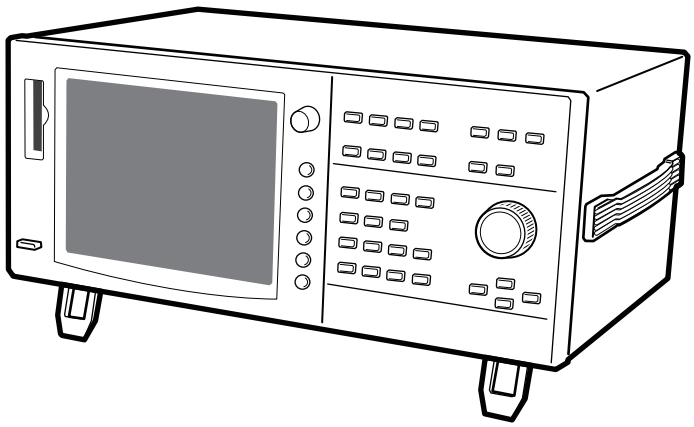
Part No. Z1-003-482, IB011408
Apr. 2017

Operation Manual

Harmonic/Flicker Analyzer

KHA1000



KIKUSUI

Using the Operation Manual

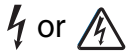
Please read through this Operation Manual and make sure that you fully understand everything before operating the product. After reading the manual, always keep it nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

If you find any incorrectly arranged or missing pages in this manual, they will be replaced. If the manual is lost or damaged, a new copy can be provided for a fee. In either case, please contact the Kikusui distributor/agent, and provide the "Kikusui Part No." given on the cover.

This manual has been prepared with the utmost care; however, if you note any errors or omissions, or have any questions, please contact the Kikusui distributor/agent.

⚠ Safety Symbols

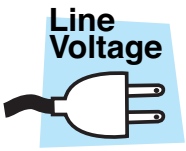
For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Note the meaning of each of the symbols to ensure safe use of the product. (Not all symbols may be used.)

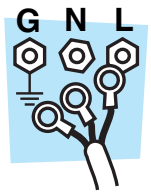
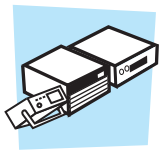
	Indicates that a high voltage (over 1000 V) is used here. Touching the part may cause a possibly fatal electric shock. If physical contact is required for your work, start work only after you make sure that no voltage is output here.
DANGER	Indicates an imminently hazardous situation that, if any mishandling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

⚠ 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 is 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 a product with a fuse holder mounted on the outside 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, follow section 2.2, "Notes on Installation Location", in the Operation 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 	• Before using this product, check that the input power voltage, fuse rating, and power cord appearance are normal. Be sure to remove the power cord plug from the outlet before checking. • 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. • Connection lines through which current flows, such as output and load wiring, should be selected from those with a margin for the current capacity. • 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 during maintenance or inspection. • Periodic maintenance, inspection, cleaning, and calibration are recommended to maintain the performance and safe operation of the 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.

How to Read This Manual

Introduction

Thank you for purchasing the KHA1000 harmonic/flicker analyzer.

This document is intended for those performing harmonic current and voltage fluctuation tests 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.

How to read this manual

This manual is configured as a read through. Before using this product for the first time, read this manual in order from beginning to end.

Related manuals

The products indicated below are used in the test systems. For details, refer to each Operation Manual.

- AC Power Supply
  PCR-LE, PCR-LE2, or PCR-LA Series
- Line Impedance Network
  LIN1020JF, LIN3020JF, or LIN40MA-PCR-L
- Multi-Outlet Unit
  OT01-KHA

Intended reader of this manual

This manual is intended for those using the KHA1000 harmonic/flicker analyzer and those teaching 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 personal computer.

Structure of this manual

This Operation Manual is made up of the following sections. An outline of each chapter is presented below.

Chapter 1 Overview

This chapter provides an overview of the product and explains its features.

Chapter 2 Installation and Preparation for Use

This chapter explains the procedures for unpacking the product and connecting the test system.

Chapter 3 To First-time Users of This Product

This chapter explains how to utilize the product's features and the operating screen views.

Chapter 4 Basic Operation

This chapter explains basic operation methods.

Chapter 5 Harmonic Current Test

This chapter explains harmonic current tests, and describes the setup for test conditions, analysis, and report printout for the respective standards.

Chapter 6 Voltage Changes and Fluctuations and Flicker Test

This chapter explains voltage change, voltage fluctuation, and flicker tests, and describes the steps from setting the test conditions to analysis and printing reports.

Chapter 7 Other Measurements

This chapter explains measurements for other than harmonic current and voltage fluctuation tests.

Chapter 8 Remote Control

This chapter explains how to connect the remote interface and how to control it using SCPI commands.

Chapter 9 Maintenance

This chapter explains maintenance including cleaning, inspection, calibration, and responses to operation failures.

Chapter 10 Specifications

This chapter explains the specifications of this product.

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Notations Used in This Manual

- In this manual, the KHA1000 harmonic/flicker analyzer may be called "KHA1000." The PCR-LE, PCR-LE2, or PCR-LA Series AC Power Supply may be called "AC Power Supply." The LIN1020JF, LIN3020JF, or LIN40MA-PCR-L Line Impedance Network may be called "Line Impedance Network."
- "PC" in this manual is a generic term for personal computers and workstations.
- "EUT" in this manual is a generic term for equipments under test.
- 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.

SHIFT + (letter or symbol on the upper part of a key)

This description instructs you to press the designated key with the SHIFT button depressed.

Pressing a key with the SHIFT button depressed will enable the feature indicated under the key that is shown in blue.

- In this manual, the menus are displayed in the following formats:

Fn	Item → Sub Menu	Option 1	Option 2	Option 3

Fn	Sub-menu item	Option 1	Option 2

Fn: Represents function keys (F1 to F6).

Item: Represents a menu item. A sub-menu is represented by "→ Sub Menu." Sub-menu items are indented.

Option 1/2/3: Represents an optional item. The number of optional items depend on the menu item selected.

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Chapter 3 To First-time Users of This Product

Chapter 4 Basic Operation

Topical List

Preparation

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How do I connect a test system?	"2.5 Connecting the Test System"	2-13
How do I check whether the connection to the EUT is correct?	"2.4 Connecting the Rear-side Terminals"	2-9
What kind of electric wire should be used to connect a test system and how long should it be?	"2.5 Connecting the Test System"	2-13
How do I know the definition of a term?	"3.1 Providing Security for Users Not Familiar with Test Standards"	3-2

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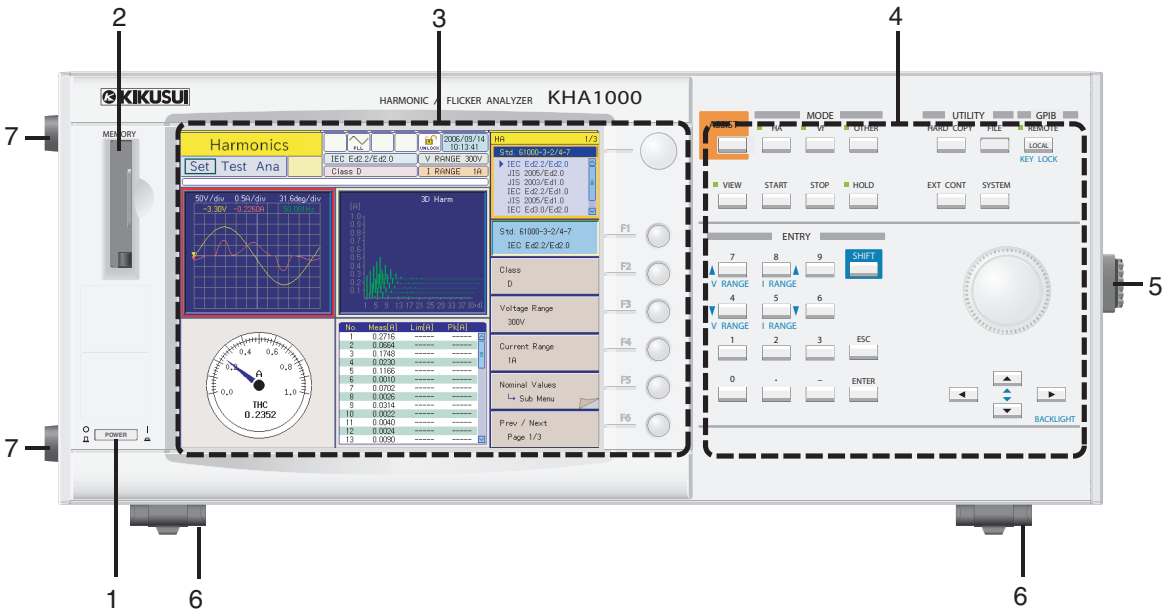
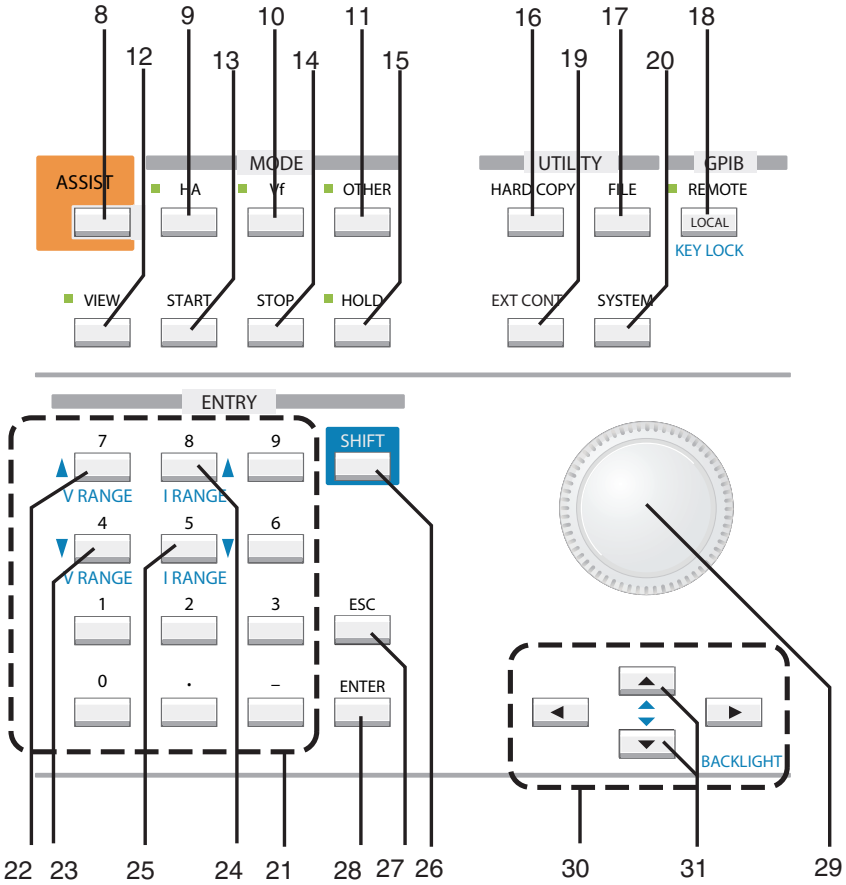
Front panel



