HIOKI

Instruction Manual

8715-01

POWER HiCORDER

HIOKI E. E. CORPORATION

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Contents

Introduction

Thank you for purchasing the HIOKI "8715-01 POWER HiCORDER." 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. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

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Options

Cord, Adapter

9199 CONVERSION ADAPTOR (BNC-Banana female)
9217 CONNECTION CORD (BNC-BNC)
(maximum input voltage: 300 V AC/DC)
9322 DIFFERENTIAL PROBE
(maximum input voltage: CAT Ⅱ: 1000 VAC, 2000 VDC, CAT Ⅲ: 600 VAC, DC)
9094 OUTPUT CORD
(for connecting with the 3283, 3284, and 3285)

Clamp

9010-10 CLAMP ON PROBE
(10 A to 500 A, 40 Hz to 1 kHz)
9018-10 CLAMP ON PROBE
(10 A to 500 A, 40 Hz to 3 kHz)
9132-10 CLAMP ON PROBE
(20 A to 1000 A, 40 Hz to 1 kHz)*1
3283 CLAMP ON LEAK HiTESTER
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3284 CLAMP ON AC/DC HiTESTER
(20 A to 500 A 40 Hz to 2 kHz)*2
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(20 A to 500 A 40 Hz to 3 kHz)*2

PC Card

9626 PC CARD 32M
9627 PC CARD 64M
9726 PC CARD 128M
9727 PC CARD 256M
9728 PC CARD 512M
9729 PC CARD 1G

*1: This device is not approved for CE marking.
*2: This device requires the 9094 OUTPUT CORD (sold separately).

Others

9335 WAVE PROCESSOR
9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN)
9447 BATTERY PACK (7.2 V/2450 mAh)
9643 CHARGE STAND
9391 CARRYING CASE
9234 RECORDING PAPER (18 m/59.06 feet, 112 mm width)
220H PAPER WINDER *1

*1: This device is not approved for CE marking.

Safety Notes


DANGER

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.

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.

Safety Symbols

- 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 the ON side of the power switch.


Indicates the OFF side of the power switch.


Indicates both DC (Direct Current) and AC (Alternating Current).


Indicates DC (Direct Current).

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

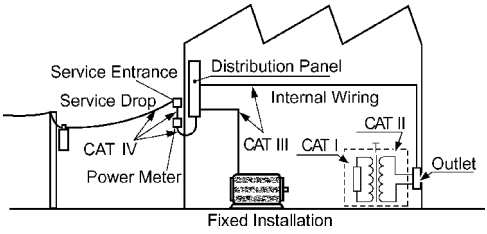
DANGER	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
CAUTION	Indicates that incorrect operation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

Measurement categories (Overvoltage categories)

This instrument complies with CAT II safety requirements.
To ensure safe operation of measurement instruments, IEC61010 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.



Accuracy

We define measurement tolerances in terms of f.s. (full scale), rdg. (reading) and dgt. (digit) values, with the following meanings:

f.s.	(maximum display value or scale length) The maximum displayable value or the full length of the scale. This is usually the maximum value of the currently selected range.
rdg.	(reading or displayed value) The value currently being measured and indicated on the measuring instrument.
dgt.	(resolution) The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1".

Notes on Use

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

DANGER

- **To avoid electric shock and damage to the instrument, do not apply more than 450 V AC or DC between the analog inputs and instrument, or between the analog inputs.**
- **Use only the supplied 9418-15 AC adapter (SA145A-1240V-6, SINO AMERICAN). AC adapter input voltage range is 100 to 240 VAC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the instrument, do not apply voltage outside of this range.**
- **To avoid damaging the instrument, do not apply voltage exceeding the selected range to the input terminals, and never exceed the maximum ratings for the analog input connection cable or probe shown in the following table. In addition to these limits, note that the absolute maximum analog input voltage is 450V AC/DC.**

Input/output terminal	Maximum input voltage
Analog input	450 V AC, DC
EXT TRIG	-5 V to +10 V
TRIG OUT	-20 V to +30 V 500 mA max, 200 mW max
	Maximum input voltage
9197 CONNECTION CORD	500 V AC, DC
9217 CONNECTION CORD	300 V AC, DC
9448 CONSENT INPUT CORD	125 V
9322 DIFFERENTIAL PROBE	1000 V AC, 2000 V DC (CAT II) 600 V AC, DC (CAT III)

WARNING

For battery operation, use only the Hioki Model 9447 BATTERY PACK. We cannot accept responsibility for accidents or damage related to the use of any other batteries.

NOTE

The 8715-01 POWER HiCORDERs are not affected by a drop in power lasting 40 ms or less. However, a drop in power lasting more than 40 ms may interrupt the power supply. Check the power supply conditions at the installation site in advance.

Chapter 1
Product Overview

1.1 Major Features

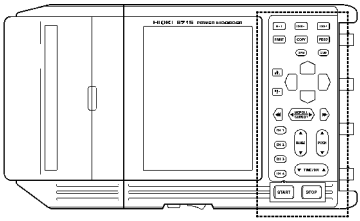
(1) Two Power Monitoring Modes
- The Waveform Measurement Mode measures the waveform level of commercial power lines.
- The RMS Trend Measurement Mode records the trend in the rms value of power line levels over a long term.

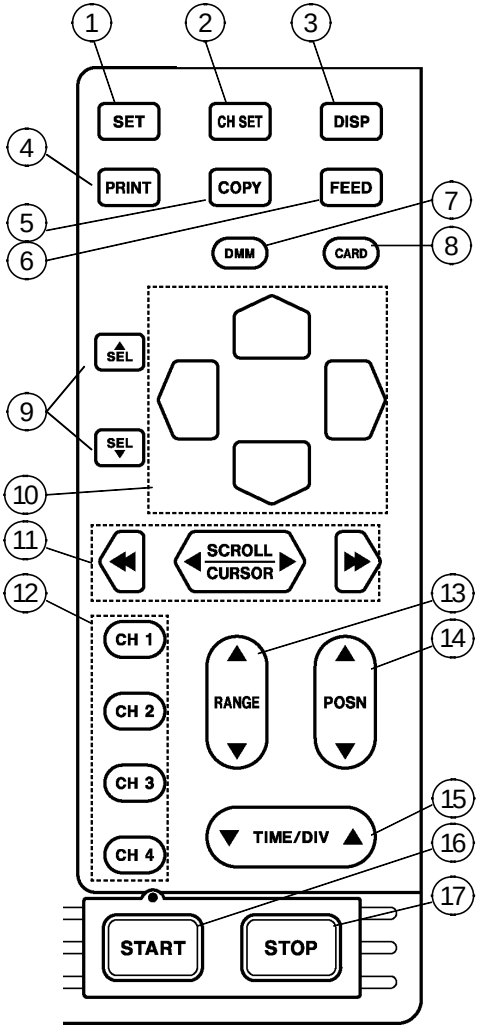
(2) Attached printer simultaneously prints measured waveforms instantaneously on site.

(3) Current Measurement Capabilities
Current measurements capabilities are available when using our clamp sensors, with which current values can be read directly.

(4) Isolated Analog Inputs Satisfy Safety Concerns
- The four channels of the 8715-01 are completely isolated from the instrument's ground (GND), allowing worry-free connections to points of independent potential.
- Accepts direct connection to and measurement of 400V lines.

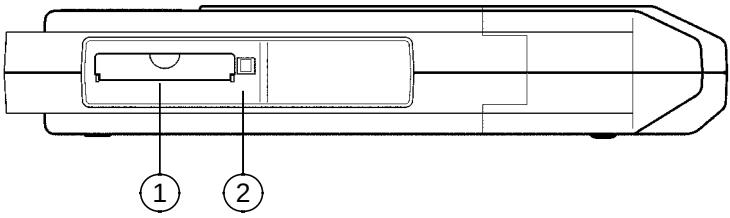
1.2 Identification of Controls and Indicators





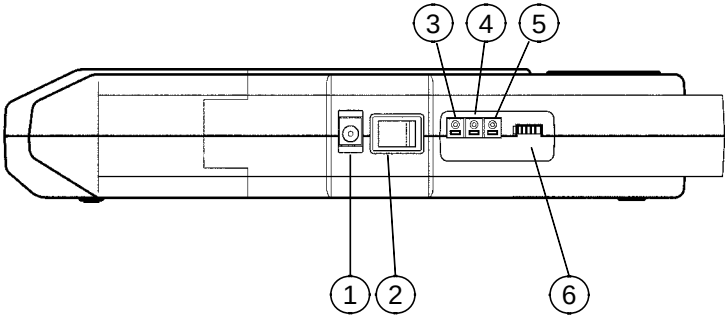
1. SET key	Selects the Basic Setting screen.
2. CH SET key	Selects the CH SETTING screen.
3. DISP key	Selects the Waveform Display screen.
4. PRINT key	Serves to print out stored waveforms.
5. COPY key	Serves to print out a copy of the current screen display.
6. FEED key	Causes the printer paper to advance for as long as the key is pressed.
7. DMM key	Selects the DMM screen.
8. CARD key	Selects the File screen.
9. ▲/▼keys	Select and accept settings here.
10. Cursor keys	Moves the flashing cursor in the four directions.
11. Scroll keys	Moves the A/B cursors and scrolls the waveforms.
12. CH1 - CH4 keys	Input and trigger settings can be made by displaying the Settings window on the Waveform Display screen.
13. RANGE key	Sets the voltage axis range for the channel.
14. POSN key	Sets the display position for the channel.
15. TIME/DIV key	Sets the input signal capture speed.
16. START key	Initiates the measurement and analysis. During measurement, the LED above the key is lit.
17. STOP key	Stops measurement.

Upper Side View



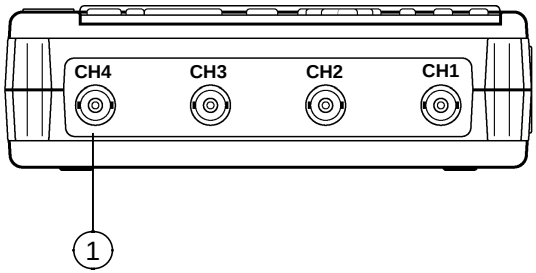
1. PC card slot	Insert the PC card.
2. Eject button	Press this button to eject a PC card.

Lower Side View



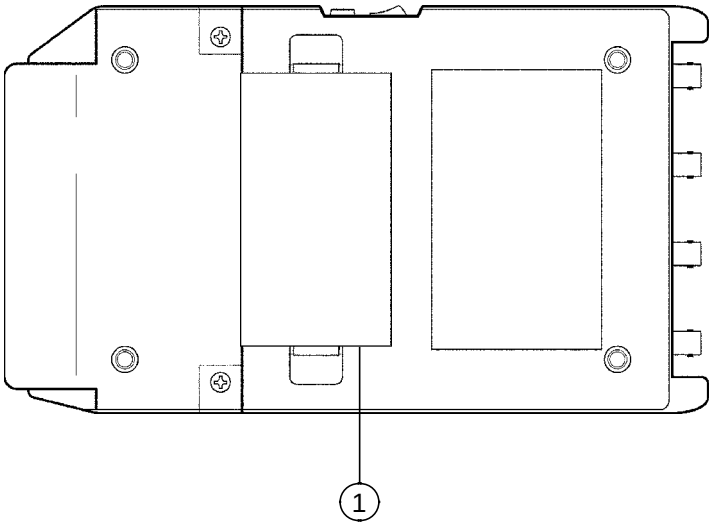
1. AC adapter connecting terminal (for the AC adapter specified by Hioki only)	
2. Power switch	Switches on or off the power supply.
3. External trigger terminal (EXT TRIG)	External trigger source input.
4. Trigger output terminal (TRIG OUT)	Trigger signals are output.
5. Ground terminal (GND)	Used together with the trigger terminal.
6. Contrast adjustment knob	Adjusts screen contrast.

Right Side View



1. Analog input terminal	Input terminals for analog inputs, non-balanced input type (8715-01: 4-channel input)

Bottom Side View



1. Battery compartment	9447 BATTERY PACK can be installed.

Chapter 2
Installation and Preparation

2.1 Installation of the Unit

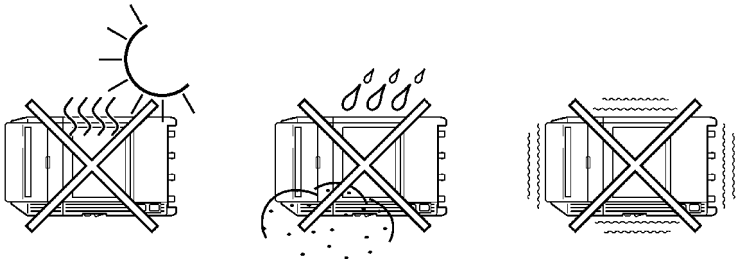
Ambient conditions

Temperature
5 to 40°C, 23±5°C (41 to 104°F, 73°F±9°F) recommended for high-precision measurements.

Humidity
35 to 80%RH (no condensation); 50±10%RH (no condensation) recommended for high-precision measurements.

Avoid the following locations:

- 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 CI_2) or substances that generate harmful gasses (e.g., organic silicones, cyanides, and formalins).
- Subject to vibrations.
- In the vicinity of equipment generating strong electromagnetic fields.

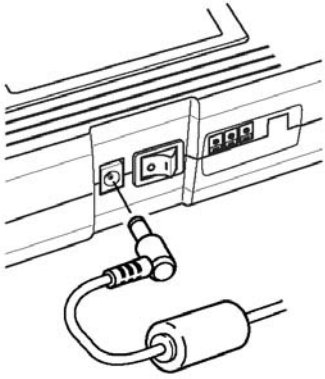


2.2 Power Supply and Ground Connection

2.2.1 Connecting the AC Adapter

DANGER

Use only the supplied 9418-15 AC adapter (SA145A-1240V-6, SINO AMERICAN). AC adapter input voltage range is 100 to 240 V AC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the instrument, do not apply voltage outside of this range.



NOTE

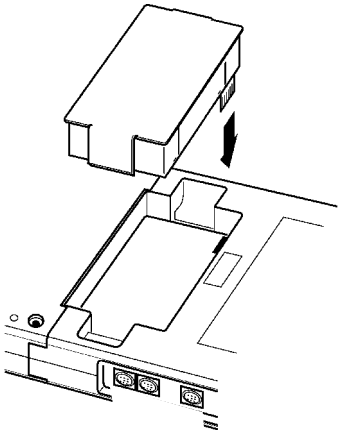
- The 8715-01 POWER HiCORDERs are not affected by a drop in power lasting 40 ms or less. However, a drop in power lasting more than 40 ms may interrupt the power supply. Check the power supply conditions at the installation site in advance.

2.2.2 Installing the 9447 BATTERY PACK

WARNING

For battery operation, use only the Hioki Model 9447 BATTERY PACK. We cannot accept responsibility for accidents or damage related to the use of any other batteries.

Installing the 9447 BATTERY PACK



1. Turn the power OFF.
2. Take off the Blank box.
3. Install the 9447 BATTERY PACK.

Effective Battery-Powered Operating Time

(typical value at normal temperature)
When the LCD power save function is on, the maximum operating time will be longer than listed in the table below. For details, see 6.1.3, "LCD Saver".

Operating condition	9447 BATTERY PACK
Not operating (waiting for trigger, etc.)	Approx. 180 min (LCD power save ON) Approx. 120 min. (LCD power save OFF)
During operating 2 s/DIV 1 Hz sinewave	Approx. 120 min (LCD power save ON)

NOTE

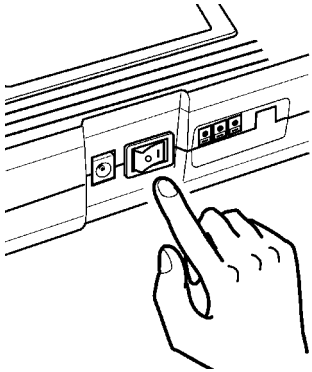
- If not recharge, the 9447 can not be used. For the details on charging batteries, refer to Section 10.2, "Recharging the 9447 BATTERY PACK."
- If the battery voltage drops while the instrument is running off of battery power, the 8715-01 will automatically switch off the power supply. If the instrument is left in this state for an extended period of time, the battery pack may be discharged too much. Be sure to turn OFF the power switch on the instrument.
- When the battery capacity is reduced, the power is automatically turned off. Before turning on the power again with AC adapter or new batteries, turn the power off and leave for about 30 seconds. If this time is shorter than 30 seconds, the power may be immediately turned off even if powering on.
- The values listed in the table above may vary depending on ambient temperature and the coverage rate in printing.
- When the printer is printing, the 8715-01 automatically reduce backlight brightness and enter LCD power save mode.

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 VAC: Voltage fluctuations of ±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).**



Depending on the type and status of power supply of the 8715-01, one of the following messages appears on the Waveform Display screen.

	Operating with the AC ADAPTER.
	Operating with 9447 BATTERY PACK.
	Battery capacity is low. Replace the batteries.

NOTE

When the instrument is turned off, it memorizes the currently used settings and reestablishes the same settings the next time the instrument is turned on again. (Backup function)

2.4 Connection of the Connection Cord

WARNING

Never connect the cable to the 8715-01 while the cable is already connected to the measurement object. Otherwise there is a risk of electric shock.

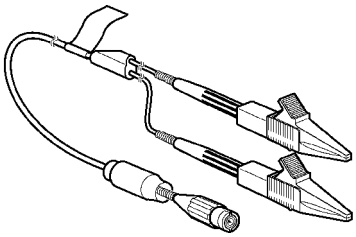
CAUTION

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

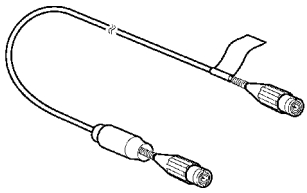
NOTE

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

Use the supplied 9197 or optional connection cord for analog input.

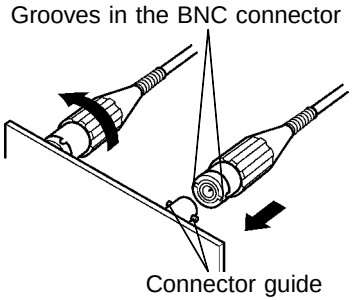


9197
Maximum input voltage: 500 V



9217
Maximum input voltage: 300 V

Connecting to the main unit



1. Align the grooves in the BNC connector with the guide pins on the instrument input connector, then turn clockwise while pressing in to lock the connector.

2. To remove from the instrument, turn the BNC connector counterclockwise to release the lock, then pull it.

2.5 Connecting the 9322 DIFFERENTIAL PROBE

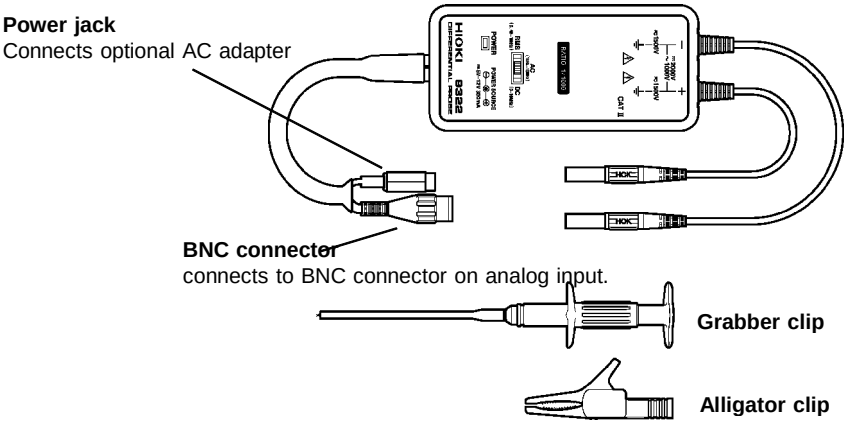
DANGER

- **When using grabber clips, the 9322's maximum rated voltage to earth is 1500 V AC or DC (CAT II) / 600 V AC or DC (CAT III); when using alligator clips, it is 1000 V AC or DC (CAT II) / 600 V AC or DC (CAT III). To avoid electrical shock and possible damage to the instrument, never apply voltage greater than these limits between the input channel terminals and chassis, or across the input of two 9322s.**
- **Maximum input voltage is 1000 VAC/2000 VDC (CAT II) / 600 V AC or DC (CAT III). Do not measure voltage in excess of these limitations, as doing so may danger the instrument or cause an accident that might result in injury or death.**

WARNING

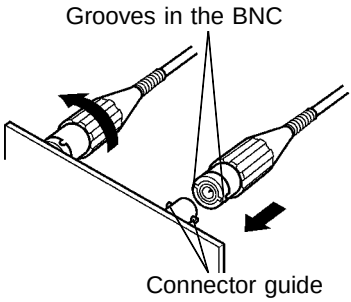
- **9322 input part is applied with high voltage. To avoid electric accident, be sure to turn off the power of equipment to be measured before connecting. After connection is properly handled, turn the power on.**
- **Before using the instrument, make sure that the insulation on the probes is undamaged and that no bare conductors are improperly exposed. Using the instrument in such conditions could cause an electric shock, so contact your dealer or Hioki representative for repair.**

9322 is a differential probe that connects to analog input. After high voltage is input to H and L terminal and divided by 1/1000, the difference is output as signal to GND.



Connection Method

1. Connect the alligator or grabber clips to the 9322 DIFFERENTIAL PROBE.
2. Connect 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) to power jack. When power is supplied, indicator turns on.
3. Connect 9322 BNC connector to analog input.



4. Connect alligator clip or grabber clip to equipment to be measured.
5. Set the output selector switch to DC.

NOTE

- One 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) is required for each 9322 to be used.
- Refer to the 9322 DIFFERENTIAL PROBE Instruction Manual for details.

2.6 Connecting the Clamp on Probe

DANGER

- **Clamp-on probe should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **To avoid short circuits and accidents that could result in injury or death, use clamp testers only with power lines carrying 600 V rms or less.**

The 8715-01 is fundamentally a voltage measuring device. Although it does not measure current directly, current measurement is possible using the voltage output of a clamp sensor.

9010-10, 9018-10
Range: AC10/20/50/100/200 A
9010-10: 40 Hz to 1 kHz
9018-10: 40 Hz to 3 kHz
ϕ 46 mm, 50 mm X 20 mm

9132-10
Range: 20/50/100/200/500/1000 A AC
40 Hz to 1 kHz
ϕ 55 mm, 80 mm X 55 mm

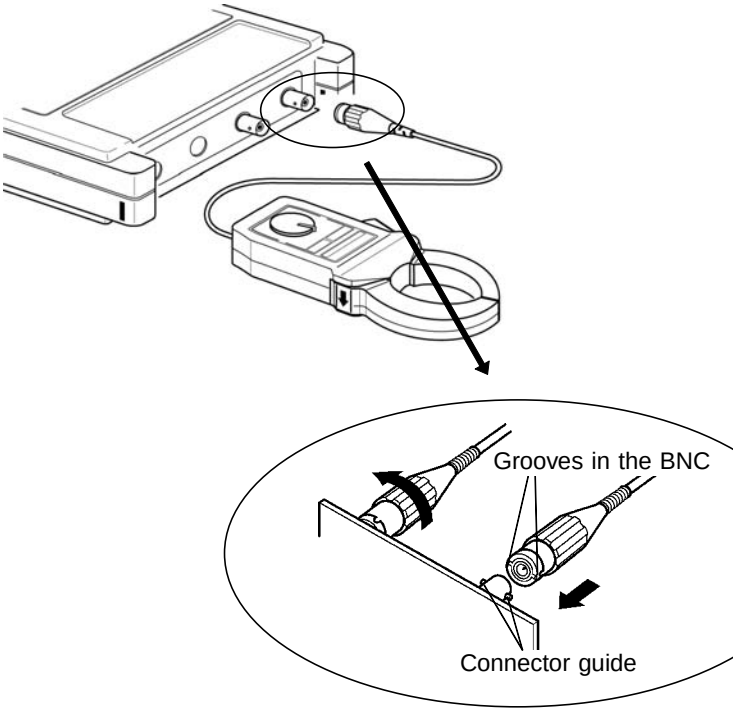
3283
Range: 10m/100m/1/10/200 A AC
40 Hz to 2 kHz
ϕ 40 mm max.

3284
Range: 20/200 A
DC, 10 Hz to 2 kHz
ϕ 33 mm max.

3285
Range: 200/2000 A
DC, 10 Hz to 1 kHz
ϕ 55 mm max.

Using the 9010-10, 9018-10, and 9132-10

1. Align the grooves in the clamp sensor's BNC plug with the connector guide pins on the analog input connector on the 8715-01.
2. Push the BNC plug all the way in, and then turn it to the right (clockwise). Confirm that the connectors are securely mated.
3. To remove from the instrument, turn the BNC connector counterclockwise to release the lock, then pull it.

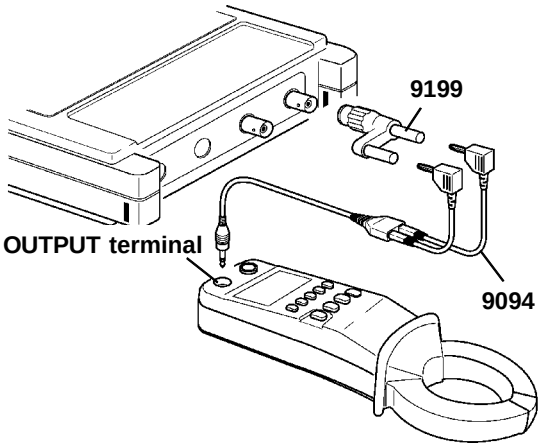


⚠CAUTION When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.

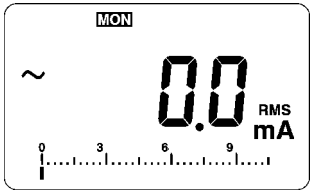
Using the 3283, 3284, and 3285

Connection to the 8715-01 requires the 9199 CONVERSION ADAPTER and 9094 OUTPUT CORD.

1. Connect the 9199 to the 8715-01.
   Refer to 2.4, for the connection procedure.
2. Connect the 9094 to the 9199.
   (The connections are non-polarized, so red and black may be reversed.)
3. Connect the 9094 to the OUTPUT terminal of the CLAMP-ON HiTESTER.



Setting the 3283, 3284, and 3285



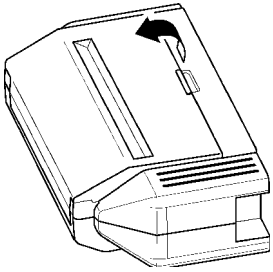
LCD display

Press the RANGE key on the clamp-on HiTESTER to set the appropriate range.
Press the OUTPUT key to display [MON] (Waveform output: AC).
Be sure to use the AC adapter when measuring over a long period.

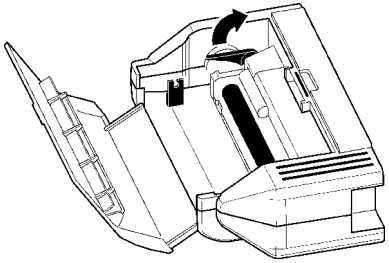
NOTE

- When the clamp-on probe is used for measurement, the measurement precision will be affected both by the instrument precision and clamp-on precision ratings.
- Set the range of the clamp sensor to match that of the 8715-01. If set to different ranges, the display will show incorrect values.

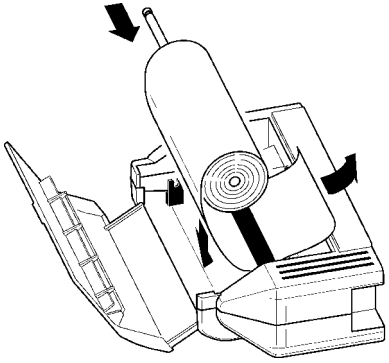
2.7 Loading Recording Paper



1. Lift the stock cover in the direction of the arrows.

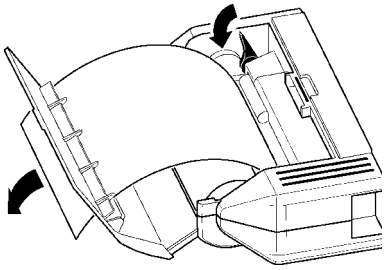


2. Raise the head up/down lever.



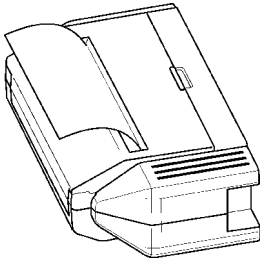
3. Insert the leading edge of the recording paper from bottom into the gap behind the printer roller, and pull it out to the other side.
   Pressing the FEED key feeds paper.

4. Insert the attachments into the ends of the roll of recording paper and set the paper into its holder.



5. Pull the end of the recording paper out at least 10 cm, and make sure that it is positioned quite straight.
6. Put down the head up/down lever.

7. Pull the recording paper to the outside through the printer exit slot in the stock cover.



8. Close the stock cover, and finish by tearing off the recording paper against the edge of the printer exit slot.

NOTE

- When the stock cover is fully open, attempting to force it open further may damage the cover.
- The paper may jam if it is not aligned with the roller.
- For shipping or long-term storage, be certain that the recording head is in the raised position. Otherwise the rollers could be deformed and cause uneven printing.
- Be careful to correctly orient the recording paper. Nothing will be printed if the recording paper is loaded with the wrong side facing the print head.
- We recommend using only the specified 9234 RECORDING PAPER.

2.8 Care of Recording Paper

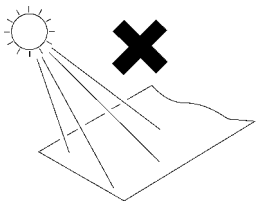
Care of recording paper

- While unopened, thermal paper will not be affected by the environment, provided that ambient temperature and humidity do not exceed normal levels. For long-term storage, temperature should be lower than 40℃ (104℉). Low temperatures cause no problem.
- After opening, protect the paper from strong light, to prevent discoloration.

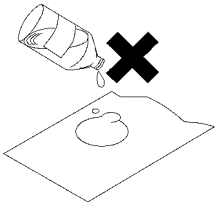
Storing data

As the recording paper is thermally sensitive, be aware of the following points:

- To avoid paper discoloration, do not expose it to direct sunlight, and store at no more than 40 ℃ and 90%RH.
- For permanent storage of important recorded data, photocopy the recording paper.
- If the thermal paper is exposed to an organic solvent such as alcohol or ketone, it may no longer develop properly, and recorded data may fade.
- Also, the thermal recording paper is ruined by contact with wet Daizo copy paper.



Direct sunlight

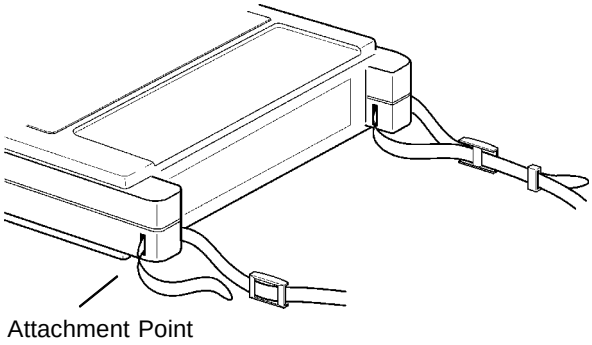


Organic solvent

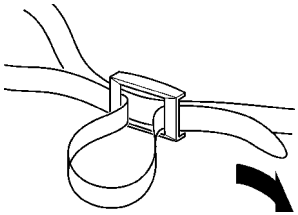
2.9 Attaching the Strap

⚠CAUTION Attach the ends of the strap securely at both attachment points. If the strap is not attached securely, the instrument could drop while being carried.

