HIOKI

2

INPUT MODULE GUIDE

8860
8861
MEMORY HiCORDER

This Guide describes the optional input modules, related cable connection procedures, and their settings and specifications.

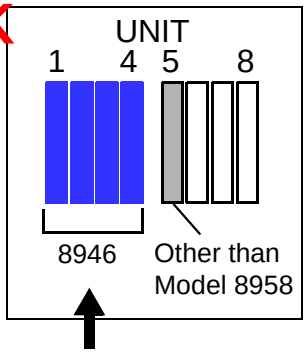
HIOKI E. E. CORPORATION

Notes for Installing the Input Units in Model 8861

IMPORTANT: When **Model 8958 16ch SCANNER UNIT** and 4 or more units of **Model 8946 4ch ANALOG UNIT** are installed in Model 8861 at the same time, only a maximum of 3 units of Model 8946 can be installed to the UNIT 1-4 slots of Model 8861.

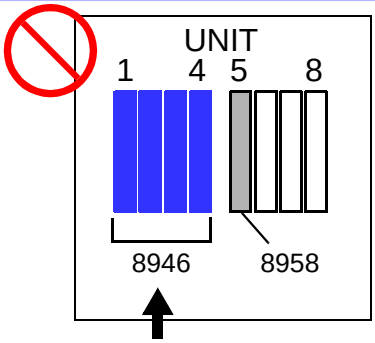
When Model 8958 is not installed

OK



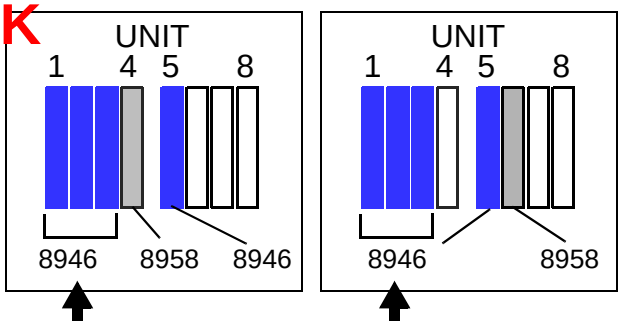
4 units of Model 8946 can be installed to the UNIT 1-4 slots.

When installing 4 or more Model 8946 and Model 8958 at the same time



Do not install 4 units of Model 8946 to the UNIT 1-4 slots.

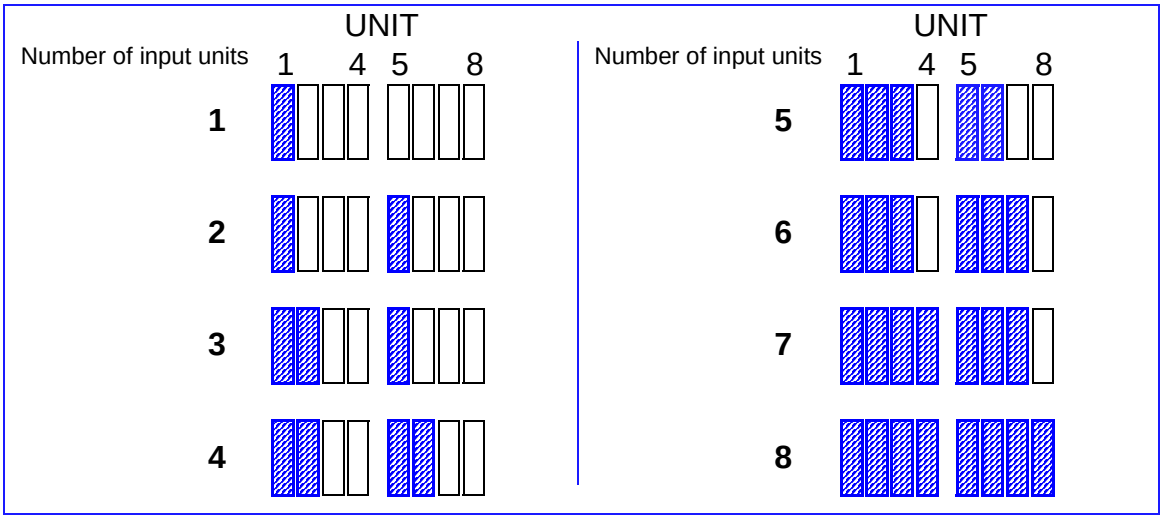
OK



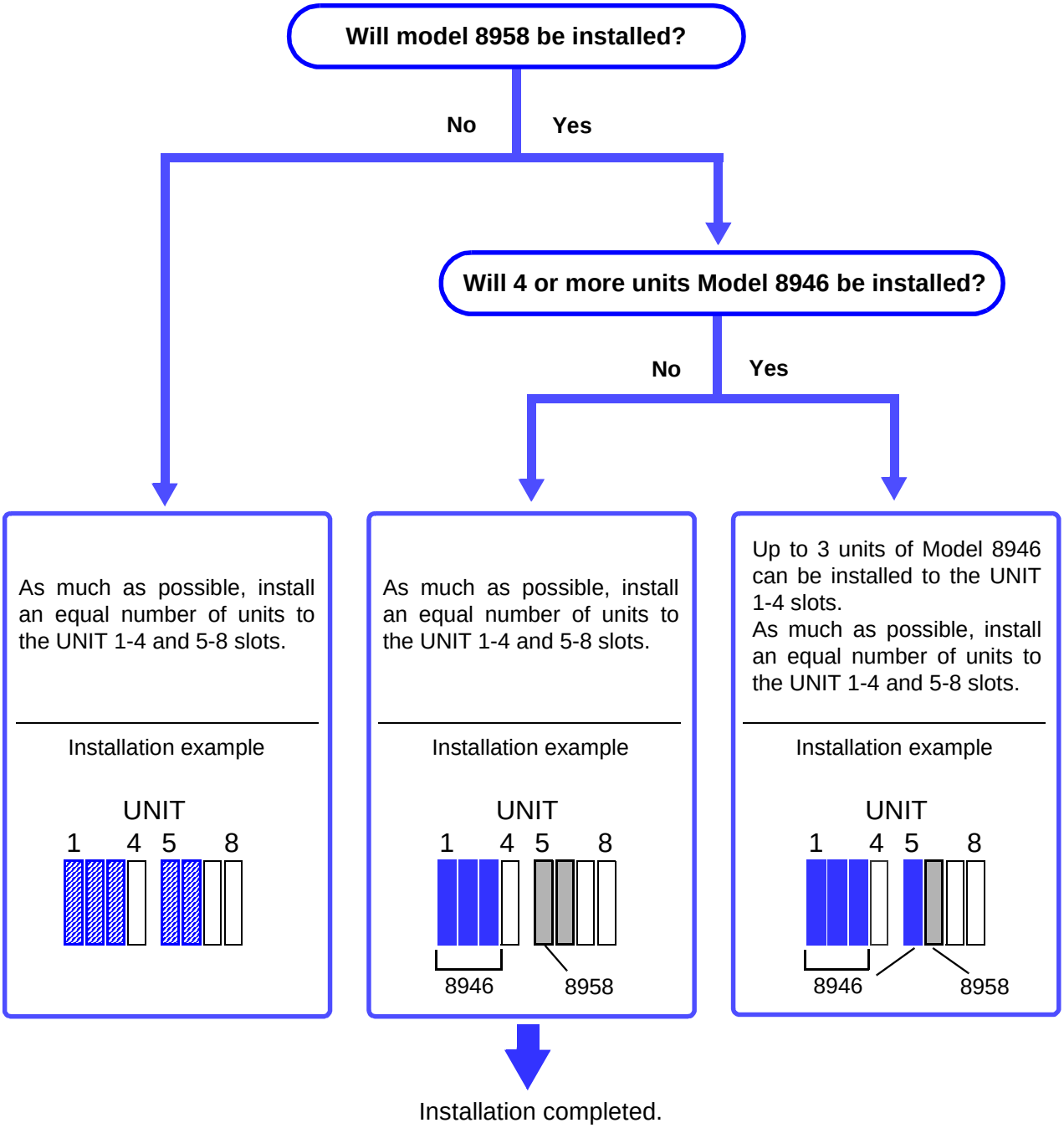
Only a maximum of 3 units of Model 8946 can be installed in the UNIT 1-4 slots.

Recommended positions for installing input units

Balanced installation of input units in the UNIT 1-4 and 5-8 slots is recommended in order to effectively utilize the internal memory of Model 8861.



Please refer to the following flow chart to when installing input units:



Contents

Contents

Introduction

The following documents are provided with Model 8860 and 8861 Memory HiCorders.
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** (This document)	**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**	**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.**

Which input module and cables to use with the instrument depend on your measurement application. Refer to this as appropriate for your application. (⇒ p. 3)

- In this document, the “instrument” means the Model 8860 or 8861 Memory HiCorder.
- “Clamp” refers to one of our optional clamp-on sensor products.

Safety Symbols

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the instrument. The ⚠ symbol printed on the instrument indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
	Indicates DC (Direct Current).
	Indicates AC (Alternating Current).
	Indicates both DC (Direct Current) and AC (Alternating Current).
	Indicates a grounding terminal.

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

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

Other Symbols

	Indicates the prohibited action.
(⇒ p.)	Indicates the location of reference information.
	Indicates quick references for operation and remedies for troubleshooting.
*	Indicates that descriptive information is provided below.
[ ]	Screen labels such as menu items, page titles, setting items, dialog titles and buttons are indicated by square brackets [ ].
CURSOR (Bold characters)	Bold characters within the text indicate operating key labels.

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)
The maximum displayable value or scale length. This is usually the name of the currently selected range.
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

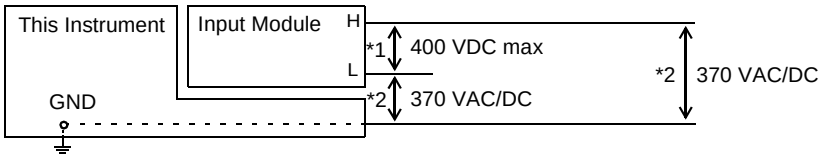
Structure of this Document

Preparation		Reference Location
Overview of Input Modules and Logic Groups	About the overview of input modules and logic groups	"1.1 Product Overview" (⇒ p. 5)
	Overview of usage, connections and settings	"1.2 Input Module Usage List" (⇒ p. 9)
	Input module connections	"1.3 List of Input Modules, Cables, Probes and Clamp Combinations" (⇒ p. 11)
	Specifications of input modules and logic probes	"Chapter 5 Specifications" (⇒ p. 83)

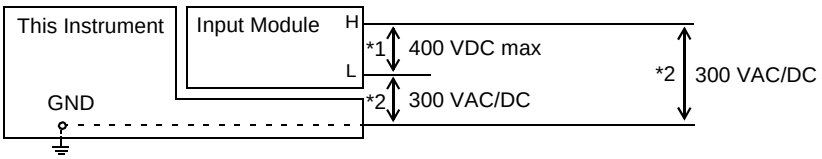
Procedure		Reference Location
Connections	Connecting the input modules, cables and logic probes to the instrument	"Chapter 2 Connections" (⇒ p. 13)
Turn Power On	Refer to the *Quick Start Manual* for other connections.	
Instrument Settings (input channel settings)	(When using an input module) Set analog channels	"Chapter 3 Input Channel Settings" (⇒ p. 43)
	(When using a logic probe) Set logic channels	"Chapter 4 Logic Input Settings" (⇒ p. 79)
	In addition to the above, perform necessary measurement settings such as measurement criteria and trigger settings. Refer to the *Quick Start Manual* for overviews of all operations. Refer to the *Instruction Manual* for details of settings other than those related to input channels.	
Measure		

Maximum Input Voltage*1 of input module and Maximum Rated Voltage to Ground*2

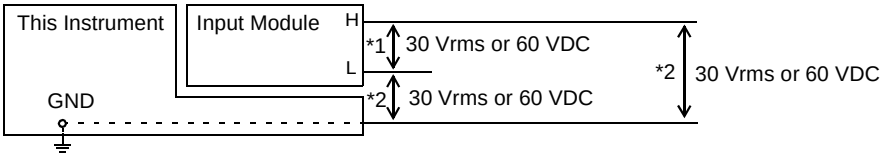
Model 8936 Analog Unit
Model 8938 FFT Analog Unit
Model 8959 DC/RMS Unit



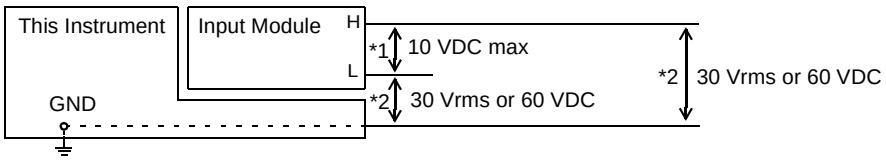
Model 8956 Analog Unit
Model 8957 High Resolution Unit



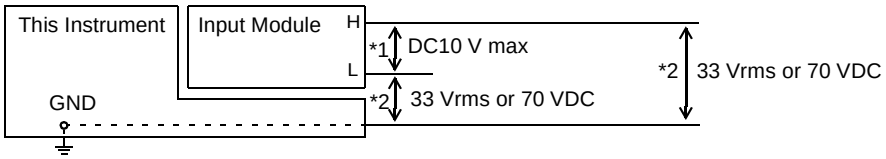
Model 8937 Voltage/Temp Unit
Model 8946 4-Ch Analog Unit



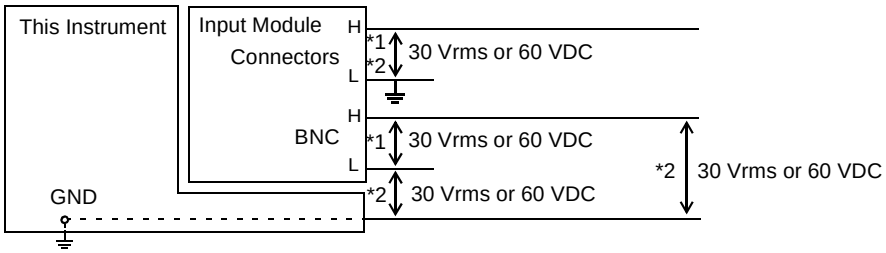
Model 8939 Strain Unit



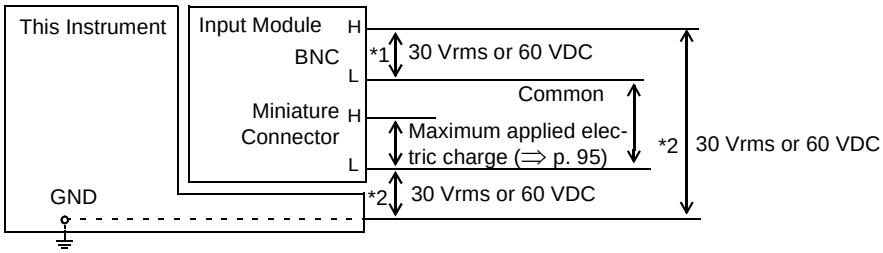
Model 8960 Strain Unit



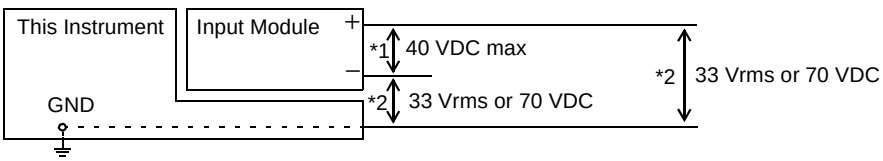
Model 8940 F/V Unit



Model 8947 Charge Unit



Model 8958 16-Ch Scanner Unit



Overview Chapter 1

1.1 Product Overview

This chapter provides an overview of the optional input modules and input cables that can be used with this instrument.
Refer to "Appendix 6 Disposing of the Instrument" in the *Instruction Manual* for a full list of options for this instrument.

Voltage Measurement

Input Module

8956 Analog Unit

2 channels, 20 MS/s, 12-bit, maximum input voltage: 400 VDC

High-speed type

8957 High Resolution Unit

2 channels, 2 MS/s, 16-bit, maximum input voltage: 400 VDC

Supports high-precision measurements. (Includes internal anti-aliasing filter.)

8936 Analog Unit

2 channels, 1 MS/s, 12-bit, maximum input voltage: 400 VDC

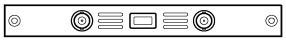
8946 4-Ch Analog Unit

4 channels, 1 MS/s, 12-bit, maximum input voltage: 30 Vrms/60 VDC

8938 FFT Analog Unit

2 channels, 1 MS/s, 12-bit, maximum input voltage: 400 VDC

(Includes internal anti-aliasing filter.)



8959 DC/RMS Unit

2 channels, 1 MS/s, 12-bit, maximum input voltage: 400 VDC

Measures both normal and RMS voltages.

8940 F/V Unit

2 channels, 1 MS/s, 12-bit, maximum input voltage: 30 Vrms/60 VDC

In addition to voltage, also measures current, frequency, rotation rate, pulse totalization and duty cycle.

8937 Voltage/Temp Unit

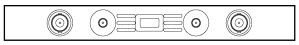
2 channels, 1 MS/s, 12-bit, maximum input voltage: 30 Vrms/60 VDC

Measures temperature in addition to voltage.

8958 16-Ch Scanner Unit

16 channels, 20 S/s, 16-bit, maximum input voltage: 40 VDC

In addition to voltage, also supports temperature measurement.



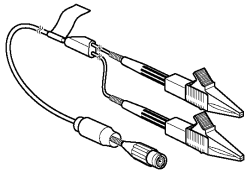
8947 Charge Unit

2 channels, 1 MS/s, 12-bit, maximum input voltage: 30 Vrms/60 VDC

In addition to voltage, also supports measurements with piezoelectric acceleration sensors. (Includes internal anti-aliasing filter.)

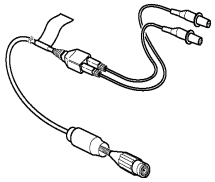
Also refer to "Maximum Input Voltage*1 of input module and Maximum Rated Voltage to Ground*2" (⇒ p. 4)

Input cables for voltage measurement with input modules (except the Model 8958 16-Ch Scanner Unit)



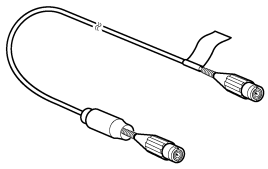
9197 Connection Cord

For high voltage, maximum input voltage: 500 V (large alligator clips)



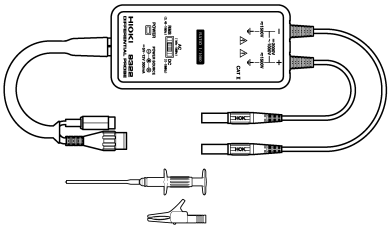
9198 Connection Cord

For low voltage, maximum input voltage: 300 V (small alligator clips)



9217 Connection Cord

Maximum input voltage: 300 V (for BNC output)

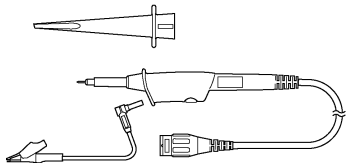


9322 Differential Probe

For high voltage, maximum input voltage: (CAT II): 2000 VDC, 1000 VAC, (CAT III): 600 VAC/DC

Applicable Modules:
- Model 8940 F/V Unit
- Input modules for voltage measurement (except the Model 8958 16-Ch Scanner Unit)

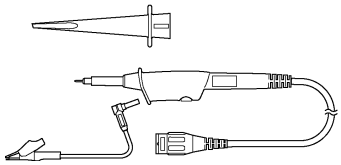
To connect to an input module, the following separate items are required:
- Model 9325 Power Cord (when using the Model 8940)
- Model 9418-15 AC Adapter
- Model 9248 Power Cord (when using the Model 9687)



9665 10:1 Probe

Maximum input voltage: 1 kVrms (1 MHz or less)

Applicable Modules:
- Model 8936 Analog Unit
- Model 8938 FFT Analog Unit
- Model 8956 Analog Unit
- Model 8957 High Resolution Unit
- Model 8959 DC/RMS Unit



9666 100:1 Probe

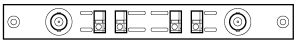
Maximum input voltage: 5 kVpeak (1 MHz or less)

Applicable Modules:
- Model 8936 Analog Unit
- Model 8938 FFT Analog Unit
- Model 8956 Analog Unit
- Model 8957 High Resolution Unit
- Model 8959 DC/RMS Unit

Refer to "1.3 List of Input Modules, Cables, Probes and Clamp Combinations" (⇒ p. 11) for combinations of cables and probes to connect to an input module.

Temperature Measurement (Thermocouple Inputs)

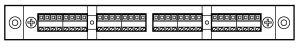
Input Module



8937 Voltage/Temp Unit

2 channels, 4 kS/s, 12-bit
Thermocouple Types: K, E, J, T, N, R, S, B

In addition to temperature, also supports voltage measurement.



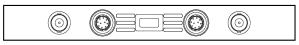
8958 16-Ch Scanner Unit

16 channels, 20 S/s, 16-bit
Thermocouple Types: K, E, J, T, N, R, S, B, W

In addition to temperature, also supports voltage measurement.

Current Measurement

Input Module



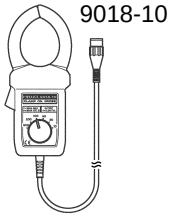
8940 F/V Unit

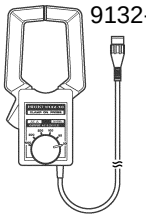
Current can be measured using a clamp.
2 channels, 1 MS/s, 12-bit, clamp input
In addition to current, also measures voltage, frequency, rotation rate, pulse totalization and duty cycle.

Input modules for voltage measurement (except the Model 8958 16-Ch Scanner Unit)

Refer to "Voltage Measurement" (⇒ p. 5) for input modules.
Measures in [Voltage] mode.

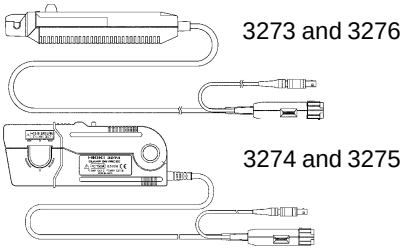
Clamps compatible with the above input modules.





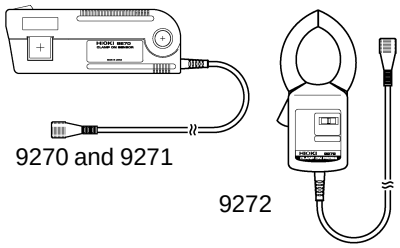
9018-10 Clamp-On Probe
9132-10 Clamp-On Probe*3

For AC
Outputs 0.2 V AC waveform of commercial power line current.
9018-10: 10 to 500 A, 40 Hz to 3 kHz
9132-10: 20 to 1000 A, 40 Hz to 1 kHz



3273 Clamp-On Probe *1
3273-50 Clamp-On Probe*1
3274 Clamp-On Probe *1
3275 Clamp-On Probe *1
3276 Clamp-On Probe *1

AC/DC
Supports high-accuracy observation over broad ranges from DC to MHz.
3273: 15 A, DC to 50 MHz
3273-50: 30 A*2, DC to 50 MHz
3274: 150 A, DC to 10 MHz
3275: 500 A, DC to 2 MHz
3276: 30 A, DC to 100 MHz



9270 Clamp-On Sensor *1, *3
9271 Clamp-On Sensor *1, *3
9272 Clamp-On Sensor *1, *3

For AC
Supports inverter secondary current measurement.
9270: 20 A, 5 Hz to 50 kHz
9271: 200 A, 5 Hz to 50 kHz
9272: 20/200 A, 5 Hz to 10 kHz

9277 Universal Clamp-On CT *1
9278 Universal Clamp-On CT *1
9279 Universal Clamp-On CT *1,*3

AC/DC
Low zero drift supports stable long-term measurements.
9277: 20 A, DC to 100 kHz
9278: 200 A, DC to 100 kHz
9279: 500 A, DC to 20 kHz

For users of the following legacy products:

- Model 9018 Clamp-On Probe
- Model 9132 Clamp-On Probe

Usable with this instrument by connecting the Model 9199 Conversion Adapter.

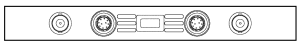
For measuring leakage current:

The Model 9657-10 Clamp-On Leak Sensor can also be used.

*1. Except for Models 9018-10 and 9132-10, a separate conversion cable or power supply is required when connecting to an input module. Refer to "1.3 List of Input Modules, Cables, Probes and Clamp Combinations" (⇒ p. 11) for details.
*2. Up to 15 A when combined with the Model 8940 F/V Unit.
*3. Not applicable to CE Marking

Frequency, Rotation Rate, Commercial Line Frequency (50/60 Hz), Pulse Count, Pulse Duty Measurement

Input Module

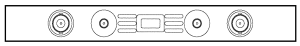


8940 F/V Unit

2 channels, 1 MS/s, 12-bit

- Frequency: can be measured from the input pulse corresponding to the measurement waveform.
- Rotation Rate: can be measured from the input pulse corresponding to the measurement waveform.
- 50/60 Hz: Frequencies near 50/60 Hz can be measured from the input pulse corresponding to the measurement waveform.
- Totalization: cumulative count of input pulses.
- Pulse Duty: measured as the percentage of High level of a single pulse waveform.

Acceleration Measurement



8947 Charge Unit

2 channels, 1 MS/s, 12-bit

- Electric Charge: can be measured using a voltage-output type acceleration pick-up sensor.
- Preamp: can be measured using an acceleration pick-up sensor with built-in preamp.

Also supports voltage measurement.

Electric Charge, Pressure, Torque, Displacement Measurement

Input Module

8939 Strain Unit

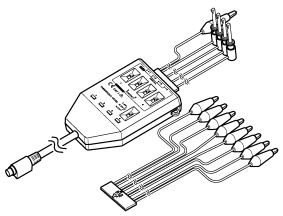
2 channels, 1 MS/s, 12-bit
Vibration and displacement can be measured using a strain gauge transducer. (conversion cable supplied)

8960 Strain Unit

2 channels, 200 kS/s, 16-bit
Vibration and displacement can be measured using a strain gauge transducer. Supports high-precision measurements. (Includes internal anti-aliasing filter.) (conversion cable supplied)

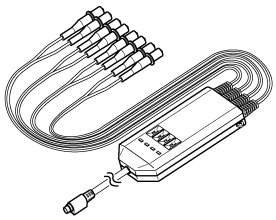
Logic Signal Measurement

Logic probes that can be connected to this instrument



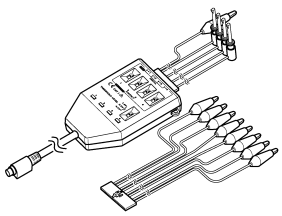
9320-01 Logic Probe

Measures digital signals and on/off switching of non-voltage contacts.



9321-01 Logic Probe

Detects the presence of AC and DC voltages. Measures activation timing of relay sequencing circuits.
Maximum input voltage: 250 Vrms (HIGH range)



9327 Logic Probe

Measures faster signals than the Model 9320-01 Logic Probe.

For users of the following legacy products:
Models 9306, 9307, 9320, 9321 Logic Probes
Usable with this instrument by connecting the Model 9323 Conversion Cable.

1.2 Input Module Usage List

Voltage Measurement

To Perform This Measurement		Recommended Input Module	Use to connect	Connection Procedure	Setting Procedure
Up to 400 V	Up to 2 channels per module	Model 8936 Analog Unit	Model 9197 Connection Cord (Up to 500 V) Model 9198 Connection Cord (Up to 300 V) Model 9217 Connection Cord (Up to 300 V)	(⇒ p. 17)	(⇒ p. 44)
	For faster sampling	Model 8956 Analog Unit		(⇒ p. 17)	(⇒ p. 44)
	To see high-precision voltage values	Model 8957 High Resolution Unit		(⇒ p. 17)	(⇒ p. 59)
	To perform FFT analysis	Model 8957 High Resolution Unit		(⇒ p. 17)	(⇒ p. 59)
		Model 8938 FFT Analog Unit		(⇒ p. 17)	(⇒ p. 48)
	To also see RMS voltage	Model 8959 DC/RMS Unit		(⇒ p. 28)	(⇒ p. 63)
Up to 30 Vrms or 60 V DC	For additional channels (four)	Model 8946 4-Ch Analog Unit		(⇒ p. 17)	(⇒ p. 44)
	To measure with high sensitivity (500 µV/div)	Model 8937 Voltage/ Temp Unit		(⇒ p. 18)	(⇒ p. 45)
		Model 8940 F/V Unit		(⇒ p. 21)	(⇒ p. 54)
		Model 8947 Charge Unit		(⇒ p. 24)	(⇒ p. 56)
Up to 40 V	When slow sampling is acceptable, but more channels desired	Model 8958 16-Ch Scanner Unit	Input Cable	(⇒ p. 26)	(⇒ p. 60)
When measured voltage exceeds the maximum input for the Input module	Up to 2000 V DC or 1000 V AC (depending on measurement site (⇒ p. 31))	Above Input Modules (except the Model 8958 16-Ch Scanner Unit)	Model 9322 Differential Probe *1	(⇒ p. 31)	(⇒ p. 75)
	Up to 1000 Vrms (@1 MHz max.)	Model 8936 Analog Unit Model 8956 Analog Unit Model 8957 High Resolution Unit Model 8938 FFT Analog Unit Model 8959 DC/RMS Unit	Model 9665 10:1 Probe *2	(⇒ p. 35)	(⇒ p. 75)
	Up to 5000 Vpeak (@1 MHz max.)		Model 9666 100:1 Probe *2	(⇒ p. 35)	(⇒ p. 75)

Overview of the above input modules (⇒ p. 5), description of cables (⇒ p. 6)
Procedures for settings unrelated to input channels are the same. Refer to the *Instruction Manual* for details.
*1. Voltage to ground complies with Model 9322 specifications. (⇒ p. 31)
*2. Voltage to ground complies with the specifications of the input module used. (⇒ p. 86)

Temperature Measurement

To Perform This Measurement	Recommended Input Module	Use to connect	Connection Procedure	Setting Procedure	Remarks
To measure temperature	Model 8937 Voltage/ Temp Unit	Thermocouple	(⇒ p. 18)	(⇒ p. 45)	Up to 2 channels can be measured per module.
To measure multi-channel temperature	Model 8958 16-Ch Scanner Unit	Thermocouple	(⇒ p. 26)	(⇒ p. 60)	Up to 16 channels can be measured per module.

