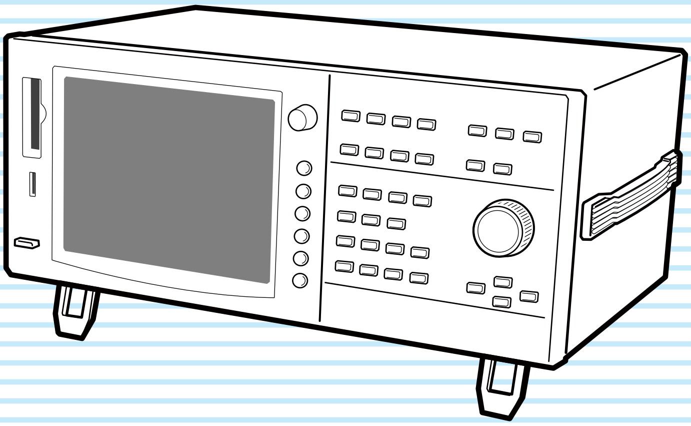
Part No. Z1-004-222, I0044101
Oct 2021

Operation Manual

Harmonic/Flicker Analyzer

KHA3000



About This Manual

This document is intended for those who use this product for the first time, and contains its overview, notes on various settings, measuring methods, SCPI commands, maintenance, and usage.

Read this manual thoroughly to ensure effective use of this product's functions. This manual will also be helpful if you forget how to operate the product during use, or if a problem occurs.

Applicable firmware version of product

This manual applies to products containing version 3.5X firmware.

Before contacting the Kikusui distributor/agent for inquiries about the product, please make a note of the following:

Type name (indicated at the upper part of the front panel)
Firmware version (see page 72)
Serial number (indicated at the lower part of the rear panel)

Intended reader of this manual

This manual is intended for those who use the harmonic/flicker analyzer KHA3000 and those who teach operators how to use it.

Explanations are given under the presumption that the reader has electrical knowledge related to harmonic current and voltage fluctuation tests.

When the SCPI commands are used, the reader is assumed to have sufficient basic knowledge for controlling measuring instruments using a PC.

Trademarks

Microsoft, Windows and Visual Basic are registered trademarks of Microsoft Corp. Other company and product names are trademarks or registered trademarks of the respective companies.

Copyright and issuance

Reproduction and reprinting of this operation manual, in whole or in part, without our permission is prohibited.

Both unit specifications and manual contents are subject to change without notice.

⚠ Safety Symbols

For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Note the meaning of each of the symbols to ensure safe use of the product. (Not all symbols may be used.)

ϟ or ⚡

Indicates that a high voltage (over 1000 V) is used here. Touching the part may cause a possibly fatal electric shock. If physical contact is required for your work, start work only after you make sure that no voltage is output here.

DANGER

Indicates an imminently hazardous situation that, if any mishandling occurs by ignoring this indication, will result in death or serious injury.

⚠ WARNING

Indicates a potentially hazardous situation that, if any mishandling occurs by ignoring this indication, will result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that, if any mishandling occurs by ignoring this indication, will result in damage to the product and other property.

⃠	**Shows that the act indicated is prohibited.**
⚠	**Indicates a danger, warning, or caution, or details on it. If this mark is displayed on the product, see the relevant sections in this manual.**
⏚	**Protective conductor terminal.**
⊥	**Chassis (frame) terminal.**
|	**ON (power).**
○	**OFF (power).**
▬	**In position of a bi-stable push control**
⊓	**Out position of a bi-stable push control**

Notations Used in This Manual

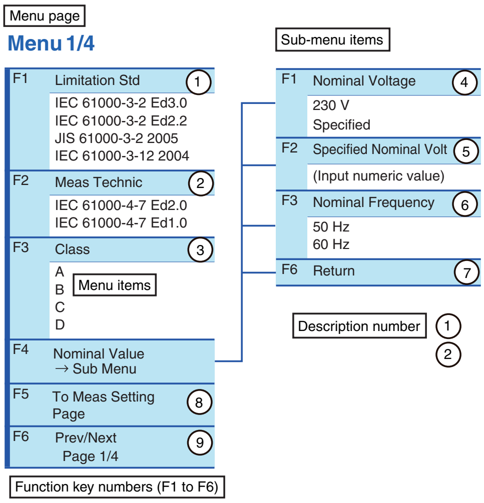
- In this manual, the KHA3000 harmonic/flicker analyzer may be called “KHA3000.”
- In this manual, the LIN3020JF, LIN1020JF and LIN40MA-PCR-L Line impedance network is also called “Line impedance network.”
- In this manual, the PCR-WE series and PCR-WE2 series (including the PCR-WE2R, a model with a regeneration function) AC power supplies, in addition, the PCR-WEA series and PCR-WEA2 series (including the PCR-WEA2R, a model with a regeneration function) AC power supplies are also referred to as the “PCR-WE.”
- In this manual, the PCR-LE series and PCR-LE2 series AC power supplies are also referred to as the “PCR-LE.”
- In this guide, the PCR-LA series is also referred to as the “PCR-LA.”
- **In this manual, all the above AC power supply series may be referred to collectively as the “AC power supply.”**
- In this manual, equipment under test may be called “EUT.”
- In this manual, the compactFlash card and USB flash drive may be collectively called the “storage media.”
- The following symbols are used with the explanations in this manual.

⚠ WARNING	Indicates a potentially hazardous situation that, if ignored, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation that, if ignored, may result in damage to the product and other property.
NOTE	Indicates information that you should know.
DESCRIPTION	Explanation of terminology or operation principle.
See	Indicates reference to detailed information.
>	This symbol indicates the layers of the item to be selected. The item to the left of “>” is the upper layer.

SHIFT+ key name

This means to press the designated blue key while pressing the SHIFT button.

Menu layer (sub-menus)



Safety Precautions

The following safety precautions must be observed to avoid fire hazards, electric shock, accidents, and other failures. Keep them in mind and make sure to observe them.

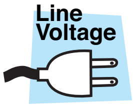
Using the product in a manner that is not specified in this manual may impair the protection functions provided by the product.

Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If unqualified personnel are to use the product, be sure the product is handled under the supervision of qualified personnel (those who have electrical knowledge). This is to prevent the possibility of personal injury.

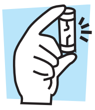
Purpose of use

- Never use the product for purposes other than the product's intended use.
- This product is not designed or manufactured for general households or consumers.



Input power

- Use the product within the rated voltage range of input power.
- To supply input power, use the specified power cord. For details, refer to the corresponding page of the Operation Manual.
- This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).

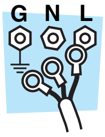


Fuse

- The fuses of this product can be replaced. Replace the fuses with those that have shapes, ratings, and characteristics that adapt to this product. For details, see the corresponding page of the Operation Manual.

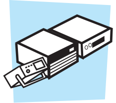
Cover

- Some parts inside the product may cause physical hazards. Do not remove the external cover.



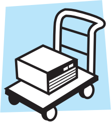
Grounding

- This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent the possibility of electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).



Installation

- This product is designed to secure safety for indoor usage. Be sure to use it indoors.
- When installing this product, observe the precautions on the installation site. For details, refer to the relevant pages of this Manual.



Relocation

- Before relocating this product, turn off the POWER switch and remove the wiring and cables.
- When relocating this product, be sure to include the Operation Manual.

Operation

- If a product malfunction or abnormality is detected, stop using it immediately, and remove the power plug from the outlet. Make sure the product is not used until it is completely repaired.
- Do not disassemble or modify this product. If modification is needed, contact the store from which the product was purchased, or your Kikusui distributor/agent.

Maintenance and inspection

- Before conducting maintenance and inspection, be sure to remove the power cord from the outlet to prevent an electric shock. Do not remove the external cover.
- Periodically check the power cord for broken sheaths and disconnection.
- If the panel surface becomes dirty, lightly wipe it with a soft cloth dipped with neutral detergent diluted with water. Do not use volatile solvents such as thinner or benzene.
- Periodic maintenance, inspection, cleaning, and calibration are recommended to maintain the performance and safe operation of this product.

Adjustment and repair

- Kikusui service engineers will perform internal adjustment and repair of the product. If the product needs adjustment or repairs, contact your Kikusui distributor/agent.

Contents

Quick Guide

Quick Guide for Wiring Measurement Circuits

1

Overview

2

Installation and Preparation for Use

3 Wiring Measurement Circuits

4 System Setup

5 Setting the Harmonic Test

6 Executing Harmonic Tests

7 Observation, Analysis and Judgement of Harmonics

8 Setting the Voltage Fluctuation Test

9 Executing Voltage Fluctuation Tests

10 Observation, Analysis and Judgement of Voltage Fluctuations

11 Other Measurements

12 File Operation

13 Remote Control

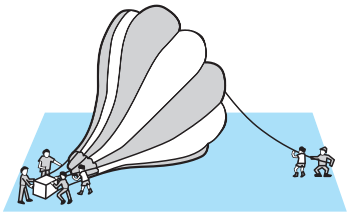
14 Maintenance

15 Specifications

Appendix

Topical List

Preparation



- How do I wire measurement circuits?

  →"Wiring Measurement Circuits" *22*

- What kinds of values are required for impedance?

  →"Using the Line Impedance Network" *56*

- What is a three-phase four-wire measurement circuit like?

  →"Three-phase Four-wire Circuit" *28*

- What kind of electric wire should be used to connect a test system and how long should it be?

  →"Selecting the Type of Electric Wire" *51*

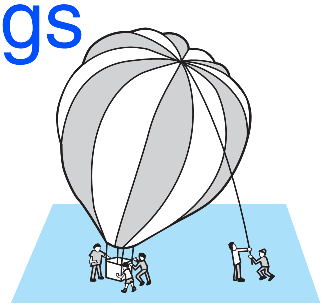
- How do I know the definition of a term?

  →"Using Assist Function" *90*

- How do I start measurements soon? It is time-consuming to view the standards each time.

  →"Using Assist Function" *90*

Settings



- How do I measure harmonic current using IEC 61000-3-2 standards?

  →"Limitation Standards, Classes and Nominal Values" *95*

- How do I measure harmonic current using IEC 61000-3-12 standards?

  →"Limitation Standards, Equipment and Rated of Equipment" *111*

- How do I measure harmonic current using IEC standards without measuring harmonic groups?

  →"Limitation Standards, Classes and Nominal Values" *95*

- How do I set the power supply for measurements?

  →" Controlling the AC Power Supply" *118*

- How do I know the classification methods?

  →"Limitation Standards, Classes and Nominal Values" *95*

- How do I correctly select impedance?

  →"Using the Line Impedance Network" *56*

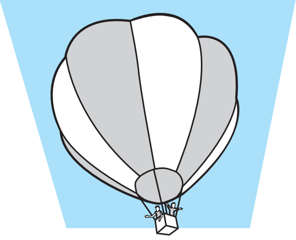
- How do I set the same setting conditions as in the previous test?

  →"Loading a Test Condition File" *268*

- How do I automatically perform the d measurement of the voltage fluctuation?

  →"Limitation Standards and Nominal Values" *187*

Measurement



- How do I find the THC maximum value?

  →"Meter" *166*

- How do I stop Plt measurement halfway?

  →"Aborting the Test by Pressing the STOP Key" *211*

- How do I know the time at which transition occurred after the measurement was started?

  →"Current Trend" *173*

- How do I evaluate harmonic current in the control values of my company?

  →"Measurement Time, Margin Comment Input and Standard Name" *96*

- How do I evaluate voltage fluctuations or flicker values in the control values of my company?

  →"Measurement Time, Count, and Margin" *188*

- How can limit values of 61000-3-12 standard be applied?

  →"61000-3-12 2011: Test Flow" *130*

  →"61000-3-12 2004: Test Flow" *132*

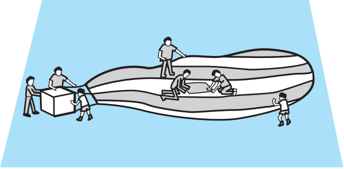
- How do I display the harmonic current in a graph?

  →"2D Harmonics" *165*

- How do I print out a report of harmonic test?

  →"Report Print" *150*

Maintenance



- How do I know when to replace the backup battery?

  →"Replacing the Backup Battery" *350*

- How do I adjust the clock?

  →"Clock and Printer" *88*

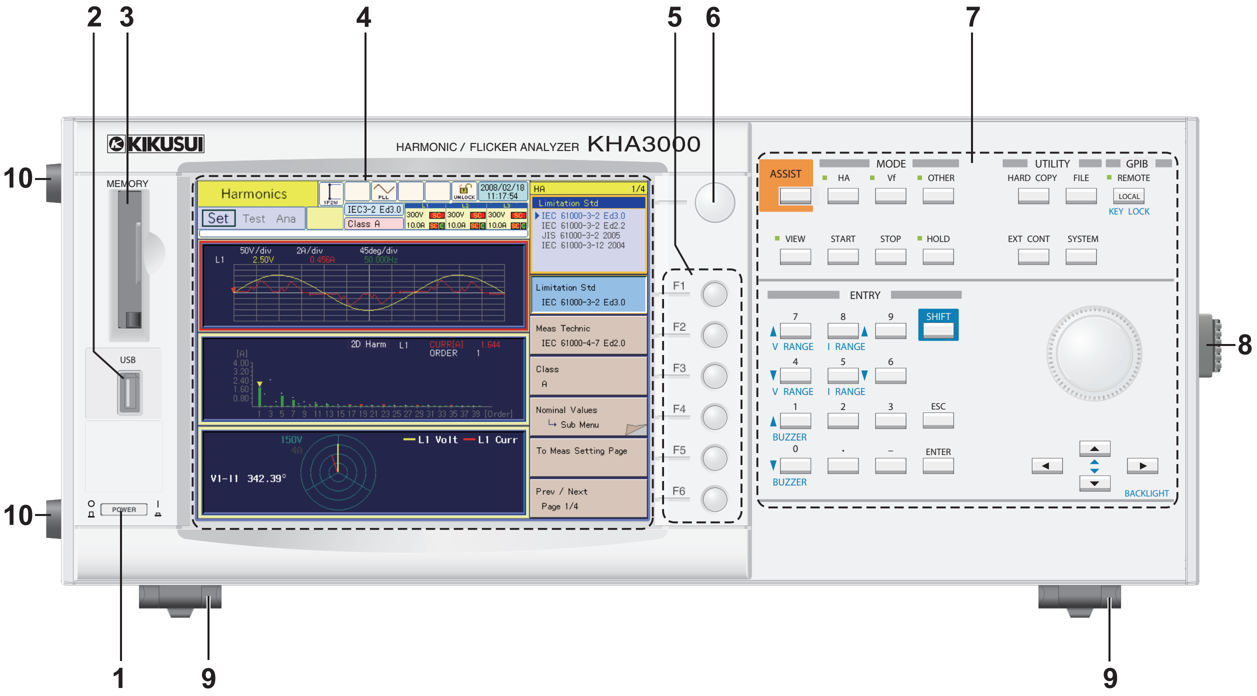
- How do I replace the fuse?

  → Replacing a Fuse *350*

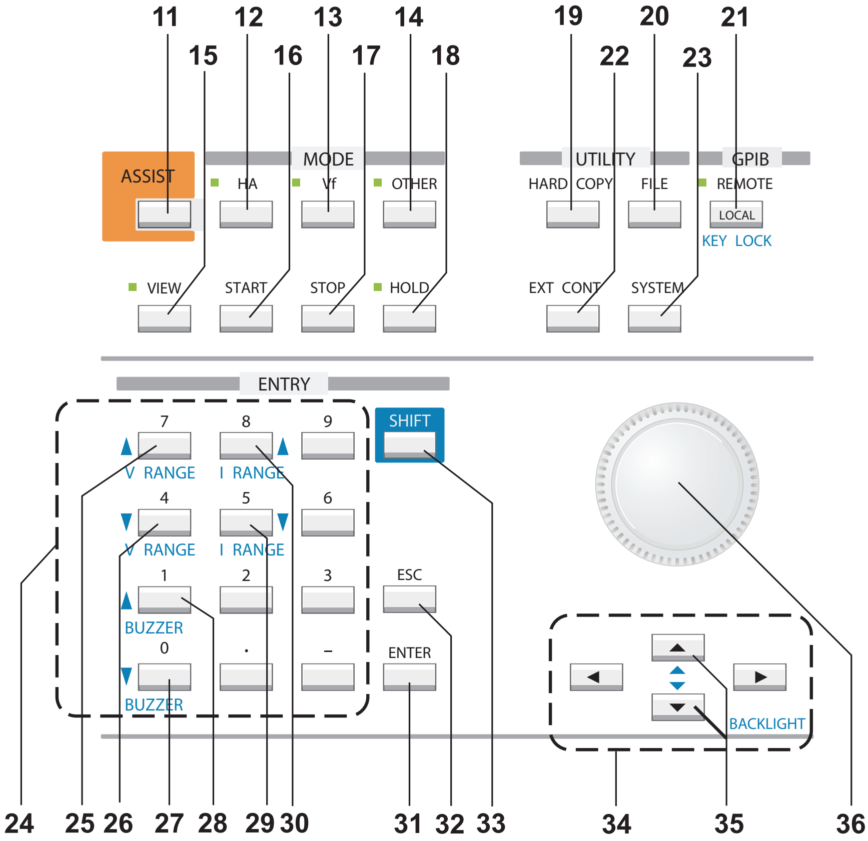
Troubleshooting

Refer to "Troubleshooting" on page 385.

Front panel

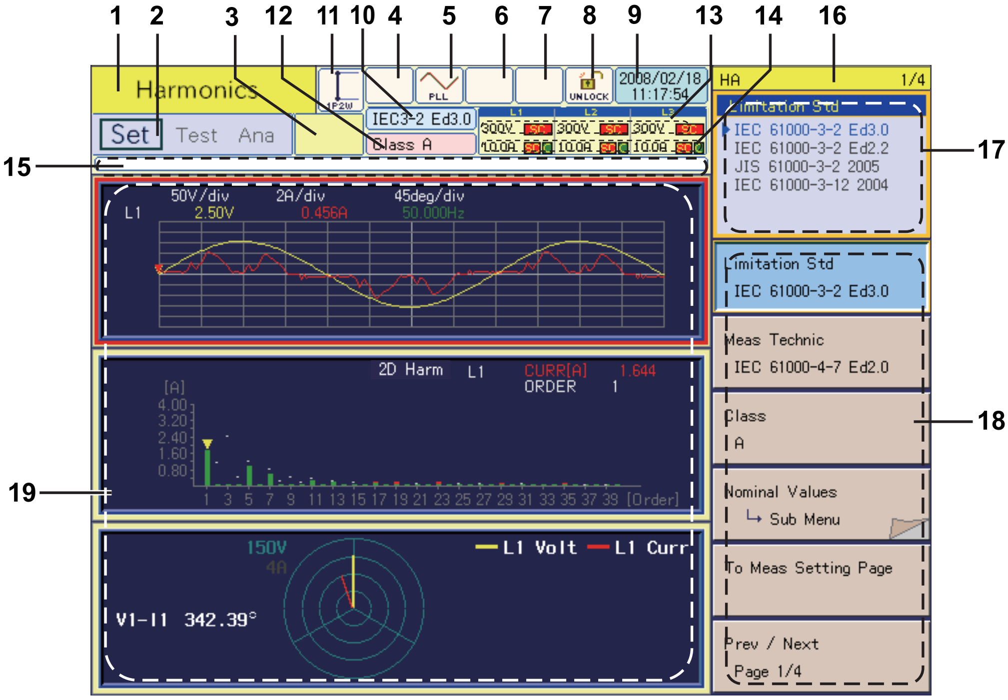


Operation unit



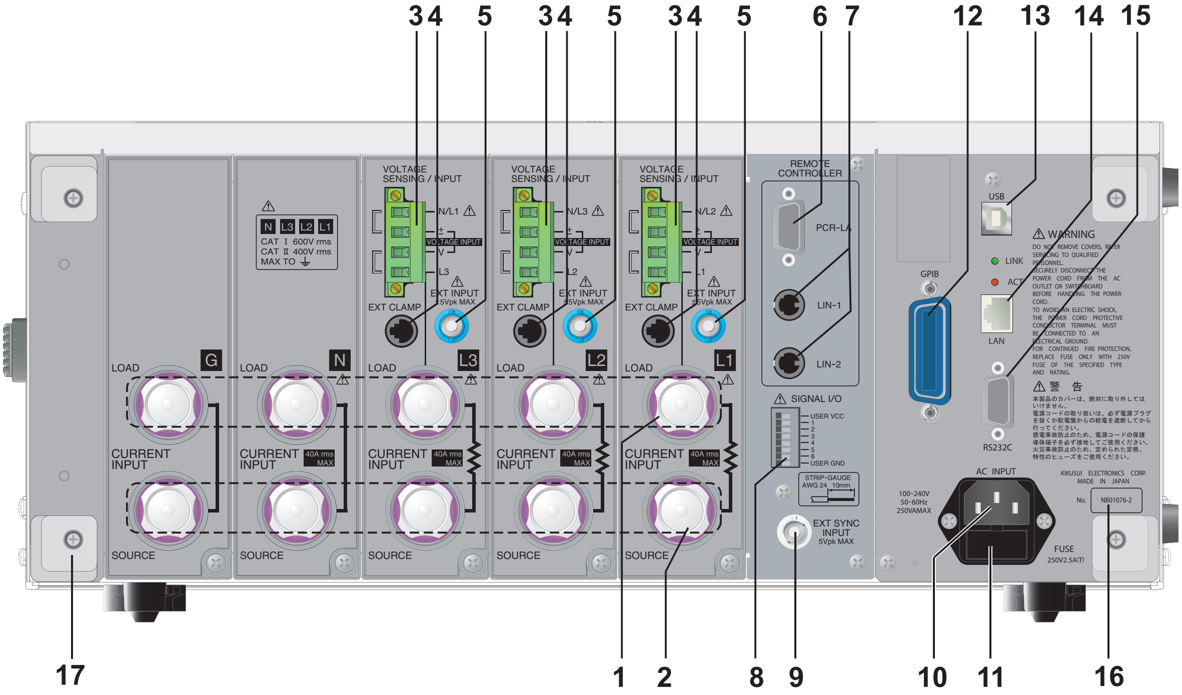
No.	Name	Function	See Page
1	POWER switch	Turns the power ON (|) or OFF (○)	*72*
2	USB	For USB flash drive.	*273*
3	MEMORY slot	For CompactFlash card.	*272*
4	Display unit	Mounted with LCD backlight.	*85*
5	F1 to F6 keys	Function keys for menu selection.	*82*
6	Small knob	Rotary knob for setting menu details.	*82*
7	Operation unit	Keys and large knob. Enlarged view is shown under front panel view.	*84*
8	Handle	Handle for carriage.	*46*
9	Leg/stand	Adjusts the angle of front panel.	*46*
10	Rubber pads on side surface	4 positions on side surface.	*46*
11	ASSIST key	Explanatory function supporting operation.	*90*
12	HA key (LED)	Harmonic current test modes	*92*
13	Vf key (LED)	Voltage fluctuation test modes	*184*
14	OTHER key (LED)	Other measurement modes	*248*
15	VIEW key (LED)	Selects measurement observation and test results analysis views (status display).	*157*
16	START key	Starts test.	*128,210*
17	STOP key	Stops test.	*128,211*
18	HOLD key	Holds screen measurement data variations.	*85*
19	HARD COPY key	Screen hard copy.	*85*
20	FILE key	Saves and opens test data file.	*266*
21	REMOTE LED/LOCAL key KEY LOCK key	Remote control status display/local setting. Key lock setting.	*84*
22	EXT CONT key	Sets external device control.	*118,203*
23	SYSTEM key	Sets test system.	*86*
24	0 to 9 and "." and "-" keys	Input numeric values.	*83*
25	7 ▲ V RANGE	Numeric key. Selects voltage range and raises sensitivity.	*110*
26	4 ▼ V RANGE	Numeric key. Selects voltage range and lowers sensitivity.	*110*
27	0 ▼ BUZZER	Numeric key. Lowers buzzer volume.	*85*
28	1 ▲ BUZZER	Numeric key. Raises buzzer volume.	*85*
29	5 ▼ I RANGE	Numeric key. Selects current range and raises sensitivity.	*110*
30	8 ▲ I RANGE	Numeric key. Selects current range and lowers sensitivity.	*110*
31	ENTER key	Confirms entry.	*83*
32	ESC key	Returns from sub-menu to upper menu.	*84*
33	SHIFT key	Shift key.	*3*
34	▲ ▼ ◀ ▶ keys	UP/DOWN and LEFT/RIGHT keys.	–
35	▲ ▼ keys BACK LIGHT key ▲ ▼	UP/DOWN key. Sets the brightness of display unit.	*85*
36	Large knob	Rotary knob for numeric value entry and cursor setting.	*83*

Screen



No.	Name	Function	See Page
1	Mode	Harmonic current test, voltage fluctuation test, other measurements, file manipulation, EXT control and system setting.	*77*
2	Test status	Test status: Setting, test, and analysis.	*122,206*
3	Testing time (remaining time)	Displays the time remaining for the test (mm:ss or hh:mm:ss for 60 minutes or longer).	*96,188*
4	OUT ON/OFF icon	AC Power Supply OUTPUT ON/OFF display.	*118,203*
5	PLL icon	Synchronous display with test AC power (PLL lock).	*128,210*
6	OVER RANGE icon	Displayed when voltage/current range is exceeded.	*101,192*
7	OHP icon	Displays overheat status of current detector.	*105,196*
8	LOCK/UNLOCK icon	Key lock status.	*84*
9	Clock	Displays the date/time.	*88*
10	Standard	Abbreviated name of the Limitation Standard used during the test.	*111,187*
11	Wiring method of measurement circuits	Single-phase two-wire, single-phase three-wire, three-phase three-wire and three-phase four wire	*101,192*
12	Class	Device class.	*95*
13	V RANGE	Voltage range (shown for each input circuit): AT for auto range and SC when scaling is used.	*101,192*
14	I RANGE	Current range (shown for each input circuit): AT for auto range, SC when scaling is used, B for BNC input, and C for current sensor.	*101,192*
15	Progress bar	The point moves from the left end to the right end during test execution.	*128,210*
16	View name and page	View name and menu page.	*82*
17	Contents of menu selected	Contents of menu selected with F1 to F6 keys.	*82*
18	Menu item	Menu items corresponding to F1 to F6 keys.	*82*
19	Data display area	Displays measured values such as graphs and lists.	*158,232*

Rear panel



No.	Name	Function	See Page
1	LOAD terminal	Connects to EUT. Input phases (channels) are L1, L2 and L3. Terminal G is not grounded. Terminals G and N are used for relay (short-circuited internally).	*54*
2	SOURCE terminal	Connects to AC power supply for test or line impedance network. Input phases (channels) are L1, L2 and L3. Terminal G is not grounded. Terminals G and N are used for relay (short-circuited internally).	*54*
3	VOLTAGE SENSING/ INPUT	Uses plug for voltage measurement of EUT terminal and plug for voltage sensing terminal.	*57*
4	EXT CLAMP	For optional current sensors (at present, no current sensor is available as an option; to be introduced in the future).	*65*
5	EXT INPUT terminal	Input terminals for external current sensor signals.	*64*
6	REMOTE CONTROLLER, PCR-LA	Control terminal for AC power supply.	*66*
7	REMOTE CONTROLLER, LIN-1, LIN-2	Control terminal for LIN (Line Impedance Network) (no function; this terminal is equipped for function expansion).	*66*
8	SIGNAL I/O	I/O signal terminal (no function; this terminal is equipped for function expansion).	–
9	EXT SYNC INPUT	External synchronizing signal input terminal	*65*
10	AC INPUT	Power cord connector.	*47*
11	FUSE	Fuse holder for power supply with 1 spare fuse included.	*350*
12	GPIB	GPIB cable connector for remote control.	*68*
13	USB	USB cable connector for remote control.	*69*
14	LAN (Ethernet port)	This function is not used.	–
15	RS232C	RS232C cable connector for remote control.	*69*
16	Serial No.	Serial number of this product.	–
17	Cord holder	Power cord holder.	–

Quick Guide

Quick Guide for Wiring Measurement Circuits

As a quick help for wiring measurement circuits, this chapter explains the single-phase two-wire, single-phase three-wire, three-phase three-wire, and three-phase four-wire methods.

Wiring Measurement Circuits

This section explains how to wire single-phase two-wire, single-phase three-wire, three-phase three-wire and three-phase four-wire circuits. An impedance network is used for a flicker test. Because the impedance network is not used for a harmonic current test except for some special cases, connect the AC power supply directly to the SOURCE terminals of this product.

Input phases (channels) are L1, L2 and L3. L1 is the reference phase for measurement. Be sure to wire L1.

⚠**WARNING**

- **This work has a risk of electric shock. For the equipment used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

Parts to be prepared by the customer

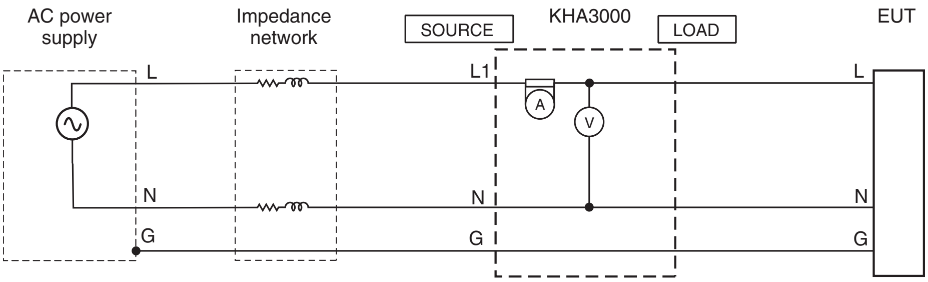
The customer is requested to prepare wires used to connect between devices of the measurement circuit and relay outlets.

Wire thickness

See p. 51

Select a wire thickness according to the input current of the EUT. It is recommended to use wire with a nominal sectional area of 8 mm^2 or larger. Use as short a wire as possible. Kikusui recommends a wire length of 1.5 m or shorter. For the test system, note the IEC 61000-4-7 requirements (voltage drop by wire impedance).

Single-phase Two-wire Circuit



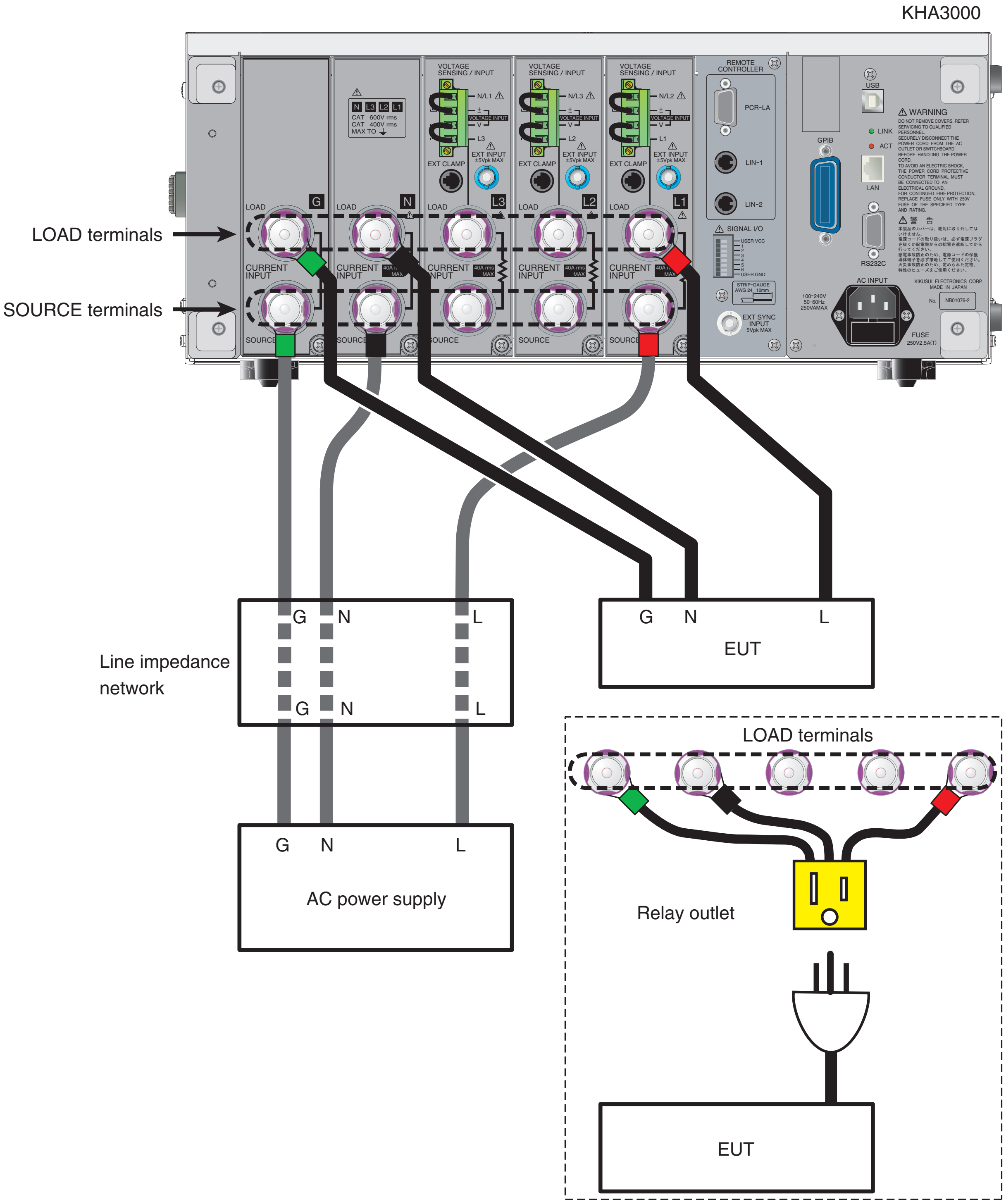
Wiring Method

Use the L1, N and G terminals in the input section on the rear of this product. Connect them according to the table on the next page. If LIN is not used, connect the wires directly from the output terminals of the AC power supply to the SOURCE terminals in the input section of this product. When the EUT uses a power cord with a plug, connect the wires to the LOAD terminals via a relay outlet. Match the terminal polarities (L, N, G) with those of the relay outlet.

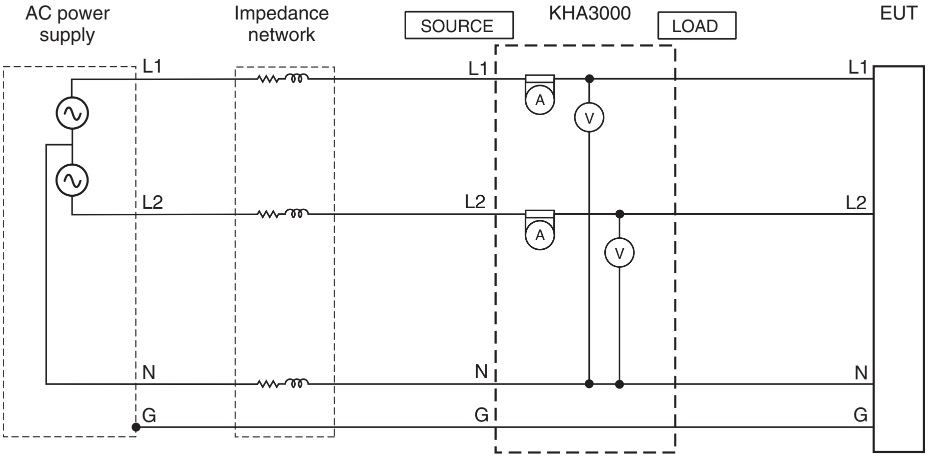
⚠**CAUTION**

Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

AC power	–	LIN		–	Input section on the rear of KHA3000		–	EUT terminal
Output terminal		INPUT	OUTPUT		SOURCE	LOAD		
L	–	L	L	–	L1	L1	–	L
N	–	N	N	–	N	N	–	N
G	–	G	G	–	G	G	–	G



Single-phase Three-wire Circuit

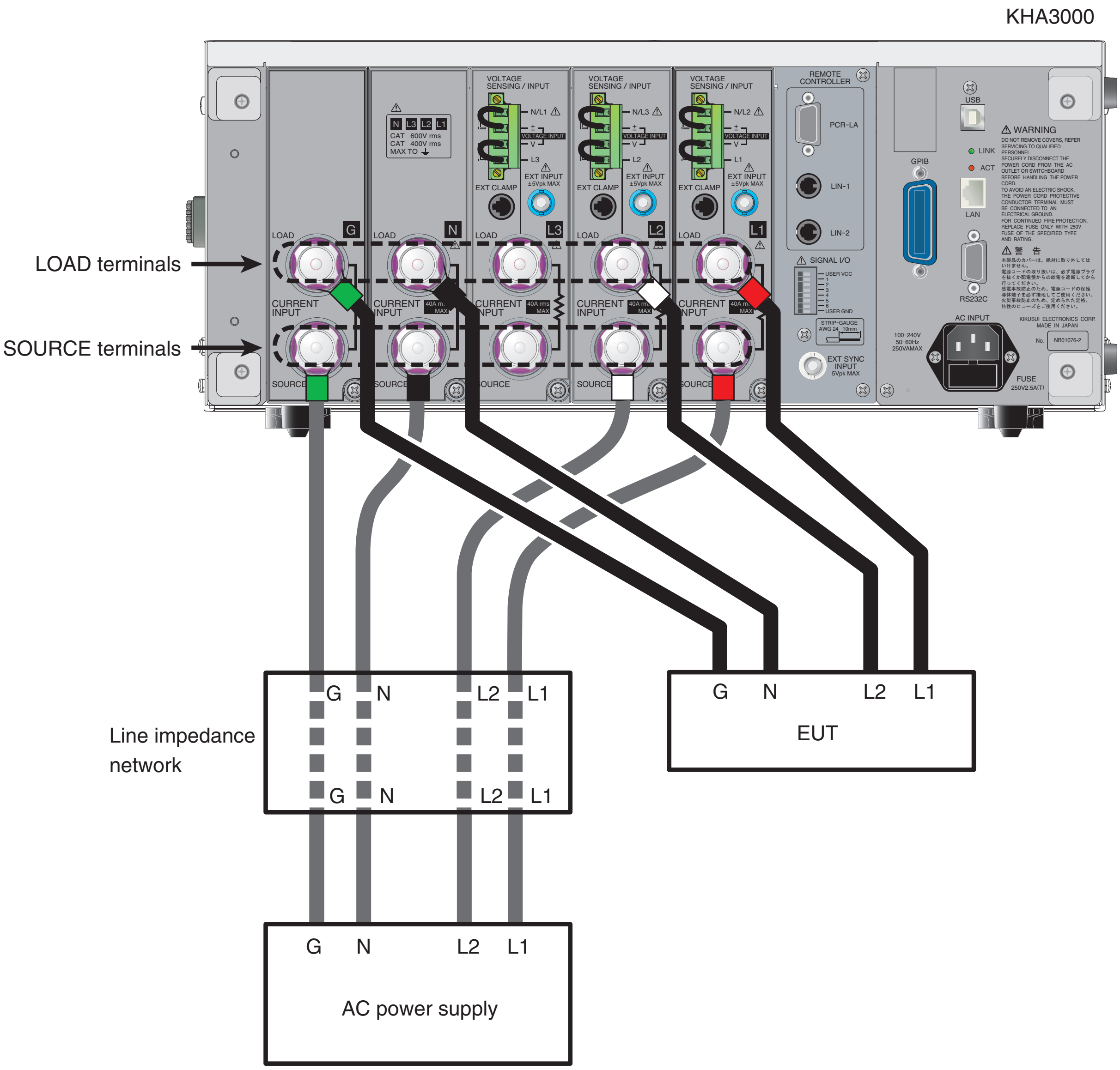


Wiring Method

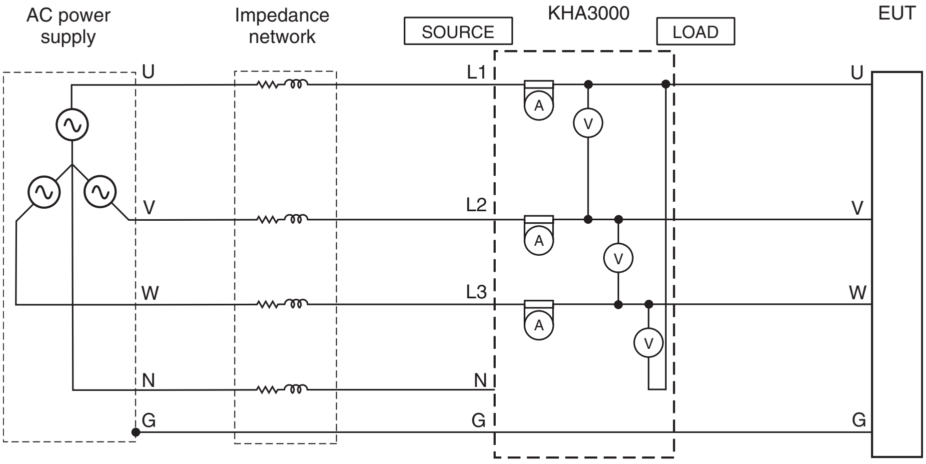
Use the L1, L2, N, and G terminals in the input section on the rear of this product. Connect them according to the following table.
If LIN is not used, connect the wires directly from the output terminals of the AC power supply to the SOURCE terminals in the input section of this product.

⚠CAUTION Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

AC power	–	LIN		–	Input section on the rear of KHA3000		–	EUT terminal
Output terminal		INPUT	OUTPUT		SOURCE	LOAD		
L1	–	L1	L1	–	L1	L1	–	L1
L2	–	L2	L2	–	L2	L2	–	L2
N	–	N	N	–	N	N	–	N
G	–	G	G	–	G	G	–	G


KHA3000
LOAD terminals
SOURCE terminals
LOAD
SOURCE
CURRENT INPUT
G
N
L3
L2
L1
Line impedance network
G
N
L2
L1
G
N
L2
L1
EUT
G
N
L2
L1
AC power supply
G
N
L2
L1

Three-phase Three-wire Circuit



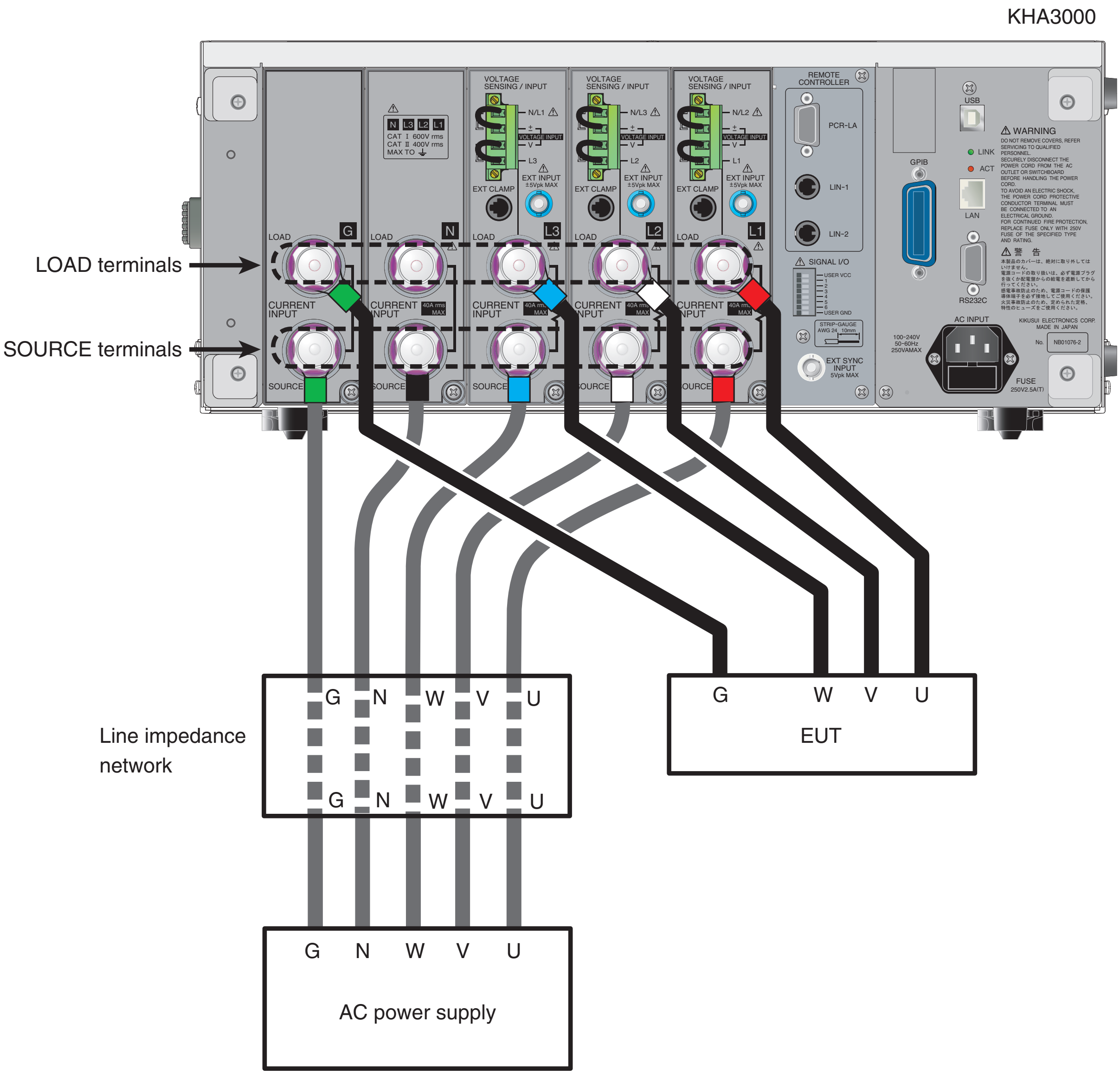
Wiring Method

Use the L1, L2, L3, and G terminals in the input section on the rear of this product. Connect them according to the following table.

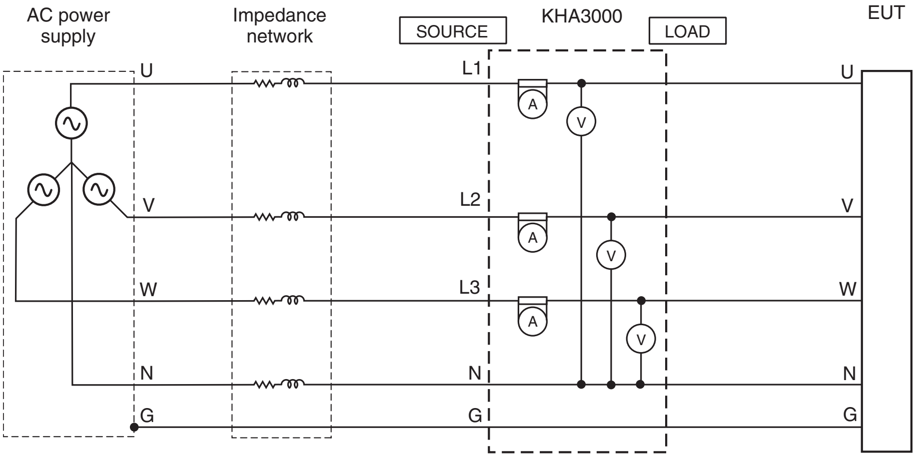
If LIN is not used, connect the wires directly from the output terminals of the AC power supply to the SOURCE terminals in the input section of this product.

⚠CAUTION Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

AC power	–	LIN		–	Input section on the rear of KHA3000		–	EUT terminal
Output terminal		INPUT	OUTPUT		SOURCE	LOAD		
U	–	U	U	–	L1	L1	–	U
V	–	V	V	–	L2	L2	–	V
W	–	W	W	–	L3	L3	–	W
N	–	N	N	–	N		–	
G	–	G	G	–	G	G	–	G


KHA3000
LOAD terminals
SOURCE terminals
Line impedance network
G
N
W
V
U
G
N
W
V
U
G
W
V
U
EUT
G
N
W
V
U
AC power supply
LOAD
CURRENT INPUT
SOURCE
VOLTAGE SENSING / INPUT
EXT CLAMP
EXT INPUT
REMOTE CONTROLLER
PCR-LA
LIN-1
LIN-2
SIGNAL I/O
EXT SYNC INPUT
GPIB
USB
LAN
RS232C
AC INPUT
WARNING
FUSE

Three-phase Four-wire Circuit

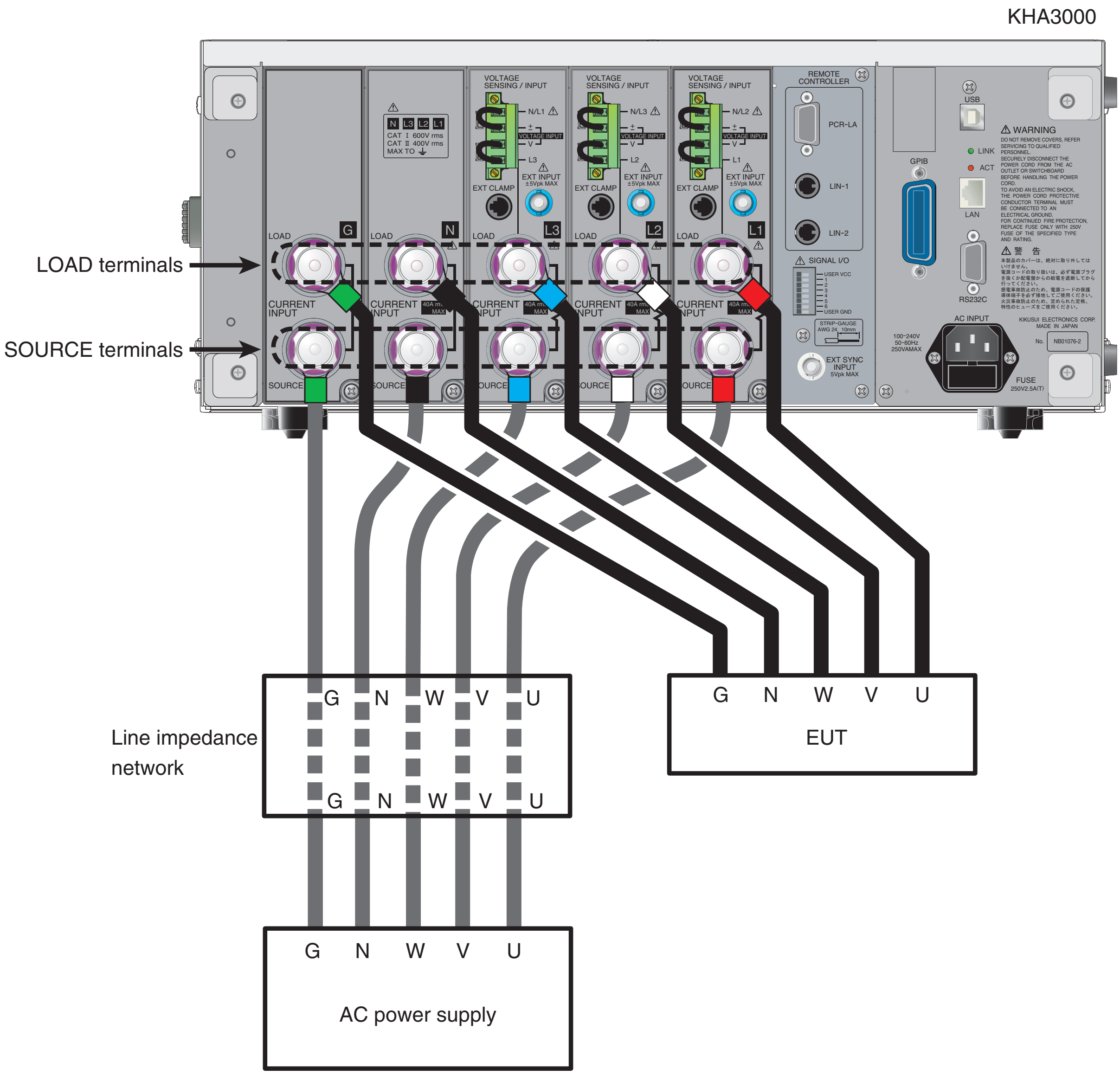


Wiring Method

Use the L1, L2, L3, N, and G terminals in the input section on the rear of this product. Connect them according to the following table.
If LIN is not used, connect the wires directly from the output terminals of the AC power supply to the SOURCE terminals in the input section of this product.

⚠CAUTION Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

AC power	–	LIN		–	Input section on the rear of KHA3000		–	EUT terminal
Output terminal		INPUT	OUTPUT		SOURCE	LOAD		
U	–	U	U	–	L1	L1	–	U
V	–	V	V	–	L2	L2	–	V
W	–	W	W	–	L3	L3	–	W
N	–	N	N	–	N	N	–	N
G	–	G	G	–	G	G	–	G


KHA3000
LOAD terminals
SOURCE terminals
G
N
L3
L2
L1
LOAD
CURRENT INPUT
SOURCE
VOLTAGE SENSING / INPUT
EXT CLAMP
EXT INPUT
REMOTE CONTROLLER
PCR-LA
LIN-1
LIN-2
SIGNAL I/O
EXT SYNC INPUT
GPIB
USB
LAN
RS232C
AC INPUT
WARNING
FUSE
Line impedance network
G N W V U
G N W V U
EUT
G N W V U
AC power supply
G N W V U

Connecting the Voltmeter to External Measurement Points

See p. 57

This section explains how to connect the voltmeter of this product to external measurement points. The explanation includes single-phase two-wire, single-phase three-wire, three-phase three-wire and three-phase four-wire measurement circuits. For more information, refer to "Connecting a Voltmeter to External Measurement Points".

⚠WARNING

- **This work has a risk of electric shock. For the equipment used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

Sensing at EUT connection terminals

Voltage sensing is performed with the voltmeter of this product connected to a terminal of the EUT. Choose one of the following two methods:

- LOAD terminal sensing (set at the time of shipment)
- Sensing at EUT connection terminal

This product is shipped with the LOAD terminal sensing set. Voltage sensing terminals L and V, and ± and N have been short-circuited with the accessory wire kit for short-circuiting the voltage sensing terminals.

Sensing at EUT connection terminals is performed by removing the accessory wire kit for short-circuiting the voltage sensing terminals and connecting the voltmeter to the EUT.

Parts to be prepared by the customer

The customer is requested to prepare wires used to connect between the voltmeter of this product and EUT. The wire should be equivalent to UL1015 and AWG18 is recommended for the wire diameter.

Outline of connection

Connect a wire from the VOLTAGE SENSING/INPUT terminal of this product to the EUT. When connecting the wire to the VOLTAGE SENSING/INPUT terminal, give the conductor a 10 mm strip margin (indicated on the rear panel). Secure the wire by tightening the screw on the terminal with the accessory screwdriver. Twist the wire as much as possible.

⚠CAUTION

Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

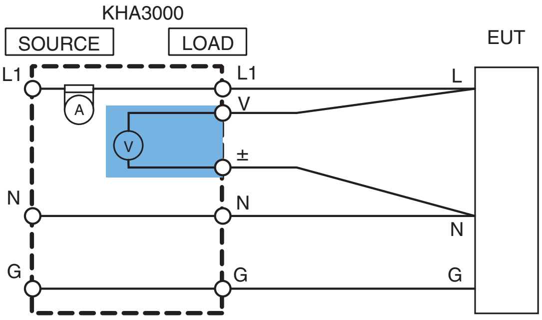
Using external PT (potential transformer)

See p. 59

When the voltage of the device to be measured exceeds the maximum voltage range of this product, a PT (potential transformer) may be connected.

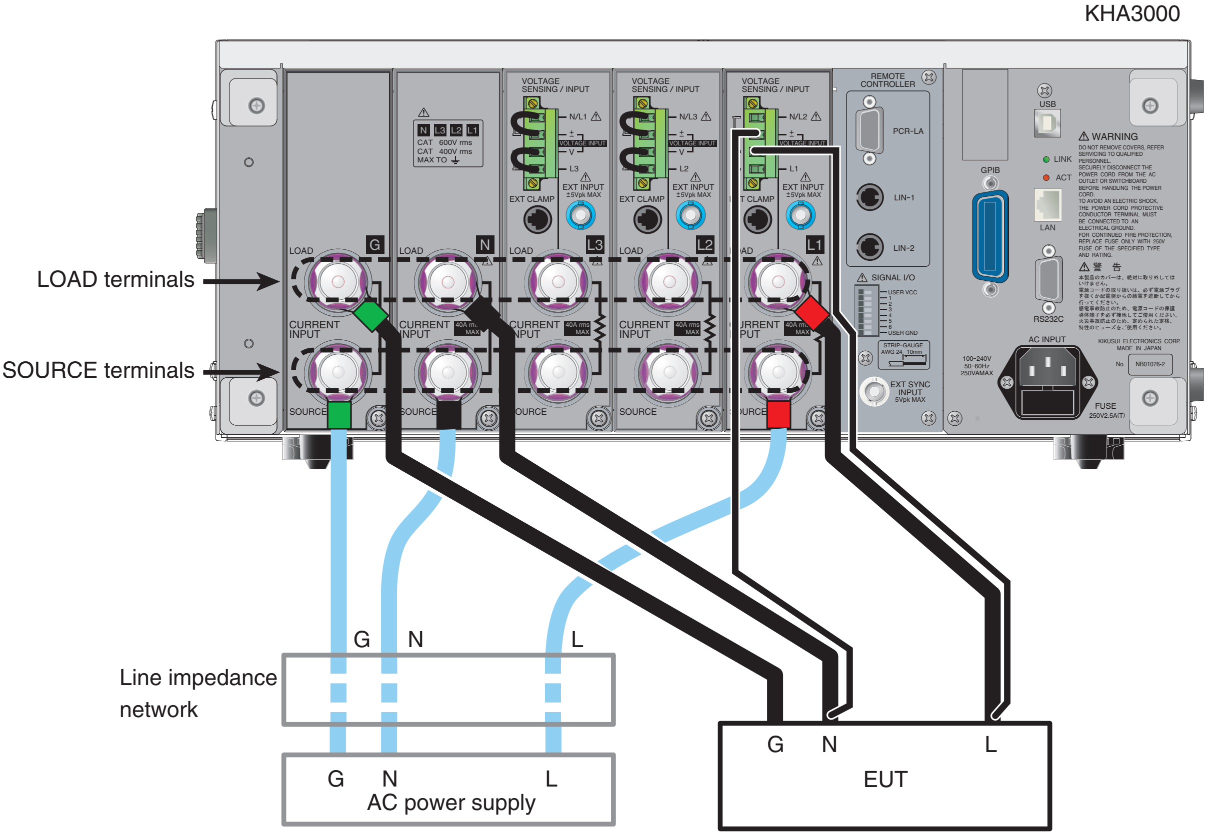
Single-phase Two-wire Circuit

Use the VOLTAGE SENSING/INPUT terminal of L1 in the input section on the rear of this product. Remove the accessory wire kit for short-circuiting the voltage sensing terminals and connect wires according to the following table. Sufficiently twist the wires at each input section.



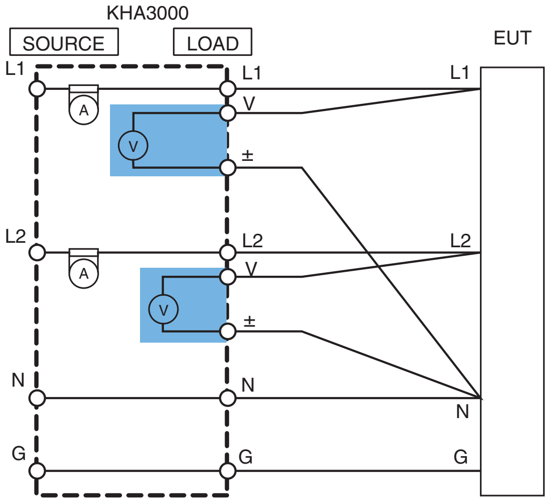
Input section	Voltmeter	–	EUT
L1	V	–	L
	±	–	N

Voltmeter: VOLTAGE SENSING/ INPUT terminal
EUT: Terminals of EUT



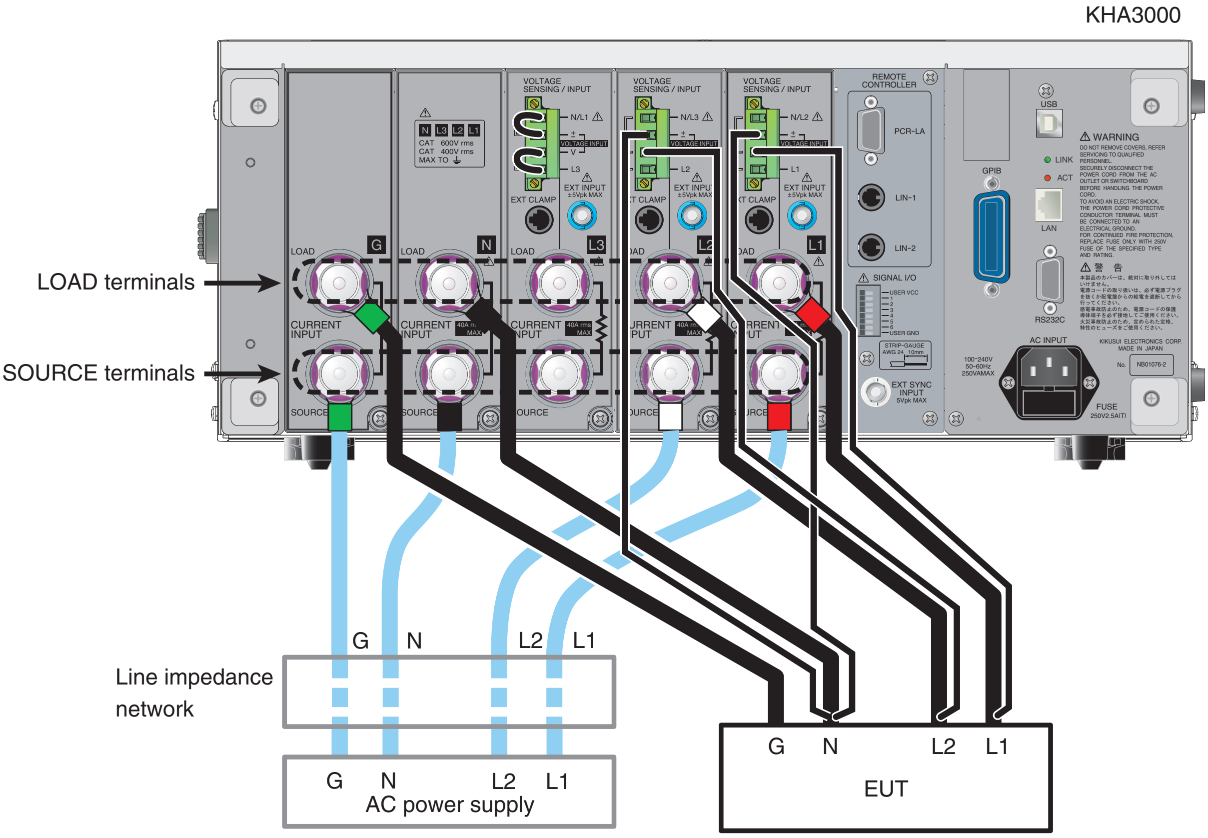
Single-phase Three-wire Circuit

Use the VOLTAGE SENSING/INPUT terminal of L1 and L2 in the input section on the rear of this product. Remove the accessory wire kit for short-circuiting the voltage sensing terminals and connect the wires according to the following table. Sufficiently twist the wires at each input section.



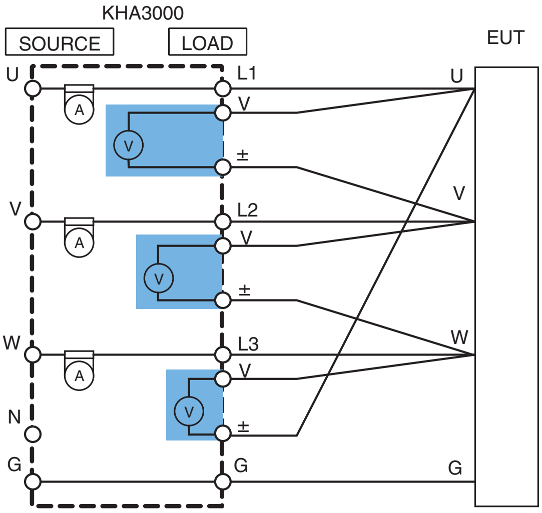
Input section	Voltmeter	–	EUT
L1	V	–	L1
	±	–	N
L2	V	–	L2
	±	–	N

Voltmeter: VOLTAGE SENSING/ INPUT terminal
EUT: Terminals of EUT



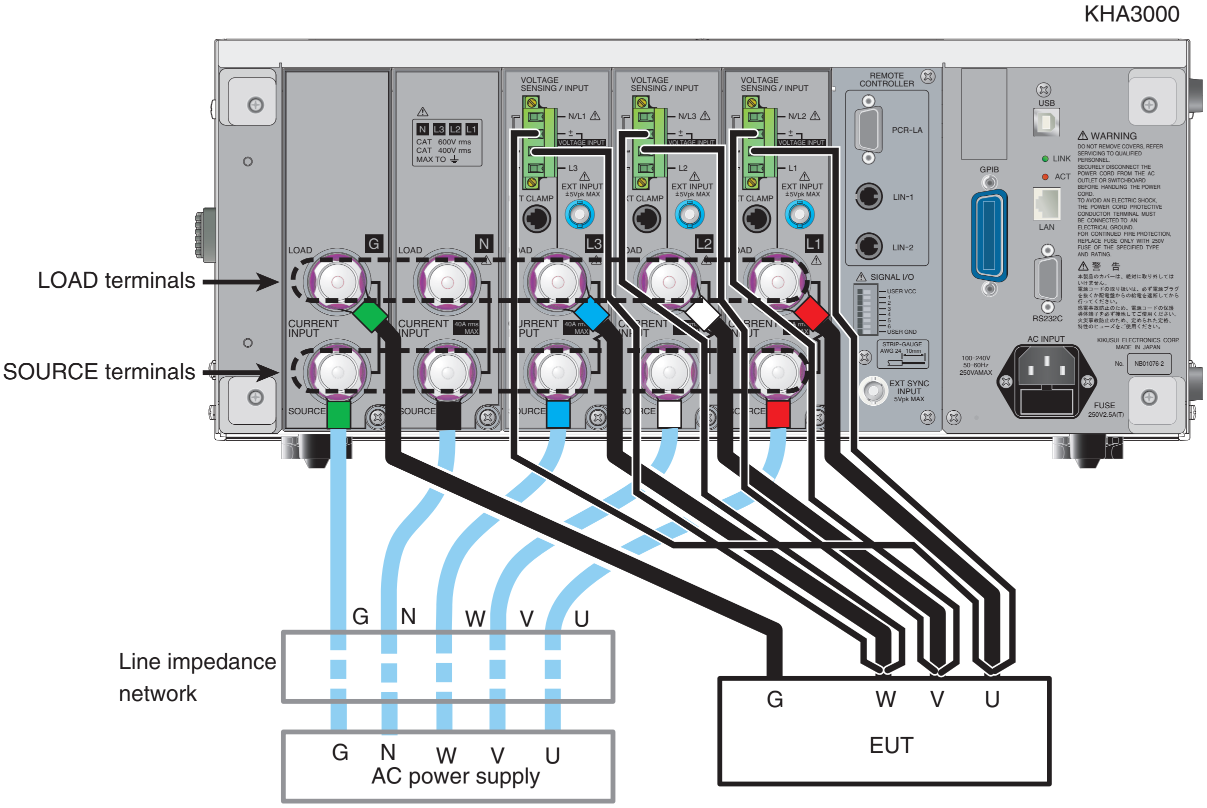
Three-phase Three-wire Circuit

Use the VOLTAGE SENSING/INPUT terminal of L1, L2, and L3 in the input section on the rear of this product. Remove the accessory wire kit for short-circuiting the voltage sensing terminals and connect the wires according to the following table. Sufficiently twist the wires at each input section.



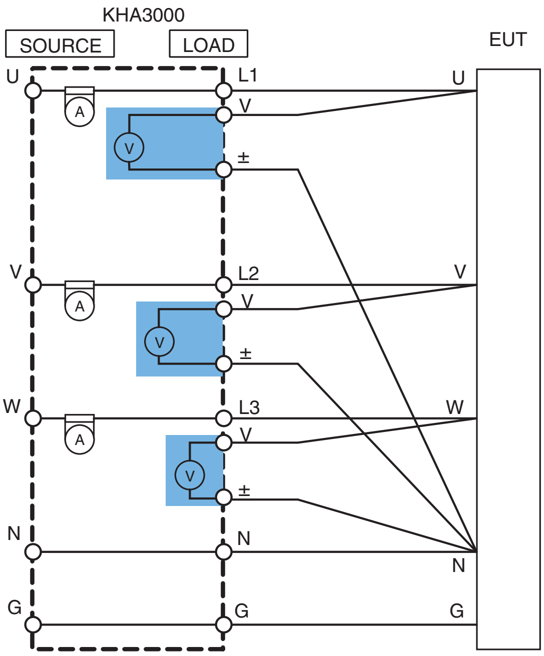
Input section	Voltmeter	–	EUT
L1	V	–	U
	±	–	V
L2	V	–	V
	±	–	W
L3	V	–	W
	±	–	U

Voltmeter: VOLTAGE SENSING/ INPUT terminal
EUT: Terminals of EUT



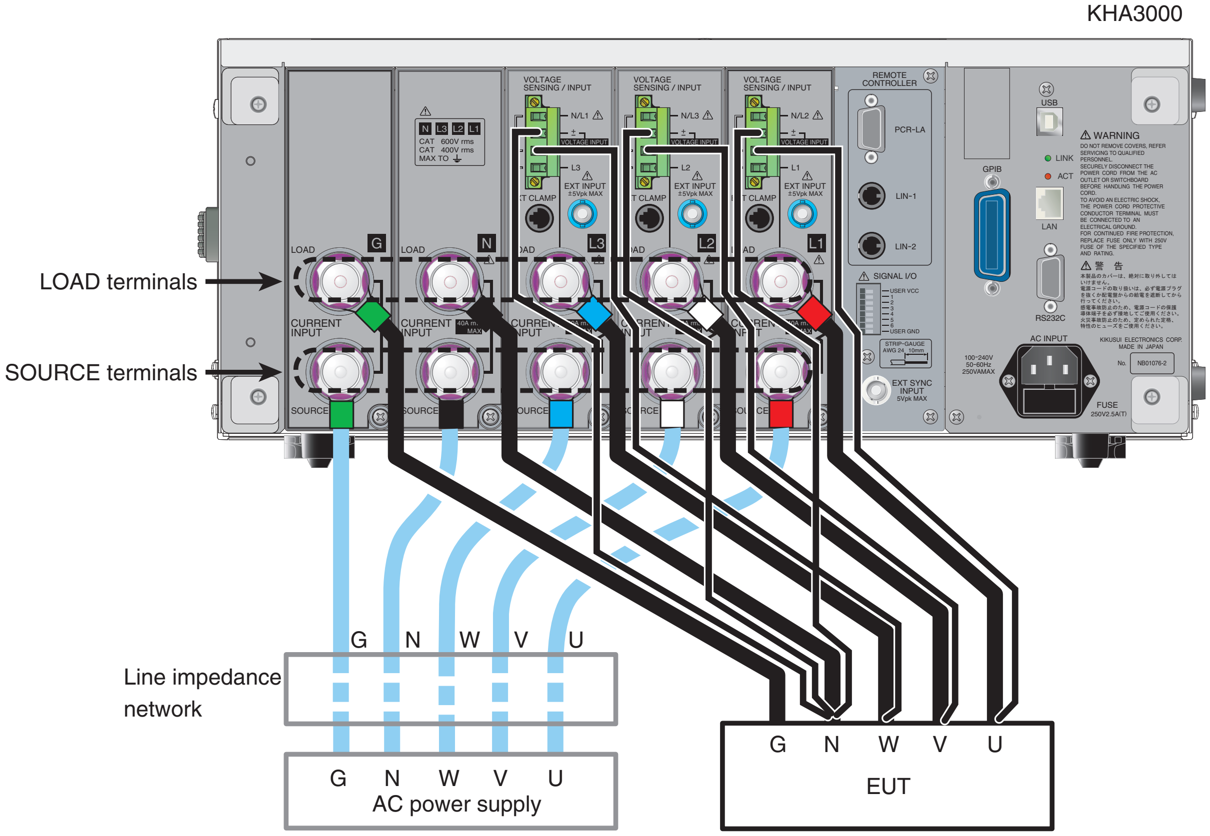
Three-phase Four-wire Circuit

Use the VOLTAGE SENSING/INPUT terminal of L1, L2, and L3 in the input section on the rear of this product. Remove the accessory wire kit for short-circuiting the voltage sensing terminals and connect the wires according to the following table. Sufficiently twist wires at each input section.



Input section	Voltmeter	–	EUT
L1	V	–	U
	±	–	N
L2	V	–	V
	±	–	N
L3	V	–	W
	±	–	N

Voltmeter: VOLTAGE SENSING/ INPUT terminal
EUT: Terminals of EUT



1

Overview

This chapter provides an overview of this product and explains the options for the product.

Overview of the Product

This product can measure harmonics current, flicker, or voltage fluctuations. It can execute tests that conform to IEC and JIS standards, in combination with the AC Power Supply and Line Impedance Network.

This product displays measured values in various display modes in real time. It can make evaluations, pass/failure decisions, and analyses by conformance test.

Because the AC power supply[1] can be controlled from this product, a test system can be configured without a PC being used. This product can also be used independently as a power analyzer.

Features

- **A test system can be configured without using a PC.**

  A harmonic current and voltage fluctuation test system can be configured without a computer being used. The AC Power Supply[1] used for the test can be controlled.

- **Single-phase and three-phase circuits can be handled.**

  Single-phase and three-phase equipment can be tested with three-channel input. Wire connections are simple because phase voltage measurement and line voltage measurement can be switched by internal circuits.

- **Pass/failure decision for standards conformance**

  The cause of a problem identified by pass/failure decision can be investigated by the analytic function.

- **Measured values are displayed in real time.**

  Measured values are displayed in real time and the status of the EUT can be displayed. The margin ratios to limit values can be known in real time. Waveform measurement is possible.

- **Compliant with the latest standards**

  This product supports the EN, IEC, and JIS standards, and can be upgraded to accommodate future revisions of the standards. The product is compliant with measuring technique standard IEC 61000-4-7 Ed2.1 and IEC 61000-4-7 Ed2.0 that measures interharmonic waves and handles them as harmonic groups and IEC 61000-4-7 Ed1.0 that permits continuous use.

---

[1] There are restrictions on the use of the following AC power sources.

・PCR-WE
This product cannot directly control PCR-WE. To use PCR-WE, the separately sold application software SD006-KHA Harmonics Analyzing Suite is required.
PCR-WE cannot be combined with a standard line impedance network. For the line impedance network for PCR-WE, contact your Kikusui distributor or agent.
・PCR-LA
PCR-LA with firmware version 3.32 or 3.33 cannot be used.

- **Selects whether to measure harmonic groups**

  This product can support older revisions of Limitation Standards and Measuring Technique Standards (Meas. Technic). Regarding Measuring Technique standards, the user can select whether or not to perform the measurement of harmonic groups.

- **Test conditions can be customized.**

  The conditions can easily be set for the EUT. Test conditions set can be saved in a file. For similar equipment under tests, time-consuming settings can be simplified. Loss due to setting error can be eliminated. The menus can be displayed either in Japanese or English.

- **Assist function, providing security for users who are not familiar with EMC or test standards**

  An assist function is available to support operation. Complex terms can also be referenced.

- **Measures in-rush current**

  In-rush current of up to 160 A can be measured. Higher current can be measured if an external current transformer is used.

- **Scaling function**

  When an external current sensor or PT (potential transformer) is used, the scaling ratio of the measurement sensitivity can be set.

  The scale of the graphic display is adjusted to the scaling value set.

- **Use of 32-bit FFT**

  Very small harmonic current values can be accurately measured with minimum operation errors.

- **External memory**

  CompactFlash card and USB flash drive are supported.

- **Remote control interface**

  The GPIB, RS232C, and USB are provided. They can be selectively used.
  SCPI commands are used.

- **Traceability**

  Measuring instruments compliant with ISO/IEC17025 are used to tune and test this product. Although calibration of this product is not compliant with ISO/IEC17025, we collaborate with foreign accredited calibration organizations, and so accredited calibration is possible.

- **Multi-outlet unit (option)**

  This unit is used for EUT that has a power cord with a plug. It can connect to devices with a wide range of plugs used in various countries. This unit is used for single-phase equipment.

- **Application software SD006-KHA Harmonics Analyzing Suite (sold separately)**

  This software executes and controls the setting and testing of this product. It can control the AC Power Supply used in the test. Harmonic spectra and current and voltage waveforms can be printed in reports. Japanese and English languages are supported.

Conforming Standards of this Product (Harmonic Current)

Limit value standards

IEC 61000-3-2 Ed5.0(2018), EN IEC 61000-3-2(2019)
IEC 61000-3-2 Ed3.0(2005), EN 61000-3-2(2006)
IEC 61000-3-2 Ed2.2(2004), EN 61000-3-2(2000)/A2(2005)

JIS C61000-3-2(2011)
JIS C61000-3-2(2005)

IEC 61000-3-12 Ed2.0(2011), EN 61000-3-12(2011)
IEC 61000-3-12 Ed1.0(2004), EN 61000-3-12(2005)

Measuring technique standards

IEC 61000-4-7 Ed2.1(2009), EN 61000-4-7(2002)/A1(2009)[1]

IEC 61000-4-7 Ed2.0(2002), EN 61000-4-7(2002)[1]

IEC 61000-4-7Ed1.0(1991), EN 61000-4-7(1993)[2]

Conforming Standards of this Product (Flicker, Voltage Fluctuation)

Limit value standards

IEC 61000-3-3 Ed3.1(2017), EN 61000-3-3(2013)/A1(2019)
IEC 61000-3-3 Ed2.0(2008), EN 61000-3-3(2008)
IEC 61000-3-11 Ed2.0(2017), EN IEC 61000-3-11(2019)

Measuring technique standards

IEC 61000-4-15 Ed2.0(2010), EN 61000-4-15(2011)
IEC 61000-4-15 Ed1.1(2003), EN 61000-4-15(1998)/A1(2003)

---

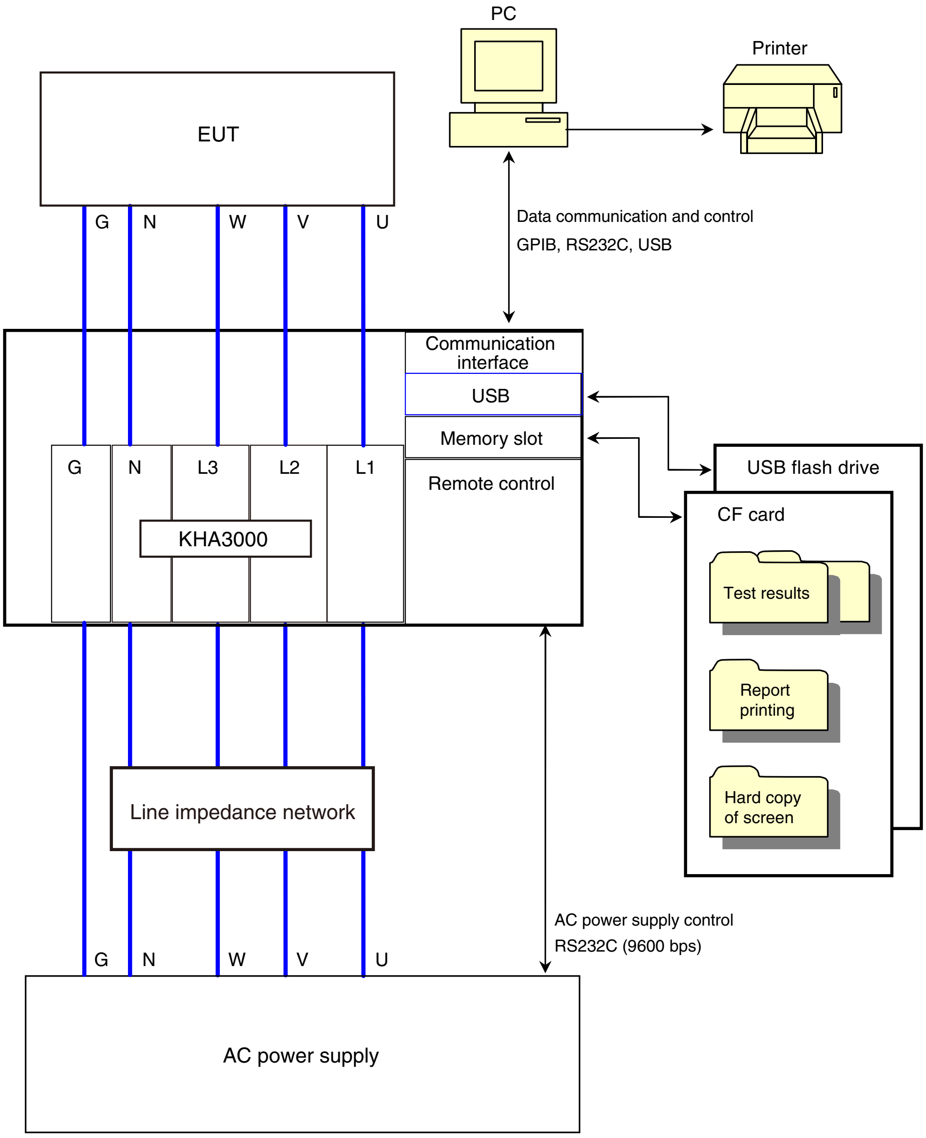
[1] The measuring window width is 0.2 second. In other words, it is 10 cycles at a fundamental frequency of 50 Hz and 12 cycles at a fundamental frequency of 60 Hz. Interharmonic waves are measured at 5 Hz intervals. Harmonic groups are measured out of harmonic waves and interharmonic waves. The values of harmonic groups are the results of measurement.

[2] The measurement window length is 16 cycles at the fundamental frequency. It is 0.32 second at a fundamental frequency of 50 Hz and 0.266 second at a fundamental frequency of 60 Hz. Interharmonic waves are not measured; only harmonic waves are measured. The values of harmonic waves are the results of measurement.

Test System Configuration

The figure shown below describes a harmonic current and voltage fluctuation test system. The test system can be configured with the AC Power Supply and Line Impedance Network combined with this product. The LIN3020JF or LIN1020JF line impedance network can be combined with PCR-LE AC power supply only.

Test results are output to the screen of this product. Test conditions and test results can be saved to a CompactFlash card (CF card) or USB flash drive. Reports can also be saved.



NOTE

There are restrictions on the use of the following AC power sources.

- PCR-WE
  This product cannot directly control PCR-WE. To use PCR-WE, the separately sold application software SD006-KHA Harmonics Analyzing Suite is required. PCR-WE cannot be combined with a standard line impedance network. For the line impedance network for PCR-WE, contact your Kikusui distributor or agent.
- PCR-LA
  PCR-LA with firmware version 3.32 or 3.33 cannot be used.

Options

The following options are available. For details, contact a Kikusui distributor/agent.

Multi-outlet Unit (OT01-KHA)

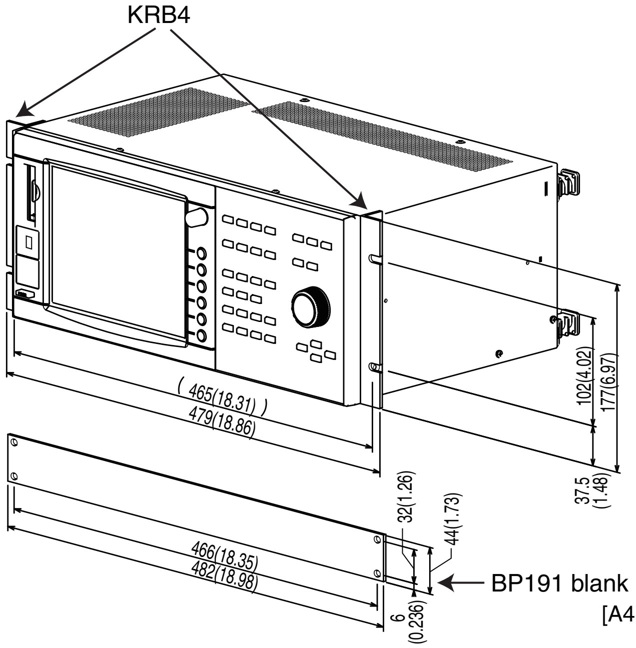
This unit is used for EUT that has a power cord with a plug. It can connect to devices that have a wide range of plugs used in various countries.

- This unit is used for single-phase equipment.
- Internal impedance is designed to be low so that the unit conforms to the voltage drop (less than 0.5 V) caused by the wiring impedance of a test system as specified in IEC Standard 61000-4-7 (Edition 2.0).
- This unit has a front grounding terminal that can ground a 2P plug with a grounding conductor.
- This unit can be placed under the KHA3000.

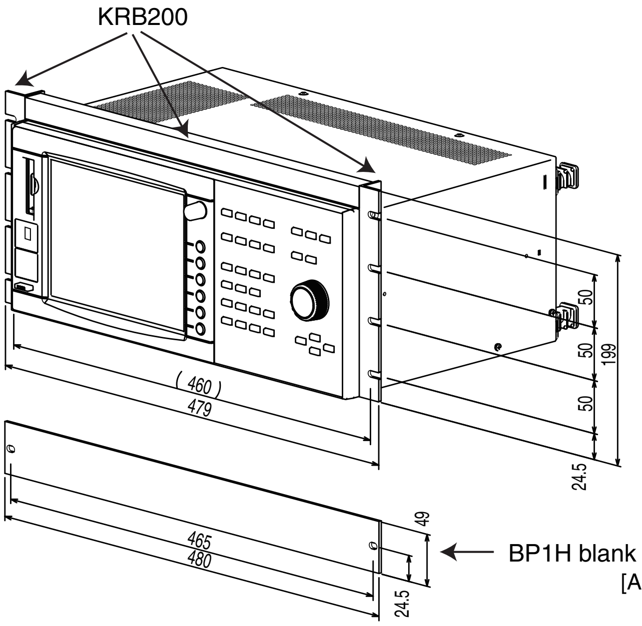
Rack Mount Options (KRB4, KRB200)

The rack mount brackets listed below are available. They require a blank panel separately for ventilation at the bottom part.

Product name	Model No.	Model applied	Remarks
Rack-mount bracket	KRB4	KHA3000	For EIA standard inch rack
	KRB200		For JIS standard millimeter rack



BP191 blank panel (sold separately)
[A4-906-001]



BP1H blank panel (sold separately)
[A4-343-911]

Unit: mm (inch)

2

Installation and Preparation for Use

This chapter explains the procedures from unpacking the product to connecting the power cord.

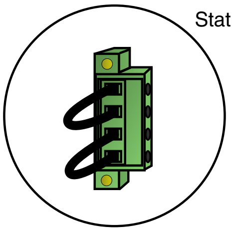
Inspection during Unpacking

When you receive the product, check that the accessories are correctly attached and that the product and accessories were not damaged during transportation.

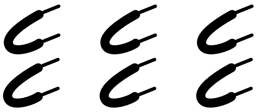
If the product and accessories are damaged or missing, contact your Kikusui distributor or agent.

The packing materials should be saved for future transport of the product.

Accessories

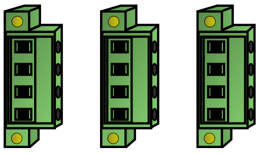


Status at time of shipment



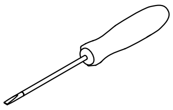
Wired to plug for voltage sensing terminal

☐ Wire kit for short-circuiting voltage sensing terminals (3 sets: 6 wires)

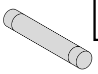


Mounted on main unit

☐ Plug for voltage sensing terminal (3 pc) [84-70-0070]

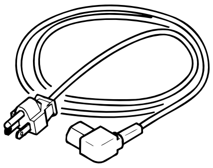


☐ Screwdriver dedicated to plug for voltage sensing terminal (1 pc) [Y2-000-002]



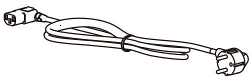
Contained in power fuse holder

☐ Spare fuse (1 pc) 2.5 A (T) 250 Vac [99-00-0027]



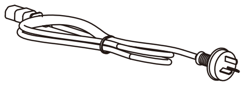
PLUG: NEMA5-15
[85-AA-0003]

or



PLUG: CEE7/7
[85-10-1070]

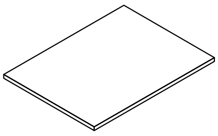
or



PLUG: GB1002
[85-10-0791]

☐ AC Power cord (1 pc.)

The power cord that is provided varies depending on the destination for the product at the factory-shipment.



☐ Operation Manual (this manual, 1 pc)
[Z1-004-222]

Notes on Installation Location

This section provides precautions on installing this product. Be sure to observe the following.

- **Do not use this product in a flammable gas atmosphere.**

  Explosion or fire may be caused. Do not use this product near inflammables such as alcohol and thinner or in an atmosphere containing their gases.

- **Avoid places where this product would be exposed to high temperature or direct sunlight.**

  Do not install this product near a heater or in a place where the temperature undergoes rapid change.

  Operating temperature range: 0 °C to +40 °C (+32 °F to +104 °F)
  Storage temperature range: -20 °C to +70 °C (-4 °F to +158 °F)

- **Avoid places with high humidity.**

  Do not install this product in humid places near a water heater, humidifier, or water supply.

  Operating humidity range: 20 %rh to 80 %rh (no condensation)
  Storage humidity range: 90 %rh or lower (no condensation)

  Condensation may occur even within the operating temperature range. In this case, do not use this product until it is completely dried.

- **Be sure to use this product indoors.**

  This product is designed to be used indoors so that safety is secured.

- **Do not install this product in a corrosive gas atmosphere.**

  Do not install this product in a corrosive gas or sulfuric acid mist. This may cause conductor corrosion and poor connector contact, leading to product malfunction/failure and a fire.

- **Do not install this product in a dusty place.**

  Dust adhesion may lead to electric shock and fire.

- **Do not use this product in a place that is not well ventilated.**

  Secure a space wide enough to allow air to flow around the product.

- **Do not place anything on this product.**

  Placing a heavy object on this product may cause a failure.

- **Install this product on a flat and stable floor.**

  The product may drop or fall down, causing damage or human injury.

- **Do not use this product in a place around a strong magnetic or electric field, or in a place with strong waveform distortion and noise from an input power supply.**

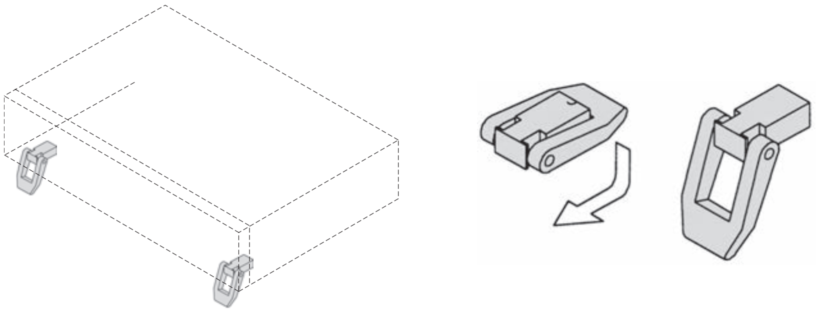
  Doing so may result in incorrect product operation.

- **Use the product in an industrial environment.**

  This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Using Stands

The stands are used to tilt the front panel so that you can easily view the screen and operate the keys. Raise the stands on the near side of the bottom surface until a click is heard.



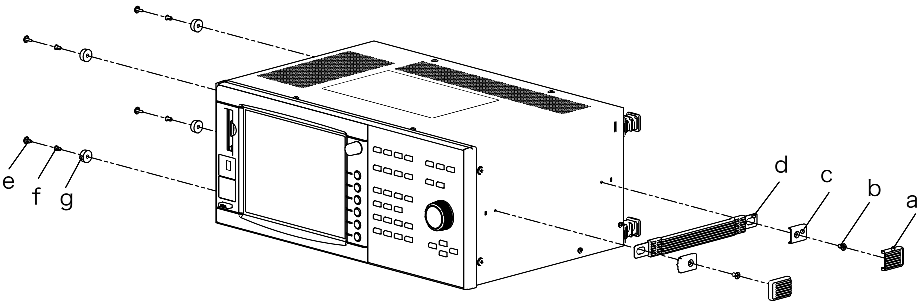
⚠CAUTION When using the stands, do not place anything on the product or apply force from above the product. Doing so may damage the stands.

Removing the Handle and Side-panel Rubber Pads

See p. 40

Before mounting this product on the rack-mount bracket, remove the handle and side-panel rubber pads. The figure below shows the proper procedure for doing this.

NOTE To reinstall the handle that has been removed, use screw locking agent (e.g., 1401B by ThreeBond International, Inc.) to prevent screws from loosening.



Removing the handle

1. **Pull the handle covers upward (a: 2 positions).**
2. **Remove the M4 flathead screws (b: 2 positions) and then remove the entire handle (c and d).**

Removing the side-panel rubber pads

Remove the rivets (e and f) on the bottom part of the rubber pads (g: 4 positions) with the head of a flat-blade screwdriver.

Connecting Power Cord

⚠WARNING

- **This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent an electric shock, be sure to ground it.**
- **This product is grounded through the grounding wire of the power cord. Be sure to connect the power plug to an outlet with an appropriate earth ground.**

NOTE

- To connect to the AC power line, use the accessory power cord.
  If the accessory power cord cannot be used because of its rated voltage or plug shape, have a qualified engineer replace it with an appropriate power cord of 3 m or shorter. If it is difficult to procure the power cord, contact your Kikusui distributor or agent.
- A power cord with a plug can be used to disconnect this product from the AC power line in an emergency. To disconnect the plug from the outlet at any time, connect the plug to an outlet within your reach and keep sufficient space around the outlet.
- Do not use the accessory power cord to operate another device.

This product is an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).

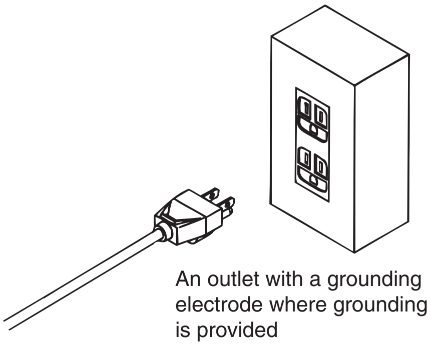
1 **Turn off the POWER switch.**

2 **Check that the AC power line to be connected conforms to the input ratings of this product.**

The voltage that can be input is a nominal power supply voltage ranging from 100 Vac to 240 Vac, and the frequency is 50 or 60 Hz.

3 **Connect the power cord to the AC inlet (AC INPUT) on the rear panel.**

4 **Connect the power cord plug to an outlet with a grounding electrode.**



Connecting the Input Power Supply of the Test System

This section explains how to use this product, AC Power Supply, and the Line Impedance Network for a test system. To turn on and off the power switches altogether in the test system, use an external power switch separately.

AC Power Supply

Connect the INPUT terminals of the AC Power Supply and the terminals on the switchboard. A person qualified for electrical work should make the connections. For more information, refer to the Operation Manual of the AC Power Supply.

Line Impedance Network

A power cord with a plug is used. For details, refer to the Operation Manual of the Line Impedance Network.

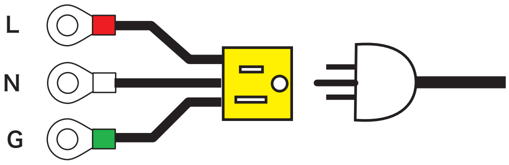
This product

See p. 47

Refer to "Connecting Power Cord".

Parts to be prepared by the customer

- **Electric wire**
  Used to connect the AC Power Supply to the input power supply
- **Crimping terminal**
  Attached to the end of an electric wire to securely connect the wire to the terminal of equipment
- **Relay outlet**
  Used to connect this product or the power cord with a plug of the Line Impedance Network to the input power supply



- **External power switch**
  Used to turn on and off the power switches altogether in the test system

Notes on Transfer

When transporting or moving this product to the installation location, note the following:

- **Turn off the POWER switch.**
  Transferring this product with the POWER switch turned on may result in electric shock or damage.
- **Remove all connected wiring.**
  Transferring this product without removing its cables may result in personal injury caused by disconnection or overturn.
- **When transporting this product, use the dedicated packing materials.**
  Otherwise, the product may be damaged by vibration or falling in transit.
- **Be sure to attach this manual.**

3

Wiring Measurement Circuits

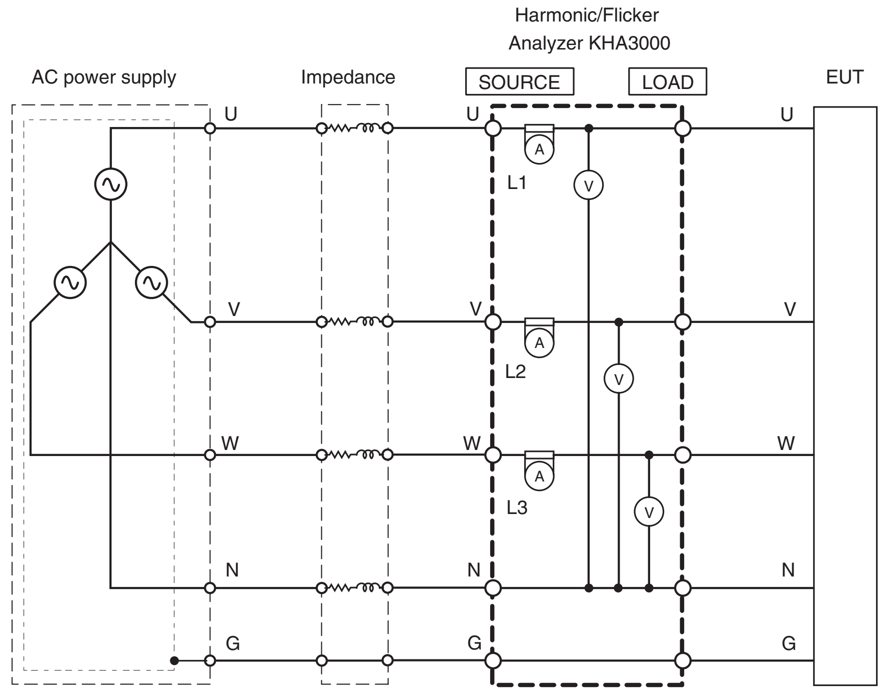
This chapter explains the wiring of measurement circuits and the control circuit.

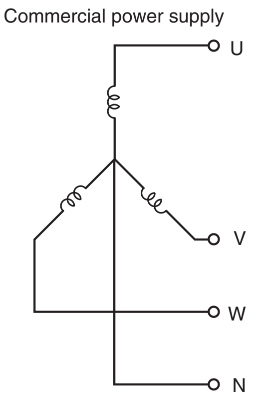
Common Information on Measurement Circuits

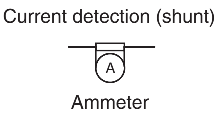
This section explains the basic common information the user should know before starting measurement.

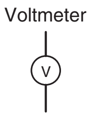
- Circuit symbols used
- Parts to be prepared by the customer
- Selecting the type of wire
- Using terminal covers to prevent an electric shock
- Performance of input terminals
- Mechanism of voltage measurement

Circuit Symbols Used









Phase/line	Three-phase four-wire	Three-phase three-wire	Single-phase three-wire	Single-phase two-wire
1	U	U	L1	L
2	V	V	L2	
3	W	W		
Neutral line	N	*	N	N
G line	G	G	G	G

* Neutral line should be connected from the AC power supply to the KHA3000.

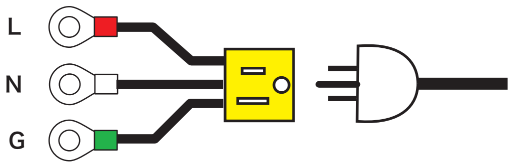
Parts to be Prepared by the Customer

- **Electric wire**

  Used to connect the devices of a measurement circuit
- **Crimping terminal**

  Attached to the end of an electric wire to securely connect the wire to the terminal of a device
- **Relay outlet**

  Used when the EUT uses a power cord with a plug



- **The following four types of impedance are used according to limit value standards IEC 61000-3-11 and IEC 61000-3-12:**
  - 0.25 Ω + jn0.25 Ω (single-phase)
  - 0.15 Ω + jn0.15 Ω (three-phase)
  - 0.10 Ω + jn0.10 Ω (three-phase neutral wire)
  - The voltage drop caused by the EUT falls within the range from 3 % to 5 % of the voltage and the ratio of the reactance component to the resistance component falls within the range from 0.5 to 0.75.

Selecting the Type of Electric Wire

Select the type of wire according to the input current of the EUT. For a rough idea for selection, the table below lists nominal sectional areas of wire and the corresponding permissible current values.

Nominal sectional area [mm^2]	AWG	(Reference sectional area) [mm^2]	Permissible current[*1] [A] (Ta = 30 °C)	Current recommended by Kikusui [A]
2	14	(2.08)	27	10
3.5	12	(3.31)	37	-
5.5	10	(5.26)	49	20
8	8	(8.37)	61	30
14	6	(13.3)	88	50

*1. Excerpt from Japanese laws related to electrical equipment

Use a crimping terminal to terminate the wire. The crimping terminal must have a screw mounting hole with a diameter of 6 mm and fit the wire. When the EUT uses a power cord with a plug, connect the wire to the LOAD terminals using a relay outlet. Do the same for the wire used for the relay outlet.