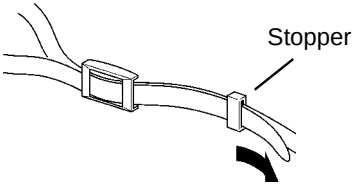
1. Insert each end of the strap through an attachment point on the instrument.



2. Thread the end of the strap through the buckle twice as shown below.



3. Finally, slide the stopper over the end of the strap. Tighten the strap to remove slackness or twisting.



Chapter 3
Waveform Measurement Mode

3.1 Outline of the Waveform Measurement Mode

The Waveform Measurement Mode provides a variety of settable triggers that can be used to easily record waveform anomalities associated with high-speed transient phenomena such as instantaneous power dropouts and brownouts. Features of the Waveform Measurement Mode are as follows.

(1) Measures instantaneous commercial mains power waveforms
- Measures instantaneous, impulse and overvoltage mains voltage waveforms
- Measures peak load current when used with a clamp sensor

(2) Powerful waveform judgment triggers
- Judges waveforms in real time at 125-µs intervals
- 2.5-µs sampling interval allows measuring nearly instantaneous impulses

(3) Voltage-drop trigger effectively detects momentary power dropouts
- Detect momentary dropouts as small as one-half cycle, or optionally set voltage drop detection according to effective value (rms) level.

The Number of Waveform

The number of waveform anomalities that can be sequentially recorded (the sequence limit) depends on the selected recording length. When the number of sequentially recorded waveforms has reached the sequence limit, the earliest recorded waveform is overwritten.
Refer to 3.3.3 "Setting the Recording Length" for sequential recording setup, and 3.8 "Sequential Save Function" for the display procedure for sequentially saved waveforms.

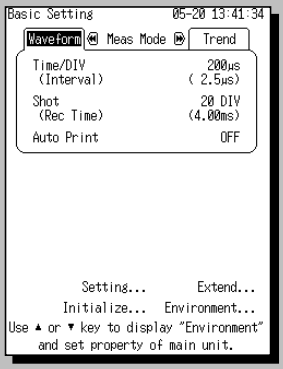
3.2 Operation Sequence (Waveform)

Waveform measurement mode operating procedures are described by the following flowcharts.

Preparation

See Chapter 2.

Basic Setting screen

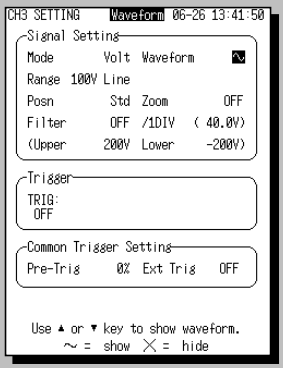


Press the SET key to display the Basic Setting screen.

Use the ◀◀ key to select the Waveform measurement mode.

- **Measurement Mode** — **See 3.3.1.**
- **Time Axis Range** — **See 3.3.2.**
- **Recording Length** — **See 3.3.3.**
- **Auto Print** — **See 3.3.4.**

CH SETTING screen



Press the CH SET key to display the desired CH SETTING screen.

- **Input Mode** — **See 3.4.1.**
- **Measurement Range** — **See 3.4.2.**
- **Waveform Position** — **See 3.4.3.**
- **Low-Pass Filter** — **See 3.4.4.**
- **Waveform Display** — **See 3.4.5.**
- **Zoom** — **See 3.4.6.**
- **Trigger** — **See 3.5.**
- **Pre-Trigger** — **See 3.5.6.**
- **Ext Trig** — **See 5.6.**

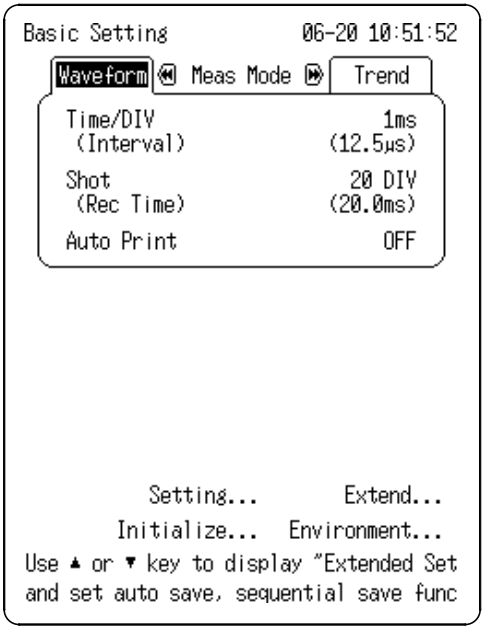
3.3 Setting Items (Waveform)

3.3.1 Setting the Measurement Mode

The 8715-01 has two measurement modes. Select the Waveform measurement mode.

Procedure **Screen: Basic Setting**

1. Press the SET key to display the Basic Setting screen.
2. Press the ◀◀ key to select Waveform measurement mode.

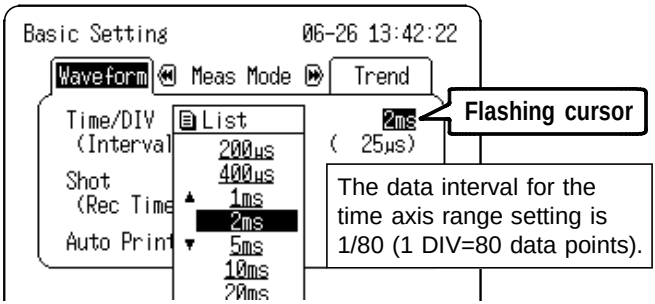


3.3.2 Setting the Time Axis Range

Set the speed for inputting and storing the waveform of the input signal. Time axis range setting expresses the time for 1 DIV.

Procedure-1 **Screen: Basic Setting**

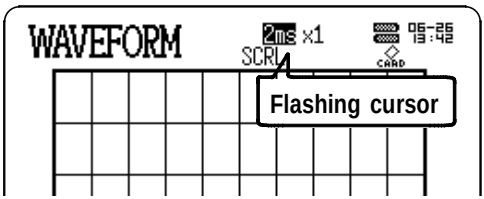
1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Time/DIV and select the time axis range using the ▲/▼ keys.



Pressing the TIME/DIV key moves the flashing cursor automatically to the Time Axis position for setting.

Procedure-2 **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.



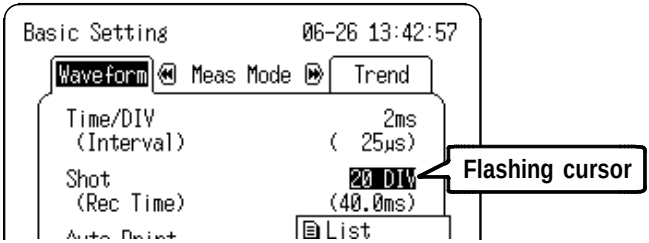
Pressing the TIME/DIV key sets the time axis regardless of the flashing cursor position.

3.3.3 Setting the Recording Length

The length of recording for one measurement operation (number of divisions) can be set.

Procedure **Screen: Basic Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Shot and select the recording length using the ▲/▼ keys.



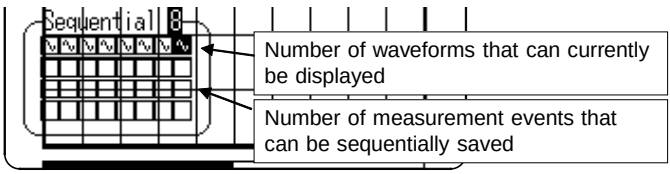
Recording Length and Sequential Save

The maximum number of events that can be sequentially recorded (the sequence limit) depends on the recording length set for each event. For sequential save operation, the internal memory is partitioned for storing multiple sets of data.

In the Waveform Measurement Mode, when the number of sequentially recorded waveforms has reached the sequence limit and a trigger event occurs, the earliest recorded waveform is overwritten.

Refer to 3.8 "Sequential Save Function" for more details.

Shot（DIV）	20	50	100	200	400
Sequence Limit	32	16	8	4	2

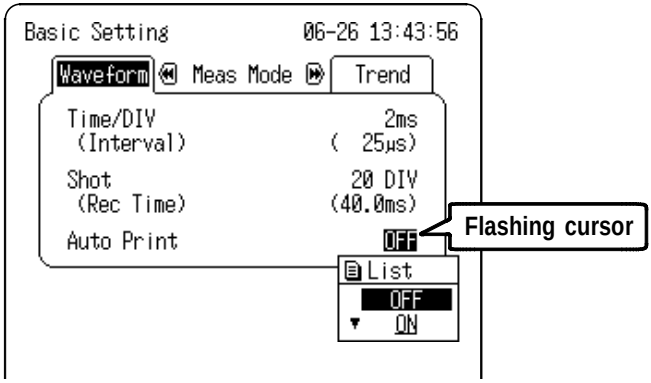


3.3.4 Setting the Auto Print Function

Waveforms print out automatically after measurement starts and each sequential save recording length (block size) has been acquired.

Procedure **Screen: Basic Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Auto Print and set to ON or OFF using the ▲/▼ keys.



OFF	Disables the auto print.
ON	Enables the auto print.

NOTE When cursor A and B are enabled, partial printing is executed. For using the A/B cursors, see Section 5.1.

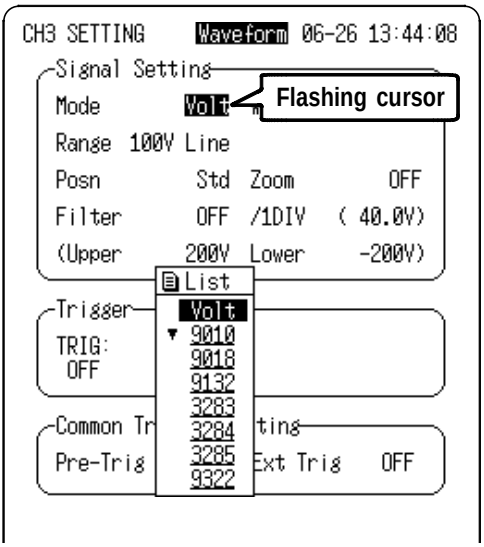
3.4 Input Channel Setting (Waveform)

3.4.1 Setting the Input Mode

Select the input mode (measurement object) for each channel. The settable range is determined by the selected input mode.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Mode position.
3. Use the ▲/▼ keys to make a setting.



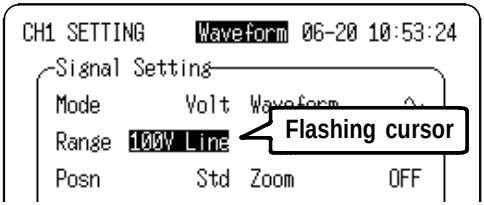
Volt	Measure voltage
9322	Measure voltage using the 9322 DIFFERENTIAL PROBE
9010 to 3285	Measure current using a clamp sensor

3.4.2 Setting the Measurement Range

Select the measurement range for each channel. The settable range is determined by the selected input mode.
The vertical and horizontal dimensions of each frame correspond to the set range, and the upper and lower limits are displayed on the screen.

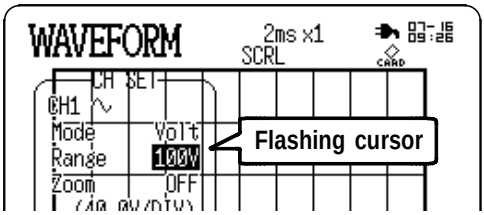
Procedure-1 **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Range position.
3. Use the ▲/▼ keys to make a setting.



Procedure-2 **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Press the CH1 - CH4 key to display the setting window.
3. Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.



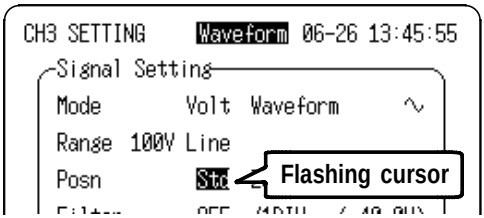
Pressing the RANGE key moves the flashing cursor automatically to the Time Axis position for setting.

3.4.3 Setting the Waveform Position

Set the waveform display position.
The waveform display can be repositioned if it is obscured, such as by an overlapping window.

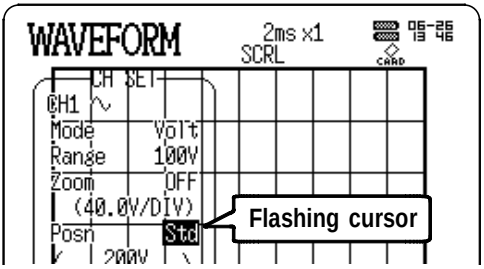
Procedure-1 **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Posn position.
3. Use the ▲/▼ keys to make a setting.



Procedure-2 **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Press the CH1 - CH4 key to display the setting window.
3. Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.



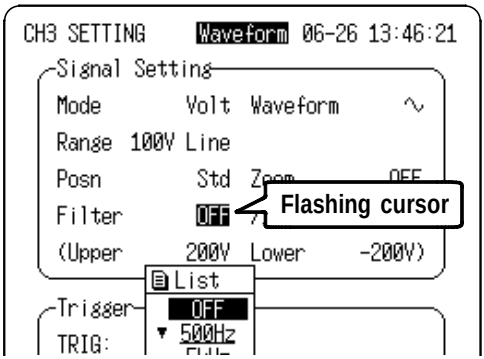
Pressing the POSN key moves the flashing cursor automatically to the Time Axis position for setting.

3.4.4 Setting the Low-Pass Filter

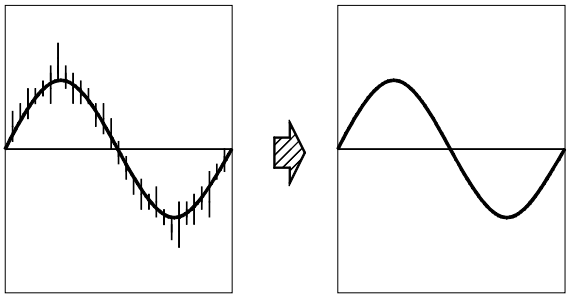
Effective for removing unneeded high-frequency components.

Procedure **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Filter position.
3. Use the ▲/▼ keys to make a setting.



OFF	No low-pass filter is connected.
500 Hz	Connect a filter with a cutoff frequency of 500 Hz
5 kHz	Connect a filter with a cutoff frequency of 5 kHz



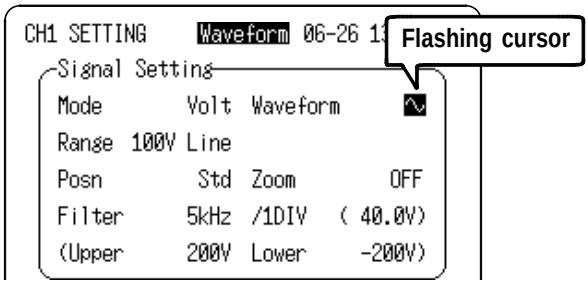
Filter: OFF Filter: 500 Hz

3.4.5 Setting the Waveform Display

Enable/disable waveform measurement and display.
The 8715-01 can record and display up to four channels.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Waveform position.
3. Use the ▲/▼ keys to make a setting.



Colors on the Waveform Display screen are used to indicate channels as follows, and are not changeable.

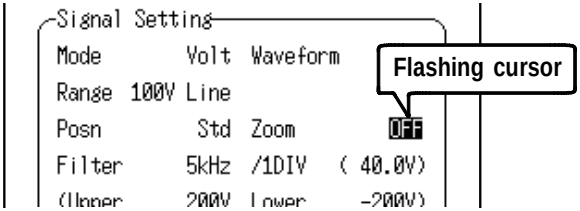
CH1	: Red	CH3	: Yellow
CH2	: Green	CH4	: Blue

3.4.6 Setting the Zoom

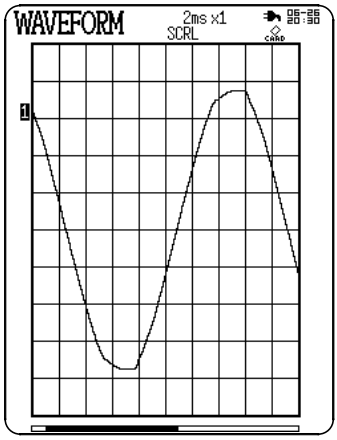
The voltage axis can be independently magnified or compressed for display and recording of each channel. Magnification and compression are applied relative to the center of the display.

Procedure **Screen: CH SETTING / Waveform Display**

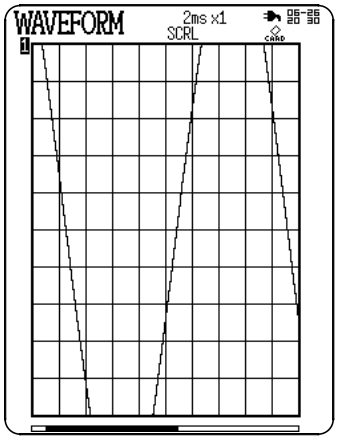
1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Zoom position.
3. Use the ▲/▼ keys to make a setting.



OFF	Display and record without magnification
ON	Display and record with magnified voltage axis



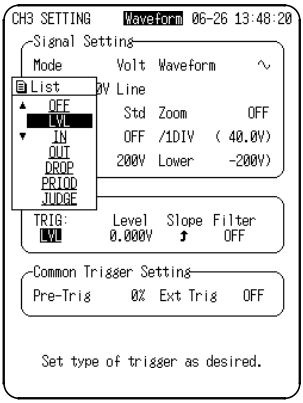
OFF

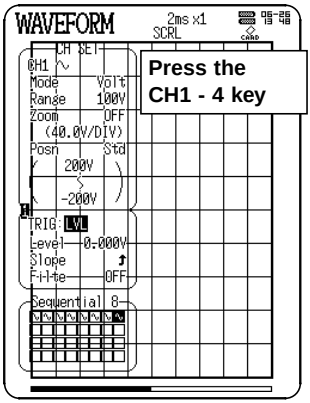


ON

3.5 Trigger Functions

- The term "trigger" refers to a signal which is used to control the timing for recording start. The term "triggering has occurred" refers to the state when such a signal has activated recording start.
- Trigger settings can be made on each CH SETTING screen or on the Waveform Display screen. This document mainly describes the CH SETTING screen settings.





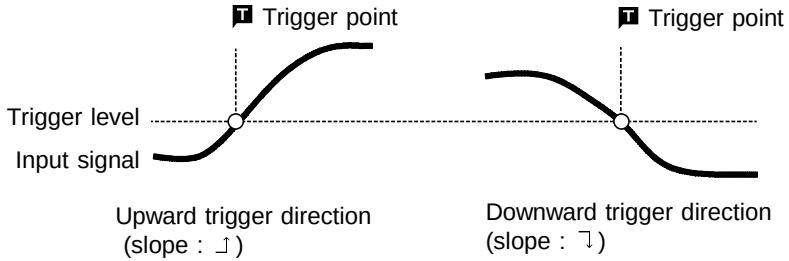
Trigger conditions for the Waveform Measurement Mode, with primary usage examples

- Level Trigger ····· In-rush current measurement
- Window-In/Out Trigger ····· Overvoltage (or current)
- Voltage Drop Trigger
  ····· Momentary voltage dropouts and brownouts
- Period Trigger ····· Power frequency anomalities
- Waveform Detection Trigger
  ····· Surge and noise measurement

- A trigger condition can be enabled by setting an OR condition with other triggers. The OR condition causes a trigger to occur when any of several trigger conditions are satisfied.
- Pre-trigger and external trigger settings can be made only on the CH SETTING screen.
- Refer to 5.6 "External Trigger Function" for external trigger details.

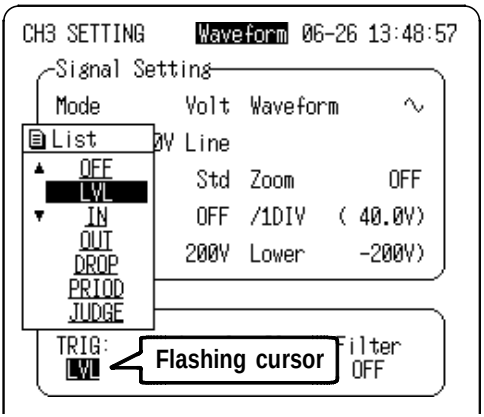
3.5.1 Level Trigger

Triggering occurs when the input signal crosses the preset trigger level with the preset trigger slope (⌋⌈, ⌉⌄).

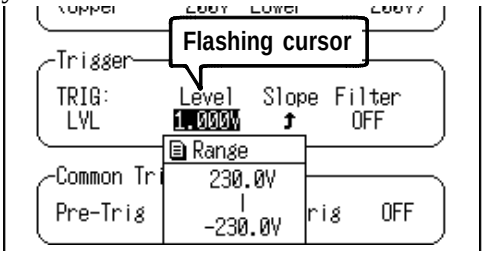


Procedure **Screen: CH SETTING / Waveform Display**

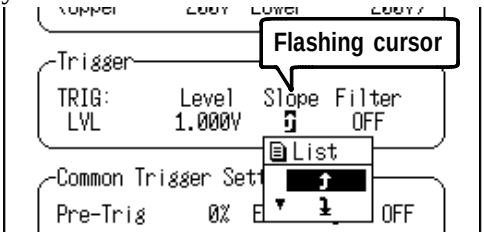
1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select LVL (level) using the ▲/▼ keys.



3. Move the flashing cursor to the position shown in the figure below, and set the trigger level using the ▲/▼ keys.

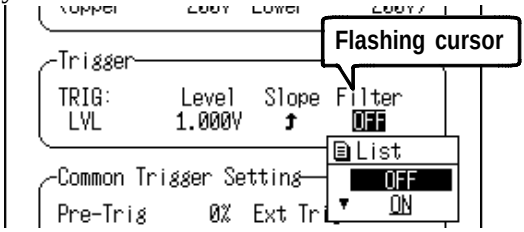


4. Move the flashing cursor to the position shown in the figure below, and set the trigger slope using the ▲/▼ keys.



⌟	Triggering occurs when the rising trigger slope (⌟) crosses the trigger level.
⌝	Triggering occurs when the falling trigger slope (⌝) crosses the trigger level.

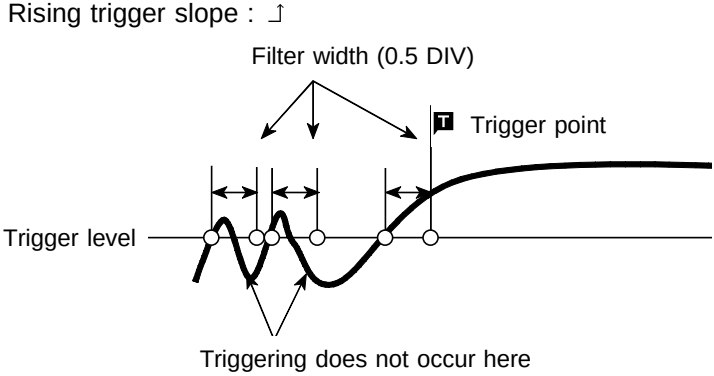
5. Move the flashing cursor to the position shown in the figure below, and set the trigger filter using the ▲/▼ keys.



OFF	Trigger filter is disabled.
ON	Trigger filter is enabled. Filter width: 0.5 DIV

Trigger Filter

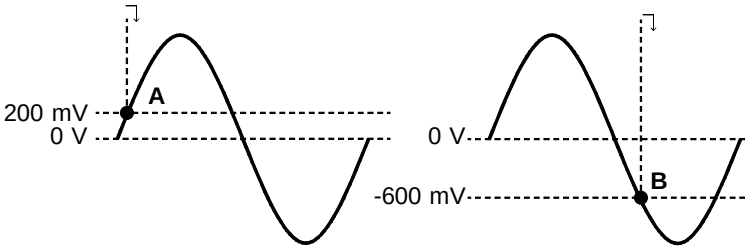
Triggering occurs when the trigger conditions are met within the filter width (0.5 DIV). This is useful to prevent spurious triggering by noise



To cause triggering at point A or point B with the sine wave shown below, make the following settings.

Point A
Trigger level: 200 mV,
Trigger slope: rising (⊥)

Point B
Trigger level: -600 mV,
Trigger slope: falling (⊤)



3.5.2 Window-In/Out Trigger

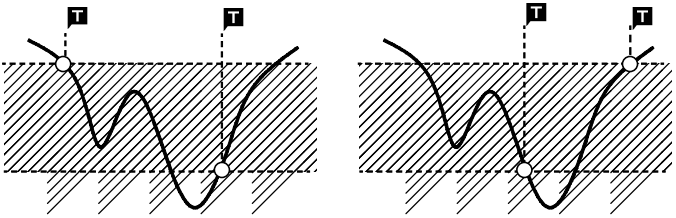
Window-In Trigger

Set upper limit level and lower limit level and activated when the input signal enters the range between these limits.

Window-Out Trigger

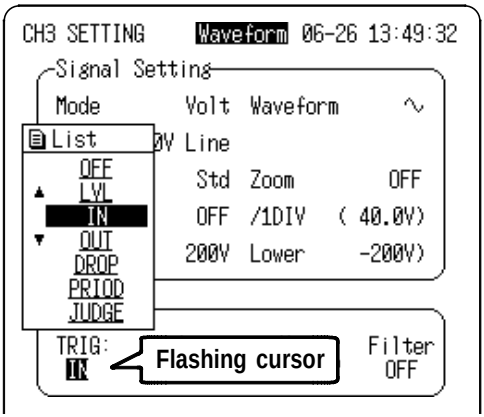
Set upper limit level and lower limit level and activated when the input signal leaves this range.

Window-In Trigger **Window-Out Trigger**

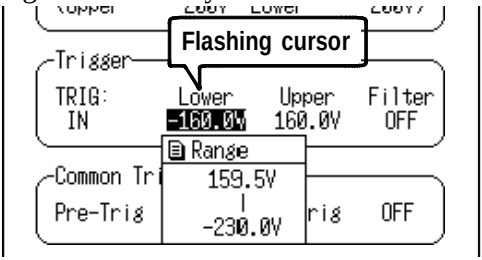


Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select IN or OUT using the ▲/▼ keys.

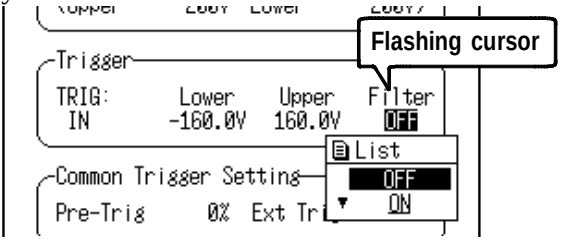


3. Move the flashing cursor to the position shown in the figure below, and set the lower limit of the trigger level using the ▲/▼ keys.



4. Move the flashing cursor to the upper limit, and set the upper limit of the trigger level using the ▲/▼ keys. The upper limits must not be smaller than the lower limits, or the lower limits must not be larger than the upper limits.

5. Move the flashing cursor to the position shown in the figure below, and set the trigger filter using the ▲/▼ keys.



OFF	Trigger filter is disabled.
ON	Trigger filter is enabled. Filter width: 0.5 DIV

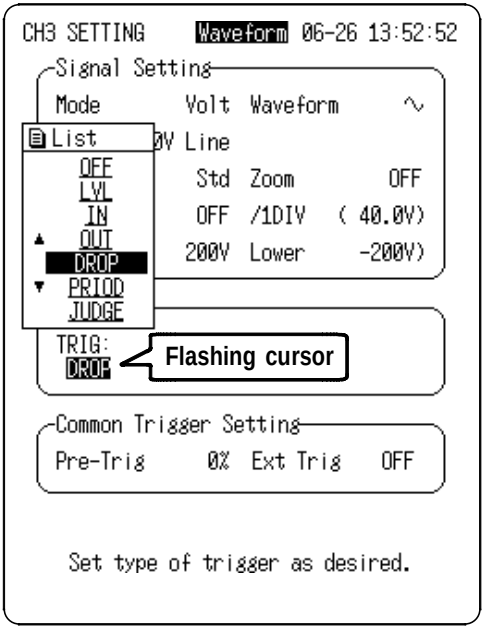
If the trigger condition has already occurred before measurement starts, the trigger is not activated. However, after the trigger condition clears, the trigger is activated when the condition next occurs.

3.5.3 Voltage Drop Trigger

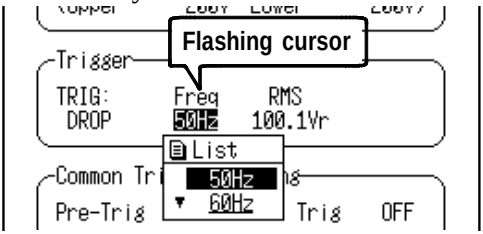
The 8715-01 is designed to measure commercial power supplies (50/60 Hz), and detects momentary voltage drops in commercial power supplies
Triggering occurs when peak voltage drops below the specified level for morethan one-half cycle.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select DROP using the ▲/▼ keys.

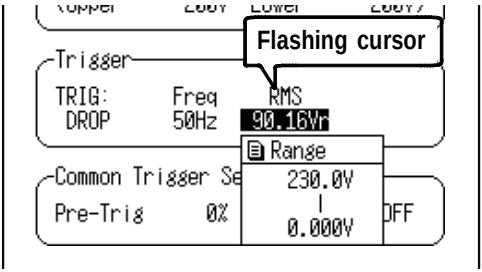


3. Move the flashing cursor to the position shown in the figure below, and set the frequency to be measured using the ▲/▼ keys.



50 Hz	This measurement is made using a 50-Hz commercial power supply.
60 Hz	This measurement is made using a 60-Hz commercial power supply.

4. Move the flashing cursor to the position shown in the figure below, and set the trigger level using the ▲/▼ keys.
   The RMS value is displayed on the right side of the trigger level.

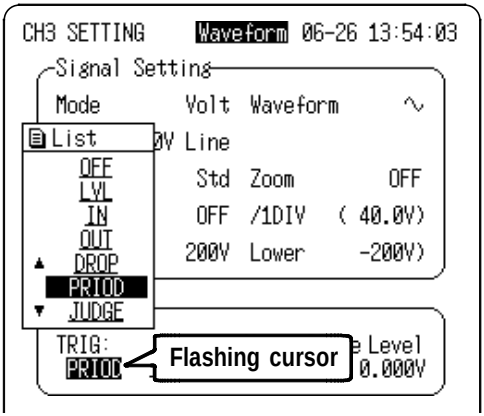


3.5.4 Period Trigger

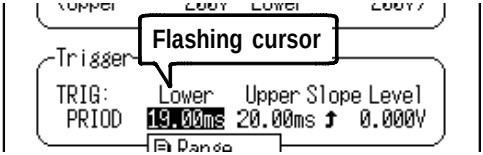
This function sets both the period reference voltage and the period range, and measures the rise (fall) period of the reference voltage. When the measured period deviates from the specified range, triggering occurs.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select PRIOD using the ▲/▼ keys.

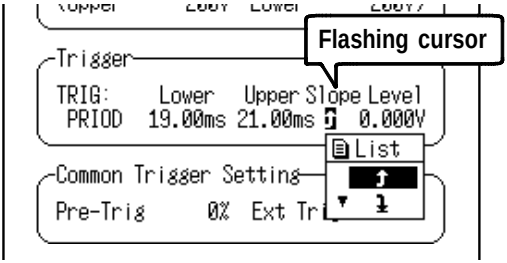


3. Move the flashing cursor to the position shown in the figure below, and set the lower limit of the trigger level (period range) using the ▲/▼ keys.