Overview of the above input modules (⇒ p. 6)
Procedures for settings unrelated to input channels are the same. Refer to the *Instruction Manual* for details.

Current Measurement

To Perform This Measurement	Recommended Input Module	Use to connect	Connection Procedure	Setting Procedure	Remarks
To read current values directly without complicated settings such as scaling	Model 8940 F/V Unit	Models 3273/ 3273-50 Clamp-On Probe Models 9270 to 9272 Clamp-On Sensor Models 9277 to 9279 Universal Clamp-On CT	(⇒ p. 21) (⇒ p. 29)	(⇒ p. 50)	A conversion cable is required for connection (⇒ p. 11).
To measure using a voltage measurement module	Voltage Measurement Input Module	Models 9018-10/ 9132-10 Clamp-On Probe Models 3273 to 3276 Clamp-On Probe Models 9270 to 9272 Clamp-On Sensor Models 9277 to 9279 Universal Clamp-On CT	(⇒ p. 29)	Refer to the voltage measurement description for each module	Scaling is required. Depending on the clamp, a power supply or sensor unit may be required for connection (⇒ p. 11).

Overview of the above input modules (⇒ p. 7), about Clamps (⇒ p. 7)
Procedures for settings unrelated to input channels are the same. Refer to the *Instruction Manual* for details.

Other Measurements

To Perform This Measurement	Recommended Input Module	Use to connect	Connection Procedure	Setting Procedure
To measure electric charge, acceleration, pressure, torque or displacement using a strain sensor.	Model 8939 Strain Unit Model 8960 Strain Unit	Conversion Cable (supplied) Strain Gauge Transducer	(⇒ p. 20)	(⇒ p. 49)
To measure acceleration	Model 8947 Charge Unit	Piezoelectric Sensor	(⇒ p. 24)	(⇒ p. 57)
To measure frequency To measure pulse counts (totalization), pulse duty and similar values	Model 8940 F/V Unit	Models 9198 Connection Cord 9217 Connection Cord	(⇒ p. 21)	(⇒ p. 50)

Overview of the above input modules (⇒ p. 8)
Procedures for settings unrelated to input channels are the same. Refer to the *Instruction Manual* for details.

Logic Measurements

To Perform This Measurement	Recommended Probe	Connection Procedure	Setting Procedure
To measure digital signals and on/off switching of non-voltage contacts	Model 9320-01 Logic Probe	(⇒ p. 37), (⇒ p. 39)	(⇒ p. 79)
To measure larger signals than the above	Model 9327 Logic Probe	(⇒ p. 37), (⇒ p. 39)	
To measure the presence or absence of AC or DC voltage	Model 9321-01 Logic Probe	(⇒ p. 37), (⇒ p. 40)	

1.3 List of Input Modules, Cables, Probes and Clamp Combinations

O = Compatible, – = Incompatible, Δ = Compatible, but scaling required

Measurement Parameter	Use to connect		Input Module											
			8936	8937	8938	8939	8940	8946	8947	8956	8957	8958	8959	8960
Voltage	Connection Cables	9197	O	O *1	O	–	O *1	O *1	O *1	O	O	–	O	–
		9198	O	O	O	–	O	O	O	O	O	–	O	–
		9217	O	O	O	–	O	O	O	O	O	–	O	–
	Differential Probe	9322	O *3	O *3	O *3	–	O *2,*9	O *3	O *3	O *3	O *3	–	O *3	–
	Attenuating Probes	9665 9666	O	–	O	–	–	–	–	O	O	–	O	–
	Input Cable		–	–	–	–	–	–	–	–	–	O	–	–
RMS Values	Same as above		–	–	–	–	–	–	–	–	–	–	O	–
FFT Analysis (with AAF installed)	Same as above		–	–	O	–	–	–	O	–	O	–	–	–
Current	Clamp-On Sensors *8	9270 *10 9271 *10 9272 *10	Δ*6	Δ*6	Δ*6	–	O *4,*9	Δ*6	Δ*6	Δ*6	Δ*6	–	Δ*6	–
	Universal Clamp-On CTs *8	9277 9278 9279 *10	Δ*6	Δ*6	Δ*6	–	O *4,*9	Δ*6	Δ*6	Δ*6	Δ*6	–	Δ*6	–
	Clamp-On Probes *8	3273 3273-50	Δ*7	Δ*7	Δ*7	–	O *5,*9	Δ*7	Δ*7	Δ*7	Δ*7	–	Δ*7	–
		3274 3275 3276					Δ*7							
		9018-10	Δ	Δ	Δ	–	Δ	Δ	Δ	Δ	Δ	–	Δ	–
		9132-10*10	Δ	Δ	Δ	–	Δ	Δ	Δ	Δ	Δ	–	Δ	–
Acceleration	Piezoelectric Sensor		–	–	–	–	–	–	O	–	–	–	–	–
Temperature	Thermocouple		–	O	–	–	–	–	–	–	–	O	–	–
Frequency, Pulse Totalization, Pulse Duty	Connection Cable (Sensor)		–	–	–	–	O	–	–	–	–	–	–	–
Electric Charge, Acceleration, Pressure, Torque, Displacement	Strain Gauge Transducer		–	–	–	O	–	–	–	–	–	–	–	O

*1. Although compatible, the 9198 is recommended instead.
To connect to the input module, the following separate items are required:

*2. Model 9325 Power Cord , 9418-15 AC Adapter, or 9248 Power Cord (when using the Model 9687)

*3. Model 9418-15 AC Adapter or 9248 Power Cord (when using the Model 9687)

*4. Model 9318 Conversion Cable or 9555 Sensor Unit

*5. Model 9319 Conversion Cable, 3272 Power Supply, 3269 Power Supply, or 9687 Probe Power Unit

*6. Model 9555 Sensor Unit*9

*7. Model 3272 , 3269 Power Supply, or 9687 Probe Power Unit

*8. Set the instrument to [Voltage] measurement mode when using combinations that do not include the Model 8940, and with the combination of the 8940 and Model 9018-10 or 9132-10. (⇒ p. 54)

*9. Up to six units can be used with the 9325
Up to eight clamps can be used
When the 9325 and clamps are used at the same time, up to eight can be used

*10. Not applicable to CE Marking

About Scaling settings: Voltage acquired from the sensor is converted to the corresponding physical measurement units for display.

See "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

1.3 List of Input Modules, Cables, Probes and Clamp Combinations

Chapter 2 Connections

This chapter describes the installation and connection of input modules to the instrument. Refer to the *Quick Start Manual* for other connections.

Input modules for measurement (analog inputs)

1 Install the input module(s) in the instrument's input module compartment. (⇒ p. 14)

2 Connect the cables and sensors to the input module(s).

Connection items differ according to your application. Refer to the description of each input module.

- Model 8936 Analog Unit (⇒ p. 17)
- Model 8937 Voltage/Temp Unit (⇒ p. 18)
- Model 8938 FFT Analog Unit (⇒ p. 17)
- Model 8939 Strain Unit (⇒ p. 20)
- Model 8940 F/V Unit (⇒ p. 21)
- Model 8946 4-Ch Analog Unit (⇒ p. 17)
- Model 8947 Charge Unit (⇒ p. 24)
- Model 8956 Analog Unit (⇒ p. 17)
- Model 8957 High Resolution Unit (⇒ p. 17)
- Model 8958 16-Ch Scanner Unit (⇒ p. 26)
- Model 8959 DC/RMS Unit (⇒ p. 28)
- Model 8960 Strain Unit (⇒ p. 20)

Also refer to the following sections when measuring voltage and current:

- Using Connection Cables (⇒ p. 16) (Voltage measurement)
- Using Differential Probes (⇒ p. 31) (Voltage measurement)
- Using Attenuating Probes (⇒ p. 35) (Voltage measurement)
- Using Clamps (⇒ p. 29) (Current measurement)
- Supplying the power from the Model 9687 Probe Power Unit (⇒ p. 41)

3 After making connections, make instrument settings (⇒ p. 43).

This Guide describes only the procedures for setting the input channels of each input module.

Refer to the *Quick Start Manual* for an overview of all settings, and to the *Instruction Manual* for the details of each setting.

Measurements with logic probes (logic inputs)

1 Connect the logic probes to the LOGIC receptacles on the instrument (⇒ p. 37).

2 After connecting, perform settings on this instrument (⇒ p. 79).

2.1 Installing Input Modules (Adding or Replacing)

Input modules specified at the time the instrument is ordered are supplied preinstalled. Use the following procedures to add or replace input modules, or to remove them from the instrument.

WARNING

Preparations

- **To avoid electric shock accident, before removing or replacing an input module, confirm that the instrument is turned off and that the connection cords are disconnected.**
- **The mounting screws must be firmly tightened or the input module may not perform to specifications, or may even fail.**

When an input module is not used

- **To avoid the danger of electric shock, never operate the instrument with an input module removed. To use the instrument after removing an input module, install a blank panel over the opening of the removed module.**

CAUTION

To avoid damaging input modules, do not touch the input module connectors on this instrument.

NOTE

Using the Model 8958 16-Ch Scanner Unit

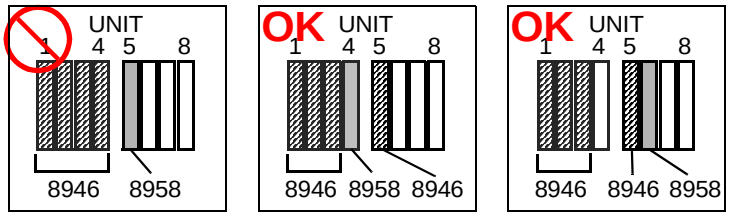
In the following cases, the Model 8958 must be adjusted before use with this instrument.

See "Scanner Unit Zero Position Adjustment" (⇒ p. 27)

- When installing the Model 8958 16-Ch Scanner Unit in this instrument
- When the zero position has shifted due to aging or environmental changes

When using the Model 8958 16-Ch Scanner Unit together with four Model 8946 4-Ch Analog Units at the same time, the 8946s cannot all be installed in UNIT locations 1 to 4 in the Model 8861.
In this case, no more than three 8946s can be installed in UNIT locations 1 to 4.

Installation examples (installing four Model 8946s, one 8958 and either additional input modules or blank panels)



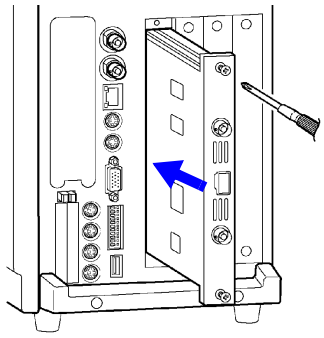
Adding an Input Module

Adding an input module does not affect the Sheet Settings screen.
To display waveforms from an added input module, select the corresponding display channel on the Sheet Settings screen. Even when waveform display is enabled ([On]), a waveform is not displayed unless it has been enabled for display on the Sheet Settings screen.

See "7.2.6 Assigning Display Channels to Graphs (Analog Channels)" in the *Instruction Manual*

Installing an input module

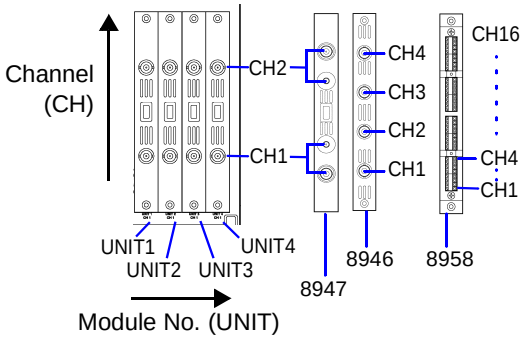
Right Side



Required item: One Phillips-head screwdriver

1. Turn the instrument's POWER switch Off.
2. With attention to the orientation of the input module, insert it firmly all the way in.
   Make certain that the labels on the input module's panel face the same direction as the labels on the right side of the instrument.
3. Using the Phillips screwdriver, tighten the two input module mounting screws.

Input Module Compartment



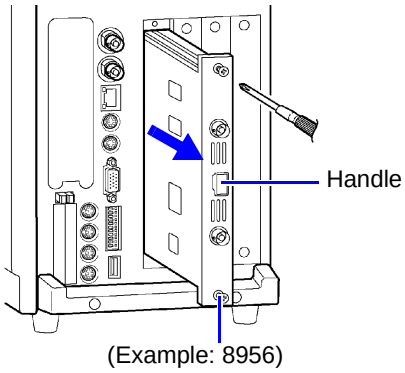
Channel Configuration

When the instrument is positioned vertically as illustrated, module number one is at the left, and channel number one is at the bottom.

Information about the input modules installed in the instrument can be verified on the initial screen that appears when power is turned on, and in the [Config] menu on the System screen.

Removing an input module

Right Side

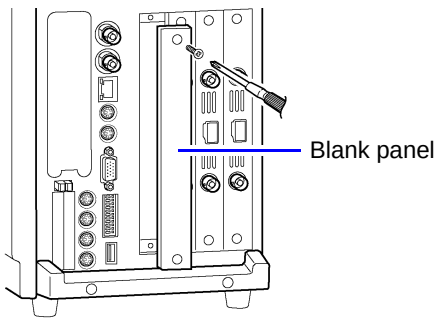


Required item: One Phillips-head screwdriver

1. Turn the instrument's POWER switch Off.
2. Remove any cables or thermocouples connected to the input module.
3. Remove the power cord.
4. Using the Phillips screwdriver, loosen the two input module mounting screws.
5. Grasp the handle and pull the module out.
   If the input module has no handle, pull it out by grasping the connectors.

If not installing another input module after removal

Right Side



Install a blank panel.
Using the Phillips screwdriver, tighten the two mounting screws.

Measurements made without a blank panel installed may fail to meet specifications because of temperature instability within the instrument.

2.2 Connecting the Cables

2.2.1 Connection Preparations

Read the following carefully before making connections.

For voltage measurement

DANGER

About maximum input ratings of input modules and cables

- **The maximum input voltage is the lesser rating of either the input module or the cable to be used. Do not measure if this voltage would be exceeded, as damage the instrument or a serious accident may result.**
  Example: When connecting the Model 9197 Connection Cord (500 Vmax) to the Model 8936 Analog Unit (400 Vmax), the maximum input voltage for measurement is 400 V DC.
  For details of maximum input voltages, refer to "1.1 Product Overview" (⇒ p. 5) and "Chapter 5 Specifications" (⇒ p. 83).
- **When connecting clip-type test leads to live terminals, be very careful to avoid accidentally shorting conductors together and causing a serious accident.**
- **When measuring voltage in a power line, connection cables should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **Do not permanently connect the device in an environment where voltage surges exceeding the maximum input voltage may occur. Failure to observe this precaution could result in damage to the device and personal injury.**

WARNING

- **Do not use cables other than those specified by Hioki. The specified cables include insulated BNC plugs to avoid electric shock. An uninsulated BNC plug may cause electric shock or damage to the BNC jack.**
- **Do not connect a cable to the instrument while it is connected to the object to be measured. Otherwise, an electric shock accident may occur.**

NOTE

Use only the specified connection cords. Using a non-specified cable may result in incorrect measurements due to poor connection or other reasons.

Using cables with BNC connectors

CAUTION

When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.

When using the Model 8958 16-Ch Scanner Unit together with other input modules

NOTE

Do not attempt to measure the same signal with the 8958 and another input module at the same time. Channel switching noise from the 8958 may affect the other input module.

2.2.2 Connecting to an Analog Unit (Models 8936, 8938, 8946, 8956 and 8957)

Be sure to read "2.2.1 Connection Preparations" (⇒ p. 16) before connecting.

Input modules

- Model 8936 Analog Unit
- Model 8956 Analog Unit
- Model 8946 4-Ch Analog Unit *1
- Model 8938 FFT Analog Unit
- Model 8957 High Resolution Unit

Maximum Input Voltage (⇒ p. 4)

*1. Use Model 9198 Connection Cords for the Model 8946 4-Ch Analog Unit.
*2. Incompatible with the Model 8946 4-Ch Analog Unit.
*3. The Model 9418-15 AC Adapter option is required for connection (⇒ p. 33).

Any of the following connects to a BNC jack on an input module.

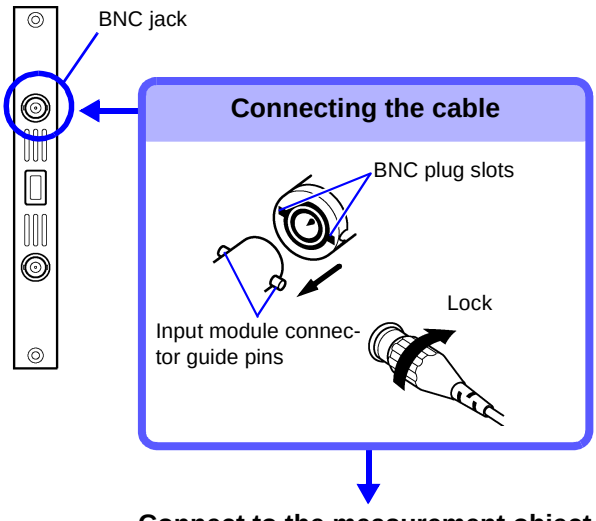
• Model 9197 Connection Cord	Maximum input voltage: 500 V (large alligator clips)
• Model 9198 Connection Cord	Maximum input voltage: 300 V (small alligator clips)
• Model 9217 Connection Cord	Maximum input voltage: 300 V (for BNC output)

If the voltage to be measured exceeds the maximum input rating of the input module being used:

- Model 9665 10:1 Probe*2 (⇒ p. 35)
- Model 9666 100:1 Probe*2 (⇒ p. 35)
- Model 9322 Differential Probe*3 (⇒ p. 31)

Connection Procedure

Example: Model 8936 Analog Unit



Required item: One of the above cables

1 Connect the BNC plug on the cable to a BNC jack on the input module.
Align the slots in the BNC plug with the guide pins on the jack on the input module, then push and twist the plug clockwise until it locks.

2 Connect the cable clips to the measurement object.

Disconnecting BNC connectors
Push the BNC plug, twist it counterclockwise, and pull it out.

2.2.3 Connecting to the Model 8937 Voltage/Temp Unit

For voltage measurement, be sure to read "2.2.1 Connection Preparations" (⇒ p. 16) before connecting.

Input module
Model 8937 Voltage/Temp Unit

Maximum Input Voltage (⇒ p. 4)

∗ The Model 9418-15 AC Adapter option is required for connection (⇒ p. 33).

Voltage Measurement:

Any of the following connects to a BNC jack on an input module.

• Model 9198 Connection Cord	Maximum input voltage: 300 V (small alligator clips)
• Model 9217 Connection Cord	Maximum input voltage: 300 V (for BNC output)

If the voltage to be measured exceeds the maximum input rating of the input module being used:

- Model 9322 Differential Probe(⇒ p. 31) *

Temperature Measurement:

Connect the thermocouple to the terminal block.
(Recommended cables (⇒ p. 19))

About Connections and Inputs

⚠CAUTION

The ground (GND) sides of the voltage and temperature inputs for each channel are common. Do not connect and apply both voltage and temperature inputs at the same time. The measurement object could be damaged.
Voltage and temperature cannot both be measured simultaneously on one channel.

When measuring temperature

⚠WARNING

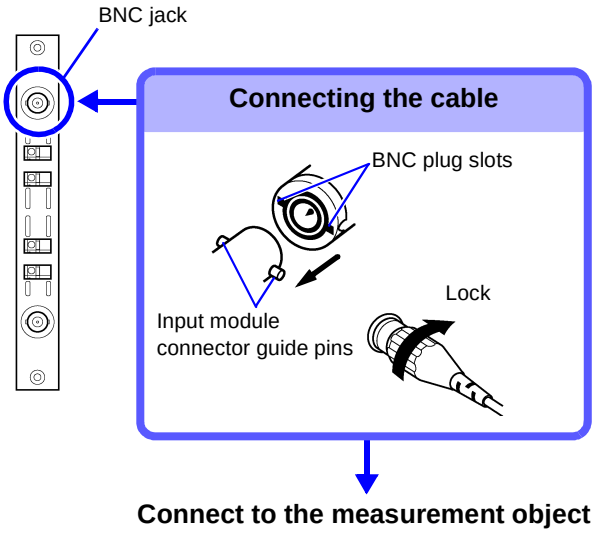
Observe the following to avoid electric shock.

- **When measuring temperature with an uninsulated thermocouple at a point that has a non-zero electric potential, be careful to avoid touching the input module's terminal block. The terminals may have voltage present.**
- **The voltage and temperature inputs are electrically isolated from one another.**

NOTE

- The push-button terminals on the Model 8937 Voltage/Temp Unit are for thermocouples only. Do not connect anything except a specified thermocouple (type K, J, E, T, N, R, S or B).
- Use a tool (screwdriver) to connect and disconnect thermocouples.
- Confirm the polarity of a thermocouple before connection. Correct values are not displayed if the thermocouple is connected with reverse polarity.

Connection Procedure: Voltage Measurement



Required item: Connection cord

1 Connect the BNC plug on the cable to a BNC jack on the input module.

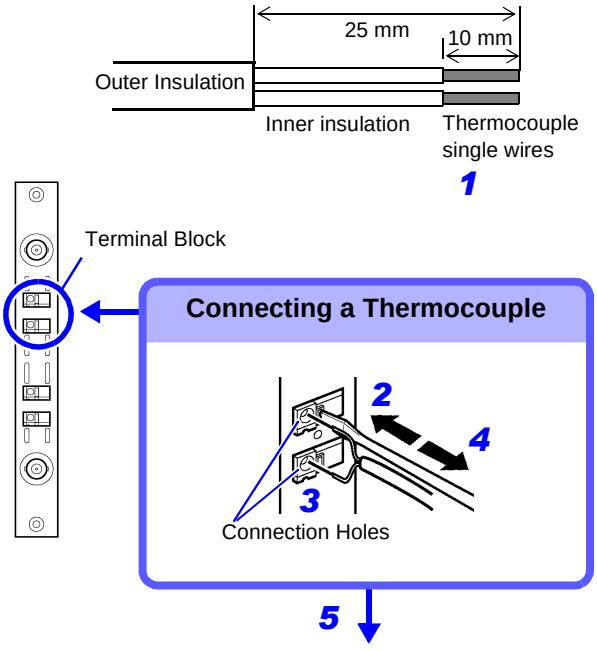
Align the slots in the BNC plug with the guide pins on the jack on the input module, then push and twist the plug clockwise until it locks.

2 Connect the cable clips to the measurement object.

Disconnecting BNC connectors

Push the BNC plug, twist it counterclockwise, and pull it out.

Connection Procedure: Temperature Measurement



Required item:
Thermocouple, flat-blade screwdriver (2.6-mm blade)

Recommended wire:
Compatible wire: Single-strand thermocouple wire, 0.4 to 1.2-mm diameter
Stripping length: 10 mm

1 Strip insulation from the thermocouple wires as shown at the left.

Stripping length: approx. 10 mm

2 Push the blade of a flat screwdriver into the button on the terminal block of the input module.

3 Insert each thermocouple wire into the appropriate terminal hole while pressing the button.
Confirm proper polarity.

4 Release the button.
The thermocouple is connected.

5 Attach to the measurement object.

To remove the thermocouple

Hold the button while pulling the thermocouple wire out.

2.2.4 Connecting to a Strain Unit (Models 8939 and 8960)

Input module
Model 8939 Strain Unit
(conversion cable supplied)

Maximum Input Voltage (⇒ p. 4)

Connect the strain gauge converter* to the input module jack.
(Depending on the sensor, the supplied conversion cable may be needed.)
A bridge box* is required for measurement using a strain gauge.*

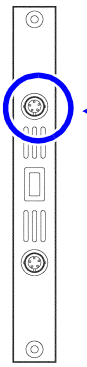
* The strain gauge converter, strain gauge and bridge box may be common types available in the market.

⚠CAUTION

When using a conversion cable
- Do not connect a sensor other than the Model 8939 Strain Unit to the supplied conversion cable.
- When removing the conversion cable, be sure to release the lock before pulling the plug out.

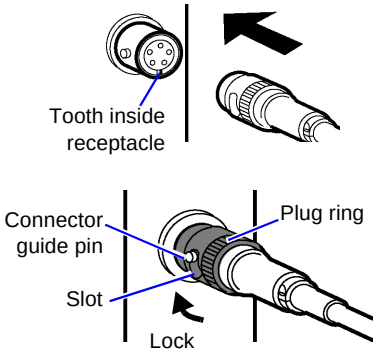
Connection Procedure: Vibration and displacement measurement

Example: Connecting the strain gauge converter with the supplied conversion cable



1

Connecting the Conversion Cable



2

Connect to the Strain Gauge Converter

3

Connect to the measurement object

The grounds of the instrument and the Connector Shell of the 8960 are not isolated.

Required item:
Conversion Cable (supplied), Strain Gauge Converter

1 Connect the supplied conversion cable to a receptacle on the input module.
Align the tooth on the inside of the receptacle with the slot in the conversion cable plug, and insert the plug. Insert it all the way to the end of the slot in the plug ring (shaded part in the illustration at the left). When inserted, twist the ring clockwise to lock.

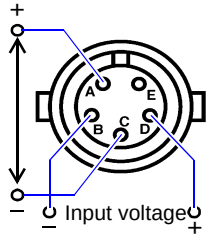
2 Connect the strain gauge transducer to the conversion cable.

3 Attach to the measurement object.

To remove the conversion cable
Push and twist the plug ring counterclockwise to unlock it, then pull the plug out.

Connector Pinout

Bridge voltage
8939:
2 V is supplied.
8960:
Selectable
(2 V/ 5 V/ 10 V)



2.2.5 Connecting to the Model 8940 F/V Unit

For voltage measurement, be sure to read "2.2.1 Connection Preparations" (⇒ p. 16) before connecting.
For current measurement, read also "2.3 Connecting Clamps" (⇒ p. 29).

Input module
Model 8940 F/V Unit

Maximum Input Voltage (⇒ p. 4)

*1. The optional Model 9325 Power Cord , Model 9418-15 AC Adapter, or Model 9248 Power Cord (when using the Model 9687) is required for connection. (⇒ p. 32)

The following items are required to connect a clamp.

*2. Any of the following models:
9319 Conversion Cable, the 3272 or 3269 Power Supply, or Model 9248 Power Cord (when using the Model 9687)

*3. The Model 3272 or 3269 Power Supply or Model 9248 Power Cord (when using the Model 9687)

*4. The Model 9318 Conversion Cable or the Model 9555 Sensor Unit

*5. When the Models 8940 and 3273-50 are used together, the input rating of the 3273-50 is 15 Arms.

Frequency, Pulse Totalization and Duty, and Voltage Measurement:

Any of the following connects to a BNC jack on an input module.

• Model 9197 Connection Cord	Maximum input voltage: 500 V (large alligator clips)
• Model 9198 Connection Cord	Maximum input voltage: 300 V (small alligator clips)
• Model 9217 Connection Cord	Maximum input voltage: 300 V (for BNC output)

If the voltage to be measured exceeds the maximum input rating of the input module being used:

- Model 9322 Differential Probe*1 (⇒ p. 31)

Current Measurement:

Connect to the BNC and sensor jacks on the input module.

(The connection procedure depends on the clamp being used.)

