HIOKI

INSTRUCTION MANUAL

8807-51
8808-51
MEMORY HiCORDER

HARMONIC WAVE ANALYSIS FUNCTION

HIOKI E. E. CORPORATION

Contents

1. General Description

The harmonic wave analysis function is designed exclusively for use with the 8807-51/8808-51 MEMORY HiCORDER.
For detailed information on the product and product functions, please refer to the manual for the main unit.

Features

(1) A range of harmonic wave analysis functions for commercial power supplies

- The 8807-51 is designed for analysis of single-phase 2-wire lines, while the 8808-51 is intended for analysis of single-phase 2-wire lines, single-phase 2-wire lines of two different systems, single-phase 3-wire lines, and 3-phase 3-wire lines.
- The function measures power supplies with a fundamental frequency ranging from 45 to 65 Hz.

(2) Fast Fourier transform in accordance with frequency

512 data points sampled at a rate of 400 kS/s are extracted for calculations.

(3) Two analysis modes to match specific applications

- Instantaneous analysis mode for analysis of instantaneous waveforms during measurement.
- Time-series analysis mode for recording and analyzing analysis data as time-series data.

(4) Extensive analysis items

Six types of analysis of harmonic waves of all degrees rms value, content ratio, phase angle, active power, power content ratio, and power phase angle and calculations of total rms value, total distortion, active power, reactive power, apparent power, and power factor are available.

(5) Instantaneous analysis mode

- Displays analysis results as spectral graphs or with numeric values, and stores result data.
- Displays all harmonic wave components from 1st degree to 40th degree on a single screen.

(6) Time-series analysis mode

- Data on 20 phenomena over a period of up to 30 days, or data on four phenomena over a maximum of 150 days, can be stored in memory.
- Four phenomena can be recorded in an overlapping manner on a single time axis to allow an easy grasp of the interrelationships among phenomena.
- The time axis can be set in seven levels from 5 min/DIV to 12 h/DIV.
- Smoothing function for cancellation of unexpected phenomena
- Pre-trigger function for observation of the signal prior to a trigger

(7) Harmonic wave trigger function

The trigger can be tripped for rms value, content ratio, all degrees power, power content ratio, power phase angle, total rms value, and any type of distortion of a selected harmonic wave component.

(8) Scaling function
Easy input setting for measurement using a clamp ammeter

(9) Equipped with anti-aliasing filter
Built-in low-pass filter prevents return distortion by eliminating all frequencies other than measurement targets.

(10) Over-range check function
Automatically switches to a lower sensitivity range when an input waveform exceeds the maximum input voltage.

2. Setup Procedures

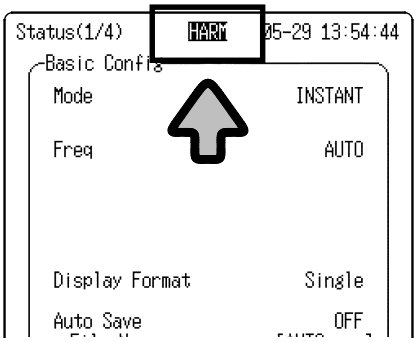
Setting examples

3. Basic Setting Items

3.1 Function Setting

The 8807-51 and 8808-51 each provide a total of four functions.
To use the harmonic wave analysis function, follow the procedures given below.

Setting Screen — **SET** **>>STATUS(1/4)/ CHANNEL(2/4)/ TRIGGER(3/4)/ ANALYZE(4/4)**

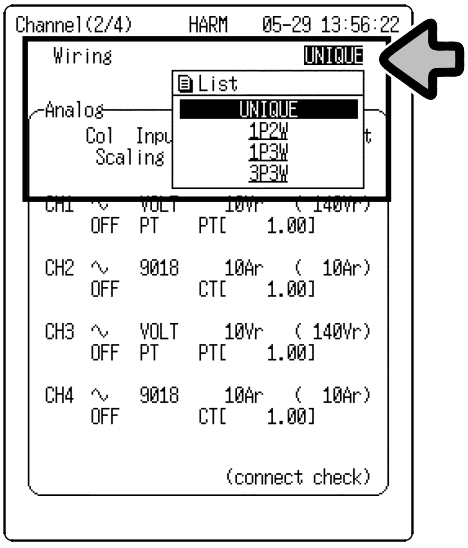


1. Move the flashing cursor to the location shown in the diagram.
2. Using the ▲▼ buttons, select **HARM**.

3.2 Measurement Target Setting

This screen is used to select the power supply type to be measured.

Setting Screen — **SET** **>>CHANNEL(2/4)**

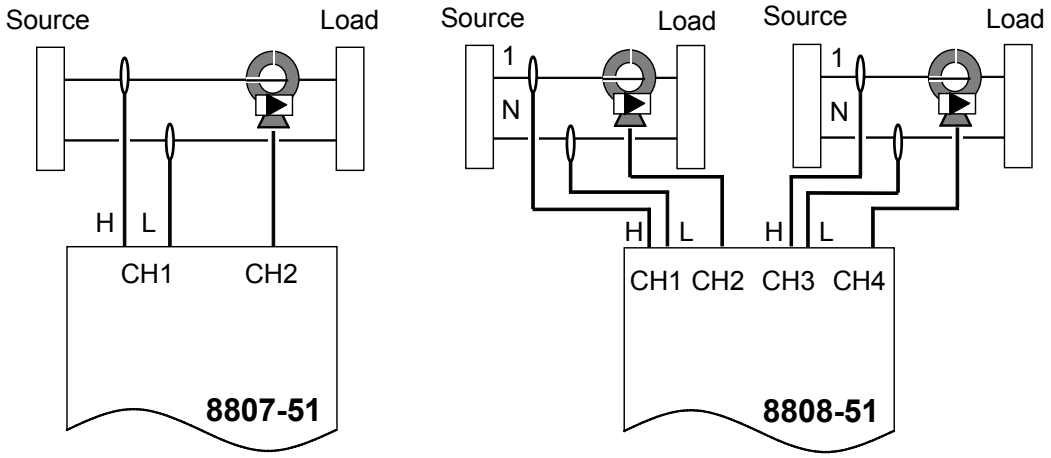


1. Move the flashing cursor to **Wiring**.
2. Make a setting using the ▲▼ buttons.

UNIQUE (Independent channels)	Conducts power analysis only when odd-number channel receives voltage input and even-number channel receives current input (clamp). (Any input type can be set.)
1P2W Single-phase 2-wire	Analyzes single-phase 2-wire line. Perform the setting so that odd-number channels receive voltage input and even-number channels receive current input (clamp). (The 8808-51 can analyze two single-phase 2-wire lines simultaneously.)
1P3W (Single-phase 3-wire)	Analyzes single-phase 3-wire line. (8808-51 only)
3P3W (3-phase 3-wire)	Analyzes 3-phase 3-wire line. (8808-51 only)

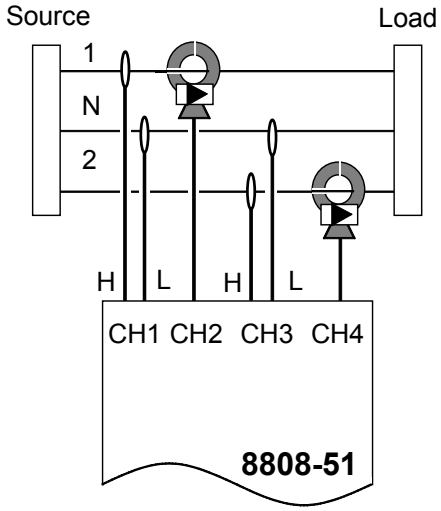
Single-phase 2-wire

Position the clamp with the current direction indicator pointing toward the load side.



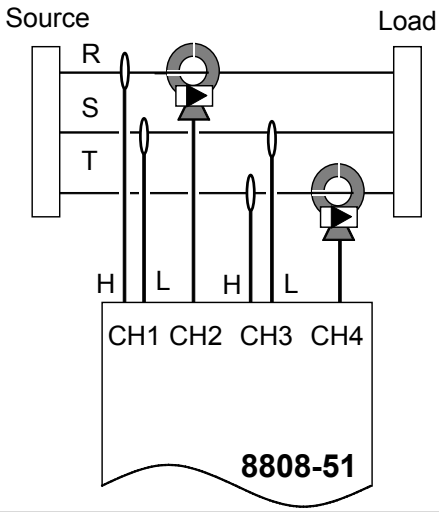
Single-phase 3-wire

8808-51 only



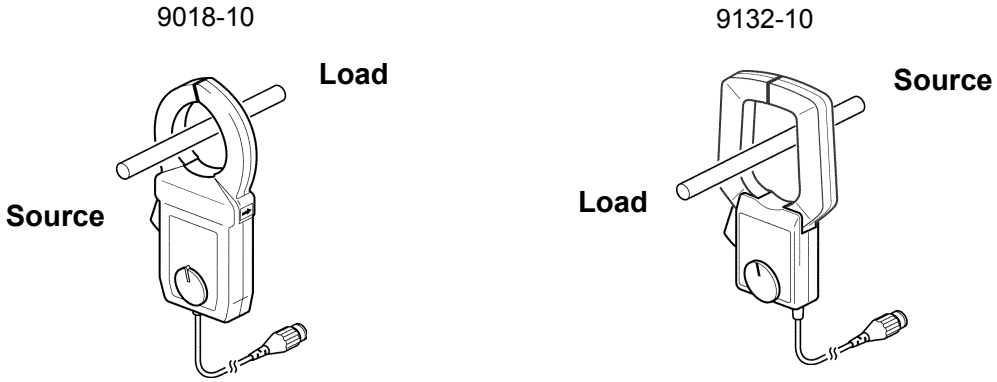
3-phase 3-wire

8808-51 only (3-phase 3-wire, 2-power meter method)



For example, when using a HIOKI clamp on probe, the clamping method should be as shown below.
If the clamp on probe is faced in the opposite direction, the phase will shift 180 degrees from the actual value.

NOTE The direction of connection for the 9132-10 is opposite from the 9018-10.

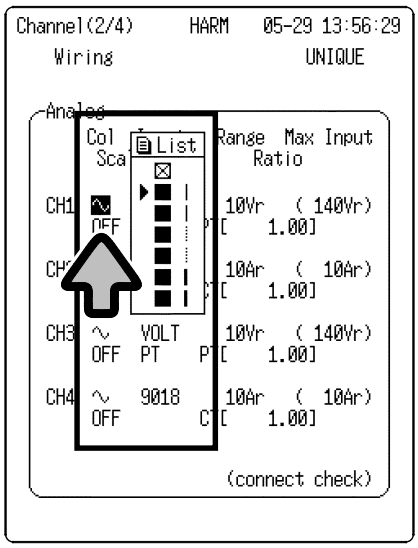


4. Analog Input Channel Setting

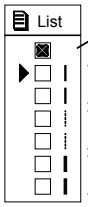
4.1 Waveform Display Color Setting

In instantaneous analysis mode, you can select the color of the displayed waveform.

Setting Screen — **SET >>CHANNEL(2/4)**



1. Move the flashing cursor to the location next to the channel to be set, as shown in the diagram.
2. Make a setting using the ▲▼ buttons.



OFF	Does not display waveform.
Red/Green	Prints waveform at standard print density.
Yellow/Light Blue	Prints waveform at low print density.
Blue/Gray	Prints waveform at high print density.

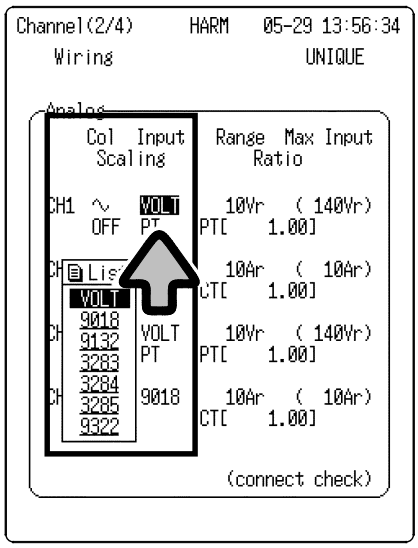
When the 8992 PRINTER UNIT is used to print a waveform, the three print densities are used to represent the selected waveform display color (6 colors).
Print density has no effect in real-time printing.

4.2 Input Type Setting

The input type must be set for each analog input channel.
Voltage and current in combination with the HIOKI Clamp Sensor can be measured.

When the name of clamp is selected, measurements are automatically converted to current values and displayed.

Setting Screen — **SET >>CHANNEL(2/4)**



(*)When a 3283, 3284, or 3285 CLAMP ON HiTESTER is selected, power analysis (harmonic wave active power, harmonic wave power content ratio, harmonic wave power phase angle, active power, apparent power, reactive power, power factor) cannot be performed due to the phase characteristics.
If the 3283, 3284, or 3285 is selected, the following warning message is displayed when power analysis begins.
"Warning 635: 3283,3284,3285 can't analyze power."

1. Move the flashing cursor to **INPUT**.
2. Make a setting using the ▲▼ buttons.

VOLT	For direct input of voltage or when using a general-purpose clamp probe
9018	(Current measurement) When using a 9018-10 CLAMP ON PROBE
9132	(Current measurement) When using a 9132-10 CLAMP ON PROBE
3283(*)	(Leakage current measurement) When using a 3283 CLAMP ON LEAK HiTESTER
3284(*)	(Current measurement) When using a 3284 CLAMP ON AC/DC HiTESTER
3285(*)	(Current measurement) When using a 3285 CLAMP ON AC/DC HiTESTER
9322	(High voltage measurement) When using a 9322 DIFFERENTIAL PROBE

NOTE

Precautions for measuring current using a HIOKI CLAMP ON PROBE/CLAMP ON HiTESTER

- Set the same measurement range for the 8807-51/8808-51 and the clamp. Accurate measurements are not possible if improper ranges are set.
- When using the 3283, 3284 or 3295 CLAMP ON HiTESTER for current measurement, press the OUTPUT button on the 3283/3284/3285 unit and set to **MON** (waveform output: AC).

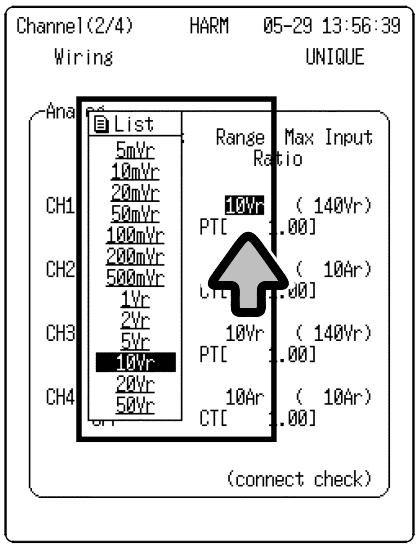
4.3 Vertical Axis Range Setting

The vertical axis range must be set for each channel.

When VOLTAGE is set as the input type:
Indicates rms voltage value per division when vertical axis magnification is set to "x1."

When CLAMP is set as the input type:
Indicates rms current value on full vertical axis scale.

Setting Screen — **SET >>CHANNEL(2/4)**



1. Move the flashing cursor to **RANGE**.
2. Make a setting using the ▲▼ buttons.

NOTE

- The input range for the harmonic wave analysis function is indicated as an rms value.
- In instantaneous analysis, the voltage value read by the cursor on the input waveform screen is indicated as an instantaneous value.
- Note that when VOLTAGE is selected as the input type, the maximum measurement voltage displayed on the channel screen becomes the guaranteed accuracy range.

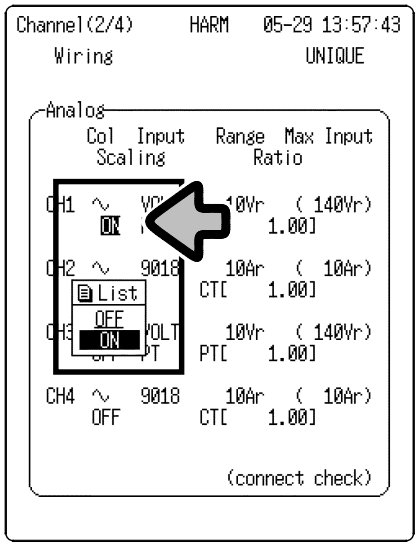
Q&A

Q1 What range should I select when measuring a commercial 110-Vrms power supply?	A1 Since commercial power supplies can fluctuate in the range of 10%, select a range that covers 121 Vrms (110 Vrms x 1.1). Maximum measurement voltage in 5-Vr range: 70 Vrms 70 Vrms < 121 Vrms X (over range) Maximum measurement voltage in 10-Vr range: 140 Vrms 140 Vrms > 121 Vrms O (appropriate range)
Q2 What range should I select when using the 9018 for 15-Arms measurement?	A2 The clamp probe range indicates the maximum full-scale input as an rms value. Select a range larger than the value of current to be measured. Be sure to set the same range in the clamp probe and the main unit. 10-Ar range setting: 10 Arms < 15 Arms X (over range) 20-Ar range setting: 20 Arms > 15 Arms O (appropriate range)

4.4 Scaling Setting

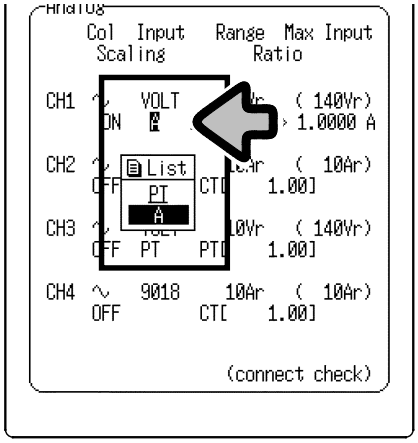
The scaling function can be turned On or Off when using a CT/PT or generic clamp probe.

Setting Screen — **SET >>CHANNEL(2/4)**



1. Move the flashing cursor to the location next to the channel to be set, as shown in the diagram.
2. Make a setting using the ▲▼ buttons.

OFF	No scaling
ON	Scaling provided



3. When VOLTAGE is set as the input type: Select the type of scaling.

PT	For PT rate setting
A	When a clamp probe other than HIOKI unit is used

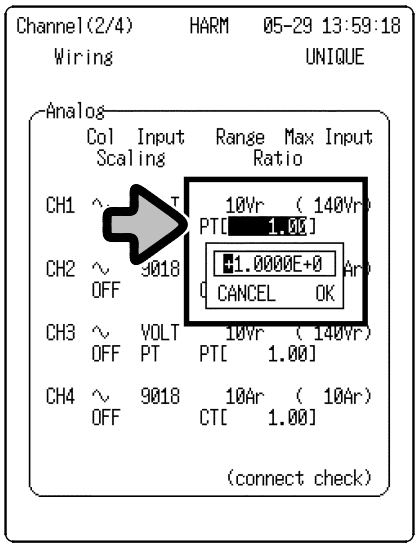
4.5 Scale Conversion Rate Setting

This screen is used to set the scaling conversion rate when using a CT/PT or other clamp probe.

Setting of CT/PT rate

Setting Screen

SET >>CHANNEL(2/4)



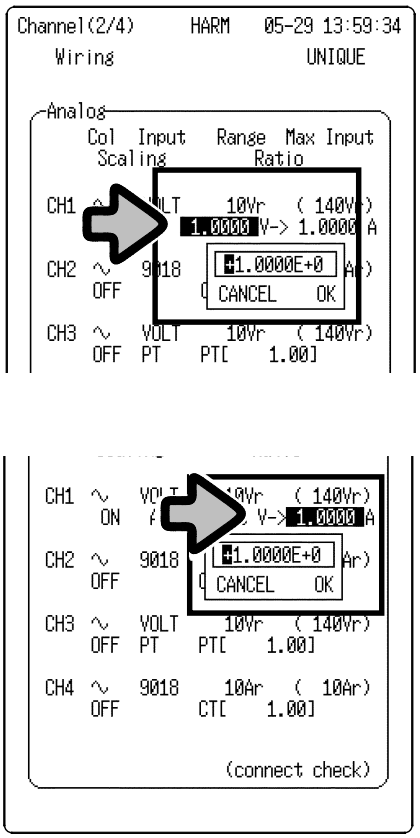
1. Move the flashing cursor to the location next to the channel to be set, as shown in the diagram.
2. Press the ▲▼ buttons to open the numerical value setting window.
3. Move the cursor to a selected digit in the numerical value setting window and enter a value using the ▲▼ buttons. (exponential notation)
4. To confirm the setting:
   Move the flashing cursor to **OK**, and press the ▲▼ buttons or the **START** button.
   To cancel the setting:
   Move the flashing cursor to **CANCEL** and press the ▲▼ buttons or the **STOP** button.

Q&A

Q1 How can I measure 1500 Arms using a combination of the 9020 CLAMP ON ADAPTER (10:1) and the 9018?	A1 When the 10:1 9020 is used to measure 1500 Arms, the 9020 unit outputs 150 Arms (1500 Arms x 1/10). To measure 150 Arms, the 9018 should be set to the 200 Arms range. With this setting, when scaling is turned ON and the conversion rate is set to "10.00," the screen will display "1500 Arms" as the measured value.

Settings for use of other clamp products

Setting Screen — SET >>CHANNEL(2/4)

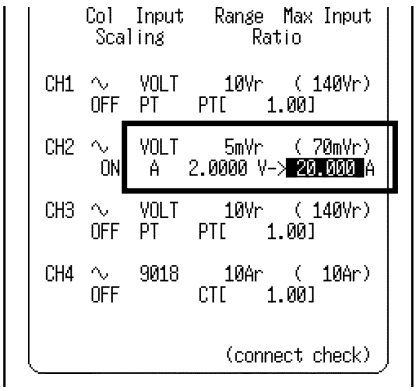


1. Move the flashing cursor to the location next to the channel to be set, as shown in the diagram.
2. Press the ▲▼ buttons to open the numerical value setting window.
3. Move the cursor to a selected digit in the numerical value setting window and enter an output voltage value using the ▲▼ buttons. (exponential notation)
4. To confirm the setting:
   Move the flashing cursor to **OK**, and press the ▲▼ buttons or the **START** button.
   To cancel the setting:
   Move the flashing cursor to **CANCEL** and press the ▲▼ buttons or the **STOP** button.
5. Move the flashing cursor to **A** and enter the measurement range of the clamp to be used. (Repeat steps 3 and 4.)

Q&A

Q1
How can I make high accuracy current measurements using a combination of the 9277 UNIVERSAL CLAMP ON CT and the 9555?

A1
When the 9277 and 9555 are used together, the voltage output becomes 2 Vf.s. with an input of 20 Af.s. In such cases, enter "2.00" in "VOLTAGE" and "20.00" in "A" for automatic conversion of measurement values to current values.



NOTE

The scaling in the harmonic wave analysis function is effective only for harmonic wave analyses.
The scaling setting in other functions is not valid in harmonic wave analyses.
You can enter a conversion rate even if scaling is set to OFF.

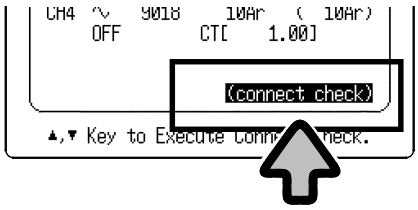
4.6 Line Connection & Level Check

This function is used to set an appropriate range for the input signal prior to measurement. When a clamp probe is used, this function checks the orientation of the probe. The check items vary by measurement target.