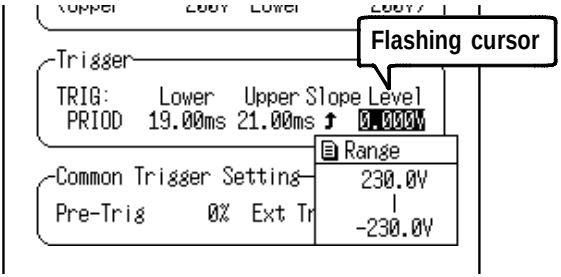
4. Move the flashing cursor to the upper limit, and set the upper limit of the trigger level (period range) using the ▲/▼ keys.

5. Move the flashing cursor to the position shown in the figure below, and set the trigger slope using the ▲/▼ keys.



⮥	Triggering occurs when the rising trigger slope (⮥) crosses the trigger level.
⮧	Triggering occurs when the falling trigger slope (⮧) crosses the trigger level.

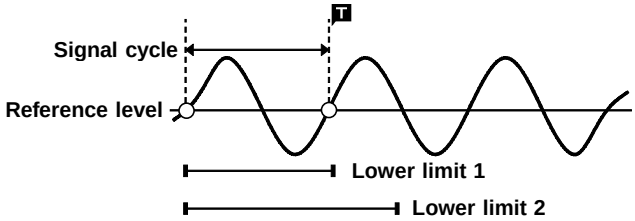
6. Move the flashing cursor to the position shown in the figure below, and set the reference level using the ▲/▼ keys.



Triggering Position of the Period Trigger

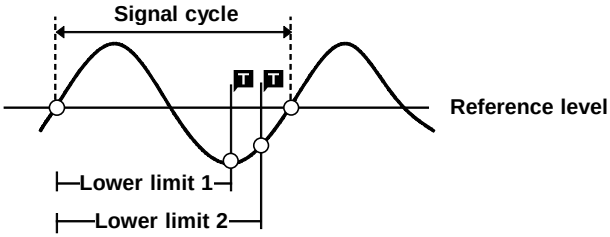
The system monitors the period of the signal that crosses the set reference level.
When the monitored period deviates from the set range, triggering occurs. The trigger position is determined by the set period range and the measurement signal period.

Signal with a period to be measured that is smaller than lower limit of the period trigger (trigger slope: ⊥↑):



When the signal crosses the reference level at the set trigger slope before the lower limit of the set period range appears on the screen, the intersection is always defined as the triggering position.

Signal with a period to be measured that is larger than the upper limit of the period trigger (trigger slope: ⊥↑):

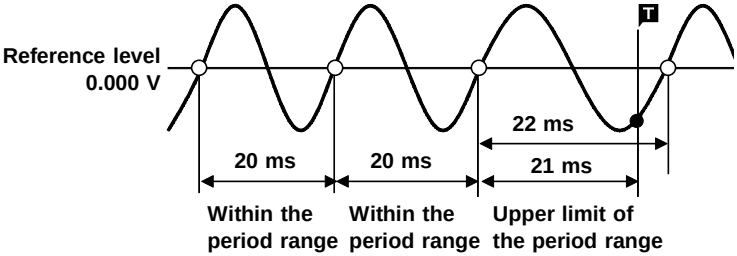


When the upper limit of the set period range appears on the screen before the signal crosses the reference level at the set trigger slope, the upper limit is defined as the triggering position. The triggering position is determined by the position of the upper limit in the period range, as shown in the figure above.

Example for period Trigger

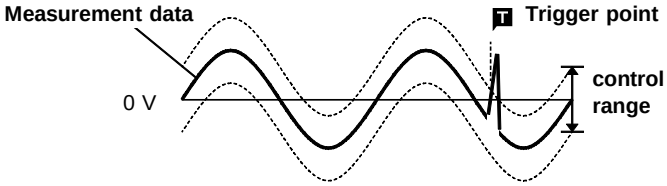
To measure a 50-Hz power trend waveform with period deviation trigger conditions between 19 ms (about 52.6 Hz) and 21 ms (about 47.6 Hz), set the following:

Lower limit: 19 ms Upper limit: 21 ms
Reference level: 0.000 V Slope: ⊥



3.5.5 Waveform Detection Trigger

The waveform detection trigger function compares the measured signal with a pre-defined control waveform range, and triggers if the signal deviates from the control range voltage. The control range consists of a positive and negative amplitude offset from either a standard sine wave or the previous input cycle.



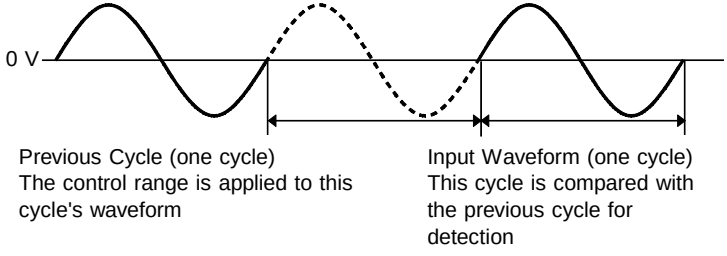
For purposes of creating a control range for a standard waveform (either a sine wave or the previous cycle), one cycle period is considered to begin at the positive-going 0-volt crossing (positive 0 crossing).

(1) Sine Wave

The control range is based on a sine wave (with RMS value voltage) at the mains frequency.

(2) Previous Cycle

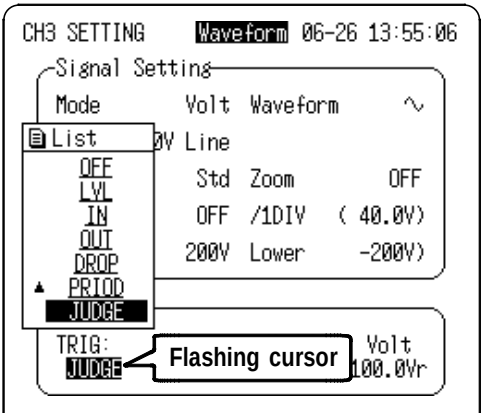
The control range of each cycle is based on the previous cycle of the input waveform. This selection is used when gradual changes should not cause triggering.



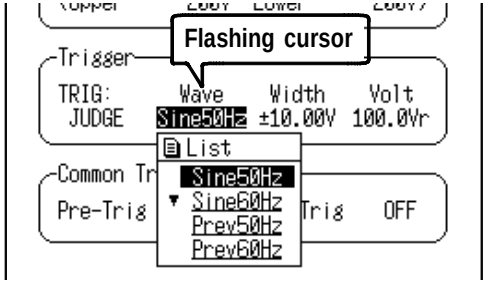
- This function is not available in the 20-ms time axis range.
- The settable standard voltage and control range are limited by the voltage range setting.
- We recommend setting the standard voltage after verifying the actual rms voltage with the DMM function.

Procedure **Screen: CH SETTING / Waveform Display**

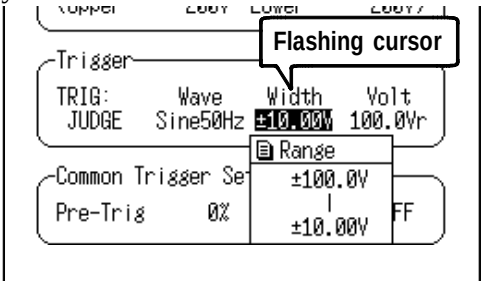
1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select JUDGE using the ▲/▼ keys.



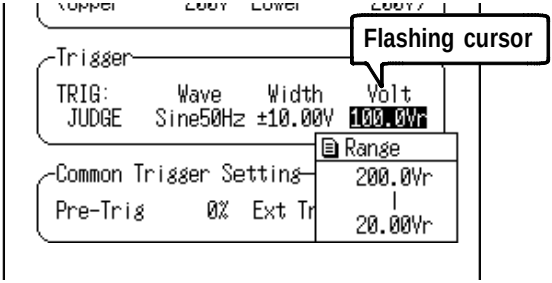
3. Move the flashing cursor to the position shown in the figure below and select the reference waveform using the ▲/▼ keys.



4. Move the flashing cursor to the position shown in the figure below and set the control range using the ▲/▼ keys.

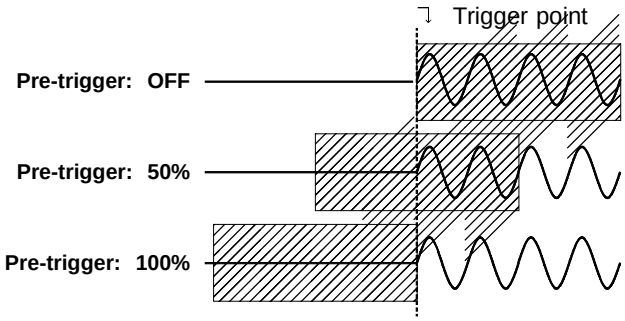


5. When 50- or 60-Hz Sine Wave was selected in step 3, set the Standard Voltage.
   Move the flashing cursor to the position shown in the figure below and set the standard voltage using the ▲/▼ keys.
   When measuring 100-V commercial lines: Set the standard voltage to 100 Vr.
   When measuring 200-V commercial lines: Set the voltage to 200 Vr.



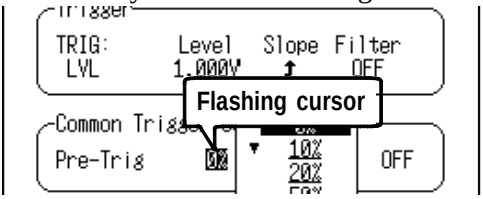
3.5.6 Setting the Pre-Trigger

The pre-trigger function serves to record the waveform not only after but also before triggering has occurred.
In the Waveform measurement mode, using the recording start point as 0% and the recording end point as 100%, the trigger point can be specified in percent. When all trigger sources are set to OFF, the pre-trigger setting is invalid.



Procedure **Screen: CH SETTING**

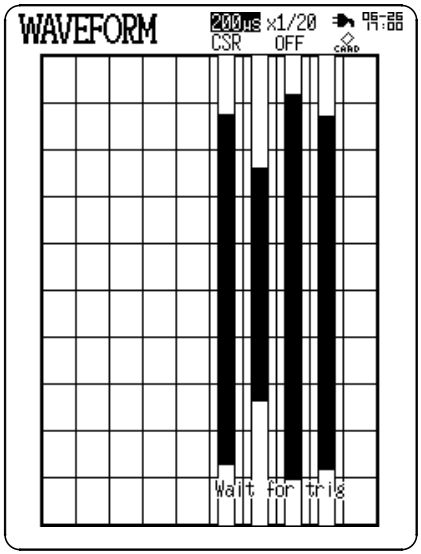
1. Press the CH SET key to display the CH SETTING screen.
2. Move the flashing cursor to the Pre-Trig position and use the ▲/▼ keys to make a setting.



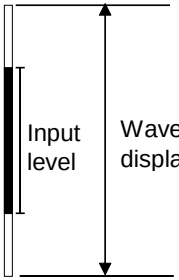
- In Waveform measurement mode, when the pre-trigger is set, the trigger will not be registered for a certain period after the start of measurement. (During this interval, Pre-trig wait is shown on the Waveform display screen.)
- When the trigger can be registered, the indication Wait for trig is shown on the waveform display screen.

3.5.7 Input Level Monitor Function

- The input signal is monitored in real time when waiting for the trigger in Waveform measurement mode.
- The input settings can be made for a particular channel using the Channel Select keys (CH1 to CH4) while monitoring on the Waveform Display screen.



Analog channels



CH1 to 4, left-to-right

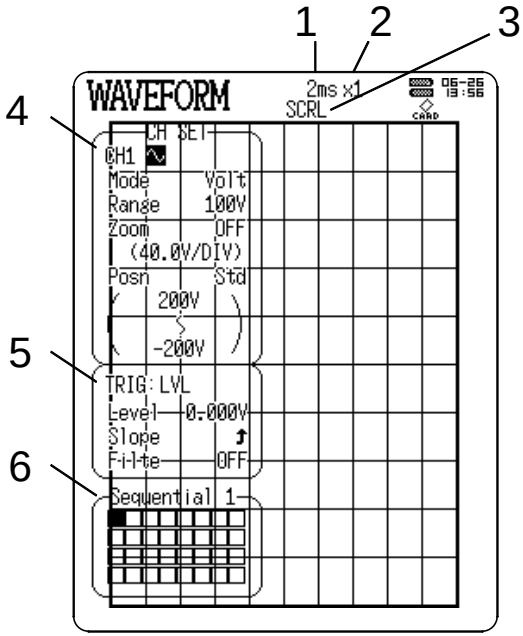
When the input level is not displayed on the screen display range

↑ The input level exceeds the upper limit.

↓ The input level exceeds the lower limit.

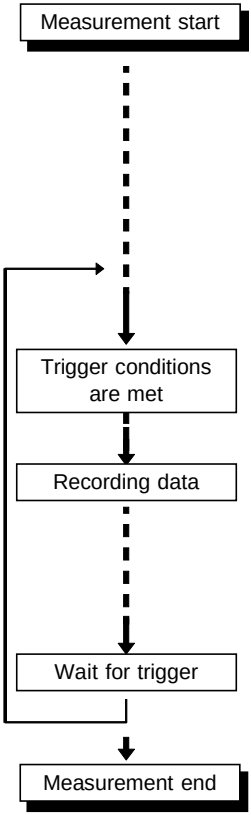
3.6 Waveform Display Screen Settings

This section describes the settings on the Waveform Display screen. Pressing CH1 to CH4 displays the input channel and trigger settings. Press the same key again to return to the previous screen.



Display item	Selection	Reference
1. Time axis range	200 µs to 20 ms /DIV	3.3.2
2. Magnification/ Compression of the time axis	X10 to X1/50	5.3
3. A/B cursor measurement or waveform scrolling		5.1, 5.2
4. Input channel setting	Sets each channels	3.4
5. Trigger setting	Sets each channels	3.5
6. Sequential save	When multiple waveforms have been stored, select one to display.	3.8

3.7 Start and Stop Operation (Waveform)



- Pressing the START key causes a confirmation window to appear.
  Press the START key again to start measurement.
  The LED lights green when measurement starts.
- When pre-trigger is activated, the trigger is not enabled until the specified pre-trigger data has been read.("Pre-trig wait" is displayed.)
- "Wait for trig" is displayed until the trigger condition occurs.
- Data recording starts when the trigger conditions are met.
- If no trigger conditions are enabled, data acquisition starts when measurement starts.
- During recording, "Storing" is displayed.
- When automatic printing is selected, data is printed after display.
- Measurement can be aborted by pressing the STOP key twice.
  Waveform data acquired before the Stop key was pressed is displayed and saved.(automatic printing will not execute)

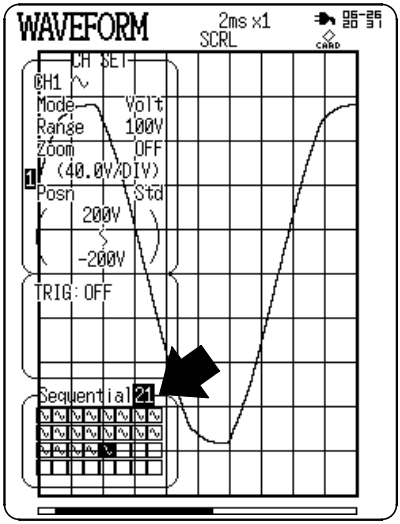
・ If measurement is aborted before a trigger event has occurred, no waveforms are stored. However, if a waveform was acquired during a previous trigger event, that waveform is displayed (unless it was the maximum recording length).
・ When the number of recorded trigger events has reached the sequence limit, the earliest recorded data is overwritten.

3.8 Sequential Save Function

When multiple trigger events occur during measurement and several waveforms are acquired, the last-acquired waveform is displayed by the Sequential Save function.

Waveform Display Procedure
Press CH1 to CH4 to display Sequential.
The selected number is displayed in a reversed block in the figure.
This block indicates the waveform currently displayed on the Waveform Display screen.

To change the display, move the blinking cursor to the position of the desired number or directly to the block ( ), and press the ▲/▼ keys to change.



When measurement is restarted, all previous waveforms are deleted and recording commences from the first block.

Chapter 4
RMS Trend Measurement Mode

4.1 Outline of the RMS Trend Measurement

The RMS Trend Measurement Mode records mains voltage and changes in current levels as effective (rms) values. This mode has the following features:

(1) Measures rms values of commercial power (50/60 Hz).
- Mains voltage measurement
- Load current measurement when used with clamp sensor
- Leakage current measurement when used with clamp sensor (3283)

(2) Continuous real-time recording
- Records rms value trends on the printer
- Capability to print measured value at specified intervals (1 frame) simultaneously with rms trend waveform (hybrid recording)

Instantaneous waveform recording on the Basic Setting screen must be enabled (ON) in order to set or change the instantaneous waveform trigger for the time axis, recording length and the channel screen for instantaneous waveform recording.

4.2 Operation Sequence (Trend)

RMS Trend Measurement Mode operating procedures are described by the following flowcharts.

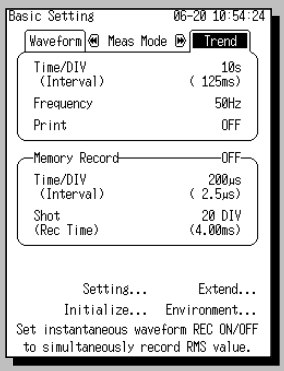
Preparation

See Chapter 2.

Basic Setting screen

Press the SET key to display the Basic Setting screen.

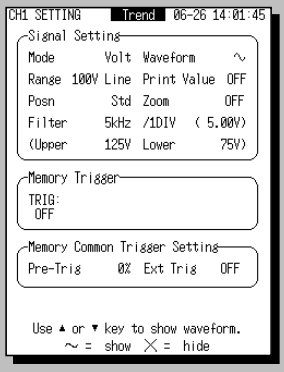
Use the ⏩ key to select the Trend measurement mode.



- **Measurement Mode** — See 4.3.1.
- **Time Axis Range** — See 4.3.2.
- **Frequency** — See 4.3.3.
- **Real Time Print** — See 4.3.4.
- **Memory Record** — See 4.5.

CH SETTING screen

Press the CH SET key to display the desired CH SETTING screen.



- **Input Mode** — See 4.4.1.
- **Measurement Range** — See 4.4.2.
- **Waveform Position** — See 4.4.3.
- **Low-Pass Filter** — See 4.4.4.
- **Waveform Display** — See 4.4.5.
- **Print Value** — See 4.4.6.
- **Zoom** — See 4.4.6.
- **Memory Trigger** — See 4.5.
- **Pre-Trigger** — See 4.5.6.
- **Ext Trigger** — See 5.6.

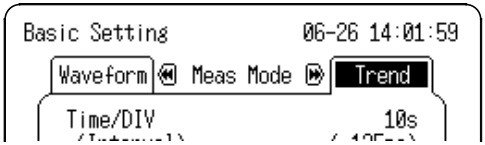
4.3 Setting Items (Trend)

4.3.1 Setting the Measurement Mode

The 8715-01 has two measurement modes. Select the RMS Trend Measurement Mode.

Procedure **Screen: Basic Setting**

1. Press the SET key to display the Basic Setting screen.
2. Press the ▶▶ key to select RMS Trend measurement mode.



With the RMS Trend Mode (rms recording), the rms value is continuously recorded in real time from the moment the START key is pressed to start measuring until the STOP key is pressed.
Up to 200 divisions of data are stored in internal memory, after which data is overwritten.
After measurement, data stored in internal memory can be viewed by reverse scrolling, or printed later.
The relationship between the time axis range and the recording time storage capacity of the internal memory is indicated in the following table. The maximum possible recording time is the instrument of the time axis and 200 divisions.

Time/DIV	Recording Time	Time/DIV	Recording Time
1 s	3 min 20 s	1 min	3 h 20 min
2 s	6 min 40 s	2 min	6 h 40 min
5 s	16 min 40 s	5 min	16 h 40 min
10 s	33 min 40 s	10 min	1 day 9 h 20 min
30 s	1 h 40 min	30 min	4 day 4 h
		1 h	8 day 8 h

NOTE

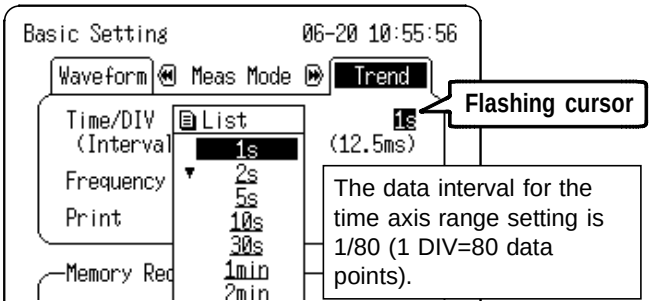
- When the time axis ranges from 1 to 5 s/DIV, simultaneous numerical data printing is unavailable.
- If the instrument is used with battery pack 9447, simultaneous printing is unavailable at 1 s/DIV of the time axis.

4.3.2 Setting the 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 DIV.

Procedure-1 **Screen: Basic Setting**

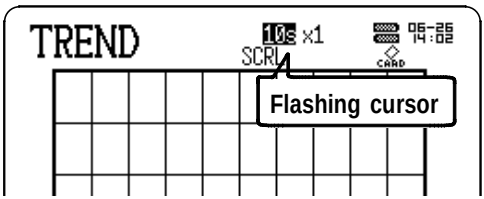
1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Time/DIV and select the time axis range using the ▲/▼ keys.



Pressing the TIME/DIV key moves the flashing cursor automatically to the Time Axis position for setting.

Procedure-2 **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.



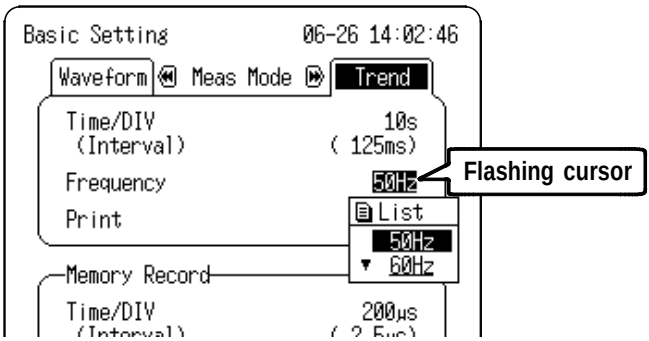
Pressing the TIME/DIV key sets the time axis regardless of the flashing cursor position.

4.3.3 Setting the Frequency

Serves to set the frequency of the signal to be measured.

Procedure **Screen: Basic Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Frequency and select the frequency using the ▲/▼ keys.



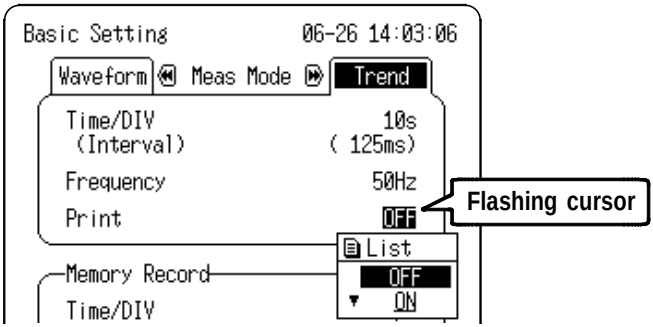
50 Hz	Measure rms value of 50 Hz signal
60 Hz	Measure rms value of 60 Hz signal

4.3.4 Setting the Printer (Real Time Printing)

The input waveform is continuously printed in real time.

Procedure **Screen: Basic Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Print and use the ▲/▼ keys to make a setting.



OFF	Disables the print.
ON	Enables the print.

Relationship between time axis (recording speed) and amount of remaining recording paper

For the Trend RMS Recording, the maximum print time is the instrument of the time axis and the remaining amount of recording paper (cm). Be particularly aware of the remaining amount of paper during simultaneous printing.

Time/DIV	Printing Time	Time/DIV	Printing Time
1 s	Approx. 30 min	1 min	Approx. 30 h
2 s	Approx. 60 min	2 min	Approx. 2 day 12 h
5 s	Approx. 2h 30min	5 min	Approx. 6 day 6 h
10 s	Approx. 5h	10 min	Approx. 12 day12 h
30 s	Approx. 15h	30 min	Approx. 37 day12 h
		1 h	Approx. 73 day

Applicable when using a new roll (1800 cm) of 9234 RECORDING PAPER

NOTE

- When the time axis ranges from 1 to 5 s/DIV, simultaneous numerical data printing is unavailable.
- If the instrument is used with battery pack 9447, simultaneous printing is unavailable at 1 s/DIV of the time axis.

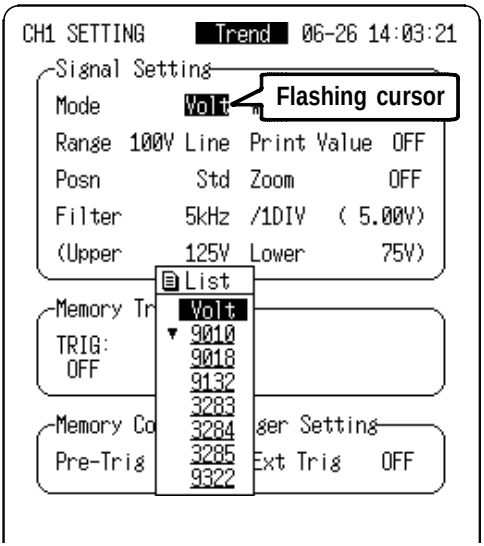
4.4 Input Channel Setting (Trend)

4.4.1 Setting the Input Mode

Select the input mode (measurement object) for each channel. The settable range is determined by the selected input mode.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Mode position.
3. Use the ▲/▼ keys to make a setting.



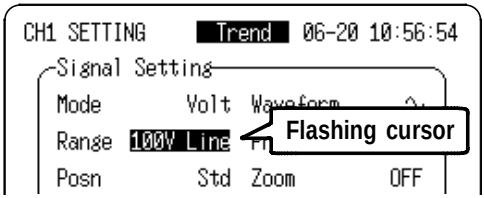
Volt	Measure voltage
9322	Measure voltage using the 9322 DIFFERENTIAL PROBE
9010 to 3285	Measure current using a clamp sensor

4.4.2 Setting the Measurement Range

Select the measurement range for each channel. The settable range is determined by the selected input mode.
The vertical and horizontal dimensions of each frame correspond to the set range, and the upper and lower limits are displayed on the screen.

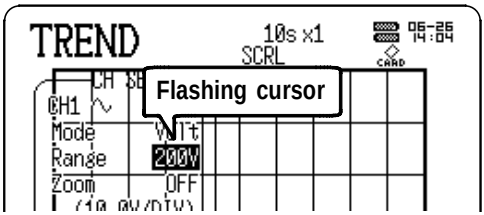
Procedure-1 **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Range position.
3. Use the ▲/▼ keys to make a setting.



Procedure-2 **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Press the CH1 - CH4 key to display the setting window.
3. Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.



Pressing the RANGE key moves the flashing cursor automatically to the Time Axis position for setting.

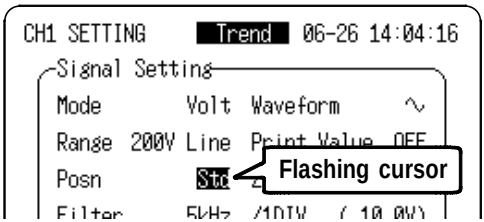
NOTE In the DC 100 V range, RMS values are not calculated; rather, instantaneous waveforms are recorded.

4.4.3 Setting the Waveform Position

Set the waveform display position.
The waveform display can be repositioned if it is obscured, such as by an overlapping window.

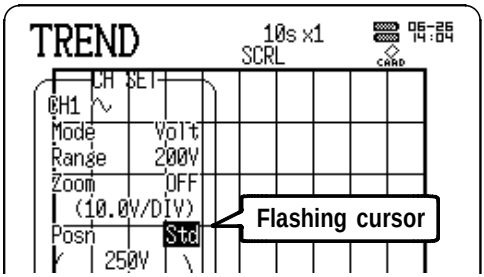
Procedure-1 **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Posn position.
3. Use the ▲/▼ keys to make a setting.



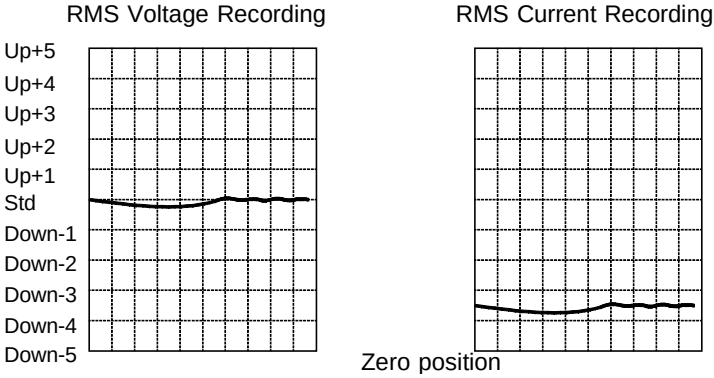
Procedure-2 **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Press the CH1 - CH4 key to display the setting window.
3. Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.



Pressing the POSN key moves the flashing cursor automatically to the Time Axis position for setting.

In the RMS Trend Measurement Mode, voltage and current display positions are different.

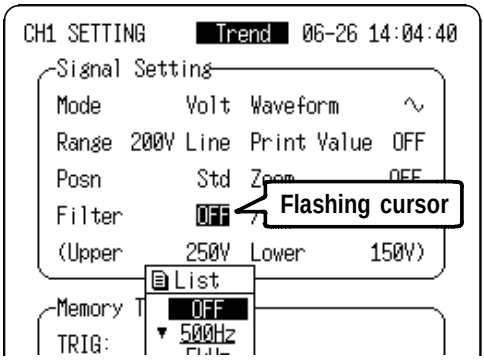


4.4.4 Setting the Low-Pass Filter

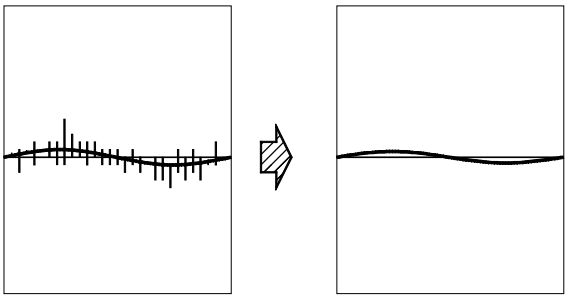
Effective for removing unneeded high-frequency components.

Procedure **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Filter position.
3. Use the ▲/▼ keys to make a setting.



OFF	No low-pass filter is connected.
500 Hz	Connect a filter with a cutoff frequency of 500 Hz
5 kHz	Connect a filter with a cutoff frequency of 5 kHz



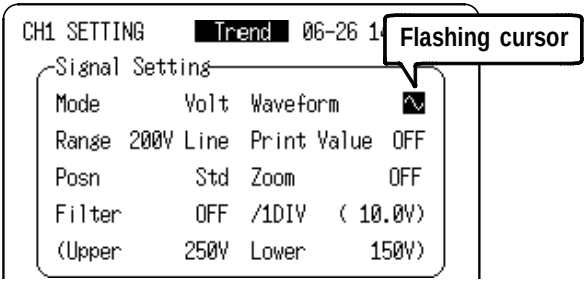
Filter: OFF | Filter: 500 Hz

4.4.5 Setting the Waveform Display

Enable/disable waveform measurement and display.
The 8715-01 can record and display up to four channels.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Waveform position.
3. Use the ▲/▼ keys to make a setting.



Colors on the Waveform Display screen are used to indicate channels as follows, and are not changeable.

