		
			Left	10 mm		
		External Printer	Right	10 mm		
			Тор	10 mm		
			Bottom	10 mm		
			Printing Colors	Color		
		Common Settings	Printout Type	Screen Link	11.6.1 (⇒ p. 311)	
			Grid Type	Normal		
			Channel Markers	Ch No.		
			Marker Position	Inside		
			List & Gauge	Off		
		Waveform	Upper/Lower Limits	Off	14.00()	
		Print Items	Zero-Position Comment	Off	11.6.2 (⇒ p. 313)	
			Counter Printing	Off		
	Print Items		Counter Name	Blank		
			Count	0		
			Mag/Comp	Screen Link		
		Numerical Value Printing Items	Thinning	Screen Link	11.6.3 (⇒ p. 318)	
		External Printer Print Items	Gauge	All Pages	11.6.4 (⇒ p. 320)	
			Title	Settings		
		Comment Print-	Analog	Settings	11.6.5 (⇒ p. 321)	
		ing Settings	Logic	Off	, , , , , , , , , , , , , , , , , , , ,	

## **Recorder Function**

Menu	Setting Item	าร		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. 89)	
	Dasic	Sampling Speed		100 ns/S		
		Shot (recording le	ength)	Fixed	- 4.2.4 (⇒ p. 95)	
		Fixed Shot		25 div	4.2.4 ( $\Rightarrow$ p. 93)	
	One Ch			Refers to the default value of each input module	(⇒ p. A16)	
Channel	Comment			All blank	5.2 (⇒ p. 112)	
Channel	Scaling		-	Off	5.4 (⇒ p. 117)	
	Variable			Off	8.9.4 (⇒ p. 208)	
	Logic			All Off	7.3 (⇒ p. 176)	
	Trigger Mode	Э		Single	6.3 (⇒ p. 132)	
	Source (AND/OR)			OR	6.4 (⇒ p. 133)	
Trigger	Trigger Timing			Start	6.6 (⇒ p. 138)	
iiiggei	Timer Trigger			Off	6.9 (⇒ p. 156)	
	External Trig	ger		Off	6.11 (⇒ p. 160)	
	All Trigger Sources			Off		
	Sheet display	У		On (Sheet 1 only)	7.2.2 (⇒ p. 171)	
	Sheet Name			Blank	7.2.2 (⇒ p. 171)	
Sheet	Display Type	)		Waveform	7.2.3 (⇒ p. 171)	
Officer	Split Screen			1 Graph	- 7.2.4 (⇒ p. 172)	
	Pattern			Pattern 1	7.2.4 (→ p. 172)	
	Scroll			Horizontal	7.2.5 (⇒ p. 173)	
Save	Auto Save			Off	10.3.4 (⇒ p. 261)	
0.3.70	Refer to Memory Function "Save" for other items					
Print	Printer	Auto-Print Settings	Real-Time Print	Off	11.3 (⇒ p. 301)	
	Refer to Memory Function "Print" for other items				(⇒ p. A8)	

## **FFT Function**

Menu	Setting Item	ıs		Default Setting	Reference for Setting	
	Reference			New Data		
		Sampling Clock		INT		
		Frequency Rang	е	8MHz		
		Sampling Point		1000		
		Window		Rectangular		
Status	Basic	Williaow	Multiplication	None	Analysis Supplement	
		Peak		Off		
		Averaging		Off		
		Highlight (phase	)	Off		
		Analyze		Nos. 1 to 8 all Off		
		Scale		Nos. 1 to 8 all Auto		
	One Ch			Refers to the default value of each input module	(⇒ p. A16)	
	Comment			All blank	5.2 (⇒ p. 112)	
Channel	Scaling		Off	5.4 (⇒ p. 117)		
	Variable			Off	8.9.4 (⇒ p. 208)	
	Logic			All Off	7.3 (⇒ p. 176)	
	Trigger Mode			Auto	6.3 (⇒ p. 132)	
	Source (AND	/OR)		OR	6.4 (⇒ p. 133)	
	Pre-Trigger	% Setting		0%	6.5.1 (⇒ p. 134)	
Trigger	i ie-riiggei	Trigger Priority		Off	6.5.2 (⇒ p. 137)	
	Timer Trigger		Off	6.9 (⇒ p. 156)		
	External Trigger			Off	6.11 (⇒ p. 160)	
	All Trigger Sources			Off		
	Sheet display	′		On (Sheet 1 only)		
Sheet	Sheet Name			Blank	- Analysis Supplement	
Sneet	Display Type			FFT		
	Split Screen			1 Graph		

#### Appendix 2 Reference

Menu	Setting Item	ns		Default Setting	Reference for Setting
		Auto Save		Off	
		Save in 1		PC Card #1:\	
		Save in 2		Off	10.3.4 (⇒ p. 261)
		Save Method		Normal Save	
		Directory Creation	on	On	
				On	
	Auto Save	Waveform	Name	AUTO	10.3.7 (⇒ p. 267)
	rate care	waveloiiii	Name Pattern	Trig (prefix)	10.0.1 ( >> p. 201)
			Format	Binary	
				Off	
		Screen Image	Name	IMAGE	
Save			Name Pattern	Trig (prefix)	10.3.9 (⇒ p. 272)
			Format	BMP Color	
			GUI Save	With	
		SAVE Key Operation		Selection Save	
		Save in		PC Card #1:\	
		Name		Blank	10.3.5 (⇒ p. 263)
		Same Name		Numbering	10.0.0 (-> p. 200)
	SAVE Key	Name Pattern		Trig (prefix)	
		Save Type		Waveform	
		Waveform	Format	Binary	10.3.8 (⇒ p. 270)
		Screen Image	Format	BMP Color	10.3.10 (⇒ p. 274)
		Ocicen image	GUI Save	With	15.5.10 ( p. 214)

## Appendix 2 Reference

Menu	Setting Item	าร		Default Setting	Reference for Setting
			Auto Print	Off	
		Auto Print Settings	Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	11.3 (⇒ p. 301)
			Output Destination	Printer (if optional printer is installed), or USB (if it is not installed)	
		Manual Print	PRINT Key Action	Selection Print	11.4 (⇒ p. 303)
			Print GUI Area	With	
			A4 Size	Off	
			Printer Density	Normal	
				C 01, 05, 09, 13, 17, 21, 25, 29, 33: Normal	
	Printer		Woyafarm Danaity	C 02, 06, 10, 14, 18, 22, 26, 30, 34: Slightly Dark	
		Internal Printer	Waveform Density	C 03, 07, 11, 15, 19, 23, 27, 31, 35: Dark	11.5.1 (⇒ p. 307)
Print				C 04, 08, 12, 16, 20, 24, 28, 32, 36: Light	
			Feed After Printing	Yes	
			Print Quality	Normal	
		External Printer	Orientation	Portrait	11.5.2 (⇒ p. 309)
			Margins	Custom	
			Left	10 mm	
			Right	10 mm	
			Тор	10 mm	
			Bottom	10 mm	
			Printing Colors	Color	
		Common Settings	Printout Type	Screen Link	11.6.1 (⇒ p. 311)
			Grid Type	Normal	
			List & Gauge	Off	
		Waveform	Upper/Lower Limits	Off	1162(-> = 242)
	Drint Itams	Print Items	Counter Printing	Off	- 11.6.2 (⇒ p. 313)
	Print Items		Counter Name	Blank	
			Count	0	
		Numerical Value Printing Items	Thinning	Screen Link	11.6.3 (⇒ p. 318)
		Comment Print-	Title	Settings	11.6.5 (⇒ p. 321)
		ing Settings	Analog	Settings	- 11.0.3 (→ p. 321)