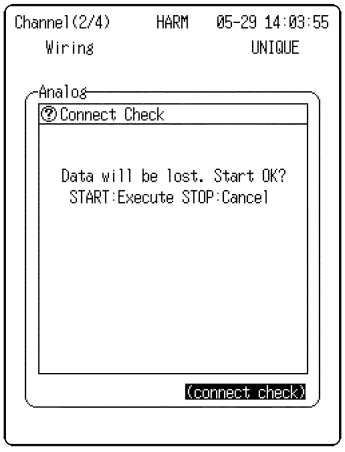
UNIQUE	Range check, voltage, and current phase check (when power analysis is valid)
1P2W	Input type check, range check, voltage, and current phase check
1P3W	Input type check, range check, voltage, and current phase check, voltage level imbalance check, single-phase 3-wire and 3-phase 3-wire detection
3P3W	Input type check, range check, voltage, and current phase check, voltage level imbalance check, single-phase 3-wire and 3-phase 3-wire detection, phase sequence check

Setting Screen

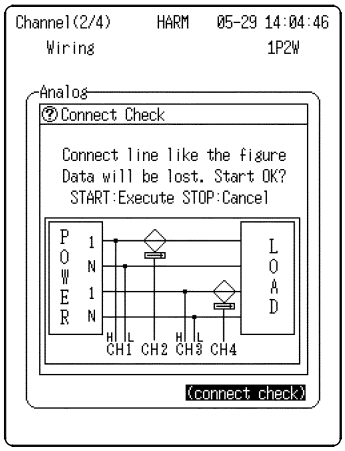
SET >>CHANNEL(2/4)



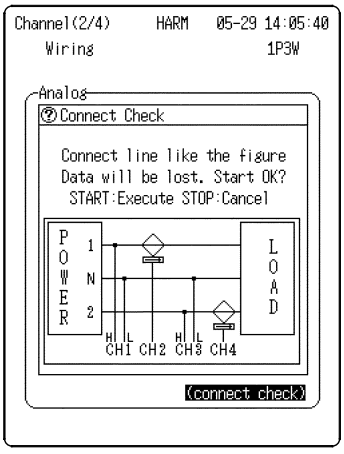
1. Move the flashing cursor to **(connect check)**, and press the ▲▼ buttons to open the connection diagram and check start window (diagrams at lower left). (The displayed window corresponds to the measurement target.)
2. Make connections according to the connection diagram.
3. To run the check after completing the connections:
   Press the **START** button.
   (The line connection & level check begins automatically.)
   To cancel:
   Press the **STOP** button.



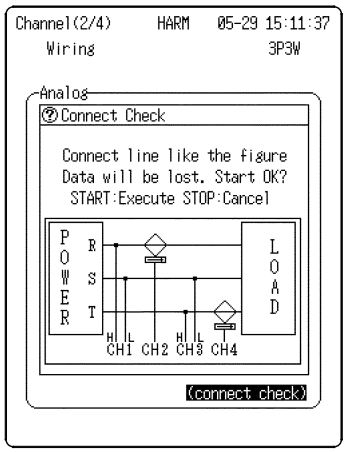
Independent channels



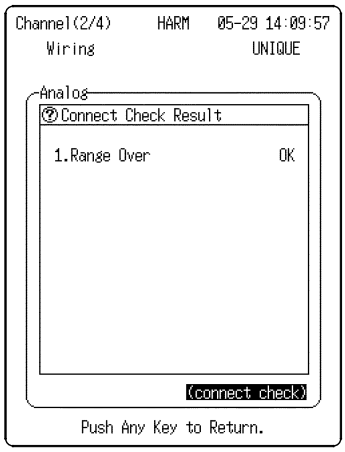
Single-phase 2-wire



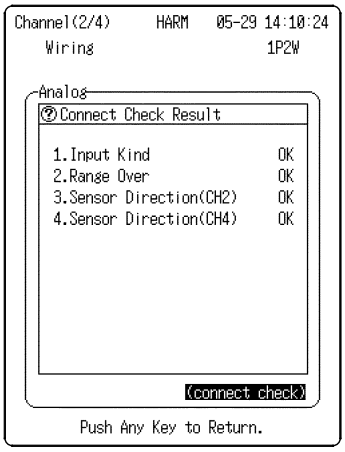
Single-phase 3-wire



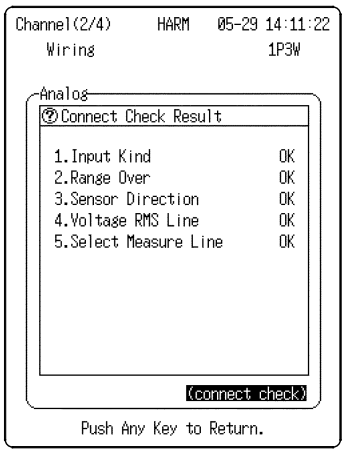
3-phase 3-wire



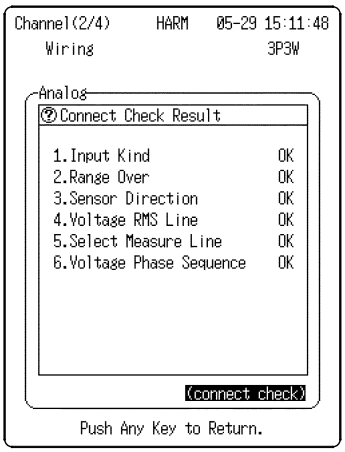
Independent channels



Single-phase 2-wire



Single-phase 3-wire



3-phase 3-wire

The result of each check is indicated by "OK" or "NG" (no good). When a check results in a "NG" result, the line connection & level check function halts, and details of the connection error are displayed.

4. Check the results of the line connection & level check.
   (The check items are automatically selected from the items listed below, according to measurement target.)

Range Over
Checks whether the range is appropriate for the waveform to be measured.
For voltage measurement, the range switches automatically to prevent input overshoot.
When the range switches, the following message appears: "Range changed. (Out of range) " (at the bottom of the screen)

Input type
(modes except "UNIQUE")
Checks that the settings are appropriate for power measurement.
Checks whether an appropriate clamp probe is connected.

Sensor Direction
Checks the orientation of the clamp probe.
If the level of voltage/current input signal is low, the screen indicates that a determination cannot be made.

Voltage RMS line
(when set for 1P3W or 3P3W)
Checks voltage level imbalance

Select Measure Line
(when set for 1P3W or 3P3W)
Checks whether measurement is for a single-phase 3-wire line or 3-phase 3-wire line.

Voltage Phase Sequence
(when set for 3P3W)
Checks the phase sequence when measuring a 3-phase 3-wire line.

5. When a check results in "NG":
   Check and correct connections and restart the line connection & level check.
   Repeat the check until all items show "OK."

NOTE

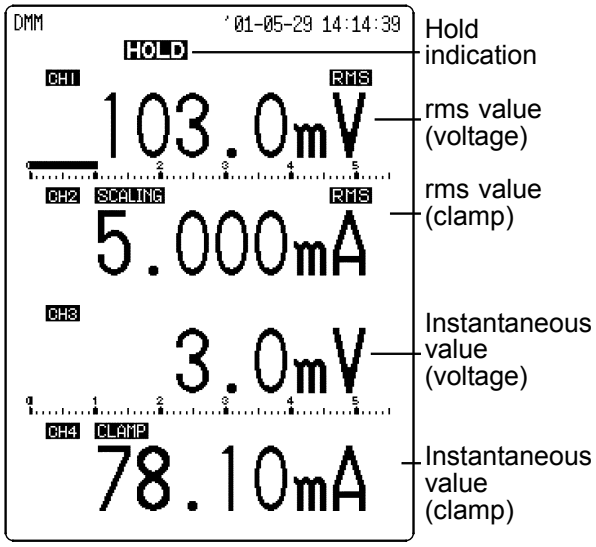
- If the input waveform phase is reversed, an accurate active power will not be displayed. Be sure to perform the line connection & level check before measurement.
- Note that the waveform data stored in memory is deleted when the line connection & level check is executed.
- If the voltage/current level is low, a reversed clamp connection may not be detected. In this case, the result of the clamp reversal connection check is displayed as "?."
- Connection errors may not be detected under the following conditions.
  1) When there are two or more connection errors.
  2) When the voltage/current level is low.
  3) When the power factor is low.
- In addition to the line connection & level check, we recommend checking the DMM screen for abnormal measured values.

4.7 DMM Function

The DMM function provides a numeric display of the input voltage of a commercial power supply (50/60 Hz) and DC signal on the screen.
The digital display can be switched between instantaneous value and rms value.
This function will not display accurate values if the input voltage is not of a commercial power supply (50/60 Hz) or a DC signal.
When the DMM screen is used with the harmonic wave analysis function, the range set in the harmonic wave analysis function is reflected in the display values.

Setting Screen

DISP >>DMM



1. Press the **DISP** button to open the waveform screen.
2. Press the **DISP** button on the waveform screen to open the DMM screen.

   To return to the waveform screen, press the **DISP** button on the DMM screen.

Display contents

Instantaneous value display: The indications show the instantaneous values of the input voltage of a commercial power supply (50/60 Hz) and DC signal.
RMS value display: The displayed value is an rms value calculated on the basis of the input voltage. The calculation is based on the following equation:

$$RMS = \sqrt{\left(\sum_{i=1}^{n} di^2/n\right)}$$

RMS: Rms value
n: Data number source
di: ith data in channel

"A" indication when clamp is used

This indication shows the channel that measures the current using the 9018-10/9132-10 CLAMP ON PROBE, 3283 CLAMP ON LEAK HiTESTER, or 3284/3285 CLAMP ON AC/DC HiTESTER, or with scaling applied by a generic clamp.

Switching between instantaneous value display and rms value display

Channels with rms value display are indicated with an "RMS" displayed on the DMM screen. You can toggle the display between instantaneous value and rms value in the following ways:
Change to all-channel rms value display: ▲ button
Change to all-channel instantaneous value display: ▼ button
Change the specified channel: **CH1, CH2, CH3, CH4** (channel to be changed)

Display hold/cancellation of hold

Display hold: **STOP**(The screen shows **HOLD**. The values displayed at the time that the button is pressed remain on screen.)
Canceling hold: **START**

Printing the DMM screen

Printing the displayed values: **PRINT**
Screen copy: **COPY**

DMM function specifications in harmonic wave analysis function

Measurement target: Commercial power supply (50/60 Hz) (automatic frequency setting)
Displayed information: Rms value or instantaneous value
Update rate: 1 s
Sampling speed: 4 kS/s
The number of displayed digits: 4 digits (the lowest digit indicates "0" when the actual value is between 0 and 4, and "5" when the actual value is between 5 and 9.). When scaling turned ON, exponential notation is used.
Accuracy: ±3% rdg. ±5 dgt.

NOTE

- With scaling turned OFF, the maximum voltage value that can be displayed is 5499. The auto range function switches to a lower range when the count falls below 500. The lowest digit indicates either "0" or "5."
- The color of the digital indication for each channel corresponds to the waveform display color set in instantaneous analysis mode.

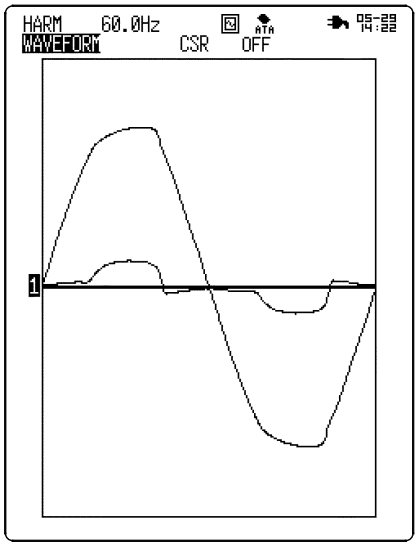
5. Instantaneous Analysis Mode

This mode is used to perform various analyses on one cycle of an input waveform.

5.1 Analyses and Display Screens

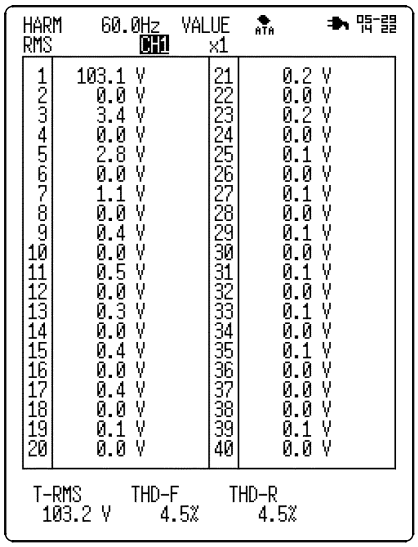
The analyses that can be performed in instantaneous analysis mode and analysis result screens are described below.
The instantaneous analysis mode supports six analyses (items), each with its own analysis screen, and seven analyses (parameter values) with numeric indications only.

(1) Input waveform ——— (WAVEFORM screen)

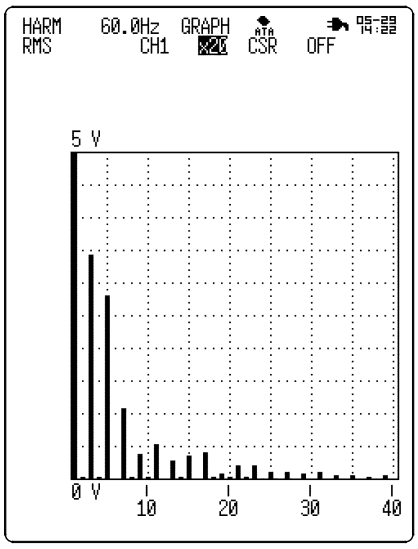


512 sample points are extracted from the data, which is sampled at a frequency of 400 kS/s.

(2) Harmonic wave rms value ——— (RMS screen)



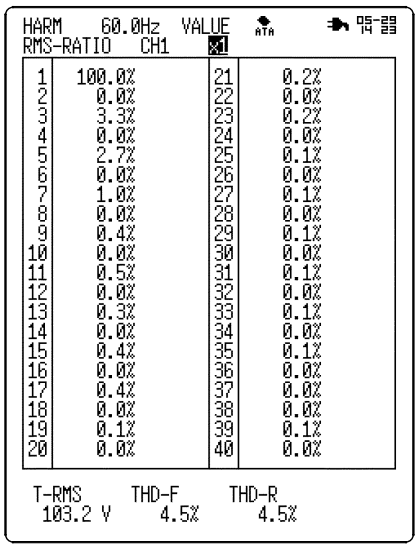
Numeric screen



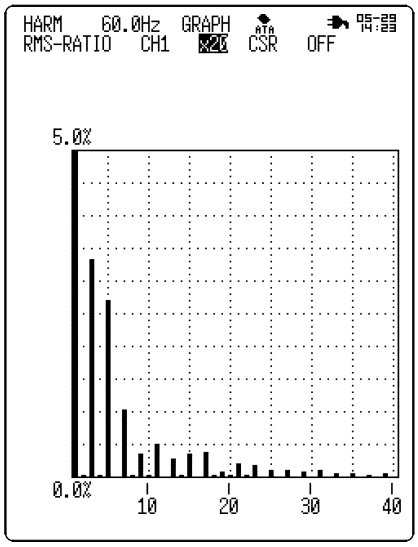
Graph screen

The screen displays the rms values of harmonic wave components of each input signal, ranging from the fundamental wave to the 40th degree.

(3) Harmonic wave content ratio (RMS-RATIO screen)



Numeric screen



Graph screen

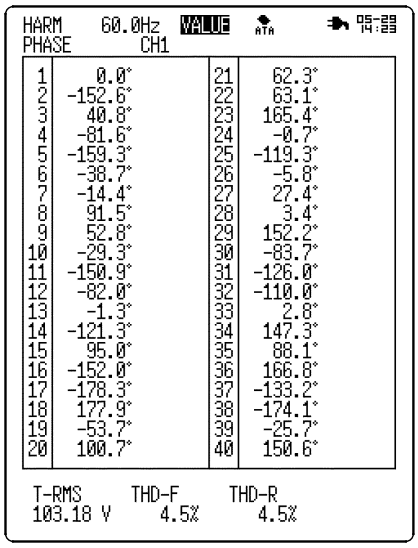
The screen displays the content ratios (%) of harmonic wave components of all degrees to the input signal.

The fundamental wave content ratio is assigned a value of 100% for the calculations.

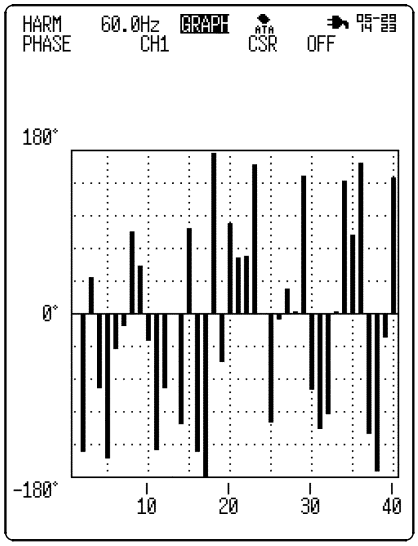
$$\text{Content ratio} = \sqrt{\frac{(\text{nth-degree harmonic wave})^2}{(\text{Fundamental wave})^2}} \times 100\ (\%)$$

(n = degree of harmonic wave)

(4) Harmonic wave phase angle (PHASE screen)



Numeric screen



Graph screen

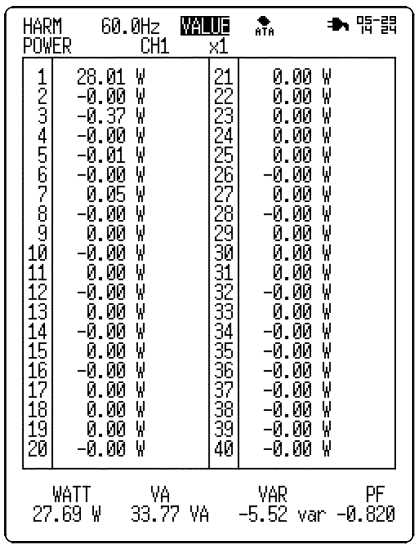
The screen displays the phase deviation of the harmonic wave components of all degrees from the fundamental input signal wave.

The input signal V can be expressed by the following equation:

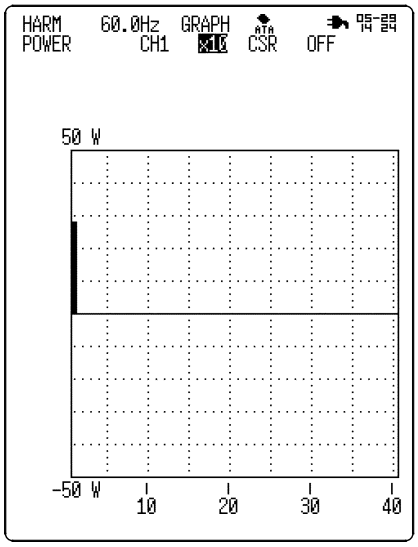
$$V = V_1\sin(\omega t)+V_2\sin(2\omega t+\theta_2)+V_3\sin(3\omega t+\theta_3)+ \ldots$$
$$\ldots. +V_{(n-1)}\sin\{(n-1)\omega t+\theta_{(n-1)}\}+V_n\sin(n\omega t+\theta_n)$$

$\omega = 2\pi/T$
t: Fundamental wave frequency
V_n: Rms value of nth degree
θ_n: Phase deviation of nth-degree harmonic wave from fundamental wave

(5) Harmonic wave active power (POWER screen)



Numeric screen



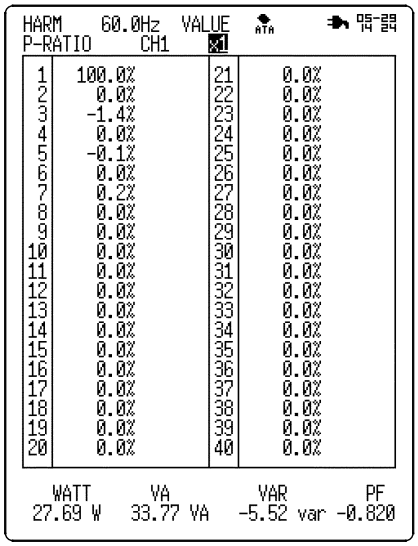
Graph screen

The screen displays the active power values (W) of the input signal harmonic wave components, ranging from the fundamental wave to the 40th degree.

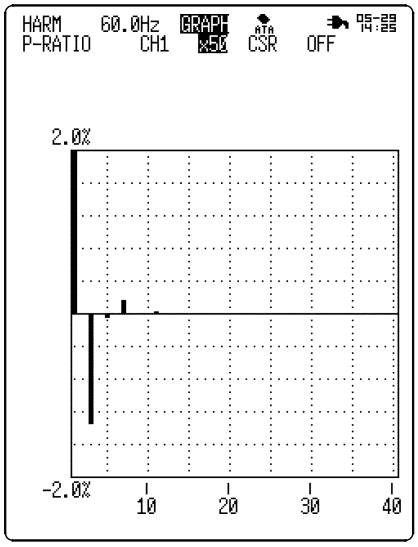
Active power = (Rms voltage value)$_n$ x (Rms current value)$_n$ x cos(Power phase angle)$_n$

(n = 1 to 40)

(6) Harmonic wave active power content ratio (P-RATIO screen)



Numeric screen



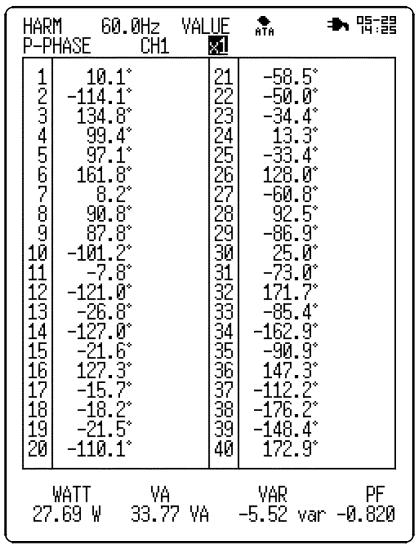
Graph screen

The screen displays the percentage of active power value of the harmonic wave component of each degree in the active power value (given a value of 100%) of the fundamental wave of input signal.

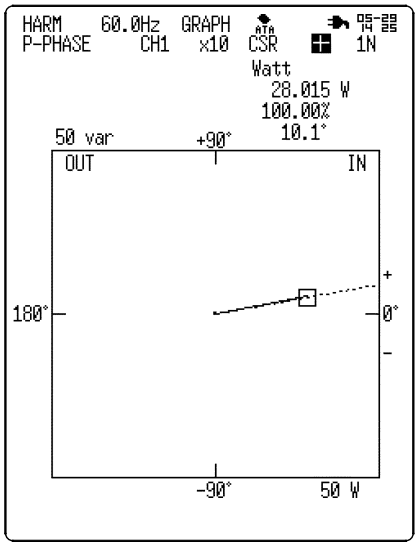
$$\text{Active power content ratio} = \frac{\text{Active power of nth-degree harmonic wave}}{\text{Active power of fundamental wave}} \times 100\ (\%)$$

(n = degree of harmonic wave)

(7) Harmonic wave power phase angle (P-PHASE screen)



Numeric screen

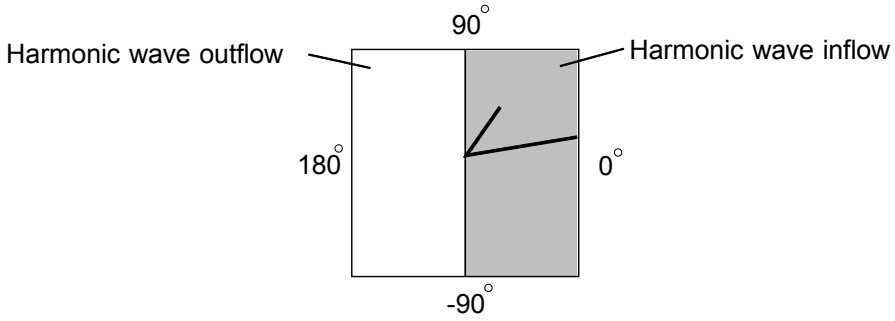


Graph screen

By measuring the phase angle of harmonic wave current of each degree relative to the voltage waveform, the screen indicates the direction of drift in the harmonic wave of each degree.