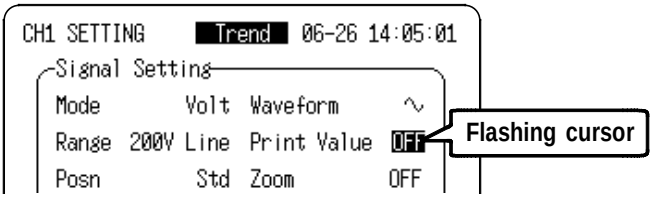
CH1	: Red	CH3	: Yellow
CH2	: Green	CH4	: Blue

4.4.6 Setting the Print Value

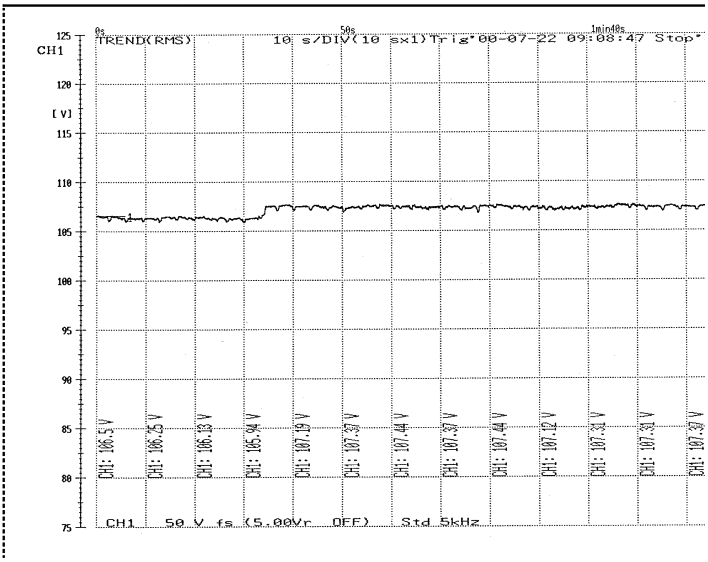
In the RMS Trend Measurement Mode, if numerical value printing is enabled (ON) when printing an rms recording, the measured value for each frame is printed along with the rms waveform.

Procedure **Screen: CH SETTING**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Print Value position.
3. Use the ▲/▼ keys to make a setting.



Numerical Value Printing Example



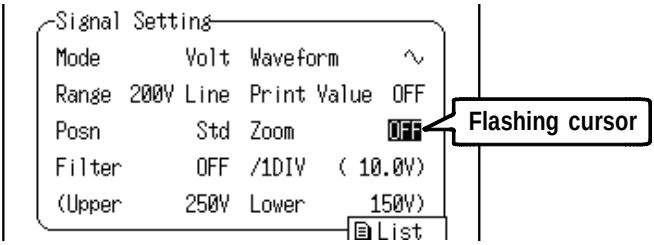
NOTE When the time axis ranges from 1 to 5 s/DIV, simultaneous numerical data printing is unavailable.

4.4.7 Setting the Zoom

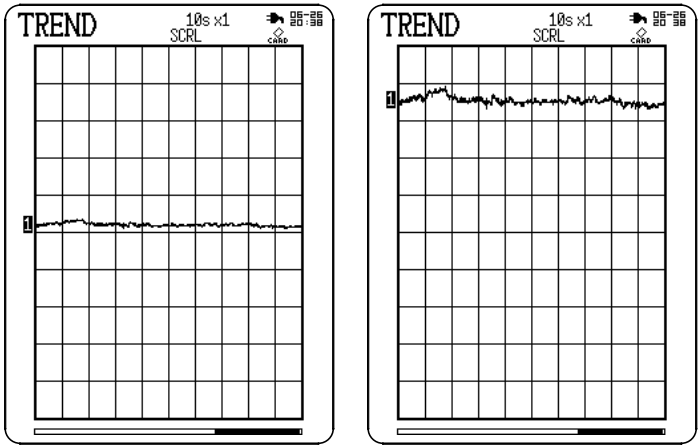
The voltage axis can be independently magnified or compressed for display and recording of each channel. Magnification and compression are applied relative to the center of the display.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the Zoom position.
3. Use the ▲/▼ keys to make a setting.



Std	Display and record without magnification
Exp	Display and record with magnified voltage axis



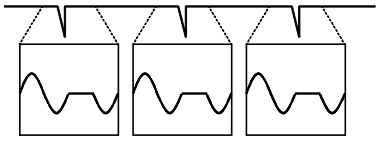
OFF **ON**

4.5 Instantaneous Waveform Recording (Memory Record)

4.5.1 Setting the Instantaneous Waveform Recording

When Instantaneous Waveform Recording is enabled, an abnormal phenomena that occurs during measurement is captured by the trigger and recorded in parallel by the Instantaneous Waveform Recording using high-speed sampling.

Sequential Save Recording Function

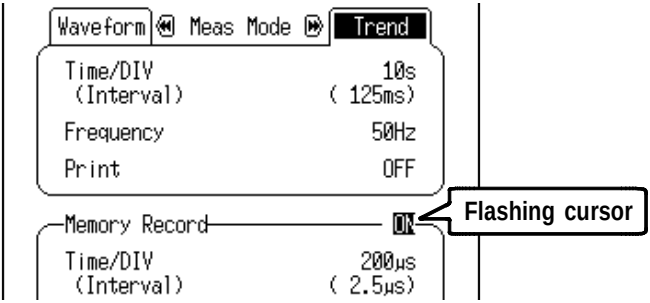


Multiple waveforms can be recorded

Procedure **Screen: Basic Setting**

(1) Set Instantaneous Waveform Recording on or off.

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to the Memory Record (Instantaneous Waveform Recording) item and set to on or off using the ▲/▼ keys to make a setting.



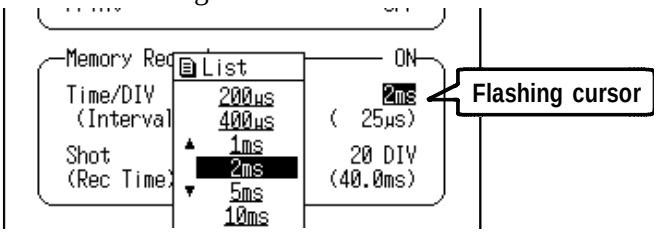
OFF	Disables Instantaneous Waveform Recording (Memory Recording)
ON	Enables Instantaneous Waveform Recording (Memory Recording)

NOTE

If the power supply is interrupted during measurement and Instantaneous Waveform Recording is enabled, then the effective value waveform data will not be saved but instantaneous waveform data will be saved.

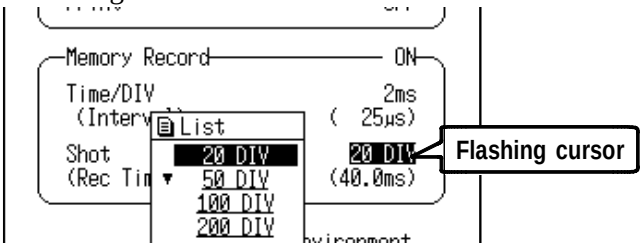
(2) Set the time axis of the Instantaneous Waveform Recording.

When Instantaneous Waveform Recording is turned on, settings for the memory waveform are displayed.
Set the time axis for the memory waveform.
Move the flashing cursor to Time/DIV and use the ▲/▼ keys to make a setting.



(3) Set the recording length the Instantaneous Waveform Recording.

Move the flashing cursor to Shot and use the ▲/▼ keys to make a setting.



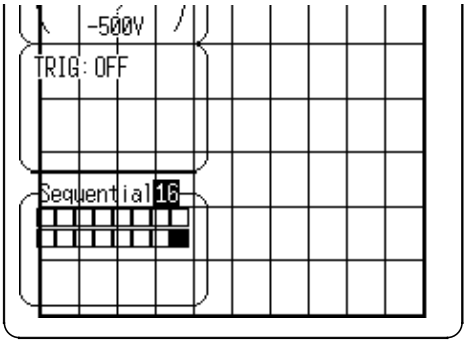
(4) Set the trigger for the Instantaneous Waveform Recording. For details, see Section 4.5.2.

Recording Length and Sequential Save

The maximum number of events that can be sequentially recorded (the sequence limit) depends on the recording length set for each event. For sequential save operation, the internal memory is partitioned for storing multiple sets of data.

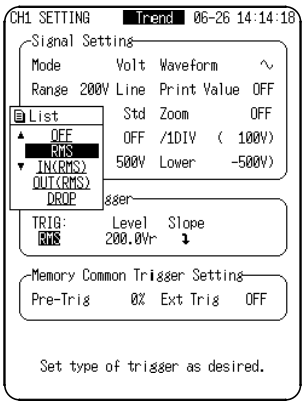
When the number of waveforms acquired reaches the sequence limit, no more waveforms will be acquired in response to further trigger events.

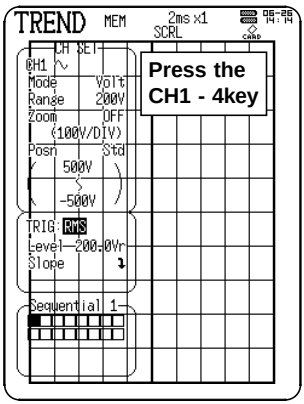
Refer to Section "6.4.2 Sequential Save Function" for the details.



4.5.2 Setting the Instaneous Waveform Trigger

- The term "trigger" refers to a signal which is used to control the timing for recording start. The term "triggering has occurred" refers to the state when such a signal has activated recording start.
- Instantaneous waveform triggering can be set when instantaneous waveform recording in the RMS Trend Measurement Mode is enabled (ON).
- The instantaneous waveform trigger can be set on each CH SETTING screen, or on the Instantaneous Waveform Display screen in RMS Trend Measurement Mode. This document mainly describes the CH SETTING screen settings.





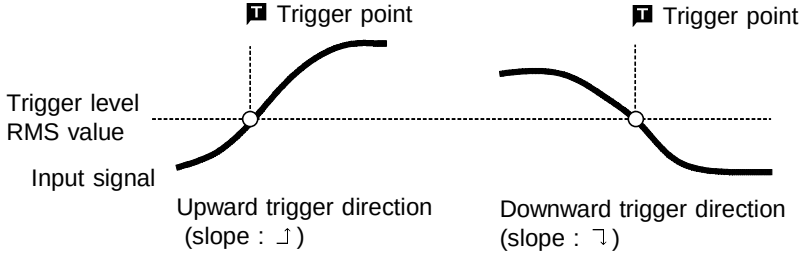
Instantaneous Waveform Trigger Types and Primary Applications

- RMS Level Trigger
  ..... Instantaneous power trend waveforms
- RMS Window In/Out Trigger
  ..... Instantaneous power trend waveforms
- Voltage Drop Trigger
  ..... Voltage Dropouts, Instantaneous stop waveforms
- Level Trigger and Window In/Out Trigge
  ..... DC measure voltage (100V DC range only)

- A trigger condition can be enabled by setting an OR condition with other triggers. The OR condition causes a trigger to occur when any of several trigger conditions are satisfied.
- Pre-trigger and external trigger settings can be made only on the CH SETTING screen.
- Refer to 5.6 "External Trigger Function" for external trigger details.
- Refer to Sections 3.5.1 and 3.5.2 for the trigger under the 100 V DC range condition.

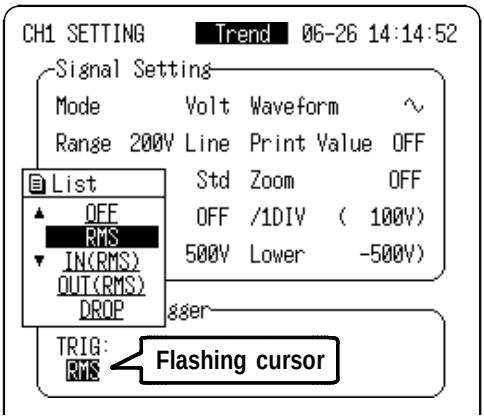
4.5.3 RMS Level Trigger

Triggering occurs when the input signal crosses the preset trigger level (rms value) with the preset trigger slope (⤴, ⤵).

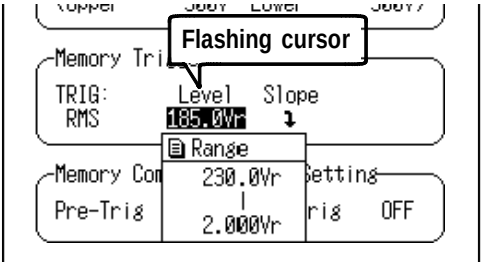


Procedure **Screen: CH SETTING / Waveform Display**

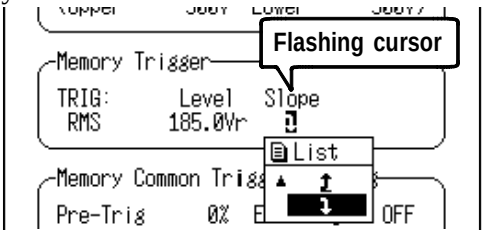
1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select RMS using the ▲/▼ keys.



3. Move the flashing cursor to the position shown in the figure below, and set the trigger level using the ▲/▼ keys.



4. Move the flashing cursor to the position shown in the figure below, and set the trigger slope using the ▲/▼ keys.

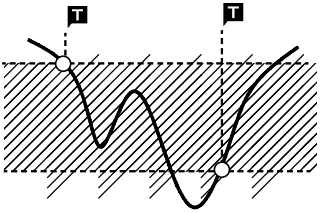


⌋⤴	Triggering occurs when the rising trigger slope (⌋⤴) crosses the trigger level.
⤵⌊	Triggering occurs when the falling trigger slope (⤵⌊) crosses the trigger level.

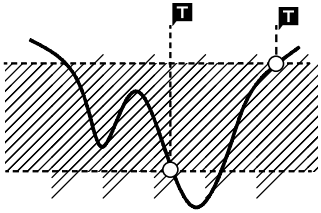
4.5.4 RMS Window-In/Out Trigger

Set RMS upper limit level and lower limit level and activated when the input signal enters or leaves the range between these limits.

RMS Window-In Trigger

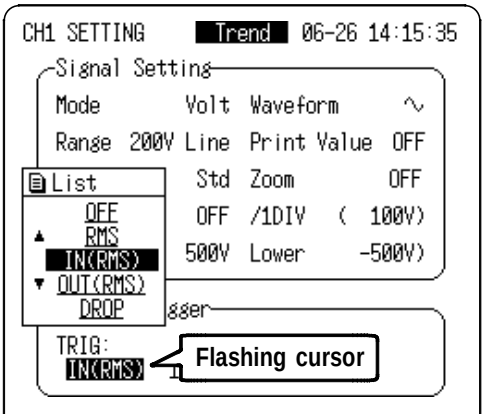


RMS Window-Out Trigger

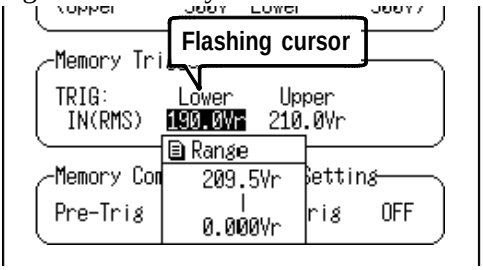


Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select IN(RMS) or OUT(RMS) using the ▲/▼ keys.



3. Move the flashing cursor to the position shown in the figure below, and set the lower limit of the trigger level using the ▲/▼ keys.



4. Move the flashing cursor to the upper limit, and set the upper limit of the trigger level using the ▲/▼ keys. The upper limits must not be smaller than the lower limits, or the lower limits must not be larger than the upper limits.

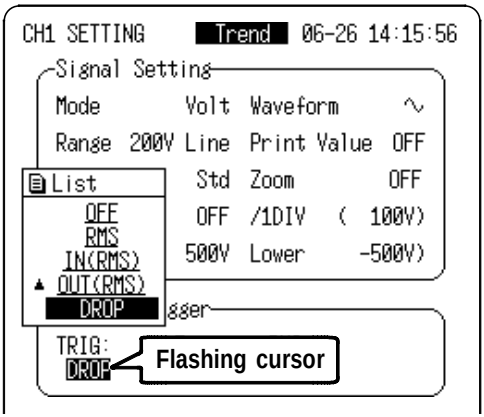
If a trigger condition exists at the time of starting measurement, the trigger will be activated simultaneously with the start of measurement.

4.5.5 Voltage Drop Trigger

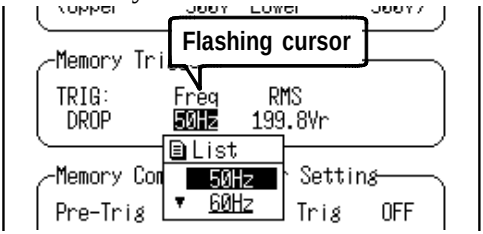
When the peak of the voltage falls lower than the setting RMS level, the trigger will occur.

Procedure **Screen: CH SETTING / Waveform Display**

1. Press the CH SET key to display the desired CH SETTING screen.
2. Move the flashing cursor to the TRIG position and select DROP using the ▲/▼ keys.

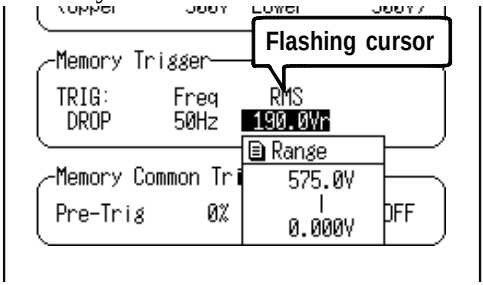


3. Move the flashing cursor to the position shown in the figure below, and set the frequency to be measured using the ▲/▼ keys.



50 Hz	This measurement is made using a 50-Hz commercial power supply.
60 Hz	This measurement is made using a 60-Hz commercial power supply.

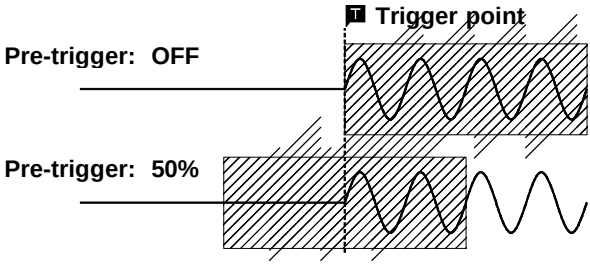
4. Move the flashing cursor to the position shown in the figure below, and set the trigger RMS level using the ▲/▼ keys.



- The settable range of the trigger level is limited by the selected measurement range.
- When the Voltage Drop trigger level setting is made on the Waveform Display screen, a level bar (dotted line) is displayed at the top of the screen to indicate the set level.

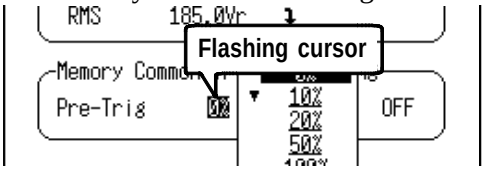
4.5.6 Setting the Pre-Trigger

The pre-trigger function serves to record the waveform not only after but also before triggering has occurred.
In the Waveform measurement mode, using the recording start point as 0% and the recording end point as 100%, the trigger point can be specified in percent. When all trigger sources are set to OFF, the pre-trigger setting is invalid.



Procedure **Screen: CH SETTING**

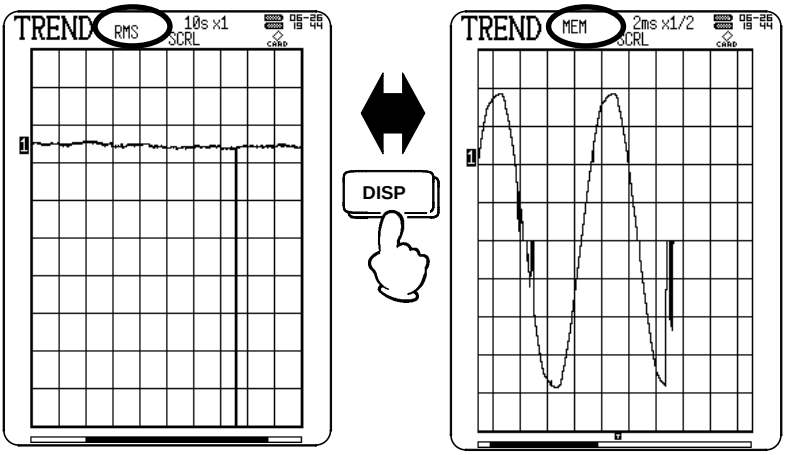
1. Press the CH SET key to display the CH SETTING screen.
2. Move the flashing cursor to the Pre-Trig position and use the ▲/▼ keys to make a setting.



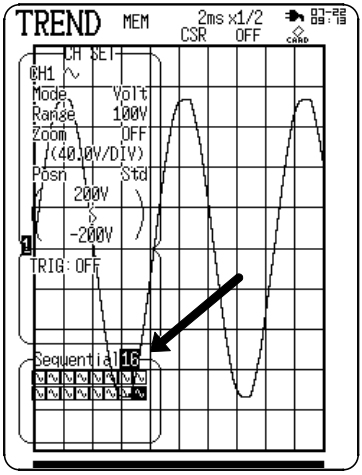
- During the trigger waiting condition of the instantaneous waveform trigger, NOT MEM STORAGE is displayed until a trigger event occurs.
- When a trigger event occurs, the number of waveforms acquired relative to the number of blocks available for acquisition is indicated as MEM STORAGE 1/16.
- In the RMS Trend Measurement Mode, a trigger event can be sensed during the pre-trigger period. In this case, the length of data that can be acquired is shorter than the set recording length.

4.5.7 Instantaneous Waveform Recording Display Procedure

Press the Stop key to stop measurement.
If instantaneous waveform recording is enabled (ON) on the Basic Setting screen and the DISP key on the Waveform Display screen is pressed in the RMS Trend Measurement Mode, the screen switches between RMS Recording (RMS) and Instantaneous Recording (MEM).
The Instantaneous Recording screen (MEM) displays the last-acquired waveform.



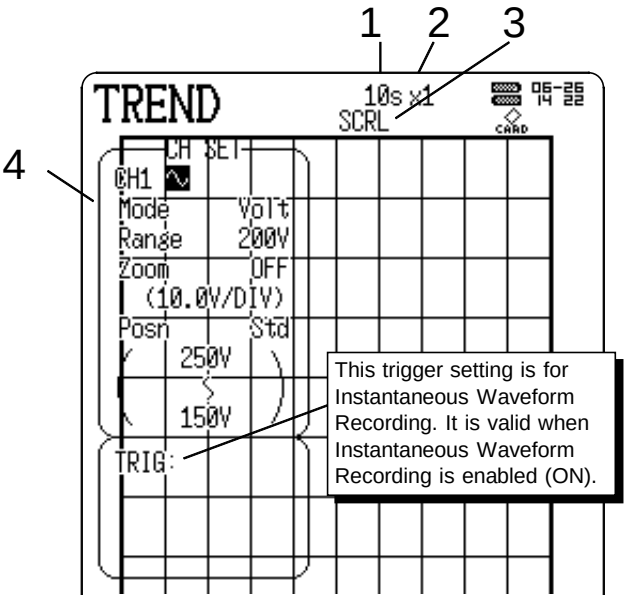
Displaying an Instantaneous Waveform Measurement (Sequential Save)



Press CH1 to CH4 on the Instantaneous Recording screen (MEM) to move the flashing cursor to the Sequential position or directly to the frame (∿) where the waveform is recorded.
Press the ▲/▼ keys to select the instantaneous waveform to display.

4.6 Waveform Display Screen Settings

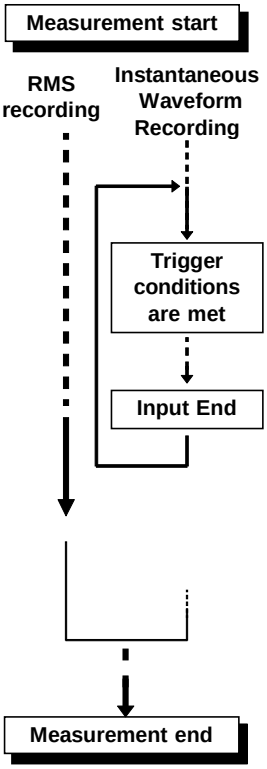
Items that can be set on the Waveform Display screen of the RMS Trend Measurement Mode are described below. Press CH1 to CH4 to display the input channel settings, and press the same key again to return to the previous screen.
Refer to "4.5.7" for details of the Waveform Display screen for Instantaneous Waveform Recording.



Display item	Selection	Reference
1. Time axis range	200 µs to 20 ms /DIV	4.3.2
2. Magnification/ Compression of the time axis	X10 to X1/50	5.3
3. A/B cursor measurement or waveform scrolling		5.1, 5.2
4. Input channel setting	Sets each channels	4.4

4.7 Start and Stop Operation (Trend)

This diagram describes the start/stop actions of basic RMS Trend measurement mode. Instantaneous Waveform Recording is presumed to be enabled (ON).



- Pressing the START key causes a confirmation window to appear. Press the START key again to start measurement. The LED lights green when measurement starts.
- If the Print setting is enabled, the RMS recording waveform prints as it is displayed.
- Data input starts when the trigger conditions of the Instantaneous Waveform Recording are met. If pre-trigger operation is enabled for the Instantaneous Waveform Recording and if the trigger conditions are met before the timed trigger point, data input starts from the trigger event.
- Instantaneous waveforms are acquired up to the sequence limit, after which no further data is acquired even if trigger conditions are met.
- Pressing the STOP key during measurement stops RMS recording.

- Up to the last 200 divisions of RMS recording data is saved to internal memory. When more than this amount of data is recorded, the oldest data is overwritten.
- The size of the Instantaneous Waveform Recording sequence limit depends on the recording length set for Instantaneous Waveform Recording.

Chapter 5
Advanced Functions

Indicates the advanced functions.

- **Using the A/B Cursor**
  A/B cursors measurements can be performed on the Waveform Display screen. (See 5.1)

- **Scrolling the Waveform**
  Waveforms can be scrolled on the Waveform Display screen. (See 5.2)

- **Magnification/Compression Ratio Along the Time Axis**
  Time axis magnification and compression can be performed on the Waveform Display screen. (See 5.3)

- **DMM Function**
  Pressing the DMM key causes the DMM screen to appear. The DMM screen can display RMS values. (See 5.4)

- **Key Lock Function**
  The function serves to prevent unintended changes to settings during a measurement. (See 5.5)

- **External Trigger Function**
  An external signal can be used as trigger source. (See 5.6)

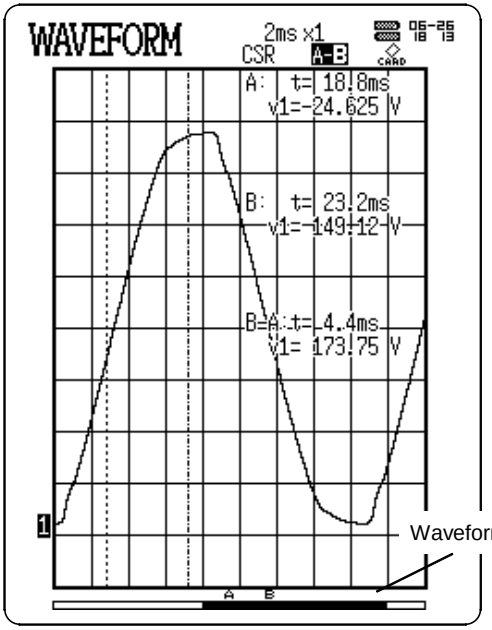
- **Using the Trigger Output Signal**
  This can be used to synchronize several Model 8715-01. (See 5.7)

5.1 Using the A/B Cursors

The A/B cursors can be used to read a measurement value on screen.

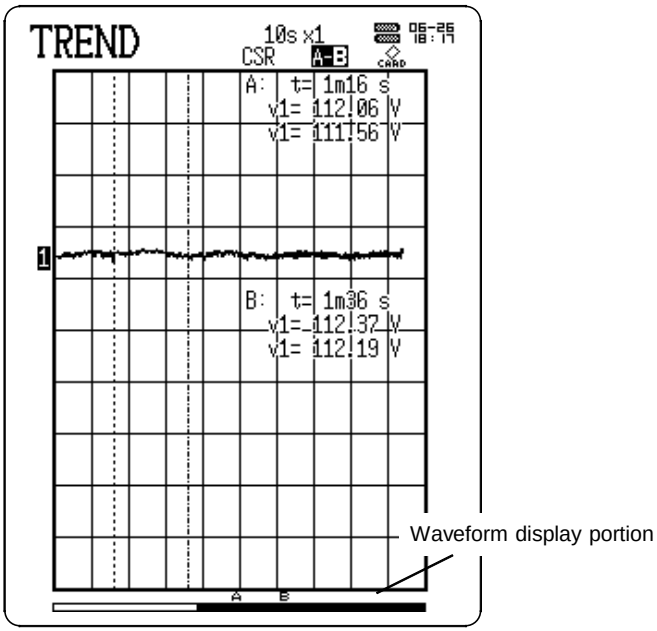
Waveform / Trend MEM Display Screen

	Display	Meaning
A	t = 18.8 ms	Time from the trigger point to A cursor
	v1 = -24.625 V	The value at cursor A
B	t = 23.2 ms	Time from the trigger point to B cursor
	v1 = 149.12 V	The value at cursor B
B-A	t = 4.4 ms	Time interval between the A and B cursors
	v1 = 173.75 V	The value between the two cursors can be determined.



Trend RMS Recording Display Screen

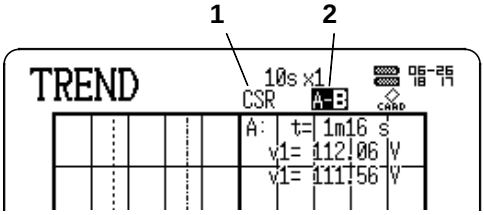
	Display	Meaning
A	t = 1 m16 s	Time from the trigger point to A cursor
	v1 = 112.06 V	Maximum value of A cursor position
	v1 = 111.56 V	Minimum value of A cursor position
B	t = 1 m 36 s	Time from the trigger point to B cursor
	v1 = 112.37 V	Maximum value of B cursor position
	v1 = 112.19 V	Minimum value of B cursor position



NOTE Refer to "11.2 RMS Value", for information about the values used in Trend RMS Recording.

Procedure **Screen: Waveform Display**

The cursor displays the time from the trigger position and measurement value.
In Trend RMS recording, the cursor displays the time from start time and the maximum and minimum values.



1. Press the DISP key to display the waveform display screen.
2. When position 1 shown in the figure below is selected to SCRL (scroll), use the ▲/▼ keys to set to CSR (cursor). Pressing the ◁ and ▷ keys simultaneously also changes setting.
3. Move the flashing cursor to position 2 and select the cursor to be moved.

A	Use the cursor A only
A-B	Move the cursor A only
A-**B**	Move the cursor B only
A-B	Move simultaneously both cursors A and B

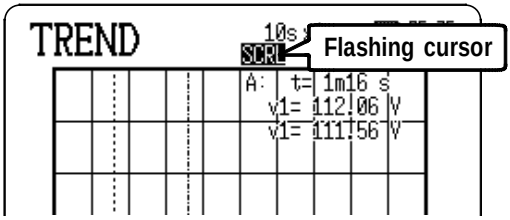
4. Move the A/B cursors using the ◀ ▶ scrolling key to view the display. Pressing the ◀◀/▶▶ keys moves the cursors faster.

5.2 Scrolling the Waveform

The waveform on the display can be scrolled horizontally.

Procedure **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. When figure below is selected to CSR (cursor), use the ▲/▼ keys to set to SCRL (scroll).
   Pressing the ◁ and ▷ keys simultaneously also changes setting.