Operation unit



No.	Name +SHIFT	Description	See Page
1	POWER switch	ON (I) with key pressed and locked; OFF (O) with key released.	4-2
2	MEMORY slot	For compact flash card.	4-27
3	Display unit	Mounted with LCD backlight.	–
4	Operation unit	Keys and large knob. Enlarged view is shown under front panel view.	–
5	Handle	Handle for carriage.	2-8
6	Leg/stand	Adjusts the angle of front panel.	2-7
7	Rubber pads on side surface	4 positions on side surface.	2-8
8	ASSIST key	Explanatory function supporting operation.	3-2
9	HA key (LED)	Sets harmonic current test modes (status display) and test conditions, and displays measurement data in graph and list windows.	3-12
10	Vf key (LED)	Sets voltage fluctuation test modes (status display) and test conditions, and displays measurement data in graph and list windows.	3-14
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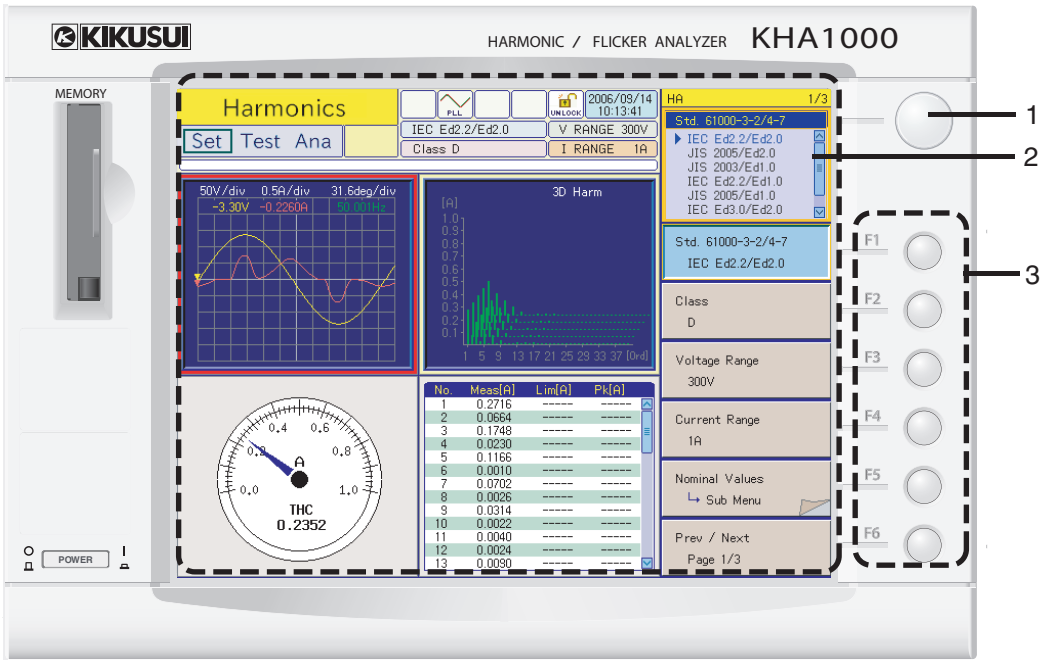
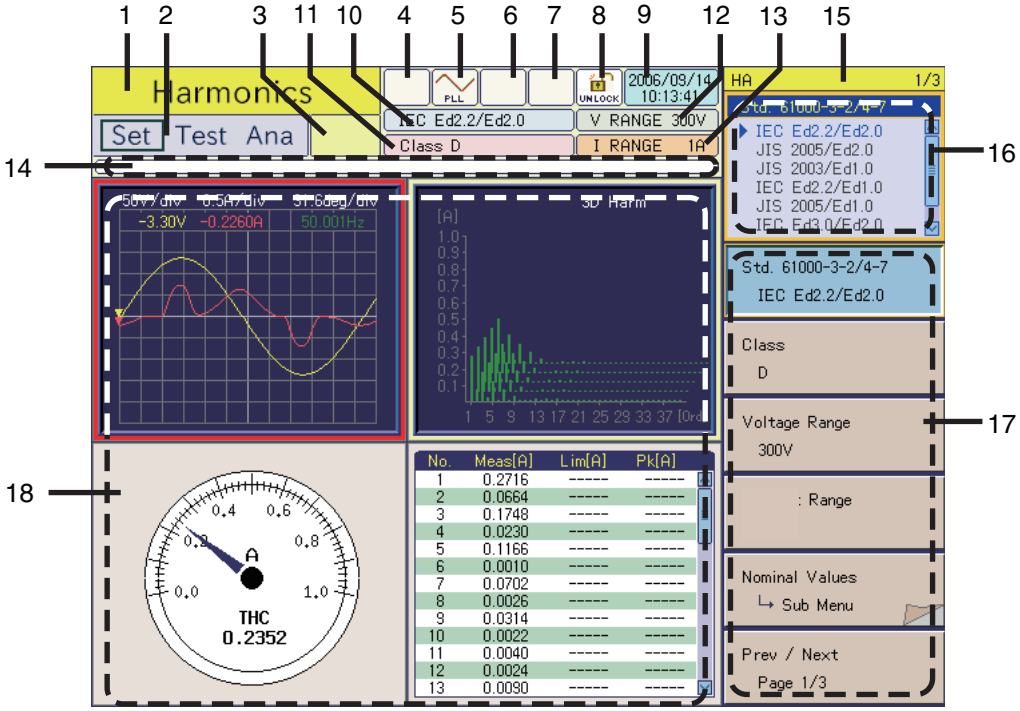
14	STOP key	Stops test.	5-43
15	HOLD key	Holds screen measurement data variations.	4-26
16	HARD COPY key	Screen hard copy.	4-26
17	FILE key	Saves and opens test data file.	4-21
18	REMOTE LED/LOCAL key	Remote control status display/local setting.	4-27
	KEY LOCK key	Key lock setting.	4-26
19	EXT CONT key	Sets external device control.	4-19
20	SYSTEM key	Sets test system.	4-12
21	0 to 9 and "." and "-" keys	Input numeric values.	–
22	7	Numeric key.	–
	▲V RANGE	Selects voltage range and raises sensitivity.	4-10
23	4	Numeric key.	–
	▼V RANGE	Selects voltage range and lowers sensitivity.	4-10
24	8	Numeric key.	–
	▲I RANGE	Selects current range and raises sensitivity.	4-10
25	5	Numeric key.	–
	▼I RANGE	Selects current range and lowers sensitivity.	4-10
26	SHIFT key	Shift key.	–
27	ESC key	Returns from sub-menu to upper menu.	–
28	ENTER key	Confirms entry.	–
29	Large knob	Rotary knob for numeric value entry and cursor setting.	–
30	Arrow keys ▲ ▼ ◀ ▶	UP/DOWN and LEFT/RIGHT keys.	–
31	Arrow keys ▲ ▼	UP/DOWN key.	–
	BACK LIGHT key▲ ▼	Sets the brightness of display unit backlight.	4-26

Display unit



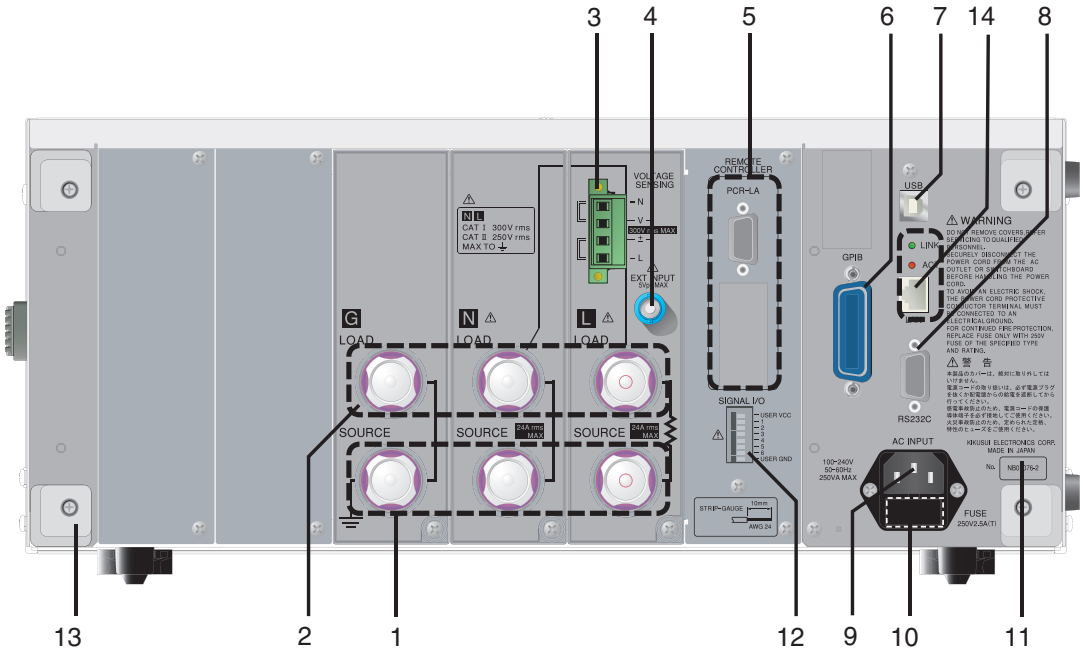
Screen (example of harmonic current test)



No.	Name	Description	See Page
1	Small knob	Rotary knob for setting menu details.	4-7
2	Screen	See below.	–
3	F1 to F6 keys	Function keys for menu selection.	4-7

No	Name	Description	See Page
1	Mode	Harmonic current test, voltage fluctuation test, other measurements, file manipulation, EXT control, and system setting.	–
2	Test status	Test status: Setting, test, and analysis.	5-41
3	Testing time (remaining time)	Displays the time remaining for the test (mm:ss or hh:mm:ss for 60 minutes or longer).	–
4	OUT ON/OFF icon	AC Power Supply OUTPUT ON/OFF display.	4-19
5	PLL icon	Synchronous display with test AC power (PLL lock).	5-42 6-16
6	OVER RANGE icon	Displayed when voltage/current range is exceeded.	5-4 5-11 5-17 6-4 7-6
7	OHP icon	Displays overheat status of current detector.	
8	LOCK/UNLOCK icon	Key lock status.	4-19
9	Clock	Displays the date/time.	4-12
10	Standard	In-test standard.	5-2
11	Class	Device class.	5-2
12	V RANGE	Voltage range.	4-7
13	I RANGE	Current range.	4-7
14	Progress bar	The point moves from the left end to the right end during test execution.	5-41
15	View name and page	View name and menu page.	4-7
16	Contents of menu selected	Contents of menu selected with F1 to F6 keys.	4-7
17	Menu item	Menu items corresponding to F1 to F6 keys.	4-7
18	Data display area	Displays measured values such as graphs and lists.	5-23

Rear panel


3
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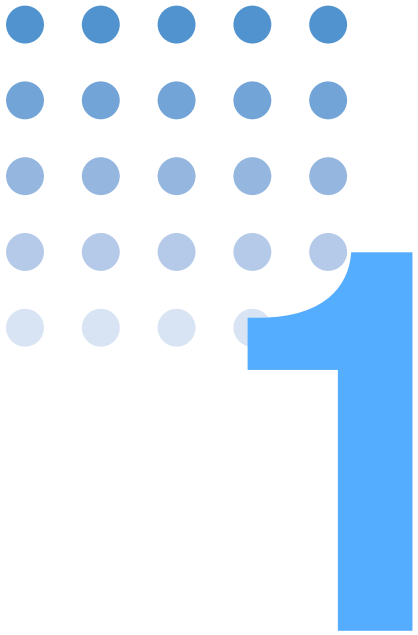
G
LOAD
N
LOAD
L
LOAD
SOURCE
SOURCE
SOURCE
VOLTAGE SENSING
EXT. INPUT
REMOTE CONTROLLER
PCR-LA
SIGNAL I/O
USB
GPIB
LINK
ACT
RS232C
AC INPUT
FUSE

No.	Name	Description	See Page
1	SOURCE terminal	Connects to AC power supply for test or line impedance network.	2-9
2	LOAD terminal	Connects to EUT.	2-9
3	VOLTAGE SENSING terminal	Uses plug for voltage measurement of EUT terminal and plug for voltage sensing terminal.	2-11
4	EXT INPUT terminal	External input terminal (no function; this terminal is equipped for function expansion).	2-15
5	REMOTE CONTROLLER	Control terminal for AC power supply.	2-12
6	GPIB	GPIB cable connector for remote control.	–
7	USB	USB cable connector for remote control.	–
8	RS232C	RS232C cable connector for remote control.	–
9	AC INPUT	Power cord connector.	2-18
10	FUSE	Fuse holder for power supply with 1 spare fuse included.	9-3
11	Serial No.	Serial number of this product.	–
12	SIGNAL I/O	I/O signal terminal (no function; this terminal is equipped for function expansion).	–
13	Cord holder	Power cord holder.	–
14	LAN (Ethernet port)	Connects to network printer (factory option). LINK LED (green) turns on when link is established. ACT LED (red) turns on when data is transmitted or received.	1-6



Overview

This chapter provides an overview of the product and explains its features.

1.1 About This Manual

Firmware version of the product to which this manual applies

This manual applies to products with firmware version 1.9x installed.

See Page 4-2

For product inquiries, please provide us with the following:

- Model name (indicated on the front page of this manual)
- Firmware version
- Serial No. (indicated in the lower part on the back of the product)

1.2 Overview

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 can be controlled from this product, a test system can be configured without a personal computer being used. This product can also be used independently as a power analyzer.

1.2.1 Conforming Standards

This product conforms to the standards listed in Table 1-1. The “Standard name notations” in the table are the symbols used in this product, and indicate the relevant standards for limit values and measuring techniques. Figure 1-2 indicates the rules for these notations.

Table 1-1 Applicable standards

Classification	Standard name notation	Standard number and edition for limit value*1	Standard number and edition for measuring technique*1,*2
Harmonic current	IEC Ed2.2/Ed2.0	IEC 61000-3-2:Ed2.2(2004) EN 61000-3-2(2000)/A2(2005)	IEC 61000-4-7:Ed2.0(2002) EN 61000-4-7(2002)
	JIS 2011/Ed2.0	JIS C61000-3-2(2011)	IEC 61000-4-7(2007)
	JIS 2005/Ed2.0	JIS C61000-3-2(2005)	IEC 61000-4-7:Ed2.0(2002)
	JIS 2003/Ed1.0	JIS C61000-3-2(2003)	JIS C61000-4-7(1997)
	IEC Ed2.2/Ed1.0	IEC 61000-3-2:Ed2.2(2004) EN 61000-3-2(2000)/A2(2005)	IEC 61000-4-7(1991) EN 61000-4-7(1993)
	JIS 2011/Ed1.0	JIS C61000-3-2(2011)	JIS C61000-4-7(1997)
	JIS 2005/Ed1.0	JIS C61000-3-2(2005)	JIS C61000-4-7(1997)
	IEC Ed3.0/Ed2.0	IEC 61000-3-2:Ed3.0(2005) EN 61000-3-2(2006)	IEC 61000-4-7:Ed2.0(2002) EN 61000-4-7(2002)
	IEC Ed3.0/Ed1.0	IEC 61000-3-2:Ed3.0(2005) EN 61000-3-2(2006)	IEC 61000-4-7(1991) EN 61000-4-7(1993)
	IEC Ed4.0/Ed2.1	IEC 61000-3-2:Ed4.0(2014) EN 61000-3-2(2014)	IEC 61000-4-7:Ed2.1(2009) EN 61000-4-7(2002)/A1(2009)
	IEC Ed4.0/Ed1.0	IEC 61000-3-2:Ed4.0(2014) EN 61000-3-2(2014)	IEC 61000-4-7(1991) EN 61000-4-7(1993)
Flicker voltage fluctuation	IEC Ed2.0/Ed1.1	IEC 61000-3-3:Ed2.0(2008) EN 61000-3-3(2008)	IEC 61000-4-15:Ed1.1(2003) EN 61000-4-15(1998)/A1(2003)
	IEC Ed3.0Ed2.0	IEC 61000-3-3:Ed3.0(2013) EN 61000-3-3(2013)	IEC 61000-4-15:Ed2.0(2010) EN 61000-4-15(2011)

*1. EN standard names are also included in report printouts.
*2. Measuring technique standard that corresponds to limit value standard
IEC 61000-4-7:Ed2.0(2002), IEC 61000-4-7:Ed2.1(2009)
The window width in measuring technique standards is 0.2 second. It is 10 cycles at a basic frequency of 50 Hz and 12 cycles at a basic frequency of 60 Hz. Harmonic groups are measured out of harmonic waves and interharmonic waves.
IEC 61000-4-7(1991)
The window width in measuring technique standards is 0.32 second at a basic frequency of 50 Hz and 0.266 second at a basic frequency of 60 Hz (either is a basic frequency of 16 cycles). Harmonic groups are not measured.
JIS C61000-4-7(1997)
The window width in measuring technique standards is 0.32 second at a basic frequency of 50 Hz and 0.266 second at a basic frequency of 60 Hz (either is a basic frequency of 16 cycles). Interharmonic waves and harmonic groups are not measured.