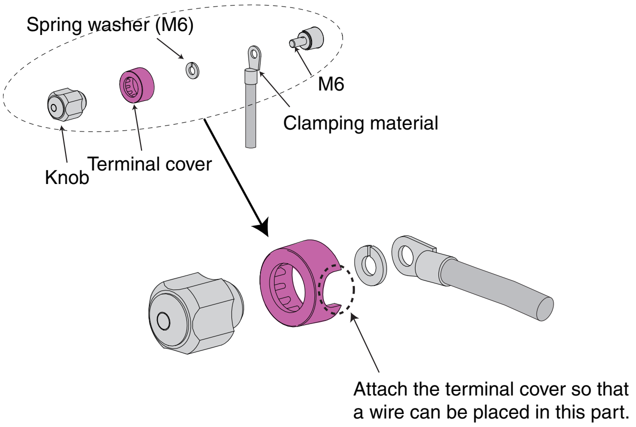
NOTE

- Kikusui recommends wire of a nominal sectional area of 8 mm^2 or larger. Use as short a wire as possible. Kikusui recommends a wire length of 1.5 m or shorter. For the test system, note the IEC 61000-4-7 standard requirements (voltage drop by wiring impedance).

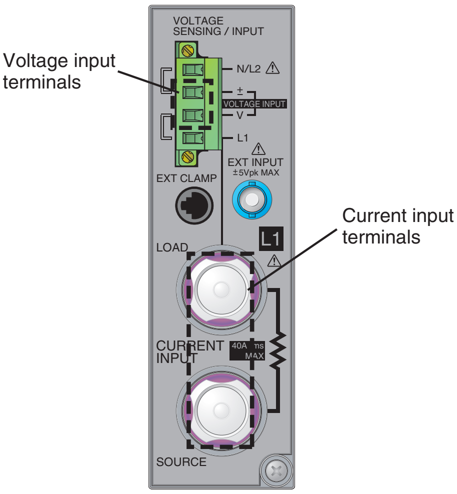
Prevent an Electric Shock with Terminal Cover

⚠WARNING
- **To prevent an electric shock, attach the terminal cover.**

To prevent an electric shock, covers are attached to the LOAD and SOURCE terminals. Use these terminals as shown in the figure below.



Performance of Input Terminals



●Maximum input voltage

The maximum input voltage at the voltage input terminal and current input terminal is 600 Vms/ 900 Vpeak. This product cannot be used if the maximum voltage is exceeded.

●Maximum input current

The maximum input current at the current input terminal is 40 Arms/100 Apeak. This product cannot be used if the maximum current is exceeded.

●Instrument loss (input resistance)

The instrument loss (input resistance) of the voltage input terminal is about 4.7 MΩ, and that of the current input terminal is about 3.5 mΩ.

●Measurement category

The voltage input terminal and current input terminal conform to IEC standard measurement category CAT I or CAT II. The measurement category varies depending on the input voltage.

⚠WARNING

- **If the input voltage exceeds 400 Vrms, the primary circuit of equipment connected directly to an outlet (CAT II) cannot be measured. Only the circuit that is not directly connected to a commercial power supply (CAT I) is measured.**
- **With the input voltage equal to or less than 400 Vrms, the circuit that is not directly connected to a commercial power supply (CAT I) and the primary circuit of equipment connected directly to an outlet (CAT II) can be measured.**

Item	Performance	Remarks
Maximum input voltage	600 Vrms/900 Vpeak	Voltage input terminals and current input terminals between L1 and N, L2 and N, L3 and N, L1 and L2, L2 and L3, and L3 and L1 Measurement category CAT I *1 between 500 Vrms (exclusive) and 600 Vrms Measurement category CAT II *2 below 400 Vrms
Maximum input current	40 Arms/100 Apeak	Current input terminal
Instrument loss (input resistance) of voltage measurement	About 4.7 MΩ	Voltage input terminals between L1 and N, L2 and N, L3 and N, L1 and L2, L2 and L3, and L3 and L1
Instrument loss (input resistance) of voltage measurement	About 3.5 mΩ	Current input terminal

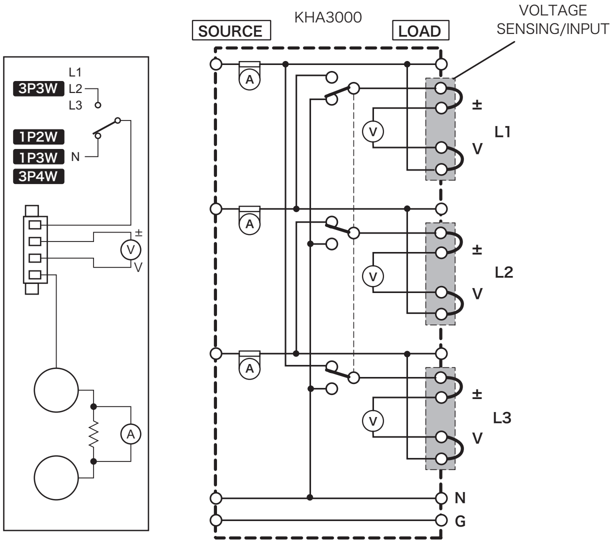
*1. Used to measure circuits that are not directly connected to a commercial power supply

*2. Used to measure the primary circuit of equipment (home appliances, portable tools, etc.) that is directly connected to a low voltage facility such as outlets

Mechanism of Voltage Measurement

The figure below shows voltage terminal switching circuits. In the single-phase two-wire, single-phase three-wire and three-phase four-wire circuits, the switch provided on one end of each voltmeter connects the voltmeter of each phase between L1 and N, L2 and N, or L3 and N.

In the three-phase three-wire circuit, the voltmeter of each phase is connected between L1 and L2, L2 and L3, or L3 or L1.



Wiring Measurement Circuits

This section explains how to wire single-phase two-wire, single-phase three-wire, three-phase three-wire and three-phase four-wire circuits. An impedance network is used for a flicker test. Because the impedance network is not used for a harmonic current test except for some special cases, connect the AC power supply directly to the SOURCE terminals of this product.

Input phases (channels) are L1, L2 and L3. L1 is the reference phase for measurement. Be sure to wire L1.

⚠WARNING

- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

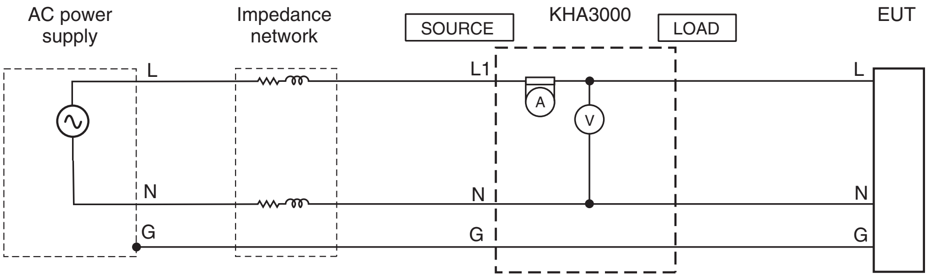
⚠CAUTION Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

Circuit Diagrams

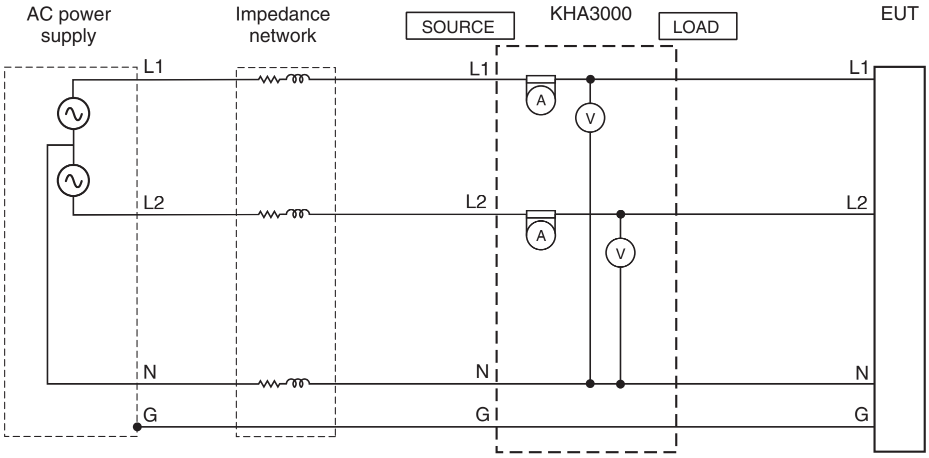
See p. 22

This section shows individual types of measurement circuits. For actual wiring, refer to the connection table and wiring diagram in the section explaining "Wiring Measurement Circuits".

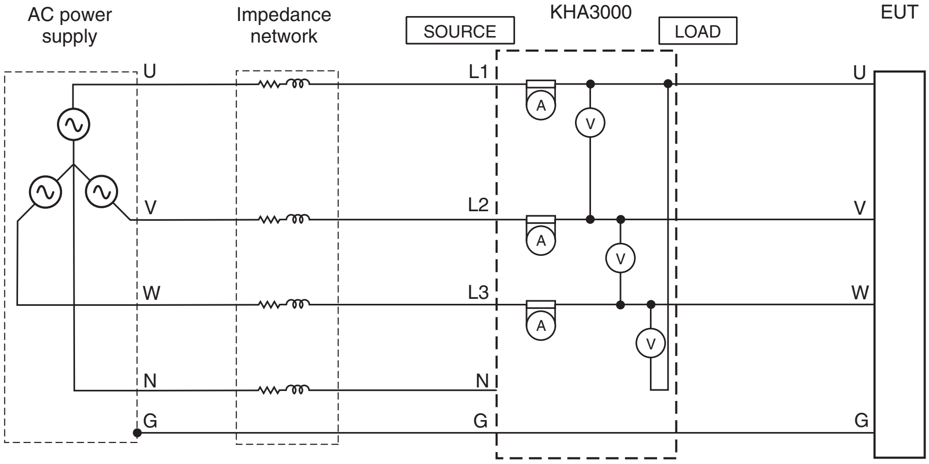
Single-phase two-wire circuit



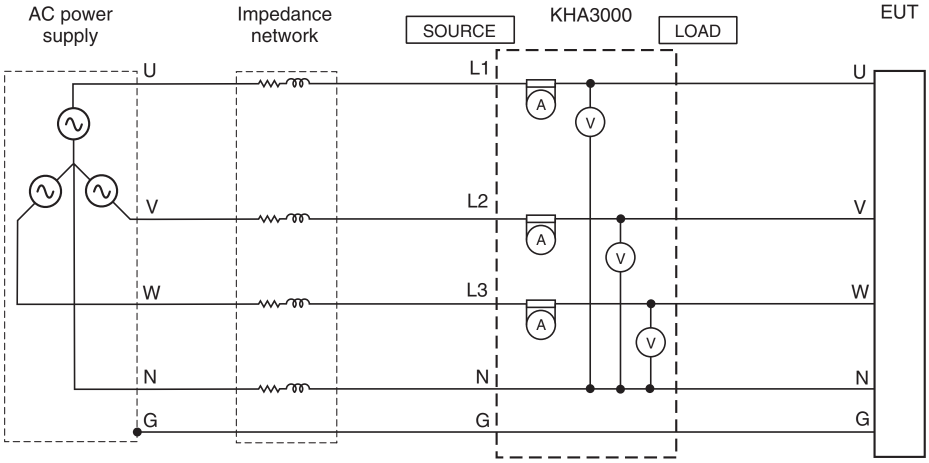
Single-phase three-wire circuit



Three-phase three-wire circuit



Three-phase four-wire circuit



Using the Line Impedance Network

Use the Line Impedance Network in harmonic current tests (JIS C61000-3-2) and voltage fluctuation tests (IEC Standards 61000-3-3 and 61000-3-11).

Limit value standard	Setting of the Line Impedance Network
JIS C61000-3-2	Bypass(THRU)[*1] or Z1 (0.4 Ω + 0.37 mH): Nominal voltage 100 V (single-phase) Z2 (0.38 Ω + 0.46 mH): Nominal voltage 200 V (single-phase) The standard specifies that this impedance network can be used when “the measurement result may fluctuate.” (Attachment A)
IEC 61000-3-3	Z3(0.40 Ω + jn0.25 Ω) (single-phase) 0.24 Ω + jn0.15 Ω (three-phase) 0.16 Ω + jn0.10 Ω (three-phase)
IEC 61000-3-11	0.24 Ω + jn0.15 Ω (three-phase) 0.16 Ω + jn0.10 Ω (three-phase)

*1. Bypass(THRU) for the LIN1020JF or LIN3020JF Line Impedance Network
OUT (THRU) for the LIN40MA-PCR-L

See p. 214

Line Impedance Network is not equipped with the following impedance networks used for limit value standard IEC 61000-3-11:

- 0.25 Ω + jn0.25 Ω (single-phase)
- 0.15 Ω + jn0.15 Ω (three-phase)
- 0.10 Ω + jn0.10 Ω (three-phase neutral line)

For information on the connection terminals of the Line Impedance Network and how to select line impedance networks, refer to the Operation Manual of the Line Impedance Network.

NOTE

- The wiring have impedance inherently. In a test system, attention must be paid to the requirements of IEC 61000-4-7 (voltage drop caused by wiring impedance).
- PCR-WE cannot be combined with a standard line impedance network. For the line impedance network for PCR-WE, contact your Kikusui distributor or agent.

Connecting a Voltmeter to External Measurement Points

This section explains how to connect the voltmeter of this product to external measurement points. The explanation includes single-phase two-wire, single-phase three-wire, three-phase three-wire and three-phase four-wire measurement circuits.

⚠WARNING

- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

Sensing at EUT connection terminals

Voltage sensing is performed with the voltmeter of this product connected to a terminal of the EUT. Choose one of the following two methods:

- Load terminal sensing (set at the time of shipment)
- Sensing at EUT connection terminal

This product is shipped with the LOAD terminal sensing set. Voltage sensing terminals L and V, and ± and N have been short-circuited with the accessory wire kit for short-circuiting the voltage sensing terminals.

Sensing at EUT connection terminals is performed by removing the accessory wire kit for short-circuiting the voltage sensing terminals and connecting the voltmeter to the EUT.

Parts to be prepared by the customer

- The customer is requested to prepare wires used to connect between the voltmeter of this product and EUT. The wire should be equivalent to UL1015 and AWG18 is recommended for the wire diameter.

Outline of connection

Connect a wire from the VOLTAGE SENSING/INPUT terminal of this product to the EUT. When connecting the wire to the VOLTAGE SENSING/INPUT terminal, give the conductor a 10 mm strip margin (indicated on the rear panel). Secure the wire by tightening the screw on the terminal with the accessory screwdriver. Twist the wire as much as possible.

⚠CAUTION

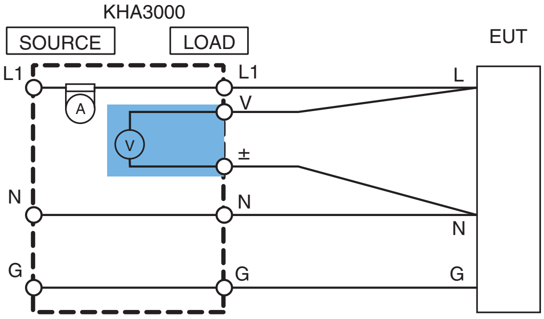
Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

Circuit Diagrams

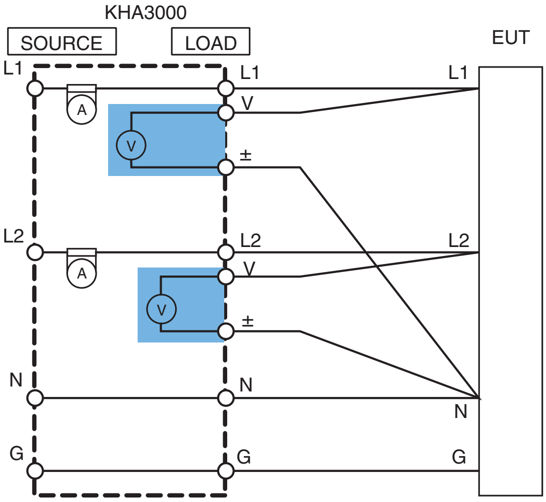
See p. 30, p. 107

This section shows individual types of measurement circuits. For actual wiring, refer to the connection table and wiring diagram in the section explaining "Connecting the Voltmeter to External Measurement Points".

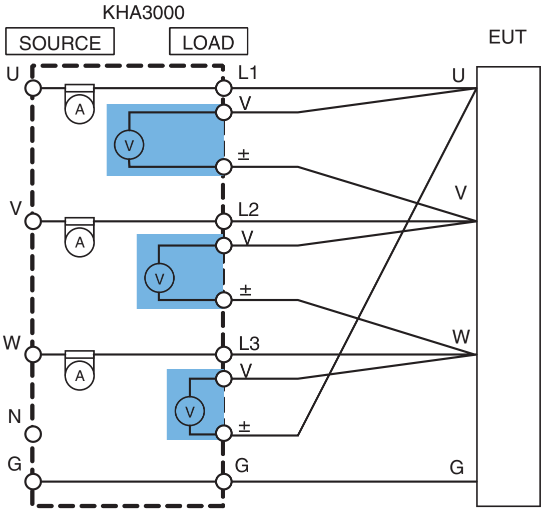
Single-phase two-wire circuit



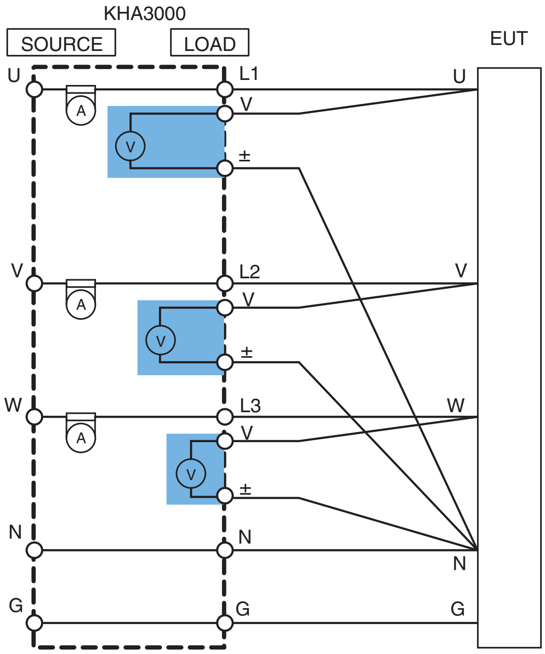
Single-phase three-wire circuit



Three-phase three-wire circuit



Three-phase four-wire circuit

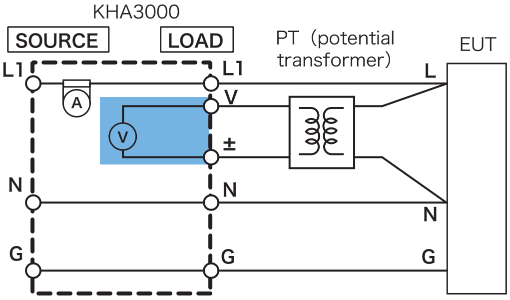


Using PT (potential transformer)

When the voltage of the device to be measured exceeds the maximum voltage range of this product, a PT (potential transformer) may be connected. The connection circuit is shown for single-phase, two-wire circuits. For other circuits, similarly connect a PT for each phase.

See p. 101, p. 116, p. 192, p. 201

When a PT is used, it is necessary to set the scaling that corresponds to the transformer ratio.



Using CT (current transformer)

When the current of the device to be measured exceeds the maximum current range of this product, a CT (current transformer) may be connected. Here, the connections for single-phase two-wire (1P2W), single-phase three-wire (1P3W), three-phase three-wire (3P3W), and three-phase four-wire (3P4W) systems are described. The impedance shown is used in the flicker tests. Except for some special cases, the impedance will not be used in the harmonic current tests.

The voltmeter is for the connection to external measurement points.

L1, L2, and L3 are the three input phases (channels). L1 will be the reference phase for the measurement. Be sure to connect L1.

⚠WARNING

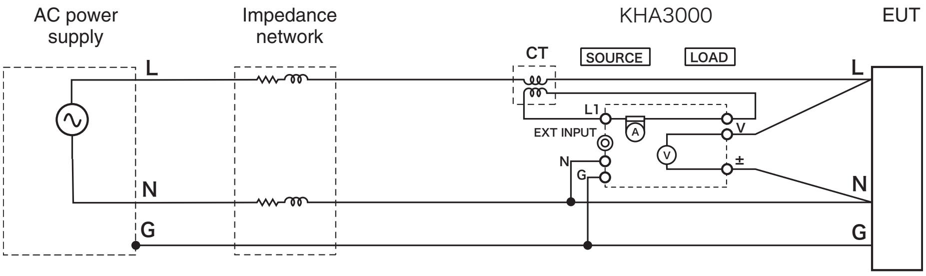
- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

⚠CAUTION

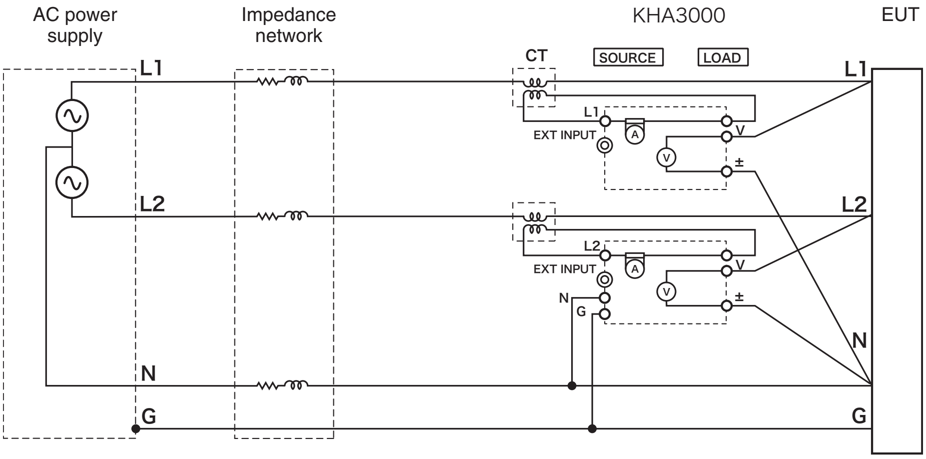
Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

Circuit diagram

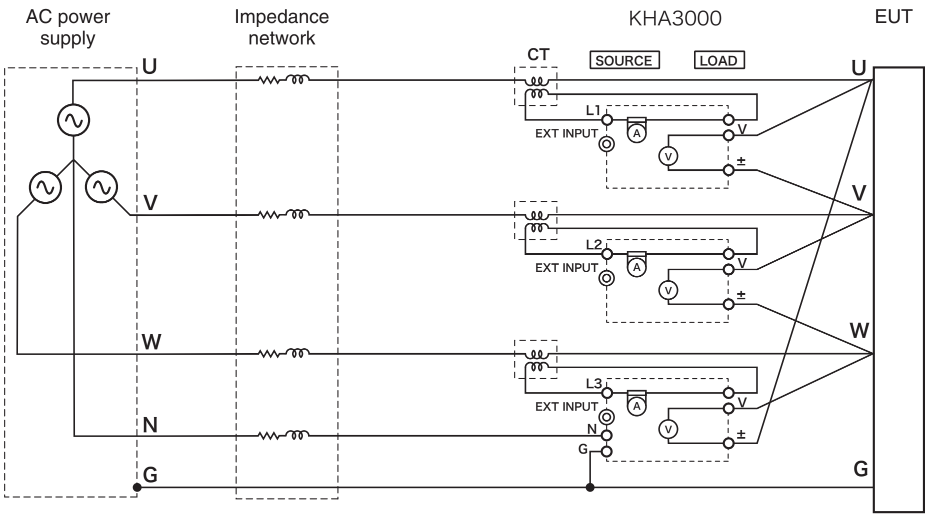
Single-phase two-wire (1P2W) circuit



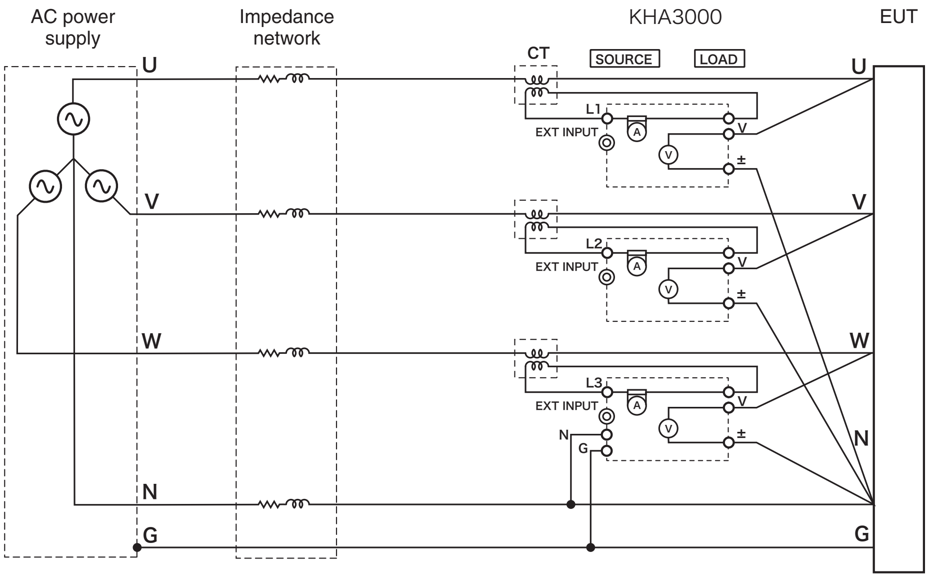
Single-phase three-wire (1P3W) circuit



Three-phase three-wire (3P3W) circuit



Three-phase four-wire (3P4W) circuit



Using external current shunts

When the current of the device to be measured exceeds the maximum current range of this product, external current shunts may be connected. Here, the connections for single-phase two-wire (1P2W), single-phase three-wire (1P3W), three-phase three-wire (3P3W), and three-phase four-wire (3P4W) systems are described. The impedance shown is used in the flicker tests. Except for some special cases, the impedance will not be used in the harmonic current tests.

The voltmeter is for the connection to external measurement points.

L1, L2, and L3 are the three input phases (channels). L1 will be the reference phase for the measurement. Be sure to connect L1.

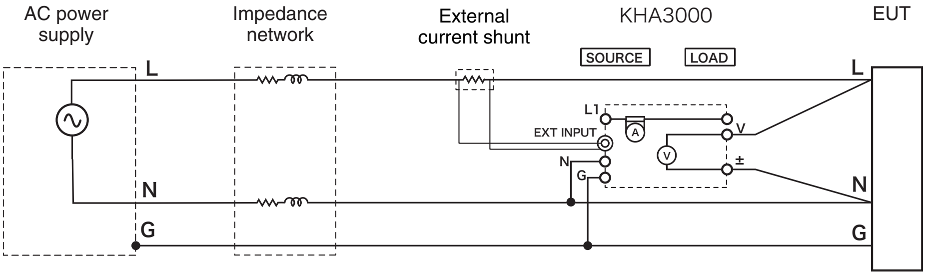
⚠WARNING

- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

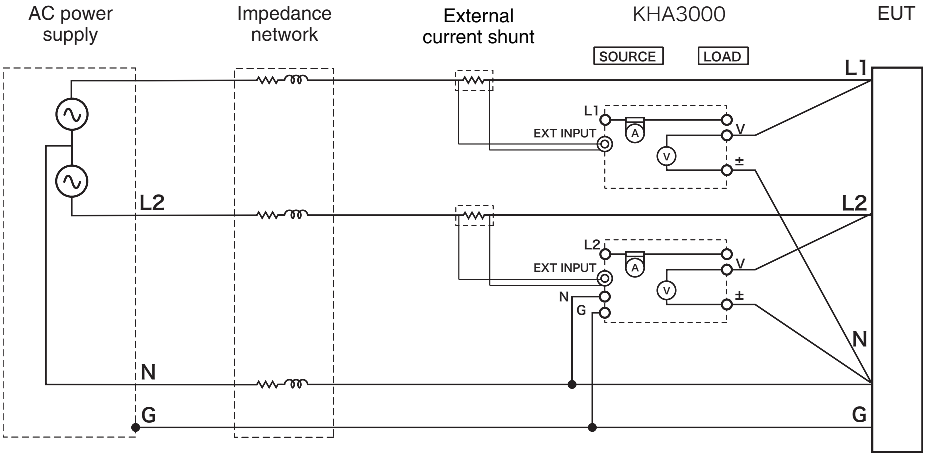
⚠CAUTION Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

Circuit diagram

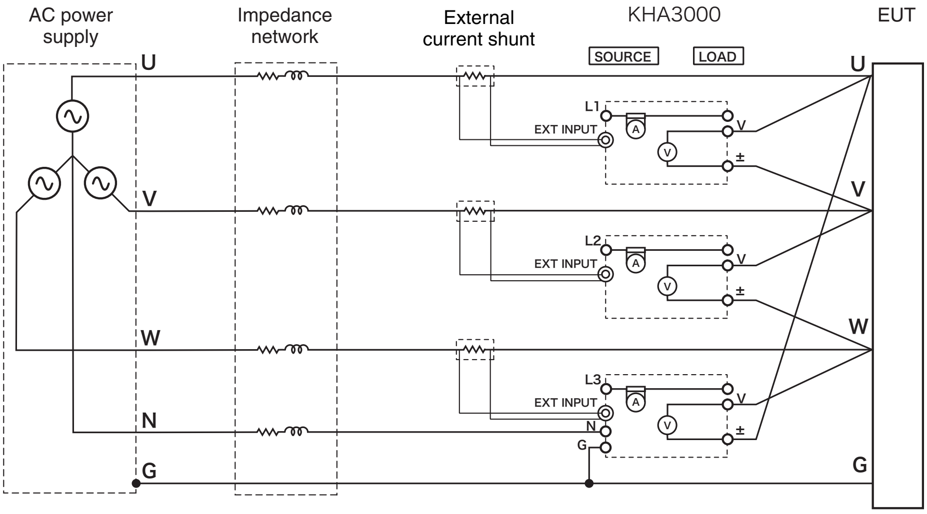
Single-phase two-wire (1P2W) circuit



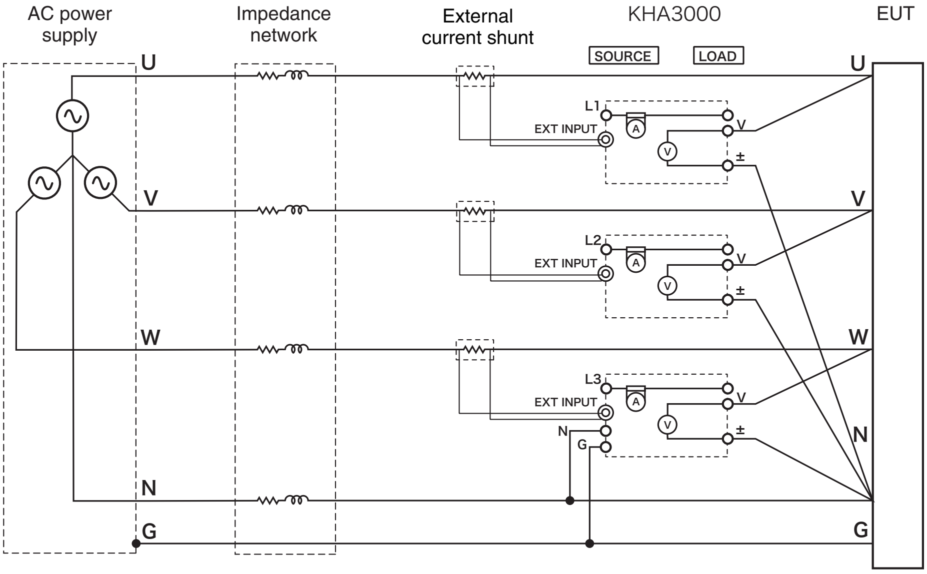
Single-phase three-wire (1P3W) circuit



Three-phase three-wire (3P3W) circuit



Three-phase four-wire (3P4W) circuit

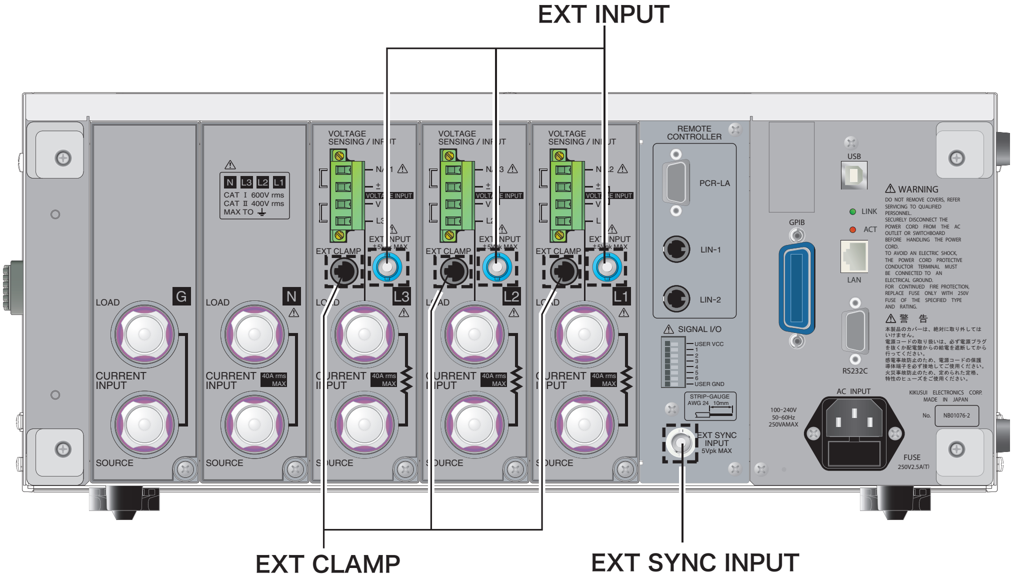


Connecting External Signals

The terminals to which external signals are connected are EXT INPUT and EXT SYNC INPUT.

Parts to be prepared by the customer

- BNC coaxial cable

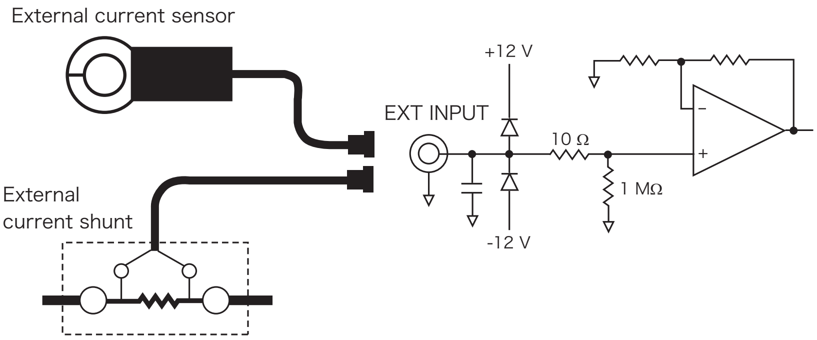


EXT INPUT (BNC connector)

These are external signal input terminals for connection to the outputs of external current sensors or external current shunts. The terminals are provided in the L1, L2, and L3 input sections. The maximum input voltage is 5V peak. These terminals are enabled when "BNC" is selected in the "Curr Input Terminal" in the setting menu.

When external current sensors or current shunts are used, it is necessary to set the scaling.

See p. 101, p. 116, p. 192, p. 201



EXT CLAMP (only for options)

See p. 101, p. 116, p. 192, p. 201

Connect optional current sensors. This connection terminal is provided at each of the L1, L2, and L3 input sections.

These terminals are enabled when "Sensor" is selected in the "Curr Input Terminal" in the setting menu. The type and serial number of the current sensor will be displayed in the option data in the system setting screen.

* At present, no optional current sensors are available although they are to be released in the future.

Automatic recognition of optional current sensors

This product automatically recognizes any optional current sensors connected to the EXT CLAMP terminals when the power is turned on. If a current sensor is replaced or newly connected with the POWER switch turned on, the current sensor cannot be automatically recognized.

- Whenever a current sensor is replaced or newly connected with the POWER switch turned on, the user should take an action to make this product recognize the sensor.

See p. 87

- The operation to make this product recognize the current sensor (i.e., to press the "Update Opt. Information" key) is performed in system setup.

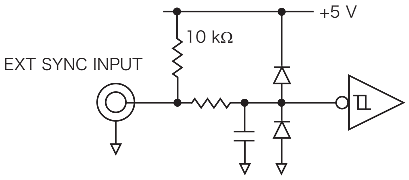
- If any current sensor connected to this product has not been recognized, a dialog message to prompt the operation to make the system recognize the current sensor (i.e., pressing the "Update Opt. Information" key) will be presented when the "Curr Input Terminal" menu is selected or when the test is started.

- If the power is turned on again after the current sensor is connected, the current sensors connected will be automatically recognized.

EXT SYNC INPUT

See p. 101, p. 116, p. 192, p. 201

EXT SYNC INPUT is an external synchronizing signal input terminal. The maximum input voltage is 5 Vpeak. EXT SYNC INPUT is enabled when EXT is selected for “PLL Source” in the setting menu.

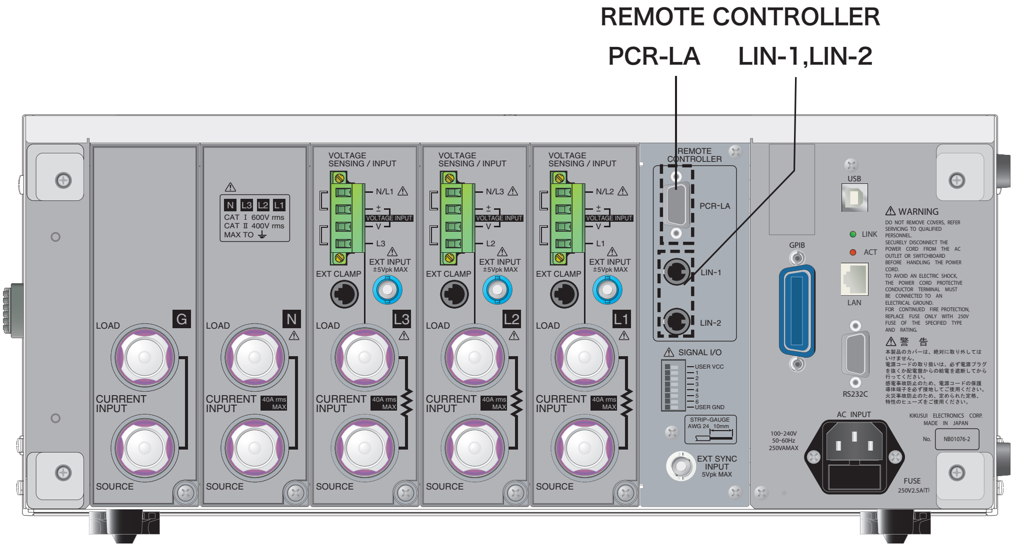


Connecting Control Cables

The terminals used to control external equipment include PCR-LA and LIN-1/LIN-2 of REMOTE CONTROLLER.

Parts to be prepared by the customer

- RS232C cable (cross cable)
  Used to control the AC Power Supply



REMOTE CONTROLLER PCR-LA

This terminal is used to control the AC Power Supply. An RS232-C cable (cross cable) is necessary. For the connection to the AC Power Supply, refer to the Operation Manual of the AC Power Supply.

NOTE Do not connect PCR-WE to this terminal. PCR-WE is controlled by the separately sold application software SD006-KHA Harmonics Analyzing Suite.

REMOTE CONTROLLER LIN-1/LIN-2

This function is currently not supported.

Measurement Circuit Using Commercial Power Supply

See p. 262

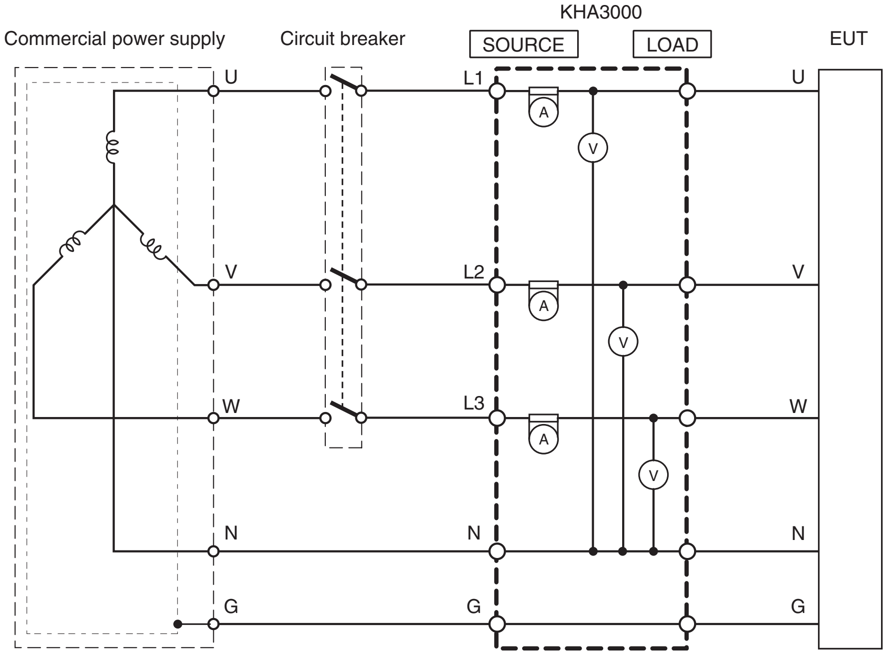
Connect this product to the commercial power supply directly. In directly connecting the SOURCE terminal to the commercial power supply (AC line) without an AC power supply, such as when measuring in-rush current, use a circuit breaker that can disconnect this product from the commercial power supply (AC line) for safety (diagram shown below).

⚠WARNING

- **You may receive an electric shock. To install a circuit breaker between the SOURCE terminal and commercial power supply (AC line), be sure to shut off the power supply from the switchboard by turning off the switches on the switchboard.**
- **Use the circuit breaker with the rated current set to 40 Arms (maximum input current of this product) or less.**
- **Use a circuit integrating three circuit breaker poles so that the U, V and W poles can be shut down simultaneously.**

Parts to be prepared by the customer

- Circuit breaker
- Connection cable with commercial power supply



⚠CAUTION

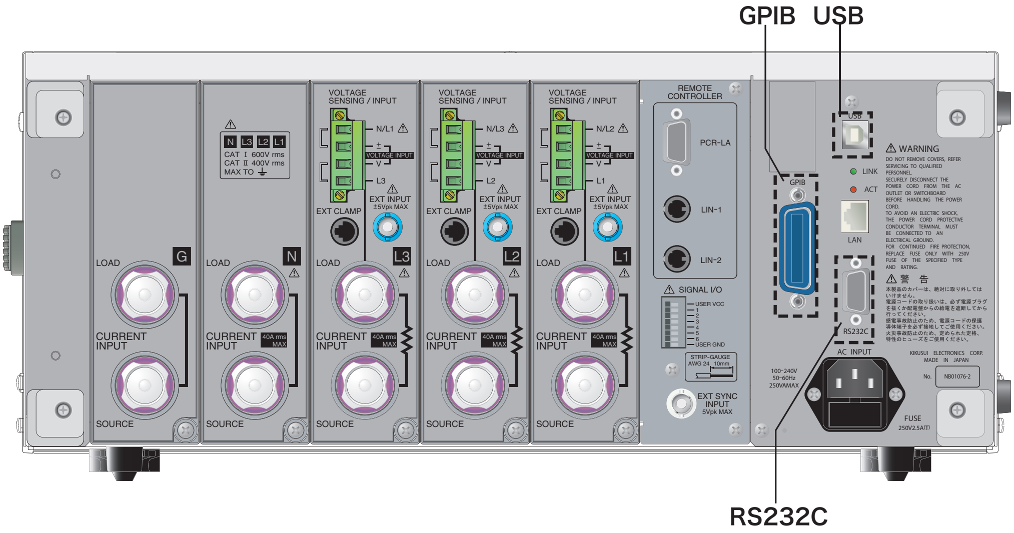
Terminal G of this product is not a protective conductor terminal. It is not grounded even if the wire is connected to terminal G. For terminals G and N, the respective SOURCE and LOAD terminals are short-circuited internally.

Connecting Communication Cables

Communication terminals include GPIB, RS232C and USB.

Parts to be prepared by the customer

- GPIB cable
- RS232C cable
- USB cable



GPIB

Use a standard IEEE488 cable. Make sure that the POWER switches of this product and computer are turned off, and then connect this product to the computer.

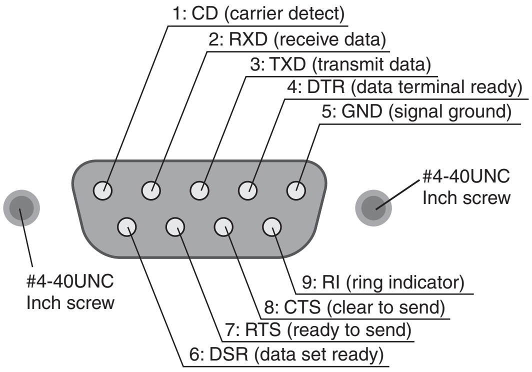
RS232C

The RS232C port on the KHA3000 is a standard D-sub 9-pin male connector.

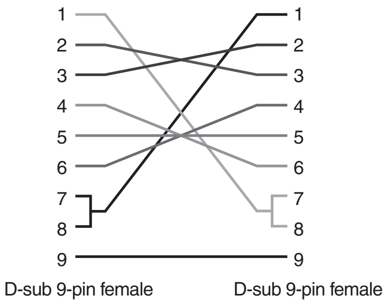
Check that the POWER switches of the KHA3000 and computer are off, and connect the KHA3000 to the computer using a standard cross cable (null modem cable).

Use a D-sub 9-pin female-to-female AT type for the cross cable. The figure shows the connector pin arrangement.

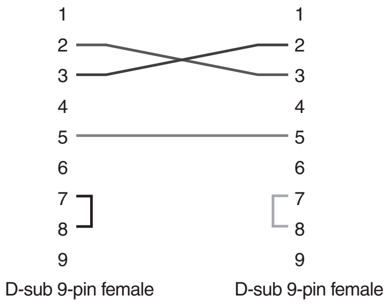
The KHA3000 does not use hardware handshaking (as shown in the cross cable example 2).



Facing the KHA3000 rear panel



Cross cable example 1



Cross cable example 2

USB

Use a standard USB cable. Make sure that the POWER switches of this product and computer are turned off, and then connect this product to the computer.

4

System Setup

This chapter explains how to turn on the power and how to set up the system.

Turning On the Power

This section explains how to turn on the power to this product independently, and then explains how to turn on the power to the test system including the AC power supply.

Turning On the POWER Switch

1 **Turn the POWER switch to ON (|).**

Depress the POWER switch (|). With the startup sound, all LEDs illuminate and the firmware version is displayed. The built-in cooling fan starts to rotate.

See p. 2

2 **Check the firmware version on the screen.**

After the firmware version is displayed for several seconds, the harmonic current test display (HA-Observation and Analysis display) appears.

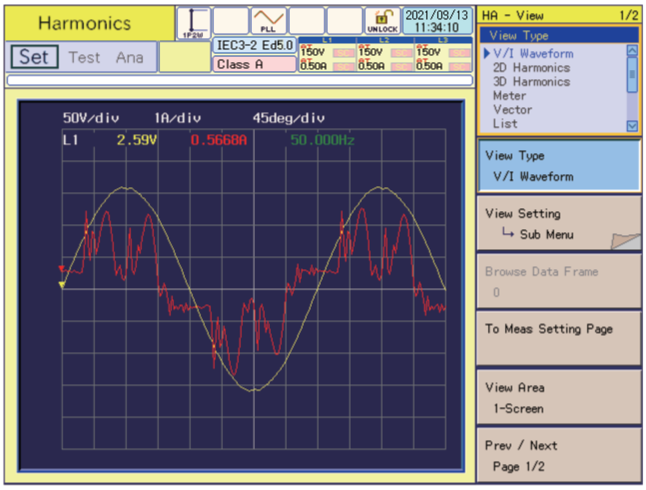
KHA3000

Ver1.00

3 **Allow a sufficient warm-up period before starting the test.**

When the POWER switch is turned on for the first time after purchasing this product

The HA-Observation and Analysis display (HA-VIEW) shown below appears. The system starts up with the factory default settings. When the power is turned on for the second time and thereafter, the system starts up in the state it was in when the POWER switch was turned off last.



IEC3-2 Ed5.0
Class A

View Type V/I Waveform

View Area 1-Screen

Prev / Next Page 1/2

(The waveform on the screen is an example for reference.)

Turning Off the POWER Switch

Turn the POWER switch of this product to OFF (○).

This product can control the AC Power Supply used in the test system (EXT control function). When the EXT control function is used, also turn off the AC Power Supply.

Power-On of the Test System

This section explains how to turn on the power to the test system including this product, the AC Power Supply and Line Impedance Network. There are the following two methods for turning on/off the power switch:

- **Separate ON/OFF**

  Turn on and off the POWER switches of individual devices separately.

- **Collective ON/OFF**

  Turn on and off the power collectively using an external power switch. Lock the POWER switches of individual devices in the ON position. The customer is requested to prepare the external power switch.

Separate ON/OFF

This method is normally used to control the AC Power Supply from this product. This procedure is explained below.

To prevent damage to the internal relay contact of the Line Impedance Network, follow the procedure exactly. For details on preventing damage to the internal relay contact, refer to the Operation Manual of the Line Impedance Network.

Turning on the POWER switch

1. **Turn on the POWER switch of the Line Impedance Network.**
2. **Turn on the POWER switch of the AC Power Supply.**

   The version is displayed for several seconds on the control panel of the AC Power Supply. The output remains at OFF. For details on the version display, refer to the Operation Manual of the AC Power Supply.

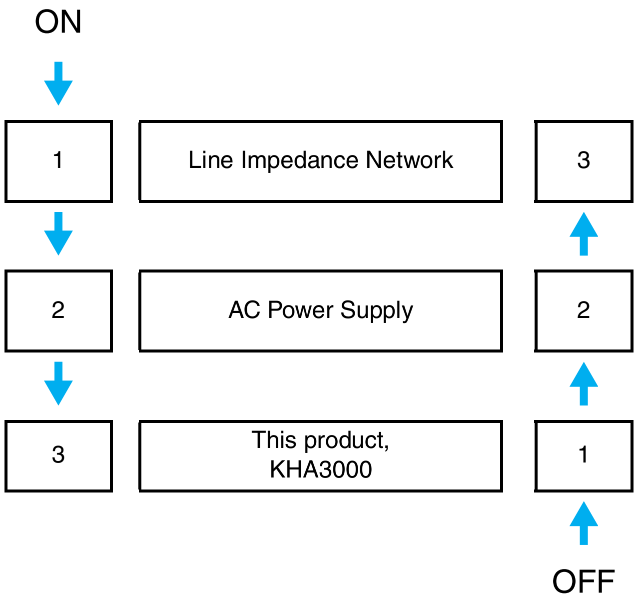
   Subsequent operations are controlled from this product, KHA3000.
3. **Turn on the POWER switch of this product.**

   Press the POWER switch (|). With the startup sound, all LEDs illuminate and the firmware version is displayed.

Turning off the POWER switch

1. **Turn off the POWER switch of this product.**
2. **Turn off the POWER switch of the AC Power Supply.**
3. **Turn off the POWER switch of the Line Impedance Network.**

ON/OFF sequence of the POWER switch



Collective Power-on/off

See p. 47

The power supply of the test system is collectively turned on/off using an external power switch.

Turning on the power switch

Turn on the external power switch.

The power supply for this product, AC Power Supply, and the Line Impedance Network are turned on.

Turning off the power switch

1 **Press the EXT CONT key.**

The External Control display appears.

2 **Press the F1 key to select AC power supply control.**

A sub-menu appears.

3 **Select OFF in "F1 Key (AC power supply OUTPUT)."**

The AC power supply output is turned off. The icon in the upper part of the display shows a turned-off light bulb.

4 **Turn off the external power switch.**

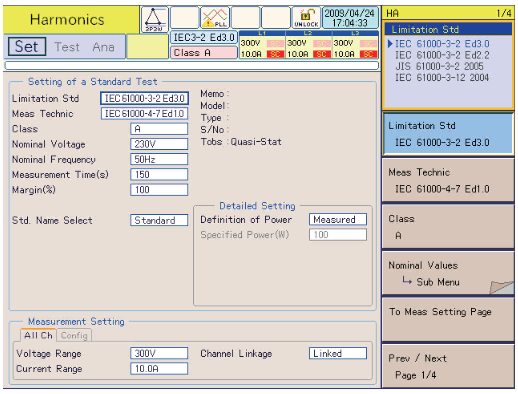
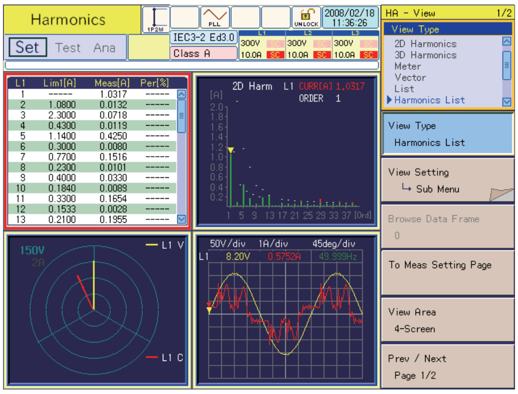
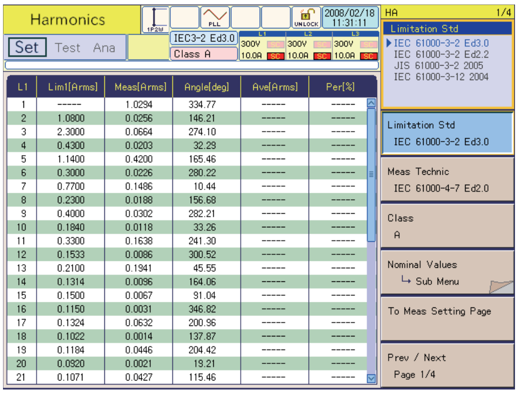
The power supply for this product, AC Power Supply, and the Line Impedance Network are turned off.

Switching Displays

Types and Names of Basic Views

The basic views can be classified into harmonic current testing display, voltage fluctuation testing display, and system and others display. Select the necessary functions using the function keys in the menu.

Harmonic current testing displays

Name and contents	Example
HA-Test Conditions List display **Display** Displays a list of the test conditions selected from the menu. **Menu** Displays the menu from which test conditions are selected.	
HA-Observation and Analysis display (HA-VIEW) **Display** Displays data in the display format selected from the menu. **Menu** Displays the menu from which the display format is selected.	
HA-Observation and Test Conditions display **Display** Displays data in the display format selected from the HA-Observation and Analysis display (HA-VIEW) menu. **Menu** Displays the menu from which test conditions are selected.	

Setting of a Standard Test
Limitation Std: IEC61000-3-2 Ed3.0
Meas Technic: IEC61000-4-7 Ed1.0
Class: A
Nominal Voltage: 230V
Nominal Frequency: 50Hz
Measurement Time(s): 150
Margin(%): 100
Std. Name Select: Standard
Memo :
Model :
Type :
S/No :
Tobs : Quasi-Stat

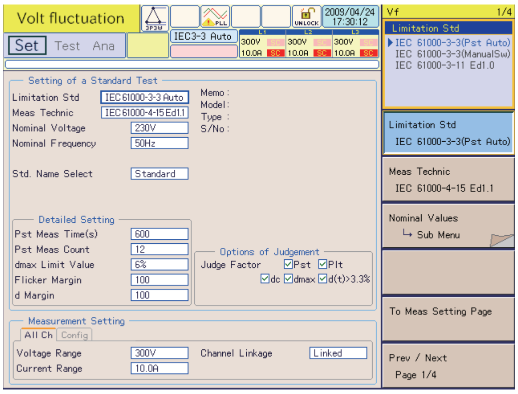
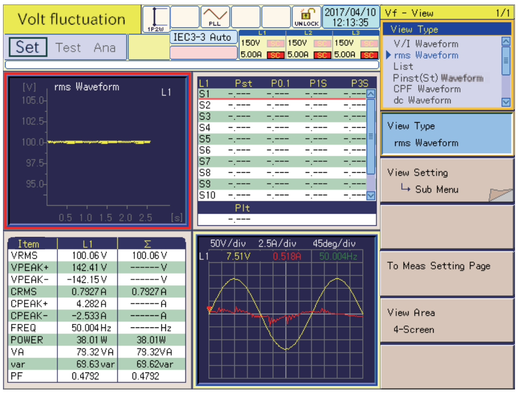
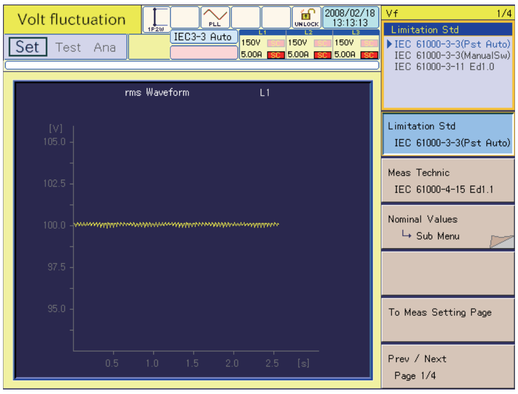
Detailed Setting
Definition of Power: Measured
Specified Power(W): 100

Measurement Setting
All Ch Config
Voltage Range: 300V
Current Range: 10.0A
Channel Linkage: Linked

L1	Lim1[A]	Meas[A]	Per[%]
1	-----	1.0317	-----
2	1.0800	0.0132	-----
3	2.3000	0.0718	-----
4	0.4300	0.0119	-----
5	1.1400	0.4250	-----
6	0.3000	0.0080	-----
7	0.7700	0.1516	-----
8	0.2300	0.0101	-----
9	0.4000	0.0330	-----
10	0.1840	0.0089	-----
11	0.3300	0.1654	-----
12	0.1533	0.0028	-----
13	0.2100	0.1955	-----

L1	Lim1[Arms]	Meas[Arms]	Angle[deg]	Ave[Arms]	Per[%]
1	-----	1.0294	334.77	-----	-----
2	1.0800	0.0256	146.21	-----	-----
3	2.3000	0.0664	274.10	-----	-----
4	0.4300	0.0203	32.29	-----	-----
5	1.1400	0.4200	165.46	-----	-----
6	0.3000	0.0226	280.22	-----	-----
7	0.7700	0.1486	10.44	-----	-----
8	0.2300	0.0188	156.68	-----	-----
9	0.4000	0.0302	282.21	-----	-----
10	0.1840	0.0118	33.26	-----	-----
11	0.3300	0.1638	241.30	-----	-----
12	0.1533	0.0086	300.52	-----	-----
13	0.2100	0.1941	45.55	-----	-----
14	0.1314	0.0096	164.06	-----	-----
15	0.1500	0.0067	91.04	-----	-----
16	0.1150	0.0031	346.82	-----	-----
17	0.1324	0.0632	200.96	-----	-----
18	0.1022	0.0014	137.87	-----	-----
19	0.1184	0.0446	204.42	-----	-----
20	0.0920	0.0021	19.21	-----	-----
21	0.1071	0.0427	115.46	-----	-----

■ Voltage fluctuation testing displays

Name and contents	Example
Vf-Test Conditions List display Display Displays a list of the test conditions selected from the menu. Menu Displays the menu from which test conditions are selected.	
Vf-Observation and Analysis display (Vf-VIEW) Display Displays data in the display format selected from the menu. Menu Displays the menu from which the display format is selected.	
Vf-Observation and Test Conditions display Display Displays data in the display format selected from the Vf-Observation and Analysis display (Vf-VIEW) menu. Menu Displays the menu from which test conditions are selected.	

Setting of a Standard Test

Limitation Std: IEC 61000-3-3 Auto
Meas Technic: IEC 61000-4-15 Ed1.1
Nominal Voltage: 230V
Nominal Frequency: 50Hz
Std. Name Select: Standard

Memo :
Model :
Type :
S/No :

Detailed Setting

Pst Meas Time(s): 600
Pst Meas Count: 12
dmax Limit Value: 6%
Flicker Margin: 100
d Margin: 100

Options of Judgement

Judge Factor ☑Pst ☑Plt ☑dc ☑dmax ☑d(t)>3.3%

Measurement Setting

All Ch | Config

Voltage Range: 300V
Current Range: 10.0A
Channel Linkage: Linked

L1	Pst	P0.1	P1S	P3S
S1	-.---	-.---	-.---	-.---
S2	-.---	-.---	-.---	-.---
S3	-.---	-.---	-.---	-.---
S4	-.---	-.---	-.---	-.---
S5	-.---	-.---	-.---	-.---
S6	-.---	-.---	-.---	-.---
S7	-.---	-.---	-.---	-.---
S8	-.---	-.---	-.---	-.---
S9	-.---	-.---	-.---	-.---
S10	-.---	-.---	-.---	-.---

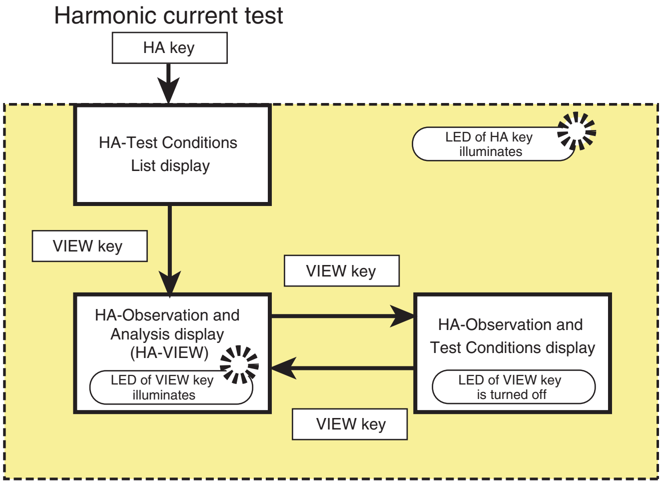
Plt
-.---

Item	L1	Σ
VRMS	100.06 V	100.06 V
VPEAK+	142.41 V	------ V
VPEAK-	-142.15 V	------ V
CRMS	0.7927 A	0.7927 A
CPEAK+	4.282 A	------ A
CPEAK-	-2.533 A	------ A
FREQ	50.004 Hz	------ Hz
POWER	38.01 W	38.01W
VA	79.32 VA	79.32VA
var	69.63 var	69.62var
PF	0.4792	0.4792

Keys Used to Switch between the Three Basic Views

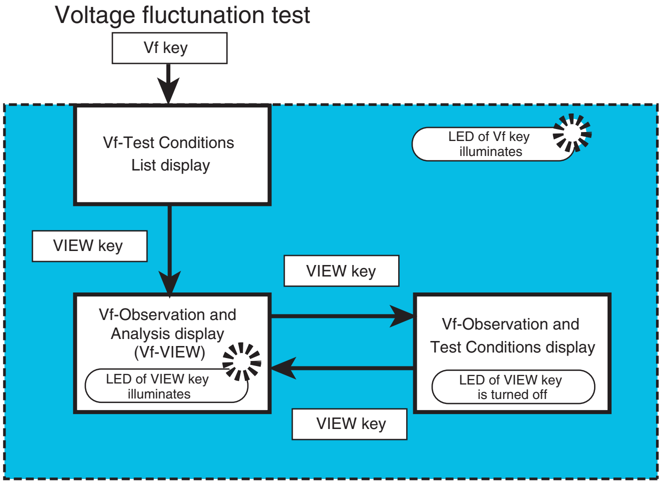
As explained above, the harmonic current testing display and voltage fluctuation testing display each has three basic views. In the harmonic current testing display, use the HA key and VIEW key to change views. In the voltage fluctuation testing display, use the Vf key and VIEW key to change views.

Harmonic current testing display



- Press the HA key to display the HA-Test Conditions List display (the HA key LED illuminates.)
- Pressing the VIEW key while the HA key's LED is lit displays the HA-Observation and Analysis display (HA-VIEW). Under this condition, the HA-Observation and Test Conditions display and HA-Observation and Analysis display (HA-VIEW) are displayed alternately each time the VIEW key is pressed.
- Pressing the HA key displays the HA-Test Conditions List display again.

Voltage fluctuation testing display



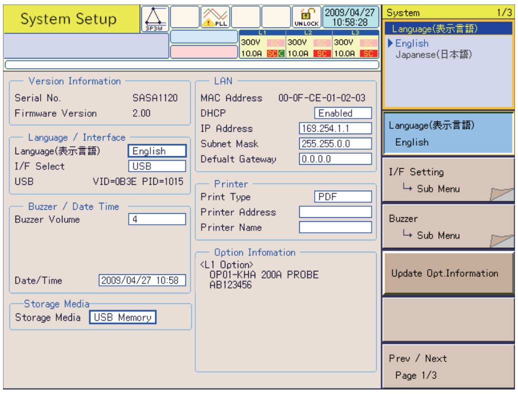
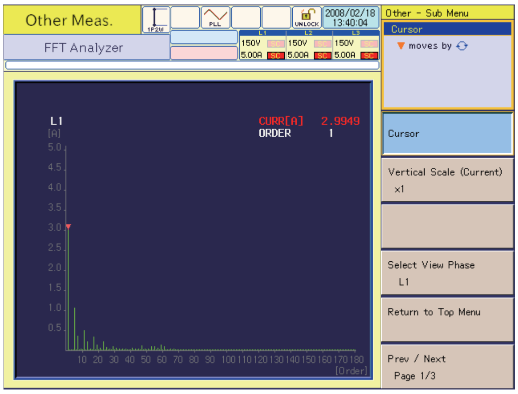
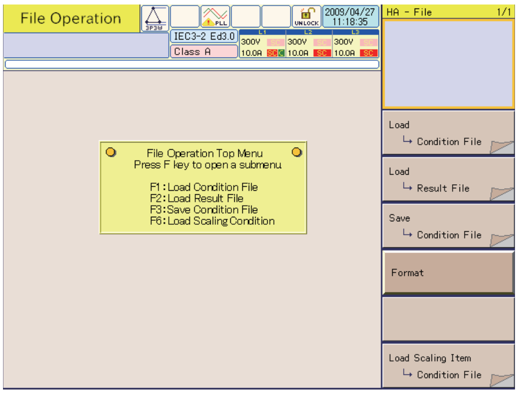
- Press the Vf key to display the Vf-Test Conditions List display (the Vf key LED illuminates).
- Pressing the VIEW key while the Vf key's LED is lit displays the Vf-Observation and Analysis display (Vf-VIEW). Under this condition, the Vf-Observation and Test Conditions display and Vf-Observation and Analysis display (Vf-VIEW) are displayed alternately each time the VIEW key is pressed.
- Pressing the Vf key displays the Vf-Test Conditions List display again.

Keys Used to Display the System Setup Display and Other Displays

Dedicated keys are used respectively to display the following displays:

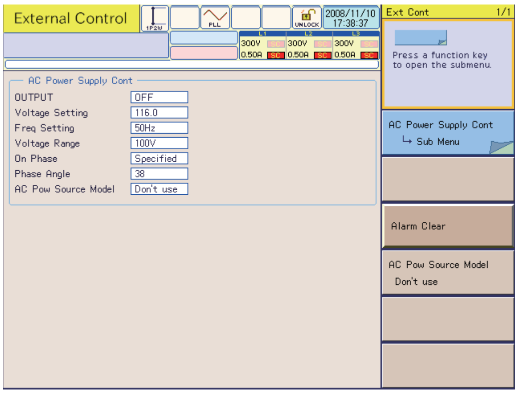
- System Setup display: SYSTEM key
- Other Measurement displays: OTHER key
- File Operation display: FILE key
- External Control display: EXT CONT key
- Assist display: ASSIST key

■ System Setup Display and Other Displays

Name and contents	Example
System Setup display Setting common items Communication interface, buzzer volume, date and time, etc. * The option information shown is an example	System Setup 2009/04/27 10:58:28 300V 10.0A / 300V 10.0A / 300V 10.0A Version Information Serial No. SASA1120 Firmware Version 2.00 Language / Interface Language(表示言語) English I/F Select USB USB VID=0B3E PID=1015 Buzzer / Date Time Buzzer Volume 4 Date/Time 2009/04/27 10:58 Storage Media Storage Media USB Memory LAN MAC Address 00-0F-CE-01-02-03 DHCP Enabled IP Address 169.254.1.1 Subnet Mask 255.255.0.0 Defualt Gateway 0.0.0.0 Printer Print Type PDF Printer Address Printer Name Option Infomation <L1 Option> OP01-KHA 200A PROBE AB123456
Other Measurement display Basic measurement FFT analyzer In-rush current measurement	Other Meas. FFT Analyzer 2008/02/18 13:40:04 150V 5.00A / 150V 5.00A / 150V 5.00A CURR[A] 2.9949 ORDER 1
File Operation display Calling the test condition file (load) Calling the test result file (load) Saving the test condition file (save) Calling the scaling setting condition (load)	File Operation 2009/04/27 11:18:35 IEC3-2 Ed3.0 Class A 300V 10.0A / 300V 10.0A / 300V 10.0A File Operation Top Menu Press F key to open a submenu F1 : Load Condition File F2 : Load Result File F3 : Save Condition File F6 : Load Scaling Condition

External Control display

Controlling the AC power supply

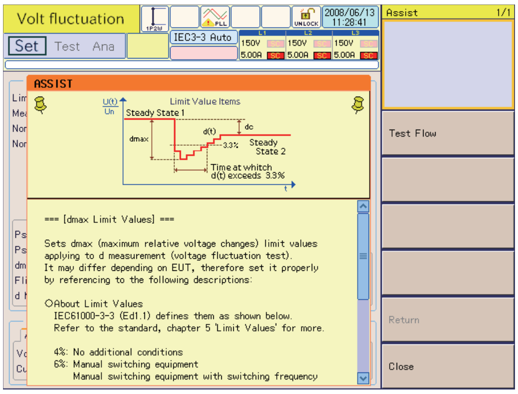


AC Power Supply Cont

OUTPUT: OFF
Voltage Setting: 116.0
Freq Setting: 50Hz
Voltage Range: 100V
On Phase: Specified
Phase Angle: 38
AC Pow Source Model: Don't use

Assist display

Explanation of menu items
Specification terminology



=== [dmax Limit Values] ===

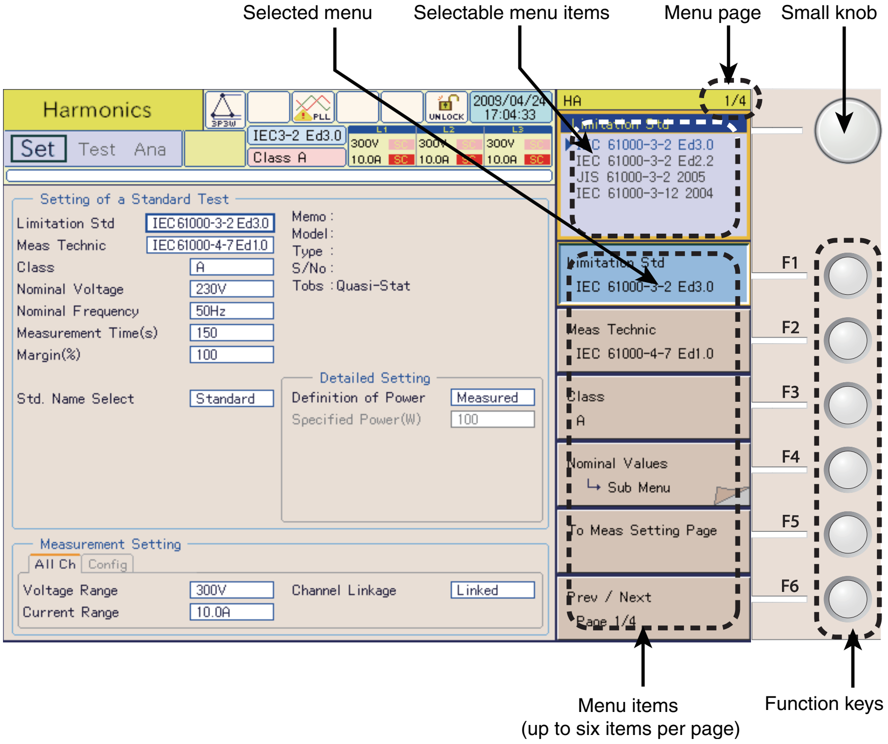
Sets dmax (maximum relative voltage changes) limit values applying to d measurement (voltage fluctuation test).
It may differ depending on EUT, therefore set it properly by referencing to the following descriptions:

○About Limit Values
IEC61000-3-3 (Ed1.1) defines them as shown below.
Refer to the standard, chapter 5 'Limit Values' for more.

4%: No additional conditions
6%: Manual switching equipment
Manual switching equipment with switching frequency

Using the Menu

Menu operation is the same in all menu displays. Display the menu to be used and then perform the following operations.



IEC3-2 Ed3.0
Class A
2009/04/24 17:04:33

Setting of a Standard Test
Limitation Std IEC61000-3-2 Ed3.0
Meas Technic IEC61000-4-7 Ed1.0
Class A
Nominal Voltage 230V
Nominal Frequency 50Hz
Measurement Time(s) 150
Margin(%) 100
Std. Name Select Standard

Memo :
Model :
Type :
S/No :
Tobs : Quasi-Stat

Detailed Setting
Definition of Power Measured
Specified Power(W) 100

Measurement Setting
All Ch Config
Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Selecting Menu Items

Pressing the function key

1 **Press the function key of the menu to be set.**

The color of the selected menu item column changes. The selected menu contents (the top part of the menu) show the set contents. An input frame is displayed for items in which a numeric value can be set.

2 **Select an item by pressing the same function key again.**

Every time the function key is pressed, another item is selected. The display part and menu in the display show the selected item. In items where the numeric value can be set, the numeric value in the input frame varies (increases only). When the maximum set value is reached, the system is reset to the minimum value.

Turning the small knob

1 **Press the function key of the menu to be set.**

The color of the selected menu item column changes. The selected menu contents (the top part of the menu) show the set contents. An input frame is displayed for items in which a numeric value can be set.

2 **Select the set contents using the small knob.**

The selected items change in response to the operation of the small knob. The display part and menu in the display show the selected item. In items where the numeric value can be set, the numeric value in the input frame varies. The selected item or the numeric value is fixed as is.

Entering Numeric Values or Characters

Using numeric keypad

Use the keypad to enter a numeric value for the selected menu item.

1 **Press the function key of the menu to be set.**

The color of the selected menu item column changes. An input frame for setting a numeric value is displayed.

2 **Enter a numeric value using the numeric keypad.**

The numeric value is entered in the input frame. The display part and menu in the display show the set numeric value.

3 **Press the ENTER key.**

The value entry is fixed.

Turning the large knob

Use the large knob to enter numeric values or characters for the selected menu item.

1 **Press the function key of the menu to be set.**

The color of the selected menu item column changes. An input frame for setting a numeric value or a character is displayed.

2 **Select the set contents using the large knob.**

The numeric value or the character will be displayed in the entry box. The numeric value or the character will appear on the display screen and on the menu. The selected character or the numeric value will be fixed as is.

Displaying a Sub-menu

“→ Sub Menu” is displayed as a menu item.

1 **Press the function key with the indication of “→ Sub Menu.”**

The sub-menu is displayed.

2 **Press the function key of the item to be set.**

Every time the function key is pressed, another item is selected. The display part and sub-menu in the display show the selected item.

3 **Select set contents.**

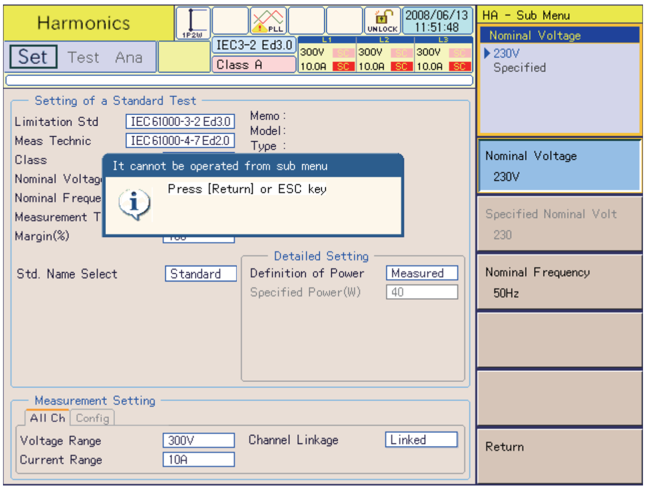
The selected items change in response to the operation of the small or large knob, function key, or ten-key keypad. The selected item is displayed in the display part and sub-menu in the display.

4 **Press the function key (return).**

Exit from the sub-menu.

■ Error in moving to upper menu

Another state cannot be entered without the function key (return) being pressed. In this case, the dialog box shown below is displayed.



It cannot be operated from sub menu

Press [Return] or ESC key

Setting of a Standard Test

Limitation Std: IEC61000-3-2 Ed3.0

Meas Technic: IEC61000-4-7 Ed2.0

Memo :

Model :

Type :

Std. Name Select: Standard

Detailed Setting

Definition of Power: Measured

Specified Power(W): 40

Measurement Setting

Voltage Range: 300V

Current Range: 10A

Channel Linkage: Linked

Key Used to Lock Operation, and Other Keys

Locking Key Operation

1 **Press the KEY LOCK (SHIFT + REMOTE) key.**

The key icon displayed on the upper part of the display is changed to LOCK to lock key operation. The function keys for menu selection are also locked.

2 **Press the KEY LOCK key again.**

The key icon displayed on the upper part of the display is changed to UNLOCK to unlock key operation.

Holding the Display

Press the HOLD key.

Measured values and graphics in the display are left unchanged. With the measurement active, only the view display is held still. This key is used to monitor changes, detect abnormal values, and determine the view to be output to the printer.

Saving the Current Display

Press the HARD COPY key.

The hard copy dialog box is displayed. The display is saved to the external memory CompactFlash card or USB flash drive. A file name is automatically created. When the saving is finished, the hard copy dialog box disappears.

This function cannot be used during the test.

Changing the Display Brightness

Press the BACK LIGHT (SHIFT + Up/Down Arrow) key.

The Up Arrow increases the brightness. The Down Arrow decreases the brightness.

Changing the Buzzer Volume

Press the BUZZER (SHIFT + 1) key or (SHIFT + 0).

Pressing the 1 key turns up the volume, and pressing the 0 key turns down the volume.

Changing to Local Operation

Press the LOCAL key.

Remote control operation is finished and key operation is enabled (the REMOTE LED is turned off).

When the remote control is active, the REMOTE LED is ON.

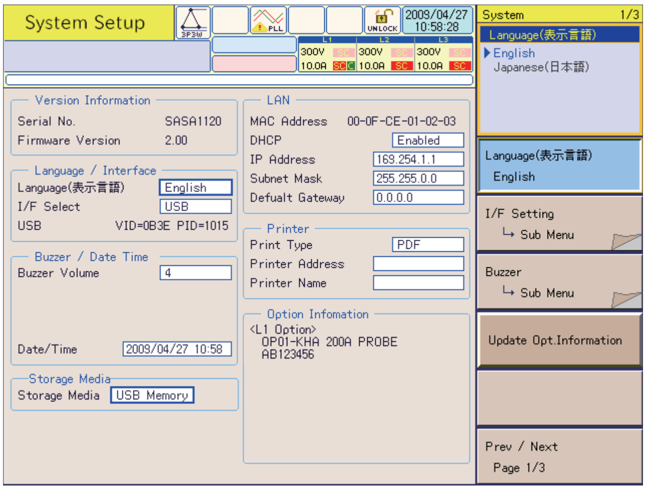
Setting the System

This section sets items that are common to the entire system. These items include selecting communication interfaces and setting the buzzer volume, PCR-LA control and date/time.

Showing the System Setup Display

Press the SYSTEM key.

The System Setup display appears. The serial No. and firmware version are displayed in the upper part of the data view area (example of firmware version 1.0x).



System Setup

2009/04/27 10:58:28

Version Information
Serial No. SASA1120
Firmware Version 2.00

Language / Interface
Language(表示言語) English
I/F Select USB
USB VID=0B3E PID=1015

Buzzer / Date Time
Buzzer Volume 4
Date/Time 2009/04/27 10:58

Storage Media
Storage Media USB Memory

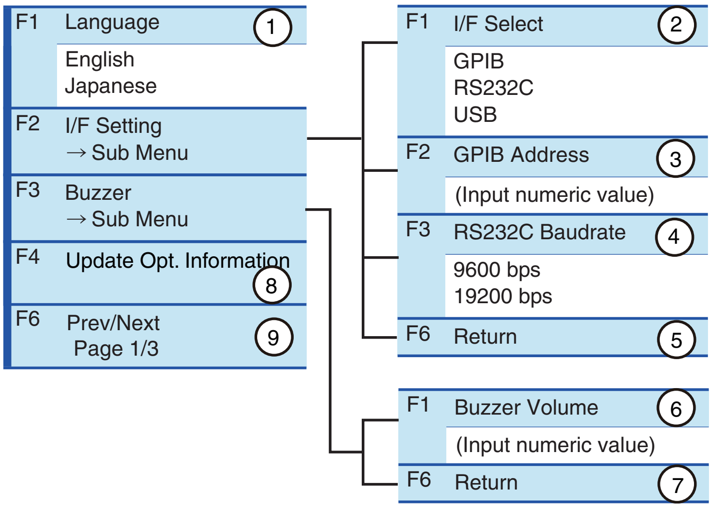
LAN
MAC Address 00-0F-CE-01-02-03
DHCP Enabled
IP Address 169.254.1.1
Subnet Mask 255.255.0.0
Defualt Gateway 0.0.0.0

Printer
Print Type PDF
Printer Address
Printer Name

Option Infomation
<L1 Option>
OP01-KHA 200A PROBE
AB123456

Language, I/F Setting and Buzzer

Menu 1/3



No.	Menu item	Description	Default
1	Language	Select the language in which menus are to be displayed. From the second power-on, the system starts with the language used when the POWER switch was turned off previously.	English
2	I/F Select	Select the type of interface (I/F).	USB
3	GPIB Address	Enter the GPIB address in the range from 1 to 30. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value. Turn off the POWER switch and turn it on again to enable the setting.	1
4	RS232C Baudrate	Select the RS232C baudrate. Turn off the POWER switch and turn it on again to enable the setting.	19200 bps
5	Return	Terminates I/F Setting.	–
6	Buzzer Volume	Specify the buzzer volume in the range from 0 to 8. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	4
7	Return	Terminates buzzer setting.	–
8	Update Opt. Information	Check and update the connection status of current sensors. The check results will be displayed in the option information field of the System Setup screen.	–
9	Prev/Next Page 1/3	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

Direct setting for the buzzer volume

You can directly set the buzzer volume. Arrows are indicated beside number keys 1 and 0 on the operation panel. The up arrow turns up the volume and the down arrow turns down the volume. These keys cannot be used during testing or analysis. Press the “SHIFT + 1” keys to turn up the volume, or press the “SHIFT + 0” keys to turn down the volume.

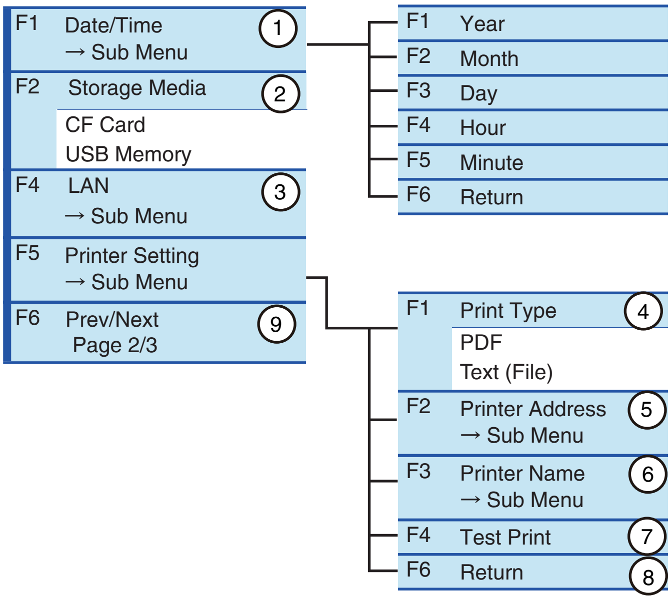
Updating information for options

See p. 65

This product automatically recognizes any optional current sensors connected to the EXT CLAMP terminals when the power is turned on. Whenever any current sensor is replaced or newly connected with the POWER switch already turned on, press the Update Opt. Information key to make the system recognize the sensor as the system will not automatically recognize the connection. If any current sensor connected to the system has not been recognized, a dialog message to prompt the operation to make the system recognize the current sensor (i.e., pressing the "Update Opt. Information" key) will be presented when the "Curr Input Terminal" menu is selected or when the test is started. If the power is turned on again after the current sensor is connected, the current sensors connected will be automatically recognized.

Clock and Printer

Menu 2/3



No.	Menu item	Description	Default
1	Date/Time	The current system time is displayed on the display. Set the date and time by using the corresponding function keys. Set the calendar year.	–
2	Storage Media	Specify the storage media. Selects either "CF Card"(CompactFlash card) or "USB Memory" (USB flash drive).	CF Card
3	LAN	Use this item when connecting this product to a network printer. This product currently does not support this function. This menu item is displayed dimmed. Although the DHCP, IP Address, Subnet Mask and Default Gateway items are displayed, they are invalid.	–
4	Print Type	PDF PDF format (the file format used if data is saved to a storage media)	–
		Text (File) Text format (the file format used if data is saved to a storage media)	
5	Printer Address	Specify the IP address of the network printer. This product currently does not support this function. This menu item is displayed dimmed.	–
6	Printer Name	Specify the name of the network printer. This product currently does not support this function. This menu item is displayed dimmed.	–
7	Test Print	This product currently does not support this function. This menu item is displayed dimmed.	–
8	Return	Terminates printer setting.	–
9	Prev/Next Page 2/3	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

See p. 273

Setting the Storage Media

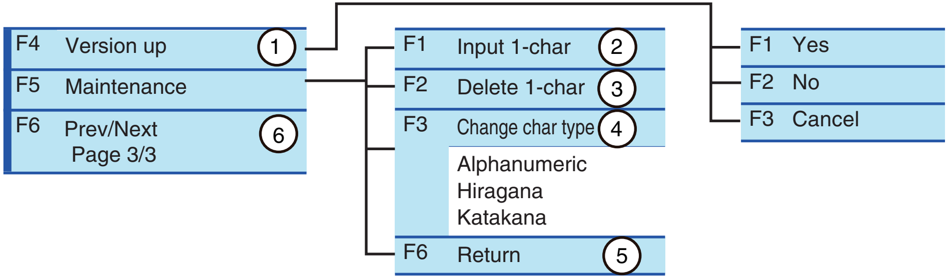
Remove the USB flash drive temporarily when the storage media is changed from the CompactFlash card to the USB flash drive. If the USB flash drive is not remove temporarily and then the HARD COPY key is pressed, the buzzer sounds and the dialog box “Disk Error. Media could not be detected” is displayed. In this case, press the F1 key (OK) and remove the USB flash drive temporarily and then connect it.

Updating the firmware version and Maintenance

This menu is used to update the firmware version of this product. For details, contact your Kikusui distributor or agent.

When “Yes” is selected without preparing for updating the firmware version, the dialog box “Disk Error. Media could not be detected.” is displayed. Because the firmware version is not update, press the OK function key to return to the previous state.

Menu 3/3



No.	Menu item	Description	Default
1	Version up	This menu is used to update the firmware version of this product. A dialog box asking “Are you sure?” appears with answer options “Yes,” “No,” and “Cancel.” If you select “Yes” without preparing to upgrade the version, a dialog box stating “Disk Error. Media could not be detected” appears. Because version upgrading is not possible under this condition, press the F1 key (OK) to return.	–
2	Input 1-char	Used to enter a character for a password. Up to 20 alphanumeric characters or up to 10 hiragana or katakana characters can be input. The procedure is shown below.	–
3	Delete 1-char	Used to delete a character from the password. The procedure is shown below.	–
4	Change char type	Used to change the character type of the password. The character types (alphanumeric, hiragana, katakana) change each time the F3 key is pressed.	–
5	Return	Terminates character input, character deletion and character type change.	–
6	Prev/Next Page 3/3	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 **Press the F5 (Maintenance) key.**

The password dialog will be presented.

2 **Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.**

3 **Press the F1 (Input 1-char) key.**

The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 **Press the ENTER key.**

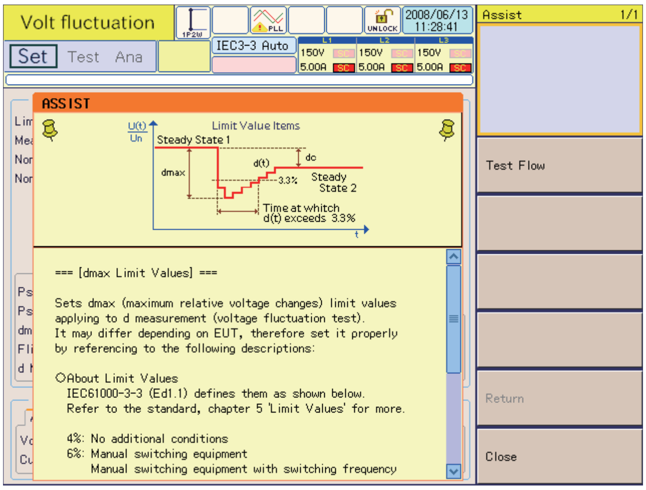
The characters entered will be fixed and saved.

Using Assist Function

Supporting security for users not familiar with the standards

This product has an assist function to support the operation. Use the function when you are not sure how to select menu items.

Press the function key of the menu item that you want to know in detail. Next, press the ASSIST key to show the Assist display. The description corresponds to the current menu item can be viewed. Standards terms can also be viewed. This function can be used at any time.



```
=== [dmax Limit Values] ===

Sets dmax (maximum relative voltage changes) limit values
applying to d measurement (voltage fluctuation test).
It may differ depending on EUT, therefore set it properly
by referencing to the following descriptions:

○About Limit Values
  IEC61000-3-3 (Ed1.1) defines them as shown below.
  Refer to the standard, chapter 5 'Limit Values' for more.

  4%: No additional conditions
  6%: Manual switching equipment
      Manual switching equipment with switching frequency
```

■ The assist function is convenient in the following cases:

- When the user feels it is time-consuming to view the standards each time. You want to start making measurements immediately.
- When the classification method is unknown.
- When the user wants to correctly select the impedance.
- When the user wants to know how to set a measurement time.
- When a term is unknown.

5

Setting the Harmonic Test

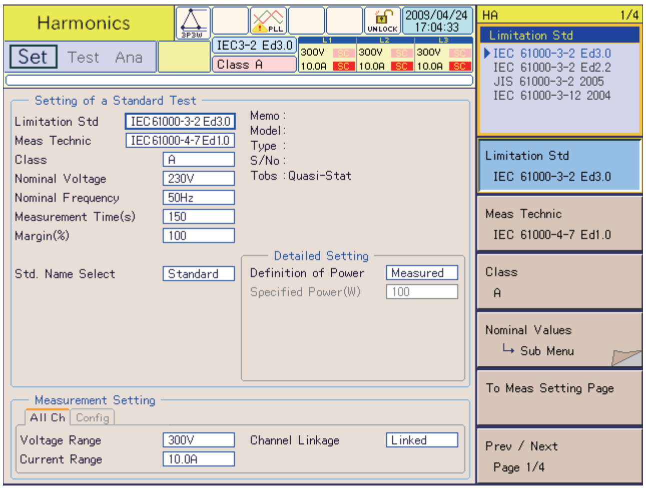
This chapter explains how to set the test conditions for the harmonic current test.

Test Conditions Setting Displays

Two types of display are available for setting test conditions. Choose either one.

- HA-Test Conditions List display for setting test conditions while checking the test conditions that were selected in the menu
- HA-Observation and Test Conditions display for setting test conditions during measurement

Using the HA-Test Conditions List Display (Setting with viewing test conditions)



Setting of a Standard Test

Limitation Std IEC61000-3-2 Ed3.0
Meas Technic IEC61000-4-7 Ed1.0
Class A
Nominal Voltage 230V
Nominal Frequency 50Hz
Measurement Time(s) 150
Margin(%) 100

Std. Name Select Standard

Memo :
Model :
Type :
S/No :
Tobs :Quasi-Stat

Detailed Setting

Definition of Power Measured
Specified Power(W) 100

Measurement Setting

All Ch Config

Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

1 **Press the HA key.**

The HA key LED illuminates and the HA-Test Conditions List display appears. If the display is not shown, proceed to the following step.

If the display does not appear by pressing the HA key

A dialog box “Can’t execute during test/analysis. Please operate it after ending” is displayed and the display switches to the test ending menu.

See p. 146

While the test status display (in the upper left of the screen, “Set” in the case of the figure shown above) is “Test” or “Analysis,” pressing the HA key does not display the HA-Test Conditions List display. Because displaying the HA-Test Conditions List display starts a new test with the test conditions changed, the test that has been executed needs to be terminated.

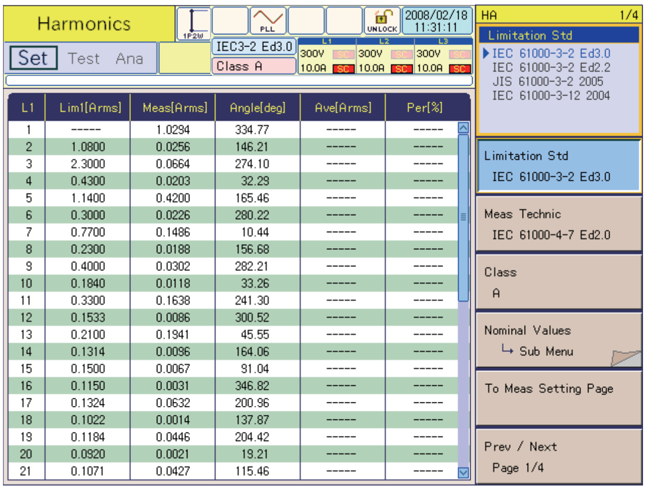
2 **Press the F3 key (Exit) in the Ending menu.**

The test ends. The test status indication on the screen switches from “Analysis” to “Set.” If test results have not been saved with the F1 key (Save), the dialog box and menu for saving are displayed. To save the test results, select F1 (Yes); otherwise, select F2 (No).

3 **Press the HA key.**

The HA key LED illuminates and the HA-Test Conditions List display appears.

Using the HA-Observation and Test Conditions Display (Setting during Measurement)



L1	Lim1[Arms]	Meas[Arms]	Angle[deg]	Ave[Arms]	Per[%]
1	-----	1.0294	334.77	-----	-----
2	1.0800	0.0256	146.21	-----	-----
3	2.3000	0.0664	274.10	-----	-----
4	0.4300	0.0203	32.29	-----	-----
5	1.1400	0.4200	165.46	-----	-----
6	0.3000	0.0226	280.22	-----	-----
7	0.7700	0.1486	10.44	-----	-----
8	0.2300	0.0188	156.68	-----	-----
9	0.4000	0.0302	282.21	-----	-----
10	0.1840	0.0118	33.26	-----	-----
11	0.3300	0.1638	241.30	-----	-----
12	0.1533	0.0086	300.52	-----	-----
13	0.2100	0.1941	45.55	-----	-----
14	0.1314	0.0096	164.06	-----	-----
15	0.1500	0.0067	91.04	-----	-----
16	0.1150	0.0031	346.82	-----	-----
17	0.1324	0.0632	200.96	-----	-----
18	0.1022	0.0014	137.87	-----	-----
19	0.1184	0.0446	204.42	-----	-----
20	0.0920	0.0021	19.21	-----	-----
21	0.1071	0.0427	115.46	-----	-----

1. **Press the VIEW key on the HA-Test Conditions List display.**

   The VIEW key LED illuminates, and the HA-Observation and Analysis display (HA-VIEW) appears.

2. **Press the F1 key to select the display type to be viewed.**

3. **Press the VIEW key on the HA-Observation and Analysis display (HA-VIEW).**

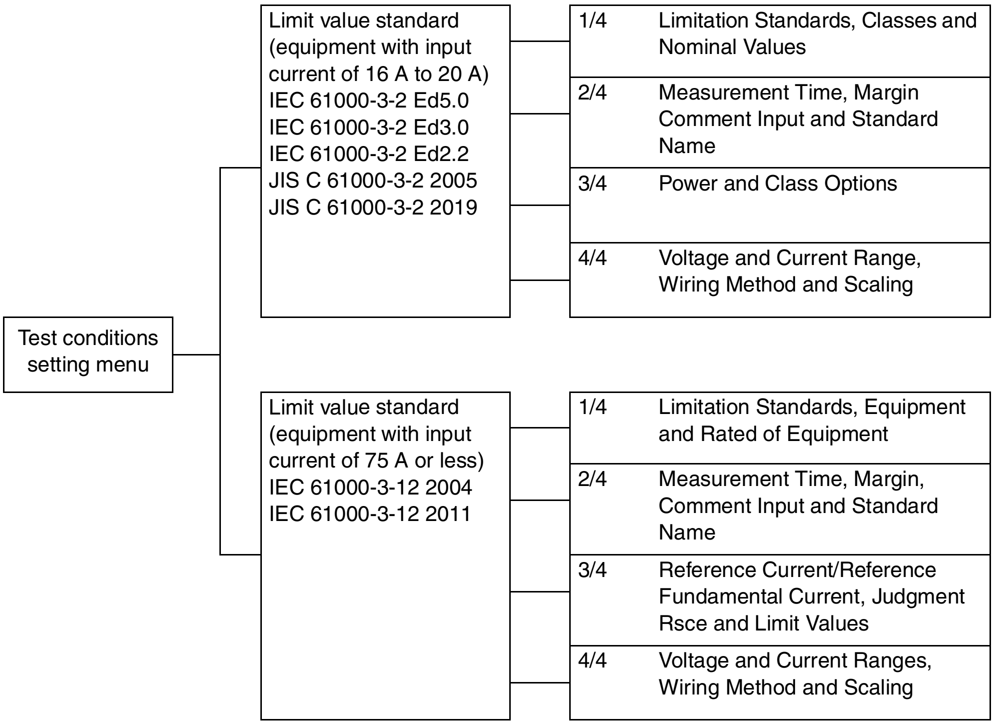
   The LED of the VIEW key goes out and the HA-Observation and Test Conditions display appears. This display is normally in measurement mode. Measured values are shown on the display.

Configuration of Test Conditions Setting Menu

The menu is firstly classified into two classes according to the type of the limit value standards. Each of these classified menus is secondly classified into four pages (1/4 to 4/4). Each of the classified pages is thirdly classified by menu item (function keys F1 to F6).

To switch between the firstly classified two menus, select a limit value standard in the F1 menu on page 1/4.

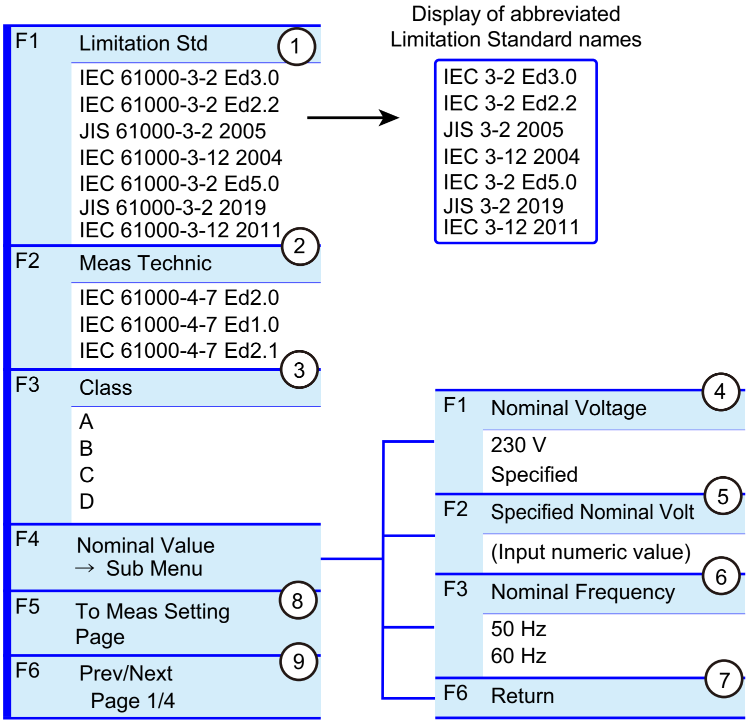
The major menu items on each page are as follows.