NOTE

- In the graph, the horizontal axis and vertical axis show active power and reactive power, respectively, while vector length indicates the magnitude of rms value (apparent power).
- The power phase angle vector diagram shows the harmonic wave components of all degrees from the fundamental wave to the 40th degree.
- Specifying a desired harmonic wave component displays the component in the vector diagram as a solid line.
- Harmonic wave inflow and outflow can be determined as shown below.



(8) Parameters

The numeric screen displays the following parameters:

Analysis screen	Displayed parameters
RMS, RMS-RATIO, PHASE	Total rms, total distortion-F, total distortion-R
POWER, P-RATIO, P-PHASE	Active power, apparent power, reactive power, power factor

Total rms value

Sum of rms values of all harmonic wave components.

$$\text{Total rms value} = \sqrt{\sum_{i=1}^{40} (\text{nth-degree harmonic wave})^2} \quad \text{[V] or [A]}$$

(n = degree of harmonic wave)

Total distortion-F

Percentage of all harmonic waves in fundamental wave.
"F" refers to "fundamental."

$$\text{Total distortion-F} = \sqrt{\frac{\sum_{i=2}^{40} (\text{nth-degree harmonic wave})^2}{(\text{Fundamental wave})^2}} \quad [\%]$$

(n = degree of harmonic wave)

Total distortion-R

Percentage of all harmonic waves in total rms value.
"R" refers to "rms."

$$\text{Total distortion- R} = \sqrt{\frac{\sum_{i=2}^{40} (\text{nth-degree harmonic wave})^2}{\text{Total rms value}}} \quad [\%]$$

(n = degree of harmonic wave)

Active power

Mean value of the amount of work performed by one cycle of AC instantaneous power

$$\text{Active power} = \sum_{i=1}^{40} \{(\text{Rms voltage value})_n \times (\text{Rms current value})_n \times \cos(\text{Power phase angle})_n\} \quad [\text{W}]$$

(n = degree of harmonic wave)

Apparent power

Product of rms values of voltage and current

Apparent power = (Total rms voltage value) x (Total rms current value) (VA)

Reactive power

Value obtained by multiplying the product of rms values of voltage and current by sin.

$$\text{Reactive power} = \sum_{i=1}^{40} \{(\text{Rms voltage value})_n \times (\text{Rms current value})_n \times \sin(\text{Power phase angle})_n\} \quad [\text{var}]$$

(n = degree of harmonic wave)

Power factor

Cos of the phase difference between voltage and current.

Power factor = (Active power)/(Apparent power)

NOTE

- Harmonic wave analysis shows the results of analysis performed on sample data.
- Based on analysis results, the rms value and content ratio are calculated independently with a greater number of decimal places than are actually displayed on screen. Therefore, the results calculated for rms value and content ratio may differ slightly from the results obtained by calculating with the values displayed on the screen.
- If any of the following conditions is met, power measurement cannot be performed.

Condition 1	When CH1 and CH3 are set for current measurement (input type: voltage/ 9322, scaling: A) or (input type: 9018/ 9132/ 3283/ 3284/ 3285)
Condition 2	When CH2 and CH4 are set for voltage measurement (input type: voltage/ 9322, scaling: OFF/ PT)
Condition 3	When the input types of CH2 and CH4 are set to 3283/ 3284/ 3285

- If one of conditions 1 through 3 is met at the start of measurement and the following conditions apply, a warning message is displayed.

Setting		Condition		
		1	2	3
a	(Harmonic wave trigger) When the harmonic wave trigger source is set to "power of each degree," "power content ratio," or "power phase"	*1 Warning 633 (in 8807-51) 634 (in 8808-51)		*1 Warning 635
b	(Instantaneous analysis) When the analysis type is set to "active power," "power content ratio," or "power phase angle"			
c	(Time-series analysis) When the analysis item is set to "active power of each degree," "power content ratio," "power phase angle," "active power," "reactive power," or "power factor"			
d	(Instantaneous analysis) With the measurement target set to "independent channels" and the analysis type set to "waveform," "rms value," "content ratio," or "phase angle," when the analysis type is changed to "active power," "power content ratio," or "power phase angle" after measurement	*2 Warning 636		

*1: Measurement halts if one of the following warning messages is displayed:

Warning 633: Set CH1=Volt, CH2=Current (for 8807-51).

Warning 634: Set CH1,CH3=Volt, CH2,CH4= Current (for 8808-51).

Warning 635: 3283,3284,3285 can't analyze power.

*2: When the following warning message is displayed, the screen displays a table with no numeric values.

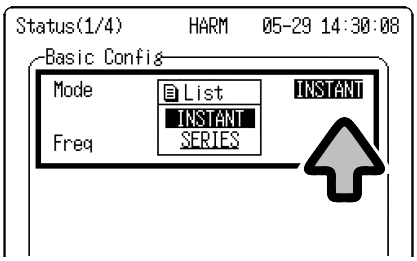
Warning 636: Don't analyze power.

5.2 Basic Item Setting

The following describes various setting items and setting methods.

1. Settings on Status Screen

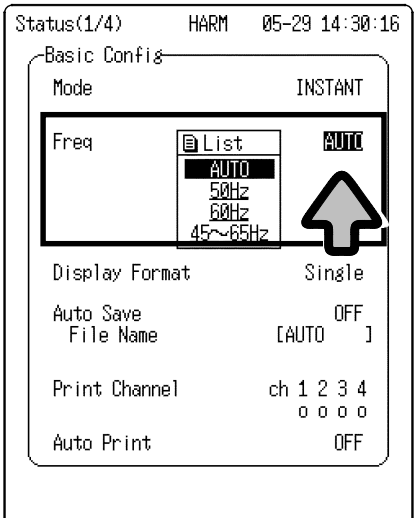
(1) Analysis mode setting — SET >>STATUS(1/4)



1. Move the flashing cursor to **MODE**.
2. Using the ▲▼ buttons, select **INSTANT**.

INSTANT	Conducts instantaneous analysis.
SERIES	Conducts time-series analysis.

(2) Frequency setting — SET >>STATUS(1/4)



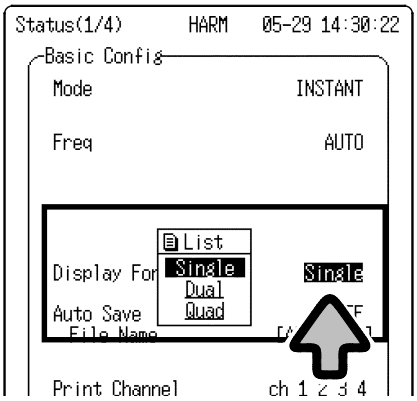
This item is used to set the power supply frequency of the analysis target.

1. Move the flashing cursor to **Freq**.
2. Select the setting using the ▲▼ buttons.

Auto	The frequency of the measurement target is automatically calculated (in 0.1-Hz steps) based on the input waveform.
50Hz	The frequency of the measurement target is set to 50 Hz.
60Hz	The frequency of the measurement target is set to 60 Hz.
45Hz-65Hz	For manual frequency settings (in 0.1-Hz steps).

NOTE The frequency estimate may fail if the waveform contains a significant amount of noise, or with square waves. If this happens, set the basic frequency manually.

(3) Multi-screen setting — SET >>STATUS(1/4)



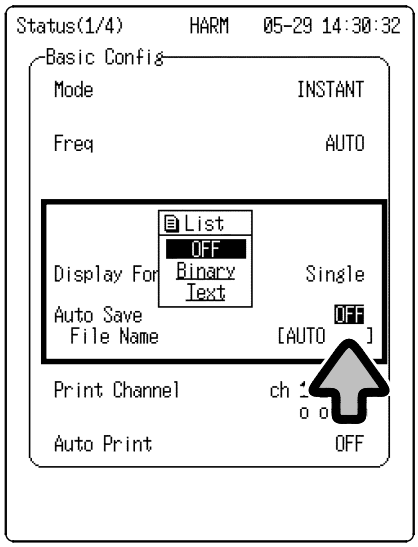
The input waveform screen can be divided into sub-screens, each displaying one channel.

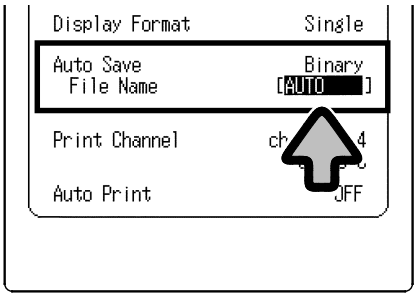
1. Move the flashing cursor to **Display format**.
2. Using the ▲▼ buttons, select the number of sub-screens to display.

Single	One graph for display and recording
Dual	Two graphs for display and recording
Quad	Four graphs for display and recording

The setting is valid only when the analysis type is set to "WAVEFORM."

(4) Auto save setting — SET >>STATUS(1/4)





You can have data saved automatically to a PC card when waveform analysis is complete. Data files are stored in the directory selected in the file screen.

Selecting the data format for auto save

1. Move the flashing cursor to **Auto Save**.
2. Using the ▲▼ buttons, select the data format for data to be saved by the auto save function.

OFF	The auto save function is turned off.
Binary	Data is saved in binary format (for use in 8807-51/8808-51 only).
Text	Data is saved in text format (for used in PC). (Data saved in text format cannot be loaded on the 8807-51 or 8808-51.)

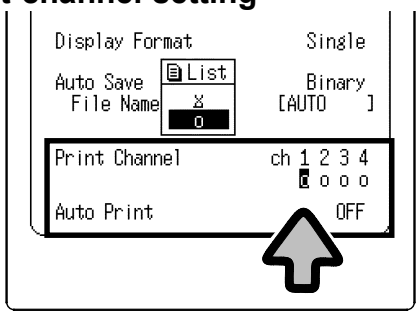
Entering a file name for auto save

When a file name is entered, the auto save function stores the file with that name. When several files are saved in succession, they are assigned individual numbers.

If no file name is entered, files are named "AUTO.***", "AUTO0001.***", and so on.

For information on the file input method, see Section 9.1 "Input of File Name."

(5) Print channel setting — SET >>STATUS(1/4)



Select a channel from which results of measured data analysis are printed.

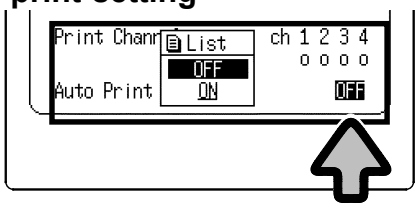
1. Move the flashing cursor to the location of each channel position, as shown in the diagram.
2. Using the ▲▼ buttons, select to print or not print analysis results for each channel.

O	Print analysis results.
x	Do not print analysis results.

The setting is valid only when analysis results are displayed as numerical values.

For active power, power content ratio, and power phase angle, the power analysis results of the systems containing the channels set for printout are printed.

(6) Auto print setting — SET >>STATUS(1/4)

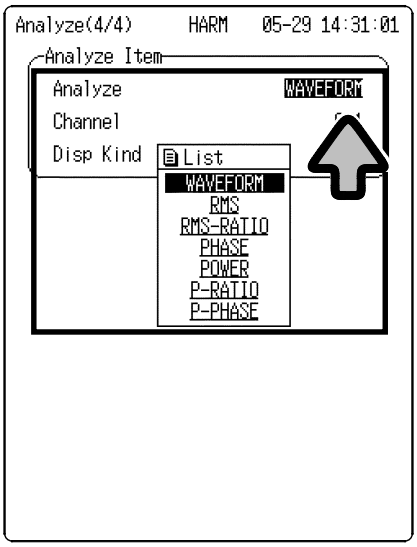


You can have data printed automatically when waveform analysis is complete.

1. Move the flashing cursor to **Auto Print**.
2. Using the ▲▼ buttons, select ON/OFF for the auto print function.

2. Settings in the Analysis Item Screen

(1) Analysis type setting — SET >>ANALYZE (4/4)

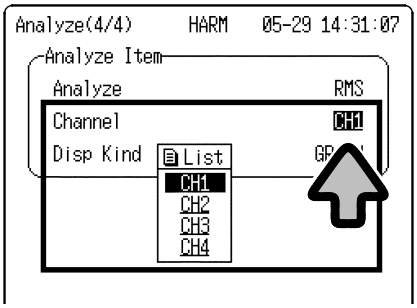


(*) Measurement is possible only when odd-number channels are set for voltage and even-number channels set for current. With HIOKI CLAMP ON SENSORS 3283, 3284, or 3285, power measurement cannot be performed, due to inadequate phase accuracy.

Select the analysis result to be displayed.
1. Move the flashing cursor to **Analyze**.
2. Select the setting using the ▲▼ buttons.

WAVEFORM	Displays waveform data based on 512 points extracted from data sampled at a rate of 400 kS/s.
RMS	Displays the harmonic wave rms value component of an input signal.
RMS-RATIO	Displays the content ratio of the harmonic wave component of any degree for the input signal.
PHASE	Displays deviations in harmonic wave component of any degree from fundamental wave of the input signal.
POWER (*)	Displays active power value (W) of harmonic wave component of any degree in input signal.
P-RATIO(*)	Displays active power content ratio of the harmonic wave component of any degree in active power (given a value of 100%) of fundamental wave of the input signal.
P-PHASE(*)	Displays the phase angle of the harmonic wave current of any degree relative to voltage waveform.

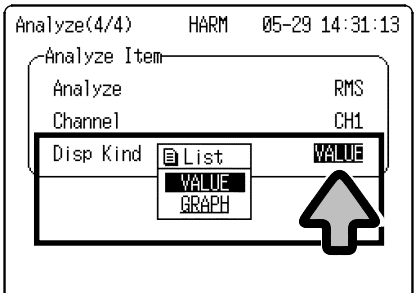
(2) Analysis channel setting — SET >>ANALYZE (4/4)



Select the channel to be analyzed.
Selection options vary depending on the analysis item.
vary depending on the analysis item.
1. Move the flashing cursor to **Channel**.
2. Select the setting using the ▲▼ buttons.

8807-51	CH1/CH2
8808-51	CH1/CH2/CH3/CH4

(3) Analysis result display setting — SET >>ANALYZE (4/4)

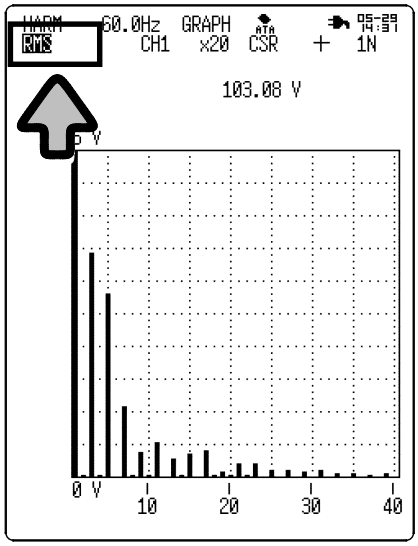


Select the method for displaying analysis results.
1. Move the flashing cursor to **Disp Kind**.
2. Select the setting using the ▲▼ buttons.

VALUE	Displays analysis results numerically.
GRAPH	Displays analysis results in graph.

3. Settings on Measurement Screen

(1) Analysis type setting — DISP >>Waveform display



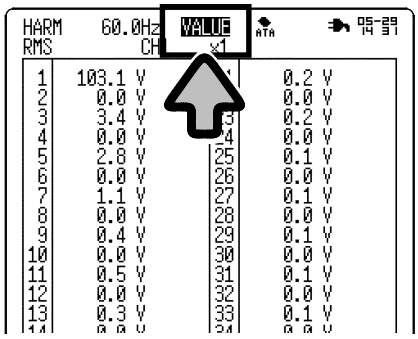
(*) Measurement is possible only when odd-number channels are set for voltage and even-number channels are set for current. With HIOKI CLAMP ON SENSORS 3283, 3284, or 3285, power measurements cannot be performed due to inadequate phase accuracy.

Select the analysis results to be displayed.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select the setting using the ▲▼ buttons.

WAVEFORM	Displays waveform data based on 512 points extracted from data sampled at a rate of 400 kS/s.
RMS	Displays the harmonic wave rms value component of the input signal.
RMS-RATIO	Displays the content ratio of the harmonic wave component of any degree for the input signal.
PHASE	Displays deviations in the harmonic wave component of any degree from the fundamental wave of the input signal.
POWER(*)	Displays active power value (W) of harmonic wave component of any degree in the input signal.
P-RATIO(*)	Displays active power content ratio of the harmonic wave component of any degree in active power (given a value of 100%) of the fundamental wave of the input signal.
P-PHASE(*)	Displays phase angle of harmonic wave current of any degree relative to voltage waveform.

(2) Analysis result display setting — DISP >>Waveform display

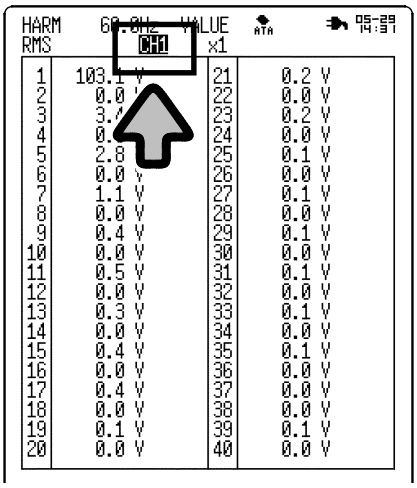


Select the method for displaying analysis results.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select the setting using the ▲▼ buttons. (not displayed on the input waveform screen)

VALUE	Displays analysis results numerically.
GRAPH	Displays analysis results in graph.

(3) Analysis channel setting ——— DISP >>Waveform display



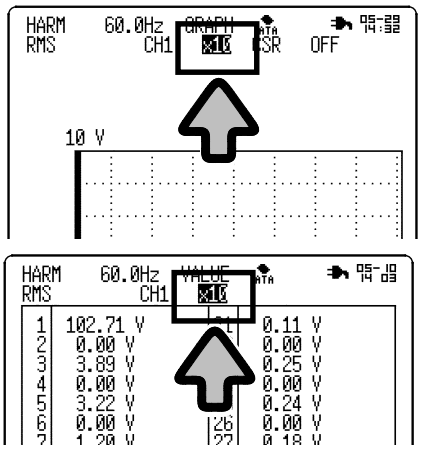
Select the channel to be analyzed.

1. Move the flashing cursor to the location indicated in the diagram
2. Select the setting using the ▲▼ buttons. Selection options vary depending on the analysis item.

8807-51	CH1/CH2
8808-51	CH1/CH2/CH3/CH4

For POWER, P-RATIO, P-PHASE, the analysis results of the system containing the selected channel are displayed.

(4) Analysis result magnification/compression ——— DISP >>Waveform display



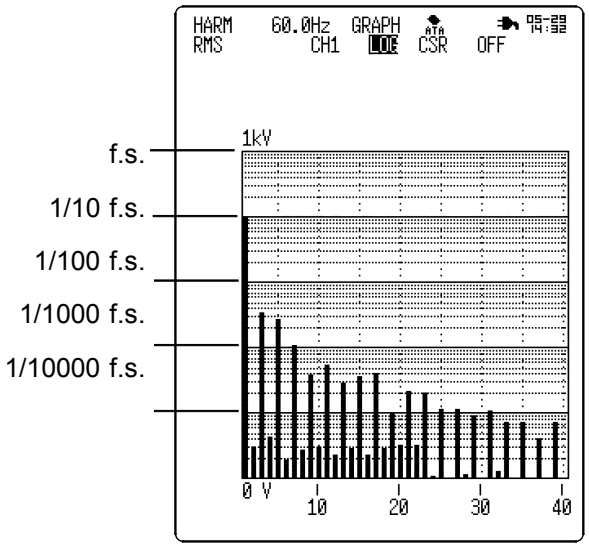
You can magnify or compress the displayed analysis results.
Magnified graph allows detailed examination of the results.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select the setting using the ▲▼ buttons.

LOG, x1/2, x1, x2, x5, x10, x20, x50, x100

NOTE

- When the analysis result is magnified by x10 or more, the display resolution increases order of magnitude. Note that the measurement accuracy is based on a display of x1 magnification.
- The vertical axis of the LOG display is as follows:

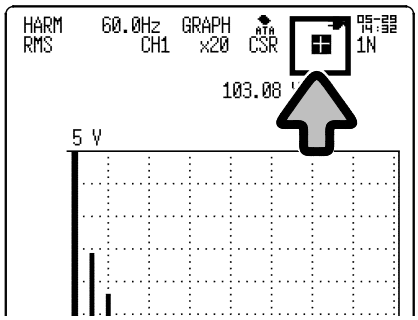


When the magnification is set to the LOG display on the POWER screen, the center value of the graph indicates the following:

When POWER (W) is selected: (1/100,000 of f.s.)

When P-RATIO (%) is selected: 0.01%

(5) Cursor ON/OFF setting (for graph screen only) ——— DISP >>Waveform display

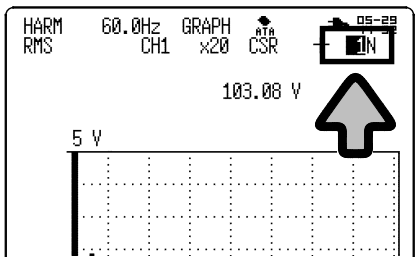


You can choose to hide or display detailed data for each harmonic wave on the screen.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select the setting using the ▲▼ buttons.

OFF	Cursor is not used.
+	Cursor is used.

(6) Analysis degree setting (for graph screen only) ——— DISP >>Waveform display

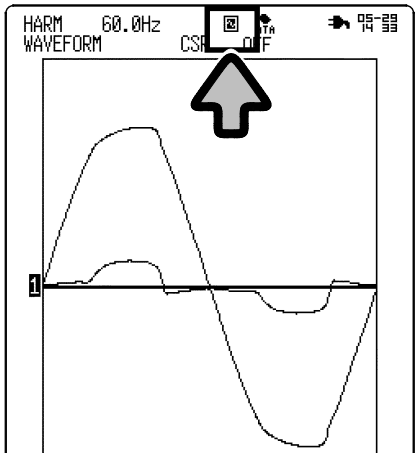


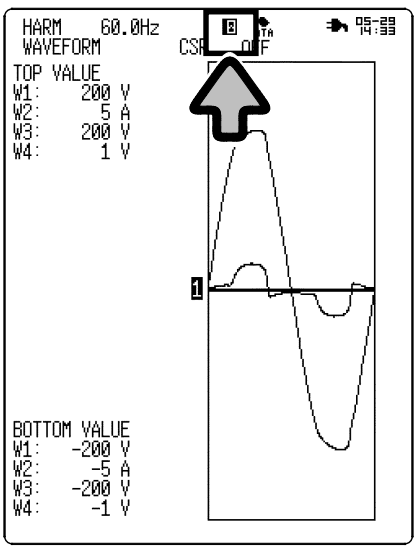
Use the cursor to select the analysis degree to read.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select the setting using the ▲▼ buttons.

From first degree to 40th degree

(7) Waveform display range setting (for waveform input screen only) ——— DISP >>Waveform display





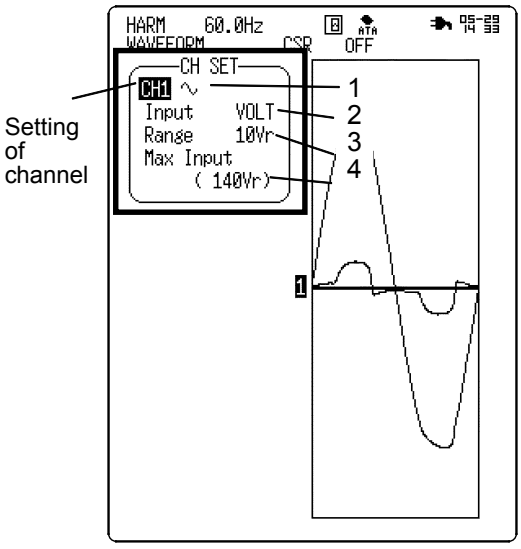
You can select the display size of the waveform input screen. Selecting the multi-screen setting displays the input range for the instantaneous waveform used for harmonic wave analysis.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select the setting using the ▲▼ buttons.