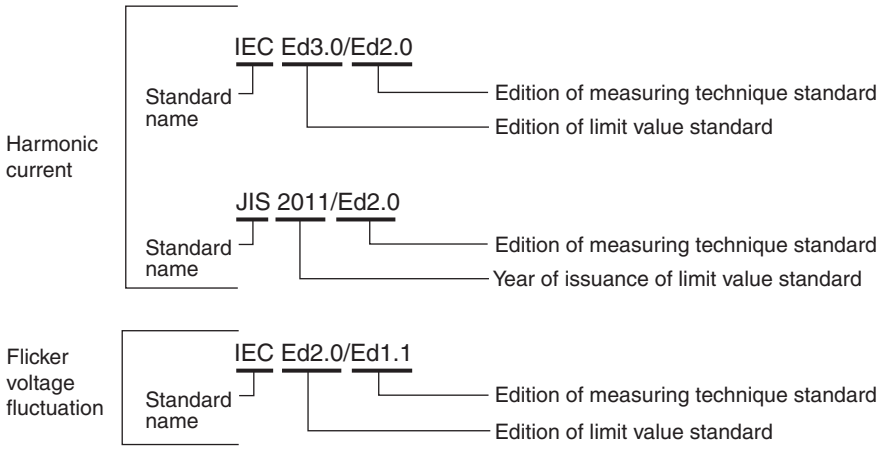


Fig.1-1 Rules for standard name notations

1.2.2 Test System

Fig.1-2 shows 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.

Test results are output to the screen of this product. Test conditions and test results can be saved to a compact flash card. Reports can also be saved.

The AC Power Supply can be controlled from this product. The Impedance Network cannot be directly controlled from this product.

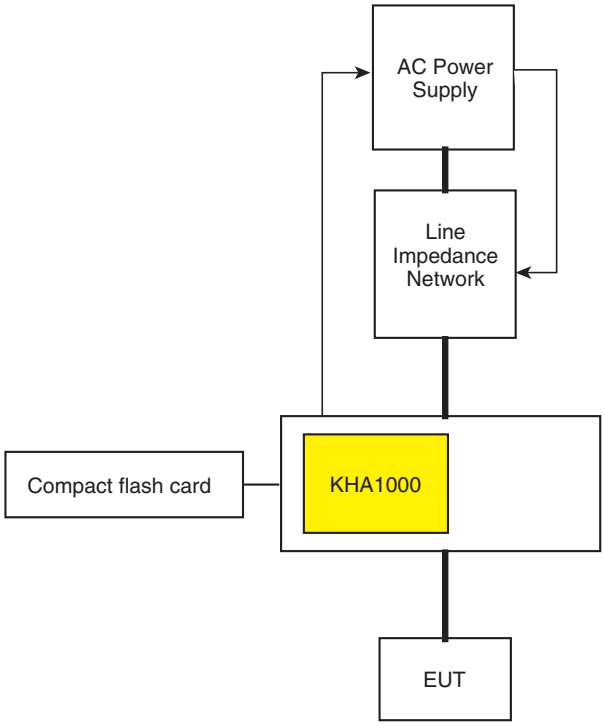


Fig.1-2 Test system

1.3 Features

- Test system that does not need a computer

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

- Pass/failure decision function

  An evaluation test for standards conformance can be made. The cause of a problem can be sought through the analytic function.

- Adaptation to revision backgrounds of standards

  This product can adapt to the revision backgrounds of limit value and measuring technique standards. In the measuring technique standards, whether to measure harmonic groups out of harmonic waves and interharmonic waves can be specified for the same limit value standard.

- **Customizing test conditions**

  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.

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

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

- **Correspondence to latest standards**

  Upgrade is possible for future revision of standards.

- **Simple connection**

  Connection is so simple that the EUT only has to be connected to the LOAD terminal. The voltage input terminal is internally routed.

- **Intuitive operation by dedicated keys**

  There are a number of dedicated keys that correspond to specific functions. Any desired function can be directly operated.

- **Real-time measurement**

  Measured values are displayed in real time. The status of the EUT can be displayed. Waveform measurement is possible.

- **External memory**

  Compact flash card is supported.

- **Remote control interface**

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

- **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.

- **Direct output to network printer (factory option)**

  Reports can be output through a network printer by using Ethernet communication.

- **Application software (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.

1.4 Options

1.4.1 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.

- 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 (Ed2.0).
- This unit has a front grounding terminal that can ground a 2P plug with a grounding conductor.
- The installation area is the same as this product, KHA1000. This unit can be placed under the KHA1000.

1.4.2 Ethernet Port (Factory Option)

Reports can be printed through a network printer by using Ethernet communication. Network protocol TCP/IP (LPR) is supported. The following printer definition formats can be selected.

- Text
- ESC/Page (page definition language that is expanded for page printers with printer control codes recommended by Seiko Epson.)
- PostScript (page definition language developed by Adobe Systems)

1.4.3 Rack Mount Bracket (KRB4, KRB200)

The rack-mount options listed below are available. The blank panel shown below is required for ventilation at the bottom part. For details, contact your Kikusui distributor or agent.

Table 1-2 Rack mounting options

Product name	Model No.	Model applied	Remarks
Rack-mount bracket	KRB4	KHA1000	For EIA standard inch rack
	KRB200		For JIS standard millimeter rack

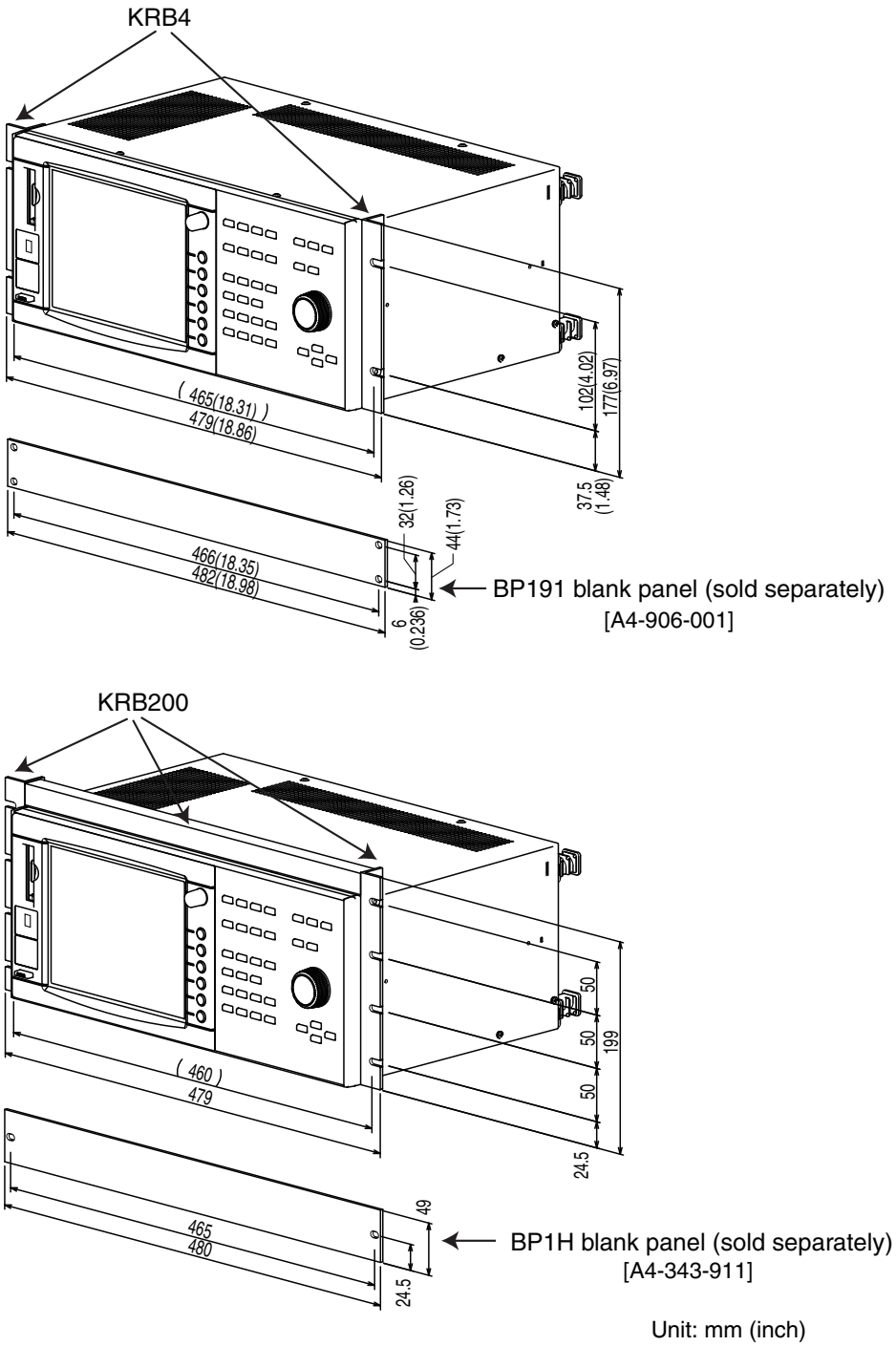
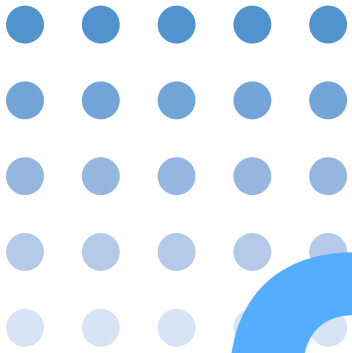


Fig.1-3 Rack mount brackets



2

Installation and Preparation for Use

This chapter explains the procedures for unpacking the product and connecting the test system.

2.1 Inspection during Unpacking

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

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

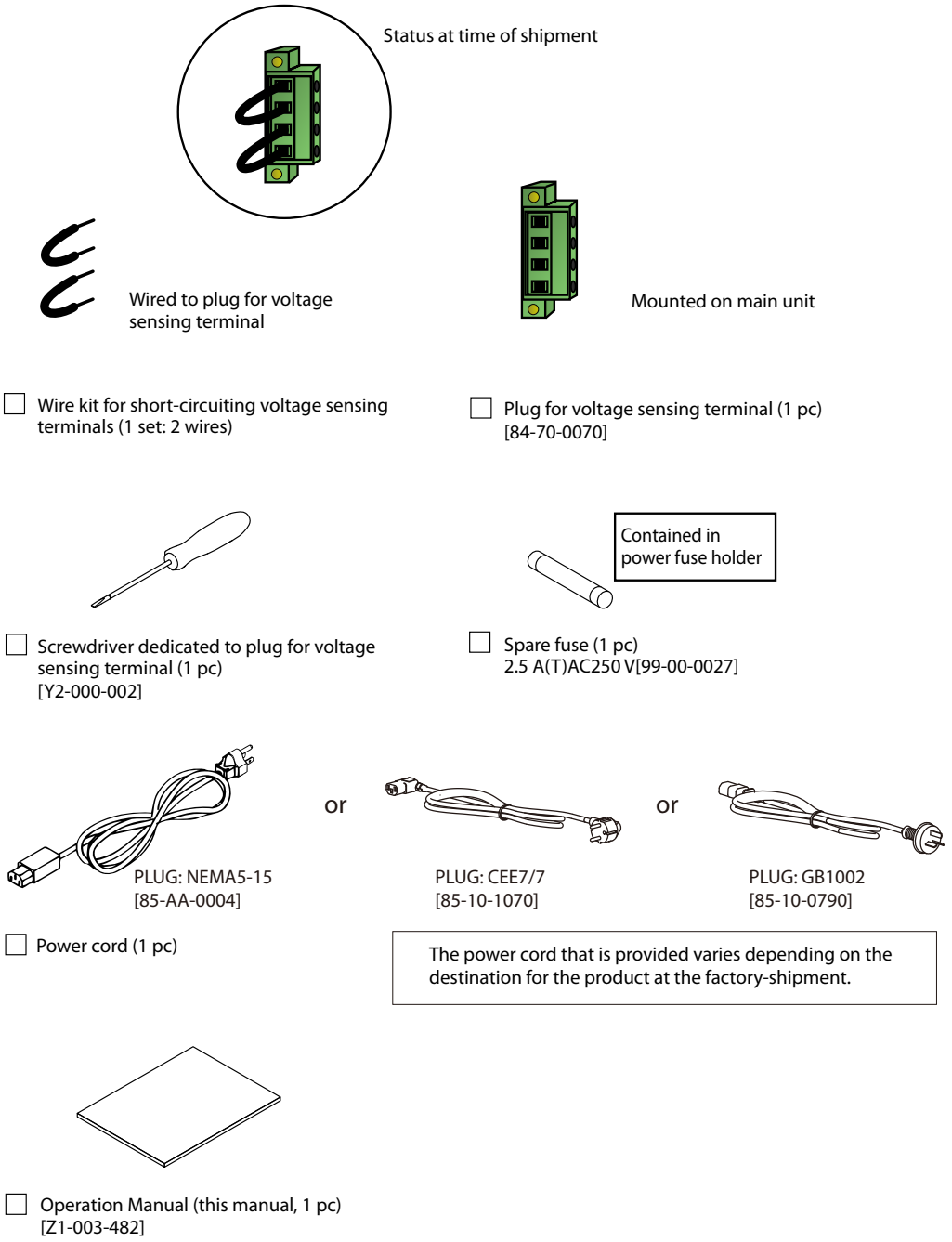


Fig.2-1 Accessories

2.1.1 Components Used in the Test System

Table 2-1 and Table 2-2 (page 2-4) list the components that are used in a harmonic current test and voltage fluctuation test system (excluding Fig.2-1 "Accessories"). The customer is requested to prepare accessories other than those listed in the tables.