- Model 3273 or 3273-50*5Clamp-On Probe*2
- Model 3274, 3275, or 3276 Clamp-On Probe*3
- Model 9270, 9271, or 9272 Clamp-On Sensor*4
- Model 9277, 9278, or 9279 Universal Clamp-On CT*4

When measuring current

DANGER

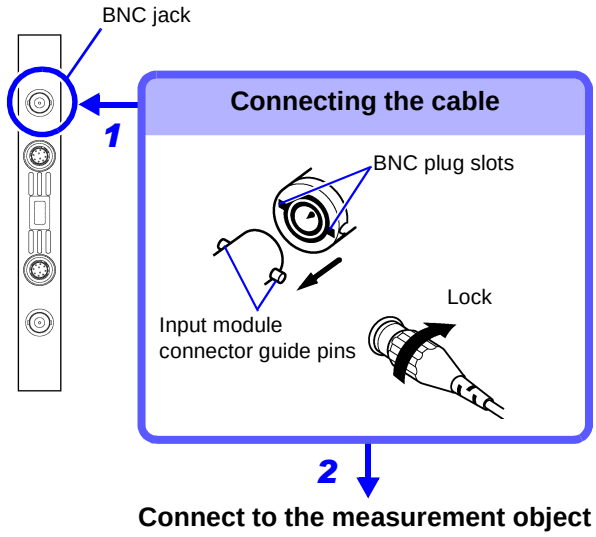
- **Connect the clamp using the Model 9318 or 9319 Conversion Cable**
  The grounds of this instrument and the clamp are not isolated. Pay careful attention to the connections to avoid damage to the equipment and serious injury.
- **When using the Model 3273 or 3273-50 Clamp-On Probe**
  To avoid short circuits and serious injury when opening the sensor jaws to measure, if the voltage on the conductor to be measured may exceed safe voltage up to 300 V, the conductor should be well-insulated (with 1400 V AC withstand voltage), comply with overvoltage category I, pollution level 2 and have double (strength) insulation rated for 300 V operation. To maintain safety, do not clamp over bare conductors. The core and shield cover are not insulated.
- **To avoid electric shock when using a clamp, be careful not to damage the insulation on conductors being measured.**

See below for the standards defining the underlined terms.
IEC61010-1 (JIS C1010-1)
IEC61010-2-031 (JIS C1010-2-31)
IEC61010-2-032 (JIS C1010-2-32)

For information about other clamps, see "2.3 Connecting Clamps" (⇒ p. 29).

⚠WARNING **To maintain safety, always use the optional Model 9318 or 9319 Conversion Cables when using one of theses clamp models: 3273, 3273-50, 9270 – 9272 or 9277 – 9279.**

Connection Procedure: Frequency, Pulse Totalization and Duty, and Voltage Measurement



Required item: Connection Cables

1 Connect the BNC plug on the cable to a BNC jack on the input module.
Align the slots in the BNC plug with the guide pins on the jack on the input module, then push and twist the plug clockwise until it locks.

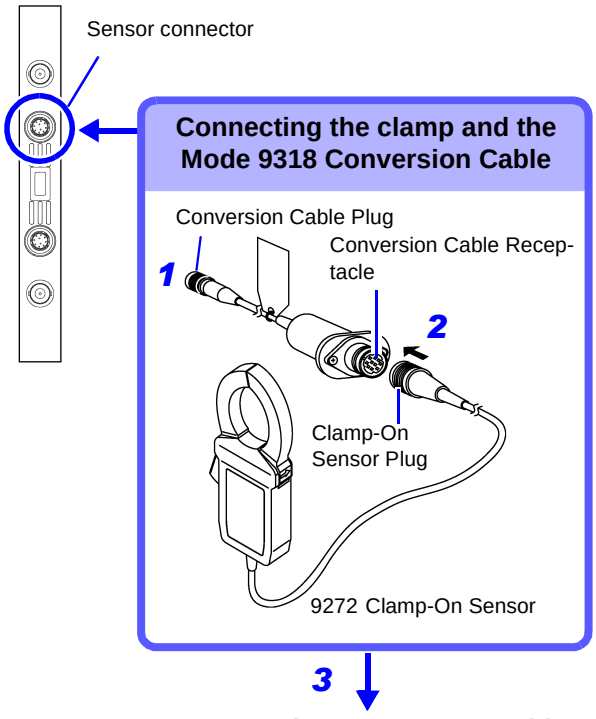
2 Connect the cable clips to the measurement object.

Disconnecting BNC connectors
Push the BNC plug, twist it counterclockwise, and pull it out.

Connection Procedure: Current measurement (with Model 9318 Conversion Cable)

(for Model 9270 to 9272 Clamp-On Sensors and Model 9277 to 9279 Universal Clamp-On CTs)

Example: When connecting the Model 9272 Clamp-On Sensor



Required item:
Model 9318 Conversion Cable and 9272 Clamp-On Sensor

1 Align the slot in the conversion cable plug with the sensor receptacle on the input module, then insert and twist the plug until it locks.

2 Align the slot in the sensor cable plug with the conversion cable receptacle, then insert and twist the plug until it locks.

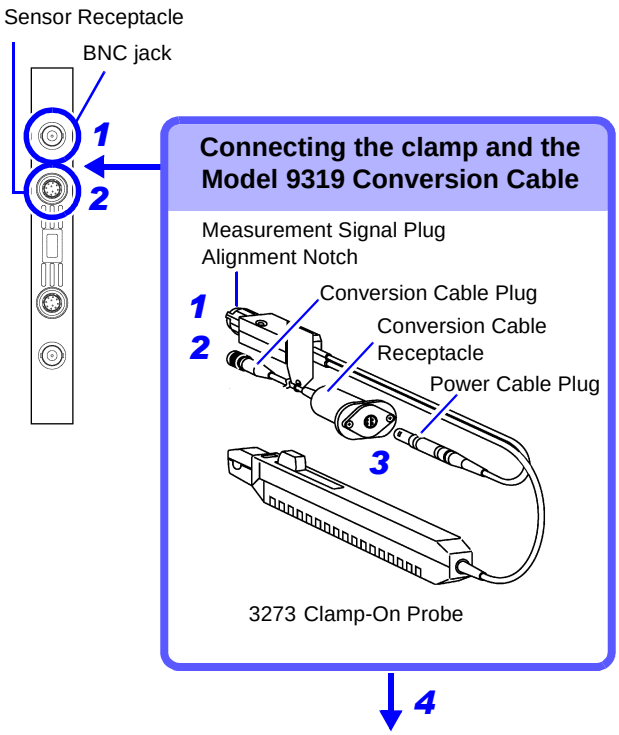
3 Clamp the sensor around the measurement object.

To remove the conversion cable
Push and twist the plug to unlock it, then pull it out.

Connection Procedure: Current measurement (with Model 9319 Conversion Cable)

(for Model 3273 or 3273-50Clamp-On Probe)

Example: When using the Model 3273 Clamp-On Probe



Required item:
Models 9319 Conversion Cable and 3273 Clamp-On Probe

1 Align the slots in the clamp-on probe plug with the pins on the input module's BNC jack, press and twist.

2 Align the groove in the conversion cable plug with the sensor receptacle on the input module, then insert and twist the plug until it locks.

3 Align the groove in the probe's power cable plug with the conversion cable receptacle, and mate the connectors.

4 Clamp the sensor around the measurement object.

To remove the conversion cable

Push and twist the plug to unlock it, then pull it out.

2.2.6 Connecting to the Model 8947 Charge Unit

Before measuring voltage and connecting to the BNC jack, be sure to read "2.2.1 Connection Preparations" (⇒ p. 16).

Input module
Model 8947 Charge Unit

Maximum Input Voltage (⇒ p. 4)

*1. A commercially available acceleration sensor can be used.
*2. For voltage measurement, the connection procedure is described in "2.2.2 Connecting to an Analog Unit (Models 8936, 8938, 8946, 8956 and 8957)" (⇒ p. 17).

Measurement using a piezoelectric acceleration sensor:
Connect to the BNC jack or miniature receptacle (according to the particular sensor).

- Preamplified acceleration sensor *1
  (BNC connector, 2-mA, 15-V power supply)
- Charge-output type piezoelectric acceleration sensor *1
  (Miniature #10-32 connector)

Voltage measurement*2:
Connect to the BNC jack on an input module.
Model 9198 Connection Cord (recommended)

Connection Preparations

⚠WARNING

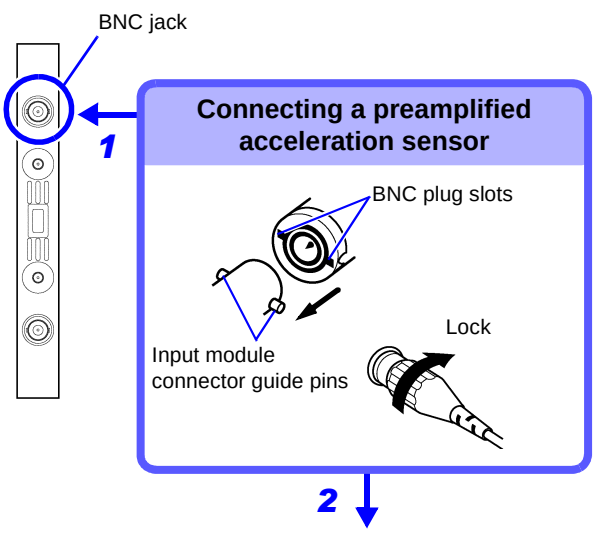
- **Never connect the cable to the instrument while connected to a measurement object. An electric shock could result.**
- **The BNC jack for each channel and the miniature receptacles all share common ground. To avoid short circuits, do not connect to two receptacles at the same time.**
- **To avoid electric shock or damage to the measurement object, turn the instrument off while connecting a sensor or probe to the BNC jack. When the [Preamp] measurement mode is selected, internal power (15 V @ 2 mA) is applied to the BNC jack when measurement starts.**

⚠CAUTION

About preamplified acceleration sensors

The sensor should be compatible with the specification (15 V @ 2 mA) of the Model 8947 Charge Unit. Incompatible sensors are likely to be damaged.

Connection Procedure: Using a preamplified acceleration sensor



Required item:
Preamplified acceleration sensor

1 Connect the BNC plug from the sensor to a BNC jack on the input module.

Align the slots in the BNC plug with the guide pins on the jack on the input module, then push and twist the plug clockwise until it locks.

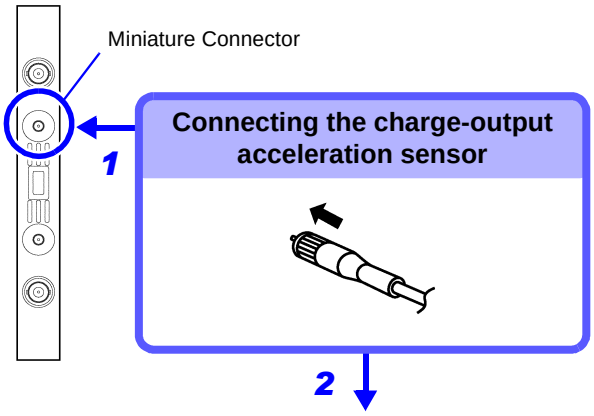
2 Connect the sensor to the measurement object.

Disconnecting BNC connectors

Push the BNC plug, twist it counterclockwise, and pull it out.

When using a sensor/preamp that has no BNC plug
Use an adapter or conversion cable to connect to the BNC jack.

Connection Procedure: Using a charge-output acceleration sensor



Required item:
Charge-output acceleration sensor

1 Connect the miniature plug from the charge-output acceleration sensor to the receptacle on the input module, and twist the plug clockwise until tight.

2 Connect the sensor to the measurement object.

To disconnect the miniature connector, twist the plug counterclockwise and pull it out.

With a charge-output sensor that does not have a (#10-32) miniature connector
Use an adapter or conversion cable to connect to the miniature connector.

2.2.7 Connecting to the Model 8958 16-Ch Scanner Unit

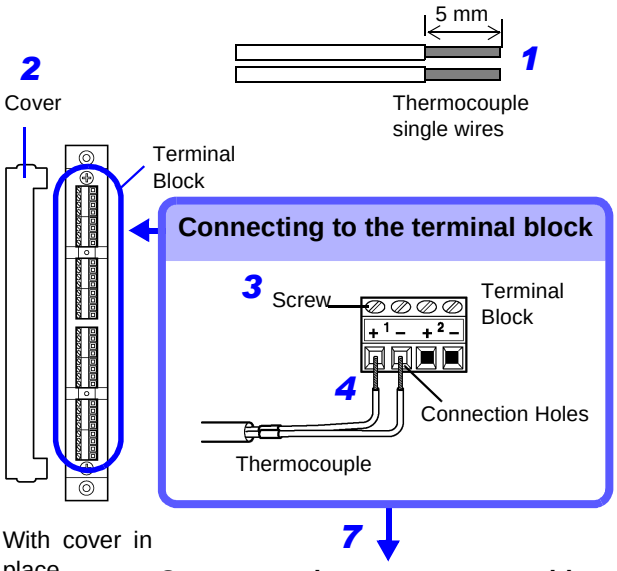
Input module
Model 8958 16-Ch Scanner Unit

Maximum Input Voltage (⇒ p. 4)

Connect to the terminal block on the input module.
Temperature Measurement: Thermocouple
Voltage Measurement: Input Cable
Recommended cables: Solid 0.14 to 1.5 mm^2
Stranded 0.14 to 1 mm^2
16 to 26 AWG

Connection Procedure (for both temperature and voltage measurements)

Example: Connecting a thermocouple for temperature measurement (the connection procedure is the same for voltage measurement)



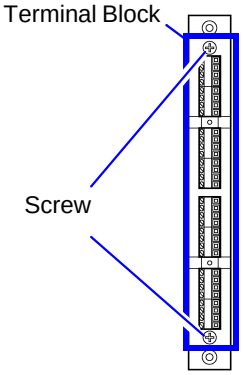
Connect to the measurement object

To remove the thermocouple
Loosen the screws on the terminal block and pull the wires out.

Required item:
Thermocouple, flat-bladed screwdriver (supplied)

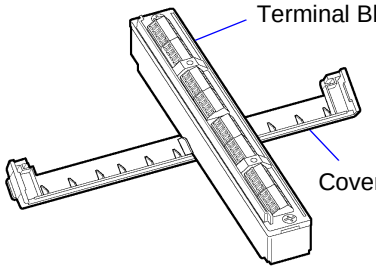
1. Strip back the insulation from the thermocouple wires as shown at the left.
   Stripping length: approx. 5 mm
2. Remove the terminal block cover from the input module.
3. Loosen the screws in the input module's terminal block using the screwdriver.
4. Insert the thermocouple wires into the connection holes.
   Confirm proper polarity.
5. Tighten the screws in the terminal block using the screwdriver to affix the thermocouple leads.
6. Replace the terminal block cover.
7. Attach the thermocouple to the measurement object.

If difficulties are encountered connecting input cables or thermocouples



The terminal block can be detached from the Model 8958 16-Ch Scanner Unit.

How to detach:
Loosen the screws at the top and bottom of the terminal block (left illustration).
When attaching, be careful not to overtighten the screws.

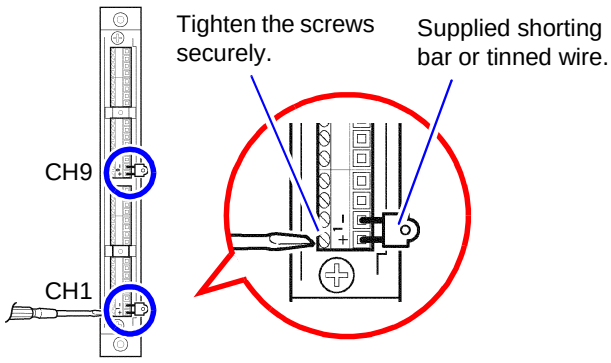


Turn the cover over and place the terminal block on it as shown above for stability while making connections.

Scanner Unit Zero Position Adjustment

The zero position of the Model 8958 16-Ch Scanner Unit needs to be adjusted in the following cases. If the adjustment is not performed, the accuracy specification may not be satisfied.
Allow one hour warm-up after turning power on before adjusting.

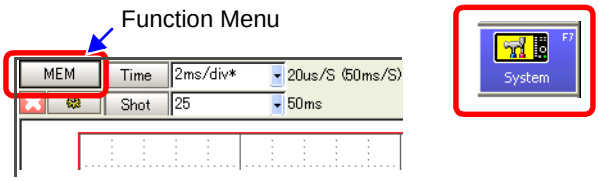
- When the Model 8958 16-Ch Scanner Unit has just been installed in the instrument (a message requesting adjustment appears when the instrument is turned on)
- When the zero position has shifted due to aging or environmental changes



1 Short the + and – terminals of channels 1 and 9 on the Model 8958 16-Ch Scanner Unit to be adjusted.

Opening Screen

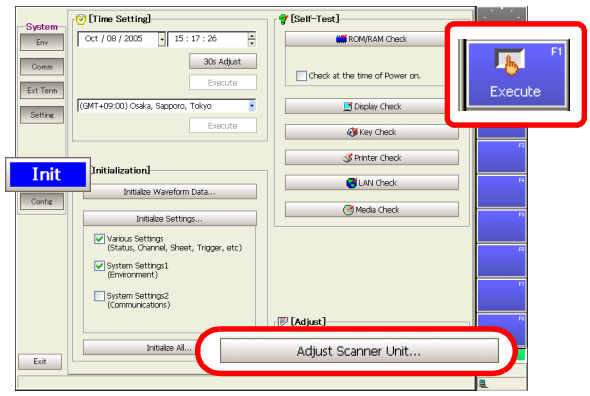
2 Press **F7** [System] on the Opening screen, or place the cursor on the Function menu of the Waveform or Settings screen, and press the **F7** [System] key.



Waveform or Settings Screen

The System screen appears.

3 Press the **SUB MENU** keys to select the [Init] menu item.

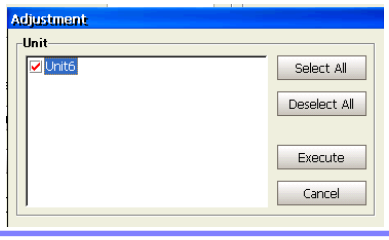


Init Settings Screen

The Initialization (Init) Settings screen appears.

4 Using the **CURSOR** keys, place the cursor on the [Adjust Scanner Unit] button, and press the **F1** [Execute] key.

The Adjustment dialog box appears.



5 Select the module to be adjusted, and press the **F7** [Execute] key.
To cancel, press the **F8** [Cancel] key.

A processing message appears when executed, and the 8958 16-Ch Scanner Unit is adjusted.

Adjustment is complete when “Completed normally” appears.

2.2.8 Connecting to the Model 8959 DC/RMS Unit

Be sure to read "2.2.1 Connection Preparations" (⇒ p. 16) before connecting.

Input module
Model 8959 DC/RMS Unit

Maximum Input Voltage (⇒ p. 4)

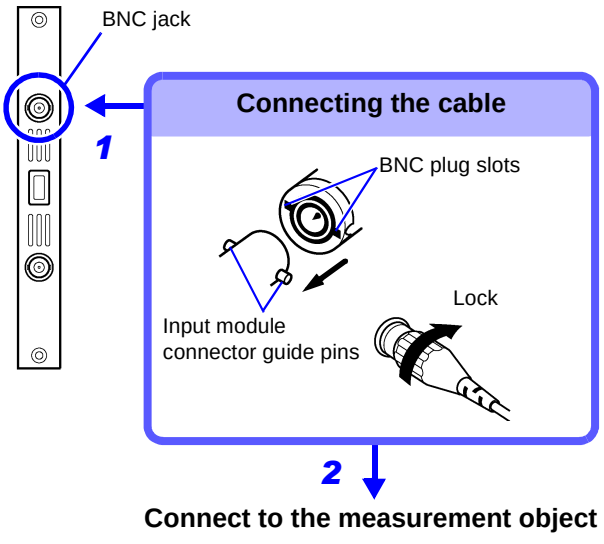
*1. The Model 9418-15 AC Adapter option is required for connection (⇒ p. 33).

Any of the following connects to a BNC jack on an input module.

• Model 9197 Connection Cord	Maximum input voltage: 500 V (large alligator clips)
• Model 9198 Connection Cord	Maximum input voltage: 300 V (small alligator clips)
• Model 9217 Connection Cord	Maximum input voltage: 300 V (for BNC output)

If the voltage to be measured exceeds the maximum input rating of the input module being used:
- Model 9665 10:1 Probe (⇒ p. 35)
- Model 9666 100:1 Probe (⇒ p. 35)
- Model 9322 Differential Probe*1 (⇒ p. 31)

Connection Procedure



Required item: One of the above cables

1 Connect the BNC plug on the cable to a BNC jack on the input module.

Align the slots in the BNC plug with the guide pins on the jack on the input module, then push and twist the plug clockwise until it locks.

2 Connect the cable clips to the measurement object.

Disconnecting BNC connectors

Push the BNC plug, twist it counterclockwise, and pull it out.

2.3 Connecting Clamps

Because it measures only voltage input, current is not measured directly by this instrument.
Use a clamp that provides voltage output for current measurement.
Refer to "1.3 List of Input Modules, Cables, Probes and Clamp Combinations" (⇒ p. 11) for compatible combinations of Hioki clamps and input modules.
Refer also to the clamp's *Instruction Manual* for clamp-specific details.

Preparations for Using Clamps

DANGER

Connect the clamp-on sensors to the instrument first, and then to the active lines to be measured. Observe the following to avoid electric shock and short circuits.

- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than the maximum rated voltage, or over bare conductors.**
- **Clamps should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **When the clamp sensor is opened, do not allow the metal part of the clamp to touch any exposed metal, or to short between two lines, and do not use over bare conductors.**

WARNING

To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.

CAUTION

- To prevent damage to the instrument and clamp, never connect or disconnect a sensor while the power is on, or while the sensor is clamped around a conductor.
- Be careful to avoid dropping the clamps or otherwise subjecting them to mechanical shock, which could damage the mating surfaces of the core and adversely affect measurement.

NOTE

- Measurements are affected by the combined accuracy of this instrument and the clamp.
- The measured value is displayed as voltage [V], although this can be converted for display as current [A] using the Scaling function.

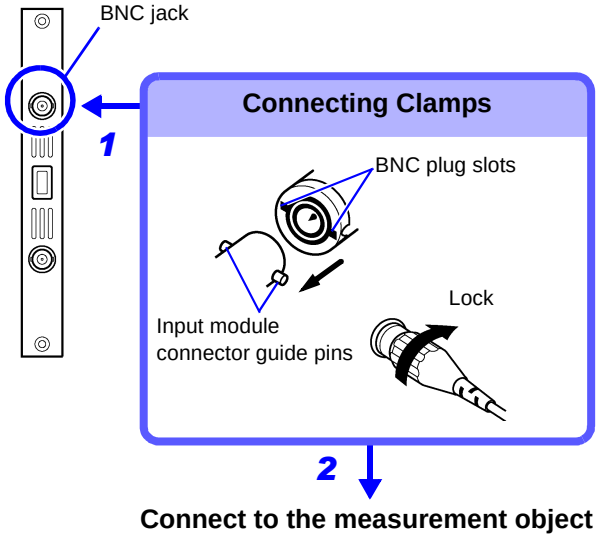
  See "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*
- In the following cases, scaling setup is necessary:
  (1) When using a clamp with a voltage measurement input module other than the Model 8940 F/V Unit
  (2) When connecting a clamp to the Model 8940 F/V Unit without the Model 9318 or 9319 Conversion Cable

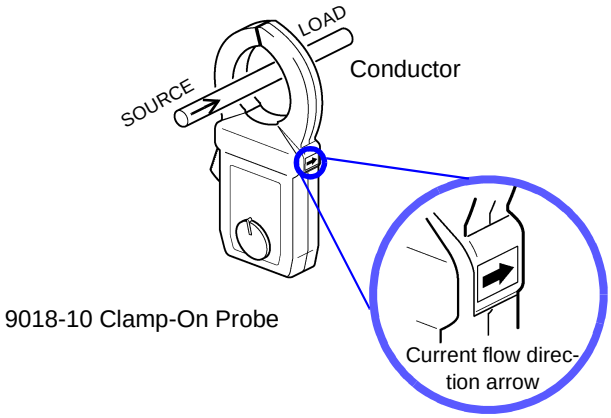
  For details about connecting clamps to the Model 8940 F/V UNIT:

  See "2.2.5 Connecting to the Model 8940 F/V Unit" (⇒ p. 21).

Connection Procedure

Example: Connecting the Model 9018-10 Clamp-On Probe to the 8936 Analog Unit



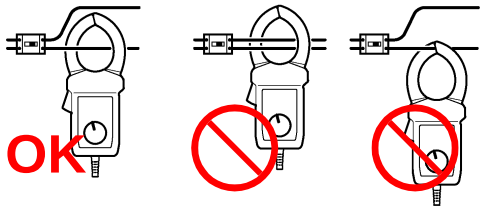


Required item:
9018-10 Clamp-On Probe

1 Connect the probe to a BNC jack on the input module.

2 Clamp the sensor around the measurement object.

Disconnecting BNC connectors
Push the BNC plug, twist it counterclockwise, and pull it out.



Attach the clamp around only one conductor. Single-phase (2-wire) or three-phase (3-wire) cables clamped together will not produce any reading.

The arrows on the clamp indicating the direction of current flow should point toward the load side.

For connection details, refer to "2.2.5 Connecting to the Model 8940 F/V Unit" (⇒ p. 21).

2.4 Connecting a Differential Probe

Input modules that are compatible with the Model 9322 Differential Probe:

- Model 8940 F/V Unit*1
- Voltage measurement input modules other than the Model 8940 *2

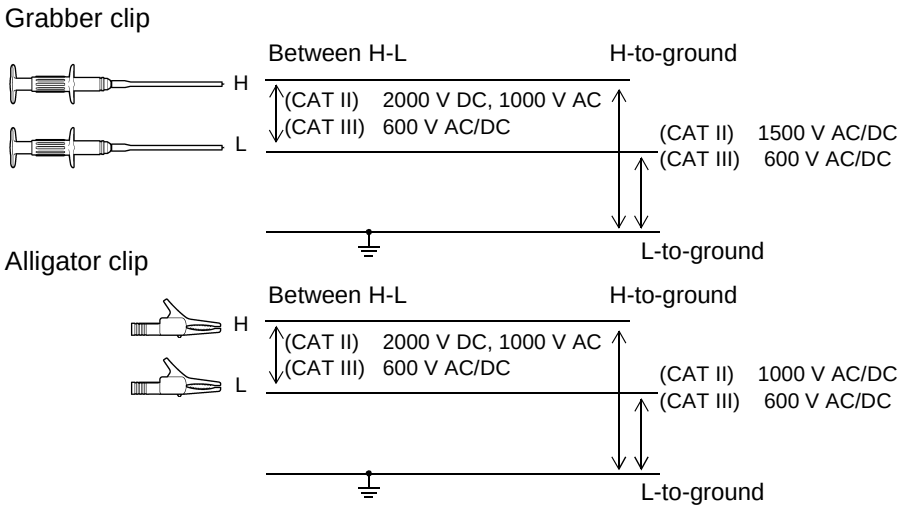
*1. The Model 9325 Power Cord or Model 9418-15 AC Adapter is required for connection.
*2. The Model 9418-15 AC Adapter is required for connection.

Refer to the instruction manual for the 9322 Differential Probe.

DANGER

Note the following maximum input voltage and maximum rated voltage to earth. If their voltages are exceeded, this device will be damaged and personal injury will result. Therefore, do not perform measurement in this case.

- **Maximum input voltage**
  (CAT II) 2000 V DC, 1000 V AC, (CAT III) 600 V AC/DC
- **Maximum rated voltage to earth**
  When using the Grabber clip:
  (CAT II) 1500 V AC/DC, (CAT III) 600 V AC/DC
  When using the Alligator clip:
  (CAT II) 1000 V AC/DC, (CAT III) 600 V AC/DC

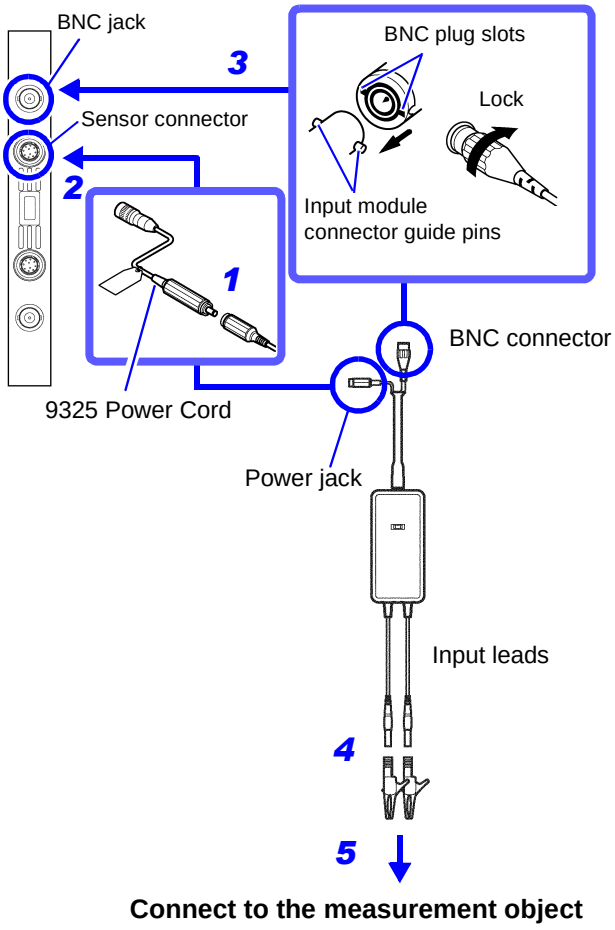


When using an input module other than the Model 8940 F/V Unit

WARNING

- **Turn the instrument off before connecting the AC adapter to the 9322 and to AC power.**
- **Use only the specified Model 9418-15 AC Adapter (SA130A-1225V-S, SINO AMERICAN). AC adapter input voltage range is 100 to 240 VAC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the instrument, do not apply voltage outside of this range.**

Connection Procedure: When connecting to the Model 8940 F/V Unit (using the 9325 Power Cord)



Required item:
Model 9322 Differential Probe and 9325 Power Cord

1. Connect the power cord to the power jack on the probe.
2. Connect the other end of the power cord to the sensor receptacle on the 8940 F/V Unit
3. Connect the BNC plug on the probe to a BNC jack on the input module.
4. Connect an alligator clip or grabber clip to the input lead of the probe.
5. Attach to the measurement object.

