

HIOKI

Instruction Manual

8730-10
8731-10

WAVE COMPARATOR

HIOKI E. E. CORPORATION

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Introduction

Thank you for purchasing the HIOKI "8730-10, 8731-10 WAVE COMPARATOR". To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

Inspection

When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

Accessories

Power cord	1
Jumper connector	1
External control terminals label	1
Instruction manual	1
Communications command manual (FD)	1
Application disk (CD-R)	1

Options

9626 PC CARD 32M
 9627 PC CARD 64M
 9726 PC CARD 128M
 9727 PC CARD 256M
 9728 PC CARD 512M
 9729 PC CARD 1G
 9637 RS-232C CABLE (9pin-9pin/1.8m)
 9638 RS-232C CABLE (9pin-25pin/1.8m)
 9642 LAN CABLE
 9333 LAN COMMUNICATOR

ISO _DCV	EXT _DCV	EXT _COM	ISO _GND	STOP	START	EXT _TRIG	EXT _SAMP	MODE3	MODE2	MODE1	MODE0	MODE SET	EXT IN	HOLD	JUDGE _OFF
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
NG _VALUE	OK _VALUE	NG _AREA2	OK _AREA2	NG _AREA1	OK _AREA1	JUDGE _OUT	TRIG _OUT	ERROR	BUSY	STOR AGE	EXT _OUT5	EXT _OUT4	EXT _OUT3	EXT _OUT2	EXT _OUT1
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

External Control Terminals label



Jumper connector

Safety Notes



This instrument is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the instrument. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from instrument defects.

Safety symbols (Used on the 8730-10, 8731-10 and other units)

This manual contains information and warnings essential for safe operation of the instrument and for maintaining it in safe operating condition. Before using the instrument, be sure to carefully read the following safety notes.

	- 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. - In the manual, the symbol indicates particularly important information that the user should read before using the instrument.
	Indicates a grounding terminal.
	Indicates AC (Alternating Current).
	Indicates DC (Direct Current).
	Indicates the ON side of the power switch.
	Indicates the OFF side of the power switch.

Symbols Used in This Manual

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

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

Measurement categories (Overvoltage categories)

This instrument complies with CAT I safety requirements.

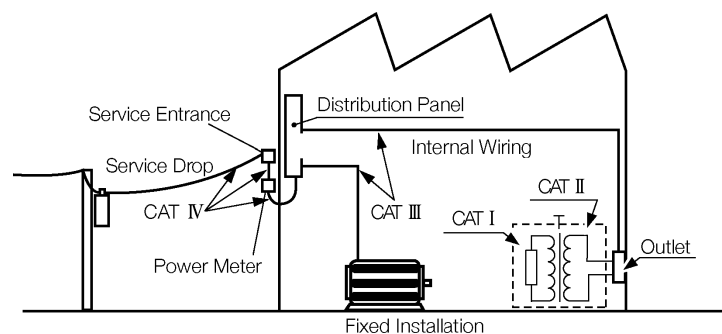
To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. These are defined as follows.

CAT I	Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.
CAT II	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)
CAT III	Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.
CAT IV	The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Higher-numbered categories correspond to electrical environments with greater momentary energy. So a measurement device designed for CAT III environments can endure greater momentary energy than a device designed for CAT II.

Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.

Never use a CAT I measuring instrument in CAT II, III, or IV environments. The measurement categories comply with the Overvoltage Categories of the IEC60664 Standards.



Notes on Use



Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

Preliminary Checks

Before using the instrument the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.



Probe Connection, Measurement Voltage input

- Maximum input voltage ratings for the CH1, CH2 and the external control terminals are shown below. To avoid the risk of electric shock and damage to the unit, take care not to exceed these ratings.
- The maximum rated voltage to earth of the CH1, CH2 and external control terminals (voltage between each channel and the 8730-10, 8731-10, between channels, and between an external control terminal and the 8730-10, 8731-10) is shown below. To avoid the risk of electric shock and damage to the unit, take care that voltage between channels and between a channel and ground does not exceed these ratings.
- The maximum rated voltage to earth rating applies also if an input attenuator or similar is used. Ensure that voltage does not exceed these ratings.

Power cord Connection

- Before using the instrument, make sure that the insulation on the power cord is undamaged and that no bare conductors are improperly exposed. Using the instrument under such conditions could result in electrocution. Replace the power cord specified by Hioki.

Input/Output Terminals	Maximum Input Voltage	Maximum rated voltage to earth
CH1, CH2 Input Terminals	30 V rms or 60 V DC	30 V rms or 60 V DC
External Control Terminals	30 V DC	30 V rms or 60 V DC



Power Supply Connections

- Before turning the instrument on, make sure the source voltage matches that indicated on the instrument's power connector. Connection to an improper supply voltage may damage the instrument and present an electrical hazard.

Grounding the Unit

- To avoid electric shock and ensure safe operation, connect the power cable to a grounded (3-contact) outlet. (See 2.2)

Before Powering on

- Check that the power supply is correct for the rating of the unit. (The AC fuse is integrated in the unit.)



Installation Environment

- This instrument should be installed and operated indoors only, between 5 and 40°C and 30 to 85% RH.
- Do not store or use the instrument where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the instrument may be damaged and insulation may deteriorate so that it no longer meets specifications.

Carrying

- Grasp the handle when carrying the 8730-10, 8731-10 to avoid dropping it accidentally. (See 1.2)

Shipping

- To avoid damage to the instrument, Remove the PC card from the unit.
- Use the original packing materials when reshipping the instrument, if possible.

Handling the CD-R

- Always hold the disc by the edges, so as not to make fingerprints on the disc or scratch the printing.
- Never touch the recorded side of the disc. Do not place the disc directly on anything hard.
- Do not wet the disc with volatile alcohol or water, as there is a possibility of the label printing disappearing.
- To write on the disc label surface, use a spirit-based felt pen. Do not use a ball-point pen or hard-tipped pen, because there is a danger of scratching the surface and corrupting the data. Do not use adhesive labels.
- Do not expose the disc directly to the sun's rays, or keep it in conditions of high temperature or humidity, as there is a danger of warping, with consequent loss of data.
- To remove dirt, dust, or fingerprints from the disc, wipe with a dry cloth, or use a CD cleaner. Always wipe radially from the inside to the outside, and do no wipe with circular movements. Never use abrasives or solvent cleaners.
- Hioki shall not be held liable for any problems with a computer system that arises from the use of this CD-R, or for any problem related to the purchase of a Hioki product.

Others

- In the event of problems with operation, first refer to Section 12.3.
- Carefully read and observe all precautions in this manual.

Chapter Summary

Chapter 1 Instrument Overview

Contains an overview of the unit and its features.

Chapter 2 Installation and Preparation

Explains how to set the unit up for measurement.

Chapter 3 Basic Operation and Settings

Explains how to operate the keys and the Jog/Shuttle control for carrying out basic measurement functions.

Chapter 4 Settings on the Measurement Screen

Explains measurement settings.

Chapter 5 Comparison and Calculation

Explains the settings for comparison and calculation. Also explains how to create a comparison area.

Chapter 6 Saving and Loading Data

Explains how to store, recall, and delete measurement data and measurement settings.

Chapter 7 Adjustment and Setting of the Unit

Explains how to adjust and diagnose the 8730-10, 8731-10 and set up the interface and external control terminals.

Chapter 8 External Control Terminals

Gives specifications and usage details of the external control terminals.

Chapter 9 Interface

Explains about LAN and RS-232C interface.

Chapter 10 A/B Cursors and Scrolling the Waveform

Explains how to perform waveform scrolling, how to use the A/B cursors and so.

Chapter 11 Specifications

Contains general specifications and detailed function specifications.

Chapter 12 Maintenance and Service

Describes maintenance procedures.

Chapter 13 Appendix

Chapter 1

Instrument Overview

1.1 Major Features

(1) Waveform Comparison Function

- The 8730-10, 8731-10 Waveform Comparator are designed specifically to compare waveforms, which is a function of our MEMORY HiCORDERs. The 8730-10 is the one-channel model; the 8731-10 is the two-channel model.
- Two methods of comparison are available: Area Comparison (which uses a comparison area created for the waveform), and Value Comparison (which uses upper and lower limits). Both methods can be used simultaneously.
- In Area Comparison, separate areas can be used for CH1 and CH2, with independent comparison possible. (This is only available with the 8731-10.)
- Value Comparison is based on the result of value calculation (e.g., maximum, minimum, or average value).

(2) Forms of Installation

- Both 8730-10, 8731-10 models have handles and rubber feet. The units are portable and can be installed on a workbench or shelf.
- The handles and rubber feet are easily secured with screws and can be easily removed. The 8730-10, 8731-10 can be assembled on a rack (compliant with JIS or EIA standard) or a panel. A custom-made mounting bracket is optionally available. Please contact your vendor or our agent for details.

(3) High-Speed Sampling

- The 8730-10 records the waveform of one channel and the 8731-10 records the waveforms of two channels simultaneously at a maximum speed of 1MS/s.
- Given the high-speed sampling of 1,000,000 times per second, even an instantaneous change in input signal is not missed.

(4) Saving Data

- Not only waveform comparison, but also waveform data can be saved on a PC card.
- Data is saved in binary format for reading with the 8730-10, 8731-10, in CSV format for reading with a PC, or in BMP format for screen images.
- Comparison area and waveform data (up to 500DIV when using the 8936) saved on the 8835-01 can be read with the 8730-10, 8731-10.

(5) Color LCD

- A 7.2-inch (640 x 480 dots) STN color LCD is used. The waveforms of CH1 and CH2, or a waveform and its comparison area are clearly distinguished.
- The screen background is blue when comparison is not being conducted. The background changes to green when the comparison result is PASS or red when the result is FAIL.

(6) Data Display

- A gauge (for graduations) or an individual comparison result is displayed at the left of the screen.
- Comments are shown at the top of the screen.

(7) Interface

- The 8730-10, 8731-10 is equipped with LAN (10BASE-T) and RS-232C interfaces.
- The 9333 LAN COMMUNICATOR enables data transfers and remote control.

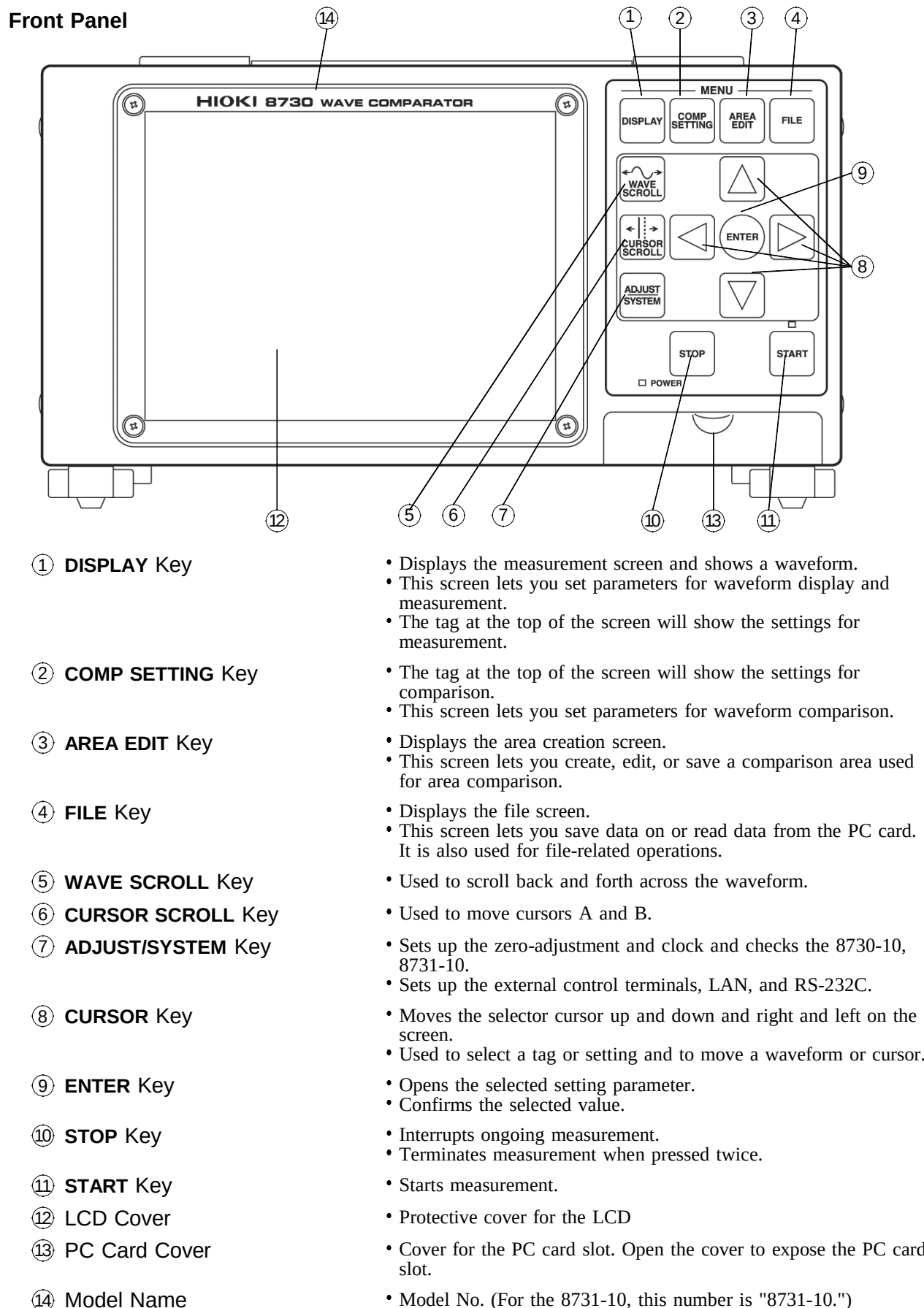
(8) External Control Terminals

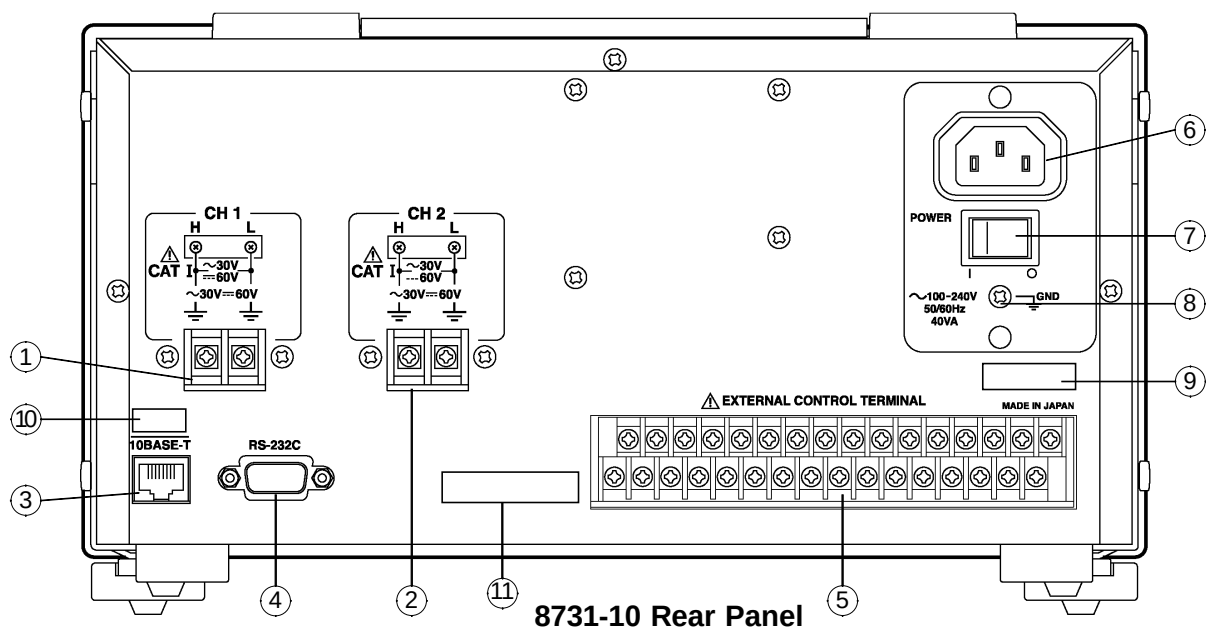
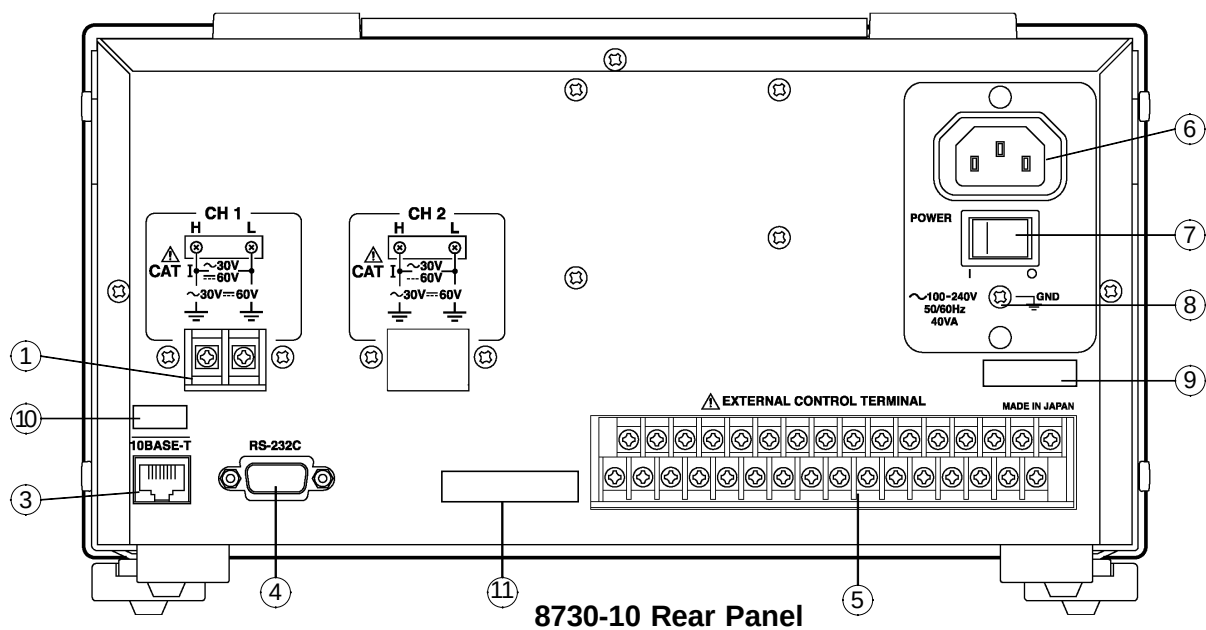
- The external control terminals are used to output comparison results (PASS or FAIL) and to control the 8730-10, 8731-10.
- The external control terminals are insulated from the power supply and GND of the 8730-10, 8731-10.
- Value comparison and area comparison results are output from different terminals. (The 8731-10 compares data for CH1 and CH2 separately, then outputs the results separately.)

(9) Dust-proof Structure

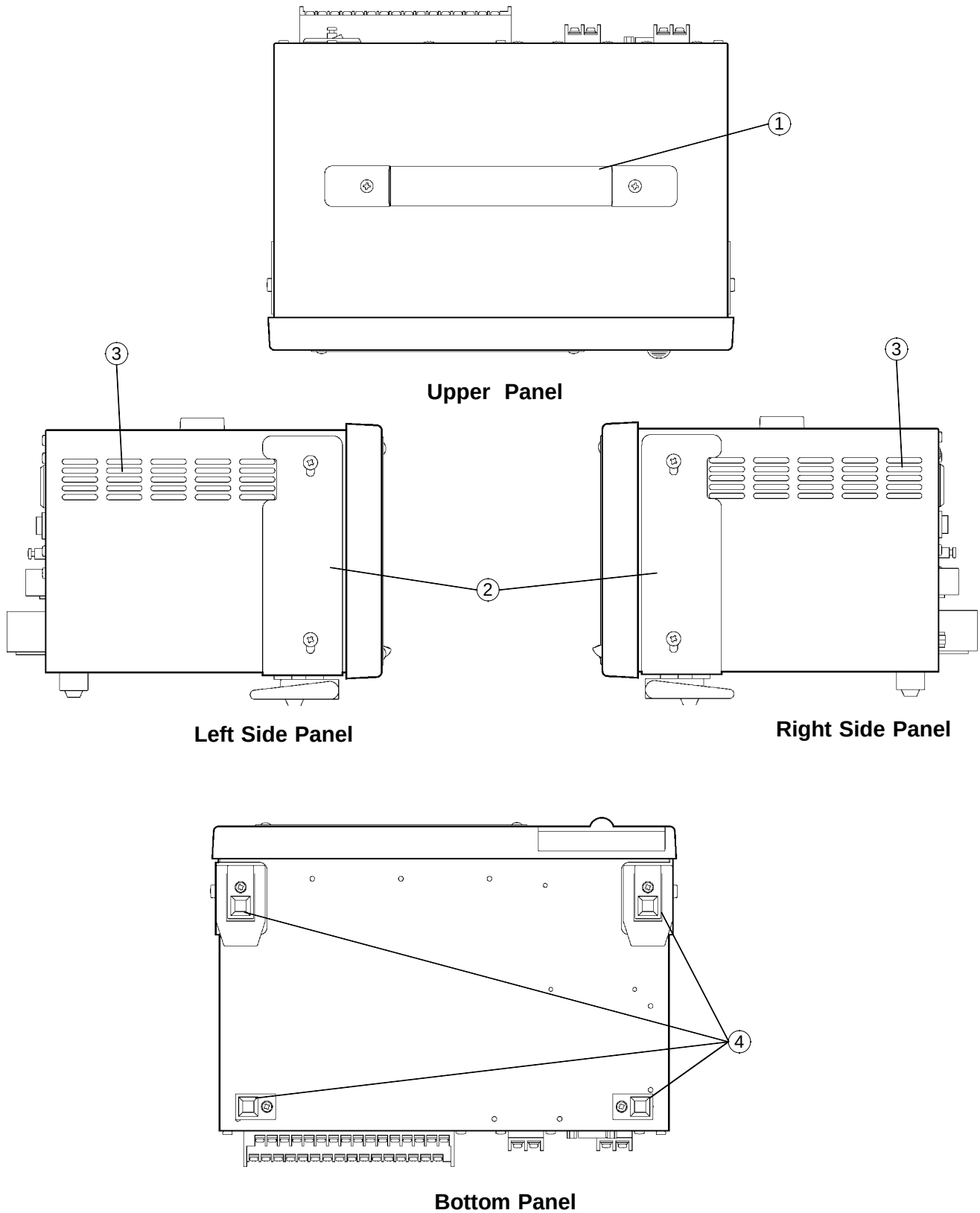
- Flat sheet keys eliminate gaps where dust can gather.
- The front panel has a simplified dust-proof structure. The PC card slot has a cover.

1.2 Identification of Controls and Indicators





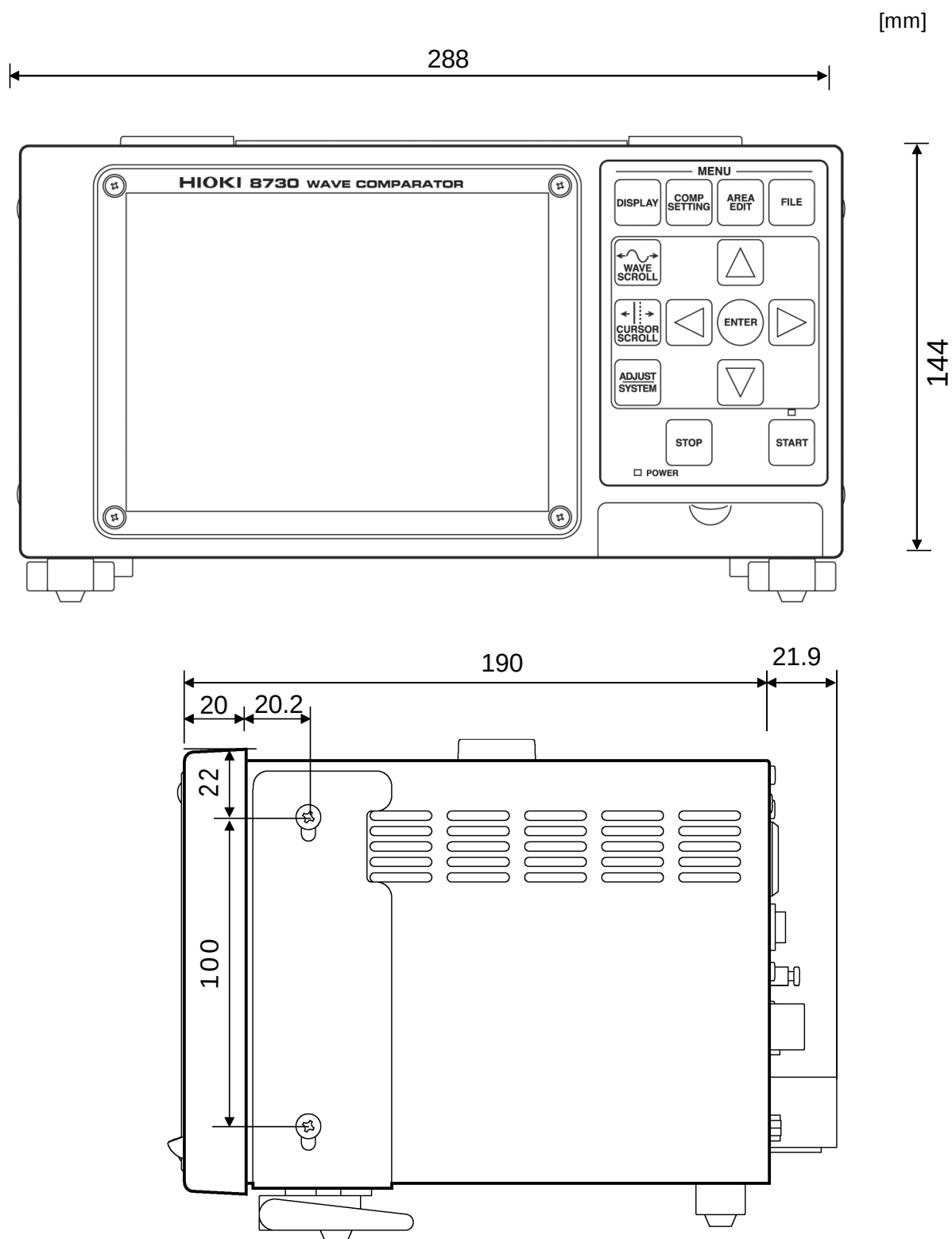
- | | |
|----------------------------------|---|
| ① CH1 Input Terminal | • Inputs the CH1 waveform |
| ② CH2 Input Terminal | • Inputs the CH2 waveform. |
| ③ LAN Connector | • Connects the 8730-10, 8731-10 to a LAN. |
| ④ RS-232C Connector | • Allows remote control using the RS-232C. |
| ⑤ External Control Terminals | • Used to output comparison results and control the 8730-10, 8731-10. |
| | • The terminal block cover includes the terminal nameplates. |
| ⑥ AC Connector | • The supplied power cord must be plugged in here. |
| ⑦ AC Power Switch | • Switches on or off the AC power supply. |
| ⑧ Function Ground Terminal (GND) | • Connects to the earth. |
| ⑨ Serial No. | • Serial No. Label |
| ⑩ MAC Address | • MAC address label |
| ⑪ Model name | • Model name label |



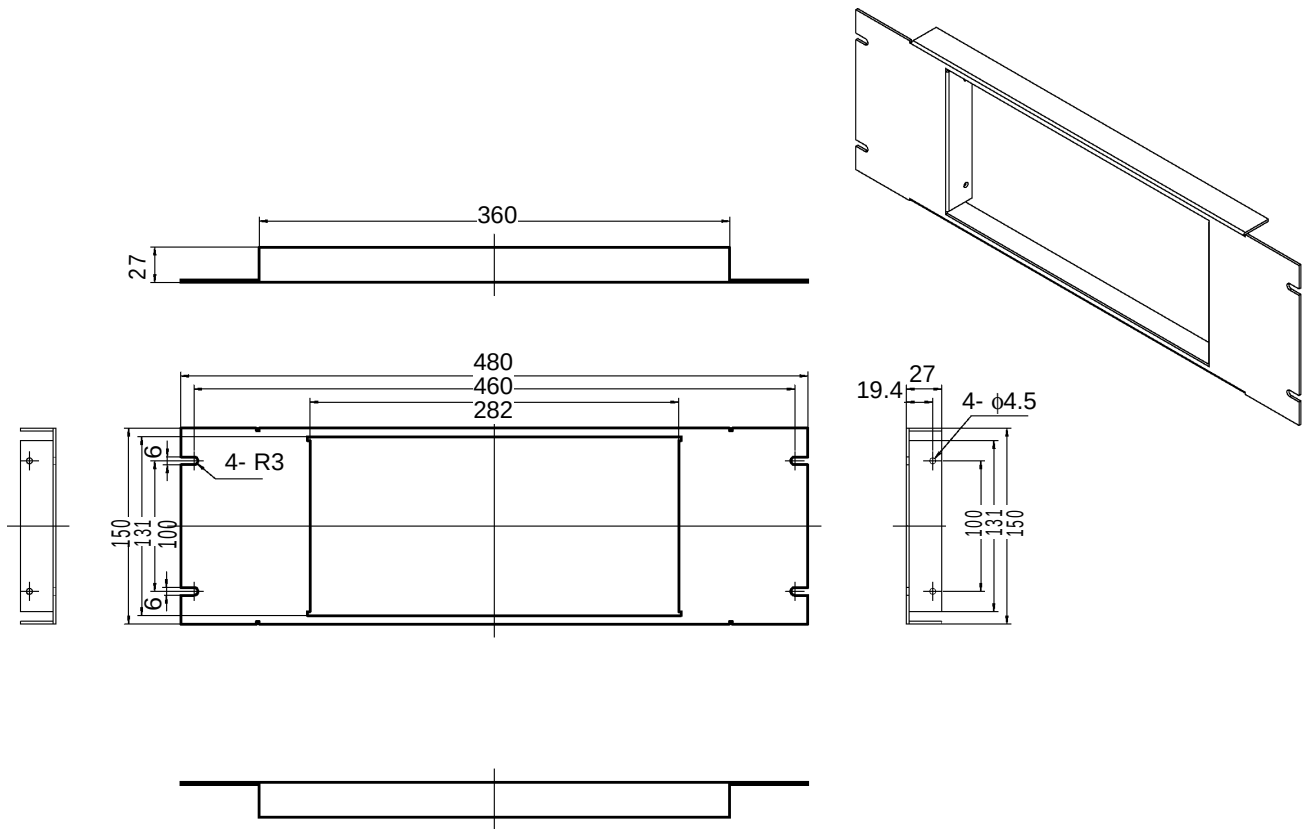
- | | |
|---------------------|---|
| ① Handle | • Serves for transporting the |
| ② L-shaped bracket | • Front rubber feet with a stand are attached. |
| ③ Ventilation slots | • Heat is discharged from this opening. Never block this opening. |
| ④ Rubber Foot | |

1.3 Dimension Diagrams

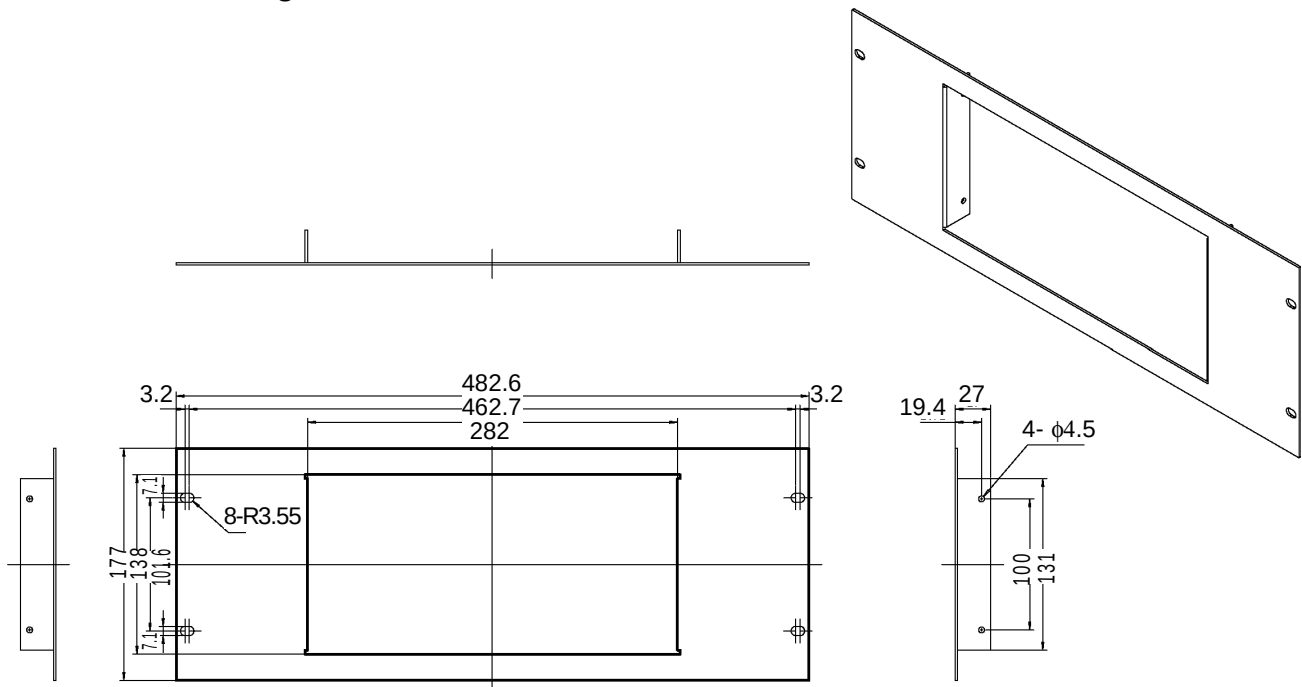
Main Unit Dimensions



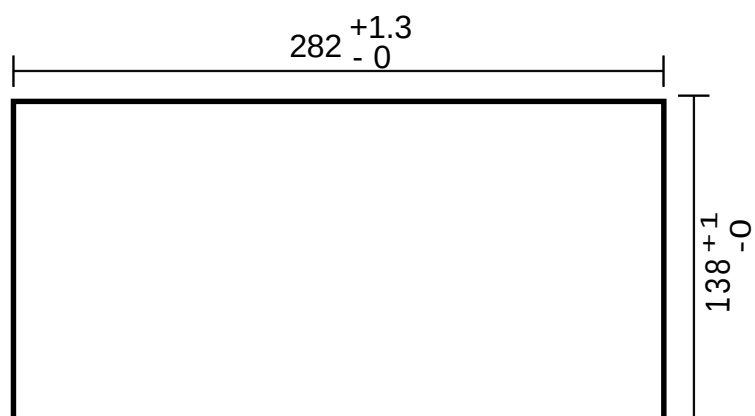
JIS Rack-Mounting Bracket



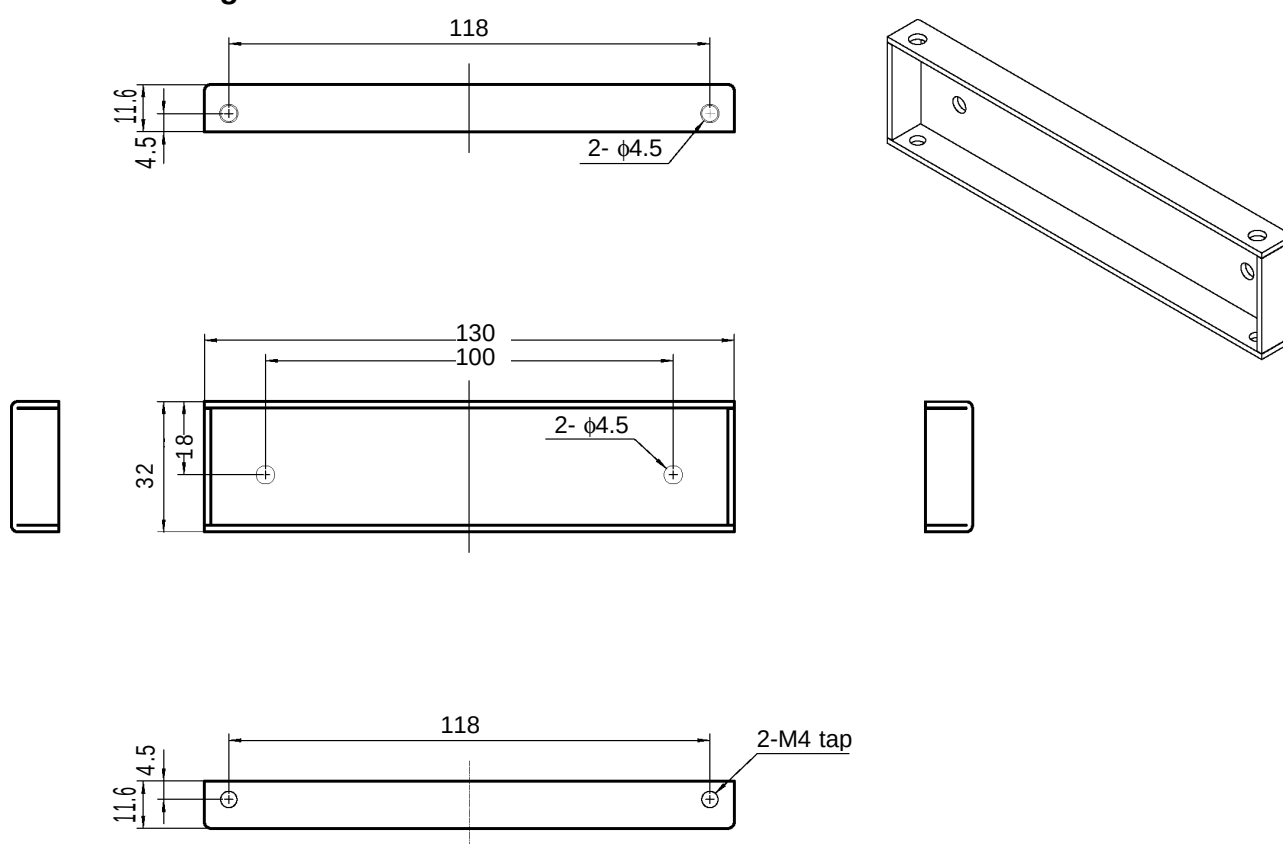
EIA Rack-Mounting Bracket



Panel Dimensions



Panel-Mounting Bracket



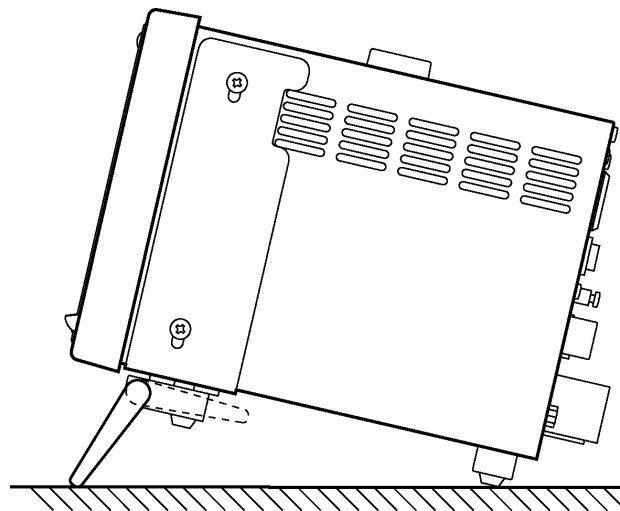
Chapter 2

Installation and Preparation

2.1 Installation of the Unit

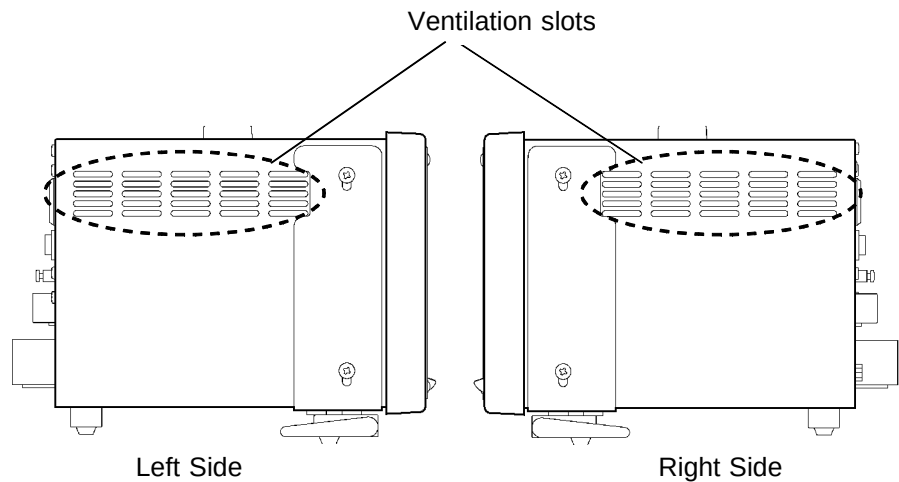
2.1.1 Installation Orientation

- Install the unit on a flat, level surface.
- The unit can also be propped up at an angle, using the stand.

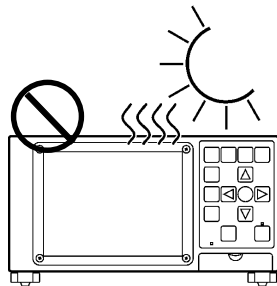


2.1.2 Ambient Conditions

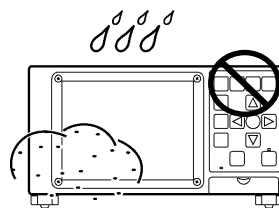
- (1) Temperature: 5 to 40°C, $23 \pm 5^\circ\text{C}$ recommended for high-precision measurements.
- (2) Humidity : 30 to 85%RH (no condensation); $50 \pm 10\%$ RH (no condensation) recommended for high-precision measurements.
- (3) Ventilation :
 - Take care not to block the ventilation openings and assure proper ventilation. When using the unit in an upright position, take care not to block the openings on both side.
 - Provide at least 10 cm of space all around the 8730-10, 8731-10.
 - Keep the 8730-10, 8731-10 away from heat sources.



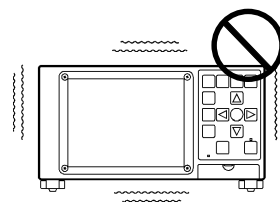
- (4) Avoid the following locations:
 - In the vicinity of equipment generating strong electromagnetic fields.



- Subject to direct sunlight.



- Subject to high levels of dust, steam, or corrosive gases (Avoid using the equipment in an environment containing corrosive gases (e.g., H_2S , SO_2 , NI_2 , and Cl_2) or substances that generate harmful gasses (e.g., organic silicones, cyanides, and formalins).



- Subject to vibrations.

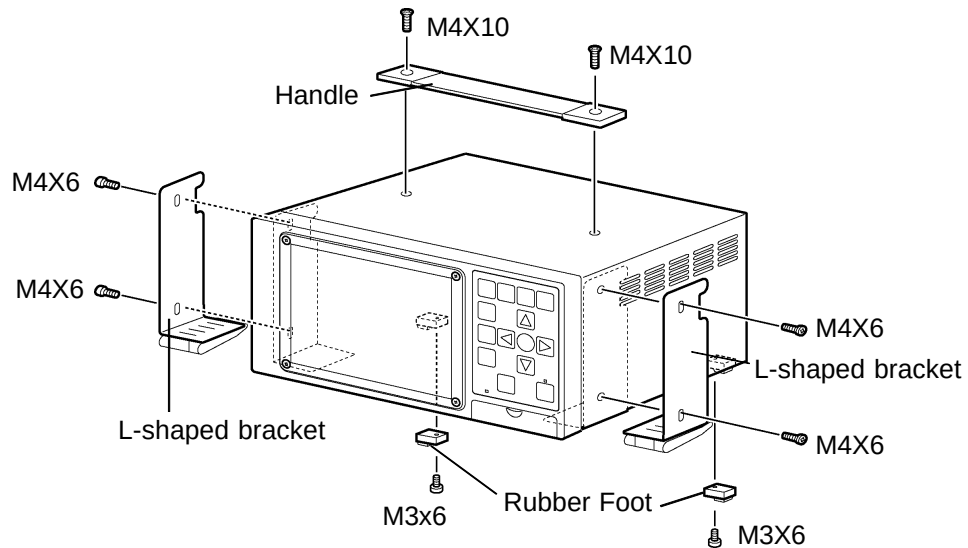
2.1.3 Installation Procedure

- Remove the handle and rubber feet to mount the 8730-10, 8731-10 on a rack or panel.



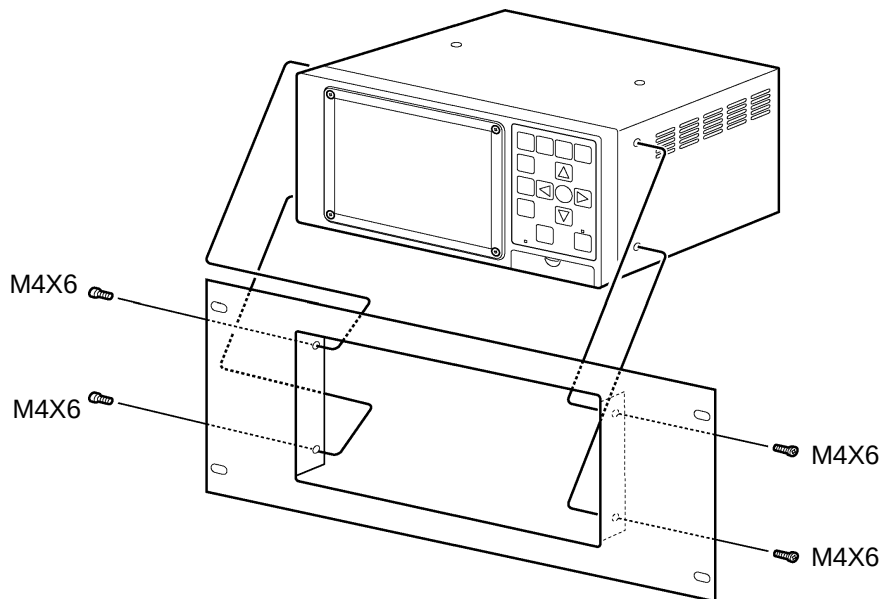
- Use the screws used on the 8730-10, 8731-10 or other specified screws.

- (1) Remove the L-shaped brackets, handle, and rubber feet on the sides of the 8730-10, 8731-10.



- (2) Secure the mounting bracket into the screw holes previously used to fasten the L-shaped brackets.

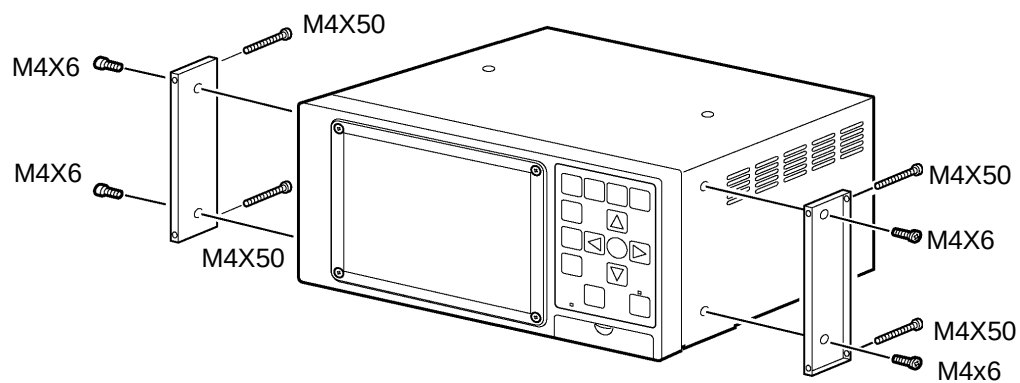
- Mounting the 8730-10, 8731-10 on a rack



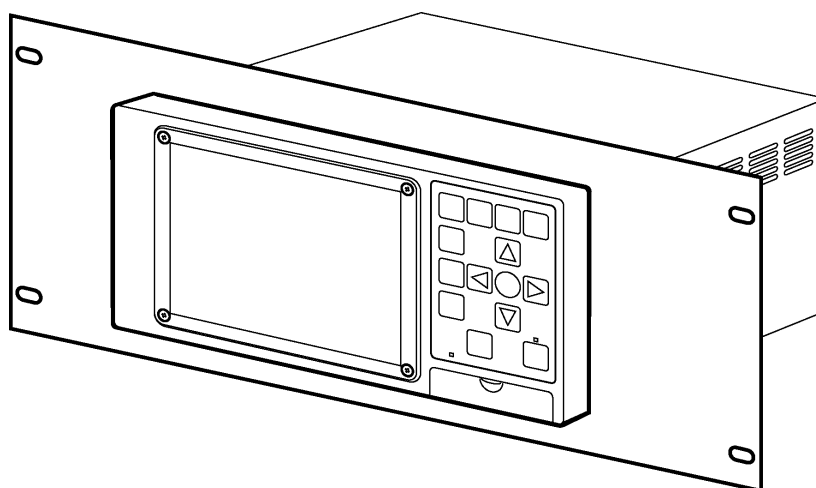
* Rack Mounting

For the dimensions of rack-mounting brackets, see 1.3.

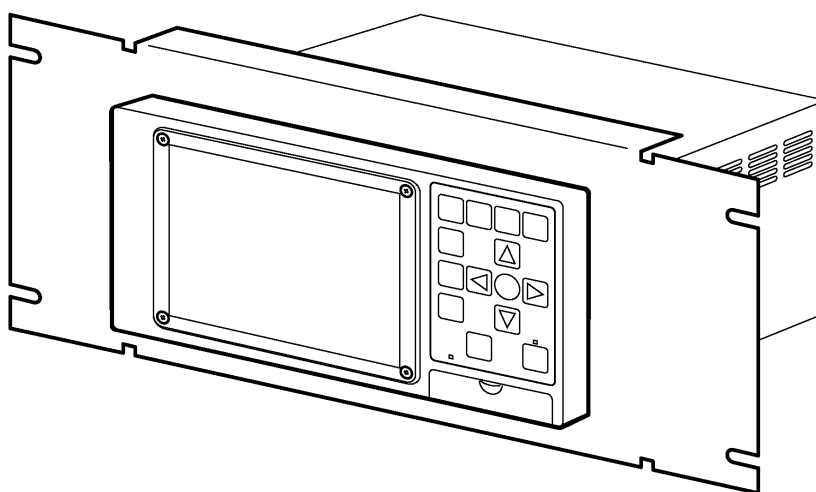
- Panel Mounting



For the dimensions of panel mounting brackets, see 1.3.
We can provide made-to-order panel-mounting brackets. Contact your dealer or Hioki representative for details.



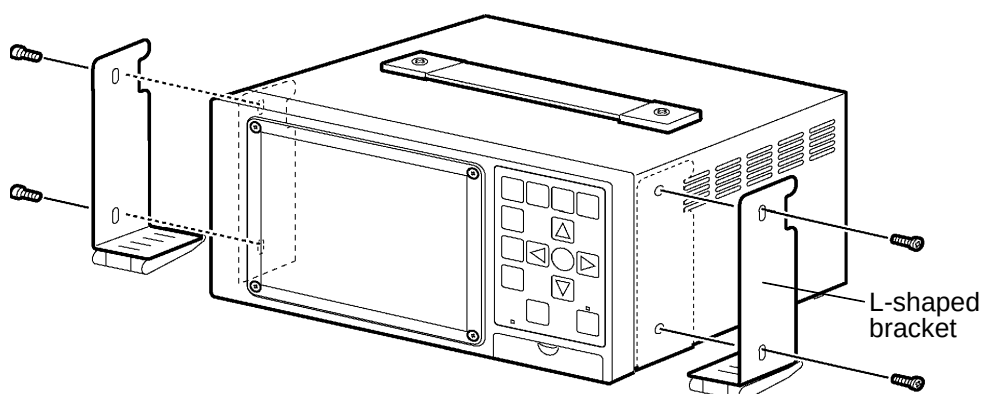
JIS Rack-Mounting Bracket



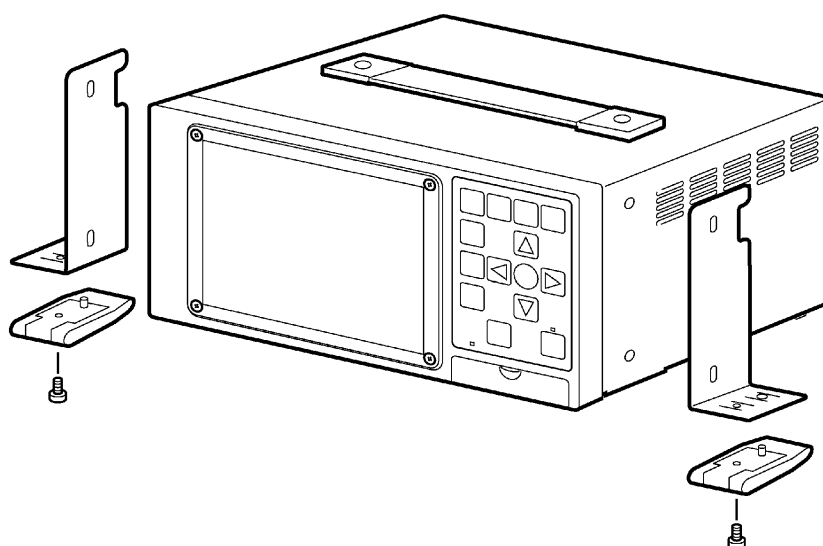
EIA Rack-Mounting Bracket

- The L-shaped brackets with the rubber feet may be used as simplified mounting brackets.

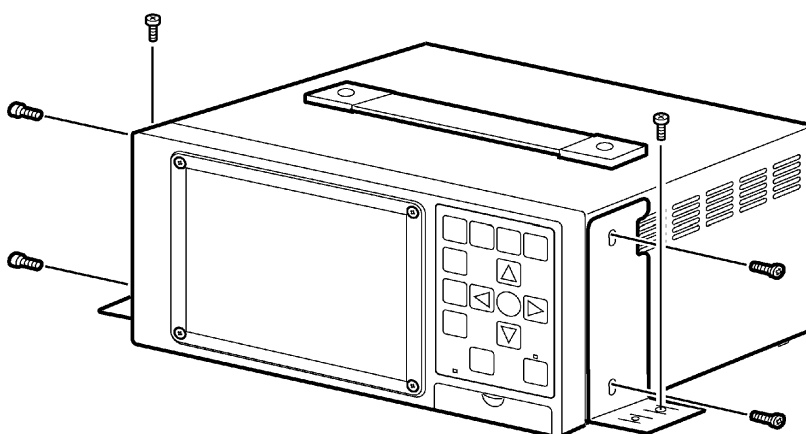
(1) Remove the L-shaped brackets on the side of the 8730-10, 8731-10.

2

(2) Remove the rubber feet from the L-shaped brackets and exchange the right and left brackets.



(3) Use the M3 screws to secure the L-shaped brackets in place.



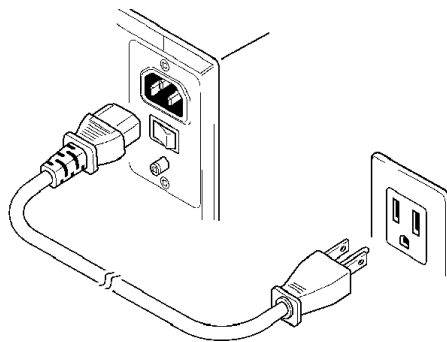
2.2 Power Supply and Ground Connections

2.2.1 Connecting the AC Power Supply

⚠ WARNING

- Check the following points before connecting the unit to a power supply. Take care never to exceed the power supply ratings given below, to avoid the risk of electric shock and damage to the unit.
 1. Power supply matches Rated supply voltage (100 to 240 V AC: Voltage fluctuations of $\pm 10\%$ from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).
 2. The AC power switch of the 8730-10, 8731-10 is set to OFF.
 3. Use only the supplied AC power cord.
- When supplying power with an inverter or an uninterruptible power supply (UPS), use a device that complies with the following conditions. To avoid the risk of electric shock and damage to the unit, do not use devices that have a voltage frequency outside the specified range, or that output square waves.
 1. Voltage: 100 V to 240 V AC
 2. Power frequency: 50/60 Hz
 3. Sine wave output (Do not use devices that have an unstable output, even if the output is sinusoidal.)
- The 8730-10, 8731-10 has no protective ground terminal, but is intended to be connected to a ground wire via the grounded three-core power cord supplied. In order to avoid electric shock accidents, be sure to connect the grounded three-core power cord supplied to a power supply socket one of whose terminals is properly grounded.

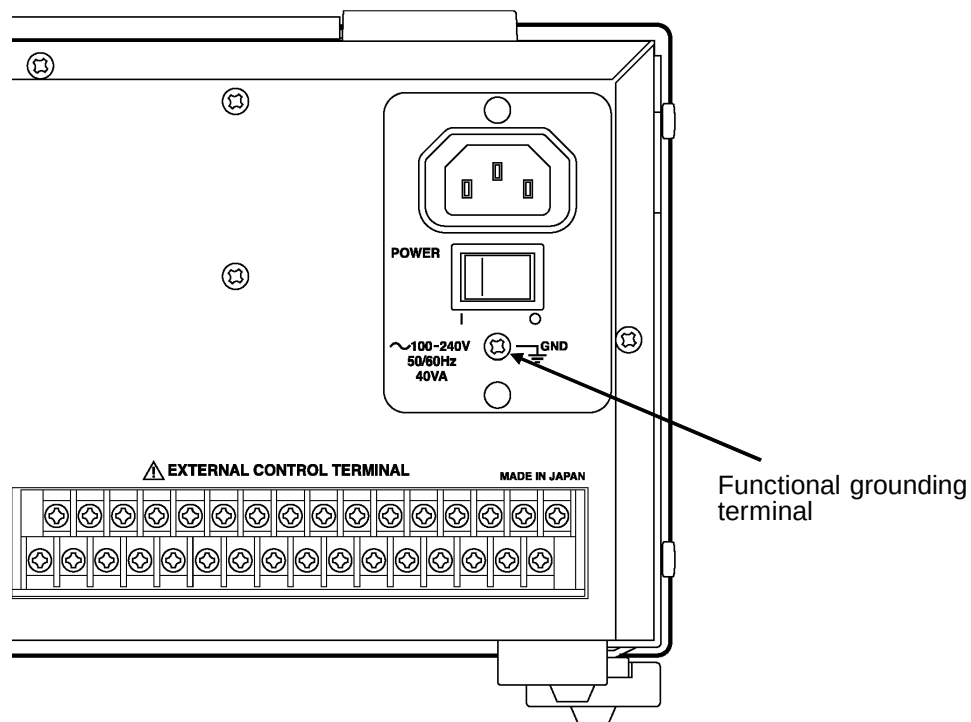
1. Verify that the AC power switch of the 8730-10, 8731-10 is set to OFF.
2. Plug the grounded three-core power cord supplied into the AC power connector on the right side of the 8730-10, 8731-10.
3. Plug the power cord into an AC outlet corresponding to the rating of the 8730-10, 8731-10.

**NOTE**

The fuse is incorporated in power supply. It is not user-replaceable. If a problem is found, contact your dealer or Hioki representative.

2.2.2 Functional Grounding of the 8730-10, 8731-10

When the 8730-10, 8731-10 is used in noise-prone environments, connect the functional grounding terminal to improve noise characteristics.

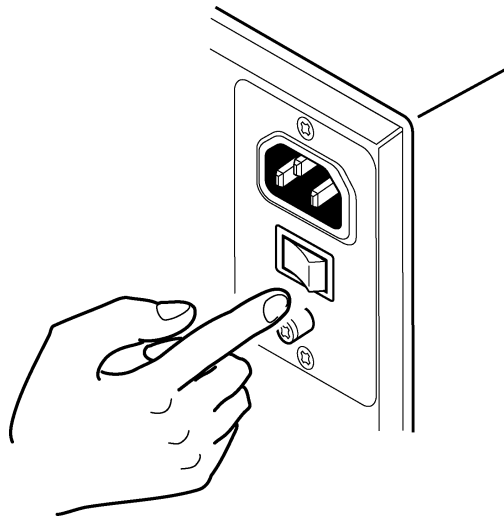


2.3 Power ON/OFF

⚠ WARNING

Check the following points before the power switch is turned on.

- Power supply matches Rated supply voltage (100 to 240 V AC: Voltage fluctuations of $\pm 10\%$ from the rated supply voltage are taken into account.) and rated supply frequency (50/60 Hz).
- The Unit is correctly installed (Section 2.1).
- Power cord is correctly connected.
- The unit is properly grounded (Section 2.2).

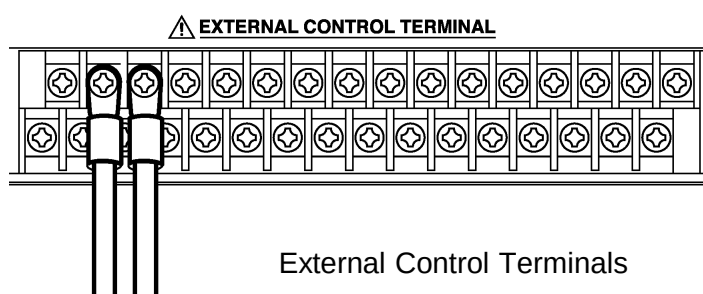
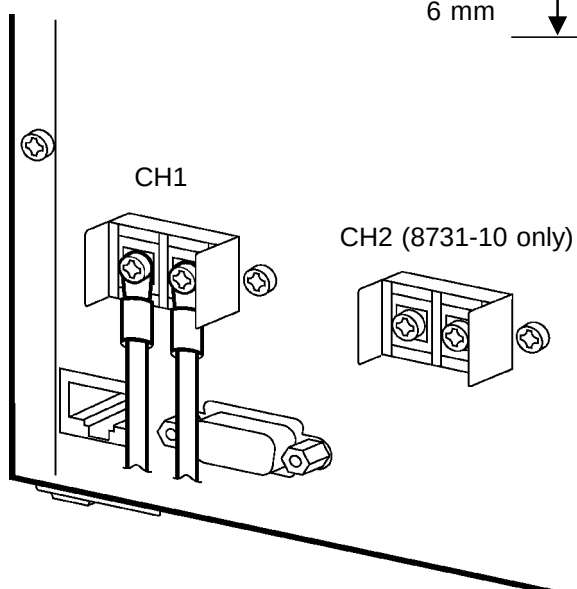
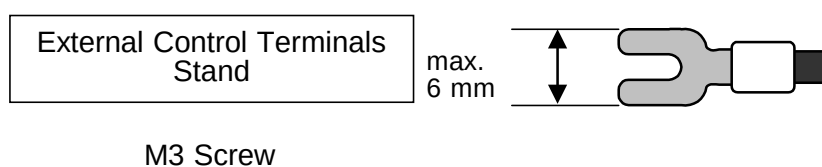
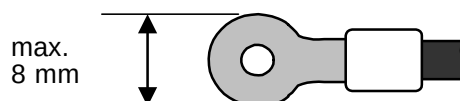
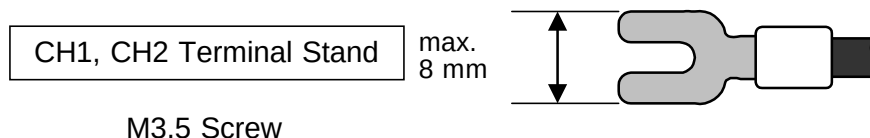
**NOTE**

- To ensure accurate measurement, after powering on, allow 30 minutes for temperatures within the 8730-10, 8731-10 to stabilize. Then perform zero adjustment and start measurement. For details, see 11.2.
- Zero adjustment → see Section 7.2.1.
- When the unit is turned off, it memorizes the currently used settings and reestablishes the same settings the next time the unit is turned on again. Note that this will clear the waveform data.

2.4 Cable Connection



- M3.5 screws are used for the CH1 and CH2 terminal blocks (for the 8731-10 only).
- M3 screws are used for the external control terminal blocks.
- Cables are not supplied. We can provide made-to-order cable. Contact your dealer or Hioki representative.



2.5 Notes on Measurement



Probe Connection, Measurement Voltage input

- Maximum input voltage ratings for the CH1, CH2 and the external control terminals are shown below. To avoid the risk of electric shock and damage to the unit, take care not to exceed these ratings.
- The maximum rated voltage to earth of the CH1, CH2 and external control terminals (voltage between each channel and the 8730-10, 8731-10, between channels, and between an external control terminal and the 8730-10, 8731-10) is shown below. To avoid the risk of electric shock and damage to the unit, take care that voltage between channels and between a channel and ground does not exceed these ratings.
- The maximum rated voltage to earth rating applies also if an input attenuator or similar is used. Ensure that voltage does not exceed these ratings.

Power cord Connection

- Before using the product, make sure that the insulation on the power cord is undamaged and that no bare conductors are improperly exposed. Using the product under such conditions could result in electrocution. Replace the power cord specified by Hioki .

Input/Output Terminals	Maximum Input Voltage	Maximum rated voltage to earth
CH1, CH2 Input Terminals	30 V rms or 60 V DC	30 V rms or 60 V DC
External Control Terminals	30 V DC	30 V rms or 60 V DC

WARNING

Power Supply Connections

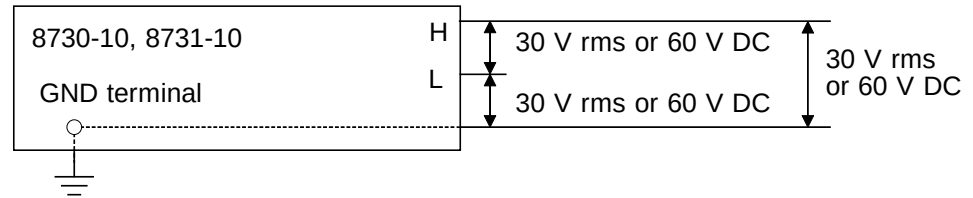
- Before turning the product on, make sure the source voltage matches that indicated on the product's power connector. Connection to an improper supply voltage may damage the product and present an electrical hazard.

NOTE

- Be sure to select a suitable input voltage axis range to avoid range-over. (See 4.3.1 and 4.3.5)
- If a range-over occurs, a warning message appears and the ERROR terminal of the external control terminals is activated. You can enable or disable this function. (See 7.5.3)
- The measurable range of each range is -10 times to +11 times the voltage axis range. If input exceeds the measurable range, a range-over occurs, and the waveform is shown in black.

2.6 Maximum Input Voltage

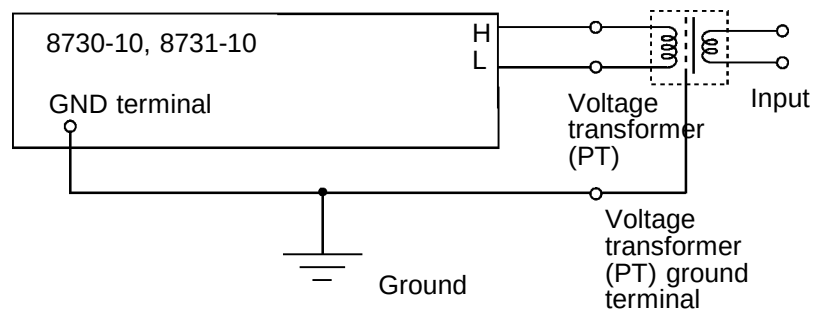
■ CH1, CH2



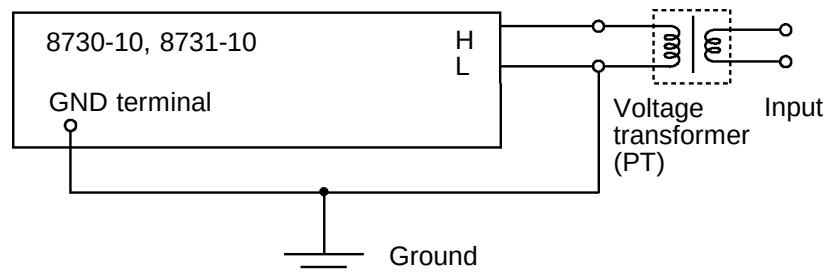
2.7 Using a Voltage Transformer

When making measurements on an AC power line for example, using a voltage transformer, be sure to connect the voltage transformer ground terminal to ground.

When the voltage transformer has a ground terminal



When the voltage transformer has no ground terminal



2.8 Startup Inspection and Shutdown Inspection

- Confirm that there are no abnormalities with the 8730-10, 8731-10 or cables before beginning operations. Wait at least 30 minutes after powering on to allow temperatures inside the 8730-10, 8731-10 to stabilize before starting measurement. Make sure that the 8730-10, 8731-10 performs the measurement and comparison properly.
- Perform the same inspection when shutting down to confirm that there are no abnormalities. Contact your dealer (Hioki representative) if you find any abnormalities in appearance or function.

■ Checking Comparison Action

Measure a non-defective sample and a defective sample to check for correct comparison.

■ Checking 8730-10, 8731-10 Performance

Use three functions below to check the performance of the 8730-10, 8731-10. Use these functions to check for problems.

- ROM/RAM Check (See 7.2.9)
Checks the built-in memory (ROM and RAM) of the 8730-10, 8731-10.
- Key Check (See 7.2.10)
Checks the keys of the 8730-10, 8731-10.
- Screen Check (See 7.2.11)
Checks the Screen display of the 8730-10, 8731-10.

2.9 Contrast Adjustment

- The STN color LCD is used as the display for the 8730-10, 8731-10. When used in environments with high temperatures or if started in very cold locations, the 8730-10, 8731-10 display may exhibit poor contrast, affecting image clarity. For details, see 7.2.6

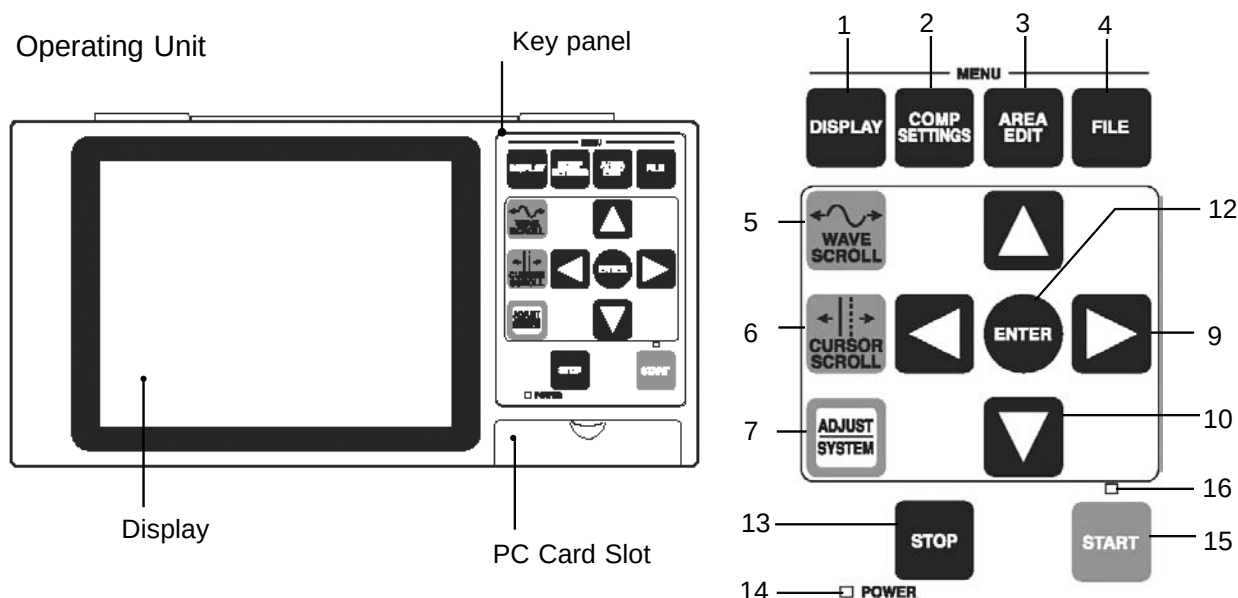
Chapter 3

Basic Operation and Settings

3.1 Basic Operation

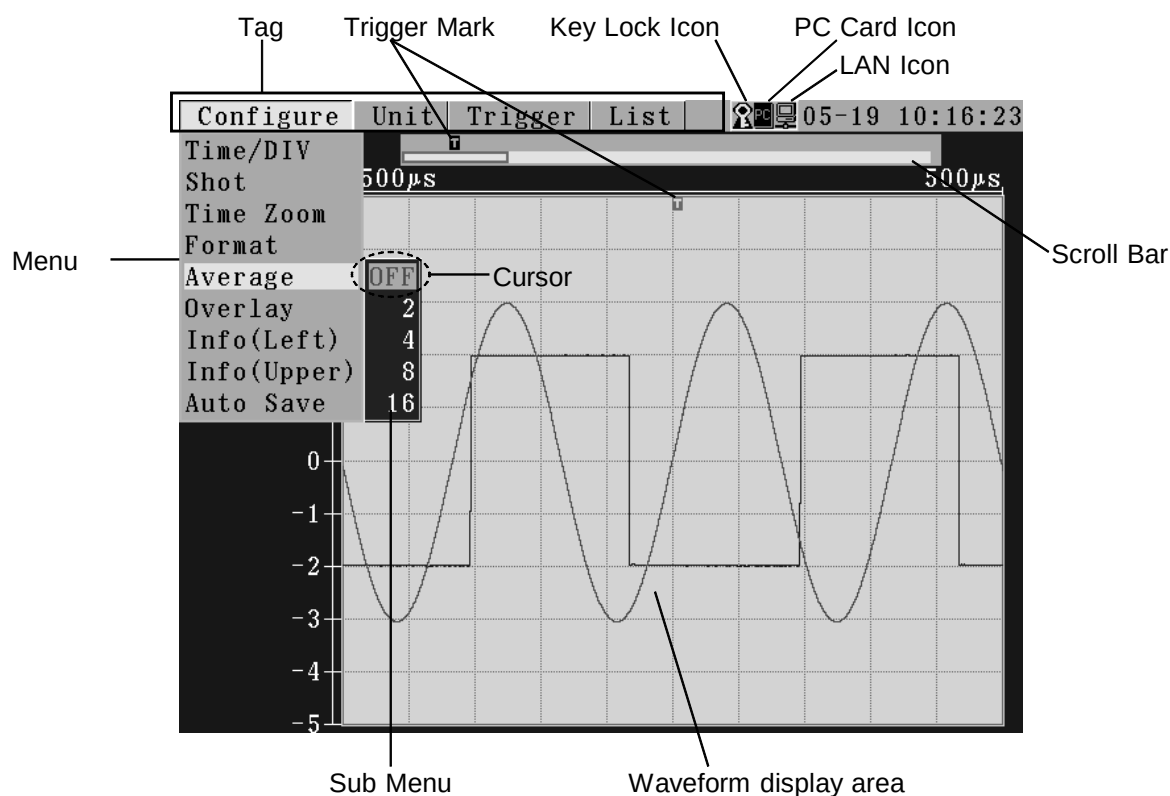
3.1.1 Basic Key Operation

- This section explains the basic key operations.



1	DISPLAY Key (Chapter 4)	• Displays the measurement screen. • This screen lets you set parameters for waveform display, and measurement settings.
2	COMP SETTINGS Key (Chapter 5)	• Displays the comparison setting screen. • This screen lets you set parameters for waveform display, area comparison, and value comparison.
3	AREA EDIT Key (5.3.2)	• Displays the area creation screen. • This screen lets you create a waveform comparison area.
4	FILE Key (Chapter 6)	• Displays the file screen. • This screen lets you save data to or read data from a PC card.
5	WAVE SCROLL Key (Chapter 10)	• Used to scroll back and forth across the waveform.
6	CURSOR SCROLL Key (Chapter 10)	• Used to move or select cursors A and B.
7	ADJUST/SYSTEM Key (Chapter 7)	• Displays the adjustment screen. • Performs various adjustments and self-checks.
8-11	CURSOR Key (Chapter 3)	• Moves the cursor.
12	ENTER Key (Chapter 3)	• Confirms the selected value.
13	STOP Key (Chapter 3)	• Interrupts ongoing measurement. • Press once to stop after finishing measurement for the set recording length. • Press twice to abort, stopping measurement immediately.
14	POWER LED (Chapter 3)	• Goes on when power is turned on.
15	START Key (Chapter 3)	• Starts measurement.
16	START LED(Chapter 3)	• Stays on during measurement. • Goes off when waveform loading is complete.

Display Unit



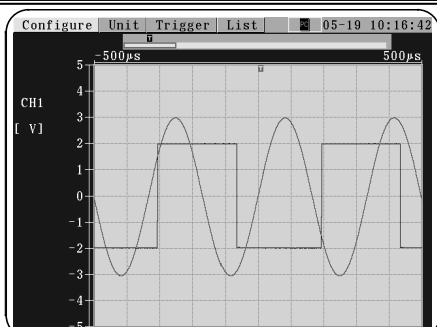
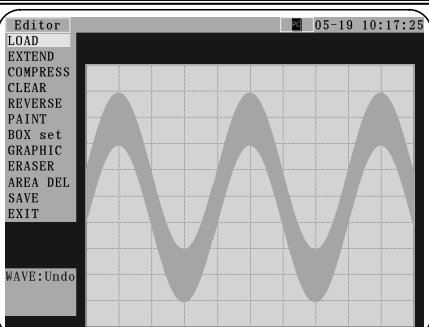
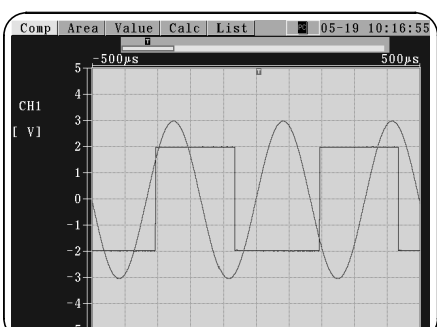
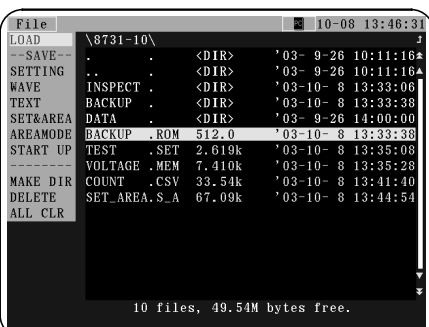
Tag	Appears when MENU key 1 or 2 is pressed. A different tag is displayed, depending on which key is pressed.
Menu	Appears when the tag is selected.
Sub Menu	Appears when a menu option is selected.
Key Lock Icon	Appears when the keys are locked.
PC Card Icon	Appears when a PC card is inserted. The icon is shown in red when the auto save function is enabled.
LAN Icon	Appears when the 8730-10, 8731-10 is connected to a LAN.
Clock	Shows the current time.
Cursor	Indicates that an item is selected with the cursor.
Waveform Display Area	Displays the waveform of a measurement.
Scroll Bar	Displays the length of the waveform (yellow) and display range (red frame) compared to the recording length. It also shows the trigger position (■), cursor A position (▲), cursor B position (●), and value calculation range (▼).

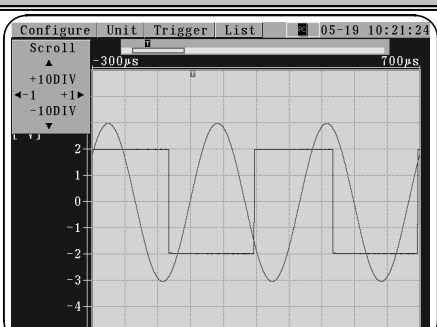
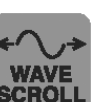
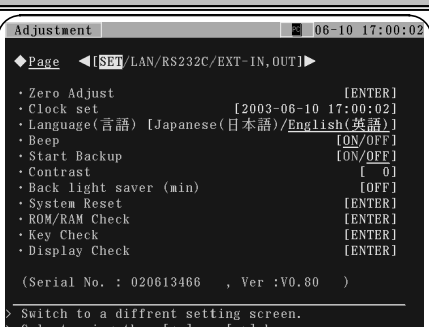
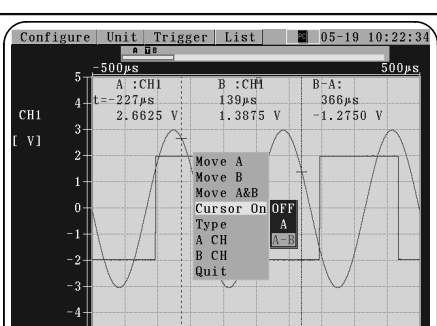
3.1.2 Common Operations

- This section explains key operations common to all screens.

1. Selecting Menu Options

The 8730-10, 8731-10 has seven keys, as shown below for setting parameters, working with files, and performing initial settings. Press a key to retrieve the corresponding screen.

Display	Key	Display	Key
	 (→4.2)		 (→5.3.2)
	 (→5.2)		 (→6.4)

Display	Key	Display	Key
	 (→10.2)		 (→7)
	 (→10.1)		

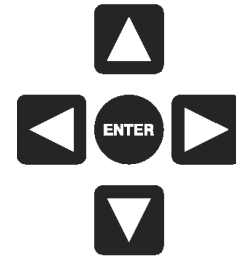
2. Exiting Menu Options

While setting a menu option, press one of the MENU keys to exit the current menu screen.



3. Selecting and Confirming Menu Options

Settings are made on each screen using the **CURSOR** key. The item selected with the cursor is shown against a yellow background. After selecting an item, press the **ENTER** key to move the cursor to the submenu. Select an option from the submenu, then press the **ENTER** key to confirm.



3

4. Saving Screens

With a PC card inserted, hold down the **FILE** key for at least two seconds to save the current screen in bitmap (BMP) format. This operation is not available during measurement. File name is "CPhhmmss.BMP". "hhmmss" are the six digits of the hour, minute and second when the file is saved.



5. System Reset

To reset the 8730-10, 8731-10 in case of problems, turn off the power, then turn it on again while holding down the **STOP** key. This will reset all settings except those for communications (LAN and RS232C), test mode (MODE01 to 16), and comparison area (A01 to A16). (See 7.2.8.)



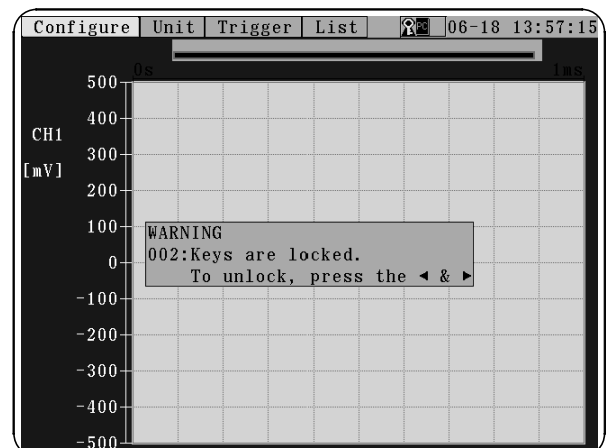
6. Full Reset

To restore the 8730-10, 8731-10's default settings in case of problems, turn off the power, then turn it on again while simultaneously holding down both the **STOP** key and **START** key. This will reset all settings, including those for communications (LAN and RS232C), measurement conditions, and area data stored in internal memory.



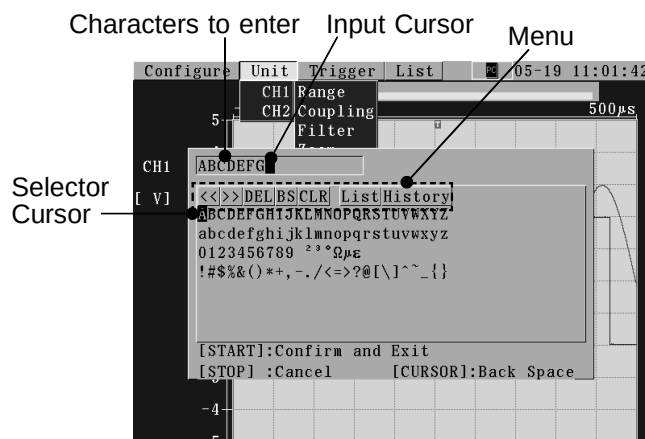
7. Key Lock

The key lock function disables key operations on the front panel. This function is used to prevent unintended changes in settings during measurement. To lock or unlock, press the right and left **CURSOR** keys simultaneously.



8. Entering Characters

The 8730-10, 8731-10 lets you enter characters for filenames, comments, and LAN settings.



1. When the 8730-10, 8731-10 is ready for character entry, the screen shown at the left will appear.
2. Use the **CURSOR** key to move the cursor to the menu, then press **ENTER** key to move the input cursor or make corrections. For the function of each menu command, see the table 3.1.2-1 "**Command function**" below.

NOTE

- The range of characters available for entering a filename or editing LAN settings is limited. The screen may differ from the example shown on the left.

Table 3.1.2 -1 Command function

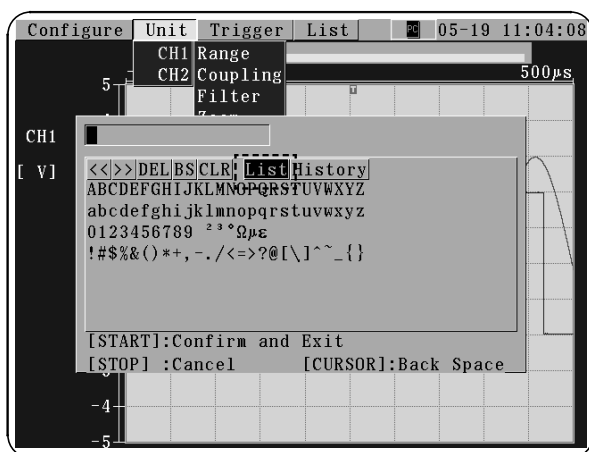
Menu	Explanation
<<	Moves the input cursor to the left.
>>	Moves the input cursor to the right.
DEL	Deletes the character at the input cursor position.
BS	Deletes the character to the left of the input cursor position.
CLR	Clears all characters you have entered.
List	Lets you select a word from a list.
History	Lets you select a word from those previously entered.