General

Table 2-1 List of components (general)

Name	Purpose	See
RS232C cable	• For remote control (cross cable)	"RS232C Interface" on page 8-5
GPIB cable	• For remote control	"GPIB Interface" on page 8-4
Rack mount bracket	• For mounting on rack • Optional product	"Rack mount brackets" on page 1-7
Blank panel for rack mounting	• For mounting on rack • Optional product	
Switch or circuit breaker	• Used to connect commercial power supply (AC line) directly to this product without using AC power supply for test	"Switch or circuit breaker to be used for direct connection to commercial power supply (AC line)" on page 2-17
Power cable	• Used to connect commercial power supply (AC line) directly to this product	
Compact flash card	• Insert in the dedicated slot of this product to save test results and printed reports. • Use an operation-verified card.	"External Memory (Compact Flash Card)" on page 4-27

Harmonic current test and voltage fluctuation test system

Table 2-2 Components (harmonic current test and voltage fluctuation test system)

Name	Purpose	See No. indicated in Fig.2-2 on page 2-5
Power cable 1	• Connects AC Power Supply to Line Impedance Network.	1
Power cable 2	• Connects Line Impedance Network to this product.	2
Power cable 3	• Connects EUT to this product.	3
Relay outlet	• Connects EUT to this product. • Used when EUT has a cord with a plug. • Outlet shape must suit the plug.	4
Wire kit for short-circuiting voltage sensing terminals	• For voltage sensing in this product UL1015 and AWG18 wires. • Wired to voltage sensing terminal plug at the time of shipment.	5
Wire for externally connecting voltage sensing terminal	• For voltage sensing when the wire to EUT is long UL1015 and AWG18 wires.	6
Cable for AC Power Supply control signal	• Connects AC Power Supply to this product. RS232C cable (cross cable)	7
Cable for Line Impedance Network control signal	• Connects AC Power Supply to Line Impedance Network. • Attached to Line Impedance Network (mini DIN connector type cable).	8
Control card for Line Impedance Network	• Connects cable for Line Impedance Network control signal. • Attached to Line Impedance Network.	9
LAN cable (category 5)	• Connects to network printer (only when factory option is mounted).	10

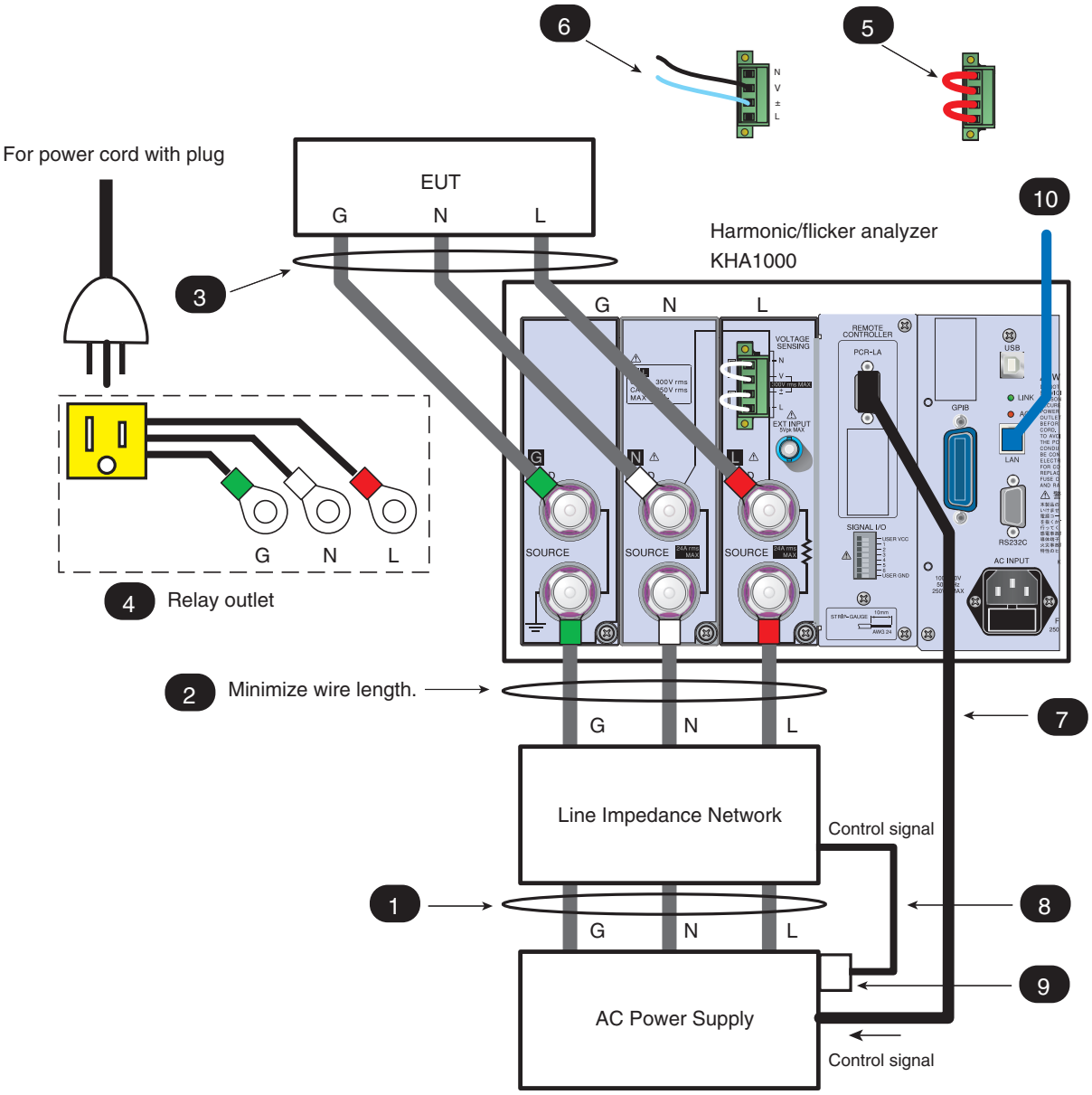


Fig.2-2 Components used in test system

2.2 Notes on Installation Location

Install this product indoors, observing the following conditions:

- 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)
  Temperature range guaranteed by specification: 23±5 °C (73±41 °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)
  Humidity range guaranteed by specification:
  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 can be used to tilt the front panel. They are intended to allow easy viewing of the screen and to enhance operability.

Use the stands on the floor, raising them until they click into place.

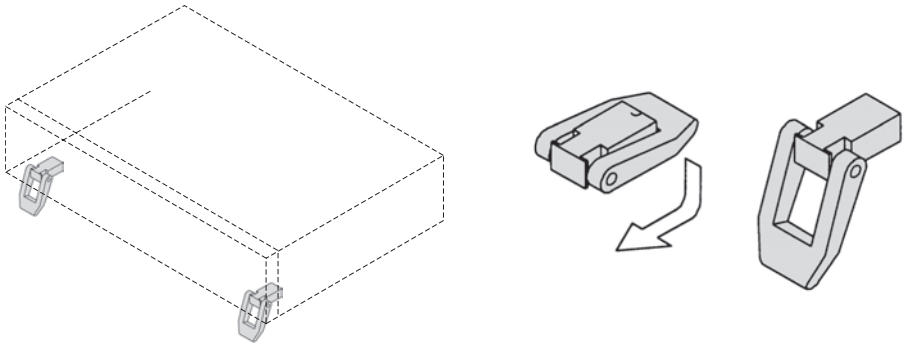


Fig.2-3 Usage of stands

⚠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 Page 1-6

Before mounting this product on the rack-mount bracket, remove the handle and side-panel rubber pads. Figure 2-4 shows the proper procedure for doing this.

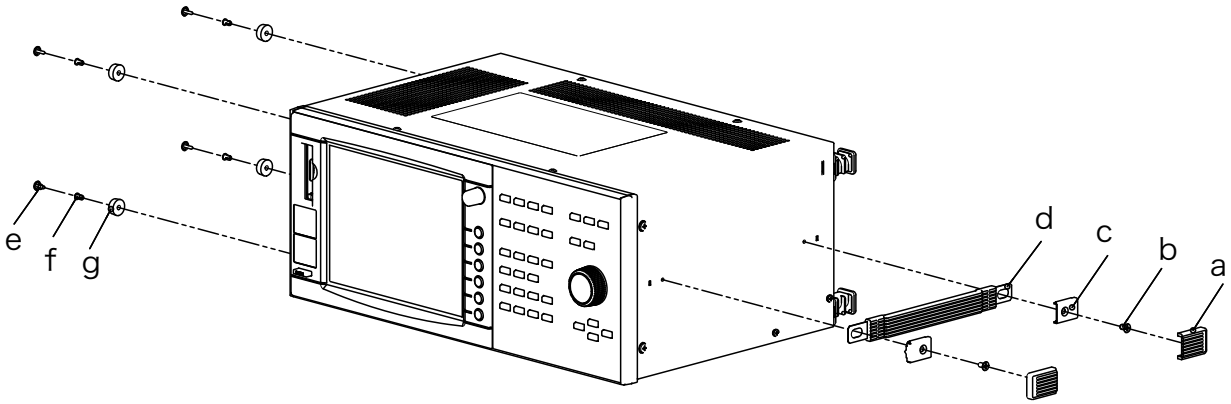


Fig.2-4 Removing the handle and side-panel rubber pads

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.

2.3 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.

- Fold down the stands.

  Transferring this product with the stands raised may result in damage to the stands.

- 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.

2.4 Connecting the Rear-side Terminals

⚠WARNING • **To prevent an electric shock, be sure to remove the power cord from the outlet or turn off the POWER switch.**

The L and N polarities of the LOAD and SOURCE terminals conform to IEC standard measurement category CAT I or CAT II. This category depends on the input voltage (Table 2-3).

Table 2-3 Measurement categories

Input voltage	Measurement category
250 Vrms(exclusive) to 300 Vrms	CAT I: Measures circuits that are not directly connected to commercial power.
250 Vrms or less	CAT II: Measures the primary-side circuits of devices (such as home electric appliances and portable tools) that are directly connected to low-voltage fixtures such as outlets.

2.4.1 Connecting EUT (LOAD Terminal)

Connect the equipment under test to the LOAD terminals. Match the polarities (L, N, and G) of the terminals and equipment under test to each other. (G is a protective grounding or grounding terminal.)

When the equipment under test has a power cord with a plug, connect it to the LOAD terminals using a relay outlet. Match the polarities (L, N, and G) of the terminals and relay outlet to each other. (G is a protective grounding or grounding terminal.)

The customer is required to obtain the relay outlet according to the measurement environment.

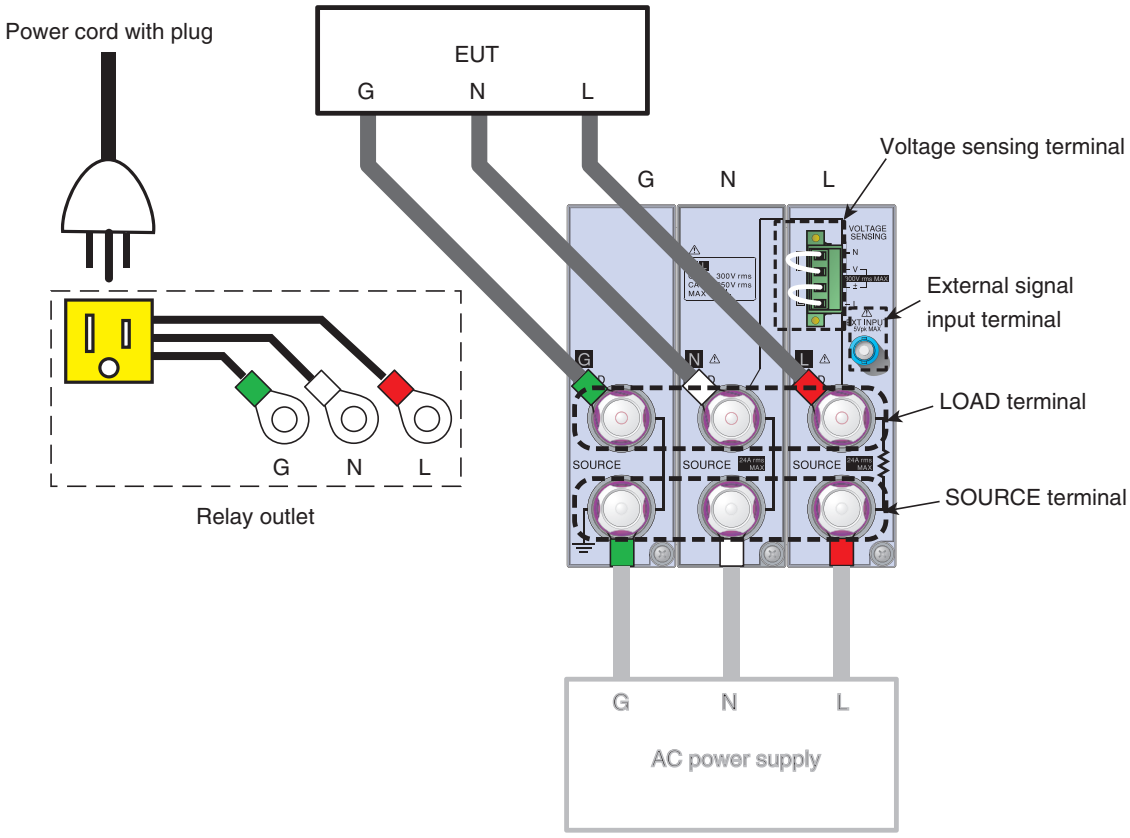


Fig.2-5 Connecting the input terminals

■ Using the terminal cover

To prevent an electric shock, covers are attached to the LOAD and SOURCE terminals. Use these terminals as shown in Fig.2-6.