## **Real-Time Saving Function**

Menu	Setting Item	ns		Default Setting	Reference for Setting	
		Save	Save in	HD:¥ (when Model 9718 HD Unit is installed) MO:¥ (when Model 9717 MO Unit is installed) PC CARD #1:¥ (except the above)		
			Same Name	REAL		
			Name Pattern	Trig (prefix)		
Status	Basic		Timebase	All installed modules are set to their fastest settings.	Chapter 9 (⇒ p. 225)	
Status			Sampling Speed	1μs/S	Chapter 9 (→ p. 225)	
		Sampling	Shot (Recording length)	Fixed		
			Fixed Shot (Fixed recording length)	25 div		
		Whole Wave	Timebase	Auto		
		Trigger Mode		Single		
	Use Ch			Set to enable use of all installed modules (excluding the Model 8958)		
	One Ch			Refers to the default value of each input module	(⇒ p. A16)	
	Comment			All blank	5.2 (⇒ p. 112)	
Channel	Scaling			Off	5.4 (⇒ p. 117)	
	Variable			Off	8.9.4 (⇒ p. 208)	
	Logic			All Off	7.3 (⇒ p. 176)	
	Sheet display		On (Sheet 1 only)	7.2.2 (⇒ p. 171)		
	Sheet Name			Blank	7.2.2 (⇒ p. 171)	
Sheet	Display Type			Waveform	7.2.3 (⇒ p. 171)	
	Split Screen			1 Graph	7.2.4 (⇒ p. 172)	
	Scroll			Horizontal	7.2.5 (⇒ p. 173)	
		SAVE Key Opera	ation	Selection Save		
		Save in		PC Card #1:\	- 10.3.5 (⇒ p. 263)	
		Name		Blank		
		Same Name		Numbering		
		Name Pattern		Trig (prefix)		
Save	CANE Kan	Save Type		Waveform	İ	
Save	SAVE Key		Format	Binary		
			Area	Whole	40.0.0 (-> = 070)	
		Waveform	Channels	Displayed Ch	10.3.8 (⇒ p. 270)	
			Division	Off		
		Caracia large	Format	BMP Color	10 3 10 (-> 5, 274)	
		Screen Image	GUI Save	With	- 10.3.10 (⇒ p. 274)	
Print		nt setting is not av	ailable with the Real-Time Sant" for other items	aving function.	(⇒ p. A10)	

## **Input Channel**

Input Module	Setting Items	Default Setting	Reference for Setting	
	Mode	Voltage		
	Range (/div)	5 mV		
8936 Analog Unit	Coupling	DC	Input Module Guide:	
0930 Analog Offic	LPF	Off	"3.1 Analog Unit Settings (Models 8936, 8946 a 8956)"	
	Probe	1:1		
	Position (zero position)	50%		
	Mode	Voltage		
	Range (/div)	500μV		
	Coupling	DC	Input Module Guide:	
8937 Voltage/Temp Unit	LPF	Off	"3.2 Model 8937 Voltage and Temperature Unit Set-	
	Position	50%	tings"	
	Probe	1:1		
	Digital F	Off		
	Mode	Voltage		
	Range (/div)	5mV		
	Coupling	DC		
8938 FFT Analog Unit	LPF	Off	Input Module Guide:  "3.3 Model 8938 FFT Analog Unit Settings"	
	Probe	1:1	3.3 Model 6936 FFT Alialog Unit Settings	
	Position (zero position)	50%		
	AAF	Off		
	Mode	Strain		
8939 Strain Unit	Range (/div)	20με	Input Module Guide:	
0939 Strain Onit	LPF	Off	"3.4 Strain Unit Settings (Models 8939 and 8960)"	
	Position (zero position)	50%		
	Mode	Frequency		
	Range (/div)	0.05Hz		
	Coupling	DC		
	LPF	Off		
8940 F/V Unit	Position (zero position)	0%	Input Module Guide: "3.5 Model 8940 F/V Unit Settings"	
	Probe	1:1	3.5 Woder 6940 177 Offic Settings	
	Threshold	0V		
	Pull-Up	Off		
	Hold	10-ms Off		
	Mode	Voltage		
	Range (/div)	10mV		
8946 4-Ch Analog Unit	Coupling	DC	Input Module Guide:	
OJTO TON ANAIOS ONE	LPF	Off	"3.1 Analog Unit Settings (Models 8936, 8946 and 8956)"	
	Probe	1:1		
	Position (zero position)	50%		

Input Module	Setting Items	Default Setting	Reference for Setting
	Mode	Charge	
	Range (/div)	500mm/s <sup>2</sup>	
	Coupling	AC	
8947 Charge Unit	LPF	Off	Input Module Guide:  "3.6 Model 8947 Charge Unit Settings"
	AAF	Off	old imeder of it change thin comings
	Sensitivity	1pC	
	Position (zero position)	50%	
	Mode	Voltage	
	Range (/div)	5mV	
8956 Analog Unit	Coupling	DC	Input Module Guide:
10000 Androg Offic	LPF	Off	"3.1 Analog Unit Settings (Models 8936, 8946 and 8956)"
	Probe	1:1	,
	Position (zero position)	50%	
	Mode	Voltage	
	Range (/div)	5mV	
	Coupling	DC	
8957 High Resolution Unit	LPF	Off	Input Module Guide: "3.7 Model 8957 High Resolution Unit Settings"
	Probe	1:1	5.7 Woder 6557 Fight Resolution Offic Settings
	Position (zero position)	50%	
	AAF	Off	
	Mode	Voltage	
8958 16-Ch Scanner Unit	Range (/div)	5mV	Input Module Guide:
osso to on ocaliner offic	Digital F	Off	"3.8 Model 8958 16-Ch Scanner Unit Settings"
	Position (zero position)	50%	
	Mode	DC	
	Range (/div)	5mV	
	Coupling	DC	
8959 DC/RMS Unit	LPF	Off	Input Module Guide:  "3.9 Model 8959 DC/RMS Unit Settings"
	Probe	1:1	5.5 Woder 6555 Bortimo offic detailings
	Position (zero position)	50%	
	Response	Fast	
	Mode	Strain	
	Range (/div)	20με	
8960 Strain Unit	LPF	Off	Input Module Guide:
ooo on an om	Bridge	2 V	"3.4 Strain Unit Settings (Models 8939 and 8960)"
	AAF	Off	
	Position (zero position)	50%	

## System Settings

Menu	Setting Items			Default Setting	Reference for Setting
	Grid Type			Dotted Line	12.1.1 (⇒ p. 334)
		Display Comments	<u> </u>	Off	12.1.2 (⇒ p. 335)
		Time Value Displa		Time	12.1.3 (⇒ p. 336)
		START Key Activa		One Push	12.2.1 (⇒ p. 337)
	Waveform	Auto-Resume	···	Off	12.2.2 (⇒ p. 338)
	Screen	Jog & Shuttle		Positive	12.2.3 (⇒ p. 339)
		Sheet Scroll Linka	ae	Linkage	12.2.4 (⇒ p. 340)
		Zero Position	9-	Off	12.1.4 (⇒ p. 336)
		SHEET/PAGE Key	, ,	Sheet	12.2.5 (⇒ p. 340)
		Restart	'	Yes	12.2.6 (⇒ p. 341)
Env	Settings Screen	Variable Auto Adju	stment	On	12.2.7 (⇒ p. 341)
(Environment)	Comingo Concom	Beep Sound		Beep 1	
	Sound	Keypress Sound		Off	- 12.2.8 (⇒ p. 342)
	System Envi-	Screen Saver		Off	12.2.9 (⇒ p. 343)
	ronment	Backlight Saver		Off	12.2.10 (⇒ p. 344)
		Back		RGB 0, 0, 0	т=(
		Frame		RGB 240, 0, 0	
				RGB 100, 100, 100	
	Display Colors	Grid		RGB 240, 240, 240	- 12.2.12 (⇒ p. 346)
		Text		RGB 0, 50, 200	
		Blank		RGB 255, 255, 0	-
		Cursors	Host Name	Blank	
	Communication	Basic Settings			
			User Name	Blank	- 13.2 (⇒ p. 362)
		Laterifica	Password	Blank	
		Interface DHCP		On Off	
	File	FTP Server		Off	
		Access Restriction	S	Read/Write	- 13.3 (⇒ p. 369)
Comm		Time Difference		0 h	
(Communica-		Character Code		Local	40.4(-) = 074)
tion)	Web	Web Server		Off	13.4 (⇒ p. 374)
		Command		Off	
		Processing	Delimiter	CR+LF	_
			Header	Off	40.0 ( ) 004)
	Command	LAN	Error Response	Off	13.6 (⇒ p. 381)
			Command Port	880x	
		GP-IB	Mode	Addressable	
			Address	5	
			START/EXT.IN1 STOP/EXT.IN2	START STOP	14.2.7 (⇒ p. 403)
		Input Terminal	PRINT/EXT.IN3	PRINT	- 11.2.1 (, β. 100)
E 4 T			EXT.TRIG	<b>\</b>	14.2.1 (⇒ p. 390)
Ext Term	External Con-		EXT.SMPL	<b>↓</b>	14.2.3 (⇒ p. 394)
(External Terminal)	trol Terminal		GO/EXT.OUT1	Num Calc	14.2.5 (⇒ p. 399)
i Si i i i i i i i i i i i i i i i i i		Output Terminal	NG/EXT.OUT2	Num Calc	14.2.6 (⇒ p. 401)
			TRIG.OUT/CAL	Trig Out	14.2.2 (⇒ p. 392)
		CYNC	SYNC.OUT		14.2.8 (⇒ p. 405) 14.2.4 (⇒ p. 396)
		SYNC	31110.001	Off	17.2.7 (-/ p. 390)
Setting	Settings			All settings are cleared by All Reset.	10.3.6 (⇒ p. 265)
	Auto Setup			Off	10.4.2 (⇒ p. 278)