How to enter characters

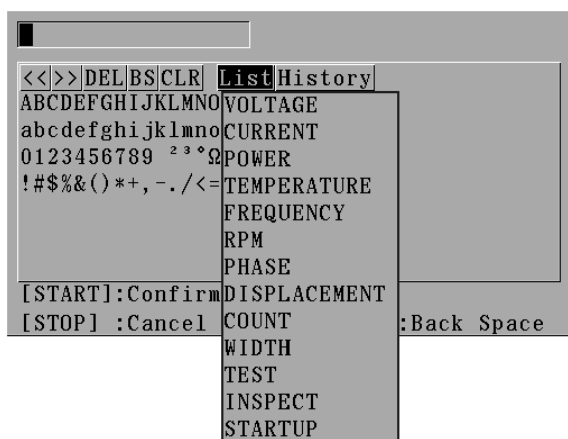
- (1) Press the **CURSOR** key to move the selector cursor to the character you wish to enter, then press the **ENTER** key.
- (2) To delete a character, use the **CURSOR** key to select [<<] or [>>] on the menu, then press the **ENTER** key. Move the input cursor to the character to delete, select [DEL] on the menu, then press the **ENTER** key. To delete a character you have just entered, use [BS].
- (3) To insert a character, select [<<] or [>>] on the menu, then press the **ENTER** key to move the input cursor to the right of where you wish to insert a character. Enter the character in the same way as described in (1) above.
- (4) Press the **START** key to confirm characters entered, then exit the screen for character entry. Press the **STOP** key to cancel the character entry and exit the screen.

- The **CURSOR SCROLL** key also functions as the [BS].

- Words may be entered from "List" registered in the 8730-10, 8731-10.



1. Select "List" on the menu, then press the **ENTER** key. A list of registered words will appear.



2. Select a word, then press the **ENTER** key. The selected word is entered.

- Characters may be entered from "History" registered in the 8730-10, 8731-10.

1. Select "History" on the menu, then press the **ENTER** key. A list of registered words will appear.
2. Select a word, then press the **ENTER** key. The selected word is entered.

NOTE

- When the special characters listed below are entered, then read on a waveform viewer (Wv), the characters will be converted as shown below. This is because the computer does not have a half-size special character font.

$^2(=^2)$	$^3(=^3)$	$^{\circ}(=^{\circ}C)$	$\epsilon(=\tilde{e})$	$\mu(=\tilde{u})$	$\Omega(=\tilde{o})$
-----------	-----------	------------------------	------------------------	-------------------	----------------------

- Filenames or directory names may not contain spaces.

3.2 Basic Measurement and Setting

This section describes the general flow of operations and explains how to set the parameters for measurement examples.

3.2.1 Operation Sequence

1. Measurement Setting

MENU Key	Setting Item (Tag)		Detail
DISPLAY	Configure Unit	Trigger List	Sets the conditions for loading data.



2. Comparison Setting

MENU Key	Setting Item (Tag)		Detail
COMP SETTINGS	Comparison Area	Value Calc List	Sets the various parameters for waveform comparison.



3. Creating Area

MENU Key	Setting Items (Tag)		Detail
AREA EDIT	LOAD EXTEND COMPRESS CLEAR REVERSE BOX set/ BOX reset	DRAWING PAINT ERASER AREA DEL SAVE EXIT	Create the comparison area.



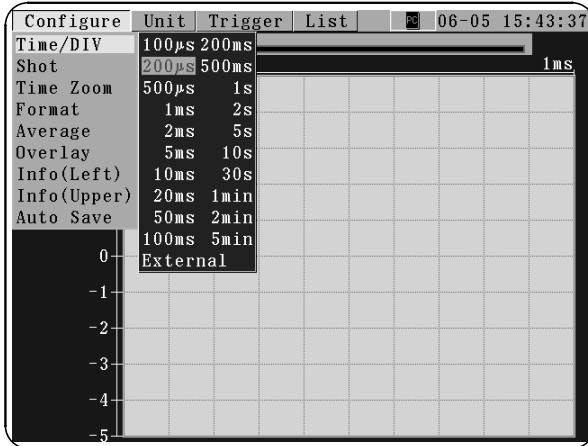
4. Loading waveform data

Panel Key	Setting Items (Tag)	Detail
START		Begins loading data.

3.2.2 Measurement Examples

Example 1) Connect an oscillator to the 8730-10, 8731-10 and measure 4 Vp-p 1 kHz sine waves.

1. Connect an oscillator to the 8730-10, 8731-10.
2. Set the oscillator to generate 4Vp-p 1kHz sine waves.
3. Set the measurement parameters.

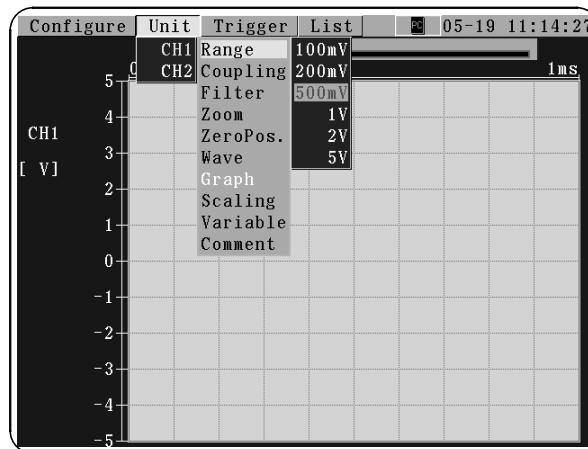


DISPLAY



Configure	
Time/DIV	200 ms
Shot	10 DIV
Time Zoom	X1
Format	Single
Average	OFF
Overlay	OFF
Info (Left)	Gauge (CH1)
Info (Upper)	OFF
Auto Save	OFF

4. Set the input parameters.

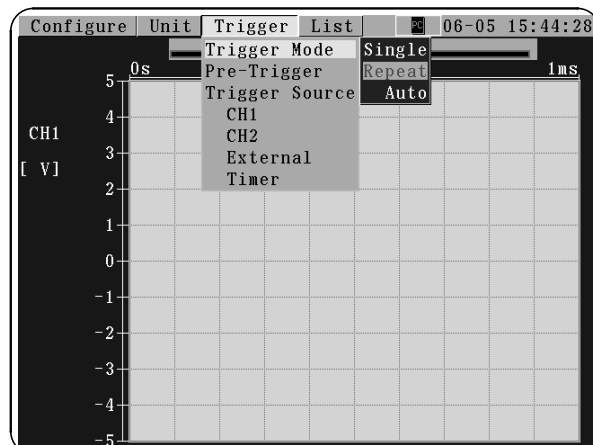


DISPLAY



Unit (CH1)	
Range	500 mV
Coupling	DC
Filter	5kHz
Zoom	X1
ZeroPos.	+50%
Wave	Red
Scaling	OFF
Variable	OFF

5. Set the trigger parameters.

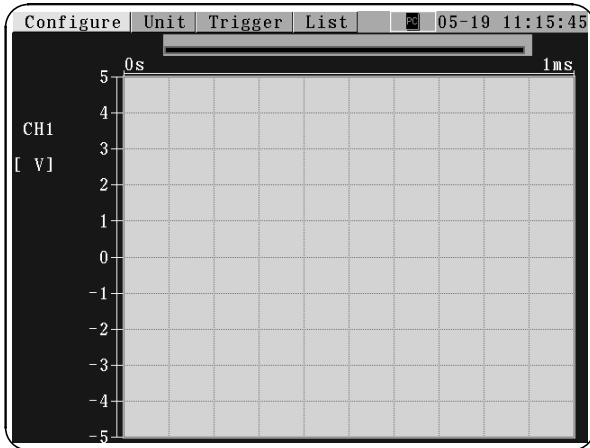


DISPLAY



Trigger	
Trigger Mode	Repeat
Pre-Trigger	0%
Trigger Source	OR
CH1	Level, 0 V, UP
CH2	OFF
External	OFF
Timer	OFF

6. Start measurement.

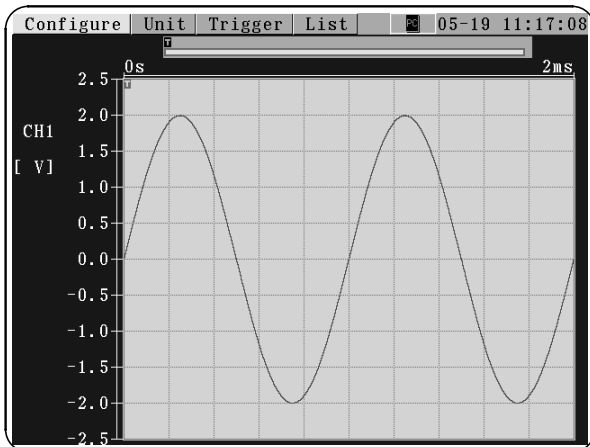


START



- Press the **START** key. The LED above the key will go on. In this example, the 8730-10, 8731-10 has already received input and the trigger is activated immediately.
- Since the trigger is set to "**Repeat**", measurement will not stop automatically even if the recording length of data has been exceeded.

7. Stop measurement.

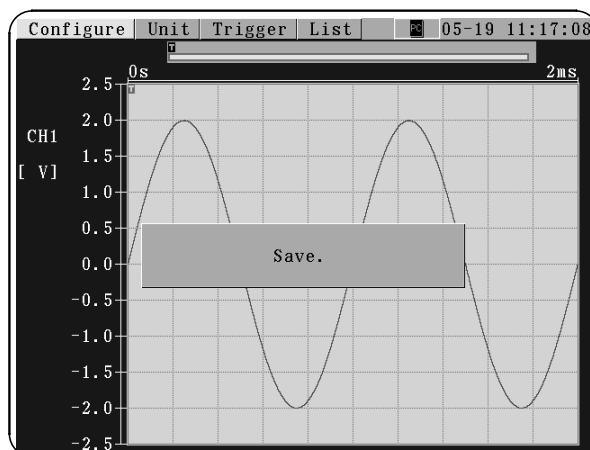


STOP



- Press the **STOP** key. The LED above the key will go out. Measurement is interrupted.

8. Saves the screen as a bitmap file.



FILE

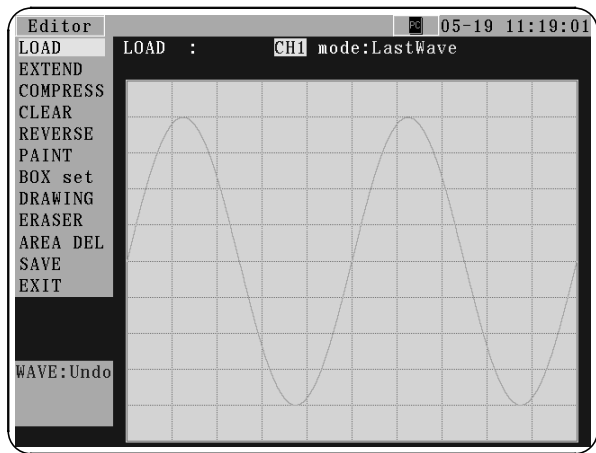


(2 seconds)

- Hold down the **FILE** key for at least two seconds to save the data in bitmap format on the PC card.

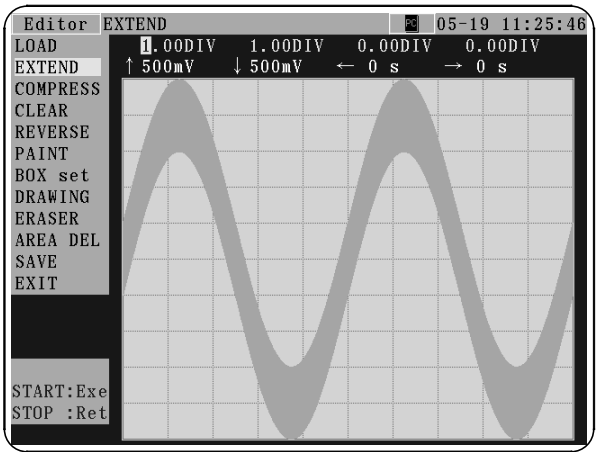
Example 2) Create a comparison area using the loaded waveform and compare the area.

- 1. Set the parameters via steps 1 to 5 of Example 1.
- 2. Load a waveform.



- Press the **AREA EDIT** key to display the Editor screen.
- Select "**LOAD**" and set "**CH1**" as the load source to load the CH1 waveform. (Set the mode to "**LastWave**")
Press the **START** key to start loading.

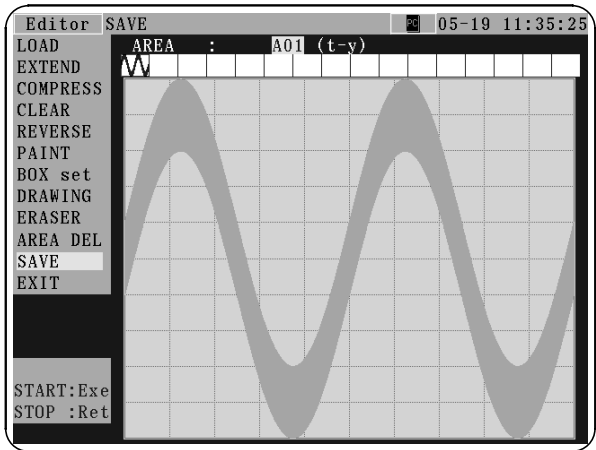
- 3. Extend the loaded waveform data, and create a comparison area.



EXTEND	
↑	1.00 DIV
↓	1.00 DIV
←	0 DIV
→	0 DIV

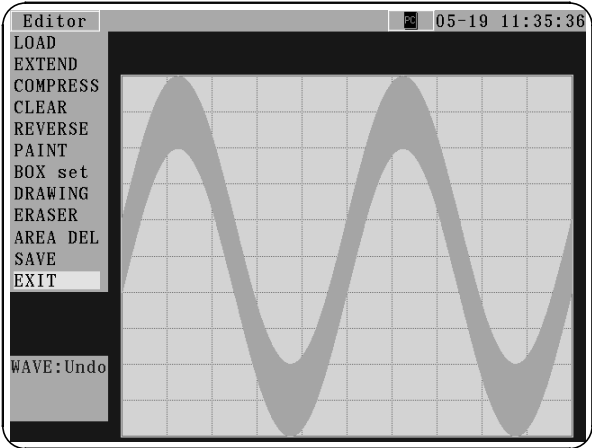
- Use the **CURSOR** key to set the extension width, then press the **START** key.

- 4. Save the comparison area.



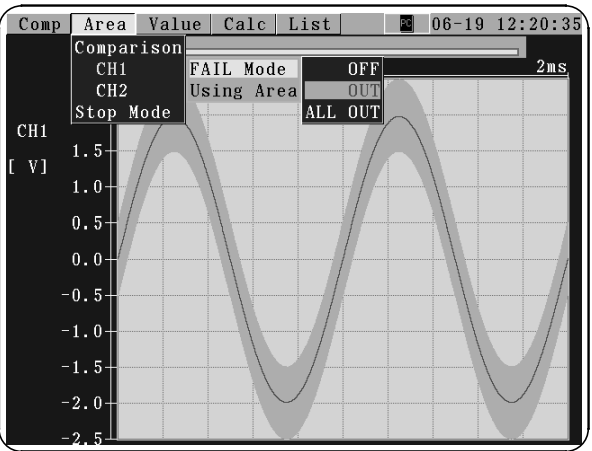
- Select the destination at which to save the comparison area.
Select the "**SAVE**" command, then press the **ENTER** key. Select the area No. and press the **START** key. In the example, "**A01**" is selected.

5. Exit the Editor screen.



- Select "EXIT" to end area edit.

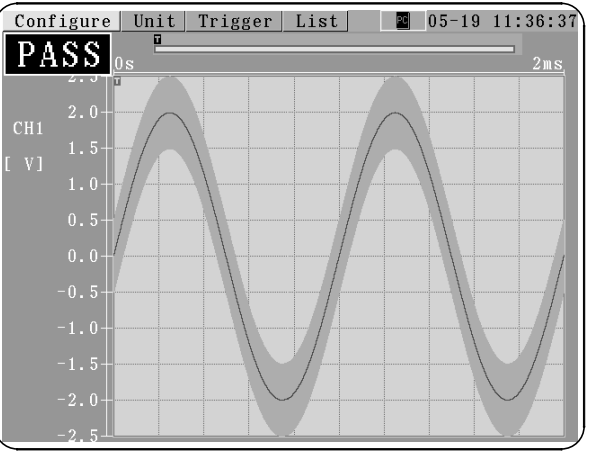
6. Set the area comparison parameters. Press the **COMP SETTINGS** key.



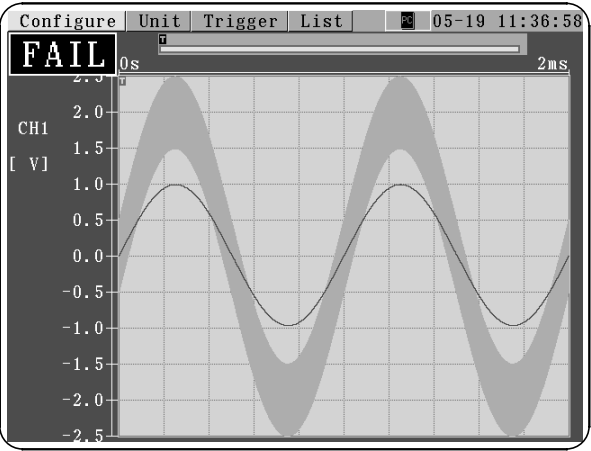
Comp	
Common Stop Mode	Area or Value

Area (CH1)	
Comparison	ON
FAIL Mode	OUT
Using Area	A01
Stop Mode	FAIL

7. Press the **START** key to start area comparison.



The comparison result is **PASS**, with the waveform shown against a green background.

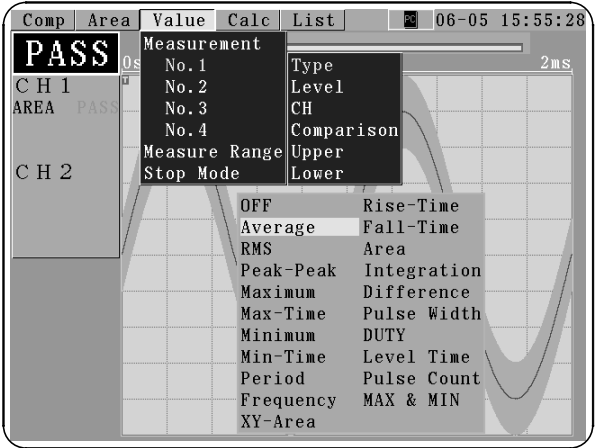


The comparison result is **FAIL**, the waveform shown against a red background.

8. Press the **STOP** key to end the area comparison.

Example 3) Compare the value.

- 1. Set the parameters via steps 1 to 5 of Example 1 (except for setting the "Info (left)" to "CompResult" in the step 3 measurement setting of Example 1).
- 2. Set the value comparison parameters.



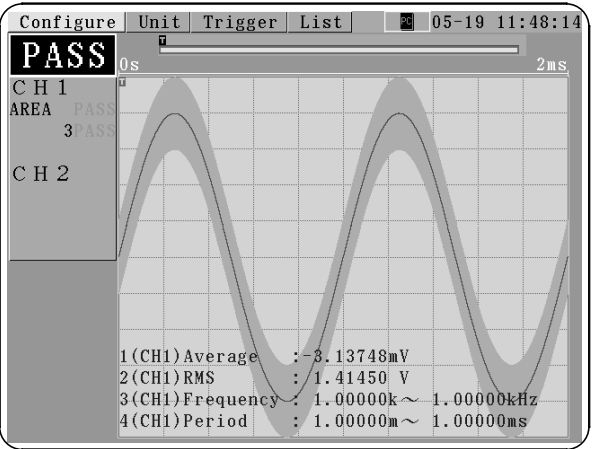
COMP
SETTINGS



Comp	
Common Stop Mode	Area or Value

Value	
Measurement	ON
No.1	Average Comparison: OFF
No.2	RMS Comparison: OFF
No.3	Frequency Comparison: ON Upper 1.01 k Lower 980
No.4	Period Comparison: OFF
Measure Range	All Wave
Stop Mode	FAIL

- 3. Press the **START** key to start value comparison.

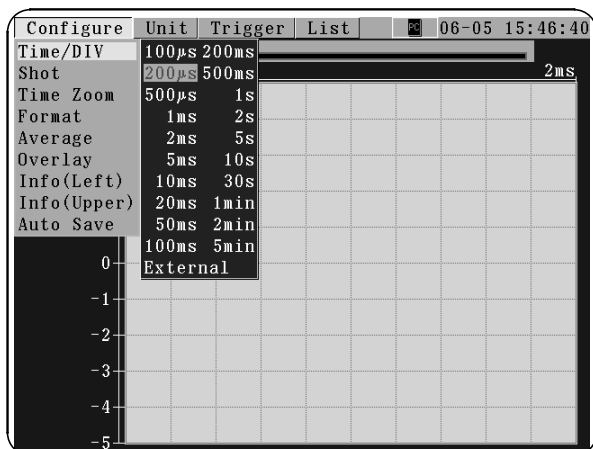


START



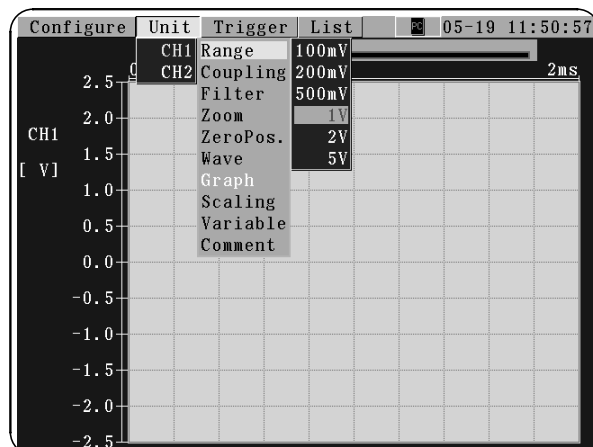
Example 4) Detect overshoot and undershoot.

1. Connect the output terminal to be measured to the input terminal (CH1) of the 8730-10, 8731-10.
2. Set the measurement parameters.



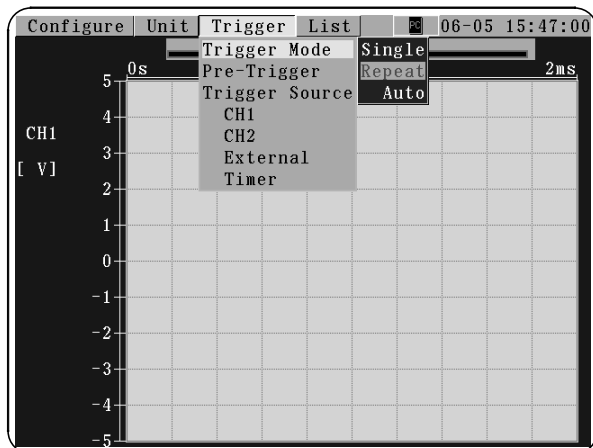
Configure	
Time/DIV	200ms
Shot	10 DIV
Time Zoom	X1
Format	Single
Average	OFF
Overlay	OFF
Info (Left)	Gauge (CH1)
Info (Upper)	OFF
Auto Save	OFF

3. Set the input parameters.



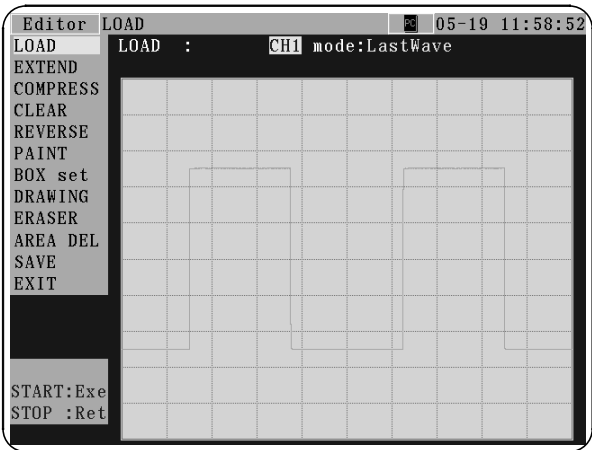
Unit (CH1)	
Range	1 V
Coupling	DC
Filter	OFF
Zoom	X1
ZeroPos.	+50%
Wave	Red
Graph	(Not selectable)
Scaling	OFF
Variable	OFF
Comment	(Blank)

4. Set the trigger parameters.



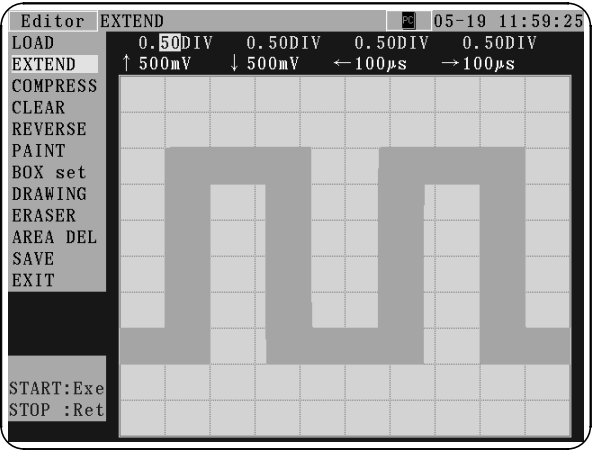
Trigger	
Trigger Mode	Repeat
Pre-Trigger	15%
Trigger Source	OR
CH1	Level -Level 0 V -UP -Filter: OFF
External	OFF
Timer	OFF

5. Load the waveform data and create an area.



- Press the **START** key to load the waveform data.
- Press the **AREA EDIT** key and execute the "LOAD" command. Set the load source to "CH1" and the mode to "LastWave."

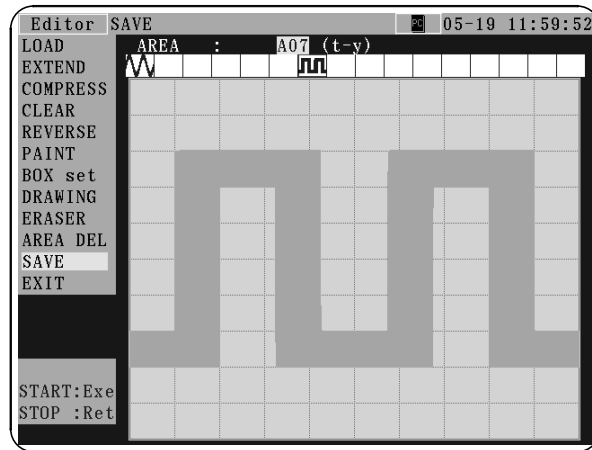
6. Extend the comparison area.



EXTEND	
↑	0.50 DIV (500 mV)
↓	0.50 DIV (500 mV)
←	0.50 DIV (100 µs)
→	0.50 DIV (100 µs)

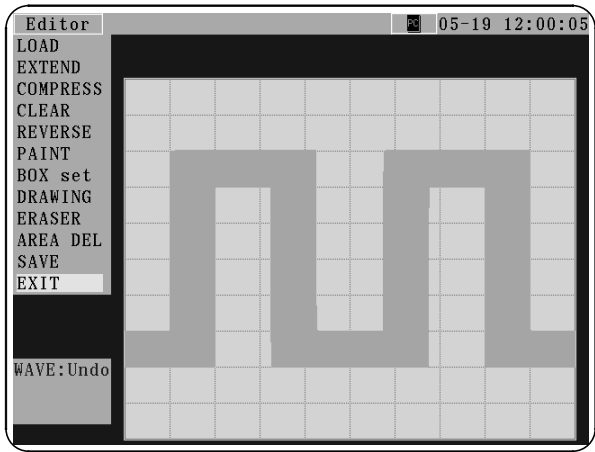
- Use the "EXTEND" command to set the width, then press the **START** key.

7. Save the created area to internal memory.



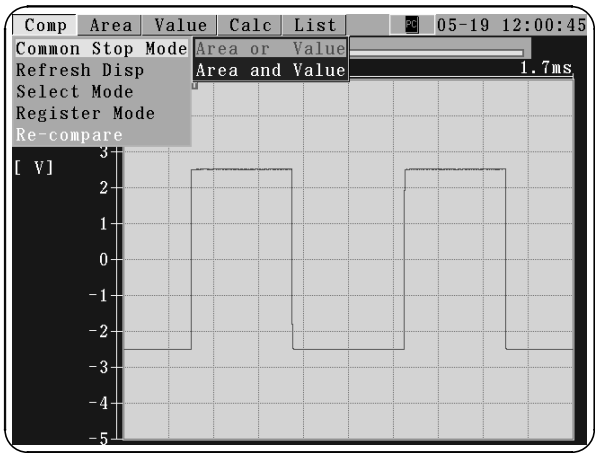
- Select the "SAVE" command to save the area created.
- In this example, the area will be saved in "A07."

8. Exit the Editor screen



- Select "EXIT" and press the **ENTER** key.

9. Set the comparison parameters.

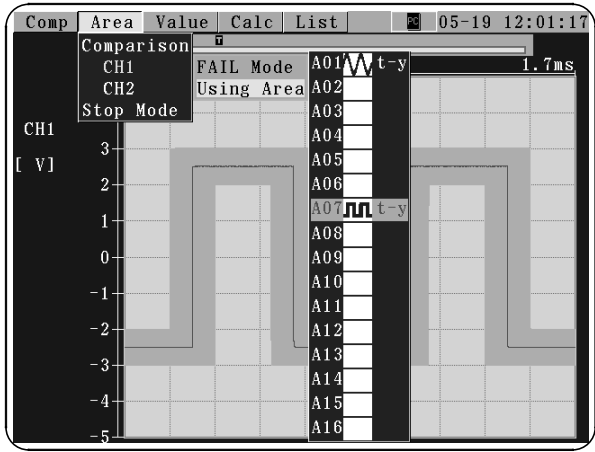


- Press the **COMP SETTINGS** key.



Comp	
Common Stop Mode	Area or Value
Refresh Disp	Always
Select Mode	(Do not set)
Register Mode	(Do not set)
Re-compare	(Disabled by default.)

10. Set the area comparison parameters.



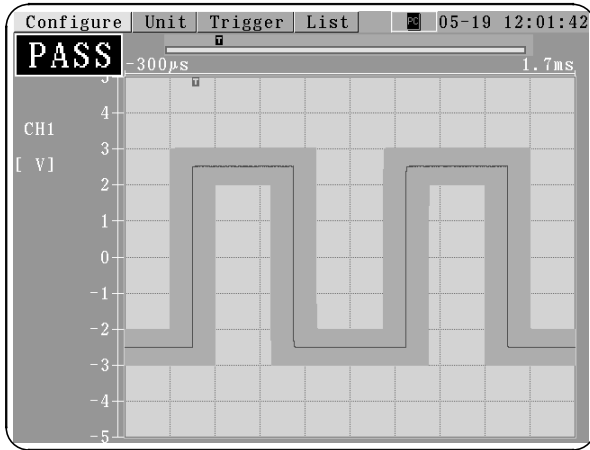
- Select the "Area" tag and set the parameters as shown below.



Area	
Comparison	ON
CH1 - FAIL Mode	OUT
CH1 - Using Area	A07
Stop Mode	FAIL

In this example, the "Value" tag setting is not made.

11. Press the **START** key to start measurement. After loading the waveform, a comparison begins.

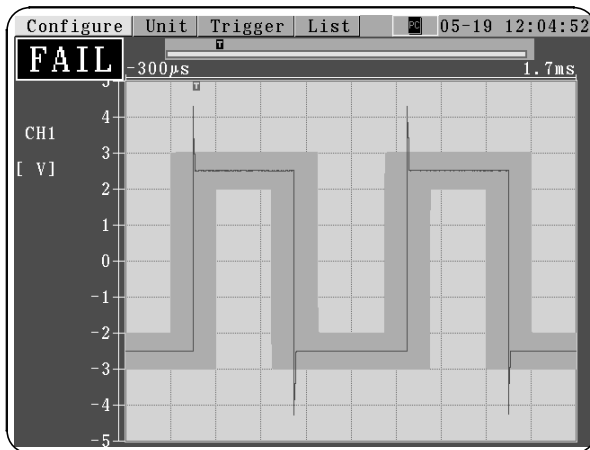


START

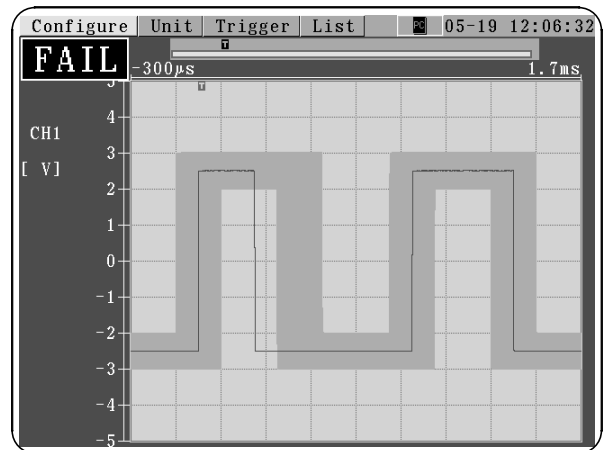


- As shown below, if a waveform has an overshoot or an undershoot (left figure), the measured waveform deviates from the comparison area and will be compared as FAIL. If the duty ratio of the pulse is disturbed (in the right figure), the waveform also deviates from the area and will be compared as FAIL.

[PASS]
(The measured waveform is within the comparison area)



[FAIL]
(The measured waveform deviates from the comparison area)



[FAIL]
(The measured waveform deviates from the comparison area)

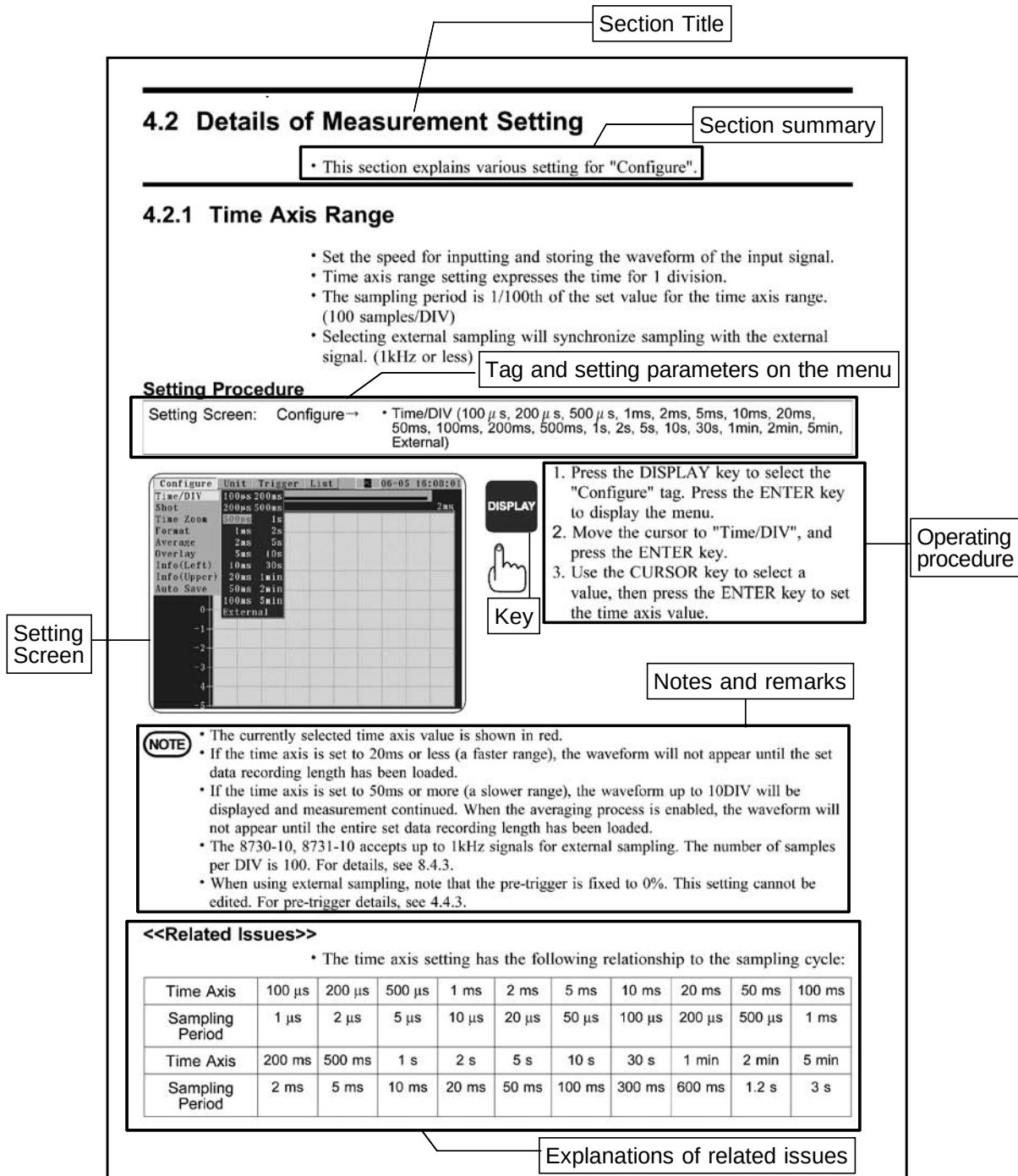
12. Press the **STOP** key to end the area comparison.

STOP



3.3 Guide to Using This Manual

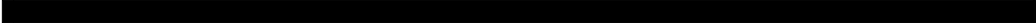
- This instruction manual is organized as shown below.





Chapter 4

Settings on the Measurement Screen



The Measurement screen lets you make settings for the parameters given below.

Configure (See 4.2)	Time /DIV (See 4.2.1)	100 ms to 5 min External	
	Shot (See 4.2.2)	100 DIV to 500 DIV (Constant Recording Length)	
		Arbitrary	1 DIV to 500 DIV (Arbitrary recording length)
	Time Zoom (See 4.2.3)	X 1/100 to X 10	
	Format (See 4.2.4)	Single, Dual, XY	
	Average (See 4.2.5)	OFF, 2 to 16 times	
	Overlay (See 4.2.6)	OFF, ON	
	Info (Left) (See 4.2.7)	OFF Gauge(CH1) Gauge(CH2) CompResult Measure	
	Info (Upper) (See 4.2.8)	OFF Comment Setting	
	Auto Save (See 4.2.9)	Wave Data	OFF, PC CARD, LAN
		Save Type	Binary Text
		Thin out text	OFF, 1/2 to 1/100
		Wave BMP	OFF, PC CARD, LAN
		Save Type	Noncompress Compress
		Measure	OFF, PC CARD, LAN
		Make Directory	Name, Date, Time

Unit (See 4.3)	CH1	Range (See 4.3.1)	100 mV to 5 V	
		Coupling (See 4.3.2)	DC, GND	
		Filter (See 4.3.3)	OFF, 5 Hz to 100 kHz	
		Zoom (See 4.3.4)	X1/2 to X10	
		ZeroPos. (See 4.3.5)	-950% to 1050% max.	
		Wave (See 4.3.6)	OFF, RED, GREEN BLUE, CYAN	
		Graph (See 4.3.7)	Graph1, Graph2	
		Scaling (See 4.3.8)	Setting	OFF, ON
			Ratio Setting	EU
				OFFSET
			Point Setting	Input1
				Scale1
				Input2
				Scale2
			Unit	
		Variable (See 4.3.9)	OFF	
			ON	Upper
				Lower
		Comment (See 4.3.10)		
	CH2	Same as CH1		

Trigger (See 4.4)	Trigger Mode (See 4.4.2)	Single Repeat Auto		
	Pre-Trigger (See 4.4.3)	0% to 100%		
	Trigger Source (See 4.4.4)	OR, AND		
	CH1 (See 4.4.5)	OFF		
		Level	Level	-50 V to +55 V
			Slope	UP, DOWN
			Filter	OFF 0.1 DIV to 10 DIV
		In	Upper	+55 V max
			Lower	-50 V min.
			Filter	OFF 0.1 DIV to 10 DIV
		Out	Upper	+55 V max.
			Lower	-50 V min.
			Filter	OFF 0.1 DIV to 10 DIV
		Period	Level	-50 V to +55 V
			Slope	UP, DOWN
			Upper	1000 min max.
			Lower	10 ms min.
	CH2 (See 4.4.5)	Same as CH1		
	External (See 4.4.6)	OFF, ON		
	Timer (See 4.4.7)	OFF		
		ON	Start Stop Interval	
	List (See 4.5)			

4.1 Overview

4.1.1 Measurement Screen Overview

The 8730-10, 8731-10 has the following functions:

- (1) Stores the input signal data in internal memory, then displays the waveform.**
- (2) Stores the data for two input channels on the same time axis (for the 8731-10 only).**
 - The waveforms of both channels are superimposed. This helps clarify the correlation between input signals.
- (3) Time axis setting**
 - 100 μ s/DIV to 5 min/DIV
- (4) Time axis resolution**
 - 100 points/DIV
- (5) Storage capacity**
 - Up to 500 DIV
- (6) Displayed waveforms can be magnified or compressed.**
 - Time axis direction x10 to x1/100
 - Voltage axis direction x10 to x1/2
 - Variable function
- (7) Display format**
 - Single screen, dual screen, or XY screen
- (8) Screen printout**
 - Screens can also be auto-saved or printed out.
- (9) Pre-trigger function**
 - Signals can be recorded before triggering.

4.1.2 Flow of Settings on the Measurement Screen and Measurement

- The Measurement screen lets you set the parameters needed to perform measurement with the 8730-10, 8731-10.
- This section provides the minimum settings and operating procedure needed for measurement.

1. Setting time axis

- Determines the resolution of the time axis direction (sampling period) for loading a waveform
- The recording time for loading varies, depending on the time axis setting.

2. Setting recording length

- Determines the size of waveform data to load.
- The recording length varies, depending on the loading time and time axis setting.

3. Voltage axis range setting

- Select a suitable voltage axis range for the voltage to be measured.
- Failure to set an appropriate voltage axis range may result in inaccurate measurement. For example, the waveform may exceed the range, or a large measurement error may occur.

4. Trigger setting

- Select "**Single**" to record only the set data length. Select "**Repeat**" to accept the trigger repeatedly. When "**Auto**" is selected, the trigger is accepted repeatedly. If the trigger is not activated more than one second after selecting "**Auto**", however, the set recording length of data is automatically recorded.
- When all trigger sources are turned OFF and the **START** key is pressed, the 8730-10, 8731-10 immediately begins loading a waveform.

5. Press the **START** key to start measurement. When the trigger sources are met, the 8730-10, 8731-10 starts loading data.

- Press the **STOP** key once to stop measurement after loading the set waveform recording length.
- Press the **STOP** key twice to stop measurement immediately.

4.2 Details of Measurement Setting

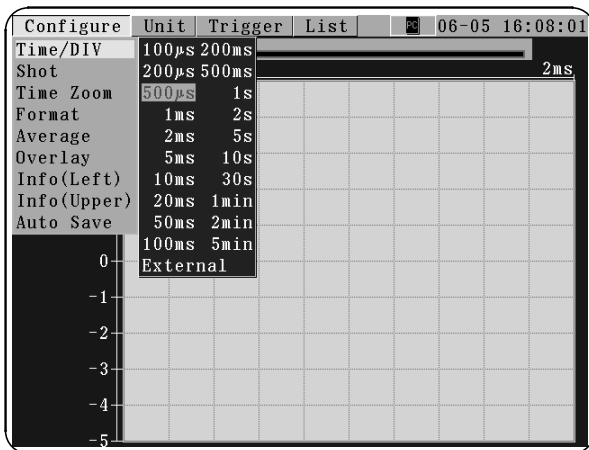
- This section explains various setting for "Configure" tab.

4.2.1 Time Axis Range

- Set the speed for inputting and storing the waveform of the input signal.
- Time axis range setting expresses the time for 1 division.
- The sampling period is 1/100th of the set value for the time axis range. (100 samples/DIV)
- Selecting external sampling will synchronize sampling with the external signal. (1 kHz or less)

Setting Procedure

Setting Screen: Configure → • Time/DIV (100 μ s, 200 μ s, 500 μ s, 1ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 30s, 1min, 2min, 5min, External)



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "Time/DIV", and press the **ENTER** key.
3. Use the **CURSOR** key to select a value, then press the **ENTER** key to set the time axis value.

NOTE

- The currently selected time axis value is shown in red.
- If the time axis is set to 20ms or less (a faster range), the waveform will not appear until the set data recording length has been loaded.
- If the time axis is set to 50ms or more (a slower range), the waveform up to 10DIV will be displayed and measurement continued. When the averaging process is enabled, the waveform will not appear until the entire set data recording length has been loaded.
- The 8730-10, 8731-10 accepts up to 1kHz signals for external sampling. The number of samples per DIV is 100. For details, see 8.4.3.
- When using external sampling, note that the pre-trigger is fixed to 0%. This setting cannot be edited. For pre-trigger details, see 4.4.3.

<<Related Issues>>

- The time axis setting has the following relationship to the sampling period:

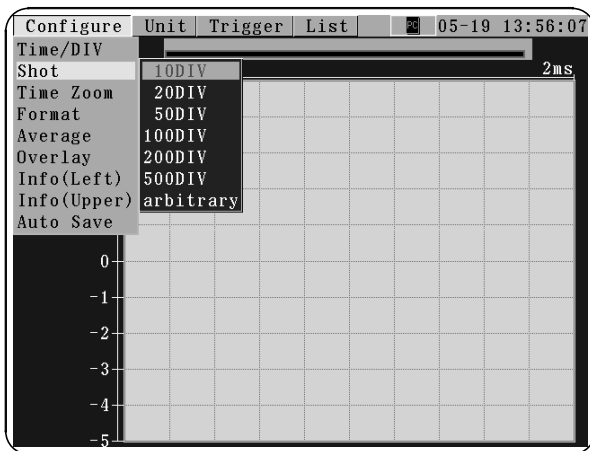
Time Axis	100 μ s	200 μ s	500 μ s	1 ms	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms
Sampling Period	1 μ s	2 μ s	5 μ s	10 μ s	20 μ s	50 μ s	100 μ s	200 μ s	500 μ s	1 ms
Time Axis	200 ms	500 ms	1 s	2 s	5 s	10 s	30 s	1 min	2 min	5 min
Sampling Period	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms	300 ms	600 ms	1.2 s	3 s

4.2.2 Recording Length

- The length of recording for one measurement operation (number of DIV) can be set.
- There are 2 types of setting.
 1. Constant recording length mode: Select a recording length of 10, 20, 50, 100, 200, or 500.
 2. Arbitrary recording length mode: Set an arbitrary number for recording length.

Setting Procedure 1 (Constant recording length mode)

Setting Screen: Configure → • Shot (10, 20, 50, 100, 200, 500 DIV)



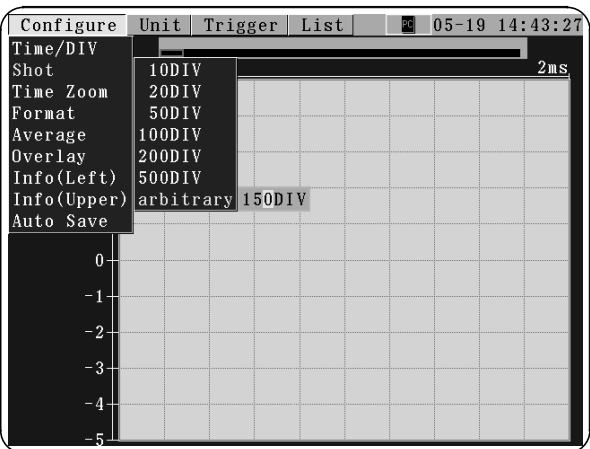
1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "Shot", and press the **ENTER** key.
3. Use the **CURSOR** key to select a value, then press the **ENTER** key to set the recording length value.

NOTE

- The currently selected recording length value is shown in red.

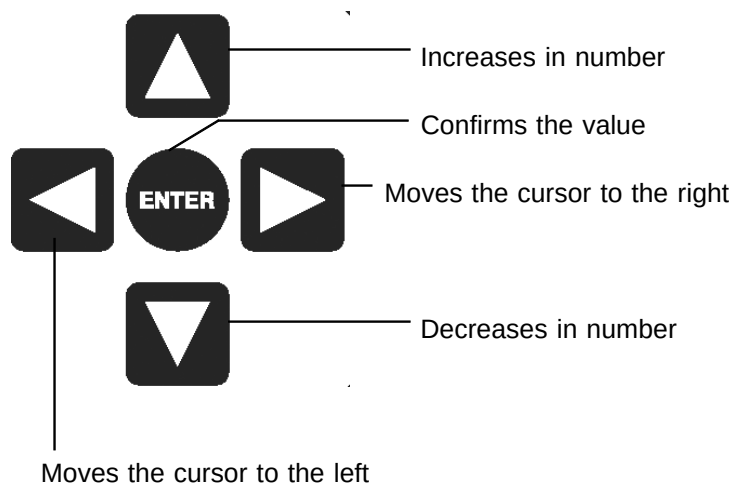
Setting Procedure 2 (Arbitrary recording length mode)

Setting Screen: Configure → • Shot - arbitrary (1 DIV to 500 DIV)
• Shot (100 to 50000 sample)



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Select "Shot" on the menu.
3. Move the cursor to "arbitrary", and press the **ENTER** key.
4. Use the **CURSOR** key to change the recording length setting, then press the **ENTER** key to confirm the change. ^(Note 1)

Editing Recording Length



NOTE

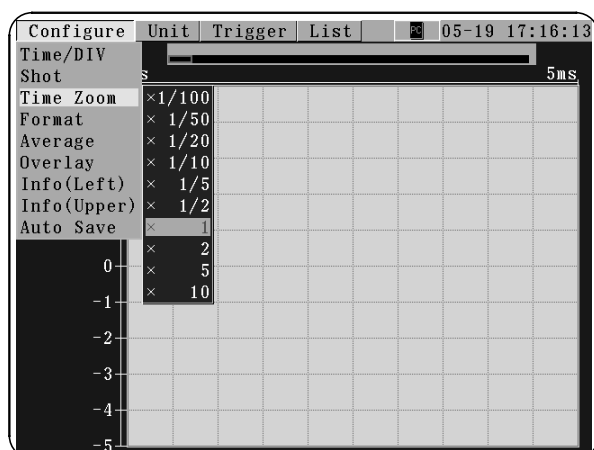
- In arbitrary recording length mode, the selectable range is from 1 DIV to 500 DIV.
- (Note 1) When the time axis range is set to "**External**", the recording length is expressed as the number of samples. The selectable range is 100 to 50,000 samples. (The number of samples to be actually measured is the setting +1.)

4.2.3 Time Axis Magnification Rate

- Edits the magnification/compression rate of the time axis.
- The time axis may be magnified to show the waveform in detail, or compressed to show overall changes.
- The image is magnified or compressed with the left edge as the datum line.

Setting Procedure

Setting Screen: Configure → • Time Zoom (X1/100, X1/50, X1/20, X1/10, X 1/5, X1, X2, X5, X10)



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "Time Zoom", and press the **ENTER** key.
3. Select a magnification, and press the **ENTER** key to confirm it.

NOTE

- The currently selected time axis magnification rate is shown in red.

4.2.4 Display Format

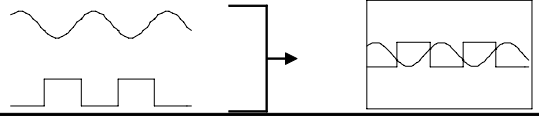
- Sets the display format to display a waveform.
- The display formats include single screen, dual screen, and XY screen (for the 8731-10 only).

Setting Procedure

Setting Screen: Configure → • Format (Single, Dual, XY)

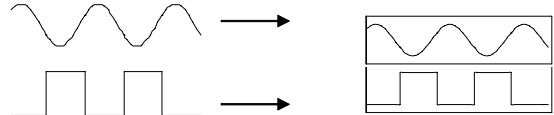
(1) Single Screen Display

- Displays the waveform as a single graph.



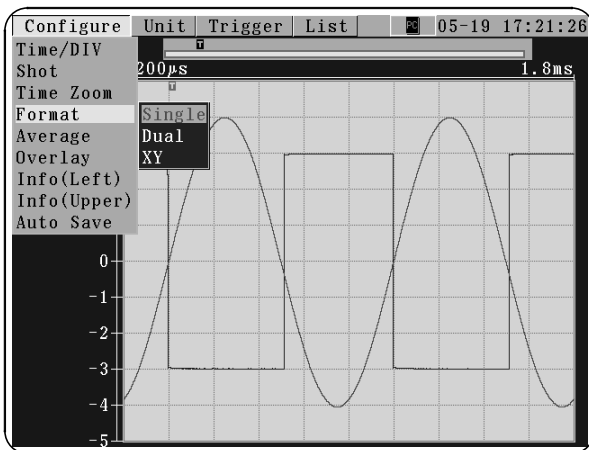
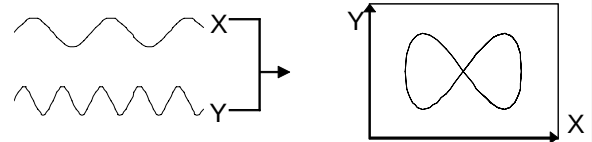
(2) Dual Screen Display

- Displays the waveform as a dual graph.
- You can select the type of graph in which to display the waveform.



(3) XY Screen Display

- Displays an XY plotted waveform by synthesizing the CH1 and CH2 waveforms.
- CH1 waveform is plotted on the X axis, CH2 is plotted on the Y axis.



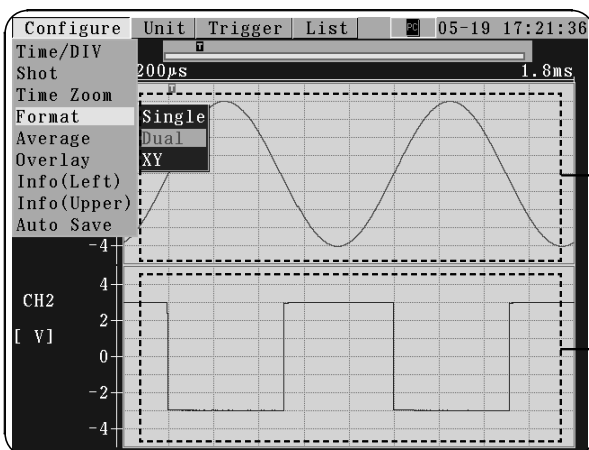
Single screen display



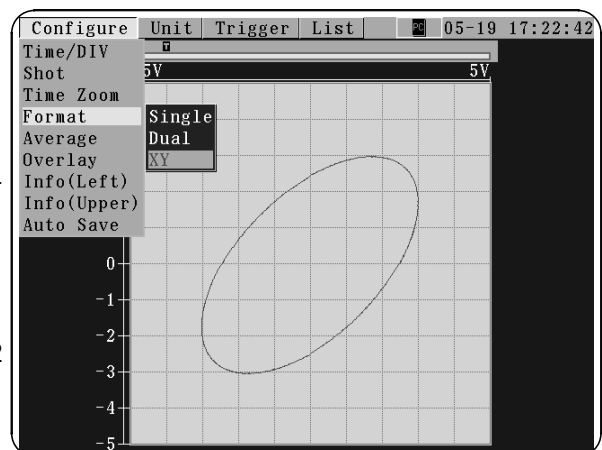
1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.c
2. Move the cursor to "Format", and press the **ENTER** key.
3. Select the screen display, and press the **ENTER** key to confirm it.

NOTE

- The currently selected display format is shown in red.
- When dual screen is selected, select a graph to display the waveform. (See 4.3.7)
- When displayed in dual-screen format, the waveform is compressed 50% along the voltage axis, but the resolution for comparison is the same as in single-screen format.



Dual screen display



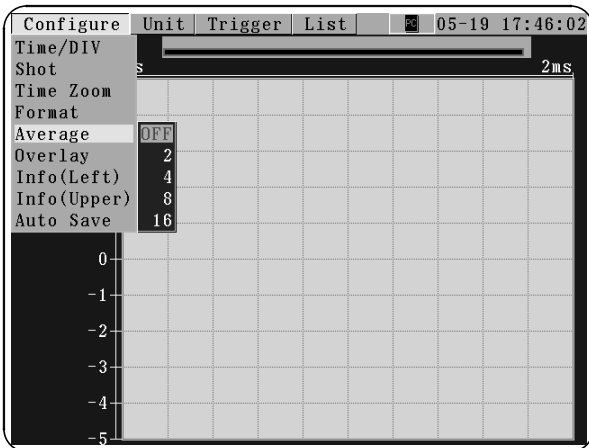
XY screen display

4.2.5 Averaging

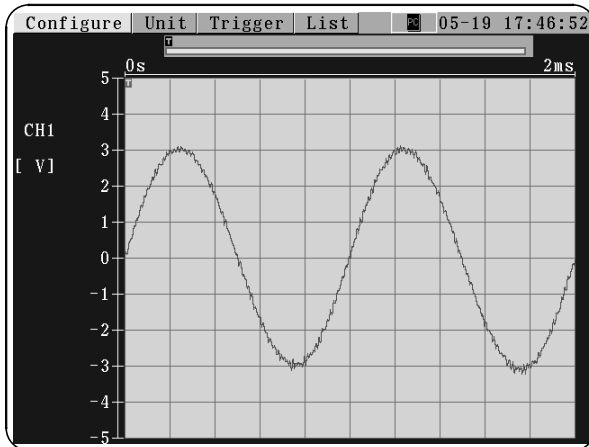
- The averaging function allows capturing several instances of a waveform and determining the average.
- This makes it possible to eliminate noise and irregular signal components.

Setting Procedure

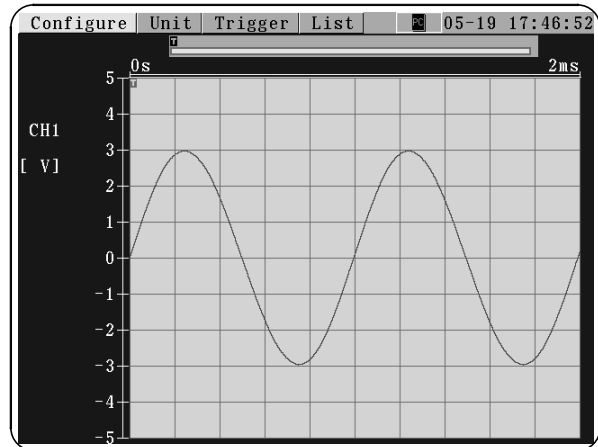
Setting Screen: Configure → • Average (OFF, 2, 4, 8, 16)



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "Average", and press the **ENTER** key.
3. Select an averaging count, then press the **ENTER** key to confirm.



Waveform before averaging



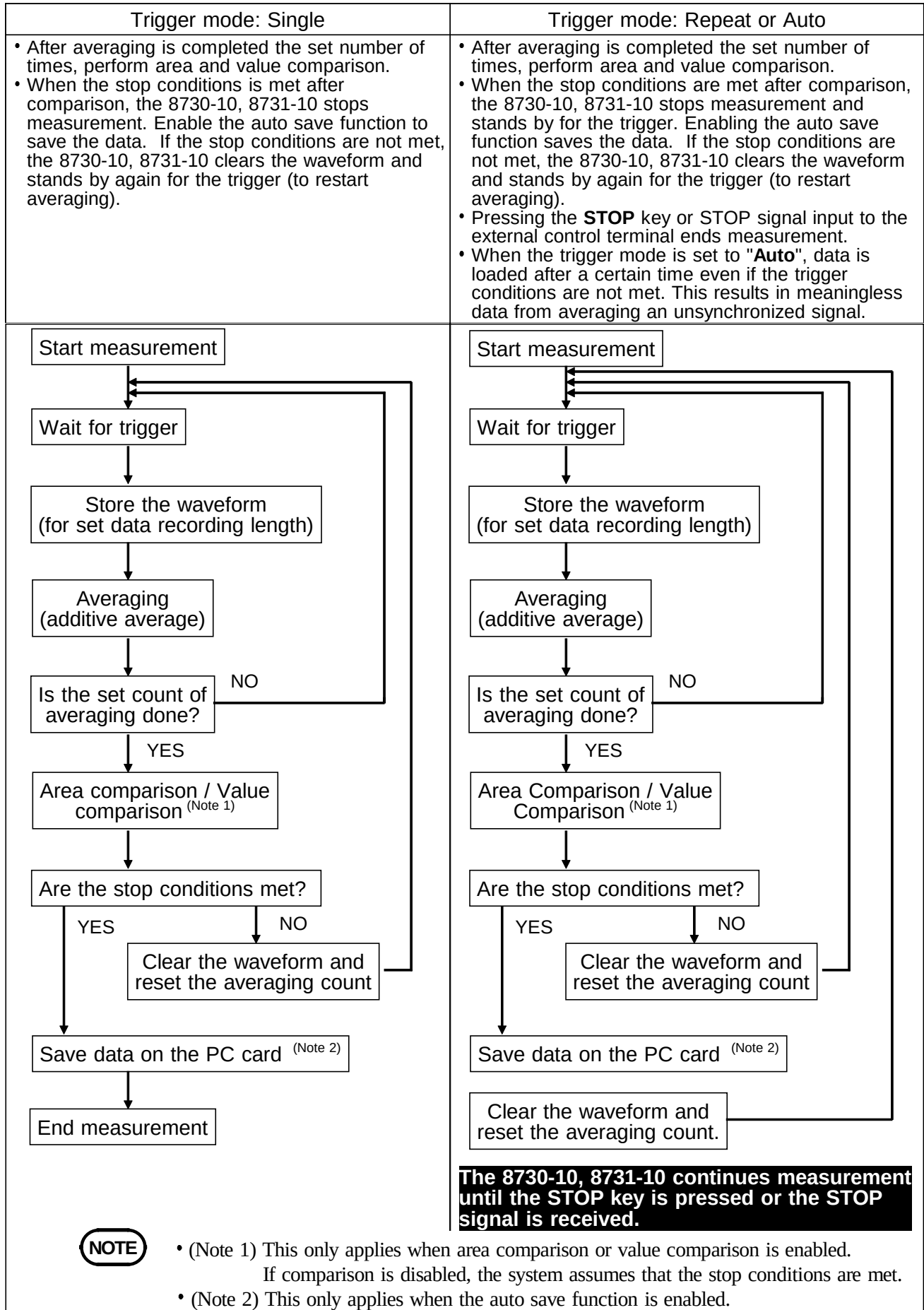
Waveform after averaging

NOTE

- The currently selected averaging count is shown in red.
- If the trigger is not set properly, the intended result may not be obtained. (See 4.4)
- For the calculation equations for averaging, see 13.2.4.
- When averaging is enabled, waveform calculation (see 5.6) is disabled.

<<Related Issues>> Relationship between Averaging and Trigger Mode

- Perform averaging as shown in the flowchart below.

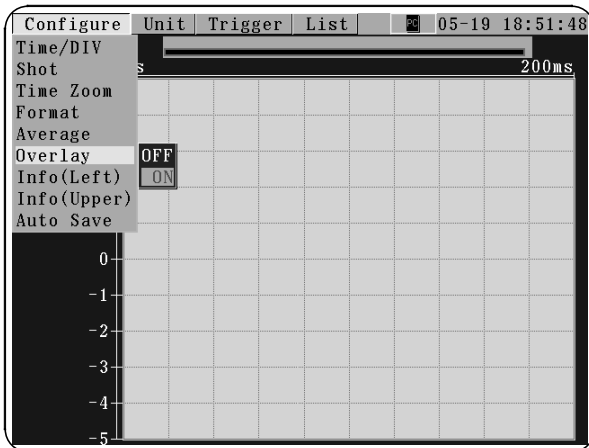


4.2.6 Overlay Function

- Overlay is performed without clearing the currently displayed waveform (if trigger mode is "**Repeat**" or "**Auto**").
- This allows comparison to the immediately preceding waveform.

Setting Procedure

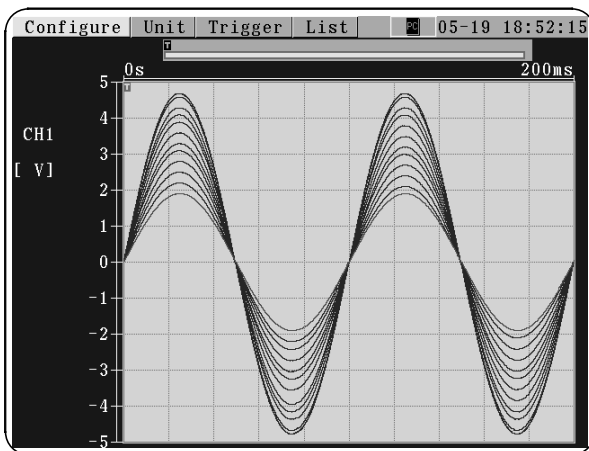
Setting Screen: Configure → • Overlay (OFF, ON)



1. Press the **DISPLAY** key to select the "**Configure**" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "**Overlay**", and press the **ENTER** key.
3. Select "**ON**" or "**OFF**", then press the **ENTER** key to confirm the overlay function setting.

NOTE

- When the trigger mode is set to "**Single**", overlay is not available since measurement will end after loading data once.
- The following changes are only reflected in the waveform loaded last.
Changes in magnification or compression rate (time axis or voltage axis)



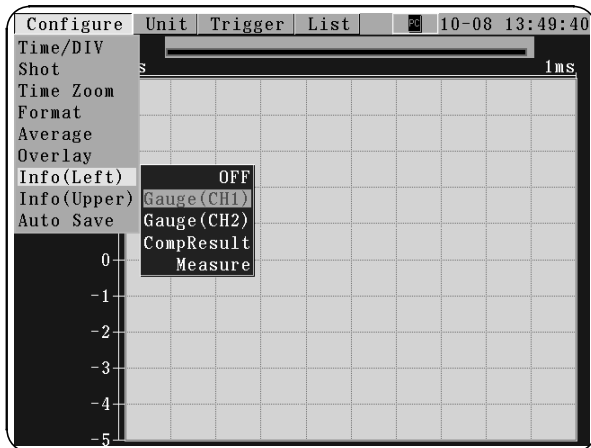
Overlaid display

4.2.7 Information (Left)

- Sets the information to be displayed at the left of the screen.
- A gauge (for graduations) or comparison result is displayed.

Setting Procedure

Setting Screen: Configure → • Info (Left) (OFF, Gauge (CH1), Gauge (CH2), CompResult, Measure)



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "Info (Left)", and press the **ENTER** key.
3. Use the **CURSOR** key to select an item, then press the **ENTER** key.

OFF : Does not display any information.

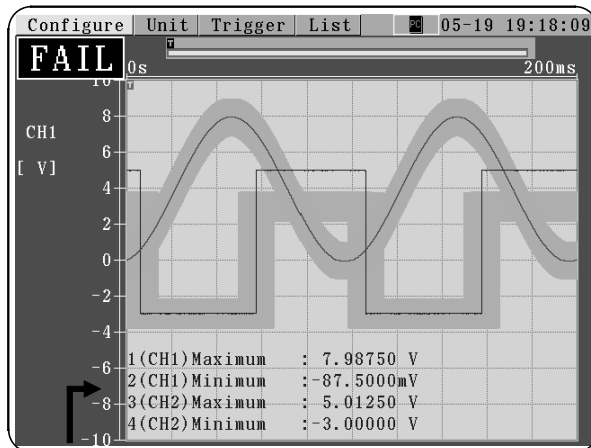
Gauge (CH1) : Displays the gauge of CH1. ^(Note 1)

Gauge (CH2) : Displays the gauge of CH2. ^(Note 2)

CompResult : Displays the Waveform comparison result (PASS, FAIL).

Measure : Displays the comparison result, and upper and lower limits (thresholds) of value comparisons.

When the "Gauge (CH1)" is selected:

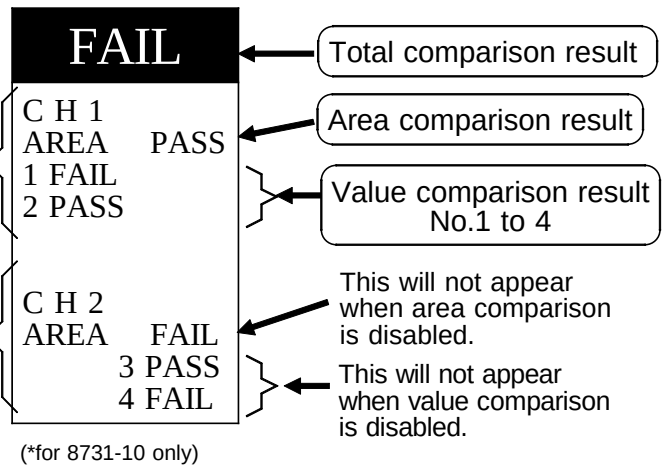
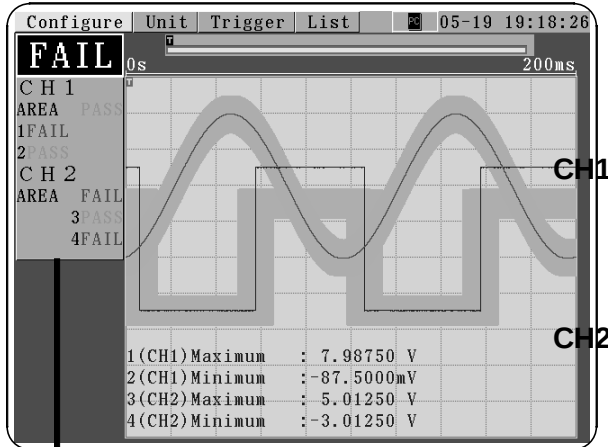


Gauge of CH 1

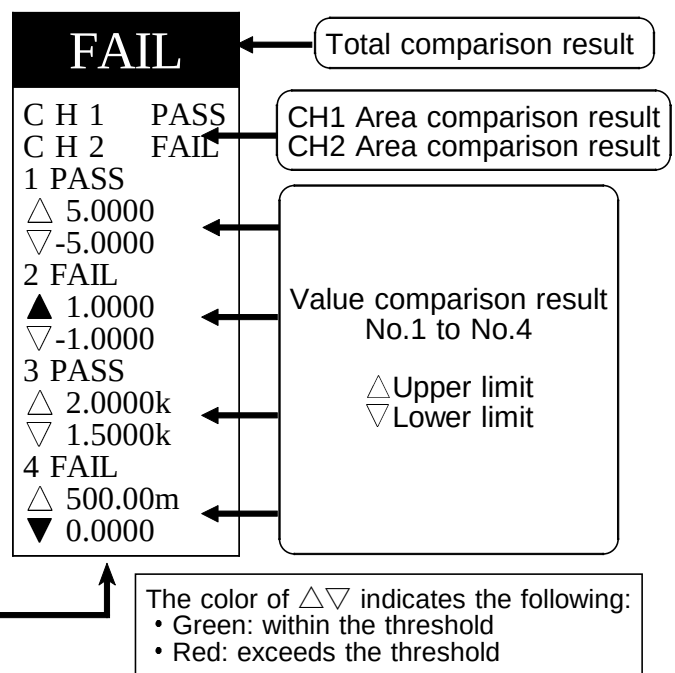
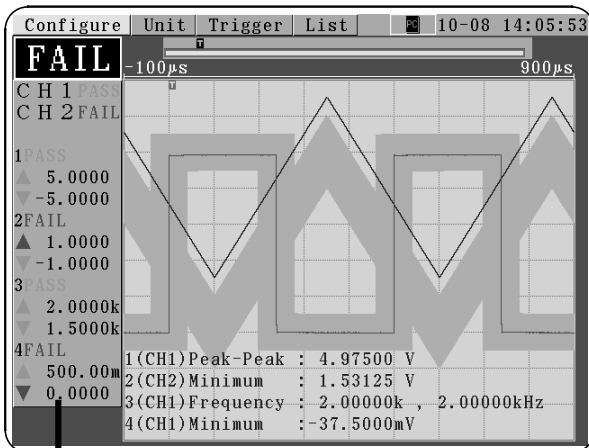
NOTE

- (Note 1) This cannot be selected when the XY screen format is selected.
- (Note 2) The 8730-10 cannot display the gauge of CH2.
- Normally, the waveform and area of CH1 are superimposed over those of CH2. When the "Gauge (CH2)" is selected, however, the waveform and area of CH2 are superimposed over those of CH1.

When the "CompResult" is selected:



When the "Measure" is selected:

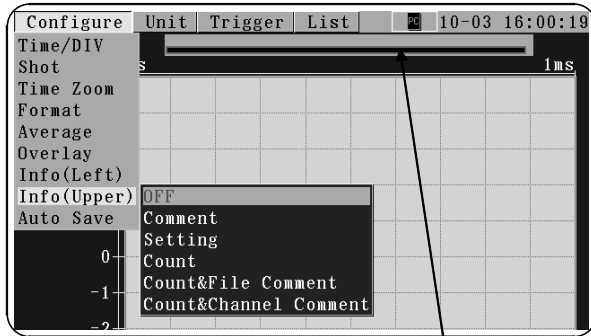


4.2.8 Information (Upper)

- Sets the information to be displayed at the upper part of the screen.
- Displays comments, setting info. and test counts.
- "Count" displays PASS, FAIL and TEST counts. Displays OVER when the count exceeds 999,999. The counter will be resetted when starting measurements, powering on, loading a file or switching test modes.

Setting Procedure

Setting Screen: Configure → • Info (Upper) (OFF, Comment, Setting, Count, Count&File Comment, Count&Channel Comment)



"OFF"

Scroll Bar



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.

2. Move the cursor to "Info (Upper)", and press the **ENTER** key.

3. Use the **CURSOR** key to select an item, then press the **ENTER** key.

OFF : Displays the scroll bar and time on both sides of the screen.

Comment: Displays comments on files and on each channel.

Setting : Displays current settings.

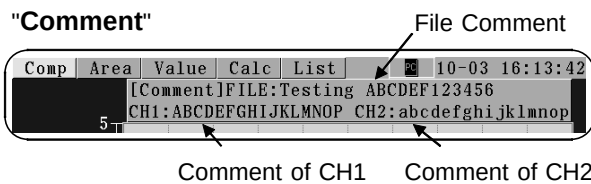
Count : Displays the counted number of PASS, FAIL and TEST.

Count&File Comment

: Displays the counted numbers and file comment.

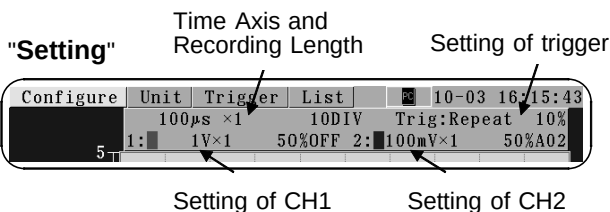
Count&Channel Comment

: Displays the counted numbers and channel comments.



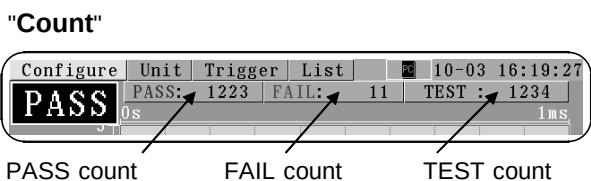
Comment of CH1

Comment of CH2



Setting of CH1

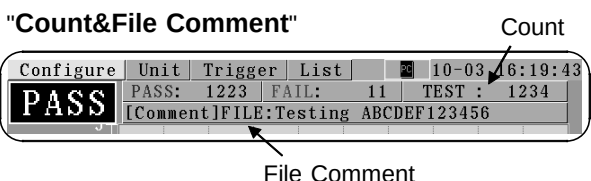
Setting of CH2



PASS count

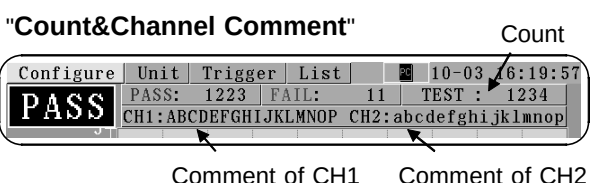
FAIL count

TEST count



File Comment

Count



Comment of CH1

Comment of CH2

NOTE

- Comments will not appear without inputting it in advance.
- A file comment will appear when loading a file or switching test modes.
- In case of no comparison, only the TEST count is displayed.
- As for averaging, whenever set count is completed, the counter is increased.
- "Setting" displays Time axis/ Shot/ Trigger in the upper and displays the voltage axis/ zero position/ comparison area in the lower.

<<Related Issues>>

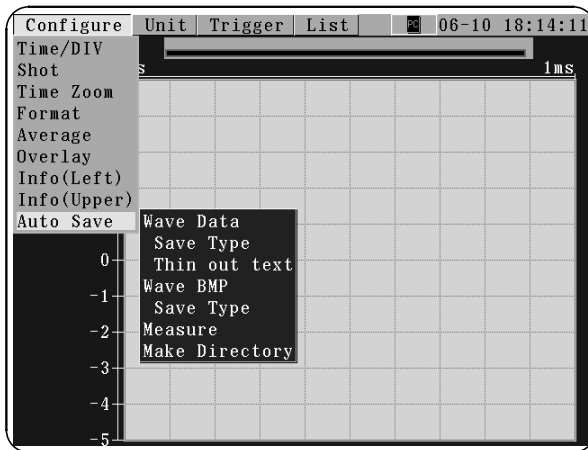
- For file comments, see 6.4.2.
- For channel comments, see 4.3.10.
- For how to enter comments, see 8 in 3.1.2.

4.2.9 Auto Save

- The waveform loaded is automatically saved on the PC card.
- When a comparison is performed, the data is saved if the stop conditions are met. This lets you save only those waveforms that meet the desired comparison results. See 4.6 for details.
- Waveform data, screen data, and value calculation results can be saved.
- When using the 9333 LAN COMMUNICATOR, note that data can be saved on a LAN-connected PC.

Setting Procedure

Setting Screen: Configure → • Auto Save (Wave Data, Save Type, Thin out text, Wave BMP, Measure, Make Directory)



DISPLAY



1. Press the **DISPLAY** key to select the "Configure" tag. Press the **ENTER** key to display the menu.
2. Move the cursor to "Auto Save", and press the **ENTER** key.
3. Use the **CURSOR** key to select the setting item, then press the **ENTER** key to confirm each item.

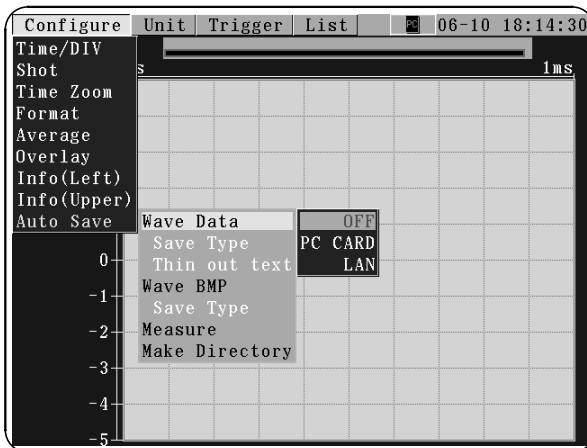
NOTE

- The file is saved in the currently selected directory on the file screen.
- A limited number of directories or files can be saved in a directory. Data exceeding a certain size may not be saved to a PC card. For details, see 6.4.11.

1. Saving Waveform Data (OFF, PC CARD, LAN)

- Measured waveform data can be saved to a PC card.
- When using the 9333 LAN COMMUNICATOR, note that data can be saved on a LAN-connected PC.
- Data is saved in "Binary" or "Text" format.

Setting Procedure



1. Use the **CURSOR** key to select "Wave Data" on the "Auto Save" menu.
2. Use the **CURSOR** key to select the destination at which to save the waveform data, then press the **ENTER** key.

OFF : Does not save data automatically.

PC CARD: Saves waveform data to a PC card

LAN : Saves waveform data on a LAN-connected PC. (Requires use of the 9333 LAN COMMUNICATOR.)

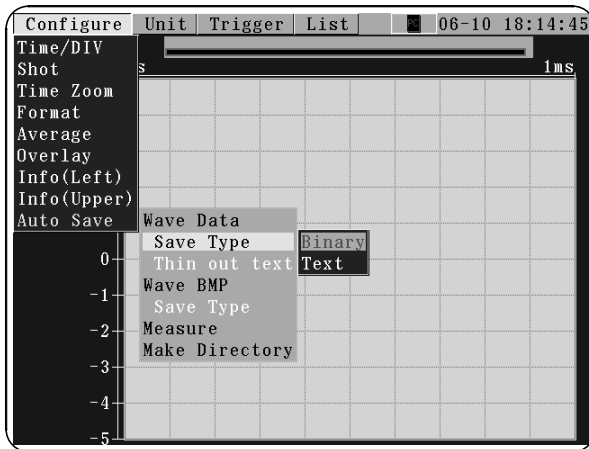
NOTE

- During comparison, the data is saved when the stop conditions are met.

2. Setting Waveform Data Save Format (Binary, Text)

- Waveform data can be saved in binary format or text format.
- "Wave Data" can be set when "PC CARD" or "LAN" is selected.

Setting Procedure



1. Select "Save Type" under "Wave Data" with the **CURSOR** key, then press the **ENTER** key.
2. Select "Binary" or "Text", and press the **ENTER** key.

Binary: Saves the data in binary format. The data saved can be read into the 8730-10, 8731-10.

Text : Saves the data in text format (CSV). This format delimits items of data with a comma (,) and can only be read into a PC, and not into the 8730-10, 8731-10.

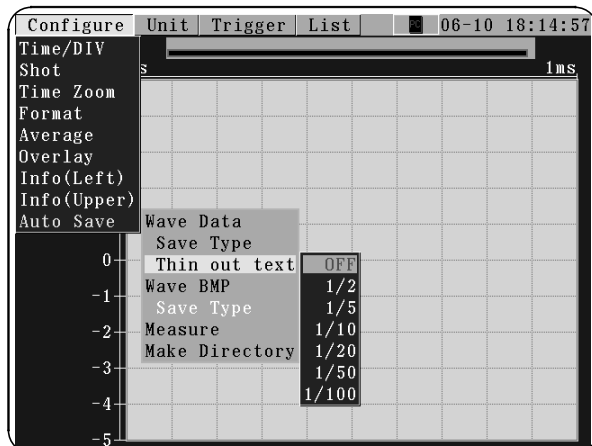
NOTE

- When "Wave Data" is set to "OFF", the save format cannot be selected.
- For an example of saving in text (CSV) format, see 4 of 6.4.11.
- When LAN is set as the saving destination, data is saved in TXT format files named "WAVEhhmmss.TXT", where hhmmss are the six digits of the hour, minute and second when the file is saved.
- When waveform calculation is enabled, only calculated waveforms are saved.

3. Setting the Thinning out Text Saving (OFF, 1/2, 1/5, 1/10, 1/20, 1/50, 1/100)

- Selecting "Text" in 2 above enables thinning out text saving.
- Thinning out text saving is set by specifying the intervals of samples at which data is recorded.
- Use thinning out text saving when you need specific items of data included in an extensive amount of data (saved over many hours).

Setting Procedure



1. Use the **CURSOR** key to select "Thin out text" on the "Auto Save" menu, then press the **ENTER** key.
2. Select an interval, then press the **ENTER** key.

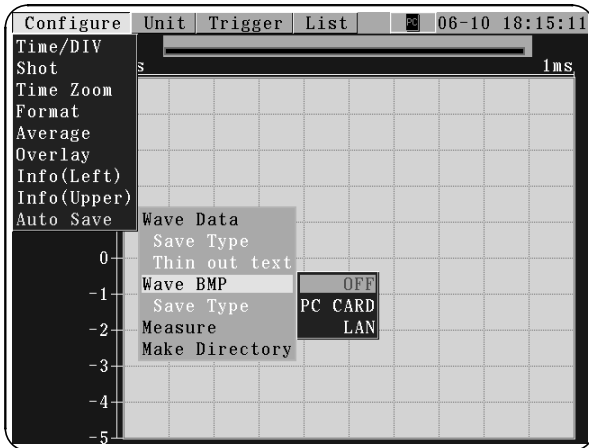
NOTE

- Setting the save format to "Binary" disables the selection of intermittent saving.

4. Saving Screens in BMP Format (OFF, PC CARD, LAN)

- The current screen image may be saved. The screen data is saved in bitmap format (BMP) to the PC card.
- When using the 9333 LAN COMMUNICATOR, note that the screen may be saved to a LAN-connected PC.
- The save format is selectable between "**Compress**" or "**Noncompress**".

Setting Procedure



1. Use the **CURSOR** key to select "**Wave BMP**" on the "**Auto Save**" menu, then press the **ENTER** key.
2. Select the destination at which to save the screen data, and press the **ENTER** key.

OFF : Does not save data automatically.

PC CARD: Saves BMP data to a PC card

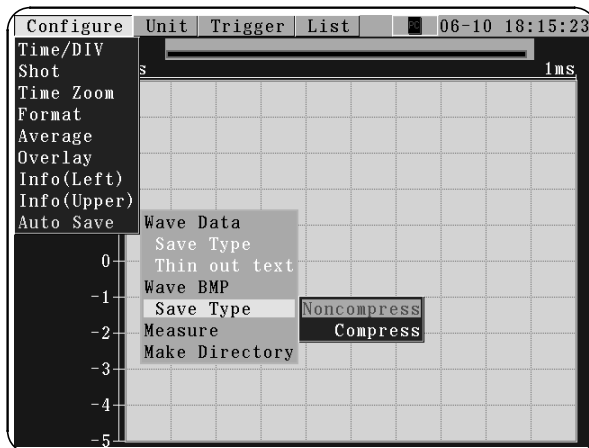
LAN : Saves BMP data on a LAN-connected PC. (Requires use of the 9333 LAN COMMUNICATOR.)

(NOTE) • During comparison, the data is saved when the stop conditions are met.

5. Setting the Save Format of BMP Screen Data (Non-compressed, Compressed)

- The BMP screen data is saved in either compressed or non-compressed format.
- This selection is available when "**Wave BMP**" is set to "**PC CARD**" or "**LAN**".
- When saved in compressed format, the file size is reduced without deteriorating image quality. However, some application software may not be able to read compressed files. In such cases, select non-compressed format.

Setting Procedure



1. Use the **CURSOR** key to select "**Save Type**" under "**Wave BMP**", then press the **ENTER** key.
2. Select "**Noncompress**" or "**Compress**", and press the **ENTER** key.

Noncompress: Saves BMP data without compression

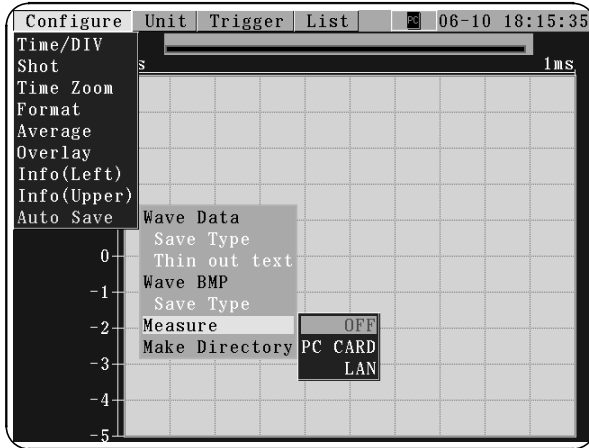
Compress : Saves BMP data in compressed format.