61000-3-2

Limitation Standards, Classes and Nominal Values

Menu 1/4

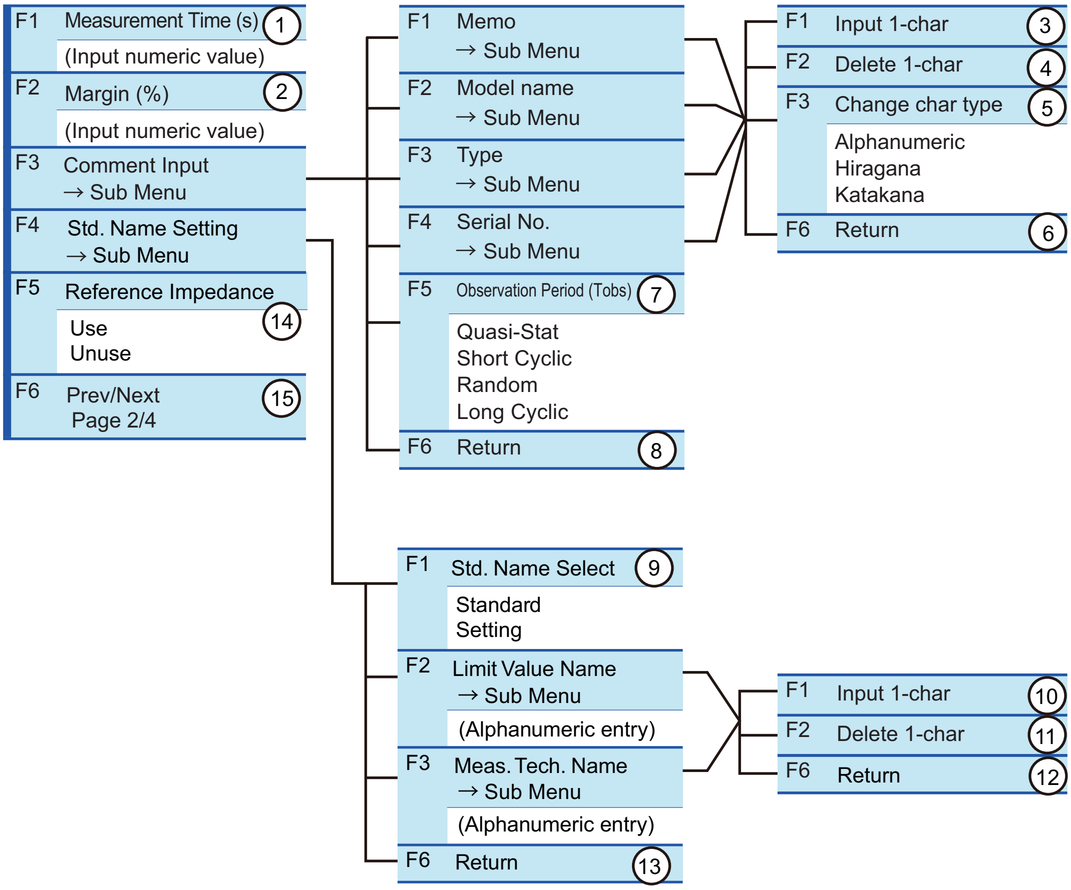


No.	Menu item	Description	Default
1	Limitation Std	Select a limit value standard. Selecting IEC 61000-3-12 2004 or IEC 61000-3-12 2011 displays a menu for equipment with input current 75 A or less. Abbreviated Standard names are shown on the display.	IEC 61000-3-2 Ed5.0
2	Meas Technic	Select a measuring technique standard. IEC 61000-4-7 Ed2.1 and IEC 61000-4-7 Ed2.0 measure interharmonic waves and specifies the result as a harmonic group value. IEC 61000-4-7 Ed2.1 or IEC 61000-4-7 Ed2.0 are recommended for measuring fluctuating harmonics. Abbreviated Standard names are shown on the display.	IEC 61000-4-7 Ed2.1
3	Class	Select the class of the EUT. The limit value for the selected class is used.	A
4	Nominal Voltage	Specify the rated power voltage of the EUT. Select “230 V” (fixed value) or “Specified.”	230 V
5	Specified Nominal Volt	When “Specified” was selected in the F1 menu, enter the rated power voltage of the EUT. The input range is 100 V to 600 V. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	230 V
6	Nominal Frequency	Select the rated power frequency of the EUT.	50 Hz
7	Return	Terminates the specification of the nominal voltage and frequency.	–
8	To Meas Setting Page	Switches to page 4/4.	–
9	Prev/Next Page 1/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

Measurement Time, Margin Comment Input and Standard Name

Menu 2/4



No.	Menu item	Description	Default
1	Measurement Time (s)	Enter a measurement time. The input range is 1 to 9600 seconds. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value. If you set the standard to IEC 61000-3-2 Ed5.0 Class C or JIS C61000-3-2 2019 Class C, and set the limit values to 3rd/5th/ Current Wave, the measurement time will be 0.2 seconds.	150 seconds
2	Margin (%)	Enter a margin for a limit value. The input range is 10 to 100 (for example, enter 80 to set 80 % of the standard limit value). Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	100 %
3	Input 1-char	Use this item to enter characters for Memo, Model name, Type and Serial No. in report printouts. Up to 20 alphanumeric characters and up to 10 hiragana and katakana characters can be input. For details on the procedure, see page 97.	–
4	Delete 1-char	Use this item to delete characters of Memo, Model name, Type and Serial No. from report printouts. For details on the procedure, see page 97.	–
5	Change char type	Use this item to change the character types of Memo, Model name, Type and Serial No. Every time the F3 key is pressed, the character types switch to alphanumeric, hiragana and katakana characters in this order.	–
6	Return	Terminates the character input, character deletion and character type change.	–
7	Observation Period (Tobs)	Select the operation type of the EUT as a condition for setting an observation period (measurement time for this product). The selected item is printed on reports. Measurement results and judgment are not affected.	Quasi-stationary

8	Return	Terminates the comment input.	–
9	Std. Name Select	Select how the "Limitation Std" and "Meas. Tech" names are presented in Report Print. Selects either "Standard" or "Setting".	Standard
10	Input 1-char	This function is used to enter characters for the local Limitation Standard name or the local Measuring technique name to be presented in Report Print. Up to 20 alphanumeric characters can be entered. On how to use this function, refer to the procedures shown below.	–
11	Delete 1-char	This function is used to delete characters from the local Limitation Standard names or the local Measuring technique names to be presented in Report Print. On how to use this function, refer to the procedures shown below.	–
12	Return	Exit from the character entry/deletion procedures to display local Limitation Standard or local Measuring technique names.	–
13	Return	Exit from the setting of standard names to be presented.	–
14	Reference Impedance	Set whether to use the reference impedance.	Unuse
15	Prev/Next Page 2/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

- **Observation period (Tobs)**

“Tobs” is the observation period of a test that is specified by a standard. A period of time required by the operation type of the EUT is specified as the observation period. There are four categories of observation type: “quasi-static,” “short cycle,” “random” and “long cycle,” according to the type of harmonic current fluctuation.

To specify the test observation period, check the operation type of the EUT and set a measurement time that is longer than the observation period required for the operation type.

- **Standard names and their standard presentations**

Menu presentation	Standard presentation for Report Print[*1]
IEC 61000-3-2 Ed3.0	EN 61000-3-2(2006)
IEC 61000-3-2 Ed5.0	EN IEC 61000-3-2(2019)
IEC 61000-3-2 Ed2.2	EN 61000-3-2(2000)/A2(2005)
JIS 61000-3-2 2005	JIS C61000-3-2(2005)
JIS 61000-3-2 2019	JIS C61000-3-2(2019)
IEC 61000-3-12 2004	EN 61000-3-12(2005)
IEC 61000-3-12 2011	EN 61000-3-12(2011)
IEC 61000-4-7 Ed2.0	EN 61000-4-7(2002)
IEC 61000-4-7 Ed2.1	EN 61000-4-7(2002)/A1(2009)
IEC 61000-4-7 Ed1.0	EN 61000-4-7(1993)

*1. At factory shipment, the default names presented for the "Setting" mode are the same as Standard names.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 **Press the F1, F2, F3 or F4 key.**

The Comment Input dialog will be presented.

2 **Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.**

3 **Press the F1 (Input 1-char) key.**

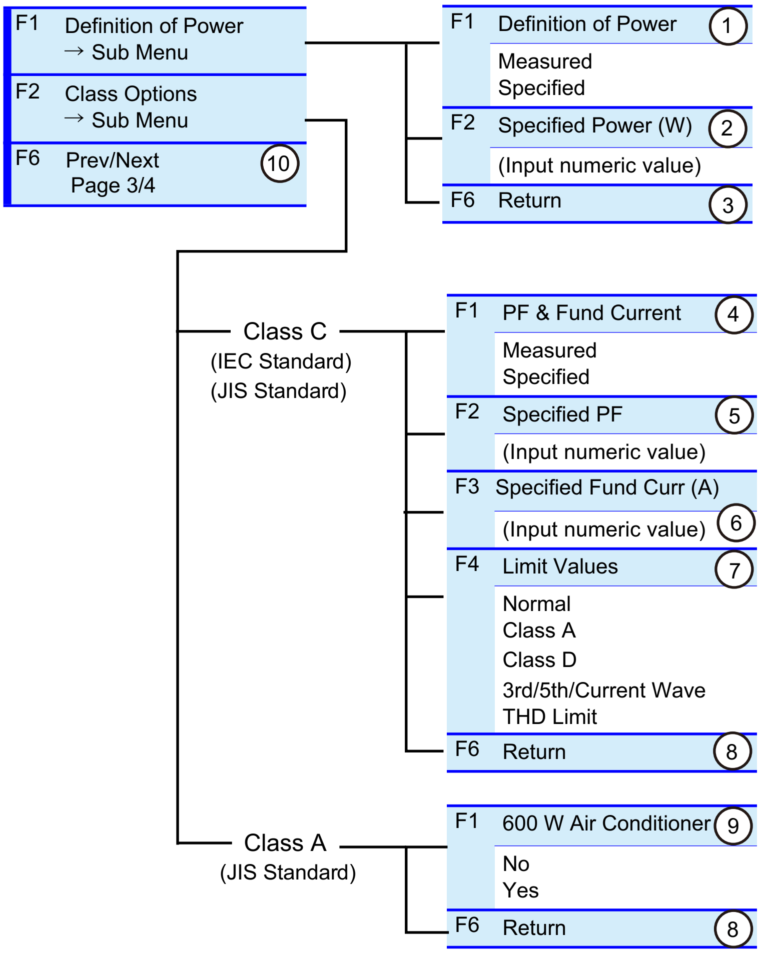
The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 **Press the ENTER key.**

The characters entered will be fixed and saved.

Power and Class Options

Menu 3/4



No.	Menu item	Description	Default
1	Definition of Power	Specify the power value of the EUT. Select “Measured” or “Specified.”	Measured
2	Specified Power (W)	When “Specified” was selected in the F1 menu, enter the power value of the EUT. The input range is 0 W to 135,000 W. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	100 W
3	Return	Terminates the power specification.	–
4	PF & Fund Current	(Class C) Specify the power factor and fundamental current of the EUT. Select “Measured” or “Specified.”	Measured
5	Specified PF	(Class C) When “Specified” was selected in the F1 menu, enter the power factor value of the EUT. The input range is 0.00 to 1.00. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	1.00
6	Specified Fund Curr (A)	(Class C) When “Specified” was selected in the F1 menu, enter the fundamental current value of the EUT. The input range is 0.0 A to 75.0 A. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	20.0 A

7	Limit Values (IEC standard)	(Class C) Select the limit value.		Normal limit value
		Normal	The class C limit value is specified. Select this item for lighting equipment exceeding 25 W.	
		Class A	Select this item for incandescent lighting equipment with a dimmer exceeding 25 W.	
		Class D	Select this item for discharge lighting equipment of up to 25 W.	
		3rd/5th/ Current Wave	Select this item for discharge lighting equipment of 25 W or lower. Only selectable for IEC 61000-3-2 Ed5.0 Class C. This is only valid for single-phase, two-wire circuits. If you select this item, you will not be able to print test result reports.	
		THD Limit	Select this item for discharge lighting equipment of 5 W or grater and 25 W or lower. Only selectable for IEC 61000-3-2 Ed5.0 Class C.	
	Limit Values (JIS standard)	(Class C) Select the limit value.		Normal limit value
		Normal	The class C limit value is specified. Select this item for lighting equipment exceeding 25 W (35 W for household luminaire).	
		Class A	Select this item for incandescent lighting equipment with a dimmer exceeding 25 W (35 W for household luminaire).	
		Class D	Select this item for discharge lighting equipment of up to 25 W and compact fluorescent lamps exceeding 25 W and of up to 35 W.	
		3rd/5th/ Current Wave	Only selectable for JIS C61000-3-2 2019 Class C. This is only valid for single-phase, two-wire circuits. If you select this item, you will not be able to print test result reports.	
		THD Limit	Select this item for discharge lighting equipment of 5 W or grater and 25 W or lower. Only selectable for IEC 61000-3-2 Ed5.0 Class C.	
8	Return	Terminates the class option selection.		–
9	600 W Air Conditioner	(JIS class A) Specify whether air conditioners have an effective power exceeding 600 W.		No
10	Prev/Next Page 3/4	Switches to another menu page.		–

F key: Function key. You can also use the ESC key to return.

NOTE

If you want to use the values (specific values) specified by the manufacturer in place of the actually measured values for the power, fundamental current, and power factor of the EUT, select "Measured" to execute the test. Then, check that the specified value is within ±10 % of the measured value, and execute the test using specific values.

Write the test results using measured values (power (Class D), fundamental current, and power factor (Class C)) in the Memo column of the report for tests using specific values, or prepare each report separately and use them together.

Testing is possible even when the difference between measured values and specific values exceeds ±10 %, but it is important to note that the limit value of the obtained test results does not meet the standard.

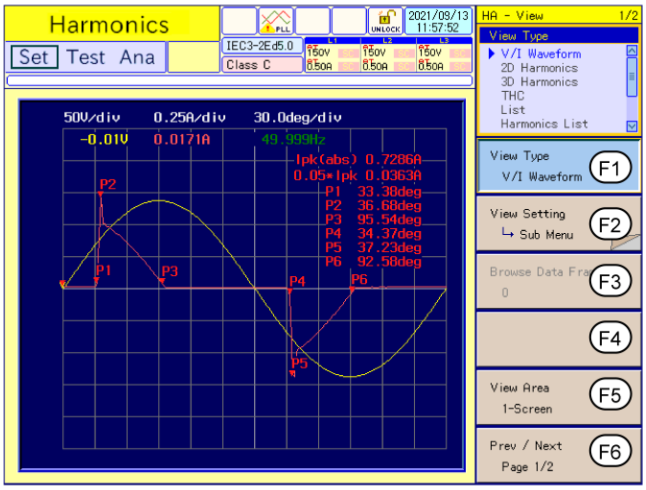
3rd/5th/Current Wave（Limit Values）

If you set Limit Values to “3rd/5th/Current Wave,” the tests using third and fifth harmonic currents and current waveforms that are shown in section 7.4.3, “Rated power ≥ 5 W and ≤ 25 W” of IEC 61000-3-2 Ed5.0 are performed. (It is only valid for single-phase, two-wire circuits.)

When you select “3rd/5th/Current Wave,” the phase angles of the points of the current waveform are displayed on the V/I waveform screen. This is only valid when the view area is set to 1-Screen.

The phase angles of the points of the current waveform are measured automatically. From the cycle that includes the maximum absolute peak value within the window, the phase angles are determined from the following references: the points that reached the current threshold (which is 5 % of the absolute peak) and the points where the voltage crossed zero on the rising and falling slopes.

Correct judgments cannot be made for half-wave rectification circuits.

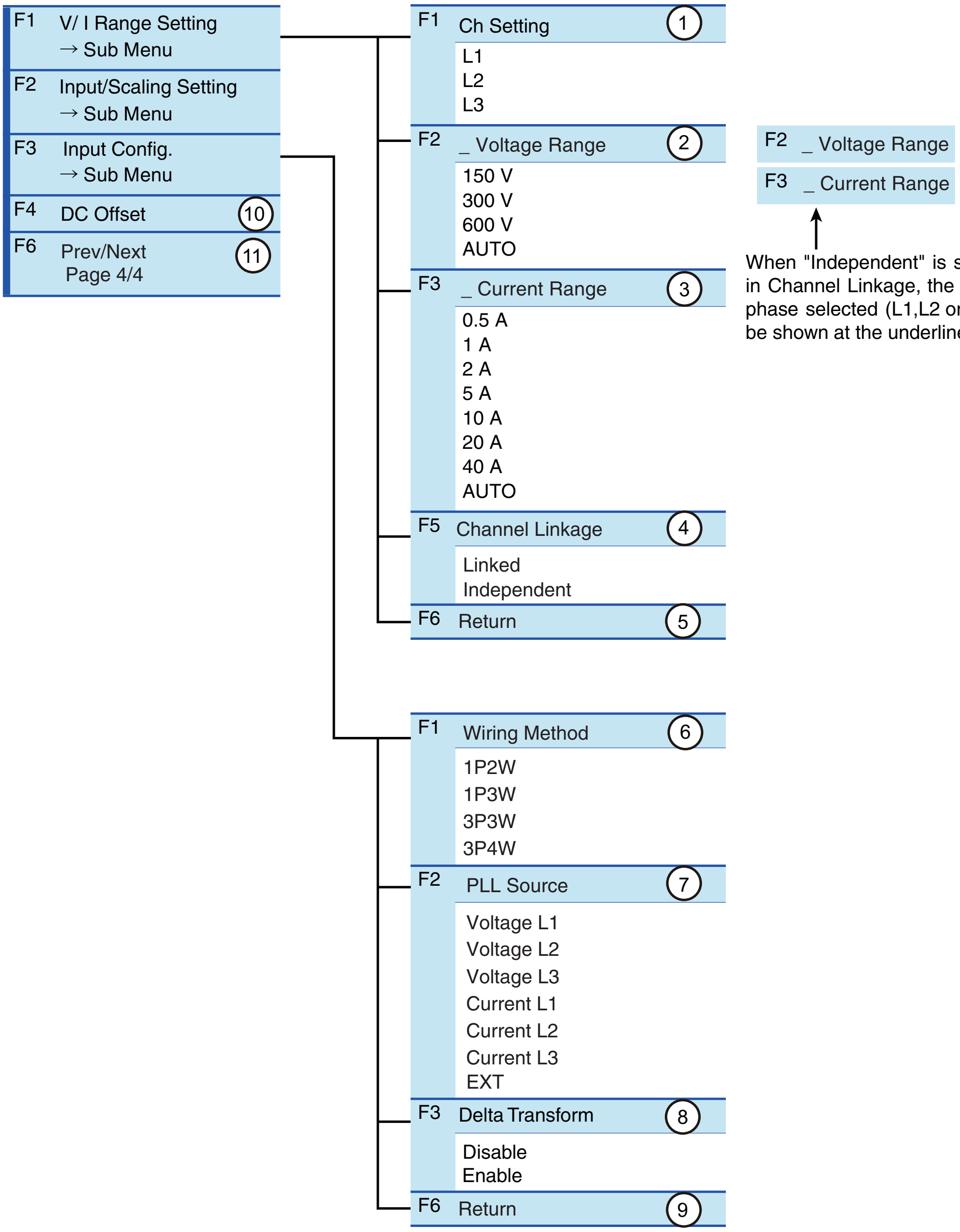


```
50V/div      0.25A/div      30.0deg/div
 -0.01V      0.0171A          49.999Hz
                        Ipk(abs) 0.7286A
                        0.05*Ipk 0.0363A
                           P1   33.38deg
                           P2   36.68deg
                           P3   95.54deg
                           P4   34.37deg
                           P5   37.23deg
                           P6   92.58deg
```

Ipk(abs):	Maximum absolute peak value within the window
0.05*Ipk:	Current threshold
P1, P4:	The phase angles of the points where the current reached the current threshold with the points where current began flowing as the references
P2, P5:	Phase angles of the positive and negative peaks
P3, P6:	The phase angles of the points where the current decreases to the threshold

Voltage and Current Range, Wiring Method and Scaling

Menu 4/4 (part 1)



When "Independent" is selected in Channel Linkage, the input phase selected (L1,L2 or L3) will be shown at the underlined position.

No.	Menu item	Description	Default
1	Ch Setting (V/I Range)	Select the input phase for the voltage and current measurement. This is used when "Independent" is selected in F5 Channel Linkage. If "Linked" is selected in F5 Channel Linkage, this part is grayed out and operation is inhibited. When "Linked" is selected, the L1 phase will be the reference.	L1
2	_ Voltage Range	Select the measurement range of the input phase selected in Setting Ch (V/I Range). Select the range in accordance with the rated power supply voltage of the EUT. In the AUTO mode, the range will be fixed once the test is started. The input phase selected (L1, L2 or L3) will be shown at the underlined position of the menu item. When "Volt. Scaling" is used, the menu will show the measurement range that corresponds to the scaling. When "Linked" is selected in F5 Channel Linkage, the input phase selected will not be shown at the underlined position of the menu item. The menu will be that for the L1 phase.	AUTO
3	_ Current Range	Select the measurement range of the input phase selected in Setting Ch (V/I Range). Select the range in accordance with the rated power supply current of the EUT. In the AUTO mode, the range will be fixed once the test is started. The input phase selected (L1, L2 or L3) will be shown at the underlined position of the menu item. When "Curr. Scaling" is used, the menu will show the measurement range that corresponds to the scaling. When "Linked" is selected in F5 Channel Linkage, the input phase selected will not be shown at the underlined position of the menu item. The menu will be that for the L1 phase.	AUTO
4	Channel Linkage	Select the "Linked" or "Independent" status between the lines L1, L2, and L3. When "Linked" is selected, independent setting of L1, L2, and L3 cannot be made. The "Linked" setting is applied to voltage and current ranges.	Linked
5	Return	Terminates the V/I Range setting.	–
6	Wiring Method	Select a wiring method for a measuring circuit.	3P4W
7	PLL Source	Select a source to synchronize with the AC power frequency. The voltage or current signal of each of the L1, L2 and L3 phases can be selected. To use the EXT SYNC INPUT input signal, select EXT.	Voltage L1
8	Delta TransformDisable See p. 107	This item becomes valid when 3P3W is selected in F1 Wiring Method. In the case of EUT that doesn't use the neutral line, the voltages between lines (line voltages) will be calculated from the measured voltages of each phase.	Disable
9	Return	Terminates the Input Config. (detailed measurement setting) function.	–
10	DC Offset	Controls the DC offset of the internal circuit.	–
11	Prev/Next Page 4/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

DC Offset adjustment function

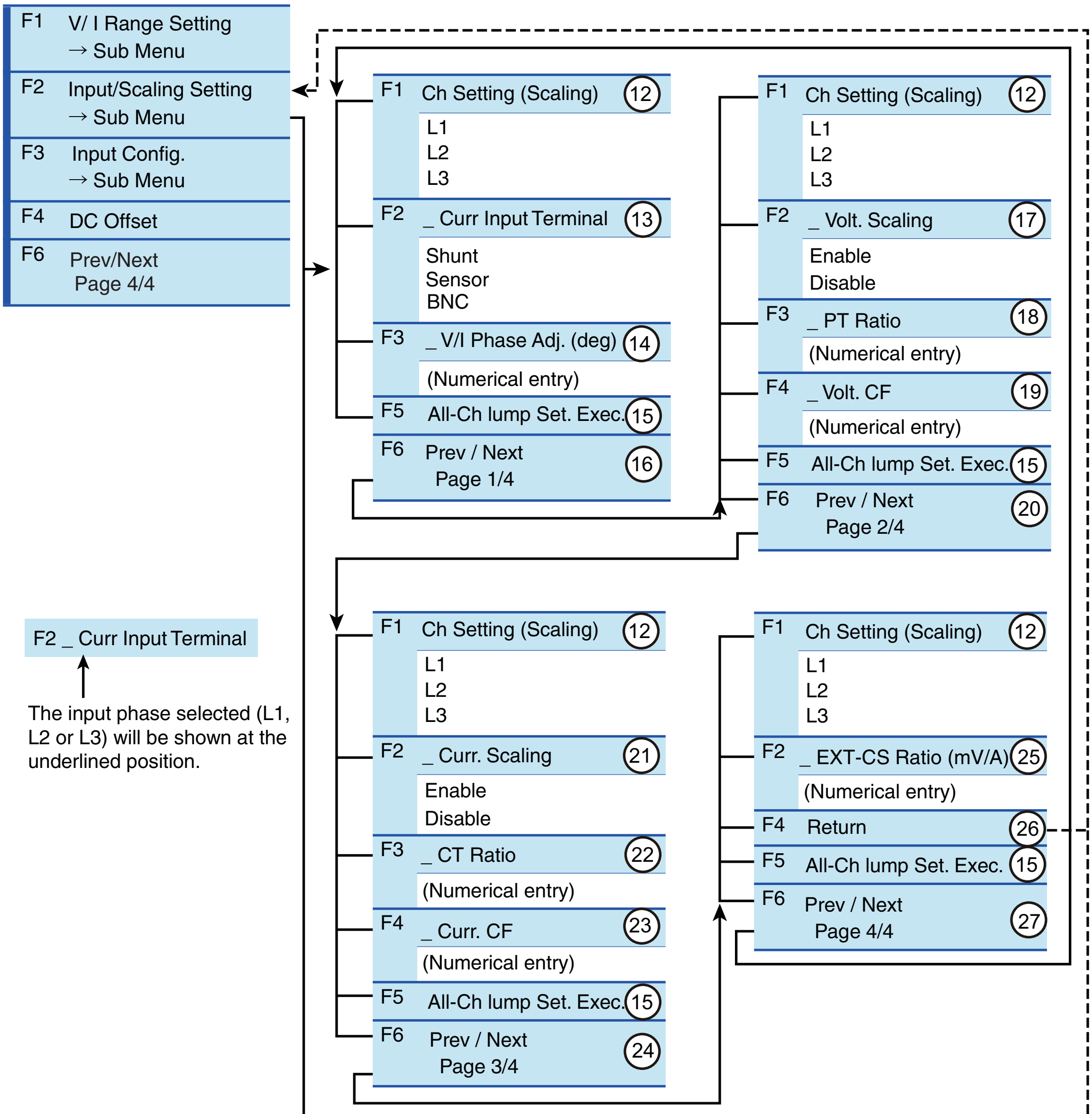
This function automatically adjusts the offset so that the average DC current is zeroed at the time of pressing the F key. Although this adjustment can be made while input voltage and current are applied, it is recommended that the adjustment is performed while no input voltage/current is applied.

- If the automatic adjustment is made while a signal with non-zero average DC current is applied, the resulting offset will be shifted by the amount of the non-zero average DC current that existed in the input signal.

- As the adjustment is cleared when the range is changed, it is recommended to use this function after selecting a fixed range, instead of using the AUTO range.

- When the POWER switch is turned off, the adjustment will be cleared.

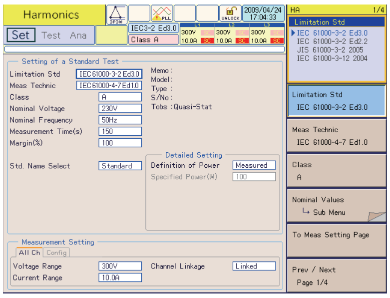
Menu 4/4 (part 2)



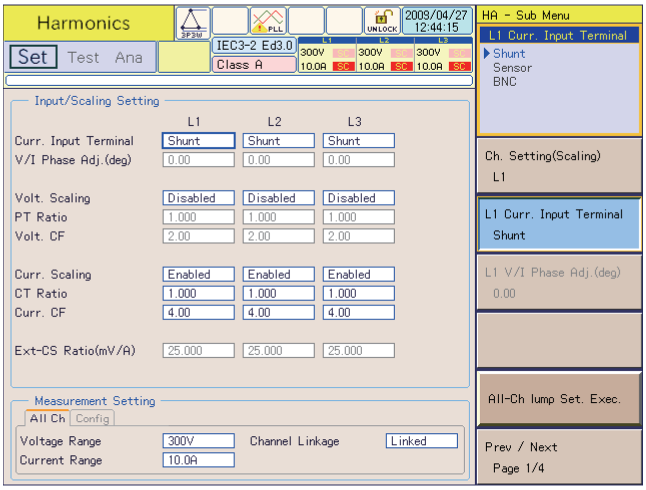
F2 _ Curr Input Terminal

The input phase selected (L1, L2 or L3) will be shown at the underlined position.

HA- Test Condition List display



Input/Scaling Setting display



Input/Scaling Setting

	L1	L2	L3
Curr. Input Terminal	Shunt	Shunt	Shunt
V/I Phase Adj.(deg)	0.00	0.00	0.00
Volt. Scaling	Disabled	Disabled	Disabled
PT Ratio	1.000	1.000	1.000
Volt. CF	2.00	2.00	2.00
Curr. Scaling	Enabled	Enabled	Enabled
CT Ratio	1.000	1.000	1.000
Curr. CF	4.00	4.00	4.00
Ext-CS Ratio(mV/A)	25.000	25.000	25.000

Measurement Setting

All Ch Config

Voltage Range 300V

Current Range 10.0A

Channel Linkage Linked

No.	Menu item	Description	Default
12	Ch Setting (Scaling)	Select the input phase subject to the scaling. They are in the submenu pages of the pages 1/4 to 4/4.	L1
13	_ Curr Input Terminal See p. 86 ,p. 105	Select the current input terminal. Select "Shunt" if the source and load terminals on the rear panel of this product are used. Select "Sensor" when EXP CLAMP is used. Select "BNC" when EXT INPUT is used. When Sensor or BNC is selected, the IRANGE part of the display will show C or B icon, respectively. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	Shunt
14	_ V/I Phase Adj. (deg) See p. 108	Adjust the current phase of the external current sensor. This item is enabled when "BNC" is selected in the Current Input Terminal menu. It is independent of the Enable/Disable setting of the Current Scaling menu. The input range is -180.00 to +180.00 degrees. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	0.00
15	All-Ch lump Set. Exec.	Copy the current channel settings set for execution to all other input channels (channels L1, L2, and L3) for setting them identically. When the F key is pressed, a confirmation dialog will be displayed. If you are sure to copy them, press the F1 key, "OK". If not, press the F2 key, "Cancel". * Whenever "Sensor" is selected for Current Input Terminal, copy the Current Input Terminal settings to all other input channels (channels L1, L2, and L3) for setting them identically. Items such as CT Ratio will not be copied.	-
16	Prev/Next Page 1/4	Move to other sub-menu pages.	-
17	_Volt. Scaling	Enable or disable the scaling of the voltage ratio for the external PT (potential transformer). If "Enable" is selected, the SC icon will be shown in the V RANGE part of the display. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	-
18	_ PT Ratio	This item is enabled when "Enable" is selected in the Volt. Scaling menu. Here, the voltage ratio (scaling) of PT (potential transformer) is set. The input range is 0.001 to 100.000. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	1.000
19	_ Volt. CF	This item is enabled when "Enable" is selected in the Volt. Scaling menu. In order to measure the peak value without the effect of any distortion, the peak to rms ratio (CF) is set for the range currently set. The CF setting affects the measurement resolution. The input range is 1.00 to 2.00. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	2.00
20	Prev/Next Page 2/4	Move to other sub-menu pages.	-
21	_ Curr. Scaling	Enable or disable the scaling of the current signal from the external current sensor. If "Enable" is selected, the SC icon will be shown in the I RANGE part of the display. When "Sensor" is selected in the Current Input Terminal menu, this item is fixed and grayed out in the "Enabled" status. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	-

22	_ CT Ratio	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "Shunt" is selected in the Current Input Terminal menu. Here, the scaling ratio of CT (current transformer) is set. The input range is 0.001 to 1000.000. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	1.000
23	_ Curr. CF	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "Shunt" or "BNC" is selected in the Current Input Terminal menu. In order to measure the peak value without the effect of any distortion, the peak to rms ratio (CF) is set for the range currently set. The CF setting affects the measurement resolution. The input range is 1.00 to 4.00. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	4.00
24	Prev/Next Page 3/4	Move to other sub-menu pages.	-
25	_ EXT-CS Ratio (mV/A)	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "BNC" is selected in the Current Input Terminal menu. Here, the voltage to current scaling ratio is set for the external current sensor. The input range is 0.250 mV/A to 2500.000 mV/A. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	25.000 mV/A
26	Return	Exit from the Input/Scaling Setting menu.	–
27	Prev/Next Page 4/4	Move to other sub-menu pages.	–

F key: Function key. You can also use the ESC key to return.

Selection of the Current Input Terminal menu

Shunt

Select "Shunt" to use the SOURCE and LOAD terminals on the rear panel of this product. The shunts are contained inside the L1, L2, and L3 input sections. When CTs (current transformers) are to be used, also select "Shunt". The secondary circuits of CTs are to be connected to the SOURCE and LOAD terminals.

⚠CAUTION

- The maximum value of input current is 40 Arms or 100 Apeak, whichever smaller. Exceeding this value may cause overheating of the current detector.
- If the current detector overheats, the OHP icon appears on the upper part of the screen. Immediately shut down the power to the EUT to cut the input current of this product. Restart the test after the OHP icon disappears.

See p. 86

Sensor(C C icon)

Select "Sensor" to use the optional current sensors connected to the EXT CLAMP terminals on the rear panel of this product. When "Sensor" is selected, the C icon will be shown in the I RANGE part of the display. The EXT CLAMP terminals are provided at the L1, L2, and L3 input sections.

BNC(B B icon)

Select "BNC" to use external current shunts or other current sensors connected to the EXT INPUT terminals on the rear panel of this product. When "BNC" is selected, the B icon will be shown in the I RANGE part of the display. The EXT INPUT terminals are provided in the L1, L2, and L3 input sections.

Using Scaling Menu items

Scaling (SC SC icon)

● Range setting to use external sensors

When external sensors are used, the measurement range is determined by the conversion ratio of the external sensor and the peak to rms ratio of the signal. Because the calculated range is based on the particular range of this product, some range may not be used depending on the maximum voltage or the maximum current of the external sensor.

Example Setting:

Current Range	Range (A) when external sensors are used	
Product-specific range (A)	Example 1: Current Sensor EXT-CS Ratio: 10 mV/A Max. current: 200A rms Saturation current: 400A peak Current CF: 2 (= 400/200)	Example 2: CT (current transformer) CT Ratio: 50 (50:1) Max. current: 500A rms Saturation current: 1000A peak Current CF: 2 (= 1000/500)
0.5	1.25	25
1	2.5	50
2	5	100
5	12.5	250
10	25	500
20	50	1000[*1]
40	100	2000[*1]

[*1] The range cannot be used because it exceeds the maximum current of the CT.

● Setting of CF (peak to rms ratio)

The peak to rms ratio (i.e., peak value divided by the rms value) of the input signal is set for CF. The CF value is used for over-range detection and automatic range control. By adequately setting the CF value according to the characteristics of the sensors or transformers to be used, magnetic saturation and other problems can be prevented.

● Phase Adjustment

See p. 108

When using external current sensors, the phase difference that may exist between the voltage signal and the sensor signal can be adjusted.

● List of Scaling Menu Items

External sensor for scaling		Menu item (○ : Operable, ×: Inoperable)					
		PT Ratio	Voltage CF	CT Ratio	Current CF	EXT-CS Ratio	V/I Phase Adj.
Voltage	PT (potential transformer)	○	○	×	×	×	×
Current	CT (current transformer)	×	×	○	○	×	×
	Optional current sensor	×	×	×	×	×	×
	External current sensor /shunt	×	×	×	○	○	○

● List of Available Scaling Ranges

Setting Item		Setting Range
Voltage measurement	PT Ratio	0.00 to 100.000
	Voltage CF	1.00 to 2.00
Current measurement	CT Ratio	0.001 to 1000.000
	Current CF	1.00 to 4.00
	EXT-CS Ratio (mV/A)	0.250 mV/A to 2500.000 mV/A

Delta Transform (Star-delta conversion)

The delta transform function associated with the voltage measurement function of this product is used to convert the measured phase voltages to voltages between lines (line voltages). Even if the actual measurement circuit is wired for a three-phase four-wire (3P4W) system, the measurement of three-phase three-wire (3P3W) EUT can be performed. The delta transform function is enabled when 3P3W is selected in the Wiring Method menu.

See p. 53

In the case of standard wiring where no voltmeter is connected to external measurement points, the voltmeter connection is switched inside this product according to the selection made in the Wiring Method menu. Accordingly, it is unnecessary to think about the selection between phase voltage and line voltage measurements.

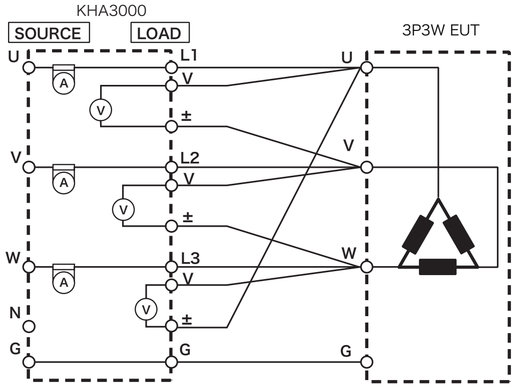
However, if any voltmeter is connected to an external measurement point, such a selection cannot be made automatically. Because typical AC power supplies that are used for tests are in 3P4W configuration, it is generally necessary to change the wiring of the voltage measurement points for 3P4W circuits to that of 3P3W circuits.

As the phase voltages measured in a 3P4W circuit can be converted to line voltages by using the delta transform function, any 3P3W EUT can be tested even if the actual measurement circuit is wired for a 3P4W system. The following figures show the 3P3W and 3P4W circuits to test a 3P3W EUT. In the case of the 3P4W circuit, the delta transform function is used.

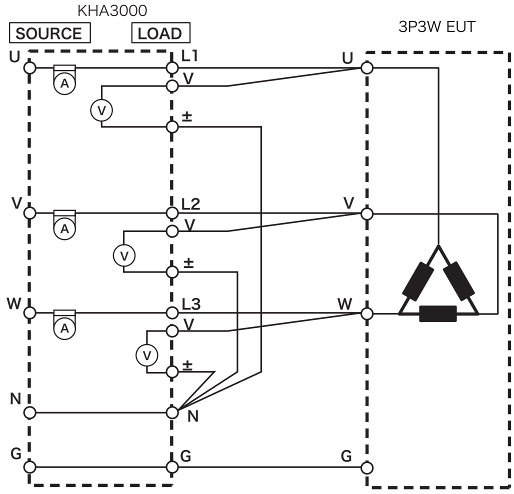
⚠CAUTION

- Don't use the delta transform function when the actual measurement circuit is wired for 3P3W.In such a case, delta transform is unnecessary. If the delta transform function is used, the voltage measurements will be in error.

3P3W circuit



3P4W circuit



Adjusting the phase difference between voltage and current

When using external current sensors that are connected to the EXT INPUT (BNC) terminals on the rear panel, the phase difference between the current detected by the current sensor and the voltage measured by this product at a voltage measurement point can be adjusted. For the phase adjustment, pure resistors are connected in place of the EUT.

The adjustment is made by observing the power factor shown on the screen of this product. The adjustment is made separately for each phase. Incorrect adjustment can adversely affect the measurement of real power.

The components to be prepared by the customer

● **Resistance Load**

Non-inductive resistors are required. Be sure to use resistors of which power rating is as close as to the power consumption of the EUT.

Connecting Resistance Loads

Connect pure resistors in place of the EUT.

1 **Turn off the output of the AC power supply.**

2 **Connect the resistance load(s) in place of the EUT.**

⚠WARNING

- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

---

3 **Turn on the output of the AC power supply.**

Set the output voltage to the rated voltage of the EUT.

Setting of Observation Display (HA- Observation/Analysis Display)

Observe the power factor value on the list display.

1 **Press the VIEW key.**

The HA-Observation/Analysis display will open.

2 **Press the F6 key to select Page 1/2 of the menu.**

See p. 168

3 **Press the F1 key for the list display type.**

A list of measured values will be presented.

4 **Press the F1 key to select View Items.**

A sub-menu is displayed.

5 **Turn the small knob to select Power Factor.**

6 **Press the ENTER key to save the selection.**

The Power Factor check box will be checked. You can freely select other view items at the same time.

7 **Press the F5 key to select Check View Phase.**

8 **Turn the small knob to select L1.**

9 **Press the ENTER key to save the selection.**

The Power Factor check box will be checked. In the case of three-phase systems, similarly select L2 and L3 and save the selection.

10 **Press the F6 key to return.**

■ Viewing the HA- Observation/Analysis display

11 **Press the VIEW key.**

The HA- Observation/Analysis display will open and the setting menu will be shown together with the measured values presented in a list form.

Phase Difference Adjustment (HA- Observation/Analysis display)

1 **Press the F6 key to select Page 4/4 of the menu.**

2 **Press the F2 key to select Input/Scaling Setting.**

A sub-menu (page 1/4) will be displayed.

3 **Press the F1 key to select L1 of Ch. Setting (Scaling).**

4 **Press the F2 key to select BNC of Current Input Terminal.**

The adjustment is for the current sensor connected to the EXT INPUT terminal (BNC connector).

5 **Press the F3 key to enter the value for V/I Phase Adjustment.**

The input range is -180.00 to +180.00 degrees. Make adjustment until the Power Factor of line L1 indicated on the screen becomes 1.00.

6 **Press the F1 key to select L2 of Ch. Setting (Scaling).**

Similarly to the above step 5, make adjustments for L2 and L3 for the Power Factor of 1.00.

Connecting EUT

1 **Turn off the output of the AC power supply.**

2 **Connect EUT.**

⚠ **WARNING**

- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

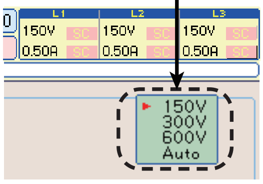
---

3 **Turn on the output of the AC power supply.**

Directly Setting Voltage and Current Ranges

The voltage and current ranges can be directly set. The triangular mark beside each numeric key on the operation panel increases (upward triangle) or decreases (downward triangle) the sensitivity. This setting is disabled during test execution and analysis.

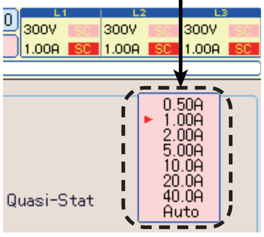
Voltage range


Voltage range display
(Input phase L1)

Press “SHIFT + 7” (increase sensitivity) or “SHIFT + 4” (decrease sensitivity) for the range to be set.

All ranges are displayed on the upper right of the screen. The set range is indicated with a triangular mark. Every time the keys are pressed, the range switches and the triangular mark shifts. If the key operation is stopped, the range display disappears automatically.

Current range


Current range display
(input phase L1)

The operation is the same as for the voltage range. Use “SHIFT + 8” (increase sensitivity) or “SHIFT + 5” (decrease sensitivity).

When scaling is not used:

For the voltage and current ranges, set the original ranges of this product. The range shown on the display is the range for L1.

As no scaling is applied, the voltage and current ranges of L2 and L3 are the same as that for L1.

When scaling is used:

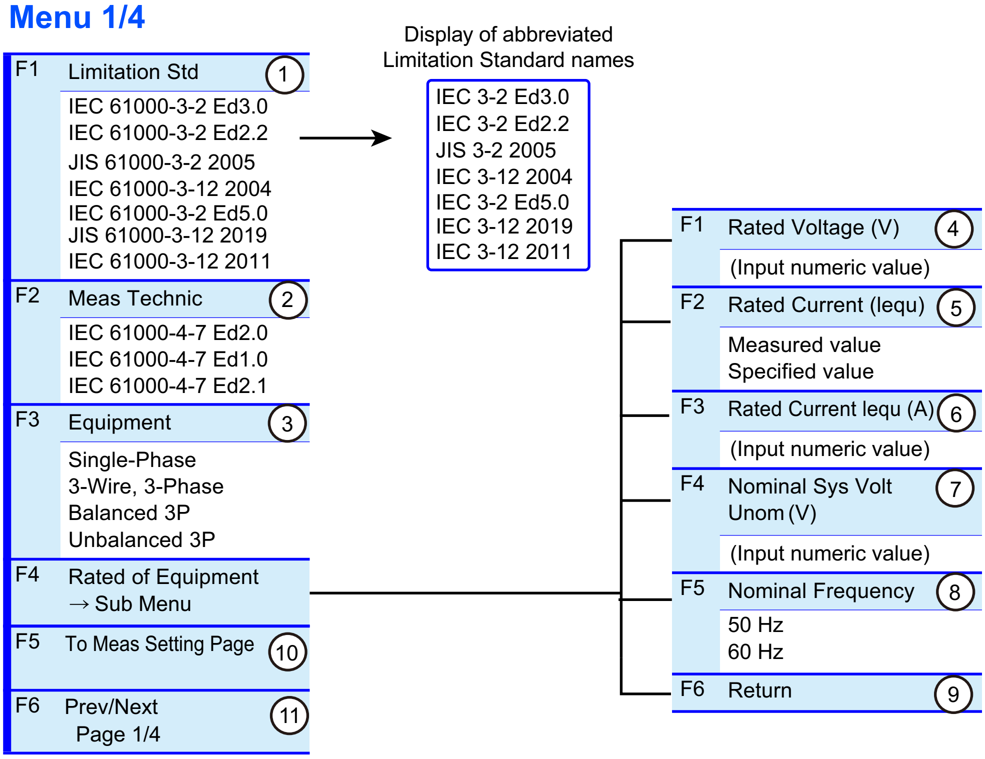
For the voltage and current ranges, set the ranges after the scaling. The range shown on the display is the range for L1. Because scaling is applied, the voltage and current ranges of L1, L2, and L3 will be the ranges individually set.

When the ranges with and without scaling are mixed:

Regarding the voltage and current ranges, set the original range for the line without scaling and set the range after the scaling for the line with scaling. The range shown on the display is the range for L1.

Limitation Standards, Equipment and Rated of Equipment

Menu 1/4



No.	Menu item	Description	Default
1	Limitation Std	Select limit value standard IEC 61000-3-12 2004 or IEC 61000-3-12 2011. If a standard other than IEC 61000-3-12 2004 and IEC 61000-3-12 2011 is selected, the menu for equipment with input current 16, 20 A or less is selected. Abbreviated Standard names are shown on the display.	IEC 61000-3-2 Ed5.0
2	Meas Technic	Select a measuring technique standard. IEC 61000-4-7 Ed2.1 and IEC 61000-4-7 Ed2.0 measure interharmonic waves and specifies the result as a harmonic group value. IEC 61000-4-7 Ed2.1 or IEC 61000-4-7 Ed2.0 are recommended for measuring fluctuating harmonics. Abbreviated Standard names are shown on the display.	IEC 61000-4-7 Ed2.1
3	Equipment	Select the type of EUT. Single-phase equipment includes the single-phase part of hybrid equipment. Balanced three-phase equipment includes the three-phase part of hybrid equipment. This item is used for calculating the Sequ value.	Single-phase equipment
4	Rated Voltage (V)	Enter the rated voltage of the EUT. For the rated voltages of single-phase and unbalanced three-phase equipment, enter phase voltages. For the rated voltages of three-wire/three-phase equipment and balanced three-phase equipment, enter line voltages. This item is used for calculating the Sequ value. The input range is 100 V to 600 V. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	230 V
5	Rated Current (Iequ)	Specify the rated current (Iequ). Select “Measured” or “Specified.”	Measured value

6	Rated Current Iequ (A)	Enter the rated current value of the EUT. For an unbalanced three-phase device, enter the value of the maximum current that flows in one of the three phases. This item is used for calculating the Sequ value. The input range is 0.0 A to 75.0 A. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	20.0 A
7	Nominal Sys Volt Unom（V）	Enter a nominal system voltage. This item is used for calculating the Ssc value. The input range is 100 V to 600 V. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	230 V
8	Nominal Frequency	Select the rated power frequency of the EUT.	50 Hz
9	Return	Terminates the specification of the rated voltage and frequency.	–
10	To Meas Setting Page	Switches to page 4/4.	–
11	Prev/Next Page 1/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

NOTE

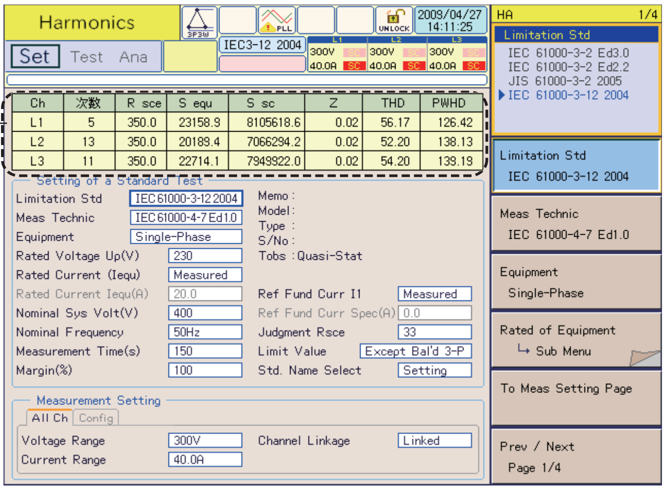
If you want to use the values (specific values) specified by the manufacturer in place of the actually measured values for the rated current Iequ, fundamental current (Iref), and standard fundamental current (I1) of the EUT, select "Measured" to execute the test. Then, check that the specified value is within ±10 % of the measured value, and execute the test using specific values.

Write the test results using measured values in the Memo column of the report for tests using specific values, or prepare each report separately and use them together.

Testing is possible even when the difference between measured values and specific values exceeds ±10 %, but it is important to note that the limit value of the obtained test results does not meet the standard.

Setting with measured monitor values displayed (61000-3-12 2004 only)

The monitor values of real-time measurement are displayed in the upper part of the setting item display. The measured monitor values indicate the current status of the EUT. This function does not observe all operation cycles of the EUT.



Measured monitor value

Ch	次数	R sce	S equ	S sc	Z	THD	PWHD
L1	5	350.0	23158.9	8105618.6	0.02	56.17	126.42
L2	13	350.0	20189.4	7066294.2	0.02	52.20	138.13
L3	11	350.0	22714.1	7949922.0	0.02	54.20	139.19

Setting of a Standard Test

Limitation Std	IEC 61000-3-12 2004	Memo :	
Meas Technic	IEC 61000-4-7 Ed1.0	Model :	
Equipment	Single-Phase	Type :	
Rated Voltage Up(V)	230	S/No :	
Rated Current (Iequ)	Measured	Tobs : Quasi-Stat	
Rated Current Iequ(A)	20.0	Ref Fund Curr I1	Measured
Nominal Sys Volt(V)	400	Ref Fund Curr Spec(A)	0.0
Nominal Frequency	50Hz	Judgment Rsce	33
Measurement Time(s)	150	Limit Value	Except Bal'd 3-P
Margin(%)	100	Std. Name Select	Setting

Measurement Setting

All Ch　Config

Voltage Range	300V	Channel Linkage	Linked
Current Range	40.0A		

Limitation Std
IEC 61000-3-2 Ed3.0
IEC 61000-3-2 Ed2.2
JIS 61000-3-2 2005
▶ IEC 61000-3-12 2004

Measured monitor value

CH	Factor	Rsce	Sequ (VA)	Ssc (W)	Z (Ohm)	THD (%)	PWHD (%)
Phase of measuring circuit L1 L2 L3	Harmonic orders 2nd to 40th, THD, PWHD	Short-circuit ratio	Rated apparent power of equipment	Short-circuit power	System impedance	Total harmonic distortion	Partial weighted harmonic distortion
	–	Calculated value	Calculated value	Calculated value	Calculated value	Measured value	Measured value
Calculating Formula	Rated apparent power (Sequ) of single-phase equipment = Rated voltage (phase voltage) (Up) × Rated current (Iequ)						
	Rated apparent power (Sequ) of three-phase/three-wire equipment = Rated voltage (line voltage) (Ui) × Rated current (Iequ)						
	Rated apparent power (Sequ) of balanced three-phase equipment = $\sqrt{3}$ × Rated voltage (line voltage) (Ui) × Rated current (Iequ)						
	Rated apparent power (Sequ) of unbalanced three-phase equipment = 3 × Rated voltage (phase voltage) (Up) × Rated current (Iequ)						
	Short-circuit power (Ssc) = Short-circuit ratio (Rsce) × (3 × Rated apparent power (Sequ) of single-phase equipment)						
	Short-circuit power (Ssc) = Short-circuit ratio (Rsce) × (2 × Rated apparent power (Sequ) of three-phase/three-wire equipment)						
	Short-circuit power (Ssc) = Short-circuit ratio (Rsce) × Rated apparent power (Sequ) of all three-phase equipment						
	System impedance (Z) = (Nominal system voltage (Unom))^2/Short-circuit power (Ssc)						

● Table format of measured monitor

The measured monitor table is formatted to always display L1, L2 and L3, irrespective of equipment type settings. L1, L2 and L3 correspond to LOAD terminals L1, L2 and L3 on the rear of this product.

● Sequ, Ssc, Z

The Sequ, Ssc and Z values are calculated for each phase of L1, L2 and L3 and displayed. The formulas for computation are shown in the table above.

● Calculating and displaying the minimum Rsce value that satisfies a limit value

The minimum Rsce value that satisfies the limit 1 of each phase is calculated from harmonic orders (I_2 to I_{13}) or measured value of the THD or PWHD according to the setting of the applied limit value. The “Factor” column indicates the harmonic order, the THD or the PWHD that is the lowest factor for the margin.

The Rsce value is calculated for each phase of L1, L2 and L3. Set the maximum value out of the L1, L2 and L3 phases as the judgment Rsce value that is necessary for satisfying the limit value. The set judgment Rsce value becomes the minimum Rsce value in the standard limit value table.

● Calculating short-circuit power Ssc and system impedance Z

The short-circuit power Ssc and system impedance Z are calculated from the calculated Rsce value and the rated apparent power of a device. The short-circuit power Ssc indicates the minimum value of a connectable system, and the system impedance Z indicates the maximum value of a connectable system.

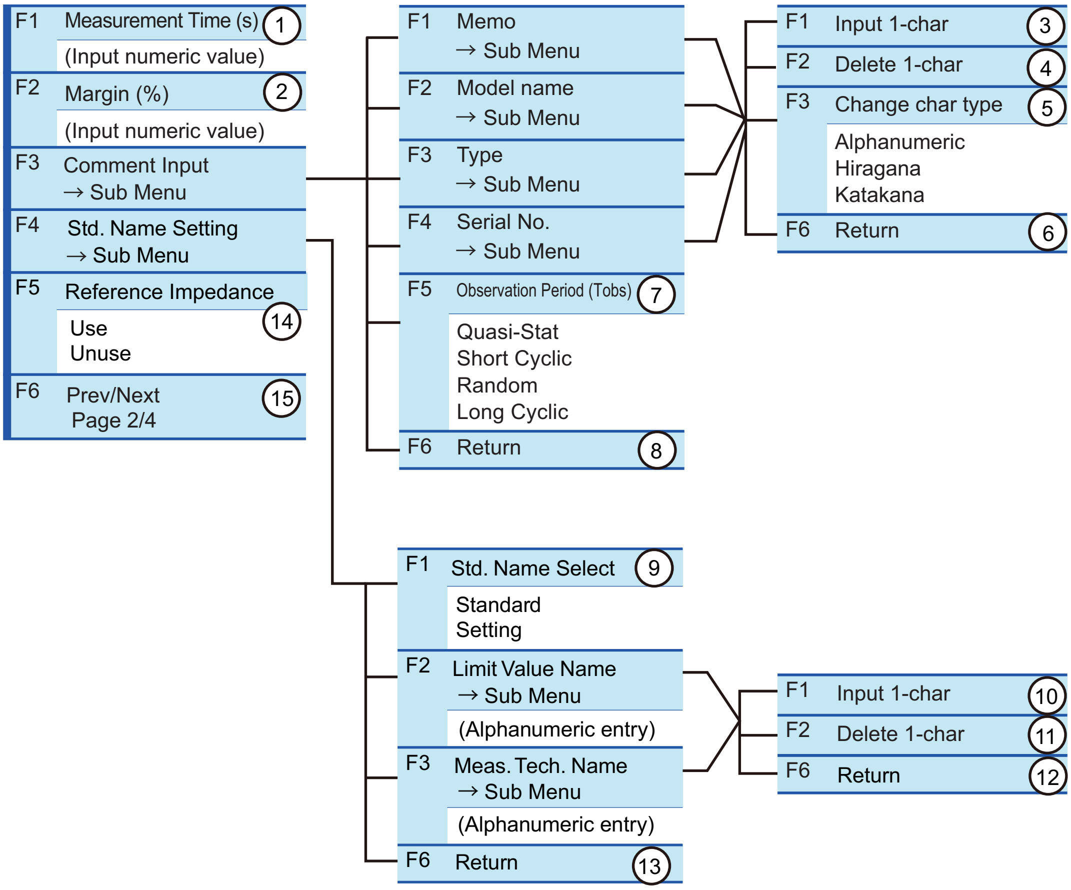
● Rsce of hybrid equipment

The Rsce of a hybrid equipment executes tests for each component. Measured monitor values, therefore, are observed for each component. From among the calculated Rsce values of the components, the maximum value is employed.

Measurement Time, Margin, Comment Input and Standard Name

This is the same menu as for the IEC 61000-3-2 Standard.

Menu 2/4



Reference Current/Reference Fundamental Current, Judgment Rsce and Limit Values

Menu 3/4
(61000-3-12 2011)

F1	Ref Curr Iref	①
	Measured value Specified value	
F2	Ref Spec (A)	②
	(Input numeric value)	
F3	Judgment Rsce	③
	(Input numeric value)	
F4	Limit Value	④
	Except Bal'd 3-P Balanced 3-P Spec Bal'd 3-P Table5 3-P	
F6	Prev/Next Page 3/4	⑤

Menu 3/4
(61000-3-12 2004)

F1	Ref Fund Curr I1	①
	Measured value Specified value	
F2	Ref Fund Curr Spec (A)	②
	(Input numeric value)	
F3	Judgment Rsce	③
	(Input numeric value)	
F4	Limit Value	④
	Except Bal'd 3-P Balanced 3-P Spec Bal'd 3-P	
F6	Prev/Next Page 3/4	⑤

No.	Menu item	Description	Default
1	Ref Curr Iref Ref Fund Curr I1	Specify the reference current/reference fundamental current of the EUT. Select “Measured” or “Specified.”	Measured
2	Ref Curr Spec (A) Ref Fund Curr Spec (A)	When “Specified” was selected in the F1 menu, enter the reference current value/reference fundamental current value of the EUT. The input range is 0.0 A to 75.0 A. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	20.0 A
3	Judgment Rsce	Enter the Rsce value. The input range is 33 to 350. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	33
4	Limit Value	Select a limit value (equipment type).	Except Bal'd 3-P
5	Prev/Next Page 3/4	Switches to another menu page.	–

F key: Function key

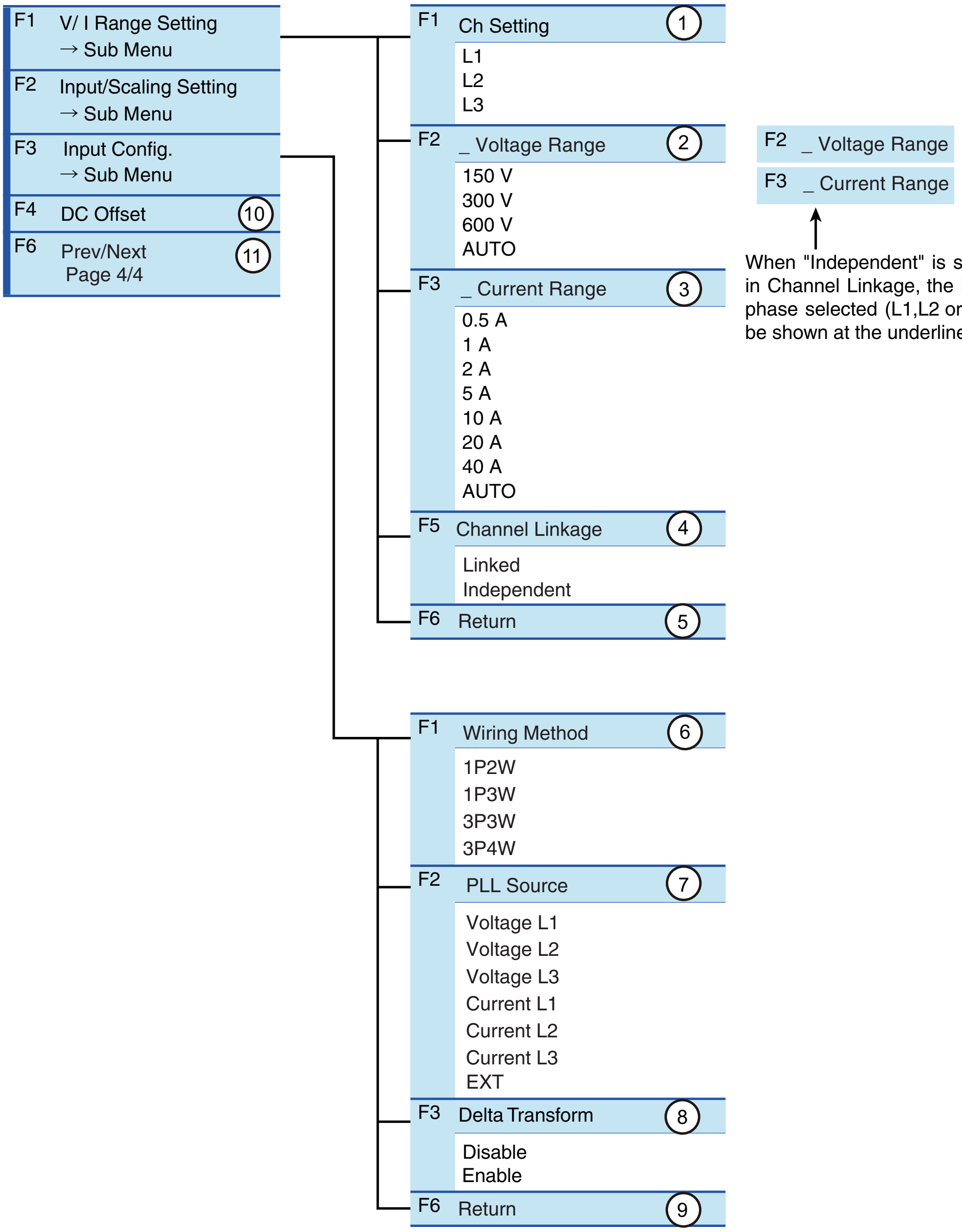
NOTE

If you want to use the values (specific values) specified by the manufacturer in place of the actually measured values for the rated current Iequ, fundamental current (Iref), and standard fundamental current (I1) of the EUT, select "Measured" to execute the test. Then, check that the specified value is within ±10 % of the measured value, and execute the test using specific values.
Write the test results using measured values in the Memo column of the report for tests using specific values, or prepare each report separately and use them together.
Testing is possible even when the difference between measured values and specific values exceeds ±10 %, but it is important to note that the limit value of the obtained test results does not meet the standard.

Voltage and Current Ranges, Wiring Method and Scaling

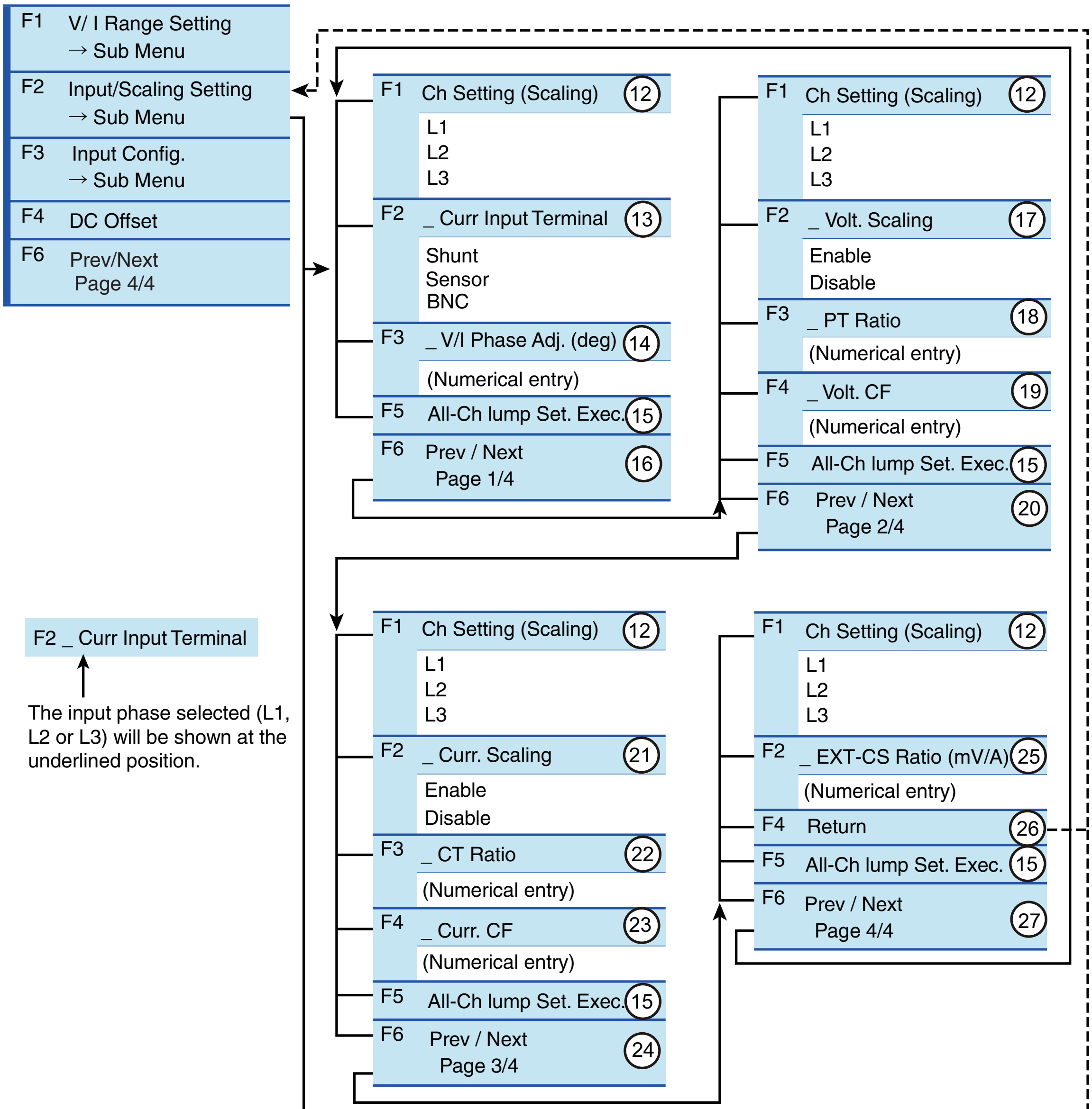
This is the same menu as for the 61000-3-2 standard.

Menu 4/4 (part 1)



When "Independent" is selected in Channel Linkage, the input phase selected (L1,L2 or L3) will be shown at the underlined position.

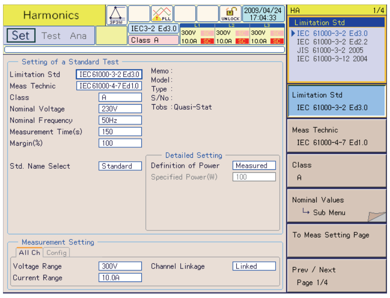
Menu 4/4 (part 2)



F2 _ Curr Input Terminal

The input phase selected (L1, L2 or L3) will be shown at the underlined position.

HA- Test Condition List display



Setting of a Standard Test

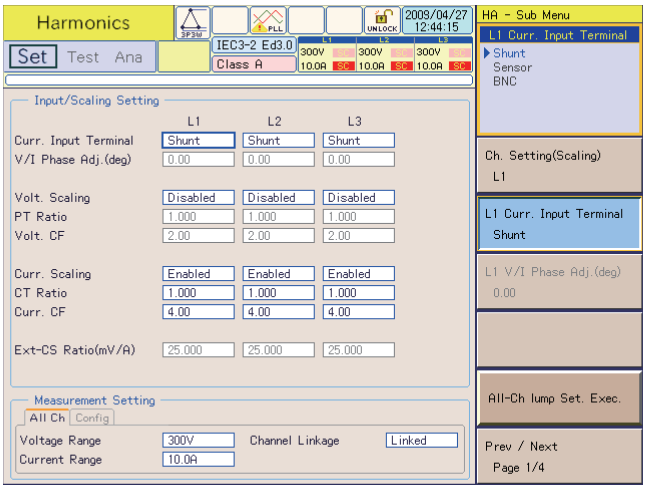
Limitation Std IEC61000-3-2 Ed3.0
Meas Technic IEC61000-4-7 Ed1.0
Class A
Nominal Voltage 230V
Nominal Frequency 50Hz
Measurement Time(s) 150
Margin(%) 100
Std. Name Select Standard

Memo :
Model :
Type :
S/No :
Tobs : Quasi-Stat

Detailed Setting
Definition of Power Measured
Specified Power(W) 100

Measurement Setting
All Ch Config
Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Input/Scaling Setting display



Input/Scaling Setting

	L1	L2	L3
Curr. Input Terminal	Shunt	Shunt	Shunt
V/I Phase Adj.(deg)	0.00	0.00	0.00
Volt. Scaling	Disabled	Disabled	Disabled
PT Ratio	1.000	1.000	1.000
Volt. CF	2.00	2.00	2.00
Curr. Scaling	Enabled	Enabled	Enabled
CT Ratio	1.000	1.000	1.000
Curr. CF	4.00	4.00	4.00
Ext-CS Ratio(mV/A)	25.000	25.000	25.000

Measurement Setting
All Ch Config
Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Controlling the AC Power Supply

The AC power sources that this product can directly control are PCR-LE and PCR-LA[1]. PCR-WE is controlled by the separately sold application software SD006-KHA Harmonics Analyzing Suite.

Setting the AC Power Supply

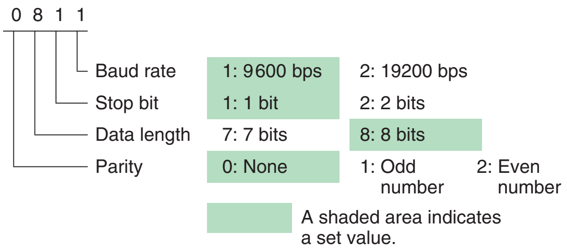
To establish communication with the AC Power Supply, set the communication parameters from the AC power supply panel as shown below.

PCR-LE

Baudrate:	9600 bps/ 19200 bps/ 38400 bps
Data:	8 bits / 7 bits
Stop:	1 bit / 2 bits
Parity:	None (fix)
Flow Ctrl:	OFF / RTS･CTS

🟩 A shaded area indicates a set value.

PCR-LA



0 8 1 1

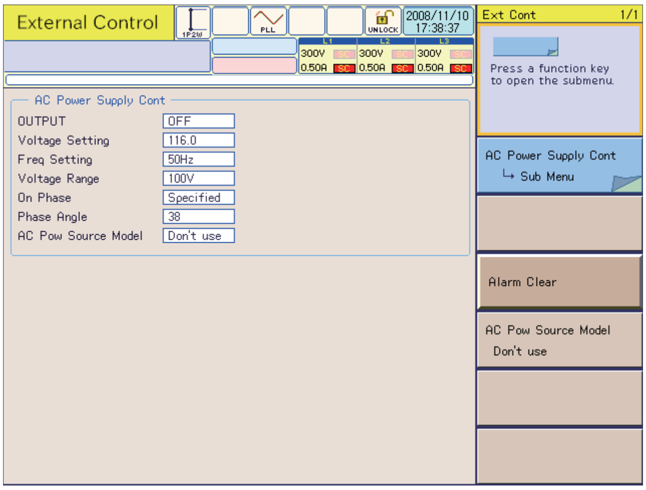
Baud rate	1: 9600 bps	2: 19200 bps	
Stop bit	1: 1 bit	2: 2 bits	
Data length	7: 7 bits	8: 8 bits	
Parity	0: None	1: Odd number	2: Even number

🟩 A shaded area indicates a set value.

Showing the External Control Display

Press the EXT CONT key.

The External Control display appears.



External Control

2008/11/10 17:38:37

AC Power Supply Cont

OUTPUT	OFF
Voltage Setting	116.0
Freq Setting	50Hz
Voltage Range	100V
On Phase	Specified
Phase Angle	38
AC Pow Source Model	Don't use

Ext Cont 1/1

Press a function key to open the submenu.

⚠WARNING

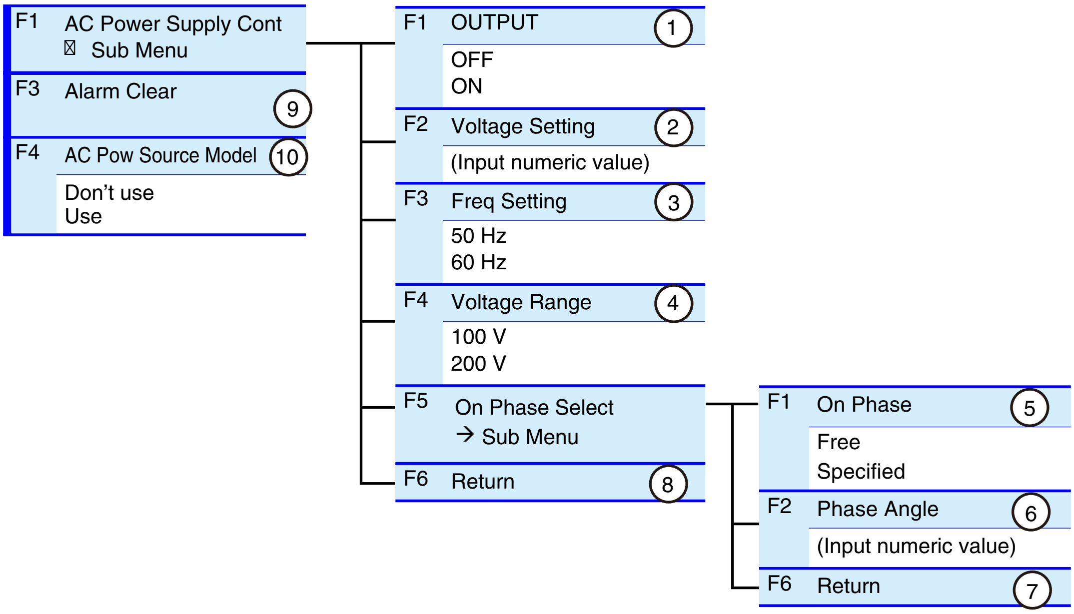
- **To prevent an electric shock, do not touch the SOURCE and LOAD terminals of this product.**
- **Do not touch the OUTPUT terminal of the AC Power Supply.**
- **Do not touch the INPUT and OUTPUT terminals of the Line Impedance Network.**

---

[1] PCR-LA with firmware version 3.32 or 3.33 cannot be used.

Voltage and Frequency Settings and ON Phase

Menu 1/1



No.	Menu item	Description	Default
1	OUTPUT	Turn on or off the output of the AC power. In the ON state, the icon in the upper part of the screen lights up.	OFF
2	Voltage Setting	Enter the output voltage of the AC power. The input range is 0.0 V to 304.8 V. Specify the voltage according to the rated voltage of the EUT. This value determines the voltage range that will be decided in the F4 menu item. The type of the set value of the output voltage depends on the wiring method. If the wiring method is single-phase two-wire, single-phase three-wire, or three-phase four-wire, the phase voltage is used. In the case of three-phase three-wire, the line voltage is used. (The menus for setting the wiring method are described in the chapters of harmonic test, voltage fluctuation test and other tests.) Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	–
3	Freq Setting	Select the output frequency of the AC power according to the rated frequency of the EUT.	50 Hz
4	Voltage Range	Select the output voltage range of the AC power. Select the 100 V range for an output voltage setting range of 0 V to 152.5 V. Select the 200 V range for an output voltage setting range of 0 V to 304.8 V.	100 V
5	ON Phase	The voltage phase angle when the output of the AC power is turned on can be specified. In this menu item, select a specification method. When "Free" is selected, the voltage phase is not specified. When "Specified" is selected, enter a value in the F2 menu item, Phase Angle.	Free
6	Phase Angle	Enter a value of the phase angle when "Specified" is selected in the F1 menu item. The input range is 0° to 360°. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	0
7	Return	Terminates the ON phase selection.	–
8	Return	Terminates the control of the ON phase.	–
9	Alarm Clear	Clears the alarm of the AC power.	–
10	AC Pow Source Model	Select Don't use or Use.	Don't use

F key: Function key. You can also use the ESC key to return.

6

Executing Harmonic Tests

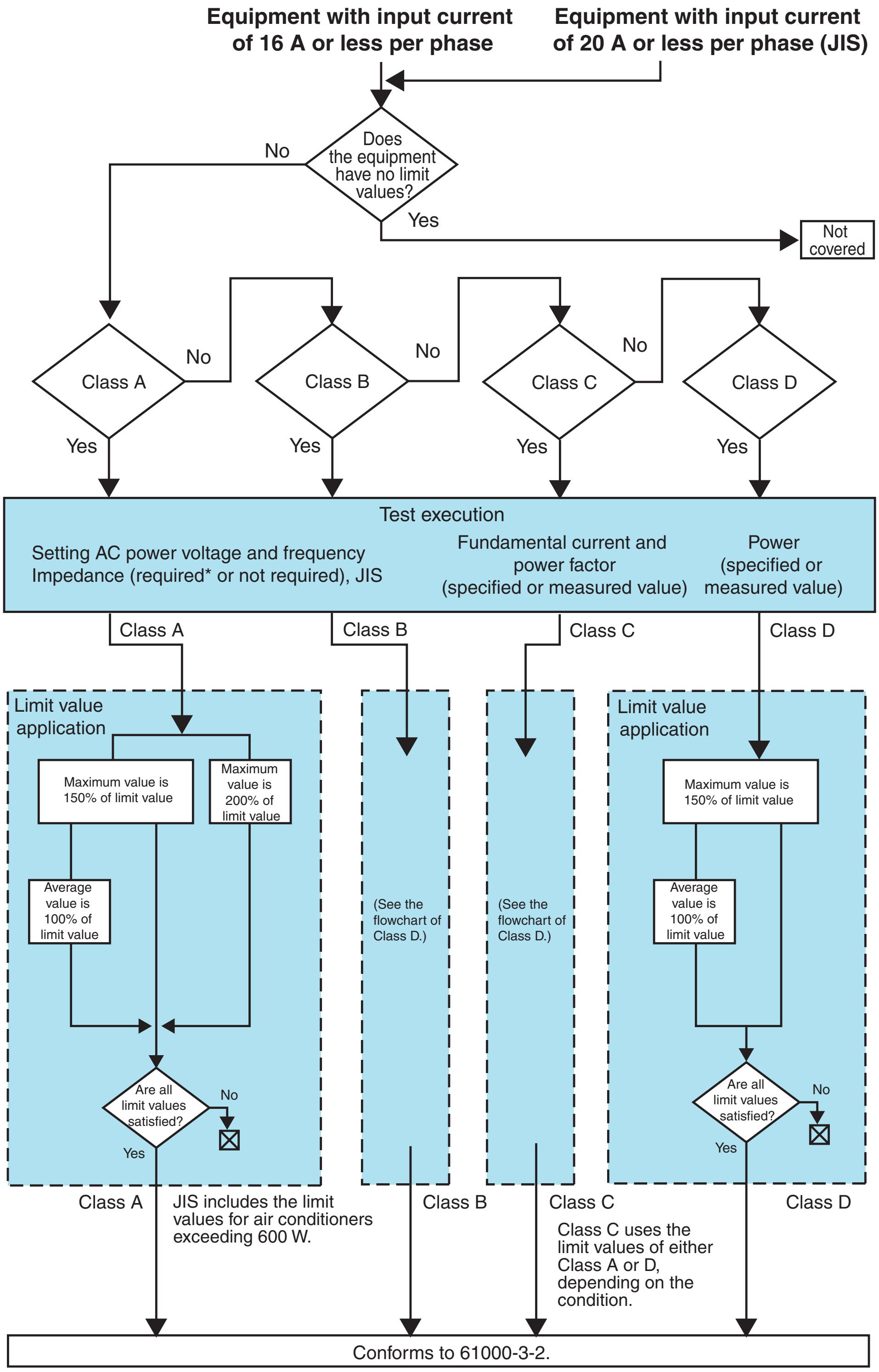
This chapter describes the procedures from executing the harmonic test to printing reports. The procedures are explained for each limit value standard (61000-3-2 and 61000-3-12).

61000-3-2: Test Flow

See p. 155

The test flow is shown below. The test execution is from when the START key is pressed, and until when the test time expires. After the end of the test time, you can save the test results, print reports, terminate the test and analyze the test results.

For details on analyzing the test results and judging conformance to the standard and AC power supply and repeatability checking, see Chapter 7 “Observation, Analysis and Judgement of Harmonics.”



☒ Nonconforming

*If impedance is required, it is necessary to check the AC power source with no load before the test.

The expression of each item is simplified. For details, refer to the standards.

Setting the LIN and AC Power Supply (61000-3-2)

Set the LIN (Line Impedance Network) and AC power supply before turning on the power to the EUT.

1 **Set the impedance of the LIN.**

See p. 56

Operate the LIN panel to set the impedance to OUT (THRU).

2 **Press the EXT CONT key.**

The External Control display appears.

3 **Press the F1 key to select AC Power Supply Control.**

A sub-menu is displayed.

4 **Press the F2 and F3 keys to set the output voltage and frequency respectively.**

See p. 119

Set the AC power supply voltage and frequency according to the rated power of the EUT.

5 **Press the F1 key to set OUTPUT to ON.**

OUTPUT of the AC power supply is set to ON. The lamp icon in the upper part of the screen lights up.

When it is synchronized with the frequency of the AC power supply, the triangular wave in the PLL icon in the upper part of the screen becomes still.

If the triangular wave in the PLL icon does not become still	
AC power supply	Check whether it is output correctly.
Wiring	Check whether the plug for the voltage-sensing terminal is set and connected to the VOLTAGE SENSING terminal on the rear.
Frequency	The PLL lock frequency range is 45 Hz to 65 Hz.

6 **Press the F6 key to return.**

7 **If you have set the limitation standard to JIS 61000-3-2 2005 or JIS 61000-3-2 2019, use the AC power source confirmation screen to record the measured values.**

See p. 180

Disconnect the EUT's AC power supply before you record the values.

The recorded values are held until the KHA3000 is turned off. You can use the SD006-KHA application software to print these recorded values.

8 **Turn on the power to the EUT.**

Setting Test Conditions (61000-3-2)

Set the test conditions with the HA-Test Conditions List display. When the test condition setting is complete, switch to the HA-Observation and Analysis display for observation during the test.

Setting Limit Value and Measuring Technique Standards

1. **Press the HA key.**

   The HA-Test Conditions List display appears.

2. **Select test conditions.**

   See p. 267

   To use the same conditions as for a test that was executed in the past, call up a test condition file and use it.

3. **Press the F6 key to select menu page 1/4.**

4. **Press the F1 key to select Limitation Standard.**

   Select IEC 61000-3-2 Ed5.0, IEC 61000-3-2 Ed3.0, IEC 61000-3-2 Ed2.2, JIS C 61000-3-2 2005 or JIS C 61000-3-2 2019.

5. **Press the F2 key to select Measuring Technique Standard.**

   To employ a measuring method for harmonic groups, select IEC 61000-4-7 Ed2.0 or IEC 61000-4-7 Ed2.1.

6. **Press the F6 key to switch to another menu page and set other test conditions.**

Optimizing the Current Range

1 **Press the VIEW key.**

See p. 79

The HA-Observation and Analysis display appears.

2 **Press the F1 key to select List in View Type.**

Measured values are displayed in the form of a list.

3 **Press the VIEW key.**

The HA-Observation and Test Conditions display appears and the menu for setting the measured values, which are still listed, is displayed.

4 **Change the operating conditions of the EUT to maximize the input current.**

5 **Press the F6 key to select menu page 4/4.**

6 **Press the F1 key to select V/I Range Setting.**

A sub-menu is displayed.

7 **Press the F1 key to select Ch. Setting (V/I Range).**

See p. 101

When "Linked" is selected in the Channel Linkage menu, independent setting of L1, L2, and L3 cannot be made.

8 **Press the F3 key to select Current Range.**

Select the range on the basis of the maximum current obtained in step 4. We recommend performing the test using a fixed range.

If you do not know the current, select AUTO (auto range). In auto range, however, it takes approximately 6 seconds for the measured values to stabilize after the range switches. If a current variation causes the range to switch, wait at least 6 seconds before starting the test. During the test, the range is fixed to the present range.

9 **Press the F6 key to return.**

Input Procedure when Specified is Selected in the Setting Menu

See p. 98

NOTE If you want to use the values (specific values) specified by the manufacturer in place of the actually measured values for the power, fundamental current, and power factor of the EUT, select "Measured" to execute the test. Then, check that the specified value is within ±10 % of the measured value, and execute the test using specific values.
Write the test results using measured values (power (Class D), fundamental current, and power factor (Class C)) in the Memo column of the report for tests using specific values, or prepare each report separately and use them together.
Testing is possible even when the difference between measured values and specific values exceeds ±10 %, but it is important to note that the limit value of the obtained test results does not meet the standard.

Use the following procedure for specifying the nominal voltage, power, power factor and fundamental current.

1 **Press the HA key.**

The HA-Test Conditions List display appears.

2 **Press the F6 key to select menu page 1/4.**

3 **Press the F4 key to select Nominal Values.**

A sub-menu is displayed.

4 **Press the F1 key to select Specified in Nominal Voltage.**

5 **Press the F2 key to input a nominal voltage value (Specified Nominal Voltage).**

The input range is 100 V to 600 V.

6 **Press the F6 key to return.**

7 **Press the F6 key to select menu page 3/4.**

8 **Press the F1 key to select Definition of Power.**

A sub-menu is displayed.

9 **Press the F1 key to select Specified in Definition of Power.**

10 **Press the F2 key to input a power value (Specified Power).**

The input range is 0 W to135,000 W.

11 **Press the F6 key to return.**

12 **Press the F2 key to select Class Options.**

A sub-menu of Class C is displayed (when Class C was selected in page 1/4).

13 **Press the F1 key to select Specified in PF & Fundamental Current.**

14 **Press the F2 key to input a power factor (Specified PF).**

This operation is when Class C is selected in the setting menu. The input range is 0.00 to 1.00.

15 **Press the F3 key to input a fundamental current value (Specified Fundamental Current).**

This operation is when Class C is selected in the setting menu. The input range is 0.0 A to75.0 A.

Inputting Comments for Report Printing

1 **Press the HA key.**

The HA-Test Conditions List display appears.

2 **Press the F6 key to select menu page 2/4.**

3 **Press the F3 key to select Comment Input.**

A sub-menu is displayed.

4 **Input comments for the menu items.**

See p. 96

The input comments can be checked on the screen.

5 **Press the F6 key to return.**

Starting the Test by Pressing the START Key (61000-3-2)

See p. 98

NOTE If JIS 61000-3-2 2005 or JIS 61000-3-2 2019 is selected and the reference impedance is used, check the AC power source and record before the test. If the START key is pressed without doing this, an AC power source check dialog will be displayed.

1 **Press the VIEW key.**

The HA-Observation and Analysis display appears.

See p. 79

2 **Select a view type for the test.**

To observe the harmonic current of each order, select 2D Harmonics. Some displays can be selected only after the test ends.

See p. 87

3 **Press the START key.**

The dialog box for confirming the line impedance is displayed.

If the optional current sensor is not connected or recognized although "Sensor" is selected in the Current Input Terminal setting, a confirmation dialog will be presented.If the sum (Σ) of the real power of each input phase is negative, a confirmation dialog will be presented.

4 **After checking presence/absence of impedance and the setting of line impedance, select the F1 key (OK).**

If the F2 key (Cancel) is selected, the test start is canceled. To start the test, return to Step 3 and press the START key.

The test is started.

Display during test	
Test status display	Switches from “Set” to “Test.” The progress bar extends from left to right. When it reaches the right end, the test ends.
Time display	Remaining test time
View type	The view type that is set in the HA-Observation and Analysis display (HA-VIEW)

Aborting the Test by Pressing the STOP Key

Press the STOP key during the test.

The test ending menu (p. 129) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-2).”

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end.

When the Test is Aborted Automatically

The test is aborted automatically when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

The test ending menu (p. 129) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-2).”

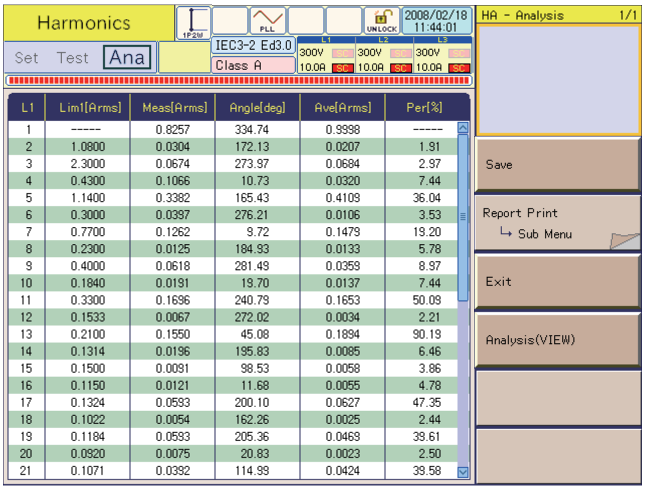
When the Test Time Expires (61000-3-2)

When the test time is up, the buzzer sounds and the ending dialog box is displayed.

1 **Press the F1 key (OK).**

The test ending menu shown below is displayed and the buzzer stops.

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end and its color changes according to the judgment.
PASS	The result of the general judgment is acceptable (the progress bar is green).
WARNING	The result of the general judgment is acceptable but the margin is exceeded (the progress bar is yellow).
FAIL	The result of the general judgment is not acceptable (the progress bar is red).



L1	Lim1[Arms]	Meas[Arms]	Angle[deg]	Ave[Arms]	Per[%]
1	-----	0.8257	334.74	0.9998	-----
2	1.0800	0.0304	172.13	0.0207	1.91
3	2.3000	0.0674	273.97	0.0684	2.97
4	0.4300	0.1066	10.73	0.0320	7.44
5	1.1400	0.3382	165.43	0.4109	36.04
6	0.3000	0.0397	276.21	0.0106	3.53
7	0.7700	0.1262	9.72	0.1479	19.20
8	0.2300	0.0125	184.93	0.0133	5.78
9	0.4000	0.0618	281.49	0.0359	8.97
10	0.1840	0.0191	19.70	0.0137	7.44
11	0.3300	0.1696	240.79	0.1653	50.09
12	0.1533	0.0067	272.02	0.0034	2.21
13	0.2100	0.1550	45.08	0.1894	90.19
14	0.1314	0.0196	195.83	0.0085	6.46
15	0.1500	0.0091	98.53	0.0058	3.86
16	0.1150	0.0121	11.68	0.0055	4.78
17	0.1324	0.0593	200.10	0.0627	47.35
18	0.1022	0.0054	162.26	0.0025	2.44
19	0.1184	0.0593	205.36	0.0469	39.61
20	0.0920	0.0075	20.83	0.0023	2.50
21	0.1071	0.0392	114.99	0.0424	39.58

2 **In the test ending menu, select an item you want to operate.**

For details on the selection, see "Overview of the Test Ending Menu".

See p. 146

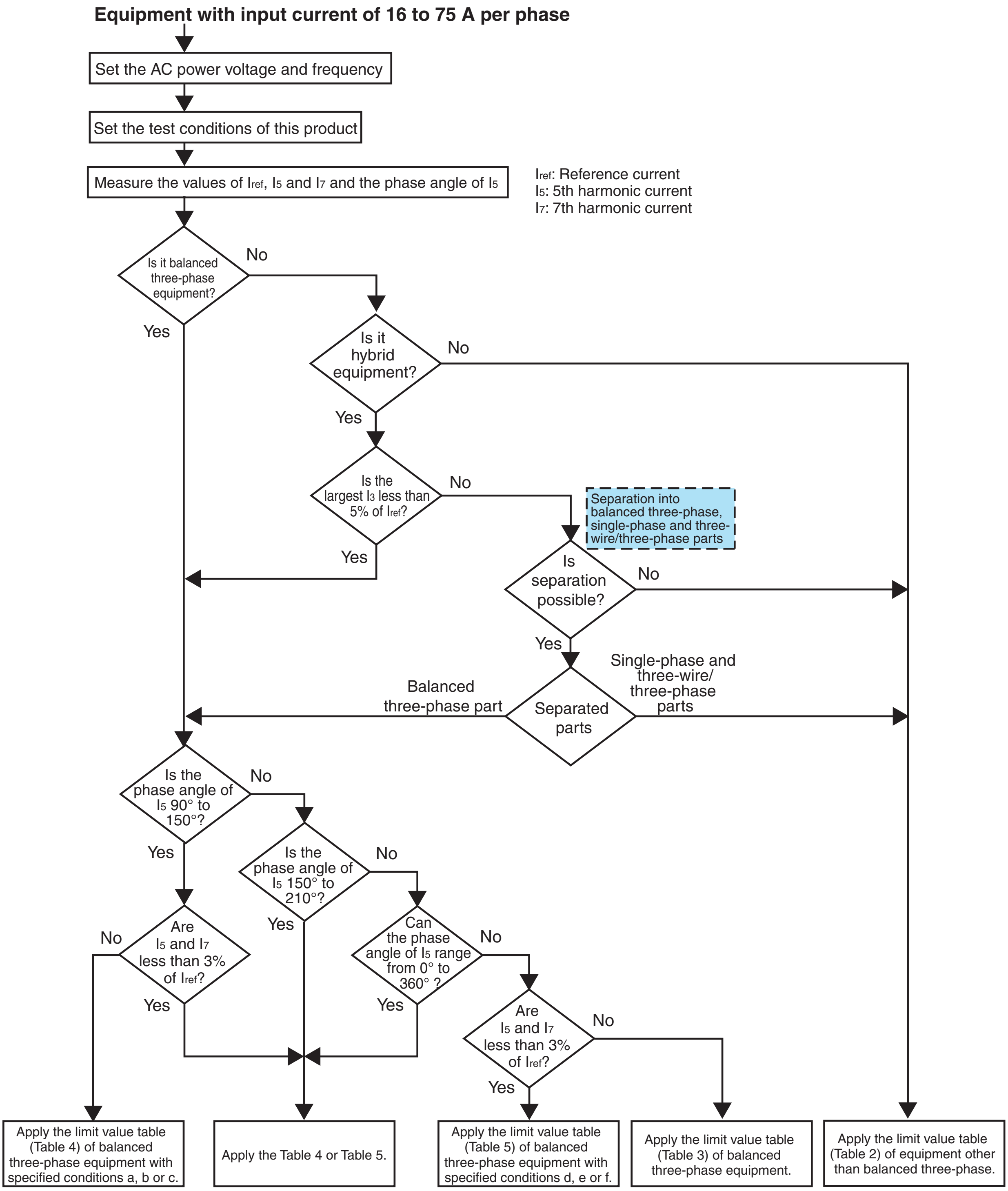
61000-3-12 2011: Test Flow

See p. 155

The test flow is shown below. Execute the test while selecting the Rsce. After the end of the test time, you can save the test results, print reports, terminate the test and analyze the test results.

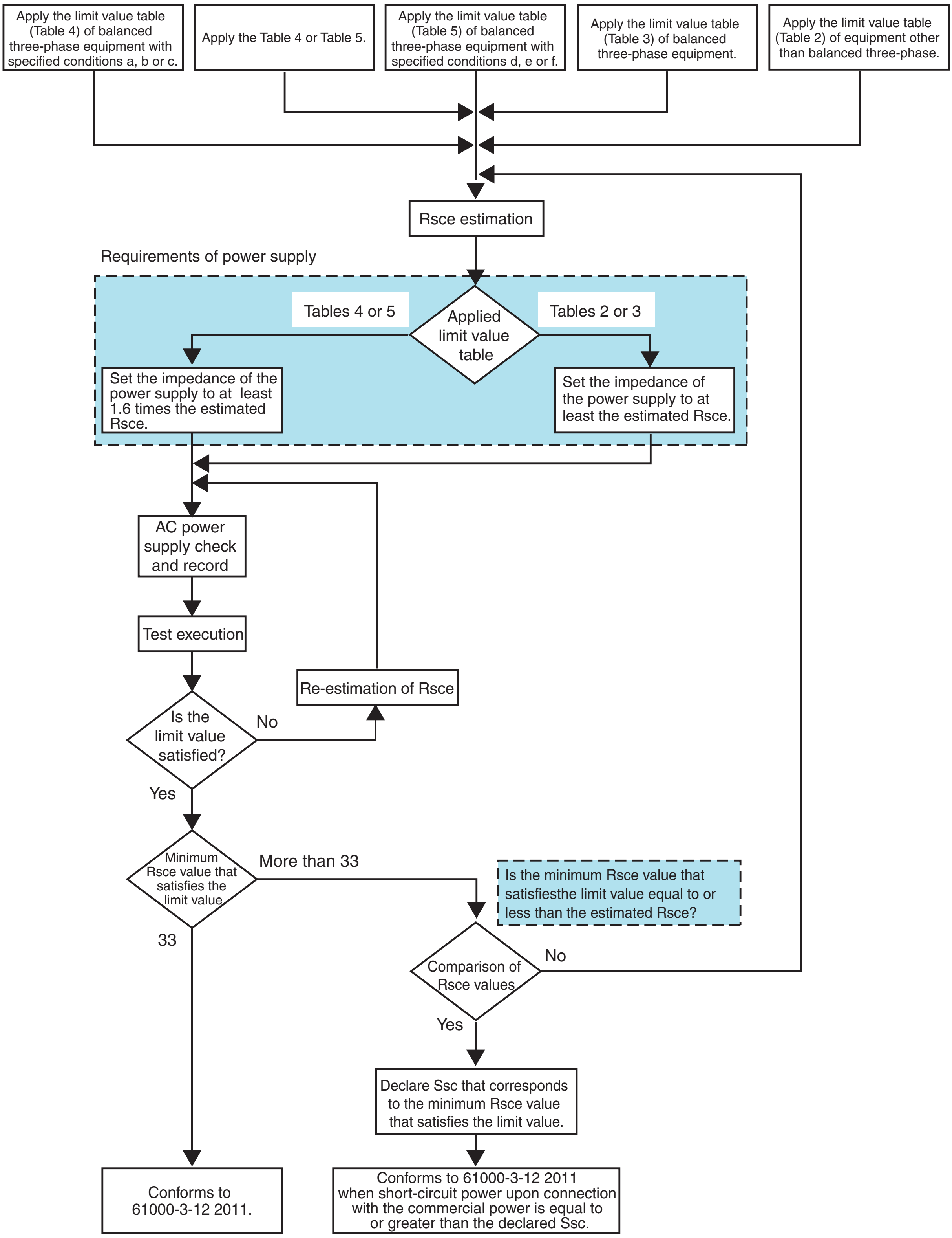
For details on analyzing the test results and judging conformance to the standard and AC power supply and repeatability checking, see Chapter 7 “Observation, Analysis and Judgement of Harmonics.”

■ Determining the limit values



The expression of each item is simplified. For details, refer to the standards.

■ Test execution



The expression of each item is simplified. For details, refer to the standards.

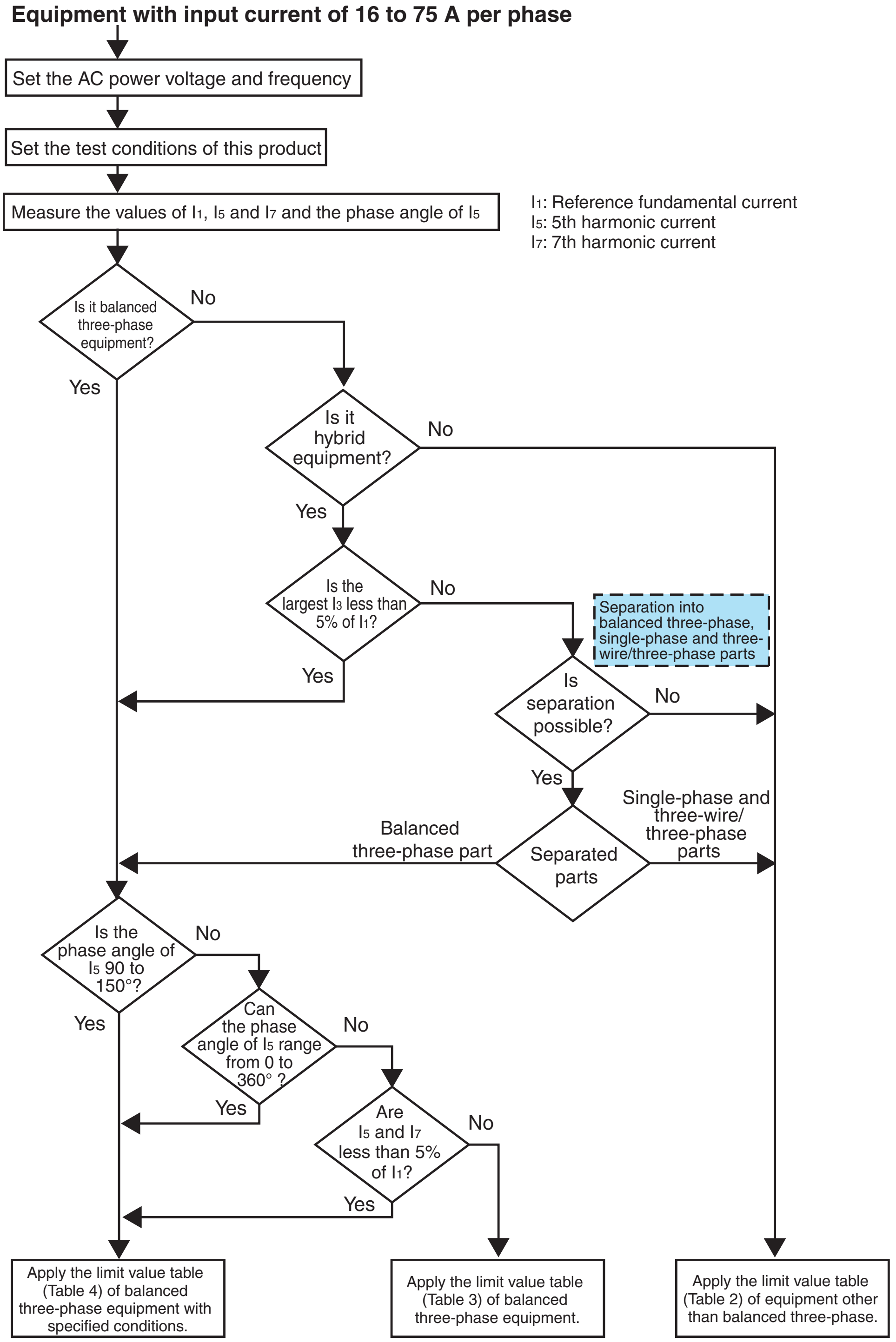
61000-3-12 2004: Test Flow

See p. 155

The test flow is shown below. Execute the test while selecting the Rsce. After the end of the test time, you can save the test results, print reports, terminate the test and analyze the test results.