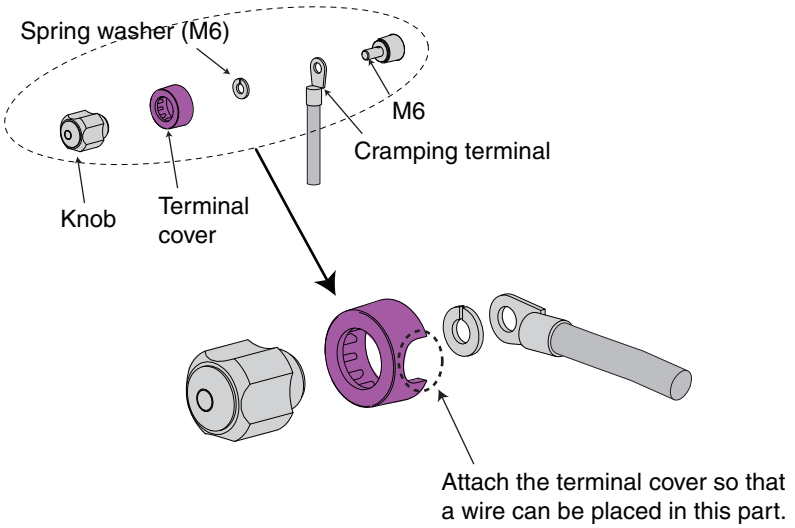


Fig.2-6 Details on connecting LOAD and SOURCE terminals

■ Wire to be used, and its terminal treatment

Select the wire according to the input current of the EUT. Table 2-4 lists selection standards. Similarly, select the wire to be used in the relay outlet. Use the relay outlet with minimized wire length 1.5 m or shorter is recommended.

Table 2-4 Nominal cross-sectional area and allowable current for wire

Nominal cross-sectional area [mm^2]	AWG	(Reference cross-sectional area) [mm^2]	Allowable 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.

Attach a cramping terminal to terminate the wire.

Use a cramping terminal that has a screw mounting part with a hole diameter of 6 mm and fits the wire.

2.4.2 Connecting EUT (Multi-outlet Unit)

When the EUT has a power cord with a plug, it cannot be connected directly to the LOAD terminal. To connect devices with a wide range of plugs of various countries, use the optional OT01-KHA multi-outlet unit. For details on the connection, refer to the OT01-KHA Operation Manual.

NOTE

- To execute a test using the OT01-KHA multi-outlet unit according to harmonic current test standard IEC 61000-3-2 (Ed4.0), (Ed3.0), (Ed2.2), JIS C61000-3-2 (2005) or JIS C61000-3-2 (2011), input current of the EUT should be a maximum of 5 A. Because the multi-outlet unit has impedance including the contact resistance of the outlet part, attention must be paid to the requirements of IEC Standard 61000-4-7 (voltage drop caused by wiring impedance) in a test system.

2.4.3 Wiring Voltage Sensing Terminal (VOLTAGE SENSING)

The voltage sensing terminals are connected to the terminals of the EUT. Voltage sensing includes the following:

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

At the time of shipment, the LOAD terminal sensing is set. Voltage sensing terminals N and V and ± and L have been short-circuited with the accessory wire kit for short-circuiting the voltage sensing terminals. Voltage sensing should be used with the setting at the time of shipment as much as possible.

Select the sensing at the connection end of the EUT when the voltage drop is appreciable, for example, when the wire to the EUT is long. To measure the voltage at the end of the EUT, connect the voltage sensing terminals directly to the EUT (See Fig.2-7).

NOTE

- When long wires are used to connect the EUT with the LOAD terminals of this product, the requirements of IEC Standard 61000-4-7 may not be met. Use the system, minimizing the wire length 1.5 m or shorter is recommended.

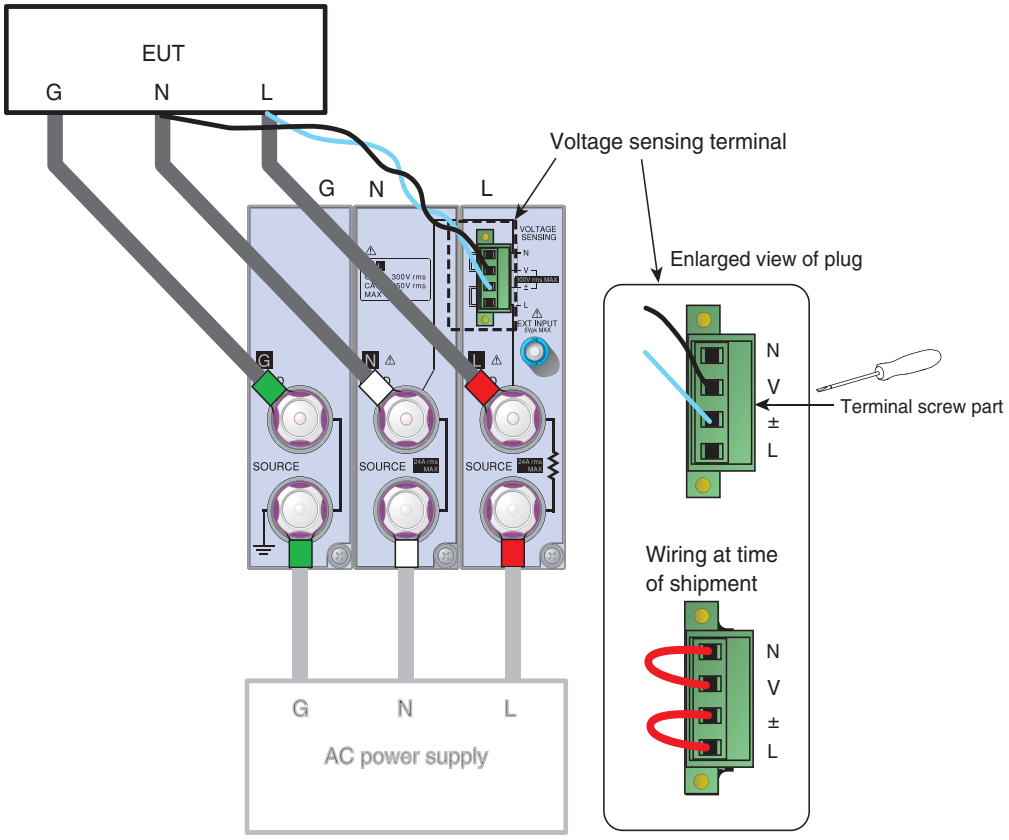


Fig.2-7 Voltage input sensing, and wires used

Use wires UL1015 and AWG18 with a conductor exposure margin of 10 mm (indicated on the rear panel). To secure the wires, tighten the screw part of the terminal with the accessory screwdriver.

2.4.4 Connecting the AC Power Supply or Line Impedance Network (to SOURCE Terminals)

Connect the AC power supply or line impedance network to the SOURCE terminals. Match the polarities (L, N, and G) of the terminals and the output terminal polarities of the AC power supply or line impedance network to each other (G is a protective grounding or grounding terminal).

■ Using the terminal covers

See Fig.2-6

To prevent an electric shock, covers are attached to the LOAD and SOURCE terminals.

■ Wire to be used and terminal treatment

See Table 2-4

Select a wire according to the input current of the EUT. Attach a cramping terminal to terminate the wire. Use a cramping terminal that has a screw mounting part with a hole diameter of 6 mm and fits the wire.

2.5 Connecting the Test System

Use the Line Impedance Network in harmonic current tests (JIS C61000-3-2 (2011), JIS C61000-3-2 (2005) and JIS C610003-2 (2003)) and a voltage fluctuation test (IEC 61000-3-3 (Ed1.2)).

The impedance is not used in IEC 61000-3-2 (Ed4.0), IEC 61000-3-2 (Ed3.0), and IEC 61000-3-2 (Ed2.2). In JIS C61000-3-2 (2003), the impedance is always used. In JIS C61000-3-2 (2005) and JIS C61000-3-2 (2011), the impedance may be used if test results have variations (optional). In a voltage fluctuation test (IEC 61000-3-3 (Ed2.0)), the impedance is used to measure current fluctuations that are generated by voltage fluctuations and flicker.

⚠WARNING • **To prevent an electric shock, be sure to remove the power cord of a devices used in a test system or turn off the POWER switch.**

■ Setting line impedance values

Standard	Setting Line Impedance Network
IEC 61000-3-2(Ed4.0) IEC 61000-3-2(Ed3.0) IEC 61000-3-2(Ed2.2)	Bypass (THRU)*1
JIS C61000-3-2(2005) JIS C61000-3-2(2011)	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)
JIS C61000-3-2(2003)	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)
IEC 61000-3-3(Ed2.0)	0.4 Ω + j0.25 Ω

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

2.5.1 Connecting the AC Power Supply and Line Impedance Network

Connect to the OUTPUT terminals of the AC Power Supply and those of the Line Impedance Network. Match the polarities (L, N, and G) of the terminals and the output terminal polarities of the AC Power Supply or Line Impedance Network to each other (G is a protective grounding or grounding terminal). For details, refer to the Operation Manuals of the AC Power Supply and Line Impedance Network.

See Table 2-4

Select the wire to be used according to the input current of the EUT. A nominal cross-sectional area of 8 mm^2 or larger should be used. Be sure to minimize the wire length.

NOTE

- The wiring have impedance. In a test system, attention must be paid to the requirements of IEC Standard 61000-4-7 (voltage drop caused by wiring impedance).

■ Cable for control signal

This cable is used to control the AC Power Supply and Line Impedance Network.

AC Power Supply: RS232C cable (cross cable)

Line Impedance Network: Mini DIN connector type cable (attached to Line Impedance Network).

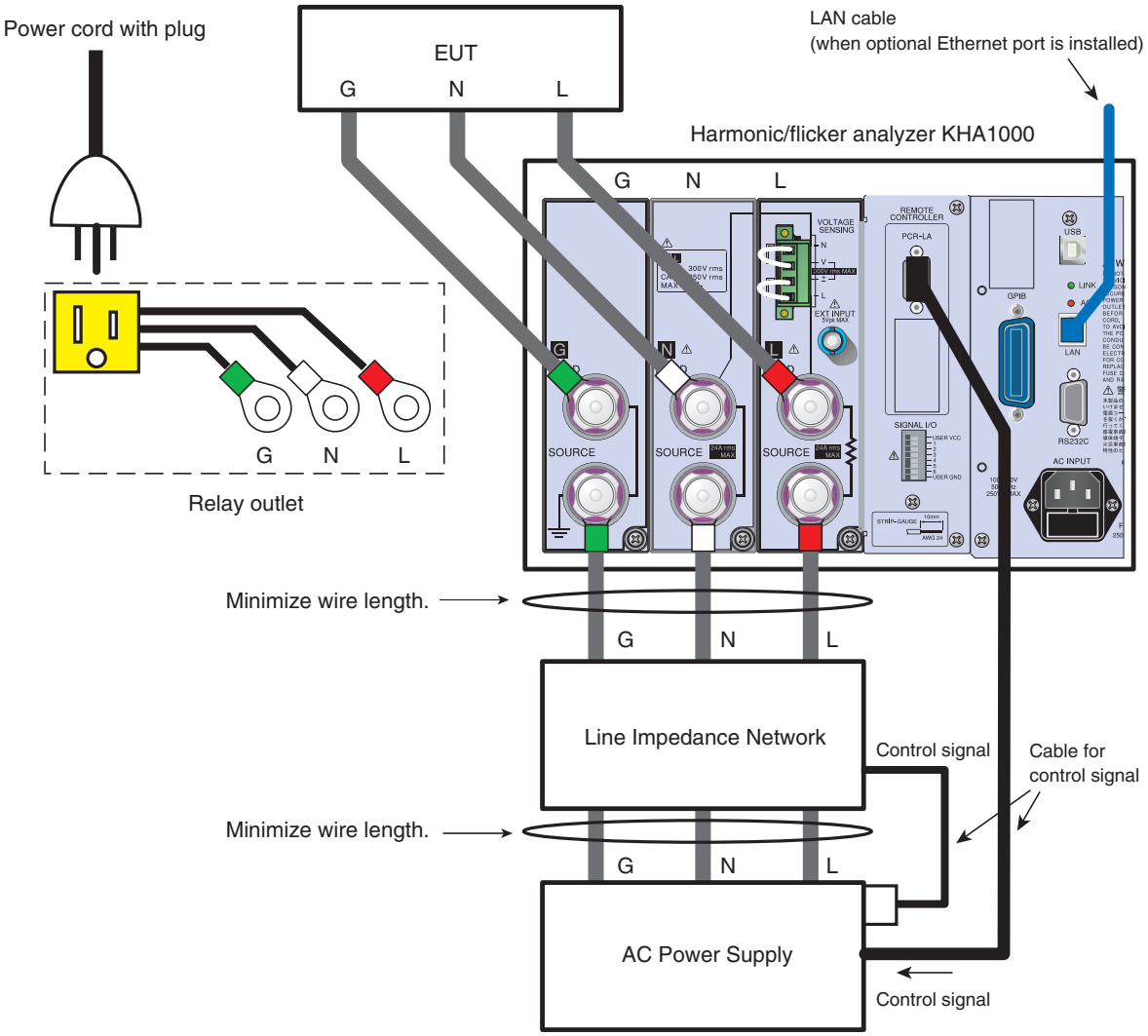


Fig.2-8 System connection

2.5.2 Connecting the Ethernet Port

See xviii , Page 4-14

This is an optional function for connection to a network printer. It is a factory option. When the optional function is installed, the Ethernet port is mounted on the rear side. Connect to the network using a Category 5 LAN cable or higher (RJ-45).