	Displays the input instantaneous waveform in a full screen.
	Displays the input instantaneous waveform in a sub-screen.

Upper and lower limit values for four channels (two channels with 8807-51) are displayed on the screen.

(8) Input setting (for waveform input screen only) ——— DISP >>Waveform display



Input can be set for each channel on the waveform input screen.

1. Using the **CH1**, **CH2**, **CH3**, **CH4** buttons, display the setting window for a selected channel.
2. Move the flashing cursor to the position of the channel to set and press the ▲▼ buttons. (You can change the setting window to input channels CH1 through CH4 (CH2 for the 8807-51).)
3. Move the flashing cursor to the item to be set.
4. Press the ▲▼ buttons.
5. To close the setting window, press the channel button again.

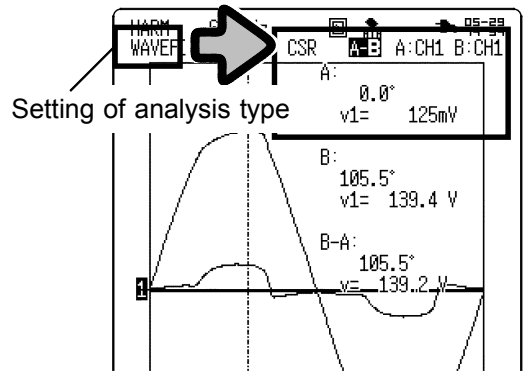
Setting details

1. Waveform display color	Used to select waveform display color
2. Input type	Used to select the input type for the analog input channel
3. Vertical axis range	Used to set the vertical axis range for each channel
4. Maximum input (display only)	Displays the maximum input that can be measured in the set vertical axis range.

5.3 Cursor Operation

In the input waveform screen, you can use the cursor to simultaneously read the phase relative to the zero crossing point and the voltage value.

Setting Screen ——— DISP >>Waveform display



1. Using the ▲▼ buttons, set the analysis type to **WAVEFORM**.
2. Move the flashing cursor to the location indicated in the diagram and select the cursor type using the ▲▼ buttons.

OFF	Do not use cursors A/B.
A	Use only cursor A.
A-B	Use cursors A and B and move cursor A.
A-**B**	Use cursors A and B and move cursor B.
A-B	Use cursors A and B and move both simultaneously.

3. Move the cursor using the ◀ SCROLL/CURSOR ▶ button and read an indication. Use the ◀◀ ▶▶ buttons to move the cursor quickly.

	Value of A or B	Value of B-A
t	Phase difference from zero crossing point	Phase difference between cursors
v	Instantaneous voltage (current) value of selected channel	Potential difference between cursors

5.4 Analysis Example 1: Simultaneous Instantaneous Analysis of Two 100-VAC Single-Phase 2-Wire Lines

NOTE

- This equipment is designed to measure input voltage. To measure current, use a voltage-output-type clamp ammeter. We recommend our CLAMP ON PROBE and CLAMP ON HiTESTER for current measurements.
- If a clamp ammeter is used to take measurements, the accuracy of both the 8807-51/8808-51 and the clamp affects the accuracy of measurements. Carefully check the specifications for the CLAMP ON PROBEs and select the unit most appropriate for the specific application. (Refer to Section 10 "Characteristics of Clamp-on Probes.")

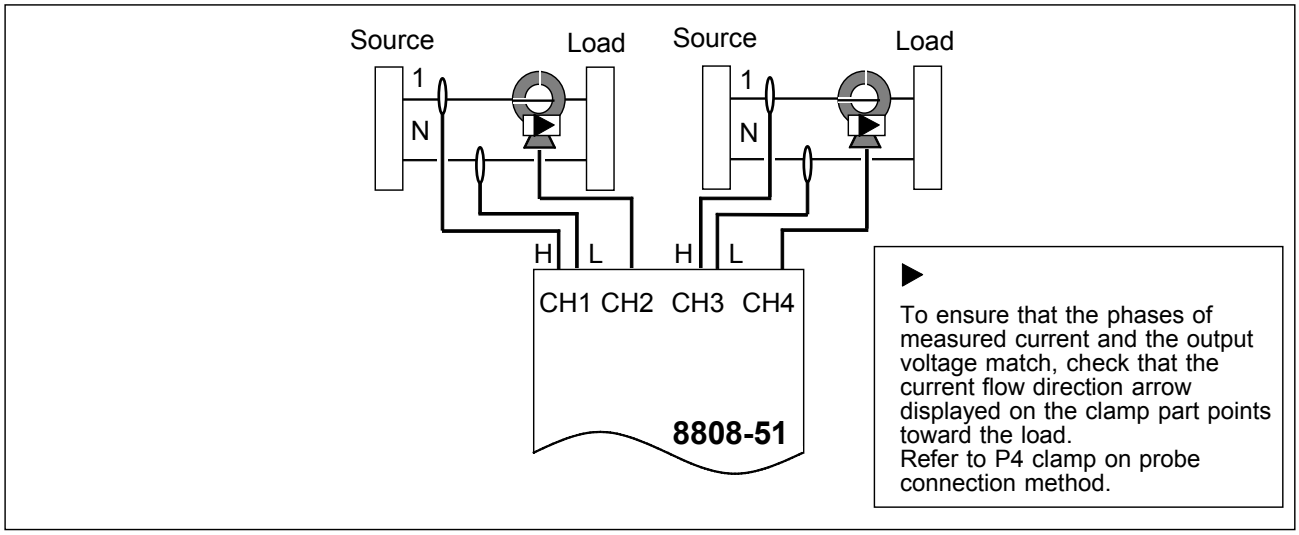
Described below is a method for performing instantaneous analysis of two 100-VAC single-phase 2-wire lines simultaneously using the 8808-51.
In the example, the HIOKI 9018-10 CLAMP ON PROBE is used for current measurement.

(1) Power supply on

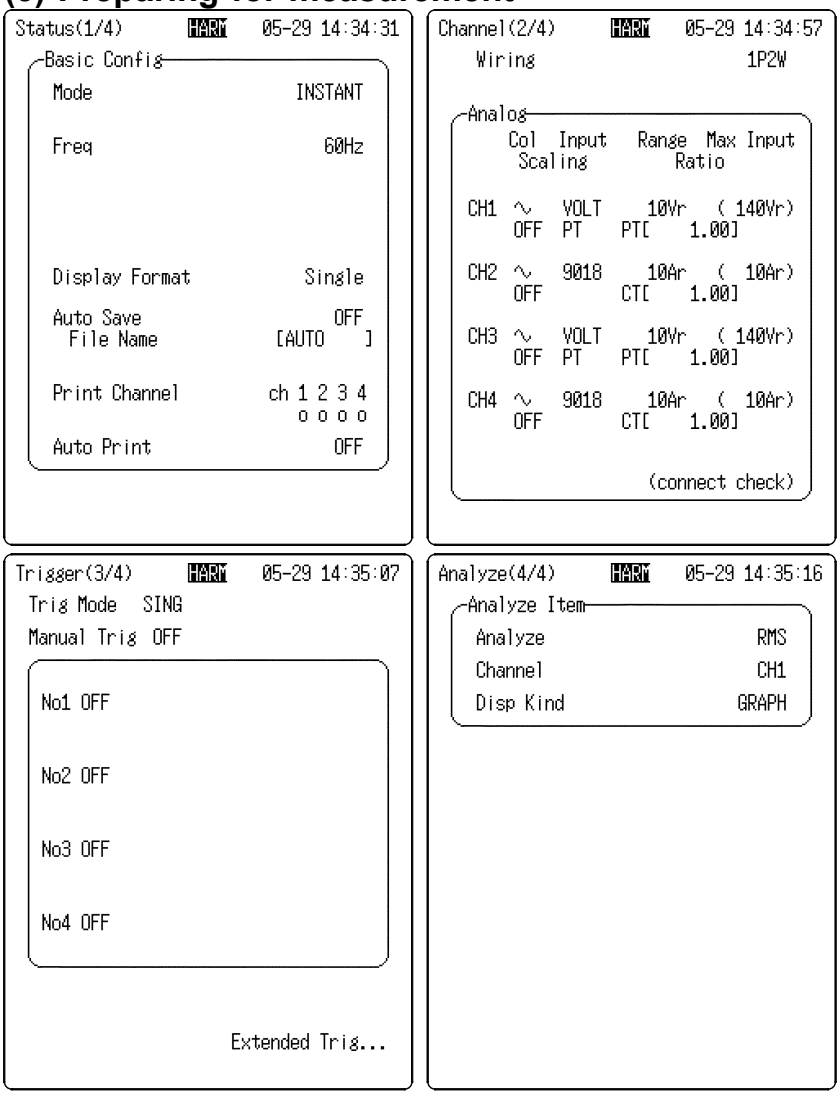
Turn on the power switch for the 8808-51.

(2) Input connection

Connect the 8808-51, as shown in the diagram below.

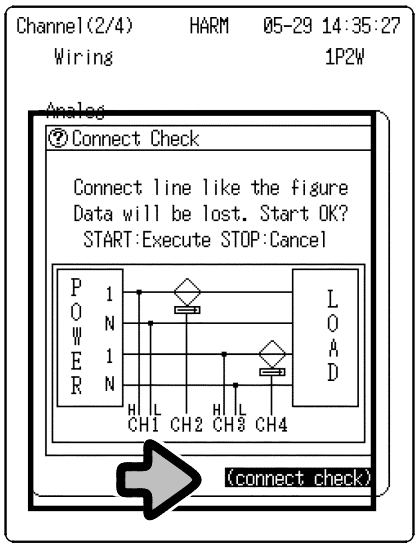


(3) Preparing for measurement



1. Using the **SET** button, proceed to the screen in which settings are to be made.
2. Using the cursor and ▲▼ buttons, make the settings as shown in the diagrams on the left.

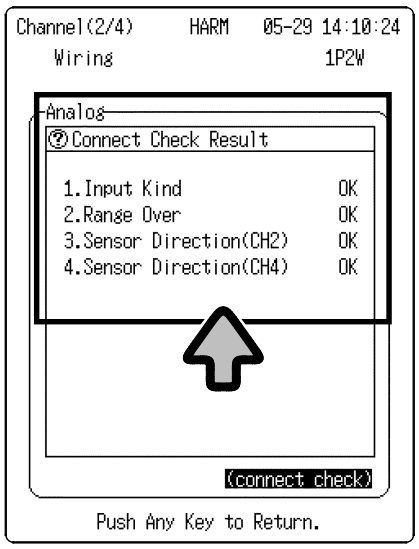
(4) Line connection & level check



This item is used to check the connections.

1. Move the flashing cursor to **(connect check)** on the channel screen (2/4).
2. Press the ▲▼ buttons to open the confirmation window.
3. To start the line connection & level check: Press the **START** button.
4. To cancel the line connection & level check: Press the **STOP** button.

NOTE When a line connection & level check is executed, measurement data stored in memory is deleted.
We recommend saving any required data to a PC card before running a line connection & level check.



Line connection & level check start

The voltage range automatically switches to prevent input overshoot. When the range changes, the following message appears at the bottom of the screen:

"Range changed. (Out of range)."

1) After the line connection & level check, check the window.
2) When the line connection check result is "NG" (no good):
   Cause: Reverse probe connection
   Remedy: Check the direction of the arrow on the probe and correct the probe orientation. Restart the line connection & level check.
   Make sure that the check result shows "OK."
   For details, see Section 4.6, "Line Connection & Level Check."

(5) Measurement start

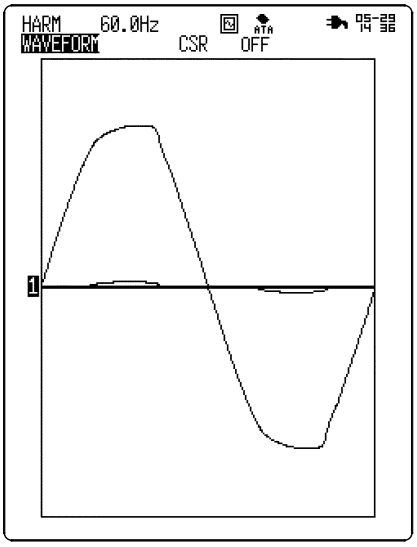
Press the **START** button to execute the measurement. (Green LED lights.)

(6) Measurement complete

When one cycle of data is input, the LED turns off and measurement halts. The screen displays a waveform.

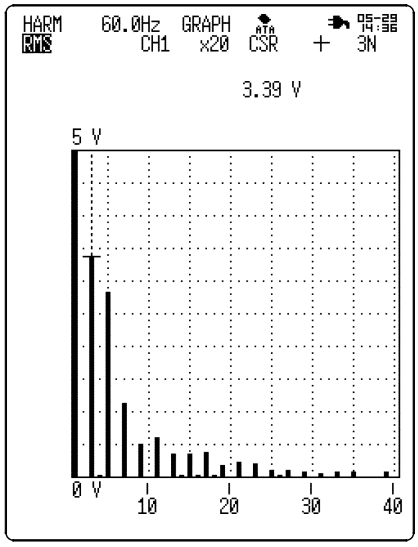
(7) Other analyses

Proceed to the analysis type item and select the analysis screen by pressing the ▲▼ buttons.



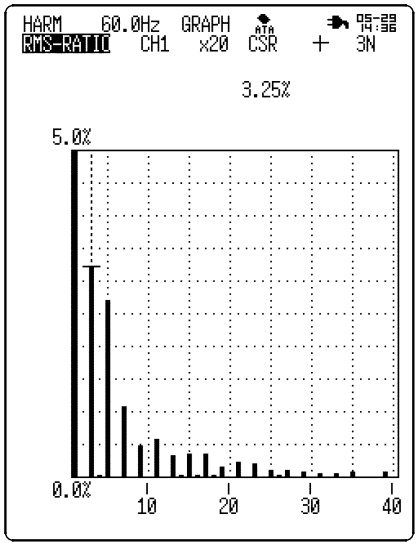
Waveform input screen

This example indicates that the analysis target is a waveform with a frequency of 60 Hz.



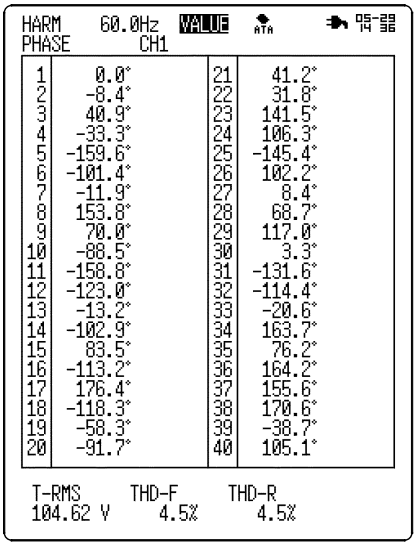
Rms value graph screen

This example shows that the third-degree, fifth-degree and seventh-degree harmonic wave

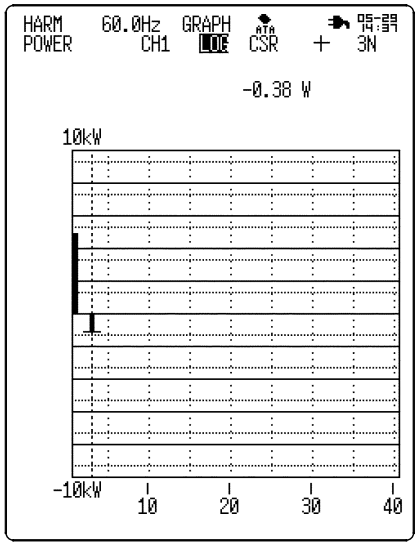


Content ratio graph screen

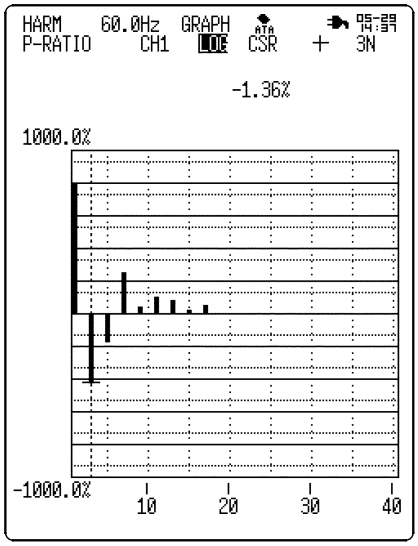
Indicates harmonic wave components by content ratios. This example indicates that odd-numbered harmonic wave components are high in content.



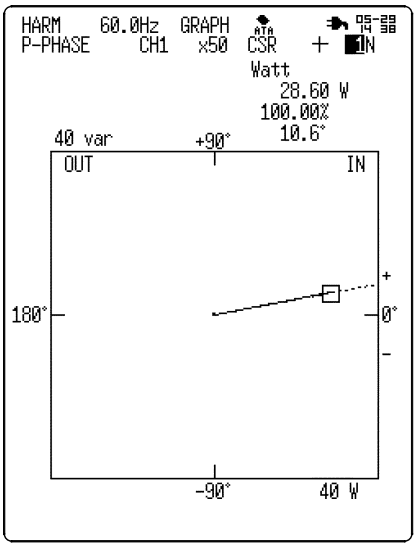
Phase angle numeric screen



Active power graph screen
Shows the harmonic wave active power of any degree with a bar graph.



Power content ratio screen
Indicates the percentage of the active power of harmonic wave component of any degree in active power (given a value of "100%") of the fundamental wave.



Power phase angle vector graph screen
The vector graph shows the inflow and outflow of harmonic waves.

(8) Printout

Press the **PRINT** button.
When the numeric screen is displayed, the numeric data is printed. When the graph screen is displayed, a hard copy of the screen is printed. For more information, refer to Section 8.1 "Recording on Printer."

Trig-time : '01-05-29 14:57:37
Fund. Freq. 60.0Hz

CH1 T-RMS	CH1 THD-F	CH1 THD-R	CH2 T-RMS	CH2 THD-F	CH2 THD-R
103.9 V	4.4%	4.4%	0.33 A	64.4%	54.1%
CH3 T-RMS	**CH3 THD-F**	**CH3 THD-R**	**CH4 T-RMS**	**CH4 THD-F**	**CH4 THD-R**
103.5 V	4.4%	4.4%	2.75 A	23.3%	22.6%

N	CH1 RMS	CH1 RATIO	CH1 PHASE	CH2 RMS	CH2 RATIO	CH2 PHASE
1	103.8 V	100.0%	0.0°	0.28 A	100.0%	0.0°
2	0.0 V	0.0%	104.3°	0.00 A	0.8%	84.7°
3	3.3 V	3.2%	42.4°	0.16 A	57.3%	144.8°
4	0.0 V	0.0%	2.1°	0.00 A	0.2%	85.2°
5	2.7 V	2.6%	-159.6°	0.05 A	16.7%	-113.6°
6	0.0 V	0.0%	-1.5°	0.00 A	0.3%	34.9°
7	1.1 V	1.1%	-12.5°	0.05 A	17.0%	-80.3°
8	0.0 V	0.0%	39.1°	0.00 A	0.1%	-36.0°
9	0.4 V	0.4%	75.6°	0.03 A	11.5%	46.0°
10	0.0 V	0.0%	-63.4°	0.00 A	0.1%	32.4°
11	0.6 V	0.6%	-159.5°	0.02 A	6.0%	89.9°
12	0.0 V	0.0%	177.0°	0.00 A	0.2%	16.2°

Numeric data
Example of printout of RMS, RATIO, PHASE screen

Trig-time : '01-05-29 14:57:37
Fund. Freq. 60.0Hz

CH1&2 WATT	CH1&2 VA	CH1&2 var	CH1&2 P-FACTOR	CH3&4 WATT	CH3&4 VA
28.3 W	34.6 VA	-5.8 var	-0.817	37.0 W	284.5 VA

N	CH1&2 POWER	CH1&2 P-RATIO	CH1&2 P-PHASE	CH3&4 POWER	CH3&4 P-RATIO	CH3&4 P-PHASE
1	28.6 W	100.0%	10.5°	36.8 W	100.0%	82.4°
2	0.0 W	0.0%	1.4°	0.0 W	0.0%	21.1°
3	-0.3 W	-1.3%	133.9°	0.0 W	0.1%	88.5°
4	-0.0 W	0.0%	125.1°	-0.0 W	0.0%	119.8°
5	-0.0 W	-0.1%	98.6°	0.1 W	0.3%	83.7°
6	-0.0 W	0.0%	99.4°	0.0 W	0.0%	81.8°
7	0.0 W	0.2%	5.9°	0.0 W	0.0%	86.2°
8	0.0 W	0.0%	9.1°	0.0 W	0.0%	65.0°
9	0.0 W	0.0%	65.0°	-0.0 W	0.0%	93.9°
10	-0.0 W	0.0%	-159.1°	-0.0 W	0.0%	135.6°
11	0.0 W	0.0%	5.2°	-0.0 W	0.0%	92.0°
12	0.0 W	0.0%	-34.5°	0.0 W	0.0%	-58.4°

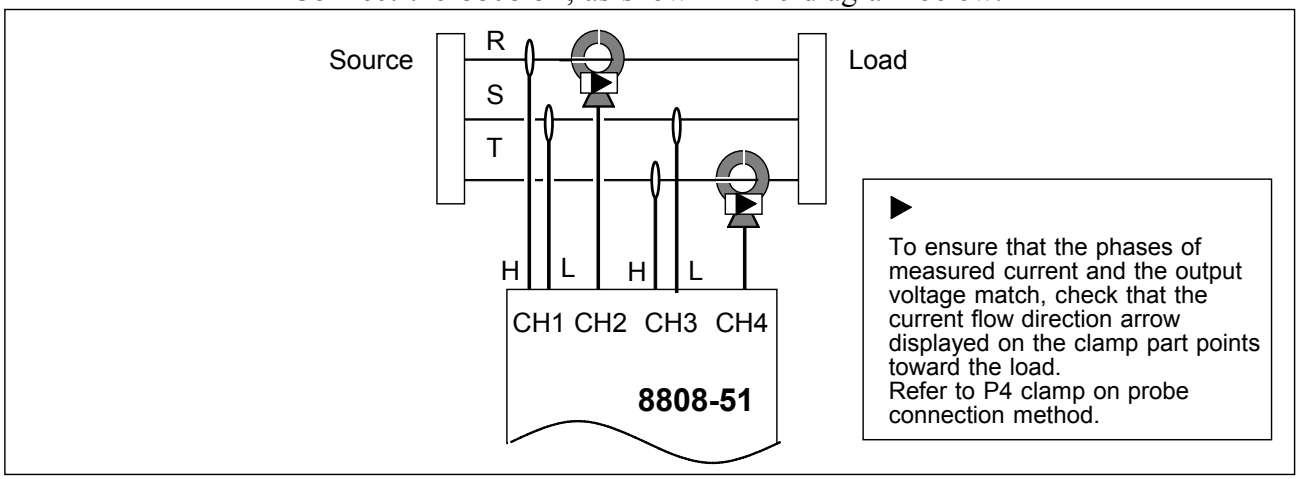
Numeric data
Example of printout of POWER, P-RATIO, P-PHASE screen

5.5 Analysis Example 2: Instantaneous Analysis of 200-VAC 3-Phase 3-Wire Line

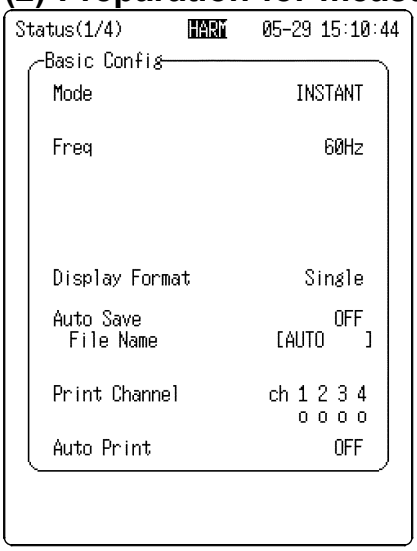
Describes below is a method for performing an instantaneous analysis of a 200-VAC 3-phase 3-wire line using the 8808-51.
The 8808-51 uses a 2-wattmeter method for power analysis of 3-phase lines.