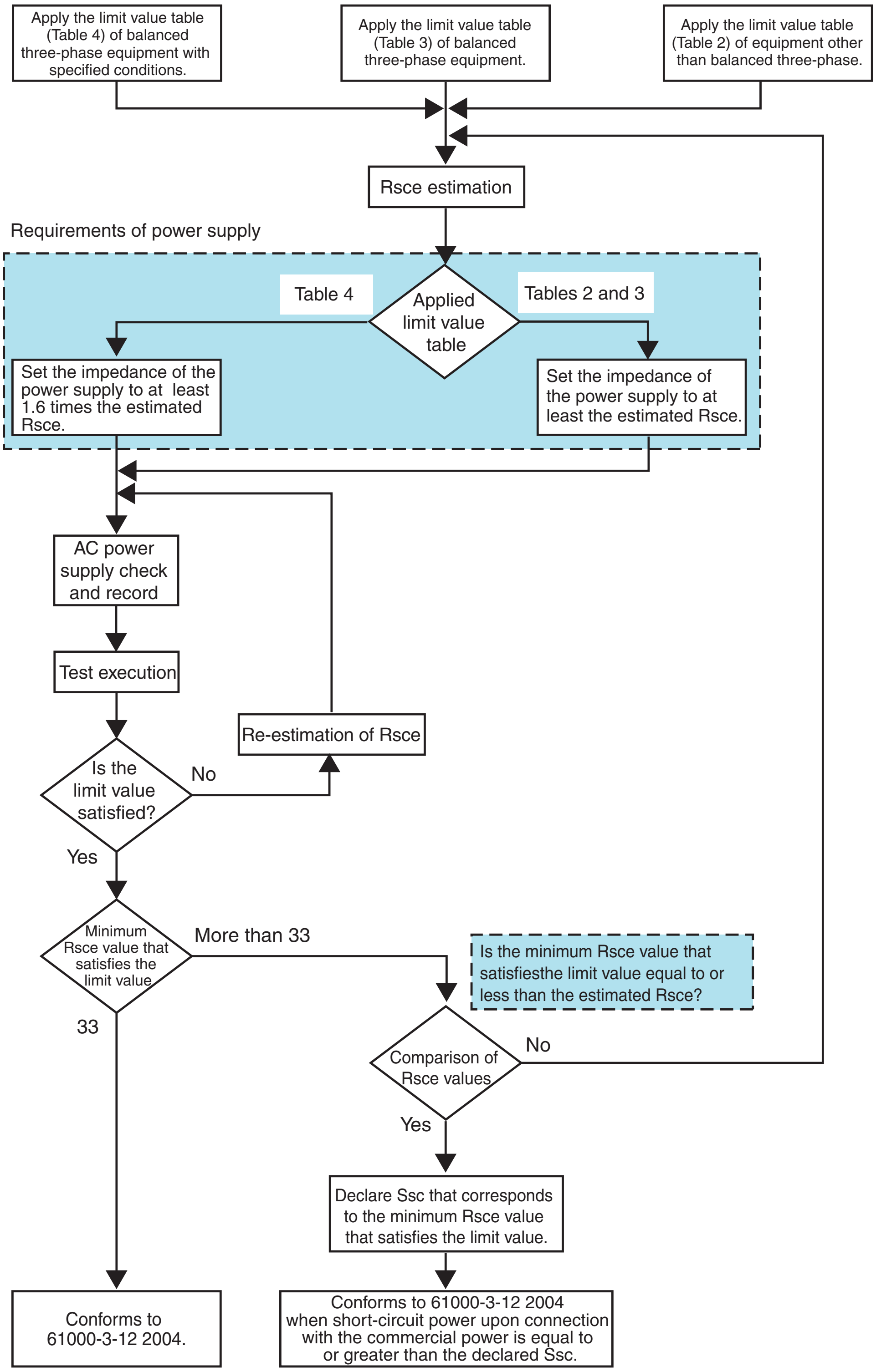
For details on analyzing the test results and judging conformance to the standard and AC power supply and repeatability checking, see Chapter 7 "Observation, Analysis and Judgement of Harmonics."

■ Determining the limit values



The expression of each item is simplified. For details, refer to the standards.

■ Test execution



The expression of each item is simplified. For details, refer to the standards.

Setting the LIN and AC Power Supply (61000-3-12)

Set the LIN (Line Impedance Network) and AC power supply before turning on the power to the EUT.

1 **Set the impedance of the LIN.**

Operate the LIN panel to set the impedance to Bypass (THRU)[1] .

2 **Press the EXT CONT key.**

The External Control display appears.

3 **Press the F1 key to select AC Power Supply Control.**

A sub-menu is displayed.

4 **Press the F2 and F3 keys to set the output voltage and frequency respectively.**

See p. 119

Set the AC power supply voltage and frequency according to the rated power of the EUT.

5 **Press the F1 key to set OUTPUT to ON.**

OUTPUT of the AC power supply is set to ON. The lamp icon in the upper part of the screen lights up.

When it is synchronized with the frequency of the AC power supply, the triangular wave in the PLL icon in the upper part of the screen becomes still.

If the triangular wave in the PLL icon does not become still	
AC power supply	Check whether it is output correctly.
Wiring	Check whether the plug for the voltage-sensing terminal is set and connected to the VOLTAGE SENSING terminal on the rear.
Frequency	The PLL lock frequency range is 45 Hz to 65 Hz.

6 **Press the F6 key to return.**

7 **Use the AC power source confirmation screen to record the measured values.**

See p. 180

Disconnect the EUT's AC power supply before you record the values.

The recorded values are held until the KHA3000 is turned off. You can use the SD006-KHA application software to print these recorded values.

8 **Turn on the power to the EUT.**

---

[1] OUT (THRU) for the LIN40MA-PCR-L Line Impedance Network.

Setting Test Conditions (61000-3-12)

Set the test conditions with the HA-Test Conditions List display. When the test condition setting is complete, switch to the HA-Observation and Analysis display for observation during the test.

Setting Limit Value Standard, Measuring Technique Standard and Equipment

1. **Press the HA key.**
   The HA-Test Conditions List display appears.

See p. 267

2. **Select test conditions.**
   To use the same conditions as for a test that was executed in the past, call up a test condition file and use it.
3. **Press the F6 key to select menu page 1/4.**
4. **Press the F1 key to select Limitation Standard.**
   Select IEC 61000-3-12 2004 or IEC 61000-3-12 2011.
5. **Press the F2 key to select Measuring Technique Standard.**
   To employ a measuring method for harmonic groups, select IEC 61000-4-7 Ed2.0 or IEC 61000-4-7 Ed2.1.
6. **Press the F3 key to select Equipment.**
   Select the equipment according to the type of the EUT.
   Single-phase equipment includes the single-phase part of hybrid equipment. Balanced three-phase equipment includes the three-phase part of hybrid equipment.
7. **Press the F6 key to switch to another menu page and set other test conditions.**

Optimizing the Current Range

See p. 79

1. **Press the VIEW key.**
   The HA-Observation and Analysis display appears.
2. **Press the F1 key to select List in View Type.**
   Measured values are displayed in the form of a list.
3. **Press the VIEW key.**
   The HA-Observation and Test Conditions display appears and the menu for setting the measured values, which are still listed, is displayed.
4. **Change the operating conditions of the EUT to maximize the input current.**
5. **Press the F6 key to select menu page 4/4.**

6 **Press the F1 key to select V/I Range Setting.**

A sub-menu is displayed.

See p. 101

7 **Press the F1 key to select Ch. Setting (V/I Range).**

When "Linked" is selected in the Channel Linkage menu, independent setting of L1, L2, and L3 cannot be made.

8 **Press the F3 key to select Current Range.**

Select the range on the basis of the maximum current obtained in step 4. We recommend performing the test using a fixed range.

If you do not know the current, select AUTO (auto range). In auto range, however, it takes approximately 6 seconds for the measured values to stabilize after the range switches. If a current variation causes the range to switch, wait at least 6 seconds before starting the test. During the test, the range is fixed to the present range.

9 **Press the F6 key to return.**

Input Procedure when Specified is Selected in the Setting Menu

See p. 111, p. 115

NOTE

If you want to use the values (specific values) specified by the manufacturer in place of the actually measured values for the rated current Iequ, fundamental current (Iref), and standard fundamental current (I1) of the EUT, select "Measured" to execute the test. Then, check that the specified value is within ±10 % of the measured value, and execute the test using specific values.

Write the test results using measured values in the Memo column of the report for tests using specific values, or prepare each report separately and use them together.

Testing is possible even when the difference between measured values and specific values exceeds ±10 %, but it is important to note that the limit value of the obtained test results does not meet the standard.

Use the following procedure for specifying the rated voltage, nominal system voltage and reference current/reference fundamental current.

1 **Press the HA key.**

The HA-Test Conditions List display appears.

2 **Press the F6 key to select menu page 1/4.**

3 **Press the F4 key to select Rated of Equipment.**

A sub-menu is displayed.

4 **Press the F2 key to select Specified in Rated Current.**

5 **Press the F3 key to input a rated voltage value (Rated Current Iequ).**

The input range is 0.0 A to 75.0 A.

6 **Press the F4 key to input a nominal system voltage value (Nominal System Voltage Unom).**

The input range is 100 V to 600 V.

7 **Press the F6 key to return.**

8 **Press the F6 key to select menu page 3/4.**

9 **Press the F1 key to select Specified in Reference Current/Reference Fundamental Current.**

10 **Press the F2 key to input a reference current specigication/reference fundamental current specification.**

The input range is 0.0 A to 75.0 A.

Inputting Comments for Report Printing

1 **Press the HA key.**

The HA-Test Conditions List display appears.

2 **Press the F6 key to select menu page 2/4.**

3 **Press the F3 key to select Comment Input.**

A sub-menu is displayed.

4 **Input comments for the menu items.**

The input comments can be checked on the screen.

See p. 114

5 **Press the F6 key to return.**

Checking the Third, Fifth and Seventh Harmonics

1 **Press the VIEW key.**

The HA-Observation and Analysis display appears.

See p. 169

2 **Press the F6 key to select menu page 1/2.**

3 **Press the F1 key to select Harmonics List in View Type.**

The harmonics list of measured values is displayed.

4 **Press the F2 key to select View Setting.**

A sub-menu is displayed.

5 **Press the F4 key to select In/Iref [%] or In/I1 [%] in Measurement Value Selection.**

6 **Press the F5 key to select L1 in Check View Phase.**

Select the L1 phase first. Make checks for each phase by the following procedure.

7 **Check that the largest third harmonic current value is less than 5% of the reference current value/reference fundamental current value.**

Check for each phase.

8 **Check that the phase angle of the fifth harmonic current is 90 to 150° against the phase angle of the fundamental voltage.**

Check for each phase.

9 **Check that the fifth and seventh harmonic current values are less than 5% of the reference current value/reference fundamental current value.**

Check for each phase.

10 **Press the F6 key to return.**

NOTE Regarding the condition “The phase angle of the fifth harmonic current of the EUT against the fundamental voltage is designed to change with time to take all values from 0° to 360°,” under which the limit value table (Standard Table 4) of the balanced three-phase equipment with specified conditions can be used, customers are asked to investigate the details themselves.

Determining the Limit Value

11 **Determine the limit value according to the limit value standard.**

Estimating the Rsce (61000-3-12)

Estimate the Rsce before preparing a power supply that satisfies the standard requirements for the impedance in relation to estimated values. Because the AC power supply does not have an impedance function that satisfies the standard requirements, the customer is requested to prepare it separately.

Standard Requirements for Impedance

The standard requirements for the impedance depend on the applied limit value.

- When the limit value of balanced three-phase equipment with specified conditions is applied, the impedance must be at least 1.6 times the estimated Rsce.
- When the limit value of balanced three-phase equipment or other equipment is applied, the impedance must be equal to or greater than the estimated Rsce.

Selecting the Limit Value

1 **Press the HA key.**
The HA-Test Conditions List display appears.

2 **Press the F6 key to select menu page 1/4.**

3 **Press the F3 key to select Equipment.**

4 **Press the F6 key to select menu page 3/4.**

5 **Press the F4 key to select Limit Value.**
Select Except Bal'd 3-P for the limit value of equipment other than balanced three-phase.
Select Balanced 3-P for the limit value of balanced three-phase equipment.

Select Spec Bal'd 3-P for the limit value of balanced three-phase equipment with specified conditions.

Select Except Bal'd 3-P for the limit value of the single-phase part of hybrid equipment.
Select Bal'd 3-P for the limit value of the three-phase part of hybrid equipment.

6 **Set OUTPUT of the AC power supply to OFF.**

7 **Ensure the impedance of the AC power supply conforms to the standard requirements.**
To satisfy the standard requirements, the impedance or the AC power supply may need to be replaced.

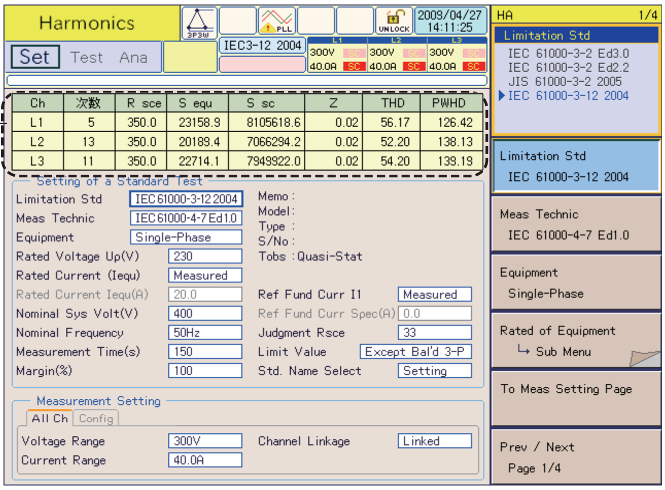
⚠WARNING
- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the switchboard to which the power cord is connected, and turn off the POWER switch.**

---

8 **Set OUTPUT of the AC power supply to ON.**

Searching for the Minimum Rsce Value with the Measured Monitor Values Displayed (61000-3-12 2004 only)

Measured monitor values indicate the current status of the EUT. It is not a function to observe all the operation cycles of the EUT.



Ch	次数	R sce	S equ	S sc	Z	THD	PWHD
L1	5	350.0	23158.9	8105618.6	0.02	56.17	126.42
L2	13	350.0	20189.4	7066294.2	0.02	52.20	138.13
L3	11	350.0	22714.1	7949922.0	0.02	54.20	139.19

Setting of a Standard Test

Limitation Std: IEC 61000-3-12 2004
Meas Technic: IEC 61000-4-7 Ed1.0
Equipment: Single-Phase
Rated Voltage Up(V): 230
Rated Current (Iequ): Measured
Rated Current Iequ(A): 20.0
Nominal Sys Volt(V): 400
Nominal Frequency: 50Hz
Measurement Time(s): 150
Margin(%): 100

Memo :
Model :
Type :
S/No :
Tobs :Quasi-Stat
Ref Fund Curr I1: Measured
Ref Fund Curr Spec(A): 0.0
Judgment Rsce: 33
Limit Value: Except Bal'd 3-P
Std. Name Select: Setting

Measurement Setting

Voltage Range: 300V
Current Range: 40.0A
Channel Linkage: Linked

Measured monitor value

CH	Factor	Rsce	Sequ (VA)	Ssc (W)	Z (Ohm)	THD (%)	PWHD (%)
Phase of measurement circuit L1 L2 L3	Harmonic orders 2nd to 40th, THD, PWHD	Short-circuit ratio	Rated apparent power of equipment	Short-circuit power	System impedance	Total harmonic distortion	Partial weighted harmonic distortion
	–	Calculated value	Calculated value	Calculated value	Calculated value	Measured value	Measured value
Calculating Formula	Rated apparent power (Sequ) of single-phase equipment = Rated voltage (phase voltage) (Up) × Rated current (Iequ)						
	Rated apparent power (Sequ) of three-phase/three-wire equipment = Rated voltage (line voltage) (Ui) × Rated current (Iequ)						
	Rated apparent power (Sequ) of balanced three-phase equipment = $\sqrt{3}$ × Rated voltage (line voltage) (Ui) × Rated current (Iequ)						
	Rated apparent power (Sequ) of unbalanced three-phase equipment = 3 × Rated voltage (phase voltage) (Up) × Rated current (Iequ)						
	Short-circuit power (Ssc) = Short-circuit ratio (Rsce) × (3 × Rated apparent power (Sequ) of single-phase equipment)						
	Short-circuit power (Ssc) = Short-circuit ratio (Rsce) × (2 × Rated apparent power (Sequ) of three-phase/three-wire equipment)						
	Short-circuit power (Ssc) = Short-circuit ratio (Rsce) × Rated apparent power (Sequ) of all three-phase equipment						
	System impedance (Z) = (Nominal system voltage (Unom))^{2}/Short-circuit power (Ssc)						

● Table format of measured monitor

The measured monitor table is formatted to always display L1, L2 and L3, irrespective of equipment settings. L1, L2 and L3 correspond to LOAD terminals L1, L2 and L3 on the rear of this product.

● Sequ, Ssc and Z

The Sequ, Ssc and Z values are calculated for each phase of L1, L2 and L3 and displayed. The formulas for computation are shown in the table above.

- **Calculating and displaying the minimum Rsce value that satisfies a limit value**

  The minimum Rsce value that satisfies the limit value of each phase is calculated from harmonic orders (I_2 to I_{13}) or measured value of the THD or PWHD according to the setting of the applied limit value. The “Factor” column indicates the harmonic order, the THD or the PWHD that is the lowest factor for the margin.

  The Rsce value is calculated for each phase of L1, L2 and L3. Set the maximum value out of the L1, L2 and L3 phases as the judgment Rsce value that is necessary for satisfying the limit value. The set judgment Rsce value becomes the minimum Rsce value in the standard limit value table.

- **Calculating short-circuit power Ssc and system impedance Z**

  The short-circuit power Ssc and system impedance Z are calculated from the calculated Rsce value and the rated apparent power of the equipment. The short-circuit power Ssc indicates the minimum value of a connectable system, and the system impedance Z indicates the maximum value of a connectable system.

- **Rsce of hybrid equipment**

  The Rsce of hybrid equipment executes tests for each component. Measured monitor values, therefore, are observed for each component. From among the calculated Rsce values of the components, the maximum value is employed.

1. **Press the HA key.**

   The HA-Test Conditions List display appears.

   Real-time measurement monitor values are displayed in the upper part of the setting item display on the screen.

2. **Press the F6 key to select menu page 3/4.**

3. **Press the F3 key to input a judgment Rsce (estimated value).**

   The input range is 33 to 350.

Starting the Test by Pressing the START Key (61000-3-12)

See p. 180

NOTE Check the AC power source and record before the test. If the START key is pressed without doing this, an AC power source check dialog will be displayed.

See p. 79

See p. 87

1 **Press the VIEW key.**

The HA-Observation and Analysis display appears.

2 **Select a view type for the test.**

To observe the harmonic current of each order, select Harmonics List. Some displays can be selected only after the test ends.

3 **Press the START key.**

The dialog box for confirming the line impedance is displayed.

If the optional current sensor is not connected or recognized although "Sensor" is selected in the Current Input Terminal setting, a confirmation dialog will be presented.If the sum (Σ) of the real power of each input phase is negative, a confirmation dialog will be presented.

4 **After checking presence/absence of impedance and the setting of line impedance, select the F1 key (OK).**

If the F2 key (Cancel) is selected, the test start is canceled. To start the test, return to Step 3 and press the START key.

The test is started.

Display during test	
Test status display	Switches from “Set” to “Test.” The progress bar extends from left to right. When it reaches the right end, the test ends.
Time display	Remaining test time
View type	The view type that is set in the HA-Observation and Analysis display (HA-VIEW)

Aborting the Test by Pressing the STOP Key

Press the STOP key during the test.

The test ending menu (p. 143) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-12).”

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end.

The result of the test is aborted.

When the Test is Aborted Automatically

The test is aborted automatically when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

The test ending menu (p. 143) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-12).”

When the Test Time Expires (61000-3-12)

Rsce (short circuit ratio) and limits

This product uses a preset reference Rsce value to determine the limits of each order and uses them to perform pass/fail judgments. As such, if a pass judgment is obtained, connection is possible to a power supply that has a short circuit ratio greater than or equal to the reference Rsce.

The minimum Rsce value (Minimum Rsce (measured)) is displayed in reports. This value is determined through backcalculation based on the limits corresponding to the average and maximum values of each harmonic current order measured in the test period.

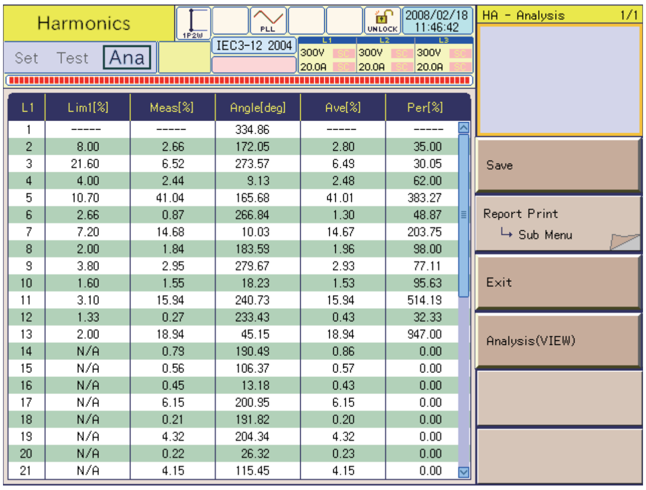
If you want to check the limit corresponding to the minimum Rsce value, run the test once to measure the minimum Rsce value. Then, set the reference Rsce value to the obtained value and run the test again to display the test report and the limit values corresponding to the limit values of the result list. The measurement time can be short. In principle, a fail judgment may result due to measurement errors or differences in the phase currents (in the case of three phase), but this is not abnormal.

- When the result of the general judgment is acceptable (PASS,the progress bar is green), follow the procedure described below.
- When the result of the general judgment is not acceptable (FAIL,the progress bar is red), return to "Estimating the Rsce (61000-3-12)" on page 139.

1 **Press the F1 key (OK).**

The test ending menu shown below is displayed and the buzzer stops.

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end and its color changes according to the judgment.
PASS	The result of the general judgment is acceptable (the progress bar is green).
WARNING	The result of the general judgment is acceptable but the margin is exceeded (the progress bar is yellow).
FAIL	The result of the general judgment is not acceptable (the progress bar is red).



L1	Lim1[%]	Meas[%]	Angle[deg]	Ave[%]	Per[%]
1	-----	-----	334.86	-----	-----
2	8.00	2.66	172.05	2.80	35.00
3	21.60	6.52	273.57	6.49	30.05
4	4.00	2.44	9.13	2.48	62.00
5	10.70	41.04	165.68	41.01	383.27
6	2.66	0.87	266.84	1.30	48.87
7	7.20	14.68	10.03	14.67	203.75
8	2.00	1.84	183.59	1.96	98.00
9	3.80	2.95	279.67	2.93	77.11
10	1.60	1.55	18.23	1.53	95.63
11	3.10	15.94	240.73	15.94	514.19
12	1.33	0.27	233.43	0.43	32.33
13	2.00	18.94	45.15	18.94	947.00
14	N/A	0.79	190.49	0.86	0.00
15	N/A	0.56	106.37	0.57	0.00
16	N/A	0.45	13.18	0.43	0.00
17	N/A	6.15	200.95	6.15	0.00
18	N/A	0.21	191.82	0.20	0.00
19	N/A	4.32	204.34	4.32	0.00
20	N/A	0.22	26.32	0.23	0.00
21	N/A	4.15	115.45	4.15	0.00

When the General Judgment is PASS

2 **Terminate the test.**

Select an item that you want to operate from the test ending menu. For details on the selection, see "Overview of the Test Ending Menu" on page 146.

3 **Compare the set judgment Rsce and Rsce (estimated value) with each other.**

If the judgment Rsce is greater than 33, calculate the Ssc from the judgment Rsce and rated apparent power of the equipment.

When the judgment Rsce is greater than 33 and equal to or smaller than the Rsce (estimated value)

4 **Calculate the Ssc from the judgment Rsce and rated apparent power of the equipment.**

For details on calculating the Ssc, see "Ssc calculation" on page 144.

When the judgment Rsce is greater than 33 and exceeds the Rsce (estimated value)

5 **Return to "Estimating the Rsce (61000-3-12)" on page 139.**

Ssc calculation

Find the Ssc from the rated apparent power of the equipment and judgment Rsce using the formula for computation in the table on page 140.

In the case of hybrid equipment, each hybrid part is separated for the test. Out of the Rsce for each separated part, the maximum Rsce is employed as the judgment Rsce. Find the Ssc from the rated apparent power of the equipment part that is employed as the judgment Rsce and the judgment Rsce value, using the formula for computation in the table on page 140.

When the General Judgment is FAIL, Increase the Judgment Rsce

Terminate the test once and restart it. Repeat the following procedure until the general judgment becomes PASS.

1 **Press the F3 key to select Exit.**

A dialog box asking whether to save the test results is displayed.

2 **Select “No.”**

Finish all the exit operations. The screen does not return to the test ending menu. The next test can be started.

3 **Increase the judgment Rsce to a greater value than used the previous time.**

The input range is 33 to 350.

4 **Press the START key.**

A confirmation dialog will be presented regarding the line impedance, optional current sensor or any negative sum (Σ) of the real power.

5 **After checking presence/absence of impedance and the setting of line impedance, select the F1 key (OK).**

If the F2 key (Cancel) is selected, presence/absence of impedance is neglected. To start the test, press the START key again.

The test is started.

6 **When the test ends, execute Step 1 in "When the Test Time Expires (61000-3-12)" on page 143.**

7 **If the general judgment is FAIL, return to Step 1.**

Repeat the procedure until the general judgment becomes PASS.

When the general judgment becomes PASS

8 **Terminate the test.**

Select an item that you want to operate in the test ending menu. For details on the selection, see "Overview of the Test Ending Menu" on page 146.

9 **Compare the set judgment Rsce and Rsce (estimated value) with each other.**

When the judgment Rsce is greater than 33 and equal to or smaller than the Rsce (estimated value)

10 **Calculate the Ssc from the judgment Rsce and rated apparent power of the equipment.**

For details on calculating the Ssc, see "Ssc calculation" on page 144.

When the judgment Rsce is greater than 33 and exceeds the Rsce (estimated value)

11 **Return to "Estimating the Rsce (61000-3-12)" on page 139.**

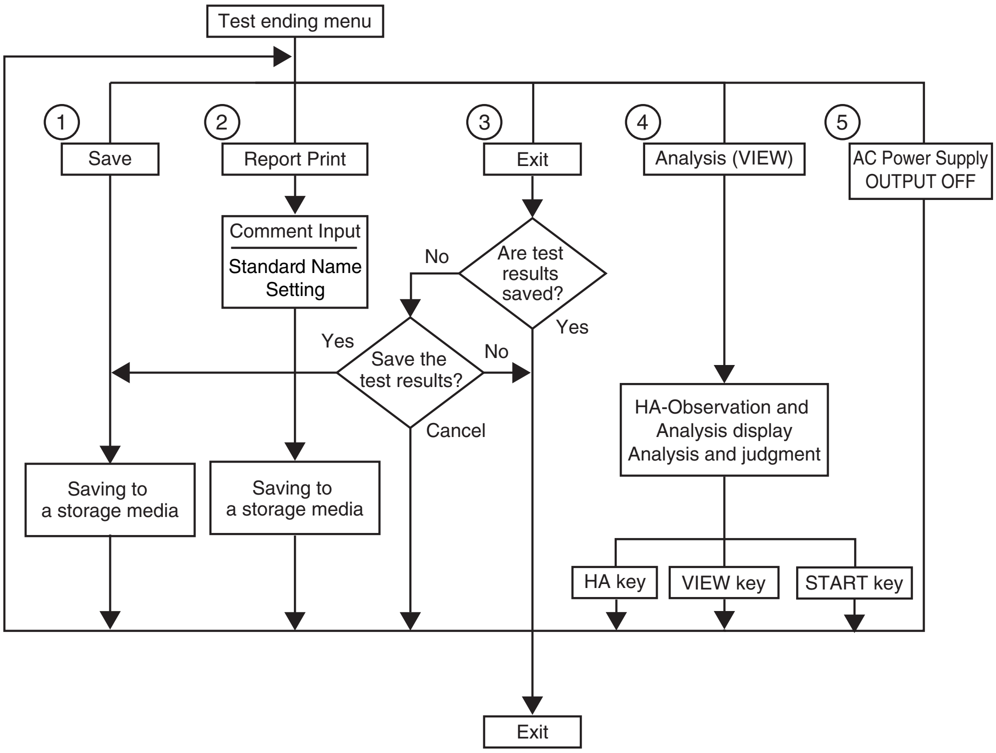
Overview of the Test Ending Menu

After the test time expires, the test ending menu is displayed. This menu consists of the first hierarchical menu and sub-menus.

The first hierarchical menu is composed of five menu items.

- Save the test results
- Report Print
- Exit
- Analysis (VIEW key)
- AC Power Supply OUTPUT OFF

The basic structure is so designed as to return to the beginning of the test ending menu after any menu is executed. The test ends only when Exit is executed after the test results have already been saved or selected not to be saved.



① Save the test results

Select Save and save the results using the sub-menus. The test results are saved to a storage media. The file name is assigned automatically. After saving, the test ending menu is displayed.

② Report Print

Select Report Print and print reports using the sub-menus. The test results are saved in the report format to the storage media. After saving, the test ending menu is displayed.

The sub-menu includes the "Std. Name Setting" menu. Using this menu, the Standard name to be printed on the report can be modified.

③ Exit (when the test results have been saved)

When the test results have been saved, selecting Exit terminates all the test ending operations. The screen does not return to the test ending menu. The next test can be started.

③Exit (when the test results have not been saved)

When the test results have not been saved, selecting Exit displays a dialog box again.

■ Yes (to save the test results)

When Yes is selected, the procedure becomes the same as when Save is selected.

■ No (not to save the test results)

If No is selected, all the test ending operations end. The screen does not return to the test ending menu. The next test can be started.

■ Cancel (not executing the saving operation)

If Cancel is selected, the screen returns to the test ending menu.

④Analysis

See p. 155

When Analysis is selected, the test results are analyzed.

■ VIEW key

Press the VIEW key to end the analysis. The screen returns to the test ending menu. Select Exit.

■ HA key

If you want to set test conditions for a new test, press the HA key. The screen returns to the test ending menu. Select Exit.

Terminate test ending menus other than the one for Analysis to terminate all the test ending operations. The screen does not return to the test ending menu. The next test can be started.

■ START key

Pressing the START key displays the test ending menu. Select Exit.

⑤AC Power Supply OUTPUT OFF

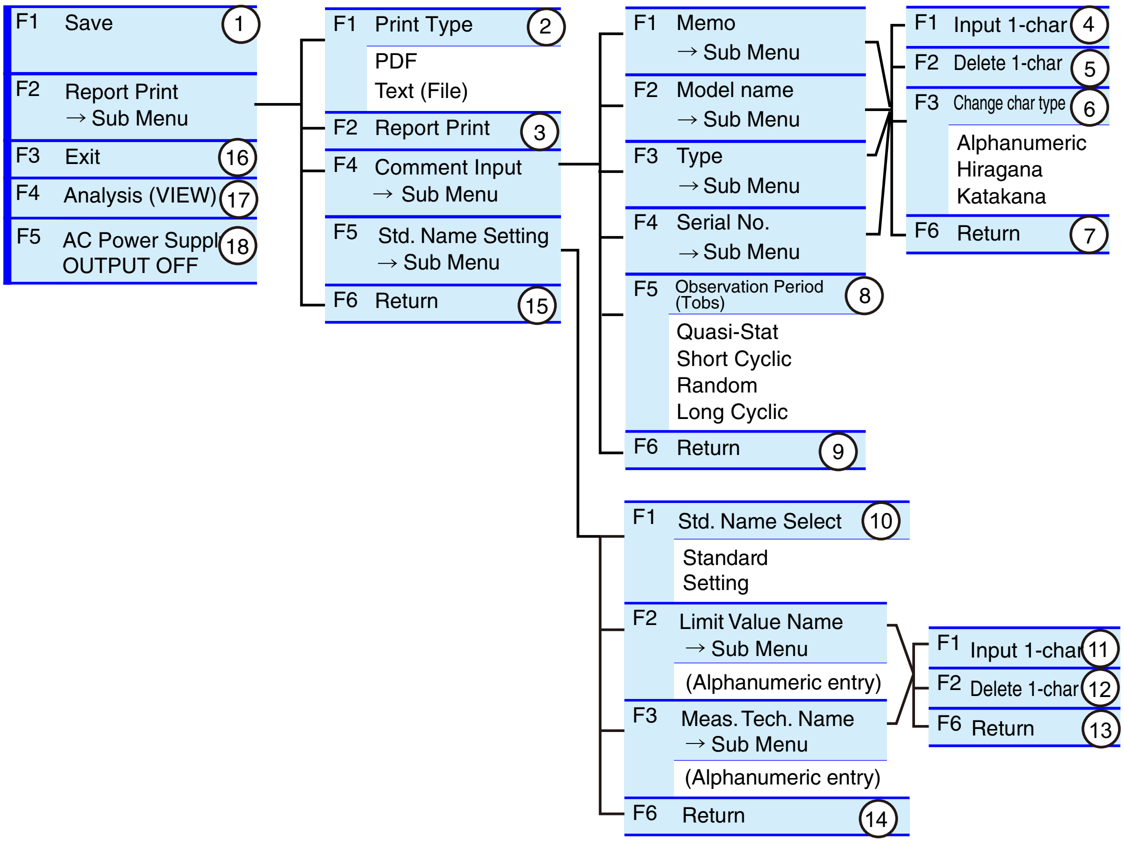
Turn off the output of the AC power supply. The bulb icon at the top of the display will be turned off. this item is displayed when it is so set to control the AC power supply.

Test Ending Menu

See p. 150

The test ending menu consists of the first hierarchical menu and sub-menus. For details on the sub-menus, see page 150 or later.

Menu 1/1



No.	Menu item	Description		Default
1	Save	Used to save test results.		–
2	Print Type	PDF	PDF format (a file format for saving to the storage media)	PDF
		Text (File)	Text format (a file format for saving to the storage media)	
3	Report Print	Use this item for saving to the storage media.		–
4	Input 1-char	Use this item to enter characters for Memo, Model name, Type and Serial No. Up to 20 alphanumeric characters and up to 10 hiragana and katakana characters can be input. For details on the procedure, see page 149.		–
5	Delete 1-char	Use this item to delete characters of Memo, Model name, Type and Serial No. For details on the procedure, see page 149.		–
6	Change char type	Use this item to change the character types of Memo, Model name, Type and Serial No. Every time the F3 key is pressed, the character types switch to alphanumeric, hiragana and katakana characters in this order.		–
7	Return	Terminates the character input, character deletion and character type change.		–
8	Observation Period (Tobs)	Select the operation type of the EUT as a condition for setting an observation period (measurement time for this product). The selected item is printed on reports. Measurement results and judgment are not affected.		Quasi-Stat

9	Return	Terminates the comment input.	–
10	Std. Name Select	Select how the "Limitation Std" and "Meas. Tech" names are presented in Report Print. Selects either "Standard" or "Setting".	Standard
11	Input 1-char	This function is used to enter characters for the local Limitation Standard name or the local Measuring technique name to be presented in Report Print. Up to 20 alphanumeric characters can be entered. On how to use this function, refer to the procedures shown below.	–
12	Delete 1-char	This function is used to delete characters from the local Limitation Standard names or the local Measuring technique names to be presented in Report Print. On how to use this function, refer to the procedures shown below.	–
13	Return	Exit from the character entry/deletion procedures to display local Limitation Standard or local Measuring technique names.	–
14	Return	Exit from the setting of standard names to be presented.	–
15	Return	Terminates the report printing.	–
16	Exit	Terminates the test.	–
17	Analysis (VIEW)	Analyses test results.	–
18	AC Power Supply OUTPUT OFF	Turn off the output of the AC power supply. This item is displayed when it is so set to control the AC power supply. See p. 118	

F key: Function key. You can also use the ESC key to return.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 **Press the F1, F2, F3 or F4 key.**

The Comment Input dialog will be presented.

2 **Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.**

3 **Press the F1 (Input 1-char) key.**

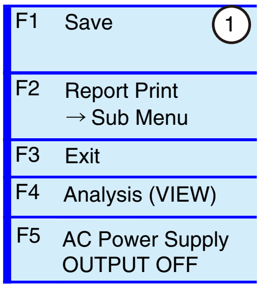
The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 **Press the ENTER key.**

The characters entered will be fixed and saved.

Save

Menu1/1



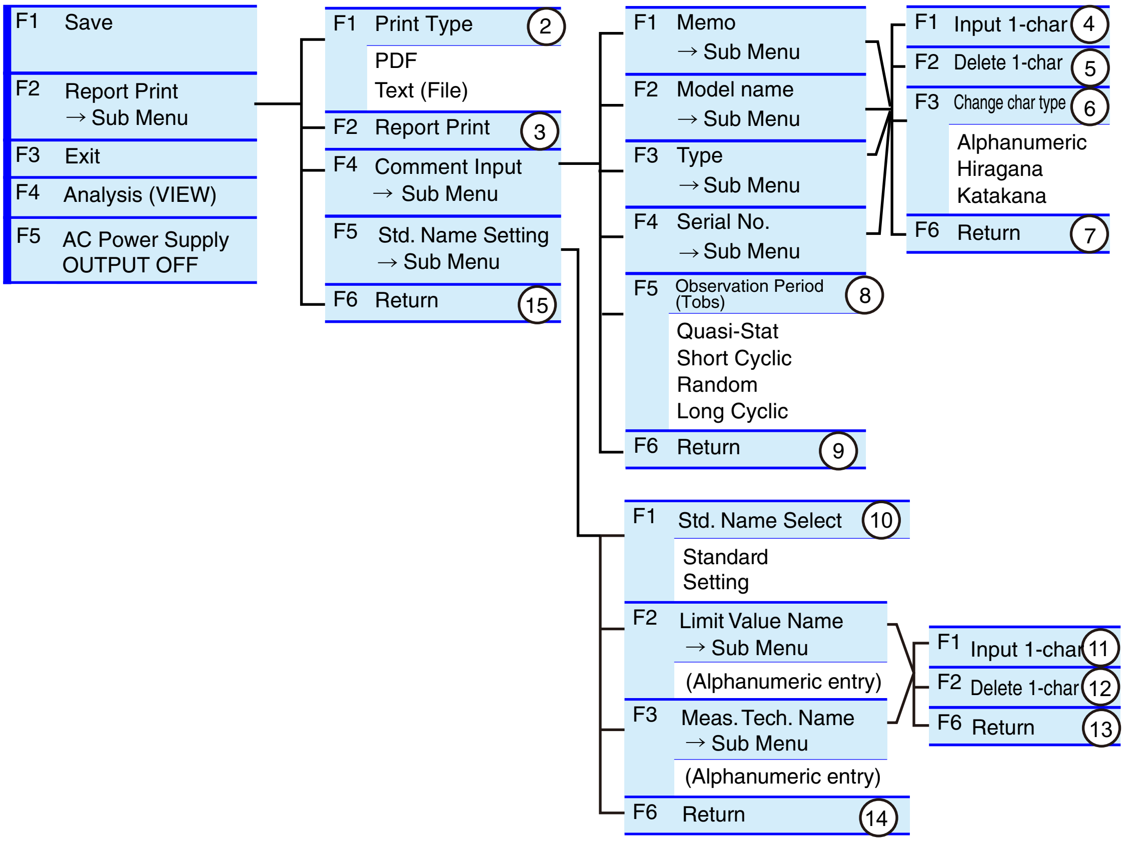
Press the F1 key to select Save.

A dialog box is displayed during saving. A file name is automatically assigned and the result file is saved to the storage media. When the saving ends, the menu display “Save” is displayed dimmed and the menu function key is disabled.

If the storage media is not found, the buzzer sounds and the dialog box “Disk Error. Media could not be detected” is displayed. If the dialog box is displayed, press the F1 key (OK) and insert a storage media.

Report Print

Menu 1/1



Select a print type and execute report printing

1 **Press the F2 key to select Report Print.**

A sub-menu is displayed.

2 **Press the F1 key to select Print Type.**

Select a print type. Select the file format for saving to the storage media.

3 **Press the F2 key to select Report Print.**

Saving to the storage media is initiated.

4 **Press the F6 key to return.**

Completing the saving to the storage media, it returns to the test ending menu.

Inputting comments

1 **Press the F2 key to select Report Print.**

A sub-menu is displayed.

2 **Press the F4 key to select Comment Input.**

The lower menu is displayed.

3 **Press the function key of a sub-menu to which you want to input a comment.**

The lower menu is displayed.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

4 **Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.**

5 **Press the F1 (Input 1-char) key.**

The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 4.

6 **Press the ENTER key.**

The characters entered will be fixed and saved.

7 **Press the F6 key to return.**

Character input, character deletion and character type change are terminated and return to the upper hierarchy.

8 **Press the F5 key to select Observation Period (Tobs).**

Select an operation type of the EUT to set an operation period (Tobs).

9 **Press the F6 key to return.**

Comment input is terminated.

10 **Press the F6 key to return.**

Finishing Report Print, it returns to the test ending menu.

Standard. Name Setting

The settings are saved. Once you set it, you do not have to set it again.

1 **Press the F2 key to select Report Print.**

A sub-menu is displayed.

2 **Press the F5 key to select Std. Name Setting.**

A lower layer menu is displayed.

3 **Press the F1 key to select Std. Name Select.**

4 **Press the F1 key to select Setting.**

5 **Press the F2 key to select Limit Value Name.**

A dialog and sub-menu will be displayed.

■ Input 1-char (F1 key), Delete 1-char (F2 key)

The procedure is the same as given in page 151. Only alphanumeric characters can be used.

6 **Press the F6 key to return.**

After completing the Input 1-char and/or Delete 1-char operations, return to the upper layer.

7 **Press the F2 key to select Meas. Tech. Name.**

A dialog and sub-menu will be displayed.

■ Input 1-char (F1 key), Delete 1-char (F2 key)

The procedure is the same as given in page 151. Only alphanumeric characters can be used.

8 **Press the F6 key to return.**

After completing the Input 1-char and/or Delete 1-char operations, return to the upper layer.

9 **Press the F6 key to return.**

Exit from Std. Name Setting.

10 **Press the F6 key to return.**

Finishing Report Print, it returns to the test ending menu.

Exit

Menu 1/1

F1	Save
F2	Report Print → Sub Menu
F3	Exit ⑯
F4	Analysis (VIEW)
F5	AC Power Supply OUTPUT OFF

When test results have been saved

1 **Press the F3 key to select Exit.**

The test status display switches from “Test” to “Analysis.” The progress bar goes out. All the test ending operations end. The screen does not return to the test ending menu. The next test can be started.

When test results have not been saved

1 **Press the F3 key to select Exit.**

The test status display switches from “Test” to “Analysis.” The progress bar goes out. A dialog box asking whether to save the test results is displayed.

■ How to save the test results

2 **Select the F1 key for "Yes".**

The screen returns to the Save menu.

3 **Follow the procedure for saving (F1 key).**

■ When not saving the test results

4 **Select the F2 key for "No".**

All the test ending operations end. The screen does not return to the test ending menu. The next test can be started.

■ When not executing the saving operation

5 **Select the F3 key for "Cancel".**

The screen returns to the test ending menu.

Analysis

Menu 1/1

F1	Save
F2	Report Print → Sub Menu
F3	Exit
F4	Analysis (VIEW) ⑰
F5	AC Power Supply OUTPUT OFF

1 **Press the F4 key to select Analysis.**

The test status display switches from “Test” to “Analysis.” The progress bar goes out.

See p. 155

2 **Execute analysis using the Analysis display.**

For details on the operation, see Chapter 7 “Observation, Analysis and Judgement of Harmonics.”

■ How to terminate Analysis

3 **Press the VIEW key.**

The screen returns to the test ending menu.

AC Power Supply OUTPUT OFF

Turn off the power to the EUT.

Menu 1/1

F1	Save
F2	Report Print → Sub Menu
F3	Exit
F4	Analysis (VIEW)
F5	AC Power Suppl⑱ OUTPUT OFF

1. **Press the F5 key to select AC Power Supply OUTPUT OFF.**

   The output of the AC power supply will be turned off. The bulb icon at the top of the display will be turned off.

Using EXT CONT

An alternative method to turn off the AC power supply output is described below:

1. **Press the EXT CONT key.**

   The External Control display appears.

2. **Press the F1 key to select AC Power Supply Control.**

   A sub-menu is displayed.

3. **Press the F1 key to select OFF in OUTPUT.**

   OUTPUT of the AC power supply is set to OFF. The lamp icon in the upper part of the screen goes out.

4. **Press the F6 key to return.**

7

Observation, Analysis and Judgement of Harmonics

This chapter explains how to observe and analyze harmonics and judge conformance to the standards.

Functions of Observation, Analysis and Judgment

See p. 158

There are ten view types. For some functions concerning observation, analysis and judgment, available view types are limited. See "View Type List".

● **Observation**

- Before and during the test, measurement circuit data is continuously collected and displayed on the screen.
- Displays can be enlarged, reduced and changed in color. Measured values can be read using the cursor.

● **Analysis**

- After the test ends, test results can be analyzed.
- Saved test results can be called up and analyzed.
- Displays can be enlarged, reduced and changed in color. Measured values can be read using the cursor.

● **Judgment**

- After the test ends, test results can be judged in terms of the conformance to the standards.
- Saved test results can be called and judged in terms of the conformance to the standards.
- Before and during the test, measurement circuit data can be continuously collected and judged in terms of the conformance to the standards.
- Limit values, PASS, WARN and FAIL can be displayed. Displays can be changed in color.

Selecting the Targets of Observation, Analysis and Judgment

The three types of target data of observation, analysis and judgment are as described below.

● **Current measurement data that are being observed before and during the test**

- Used during the setting and test.
- This type of data can be observed by selecting a view type on the HA-Observation and Analysis display (HA-VIEW).

● **Test result data after the test ends**

- Used after terminating a test.
- This type of data can be observed by selecting a view type on the HA-Observation and Analysis display (HA-VIEW).

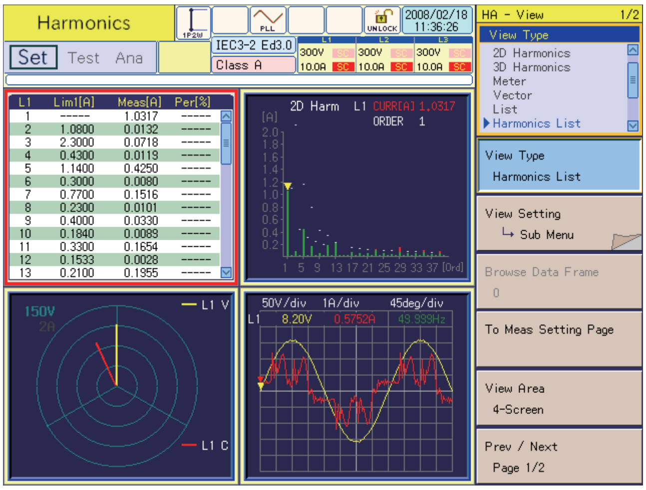
● **Called-up test result data that have been saved**

- Used by calling them up after terminating a test.
- This type of data can be observed by selecting a view type on the HA-Observation and Analysis display (HA-VIEW).

See p. 266

For details on how to call up result files, see “Displaying the File Operation.”

Displaying the HA-Observation and Analysis Display (HA-VIEW)



L1	Lim1[A]	Meas[A]	Per[%]
1	-----	1.0317	-----
2	1.0800	0.0132	-----
3	2.3000	0.0718	-----
4	0.4300	0.0119	-----
5	1.1400	0.4250	-----
6	0.3000	0.0080	-----
7	0.7700	0.1516	-----
8	0.2300	0.0101	-----
9	0.4000	0.0330	-----
10	0.1840	0.0089	-----
11	0.3300	0.1654	-----
12	0.1533	0.0028	-----
13	0.2100	0.1955	-----

Displaying the HA-Observation and Analysis Display (Switching Displays)

1 **Press the HA key.**
The HA key LED illuminates and the HA-Test Conditions List display appears.

2 **Press the VIEW key in the HA-Test Conditions List display.**
The VIEW key LED illuminates and the HA-Observation and Analysis display (HA-VIEW) appears.

3 **Press the VIEW key again.**
The screen switches between the HA-Observation and Analysis display (HA-VIEW) and HA-Observation and Test Conditions display (toggle operation).

If the display does not appear by pressing the HA key

A dialog box “Can’t execute during test/analysis. Please operate it after ending” is displayed and the display switches to the test ending menu.

See p. 146

While the test status display (in the upper left of the screen, “Set” in the case of the figure shown above) is “Test” or “Analysis,” pressing the HA key does not display the HA-Test Conditions List display. Because displaying the HA-Test Conditions List display starts a new test with the test conditions changed, the test that has been executed needs to be terminated.

4 **Press the F3 key (Exit) in the test ending menu.**
The test ends. The test status display on the screen switches from “Analysis” to “Set.” If the test results have not been saved with the F1 key (Save), a dialog box and a menu for saving operation appear. To save the test results, select F1 (Yes); otherwise, select F2 (No).

5 **Press the HA key.**
The HA key LED illuminates and the HA-Test Conditions List display appears.

6 **Press the View key.**
The VIEW key LED illuminates and the HA-Observation and Analysis display (HA-VIEW) appears.

View Type List

View Type	Function	When to use	See Page
V/I Waveform	Displays input voltages/current waveforms.	Setting an appropriate current range.	*164*
	Enlarges and reduces the vertical and horizontal axes.	Measuring the crest factor of a power supply current waveform of the EUT.	
	Displays the values of voltage, current and frequency by using the cursor.	Obtaining the phase difference of the current against the voltage.	
	Sets the current range and checks the operating conditions of the EUT by observing waveforms like an oscilloscope.	Enlarging the waveform of the current at a switching portion.	
		Monitoring the operating status of the EUT in real time.	
2D Harmonics	Displays each of harmonics up to the fortieth order in bar graphs.	Displaying spectral distribution of harmonics.	*165*
	Enlarges and reduces the vertical axis (current).	Displaying the spectral distribution of a specific data frame that was analyzed in the display of Harmonics Trend.	
	Displays the value of the current of a specified harmonic order using the cursor.	Obtaining the margin in relation to a limit value.	
	Displays limit values.	Making judgment on the spot.	
3D Harmonics	Displays each of harmonics up to the fortieth order in bar graphs.	Displaying spectral distribution of harmonics.	*166*
	The bar graph is three-dimensional. The latest data is displayed in the remotest area and moves toward you gradually.	Displaying changes in harmonics in a bird's-eye view.	
	Enlarges and reduces the vertical axis (current).	Displaying the time transition of the spectral distribution of harmonics.	
Meter	Displays measurement items with two analog meters.	Observing changes in measured values.	*166*
	Retains maximum values (displayed in red).	Obtaining the maximum THC value.	
	Both the voltage and current ranges are set to AUTO.	Capturing excessive peaks.	
Vector	Displays input voltages/current phases in vectors.	Obtaining the difference between each phase.	*167*
	Enlarges and reduces the voltage and current axes.	Continuously observing the difference between each phase.	
	Displays the phase difference of the voltage and current.	Obtaining the phase difference of the current against the voltage.	
List	Displays selected measurement items in numeric values.	Obtaining the maximum THC value.	*168*
		Obtaining the maximum value of the apparent power.	
		Monitoring the operating status of the EUT in real time.	

View Type	Function	When to use	See Page
Harmonics List	Displays each of harmonics up to the fortieth order in numeric values.	Displaying spectral distribution of harmonics.	*169*
	Displays hidden parts of the screen by using the scroll function.	Obtaining the margin in relation to a limit value.	
	Displays limit values.	Making judgment on the spot.	
Current Trend	Displays the time transition of the input current (effective value).	Grasping the overall image of input current changes.	*173*
	Enlarges and reduces the vertical axis.	Obtaining the occurrence time of a large current change.	
	Searches for peaks and bottoms.		
Harmonics Trend	Displays the time transition of harmonics.	Grasping the overall image of harmonic changes.	*174*
	Enlarges and reduces the vertical axis.	Monitoring the harmonic of a specific order.	
	Searches for peaks and bottoms.	Obtaining the occurrence time of a large harmonic change.	
Result List	Displays each of harmonics up to the fortieth order in numeric values.	Displaying the spectral distribution of harmonics.	*175*
	Displays hidden parts of the screen by using the scroll function.	Obtaining the margin in relation to a limit value.	
	Displays limit values.	Making a general judgment.	

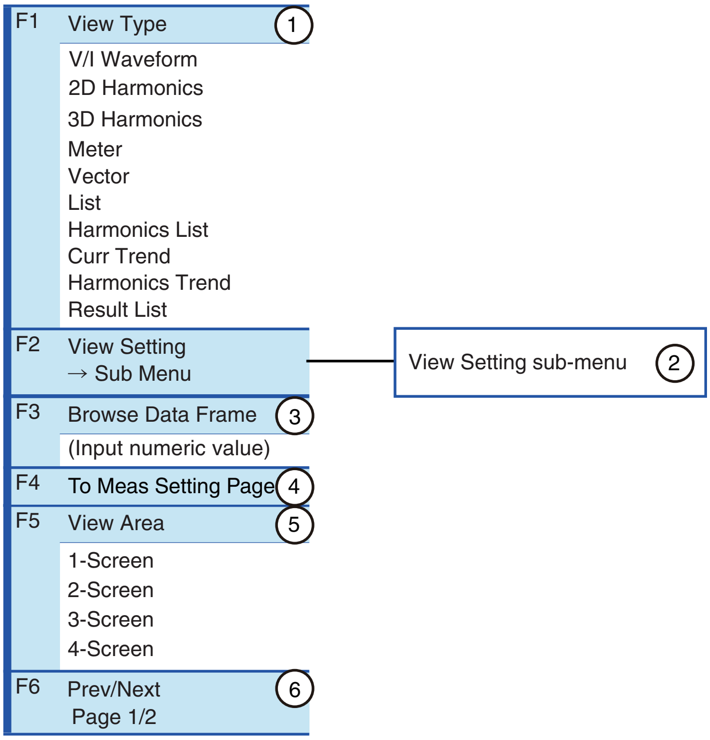
View Type	Function	When to use	See Page
Check AC Power Supply	Checks the performance of the AC power supply (voltage, voltage distortion factor and frequency).	Measuring the performance in real time during the test condition setting before executing the test.	*180*
Repeatability Checking	Checks repeatability.	Selecting a past test result file.	*181*

HA-Observation and Analysis Menu

This menu is composed of two pages. Menu 1/2 contains the common part of the view types and the view setting sub-menu for each view type. Menu 2/2 contains the menu items for checking the AC power supply and repeatability.

Menu Common to All the View Types

Menu 1/2

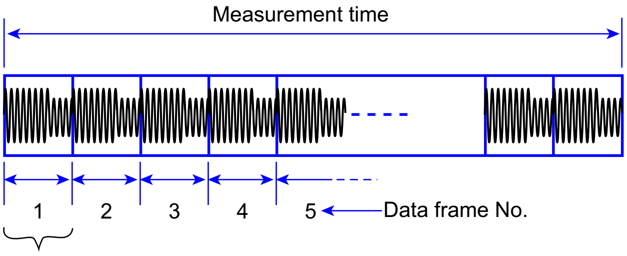


No.	Menu item	Description	Default
1	View Type	Select a view type.	V/I Waveform
2	View Setting sub-menu	For details, see “View Setting Sub-menu.” The sub-menu changes depending on the graph selected in View Type.	–
3	Browse Data Frame	Input the value of the data frame. The measurement time is divided into data frames and the measurement window to be analyzed is specified. The value specified here for the data frame is applied to each view selected in View Type (excluding the Current Trend and Harmonic Trend views). For details on the input range, see "Browsing Data Frame" on page 161. This item is enabled only while the analysis is ongoing. It will be grayed out while any setting or test is ongoing.	–
4	To Meas Setting Page	Switches to page 4/4 of setting menu. This item is enabled only while any setting is ongoing. It will be grayed out while any test or analysis is ongoing.	
5	View Area	Select the number of divisions of the screen.	4-Screen
6	Prev/Next Page 1/2	Switches to the menu page for checking the AC power supply and repeatability.	–

F key: Function key

Browsing Data Frame

The time position of a measurement window can be specified for analysis. The time position of the measurement window is controlled as a data frame. The length of time for each data frame varies depending on the measurement time. The longer the measurement time, the longer the length of time for each data frame and the lower the resolution in the time direction.



Measurement window: 0.2 s or 16 cycles:

Length of time for a data frame

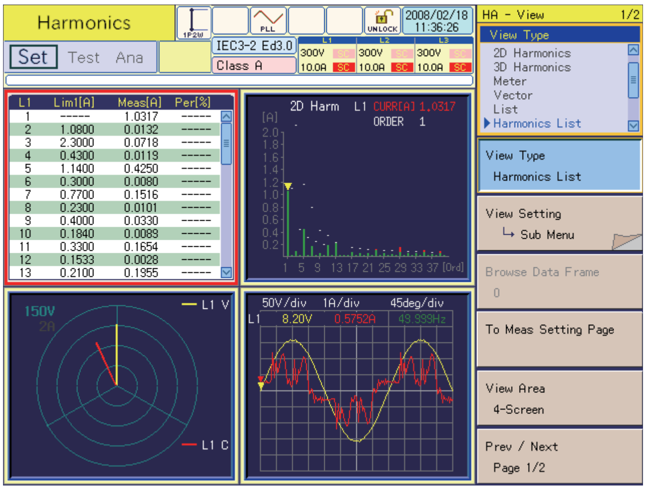
1 measurement window : T ≤ 150 s
2 measurement windows : 150 s < T ≤ 300 s
4 measurement windows : 300 s < T ≤ 600 s
8 measurement windows : 600 s < T ≤ 1200 s
64 measurement window : 1200 s < T ≤ 2400 s
128 measurement windows : 2400 s < T ≤ 4800 s
256 measurement windows : 4800 s < T ≤ 9600 s

T: Measurement time

Measuring technique standard	Measurement time (T)	Time per data frame (second)	Number of data frames that can be input (proportional to measurement time)
IEC 61000-4-7 Ed2.0 IEC 61000-4-7 Ed2.1	T ≤ 150 s	0.2	0 to 750 (fundamental frequency 50 Hz or 60 Hz)
	150 s < T ≤ 300 s	0.4	
	300 s < T ≤ 600 s	0.8	
	600 s < T ≤ 1200 s	1.6	
	1200 s < T ≤ 2400 s	3.2	
	2400 s < T ≤ 4800 s	6.4	
	4800 s < T ≤ 9600 s	12.8	
IEC 61000-4-7 Ed1.0	T ≤ 150 s	0.32[*1]	0 to 469 (fundamental frequency 50 Hz[*1]) 0 to 564 (fundamental frequency 60 Hz[*2])
		0.266[*2]	
	150 s < T ≤ 300 s	0.64[*1]	
		0.532[*2]	
	300 s < T ≤ 600 s	1.28[*1]	
		1.06[*2]	
	600 s < T ≤ 1200 s	2.56[*1]	
		2.13[*2]	
	1200 s < T ≤ 2400 s	5.12[*1]	
		4.25[*2]	
	2400 s < T ≤ 4800 s	10.24[*1]	
		8.51[*2]	
	4800 s < T ≤ 9600 s	20.48[*1]	
		17.02[*2]	

Example: If the measurement time is set to 150 seconds in IEC 61000-4-7 Ed2.0, the setting range of the data frame becomes 0 to 750. Five data frames correspond to 1 second.

Dividing the View Area



L1	Lim1[A]	Meas[A]	Per[%]
1	-----	1.0317	-----
2	1.0800	0.0132	-----
3	2.3000	0.0718	-----
4	0.4300	0.0119	-----
5	1.1400	0.4250	-----
6	0.3000	0.0080	-----
7	0.7700	0.1516	-----
8	0.2300	0.0101	-----
9	0.4000	0.0330	-----
10	0.1840	0.0089	-----
11	0.3300	0.1654	-----
12	0.1533	0.0028	-----
13	0.2100	0.1955	-----

The view area can be divided to simultaneously display different view types.

To select a divided view area, use the UP/DOWN and LEFT/RIGHT keys. The selected area is displayed in a red frame. Some items that can be displayed in a 1-screen view cannot be displayed when the number of view areas exceeds a certain value.

Display Screen when the Scaling Function is used

If the scaling function is used for any external sensor connected, the scale of the graph will be changed according to the scaling value set.

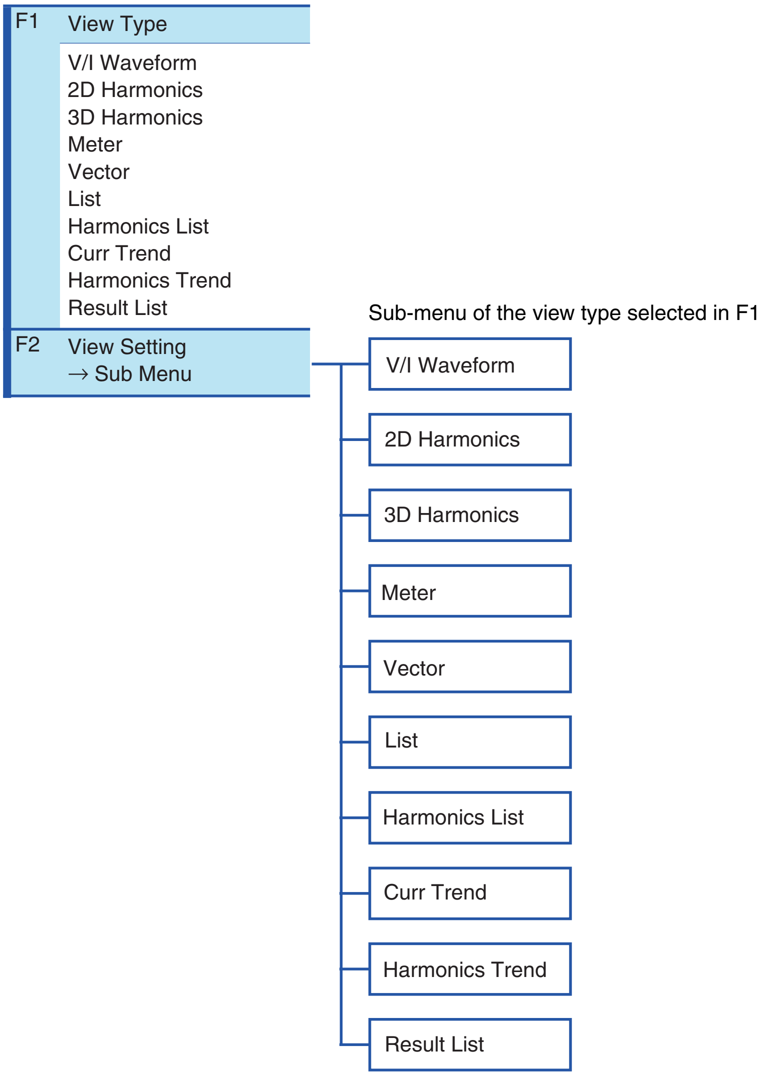
View Setting Sub-menu

The configuration of the View Setting sub-menu is shown below. Observation, analysis and judgment are executed using 10 types of graphs or numeric value display. The general judgment of conformance to the standards is performed using the test results.

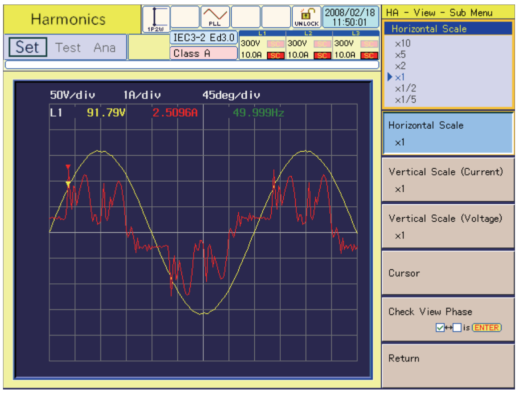
View Setting sub-menu and view area

When the view area is set to 1-Screen, the View Setting sub-menu becomes the sub-menu of the view selected in View Type. When set to 2-Screen, 3-Screen or 4-Screen, select the view type using the UP/DOWN and LEFT/RIGHT keys. The sub-menu of the selected view appears.

Selecting the view type using the UP/DOWN and LEFT/RIGHT keys when the sub-menu is displayed returns the screen from the sub-menu. Press the F2 key again to display the View Setting menu.



V/I Waveform



F1 Horizontal Scale ①
× 10, × 5, × 2,
× 1, × 1/2, × 1/5

F2 Vertical Scale (Current) ②
× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F3 Vertical Scale (Voltage) ③
× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F4 Cursor ④
(Input numeric value)

F5 Check View Phase ⑤
☐ L1
☐ L2
☐ L3

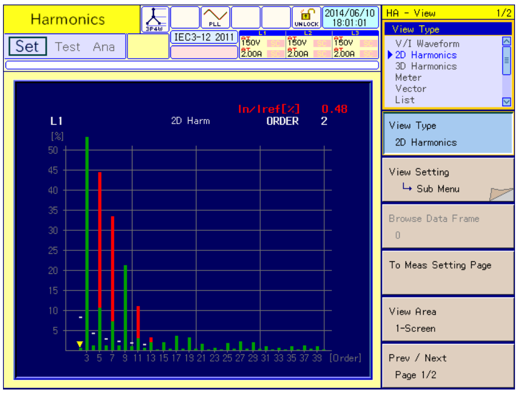
F6 Return ⑥

No.	Menu item	Description	Default
1	Horizontal Scale	Select a horizontal scale (scale factor). During analysis, it is fixed to × 1.	× 1
2	Vertical Scale (Current)	Select a vertical scale of voltage (scale factor).	× 1
3	Vertical Scale (Voltage)	Select a vertical scale of current (scale factor).	× 1
4	Cursor	Moves the cursor in the horizontal axis direction (time). Move the cursor using the small knob or the large knob. The measured value at the cursor is displayed.	1
5	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
6	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The waveform of each phase is displayed in a specific color. As for current, L1 is displayed in red, L2 in greenish yellow and L3 in purple, and for voltage, L1 in yellow, L2 in green and L3 in magenta.
- Used for observation and analysis.
- If you set Limit Values to 3rd/5th/Current Wave for the IEC 61000-3-2 Ed5.0 Class C standard, the six phase angles that are required by the standard are displayed.

2D Harmonics



F1 Vertical Scale (Current) ①
× 10, × 5, × 2,
× 1, × 1/2, × 1/4, log

F2 Cursor ②
(Input numeric value)

F5 Check View Phase ③
L1
L2
L3

F6 Return ④

No.	Menu item	Description	Default
1	Vertical Scale (Current)	Select a vertical scale of current (scale factor). The vertical scale is displayed in the following manner. "log" denotes logarithmic scale. 61000-3-2: Current 61000-3-12 2011: Percentage of the rms current[*1], [*2] 61000-3-12 2004: Percentage of the fundamental current[*2]	× 1
2	Cursor	Moves the cursor in the horizontal direction (harmonic order). Move the cursor using the small knob or the large knob. The measured value at the cursor is displayed.	1
3	Check View Phase	Select a phase to be measured.	L1
4	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

[*1] In 61000-3-12 2011, in place of displaying the percentage of the reference current Iref, which is the rms current during the test period, the instantaneous rms current is used.

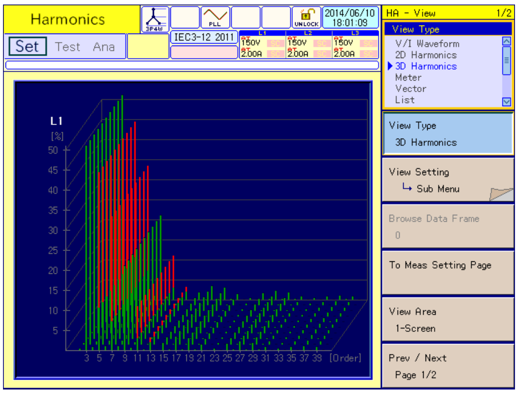
[*2] The bar graph of the 1st harmonic order is not displayed.

- Display color changes.

Graph	Judgment
White	Limit value
Red	Part exceeding 100% of the limit value
Yellow	Part exceeding the set margin value and up to 100% of the limit value
Green	Part up to the set margin value
–	Part up to the set margin value

- Used for observation, analysis and judgment.

3D Harmonics



F1 Vertical Scale (Current) ①

× 10, × 5, × 2,
× 1, × 1/2, × 1/4, log

F5 Check View Phase ②

L1
L2
L3

F6 Return ③

No.	Menu item	Description	Default
1	Vertical Scale (Current)	Select a vertical scale of current (scale factor). The vertical scale is displayed in the following manner. "log" denotes logarithmic scale. 61000-3-2: Current 61000-3-12 2011: Percentage of the rms current[*1,*2] 61000-3-12 2004: Percentage of the fundamental current[*2]	× 1
2	Check View Phase	Select a phase to be displayed.	L1
3	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

*1. In 61000-3-12 2011, in place of displaying the percentage of the reference current Iref, which is the rms current during the test period, the instantaneous rms current is used.

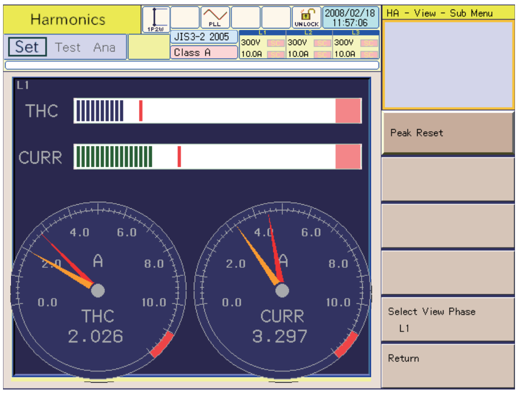
*2. The bar graph of the 1st harmonic order is not displayed.

- Display color changes.

Graph	Judgment
Red	Part exceeding 100% of the limit value
Yellow	Part exceeding the set margin value and up to 100% of the limit value
Green	Part up to the set margin value

- Used for observation and analysis.

Meter



F1 Peak Reset ①

F5 Check View Phase ②

L1
L2
L3

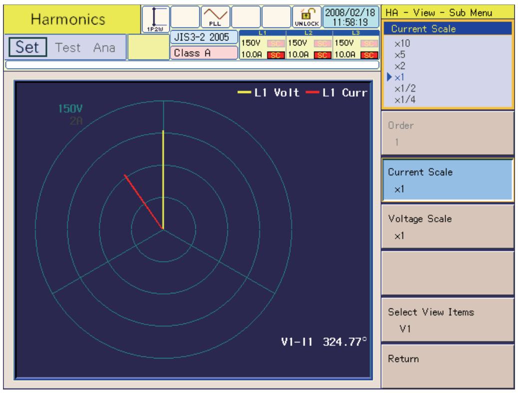
F6 Return ③

No.	Menu item	Description	Default
1	Peak Reset	Resets a maximum value. This item cannot be used during analysis.	–
2	Check View Phase	Select a phase to be displayed.	L1
3	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The red area of the meter scale indicates 110 to 120 % of the measurement range.
- Used for observation and analysis.

Vector



F1 Order ①
(Input numeric value)

F2 Current Scale ②
× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F3 Voltage Scale ③
× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F5 Select View Items ④
☐ V1
☐ I1
☐ V2
☐ I2
☐ V3
☐ I3

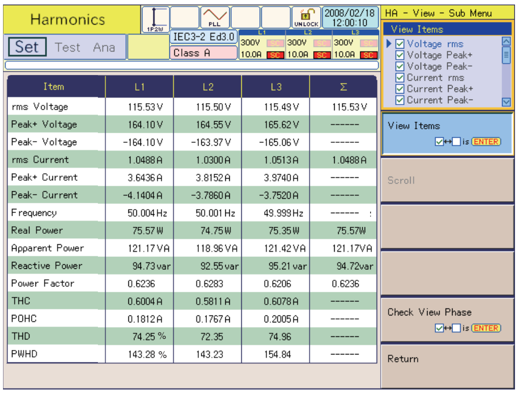
F6 Return ⑤

No.	Menu item	Description	Default
1	Order	Select a harmonic order. This function is now not available. It is fixed to 1. The menu is displayed dimmed.	1
2	Current Scale	Select a vertical scale of current (scale factor).	× 1
3	Voltage Scale	Select a vertical scale of voltage (scale factor).	× 1
4	Select View Items	Select an item to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	V1, I1, V2, I2, V3, I3
5	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- Used for observation and analysis.

List



Item	L1	L2	L3	Σ
rms Voltage	115.53 V	115.50 V	115.49 V	115.53 V
Peak+ Voltage	164.10 V	164.55 V	165.62 V	------
Peak- Voltage	-164.10 V	-163.97 V	-165.06 V	------
rms Current	1.0488 A	1.0300 A	1.0513 A	1.0488 A
Peak+ Current	3.6436 A	3.8152 A	3.9740 A	------
Peak- Current	-4.1404 A	-3.7860 A	-3.7520 A	------
Frequency	50.004 Hz	50.001 Hz	49.999 Hz	------
Real Power	75.57 W	74.75 W	75.35 W	75.57W
Apparent Power	121.17 VA	118.96 VA	121.42 VA	121.17VA
Reactive Power	94.73 var	92.55 var	95.21 var	94.72var
Power Factor	0.6236	0.6283	0.6206	0.6236
THC	0.6004 A	0.5811 A	0.6078 A	------
POHC	0.1812 A	0.1767 A	0.2005 A	------
THD	74.25 %	72.35	74.96	------
PWHD	143.28 %	143.23	154.84	------

F1 Select View Items ①
☐ Voltage rms
☐ Voltage Peak +, ☐ Voltage Peak -
☐ Current rms
☐ Current Peak +, ☐ Current Peak -
☐ Frequency
☐ Real Power (W)
☐ Apparent Power (VA)
☐ Reactive Power (var), ☐ Power Factor
☐ THC, ☐ POHC
☐ THD/Iref, ☐ PWHC/Iref 61000-3-12 2011
☐ THD, ☐ PWHD 61000-3-12 2004

F2 Scroll ②
(Input numeric value)

F5 Check View Phase ③
☐ L1
☐ L2
☐ L3

F6 Return ④

No.	Menu item	Description		Default
1	Select View Items	Select an item to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.		Current rms
		Voltage rms	Effective value of input voltage	
		Voltage Peak +	Positive amplitude peak value of input voltage	
		Voltage Peak -	Negative amplitude peak value of input voltage	
		Current rms	Effective value of input current	
		Current Peak +	Positive amplitude peak value of input current	
		Current Peak -	Negative amplitude peak value of input current	
		Frequency	Input frequency measured with input voltage	
		Real Power [*1](W)	Real power (W) of the EUT	
		Apparent Power[*1] (VA)	Apparent power (VA) of the EUT	
		Reactive Power [*1](var)	Reactive power (var) of the EUT	
		Power Factor[*1]	Power factor of the EUT	
		THC	Total harmonic current of input current, effective value of all the harmonic current components from the 2nd to 40th order	
		POHC	Odd-order harmonic current of input current, effective value of odd-order harmonic current components from the 21st to 39th order	
		THD[*2]	Total harmonic distortion factor of input current, effective value ratio of all the harmonic current components from the 2nd to the 40th order against the effective value of the fundamental components	
		THD-I	Total harmonic distortion factor of input current, effective value ratio of rms current from the 2nd to the 40th order against the effective value of the fundamental components	
		PWHD[*2]	Partial-weighted harmonic distortion factor of input current, effective value ratio of all the harmonic current components from the 14th to 40th order against the effective value of the fundamental components	

---

*1 In a three-phase three-wire connection, the Σ (sigma) values are the valid values. The values of each phase (L1 to L3) carry no meaning, so they are displayed as "-----."

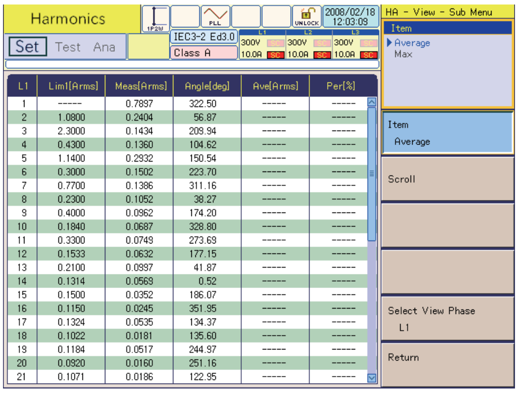
*2 In 61000-3-12 2011, THD becomes THC/Iref, and PWHD becomes PWHC/Iref. Iref is displayed as "-----," because it is determined at the end of the test.

No.	Menu item	Description	Default
2	Scroll	Displayed when there are too many items to be displayed simultaneously. Use this item to see the hidden portion of the screen. Turn the small knob to vertically move the screen.	–
3	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
4	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- Used for observation and analysis.
- The sigma (Σ) value is an average or total sum. Refer to the appendix for the calculation formula.

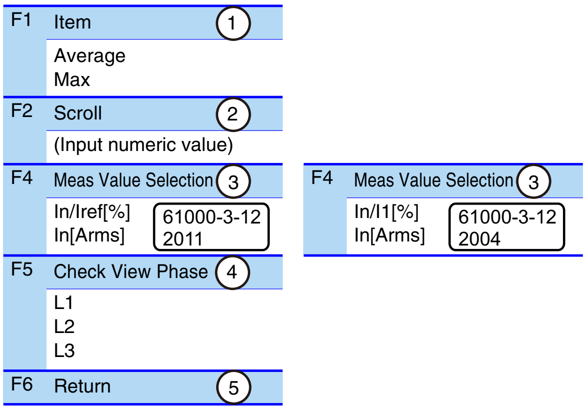
Harmonics List



Item
Average

Select View Phase
L1

L1	Lim1[Arms]	Meas[Arms]	Angle[deg]	Ave[Arms]	Per[%]
1	-----	0.7897	322.50	-----	-----
2	1.0800	0.2404	56.87	-----	-----
3	2.3000	0.1434	209.94	-----	-----
4	0.4300	0.1360	104.62	-----	-----
5	1.1400	0.2932	150.54	-----	-----
6	0.3000	0.1502	223.70	-----	-----
7	0.7700	0.1386	311.16	-----	-----
8	0.2300	0.1052	38.27	-----	-----
9	0.4000	0.0962	174.20	-----	-----
10	0.1840	0.0687	328.80	-----	-----
11	0.3300	0.0749	273.69	-----	-----
12	0.1533	0.0632	177.15	-----	-----
13	0.2100	0.0997	41.87	-----	-----
14	0.1314	0.0569	0.52	-----	-----
15	0.1500	0.0352	186.07	-----	-----
16	0.1150	0.0245	351.95	-----	-----
17	0.1324	0.0535	134.37	-----	-----
18	0.1022	0.0181	135.60	-----	-----
19	0.1184	0.0517	244.97	-----	-----
20	0.0920	0.0160	251.16	-----	-----
21	0.1071	0.0186	122.95	-----	-----



No.	Menu item	Description	Default
1	Item	Select the “Average” or “Maximum” value of a display item.	Average
2	Scroll	Displayed when there are too many items to be displayed simultaneously. Use this item to see the hidden portion of the screen. Turn the small knob to vertically move the screen.	–
3	Meas Value Selection	Select a measured value to be displayed. Select the percentage or the current value. This item is enabled when IEC 61000-3-12 is selected.	–
4	Check View Phase	Select a phase to be displayed.	L1
5	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The display color of numeric values changes.

Measured value	Judgment
Red	Part exceeding 100% of the limit value
Yellow	Part exceeding the set margin value and up to 100% of the limit value
Black	Part up to the set margin value

- Used for observation, analysis and judgment.

Explanation of display items

● 61000-3-2

Item	Order	Lim1[Arms]	Meas[Arms]	Angle[deg]	Ave[Arms]	Per[%]
					Max[Arms]	
Description	Harmonic orders 1st to 40th, POHC	Limit value (A)	Measured value of harmonic current (A)	Measured value of phase angle	(Upper) Average value (A) from the beginning of the test When “Average” is selected with the F1 key	Ratio of the Ave[Arms] to limit value when “Average” is selected with the F1 key Ratio of the Max[Arms] to limit value when “Maximum” is selected with the F1 key
					(Lower) Maximum value (A) from the beginning of the test When “Maximum” is selected with the F1 key	
		“-----” means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)	Display color changes.	–	“-----” means there is no value to be displayed: • In the test condition setting state (real-time measurement)	–

Measured values are those in a selected data frame.

● 61000-3-12 2011

When In/Iref[%] is selected with the F4 key

Item	Order	Lim1[%]	Meas[%]	Angle[%]	Ave[%]	Per[%]
					Max[%]	
Description	Harmonic orders 1st to 40th. The 1st order is the reference current[*1], THC[*2] and PWHC.	Limit value (%)	Measured value of harmonic current Ratio (%) to reference current	Measured value of phase angle	(Upper) Average value (%) from the beginning of the test When "Average" is selected with the F1 key	Ratio of the Ave[%] to limit value when "Average" is selected with the F1 key Ratio of the Max[%] to limit value when "Maximum" is selected with the F1 key
					(Lower) Maximum value (%) from the beginning of the test When "Maximum" is selected with the F1 key	
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)	Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

*1. Instantaneous rms current is substituted for reference current Iref.
*2. THC denotes THC/Iref; PWHC denotes PWHC/Iref. Iref is displayed as "-----," because it is determined at the end of the test.

Measured values are those in a selected data frame. They are expressed as the ratio to the reference fundamental current.

● 61000-3-12 2011

When In[Arms] is selected with the F4 key

Item	Order	Lim1[A]	Meas[Arms]	Angle[deg]	Ave[Arms]	Per[%]
					Max[Arms]	
Description	Harmonic orders 1st to 40th. The 1st order is the reference current[*1], THC[*2] and PWHC.	"-----" means there is no value to be displayed.	Measured value of harmonic current (A)	Measured value of phase angle	(Upper) Average value (A) from the beginning of the test When "Average" is selected with the F1 key	Ratio of the Ave[%] to limit value when "Average" is selected with the F1 key Ratio of the Max[%] to limit value when "Maximum" is selected with the F1 key
					(Lower) Maximum value (A) from the beginning of the test When "Maximum" is selected with the F1 key	
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)	Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

*1. Instantaneous rms current is substituted for reference current Iref.
*2. THC denotes THC/Iref; PWHC denotes PWHC/Iref. Iref is displayed as "-----," because it is determined at the end of the test.

Measured values are those in a selected data frame.

● 61000-3-12 2004

When In/I1[%] is selected with the F4 key

Item	Order	Lim1[%]	Meas[%]	Angle[%]	Ave[%] Max[%]	Per[%]
Description	Harmonic orders 1st to 40th. The 1st order is the reference fundamental current, THD and PWHD.	Limit value (%)	Measured value of harmonic current Ratio (%) to reference fundamental current	Measured value of phase angle	(Upper) Average value (%) from the beginning of the test When "Average" is selected with the F1 key (Lower) Maximum value (%) from the beginning of the test When "Maximum" is selected with the F1 key	Ratio of the Ave[%] to limit value when "Average" is selected with the F1 key Ratio of the Max[%] to limit value when "Maximum" is selected with the F1 key
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)	Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

Measured values are those in a selected data frame. They are expressed as the ratio to the reference fundamental current.

● 61000-3-12 2004

When In[Arms] is selected with the F4 key

Item	Order	Lim1[A]	Meas[Arms]	Angle[deg]	Ave[Arms] Max[Arms]	Per[%]
Description	Harmonic orders 1st to 40th. The 1st order is the reference fundamental current, THD and PWHD.	"-----" means there is no value to be displayed.	Measured value of harmonic current (A)	Measured value of phase angle	(Upper) Average value (A) from the beginning of the test When "Average" is selected with the F1 key (Lower) Maximum value (A) from the beginning of the test When "Maximum" is selected with the F1 key	Ratio of the Ave[%] to limit value when "Average" is selected with the F1 key Ratio of the Max[%] to limit value when "Maximum" is selected with the F1 key
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)	Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

Measured values are those in a selected data frame.

Current Trend

F1 Vertical Scale (Current) ①
× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F2 Peak Search ②

F3 Bottom Search ③

F4 Display Peak Current ④
☐ rms
☐ Peak

F5 Check View Phase ⑤
☐ L1
☐ L2
☐ L3

F6 Return ⑥

No.	Menu item	Description	Default
1	Vertical Scale (Current)	Select the vertical scale of current (scale factor)	× 1
2	Peak Search	Searches for a maximum value. The cursor moves to the maximum value. The current value at the cursor and the elapsed time from the test start are displayed.	–
3	Bottom Search	Searches for a minimum value. The cursor moves to the minimum value. The current value at the cursor and the elapsed time from the test start are displayed.	–
4	Display Peak Current	Select a display format of the peak current from either “rms” or “Peak.”	rms
5	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
6	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The waveform of each phase is displayed in a specific color. As for current, L1 is displayed in red, L2 in greenish yellow and L3 in purple.
- Used for observation and analysis.

Harmonics Trend

Order
3

Vertical Scale (Current)
×1

F1 Order ①
1, 2, ... 40

F2 Vertical Scale (Current) ②
× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F3 Peak Search ③

F4 Bottom Search ④

F5 Check View Phase ⑤
☐ L1
☐ L2
☐ L3

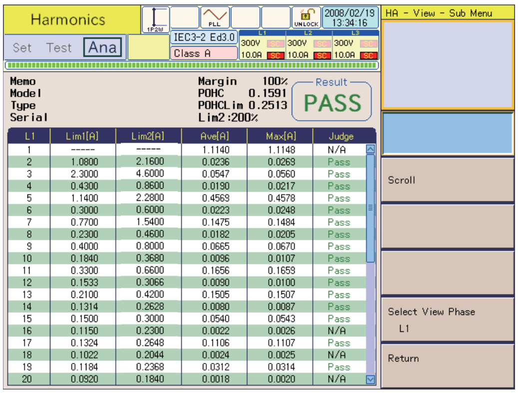
F6 Return ⑥

No.	Menu item	Description	Default
1	Order	Select a harmonic order.	1
2	Vertical Scale (Current)	Selects the vertical scale of current (scale factor).	× 1
3	Peak Search	Searches for a maximum value. The cursor moves to the maximum value. The current value at the cursor and the elapsed time from the test start are displayed.	–
4	Bottom Search	Searches for a minimum value. The cursor moves to the minimum value. The current value at the cursor and the elapsed time from the test start are displayed.	–
5	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
6	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The waveform of each phase is displayed in a specific color. As for current, L1 is displayed in red, L2 in greenish yellow and L3 in purple.
- Used for observation and analysis.

Result List (with the Standard Judgment Function)



Memo
Model
Type
Serial

Margin 100%
POHC 0.1591
POHCLim 0.2513
Lim2:200%

Result
PASS

L1	Lim1[A]	Lim2[A]	Ave[A]	Max[A]	Judge
1	-----	-----	1.1140	1.1148	N/A
2	1.0800	2.1600	0.0236	0.0269	Pass
3	2.3000	4.6000	0.0547	0.0560	Pass
4	0.4300	0.8600	0.0190	0.0217	Pass
5	1.1400	2.2800	0.4569	0.4578	Pass
6	0.3000	0.6000	0.0223	0.0248	Pass
7	0.7700	1.5400	0.1475	0.1484	Pass
8	0.2300	0.4600	0.0182	0.0205	Pass
9	0.4000	0.8000	0.0665	0.0670	Pass
10	0.1840	0.3680	0.0096	0.0107	Pass
11	0.3300	0.6600	0.1656	0.1659	Pass
12	0.1533	0.3066	0.0090	0.0100	Pass
13	0.2100	0.4200	0.1505	0.1507	Pass
14	0.1314	0.2628	0.0080	0.0087	Pass
15	0.1500	0.3000	0.0540	0.0543	Pass
16	0.1150	0.2300	0.0022	0.0026	N/A
17	0.1324	0.2648	0.1106	0.1107	Pass
18	0.1022	0.2044	0.0024	0.0025	N/A
19	0.1184	0.2368	0.0312	0.0314	Pass
20	0.0920	0.1840	0.0018	0.0020	N/A

F2 Scroll ①
(Input numeric value)

F4 Meas Value Selection ②
In/I1[%]
In[Arms]

F5 Check View Phase ③
L1
L2
L3

F6 Return ④

No.	Menu item	Description	Default
1	Scroll	Displayed when there are too many items to be displayed simultaneously. Use this item to see the hidden portion of the screen. Turn the small knob to vertically move the screen.	–
2	Meas Value Selection	Select a measured value to be displayed. Select the percentage or the current value. This item is enabled when IEC 61000-3-12 is selected.	–
3	Check View Phase	Select a phase to be displayed.	L1
4	Return	Terminates the view setting.	–

F key: Function key

- The display color of numeric values changes.

Measured value	Judgment
Red	Ave: Part exceeding 100% of the limit value
	Max: Part exceeding 150% or 200% of the limit value
	POHC: When exceeding POHCLim
Yellow	Part exceeding the set margin value and up to 100% of the limit value
Black	Part up to the set margin value

- Used for analysis and judgment.

Explanation of display items

● General judgment and judgment of conformance to the standards for harmonic current of each order

Item	Description
Result	General judgment (PASS/FAIL/WARN) Displays WARN if the margin is exceeded. Displays ABORT if the test is aborted[*1] .
Margin---%	Margin in relation to the limit value
POHC	Maximum POHC value during the test
POHCLim	POHC calculated from applied limit value
Lim2:200 %	Indicates that the Lim2 value is 200 % of the limit value.

*1. The test is aborted when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

● 61000-3-2

Item	Order	Lim1[Arms]	Lim2[Arms]	Ave[Arms]	Max[Arms]	Judge
Description	Harmonic orders 1st to 40th	Limit value (A)	150% or 200% of the limit value (A)	Average value of all the test times (A)	Maximum value during the test (A)	Judgment of the limit values
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)	Display color changes.	–	"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	"N/A" indicates that limit values are not applied: When limit values do not exist When a measured harmonic current value is smaller than 0.6% of the input current or 5 mA, whichever is larger When the real power is 75 W or less in Class A, B or D

● 61000-3-12 2011

When In/Iref[%] is selected with the F4 key

Item	Order	Lim1[%]	Lim2[%]	Ave[%]	Max[%]	Per[%]	Judge
Description	Harmonic orders 1st to 40th. The 1st order is the reference current*1 , THC*2 and PWHC.	Limit value (A)	150% of the limit value (A)	Average value of all the test times. Ratio (%) to the reference fundamental current	Maximum value in all the test times. Ratio (%) to the reference fundamental current	Ratio to the limit value	Judgment of the limit values
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)		Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

*1. Instantaneous rms current is substituted for reference current Iref.

*2. THC denotes THC/Iref; PWHC denotes PWHC/Iref.

● 61000-3-12 2011

When In[Arms] is selected with the F4 key

Item	Order	Lim1[%]	Lim2[%]	Ave[A]	Max[A]	Per[%]	Judge
Description	Harmonic orders 1st to 40th. The 1st order is the reference current*1 , THC*2 and PWHC.	"-----" means there is no numeric value to be displayed.		Average value of all the test times (A)	Maximum value (A) in all the test times	Ratio to the limit value	Judgment of the limit values
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)		Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

*1. Instantaneous rms current is substituted for reference current Iref.

*2. THC denotes THC/Iref; PWHC denotes PWHC/Iref.

- **61000-3-12 2004**

When In/I1[%] is selected with the F4 key

Item	Order	Lim1[%]	Lim2[%]	Ave[%]	Max[%]	Per[%]	Judge
Description	Harmonic orders 1st to 40th. The 1st order is the reference fundamental current, THD and PWHD.	Limit value (A)	150% of the limit value (A)	Average value of all the test times. Ratio (%) to the reference fundamental current	Maximum value in all the test times. Ratio (%) to the reference fundamental current	Ratio to the limit value	Judgment of the limit values
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)		Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

- **61000-3-12 2004**

When In[Arms] is selected with the F4 key

Item	Order	Lim1[%]	Lim2[%]	Ave[A]	Max[A]	Per[%]	Judge
Description	Harmonic orders 1st to 40th. The 1st order is the reference fundamental current, THD and PWHD.	"-----" means there is no numeric value to be displayed.		Average value of all the test times (A)	Maximum value (A) in all the test times	Ratio to the limit value	Judgment of the limit values
		"-----" means there is no numeric value to be displayed: • When limit values do not exist • When a calculated limit value is less than 0.0001 A (0.001 A in the 10 A range or higher)		Display color changes.		"-----" means there is no value to be displayed: • In the test condition setting state (real-time measurement)	

Rsce (short circuit ratio) and limits

This product uses a preset reference Rsce value to determine the limits of each order and uses them to perform pass/fail judgments. As such, if a pass judgment is obtained, connection is possible to a power supply that has a short circuit ratio greater than or equal to the reference Rsce.

The minimum Rsce value (Minimum Rsce (measured)) is displayed in reports. This value is determined through backcalculation based on the limits corresponding to the average and maximum values of each harmonic current order measured in the test period.

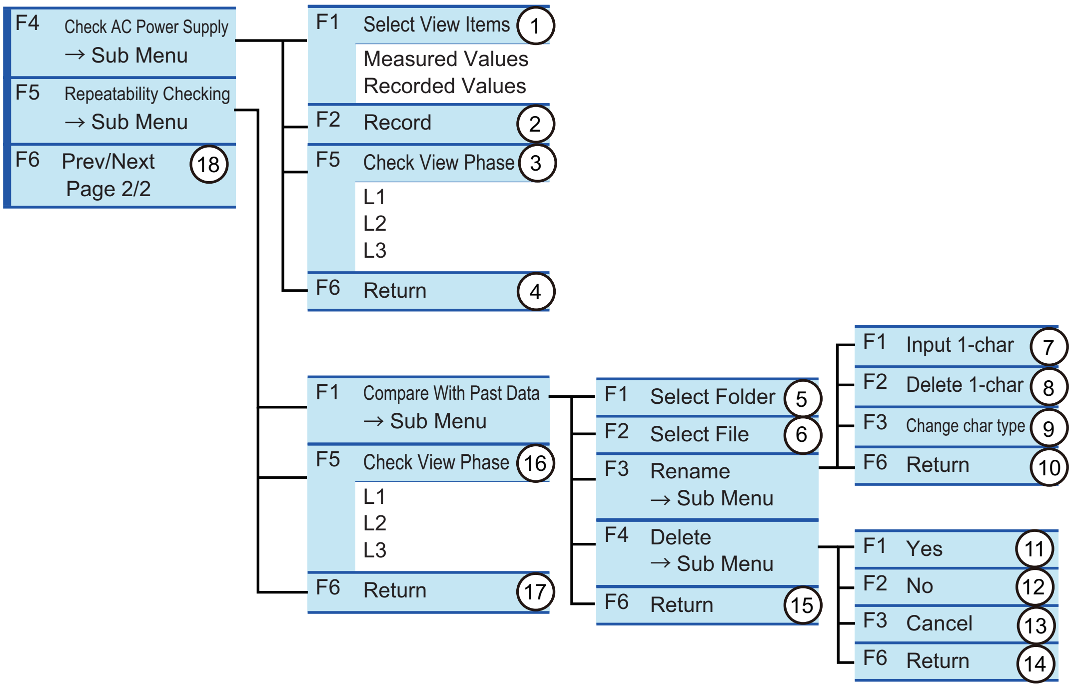
If you want to check the limit corresponding to the minimum Rsce value, run the test once to measure the minimum Rsce value. Then, set the reference Rsce value to the obtained value and run the test again to display the test report and the limit values corresponding to the limit values of the result list. The measurement time can be short. In principle, a fail judgment may result due to measurement errors or differences in the phase currents (in the case of three phase), but this is not abnormal.

Checking the AC Power Supply and Repeatability

WARNING

- **To prevent an electric shock, do not touch the SOURCE and LOAD terminals of this product.**
- **Do not touch the OUTPUT terminal of the AC Power Supply.**
- **Do not touch the INPUT and OUTPUT terminals of the Line Impedance Network.**

Menu 2/2



No.	Menu item	Description	Default
1	Select View Items	Specify the values to display. Select either the currently measured values or the values that have been recorded to the KHA3000. This can only be selected when you are using the following standards. • IEC 61000-3-12 2004 • IEC 61000-3-12 2011 • JIS 61000-3-2 2005 (Using reference impedance) • JIS 61000-3-2 2019 (Using reference impedance)	Measured Values
2	Record	Records the current measured values. This can only be selected when you are using the following standards. • IEC 61000-3-12 2004 • IEC 61000-3-12 2011 • JIS 61000-3-2 2005 (Using reference impedance) • JIS 61000-3-2 2019 (Using reference impedance) A test cannot be started without checking the AC power source and recording the result before the test. You can use the SD006-KHA application software to print these recorded values.	–

3	Check View Phase	Select a phase to be displayed.	L1
4	Return	Terminates the AC power supply check.	–
5	Select Folder	Select a folder that has been saved. Every time the F1 key is pressed, the selected folder is indicated with a frame. The value shown in contents of menu selected is the folder number (the number of the top folder is 1).	–
6	Select File	Select a folder that has been saved. Every time the F2 key is pressed, the selected folder is indicated with a frame. The value shown in contents of menu selected is the folder number (the number of the top folder is 1).	–
7	Input 1-char	Used to enter characters for the file. Up to 20 alphanumeric characters and up to 10 hiragana and katakana characters can be input. For details on the procedure, see page 179.	–
8	Delete 1-char	Used to delete characters in the file. For details on the procedure, see page 179.	–
9	Change char type	Used to change the character types of the file. Every time the F3 key is pressed, the character types switch to alphanumeric, hiragana and katakana characters in this order.	–
10	Return	Terminates the rename operation.	–
11	Yes	Deletes the file.	–
12	No	Does not delete the file.	–
13	Cancel	Cancels the delete operation.	–
14	Return	Terminates the delete operation.	–
15	Return	Terminates the operation of comparing the file with past data.	–
16	Check View Phase	Select a phase to be displayed.	L1
17	Return	Terminates the repeatability check.	–
18	Prev/Next Page 2/2	Switches to the menu page common to the view types.	–

F key: Function key. You can also use the ESC key to return.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 **Press the F3 (Rename) key.**

The Rename dialog will be presented.

2 **Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.**

3 **Press the F1 (Input 1-char) key.**

The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 **Press the ENTER key.**

The characters entered will be fixed and saved.

Checking the AC Power Supply

Use this menu to check the performance of the AC power supply (voltage, voltage distortion factor and frequency). Check the performance using the LOAD terminal of this product. When the test conditions are set before the test is executed, judgment (PASS/FAIL) is made by real-time measurement. After the test is executed, judgment (PASS/FAIL) is made from in-test measurement values.

When the connection cable to the EUT is long, standard requirements may not be satisfied because of an increase in voltage drop and inductance.

● Operation when the following standards are selected and operation of this product

- IEC 61000-3-2 standard

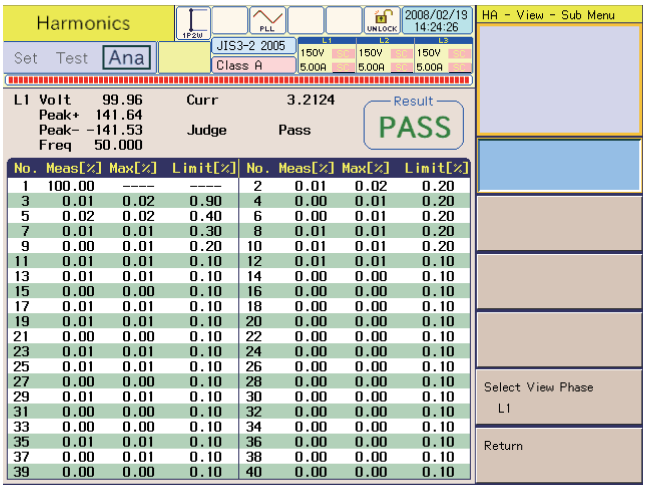
  Jjudgment (PASS/FAIL) is made from the measurement values after the test.

- JIS 61000-3-2 2005 standard (Using reference impedance), JIS 61000-3-2 2019 standard (Using reference impedance) or IEC 61000-3-12 standard

  Before starting the test, remove the equipment under test (EUT) and check the AC power source.

  Press the F2 (Record) key to record the measured values. If you do not record the values, when you set Select View Items to Measured Values, the correct values will not be displayed.

  After the test starts, the recorded values will be displayed.



L1 Volt 99.96
Peak+ 141.64
Peak- -141.53
Freq 50.000
Curr 3.2124
Judge Pass
Result PASS

No.	Meas[%]	Max[%]	Limit[%]	No.	Meas[%]	Max[%]	Limit[%]
1	100.00	----	----	2	0.01	0.02	0.20
3	0.01	0.02	0.90	4	0.00	0.01	0.20
5	0.02	0.02	0.40	6	0.00	0.01	0.20
7	0.01	0.01	0.30	8	0.01	0.01	0.20
9	0.00	0.01	0.20	10	0.01	0.01	0.20
11	0.01	0.01	0.10	12	0.01	0.01	0.10
13	0.01	0.01	0.10	14	0.00	0.00	0.10
15	0.00	0.00	0.10	16	0.00	0.00	0.10
17	0.01	0.01	0.10	18	0.00	0.00	0.10
19	0.01	0.01	0.10	20	0.00	0.00	0.10
21	0.00	0.00	0.10	22	0.00	0.00	0.10
23	0.01	0.01	0.10	24	0.00	0.00	0.10
25	0.01	0.01	0.10	26	0.00	0.00	0.10
27	0.00	0.00	0.10	28	0.00	0.00	0.10
29	0.01	0.01	0.10	30	0.00	0.00	0.10
31	0.00	0.00	0.10	32	0.00	0.00	0.10
33	0.00	0.00	0.10	34	0.00	0.00	0.10
35	0.01	0.01	0.10	36	0.00	0.00	0.10
37	0.00	0.01	0.10	38	0.00	0.00	0.10
39	0.00	0.00	0.10	40	0.00	0.00	0.10

Explanation of display items

Item	Description
Volt	Effective value of voltage (V)
Curr	Effective value of current (A)
Peak+	Positive peak voltage (V)
Peak-	Negative peak voltage (V)
Freq	Frequency (Hz)
Result	Result of the general judgment (PASS/FAIL)

Item	Order	Meas[%)]	Max[%]	Limit[%]
Description	Harmonic orders 1st to 40th	Measured value of voltage distortion factor (%). Continuously in measurement state during test condition setting. Measured value at the end of the test time during analysis.	Worst value of in-test distortion factor	Limit value of distortion factor (%)

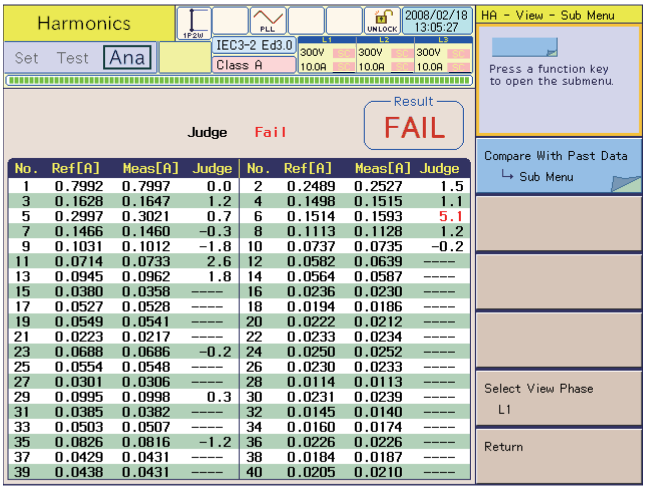
Repeatability Checking

Use this menu to check repeatability. To perform this check, the test results to be compared with each other must have been obtained from tests executed under the same conditions with the same test system. Select one of the past test result files that has the same test conditions as the current one.