## **Appendix 2.2 Waveform File Sizes**

#### References

File Type	Operating Function	Calculation Method	8860	8861	
MEM File	Memory Function	(⇒ p. A19)	(⇒ p. A22)	(⇒ p. A23)	
REC File	Recorder Function	(⇒ p. A20)	(⇒ p. A24)	(⇒ p. A24)	
RSM Files	Real-Time Saving Function	(⇒ p. A20)	(⇒ p. A25)		
RSR Files	Treal-Time Saving Tunction	(⇒ p. A20)	(⇒ p. A25)		
FFT File	FFT Function	(⇒ p. A20)	(⇒ p. A26)		
	Memory Function	(⇒ p. A21)	(⇒ p. A27)	(⇒ p. A28)	
TXT File	Recorder Function	(⇒ p. A21)	(⇒ p. A29)	(⇒ p. A30)	
IXITIE	Real-Time Saving Function	(⇒ p. A21)	(⇒ p. A27)	(⇒ p. A28)	
	FFT Function	(⇒ p. A21)	(⇒ p. A31)		

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.

Refer to "File Sizes"(⇒ p. 253) for information about the sizes of files for settings and screen image files.

#### Waveform File Size Calculation Method \_\_\_\_

#### **MEM Files**

#### File size (bytes) = settings size\*1 + data size\*2

\*1 Settings size = 100560 + analog channel portion + logic channel portion

Analog channel portion = 1104 x saved analog channels

Logic channel portion = 3584 x 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  $\times$  (2  $\times$  saved channels on Timebase 1 $^{*3}$ )

Samples on Timebase  $1 = Recording Length \times 100 + 1$ 

(Example: If the Recording Length is 25 divisions,  $25 \times 100 + 1 = 2501$ )

Data size of Timebase 2 = 11672 + samples on Timebase 2 x (2 x saved channels on Timebase 2)

Samples on Timebase 2 = Samples on Timebase 1  $\times$  ratio of sampling periods on the second and first Time Axes + 1

(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  $2501 \times (1/10) + 1 = 251$ )

\*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)

#### **REC Files**

#### File size (bytes) = settings size\*1 + data size\*2

\*1. Settings size = 111672 + analog channel portion + logic channel portion

Analog channel portion = 1104 x saved analog channels

Logic channel portion = 3584 x saved logic channels (0: none saved / 4: saved)

\*2. Data size = samples × (4 × saved channels\*3)

Samples = Recording Length  $\times$  100 + 1

(Example: If the Recording Length is 25 divisions,  $25 \times 100 + 1 = 2501$ )

\*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)

#### **RSM Files (Real-Time Saving Function)**

#### File size (bytes) = settings size\*1 + data size\*2

\*1: Settings size = 174224 + analog channel portion + logic channel portion

Analog channel portion = 1120 x saved analog channels

Logic channel portion = 3584 x saved logic channels (0: none saved / 4: saved)

\*2: Data size = samples × (2 × saved channels\*3)

Samples = Recording Length x 100 + 1

(Example: If the Recording Length is 25 divisions,  $25 \times 100 + 1 = 2501$ )

\*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)

#### **RSR Files (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 x saved analog channels

Logic channel portion = 3584 x saved logic channels (0: none saved / 4: saved)

\*2. Data size = samples × (4 × saved channels\*3)

Samples = Recording Length x 100 + 1

(Example: If the Recording Length is 25 divisions,  $25 \times 100 + 1 = 2501$ )

\*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)

#### **FFT Files**

#### 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.

#### **TXT Files**

#### **Memory Function and Real-Time Saving Function**

#### File size (bytes) = header size\*1 + data size\*2

- \*1. Header size = 190 + 27 x saved analog channels + 64 x saved logic channels
- \*2. Data size =  $(20 + 16 \times \text{saved analog channels} + 9 \times \text{saved logic channels}) \times (\text{Recording Length (div)} \times 100 + 1)$  (Saved logic channels = 0: none saved / 4: saved)

#### **Recorder Function**

#### File size (bytes) = header size\*1 + data size\*2

- \*1. Header size = 190 + 27 x saved analog channels + 64 x saved logic channels
- \*2. Data size =  $(20 + 32 \times \text{saved analog channels} + 18 \times \text{saved logic channels}) \times (\text{Recording Length (div)} \times 100 + 1)$  (Saved logic channels = 0: none saved / 4: saved)

#### **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 x no. of calculation points x (2/5)

#### File Size Reference Value

#### **MEM File Size (Memory Function)**

8860

Memory board (W: words)

9715 (32MW) to 9715-03 (1GW)

9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW)

9715-03 (1GW) only

File size (bytes) = settings size + data size

Calculation Method: "MEM Files" (⇒ p. A19)

When saving both Timebase 1 and Timebase 2, add both file sizes.

When the Model 8958 16-Ch Scanner Unit is not installed						(8860:MEM)
Recording	Timebase 1		Time	ebase 1 Saved Char	nels	
length (div)	Data Quantity	1	2	4	8	16
100	10,000	119 KB	140 KB	181 KB	264 KB	428 KB
1,000	100,000	295 KB	491 KB	884 KB	1.6 MB	3.2 MB
10,000	1,000,000	2.0 MB	3.9 MB	7.7 MB	15 MB	31 MB
100,000	10,000,000	19 MB	38 MB	76 MB	153 MB	305 MB
1,000,000	100,000,000	191 MB	382 MB	763 MB	1,526 MB	
10,000,000	1,000,000,000	1,907 MB				

Recording	Timebase 2	Timebase 2 Saved Channels				
length (div)	Data Quantity*	4	8	16	32	48
	100	17 KB	22 KB	32 KB	52 KB	73 KB
	1,000	24 KB	36 KB	60 KB	108 KB	157 KB
	10,000	94 KB	176 KB	341 KB	671 KB	1,001 KB
	100,000	797 KB	2 MB	3.1 MB	6.1 MB	9.2 MB
	1,000,000	7.6 MB	15.3 MB	31 MB	61 MB	92 MB
	10,000,000	76 MB	153 MB	305 MB	610 MB	916 MB

<sup>\*</sup> 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  $\times$  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) x ratio of timebases of Timebase 1 and Timebase 2 (1 ms / 100 ms)
- $= 10000 \times (1/100)$
- = 100

With only	(8860: MEM)						
Recording		Saved channels					
length (div)	8	16	32	64			
100	264 KB	428 KB	758 KB	1.4 MB			
1,000	1.6 MB	3.2 MB	6.2 MB	12 MB			
10,000	15 MB	31 MB	61 MB	122 MB			
100,000	153 MB	305 MB	610 MB	1,221 MB			
1,000,000	1,526 MB						

#### **MEM File Size (Memory Function)**

8861

Memory board x 2 (W: words)

9715 (32MW) to 9715-03 (1GW)

9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW)

9715-03 (1GW) only

File size (bytes) = settings size + data size

Calculation Method: "MEM Files" (⇒ p. A19)

When saving both Timebase 1 and Timebase 2, add both file sizes.

Note: Values in parentheses () in the following table exceed 2 GB, and so cannot be saved unless size is reduced by partial saving.

When the Model 8958 16-Ch Scanner Unit is not installed(8861: MEM)						
Recording	Timebase 1		Time	base 1 Saved Char	inels	
length (div)	Data Quantity	2	4	8	16	32
100	10,000	140 KB	181 KB	264 KB	428 KB	758 KB
1,000	100,000	491 KB	884 KB	1.6 MB	3.2 MB	6.2 MB
10,000	1,000,000	3.9 MB	7.7 MB	15 MB	31 MB	61 MB
100,000	10,000,000	38 MB	76 MB	153 MB	305 MB	610 MB
1,000,000	100,000,000	382 MB	763 MB	1,526 MB	(3,052 MB)	
10,000,000	1,000,000,000	(3,815 MB)				

Recording	Timebase 2	Timebase 2 Saved Channels				
length (div)	Data Quantity*	8	16	32	64	96
	100	22 KB	32 KB	52 KB	93 KB	134 KB
	1,000	36 KB	60 KB	108 KB	206 KB	303 KB
	10,000	176 KB	341 KB	671 KB	1.3 MB	1.9 MB
	100,000	1.5 MB	3.1 MB	6.1 MB	12 MB	18 MB
	1,000,000	15 MB	31 MB	61 MB	122 MB	183 MB
	10,000,000	153 MB	305 MB	610 MB	1,221 MB	1,831 MB