Disconnecting BNC connectors

Push the BNC plug, twist it counterclockwise, and pull it out.

Set the [Probe] selection on the Channel Setting screen to [9322+9325].

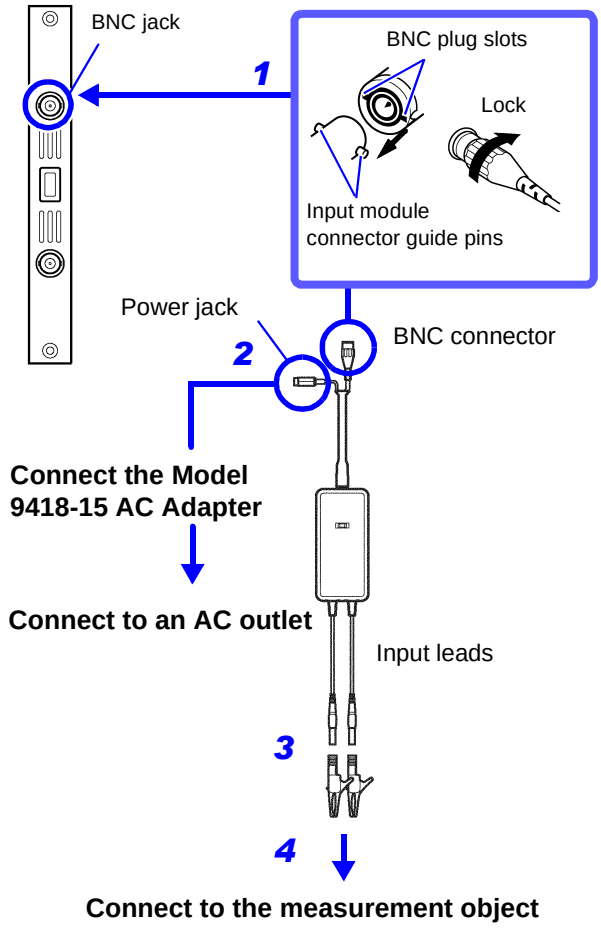
When connecting to the Model 8940 F/V Unit (using the 9418-15 AC Adapter)

Refer to "Connection Procedure: Measuring voltage with the input module (using the Model 9418-15 AC Adapter)" (⇒ p. 33) for connection details.

Set the [Probe] selection on the Channel Setting screen to [9322+9418].

Connection Procedure: Measuring voltage with the input module (using the Model 9418-15 AC Adapter)

Example: Connecting to the Model 8936 Analog Unit



Required item:
9322 Differential Probe and 9418-15 AC Adapter

1 Connect the BNC plug on the probe to a BNC jack on the input module.

2 Connect the AC adapter to the power jack on the probe, and plug it into an AC outlet.

3 Connect an alligator clip or grabber clip to the input lead of the probe.

4 Connect to the measurement object.

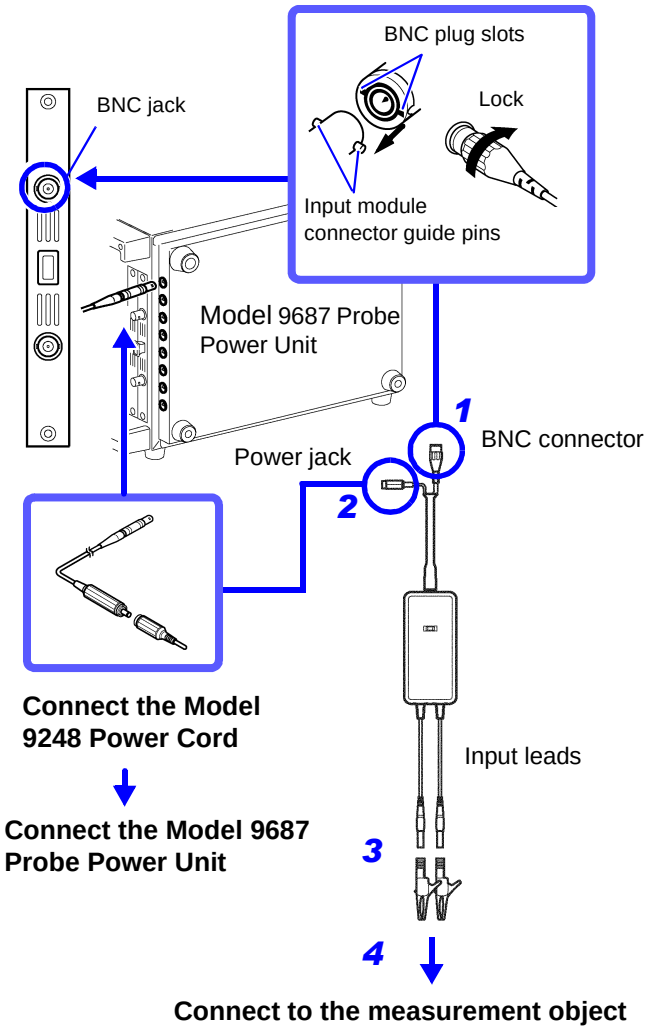
Disconnecting BNC connectors

Push the BNC plug, twist it counterclockwise, and pull it out.

Set the [Probe] selection on the Channel Setting screen to [1000:1].

Connection Procedure: Supplying power from the Model 9687 Probe Power Unit (Using the Model 9248 Power Cord)

Example: Connecting to the Model 8936 Analog Unit



Required item:
Model 9322 Differential Probe and Model 9248 Power Cord

1. Connect the BNC plug on the probe to a BNC jack on the input module.
2. Connect the Model 9248 Power Cord to the power jack on the probe, and plug it into the Model 9687 Probe Power Unit.
3. Connect an alligator clip or grabber clip to the input lead of the probe.
4. Connect to the measurement object.

Disconnecting BNC connectors

Push the BNC plug, twist it counterclockwise, and pull it out.

Set the [Probe] selection on the Channel Setting screen to [1000:1].

When using the Model 8940, select [9322+9325] or [9322+9418]. Either setting is acceptable.

2.5 Connecting Attenuating Probes

The Model 9665 10:1 Probe and 9666 100:1 Probe can be connected to the following input modules:

- Model 8936 Analog Unit
- Model 8938 FFT Analog Unit
- Model 8956 Analog Unit
- Model 8957 High Resolution Unit
- Model 8959 DC/RMS Unit

Refer to the probe's instruction manual for details.

DANGER

Note the following maximum input voltage and maximum rated voltage to earth. If their voltages are exceeded, this device will be damaged and personal injury will result. Therefore, do not perform measurement in this case.
The measurement category (overvoltage category) must correspond with that of the input module being used.

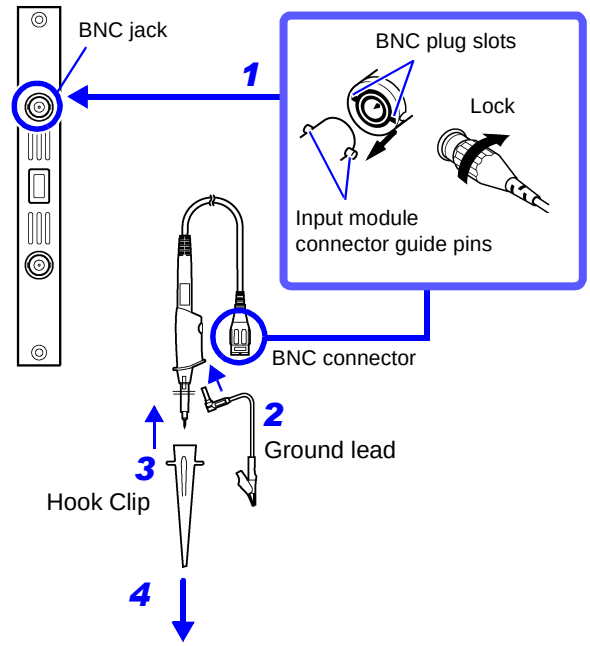
- **Maximum input voltage**
  Model 9665 10:1 Probe 1000 Vrms (1 MHz max)
  Model 9666 100:1 Probe 5000 Vpeak (1 MHz max)
- **Maximum rated voltage to earth**
  The maximum rated voltage to ground of the input module being used

NOTE

Calibrate the attenuating probe before measurement.
Procedure: "Calibration" (⇒ p. 36)

Connection Procedure

Example: Connecting the Model 9665 10:1 Probe to the 8936 Analog Unit

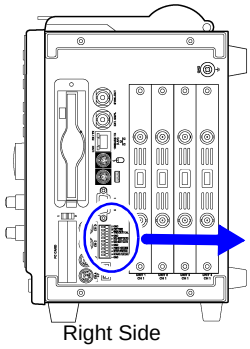


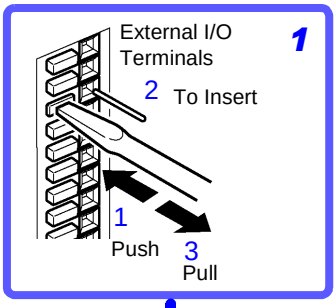
Required item: 9665 10:1 Probe

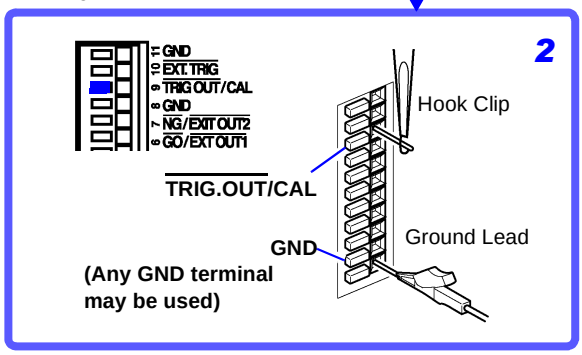
1. Connect the BNC plug on the probe to a BNC jack on the input module.
2. Connect the ground lead to the probe.
3. Connect the hook clip to the probe.
4. Connect to the measurement object.

Disconnecting BNC connectors
Push the BNC plug, twist it counterclockwise, and pull it out.

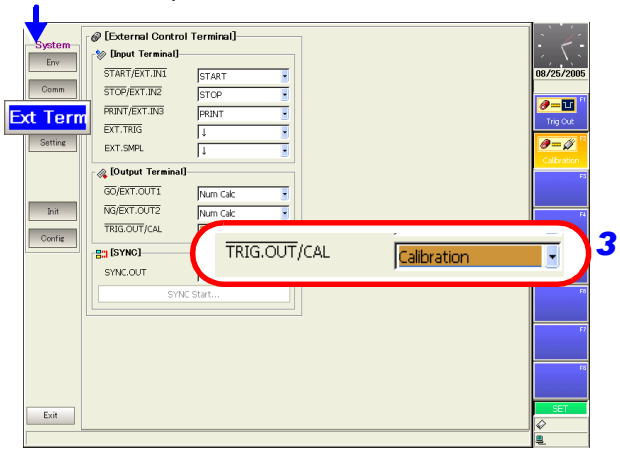
Calibration



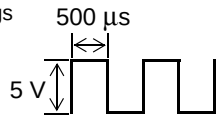


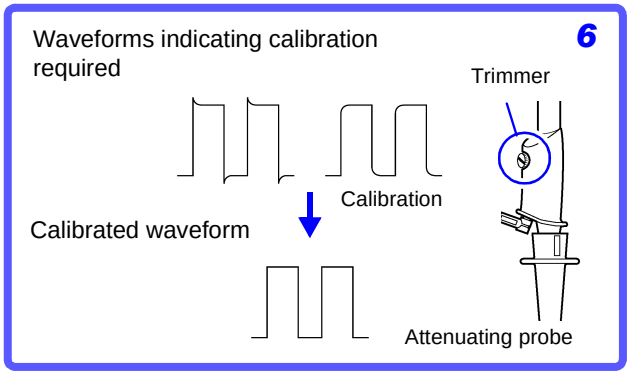


Press the **DISP** key, and the **F7** [System] key.
The System screen appears.
Press the **SUB MENU** keys to select the [Ext Term] (External terminal) menu.



Ext Term Settings Screen





Required item:
Flat-blade screwdriver (2.6-mm blade)
Connect the probe between the TRIG.OUT/CAL and GND external I/O terminals using metal pins or two short leads
Metal pin example: Mac8
- DH-4-20 pin for surface mounting
- Terminal for hybrid ICs
  CD-5-20, CF-1-15 and CA-7-3

(Attenuating probes do not connect directly to the external I/O terminals.)

1 Connect the metal pins or lead wires to the TRIG.OUT/CAL and GND I/O terminals.

While pressing the terminal button with the screwdriver, insert the metal pin or lead wire. Removing the screwdriver affixes the pin or wire.

2 Connect the hook clip of the probe to the metal pin or lead wire in the TRIG.OUT/CAL terminal, and the ground lead to the GND terminal.

3 Select the [Ext Term] menu from the System screen, and select [Calibration] for the [TRIG.OUT/CAL] setting.

4 Select the following for each settings screen.

Settings Screen	Setting Item	Settings
Status	Timebase	100µS/div
	Shot (recording length)	25 div
Channel	Range	1V/div
Trigger	Trigger Mode	Repeat
[Analog] page	Type	Level
	Level	2.5V
	Slope	↑

5 Press the instrument's **START** key to begin recording.

A 1-kHz, 5-V square wave is displayed and output at the terminals.

6 Adjust the trimmer on the probe to obtain the proper waveform on the screen.

2.6 Connecting Logic Probes

Up to four logic probes can be connected to the LOGIC receptacles on the right side of the instrument.
Each logic probe provides four logic input channels, so up to 16 logic waveforms can be recorded.

The following logic probes are supported:

- Model 9327 Logic Probe
- Model 9321-01 Logic Probe
- Model 9320-01 Logic Probe

Refer to the instruction manual supplied with the logic probe for specific details.

NOTE

Do not connect logic probes other than those supplied by Hioki to the logic inputs.

For users of the following legacy models:

Models: 9306, 9307, 9320 and 9321

These can be used with this instrument by connecting the Model 9323 Conversion Cable.

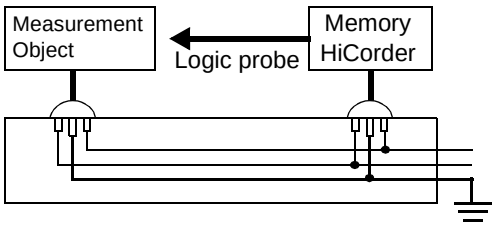
Before connecting a logic probe to the measurement object

DANGER

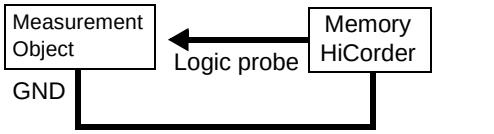
To avoid electric shock and short circuit accidents or damage to the instrument, pay attention to the following:

- **The ground pin in the LOGIC connector (plug) of the Model 9320-01 and 9327 Logic Probes (and legacy Models 9306 and 9320) is not isolated from this instrument's ground (common ground).**
  Use grounding-type polarized power cords for the measurement object and this instrument, and obtain power from the same mains circuit.
  Connecting to different mains circuits or using a non-grounding power cord may cause damage to the measurement object or this instrument because of current flow through the logic probes resulting from potential difference between the grounds of the different wiring systems.
  To avoid these problems, we recommend the following connection procedure:

Connect this instrument to the same outlet as the measurement object using the (supplied) grounding polarized power cord.



Connect the measurement object's ground to the GND terminal of this instrument. (Always obtain power from the same mains circuit.)



About Functional Earth:

Functional Earth Terminals

See "3.5 Grounding the Instrument's Functional Earth" in the *Quick Start Manual*

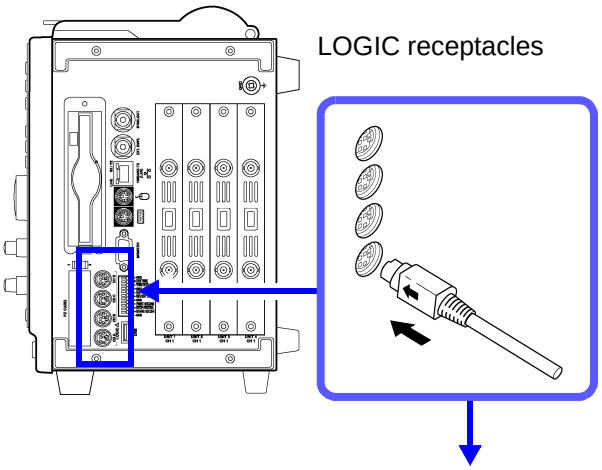
DANGER

- **Maximum logic probe input voltages are as follows. Do not measure if the maximum voltage would be exceeded, as damage the instrument or personal injury may result.**
  Model 9327 Logic Probe: +50 VDC
  Model 9320-01 Logic Probe: +50 VDC
  Model 9321-01 Logic Probe: 250 Vrms (HIGH range), 150 Vrms (LOW range)
- **Do not allow the metal tip of a logic probe to cause a short between conductors on the measurement object. Never touch the metal tip of a probe.**

Connection Procedure

Example: Connecting the Model 9327 Logic Probe

Right Side



Required item:
Model 9327 Logic Probe

1. Connect the logic probe by aligning the groves on the plug and a LOGIC receptacle.
2. Connect to the measurement object.

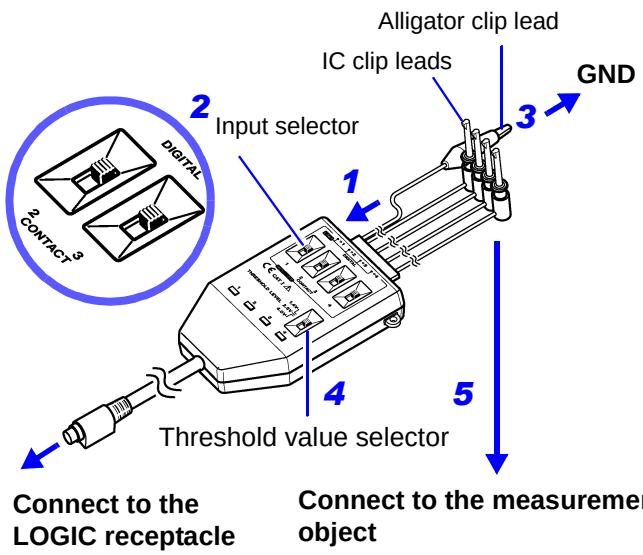
See "Logic Probe Usage Procedures" (⇒ p. 39)

NOTE

When a logic probe is not connected, the corresponding logic waveform appears at HIGH level on the waveform screen.

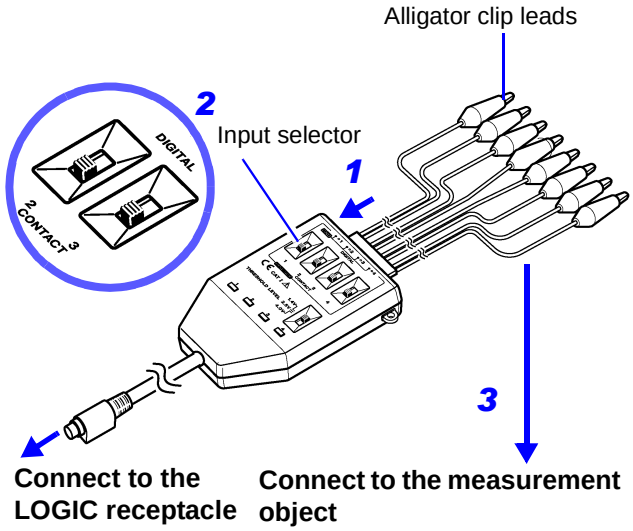
Logic Probe Usage Procedures

Using Model 9327 and 9320-01 Logic Probes



When measuring digital signals (Digital input)

1. Connect the IC clip leads to the logic probe.
2. Set the input selector to DIGITAL.
3. Connect the alligator clip to the circuit ground.
4. Use the threshold value selector to select the threshold value.
5. Connect the IC clips to the measurement object.



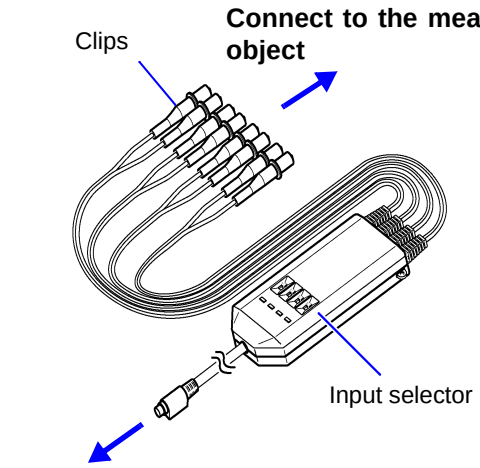
When measuring the contact signal (Contact input)

1. Connect the Alligator clip leads to the logic probe.
2. Set the input selector to CONTACT.
3. Connect the alligator clips to the measurement object.

Range Table

Range	Digital input (Threshold value)	Contact input (Detecting resistance value)	
1.4 V	1.4 V±0.3 V	more than 1.5 kΩ less than 500Ω	opened (Output L) shorted (Output H)
2.5 V	2.5 V±0.4 V	more than 3.5 kΩ less than 1.5 kΩ	opened (Output L) shorted (Output H)
4.0 V	4.0 V±0.5 V	more than 2.5 kΩ less than 8 kΩ	opened (Output L) shorted (Output H)

Using the Model 9321-01 Logic Probe



1 Set the input selector in accordance with the measured voltage.
LOW range: On/off for 100 VAC and 24 VDC, etc.
HIGH range: On/off for 200 VAC, etc.

2 Connect the clips to the measurement object.

The number of channels	4 (Isolated between channels and the instrument)	
Range	LOW	HIGH
Input resistance	30 kΩ min	100 kΩ min
Sensitivity Output: L Output: H	 0 to 10 VAC ±(0 to 15) VDC 60 to 150 VAC ±(20 to 150) VDC	 0 to 30 VAC ±(0 to 43) VDC 170 to 250 VAC ±(70 to 250) VDC
Response time ↑ ↓	Less than 1 ms Less than 3 ms with 100 VDC	Less than 1 ms Less than 3 ms with 200 VDC
Maximum input voltage	150 V rms	250 V rms
Maximum rated voltage to earth	250 V rms	
Dielectric strength	(between unit and channels, between channels)	
Insulation resistance	More than 100 MΩ / 500 VDC (between unit and channels, between channels)	

For other models, refer to the specifications (⇒ p. 84).

NOTE

- Inputs are non-polarized, so polarity can be disregarded.
- Inputs are isolated, so each channel can be connected to a point of independent potential.
- This instrument detects absolute values, so DC of either polarity can be input.
- AC voltage is evaluated as a 50/60 Hz standard sine wave.

2.7 Supplying power from the Model 9687 Probe Power Unit

The optional Model 9687 Probe Power Unit can be used to supply power to our optional clamp-on and differential probes.

Probe models compatible with the Model 9687 Probe Power Unit

- 3273, 3273-50, 3274, 3275, 3276 Clamp-On Probes
- 9322 Differential Probe (using Model 9248 Power Cord)

⚠CAUTION

The power output connectors on the Model 9687 are especially designed for our clamp-on and differential probes. To avoid damage, do not use the power supply for any purpose other than supplying power.

NOTE

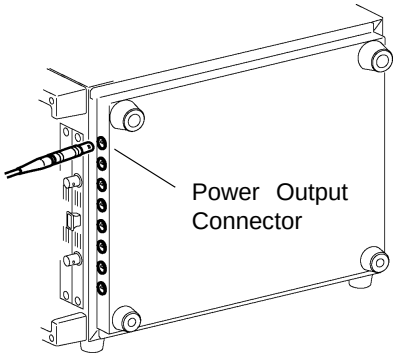
There are limits to how many probes can be used with a single Model 8860 or 8861 with a 9687 installed.
Avoid exceeding the quantities in the following table for all probes to be used. When mixing probe types, the lower quantity of usable probes applies.

Probe	Usable Quantity
3273 Clamp-On Probe	8
3273-50, 3274, 3276 Clamp-On Probe	6
3275 Clamp-On Probe	5
9322 Differential Probe	8

9687 Probe Power Unit Specifications
Accuracy is specified at 23±5°C 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
Weight	Adds approx. 570 g (20.1 oz.) to the weight of Models 8860/ 8861
Supported Models	Model 8860 Serial Nos. 051040422 and above Model 8861 Serial Nos. 051040432 and above

Connections



Connect the power cables from the probes to the output connectors of the Model 9687 Probe Power Unit.

2.7 Supplying power from the Model 9687 Probe Power Unit

Input Channel Settings

Chapter 3

After turning power on, set the measurement criteria before measuring.
This chapter describes the input channel setting procedures for each input module.
Refer to "3.10 About Setting Contents" (⇒ p. 64) for details of each setting.
Refer to the *Instruction Manual* for other settings.

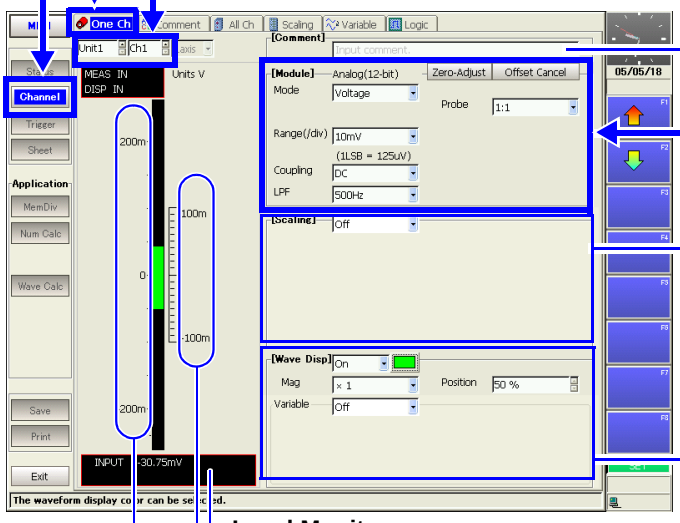
Make settings on the Channel Settings screen.

1 Press the **SET** key.

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

3 Press the **SHEET/PAGE** keys to select the [One Ch] page.

4 Use the **CURSOR** keys to move among the setting items, and press the **F1** to **F8** keys to select a setting.



Select the module and channel number to be set.

Comments can be entered for each channel.

See "5.2 Adding Comments" in the *Instruction Manual*

Set up the input channel.
Display appearance depends on the particular input module. Refer to the description of each module.

Set the scaling if you want to convert the measured units for display.

Measured values (output voltage) from sensors can be converted to physical values appropriate to the measurement object.

See "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

Measurement Range
Indicates the selected range.

Level Monitor
Shows the input level while making settings.

See "5.3 Monitoring Input Status" in the *Instruction Manual*

The display color of acquired waveforms, zero position, vertical magnification and display range can be changed.

See "7.1 Making Input Waveform Display Settings (Analog Waveforms)" in the *Instruction Manual*

Displayed Range
Indicates the range displayed on the screen. To change the display position or range, change the waveform display settings.