(NOTE) • The saved data can only be read on a PC. It cannot be read by the 8730-10, 8731-10.
 • The compression rate varies, depending on the screen (waveform).

6. Saving Value Calculation Results (OFF, PC card, LAN)

- Value calculation results can be saved.
- The data is saved in CSV format.
- When value comparison is enabled, the comparison results are saved together with data.

Setting Procedure



1. Use the **CURSOR** key to select "Measure" on the "Auto Save" menu.
2. Use the **CURSOR** key to select the destination at which to save calculation results, then press the **ENTER** key.

OFF : Does not save data automatically.

PC CARD: Saves value calculation results to a PC card

LAN : Saves value calculation results on a LAN-connected PC.
(Requires use of the 9333 LAN COMMUNICATOR)

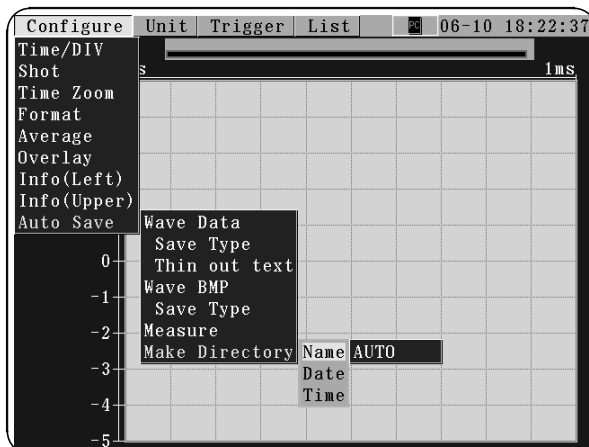
NOTE

- When comparison is enabled, the data is saved when the stop conditions are met.
- For examples of saving calculation results, see 5 in 6.4.11.
- Calculation results are successively saved in one file. The file name is "MEASURE.CSV".
- When "LAN" is set as the saving destination for selected text, data is saved in TXT format files named "PARAMETER.TXT". A new file is created whenever measurement is stopped and restarted.

7. Setting Destination Directory (Name, Date, Time)

- Sets the name of a directory to save waveform data, screen data (BMP), or calculation result data.

Setting Procedure



1. Use the **CURSOR** key to select "Make Directory" on the "Auto Save" menu, then press the **ENTER** key.
2. Select "Name", "Date", or "Time", then press the **ENTER** key.

Name: The directory name is set to "AUTO" and the file is saved under that directory. ^(Note 1)

Date : The directory name is set to xxYxxMxx and the file is saved under that directory. "xx" represents the date. When the date is September 1, 2002, the directory name will be "02Y09M01."

Time : The directory name is set to xxHxx and the file is saved under that directory. "xx" represents the time. When the time is 8:41, the directory name will be "08H41."

NOTE

- (Note 1) The directory name is changeable. For how to change the name, see 8, in 3.1.2.
- For the names of files saved under the directory, see 6.4.11.
- Spaces cannot be included in a directory name.

4.3 Details of Input Setting

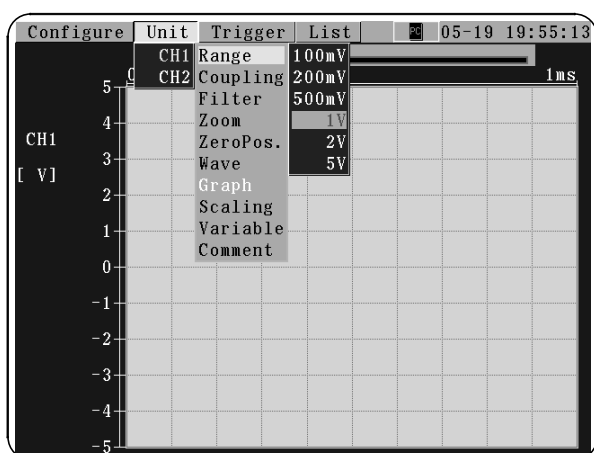
- This section explains various setting for "Unit" tab.

4.3.1 Range

- Sets the voltage axis range for input signals.
- The values shown in the range menu represent the voltages per DIV in the voltage axis direction.
- After the range has been changed, perform zero adjustment (see 7.2.1).

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Range (100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "**Range**", then press the **ENTER** key.
4. Select a value, then press the **ENTER** key.

NOTE

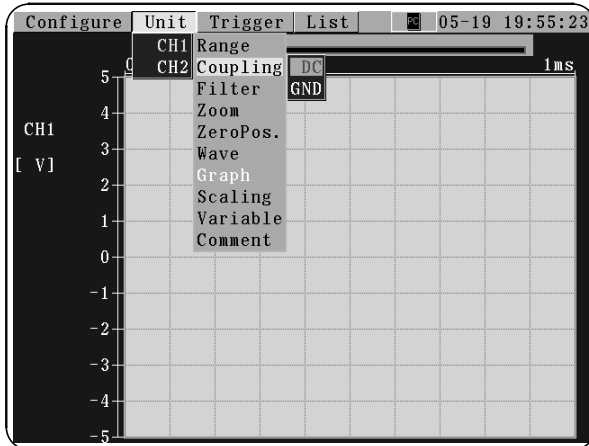
- (Note 1) Channel selection is not possible with the 8730-10.
- Select a suitable range for input. Each range is measurable between -10 times and +11 times the set range. If measurement exceeds this range, a range-over occurs and the waveform will not be correctly displayed. (See 4.3.5)
- The currently selected range is shown in red.
- Changing the range also changes the trigger level. (See 4.4)

4.3.2 Coupling

- Sets the coupling method of input signals.

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Coupling (DC, GND)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "Coupling", then press the **ENTER** key.
4. Select "DC" or "GND", then press the **ENTER** key.

DC : Performs DC coupling.

GND: The input signal is not connected.
This is used to check the zero position.

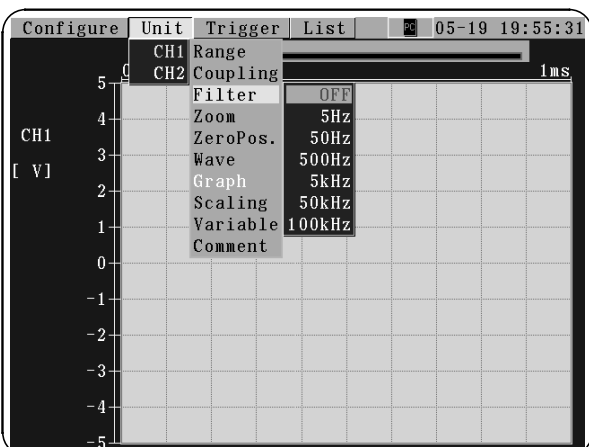
- NOTE**
- (Note 1) Channel selection is not possible with the 8730-10.
 - The currently selected setting is shown in red.

4.3.3 Filter

- Sets a low-pass filter for input signals.
- This is effective in removing unwanted harmonic components.

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Filter (OFF, 5 Hz, 50 Hz, 500 Hz, 5 kHz, 50 kHz, 100 kHz)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "Filter" on the menu, then press the **ENTER** key.
4. Select a cutoff frequency, then press the **ENTER** key.

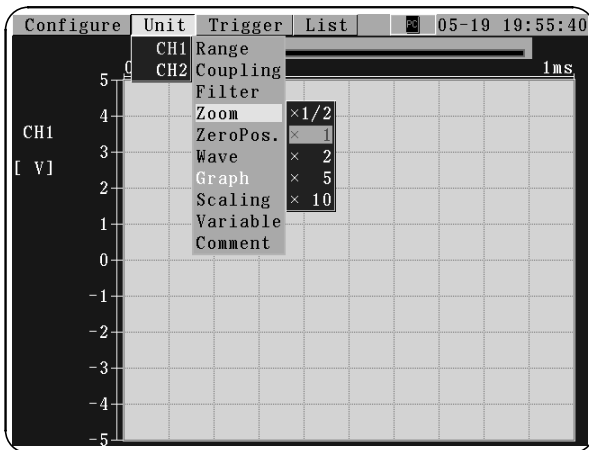
- NOTE**
- (Note 1) Channel selection is not possible with the 8730-10.
 - The currently selected cutoff frequency is shown in red.

4.3.4 Voltage Axis Magnification

- Magnification and compression of waveform display in the voltage axis direction can be done.
- Waveforms are magnified or compressed using the center of the screen as a datum point.

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Zoom (X1/2, X1, X2, X5, X10)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "**Zoom**", then press the **ENTER** key. ^(Note 2)
4. Select a ratio, then press the **ENTER** key.

NOTE

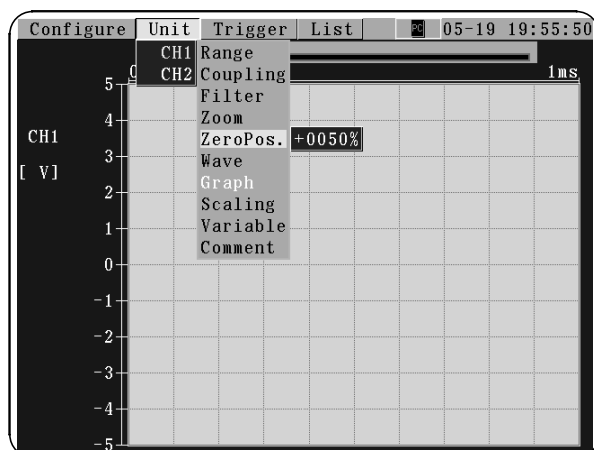
- (Note 1) Channel selection is not possible with the 8730-10.
- (Note 2) "**Zoom**" cannot be selected when the variable function is ON. (See 4.3.9)
- The currently selected ratio is shown in red.
- If the zero position is not set to 50% at waveform magnification or compression using the center of the screen as a datum point, the zero position will change when the magnification/compression rate changes. (See 4.3.5)

4.3.5 Zero Position

- Sets the "0V" position.
- Moves the screen display position of the waveform up and down. Set the percentage of screen height where "0V" is to be positioned. The bottom of the graph is 0%; the top is 100%.

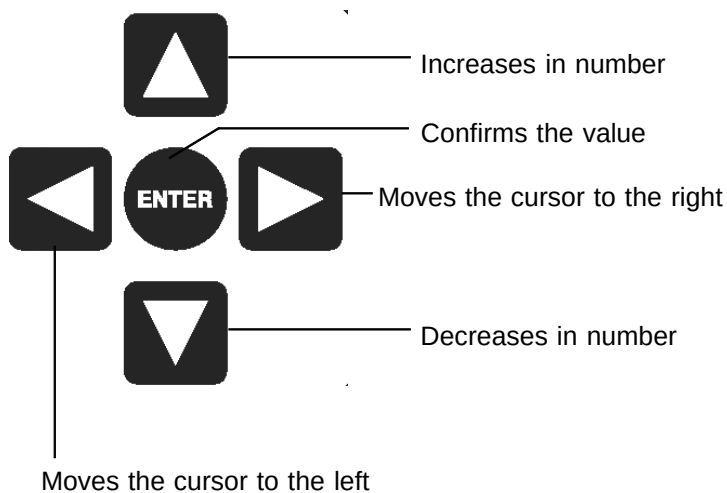
Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • ZeroPos. (-950% to 1050% max)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "ZeroPos." on the menu, then press the **ENTER** key. ^(Note 2)
4. Select a value, then press the **ENTER** key.

How to Change Value for Zero Position



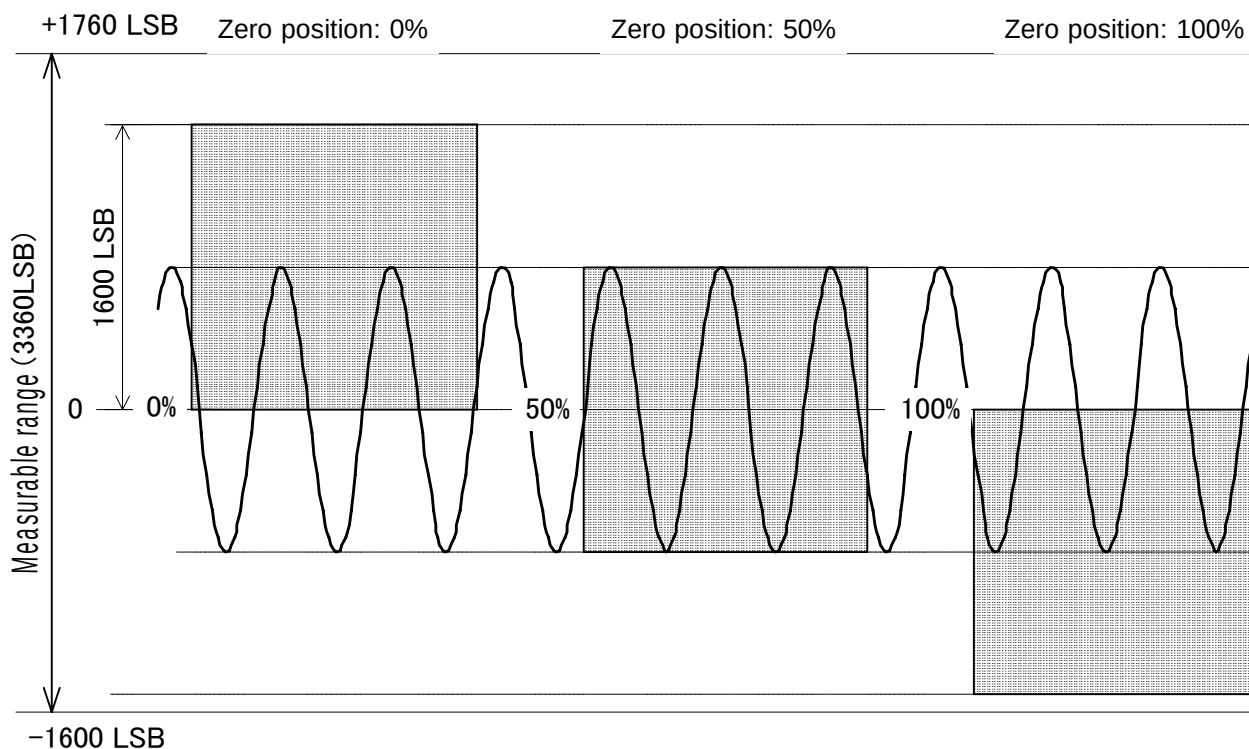
NOTE

- (Note 1) Channel selection is not possible with the 8730-10.
- (Note 2) It can not be selected when variable setting is ON. (See 4.3.9)
- The setting range of the zero position varies depending on the magnification or compression rate of the voltage axis. For details, see "Relationship between Zero Position and Screen Display" on the next page.
- For adjustment of the zero position, see 7.2.1.

Relationship between Zero Position and Screen Display

- The zero position has the following relationship with screen display.
- You will be able to display any hidden part of the waveform by changing the percentage of "0V" position.

 : Screen display range



When voltage axis magnification is x1

Zoom	X1/2	X1	X2	X5	X10
Number of full scale LSB	3200	1600	800	320	160
Zero position [%] setting range	0 to 100	-50 to 150	-150 to 250	-450 to 550	-950 to 1050

NOTE

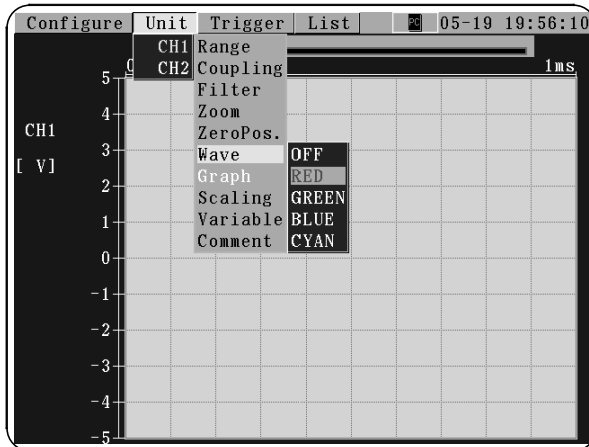
- Each range is measurable between -10 times to +11 times the set voltage axis range. If input exceeds the measurable range, a range-over occurs and the waveform is shown in black.
- If a range-over occurs, a warning message appears and the ERROR terminal (of the external control terminals) becomes active. You can enable or disable this function. See 7.5.3 for details.
- Changing the zero position or the magnification or compression rate of the voltage axis will change the voltage range shown on the waveform display screen, but not the measurable range.

4.3.6 Color of Wave Display

- Specifies the color of wave display.
- Waveform display may be turned off.
- Even when waveform display is OFF, comparison will be performed.

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Wave (OFF, RED, GREEN, BLUE, CYAN)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "Wave", then press the **ENTER** key.
4. Select "OFF" or a color, then press the **ENTER** key.

NOTE

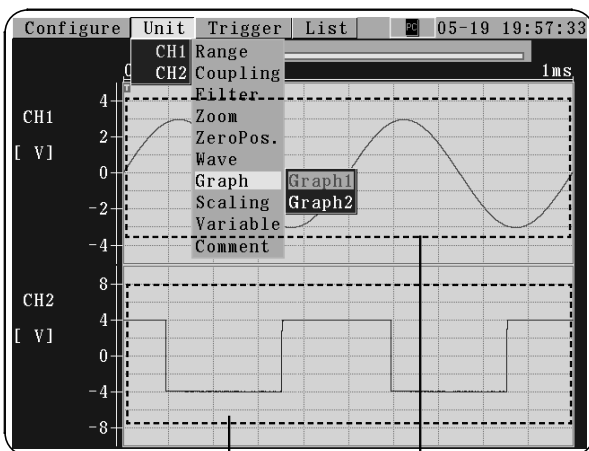
- (Note 1) Channel selection is not possible with the 8730-10.
- The currently selected wave display color is shown in red.
- When "OFF" is selected, the waveform is not displayed. The comparison area or calculation result is not displayed either, but comparison is performed. This saves time for display processing and thus slightly reduces the comparison period.

4.3.7 Graph of Waveform Display

- Selects a graph for displaying a waveform when display format is set to dual screen (see 4.2.4).

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Graph (Graph1, Graph2)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
 2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
 3. Select "Graph", then press the **ENTER** key. ^(Note 2)
 4. Select a graph, then press the **ENTER** key.
- Graph1: Displays the waveform on Graph 1.
Graph2: Displays the waveform on Graph 2.

NOTE

- (Note 1) Channel selection is not possible with the 8730-10.
- (Note 2) This selection is not available when the display format is set to "Single" screen.

4.3.8 Scaling Function

- The scaling function can be used to convert an output voltage from a sensor or similar into a physical quantity.
- Two types of scaling functions are available.

(1) Ratio Setting

Scaling is performed by specifying a physical quantity to correspond to a 1 V input signal (conversion ratio: EU/V), an offset value, and the unit (EU: Engineering Units). This will cause the measurement voltage to be converted into the selected units.

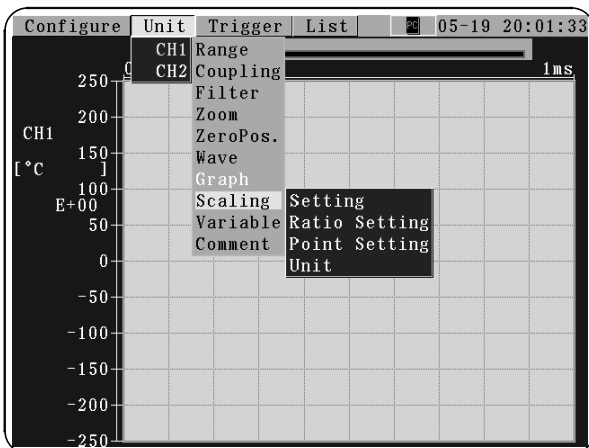
(2) Point Setting

Scaling is performed by specifying two input signal points (voltage values) and the conversion values for these two points in engineering units (EU). This will cause the measurement voltage to be converted into the selected units.

- The gauge scale and A • B cursor measurement values are displayed in the scaled units.
- Scaling can be performed for every channel. (8731-10 only)
- This function may be used together with the variable function.

Setting Procedure

Setting Screen: Unit → CH1 (CH2) → • Scaling (Setting, Ratio Setting, Point Setting, Unit)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "Scaling", then press the **ENTER** key.
4. Use the **CURSOR** key to select an item, then use the **ENTER** key to confirm each scaling item.

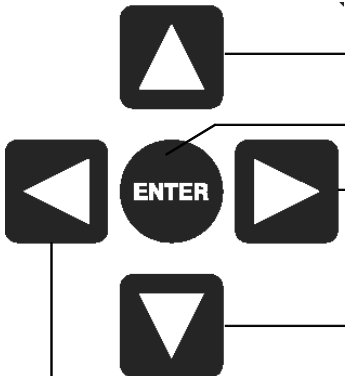
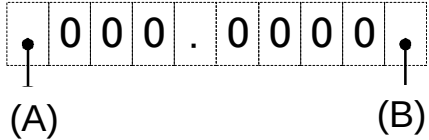
NOTE • (Note 1) Channel selection is not possible with the 8730-10.

• Entering values in Ratio Setting or Point Setting

- Use the **CURSOR** keys and **ENTER** key to enter values. The function of each key is shown in the figure below.
- The input field is nine digits long (excluding the decimal point), as shown in the figure below. Digits (A) and (B) are used for signs and prefixes. The five most significant digits of numbers are effective.

(A): Displays a blank or -. A blank indicates a positive value; the - indicates a negative value.

(B): Displays a blank or SI prefix. For details of SI prefix, see 13.2.5.

Setting Procedure	Value input screen
 Increases in number Confirms the number Moves the cursor to the right Decreases in number Moves the cursor to the left	

1. Setting the Scaling (OFF, ON)

- Turns the scaling function ON/OFF.

Setting Procedure



1. Select "**Setting**" on the "Scaling" menu, then press the **ENTER** key.
2. Select "**ON**" or "**OFF**", and press the **ENTER** key.

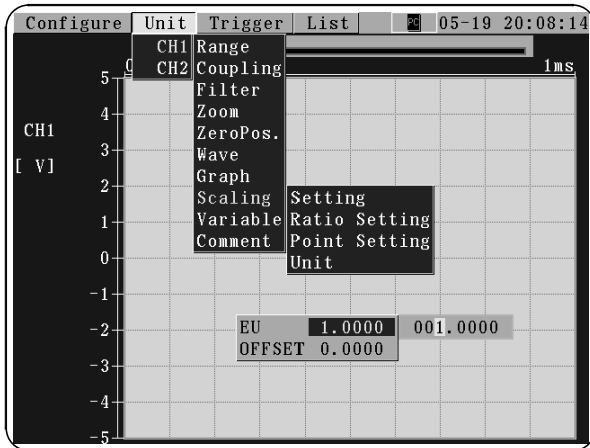
OFF: Does not perform scaling.

ON : Performs scaling and displays the value with SI prefix. For details of SI prefix, see 13.2.5.

2. Scaling in "Ratio Setting" (EU, OFFSET)

- Scaling is performed by specifying a physical quantity to correspond to a 1 V input signal (conversion ratio: EU/V), an offset value, and the unit (EU: Engineering Units). This will cause the measurement voltage to be converted into the selected units.

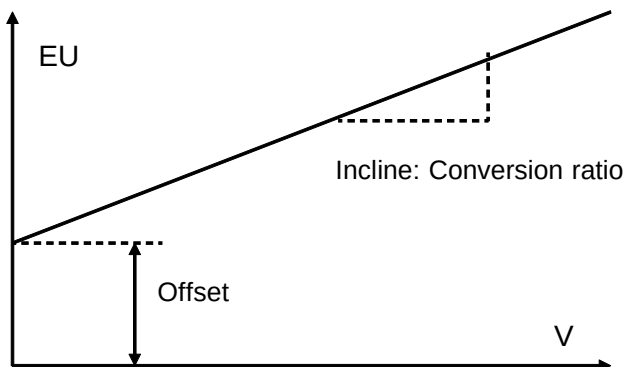
Setting Procedure



1. Select "Ratio Setting" on the "Scaling" menu, then press the **ENTER** key.
2. Enter a value for "EU".
3. Enter a value for "OFFSET".

NOTE

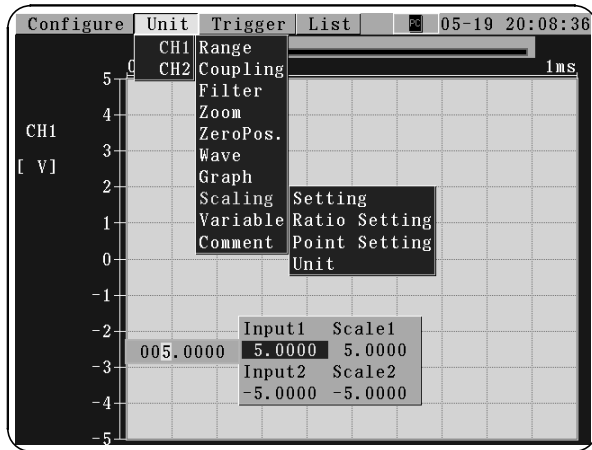
- The offset setting range is from -9.9999E+9 to 9.9999+9.



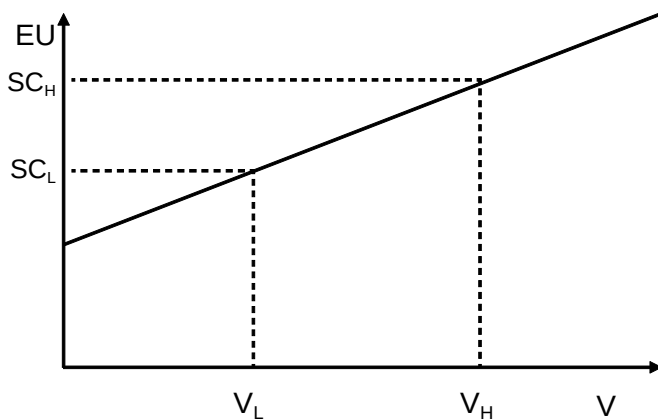
3. Scaling in "Point Setting" (Input 1 • 2, Scale 1 • 2)

- Scaling is performed by specifying two input signal points (voltage values) and the conversion values for these two points in engineering units (EU). This will cause the measurement voltage to be converted into the selected units.

Setting Procedure



1. Select "Point Setting" on the "Scaling" menu, then press the **ENTER** key.
2. Enter a value for "Input1".
3. Enter a value for "Scale1".
4. Enter a value for "Input2".
5. Enter a value for "Scale2".



NOTE

- The value at the cursor position (if between 0.0001 and below 100000) is not expressed as an exponent, but is shown as is.
- The setting range of each value is from -9.9999E+19 to 9.9999E+19.
- In the "Point Setting", scaling is performed according to the following equation:

$$Y = \frac{SC_H - SC_L}{V_H - V_L} X + \frac{V_H \times SC_L - V_L \times SC_H}{V_H - V_L}$$

V_H : High voltage point SC_H : Value for high voltage point
 V_L : Low voltage point SC_L : Value for low voltage point

- The range for each portion of the above equation enclosed by a broken line is shown below. The setting shall be made so that the result of each portion is within the range.

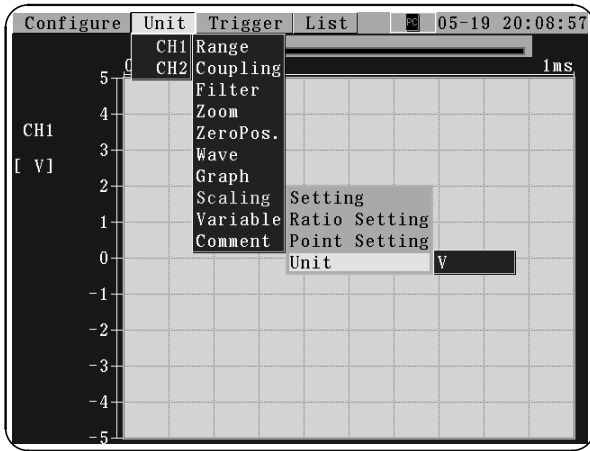
$$\begin{aligned} -9.9999E+9 &\leq \text{Value of portion enclosed by broken line} \leq -1.0000E-9 \\ \text{Value of portion enclosed by broken line} &= 0 \\ +1.0000E-9 &\leq \text{Value of portion enclosed by broken line} \leq +9.9999E+9 \end{aligned}$$

- If the result above exceeds the range, a warning occurs and the setting is automatically adjusted so that the converted value equals the voltage ($X=Y$).
- The scaled value is displayed on the gauge or as an A/B cursor reading.

4. Setting the Unit

- Input the unit (EU) used for a scaled value.

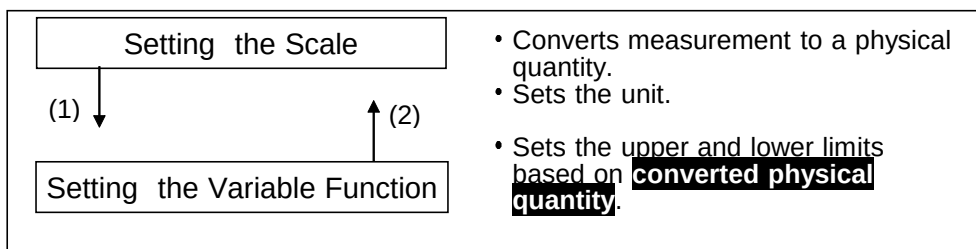
Setting Procedure



1. Select "Unit" on the "Scaling" menu, then press the **ENTER** key.
2. The screen for entering characters will appear so you can enter a unit.
For how to enter comments, see 8, in 3.1.2.
Up to seven characters can be entered.

• Relationship between Scaling and Variable Function

- You may set the scaling function and variable function in order of either (1) or (2) below. The order does not affect the result.
- In case of (2), the variable is set based on the scaled value.
(The unit (EU) is set in the scaling setting.)



NOTE

- When scaling and variable functions are both enabled, the setting ranges of the upper and lower limits of the scaled value are as shown below.
Any attempt to set an upper or lower limit outside the range will display a warning message.

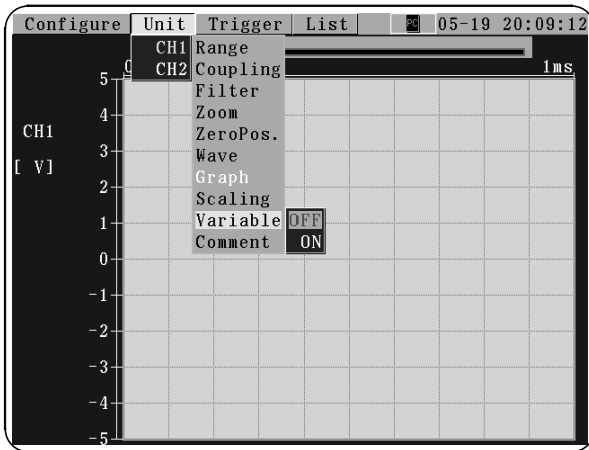
$$\begin{aligned}
 & -9.9999\text{E}+19 \leq \text{Set value} \leq -1.0000\text{E}-19 \\
 & \text{Set value} = 0 \\
 & +1.0000\text{E}-19 \leq \text{Set value} \leq +9.9999\text{E}+19
 \end{aligned}$$

4.3.9 Variable Function

- Using the variable function allows you to freely set the display position and size of waveform.
- For the variable function, the upper and lower limits of the waveform display range are set.
- The upper and lower limits of the waveform display setting range are up to ± 5000 times the selected range. Once the variable function is turned ON, the maximum magnification is limited to 1000.
- The variable function can be set to ON or OFF for each channel individually. ^(Note 1)
- Waveform calculation turns on the variable function (see 5.6).

Setting Procedure

Setting Screen: Unit→CH1 (CH2)→ • Variable (OFF, ON)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "**Variable**" on the display menu, then press the **ENTER** key.
4. Use the **CURSOR** key and **ENTER** key to select "**ON**", then set the upper and lower limits. ^(Note 2)

NOTE

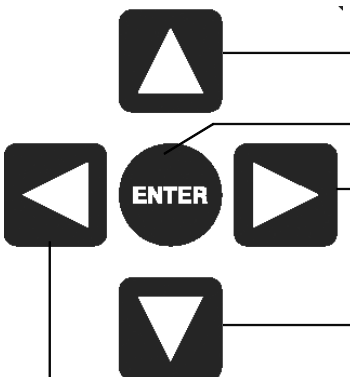
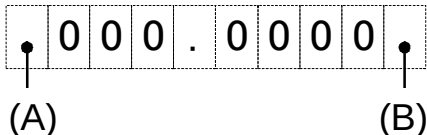
- (Note 1) Channel selection is not possible with the 8730-10.
- (Note 2) When the variable function is "ON", the menu options of "**Zoom**" and "**ZeroPos.**" are disabled. (See 4.3.4 and 4.3.5)
- Changing the voltage axis range when the variable function is "ON" does not change the size of the waveform on the screen.
- If the upper or lower-limit setting is outside the setting range, a warning message will appear at initial screen display (i.e., when starting measurement). In such case, the setting will be changed to one within the setting range.

• Entering values in Variable function

- Use the **CURSOR** keys and **ENTER** key to enter values. The function of each key is shown in the figure below.
- The input field is nine digits long (excluding the decimal point) as shown in the figure below. Digits (A) and (B) are used for signs and prefixes. The five most significant digits of numbers are effective.

(A): Displays a blank or -. A blank indicates a positive value, the - indicates a negative value.

(B): Displays a blank or SI prefix. For details of the SI prefix, see 13.2.5.

Setting Procedure	Value input screen
 Increases in number Confirms the value Moves the cursor to the right Decreases in number Moves the cursor to the left	 (A) (B)

<<Related Issues>>

- Variable function and scaling function processing can be carried out simultaneously. (See 4.3.8) For example, this is convenient when you want to display sensor output in full span.

(Example)

Output of sensor	➔ Scaling	After conversion
Upper limit: 5.78 [V] Lower limit: 1.23 [V]		Upper limit: 10 [EU] Lower limit: 0 [EU]

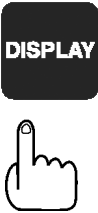
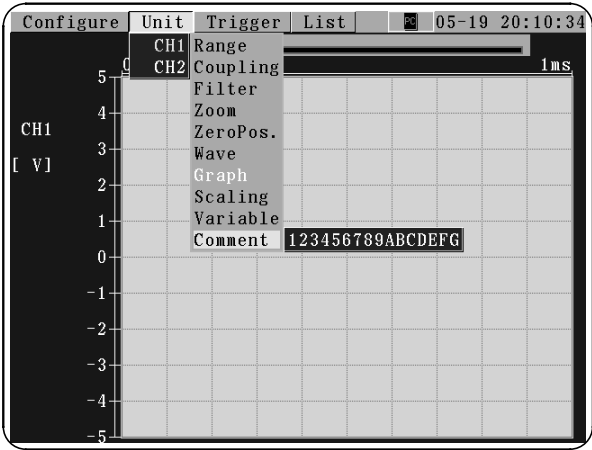
- With the scaling function, voltage from the sensor may be converted into the type of physical quantity you wish to measure. However, the waveform display will not change. "To display sensor output in full span," set as shown below.
Lower limit → 0 [EU], Upper limit → 10 [EU]

4.3.10 Entering Channel Comments

- Allows you to enter a comment for each channel.
- The comment is displayed when "Comment" is selected for the "Info (Upper)" setting.

Setting Procedure

Setting Screen: Unit→CH1 (CH2)→ • Comment



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Unit" tag.
2. Select the channel to set, then press the **ENTER** key. ^(Note 1)
3. Select "Comment", then press the **ENTER** key.
4. Enter a comment. For how to enter comments, see 8 in 3.1.2.

NOTE

- (Note 1) Channel selection is not possible with the 8730-10.
- Up to sixteen characters can be entered.

4.4 Trigger Functions

4.4.1 Overview of the Trigger Functions

- The term "**Trigger**" refers to a signal which is used to control the timing for recording start or stop.
- The term "Triggering has occurred" refers to the state when such a signal has activated recording start or stop.
- The trigger mark  is displayed at the waveform trigger position (i.e., point where a trigger is activated).
- A signal to activate a trigger is called the trigger source. The 8730-10, 8731-10 has three trigger sources as shown below.

(1) Channel Trigger

Uses the input signals of CH1 and CH2 ^(Note).

(2) External Trigger

The input signal to the EXT TRIG connectors used as trigger source

(3) Timer Trigger

Triggering occurs from a preset start time to a preset stop time.
^(Note) CH2 is not available with the 8730-10.

- The following two triggering methods are available:

(1) Setting Trigger Mode

Sets whether to accept a trigger repeatedly after measurement is completed.

(2) Setting the Pre-trigger

Records the waveform before a trigger in addition to the waveform after a trigger.

NOTE

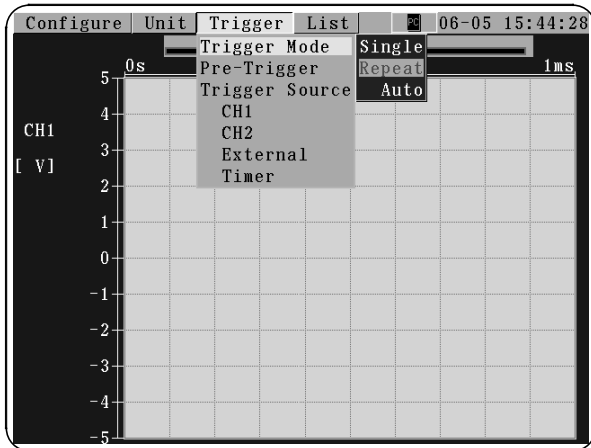
- When all trigger sources are OFF, the 8730-10, 8731-10 loads the waveform as soon as it starts measurement (free-run operation).
- During recording operation, "**Wait for trig**" appears on the screen until the trigger sources are met.

4.4.2 Trigger Mode

- The trigger mode determines the way triggering is used to control operation of the unit.
- When all trigger sources are OFF, a recording operation begins immediately (free-run operation).

Setting Procedure

Setting Screen: Trigger → • Trigger Mode (Single, Repeat, Auto)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Trigger" tag.
2. Select "Trigger Mode", then press the **ENTER** key. ^(Note 1)
3. Select an item, then press the **ENTER** key.

Single : Trigger is registered only once. 8730, 8730-10 starts waveform recording when triggering occurs and continues for preset recording length. Measurement then ends automatically.

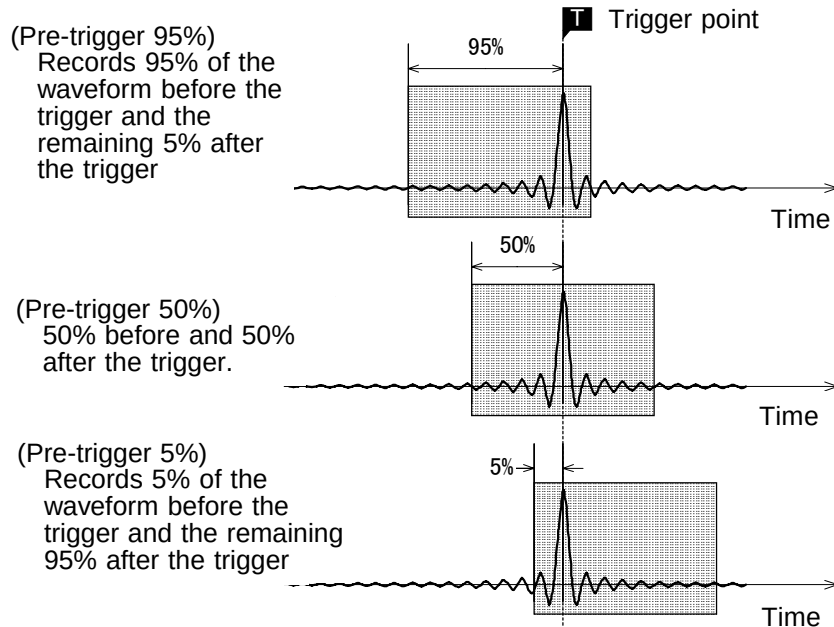
Repeat: Trigger is registered continuously. Unit is in trigger standby condition when trigger conditions are not met. Measurement ends when **STOP** key is pressed.

Auto : Trigger is registered continuously. If trigger sources are not met within 1 second, waveform recording starts automatically and continues for preset recording length. Measurement ends when **STOP** key is pressed.

4.4.3 Pre-trigger

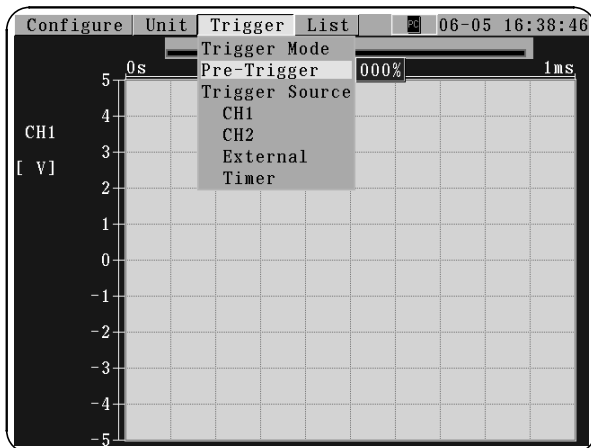
- The pre-trigger function serves to record the waveform not only after but also before triggering has occurred.
- When recording a waveform, using the recording start point as 0% and the recording end point as 100%, the trigger point can be specified in percent.

 Recording Range (Recording Length)



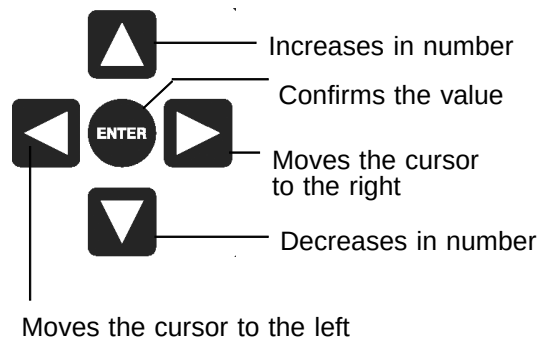
Setting Procedure

Setting Screen: Trigger → • Pre trigger (0% to 100%)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Trigger" tag.
2. Select "**Pre-Trigger**" on the display menu, then press the **ENTER** key. ^(Note 1)
3. Select a value to set, then press the **ENTER** key.

Editing Pre-trigger



NOTE

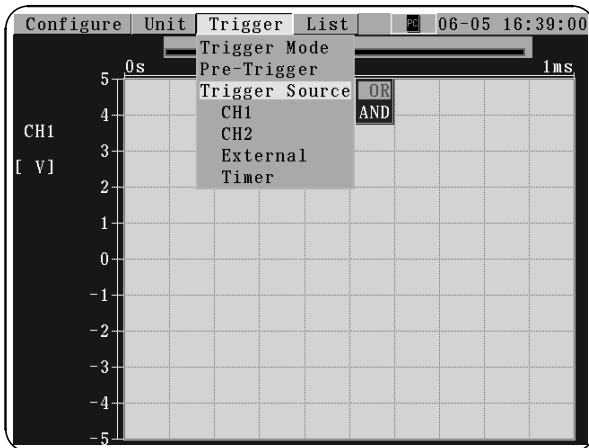
- When all trigger sources are "**OFF**", the pre-trigger is not selectable (0%).
- When the pre-trigger is set, the trigger will not be registered for a certain period after the start of measurement. (During this interval, "**Pre-trig wait**" is shown on the display.)
- During external sampling, the pre-trigger setting is fixed to 0% and you cannot select menu options. For details of setting external sampling, see 4.2.1.

4.4.4 Trigger Source AND/OR Linking

- The channel trigger [CH1, CH2 ^(Note)], external trigger, and timer trigger may be combined to activate a trigger using AND/OR logic.
- (Note) Only CH1 is available with the 8730-10.

Setting Procedure

Setting Screen: Trigger→ • Trigger Source (OR, AND)



DISPLAY



- Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Trigger" tag.
- Select "Trigger Source" on the display menu, then press the **ENTER** key.
- Select an item, then press the **ENTER** key.

OR : Activates a trigger when any trigger source meets the set conditions.

AND: Activates a trigger when all trigger sources meet the set conditions.

NOTE

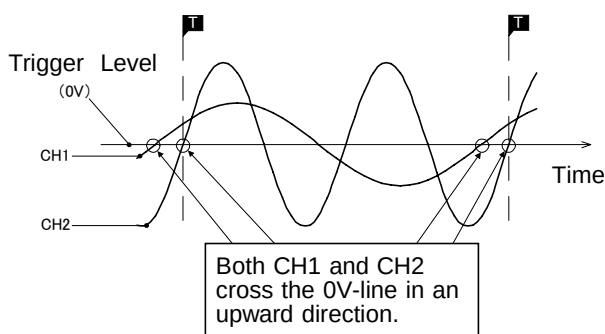
- If the trigger sources are set to "AND", and the trigger source setting conditions have already been met when the **START** key is pressed, triggering does not occur. When the conditions are not met once but met subsequently, triggering occurs.

(Setting Example)

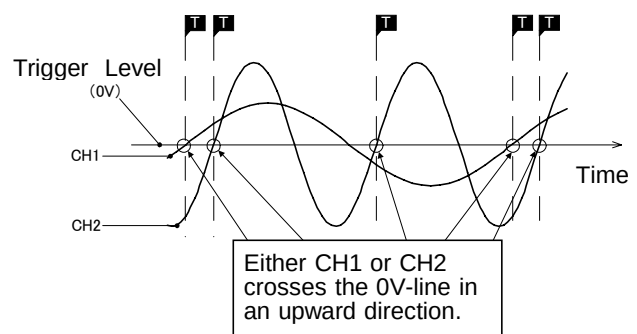
When the trigger sources are set as shown below, a trigger is activated differently depending on the AND/OR setting as shown in the figure below.

Channel	Trigger	Trigger Level	Slope	Filter
CH1	Level	0.000 V	UP	OFF
CH2	Level	0.000 V	UP	OFF

AND



OR

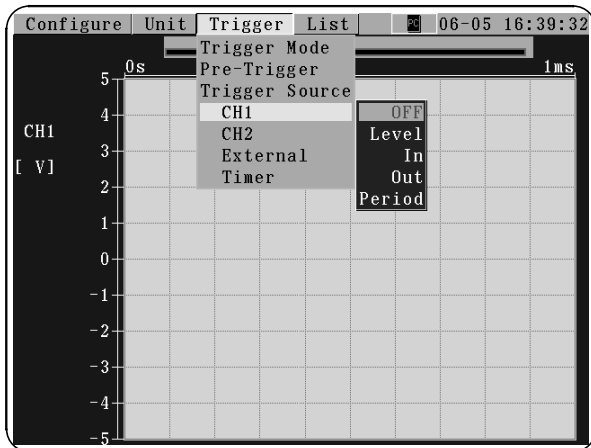


4.4.5 Channel Trigger

- A signal input to each channel [CH1, CH2 ^(Note)] is used as the trigger source.
(Note) Only CH1 is available with the 8730-10.

Setting Procedure

Setting Screen: Trigger → • CH1(CH2) (OFF, Level, In, Out, Period)



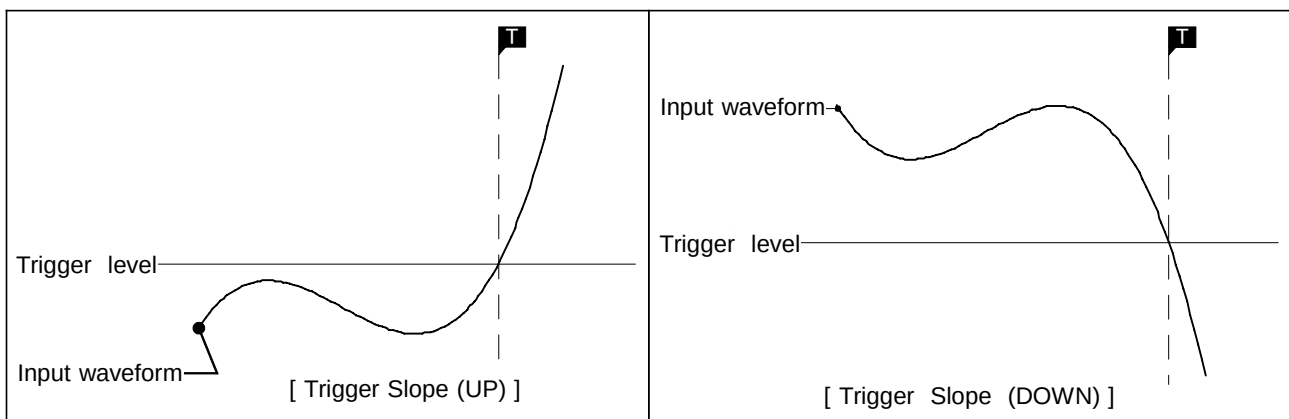
1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Trigger" tag.
2. Select "CH1" or "CH2" on the display menu, then press the **ENTER** key.
3. Using the **CURSOR** key to select an item to set, then press the **ENTER** key.

NOTE

- The currently selected trigger source is shown in red.
- When the trigger sources are "OFF", a trigger will not be activated.

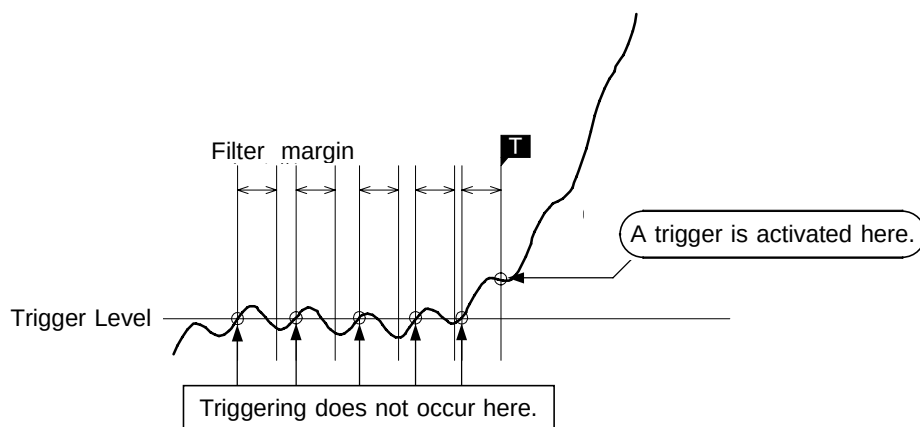
1. Level Trigger (Level, Slope, Filter)

- Using the trigger level (voltage), triggering occurs when the input signal crosses the preset trigger level (voltage) with the preset trigger slope (UP, DOWN).
- The trigger slope (UP, DOWN) is used to select whether a trigger is to be activated at the rise or fall of an input signal waveform.

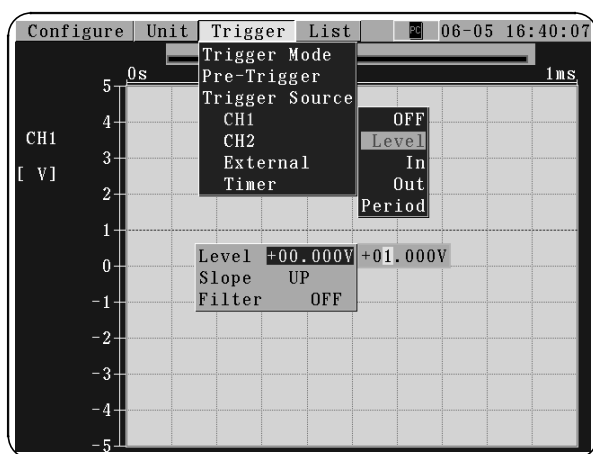


- Using the trigger filter prevents an unintended trigger from being activated by noise.
- A trigger will be activated when the trigger conditions are met within the set filter width.

(Example) The trigger slope is set to UP and the trigger filter is used.



Setting the Level Trigger

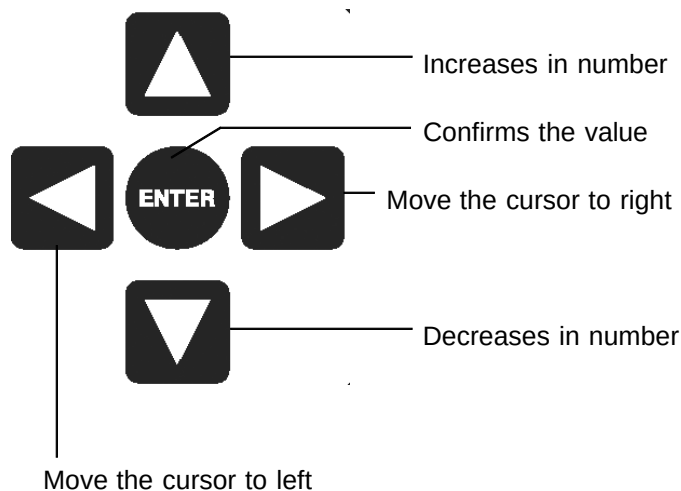


1. On the trigger condition menu of a channel (CH1 or CH2), select "**Level**", then press the **ENTER** key.
2. Set the trigger level under "**Level**".

NOTE

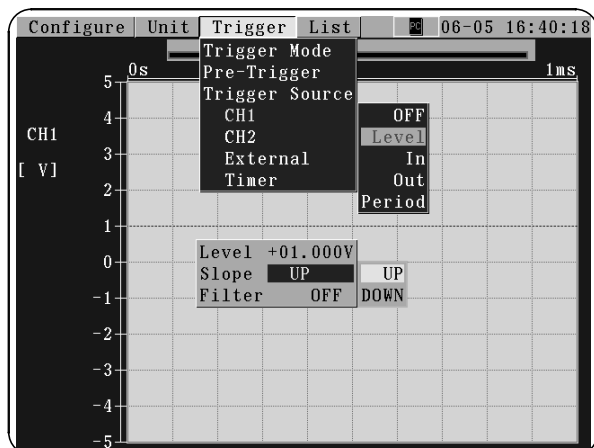
- The setting range of the trigger level varies depending on the input signal range. The value input for the level setting will also vary depending on the range.

Editing Trigger Level



Range	Setting range	Step
100 mV	-1 V to + 1.1 V	0.0025 V
200 mV	-2 V to + 2.2 V	0.005 V
500 mV	-5 V to + 5.5 V	0.0125 V
1 V	-10 V to + 11 V	0.025 V
2 V	-20 V to + 22 V	0.05 V
5 V	-50 V to + 55 V	0.125 V

Setting the Trigger Slope



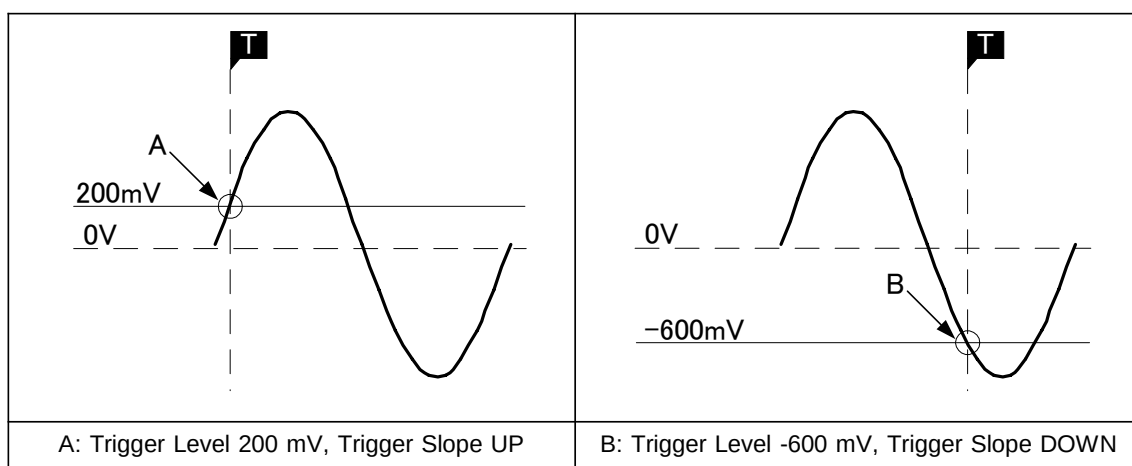
3. Set the slope condition under "**Slope**" as follows:

UP : Activates a trigger at the rise of a waveform.

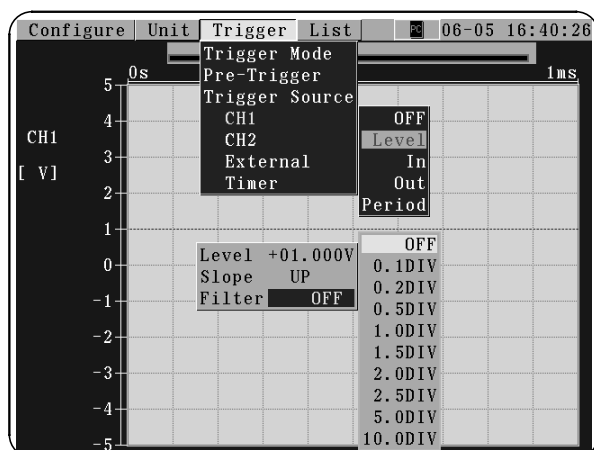
DOWN: Activates a trigger at the fall of a waveform.

(Examples for Setting)

To activate a trigger at points A and B of a sine wave as shown in the figure below, set the conditions as follows:



Setting the Trigger Filter



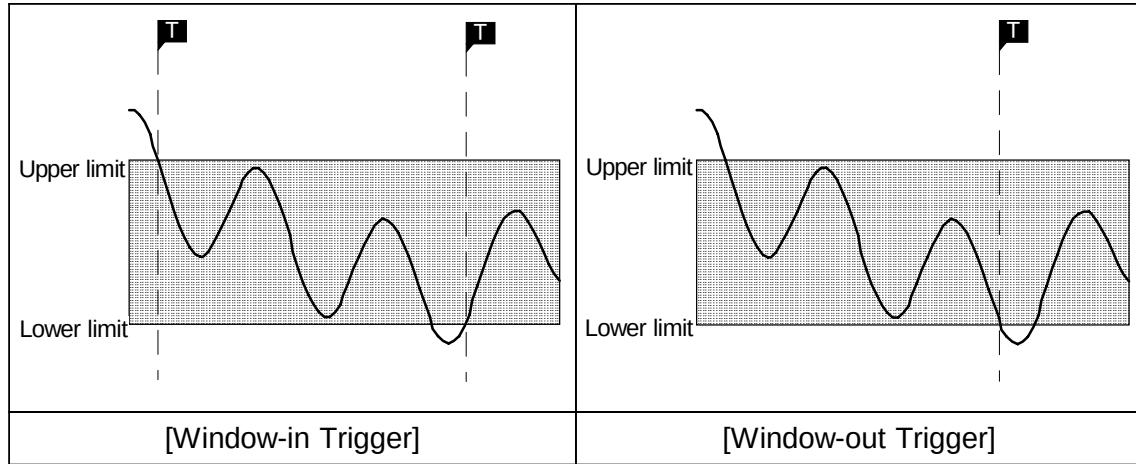
4. Set the trigger filter under "**Filter**".

OFF : Does not use a trigger filter.

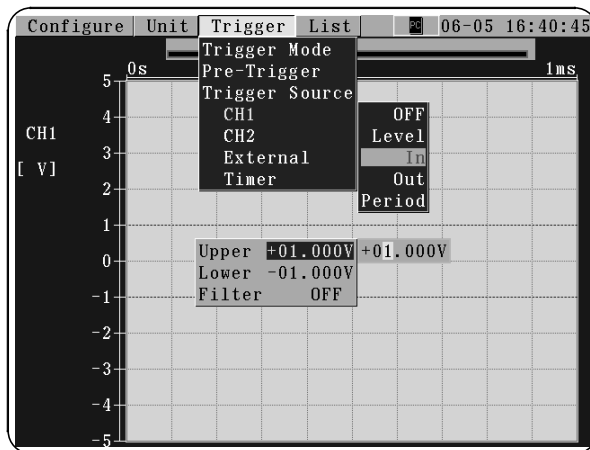
0.1 to 10.0 DIV: Uses a trigger filter with the width of the set number of DIV.

2. Window-in/out Trigger (Upper limit, Lower limit, Filter)

- When using the window-in/out trigger, a trigger is activated when the waveform enters or exits the range between the upper and lower limits of the trigger level.
- Using the trigger filter prevents an unintended trigger from being activated by noise. (See 1. Level Trigger)

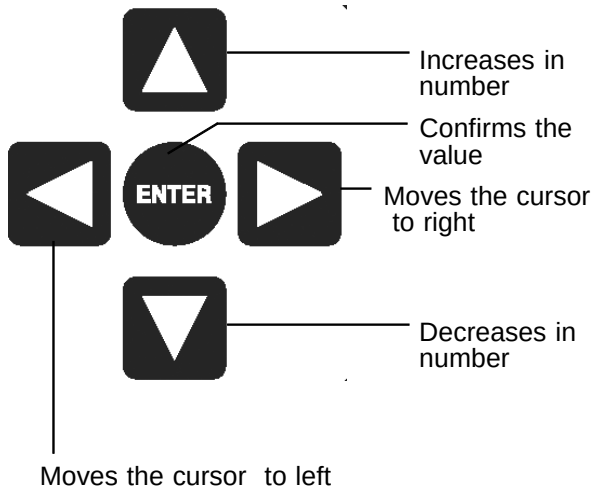


Setting the Window-in/out Trigger



1. On the trigger condition menu of a channel (CH1 or CH2), select "In" or "Out", then press the **ENTER** key.
2. Set the value of "Upper"
3. Then, set the value of "Lower".

Editing Window-in/out Trigger

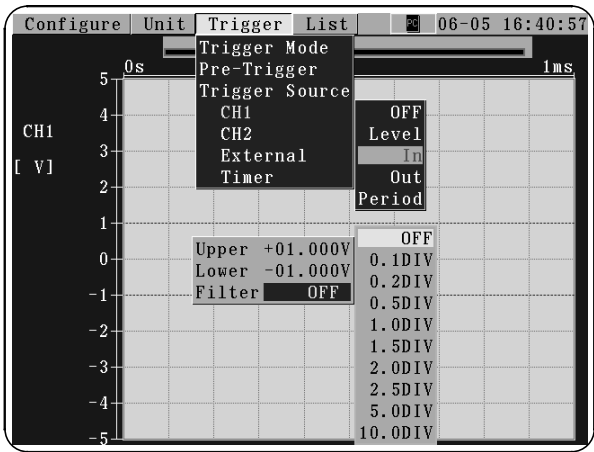


NOTE

The setting ranges of the upper and lower limits for the window in/out trigger are as follows:

Range	Upper limit = A	Lower limit = B	Step
100 mV	$+1.1 \text{ V} \geq A \geq B$	$A \geq B \geq -1 \text{ V}$	0.0025 V
200 mV	$+2.2 \text{ V} \geq A \geq B$	$A \geq B \geq -2 \text{ V}$	0.005 V
500 mV	$+5.5 \text{ V} \geq A \geq B$	$A \geq B \geq -5 \text{ V}$	0.0125 V
1 V	$+11 \text{ V} \geq A \geq B$	$A \geq B \geq -10 \text{ V}$	0.025 V
2 V	$+22 \text{ V} \geq A \geq B$	$A \geq B \geq -20 \text{ V}$	0.05 V
5 V	$+55 \text{ V} \geq A \geq B$	$A \geq B \geq -50 \text{ V}$	0.125 V

Setting the Trigger Filter



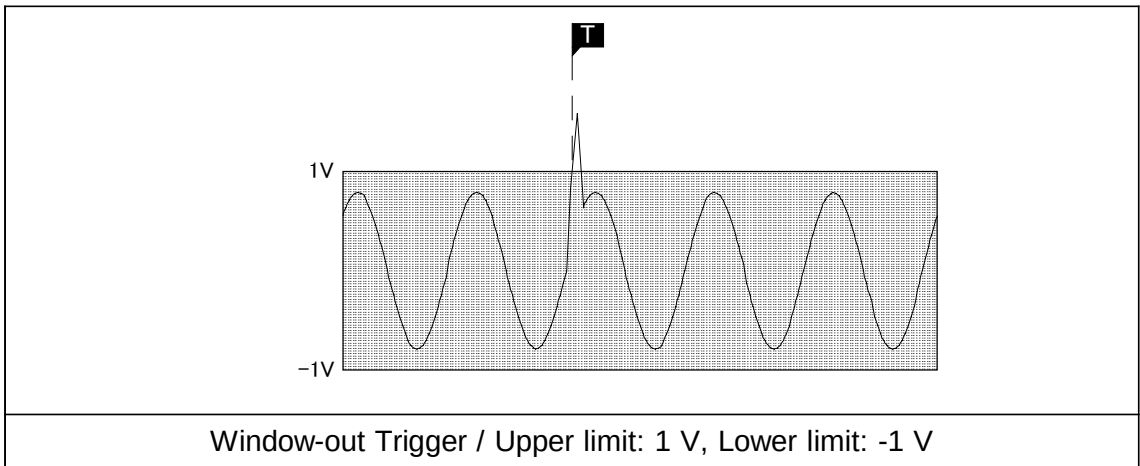
4. Next, move to the "Filter" setting.

OFF : Does not use a trigger filter.

0.1 to 10.0 DIV: Uses a trigger filter with the width of the set number of DIV.

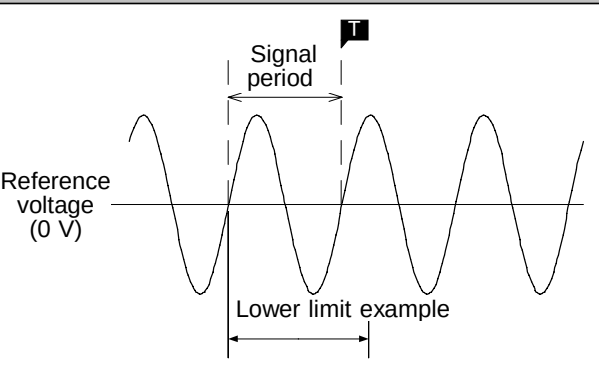
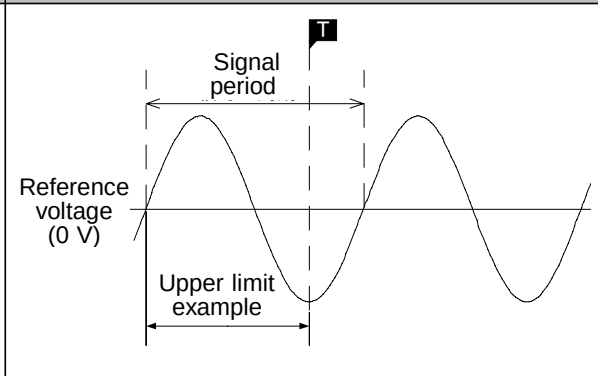
(Setting Example)

To activate a trigger when a waveform (as shown in the figure below) deviates from the shaded area, set the conditions as follows:



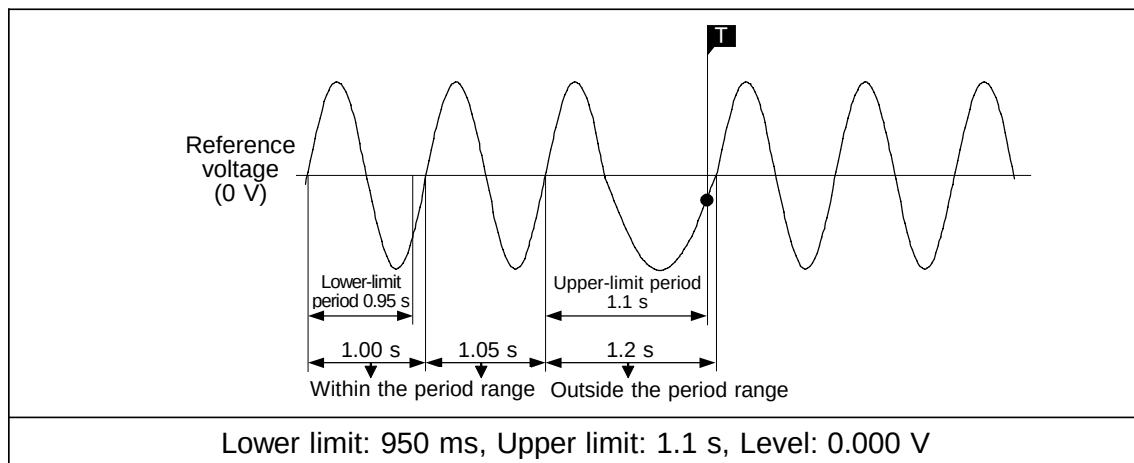
3. Period Trigger (Level, Slope, Upper limit, Lower limit)

- When using the period trigger, the period between rises (or falls) of a reference voltage is measured and a trigger activated when a waveform deviates from the period.
- To set the period trigger, the reference voltage level and period range must be set.
- With the period trigger, the 8730-10, 8731-10 monitors the period for which a waveform crosses the set reference voltage and, if the period deviates from the set range, a trigger is activated. The position where a trigger is activated varies depending on the set period range and period of the signal to be measured.

(1) The period of the signal to be measured is shorter than the lower limit of the period trigger. (Trigger slope is set to UP.)	(2) The period of the signal to be measured is longer than the upper limit of the period trigger. (Trigger slope is set to UP.)
	
• When the waveform crosses the trigger level in the set trigger slope direction before the set lower-limit period is complete, a trigger activates at the point where the waveform crosses the reference voltage.	• When the set upper-limit period is complete before the waveform crosses the trigger level in the set trigger slope direction, a trigger is activated where the set upper-limit period is complete. Therefore, the trigger position varies depending on the upper limit of the period range as shown above.

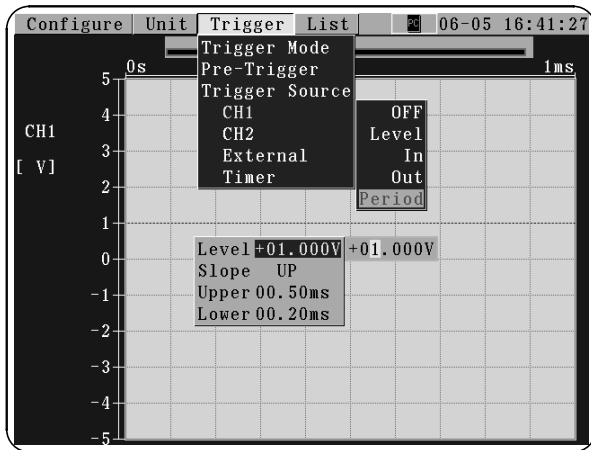
(Setting Example)

To activate a trigger when the waveform period deviates from the range between 0.95 s and 1.1 s:



A trigger may be activated by a period shorter than the actual period of the waveform due to noise. In such case, set an appropriate low-pass filter. (See 4.3.3)

Setting the Period Trigger

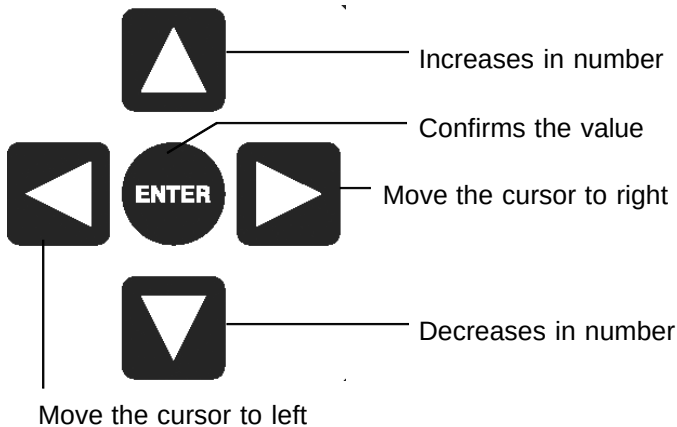


1. On the trigger condition menu of a channel (CH1 or CH2), select "**Period**", then press the **ENTER** key.
2. Set a trigger level under "**Level**".
3. Set a slope condition under "**Slope**".

UP : Activates a trigger at the rise of a waveform.

DOWN: Activates a trigger at the fall of a waveform.

Editing Trigger Level, Upper limit, Lower Limit of the Period Trigger



4. Set the upper limit of the period under "**Upper**".
5. Set the lower limit of the period under "**Lower**".

NOTE

- The trigger filter is not provided for the period trigger and an untended trigger may be activated due to noise. In such case, set an appropriate low-pass filter. (See 4.3.3)
- The period range setting for the period trigger varies depending on the sampling period (time axis setting). (See 4.2.1)

Lower limit : 10 times of the sampling period.

Upper limit : 20000 times of the sampling period.

External Sampling; Lower limit: 10 samples, Upper limit: 20000 samples

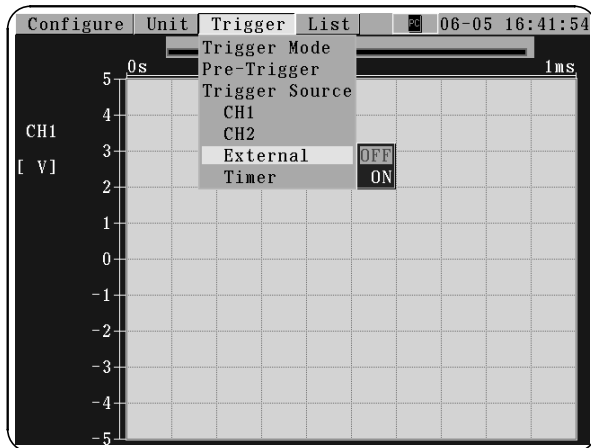
Time Axis	100 μ s	200 μ s	500 μ s	1 ms	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms
Sampling Period	1 μ s	2 μ s	5 μ s	10 μ s	20 μ s	50 μ s	100 μ s	200 μ s	500 μ s	1 ms
Maximum upper limit	20 ms	40 ms	100 ms	200 ms	400 ms	1 s	2 s	4 s	10 s	20 s
Minimum lower limit	10 μ s	20 μ s	50 μ s	100 μ s	200 μ s	500 μ s	1 ms	2 ms	5 ms	10 ms
Time Axis	200 ms	500 ms	1 s	2 s	5 s	10 s	30 s	1 min	2 min	5 min
Sampling Period	2 ms	5 ms	10 ms	20 ms	50 ms	100 ms	300 ms	600 ms	1.2 s	3 s
Maximum upper limit	40 s	100 s	200 s	400 s	1000 s	2000 s	100 min	200 min	400 min	1000 min
Minimum lower limit	20 ms	50 ms	100 ms	200 ms	500 ms	1 s	3 s	6 s	12 s	30 s

4.4.6 External Trigger

- The external input terminal may be used as a trigger source.
- Use the EXT_TRIG terminal.
When using the EXT_TRIG terminal, see 8.4.2 for details.

Setting Procedure

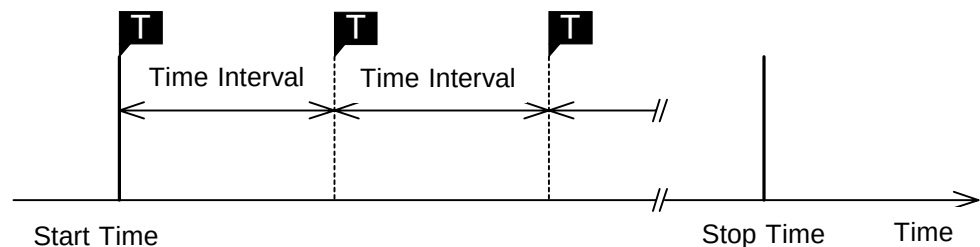
Setting Screen: Trigger → • External (OFF, ON)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Trigger" tag.
2. Select "External", then press the **ENTER** key.
ON : Uses the external trigger.
OFF : Does not use the external trigger.

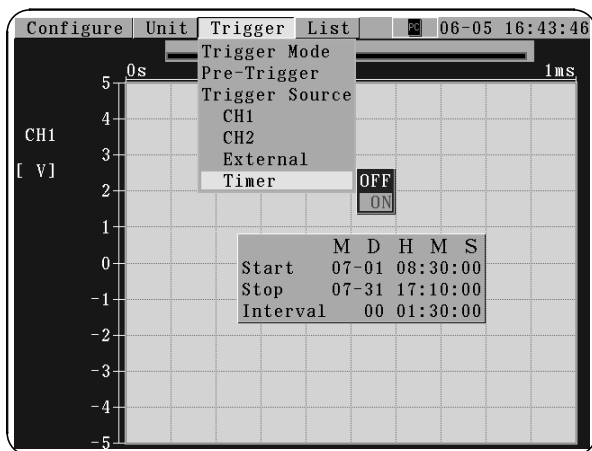
4.4.7 Timer Trigger

- The timer trigger is used for preset time recording.
- A trigger is activated at regular intervals between the set start time and stop time.
- Setting the interval to 0 enables the channel trigger between the set start time and stop time.



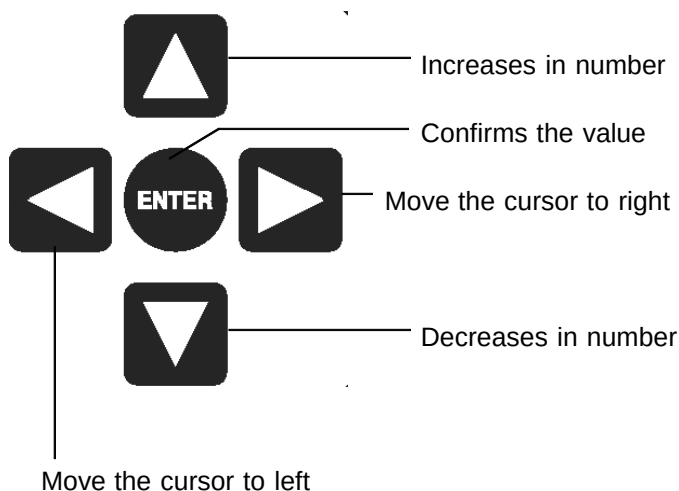
Setting Procedure

Setting Screen: Trigger → • Timer (OFF, ON)



1. Press the **DISPLAY** key and use the right and left **CURSOR** keys to select the "Trigger" tag.
2. Select "Timer", then press the **ENTER** key.
ON : Use the timer trigger.
OFF : Does not use the timer trigger.
3. Set the start time (month, date, hour, minute) under "Start".
Press the **CURSOR SCROLL** key to enter the current time.
4. Set the stop time (month, date, hour, minute) under "Stop".
5. Set the interval (date, hour, minute, second) under "Interval".

Setting the Time



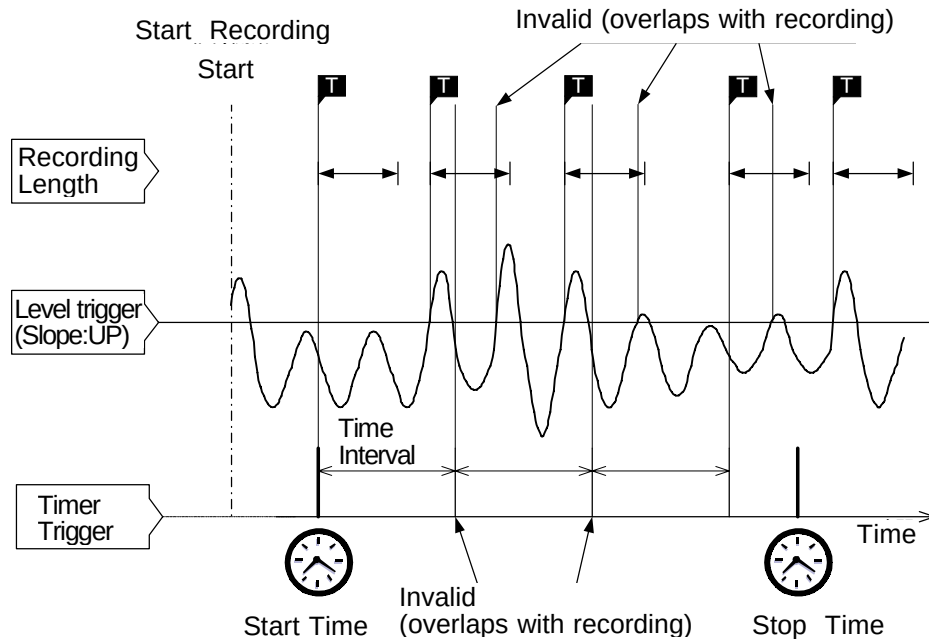
NOTE

- The start time and stop time must be set to come after the time **START** key is pressed.
- When the trigger mode is set to "Single", a trigger is activated only once at the start time. The interval or stop time settings are ineffective (when only the timer trigger is ON).
- When trigger sources have been linked with "OR", all trigger sources are valid. Therefore triggering may occur even before the start time, and trigger standby and measurement may continue even after the stop time.
- When the AND/OR setting is set to "AND", the trigger enters the standby state at the start time and set intervals. Moreover, a trigger will be activated if a trigger other than timer trigger occurs at the same time.
- For recording at regular intervals between the start time and stop time, set as follows:
Trigger mode: Repeat
Trigger source AND/OR: AND or OR
Other trigger sources: OFF
Between end of recording and standby, triggers are invalid while processing is taking place (auto save, waveform display, calculation, evaluation, etc.) and therefore data may not be recorded at regular intervals with some measurement setting.

Relation between Timer Trigger and AND/OR linking

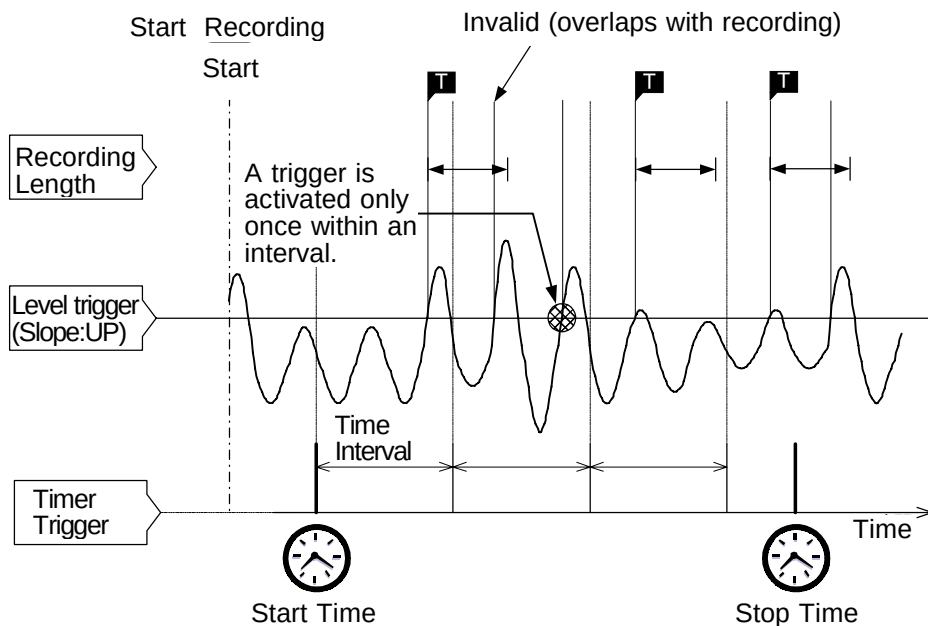
(a) Trigger source AND/OR is set to "OR".

- All trigger sources become effective. If another trigger source is set, a trigger may be activated before the start time or after the stop time.



(b) Trigger source AND/OR is set to "AND".

- Measurement is carried out from the start time to the end time. Triggering occurs at the preset intervals if the conditions for the other trigger sources are also met at these points.
- If the interval has been set to 0 s, triggering occurs at any point between the start and end time, if the conditions for the other trigger sources are met.

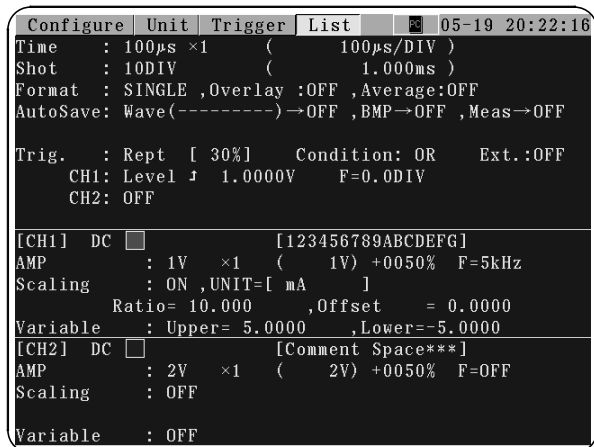


4.5 Details of List

- "List" shows a list of parameters set under the "Configure", "Unit", and "Trigger" tags.