\* 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)
- $= 10000 \times (1/100)$
- = 100

With only	(8861: MEM)			
Recording		Saved c	hannels	
length (div)	16	32	64	128
100	428 KB	758 KB	1.4 MB	2.7 MB
1,000	3.2 MB	6.2 MB	12 MB	25 MB
10,000	31 MB	61 MB	122 MB	244 MB
100,000	305 MB	610 MB	1,221 MB	(2,442 MB)
1,000,000	(3,052 MB)			

#### **REC File Size (Recorder Function)**

8860

Memory board (W: words)

9715 (32MW) to 9715-03 (1GW) 9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW)

9715-03 (1GW) only

File size (bytes) = settings size + data size

Calculation Method: "REC Files" (⇒ p. A20)

When the M	(8860: REC)					
Recording	ding Saved channels					
length (div)	1	2	4	8	16	
100	150 KB	190 KB	271 KB	431 KB	752 KB	
1,000	502 KB	893 KB	1.6 MB	3.2 MB	6.2 MB	
10,000	3.9 MB	7.7 MB	15 MB	31 MB	61 MB	
100,000	38 MB	76 MB	153 MB	305 MB	610 MB	

With only Model 8958 16-Ch Scanner Unit Installed (8860: REC)						
Recording						
length (div)	8	16	32	64		
100	431 KB	752 KB	1.4 MB	2.6 MB		
1,000	3.2 MB	6.2 MB	12 MB	25 MB		
10,000	31 MB	61 MB	122 MB	244 MB		
20,000	61 MB	122 MB	244 MB	488 MB		

## **REC File Size (Recorder Function)**

8861

Memory board x 2 (W: words)

9715 (32MW) to 9715-03 (1GW)

9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW)

9715-03 (1GW) only

File size (bytes) = settings size + data size

Calculation Method: "REC Files" (⇒ p. A20)

When the M	When the Model 8958 16-Ch Scanner Unit is not installed(8861:REC)									
Recording		Saved channels								
length (div)	2	4	8	16	32					
100	190 KB	271 KB	431 KB	752 KB	1.4 MB					
1,000	893 KB	1.6 MB	3.2 MB	6.2 MB	12 MB					
10,000	7.7 MB	15 MB	31 MB	61 MB	122 MB					
100,000	76 MB	153 MB	305 MB	610 MB	1,221 MB					

With only M	(8861: REC)					
Recording		Saved c	hannels			
length (div)	16	32	64	128		
100	752 KB	1.4 MB	2.6 MB	5.1 MB		
1,000	6.2 MB	12 MB	25 MB	49 MB		
10,000	61 MB 122 MB 244 MB 489					
20,000	122 MB	244 MB	488 MB	977 MB		

### **RSM File Size (Real-Time Saving Function)**

8860/8861

File size (bytes) = settings size + data size

Calculation Method: "RSM Files (Real-Time Saving Function)" (⇒ p. A20)

Sampled			hannels			
waveform Recording length (div)	1	2	4	8	16	32
100	202 KB	223 KB	264 KB	347 KB	512 KB	842 KB
1,000	378 KB	574 KB	967 KB	1.7 MB	3.2 MB	6.3 MB
10,000	2.1 MB	4.0 MB	7.8 MB	15 MB	31 MB	61 MB
100,000	19 MB	38 MB	76 MB	153 MB	305 MB	611 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)

8860/8861

File size (bytes) = settings size + data size

Calculation Method: "RSR Files (Real-Time Saving Function)" (⇒ p. A20)

Whole		Saved channels						
waveform Recording length (div)	1	2	4	8	16	32		
100	150 KB	190 KB	271 KB	431 KB	752 KB	1.4 MB		
1,000	502 KB	893 KB	1.6 MB	3.2 MB	6.2 MB	12 MB		
10,000	3.9 MB	7.7 MB	15 MB	31 MB	61 MB	122 MB		
100,000	38 MB	76 MB	153 MB	305 MB	610 MB	1,221 MB		

## **FFT File Size (FFT Function)**

8860/8861

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

Averaging [Off]								
Number of		No. of calculations						
points	1	2	4	8				
1000	114 KB	130 KB	163 KB	228 KB				
2000	130 KB	16 2 KB	225 KB	353 KB				
5000	177 KB	255 KB	422 KB	728 KB				
10000	256 KB	412 KB	725 KB	1.3 MB				

Averaging [On]								
Number of		No. of ca	lculations					
points	1	2	4	8				
1000	124 KB	151 KB	204 KB	310 KB				
2000	150 KB	202 KB	305 KB	513 KB				
5000	226 KB	354 KB	610 KB	1.1 MB				
10000	353 KB	608 KB	1.1 MB	2.1 MB				

## TXT (Text) File Size (Memory Function and Real-Time Saving Function) 8860

Memory board (W: words)

9715 (32MW) to 9715-03 (1GW) 9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW) 9715-03 (1GW) only File size (bytes) = header size + data size

Calculation Method: "TXT Files" (⇒ p. A21)

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.

When the M	odel 8958 16-C	h Scanner Unit	is not installed	I (None saved I	ogic channels)	(8860: TXT)
Recording			Saved c	hannels		
length (div)	0	1	2	4	8	16
100		352 KB	508 KB	821 KB	1.4 MB	2.6 MB
1,000		3.4 MB	5.0 MB	8.0 MB	14 MB	26 MB
10,000		34 MB	50 MB	80 MB	141 MB	263 MB
100,000		343 MB	496 MB	801 MB	1,411 MB	(2,632 MB)
1,000,000		(3,433 MB)	(4,959 MB)	(8,011 MB)	(14,114 MB)	
10,000,000		(34,332 MB)				

When the M	Model 8958 16-Ch Scanner Unit is not installed (All saved logic channels)						
Recording			Saved o	hannels			
length (div)	0	1	2	4	8	16	
100	547 KB	704 KB	860 KB	1.1 MB	1.8 MB	3.0 MB	
1,000	5.3 MB	6.9 MB	8.4 MB	11 MB	18 MB	30 MB	
10,000	53 MB	69 MB	84 MB	114 MB	175 MB	298 MB	
100,000	534 MB	687 MB	839 MB	1,144 MB	1,755 MB	(2,975 MB)	
1,000,000	(5,341 MB)	(6,866 MB)	(8,392 MB)	(11,444 MB)	(17,548 MB)		
10,000,000	(53,406 MB)	(68,665 MB)					

With only M	lodel 8958 16-C	h Scanner Unit	Installed (None	e saved logic cl	hannels) (8860: TXT)
Recording		Saved	channels(Analog ch	annels)	
length (div)	0	8	16	32	64
100		1.4 MB	2.6 MB	5.1 MB	10.0 MB
1,000		14 MB	26 MB	51 MB	100 MB
10,000		141 MB	263 MB	507 MB	996 MB
100,000		1,411 MB	(2,632 MB)	(5,074 MB)	(9,956 MB)
1,000,000		(14,114 MB)	(26,321 MB)	(50,735 MB)	(99,564 MB)
10,000,000		(141,144 MB)			

With only M	lodel 8958 16-C	h Scanner Unit	Installed (All s	aved logic chai	nnels) (8860: TXT)
Recording		Saved	channels(Analog ch	annels)	
length (div)	0	8	16	32	64
100	547 KB	1.8 MB	3.0 MB	5.4 MB	10.3 MB
1,000	5.3 MB	17.5 MB	29.8 MB	54 MB	103 MB
10,000	53 MB	175 MB	298 MB	542 MB	1,030 MB
100,000	534 MB	1,755 MB	(2,975 MB)	(5,417 MB)	(10,300 MB)
1,000,000	(5,341 MB)	(17,548 MB)	(29,755 MB)	(54,169 MB)	(102,997 MB)
10,000,000	(53,406 MB)	(175,476 MB)			

#### TXT (Text) File Size (Memory Function and Real-Time Saving Function) 8861

Memory board x 2 (W: words)

9715 (32MW) to 9715-03 (1GW) 9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW)

9715-03 (1GW) only

File size (bytes) = header size + data size

Calculation Method: "TXT Files" (⇒ p. A21)

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

When the Model 8958 16-Ch Scanner Unit is not installed (None saved logic channels) (8861:TXT)

Recording Saved channels

when the M	ouel 6936 16-C	del 6956 To-Ch Scanner Unit is not installed (None Saved logic channels)						
Recording			Saved c	hannels				
length(div)	0	2	4	8	16	32		
100		508 KB	821 KB	1.4 MB	2.6 MB	5.1 MB		
1,000		5.0 MB	8.0 MB	14 MB	26 MB	51 MB		
10,000		50 MB	80 MB	141 MB	263 MB	507 MB		
100,000		496 MB	801 MB	1,411 MB	(2,632 MB)	(5,074 MB)		
1,000,000		(4,959 MB)	(8,011 MB)	(14,114 MB)	(26,321 MB)			
10,000,000		(49,591 MB)						