3. Move the cursor using the ◀ ▶ scrolling key to scroll the display. Pressing the ◀◀ / ▶▶ keys scrolls faster.

Auto-scroll

Holding down the Scroll key for 5 seconds causes the waveform to be scrolled automatically ("Auto-scroll" is displayed).
Press the Scroll key again to cancel.

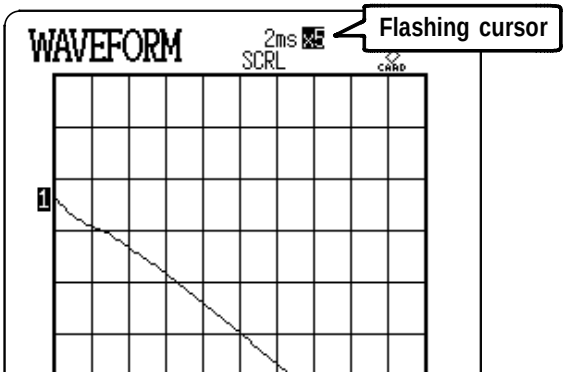
NOTE Even if the display is switched from A/B cursor to scroll, cursor measurements remain valid unless the cursors are disabled (OFF).

5.3 Magnification/compression Ratio Along the Time Axis

- By magnifying the waveform, detailed observations can be made. By compressing the waveform, an entire change can be promptly apprehended.
- Magnification/compression of the screen uses the left edge as reference, regardless of the status of the A/B cursor.
- The magnification/compression factor can be changed also after measurement is completed.

Procedure **Screen: Waveform Display**

1. Press the DISP key to display the waveform display screen.
2. Move the flashing cursor to the position shown in the figure below and select the magnification or compression ratio using the ▲/▼ keys.



Waveform, Trend instantaneous waveform recording:
x10, x5, x2, x1, x1/2, x1/5, x1/10, x1/20, x1/50

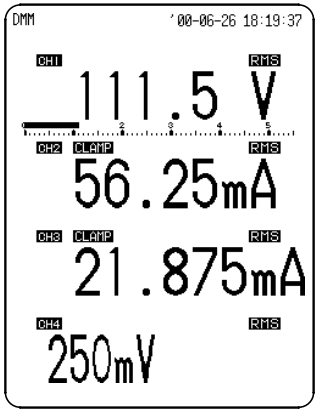
Trend RMS recording:
x1, x1/2, x1/5, x1/10, x1/20, x1/50

5.4 DMM Function

Commercial mains can be displayed RMS values in real time. Correct values are displayed only when the input voltage is commercial mains (50/60 Hz).

Procedure **Screen: Waveform Display**

1. Press the DMM key to display the DMM screen. Measurement begins when the DMM screen appears.
2. When finished with the DMM screen, press any screen display key other than DMM.



Display hold

Press the STOP key to Hold the current status and "HOLD" is displayed.
Press the START key to cancel the hold.

DMM Screen Printing

- Pressing the PRINT key prints the currently displayed values.
- Pressing the COPY key copies the screen.

Specifications

Measuring object	Commercial mains (50/60 Hz, auto-selection)
Displays	RMS value
Update rate	1 s (Sampling rate: 4 kS/s)
Number of displayed digits	4 (The lowest digit is displayed as 0 for values 0 to 4, and as 5 for values 5 to 9.)
Accuracy	±3% rdg.±5 dgt.

NOTE The display changes to the next lower range when the count is less than 500. The minimum digit display is either 0 or 5. The displayed color of the digital values for each channel corresponds to the waveform display color.

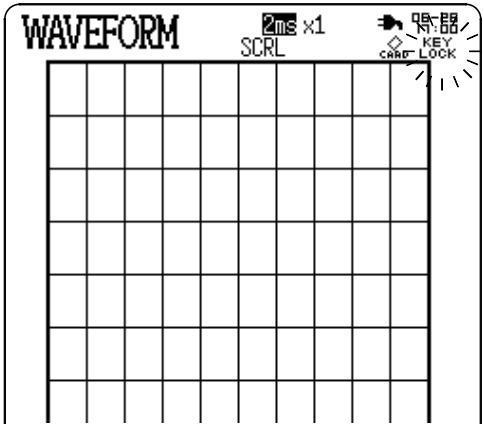
5.5 Key Lock Function

This function disables all front-panel key controls of the 8715-01. The function serves to prevent unintended changes to settings during a measurement.

Procedure **Screen: Waveform Display**

Press both cursor keys (△ and ▽) simultaneously for 3 seconds to switch the key lock on/off.
The key lock function will not be canceled by turning the power off and on.

- When the key lock function is active, the indication "KEY LOCK" is shown on the display.
- If the LCD saver function is used and the display backlight turns off, it can be turned on again by touching any key. The function assigned to the key will not be activated.

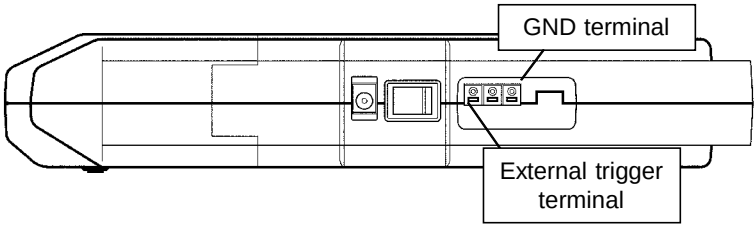


5.6 External Trigger Function

DANGER

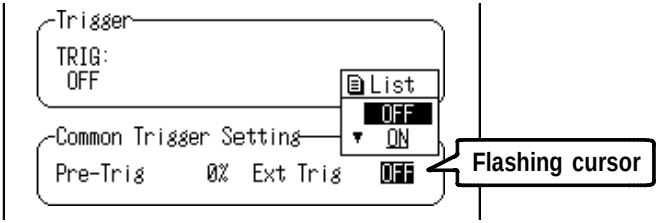
To avoid damaging the instrument, do not apply voltage outside of the range -5 to +10 V to the external trigger terminal.

- An external signal can be used as trigger source.
- The external trigger facility can be used to synchronize a number of the 8715-01 units for parallel operation.



Procedure **Screen: CH SETTING**

1. Press the CH SET key to display the CH SETTING screen.
2. Move the flashing cursor to Ext Trig and use the ▲/▼ keys to make a setting.

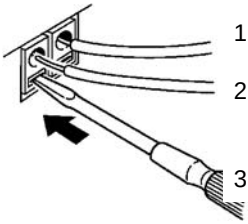


OFF	External trigger is disabled.
ON	External trigger is enabled.

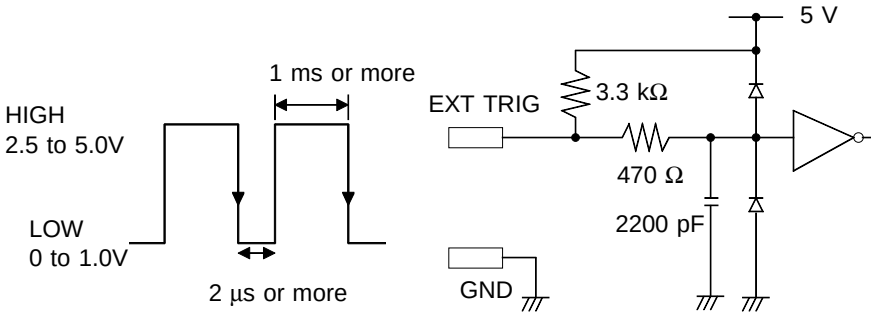
Signal Input

Triggering can be executed by shorting the external trigger terminal to ground, or at the transition from a high logic level (2.5 to 5.0V) to low level (0 to 1.0V).

Voltage range	High level: 2.5 to 5.0 V, Low level: 0 to 1.0 V
Pulse width	High level: Min. 1 ms, Low level: Min. 2 μs
Maximum input voltage	-5 to 10 V
Recommended wire	Single strand: 1.0 mm dia. (AWG #18) Multi-strand: 0.75 mm^2
Usable limits	Single strand: 0.3 to 1.0 mm dia. (AWG #26 to #18) Multi-strand: 0.3 to 0.75 mm^2 (AWG #22 to #20) Strand diameter: minimum 0.18 mm
Standard insulation stripping length	10 mm



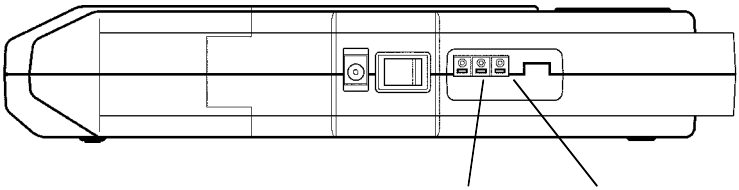
1. Push the tab with a flatblade screwdriver or similar.
2. While keeping the tab depressed, insert a stripped wire into the connector opening.
3. Release the tab to lock the wire.



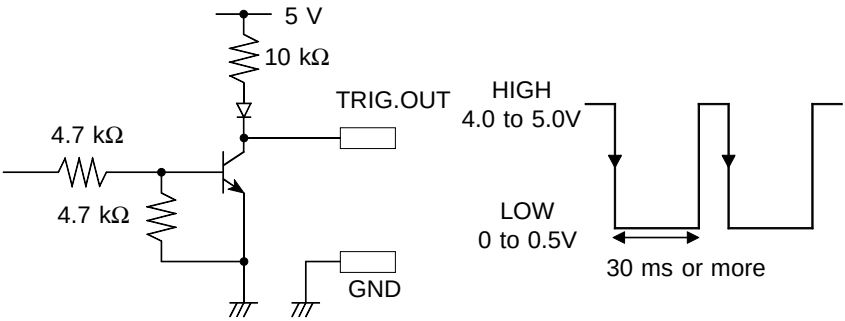
NOTE The external trigger input (EXT TRIG) cannot be used, unless the external trigger is enabled on the CH SETTING screen.

5.7 Trigger Output Terminal

When triggering occurs, a signal is output from the TRIG OUT terminal.
This can be used to synchronize several Model 8715-01.

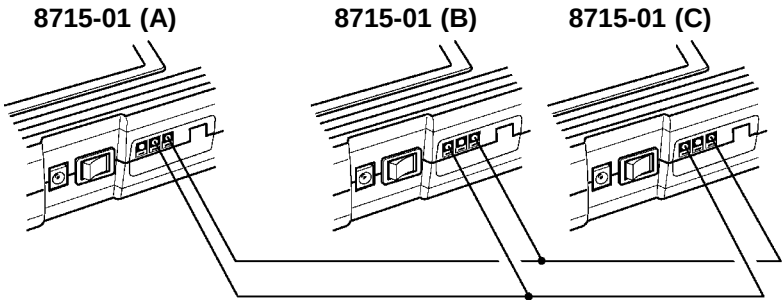


Output voltage	Open-collector signal (with voltage output), active Low
Output voltage range	High level: 4.0 to 5.0 V Low level: 0 to 0.5 V
Pulse width	Low level: Min. 30 ms
Recommended wire	Single strand: 1.0 mm dia. (AWG #18) Multi-strand: 0.75 mm^2
Usable limits	Single strand: 0.3 to 1.0 mm dia. (AWG #26 to #18) Multi-strand: 0.3 to 0.75 mm^2 (AWG #22 to #20) Strand diameter: Min. 0.18 mm dia
Standard insulation stripping length	10 mm
Maximum input voltage	-20 V to +30 V 500 mA max, 200 mW max



Example of synchronous measurement using multiple the 8715-01 units

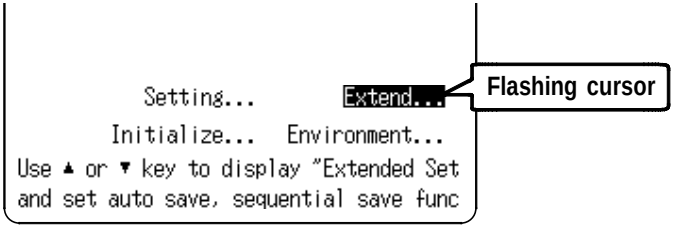
For parallel synchronous measurement, connect the 8715-01(A) trigger output to the 8715-01(B) and (C) external trigger inputs as shown in the figure. External triggering should be enabled (ON) in the 8715-01(B) and (C) units to receive the external trigger.



When the trigger conditions of the 8715-01 (A) are met and the trigger is activated, a pulse signal is output from the trigger output terminal.
When the pulse signal is received from the 8715-01 (A), the triggers are activated on the 8715-01 (B) and 8715-01 (C) to initiate measurement.

Chapter 6
Advanced Settings

Press the SET key to display the Basic Setting screen.
And move the flashing cursor to one of the following items and press the ▲/▼ keys to display the setting screen for that item.



The following functions can be set from the Advanced Setting screen.

Environment...	**Start Backup**	Refer to 6.1.1.
	Grid Type	Refer to 6.1.2.
	LCD Saver	Refer to 6.1.3.
	Display Color	Refer to 6.1.4.
	Language	Refer to 6.1.5.
	List & Gauge	Refer to 6.1.6.
	Copy	Refer to 6.1.7.
Setting...	**Using the Previous State Settings**	Refer to 6.2.
Initialize...	**Data**	Refer to 6.3.1.
	Wave Reset	Refer to 6.3.2.
	System Reset	Refer to 6.3.3.
	Self-Check	Refer to 6.3.4.
Extended Setting...	**Auto Save Settings**	Refer to 6.4.1.
	Sequential Save	Refer to 6.4.2.

6.1 Environment Settings

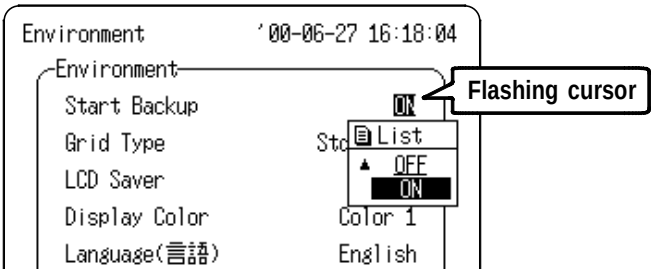
6.1.1 Start Backup

If the power supply is interrupted during recording operation (while the START key LED is lit), and then the power supply is restored, the 8715-01 goes back into the measurement operation mode, and recording is restarted immediately.
Previous measurement data is erased during Trend RMS Recording.

If the trigger function is used, the instrument goes into trigger standby mode. If Start Backup is disabled (OFF), measurement stops when power fails, but data recorded up to that time is retained in memory.

Procedure **Screen: Basic Setting > Environment**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to Start Backup and use the ▲/▼ keys to make a setting.



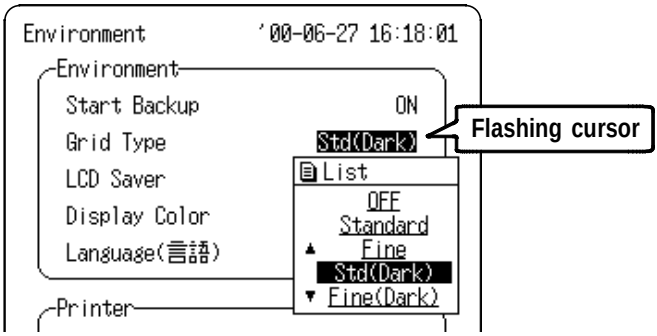
OFF	The Start Backup function is not used.
ON	The Start Backup function is used.

6.1.2 Grid Type

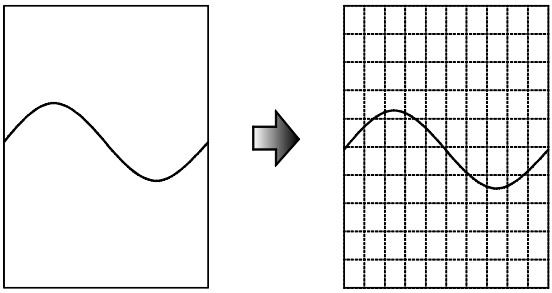
Selects the type of grid shown on the Waveform display screen and drawn on the recording paper.

Procedure **Screen: Basic Setting > Environment**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to Grid Type and use the ▲/▼ keys to make a setting.



OFF	No grid is displayed or printed.
ON	Select from Standard, Fine, Std(Dark), Fine(Dark)(There is no difference between Standard and Fine on the Waveform Display screen.)



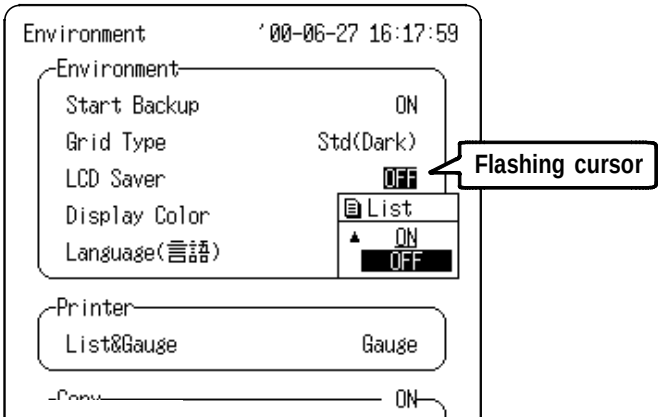
Grid: **OFF** Grid: **ON**

6.1.3 LCD Saver

When the LCD power saving function is enabled, the LCD blanks after about five minutes of key inactivity. When the printer is printing, the 8715-01 automatically reduce backlight brightness.
If the LCD saver occurs while measuring, and LCD blanks, the green LED remains lit. If the LCD saver occurs while setting, the green LED blinks.

Procedure **Screen: Basic Setting > Environment**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to LCD Saver and use the ▲/▼ keys to make a setting.



OFF	The LCD Saver function is not used.
ON	The LCD Saver function is used.

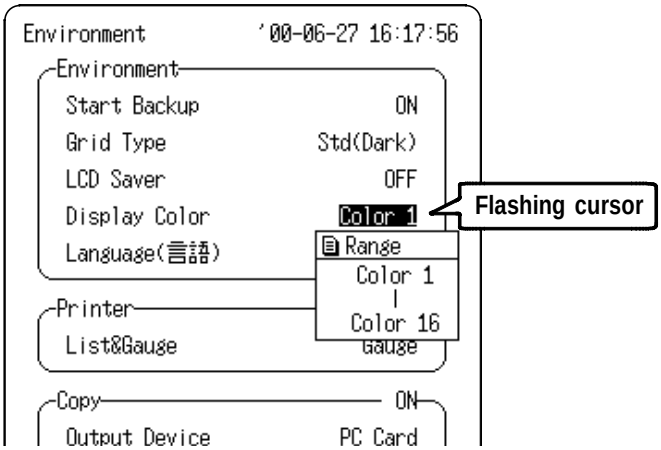
NOTE When the printer is printing, the 8715-01 automatically reduce backlight brightness and enter LCD power save mode.

6.1.4 Display Color

Serves to set the display color. Screen display color can be selected from colors 1 to 16.

Procedure **Screen: Basic Setting > Environment**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to Display Color and select a color using the ▲/▼ keys.



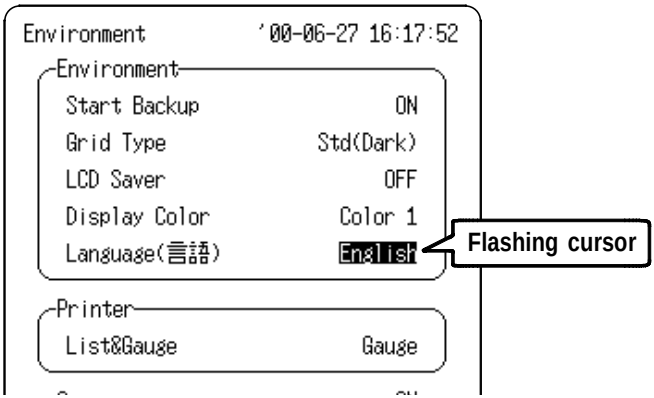
When colors 1 to 6 are selected, the screen displays are shown in colors. The settable items are displayed in yellow, and non-settable items are displayed in gray.
When colors 7 to 16 are selected, the screen displays are shown in single color. Settable items are underlined (__) and non-settable items are displayed as double lines(__).

6.1.5 Language

Serves to set the display language.

Procedure **Screen: Basic Setting > Environment**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to Language and use the ▲/▼ keys to make a setting.



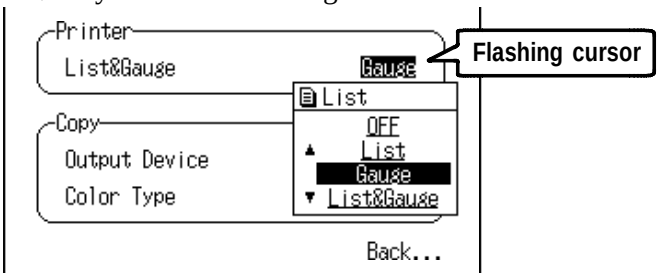
English	Displays in English.
Japanese	Displays in Japanese.

6.1.6 List & Gauge

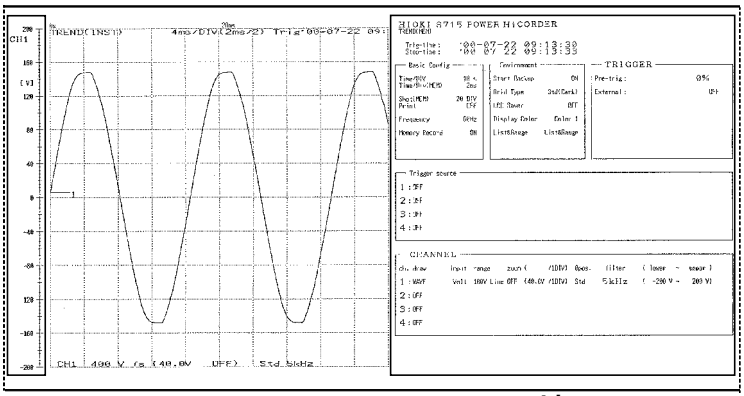
When a waveform is printed out, the gauge can be printed out at the beginning, and a listing can be printed out at the end.

Procedure **Screen: Basic Setting > Environment**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to List & Gauge and use the ▲/▼ keys to make a setting.



OFF	No gauges or listing
List	Print listing only
Gauge	Print gauges only
List&Gauge	Print both gauges and listing



Gauge **List**

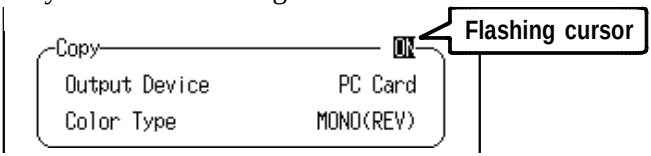
6.1.7 Screen Copy Output Destination

The destination for output of displayed by the COPY key can be specified.

Procedure **Screen: Basic Setting > Environment**

(1) Enable screen copy.

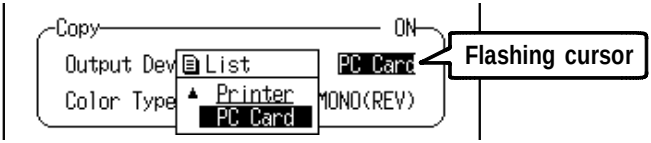
1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Environment... and use the ▲/▼ keys to display the Environment screen.
3. Move the flashing cursor to Copy and use the ▲/▼ keys to make a setting.



OFF	Screen copy is disabled.
ON	Screen copy is enabled.

(2) Select the output destination.

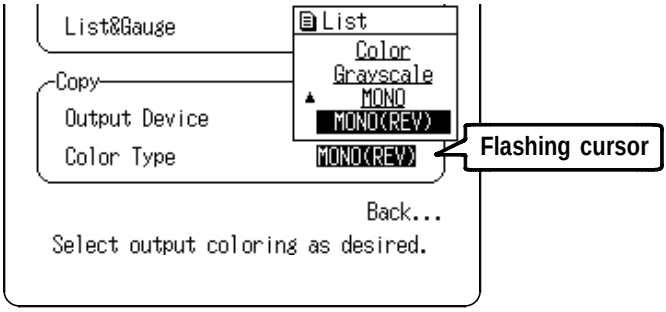
Move the flashing cursor to Output Device and use the ▲/▼ keys to make a setting.



Printer	Prints on the printer
PC Card	Screen data is saved as BMP file on the PC card.

(3) Select output coloring

Move the flashing cursor to Color Type and use the ▲/▼ keys to make a setting.



Color	Output in color
Grayscale	Output in gray scale
MONO	Output in black and white (black background)
MONO(REV)	Output in black and white (white background)

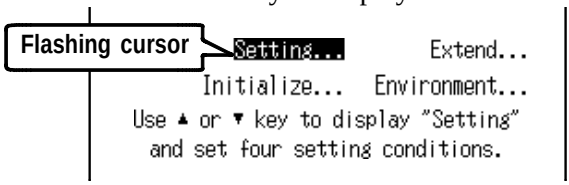
6.2 Using the Previous State Settings

6.2.1 Storing Settings

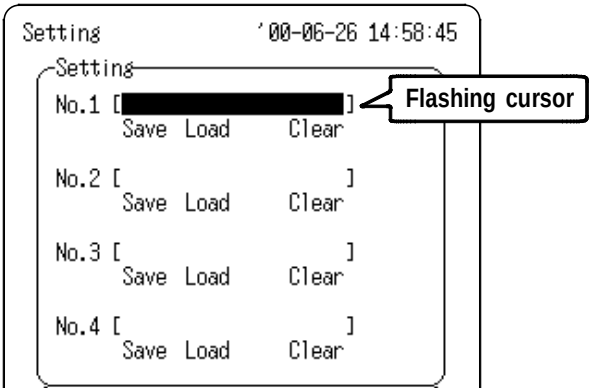
All settings of the present state are stored in internal memory. Up to four states can be saved for later recall when needed.

Procedure **Screen: Basic Setting > Setting**

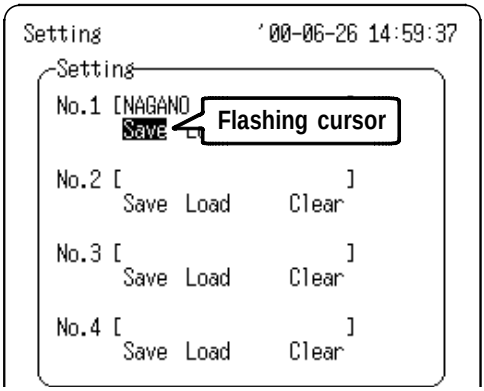
1. Press the SET key to display the Basic Setting screen.



2. Move the flashing cursor to Setting... and use the ▲/▼ keys to display the Setting screen.
3. Move the flashing cursor to the number of the setting state to be entered.



4. Use the ▲/▼ keys to display the Comment entry screen.
   For details to entering the comment, see Section 8.3.3.
5. Press the START key to accept, or the STOP key to cancel.
   It is not necessary to enter a comment to save the settings.
6. Move the flashing cursor to Save position and press the ▲/▼ keys.

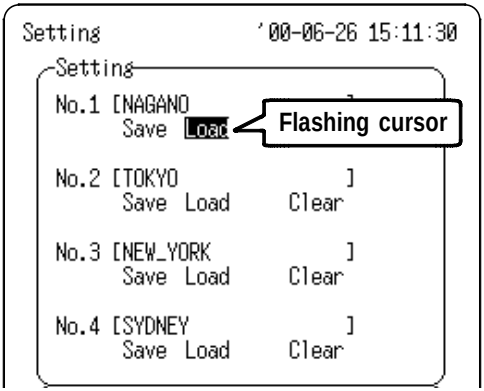


7. A confirmation window appears.
8. Press the START key to execute saving, or press STOP key to cancel.
9. To return to the Basic Setting screen, move the flashing cursor to Back... , and press the ▲/▼ keys or SET key.

6.2.2 Loading Previously Saved State Settings

Procedure **Screen: Basic Setting > Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Setting... and use the ▲/▼ keys to display the Setting screen.
3. Move the flashing cursor to the Load position for the number of the setting state to be loaded.

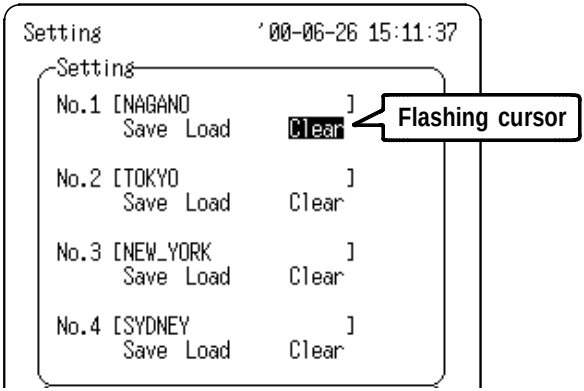


4. Press the ▲/▼ keys. A confirmation screen appears.
5. Press the START key to execute saving, or press STOP key to cancel.
6. To return to the Basic Setting screen, move the flashing cursor to Back... , and press the ▲/▼ keys or SET key.

6.2.3 Deleting saved state settings

Procedure **Screen: Basic Setting > Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Setting... and use the ▲/▼ keys to display the Setting screen.
3. Move the flashing cursor to the Delete position for the number of the setting state to be deleted.



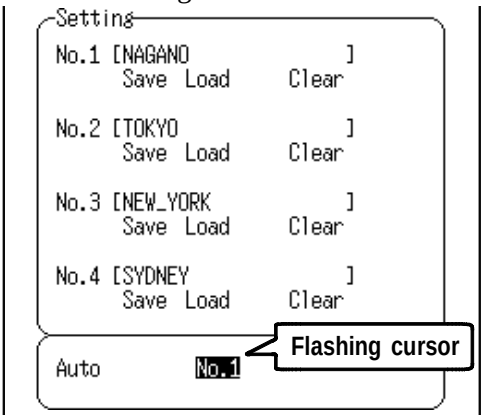
4. Press the ▲/▼ key. A confirmation screen appears.
5. Press the START key to accept, or the STOP key to cancel.
6. To return to the Basic Setting screen, move the flashing cursor to Back... , and press the ▲/▼ keys or SET key.

6.2.4 Auto Setting

When power is turned on, the specified state number (No. 1 to 4) is loaded automatically.

Procedure **Screen: Basic Setting > Setting**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Setting... and use the ▲/▼ keys to display the Setting screen.
3. Move the flashing cursor to the Autosetting position.



4. Press the ▲/▼ key to select number to be set automatically.
   Selecting a "NO." for which the settings have not been saved is the same as setting OFF.

5. To return to the Basic Setting screen, move the flashing cursor to Back... , and press the ▲/▼ keys or SET key.

NOTE Settings can be saved to a PC Card.
Refer to 8.3.2, " Saving Measurement and Setting Data" for details.

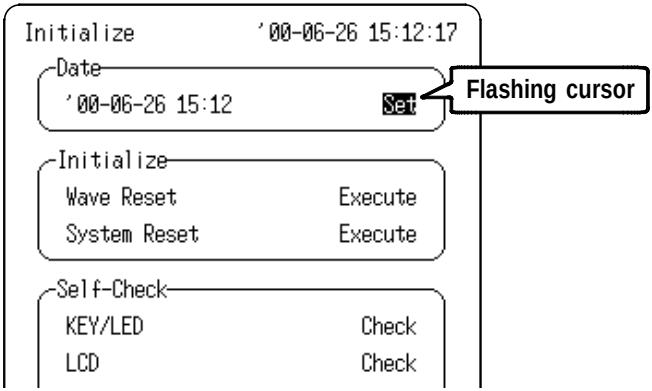
6.3 Initialize Screen Settings

6.3.1 Setting the Clock

This instrument incorporates a calendar with automatic leap year compensation and 24-hour clock.