Setting Procedure

Setting Screen: List



DISPLAY



1. Press the **DISPLAY** key and use the **CURSOR** keys to select the "List" tag.

Top : Settings for measurement and trigger

Middle: Settings for CH1 input

Bottom: Settings for CH2 input

(This is not shown with the 8730-10)

"List" on Measurement screen

```
Time : 1ms  $\times$ 2 ( 500 $\mu$ s/DIV )
Shot : 20DIV ( 20.000ms )
Format : SINGLE ,Overlay : ON ,Average: 16times
AutoSave: Wave(CSV 1/2 )→CARD,BMP→CARD,Meas→LAN
SaveDir: Name [AUTO ]
Trig. : SING [ 20%] Condition: OR Ext.:ON
CH1: Level  $\uparrow$  1.0000V F=0.0DIV
CH2: OFF
Timer : 06-01 08:30:00▶06-30 17:10:00 △00 01:30:00
```

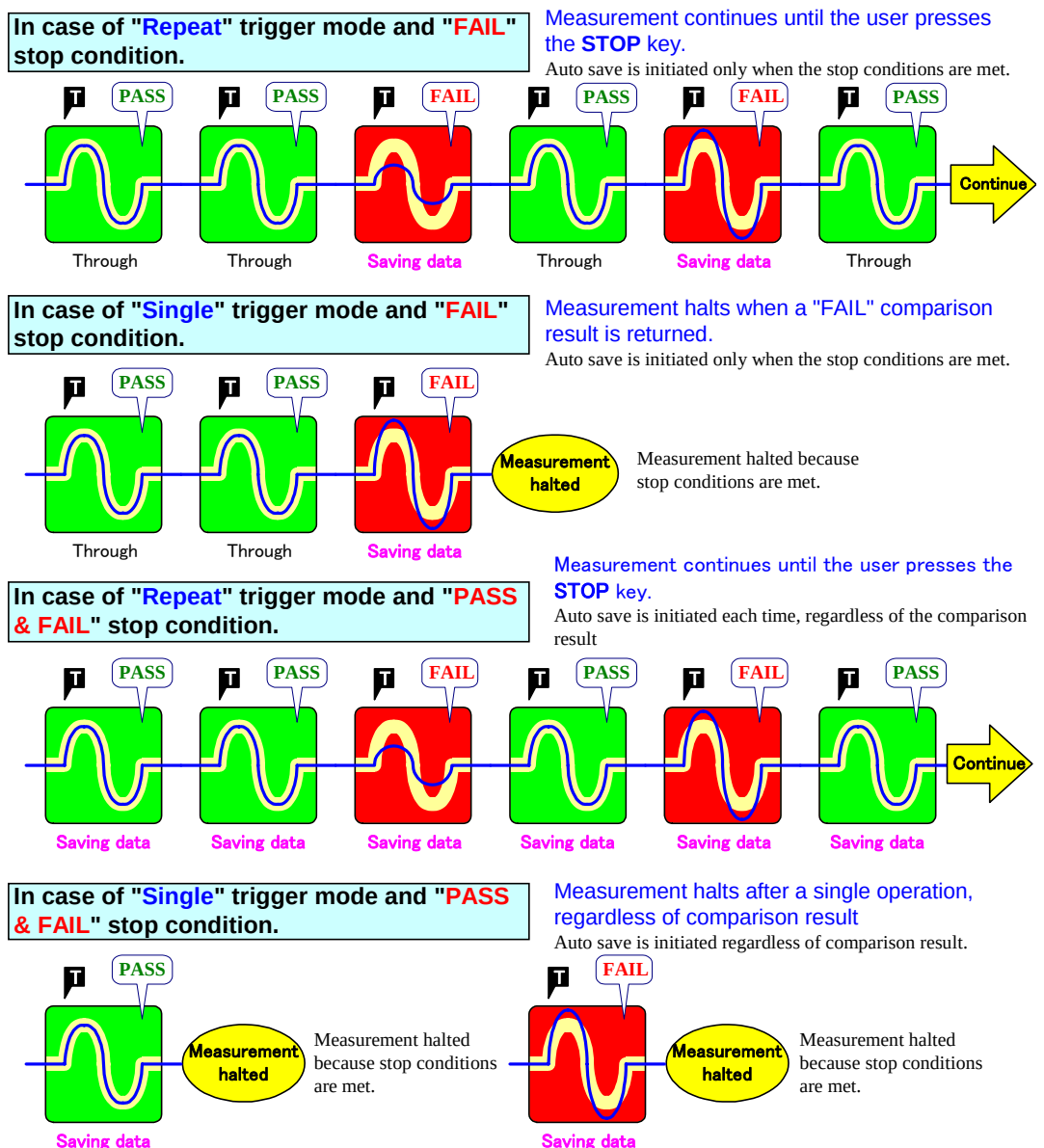
Time Axis Range	Time axis magnification		Time per DIV on display	
Recording Length	Recording Time (Time axis range x recording length)			
Format		Overlay		Averaging
Auto Save	Waveform data (Format, Compression ratio)		Screen BMP	Value calculation result
	Directory name			
Trigger	Trigger mode	Pre-trigger	Trigger AND/OR	External trigger
	Trigger setting of CH1 ("F" indicates setting of the trigger filter)			
	Trigger setting of CH2 ("F" indicates setting of the trigger filter)			
	Setting of the timer trigger (Start time → Stop time △ Time interval)			

```
[CH1] DC ☐ [123456789ABCDEFGH]
AMP : 1V  $\times$ 1 ( 1V ) +0050% F=5kHz
Scaling : ON ,UNIT=[ mA ]
Ratio= 10.000 ,Offset = 0.0000
Variable : Upper= 5.0000 ,Lower=-5.0000
[CH2] DC ☐ [Comment Space***]
AMP : 2V  $\times$ 2 ( 1V ) +0050% F=OFF
Scaling : OFF
Variable : OFF
```

CH1	Coupling	Display Color	Comment of CH1	
	Range	Time axis magnification (Range on the display)	Zero Position	Filter
	Setting of the Scaling Function		Unit	
			Conversion Ratio	Offset
CH2	Setting of the Variable Function		Upper limit	Lower limit
	Coupling	Display Color	Comment of CH2	
	Range	Time axis magnification (Range on the display)	Zero Position	Filter
	Setting of the Scaling Function		Unit	
			Conversion Ratio	Offset
	Setting of the Variable Function		Upper limit	Lower limit

4.6 Auto save based on comparison results

- There are three trigger modes: Single, Repeat, and Auto.
(See 4.4.2)
- There are three stop conditions: PASS, FAIL, and PASS & FAIL.
(See 5.4.3 and 5.5.5)
- By combining a trigger mode and a stop condition, you can halt measurement when a desired comparison result is achieved.
It's also possible to automatically save waveforms that satisfy a set comparison results.
Auto save is executed only when the stop conditions are met.



- When "Single" trigger mode is selected, measurement halts when the stop conditions are met. Measurement continues until the stop conditions are met.
- When the "Repeat" or "Auto" trigger mode is set, measurement continues until the STOP key is pressed (or a STOP signal is input), whether or not the stop conditions are met.

Chapter 5

Comparison and Calculation

5

The area creation screen lets you set the commands below.

AREA EDIT Key (See 5.3)	LOAD (See. 5.3.3 -1)	
	EXTEND (See 5.3.3 -2)	
	COMPRESS (See 5.3.3 -3)	
	CLEAR (See 5.3.3 -4)	
	REVERSE (See 5.3.3 -5)	
	PAINT (See 5.3.3 -6)	
	BOX set (See 5.3.3 -7)	
	DRAWING (See 5.3.3 -8)	LINE
		RECT ☐
		RECT ☒
		CIRCLE ☐
		CIRCLE ☒
	ERASER (See 5.3.3 -9)	
	AREA DEL (See 5.3.3 -10)	
	SAVE (See 5.3.3 -11)	
	EXIT (See 5.3.3 -12)	

The Comparison setting screen lets you make settings for the parameters given below.

Comp (See 5.2)	Common Stop Mode (See 5.2.1)	Area or Value
		Area and Value
	Refresh Disp (See 5.2.2)	OFF
		Stop Mode
		Always
	Select Mode (See 5.2.3)	MODE01 to MODE16
	Register Mode (See 5.2.4)	MODE01 to MODE16
	Erase Mode (See 5.2.5)	MODE01 to MODE16
	PASS Beep (See 5.2.6)	OFF, BEEP1, BEEP2, BEEP3
	FAIL Beep (See 5.2.7)	OFF, BEEP1, BEEP2, BEEP3
	Re-compare (See 5.2.8)	

Area (See 5.4)	Comparison (See 5.4.1)	OFF, ON	
	CH1 (See 5.4.2)	FAIL Mode (See 5.4.2)	OFF, OUT ALL OUT
		Using Area (See 5.4.2)	A01 to A16
	CH2 (See 5.4.2)	Same as CH1	
	Stop Mode (See 5.4.3)	PASS, FAIL PASS & FAIL	

Value (See 5.5)	Measurement (See 5.5.2)	OFF, ON	
	No. 1 (See 5.5.3)	Type	OFF Average RMS Peak-Peak Maximum Max-Time Minimum Min-Time Period Frequency XY Area
		Rise-Time	
		Fall-Time	
		Area	
		Integration	
		Difference	
		Pulse Width	
		DUTY	
		Level Time	
		Pulse Count	
		MAX & MIN	
		Level	
		CH	CH1, CH2
		Comparison	OFF, ON
		Upper	
		Lower	
	No. 2 (See 5.5.3)	Same as No.1	
	No. 3 (See 5.5.3)	Same as No.1	
	No. 4 (See 5.5.3)	Same as No.1	
	Measure Range (See 5.5.4)	All Wave Part Wave	
	Stop Mode (See 5.5.5)	PASS, FAIL PASS & FAIL	

Calc (See 5.6)	Calculation (See 5.6.1)	OFF, ON	
	CH1 (See 5.6.2)	ABS	Rectifx
		CH1+CH2	CH1-CH2
		CH1xCH2	CH1/CH2
	CH2 (See 5.6.2)	ABS	Rectifx
		CH2+CH1	CH2-CH1
		CH2xCH1	CH2/CH1
	Re-calculate (See 5.6.3)		

List (See 5.7)

5.1 Overview

- The comparison function is divided into "Area comparison" and "Value comparison." Area comparison compares the shape of a waveform. Value comparison compares the numeric data in a waveform. Both comparisons can be used at the same time.
- Also available is "Waveform Calculation," which handles the addition, subtraction, multiplication, and division of stored waveforms between channels. When waveform calculation has been performed, the operation results are subjected to area comparison and/or value comparison.

(1) Area Comparison (See 5.3 and 5.4)

- The shape of a stored waveform is compared to determine acceptance. Checks whether the waveform is within or outside the "Comparison area" (i.e., range of an acceptable waveform).
- In area comparison, the waveform is compared by the pixels (dots) on the screen. The waveform displayed on the screen is compared regardless of recording length.
- A comparison area may be created using an acceptable waveform. The 8730-10, 8731-10 can store up to 16 areas in memory. The areas can be also stored on a PC card.
- Depending on the comparison results, signals are output from the OK terminal or NG terminal of the external control terminals. (See 8.5.2 for details.)

(2) Value Comparison (See 5.5)

- Performs value calculations for a stored waveform and compares the results. Checks whether a calculation result (value) is within or outside the set range of the upper and lower limits.
- Value comparison is made on all areas of a measured waveforms for the recording length, including the portion not displayed on the screen. A range for calculation can be set. (See 5.5.4 for details.)
- Depending on the comparison results, signals are output from the OK terminal or NG terminal of the external control terminals. (See 8.5.1 for details.)

(3) Waveform Calculation (See 5.6)

- Performs calculation (i.e., four basic arithmetic operations) for a stored waveform.
Waveform calculation is performed on all areas of a measured waveform for the recording length, including the portion not displayed on the screen.
- Both area and value comparison are made on the waveform obtained by calculation.

5.2 Comparison Details

- This section explains various setting using with "**Comp**" tag.

5.2.1 Common Stop Condition

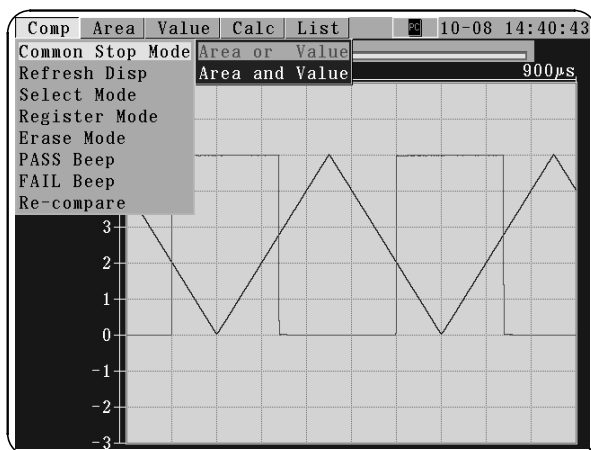
- Sets the stop conditions for waveform comparison (both area and value comparison).
- The 8730-10, 8731-10 may be set to stop measurement depending on the area or value comparison result (PASS or FAIL). In addition, the data may be saved depending on whether the auto save setting has been selected. (See 4.2.9 for details.)

Setting Condition	Detail
Area or Value	Stops measurement when the stop conditions for either area or value comparison are met.
Area and Value	Stops measurement when the stop conditions for both area and value comparison are met.

For the area and value comparison stop conditions, see 5.4.3, and 5.5.5. If comparison is disabled, the system assumes that the stop conditions of the disabled comparison are met at all times.

Setting Procedure

Setting Screen: Comp→ • Common Stop Mode (Area or Value, Area or Value)



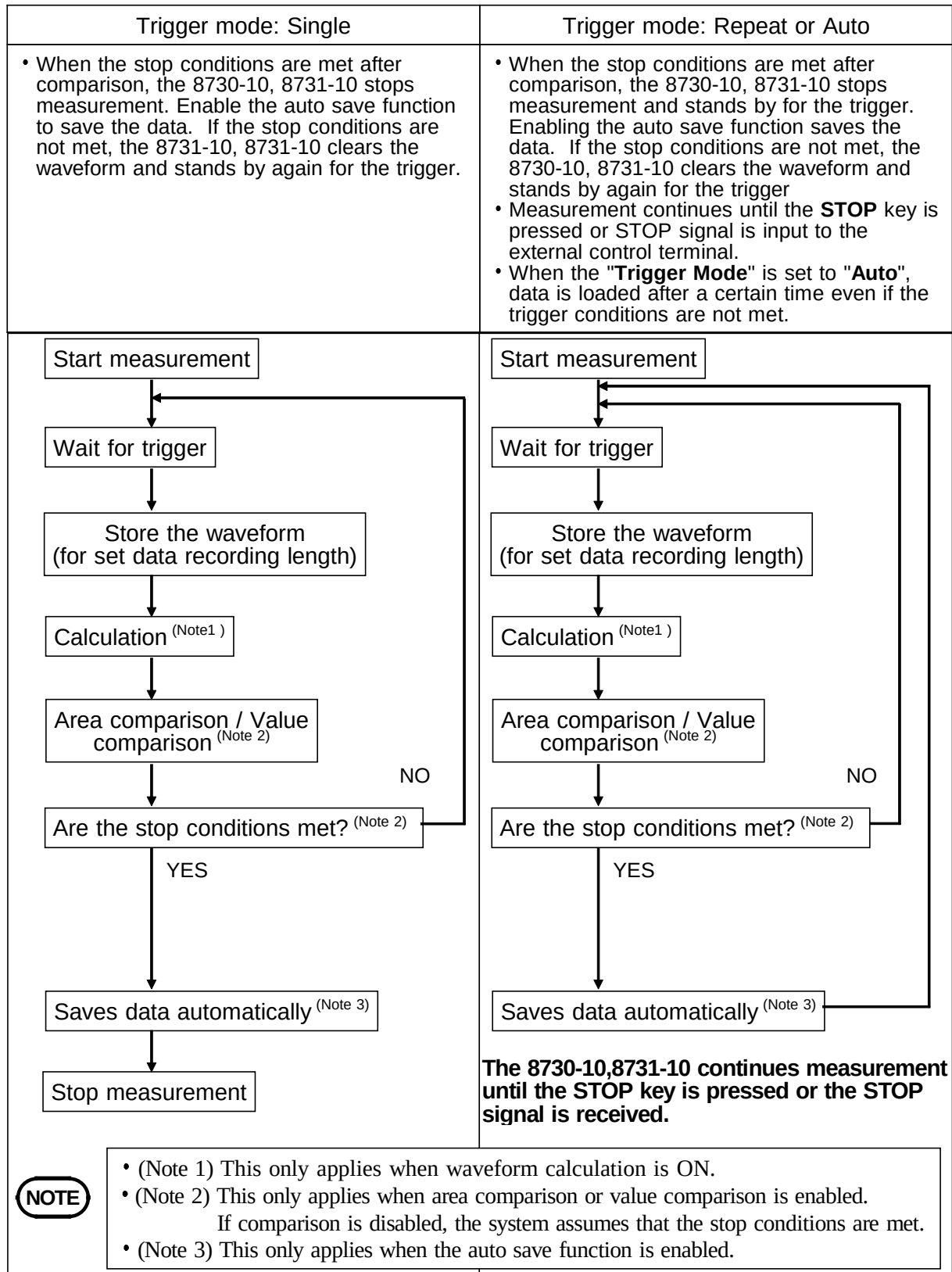
1. Press the **COMP SETTINGS** key, then select "**Comp**" tag.
2. Use the **CURSOR** key to select "**Common Stop Mode**" on the menu.
3. Use the **CURSOR** key to select a stop condition, then press the **ENTER** key.



- When the "**Trigger Mode**" is set to "**Single**", measurement continues until the stop conditions are met and ends as soon as the stop conditions are met. When the "**Trigger Mode**" is set to "**Repeat**" or "**Auto**", measurement continues until the **STOP** key is pressed or STOP signal is input.

<<Related Issues>> Relation between Trigger Mode and Stop Conditions

- Waveform calculation and waveform comparisons (value and area) are performed as shown in the flowcharts below. Operations vary depending on the "**Trigger Mode**" (see 4.4.2) and stop conditions.
- When calculation is enabled, averaging is not available. (For averaging, see 4.2.5)

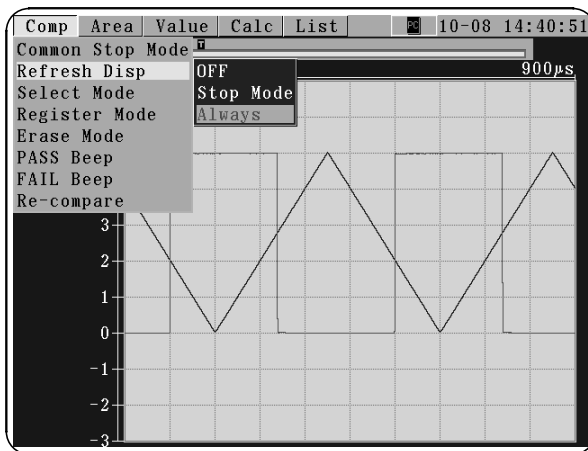


5.2.2 Screen Updating

- The 8730-10, 8731-10 may be set to update the screen during comparison.
- Normally set the unit to "Always" (default).
- Select "OFF" to shorten the comparison cycle for reducing the tact time. Without screen updating, the display processing time (see figure in 8.5.2) is reduced, thus reducing the comparison cycle.
- Not updating the screen reduces the comparison cycle by 100 ms for the 8730-10 and 50 ms for the 8731-10. However, this also reduces the output period ("L" pulse) of comparison results (PASS or FAIL). The "L" part of output is at least 10 ms. For details, see 8.5.2.

Setting Procedure

Setting Screen: Comp → • Refresh Disp (OFF, Stop Mode, Always)



1. Press the **COMP SETTINGS** key, and select "Comp" tag.
2. Use the **CURSOR** key to select "Refresh Disp" on the menu.
3. Use the **CURSOR** key to select a condition, then press the **ENTER** key.

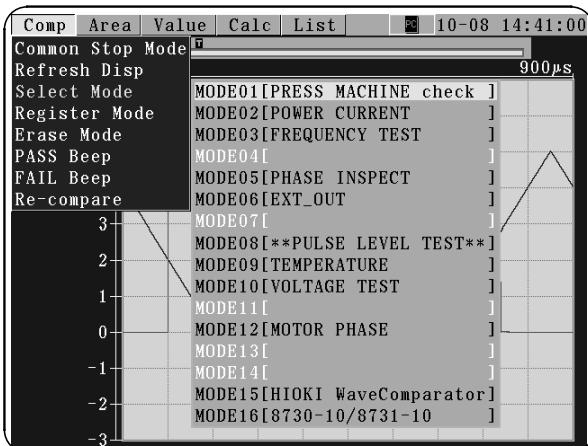
OFF : Does not update the screen.
 Stop Mode : Updates the screen only when the comparison result satisfies the stop conditions.
 Always : Always updates the screen.

5.2.3 Switching Test Modes

- Switches to the test mode saved in 8730-10, 8731-10 internal memory and has been registered according to 5.2.4.
- The registered test mode settings are read into the 8730-10, 8731-10.
- When "Info (Upper)" is set to "Comment" (see 4.2.8), the comments entered at mode registration appear in the file comment field.

Setting Procedure

Setting Screen: Comp → • Select Mode (MODE01 to MODE16)



1. Press the **COMP SETTINGS** key, select "Comp" tag, then press the **ENTER** key.
2. Select "Select Mode" on the menu, and press the **ENTER** key.
3. Use the **CURSOR** key to select a test mode from "MODE01" to "MODE16" on the menu, then press the **ENTER** key.

NOTE

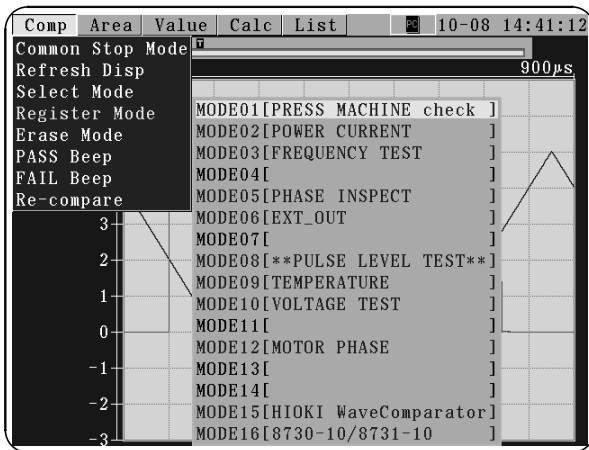
- On the menu, the saved test modes are shown in black. A mode must be saved before it can be selected.

5.2.4 Registering Test Modes

- Register the test modes to be selected by using a MODE terminal of the external control terminals or the procedure described in 5.2.3. (Also see 8.4.4 for details.)
- You can register up to 16 test modes (MODE01 to MODE16) in internal memory.
- Each test mode is saved with all setting data for area comparison, value comparison, and measurement, except for communications (LAN/RS-232C) and contrast.
- If test modes are registered in advance, the settings can be changed using the MODE terminals of the external control terminals.
- Comments can be entered for each test mode.

Setting Procedure

Setting Screen: Comp→ • Register Mode (MODE01 to MODE16)



1. Press the **COMP SETTINGS** key, select "Comp" tag, then press the **ENTER** key.
2. Select "Register Mode" on the display menu, and press the **ENTER** key.
3. Use the **CURSOR** key to select a test mode from "MODE01" to "MODE16" on the menu, then press the **ENTER** key.
4. Enter a comment, then press the **START** key. This will register the test mode.

For how to enter comments, see 8, in 3.1.2.

NOTE

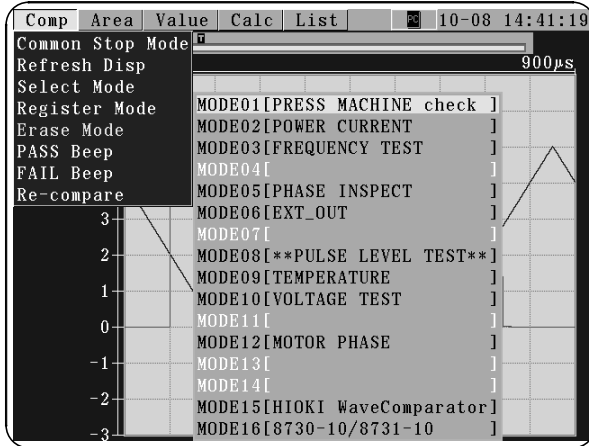
- On the menu, the saved test modes are shown in blue, while unsaved test modes are shown in black.
- The test mode data may be saved on a PC card. See 6.4.6 for details.

5.2.5 Clearing Test Modes

- Clear the test modes to be saved in internal memory by the procedure described in 5.2.4.
- This setting is effective only when the test modes were registered.

Setting Procedure

Setting Screen: Comp→ • Erase Mode (MODE01 to MODE16)



1. Press the **COMP SETTINGS** key, select "**Comp**" tag, then press the **ENTER** key.
2. Select "**Erase Mode**" on the display menu, and press the **ENTER** key.
3. Use the **CURSOR** key to select a test mode should be cleared from "**MODE01**" to "**MODE16**" on the menu, then press the **ENTER** key.

NOTE

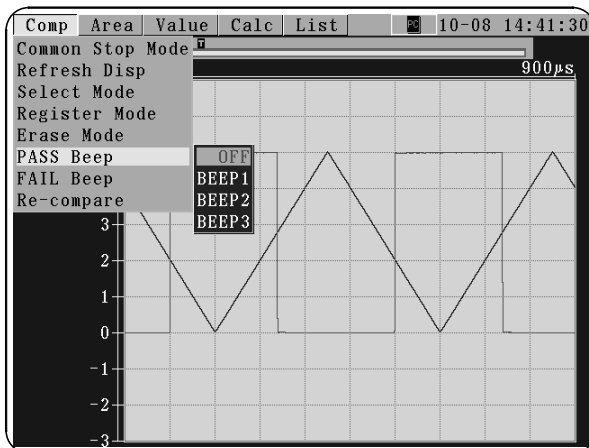
- On the menu, the saved test modes are shown in black. A mode must be saved before it can be selected.

5.2.6 Setting the Beep sound for PASS decisions

- The beeper can be set to indicate the comparison results.
- You can select the type of beep to sound upon PASS results.
- This setting is effective only when the Beep sound setting (7.2.4) is ON.

Setting Procedure

Setting Screen: Comp→ • PASS Beep (OFF, BEEP1, BEEP2, BEEP3)



1. Press the **COMP SETTINGS** key, select "**Comp**" tag, then press the **ENTER** key.
2. Select "**PASS Beep**" on the display menu, and press the **ENTER** key.
3. Use the **CURSOR** key to select a beep sound on the menu, then press the **ENTER** key.

OFF : No beep sounds.

BEEP1: PASS results are indicated by four short beeps.

BEEP2: PASS results are indicated by one beep.

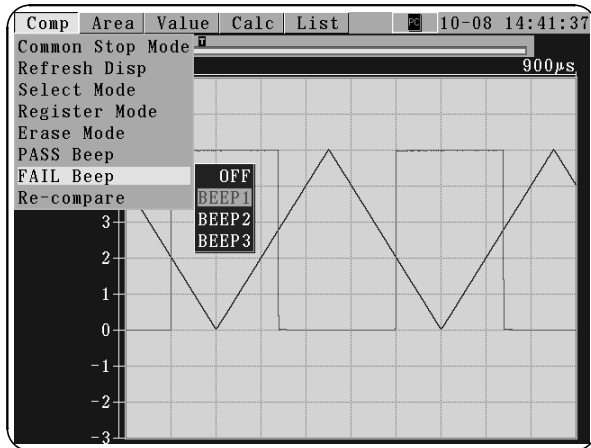
BEEP3: PASS results are indicated by a long and a short beep.

5.2.7 Setting the Beep sound for FAIL decisions

- The beeper can be set to indicate the comparison results.
- You can select the type of beep to sound upon FAIL results.
- This setting is effective only when the Beep sound setting (7.2.4) is ON.

Setting Procedure

Setting Screen: Comp → • FAIL Beep (OFF, BEEP1, BEEP2, BEEP3)



COMP SETTINGS



1. Press the **COMP SETTINGS** key, select "Comp" tag, then press the **ENTER** key.
2. Select "FAIL Beep" on the display menu, and press the **ENTER** key.
3. Use the **CURSOR** key to select a beep sound on the menu, then press the **ENTER** key.

OFF : No beep sounds.

BEEP1: FAIL results are indicated by four short beeps.

BEEP2: FAIL results are indicated by one beep.

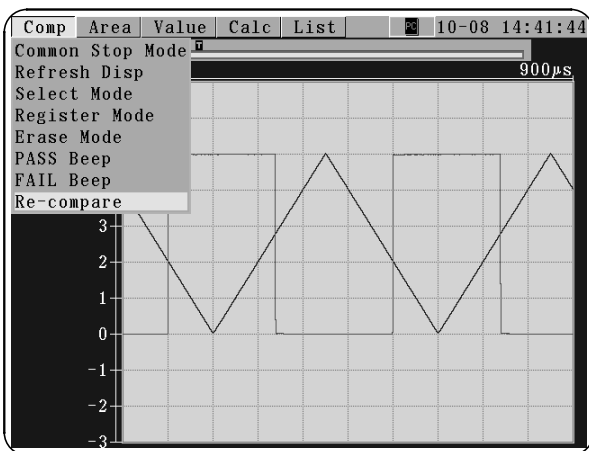
BEEP3: FAIL results are indicated by a long and a short beep.

5.2.8 Re-compare

- Compares the waveform previously stored. (Only calculation is possible here.)
- Upon comparison, the comparison result is output from the OK or NG terminal of the external control terminals.

Setting Procedure

Setting Screen: Comp → • Re-compare



COMP SETTINGS



1. Press the **COMP SETTINGS** key, select "Comp" tag, then press the **ENTER** key.
2. On the menu, select "Re-compare" and press the **ENTER** key. The waveform is then compared.

NOTE

- Area comparison is performed on the waveform within the range shown on the screen (10DIV x 10DIV).
- Recomparison cannot be conducted when comparison or calculation is "OFF", or without a stored waveform.

5.3 Creating Comparison Area

- Create an "Comparison Area" used for area comparison on the area creation screen.
- The comparison area (which is filled with color) represents the acceptable area. Area comparison determines PASS or FAIL depending on whether the waveform is within or outside the area.
- By comparing an input waveform, an abnormal waveform can be detected.

5.3.1 Area Comparison Sequence

- This section explains the general flow of operation and settings.

1. Creating the Comparison Area

Load: Read an already created comparison area from the PC card. This is done on the File screen.

New: Use the editor commands to create a Comparison area. The created areas may be saved in internal memory or on a PC card. Memory can store up to 16 areas.

2. Area Comparison Setting

OFF : Does not conduct area comparison.

OUT : The waveform is FAIL if any part goes beyond the comparison area.

ALL-OUT: The waveform is FAIL if it fully extends beyond the comparison area.

3. Set the stop conditions.

- This sets the 8730-10, 8731-10 to stop measurement depending on the area comparison result (PASS, FAIL, or PASS&FAIL).
- This setting may be combined with value comparison.

4. Press the START key to start measurement. After loading a waveform, conduct area comparison.

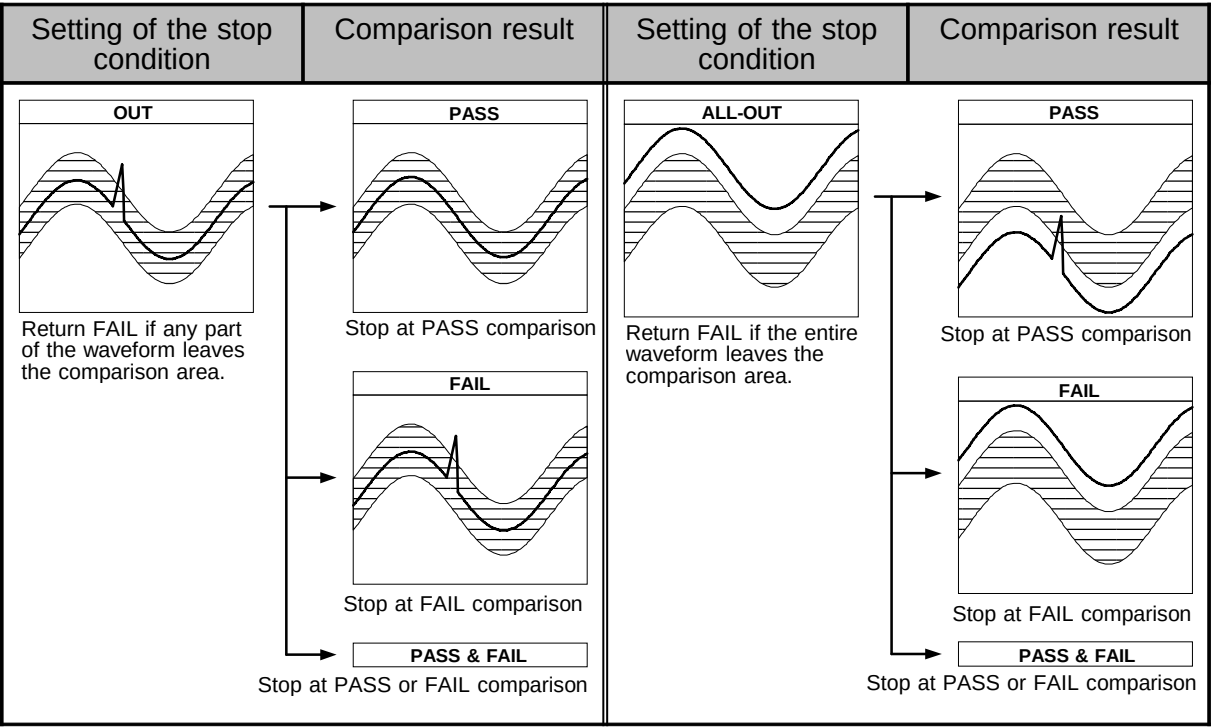
- Press the **STOP** key once to stop measurement after loading the waveform for the recording length.
- Press the **STOP** key twice to immediately stop measurement.
- The comparison result appears on the screen.

5. A signal is output from the OK or NG output terminal. Enabling the auto save function also saves the data.



- When the "Trigger Mode" is set to "Single", measurement continues until the stop conditions are met and ends as soon as these conditions are met. When the "Trigger Mode" is set to "Repeat" or "Auto", measurement continues until the **STOP** key is pressed.
- Setting "Auto save" to "ON" saves the data when the stop conditions are met.
- Area comparison alternately repeats (1) data loading and (2) comparison so that data is not loaded during area comparison. For this reason, input signals are not always monitored.
- Note that a long recording length or compressed display increases the comparison cycle.

Relation between Setting of the Area comparison and Stop conditions



NOTE

- The A/B cursor function is effective even during area comparison.
- The cursors to specify the range of value calculation cannot be used to specify the range of area comparison (see 5.5.4).

5.3.2 Creating Area

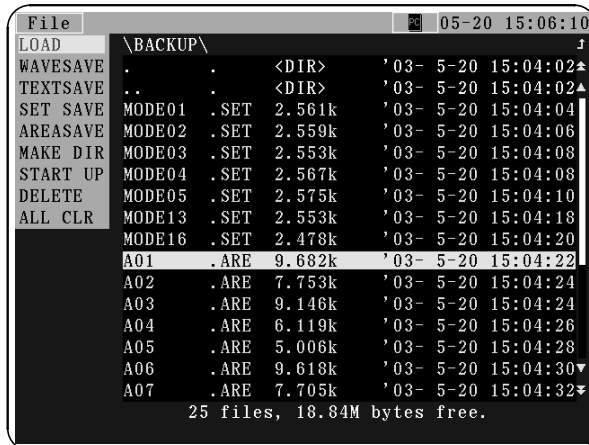
- A comparison area is required for area comparison.
- A comparison area can be created or an existing area can be edited.

(1) Editing Existing Area

- An area may be loaded from a PC card and edited to create a new area.

Setting Procedure (When loading area data from a PC card)

Setting Screen: File→ • LOAD



1. Insert the PC card containing the comparison area data into the card slot, then press the **FILE** key.
2. Use the **CURSOR** key to select a file to load, then press the **ENTER** key.
3. Under "AREA" the up and down **CURSOR** keys to select the destination area No. (from A01 to A16) to be loaded.
4. Press the **START** key to load area data in the area No. selected in 3 above.
5. Press the **AREA EDIT** key. Use the "LOAD" command to load the area specified in 3 above, then edit the area. (For details of the LOAD command, see 5.3.3)

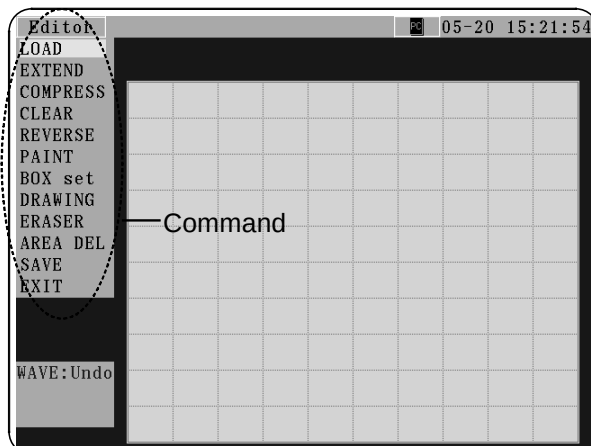
(NOTE) • You can simultaneously load all area data saved in a directory on the 8730-10, 8731-10 by loading the index file. For details of the index file, see 6.4.6.

(2) Creating a New Area

- This section explains how to create a new comparison area.
- A comparison area may be freely drawn on the screen.
- A comparison area may be created using a stored waveform.
- Up to 16 waveform comparison areas can be saved in internal memory.
- To validate a newly created comparison area, save it in internal memory, then exit the Area creation screen.

Drawing Procedure

Setting Screen: Area Edit Key



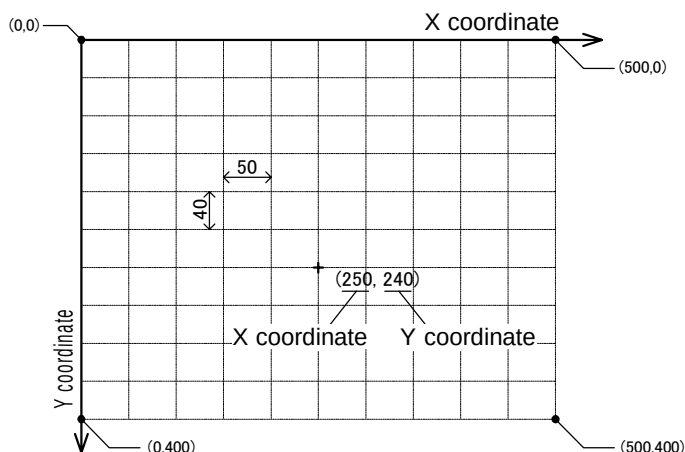
1. Press the **AREA EDIT** key to display the Edition screen.
2. Use the various editor commands to create the comparison area. To use a command, select it on the menu.
3. After creating an area, use the "SAVE" command to save the area in the 8730-10, 8731-10's internal memory. Memory can hold up to 16 areas (A01 to A16).
4. Move the cursor to "EXIT" and press the **ENTER** key to exit the Edition screen.

● Creating Area "Edit Command"

Editor Command	Details
1. LOAD	Load a measured waveform, file, or area from internal memory
2. EXTEND	Enlarge the area up or down and left or right
3. COMPRESS	Compress the area up or down and left or right
4. CLEAR	Delete the area you are working on
5. REVERSE	Reverse the area
6. PAINT	Fill the space surrounded by the closed curves with color
7. BOX set	Specify the range of enlargement, compression, deletion, reversal, and painting
8. DRAWING	Display the drawing commands for drawing a line, rectangle, or circle
9. ERASER	Delete part of the area
10. AREA DEL	Delete an area (A01 to A16) in internal memory
11. SAVE	Save the created area (A01 to A16) or in internal memory or file
12. EXIT	Exit the area creation screen

● Area Edit Display

- Displays X-Y coordinates with the origin (0, 0) placed at the upper-left corner of the screen.



Time and voltage values are also displayed. With the default setting, the voltage values are calculated based on the CH1 voltage axis range. When the waveform of CH2 is loaded, calculation is based on the CH2 voltage axis range. When scaling is ON, the scaled values are also displayed (with the unit of measure abbreviated to the first two characters only). 1 DIV equals 40 (vertically)*50 (horizontally) dots, with X coordinates 0 to 500 and Y coordinates 0 to 400. (40 (vertically)*40 (horizontally) dots and X coordinates 0 to 400 in XY screen format.)

● Undoing a Command

- After executing a command, you can press the **WAVE SCROLL** key to undo the change made by the command. A command change can be undone only once.
The commands, "**BOX set/reset**", "**AREA DEL**", or "**SAVE**" cannot be undone.

● Editing the Area on a PC

- By saving the comparison area (see 5.3.3⑪) with a BMP image, the area can be edited on a PC.
- The BMP image data of an area is loaded to the Area Edit Display by the Load command (see 5.3.3①). However, it cannot be loaded on a PC if the BMP image has been resized or its color changed.

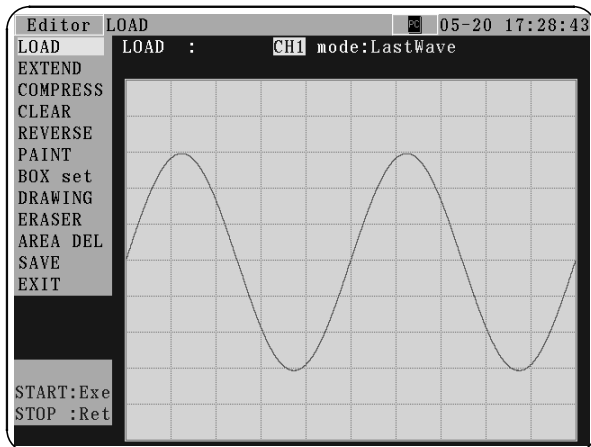
5.3.3 Editor Command Details

- This section explains the "Editor Commands" used to create a comparison area.

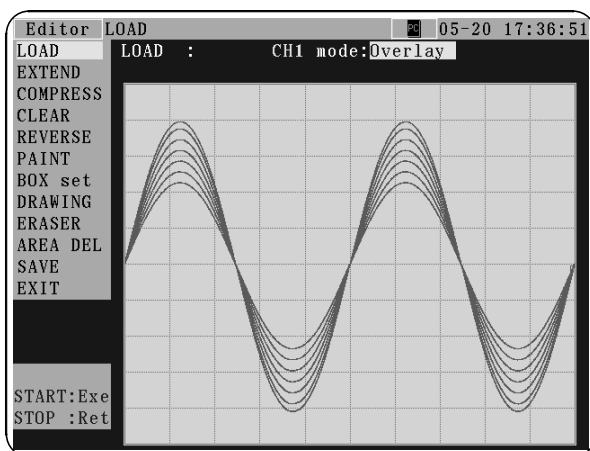
1. LOAD: Load a measured waveform or area saved in internal memory.

- Loads the measured waveform, file, or an area in internal memory.
- Execute this command when creating an area based on an acceptable waveform.
- "CH1" or "CH2", "FILE (AREA)", "FILE (BITMAP)", or an area from "A01" to "A16" may be selected as the source from which to load the data. (CH2 is available only with the 8731-10.)
- When CH1 or CH2 is selected as the load source, choose a type from "LastWave," "Overlay," "Magnify," and "AREA". When a file is selected as the load source, specify the file name.

Drawing Procedure



Waveform loaded with "LastWave"



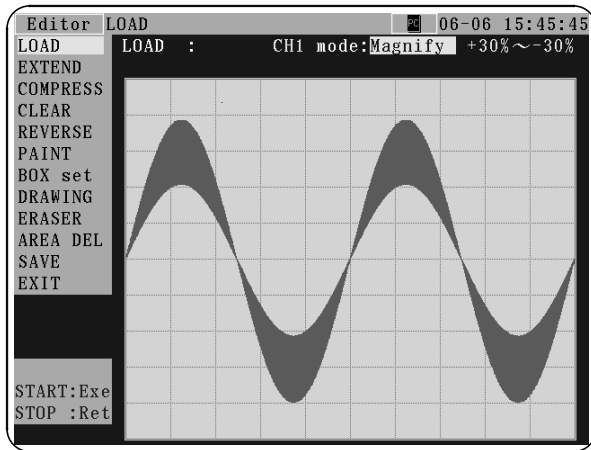
Waveform loaded with "Overlay"

1. Use the **CURSOR** key to select "LOAD" command, then press the **ENTER** key.
2. Use the up and down **CURSOR** keys to set the load source.

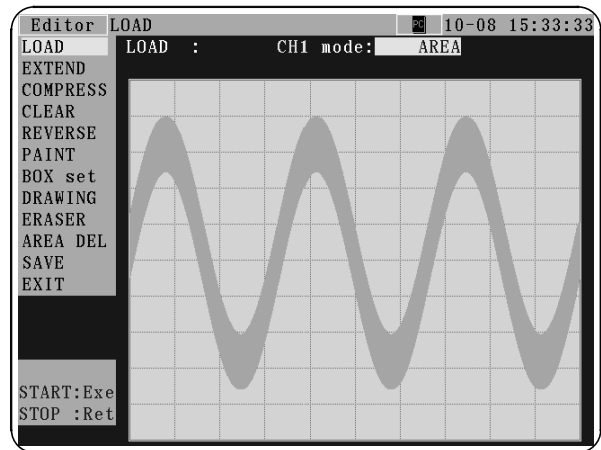
CH1 : Loads the waveform of CH1.
 CH2 : Loads the waveform of CH2 (for the 8731-10 only).
 FILE (AREA) : Loads the Area data.
 FILE (BITMAP): Loads the Image data.
 A01 to A16: Loads an area from A01 to A16 from internal memory.

3. When "CH1" or "CH2" is selected, choose a type in the field on the right.

LastWave: Loads the last waveform measured.
 (For overlaid waveforms, only the latest waveform is loaded.)
 Overlay : Loads the overlaid waveforms.
 (This is effective when the overlay function is ON.)
 Magnify : Loads a waveform and magnifies it in the voltage axis direction.
 (Setting range: -50% to +50%)
 AREA : Loads the area currently being used by this channel.

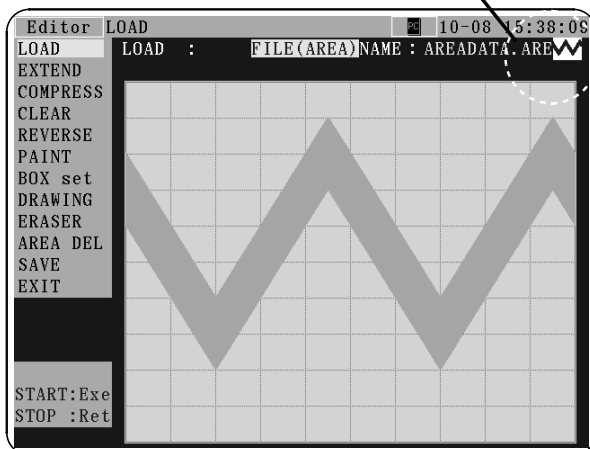


Waveform loaded with "Magnify"

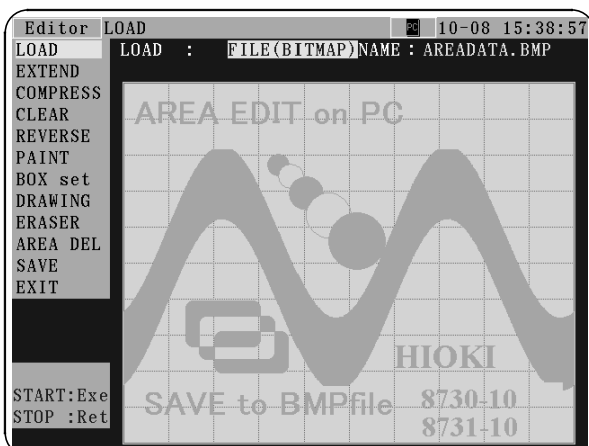


Waveform loaded with "AREA"

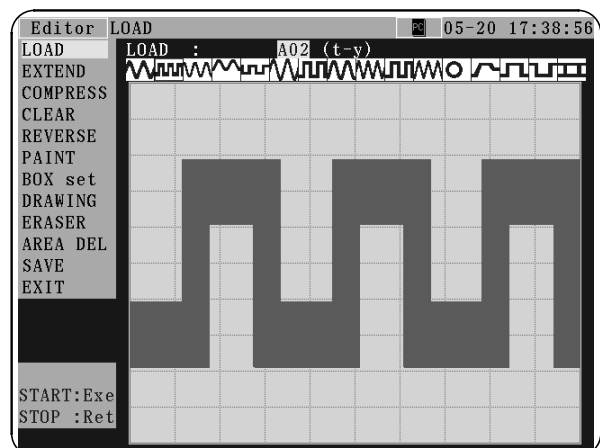
The selected file area is reduced and displayed.



Waveform loaded with "FILE (AREA)"



Waveform loaded with "FILE (BITMAP)"



Areas No. A01 to A16 loaded from internal memory

4. When an "FILE (AREA)" or "FILE (BITMAP)" is selected, specify the file name from the items at the right. The files in the current directory selected on the Card screen are displayed.

5. Press the **START** key to start loading.

- Use the up and down **CURSOR** keys to select a file.

Only those files that can be loaded from the current directory (selected on the File screen) are displayed.

- The BMP image data of the area saved by the "SAVE" command is loaded.

The area can be changed on the PC, but if resized or if colors are changed, it cannot be reloaded.

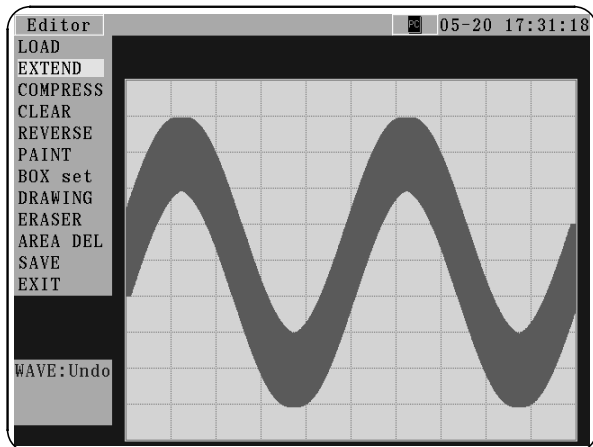
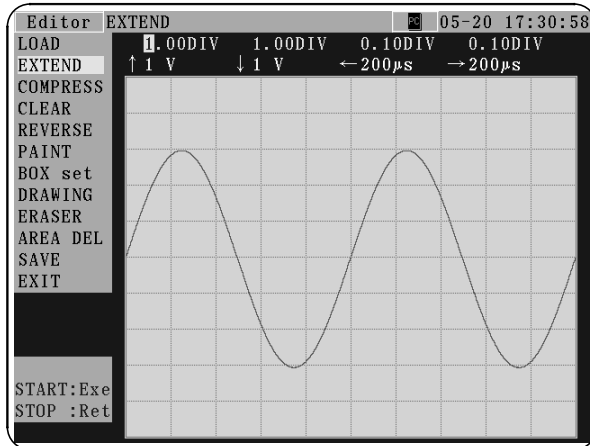
Only the monochrome BMP save format is available.

- Only those files that can be loaded from the current directory (selected on the Card screen) are displayed.

2. EXTEND: Extend the area up or down and left or right

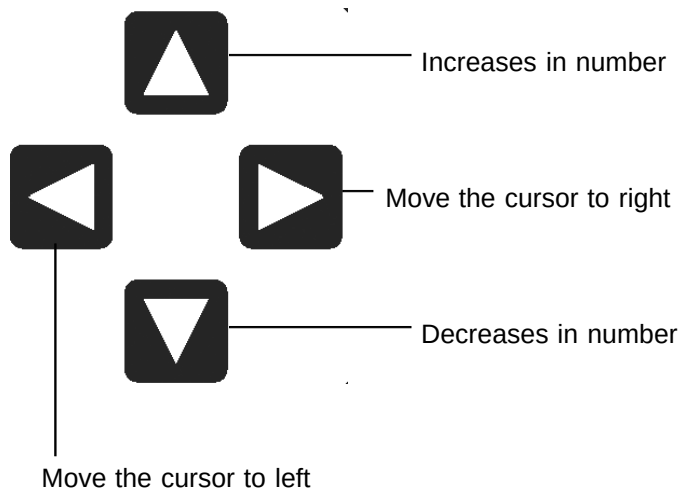
- Extends an object on the screen up and down, and left and right.
- Use this command to create an area based on an acceptable waveform.
- The extension width is defined by specifying the number of DIVs. The time and voltage values corresponding to the number of DIVs appear under the number of DIVs.
- The "**BOX set**" command can be used for partial area enlargement.

Drawing Procedure



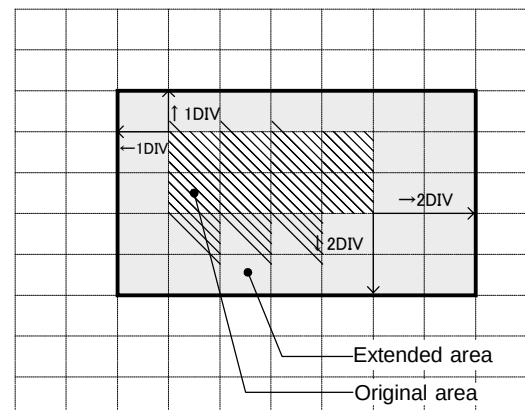
1. Use the **CURSOR** key to select "**EXTEND**" command, then press the **ENTER** key.
2. Use the up and down $\uparrow \downarrow$ (voltage axis direction) and left and right $\leftarrow \rightarrow$ (time axis direction) **CURSOR** keys to set the enlargement width.
The number of DIVs defines the width.
 - The time and voltage axis values corresponding to the number of DIVs appear under the number of DIVs. When scaling is ON, the scaled values will be displayed. (The unit of measure is abbreviated to the first two characters only.)
3. Press the **START** key to start extension.

Select menu and Edit extension width (DIV,Time)



Relationship between original area and extended area

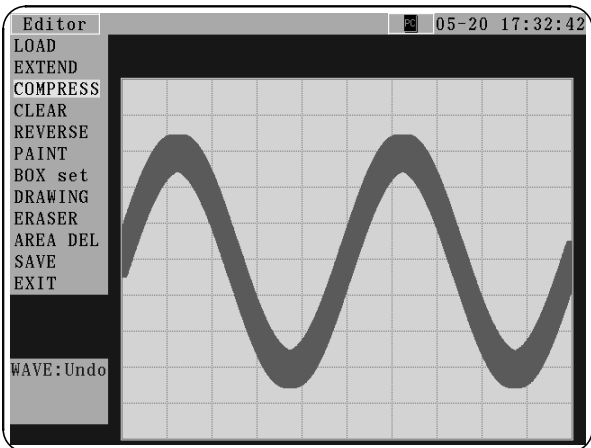
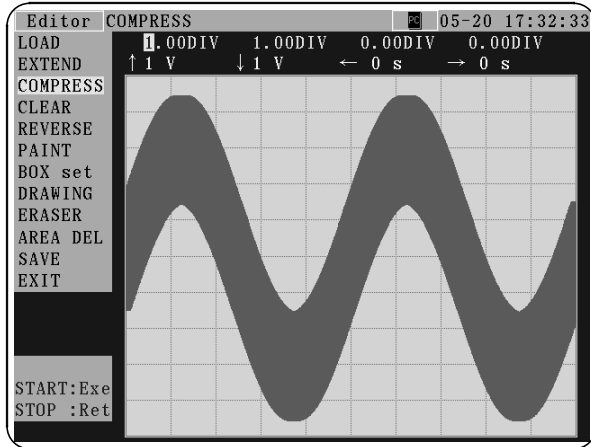
$\uparrow :1\text{DIV}, \downarrow :2\text{DIV}, \leftarrow :1\text{DIV}, \rightarrow :2\text{DIV}$



3. COMPRESS: Compress the area up or down and left or right

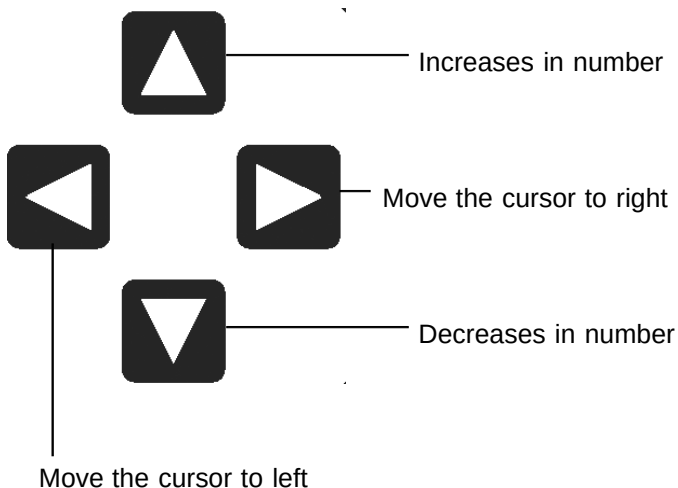
- Compresses an object on the screen up and down, and left and right.
- The compression width is defined by specifying the number of DIVs. The time and voltage values corresponding to the number of DIVs appear under the number of DIVs.
- The "BOX set" command can be used for partial area compression.

Drawing Procedure

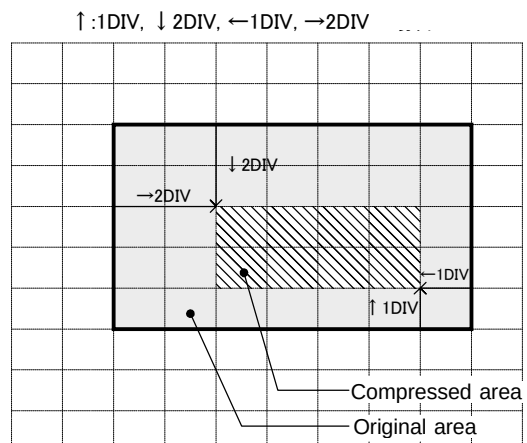


1. Use the **CURSOR** key to select "COMPRESS" command, then press the **ENTER** key.
2. Use the up and down $\uparrow \downarrow$ (voltage axis direction) and left and right $\leftarrow \rightarrow$ (time axis direction) **CURSOR** keys to set the compression width. The number of DIVs defines the width.
 - The time and voltage axis values corresponding to the number of DIVs appear under the number of DIVs. When scaling is ON, the scaled values will be displayed. (The unit of measure is abbreviated to the first two characters only.)
3. Press the **START** key to start compression.

Select menu and Edit compression width (DIV,Time)



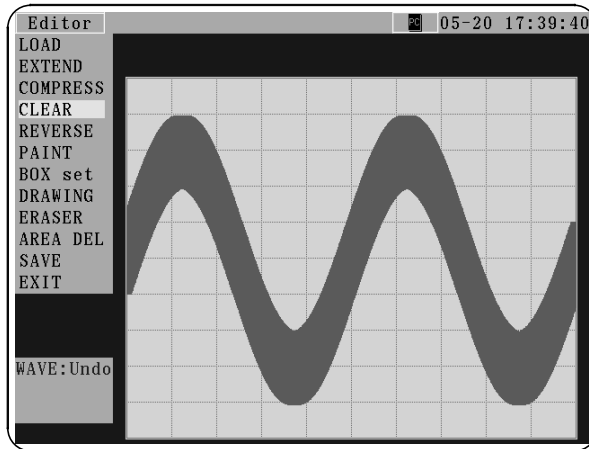
Relationship between original area and compressed area



4. CLEAR: Delete the area you are working on

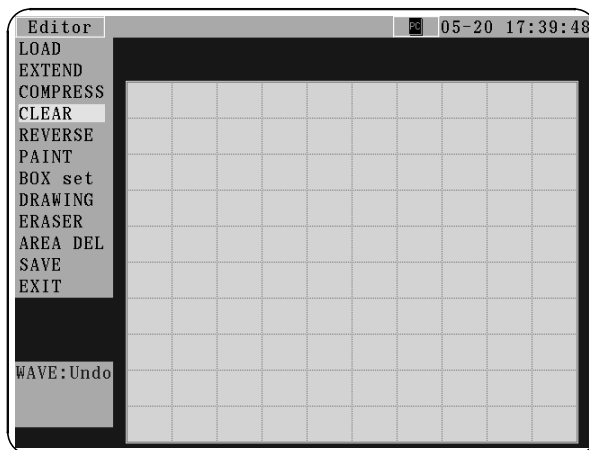
- Deletes the entire area you are working on.
- The "BOX set" command can be used for partial area deletion.

Drawing Procedure

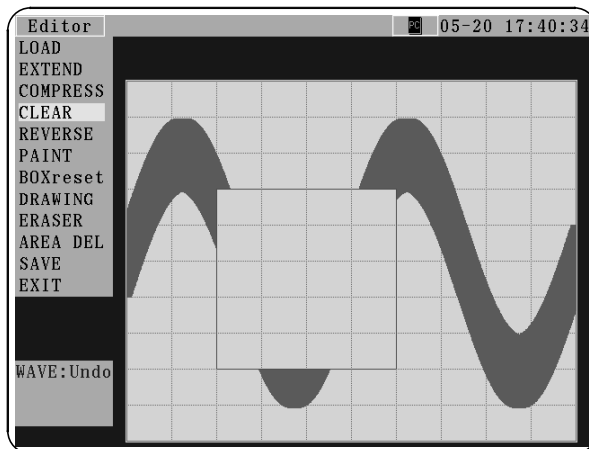


Screen image before deletion

1. Use the **CURSOR** key to select "CLEAR" command, and press the **ENTER** key. Then the area is deleted.



Screen image after deletion



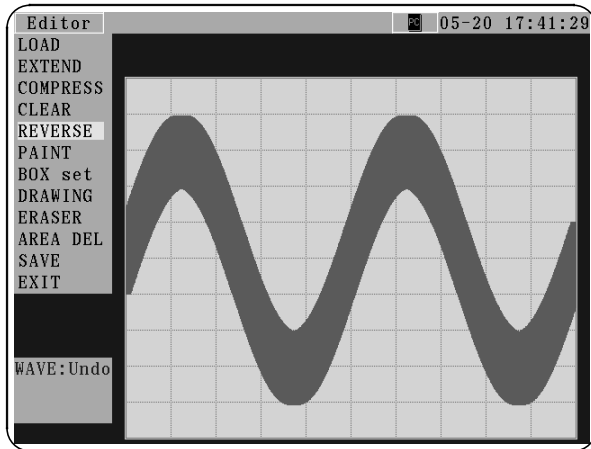
Screen image after deletion with a range specified

- Executing "CLEAR" with a range specified only deletes the specified range of the area.

5. REVERSE: Reverse the area

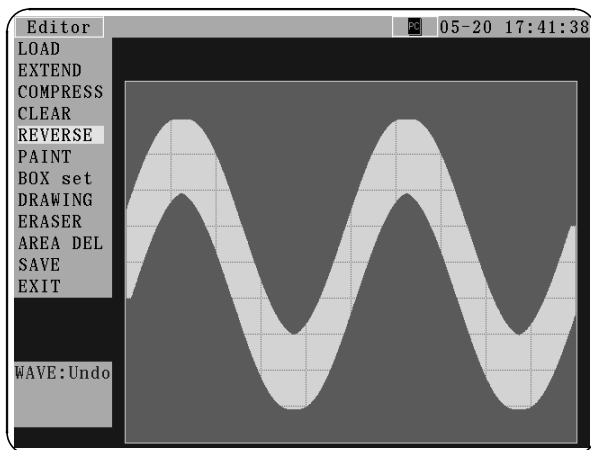
- Reverse the filled-in area and unfilled area.
- The "BOX set" command can be used for partial area reversal.

Drawing Procedure

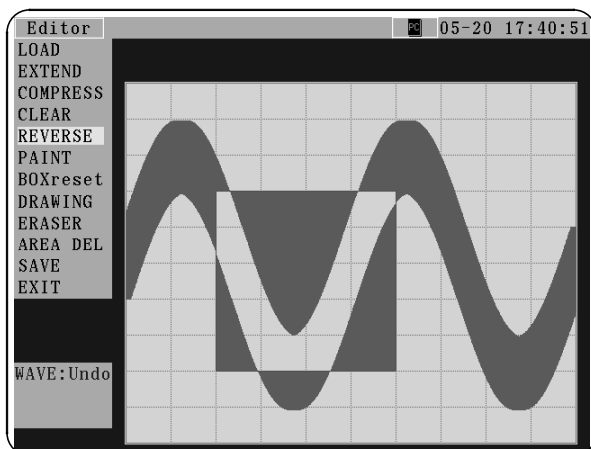


Screen image before reversal

1. Use the **CURSOR** key to select "REVERSE" command, then press the **ENTER** key.



Screen image after reversal



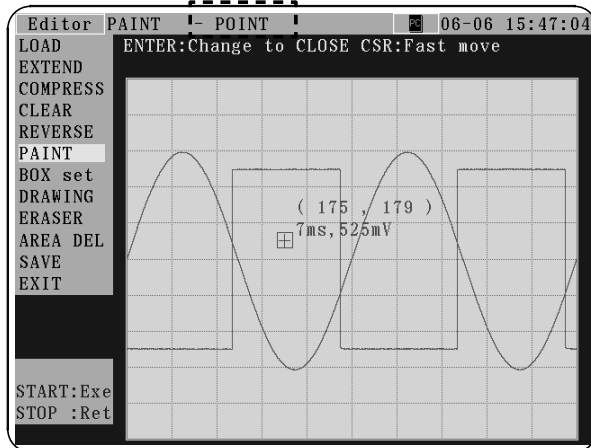
Screen image after reversal with a range specified

- Executing "REVERSE" with a range specified only reverse the specified range of the area.

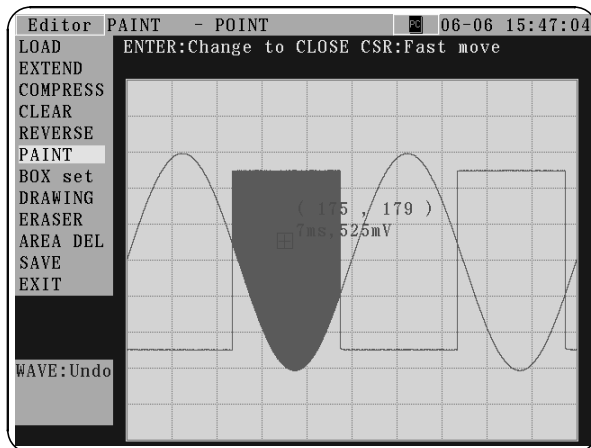
6. PAINT: Fill the space surrounded by the closed curves with color

- Fills the space surrounded by the closed curves. The filled-in space is the comparison area.
- There are two methods of filling in color:
 - (1) "**POINT**" mode : Fills the enclosed space selected by the cross cursor +.
 - (2) "**CLOSED**" mode: Fills all enclosed spaces you are working on. This is useful for creating an area based on overlaid waveforms.
- The "**BOX set**" command can be used for partial area filling.

Drawing Procedure



"POINT" Mode



1. Use the **CURSOR** key to select "**PAINT**" command, then press the **ENTER** key.
2. Select a filling mode. The mode is set to "**POINT**" by default. Each pressing of the **ENTER** key alternately selects one of the two modes ("**POINT**" mode or "**CLOSED**" mode). The currently selected mode is displayed at the top of the screen.
3. Selecting "**POINT**" mode displays the + cursor and the coordinates on the screen. Move the + cursor to the enclosed space you wish to fill, then press the **START** key. Only that space will be filled with color. In "**CLOSED**" mode, press the **START** key to fill all enclosed spaces with color.

<<Related Issues>>



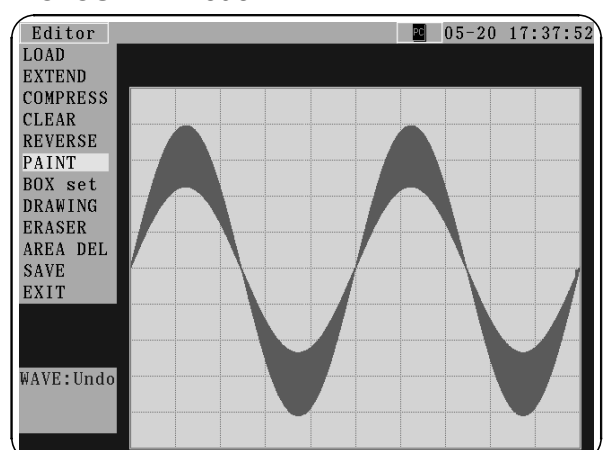
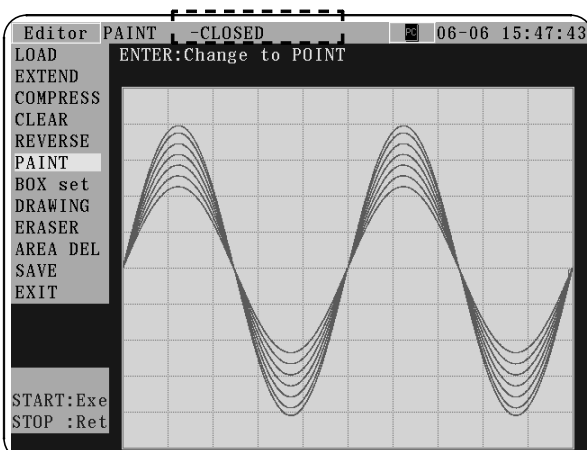
- Press the **STOP** key to exit the "**PAINT**" menu.



- Press the **CURSOR SCROLL** key to move the + cursor fast (1 DIV each movement). Pressing the **CURSOR SCROLL** key once again switches modes to low-speed motion (dot-by-dot movement).



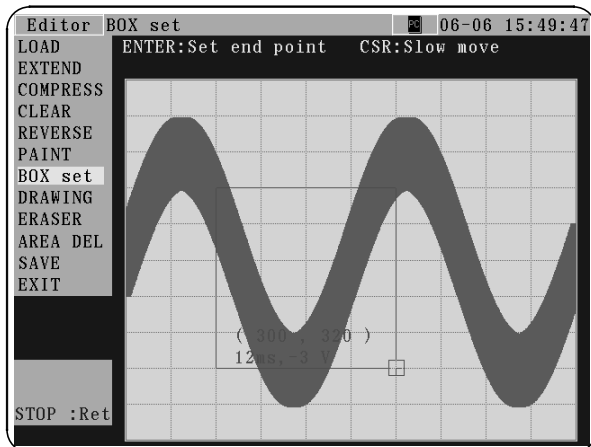
"CLOSED" Mode



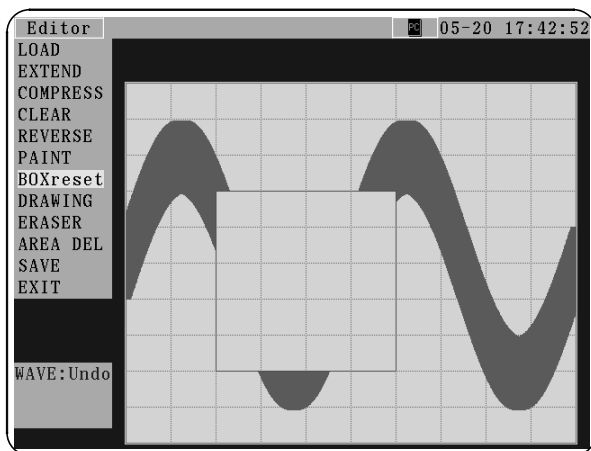
7. BOX set: Specify the range of extension, compression, deletion, reversal, and painting

- Sets a range for the "EXTEND", "COMPRESS", "CLEAR", "REVERSE", or "PAINT" command.
- Sets a range by specifying the start and end points, and draws a rectangle (box) with diagonal line specified by these two points. The specified range is enclosed in a red frame.
- The lines of the rectangle are included in the range.

Operation Procedure



1. Use the **CURSOR** key to select "BOX set" command, then press the **ENTER** key.
2. The + cursor and the coordinates (X coordinate, Y coordinate) are displayed on the screen
3. Use the **CURSOR** key to move the + cursor to the start point, then press the **ENTER** key.
4. Use the **CURSOR** key to move the + cursor to the end point, then press the **ENTER** key.
5. A rectangle (box) with diagonal line specified by the start and end points is then confirmed.
6. To cancel the range, use the **CURSOR** key to select the "BOXreset" command, then press the **ENTER** key.

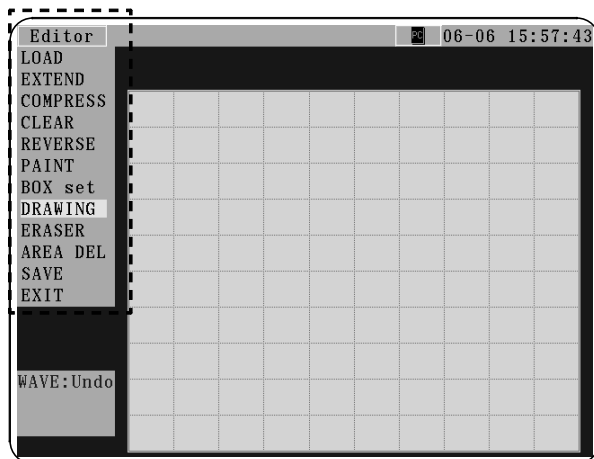


Screen image after deletion with a range specified

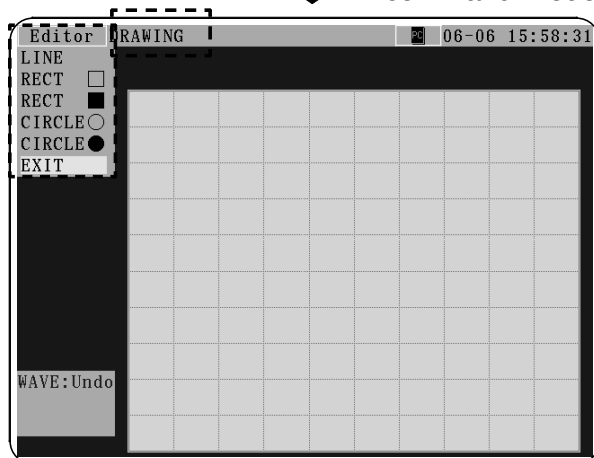
8. DRAWING: Display the drawing commands for drawing a line, rectangle, or circle

- "DRAWING" commands allow you to draw a line, rectangle, and circle.
- There are five "DRAWING" commands:
 - (1) LINE : Draws a line between the start and end points you specify.
 - (2) RECT ☐ : Draws a rectangle with diagonal line specified by two points. The rectangle will not be filled in.
 - (3) RECT ☒ : Draws a rectangle with diagonal line specified by two points. The rectangle will be filled in.
 - (4) CIRCLE ☐ : Draws a circle with the radius specified by two points. The circle will not be filled in.
 - (5) CIRCLE ☒ : Draws a circle with the radius specified by two points. The circle will be filled in.

Drawing Procedure



Screen in normal
command mode



Screen in DRAWING command mode

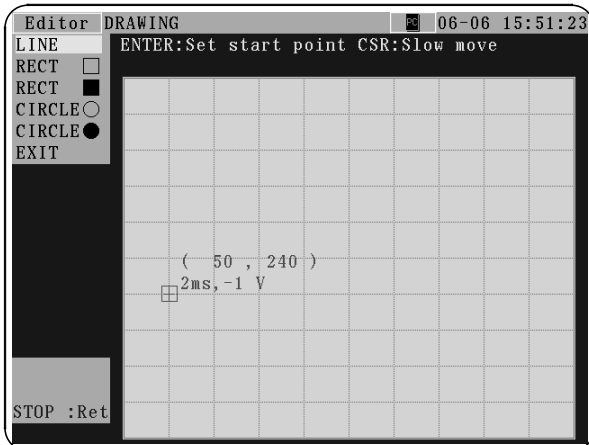
1. Use the **CURSOR** key to select "DRAWING" command, then press the **ENTER** key.
2. DRAWING command menu replaces the normal command menu at the left of the screen.
3. Select a command for the object you wish to draw, then press the **ENTER** key. For details of the DRAWING commands, see 8-1 to 8-5 in the following page.

4. To exit the DRAWING menu, select "EXIT" and press the **ENTER** key. The normal command menu then appears.

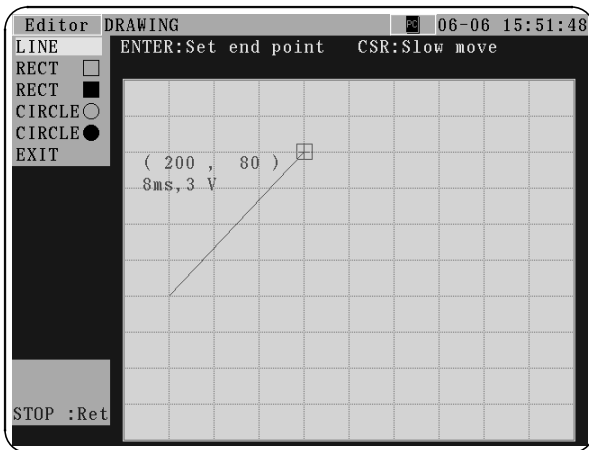
8-1. LINE: Draws a line.

- Draws a line between the start and end points you specify.

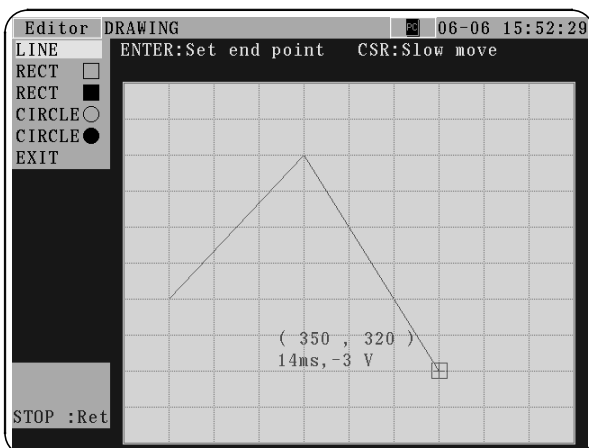
Drawing Procedure



Screen image of start point set for line



Screen image of end point set for line



Screen image of lines drawn continuously from same start point

1. Use the **CURSOR** key to select "**DRAWING**" command, then press the **ENTER** key. The **DRAWING** command menu will then appear. Select the "**LINE**" command, then press the **ENTER** key.
2. The + cursor and the coordinates (X coordinate, Y coordinate) are displayed on the screen
3. Use the **CURSOR** key to move the + cursor to specify the start point, then press the **ENTER** key to confirm the start point.
4. Specify the end point.
Use the **CURSOR** key to move the + cursor. A red line will appear between the start point and + cursor. (Note that the line is not yet confirmed.)
5. Press the **ENTER** key to confirm the end point and draw a green line between the start and end points.
6. By moving the + cursor you can continue drawing another line from the same start point.
To specify a new start point, press the **STOP** key and repeat the steps from 3 above.
7. To exit the command, press the **STOP** key.
8. To exit the **DRAWING** menu, select "**EXIT**" and press the **ENTER** key. The editor command menu then appears.

<<Related Issues>>

- In step 3 above, pressing the **STOP** key after setting the start point cancels the task of drawing a line. Pressing the **STOP** key again exits the "**LINE**" command.
- In step 6 above, pressing the **STOP** key when drawing lines continuously from the same start point cancels the mode for the continuous drawing of lines. Use this key to specify a new start point. Pressing the **STOP** key again exits the "**LINE**" command.



- Press the **CURSOR SCROLL** key to make the + cursor move fast (1 DIV each movement). Pressing the **CURSOR SCROLL** key once again switches modes to low-speed motion (dot-dot movement).



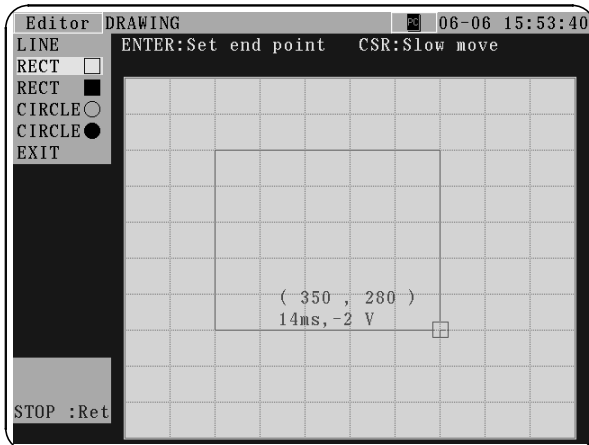
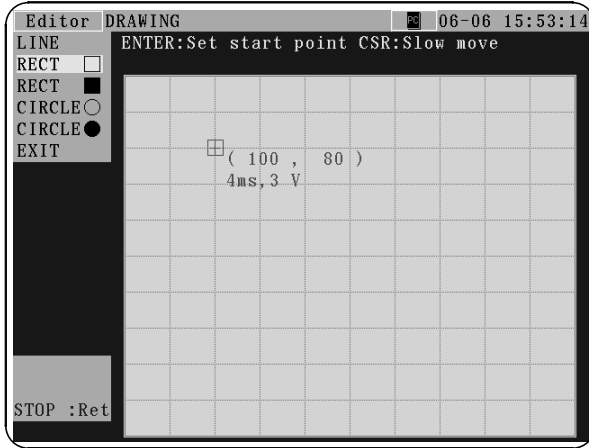
8-2. RECT ☐: Draw a rectangle and do not fill it in.

- Draws a rectangle that has a line from two specified points at diagonal corners. The rectangle will not be filled in.

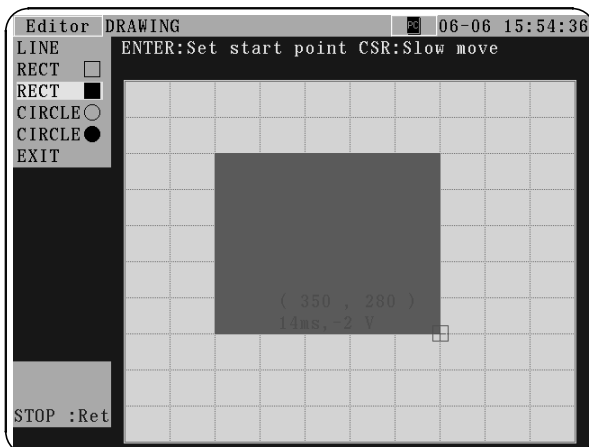
8-3. RECT ☒: Draw a rectangle and fill it in.

- Draws a rectangle with diagonal line specified by two points. The rectangle will be filled in.

Drawing Procedure



"RECT ☐"



"RECT ☒"

1. Use the **CURSOR** key to select "**DRAWING**" command, then press the **ENTER** key. The DRAWING command menu then appears. Select the "RECTANGLE" command, then press the **ENTER** key.
RECT ☐: Does not fill in the rectangle.
RECT ☒: Automatically fills in the rectangle.
2. The + cursor and the X-Y coordinates will appear on the screen.
3. Use the **CURSOR** key to move the + cursor for specifying the start point, then press the **ENTER** key to confirm the start point.
4. Specify the end point. Use the **CURSOR** key to move the + cursor. A rectangle with diagonal line specified by the start point and + cursor is then drawn using a red line. (The rectangle is not yet confirmed.)
5. Press the **ENTER** key to confirm the rectangle and change the line to green. Selecting "**RECT ☒**" fills in the rectangle.
6. To exit the command, press the **STOP** key.
7. To exit the DRAWING menu, select "**EXIT**" and press the **ENTER** key. The editor command menu then appears.

<<Related Issues>>

- In step 3 above, pressing the **STOP** key after setting the start point cancels the task of drawing a line. Pressing the **STOP** key again exits the "RECTANGLE" command.



- Press the **CURSOR SCROLL** key to make the + cursor move fast (1 DIV each movement). Pressing the **CURSOR SCROLL** key once again switches modes to low-speed motion (dot-by-dot movement).



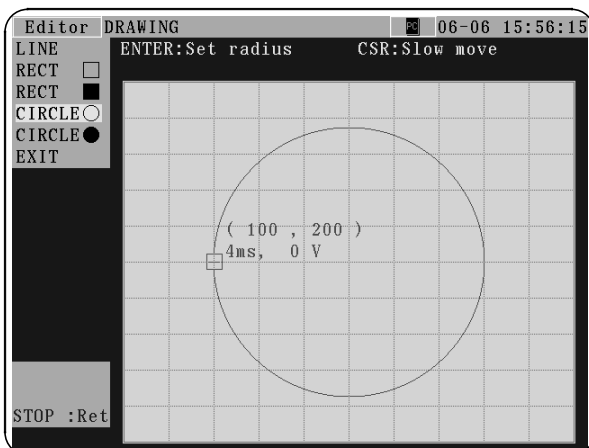
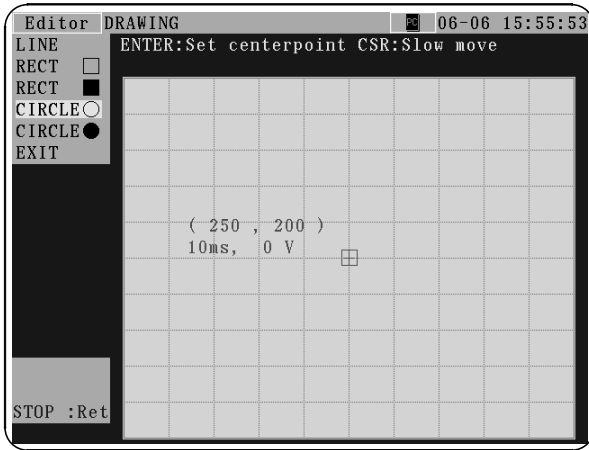
8-4. CIRCLE ○: Draws a circle and does not fill it in.

- Draws a circle with the radius specified by two points: center point and circumferential point. The circle will not be filled in.

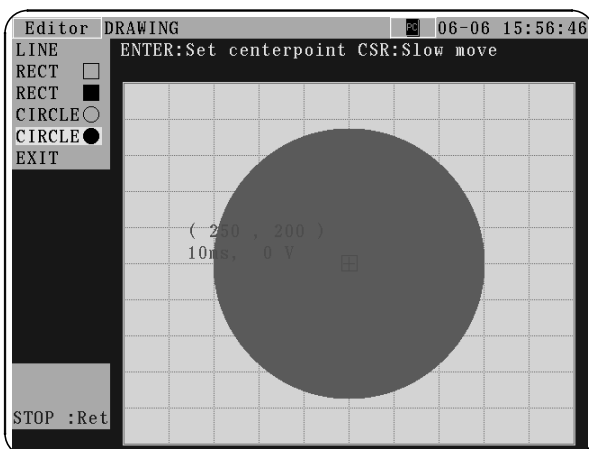
8-5. CIRCLE ●: Draws a circle and fills it in.

- Draws a circle with the radius specified by two points: center point and circumferential point. The circle will be filled in.

Drawing Procedure



"CIRCLE ○"



"CIRCLE ●"

1. Use the **CURSOR** key to select "**DRAWING**" command, then press the **ENTER** key. The DRAWING command menu then appears. Select the "CIRCLE" command, then press the **ENTER** key.
CIRCLE ○: Does not fill in the circle.
CIRCLE ●: Automatically fills in the circle.
2. The + cursor and the X-Y coordinates will appear on the screen.
3. Use the **CURSOR** key to move the + cursor to a point specifying the center of the circle. Press the **ENTER** key to confirm the center point.
4. Specify a point on the periphery of the circle. Use the **CURSOR** key to move the + cursor, and a circle with the radius specified by the center point and + cursor will be drawn using a red line. (The circle is not yet confirmed.) A circle cannot be drawn beyond the screen size.
5. Press the **ENTER** key to confirm the circle and change the line to green.
"CIRCLE ●" is selecting, the circle will be filled in.
6. To exit the command, press the **STOP** key.
7. To exit the DRAWING menu, select "**EXIT**" and press the **ENTER** key. The editor command menu then appears.

<<Related Issues>>

- In step 3 above, pressing the **STOP** key after setting the center point cancels the task of drawing a circle. Pressing the **STOP** key again exits the "CIRCLE" command.



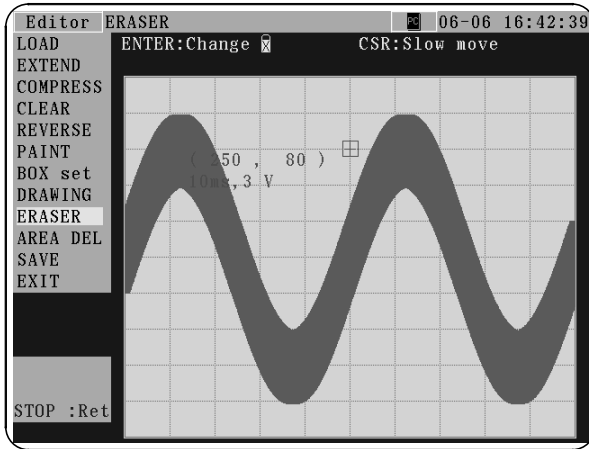
- Press the **CURSOR SCROLL** key to make the + cursor move fast (1 DIV each movement). Pressing the **CURSOR SCROLL** key once again switches modes to low-speed motion (dot-by-dot movement).