When the M	When the Model 8958 16-Ch Scanner Unit is not installed (All saved logic channels)								
Recording			Saved c	hannels					
length(div)	0	2	4	8	16	32			
100	547 KB	860 MB	1.1 MB	1.8 MB	3.0 MB	5.4 MB			
1,000	5 MB	8.4 MB	11 MB	18 MB	30 MB	54 MB			
10,000	53 MB	84 MB	114 MB	175 MB	298 MB	542 MB			
100,000	534 MB	839 MB	1,144 MB	1,755 MB	(2,975 MB)	(5,417 MB)			
1,000,000	(5,341 MB)	(5,341 MB) (8,392 MB) <b>(11,444 MB) (17,548 MB)</b> (29,755 MB) —							
10,000,000	(53,406 MB)	(83,923 MB)							

With only Model 8958 16-Ch Scanner Unit Installed (None saved logic channels) (8861:TXT)								
Recording		Saved	channels (Analog ch	annels)				
length(div)	0	16	32	64	128			
100		2.6 MB	5.1 MB	10.0 MB	20 MB			
1,000		26 MB	51 MB	100 MB	197 MB			
10,000		263 MB	507 MB	996 MB	1,972 MB			
100,000		(2,632 MB)	(5,074 MB)	(9,956 MB)	(19,722 MB)			
1,000,000		(26,321 MB)	(50,735 MB)	(99,564 MB)	(197,220 MB)			
10,000,000		(263,214 MB)						

With only M	With only Model 8958 16-Ch Scanner Unit Installed (All saved logic channels) (8861:TXT)								
Recording		Saved of	channels (Analog ch	annels)					
length(div)	0	16	32	64	128				
100		2.6 MB	5.1 MB	10.0 MB	20 MB				
1,000		26 MB	51 MB	100 MB	197 MB				
10,000		263 MB	507 MB	996 MB	1,972 MB				
100,000		(2,632 MB)	(5,074 MB)	(9,956 MB)	(19,722 MB)				
1,000,000		(26,321 MB)	(50,735 MB)	(99,564 MB)	(197,220 MB)				
10,000,000		(263,214 MB)							

#### **TXT (Text) File Size (Recorder Function)**

8860

Memory board (W: words)

9715 (32MW) to 9715-03 (1GW)

9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW) 9715-03 (1GW) only File size (bytes) = header size + data size

Calculation Method: "TXT Files" (⇒ p. A21)

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.

When the Model 8958 16-Ch Scanner Unit is not installed (None saved logic channels)								
Recording			Saved c	hannels				
length(div)	0	1	2	4	8	16		
100		508 KB	821 MB	1.4 MB	2.6 MB	5.1 MB		
1,000		5.0 MB	8.0 MB	14 MB	26 MB	51 MB		
10,000		50 MB	80 MB	141 MB	263 MB	507 MB		
100,000		496 MB	801 MB	1,411 MB	(2,632 MB)	(5,074 MB)		

When the M	When the Model 8958 16-Ch Scanner Unit is not installed (All saved logic channels) (8860:TX									
Recording			Saved channels							
length(div)	0	1	2	4	8	16				
100	899 KB	1.2 MB	1.5 MB	2.1 MB	3.3 MB	5.8 MB				
1,000	8.8 MB	12 MB	15 MB	21 MB	33 MB	58 MB				
10,000	88 MB	118 MB	149 MB	210 MB	332 MB	576 MB				
100,000	877 MB	1,183 MB	1,488 MB	(2,098 MB)	(3,319 MB)	(5,760 MB)				

With only M	With only Model 8958 16-Ch Scanner Unit Installed (None saved logic channels) (8860: TXT)							
Recording		Saved	channels(Analog ch	annels)				
length(div)	0	8	16	32	64			
100		2.6 MB	5.1 MB	10.0 MB	20 MB			
1,000		26 MB	51 MB	100 MB	197 MB			
10,000		263 MB	507 MB	996 MB	1,972 MB			
100,000		(2,632 MB)	(5,074 MB)	(9,956 MB)	(19,722 MB)			

With only Model 8958 16-Ch Scanner Unit Installed (All saved logic channels) (8860: TXT								
Recording		Saved channels(Analog channels)						
length(div)	0	8	16	32	64			
100	899 KB	3.3 MB	5.8 MB	11 MB	20 MB			
1,000	8.8 MB	33 MB	58 MB	106 MB	204 MB			
10,000	88 MB	332 MB	576 MB	1,064 MB	2,041 MB			
100,000	877 MB	(3,319 MB)	(5,760 MB)	(10,643 MB)	(20,409 MB)			

## **TXT (Text) File Size (Recorder Function)**

8861

Memory board x 2 (W: words)

9715 (32MW) to 9715-03 (1GW)

9715-01 (128MW) to 9715-03 (1GW)

9715-02 (512MW) to 9715-03 (1GW)

9715-03 (1GW) only

File size (bytes) = header size + data size

Calculation Method: "TXT Files" (⇒ p. A21)

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.

When the Model 8958 16-Ch Scanner Unit is not installed (None saved logic channels)								
Recording	Saved channels							
length(div)	0	2	4	8	16	32		
100		821 KB	1,446 MB	2.6 MB	5.1 MB	10.0 MB		
1,000		8.0 MB	14 MB	26 MB	51 MB	100 MB		
10,000		80 MB	141 MB	263 MB	507 MB	996 MB		
100,000		801 MB	1,411 MB	(2,632 MB)	(5,074 MB)	(9,956 MB)		

When the M	When the Model 8958 16-Ch Scanner Unit is not installed (All saved logic channels)								
Recording	g Saved channels								
length(div)	0	2	4	8	16	32			
100	899 KB	1.5 MB	2.1 MB	3.3 MB	5.8 MB	10.6 MB			
1,000	8.8 MB	15 MB	21 MB	33 MB	MB 58 MB	106 MB			
10,000	88 MB	149 MB	210 MB	332 MB	576 MB	1,064 MB			
100,000	877 MB	1,488 MB	(2,098 MB)	(3,319 MB)	(5,760 MB)	(10,643 MB)			

With only M	With only Model 8958 16-Ch Scanner Unit Installed (None saved logic channels) (8861: TXT)							
Recording		Saved	channels(Analog ch	annels)				
length(div)	0	16	32	64	128			
100		5.1 MB	10.0 MB	20 MB	39 MB			
1,000		51 MB	100 MB	197 MB	393 MB			
10,000		507 MB	996 MB	1,972 MB	(3,925 MB)			
100,000		(5,074 MB)	(9,956 MB)	(19,722 MB)	(39,253 MB)			

With only Model 8958 16-Ch Scanner Unit Installed (All saved logic channels) (8861: TXT)							
Recording	Saved channels(Analog channels)						
length(div)	0	16	32	64	128		
100	899 KB	5.8 MB	10.6 MB	20 MB	40 MB		
1,000	8.8 MB	58 MB	106 MB	204 MB	399 MB		
10,000	88 MB	576 MB	1,064 MB	2,041 MB	(3,994 MB)		
100,000	877 MB	(5,760 MB)	(10,643 MB)	(20,409 MB)	(39,940 MB)		

## **TXT (Text) File Size (FFT Function)**

8860/8861

File size (bytes) = header size + data size

Calculation Method: "TXT Files" (⇒ p. A21)

#### **Units: Bytes**

	An	alysis Modes			
Number of points	Storage Auto correlation function Cross-correlation function Impulse response	Octave analysis	Analysis modes except those at the left	Nyquist display	
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	10000 312 KB		125 KB	133 KB	

# 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. A37).

#### Reference

	Functions	Installed Memory	8860	8861	Fixed Recording Length (Fixed)	Arbitrary Recording Length (User)
I	Memory Function	9715 Memory Board	32 MWords	64 MWords	(⇒ p. A32)	(⇒ p. A33)
	iviernory i direttori	9715-03 Memory Board	1 GWord	2 GWords	(⇒ p. A34)	(⇒ p. A35)
I	Recorder Function	9715 Memory Board	32 MWords	64 MWords	(⇒ p.	. A36)
	recorder i dilettori	9715-03 Memory Board	1 GWord	2 GWords	(⇒ p. A36)	