Procedure **Screen: Basic Setting > Initialize**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Initialize... and use the ▲/▼ keys to display the Initialize screen.
3. Move the flashing cursor to the Date item to be set and use the ▲/▼ keys to make a setting.
4. Move the flashing cursor to the Set position and press the ▲/▼ keys to confirm the time settings and exit settings.

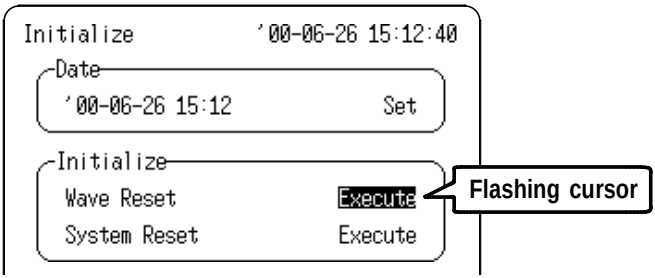


6.3.2 Clearing the Waveform Data

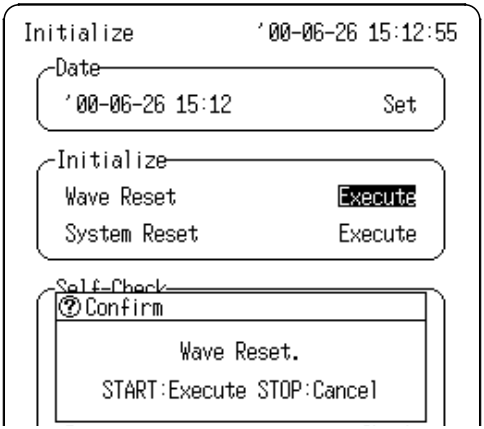
Clears the waveform data stored in memory and initializes.

Procedure **Screen: Basic Setting > Initialize**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Initialize... and use the ▲/▼ keys to display the Initialize screen.
3. Move the flashing cursor to Execute of Wave Reset item and press the ▲/▼ keys.



4. A confirmation window appears.
   Press the START key to execute clearing, or press the STOP key to cancel.

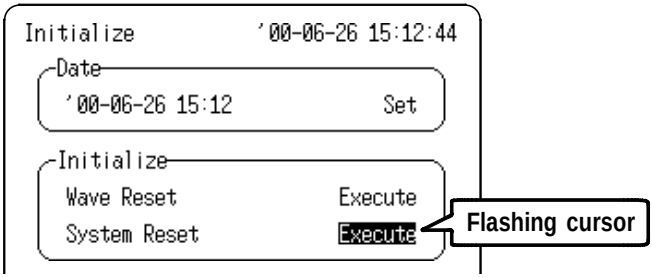


6.3.3 System Reset

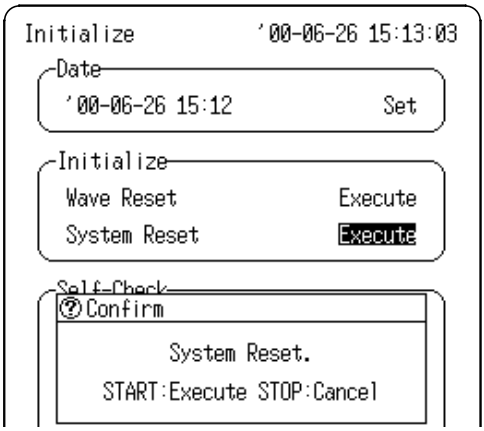
- Resets all settings to the factory default values.
- The same effect can be achieved by turning power to the instrument on while holding down the STOP key.

Procedure **Screen: Basic Setting > Initialize**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Initialize... and use the ▲/▼ keys to display the Initialize screen.
3. Move the flashing cursor to Execute of System Reset item and press the ▲/▼ keys.



4. A confirmation window appears.
   Press the START key to execute clearing, or press the STOP key to cancel.

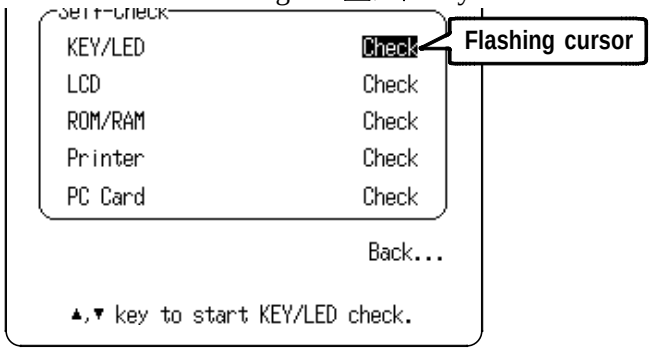


6.3.4 Self-check

If you run a self-check and the message "NG" appears or there seems to be a problem, please have the instrument serviced.

Procedure **Screen: Basic Setting > Initialize**

1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Initialize... and use the ▲/▼ keys to display the Initialize screen.
3. Move the flashing cursor to the Self-check item to be checked and execute using the ▲/▼ keys.



(1) KEY/LED Check

The key check is completed by pressing every keys. If a malfunction is found, press the START and STOP keys at the same time to abort checking.
To check LED operation, confirm that the LED lights green when the START key is pressed.

(2) LCD Check

The LCD check tests character display, and solid displays. Press any key to change screen.

(3) ROM/RAM Check

The following items can be checked.

ROM ..... OK/NG
Storage RAM ..... OK/NG
Backup RAM ..... OK/NG
Work RAM ..... OK/NG
Video RAM ..... OK/NG
Address bus ..... OK/NG

(4) Printer Check

The printer check tests solid printing and character printing. Pressing the STOP key aborts.

Pressing the DMM key causes print head cleaning by solid printing while the key is pressed.

(5) PC card Check

The following conditions are verified when a PC Card is inserted.

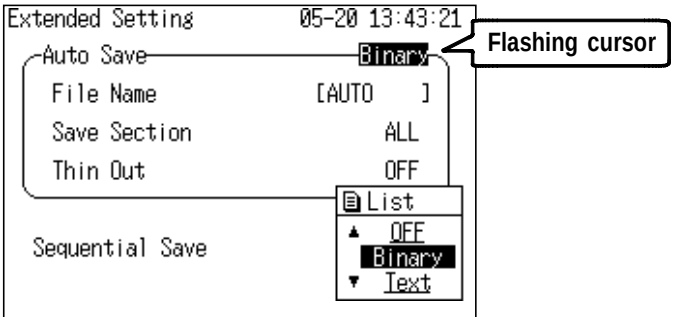
PC Card Type	ATA card
RAM Size	Capacity of the using card
Battery Level	OK (normal)
	LOW (The battery should be changed soon)
	NG (The battery change is needed immediately)
Write protect	PROTECT/NONE

6.4 Extended Setting

6.4.1 Auto Save Settings

Measurement data can be saved to a PC Card automatically.

(1) Select the command to save.



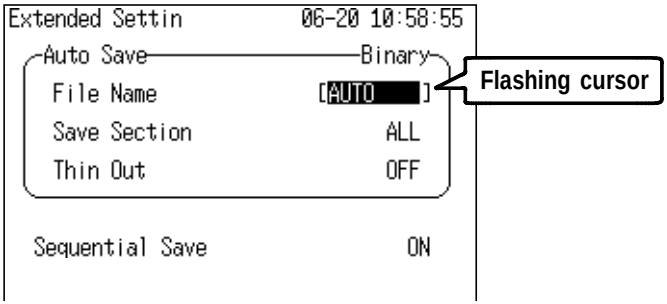
1. Press the SET key to display the Basic Setting screen.
2. Move the flashing cursor to Extended Setting... and use the ▲/▼ keys to display the Extended Setting screen.
3. Move the flashing cursor to Execute of Auto Save item and press the ▲/▼ keys.

OFF	Automatic saving is disabled.
Binary	The waveform data is saved in binary format.
Text	The waveform data is saved in text format. Data stored in the text format is not readable by the 8715-01.

NOTE When the RMS Trend Measurement Mode is selected, saved to a PC Card when press the STOP key to stops measurement.

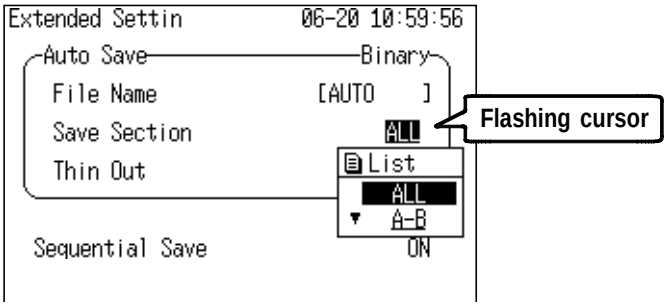
(2) Enter the file name.

Move the flashing cursor to the position shown in the figure below and enter the file name.



If the file name entered as a blank [.], it is assigned automatically according to the following principle.
[AUTO]→[AUTO0001]. . . [AUTO0010]. . .
For details, see Section 8.3.3.

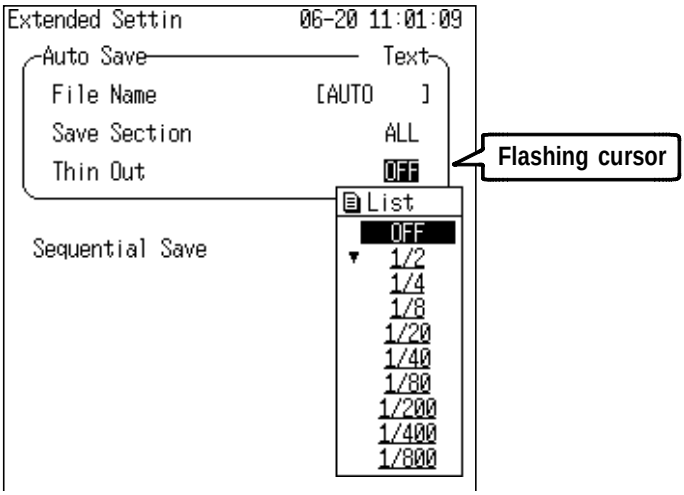
(3) If using the A/B cursors on the screen, specify the area to save.



Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

ALL	Store data for all captured waveforms.
A-B (partial saving)	If A cursor is in use, data is saved from the cursor to the end of input. If both A and B cursors are in use, data between the cursors is saved.

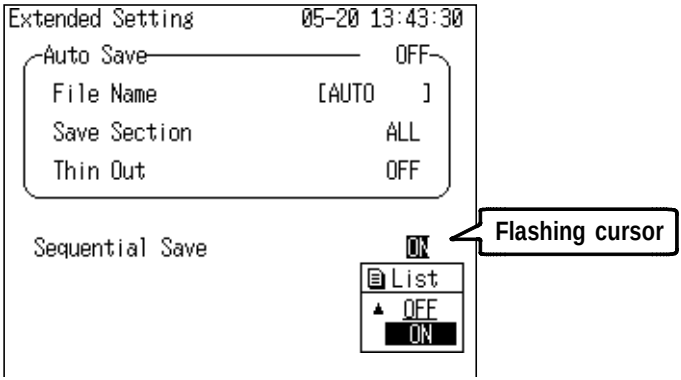
(4) Set the thinning when the text format is selected.



Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

6.4.2 Sequential Save Function

Set the Sequential Save.



OFF	Does not divide the measurement data memory.
ON	Divides the measurement data memory into several blocks. Acquires the waveform data generated by the trigger continuously and records the sets of acquired data to the blocks in succession.

The number of blocks divided from the memory is automatically determined by the set recording length.

	20 DIV	50 DIV	100 DIV	200 DIV	400 DIV	800 DIV
Waveform	32	16	8	4	2	-
RMS Trend Measurement (Instantaneous Waveform Recording)	16	8	4	2	—	—

NOTE When recording instantaneous waveforms for power fluctuation measurement after the maximum number of storable waveform blocks are loaded, the 8715-01 will not load any more waveforms even at trigger activation.

Chapter 7
Printout of Measurement Data

Five different procedures can be used to print out the measured waveforms.

Manual print	Refer to **7.2.1.**
Auto print	Refer to **7.2.2.**
Real-time print	Refer to **7.2.3.**
Partial print	Refer to **7.2.4.**
Screen copy	Refer to **7.2.5.**

NOTE

- Environmental settings that affect printing are "Grid Type" and "List & Gauge". Refer to 6.1.2 for information about Grid Type, and 6.1.6 for information about List & Gauge.
- Channel markers for each waveform are printed at the same time.
- The amount of paper remaining is printed at the end of a print job. When new printing paper is installed, the value is reset to indicate the new remaining quantity.

7.1 Printing Procedure

7.1.1 Manual Print

This mode serves to print waveform data from the internal memory.

Waveform	Measurement data from one measurement (entire recording length) are printed
Trend Instaneous waveform recording	The function is switched to MEM on the Waveform Display screen. Measurement data from one measurement (entire recording length) are printed.
Trend RMS recording	Measurement data stored in memory before the end of measurement are printed.
DMM screen	The numerical values on the DMM screen are printed.

Procedure **Screen: Waveform Display**

After the measurement is completed, press the PRINT key.

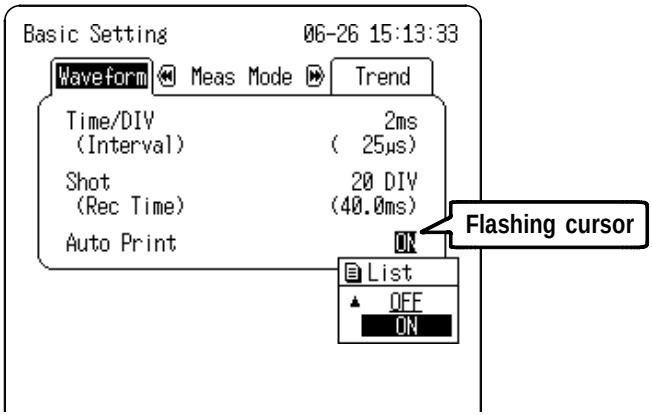
- Since data are stored, they can be printed as often as desired.
- When magnification/compression was used, the printout reflects this condition.
- If you want to stop the printing, press the STOP key.
- When cursors A and B are enabled, partial printing is executed.

7.1.2 Auto Print (Waveform)

When Auto Print is enabled (ON) in the Waveform Measurement Mode, after the measurement starts, each waveform block for the recording length is automatically printed after being loaded.
When cursor A and B are enabled, partial printing is executed.

Procedure **Screen: Basic Setting (Waveform)**

1. Press the SET key and ◀ key to display the Basic Setting screen (Waveform).
2. Move the flashing cursor to Auto Print and use the ▲/▼ keys to make a setting.



OFF	Disables the auto print.
ON	Enables the auto print.

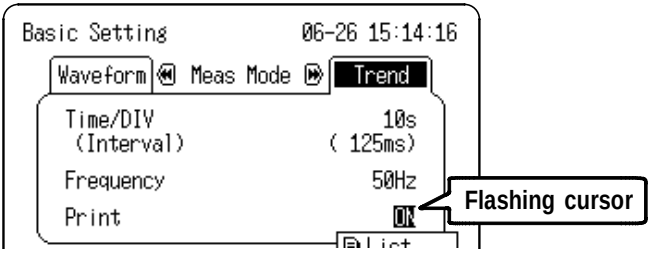
3. When Auto Print is enabled (ON) in the Waveform Measurement Mode, after the measurement starts, each waveform block for the recording length is automatically printed after being loaded.

7.1.3 Real Time Print (Trend RMS Recording)

The input waveform and data are printed out continuously in real time.
Print density differs according to the time axis setting.

Procedure **Screen: Basic Setting (Trend)**

1. Press the SET key and ▶ key to display the Basic Setting screen (Trend).
2. Move the flashing cursor to Print and use the ▲/▼ keys to make a setting.



OFF	Disables the real time print.
ON	Enables the real time print.

3. When measurement starts, waveforms are simultaneously printed as they are displayed.

Relationship between time axis (recording speed) and amount of remaining recording paper

For the Trend RMS Recording, the maximum print time is the instrument of the time axis and the remaining amount of recording paper (cm). Be particularly aware of the remaining amount of paper during simultaneous printing.

Time/DIV	Printing Time	Time/DIV	Printing Time
1 s	Approx. 30 min	1 min	Approx. 30 h
2 s	Approx. 60 min	2 min	Approx. 2 day 12 h
5 s	Approx. 2 h 30 min	5 min	Approx. 6 day 6 h
10 s	Approx. 5 h	10 min	Approx. 12 day12 h
30 s	Approx. 15 h	30 min	Approx. 37 day12 h
		1 h	Approx. 73 day

Applicable when using a new roll (1800 cm) of 9234 RECORDING PAPER

NOTE

- When the time axis ranges from 1 to 5 s/DIV, simultaneous numerical data printing is unavailable.
- If the instrument is used with the 9447 BATTERY PACK, simultaneous printing is unavailable at 1 s/DIV of the time axis.

7.1.4 Partial Print

This function prints the waveform between the A and B cursors. The function is available also when the A/B cursors are currently outside the range displayed on screen. When only the A cursor is enabled, waveform data is printed from the A cursor to the end of the data.
For details regarding the use of the A/B cursors, refer to Section 5.1.

• Waveform • Trend Instaneous waveform recording	Specified range (out of entire data recorded from a measurement) is printed.
Trend RMS recording	Measurement data stored in memory (200 DIV max.) before the end of measurement are printed.

Procedure **Screen: Waveform Display**

1. Press the DISP key to display the Waveform Display screen.
2. Position cursor A at the start point of the range to be printed.
3. Specify the end point of the range with cursor B.
   (Move cursor B (or A) to the right. When the cursor is at the rightmost edge of the screen, the waveform scrolls to the left, and cursor A (or B) scrolls with it.)
4. Then press the PRINT key.
   The specified range is printed, also if cursor A (or B) is currently off screen.

7.1.5 Screen Copy

Prints a copy of the display screen.

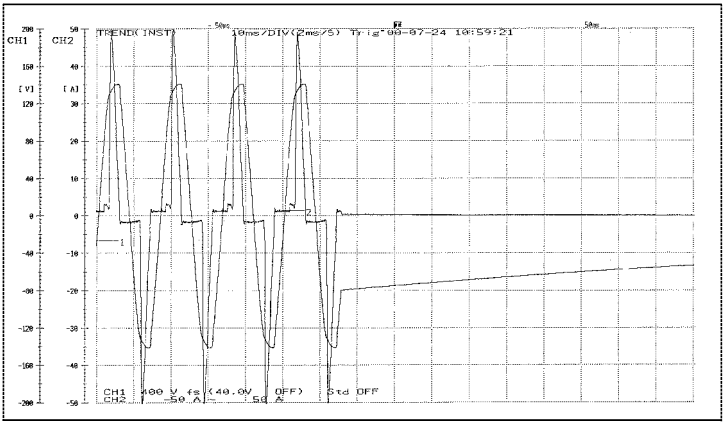
Procedure **Screen: All**

1. Display the desired screen.
2. Press the COPY key.

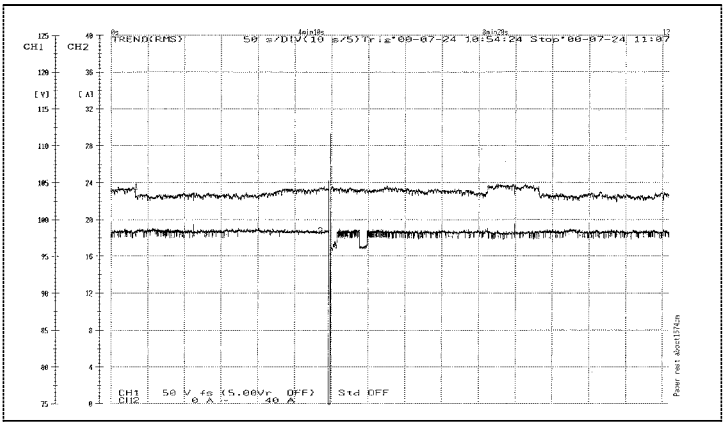
NOTE Even if the gauge is set to the List & Gauge function, the gauge is not printed out in the screen copy mode. The screen copy function is not available during measurement.

7.2 Example of Printer Output

Waveform / Trend Instaneous waveform recording

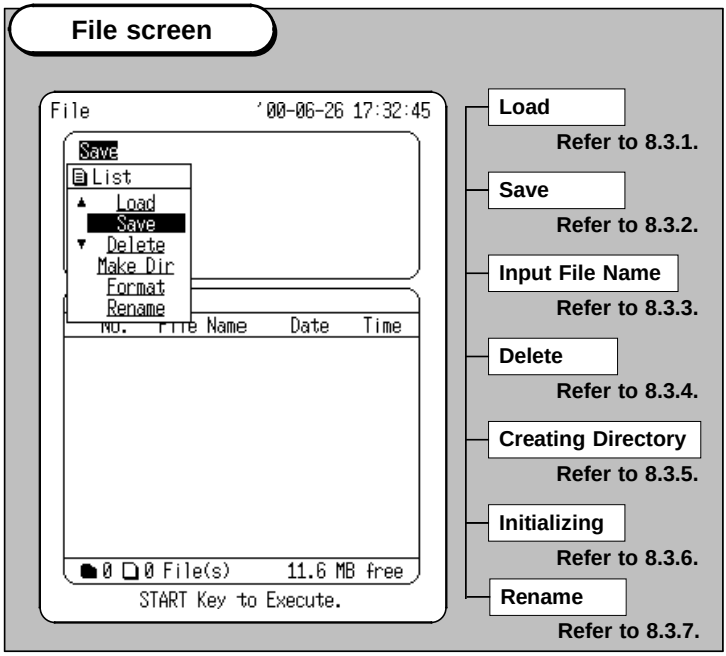


Trend RMS Recording



Chapter 8
Storing the Measurement Data

Measurement data and settings in the 8715-01 can be saved to and loaded from a PC Card.
The CARD key selects the File screen for PC Card settings and operations.



8.1 PC Card

(1) Saving and Loading Measurement Data (binary format)
Measurement data is saved in binary format so that, when needed, it can be loaded back into the 8715-01 for data analysis and printing.

(2) Saving Measurement Data (text format)
Measurement data can be saved in text (CSV) format. The saved data can be thinned, and can be used directly by many word processing and spreadsheet applications, but the text format cannot be read back into the 8715-01.

(3) Partial Saving of Measurement Data (binary and text formats)
Measurement data to be saved to the PC Card can be limited to that between the A and B cursors.

WARNING

- **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. Moreover, data on the PC card may be damaged.**

CAUTION 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.

HIOKI options PC cards (includes adapter)
9626 PC CARD 32M
9627 PC CARD 64M
9726 PC CARD 128M
9727 PC CARD 256M
9728 PC CARD 512M
9729 PC CARD 1G

8.2 Using the PC Card Slot

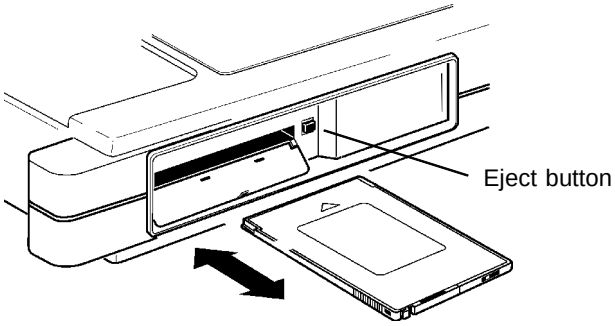
⚠CAUTION

- If a PC card is inserted upside down, backwards, or in the wrong direction, the PC card or the instrument may suffer damage.
- Do not remove the PC card while the PC card unit is operating.
- Before shipping the instrument, always remove the PC card and close the cover.

Before using a new PC Card, it must be initialized. For details, see Section 8.3.6.

PC Card Insertion and Removal

Open the cover and insert the PC Card face up.
To remove the card, press the Eject button and remove the PC card.
Always close the cover when the PC card is not used.

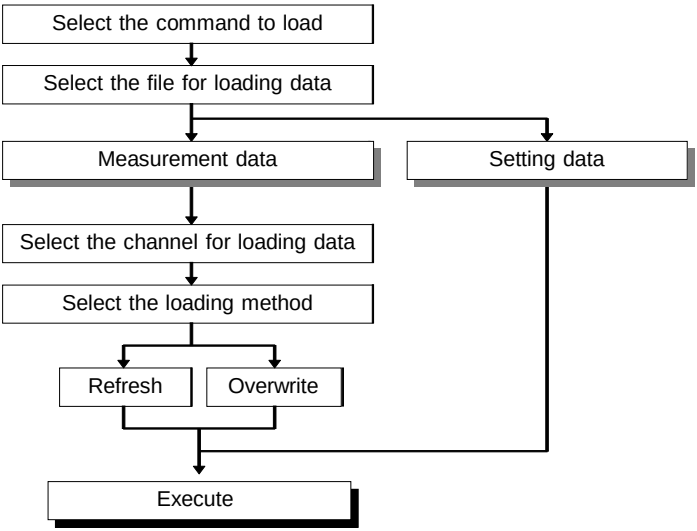


8.3 Settings on the File Screen

8.3.1 Loading the Data

The instrument settings or the measurement data are transferred from the PC card to the memory of the instrument.
Data stored in the text format is not readable by the 8715-01.

Operation Sequence



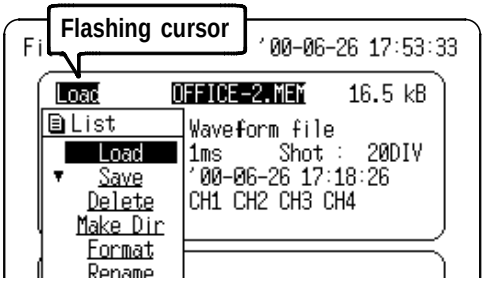
NOTE

- Saved data is loaded in this order: analog channels 1 through 4.
- When the one channel is specified as the load destination for data from multiple channels, data is read to that channel repeatedly, so that only the last data loaded remains.
- The amount of time needed to load the data is determined by the recording length and the number of channels.

Procedure **Screen: File**

(1) Select the command to load.

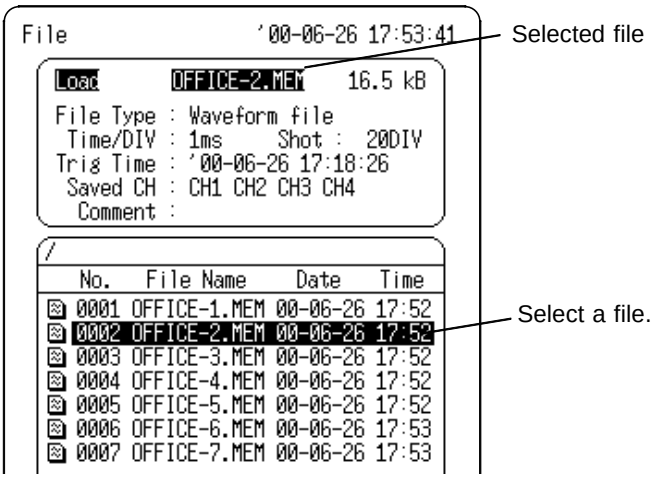
1. Press the CARD key to display the File screen.
2. Move the flashing cursor to the position shown in the figure below and select Load using the ▲/▼ keys.



(2) Select the file for loading data.

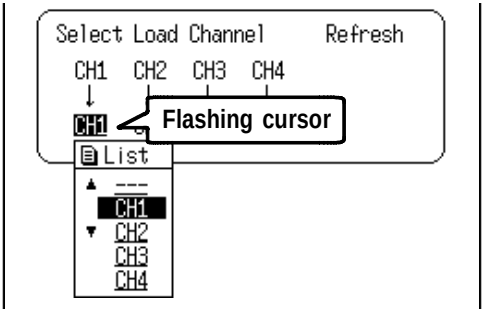
Using the cursor △/▽ keys, select the file for loading data from the file list.

You can select files in multiples of ten using the ◀/▶ key, and multiples of one hundred using the ◀◀/▶▶ key.



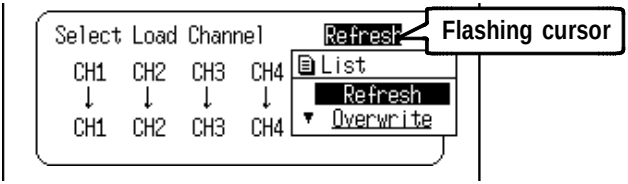
(3) Select the channel for loading data

1. Press the START key to display the channel selection screen for the loading destination.
2. Move the flashing cursor to the position shown in the figure and specify the channel from which to load the saved data using the ▲/▼ keys.



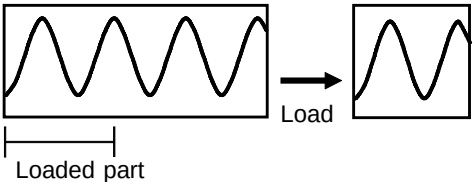
(4) Select Refresh or Overwriting Load

Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

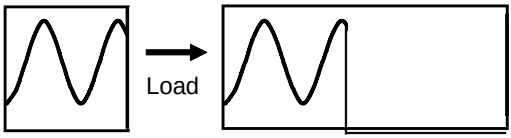


Refresh	Clears the screen and read waveform.
Overwrite	Reads the waveform without first clearing the screen. Overwriting is possible only when both the function and time axis range are the same.

If the recorded length of the saved data is longer than the recording length set in the 8715-01, the saved data is loaded for the set recording length, and the remainder of the data is not loaded.



If the recording length set in the 8715-01 is longer than the saved data, the data from the end of the last saved waveform to the end of the 8715-01 recording length is invalid.



(5) Press the START key to load, and press the STOP key to cancel.

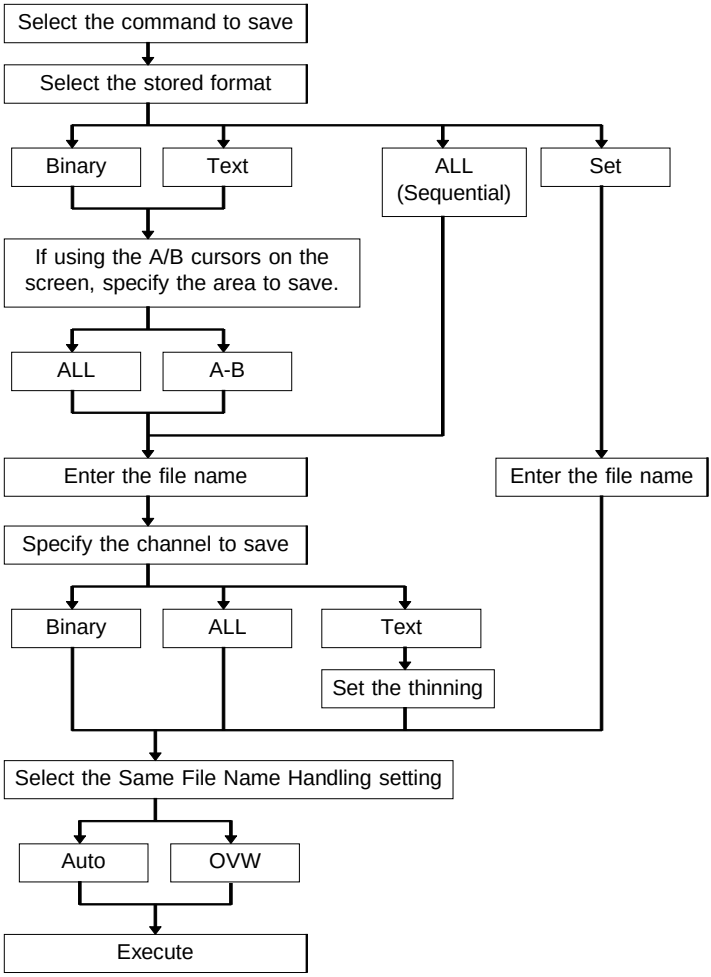
NOTE

Loading only a Trend RMS Recording file (RMS extension) erases the instantaneous value data in internal memory. To load both instantaneous and rms values at the same time, load the index file (RMM extension), or load the rms file first. Also, the loading capacity for instantaneous value data depends on the settings of the instrument at load time.