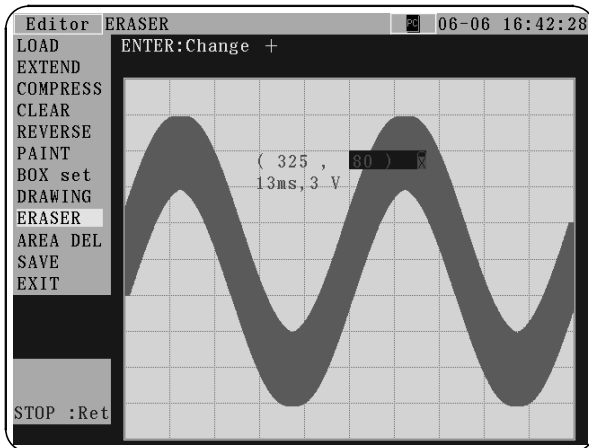
9. ERASER: Delete part of the area

- Delete part of an area by moving the eraser mark (10 dots wide & 20 dots long).

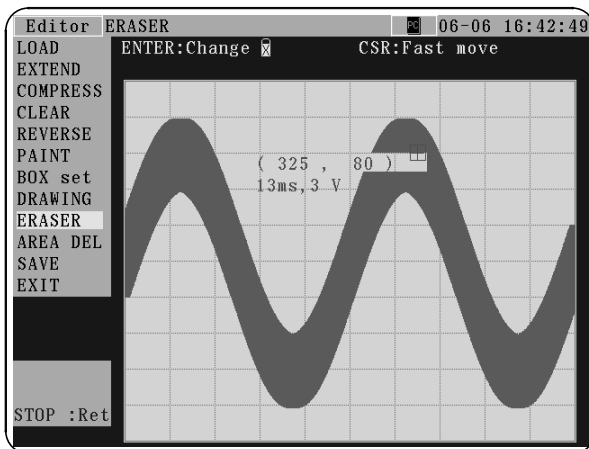
Procedure



Screen image before deletion



Screen image deleting



Screen image after deletion

1. Use the **CURSOR** key to select "ERASER" command, then press the **ENTER** key.
2. The + cursor and the X-Y coordinates will appear on the screen.
3. Use the **CURSOR** key to move the + cursor to a section to delete, then press the **ENTER** key. The cursor will change to .
4. As the cursor moves, the section where  is located will be deleted.
5. Press the **ENTER** key to confirm the deleted section.
6. To delete another section, repeat the steps from 2 to 5 above.
7. To exit the command, press the **STOP** key.

<<Related Issues>>

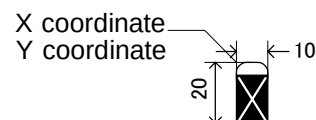
- Press the **STOP** key to exit the "ERASER"



- Press the **CURSOR SCROLL** key to make the + cursor move fast (1 DIV each movement). Pressing the **CURSOR SCROLL** key once again switches modes to low-speed motion (dot-by-dot movement).



- Eraser
- The size of the eraser is 10 dots in the X-axis direction by 20 dots in the Y-axis direction. The reference point during deletion is the left corner of the eraser.

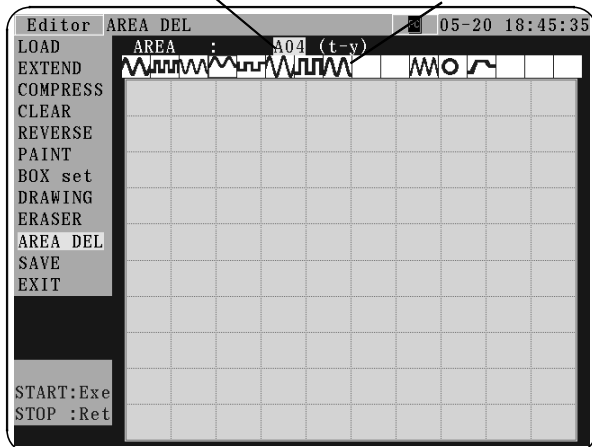


10. AREA DEL: Delete an area saved in internal memory.

- Delete an area (A01 to A16) in internal memory.

Procedure

Selects the No. of the area to delete. Displays a compressed view of the saved area.



1. Use the **CURSOR** key to select "AREA DEL" command, then press the **ENTER** key.
2. Use the **CURSOR** key to select an area (from A1 to A16, or ALL) to delete.
3. Press the **START** key to start deletion.



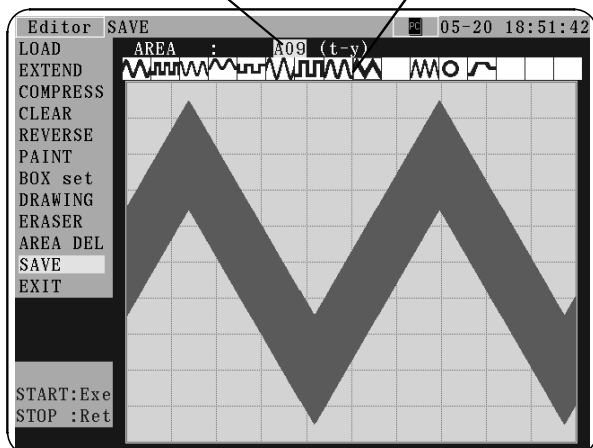
• Note that selecting "ALL" deletes all areas in memory.

11. SAVE: Save the created area.

- Save the created area (A01 to A16) in internal memory or file (PC card). When a file is selected as the load source, specify the file name.
- A created area will not be valid unless saved in 8730-10, 8731-10 internal memory.

Procedure

Selects the No. of the destination to save the area. Displays a compressed view of the saved area. (When selecting A01 to A16)



1. Use the **CURSOR** key to select "SAVE" command, then press the **ENTER** key.
2. Use the **CURSOR** key to select a saving destination area No. from A01 to A16 or file.
A compressed view of the area saved in the selected No. appears at the top of the screen.
When a file is selected as the save destination, specify the file name at the right.

FILE(AREA):

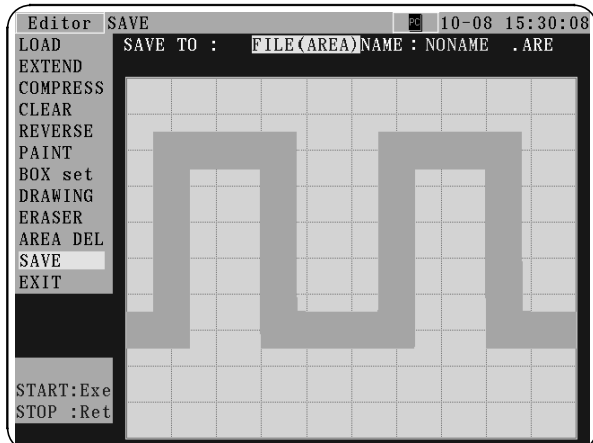
Saves the area data.

These files can be loaded from this instrument's File screen, and by the 8835-01.

FILE(BITMAP):

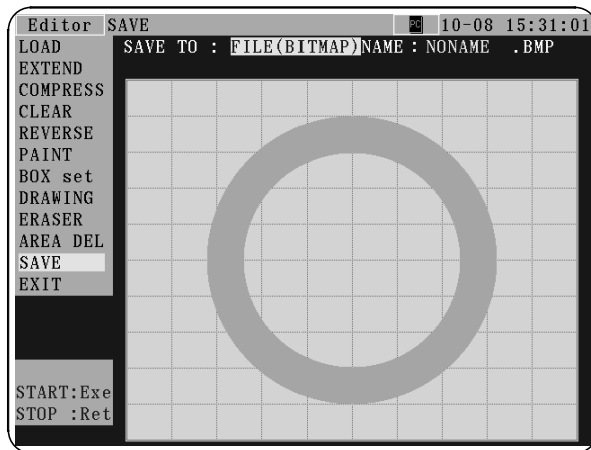
Saves the image in BMP format.

These files can be loaded from this instrument's Area creation screen, or from a PC.



3. Press the **START** key to save the created area.

FILE (AREA)



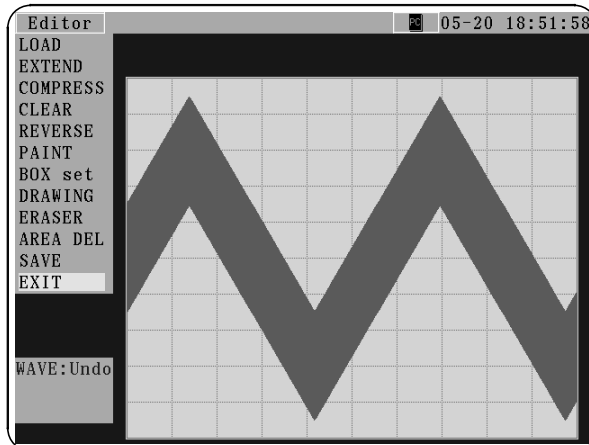
FILE (BITMAP)

NOTE

- Saving an area with an area No. previously used to save another area will overwrite the previous area.

12. EXIT: Ends area creation

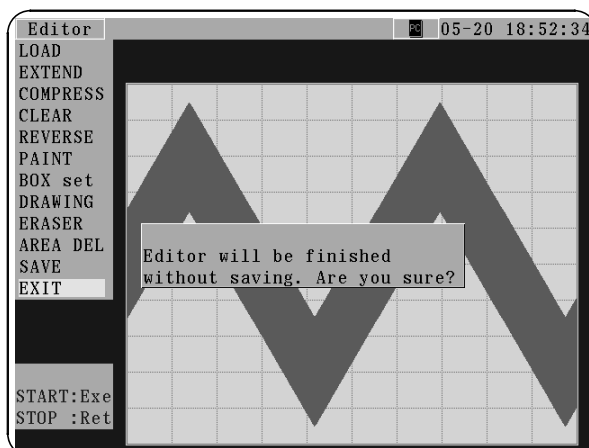
- Ends area creation and exits the Area creation screen.

Procedure

1. Use the **CURSOR** key to select "**EXIT**" command, then press the **ENTER** key. The Area creation screen is then exited and the waveform display screen appears.

NOTE

- After creating an area, if you select "**EXIT**" without saving the area, a warning message will appear. Press the **START** key to exit. Press the **STOP** key to continue area creation. Pressing the menu key without saving the area will also display a warning message.



A warning message appears if you attempt to exit without saving the area.

5.4 Area Comparison Details

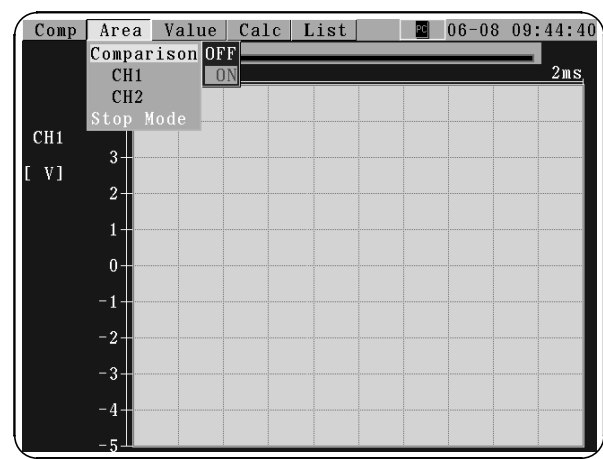
- The "Area" tag allows you to set various parameters for area comparison.
- The setting shall be made separately for each channel (except for the 8730-10).
- Area comparison enables the detection of an abnormal waveform that deviates from the set waveform range. The comparison result (PASS or FAIL) is output from an external control terminal. (For details of the external control terminals, see 8.5.2)

5.4.1 Area Comparison Setting

- Turns area comparison ON/OFF.

Setting Procedure

Setting Screen: Area→ • Comparison



1. Press the **COMP SETTINGS** key, and select "Area" tag.
2. Select "**Comparison**" on the menu, then press the **ENTER** key.
3. Select "**OFF**" or "**ON**", then press the **ENTER** key.

OFF : Does not conduct area comparison.
ON : Conducts area comparison.

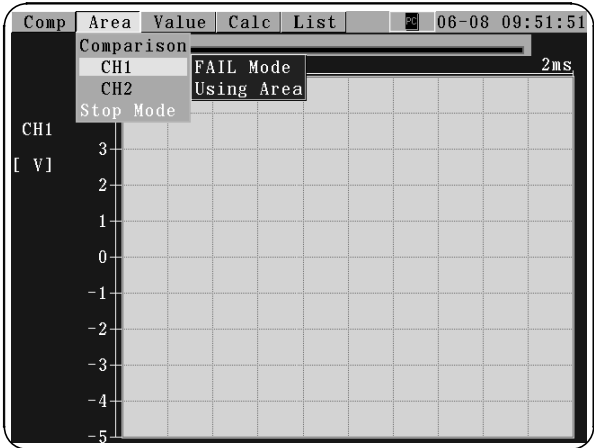
NOTE • The currently selected setting condition is shown in red.

5.4.2 Area Comparison Conditions

- Sets the conditions for area comparison.
- The comparison conditions may be set separately for each channel (except for the 8730-10).
- By registering comparison areas, you can easily switch between different areas. Up to 16 comparison areas may be registered. (For how to create a comparison area, see (2) in 5.3.2.)

Setting Procedure

Setting Screen: Area→ • CH1 (CH2)^(Note1) (FAIL Mode, Using Area)



1. Press the **COMP SETTINGS** key, and select "**Comparison**" tag.^(Note 1)
2. Select a channel (CH1 or CH2^(Note 2)), then press the **ENTER** key.
3. Use the **CURSOR** key to select "**FAIL Mode**" or "**Using Area**".

FAIL Mode : Selects a comparison condition.

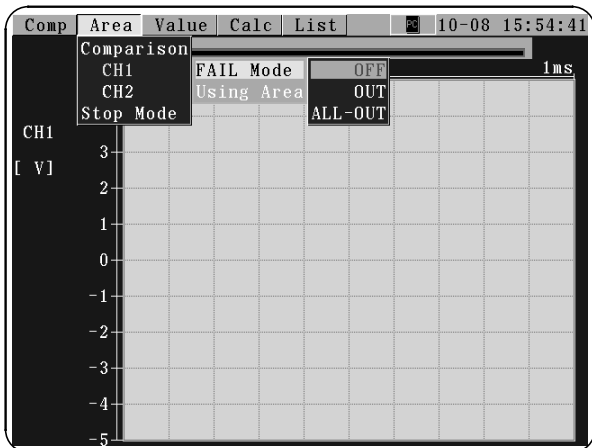
Using Area : Switches a comparison area.

- NOTE**
- (Note 1) The AREA tag cannot be selected unless area comparison is turned ON as described in 5.4.1.
 - (Note 2) CH2 cannot be selected with the 8730-10. Selecting the X-Y screen displays "X-Y" on the screen.

1. FAIL Mode (OFF, OUT, ALL-OUT)

- Conducts area comparison according to set comparison conditions. For details of comparison conditions and stop conditions, see the "Relation between Setting of the Area comparison and Stop conditions" in 5.3.1.
- Area and value comparison both end according to the stop conditions. For details of stop conditions, see 5.4.3.

Setting Procedure



1. Use the **CURSOR** key to select "**FAIL Mode**", then press the **ENTER** key.
2. Select a comparison condition, then press the **ENTER** key.

OFF : Does not conduct area comparison.

OUT : The waveform is FAIL if any part goes beyond the comparison area.

ALL-OUT: The waveform is FAIL if it fully extends beyond the comparison area.

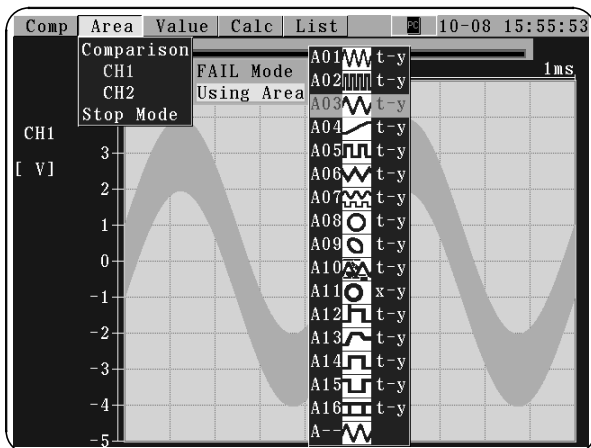
NOTE

- When "**FAIL Mode**" is "**OFF**" for both CH1 and CH2, comparison will not be conducted.
- The A/B cursor function is available even during area comparison.
- A range for area comparison cannot be specified.
- When the "**Trigger Mode**" is set to "**Single**", measurement continues until the stop conditions are met and ends as soon as these conditions are met.
- When the "**Trigger Mode**" is set to "**Repeat**" or "**Auto**", the waveform is recorded continuously and compared. Measurement continues until the **STOP** key is pressed.

2. Using Area (A01 to A16)

- Select a comparison area.
 - By registering comparison areas, you can easily switch between different areas.
- Up to 16 comparison areas may be registered. (For how to create a comparison area, see (2) in 5.3.2.)

Setting Procedure



1. Use the **CURSOR** key to select "**Using Area**", then press the **ENTER** key.
2. Use the **CURSOR** key to select an area from "**A01 to A16**", then press the **ENTER** key.

NOTE

- When display format (see 4.2.4) is set to single screen or dual screen, the area is shown with "t-y." When display format is set to X-Y screen, the area is shown with "x-y."
- To register a settings & area file (see 6.4.5), select "A- -". The registered area is cleared by turning power off or by changing the area.

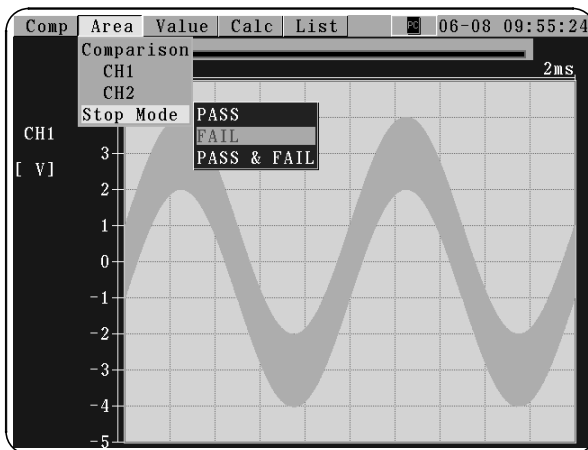
5.4.3 Stop Conditions of Area Comparison

- The 8730-10, 8731-10 may be set to stop measurement according to the result of area comparison (PASS or FAIL). Enabling the auto save function saves the data (see 4.2.9).
- When value comparison is also conducted simultaneously, measurement ends according to the common stop conditions (see 5.2.1).

Stop Mode	Details
PASS	Stops measurement when area comparison result is PASS.
FAIL	Stops measurement when area comparison result is FAIL.
PASS&FAIL	Stops measurement when area comparison result is PASS or FAIL.

Setting Procedure

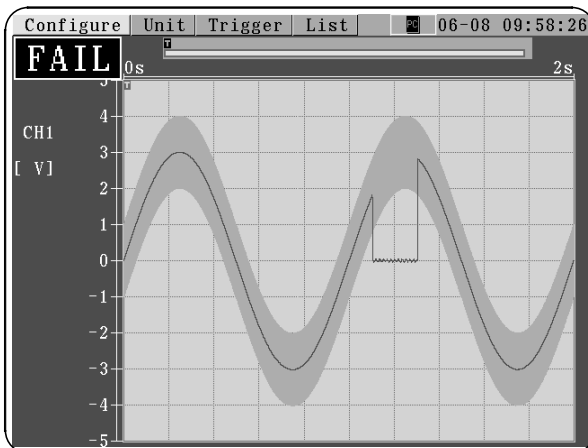
Setting Screen → Area → • Stop Mode (PASS, FAIL, PASS&FAIL)



1. Press the **COMP SETTINGS** key, and select "Area" tag. ^(Note 1)
2. Use the **CURSOR** key to select "Stop Mode", then press the **ENTER** key.
3. Select a condition, then press the **ENTER** key.

NOTE

- When the "Trigger Mode" is set to "Single", measurement continues until the stop conditions are met and ends as soon as these conditions are met. When the "Trigger Mode" is set to "Repeat" or "Auto", measurement continues until the **STOP** key is pressed.
- (Note 1) The "Area" tag cannot be selected when "FAIL Mode" is "OFF" as described in 5.4.2.



Trigger Mode: When the "Trigger Mode" is "Single" with "Stop Mode" set to "FAIL", measurement ends when the result is FAIL.

5.5 Value Comparison Details

- This section explains the parameters set under the "Value" tag.
- The value calculation result is checked to determine whether it is between the upper and lower limits. This enables the detection of an abnormal waveform that deviates from the set range. The comparison result (PASS or FAIL) is output from an external control terminal. (For details, see 8.5.1)
- Make setting separately for each channel (except on the 8730-10).
- Up to four calculations (No.1 to No.4) may be set. Calculations are made in order from No.1 to No.4.
- Value calculations can also be made without comparison.
- The results of value calculations can be saved (see 4.2.9⑥ and 6.4.11 No. 5)

5.5.1 Flow of Setting Value Comparison and Measurement

- This section describes the minimum settings and operating procedure.
- This function makes calculations on a waveform to be stored.

1. Value Comparison Setting

OFF: Does not conduct value comparison.

ON : Conducts value comparison. Value calculations without comparison can also be made.

2. Define the types of value calculations

- Set the type and comparison of each calculation (No.1 to No.4).

3. Specify the range of calculations

- Select whether to calculate for the entire waveform or a specified range.

4. Set the stop conditions

- Select whether to stop measurement with PASS or FAIL.
- The stop conditions may be combined with those for waveform area comparison.

5. Press the START key to start measurement. Calculations and value comparison are conducted on the stored waveform

- The comparison result is displayed on the screen and output from an external control terminal.
- The value calculation result is displayed at the bottom of the screen.



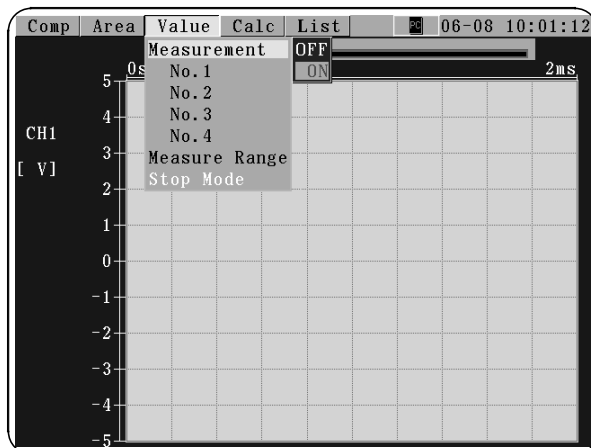
- When the "Trigger Mode" is set to "Single", measurement continues until the stop conditions are met and ends as soon as these conditions are met. When the "Trigger Mode" is set to "Repeat" or "Auto", measurement continues until the STOP key is pressed.
- Enabling the auto save function saves the data when the stop conditions are met.
- For information on saving value calculation results, see (6) in 4.2.9 and 5 in 6.4.11.

5.5.2 Value Comparison

- Turns value comparison ON/OFF.
- When this setting is ON, you can set the parameters for value comparison.
- Even if this comparison is turned OFF, the 8731-10, 8731-10 retains the settings so that you do not need to set them again each time you turn this setting ON or OFF.

Setting Procedure

Setting Screen: Value → • Setting

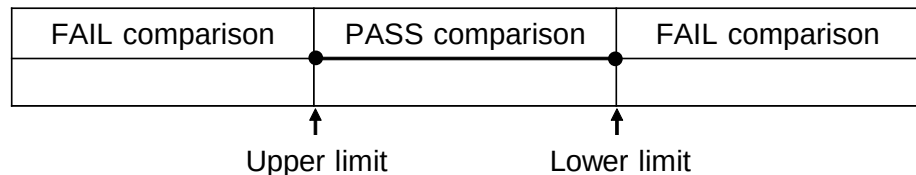


1. Press the **COMP SETTINGS** key, and select "Value" tag.
2. Select a value on the menu, then press the **ENTER** key.
3. Use the **CURSOR** key to select "OFF" or "ON", then press the **ENTER** key.

OFF: Does not conduct value comparison.
 ON : Conducts value comparison.
 Calculations without comparison can also be made.

5.5.3 Value Calculations

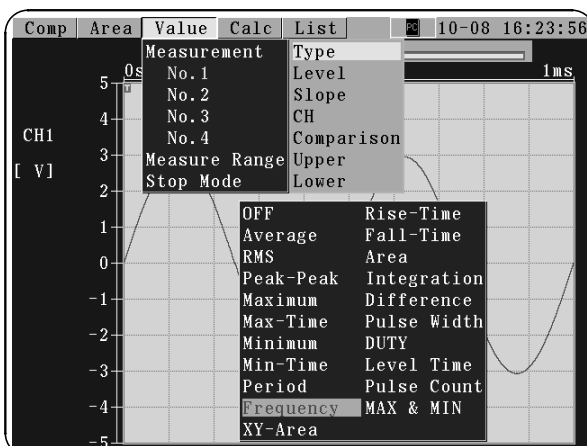
- The upper and lower limits are set for each calculation result. The calculation result is FAIL if the result falls outside this range.
- You can set up to four calculations (No.1 to No.4).



1. Calculation Type Setting

Setting Procedure

Setting Screen: Value → • No.1 to No.4 (20 kinds of settings such as "Average" etc.)



1. Press the **COMP SETTINGS** key, and select "Value" tag
2. Select "No.1" to "No. 4" on the menu, then press the **ENTER** key.
3. Move the cursor to "Type", then press the **ENTER** key.
4. Select a item, then press the **ENTER** key. (See the following page for details of calculations.)

- Listed below are the types of calculation available for value comparison.

Average	Minimum	Rise-Time	Pulse Width
RMS	Min-Time	Fall-Time	DUTY
Peak-Peak	Period	Area	Level Time
Maximum	Frequency	Integration	Pulse Count
Max-Time	XY-Area	Difference	MAX & MIN

(1) OFF

No calculations are made.

(2) Average

Obtains the average [V] of waveform data.

<Formula>

AVE: Averaging value

n: Source number of data

di: "i"th data of the channel

$$AVE = \frac{1}{n} \sum_{i=1}^n di$$

(3) RMS

Obtains the RMS[V] of waveform data.

When scaling is ON, calculation is made after the waveform data is scaled.

<Formula>

RMS: RMS

n: Source number of data

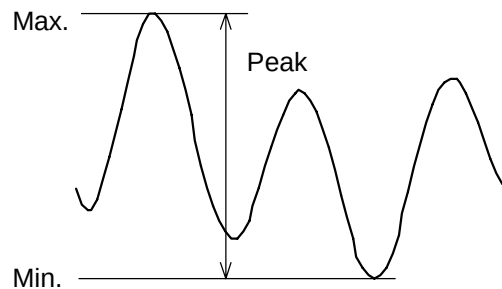
di: "i"th data of the channel

$$RMS = \sqrt{\frac{1}{n} \sum_{i=1}^n di^2}$$

(4) Peak-Peak

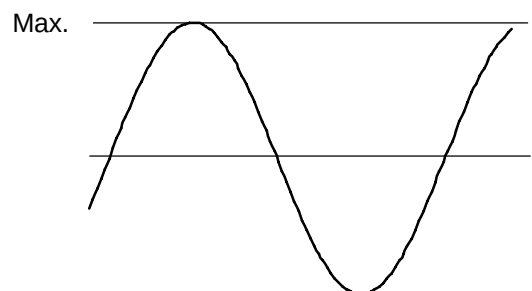
Obtains the peak-to-peak value

(Max. - Min.) [V] of waveform data.



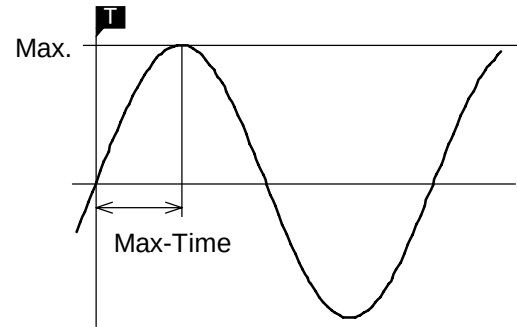
(5) Maximum

Obtains the maximum value [V] of waveform data.

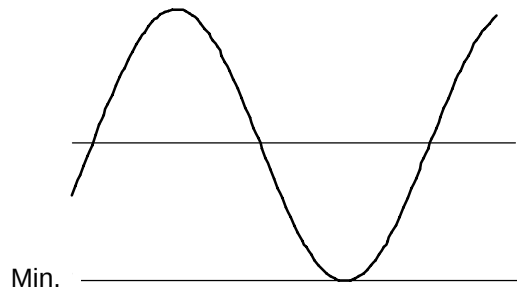


(6) Max-Time

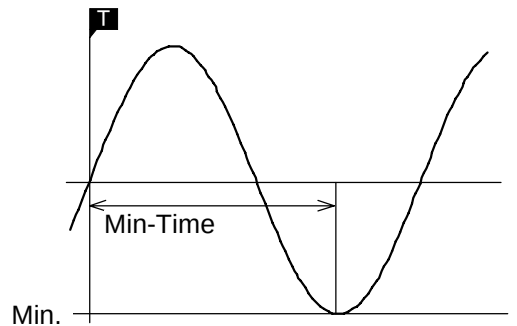
- Obtains the time at which the maximum value is measured and obtains the difference (time [s]) between that time and the trigger time.
(Note that measuring the maximum value before the trigger due to pre-trigger will result in a negative value.)
- When the maximum value is measured at multiple points, only the first measurement is used as the maximum value.

**(7) Minimum**

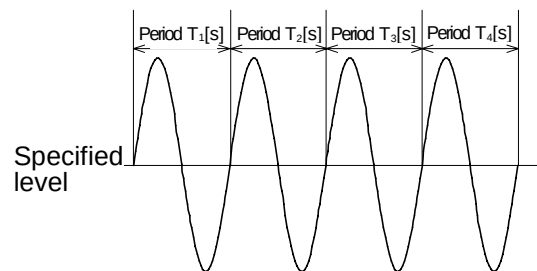
Obtains the minimum value [V] for waveform data.

**(8) Min-Time**

- Obtains the time at which the minimum value is measured and obtains the difference (time [s]) between that time and the trigger time.
(Note that measuring the minimum value before the trigger due to pre-trigger will result in a negative value.)
- When the minimum value is measured at multiple points, only the first measurement is used as the minimum value.

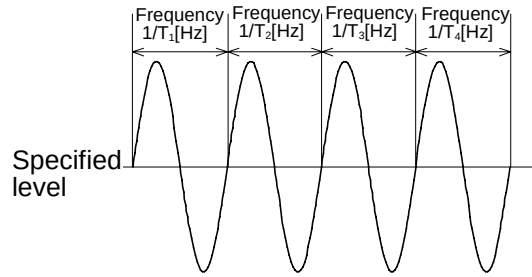
**(9) Period**

- Obtains the period T [s] of waveform data.
- Determines the period from the intervals between the points where the waveform crosses the specified level in the same slope direction, and calculates maximum and minimum values.
- The diagram at the right shows an up-slope case.
(Maximum period) = $\max\{T_i\}(i=1,2,3\dots)$
(Minimum period) = $\min\{T_i\}(i=1,2,3\dots)$

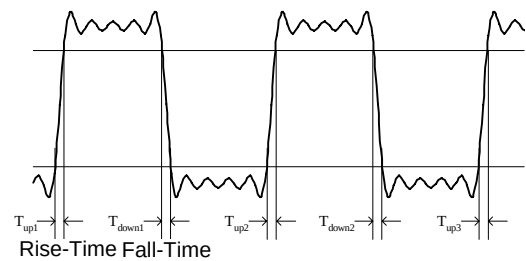


(10) Frequency

- Obtains the frequency $f (= 1/T)$ [Hz] of waveform data.
- Determines the frequencies from the intervals between the points where the waveform crosses the specified level in the same slope direction, and calculates maximum and minimum frequencies.
- The diagram at the right shows an up-slope case.
 (Maximum frequency) = $\max\{1/T_i\}(i=1,2,3\dots)$
 (Minimum frequency) = $\min\{1/T_i\}(i=1,2,3\dots)$

**(11) Rise-Time,****(12) Fall-Time**

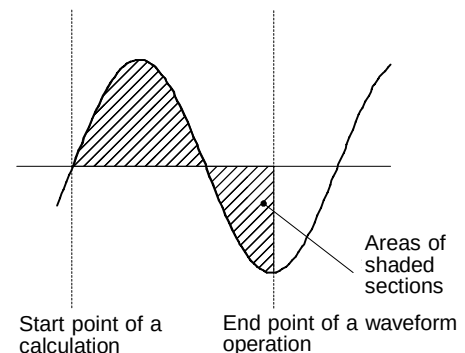
- Calculates the 0% and 100% levels of stored waveform data using a histogram. Obtains the rise time from 10% to 90% (fall time from 90% to 10%) [s].
- Obtains the Rise-Time (Fall-Time) of the waveform within the range for calculation and selects the maximum and minimum values.
 (Maximum Rise-Time) = $\max \{T_{upi}\}(i=1,2,3\dots)$
 (Minimum Rise-Time) = $\min \{T_{upi}\}(i=1,2,3\dots)$
 (Maximum Fall-Time) = $\max \{T_{downi}\}(i=1,2,3\dots)$
 (Minimum Fall-Time) = $\max \{T_{downi}\}(i=1,2,3\dots)$

**NOTE**

When using an inadequate number of points for calculation, note that the calculation results may not be accurate.

(13) Area

- Obtains the areas [V*s] of sections enclosed within the zero position (potential of 0V) and signal waveform.
- Specifying a range obtains the areas of sections between the range-specifying cursors.

**<Formula>**

$$S = \sum_{i=1}^n |di| \cdot h$$

S: Sections

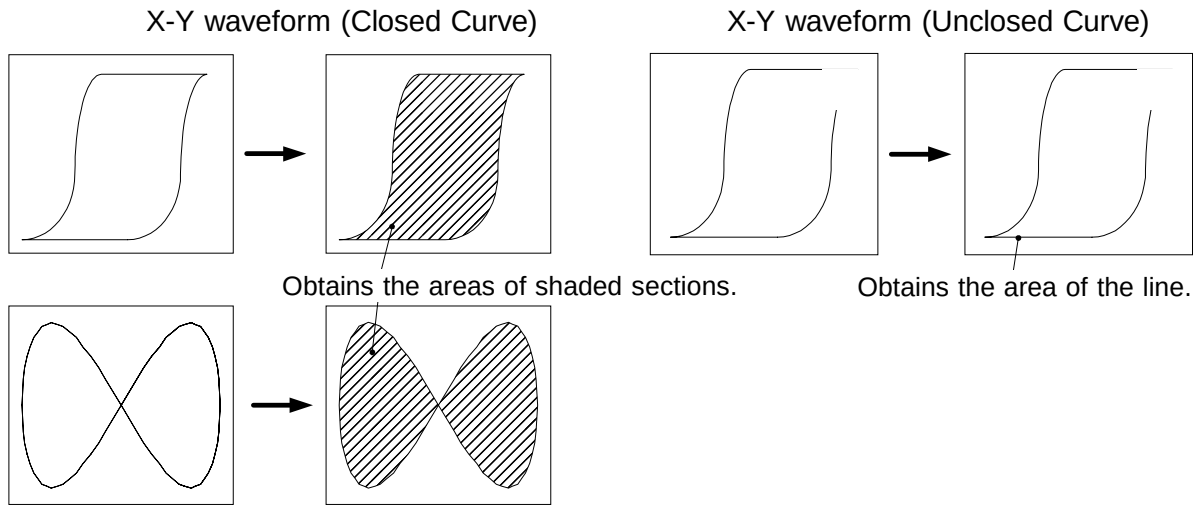
n: Number of data

di: "i"th data of the channel

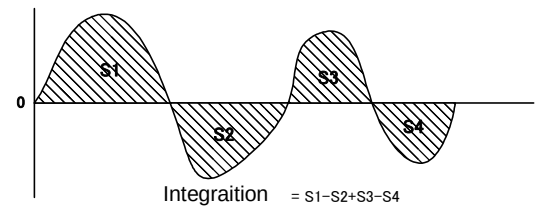
$h = \Delta t$: Sampling Period

(14) XY-Area

- Obtains the area [V2] of an X-Y synthesized waveform.
- Calculates the areas enclosed in lines of the waveform on the X-Y screen.
- Specifying a range obtains the areas of sections between the range-specifying cursors.

**(15) Integration**

- Adds all data from the start of the calculation range. A negative value is added with its sign.

**<Formula>**

$$\text{SUM} = \sum_{i=1}^n d_i$$

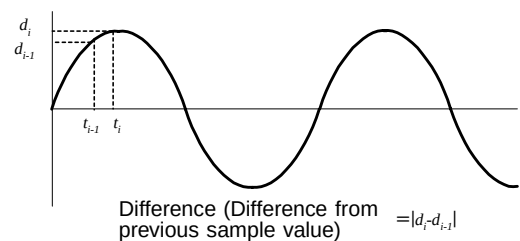
SUM: Integration

n: Total number of data

di: "i"th data of the channel

(16) Difference

- Obtains the difference between the current data and previous data.
- Obtains the difference of the waveform within the range for calculation and selects the maximum values.

**<Formula>**

$$\text{DIFF} = |d_i - d_{i-1}|$$

DIFF: Difference

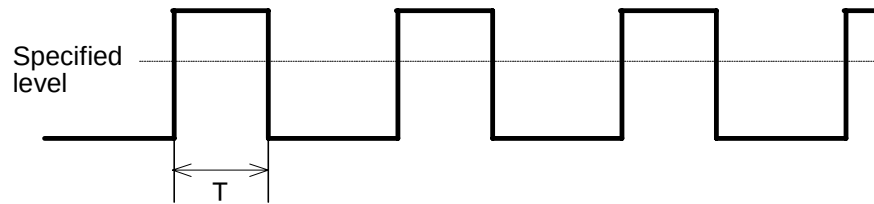
i: Current data sample

di: "i"th data of the channel

$$(\text{Maximum Difference}) = \max\{|d_i - d_{i-1}|\} \quad (i = 1, 2, 3, \dots)$$

(17) Pulse Width

- Calculates the time between the waveform crossing the specified level in the selected direction and crossing in the opposite direction.
- Obtains the pulse width of the waveform within the range for calculation and selects the maximum and minimum values.
 (Maximum pulse width) = $\max\{T_i\}(i=1, 2, 3\dots)$
 (Minimum pulse width) = $\min\{T_i\}(i=1, 2, 3\dots)$
- The diagram below shows an up-slope case. When UP is selected, the width of the "H" pulse is calculated, and when DOWN is selected, the width of the "L" pulse is calculated.



(18) DUTY

- Obtains the time from when a wave rises and crosses the specified level to when it falls and crosses the specified level. Obtains the time from when a wave falls and crosses the specified level to when it rises and crosses the specified level. Determines the ratio using both time measurements.
- Obtains the duty ratio of the waveform within the range for calculation and selects the maximum and minimum values.
 (Maximum duty ratio) = $\max\{T_i\}(i=1,2,3\dots)$
 (Minimum duty ratio) = $\min\{T_i\}(i=1,2,3\dots)$

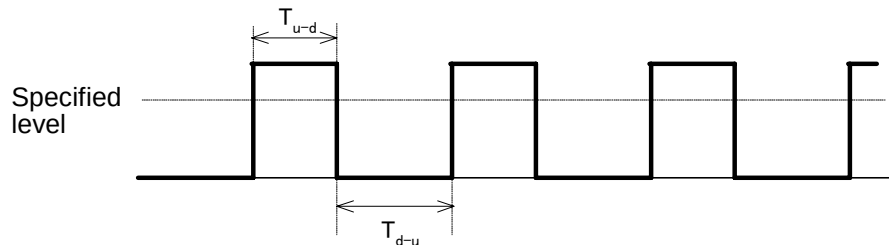
<Formula>

$$\text{Duty} = \frac{T_{u-d}}{T_{u-d} + T_{d-u}} \times 100 [\%]$$

DUTY: Duty ratio

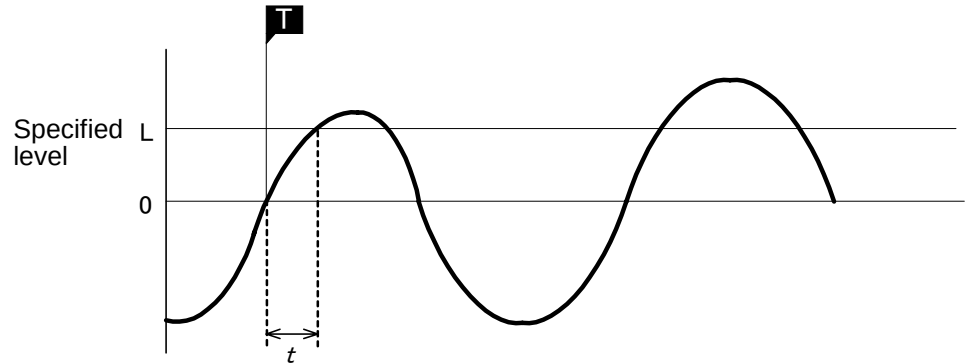
T_{u-d} : Time between rise and fall [s]

T_{d-u} : Time between fall and rise [s]

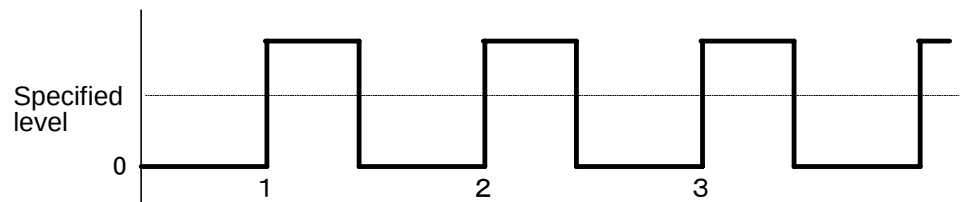


(19) Level Time (Specified Level Time)

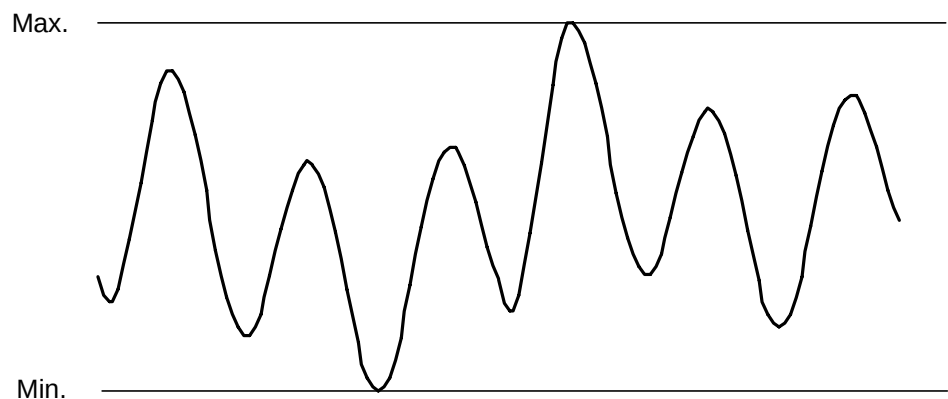
- Calculates time [in seconds] from a trigger event to the waveform first crossing the specified level in the selected direction.
(If the wave crosses the specified level before the trigger due to pre-trigger, this result will be a negative value.)
(Specified level) = L (Specified time) = t
- The diagram below shows an up-slope case.

**(20) Pulse Count**

- Counts the number of times the waveform crosses the specified level in the selected direction and then crosses again in the opposite direction.
- The diagram below shows an up-slope case. When UP is selected, the width of the "H" pulse is calculated, and when DOWN is selected, the width of the "L" pulse is calculated.

**(21) MAX & MIN**

- Obtains the maximum and minimum values of the stored waveform.

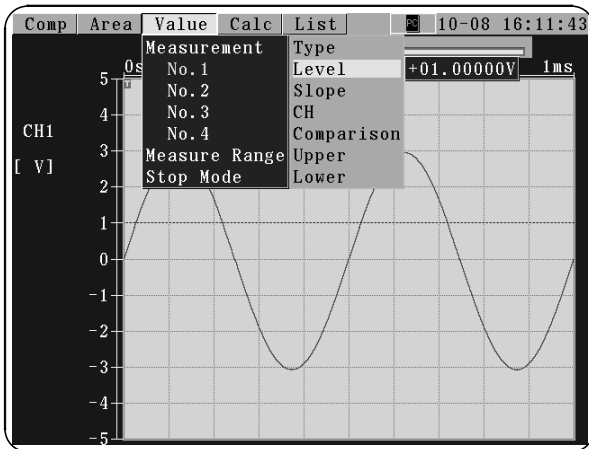
**NOTE**

- The calculation results of (9) to (12) above may not be displayed, depending on the waveform.
- When scaling is ON, calculations are made after the waveform data is scaled. The unit will be the one set for scaling.

2. Setting Specified level (Level)

- Set the specified level to use as a reference for period, frequency, pulse width, duty ratio, specified level time, and pulse count.

Setting Procedure

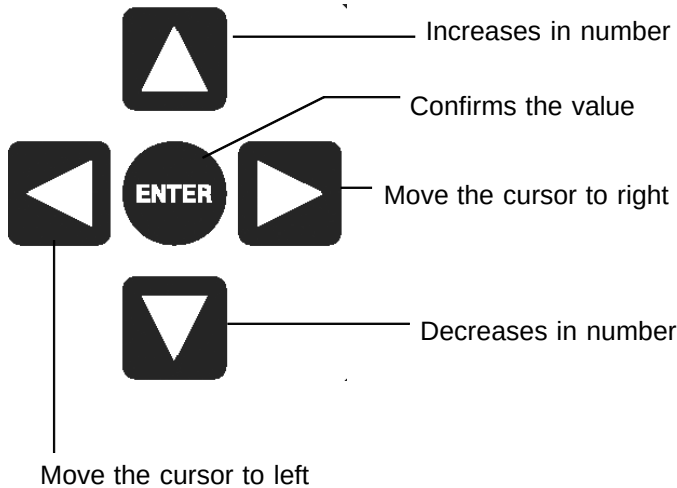


1. Move the cursor to "Level" ^(Note), then press the **ENTER** key.
2. Use the **CURSOR** key to change the numeric value, then press the **ENTER** key to confirm the change.

NOTE

- (Note) This can only be selected when the type of calculation uses the specified level.
- When using waveform calculations (See 5.6), make the setting using LSB (minimum resolution).

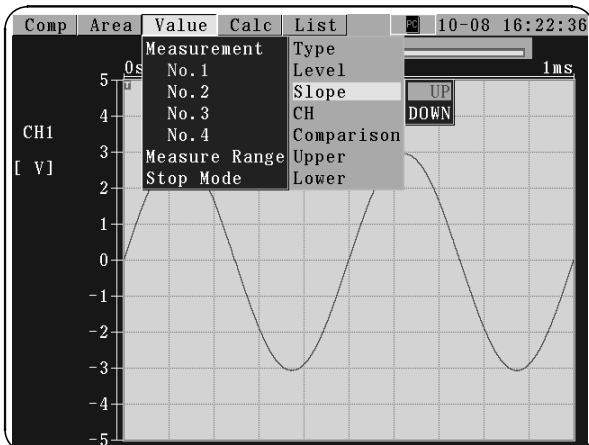
Edit value of specified level



3. Setting Slope

- Select the slope direction to serve as the measurement reference for period, frequency, pulse width, specified level timing and pulse count.

Setting Procedure



1. Move the cursor to "Slope" ^(Note), then press the **ENTER** key.
2. Use the **CURSOR** key to select the slope, then press the **ENTER** key.

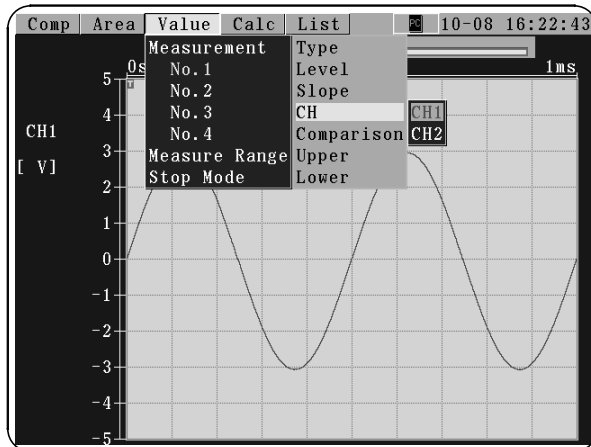
UP : Up-slope
DOWN: Down-slope

NOTE

- (Note) This selection can be made when the calculation type involves the slope direction.

4. Setting Calculation Channel (8731-10 Only)

Setting Procedure



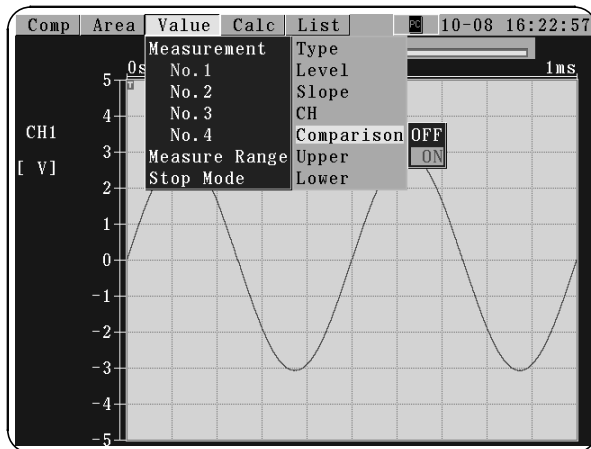
1. Move the **CURSOR** key to "**CH**", then press the **ENTER** key.
2. Select the desired channel for calculation, then press the **ENTER** key.

CH1: Performs calculations on CH1 data.

CH2: Performs calculations on CH2 data.

5. Setting the Comparison of Value Calculation

Setting Procedure



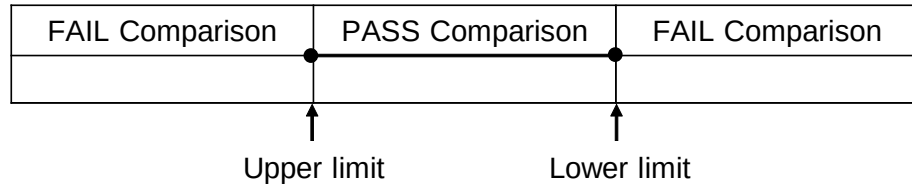
1. Move the **CURSOR** key to "**Comparison**", then press the **ENTER** key.
2. Select "**ON**" or "**OFF**", then press the **ENTER** key.

ON : Conducts value comparison.

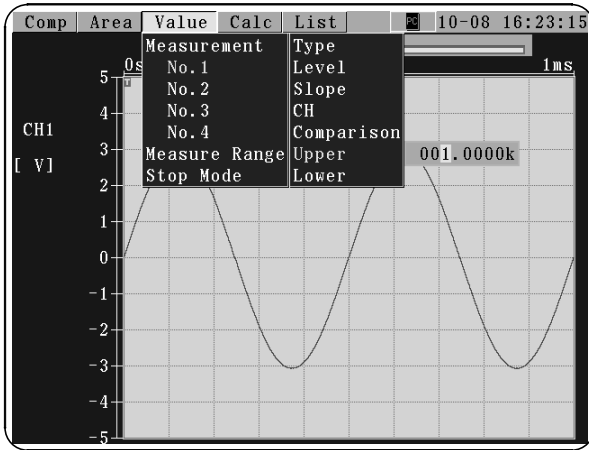
OFF: Does not conduct value comparison.

6. Setting of the Upper limit and Lower limit

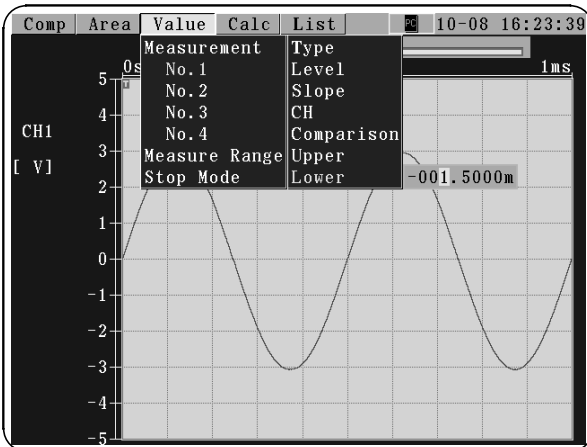
- Checks whether the value calculation result is within the upper and lower limits.



Setting Procedure



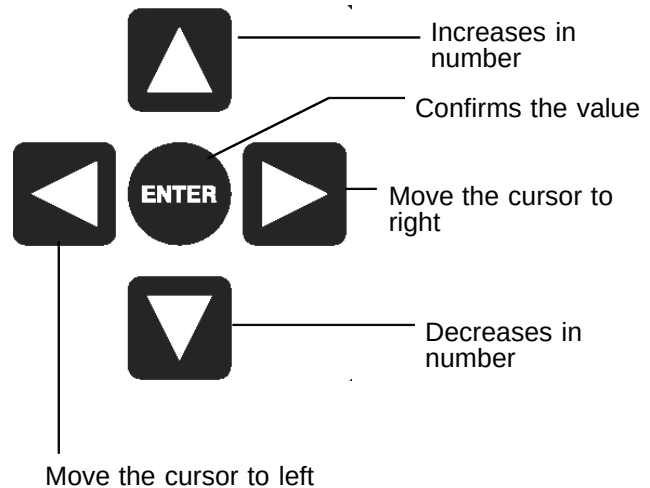
Setting of the Upper limit



Setting of the Lower limit

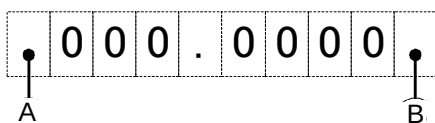
1. Move the **CURSOR** key to "**Upper**", then press the **ENTER** key.
2. Use the **CURSOR** key to change the value, then press the **ENTER** key to confirm the change.
3. Move the **CURSOR** key to "**Lower**", then press the **ENTER** key.
4. Use the **CURSOR** key to change the value, then press the **ENTER** key to confirm the change.

Setting of the Upper limit / Lower limit



NOTE

- The input fields for the upper limit and lower limit are both nine digits (excluding the decimal point), as shown in the figure below. Sign and prefix can be entered in digits A and B.
- A: Displays a blank, -, or *. A blank indicates a positive value; a - indicates a negative value. The * indicates "don't care" and the setting is ignored. For example, to output FAIL only when voltage exceeds 3V, set the upper limit to 3 and enter * for the lower limit. Only the upper limit is used for value comparison. Enter * and press the **ENTER** key. The setting will be displayed as [*000.000].
- B: Displays a blank or SI prefix. For details of SI prefix, see 13.2.5.
- Setting "**Scaling**" (see 4.3.8) "**ON**" displays the scaled values.

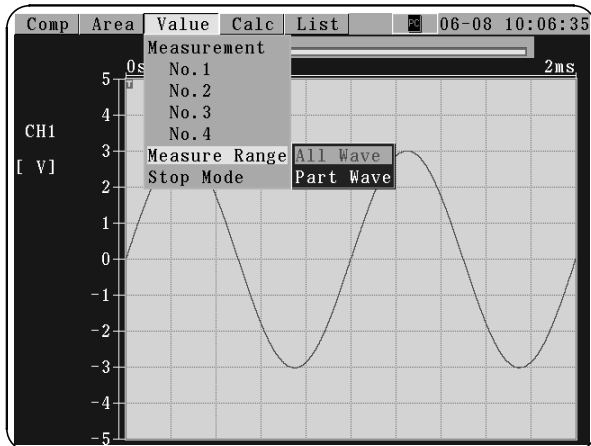


5.5.4 Setting Calculation Range

- Sets a value calculation range.
- Value calculations are performed on data in the range between the two range-specifying cursors.

Setting Procedure

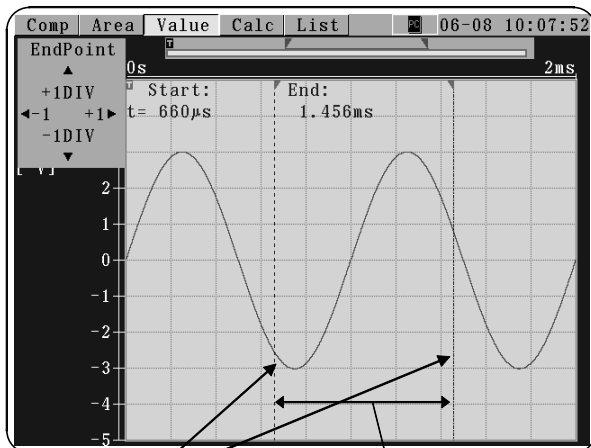
Setting Screen: Value → • Measure Range (All Wave, Part Wave)



1. Press the **COMP SETTINGS** key, and select "Value" tag.
2. Select "Measure Range", then press the **ENTER** key. ^(Note 1)
3. Select "All Wave" or "Part Wave", then press the **ENTER** key.

All Wave : Performs calculations on all data.

Part Wave : Performs calculations on data within the specified range.

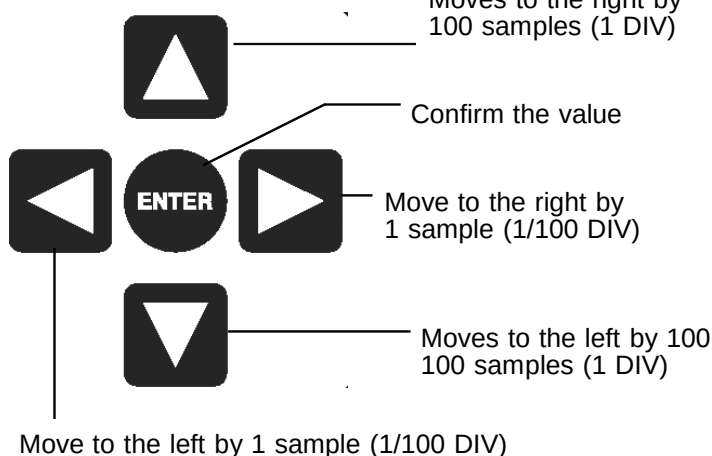


Range-specifying cursor

Calculations are performed on data in this range

Screen with a range specified

Specifying select range



NOTE

- (Note 1) This selection requires that "Measurement" be set "ON" under the "Value" tag.
- The ▼ mark appears at the start point and end point.
- A line is displayed as the range-specifying cursor is being moved.

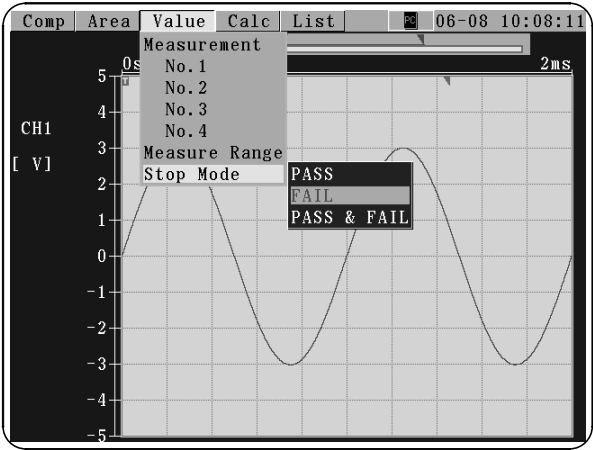
5.5.5 Stop Conditions of the Value Comparison

- The 8730-10, 8731-10 may be set to halt measurement according to the result of value comparison (PASS or FAIL). Enabling the auto save function saves the data (see 4.2.9 for details).
- When area comparison is also selected, measurement ends according to the common stop conditions (see 5.2.1 for details).

Stop Mode	Details
PASS	Stops measurement when value comparison result is PASS.
FAIL	Stops measurement when value comparison result is FAIL.
PASS&FAIL	Stops measurement when value comparison result is PASS or FAIL.

Setting Procedure

Setting Screen:	Value→	• Stop Mode (PASS, FAIL, PASS & FAIL)
-----------------	--------	---------------------------------------



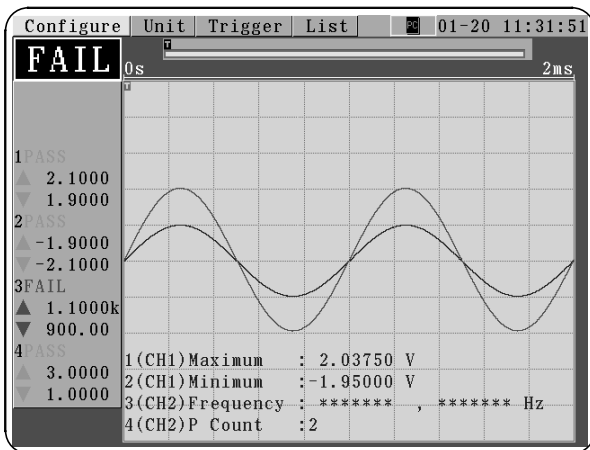
1. Press the **COMP SETTINGS** key, and select "Value" tag.
2. Select "Stop Mode" on the menu, then press the **ENTER** key.
3. Select a condition, then press the **ENTER** key.

NOTE

- When the "Trigger Mode" is set to "Single", measurement continues until the stop conditions are met and ends as soon as these conditions are met. When the "Trigger Mode" is set to "Repeat" or "Auto", measurement continues until the **STOP** key is pressed.
- When the "Trigger Mode" is set to "Repeat" or "Auto", measurement continues until the **STOP** key is pressed or STOP signal input.

5.5.6 Display of value calculation results

- Value calculations are executed automatically on the acquisition of a waveform of set recording length.
Value calculations can also be performed for waveforms already acquired or transferred from a PC card. (See 5.2.8)
- If a value comparison is set, a comparison is made to determine if the value of the calculation result falls within the range defined by the upper and lower limits.
- The value calculation result is displayed at the bottom of the screen, as shown below.
If the calculation cannot be executed properly, "*****" is indicated. In such cases, the comparison result will be "FAIL."
- The value comparison result can be displayed on the left side of the screen. (See 4.2.7)



The left diagram shows an example of a FAIL for value calculation No. 3.

- The value calculation result No. 3 is indicated as "*****."
- The value comparison result No. 3 is "FAIL."

The overall comparison result at the upper-left corner of the screen will be "FAIL."

The overall comparison result will be "PASS" when all comparison results are "PASS." If even one "FAIL" comparison result is obtained, the overall comparison result will be "FAIL."

If two values, the maximum value and minimum value, are calculated (e.g., for frequency), the results will be displayed as "minimum value - maximum value," as shown on the left.

5.6 Waveform Calculation

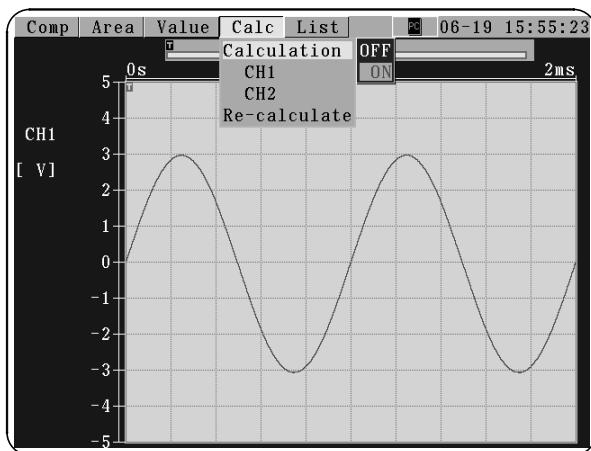
- Waveform calculations perform the four basic arithmetic operations on a stored waveform.
- Area and value comparison are both conducted on the waveform obtained by calculations.
- The A/B cursor is used to read the waveform values obtained by waveform calculations.
- When set ON, waveform calculations are automatically performed after a waveform has been stored. Waveform calculations may be performed on previously stored waveforms, as well as newly stored waveforms. (See 5.6.3)
- There are six Calculations, as shown below.
 - (1) Absolute value (ABS)
 - (2) Half-wave rectification (Rectify)
 - (3) CH1+CH2 or CH2+CH1
 - (4) CH1-CH2 or CH2-CH1
 - (5) CH1xCH2 or CH2xCH1
 - (6) CH1/CH2 or CH2/CH1
- For flow of measurement/comparison with calculations, see <<Related Issues>> in 5.2.1
- When "**Average**" is "**ON**" (see 4.2.5), waveform calculations are not available.
- Calculation turns on the variable function (see 4.3.9).
- When waveform calculation is enabled, only calculated waveforms are saved.

5.6.1 Setting the Waveform Calculation

- Turns the waveform calculation function ON/OFF.

Setting Procedure

Setting Screen: Calc → • Calculation (OFF, ON)



1. Press the **COMP SETTINGS** key, and select "**Calc**" tag.
2. Select "**Calculation**" on the menu, then press the **ENTER** key.
3. Use the **CURSOR** key to select "**OFF**" or "**ON**", then press the **ENTER** key.

OFF : Does not use the calculation function.
ON : Uses the calculation function.

NOTE

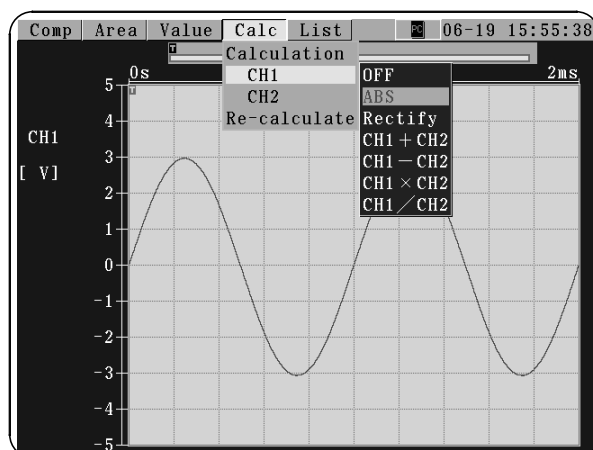
- When "**Scaling**" is "**ON**", calculations are performed on scaled values.
- When "**Average**" is "**ON**", calculations are not available. For details of averaging, see 4.2.5.

5.6.2 Setting Type of Calculation

- Sets the type of waveform calculation.

Setting Procedure

Setting Screen: Calc→ • CH1 (CH2)



**COMP
SETTINGS**

1. Press the **COMP SETTINGS** key, and select "**Calc**" tag.
2. Select "**CH1**" on the menu, then press the **ENTER** key.
3. Use the **CURSOR** key to select an item, then press the **ENTER** key. The waveforms obtained by the calculations below will be displayed on CH1.

OFF : Does not perform calculation.
 ABS : Calculates Absolute value for CH1.
 Rectify : Calculates Half-wave rectification for CH1.
 CH1+CH2 : Calculates CH1+CH2.
 CH1-CH2 : Calculates CH1-CH2.
 CH1xCH2 : Calculates CH1xCH2.
 CH1/CH2 : Calculates CH1/CH2.

4. When using the 8731-10, also be sure to set the type for "**CH2**". The waveforms obtained by the following calculations will be displayed on CH2.

OFF : Does not perform calculation.
 ABS : Calculates Absolute value for CH2.
 Rectify : Calculates Half-wave rectification for CH2.
 CH2+CH1 : Calculates CH2+CH1.
 CH2-CH1 : Calculates CH2-CH1.
 CH2xCH1 : Calculates CH2xCH1.
 CH2/CH1 : Calculates CH2/CH1.

NOTE • For the 8730-10, only "**ABS**" and "**Rectify**" are available.

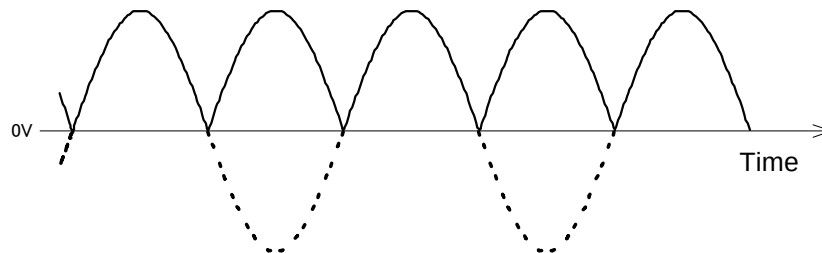
- Shown below are the types of waveform calculations available for calculations.

(1) Four basic operations (+, -, x, /)

Performs addition, subtraction, multiplication, and division for the waveforms between channels.

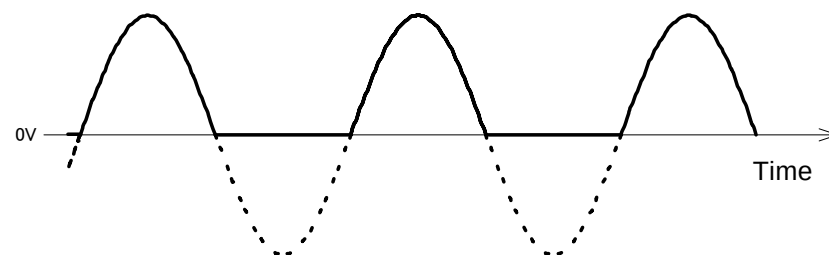
(2) ABS (Absolute value)

Calculates the absolute value of the input waveform (i.e., negative values are regarded as positive) and displays it on the screen.



(3) Rectify (Half-wave rectification)

Calculates half-wave rectification of the input waveform (with a negative value converted to zero) and displays it on the screen.

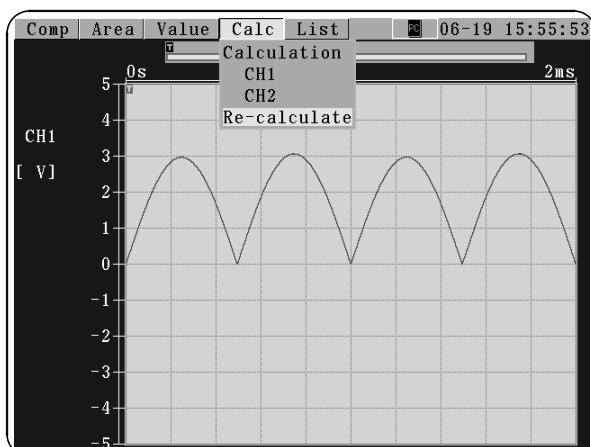


5.6.3 Re-calculation

- Repeats calculations on a previously stored waveform.
- Normally, waveform calculations are performed automatically as a waveform is stored. Repeat calculation for another type of calculation on the waveform.

Setting Procedure

Setting Screen: Calc → • Re-calculate



**COMP
SETTINGS**



1. Press the **COMP SETTINGS** key, and select "Calc" tag.
2. Select "Re-calculate" on the menu, then press the **ENTER** key.
3. Press the **ENTER** key to repeat calculation.

NOTE

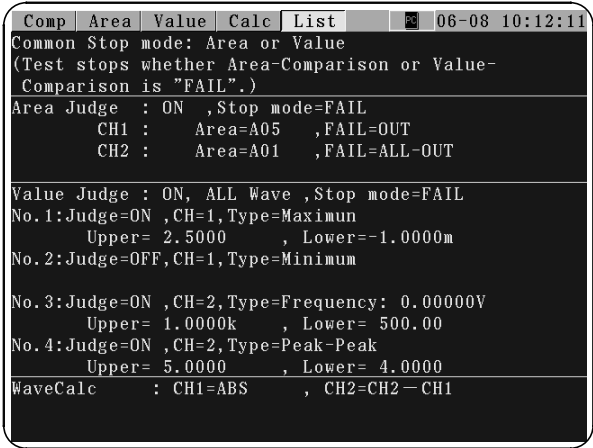
- Waveform once calculated cannot be re-calculated.

5.7 List

- "List" displays a list of various parameters set with the **COMP SETTINGS** key.

Display Procedure

Setting Screen:	List
-----------------	------



"List" of comparison settings

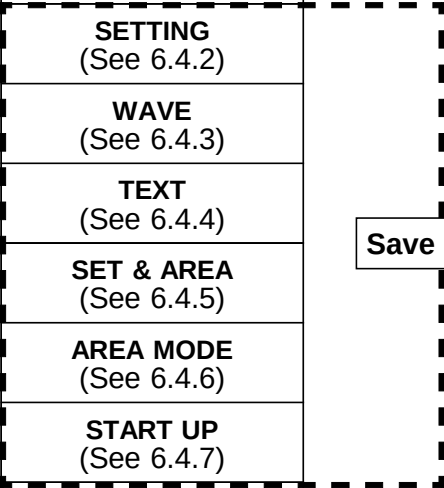


1. Press then **COMP SETTINGS** key, then using the **CURSOR** key to select "List" tag.
The four lists below are displayed.
 - Common Stop Conditions
 - Area Comparison
 - Value Comparison
 - Wave Calculation
2. Press the **COMP SETTINGS** key to return to the previous screen.

Chapter 6

Saving and Loading Data

The File screen lets you set the commands below.

FILE Key (See 6.4)	LOAD (See 6.4.1)	 Save command
	SETTING (See 6.4.2)	
	WAVE (See 6.4.3)	
	TEXT (See 6.4.4)	
	SET & AREA (See 6.4.5)	
	AREA MODE (See 6.4.6)	
	START UP (See 6.4.7)	
	MAKE DIR (See 6.4.8)	
	DELETE (See 6.4.9)	
	ALL CLR (See 6.4.10)	

6.1 Overview

The File screen has the following functions:

Saving and loading of measurement data and setting data

- Data may be saved to or loaded from a PC card.

6.2 PC Card

- A PC card (Compact Flash) may be used to save data and other purposes
- Use HIOKI optional PC cards. The PC cards come in six sizes or capacities (32MB to 1GB), as shown below.



Use only PC Cards sold by HIOKI.

Compatibility and performance are not guaranteed for PC cards made by other manufacturers. You may be unable to read from or save data to such cards. Also, using PC cards other than HIOKI optional PC cards may lead to loss of data on the PC card.

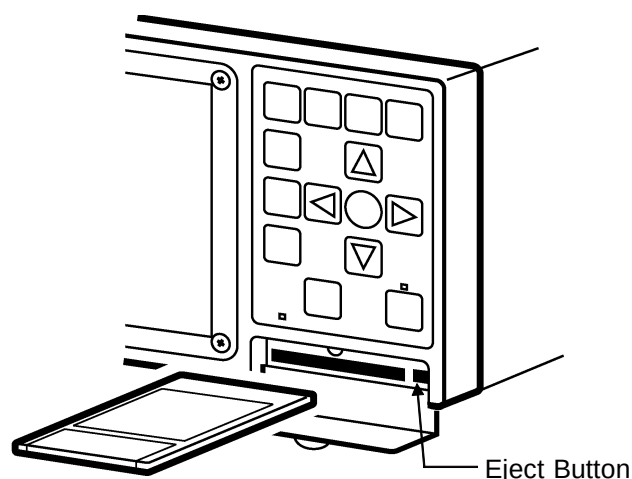


- Although the PC cards have a function to prevent incorrect insertion, do not forcibly insert a card into the slot. This will prevent possible malfunction of the 8730-10, 8731-10 and PC card.
- Forcibly inserting a PC card into the slot or inserting it upside down may damage the PC card slot or result in PC card malfunctions.
- Do not insert or remove the PC card during measurement or command execution. This will prevent possible malfunction of the 8730-10, 8731-10 and PC card.
- Before shipping, be sure to remove the PC card to avoid damage to the instrument.
- When formatting a PC card on a PC, use the FAT-16 format. Formatting a card in FAT-32 format may result in incompatibility problems.

• Option

9626: PC CARD 32M	[Set of the PCMCA Adapter and Compact Flash, 32MB]*
9627: PC CARD 64M	[Set of the PCMCA Adapter and Compact Flash, 64MB]*
9726: PC CARD 128M	[Set of the PCMCA Adapter and Compact Flash, 128MB]
9727: PC CARD 256M	[Set of the PCMCA Adapter and Compact Flash, 256MB]
9728: PC CARD 512M	[Set of the PCMCA Adapter and Compact Flash, 512MB]
9729: PC CARD 1G	[Set of the PCMCA Adapter and Compact Flash, 1GB]
*: discontinued product	

Insert the PC card



- Gently insert the PC card all the way into the PC card slot of the 8730-10, 8731-10.
- Confirm that the PC card is inserted in the ▲ mark direction on the card, as shown on the left.

6

Removing the PC card

- To remove the PC card, press the eject button as shown in the figure above.

CAUTION

Take appropriate steps to avoid electrostatic discharge when inserting and removing the PC Card. Electrostatic discharge could damage the instrument and the PC Card.

Using a PC Card on Personal Computer

- When using the PC card on a PC, refer to help information for the PC card adapter and OS used.
- For Windows 95/98/Me/2000/XP^(Note 1), simply insert the PC card into the PC card slot.

NOTE

(Note 1) Windows is a registered trademark of Microsoft Corporation.

6.3 Saveable Data

- The following data can be stored on a PC card:

1. Screen data (BMP)

- Screenshots for the 8730-10, 8731-10 are saved as bitmap files (BMP).
- The bitmap file is a standard graphic format for Windows^(Note 1) and compatible with many graphic software programs.
- For the procedure for saving screen image data, see 4. in 3.1.2, or 4.2.9.

NOTE

(Note 1) Windows is a registered trademark of Microsoft Corporation in the U.S.

2. Waveform data (CSV)

- Waveform data stored on the 8730-10, 8731-10 and value calculation results is saved in text format (CSV).
- Waveform data is saved with the setting conditions (e.g., recording length, time axis, voltage axis, scaling, and comments) used when saving waveform measurement data.

3. Waveform data (MEM)

- The measurement data for waveforms stored on the 8730-10, 8731-10 is saved in binary format (MEM).
- The saved waveform data can be loaded into the 8730-10, 8731-10, and 8835-01.
- For details on file size, see 13.3.

4. Area data (ARE)

- The comparison area data is saved in ARE format.
- The saved area data can be loaded into the 8730-10, 8731-10, and 8835-01.
- When area data is loaded on the 8730-10, 8731-10, the area data saved on the PC card is loaded into the specified area No. of memory.

5. Setting data (SET)

- Setting conditions (e.g., recording length, time axis, voltage axis, scaling) are saved.
- When setting conditions are loaded on the 8730-10, 8731-10, the 8730-10, 8731-10 is set with the loaded setting conditions.

6. Index file (ROM)

- All comparison area data and comparison condition data (16 items each) saved in the internal memory of the 8730-10, 8731-10 are saved at once. The data is saved in a directory, and an index file is created.
- When an index file is loaded, the comparison area and comparison conditions are loaded together.

7. Setting & area data (S_A)

- Saves setting conditions together with the current comparison area.
- Loading this file restores the setting conditions and comparison area.

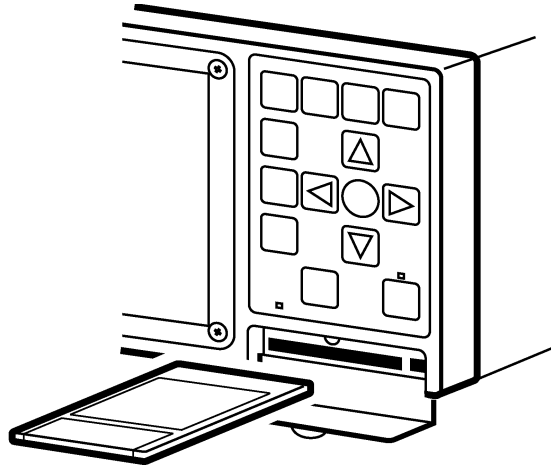
NOTE

- Storage capacity depends on the PC card type.
- Data in BMP or CSV format cannot be read by the 8730-10, 8731-10.
- Filenames may not include spaces.
- As a guide, limit the number of files within one directory to 1000. Saving a file in a directory containing many files will take longer than usual.
- Up to 512 directories and files can be created in the root directory.

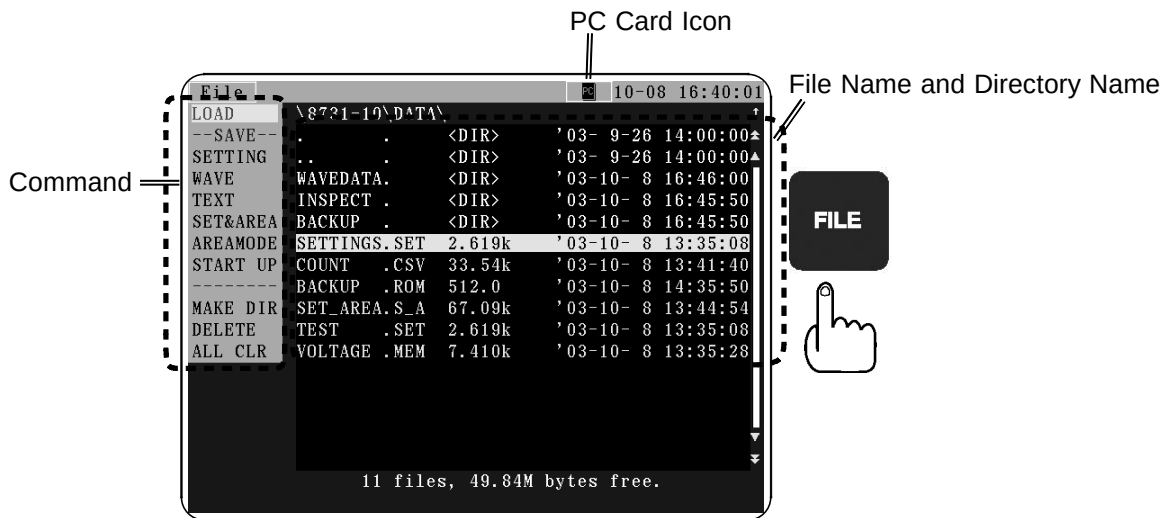
6.4 File Screen

- The File screen appears when the **FILE** key is pressed.
- The basic flow of operations is shown below.

1. Insert the PC card.



2. Press the FILE key to display the File screen.



3. Select the command.

4. Execute the command.

NOTE

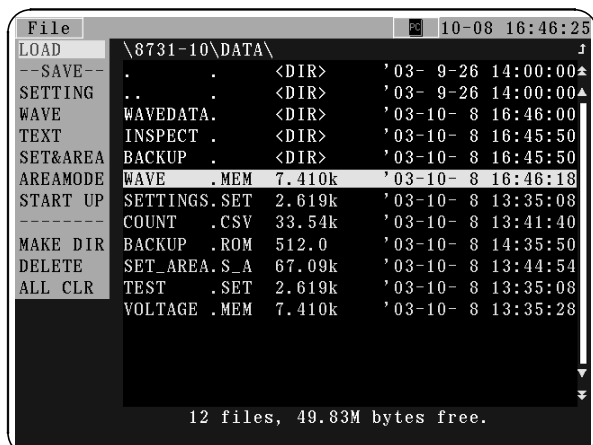
- Gently insert a PC card fully into the PC card slot. Also be sure to gently extract the PC card.
- When working on data saved on a PC card, make sure that the PC card icon appears on the screen.
- After being powered on, the 8730-10, 8731-10 searches for the START UP file (see 6.4.7). Do not insert or extract the PC card until the opening screen closes.

6.4.1 Loading the Data

- Transfers the 8730-10, 8731-10's setting conditions, waveform data, or area data from a PC card to the internal memory of the 8730-10, 8731-10.
- When loading measurement data, the channel can be specified.
- You can switch channels by using this command, for example, to read CH1 data from the PC card to CH2 of the 8730-10, 8731-10.

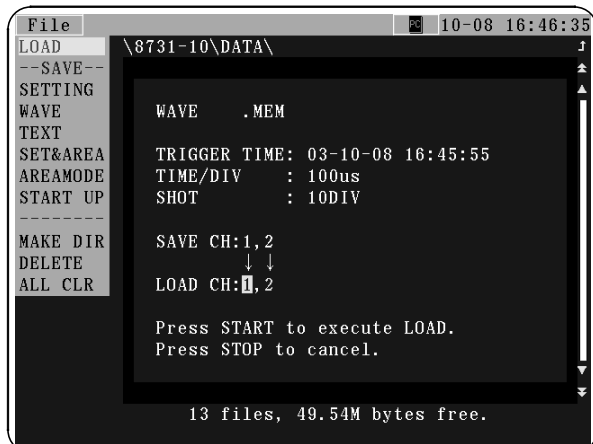
Procedure

Command: **LOAD**



FILE

1. Press the **FILE** key to display the File screen.
2. Use the **CURSOR** key to select a file to load, then press the **ENTER** key.
3. When loading waveform data, specify the destination channel. ^(Note 1)
When loading area data, specify a destination area from A01 to A16.
4. Press the **START** key to start loading.
Press the **STOP** key to cancel.



START

Start the loading.

STOP

Cancel the loading.

NOTE

- Data saved in BMP format or text format (CSV) cannot be read by the 8730-10, 8731-10.
- Only files with the following extensions can be read by the 8730-10, 8731-10.
MEM : Waveform data in 8730-10 (binary) format
ARE : Area data
SET : Setting data
ROM : Index file for loading area data and comparison condition data all at once
- (Note 1) Channel selection is not possible with the 8730-10.
- The 8835-01 waveform data measured with the 8936 ANALOG UNIT can be read (up to 500 DIV).
If the waveform data are equal to or greater than 501 DIV, the waveform data file cannot be loaded.

SAVE CH: 1, 2



LOAD CH: 1, 2

Data saved on PC card

Destination channel of the 8730-10, 8731-10

SAVE CH: 1, 2



LOAD CH: -, 1

In the example as shown on the left, CH1 data and CH2 data are saved on the PC card.

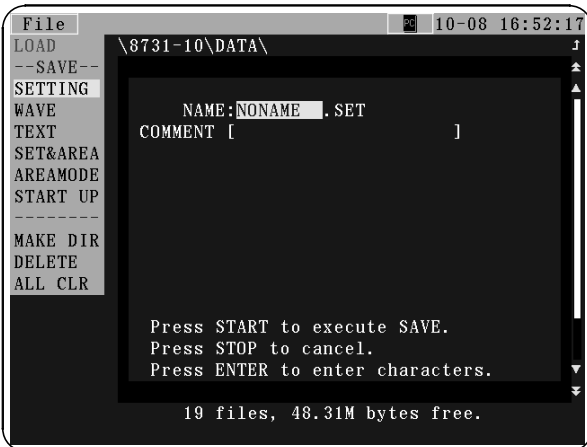
Loads the data of CH2 on the PC card to CH1. Clears the waveform of CH2.