To connect to the network via the hub, use a straight cable. To connect directly to the printer, use a cross cable.

For details on setting Ethernet communication conditions, see Section 4.4.2 "Setting the Date/Time, TCP/IP (Network Protocol) and Printer".

2.5.3 External Signal Input Terminal (EXT INPUT)

This terminal has no function. It is equipped for function expansion.

2.6 When the SOURCE Terminal is Connected Directly to Commercial Power Supply (AC Line)

See Page 7-9

In directly connecting the SOURCE terminal to the commercial power supply (AC line) without an AC power supply, such as when measuring rush current, use a switch or circuit breaker that can disconnect this product from the commercial power supply (AC line) (Fig.2-9) for safety.

⚠WARNING

- **You may receive an eclectic shock. To install a switch or 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.**
- **Set the current rating of the switch greater than the input current of the EUT.**
- **Use a bipolar switch circuit that can simultaneously shut off L and N.**

The L and N polarities of the LOAD and SOURCE terminals conform to IEC standard measurement category CAT I or CAT II. This category depends on the input voltage (Table 2-3).

■ Wire used, and terminal treatment

See Table 2-4

Select the wire according to the input current of the EUT. Mount a cramping terminal to terminate the wire. Use a cramping terminal that has a switch mounting part with a hole diameter that fits the switch or circuit breaker.

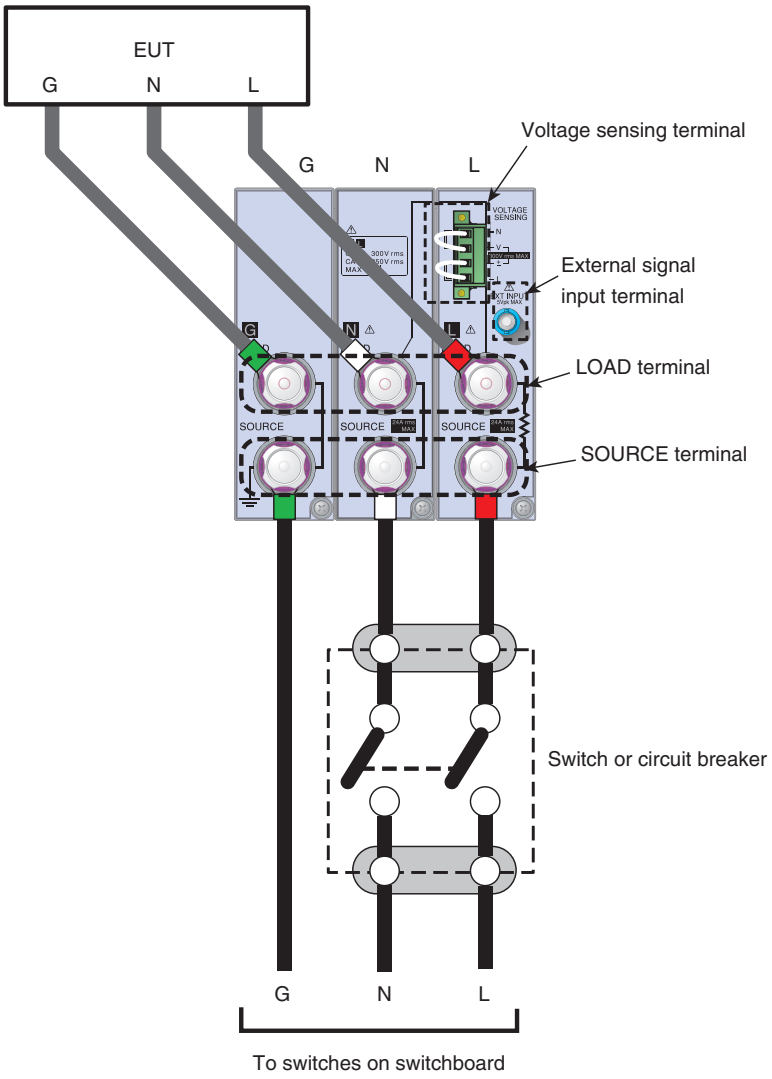


Fig.2-9 Switch or circuit breaker to be used for direct connection to commercial power supply (AC line)

1. Turn off the switches on the switchboard.
2. Connect the grounding terminal on the switchboard to G of the SOURCE terminal.
   The customer is required to obtain an installation wire. Select the rated current of the wire according to the input current of the EUT.
3. As shown in Fig. 2-9, install the switch or circuit breaker between the SOURCE terminal and the commercial power supply (AC line).
   Match the polarities (L, N, and G) of the terminal and switchboard to each other. The customer is requested to prepare the switch or circuit breaker and wires.
   Turn on the switches on the switchboard and installed switch or circuit breaker immediately before starting a test.

See page 4-4

2.7 Connecting Power Cord

WARNING

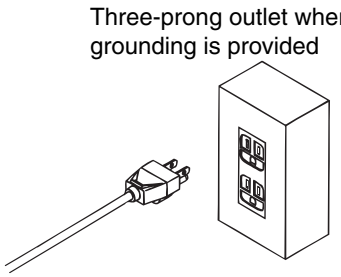
- **To avoid electric shock:**
  This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent an electric shock, be sure to ground it.
- **The product is grounded through the power cord ground wire. Connect the protective conductor terminal to earth ground.**

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 designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).

1. 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.
2. Check that the POWER switch is OFF.
3. Connect the power cord to AC INPUT on the rear panel.
4. Insert the power cord plug into the outlet.



To First-time Users of This Product

This chapter explains how to utilize the product's features and the operating screen views.

3.1 Providing Security for Users Not Familiar with Test Standards

Assist function

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. An explanation for the current menu item can be viewed. Standards terms can also be viewed. This function can be used at any time.

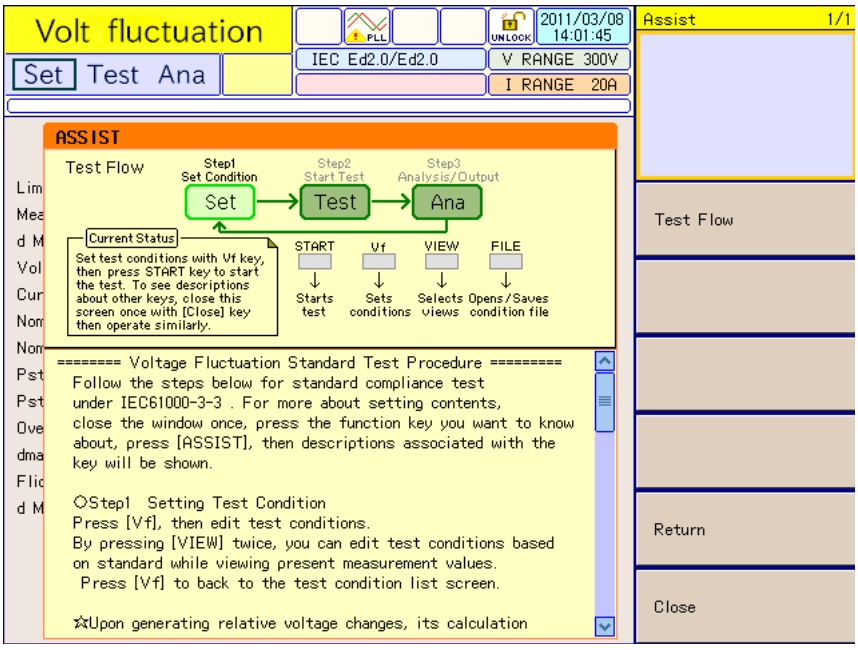


Fig.3-1 Example of assist function

■ 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.

3.2 Immediate Identification of the Status of EUT

Steady measurement state

See Page 5-23, Page 6-7

Because this product is in a steady measurement state, the user can set test conditions while making measurements.

The time until a test is started can be reduced.

If the graph and list displays of an item that the user wants to measure is set in advance, the status of the EUT can be determined before the test.

3.2.1 Harmonic Current Test

Graph display

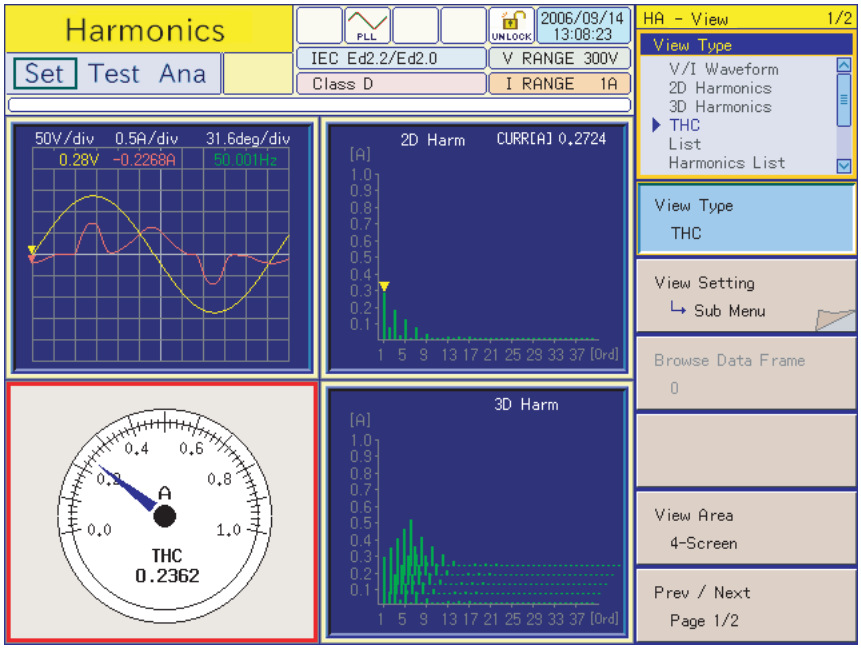


Fig.3-2 Example of graph display (4-screen)

■ V / I waveform

Voltage and current waveforms can be observed in the same way as an oscilloscope.

Amplitude fluctuations can be observed in real time.

Vertical scales can be set separately.

Waveforms can be enlarged and reduced.

The input waveform of the EUT can be observed.

The phase progress or delay of current to voltage can be roughly determined.

■ 2D harmonics

Harmonic current is represented in units of orders. Harmonic fluctuations can be viewed every hour. Small, high-order harmonics can be enlarged by raising the vertical scale sensitivity.

■ 3D harmonics

Harmonic current is represented in units of orders. The time transition of harmonics can be viewed in 3D display. Small, high-order harmonics can be enlarged by raising the vertical scale sensitivity.

■ THC (Total Harmonic Current)

Total harmonic current (THC) is the effective value of the harmonic current components from the 2nd to 40th orders.

The THC can be observed in real time. It is used to find the maximum THC by changing the operating conditions of the EUT.

THC was introduced in IEC 61000-3-2 (Ed4.0), IEC 61000-3-2 (Ed3.0), IEC 61000-3-2 (Ed2.2), JIS C61000-3-2 (2005) and JIS C61000-3-2 (2011). The EUT, for which the test conditions are not specified in the standards, is tested under usual operating conditions in operation mode in which the maximum THC is generated.

List display

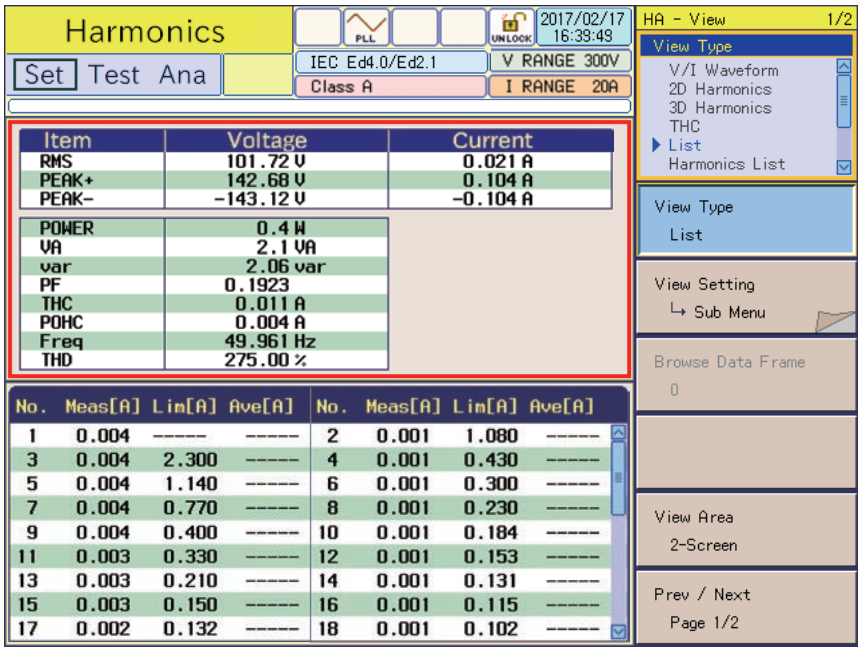


Fig.3-3 Example of list display (2-screen)

■ List

Measurement items are displayed as a list. The display items below are available. They can be selectively displayed.

- RMS (effective value rms): Effective values of input voltage and current
- PEAK+ (peak+): Peak value of positive amplitude of input voltage and current
- PEAK- (peak-): Peak value of negative amplitude of input voltage and current

- POWER (effective power): Effective power W of EUT
- VA (apparent power): Apparent power VA of EUT
- var (reactive power): Reactive power of EUT
- PF (power factor): Power factor of EUT
- THC: Total harmonic current of input current, effective value of harmonic current components from 2nd to 40th orders
- POHC: Harmonic current of partial odd order of input current, effective value of harmonic current components of odd orders from 21st to 39th orders
- Freq (frequency): Input frequency measured at input voltage
- THD (total harmonic distortion): Total harmonic distortion of the input current. The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

■ Harmonics list

Harmonic current in each order can be measured in real time. A limit value for the class of a device that is set in advance is also displayed.