#### **Memory Function**

#### (Using Only Timebase 1)

## With Model 9715 Memory Board Installed (32 MWords in Model 8860, or 64 MWords in Model 8861)

#### **Fixed Recording Length**

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling - Period -	Channels used and recording length ( ): 8861					
		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	
<b>5</b> μ <b>s</b>	50ns	100ms	100ms	250ms	500ms	1s	
<b>10</b> μ <b>s</b>	100ns	200ms	200ms	500ms	1s	2s	
<b>20</b> μ <b>s</b>	200ns	400ms	400ms	1s	2s	4s	
<b>50</b> μ <b>s</b>	500ns	1s	1s	2.5s	5s	10s	
<b>100</b> μs	1μs	2s	2s	5s	10s	20s	
<b>200</b> μs	2μs	4s	4s	10s	20s	40s	
<b>500</b> μs	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 Memory Board Installed (32 MWords in Model 8860, or 64 MWords in Model 8861)

#### **Arbitrary Recording Length**

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling Period	Channels used and recording length					
		Channels used and recording length  16 (32) 8 (16) 4 (8) 2 (4) 1 (2)					
		20,000 div	40,000 div	<b>4 (8)</b> 80,000 div	<b>2 (4)</b> 160,000 div	<b>1 (2)</b> 320,000 div	
_			,		,	·	
<b>5</b> μ <b>s</b>	50ns	100ms	200ms	400ms	800ms	1.6s	
<b>10</b> μ <b>s</b>	100ns	200ms	400ms	800ms	1.6s	3.2s	
<b>20</b> μ <b>s</b>	200ns	400ms	800ms	1.6s	3.2s	6.4s	
<b>50</b> μ <b>s</b>	500ns	1s	2s	4s	8s	16s	
<b>100</b> μ <b>s</b>	1μs	2s	4s	8s	16s	32s	
<b>200</b> μ <b>s</b>	2μs	4s	8s	16s	32s	1min 04s	
<b>500</b> μ <b>s</b>	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 9715-03 Memory Board Installed (1 GWord in Model 8860, or 2 GWords in Model 8861)

**Fixed Recording Length** 

(d: days/ h: hours/ min: minutes/ s: seconds)

Timebase (/div)	Sampling period	Channels used and recording length ( ): 8861					
		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	
<b>5</b> μ <b>s</b>	50ns	2.5s	5s	10s	25s	50s	
<b>10</b> μ <b>s</b>	100ns	5s	10s	20s	50s	1min 40s	
<b>20</b> μ <b>s</b>	200ns	10s	20s	40s	1min 40s	3min 20s	
<b>50</b> μ <b>s</b>	500ns	25s	50s	1min 40s	4min 10s	8min 20s	
<b>100</b> μ <b>s</b>	1μs	50s	1min 40s	3min 20s	8min 20s	16min 40s	
<b>200</b> μ <b>s</b>	2μs	1min 40s	3min 20s	6min 40s	16min 40s	33min 20s	
<b>500</b> μ <b>s</b>	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 9715-03 Memory Board Installed (1 GWord in Model 8860, or 2 GWords in Model 8861)

### **Arbitrary Recording Length**

(d: days/ h: hours/ min: minutes/ s: seconds)

Timelian	0		Channels us	sed and recording leng	th ( ): 8861	
Timebase (/div)	Sampling period	16 (32)	8 (16)	4 (8)	2 (4)	1 (2)
(/ulv)	period	640,000 div	1,280,000 div	2,560,000 div	5,120,000 div	10,240,000 div
<b>5</b> μ <b>s</b>	50ns	3.2s	6.4s	12.8s	25.6s	51.2s
<b>10</b> μ <b>s</b>	100ns	6.4s	12.8s	25.6s	51.2s	1min 42.4s
<b>20</b> μ <b>s</b>	200ns	12.8s	25.6s	51.2s	1min 42.4s	3min 24.8s
<b>50</b> μ <b>s</b>	500ns	32s	1min 04s	2min 08s	4min 16s	8min 32s
<b>100</b> μ <b>s</b>	1μs	1min 04s	2min 08s	4min 16s	8min 32s	17min 04s
<b>200</b> μs	2μs	2min 08s	4min 16s	8min 32s	17min 04s	34min 08s
<b>500</b> μ <b>s</b>	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 Memory Board Installed (32 MWords in Model 8860, or 64 MWords in Model 8861)

(d: days/ h: hours/ min: minutes/ s: seconds)

	Fixed Recor	ding Length	Arbitrary Reco	ording Length
Timebase	Model 8958 16-0	Ch Scanner Unit	Model 8958 16-	Ch Scanner Unit
(/div)	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 9715-03 Memory Board Installed (1 GWord in Model 8860, or 2 GWords in Model 8861)

(d: days/ h: hours/ min: minutes/ s: seconds)

	Fixed Recor	ding Length	Arbitrary Reco	ording Length
Timebase	Model 8958 16-0	Ch Scanner Unit	Model 8958 16-0	Ch Scanner Unit
(/div)	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)								
	Installed Memory (Words) No. of Chs Used							
		16 + logic	16	8	4	2	1	
8860	8861	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)								
	Installed Memory (Words) No. of Chs Used							
		16 + logic	16	8	4	2	1	
8860	8861	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 R	Fixed Recording Length (Fixed) [Divisions							
Installed	Memory	1	No. of Chs Used	I x 8 ( ): Indicat	ted when setting	1		
(Wo	rds)	(8 x 8CH+L)	(8 x 8CH)	(4 x 8CH)	(2 x 8CH)	(1 x 8CH)		
		8 + logic	8	4	2	1		
8860	8861	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)							
Installed	Memory	١	No. of Chs Used	x8 (): Indicat	ed when setting	1	
(Wo	rds)	(8 x 8CH+L)	(8 x 8CH)	(4 x 8CH)	(2 x 8CH)	(1 x 8CH)	
		16	8	4	2	1	
8860	8861	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 R	Fixed Recording Length (Fixed) [Div							
	Installed Memory (Words)  Channels Using Timebase 1 / ( ):Channels Using Timebase 2							
		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)		
8860	8861	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		

Arbitra	Arbitrary Recording Length (User) [Divisions]						
	Installed Memory (Words)  Channels Using Timebase 1 / ( ): Channels Using Timebase 2						
		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)	
8860	8861	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 R	Fixed Recording Length (Fixed) [Divisions]							
	Installed Memory (Words) Channels Using Timebase 1 / ( ): 8 x Channels on Model 8958							
,		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)		
8860	8861	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		

Arbitra	Arbitrary Recording Length (User) [Divisions]							
	Installed Memory (Words) Channels Using Timebase 1 / ( ): 8 x Channels on Model 8958							
		16 (8)	8 (8)	4 (4)	2 (2)	1 (1)		
8860	8861	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	J Length (Fixed)	Arbitrary Recording Length (User)/ Continuous Recording Length (Cont)		
		Model 8958 16-0	Ch Scanner Unit	Model 8958 16-0	Ch Scanner Unit	
8860	8861	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	10,0000	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 Memory Board Installed

(32 MWords in Model 8860, or 64 MWords in Model 8861)

[Blocks]

#### With Model 9715-01 Memory Board Installed

(128 MWords in Model 8860, or 256 MWords in Model 8861)

Blocks1

-							[Diooko]		
Record (	ling (div)		Channels used						
8	3860	)	16	8	4	2	1		
8	8861			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		

							[Blocks]			
Record	ding (div)	•		Channels used						
8	3860	)	16	8	4	2	1			
8	3861		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 9715-02 Memory Board Installed

(512 MWords in Model 8860, or 1 GWords in Model 8861)

[Blocks]

Recordin	g le	ngth (div)	Channels used						
8	3860	)	16	8	4	2	1		
3	8861			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

#### With Model 9715-03 Memory Board Installed

(1 GWords in Model 8860, or 2 GWords in Model 8861)

[Blocks]

Recording	g le	ngth (div)	Channels used						
8	3860	)	16	8	4	2	1		
3	386°	1	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 Memory Board Installed

(32 MWords in Model 8860, or 64 MWords in Model 8861)

#### Recording length (div) Channels used 1 to 4 to 8 to 16 to 31 to 61 to 141 to 301 to 621 to 1251 to 2501 to 5001 to

#### With Model 9715-01 Memory Board Installed

(128 MWords in Model 8860, or 256 MWords in Model 8861)

Blocks1

Recording	ler	ngth (div)	Channels used						
	, 860	• ,	16	8	4	2	1		
8	861		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 9715-02 Memory Board Installed

10001 to

20001 to

40001 to

(512 MWords in Model 8860, or 1 GWords in Model 8861)

[Blocks]

[Blocks]

Recording	g le	ngth (div)	h (div) Channels used				
8	8860	0	16	8	4	2	1
8861			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 9715-03 Memory Board Installed

(1 GWords in Model 8860, or 2 GWords in Model 8861)