6.4.2 Saving the Setting conditions (SET)

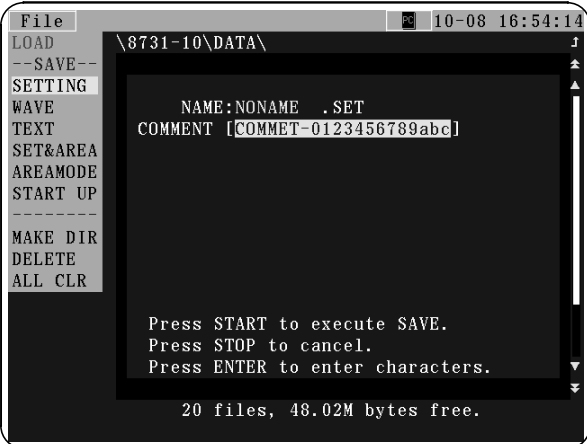
- Saves setting conditions.
- Saves all settings except for communications (LAN and RS-232C) and contrast, and the contents of comparison conditions MODE01 to MODE16, and comparison areas A01 to A16.
- When setting conditions are loaded on the 8730-10, 8731-10, the 8730-10, 8731-10 is set with the loaded setting conditions.
- If a settings file is saved with a file comment, the comment will appear at the top of the screen when the file is loaded (with "Info (Upper)" set to "Comment"). (See 4.2.8 for details.)

Procedure

Command: SETTING



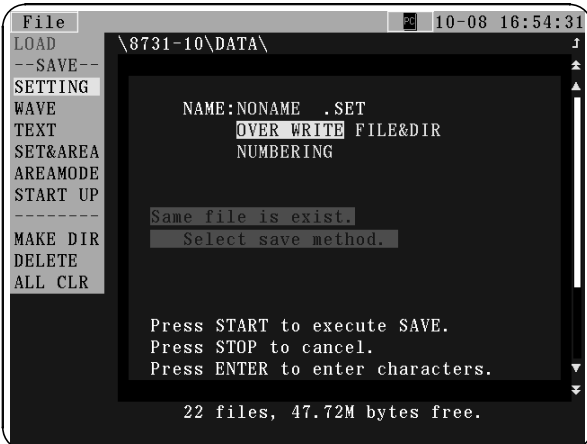
1. Press the **FILE** key, and display the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**SETTING**", then press the **ENTER** key.
4. Enter a filename. For details, see 8. in 3.1.2.
5. To enter a file comment, move the cursor to the comment field and enter a comment as described in 4.
6. Press the **START** key to save the data; press the **STOP** key to cancel.



Starts saving.

Cancels saving

Screen image when input file comment



NOTE

- If the amount of data is too large, the data may not be successfully saved on the PC card. For details, see 13.3.
- It is possible to save without input any file comment.
- If a file with the same name already exists, a warning message will appear. Rename the file in step 4 above or save the file by one of the following two methods:
OVER WRITE : Overwrite the existing file.
NUMBERING : Append a number to the filename.

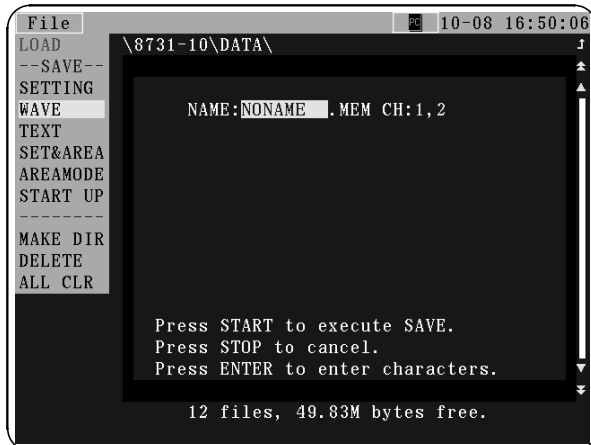
If a file with the same name already exists, a warning message will appear

6.4.3 Saving the Waveform Data (MEM)

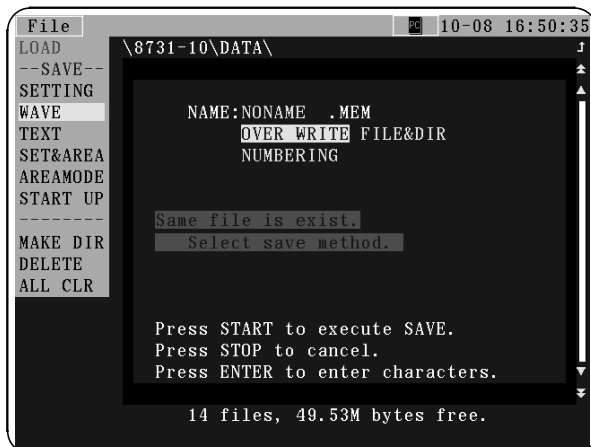
- Saves 8730-10, 8731-10 waveform data to a PC card.
- The data is saved in binary format (MEM).
- When data in MEM format is read by the 8730-10, 8731-10, the saved waveform will appear on the screen.

Procedure

Command: WAVE



1. Press the **FILE** key, and display the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**WAVE**", then press the **ENTER** key.
4. Enter a filename. For details, see 8. in 3.1.2.
5. Use the up and down **CURSOR** keys to move the cursor to "**CH**" and select the channel for which to save data. Note that selecting "-" for a channel will not save the channel data.
6. Press the **START** key to save the data; press the **STOP** key to cancel.



Starts saving.

Cancels saving.

NOTE

- If the amount of data is too large, the data may not be successfully saved on the PC card. For details, see 13.3.
- If a file with the same name already exists, a warning message will appear. Rename the file in step 4. above or save the file by one of the following two methods:
 OVER WRITE: Overwrite the existing file.
 NUMBERING: Append a number to the filename.
- When waveform calculation is enabled, only calculated waveforms are saved.

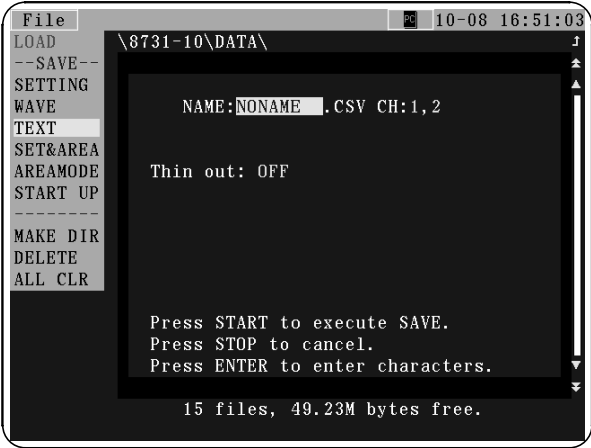
If a file with the same name already exists, a warning message will appear

6.4.4 Saving the Text Data (CSV)

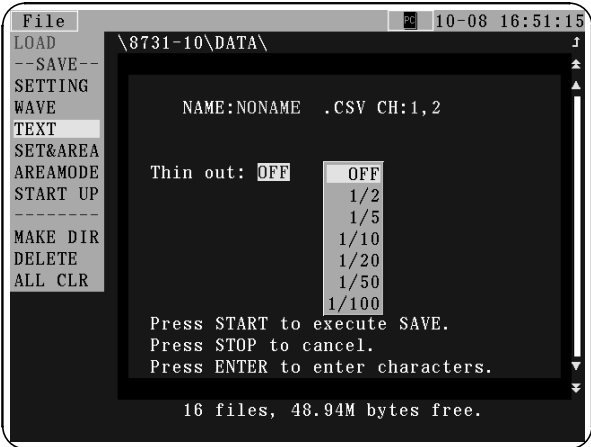
- Saves 8730-10, 8731-10 waveform data to a PC card.
- The data is saved in text (CSV) format, delimited by commas (,).

Procedure

Command: TEXT



1. Press the **FILE** key, and display the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**TEXT**", then press the **ENTER** key.
4. Enter a filename. For details, see 8. in 3.1.2.
5. Move the cursor to "**CH**" and select the channel for which to save data. ^(Note 1)
6. For intermittent saves, move the cursor to "**Thin out**" and press the **ENTER** key. Then select an item on the menu and press the **ENTER** key.
7. Press the **START** key to save the data; press the **STOP** key to cancel.



Starts saving.

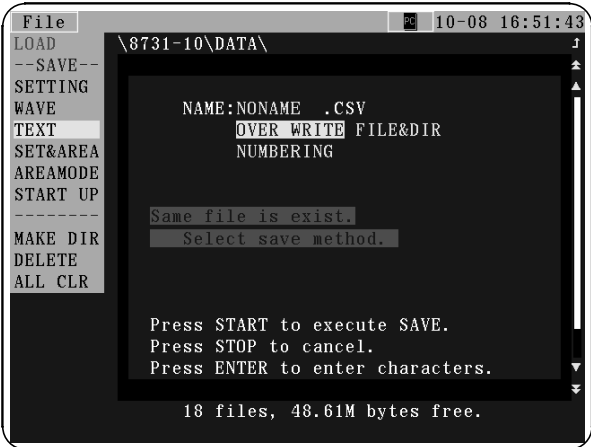


Cancels saving.

NOTE

- If the amount of data is too large, the data may not be successfully saved on the PC card. For details, see 13.3.
- (Note 1) Channel selection is not possible with the 8730-10.
- "**TEXT**" data can be loaded with personal computer only. It is not possible to load it with 8730-10, 8731-10. When loading a data with 8730-10, 8731-10, select "**WAVE**".
- If a file with the same name already exists, a warning message will appear. Rename the file in step 4 above or save the file by one of the following two methods:
OVER WRITE : Overwrite the existing file.
NUMBERING : Append a number to the filename.

Screen image when selecting "Thin out"



If a file with the same name already exists, a warning message will appear

6.4.5 Saving the Setting & Area (S_A)

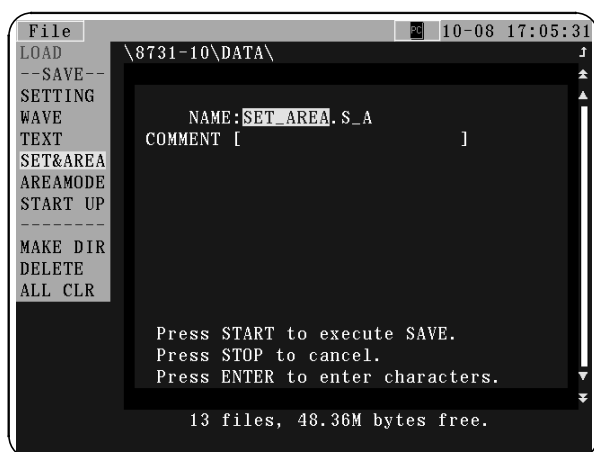
- Saves setting conditions together with the current comparison area.
- Loading this file restores the setting conditions and comparison area.
- The loaded comparison area is not stored in instrument internal memories A01 to A16.

The comparison area selection (see 5.4.2) is indicated as "A- -".

The loaded area is cleared by turning power off or by changing the area.

Procedure

Command: SET & AREA



1. Press the **FILE** key, and display the File screen.

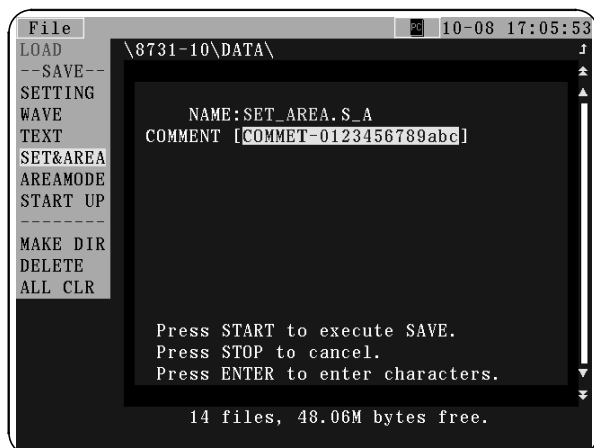
2. Press the left **CURSOR** key to move the cursor to a command.

3. Select "**SET&AREA**", then press the **ENTER** key.

4. Enter a filename. For details, see 8. in 3.1.2.

5. To enter a file comment, move the cursor to the comment field and enter a comment as described in 4.

6. Press the **START** key to save the data; press the **STOP** key to cancel.



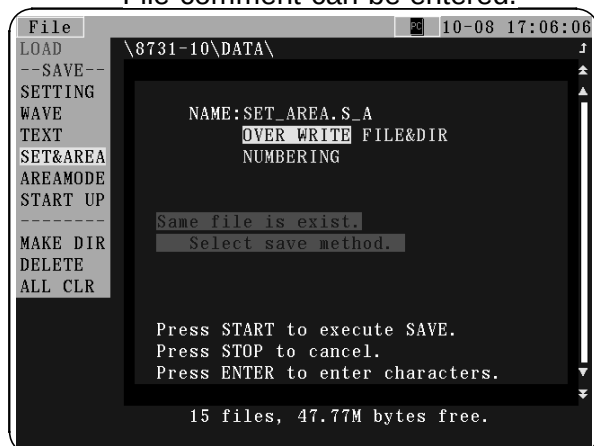
START

Starts saving.

STOP

Cancels saving

File comment can be entered.



NOTE

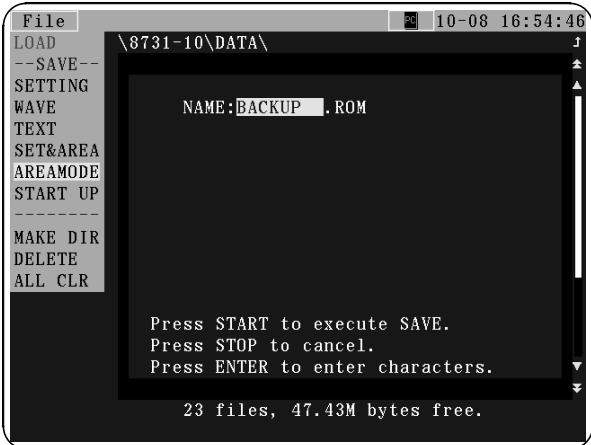
- If the amount of data is too large, the data may not be successfully saved on the PC card. For details, see 13.3.
- It is possible to save without input any file comment.
- If a file with the same name already exists, a warning message will appear. Rename the file in step 4 above or save the file by one of the following two methods:
OVER WRITE : Overwrite the existing file.
NUMBERING : Append a number to the filename.

6.4.6 Saving the Area & Modes (ROM)

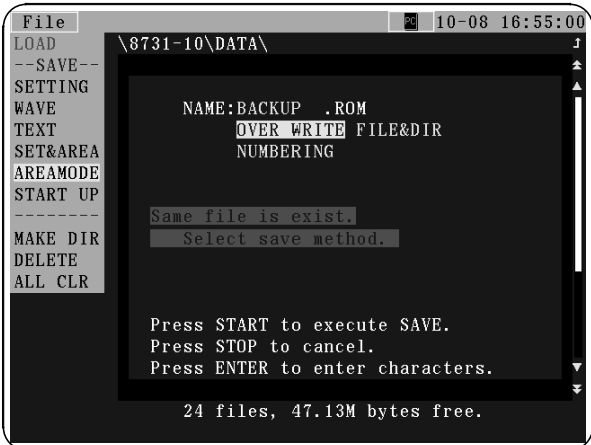
- Saves all comparison areas A01 to A16 and comparison conditions MODE01 to MODE16 in 8730-10, 8731-10 internal memory at once. Only the comparison areas and comparison conditions saved in internal memory are saved to a PC card.
- The comparison areas and comparison conditions are restored when loaded.
- For information on saving comparison areas, see 11. in 5.3.3.
- For information on saving comparison conditions, see 5.2.4.

Procedure

Command:	AREA MODE
----------	-----------



1. Press the **FILE** key, and display the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**AREAMODE**", then press the **ENTER** key.
4. Enter a filename. For details, see 8. in 3.1.2.
5. Press the **START** key to save the data; press the **STOP** key to cancel.



Starts saving.



Cancels saving

NOTE

- Do not change the folder name. Because folder information is contained in the index file, renamed folders are inaccessible.

If a file with the same name already exists, a warning message will appear

NOTE

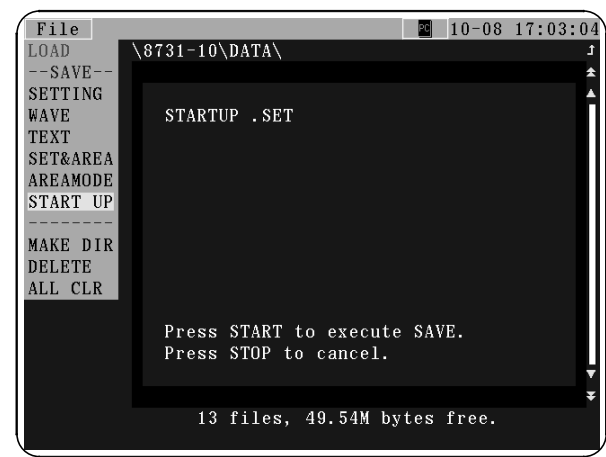
- If the amount of data is too large, the data may not be successfully saved on the PC card. For details, see 13.3.
- Executing the save command creates an index file (in ROM) using the name specified in step 4. above and a directory with the same name. The data (SET) for comparison conditions MODE01 to 16 and data (ARE) of areas A01 to A16 will be saved in the directory. This data can be loaded individually.
- Loading an index file (ROM) loads all comparison conditions MODE01 to 16 and areas A01 to A16 at once.
- Only the data saved in internal memory is saved.
- If a file with the same name already exists, a warning message will appear. Rename the file in step 4. above or save the file by one of the following two methods:
OVER WRITE : Overwrite the existing file.
NUMBERING : Append a number to the filename.

6.4.7 Automatic Loading of Setting Data (START UP)

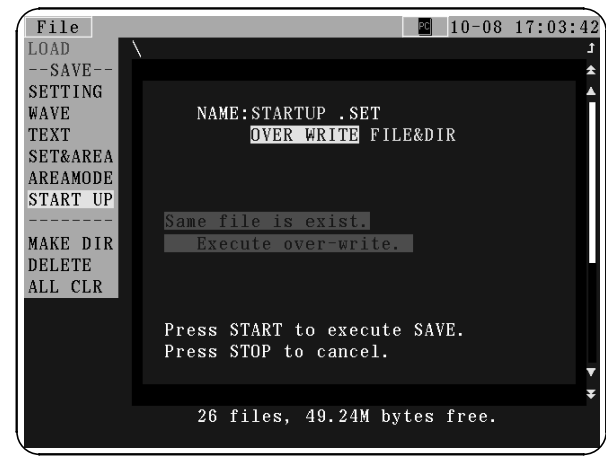
- When power is turned on, the setting file named STARTUP.SET on the PC card is loaded automatically.
- Up to 512 directories and files can be created in the root directory.

Procedure

Command:	START UP
----------	----------



1. Press the **FILE** key, and display the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**START UP**", then press the **ENTER** key.
4. Press the **START** key to create a setting file named "**STARTUP.SET**". Press the **STOP** key to cancel.



Creates a file.



Cancels the creating the file.

If a file with the same name already exists, a warning message will appear

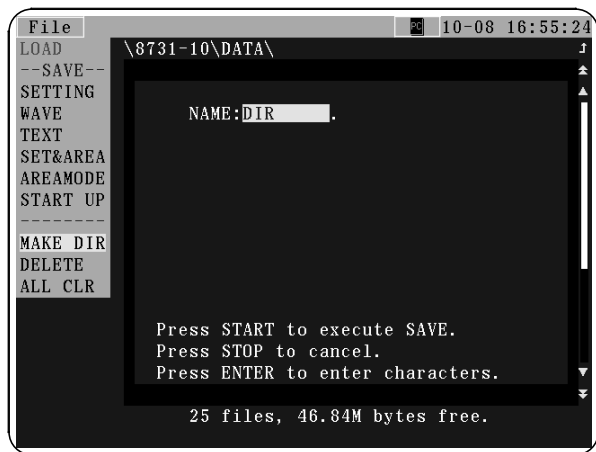
- NOTE**
- If the amount of data is too large, the data may not be successfully saved on the PC card. For details, see 13.3.
 - Creates only a startup file (STARTUP.SET) in the root directory.
 - If the start backup function (7.2.5) is ON, STARTUP.SET will not be loaded when power is turned on.
 - If a file with the same name already exists, a warning message will appear. Press the **START** key to overwrite the existing file. Press the **STOP** key to cancel.

6.4.8 Creating the Directory (DIR)

- Creates a directory on the PC card.
- You can classify the files created in directories.
- The directories are marked <DIR> on the CARD screen, to distinguish them from files.
- Up to 512 directories and files can be created in the root directory.

Procedure

Command:	MAKE DIR
----------	----------



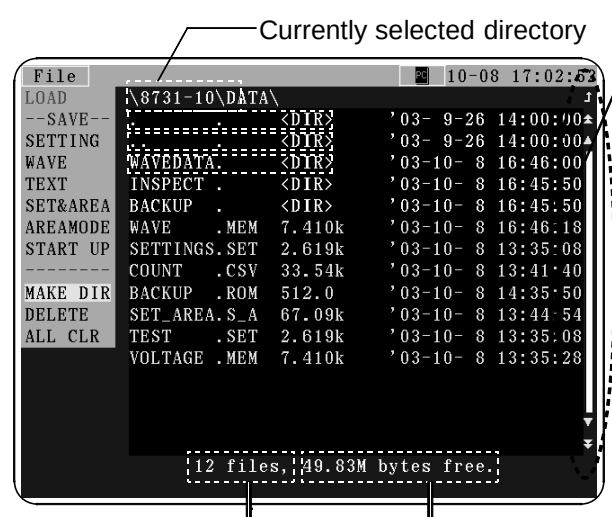
1. Press the **FILE** key, and display the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**MAKE DIR**", then press the **ENTER** key.
4. Enter a filename. For details, see 8. in 3.1.2.
5. Press the **START** key to create a directory; press the **STOP** key to cancel.



Creates a directory.



Cancels creating the directory.



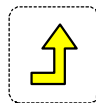
Currently selected directory

Scroll bar

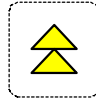
Existing files in the current directory and number of directory.

Free space on PC card

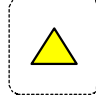
Move the cursor to one of the following indicators at the right edge of the screen, and press the **ENTER** key.



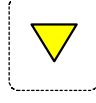
Moves up one directory.



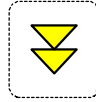
Moves up ten screens.



Moves up one screen.



Moved down one screen.



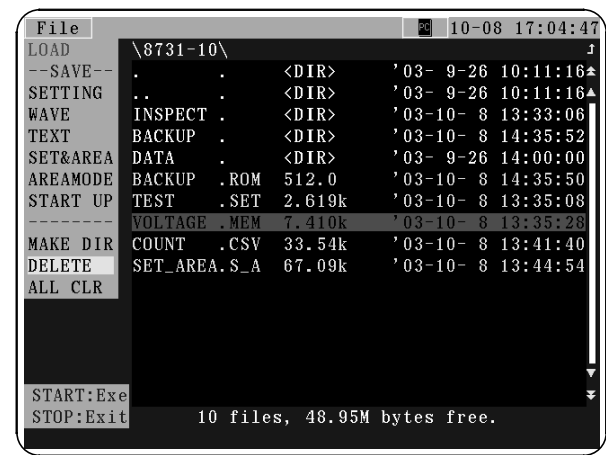
Moved down ten screens.

6.4.9 Delete files

- Deletes data (file/directory) on the PC card.

Procedure

Command: DELETE



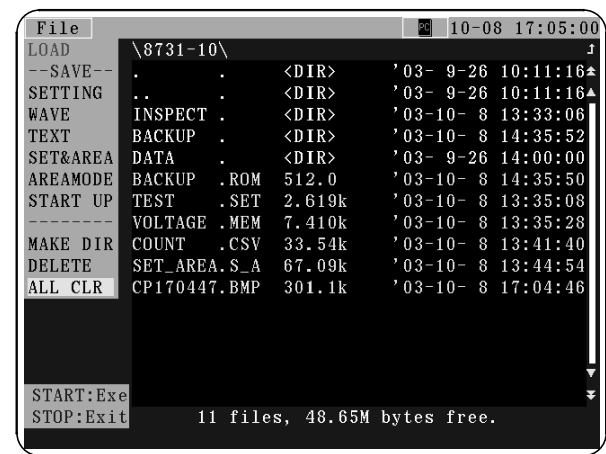
1. Press the **FILE** key, and displays the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**DELETE**", then press the **ENTER** key.
4. Use the **CURSOR** key to select a file to delete. The file selected is highlighted against a red background.
5. Press the **START** key to delete the data; press the **STOP** key to cancel.

6.4.10 Deleting all files

- Deletes all files on the PC card.

Procedure

Command: ALL CLR



1. Press the **FILE** key, and displays the File screen.
2. Press the left **CURSOR** key to move the cursor to a command.
3. Select "**ALL CLR**", then press the **ENTER** key.
4. Press the **START** key to delete all data; press the **STOP** key to cancel.

NOTE • Executing the all-clear command deletes all data on the PC card.

6.4.11 File Details

1. File Extension

Files compatible with the 8730-10, 8731-10 are shown below.

Extension	Details	Reading to 8730-10, 8731-10
MEM	Waveform data file in binary format	○
CSV	Data file (waveform/calculation result) in text format	×
SET	Data file for setting conditions	○
ARE	Area data file	○
BMP	Image data file in bitmap (BMP) format	×
ROM	Index file for area data and comparison conditions	○
S_A	A file containing both setting conditions and area data	○

○ : Readable, × : Not readable

2. Auto Setting of Filename

If a file or directory is saved with the name left blank, the file or directory will be named automatically, as shown below.

Auto saving	Waveform data, Image data
[AUTO0001.extension]	[NONAME01.extension]
↓	↓
[AUTO0010.extension]	[NONAME10.extension]
↓	↓
[AUTO0100.extension]	[NONAM100.extension]
↓	↓
[AUTO5000.extension]	[NONA5000.extension]



- Automatic naming appends a number to the end of filenames.
- When data is saved with the auto save function, a directory may be created automatically with the saved data, depending on measurement settings for the directory.

3. Maximum Number of Directories and Files

The PC card can store up to 512 directories and files in its root directory

4. Example of Saving Waveform Data (CSV Format)

Example of waveform data saved automatically in CSV format.

8730 MEM DATA						
Shot	Time/Div	Trig_Date	Trig_Time			
10DIV	5ms(50us)	2003/6/11	17:16:57			
Ch	Unit	Range	Comment	Scaling	eu	offset
CH1	8730 analog	1 V	COMMENT of CH1	ON	5.00E+01	1.00E+01
CH2	8730 analog	500mV	COMMENT of CH2	OFF	-	-
Time[s]----	CH1[mA]----	CH2[V]----				
0.00E+00	1.47E+02	1.99E+00				
1.00E-03	1.85E+02	1.99E+00				
2.00E-03	2.17E+02	-2.11E+00				
3.00E-03	2.42E+02	-2.11E+00				
4.00E-03	2.56E+02	-2.11E+00				
5.00E-03	2.59E+02	-2.11E+00				
6.00E-03	2.49E+02	-2.10E+00				
7.00E-03	2.29E+02	-2.11E+00				
8.00E-03	1.99E+02	-2.11E+00				
9.00E-03	1.63E+02	-2.11E+00				
1.00E-02	1.25E+02	1.99E+00				
1.10E-02	8.75E+01	1.99E+00				
1.20E-02	5.47E+01	1.99E+00				
1.30E-02	3.00E+01	1.99E+00				
1.40E-02	1.59E+01	1.99E+00				
1.50E-02	1.34E+01	1.99E+00				
1.60E-02	2.28E+01	1.99E+00				
1.70E-02	4.31E+01	1.99E+00				
1.80E-02	7.31E+01	-2.11E+00				
1.90E-02	1.09E+02	-2.11E+00				
2.00E-02	1.47E+02	-2.11E+00				

From left to right, recording length, value on time axis (sampling period), date and time the trigger conditions are met.

From left to right, Channel, instrument model No., range, channel comments, scaling ON/OFF, conversion rate, and offset.
Both the 8730-10 and 8731-10 are indicated as "8730"

Data



Enable the thinning out function saves to save data at set intervals.

5. Examples of Saving Calculation Results

Calculation results are saved in CSV format by the "Auto Save (4.2.9)".
(In continuous-trigger mode, example of value calculation results No.1 to No.3 and comparisons)

judge all	trigger time	NO1 Average	CH1	judge	NO2 Maximum	CH1	judge	NO3 Minimum	CH2	judge	ALLwave
FAIL	2003/6/11 16:27	2.45E+00		FAIL	4.99E+00		FAIL	3.75E-02		FAIL	
PASS	2003/6/11 16:28	2.44E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
FAIL	2003/6/11 16:28	2.44E+00		PASS	5.00E+00		PASS	3.75E-02		FAIL	
FAIL	2003/6/11 16:29	2.45E+00		FAIL	4.99E+00		FAIL	3.75E-02		FAIL	
PASS	2003/6/11 16:29	2.44E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
PASS	2003/6/11 16:30	2.44E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
FAIL	2003/6/11 16:30	2.44E+00		PASS	4.99E+00		FAIL	3.75E-02		FAIL	
FAIL	2003/6/11 16:31	2.45E+00		FAIL	5.00E+00		PASS	3.75E-02		FAIL	
PASS	2003/6/11 16:32	2.44E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
judge all	trigger time	NO1 Average	CH1	judge	NO2 Maximum	CH1	judge	NO3 Minimum	CH2	judge	PARTwave
PASS	2003/6/11 16:35	2.88E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
FAIL	2003/6/11 16:36	2.87E+00		PASS	4.99E+00		FAIL	3.75E-02		FAIL	
FAIL	2003/6/11 16:36	2.88E+00		PASS	4.99E+00		FAIL	4.38E-02		PASS	
PASS	2003/6/11 16:37	2.87E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
PASS	2003/6/11 16:37	2.88E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
FAIL	2003/6/11 16:38	2.88E+00		PASS	4.99E+00		FAIL	4.38E-02		PASS	
FAIL	2003/6/11 16:38	2.87E+00		PASS	5.00E+00		PASS	3.75E-02		FAIL	
PASS	2003/6/11 16:39	2.88E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
FAIL	2003/6/11 16:39	2.87E+00		PASS	4.99E+00		FAIL	3.75E-02		FAIL	
PASS	2003/6/11 16:40	2.88E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
PASS	2003/6/11 16:40	2.87E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
PASS	2003/6/11 16:41	2.87E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	
FAIL	2003/6/11 16:41	2.87E+00		PASS	4.99E+00		FAIL	3.75E-02		FAIL	
PASS	2003/6/11 16:42	2.88E+00		PASS	5.00E+00		PASS	4.38E-02		PASS	

Total value comparison

Date and time when trigger
conditions are met

Result of calculation No.1

Comparison No.1

Result of calculation No.2

Comparison No.2

Result of calculation No.3

Comparison No.3

Calculation range

The "Judge all" result of total value comparison is PASS when value calculation results 1 to 4 are all PASS, or FAIL when any individual result is FAIL.

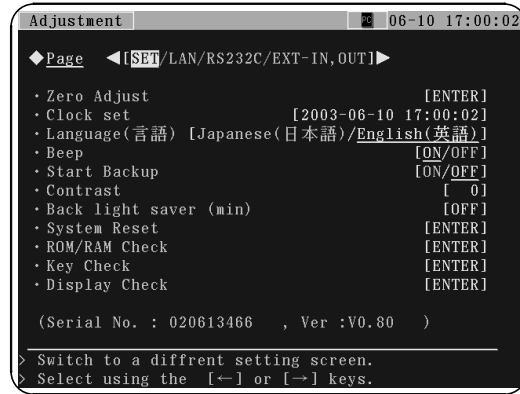
Chapter 7

Adjustment and Setting of the Unit

The Adjustment and Device Setup screen lets you make settings for the parameters given below for each page.

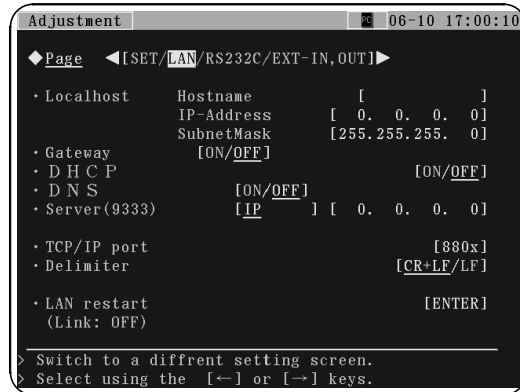
SET (See 7.2)	Zero Adjust (See 7.2.1)	
	Clock set (See 7.2.2)	
	Language (See 7.2.3)	
	Beep (See 7.2.4)	
	Start Backup (See 7.2.5)	
	Contrast (See 7.2.6)	
	Back light saver (See 7.2.7)	
	System Reset (See 7.2.8)	
	ROM/RAM Check (See 7.2.9)	
	Key Check (See 7.2.10)	
	Display Check (See 7.2.11)	
LAN (See 7.3)	Local host (See 7.3.1)	Host name
		IP-Address
		Subnet Mask
	Gateway (See 7.3.2)	
	DHCP (See 7.3.3)	
	DNS (See 7.3.4)	
	Server (9333) (See 7.3.5)	
	TCP/IP port (See 7.3.6)	
	Delimiter (See 7.3.7)	
	LAN restart (See 7.3.8)	
RS-232C (See 7.4)	Speed (See 7.4.)	1200, 2400, 4800 9600, 19200
	Data Bit (See 7.4.2)	8 bit, 7 bit
	Parity (See 7.4.3)	OFF, EVEN, ODD
	Stop Bit (See 7.4.4)	1 bit, 2 bit
	Flow Control (See 7.4.5)	OFF, XON-XOFF Hard
	Delimiter (See 7.4.6)	CR+LF, LF
EXT-IN, OUT (See 7.5)	EXT-OUT1 (See 7.5.1)	TOTAL, Area, Value
	EXT-OUT2 (See 7.5.1)	PASS, FAIL
	EXT-OUT3 (See 7.5.1)	Same as for EXT-OUT1
	EXT-OUT4 (See 7.5.1)	Same as for EXT-OUT1
	EXT-OUT5 (See 7.5.1)	Same as for EXT-OUT1
	EXT-IN (See 7.5.2)	Clear Judge-output Start & Stop
	Detect range-over (See 7.5.3)	ON, OFF

Screen display when selecting "SET" page



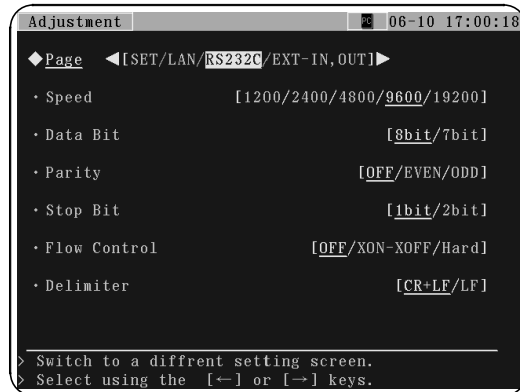
(→ See 7.2)

Screen display when selecting "LAN" page



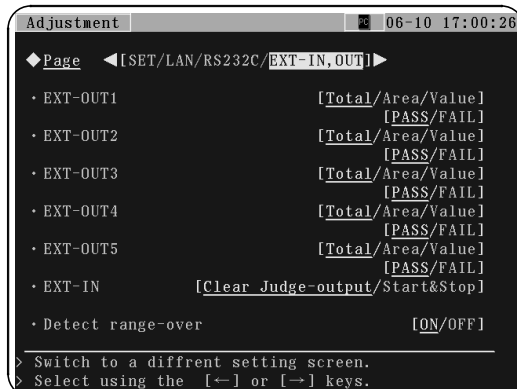
(→ See 7.3)

Screen display when selecting "RS-232C" page



(→ See 7.4)

Screen display when selecting "EXT-IN, OUT" page



(→ See 7.5)

7.1 Overview

- There are four Adjustment Screens, as shown below.

(1) SET

- Sets up and adjusts the 8730-10, 8731-10 and conducts various tests.

(2) LAN

- Sets parameters for connecting the 8730-10, 8731-10 to a LAN.

(3) RS-232C

- Sets the parameters for RS-232C connection.

(4) EXT-IN, OUT

- Sets the multi-function terminals EXT_OUT (See 8.5.8) and EXT_IN (See 8.4.5), among the external control terminals.
- Sets warning output for range-over.

- Screens are changed using "**Page**" at the top of the screen. You can also move to the next "**Page**" menu screen by pressing the **ADJUST/SYSTEM** key.
- Help information on the selected setting item is displayed at the bottom of the screen.
- The serial number and software version are displayed at the bottom of the "SET" menu.

7.2 Setting / Check

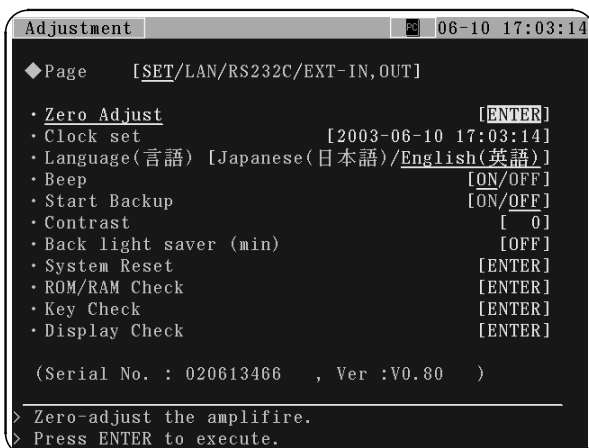
- The "**SET**" menu lets you adjust the 8730-10, 8731-10 before measurement, set the screen, beep sounds, and other basic settings, or conduct various tests on the 8730-10, 8731-10.
- The serial number and software version are displayed at the bottom .
(They are also displayed when power is turned on.)

7.2.1 Zero Adjustment

- The zero adjustment function sets the 0V position (GND position) to correspond to the value of the zero position (see 4.3.5).
- Perform zero adjustment to cancel any drift that may occur due to temperature changes.
- Before performing zero adjustment, allow at least 30 minutes after powering on to allow internal temperatures of the 8730-10, 8731-10 to stabilize.

Procedure

Setting Screen: SET → • Zero Adjust (ENTER)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**SET**" on the "**Page**" menu.
You can also use the **ADJUST/SYSTEM** key to change the page. (Pressing this key moves to the next "**Page**" menu screen.)
3. Use the **CURSOR** key to select "**Zero Adjust**", then press the **ENTER** key to start the zero adjustment.

NOTE

- Repeat zero adjustment after changing the voltage axis range, turning power ON/OFF, or resetting the system.
- Any sudden change in ambient temperature may cause a drift in the zero position. To ensure accurate measurement, repeat zero adjustment.

<<Alternative Method>>

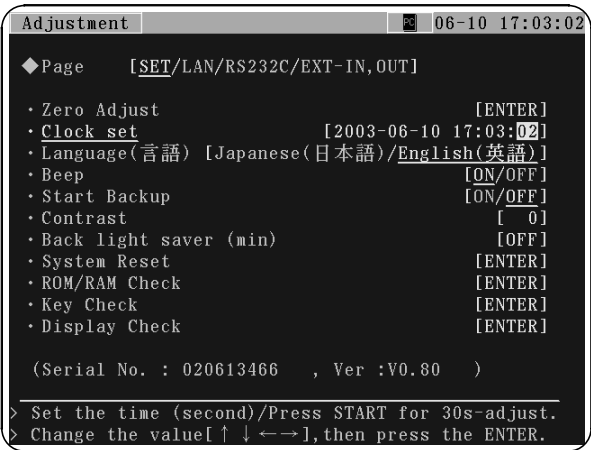
- Hold down the **ADJUST/SYSTEM** key for at least two seconds to perform zero adjustment. Note that zero adjustment cannot be performed during operations.

7.2.2 Clock setting

- Sets the clock.
- The 8730-10, 8731-10 has a built-in 24-hour clock with an auto-calendar and automatic leap-year correction.
-

Procedure

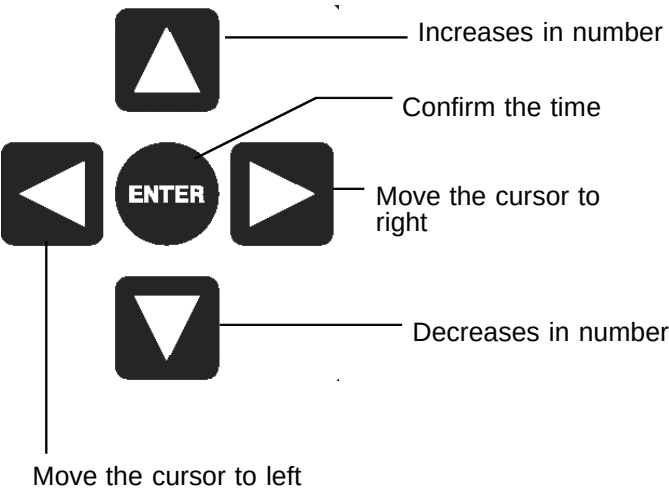
Setting Screen: SET→ • Clock set



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "SET" on "Page".
3. Use the **CURSOR** key to select "Clock set" on the display menu.
4. Use the **CURSOR** key to select a value, then press the **ENTER** key to change the value.
5. Pressing the **ENTER** key sets the clock to the time selected. Confirms the time.

7

Editing Time

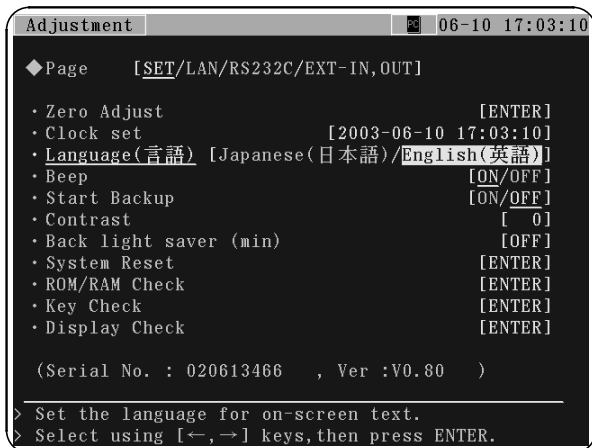


7.2.3 Language

- Select the language displayed. (Japanese/English)

Procedure

Setting Screen: SET → • Language



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**SET**" on "**Page**".
3. Use the **CURSOR** key to select "**Language**" on the display menu, then press the **ENTER** key.
4. Use the right and left **CURSOR** keys to select "**Japanese**" or "**English**", then press the **ENTER** key.
Japanese : Displayed in Japanese.
English : Displayed in English

NOTE

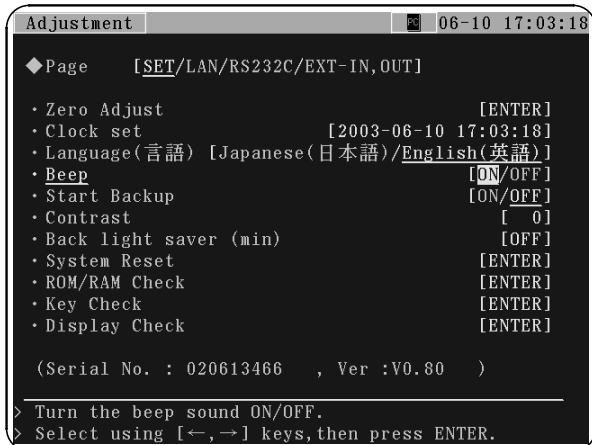
- Underlined characters in yellow indicate the currently selected status.

7.2.4 Beep Sound

- Turns the beep sound ON/OFF.

Procedure

Setting Screen: SET → • Beep Sound (ON, OFF)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**SET**" on "**Page**".
3. Use the **CURSOR** key to select "**Beep**" on the display menu.
4. Press the **ENTER** key, use the right and left **CURSOR** keys to select "**ON**" or "**OFF**", then press the **ENTER** key again.
OFF: Does not generate a beep sound.
ON : Generates a beep sound when an error or warning occurs, when result of area/value comparison is output, or a key is operated.

NOTE

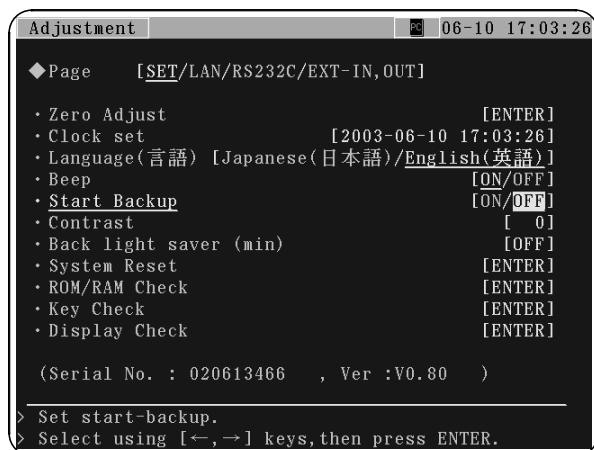
- Underlined characters in yellow indicate the currently selected status.

7.2.5 Start Backup

- When the "Start Backup" function is "ON" and power is turned off during recording (with the LED above the **START** key on), then turned back on again, the 8730-10, 8731-10 will restart recording immediately.
- When a trigger is used, the 8730-10, 8731-10 will enter the trigger standby state. This function is not effective, however, for the timer trigger.

Procedure

Setting Screen: SET → • Start Backup (ON, OFF)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "SET" on "Page".
3. Use the **CURSOR** key to select "Start Backup" on the display menu.
4. Press the **ENTER** key, and use the right and left **CURSOR** keys to select "ON" or "OFF", then press the **ENTER** key.

OFF: Does not use the start backup function.

ON : Uses the start backup function.

NOTE

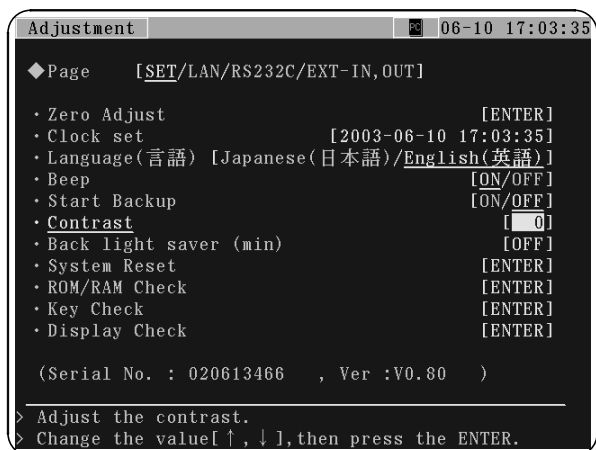
- Underlined characters in yellow indicate the currently selected status.

7.2.6 Contrast

- Adjusts the contrast of the LCD.
- Adjust contrast when the screen is not clear due to changes in ambient temperature or other causes.

Procedure

Setting Screen: SET → • Contrast (-11 to 9)

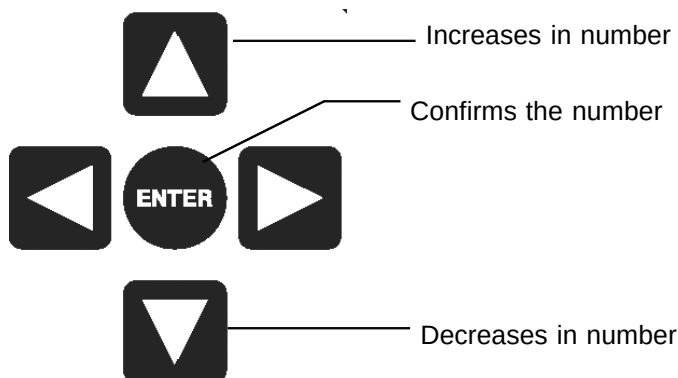


1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "SET" on "Page".
3. Use the **CURSOR** key to select "Contrast" on the display menu.
4. Press the **ENTER** key, and use the **CURSOR** key to select contrast value, then press the **ENTER** key.

NOTE

- The default value of contrast is "0."
- The contrast value temporarily becomes "0" on the Adjustment screen.

Editing Contrast

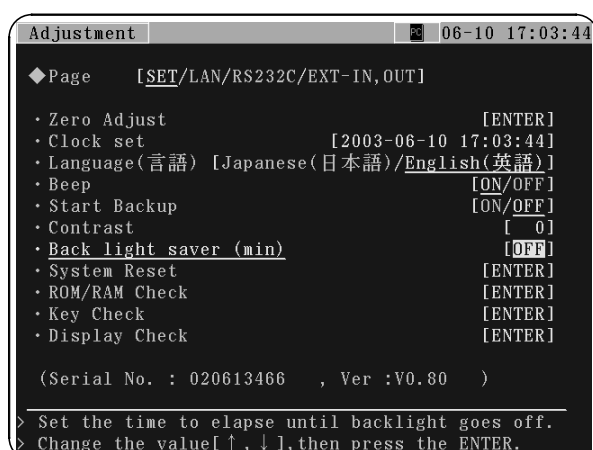


7.2.7 Back Light Saver

- If no keys are operated after a set time, the LCD backlight goes off automatically.
- Pressing any key or obtaining an FAIL waveform comparison result with the LCD backlight off will turn the backlight on again.
- This ensures that the backlight is only on when necessary, thus prolonging its service life.

Procedure

Setting Screen: SET → • Back light saver (min) (OFF, 1 to 30)

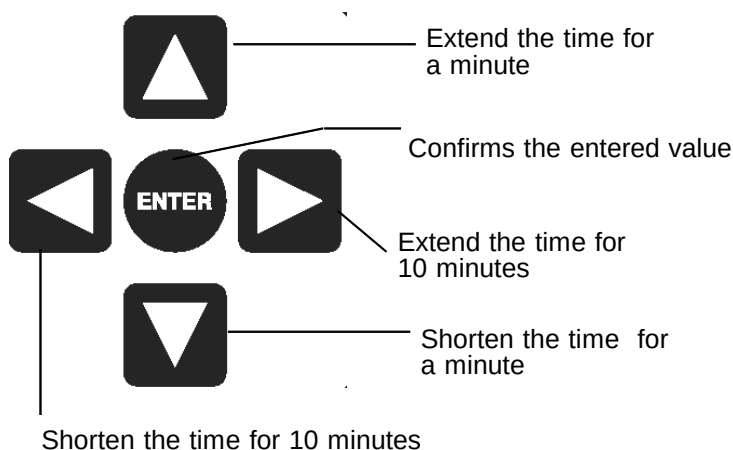


1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "SET" on the "Page" menu.
3. Use the **CURSOR** key to select "Back light saver (min)" on the menu.
4. Press the **ENTER** key. Use the **CURSOR** key to set the time at which to turn off the backlight, then press the **ENTER** key.

NOTE

- The "Back light saver (min)" is set to "OFF" by default.
- Setting the "Back light saver (min)" to "OFF" disables the backlight saver function and causes the backlight to remain on.

Editing Back Light Saver

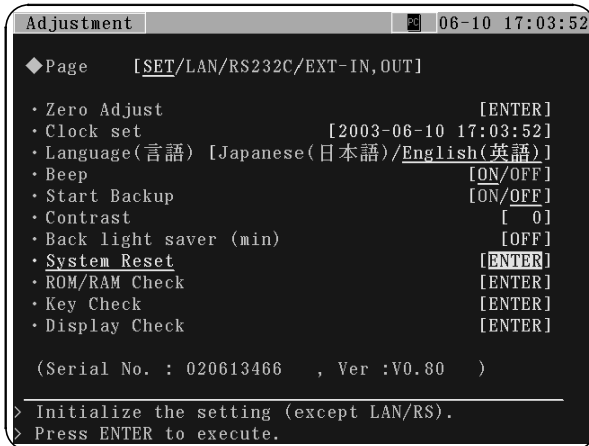


7.2.8 System Reset

- Resets 8730-10, 8731-10 settings.
However, the 8730-10, 8731-10 will retain LAN and RS-232C settings, test modes MODE01 to 16, comparison areas A01 to 16, contrast, and setting of the language in internal memory.
- Holding down the **STOP** key at power-on will also execute a system reset.
(See 3.1.2 for details.)

Procedure

Setting Screen: SET → • System Reset



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**SET**" on "Page".
3. Use the **CURSOR** key to select "**System Reset**" on the display menu, then press the **ENTER** key to start the system reset.

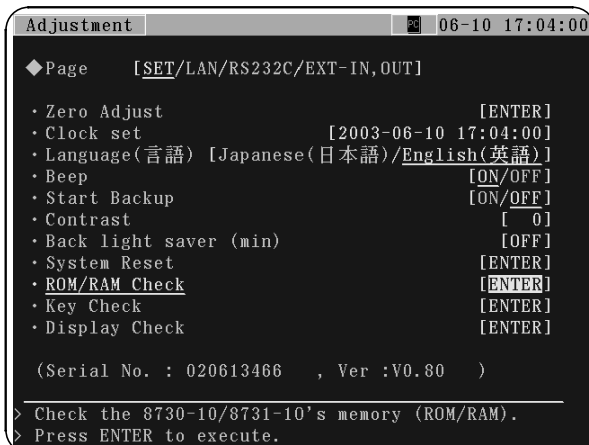
7.2.9 ROM/RAM Check

- Checks the internal memory (ROM and RAM) of the 8730-10, 8731-10.
- After the ROM/RAM test, the contents of ROM and RAM are retained.
- The results are displayed on the screen.

PASS : No problem was found.
FAIL : A problem was found.

Procedure

Setting Screen: SET → • ROM/RAM Check



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**SET**" on "Page".
3. Use the **CURSOR** key to select "**ROM/RAM Check**" on the display menu, then press the **ENTER** key to start the ROM/RAM check.

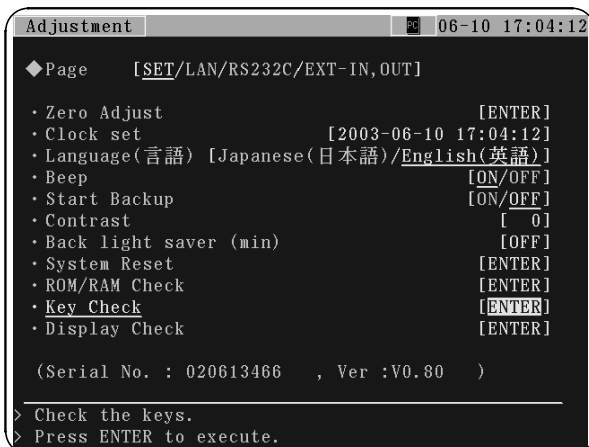
- NOTE**
- During the ROM/RAM check, key operations are disabled.
 - If the result is "**FAIL**", perform a system reset, then repeat the ROM/RAM check. If the result is "**FAIL**" again, contact your dealer or HIOKI representative.

7.2.10 Key Check

- Checks whether the keys operate correctly.

Procedure

Setting Screen: SET → • Key Check



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "SET" on "Page".
3. Use the **CURSOR** key to select "Key Check" on the display menu, then press the **ENTER** key.
4. When a key is pressed, the color of the corresponding key on the screen changes.
5. After all keys have been pressed at least once, the key check is completed.

NOTE

- When the "Beep" is "ON", a beep sound is generated every time a key is pressed.
- If there is a problem with a key or there is a key that is not recognized, the key check cannot be completed.
- Press the **START** key and **STOP** key simultaneously to interrupt the check. However, this operation is not possible if there is problem with either key.
- Checking the **START** key also tests its LED.

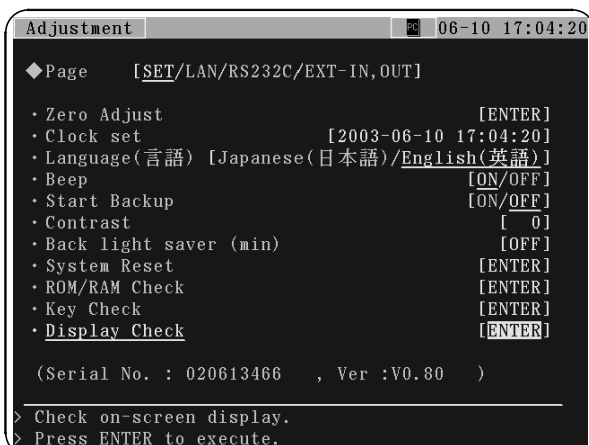
7.2.11 Display Check

- Checks the display.
- There are two check patterns: solid color and gradation.

- (1) Solid-color check
 - The entire screen is displayed in red, green, blue, black, or white
- (2) Gradation check
 - The entire screen is displayed in 8 gradations each of red, green, or blue

Procedure

Setting Screen: SET → • Display Check



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "SET" on "Page".
3. Use the **CURSOR** key to select "Display Check" on the display menu, then press the **ENTER** key.
4. Press the key successively to check color and gradation of the screen.
5. The screen check is complete when both the solid-color check and gradation check are completed.

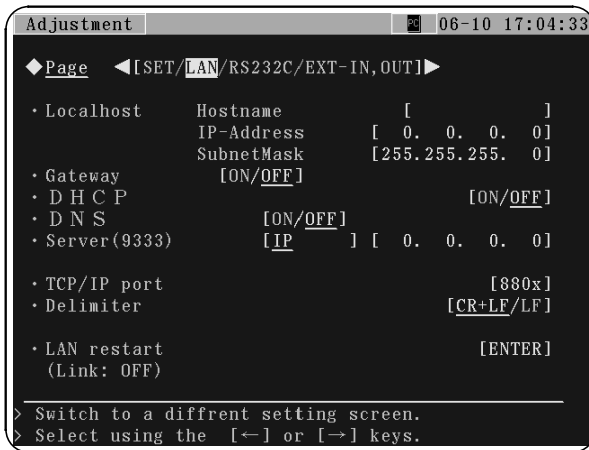
7.3 LAN

- LAN setting lets you set the initial settings for communications with the 8730-10, 8731-10 using a LAN.
- When the LAN cable is connected to the 8730-10, 8731-10, "Link" at the bottom of the screen will go "ON".
- For setting terminology, see 9.1.

7.3.1 Local host

Procedure

Setting Screen: LAN → • Local host

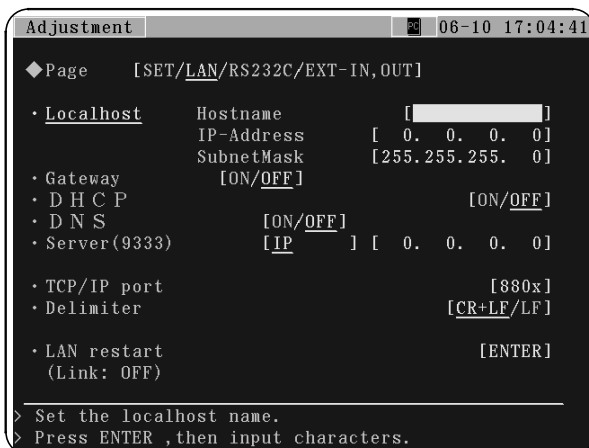


1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page" You can also use the **ADJUST/SYSTEM** key to change the menu page. (Pressing this key moves to next page.)
3. Set "Hostname," "IP-Address," and "Subnet Mask."

1. Setting the Host name

- Set the host name of the 8730-10, 8731-10.

Procedure

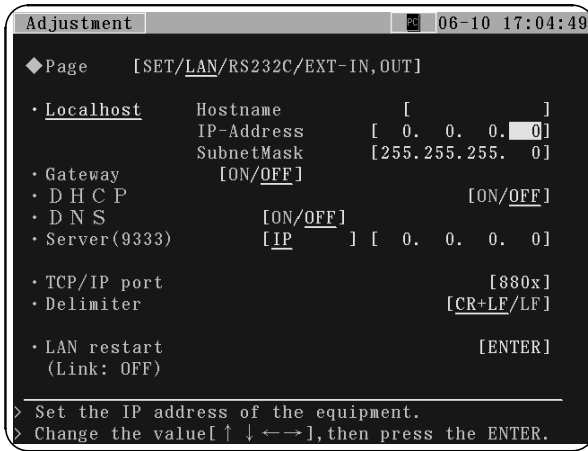


1. Select "Hostname" on the menu, then press the **ENTER** key.
2. Enter a filename. For details, see 8. in 3.1.2.

2. Setting the IP address

- Set the IP address of the 8730-10, 8731-10.

Procedure

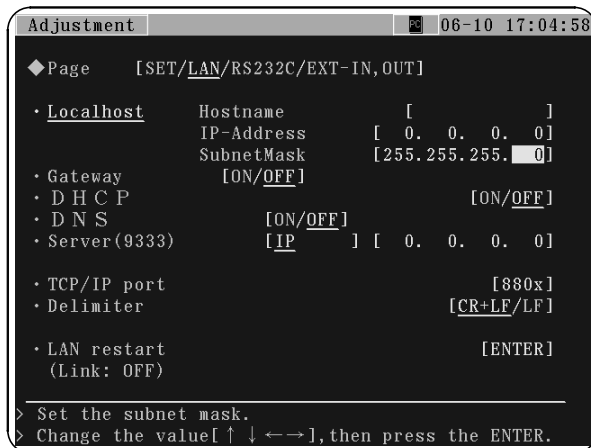


1. Select "**IP-Adress**" on the menu.
2. Use the right and left **CURSOR** keys to select the digit to set, then press the **ENTER** key.
3. Use the **CURSOR** key to change the value. Press the **ENTER** key to confirm the value.
4. To set other digits, repeat steps 2 and 3 above.

3. Setting the Subnet Mask

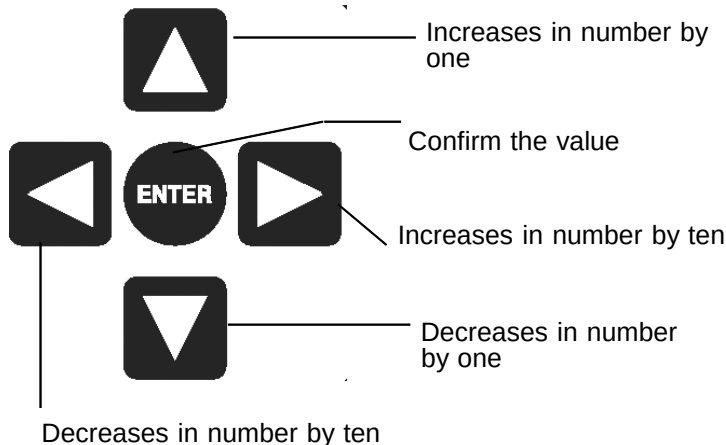
- Set the Subnet Mask.

Procedure



1. Select "**SubnetMask**" on the menu.
2. Use the right and left **CURSOR** keys to select the digit to set, then press the **ENTER** key.
3. Use the **CURSOR** key to change the value. Press the **ENTER** key to confirm the value.
4. To set other digits, repeat steps 2. and 3. above.

IP Address and Subnet Mask Setting

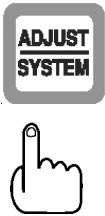
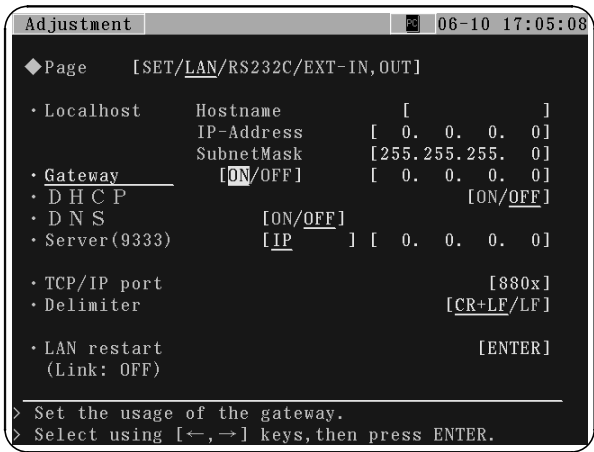


7.3.2 Gateway

- Sets whether to use a gateway.

Procedure

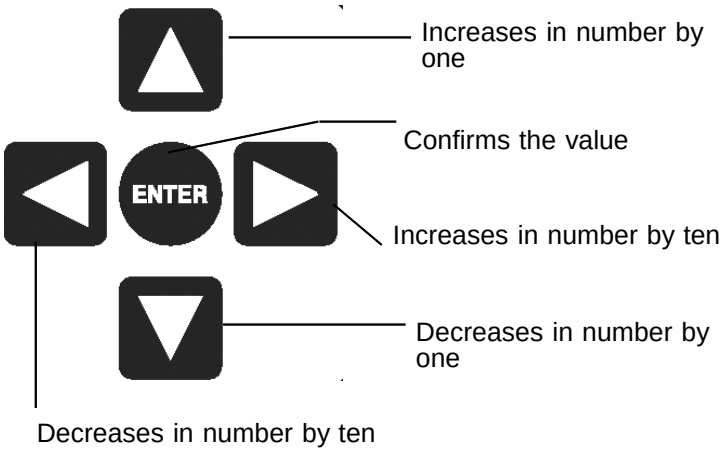
Setting Screen: LAN Setting→ • Gateway (ON, OFF)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page".
3. Use the **CURSOR** key to move the cursor to the "Gateway". Select "ON" or "OFF", then press the **ENTER** key.

OFF: Does not set a gateway.
ON : Sets a gateway.

Gateway Setting



When select "ON"

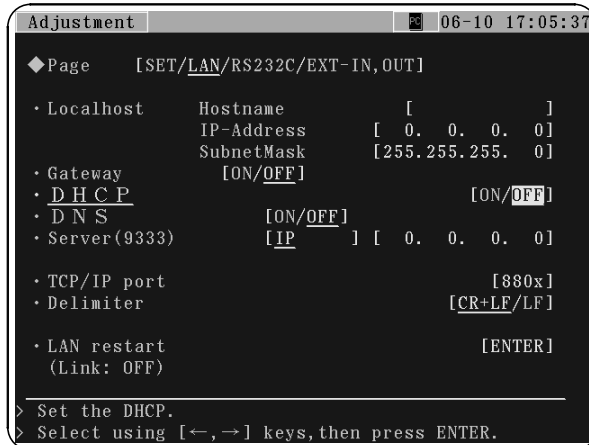
4. Use the right and left **CURSOR** keys to select the digit to set, then press the **ENTER** key.
5. Use the **CURSOR** key to change the value. Press the **ENTER** key to confirm the value.
6. To set other digits, repeat steps 4. and 5. above.

7.3.3 DHCP

- Turns DHCP (automatic assignment of IP address) ON/OFF.

Procedure

Setting Screen: LAN Setting → • DHCP (ON, OFF)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**LAN**" on "**Page**".
3. Use the **CURSOR** key to select "**DHCP**", then press the **ENTER** key.
4. Use the **CURSOR** key to select "**ON**" or "**OFF**", then press the **ENTER** key.

OFF: Does not use DHCP.

ON : Uses DHCP.

NOTE

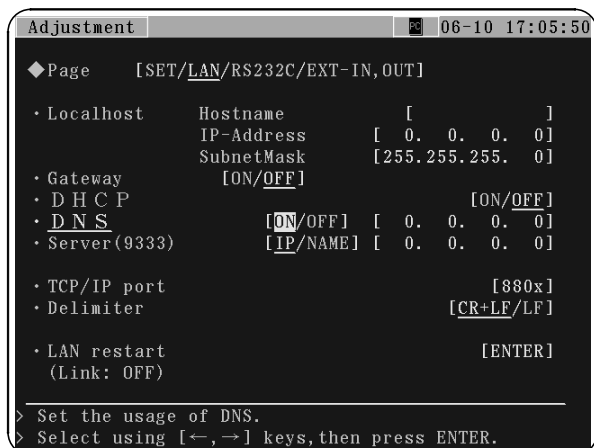
- Underlined characters in yellow indicate the currently selected status

7.3.4 DNS

- Sets whether to use a DNS.

Procedure

Setting Screen: LAN Setting → • DNS (ON, OFF)

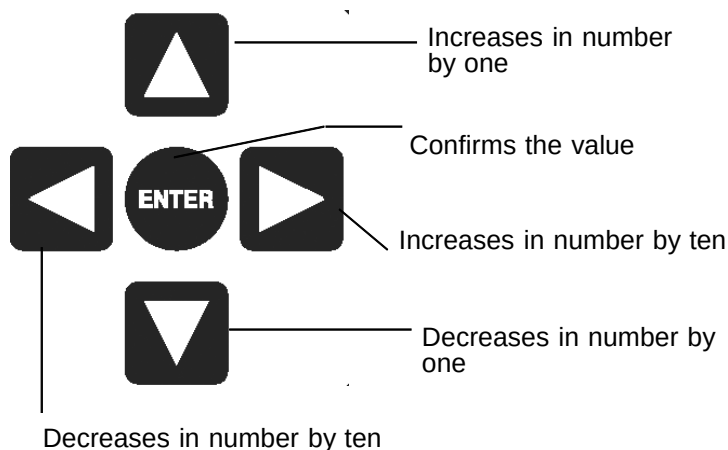


1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page".
3. Move the cursor to "DNS", then press the **ENTER** key.
4. Select "ON" or "OFF", then press the **ENTER** key.

ON : Uses DNS.

OFF: Does not use DNS.

DNS Setting



When select "ON"

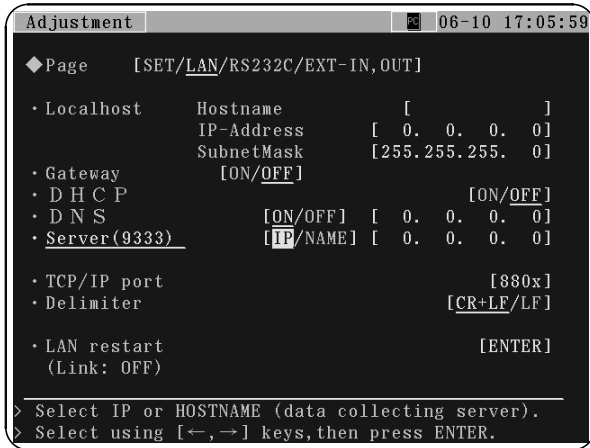
5. Use the right and left **CURSOR** keys to select the digit to set, then press the **ENTER** key.
6. Use the **CURSOR** key to change the value. Press the **ENTER** key to confirm the value.
7. To set other digits, repeat steps 5. and 6. above

7.3.5 Server (9333)

- Sets the IP address or name of the 9333 data acquisition server.

Procedure

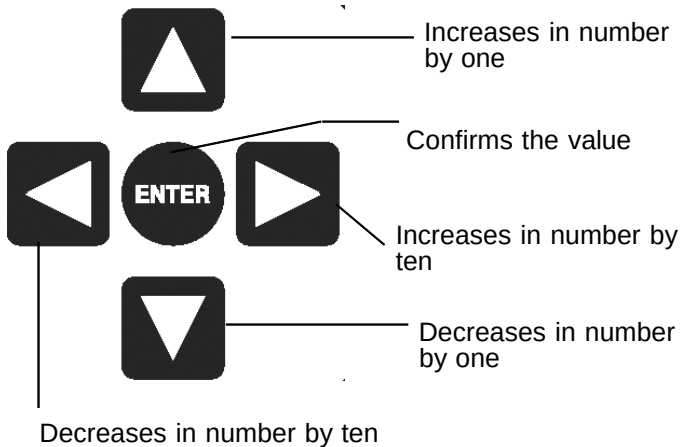
Setting Screen: LAN Setting → • Server (9333) (IP, NAME)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page".
3. Move the cursor to "Server (9333)", then press the **ENTER** key.
4. Select "IP" or "NAME", then press the **ENTER** key.

IP : Sets the server with an IP address.
 NAME: Sets the server with a name. ^(Note 1)

IP Setting



When select "IP"

5. Use the right and left **CURSOR** keys to select the digit to set, then press the **ENTER** key.
6. Use the **CURSOR** key to change the value. Press the **ENTER** key to confirm the value.
7. To set other digits, repeat steps 5. and 6. above

When select "NAME"

5. Move the cursor to the right, then press the **ENTER** key.
6. Enter a name. For details, see 8. in 3.1.2.

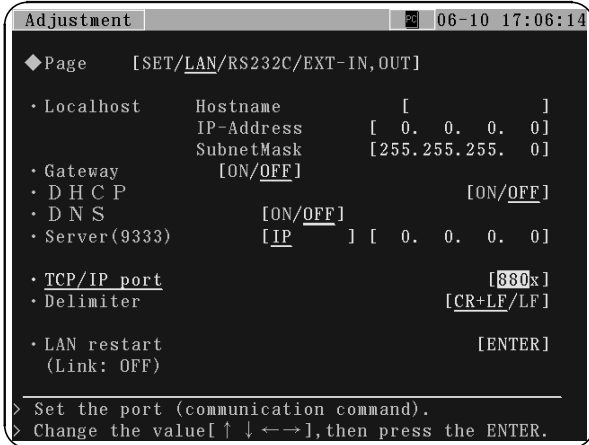
NOTE • (Note 1) This cannot be selected when "DHCP" and "DNS" are both "OFF".

7.3.6 TCP/IP Port

- Sets the port used for communications commands.

Procedure

Setting Screen: LAN Setting → • TCP/IP port (100x to 999x)

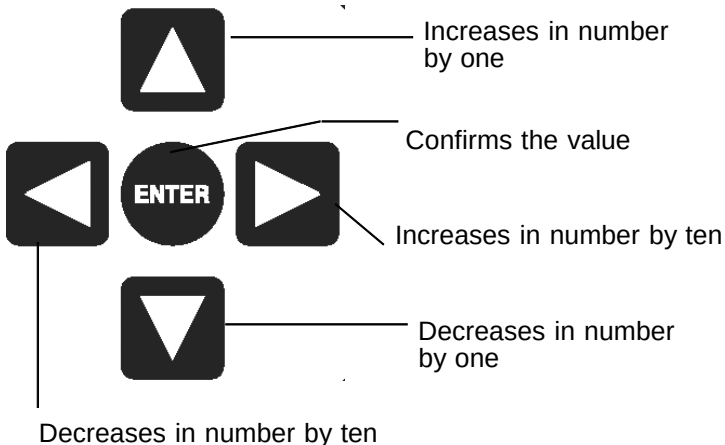


1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page".
3. Use the **CURSOR** key to select "TCP/IP port", then press the **ENTER** key.
4. Use the **CURSOR** key to change the port value, then press the **ENTER** key to confirm the value.

NOTE

- The setting range for the port is between 100x and 999x.
- The default setting is 880x.

Port Setting

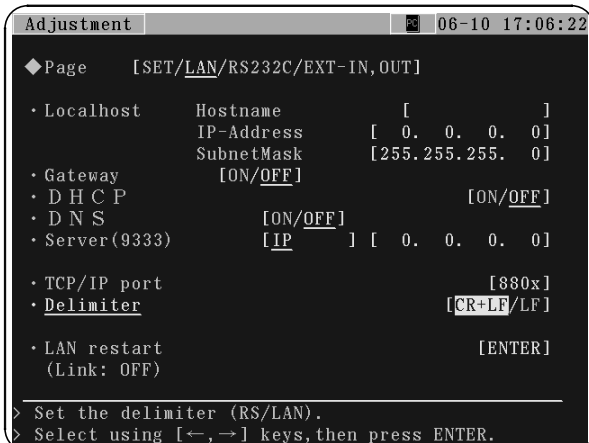


7.3.7 Delimiter

- Sets the delimiter for communications commands.

Procedure

Setting Screen: LAN Setting → • Delimiter (CR+LF, LF)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page".
3. Use the **CURSOR** key to select "Delimiter", then press the **ENTER** key.
4. Use the **CURSOR** key to select "CR+LF" or "LF", then press the **ENTER** key.
CR+LF: Sets the delimiter to CR+LF.
LF : Sets the delimiter to LF.

NOTE

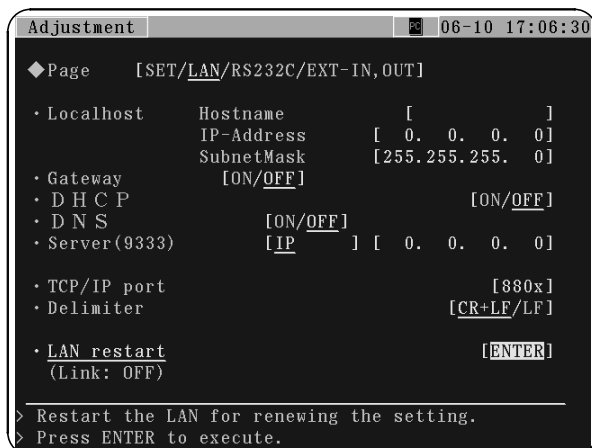
- The delimiter setting is common to LAN and RS-232C.

7.3.8 LAN Restart

- Enables the LAN setting.

Procedure

Setting Screen: LAN Setting → • LAN restart (ENTER)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "LAN" on "Page".
3. Use the **CURSOR** key to select "LAN restart", then press the **ENTER** key.

NOTE

- When the LAN cable is connected to the 8730-10, 8731-10, "Link" will go "ON" at the bottom of the screen. If the cable (cross/straight) is improperly connected, "Link" will remain "OFF".

7.4 RS-232C

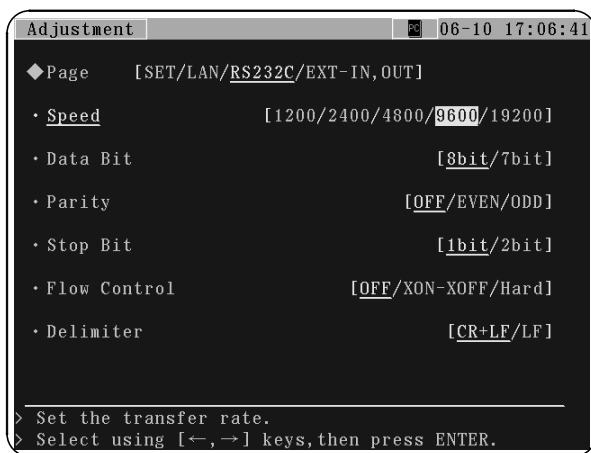
- The RS-232C setting lets you make the initial settings for communications with the 8730-10, 8731-10 via the RS-232C.
- For detailed information on the of RS-232C connection, see 9.2.

7.4.1 Transmission Speed

- Sets the transmission speed.

Procedure

Setting Screen: RS-232C → • Speed (1200, 2400, 4800, 9600, 19200)



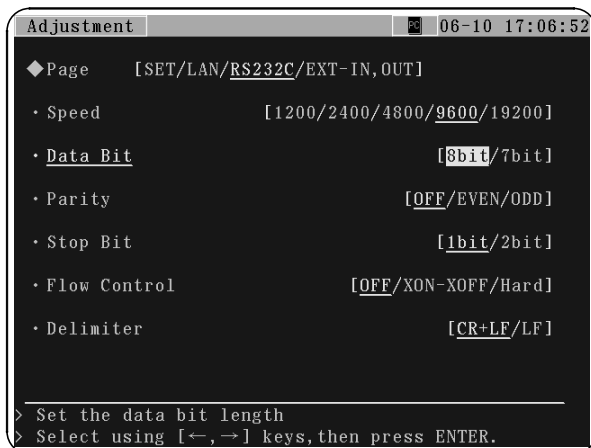
1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**RS232C**" on "**Page**". You can also use the **ADJUST/SYSTEM** key to change the menu page. (Pressing this key moves to next page.)
3. Use the **CURSOR** key to select "**Speed**", then press the **ENTER** key.
4. Use the **CURSOR** key to select a speed, then press the **ENTER** key.

7.4.2 Data Bit

- Sets the data bit length.

Procedure

Setting Screen: RS-232C → • Data Bit (8 bit, 7 bit)



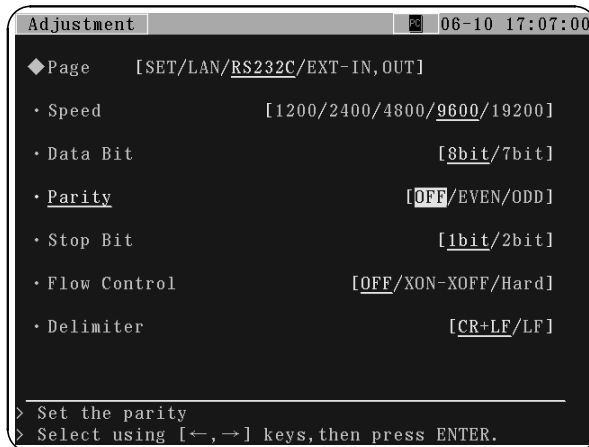
1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**RS232C**" on "**Page**".
3. Use the **CURSOR** key to select "**Data Bit**", then press the **ENTER** key.
4. Use the **CURSOR** key to select "**8bit**" or "**7bit**", then press the **ENTER** key.

7.4.3 Parity

- Sets the parity.

Procedure

Setting Screen: RS-232C → • Parity (OFF, EVEN, ODD)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "RS232C" on "Page".
3. Use the **CURSOR** key to select "Parity", then press the **ENTER** key.
4. Use the **CURSOR** key to select a parity, then press the **ENTER** key.

OFF : No parity

EVEN : Even number parity

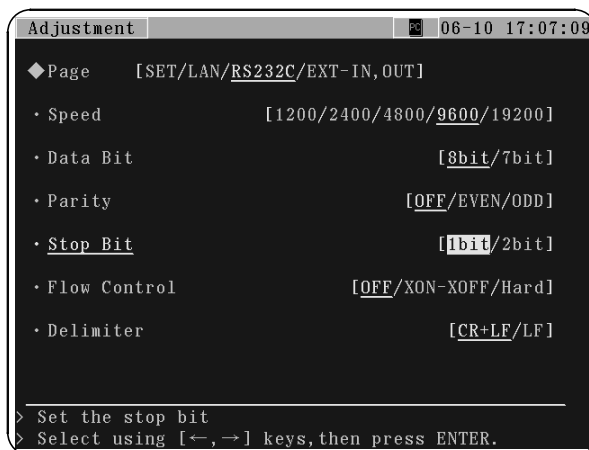
ODD : Odd number parity

7.4.4 Stop Bit

- Sets the stop bit.

Procedure

Setting Screen: RS-232C → • Stop Bit (1bit, 2bit)



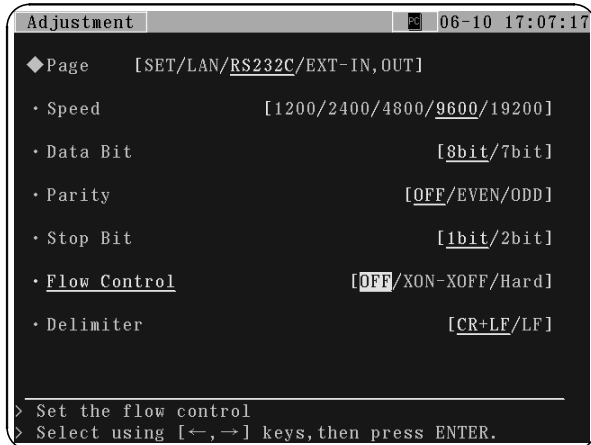
1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "RS232C" on "Page".
3. Use the **CURSOR** key to select "Stop Bit", then press the **ENTER** key.
4. Use the **CURSOR** key to select "1bit" or "2bit", then press the **ENTER** key.

7.4.5 Flow Control

- Sets the flow control.

Procedure

Setting Screen: RS-232C → • Flow Control (OFF, XON-XOFF, Hard)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**RS232C**" on "**Page**".
3. Use the **CURSOR** key to select "**Flow Control**", then press the **ENTER** key.
4. Use the **CURSOR** key to select an item, then press the **ENTER** key.

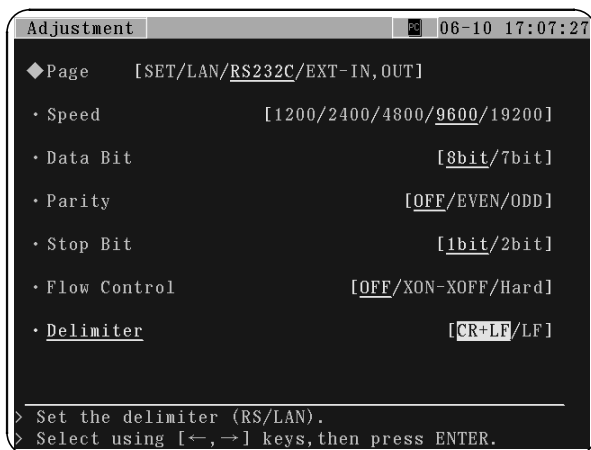
OFF : No flow control
XON-XOFF: Software handshake
Hard : Hardware handshake

7.4.6 Delimiter

- Sets the delimiter for communications commands.

Procedure

Setting Screen: RS-232C → • Delimiter (CR+LF, LF)



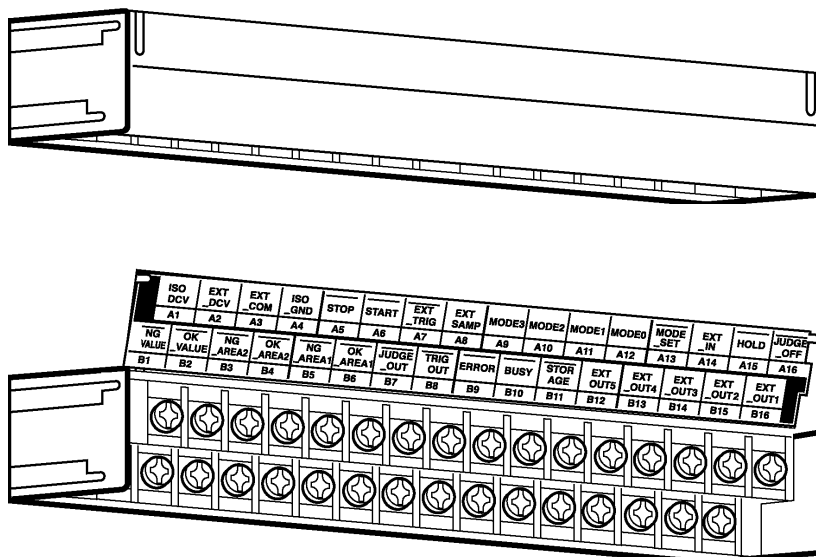
1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**RS232C**" on "**Page**".
3. Use the **CURSOR** key to select "**Delimiter**", then press the **ENTER** key.
4. Use the **CURSOR** key to select "**CR+LF**" or "**LF**", then press the **ENTER** key.

CR+LF: Sets the delimiter to CR+LF.
LF : Sets the delimiter to LF.

NOTE • The delimiter setting is common to LAN and RS-232C.

7.5 External Control Terminals

- Waveform comparison (area/value comparison) results may be output to external control terminals EXT_OUT1 to EXT_OUT5.
- External control terminal EXT_IN is used for signal input to clear a comparison result or to control the starting and stopping of measurement.
- For detailed information on the external control terminals, see Chapter 8.
- You can select whether to output a warning in the case of a range-over.