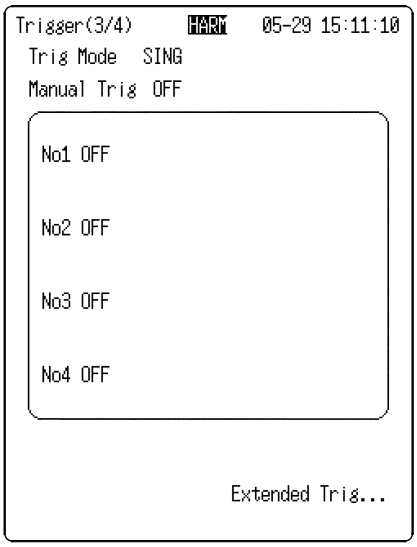
(1) Input connection

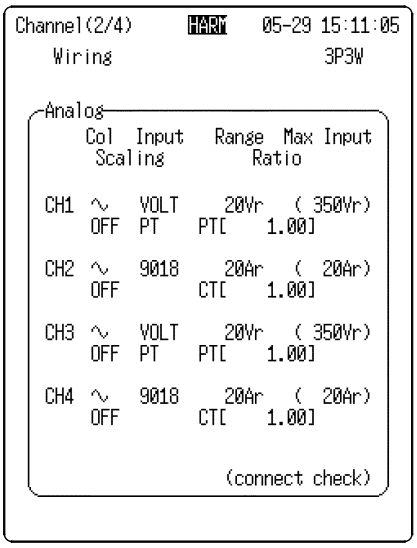
Connect the 8808-51, as shown in the diagram below.

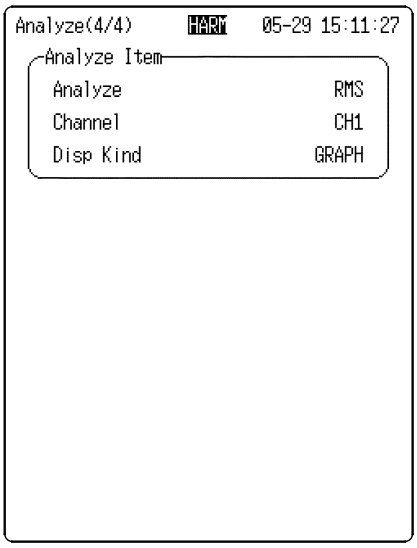


(2) Preparation for measurement



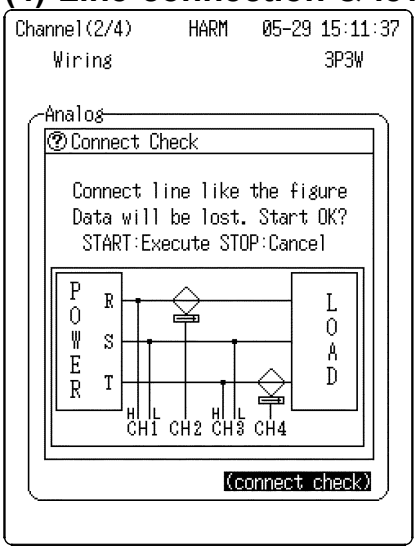


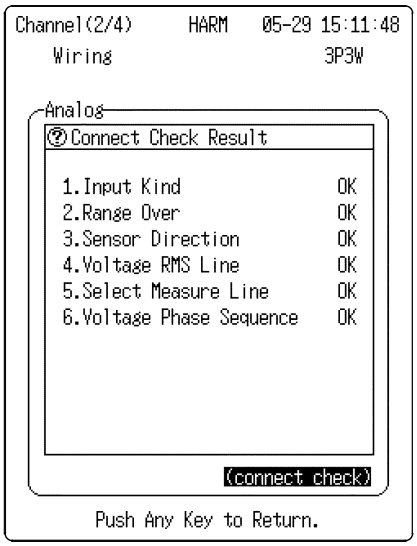




1. Using the **SET** button, proceed to the screen in which settings are to be made.
2. Using the cursor and ▲▼ buttons, make the settings as shown in the diagrams on the left.

(4) Line connection & level check





This item is used to check connections.

For detailed information, refer to Measurement Example 1(4).

(5) Measurement start/end

Press the **START** button to perform the measurement. (Green LED lights.)

When one cycle of data is input, the LED goes out and measurement stops. The screen displays a waveform.

6. Time-Series Analysis Mode

The time-series analysis mode is used to perform data analysis for a specific time interval for any of the 13 types of analysis available in instantaneous analysis mode, and then to record changes in data over time.

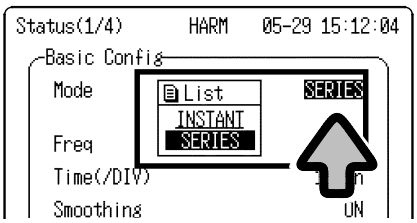
The following section describes how to use the time-series analysis mode and provides examples of analysis.

6.1 Basic Item Setting

Described below are selection options and setting methods for various setting items:

1. Settings in the Status Screen

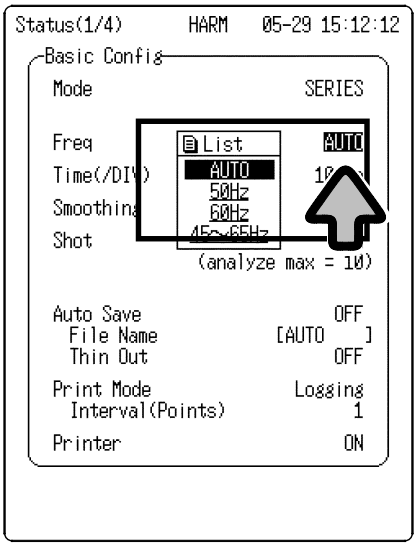
(1) Analysis mode setting — SET >>STATUS(1/4)



1. Move the flashing cursor to **Mode**.
2. Using the ▲▼ buttons, select **SERIES**.

INSTANT	Conducts instantaneous analysis.
SERIES	Conducts time-series analysis.

(2) Frequency setting — SET >>STATUS(1/4)



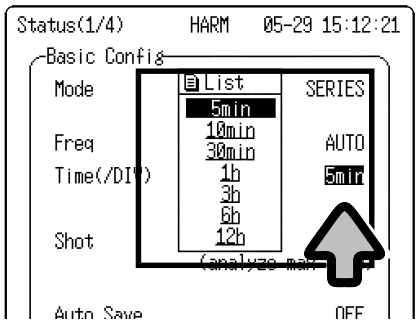
This screen is used to set the frequency of the analysis target.

1. Move the flashing cursor to **Freq**.
2. Select a setting using the ▲▼ buttons.

Auto	The frequency of the measurement target is automatically calculated (in 0.1-Hz steps) based on the input waveform.
50Hz	Sets 50 Hz as the frequency of the measurement target.
60Hz	Sets 60 Hz as the frequency of the measurement target.
45Hz-65Hz	Used to set the frequency manually (in 0.1-Hz steps).

NOTE Frequency estimations may fail if the waveform contains significant amounts of noise or consists of square waves. If this happens, set the basic frequency manually.

(3) Time-axis range — SET >>STATUS(1/4)



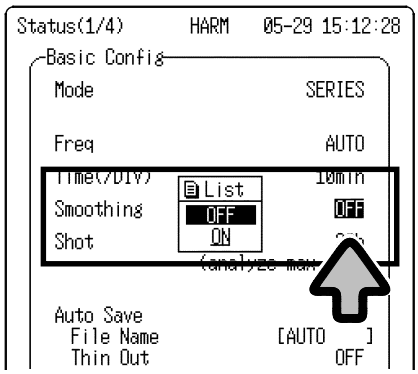
This item is used to set the time per division on the time axis (one grid on recording paper).

1. Move the flashing cursor to **Time (/DIV)**.
2. Select a setting using the ▲▼ buttons.

5, 10, 30 min/DIV, 1, 3, 6, 12 h/DIV

NOTE The data interval is 1/80 of the time-axis range setting.

(4) Average processing — SET >>STATUS(1/4)



This function cancels out unexpected phenomena by obtaining an average of the analysis data.
A simple average of all data measured in a data interval is recorded for each data interval.

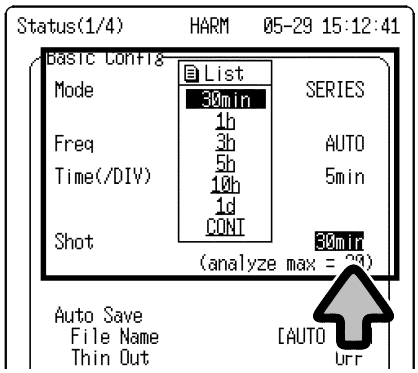
1. Move the flashing cursor to **Smoothing**.
2. Select a setting using the ▲▼ buttons.

OFF, ON

NOTE The number of data used to calculate the average depends on the time-axis range.

Time-axis range	5 min	10 min	30 min	1 h	3 h	6 h	12 h
No. of data	Not available	2	6	12	24	48	96

(5) Recording length — SET >>STATUS(1/4)



This item is used to set the recording length (recording time) of one measurement input operation.

1. Move the flashing cursor to **Shot**.
2. Select a setting using the ▲▼ buttons.

Relationship between time-axis range and recording length
(min: minutes/ h: hours/ d: days)

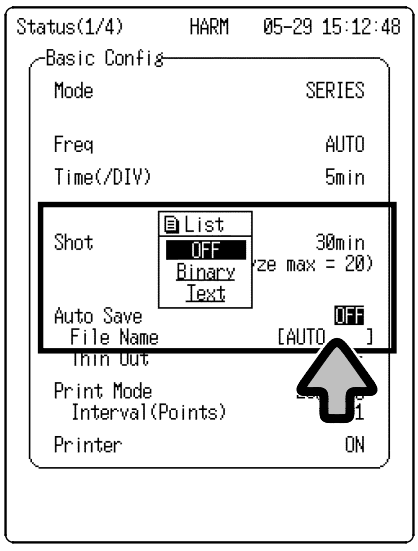
Time axis / No. of analysis items	5 min	10 min	30 min	1 h	3 h	6 h	12 h
20	30 minutes	1 hour	3 hours	6 hours	12 hours	1 day	3 days
20	1 hour	3 hours	6 hours	12 hours	1 day	3 days	7 days
20	3 hours	6 hours	12 hours	1 day	3 days	7 days	14 days
20	5 hours	10 hours	1 day	2 days	7 days	14 days	30 days
10	10 hours	20 hours	2 days	4 days	14 days	30 days	60 days
4	1 day	2 days	6 days	12 days	37 days	75 days	150 days
20	CONT* (5 hours)	CONT* (10 hours)	CONT* (30 hours)	CONT* (2.5 days)	CONT* (7.5 days)	CONT* (15 days)	CONT* (30 days)

(*) The last 60 divisions of analysis data are stored in memory. Figures in ( ) indicate recording time lengths.

NOTE

- When the recording length is set to "CONT," measurement continues until the **STOP** button is pressed.
- When the recording length is set to "CONT," waveforms for the last 60 divisions (including the screen currently displayed) are saved to memory.

(6) Auto save setting — SET >>STATUS(1/4)

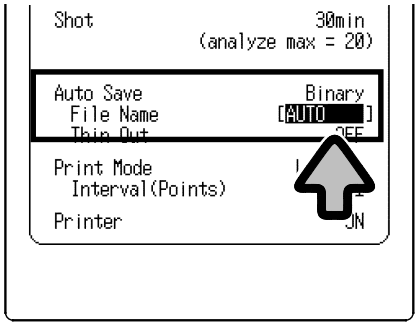


As soon as waveform analysis is complete, data can be saved automatically to a PC card. Data files are stored in the current directory set in the file screen.

Selection of data format for auto save

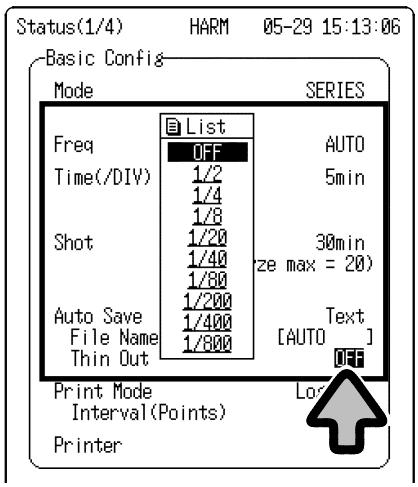
1. Move the flashing cursor to **Auto Save**.
2. Using the ▲▼ buttons, select the format for data to be stored by the auto save function.

OFF	Auto save function is turned off.
Binary	Data is saved in binary format (for use in 8807-51/8808-51 only).
Text	Data is saved in text format (for use on a PC).(Data saved in text format cannot be loaded by the 8807-51 or 8808-51. Data for all set analysis items (max. 20 items) is saved.)



Entering name of file to be auto-saved

If a file name is entered, the auto save function stores the file under that name. If files are saved in succession, they are assigned individual numbers. If no file name is entered, files are named "AUTO.***," "AUTO0001.***", and so forth.
For information on the file input method, refer to Section 9.1 "Input of File Name."



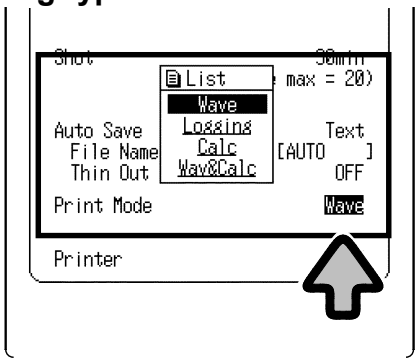
Selective save setting

When "Text" is set for the data saving format, data can be saved at selected intervals.
The selective save function stores data at selected intervals. No other data is included in the data file.

1. Move the flashing cursor to **Thin out**.
2. Using the ▲▼ buttons, select the interval for saving data.

OFF, x1/2, x1/4, x1/8, x1/20, x1/40, x1/80, x1/200, x1/400, x1/800

(7) Printing types — SET >>STATUS(1/4)



This item is used to select the printer output type.

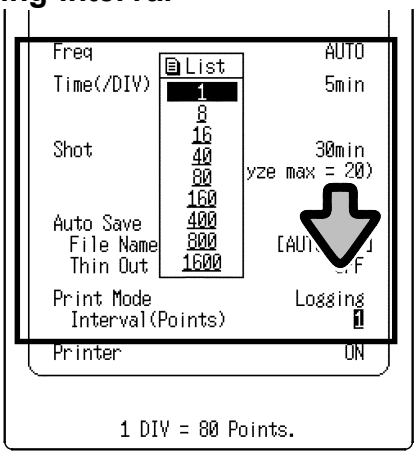
1. Move the flashing cursor to **Print Mode**.
2. Select a setting using the ▲▼ buttons.

Wave	Outputs waveform.
Logging	Outputs numeric values.
Calc	Outputs calculation values.
Wav & Calc	Outputs waveform and calculation values.

NOTE

- The calculation operation determines the maximum value and average value of measurement data collected over the entire recording length.
- The calculation operation is performed only for analysis displayed on the screen.
- When cursors are used, calculations are performed for the section located between the cursors.

(8) Printing interval — SET >>STATUS(1/4)

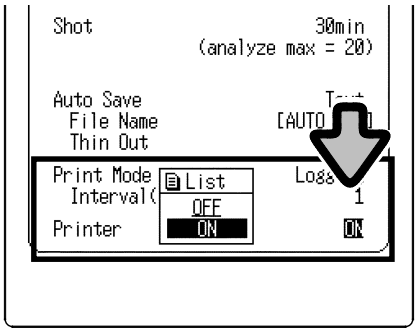


When "Logging" is selected as the print type in step 7, this item allows the setting of the interval of data to be printed.
The selective printing function prints data at selected intervals.
The number of points per one division of the record is 80.

1. Move the flashing cursor to **Interval (Points)**.
2. Select a setting using the ▲▼ buttons.

1, 8, 16, 40, 80, 160, 400, 800, 1600

(9) Printer setting — SET >>STATUS(1/4)



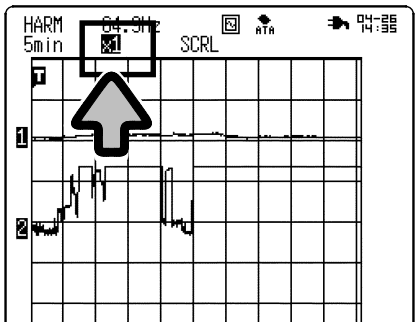
Measurements can be printed simultaneously as analysis is being carried out.

1. Move the flashing cursor to **Printer**.
2. Select a setting using the ▲▼ buttons.

OFF	Does not print measurements in real time.
ON	Prints measurements as data is input.

2. Settings on Measurement Screen

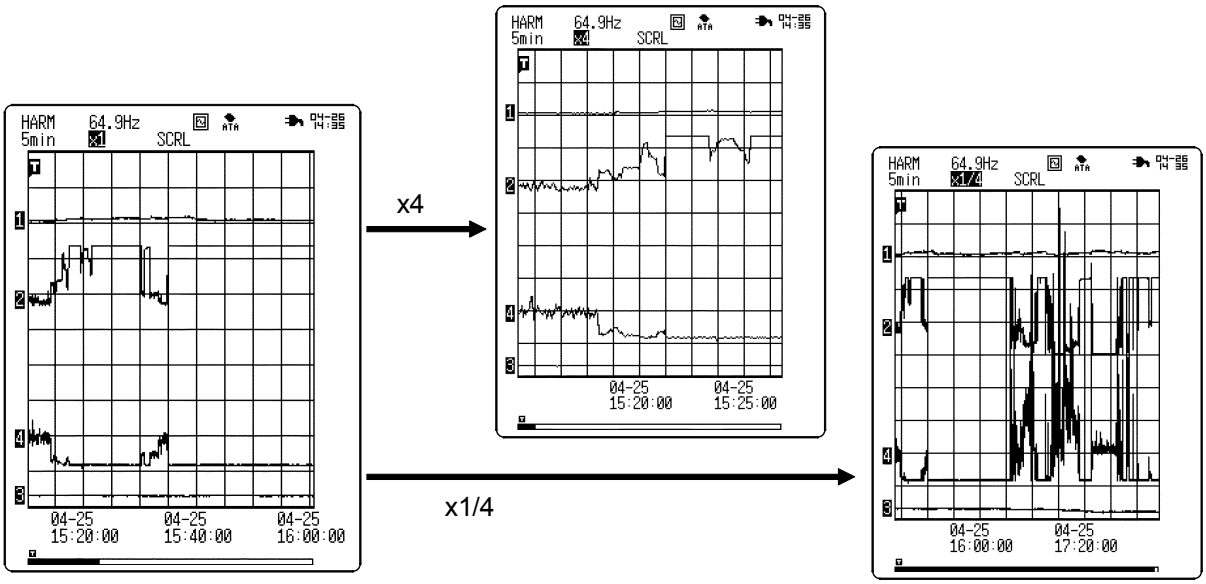
(1) Time-axis range magnification/compression — DISP >>Waveform display



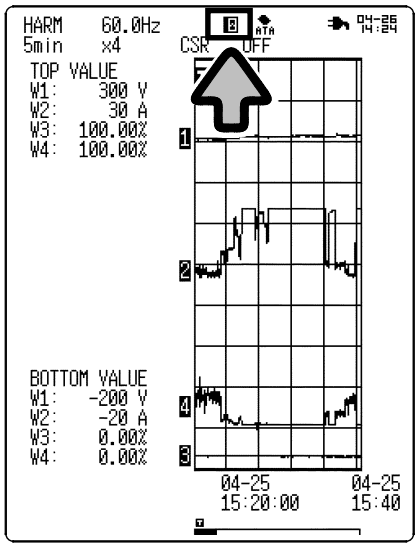
The magnification/compression rate can be set for the time axis in the waveform screen.
A magnified display of waveforms allows detailed examination of results.
A compressed display of waveforms makes it easier to see overall changes.
Waveform magnification/compression uses the left edge of the screen as the stationary point.

1. Move the flashing cursor to the location indicated in the diagram.
2. Select a setting using the ▲▼ buttons.

x4, x2, x1, x1/2, x1/4, x1/6, x1/12, x1/24, x1/48



(2) Waveform display range setting ——— DISP >>Waveform display



You can select the display size of the waveform input screen. When the multi-screen setting is selected, the upper and lower limit values for the display of the selected analysis item are indicated.

	Displays measurement screen on full screen.
	Displays measurement screen on sub-screen.

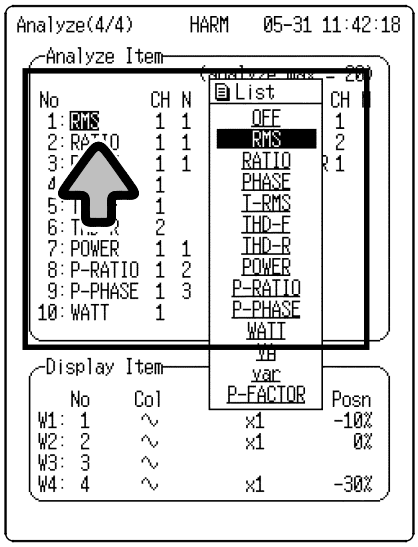
Upper and lower limit values for four channels (two channels with 8807-51) are displayed on the screen.

6.2 Analysis Item Setting

In time-series analysis mode, a maximum of 20 items from the following 13 types can be analyzed for harmonic waves of all degrees simultaneously. Harmonic wave rms value, harmonic wave content ratio, harmonic wave phase angle, total rms value, total distortion-F, total distortion-R, active power of each degree, power content ratio, power phase angle, active power, apparent power, reactive power, and power factor
(For calculation methods, refer to Section 5.1.)

1. Settings in Analysis Item Screen

(1) Analysis type setting — SET >>Analyze



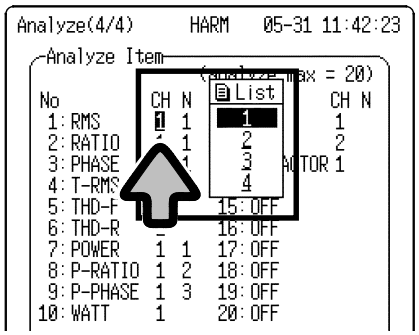
This screen is used to select the analysis to be performed.
1. Move the flashing cursor to an analysis item.
2. Select a setting using the ▲▼ buttons.