[Blocks]

Recordin	Recording length (div)			Channels used						
8	3860	)	16	8	4	2	1			
8	8861			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 Memory Board Installed

(32 MWords in Model 8860, or 64 MWords in Model 8861)

[Blocks]

							[5.00.10]			
Recording	g ler	ngth (div)		Channels used						
8	8860			8	4	2	1			
8	3861		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 9715-01 Memory Board Installed

(128 MWords in Model 8860, or 256 MWords in Model 8861)

[Blocks]

Recording	g len	gth (div)	Channels used						
8	860		16	8	4	2	1		
8	861		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 9715-02 Memory Board Installed

(512 MWords in Model 8860, or 1 GWords in Model 8861)

[Blocks]

### With Model 9715-03 Memory Board Installed

(1 GWords in Model 8860, or 2 GWords in Model 8861)

[Blocks]

Recording	g ler	ngth (div)	div) Channels used				
8	3860		16	8	4	2	1
8	3861		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

Recording	g ler	ngth (div)	Channels used					
8	860		16	8	4	2	1	
8861			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 Memory Board Installed

(32 MWords in Model 8860, or 64 MWords in Model 8861)

[Blocks]

							[Бюска]	
Recording	len	gth (div)		Channels used (x 8ch)				
8	860		8+L	8	4	2	1	
8	861		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 9715-01 Memory Board Installed

(128 MWords in Model 8860, or 256 MWords in Model 8861)

Blocks]

	-	( !! )		<u> </u>		/ a \	<u> </u>
Recording	Recording length (div)			Channe	els used	(x 8ch)	
8	860		8+L	8	4	2	1
8	861		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 9715-02 Memory Board Installed

(512 MWords in Model 8860, or 1 GWords in Model 8861)

[Blocks]

Recording length (div)			Channe	els used	(x 8ch)		
8	3860		8+L	8	4	2	1
8	861		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 9715-03 Memory Board Installed

(1 GWords in Model 8860, or 2 GWords in Model 8861)

[Blocks]

Recording length (div)				Channe	els used	(x 8ch)	
8	8860		8+L	8	4	2	1
8	861		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 equipped with an USB interface Printers with confirmed compatibility:

- HP deskjet 5551
- HP deskjet 5740
- HP deskjet 450cbi \*

Non-HP (Hewlett-Packard) printers are incompatible.

\* 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.

# 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 ( $\sigma$ ) = E × $\varepsilon$

For temperature compensation with two or four gauges, position the gauges perpendicularly.

Stress ( $\sigma$ ) is obtained by 1 / (1 +  $\nu$ ) for two gauges, and by 1 / {2 (1 +  $\nu$ )} for four gauges.

#### Bending Stress Measurement: Stress ( $\sigma$ ) = E × $\epsilon$

For temperature compensation with two or four gauges, stress ( $\sigma$ ) is obtained as a multiple of  $\frac{1}{2}$  or  $\frac{1}{4}$ , respectively.

## Torsional Stress Measurement: Stress ( $\sigma$ ) = E / {2 (1 + V)} × $\epsilon$ (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 × 10<sup>9</sup> × Measurement Value (in με units) × 10<sup>-6</sup> (in με units)

- = 73 x Measurement Value (in kPa units)
- = 7.44\* × Measurement Value (in gf/mm<sup>2</sup> units)
- \*: 1 Pa =  $1.01971621 \times 10^{-7} \text{ kgf/mm}^2$

Unit: gf/mm<sup>2</sup>, Conversion Ratio = 7.44 gf/mm<sup>2</sup>

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 Copper (0.1 to 0.25% C)	205	0.28 to 0.3
Carbon Copper (> 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
	DISP	Ctrl + Alt + D	Alt + F1
	SET	Ctrl + Alt + S	Alt + F2
	SET (Hold)	Ctrl + Alt + S (Hold)	
Menu	FILE	Ctrl + Alt + F	Alt + F3
MEHU	SUB MENU ↑	Ctrl + Alt + ↑	Alt + F4
	SUB MENU ↓	Ctrl + Alt + ↓	Alt + F5
	SHEET/PAGE ←	Ctrl + Alt + ←	Alt + F6
	SHEET/PAGE $\rightarrow$	Ctrl + Alt + →	Alt + F7
	Up	<b>↑</b>	
0	Left	←	
Cursor Keys	Down	$\downarrow$	
	Right	$\rightarrow$	
	ESC	Esc	
	ENTER	Enter	
Operation	SELECT	(space)	
	HELP/CONV	Ctrl + Alt + H	
Save	SAVE	Ctrl + Alt + V	Alt + F11
Deintor	PRINT	Ctrl + Alt + Q	
Printer	FEED	Ctrl + Alt + W	
	F1	F1	
	F2	F2	
	F3	F3	
	F4	F4	
Function Keys	F5	F5	
	F6	F6	
	F7	F7	
	F8	F8	
	FN	Ctrl + Alt + F11	Alt + F12
	UNIT ↑	Ctrl + Alt + U	
	UNIT ↓	Shift + Ctrl + Alt + U	
	CH ↑	Ctrl + Alt + C	
	CH↓	Shift + Ctrl + Alt + C	
	RANGE ↑	Ctrl + Alt + R	
Channels	RANGE ↓	Shift + Ctrl + Alt + R	
Chamileis	POSN T	Ctrl + Alt + P	
	POSN↓	Shift + Ctrl + Alt + P	
	CH ON/Off	Ctrl + Alt + O	
	TIME/DIV ↑	Ctrl + Alt + T	
	TIME/DIV ↓	Shift + Ctrl + Alt + T	
Timebase	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
	Move Cursor A right	Ctrl + Alt + A	
	Move Cursor A left	Shift + Ctrl + Alt + A	
	Move Cursor B right	Ctrl + Alt + B	
AB Cursors	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	
log	Turn Left	Ctrl + Alt + 0	
Jog	Turn Right	Ctrl + Alt + 9	
Shuttle	Turn Left 4	Ctrl + Alt + 1	
Shuttle	Turn Left 3	Ctrl + Alt + 2	
L , 1 <u>1</u> 1 , R	Turn Left 2	Ctrl + Alt + 3	
	Turn Left 1	Ctrl + Alt + 4	
3 3	Turn Right 1	Ctrl + Alt + 5	
4 4	Turn Right 2	Ctrl + Alt + 6	
	Turn Right 3	Ctrl + Alt + 7	
	Turn Right 4	Ctrl + Alt + 8	
	STOP	F11	Storage Media Stop Key (■)
Measurement	START	F12	Storage Media Play/ Pause Key (▶/▮)
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. A49)
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 opamp. 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 signal output to input, in decik 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		

## Appendix 3 Terminology

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 Corporatio (USA), and a registered trademar 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, tim that passes before a trigger ever 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 temper- ature, expressed as a percentage			
Ripple Component	An AC noise component			
RMS	Abbreviation of root-mean-square which is the value of AC that per forms 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			

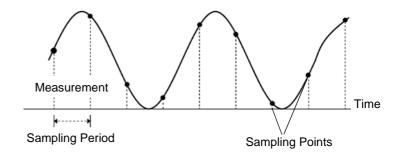
Storage	Writing a waveform (A/D signal) to memory	
TFT	Abbreviation for thin-film transistor	
Thermal Head	Provides thermosensitive printing	
Threshold	The values of separate High and Low boundary levels at which an an- alog signal is converted to a logic signal	
Trigger	An event that initiates an operation. 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).



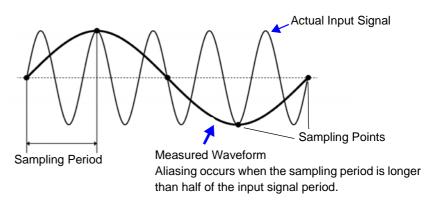
The rate of measurement is called the sampling rate.

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.



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.

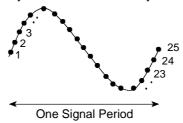
Because the timebase determines the measurement frequency limit, the fastest possible timebase setting should be used.

When the signal can be recorded repeatedly, the auto-ranging function ( $\Rightarrow$  p. 73) 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.