Measured values exceeding a limit value are displayed in red. This cannot be used for standards conformance determination, but it enables estimation.

3.2.2 Voltage Fluctuation Test

Graph display

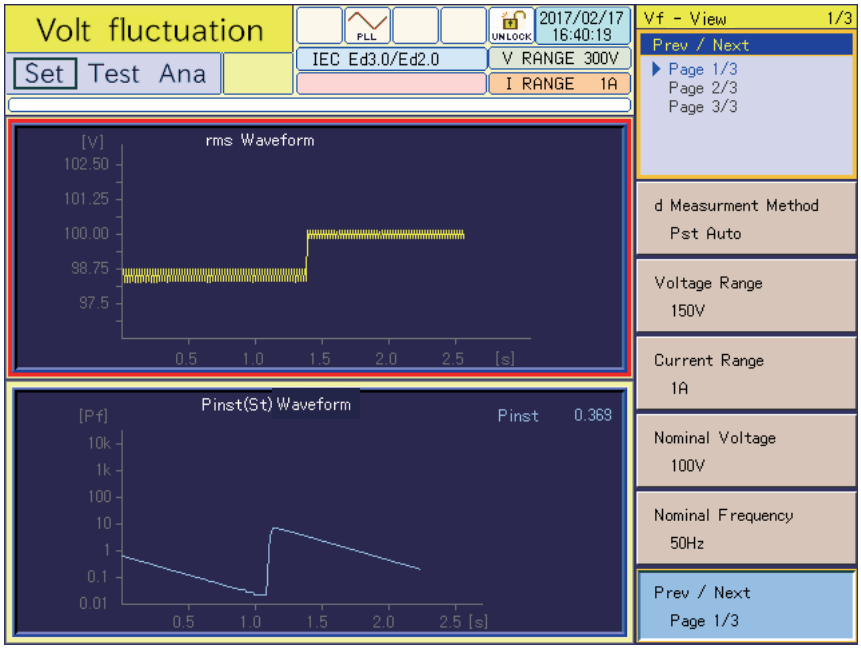


Fig.3-4 Example of graph display (2-screen)

■ rms waveform

The time transiting of input voltage, effective values is displayed. Hourly fluctuations can be viewed.

■ Pinst (St) waveform

Real-time waveform of Pinst (St) (momentary flicker value) is shown. Constant change can be monitored.

3.3 Features of the Test System

This section explains the features of a test system using the AC Power Supply and Line Impedance Network.

- Computer not required
- Capable of remote-controlling AC Power Supply
- Controlling the Line Impedance Network from the AC Power Supply
- Including power performance check function

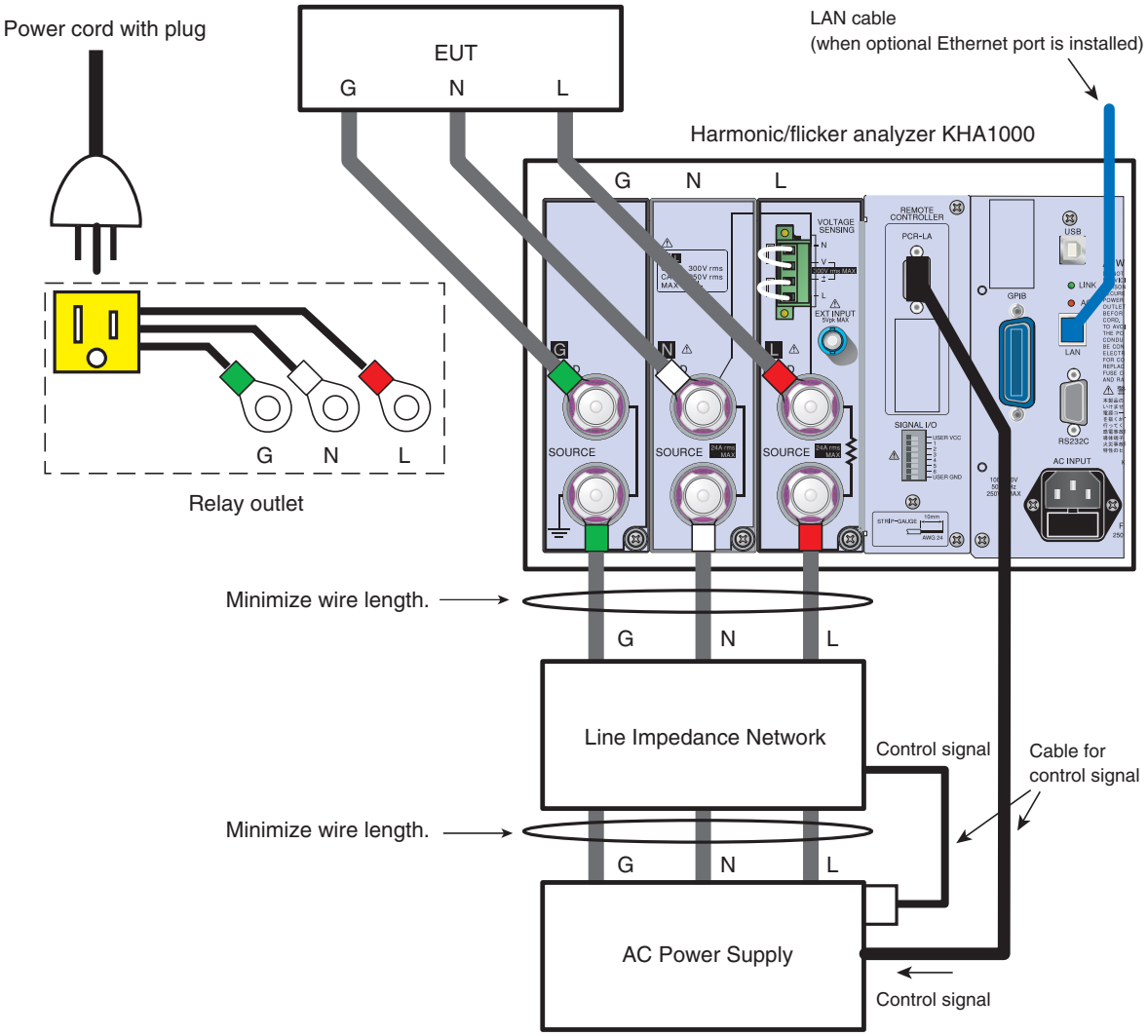


Fig.3-5 Test system using this product

Computer not required

This product does not need a computer. It has a standard testing function for harmonic current and voltage fluctuations. Standards conformance determination and analytic functions are included.

AC Power Supply not requiring direct operation

The AC Power Supply can be controlled from this product.

Power performance check function available

See Page 5-36

This function checks the performance of the AC Power Supply including the wiring impedance of a test system.

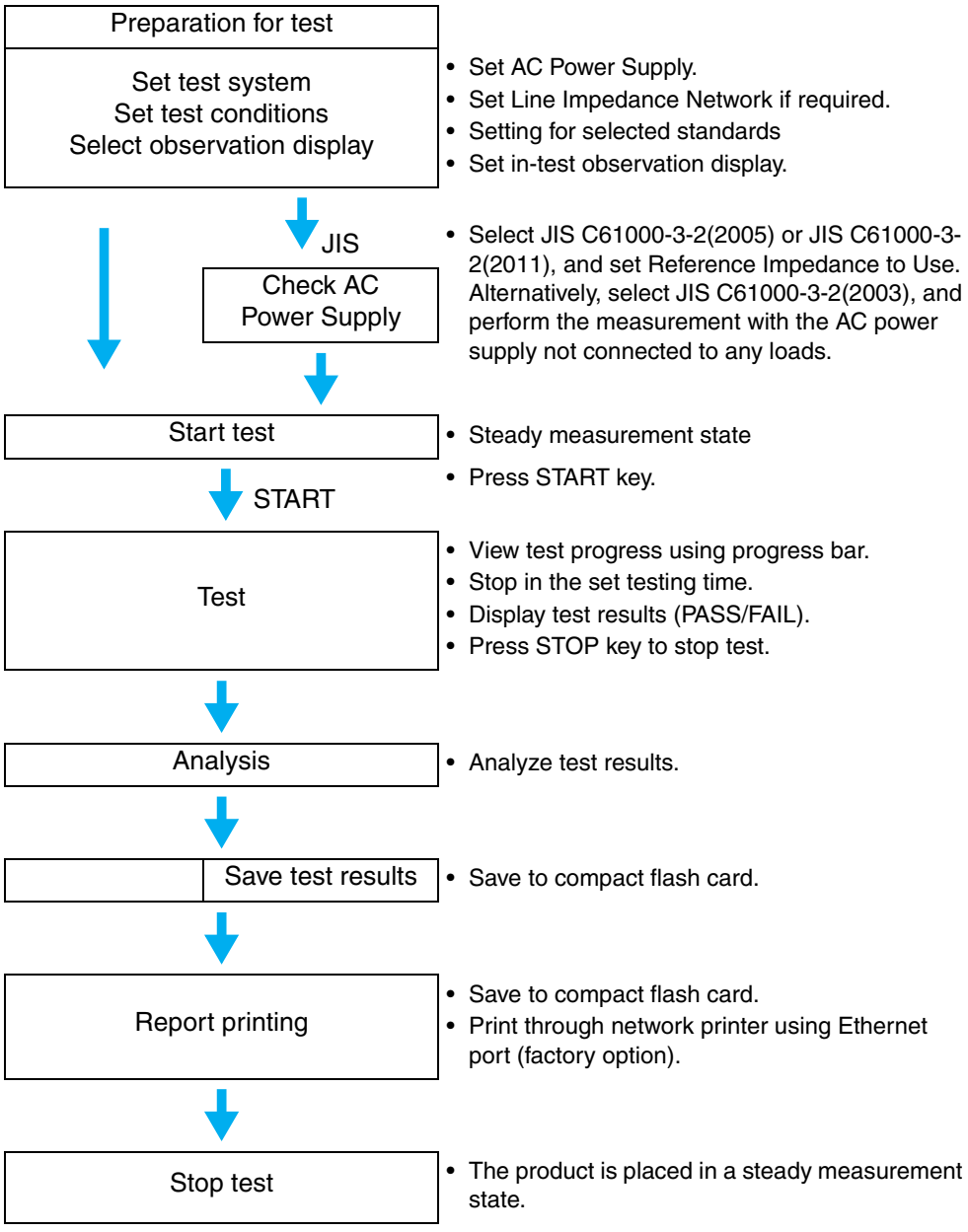
When a connection cable to an EUT is long, standards requirements may not be met because of an increase in voltage drop and inductance.

3.4 Test Perspective

Harmonic current test

- IEC 61000-3-2(Ed4.0)
- IEC 61000-3-2(Ed3.0)
- IEC 61000-3-2(Ed2.2)
- JIS C61000-3-2(2005)
- JIS C61000-3-2(2011)
- JIS C61000-3-2(2003)

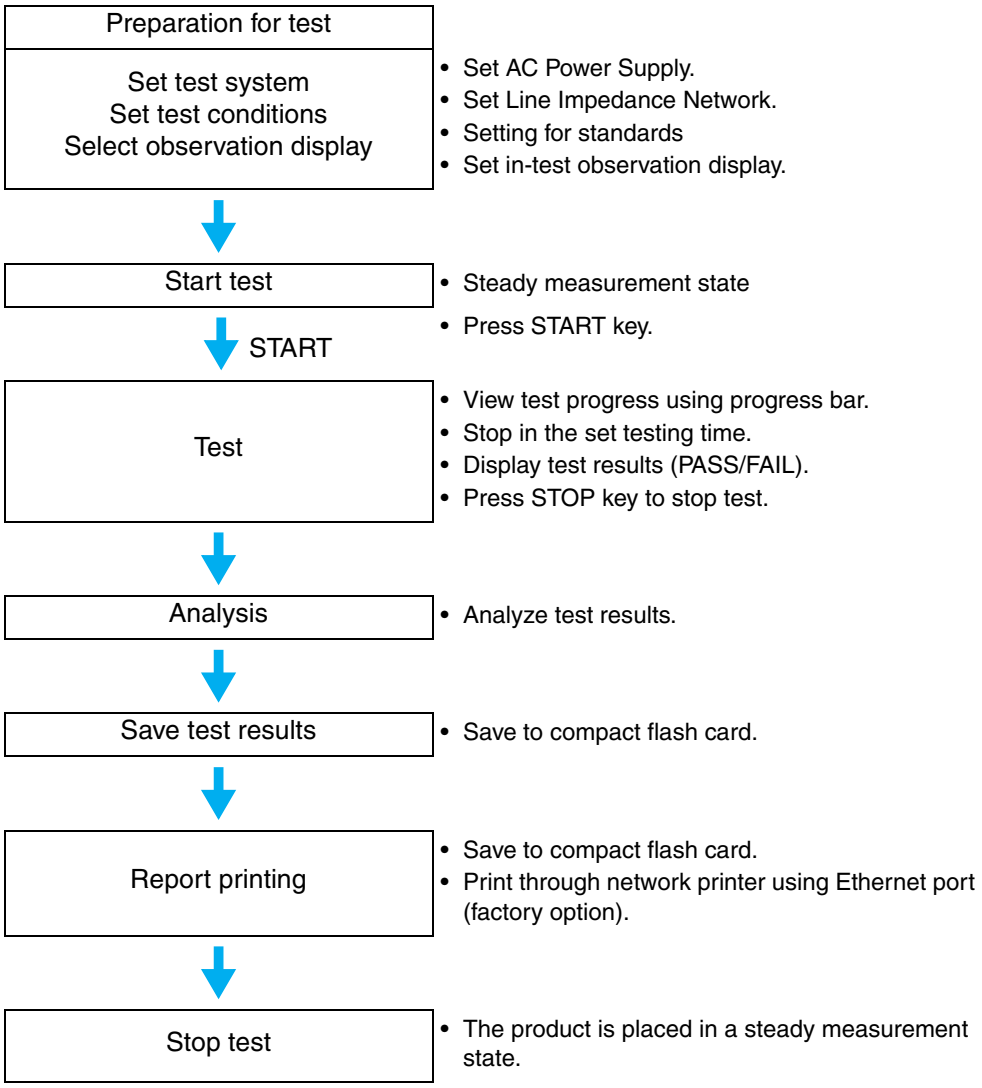
Steps from setting test conditions to printing reports are shown below.