RMS	Rms value of harmonic wave component of each degree
RATIO	Content ratio of harmonic wave component of each degree in the fundamental wave
PHASE	Phase deviation of harmonic wave component of each degree relative to the fundamental wave
T-RMS	Sum of rms values of all harmonic wave components (overall rms value)
THD-F	Percentage of all harmonic waves in fundamental wave
THD-R	Percentage of all harmonic waves in total rms value
POWER	Active power value of harmonic wave component of each degree
P-RATIO	Active power content ratio of harmonic wave component of each degree in active power of the fundamental wave
P-PHASE	Phase angle of harmonic wave current of each degree relative to the voltage waveform
WATT	Active power containing all harmonic wave components
VA	Apparent power
var	Reactive power
P-FACTOR	Power factor

NOTE

- The following conditions must be met to measure active power of each degree, power content ratio of each degree, power phase angle of each degree, active power, apparent power, reactive power, and power factor.
  1. Odd-numbered channels are set to receive voltage waveforms, while even-numbered channels are set for current waveforms.
  2. The 9018, 9132, or general-purpose clamp is selected for current measurement.
- If the above conditions are not met for the measurement of power values, one of the following warning messages is displayed when measurement starts, and measurement then stops.
  Warning 633: Set CH1=Volt, CH2=Current. (for 8807-51).
  Warning 634: Set CH1,CH3=Volt, CH2,CH4= Current. (for 8808-51).
  Warning 635: 3283,3284,3285 can't analyze power. (for both 8807-51 and 8808-51).

(2) Analysis channel setting — SET >>Analyze



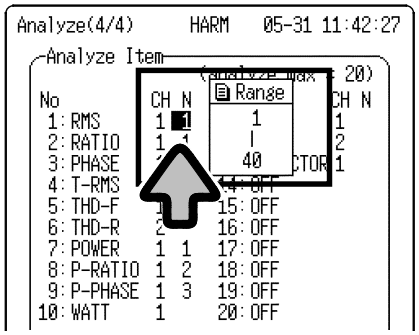
You can select the channel to be analyzed.

1. Move the flashing cursor to **CH**.
2. Select a setting using the ▲▼ buttons.

8807-51	CH1/CH2
8808-51	CH1/CH2/CH3/CH4

For POWER, P-RATIO, P-PHASE, WATT, VA, var, and P-FACTOR, data for the system containing the selected channel is analyzed.

(3) Setting Degree of analysis — SET >>Analyze

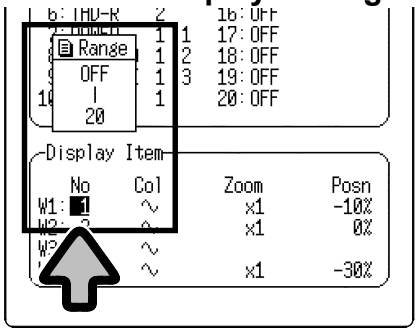


When harmonic wave rms value, harmonic wave content ratio, harmonic wave phase angle, active power of each degree, power content ratio of each degree, and power phase angle of each degree are selected, this item is used to select the degree of harmonic wave to be analyzed.

1. Move the flashing cursor to the **N** section of an analysis item.
2. Select a setting using the ▲▼ buttons.

1 to 40

(4) Result screen display setting — SET >>Analyze

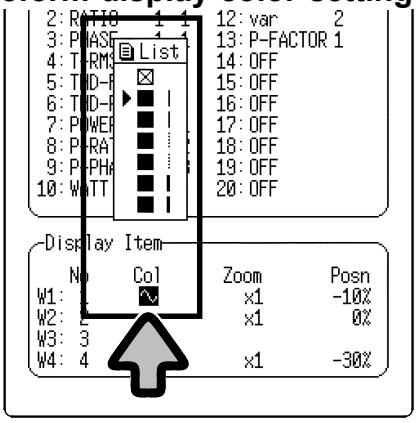


A maximum of four analysis result phenomena can be displayed on the screen and printed. Waveforms to be displayed are set in W1 through W4.

1. Move the flashing cursor to **No** in the display item section.
2. Select a setting using the ▲▼ buttons.

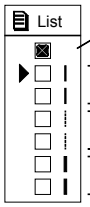
OFF	Hides analysis results.
1-20	Used to select analysis result to be displayed.

(5) Waveform display color setting — SET >>Analyze



Select the color of the displayed waveforms.

1. Move the flashing cursor to **Col** in the display item section.
2. Select a setting using the ▲▼ buttons.

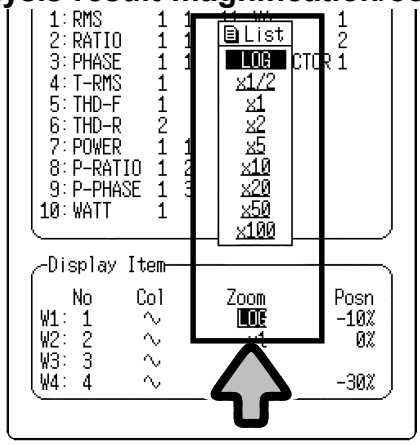


OFF	Hides waveform.
Red/Green	Prints waveform at standard print density.
Yellow/Light Blue	Prints waveform in low print density.
Blue/Gray	Prints waveform in high print density.

NOTE

- When the 8992 PRINTER UNIT is used to print a waveform, the three print densities are used to represent the 6 selected waveform display colors.
- The print density setting has no effect for real-time printing.

(6) Analysis result magnification/compression

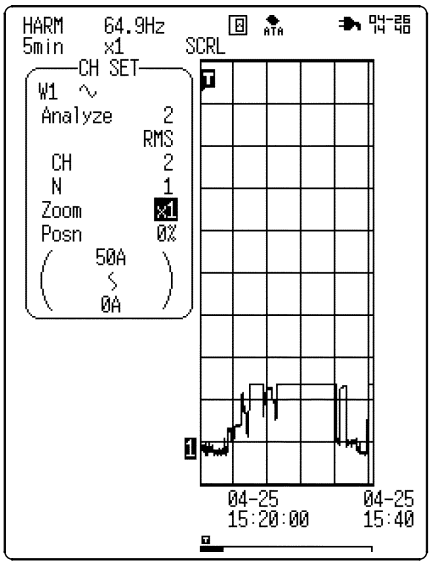


Magnify or compress the display of analysis results. A magnified display allows detailed examination of the results.

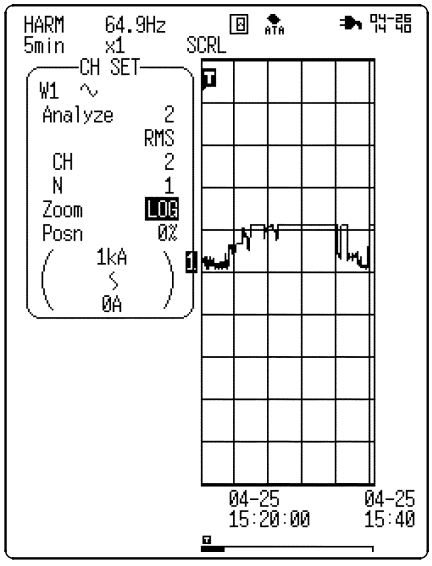
1. Move the flashing cursor to **Zoom** in the display item section.
2. Select a setting using the ▲▼ buttons.

LOG, x1/2, x1, x2, x5, x10, x20, x50, x100

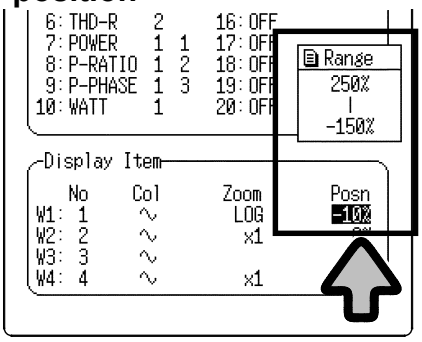
x1



xLOG



(7) Zero position

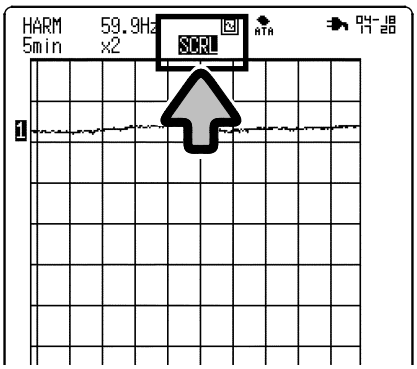


This item is used to set the zero position of an analysis result.

1. Move the flashing cursor to **Posn** in the display item section.
2. Select a setting using the ▲▼ buttons.

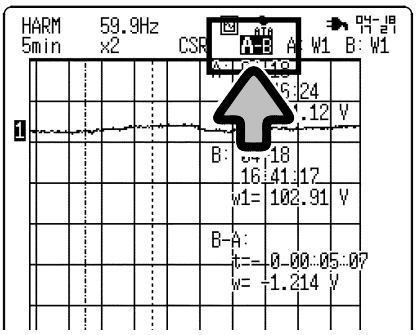
6.3 Cursor Operations

On the waveform screen, use cursors A and B to read measurement time and analysis values.



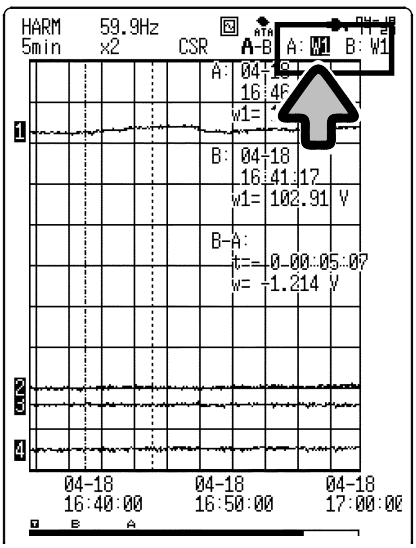
1. Move the flashing cursor to the location indicated in the diagram and select **CSR**, using the ▲▼ buttons.
   (You can also make this selection by simultaneously pressing both right and left cursor buttons.)

CSR	To move cursors A and B
SCRL	To scroll waveform



2. Move the flashing cursor to the location indicated in the diagram and select the cursor type using the ▲▼ buttons.

OFF	Cursors A/B are not used.
A	Only cursor A is used.
A-B	Cursors A/B are used, and cursor A moves.
A-**B**	Cursors A/B are used, and cursor B moves.
A-B	Cursors A/B are used, and they move simultaneously.



3. Move the flashing cursor to the location indicated in the diagram. Using the ▲▼ buttons, select the type of analysis result for which the cursor is used.

W1 to W4

4. Move the cursor using the ◀ SCROLL/CURSOR ▶ button, and read an indication.
   Use the ◀◀ ▶▶ buttons to move the cursor quickly.

Value indicated by cursor

	Value of A or B	Value of B-A
t	Time indicated by cursor position	Time difference between cursors
v	Analysis result read by cursor	Difference of analysis results between cursors

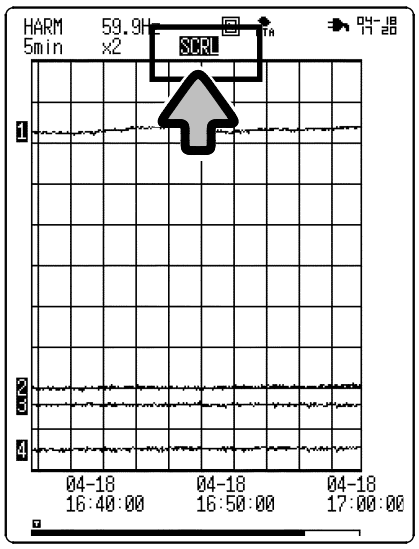
NOTE

- On the waveform screen, the scale for the analysis result for which the cursor is used is indicated on the side of the screen.
- When scrolling a waveform, cursors A and B move along with the waveform.
- When the cursors A and B are used for different analyses, the (B-A) cursor value is not displayed.

6.4 Waveform Scrolling

The analysis result in the waveform screen can be scrolled horizontally.

Setting Screen — **DISP >>Waveform display**



1. Move the flashing cursor to the location indicated in the diagram and select **SCRL** using the ▲▼ buttons.
   (You can also make this selection by simultaneously pressing both right and left cursor buttons.)

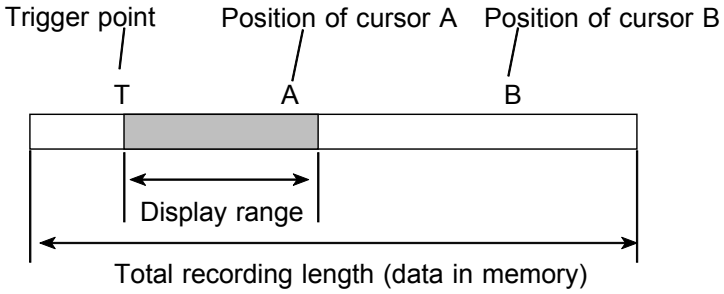
CSR	To move cursors A and B
SCRL	To scroll waveform

2. Move the cursor using the ◀ SCROLL/CURSOR ▶ button and read an indication.
   Use the ◀◀ ▶▶ buttons to move the cursor quickly.

Auto scroll

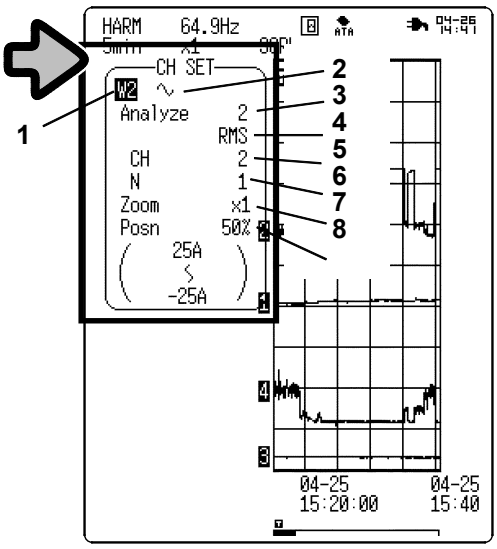
When the ◀ SCROLL/CURSOR ▶ button is held pressed for about five seconds, the waveform automatically scrolls (**Auto scroll** indication appears on the screen).
Press any button to cancel the auto scroll function.

NOTE The bar graph shown at the bottom of the screen indicates the location of the displayed waveform along the total recording length.



6.5 Input Setting in Waveform Display Screen

In the waveform display screen, you can select the contents of result display Nos. W1 through W4.



1. Using the **CH1**, **CH2**, **CH3**, **CH4** buttons, open the setting window for a selected result display No.
   (W1: CH1, W2: CH2, W3: CH3, W4: CH4)
   (Example) To display the setting screen for result display No. W2:
   Press the **CH2** button.
2. Move the flashing cursor to **Display waveform No.** and select a result display No. from W1 through W4 using the ▲▼ buttons.
3. Set the analysis item No., analysis item, analysis channel, degree of analysis, display magnification, and display position, as necessary.

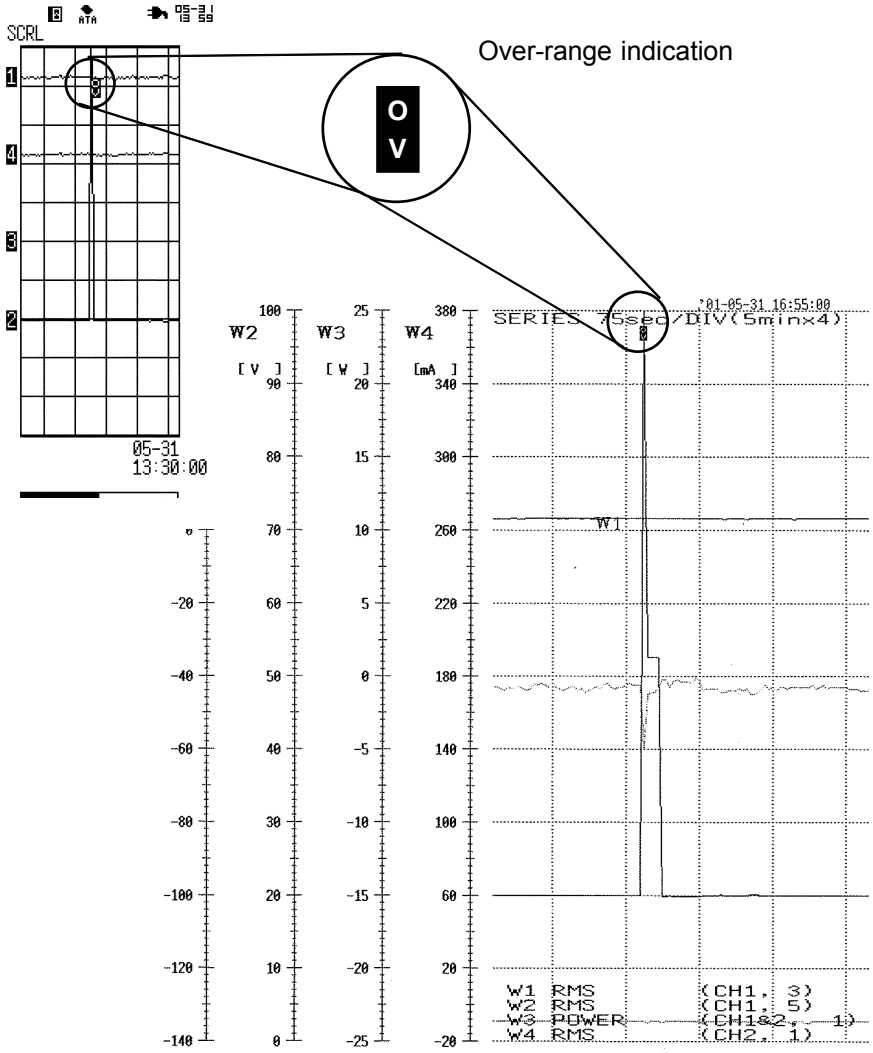
1 Display waveform	To select display waveform to be set
2 Waveform display color	To select color of waveform to be displayed
3 Analysis item No.	To select analysis item No.
4 Analysis item	To select analysis item
5 Analysis channel	To select input channel to be analyzed
6 Degree of analysis	To select degree of harmonic wave to be analyzed
7 Display magnification	To set magnification/compression rate of analysis result display
8 Zero position	To set zero position for analysis result.

4. Press the same button that was pressed in step 1 to close the setting window.

6.6 Over-Range Check Function

When the input wave exceeds the set maximum input range during measurement, this function lowers the range by one level to prevent input overshoot in the next measurement.

When the auto range check function is activated during extended measurement (time-series analysis), a symbol [**OV**] (OVER) is indicated at the time at which the range switched.



NOTE

- Note that data collected at the time indicated by "**OV**" will contain errors due to input overshoot.
- When the auto range check function is activated during measurement and switches the range, the following warning message appears.
  Warning 631: Range changed. (Out of range).
- Note that the auto range check function only switches a range from a higher sensitivity level to a lower one.

6.7 Analysis Example: Time-Series Analysis of 100-VAC Single-Phase 3-Wire Line

Described below is a method for performing time-series analysis of a 100-VAC single-phase 3-wire line using the 8808-51.

In this example, a HIOKI 9018-10 CLAMP ON PROBE is used for current measurement.

NOTE

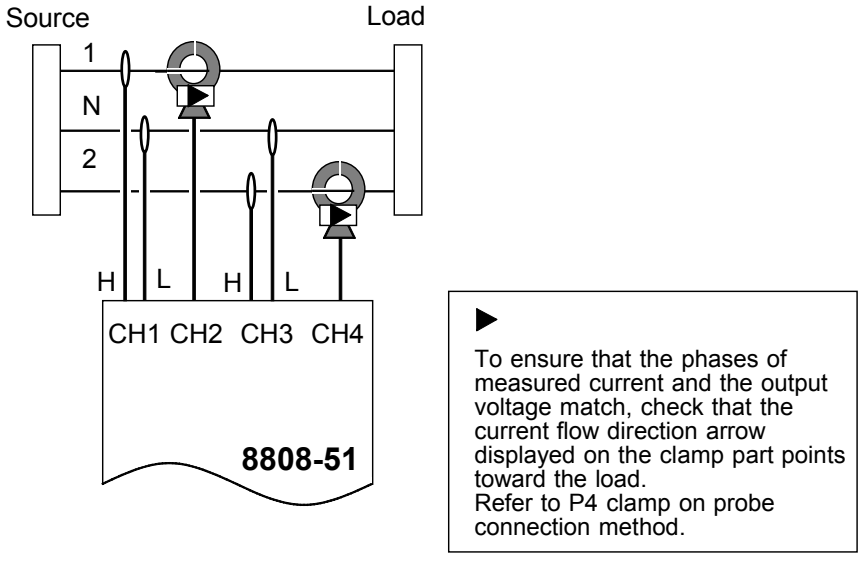
- This equipment is designed to measure input voltage. To measure current, use a clamp ammeter with a voltage output function. We recommend a HIOKI CLAMP ON PROBE or CLAMP ON HiTESTER for current measurement.
- If a clamp ammeter is used to take measurements, the accuracy of both the 8807-51/8808-51 and the clamp will affect measurement accuracy. Carefully check the specifications of the CLAMP ON PROBES and select the most appropriate unit for the specific application. (Refer to Section 10 "Characteristics of CLAMP ON PROBES.")

(1) Power supply on

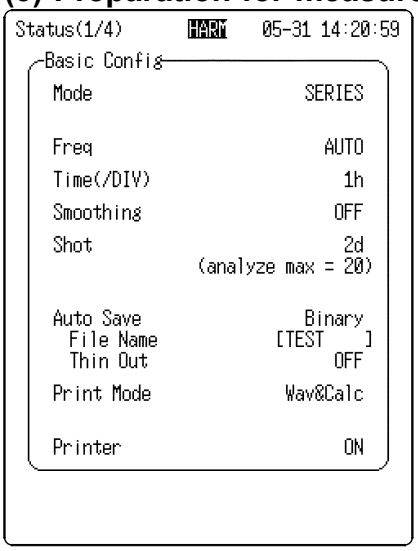
Turn on the power switch of the 8808-51.

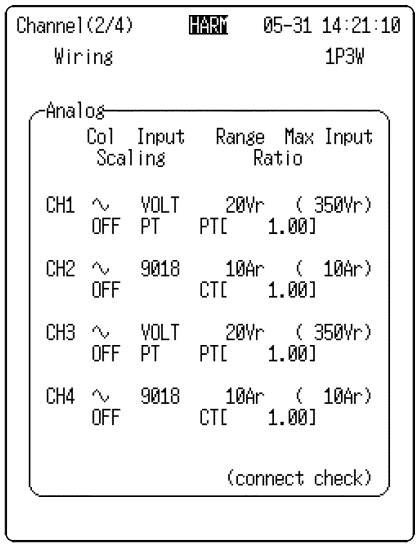
(2) Input connection

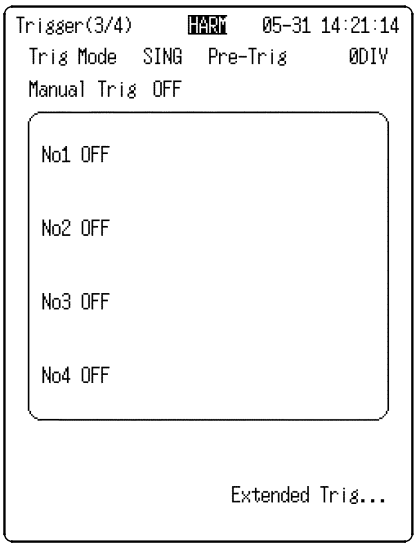
Connect the 8808-51, as shown in the following diagram.