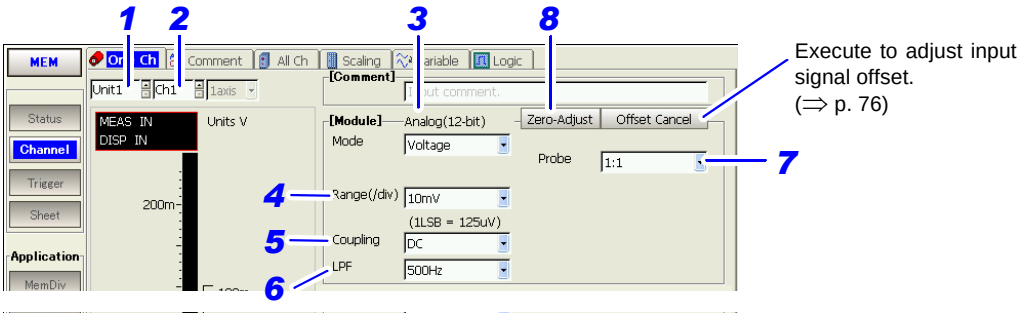
3.1 Analog Unit Settings (Models 8936, 8946 and 8956)

Set the input channel for voltage measurement when using the following input modules:

- Model 8936 Analog Unit
- Model 8956 Analog Unit
- Model 8946 4-Ch Analog Unit

([One Ch] Page of Channel Setting Screen)

Example: Setting a channel on the Model 8936 Analog Unit



Setting Procedure

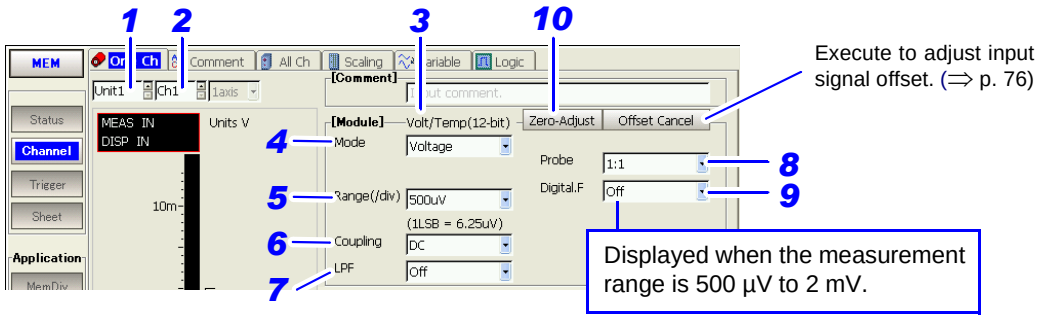
Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the input module and measurement mode**	[Module]	Confirm the type of the selected module. • Model 8936 Analog Unit..... [Analog] • Model 8956 Analog Unit..... [H-Speed] • Model 8946 4-Ch Analog Unit ..... [4CH]
		[Mode]	Confirm that the display is set for [Voltage].
4	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 86).
5	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
6	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]** (in the Model 8936 case)
7	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1 , 100:1 or 1000:1]**
8	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least 30 minutes after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.2 Model 8937 Voltage and Temperature Unit Settings

3.2.1 Voltage Measurement

([One Ch] Page of Channel Setting Screen)



Setting Procedure

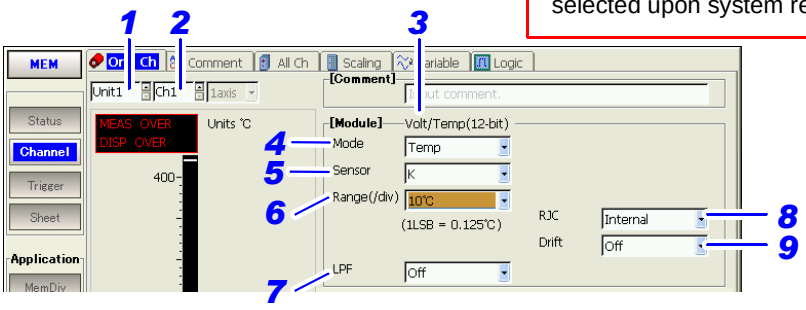
Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [Volt/Temp].
4	**Select the measurement mode**	[Mode]	Select [Voltage].
5	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 88).
6	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
7	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
8	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1 or 1000:1]**
9	**Set the digital filter**	[Digital F]	(Effective measurement ranges: 500 µV to 2 mV) Set the digital filter function to be enabled or disabled. Set it to ON to suppress noise components (⇒ p. 67). **[Off or On]**
10	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least one hour after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.2.2 Temperature Measurement

([One Ch] Page of Channel Setting Screen)

The [Voltage] measurement mode is selected upon system reset.



Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

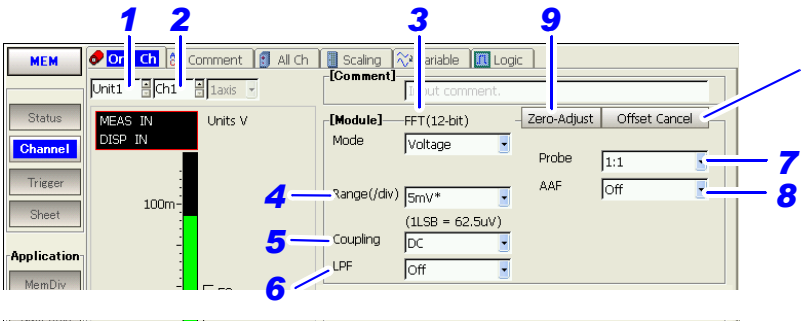
Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [Volt/Temp].
4	**Select the measurement mode**	[Mode]	Select [Temp].
5	**Select thermocouple**	[Sensor]	Select the type of thermocouple (⇒ p. 68). **[K, J, E, T, N, R, S or B]**
6	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). **[10, 20, 50 or 100°C/div]**
7	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz or 500Hz]**
8	**Set the reference junction compensation**	[RJC]	Select whether reference junction compensation should be provided internally (⇒ p. 68). **[Internal or External]**
9	**Set drift correction**	[Drift]	Set whether to cancel variations in the reference voltage. Set this On to improve the temperature characteristic (⇒ p. 69). **[Off or On]**
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

NOTE

- The upper and lower limits of measurement input depend on the measurement range.
  Refer to "About Measurement Range, Upper and Lower Input Limits and the Waveform Display:" (⇒ p. 64).
- When the input terminals of the Model 8937 Voltage/Temp Unit are exposed to strong drafts:
  Loss of thermal equilibrium of the input section may result in measurement errors. To measure in such environments, reposition the equipment so that the input terminals are protected from the drafts.
- When the ambient temperature changes rapidly:
  Loss of thermal equilibrium may result in measurement errors. If this occurs, allow about an hour for the equipment to acclimatize to the new temperature, then take measurements after thermal equilibrium is achieved.
- In an environment with fluctuating ambient temperature, when recording for a long time using a thermocouple with weak thermoelectromotive force (R, S or B sensors):
  Temperature characteristic can be improved by setting drift correction On.
- The [Voltage] measurement mode is selected upon system reset.

3.3 Model 8938 FFT Analog Unit Settings

([One Ch] Page of Channel Setting Screen)



Execute to adjust input signal offset. (⇒ p. 76)

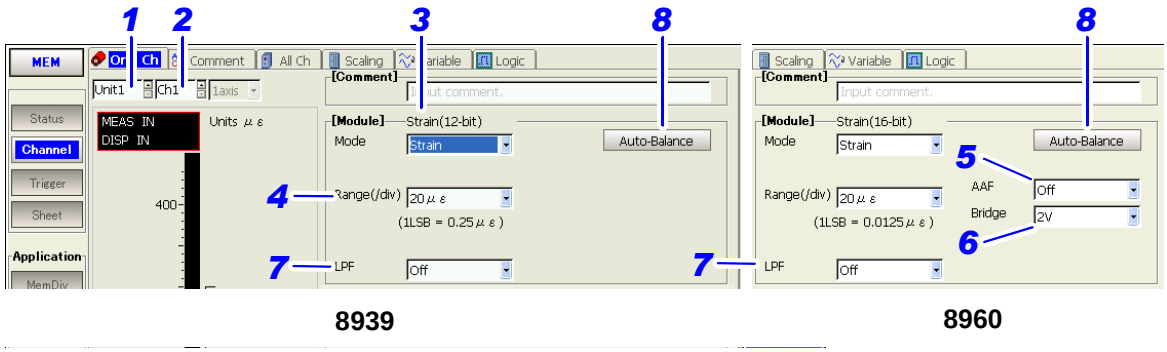
Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the input module and measurement mode**	[Module] [Mode]	Confirm that the display is set for [FFT]. Confirm that the display is set for [Voltage].
4	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 90).
5	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
6	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
7	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1 or 1000:1]**
8	**Set the anti-aliasing filter**	[AAF]	Turn this on to suppress anti-aliasing distortion, such as for FFT analysis (⇒ p. 67). **[Off or On]**
9	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least 30 minutes after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.4 Strain Unit Settings (Models 8939 and 8960)

([One Ch] Page of Channel Setting Screen)



8939 8960

Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the input module and measurement mode**	[Module] [Mode]	Confirm that the display is set for [Strain].
4	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. (Units: [μ] Microstrain = 1/2 μV/V) The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 91).
5	**Select the bridge voltage** (Model 8960 only)	[Bridge]	Select the bridge voltage (⇒ p. 75). **[2V, 5V, 10V]**
6	**Set the anti-aliasing filter** (Model 8960 only)	[AAF]	Turn this on to suppress anti-aliasing distortion, such as for FFT analysis (⇒ p. 67). **[Off or On]**
7	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **8939: [Off, 10Hz, 30Hz, 300Hz or 3kHz]** **8960: [OFF, 5Hz, 10Hz, 100Hz, 1kHz]**
8	**Execute auto-balance**	[Auto-Balance]	Sets the reference output level of the transducer to the specified zero position (⇒ p. 78). Execute one hour after turning the power on, with the sensor in the unloaded state.
	Set up scaling		Set as occasion demands. **See** "Scaling Setting Examples" in "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.5 Model 8940 F/V Unit Settings

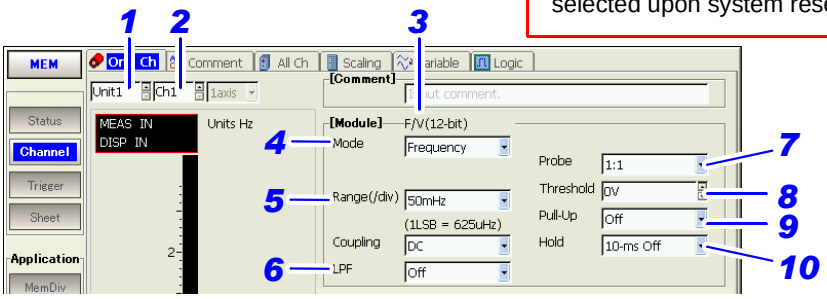
Settings are related to the following measurements. One measurement type can be set per channel.

- Measure frequency from the input pulse corresponding to the measurement waveform (⇒ p. 50)
- Measure frequencies near 50/60 Hz from the input pulse corresponding to the measurement waveform (⇒ p. 50)
- Measure rotation rate from the input pulse corresponding to the measurement waveform (⇒ p. 50)
- Count of input pulses (⇒ p. 52)
- Measure the percentage of High level of a single pulse waveform (pulse duty) (⇒ p. 53)
- Measure voltage (⇒ p. 54)
- Measure current (⇒ p. 55)

3.5.1 Measuring Frequency, 50/60 Hz and Rotation Rate

([One Ch] Page of Channel Setting Screen)
Example: Measuring frequency

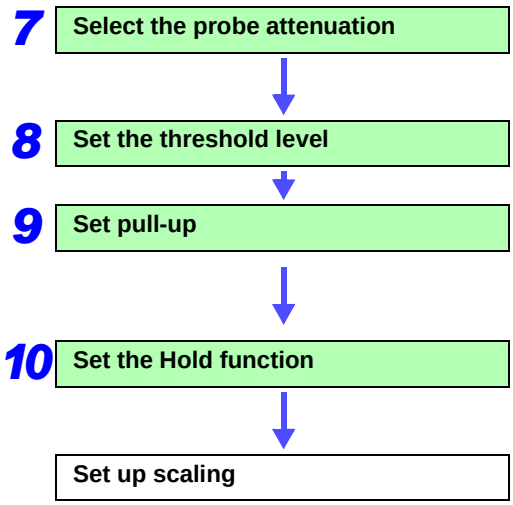
The [Frequency] measurement mode is selected upon system reset.



Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [F/V].
4	**Select the measurement mode**	[Mode]	Select the measurement mode. **[Frequency, Rotation, 50/60 Hz]**
5	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 92).
6	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**



[Probe] Select according to the cable or probe being used (⇒ p. 75).
[1:1, 10:1, 100:1, 1000:1(9322+9325) or 1000:1(9322+9418)]

[Threshold] Set the threshold value (⇒ p. 72).

[Pull-Up] Enable (set On) the pull-up resistance when connecting to an open-collector output signal. Disable it (Off) for normal measurements (⇒ p. 71).
[Off or On]

[Hold] Select whether to hold the last measured value until the next frequency or rotation rate is determined (⇒ p. 70).
[On, 10-ms Off or 1-s Off]

Set as occasion demands.
See "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

NOTE

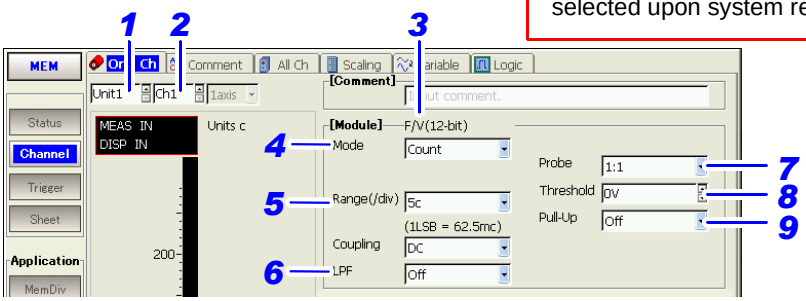
Difference between frequency measurement and 50/60 Hz frequency measurement

The frequency measurement function consists of selecting a range from 50 mHz to 5 kHz and observing changes in frequency.
The 50/60 Hz frequency measurement function consists of setting either 50 or 60 Hz as the zero position, and observing deviations from that frequency.

3.5.2 Pulse Count Measurement

([One Ch] Page of Channel Setting Screen)

The [Frequency] measurement mode is selected upon system reset.



Setting Procedure

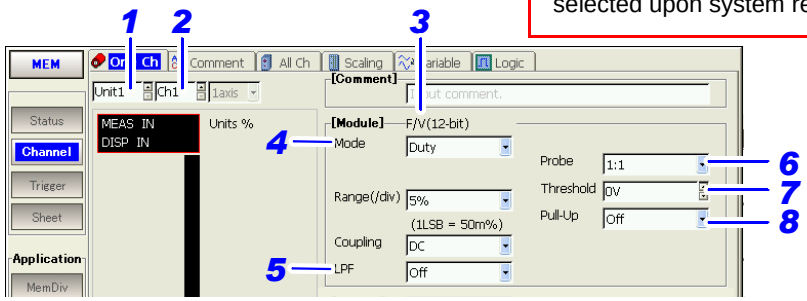
Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [F/V].
4	**Select the measurement mode**	[Mode]	Select [Count].
5	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. (Units: c = count) The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 92).
6	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
7	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1, 1000:1(9322+9325) or 1000:1(9322+9418)]**
8	**Set the threshold level**	[Threshold]	Set the threshold level (⇒ p. 72).
9	**Set pull-up**	[Pull-Up]	Enable (set On) the pull-up resistance when connecting to an open-collector output signal. Disable it (Off) for normal measurements (⇒ p. 71). **[Off or On]**
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.5.3 Pulse Duty Measurement

([One Ch] Page of Channel Setting Screen)

The [Frequency] measurement mode is selected upon system reset.



Setting Procedure

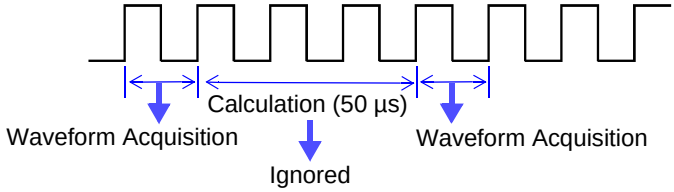
Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [F/V].
4	**Select the measurement mode**	[Mode]	Select [Duty].
5	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
6	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75) **[1:1, 10:1, 100:1, 1000:1(9322+9325) or 1000:1(9322+9418)]**
7	**Set the threshold level**	[Threshold]	Set the threshold level (⇒ p. 72).
8	**Set pull-up**	[Pull-Up]	Enable (set On) the pull-up resistance when connecting to an open-collector output signal. Disable it (Off) for normal measurements (⇒ p. 71). **[Off or On]**
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

NOTE

Pulse duty measurement

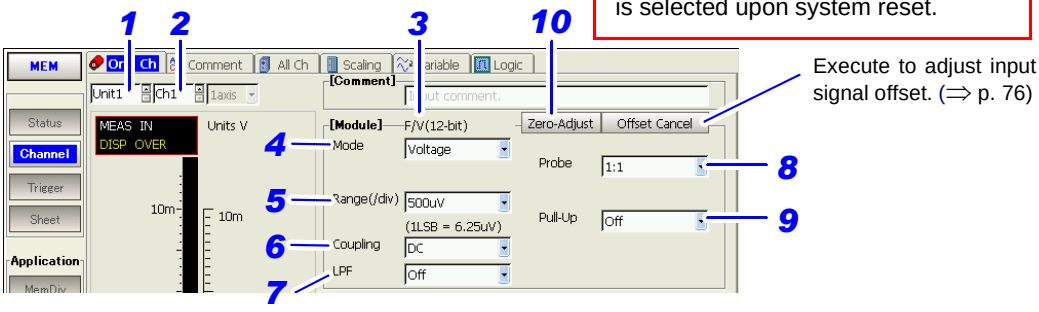
If a rising pulse (at 20 kHz or above) is applied during calculation (“dead time”), the duty during the dead time cannot be measured. Duty is measured from the pulse following the dead time.



3.5.4 Voltage Measurement

([One Ch] Page of Channel Setting Screen)

The [Frequency] measurement mode is selected upon system reset.



Execute to adjust input signal offset. (⇒ p. 76)

Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [F/V].
4	**Select the measurement mode**	[Mode]	Select [Voltage].
5	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 92).
6	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
7	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
8	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1, 1000:1(9322+9325) or 1000:1(9322+9418)]**
9	**Set pull-up**	[Pull-Up]	Enable (set On) the pull-up resistance when connecting to an open-collector output signal. Disable it (Off) for normal measurements (⇒ p. 71). **[Off or On]**
10	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least 30 minutes after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

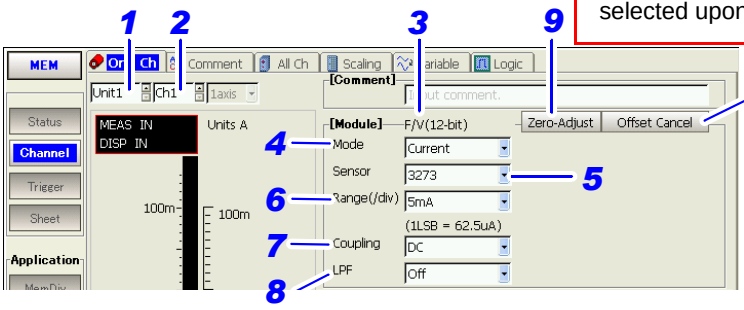
3.5.5 Current Measurement

When using the Model 9018-10 and 9132-10 Clamp-On Probe, select [Voltage] mode.

See "3.5.4 Voltage Measurement" (⇒ p. 54)

([One Ch] Page of Channel Setting Screen)

The [Frequency] measurement mode is selected upon system reset.



Execute to adjust input signal offset. (⇒ p. 76)

Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [F/V].
4	**Select the measurement mode**	[Mode]	Select [Current].
5	**Select a sensor**	[Sensor]	Select the clamp to be used. **[3273, 3273-50, 9270, 9271, 9272LO*, 9272HI*, 9277, 9278 or 9279]** * 9272HI: 200A-range, 9272LO: 20A-range
6	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 92).
7	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
8	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
9	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least 30 minutes after turning power on** (⇒ p. 76).

NOTE

- Up to eight channels can be used simultaneously when measuring with the Model 9318 and 9319 Conversion Cables.
- When using a clamp model that is not displayed in the sensor selection list, measure in [Voltage] mode, and apply the scaling function.

See:"5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

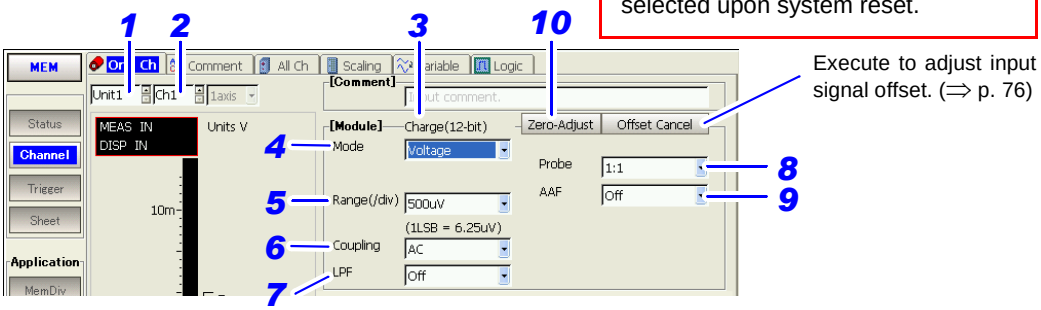
3.6 Model 8947 Charge Unit Settings

Make settings regarding input channels for measuring voltage or acceleration (Charge and Preamp). One type can be measured per channel.

3.6.1 Voltage Measurement

([One Ch] Page of Channel Setting Screen)

The [Charge] measurement mode is selected upon system reset.



Execute to adjust input signal offset. (⇒ p. 76)

Setting Procedure

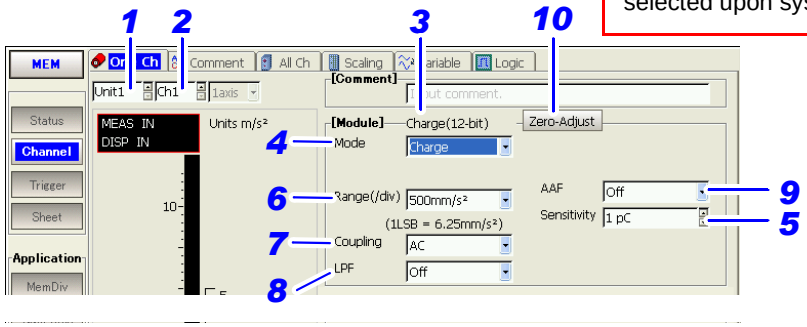
Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [Charge].
4	**Select the measurement mode**	[Mode]	Select [Voltage].
5	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 95).
6	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
7	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
8	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1 or 1000:1]**
9	**Set the anti-aliasing filter**	[AAF]	Turn this on to suppress anti-aliasing distortion, such as for FFT analysis (⇒ p. 67). **[Off or On]**
10	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least one hour after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.6.2 Acceleration Measurement (Charge, Preamp)

([One Ch] Page of Channel Setting Screen)

The [Charge] measurement mode is selected upon system reset.



Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [Charge].
4	**Select the measurement mode**	[Mode]	Select the measurement mode. • [Charge]: When using a charge-output acceleration pick-up sensor • [Preamp]: When using an acceleration pick-up sensor equipped with an internal preamp
5	**Set sensor sensitivity**	[Sensitivity]	Set the value per m/s^2 defined for the acceleration sensor to be used (⇒ p. 73). "Sensor Sensitivity Setting Examples" (⇒ p. 73)
6	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. (Units: m/s^2 = acceleration) The RANGE/POSN knob selects the range. Refer to the specifications for available ranges (⇒ p. 95).
7	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[AC or GND]**
8	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 500Hz or 5kHz]**
9	**Set the anti-aliasing filter**	[AAF]	Turn this on to suppress anti-aliasing distortion, such as for FFT analysis (⇒ p. 67). **[Off or On]**
10	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least one hour after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "To convert [m/s^2] units to [G] for display" (⇒ p. 73) in this manual, "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

Supplement

Before connecting sensors and probes

WARNING

To avoid electric shock or damage to the measurement object, turn the instrument off before connecting a sensor or probe to the BNC jack.
When the [Preamp] measurement mode is selected, internal power (15 V @ 2 mA) is applied to the BNC jack when measurement starts.

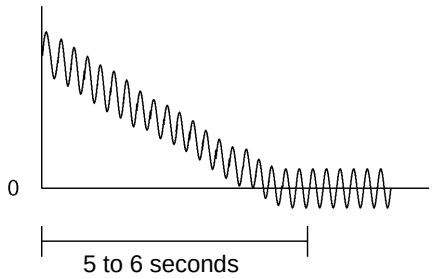
Range Setting

Auto-ranging cannot be used on channels for which the measurement mode is set to [Charge] or [Preamp].
For more on auto-ranging, refer to "3.3.5 Automatic Range Setting (Auto-Ranging Function)" in the *Instruction Manual*.

Measuring Timing

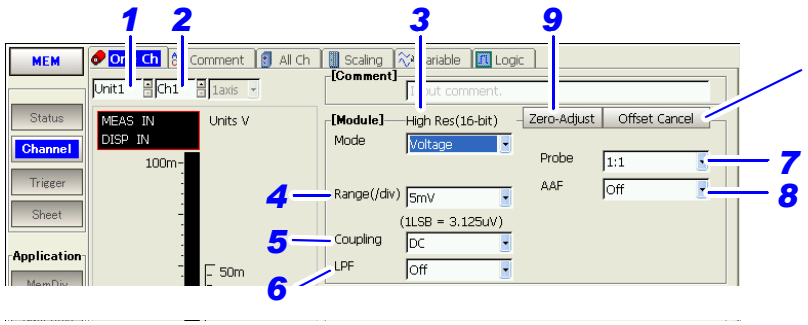
In the following cases, five or six seconds should be allowed for input stabilization:

- Measurement Mode: [Charge]
  When switching the measurement range between one of the six high-sensitivity ranges and one of the six low-sensitivity ranges.
- Measurement Mode: [Preamp]
  After selecting preamp mode and before starting a new measurement



3.7 Model 8957 High Resolution Unit Settings

([One Ch] Page of Channel Setting Screen)



Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the input module and measurement mode**	[Module]	Confirm that the display is set for [High Res].
		[Mode]	Confirm that the display is set for [Voltage].
4	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 98).
5	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
6	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 50Hz, 500Hz, 5kHz or 50kHz]**
7	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1 or 1000:1]**
8	**Set the anti-aliasing filter**	[AAF]	Turn this on to suppress anti-aliasing distortion, such as for FFT analysis (⇒ p. 67). **[Off or On]**
9	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least 30 minutes after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.8 Model 8958 16-Ch Scanner Unit Settings

NOTE

Before Setting

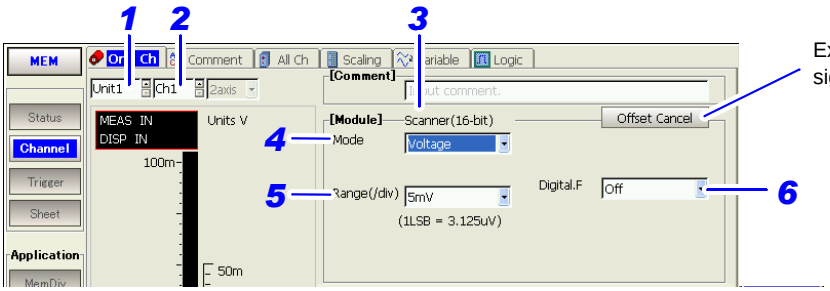
The zero position of the Model 8958 16-Ch Scanner Unit needs to be adjusted in the following cases.

See "Scanner Unit Zero Position Adjustment" (⇒ p. 27)

- When the Model 8958 16-Ch Scanner Unit has just been installed in the instrument (a message requesting adjustment appears when the instrument is turned on)
- When the zero position has shifted due to aging or environmental changes

3.8.1 Voltage Measurement

([One Ch] Page of Channel Setting Screen)



Execute to adjust input signal offset. (⇒ p. 76)

Setting Procedure

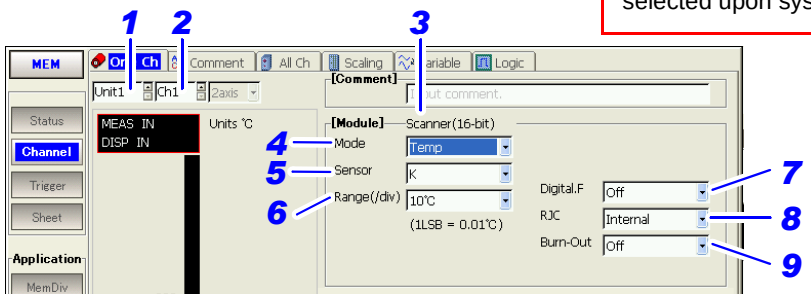
Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [Scanner].
4	**Select the measurement mode**	[Mode]	Select [Voltage].
5	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 99).
6	**Set the digital filter**	[Digital F]	Set the digital filter function to be enabled or disabled. Set it to ON to suppress noise components (⇒ p. 67). **[Off, 60Hz, 50Hz or 10Hz]**
	Set up scaling		Set as occasion demands. See "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.8.2 Temperature Measurement

([One Ch] Page of Channel Setting Screen)

The [Voltage] measurement mode is selected upon system reset.



Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [Scanner].
4	**Select the measurement mode**	[Mode]	Select [Temp].
5	**Select thermocouple**	[Sensor]	Select the type of thermocouple (⇒ p. 68). **[K, J, E, T, N, R, S, B or W]**
6	**Select the measurement range**	[Range]	Select the appropriate measurement range. The setting value is the units per division on the vertical axis. The RANGE/POSN knob selects the range (⇒ p. 64). **[10, 50 or 100°C/div]**
7	**Set the digital filter**	[Digital F]	Set the digital filter function to be enabled or disabled. Set it to ON to suppress noise components (⇒ p. 67). **[Off, 60Hz, 50Hz or 10Hz]**
8	**Set the reference junction compensation**	[RJC]	Select whether reference junction compensation should be provided internally (⇒ p. 68). **[Internal or External]**
9	**Set disconnect detection**	[Burn-Out]	Select thermocouple broken-wire detection (⇒ p. 69). When enabled (On), the waveform trace of a broken wire stays at the top of the screen and the cursor value is displayed as "+OVER" when a broken wire is present. **[Off or On]**
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

NOTE

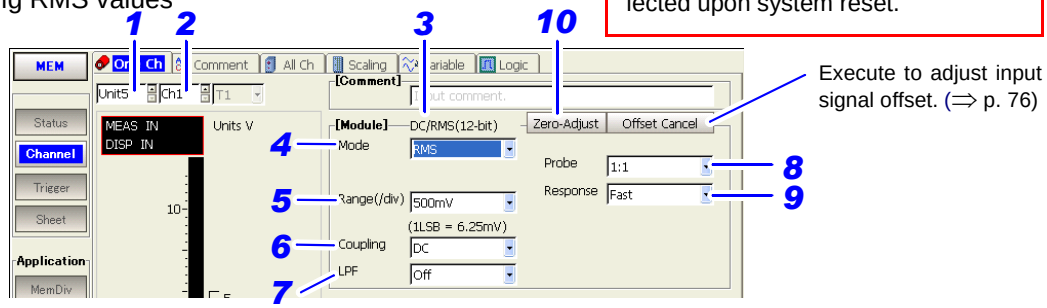
- The upper and lower limits of measurement input depend on the measurement range. Refer to "About Measurement Range, Upper and Lower Input Limits and the Waveform Display:" (⇒ p. 64).
- When the input terminals of the Model 8958 16-Ch Scanner Unit are subject to strong drafts:
  Loss of thermal equilibrium of the input section may result in measurement errors. To measure in such environments, install the supplied cover or relocate the equipment out of the wind.
- When the ambient temperature changes rapidly:
  Loss of thermal equilibrium may result in measurement errors. If this occurs, allow about an hour for the equipment to acclimatize to the new temperature, then take measurements after thermal equilibrium is achieved.