Values are compared for each harmonic order conforming to the selected test standard as a test condition and then the values are automatically judged. This menu can be set after analysis and test execution. Before the test, the menu is displayed dimmed and cannot be selected.

See p. 267

Select a past test result file in the File Operation display. File operations such as file name change and file deletion are possible.



Result FAIL

Judge Fail

No.	Ref[A]	Meas[A]	Judge	No.	Ref[A]	Meas[A]	Judge
1	0.7992	0.7997	0.0	2	0.2489	0.2527	1.5
3	0.1628	0.1647	1.2	4	0.1498	0.1515	1.1
5	0.2997	0.3021	0.7	6	0.1514	0.1593	5.1
7	0.1466	0.1460	-0.3	8	0.1113	0.1128	1.2
9	0.1031	0.1012	-1.8	10	0.0737	0.0735	-0.2
11	0.0714	0.0733	2.6	12	0.0582	0.0639	----
13	0.0945	0.0962	1.8	14	0.0564	0.0587	----
15	0.0380	0.0358	----	16	0.0236	0.0230	----
17	0.0527	0.0528	----	18	0.0194	0.0186	----
19	0.0549	0.0541	----	20	0.0222	0.0212	----
21	0.0223	0.0217	----	22	0.0233	0.0234	----
23	0.0688	0.0686	-0.2	24	0.0250	0.0252	----
25	0.0554	0.0548	----	26	0.0230	0.0233	----
27	0.0301	0.0306	----	28	0.0114	0.0113	----
29	0.0995	0.0998	0.3	30	0.0231	0.0239	----
31	0.0385	0.0382	----	32	0.0145	0.0140	----
33	0.0503	0.0507	----	34	0.0160	0.0174	----
35	0.0826	0.0816	-1.2	36	0.0226	0.0226	----
37	0.0429	0.0431	----	38	0.0184	0.0187	----
39	0.0438	0.0431	----	40	0.0205	0.0210	----

Explanation of display items

Item	Description
Result	Judgment for limit value (PASS/FAIL)

Item	Order	Ref[A]	Meas[A]	Judge
Description	Harmonic orders 1st to 40th	Harmonic current (A) of a reference file used for comparison	Harmonic current (A) of a current test result	Ratio of a current test result to a reference value {(Meas-Ref)/Ref} × 100% When you have selected IEC 61000-3-2 Ed5.0: {(Meas-Ref)/limit value} A value of 3% or less of the current range is not calculated.

8

Setting the Voltage Fluctuation Test

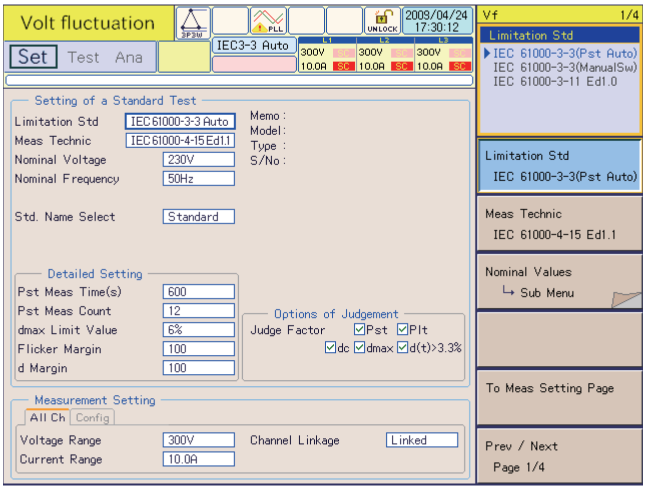
This chapter describes how to set the test conditions of voltage fluctuation and flicker tests.

Test Condition Setting Displays

Two types of displays are available for setting test conditions. Choose either one.

- Vf-Test Conditions List display for setting test conditions while checking the test conditions that were selected in the menu
- Vf-Observation and Test Conditions display for setting test conditions during measurement

Using the Vf-Test Conditions List Display (Setting while viewing test conditions)



Setting of a Standard Test

Limitation Std: IEC61000-3-3 Auto
Meas Technic: IEC61000-4-15Ed1.1
Nominal Voltage: 230V
Nominal Frequency: 50Hz
Std. Name Select: Standard

Memo :
Model :
Type :
S/No :

Detailed Setting

Pst Meas Time(s): 600
Pst Meas Count: 12
dmax Limit Value: 6%
Flicker Margin: 100
d Margin: 100

Options of Judgement

Judge Factor: ☑Pst ☑Plt ☑dc ☑dmax ☑d(t)>3.3%

Measurement Setting

All Ch | Config

Voltage Range: 300V
Current Range: 10.0A
Channel Linkage: Linked

1 **Press the Vf key.**

The Vf key LED illuminates and the Vf-Test Conditions List display appears. If the screen does not switch to this display, perform the following procedure.

If the display does not appear by pressing the Vf key

A dialog box “Can’t execute during test/analysis. Please operate it after ending” is displayed and the display switches to the test ending menu.

See p. 220

While the test status display (in the upper left of the screen, “Set” in the case of the figure shown above) is “Test” or “Analysis,” pressing the Vf key does not display the Vf-Test Conditions List display. Because displaying the Vf-Test Conditions List display starts a new test with the test conditions changed, the test that has been executed needs to be terminated.

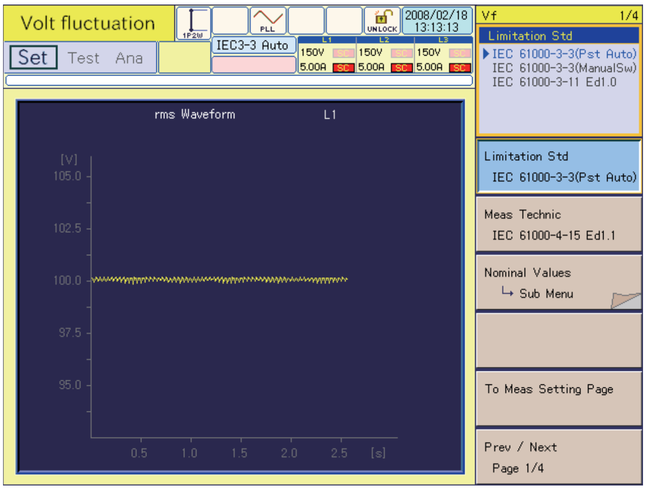
2 **Press the F3 key (Exit) in the test ending menu.**

The test ends. The test status display on the screen switches from “Analysis” to “Set.” If the test results have not been saved with the F1 key (Save), a dialog box and a menu for saving operation appear. To save the test results, select F1 (Yes); otherwise, select F2 (No).

3 **Press the Vf key.**

The Vf key LED illuminates and the Vf-Test Conditions List display appears.

Using the Vf-Observation and Test Conditions Display (Setting during Measurement)



1 **Press the VIEW key in the Vf-Test Conditions List display.**

The VIEW key LED illuminates and the Vf-Observation and Analysis display (Vf-VIEW) appears.

2 **Press the F1 key to select the display type to be viewed.**

3 **Press the VIEW key in the Vf-Observation and Analysis display (Vf-VIEW).**

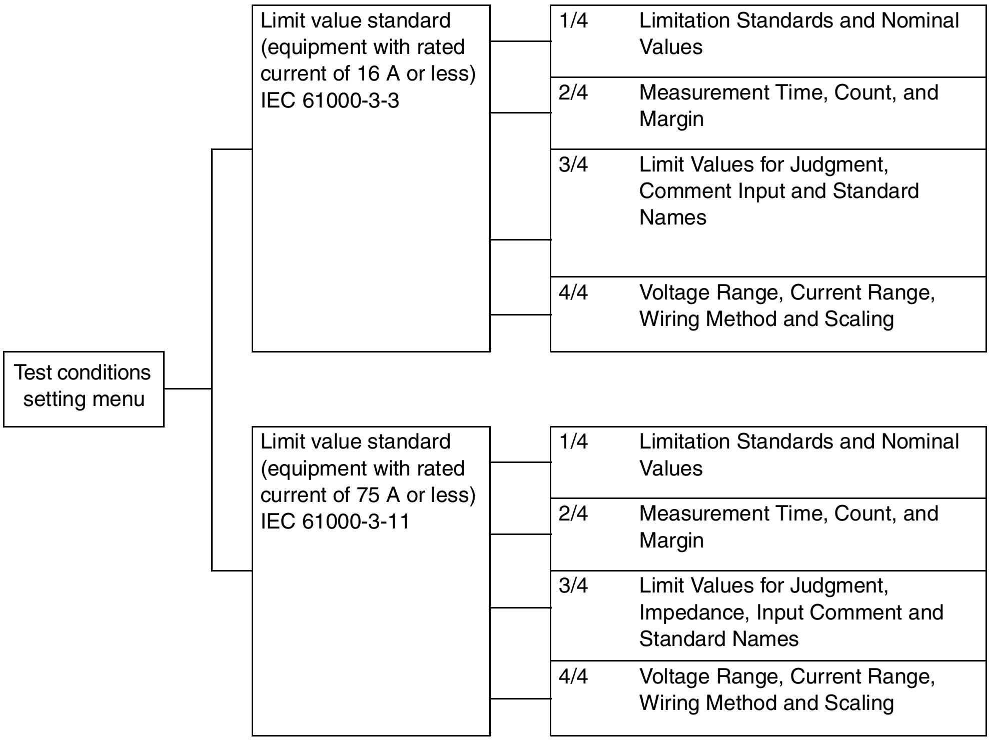
The VIEW key LED goes out and the Vf-Observation and Test Conditions display appears. The display is always in the measurement state. Measured values are displayed on the screen.

Configuration of Menu for Setting Voltage Fluctuation Test Conditions

The menu is firstly classified into two classes according to the type of the limit value standards. Each of these classified menus is secondly classified into four pages (1/4 to 4/4). Each of the classified pages is thirdly classified by menu item (function keys F1 to F6).

To switch between the firstly classified two menus, select a limit value standard in the F1 menu on page 1/4.

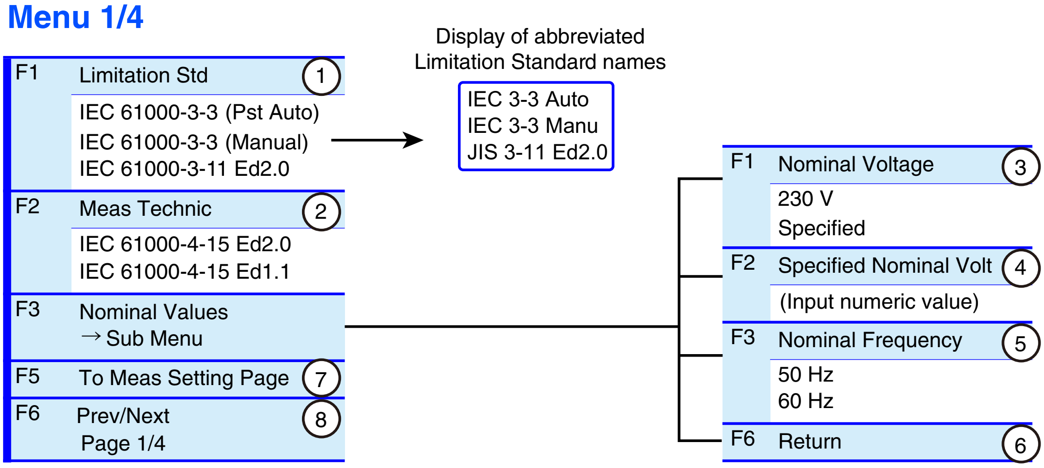
The major menu items on each page are as follows.



61000-3-3

Limitation Standards and Nominal Values

Menu 1/4



No.	Menu item	Description	Default
1	Limitation Std	Select a limit value standard. Select either “Pst Auto” or “Manual” for the measuring method for IEC 61000-3-3. When IEC 61000-3-11 Ed2.0 is selected, the menu for equipment with rated current of 75 A or less is displayed. The limitation standard IEC 61000-3-3 Ed to be set depends on the selection of the standard for measurement techniques. Abbreviated Standard names are shown on the display.	IEC 61000-3-3 (Pst Auto)
2	Meas Technic	Select a measurement technique. If IEC 61000-4-15:Ed2.0 is selected, the limitation standard is set to IEC 61000-3-3:Ed3.1(2017). If IEC 61000-4-15:Ed1.1 is selected, the limitation standard is set to IEC 61000-3-3:Ed2.0(2008). Abbreviated Standard names are shown on the display.	IEC 61000-4-15 Ed2.0
3	Nominal Voltage	Specify the rated power voltage of the EUT. Select “230 V” (fixed value) or “Specified.”	230 V
4	Specified Nominal Volt	When “Specified” was selected in the F1 menu, enter the rated power voltage of the EUT. The input range is 100 V to 600 V. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	100 V
5	Nominal Frequency	Select the rated power frequency of the EUT.	50 Hz
6	Return	Terminates the specification of the nominal voltage and frequency.	–
7	To Meas Setting Page	Switches to page 4/4.	–
8	Prev/Next Page 1/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

- **Pst Auto**

  Simultaneously executes the d measurement (dmax, Tmax (or d(t)>3.3%), dc) and the Pst and Pit (flicker) measurement. The maximum value for each Pst measurement segment time is displayed as the results of the d measurement.

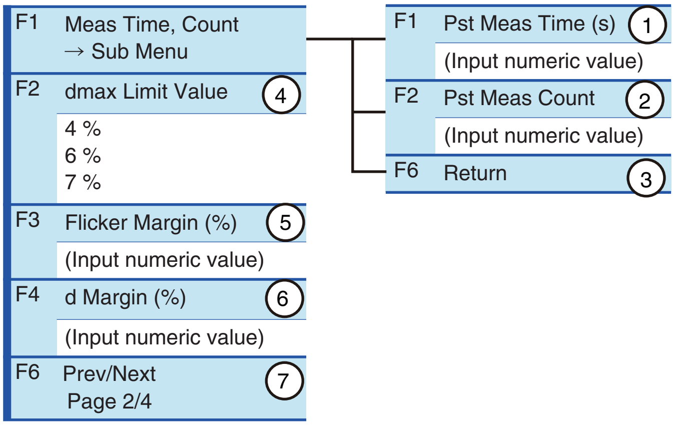
- **Manual**

  Executes measurement with a method that conforms to “Test conditions and procedures for measuring voltage changes caused by manual switching.” This product makes judgment by using the arithmetic average of 22 measured values obtained by excluding the maximum and minimum values of 24 collected measurements.

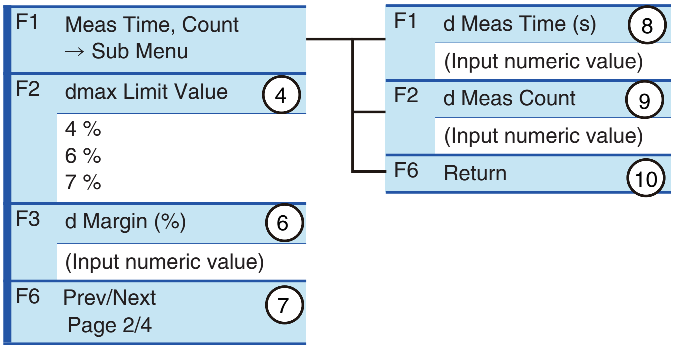
Measurement Time, Count, and Margin

Menu 2/4

Pst Auto



Manual SW

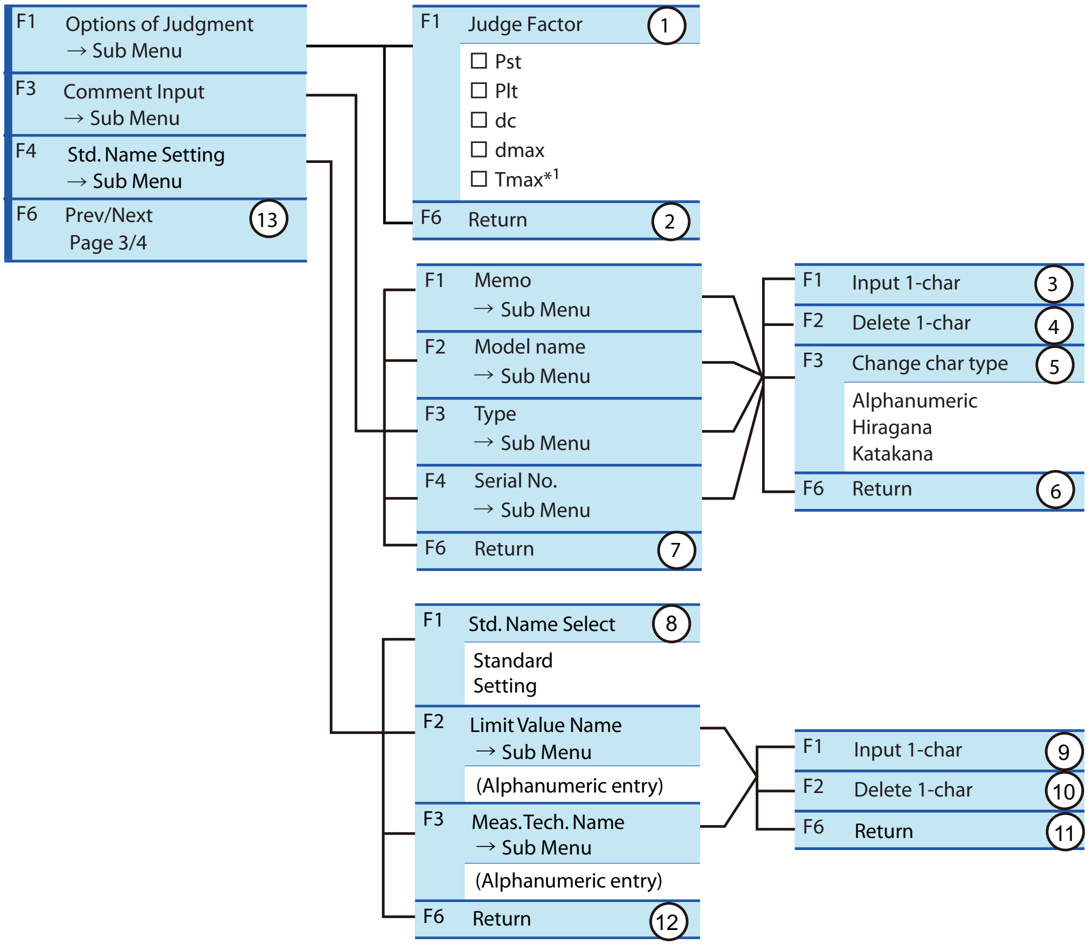


No.	Menu item	Description	Default
1	Pst Meas Time (s)	Enter the Pst measurement time. The input range is 30 to 900 seconds. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value.	600 s
2	Pst Meas Count	Enter the number of Pst measurements. The input range is 1 to 12. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value.	12 times
3	Return	Terminates the specification of Measurement Time and Count.	–
4	dmax Limit Value	Select the value according to the conditions of the EUT.	6 %
5	Flicker Margin (%)	Input a margin for a flicker limit value. The input range is 10 to 100 (for example, enter 80 to set the margin to 80% of the limit value of the standard). This menu item is disabled when the limit value standard is IEC 61000-3-3 (Manual) or IEC 61000-3-11 Ed2.0. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	100 %
6	d Margin (%)	Input a margin for a d limit value. The input range is 10 to 100 (for example, enter 80 to set the margin to 80% of the limit value of the standard). This menu item is disabled when the limit value standard is IEC 61000-3-11 Ed2.0. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	100 %
7	Prev/Next Page 2/4	Switches to another menu page.	–

8	d Meas Time (s): Manual	Input a measurement time. The input range is 30 to 180 seconds. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	60 s
9	d Meas Count: Manual	Input a measurement count. The input range is 3 to 24. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	24 times
10	Return	Terminates the specification of Measurement Time and Count.	–

F key: Function key. You can also use the ESC key to return.

Limit Values for Judgment, Comment Input and Standard Names



*1. Displayed as d(t)>3.3% depending on the selected standard.

No.	Menu item	Description	Default
1	Judge Factor	Select the condition item of Judge Factor. The items Pst and Plt cannot be selected in manual measuring method. Select the item with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected. When multiple items are selected, the limit values of those items become the conditions of the judgment.	Pst, Plt, dc, dmax, Tmax
2	Return	Terminates the specification of Options of Judgment.	–
3	Input 1-char	Use this item to enter characters for Memo, Model name, Type and Serial No. in report printouts. Up to 20 alphanumeric characters and up to 10 hiragana and katakana characters can be input. For details on the procedure, see page 191.	–
4	Delete 1-char	Use this item to delete characters of Memo, Model name, Type and Serial No. from report printouts. For details on the procedure, see page 191.	–
5	Change char type	Use this item to change the character types of Memo, Model name, Type and Serial No. Every time the F3 key is pressed, the character types switch to alphanumeric, hiragana and katakana characters in this order.	–

6	Return	Terminates the character input, character deletion and character type change.	–
7	Return	Terminates the comment input.	–
8	Std. Name Select	Select how the "Limitation Std" and "Meas. Tech" names are presented in Report Print. Selects either "Standard" or "Setting".	Standard
9	Input 1-char	This function is used to enter characters for the local Limitation Standard name or the local Measuring technique name to be presented in Report Print. Up to 20 alphanumeric characters can be entered. On how to use this function, refer to the procedures shown below.	–
10	Delete 1-char	This function is used to delete characters from the local Limitation Standard names or the local Measuring technique names to be presented in Report Print. On how to use this function, refer to the procedures shown below.	–
11	Return	Exit from the character entry/deletion procedures to display local Limitation Standard or local Measuring technique names.	–
12	Return	Exit from the setting of standard names to be presented.	–
13	Prev/Next Page 3/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

● Standard names and their standard presentations

Menu presentation	Standard presentation for Report Print[*1]
IEC 61000-3-3 Ed3.1 (Pst Auto)	EN 61000-3-3(2013)/A1(2019)
IEC 61000-3-3 Ed3.1 (Manual)	EN 61000-3-3(2013)/A1(2019)
IEC 61000-3-3 Ed2.0 (Pst Auto)	EN 61000-3-3(2008)
IEC 61000-3-3 Ed2.0 (Manual)	EN 61000-3-3(2008)
IEC 61000-3-11 Ed2.0	EN IEC 61000-3-11(2019)
IEC 61000-4-15 Ed1.1	EN 61000-4-15(1998)/A1(2003)
IEC 61000-4-15 Ed2.0	EN 61000-4-15(2011)

[*1] At factory shipment, the default names presented for the "Setting" mode are the same as Standard names.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 Press the F1, F2, F3 or F4 key.

The Comment Input dialog will be presented.

2 Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.

3 Press the F1 (Input 1-char) key.

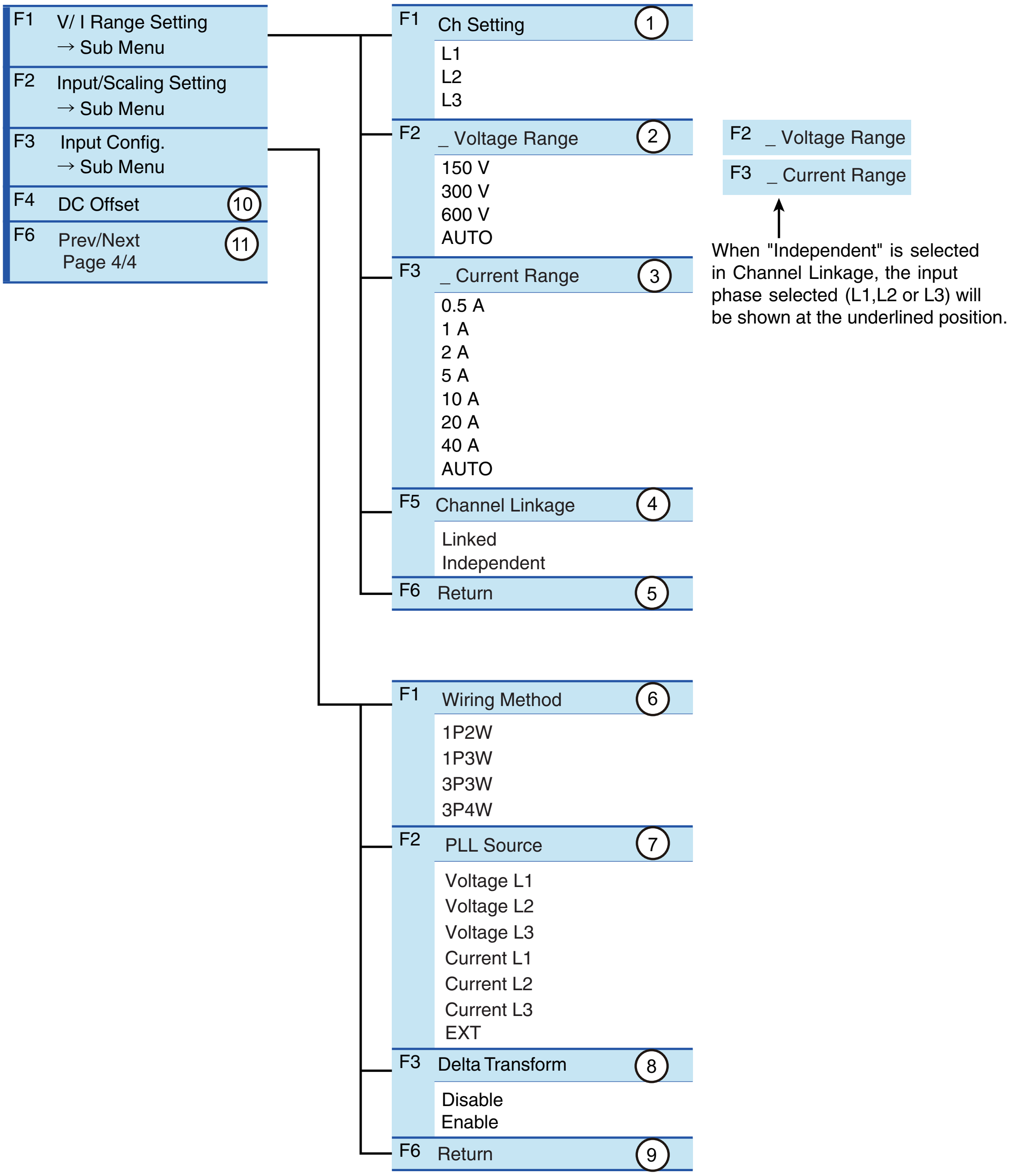
The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 Press the ENTER key.

The characters entered will be fixed and saved.

Voltage Range, Current Range, Wiring Method and Scaling

Menu 4/4 (part 1)



When "Independent" is selected in Channel Linkage, the input phase selected (L1,L2 or L3) will be shown at the underlined position.

No.	Menu item	Description	Default
1	Ch Setting (V/I Range)	Select the input phase for the voltage and current measurement. This is used when "Independent" is selected in F5 Channel Linkage. If "Linked" is selected in F5 Channel Linkage, this part is grayed out and operation is inhibited. When "Linked" is selected, the L1 phase will be the reference.	L1

2	_ Voltage Range	Select the measurement range of the input phase selected in Setting Ch (V/I Range). Select the range in accordance with the rated power supply voltage of the EUT. In the AUTO mode, the range will be fixed once the test is started. The input phase selected (L1, L2 or L3) will be shown at the underlined position of the menu item. When "Volt. Scaling" is used, the menu will show the measurement range that corresponds to the scaling. When "Linked" is selected in F5 Channel Linkage, the input phase selected will not be shown at the underlined position of the menu item. The menu will be that for the L1 phase.	AUTO
3	_ Current Range	Select the measurement range of the input phase selected in Setting Ch (V/I Range). Select the range in accordance with the rated power supply current of the EUT. In the AUTO mode, the range will be fixed once the test is started. The input phase selected (L1, L2 or L3) will be shown at the underlined position of the menu item. When "Curr. Scaling" is used, the menu will show the measurement range that corresponds to the scaling. When "Linked" is selected in F5 Channel Linkage, the input phase selected will not be shown at the underlined position of the menu item. The menu will be that for the L1 phase.	AUTO
4	Channel Linkage	Select the "Linked" or "Independent" status between the lines L1, L2, and L3. When "Linked" is selected, independent setting of L1, L2, and L3 cannot be made. The "Linked" setting is applied to voltage and current ranges.	Linked
5	Return	Terminates the V/I Range setting.	–
6	Wiring Method	Select a wiring method for a measuring circuit.	3P4W
7	PLL Source	Select a source to synchronize with the AC power frequency. The voltage or current signal of each of the L1, L2 and L3 phases can be selected. To use the EXT SYNC INPUT input signal, select EXT.	Voltage L1
8	Delta TransformDisable See p. 107	This item becomes valid when 3P3W is selected in F1 Wiring Method. In the case of EUT that doesn't use the neutral line, the voltages between lines (line voltages) will be calculated from the measured voltages of each phase.	Disable
9	Return	Terminates the Input Config. (detailed measurement setting) function.	–
10	DC Offset	Controls the DC offset of the internal circuit.	–
11	Prev/Next Page 4/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

DC Offset adjustment function

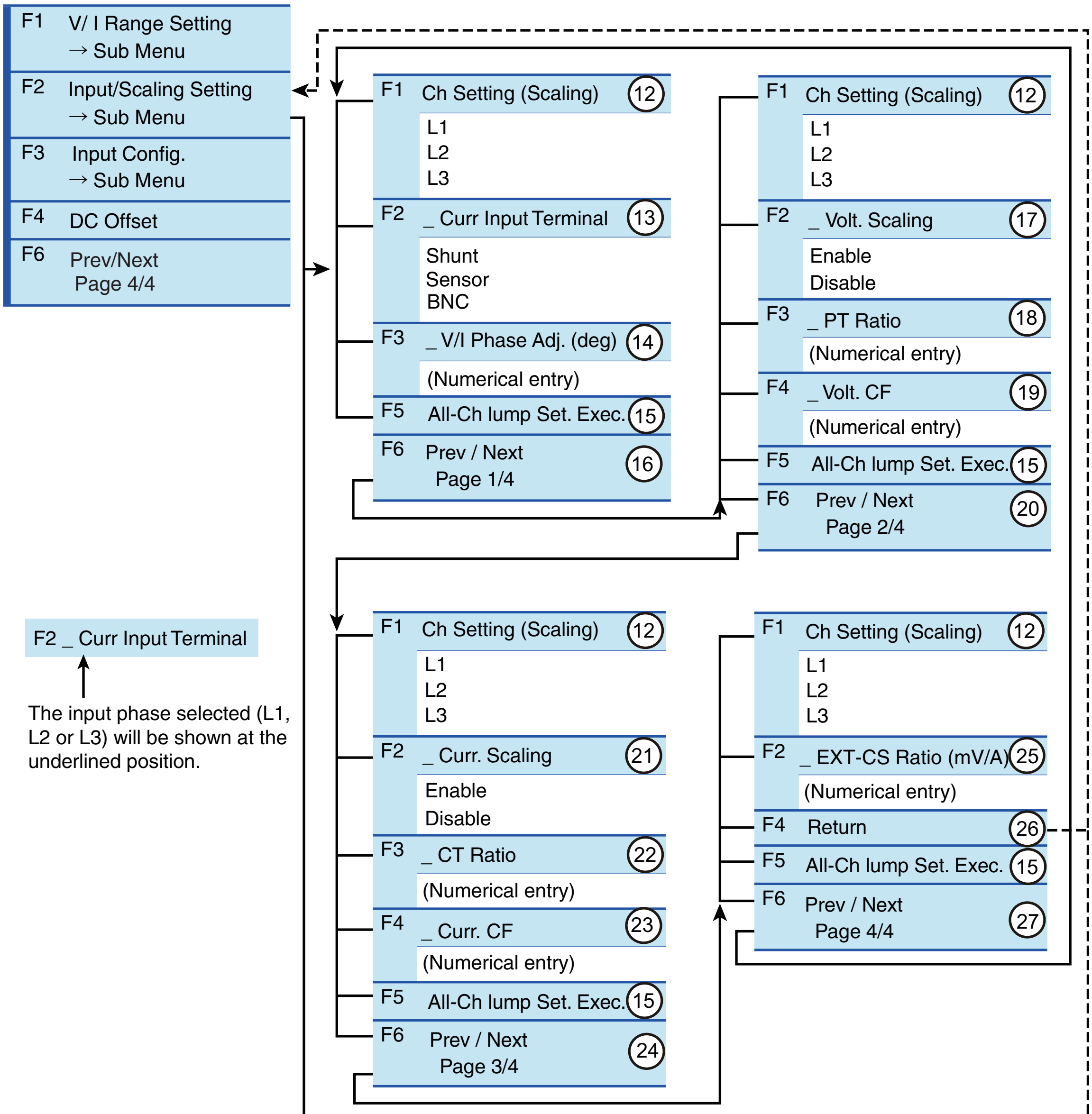
This function automatically adjusts the offset so that the average DC current is zeroed at the time of pressing the F key. Although this adjustment can be made while input voltage and current are applied, it is recommended that the adjustment is performed while no input voltage/current is applied.

- If the automatic adjustment is made while a signal with non-zero average DC current is applied, the resulting offset will be shifted by the amount of the non-zero average DC current that existed in the input signal.

- As the adjustment is cleared when the range is changed, it is recommended to use this function after selecting a fixed range, instead of using the AUTO range.

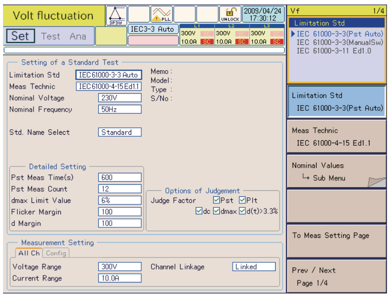
- When the POWER switch is turned off, the adjustment will be cleared.

Menu 4/4 (part 2)



The input phase selected (L1, L2 or L3) will be shown at the underlined position.

Vf- Test Condition List display



Limitation Std
- IEC 61000-3-3(Pst Auto)
- IEC 61000-3-3(ManualSw)
- IEC 61000-3-11 Ed1.0

Setting of a Standard Test

Limitation Std	IEC 61000-3-3 Auto
Meas Technic	IEC 61000-4-15 Ed1.1
Nominal Voltage	230V
Nominal Frequency	50Hz
Std. Name Select	Standard

Memo :
Model :
Type :
S/No :

Detailed Setting

Pst Meas Time(s)	600
Pst Meas Count	12
dmax Limit Value	6%
Flicker Margin	100
d Margin	100

Options of Judgement
Judge Factor ☑Pst ☑Plt ☑dc ☑dmax ☑d(t)>3.3%

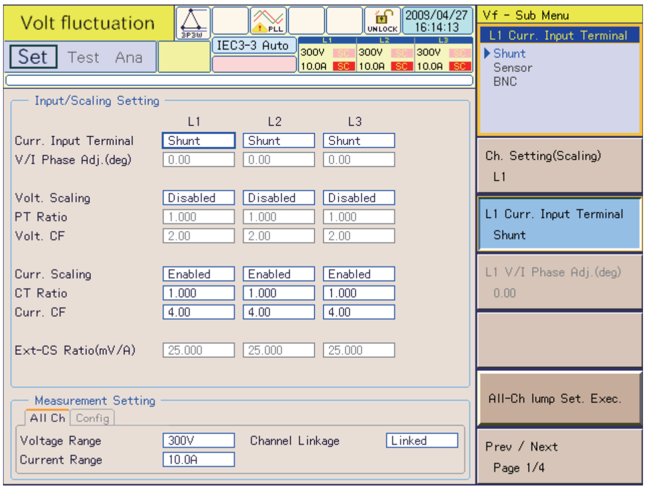
Measurement Setting
All Ch Config
Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Limitation Std
IEC 61000-3-3(Pst Auto)

Meas Technic
IEC 61000-4-15 Ed1.1

Nominal Values
↳ Sub Menu

Input/Scaling Setting display



L1 Curr. Input Terminal
- Shunt
- Sensor
- BNC

Input/Scaling Setting

	L1	L2	L3
Curr. Input Terminal	Shunt	Shunt	Shunt
V/I Phase Adj.(deg)	0.00	0.00	0.00
Volt. Scaling	Disabled	Disabled	Disabled
PT Ratio	1.000	1.000	1.000
Volt. CF	2.00	2.00	2.00
Curr. Scaling	Enabled	Enabled	Enabled
CT Ratio	1.000	1.000	1.000
Curr. CF	4.00	4.00	4.00
Ext-CS Ratio(mV/A)	25.000	25.000	25.000

Measurement Setting
All Ch Config
Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Ch. Setting(Scaling)
L1

L1 Curr. Input Terminal
Shunt

L1 V/I Phase Adj.(deg)
0.00

No.	Menu item	Description	Default
12	Ch Setting (Scaling)	Select the input phase subject to the scaling. They are in the submenu pages of the pages 1/4 to 4/4.	L1
13	_ Curr Input Terminal See p. 86,p. 196	Select the current input terminal. Select "Shunt" if the source and load terminals on the rear panel of this product are used. Select "Sensor" when EXP CLAMP is used. Select "BNC" when EXT INPUT is used. When Sensor or BNC is selected, the IRANGE part of the display will show C or B icon, respectively. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	Shunt
14	_ V/I Phase Adj. (deg) See p. 108	Adjust the current phase of the external current sensor. This item is enabled when "BNC" is selected in the Current Input Terminal menu. It is independent of the Enable/Disable setting of the Current Scaling menu. The input range is -180.00 to +180.00 degrees. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	0.00
15	All-Ch lump Set. Exec.	Copy the current channel settings set for execution to all other input channels (channels L1, L2, and L3) for setting them identically. When the F key is pressed, a confirmation dialog will be displayed. If you are sure to copy them, press the F1 key, "OK". If not, press the F2 key, "Cancel". * Whenever "Sensor" is selected for Current Input Terminal, copy the Current Input Terminal settings to all other input channels (channels L1, L2, and L3) for setting them identically. Items such as CT Ratio will not be copied.	-
16	Prev/Next Page 1/4	Move to other sub-menu pages.	-
17	_Volt. Scaling	Enable or disable the scaling of the voltage ratio for the external PT (potential transformer). If "Enable" is selected, the SC icon will be shown in the V RANGE part of the display. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	-
18	_ PT Ratio	This item is enabled when "Enable" is selected in the Volt. Scaling menu. Here, the voltage ratio (scaling) of PT (potential transformer) is set. The input range is 0.001 to 100.000. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	1.000
19	_ Volt. CF	This item is enabled when "Enable" is selected in the Volt. Scaling menu. In order to measure the peak value without the effect of any distortion, the peak to rms ratio (CF) is set for the range currently set. The CF setting affects the measurement resolution. The input range is 1.00 to 2.00. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	2.00
20	Prev/Next Page 2/4	Move to other sub-menu pages.	-
21	_ Curr. Scaling	Enable or disable the scaling of the current signal from the external current sensor. If "Enable" is selected, the SC icon will be shown in the I RANGE part of the display. When "Sensor" is selected in the Current Input Terminal menu, this item is fixed and grayed out in the "Enabled" status. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	-

22	_ CT Ratio	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "Shunt" is selected in the Current Input Terminal menu. Here, the scaling ratio of CT (current transformer) is set. The input range is 0.001 to 1000.000. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	1.000
23	_ Curr. CF	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "Shunt" or "BNC" is selected in the Current Input Terminal menu. In order to measure the peak value without the effect of any distortion, the peak to rms ratio (CF) is set for the range currently set. The CF setting affects the measurement resolution. The input range is 1.00 to 4.00. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	4.00
24	Prev/Next Page 3/4	Move to other sub-menu pages.	-
25	_ EXT-CS Ratio (mV/A)	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "BNC" is selected in the Current Input Terminal menu. Here, the voltage to current scaling ratio is set for the external current sensor. The input range is 0.250 mV/A to 2500.000 mV/A. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	25.000 mV/A
26	Return	Exit from the Input/Scaling Setting menu.	–
27	Prev/Next Page 4/4	Move to other sub-menu pages.	–

F key: Function key. You can also use the ESC key to return.

Selection of the Current Input Terminal menu

Shunt

Select "Shunt" to use the SOURCE and LOAD terminals on the rear panel of this product. The shunts are contained inside the L1, L2, and L3 input sections. When CTs (current transformers) are to be used, also select "Shunt". The secondary circuits of CTs are to be connected to the SOURCE and LOAD terminals.

⚠CAUTION

- The maximum value of input current is 40 Arms or 100 Apeak, whichever smaller. Exceeding this value may cause overheating of the current detector.
- If the current detector overheats, the OHP icon appears on the upper part of the screen. Immediately shut down the power to the EUT to cut the input current of this product. Restart the test after the OHP icon disappears.

Sensor(C C icon)

See p. 86

Select "Sensor" to use the optional current sensors connected to the EXT CLAMP terminals on the rear panel of this product. When "Sensor" is selected, the C icon will be shown in the I RANGE part of the display. The EXT CLAMP terminals are provided at the L1, L2, and L3 input sections.

BNC(B B icon)

Select "BNC" to use external current shunts or other current sensors connected to the EXT INPUT terminals on the rear panel of this product. When "BNC" is selected, the B icon will be shown in the I RANGE part of the display. The EXT INPUT terminals are provided in the L1, L2, and L3 input sections.

Using Scaling Menu items

Scaling (SC SC icon)

● Range setting to use external sensors

When external sensors are used, the measurement range is determined by the conversion ratio of the external sensor and the peak to rms ratio of the signal. Because the calculated range is based on the particular range of this product, some range may not be used depending on the maximum voltage or the maximum current of the external sensor.

Example Setting:

Voltage Range	Range (V) when external sensors are used
Product-specific range (V)	Example 1: Current Sensor EXT-CS Ratio: 10 mV/A Max. current: 200A rms Saturation current: 400A peak Current CF: 2 (= 400/200)
150	300
300	600
600	1.2 k

● Setting of CF (peak to rms ratio)

The peak to rms ratio (i.e., peak value divided by the rms value) of the input signal is set for CF. The CF value is used for over-range detection and automatic range control. By adequately setting the CF value according to the characteristics of the sensors or transformers to be used, magnetic saturation and other problems can be prevented.

● Phase Adjustment

See p. 108

When using external current sensors, the phase difference that may exist between the voltage signal and the sensor signal can be adjusted.

● List of Scaling Menu Items

External sensor for scaling		Menu item (○ : Operable, ×: Inoperable)					
		PT Ratio	Voltage CF	CT Ratio	Current CF	EXT-CS Ratio	V/I Phase Adj.
Voltage	PT (potential transformer)	○	○	×	×	×	×
Current	CT (current transformer)	×	×	○	○	×	×
	Optional current sensor	×	×	×	×	×	×
	External current sensor /shunt	×	×	×	○	○	○

● List of Available Scaling Ranges

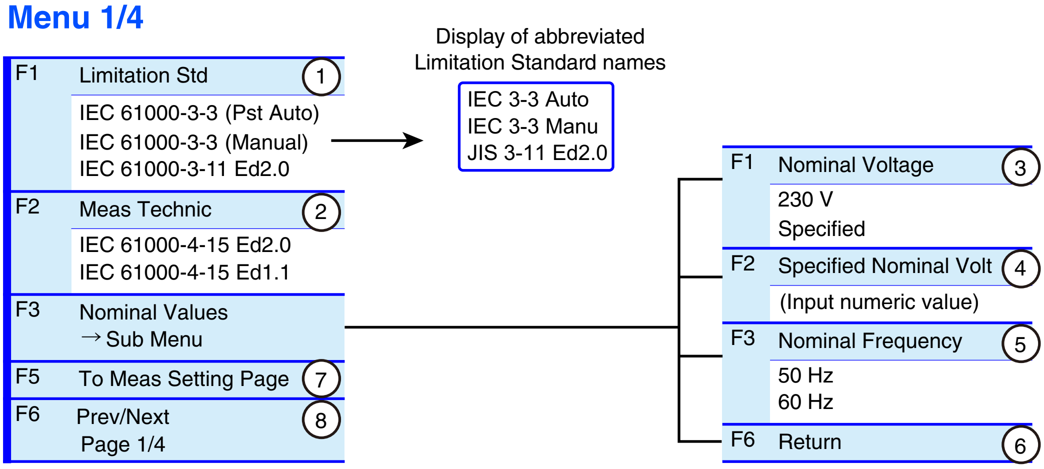
Setting Item		Setting Range
Voltage measurement	PT Ratio	0.00 to 100.000
	Voltage CF	1.00 to 2.00
Current measurement	CT Ratio	0.001 to 1000.000
	Current CF	1.00 to 4.00
	EXT-CS Ratio (mV/A)	0.250 mV/A to 2500.000 mV/A

61000-3-11

Limitation Standards and Nominal Values

The menu is the same as that of the 61000-3-3 standard. Select the limit value standard IEC 61000-3-11 Ed2.0.

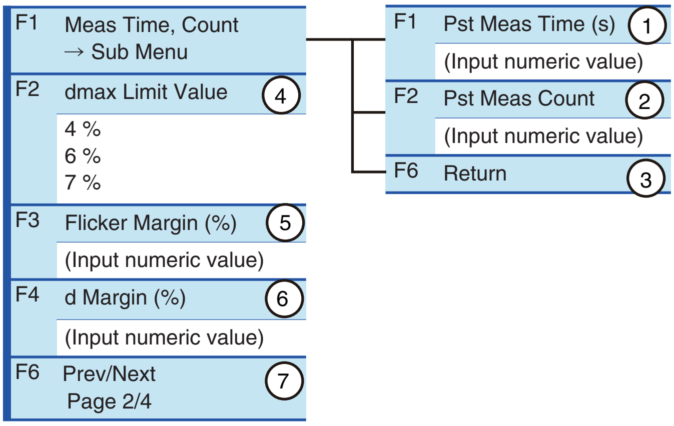
Menu 1/4



Measurement Time, Count, and Margin

This menu is the same as for the IEC 61000-3-3 standard (Pst Auto).

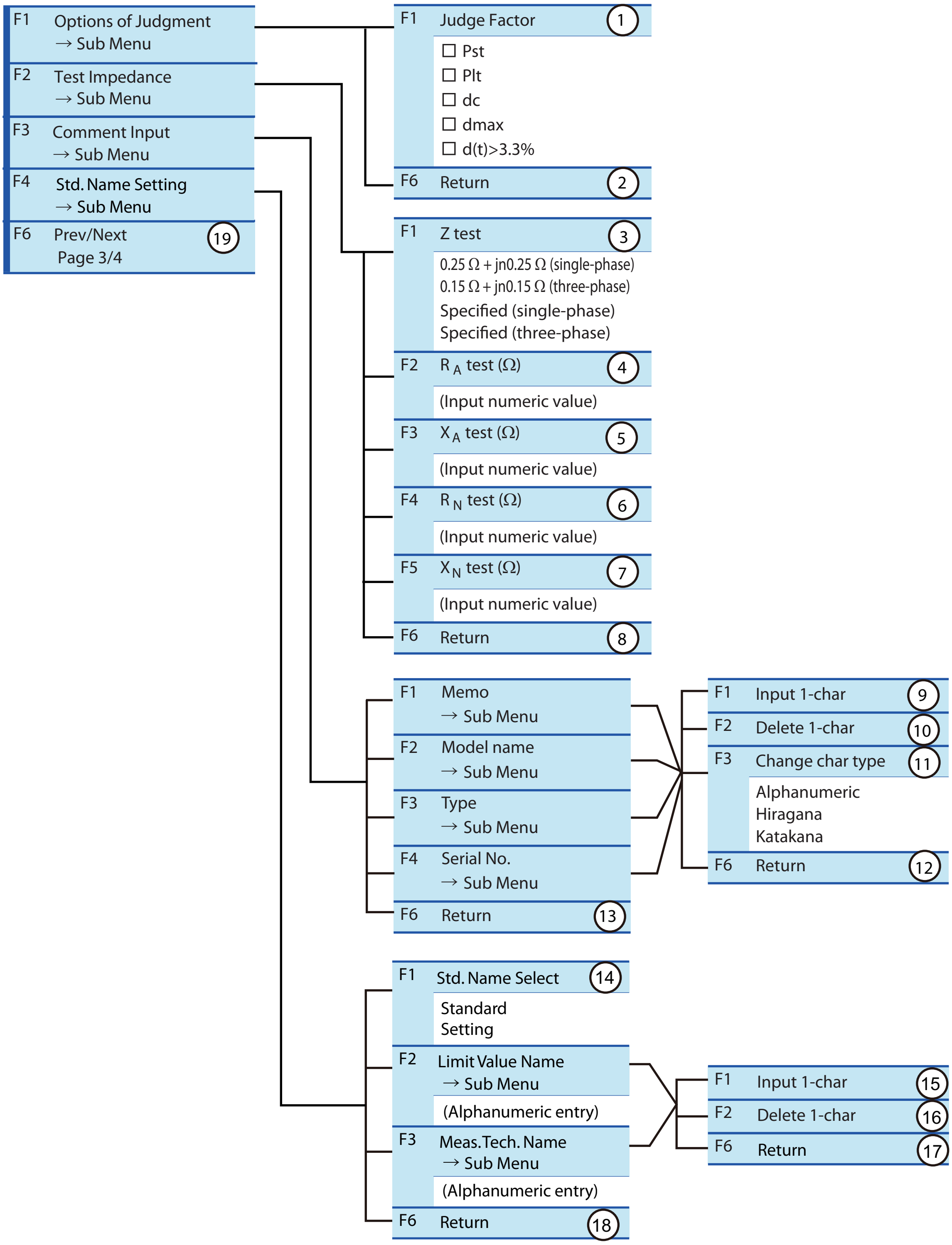
Menu 2/4



Limit Values for Judgment, Impedance, Input Comment and Standard Names

Except for the Test Impedance menu item, other menus are the same as for the IEC 61000-3-3 Standard.

Menu 3/4



No.	Menu item	Description	Default
1	Judge Factor	Select the condition item of Judge Factor. The items Pst and Plt cannot be selected in manual measuring method. Select the item with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected. When multiple items are selected, the limit values of those items become the conditions of the judgment.	Pst, Plt, dc, dmax, d(t)>3.3%
2	Return	Terminates the specification of Options of Judgment.	–
3	Z test	When the reference impedance in the 61000-3-3 standard is not used, specify Test Impedance. Select the standard value 0.25 Ω + jn0.25 Ω (single-phase) or 0.15 Ω + jn0.15 Ω (three-phase) or “Specified.”	0.25 Ω + jn0.25 Ω
4	R_A test (Ω)	When “Specified” is selected in the F1 menu, input the resistance of Test Impedance for each phase. The input range is 0.00 Ω to 1.00 Ω. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	0.24 Ω
5	X_A test (Ω)	When “Specified” is selected in the F1 menu, input the reactance at the fundamental frequency of Test Impedance for each phase. The input range is 0.00 Ω to 1.00 Ω. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	0.15 Ω
6	R_N test (Ω)	When “Specified” is selected in the F1 menu, input the resistance of the neutral line of Test Impedance. The input range is 0.00 Ω to 1.00 Ω. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	0.16 Ω
7	X_N test (Ω)	When “Specified” is selected in the F1 menu, input the neutral line reactance at the fundamental frequency of Test Impedance. The input range is 0.00 Ω to 1.00 Ω. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	0.10 Ω
8	Return	Terminates the specification of Test Impedance.	–
3	Input 1-char	Refer to Menu 3/4 of 61000-3-3 Standard.	–
4	Delete 1-char		–
5	Change char type		–
6	Return		–
7	Return		–
8	Std. Name Select		Standard
9	Input 1-char		–
10	Delete 1-char		–
11	Return		–
12	Return		–
9	Prev/Next Page 3/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

- **Standard values of test impedance**

Use these values when the current capacity of a power supply to be connected is 100 A or more.

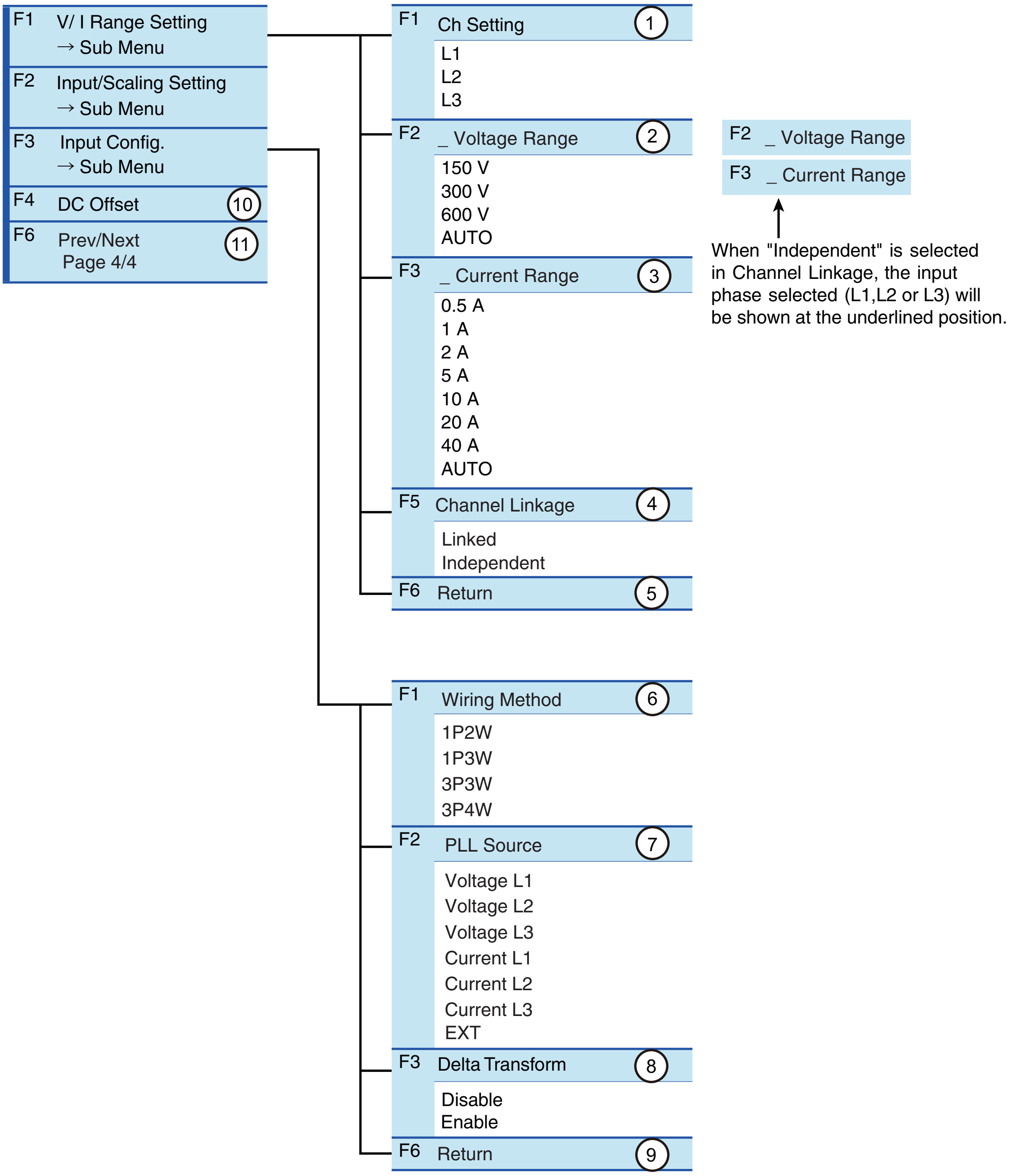
0.25 Ω + jn0.25 Ω is for a single-phase EUT and 0.15 Ω + jn0.15 Ω is for a three-phase EUT.

This product cannot set the standard values of the above impedance. A selected or input value in the menu is used for internal calculation.

Voltage Range, Current Range, Wiring Method and Scaling

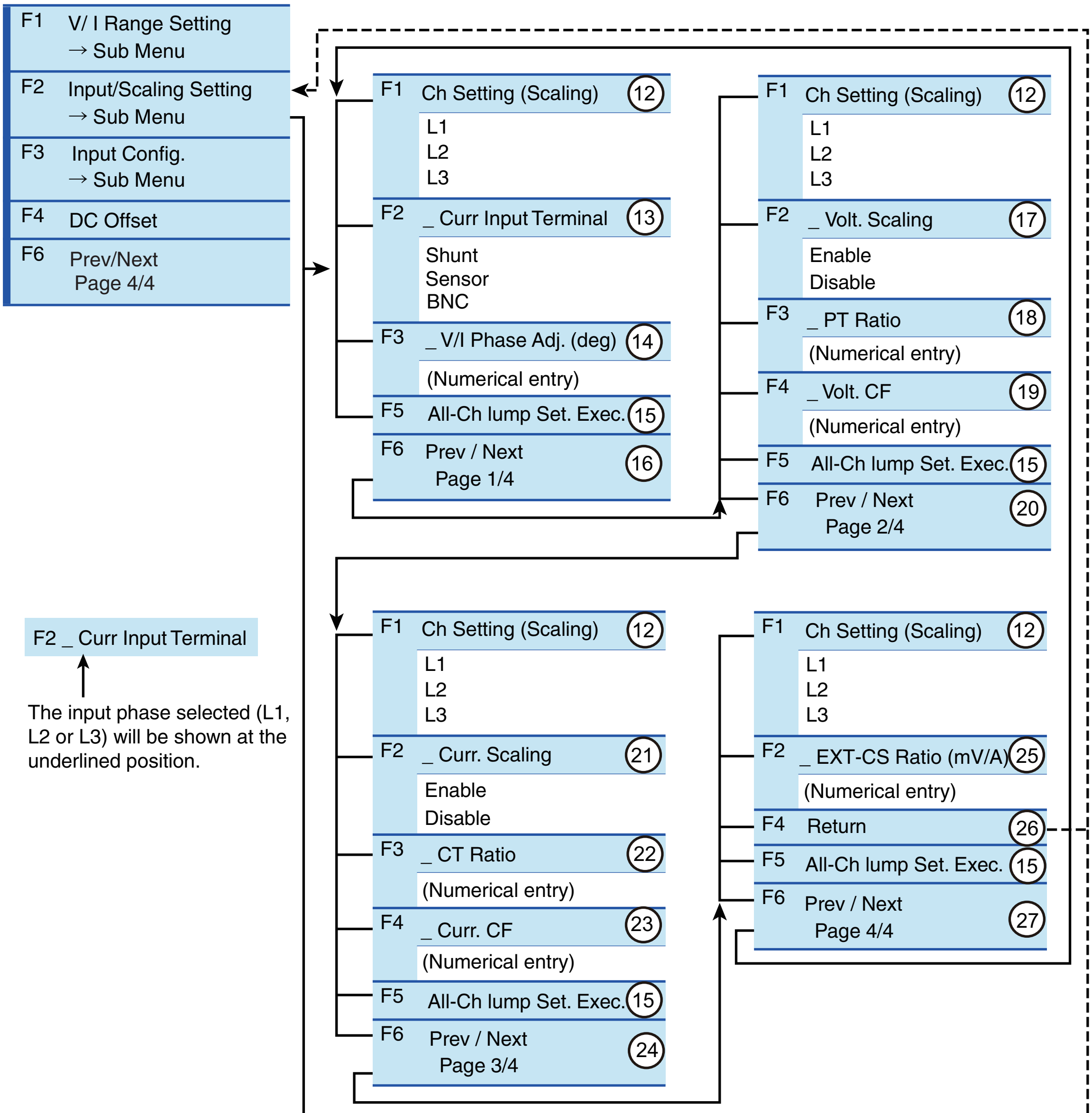
The menu is the same as that of the 61000-3-3 standard.

Menu 4/4 (part 1)



When "Independent" is selected in Channel Linkage, the input phase selected (L1,L2 or L3) will be shown at the underlined position.

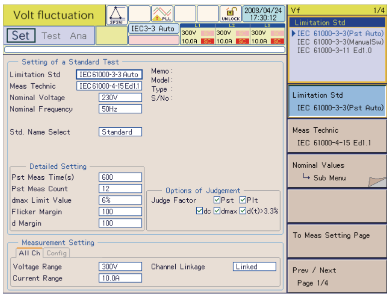
Menu 4/4 (part 2)



F2 _ Curr Input Terminal

The input phase selected (L1, L2 or L3) will be shown at the underlined position.

Vf- Test Condition List display



2009/04/24 17:30:12

Setting of a Standard Test

Limitation Std	IEC 61000-3-3 Auto
Meas Technic	IEC 61000-4-15 Ed1.1
Nominal Voltage	230V
Nominal Frequency	50Hz
Std. Name Select	Standard

Memo :
Model :
Type :
S/No :

Detailed Setting

Pst Meas Time(s)	600
Pst Meas Count	12
dmax Limit Value	6%
Flicker Margin	100
d Margin	100

Options of Judgement

Judge Factor ☑Pst ☑Plt ☑dc ☑dmax ☑d(t)>3.3%

Measurement Setting

All Ch Config

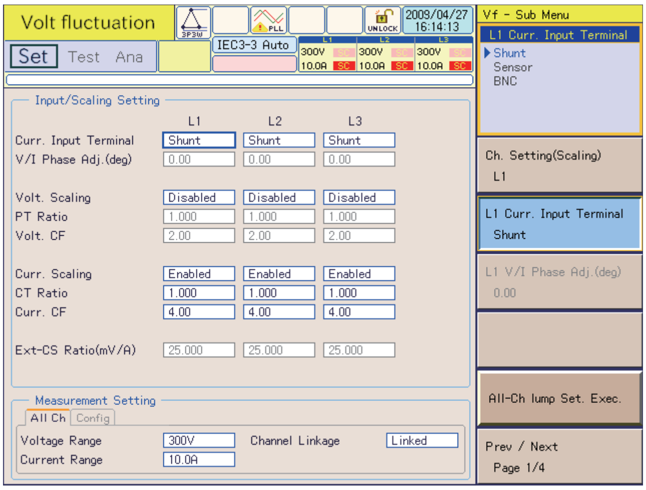
Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Vf 1/4

Limitation Std
- IEC 61000-3-3(Pst Auto)
- IEC 61000-3-3(ManualSw)
- IEC 61000-3-11 Ed1.0

Limitation Std IEC 61000-3-3(Pst Auto)
Meas Technic IEC 61000-4-15 Ed1.1
Nominal Values ↳ Sub Menu
To Meas Setting Page
Prev / Next Page 1/4

Input/Scaling Setting display



2009/04/27 16:14:13

Input/Scaling Setting

	L1	L2	L3
Curr. Input Terminal	Shunt	Shunt	Shunt
V/I Phase Adj.(deg)	0.00	0.00	0.00
Volt. Scaling	Disabled	Disabled	Disabled
PT Ratio	1.000	1.000	1.000
Volt. CF	2.00	2.00	2.00
Curr. Scaling	Enabled	Enabled	Enabled
CT Ratio	1.000	1.000	1.000
Curr. CF	4.00	4.00	4.00
Ext-CS Ratio(mV/A)	25.000	25.000	25.000

Measurement Setting

All Ch Config

Voltage Range 300V
Current Range 10.0A
Channel Linkage Linked

Vf - Sub Menu

L1 Curr. Input Terminal
- Shunt
- Sensor
- BNC

Ch. Setting(Scaling) L1
L1 Curr. Input Terminal Shunt
L1 V/I Phase Adj.(deg) 0.00
All-Ch lump Set. Exec.
Prev / Next Page 1/4

Controlling the AC Power Supply

The AC power sources that this product can directly control are PCR-LE and PCR-LA[1]. PCR-WE is controlled by the separately sold application software SD006-KHA Harmonics Analyzing Suite.

Setting the AC Power Supply

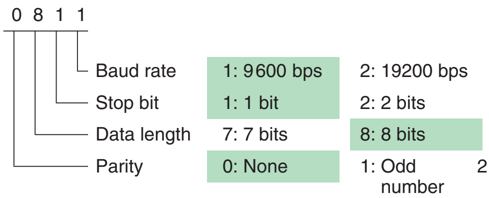
To establish communication with the AC Power Supply, set the communication parameters from the AC power supply panel as shown below.

PCR-LE

Baudrate:	🟩 9600 bps/ 19200 bps/ 38400 bps
Data:	🟩 8 bits / 7 bits
Stop:	🟩 1 bit / 2 bits
Parity:	🟩 None (fix)
Flow Ctrl:	🟩 OFF / RTS･CTS

🟩 A shaded area indicates a set value.

PCR-LA



0 8 1 1

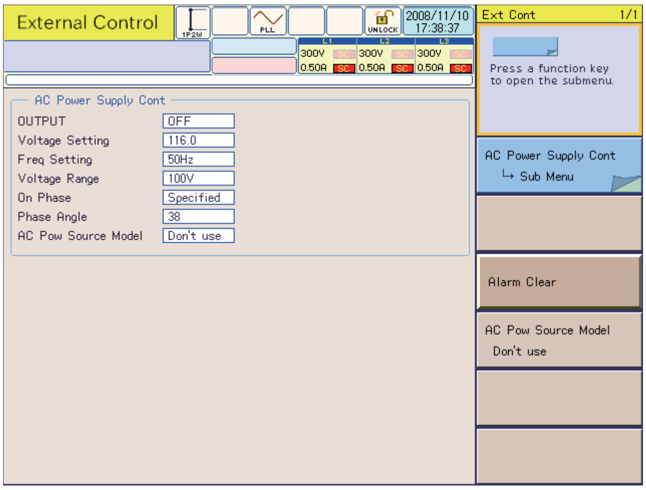
Baud rate	🟩 1: 9600 bps	2: 19200 bps	
Stop bit	🟩 1: 1 bit	2: 2 bits	
Data length	7: 7 bits	🟩 8: 8 bits	
Parity	🟩 0: None	1: Odd number	2: Even number

🟩 A shaded area indicates a set value.

Showing the External Control Display

Press the EXT CONT key.

The External control display appears.



AC Power Supply Cont

OUTPUT	OFF
Voltage Setting	116.0
Freq Setting	50Hz
Voltage Range	100V
On Phase	Specified
Phase Angle	38
AC Pow Source Model	Don't use

Press a function key
to open the submenu.

AC Power Supply Cont
↳ Sub Menu

AC Pow Source Model
Don't use

WARNING

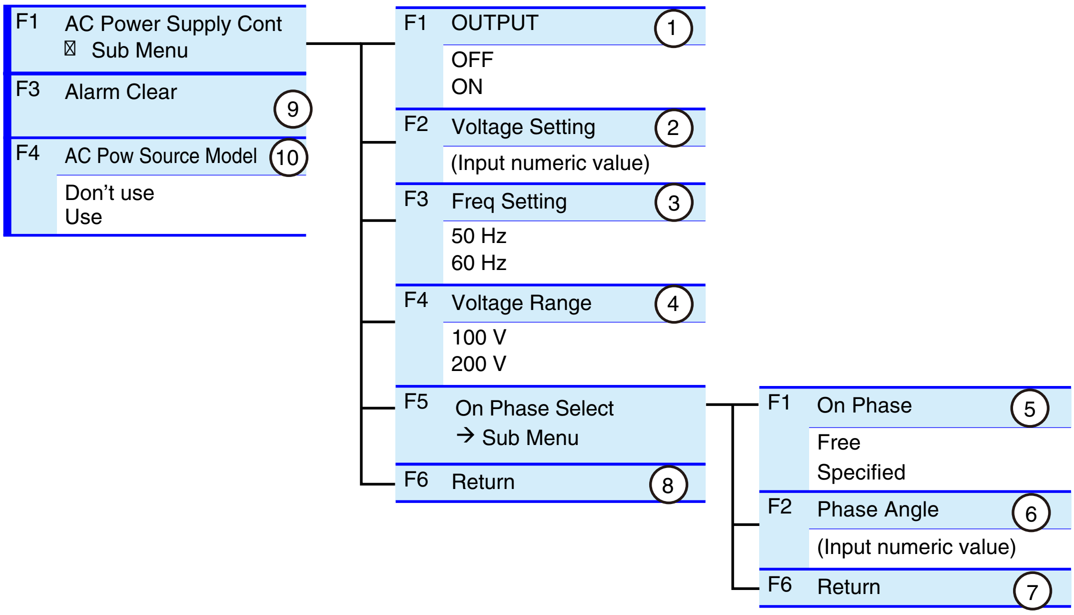
- **To prevent an electric shock, do not touch the SOURCE and LOAD terminals of this product.**
- **Do not touch the OUTPUT terminal of the AC Power Supply.**
- **Do not touch the INPUT and OUTPUT terminals of the Line Impedance Network.**

---

[1] PCR-LA with firmware version 3.32 or 3.33 cannot be used.

Voltage and Frequency Setting and On Phase

Menu 1/1



No.	Menu item	Description	Default
1	OUTPUT	Turns on and off the output of the AC power supply. In the ON state, the lamp icon in the upper part of the screen lights up.	OFF
2	Voltage Setting	Input the output voltage of the AC power supply. The input range is 0.0 V to 304.8 V. The output voltage must be within the Voltage Range (F4) and conform to the rated power of the EUT. The set value of the output voltage varies in type depending on the wiring method. The phase voltage is used for 1P2W, 1P3W and 3P4W and the line voltage is used for 3P3W. (The menus for setting the wiring method are described in the chapters for the harmonic test, voltage fluctuation test and other tests.) Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	–
3	Freq Setting	Select the output frequency of the AC power supply. Select it conforming to the rated power of the EUT.	50 Hz
4	Voltage Range	Select the output voltage range of the AC power supply. Select the 100 V range for the output voltage setting range 0 V to 152.5 V. Select the 200 V range for the output voltage setting range 0 V to 304.8 V.	100 V
5	On Phase	The voltage phase angle when the output of the AC power is turned on can be specified. In this menu item, select a specification method. When “Free” is selected, the voltage phase is not specified. When “Specified” is selected, enter a value in the F2 menu item, Phase Angle.	Free
6	Phase Angle	Enter a value of the phase angle when “Specified” is selected in the F1 menu item. The input range is 0° to 360°. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	0
7	Return	Terminates the selection of On Phase.	–
8	Return	Terminates the specification of AC Power Supply Control.	–
9	Alarm Clear	Clears the alarm of the AC power supply.	–
10	AC Pow Source Model	Select Don’t use or Use.	Don’t use.

F key: Function key. You can also use the ESC key to return.

9

Executing Voltage Fluctuation Tests

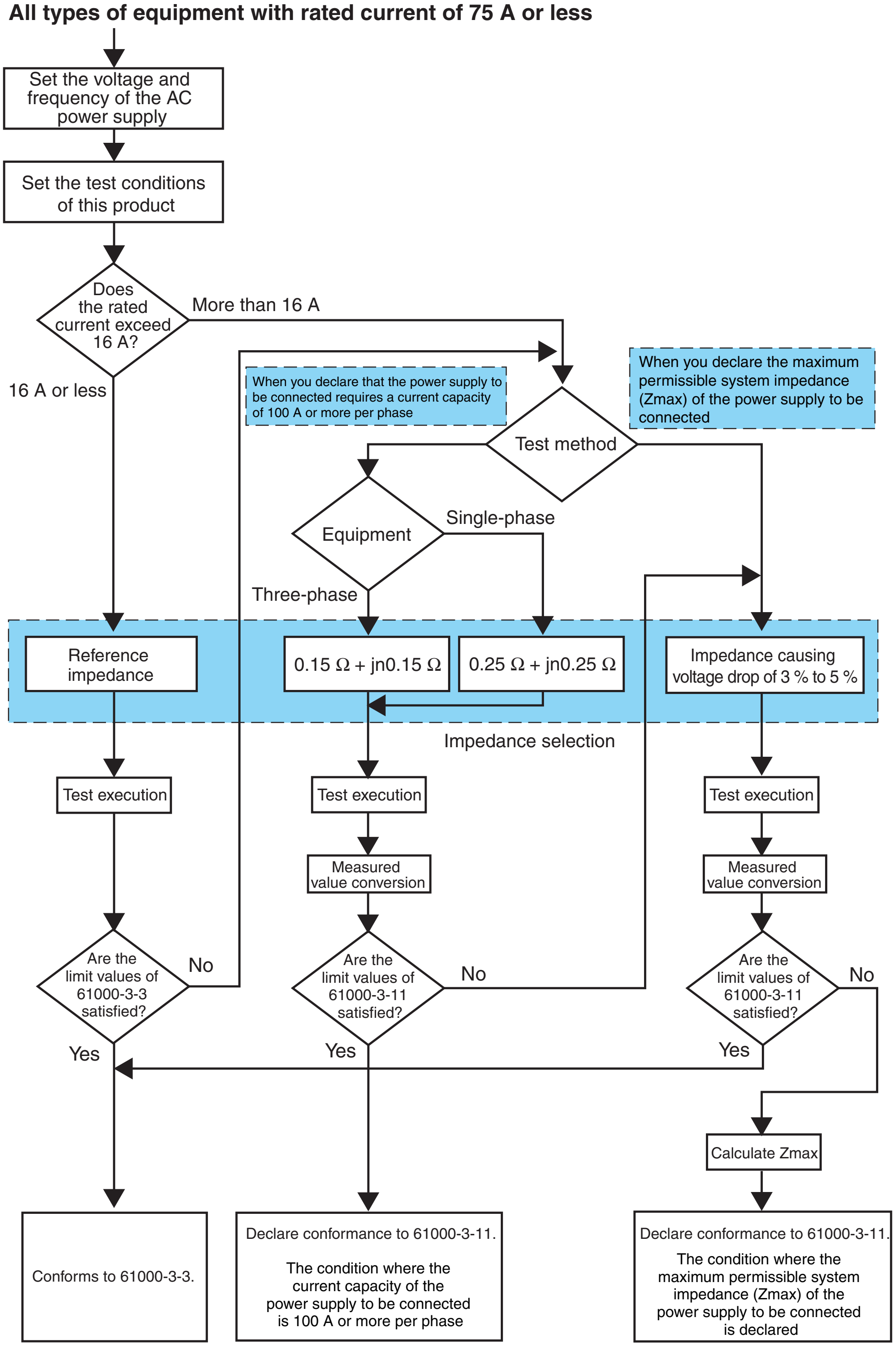
This chapter describes the procedures from executing the voltage fluctuation and flicker tests to printing reports. The procedures are explained for each limit value standard (610000-3-3 and 61000-3-11).

61000-3-3 and 61000-3-11: Test Flow

The test flow is shown below. The test execution is from when the START key is pressed to when the test time expires. After the end of the test time, you can save the test results, print reports, terminate the test and analyze the test results.

See p. 229

For details on analyzing the test results and judging conformance to the standard and AC power supply and repeatability checking, see Chapter 10 "Observation, Analysis and Judgement of Voltage Fluctuations."



The expression of each item is simplified. For details, refer to the standards.

Setting the Impedance and AC Power Supply

The following procedure is common to the 61000-3-3 and 61000-3-11 standards.

1 **Set the impedance.**

See "Setting the Impedance" below.

2 **Press the EXT CONT key.**

The External Control display appears.

3 **Press the F1 key to select AC Power Supply Control.**

A sub-menu is displayed.

4 **Press the F2 and F3 keys to set the output voltage and frequency respectively.**

See p. 204

Set the AC power supply voltage and frequency according to the rated power of the EUT.

5 **Set OUTPUT of the AC power supply to ON.**

OUTPUT of the AC power supply is set to ON. The lamp icon in the upper part of the screen lights up.

When it is synchronized with the frequency of the AC power supply, the triangular wave in the PLL icon in the upper part of the screen becomes still.

If the triangular wave in the PLL icon does not become still	
AC power supply	Check whether it is output correctly.
Wiring	Check whether the plug for the voltage-sensing terminal is set and connected to the VOLTAGE SENSING terminal on the rear.
Frequency	The PLL lock frequency range is 45 Hz to 65 Hz.

6 **Press the F6 key to return.**

7 **Turn on the power to the EUT.**

Setting the Impedance

61000-3-3

Set to the reference impedance. The Line Impedance Network can be used; for details on how to select the impedance, refer to the Operation Manual of the Line Impedance Network.

- 0.40 Ω + jn0.25 Ω (single-phase)
- 0.24 Ω + jn0.15 Ω (three-phase)
- 0.16 Ω + jn0.10 Ω (three-phase neutral line)

61000-3-11

Customers are asked to prepare the impedance.

● **When you declare that the power supply to be connected requires a current capacity of 100 A or more per phase as the operating condition of the equipment**

- 0.25 Ω + jn0.25 Ω (single-phase)
- 0.15 Ω + jn0.15 Ω (three-phase)
- 0.10 Ω + jn0.10 Ω (three-phase neutral line)

● **When you declare the maximum permissible system impedance (Zmax) of the power supply to be connected as the operating condition of the equipment**

- The voltage drop caused by the EUT is 3% to 5% of the voltage.
- The ratio of the reactance component to the resistance component of the impedance is 0.5 to 0.75.

Setting Test Conditions (61000-3-3)

Set the test conditions in the Vf-Test Conditions List display. When the test condition setting is complete, switch to the Vf-Observation and Analysis display for observation during the test.

Setting a Limit Value Standard

1. **Press the Vf key.**
   The Vf-Test Conditions List display appears.

2. **Select test conditions.**
   To use the same conditions as for a test that was executed in the past, call up a test condition file and use it.
   See p. 267

3. **Press the F6 key to select menu page 1/4.**

4. **Press the F1 key to select Limitation Standard.**
   Select IEC 61000-3-3 (Pst Auto) or IEC 61000-3-3 (Manual).

5. **Press the F2 key to select Measurement Technic Standard.**
   Select IEC 61000-4-15 Ed2.0 for measurements based on the IEC 61000-3-3 Ed3.1 standard. you can measure Tmax and other parameters according to IEC 61000-3-3 Ed3.1.

   Select IEC 61000-4-15 Ed1.1 for measurements based on earlier than the IEC 61000-3-3 Ed3.1 standard.

6. **Press the F6 key to switch to another menu page and set other test conditions.**

Optimizing the Current Range

1. **Press the VIEW key.**
   The Vf-Observation and Analysis display appears.
   See p. 79

2. **Press the F1 key to select List in View Type.**
   Measured values are displayed in the form of a list.

3. **Press the VIEW key.**
   The Vf-Observation and Test Conditions display appears and the menu for setting the measured values, which are still listed, is displayed.

4. **Change the operating conditions of the EUT to maximize the input current.**

5. **Press the F6 key to select menu page 4/4.**

6. **Press the F1 key to select V/I Range Setting.**
   A sub-menu is displayed.

7. **Press the F1 key to select Ch. Setting (V/I Range).**
   When "Linked" is selected in the Channel Linkage menu, independent setting of L1, L2, and L3 cannot be made.
   See p. 192

8 **Press the F2 key to select Current Range.**

Select the range on the basis of the maximum current obtained in step 4. We recommend performing the test using a fixed range.

If you do not know the current, select AUTO (auto range). In auto range, however, it takes approximately 6 seconds for the measured values to stabilize after the range switches. If a current variation causes the range to switch, wait at least 6 seconds before starting the test. During the test, the range is fixed to the present range.

9 **Press the F6 key to return.**

Input Procedure with Specified is Selected in the Setting Menu

Use the following procedure for specifying the nominal voltage.

1 **Press the Vf key.**

The Vf-Test Conditions List display appears.

2 **Press the F6 key to select menu page 1/4.**

3 **Press the F3 key to select Nominal Values.**

A sub-menu is displayed.

4 **Press the F1 key to select Specified in Nominal Voltage.**

5 **Press the F2 key to input a nominal voltage value (Specified Nominal Voltage).**

The input range is 100 V to 600 V.

6 **Press the F6 key to return.**

Inputting Comments for Report Printing

1 **Press the Vf key.**

The Vf-Test Conditions List display appears.

2 **Press the F6 key to select menu page 3/4.**

3 **Press the F3 key to select Comment Input.**

A sub-menu is displayed.

See p. 188

4 **Input comments for the menu items.**

The input comments can be checked on the screen.

5 **Press the F6 key to return.**

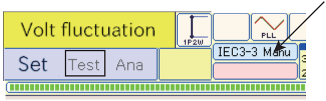
Starting the Test by Pressing the START Key (61000-3-3)

In IEC 61000-3-3 standard, different test procedures are used depending on the selection of Limitation Standard.

- When 61000-3-3 (Pst Auto) is selected, the test duration of “Pst Meas Time” is continuously repeated for the number of times defined by “Pst Meas Count” and the test is terminated upon completion of the “Pst Meas Count”.
- When 61000-3-3 (Manual SW) is selected, the measurement is stopped each time the “d Meas Time” of one “d Meas Count” cycle is completed. During the pause, prepare the EUT for the next operation and then command this product to start the test for the next “d Meas Time”. After repeating this procedure, terminate the test when the cycles defined by “d Meas Count” are completed.

See p. 212

The currently selected Limitation Standard can be checked by the Standard name shown in the display.



Limitation Standard Name

1 Press the VIEW key.

The Vf-Observation and Analysis display appears.

See p. 79

2 Select a view type for the test.

To observe voltage fluctuations, select Pinst (St) Waveform. Some displays can be selected only after the test ends.

3 Press the START key.

The dialog box for confirming the line impedance is displayed.

If the optional current sensor is not connected or recognized although "Sensor" is selected in the Current Input Terminal setting, a confirmation dialog will be presented.

See p. 87

If the sum (∑) of the real power of each input phase is negative, a confirmation dialog will be presented.

4 Select the F1 key (OK), after checking the setting of the test conditions according to the comment in the dialogbox.

If the F2 key (Cancel) is selected, the test start is canceled. To start the test, return to Step 3.

The test is started.

Display during test	
Test status display	Switches from “Set” to “Test.” The progress bar extends from left to right. When it reaches the right end, the test ends.
Time display	Remaining test time
View type	The view type that is set in the Vf-Observation and Analysis display (Vf-VIEW)

Aborting the Test by Pressing the STOP Key

Press the STOP key during the test.

The test ending menu (page 213) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-3).”

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end.

When the Test is Aborted Automatically

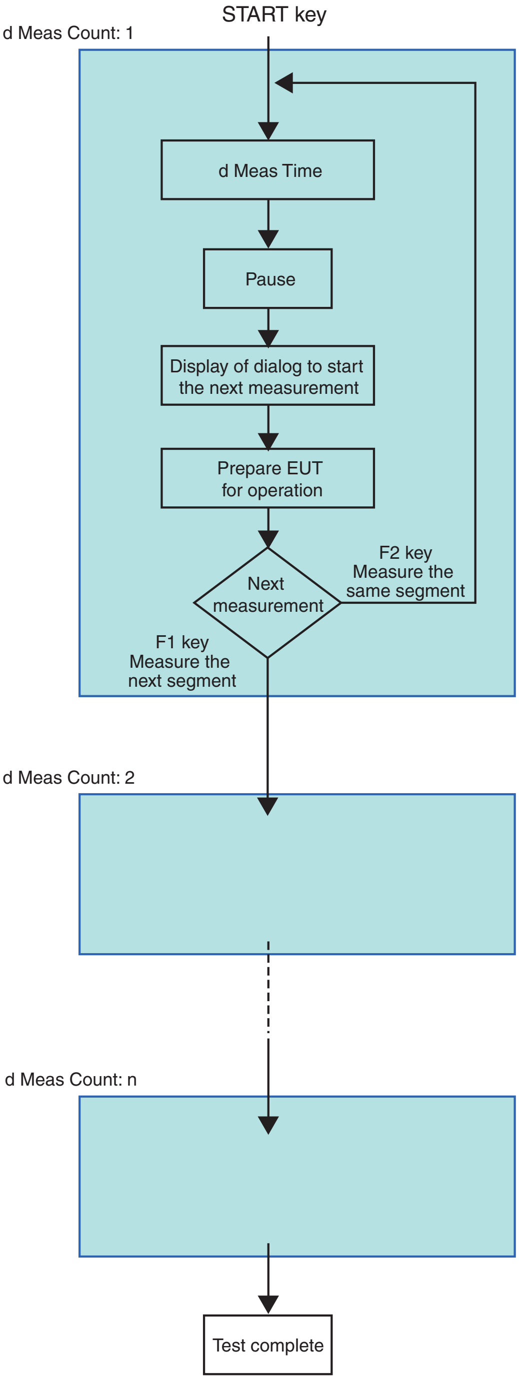
The test is aborted automatically when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

The test ending menu (p.213) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-3).”

Operation after Starting the Test (61000-3-3, Manual SW)

The following figure shows the operation procedures for the case IEC 61000-3-3 (Manual SW) is selected.

- The measurement is stopped each time the “d Meas Time” of one “d Meas Count” is completed.
- During the pause, prepare the EUT for the next operation.
- According to the dialog and menu displayed, press the appropriate function key to start the next “d Meas Time”.
- After repeating the above, terminate the test when the “d Meas Count” is completed.



When the Test Time Expires (61000-3-3)

- When the result of the general judgment is acceptable (PASS,the progress bar is green), follow the procedure described below.
- When the result of the general judgment is not acceptable (FAIL,the progress bar is red), set the impedance again and re-execute the test for the 61000-3-11 standard. For details, see "Setting the Impedance Again (61000-3-11)".

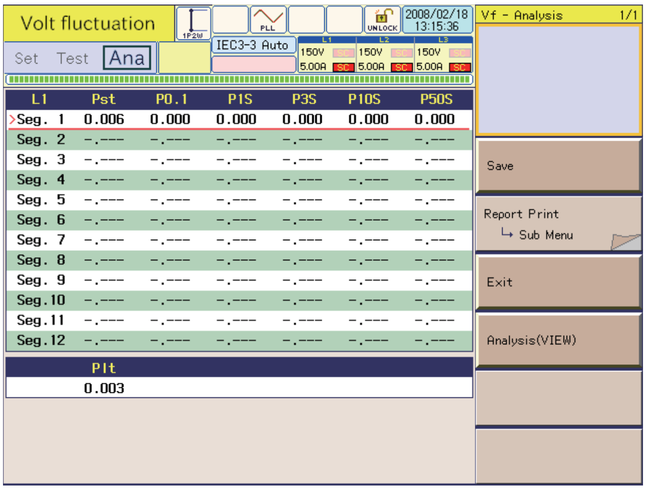
See p. 214

When the General Judgment is PASS

1 **Press the F1 key (OK).**

The test ending menu shown below is displayed and the buzzer stops.

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end and its color changes according to the judgment.
PASS	The result of the general judgment is acceptable (the progress bar is green).
WARNING	The result of the general judgment is acceptable but the margin is exceeded (the progress bar is yellow).
FAIL	The result of the general judgment is not acceptable (the progress bar is red).



L1	Pst	P0.1	P1S	P3S	P10S	P50S
Seg. 1	0.006	0.000	0.000	0.000	0.000	0.000
Seg. 2	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 3	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 4	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 5	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 6	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 7	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 8	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 9	-.---	-.---	-.---	-.---	-.---	-.---
Seg.10	-.---	-.---	-.---	-.---	-.---	-.---
Seg.11	-.---	-.---	-.---	-.---	-.---	-.---
Seg.12	-.---	-.---	-.---	-.---	-.---	-.---

Plt
0.003

2 **When terminating the test, select an item you want to operate from the test ending menu.**

For details on the selection, see "Overview of the Test Ending Menu".

See p. 220

When the General Judgment is FAIL

Set the impedance again and re-execute the test for the 61000-3-11 standard.

See "Setting the Impedance Again (61000-3-11)".

See p. 214

Setting the Impedance Again (61000-3-11)

Customers are asked to prepare the impedance.

● When you declare that the power supply to be connected requires a current capacity of 100 A or more per phase as the equipment operating condition

- 0.25 Ω + jn0.25 Ω (single-phase)
- 0.15 Ω + jn0.15 Ω (three-phase)
- 0.10 Ω + jn0.10 Ω (three-phase neutral line)

● When you declare the maximum permissible system impedance (Zmax) of the power supply to be connected as the equipment operating condition

- The voltage drop caused by the EUT is 3% to 5% of the voltage.
- The ratio of the reactance component to the resistance component of the impedance is 0.5 to 0.75.

1 **Set OUTPUT of the AC power supply to OFF.**

2 **Ensure the impedance of the AC power supply conforms to the standard requirements.**

To satisfy the standard requirements, the impedance or the AC power supply may need to be replaced.

⚠WARNING

- **This work has a risk of electric shock. For the AC power supply used for the measurement circuit, be sure to disconnect the power cord from the outlet, turn off the switch on the distribution panel to which the power cord is connected, and turn off the POWER switch.**

---

3 **Press the Vf key.**

The Vf-Test Conditions List display appears.

4 **Press the F6 key to select menu page 3/4.**

5 **Press the F2 key to select Test Impedance.**

A sub-menu is displayed.

6 **Press the F1 key to select 0.25 Ω + jn0.25 Ω (single-phase), 0.15 Ω + jn0.15 Ω (three-phase), or Specified in Z test.**

When Specified is selected, input values in the F2 to F5 menus. The input values are used for converting limit values.

7 **Press the F6 key to return.**

8 **Set OUTPUT of the power supply to ON.**

Setting Test Conditions (61000-3-11)

Setting the Limit Value Standard

1 **Press the Vf key.**

The Vf-Test Conditions List display appears.

See p. 267

2 **Set test conditions.**

To use the same conditions as for a test that was executed in the past, call up a test condition file and use it.

3 **Press the F6 key to select menu page 1/4.**

4 **Press the F1 key to select Limitation Standard.**

Select IEC 61000-3-11 Ed2.0.

5 **Press the VIEW key.**

The Vf-Observation and Analysis display appears.

Optimizing the Current Range

See p. 79

1 **Press the VIEW key.**

The Vf-Observation and Analysis display appears.

2 **Press the F1 key to select List in View Type.**

Measured values are displayed in the form of a list.

3 **Press the VIEW key.**

The Vf-Observation and Test Conditions display appears. The menu for setting the measured values, which are still listed, is displayed.

4 **Change the operating conditions of the EUT to maximize the input current.**

5 **Press the F6 key to select menu page 4/4.**

6 **Press the F1 key to select V/I Range Setting.**

A sub-menu is displayed.

See p. 192

7 **Press the F1 key to select Ch. Setting (V/I Range).**

When "Linked" is selected in the Channel Linkage menu, independent setting of L1, L2, and L3 cannot be made.

8 **Press the F2 key to select Current Range.**

Select the range on the basis of the maximum current obtained in step 4. We recommend performing the test using a fixed range.

If you do not know the current, select AUTO (auto range). In auto range, however, it takes approximately 6 seconds for the measured values to stabilize after the range switches. If a current variation causes the range to switch, wait at least 6 seconds before starting the test. During the test, the range is fixed to the present range.

9 **Press the F6 key to return.**

Input Procedure when Specified value is Selected in the Setting Menu

Use the following procedure for specifying the rated voltage.

1. **Press the Vf key.**
   The Vf-Test Conditions List display appears.
2. **Press the F6 key to select menu page 1/4.**
3. **Press the F3 key to select Nominal Values.**
   A sub-menu is displayed.
4. **Press the F1 key to select Specified in Nominal Voltage.**
5. **Press the F2 key to input a nominal voltage value (Specified Nominal Voltage).**
   The input range is 100 V to 600 V.
6. **Press the F6 key to return.**

Inputting Comments for Report Printing

1. **Press the Vf key.**
   The Vf-Test Conditions List display appears.
2. **Press the F6 key to select menu page 3/4.**
3. **Press the F3 key to select Comment Input.**
   A sub-menu is displayed.
4. **Input comments for the menu items.**
   The input comments can be checked on the screen.
5. **Press the F6 key to return.**

See p. 198

Starting the Test by Pressing the START key (61000-3-11)

See p. 79

1 Press the VIEW key.

The Vf-Observation and Analysis display appears.

2 Select a view type for the test.

To observe voltage fluctuations, select Pinst (St) Waveform. Some displays can be selected only after the test ends.

See p. 87

3 Press the START key.

The dialog box for confirming the line impedance is displayed.

If the optional current sensor is not connected or recognized although "Sensor" is selected in the Current Input Terminal setting, a confirmation dialog will be presented.

If the sum (Σ) of the real power of each input phase is negative, a confirmation dialog will be presented.

4 Select the F1 key (OK), after checking the setting of the test conditions according to the comment in the dialogbox.

If the F2 key (Cancel) is selected, the test start is canceled. To start the test, return to Step 3.

The test is started.

Display during test	
Test status display	Switches from “Set” to “Test.” The progress bar extends from left to right. When it reaches the right end, the test ends.
Time display	Remaining test time
View type	The view type that is set in the Vf-Observation and Analysis display (Vf-VIEW)

Aborting the Test by Pressing the STOP Key

Press the STOP key during the test.

The test ending menu (p.218) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-11).”

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end.

When the Test is Aborted Automatically

The test is aborted automatically when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

The test ending menu (p.218) is displayed. Test results are aborted. The subsequent operations are the same as for “When the Test Time Expires (61000-3-11).”

When the Test Time Expires (61000-3-11)

- When the result of the general judgment is acceptable (PASS,the progress bar is green), follow the procedure described below.

See p. 214

- When the result of the general judgment is not acceptable (FAIL,the progress bar is red) and you have employed an impedance to declare that the power supply to be connected requires a current capacity of 100 A or more per phase as the equipment operating condition (hereafter called “100 A power supply declaration”)

  In this case, set the impedance again and re-execute the test for the 61000-3-11 standard to declare the maximum permissible system impedance (Zmax) of the power supply to be connected. For details, see "Setting the Impedance Again (61000-3-11)".

See p. 219

- When the result of the general judgment is not acceptable (FAIL,the progress bar is red) and you have employed an impedance to declare the maximum permissible system impedance (Zmax) of the power supply to be connected as the equipment operating condition (hereafter called “Zmax declaration”)

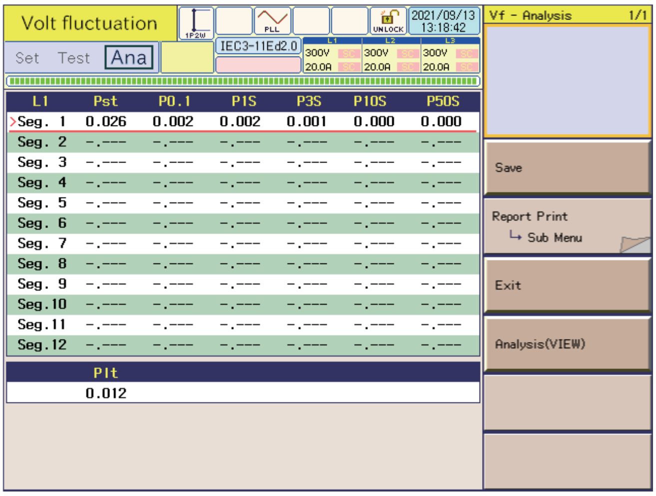
  In this case, obtain the maximum permissible system impedance (Zmax). For details, see "Maximum permissible system impedance (Zmax)".

When the General Judgment is PASS

1 **Press the F1 key (OK).**

The test ending menu shown below is displayed and the buzzer stops.

Display after the test ends	
Test status display	Switches from “Test” to “Analysis.” The progress bar extends to the right end and its color changes according to the judgment.
PASS	The result of the general judgment is acceptable (the progress bar is green).
WARNING	The result of the general judgment is acceptable but the margin is exceeded (the progress bar is yellow).
FAIL	The result of the general judgment is not acceptable (the progress bar is red).



L1	Pst	P0.1	P1S	P3S	P10S	P50S
>Seg. 1	0.026	0.002	0.002	0.001	0.000	0.000
Seg. 2	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 3	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 4	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 5	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 6	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 7	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 8	-.---	-.---	-.---	-.---	-.---	-.---
Seg. 9	-.---	-.---	-.---	-.---	-.---	-.---
Seg.10	-.---	-.---	-.---	-.---	-.---	-.---
Seg.11	-.---	-.---	-.---	-.---	-.---	-.---
Seg.12	-.---	-.---	-.---	-.---	-.---	-.---

	Plt
	0.012

2 **When terminating the test, select an item you want to operate from the test ending menu.**

See p. 220

For details on the selection, see "Overview of the Test Ending Menu".

When the General Judgment is FAIL (“100 A Power Supply Declaration”)

Use the following procedure when the impedance for “100 A Power Supply Declaration” has been employed.

Set the impedance again and re-execute the test or the 61000-3-11 standard.

See p. 214

For details, see "Setting the Impedance Again (61000-3-11)".

When the General Judgment is FAIL (“Zmax Declaration”)

Use the following procedure when the impedance for “Zmax Declaration” has been employed.

Maximum permissible system impedance (Zmax)

Obtain the maximum permissible system impedance (Zmax) to declare the maximum permissible system impedance (Zmax) of the power supply to be connected as the equipment operating condition.

See p. 79

1 **Press the VIEW key.**

The Vf-Observation and Analysis display appears.

2 **Press the F1 key to select Result List in View Type.**

Measured values are displayed in the form of a list.

3 **Press the F2 key to select View Setting.**

A sub-menu is displayed.

4 **Press the F2 key to select Zmax in Item Change.**

The value is displayed in the item of Zmax on the screen.

5 **Press the F6 key to return.**

NOTE

- The measured values of dc, dmax, Pst and Plt are converted internally and automatically using the employed and reference impedance values to apply limit values. The maximum permissible system impedance (Zmax) is also calculated internally and automatically.

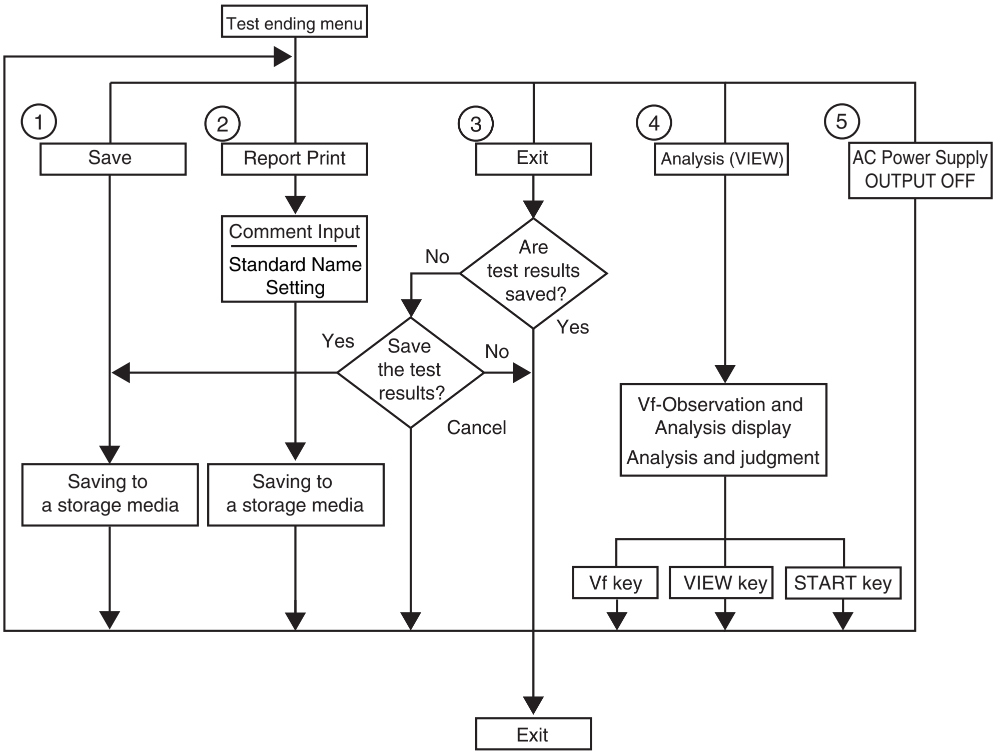
Overview of the Test Ending Menu

After the test time expires, the test ending menu is displayed. This menu consists of the first hierarchical menu and sub-menus.

The first hierarchical menu is composed of five menu items.

- Save the test results
- Report Print
- Exit
- Analysis (VIEW key)
- AC Power Suppy OUTPUT OFF

The basic structure is so designed as to return to the beginning of the test ending menu after any menu is executed. The test ends only when Exit is executed after the test results have already been saved or selected not to be saved.



① Save the test results

Select Save and save the results using the sub-menus. The test results are saved to a storage media. The file name is assigned automatically. After saving, the test ending menu is displayed.

② Report Print

Select Report Print and print reports using the sub-menus. The test results are saved in the report format to the storage media. After saving, the test ending menu is displayed.

The sub-menu includes the "Std. Name Setting" menu. Using this menu, the Standard name to be printed on the report can be modified.

③Exit (when the test results have been saved)

When the test results have been saved, selecting Exit terminates all the test ending operations. The screen does not return to the test ending menu. The next test can be started.