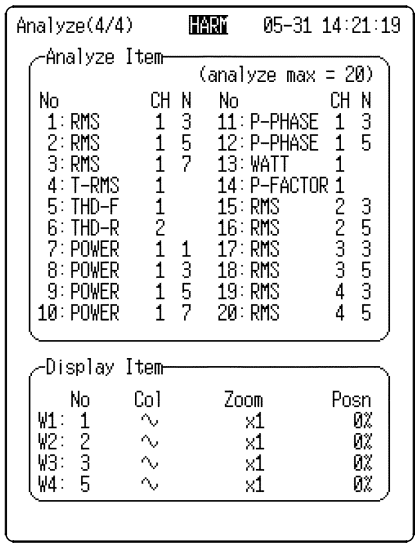


(3) Preparation for measurement



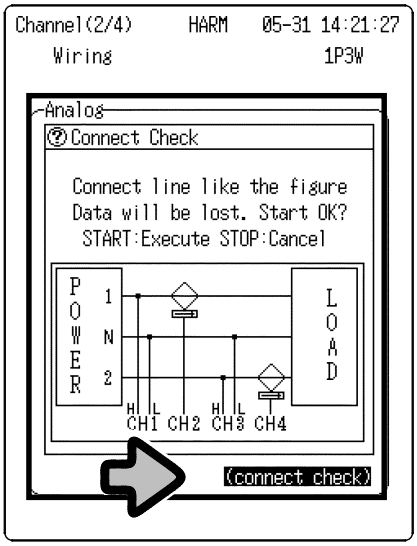






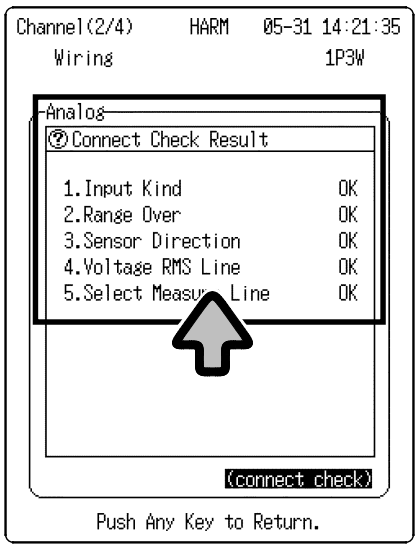
1. Using the **SET** button, proceed to the screen in which settings are to be made.
2. Using the cursor and ▲▼ buttons, make the settings as shown in the diagrams on the left.

(4) Line connection & level check



1. Move the flashing cursor to **(Connect check)** in the channel screen (2/4).
2. Press the ▲▼ buttons to open the confirmation window.
3. To start the line connection & level check:
   Press the **START** button.
   To cancel the line connection & level check:
   Press the **STOP** button.

NOTE When a line connection & level check is executed, any measurement data currently saved in the unit is deleted.
We recommend saving necessary data to a PC card before performing a line connection & level check.



Line connection & level check start

The voltage range is automatically shifted to prevent input overshoots. The following message is displayed at the bottom of the screen.
"Range changed.(Out of range)."

1) After the line connection & level check, check the window.
2) If the line connection check results in a "NG" (no good) assessment:
   Cause: Reverse probe connection
   Remedy: Check the direction of the arrow on the probe and correct the probe orientation. Restart the line connection & level check.
   Make sure that the check result shows "OK."

For details, refer to Section 4.6, "Line Connection & Level Check."

(5) Measurement start

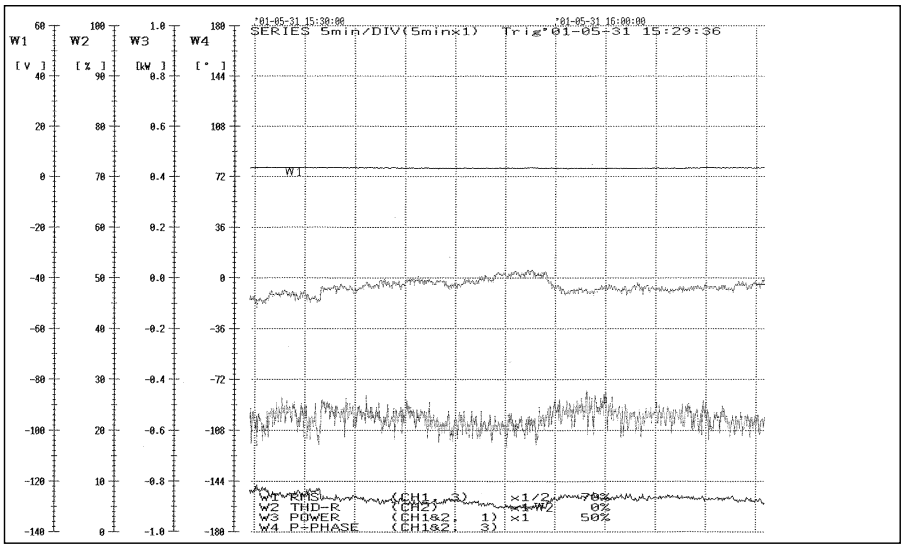
Press the **START** button to execute measurement. (Green LED lights.)
To start measurement: Press the **START** button.
To cancel measurement: Press the **STOP** button.
As soon as a trigger is tripped, the screen displays a waveform and printing begins.
When the **STOP** button is pressed during measurement, the following message appears on the screen:
"STOP key to abort."
To abort measurement: Press the **STOP** button. (The LED goes out and measurement halts.)

(6) Measurement complete

When data for a period of two days is input, the LED goes out and measurement stops.

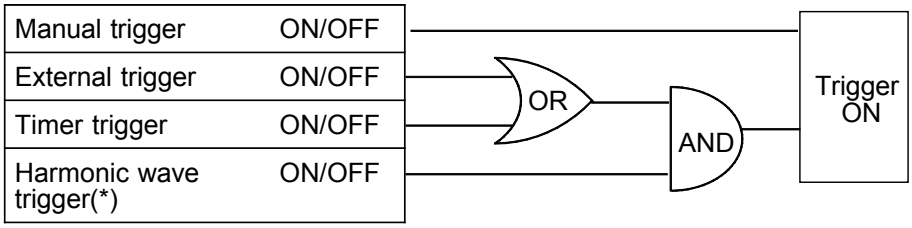
(7) Other analyses

Simply changing the result display setting allows up to 20 analysis results to be displayed on the screen and printed.



7. Triggers for Harmonic Wave Analysis Function

The following four triggers can be used with the harmonic wave analysis function:
Manual trigger, external trigger, timer trigger, harmonic wave trigger
The following diagram illustrates the relationship among the four triggers.
A maximum of four conditions can be set for the harmonic wave trigger.

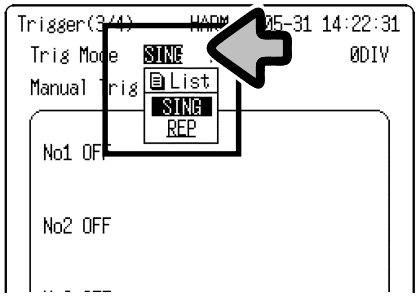


(*) Four harmonic wave trigger sources are ORed together.

7.1 Basic Trigger Setting Items and Setting Methods

Described below are methods for setting triggers for the harmonic wave analysis function.

(1) Trigger mode

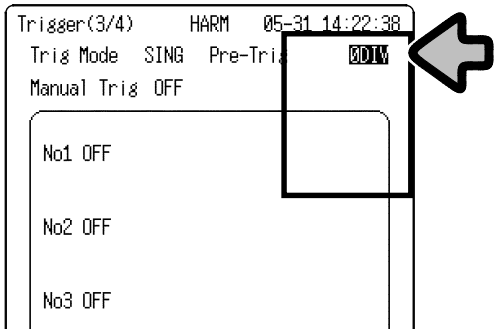


This item is used to set whether to end recording after one measurement or to continue recording.

1. Move the flashing cursor to **Trig Mode**.
2. Select the setting using the ▲▼ buttons.

SING, REP

(2) Pre-trigger



This selection is valid only in time-series analysis mode.
It is used to set the number of divisions for the signal to be recorded prior to a trigger.

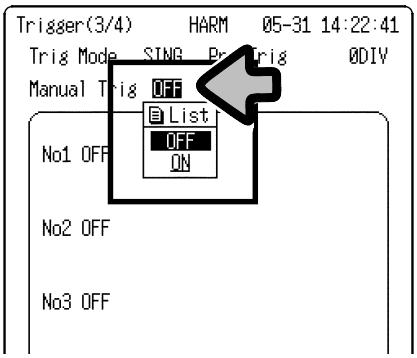
1. Move the flashing cursor to **Pre-Trig**.
2. Select the setting using the ▲▼ buttons.

0, 5, 10 DIV

NOTE

- The pre-trigger function is disabled when the external trigger/timer trigger is turned ON.
- In the harmonic wave analysis function, a trigger can be accepted immediately after starting. Thus, the pre-trigger portion of a recording may not be available in some cases.

(3) Manual trigger



This item is used to activate a trigger when the T button is pressed.
The manual trigger on standby is given priority over all other trigger settings.

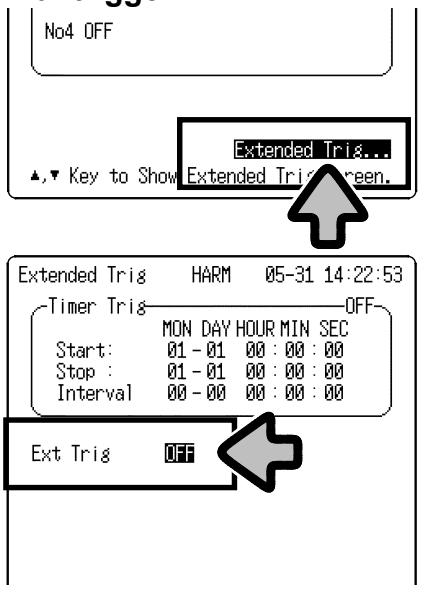
1. Move the flashing cursor to **Manual Trig**.
2. Select the setting using the ▲▼ buttons.

OFF	Manual trigger is not used.
ON	Manual trigger is used.

(4) Harmonic wave trigger

This is used to set the harmonic wave trigger.
(Refer to Section 7.2 "Harmonic Wave Trigger.")

(5) External trigger



This enables use of an external input as a trigger source. (For detailed information, refer to Section 8.10 "External Trigger" in the operating manual for the main unit.)

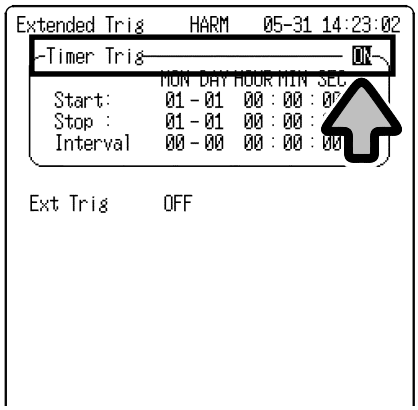
1. Move the flashing cursor to **Extended Trig...** on the trigger screen (3/4).
2. Press the ▲▼ buttons to open the extended trigger screen.
3. Move the flashing cursor to **Ext Trig**.
4. Select the setting using the ▲▼ buttons.

OFF	External trigger is not used.
ON	External trigger is used.

(6) Timer trigger

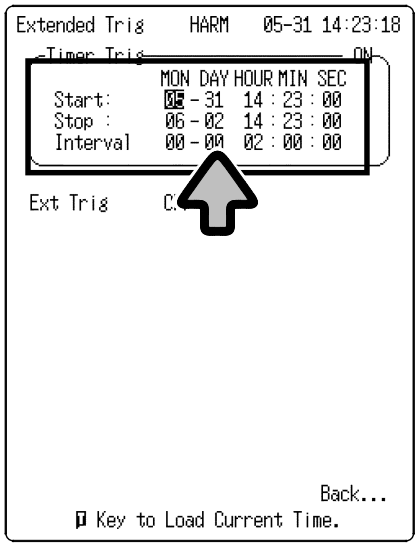
This trigger is tripped for a fixed time interval from the set starting time to the set ending time.

This function is used to make recordings at regular intervals.



1. Move the flashing cursor to **Extended Trig** on the trigger screen (3/4) and press the ▲▼ buttons to open the extended trigger screen.
2. Move the flashing cursor to **Timer Trig**.
3. Select the setting using the ▲▼ buttons.

OFF	Timer trigger is not used.
ON	Timer trigger is used.



4. Move the flashing cursor to **START**.
5. Set the starting time, using the ▲▼ buttons. In the same way, set the ending time and the time interval.

To set to the current time:
With the cursor on "START," press the T button. (The current time is read.)

NOTE

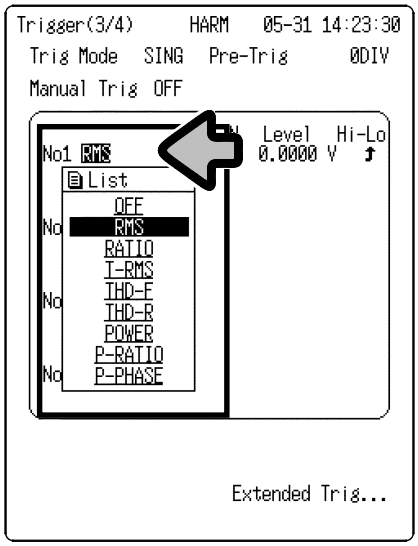
- Before setting the timer trigger, be sure to set the current time in the system screen. (For information on time setting, refer to Section 10.5.1 "Time Setting" in the operating manual for the main unit.)
- Make sure the start/end times are set later than the time at which the **START** button is pressed and measurement starts.
- When using a single trigger mode, only one trigger that is tripped at the start time is valid. In such cases, the time interval and end time become invalid (when only the timer trigger function is turned On).
  Note that the end time setting becomes valid in the following conditions.
  1. When the recording length is set to "CONT."
  2. When the end time comes before the data of the set recording length is obtained.
- To make recordings at regular intervals, set the trigger mode to "REPEAT" and the harmonic wave trigger to "OFF."

7.2 Harmonic Wave Trigger

A trigger can be tripped during harmonic wave analysis according to specified conditions.

Up to four conditions can be set as trigger sources.

(1) Harmonic wave trigger type setting

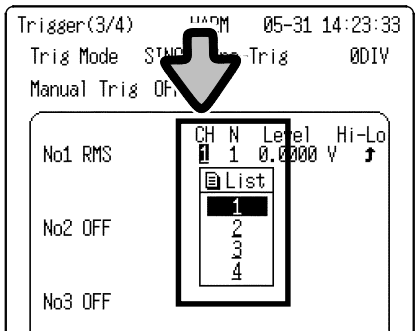


A maximum of four harmonic wave triggers can be set in No. 1 through No. 4.

1. Move the flashing cursor to **Harmonic wave trigger type**.
2. Select the setting using the ▲▼ buttons.

OFF	Harmonic wave trigger is not used.
RMS	Rms value of harmonic wave component of each degree
RATIO	Content ratio of harmonic wave component of each degree in fundamental wave
T-RMS	Sum of rms values of all harmonic wave components (overall rms value)
THD-F	Percentage of all harmonic waves in fundamental wave
THD-R	Percentage of all harmonic waves in total rms value
POWER	Active power value of harmonic wave component of each degree
P-RATIO	Active power content ratio of harmonic wave component of each degree in active power of fundamental wave
P-PHASE	Phase angle of harmonic wave current of each degree relative to voltage waveform

(2) Trigger channel setting

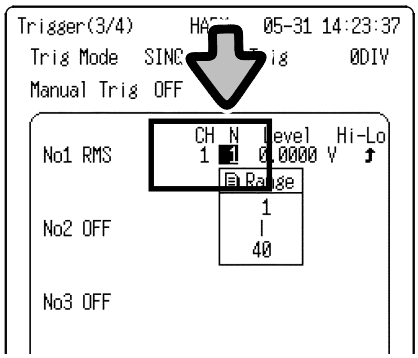


This is used to set the channel to be applied with a harmonic wave trigger.

1. Move the flashing cursor to **CH**.
2. Select the setting using the ▲▼ buttons.

CH1, CH2, CH3, CH4	(CH3 and CH4 are available only in the 8808-51.)

(3) Harmonic wave degree setting

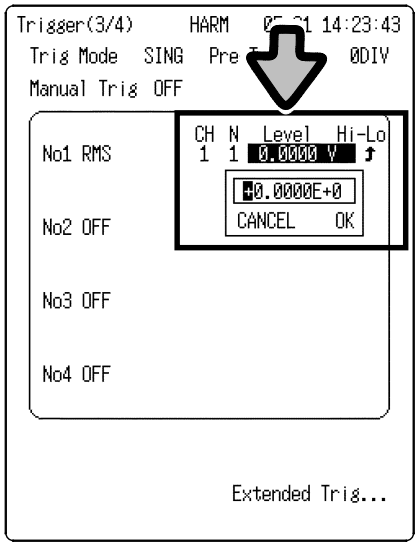


This item is used to set the degree of harmonic wave analysis results to be triggered.
A selection can be made only when rms value, content ratio, active power, power content ratio, and power phase angle settings have been made.

1. Move the flashing cursor to **N**.
2. Select the setting using the ▲▼ buttons.

1 to 40

(4) Trigger level setting



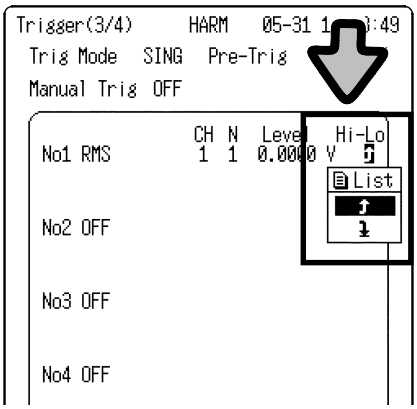
This item is used to set the level of a selected harmonic wave trigger.

1. Move the flashing cursor to **Level**.
2. Open the numeric input window using the ▲▼ buttons.
3. Using the ◀ SCROLL/CURSOR ▶ button, move the flashing cursor to a selected digit. Enter a value using the ▲▼ buttons.
4. To confirm the setting:
   Move the flashing cursor to **OK** and press the ▲▼ buttons or the **START** button.
   To cancel the setting:
   Move the flashing cursor to **CANCEL** and press the ▲▼ buttons or the **STOP** button.

NOTE

- Level input is in scientific notation format, using "E."
- Settings based on unit prefixes such as "m" ("mill") and "k" ("kilo") cannot be used.

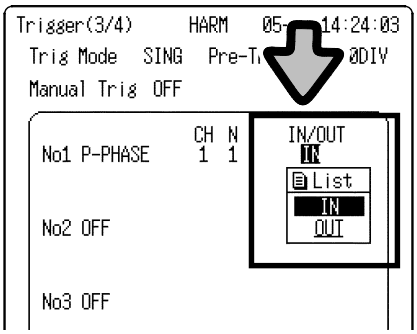
(5) Trigger condition setting



This is used to set the conditions required to trip the trigger set in steps (1) through (4).
In case of parameters other than power phase angle

1. Move the flashing cursor to **Hi-Lo**.
2. Select the setting using the ▲▼ buttons.

↑	Trigger is tripped when the value is above the trigger level.
↓	Trigger is tripped when the value is below the trigger level.



In case of **P-PHASE**

1. Move the flashing cursor to **IN/OUT**.
2. Select the setting using the ▲▼ buttons.

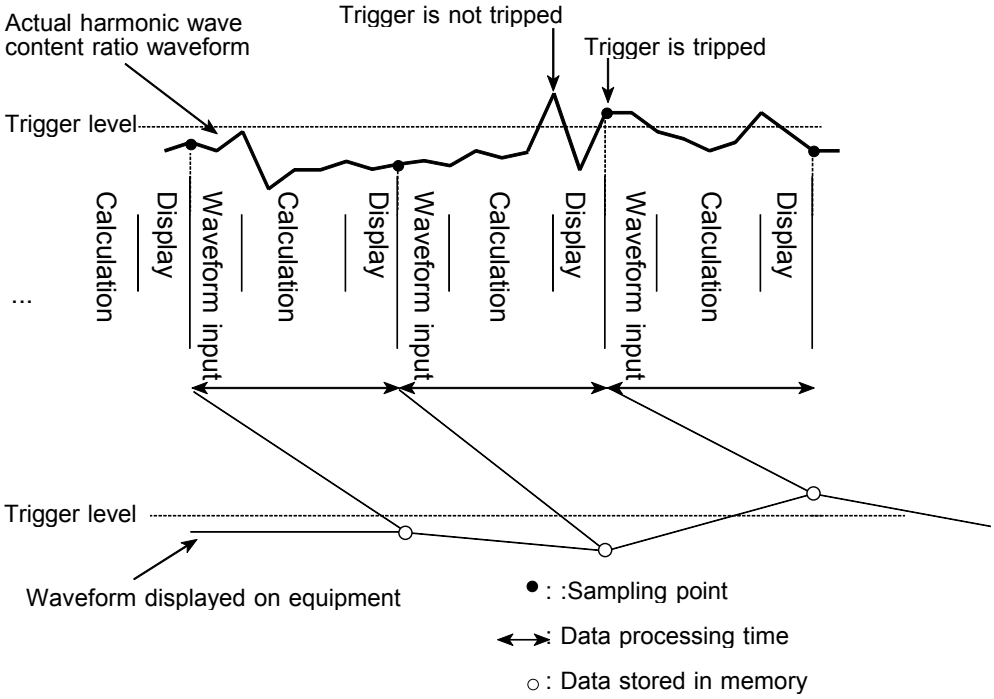
IN	Trigger is tripped when harmonic wave is flowing in.
OUT	Trigger is tripped when harmonic wave is flowing out.

NOTE

- The harmonic wave trigger is tripped according to the ORed result of the four conditions that can be set.
- In the harmonic wave analysis function, the external trigger and timer trigger are ANDed with the harmonic wave trigger.
- When either the external trigger or timer trigger is ON, the harmonic wave trigger condition is checked against the input waveform acceding to those trigger conditions.

Theory behind harmonic wave trigger

In harmonic wave analysis, the harmonic wave trigger is not tripped in real time because the trigger is based on a comparison of the results of FFT calculations performed on the input waveform with the set conditions. Note that a trigger is not tripped by unexpected phenomena that occur as data is being processed, as shown below.



8. Printer Operations

Recording types and analysis modes

Analysis mode Recording method	Instantaneous analysis mode	Time-series analysis mode
Manual print	●	●
Partial print	x	●
Auto print	●	●
Screen copy	●	●

●:Possible/ x:Not possible

NOTE
- The printer cant be used when the main unit is running on alkaline batteries.
- To use the printer, use the 9418-10 AC ADAPTER or 9447 BATTERY PACK.
- In manual print, real time print, and partial print, the list and gauge can be printed with the waveform. (Refer to Section 11.2.3 "List & Gauge" in the operating manual for the main unit.)

8.1 Recording on Printer

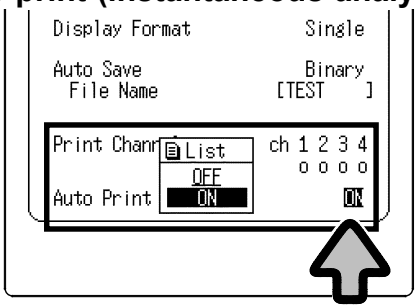
(1) Manual print

- In instantaneous analysis mode, this setting prints the results of analysis of data obtained in one measurement.
- In time-series analysis mode, this setting prints a maximum of 60 divisions of analysis results stored in memory.
- Since measurement data is saved to memory, it can be reprinted as many times as required.

After measurement, pressing **PRINT** button prints measurement results.

NOTE
- In instantaneous analysis mode, manual printing performs the following operations:
  Waveform display screen: Displayed waveform data is printed.
  Gauge & list and comment setting become valid. (*1)
  Displayed cursors A and B are printed.
  Numeric screen: Numerical data is printed.
  Graph screen: Displayed graph data is printed.
  Gauge & list and comment setting become valid. (*1)
  Displayed cursors are printed.
  (*1) (For detailed information, refer to Section 11.2.3 "List & Gauge" and Section 11.3 "Comment Screen Setting" in the operating manual for the main unit.)
- Press the **FEED** button to feed the recording, except during measurement.
- When the waveform is magnified or compressed in the time-series analysis mode, the printing reflects that setting.
- Partial printing occurs if cursors A and B are used in time-series analysis mode.