8.3.2 Saving Measurement and Setting Data

Measurement and setting data can be saved to a PC Card. The data to be saved must first be stored in internal memory.
If the A-B cursors are used, settings for partial saving can be made.

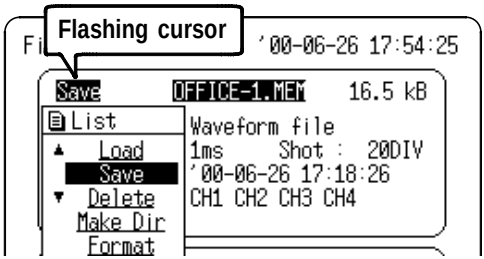
Operation Sequence



Procedure **Screen: File**

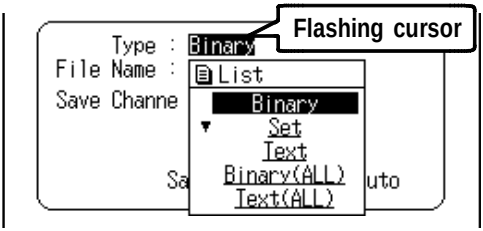
(1) Select the command to save.

1. Press the CARD key to display the File screen.
2. Move the flashing cursor to the position shown in the figure below and select Save using the ▲/▼ keys.



(2) Select the stored format.

1. Press the START key to display the Storing Format setting screen.
2. Move the flashing cursor to the position shown in the figure below and select the format using the ▲/▼ keys.

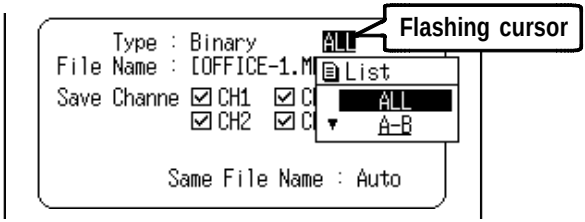


Binary	The waveform data is saved in binary format.
Set	The settings are saved.
Text	The waveform data is saved in text format. Data stored in the text format is not readable by the 8715-01.
Binary (ALL)	Sequential Save data can be saved in binary format. An index file is also created.
Text (ALL)	Sequential Save data can be saved in a text format. An index file is not created.

NOTE

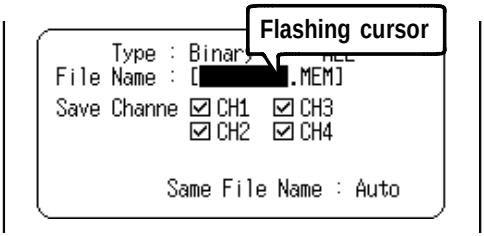
When sequential save is used with instantaneous waveform recording by the WAVEFORM sequential save and RMS TREND instaneous waveform recording, "Binary ALL" and "Text ALL" can be used for saving files.
If measurement data is saved using "Binary ALL," an index file is created. All saved measurement data can be read at once by reading the index file (the file with the extension SEQ and RMM).

(3) If using the A/B cursors on the screen, specify the area to save.
Move the flashing cursor to the position shown in the figure below and use the ▲/▼ keys to make a setting.

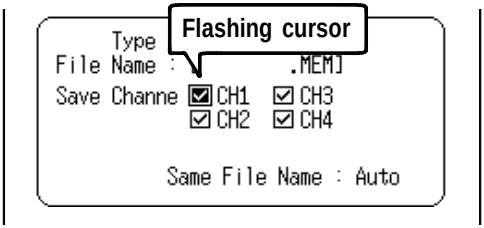


ALL	Store data for all captured waveforms.
A-B (partial saving)	If A cursor is in use, data is saved from the cursor to the end of input. If both A and B cursors are in use, data between the cursors is saved.

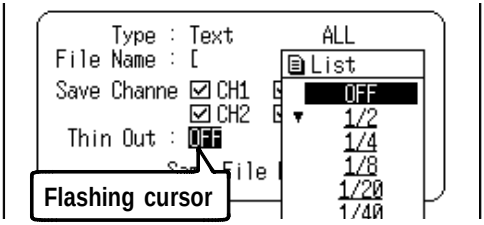
(4) Enter the file name.
Move the flashing cursor to the position shown in the figure below and enter the file name.
If the file name entered as a blank [.], it is assigned automatically according to the following principle.
[NONAME] → [NONAME01] ....→ [NONAME10]...
For details, see Section 8.3.3.



(5) Specify the channel to save. (for measurement data)
Move the flashing cursor to the position shown in the figure below and select channel using the ▲/▼ keys. (The channel that has been check marked is saved.)



(6) Set the thinning when the text format is selected.



(7) Select the Same File Name Handling setting (if same-name saving is desired).

Auto	When saving with the same name, automatically append a number after the file name. If the last file was saved with a number appended, the next save just increments the number. Example: TEST1, TEST2
OVW (Overwrite)	When saving with the same name, overwrite the previous contents of the file.

(8) Execute the Save.
After selecting the channel to save, press the START key to execute, or the STOP key to abort saving.

File name extension

The following extensions are automatically assigned, according to the stored data type.

Extension	Meaning
MEM	WAVEFORM binary data file ····· ● RMS TREND Instaneous Waveform Recording binary data file ····· ●
RMS	RMS TREND RMS Recording binary data file ····· ●
SEQ	WAVEFORM sequential save index file ····· ●
TXT	Text data file ····· –
SET	Setting data file ····· ●
RMM	RMS TREND Instaneous Waveform Recording sequential save index file ····· ●

●: Files can be read into the instrument.
–: Reading is not possible

Auto save of filename

A file saved with the filename ([.]) left blank is automatically set as shown below.

Auto save	Waveform Data/Screen Data
[AUTO]	[NONAME]
[AUTO0001]	[NONAME01]
↓	↓
[AUTO0010]	[NONAME10]
↓	↓
[AUTO0100]	[NONAM100]
↓	↓
[AUTO5000]	[NONA5000]

Waveform file size (in bytes)

File size = Header field + Data field
Omit the decimals of quotients.

(1) Binary file size of instantaneous waveform data of anomalous waveform measurement/power fluctuation measurement
Header field = 512 (4 + number of analog storage channels)
Data field = (2 x number of analog storage channels) x (recording length (DIV) x 80 + 1)

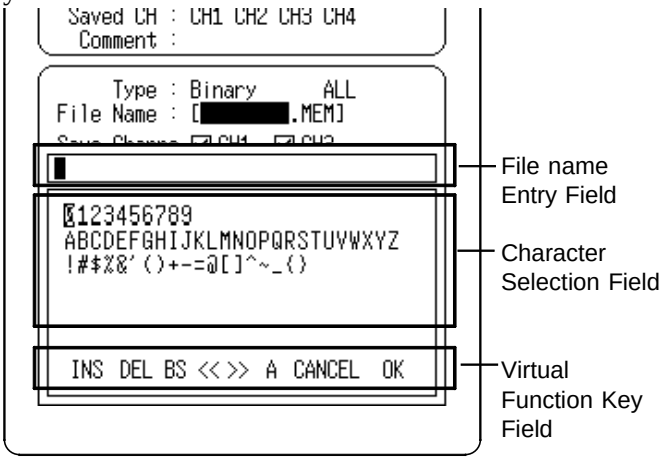
(2) Binary file size of RMS data of power fluctuation measurement
Header field = 512 (4 + number of analog storage channels)
Data field = (4 x number of analog storage channels) x (recording length (DIV) x 80 + 1)

(3) Text file size of instantaneous waveform data of anomalous waveform measurement/power fluctuation measurement (as a guide only)
Header field = 170 + 27 x number of analog storage channels
Data field = (14 + 13 x number of analog storage channels) x (recording length (DIV) x 80 + 1)

(4) Binary file size of RMS data of power fluctuation measurement (as a guide only)
Header field = 170 + 64 x number of analog storage channels
Data field = (14 + 26 x number of analog storage channels) x (recording length (DIV) x 80 + 1)

8.3.3 Entering the File Name

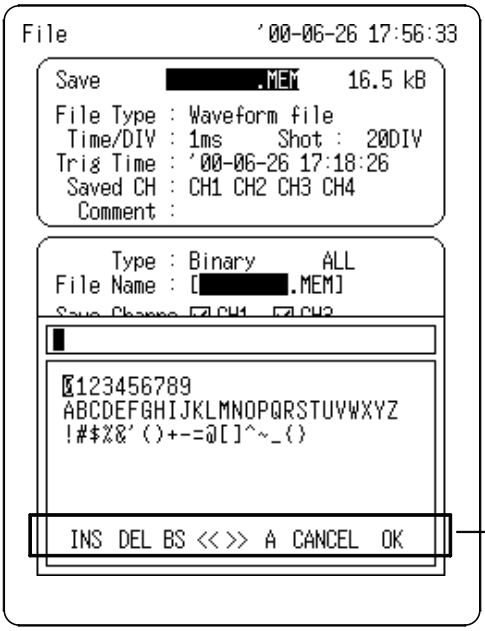
Characters are entered by the following key operations on the file name entry screen.
Enter characters by copying from the Character Selection Field to the File Name Entry Field. When all characters have been entered, press the START key to accept the entry.



File Entry Field Procedures	
Key	Meaning
DMM	Back space
◀◀	Moves the cursor to the front of the File Name Entry Field.
▶▶	Moves the cursor to the end of the File Name Entry Field.
◀ SCROLL/CURSOR ▶	Moves the cursor left or right one character.
Character Selection Field Procedures	
Key	Meaning
△▽◁▷	Cursor movement
▲/▼	Accepts character entry
START	Accepts file name entry
STOP	Cancels file name entry

Virtual function keys

The virtual function keys provide shortcuts by duplicating the process of moving the cursor to a particular location and pressing the ▲/▼ keys to accept the selection.



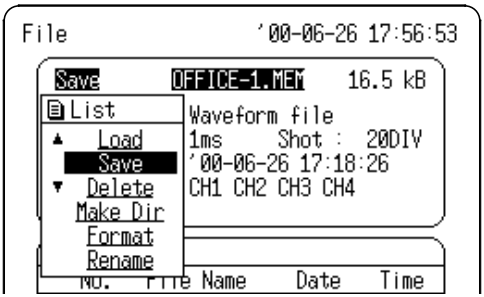
Virtual Function Key Operations	
Item	Meaning
INS /OVER (Insert/Overwrite)	Switches between Insert and Overwrite modes.
DEL	Deletes the character at the cursor.
BS	Moves back one space.
<< >>	Moves the input position left and right.
A	No function in English display mode.
CANCEL	Exits File Name Entry Screen unchanged.
OK	Accepts file name Entry.

NOTE

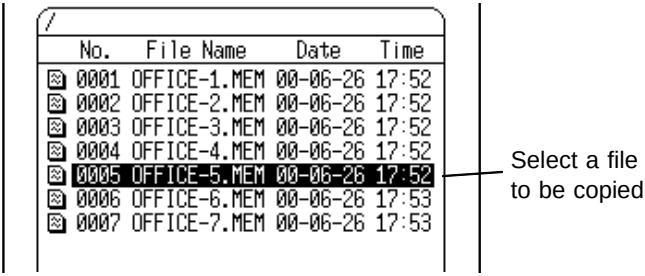
Do not use the characters and symbols below in a file name. A file containing any of these characters/symbols in its file name cannot be processed under Windows 2000 or XP.
Half-size symbols: +, =, [,]

Copying File Name

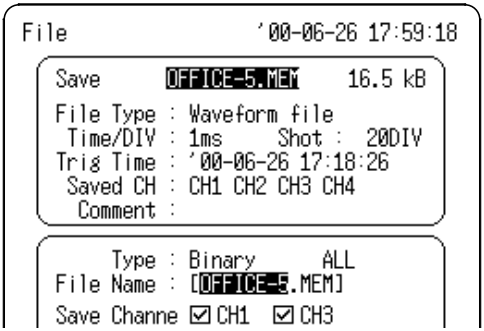
1. Press the CARD key to display the File screen.
2. Select the Save command using the ▲/▼ keys.



3. Select the file with the name to be copied.



4. Press the START key to display the setting screen for saving format.



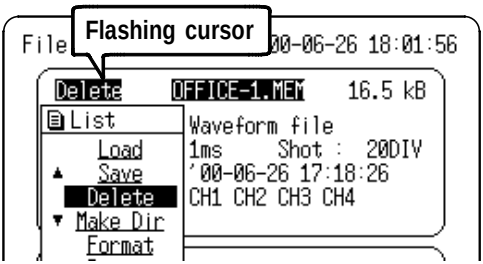
5. Move the flashing cursor to the File name, and press the DMM key twice. The file name selected in step 3 entries in the File Name entry location.

8.3.4 Deleting the Files and Directories

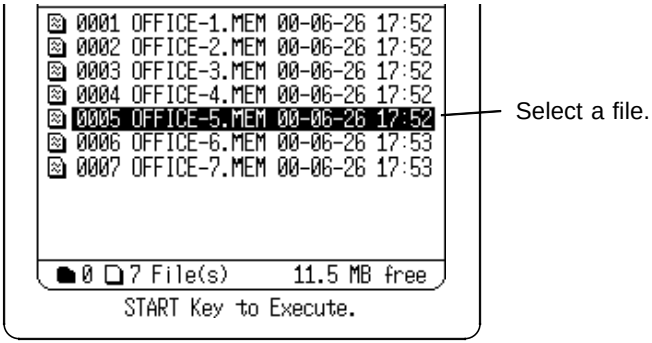
The files and directories can be deleted.

Procedure **Screen: File**

(1) Select the command to delete.
1. Press the CARD key to display the File screen.
2. Move the flashing cursor to the position on the figure below and select Delete using the ▲/▼ keys.



(2) Select the file or directory to be deleted.
Using the ⌂/▽ keys, select a file or directory to be deleted.



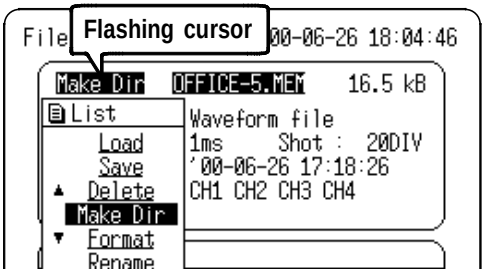
(3) Execute deleting.
1. Pressing the START key displays a confirmation screen before deleting.
2. Press the START key to delete or the STOP key to cancel deletion.

8.3.5 Creating the Directory

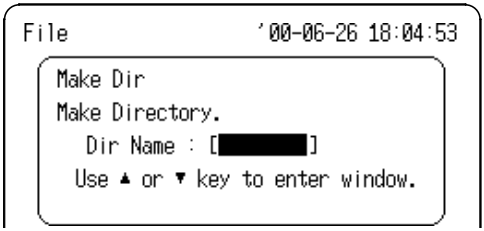
Creates a subdirectory on the selected medium.

Procedure **Screen: File**

(1) Select the command to create a directory.
1. Press the CARD key to display the File screen.
2. Move the flashing cursor to the position on the figure below and select Make Dir using the ▲/▼ keys.



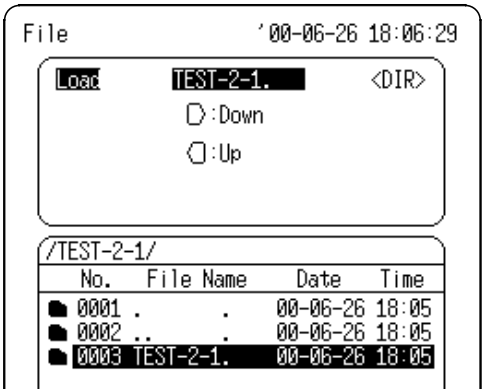
(2) Enter the directory name.
1. Press the START key to display the directory name entry screen.
2. Press the ▲/▼ keys to display the Comment Entry Screen.



3. Move the cursor to the characters to be entered to enter the directory name (refer to Section 8.3.3).
4. Press the START key to create the directory.

Changing a directory

1. Press the CARD key to display the File screen.
2. Select the desired directory to move using the △/▽ cursor keys.



3. Change the directory using the ◁/▷ cursor keys.
   To move to the upper directory, use ◁ key
   To move to the lower directory, use the ▷ key.

NOTE

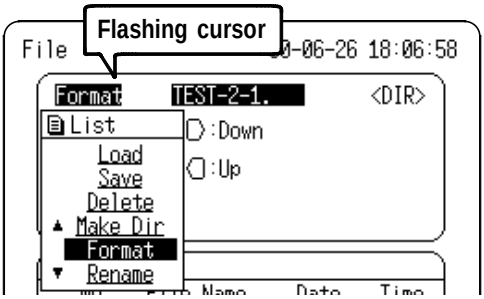
- Files cannot be moved from one directory to another with the 8715-01.
- The maximum number of files that can be stored in the root directory of a flash ATA card is 512 files (depending on manufacturer). Up to 5000 files can be stored in a subdirectory.

8.3.6 Initializing

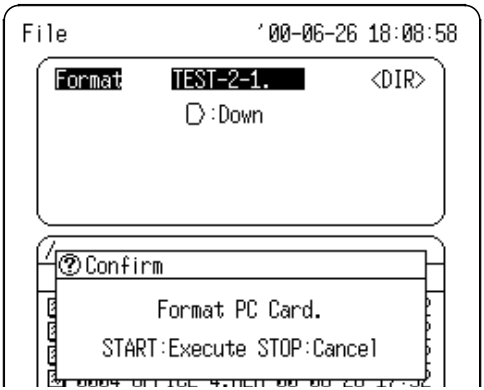
Initialization method is described below.

Procedure **Screen: File**

(1) Select the command to initialize a PC card.
1. Press the CARD key to display the File screen.
2. Move the flashing cursor to the position on the figure below and select Format using the ▲/▼ keys.



(2) Execute Initialization.
Press the START key to display a confirmation screen, and press it again to proceed with initialization, or press the STOP key to abort initialization.

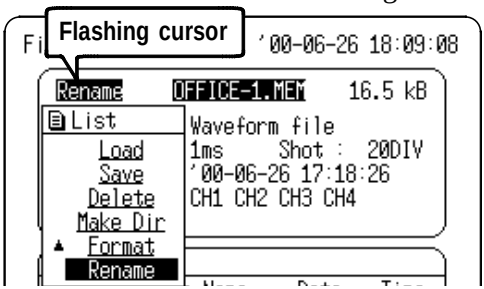


8.3.7 Changing the Names of Files and Directories

Change the name of a saved file, or a directory name.

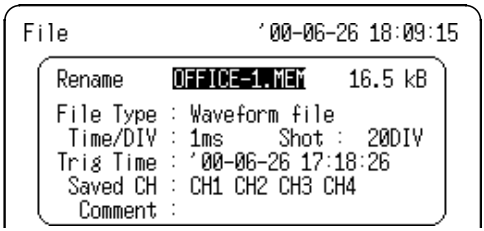
Procedure **Screen: File**

(1) Select the command to rename.
1. Press the CARD key to display the File screen.
2. Move the flashing cursor to the position on the figure below and select Rename using the ▲/▼ keys.



(2) Select the file to be renamed.
Select the file or directory to be renamed using the △/▽ Cursor keys.

(3) Rename the file
1. Press the START key to display the old and new file name fields.



2. Enter the file name (refer to Section 8.3.3).
3. When finished with settings, press the START key to accept or STOP key to cancel renaming.

Chapter 9
Specifications

9.1 General Specifications

Measurement modes	Waveform : Power Waveform Monitoring Trend : RMS Trend Monitoring
Number of channels (maximum)	4 analog channels
Memory capacity	4 ch, 64 K words/channel
Maximum sampling speed	400 kS/s (all channels simultaneously)
Time axis accuracy	±0.01% (difference between grid and actual time)
External control terminals	External trigger input, trigger output, GND
Time functions	Auto calendar with automatic leap year, 24 hour clock
Backup battery and lifetime	Used for clock and to preserve waveforms and settings, at least 5 years (reference value at 25℃, 77˚F)
Location for use	Max. 2000 m (6562 feet) height, indoors
Operational ranges for temperature and humidity	Temperature: 5℃ to 40℃ (41˚F to 104˚F) Relative humidity: 35% to 80%RH (with no condensation)
Temperature and humidity ranges for assured accuracy	Temperature: 23±5℃ (73˚F±9˚F) Relative humidity: 35% to 80%RH (with no condensation)
Temperature and humidity ranges for storage	Temperature: -10℃ to 50℃ (50˚F to 122˚F) Relative humidity: 20% to 80%RH (with no condensation)

Dielectric strength	One minute at 3.7 kVAC (between the main unit and input channels, between input channels)
Power supply	Depending on the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) (powering at 12 VDC±10%) Rated supply voltage of the AC adapter is 100 to 240 VAC. (Voltage fluctuations of ± 10% from the rated supply voltage are taken into account.) Rated supply frequency is 50/60 Hz. 9447 BATTERY PACK is used. (The AC adapter is prior to batteries when using together.)
Maximum rated power	15 VA
Continuous Operating Time	Approx. 3 hours (when using with 9447 BATTERY PACK) (Waiting for trigger, 23℃ reference value)
Charging function	With the 9447 BATTERY PACK The 9447 BATTERY PACK can be charged with the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) when the instrument is turned off. Approx. 2 hours necessary to charge (23℃ reference value)
Dimensions	Approx. 280W x 170H x 52D mm (11.02"W x 6.69"H x 2.05"D)
Mass (excluding batteries)	Approx. 1.6 kg (56.4 oz.)
Standards Applying	Safety: EN 61010 Pollution Degree 2, Measurement Category Ⅱ (anticipated transient overvoltage 4000 V) EMC: EN 61326 Class A EN61000-3-2 EN61000-3-3

Display

Display language	Japanese/English (selectable)
Screen	5.7- inch STN color LCD display (320 x 240 dots)
Display resolution	Waveform: 10 DIVf.s. x 10 DIV f.s. (1 DIV = 20 (horizontally) x 28 (vertically) dots)
Dots spacing	0.36 (horizontal) x 0.36 (vertical) mm
Backlight lifetime	Approx. 25000 hours (23℃ reference value)
LCD saver	Available

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 three or fewer such defects to indicate a damaged or faulty display. Please be aware of this in advance.

Printer interface

Recording width	Total recording width: 104 mm (832 dots) Waveform area: 100 mm f.s. (1 DIV=10 mm 10 DIV f.s.) 9234 RECORDING PAPER (18 m/59.06 feet, 112 mm width)
Recording speed	Max 1 s /cm (using with AC adapter)

External storage (PC card)

Slot	Complies with PC card standard specification 68-pin (1 slot) Accepts TYPE I, II PC cards
Card type	Flash ATA card
Card capacity	1 GB max.
Data format	MS-DOS format (MS-DOS is the registered trademark of Microsoft Corporation in USA.)
Data stored	Settings, measurement data (binary or text) (Measurement data can be saved between cursors A and B.)

9.2 Analog Inputs

Accuracy at 23℃±5℃, after 30-minutes warming-up time.
Period of guaranteed accuracy: 1 year

Input mode	Voltage, 9010, 9018, 9132, 3283, 3284, 3285, 9322
Measurement ranges	Volt : 100 V Line, 200 V Line, 400 V Line, 100 VDC 9010: 10, 20, 50, 100, 200, 500 A 9018: 10, 20, 50, 100, 200, 500 A 9132: 20, 50, 100, 200, 500, 1000 A 3283: 10 m, 100 m, 1, 10, 200 A 3284: 20, 200 A 3285: 200, 2000 A 9322: 400 V Line, 600 V Line
Accuracy	±0.5%f.s. (f.s.=10 DIV) (For details, see the accuracy specifications*) (add clamp accuracy when a clamp is used)
Temperature characteristic	Gain: ±0.1%f.s./℃ Zero position: ±0.1%f.s./ ℃
Frequency characteristic	DC to 50 kHz ±3 dB
Low-pass filter	OFF, 500 Hz, 5 kHz 500 Hz: 500 Hz±50% -3 dB Roll-off: -6 dB/oct (2-stage active filter) 5 kHz: 4.84 kHz±200 Hz -3 dB Roll-off: -24 dB/oct (4-stage active filter)
Common mode rejection ratio	90 dB min. (at 50/60 Hz and with signal source resistance 100 Ω max)
Input type	Unbalanced (input isolated from output)
Input resistance and capacitance	1 MΩ±1%, 7 pF±3 pF (at 100 kHz)
A/D resolution	12 bits (Voltage axis resolution: 160 data/DIV)
Maximum sampling speed	400 kS/s
Input coupling	DC fixed

Input terminals	Insulated BNC terminal
Maximum input voltage	450 Vrms/DC max (CAT ll)
Maximum rated voltage to earth	450 V AC/DC (between each input channel and main unit, and between input channels)

*Accuracy Specifications

Input mode	Range	Waveform measurement Trend instateneous waveform		Trend instaneous waveform (RMS value)		Max. input (rms)
		f.s.	Accuracy	f.s.	Accuracy	
Voltage	100 V line	200 V peak	±1 V	100 Vrms	±3 Vrms	140 Vrms
	200 V line	500 V peak	±2.5 V	100 Vrms	±6 Vrms	350 Vrms
	400 V line	1000 V peak	±5 V	100 Vrms	±15 Vrms	450 Vrms
	100 VDC line	100 V peak	±0.5 V	100 V peak	±0.5 V	100 V
9010	10 A *1	25 A peak	±0.125 A	10 Arms	±0.3 Arms	10 Arms
	20 A	50 A peak	±0.25 A	20 Arms	±0.6 Arms	20 Arms
9018	50 A	125 A peak	±0.625 A	50 Arms	±1.5 Arms	50 Arms
	100 A	250 A peak	±1.25 A	100 Arms	±3 Arms	100 Arms
9132	200 A	500 A peak	±2.5 A	200 Arms	±6 Arms	200 Arms
	500 A	1250 A peak	±6.25 A	500 Arms	±15 Arms	500 Arms
	1000 A *2	2500 A peak	±12.5 A	1000 Arms	±30 Arms	1000 Arms
3283	10 mA	20 mA peak	±0.1 mA	10 mArms	±0.3 Arms	10 mArms
	100 mA	200 mA peak	±1 mA	100 mArms	±3 Arms	100 mArms
	1 A	2 A peak	±10 A	1 Arms	±30 Arms	1 Arms
	10 A	20 A peak	±100 A	10 Arms	±0.3 Arms	10 Arms
	200 A	500 A peak	±2.5 A	200 Arms	±6 Arms	200 Arms
3284	20 A *3	40 A peak	±200 mA	20 Arms	±0.6 Arms	20 Arms
	200 A	400 A peak	±2 A	200 Arms	±6 Arms	200 Arms
3285	2000 A *4	4000 A peak	±20 A	2000 Arms	±60 Arms	2000 Arms
9322	400 V line	1000 V peak	±5 V	500 Vrms	±15 Vrms	1000 Vrms
	600 V line	2000 V peak	±10 V	1000 Vrms	±30 Vrms	1000 Vrms

*1: except for 9132 *2: 9132 only *3: 3284 only
*4: 3285 only
*5: The accuracy of the clamp probe is added when using a clamp probe.
*6: The accuracy of the differential probe is added when using a differential probe

Trigger

Trigger Method	Digital comparison
Trigger source	Trigger conditions can be set for each channel. Analog input, external trigger Sources can be set on or off. When all sources are off, the instrument is in the free-run state. External trigger (With an external trigger, the triggering occurs on a falling edge of 2.5 V, or when the terminals are shorted together.)
Trigger conditions	OR of any trigger sources
Trigger types	**Waveform measurement mode** Level trigger, Voltage drop trigger, Window-in, window-out trigger, Period trigger, Waveform detection trigger **Trend instantaneous waveform recording** Voltage drop trigger, RMS level trigger, RMS window-in, window-out trigger
Trigger filter	ON/OFF for Waveform Measurement Mode (fixed 0.5-div filter width)
Trigger level resolution	0.25%f.s. (f.s. = 10 DIV) (0.1% f.s. only when using the waveform detection trigger)
Pre-trigger	0, 10, 20, 50, 100% (Waveform, Trend instantaneous waveform recording)
Trigger output	Open collector output (with 5 V output voltage, active low) Pulse width 30 ms minimum
Trigger input/ output terminal	Terminal block

9.3 Measurement Modes

Waveform Measurement Mode

Time axis	200, 400 µs/DIV 1, 2, 5, 10, 20 ms/DIV
Time axis resolution	80 points/DIV (with the printer)
Sampling period	1/80 of the time axis
Recording length	20, 50, 100, 200, 400 DIV (Sequential save ON) 20, 50, 100, 200, 400, 800 DIV (Sequential save OFF)
Waveform magnification/ compression	Time axis x10, x5, x2, x1, x1/2, x1/5, x1/10, x1/20, x1/50 Voltage axis ON/OFF
Waveform scrolling	Available in the left / right directions
Auto-print	Automatically prints the memorized waveform
Partial print	Prints between the A and the B cursors

RMS Trend Measurement Mode (RMS Recording)

Input mode	Commercial mains power only (50/60 Hz)
Time axis	1, 2, 5, 10, 30 s/DIV, 1, 2, 5, 10, 30 min/DIV 1 h/DIV
Time axis resolution	80 points/DIV (with the printer)
Sampling period	250 µs fixed (800 rms data/s)
RMS accuracy	±3% f.s.
Recording length	Continuous measurement Last 200 divisions of data saved in memory Can be checked by reverse scrolling and reprinted.
Waveform display range	Volt-100 V Line: 75 V to 125 Vrms (Std) Volt-200 V Line: 150 V to 250 Vrms (Std) Volt-400 V Line: 275 V to 525 Vrms (Std) Clamp: 0 A to Setting range full scale (rms) 9322-400 V Line: 275 V to 525 Vrms (Std) 9322-600 V Line: 475 V to 725 Vrms (Std)
Waveform magnification/ compression	Time axis x1, x1/2, x1/5, x1/10, x1/20, x1/50 Voltage axis ON/OFF
Waveform scrolling	Available in the left/right directions
Real time print	ON/OFF (prints simultaneously as display)
Partial print	Prints between the A and the B cursors
Hybrid recording	ON/OFF for each channel (numerical data values for each frame are printed with the waveforms)

RMS Trend Measurement Mode (Instantaneous Waveform Recording)

Time axis	200, 400 µs/DIV 1, 2, 5, 10, 20 ms/DIV
Sampling period	1/80 of the time axis
Recording length	20, 50, 100, 200 DIV (Sequential save ON) 20, 50, 100, 200, 400 DIV (Sequential save OFF)
Waveform magnification/ compression	Time axis x10, x5, x2, x1, x1/2, x1/5, x1/10, x1/20, x1/50 Voltage axis ON/OFF
Waveform scrolling	Available in the left/right directions

9.4 Others

Waveform display	ON/OFF
Cursor measurement function	Time difference, voltage difference between cursors A and B, voltage at each cursor, time from trigger can be measured.
List/gauge functions	OFF, list, gauge, list & gauge can be selected
List print	Settings are printed after waveform is printed.
Backup function *	Provided Waveform data and settings are saved even if the power switch is turned off.
Start backup function	ON/OFF (Initial setting: ON)
Auto setup function	Settings can be read automatically at power on.
LCD saver	ON/OFF (Initial setting: OFF) The Power Saver function activates while printing, and after no key presses occur for about five minutes.
DMM function	Displays input voltage numerically. Update rate: 1second Displays rms value, instantaneous value Measuring object: DC, 50/60 Hz (auto-selection) Sampling rate: 4 kS/s Number of displayed digits: 4 The lowest digit is displayed as 0 for values 0 to 4, and as 5 for values 5 to 9. (the actual digit is displayed while setting scaling) Accuracy: ±3% rdg.±5 dgt. Print function Numerical printing of rms values, and screen hard copy
Automatic Saving	Select off or binary or text

*: If the power supply is interrupted during measurement and Instantaneous Waveform Recording is enabled in the RMS Trend Measurement Mode, then the effective value waveform data will not be backed up.