3.9 Model 8959 DC/RMS Unit Settings

([One Ch] Page of Channel Setting Screen)

Example: Measuring RMS values

The [DC] measurement mode is selected upon system reset.



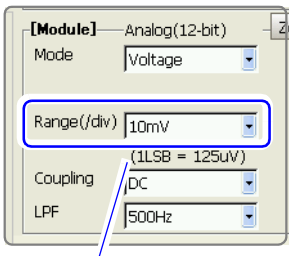
Setting Procedure

Use the **CURSOR** keys to move among items. Select a setting with the **F1** to **F8** keys.

Step		Setting Item	Description
1	**Select the module No.**	[Unit]	Select the number of the input module to set up. ("Channel Configuration" (⇒ p. 15))
2	**Select the channel No.**	[Ch]	Select the channel number on the input module.
3	**Confirm the module**	[Module]	Confirm that the display is set for [DC/RMS].
4	**Select the measurement mode**	[Mode]	Select the measurement mode. • [DC]: Voltage measurement • [RMS]: RMS measurement
5	**Select the measurement range**	[Range]	Select the voltage per division on the voltage (vertical) axis. The RANGE/POSN knob selects the range (⇒ p. 64). Refer to the specifications for available ranges (⇒ p. 101).
6	**Select the input coupling method**	[Coupling]	Select the coupling method for input signals (⇒ p. 65). **[DC, AC or GND]**
7	**Select the low-pass filter**	[LPF]	To suppress high-frequency components, select a low-pass filter within the input module (⇒ p. 66). **[Off, 5Hz, 500Hz, 5kHz or 100kHz]**
8	**Select the probe attenuation**	[Probe]	Select according to the cable or probe being used (⇒ p. 75). **[1:1, 10:1, 100:1 or 1000:1]**
9	**Set the response speed**	[Response]	Select the response speed (⇒ p. 72). **[Fast, Medium or Slow]**
10	**Perform zero adjustment**	[Zero-Adjust]	**Perform at least 30 minutes after turning power on** (⇒ p. 76).
	Set up scaling		Set as occasion demands. **See** "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

3.10 About Setting Contents

3.10.1 Measurement Range Setting



Select the appropriate measurement range. The setting value is the units per division on the vertical axis.
Use the **RANGE/POSN** knob to make the setting independently from the cursor position.

Setting Item: [Range]

- Refer to "Chapter 5 Specifications" (⇒ p. 83) for the extents of the measurement ranges.
- If the range is undetermined, auto-range selection can be enabled.
  Refer to "3.3.5 Automatic Range Setting (Auto-Ranging Function)" in the *Instruction Manual*
- When data has been stored in the instrument's memory, an asterisk "*" appears beside the data value's measurement range.
- When a portion of the input waveform is outside of the measurement range, that portion is indicated by a different color on the display.

NOTE

If the range is changed while measuring, acquired data is deleted and data recording is restarted.

Voltage Axis Range

When variable auto adjustment is enabled [On] (default setting) and the variable function is enabled, the variable setting becomes linked for measurement range changes.
If you do not want the display area of the screen to change, disable variable auto adjustment [Off].

See "12.2.7 Performing Variable Function Auto Adjustment" in the *Instruction Manual*

Temperature Measurement

About Measurement Range, Upper and Lower Input Limits and the Waveform Display:

The upper and lower limits of measurement input depend on the measurement range.
Measurement is not available outside of the temperature range limits in the following tables:

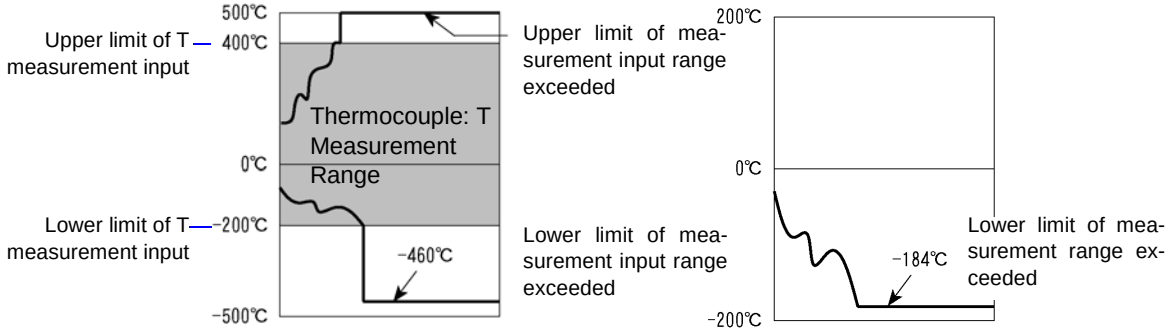
Model 8937 Voltage/Temp Unit

Measurement Range [°C/div]	10	20	50	100
Upper Limit [°C]	400	800	2000	4000
Lower Limit [°C]	-92	-184	-460	-920

Model 8958 16-Ch Scanner Unit

Measurement Range [°C/div]	10	50	100
Upper Limit [°C]	200	1000	2000
Lower Limit [°C]	-100	-200	-200

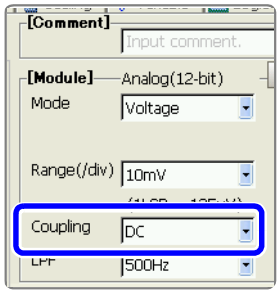
Example: Zero position = 50%, Magnification = ×1, Thermocouple = type T (using Model 8973)
(Measurement input range of T = -200 to 400°C



Measurement range: 50°C/div
(-460 to 2000°C)
When T measurement input range exceeded

Measurement range: 20°C/div
(-184 to 800°C)
Lower limit of measurement range (-184°C) exceeded

3.10.2 Setting Input Coupling



Select the coupling method for input signals

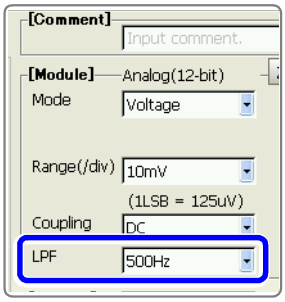
Setting Item: [Coupling]

Selections	Description
DC	DC Coupling (Default setting) Select this to acquire both DC and AC components of an input signal.
AC	AC Coupling Select this to eliminate any DC component from an input signal. Use this to measure only the ripple component superimposed on pulsating currents.
GND	The input signal is disconnected. Zero position can be confirmed.

Available selections depend on the input module and measurement mode.

Input modules	Modes	Selections		
8936	Voltage	DC	AC	GND
8937	Voltage	DC	AC	GND
	Temp	DC	–	–
8938	FFT	DC	AC	GND
8940	Frequency, Rotation, 50/60Hz, Count, Duty	DC	–	–
	Voltage	DC	AC	GND
	Current	depends on the particular clamp		
8946	Voltage	DC	–	GND
8947	Voltage	DC	AC	GND
	Charge, Preamp	–	AC	GND
8959	DC, RMS	DC	AC	GND
8956	Voltage	DC	AC	GND
8957	Voltage	DC	AC	GND

3.10.3 Low-Pass Filter (LPF) Settings



To suppress high-frequency components, select a low-pass filter within the input module

Setting Item: [LPF]

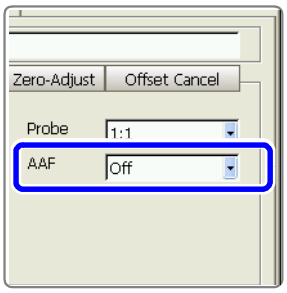
Selections	Description
Off	The low-pass filter is disabled. (Default setting)
5Hz	Applies a filter with 5-Hz cutoff frequency.
500Hz	Applies a filter with 500-Hz cutoff frequency.
5kHz	Applies a filter with 5-kHz cutoff frequency.
100kHz	Applies a filter with 100-kHz cutoff frequency.

Available selections depend on the input module and measurement mode.

Input modules	Modes	Selections [Hz]
8936	Voltage	Off, 5, 500, 5 k, 100 k
8937 *	Voltage	Off, 5, 500, 5 k, 100 k
	Temp	Off, 5, 500
8938	Voltage	Off, 5, 500, 5 k, 100 k
8939	Strain	Off, 10, 30, 300, 3 k
8940	Voltage	Off, 5, 500, 5 k, 100 k
8946	Voltage	Off, 5, 500, 5 k, 50 k
8947	Voltage	Off, 5, 500, 5 k, 100 k
	Charge, Preamp	Off, 500, 5 k
8956	Voltage	Off, 5, 500, 5 k, 1 M
8957	Voltage	Off, 5, 50, 500, 5 k, 50 k
8959	DC, RMS	Off, 5, 500, 5 k, 100 k
8960	Strain	Off, 5, 10, 100, 1 k

* When the digital filter is enabled [On], only Off, 5 Hz and 500 Hz selections are available.

3.10.4 Anti-Aliasing Filter (AAF) Settings



Enable the anti-aliasing filter to remove aliasing distortion. The cutoff frequency is automatically set according to the time axis range setting.

Setting Item: [AAF]

Selections	Description
Off	The anti-aliasing filter is disabled. (Default setting)
On	The anti-aliasing filter is enabled. (When the Recorder function or External sampling is used, the anti-aliasing filter (AAF) is not available.)

NOTE

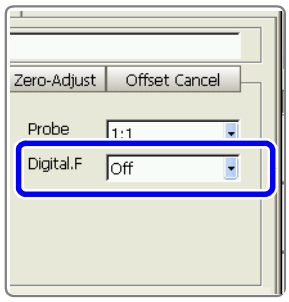
To perform sampling for analysis without being affected by aliasing distortion

We recommend using an input module that supports anti-aliasing filtering. (Supporting input module models: 8938, 8947 and 8957)

Printing setting data (List Print)

Settings can be printed as follows:
(Example) When enabled: “AAF ON”

3.10.5 Digital Filter (Digital F) Settings



Noise can be removed by applying additional averaging to the measurement data within the input module.
With the 8937 Voltage/Temp Unit, digital filtering is available only in the measurement ranges from 500 µV to 2 mV/div.
The digital filter is not available in other ranges.

Setting Item: [Digital F]

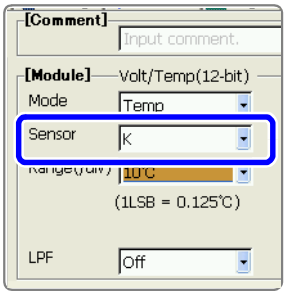
	Selections	Description
8937	**Off**	The digital filter function is disabled. (Default setting)
	On	The digital filter function is enabled. (Data refresh rate: Approx. 100 µs)
8958	**Off**	The digital filter function is disabled. (Default setting)
	60Hz, 50Hz or 10Hz	The digital filter function is enabled. The data refresh rate is affected by the filter setting. **See** "5.2.10 Model 8958 16-Ch Scanner Unit" (⇒ p. 99)

NOTE

Printing setting data (List Print)

Settings can be printed as follows:
Example: Enabled = “Digital F ON"

3.10.6 Thermocouple (Sensor) Type Setting



Set to match the type of thermocouple being used.

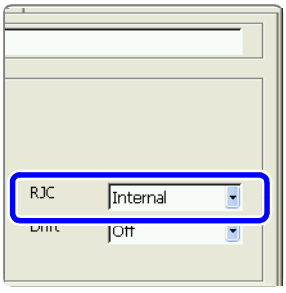
Setting Item: [Sensor]
8937 Voltage/Temp Unit

Selections	Measurement Range	Selections	Measurement Range
K	-200 to 1350°C	**R**	0 to 1700°C
J	-200 to 1100°C	**S**	0 to 1700°C
E	-200 to 800°C	**B**	300 to 1800°C
T	-200 to 400°C		
N	-200 to 1300°C		

8958 16-Ch Scanner Unit

Selections	Measurement Range	Selections	Measurement Range
K	-200 to 1350°C	**R**	0 to 1700°C
J	-200 to 1200°C	**S**	0 to 1700°C
E	-200 to 1000°C	**B**	400 to 1800°C
T	-200 to 400°C	**W**	0 to 2000°C
N	-200 to 1300°C		

3.10.7 Reference Junction Compensation Setting

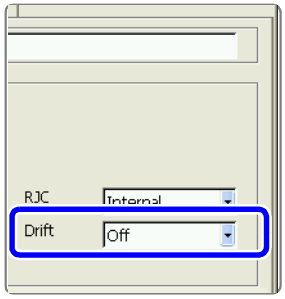


When connecting a thermocouple directly to the input module, select [Internal]. Reference junction compensation is performed within the input module.
When connecting through a reference junction device (e.g., a 0°C control tank), select [External].

Setting Item: [RJC]

Selections	Description
Internal	Reference junction compensation is provided within the input module. (Default setting) (Measurement Accuracy: The sum of the accuracies of the temperature measurement and the reference junction compensation.)
External	Reference junction compensation is not provided within the input module. (Measurement Accuracy: The accuracy of temperature measurement only)

3.10.8 Drift Correction Setting



This function periodically corrects for drift of the reference potential (about once per second) to improve thermal characteristics in thermocouple mode.

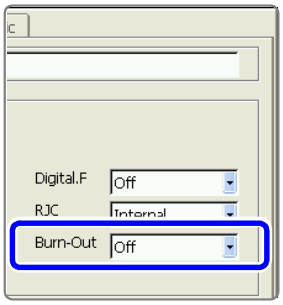
Setting Item: [Drift]

Selections	Description
Off	Drift correction is disabled. (Default setting)
On	Drift correction is enabled.

NOTE

- Data refresh rate is about once per second when drift correction is enabled.
- Drift correction is available only while measuring. It does not affect the Level Monitor on the Waveform and Channel Setting screens.

3.10.9 Disconnect (Burn-Out) Detection Setting

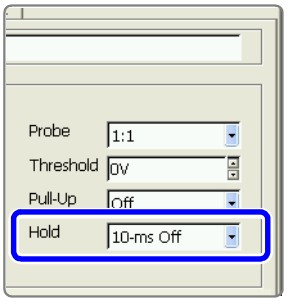


A broken thermocouple wire can be detected during temperature measurement. Normally when a thermocouple wire breaks, measured values exhibit random instability.

Setting Item: [Burn-Out]

Selections	Description
Off	Broken wires are not detected.
On	Broken wires are detected. When a broken wire is present, the waveform trace stays at the top of the screen and the cursor value is displayed as “+OVER”. Wire breakage is detected by sensing a miniscule current flow (about 200 nA) through the thermocouple. If the thermocouple wires are long or composed of a high-resistance material, set [Burn-Out] to [Off] to avoid measurement errors.

3.10.10 Hold Setting



During measurement, the measured frequency value can be retained by the Hold function until the frequency of the next cycle has been determined.
Also, if the value is not retained and the next value cannot be determined within a specified period, one half of the last measured value can be displayed.

Setting Item: [Hold]

Selections	Description
On	Retains the measured value until the next frequency value is determined.
10-ms Off	If the next frequency value is not determined within 10 ms, the last value is divided in half. (Default setting)
1-s Off	If the next frequency value is not determined within 1 s, the last value is divided in half.

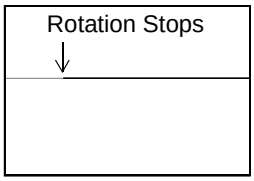
NOTE

The on/off settings of the Hold and Pull-Up functions are not indicated on the Waveform screen. The settings are indicated on the Channel Settings screen.

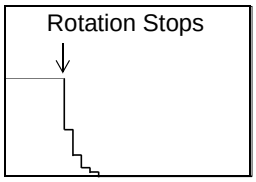
What is the difference between Hold On and Off?

When measuring frequency and rotation rate, results are displayed only after the value of one cycle has been determined.
When Hold is On, the previously measured value is retained, and with Hold Off, one half of the previous value is displayed if a new value cannot be determined within the specified period.

Example: Measuring the phenomena of stopping a rotating body

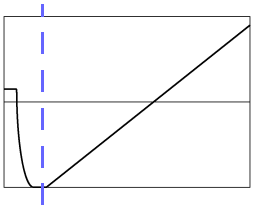


Hold: On
The previously measured value is retained continuously until the next cycle is determined. Because the next cycle never occurs, the stopping condition is not detected.

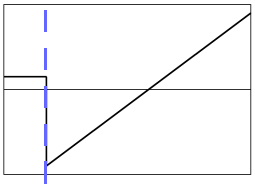


Hold: Off
If the cycle is not detected within the specified period (10 ms or 1 s), half of the value of the previous signal is displayed.
As a result, the displayed value gradually approaches zero, allowing the stopping condition to be estimated.

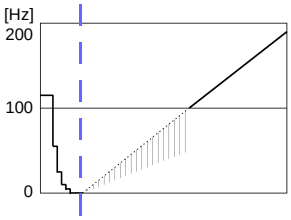
Example: Measuring frequency dropping to 0 Hz, and then increasing



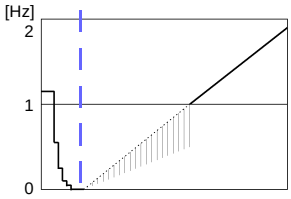
Actual Phenomena
Frequency drops from a certain cycle to 0 Hz, and then increases from that point.



Hold: On
The previous value is retained until the 0-Hz event.

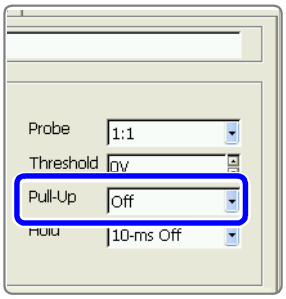


Hold: 10-ms Off
At frequencies below 100 Hz, the displayed value is successively halved to 0 Hz.
However, until the frequency reaches 100 Hz again, the halved signal is now added.



Hold: 1-s Off
At frequencies below 1 Hz, the displayed value is successively halved to 0 Hz.
However, until the frequency reaches 1 Hz again, the halved signal is now added.

3.10.11 Pull-Up Setting

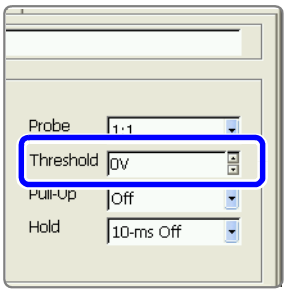


The pull-up resistance function is used when connecting to an open-collector output signal.
The input terminal is pulled up to +5 V.
Set Pull-Up to Off for normal measurements.

Setting Item: [Pull-Up]

Selections	Description
Off	Pull-up resistance is disable (Off).
On	Pull-up resistance is enabled. (for connection to open-collector output)

3.10.12 Threshold Setting



Sets threshold value. Measures when the waveform crosses a preset threshold.

Setting Item: [Threshold]

Selections	Description
↑↑	Increases value by large steps.
↑	Increases value by small steps.
↓	Decreases value by small steps.
↓↓	Decreases value by large steps.

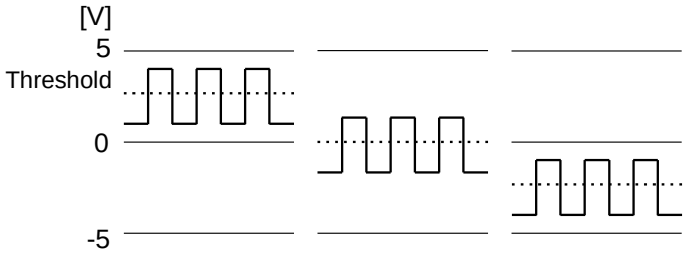
Values can also be entered by numeric keypad.

See "3.3.3 Entering Text and Numbers" in the *Instruction Manual*

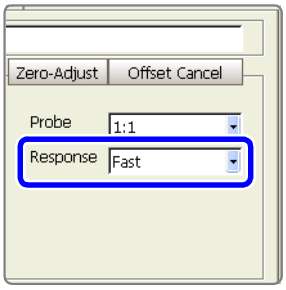
NOTE

Measurement results may differ according to the threshold setting. To obtain the correct measurement results, set the threshold level to suit the input waveform.

Threshold Setting Example



3.10.13 Response (Timing) Setting

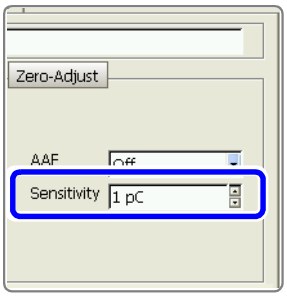


Response can be set to three speeds: Fast, Medium and Slow.
Normally set to [Fast], this can be changed to [Medium] or [Slow] to stabilize the display when measuring low frequencies, or when severe fluctuations are present.

Setting Item: [Response]

Selections	Description
Fast	Sets the response time to about 100 ms.
Medium	Sets the response time to about 800 ms.
Slow	Sets the response time to about 5 s.

3.10.14 Sensor Sensitivity Setting



Sets the value per m/s^2 defined for the acceleration sensor to be used.

Setting Item: [Sensitivity]
Setting Range: 0.1 to 10 (pC/(m/s^2)) [Charge], 0.1 to 10 (mV/(m/s^2) [Preamp]

When using a sensor with specified value per G:
See Example 2 of the "Sensor Sensitivity Setting Examples" (⇒ p. 73)

To use a sensor outside of the setting range:
See "To Use a Sensor Outside of the Setting Range" (⇒ p. 74)

NOTE

The measurement range can be affected by the sensor sensitivity. So sensor sensitivity should be set before setting the measurement range.

Sensor Sensitivity Setting Examples

Setting Example 1:
When using a sensor with sensitivity specified in units of m/s^2
If the specified sensor sensitivity is 1.08 pC/(m/s^2)
Sensor sensitivity setting value: 1.08

Setting Example 2:
When using a sensor with sensitivity specified in units of G
An acceleration sensor with sensitivity specified in units of G can be set by dividing the specified sensitivity value by 9.8 (m/s^2).
If the specified sensor sensitivity is 64.0 (pC/G): 64.0 / 9.8 = 6.53 (pC/(m/s^2))
Sensor sensitivity setting value: 6.53

To convert [m/s^2] units to [G] for display
This instrument measures charge value in units of m/s^2. The scaling function can be used to convert to charge value in units of G.
See "5.4 Converting Input Values (Scaling Function)" in the *Instruction Manual*

Set up scaling as follows.

- Conversion ratio setting [Ratio]

Conversion ratio:	1/9.8 = 0.1020E+00
Offset:	0.0000E+00
Units:	G

- Two-point setting [2-Point]

Entry 1:	9.8000E+00	Physical value 1:	1.0000E+00
Entry 2:	0.0000E+00	Physical value 2:	0.0000E+00
Units:	G		

To Use a Sensor Outside of the Setting Range

The scaling function can be employed to use a sensor outside of the setting range.

1 On the Channel Settings screen, select the channel on which to use the sensor outside of the setting range.

2 Move the cursor to [Sensitivity] to set the sensor sensitivity.
Enter a multiplier value that will produce a settable value (0.1 to 10) when multiplied by the actual sensitivity of the sensor.

3 Move the cursor to [Scaling], and set it to [On].

4 Set the conversion ratio to the sensitivity multiplier value.

Setting Example 1:
If the specified sensor sensitivity is 23.4 pC/(m/s^2):
Set 1/2.34 as the sensor sensitivity multiplier, and 10 (pc/m/s^2)) as the sensor sensitivity.
Scaling is set as follows to display measured values multiplied by 1/2.34.

- Conversion ratio setting [Ratio]

Conversion ratio:	10/23.4 = 0.4274E+00
Offset:	0.0000E+00
Units:	m/s^2

- Two-point setting [2-Point]

Input 1:	2.3400E+01	Scale 1:	1.0000E+01
Input 2:	0.0000E+00	Scale 2:	0.0000E+00
Units:	m/s^2		

Setting Example 2:
If the specified sensor sensitivity is 0.05 pC/(m/s^2)
Set the sensor sensitivity multiplier to 2, and the sensor sensitivity to 0.1 (pc/m/s^2)).
Scaling is set as follows to display measured values multiplied by 2.

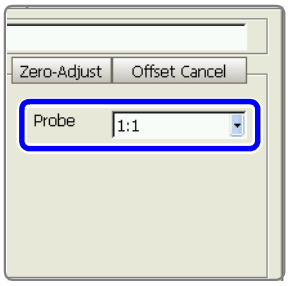
- Conversion ratio setting [Ratio]

Conversion ratio:	0.1/0.05 = 2.0000E+00
Offset:	0.0000E+00
Units:	m/s^2

- Two-point setting [2-Point]

Input 1:	0.0500E+00	Scale 1:	0.1000E+00
Input 2:	0.0000E+00	Scale 2:	0.0000E+00
Units:	m/s^2		

3.10.15 Probe Attenuation Selection



Probe attenuation can be selected when measuring using a connection cable, differential probe or attenuating probe. (Only for voltage measurement)

By matching the input channel probe setting to the attenuation ratio of a probe connected to an analog input module, the voltage axis range is automatically converted for direct reading of numerical values.
Each channel should be set to match the attenuation ratio of its input probe.

Setting Item: [Probe]

Selections	Description
1:1	Select this setting when measuring with the Model 9197, 9198 or 9217 cable connected to the input module.
10:1	Select this setting when measuring with the Model 9665 10:1 Probe connected to the input module.
100:1	Select this setting when measuring with the Model 9666 100:1 Probe connected to the input module.
1000:1	Select this setting when using the 9322 Differential Probe.

When using the Model 8940 F/V Unit with the 9322 Differential Probe:

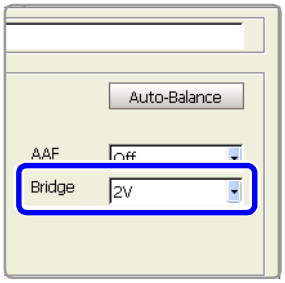
9322+9325	Select this setting when using the Model 9325 Power Cord to connect the 9322 Differential Probe.
9322+9418	Select this setting when using the Model 9418-15 AC Adapter to connect the 9322 Differential Probe.

When supplying power from the Model 9687 Probe Power Unit, either of the above settings can be selected.
The factory default and system reset default setting is 1:1.

NOTE

Some probes cannot be used with certain input modules.
See "1.3 List of Input Modules, Cables, Probes and Clamp Combinations" (⇒ p. 11)

3.10.16 Bridge Voltage Setting



Set to suit the sensor to be used.

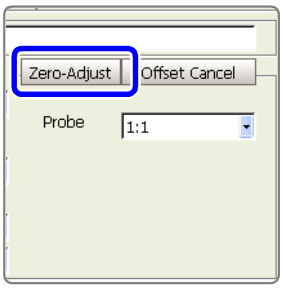
Setting Item: [Bridge]

Selections	Description
2V	Sets the bridge voltage to 2 V (Bridge resistance = 120 Ω to 1 kΩ)
5V	Sets the bridge voltage to 5 V (Bridge resistance = 350 Ω to 1 kΩ)
10V	Sets the bridge voltage to 10 V (Bridge resistance = 350 Ω to 1 kΩ)

NOTE

This setting should not exceed the allowable applied voltage for the strain gauge type converter to be used. Otherwise, converter specifications will not be satisfied, and correct measurements will not be possible.

3.10.17 Executing Zero Adjustment



The input module can apply an internal offset to set the reference potential of the instrument to zero volts. Adjustment applies to the currently selected range.

Before executing zero adjustment

- Turn power on and wait 30 minutes to allow the internal temperature of the input module to stabilize. (Some input modules may require one hour warm-up.)
- Zero adjustment cannot be performed while measuring.
- Key operations are not accepted while zero adjustment is executing.

To execute zero adjustment

Move the cursor to the [Zero-Adjust] button, and select **F1** [Execute].
Zero adjustment can be performed from the CH SET dialog on the Waveform screen.

NOTE

Zero adjustment is not applicable to the following modules:

- The [Temp] mode of the Model 8937 Voltage/Temp Unit
- Model 8939 Strain Unit
- Modes other than [Voltage] and [Current] of the Model 8940 F/V Unit
- Model 8958 16-Ch Scanner Unit

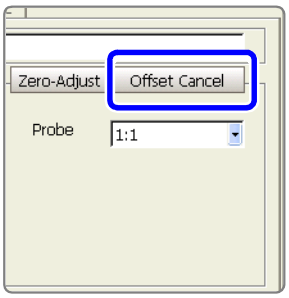
In the following cases, zero adjustment should be executed again.