③Exit (when the test results have not been saved)

When the test results have not been saved, selecting Exit displays a dialog box again.

■ Yes (to save the test results)

When Yes is selected, the procedure becomes the same as when Save is selected.

■ No (not to save the test results)

If No is selected, all the test ending operations end. The screen does not return to the test ending menu. The next test can be started.

■ Cancel (not executing the saving operation)

If Cancel is selected, the screen returns to the test ending menu.

④Analysis

See p. 229

When Analysis is selected, the test results are analyzed.

■ VIEW key

Press the VIEW key to end the analysis. The screen returns to the test ending menu. Select Exit.

■ Vf key

If you want to set test conditions for a new test, press the Vf key. The screen returns to the test ending menu. Select Exit.

Terminate test ending menus other than the one for Analysis to terminate all the test ending operations. The screen does not return to the test ending menu. The next test can be started.

■ START key

Pressing the START key displays the test ending menu. Select Exit.

⑤AC Power Supply OUTPUT OFF

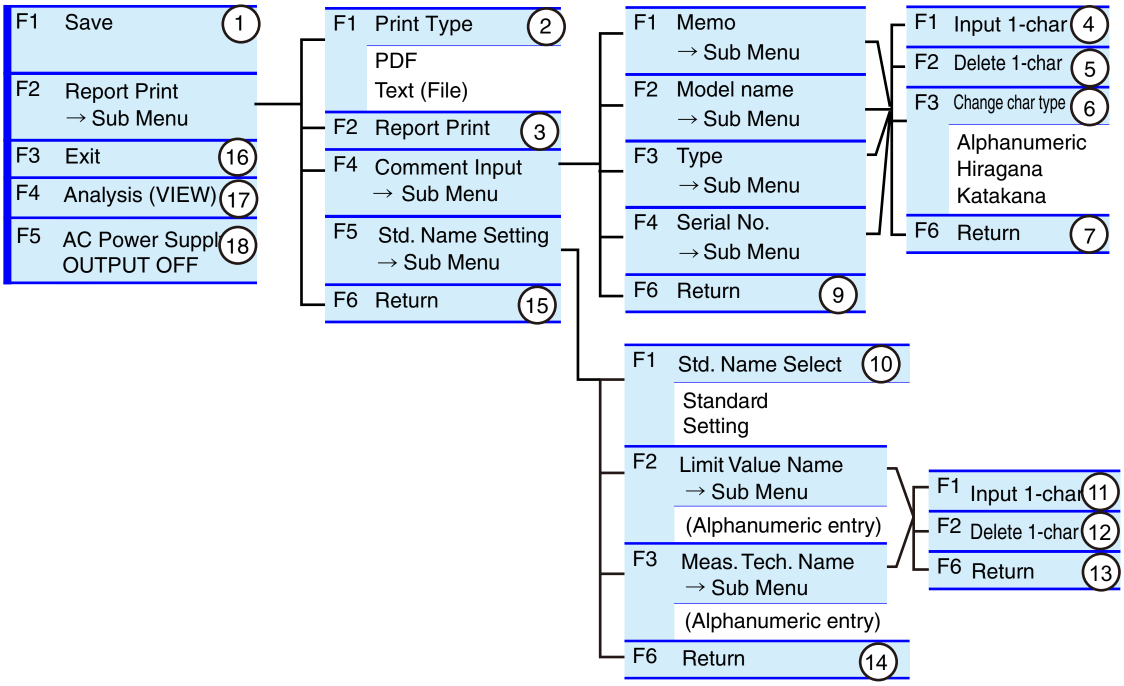
Turn off the output of the AC power supply. The bulb icon at the top of the display will be turned off. this item is displayed when it is so set to control the AC power supply.

Test Ending Menu

See p. 223

The test ending menu consists of the first hierarchical menu and sub-menus. For details on the sub-menus, see page 223 or later.

Menu 1/1



No.	Menu item	Description		Default
1	Save	Used to save test results.		–
2	Print Type	PDF	PDF format (a file format for saving to the storage media)	PDF
		Text (File)	Text format (a file format for saving to the storage media)	
3	Report Print	Use this item for saving to the storage media.		–
4	Input 1-char	Use this item to enter characters for Memo, Model name, Type and Serial No. Up to 20 alphanumeric characters and up to 10 hiragana and katakana characters can be input. For details on the procedure, see page 223.		–
5	Delete 1-char	Use this item to delete characters of Memo, Model name, Type and Serial No. For details on the procedure, see page 223.		–
6	Change char type	Use this item to change the character types of Memo, Model name, Type and Serial No. Every time the F3 key is pressed, the character types switch to alphanumeric, hiragana and katakana characters in this order.		–
7	Return	Terminates the character input, character deletion and character type change.		–
8	Margin	Margin		Margin
9	Return	Terminates the comment input.		–
10	Std. Name Select	Select how the "Limitation Std" and "Meas. Tech" names are presented in Report Print. Selects either "Standard" or "Setting".		Standard
11	Input 1-char	This function is used to enter characters for the local Limitation Standard name or the local Measuring technique name to be presented in Report Print. Up to 20 alphanumeric characters can be entered. On how to use this function, refer to the procedures shown below.		–

12	Delete 1-char	This function is used to delete characters from the local Limitation Standard names or the local Measuring technique names to be presented in Report Print. On how to use this function, refer to the procedures shown below.	–
13	Return	Exit from the character entry/deletion procedures to display local Limitation Standard or local Measuring technique names.	–
14	Return	Exit from the setting of standard names to be presented.	–
15	Return	Terminates the report printing.	–
16	Exit	Terminates the test.	–
17	Analysis (VIEW)	Analyses test results.	–
18	AC Power Supply OUTPUT OFF	Turn off the output of the AC power supply. This item is displayed when it is so set to control the AC power supply. See p. 203	

F key: Function key.You can also use the ESC key to return.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 **Press the F1, F2, F3 or F4 key.**

The Comment Input dialog will be presented.

2 **Use the small knob, large knob or arrow keys to select a character.**

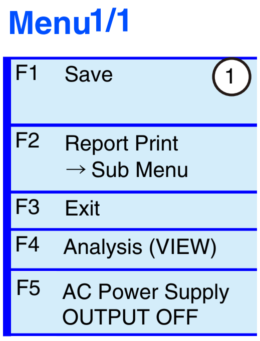
3 **Press the F1 (Input 1-char) key.**

The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 **Press the ENTER key.**

The characters entered will be fixed and saved.

Save



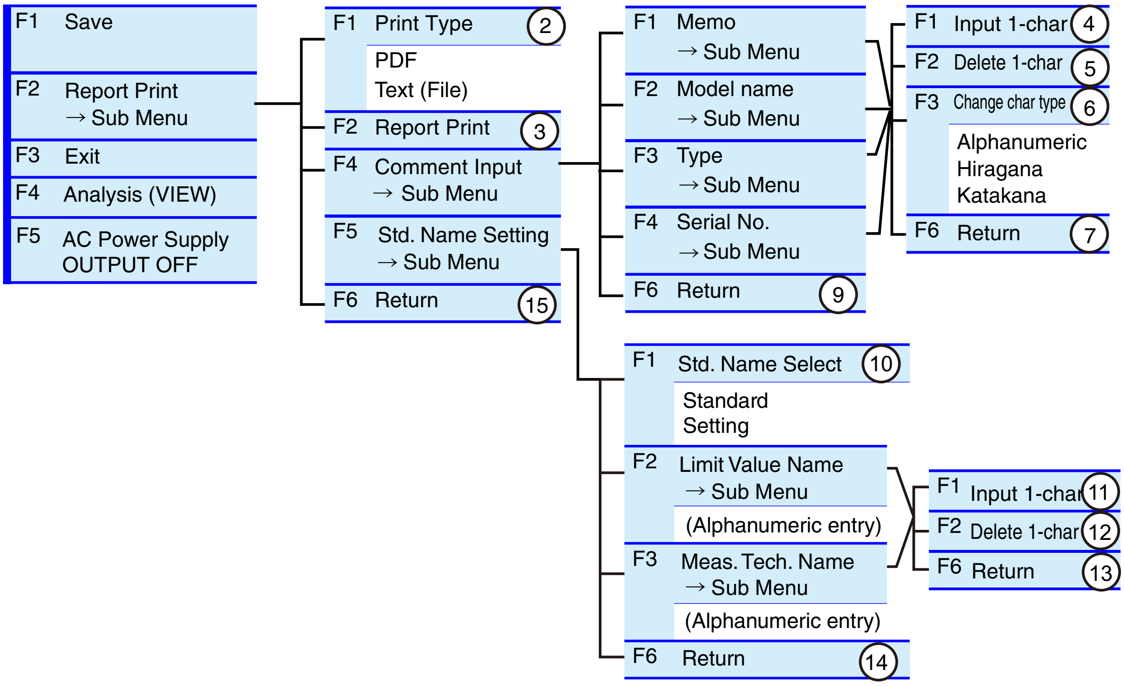
Press the F1 key to select Save.

A dialog box is displayed during saving. A file name is automatically assigned and the result file is saved to the storage media.

When the saving ends, the menu display “Save” is displayed dimmed and the menu function key is disabled.If the storage media is not found, the buzzer sounds and the dialog box “Disk Error. Media could not be detected” is displayed. If the dialog box is displayed, press the F1 key (OK) and insert a storage media.

Report Print

Menu 1/1



Select a print type and execute report printing

1 **Press the F2 key to select Report Print.**

A sub-menu is displayed.

2 **Press the F1 key to select Print Type.**

Select a print type. Select the file format for saving to the storage media.

3 **Press the F2 key to select Report Print.**

Saving to the storage media is initiated.

4 **Press the F6 key to return.**

Completing the saving to the storage media, it returns to the test ending menu.

Inputting comments

1 **Press the F2 key to select Report Print.**

A sub-menu is displayed.

2 **Press the F4 key to select Comment Input.**

The lower menu is displayed.

3 **Press the function key of a sub-menu to which you want to input a comment.**

The lower menu is displayed.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

4 **Use the small knob, large knob or arrow keys to select a character by moving the rectangular frame.**

5 **Press the F1 (Input 1-char) key.**

The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 4.

6 **Press the ENTER key.**

The characters entered will be fixed and saved.

7 **Press the F6 key to return.**

Character input, character deletion and character type change are terminated and return to the upper hierarchy.

8 **Press the F6 key to return.**

Comment input is terminated.

9 **Press the F6 key to return.**

Finishing Report Print, it returns to the test ending menu.

Standard Name Setting

The settings are saved. Once you set it, you do not have to set it again.

1 **Press the F2 key to select Report Print.**

A sub-menu is displayed.

2 **Press the F5 key to select Std. Name Setting.**

A lower layer menu is displayed.

3 **Press the F1 key to select Std. Name Select.**

4 **Press the F1 key to select Setting.**

5 **Press the F2 key to select Limit Value Name.**

A dialog and sub-menu will be displayed.

■ Input 1-char (F1 key), Delete 1-char (F2 key)

The procedure is the same as given in page 225. Only alphanumeric characters can be used.

6 **Press the F6 key to return.**

After completing the Input 1-char and/or Delete 1-char operations, return to the upper layer.

7 **Press the F2 key to select Meas. Tech. Name.**

A dialog and sub-menu will be displayed.

■ Input 1-char (F1 key), Delete 1-char (F2 key)

The procedure is the same as given in page 225. Only alphanumeric characters can be used.

8 **Press the F6 key to return.**

After completing the Input 1-char and/or Delete 1-char operations, return to the upper layer.

9 **Press the F6 key to return.**

Exit from Std. Name Setting.

10 **Press the F6 key to return.**

Finishing Report Print, it returns to the test ending menu.

Exit

Menu 1/1

F1	Save
F2	Report Print → Sub Menu
F3	Exit ⑯
F4	Analysis (VIEW)
F5	AC Power Supply OUTPUT OFF

When the test results have been saved

1 **Press the F3 key to select Exit.**

The test status display switches from “Test” to “Analysis.” The progress bar goes out. All the test ending operations end. The screen does not return to the test ending menu. The next test can be started.

When the test results have not been saved

1 **Press the F3 key to select Exit.**

The test status display switches from “Test” to “Analysis.” The progress bar goes out. A dialog box asking whether to save the test results is displayed.

■ How to save the test results

2 **Select the F1 key for "Yes".**

The screen returns to the Save menu.

3 **Follow the procedure for saving (F1 key).**

When not saving the test results

4 **Select the F2 key for "No".**

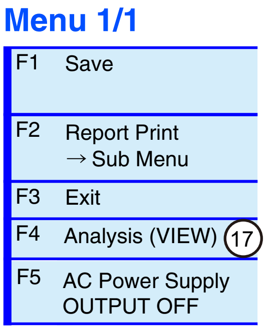
All the test ending operations end. The screen does not return to the test ending menu. The next test can be started.

When aborting the saving operation

5 **Select the F3 key for "Cancel".**

The screen returns to the test ending menu.

Analysis



1 **Press the F4 key to select Analysis.**

The test status display switches from “Test” to “Analysis.” The progress bar goes out.

2 **Execute analysis using the Analysis display.**

For details on the operation, see Chapter 10, “Observation, Analysis and Judgement of Voltage Fluctuations.”

See p. 229

How to terminate Analysis

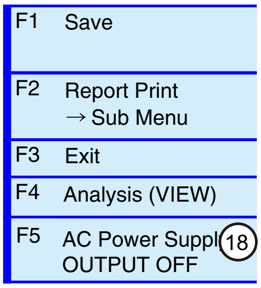
3 **Press the VIEW key.**

The screen returns to the test ending menu.

AC Power Supply OUTPUT OFF

Turn off the power to the EUT.

Menu 1/1



1. **Press the F5 key to select AC Power Supply OUTPUT OFF.**
   The output of the AC power supply will be turned off. The bulb icon at the top of the display will be turned off.

Using EXT CONT

An alternative method to turn off the AC power supply output is described below:

1. **Press the EXT CONT key.**
   The External Control display appears.
2. **Press the F1 key to select AC Power Supply Control.**
   A sub-menu is displayed.
3. **Press the F1 key to select OFF in OUTPUT.**
   OUTPUT of the AC power supply is set to OFF. The lamp icon in the upper part of the screen goes out.
4. **Press the F6 key to return.**

10

Observation, Analysis and Judgement of Voltage Fluctuations

This chapter explains how to observe and analyze voltage fluctuation and flicker tests and judge conformance to the standards.

Functions of Observation, Analysis and Judgment

See p. 232

There are ten view types. For some functions concerning observation, analysis and judgment, available view types are limited. See "View Type List".

● Observation

- Before and during the test, measurement circuit data is continuously collected and displayed on the screen.
- Displays can be enlarged, reduced and changed in color. Measured values can be read using the cursor.

● Analysis

- After the test ends, test results can be analyzed.
- Saved test results can be called up and analyzed.
- Displays can be enlarged, reduced and changed in color. Measured values can be read using the cursor.

● Judgment

- After the test ends, test results can be judged in terms of the conformance to the standards.
- Saved test results can be called and judged in terms of the conformance to the standards.
- Before and during the test, measurement circuit data can be continuously collected and judged in terms of the conformance to the standards.
- Limit values, PASS, WARN and FAIL can be displayed. Displays can be changed in color.

Selecting the Targets of Observation, Analysis and Judgment

The three types of target data of observation, analysis and judgment are as described below.

● Current measurement data that are being observed before and during the test

- Used during the setting and test.
- This type of data can be observed by selecting a view type on the Vf-Observation and Analysis display (Vf-VIEW).

● Test result data after the test ends

- Used after terminating a test.
- This type of data can be observed by selecting a view type on the Vf-Observation and Analysis display (Vf-VIEW).

● Called-up test result data that have been saved

- Used by calling them up after terminating a test.
- This type of data can be observed by selecting a view type on the Vf-Observation and Analysis display (Vf-VIEW).

See p. 266

For details on how to call up result files, see “Displaying the File Operation.”

Displaying the Vf-Observation and Analysis Display (Vf-VIEW)

View Type
rms Waveform

View Area
4-Screen

L1	Pst	P0.1	P1S	P3S
S1	-.---	-.---	-.---	-.---
S2	-.---	-.---	-.---	-.---
S3	-.---	-.---	-.---	-.---
S4	-.---	-.---	-.---	-.---
S5	-.---	-.---	-.---	-.---
S6	-.---	-.---	-.---	-.---
S7	-.---	-.---	-.---	-.---
S8	-.---	-.---	-.---	-.---
S9	-.---	-.---	-.---	-.---
S10	-.---	-.---	-.---	-.---

Plt
-.---

Item	L1	Σ
VRMS	100.06 V	100.06 V
VPEAK+	142.41 V	------ V
VPEAK-	-142.15 V	------ V
CRMS	0.7927 A	0.7927 A
CPEAK+	4.282 A	------ A
CPEAK-	-2.533 A	------ A
FREQ	50.004 Hz	------ Hz
POWER	38.01 W	38.01W
VA	79.32 VA	79.32VA
var	69.63 var	69.62var
PF	0.4792	0.4792

Display the Vf-Observation and Analysis display (Vf-VIEW) (switching displays)

1 **Press the Vf key.**
The Vf key LED illuminates and the Vf-Test Conditions List display appears.

2 **Press the VIEW key in the Vf-Test Conditions List display.**
The VIEW key LED illuminates and the Vf-Observation and Analysis display (Vf-VIEW) appears.

3 **Press the VIEW key again.**
The screen switches between the Vf-Observation and Analysis display (Vf-VIEW) and Vf-Observation and Test Conditions display (toggle operation).

If the display does not appear by pressing the Vf key

A dialog box “Can’t execute during test/analysis. Please operate it after ending” is displayed and the display switches to the test ending menu.

See p. 220

While the test status display (in the upper left of the screen, “Set” in the case of the figure shown above) is “Test” or “Analysis,” pressing the Vf key does not display the Vf-Test Conditions List display. Because displaying the Vf-Test Conditions List display starts a new test with the test conditions changed, the test that has been executed needs to be terminated.

4 **Press the F3 key (Exit) in the test ending menu.**
The test ends. The test status display on the screen switches from “Analysis” to “Set.” If the test results have not been saved with the F1 key (Save), a dialog box and a menu for saving operation appear. To save the test results, select F1 (Yes); otherwise, select F2 (No).

5 **Press the Vf key.**
The Vf key LED illuminates and the Vf-Test Conditions List display appears.

6 **Press the View key.**
The VIEW key LED illuminates and the Vf-Observation and Analysis display (Vf-VIEW) appears.

View Type List

View Type	Function	When to use	See Page
V/I Waveform	Displays input voltages/current waveforms.	Setting an appropriate current range.	*236*
	Enlarges and reduces the vertical and horizontal axes.	Measuring the crest factor of a power supply current waveform of the EUT.	
	Displays the values of voltage, current and frequency by using the cursor.	Obtaining the phase difference of the current against the voltage.	
	Sets the current range and checks the operating conditions of the EUT by observing waveforms like an oscilloscope.	Enlarging the waveform of the current at a switching portion.	
rms Waveform	Displays the time transition of the voltage value.	Grasping the time transition of the voltage value.	*237*
List	Displays selected measurement items in numeric values.	Monitoring the operating status of the EUT in real time.	*238*
		Obtaining the maximum value of the apparent power.	
Pinst (St) Waveform	Displays momentary flicker values in real time.	Monitoring voltage fluctuations	*239*
CPF Waveform	Displays CPF (cumulative probability function).	Displaying the probability distribution of voltage fluctuations	*240*
dc Waveform dmax Waveform Tmax[*1] Waveform	Enlarges and reduces the vertical and horizontal axes.	Displaying the details of the dc, dmax and Tmax[*1] waveforms.	*241*
	Scrolls the time axis.	Finding a large fluctuation.	
Flicker List	Displays P0.1, P1s, P3s, P10s and P50s.	Displaying the elements of a flicker.	*242*
	Displays hidden parts of the screen by using the scroll function.	Obtaining the margin in relation to a limit value.	
	Displays limit values.	Making judgment on the spot.	
Result List	Displays hidden parts of the screen by using the scroll function.	Obtaining the margin in relation to a limit value.	*243*
	Displays limit values.	Making a general judgment.	

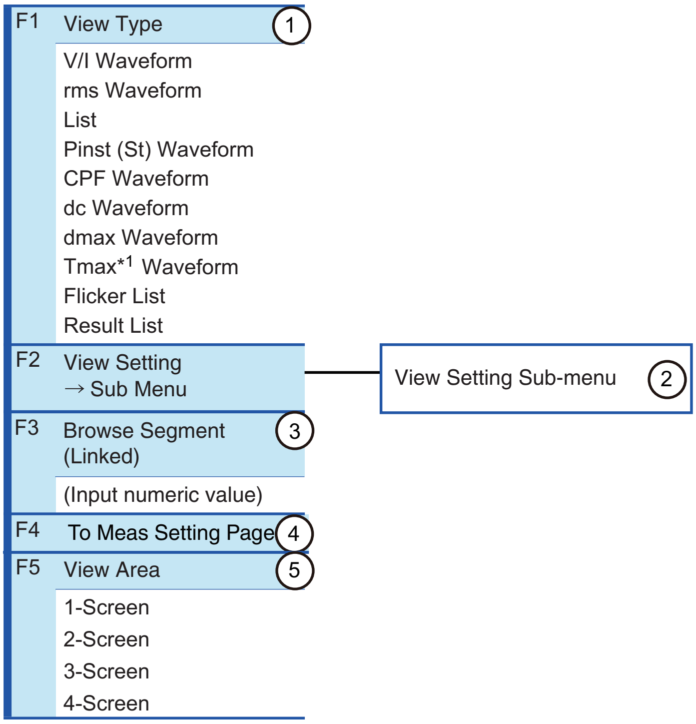
*1. Displayed as d(t)>3.3% depending on the selected standard.

VF-Observation and Analysis Menu

This menu contains the common part of the view types and the view setting sub-menu for each view type.

Common Menu for all View Types

Menu 1/1



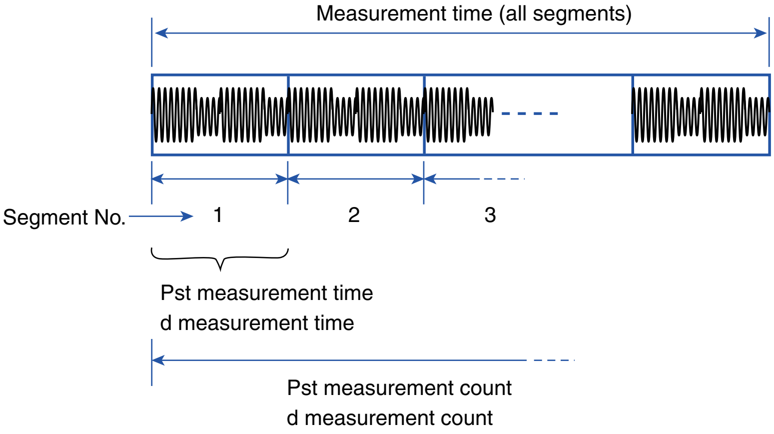
No.	Menu item	Description	Default
1	View Type	Select a view type.	V/I Waveform
2	View Setting Sub-menu	For details, see “View Setting Sub-menu.” Depends on the graph that is selected in View Type.	–
3	Browse Segment (Linked)	Enter the segment value. This menu item is applied to all the view types commonly. The value can be entered when any of CPF Waveform, dc Waveform, dmax Waveform, Tmax*1 Waveform, Flicker List and Result List is selected as the view type.This item is enabled only while the analysis is ongoing. It will be grayed out while any setting or test is ongoing.	1
4	To Meas Setting Page	Switches to page 4/4 of setting menu. This item is enabled only while any setting is ongoing. It will be grayed out while any test or analysis is ongoing.	
5	View Area	Select the number of divisions of the screen.	1-Screen

F key: Function key

[1] Displayed as d(t)>3.3% depending on the selected standard.

Browsing Segments (Linked)

Segments can be specified for analysis. Each measurement time is controlled as a series of segments. The specification of the segments is applied to all the view types commonly.



Dividing the View Area

L1	Pst	P0.1	P1S	P3S
S1	-.---	-.---	-.---	-.---
S2	-.---	-.---	-.---	-.---
S3	-.---	-.---	-.---	-.---
S4	-.---	-.---	-.---	-.---
S5	-.---	-.---	-.---	-.---
S6	-.---	-.---	-.---	-.---
S7	-.---	-.---	-.---	-.---
S8	-.---	-.---	-.---	-.---
S9	-.---	-.---	-.---	-.---
S10	-.---	-.---	-.---	-.---

Plt
-.---

Item	L1	Σ
VRMS	100.06 V	100.06 V
VPEAK+	142.41 V	------ V
VPEAK-	-142.15 V	------ V
CRMS	0.7927 A	0.7927 A
CPEAK+	4.282 A	------ A
CPEAK-	-2.533 A	------ A
FREQ	50.004 Hz	------ Hz
POWER	38.01 W	38.01W
VA	79.32 VA	79.32VA
var	69.63 var	69.62var
PF	0.4792	0.4792

The view area can be divided to simultaneously display different view types.

To select a divided view area, use the UP/DOWN and LEFT/RIGHT keys. The selected area is displayed in a red frame. Some items that can be displayed in a 1-screen view cannot be displayed when the number of view areas exceeds a certain value.

Display Screen when the Scaling Function is used

If the scaling function is used for any external sensor connected, the scale of the graph will be changed according to the scaling value set.

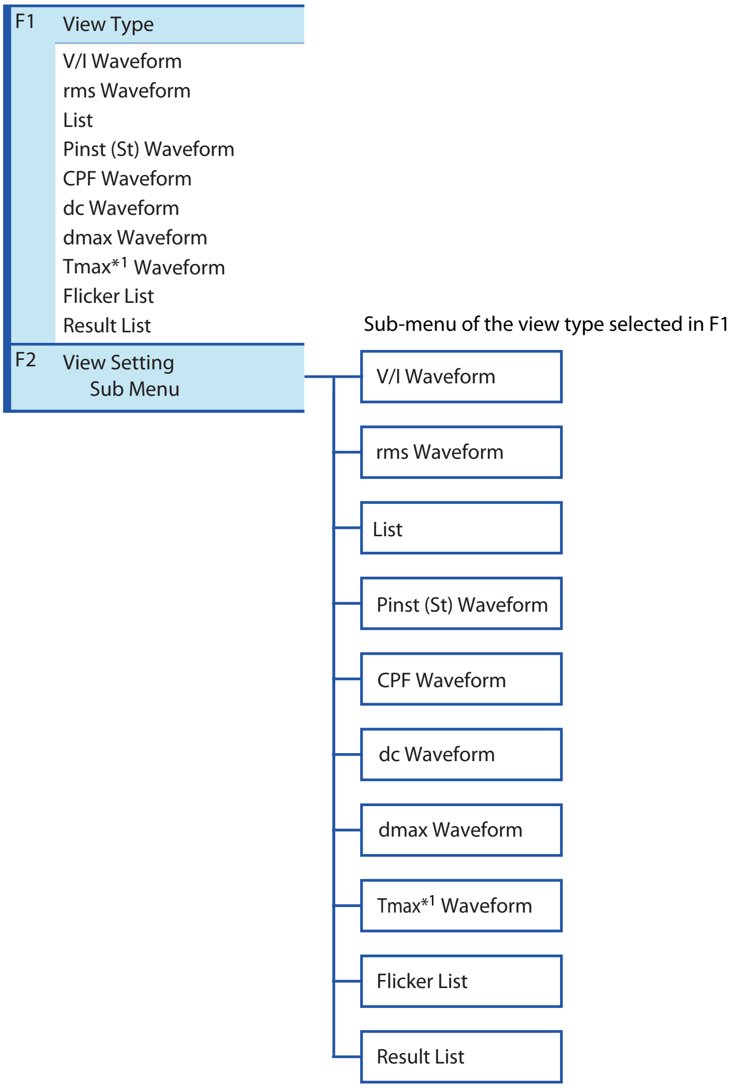
View Setting Sub-menu

The configuration of the View Setting sub-menu is shown below. Observation, analysis and judgment are executed using 10 types of graphs or numeric value display. The general judgment of conformance to the standards is performed using the test results.

View Setting sub-menu and view area

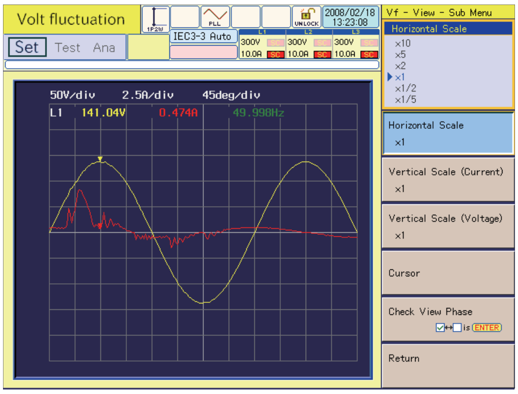
When the view area is set to 1-Screen, the View Setting sub-menu becomes the sub-menu of the view selected in View Type. When set to 2-Screen, 3-Screen or 4-Screen, select the view type using the UP/DOWN and LEFT/RIGHT keys. The sub-menu of the selected view appears.

Selecting the view type using the UP/DOWN and LEFT/RIGHT keys when the sub-menu is displayed returns the screen from the sub-menu. Press the F2 key again to display the View Setting menu.



*1. Displayed as d(t)>3.3% depending on the selected standard.

V/I Waveform



F1 Horizontal Scale ①

× 10, × 5, × 2,
× 1, × 1/2, × 1/5

F2 Vertical Scale (Current) ②

× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F3 Vertical Scale (Voltage) ③

× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F4 Cursor ④

(Input numeric value)

F5 Check View Phase ⑤

☐ L1
☐ L2
☐ L3

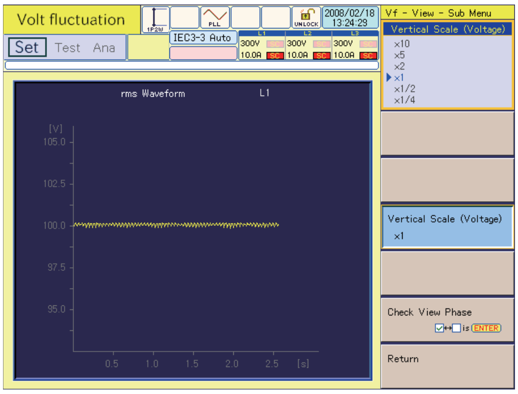
F6 Return ⑥

No.	Menu item	Description	Default
1	Horizontal Scale	Select a horizontal scale (scale factor). During analysis, it is fixed to × 1.	× 1
2	Vertical Scale (Current)	Select a vertical scale of current (scale factor).	× 1
3	Vertical Scale (Voltage)	Select a vertical scale of voltage (scale factor).	× 1
4	Cursor	Moves the cursor in the horizontal axis direction (time). Move the cursor using the small knob or the large knob. The measured value at the cursor is displayed.	1
5	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
6	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The waveform of each phase is displayed in a specific color. As for current, L1 is displayed in red, L2 in greenish yellow and L3 in purple, and for voltage, L1 in yellow, L2 in green and L3 in magenta.
- Used for observation and analysis.

rms Waveform



F3 Vertical Scale (Voltage) ①

× 10, × 5, × 2,
× 1, × 1/2, × 1/4

F5 Check View Phase ②

☐ L1
☐ L2
☐ L3

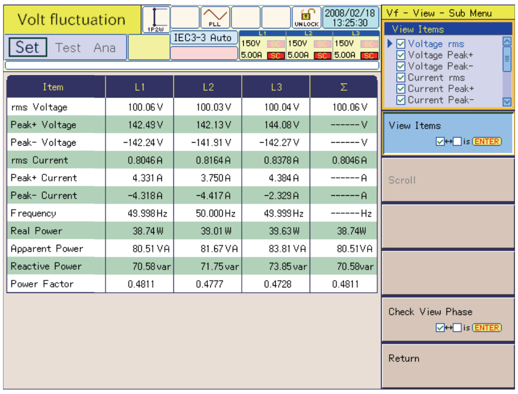
F6 Return ③

No.	Menu item	Description	Default
1	Vertical Scale (Voltage)	Select a vertical scale of current (scale factor).	× 1
2	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
3	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The waveform of each phase is displayed in a specific color. As for voltage, L1 is displayed in yellow, L2 in green and L3 in magenta.
- Used for observation.

List



Item	L1	L2	L3	Σ
rms Voltage	100.06 V	100.03 V	100.04 V	100.06 V
Peak+ Voltage	142.49 V	142.13 V	144.08 V	------ V
Peak- Voltage	-142.24 V	-141.91 V	-142.27 V	------ V
rms Current	0.8046 A	0.8164 A	0.8378 A	0.8046 A
Peak+ Current	4.331 A	3.750 A	4.384 A	------ A
Peak- Current	-4.318 A	-4.417 A	-2.329 A	------ A
Frequency	49.998 Hz	50.000 Hz	49.999 Hz	------ Hz
Real Power	38.74 W	39.01 W	39.63 W	38.74W
Apparent Power	80.51 VA	81.67 VA	83.81 VA	80.51VA
Reactive Power	70.58 var	71.75 var	73.85 var	70.58var
Power Factor	0.4811	0.4777	0.4728	0.4811

F1 Select View Items ①

☐ Voltage rms
☐ Voltage Peak +, ☐ Voltage Peak -
☐ Current rms
☐ Current Peak +, ☐ Current Peak -
☐ Frequency
☐ Real Power (W)
☐ Apparent Power (VA)
☐ Reactive Power (var)
☐ Power Factor

F2 Scroll ②

(Input numeric value)

F5 Check View Phase ③

☐ L1
☐ L2
☐ L3

F6 Return ④

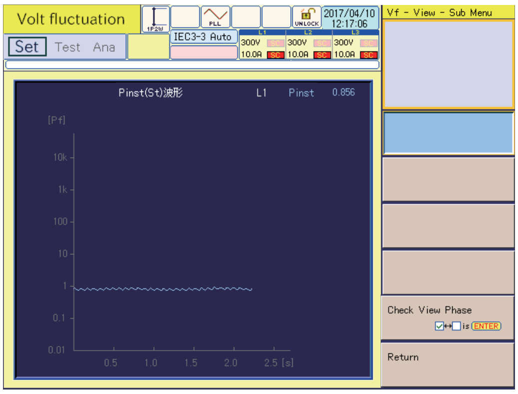
No.	Menu item	Description		Default
1	Select View Items	Voltage rms	Effective value of input voltage	Voltage rms
		Voltage Peak +	Positive amplitude peak value of input voltage	
		Voltage Peak -	Negative amplitude peak value of input voltage	
		Current rms	Effective value of input current	
		Current Peak +	Positive amplitude peak value of input current	
		Current Peak -	Negative amplitude peak value of input current	
		Frequency	Input frequency measured with input voltage	
		Real Power*1 (W)	Real power (W) of the EUT	
		Apparent Power*1 (VA)	Apparent power (VA) of the EUT	
		Reactive Power*1 (var)	Reactive power (var) of the EUT	
		Power Factor*1	Power factor of the EUT	
2	Scroll	Displayed when there are too many items to be displayed simultaneously. Use this item to see the hidden portion of the screen. Turn the small knob to vertically move the screen.		–
3	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.		L1, L2, L3
4	Return	Terminates the view setting.		–

*1 In a three-phase three-wire connection, the Σ (sigma) values are the valid values. The values of each phase (L1 to L3) carry no meaning, so they are displayed as "-----."

F key: Function key. You can also use the ESC key to return.

- Used for observation and analysis.
- The sigma (Σ) value is an average or total sum. Refer to the appendix for the calculation formula.

Pinst (St) Waveform



F5 Check View Phase ①

☐ L1
☐ L2
☐ L3

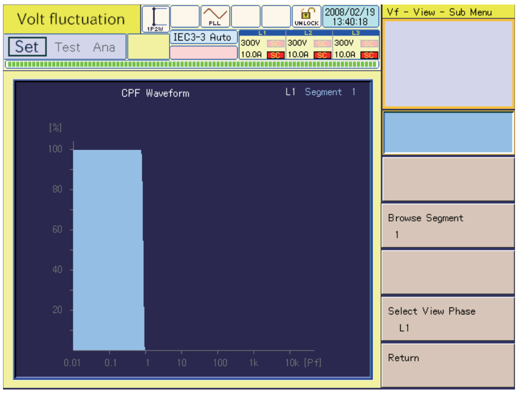
F6 Return ②

No.	Menu item	Description	Default
1	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
2	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The waveform of each phase is displayed in a specific color. As for voltage, L1 is displayed in yellow, L2 in green and L3 in magenta.
- Used for observation.

CPF Waveform



F3	Browse Segment ①
	(Input numeric value)
F5	Check View Phase ②
	☐ L1 ☐ L2 ☐ L3
F6	Return ③

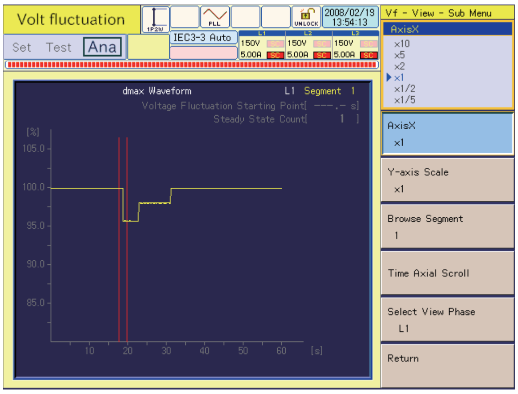
No.	Menu item	Description	Default
1	Browse Segment	Moves a segment (Pst measurement time per measurement). When Pst Auto is selected in Limitation Standard, the input range is 1 to 12. When Manual is selected in Limitation Standard, the input range is 3 to 24. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	1
2	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
3	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

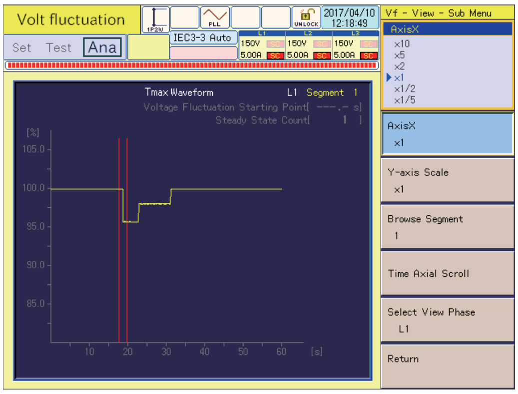
- The waveform of each phase is displayed in a specific color. As for voltage, L1 is displayed in yellow, L2 in green and L3 in magenta.
- Used for observation and analysis.

dc Waveform, dmax Waveform and Tmax (or d(t)>3.3%) Waveform

IEC61000-3-3
(Pst Auto)
dc Wavedorm



IEC61000-3-3
(Pst Auto)
dmax Waveform



IEC61000-3-3
(Pst Auto)
Tmax Waveform

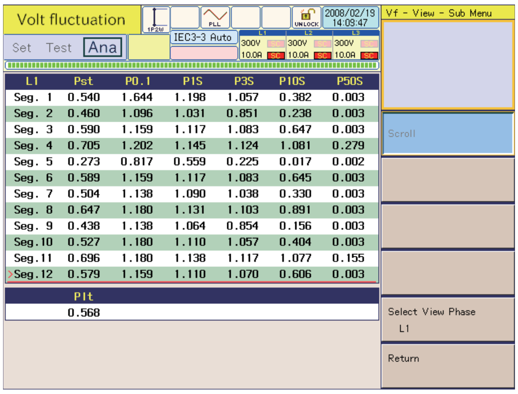
F1	Axis X ①	× 10, × 5, × 2, × 1, × 1/2, × 1/5
F2	Y-axis Scale ②	× 10, × 5, × 2, × 1, × 1/2, × 1/4
F3	Browse Segment ③	(Input numeric value)
F4	Time Axis Scroll ④	(Input numeric value)
F5	Check View Phase ⑤	L1 L2 L3
F6	Return ⑥	

No.	Menu item	Description	Default
1	Axis X	Select a horizontal scale (scale factor).	× 1
2	Y-axis Scale	Select a vertical scale of voltage (scale factor).	× 1
3	Browse Segment	Moves a segment (Pst measurement time per measurement). When Manual is selected in Limitation Standard, the input range is 3 to 24. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	1
4	Time Axis Scroll	Moves the time axis on the screen. Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	–
5	Check View Phase	Select a phase to be displayed.	L1
6	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- Used for observation and analysis.

Flicker List



L1	Pst	P0.1	P1S	P3S	P10S	P50S
Seg. 1	0.540	1.644	1.198	1.057	0.382	0.003
Seg. 2	0.460	1.096	1.031	0.851	0.238	0.003
Seg. 3	0.590	1.159	1.117	1.083	0.647	0.003
Seg. 4	0.705	1.202	1.145	1.124	1.081	0.279
Seg. 5	0.273	0.817	0.559	0.225	0.017	0.002
Seg. 6	0.589	1.159	1.117	1.083	0.645	0.003
Seg. 7	0.504	1.138	1.090	1.038	0.330	0.003
Seg. 8	0.647	1.180	1.131	1.103	0.891	0.003
Seg. 9	0.438	1.138	1.064	0.854	0.156	0.003
Seg.10	0.527	1.180	1.110	1.057	0.404	0.003
Seg.11	0.696	1.180	1.138	1.117	1.077	0.155
>Seg.12	0.579	1.159	1.110	1.070	0.606	0.003

Plt
0.568

F1 Scroll ①
(Input numeric value)
F5 Check View Phase ②
L1
L2
L3
F6 Return ③

No.	Menu item	Description	Default
1	Scroll	A scroll bar is displayed when there are too many items to be displayed simultaneously. Use the scroll bar to see the hidden portion of the screen. Turn the small knob to vertically move the screen.	–
2	Check View Phase	Select a phase to be displayed.	L1
3	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The display color of numeric values changes.

Measured value	Judgment
Red	Part exceeding 100% of the limit value
Yellow	Part exceeding the set margin value and up to 100% of the limit value
Black	Part up to the set margin value

- Used for observation, analysis and judgment.

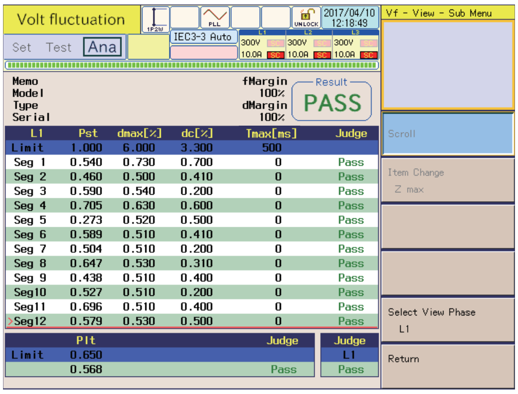
● Explanation of display items

Item	Pst	P0.1	P1s	P3s	P10s	P50s
Description	Short-time flicker value of one segment time	Parameters for Pst calculation				

Seg 1, 2---	The Pst measurement time corresponds to one segment (Seg1 or any later segment) time.

Plt	Long-time flicker value in all segment (Seg1 and subsequent segments) times (set with the Pst measurement count).

Result List (with the Standard Judgment Function)



Memo
Model
Type
Serial

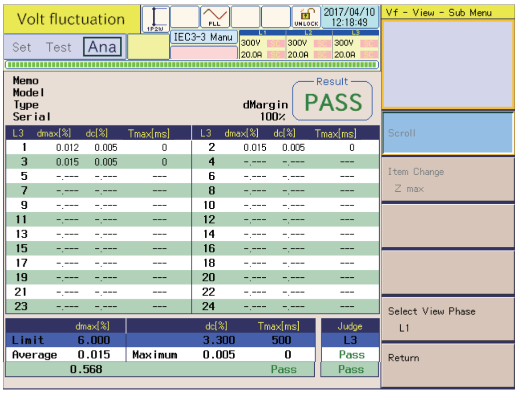
fMargin 100%
dMargin 100%

Result PASS

L1	Pst	dmax[%]	dc[%]	Tmax[ms]	Judge
Limit	1.000	6.000	3.300	500	
Seg 1	0.540	0.730	0.700	0	Pass
Seg 2	0.460	0.500	0.410	0	Pass
Seg 3	0.590	0.540	0.200	0	Pass
Seg 4	0.705	0.630	0.600	0	Pass
Seg 5	0.273	0.520	0.500	0	Pass
Seg 6	0.589	0.510	0.410	0	Pass
Seg 7	0.504	0.510	0.200	0	Pass
Seg 8	0.647	0.530	0.310	0	Pass
Seg 9	0.438	0.510	0.400	0	Pass
Seg10	0.527	0.510	0.200	0	Pass
Seg11	0.696	0.510	0.400	0	Pass
>Seg12	0.579	0.530	0.500	0	Pass

	Plt	Judge	Judge
Limit	0.650		L1
	0.568	Pass	Pass

IEC61000-3-3
(Pst Auto)



Memo
Model
Type
Serial

dMargin 100%

Result PASS

L3	dmax[%]	dc[%]	Tmax[ms]	L3	dmax[%]	dc[%]	Tmax[ms]
1	0.012	0.005	0	2	0.015	0.005	0
3	0.015	0.005	0	4	-.---	-.---	---
5	-.---	-.---	---	6	-.---	-.---	---
7	-.---	-.---	---	8	-.---	-.---	---
9	-.---	-.---	---	10	-.---	-.---	---
11	-.---	-.---	---	12	-.---	-.---	---
13	-.---	-.---	---	14	-.---	-.---	---
15	-.---	-.---	---	16	-.---	-.---	---
17	-.---	-.---	---	18	-.---	-.---	---
19	-.---	-.---	---	20	-.---	-.---	---
21	-.---	-.---	---	22	-.---	-.---	---
23	-.---	-.---	---	24	-.---	-.---	---

	dmax[%]		dc[%]	Tmax[ms]	Judge
Limit	6.000		3.300	500	L3
Average	0.015	Maximum	0.005	0	Pass
	0.568			Pass	Pass

IEC61000-3-3
(Manual)

F1 Scroll ①
(Input numeric value)

F2 Item Change ②
Zmax
Zsys1
Zsys2
Zsys3

F5 Check View Phase ③
L1
L2
L3

F6 Return ④

No.	Menu item	Description	Default
1	Scroll	A scroll bar is displayed when there are too many items to be displayed simultaneously. Use the scroll bar to see the hidden portion of the screen. Turn the small knob to vertically move the screen.	–
2	Item Change	This item is enabled when IEC 61000-3-11 Ed2.0 is selected for the Limitation Std. Select the calculated value of permissible system impedance. This menu item can be used during analysis. Zmax is the maximum permissible system impedance of a power supply to which equipment is connected (power receiving point). This value is declared as the condition for connection. Zsys1, Zsys2 and Zsys3 are the permissible system impedances calculated for each segment.	Zmax
3	Check View Phase	Select a phase to be displayed.	L1
4	Return	Terminates the view setting.	–

F key: Function key. You can also use the ESC key to return.

- The display color of the Judge column changes.

Measured value	Judgment
Red	Part exceeding 100% of the limit value
Yellow	Part exceeding the set margin value and up to 100% of the limit value
Black	Part up to the set margin value

- Used for analysis and judgment.

NOTE

- The measured values of dc, dmax, Pst and Plt are converted internally and automatically using the employed and reference impedance values to apply limit values. The maximum permissible system impedance (Zmax) is also calculated internally and automatically.

Explanation of display items

61000-3-3 (Pst Auto)

General judgment and judgment of conformance to the standards

Item	Description
Result	General judgment (PASS/FAIL/WARN) Displays WARN if the margin is exceeded. Displays ABORT if the test is aborted.*1
fMargin	Margin in relation to the limit values of Pst and Plt
dMargin	Margin in relation to the limit values of dc, dmax and Tmax*2

*1. The test is aborted when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

*2. Displayed as d(t)>3.3% depending on the selected standard.

Test data and judgment

Item	Pst	dmax[%]	dc[%]	Tmax*1[ms]	Judge
Limit	Limit value				–
Description	Short-time flicker value in one segment (Seg1 or any later segment) time	Maximum value of maximum relative voltage changes in one segment (Seg1 or any later segment) time	Maximum value of relative steady-state voltage changes in one segment (Seg1 or any later segment) time	Maximum value of time during which d(t) exceeds 3.3% in one segment (Seg1 or any later segment) time	Judgment (PASS/FAIL/WARN) for each segment. WARN is displayed if the margin is exceeded.

Seg 1, 2---	The Pst measurement time corresponds to one segment (Seg1 or any later segment) time.

Item	Plt	Judge
Limit	Limit value	–
Description	Long-time flicker value in all segment (Seg1 and subsequent segments) times (set in Pst Measurement Count).	Judgment (PASS/FAIL/WARN) of voltage fluctuations and flicker in one segment (Seg1 or any later segment) time. WARN is displayed if the margin is exceeded.

Judge
Target phase
Judgment according to limit values

*1 Displayed as d(t)>3.3% depending on the selected standard.

■ 61000-3-3 (Manual)

● General judgment and judgment of conformance to the standards

Item	Description
Result	General judgment (PASS/FAIL/WARN) Displays WARN if the margin is exceeded. Displays ABORT if the test is aborted.[*1]
dMargin	Margin in relation to the limit values of dc, dmax and Tmax[*2]

*1. The test is aborted when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

*2. Displayed as d(t)>3.3% depending on the selected standard.

● Test data and judgment

Item	Seg	dmax[%]	dc[%]	Tmax[*1][ms]
Limit	Limit value			
Description	The d measurement time corresponds to one segment (Seg1 or any later segment) time.	dmax (%) value of all segment (Seg1 and subsequent segments) time (set in d Measurement Count)	dc(%) value of all segment (Seg1 and subsequence segments) times (set in d Measurement Count)	Tmax[*1] time (ms) of all segment (Seg1 and subsequence segments) times (set in d Measurement Count)

Item	dmax[%]	Item	dc[%]	Tmax[*1] [ms]
Limit	Limit value	Limit	Limit value	Limit value
Average	Average of measured values excluding the maximum and minimum values	Maximum	Maximum value	Maximum value

Judge
Target phase
Judgment according to limit values

*1. Displayed as d(t)>3.3% depending on the selected standard.

■ 61000-3-11

● General judgment and judgment of conformance to the standards

Item	Description
Result	General judgment (PASS/FAIL/WARN) Displays WARN if the margin is exceeded. Displays ABORT if the test is aborted.[*1]
fMargin	Margin in relation to the limit values of Pst and Plt
dMargin	Margin in relation to the limit values of dc, dmax and d(t)>3.3%

*1. The test is aborted when a measured value exceeds the voltage or current range, synchronization of PLL fails, or overheating of the current detecting portion is detected.

● Test data and judgment

Item	Pst	dmax[%]	dc[%]	d(t)>3.3%[ms]	Judge
Limit	Limit value				–
Description	Short-time flicker value in one segment (Seg1 or any later segment) time	Maximum value of maximum relative voltage changes in one segment (Seg1 or any later segment) time	Maximum value of relative steady-state voltage changes in one segment (Seg1 or any later segment) time	Maximum value of time during which d(t) exceeds 3.3% in one segment (Seg1 or any later segment) time	Judgment (PASS/FAIL/WARN) for each segment. WARN is displayed if the margin is exceeded.

Seg 1, 2---	The Pst measurement time corresponds to one segment (Seg1 or any later segment) time.

Item	Plt	Zsys4[Ω]	Judge	Zmax[Ω]
Limit	Limit value	–	–	–
Description	Long-time flicker value in all segment (Seg1 and subsequent segments) times (set in Pst Measurement Count).	Permissible system impedance value calculated after converting the measured value of Plt with a set impedance	Judgment (PASS/FAIL/WARN) of voltage fluctuations and flicker in one segment (Seg1 or any later segment) time. WARN is displayed if the margin is exceeded.	Calculated value of the maximum permissible system impedance. Calculated minimum values of Zsys1, Zsys2, Zsys3 and Zsys4. Maximum permissible system impedance of a power supply to which equipment is connected (power receiving point). Value to be declared as the condition for connection.

Judge
Target phase
Judgment according to limit values

11

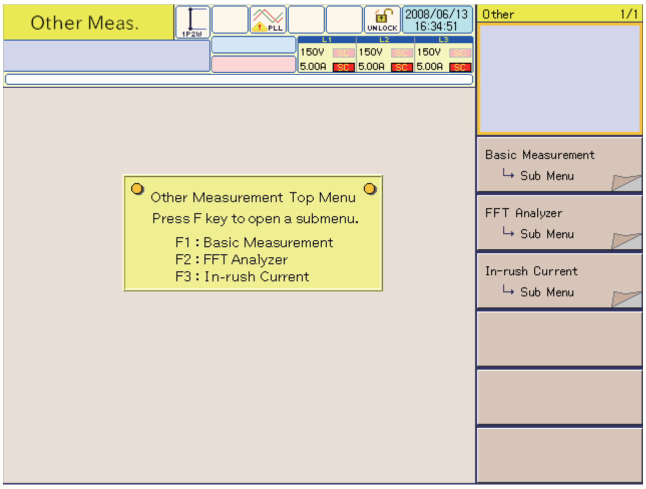
Other Measurements

This chapter explains basic measurement, FFT analyzer and in-rush current measurement.

Displaying the Other Measurement Display

The “Other Measurement display” has three measurement items, which observe and analyze signals. Judgment, saving and report printing are not possible. Waveforms are saved to the storage media as external memory by pressing the HARD COPY key.

- Basic measurement
- FFT analyzer
- In-rush current measurement



Other Measurement Top Menu
Press F key to open a submenu.
F1 : Basic Measurement
F2 : FFT Analyzer
F3 : In-rush Current

1 Press the OTHER key.

The OTHER key LED illuminates and the Measurement Item Selection display appears with a dialog box. If the screen does not switch to this display, perform the following procedure.

If the display does not appear by pressing the OTHER key

A dialog box “Can’t execute during test/analysis. Please operate it after ending” is displayed and the display switches to the test ending menu.

2 Press the F3 key (Exit) in the test ending menu.

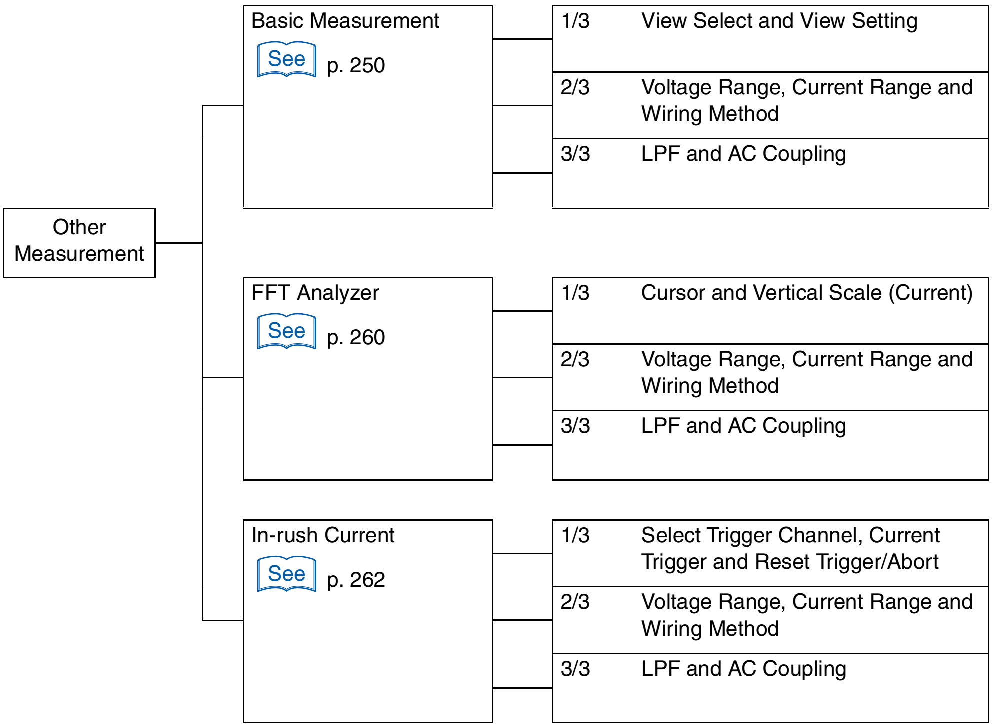
The test ends. The test status display on the screen switches from “Analysis” to “Set.” If the test results have not been saved with the F1 key (Save), a dialog box and a menu for saving operation appear. To save the test results, select F1 (Yes); otherwise, select F2 (No).

3 Press the OTHER key.

The OTHER key LED illuminates and the Measurement Item Selection display appears with a dialog box.

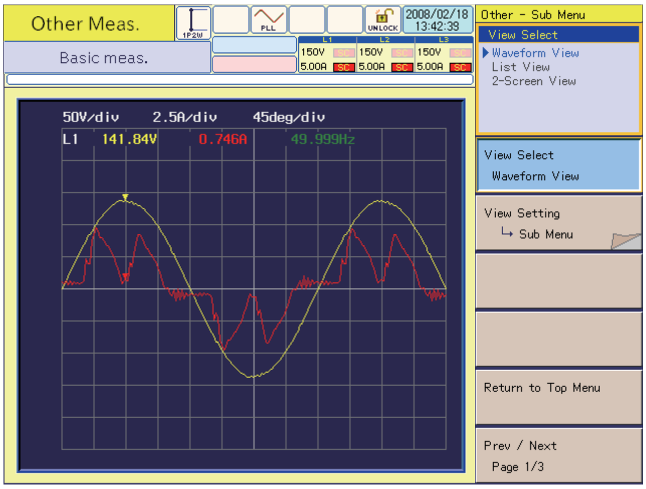
Entering Sub-menus

Basic measurement, FFT analyzer and in-rush current measurement each have their own sub-menus. Each sub-menu is composed of one or more pages. Each page has menu items (function keys F1 to F6). The following shows the main menu items of each page.



Basic Measurement

In the Basic Measurement display, voltage and current waveforms are observed. They are constantly measured. The items that are set in this menu are also applied to the settings of "FFT Analyzer" and “In-rush Current Measurement.”



50V/div 2.5A/div 45deg/div

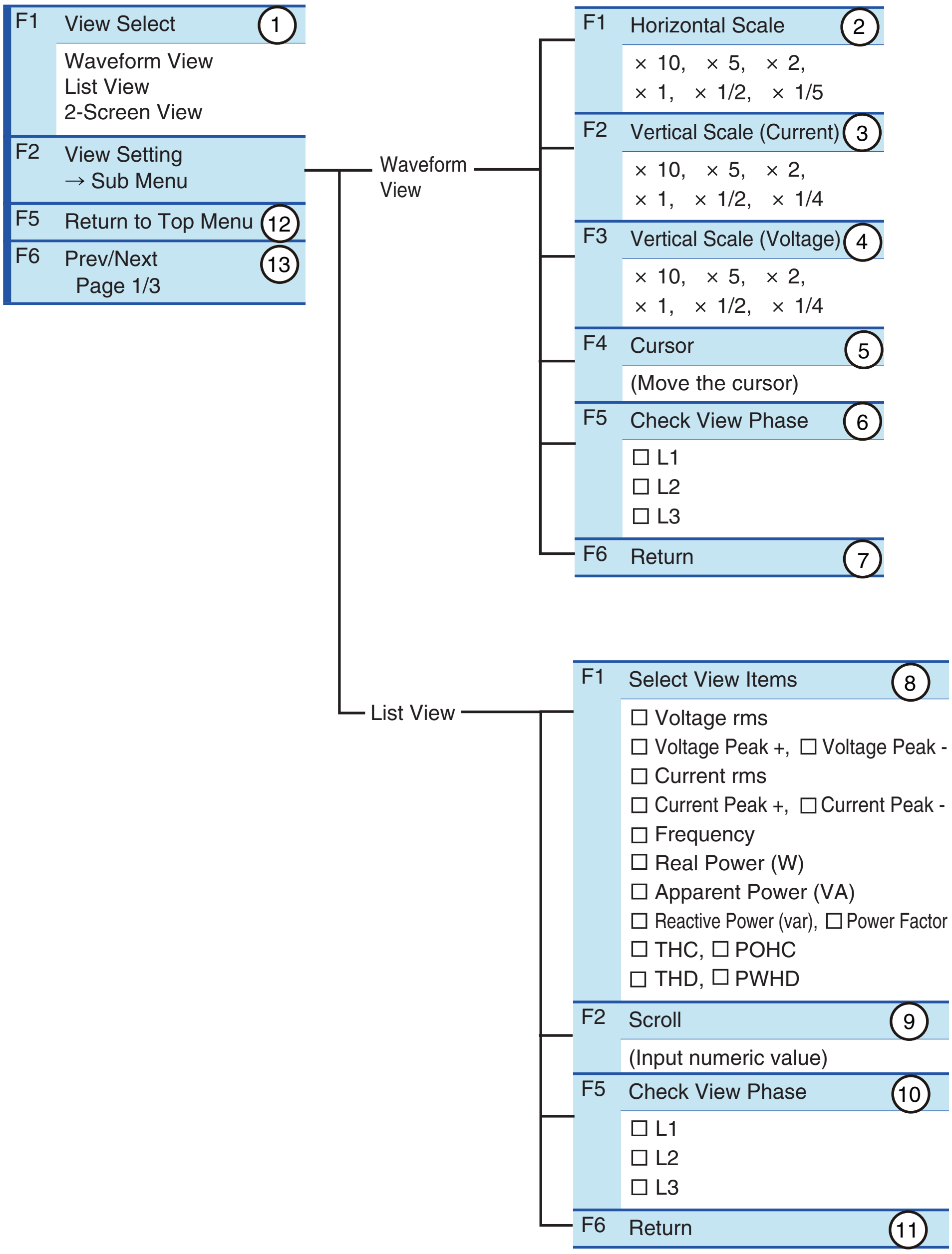
L1 141.84V 0.746A 49.999Hz

View Select
Waveform View

View Select and View Setting

In the View Select menu item, select Waveform View, List View or 2-Screen View. The 2-Screen View displays the Waveform and List views at the same time. In 1-screen view mode, the View Setting menu item shows the menu of a view selected in View Select. In 2-screen view mode, selecting a view with the UP/DOWN key returns the display from the sub-menu to the upper menu. Press the F2 key again to enter the View Setting menu item.

Basic Measurement sub-menu 1/3



No.	Menu item	Description	Default
1	View Select	Select a view.	Waveform View
2	Horizontal Scale	Select a horizontal scale of waveforms (scale factor).	× 1
3	Vertical Scale (Current)	Select a vertical scale of waveforms (scale factor).	× 1
4	Vertical Scale (Voltage)	Select a vertical scale of waveforms (scale factor).	× 1
5	Cursor	Moves the cursor in the horizontal axis direction (harmonic order). Move the cursor using the small knob or the large knob. The measured value at the cursor is displayed.	1
6	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
7	Return	Terminates the view setting for Waveform View.	

8	Select View Items	Select an item to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.		–
		Voltage rms	Effective value of input voltage	
		Voltage Peak +	Positive amplitude peak value of input voltage	
		Voltage Peak -	Negative amplitude peak value of input voltage	
		Current rms	Effective value of input current	
		Current Peak +	Positive amplitude peak value of input current	
		Current Peak -	Negative amplitude peak value of input current	
		Frequency	Input frequency measured with input voltage	
		Real Power[*1] (W)	Real power (W) of the EUT	
		Apparent Power[*1] (VA)	Apparent power (VA) of the EUT	
		Reactive Power[*1] (var)	Reactive power (var) of the EUT	
		Power Factor[*1]	Power factor of the EUT	
		THC	Total harmonic current of input current, effective value of all the harmonic current components from the 2nd to 40th order	
		POHC	Odd-order harmonic current of input current, effective value of odd-order harmonic current components from the 21st to 39th order	
		THD	Total harmonic distortion factor of input current, effective value ratio of all the harmonic current components from the 2nd to the 40th order against the effective value of the fundamental components	
		PWHD	Partial-weighted harmonic distortion factor of input current, effective value ratio of all the harmonic current components from the 14th to 40th order against the effective value of the fundamental components	
9	Scroll	Displayed when there are too many items to be displayed simultaneously. Use this item to see the hidden portion of the screen. Turn the small knob to vertically move the screen. This item is used in 2-screen view mode.		–
10	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.		L1, L2, L3
11	Return	Terminates the view setting.		–
12	Return to Top Menu	Returns to top menu of Other Measurement.		–
13	Prev/Next Page 1/3	Switches to another menu page.		–

*1 In a three-phase three-wire connection, the Σ (sigma) values are the valid values. The values of each phase (L1 to L3) carry no meaning, so they are displayed as "-----."

F key: Function key. You can also use the ESC key to return.

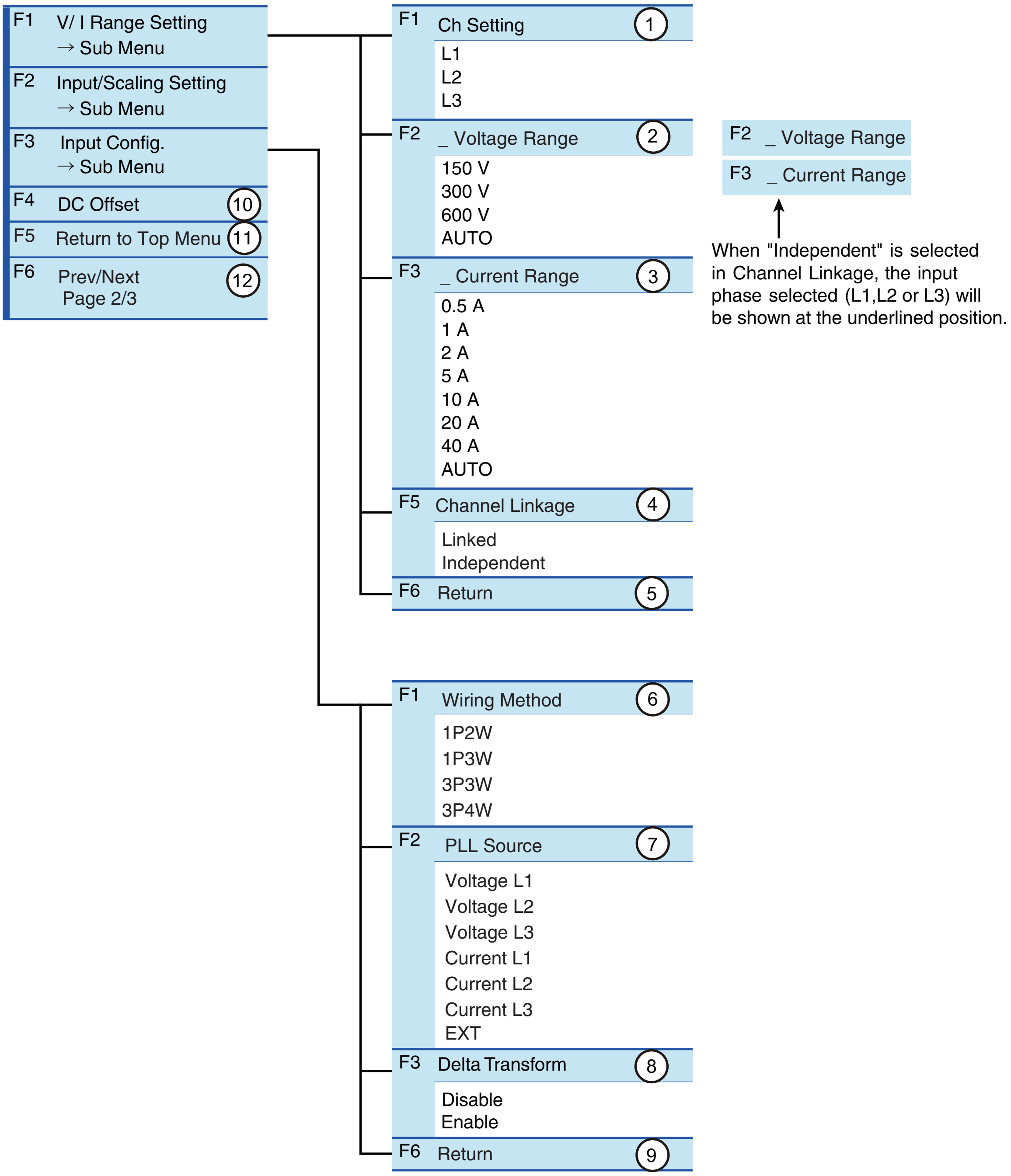
The set items are also applied to the settings of "V/I Waveform" on page 164 and "In-rush Current Measurement" on page 262.

Used for observation and analysis. The sigma (Σ) value is an average or total sum. Refer to the appendix for the calculation formula.

Voltage Range, Current Range and Wiring Method

Basic Measurement sub-menu 2/3
FFT Analyzer Sub-menu 2/3
In-rush Current Measurement sub-menu 2/3

(part 1)



When "Independent" is selected in Channel Linkage, the input phase selected (L1,L2 or L3) will be shown at the underlined position.

No.	Menu item	Description	Default
1	Ch Setting (V/I Range)	Select the input phase for the voltage and current measurement. This is used when "Independent" is selected in F5 Channel Linkage. If "Linked" is selected in F5 Channel Linkage, this part is grayed out and operation is inhibited. When "Linked" is selected, the L1 phase will be the reference.	L1

2	_ Voltage Range	Select the measurement range of the input phase selected in Setting Ch (V/I Range). Select the range in accordance with the rated power supply voltage of the EUT. In the AUTO mode, the range will be fixed once the test is started. The input phase selected (L1, L2 or L3) will be shown at the underlined position of the menu item. When "Volt. Scaling" is used, the menu will show the measurement range that corresponds to the scaling. When "Linked" is selected in F5 Channel Linkage, the input phase selected will not be shown at the underlined position of the menu item. The menu will be that for the L1 phase.	300 V
3	_ Current Range	Select the measurement range of the input phase selected in Setting Ch (V/I Range). Select the range in accordance with the rated power supply current of the EUT. In the AUTO mode, the range will be fixed once the test is started. The input phase selected (L1, L2 or L3) will be shown at the underlined position of the menu item. When "Curr. Scaling" is used, the menu will show the measurement range that corresponds to the scaling. When "Linked" is selected in F5 Channel Linkage, the input phase selected will not be shown at the underlined position of the menu item. The menu will be that for the L1 phase.	20 A
4	Channel Linkage	Select the "Linked" or "Independent" status between the lines L1, L2, and L3. When "Linked" is selected, independent setting of L1, L2, and L3 cannot be made. The "Linked" setting is applied to voltage and current ranges.	Linked
5	Return	Terminates the V/I Range setting.	–
6	Wiring Method	Select a wiring method for a measuring circuit.	3P4W
7	PLL Source	Select a source to synchronize with the AC power frequency. The voltage or current signal of each of the L1, L2 and L3 phases can be selected. To use the EXT SYNC INPUT input signal, select EXT.	Voltage L1
8	Delta TransformDisable See p. 107	This item becomes valid when 3P3W is selected in F1 Wiring Method. In the case of EUT that doesn't use the neutral line, the voltages between lines (line voltages) will be calculated from the measured voltages of each phase.	Disable
9	Return	Terminates the Input Config. (detailed measurement setting) function.	–
10	DC Offset	Controls the DC offset of the internal circuit.	–
11	Return to Top Menu	Returns to the top menu of Other Measurement.	–
12	Prev/Next Page 4/4	Switches to another menu page.	–

F key: Function key. You can also use the ESC key to return.

DC Offset adjustment function

This function automatically adjusts the offset so that the average DC current is zeroed at the time of pressing the F key. Although this adjustment can be made while input voltage and current are applied, it is recommended that the adjustment is performed while no input voltage/current is applied.

- If the automatic adjustment is made while a signal with non-zero average DC current is applied, the resulting offset will be shifted by the amount of the non-zero average DC current that existed in the input signal.

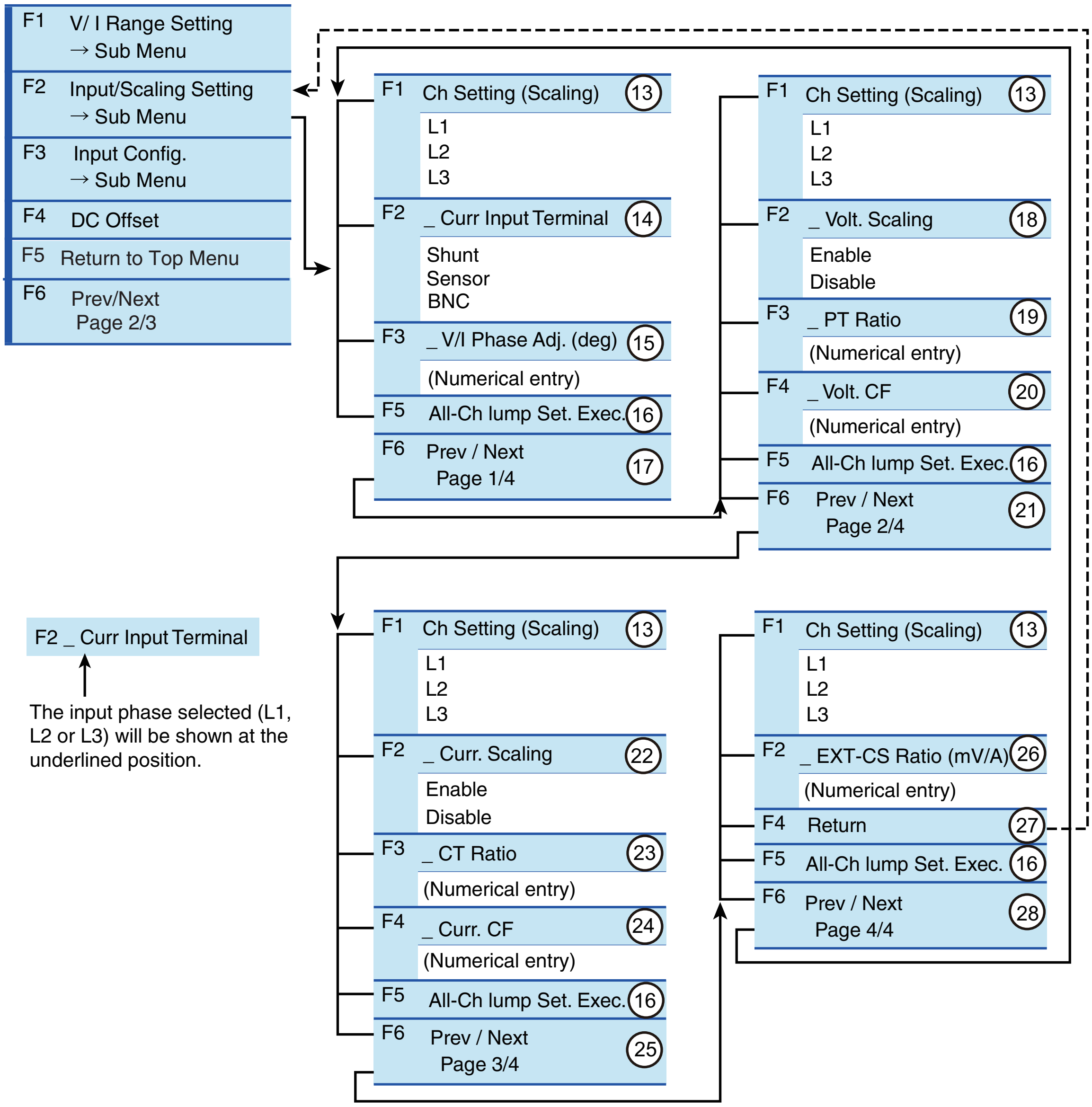
- As the adjustment is cleared when the range is changed, it is recommended to use this function after selecting a fixed range, instead of using the AUTO range.

- When the POWER switch is turned off, the adjustment will be cleared.

Scaling, Cuurent input Terminal

Basic Measurement sub-menu 2/3
FFT Analyzer Sub-menu 2/3
In-rush Current Measurement sub-menu 2/3

(part 2)



The input phase selected (L1, L2 or L3) will be shown at the underlined position.

No.	Menu item	Description	Default
13	Ch Setting (Scaling)	Select the input phase subject to the scaling. They are in the submenu pages of the pages 1/4 to 4/4.	L1
14	_ Curr Input Terminal See p. 86,p. 257	Select the current input terminal. Select "Shunt" if the source and load terminals on the rear panel of this product are used. Select "Sensor" when EXP CLAMP is used. Select "BNC" when EXT INPUT is used. When Sensor or BNC is selected, the IRANGE part of the display will show C or B icon, respectively. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	Shunt

15	_ V/I Phase Adj. (deg) See p. 108	Adjust the current phase of the external current sensor. This item is enabled when "BNC" is selected in the Current Input Terminal menu. It is independent of the Enable/Disable setting of the Current Scaling menu. The input range is -180.00 to +180.00 degrees. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	0.00
16	All-Ch lump Set. Exec.	Copy the current channel settings set for execution to all other input channels (channels L1, L2, and L3) for setting them identically. When the F key is pressed, a confirmation dialog will be displayed. If you are sure to copy them, press the F1 key, "OK". If not, press the F2 key, "Cancel". * Whenever "Sensor" is selected for Current Input Terminal, copy the Current Input Terminal settings to all other input channels (channels L1, L2, and L3) for setting them identically. Items such as CT Ratio will not be copied.	-
17	Prev/Next Page 1/4	Move to other sub-menu pages.	-
18	_Volt. Scaling	Enable or disable the scaling of the voltage ratio for the external PT (potential transformer). If "Enable" is selected, the SC icon will be shown in the V RANGE part of the display. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	-
19	_ PT Ratio	This item is enabled when "Enable" is selected in the Volt. Scaling menu. Here, the voltage ratio (scaling) of PT (potential transformer) is set. The input range is 0.001 to 100.000. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	1.000
20	_ Volt. CF	This item is enabled when "Enable" is selected in the Volt. Scaling menu. In order to measure the peak value without the effect of any distortion, the peak to rms ratio (CF) is set for the range currently set. The CF setting affects the measurement resolution. The input range is 1.00 to 2.00. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	2.00
21	Prev/Next Page 2/4	Move to other sub-menu pages.	-
22	_ Curr. Scaling	Enable or disable the scaling of the current signal from the external current sensor. If "Enable" is selected, the SC icon will be shown in the I RANGE part of the display. When "Sensor" is selected in the Current Input Terminal menu, this item is fixed and grayed out in the "Enabled" status. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	-
23	_ CT Ratio	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "Shunt" is selected in the Current Input Terminal menu. Here, the scaling ratio of CT (current transformer) is set. The input range is 0.001 to 1000.000. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	1.000
24	_ Curr. CF	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "Shunt" or "BNC" is selected in the Current Input Terminal menu. In order to measure the peak value without the effect of any distortion, the peak to rms ratio (CF) is set for the range currently set. The CF setting affects the measurement resolution. The input range is 1.00 to 4.00. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	4.00

25	Prev/Next Page 3/4	Move to other sub-menu pages.	-
26	_ EXT-CS Ratio (mV/A)	This item is enabled when "Enable" is selected in the Current Scaling menu. This item is enabled when "BNC" is selected in the Current Input Terminal menu. Here, the voltage to current scaling ratio is set for the external current sensor. The input range is 0.250 mV/A to 2500.000 mV/A. Use the ten-key to enter the value and press the ENTER key or use the large knob to increment or decrement the value. The input phase (channel L1, L2 or L3) that has been selected in Ch Setting (Scaling) will be shown at the underlined position of the menu item.	25.000 mV/A
27	Return	Exit from the Input/Scaling Setting menu.	–
28	Prev/Next Page 4/4	Move to other sub-menu pages.	–

F key: Function key. You can also use the ESC key to return.

The set items are also applied to the settings of "FFT Analyzer" on page 260 and "In-rush Current Measurement" on page 262. In the case of AUTO range being selected, it is not applied.

The peak current that can be measured is four times the range value in the 0.5 A to 10 A ranges and 2.5 times in the 20 A and 40 A ranges.

NOTE

- If waveforms with a large crest factor are input while AUTO range is ON, the range may not remain constant. In this case, set AUTO range to OFF.

Selecting the Current Input Terminal menu

Shunt

Select "Shunt" to use the SOURCE and LOAD terminals on the rear panel of this product. The shunts are contained inside the L1, L2, and L3 input sections. When CTs (current transformers) are to be used, also select "Shunt". The secondary circuits of CTs are to be connected to the SOURCE and LOAD terminals.

⚠CAUTION

- The maximum value of input current is 40 Arms or 100 Apeak, whichever smaller. Exceeding this value may cause overheating of the current detector.
- If the current detector overheats, the OHP icon appears on the upper part of the screen. Immediately shut down the power to the EUT to cut the input current of this product. Restart the test after the OHP icon disappears.

Sensor(C C icon)

See p. 86

Select "Sensor" to use the optional current sensors connected to the EXT CLAMP terminals on the rear panel of this product. When "Sensor" is selected, the C icon will be shown in the I RANGE part of the display. The EXT CLAMP terminals are provided at the L1, L2, and L3 input sections.

BNC(B B icon)

Select "BNC" to use external current shunts or other current sensors connected to the EXT INPUT terminals on the rear panel of this product. When "BNC" is selected, the B icon will be shown in the I RANGE part of the display. The EXT INPUT terminals are provided in the L1, L2, and L3 input sections.

Using Scaling Menu items

Scaling (SC SC icon)

● Range setting to use external sensors

When external sensors are used, the measurement range is determined by the conversion ratio of the external sensor and the peak to rms ratio of the signal. Because the calculated range is based on the particular range of this product, some range may not be used depending on the maximum voltage or the maximum current of the external sensor.

Example Setting:

Current Range	Range (A) when external sensors are used	
Product-specific range (A)	Example 1: Current Sensor EXT-CS Ratio: 10 mV/A Max. current: 200A rms Saturation current: 400A peak Current CF: 2 (= 400/200)	Example 2: CT (current transformer) CT Ratio: 50 (50:1) Max. current: 500A rms Saturation current: 1000A peak Current CF: 2 (= 1000/500)
0.5	1.25	25
1	2.5	50
2	5	100
5	12.5	250
10	25	500
20	50	1000[*1]
40	100	2000[*1]

[*1] The range cannot be used because it exceeds the maximum current of the CT.

● Setting of CF (peak to rms ratio)

The peak to rms ratio (i.e., peak value divided by the rms value) of the input signal is set for CF. The CF value is used for over-range detection and automatic range control. By adequately setting the CF value according to the characteristics of the sensors or transformers to be used, magnetic saturation and other problems can be prevented.

● Phase Adjustment

See p. 108

When using external current sensors, the phase difference that may exist between the voltage signal and the sensor signal can be adjusted.

● List of Scaling Menu Items

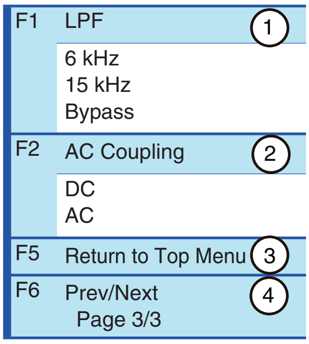
External sensor for scaling		Menu item (○ : Operable, ×: Inoperable)					
		PT Ratio	Voltage CF	CT Ratio	Current CF	EXT-CS Ratio	V/I Phase Adj.
Voltage	PT (potential transformer)	○	○	×	×	×	×
Current	CT (current transformer)	×	×	○	○	×	×
	Optional current sensor	×	×	×	×	×	×
	External current sensor /shunt	×	×	×	○	○	○

● List of Available Scaling Ranges

Setting Item		Setting Range
Voltage measurement	PT Ratio	0.00 to 100.000
	Voltage CF	1.00 to 2.00
Current measurement	CT Ratio	0.001 to 1000.000
	Current CF	1.00 to 4.00
	EXT-CS Ratio (mV/A)	0.250 mV/A to 2500.000 mV/A

LPF and AC Coupling

Basic Measurement sub-menu 3/3



F1 LPF ①
6 kHz
15 kHz
Bypass

F2 AC Coupling ②
DC
AC

F5 Return to Top Menu ③

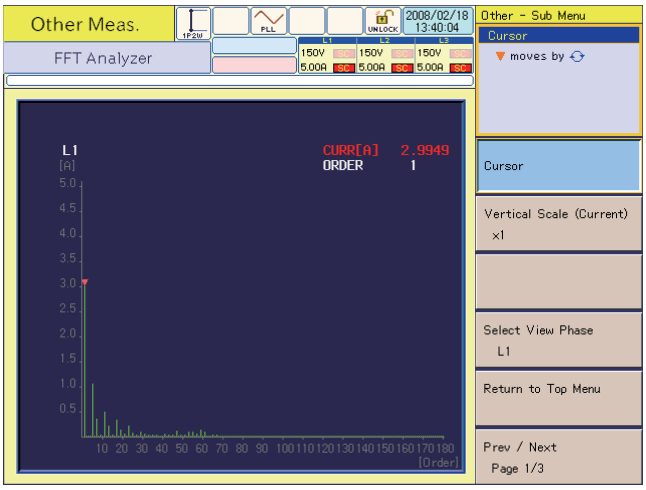
F6 Prev/Next ④
Page 3/3

No.	Menu item	Description	Default
1	LPF	Select the cutoff frequency of the anti-aliasing filter. Select “Bypass” when no filter is used.	6 kHz
2	AC Coupling	Select the input coupling for voltage and current measurement. DC means DC coupling and AC means AC coupling.	DC
3	Return to Top Menu	Returns to the top menu of Other Measurement.	–
4	Prev/Next Page 3/3	Switches to another sub-menu page.	–

F key: Function key. You can also use the ESC key to return.

FFT Analyzer

In the FFT Analyzer display, harmonic current up to the 180th order is observed. It is constantly measured.



CURR[A] 2.9949
ORDER 1

Cursor and Vertical Scale (Current)

FFT Analyzer Sub-menu 1/3

F1	Cursor (Move the cursor)	①
F2	Vertical Scale (Current) × 10, × 5, × 2, × 1, × 1/2, × 1/4	②
F4	Check View Phase L1 L2 L3	③
F5	Return to Top Menu	④
F6	Prev/Next Page 1/3	⑤

No.	Menu item	Description	Default
1	Cursor	Moves the cursor in the horizontal axis direction (harmonic order). Move the cursor using the small knob or the large knob. The measured value at the cursor is displayed.	1
2	Vertical Scale (Current)	Select a vertical scale (scale factor).	× 1
3	Check View Phase	Select a phase to be displayed.	L1
4	Return to Top Menu	Returns to the top menu of Other Measurement.	–
5	Prev/Next Page 1/3	Switches to another sub-menu page.	–

F key: Function key. You can also use the ESC key to return.

Voltage Range, Current Range and Wiring Method

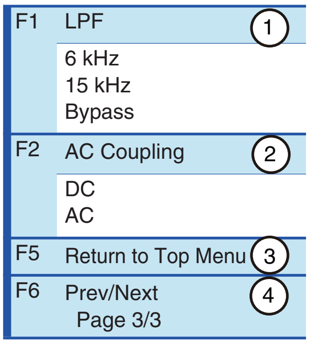
The FFT Analyzer Submenu 2/3 is identical to the Basic Measurement Submenu 2/3.

Scaling, Current input Terminal

The FFT Analyzer Submenu 2/3 is identical to the Basic Measurement Submenu 2/3.

LPF and AC Coupling

FFT Analyzer Sub-menu 3/3



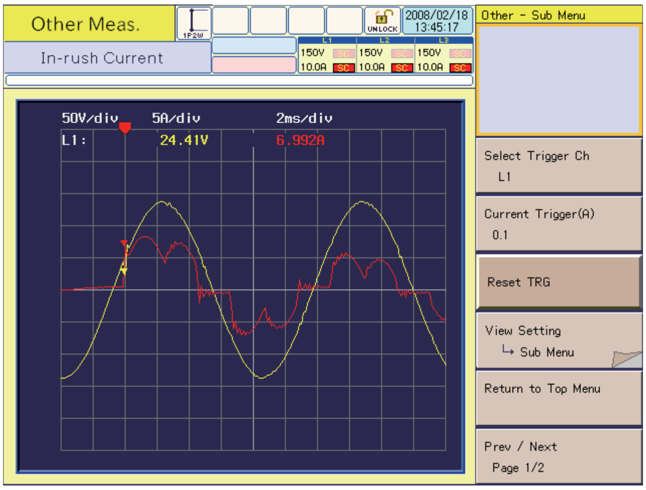
No.	Menu item	Description	Default
1	LPF	Select the cut-off frequency of the anti-aliasing filter. Select "Bypass" is no filter is used. If it is the first time to enter the FFT Analyzer submenu, 15 kHz is selected.	15 kHz
2	AC Coupling	Select the input coupling mode for voltage and current measurements. DC is for DC coupling and AC is for AC coupling. If it is the first time to enter the FFT Analyzer submenu, DC is selected.	DC
3	Return to Top Menu	Returns to the top menu of Other Measurement.	–
4	Prev/Next Page 3/3	Switches to another sub-menu page.	–

F key: Function key. You can also use the ESC key to return.

In-rush Current Measurement

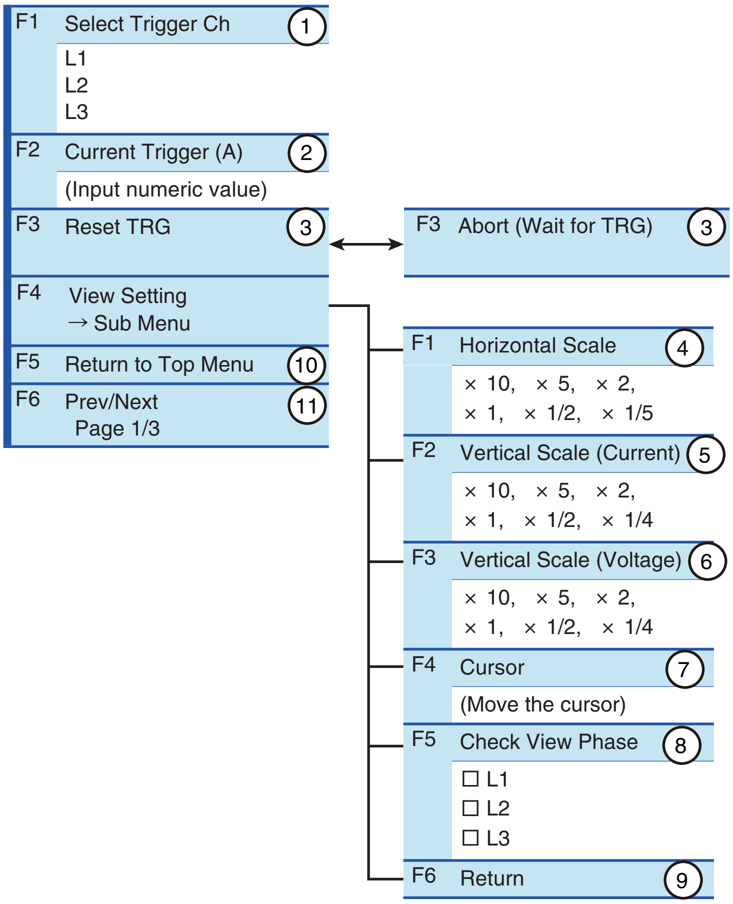
This function monitors in-rush current waveforms exceeding the trigger level. It can also monitor voltage waveforms.

After the reset trigger function key is pressed, the present waveform is maintained until the current value exceeds the trigger level. The scale sensitivity is displayed on the upper part of the graph according to the selected menu.



Select Trigger Channel, Current Trigger and Reset Trigger/Abort

In-rush Current Measurement sub-menu 1/3



- F1 Select Trigger Ch ①
  - L1
  - L2
  - L3
- F2 Current Trigger (A) ②
  - (Input numeric value)
- F3 Reset TRG ③ ↔ F3 Abort (Wait for TRG) ③
- F4 View Setting → Sub Menu
  - F1 Horizontal Scale ④
    - × 10, × 5, × 2,
    - × 1, × 1/2, × 1/5
  - F2 Vertical Scale (Current) ⑤
    - × 10, × 5, × 2,
    - × 1, × 1/2, × 1/4
  - F3 Vertical Scale (Voltage) ⑥
    - × 10, × 5, × 2,
    - × 1, × 1/2, × 1/4
  - F4 Cursor ⑦
    - (Move the cursor)
  - F5 Check View Phase ⑧
    - ☐ L1
    - ☐ L2
    - ☐ L3
  - F6 Return ⑨
- F5 Return to Top Menu ⑩
- F6 Prev/Next Page 1/3 ⑪

No.	Menu item	Description	Default
1	Select Trigger Ch	Select the phase to be a trigger source.	L1
2	Current Trigger (A)	Set a current trigger level. The setting range is 0.1 to 80.0. The value corresponds to the approximate current value (A). Enter the value with the numeric keypad and press the ENTER key, or use the large knob to increase or decrease the value.	–
3	Reset TRG Abort (Wait for TRG)	Press this and wait for a trigger. This menu item switches to “Abort (Wait for TRG)” until a trigger is generated. To reset the trigger, press the F3 key while Abort (Wait for TRG) is displayed.	–
4	Horizontal Scale	Select a horizontal scale of waveforms (scale factor).	× 1
5	Vertical Scale (Current)	Select a vertical scale of waveforms (scale factor).	× 1
6	Vertical Scale (Voltage)	Select a vertical scale of waveforms (scale factor).	× 1
7	Cursor	Moves the cursor in the horizontal axis direction (harmonic order). Move the cursor using the small knob or the large knob. The measured value at the cursor is displayed.	1
8	Check View Phase	Select a phase to be displayed. Select it with the small knob and press the ENTER key. Every time the ENTER key is pressed, the check mark turns on or off. Multiple checkboxes can be selected.	L1, L2, L3
9	Return	Terminates the view setting.	–
10	Return to Top Menu	Return to the top menu of Other Measurement.	–
11	Prev/Next Page 1/2	Switches to another sub-menu page.	–

F key: Function key. You can also use the ESC key to return.

The set items are also applied to the settings of "V/I Waveform" on page 164 and "Basic Measurement" on page 250.

Setting the current trigger level

1. **Press the F1 key to select a trigger phase.**
2. **Press the F2 key and set the current trigger level (A).**

   The current trigger level (A) that has been set is displayed in the selected menu on the upper right of the screen.
3. **Press the F3 key (Reset TRG).**

   The menu changes to Abort (Wait for TRG). To cancel triggers, follow the procedure for "Canceling triggers" described below.
4. **Turn on the power of the EUT.**

   When the current value exceeds the trigger level, the voltage/current waveforms are updated.

   Once a trigger is generated, the display of the F3 key changes to Reset TRG.

Canceling triggers

1. **Confirm that the F3 key menu is Abort (Wait for TRG).**

   The menu item indicates Abort (Wait for TRG).
2. **Press the F3 key.**

Reset Trigger is canceled and triggers are inhibited. The screen keeps displaying the present waveform. The F3 key menu changes to Reset TRG. To enable triggers again, perform Step 3 of “Setting the current trigger level.”

Voltage Range, Current Range and Wiring Method

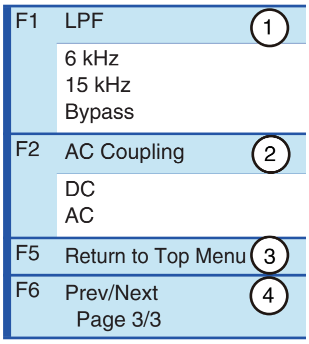
The In-rush Current Measurement submenu 2/3 is identical to the Basic Measurement submenu 2/3.

Scaling, Current input Terminal

The In-rush Current Measurement submenu 2/3 is identical to the Basic Measurement submenu 2/3.

LPF and AC Coupling

In-rush Current Measurement sub-menu 3/3



No.	Menu item	Description	Default
1	LPF	Select the cut-off frequency of the anti-aliasing filter. Select "Bypass" is no filter is used. If it is the first time to enter the In-rush Current Measurement submenu, "Bypass" has been selected.	Bypass
2	AC Coupling	Select the input coupling mode for voltage and current measurements. DC is for DC coupling and AC is for AC coupling. If it is the first time to enter the In-rush Current Measurement submenu, "DC" has been selected.	DC
3	Return to Top Menu	Returns to the top menu of Other Measurement.	–
4	Prev/Next Page 3/3	Switches to another sub-menu page.	–

F key: Function key. You can also use the ESC key to return.

12

File Operation

This chapter explains the file operation using CompactFlash card and USB flash drive, which are an external memory device.

Displaying the File Operation

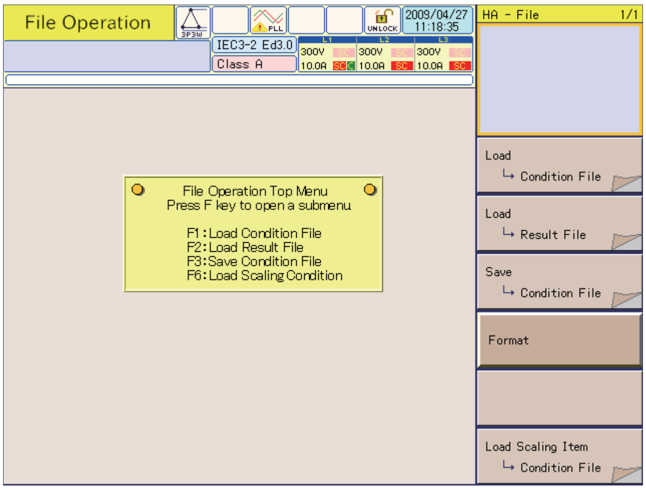
The file operation has four functions. Each function has a sub-menu.

- Calling a test condition file (Load)
- Calling a test result file (Load)
- Saving a test condition file (Save)
- Calling only the scaling setting items of the test condition file (Load)

Files are saved to and called from a CompactFlash card or USB flash drive.

The files that correspond to the currently used test mode (harmonic current test or voltage fluctuation test) can be used. This function is also used to format a CompactFlash card or USB flash drive.

In this manual, the compactFlash card and USB flash drive may be collectively called the storage media.



File Operation Top Menu
Press F key to open a submenu

F1 : Load Condition File
F2 : Load Result File
F3 : Save Condition File
F6 : Load Scaling Condition

1 **Insert a storage media in the MEMORY slot or the USB connector on the front panel.**

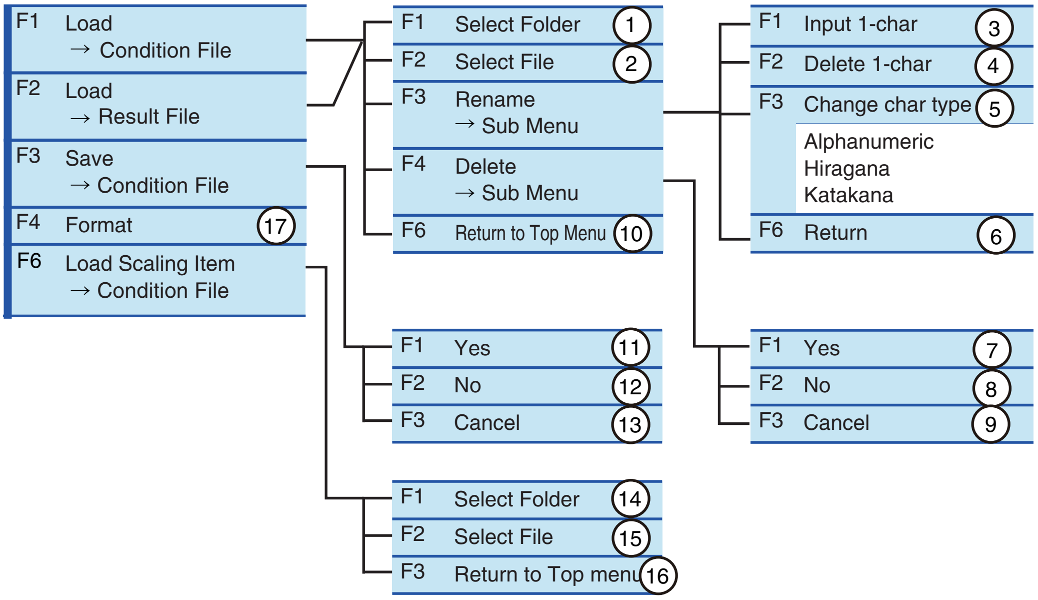
2 **Press the FILE key.**

The File Operation display appears.

If the storage media is not found, the buzzer sounds and the dialog box “Disk Error. Media could not be detected” is displayed. If the dialog box is displayed, press the F1 key (OK) and insert a storage media.

Loading and Saving Files

Menu 1/1



No.	Menu item	Description	Default
1	Select Folder	Select a folder that contains a test condition or test result file from the specific folders of the test mode that is being used. Every time the F1 key is pressed, the selected folder is indicated with a frame. The value shown in the selected menu content column is the folder number (the number of the top folder is 1). Press the ENTER key to confirm the selection.	–
2	Select File	Select a test condition or test result file from the specific folder selected in Select Folder. Every time the F2 key is pressed, the background color of the selected file is reversed. The value shown in the selected menu content column is the folder number (the number of the top folder is 1). Press the ENTER key to confirm the selection.	–
3	Input 1-char	Used to enter characters for renaming. Up to 20 alphanumeric characters and up to 10 hiragana and katakana characters can be input. For details on the procedure, see page 268.	–
4	Delete 1-char	Used to delete characters for renaming. For details on the procedure, see page 268.	–
5	Change char type	Used to change the character types for renaming. Every time the F3 key is pressed, the character types switch to alphanumeric, hiragana and katakana characters in this order.	–
6	Return	Terminates the rename operation.	–
7	Yes	Deletes the file.	–
8	No	Does not delete the file.	–
9	Cancel	Cancels the delete operation.	–
10	Return to Top Menu	Returns to the top menu of File Operation.	–
11	Yes	Saves a condition file. The test condition file is saved to the specific folder in the test mode that is being used. A folder name is automatically assigned. The file can be saved in the "Set" state only; it cannot be saved in the "Test" or "Analysis" state.	–
12	No	Does not save a condition file.	–
13	Cancel	Cancels the saving operation of a condition file.	–

14	Select Folder	Select a folder that contains test condition files (HASET or) from the folders for the test mode being used. Each time the F1 key is pressed, the selected folder is boxed. The value shown in the menu selection field is the folder number (the number of the top folder is 1). Press the ENTER key to complete the entry.	–
15	Select File	Select a test condition file in the test condition folder (HASET or) selected in the Select Folder menu. This test condition file contains only the information on the Current Input Terminal settings and Scaling settings. Each time the F2 key is pressed, the background color of the selected file is reversed. The value shown in the menu selection field is the file number (the number of the top file is 1). Press the ENTER key to complete the entry.	–
16	Return to Top Menu	Returns to the top menu of File Operation.	–
17	Format	Formats the storage media.	–

F key: Function key. You can also use the ESC key to return.