Chapter 10
Maintenance and Service

Service

- If damage is suspected, check the section 10.5 "Troubleshooting" before contacting your dealer or Hioki representative.
- When transporting the instrument, use the original packing materials in which it was shipped, and pack in a double carton. Damage occurring during transportation is not covered by warranty.

Cleaning of the Instrument

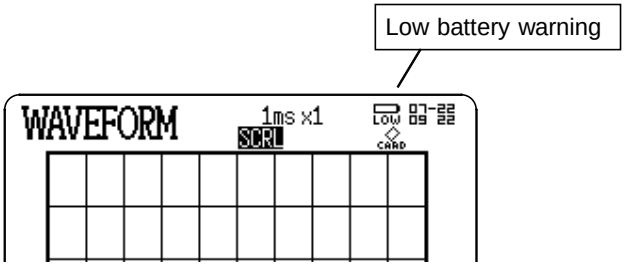
- To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- Wipe the LCD gently with a soft, dry cloth.

10.1 Changing the 9447 BATTERY PACK

WARNING

- **To avoid electric shock when replacing the battery pack, turn the power switch off and disconnect the input cable before beginning.**
- **Use the specified 9447 BATTERY PACK.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery pack.**
- **Handle and dispose of battery pack in accordance with local regulations.**

A low battery warning appears on the Waveform Display screen when the battery charge is low. When this indicator or "WARNING 620: Battery low." appears, replace the battery pack or recharge the battery pack as soon as possible.

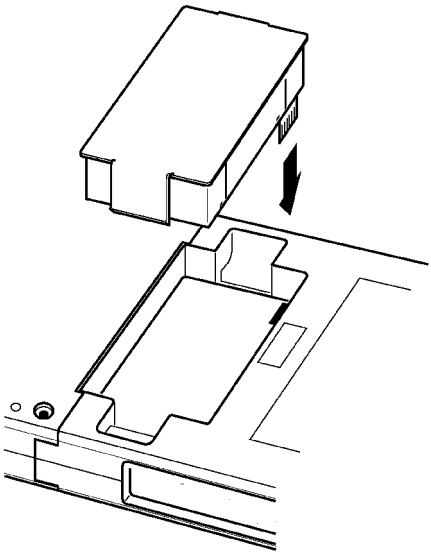


NOTE

- To avoid problems with battery operation, remove the batteries from the instrument if it is to be stored for a long time.
- If the 8715-01 shuts down because the batteries are exhausted, it still continues to consume a very small amount of power. After the shutdown, be sure to turn the power switch off.

Replacing the 9447 BATTERY PACK

1. Turn the power OFF.
2. Take off the cover of the battery compartment.
3. Remove the battery pack.
4. Replace the new or recharged battery pack.



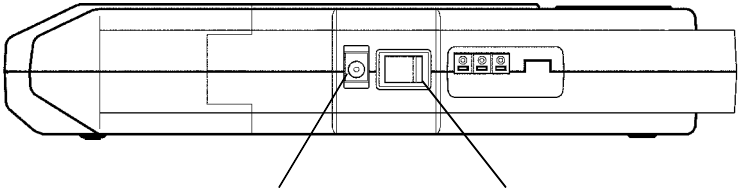
NOTE

- The battery pack is subject to self-discharge. Be sure to charge the battery before initial use. If the battery pack capacity remains very low after correct recharging, the useful battery pack life is at an end.
- Before storing the instrument, remove the battery pack from the instrument.
- The 9447 BATTERY PACK has a tendency to self-discharge. When the battery pack is in long-term storage, recharge about once every two months. If stored long-term in the discharged state, the battery pack characteristics will be impaired.
- If the battery capacity remains very low after correct recharging, the useful battery life is at an end.
- When not in use for a long time, remove the battery packs from the instrument before storage.

10.2 Recharging the 9447 BATTERY PACK

- When using the 9447 BATTERY PACK and the following warning message is displayed, recharge them. "WARNING 620: Battery low"
- If not using the 9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN), the recharging of the 9447 is not possible.

1. Connect the AC ADAPTER.
2. When the power switch is OFF, the LED above the START key will light in red to start the charging.
3. About 2 hours, the charging is completed and the LED automatically goes off to end.



NOTE

- When the power switch is ON, the battery charging is not performed.
- Always carry out battery charging at an ambient temperature between 10℃ and 40℃. Outside this range, not only is the charging capacity reduced, but also there is a possibility of reduced performance or electrolyte leakage.
- Attempting to recharge the battery outside of the temperature range (10 to 40℃) may degrade compounds within the battery, permanently shortening battery life.
- Only use the specified 9418-10 AC ADAPTER or 9418-15 AC ADAPTER for charging.

10.3 Removing the Battery Before Discarding the Instrument

WARNING

- **To avoid the risk of electric shock, be sure that all cables and the power cord are disconnected before removing the battery.**
- **Dispose of used batteries according to their type in the prescribed manner and in the proper location.**

The 8715-01 incorporates a lithium battery for memory backup. Before final disposal of the 8715-01, remove the lithium battery as described below.

1. Check that the instrument is powered OFF.
2. Remove the four screws which is holding on the rear panel with a Phillips screwdriver (see Figure 1). And remove the printer instrument connecting portion.
3. Remove the two hidden screws in the cover using a Phillips screwdriver (see Figure 2).
4. Remove the upper case (front).
5. Wrench up the battery, and cut the positive (+) connection with nippers (see Figure 3). Wrench the battery up further.
6. Cut the negative (-) connection, which was underneath the battery.

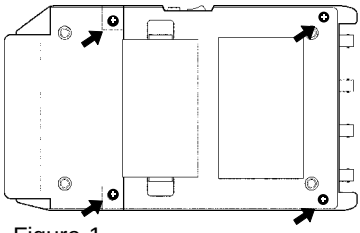


Figure 1

CALIFORNIA, USA ONLY

This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply.
See
www.dtsc.ca.gov/hazardouswaste/perchlorate

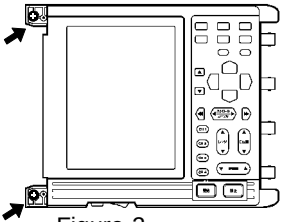


Figure 2

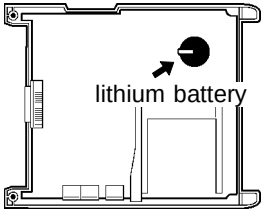


Figure 3

10.4 Cleaning the Printer Head

The maintenance of the printer is not especially required. However, depending upon the conditions of use, and especially if the printer has been used over a long period of time, it is possible for dirt or paper dust to adhere to the printer thermal head, causing the printing to be faint or otherwise indistinct. If this occurs, use one of the following procedures to clean the printer head.

Method 1

1. Press the SET key and ▲/▼ key to call up the Initialize screen.
2. Move the flashing cursor to the "Printer" item.
3. Press the DMM key to clean the print head by printing a solid pattern.
   If this method does not alleviate the problem, perform the steps of cleaning method 2 as described below.

Method 2

1. Moisten printer paper on the rear with alcohol and set the paper in the printer. (If the front side of the paper is moistened, discoloring will occur.)
2. Lower the head up/down lever and move the printer paper back and forth to clean the head.

NOTE

- Do not use organic solvents such as thinner or benzene, which could discolor or deform the instrument.
- After applying a solvent, be certain that the printer is completely dry before use to avoid discoloring or deforming the instrument.
- After extended use, paper residue (visible as a white powder-like substance) may accumulate on the roller. While a small amount of residue has no adverse effect, the roller can be cleaned using a air-blow brush (such as sold as a camera accessory).
- Always use the paper cutter integrated in the printer cover to cut printer paper. If the paper is cut near the thermal head, a large amount of paper residue may accumulate on the roller.

10.5 Troubleshooting

If the instrument does not seem to operate normally, check the following points before requesting service.

The screen and indicators do not light when powered on.	・Is the AC Adapter correctly connected? ・Are the batteries correctly inserted? ・Are the batteries near the end of their useful life? ・When the battery capacity is reduced, the power is automatically turned off. Before turning on the power again, turn the power off first and leave the instrument for about 30 seconds. ・Is the contrast too dark?
The normal screen is not displayed when turning the power on.	Are the batteries near the end of their useful life?
No waveform appears on the screen when the START key is pressed.	・Is the "Pre-Trig wait." message displayed? When recording before the trigger, until the corresponding item interval has elapsed, a trigger is not accepted. ・Has the "Wait for trigger" message appeared? Check the trigger settings. ・Are all of the waveform display colors for each channels switched off?
There is absolutely no variation in the recorded waveform.	・Is the measurement range setting appropriate? ・Is the input cord correctly connected? ・Has a low pass filter been set?
The printed recording is very faint or non-existent.	・Is the recording paper back to front? ・Are you using the correct recording paper? ・Is there enough power left in the battery pack?
Recording lines are dense or blurred.	Input signal contains ripple components. Make suitable filter settings.
The screen does not appear and the green LED stays on or blinks.	The backlight has been switched off by the LCD saver function. Press any key to switch on the backlight.

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.
Also refer to Appendices (Error messages) and Index for more information.

System reset

To perform a system reset, power ON the instrument while holding down the STOP key. The settings are initialized, and revert to the factory settings.

10.6 Cleaning of the Instrument

- 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.

Chapter 11
Appendix

11.1 Messages

Error messages

Error messages are displayed until the cause of the error is remedied or the STOP key is pressed.

1	Paper End.	Printer paper has run out. Reload.
2	Set printer lever.	Lower the head up/down lever.
12	Printer is not connected.	The printer is not connected.
14	Printer Error.	Check the built-in printer.
21	Battery low (Printer)	Battery voltage is low

Warning messages

When an error occurs, the accompanying warning message is displayed only once (and disappears after a few seconds). Warning messages can be cleared by pressing any key.

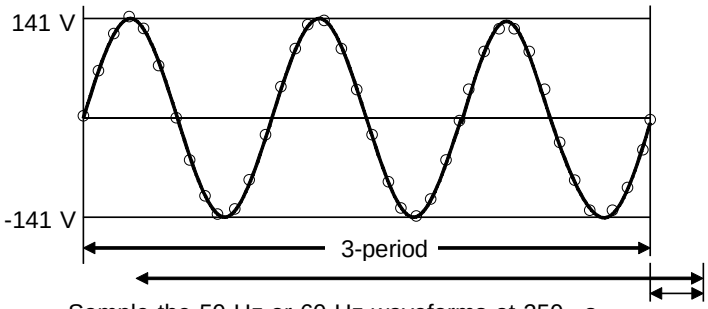
50	Error	The PC card format is incorrect. Please use a PC to reformat it to FAT-16 format.
71	Cannot load.	Data cannot be loaded, because it is not a set of data created by the 8715-01.
72	Illegal format.	The media is not a correctly formatted MS-DOS.
75	File is read only.	File cannot be deleted, because it is read- only.
76	General failure.	Access to disk is not possible because of some error, such as in formatting or file saving.
80	Insert PC card.	No card is present in the PC card slot. Insert one.
90	File already exists.	Rename a file.

91	Directory full.	Since only a limited number of files (including directory) can be created in the root directory.
93	Disk full.	Little capacity is available. Delete files or use new media.
94	Path name error.	Up to 127 characters can be used for a path name.
95	Empty directory name.	Name the directory.
96	Directory already exists.	Another directory of the same name exists. Saving cannot be performed.
99	Conditions for OVERWRITE are not satisfied.	Match the unit condition and file data condition (function and time-axis).
201	Set printer paper.	Printer paper has run out. Reload.
202	Set printer lever.	The head up/down lever has been left in the up position.
205	Invalid.	The key pressed is not valid, because measurement operation is in progress.
300	Cannot START.	Cannot start measurement from Advanced setting screen
349	Invalid.	When the time axis range is 20 ms/DIV, the waveform evaluation trigger is disabled.
382	No waveform data.	There is no waveform data to display on the Waveform Display screen. Data must be input before processing can start.
397	Out of range.	Input the appropriate value.
398	A/B cursor positions invalid.	Move the cursors to the appropriate position.
620	Battery low.	Recharge or change the battery pack.
621	Battery low	Battery voltage is low.

11.2 RMS Value

Input data sampled at a fixed 250 µs rate is subjected to 800 RMS calculations per second.
One division is equal to 80 samples.

Calculate one RMS value



Sample the 50 Hz or 60 Hz waveforms at 250 µs and calculate one RMS value item using three-period data.

1/800seconds

Afterwards, the RMS data is calculated in 1/800 second intervals.

The maximum and minimum values are specified based on the RMS-value data (by multiplying 600 RMS-value data items per second by the time-axis range [s/division]/80), and the data containing these maximum and minimum values are defined as one item of sample data. When the time-axis range is set to 1 min/division, the maximum and minimum values are specified in the RMS-value data (800X60 [s/division]/80 = 600), and the data containing these maximum and minimum values are defined as one item of sample data.

11.3 Text File Internal Format

Text files consist of a header and a data section.
The header consists of the following measurement-related information:

COMMENT	Overall waveform comment
DATE	Measurement month, day and year (in MM-DD-YYYY format)
TIME	Trigger time (in HH:MM:SS format)
NUM_SIGS	Number of data types (including time axis data)
INTERVAL	Sampling rate (= time axis range / 80) (When intermittent measurement is not on)
HORZ_UNITS	Time axis units (S = seconds)
VERT_UNITS	Vertical data units (including time axis data)
SIGNAL	Data name
DATA	Indicates the end of the header. Measurement data follows.

Data from four channels saved in the Waveform Measurement Mode

"COMMENT","8715 Waveform Measurement Data"
"DATE","01-01-2000"
"TIME","00:00:24"
"NUM_SIGS", 5
"INTERVAL", 1.250E-05
"HORZ_UNITS", "S"
"VERT_UNITS", "S", "V", "V", "V", "V"
"SIGNAL","TIME", "ACH1", "ACH2", "ACH3", "ACH4"
"DATA"
+0.000000E+00, +2.5000E+00, +2.7500E+00, +2.5000E+00, +2.3750E+00
+1.250000E-05, +2.5000E+00, +2.7500E+00, +2.5000E+00, +2.5000E+00
+2.500000E-05, +2.5000E+00, +2.7500E+00, +2.5000E+00, +2.3750E+00
+3.750000E-05, +2.5000E+00, +2.7500E+00, +2.5000E+00, +2.3750E+00
+5.000000E-05, +2.5000E+00, +2.7500E+00, +2.5000E+00, +2.5000E+00
+6.250000E-05, +2.5000E+00, +2.7500E+00, +2.5000E+00, +2.5000E+00

Saved data from Power Trend RMS Recording

"COMMENT","8715 Power Monitoring RMS Data"
"DATE","01-01-2000"
"TIME","00:02:49"
"NUM_SIGS", 9
"INTERVAL", 1.250E-01
"HORZ_UNITS", "S"
"VERT_UNITS", "S", "V", "V", "V", "V", "V", "V", "V", "V"
"SIGNAL","TIME", "ACH1(Max)", "ACH1(Min)", "ACH2(Max)", "ACH2(Min)", "ACH3(Max)", "ACH3(Min)", "ACH4(Max)", "ACH4(Min)"
"DATA"
+0.000000E+00, +2.4375E+00, +2.4375E+00, +2.6250E+00, +2.5625E+00, +2.5000E+00, +2.5000E+00, +2.3750E+00, +2.3750E+00

+1.250000E-01, +2.4375E+00, +2.4375E+00, +2.6250E+00, +2.6250E+00, +2.5000E+00, +2.5000E+00, +2.3750E+00, +2.3750E+00

+2.500000E-01, +2.4375E+00, +2.4375E+00, +2.6250E+00, +2.5625E+00, +2.5000E+00, +2.5000E+00, +2.3750E+00, +2.3750E+00

+3.750000E-01, +2.4375E+00, +2.4375E+00, +2.6250E+00, +2.5625E+00, +2.5000E+00, +2.5000E+00, +2.3750E+00, +2.3750E+00

+5.000000E-01, +2.4375E+00, +2.4375E+00, +2.6250E+00, +2.5625E+00, +2.5000E+00, +2.5000E+00, +2.3750E+00, +2.3750E+00

NOTE

- With the Trend RMS recording, sampling is performed faster than the time axis on the screen (the Recorder function samples at 4 kS/s.
- Input data is converted to sampling data corresponding to the range to be displayed on the screen.
  To save this data in the Trend RMS recording, two values, the maximum and minimum, are stored in memory.
- However, when data thinning is enabled, only the thinned data is retained.

11.4 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

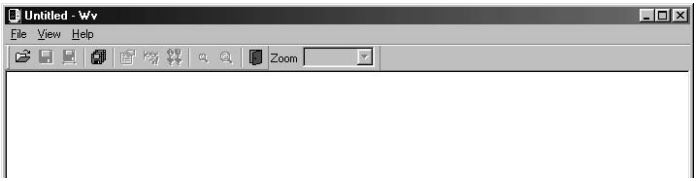
Installation

Install the viewer by following the procedure below.

1. When you insert the Application Disk (CD) 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.
   Click the [Browse] button to change the installation folder.
7. Click [Next] to start installation.
   The program is now installed.

11.4.1 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

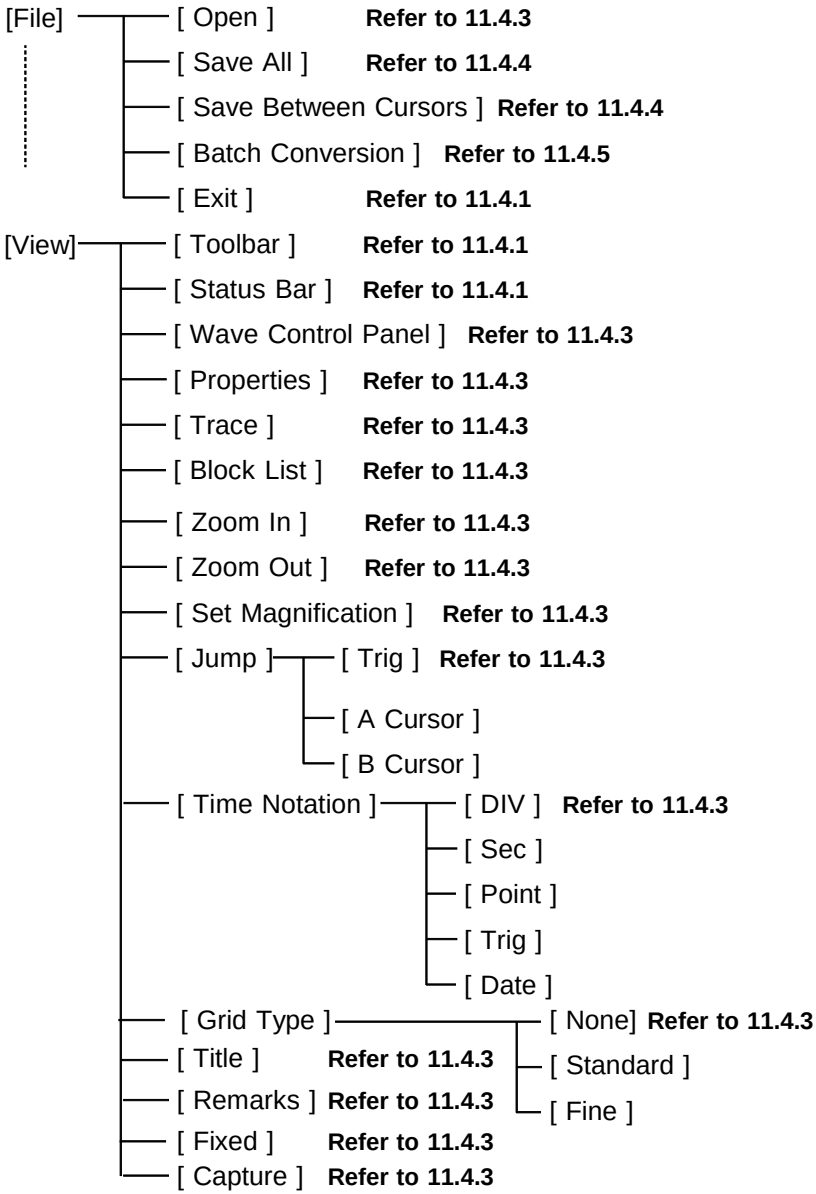
The status bar shows, from the left, the model name, function, recording length, time axis, trigger time, and pretrigger.

Version information

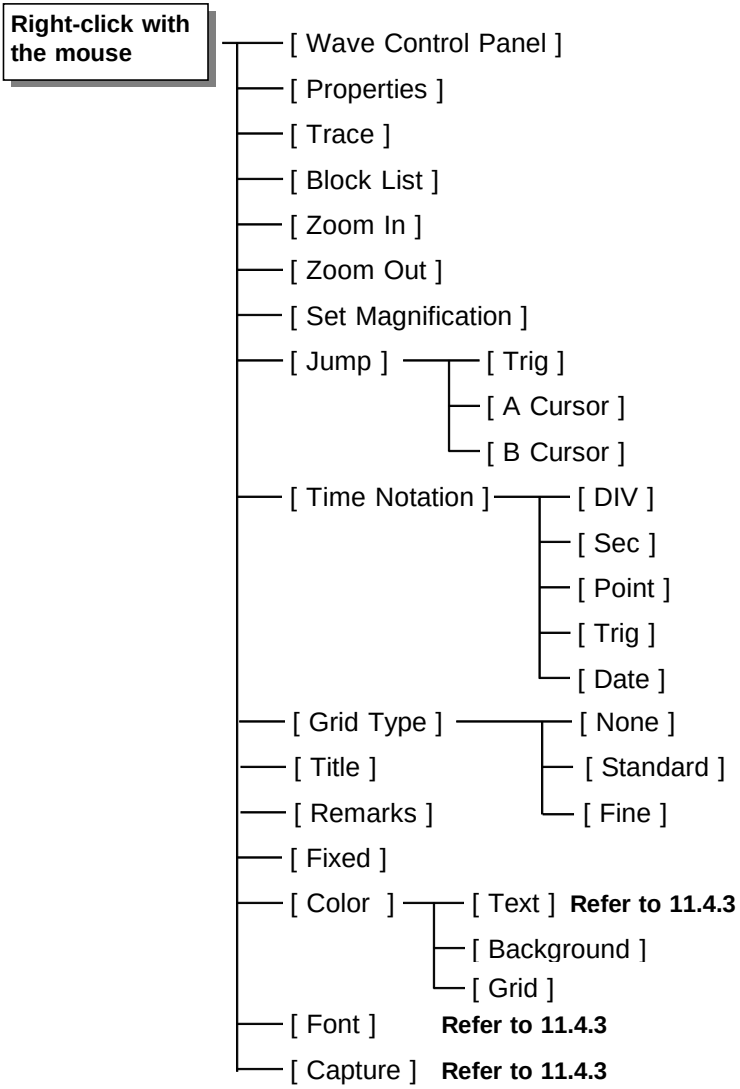
When making inquiries, the version number will be required.
To check the software version number, in the [Help] menu select [**About Wv**].

11.4.2 Waveform Viewer Menus

The following is the complete menu tree of the waveform viewer application.



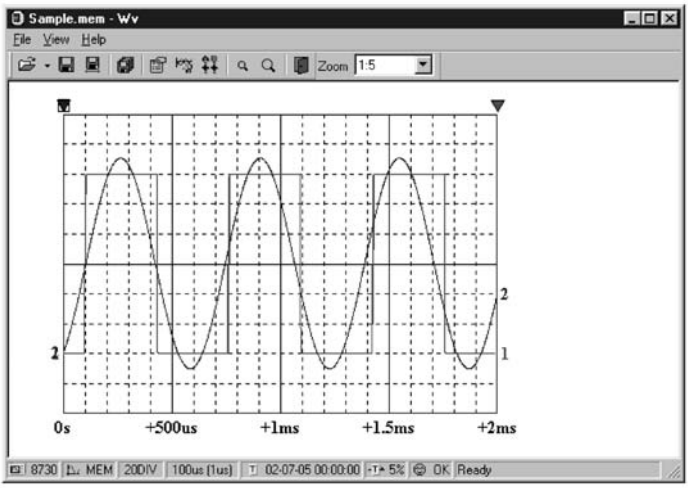
Right-click with the mouse in the waveform display screen for the following functions.



11.4.3 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.

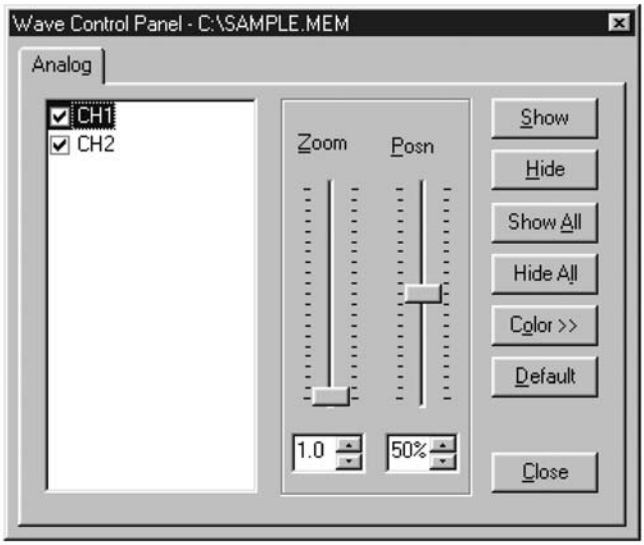


Changing the time axis scale (zoom function)

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 [**Waveform 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) back to their default values.
Close	Close the Waveform Control Panel.

Checking the waveform measurement conditions (Properties)

Select [**View**] - [**Properties**] on the menu to display the measurement settings on the MEMORY HiCORDER.

Checking voltage values (Trace)

Select [**View**] - [**Trace**] on 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**] - [**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**] - [**Jump**] on the menu to jump to the trigger position or the positions of the A or B cursors.

Time Notation

Select [**View**] - [**Time Notation**] on the menu to select the time notation on the waveform display screen.

Setting Grid Type

Select [**View**] - [**Grid Type**] on the menu to set the type of grid (None, Standard, or Fine).

Display of Title Comment

Select [**View**] - [**Title**] on the menu to display a title comment at the top of the waveform screen.

Waveform legend view

Select [**View**] - [**Remarks**] on the menu to view the instrument 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**] - [**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**] - [**Text**] [**Background**] [**Grid**] to display a dialog box for setting the respective colors.

Font settings (character size)

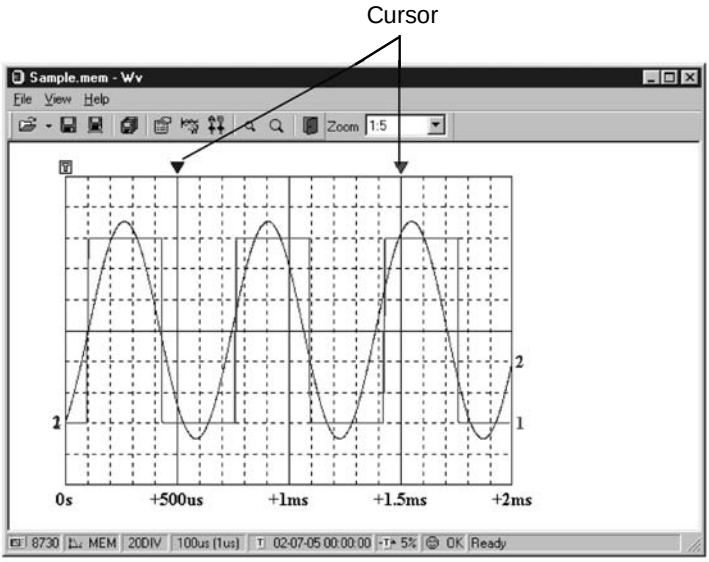
Right-click on the waveform display screen, and select [**Font**], to display the font setting dialog box. You can then select the font for text on the waveform display screen.

Waveform display snaps (capture)

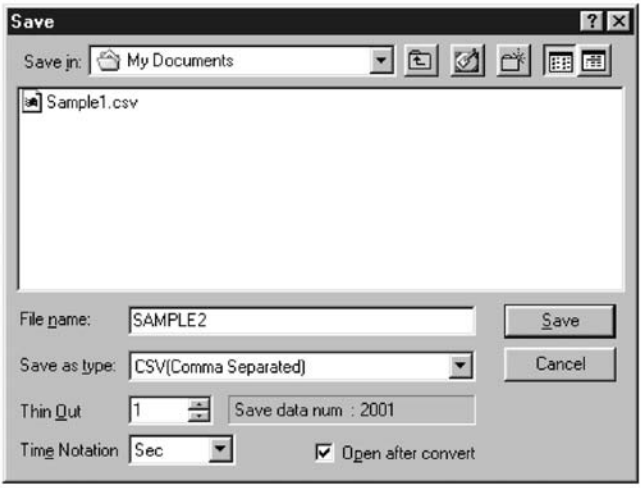
Select [**View**] - [**Capture**] on the menu to capture waveform display and copy to clipboard as a bit image. You can paste it into other applications.

11.4.4 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.

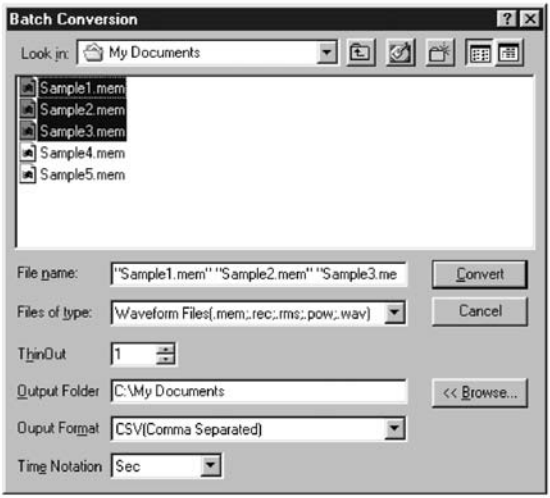
Select [**Time Notation**] from among [**Sec**], [**Date**], [**Trig**], and [**Point**].

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.

11.4.5 Converting Multiple Waveform Files into CSV Files

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.

Index

- K -

- L -

- M -

- O -

- P -

- R -

- S -

- T -

- V -

- W -

- Z -

- Other -

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name:	HIOKI E.E. CORPORATION
Manufacturer's Address:	81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name:	POWER HiCORDER
Model Number:	8715-01
Accessories:	9418-15 AC ADAPTER (SA145A-1240V-6, SINO AMERICAN) 9197 CONNECTION CORD
Options:	9217 CONNECTION CORD 9198 CONNECTION CORD 9199 CONVERSION ADAPTOR 9447 BATTERY PACK

The above mentioned products conform to the following product specifications:

Safety:	EN61010-1:2001 EN61010-031:2002
EMC:	EN61326-1:2006 Class A equipment Basic immunity test requirement EN61326-2-2:2006 Class A equipment Portable test, measuring and monitoring equipment used in low-voltage distribution systems 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.

HIOKI E.E. CORPORATION

19 December 2008

Atsushi Mizuno

Director of Quality Assurance

8715A999-06

HIOKI

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