- After an input module has been removed or inserted
- After power has been turned off and on
- After complete reinitialization
- When ambient temperature has changed significantly
  The zero position may have drifted.

When using the Model 8958 16-Ch Scanner Unit, zero position adjustment of the module from the System screen may be needed.

See "Scanner Unit Zero Position Adjustment" (⇒ p. 27)

3.10.18 Executing Offset Cancellation



The input value can be forced to display as zero volts. Input signal bias, such as sensor emf, can be adjusted to display as zero volts. This function applies to voltage and current measurement.

See " What is the difference between Offset Cancellation and Zero Adjustment?" (⇒ p. 77)

Before executing offset cancellation

Connect the probe or clamp to the measurement object and apply the input signal that is supposed to measure zero volts.

See "About input voltage during offset cancellation" (⇒ p. 77)

When also using scaling, execute offset cancellation before setting the scaling.

To execute offset cancellation

Move the cursor to the [Offset Cancel] button, and select **F1** [Execute].
An asterisk "∗" appears on the [Offset Cancel] button when offset cancellation is active.
To revert to the offset value prior to executing offset cancellation, select **F2** [Reset].

NOTE

Offset cancellation cannot be executed in the following cases:
- When measuring other than voltage or current
- When the input voltage is more than ±10 divisions from zero

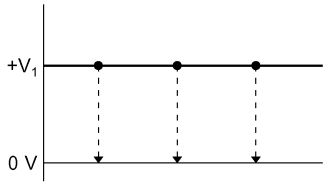
About input voltage during offset cancellation

⚠WARNING

The maximum input voltage and maximum rated voltage to ground are unaffected by offset cancellation of an input voltage to zero volts. Therefore, careful attention is necessary during measurement.

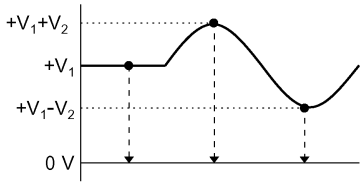
A constant input voltage is required to execute offset cancellation.
If the input voltage is fluctuating, the offset to zero volts depends on the timing of offset cancellation execution.

When input voltage is constant



Offset voltage $+V_1$ is set to display as zero regardless of execution time.

When input voltage is fluctuating



The offset voltage set to display as zero depends on the timing of offset cancellation execution.

Offset cancellation

Offset cancellation is not reset even when power is turned off. It is reset when the input module configuration is changed (after an input module has been inserted or removed).

If “Warning: Offset Cancel failed.” appears

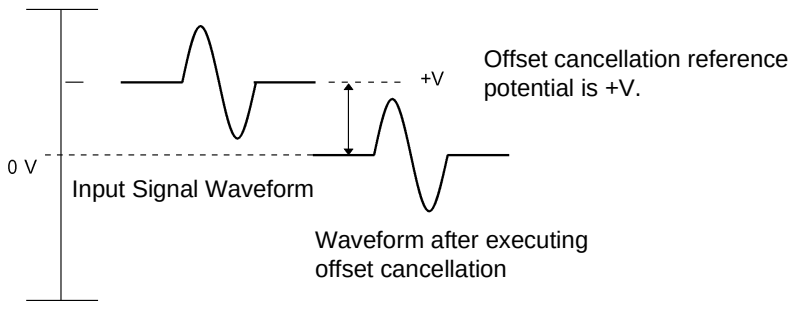
This appears when executing offset cancellation if the input voltage is more than ±10 divisions from zero volts.

To avoid the warning, set the input signal within ±10 divisions of zero volts.

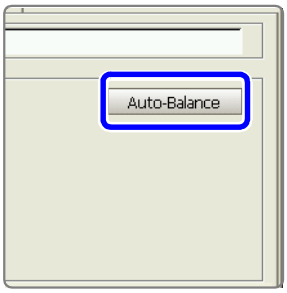
What is the difference between Offset Cancellation and Zero Adjustment?

Offset cancellation adjusts for input signal bias if there is a potential difference between the reference potential of the measurement object and the reference potential (0 V) of this instrument, so that the reference potential of the measurement object appears as zero volts.

Zero adjustment sets the input module’s internal bias so the reference potential of the instrument is zero volts.



3.10.19 Executing Auto-Balance



Auto-balance sets the reference output level of a transducer to the specified zero position.
It is applicable only to a strain module.

Before executing auto-balance

- Turn power on and wait 1 hour to allow the internal temperature of the input module to stabilize.
- With the sensor connected to the input module, execute auto-balance under stable input conditions.
- Auto-balance cannot execute during measurement.
- Key operations are not accepted while auto-balance is executing.

To execute auto-balance

Move the cursor to the [Auto-Balance] button, and select **F1** [Execute].
Auto-balance can be performed from the CH SET dialog on the Waveform screen (when the unit and channel numbers of the strain module is selected).

In the following cases, auto-balance should be executed again.

- After changing the measurement range
- After an input module has been removed or inserted
- After the strain gauge transducer has been replaced
- After power has been turned off and on
- After performing a system reset
- When ambient temperature has changed significantly (the zero position may drift)

If “Warning: Auto balance failed.” appears

The channel on which auto-balance failed is displayed.
Verify the following, and execute again:

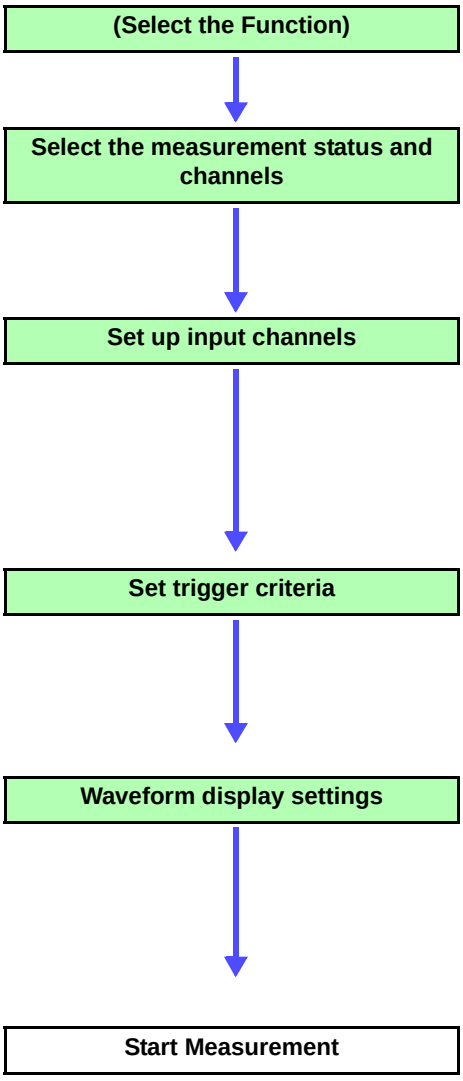
- Is the sensor in a discharged state? (Make sure that it is not being subject to vibration, etc.)
- Is the sensor connected correctly?

Logic Input Settings

Chapter 4

After turning power on, set the measurement criteria before measuring.
This chapter describes the settings related to logic inputs.
Refer to "7.3 Displaying Logic Waveforms" in the *Instruction Manual* for setting details.
Measurement status and trigger settings are the same as for analog inputs. Refer to the related chapters in the *Instruction Manual*.

4.1 Operation Overview



To record simultaneously with an analog signal, select a function that suits the analog input.
When recording only logic signals, the function can be set freely.

(For Memory Function)

[Use Ch] page on Status Settings screen

Enable (set to On) the logic channels to be used.

See "4.2.1 Selecting Channels to Use" in the *Instruction Manual*

[Logic] page on Channel Settings screen

Select whether to enable (On) or disable (Off) the input waveform for each logic channel probe.

(Default setting: All Off)

Select waveform colors as desired.

See "7.3 Displaying Logic Waveforms" in the *Instruction Manual*

[Logic] page on Trigger Settings screen

To apply a trigger event for measurements, set the logic trigger for each channel.

See "6.8 Triggering by Logic Signals (Logic Trigger)" in "Chapter 6 Trigger Settings" in the *Instruction Manual*

[Logic] page on Sheet Settings screen

Select the channels to appear on the waveform display.

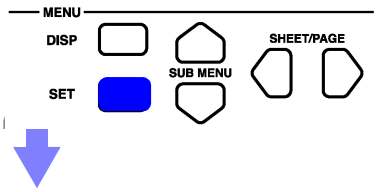
(Default setting: All On)

Set the waveform display position and height for each channel as needed.

See "7.2 Setting the Screen Layout of the Waveform Screen (Sheet Settings Screen)" and "7.3 Displaying Logic Waveforms" in the *Instruction Manual*

4.2 Setting Procedure

Display Settings Screen



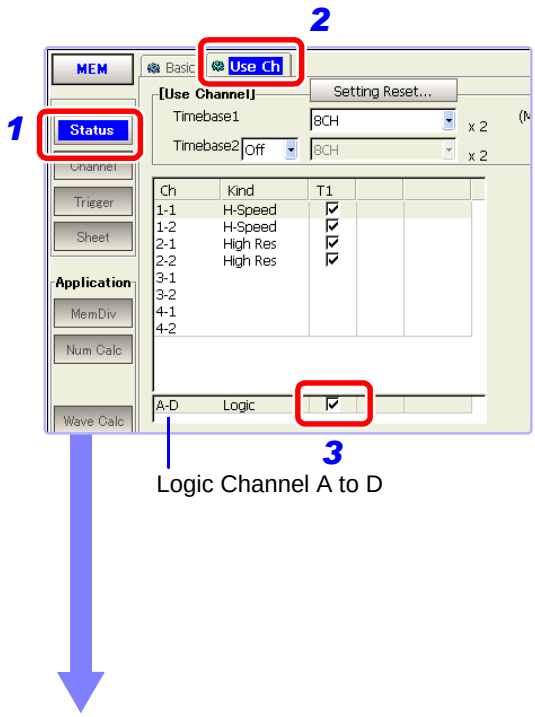
Press the **SET** key.

The Settings screen appears.
Function setting is not needed.

Selecting channels to use (when displayed with the memory function)

Status Settings Screen

(Default setting: depends on the settings of the channels to be used)



1 Press the **SUB MENU** keys to select the [Status] menu item.

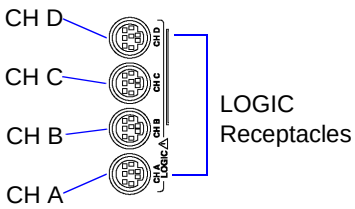
2 Press the **SHEET/PAGE** keys to select the [Use Ch] page.

To record simultaneously with analog input:

See "4.2.1 Selecting Channels to Use" in the *Instruction Manual*

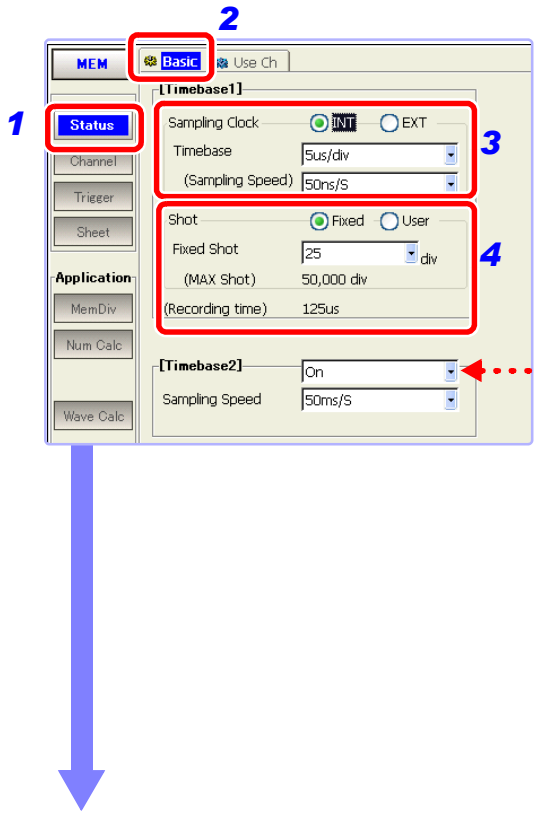
3 Use the **CURSOR** keys to move the cursor to the Setting column of the logic channel, and press the **F2** [On] key.

Logic Channels



Select the time axis range and recording length

Status Setting Screen (with memory function)



1 Press the **SUB MENU** keys to select the [Status] menu item.

2 (When using the memory function)
Press the **SHEET/PAGE** keys to select the [Basic] page.

3 (To record only logic inputs)
Use the **CURSOR** keys to move the cursor to [Time base], and press an F key to select the time per division for the horizontal axis.

(When the Timebase 2 is enabled [On], and only logic inputs are assigned)
Set the sampling rate.

4 Use the **CURSOR** keys to move the cursor to [Shot] (Recording Length), and press an F key to select the number of divisions for the recording time.

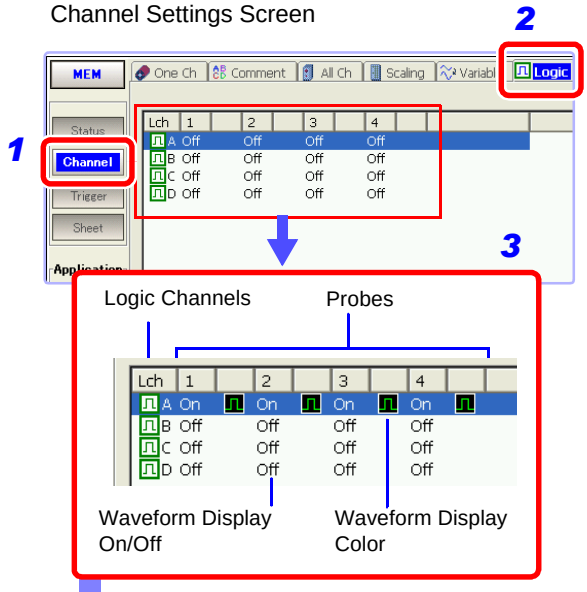
About measurement configuration (timebase, recording length, etc.)

See "Chapter 4 Measurement Configuration Settings" in the *Instruction Manual*

Select the input channels

Channel Settings Screen

(Default setting: [Off])



If you want to enter comments for individual channels:
Select the [Comment] page.

See "5.2 Adding Comments" in the *Instruction Manual*

1 Press the **SUB MENU** keys to select the [Channel] menu item.

2 Press the **SHEET/PAGE** keys to select the [Logic] page.

The [Logic] page of the Channel Setting screen appears.

3 Use the **CURSOR** keys to move the cursor to the Setting column for each probe (1 to 4) of the logic channel, and press the **F2** [On] key.

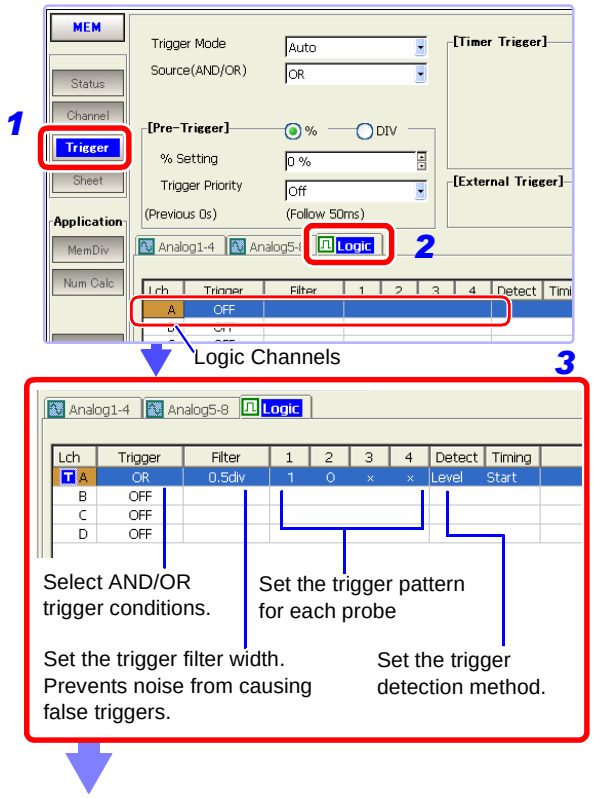
(On = display waveform, Off = do not display waveform)
To change a waveform's color, move the cursor to the waveform display color setting column and select the color with the **F1** or **F2** key.

See "7.3.1 Setting the Waveform Display" in the *Instruction Manual*

Set the trigger conditions (if applying a trigger)

Trigger Settings Screen

(Default setting: Logic trigger [Off])



1 Press the **SUB MENU** keys to select the [Trigger] menu item.

2 Press the **SHEET/PAGE** keys to select the [Logic] page.

The [Logic] page of the Trigger Settings screen appears.

3 Use the **CURSOR** keys to move to each channel to be triggered, and set each as needed.

See "6.8 Triggering by Logic Signals (Logic Trigger)" in the *Instruction Manual*

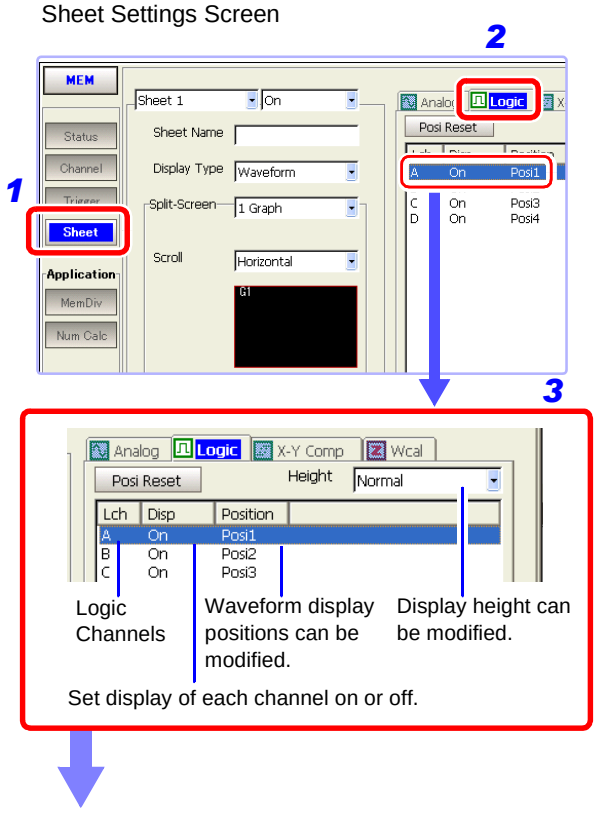
4 Set triggering as occasion demands.

See "Chapter 6 Trigger Settings" in the *Instruction Manual*

Set the waveform display method (as occasion demands)

Sheet Settings Screen

(Default setting: All logic channels displayed [On])



1 Press the **SUB MENU** keys to select the [Sheet] menu.

2 Press the **SHEET/PAGE** keys to select the [Logic] page.

The [Logic] page of the Sheet Settings screen appears.

3 Use the **CURSOR** keys to move to a logic channel to be displayed, and press the F keys to select the setting contents for each item.

See "7.3.2 Setting the Display Position" and "7.3.3 Setting the Display Height" in the *Instruction Manual*

Setting other display sheets

See "Chapter 7 Waveform Display Settings" in the *Instruction Manual*

Set storage and printing as occasion demands, then start measuring.

Chapter 5 Specifications

Refer to "Safety Information" for the “Measurement Category (Overvoltage Category)” in the *Quick Start Manual*.

5.1 Logic Input Section

5.1.1 Model 9327 Logic Probe

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH
Period of guaranteed accuracy	1 year
The number of input channels	4 channels (Common ground between chassis and between channels)
Input type	Digital input / Contact input Input type can be selected for each channels. Open collector outputs can be directly measured using contact inputs.
Input resistance	1 MΩ±5% (Digital input: 0 to +5 V) 500 kΩ or more (Digital input: +5 to +50 V)
Pull-up resistance	2 kΩ (Contact inputs: internally connected through pull-up resistance to +5 V)
Detecting level	

	Digital input Threshold value	Contact input Detecting resistance value	
1.4 V range	1.4 V±0.3 V	more than 1.5 kΩ less than 500Ω	opened (Output L) shorted (Output H)
2.5 V range	2.5 V±0.4 V	more than 3.5 kΩ less than 1.5 kΩ	opened (Output L) shorted (Output H)
4.0 V range	4.0 V±0.5 V	more than 25 kΩ less than 8 kΩ	opened (Output L) shorted (Output H)

Response pulse width	100 ns or more
Maximum input voltage	0 to +50 VDC
Operating temperature and humidity ranges	0 to 40°C (32 to 104°F), 80%RH or less (non-condensating)
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 90%RH or less (non-condensating)
Operating environment	Altitude up to 2000 m (6562-ft.), indoors
Dimensions	Approx. 62W x 94H x 20D mm (2.44"W x 3.70"H x 0.79"D) (sans protrusions)
Connector cable length	Approx. 1500 mm (59")
Probe tip cable length	Approx. 300 mm (11.8")
Mass	Approx. 150 g (5.3 oz.) (including connector cable, excluding input leads)
Accessories	IC clip leads, Alligator clip leads, Carrying case, Instruction Manual

5.1.2 Model 9321-01 Logic Probe

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH			
Period of guaranteed accuracy	1 year			
The number of input channels	4 channels (Isolated from chassis and between channels)			
Input voltage range	LOW		HIGH	
Input resistance	More than 30 kΩ		More than 100 kΩ	
Detecting level (Output: L) (Output: H)	0 to 10 VAC 60 to 150 VAC	±(0 to 15) VDC ±(20 to 150) VDC	0 to 30 VAC 170 to 250 VAC	±(0 to 43) VDC ±(70 to 250) VDC
Response time (Rising) ↑ **(Falling)** ↓	Less than 1 ms Less than 3 ms at 100 V DC		Less than 1 ms Less than 3 ms at 200 V DC	
Maximum input voltage	150 V rms		250 V rms	
Maximum rated voltage to earth	250 V rms			
Dielectric strength	2.3 kVAC for 1 minute (between each input channel and chassis, and between input channels)			
Insulation resistance	At least 100 MΩ at 500 V DC (between each input channel and chassis, and between input channels)			
Operating temperature and humidity ranges	0 to 40°C (32 to 104°F), 80%RH or less (non-condensating)			
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 90%RH or less (non-condensating)			
Operating environment	Altitude up to 2000 m (6562-ft.), indoors			
Dimensions	Approx. 62W x 128H x 20D mm (2.44"W x 5.04"H x 0.79"D) (sans protrusions)			
Connector cable length	Approx. 1500 mm (59")			
Probe tip cable length	Approx. 1000 mm (39.37")			
Mass	Approx. 320 g (11.3 oz.)			
Accessories	Carrying case, Instruction Manual			

NOTE

- Absolute values are detected, so either polarity DC may be input. AC voltage is evaluated as a 50/60-Hz standard sine wave.
- On/off judgment of the input signal is performed within the above detection range. On/off judgment of input signals cannot be performed correctly with input voltage between L and H detection levels.

5.1.3 Model 9320-01 Logic Probe

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH
Period of guaranteed accuracy	1 year
The number of input channels	4 channels (Common ground between chassis and between channels)
Input type	Digital input / Contact input Input type can be selected for each channel. Open collector outputs can be directly measured using contact inputs.
Input resistance	Digital input: 1 MΩ±5% (0 to +5 V), 500 kΩ or more (+5 to +50 V) Contact inputs: Approx. 2 kΩ (input terminals are connected to +5 V through 2-kΩ resistance)
Detecting level	

	Digital input Threshold value	Contact input Detecting resistance value	
1.4 V range	1.4 V±0.3 V	more than 1.5 kΩ less than 500Ω	opened (Output L) shorted (Output H)
2.5 V range	2.5 V±0.4 V	more than 3.5 kΩ less than 1.5 kΩ	opened (Output L) shorted (Output H)
4.0 V range	4.0 V±0.5 V	more than 25 kΩ less than 8 kΩ	opened (Output L) shorted (Output H)

Response time	Less than 500 ns
Maximum input voltage	0 to +50 VDC
Operating temperature and humidity ranges	0 to 40°C (32 to 104°F), 80%RH or less (non-condensating)
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 90%RH or less (non-condensating)
Operating environment	Altitude up to 2000 m (6562-ft.), indoors
Dimensions	Approx. 62W x 94H x 20D mm (2.44"W x 3.70"H x 0.79"D) (sans protrusions)
Connector cable length	Approx. 1500 mm (59")
Probe tip cable length	Approx. 300 mm (11.8")
Mass	Approx. 150 g (5.3 oz.) (including connector cable, excluding input leads)
Accessories	IC clip leads, Alligator clip leads, Carrying case, Instruction Manual

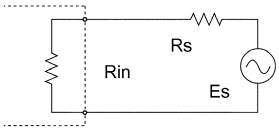
5.2 Analog Input Section

Input module specifications are described here.

Measurement error caused by signal source impedance

- Errors occur when the signal source impedance is greater than the input impedance of the module.
- The input impedance of the Model 8936 Analog Unit is 1 MΩ. Errors of about 0.1% occur when the signal source impedance is 1 kΩ.

$$\text{Measurement Error} = Es\left[1 - \frac{Rin}{Rs + Rin}\right][V]$$



Es: signal voltage
Rs: signal source impedance
Rin: input impedance

5.2.1 Model 8936 Analog Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
Measurement ranges	5 m, 10 m, 20 m, 50 m, 100 m, 200 m, 500 m, 1, 2, 5, 10, 20 V/div
DC amplitude accuracy	±0.4%f.s.
Zero position accuracy	±0.1%f.s. (after zero adjustment)
Temperature characteristic	Gain: ±0.025%f.s./°C Zero position: ±0.02%f.s./°C (after zero adjustment)
Frequency characteristic	DC coupling: DC to 400 kHz ±3 dB AC coupling: 7 Hz to 400 kHz ±3 dB (low cut-off frequency: 7 Hz±20%)
Noise	450 µV p-p typ., 750 µV p-p max. (sensitivity range, with input shorted) (S/N 2004-041018235 and later)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 100k±50% (Hz) -3 dB
Input type	Unbalanced (input isolated from output)
Input coupling	DC, GND, AC
Input resistance	1 MΩ±1%
Input capacitance	30 pF±10 pF (at 100 kHz)
A/D resolution	12 bits
Voltage axis resolution	80 points/div (with 1X magnification)
Maximum sampling rate	1 MS/s (sampling period: 1 µs)
Input terminals	Insulated BNC terminal
Maximum input voltage	400 VDC
Maximum rated voltage to earth	370 VAC/DC (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Effect of radiated radio-frequency electromagnetic field	±2%f.s. at 3 V/m max.