External Control Terminals

7.5.1 EXT_OUT1 to EXT_OUT5

- The multi-function terminals (EXT_OUT) are external control terminals (output) for which you can select functions.
- There are five terminals (EXT_OUT1 to EXT_OUT5). You can set the functions of these terminals individually.
- The following three functions are available:

(1) Total Comparison	: Outputs " Total comparison " of all comparison results from EXT_OUT terminals; CH1 area comparison, CH2 area comparison, and value comparisons No.1 to 4. Outputs " PASS " when all comparison results are PASS. Outputs " FAIL " if any result is FAIL.
(2) Area Comparison	: Outputs " Total comparison " of CH1 area comparison and CH2 area comparison results from EXT_OUT terminals. Outputs " PASS " when both CH1 and CH2 area comparison results are PASS. Outputs " FAIL " if either result is FAIL.
(3) Value Comparison	: Outputs individual results of value comparisons No. 1 to 4 from EXT_OUT terminals.

- For detailed information on EXT_OUT1 to 5, see 8.5.8.

(1) Total comparison result

	The results of value comparisons No.1 to No.4 are all "PASS"	Either the result of value comparison No.1 to No.4 is "FAIL"
Both CH1 and CH2 area comparison results are "PASS"	PASS	FAIL
Either the CH1 or CH2 area comparison result is "FAIL"	FAIL	FAIL

(2) Area comparison result

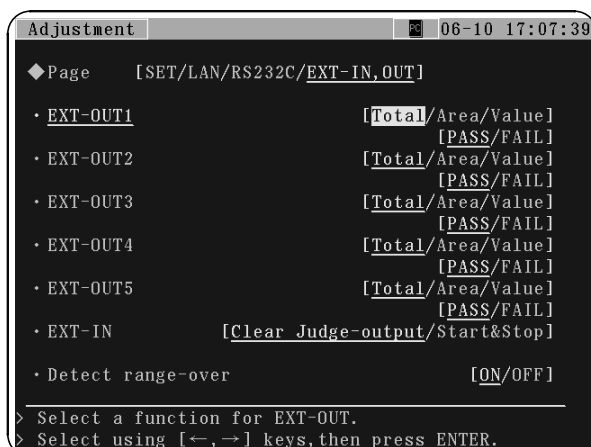
	Both CH1 and CH2 area comparison results are "PASS"	Either the CH1 or CH2 area comparison result is "FAIL"
Comparison result	PASS	FAIL

(3) Value comparison result

	The result of the value comparison selected (from No.1 to 4) is "PASS"	The result of the value comparison selected (from No.1 to 4) is "FAIL"
Comparison result	PASS	FAIL

Procedure

Setting Screen: EXT-IN, OUT → • EXT_OUT1 to EXT_OUT5 (Total, Area, Value)

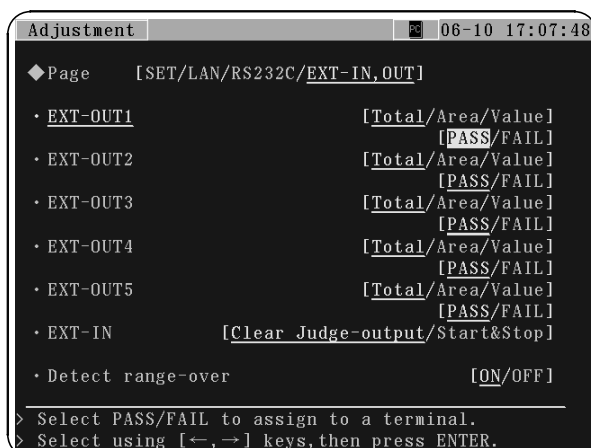


1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "**EXT-IN, OUT**" on "**Page**". You can also use the **ADJUST/SYSTEM** key to change the menu page. (Pressing this key moves to next page.)
3. Use the **CURSOR** key to select "**EXT_OUT1**", then press the **ENTER** key.
4. Use the **CURSOR** key to select an output condition, then press the **ENTER** key.

Total : Result of all area and value comparisons

Area : Result of area comparisons (CH1 x CH2)

Value : Result of individual value comparison

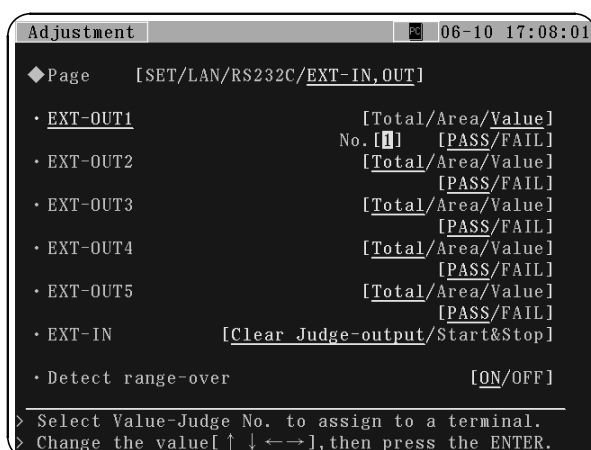


5. Move the **CURSOR** key to "**PASS/FAIL**", then press the **ENTER** key.

6. Use the **CURSOR** key to select "**PASS**" or "**FAIL**", then press the **ENTER** key.

PASS : Outputs the signal when the result set in 4. above is "**PASS**".

FAIL : Outputs the signal when the result set in 4. above is "**FAIL**".



When value comparison is selected, select the type of calculation by number

7. When value comparison is selected, select the type of calculation by number. Press the **ENTER** key. After selecting a No., press the **ENTER** key once again.
8. When setting other terminals (EXT_OUT2 to EXT_OUT5), repeat steps 3. to 7. above.

7.5.2 EXT_IN

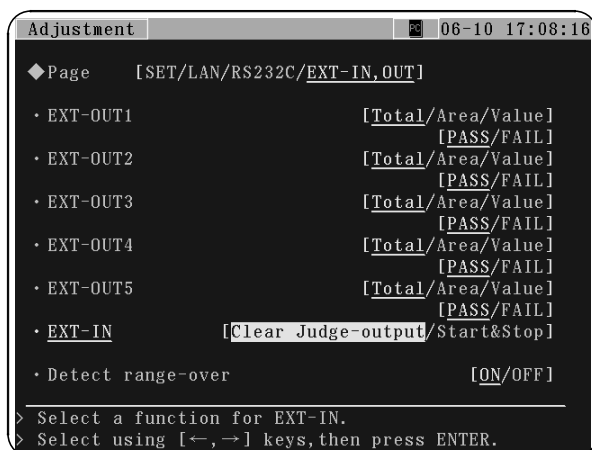
- The multi-function terminal (EXT_IN) is an external control terminal (input) for which you can select functions.
- The following two functions are available:

- | | |
|------------------------|--|
| (1) Clear Judge-output | : Clears comparison result output (OK_VALUE, NG_VALUE, OK_AREA, NG_AREA, or JUDGE_OUT) using EXT_IN terminal. |
| (2) Start&Stop | : Controls the starting/stopping of measurement using EXT_IN terminal. A falling signal starts measurement and a rising signal stops it. |

- For the details, See 8.4.5.

Procedure

Setting Screen: EXT-IN, OUT → • EXT_IN (Clear Judge-output, Start&Stop)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "EXT-IN, OUT" on "Page".
3. Use the **CURSOR** key to select "EXT_IN", then press the **ENTER** key.
4. Use the **CURSOR** key to select a input condition, then press the **ENTER** key.

Clear Judge-output: Clears comparison result output.

Start&Stop : Controls the start/stop of measurement with signal input to the terminal.

7.5.3 Range-over Detection

- The 8730-10, 8731-10 can output a warning should a waveform exceeding the range be input.

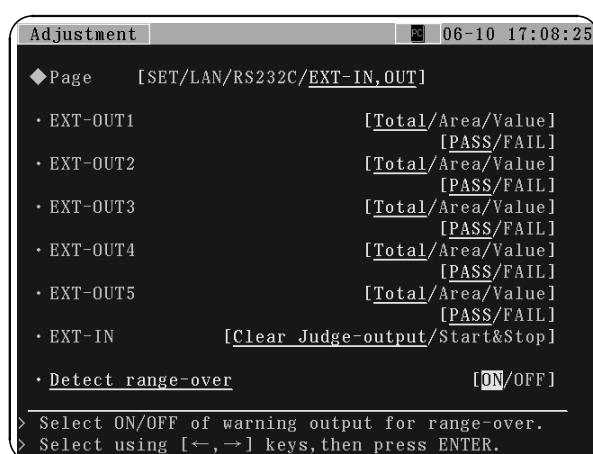
The measurable range of each range is -10 times to +11 times the voltage axis range. (See 2.5 and 4.3.5 for details.)

If a waveform exceeds the measurable range, a range-over is detected, a warning message appears on the screen, and the external control terminal (ERROR) is activated

- Turn this function OFF to disable the range-over warning. (ON by default)

Procedure

Setting Screen: EXT-IN, OUT → • Detect range-over (ON, OFF)



1. Press the **ADJUST/SYSTEM** key to display the Adjustment screen.
2. Use the **CURSOR** key to select "EXT-IN, OUT" on "Page".
3. Use the **CURSOR** key to select "Detect range-over", then press the **ENTER** key.
4. Use the right and left **CURSOR** keys to select "ON" or "OFF", then press the **ENTER** key.

OFF : Does not detect a range-over.

ON : Detects a range-over.



- Should a range-over waveform be input, the part that exceeds the measurable range will be shown in a different waveform than the original waveform.

With this function OFF, accurate comparison may not be possible because a range-over will go undetected. Before disabling this function, confirm that comparison will not be affected by a range-over.

Chapter 8

External Control Terminals

8.1 Overview

Comparison results (PASS and FAIL) may be output from the external control terminals. Moreover, these are used to control the 8730-10, 8731-10 and external sampling, and more.

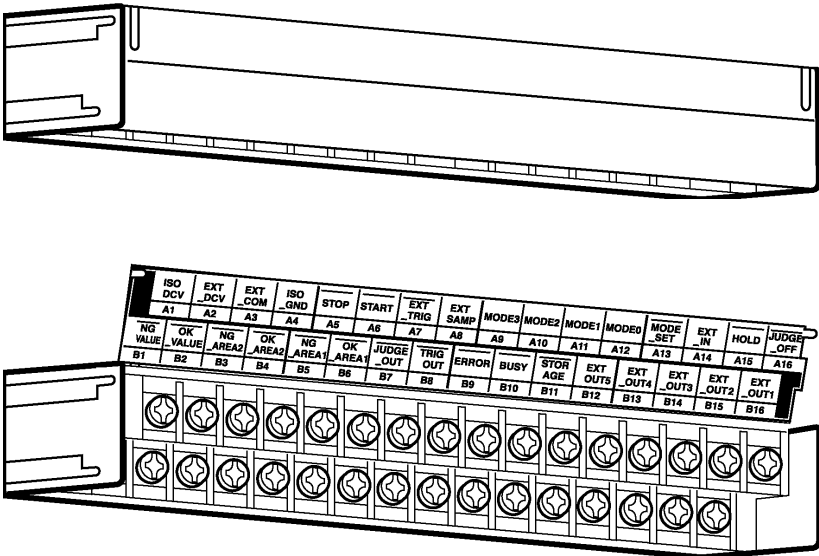
● Table of External Control Terminals

Terminal No.	Terminal	I/O	Function	Terminal No.	Terminal	I/O	Function
A1	ISO_DCV	-	Built-in isolated power supply	B1	NG_VALUE	OUT	Value comparison: FAIL
A2	EXT_DCV	-	External power supply	B2	OK_VALUE	OUT	Value comparison: PASS
A3	EXT_COM	-	Common output terminal	B3	NG_AREA2	OUT	CH2 Area comparison: FAIL
A4	ISO_GND	-	Built-in isolated GND	B4	OK_AREA2	OUT	CH2 Area comparison: PASS
A5	STOP	IN	Measurement stop	B5	NG_AREA1	OUT	CH1 Area comparison: FAIL
A6	START	IN	Measurement start	B6	OK_AREA1	OUT	CH1 Area comparison: PASS
A7	EXT_TRIG	IN	External Trigger	B7	JUDGE_OUT	OUT	Comparison result being output
A8	EXT_SAMP	IN	External Sampling	B8	TRIG_OUT	OUT	Trigger output
A9	MODE3	IN	Test Mode Bit 3	B9	ERROR	OUT	Error detected
A10	MODE2	IN	Test Mode Bit 2	B10	BUSY	OUT	Processing
A11	MODE1	IN	Test Mode Bit 1	B11	STORAGE	OUT	Measuring
A12	MODE0	IN	Test Mode Bit 0	B12	EXT_OUT5	OUT	Multi-function terminal (Output)
A13	MODE_SET	IN	Test Mode Setting	B13	EXT_OUT4	OUT	Multi-function terminal (Output)
A14	EXT_IN	IN	Multi-function terminal (Input)	B14	EXT_OUT3	OUT	Multi-function terminal (Output)
A15	HOLD	IN	Comparison/result hold	B15	EXT_OUT2	OUT	Multi-function terminal (Output)
A16	JUDGE_OFF	IN	Comparison output stop	B16	EXT_OUT1	OUT	Multi-function terminal (Output)

8.2 Terminals



- To avoid damage to the instrument, do not apply voltage exceeding the followings.
 - Maximum Input Voltage: 30 V DC.
 - Maximum Voltage to earth: 30 V rms or 60 V DC.
-
- The 8730-10, 8731-10 has 32 external control terminals. Input terminals: 12; output terminals: 16; power supply/GND: 4
 - The external control terminals are isolated from the 8730-10, 8731-10 by a photocoupler.
 - M3 screws are used to secure the terminals.
 - Lift the terminal block cover to expose the terminals.
 - The cover contains a terminal nameplate. The rear of this nameplate is left blank so that you can fill in names or functions there.
 - Terminal name labels are provided with the 8730-10, 8731-10. Attach the labels to the 8730-10, 8731-10, as required. Never attach labels on the ventilation slot on the side of the 8730-10, 8731-10.



External Control Terminals

ISO _DCV	EXT _DCV	EXT _COM	ISO _GND	STOP	START	EXT _TRIG	EXT _SAMP	MODE3	MODE2	MODE1	MODE0	MODE _SET	EXT _IN	HOLD	JUDGE _OFF
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
NG VALUE	OK VALUE	NG _AREA2	OK _AREA2	NG _AREA1	OK _AREA1	JUDGE _OUT	TRIG _OUT	ERROR	BUSY	STOR AGE	EXT _OUT5	EXT _OUT4	EXT _OUT3	EXT _OUT2	EXT _OUT1
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Nameplate

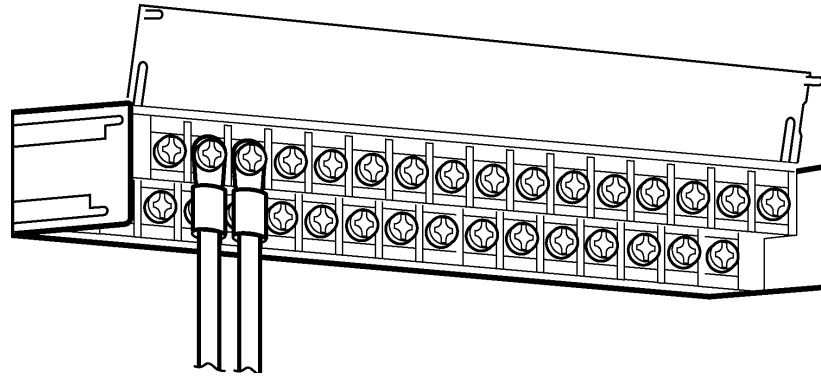
8.3 Power Supply Terminal



- An external power supply or the isolated power supply built into the 8730-10, 8731-10 may be used to drive the external control terminals.
 <External power supply> 30 V DC (max.) to 5 V DC (min.)
 <Internal power supply> 5 V $\pm$ 0.5V (total 40 mA)

8.3.1 External Power Supply

- When using an external power supply, connect the anode to EXT_DCV terminal (A2) and the cathode to EXT_COM terminal (A3).
- When using an external power supply, do not connect A1 to A2 or A3 to A4.
- Input voltage is 5 to 30 VDC.



External Control Terminals

+		-														
ISO_DCV	EXT_DCV	EXT_COM	ISO_GND	STOP	START	EXT_TRIG	EXT_SAMP	MODE3	MODE2	MODE1	MODE0	MODE_SET	EXT_IN	HOLD	JUDGE_OFF	
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	
NG_VALUE	OK_VALL	NG_AREA2	OK_REA2	NG_AREA1	OK_AREA1	JUDGE_OUT	TRIG_OUT	ERROR	BUSY	STOR AGE	EXT_OUT5	EXT_OUT4	EXT_OUT3	EXT_OUT2	EXT_OUT1	
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	

When using an external power supply

Connection when using an external power supply

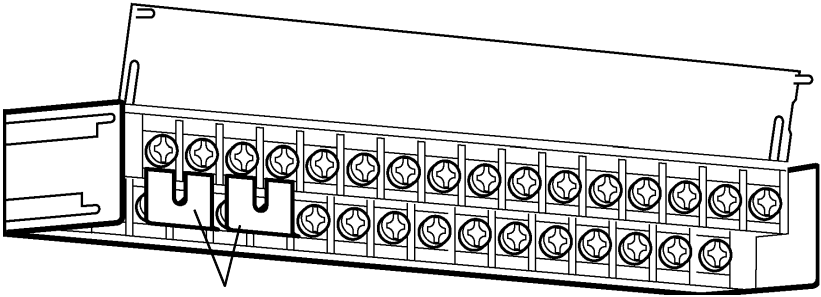


To avoid damage to the 8730-10, 8731-10 when using an external power supply, avoid short-circuiting the ISO_DCV terminal (A1) and EXT_DCV terminal (A2) or the EXT_COM terminal (A3) and ISO_GND terminal (A4).

8.3.2 Internal Power Supply



- When using the built-in power supply, connect ISO_DCV terminal (A1) to EXT_DCV terminal (A2) and EXT_COM terminal (A3) to ISO_GND terminal (A4).
Use the jumpers supplied to make these connections.
- Output voltage is $5V \pm 0.5V$ at 40 mA maximum.



Jumper connector External control terminals

A1-A2
Short-
Circuit

A3-A4
Short-
Circuit

ISO_DCV	EXT_DCV	EXT_COM	ISO_GND	STOP	START	EXT_TRIG	EXT_SAMP	MODE3	MODE2	MODE1	MODE0	MODE_SET	EXT_IN	HOLD	JUDGE_OFF
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16
NG_VAL	OK	NG_RE	OK	NG_REA1	OK_AREA1	JUDGE_OUT	TRIG_OUT	ERROR	BUSY	STOR_AGE	EXT_OUT5	EXT_OUT4	EXT_OUT3	EXT_OUT2	EXT_OUT1
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

When using an internal power supply

Connection when using an internal power supply



To avoid damage to the 8730-10, 8731-10, do not connect an external power supply to the 8730-10, 8731-10 when using the built-in power supply.

8.4 Input Terminals

- You can start (START) and stop (STOP) measurement and select comparison conditions (MODE) using external control terminals. You can also input external sampling (EXT_SAMP) and external trigger (EXT_TRIG) signals or hold comparison results (HOLD) and stop the output of comparison results (JUDGE_OFF).

• Specifications for external control input terminals

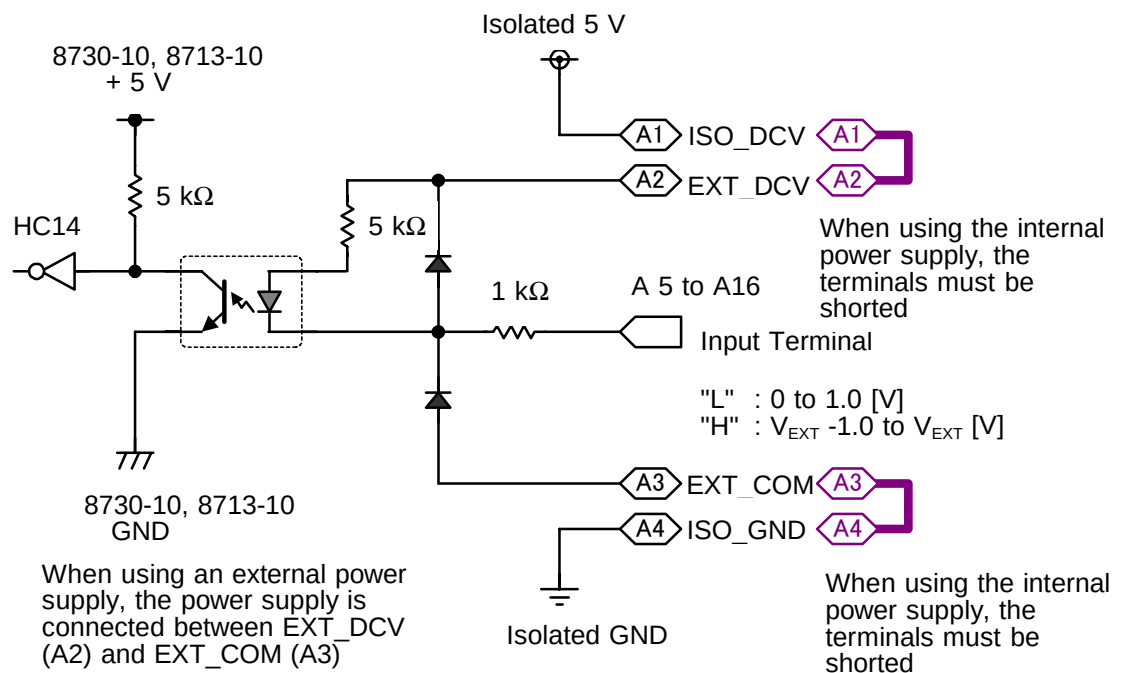
- HIGH level voltage:** When using an external power supply V_{EXT}
Max.: V_{EXT} , Min.: $V_{EXT}-1.0$ [V]
When using an internal power supply
Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage :** When using an external power supply V_{EXT}
Max.: 1.0 [V], Min.: 0 [V]
When using an internal power supply
Max.: 1.0 [V], Min : 0 [V]
- Maximum input voltage** : 30 V DC
- Maximum rated voltage to earth:** 30 V rms or 60 V DC.

NOTE

- Shorting an input terminal with EXT_COM (A3) has the same effect as a low-level signal input. Opening an input terminal from EXT_COM (A3) has the same effect as a high-level signal input.
- When using a relay or switch, provide a chattering prevention circuit to prevent errors.

8

• Circuit for external control input terminals



When using an external power supply, do not short-circuit A1 and A2, or A3 and A4.

8.4.1 Start/Stop Measurement <START Terminal (A6), STOP Terminal (A5)>

- Controls starting/stopping of measurement by the 8730-10, 8731-10.
- The START terminal (terminal No.: A6) corresponds to the **START** key.
- The STOP terminal (terminal No.: A5) corresponds to the **STOP** key.
- Controls the falling of a signal (active LOW).
- The maximum delay from the falling edge until detection is 50 ms.
- The START terminal does not accept signals when the BUSY terminal is LOW.
- When setting STOP terminal to LOW signal twice, the measurement will be aborted.

Input Signal

- The START terminal (A6) and STOP terminal (A5) must be shorted with EXT_COM (A3), or a low-level signal must be input to these terminals.

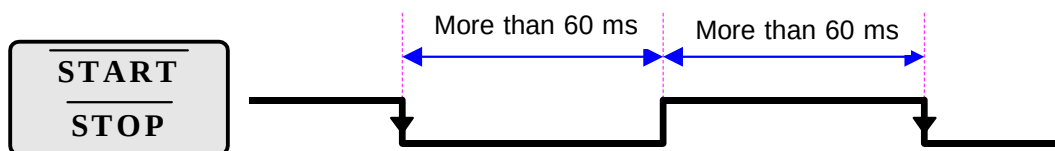
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.4.2 External Trigger <EXT_TRIG Terminal (A7)>

- A trigger signal may be input from an external device.
- The trigger is activated when the EXT_TRIG terminal (terminal No.: A7) detects a falling signal (active LOW).
- The maximum delay from the falling edge until activation is 100 μ s.
- When STORAGE terminal begins to output LOW signal, triggering is acceptable. (See 8.5.7)

Input Signal

- The EXT_TRIG terminal (A7) must be shorted with EXT_COM (A3), or a low-level signal must be input to these terminals.
- The trigger is activated at the falling edge.
- Input signals of up to 1 KHz are available to activate the trigger.

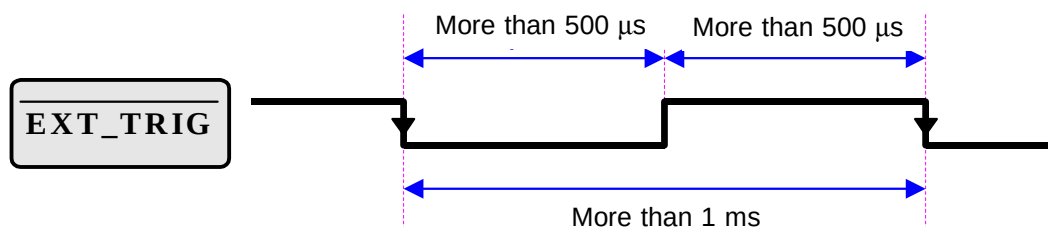
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.4.3 External Sampling <EXT_SAMP Terminal (A8)>

- A trigger signal may be input from an external device.
- The EXT_SAMP terminal (terminal No.: A8) initiates sampling with the rising of a signal (active HIGH).
- The maximum delay from the falling edge until activation is 100 μ s.

Input Signal

- Input a signal rising from LOW to HIGH to EXT_SAMP terminal (A8).
- Sampling is done at a rising edge.
- Input signals of up to 1KHz are available to activate the trigger.

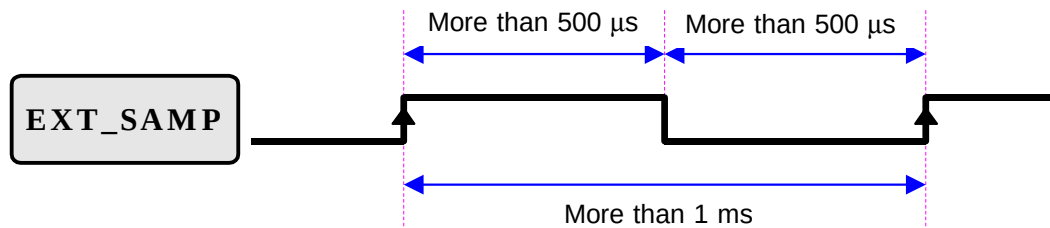
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.4.4 Selecting a Test Mode <MODE3 to 0 Terminals (A9 to 12), MODE_SET Terminal (A13)>

- An external signal may be used to change the test mode.
(For detailed information on test modes, see 5.2.4)
- When the MODE_SET terminal (terminal No.: A13) detects the falling of a signal (active LOW), the 8730-10, 8731-10 loads the 4-bit combination of MODE3 to 0 (terminal Nos.: A9 to 12).
- According to the 4-bit combination of MODE3 to 0, a setting (test mode) saved is loaded to 8730-10, 8731-10 internal memory. See the table below for the 4-bit combinations and corresponding test modes.
- These terminals are effective when measurement is not being conducted. While switching the test mode, the BUSY terminal (B10) indicates "L." (Measurement cannot begin while the status of the BUSY terminal is "L.")
- When the test mode is changed, the displayed waveform will be cleared.

Input Signal

- The MODE_SET terminal (A13) will be shorted with EXT_COM terminal (A3) or a low-level signal will be input to the terminal. The 4-bit combination of MODE3 to 0 will be loaded at the falling edge.

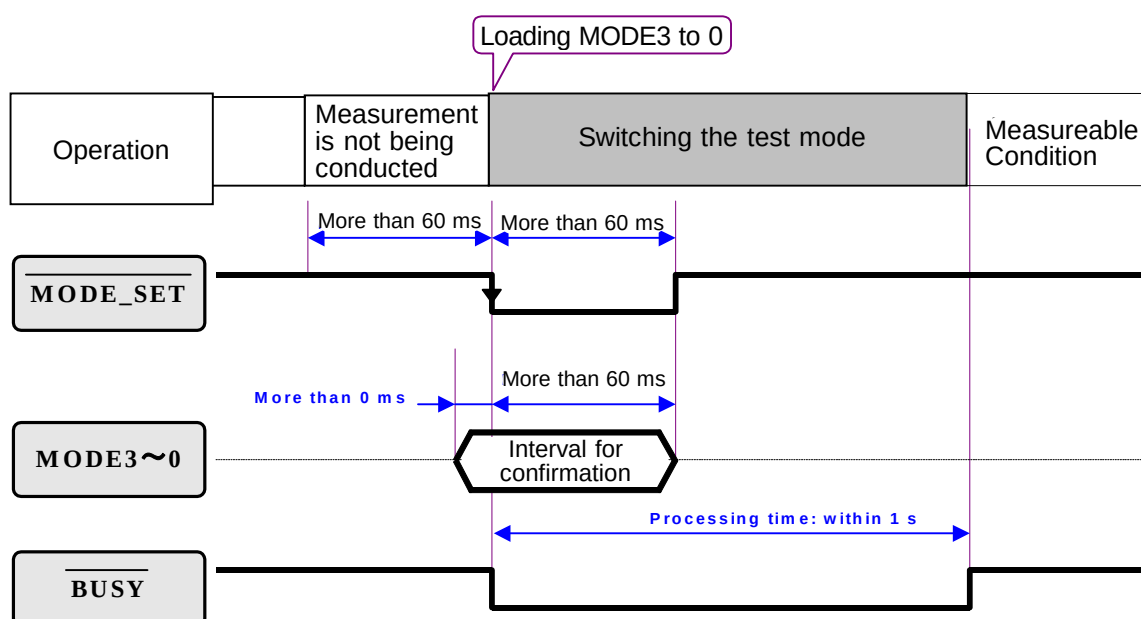
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



MODE3 to 0 terminals and MODE01 to 16 test modes

MODE3	MODE2	MODE1	MODE0	Test Mode
L	L	L	L	MODE01
L	L	L	H	MODE02
L	L	H	L	MODE03
L	L	H	H	MODE04
L	H	L	L	MODE05
L	H	L	H	MODE06
L	H	H	L	MODE07
L	H	H	H	MODE08
H	L	L	L	MODE09
H	L	L	H	MODE10
H	L	H	L	MODE11
H	L	H	H	MODE12
H	H	L	L	MODE13
H	H	L	H	MODE14
H	H	H	L	MODE15
H	H	H	H	MODE16

L: Low level (or shorted with EXT_COM terminal (A3))

H: HIGH level (or opened terminals)

8.4.5 Multi-function terminal (Input) <EXT_IN Terminal (A14)>

- The EXT_IN terminal (terminal No.: A14) is a multi-function terminal for which you can select a function.
- The following two functions are available:

1. Clears comparison output:

Clears comparison result output (OK, NG, or JUDGE_OUT) at the falling signal (active LOW) of the EXT_IN terminal. Note that output is not cleared when the HOLD terminal (terminal No.: A15) is "L."

2. START & STOP:

Starts measurement at the falling signal (active LOW) of the EXT_IN terminal and stops measurement at the rising of an input signal (active HIGH). Measurement cannot start when the BUSY terminal is LOW.

- For information on setting the multi-function terminal, see 7.5.2.
- The maximum delay from the falling or rising edge until activation is 50 ms.
- Activated when a edge is detected.

Input Signal

- The EXT_IN terminal (A14) inputs a signal to LOW or HIGH level according to the function selected.

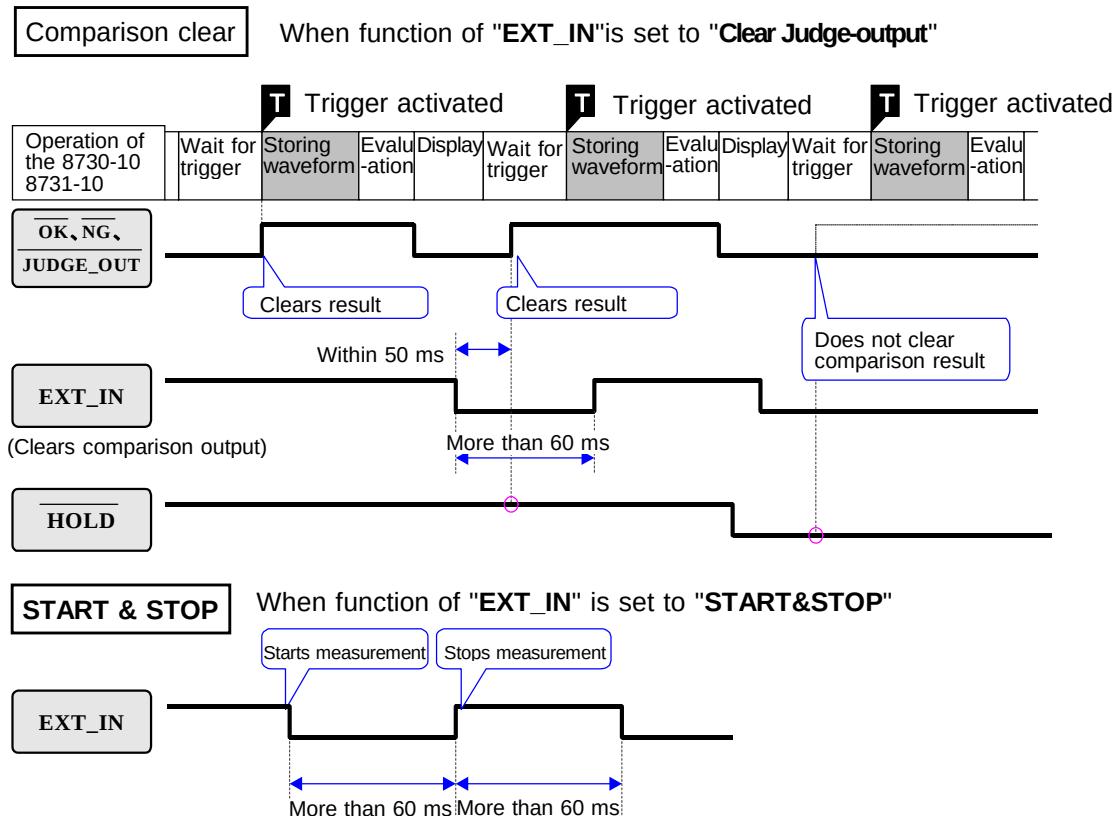
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.4.6 Holding Comparison Results <HOLD Terminal (A15)>

- Holds the output of a comparison result.
- Updates the screen for the comparison operation and result, but holds the output of the comparison result (OK, NG, or JUDGE_OUT).
- The result is held if the HOLD terminal (terminal No.: A15) receives a low-level signal (active LOW).
- Usually, a comparison result is cleared when the next trigger is activated. If the HOLD terminal is LOW, however, the comparison result is not cleared.

Input Signal

- The HOLD terminal (A15) will be shorted with EXT_COM terminal (A3) or a low-level signal will be input to the terminal.
- The HOLD terminal is checked at trigger activation.

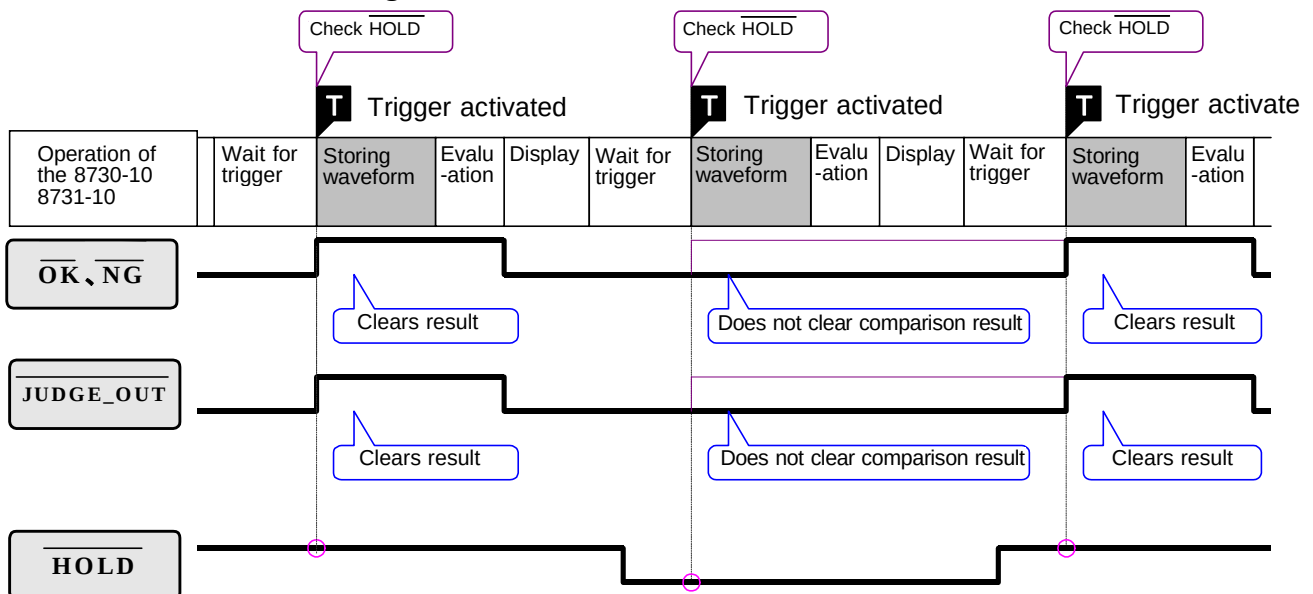
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.4.7 Canceling Output of Comparison Result

<JUDGE_OFF Terminal (A16)>

- Halts the output of a comparison result.
- Conducts comparison and displays the comparison result on the screen, but does not output the result (OK, NG, or JUDGE_OUT).
- The output is canceled when the JUDGE_OFF terminal (terminal No.: A16) receives a low-level signal (active LOW).
- Usually, a comparison result is output after a waveform has been loaded and compared. If the JUDGE_OFF terminal is LOW, however, the comparison result is not output.

Input Signal

- The JUDGE_OFF terminal (A16) will be shorted with EXT_COM terminal (A3) or a low-level signal will be input to the terminal.
- The JUDGE_OFF terminal is checked when comparison has been completed.

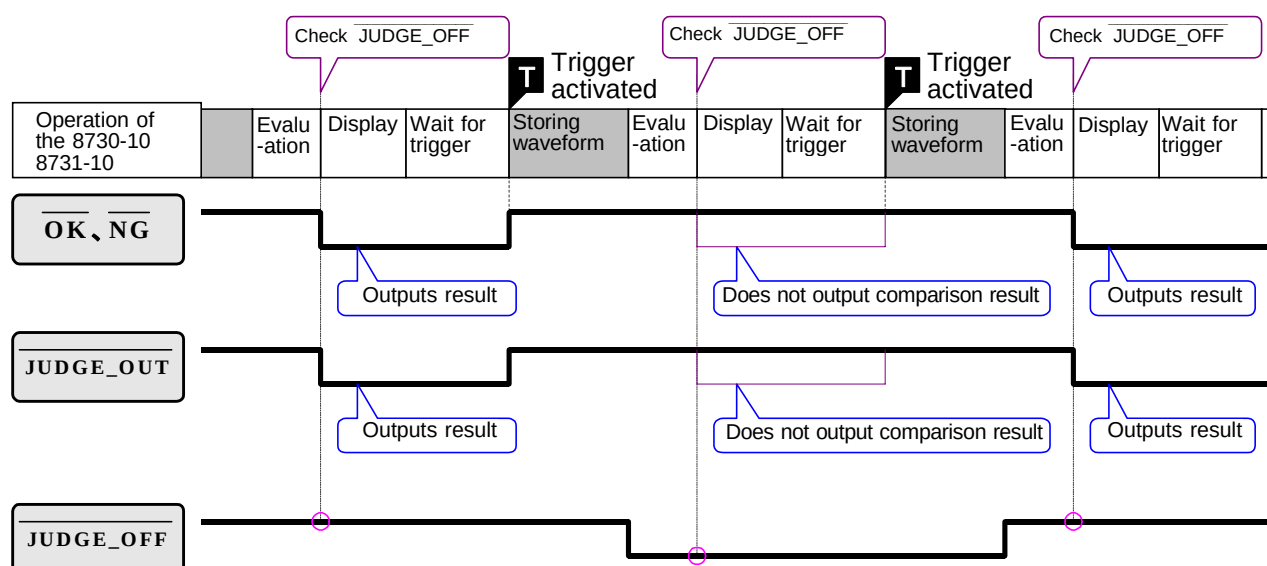
<When using an internal power supply>

- HIGH level voltage: Max.: 5.0 [V], Min.: 4.0 [V]
- LOW level voltage : Max.: 1.0 [V], Min: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V]
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.5 Output Terminals

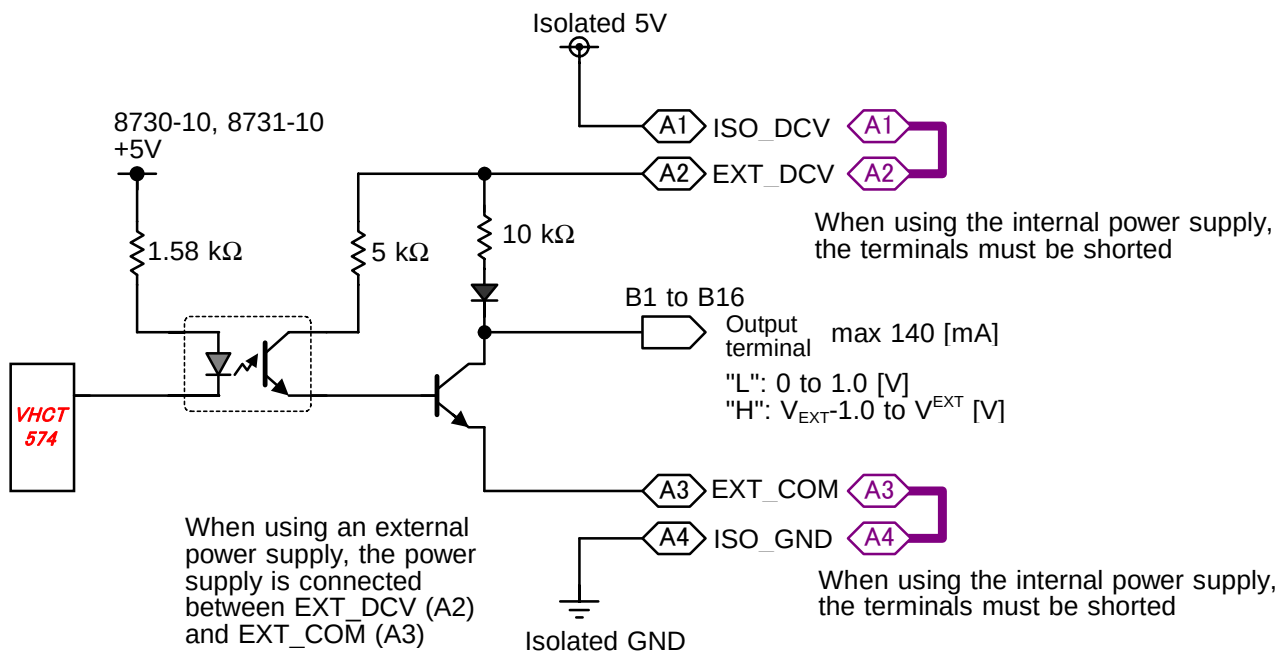
- Signals representing comparison results (OK, NG and JUDGE_OUT) and 8730-10, 8731-10 status (ERROR, BUSY and STORAGE) may be output from external control terminals.

In addition, a trigger signal (TRIG_OUT) may be output.

• Specifications for external control output terminals

- HIGH level voltage: When using an external power supply V_{EXT}
Max.: V_{EXT} , Min.: $V_{EXT}-1.0$ [V] (When there is no load)
When using an internal power supply
Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : When using an external power supply V_{EXT}
Max.: 1.0 [V], Min.: 0 [V]
When using an internal power supply
Max.: 1.0 [V], Min.: 0 [V]
- Output signal : Open-collector output (pull-up resistance 10k Ω)
- Maximum sink current : 140 mA DC (per terminal)
- Maximum input voltage : 30 V DC
- Maximum rated voltage to earth: 30 V rms or 60 V DC.

• Circuit for external control output terminals



When using an external power supply, do not short-circuit A1 and A2, or A3 and A4.



A maximum delay of up to 100 μ s occurs from the completion of 8730-10, 8731-10 internal processing to terminal output, since the terminals are isolated from the 8730-10, 8731-10 by a photocoupler.

8.5.1 Output of Value Comparison Results

<OK_VALUE Terminal (B2), NG_VALUE Terminal (B1)>

- Outputs the result of value comparison.
- The NG_VALUE terminal (terminal No.: B1) outputs the total comparison of value comparisons No.1 to No.4.
- The OK_VALUE terminal (terminal No.: B2) outputs the total comparison result of value comparisons No.1 to No.4.
- The total comparison result is PASS when the results of value comparisons No.1 to No.4 are all PASS. If any result is FAIL, the total comparison result is FAIL.
- Each value comparison result (No.1 to No.4) can be outputted separately. (See 8.5.8)

Output Signal

- The NG_VALUE terminal (B1) outputs a low-level signal (active LOW) when any result of value comparisons No.1 to No.4 is FAIL.
- The OK_VALUE terminal (B2) outputs a low-level signal (active LOW) when the results of value comparisons No.1 to No.4 are all PASS.

<When using an internal power supply>

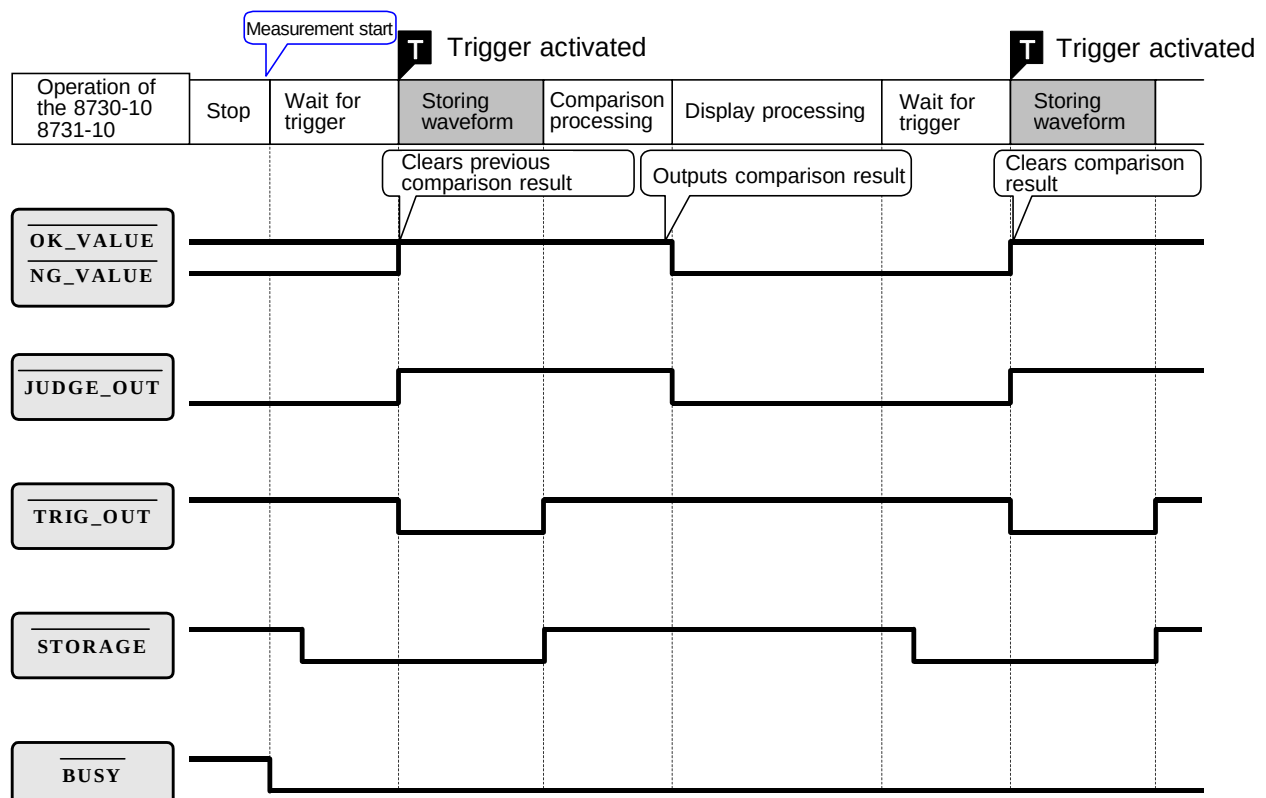
- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>

1. Trigger Mode: Repeat, Auto Save: OFF





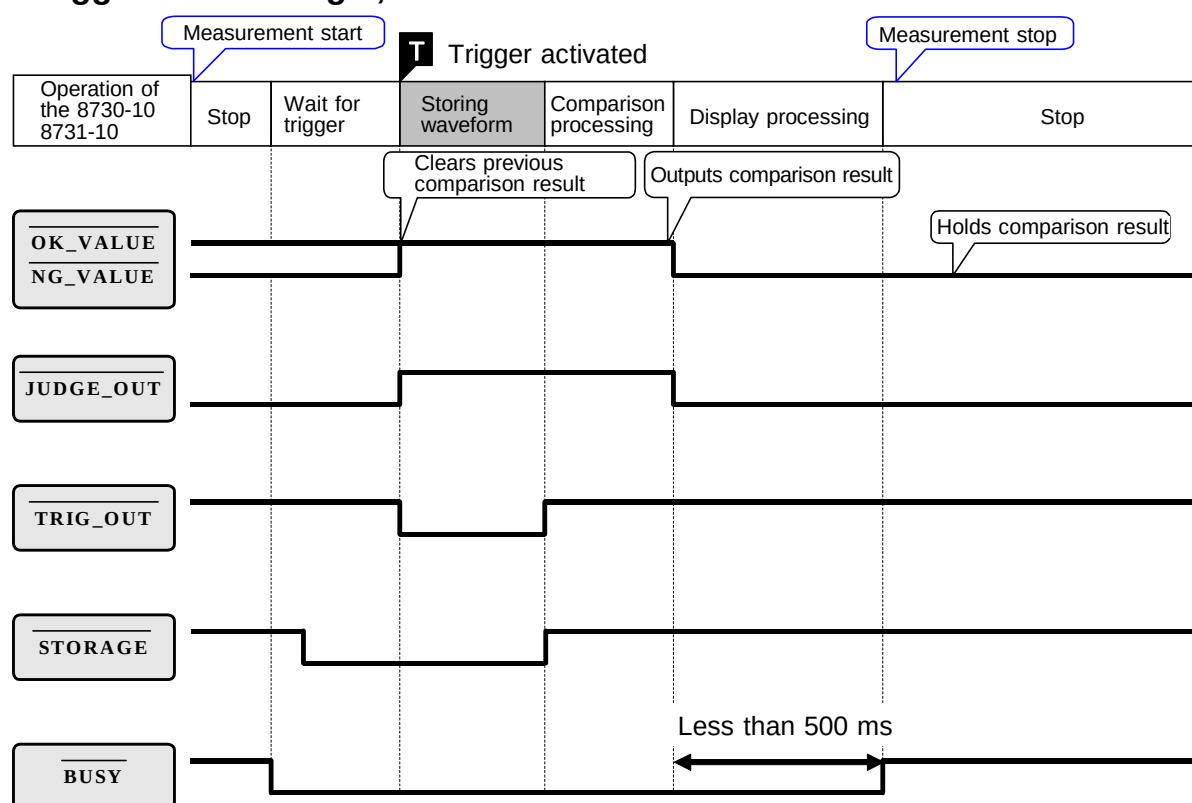
Comparison time and cycle vary depending on the type of calculation and recording length.

Referring Data

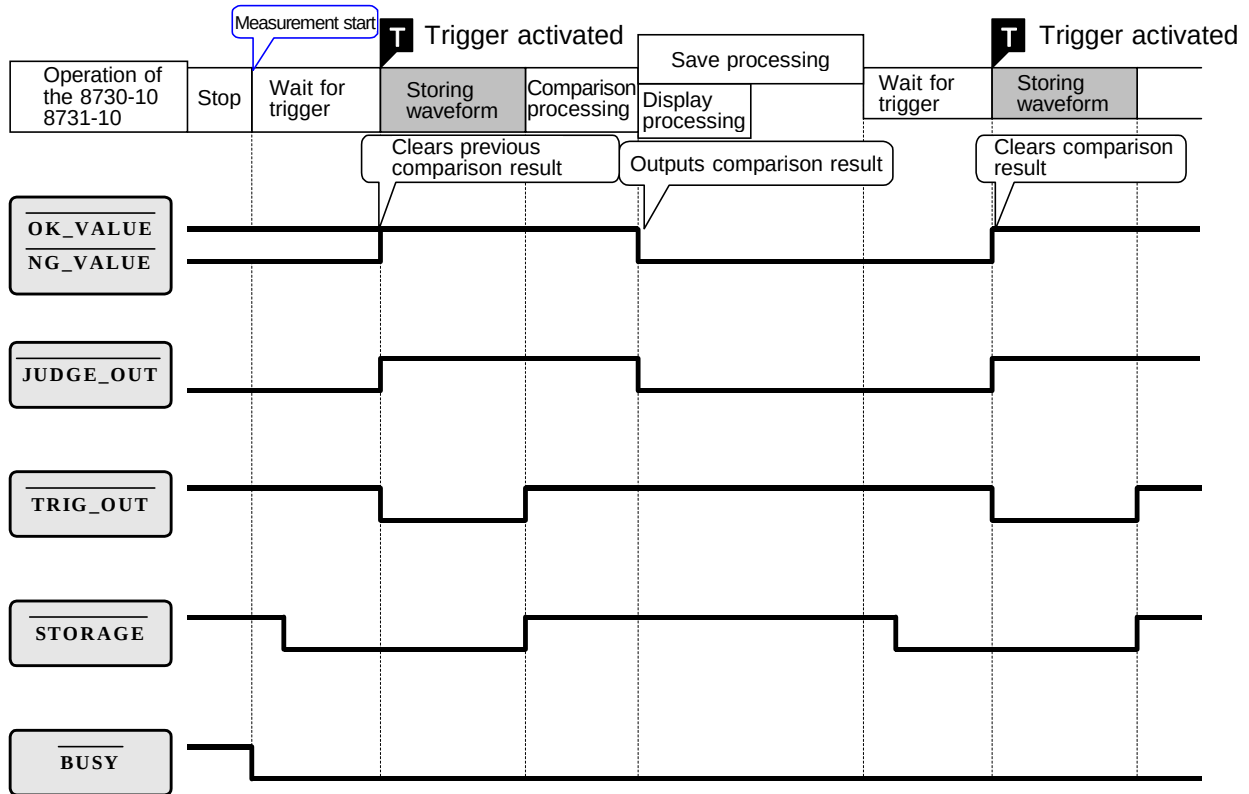
When conducting value comparison on a 1 kHz sine wave for No.1: CH1 maximum value, No.2: CH1 minimum value, No.3: CH2 maximum value, and No.4: CH2 minimum value with time axis range: 100 μ s/DIV, recording length: 10 DIV, display format: single screen.

- Comparison time (duration of comparison): Approx. 70 ms
- Comparison cycle (from trigger to next trigger): Approx. 220 ms

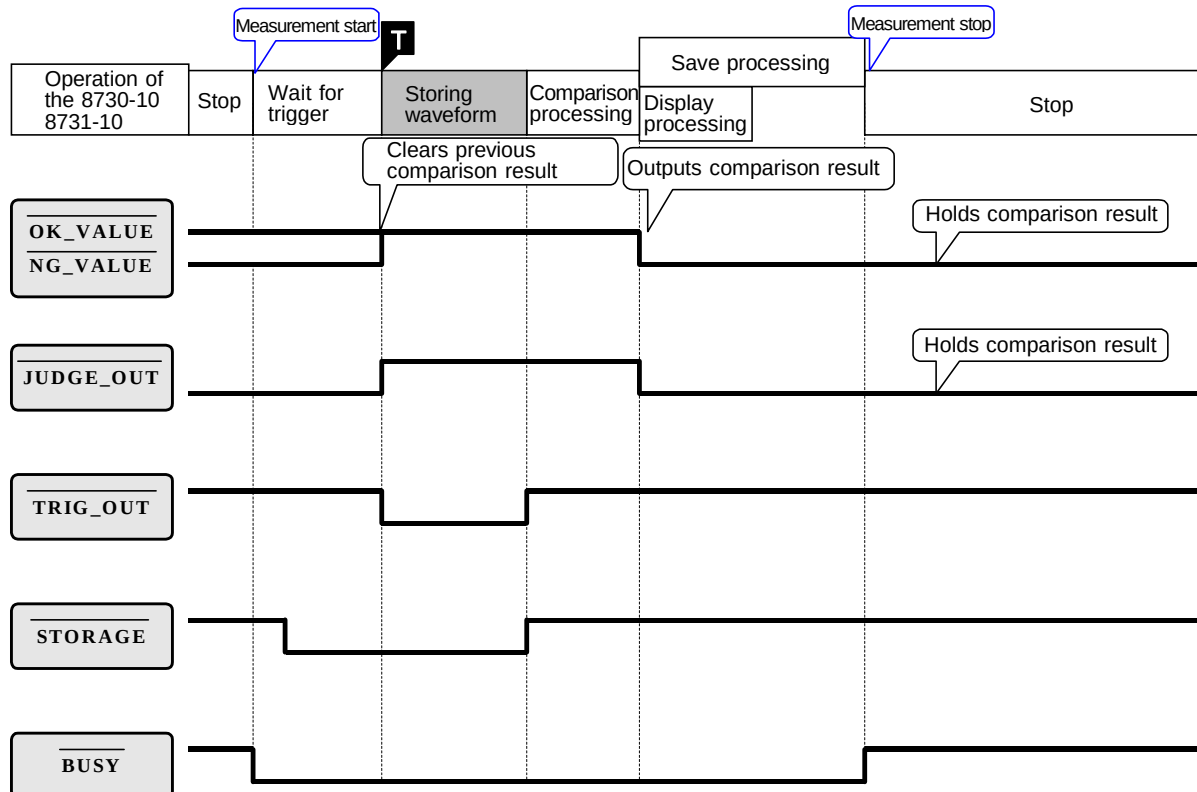
2. Trigger Mode: Single, Auto Save: OFF



3. Trigger Mode: Repeat, Auto Save: ON



4. Trigger Mode: Single, Auto Save: ON



8.5.2 Output of Area Comparison Results <OK_AREA Terminals (B4, B6), NG_AREA Terminals (B3, B5)>

- Outputs the result of area comparison.
- CH1 and CH2 are both compared separately, with the results being output separately. (CH1 only for the 8730-10)
- For an X-Y synthesized waveform, the same result is output for both CH1 and CH2.
- The NG_AREA2 terminal (terminal No.: B3) outputs a signal when the area comparison of CH2 is FAIL.
- The OK_AREA2 terminal (terminal No.: B4) outputs a signal when the area comparison of CH2 is PASS.
- The NG_AREA1 terminal (terminal No.: B5) outputs a signal when the area comparison of CH1 is FAIL.
- The OK_AREA1 terminal (terminal No.: B6) outputs a signal when the area comparison of CH1 is PASS.

Output Signal

- When the comparison result is PASS, the OK_AREA1 and 2 terminals output a low-level signal (active LOW).
- When the comparison result is FAIL, the NG_AREA1 and 2 terminals output a low-level signal (active LOW).

<When using an internal power supply>

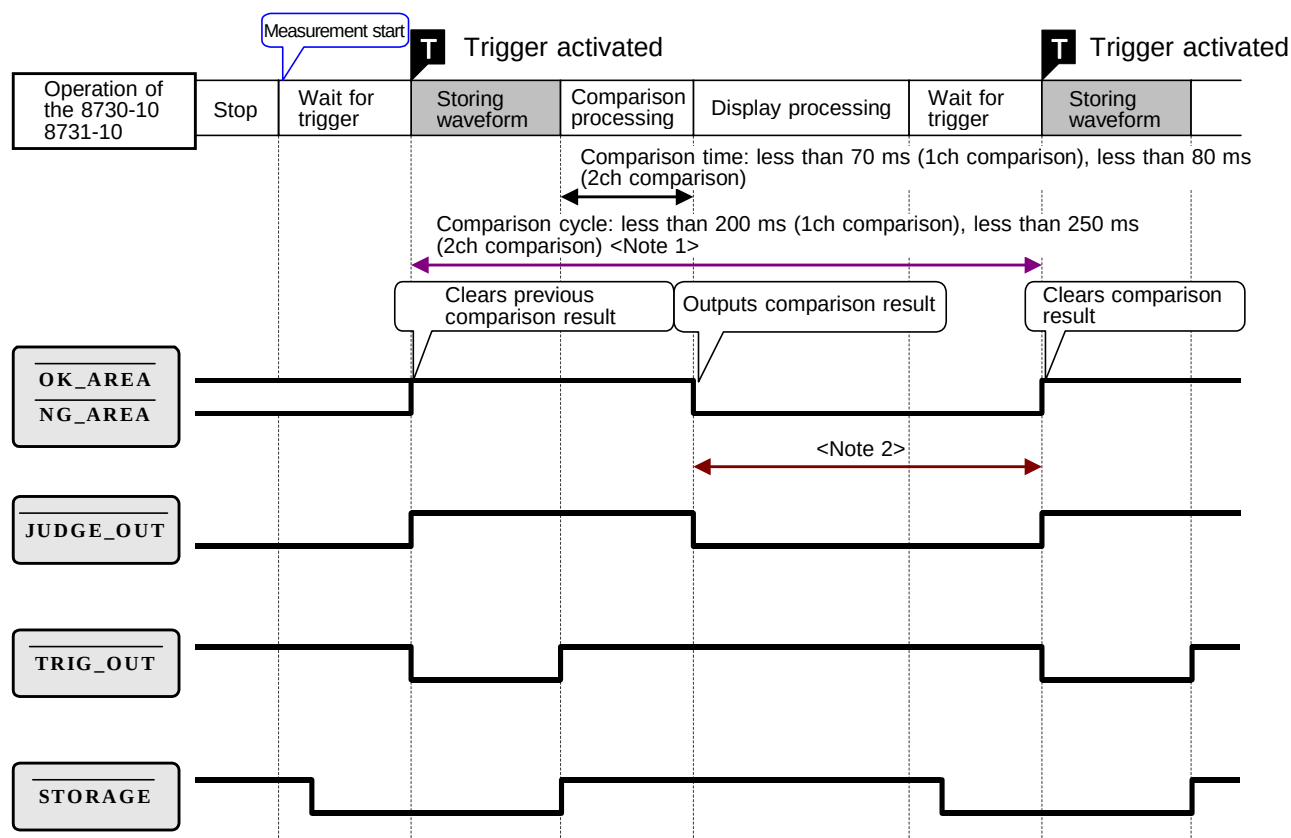
- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage :Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage :Max.: 1.0 [V], Min.: 0 [V]

<Timing>

1. Trigger Mode: Repeat, Auto Save: OFF



NOTE

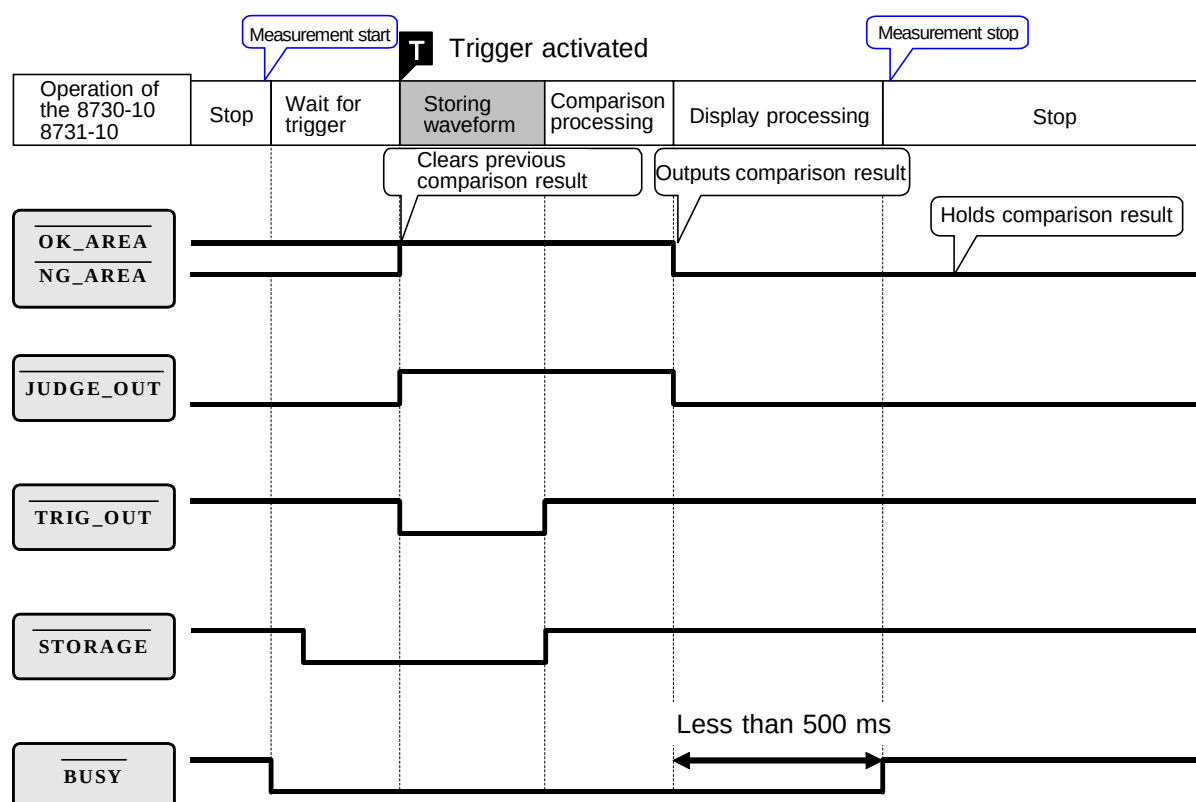
<Note 1>: The comparison cycles are calculated assuming that only area comparison is conducted on a 1-kHz sine wave under the settings below.

- * Time axis range: 100 μ s/DIV, recording length: 10 DIV (waveform storing time = 1 ms)
- * Display format: single screen, no LAN connection, no A/B cursor display (Note that 1ch comparison means that one channel is used by the 8730-10 or 8731-10; 2ch comparison means that two channels are used by the 8731-10.)
- Setting screen update OFF (see 5.2.2) shortens the comparison cycle as shown below.
- * 8730-10: 100 ms, 8731-10 (1ch only): 150 ms, 8731-10 (2ch): 200 ms

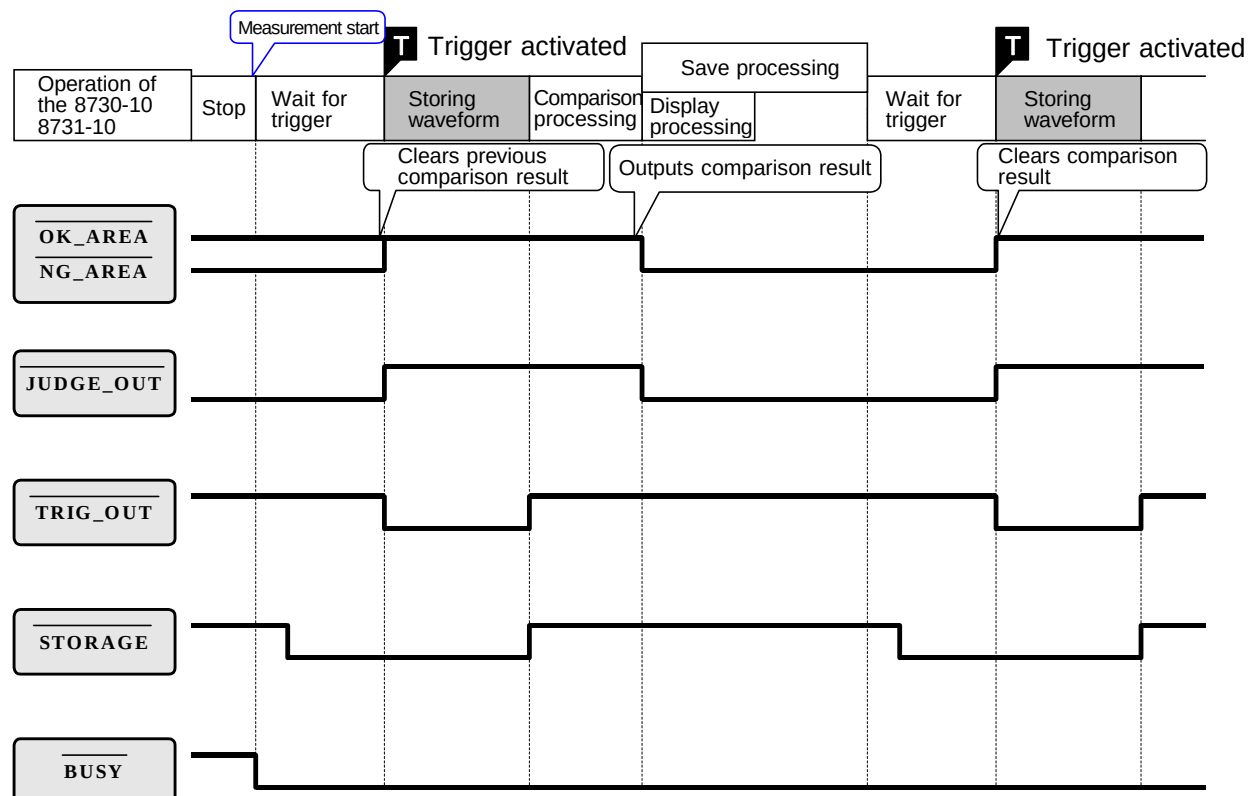
<Note 2>: Setting screen update OFF (see 5.2.2) inhibits display processing, but outputs the comparison result for at least 10 ms.

- OK AREA2 and NG AREA2 are only effective for the 8731-10.

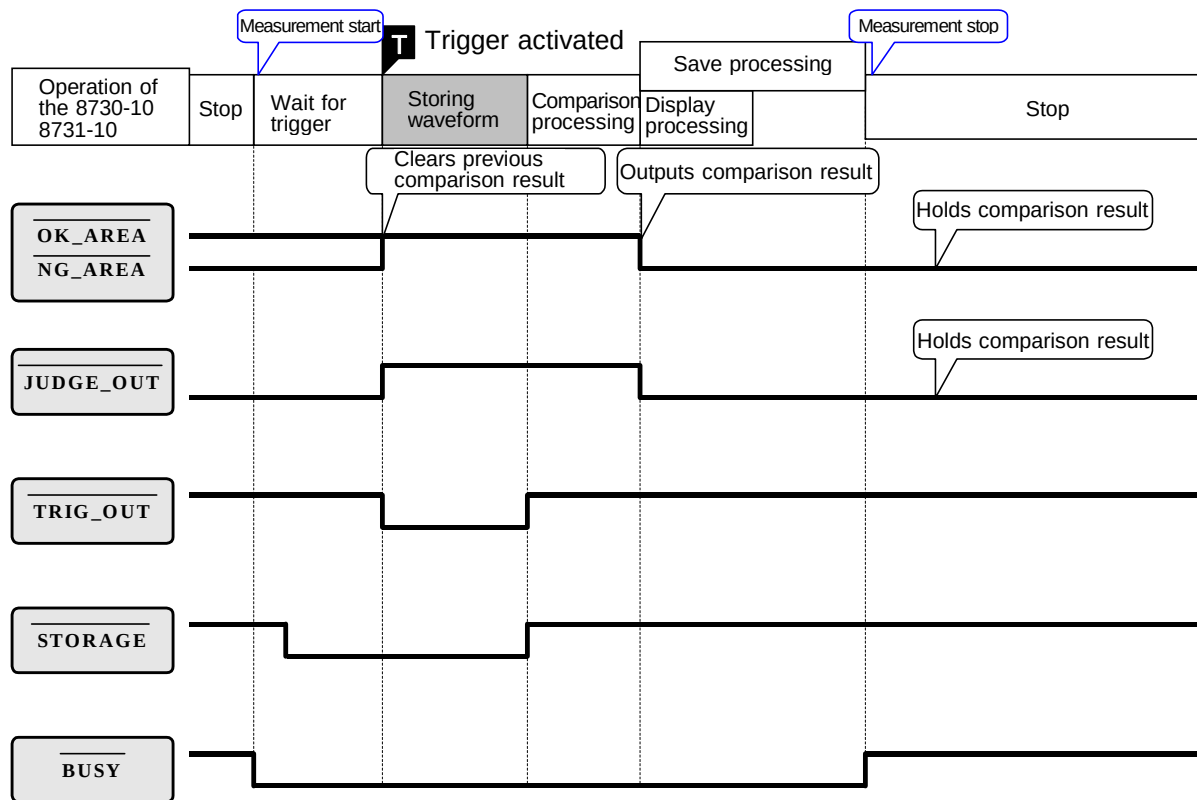
2. Trigger Mode: Single, Auto Save: OFF



3. Trigger Mode: Repeat, Auto Save: ON



4. Trigger Mode: Single, Auto Save: ON



8.5.3 Comparison Result Being Output <JUDGE_OUT Terminal (B7)>

- Indicates that a comparison result is being output.
- The JUDGE_OUT terminal (terminal No.: B7) outputs a low-level signal (active LOW) during output of an area or value comparison result.

Output Signal

- The JUDGE_OUT terminal (B7) outputs a low-level signal (active LOW) during output of a comparison result.

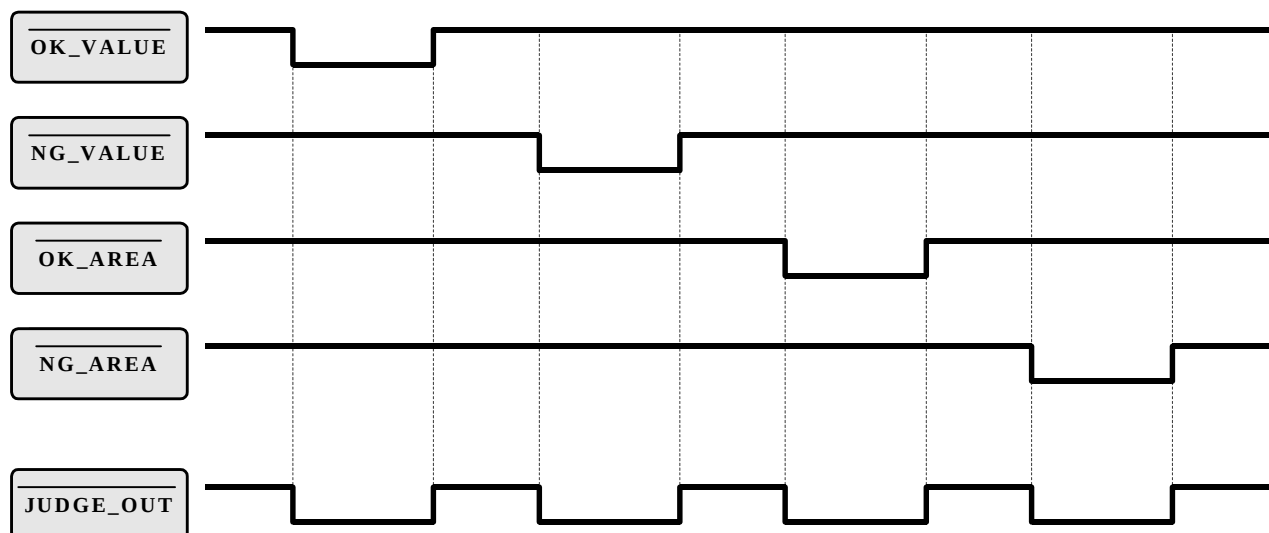
<When using an internal power supply>

- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



8.5.4 Trigger Output <TRIG_OUT Terminal (B8)>

- Indicates that the trigger is activated.
- The TRIG_OUT terminal (terminal No.: B8) outputs a low-level signal (active LOW) at trigger activation.

Output Signal

- The TRIG_OUT terminal (B8) outputs a low-level signal (active LOW) at trigger activation. Once the waveform has been loaded, the signal returns to HIGH level.

<When using an internal power supply>

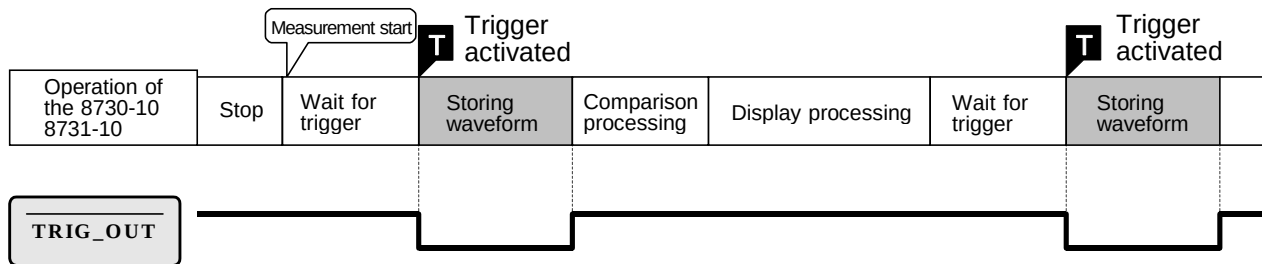
- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>

1. Trigger Mode: Repeat, Auto Save:



8.5.5 Error Signals Output <ERROR Terminal (B9)>

- Indicates that an error occurred on the 8730-10, 8731-10.
- The ERROR terminal (terminal No.: B9) outputs a low-level signal (active LOW) at error occurrence, for example, when data cannot be saved because the PC card is full.
- For details of errors, see 13.1.

Output Signal

- The ERROR terminal (B9) outputs a low-level signal (active LOW) at error occurrence.
- The ERROR terminal continues low-level signal output until the **STOP** key is pressed or a STOP signal is input. (The STOP signal can be input to the STOP terminal (A5) or EXT_IN terminal (A14).

<When using an internal power supply>

- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

8.5.6 Processing <BUSY Terminal <(B10)>

- Indicates that the 8730-10, 8731-10 is conducting measurement and processing a task (e.g., storing a waveform, comparison, saving data).
- The BUSY terminal (terminal No.: B10) outputs a low-level signal (active LOW) during 8730-10, 8731-10 operation or processing when it cannot accept the START signal to start measurement.

Output Signal

- The BUSY terminal (B10) outputs a low-level signal (active LOW) during 8730-10, 8731-10 processing.

<When using an internal power supply>

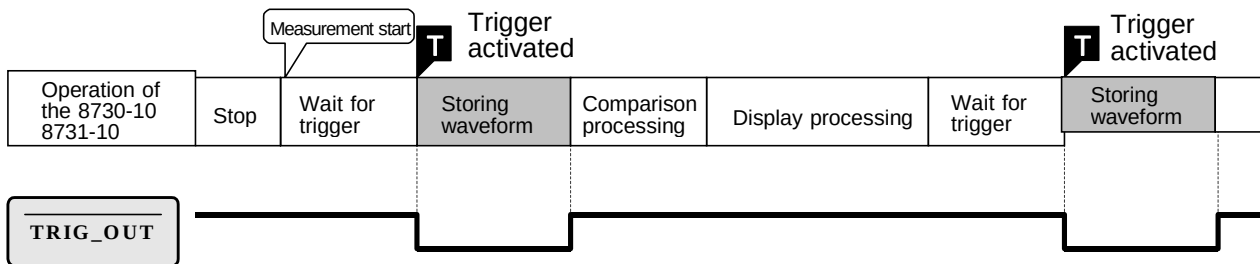
- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min: 0 [V]

<When using an external power supply>

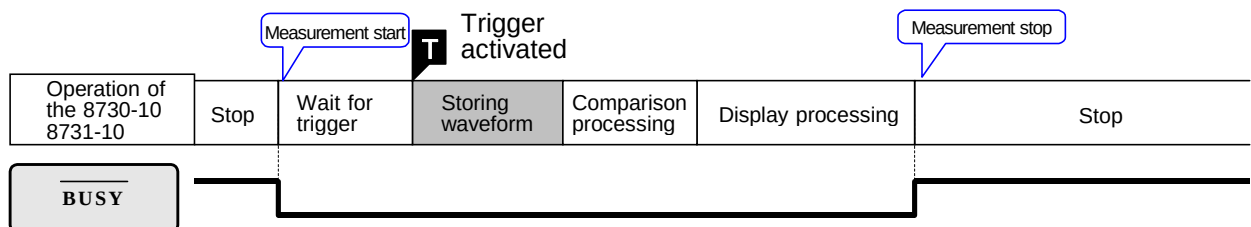
- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>

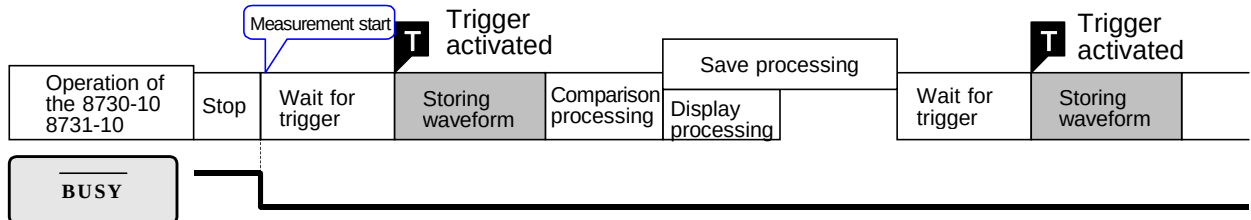
1. Trigger Mode: Repeat, Auto Save: OFF



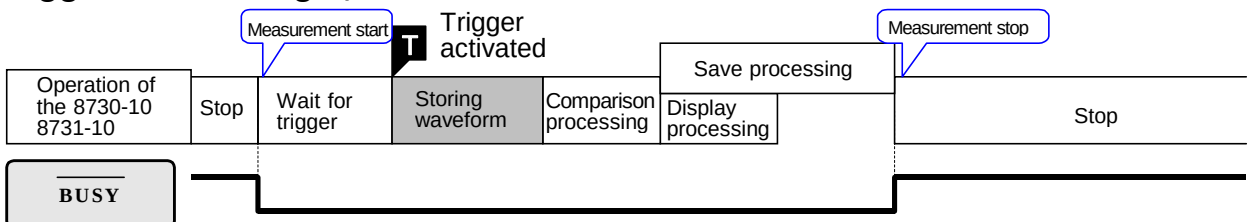
2. Trigger Mode: Single, Auto Save: OFF



3. Trigger Mode: Repeat, Auto Save: ON



4. Trigger Mode: Single, Auto Save: ON



8.5.7 Measuring <STORAGE Terminal (B11)>

- Indicates that the 8730-10, 8731-10 is storing a waveform.
- The STORAGE terminal (terminal No.: B11) begins to output a low-level signal (active LOW) when the 8730-10, 8731-10 starts measurement and updates the screen, and continues signal output until the 8730-10, 8731-10 completes waveform storing.
- When STORAGE terminal begins to output LOW signal, triggering is acceptable.

Output Signal

- The STORAGE terminal (B11) outputs a low-level signal (active LOW) while the 8730-10, 8731-10 is storing a waveform. The terminal is also set to LOW level while the 8730-10, 8731-10 is waiting for a signal from the amplifier or a trigger.

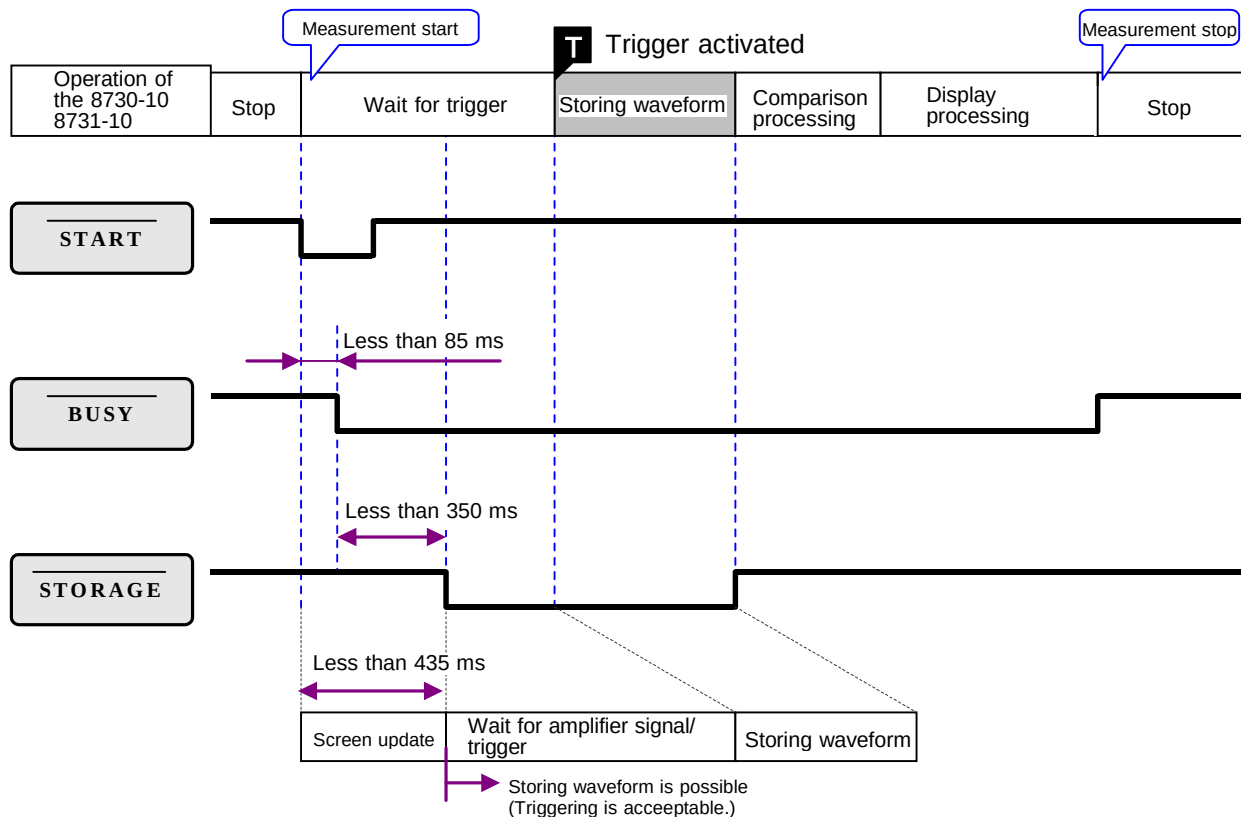
<When using an internal power supply>

- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>



- The conditions for the above timing example are Single screen format, with no LAN connection and no A/B cursor display.