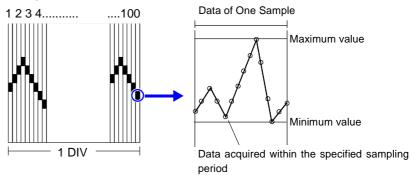
Timebase	Sampling period	Measurement limit frequency
5 μs/div	50 ns	800 kHz
10 μs/div	100 ns	400 kHz
20 μs/div	200 ns	200 kHz
50 μs/div	500 ns	80 kHz
100 μs/div	1 μs	40 kHz
200 μs/div	2 μs	20 kHz
500 μs/div	5 µs	8 kHz
1 ms/div	10 μs	4 kHz
2 ms/div	20 μs	2 kHz
5 ms/div	50 μs	800 Hz
10 ms/div	100 μs	400 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**

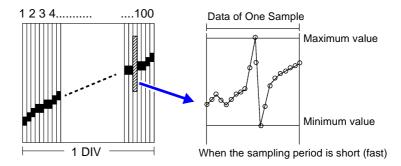
Waveform data consists of 100 samples per division.

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  $V_I$ : Lower potential point  $SC_I$ : Value at lower potential point

The ranges of the values enclosed in curly brackets { } are as follows:

 $-9.9999E+9 \le Value enclosed in \{ \} \le -1.0000E-9$ 

 $-9.9999E+9 \le Value enclosed in \{\} = 0$ 

 $+1.0000E-9 \le Value enclosed in \{ \} \le +9.9999E+9$ 

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
	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
Voltage Measurements	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
<b>RMS Voltage Measurements</b>	Model 8959 DC/RMS Unit	2	1 MS/s	12-bit	400 V DC
Voltage and Temperature (Thermometer) Measure- ments	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	Model 8939 Strain Unit	2	1 MS/s	12-bit	10 V DC
Converter) Measurements	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
	Model 9197 Connection Cord	For high voltage	500 V
	Model 9198 Connection Cord	For low voltage	300 V
	Model 9217 Connection Cord	Isolated BNC-BNC	300 V
For Voltage Measurement	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	2000 V DC, 1000 V AC (CAT III)
	Model 9665 10:1 Probe	Maximum rate voltage above ground is that of the input module.	1 kVrms (up to 1 MHz)
	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 Model 8940	
	*2. Model 9418-15 AC Adapter	For Model 9322	
	*3. Model 9248 Power Cord	For connecting the Model 9322 and 9687	
	Model 9320-01 Logic Probe	Four channels, for detecting voltage and closed/op contact points	
For Logic Signal Input	Model 9321-01 Logic Probe	Four isolated channels, for detecting AC/DC voltage off (for small terminal types and for lines)	
	Model 9327 Logic Probe	Four channels, for detecting voltage ar contact points (high-speed type)	nd closed/open

	Model 3273 Clamp-On Probe <sup>(1), (4)</sup>	15 A, DC to 50 MHz
For current measurement AC/DC, wide range	Model 3273-50 Clamp-On Probe <sup>(1), (4)</sup>	30 A, DC to 50 MHz (up to 15 A when used with the Model 8940 F/V Unit) $$
Following item (1) or (4) is	Model 3274 Clamp-On Probe <sup>(1)</sup>	150 A, DC to 10 MHz
required for connection.	Model 3275 Clamp-On Probe <sup>(1)</sup>	500 A, DC to 2 MHz
	Model 3276 Clamp-On Probe <sup>(1)</sup>	30 A, DC to 100 MHz
AC/DC	Model 9277 Universal Clamp-On CT (2),(3)	20 A, DC to 100 kHz
Following item (2) or (3) is	Model 9278 Universal Clamp-On CT $^{(2),(3)}$	200 A, DC to 100 kHz
required for connection.	Model 9279 Universal Clamp-On CT*(2),(3)	500 A, DC to 20 kHz
For AC	Model 9270 Clamp-On Sensor* (2),(3)	20 A, 5 Hz to 50 kHz
Following item (2) or (3) is	Model 9271 Clamp-On Sensor* (2),(3)	200 A, 5 Hz to 50 kHz
required for connection.	Model 9272 Clamp-On Sensor* (2),(3)	20/200 A, 5 Hz to 10 kHz
For AC	Model 9018-10 Clamp-On Probe	10 to 500 A, 40 Hz to 3 kHz
FOI AC	Model 9132-10 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	(1) Model 3272 Power Supply or 3269 Power Supply	for Model 3273 to 3276
module for voltage mea- surement	(2) Model 9555 Sensor Unit *	for Model 9270 to 9272, 9277 to 9279
For connecting to the Mod-	(3) Model 9318 Conversion Cable	for Model 9270 to 9272, 9277 to 9279
el 8940 F/V Unit	(4) Model 9319 Conversion Cable	for Model 3273 and 3273-50 (Rated for up to 15 Arms input)
	Model 9199 Conversion Adapter	(BNC-to-Banana) (Either Model 9018 or 9132 can be used)

<sup>\*</sup> 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)	

<sup>\*</sup> Not applicable to CE Marking

## **Storage Media**

Drives	Model 9716 FD Drive	External USB Floppy Disk Drive (YD-8U10 Y-E DATA)	
	Model 9717 MO Unit	Internal MO Drive, specify when ordering (or Model 9718 HD Unit)	
	Model 9718 HD Unit	Internal Hard Disk Drive, specify when ordering (or Model 9717 MO Unit)	
	Model 9715 Memory Board	32 MWords, specify when ordering	
Memory Boards (One in the 8860, or Two in the 8861)	Model 9715-01 Memory Board	128 MWords, specify when ordering	
	Model 9715-02 Memory Board	512 MWords, specify when ordering	
	Model 9715-03 Memory Board	1 GWords, specify when ordering	
	Model 9626 PC Card 32M	32MB, with adapter	
	Model 9627 PC Card 64M	64MB, with adapter	
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	

### Communication

Interface	Model 9558 GP-IB Card	
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 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)	with casters
	Model 9724 Carrying Case (for 8861)	with casters
Transformer	Model 9303 PT *	

<sup>\*</sup> Not applicable to CE Marking

Appendix

## **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.

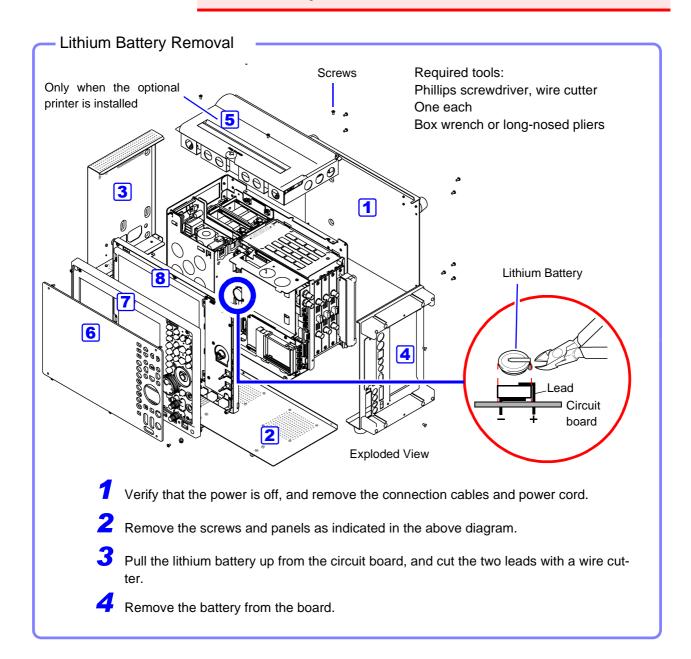
Also remove the optional Model 9719 Memory Backup Unit, if installed.  $(\Rightarrow p. A57)$ 

## **WARNING**

To avoid electric shock, turn off the power switch and disconnect the power cord before removing the lithium battery and Model 9719 Memory Backup Unit (if the option is installed).

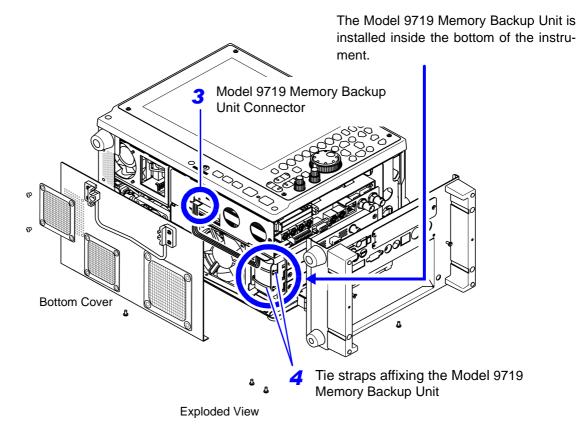
## **<u>ACAUTION</u>**

When disposing of the instrument, remove the lithium battery and Model 9719 Memory Backup Unit (if the option is installed) and dispose of them in accordance with local regulations.



#### Removing the Model 9719 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 Disconnect the Model 9719 Memory Backup Unit connector.
- 4 Using a wire cutter, cut the tie straps affixing the Model 9719 Memory Backup Unit.
- 5 Remove the Model 9719 Memory Backup Unit.

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