Effect of conducted radio-frequency electromagnetic field	±40%f.s. at 3 V max. (100 mV/div with 1 V DC input)
Dielectric strength	3.7 kVAC for 1 minute (between input module and chassis, and between input modules)
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D) (sans protrusions)
Mass	Approx. 290 g (10.2 oz.)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category II (anticipated transient overvoltage 4000 V)
EMC	EN 61326 Class A

5.2.2 Model 8937 Voltage/Temp Unit

General specifications

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH (when zero adjustment is executed 1 hour after power on)
Period of guaranteed accuracy	1 year
Common mode rejection ratio	80 dB min. (at 50/60 Hz and with signal source resistance 100 Ω max.)
Input type	Unbalanced (input isolated from output)
A/D resolution	12 bits
Maximum sampling rate	1MS/s (However, update rate differs with temperature input.)
Maximum input voltage	30 V rms or 60 VDC (voltage and temperature inputs)
Maximum rated voltage to earth	30 V rms or 60 VDC (voltage and temperature inputs)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Effect of radiated radio-frequency electromagnetic field	±2% f.s. at 3 V/m max. (in 5-mV/div range)
Effect of conducted radio-frequency electromagnetic field	±5% f.s. at 3 V max. (100 mV/div with 1 V DC input)
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D) (sans protrusions)
Mass	Approx. 300 g (10.6 oz.)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A

Voltage input

Measurement ranges	500 µ, 1 m, 2 m, 5 m, 10 m, 20 m, 50 m, 100 m, 200 m, 500 m, 1, 2 V/div
DC amplitude accuracy	±0.4%f.s.
Zero position accuracy	±0.15%f.s. (after zero adjustment)
Temperature characteristic	Gain: ±0.02%f.s./°C, Zero position: ±0.03%f.s./°C
Frequency characteristic	DC to 400 kHz $^{+1}_{-3}$dB (in 500 µV to 2 V/div range) With digital filter ON: DC to 3 kHz $^{+1}_{-3}$ dB (Data update rate: 100 µs±20% (in 500 µV to 2 mV/div range))
Noise	75 µVp-p typ.,120 µVp-p max. with digital filter OFF (in 500 µV/div range) 20 µVp-p typ., 30 µVp-p max. with digital filter ON (in 500 µV/div range) (S/N 2004-041135258 and later)
Input terminals	BNC terminal
Input resistance	1 MΩ±1%
Input capacitance	50 pF±20 pF (at 100 kHz)
Input coupling	DC, GND, AC
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 100k±50% (Hz) -3 dB

Temperature input

Measurement ranges	10, 20, 50, 100°C/div
Measurement input range	K: -200 to 1350°C E: -200 to 800°C J: -200 to 1100°C T: -200 to 400°C N: -200 to 1300°C R: 0 to 1700°C S: 0 to 1700°C B: 300 to 1800°C
Temperature measurement accuracy **K, E, J, T, N** **R, S** **B**	 ±0.1% f.s.±1.0°C, ±0.1% f.s.±2.0°C (-200 to 0°C) ±0.1% f.s.±3°C ±0.1% f.s.±4°C (effective measurement range: 400 to 1800°C)
Reference junction compensation	Selectable internal or external
Reference junction compensation accuracy	±0.1% f.s.±1.5°C (with internal reference contact compensation and input terminal in state of temperature equilibrium)
Temperature characteristic	±0.05%f.s./°C (sensor: K, E, J, T, N, with drift compensation mode OFF) ±0.25%f.s./°C(sensor:R,S,B, with drift compensation mode OFF) ±0.04%f.s./°C(all sensors, with drift compensation mode ON)
Frequency characteristic	DC to 1 kHz $^{+1}_{-3}$dB Data update rate: 250 µs±70% (with drift compensation mode OFF) 1 s±20% (with drift compensation mode ON)
Input terminals	2-terminal terminal block
Input resistance	5.1 MΩ±5%
Low-pass filter	OFF, 5±50%, 500±50% (Hz) -3 dB

5.2.3 Model 8938 FFT Analog Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
The number of input channels	2 channels
Measurement ranges	5 m, 10 m, 20 m, 50 m, 100 m, 200 m, 500 m, 1, 2, 5, 10, 20 V/div
DC amplitude accuracy	±0.4%f.s.
Zero position accuracy	±0.1%f.s. (after zero adjustment)
Temperature characteristic	Gain: ±0.025%f.s./°C Zero position: ±0.02%f.s./°C (after zero adjustment)
Frequency characteristic	DC coupling: DC to 400 kHz ±3 dB AC coupling: 7 Hz to 400 kHz ±3 dB (low cut-off frequency: 7 Hz±20%)
Noise	500 µV p-p typ., 750 µV p-p max. (sensitivity range, with input shorted) (S/N 2004-041132533 and later)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 100k±50% (Hz) -3 dB
Anti-aliasing filter	Cutoff frequency (fc): 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 kHz (These frequencies are automatically set when the anti-aliasing filter is set to ON) Attenuation characteristic: -66 dB min. at 1.5 fc
Input type	Unbalanced (input isolated from output)
Input coupling	DC, GND, AC
Input resistance	1 MΩ±1%
Input capacitance	30 pF±10 pF (at 100 kHz)
A/D resolution	12 bits
Voltage axis resolution	80 points/div (with 1X magnification)
Maximum sampling rate	1 MS/s (sampling period: 1 µs)
Input terminals	Insulated BNC terminal
Maximum input voltage	400 VDC
Maximum rated voltage to earth	370 VDC (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Operating environment	Same as the Memory HiCorder in which the 8938 is installed
Effect of radiated radio-frequency electromagnetic field	±2%f.s. at 3 V/m max.
Effect of conducted radio-frequency electromagnetic field	±28%f.s. at 3 V max. (100 mV/div with 1 V DC input)
Dielectric strength	3.7 kVAC for 1 minute (between input module and chassis, and between input modules)
Dimensions	Approx.170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D)(sans protrusions)
Mass	Approx.290g (10.2 oz.)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category II (anticipated transient overvoltage 4000 V)
EMC	EN 61326 Class A

5.2.4 Model 8939 Strain Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C (73±9°F), 35 to 80% RH (When executing auto-balancing one hour after power on)
Period of guaranteed accuracy	1 year
The number of input channels	2 channels
Measurement ranges	20, 50, 100, 200, 500, 1000 με/div
DC amplitude accuracy	± (0.5%f.s. + 2 με)
Zero position accuracy	±0.5%f.s. (after auto-balancing)
Temperature characteristic	Gain: ±0.05%f.s./°C Zero position: ±2 με/°C (20,50 με/div), ±0.1%f.s./°C (other ranges)
Frequency characteristic	DC to 20 kHz $^{+1}_{-3}$dB
Appropriate adapter	Strain gauge adapter, Bridge resistance: 120 Ω to 1 kΩ
Bridge voltage	2 ± 0.05 V
Balancing	Electronic auto-balancing
Balance adjustment range	±10000 με max
Low-pass filter	OFF, 10±30%, 30±30%, 300±30%, 3k±30% (Hz) -3 dB
A/D resolution	12 bits
Maximum sampling speed	1 MS/s (sampling period: 1 μs)
Maximum input voltage	10 V (DC + AC peak)
Maximum rated voltage to earth	30 Vrms or 60 VDC
Operational ranges for temperature and humidity	Same as the host Memory HiCorder
Temperature and humidity ranges for storage	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Operating environment	Same as the host Memory HiCorder
Effect of radiated radio frequency electromagnetic field	±5%f.s. at 3 V/m max.
Effect of conducted radio-frequency electromagnetic field	±5%f.s. at 3 V max (20 με/div when +/– signal lines shorted together)
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D)
Mass	Approx. 250 g (8.8 oz.)
Accessories	Conversion cable X 2 (Compatible sensor connector: PRC03-12A10-7M10.5 by TAJIMI)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A

5.2.5 Model 8940 F/V Unit

General Specifications

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
A/D resolution	12 bits
Vertical axis resolution	80 LSB/div
Measurement mode	Frequency measurement, Count, Duty, Voltage measurement, Current measurement
Maximum sampling period	1 µs
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 100k ±50% (Hz) -3 dB
Input coupling	DC, GND, AC (Fixed DC coupling except voltage and current measurement)
Pull up	ON/OFF (Constant OFF in current measurement) Pull up resistance: 10 kΩ
BNC terminal	Input resistance: 1 MΩ±1% (at pull-up OFF) Input capacitance: 60 pF±20 pF (at 100 kHz) Input type: Unbalanced (for Voltage, Frequency, Count, Duty) Note: With the 3273 or 3273-50, the BNC connector and sensor connector are used together. GND is common with the Memory HiCorder in which the device is installed.
Sensor connector terminal (Current measurement)	Possible to connect 8 ch Note: With the 3273 or 3273-50, the BNC connector and sensor connector are used together. GND is common with the Memory HiCorder in which the device is installed.
Maximum input voltage	30 Vrms or 60 VDC
Maximum rated voltage to earth	30 Vrms or 60 VDC (BNC)
Operational ranges for temperature and humidity	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Temperature and humidity ranges for storage	-10 to 50°C (14 to 122°F) 80%RH or less (non-condensating)
Effect of radiated radio-frequency electromagnetic field	±5 %f.s. at 3 V/m max. (in 5-mV/div range)
Effect of conducted radio-frequency electromagnetic field	±28%f.s. at 3 V max. (100 mV/div with 1 V DC input)
Dimensions	Approx. 170 W x 20 H x 148.5 D mm(6.69"W x 0.79"H x 5.85"D)(sans protrusions)
Mass	Approx. 300 g (10.6 oz)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A
Options	9318 Conversion Cable (for 9270, 9271, 9272, 9277, 9278, 9279) 9319 Conversion Cable (for 3273, 3273-50)

Frequency, Count, Duty Measurement Specifications

Frequency ranges	0.05, 0.1, 0.5, 1,5, 10, 50, 100, 500 Hz/div 1, 5 kHz/div 5, 10, 50, 100, 500 r/min/div Power source frequency ranges: 50 Hz(40 to 60 Hz), 60 Hz(50 to 70 Hz)
Frequency accuracy	±0.2%f.s. (except 100 kHz f.s. range) ±0.7%f.s. (100 kHz f.s. range) ±0.032Hz (Power source frequency ranges)
Frequency hold	ON/OFF (waiting time 10 ms, 1 s variable) When hold is OFF, the current measurement value is halved if the next measurement value is not fixed within the waiting time.
Count ranges	5, 10, 50, 100, 500 counts/div, 1, 5, 10, 50, 100, 500 k counts/div
Duty range	100%f.s.
Duty accuracy	±1% (10 Hz to 10 kHz)
Threshold value	-10 to +10 V variable (0.2 V steps)
Frequency measurement ranges	DC to 100 kHz (Frequency) DC to 90 kHz (Count) 10 Hz to 100 kHz (Duty)
Response time	10 µs (Frequency (more than 300 Hz), Count) 50 µs (Frequency (300 Hz not greater), Duty)

Voltage and Current Measurement Specifications

Voltage range	500 µV/div, 1, 2, 5, 10, 20, 50, 100, 200, 500 mV/div 1, 2 V/div
Current range	• Using the 9270, 9272(20A), 9277, 3273, 3273-50 5, 10, 20, 50, 100, 200, 500 mA/div, 1, 2, 5 A/div • Using the 9271, 9272(200A), 9278 50, 100, 200, 500 mA/div, 1, 2, 5, 10, 20, 50 A/div • Using the 9279 200*, 500 mA/div 1*, 2*, 5, 10*, 20*, 50, 100* A/div * Vertical axis resolution: 64 LSB/div, and sensor accuracy is 1.25 times.
Frequency characteristic	DC to 400 kHz±3 dB (DC coupling) (When using a sensor, depends on the characteristics of the sensor.)
DC amplitude accuracy	±0.4%f.s. (Using the 9279: ±0.5%f.s.)
Zero position accuracy	±0.15%f.s. (Using the 9279: ±0.2%f.s.) (after zero adjustment)
Temperature characteristic	Gain: ±0.025%f.s./°C Zero position: ±0.04%f.s./°C (in 0.5, 1, 2 mV/div range) ±0.03%f.s./°C (except 0.5, 1, 2 mV/div range)
Common mode rejection ratio	80 dB min (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Noise	150 µVp-p max (in 500 µV/div range)

NOTE

- For current measurement, include the accuracy and characteristics of the sensor or probe.
- When used in combination with the Model 8940, the input rating of the Model 3273-50 is 15 A.

5.2.6 Model 8946 4-Ch Analog Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C (73±9°F), 35 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
The number of input channels	4 channels
Measurement ranges	10 m, 20 m, 50 m, 100 m, 200 m, 500 m, 1, 2 V/div
DC amplitude accuracy	±0.5%f.s.
Zero position accuracy	±0.15%f.s. (after zero adjustment)
Temperature characteristic	Gain: ±0.05%f.s./°C Zero position: ±0.025%f.s./°C
Frequency characteristic	DC to 100 kHz ±3dB
Noise	1 mVp-p typ., 2 mVp-p max. (sensitivity range, with input shorted)
Common mode rejection ratio	80 dB minimum(at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 50k±50% (Hz) -3 dB
Input type	Unbalanced (input isolated from output)
Input coupling	DC, GND
Input resistance	1 MΩ±1%
Input capacitance	15 pF±10 pF (at 100 kHz)
A/D resolution	12 bits
Maximum sampling rate	1 MS/s (sampling period: 1 μs)
Input terminals	BNC terminal
Maximum input voltage	30 V rms or 60 VDC
Maximum rated voltage to earth	30 V rms or 60 VDC (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Effect of radiated radio-frequency electromagnetic field	±2 %f.s. at 3 V/m max.
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69"W x 0.79"H x 5.85"D) (sans protrusions)
Mass	Approx. 310 g (10.9 oz.)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A

5.2.7 Model 8947 Charge Unit

General Specifications

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH (when zero adjustment is executed 1 hour after power on)
Period of guaranteed accuracy	1 year
The number of input channels	2 channels (switchable) Charge input, internal preamp input, voltage input (select one for each channel)
Input type	Unbalanced input (floating between input terminals, and floating input terminals to chassis ground, voltage input terminals and charge input terminal ground)
Common mode refection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 É¹ maximum)
Anti-aliasing filter	Cutoff frequency (fc) 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 k (Hz) (ON/OFF, auto setting corresponding to the time axis and frequency axis range) Attenuation: -66 dB min at 1.5 fc
Maximum sampling speed	1 MS/s
A/D resolution	12 bits
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Effect of radiated radio-frequency electromagnetic field	±10%f.s. at 3 V/m max. (in 5-mV/div range)
Effect of conducted radio-frequency electromagnetic field	±5%f.s. at 3 V max. (100 mV/div with 1 V DC input)
Dimensions	Approx. 170 W x 20 H x 148.5 D mm (6.69" W x 0.79" H x 5.85" D) (sans protrusions)
Mass	Approx. 310 g (10.9 oz)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A

Charge Input

Compatible converter	Charge-output type piezoelectric accelerator pickup sensor
Measurement sensitivity	0.1 to 10 pC/(m/s^2)
Measurement range	2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k (m/s^2)/div (Measurement sensitivity: 0.1 to 0.25 pC/(m/s^2)) 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k (m/s^2)/div (Measurement sensitivity: 0.251 to 0.5 pC/(m/s^2)) 500m, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k (m/s^2)/div (Measurement sensitivity: 0.501 to 1.0 pC/(m/s^2)) 200m, 500m, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k (m/s^2)/div (Measurement sensitivity: 1.01 to 2.5 pC/(m/s^2)) 100m, 200m, 500m, 1, 2, 5, 10, 20, 50, 100, 200, 500 (m/s^2)/div (Measurement sensitivity: 2.51 to 5.0 pC/(m/s^2)) 50m, 100m, 200m, 500m, 1, 2, 5, 10, 20, 50, 100, 200 (m/s^2)/div (Measurement sensitivity: 5.01 to 10.0 pC/(m/s^2))
Amplitude accuracy	±2%f.s.

Charge Input

Temperature characteristic	±0.2%f.s./°C
Frequency characteristic	1 Hz to 50 kHz $^{+1}_{-3}$ dB
Low-pass filter	OFF, 500±50%, 5k±50% (Hz) -3 dB
Maximum input charge	±500 pC (with six high-sensitivity ranges selected) ±50,000 pC (with six low-sensitivity ranges selected)
Input terminal	Miniature connector (#10-32 UNF)

Input for Sensor Preamp

Compatible converter	Internal preamp type acceleration pickup sensor
Measurement sensitivity	0.1 to 10 mV/(m/s^2)
Measurement range	2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k (m/s^2)/div (Measurement sensitivity: 0.1 to 0.25 mV/(m/s^2)) 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k (m/s^2)/div (Measurement sensitivity: 0.251 to 0.5 mV/(m/s^2)) 500m, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k (m/s^2)/div (Measurement sensitivity: 0.501 to 1.0 mV/(m/s^2)) 200m, 500m, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k (m/s^2)/div (Measurement sensitivity: 1.01 to 2.5 mV/(m/s^2)) 100m, 200m, 500m, 1, 2, 5, 10, 20, 50, 100, 200, 500 (m/s^2)/div (Measurement sensitivity: 2.51 to 5.0 mV/(m/s^2)) 50m, 100m, 200m, 500m, 1, 2, 5, 10, 20, 50, 100, 200 (m/s^2)/div (Measurement sensitivity: 5.01 to 10 mV/(m/s^2))
Amplitude accuracy	±2%f.s.
Temperature characteristic	±0.2%f.s./°C
Frequency characteristic	1 Hz to 50 kHz $^{+1}_{-3}$dB (low-end cutoff frequency = 1 Hz ±50%)
Low-pass filter	OFF, 500±50%, 5k±50% (Hz) -3 dB
Drive power	2 mA ±20%, +15 V ±5%
Input terminal	BNC terminal

Voltage Input

Measurement range	500µ, 1m, 2m, 5m, 10m, 20m, 50m, 100m, 200m, 500m, 1, 2 V/div
DC amplitude accuracy	±0.4%f.s.
Zero position setting accuracy	±0.15%f.s. (after zero adjustment)
Tempearture characteristic	Gain: ±0.02%f.s./°C, Zero position: ±0.03%f.s./°C
Frequency characteristic	DC coupling: DC to 400 kHz $^{+1}_{-3}$ dB AC coupling: 1 Hz to 400 kHz $^{+1}_{-3}$ dB (low-end cut-off frequency 1Hz ±50%) (in 500 µV to 2 mV/div range)
Noize	75µVp-p typ., 120µVp-p max. (in 500µV/div range) (S/N 2004-040933651 and later)
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 100k±50% (Hz) -3 dB
Input resistance	1 MΩ±1%
Input capacity	200 pF max (at 100 kHz)
Input coupling	DC, GND, AC
Maximum input voltage	30 Vrms or 60 VDC
Maximum rated voltage to earth	30 Vrms or 60 VDC
Input terminal	BNC terminal

5.2.8 Model 8956 Analog Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C (73±9°F), 30 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
The number of input channels	2 channels
Measurement ranges	5, 10, 20, 50, 100, 200, 500 mV/div, 1, 2, 5, 10, 20 V/div
DC amplitude accuracy	±0.4%f.s. (filter 5 Hz ON)
Zero position accuracy	±0.1%f.s. (filter 5 Hz ON, after zero adjustment)
Temperature characteristic	Gain: ±0.03%f.s./°C Zero position: ±0.05%f.s./°C (after zero adjustment)
Frequency characteristic	DC coupling: DC to 10 MHz ±3 dB AC coupling: 7 Hz to 10 MHz ±3 dB (low cut-off frequency: 7 Hz±50%)
Noise	1.5 mV p-p typ., 2 mV p-p max. (sensitivity range, with input shorted)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 1M±50% (Hz) -3 dB
Input type	Unbalanced (input isolated from output)
Input coupling	DC, GND, AC
Input resistance	1 MΩ±1%
Input capacitance	40 pF±10 pF (at 100 kHz)
A/D resolution	12 bits
Maximum sampling rate	20 MS/s
Input terminals	Insulated BNC terminal
Maximum input voltage	400 VDC
Insulation resistance, dielectric strength	1.5 kVAC for 15 seconds (between input module and chassis, and between input modules) At least 100 MΩ at 500 V DC
Maximum rated voltage to earth	300 V AC/DC (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Effect of radiated radio-frequency electromagnetic field	±15%f.s. at 3 V/m max.
Effect of conducted radio-frequency electromagnetic field	±28%f.s. at 3 V max. (100 mV/div with 1 V DC input)
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D) (sans protrusions)
Mass	Approx. 290 g (10.2 oz.)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category II (anticipated transient overvoltage 2500 V)
EMC	EN 61326 Class A

5.2.9 Model 8957 High Resolution Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C (73±9°F), 30 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
The number of input channels	2 channels
Measurement ranges	5, 10, 20, 50, 100, 200, 500 mV/div 1, 2, 5, 10, 20 V/div
DC amplitude accuracy	±0.2%f.s. (filter 5 Hz ON)
Zero position accuracy	±0.1%f.s. (filter 5 Hz ON, after zero adjustment)
Temperature characteristic	Gain: ±0.025%f.s./°C, Zero position: ±0.02%f.s./°C (after zero adjustment)
Frequency characteristic	DC coupling: DC to 200 kHz ±3 dB AC coupling: 7 Hz to 200 kHz ±3 dB (low cut-off frequency: 7 Hz±50%)
Noise	500 µV p-p typ., 1 mV p-p max. (sensitivity range, with input shorted)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5±50%, 50±50% 500±50%, 5k±50%, 50k±50% (Hz) -3 dB
Anti-aliasing filter	Cutoff frequency (fc): 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 kHz (These frequencies are automatically set when the anti-aliasing filter is set to ON) Attenuation characteristic: -66 dB min. at 1.5 fc
Input type	Unbalanced (input isolated from output)
Input coupling	DC, GND, AC
Input resistance	1 MΩ±1%
Input capacitance	40 pF±10 pF (at 100 kHz)
A/D resolution	16 bits
Maximum sampling rate	2 MS/s
Input terminals	Insulated BNC terminal
Maximum input voltage	400 VDC
Insulation resistance, dielectric strength	1.5 kVAC for 15 seconds (between input module and chassis, and between input modules) At least 100 MΩ at 500 V DC
Maximum rated voltage to earth	300 V AC/DC (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D) (sans protrusions)
Mass	Approx. 310 g (10.9 oz.)
Effect of radiated radio-frequency electromagnetic field	±15%f.s. at 3 V/m max.
Effect of conducted radio-frequency electromagnetic field	±28%f.s. at 3 V max. (500 mV/div with 1 V DC input)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category II (anticipated transient overvoltage 2500 V)
EMC	EN 61326 Class A

5.2.10 Model 8958 16-Ch Scanner Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C (73±9°F), 30 to 80% RH (When executing zero-position adjustment one hour after power on)
Period of guaranteed accuracy	1 year
Guaranteed accuracy period	1 year
The number of input channels	16 channels (Each channel can be set for voltage, or for a thermocouple)
Input terminals	Screw-type terminal block (two terminals per channel) (Recommended diameter 0.32 mm or larger, recommended wire: 0.14 to 1.5 mm^2 single-strand or 0.14 to 1.0 mm^2 multi-strand) Detachable terminal block, terminal cover included
Measurement Parameter	Voltage, temperature (K, J, E, T, N, R, S, B, W)
Measurement ranges	Voltage input: 5m, 50m, 500m, 2 [V/div] Temperature input: 10, 50, 100 [°C/div]
Resolution	Voltage input: 1/1600 of range Temperature input: 1/1000 of range
Measurable range	Voltage input: -100%f.s. to 100%f.s. (f.s.=20div) Temperature input: (Upper and lower limits depend on the measurement input range of each sensor) 10°C/div:-100 to 200°C 50°C/div:-200 to 1000°C 100°C/div:-200 to 2000°C
Input range of thermocouple measurement	JIS C 1602-1995 K: -200 to 1350°C J: -200 to 1200°C E: -200 to 1000°C T: -200 to 400°C N: -200 to 1300°C R: 400 to 1700°C S: 400 to 1700°C B: 400 to 1800°C ASTM E-988-96 W(WRe5-26): 0 to 2000°C
Measurement accuracy	Voltage input: ±0.2%f.s. Temperature input: K, J, E, T, N: ±0.05%f.s.±1°C R, S, B, W: ±0.05%f.s.±3.5°C (less than 400°C) ±0.05%f.s.±2°C (400°C or more)
Reference junction compensation	(Temperature input) Selectable internal or external
Reference junction compensation accuracy	(Temperature input) ±1°C (with internal reference contact compensation and input terminal in state of temperature equilibrium)
Disconnect (Burn-Out) detection	(Temperature input) selectable ON or OFF
Temperature characteristic	To the measurement accuracy add (measurement accuracy × 0.15) per ºC
Digital filter	OFF/ 50Hz/ 60Hz/ 10Hz
Data refresh rate	50 ms (with digital filter: OFF) 300 ms (with digital filter: 50/60Hz) 1.4 s (with digital filter:10Hz)
Normal mode rejection ratio	50dB min. When the 50-Hz digital filter is enabled with 50-Hz input When the 60-Hz digital filter is enabled with 60-Hz input When the 10-Hz digital filter is enabled with 10-Hz input
Common mode rejection ratio	100 dB min. (at 50/60 Hz, digital filter OFF with signal source resistance 100 Ω max.) 140dB min. (at 50 Hz, digital filter 50Hz with signal source resistance 100 Ω max.) (at 60 Hz, digital filter 60Hz with signal source resistance 100 Ω max.)

5.2 Analog Input Section

Noise	Voltage input: 50 μVp-p max. (with digital filter OFF, in 5 mV/div range, with input shorted) Temperature input: 0.5°Cp-p max. (with digital filter OFF, in 10°C/div range, measurement mode: K, with input shorted)
Input resistance	1 MΩ±5% (With Disconnect (Burn-Out) Detection disabled during voltage and thermocouple measurement) 850 kΩ±5% (With Disconnect (Burn-Out) Detection enabled during thermocouple measurement)
Maximum input voltage	40 VDC
Maximum rated voltage to earth	33 V rms or 70 VDC (between each input channel and chassis, and between input channels)
Dielectric strength	350 VAC for 15 seconds (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Storage temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Dimensions	Approx. 170W x 20H x 183D mm (6.69”W x 0.79”H x 7.2”D) (sans protrusions)
Mass	Approx. 385 g (13.6 oz.)
Effect of radiated radio-frequency electromagnetic field	±2% f.s. at 3 V/m max. (in 5-mV/div range)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A
Accessories	Flathead screwdriver (for terminals), two shorting bars (for zero-position adjustment)

5.2.11 Model 8959 DC/RMS Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 30 to 80% RH (when zero adjustment is executed 30 minutes after power on)
Period of guaranteed accuracy	1 year
The number of input channels	2 channels
Measurement ranges	5, 10, 20, 50, 100, 200, 500 mV/div, 1, 2, 5, 10, 20 V/div
DC amplitude accuracy	±0.4%f.s. (filter 5 Hz ON)
RMS amplitude accuracy	±1%f.s. (DC, 20 Hz to 1 kHz) ±3%f.s. (1 to 100 kHz) (Sine wave input, response time:SLOW)
Response time	Slow 5 s (during rise 0 to 90%f.s.) Medium 800 ms (during rise 0 to 90%f.s.) Fast 100 ms (during rise 0 to 90%f.s.)
Crest factor	2
Zero position accuracy	±0.1%f.s. (filter 5 Hz ON, after zero adjustment)
Temperature characteristic	Gain: ±0.025%f.s./°C Zero position: ±0.02%f.s./°C (after zero adjustment)
Frequency characteristic	DC coupling: DC to 400 kHz ±3 dB AC coupling: 7 Hz to 400 kHz ±3 dB (low cut-off frequency: 7 Hz±50%)
Noise	500 µV p-p typ., 750 µV p-p max. (sensitivity range, with input shorted)
Common mode rejection ratio	80 dB minimum (at 50/60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	OFF, 5±50%, 500±50%, 5k±50%, 100k±50% (Hz) -3 dB
Input type	Unbalanced (input isolated from output)
Input coupling	DC, GND, AC
Input resistance	1 MΩ±1%
Input capacitance	30 pF±10 pF (at 100 kHz)
A/D resolution	12 bits
Maximum sampling rate	1 MS/s
Input terminals	Insulated BNC terminal
Maximum input voltage	400 VDC
Insulation resistance, dielectric strength	3.7 kVAC for 15 seconds (between input module and chassis, and between input modules), At least 100 MΩ at 500 V DC
Maximum rated voltage to earth	370 V AC/DC (between each input channel and chassis, and between input channels)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Dimensions	Approx. 170W x 20H x 148.5D mm (6.69”W x 0.79”H x 5.85”D) (sans protrusions)
Mass	Approx. 290 g (10.2 oz.)
Effect of radiated radio-frequency electromagnetic field	±5%f.s. at 3 V/m max.
Effect of conducted radio-frequency electromagnetic field	±28%f.s. at 3 V max. (100 mV/div with 1 V DC input)
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category II (anticipated transient overvoltage 4000 V)
EMC	EN 61326 Class A

5.2.12 Model 8960 Strain Unit

Temperature and humidity range for guaranteed accuracy	23 ±5°C(73±9°F), 35 to 80% RH (When executing auto-balancing 30 minutes after power on)
Period of guaranteed accuracy	1 year
Number of input channels	2 channels
Input terminals	R05-R5F by TAJIMI
Appropriate adapter	Strain gauge adapter
Bridge voltage	2, 5, 10 ± 0.05 V
Bridge resistance	120 Ω to 1 kΩ (Bridge voltage 2 V) 350 Ω to 1 kΩ (Bridge voltage 5, 10 V)
Balance adjustment range	±10000 με max
Balancing	Electronic auto-balancing
Measurement ranges	20, 50, 100, 200, 500, 1000 με/div
DC amplitude accuracy	±(0.4%f.s.+ 2 με) (filter 5 Hz ON) (When using the conversion cables supplied. When using other cables, cable resistance is 1.5 Ω max. at bridge resistance 350 Ω)
Zero position accuracy	±0.1%f.s. + 2 με(filter 5 Hz ON, after auto-balancing)
Temperature characteristic	Gain: ±0.05%f.s./°C Zero position (after auto-balancing):±2.5 με/°C
Frequency characteristic	DC to 20 kHz $^{+1}_{-3}$ dB
Low-pass filter	OFF, 5±30%, 10±30%, 100±30%, 1k±30% (Hz) -3 dB
Anti-aliasing filter	Cutoff frequency (fc) 20, 40, 80, 200, 400, 800, 2 k, 4 k, 8 k, 20 k, 40 k (Hz) (These frequencies are automatically set when the anti-aliasing filter is set to ON) Attenuation: -66 dB min at 1.5 fc
A/D resolution	16 bits
Maximum sampling rate	200 kS/s
Maximum input voltage	10 VDC
Maximum rated voltage to earth	33 Vrms or 70 VDC (between each input channel and main unit, and between input channels)
Dielectric strength	350 VAC for 15 seconds (between input module and main unit, and between input modules)
Operating temperature and humidity ranges	Same as the host Memory HiCorder
Operating environment	Same as the host Memory HiCorder
Storage temperature and humidity ranges	Same as the host Memory HiCorder
Dimensions and mass	Approx. 170W x 20H x 148.5D mm (6.69"W x 0.79"H x 5.85"D) (excluding projections) Approx. 290 g (10.2 oz.)
Accessories	Conversion cable x 2 (Compatible sensor connector: PRC03-12A10-7M10.5 by TAJIMI), Instruction Manual
Effect of radiated radio-frequency electromagnetic field	±5%f.s. at 3 V/m max.
Effect of conducted radio-frequency electromagnetic field	±5%f.s. at 3 V max.
Applicable Standards	
Safety	EN 61010 Pollution degree 2, Measurement category I (anticipated transient overvoltage 330 V)
EMC	EN 61326 Class A

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