■ Procedures for inputting a character (F1 key) and deleting a character (F2 key)

1 **Press the F3 (Rename) key.**

The Rename dialog will be presented.

2 **Use the small knob, large knob or arrow keys to select a character.**

3 **Press the F1 (Input 1-char) key.**

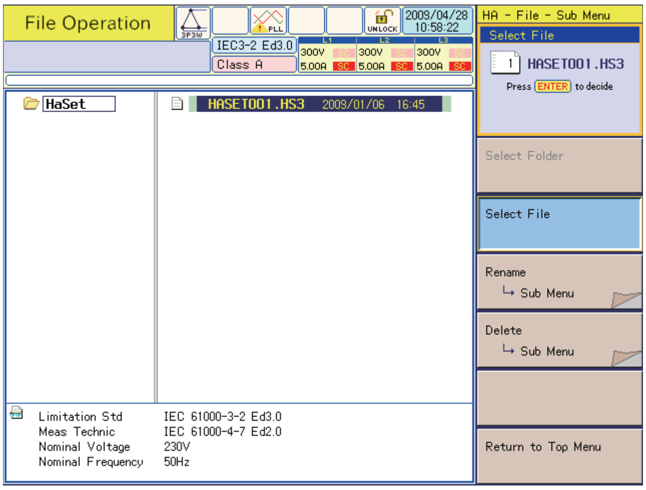
The character selected will be added to the part where the cursor is blinking (Input 1-char). To delete a character, press the F2 (Delete 1-char) key. To change the character type, press the F3 (Change char type) key to select the type. To repeat adding or deleting characters, return to the above step 2.

4 **Press the ENTER key.**

The characters entered will be fixed and saved.

Loading a Test Condition File

The procedure to load a test condition file is described below. The same procedure can be used when a test result file is to be loaded. If only the Current Input Terminal and Scaling setting information is to be loaded, press the F6 key at Step 1. On and after Step 2, the procedure is identical to the case test condition files are loaded.



Limitation Std IEC 61000-3-2 Ed3.0
Meas Technic IEC 61000-4-7 Ed2.0
Nominal Voltage 230V
Nominal Frequency 50Hz

NOTE

- Any test condition files or test result files saved in this product cannot be used in KHA3000 installed with a previous firmware version because the file formats are different. Regarding any KHA3000 unit that doesn't have the latest firmware version, an upgrade to the latest version is recommended. Please consult your supplier or our sales office for upgrade details.

■ How to check the firmware version

See p. 72

The firmware version of KHA3000 will be presented on the display when the POWER switch is turned on.

1 **Press the F1 key.**

A sub-menu is displayed. The screen displays date-specific folders in the current test mode (harmonic current or voltage fluctuation test) and their contents (files).

2 **Press the F1 key to select a folder.**

Every time the F1 key is pressed, the frame of the date-specific folders moves.

3 **Press the ENTER key.**

The selected folder is confirmed.

4 **Press the F2 key to select a file.**

Every time the F2 key is pressed, the background color of the file changes.

5 **Press the ENTER key.**

The file is loaded.

6 **Press the F6 key to terminate the loading of a condition file.**

Saving a Test Condition File

1 **Press the F3 key.**

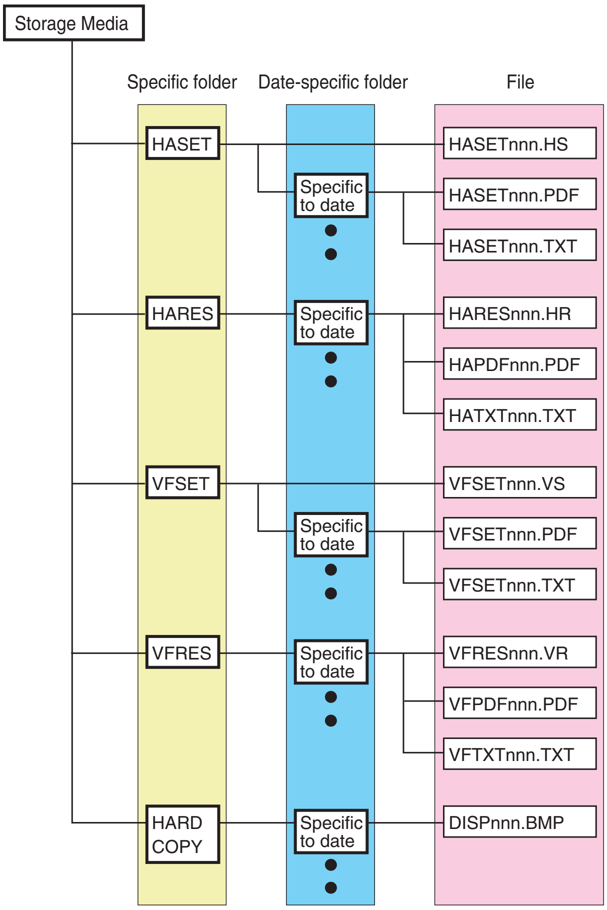
A sub-menu is displayed.

2 **Press the F1 key.**

Saves a condition file. The test condition file is saved to the specific folder in the test mode that is being used. A folder name is automatically assigned. The file can be saved in the “Set” state and cannot be saved in the “Test” or “Analysis” state.

Folder and File Configurations

The system is composed of five specific folders. When a file is saved, a date-specific folder is created in the corresponding specific folder. The date is automatically assigned according to the date/time setting.



Specific Folders and Date-specific Folders

Specific folder

- HASET (for saving test conditions for harmonic current tests)
- HARES (for saving results files and printed reports for harmonic current tests)
- VFSET (for saving test conditions for voltage fluctuation tests)
- VFRES (for saving results files and printed reports for voltage fluctuation tests)
- HARDCOPY (for saving screen hard copies)

Date format of date-specific folder

Folder type	Date-specific folder
Folder name	yyyymmdd
	yyyy indicates the year, mm indicates the month and dd indicates the day (automatically assigned).

File

See p. 88

When a file is saved, another file is created in the date-specific folder of the corresponding specific folder. A file for saving test conditions for harmonic current and voltage fluctuation tests is not created in the date-specific folder. It is created in the corresponding specific folder.

The format for PDF files or TEXT files is set by System Setup Menu (2/3) > Printer > Print Type. The file name can be changed.

■ Files created in HASET (for saving test conditions for harmonic current test) folder

File format	Exclusive to this product (condition file)[*1]	PDF (for printing test conditions)	Text
File name	HASETnnn		
	nnn is automatically assigned (001 to 999).		
Extension	.HS	.PDF	.TXT

*1. This file is created in the HASET folder, not in the date-specific folder.

■ Files created in HARES (for saving results files and printed reports for harmonic current tests) folder

File format	Exclusive to this product (result file)	PDF (for report printing)	Text
File name	HARESnnn	HAPDFnnn	HATXTnnn
	nnn is automatically assigned (001 to 999).		
Extension	.HR	.PDF	.TXT

■ Files created in VFSET (for saving test conditions for voltage fluctuation tests) folder

File format	Exclusive to this product (condition file)[*1]	PDF (for printing test conditions)	Text
File name	VFSETnnn		
	nnn is automatically assigned (001 to 999).		
Extension	.VS	.PDF	.TXT

*1. This file is created in the VFSET folder, not in the daily folder.

■ Files created in VFRES (for saving results files and printed reports for voltage fluctuation tests) folder

File format	Exclusive to this product (result file)	PDF (for report printing)	Text
File name	VFRESnnn	VFPDFnnn	VFTXTnnn
	nnn is automatically assigned (001 to 999).		
Extension	.VR	.PDF	.TXT

■ Files created in HARD COPY (for saving screen hard copies) folder

File format	Bitmap
File name	DISPnnn
	nnn is automatically assigned (001 to 999).
Extension	.BMP

Storage Media

See p. 88

Both a compactFlash card and a USB flash drive can be use as storage media.

CompactFlash Card

This memory is used to save test conditions and printed reports. It can be inserted and removed irrespective of whether the POWER switch is on or off.

- A card exceeding 512 MB cannot be used.
- Microdrives are not supported.
- This product operates in 3.3 V True IDE mode.

⚠CAUTION

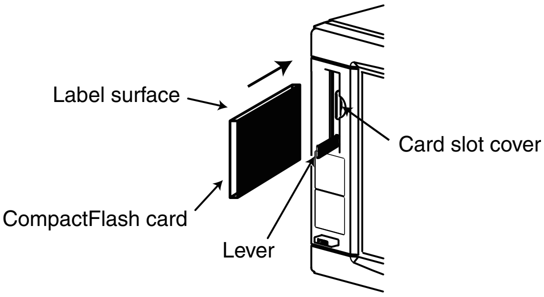
- Insert only a CompactFlash card and SD-CF adapter; otherwise, the card and this product may fail.
- To use a new card, be sure to format it with this product. If it is formatted with a computer or other device, this product may not operate or the CompactFlash card may fail.

Insertion

1 **Push the cover of the MEMORY slot on the front panel to open the slot.**

2 **Ensure that the connector part of the CompactFlash card is facing this product and insert it with the label surface positioned as shown in the illustration below.**

The connector part of this product is positioned inside. Slowly insert the card straight and deep. If it is inserted forcibly or at an angle, a failure may occur.



Removal

⚠CAUTION

- While a file is being manipulated or a report is being output, do not remove the CompactFlash card. The data may be deleted or damaged.

---

1 **Push the lever.**

The lever head comes out toward you.

2 **Push the lever again.**

The CompactFlash card comes out toward you.

Operation-verified CompactFlash Card

The CompactFlash cards listed below have been tested to check that they can save and load test condition files. The test condition files can be normally loaded and the screen hardcopy can be normally saved.

Type	Manufacturer name	Model No.[*1]	Capacity
CompactFlash	Buffalo	RCF-X64M	64 MB
	Buffalo	RCF-X128M	128 MB
	Buffalo	RCF-GP512M	512 MB
	Toshiba	CF-FA128MT	128 MB
	I-O DATA	CF85-128M	128 MB
	Lexar Media	CF064-231J	64 MB
	SanDisk	SDCFB-128-J60	128 MB
	Princeton	PCF-64	64 MB
SD-CF adapter	Panasonic	BN-CSDABP3	[*2]
	HAGIWARA SYS-COM	HPC-CDA01	[*2]

*1. The CompactFlash card may not operate because of a difference in the year model and version.

*2. SD memory card used: Buffalo RSDC-128M

USB flash drive

This memory is used to save test conditions and printed reports. It can be inserted and removed irrespective of whether the POWER switch is on or off.

- A USB flash drive exceeding 16 GB cannot be used.

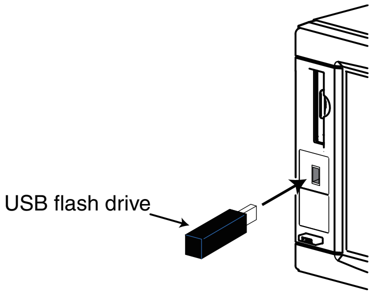
⚠CAUTION

- To use a new USB flash drive, be sure to format it with this product. If it is formatted with a computer or other device, this product may not operate or the CompactFlash card may fail.

Insertion

1 **Connect the USB flash drive to the USB connector of this product.**

While this product verifies thei USB flash drive, the acess lamp in the USB flash drive is blinking.



Removal

⚠CAUTION

- While the acess lamp in the USB flash drive is blinking, do not remove the CompactFlash card. The data may be deleted or damaged.

---

1 **Confirm that the acess lamp in the USB flash drive is not blinking.**

2 **Remove the USB flash drive from the USB connector of this product.**

Operation-verified USB flash drive

The USB flash drives listed below have been tested to check that they can save and load test condition files. The test condition files can be normally loaded and the screen hardcopy can be normally saved.

Type	Manufacturer name	Model No.	Capacity
CompactFlash	Buffalo	YUF-4G	4 GB
	Buffalo	YUF-16G	16 GB
	Buffalo	RUF2-LV16GS	16 GB

Setting the Storage Media

See p. 88

The storage media can be set by System Setup Menu (2/3).

Change the storage media from the CompactFlash card to the USB flash drive

1 **Press the F2 key to select the USB Memory (USB flash drive).**

The dialog box displays “Change of the storage media. Please remove the USB memory.”

After the operation, it may take a few seconds till the display of menu buttons switches.

2 **Remove the USB flash drive temporarily and then connect it.**

The storage media is set to the USB flash drive.
Remove the USB flash drive temporarily when the storage media is changed from the CompactFlash card to the USB flash drive.

If the USB flash drive is not remove temporarily and then the HARD COPY key is pressed, the buzzer sounds and the dialog box “Disk Error. Media could not be detected” is displayed.

In this case, press the F1 key (OK) and remove the USB flash drive temporarily and then connect it.

Change the storage media from the USB flash drive to the Compact-Flash card

1 **Press the F2 key to select the CompactFlash card (CF card).**

The dialog box displays “Change of the storage media. Please remove the USB memory.”

The storage media is set to the CompactFlash card.

After the operation, it may take a few seconds till the display of menu buttons switches.

13

Remote Control

This chapter provides an overview of remote control and describes the structure and syntax of the SCPI commands and the details of commands and registers used for remote control.

Overview of Remote Control

This product can be operated through the front panel and also remotely through the following interfaces (standard equipment):

- RS232C interface
- GPIB interface
- USB interface

These interfaces cannot be used concurrently.

The remote interfaces comply with IEEE Std 488.2-1992 and SCPI Specification 1999.0.

See p. 282

Before using SCPI commands, make sure that you understand the SCPI command syntax for this product.

The RMT LED on the front panel illuminates during operation in remote control mode. To change remote control mode to local control mode (panel operation) using the front panel, press the LOCAL key.

Measurement equipment interface standards

This product conforms to the following standards:

- IEEE Std 488.2-1992 IEEE Standard Codes, Formats, Protocols, and Common Commands For Use With IEEE Std 488.1-1987
- IEEE Std 488.1-1987 IEEE Standard Digital Interface for Programmable Instrumentation
- Standard Commands for Programmable Instruments (SCPI) version 1999.0
- Universal Serial Bus Specification Rev 2.0
- Universal Serial Bus Test and Measurement Class Specification (USBTMC) Rev 1.0
- Universal Serial Bus Test and Measurement Class, Subclass USB488 Specification (USBTMC-USB488) Rev 1.0

VISA Library

To use a VISA library (VISA COM) as an I/O library, the VISA library must be installed in the controller (host computer).

When a USB interface is used for control, a device driver compliant with the USB T&M class (USBTMC) is required. The USBTMC driver is automatically installed by the VISA library.

The Virtual Instrument Software Architecture (VISA) is a standard specification of instrument connection software established by VXIplug&play Systems Alliance.

One of the VISA libraries (driver software installed according to the VISA specifications) listed below is required.

- NI-VISA (ver. 3.2 or later) of National Instruments
- Keysight VISA (Keysight IO Libraries M01.00 or later) of Keysight Technologies
- KI-VISA ver. 3.0.0 or later

Do not install multiple VISA libraries in your PC; doing so may cause a malfunction.

KI-VISA is an original VISA library of Kikusui Electronics Corporation that is compliant with the VXIplug&play VISA specification 4.1. The latest version can be downloaded from the Kikusui website (http://www.kikusui.co.jp/download/). KI-VISA is not necessary if NI-VISA or Keysight VISA is already installed.

The KI-VISA Library Programming Guide is also available on the Kikusui website.

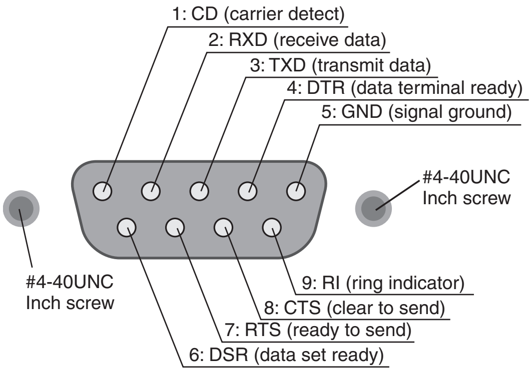
Using the RS232C Interface

The RS232C port on this product is a standard D-sub 9-pin male connector.

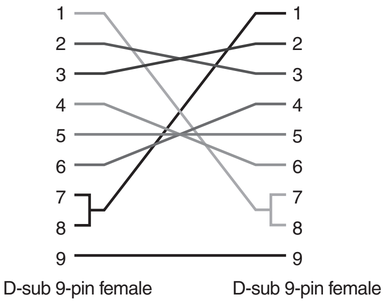
Check that the POWER switches of this product and computer are off, and connect this product to the computer using a standard cross cable (null modem cable).

Use a D-sub 9-pin female-to-female AT type for the cross cable. The connector pin arrangement is shown below.

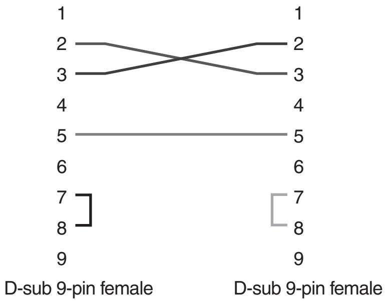
This product does not use hardware handshaking (as shown in the cross cable example 2).



Facing the KHA3000 rear panel



Cross cable example 1



Cross cable example 2

RS232C setting

See p. 86

1 **Press the SYSTEM key.**

The System Setup display appears.

2 **Press the F2 key (I/F Setting → Sub Menu).**

A sub-menu is displayed.

3 **Press the F1 key (I/F Select) a few times or turn the small knob to select RS232C.**

4 **Press the F3 key (RS232C baudrate).**

5 **Press the F3 key (RS232C baudrate) a few times or turn the small knob to set the baudrate.**

6 **Turn off the POWER switch and turn it on again.**

The I/F selection and RS232C baudrate are set.

Protocol

The details of the RS232C protocol are listed below. The underlined part indicates the default setting before shipment from the factory.

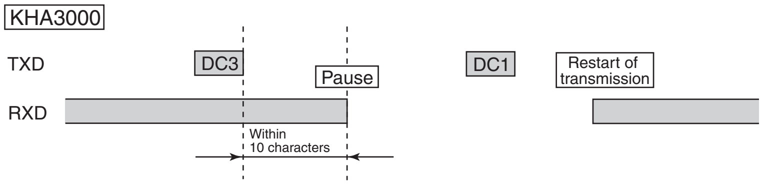
Item	Setting
Connector	9-pin D-sub terminal on the rear panel
Baudrate : Baudrate	9600 bps/19200 bps
Data: Data length	Fixed to 8
Stop: Stop bit	Fixed to 1
Parity: Parity	Fixed to none
Flow control	Fixed to X-Flow

Flow control

Use flow control for RS232C communication. DC (device control) codes are used as control codes.

Transmission/reception may not work correctly through unilateral transmission.

Code	Function	ASCII code
DC1 (Xon)	Request to send	11H
DC3 (Xoff)	Transmission stop request	13H



For the RS232C terminal, temporarily stop transmission within 10 characters after reception of DC3.

Break signal

The break signal functions as an alternative for the IEEE 488.1 dcl/sdc (Device Clear, Selected Device Clear) message.

Using the GPIB Interface

Setting the GPIB address

See p. 86

The GPIB address is set to 1 by default. The range is 1 to 30.

1 **Press the SYSTEM key.**

The System Setup display appears.

2 **Press the F2 key (I/F Setting → Sub Menu).**

A sub-menu is displayed.

3 **Press the F1 key (I/F Select) a few times or turn the small knob to select GPIB.**

4 **Press the F2 key (GPIB Address).**

5 **Press the F2 key (GPIB Address) a few times or turn the small knob to set the address.**

6 **Turn off the POWER switch and turn it on again.**

The I/F selection and GPIB address are confirmed.

GPIB functions

Function	Subset	Content
Source handshake	SH1	All functions supported
Acceptor handshake	AH1	All functions supported
Talker	T6	Functions supported
Listener	L4	Functions supported
Service request	SR1	All functions supported
Remote/local	RL1	All functions supported
Parallel poll	PP0	Functions unsupported
Device clear	DC1	All functions supported
Device trigger	DT1	All functions supported
Controller	C0	Functions unsupported
Electrical interface	E1	Open collector driver

Service request

Service request and serial polling functions are installed.

Using the USB Interface

To control this product through the USB interface, a device driver corresponding to the USB T&M class (USBTMC) is required. The USBTMC drive is automatically installed by a VISA library.

Setting the USB

See p. 86

1 **Press the SYSTEM key.**

The System Setup display appears.

2 **Press the F2 key (I/F Setting → Sub Menu).**

A sub-menu is displayed.

3 **Press the F1 key (I/F Select) a few times or turn the small knob to select USB.**

4 **Turn off the POWER switch and turn it on again.**

The I/F selection is set.

USB function

- Compliant to USB Specification 2.0
- Compliant to USBTMC Specification 1.0 and USBTMC-USB488 Specification 1.0
- Communication speed: 12 Mbps (full speed)
- VID (Vendor ID): 0x0B3E
- PID (Product ID): 0x1010

Service request

Service request and serial polling functions are installed.

NOTE

- To control this product through the USB interface, a device driver corresponding to the USB T&M class (USBTMC) is required. The USBTMC drive is automatically installed by one of the following VISA libraries:
- KI-VISA 3.0.4 or later (can be downloaded from our website)
- NI-VISA 3.3.0 or later (can be downloaded from the website of National Instruments)
- Agilent VISA (Agilent IO Libraries) Suite 14.1 or later (Can be downloaded from the website of Agilent Technologies)

Overview of Messages

The information transferred between the controller (host computer) and this product is called a message.

This product uses the SCPI format for these messages.

Messages include commands sent from the computer to this product and responses sent from this product to the computer.

Commands execute the functions of this product, change settings and check the settings and status. Responses return the settings and status of this product.

SCPI Command Syntax

Command hierarchy

SCPI is an ASCII-based command language developed for testing and measuring instruments. The command structure is organized based on common roots or nodes, which are the component blocks of the SCPI subsystem. Each command is a combination of program headers, parameters and punctuation.

The hierarchy is explained using the SENSe subsystem as an example.

Program header	Parameter	Node hierarchy
SENSe:		Root node
CURRent		Second level
:RANGe		Third level
:INDependent	<numeric>	Fourth level
:AUTO	<bool>	Fourth level
VOLTage		Second level
:RANGe		Third level
:INDependent	<numeric>	Fourth level
:AUTO	<bool>	Fourth level

- Upper and lower nodes are delimited by a colon (:).
- When a colon is provided at the beginning of the program header, the first node is the root node.

Command syntax

● Format

In this manual, SCPI commands are indicated in the following format.

Example:

```
MEASure[:SCALar]:CURRent:AC?
```

- SCPI commands have two forms: the long form that spells out all characters of a command and the short form that omits characters written in lower-case letters.
  SCPI commands can be sent in either the long form or short form.

- The SCPI commands are not case-sensitive. “VOLT,” “Volt” and “volt” are all regarded as short forms of VOLTage.
  “VOLTAGE,” “Voltage” and “voltage” are all accepted as long forms.
- A space must be inserted between the program header part and the parameter part.
- When two or more parameters are used, join them with a comma (,).
- Joining commands with a semicolon (;) forms a compound command.

Example:

```
SYSTem:TIME 12,34,56;HARMonics:NOMinal:FREQuency {50|60}
```

● Compound command

The compound command shown above works the same way as when the following two commands are entered.

Example: Individual commands

```
HARMonics:NOMinal:FREQuency {50|60}
HARMonics:NOMinal:VOLTage <NRf>
```

Because the first command “HARMonics:NOMinal:FREQuency” specifies “HARMonics: NOMinal” as the path, the path can be omitted in the second command.

If a node that is not defined as the current path (except FAIL and PASS) is specified, an error occurs.

Example: Compound command

```
HARMonics:NOMinal:FREQuency {50|60};VOLTage <NRf>
```

● Compound command (with the specified path cleared)

Example:

```
SENSe:CURRent:RANGe Maximum;:INITiate
```

This compound command includes two root nodes “SENSe” and “INITiate.”

When the second or any other subsequent command begins with a colon, the path specified in the previous command is cleared.

- A colon (:) must be inserted between program headers.
- Colons and semicolons can be used together to connect commands in different subsystems.
- Up to 128 bytes of characters can be sent on one line.

Special symbols and characters

The special symbols and characters used to create SCPI commands in this manual are defined as follows.

Symbol and character	Description
< >	A character string within <> indicates program data. Do not include the <> symbols in actual programs.
{ }	Characters or numbers delimited by “|” in { } mean that one of them should be selected. Do not include the { } symbols in actual programs.
[ ]	A character string within [ ] indicates an optional data. If it is not sent with a program, the default value is sent. Do not include the [ ] symbols in actual programs.

Query

Device settings and status can be queried.

Attach a question mark (?) at the end of the program header part. If a query has a parameter, insert a space after the question mark and continue to code a parameter.

Example:

`SENSe:CURRent:RANGe? MINimum`

NOTE When two queries are sent in separate lines, read the response to the first query before transmitting the second line. If two lines of queries are sent at the same time, an incomplete response may be received.

String termination

Every command must be terminated with a valid terminator.

Terminators include <line feed> (ASCII 0x0A) and EOI (end or identify). When either one is specified, it works as a terminator.

Always use <line feed> for the RS232C because EOI is not available.

When a command string is finished, the path is always reset to the root level.

NOTE CR (ASCII 0x0D) is not a terminator.

Common commands

See p. 288

The IEEE-488.2 and SCPI standards define a series of common commands used for resetting and self-diagnosis. Each of the common commands always begins with an asterisk (*) and may have one or more parameters.

Parameters

The SCPI parameter format comes from the program parameter format defined in IEEE 488.2.

The representation formats of program data handled by this product are shown below.

Non-numeric parameters

This product uses the following three types of non-numeric parameters:

Symbol and character	Description
Character string data (String)	Character string data is used when a series of ACSII characters is requested. Enclose a character string in single quotation marks (‘ ’) or double quotation marks (“ ”). Note that the same type of quotation marks must be used as the start and end quotations. Example: `FUNCtion “HARM”` To use a quotation mark as a character string, code two quotation marks without a character inserted between the two. ASCII codes 20H to 7EH can be used.
Character data (Character)	Character data is used when the program setting includes only a limited number of values. A response is given in an abbreviated form. Example: `TRIGger:SOURce {BUS|IMMediate}`
Boolean data (Boolean)	Boolean data represents either state, 1 or 0, or ON or OFF. A response is given in 1 or 0. Example: `SENSe:CURRent:RANGe:AUTO {ON|OFF|1|0}`

Numeric parameters

This product uses the following five types of numeric parameters:

Symbol and character	Description
NR1	NR1 indicates an integer.[*1]
NR2	NR2 indicates a real (floating-point number).[*1]
NR3	NR3 indicates a real (exponent).[*1] When 380 is returned as a response data, “+3.80000+E02” is returned. The number of digits after the decimal point is 5.
NRf	NRf is a generic term that includes NR1, NR2, and NR3.
Numeric	Numeric parameters include decimal points, optional symbols and measurement units. The coding of numeric expression is the same as NRf. Alternatives for declaring specific values such as MINimum and MAXimum are provided. Numeric parameters can be used together with units such as V, A and S. If a value that cannot be set is specified, the device rounds it to the nearest numeric. Example: `VOLTage:RANGe 350` Because the voltage range that can be set is 150, 300 or 600, 300 is returned in response to VOLT:RANG?.

[*1] Details are given in the “IEEE Standard 488.2 Programmable Instrument Standard Digital Interface.”

Alternatives

When a numeric parameter is used with this product, MINimum and MAXimum are defined for alternatives.

The following example sets the current range to the minimum value:

```
CURRent:RANGe MINimum
```

The maximum value or minimum value can be queried using a query for most parameters.

```
CURRent:RANGe? MIN
CURRent:RANGe? MAX
```

Measurement unit

The following default units are used. Values are accepted regardless of whether or not a measurement unit is specified.

- A (current)
- V (voltage)
- W (power)
- S (seconds)
- PCT (%)
- HZ (frequency)
- DEG (degree)

The following optional symbols are supported. Use “U” instead when coding “µ” in the parameter.

- M (milli)
- K (kilo)
- U (micro)

NOTE The SI unit system includes lower-case letters in unit symbols. The IEEE standard specifies upper-case letters. SCPI does not distinguish between upper-case and lower-case letters.

Command Description in This Manual

In this manual, commands are described as below:

Attach a value you want to set after a command and send the command. To set the measurement time at 20 seconds, send HARM:HTIM 20.

The set value of a command provided with these marks is influenced by *RST or *RCL when it is sent and changed to the value described in "Default Conditions."
The test time is changed to 150 seconds when *RST is sent.

HARM:MTIM

***RST**

Parameters are described. In the case of this example, because the parameter is "numeric," a specific value can be specified. The minimum or maximum value can also be specified.

Sets the measurement time.

This is the range of values that can be set. Optional symbols such as m and μ can be used.

Command
```
HARMonics:MTIMe {<numeric>|MIN|MAX}
HARMonics:MTIMe?
```

Parameter Value: 1 to 9600 (The default is 150.)

This is the unit of the value to be set. The unit can be omitted.

Unit: S

If MAX is specified, the maximum value is applied.

If MIN is specified, the minimum value is applied.

Response Returns the measurement time in the <NR3> format.

This is the expression format of the value when returned in response to the query that has been sent.

A command is described in the long form. The lower-case part can be omitted. Parts enclosed in [ ] can also be omitted.

FUNC

***RST**

Sets the operation mode.

Command
```
[SENSe:]FUNCtion[:ON]
   "{HARMonics|VFL|OTHer:BASic|OTHer:FFT|OTHer:RUSH}"
[SENSe:]FUNCtion[:ON]?
```

If a parameter is too long to fit on one line, a new line is inserted.

Parameter Value:

"HARMonics"	Harmonic measurement mode (default)
"VFL"	Voltage fluctuation measurement mode
"OTHer:BASic"	Basic measurement
"OTHer:FFT"	FFT analyzer
"OTHer:RUSH"	In-rush current measurement

Response Returns the present operation mode in the <string> format.

This is the expression format of the value when returned in response to a query that has been sent.

Reference page list of command-related sections

Section	See Page
Command syntax	*282*
Parameter	*285*
Unit	*286*
Default conditions ***RST**	*346*
Query	*284*
Messages	*366*
Error List	*373*

IEEE 488.2 Common Commands

*CLS

See p. 337

Clears all event registers including status bytes, event status and error queue.

Command `*CLS`

*ESE

See p. 341

Sets the event status enable register calculated by the event summary bit (ESB) of the status byte.

Command

```
*ESE <NR1>
*ESE?
```

Parameter Value: 0 to 255
An SCPI error (-222, “Data out of range”) occurs if outside the range.

Example: Sending *ESE16 sets bit 4 of the event status enable register. Every time the execution error bit (bit 4) of the event status register is set, the summary bit (ESB) of the status byte is set.

Response Returns the value of the event status enable register in the <NR1> format.

*ESR

See p. 341

Queries the event status register. The register that has been read is cleared.

Command `*ESR?`

Response Returns the value of the event status register in the <NR1> format and clears the register.

*IDN

Queries the model name of this product, serial number and the firmware version.

Command `*IDN?`

Response A response is returned as follows:

Example: KHA3000, serial number AB123456 and firmware version 1.00

```
"KIKUSUI, KHA3000, AB123456, 1.00" is returned.
```

*OPC

See
IEEE 488.2-1992
Section 12.5.3

Sets the OPC bit (bit 0) of the event status register when the processing of all commands standing by is complete.

Command

```
*OPC
*OPC?
```

Response Returns 1 when the processing of all commands standing by is complete.

*OPT

Queries the options installed in this product.

Command `*OPT?`

Response Returns ETHERNET if an Ethernet option is installed; otherwise, returns “0.”

*RST

Aborts measurement operation and initializes this product (to the default setting).

For commands that are influenced by *RST, see “Default Conditions.”

See p. 346

Command `*RST`

*SRE

Sets the service request enable register.

The service request enable register can be used to specify which summary message in the status byte register should be used for a service request.

Send *SRE 0 to clear the service request enable register. The cleared service register cannot be used to generate a service request based on status information.

Command

```
*SRE <NR1>
*SRE?
```

Parameter Value: 0 to 255
An SCPI error (-222, “Data out of range”) occurs if outside the range.

Example: Sending *SRE8 sets bit 3 of the service request enable register. Every time the summary bit (bit 3) of the QUEStionable status register in the status byte is set, this bit generates a service request message.

Response Returns the value of the service request enable register in the <NR1> format.

*STB

See p. 339

Queries the content of the status byte register and MSS (master summary status) message.

The response is the same as serial polling except that an MSS message appears at bit 6 instead of an RQS message.

Command `*STB?`

Response Returns the values of the status byte register and MSS message (bit 6) in the <NR1> format.

*TRG

See
IEEE 488.2-1992
Section 10.37

Trigger command.

This is an alternate command of the IEEE 488.1 GET message (Group Execute Trigger). In a condition in which a trigger cannot be accepted, the SCPI error (-211, “Trigger ignored”) occurs.

Command `*TRG`

*TST

See
IEEE 488.2-1992
Section 10.38

Executes self-diagnosis. If an error occurs, it can be checked by using SYST:ERR?.

Command `*TST?`

Response Returns “0” if there is no problem; otherwise, an error code is returned.

*WAI

Prevents this product from executing any subsequent commands and queries until every type of operation in standby is complete.

Command `*WAI`

Measurements in General

Operation mode

The messages shown below ("Setting the Operation Mode" on page 292 to "Scaling" on page 297) are valid in any operation mode (harmonic measurement, voltage fluctuation measurement, basic measurement, FFT analyzer or in-rush current measurement). Other messages are explained separately according to the operation mode. Each of these messages is valid in the relevant operation mode.

Measurement circuit wiring methods and input circuit setting (linked or independent)

The methods of wiring measurement circuits include single-phase two-wire (1P2W), single-phase three-wire (1P3W), three-phase three-wire (3P3W) and three-phase four-wire (3P4W).

For input circuit setting of each input phase (turning on/off of voltage and current ranges and voltage and current AUTO ranges), select ON (linked) or OFF (independent).

The messages used for this setting and their functions (○: valid, ×: invalid) are shown below:

● When the input circuit setting is “linked” (INP: LINK ON)

Command	INPut:WIRing:METHod			
	1P2W	1P3W	3P3W	3P4W
CURR:RANG	○	○	○	○
CURR:RANG:AUTO	○	○	○	○
VOLT:RANG	○	○	○	○
VOLT:RANG:AUTO	○	○	○	○
CURR:RANG:IND	×	×	×	×
CURR:RANG:AUTO:IND	×	×	×	×
VOLT:RANG:IND	×	×	×	×
VOLT:RANG:AUTO:IND	×	×	×	×

● When the input circuit setting is “independent” (INP: LINK OFF)

Command	INPut:WIRing:METHod			
	1P2W	1P3W	3P3W	3P4W
CURR:RANG	○	×	×	×
CURR:RANG:AUTO	○	×	×	×
VOLT:RANG	○	×	×	×
VOLT:RANG:AUTO	○	×	×	×
CURR:RANG:IND	×	○	○	○
CURR:RANG:AUTO:IND	×	○	○	○
VOLT:RANG:IND	×	○	○	○
VOLT:RANG:AUTO:IND	×	○	○	○

Setting the Operation Mode

FUNC

*RST

Sets the operation mode.

Command

```
[SENSe:]FUNCtion[:ON]
   "{HARMonics|VFL|OTHer:BASic|OTHer:FFT|OTHer:RUSH}"
[SENSe:]FUNCtion[:ON]?
```

Parameter Value:

"HARMonics"	Harmonic measurement mode (default)
"VFL"	Voltage fluctuation measurement mode
"OTHer:BASic"	Basic measurement
"OTHer:FFT"	FFT analyzer
"OTHer:RUSH"	In-rush current measurement

Response Returns the present operation mode in the <string> format.

Returns OTH when the top page of Other Measurements is displayed.

Returns " " (blank) when the System Setup or External Control page is displayed.

Setting Linked/independent of the Input Circuits

INP:LINK

*RST

Sets the input circuit of each input phase (channel) to linked or independent.

Command

```
INPut:LINKage {ON|OFF|1|0}
INPut:LINKage?
```

Parameter Value:

ON(1)	linked (default)
OFF(0)	independent

Response Returns linked or independent in the <NR1> format.

Setting the Current Input Terminals

INP:CURR:TERM

*RST

Sets the current input terminals. Each input phase (channel) is set to the same value. This command is enabled when the input circuit setting is "linked" (INP:LINK ON).

Command

```
INPut:CURRent:TERMinal {SHUNt|CLAMp|BNC}
INPut:CURRent:TERMinal?
```

Parameter	Value:	SHUNt	Internal shunt (default)
		CLAMp	Clamp type current sensor
		BNC	External signal input

Response Returns the current input terminal setting in the <character> format.

INP:CURR:TERM:IND

*RST

Sets the current input terminals. Each input phase (channel) is set independently.

This command is enabled when the input circuit setting is “independent” (INP:LINK OFF).

Command

```
INPut:CURRent:TERMinal:IHDependent
  <character>,<character>,<character>
INPut:CURRent:TERMinal:INDependent?
```

Parameter	Value:	SHUNt	Internal shunt (default)
		CLAMp	Clamp type current sensor
		BNC	External signal input

Specify the <character> commands in the order of <L1 phase>, <L2 phase> and <L3 phase>.

Response Returns the current ranges in the <character>, <character>, <character> format. The <character> responses are in the order of <L1 phase>, <L2 phase> and <L3 phase>.

Setting the PLL Source to Synchronize with the AC Power Supply

INP:PLL:SOUR

*RST

Sets the PLL source to synchronize with the frequency of the AC power supply.

Voltage or current signal in each of the L1, L2 and L3 phases can be selected. Select EXT when using the input signals of EXT SYNC INPUT.

Command

```
INPut:PLL:SOURce {CL1|CL2|CL3|VL1|VL2|VL3|EXT}
INPut:PLL:SOURce?
```

Parameter	Value:	CL1, CL2, CL3	Current signals in L1, L2 and L3 phases
		VL1, VL2, VL3	Voltage signals in L1(default), L2 and L3 phases
		EXT	Input signal in EXT SYNC INPUT

Response Returns the PLL source in the <character> format.

Setting the Wiring Method of a Measurement Circuit

INP:WIR:METH

*RST

Sets the wiring method.

Command

```
INPut:WIRing:METHod <"1P2W"|"1P3W"|"3P3W"|"3P4W">
INPut:WIRing:METHod?
```

Parameter	Value:	"1P2W"	Single-phase two-wire
		"1P3W"	Single-phase three-wire
		"3P3W"	Three-phase three-wire
		"3P4W"	Three-phase four-wire (default)

Response Returns the wiring method in the <"string"> format.

Setting the Type of Input Coupling

INP:COUP

*RST

Sets the type of input coupling. Each input phase (channel) is set to the same value.

Command

```
INPut:COUPling {AC|DC}
INPut:COUPling?
```

Parameter	Value:	AC	AC coupling
		DC	DC coupling (default)

Response Returns the setting of input coupling in the <character> format.

Setting the Anti-aliasing Filter

INP:FILT:FREQ

*RST

Sets the anti-aliasing filter. The cutoff frequency of the filter is set. Each input phase is set to the same value.

Command

```
INPut:FILTer:FREQuency {<numeric>|MIN|MAX}
INPut:FILTer:FREQuency?
```

Parameter	Value:	0 (Bypass)
		6 000 (default)
		15 000
	Unit:	Hz

Response Returns the cutoff frequency of the anti-aliasing filter in the <NR3> format.

Current Range, Voltage Range and Auto Range

See p. 291

These commands depend on linked/independent of the input circuit setting and wiring method setting.

CURR:RANG

*RST

Sets the current range of each input phase (channel) to the same value.

Command

```
[SENSe:]CURRent:RANGe {<numeric>|MIN|MAX}
[SENSe:]CURRent:RANGe?
```

Parameter Value: 0.5, 1, 2, 5, 10, 20, 40 (The default is the value selected for the auto range.)

Unit: A

Response Returns the current range value in the <NR3> format.

CURR:RANG:IND

*RST

Sets the current range of each input phase (channel) independently.

Command

```
[SENSe:]CURRent:RANGe:INDependent
  <numeric>,<numeric>,<numeric>
[SENSe:]CURRent:RANGe:INDependent?
```

Parameter Value: 0.5, 1, 2, 5, 10, 20, 40 (The default is the value selected for the auto range.) Specify the <numeric> commands in the order of <L1 phase>, <L2 phase> and <L3 phase>.

Unit: A

Response Returns the current range values in the <NR3>, <NR3>, <NR3> format. The <NR3> responses are in the order of <L1 phase>, <L2 phase> and <L3 phase>.

VOLT:RANG

*RST

Sets the voltage range of each input phase (channel) to the same value.

Command

```
[SENSe:]VOLTage:RANGe {<numeric>|MIN|MAX}
[SENSe:]VOLTage:RANGe?
```

Parameter Value: 150, 300, 600 (The default is the value selected for the auto range.)

Unit: V

Response Returns the voltage range value in the <NR3> format.

VOLT:RANG:IND

*RST

Sets the voltage range of each input phase (channel) independently.

Command

```
[SENSe:]VOLTage:RANGe:INDependent
   <numeric>,<numeric>,<numeric>
[SENSe:]VOLTage:RANGe:INDependent?
```

Parameter

Value: 150, 300, 600 (The default is the value selected for the auto range.)
Specify the <numeric> commands in the order of <L1 phase>, <L2 phase> and <L3 phase>.

Unit: V

Response Returns the voltage range values in the <NR3>, <NR3>, <NR3> format. The <NR3> responses are in the order of <L1 phase>, <L2 phase> and <L3 phase>.

CURR:RANG:AUTO
VOLT:RANG:AUTO

*RST

Decides whether to enable the auto range for the current or voltage ranges of all input phases (channel). When either CURR:RANGE:AUTO or VOLT:RANGE:AUTO is set, the other parameter is set to the same value.

Command

```
[SENSe:]CURRent:RANGe:AUTO {ON|OFF|1|0}
[SENSe:]CURRent:RANGe:AUTO?
[SENSe:]VOLTage:RANGe:AUTO {ON|OFF|1|0}
[SENSe:]VOLTage:RANGe:AUTO?
```

Parameter

Value:	ON(1)	Enables the auto range.
	OFF(0)	Disables the auto rang (default).

Response Returns whether the auto range is enabled or disabled in the <NR1> format.

CURR:RANG:AUTO:IND
VOLT:RANG:AUTO:IND

*RST

Decides whether to enable the auto range for the current or voltage range of each input phase (channel) independently. When either CURR:RANG:AUTO:IND or VOLT:RANG:AUTO:IND is set, the other parameter is set to the same value.

Command

```
[SENSe:]CURRent:RANGe:AUTO:INDependent <bool>,<bool>,<bool>
[SENSe:]CURRent:RANGe:AUTO?
[SENSe:]VOLTage:RANGe:AUTO:INDependent <bool>,<bool>,<bool>
[SENSe:]VOLTage:RANGe:AUTO?
```

Parameter

Value:	ON(1)	Enables the auto range.
	OFF(0)	Disables the auto rang (default).

Specify the <bool> commands in the order of <L1 phase>, <L2 phase> and <L3 phase>.

Response Returns whether the auto range is enabled or disabled in the <NR1>, <NR1>, <NR1> format. The <NR1> responses are in the order of <L1 phase>, <L2 phase> and <L3 phase>.

Scaling

CURR:SCAL
VOLT:SCAL

*RST

Sets the current and voltage scaling of each input phase (channel).

Command

```
[SENSe:]CURRent:SCALing[:STATe] <bool>,<bool>,<bool>
[SENSe:]CURRent:SCALing[:STATe]?
[SENSe:]VOLTage:SCALing[:STATe] <bool>,<bool>,<bool>
[SENSe:]VOLTage:SCALing[:STATe]?
```

Parameter	Value:	ON(1)	Scaling is applied
		OFF(0)	Scaling is not applied (default)
		The successive <bool> part is in the order of L1, L2 and L3.	

Response Returns the presence of scaling in the <NR1>, <NR1>, <NR1> format. The successive <NR1> part is in the order of L1, L2 and L3.

CURR:SCAL:CF
VOLT:SCAL:CF

*RST

Sets the Current CF and Voltage CF of each input phase (channel).

Command

```
[SENSe:]CURRent:SCALing:CF <numeric>,<numeric>,<numeric>
[SENSe:]CURRent:SCALing:CF?
[SENSe:]VOLTage:SCALing:CF <numeric>,<numeric>,<numeric>
[SENSe:]VOLTage:SCALing:CF?
```

Parameter	Value:	1.00 to 4.00	(Current CF: The default is 4.00)
		1.00 to 2.00	(Voltage CF: The default is 2.00)
		The successive <numeric> part is in the order of L1, L2 and L3.	
	Unit:	None	

Response Returns the Current CF and Voltage CF in the <NR3>, <NR3>, <NR3> format. The successive <NR3> part is in the order of L1, L2 and L3.

CURR:SCAL:CTR

*RST

Sets the CT Ratio of each input phase (channel).

Command

```
[SENSe:]CURRent:SCALing:CTRatio <numeric>,<numeric>,<numeric>
[SENSe:]CURRent:SCALing:CTRatio?
```

Parameter	Value:	0.001 to 1000.000 (The default is 1.000)
		The successive <numeric> part is in the order of L1, L2 and L3.
	Unit:	None

Response Returns the CT Ratio in the <NR3>, <NR3>, <NR3> format. The successive <NR3> part is in the order of L1, L2 and L3.

CURR:SCAL:ECSR

*RST

Sets the EXT-CS Ratio of each input phase (channel).

Command

```
[SENSe:]CURRent:SCALing:ECSRatio<numeric>,<numeric>,<numeric>
[SENSe:]CURRent:SCALing:ECSRatio?
```

Parameter Value: 0.250 to 2500.000 (The default is 25.000)

The successive <numeric> part is in the order of L1, L2 and L3.

Unit: None

Response Returns the EXT-CS Ratio in the <NR3>, <NR3>, <NR3> format. The successive <NR3> part is in the order of L1, L2 and L3.

CURR:SCAL:PADJ

*RST

Sets the phase adjustment value for the external sensor of each input phase (channel).

Command

```
[SENSe:]CURRent:SCALing:PADJustment<numeric>,<numeric>,<numeric>
[SENSe:]CURRent:SCALing:PADJustment?
```

Parameter Value: -180.00 to 180.00 (The default is 0.00)

The successive <numeric> part is in the order of L1, L2 and L3.

Unit: DEG

Response Returns the phase adjustment value for the external sensors in the <NR3>, <NR3>, <NR3> format. The successive <NR3> part is in the order of L1, L2 and L3.

VOLT:SCAL:PTR

*RST

Sets the PT Ratio of each input phase (channel).

Command

```
[SENSe:]VOLTage:SCALing:PTRatio <numeric>,<numeric>,<numeric>
[SENSe:]VOLTage:SCALing:PTRatio?
```

Parameter Value: 0.001 to 100.000 (The default is 1.000)

The successive <numeric> part is in the order of L1, L2 and L3.

Unit: None

Response Returns the PT Ratio in the <NR3>, <NR3>, <NR3> format. The successive <NR3> part is in the order of L1, L2 and L3.

CURR:SCAL:RANG
VOLT:SCAL:RANG

Queries the current range and voltage range of each channel after the scaling is set.

Command

```
[SENSe:]CURRent:SCALing:RANGe?
[SENSe:]VOLTage:SCALing:RANGe?
```

Response Returns the current and voltage ranges after the scaling in the <NR3>, <NR3>, <NR3> format.

The successive <NR3> part is in the order of L1, L2 and L3.

Setting the Limit Value Standard

HARM:APOW:JIS:CONF

Queries the judgment result when the AC power source was checked and the measured value was recorded.

NOTE Use this command when one of the following standards is selected.

- IEC 61000-3-12 2004
- IEC 61000-3-12 2011
- JIS 61000-3-2 2005 (Using reference impedance)
- JIS 61000-3-2 2019 (Using reference impedance)

Command

```
HARMonics:APOWer:JIS:CONFirm?
```

Response Returns the judgment result in <"string"> format.

PASS: normal, FAIL: abnormal

HARM:APOW:EXEC

Queries whether the measured value was recorded when checking the AC power source.

Command

```
HARMonics:APOWer:EXECute?
```

Response Returns the recording of measured value in <NR1> format.

0: not implemented, 1: implemented or not required

HARM:STAN:LIM

*RST

Sets the limit value standard.

Command

```
HARMonics:STANdard:LIMitation[:NAME] <“string”>
HARMonics:STANdard:LIMitation[:NAME]?
```

Parameter Value:
“IEC 61000-3-2 Ed3.0”
“IEC 61000-3-2 Ed3.0A2”
“IEC 61000-3-2 Ed2.2”
“JIS 61000-3-2 2005”
“JIS 61000-3-2 2011”
“JIS 61000-3-2 2019”
“IEC 61000-3-12 2004”
“IEC 61000-3-12 2011”
“IEC 61000-3-2 Ed5.0” (default)

Response Returns the limit value standard in the <“string”> format.

NOTE

- The conventional setting value “IEC 61000-3-2 Ed3.0A2” can be used, but the IEC61000-3-2 Ed5.0 standard is applied.
- The conventional setting value “JIS 61000-3-2 2011” can be used, but the JIS C61000-3-2(2019) standard is applied.

HARM:STAN:LIM:CATalog

Queries available limit value standards.

Command `HARMonics:STANdard:LIMitation:CATalog?`

Response Returns available limit value standards in the <“string”>, <“string”>, <“string”>... format.

Setting the Measuring Technique Standard

HARM:STAN:MTEC

*RST

Sets the measuring technique standard.

Command
```
HARMonics:STANdard:MTEChique[:NAME] <“string”>
HARMonics:STANdard:MTEChique[:NAME]?
```

Parameter Value:
“IEC 61000-4-7 Ed2.0”
“IEC 61000-4-7 Ed2.0A1” (default)
“IEC 61000-4-7 Ed1.0”

Response Returns the measuring technique standard in the <“string”> format.

NOTE To perform a test based on the IEC61000-4-7 Ed2.1 standard, select “IEC 61000-4-7 Ed2.0A1”. The standard is set to IEC 61000-4-7 Ed2.1 in test conditions, on the KHA3000 display, and in reports.

HARM:STAN:MTEC:CATalog

Queries available measuring technique standards.

Command `HARMonics:STANdard:MTEChique:CATalog?`

Response Returns available measuring technique standards in the <“string”>, <“string”>, <“string”>... format.

Setting the Standard Name

HARM:STAN:LIM:ALI

*RST

Sets whether the Limitation Standard and Measuring technique names are to be "Specified" or unchanged from the "Standard" for presenting to Report Print.

Command
```
HARMonics:STANDard:LIMitation:ALIas[:STATe] {ON|OFF|1|0}
HARMonics:STANDard:LIMitation:ALIas[:STATe]?
```

Parameter	Value:	ON(1)	Yes (Specified name)
		OFF(0)	No (Standard name, default)

Response Returns whether it is to be specified or not in the <NR1> format.

HARM:STAN:LIM:ALI:NAME

*RST

Sets the Limitation Standard name for Report Print.

Command

```
HARMonics:STANdard:LIMitation:ALIas:NAME <"string">
HARMonics:STANdard:LIMitation:ALIas:NAME?
```

Parameter

HARM:STAN:LIM	Default (Standard name)
IEC 61000-3-2 Ed3.0	EN 61000-3-2(2006)
IEC 61000-3-2 Ed3.0A2	EN IEC 61000-3-2(2019)
IEC 61000-3-2 Ed2.2	EN 61000-3-2(2000)/A2(2005)
JIS 61000-3-2 2005	JIS C61000-3-2(2005)
JIS 61000-3-2 2019	JIS C61000-3-2(2019
IEC 61000-3-12 2004	EN 61000-3-12(2005)
IEC 61000-3-12 2011	EN 61000-3-12(2011)
IEC 61000-3-2 Ed5.0	EN IEC 61000-3-2(2019)

Response Returns the Limitation Standard name for Report Print in the <"string"> format.

HARM:STAN:MTEC:ALI:NAME

*RST

Sets the Measuring technique name for Report Print.

Command

```
HARMonics:STANdard:MTEChnique:ALIas:NAME <"string">
HARMonics:STANdard:MTEChnique:ALIas:NAME?
```

Parameter

HARM:STAN:MTEC	Default (Standard name)
IEC 61000-4-7 Ed2.0	EN 61000-4-7(2002)
IEC 61000-4-7 Ed2.0A1	EN 61000-4-7(2002)/A1(2009)
IEC 61000-4-7 Ed1.0	EN 61000-4-7(1993)

Response Returns the Measuring technique name for Report Print in the <"string"> format.

Setting the Nominal Values

HARM:NOM:FREQ

*RST

Sets the nominal frequency. Set the nominal frequency according to the rating of the EUT.

Command

```
HARMonics:NOMinal:FREQuency {50|60}
HARMonics:NOMinal::FREQuency?
```

Parameter Value: 50 or 60 (The default is 50.)

Unit: Hz

Response Returns the nominal frequency in the <NR3> format.

HARM:NOM:VOLT

*RST

Sets the nominal voltage. Set the nominal voltage according to the rating of the EUT.

Executing this command simultaneously sets VFL:NOMinal:VOLTage at the same value.

Command

```
HARMonics:NOMinal:VOLTage <NRf>
HARMonics:NOMinal:VOLTage?
```

Parameter

	Value:	100, 120, 200 or 100 to 300 (The default is 230)
	Unit:	V

Response Returns the nominal voltage value in the <NR3> format.

Setting the Margin

HARM:MARG

*RST

Sets the margin for the limit value. Set a relative value of the reference limit value (100). For instance, specify 80 to set the margin to 80 % of the reference limit value.

Command

```
HARMonics:MARGin {<numeric>|MIN|MAX}
HARMonics:MARGin?
```

Parameter

	Value:	10 to 100 (The default is 100.)
	Unit:	PCT

Response Returns the margin in the <NR3> format.

Setting the Measurement Time

HARM:MTIM

*RST

Sets the measurement time.

Command

```
HARMonics:MTIMe {<numeric>|MIN|MAX}
HARMonics:MTIMe?
```

Parameter

	Value:	1 to 9600 (The default is 150.)
	Unit:	S

Response Returns the measurement time in the <NR3> format.

Comment Input

HARM:TEXT:COMM

*RST

Specifies comment items and sets comment texts. The ten types of comment items listed below can be specified. The character string for each comment item is subjected to character code encoding (normally Shift-JIS) that is set by the “SYST:CONFigure:TEXT:Encoding” command and further subjected to base64 encoding. This double encoding ensures a secure transfer of character codes that cannot be represented by ASCII 7 bits. The ten types of comment items are identified with suffixes (0, 1, 2, ..., 9) following the COMMent header.

- 0 “Memo”
- 1 “Model Name”
- 2 “Type”
- 3 “Serial No.”
- 4 “Company”
- 5 “Test Engineer”
- 6 “Operation Mode”
- 7 “Climatic Condition”
- 8 “Supply Source”
- 9 “Reference Impedance”

Command

```
HARMonics:TEXT:COMMent <numeric>,<“encoded-string”>
HARMonics:TEXT:COMMent <numeric>?
```

Parameter	Value:	<numeric>	Comment item (0 to 9: all items “ ” are specified by default.)
		<“encoded-string”>	Comment character string, base64 encoding

Response Returns comment texts in the <numeric> format.

Operation Type of the EUT

HARM:TEXT:TOBS

*RST

Sets the operation type of the EUT for setting the observation period (measurement time).

Command

```
HARMonics:TEXT:TOBServation{QSTationary|SCYClic|RANDom|LCYClic}
HARMonics:TEXT:TOBServation?
```

Parameter	Value:	QSTationary	Quasi stationary (default)
		SCYClic	Short cyclic
		RANDom	Random
		LCYClic	Long cyclic

Response Returns the operation type of the EUT for setting the observation period (measurement time) in the <character> format.

Setting the Reference Impedance

HARM:LIN:STAT

*RST

Sets whether to use the reference impedance.

Command

```
HARMonics:LIN:STATe {ON|OFF|1|0}
HARMonics:LIN:STATe?
```

Parameter	Value:	ON(1)	Use
		OFF(0)	Unuse

Response Returns the setting of whether the reference impedance is used in <NR1> format.

Harmonic Measurement Mode (61000-3-2)

Setting the Class of the EUT

HARM:IEC32:CLAS

*RST

Sets the class of the EUT. The reference value for determining conformance to the standard is the limit value corresponding to the class.

Command

```
HARMonics:IEC32:CLASs “{A|B|C|D}”
HARMonics:IEC32:CLASs?
```

Parameter	Value:		
		“A”	Class A (default)
		“B”	Class B
		“C”	Class C
		“D”	Class D

Response Returns the class of the EUT in the <“string”> format.

Class A Condition (JIS C61000-3-2)

HARM:IEC32:CONS600

*RST

When the EUT is in Class A, sets whether or not the air conditioner exceeds the effective input power of 600 W.

Command

```
HARMonics:IEC32:CONSider600{ON|OFF|1|0}
HARMonics:IEC32:CONSider600?
```

Parameter	Value:		
		ON(1)	Yes
		OFF(0)	No (default)

Response Returns whether or not the air conditioner exceeds the effective input power of 600 W in the <NR1> format.

Class C Conditions

HARM:IEC32:FUND:DEF

*RST

Sets the fundamental current value and the specification method of the power factor (measured or specified value) for Class C.

Command

```
HARMonics:IEC32:FUNDamental:DEFinition {MEASured|SPECified}
HARMonics:IEC32:FUNDamental:DEFinition?
```

Parameter	Value:	MEASured	Measured value (default)
		SPECified	Specified value

Response Returns the fundamental current value and the specification method of the power factor in the <character> format.

HARM:IEC32:FUND:CURR

*RST

Sets the specified value of the fundamental current for Class C.

Command

```
HARMonics:IEC32:FUNDamental:CURRent{<numeric>|MIN|MAX}
HARMonics:IEC32:FUNDamental:CURRent?
```

Parameter	Value:	0.0 to 75.0 (The default is 20.0.)
	Unit:	A

Response Returns the specified value of the fundamental current in the <NR3> format.

HARM:IEC32:FUND:PFAC

*RST

Sets the specified value of the power factor for Class C.

Command

```
HARMonics:IEC32:FUNDamental:PFACtor{<numeric>|MIN|MAX}
HARMonics:IEC32:FUNDamental:PFACtor?
```

Parameter	Value:	0.00 to 1.00 (The default is 1.00.)
	Unit:	None

Response Returns the specified value of the power factor in the <NR3> format.

HARM:IEC32:LVT

*RST

Sets the limit value to be applied for Class C.

Command

```
HARMonics:IEC32:LVTable
   {NORMal|CLASSA|CLASSD|WJUDge|THDLimit}
HARMonics:IEC32:LVTable?
```

Parameter	Value:	NORMal	Normal limit value (default)
		CLASSA	Limit value of Class A
		CLASSD	Limit value of Class D
		WJUDge	3rd/5th/Current Wave
		THDLimit	THD limit (valid only when IEC 61000-3-2 Ed5.0 is selected)

Response Returns the limit value to be applied in the <character> format.

Class D Conditions

HARM:IEC32:POW:DEF

*RST

Sets the type of power value for Class D. The type and the default of the value vary corresponding to the test standard.

Command

```
HARMonics:IEC32:POWer:DEFinition
   {MEASured|SPECified}
HARMonics:IEC32:POWer:DEFinition?
```

Parameter	Value:	MEASured	Measured value (default)
		SPECified	Specified value

Response Returns the type of power value in the <character> format.

HARM:IEC32:POW

*RST

Sets the specified value of the power.

Command

```
HARMonics:IEC32:POWer[:LEVel]{<numeric>|MIN|MAX}
HARMonics:IEC32:POWer[:LEVel]?
```

Parameter	Value:	0 to 135000 (The default is 100.)
	Unit:	W

Response Returns the value specified for the power in the <NR3> format.

Setting the Class of the EUT

HARM:IEC312:ETYP

*RST

Sets the type of the EUT. The criterion for judging conformance to the standards is the limit value of the type that has been set here.

Command

```
HARMonics:IEC312:ETYPe {SINGle|W3P3|BALanced|UNBalanced}
HARMonics:IEC312:ETYPe?
```

Parameter Value:

SINGle	Single-phase equipment
W3P3	Three-wire/three-phase equipment
BALanced	Balanced three-phase equipment (default)
UNBalanced	UNbalanced three-phase equipment

Response Returns the type of the EUT in the <character> format.

Setting the Reference Fundamental Current

HARM:IEC312:FUND:DEF

*RST

Sets the specification method of the reference fundamental current (measured or specified value).

Command

```
HARMonics:IEC312:FUNDamental:DEFinition {MEASured|SPECified}
HARMonics:IEC312:FUNDamental:DEFinition?
```

Parameter Value:

MEASured	Measured value (default)
SPECified	Specified value

Response Returns the specification method of the reference fundamental current in the <character> format.

HARM:IEC312:FUND:CURR

*RST

Sets the specified value of the reference fundamental current.

Command

```
HARMonics:IEC312:FUNDamental:CURRent{<numeric>|MIN|MAX}
HARMonics:IEC312:FUNDamental:CURRent?
```

Parameter Value: 0.0 to 75.0 (The default is 20.0.)

Unit: A

Response Returns the specified value of the reference fundamental current in the <NR3> format.

Setting the Judgment Rsce

HARM:IEC312:JUDG:RSCE

*RST

Sets the judgment Rsce.

Command
```
HARMonics:IEC312:JUDGe:RSCE{<numeric>|MIN|MAX}
HARMonics:IEC312:JUDGe:RSCE?
```

Parameter Value: 33 to 350 (The default is 33.)

Response Returns the judgment Rsce in the <NR1> format.

Setting the Limit Value to be Applied

HARM:IEC312:LVT

*RST

Sets the limit value to be applied.

Command
```
HARMonics:IEC312:LVTable {UNBalanced}|BALanced|SPECified}
HARMonics:IEC312:LVTable?
```

Parameter	Value:	UNBalanced	Except balanced three-phase equipment (default)
		BALanced	Balanced three-phase equipment
		SPECified	Specified three-phase equipment

Response Returns the limit value to be applied in the <character> format.

Setting the Nominal System Voltage

HARM:IEC312:NOM:SVOL

*RST

Sets the nominal system voltage.

Command
```
HARMonics:IEC312:NOMinal:SVOLtage <NRf>
HARMonics:IEC312:NOMinal:SVOLtage?
```

Parameter Value: 100 to 600 (The default is 400.)

Unit: V

Response Returns the nominal system voltage in the <NR3> format.

Setting the Rated Value

HARM:IEC312:RAT:DEF

*RST

Sets the specification method of the rated current (measured or specified value).

Command

```
HARMonics:IEC312:RATed:DEFinition {MEASured|SPECified}
HARMonics:IEC312:RATed:DEFinition?
```

Parameter Value:

MEASured	Measured value (default)
SPECified	Specified value

Response Returns the specification method of the rated current in the <character> format.

HARM:IEC312:RAT:CURR

*RST

Sets the rated current of the EUT.

Command

```
HARMonics:IEC312:RATed:CURRent <NRf>
HARMonics:IEC312:RATed:CURRent?
```

Parameter Value: 0.1 to 75.0 (The default is 20.0.)

Unit: A

Response Returns the rated current of the EUT in the <NR3> format.

HARM:IEC312:RAT:VOLT

*RST

Sets the rated voltage of the EUT.

Command

```
HARMonics:IEC312:RATed:VOLTage <NRf>
HARMonics:IEC312:RATed:VOLTage?
```

Parameter Value: 100 to 600 (The default is 230.)

Unit: V

Response Returns the rated voltage of the EUT in the <NR3> format.

Setting the Limit Value Standard

VFL:STAN:LIM

*RST

Sets the limit value standard. When setting IEC61000-3-3, select “Pst AUTO” or “ManualSW” as the measurement method. The limitation standard IEC 61000-3-3 Ed to be set depends on the selection of the standard for measurement techniques.

Command

```
VFLuctuation:STANdard:LIMitation[:NAME] <“string”>
VFLuctuation:STANdard:LIMitation[:NAME]?
```

Parameter Value:

“IEC 61000-3-3 (Pst AUTO)”	Pst Auto (default)
“IEC 61000-3-3 (ManualSW)”	Manual
“IEC 61000-3-11 Ed2.0”	

Response Returns the limit value standard in the <“string”> format.

VFL:STAN:LIM:CATalog

Queries available limit value standards.

Command

```
VFLuctuation:STANdard:LIMitation:CATalog?
```

Response Returns available limit value standards in the <“string”>, <“string”>, <“string”>... format.

Setting the Measuring Technique Standard

VFL:STAN:MTEC

*RST

Sets the measuring technique standard. IEC 61000-4-15 Ed2.0 is selected, the limitation standard is set to IEC 61000-3-3 Ed3.1(2017). If IEC 61000-4-15 Ed1.1 is selected, the limitation standard is set to IEC61000-3-3 Ed2.0(2008).

Command

```
VFLuctuation:STANdard:MTEChique[:NAME] <“string”>
VFLuctuation:STANdard:MTEChique[:NAME]?
```

Parameter Value:

“IEC 61000-4-15 Ed1.1”	
“IEC 61000-4-15 Ed2.0”	(default)

Response Returns the measuring technique standard in the <“string”> format.

NOTE To perform a test based on the IEC61000-3-3 Ed3.1 standard, select “IEC61000- 4-15 Ed2.0”. When the standard for measurement techniques is set to IEC 61000-4-15 Ed2.0, the standard is automatically set to IEC 61000-3-3 Ed3.1 in test conditions, on the KHA3000 display, and in reports. The measuring instrument requirements of the IEC 61000-3-3 Ed3.1 standard are specified in IEC 61000-4-15 Ed2.0.

VFL:STAN:MTEC:CATalog

Queries available measuring technique standards.

Command `VFLuctuation:STANdard:MTEChique:CATalog?`

Response Returns available measuring technique standards in the <“string”>, <“string”>, <“string”>... format.

Setting the Standard Name

VFL:STAN:LIM:ALI

*RST

Sets whether the Limitation Standard and Measuring technique names are to be "Specified" or unchanged from the "Standard" for presenting to Report Print.

Command

```
VFLuctuation:STANDard:LIMitation:ALIas[:STATe] {ON|OFF|1|0}
VFLuctuation:STANDard:LIMitation:ALIas[:STATe]?
```

Parameter Value:

ON(1)	Yes (Specified name)
OFF(0)	No (Standard name, default)

Response Returns whether it is to be specified or not in the <NR1> format.

VFL:STAN:LIM:ALI:NAME

*RST

Sets the Limitation Standard name for Report Print.

Command

```
VFLuctuation:STANdard:LIMitation:ALIas:NAME <"string">
VFLuctuation:STANdard:LIMitation:ALIas:NAME?
```

Parameter

VFL:STAN:LIM	Default (Standard name)
IEC 61000-3-3 Ed3.1 (Pst AUTO)	EN61000-3-3(2013)/A1(2019)
IEC 61000-3-3 Ed3.1 (Manual SW)	EN61000-3-3(2013)/A1(2019)
IEC 61000-3-11 Ed2.0	EN IEC 61000-3-11(2019)

Response Returns the Limitation Standard name for Report Print in the <"string"> format.

VFL:STAN:MTEC:ALI:NAME

*RST

Sets the Measuring technique name for Report Print.

Command

```
VFLuctuation:STANdard:MTEChnique:ALIas:NAME <"string">
VFLuctuation:STANdard:MTEChnique:ALIas:NAME?
```

Parameter

VFL:STAN:MTEC	Default (Standard name)
IEC 61000-4-15 Ed1.1	EN 61000-4-15(1998)/A1(2003)
IEC 61000-4-15 Ed2.0	EN 61000-4-15(2011)

Response Returns the Measuring technique name for Report Print in the <"string"> format.

Setting the Nominal Values

VFL:NOM:FREQ

***RST**

Sets the nominal frequency. Set the nominal frequency according to the rating of the EUT.

Command

```
VFLuctuation:NOMinal:FREQuency {50|60}
VFLuctuation:NOMinal:FREQuency?
```

Parameter

Value:	50 or 60 (The default is 50.)
Unit:	Hz

Response Returns the nominal frequency in the <NR3> format.

VFL:NOM:VOLT

***RST**

Sets the specified value of the nominal voltage.

Command

```
VFLuctuation:NOMinal:VOLTage <NRf>
VFLuctuation:NOMinal:VOLTage?
```

Parameter

Value:	100 to 600 (The default is 230.)
Unit:	V

Response The nominal voltage value is returned in the <NR3> format.

Comment Input

VFL:TEXT:COMM

***RST**

Specifies comment items and sets comment texts. The ten types of comment items listed below can be specified. The character string for each comment item is subjected to character code encoding (normally Shift-JIS) that is set by the “SYST:CONFigure:TEXT:Encoding” command and further subjected to base64 encoding. This double encoding ensures a secure transfer of character codes that cannot be represented by ASCII 7 bits. The ten types of comment items are identified with suffixes (0, 1, 2, ..., 9) following the COMMent header.

- 0 “Memo”
- 1 “Model Name”
- 2 “Type”
- 3 “Serial No.”
- 4 “Company”
- 5 “Test Engineer”
- 6 “Operation Mode”
- 7 “Climatic Condition”
- 8 “Supply Source”
- 9 “Reference Impedance”

Command

```
VFLuctuation:TEXT:COMMent <numeric>,<“encoded-string”>
VFLuctuation:TEXT:COMMent <numeric>?
```

Parameter

Value:	<numeric>	Comment item (0 to 9: all items “ ” are specified by default.)
	<“encoded-string”>	Comment character string, base64 encoding

Response Returns comment texts in the <numeric> format.

Measurement Time, Measurement Count and Limit Values

VFL:IEC33:DMAX

*RST

Sets the limit value of dmax.

Command
```
VFLuctuation:IEC33:DMAXlimit {4|6|7}
VFLuctuation:IEC33:DMAXlimit?
```

Parameter	Value:	4, 6 or 7 (The default is 6.)
	Unit:	PCT

Response Returns the limit value of dmax (maximum relative voltage changes) in the <NR3> format.

VFL:IEC33:DCO

*RST

Sets the d measurement count.

Command
```
VFLuctuation:IEC33:DCOunt <NRf>
VFLuctuation:IEC33:DCOunt?
```

Parameter	Value:	3 to 24 (The default is 24.)
	Unit:	None

Response Returns the d measurement count in the <NR3> format.

VFL:IEC33:DTIM

*RST

Sets the d measurement time.

Command
```
VFLuctuation:IEC33:DTIMe {<numeric>|MIN|MAX}
VFLuctuation:IEC33:DTIMe?
```

Parameter	Value:	30 to 180 (The default is 60.)
	Unit:	S

Response Returns the d measurement time in the <NR3> format.

VFL:IEC33:PSTC

*RST

Sets the Pst measurement count.

Command

```
VFLuctuation:IEC33:PSTCount <NRf>
VFLuctuation:IEC33:PSTCount?
```

Parameter	Value:	1 to 12 (The default is 12.)
	Unit:	None

Response Returns the Pst measurement count in the <NR3> format.

VFL:IEC33:PSTT

*RST

This command sets the Pst measurement time.

Command

```
VFLuctuation:IEC33:PSTTime {<numeric>|MIN|MAX}
VFLuctuation:IEC33:PSTTime?
```

Parameter	Value:	30 to 900 (The default is 600.)
	Unit:	S

Response Returns the Pst measurement time in the <NR3> format.

VFL:IEC33:JFAC:DC
VFL:IEC33:JFAC:DMAX
VFL:IEC33:JFAC:DT33
VFL:IEC33:JFAC:PLT
VFL:IEC33:JFAC:PST

*RST

Sets the five items of limit values to be used for judgment (dc, dmax, Tmax (d(t)>3.3%), Plt, Pst). Setting an item to ON (1) enables the corresponding limit value as a condition for judgment.

Command

```
VFLuctuation:IEC33:JFACtor:DC {ON|OFF|1|0}
VFLuctuation:IEC33:JFACtor:DC?
VFLuctuation:IEC33:JFACtor:DMAX {ON|OFF|1|0}
VFLuctuation:IEC33:JFACtor:DMAX?
VFLuctuation:IEC33:JFACtor:DT33 {ON|OFF|1|0}
VFLuctuation:IEC33:JFACtor:DT33?
VFLuctuation:IEC33:JFACtor:PLT {ON|OFF|1|0}
VFLuctuation:IEC33:JFACtor:PLT?
VFLuctuation:IEC33:JFACtor:PST {ON|OFF|1|0}
VFLuctuation:IEC33:JFACtor:PST?
```

Parameter	Value:	ON(1)	Yes (default)
		OFF(0)	No

Response Returns whether each limit value item is enabled for judgment in the <NR1> format.

Setting the Margins

VFL:IEC33:MARG:D

*RST

Sets the margin for the limit value of dc, dmax or Tmax (d(t)>3.3%). Set a relative value of the reference limit value (100). The setting range is 10 to 100. For instance, specify 80 to set the margin to 80 % of the standard limit value. For Tmax (d(t)>3.3%), set a margin for the limit value of the time exceeding Tmax (d(t)>3.3%).

Command

```
VFLuctuation:IEC33:MARGin:D {<numeric>|MIN|MAX}
VFLuctuation:IEC33:MARGin:D?
```

Parameter

Value:	10 to 100 (The default is 100.)
Unit:	PCT

Response Returns the margin for the limit value of dc, dmax, or Tmax (d(t)>3.3%) in the <NR3> format.

VFL:IEC33:MARG:FLIC

*RST

Sets the margin for the limit value of Pst or Plt. Set a relative value of the standard limit value (100). The setting range is 10 to 100. For instance, specify 80 to set the margin to 80 % of the standard limit value.

Command

```
VFLuctuation:IEC33:MARGin:FLICker {<numeric>|MIN|MAX}
VFLuctuation:IEC33:MARGin:FLICker?
```

Parameter

Value:	10 to 100 (The default is 100.)
Unit:	PCT

Response Returns the margin for the limit value of Pst or Plt in the <NR3> format.

Measurement Time, Measurement Count and Limit Values

VFL:IEC311:DMAX

*RST

Sets the limit value of dmax.

Command
```
VFLuctuation:IEC311:DMAXlimit {4|6|7}
VFLuctuation:IEC311:DMAXlimit?
```

Parameter	Value:	4, 6 or 7 (The default is 6.)
	Unit:	PCT

Response Returns the limit value of dmax (maximum relative voltage changes) in the <NR3> format.

VFL:IEC311:PSTC

*RST

Sets the Pst measurement count.

Command
```
VFLuctuation:IEC311:PSTCount <NRf>
VFLuctuation:IEC311:PSTCount?
```

Parameter	Value:	1 to 12 (The default is 12.)
	Unit:	None

Response Returns the Pst measurement count in the <NR3> format.

VFL:IEC311:PSTT

*RST

This command sets the Pst measurement time.

Command
```
VFLuctuation:IEC311:PSTTime {<numeric>|MIN|MAX}
VFLuctuation:IEC311:PSTTime?
```

Parameter	Value:	30 to 900 (The default is 600.)
	Unit:	S

Response Returns the Pst measurement time in the <NR3> format.

VFL:IEC311:JFAC:DC
VFL:IEC311:JFAC:DMAX
VFL:IEC311:JFAC:DT33
VFL:IEC311:JFAC:PLT
VFL:IEC311:JFAC:PST

*RST

Sets the five items of limit values to be used for judgment (dc, dmax, d(t)>3.3%, Plt, Pst). Setting an item to ON (1) enables the corresponding limit value as a condition for judgment.

Command

```
VFLuctuation:IEC311:JFACtor:DC {ON|OFF|1|0}
VFLuctuation:IEC311:JFACtor:DC?
VFLuctuation:IEC311:JFACtor:DMAX {ON|OFF|1|0}
VFLuctuation:IEC311:JFACtor:DMAX?
VFLuctuation:IEC311:JFACtor:DT33 {ON|OFF|1|0}
VFLuctuation:IEC311:JFACtor:DT33?
VFLuctuation:IEC311:JFACtor:PLT {ON|OFF|1|0}
VFLuctuation:IEC311:JFACtor:PLT?
VFLuctuation:IEC311:JFACtor:PST {ON|OFF|1|0}
VFLuctuation:IEC311:JFACtor:PST?
```

Parameter	Value:	ON(1)	Yes (default)
		OFF(0)	No

Response Returns whether each limit value item is enabled for judgment in the <NR1> format.

Setting the Margins

VFL:IEC331:MARG:D

*RST

Sets the margin for the limit value of dc, dmax or d(t)>3.3%. Set a relative value of the reference limit value (100). The setting range is 10 to 100. For instance, specify 80 to set the margin to 80 % of the standard limit value. For d(t)>3.3%, set a margin for the limit value of the time exceeding d(t)>3.3%.

Command

```
VFLuctuation:IEC33:MARGin:D {<numeric>|MIN|MAX}
VFLuctuation:IEC33:MARGin:D?
```

Parameter	Value:	10 to 100 (The default is 100.)
	Unit:	PCT

Response Returns the margin for the limit value of dc, dmax or d(t)>3.3% in the <NR3> format.

VFL:IEC331:MARG:FLIC

*RST

Sets the margin for the limit value of Pst or Plt. Set a relative value of the standard limit value (100). The setting range is 10 to 100. For instance, specify 80 to set the margin to 80 % of the standard limit value.

Command

```
VFLuctuation:IEC33:MARGin:FLICker {<numeric>|MIN|MAX}
VFLuctuation:IEC33:MARGin:FLICker?
```

Parameter
Value: 10 to 100 (The default is 100.)
Unit: PCT

Response Returns the margin for the limit value of Pst or Plt in the <NR3> format.

Impedance

VFL:IEC311:TIMP

*RST

Sets the specified value of the test impedance. Setting a value cancels the default value.

Command

```
VFLuctuation:IEC311:TIMPedance[:VALues]
   <numeric>,<numeric>,<numeric>,<numeric>
VFLuctuation:IEC311:TIMPedance[:VALues]?
```

Parameter
Value: R_A,X_A,R_N,X_N: 0.00 to 1.00
(The default of R_A and X_A is 0.24 and 0.15 and that of R_N and X_N is 0.16 and 0.10.)
Unit: OHM

Response Returns the specified value of the test impedance in the <NR3> format.

VFL:IEC311:TIMP:DEF

*RST

Sets the definition of the test impedance. As the definition, a fixed standard value or an optional value that can be specified by the user can be used.

Command

```
VFLuctuation:IEC311:TIMPedance:DEFinition
   {STANdard1|STANdard3|SPECified1|SPECified3}
VFLuctuation:IEC311:TIMPedance:DEFinition?
```

Parameter Value:

STANdard1	Standard value (single-phase)
STANdard3	Standard value (three-phase)
SPECified1	Specified value (single-phase)
SPECified3	Specified value (three-phase) (default)

Response Returns the type of the test impedance value in the <character> format.

Test Execution (Trigger Function)

The test is executed by the following three functions:

- Sequence 1 (ACQuire): Voltage, current and harmonic current measurement
- Sequence 2 (RUSH): In-rush current measurement
- Sequence 3 (TEST): Execution of the harmonic or voltage fluctuation test

Sequence 1 (ACQuire)

INIT
INIT:NAME

Starts the trigger function. The command is invalid during the analysis state.

After the INIT command is sent, measurement begins immediately when TRIG:SOUR:IMM is specified. When TRIG:SOUR:BUS is specified, measurement begins upon a software trigger.

The INIT command abandons and nullifies the measurement data collected previously. If an FETC? query is sent immediately after the INIT command is sent, measurement data is returned after completion of measurement.

Command (Sequence 1)

Command

```
INITiate[:IMMediate][:SEQuence[1]]
INITiate[:IMMediate]:NAME {ACQuire}
```

Parameter Value: ACQuire

INIT:CONT
INIT:CONT:NAME

***RST**

Sets the automatic continuation mode (ON/OFF) of sequence operation. The command is invalid during the analysis state.

● **When the automatic continuation mode is ON**

When TRIG:SOUR:IMM is specified, measurement begins immediately. After the measurement is finished, new measurement begins automatically.

When TRIG:SOUR:BUS is specified, measurement begins upon a software trigger. After the measurement is finished, the system waits for another trigger.

● **When the automatic continuation mode is OFF**

The measurement currently in progress is continued unless ABOR is sent. New measurement is not automatically continued.

Command

```
INITiate:CONTinuous[:SEQuence[1]] {ON|OFF|1|0}
INITiate:CONTinuous[:SEQuence[1]]?
INITiate:CONTinuous:NAME {ACQuire},{ON|OFF|1|0}
INITiate:CONTinuous:NAME?{ACQuire}
```

Parameter	Value:	ON(1)	Automatic continuation mode ON
		OFF(0)	Automatic continuation mode OFF (default)

Response Returns the automatic continuation mode (ON/OFF) of sequence operation in the <NR1> format.

TRIG:SOUR
TRIG:ACQ:SOUR

***RST**

Each sets the conditions (trigger source) for actually starting measurement after reception of the INIT command.

Command

```
TRIGger[:SEQuence[1]|ACQuire]:SOURce {BUS|IMMediate}
TRIGger[:SEQuence[1]|ACQuire]:SOURce?
```

Parameter	Value:		
		BUS	Start measurement after waiting for a software trigger (*TRG, IEEE488.1 GET (Group ExecuteTrigger)).
		IMMediate	Start measurement immediately (default)

Response Returns the current setting of the trigger source in the <character> format.

Sequence 2 (RUSH)

INIT:SEQ2
INIT:NAME RUSH

Starts in-rush current measurement. The system enters the trigger signal wait state. It does not respond to a device trigger.

Command

```
INITiate[:IMMediate]:SEQuence2
INITiate[:IMMediate]:NAME {RUSH}
```

Parameter Value: NAME

TRIG:SEQ2:SOUR
TRIG:RUSH:SOUR

***RST**

Each sets the conditions for actually starting In-rush current measurement after reception of the INIT:SEQ2 command.

Command

```
TRIGger:SEQuence2:SOURce {INTernal}
TRIGger:SEQuence2:SOURce?
TRIGger:RUSH:SOURce {INTernal}
TRIGger:RUSH:SOURce?
```

Parameter	Value:		
		INTernal	Internal trigger (fixed)

Response Returns the setting of the internal trigger in the <character> format.

TRIG:SEQ2:LEV
TRIG:RUSH:LEV

*RST

Each sets the current trigger level for in-rush current measurement.

Command

```
TRIGger:SEQuence2:LEVel {<numeric>|MIN|MAX}
TRIGger:SEQuence2:LEVel?
TRIGger:RUSH:LEVel {<numeric>|MIN|MAX}
TRIGger:RUSH:LEVel?
```

Parameter	Value:	0.1 to 80 (The default is 0.1.)
	Unit:	A

Response Returns the current trigger level in the <NR3> format.

TRIG:SEQ2:DEL
TRIG:RUSH:DEL

*RST

Sets the triggering delay for the in-rush current measurement. If a negative value is set, it becomes the measurement time (pre-delay) after the triggering.

Command

```
TRIGger:SEQuence2:DELay {<numeric>|MIN|MAX}
TRIGger:SEQuence2:DELay?
TRIGger:RUSH:DELay {<numeric>|MIN|MAX}
TRIGger:RUSH:DELay?
```

Parameter	Value:	-9.9E+37 to +9.9E+37 (The default is 0)
	Unit:	second

Response Returns the triggering current level in the <NR3> format.

TRIG:SEQ2:CHAN
TRIG:RUSH:CHAN

*RST

Sets the input phase (channel) used as a trigger for in-rush current measurement.

Command

```
TRIGger:SEQuence2:CNANnel <nrf>
TRIGger:SEQuence2:CNANnel?
TRIGger:RUSH:CNANnel <nrf>
TRIGger:RUSH:CNANnel?
```

Parameter	Value:	1, 2, 3 (L1, L2, L3; The default is 1.)
	Unit:	None

Response Returns the input phase (channel) used as a trigger in the <NR3> format.

Sequence 3 (TEST)

INIT:SEQ3
INIT:NAME TEST

Starts testing when IEC 61000-3-3 (ManualSW) is selected in the limit value standard for the voltage fluctuation measurement mode (VFLuctuation:STANdard:LIMitation).

Command

```
INITiate[:IMMediate]:SEQuence3
INITiate[:IMMediate]:NAME {TEST}
```

Parameter Value: TEST

TRIG:SEQ3
TRIG:TEST

***RST**

Executes a software trigger during test operation.

Command

```
TRIGger:SEQuence3[:IMMediate][<character>]
TRIGger:TEST[:IMMediate][<character>]
```

Parameter	Value:	NEXT	(default)
		RETRy	

TRIG:SEQ3:SOUR
TRIG:TEST:SOUR

***RST**

Each sets the conditions for actually starting measurement for test operation after reception of the INIT:SEQ3 command.

When IEC 61000-3-3 (ManualSW) is selected in the limit value standard for the voltage fluctuation measurement mode (VFLuctuation:STANDard:LIMitation), the second and subsequent tests always wait for a device trigger. To start the second or a subsequent test, use a software trigger (*TRG, IEEE 488.1 GET) regardless of the setting of TRIG:SEQ3:SOUR (TRIG:TEST:SOUR). When the last measurement cycle is completed, it will not wait for a device trigger.

Command

```
TRIGger:SEQuence3:SOURce {BUS|IMMediate}
TRIGger:SEQuence3:SOURce?
TRIGger:TEST:SOURce {BUS|IMMediate}
TRIGger:TEST:SOURce?
```

Parameter	Value:	BUS	Start measurement after waiting for a software trigger (*TRG, IEEE488.1 GET (Group ExecuteTrigger)).
		IMMediate	Start measurement immediately (default)

Response Returns the current setting of the trigger source in the <character> format.

Aborting Measurement

ABOR

Stops measurement.

The trigger state immediately after power-on of this product is the same as that when the ABOR command is sent.

If the ABOR command is sent when measurement has already begun, measurement data remains invalid.

Measurement data is not invalidated if the ABOR command is sent when the INIT command has not been sent and the retained measurement data is valid.

The ABOR command cannot specify a sequence group. ALL is always assumed.

Command `ABORt[:ALL]`

Judgment

JUDG:RES

Queries the general judgment result of the test that was finished previously.

Command `JUDGe;RESult?`

Response Returns the general judgment result of the test that was finished previously in the <character> format, that is, returns PASS, FAIL, WARN or ABORT. An error is returned if the previous test result is not retained.

Querying Measurement Data

FETC[<channel#>][SCALar]:<meas_item>
READ[<channel#>][SCALar]:<meas_item>
MEASure[<channel#>][SCALar]:<meas_item>

FETC

Queries measurement data without starting measurement operation.

If FETC? is sent without measurement, an SCPI error (-230, “Data corrupt or stale”) occurs because no measurement data is available. Always use this command with the INIT command.

If <meas_item> is not specified, the value set by previous FETC?, READ? or MEAS:<meas_item>? is used.

Command `FETCh[<channel#>][:SCALar][:<meas_item>]?`

Response Returns measurement data in the <NR3> format in response to FETC?.

READ

Queries measurement data after starting new measurement operation.

READ? works the same as the INIT command issued in combination with the FETC? query.

If <meas_item> is not specified, the value set by previous FETC?, READ? or MEAS:<meas_item>? is used.

Command `READ[<channel#>][:SCALar][:<meas_item>]?`

Response Returns measurement data in the <NR3> format in response to READ?.

MEAS

Aborts the current measurement operation and starts the measurement operation anew, and then queries measurement data.

MEAS:<meas_item>? works the same way as the ABORT command combined with the READ? query.

Command `MEASure[<channel#>][:SCALar]:<meas_item>?`

Response Returns measurement data in the <NR3> format in response to MEAS:<meas_item>?.

NOTE

- If measurement has not been completed yet immediately after transmission of the INIT command or the READ:<meas_item>? or MEAS:<meas_item>? query, the response data FETC:<meas_item>?, READ:<meas_item>? or MEAS:<meas_item>? query is generated after the completion of measurement.

<channel#>

Specifies an input phase (channel). The specifications of some input phases (channels) may become invalid depending on the wiring method setting (INPut:WIRing:METHod). If the specification of this parameter is omitted, channel 1 (input phase L1) is automatically used.

<channel#>	Input phase, all phases	Wiring method[1]			
		Single-phase two-wire 1P2W	Single-phase three-wire 1P3W	Three-phase three-wire 3P3W	Three-phase four-wire 3P4W
0	All phases	×	○	○	○
1 (default)	L1	○	○	○	○
2	L2	×	○	○	○
3	L3	×	×	○	○

[1] ○: Valid, ×: Invalid

<meas_item>

Queries the measured value of current, harmonic current, flicker, frequency, power, power factor, phase and voltage measurement.

In this manual, the fourth level nodes of FETC?, READ? and MEAS? are sometimes written as <meas_item>. Refer to the following table to replace <meas_item> with a necessary measurement method.

<meas_item>	Measurement item	Unit	Valid mode[1] (○: Valid, ×: Invalid)				
			HA[2]	VF[2]	BASIC	FFT	RUSH
CURRent:AC	Alternate current	A	○	○	○	○	×
CURRent:AMPLitude:MAXimum	Maximum current	A	○	○	○	○	×
CURRent:AMPLitude:MINimum	Minimum current	A	○	○	○	○	×
CURRent:HARMonics[:AMPLitude]	Harmonic current	A	○	×	×	○	×
CURRent:HARMonics:PHASe	Harmonic current phase angle	DEG	○	×	×	○	×
FLICker:ST	Momentary flicker value	–	×	○	×	×	×
FREQency	Frequency	Hz	○	○	○	○	×
POWer:AC[:REAL]	Real power	W	○	○	○	○	×
POWer:AC:APParent	Apparent power	VA	○	○	○	○	×
POWer:AC:REACtive	Reactive power	var	○	○	○	○	×
POWer:AC:PFACtor	Power factor	–	○	○	○	○	×
VOLTage:AC	AC voltage	V	○	○	○	○	×
VOLTage:AMPLitude:MAXimum	Maximum voltage	V	○	○	○	○	×
VOLTage:AMPLitude:MINimum	Minimum voltage	V	○	○	○	○	×

[1] HA: Harmonic measurement mode, VF: Voltage fluctuation measurement mode, BASIC: Basic measurement, FFT: FFT analyzer, RUSH: In-rush current measurement

[2] The command is invalid during the testing or analysis state.

Querying Current

FETC:CURR:AC
READ:CURR:AC
MEAS:CURR:AC

Each of these commands queries the measured value of the alternate current (rms).

Command

```
FETCh[<channel#>][:SCALar]:CURRent:AC?
READ[<channel#>][:SCALar]:CURRent:AC?
MEASure[<channel#>][:SCALar]:CURRent:AC?
```

Response Returns the measured value of the alternate current (rms) in the <NR3> format.

Unit: A(RMS)

FETC:CURR:AMPL:MAX
READ:CURR:AMPL:MAX
MEAS:CURR:AMPL:MAX

Each queries the measured value of the maximum current (positive amplitude peak value).

Command

```
FETCh[<channel#>][:SCALar]:CURRent:AMPLitude:MAXimum?
READ[<channel#>][:SCALar]:CURRent:AMPLitude:MAXimum?
MEASure[<channel#>][:SCALar]:CURRent:AMPLitude:MAXimum?
```

Response Returns the measured value of the maximum current (positive amplitude peak value) in the <NR3> format.

Unit: A

FETC:CURR:AMPL:MIN
READ:CURR:AMPL:MIN
MEAS:CURR:AMPL:MIN

Each queries the measured value of the mimimum current (negative amplitude peak value).

Command

```
FETCh[<channel#>][:SCALar]:CURRent:AMPLitude:MINimum?
READ[<channel#>][:SCALar]:CURRent:AMPLitude:MINimum?
MEASure[<channel#>][:SCALar]:CURRent:AMPLitude:MINimum?
```

Response Returns the measured value of the minimum current (negative amplitude peak value) in the <NR3> format.

Unit: A

Querying Harmonic Current

FETC:CURR:HARM
READ:CURR:HARM
MEAS:CURR:HARM

Each queries the measured value of the harmonic current.

Command

```
FETCh[<channel#>][:SCALar]:CURRent:HARMonics[:AMPLitude]?
   {ALL|<NRf>}
READ[<channel#>][:SCALar]:CURRent:HARMonics[:AMPLitude]?
   {ALL|<NRf>}
MEASure[<channel#>][:SCALar]:CURRent:HARMonics[:AMPLitude]?
   {ALL|<NRf>}
```

Parameter Value: 1 to 40 (harmonic measurement mode)
1 to 180 (FFT analyzer)
“ALL” queries data of all orders.

Response Returns the measured value of <NRf>th harmonic current in the <NR3> format for FETC:CURR:HARM? <NRf>/READ:CURR:HARM? <NRf>/MEAS:CURR:HARM?<NRf>. Returns the measured value of harmonic current of all orders in the <NR3>, <NR3>, ... format for FETC:CURR:HARM? ALL/READ:CURR:HARM? ALL/MEAS:CURR:HARM? ALL.

Unit: A

FETC:CURR:HARM:THDI
READ:CURR:HARM:THDI
MEAS:CURR:HARM:THDI

Queries the measured THD-I (total harmonic displacement, The denominator is the effective value of the current).

Command

```
FETCh[:SCALar]:CURRent:HARMonics:THDI?
READ[:SCALar]:CURRent:HARMonics:THDI?
MEASure[:SCALar]:CURRent:HARMonics:THDI?
```

Response Returns the measured THD-I (total harmonic displacement, The denominator is the effective value of the current) in <NR3> format.

Unit: %

FETC:CURR:HARM:THDF
READ:CURR:HARM:THDF
MEAS:CURR:HARM:THDF

Queries the measured THD-F (total harmonic displacement, The denominator is the effective value of the fundamental components current).

Command

```
FETCh[:SCALar]:CURRent:HARMonics:THDF?
READ[:SCALar]:CURRent:HARMonics:THDF?
MEASure[:SCALar]:CURRent:HARMonics:THDF?
```

Response Returns the measured THD-F (total harmonic displacement, The denominator is the effective value of the fundamental components current) in <NR3> format.

Unit: %

FETC:CURR:HARM:PHAS
READ:CURR:HARM:PHAS
MEAS:CURR:HARM:PHAS

Each queries the phase angle of harmonic current.

Command

```
FETCh[<channel#>][:SCALar]:CURRent:HARMonics:PHASe?
   {ALL|<NRf>}
READ[<channel#>][:SCALar]:CURRent:HARMonics:PHASe?
   {ALL|<NRf>}
MEASure[<channel#>][:SCALar]:CURRent:HARMonics:PHASe?
   {ALL|<NRf>}
```

Parameter Value: 1 to 40 (harmonic measurement mode)

1 to 180 (FFT analyzer)
"ALL" queries data of all orders.

Response Returns the phase angle of <NRf>th-order harmonic current in the <NR3> format for FETC:CURR:HARM:PHAS? <NRf>, READ:CURR:HARM:PHAS? <NRf> and MEAS:CURR:HARM:PHAS? <NRf>.
Returns the phase angles of harmonic current of all orders in the <NR3>, <NR3> ... format for FETC:CURR:HARM:PHAS? ALL, READ:CURR:HARM:PHAS? ALL and MEAS:CURR:HARM:PHAS? <ALL>.

Unit: DEG

Querying a Momentary Flicker Value

FETC:FLIC:ST
READ:FLIC:ST
MEAS:FLIC:ST

Each queries a momentary flicker value.

Command

```
FETCh[<channel#>][:SCALar]:FLICker:ST?
READ[<channel#>][:SCALar]:FLICker:ST?
MEASure[<channel#>][:SCALar]:FLICker:ST?
```

Response Returns the momentary flicker value in the <NR3> format.

Unit: None

Querying a Frequency

FETC:FREQ
READ:FREQ
MEAS:FREQ

Each queries the set value of the frequency.

Command

```
FETCh[<channel#>][:SCALar]:FREQuency?
READ[<channel#>][:SCALar]:FREQuency?
MEASure[<channel#>][:SCALar]:FREQuency?
```

Response Returns the set value of the frequency in the <NR3> format.

Unit: Hz

Querying a Voltage Phase Angle

FETC:PHAS:VOLT
READ:PHAS:VOLT
MEAS:PHAS:VOLT

Each of these commands queries a voltage phase angle.

Command

```
FETCh[<channel#>][:SCALar]:PHASe:VOLTage?
READ[<channel#>][:SCALar]:PHASe:VOLTage?
MEASure[<channel#>][:SCALar]:PHASe:VOLTage?
```

Response Returns the voltage phase angle in the <NR3> format.

Unit: DEG

Querying Power

FETC:POW:AC
READ:POW:AC
MEAS:POW:AC

Each queries the measured value of the real power.

Command

```
FETCh[<channel#>][:SCALar]:POWer:AC[:REAL]?
READ[<channel#>][:SCALar]:POWer:AC[:REAL]?
MEASure[<channel#>][:SCALar]:POWer:AC[:REAL]?
```

Response Returns the measured value of the real power in the <NR3> format.

Unit: W

FETC:POW:AC:APP
READ:POW:AC:APP
MEAS:POW:AC:APP

Each queries the measured value of the apparent power.

Command

```
FETCh[<channel#>][:SCALar]:POWer:AC:APParent?
READ[<channel#>][:SCALar]:POWer:AC:APParent?
MEASure[<channel#>][:SCALar]:POWer:AC:APParent?
```

Response Returns the measured value of the apparent power in the <NR3> format.

Unit: VA

FETC:POW:AC:REAC
READ:POW:AC:REAC
MEAS:POW:AC:REAC

Each queries the measured value of the reactive power.

Command

```
FETCh[<channel#>][:SCALar]:POWer:AC:REACtive?
READ[<channel#>][:SCALar]:POWer:AC:REACtive?
MEASure[<channel#>][:SCALar]:POWer:AC:REACtive?
```

Response Returns the measured value of the reactive power in the <NR3> format.

Unit: VAR

FETC:POW:AC:PFAC
READ:POW:AC:PFAC
MEAS:POW:AC:PFAC

Each queries the power factor.

Command

```
FETCh[<channel#>][:SCALar]:POWer:AC:PFACtor?
READ[<channel#>][:SCALar]:POWer:AC:PFACtor?
```

```
MEASure[<channel#>][:SCALar]:POWer:AC:PFACtor?
```

Response Returns the power factor in the <NR3> format.

Querying Voltage

FETC:VOLT:AC
READ:VOLT:AC
MEAS:VOLT:AC

Each queries the measured value of the AC voltage (effective value).

Command

```
FETCh[<channel#>][:SCALar]:VOLTage:AC?
READ[<channel#>][:SCALar]:VOLTage:AC?
MEASure[<channel#>][:SCALar]:VOLTage:AC?
```

Response Returns the measured value of the AC voltage (rms) in the <NR3> format.

Unit: V

FETC:VOLT:AMPL:MAX
READ:VOLT:AMPL:MAX
MEAS:VOLT:AMPL:MAX

Each queries the measured value of the maximum voltage (positive amplitude peak value).

Command

```
FETCh[<channel#>][:SCALar]:VOLTage:AMPLitude:MAXimum?
READ[<channel#>][:SCALar]:VOLTage:AMPLitude:MAXimum?
MEASure[<channel#>][:SCALar]:VOLTage:AMPLitude:MAXimum?
```

Response Returns the measured value of the maximum voltage (positive amplitude peak value) in the <NR3> format.

Unit: V

FETC:VOLT:AMPL:MIN
READ:VOLT:AMPL:MIN
MEAS:VOLT:AMPL:MIN

Each queries the measured value of the minimum voltage (negative amplitude peak value).

Command

```
FETCh[<channel#>][:SCALar]:VOLTage:AMPLitude:MINimum?
READ[<channel#>][:SCALar]:VOLTage:AMPLitude:MINimum?
MEASure[<channel#>][:SCALar]:VOLTage:AMPLitude:MINimum?
```

Response Returns the measured value of the minimum voltage (negative amplitude peak value) in the <NR3> format.

Unit: V

Controlling the AC Power Supply

Setting the AC Power Supply

SOUR:OUTP

Sets the output of the AC power supply to on or off.

Command

```
SOURce:OUTPut[:STATe] {ON|OFF|1|0}
SOURce:OUTPut[:STATe]?
```

Parameter	Value:	ON(1)	On
		OFF(0)	Off (default)

Response Returns the setting (ON/OFF) of the output of the AC power supply in the <NR1> format.

SOUR:PHAS:ON

Sets the ON phase of the output of the AC power supply.

Command

```
SOURce:PHASe:ON <NRf>
SOURce:PHASe:ON?
```

Parameter	Value:	0 to 360 -1 (no specification)
	Unit:	DEG

Response Returns the ON phase of the output of the AC power supply in the <NR3> format.

SOUR:FREQ

Sets the frequency of the AC power supply.

Command

```
SOURce:FREQuency <NRf>
SOURce:FREQuency?
```

Parameter	Value:	50 or 60
	Unit:	Hz

Response Returns the frequency of the AC power supply in the <NR3> format.

SOUR:VOLT

Sets the output voltage of the AC power supply.

Command

```
SOURce:VOLTage <NRf>
SOURce:VOLTage?
```

Parameter

Value:	0.0 to 304.8
Unit:	V

Response Returns the output voltage of the AC power supply in the <NR3> format.

SOUR:VOLT:RANG

Sets the output voltage range of the AC power supply.