(2) Auto print (instantaneous analysis mode)

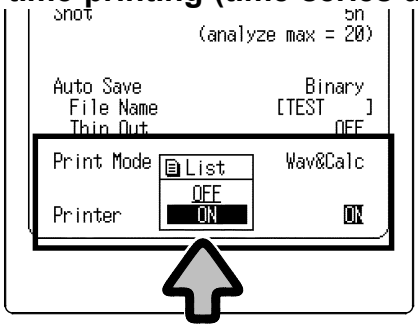


This function automatically prints the input waveform as soon as it is displayed on the screen.

1. Move the flashing cursor to **Auto Print**.
2. Select the setting using the ▲▼ buttons.

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

(3) Real-time printing (time-series analysis mode)



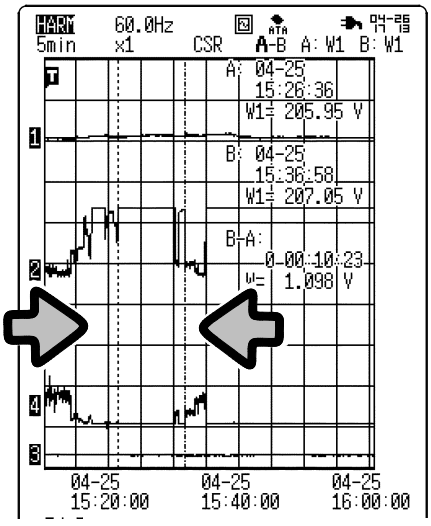
This function prints in real time as measurement data is input.

1. Move the flashing cursor to **Printer**.
2. Select the setting using the ▲▼ buttons.

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

(4) Partial print (time-series analysis mode)

- When cursors A and B are used, this function prints the section between the two cursors.
- A partial print can be produced even if either cursor A or B lies at a position off screen.
- This function can be used when the print type is set to "Wave" or "Logging."
- When only cursor A is used, the waveform data from the time indicated by the cursor is printed.
- To use cursors A and B, refer to Section 6.3 "Cursor Operations" in the operating manual for the main unit.



1. Move cursors A and B to the start and end points.
   (Either cursor may be positioned at either point.)
2. Press the **PRINT** button.

NOTE When the analysis result is magnified, the printed document also reflects the magnification setting.

(5) Screen copy

You can print any images displayed on the LCD, including waveforms, status information, trigger, and system screens.

1. Display the screen to be printed.
2. Press the **COPY** button.

(6) Report printing

This function is used to print the waveform, upper and lower limit values, and analog channel settings displayed on the waveform display screen. When cursors A and B and the comment displayed on the screen are set, comments are also printed.

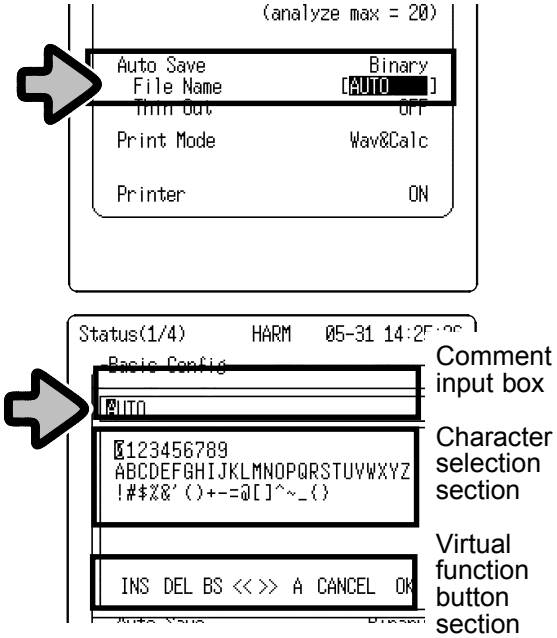
1. Display the waveform display screen.
2. Press the **FEED** and **COPY** buttons simultaneously. (Press the **FEED** button first.)

In the numeric screen for instantaneous analysis mode, the report printing function prints the results or execution performed on the graph screen.

9. PC Card

9.1 Input of File Name

Described below is a method for entering a file name for auto save.



1. Move the flashing cursor to **File Name**.
2. Press the ▲▼ buttons to open the file name input window.
3. In the character selection section in the file name input window, select a character using the cursor button. Press the ▲▼ buttons to confirm input.
4. After entering the comment, press the **START** button to confirm input. (The file name input window is closed.)

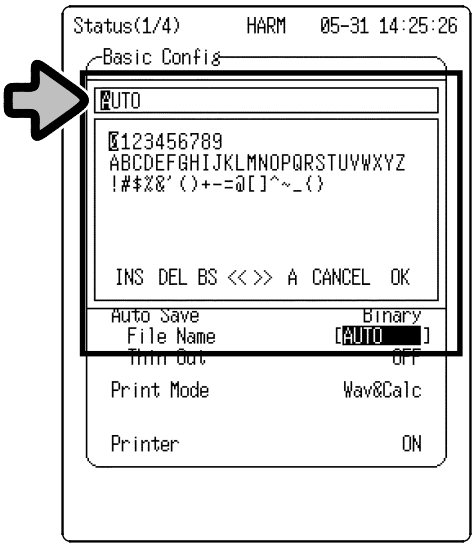
(1) Operation on comment input section (available in the comment input screen)

Backspace	T	
Cursor operations	◀◀ Moves the cursor to the beginning of the comment input box.	▶▶ Moves the cursor to the end of the comment input box.
	◀ SCROLL/CURSOR ▶ Moves the cursor one character position to the right or left.	

(2) Operation on character selection section (available in the comment input screen)

Cursor operation	△▽◁▷	Comment input confirm	**START**
Character input confirm	▲▼	Comment input cancel	**STOP**

(3) Using the virtual function buttons



Move the flashing cursor to the virtual function buttons and press the ▲▼ buttons to confirm the selection.

INS/OVER	Switches between Insert and Overwrite.
DEL	Deletes the character indicated by the flashing cursor.
BS	Backspace
<< >>	Shifts the input position to the right or left.
A	Alphanumeric character
CANCEL	Cancels comment input screen.
OK	Confirms comment input.

The virtual function buttons have the same functions as the corresponding function buttons.

9.2 Text File Internal Format

A text file contains a header and data.
The header provides the following information for measurement data.

COMMENT	General waveform comment
DATE	Measurement date (month/day/year)
TIME	Trigger time (hours:minutes:seconds)
NUM_SIGS	Number of data types (including time-axis data)
INTERVAL	Data interval (= time-axis range/80)
HORZ_UNITS	Unit of time axis (S = seconds)
VERT_UNITS	Units of data (including time-axis data)
SIGNAL	Name of data
DATA	Indicates the end of the header; measurement data follows.

9.3 Examples of Stored Files

(1) Data stored in the waveform screen in instantaneous analysis

```
"HARMONICS(INSTANT)"
"Trig.Time","Fund.Freq."
"01-05-31 15:27:49","60.0Hz"
"PHASE(CH1&2)","VALUE(CH1)","VALUE(CH2)","PHASE(CH3&4)","VALUE(CH3)","VAL
UE(CH4)"
"°","V","A","°","V","A"
+0.0000E+00,+1.2500E-01,+4.0625E+00,+0.0000E+00,+2.5000E-01,+3.1250E-02
+5.3973E-02,+2.5000E-01,+4.0625E+00,+5.8499E-02,+2.5000E-01,+3.1250E-02
+1.0795E-01,+3.7500E-01,+4.0625E+00,+1.1700E-01,+2.5000E-01,+3.1250E-02
+1.6192E-01,+5.0000E-01,+4.0469E+00,+1.7550E-01,+2.5000E-01,+3.1250E-02
+2.1589E-01,+6.2500E-01,+4.0469E+00,+2.3399E-01,+2.5000E-01,+3.1250E-02
+2.6987E-01,+7.5000E-01,+4.0469E+00,+2.9249E-01,+2.5000E-01,+3.1250E-02
+3.2384E-01,+8.7500E-01,+4.0469E+00,+3.5099E-01,+2.5000E-01,+3.1250E-02
+3.7781E-01,+1.0000E+00,+4.0469E+00,+4.0949E-01,+2.5000E-01,+3.1250E-02
+4.3178E-01,+1.1250E+00,+4.0469E+00,+4.6799E-01,+2.5000E-01,+3.1250E-02
+4.8576E-01,+1.2500E+00,+4.0625E+00,+5.2649E-01,+2.5000E-01,+3.1250E-02
+5.3973E-01,+1.5000E+00,+4.0469E+00,+5.8499E-01,+2.5000E-01,+3.1250E-02
+5.9370E-01,+1.6250E+00,+4.0625E+00,+6.4348E-01,+2.5000E-01,+3.1250E-02
+6.4768E-01,+1.7500E+00,+4.0469E+00,+7.0198E-01,+2.5000E-01,+3.1250E-02
+7.0165E-01,+1.8750E+00,+4.0625E+00,+7.6048E-01,+2.5000E-01,+3.1250E-02
```

(2) Data stored in the rms value/content ratio/phase angle screen in instantaneous analysis

```
"HARMONICS(INSTANT)"
"Trig.Time","Fund.Freq."
"01-05-31 15:27:49","60.0Hz"
"T-RMS(CH1)","THD-F(CH1)","THD-R(CH1)","T-RMS(CH2)","THD-F(CH2)","THD-
R(CH2)","T-RMS(CH3)","THD-F(CH3)","THD-R(CH3)","T-RMS(CH4)","THD-
F(CH4)","THD-R(CH4)"
"V","%","%","A","%","%","V","%","%","A","%","%"
+1.0293E+02,+4.6666E+00,+4.6615E+00,+2.9717E+00,+7.7376E+00,+7.7146E+00,+6.5
895E-03,+1.0710E+03,+9.9567E+01,+2.6618E-02,+2.2863E+01,+2.2288E+01
"N","RMS(CH1)","RATIO(CH1)","PHASE(CH1)","RMS(CH2)","RATIO(CH2)","PHASE(CH2
)","RMS(CH3)","RATIO(CH3)","PHASE(CH3)","RMS(CH4)","RATIO(CH4)","PHASE(CH4)"
"","V","%","°","A","%","°","V","%","°","A","%","°"
1,+1.0282E+02,+1.0000E+02,-4.6973E-
08,+2.9628E+00,+1.0000E+02,+0.0000E+00,+6.1258E-
04,+1.0000E+02,+0.0000E+00,+2.5949E-02,+1.0000E+02,+0.0000E+00
2,+5.9404E-02,+5.7775E-02,+7.6835E+01,+1.1931E-01,+4.0268E+00,-
1.5367E+02,+9.8334E-04,+1.6052E+02,-6.1345E+00,+9.6758E-
04,+3.7288E+00,+8.1774E+01
3,+3.5094E+00,+3.4132E+00,+4.3359E+01,+1.0508E-
01,+3.5466E+00,+7.8675E+01,+6.8968E-04,+1.1259E+02,-8.4088E-01,+2.2887E-
03,+8.8201E+00,-1.3350E+02
4,+2.2965E-02,+2.2336E-02,-1.7230E+01,+8.6278E-02,+2.9120E+00,-
4.8757E+01,+3.4679E-04,+5.6612E+01,-1.4347E+02,+2.3760E-03,+9.1565E+00,-
5.4695E+01
```

(3) Data stored in the active power/power content ratio/power phase angle screen in instantaneous analysis

```
"HARMONICS(INSTANT)"
"Trig.Time","Fund.Freq."
"01-05-31 15:27:49","60.0Hz"
"T-WATT1","T-VA1","T-var1","P-PHASE1","T-WATT2","T-VA2","T-var2","P-PHASE2"
"W","VA","var","","W","VA","var",""
-6.7137E+01,+3.0587E+02,-2.9707E+02,-2.1949E-01,+1.5441E-05,+1.7540E-04,-
7.2594E-06,-8.8034E-02
"N","WATT1","RATIO1","PHASE1","WATT2","RATIO2","PHASE2"
"","W","%","°","W","%","°"
1,-6.7363E+01,+1.0000E+02,+1.0278E+02,+1.5840E-05,+1.0000E+02,+4.7795E+00
2,+6.4257E-03,-9.5390E-03,-2.4951E+01,-1.2366E-07,-7.8064E-01,+9.7468E+01
3,+3.5383E-01,-5.2526E-01,-1.6358E+01,-7.4887E-07,-4.7276E+00,-1.1832E+02
4,+1.8669E-03,-2.7714E-03,+1.9575E+01,-2.5310E-07,-1.5978E+00,+1.0789E+02
5,-1.2927E-01,+1.9189E-01,+1.3167E+02,+4.1097E-07,+2.5945E+00,+8.3283E+01
6,+9.2634E-04,-1.3752E-03,-4.9776E+01,+4.8823E-08,+3.0822E-01,+7.9100E+01
7,+4.5029E-04,-6.6846E-04,-8.9522E+01,-8.3018E-07,-5.2409E+00,-1.4679E+02
8,-4.7267E-04,+7.0168E-04,+1.2438E+02,-9.0838E-07,-5.7346E+00,+1.4041E+02
9,-8.4780E-03,+1.2586E-02,+1.1160E+02,-1.5138E-07,-9.5564E-01,+1.0926E+02
10,-3.6396E-04,+5.4030E-04,+1.3734E+02,+2.3539E-06,+1.4860E+01,-1.5203E+00
11,+1.2904E-03,-1.9156E-03,-8.5958E+01,+2.8652E-07,+1.8088E+00,-4.8524E+01
12,+4.6008E-04,-6.8299E-04,+4.5474E+01,+9.2022E-09,+5.8094E-02,-8.9004E+01
13,+3.5138E-03,-5.2162E-03,+3.9547E+00,+3.2622E-07,+2.0594E+00,+6.9989E+01
14,+1.0265E-05,-1.5238E-05,+8.7235E+01,+2.6686E-07,+1.6847E+00,+4.7870E+01
15,-7.7404E-03,+1.1491E-02,-1.5896E+02,-1.3739E-07,-8.6733E-01,-1.1589E+02
16,+1.8826E-04,-2.7947E-04,+6.7600E+01,-1.8437E-06,-1.1639E+01,+1.7624E+02
17,+5.4396E-03,-8.0751E-03,+1.3493E+00,-8.5045E-07,-5.3689E+00,-1.5486E+02
18,+1.7781E-04,-2.6396E-04,-3.7154E+01,-1.9816E-07,-1.2510E+00,-1.6349E+02
19,-3.6645E-03,+5.4400E-03,-1.7803E+02,+7.5790E-07,+4.7847E+00,-1.1222E+01
20,+1.7362E-04,-2.5774E-04,+5.1104E+01,+1.5069E-08,+9.5133E-02,+8.8137E+01
```

(4) Data stored in time-series analysis

```
"HARMONICS(SERIES)"
"Trig.Time","Fund.Freq."
"01-05-31 15:29:36","60.0Hz"
"TIME","RMS(CH1:3)","RMS(CH1:5)","RMS(CH1:7)","T-RMS(CH1)","THD-F(CH1)","THD-
R(CH2)","POWER(CH1&2:1)","POWER(CH1&2:3)","POWER(CH1&2:5)","POWER(CH1&2:7
)","P-PHASE(CH1&2:3)","P-PHASE(CH1&2:5)","WATT(CH1&2)","P-
FACTOR(CH1&2)","RMS(CH2:3)","RMS(CH2:5)","RMS(CH3:3)","RMS(CH3:5)","RMS(CH4:3
)","RMS(CH4:5)"
"","V ","V ","V ","V ","% ","% ","W ","W ","W ","W ","","","W ","","A ","A ","V ","V
","A ","A "
"05-31
15:29:36",+3.4962E+00,+2.8201E+00,+1.1647E+00,+1.0264E+02,+4.6530E+00,+8.3525E+
00,-8.4901E+01,+3.8530E-01,-1.3868E-01,-5.1588E-03,-9.9817E+01,+7.9562E+01,-
8.4656E+01,-2.7657E-01,+1.1505E-01,+7.3934E-02,+1.1520E-03,+5.8818E-04,+4.0671E-
03,+1.1578E-03
"05-31
15:29:40",+3.5346E+00,+2.8267E+00,+1.1337E+00,+1.0302E+02,+4.6614E+00,+7.6556E+
00,-6.5415E+01,+3.5228E-01,-1.2810E-01,-2.4775E-03,-9.2103E+01,+4.6371E+01,-
6.5192E+01,-2.1310E-01,+1.0356E-01,+6.7887E-02,+1.2029E-03,+1.1705E-03,+3.0821E-
03,+2.9360E-03
"05-31 15:29:44",+3.4455E+00,+2.7576E+00,+9.5788E-
01,+1.0260E+02,+4.5220E+00,+8.3553E+00,-8.4428E+01,+3.8355E-01,-1.3524E-01,-
6.1030E-03,-1.1616E+02,-1.6450E+01,-8.4199E+01,-2.7497E-01,+1.1607E-01,+7.3884E-
02,+6.4585E-04,+1.7302E-03,+2.0581E-03,+2.7778E-03
"05-31
15:29:48",+3.5862E+00,+2.7790E+00,+1.1154E+00,+1.0264E+02,+4.6774E+00,+8.3393E+
00,-8.4258E+01,+4.0026E-01,-1.3597E-01,-6.1505E-03,-1.0172E+02,-1.4560E+02,-
8.3998E+01,-2.7448E-01,+1.1540E-01,+7.3301E-02,+9.0558E-04,+1.3632E-03,+3.0954E-
03,+2.9101E-03
"05-31
15:29:51",+3.6175E+00,+2.8012E+00,+1.1725E+00,+1.0300E+02,+4.7199E+00,+7.8889E+
00,-7.6877E+01,+3.7357E-01,-1.3122E-01,+2.6234E-04,-9.5468E+01,+2.0064E+01,-
7.6627E+01,-2.5025E-01,+1.0702E-01,+7.0269E-02,+5.4344E-04,+9.4710E-04,+2.7862E-
03,+4.0655E-03
```

10. Characteristics of CLAMP ON PROBES (Reference Information)

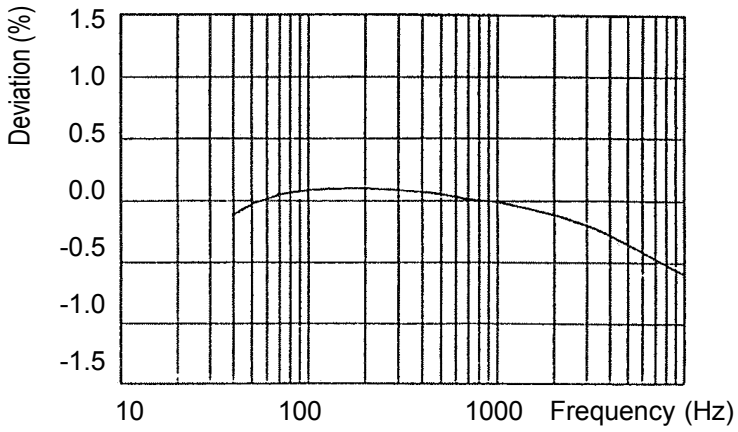
When a CLAMP ON PROBE is used to make measurements, the accuracy of both the CLAMP ON PROBE and the 8807-51/8808-51 will affect measurement accuracy.

In measurements of the direction of a harmonic wave, current value, or other values, the phase characteristics of the CLAMP ON PROBE significantly affect the measured values. Carefully check the specifications of the CLAMP ON PROBE and select the most appropriate unit for the specific measurement application.

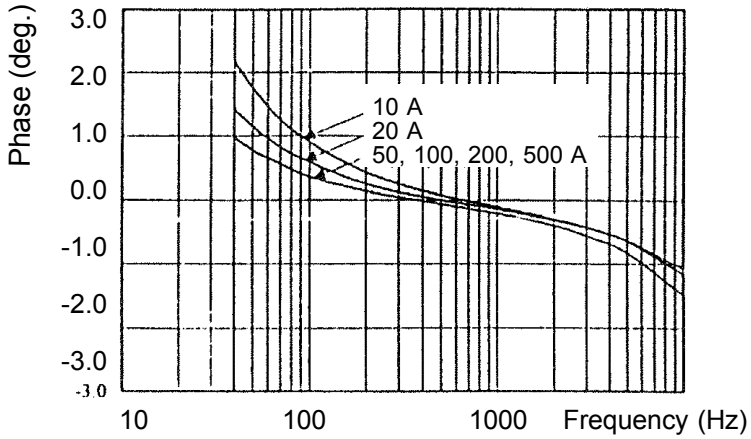
The characteristics of HIOKI CLAMP ON PROBES are given below.

9018-10 CLAMP ON PROBE

Measurement range: 10, 20, 50, 100, 500 AAC
Accuracy: ±1.5% rdg. ±0.1% f.s (23±5℃, at 45 to 66 Hz)
Frequency characteristics: within ±1% (at 40 Hz to 3 kHz, deviation from accuracy)
Phase characteristics: within ±2.5° (at 40 Hz to 3 kHz)



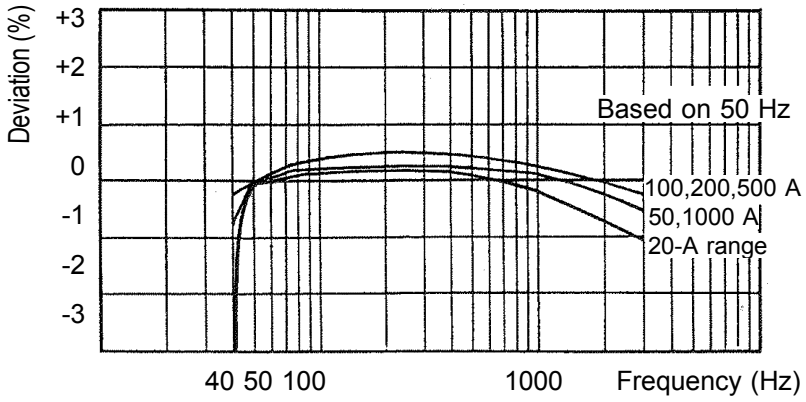
Frequency characteristics (reference data)



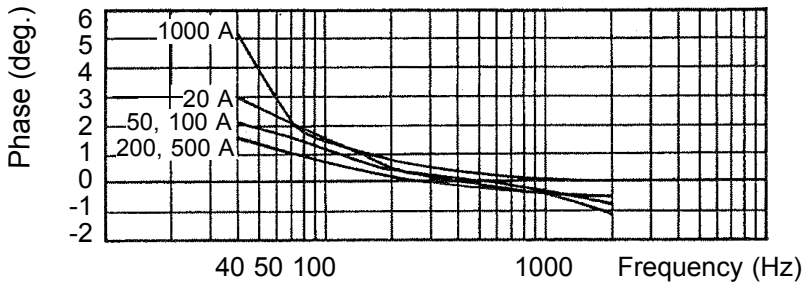
Phase characteristics (reference data)

9132-10 CLAMP ON PROBE

Measurement range: 20, 50, 100, 500, 1000 AAC
Accuracy: ±3% rdg., ±0.5 mV
Frequency characteristics: within ±1% at 40 to 1000 Hz (deviation from 55 Hz)



Frequency characteristics (reference data)



Phase characteristics (reference data)

Index

- A -

- C -

- D -

- E -

- F -

- H -

- I -

- L -

- M -

- O -

- P -

- R -

- S -

- T -

- V -

- W -

- Z -

HIOKI 8807-51/ 8808-51

HARMONIC WAVE ANALYSIS FUNCTION

Instruction Manual

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