8.5.8 Multi-Function Terminals (Output)

<EXT_OUT Terminals (B12 to B16)>

- The EXT_OUT terminals (terminal Nos.: B12 to B16) are multi-function terminals for which you can select functions.
- There are five EXT_OUT terminals: EXT_OUT1 terminal (terminal No.: B16), EXT_OUT2 terminal (B15), EXT_OUT3 terminal (B14), EXT_OUT4 terminal (B13), and EXT_OUT5 terminal (B12).
- The following three functions are available for each terminal:

- (1) Total comparison : Outputs total comparison of all area and value comparison results. Outputs PASS when all comparison results are PASS. Outputs FAIL if any one of the results is FAIL.
- (2) Area comparison : Outputs total comparison of CH1 area comparison and CH2 area comparison results. Outputs PASS when both CH1 and CH2 results are PASS. Outputs FAIL if either result is FAIL.
- (3) Value comparison : Outputs individual results of value comparisons No.1 to 4.

- For instructions on how to set the multi-function terminals, see 7.5.1.

Output Signal

- The EXT_OUT terminals (B12 to B16) output a low-level or high-level signal according to the functions selected.

<When using an internal power supply>

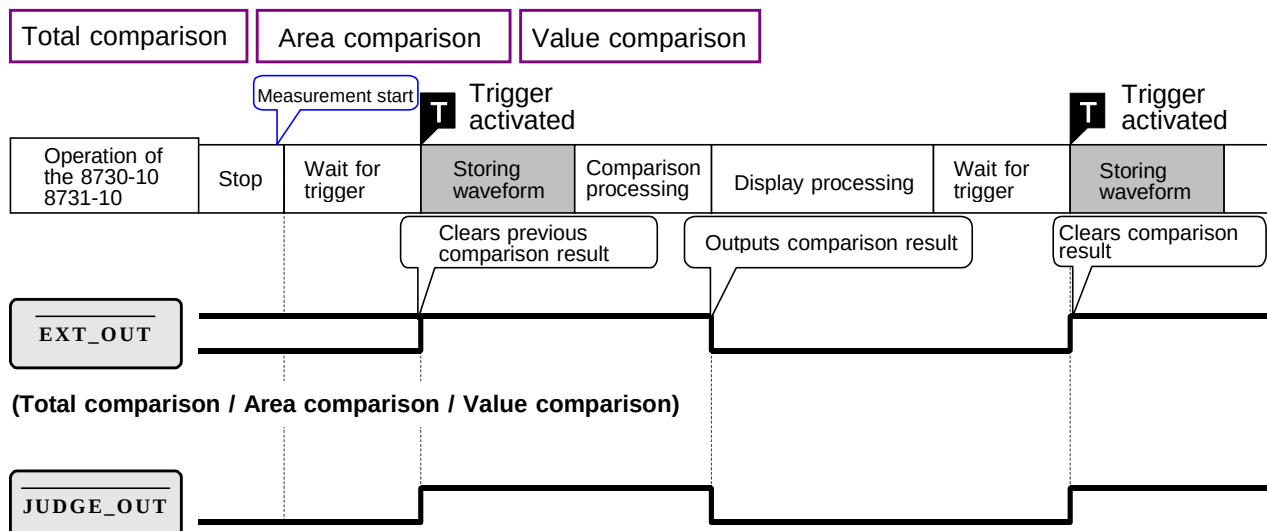
- HIGH level voltage: Max.: 5.5 [V], Min.: 3.5 [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<When using an external power supply>

- External power supply voltage V_{EXT} : Max.: 30 [V] DC, Min.: 5 [V] DC
- HIGH level voltage : Max.: V_{EXT} [V], Min.: $V_{EXT}-1.0$ [V] (When there is no load)
- LOW level voltage : Max.: 1.0 [V], Min.: 0 [V]

<Timing>

Common timing for the three EXT_OUT functions

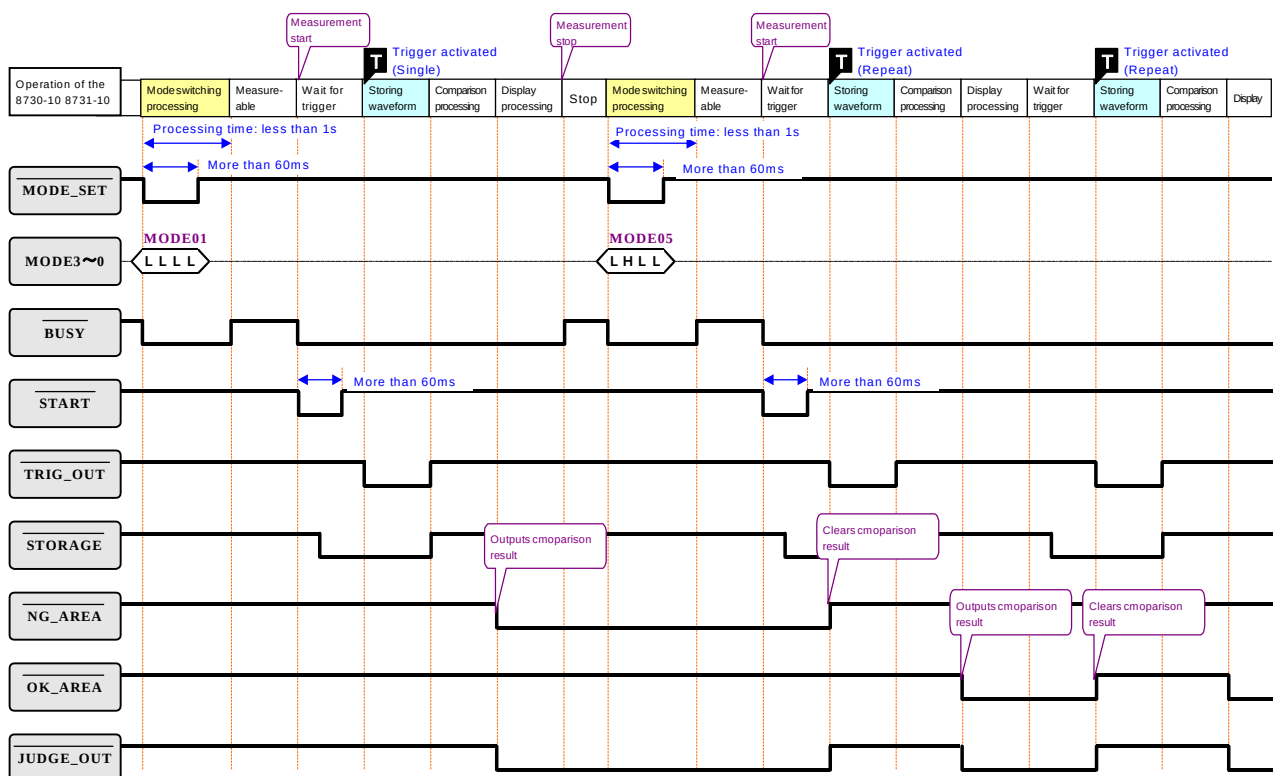


8.6 Example of Control via the External Control Terminals

- This example shows a sequence that changes the test mode via the External Control terminals while measuring.
- In this example, measurements are taken in Test Modes 01 and 05.

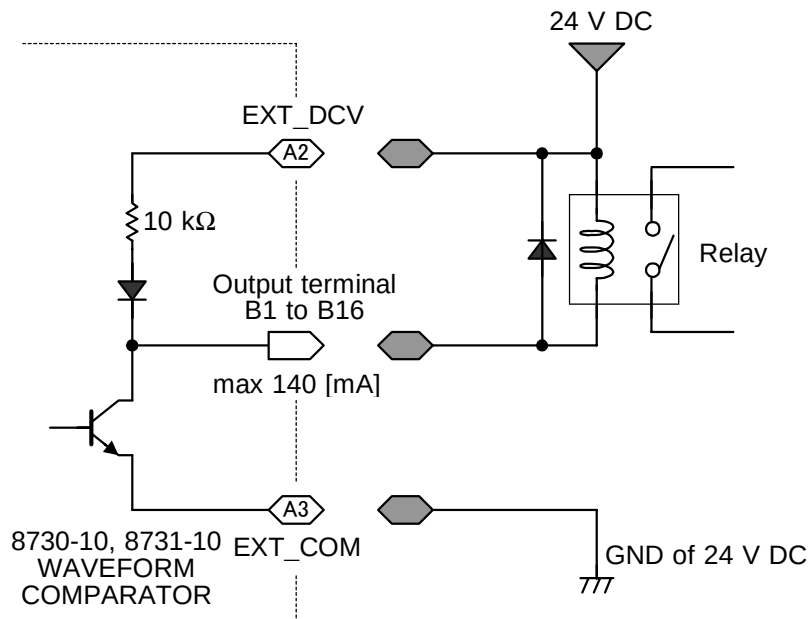
<Control Example>

1. Perform measurement and comparison with the Test Mode 01 settings R Area Comparison FAIL (Test Mode 01 is one-shot-trigger).
2. Perform measurement and comparison with the Test Mode 05 settings R Area Comparison PASS (Test Mode 05 is continuous-trigger).



8.7 External Control Connection Example

- This is an example of External Control terminal connections.
- In this example, a 24 V DC relay is connected to an output terminal.
- A 24 V DC supply connects between the EXT_DCV (A2) terminal and the EXT_COM (A3) terminal (see 8.3.1).
- The relay connects between the output terminal (any of B1 through B6) and 24 V DC (see 8.5 for output terminal description).



Chapter 9

Interface

The 8730-10, 8731-10 is equipped with RS-232C and LAN interfaces as standard. This chapter explains how to connect these interfaces. For details of communications commands, refer to the application disk (CD-R) supplied with the 8730-10, 8731-10. The disk contains a guide to the communications commands in text format and HTML format. For setting details, see 7.3 and 7.4.

9.1 LAN Interface

The LAN capabilities of the instrument are supported through the Ethernet 10Base-T interface.

You can connect to networks with an Ethernet 10BASE-T-compatible cable (maximum length 100 m).

Connecting the 8730-10, 8731-10 to a LAN network enables communications between the 8730-10, 8731-10 and HIOKI 9333 LAN COMMUNICATOR application for PCs.

The 9333 LAN COMMUNICATOR makes it possible to remotely control the 8730-10, 8731-10 from a PC and load auto saved data in the 8730-10, 8731-10 onto the PC.

Further, because the 8730-10 (8731-10) can be controlled by Communication command, control programs can be created and the unit controlled by connection to the communication command port using TCP.

For details of the communications commands, refer to the application disk (CD-R) supplied with the 8730-10, 8731-10.

This section explains LAN settings.

Setting and Connection Sequence

Follow the procedure below for setting and connection. For details, see 7.3.

1. On the Adjustment screen, set the LAN parameters.
2. Select "**ENTER**" for "**LAN restart**" and press the **ENTER** key.
(Note that "**ENTER**" is required to reflect the settings in the currently active LAN.)
3. Plug the LAN cable and connect to the network.



Editing the settings on the 8730-10, 8731-10 connected to the LAN may result in IP address overlap between the 8730-10, 8731-10 and other devices on the LAN or illegal address information may be sent to the network.

Therefore, be sure to complete the settings before connecting the 8730-10, 8731-10 to the network.

Make the following settings when connecting to the network. Ask your network administrator to provide you with the following.

DHCP	: Yes/No
Host Name and Address setting	
Host Name (Up to 12 characters)	: _____
IP Address	: ____·____·____·____
Subnet Mask	: ____·____·____·____
(When using DHCP, you do not need to enter the IP address or subnet mask.)	
DNS setting	
DNS	: Yes/No
IP Address (If Yes)	: ____·____·____·____
(When settings can be acquired from DHCP, the DHCP setting takes priority.)	
Gateway setting	
Gateway	: Yes/No
IP Address (If Yes)	: ____·____·____·____
Gateway name (If Yes)	: _____
(When using DNS, only specification of the name is necessary; when not using DNS, the IP address must be specified.)	
TPC/IP Port Number	: __x (Default: 880x)
Specify the first 3 digits of the number. The last digit ranges from 0 to 9, reserving the ports for use by the unit.	

Consult with your network administrator when a configuring a new network using only the 8730-10, 8731-10 and a PC without connection to an existing network. If there is no network administrator or if you are responsible for this procedure, we recommend that you contact the addresses below.

IP Address of the PC	: 192.168.0.1
IP address of the first recorder	: 192.168.0.2
IP address of the second recorder	: 192.168.0.3
IP address of the third recorder	: 192.168.0.4
↓	
Host Name	: Anything (However, each should be unique)
Subnet Mask	: 255.255.255.0
Gateway	: OFF
DNS	: OFF
DHCP	: OFF
TCP/IP Port Number	: 880x

DHCP

DHCP is a method whereby devices automatically acquire and set their own IP address, etc.

Enabling DHCP makes automatic acquisition and setting of an IP address and subnet mask possible when a DHCP server is operating on the same network as the device. If acquisition of DNS or Gateway information is applicable, it is acquired at the same time. (This takes priority over entered settings.)

Host Name

This name represents the device on the network. Do not duplicate the host name of other devices. Furthermore, dynamic DNS is not supported, so it is not result to register for the DNS which is set the host name.

IP Address

Address used to identify each device on the network. Do not duplicate the IP address of other devices. Furthermore, if DHCP is valid, it is set automatically by DHCP.

Subnet Mask

This setting separates the IP address into a portion representing the network and another representing the device.

Therefore, make it the same as the subnet mask of other devices on the same network. Furthermore, if DHCP is valid, it is set automatically by DHCP.

DNS

It is difficult to remember an IP address since it is simply a string of numbers. However, it is easier to remember if it can be specified as a name. When the network includes a server that can search for IP addresses from names on the network, you can specify devices by name instead of using the IP address.

This service is provided by both DNS and WINS servers; however, the 8730-10, 8731-10 only supports DNS. Further, the 8730-10 (8731-10) does not dynamically register names and IP addresses with the DNS. Enabling DNS allows a connected remote device to be specified by name.

When DHCP is enabled and DNS information can be acquired from the DHCP server, the setting obtained from DHCP is given priority.

Gateway ON/OFF, IP Address

When the communicating device (PC) is on the network which is different from the network connected to this device, turn the Gateway setting ON, and specify the IP address of the device that is the gateway. Generally, if a PC is on the same network, you can make this setting the same as the default gateway address of the PC.

No default gateway is needed when the device and the PC are connected 1-to-1 (peer-to-peer), or when connected to the same hub, therefore turn this setting OFF.

When DHCP is valid and Gateway information can be acquired from the DHCP server, the setting obtained from DHCP is given priority.

TCP/IP Port Number

This device uses TCP/IP protocols for communications. TCP/IP enables multiple connections of each type to communicate and classifies them by port number. This device normally uses numbers from 8800 to 8809.

8800 (This device is the server)	: Used in remote operation applications on the 9333
8801 (This device is a client)	: Used in data collection applications on the 9333
8802 (This device is the server)	: For the control by the communication command
8803 to 8809	: reserved

Normally, these do not need to be changed. However, if there is a port that cannot be used because for security reasons or because it is being used on the PC communicating with this device, change this port. Set the first 3 digits. The last digit, ranging between 0 and 9, is either used or reserved for use by the device.

Data Collection Server

When communicating with this device, specify the IP address of the PC running the 9333 LAN COMMUNICATOR. This is necessary when collecting data using the 9333 LAN COMMUNICATOR.

When saving the data to LAN automatically (See 4.2.9), select "**LAN**" at the setting of auto save function.

When DNS is valid, and specify the collecting direction, set NAME, and specify the host name of the collecting direction.

For example, names are set in the following format: collect.hioki.co.jp. In the case of this example, if ".hioki.co.jp" is omitted, DNS may not be able to identify the IP address.

To specify the data collection server with an IP address, select "**IP**" and set the IP address.

Delimiter

This is used when selecting control by communications commands.

Set the line feed character used in command response to LF or CR+LF.

Both LF and CR+LF are accepted in command transmission.

Communications commands are issued by transmitting a command character string to 8730-10, 8731-10 port 8802 (default) via TCP connection.

For details of the commands, refer to the application disk (CD-R) supplied with the 8730-10, 8731-10.

LAN Cable Connection

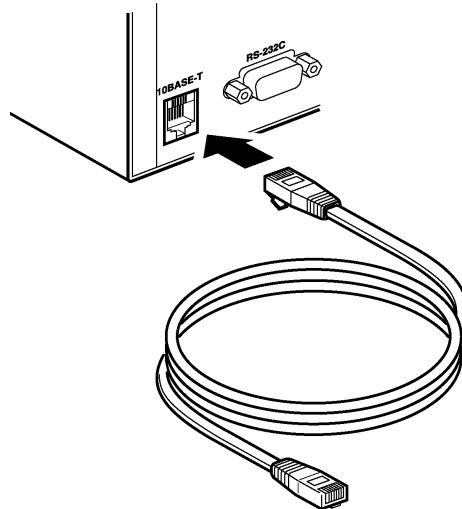
After the settings are completed, connect the devices.

- Connecting the 8730-10, 8731-10 to an existing network

Use a straight 10BASE-T cable to connect the unit to the existing network.

Use the 9642 LAN CABLE or a commercially available 10BASE-T straight cable.

Connect the LAN connector of the 8730-10, 8731-10 to the hub as shown below.



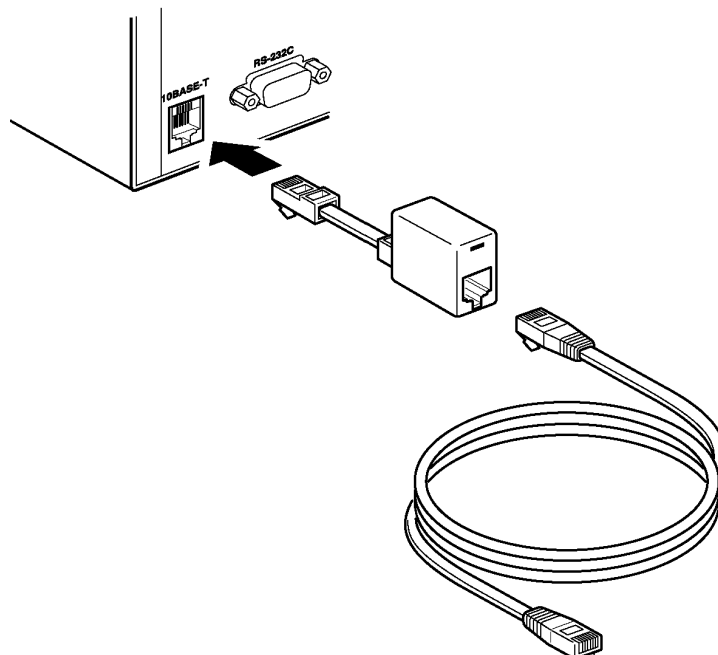
- Peer-to-peer connection between the 8730-10, 8731-10 and a PC

Use a cross 10BASE-T cable to connect the unit and PC.

Use the 9642 LAN CABLE and cross converter, a commercially available 10BASE-T cross cable, or commercially available 10BASE-T straight cable and cross converter.

The 9642 LAN CABLE (straight) is supplied with a cross converter.

The 9642 LAN CABLE is connected as shown below.



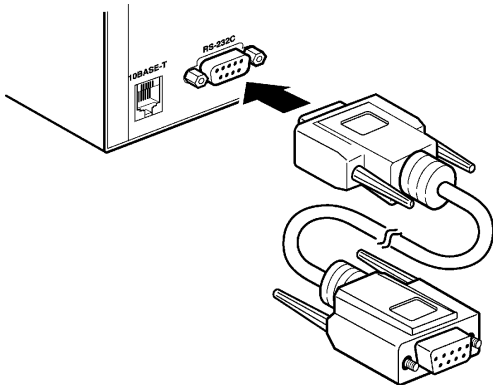
9.2 RS-232C Interface

RS-232C Connection

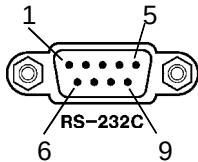
The 8730-10, 8731-10 is equipped with the RS-232C interface as standard for remote control from a personal computer (PC) and for exchanging data with the PC.

Connect the RS-232C cable (cross) to the 8730-10,8731-10 as shown below.

- 9637 RS-232C CABLE: Dsub9 pin - Dsub9 pin
- 9638 RS-232C CABLE: Dsub9 pin - Dsub25 pin



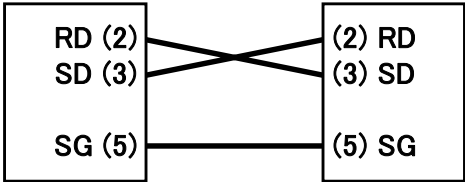
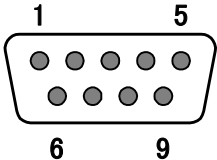
Connector pin arrangement
(D-sub 9-pin male)



Pin Number	Description	CCITT	EIA	JIS	Conventional code
		Circuit No.	Code	Code	
2.Received data	ReceiveData	104	BB	RD	RxD
3.Transmitted dat	SendData	103	BA	SD	TxD
5.Signal ground or common return	SignalGround	102	AB	SG	GND
7.Request to send	RequesttoSend	105	CA	RS	RTS
8.Clear to send	CleartoSend	106	CB	CS	CTS

NOTE

- The RS-232C interface is not isolated from the 8730-10, 8731-10.
- When connecting the RS-232C cable connector to the 8730-10, 8731-10 connector, align both connectors, then insert one connector straight into the other. Never forcibly insert a connector, to avoid damage or contact failure.



RS-232C Setting

The controller sends commands for remote control.

To enable communications between the 8730-10, 8731-10 and a PC via the RS-232C, make the same RS-232C setting for both the 8730-10, 8731-10 and a PC.

For setting details, see 7.4.

Setting item	Preset
Transmission speed	• 1200 bps to 19200 bps
Data Bit	• 8bit / 7bit
Parity	• OFF / ODD / EVEN
Stop Bit	• 1bit / 2bit
Delimiter	• LF / CR+LF
Flow Control	• OFF / XON / XOFF / Hard

NOTE

- If an overrun or framing error occurs, lower the transmission speed.
- Do not edit the setting during communication with the 8730-10, 8731-10.

Chapter 10

A/B Cursors and Scrolling the Waveform

- The A/B cursors are used to read waveform voltage, frequency, and timing.
- There are three types of A/B cursors as follows:
 - (1) Vertical cursor (V.Csr)
 - (2) Horizontal cursor (H.Csr)
 - (3) Trace cursor (Trace)
- The cursors are also used to scroll the waveform to show hidden parts.

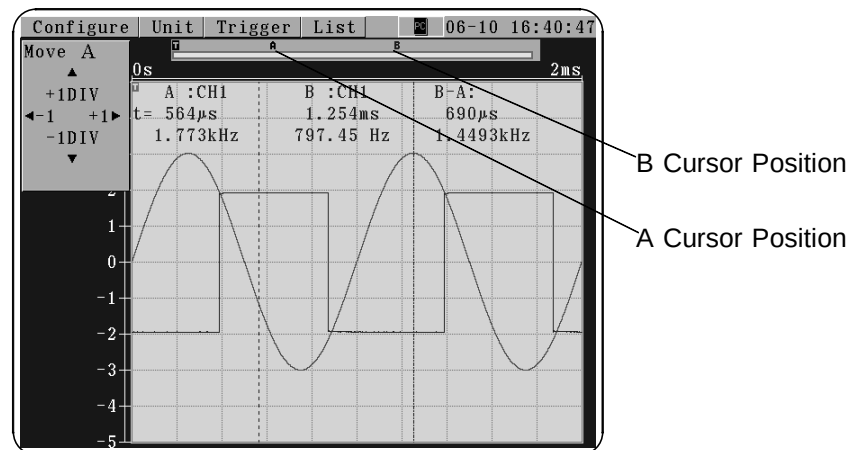
CURSOR SCROLL Key (See 10.1.4)	Move A	
	Move B	
	Move A & B	
	Cursor On	OFF
		A
		B
	Type	V.Csr (See 10.1.1) The X-axis cursor on the X-Y screen
		H.Csr (See 10.1.2) The Y-axis cursor on the X-Y screen
		Trace (See 10.1.3)
	A CH *This cannot be selected on the X-Y screen	ALL
		CH1
		CH2
	B CH	ALL
		CH1
		CH2
	Quit	

10.1 A/B Cursors

- The A/B cursors are used to read waveform voltage, frequency, and timing.
Setting "**Scaling**" (see 4.3.8) "**ON**" displays the scaled values.
- There are three types of A/B cursors as follows:
 - (1) Vertical Cursor (V.Csr): Reads timing, cycle, and frequency.
 - (2) Horizontal Cursor (H.Csr): Reads voltage.
 - (3) Trace Cursor (Trace): Reads the value at a point where the waveform intersects with the cursors (trace point).
- You can use one cursor (A) or both cursors (A and B).
When using two cursors, note that the difference between the two readings " $B - A$ " will be also calculated.

10.1.1 Vertical Cursor

- When only using A cursor:
Obtains the timing (" t ") from a trigger and frequency in one " t " cycle.
- When using A and B cursors:
Obtains the timing (" t ") from each trigger (A and B) and frequency in one " t " cycle.
Also, obtains the difference in timing between A and B ($B - A$), and frequency in one cycle of time difference.



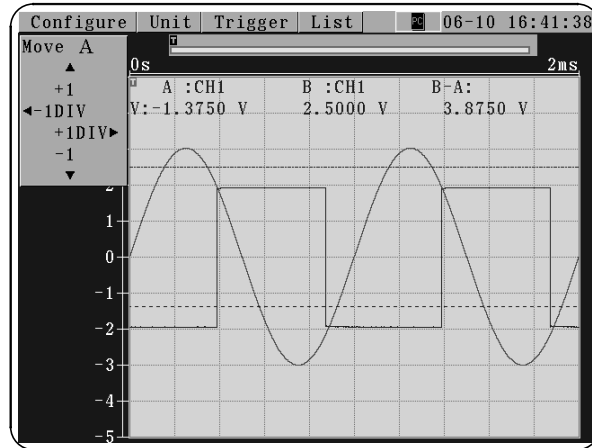
The scroll bar shows the positions of the A and B cursors.



When the X-Y screen (see 4.2.4) is selected, the "X-axis cursor" is used and voltage on the X axis is obtained.

10.1.2 Horizontal Cursor

- When only using A cursor:
Obtains the difference in potential [V] based on 0V potential.
- When using A and B cursors:
Obtains the difference in potential between A and B ($B - A$).



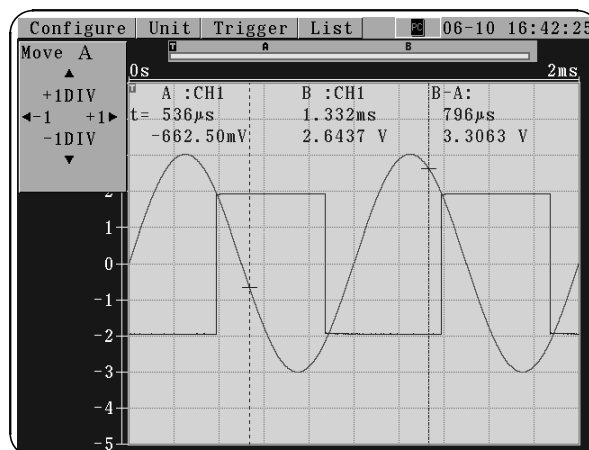
NOTE

When the X-Y screen (see 4.2.4) is selected, the "Y-axis cursor" is used and voltage on the Y axis is obtained.

10.1.3 Trace Cursor

- Reads the value at a point where the waveform intersects with the A and B cursors (trace point).
- When only using A cursor:
Obtains the timing ("t") from a trigger to the trace point.
Obtains the difference in potential [V] based on 0V potential.
- When using A and B cursors:
Obtains the timing ("t") of each of A/B trace points from a trigger.
Obtains the difference in timing between the A and B trace points ($B-A$).
Obtains the difference in potential [V] of each A/B trace point based on 0V potential.
Obtains the difference in potential between the A and B trace points ($B-A$).

10



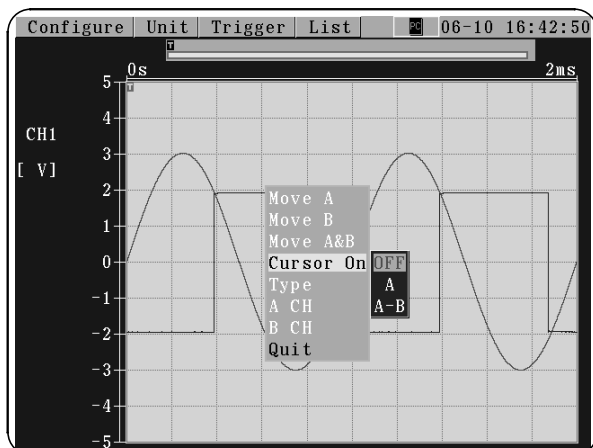
The scroll bar shows the positions of the A and B cursors.

10.1.4 Using the A/B Cursors

- This section explains how to use the A/B cursors.

Procedure

Setting Screen: Measurement Screen, Comparison Screen



1. Press the **CURSOR SCROLL** key.
2. Select "**Cursor On**" on the menu, then press the **ENTER** key to select cursor display.

OFF: Does not display the cursors.

A : Only displays the A cursor.

A-B : Displays both the A and B cursors.

3. Select "**Type**" and press the **ENTER** key to select the type of cursor.

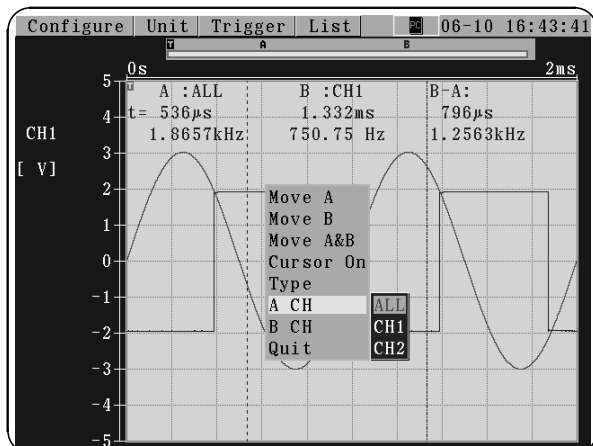
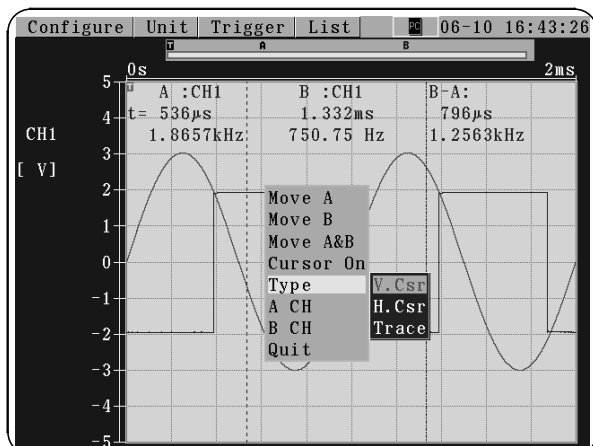
V.Csr : Vertical Cursor ^(Note1)

H.Csr : Horizontal Cursor ^(Note2)

Trace : Trace Cursor

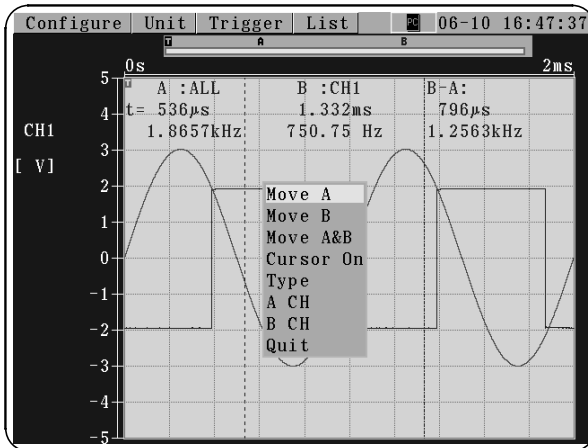
NOTE

- (Note 1) The X-axis cursor on the X-Y screen
- (Note 2) The Y-axis cursor on the X-Y screen



NOTE

- When there is no waveform, the **CURSOR SCROLL** key is disabled.
- "A CH" and "B CH" cannot be selected on the X-Y screen.
- "ALL" cannot be selected for the Horizontal cursor.



Move the cursors.

6. Select a cursor to be moved.

Move A : Only moves the A cursor.

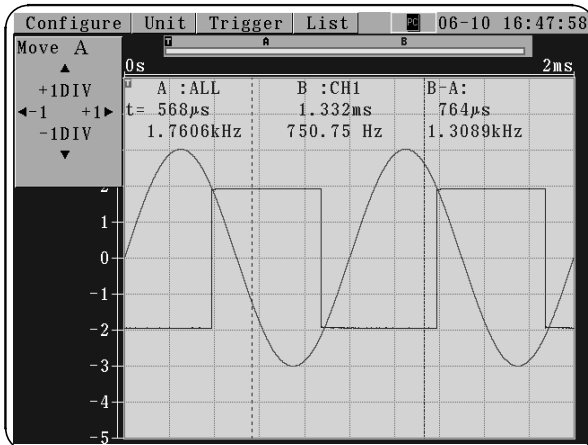
Move B : Only moves the B cursor.

Move A&B : Moves both the A and B cursors.

"Move B" and "Move A&B" can be selected when selecting A-B in step 2.

7. Press the **ENTER** key to display the scroll bar as shown on the left.

Use the "**▲**" "**▼**" "**◀**" "**▶**" keys to move the A/B cursors.



• Vertical cursor or trace cursor:

[**▶**]: Moves to the right by one sample.

[**▲**]: Moves to the right by 1 DIV (100 samples for the X-Y trace cursor).

[**◀**]: Moves to the left by one sample.

[**▼**]: Moves to the left by 1 DIV (100 samples for the X-Y trace cursor).

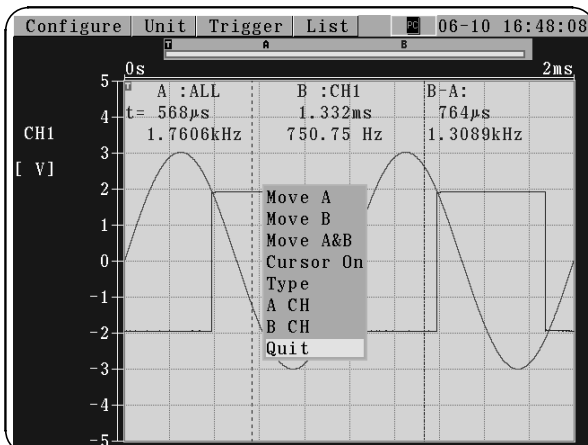
• Horizontal cursor:

[**▲**]: Moves up by 1 dot (1/40 DIV).

[**▶**]: Moves up by 40 dots (1 DIV).

[**▼**]: Moves down by 1 dot (1/40 DIV).

[**◀**]: Moves down by 40 dot (1 DIV).



NOTE

- Hold down the **CURSOR** key to move the cursor in increments greater than those described above.
- The comparison area cannot be moved.

8. Press the **ENTER** key or **CURSOR SCROLL** key to redisplay the menu as shown on the left. Select "**Quit**" and press the **ENTER** key to exit A/B cursor mode and return to the previous screen. You can also press the **STOP** key to exit.

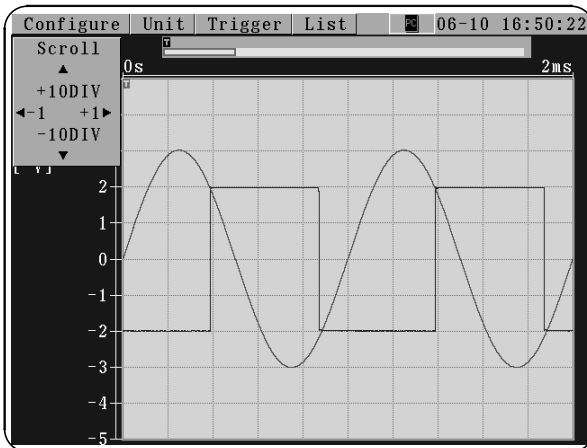
- To hide the cursors, select "**OFF**" in step 2.

10.2 Scrolling the Waveform

- This section explains how to scroll a waveform.
- By scrolling a waveform you can display hidden parts of the waveform.

Procedure

Setting Screen: Measurement Screen, Comparison Screen



1. Press the **WAVE SCROLL** key.
2. The letter, "**Scroll**" and the scroll bar as shown on the left are displayed.
Use the "**▲**" "**▼**" "**◀**" "**▶**" keys to move the waveform.

[**▶**]: Moves to the right by 1 DIV

[**▲**]: Moves to the right by 10 DIV

[**◀**]: Moves to the left by 1 DIV

[**▼**]: Moves to the left by 10 DIV

NOTE

- Hold down the **CURSOR** key to scroll the waveform in increments greater than those described above.

Holding down the key longer will activate "**Auto-scroll**" to automatically scroll the waveform without holding down the key. Press any key to stop scrolling.

3. Press the **ENTER** key or **WAVE SCROLL** key to exit waveform scroll mode and return to the previous screen.
You can also press the **STOP** key to exit.

NOTE

- You cannot scroll a waveform on the X-Y screen (see 4.2.4).



Scroll the waveform to the right side



Scroll Bar (See 3.1.1)

Indicates the currently displayed range.

Chapter 11

Specifications

11.1 General Specifications

11.1.1 Basic Specifications

Measurement functions	Memory recorder with waveform comparison function
Number of channels	8730-10: Analog 1ch, 8731-10: Analog 2ch
Memory capacity	8730-10: (Analog 12bit) X 50 k words, 8731-10: (Analog 12bit) X 50 k words/ch
Maximum sampling speed	1 MS/s (2ch simultaneously)
Time axis accuracy	$\pm 0.01\%$ (difference between grid and actual time)
Clock functions	Auto calendar with automatic leap year, 24 hour clock
Backup battery and lifetime	Used for clock and to preserve waveforms, approx. 10 years (reference value at 25°C (77°F))
Operating environment	Indoors, Max. 2000 m (6562 feet) height
Operational ranges for temperature and humidity	5°C to 40°C (41°F to 104°F), 30% to 85%RH (with no condensation)
Temperature and humidity ranges for assured accuracy	23 $\pm$ 5°C (73°F $\pm$ 9°F), 30% to 80%RH (with no condensation)
Period of guaranteed accuracy	1 year
Temperature and humidity ranges for storage	-10°C to 50°C (50°F to 122°F), 10% to 85%RH (with no condensation)
Dielectric strength	330 V AC / min. (between the input unit and the main unit, and between the each input units)
Power supply	Rated power voltage 100 to 240 V AC (Voltage fluctuations of $\pm 10\%$ from the rated supply voltage are taken into account.) Rated power frequency 50/60 Hz Inlet terminal
Maximum rated power	40 VA
Dimensions	approx. 288W X 144H X 190D mm (11.3"W X 5.7"H X 7.4"D) (excluding projections)
Mass	8730-10: approx. 3.6kg (126.99 oz), 8731-10: approx. 3.7kg (130.51oz)
Standards Applying	Safety: EN61010 Pollution Degree 2, Measurement category I (anticipated transient overvoltage 330 V) EMC : EN61326, Class A EN61000-3-2, EN61000-3-3

11.1.2 Display

Display words	Selectable (Japanese or English)
Screen	7.2 inch STN color LCD display (640X480 dots)
Display resolution	Waveform: 10 DIV f.s. X 10 DIV f.s. (1 DIV= 40 (vertically) X 50 (horizontally) dots)
Dots spacing	0.076W X 0.227H mm (0.00029W" X 0.00089H")
Backlight	Can be switched ON/OFF
Backlight lifetime	approx. 20,000 hours (reference value at 23°C (73°F))



- STN color LCDs characteristically have a few defective pixels that do not always light, or that remain lit. We do not consider the presence of six or fewer such defects to indicate a damaged or faulty display. Please be aware of this in advance.

11.1.3 External Data Storage

PC Card slot	PC card standard 1 slot (TYPE I, II)
Card types	Flash ATA card
Card capacity	2 GB max.
Data format	MS-DOS format (MS-DOS is the registered trademark of Microsoft Corporation.)
Data stored	Setting conditions, measurement data (binary or text), comparison area, screen data, calculation result

11.1.4 Operating Unit

Configuration of key	Sheet key (The front panel features a simplified dustproof structure)
----------------------	---

11.1.5 External Control Terminals

Configuration of terminals	M3-screw terminal block (12 input terminals, 16 output terminals) The external control terminals are isolated from the 8730-10, 8731-10.
Power supply terminals	External power supply V_{EXT} : between EXT_DCV and EXT_COM • Maximum external input voltage V_{EXTmax}: 30 V DC • Minimum external input voltage V_{EXTmin}: 5 V DC Internal power supply V_{INT} : between ISO_DCV and ISO_GND • Output voltage $5 V \pm 0.5 V$ 40 mA (Total)
Input terminals	External trigger: EXT_TRIG, Measurement start: START, Measurement stop: STOP, External Sampling: EXT_SAMP Switching test mode: MODE_SET, MODE3, MODE2, MODE1, MODE0, Hold: HOLD, Comparison stop: JUDGE_OFF, Multi-function terminal: EXT_IN Signal level: HIGH $V_{EXT}^{EXT}-1.0$ to V_{EXT} [V] (When there is no load) LOW 0 to 1.0 [V]
Output terminals	Trigger output: TRIG_OUT, Area comparison 1: OK_AREA1, NG_AREA1, Area comparison 2: OK_AREA2, NG_AREA2 Value comparison: OK_VALUE, NG_VALUE, Comparison result being output: JUDGE_OUT, Error detected: ERROR, Processing: BUSY, Measuring: STORAGE, Multi-function terminal: EXT_OUT1, EXT_OUT2, EXT_OUT3, EXT_OUT4, EXT_OUT5 Signal level: HIGH $V_{EXT}-1.0$ to V_{EXT} [V] (When there is no load) LOW 0 to 1.0 [V] Open collector output (pull up resistance 10 k Ω) Maximum sink current 140 mA max.
Maximum voltage to earth	300 V rms or 60 V DC (between the input/output terminals and the main unit)
Maximum input voltage	30 V DC

11.1.6 External Interface

RS-232C	In accordance with EIA RS-232C, D-sub 9 pin connector
LAN	IEEE802.3 Ethernet 10BASE-T

11.2 Input Unit Specifications

Period of guaranteed accuracy	The specifications below show the accuracy at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and 30% to 80% RH when zero adjustment is completed 30 minutes after powering on. Accuracy is guaranteed for one year
Measurement ranges	100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V/DIV
DC amplitude accuracy	$\pm 0.5\%$ f.s.
Zero position accuracy	$\pm 0.1\%$ f.s.
Temperature characteristic	Gain: $\pm 0.03\%$ f.s./ $^{\circ}\text{C}$ Zero position: $\pm 0.025\%$ f.s./ $^{\circ}\text{C}$
Frequency characteristic	DC 400 kHz max. ± 3 dB
Common mode refection ratio	80 dB min. (at 50/60 Hz and with signal source resistance 100 Ω max.)
Low-pass filter	OFF, 5, 50, 500, 5 k, 50 k, 100 k $\pm 50\%$ (Hz) -3 dB,
Noise	3 mVp-p(typ), 5 mVp-p(max.) (sensitivity range, with input shorted)
Input type	Unbalanced (input isolated from output)
Input resistance	1 M $\Omega \pm 1\%$
Input capacitance	20 pF ± 10 pF (at 100 kHz)
A/D resolution	12 bits
Voltage axis resolution	160 points/DIV (Voltage axis ratio X 1)
Maximum sampling speed	1 MS/s
Method of input signal coupling	DC, GND
Input terminals	Terminal stand, M3.5 screw
Maximum input voltage	30 V rms or 60 V DC (CAT I)
Maximum rated voltage to earth	30 V rms or 60 V DC (between the input channels and the main unit, and between the each input channels)
Effect of radioactive radio-frequency electromagnetic field	$\pm 5\%$ f.s. at 10 V/m
Effect of conductive radio-frequency electromagnetic field	$\pm 2\%$ f.s. at 3 V

11.3 Trigger Unit

Trigger Method	Digital comparison
Trigger modes	Single, Repeat, Auto
Trigger source	Analog trigger External trigger Timer trigger: • Each source can be switched ON/OFF • When all sources are off, the unit is in the free-run state. (See 4.4.1) • The external trigger is activated at a falling edge.
Trigger conditions	Logical AND or OR of any trigger sources
Trigger types (analog)	(1) Level trigger : The trigger is activated at the rise or fall of the specified voltage (2) Window trigger: The trigger is activated when the waveform comes into or goes out of range between the upper and lower limits of the trigger level (3) Period trigger : The trigger is activated when the waveform cycle deviates from the specified range
Trigger filter	OFF, 0.1, 0.2, 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10.0 DIV
Trigger level resolution	0.25% f.s. (f.s. = 10 DIV)
Pre-trigger	0 to 100% (An arbitrary value can be selected in units of 1%)
Trigger output	Open collector output (active low)
Trigger input-output terminals	Terminal stand, M3 screw (external control terminals)

11.4 Memory Recorder Function

Time axis	100, 200, 500 μ s/DIV, 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV, 1, 2, 5, 10, 30 s/DIV, 1, 2, 5 min/DIV, external sampling can be set (1 kHz max.)
Time axis resolution	100 points/DIV
Sampling period	1/100 of the time axis
Recording length	10, 20, 50, 100, 200, 500 DIV
Screen format	The styles single , dual, X-Y
Waveform magnification/compression	Time axis : X10, X5, X2, X1, X1/2, X1/5, X1/10, X1/20, X1/50, X1/100 Voltage axis: X10, X5, X2, X1, X1/2
Waveform scrolling	Available in the left/right directions
Display range	10 DIV X 10 DIV
Interpolation	Line

11.5 Comparison Function

11.5.1 Waveform Area Comparison

Waveforms can be compared against a reference area. (2 channels can be compared separately.)

Comparison mode	OUT: FAIL if any part of the waveform extends beyond the area ALL OUT: FAIL if the entire waveform extends beyond the area
Stop conditions	PASS, FAIL, PASS&FAIL (The waveform may be saved when stopped)
Comparison time	70 ms max. (1ch comparison), 80 ms max. (Compares 2 channels simultaneously)
Comparison period	200 ms max. (1ch comparison), 250ms max. (2ch simultaneous comparison) (Time axis: 100 μ s/DIV, recording length: 10 DIV, Input waveform: 1Vp-p 1 kHz sine wave)
Comparison output	PASS or FAIL is output from the terminal stand: Open collector output (2ch separate output)
Area edit function	Editor commands for creating a reference area for waveform comparison

11.5.2 Value Comparison

Calculation results may be compared by setting upper and lower limits and comparing the calculation results with the limits

11.6 Auxiliary Functions

Value Calculation	Averaging, Peak-Peak, Maximum, Max-Time, Minimum, Min-Time, RMS, Period, Frequency, Rise-Time, Fall-Time, Area, Integration, Pulse Width, Duty ratio, Level Time, Difference, Pulse Count, MAX & MIN, XY-Area
Waveform Calculation	Absolute value (ABS), Half-wave rectification (Rectify) , Four basic operations (+, -, x, /) between the each channels
Cursor measurement function	Difference in timing between A/B cursors, difference in potential, frequency, each cursor's potential, time from a trigger
Scaling function	Selectable separately for each channel
Variable function	Available
Waveform backup function	Not available
Start-status backup function	Available
Auto set up function	It is possible to read the setting condition from the PC card automatically, when the power supply is turning on.
Auto save function	Available
LCD backlight	It can be switched ON/OFF (Auto-OFF function is available)
Overlay function	Available
Test mode saving function	Up to 16 test modes (setting conditions) may be saved on the 8730-10, 8731-10. The external control terminals can be used to switch test modes
Averaging function	2, 4, 8, and 16 times

11.7 Others

Standard accessories	Power cord	1
	External control terminal label	1
	Jumper connector	2
	Instruction manual	1
	Application disk (CD-R)	1
Options	9626 PC CARD 32M	
	9627 PC CARD 64M	
	9726 PC CARD 128M	
	9727 PC CARD 256M	
	9728 PC CARD 512M	
	9729 PC CARD 1G	
	9637 RS-232C CABLE(9 pin - 9 pin/1.8 m)	
	9638 RS-232C CABLE (9pin-25pin/1.8 m)	
	9642 LAN CABLE	
	9333 LAN COMMUNICATOR	

Chapter 12

Maintenance and Service

12.1 Maintenance and Inspection

To ensure the safe operation of this unit, perform maintenance regularly.

- If the unit gets wet or oil or dust penetrates the equipment, the insulation may deteriorate, posing the risk of electric shock or fire. Immediately stop using the equipment if it becomes wet or contaminated by oil and dust, then contact your vendor or nearest agent.
- This instrument uses a lithium battery for memory backup. Thus, a depleted battery may prevent measurement conditions from being saved. If you cannot save measurement conditions, contact your vendor or nearest agent.
- Maintenance and repair parts and other supplies will be available for seven years after production of the instrument is discontinued.
- If damage is suspected, check the "12.3 Troubleshooting" before contacting your dealer or Hioki representative.
- When sending the instrument for repair, pack the instrument carefully so that it will not be damaged during shipment, and include a detailed written description of the problem. Hioki cannot be responsible for damage that occurs during shipment.

Cleaning the unit

- To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- Wipe the LCD gently with a soft, dry cloth.

Inspection

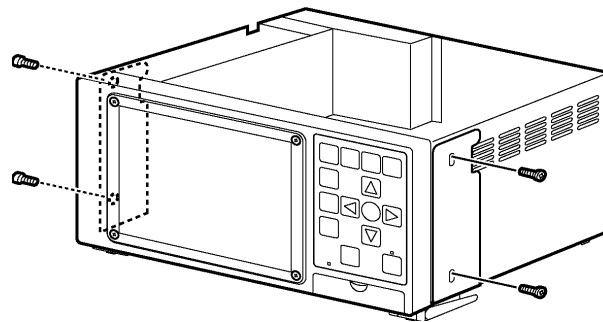
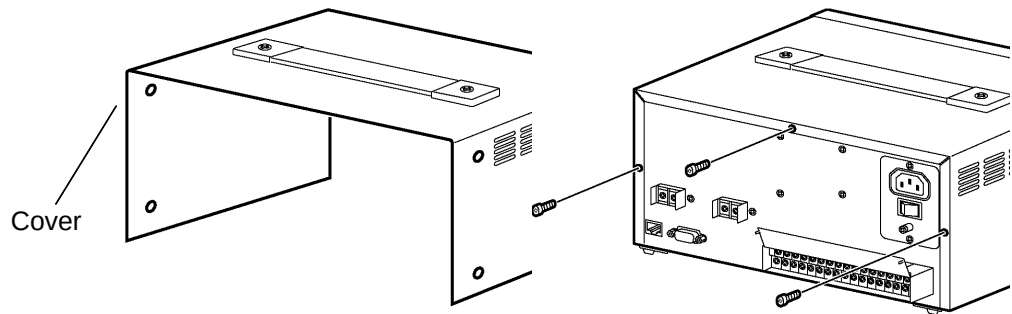
- Various inspections are available for the 8730-10, 8731-10: ROM/RAM check (7.2.9), key check (7.2.10), and screen check (7.2.11). Periodically conduct these inspections to confirm that there are no problems with the 8730-10, 8731-10. Should you find any problem, contact your dealer or our representative.

Maintenance

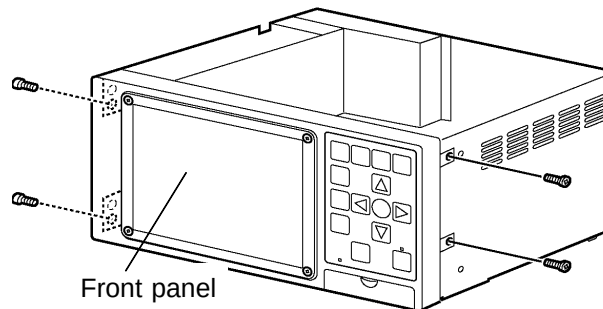
- Depending on the environment where the 8730-10, 8731-10 is used, consumables (e.g., backlight, electrolytic capacitor) require periodic replacement by our service engineers. For details, please contact your dealer or our representative.

12.2 Removing the Battery Before Discarding the Unit

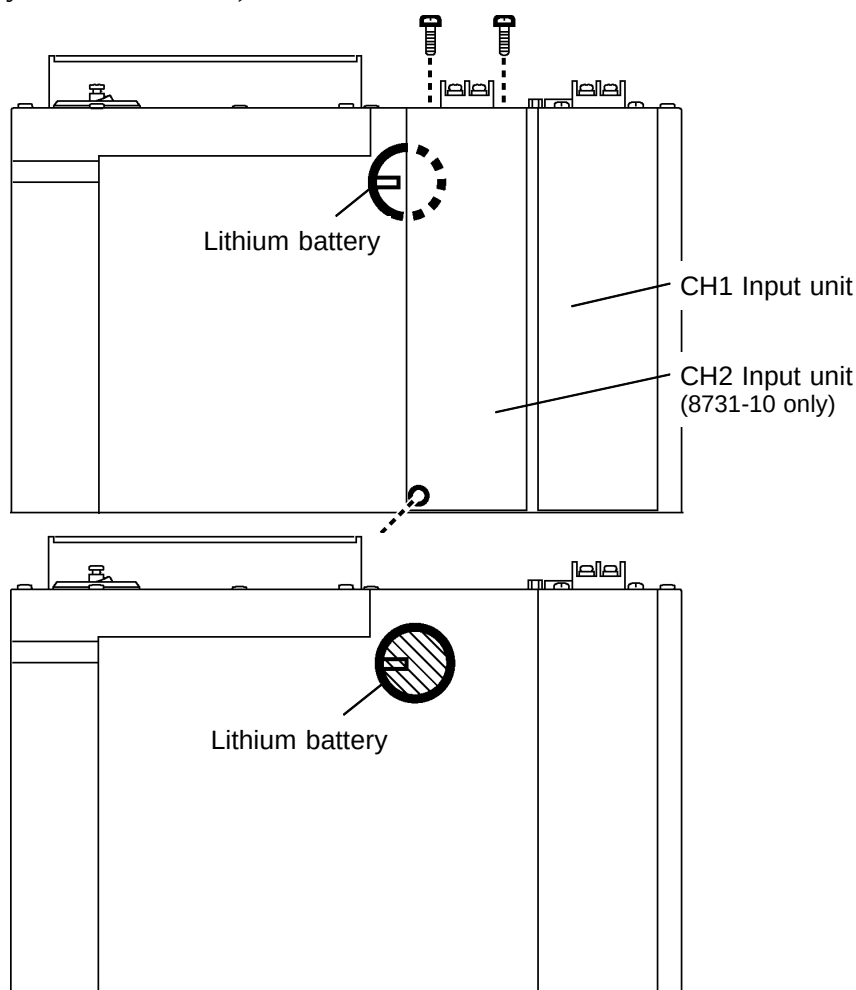
- The 8730-10, 8731-10 uses a lithium battery for memory backup.
 - When disposing of this instrument, remove the lithium battery and dispose of battery and instrument in accordance with local regulations.
1. Confirm that power of the 8730-10, 8731-10 is turned OFF.
 2. Disconnect all cables and the power cord from the 8730-10, 8731-10.
 3. Use a Phillips screwdriver to remove the seven screws below, then remove the cover.



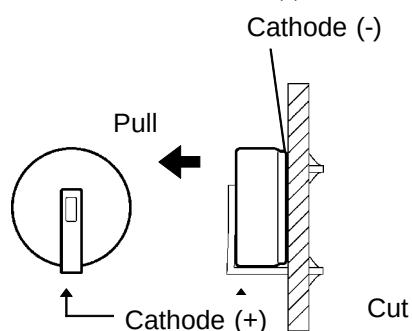
4. Remove the four screws below, then remove the front panel.



5. The battery is installed where shown below on the PCB.
6. Remove the three screws that secure the CH2 amplifier board as shown below. (only for the 8731-10)



7. Lift the battery and use a wire cutter to cut the anode (+).
8. Lift the battery a bit higher.
9. Use a wire cutter to cut the cathode (-) at the bottom of the battery.



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This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate



- To avoid electrocution, turn off the power switch and disconnect the power cord and cables before removing the lithium battery.

12.3 Troubleshooting

If the unit does not seem to operate normally, check the following points before requesting service.

Problem	Check
LED does not light when the unit is turned on.	• Is power cord connected properly?
No waveform is described on the display even if pressing the START key.	• Is the "Pre-trig wait" message displayed? (When pre-triggering is activated, triggering does not occur until the current waveform is fully captured.) • Has the "Wait for trig" message appeared? (Check the trigger settings.) • Is the waveform display OFF?
There is absolutely no variation in the recorded waveform.	• Is the measurement range setting appropriate? • Has a low pass filter been set?
Recording lines are dense	• Input signal contains ripple components. Make suitable filter settings at input unit. • Is the low-pass filter ON?
The measured frequency value is much lower than the actual frequency.	• An aliasing error has occurred. • Change the time axis range to a faster sampling rate. For details, see 13.2. • Install a low-pass filter.
The keys are dead and do not respond.	• Has the unit been put into the key lock condition (key lock icon is appeared on the display) ? (Press the left and right CURSOR key simultaneously to clear the key lock condition.)
The size of a waveform does not change, even if the input range is changed.	• Has the variable function been enabled? (Disable the variable function.)



If none of the above conditions apply, and the cause of the problem is not understood, try performing a "**SYSTEM RESET**". All the settings will revert to the factory settings. For details, see Section 7.2.8.

Chapter 13

Appendix

13.1 Error Messages

- "Warning" appears on the screen if an error occurs.
- In case of such warning, the ERROR terminal outputs a low-level signal. (See 8.5.5 for details.)

Warning messages

- The "Warning" indication appears only one time when error was happen. (The message is disappeared after few seconds)
- The "Warning" message is disappeared by pressing any key.
- If the "beep sound" item on the adjustment screen is set to "ON", then the beeper sounds intermittently while the message is displayed.

"Warning" message and explanation

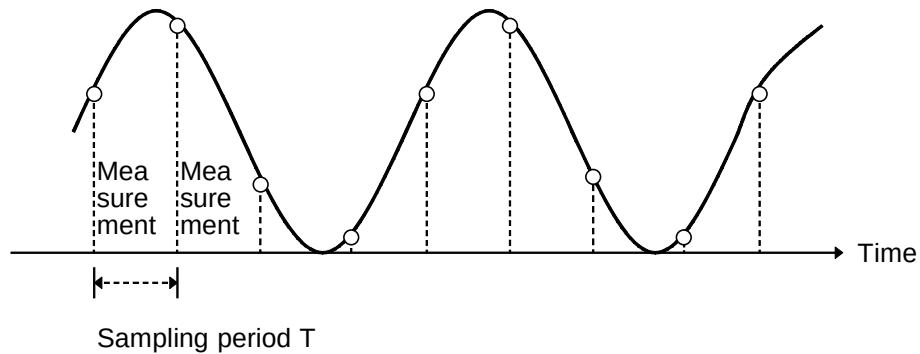
Warning Message	Action
Warning 001 There is no waveform data.	Load waveform data
Warning 002 Keys are locked. To unlock, press the ◀ & ▶	To unlock the keys, press the "◀" and "▶" keys simultaneously
Warning 011 There is no PC card.	Insert a PC card
Warning 012 Illegal format.	The recording format is not compatible with the 8730-10, 8731-10
Warning 013 The file cannot be opened.	The file may be damaged
Warning 014 The directory is full.	There is a limit to the number of files and directories that can be created in the root directory
Warning 015 Path name error.	Do not use more than 127 characters
Warning 016 Same name exists(FILE).	Change the file name
Warning 017 Disk full.	There is insufficient free space on the medium to save the data. Delete existing files or use a new medium
Warning 018 Same name exists(DIR).	Change the directory name
Warning 019 The card cannot be detected	Check the PC card

Warning 020 Failed to delete the directory.	Check the contents of the directory
Warning 021 File processing is interrupted.	File processing has been interrupted
Warning 022 Shot is too long.	Check the recording length The maximum recording length that can be read by the 8730-10, 8731-10 is 500 DIV
Warning 031 There is no area.	There is no area for comparison Create an area
Warning 032 Mode is not registered.	Register a test mode
Warning 033 The Area is specified incorrectly.	Check the comparison area settings (see 5.4.2). When the comparison area is specified "A- -", the area data is cleared by turning power off. Register a settings & area file (See 6.4.5) again, or select an area from "A01 to A16".
Warning 040 Range-over.	• Select a correct voltage axis range • See 7.5.3
Warning 041 The variable is ON. The display will not change.	The waveform display does not change Because the variable function is ON, waveform display will not change even when the range is changed. Check the setting of the variable function
Warning 042 The setting range is exceeded.	Enter a value within the setting range
Warning 044 The Upper and Lower are inappropriate.	Check the settings
Warning 045 The Using Area is inappropriate.	Check the comparison area
Warning 046 Calculations are not available.	Calculations and averaging cannot be performed simultaneously
Warning 050 The loading operation failed. The setting conditions contain an error.	Loading of settings failed. Check the setting conditions for the main unit.
Warning 090 Illegal MAC address.	The MAC address is incorrect The 8730-10, 8731-10 requires repair
Warning 091 Illegal IP address.	Correct the IP address setting
Warning 092 Illegal server IP address.	Check the server IP address
Warning 093 Failed to connect with the server.	Check the LAN setting and connection
Warning 094 Failed to connect with the 9333.	Check the settings on the 9333 and connection
Warning 095 LAN timeout.	Check the PC to which the 8730-10, 8731-10 is connected
Warning 096 LAN transmission has been interrupted	Check the PC to which the 8730-10, 8731-10 is connected
Warning 097 Network error.	Check the PC to which the 8730-10, 8731-10 is connected
Warning 098 Server cannot be found.	Check the PC to which the 8730-10, 8731-10 is connected
Warning 099 DHCP failed.	Check to see if DHCP server operates properly on the network

13.2 Reference

13.2.1 Sampling

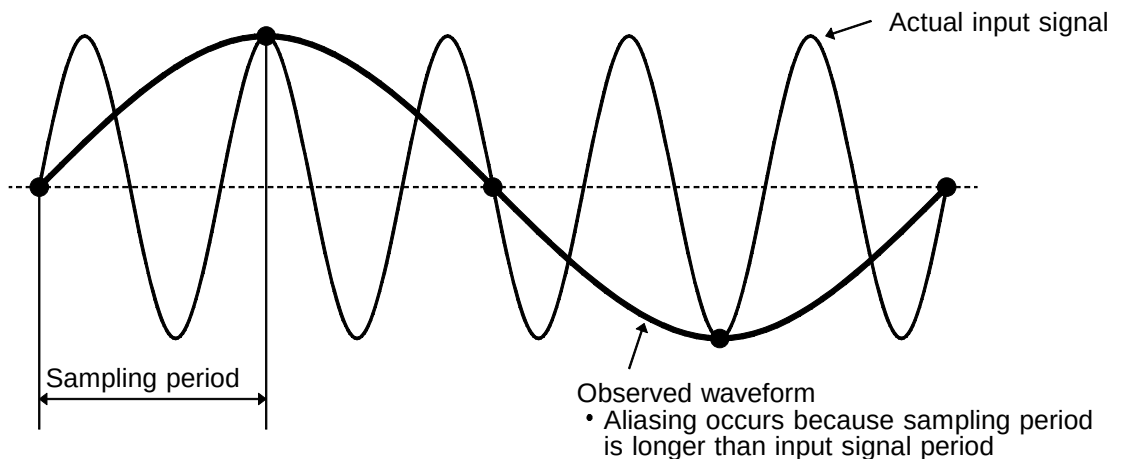
- The 8730-10, 8731-10 converts the input signal to a digital value, then carries out all internal processing digitally. This process of converting an analog signal to digital values is termed sampling.
- Sampling measures the magnitude of the signal at fixed time intervals (sampling periods).



- The rate of taking these measurements is termed the sampling rate.
- The units are S/s, read as samples per second.
- This is the reciprocal of the sampling period ($1/T$).

13.2.2 Aliasing

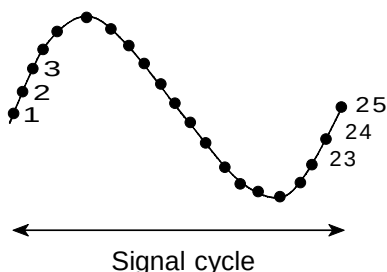
- If the frequency of the signal being measured is significantly higher than the sampling rate, it is possible for sampling to produce an apparent signal which is actually nonexistent. This phenomenon is termed aliasing.



- The measurement frequency limit is determined by the setting of the time axis range. In any event, it is always best to use the highest practicable sampling rate.
- The measurement frequency limit is determined by the time axis range, which is to be set. Use the highest practicable speed range whenever possible.

13.2.3 Measurement Limit Frequency

- As a general rule, to ensure that sampling catches the peaks of a typical sine wave input on the display, more than 25 samples are required for each input cycle.
- The measurement limit frequency changes depending on the time axis range.



TIME/DIV (s/DIV)	Sampling period (s)	Measurement limit frequency (Hz)
100 μ	1 μ	40 k
200 μ	2 μ	20 k
500 μ	5 μ	8 k
1 m	10 μ	4 k
2 m	20 μ	2 k
5 m	50 μ	800
10 m	100 μ	400
20 m	200 μ	200
50 m	500 μ	80
100 m	1 m	40
200 m	2 m	20
500 m	5 m	8
1	10 m	4
2	20 m	2
5	50 m	0.8
10	100 m	0.4
30	300 m	0.1333
1 min (60)	600 m	0.0666
2 min (120)	1.2	0.0333
5 min (300)	3	0.0133

13.2.4 Averaging Equations

- For averaging, summing averaging is synchronized by the trigger. If trigger synchronization is not performed, the results will be meaningless.

Summing averaging

Captured data are added sequentially and the sum is divided by the number of samples.

$$A_n = \{ (n - 1)A_{n-1} + Z_n \} / n$$

n : Averaging count

A_n : Result of n times averaging

Z_n : n -th measurement data

13.2.5 SI Prefix

- The SI prefix may be used to express numeric values in scaling (see 4.3.8), a variable (see 4.3.9), and to input upper and lower limits for value comparison (see 5.5.3.). Depending on the setting range limits, some prefixes below may not be used.

Unit	Reading	Meaning of Unit	Size
E	Exa	$\times 10^{18}$	Large ↑ ↓ Small
P	Peta	$\times 10^{15}$	
T	Tera	$\times 10^{12}$	
G	Giga	$\times 10^9$	
M	Mega	$\times 10^6$	
k	Kilo	$\times 10^3$	
m	Milli	$\times 10^{-3}$	
μ	Micro	$\times 10^{-6}$	
n	Nano	$\times 10^{-9}$	
p	Pico	$\times 10^{-12}$	
f	Femto	$\times 10^{-15}$	
a	Atto	$\times 10^{-18}$	
z	Zepto	$\times 10^{-21}$	

13.3 Size of a File

- This section describes the sizes of files in various formats. Actual sizes may vary slightly.

13.3.1 Screen Data (BMP Format)

- Indicates the size of a decompressed file. The size of a compressed file varies depending on the screen and waveform.

Size of the file
308,278 bytes

- A bitmap file is a standard graphic format for Windows. Windows is a registered trademark of Microsoft Corporation in the U.S.

13.3.2 Waveform Data (CSV)

- The table below lists the sizes of data (when "Thin-out" saving is set to "OFF").

Recording length (DIV)	Number of save channels	
	1	2
10	23,729 bytes	35,300 bytes
20	47,232	70,299
50	117,718	175,278
100	235,207	350,260
200	470,174	700,215
500	1,175,099	1,750,067

13.3.3 Waveform Data (MEM)

Recording length (DIV)	Number of save channels	
	1	2
10	5,074 bytes	7,588 bytes
20	7,074	11,588
50	13,074	23,588
100	23,074	43,588
200	43,074	83,588
500	103,074	203,588

13.3.4 Other Data

Setting data (SET)	
Area data (ARE)	From 2KB to 65KB (theoretical values) (Data sizes vary depending on the area created.)
Setting data (SET)	1,897 bytes
Index file (ROM)	512 bytes

13.4 Glossary

A/D conversion	Conversion of analog values to digital values
Analog	Continuous physical quantity such as voltage or current
Attenuator	Device for reducing the level of a signal
Beep sound	The sound generated at error or warning occurrence
Bit	Smallest unit of binary information
Byte	Unit of information. 1 byte is made up of 8 bits.
Channel (CH)	Input signal route
Comment	Notations that can be entered by the user.
Common mode	Voltage between ground and measurement input line
Cutoff frequency	Point where the filter output amplitude is $1/\sqrt{2}$ (3dB) of the input.
Digital	Discrete physical quantity
DIV (division)	Unit to indicate the measurement
Dynamic range	Ratio of maximum vs. minimum amplitude that can be displayed
File	A collection of data on a medium such as tape
LED	Abbreviation of "light-emitting diode"
Low-pass filter	Filter that passes through only signals below a certain frequency
Maximum rated voltage to earth	Maximum voltage applied between the 8730-10, 8731-10 (GND) and a unit (L terminal), and between units (L terminals)
Memory	A device for storing digital data
MS-DOS	Personal computer operating system. MS-DOS is a registered trademark of Microsoft Corporation.
Offset	Amount of shift in relation to 0 V when scaling is used
Open collector	Transistor output that requires a pull-up resistor
Pre-trigger	The condition of the signal before triggering occurred
PT	Abbreviation of (voltage) "potential transformer"
Recording length	Total amount of sampling data expressed as number of increments
Ripple component	AC component of noise
Sample rate	Rate at which sampling carried out; sampling frequency
Sampling	Measuring an analog waveform at regular intervals
Scaling	Conversion of voltage value into a specified unit
Storage	Storing measurement data in the internal memory
Trigger	An event that causes a certain action (such as starting or stopping a measurement) to happen.
Unbalanced input	A process to input a signal using one of two input terminals as a reference
Word	A unit for expressing digital data. The digital data for one input signal point after conversion. 1 word = 2 bytes

13.5 Waveform Viewer (Wv)

The waveform viewer provides a simplified view of data transferred to a PC by remote control or data acquisition. The viewer has a CSV conversion function. Converted files may be read by a spreadsheet program.

System requirements

For a PC running Windows 95, 98, Me, Windows NT4.0 SP3 or later, Windows 2000, or Windows XP

Installation

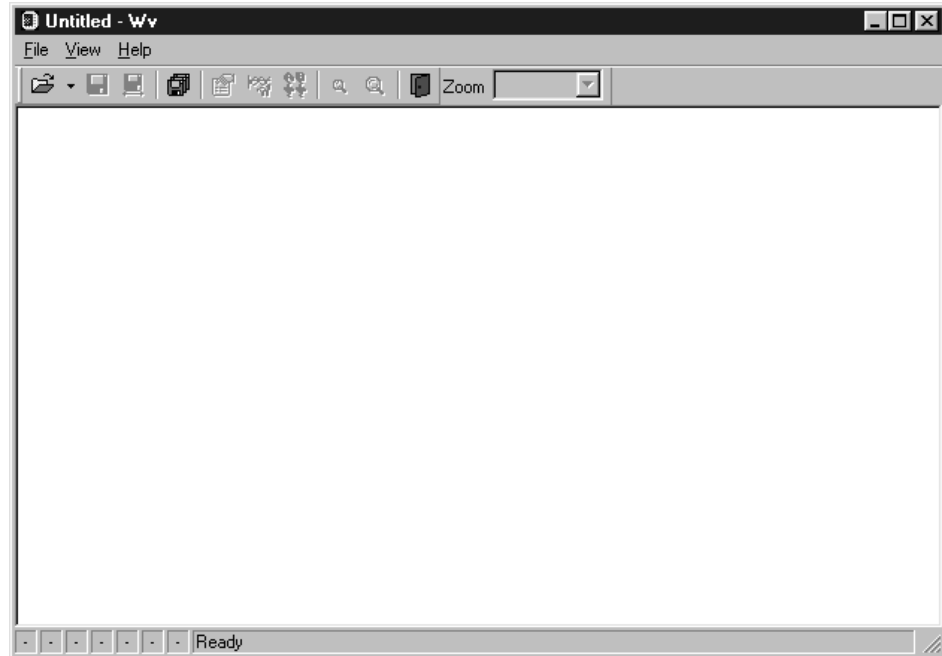
Install by the following procedure.

1. When you insert the application disk (CD-R) into the CD-ROM drive, the opening page should appear automatically. If it does not appear, open the "index.htm" file with your Web browser.
2. Select the language to display (click the **English** icon).
3. Click the [**Wave viewer (Wv)**] icon to view Wv specifications and revision history.
4. Click the [**Install**] icon at the top right of the page to open the [**File Download**] dialog.
5. Click **<Open>** to display the confirmation dialog to proceed with installation.
6. Click **<Next>** to open the installation destination selection window.
7. Click **<Next>** to start installation.
The program is now installed.

13.5.1 Starting the Waveform Viewer

In the Windows Start menu, select [**Programs**] - [**HIOKI**] - [**Wv**]. This starts the waveform viewer application.

To close the waveform viewer application, in the [**File**] menu select [**Exit**]. You can also click the Close button at the top right corner of the window.



- **Toolbar**

Click the icons in the toolbar for the respective functions.

From the left, these are: [**Open**], [**Save All**], [**Save Between Cursors**], [**Batch Conversion**], [**Properties**], [**Wave Control Panel**], [**Trace**], [**Zoom Out**], [**Zoom In**], and [**Exit**].

For details of these operations, see the descriptions of the corresponding menu items.

You can also select the magnification factor for the time axis by selecting on the toolbar.

- **Status bar**

The status bar shows, from the left, the model name, function, recording length, time axis, trigger time, pre-trigger and judgment result.

- **Version information**

When making inquiries, the version number will be required.

To check the software version number, in the [**Help**] menu select [**About Wv**].

13.5.2 Waveform Viewer Menus

The following is the complete menu tree of the waveform viewer application.

File 	Open		
	Save All		
	Save Between Cursors		
	Batch Conversion		
	Exit		
View	Toolbar		
	Status Bar		
	Wave Control Panel		
	Properties		
	Trace		
	Block List		
	Zoom In		
	Zoom Out		
	Set Magnification		
	Jump	Trig	
		A Cursor	
		B Cursor	
	Time Notation	DIV	
		Sec	
		Point	
		Trig	
		Date	
	Grid Type	None	
		Standard	
		Fine	
	Title		
	Remarks		
	Fixed		
	Capture		

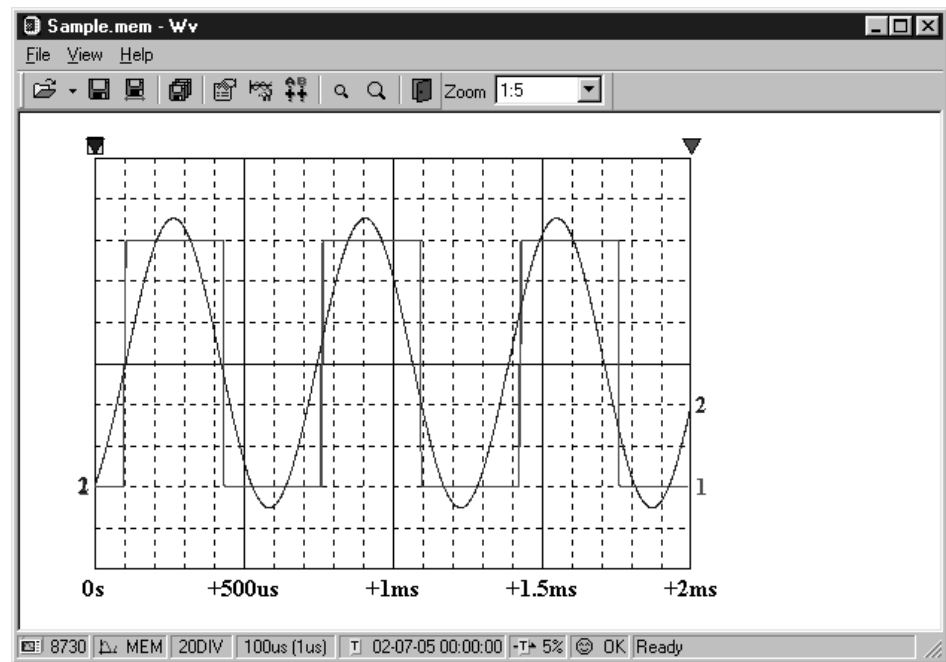
Right-click with the mouse in the waveform display screen for the following functions.

Right-click with the mouse	Wave Control Panel	
	Properties	
	Trace	
	Block List	
	Zoom In	
	Zoom Out	
	Set Magnification	
	Jump	Trig
		A Cursor
		B Cursor
	Time Notation	DIV
		Sec
		Point
		Trig
		Date
	Grid Type	None
		Standard
		Detail
	Title	
	Remarks	
	Fixed	
	Color	Text
		Background
		Grid
	Font	
	Capture	

13.5.3 Using the Waveform Viewer

- **Waveform display**

To display a waveform it is first necessary to select the file to be displayed. In the **[File]** menu, select **[Open]**, to display the file selection dialog box. Select a waveform file, and click Open to read in the file, and display the waveform.



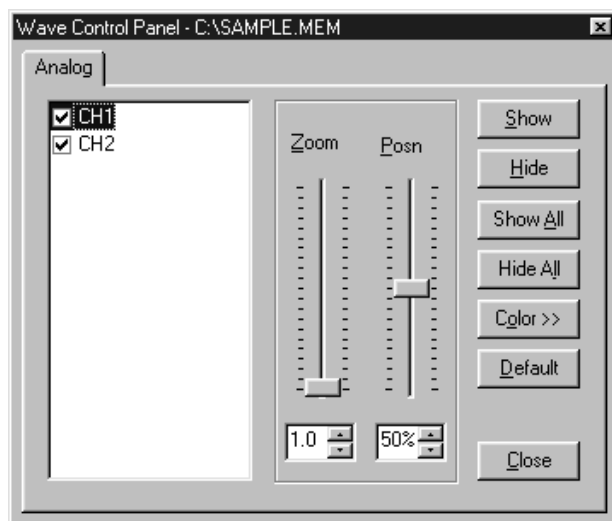
- **Changing the time axis scale (zoom function)**

You can change the time axis scale in the display using the menus or toolbar.

In the toolbar, click the **[Set Magnification]** box, to display the possible zoom factors: you can then select any desired value.

● Changing waveform scale and position (Waveform Control Panel)

You can adjust the display for each channel separately. In the [View] menu, select [Wave Control Panel] to display a dialog box.



CH	This indicate the list of channel. When a check mark is present the corresponding channel is displayed.
Zoom	Set the magnification on the voltage axis for the specified channel.
Posn	Set the position of the specified channel.
Show	Display the specified channel(s).
Hide	Do not display the specified channel(s).
Show All	Display all channels.
Hide All	Do not display all channels.
Color	Change the color of the specified channel(s).
Default	Set all values of the specified channel(s) to their default values.
Close	Close the Waveform Control Panel.

● Checking the waveform measurement conditions (Properties)

Select [View], then [Properties] from the menu to display the measurement settings on the MEMORY HiCORDER.

● Checking voltage values (Trace)

Select [View], then [Trace] from the menu to check the time value and difference of the two cursors (A and B) and the voltage values and differences of all channels.

● File list in index file

Select [View], then [Block List] to check the file list (block number, file name, time axis range, trigger time) in the index file.

Double-click a file in the list opens a new window in which you can check waveform in that file.

* This is effective only when reading Sequential, Multi-block, REC&MEM index files.

- **Waveform jump function**

Select [View], then [Jump] to jump to the trigger position or the positions of the A or B cursors.

- **Time Notation**

Select [View], then [Time Notation]. You can select the time notation on the waveform display screen.

- **Setting Grid Type**

Select [View], then [Grid Type] on the menu to set the type of grid (None, Standard, or Fine).

- **Display of Title Comment**

Select [View], then [Title] on the menu to display a title comment at the top of the waveform screen.

- **Waveform legend view**

Select [View], then [Remarks] on the menu to view the unit type of each channel, measurement mode, measurement range, filters, comments, scaling, display position, and magnification on the portion below the waveform screen.

- **Fixing waveform view conditions**

Select [View], then [Fixed] on the menu to always view waveforms with the same color, display position and magnification.

When this item is enabled, the file view settings are disabled.

The standard values for display conditions are automatically saved when the application is terminated or when the check mark is removed from [Fixed] menu.

- **Setting the display colors**

Right-click on the waveform display screen, and select [Color], then [Text] [Background] [Grid] to display a dialog box for setting the respective colors.

- **Font settings (character size)**

Right-click on the waveform display screen, and select [Font], to display the font setting dialog box. You can then select the font for text on the waveform display screen.

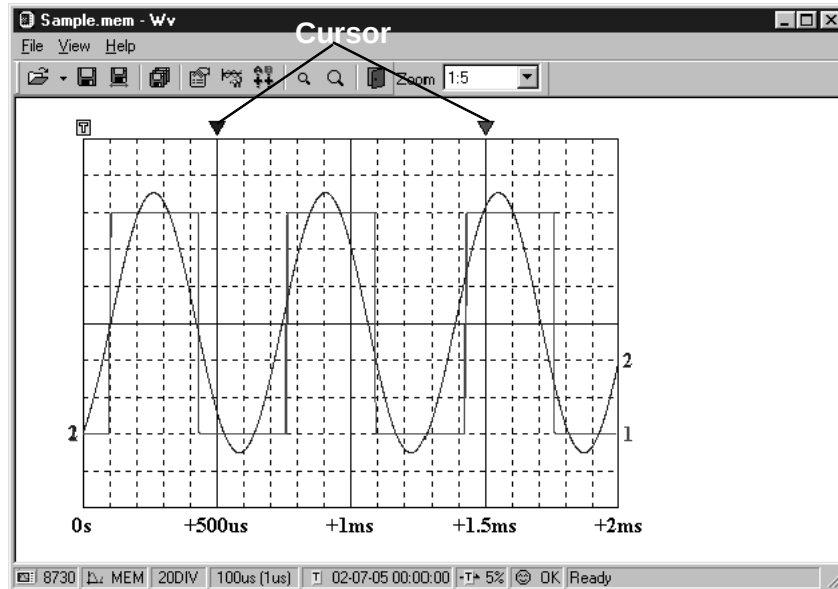
- **Waveform display snaps (capture)**

Select [View], then [Capture] on the menu to capture waveform display and copy to clipboard as a bit image. You can paste it into other applications.

13.5.4 Conversion to CSV Format

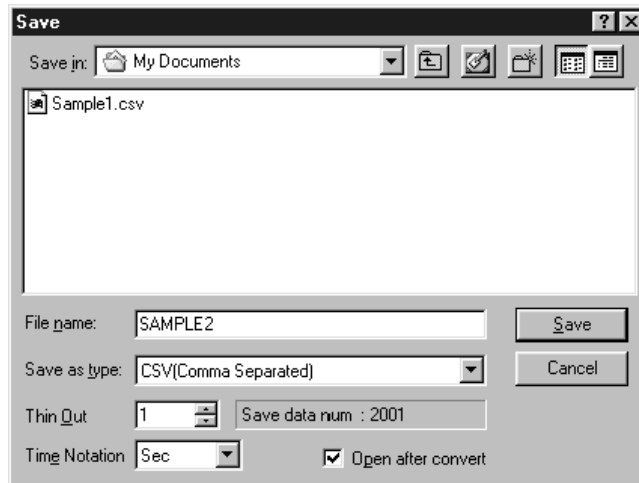
You can convert displayed waveform data to a CSV format file. Once in CSV format, the file can be loaded into spreadsheet or other software for further processing. You can either convert the whole data file or a range selected with the cursors.

If selecting a range, first set the cursors to the required positions. These are indicated at the top of the waveform screen by inverted blue and red "▼": drag these triangles with the mouse to set the range.



Then to save all of the data, in the [File] menu, select [Save All]; to save the range only, in the [File] menu, select [Save Between Cursors].

A dialog box appears for setting the file to be saved, and the thinning.



To save in text formats other than CSV (space delimited or tab delimited), select the desired format from the [Save as type] list.

In the [Thin Out] box, enter the number of original samples corresponding to one converted value.

Use this when data over a large range (long time interval) is required, but the whole set of sampled data is not required.

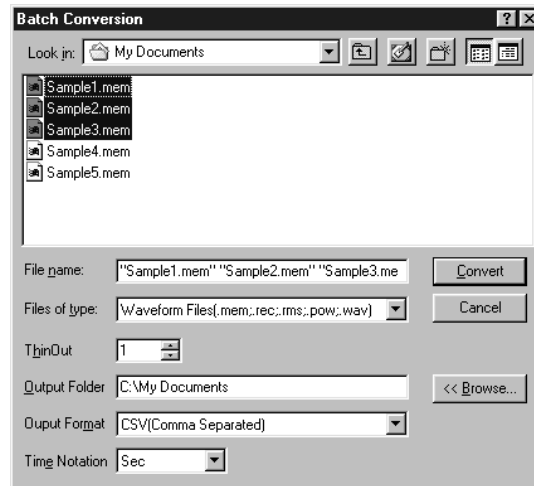
Select [Time Notation] from among [Sec], [Date], [Trig], and [Point].

Enter the name of the file to be saved, and click the [Save] button to convert the data to CSV format and save the file.

13.5.5 Batch Conversion

You can convert multiple waveform files CSV files.

1. Select [**File**] from the menu bar, then select [**Batch Conversion**] from the File menu.
2. Select the desired files from the file list. To select two or more files, left-click on the desired files while holding down the **Shift** or **Control** key.



3. If required, specify the sampling intervals in the [**ThinOut**] box at which data is to be converted. Remember that not all data needs to be converted. This setting is useful when you need data over a broad time span.
4. In the [**Output Folder**], specify the folder in which to save the CSV files converted from waveform files. You can specify the desired folder without typing simply by clicking on the [<<**Browse...**] button and selecting the desired folder from the list.
5. To save in text formats other than CSV (space delimited or tab delimited), select the desired format from the [**Output Format**] list.
6. Select [**Time Notation**] from among [**Sec**], [**Date**], [**Trig**], and [**Point**].
7. Click the [**Convert**] button. All selected waveform files are converted to CSV files and saved in the specified folder.

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HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name: HIOKI E.E. CORPORATION
Manufacturer's Address: 81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name: WAVE COMPARATOR
Model Number: 8730-10, 8731-10
Options: 9637 RS-232C CABLE
9638 RS-232C CABLE
9642 LAN CABLE

The above mentioned products conform to the following product specifications:

Safety: EN61010-1:2001
EMC: EN61326-1:2006
Class A equipment
Basic immunity test requirement
EN61000-3-2:2006
EN61000-3-3:1995+A1:2001+A2:2005

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC.

6 October 2008

HIOKI E.E. CORPORATION



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