Command

```
SOURce:VOLTage:RANGe {100|200}
SOURce:VOLTage:RANGe?
```

Parameter

Value:	100 200
Unit:	V

Response Returns the output voltage range of the AC power supply in the <NR3> format.

System Setting

Buzzer

SYST:BEEP:VOL

Sets the buzzer volume.

Command `SYSTem:BEEPer:VOLume {<numeric>|MIN|MAX}`
`SYSTem:BEEPer:VOLume?`

Parameter Value: 0 to 8
Unit: None

Response Returns the buzzer volume in the <NR3> format.

Setting the Date and Time

SYST:DATE

Sets the date.

Command `SYSTem:DATE <YEAR_NR1>,<MONTH_NR1>,<DAY_NR1>`
`SYSTem:DATE?`

Parameter <YEAR_NR1> Year
Value: 2000 to 2099

<MONTH_NR1> Month
Value: 1 to 12

<DAY_NR1> Day
Value: 1 to 31

Response Returns year, month and day in this order in the <NR1>, <NR1>, <NR1> format.

SYST:TIME

Sets the time.

Command `SYSTem:TIME <HOUR_NR1>,<MIN_NR1>,<SEC_NR1>`
`SYSTem:TIME?`

Parameter <HOUR_NR1> Hour
Value: 0 to 23

<MIN_NR1> Minute, <SEC_NR1> Second
Value: 0 to 59

Response Returns hour, minute and second in this order in the <NR1>, <NR1>, <NR1> format.

SYST:ERR

Reads the least recent error information from the error queue. The error queue can contain up to 255 error information items. The error queue is cleared by the *CLS command.

Command `SYSTem:ERRor[:NEXT]?`

Response Returns the least recent error information stored in the error queue in the <NR1>, <“string”> format.

Example: No information error exists.

`0,"No error"`

Example: Command error

`-100,"Command error"`

SYST:LOC (RS232C, USB only)

Enables panel operation (local). This is an alternate command for the IEEE 488.1 REN message (Remote Disable). SYST:REM or SYST:RWL restores the remote operation mode.

If this command is issued when GPIB is used, an SCPI error (-200, “Execution error”) occurs.

Command `SYSTem:LOCal`

SYST:REM (RS232C, USB only)

Sets the remote operation mode. Panel operation other than the LOCAL key is locked. The command is an alternate command for the IEEE 488.1 REN message (Remote Enable) and address specification.

The local operation mode is restored by SYST:LOC.

If this command is issued when GPIB is used, an SCPI error (-200, “Execution error”) occurs.

Command `SYSTem:REMote`

SYST:RWL (RS232C, USB only)

Sets the remote operation mode. Panel operation is locked (the LOCAL key cannot be used either). This is an alternate command for the IEEE 488.1 llo message (Local Lock Out).

The local operation mode is restored by SYST:LOC.

If this command is issued when GPIB is used, an SCPI error (-200, “Execution error”) occurs.

Command `SYSTem:RWLock`

SYST:OPT

Queries the options installed on this product. The command works the same as *OPT?.

Command `SYSTem:OPTion?`

Response Returns the option name if an option is installed.
Returns “0” if no option is installed.

SYST:VERS

Queries the version of the SCPI specifications with which this product is compliant.

Command

```
SYSTem:VERSion?
```

Response Always returns 1999.0.

SYST:CONF:LANG

Sets the type of language.

Command

```
SYSTem:CONFigure:LANGuage {ENGLish|JAPanese}
SYSTem:CONFigure:LANGuage?
```

Parameter	Value:		
		ENGLish	English
		JAPanese	Japanese

Response Returns the language type in the <character> format.

SYST:CONF:PCR

Specifies whether or not to enable AC Power Supply control.

Command

```
SYSTem:CONFigure:PCR[:STATe] {ON|OFF|1|0}
SYSTem:CONFigure:PCR[:STATe]?
```

Parameter	Value:		
		ON(1)	Enable
		OFF(0)	Disable (default)

Response Returns information on whether or not to enable AC Power Supply control in the <NR1> format.

SYST:CONF:TEXT:ENC

Sets the character code used for encoding when a comment text is set by a command.

Command

```
SYSTem:CONFigure:TEXT:ENcoding <string>
SYSTem:CONFigure:TEXT:ENcoding?
```

Parameter Value: “Shift-JIS”

Response Returns the character code used for encoding in the <string> format.

Status Registers and Status Report Function

The IEEE 488.2 register and SCPI register are used for status reports.

Each SCPI status register has the following subregisters: CONDition register, EVENt register, ENABle register, PTRansition filter and NTRansition filter.

The figure on page 338 shows the SCPI status register structure. “+” indicates the logical sum of register bits.

The tables on pages 339 to 343 provide a summary of bit numbers, bit weights and bit meanings.

CONDition register

The bits of the CONDition register are automatically set to indicate the current status of this product. Reading this register does not affect the register data.

EVENt register

The bits of the EVENt register are automatically set according to the changes in the CONDition register. The rule varies depending on the positive transition or negative transition registers (PTRansition and NTRansition). Reading the EVENt register clears the register data.

ENABle register

The ENABle register enables reports to the summary bit and status bit of event bits.

Transition filters

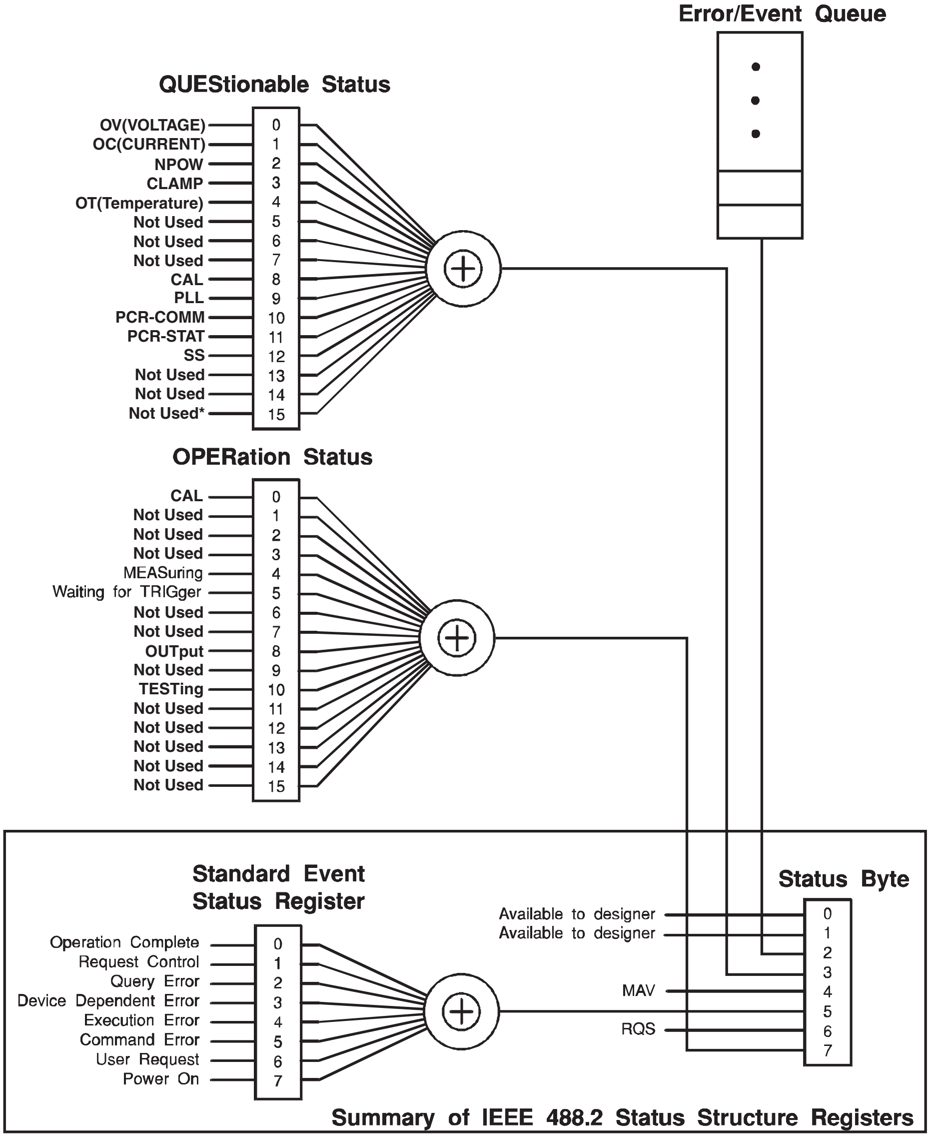
The PTRansition (positive transition) filter can be used to report an event when the condition has changed from false to true.

The NTRansition (negative transition) filter can be used to report an event when the state has changed from true to false.

If both positive and negative filters are set to true, an event can be reported every time the status changes.

If both filters are released, event reporting is disabled.

SCPI status register



* The use of Bit 15 is not allowed since some controllers may have difficulty reading a 16 bit unsigned integer. The value of this bit shall always be 0.

Partially changed SCPI Standard 1999.0 Volume 1 Fig. 9-1.

IEEE 488.2 Register Model

Status Byte Register

The status byte register stores the STB and RQS (MSS) messages as defined in the IEEE 488.1 standard. The status byte register can be read by using IEEE 488.1 serial polling or IEEE 488.2 common command *STB?.

When serial polling is performed, bit 6 responds with Request Service (RQS). The status byte value is not changed by serial polling.

*STB? causes the content of the status byte register and Master Status Summary (MSS) to be sent to equipment.

*STB? does not change the status byte, MSS or the RQS.

Bit	Bit weight	Bit name	Description
0	1	Reserved	Reserved for future use by the IEEE 488. The bit value is posted as zero.
1	2	Reserved	
2	4	Error/Event Queue	If data exists in the error or event queue, this bit is set to “true”.
3	8	Questionable Status Register (QUES)	This bit is set to “true” when a bit in the QUEStionable event status register is set and the corresponding bit in the QUEStionable status enable register is “true.”
4	16	Message Available (MAV)	This bit is set to “true” when a request from the digital programming interface has been received and the system is ready for data byte output.
5	32	Standard Event Status Bit Summary (ESB)	This bit is set to “true” when a bit is set in the event status register.
6	64	Request Service (RQS)	This bit is set to “true” when a bit in the service request enable register is set and the bit corresponds to a bit in the status byte. The GPIB SRQ line is set.
		Master Status Summary (MSS)	This bit is set when one of the status byte bits is 1 and the corresponding bit in the service request enable register is also set to 1.
7	128	Operation Status Register (OPER)	This bit is set to “true” when a bit in the OPERation event status register is set and the corresponding bit in the OPERation status enable register is set.
8-15	–	NOT USED	Not used

Event Status Register (Standard Event Status Resister)

The event status register sets the bit for a specific event caused by operation of this product. Every bit of the event status register is set by the error event queue.

The register is defined by the IEEE 488.2 standard and controlled by IEEE 488.2 common commands *ESE, *ESE? and *ESR?.

Bit	Bit weight	Bit name	Description
0	1	Operation Complete (OPC)	This bit is set when every standby operation is completed after the *OPC command is received. The Event 800 Operation complete message is loaded to the error/event queue.
1	2	Request Control (RQC)	Not used
2	4	Query Error (QYE)	This bit is set when an attempt is made to read data from the output queue even though there is no output data or the system is not in the wait state. The bit indicates that there is no data remains in the output queue.
3	8	Device Dependent Error (DDE)	This bit is set when a device-specific error exists.
4	16	Execution Error (EXE)	This bit is set when this product recognizes that the program data following the header is out of the formal input range or is not compatible with the performance of this product. It indicates that an effective SCPI command may not execute correctly depending on the status of this product.
5	32	Command Error (CME)	This bit is set when an IEEE 488.2 syntax error is detected by the syntax analysis system, an unrecognizable header is received, or a group execution trigger is input into the input buffer in the IEEE 488.2 SCPI command.
6	64	User Request (URQ)	Not used
7	128	Power ON (PON)	Set at power-on
8-15	–	Reserved	Not used

OPERation Status Register (STATus:OPERation)

The OPERation status register is a 16-bit register containing information on a certain part of normal operation of this product.

Bit	Bit weight	Bit name	Description
0	1	CAL	Calibration in progress
1	2	NOT USED	Not used
2	4	NOT USED	Not used
3	8	NOT USED	Not used
4	16	MEASuring	Indicates whether or not this product is measuring.
5	32	Waiting for TRIGger	Indicates whether or not this product is waiting for a trigger (TRIG).
6	64	NOT USED	Not used
7	128	NOT USED	Not used
8	256	OUTPut	AC power supply output ON
9	512	NOT USED	Not used
10	1024	TESTing	Test in progress
11	2048	NOT USED	Not used
12	4096	NOT USED	Not used
13	8192	NOT USED	Not used
14	16384	NOT USED	Not used
15	32768	NOT USED	Not used

STAT:OPER

Queries the event in the OPERation status register.

The query clears the register data.

Command `STATus:OPERation[:EVENt]?`

Response Returns the event in the OPERation status register in the <NR1> format.

STAT:OPER:COND

Queries the status of the OPERation status register.

The query does not clear the register data.

Command `STATus:OPERation:CONDition?`

Response Returns the status of the OPERation status register in the <NR1> format.

STAT:OPER:ENAB

This command enables the OPERation status register.

Command `STATus:OPERation:ENABle <NRf>`
`STATus:OPERation:ENABle?`

Parameter Value: 0 to 32767

Response Returns information that the OPERation status register has been enabled in the <NR1> format.

STAT:OPER:PTR

Sets positive transition for the OPERation status register.

Command `STATus:OPERation:PTRansition <NRf>`
`STATus:OPERation:PTRansition?`

Parameter Value: 0 to 32767

Response Returns information that positive transition has been set for the OPERation status register in the <NR1> format.

STAT:OPER:NTR

Sets negative transition for the OPERation status register.

Command `STATus:OPERation:NTRansition <NRf>`
`STATus:OPERation:NTRansition?`

Parameter Value: 0 to 32767

Response Returns information that negative transition has been set for the OPERation status register in the <NR1> format.

QUEStionable Status Register (STATus:QUEStionable)

The QUEStionable status register is a 16-bit register containing information on questionable events and status generated during operation of this product.

Some register bits indicate that there is a problem in the measurement data of this product.

Bit	Bit weight	Bit name	Description
0	1	Over-range on Vm	Voltage measurement exceeded the range.
1	2	Over-range on Cm	Current measurement exceeded the range.
2	4	NPOW	The total real power is negative.
3	8	CLAMP	The current sensor is not connected.
4	16	Over-Temp	Overheating is detected.
5	32	Not Used	Not used
6	64	Not Used	Not used
7	128	Not Used	Not used
8	256	Calibration failed	Calibration failure
9	512	PLL unlocked	PLL is unlocked.[*1]
10	1024	PCR-COMM	Communication with the AC power supply cannot be established.
11	2048	PCR-STAT	The AC power supply is not normal.
12	4096	SS	No steady state is found in the voltage fluctuation test.
13	8192	Not Used	Not used
14	16384	Not Used	Not used
15	32768	Not Used	Not used

[*1] Unstable during in-rush current measurement (other measurement).

STAT:QUES

Queries the event in the QUEStionable status register.

The query clears the register data.

Command `STATus:QUEStionable[:EVENt]?`

Response Returns the event in the QUEStionable status register in the <NR1> format.

STAT:QUES:COND

Queries the status of the QUEStionable status register.

The query does not clear the register data.

Command `STATus:QUEStionable:CONDition?`

Response Returns the status of the QUEStionable status register in the <NR1> format.

STAT:QUES:ENAB

Enables the QUEStionable status register.

Command

```
STATus:QUEStionable:ENABle <NRf>
STATus:QUEStionable:ENABle?
```

Parameter Value: 0 to 32767

Response Returns information that the QUEStionable status register has been enabled in the <NR1> format.

STAT:QUES:PTR

Sets positive transition for the QUEStionable status register.

Command

```
STATus:QUEStionable:PTRansition <NRf>
STATus:QUEStionable:PTRansition?
```

Parameter Value: 0 to 32767

Response Returns information that positive transition has been set for the QUEStionable status register in the <NR1> format.

STAT:QUES:NTR

Sets negative transition for the QUEStionable status register.

Command

```
STATus:QUEStionable:NTRansition <NRf>
STATus:QUEStionable:NTRansition?
```

Parameter Value: 0 to 32767

Response Returns information that negative transition has been set for the QUEStionable status register in the <NR1> format.

Preset Status

STAT:PRES

Restores the initial settings of ENABle/PTRansition/NTRansition filter registers of all status registers (including subregisters).

Initial settings:

STATus:ENABle = 0x0000
STATus:PTRansition = 0x7FFF
STATus:NTRansition = 0x0000

Command `STATus:PRESet`

Configures status data so that specific events are reported at a higher level by the status reporting mechanism. These events are summarized in the OPERation status register and QUEStionable status register of required structures.

STAT:PRES affects only the ENABle register and the transition filter registers of the status data structure.

STAT:PRES does not clear data from the event register and error/event queue.

Use *CLS to clear data from every event register and the queues in the device status reporting mechanism.

For status data required for SCPI, STAT:PRES sets the transition filter register so that only positive transition is recognized and clears the ENABle register to all 0. This command does not affect the settings of the service request enable register, parallel polling enable register, memory registers related to the *SAV command, address of this product, output queue and power-on status clear flag.

Preset values of the registers that can be set by the user

Register	Filter/Enable	Preset value
QUEStionable OPERation	Enable register	All 0
	Positive transition filter	All 1
	Negative transition filter	All 0

Default Conditions

See p. 376

When *RST or MEAS? is sent or the power is turned on, parameters are set as shown in table below.

Command	Parameter value			Unit	Function
	*RST	MEAS?[1]	Power-on		
INP:LINK	1(ON) Same	–	Setting immediately before the POWER switch is turned off	–	Sets the input circuit of each input phase (channel) to the same value or sets it independently.
INP:WIR:METH	“3P4W”	–		–	Wiring method
INP:PLL:SOUR	VL1	–		–	PLL input phase
INP:COUP	DC	DC		A	Input coupling
INP:FILT:FREQ	6000	6000		Hz	Cutoff frequency of anti-aliasing filter
INP:CURR:TERM	SHUNt (all channels)	–		–	Current input terminal (phases linked)
INP:CURR:TERM:IND	SHUNt	–		–	Current input terminal (phases independent)
FUNC	“HARM”	–		–	Operation mode
CURR:RANG CURR:RANG:IND	Selected value for the auto range	Selected value for the auto range		A	Current range (phases linked or independent)
CURR:RANG:AUTO CURR:RANG:AUTO:IND	1(ON)	1(ON)		–	Enable or disable Auto Range of current range
VOLT:RANG VOLT:RANG:IND	Selected value for the auto range	Selected value for the auto range		V	Voltage range (phases linked, phases independent)
VOLT:RANG:AUTO VOLT:RANG:AUTO:IND	1(ON)	1(ON)		–	Enables/Disables the auto range for the voltage range
CURR:SCAL	0(OFF)	–		–	Enable/disable current scaling
CURR:SCAL:CF	4.00	–		–	Current CF
CURR:SCAL:CTR	1.000	–		–	CT Ratio
CURR:SCAL:ESCR	25.000	–		–	EXT-CS
CURR:SCAL:PADJ	0.00	–		–	Phase adjustment value for the external current sensor
VOLT:SCAL	0(OFF)	–		–	Enable/disable voltage scaling
VOLT:SCAL:CF	2.00	–		–	Voltage CF
VOLT:SCAL:PTR	1.000	–		–	PT Ratio
HARM:STAN:LIM:NAME	“IEC 61000-3-2Ed5.0”	No change		–	Harmonic current limit value standard
HARM:STAN:MTEC:NAME	“IEC 61000-4-7Ed2.0A1”	No change		–	Harmonic current measuring technique standard
HARM:STAN:LIM:ALI	0(OFF)	–		–	Specifies the naming of Standard
HARM:STAN:LIM:ALI:NAME	Standard name	–		–	Limitation standard name
HARM:STAN:MTEC:ALI:NAME	Standard name	–		–	Measuring technique name
HARM:NOM:FREQ	50	–		Hz	Nominal frequency
HARM:NOM:VOLT	230	–		V	Nominal voltage
HARM:MARG	100	–		%	Margin
HARM:MTIM	150	–		s	Measurement time

Command	Parameter value			Unit	Function
	*RST	MEAS?[*1]	Power-on		
HARM:TEXT:TOBS	QSTationary	–	Setting immediately before the POWER switch is turned off	–	Operation type of the EUT
HARM:LIN:STAT	0(OFF)	–		–	Setting the reference impedance
HARM:IEC32:CLAS	"A"	–		–	Class of EUT
HARM:IEC32:CONS600	0(OFF)	–		–	Air conditioner exceeding real power 600 W
HARM:IEC32:LVT	NORMal	–		–	Applied limit value
HARM:IEC32:MTIM	150	–		s	Measurement time
HARM:IEC32:POW:DEF	MEASured	–		–	Power value definition
HARM:IEC32:POW	100	–		W	Specified power value
HARM:IEC32:FUMD:DEF	MEASured	–		–	Fundamental current value and power factor definition
HARM:IEC32:FUND:CURR	20	–		A	Specified value of fundamental current
HARM:IEC32:FUNDPFAC	1	–		–	Specified value of power factor
HARM:IEC312:ETYP	BALanced	–		–	Equipment type
HARM:IEC312:FUMD:DEF	MEASured	–		–	Definition of reference fundamental current value
HARM:IEC312:FUND:CURR	20	–		A	Specified value of reference fundamental current
HARM:IEC312:JUDG:RSCE	33	–		–	Judgment Rsce
HARM:IEC312:LVT	UNBalanced	–		–	Applied limit value
HARM:IEC312:NOM:SVOL	230	–		–	Nominal system voltage
HARM:IEC312:RAT:DEF	MEASured	–		–	Definition of the rated current of the EUT
HARM:IEC312:RAT:CURR	20	–		–	Rated current of the EUT
HARM:IEC312:RAT:VOL	230	–		–	Rated voltage of the EUT
VFL:STAN:LIM:NAME	"IEC 61000-3-3 (Pst AUTO)"	–		–	Voltage fluctuation limit value standard
VFL:STAN:MTEC:NAME	"IEC 61000-4-15Ed2.0"	–		–	Voltage fluctuation measuring technique standard
VFL:STAN:LIM:ALI	0(OFF)	–		–	Specifies the naming of Standard
VFL:STAN:LIM:ALI:NAME	Standard name	–		–	Limitation standard name
VFL:STAN:MTEC:ALI:NAME	Standard name	–		–	Measuring technique name
VFL:NOM:FREQ	50	–		Hz	Nominal frequency
VFL:NOM:VOLT	230	–		V	Nominal voltage
VFL:IEC33:MARG:D VFL:IEC311:MARG:D	100	–		%	d margin
VFL:IEC33:DMAX	6	–		–	dmax limit value
VFL:IEC33:DCO	24	–		–	d measurement count
VFL:IEC33:DTIM	60	–		s	d measurement time
VFL:IEC33:MARG:FLIC VFL:IEC311:MARG:FLIC	100	–		%	Flicker margin
VFL:IEC33:PSTC	12	–		–	Pst measurement count
VFL:IEC33:PSTT	600	–		s	Pst measurement time
VFL:IEC33:JFAC:DC	1(ON)	–		–	Whether to use for judgment
VFL:IEC33:JFAC:DMAX	1(ON)	–			
VFL:IEC33:JFAC:DT33	1(ON)	–			
VFL:IEC33:JFAC:PLT	1(ON)	–			
VFL:IEC33:JFAC:PST	1(ON)	–			

Command	Parameter value			Unit	Function
	*RST	MEAS?[*1]	Power-on		
VFL:IEC311:DMAX	6	–	Setting immediately before the POWER switch is turned off	–	dmax limit value
VFL:IEC311:PSTC	12	–		–	Pst measurement count
VFL:IEC311:PSTT	600	–		s	Pst measurement time
VFL:IEC311:JFAC:DC	1(ON)	–		–	Whether to use for judgment
VFL:IEC311:JFAC:DMAX	1(ON)	–			
VFL:IEC311:JFAC:DT33	1(ON)	–			
VFL:IEC311:JFAC:PLT	1(ON)	–			
VFL:IEC311:JFAC:PST	1(ON)	–			
VFL:IEC311:TIMP:DEF	SPECified3	–		–	Impedance definition
VFL:IEC311:TIMP	024,0.15, 0.16,0.10			–	Specified value of impedance
INIT:CONT INIT:CONT:NAME	0(OFF)	–	0(OFF)	–	Sequence operation automatic continuation mode
TRIG:SOUR TRIG:ACQ:SOUR	IMM	IMM	IMM	–	Trigger source IMM: immediately
TRIG:SEQ2:SOUR TRIG:RUSH:SOUR	INTernal	INTernal	INTernal	–	In-rush current measurement trigger
TRIG:SEQ2:LEV TRIG:RUSH:LEV	0.1	No change	No change	A	In-rush current measurement trigger level
TRIG:SEQ2:DEL TRIG:RUSH:DEL	0	No change	No change	S	In-rush current measurement trigger delay
TRIG:SEQ2:CHAN TRIG:RUSH:CHAN	1	No change	No change	–	In-rush current measurement trigger input phase
TRIG:SEQ3 TRIG:TEST	IMM	IMM	IMM	–	Software trigger
TRIG:SEQ3:SOUR TRIG:TEST:SOUR	IMM	IMM	IMM	–	d measurement and manual switching trigger

[*1] MEAS:<meas_item>?

14

Maintenance

This chapter explains how to clean and inspect this product.

Cleaning and Checking

Periodic cleaning and checking are required for maintaining the initial performance of this product for a long period.

⚠WARNING

- **There is a risk of death or injury caused by an electric shock. Be sure to turn off the POWER switch and unplug the power cord.**

Cleaning the panel surface

If the panel surface is dirty, wipe it lightly with a soft cloth dampened with neutral detergent diluted with water.

⚠CAUTION

- Do not use volatile matters such as thinner or benzene. Using these materials may cause surface discoloration, deletion of printed characters, or whitening of the display.

Checking the power cord

Check the power cord for covering breakage, plug damage and backlash.

Replacing the Backup Battery

This product contains an internal battery. Although the service life of the battery varies depending on the operating environment, the reference service life is two years after purchase. For battery replacement, contact your Kikusui agent or distributor.

This product comes with an installed CR Coin Lithium Battery which contains Perchlorate Material. Disposal of this battery may be regulated due to environmental considerations.

See www.dtsc.ca.gov/hazardouswaste/perchlorate

Replacing a Fuse

⚠WARNING

- **To prevent an electric shock, unplug the power cord of this product before replacing a fuse.**
- **Use a fuse with the suitable shape, rating, and characteristics for this product.**
- **Using a fuse with an invalid rating or a short-circuited fuse holder is dangerous. Never do it.**

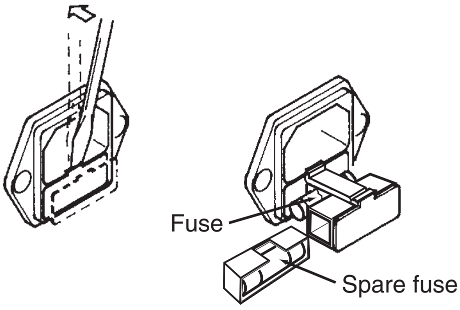
---

1 **Turn off the POWER switch and unplug the power cord.**

2 **Disconnect the power cord from the power connector on the rear panel.**

3 **Remove the fuse holder with a standard screwdriver.**

Fuse rating: 250 Vac, 2.5 A (T)



Calibration

This product is shipped after adequate calibration. Periodic calibration is recommended to maintain the initial performance. For calibration, contact your Kikusui agent or distributor.

15

Specifications

This chapter explains the specifications of this product.

The specifications are based on the following settings and conditions unless otherwise specified:

- The warm-up time is 60 minutes.
- TYP value: Typical value, which does not guarantee performance.
- rdng: Indicates a value that is read.
- set: Indicates a value that is set.
- range: Indicates a range.

Common Specifications of Input Section

Item		Specifications
Maximum input voltage	Continous	600 Vrms/900 Vpeak (CAT I), 400 Vrms (CAT II)
	Expected transient overvoltage	2500 V (CAT I), 4000 V (CAT II)
Maximum input current	Continous	40 Arms/100 Apeak, whichever is smaller
	Within 20 ms	160 Apeak
Voltage input impedance		4.7 MΩ ± 10 %
Instrument loss (between SOURCE and LOAD)[*1]	L1, L2, L3	3.6 mΩ or less
	N	0.4 mΩ or less
Coupling mode	HA/Vf mode	DC coupling
	OTHER mode	DC or AC coupling (optional)
Number of input channels		Three channels (L1, L2 and L3) for both voltage input and current input
Voltage input terminal		Direct input (resistance attenuating type)
Current input terminal		Direct input (internal shunt), BNC terminal (voltage input), dedicated clamp terminal (voltage input)
Auto range function		Independent setting of voltage and current ranges
Linkage switching of voltage and current ranges		Switching between linked and independent for each phase (L1, L2 and L3)
Voltage measurement input switching	Single-phase two-wire	Phase voltage measurement (L1-N, L2-N and L3-N)
	Single-phase three-wire	
	Three-phase three-wire	
	Three-phase four-wire	Line voltage measurement (L1-L2, L2-L3 and L3-L1)
PLL source	Selected source	L1, L2 and L3 (voltage input and current input), external input
	Lock frequency range	45 Hz to 66 Hz

[*1] At 10 Aac, 60 Hz.

Measurement and Display Items

Item		Specifications
Voltage		Real effective value and peak value (+ peak and - peak)
Current		Real effective value and peak value (+ peak and - peak)
Σ display	Voltage Σ Vrms	Single-phase three-wire: (L1 Vrms +L2 Vrms)/2 Three-phase three-wire,Three-phase four-wire: (L1 Vrms +L2 Vrms +L3 Vrms) /3
	Current Σ Arms	Single-phase three-wire: (L1 A rms +L2 Arms)/2 Three-phase three-wire,Three-phase four-wire: (L1 Arms +L2 Arms +L3 Arms) /3
	Apparent power Σ VA	Single-phase three-wire: L1 VA +L2 VA Three-phase three-wire: (L1 VA +L2 VA +L3 VA) × ($\sqrt{3}$/3) Three-phase four-wire: (L1 VA +L2 VA +L3 VA)/3
	Real power Σ W	Single-phase three-wire: L1 W +L2 W Three-phase three-wire: L1 W +L3 W Three-phase four-wire: L1 W +L2 W +L3 W
	Reactive power Σ var	Single-phase three-wire: L1 var +L2 var Three-phase three-wire: L1 var +L3 var Three-phase four-wire: L1 var +L2 var +L3 var
THD (total harmonic distortion)		Effective value ratio of all the harmonic components from the 2nd to the 40th order against the effective value of the fundamental components current
THDI (total harmonic distortion)		Effective value ratio of all the harmonic components from the 2nd to the 40th order against the effective value of the current
PWHD (partial-weighted harmonic distortion)		Effective value ratio of all the harmonic components from the 14th to 40th order, which are weighted according to the order, against the effective value of the fundamental components

Voltage Measurement Function

Item		Specifications
Range		150 V/300 V/600 V
Allowable crest factor	150 V and 300 V range	2
	600 V range	2[*1]
Display item		TrueRMS and ± peak
Accuracy[*2]		± (0.4 % of rdng+0.04 % of range)
Resolution (RMS/Peak)	150 V range	0.01 V/0.01 V
	300 V range	0.01 V/0.02 V
	600 V range	0.01 V/0.04 V
Display range (RMS/Peak)	150 V range	120 % of the range/213 % of the range
	300 V range	120 % of the range/213 % of the range
	600 V range	105 % of the range/151 % of the range
Effective input range		60 % to 110 % of the range
Excess input display		“Over” is displayed when the ± peak value or RMS value exceeds the display range.
Fundamental frequency range		45 Hz to 65 Hz

[*1] Up to ± 900 Vpeak

[*2] Accuracy is not specified for ± Peak. PLL is in the Lock state, in the effective input range, and with anti-aliasing filter cutoff frequency 6 kHz. Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation). When scaling is used, the voltage range shown on the display is the "range" value.

Current Measurement Function

Item			Specifications
Range			0.5 A/1 A/2 A/5 A/10 A/20 A/ 40 A
Allowable crest factor	0.5 A to 20 A range		4
	40 A range		2.5 and 4 (up to 20 ms)
Display item			TrueRMS and ± peak
Accuracy[1]	45 Hz to 65 Hz	0.5 A range	± (0.5 % of rdng+0.2 % of range)
		1 A to 40 A range	± (0.5 % of rdng+0.1 % of range)
	66 Hz to 2.4 kHz	0.5 A range	± ((0.5+0.417 × n kHz)% of rdng+0.2 % of range) : n is frequency.
		1 A to 40 A range	± ((0.5+0.417 × n kHz)% of rdng+0.1 % of range) : n is frequency.
	2.4 kHz to 9 kHz		Accuracy not specified.
Resolution (RMS/Peak)	0.5 A range		0.0001 A/0.0001 A
	1 A range		0.0001 A/0.0002 A
	2 A range		0.0001 A/0.0004 A
	5 A range		0.0001 A/0.001 A
	10 A range		0.001 A/0.002 A
	20 A range		0.001 A/0.004 A
	40 A range		0.001 A/0.008 A
Display range (RMS/Peak)	0.5 A to 10 A range		120 % of the range/400 % of the range
Effective input range	0.5 A range		50 % to 110 % of the range
	1 A to 40 A range		20 % to 110 % of the range
Excess input display			"Over" is displayed when the ± peak value or RMS value exceeds the display range.

[1] Accuracy is not specified for ± Peak. PLL is in the Lock state, in the effective input range, and with anti-aliasing filter cutoff frequency 6 kHz. Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation). When scaling is used, the voltage range shown on the display is the "range" value.

External Current Input Terminal (EXT INPUT)

Item		Specifications
Input method		Voltage input (BNC terminal)
Input impedance		1 MΩ ± 10 %
Maximum input voltage		± 5 Vpeak
Display current/input voltage ratio		± 20 Apeak/1 Vpp (40 Arms/1 Vrms)
Display current/ input voltage ratio (for each range)[1]	0.5 A range	± 2.0000 Apeak/0.1000 Vpp
	1 A range	± 4.0000 Apeak/0.2000 Vpp
	2 A range	± 8.0000 Apeak/0.4000 Vpp
	5 A range	± 7.0710 Apeak/0.3535 Vpp (± 20.0000 Apeak/1.0000 Vpp or equivalent)
	10 A range	± 40.0000 Apeak/2.000 Vpp
	20 A range	± 80.0000 Apeak/4.000 Vpp
	40 A range	± 160.0000 Apeak/8.000 Vpp
Measurement accuracy[2]		± (| Current measurement accuracy | + External shunt accuracy + 0.5 % of range)

[1] Accuracy is not specified for ± Peak. PLL is in the Lock state, in the effective input range, and with anti-aliasing filter cutoff frequency 6 kHz.

[2] Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation).

Power Measurement Function

Item		Specifications
Display item	Effective power(W)	---
	Apparent power (VA)[1]	VA=V × A
	Reactive power (var)[1]	var= $\sqrt{(VA)^2-W^2}$
	Power factor (PF)[1]	PF=W/(VA)
Accuracy of effective power[2]	P ≥ 150 W	± 1 % of range[3]
	P < 150 W	± 1.5 W

[1] Calculated from voltage, current and active power. Accuracy follows that of voltage, current or real power.

[2] Frequency: 45 Hz to 65 Hz, voltage and current: sine wave, in the effective input range, power factor 1.00 active power, specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation).

[3] range : Voltage range × Current range. When scaling is used, the voltage range shown on the display is the "range" value.

Frequency Measurement Function

Item	Specifications
Measurement input	The voltage frequencies of L1, L2 and L3 are measured independently.
Measurement range[1]	45 Hz to 65 Hz
Resolution	0.001 Hz
Accuracy[1]	± (0.15 % of rdng +2 digits)

[1] Applicable only in PLL locked state. Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation).

Phase Measurement Function

Item		Specifications
Measurement item	Voltage and current phase	Measurement of phase difference between fundamental voltage and fundamental current
	Line voltage phase	Measurement of phase difference between line voltages of the fundamental
	Harmonic phase	Measurement of phase angles of harmonic current from the 1st to 40th order against the fundamental of voltage
View range		0.00° to 359.99°
Resolution		0.01°
Accuracy[1] (TYP value)	Voltage and current phase	0° ± 3.5° when the power whose power factor is 0.9990 to 1.0000 is measured
	Line voltage phase	0° ± 0.4° when the same voltage is applied to L1, L2 and L3

[1] Frequency: 45 Hz to 65 Hz, sine wave. Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation).

Harmonic Current Measurement Function

Item			Specifications
Conforming standard			IEC 61000-3-2 Ed5.0, IEC 61000-3-2 Ed3.0, IEC 61000-3-2Ed2.2, JIS C61000-3-2(2011), JIS C61000-3-2(2005) IEC 61000-3-12 Ed2.0, IEC 61000-3-12 Ed1.0
Requirements for measuring instrument[1]			IEC 61000-4-7 Ed2.1(2009), IEC 61000-4-7 Ed2.0(2002), IEC 61000-4-7 Ed1.0(1991)
Harmonic analysis order	HA mode		40th order
	OTHER mode		180th order[2]
Accuracy[3]	45 Hz to 65 Hz	0.5 A range	± (0.5 % of rdng+0.2 % of range)
		1 A to 40 A range	± (0.5 % of rdng+0.1 % of range)
	66 Hz to 2.4 kHz	0.5 A range	± ((0.5+0.417 × n kHz)% of rdng+0.2 % of range) : n is frequency.
		1 A to 40 A range	± ((0.5+0.417 × n kHz)% of rdng+0.1 % of range) : n is frequency.
	2.4 kHz to 9 kHz		Accuracy not specified.
Resolution	0.5 A to 40 A range		Same as current measurement function
Interharmonics processing			Processing ON (2nd order and more): IEC 61000-4-7 Ed2.1(2009) Processing ON: IEC 61000-4-7 Ed2.0(2002) Processing OFF: IEC 61000-4-7 Ed1.0(1991)
Window function			Rectangular
Window width	10-wave (50 Hz)		IEC 61000-4-7 Ed2.1(2009), IEC 61000-4-7 Ed2.0(2002)
	12-wave (60 Hz)		
	16-wave (50 Hz/60 Hz)		IEC 61000-4-7 Ed1.0(1991)
Number of sampling points			Fixed to 16384
Sampling rate[4]			Up to 106.5 ksps
FFT processing word length			32 bit
Anti-aliasing filter	HA mode		Cutoff frequency = 6 kHz 4th Butterworth type
	OTHER mode		Cutoff frequency = 15 kHz 4th Butterworth type
	Stop Band Attenuation		The attenuation defined at the fundamental frequency of 50 Hz/60 Hz, against for the aliasing in the range from the fundamental to the 40th harmonic is more than -50 dB.
1.5 second filter			Time constant 1.5 second digital low pass filter processing for the effective values of voltage and current, real power and harmonic current

*1. Applicable when the current range is 1 A to 40 A and fundamental current input is within the effective input range. The current that satisfies IEC 61000-4-7 Ed2.0 or IEC 61000-4-7 Ed2.1 is 37.5 Arms or less (single-phase) or 40 Arms/phase or less (three-phase).

*2. When the FFT analyzer function is used.

*3. The minimum harmonic current value is 3 % or higher of the current range and fundamental current input is within the effective input range. Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation). When scaling is used, the voltage range shown on the display is the "range" value.

*4. Varies in synchronization with the AC power frequency.

Harmonic Voltage Measurement Function (Measurement Power Supply Quality Check Function)

Item		Specifications
Measurement item		Voltage, frequency, voltage harmonic content
Voltage harmonic analysis order		40th order
Voltage harmonic measurement accuracy[*1] (TYP value)	150 V range	± ((0.4+0.417 × n kHz)% of rdng+0.04 % of range+1digit) : n is frequency.
	300 V and 600 V range	± ((0.4+0.417 × n kHz)% of rdng+0.04 % of range+2digits) : n is frequency.

*1. Fundamental frequency: 45 Hz to 65 Hz; PLL is locked in the effective input range. Specified for the ambient temperature of 18 °C to 28 °C and relative humidity of 20 % to 80 % (without condensation). When scaling is used, the voltage range shown on the display is the "range" value.

Flicker/voltage Fluctuation Analysis Function

Item		Specifications
Conforming standard		IEC 61000-3-3 Ed3.1(2017), IEC 61000-3-3 Ed2.0(2008) IEC 61000-3-11 Ed2.0(2007)
Requirements for measuring instrument[*1]		IEC 61000-4-15 Ed2.0(2010), IEC 61000-4-15 Ed1.1(2003)
Flicker	Pst accuracy[*2]	1 ± 0.05
	Pst measurement time	30 to 900 seconds
	Plt measurement count	1 to 12
Voltage fluctuation	Steady voltage recognition condition	Steady state recognized when fluctuation width ± 0.1 % or less for 1 second or more
	Measurement time/ count	Conforming to the Pst measurement time and Plt measurement count
	Measurement method[*3]	Together with Pst or independent mode can be selected
dmax measurement of manual switching equipment	Measurement count	3 to 24 times
	Time of one measurement session	30 to 180 seconds

*1. Acceptable if it is within the specified range.
*2. At input of IEC 61000-4-15 Table 1 signal.
*3. d measurement in independent mode applies only to dmax measurement of manual switching equipment.

General-purpose Measurement Function (OTHER Mode)

Item	Specifications
Basic measurement function	Monitoring of voltage and current waveforms. Voltage and current values can be read with the cursor[*1] . Anti-alias filter, AC/DC coupling can be switched.
FFT analyzer function	Up to the 180th order of harmonic current can be displayed in bar graphs. The current value of each harmonic order can be read with the cursor[*1].
In-rush current measurement function	In-rush current in up to 160 A is measured and the peak current waveforms are displayed. Peak values can be read with the cursor[*1].

*1. The accuracy of values read with the cursor is not specified.

Scaling Function

Item		Specifications
PT ratio (transformer)	Setting range	0.001 to 100.000
	Resolution	0.001
Peak to rms voltage ratio (CF)	Setting range	1.00 to 2.00
	Resolution	0.01
CT Ratio[*1] (current transformer)	Setting range	0.001 to 1000.000
	Resolution	0.001
Peak to rms current ratio (CF)	Setting range	1.00 to 4.00
	Resolution	0.01
External current sensor conversion ratio[*2]	Setting range	0.250 mV/A to 2500.000 mV/A
	Resolution	0.001 mV/A
V/I phase difference adjustment	Setting range	-180.00° to +180.00°
	Resolution	0.2°

*1. When internal shunts are used.
*2. When external current sensors are used.

Communication Interface

Item	Specifications
GPIB	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1
RS232C	9600 bps, 19200 bps
USB	USB Specification 2.0 (Full Speed)

Removal Data Storage

Item	Specifications
Support media	CompactFlash card (CF card), maximum capacity of 512 MB
	USB flash drive, maximum capacity of 16 GB

External Equipment Control Function

Item		Specifications
AC power supply control	Setup item	Voltage, frequency, range, ON phase, OUTPUT on/off
	RS232C communication speed	9600 bps

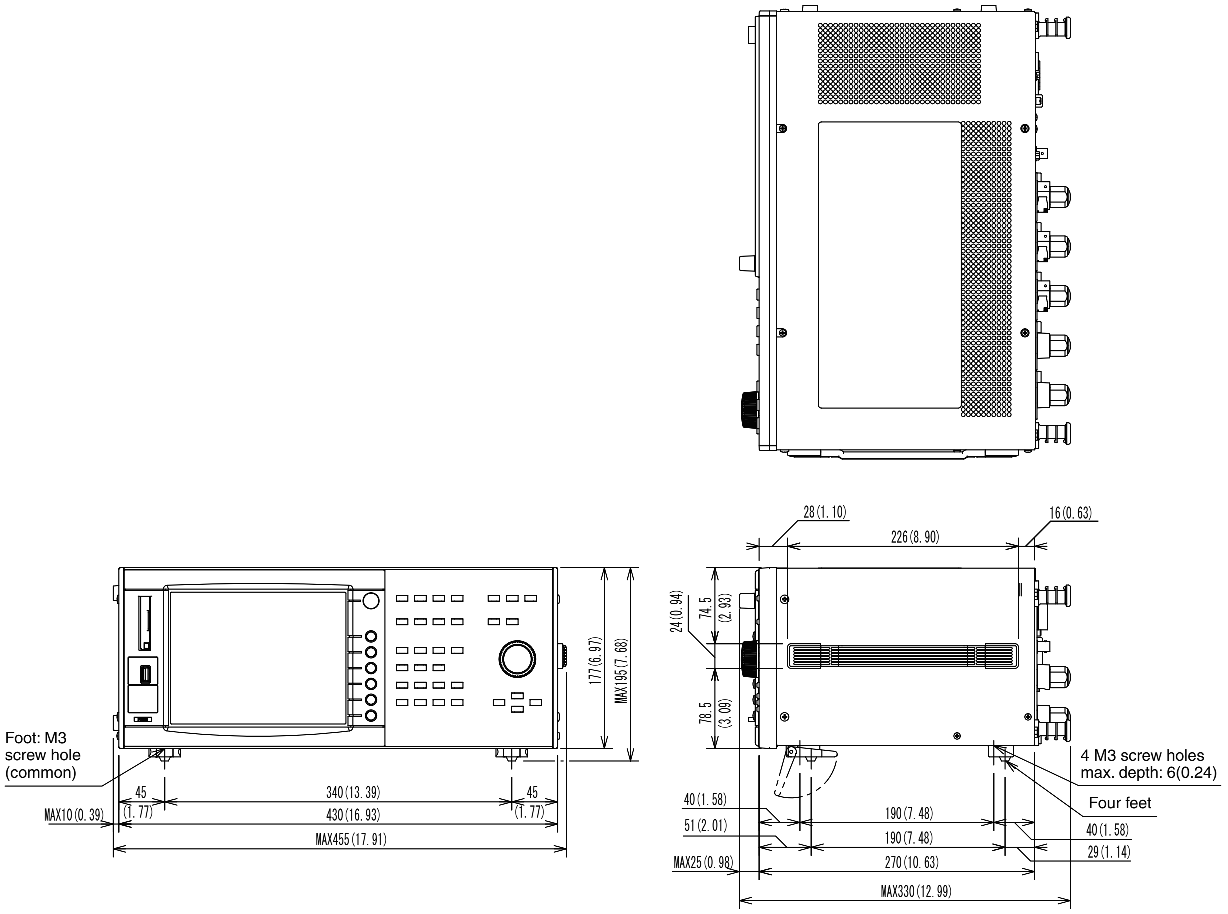
General Specifications

Item		Specifications
AC input	Nominal input rating	100 V to 240 V, 50 Hz to 60 Hz
	Voltage range	90 V to 250 V
	Maximum power consumption	250 VA
Withstanding voltage	AC input ⇔ chassis	No abnormality should occur at 1500 Vac for one minute.
	Test terminal ⇔ chassis	No abnormality should occur at 3550 Vac for one minute.
	Test terminal ⇔ Test terminal	
Insulation resistance	AC input ⇔ chassis	500 Vdc, 100 MΩ or higher
	Test terminal ⇔ chassis	
Earth continuity	Power code connector, grounding pin ⇔ chassis	25 Aac/0.1 Ω or less
Environment	Installation location	Indoor, up to 2000 m, overvoltage category II
Temperature and humidity ranges	Operating temperature	0 °C to +40 °C (+32 °F to +104 °F)
	Operating humidity	20 %rh to 80 %rh (no condensation)
	Storage temperature	-20 °C to +70 °C (-4 °F to +158 °F)
	Storage humidity	90 %rh or less (no condensation)
Safety		Conforming to the following standard requirements: IEC 61010-1:2001 (Class I[*1] , Pollution degree 2[*2])
Outside dimensions		Refer to “Outside Dimensions”
Weight		Approx. 10 kg (22.05 lb)
Accessories	Power cord	1
	Voltage sensing terminal plug	3 (product shipped with this plug installed)
	Voltage sensing terminal short-circuit wire kit	3 (two wires: product shipped with these wires attached to the voltage sensing terminal)
	Voltage sensing terminal plug screwdriver	1
	Spare fuse	1 (250 V, 2.5 A(T), in the power supply fuse holder)
	Operation manual	1 (this manual)

*1. This is a Class I equipment. Be sure to ground this product’s protective conductor terminal. The safety of this product is only guaranteed when the product is properly grounded.

*2. Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.

Outside Dimensions



Unit: mm (inch)

Appendix

A Basic Terms and Definitions

This appendix explains the main terms concerning harmonics, flicker and voltage fluctuations used in this manual. For details of each term, refer to the corresponding standards.

Basic terms related to the harmonic test

THC	Total harmonic current: the sum of effective values of harmonic current components from the 2nd to 40th order
POHC	Partial odd-order harmonic current: the sum of effective values of partial odd-order harmonic current components from the 21st to 39th order
THD	Total harmonic distortion: effective value ratio of harmonic components from the 2nd to 40th order to the effective value of the fundamental components
PWHD	Partial-weighted harmonic distortion: effective value ratio of harmonic components from the 14th to 40th order to the effective value of the fundamental components
Reference current	The average rms current during the test period.
Reference fundamental current	Effective values of fundamental components of rated line current of equipment
Ssc	Short-circuit power (three-phase short-circuit power) determined by nominal line voltage and system impedance (value of power supply frequency) at common connection point
Rsce	Short-circuit ratio: Ratio of rated apparent power of equipment to short-circuit power Single-phase equipment: Rsce = Ssc / (3 × Rated apparent power of single-phase equipment) Line equipment: Rsce = Ssc / (2 × Rated apparent power of line equipment) Three-phase equipment: Rsce = Ssc / (1 × Rated apparent power of all three-phase equipment)
Observation period (Tobs)	Observation period of the test: The operation type of the EUT determines the necessary observation period. The operation types refer to the types of changes in harmonic current and include the following four types: quasi-stationary, short cyclic, random and long cyclic.
Hybrid equipment	Equipment using composite load. A balanced three-phase load is combined with one or more loads of other circuits. A load of another circuit means a load between a phase and a neutral line or a load between lines.

Basic terms related to the voltage fluctuation and flicker tests

Pst Auto	Performs d measurement (dmax, Tmax (d(t)>3.3%) and dc) and Pst and Plt (flicker) measurement simultaneously. The results of d measurement are displayed in the form of the maximum value at each Pst measurement segment time.
Manual	Executes measurement with a method that conforms to “Test conditions and procedures for measuring voltage changes caused by manual switching.” This product makes judgment based on the arithmetic average of 22 measured values obtained by excluding the maximum and minimum values of 24 collected measurements.
Pst	Short-time flicker value of one segment (Seg1 and subsequent segment) time
Plt	Long-time flicker value in all segment (Seg1 and subsequent segments) times (set with the Pst measurement count)
dc, dc maximum value	Maximum value of relative steady voltage changes in one segment (Seg1 and subsequent segment) time
dmax, dmax maximum value	Maximum value of maximum relative voltage changes in one segment (Seg1 and subsequent segment) time
Tmax (d(t)>3.3%), Tmax (d(t)>3.3%) maximum value	Maximum value of time during which d(t) exceeds 3.3 % in one segment (Seg1 and subsequent segment) time
Zsys1-3[ohm]	Permissible system impedance value calculated after converting the measured values of dmax, dc and Plt with a set impedance

Zsys4[ohm]	Permissible system impedance value calculated after converting the measured value of Plt with a set impedance
Zmax	Calculated value of the maximum permissible system impedance. Calculated minimum values of Zsys1, Zsys2, Zsys3 and Zsys4. Maximum permissible system impedance of a power supply to which equipment is connected (power receiving point). Value to be declared as the condition for connection.

Basic terms related to the general measurement

Voltage Σ Vrms	Single-phase three-wire: (L1 Vrms +L2 Vrms) /2 Three-phase three-wire, Three-phase four-wire: (L1 Vrms +L2 Vrms +L3 Vrms) /3
Current Σ Arms	Single-phase three-wire: (L1 A rms +L2 Arms) /2 Three-phase three-wire, Three-phase four-wire: (L1 Arms +L2 Arms +L3 Arms) /3
Apparent power Σ VA	Single-phase three-wire: L1 VA +L2 VA Three-phase three-wire: (L1 VA +L2 VA +L3 VA) × ($\sqrt{3}$ /3) Three-phase four-wire: (L1 VA +L2 VA +L3 VA) /3
Real power Σ W	Single-phase three-wire: L1 W +L2 W Three-phase three-wire: L1 W +L3 W Three-phase four-wire: L1 W +L2 W +L3 W
Reactive power Σ var	Single-phase three-wire: L1 var +L2 var Three-phase three-wire: L1 var +L3 var Three-phase four-wire: L1 var +L2 var +L3 var

L1, L2 and L3 represent the values of the L1 phase, L2 phase and L3 phase.

Scaling	When any external current sensor or external PT (potential transformer) is used to input current or voltage signals, the associated conversion factor or ratio is set for the signal to determine the current or voltage range of this product and this operation is called scaling.
Current scaling	Applying scaling to the current signal of an external current sensor.
Voltage scaling	Applying scaling to match the voltage ratio of an external PT (potential transformer).
CT Ratio	The scaling factor of CT (current transformer)
PT Ratio	The scaling factor of PT (potential transformer)

B Messages

SCPI command: Short-form command name

Influence: Commands influenced by *RST are marked with O.

R/W: Query command (R)/Set command (W)

Note: A standard SCPI command is 1, a command under examination is 2, and a KIKUSUI original command is 3.

SYSTem subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
SYST									
:BEEP									
:VOL	NR3	0 to 8	–	4	NR3	–	Buzzer volume	R/W	3
:CONF									
:LANG	char	ENG | JAP	–	–	char	–	Language (Japanese or English)	R/W	3
:PCR	bool	ON | OFF	–	OFF	NR1	–	Enables/Disables control of the AC power supply.	R/W	3
:TEXT:ENC	string	“Shift-JIS”	–	–	string	–	Character code encoding	R/W	3
:DATE	NR1	2000 to 2099	–	–	NR1	–	Sets the date (calendar year).	R/W	1
	NR1	1 to 12	–	–	NR1	–	Sets the date (month).		
	NR1	1 to 31	–	–	NR1	–	Sets the date (day).		
:TIME	NR1	0 to 23	–	–	NR1	–	Sets the time (hour).		
	NR1	0 to 59	–	–	NR1	–	Sets the time (minute).		
:ERR[:NEXT]	–	–	–	–	NR1, string	–	Queries error and event information.	R	1
:LOC	–	–	–	–	–	–	Sets the local state (RS232C and USB only).	W	2
:OPT	–	–	–	–	–	–	Queries options.	R	3
:REM	–	–	–	–	–	–	Sets the remote mode, in which the keys and switches other than LOCAL and STOP are locked (RS232C and USB only).	W	2
:RWL	–	–	–	–	–	–	Sets the remote mode, in which the keys and switches other than STOP are locked (RS232C and USB only).	W	2
:VERS	–	–	–	–	1999.0	–	Queries the SCPI specification version with which this product is compliant.	R	1

HARMonics subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
HARM									
:APOW									
:JIS:CONF	–	–	–	–	string	–	Queries the judgment result of AC power source check.		
:EXEC	–	–	–	–	NR1	–	Queries whether the result was recorded when checking the AC power source.		

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
HARM									
:STAN									
:LIM									
[:NAME]	string	“IEC 61000-3-2 Ed3.0” | “IEC 61000 3-2 Ed3.0A2” | “IEC 61000 3-2 Ed2.2” | “JIS 61000-3-2 2005” | “IEC 61000-3-12 2004” | “IEC 61000-3-2 Ed5.0”	–	“IEC 61000-3-2 Ed5.0”	string	○	Limit value standard	R/W	3
:CAT	string	–	–	–	string	–	Queries available limit value standards.	R	3
:ALI[:STAT]	bool	ON | OFF	–	OFF	NR1	○	Specifies the naming of Standard	R/W	3
:ALI:NAME	string	–	–	Standard name	string	–	Limitation standard name	R/W	3
:MTEC									
[:NAME]	string	“IEC 61000-4-7 Ed2.0” | “IEC 61000-4-7 Ed2.1” | “IEC 61000-4-7 Ed1.0”	–	“IEC 61000-4-7 Ed2.1”	string	○	Measuring technique standard	R/W	3
:CAT	string	–	–	–	string	–	Queries available measuring technique standards.	R	3
:ALI:NAME	string	–	–	Standard name	string	–	Limitation standard name	R/W	3
:NOM									
:FREQ	NRf	50 | 60	HZ	50	NR3	○	Nominal frequency	R/W	3
:VOL	NRf	100 to 300	V	230	NR3	○	Nominal voltage	R/W	3
:MARG	NRf	10 to 100	PCT	100	NR3	○	Margin for the limit value	R/W	3
:MTIM	numeric	1 to 9600	S	150	NR3	○	Measurement time	R/W	3
:TEXT									
:COMM	encoded-string	0 “Memo,” etc.	–	All items“ ”	string	○	Comment text	R/W	3
:TOBS	char	QST | SCYC | RAND | LCYC	–	QST	char	○	Operation type of EUT	R/W	3
:LIN									
:STAT	bool	ON | OFF	–	OFF	NR1	○	Sets the reference impedance.	R/W	3
:IEC32									
:CALS	string	“A” | “B” | “C” | “D”	–	“A”	string	○	EUT class	R/W	3
:FUND									
:DEF	char	MEAS | SPEC	–	MEAS	char	○	Fundamental current value and method of specifying the power factor for Class C	R/W	3
:CURR	numeric	0.0 to 20.0	A	20.0	NR3	○	Specified value of the fundamental current for Class C	R/W	3
:PFAC	numeric	0.00 to 1.00	–	1.00	NR3	○	Specified value of the power factor for Class C	R/W	3
:LVT	char	NORM | CLASSA | CLASSD | WJUD | THDL	–	NORM	char	○	Limit value to be applied for Class C	R/W	3
:POWER									
:DEF	char	MEAS | SPEC	–	MEAS	char	○	Type of power value for Class C	R/W	3
[:LEV]	numeric	0 to 4000	W	100	NR3	○	Specified value of power	R/W	3
:CONS600	bool	ON | OFF	–	OFF	NR1	○	Air conditioner exceeding 600 W	R/W	3

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
HARM									
:IEC312									
:ETYP	char	SING | W3P3 | BAL | UNB	–	BAL	char	○	Type of the EUT	R/W	3
:FUND									
:DEF	char	MEAS | SPEC	–	MEAS	char	○	Method of specifying the reference fundamental current	R/W	3
:CURR	numeric	0.0 to 20.0	A	20.0	NR3	○	Specified value of reference fundamental current	R/W	3
:JUDG:RSCE	NRf	33 to 350	–	33	NR1	○	Judgment Rsce	R/W	3
:LVT	char	UNB | BAL | SPEC	–	UNB	char	○	Limit value to be applied	R/W	3
:NOM:SVOL	NRf	100 to 600	V	400	NR3	○	Normal system voltage	R/W	3
:RAT									
:DEF	char	MEAS | SPEC	–	MEAS	char	○	Method of specifying the rated current	R/W	3
:CURR	NRf	0.1 to 40.0	A	20.0	NR3	○	Rated current of the EUT	R/W	3
:VOLT	NRf	100 to 600	V	230	NR3	○	Rated voltage of the EUT	R/W	3

VFLuctuation subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
VFL									
:STAN									
:LIM									
[:NAME]	string	“IEC 61000-3-3(Pst AUTO)” | “IEC 61000 3-3(ManualSW)” | “IEC 61000-3-11 Ed2.0”	–	“IEC 61000-3-3(Pst AUTO)”	string	○	Limit value standard	R/W	3
:CAT	string	–	–	–	string		Queries available limit value standards.	R	3
:ALI[:STAT]	bool	ON | OFF	–	OFF	NR1	○	Specifies the naming of Standard	R/W	3
:ALI:NAME	string	–	–	Standard name	string	–	Limitation standard name	R/W	3
:MTEC									
[:NAME]	string	“IEC 61000-4-15 Ed1.1” | “IEC 61000-4-15 Ed2.0”	–	“IEC 61000-4-15 Ed1.1”	string	○	Measuring technique standard	R/W	3
:CAT	string	–	–	–	string		Queries available measuring technique standards.	R	3
:ALI:NAME	string	–	–	Standard name	string	–	Limitation standard name	R/W	3
:NOM									
:FREQ	NRf	50 | 60	HZ	50	NR3	○	Nominal frequency	R/W	3
:VOL	NRf	100 to 600	V	230	NR3	○	Nominal voltage	R/W	3
:TEXT									
:COMM	encoded-string	0 “Memo,” etc.	–	All items“ ”	string	○	Comment text	R/W	3
:IEC33									
:DMAX	NRf	4 | 6 | 7	PCT	6	NR3	○	dmax limit value	R/W	3
:DCO	NRf	3 to 24	–	24	NR3	○	d measurement count	R/W	3
:DTIM	numeric	30 to 180	S	60	NR3	○	d measurement time	R/W	3
:PSTC	NRf	1 to 12	–	12	NR3	○	Pst measurement count	R/W	3
:PSTT	numeric	30 to 900	S	600	NR3	○	Pst measurement time	R/W	3

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
VFL									
:IEC33									
:JFAC									
:DC	bool	ON | OFF	–	OFF	NR1	○	Limit value dc to be used for judgment	R/W	3
:DMAX							Limit value dmax to be used for judgment	R/W	3
:DT33							Limit value Tmax (d(t)>3.3%) to be used for judgment	R/W	3
:PLT							Limit value Plt to be used for judgment	R/W	3
:PST							Limit value Pst to be used for judgment	R/W	3
:MARG:D	numeric	10 to 100	PCT	100	NR3	○	Margin for the limit values dc, dmax and Tmax (d(t)>3.3%)	R/W	3
:MARG:FLIC	numeric	10 to 100	PCT	100	NR3	○	Margin for the limit values Pst and Plt	R/W	3
:IEC311									
:DMAX	NRf	4 | 6 | 7	–	6	NR3	○	dmax limit value	R/W	3
:PSTC	NRf	1 to 12	–	12	NR3	○	Pst measurement count	R/W	3
:PSTT	numeric	30 to 900	S	600	NR3	○	Pst Measurement time	R/W	3
:JFAC									
:DC	bool	ON | OFF	–	OFF	NR1	○	Limit value dc to be used for judgment	R/W	3
:DMAX							Limit value dmax to be used for judgment	R/W	3
:DT33							Limit value d(t)>3.3% to be used for judgment	R/W	3
:PLT							Limit value Plt to be used for judgment	R/W	3
:PST							Limit value Pst to be used for judgment	R/W	3
:MARG:D	numeric	10 to 100	PCT	100	NR3	○	Margin for the limit values dc, dmax and d(t)>3.3%	R/W	3
:MARG:FLIC	numeric	10 to 100	PCT	100	NR3	○	Margin for the limit values Pst and Plt	R/W	3
:TIMP:DEF	char	STAND1| STAND3 | SPEC1 | SPEC3	–	BAL	char	○	Definition of test impedance value	R/W	3
:TIMP[:VAL]	numeric	0.001 to 9.999	OHM	0.24	NR3	○	Specified value RA of the test impedance	R/W	3
	numeric			0.15			Specified value XA of the test impedance	R/W	3
	numeric			0.16			Specified value RN of the test impedance	R/W	3
	numeric			0.10			Specified value XN of the test impedance	R/W	3

INPut subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
INP									
:COUP	char	AC | DC	–	DC	char	○	Input coupling	R/W	3
:FILT:FREQ	numeric	0, 6000, 15000	HZ	15000	NR3	○	Anti-aliasing filter	R/W	3
:LINK	bool	ON | OFF	–	ON	NR1	○	Sets the input circuit of each input phase (channel) to linked.	R/W	3
:CURR									
:TERM	char	SHU | CLAM | BNC	–	SHUN	char	○	Sets the input circuit of each current input phase (channel) to the same value (linked).	R/W	3
:PLL:SOUR	char	CL1 | CL2 | CL3 | VL1 | VL2 | VL3 | EXT	–	VL1	char	○	Sets the PLL source to synchronize with the frequency of the AC power supply.	R/W	3
:WIR:METH	string	“1P2W” | “1P3W” | “3P3W” | “3P4W”	–	“3P4W”	string	○	Wiring method	R/W	3

[SENSe] subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
[SENS:]									
FUNC[:ON]	string	HARM | VFL | OTH:BAS | OTH:FFT| OTH:RUSH	–	HARM	string	○	Operation mode	R/W	1
CURR									
:RANG	numeric	0.5, 1, 2, 5, 10, 20, 40	A	Selected value of the auto range	NR3	○	Sets the current range of each input phase (channel) to the same value (linked).	R/W	3
:IND	numeric	0.5, 1, 2, 5, 10, 20, 40	A	Selected value of the auto range	NR3	○	Sets the current range of each input phase (channel) independently.	R/W	3
:AUTO	bool	ON | OFF	–	ON	NR1	○	Decides whether to enable the auto range for the current ranges of all input phases (channel).	R/W	3
:AUTO:IND	bool	ON | OFF	–	ON	NR1	○	Decides whether to enable the auto range for the current range of each input phase (channel) independently.	R/W	3
:SCAL									
[:STAT]	bool	ON | OFF	–	OFF	NR1	○	Enable/disable current scaling	R/W	3
:CF	numeric	1.00 to 4.00	–	4.00	NR3	○	Current CF	R/W	3
:CTR	numeric	0.001 to 1000.000	–	1.00	NR3	○	CT Ratio	R/W	3
:ECSR	numeric	0.250 to 2500.000	–	25.000	NR3	○	EXT-CS	R/W	3
:PADJ	numeric	-180.00 to +180.00	DEG	1.00	NR3	○	Phase adjustment value for the external current sensor	R/W	3
:RANG	–	–	–	–	NR3	–	Queries the current range after the scaling is set	R	3
[SENS:]VOLT									
:RANG	numeric	150, 300, 600	V	Selected value of the auto range	NR3	○	Sets the voltage range of each input phase (channel) to the same value (linked).	W	3
:IND	numeric	150, 300, 600	V	Selected value of the auto range	NR3	○	Sets the voltage range of each input phase (channel) independently.	R/W	3
:AUTO	bool	ON | OFF	–	ON	NR1	○	Decides whether to enable the auto range for the voltage ranges of all input phases (channel).	R/W	3
:AUTO:IND	bool	ON | OFF	–	ON	NR1	○	Decides whether to enable the auto range for the voltage range of each input phase (channel) independently.	R/W	3
[:STAT]	bool	ON | OFF	–	OFF	NR1	○	Enable/disable voltage scaling	R/W	3
:CF	numeric	1.00 to 2.00	–	2.00	NR3	○	Voltage CF	R/W	3
:PTR	numeric	0.001 to 1000.000	–	1.00	NR3	○	PT Ratio	R/W	3
:RANG	–	–	–	–	NR3	–	Queries the current range after the scaling is set	R	3

MEASure/TRIGger subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
FETC[:SCAL] | READ[:SCAL] | MEAS[:SCAL]									
:CURR									
:AC	–	–	A	–	NR3	–	Queries the measured value of alternating current (effective value).	R	3

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
FETC[:SCAL] | READ[:SCAL] | MEAS[:SCAL]									
:CURR									
:AMPL:MAX	–	–	A	–	NR3	–	Queries the measured value of maximum current (positive amplitude peak value).	R	3
:AMPL:MIN	–	–	A	–	NR3	–	Queries the measured value of minimum current (negative amplitude peak value).	R	3
:HARM[:AMPL]	–	–	A	–	NR3	–	Queries the measured value of harmonic current.	R	3
:HARM:THDI	–	–	PCT	–	NR3	–	Queries the measured THDI.	R	3
:HARM:THDF	–	–	PCT	–	NR3	–	Queries the measured THDF.	R	3
:HARM:PHAS	–	–	DEG	–	NR3	–	Queries the phase angle of harmonic current.	R	3
:FLIC:ST	–	–	–	–	NR3	–	Queries the momentary flicker value.	R	3
:FREQ	–	–	HZ	–	NR3	–	Queries the set value for frequency.	R	3
:PHAS:VOLT	–	–	DEG	–	NR3	–	Queries the phase angle of voltage.	R	3
:POW:AC									
[:REAL]	–	–	W	–	NR3	–	Queries the measured value of real power.	R	3
:APP	–	–	VA	–	NR3	–	Queries the measured value of apparent power.	R	3
:REAC	–	–	VAR	–	NR3	–	Queries the measured value of reactive power.	R	3
:PFAC	–	–	–	–	NR3	–	Queries the power factor.	R	3
:VOLT									
:AC	–	–	V	–	NR3	–	Queries the measured value of AC voltage (effective value).	R	3
:AMPL:MAX	–	–	V	–	NR3	–	Queries the measured value of maximum voltage (positive amplitude peak value).	R	3
:AMPL:MIN	–	–	V	–	NR3	–	Queries the measured value of minimum voltage (negative amplitude peak value).	R	3
ABOR[:ALL]	–	–	–	–	–	–	Aborts a test.	W	1
INIT[:IMM]									
[:SEQ[1]]	char	–	–	–	–	–	Starts a test (trigger function).	W	1
:SEQ2	char	–	–	–	–	–	Starts in-rush current measurement.	W	1
:SEQ3	char	–	–	–	–	–	Starts testing when IEC 61000-3-3 (ManualSW) is selected in the limit value standard for the voltage fluctuation test.	W	1
:NAME	char	ACQ	–	–	–	–	Starts a test (trigger function).	W	1
INI:CONT									
[:SEQ[1]]	bool	ON | OFF	–	OFF	NR1	○	Sets the automatic continuation mode (ON/OFF) of sequence operation.	R/W	3
:NAME	char, bool	ACQ, ON | OFF	–	OFF	NR1	○		R/W	3
TRIG									
[:SEQ[1]] | [:ACQ]									
:SOUR	char	IMM | BUS		IMM	char	○	Sets the trigger source.	R/W	3
SEQ2 | RUSH									
:SOUR	char	IMM | BUS		IMM	char	○	Sets the trigger source.	R/W	3
:LEV	numeric	0.1 to 80	A	0.1	NR3	○	Trigger level of current	R/W	3
:CHAN	NRf	1, 2, 3	–	1	NR3	○	Input phase (channel) used as a trigger	R/W	3
SEQ3 | TEST									
[:IMM]	char	TEST	–	–	–	–	Starts testing when IEC 61000-3-3 (ManualSW) is selected in the limit value standard for the voltage fluctuation test.	W	3
:SOUR	char	IMM | BUS		IMM	char	○	Sets the trigger source.	R/W	3
JUDG:RES	–	–	–	–	char	–	Queries the general judgment result of the test that was finished previously.	R	3

SOURce subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
SOUR									
:OUTP[:STAT]	bool	ON | OFF	–	OFF	NR1	○	ON/OFF of the output of the AC power supply	R/W	3
:PHAS:ON	NRf	0 to 359, -1	DEG	–	NR3	○	Output ON phase of the AC power supply	R/W	3
:FREQ	NRf	50, 60	HZ	–	NR3	○	Frequency of the AC power supply	R/W	3
:VOLT	NRf	0.0 to 305.0	V	–	NR3	○	Output voltage of the AC power supply	R/W	3
:VOLT:RANG	NRf	100 | 200	V	–	NR3	○	Output voltage range of the AC power supply	R/W	3

STATus subsystem

SCPI command		Setting		Default	Response	Influence	Description	R/W	Note
Program header	Parameter		Unit						
STAT									
:OPER									
[:EVEN]	–	–	–	–	NR1	–	Queries an event.[*1]	R	1
:COND	–	–	–	–	NR1	–	Queries the register status.[*1]	R	1
:ENAB	NRf	0 to 32767	–	–	NR1	–	Enable[*1]	R/W	1
:NTR	NRf	0 to 32767	–	–	NR1	–	Negative transition[*1]	R/W	1
:PTR	NRf	0 to 32767	–	–	NR1	–	Positive transition[*1]	R/W	1
:PRES			–	–		–	Initializes the filter register.	W	1
:QUES									
[:EVEN]	–	–	–	–	NR1	–	Queries an event.[*2]	R	1
:COND	–	–	–	–	NR1	–	Queries the register status.[*2]	R	1
:ENAB	NRf	0 to 32767	–	–	NR1	–	Enable[*2]	R/W	1
:NTR	NRf	0 to 32767	–	–	NR1	–	Positive transition[*2]	R/W	1
:PTR	NRf	0 to 32767	–	–	NR1	–	Negative transition[*2]	R/W	1

*1. OPERation status register
*2. QUEStionable status register

IEEE488.2 common commands

IEEE488.2 common command	Parameter	Description	R/W
*CLS	–	Clears all event registers.	W
*ESE	NR1	Sets the event status enable register bit.	R/W
*ESR	–	Queries the event status register.	R
*IDN	–	Queries the identification string (information on the manufacturer).	R
*OPC	–	When all operations of the equipment that were detected as in standby are finished, the equipment generates an operation completion message in the event status register.	R/W
*OPT	–	Queries the options installed in this product.	R
*RST	–	Resets the equipment to the default state independent of the use history of the equipment.	W
*SRE	NR1	Sets the service request enable register.	R/W
*STB	–	Queries the contents of the status byte register and master summary status message.	R
*TRG	–	Trigger command	W
*TST	–	Executes self-diagnosis.	R
*WAI	–	Prevents the equipment from executing any command or query until all operations in standby are complete.	W

C Error List

Command error list

An error in the [-199, -100] range indicates that an IEEE 488.2 syntax error was detected by the syntax parser of the measuring instrument. If an error in this class occurs, the command error bit (bit 5) of the event status register is set.

Error code		Explanation of error message
-100	Command error	Generic syntax error
-101	Invalid character	A syntactic element contains a character which is invalid.
-102	Syntax error	An unrecognized command or data type was encountered.
-103	Invalid separator	The parser was expecting a separator and encountered an illegal character.
-104	Data type error	The parser recognized a data element different than one allowed.
-105	GET not allowed	A Group Execute Trigger was received within a program message.
-108	Parameter not allowed	More parameters were received than expected for the header.
-109	Missing parameter	Fewer parameters were received than required for the header.
-110	Command header error	An error was detected in the header.
-120	Numeric data error	Generated when parsing a data element which appears to be numeric, including the nondecimal numeric types.
-130	Suffix error	Generated when parsing a suffix.
-131	Invalid suffix	The suffix does not follow the syntax, or the suffix is inappropriate for this product.
-134	Suffix too long	The suffix contained more than twelve characters.
-138	Suffix not allowed	A suffix was encountered after a numeric element which does not allow suffixes.
-140	Character data error	Generated when parsing a character data element.
-141	Invalid character data	Either the character data element contains an invalid character, or the element is not valid.
-144	Character data too Long	The character data element contains more than twelve characters.
-148	Character data not allowed	A legal character data element was encountered where prohibited by this product.
-150	String data error	Generated when parsing a string data element.
-160	Block data error	Generated when parsing a block data element.
-170	Expression error	Generated when parsing an expression data element.
-180	Macro error	Generated when defining a macro or executing a macro.

Execution error list

An error in the [-299, -200] range indicates that an error was detected by the execution control block of the measuring instrument. If an error in this class occurs, the execution error bit (bit 4) of the event status register is set.

Error code		Explanation of error message
-200	Execution error (generic)	A generic error for this product
-203	Command protected	Password protected program or query command cannot be executed.
-210	Trigger error	A trigger error
-211	Trigger ignored	A trigger was received but discarded.
-213	Init ignored	Measurement initiate operation was ignored because measurement is in progress.
-214	Trigger deadlock	Dead lock occurred because a query was received before the software trigger.
-220	Parameter error	A program data element related error occurred.
-221	Settings conflict	Received a command that cannot be executed in the current condition of this product.
-222	Data out of range	Parameter value was outside the legal range.
-223	Too much data	Too many parameters were received than the requirements.
-224	Illegal parameter value	Received an invalid parameter data.
-230	Data corrupt or stale	Received a data query before the measurement was completed.
-241	Hardware missing	Cannot be executed because the optional hardware is not installed.

Specific device error list

Error code		Explanation of error message
-330	Self-test failed	Self-diagnosis failure
-360	Communication error	Communication failure
-361	Parity error in program message	Invalid parity bit
-362	Framing error in program message	Framing error. A stop bit cannot be detected.
-363	Input buffer overrun	The input buffer is full.
-365	Time out error	Timeout

Query error list

An error in the [-499, -400] range indicates that the output queue control of the measuring instrument detected a problem in the message exchange protocol explained in IEEE 488.2 Section 6. If an error in this class occurs, the query error bit (bit 2) of the event status register is set.

Error code		Explanation of error message
-400	Query error (generic)	A generic query error of this product that is used when other types of error do not apply.
-410	Query INTERRUPTED	An INTERRUPTED query error as defined by IEEE 488.2 (6.3.2.3) occurred.
-420	Query UNTERMINATED	An UNTERMINATED query error as defined by IEEE 488.2 (6.3.2.2) occurred.
-430	Query DEADLOCKED	A DEADLOCKED query error as defined by IEEE 488.2 (6.3.1.7) occurred.
-440	Query UNTERMINATED after indefinite response	Another query is specified after a query that generates an undefined response in a same program message. Example: `*IDN?;SYST:ERR?`

Operation completion event error list

The errors/events in the [-899, -800] range are used when this product needs to report the IEEE488.2 operation completion event, which is generated when the synchronization protocol of the instrument enabled by the *OPC command completes every selected operation in standby.

This event also sets the operation completion bit (bit 0) in the standard event status register.

Error code		Explanation of error message
-800	Operation complete	Operation complete

List of errors specific to this product

Error code		Explanation of error message
+100	Operation denied due to instrument specific error	Operation is denied because of an error specific to the measuring instrument.
+101	Operation denied while in LOCal state	Operation is denied because local mode operation in progress.
+102	Operation denied while test is running	Operation is denied because test operation is in progress.
+103	Operation denied while in PROTection state	Operation is denied by the protection function.

D Factory Default Settings List

Initializing this product

See p. 73

Turning on the POWER switch with the ENTER key pressed sets this product to the factory default settings. Keep the ENTER key pressed until the start-up screen appears.

Harmonic measurement mode (test condition setting)

Item		Factory default setting
Test condition	Limitation Standard	IEC 61000-3-2 Ed5.0
	Measuring Technique Standard	IEC 61000-4-7 Ed2.1
	Class	A
	Nominal Voltage	230 V
	Specified Nominal Voltage	230 V
	Nominal Frequency	50 Hz
	Observation Period (Tobs)	Quasi-stationary
	Measurement Time	150 s
	Margin	100 %
	Reference Impedance	Unuse
	Definition of Power	Measured value
	Specified Power	100 W
	Power Factor & Fundamental Current	Measured value
	Power Factor & Fundamental Current	1.00
	Specified Fundamental Current	20.0 A
	Limit Values	Normal limit value
	600 W Air Conditioner	No
	Equipment	Single-Phase
	Rated Voltage Ui	230 V
	Rated Current Iequ	20.0 A
	Nominal System Voltage Unom	400 V
	Reference Current Iref	Measured value
	Reference Current Specification	20.0 A
	Reference Fundamental Current I1	Measured value
	Reference Fundamental Current Specification	20.0 A
	Judgment Rsce	33
	Limit Value	Except Balanced Three-Phase
	Voltage Range	AUTO
	Current Range	AUTO
	Current Input Terminal	Shunt
	Wiring Method	3P4W
	PLL Source	Voltage L1
	Channel Linkage	Linked
	Voltage CF	2.00
	Current CF	4.00
	PT Ratio	1.000
	CT Ratio	1.000
	EXT-CS Ratio	25.000 mV/A

Harmonic measurement mode (report printing)

Item		Factory default setting
Report printing	Print type	PDF
Standard name setting	Standard name select	Standard

Harmonic measurement mode (VIEW)

Item		Factory default setting
VIEW basic	View Type	V/I Waveform
	View Area	1-Screen
VIEW common	Check View Phase	L1
	Check View Phase (checkboxes)	L1, L2, L3
	Horizontal Scale	× 1
	Vertical Scale (Current)	× 1
	Vertical Scale (Voltage)	× 1
V/I waveform	Cursor	Left end
2D harmonics	Cursor	1
Vector	Order	1 (fixed)
	Select View Items	V1, I1, V2, I2, V3, I3
List	Select View Items	Voltage rms, Voltage Peak+, Voltage Peak-, Current rms, Current Peak+, Current Peak-, Frequency, Real Power (W), Apparent Power (VA), Reactive Power (var), Power Factor, THC, POHC, THD, PWHD
Harmonic list	Item	Average value
	Measurement Value Selection	In/ I1 %
Current trend	Display Peak Current	Effective value rms, Peak
Harmonic trend	Order	1
Result list	Measurement Value Selection	In/ I1 %

Voltage fluctuation measurement mode (test condition setting)

Item		Factory default setting
Test condition	Limitation Standard	IEC 61000-3-3 (Pst Auto)
	Measuring Technique Standard	IEC 61000-4-15 Ed2.0
	Nominal Voltage	230 V
	Specified Nominal Voltage	230 V
	Nominal Frequency	50 Hz
	Pst Measurement Time	60 s
	Pst Measurement Count	12
	d Measurement Time	600 s
	d Measurement Count	24
	dmax Limit Value	6 %
	Flicker Margin	100 %
	d Margin	100 %
	Judge Factor	Pst, Plt, dc, dmax, Tmax
	Z test	0.25 Ω + jn0.25 Ω
	R_A test	0.24 Ω

Item		Factory default setting
Test condition	X_A test jn	0.15 Ω
	R_N test	0.16 Ω
	X_N test jn	0.10 Ω
	Voltage Range	AUTO
	Current Range	AUTO
	Current Input Terminal	Shunt
	Wiring Method	3P4W
	PLL Source	Voltage L1
	Channel Linkage	Linked
	Voltage CF	2.00
	Current CF	4.00
	PT Ratio	1.000
	CT Ratio	1.000

Voltage fluctuation mode (report printing)

Item		Factory default setting
Report printing	Print type	PDF
Standard name setting	Standard name select	Standard

Voltage fluctuation measurement mode (VIEW)

Item		Factory default setting
VIEW basic	View Type	V/I Waveform
	View Area	1-Screen
VIEW common	Check View Phase	L1
	Check View Phase (checkboxes)	L1, L2, L3
	Horizontal Scale	× 1
	Vertical Scale (Current)	× 1
	Vertical Scale (Voltage)	× 1
CPF waveform	Browse Segment	1
	Browse Segment (Linked)	1
V/I waveform	Cursor	Left end
List	Select View Items	Voltage rms, Voltage Peak+, Voltage Peak-, Current rms, Current Peak+, Current Peak-, Frequency, Real Power (W), Apparent Power (VA), Reactive Power (var), Power Factor
Result list	Item Change	Zmax, Zsys1, Zsys2, Zsys3

Other measurements

Item		Factory default setting
Basic Measurement	View Select	Waveform View
	Horizontal Scale	× 1
	Vertical Scale (Current)	× 1
	Vertical Scale (Voltage)	× 1
	Cursor	Left end
	Check View Phase	L1
	Check View Phase (checkboxes)	L1, L2, L3
	Select View Items	Voltage rms, Voltage Peak+, Voltage Peak-, Current rms, Current Peak+, Current Peak-, Frequency, Real Power (W), Apparent Power (VA), Reactive Power (var), Power Factor
	Voltage Range	300 V
	Current Range	20 A
	Current Input Terminal	Shunt
	Wiring Method	3P4W
	PLL Source	Voltage L1
	Measurement Setting	Linked
	LPF	6 kHz
	AC Coupling	DC
FFT Analyzer	Cursor	1
In-rush Current Measurement	Current Trigger	0.1 A
	Select Trigger Channel	L1

External control

Item		Factory default setting
External control	OUTPUT	OFF
	Voltage Setting	0.0 V
	Frequency Setting	50 Hz
	Voltage Range	100 V
	On Phase Select	Free
	Phase Angle	0°
	AC Power Source Model	Don’t Use

System setup

Item		Factory default setting
System setup	Language	English
	I/F Select	USB
	GRIB Address	1
	RS232C Baudrate	19200 bps
	Buzzer Volume	4
	Print Type	PDF
	Printer Address	Blank
	Printer Name	Blank
	Storage Media	CF Card

E Report Printing Format

A report printing format is provided for each limit value standard. The format varies depending on the combination of test conditions.

Combination of test conditions

- Limit value standard (IEC, JIS)
    - IEC 61000-3-2 Ed5.0(2018)
    - IEC 61000-3-2 Ed3.0(2005)
    - IEC 61000-3-2 Ed2.2(2004)
    - IEC 61000-3-12 Ed1.0(2004)
    - JIS C61000-3-2(2019)
    - JIS C61000-3-2(2005)
    - IEC 61000-3-3 Ed3.1(2017)
    - IEC 61000-3-11 Ed2.0(2017)
- Measurement circuit type
    - Single-phase two-wire
    - Single-phase three-wire
    - Three-phase three-wire
    - Three-phase four-wire
- Measurement method for the voltage fluctuation test
    - Pst Auto
    - Manual

Examples of representative printing formats are provided on the following pages.

- IEC 61000-3-2 Ed2.2(2004), single-phase two-wire
- IEC 61000-3-3 Ed3.1(2017), single-phase two-wire, Pst Auto

IEC 61000-3-2 Ed2.2, single-phase two-wire

Harmonics Current Test Report

Company		Test Engineer	
Model Name			
Type		Type of Test	EN 61000-3-2(2000)/A2(2005) *IEC 61000-3-2:Ed2.2(2004) EN 61000-4-7(2002) *IEC 61000-4-7(2002)
Serial No.			
Operating Mode			
Date of Test	2021/03/12 10:47:27	Classification	Class A
Climatic Condition		Power Analyzer	KHA3000, Ver 3.50
Memo		Supply Source	
		Reference Impedance	
		Wiring Method	Single-Phase 2-Wire
Tobs	Quasi-Stat	Nominal	230 V/ 50 Hz
		Measuring Period	150 s
		Margin	100 %

Test Data of Current Harmonics

Final Test Result	PASS	THC(max)	0.1735 A
Voltage(max)	229.92 V	POHC(max)/Limit	0.0062 A/ 0.2513 A *3
Current(max)	1.4421 A	Apparent Power(max)	331.57 VA
Power(max)	329.12 W	Reactive Power(max)	40.27 var
Power Factor(max)	0.9926		
Fundamental Current(max)	1.4316 A		

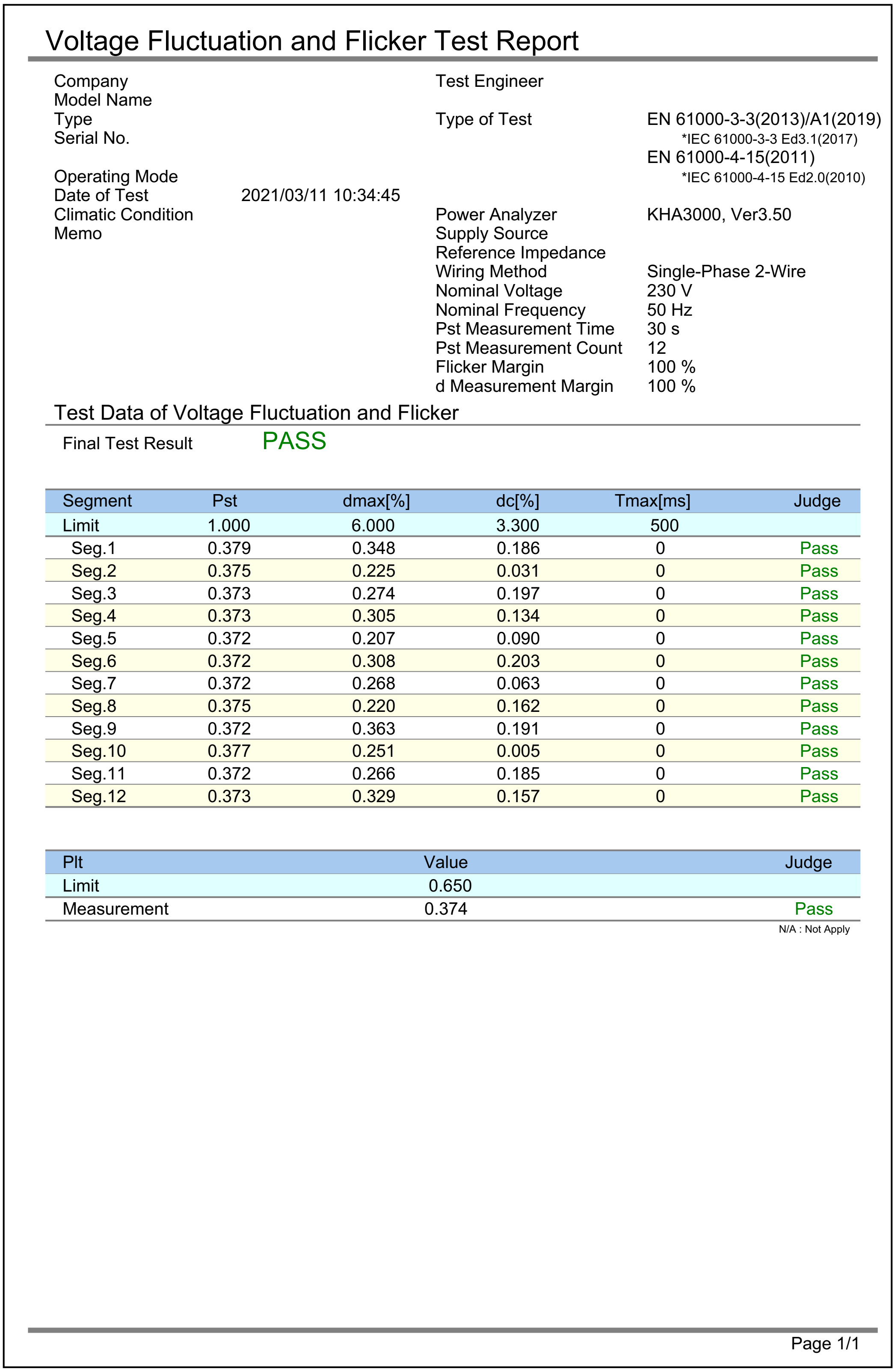
Order	Limit1[A rms]	Limit2[A rms]	Ave[A rms]	Max[A rms]	Judge
1	-----	-----	1.4314	1.4316	N/A
2	1.0800	1.6200	0.0021	0.0022	N/A
3	2.3000	3.4500	0.1591	0.1591	Pass
4	0.4300	0.6450	0.0005	0.0006	N/A
5	1.1400	1.7100	0.0573	0.0574	Pass
6	0.3000	0.4500	0.0003	0.0004	N/A
7	0.7700	1.1550	0.0292	0.0292	Pass
8	0.2300	0.3450	0.0003	0.0004	N/A
9	0.4000	0.6000	0.0177	0.0178	Pass
10	0.1840	0.2760	0.0003	0.0004	N/A
11	0.3300	0.4950	0.0118	0.0119	Pass
12	0.1533	0.2300	0.0003	0.0003	N/A
13	0.2100	0.3150	0.0085	0.0085	N/A
14	0.1314	0.1971	0.0002	0.0003	N/A
15	0.1500	0.2250	0.0064	0.0064	N/A
16	0.1150	0.1725	0.0002	0.0003	N/A
17	0.1324	0.1985	0.0050	0.0050	N/A
18	0.1022	0.1533	0.0002	0.0003	N/A
19	0.1184	0.1776	0.0040	0.0040	N/A
20	0.0920	0.1380	0.0002	0.0003	N/A
21	0.1607	0.1607	0.0032	0.0033	N/A
22	0.0836	0.1255	0.0002	0.0003	N/A
23	0.1467	0.1467	0.0028	0.0028	N/A
24	0.0767	0.1150	0.0003	0.0003	N/A
25	0.1350	0.1350	0.0023	0.0023	N/A
26	0.0708	0.1062	0.0002	0.0003	N/A
27	0.1250	0.1250	0.0020	0.0020	N/A
28	0.0657	0.0986	0.0002	0.0003	N/A
29	0.1164	0.1164	0.0017	0.0018	N/A
30	0.0613	0.0920	0.0002	0.0003	N/A
31	0.1089	0.1089	0.0015	0.0015	N/A
32	0.0575	0.0863	0.0002	0.0003	N/A
33	0.1023	0.1023	0.0013	0.0014	N/A
34	0.0541	0.0812	0.0002	0.0002	N/A
35	0.0964	0.0964	0.0012	0.0012	N/A
36	0.0511	0.0767	0.0002	0.0003	N/A
37	0.0912	0.0912	0.0011	0.0011	N/A
38	0.0484	0.0726	0.0002	0.0002	N/A
39	0.0865	0.0865	0.0010	0.0010	N/A
40	0.0460	0.0690	0.0002	0.0002	N/A

N/A : Not Apply

*3 When the POHC value does not exceed POHC Limt, 150% of limit value are applies to each Limit 1 value.

Page 1/1

IEC 61000-3-3 Ed3.1, single-phase two-wire, Pst Auto



Voltage Fluctuation and Flicker Test Report

Company		Test Engineer	
Model Name			
Type		Type of Test	EN 61000-3-3(2013)/A1(2019) *IEC 61000-3-3 Ed3.1(2017) EN 61000-4-15(2011) *IEC 61000-4-15 Ed2.0(2010)
Serial No.			
Operating Mode			
Date of Test	2021/03/11 10:34:45		
Climatic Condition		Power Analyzer	KHA3000, Ver3.50
Memo		Supply Source	
		Reference Impedance	
		Wiring Method	Single-Phase 2-Wire
		Nominal Voltage	230 V
		Nominal Frequency	50 Hz
		Pst Measurement Time	30 s
		Pst Measurement Count	12
		Flicker Margin	100 %
		d Measurement Margin	100 %

Test Data of Voltage Fluctuation and Flicker

Final Test Result PASS

Segment	Pst	dmax[%]	dc[%]	Tmax[ms]	Judge
Limit	1.000	6.000	3.300	500	
Seg.1	0.379	0.348	0.186	0	Pass
Seg.2	0.375	0.225	0.031	0	Pass
Seg.3	0.373	0.274	0.197	0	Pass
Seg.4	0.373	0.305	0.134	0	Pass
Seg.5	0.372	0.207	0.090	0	Pass
Seg.6	0.372	0.308	0.203	0	Pass
Seg.7	0.372	0.268	0.063	0	Pass
Seg.8	0.375	0.220	0.162	0	Pass
Seg.9	0.372	0.363	0.191	0	Pass
Seg.10	0.377	0.251	0.005	0	Pass
Seg.11	0.372	0.266	0.185	0	Pass
Seg.12	0.373	0.329	0.157	0	Pass

Plt	Value	Judge
Limit	0.650	
Measurement	0.374	Pass

N/A : Not Apply

Page 1/1

Terms used for the Report Printing Format

This section explains the meanings of terms used for report printing formats. Terms defined in the related standards are excluded from the explanation.

Harmonics

Related standard	Wiring method	Term	Meaning
Common	Common	Final Test result	General judgment result
		PASS, Pass	The result is acceptable.
		FAIL, Fail	The result is not acceptable.
		WARN, Warn	The result is acceptable but the specified margin is exceeded.
		Order	Harmonic order (2nd to 40th; 1st order is a fundamental.)
		Lim1[Arms]	Limit value
		Lim2[Arms]	150 % or 200 % of the limit value
		AVE[Arms]	Average value in the measurement time
		MAX[Arms]	Maximum value in the measurement time
		Judge	Judgment for each harmonic order
	Three-phase	L1 Test Result	Judgment result of the L1 input phase
		L2 Test Result	Judgment result of the L2 input phase
		L3 Test Result	Judgment result of the L3 input phase
		Total Current	Total current of all input phases
		Total Power	Total power of all input phases
		Total Power Factor	Total power factor of all input phases
		Total Apparent power	Total apparent power of all input phases
		Total Reactive Power	Total reactive power of all input phases
IEC 61000-3-2 Ed3.0	Single-phase, Three-phase	limitOver[s]	The length of time (seconds) during which 150 % of the limit value is exceeded
IEC 61000-3-12	Single-phase, Three-phase	Ave[%] Reading(In/Iref) Ave[%] Reading(In/I1)	Average value in the measurement time and its ratio to the reference current Average value in the measurement time and its ratio to the reference fundamental current
		Max[%] Reading(In/Iref) Max[%] Reading(In/I1)	Maximum value in the measurement time and its ratio to the reference current Maximum value in the measurement time and its ratio to the reference fundamental current
		Ave[Arms] Reading	Average value in the measurement time
		Max[Arms] Reading	Maximum value in the measurement time
		Iequ	Rated current of the EUT
		Iref I1	Reference current Reference fundamental current
		Judgment Rsce	Rsce value used for judgment
		Limit values	Limit values to be applied
		Ssc	Short-circuit power (calculated value)
		Sequ	Rated apparent power of equipment (calculated value)
		Z	System impedance (calculated value)

Voltage fluctuations and flicker harmonics

Related standard	Wiring method	Term	Meaning
Common	Common	Final Test result	General judgment result
		PASS, Pass	The result is acceptable.
		FAIL, Fail	The result is not acceptable.
		WARN, Warn	The result is acceptable but the specified margin is exceeded.
		Limit	Limit value
		Judge	Judgment (PASS/FAIL/WARN) of voltage fluctuations and flicker in one segment (Seg1 and subsequent segment) time. WARN is displayed if the margin is exceeded.
		Seg.1-----	The Pst measurement time or d measurement time corresponds to one segment (Seg1 and subsequent segment) time.
		Measurement	Measured value (applicable to measurement in Pst Auto)
		Average	Average value of measured values (applicable to measurement in Manual) The arithmetic average of 22 measured values obtained by excluding the maximum and minimum values of up to 24 collected measurements
		Maximum	Maximum measured value (applicable to measurement in Manual)
	Three-phase	L1 Test Result	Judgment result of the L1 input phase
		L2 Test Result	Judgment result of the L2 input phase
		L3 Test Result	Judgment result of the L3 input phase
IEC 61000-3-11	Common	Zsys1-3[ohm]	Permissible system impedance value calculated after converting the measured values of dmax, dc and Plt with a set impedance
		Zsys4[ohm]	Permissible system impedance value calculated after converting the measured value of Plt with a set impedance
		Zmax	Calculated value of the maximum permissible system impedance. Calculated minimum values of Zsys1, Zsys2, Zsys3 and Zsys4. Maximum permissible system impedance of a power supply to which equipment is connected (power receiving point). Value to be declared as the condition for connection.

F Troubleshooting

The following explains check items and measures for various problems. Typical failure symptoms are described. If a problem occurs, use the following tables to find an appropriate corrective action. Some problems can be easily solved.

See p. 376

If the problem were not applied to the corresponding item in the table, we recommend you to reset the product to the default settings. If the problem persists, contact a KIKUSUI agent or distributor.

Power-on failure

Symptom	Check item/Corrective action	See Page
The POWER switch does not work.	• Is the power cord correctly connected? • Is the power fuse not blown?	*47* *350*

Panel operation failure

Symptom	Check item/Corrective action	See Page
The screen display is difficult to read.	• Is the screen brightness setting appropriate?	*85*
Panel key operation does not work.	• Is the key icon on the upper part of the screen LOCK? Release the key lock.	*84*
	• Is the REMOTE LED lit The RS232C, GPIB or USB interface is enabled. To enable panel operation, press the LOCAL key to enter the local mode.	*85*
Menu operation does not work.	• Did you enter another test mode during menu operation? • Is the “It cannot be operated from sub-menu” dialog box displayed? Press the “Return” function key to exit from the sub-menu.	*84*
The test does not start even when the START switch is pressed.	• Did you terminate the previous test in the test ending menu? When the measurement time is finished, the system enters the analysis state. In this state, you cannot start a test. Terminate the test in the test ending menu.	*146* *220*

Measurement failure

Symptom	Check item/Corrective action	See Page
Measured values seem wrong.	• Is an appropriate measurement circuit used? Perform measurement using the measurement circuit required by the standard.	*54*
	• Synchronization with the AC power supply is probably not established. • Is the triangular waveform of the PLL icon still on the screen? Turn on OUTPUT of the AC power supply. Set the correct frequency for the AC power supply.	*118* *203*
	• Is the voltage sensing terminal wired?	*57*
	• Is the scaling correctly set? Check the setting of PT Ratio for the PT (potential transformer) being used. Check the setting of CT Ratio for the CT (current transformer) being used. Check the setting of EXT CS Ratio for the external sensor being used.	*106* *197* *258*
	• Is the phase difference with the external sensor correctly adjusted? Check the setting of V/I phase difference adjustment for the external sensor being used.	
	• Are the Voltage CF and Current CF correctly set? Set the CF values correctly so that the peak values can be measured correctly without the effect of any distortion.	
EUT does not work.	• Is OUTPUT of the AC power supply set to ON? Check the control signal cable of the AC power supply.	*118* *203*
	• Is the control signal cable of the AC power supply connected?	*66*

Report printing failure

Symptom	Check item/Corrective action	See Page
Reports cannot be printed.	• Is the limit value set to 3rd/5th/Current Wave? When 3rd/5th/Current Wave is selected, you cannot print reports. Use the SD006-KHA application software to print the reports.	–

INDEX

If you find any misplaced or missing pages in the manuals, they will be replaced. If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact your Kikusui agent or distributor. At that time, inform your agent or distributor of the “Part No.” written on the front cover of this manual.

Every effort has been made to ensure the accuracy of this manual. However, if you have any questions or find any errors or omissions, please contact your Kikusui agent or distributor.

After you have finished reading this manual, store it so that you can use it for reference at any time.

KIKUSUI ELECTRONICS CORP.

1-1-3 Higashiyamata, Tsuzuki-ku, Yokohama,
224-0023, Japan

Phone: +81-45-482-6353
Facsimile: +81-45-482-6261

www.kikusui.co.jp/en/