Voltage fluctuation test

- IEC 61000-3-3(Ed2.0)

Steps from setting test conditions to printing reports are shown below.



3.5 Display Operation

See Page 5-1, Page 6-1

Types and names of basic windows

The basic displays 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	See Page
HA-Test Conditions List Display	3-12
HA-Observation and Analysis Display (HA-VIEW)	3-13
HA-Observation and Test Conditions Display	3-12

Voltage fluctuation testing displays	See Page
Vf-test Conditions List Display	3-14
Vf-Observation and Analysis Display (Vf-VIEW)	3-15
Vf-Observation and Test Conditions Display	3-14

System and other displays	See Page
File Manipulation Display	3-17
EXT Control Display	3-18
System Setting Display	3-18
ASSIST Display	3-19
Other Measurement Displays	3-16

View structure of harmonic current and voltage fluctuation test

Display	Outline	Operation before starting the test	In-test operation	Operation during analysis
HA-Test Conditions List Display	• Test conditions setting • Specific display pattern	Possible	Not possible	
HA-Observation and Analysis Display (HA-VIEW)	• Observation or analysis • Display can be customized.		Possible*1	
HA-Observation and Test Conditions Display	• Observation or test conditions setting • Display can be customized.		Not possible	
Vf-Test Conditions List Display	• Test conditions setting • Specific display pattern		Not possible	
Vf-Observation and Analysis Display (Vf-VIEW)	• Observation or analysis • Display can be customized.		Possible*1	
Vf-Observation and Test Conditions Display	• Observation or test conditions setting • Display can be customized.		Not possible	

*1. Operation for analysis time only is included.

Displays selection and transition

Press the HA key to display the HA-test conditions list display (the HA key LED illuminates.)

Every time the VIEW key is pressed with the HA key LED illuminated, the HA-observation and analysis display (HA-VIEW) and the HA-observation and test conditions display switch with each other.

Press the Vf key to display the Vf-test conditions list display (the Vf key LED illuminates). The toggle operation using the VIEW key is similar to that of the HA related displays.

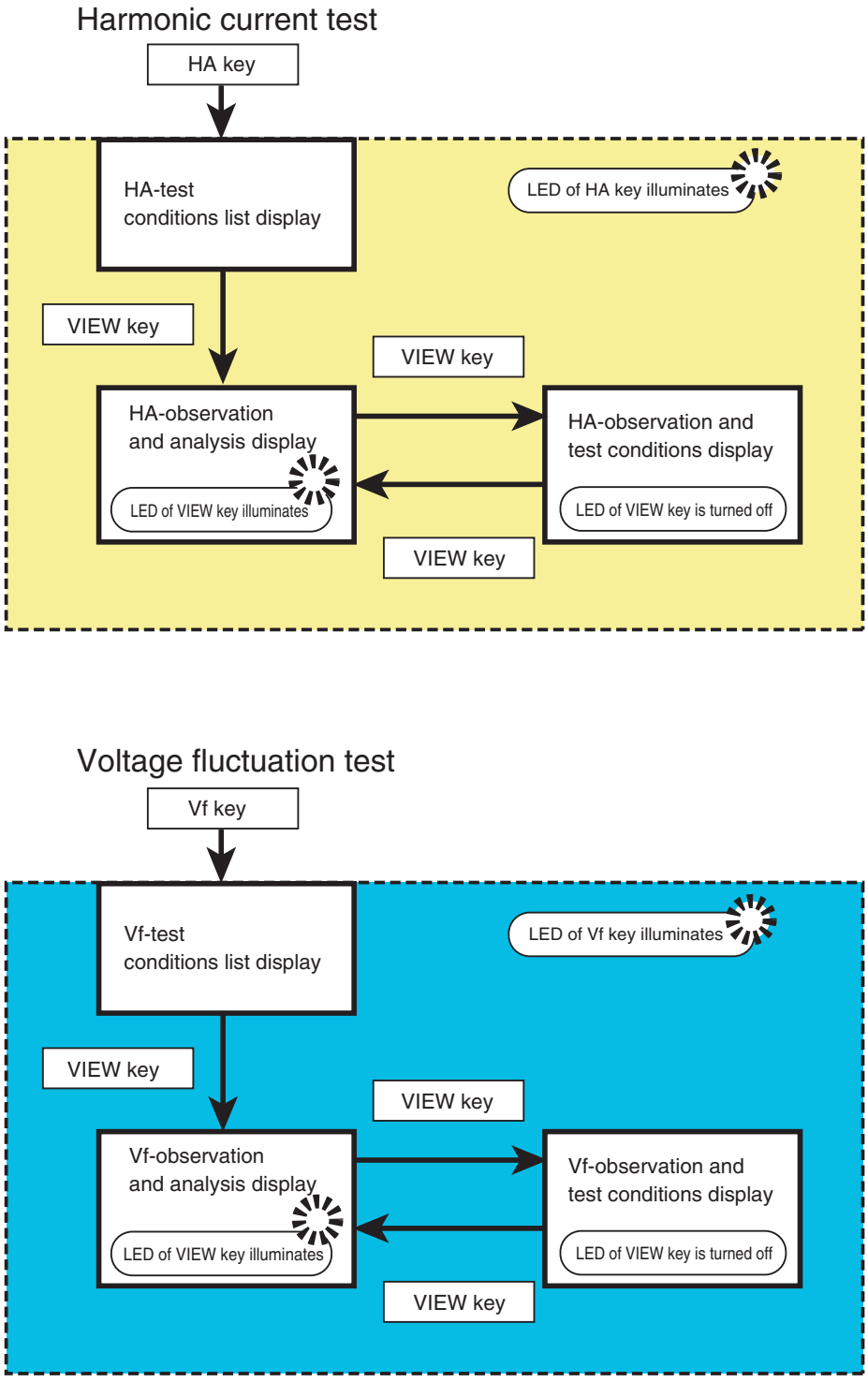
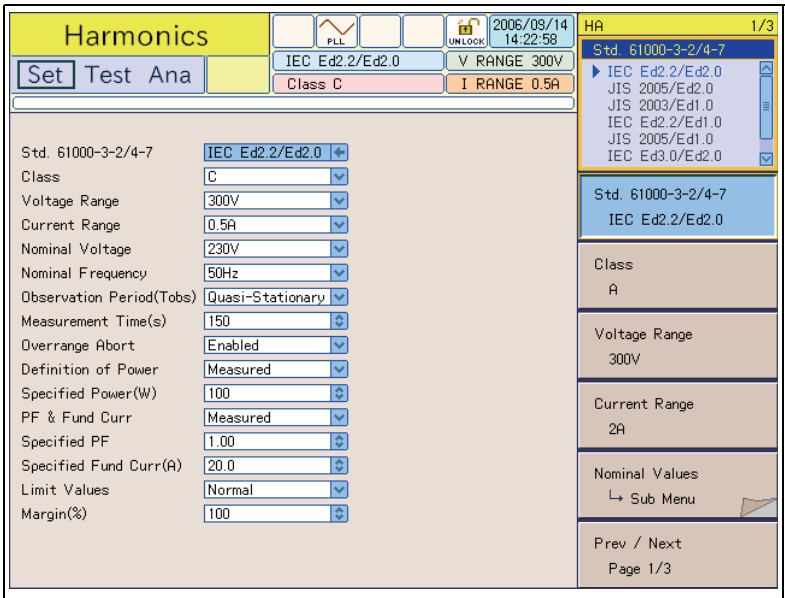


Fig.3-6 Display structure of harmonic current and voltage fluctuation test

3.5.1 Basic Views for Harmonic Current Test

Three basic displays (HA-test conditions list, HA-observation and analysis, and HA-observation and test conditions displays) are available.

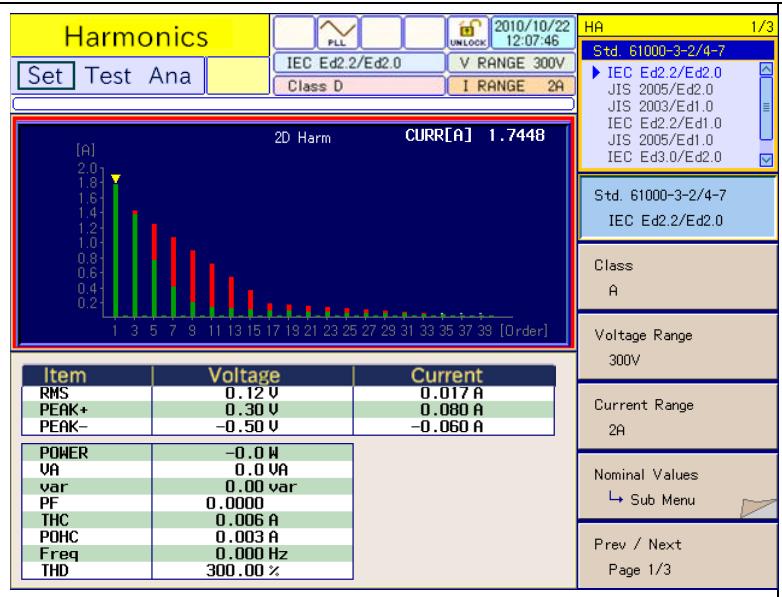
HA-test conditions list display



- Used to set the test conditions
- Specific window patterns (5 types according to measurement standards)
- Menu items are the same as the HA-observation and test conditions window.

Press the HA key to display the HA-test conditions list display. The HA key LED illuminates.

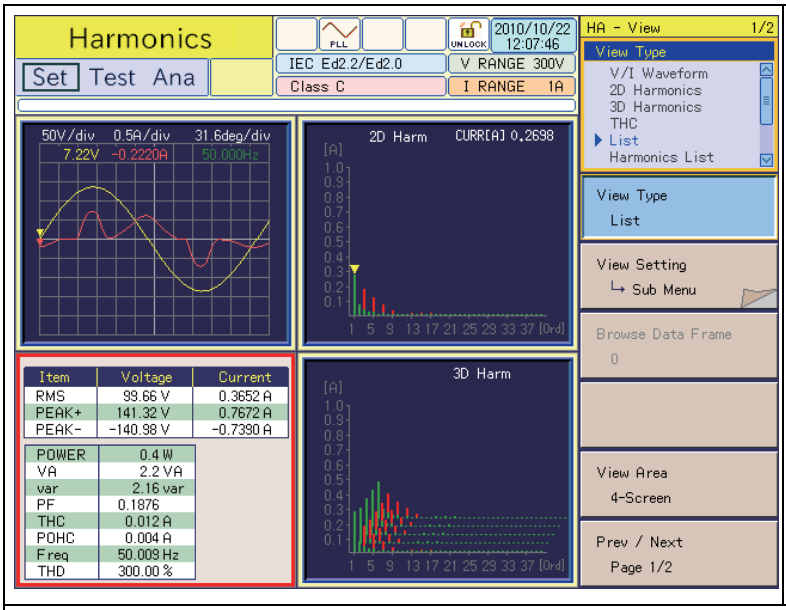
HA-observation and test conditions display



- Set test conditions while viewing measurement results.
- Display graphs and lists.
- Menu items are the same as the HA-test conditions list display.

When the VIEW key is pressed with the HA key LED illuminated, the HA-observation and analysis display (HA-VIEW) and HA-observation and test conditions display switch with each other.

HA-observation and analysis display



- Analysis of observation or test results
- There are nine types of graph and list displays (Table 3-1).
- Display surface can be divided (into 1, 2, or 4 sections), and display formats can be selectively pasted.

Every time the VIEW key is pressed with the HA key LED illuminated, the HA-observation and analysis display (HA-VIEW) and HA-observation and test conditions display switch with each other.

Table 3-1 Types of HA-observation and analysis display (HA-VIEW)

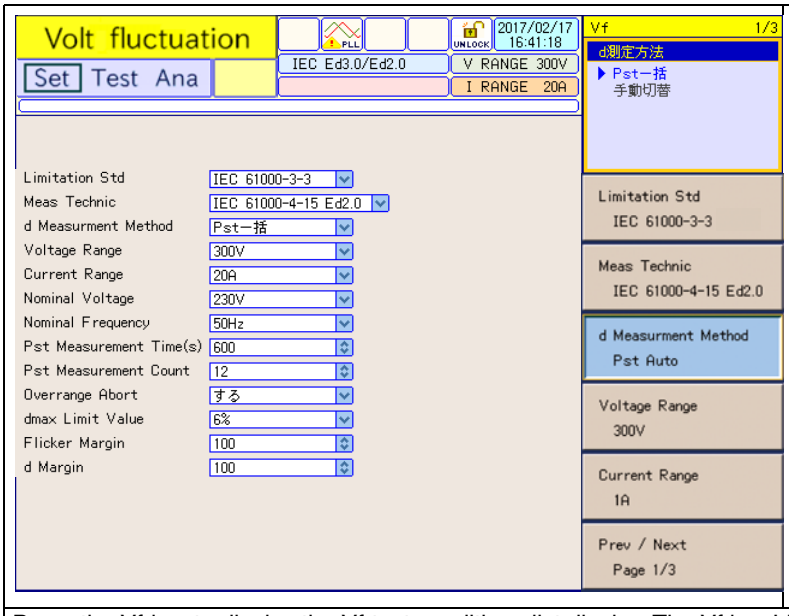
Display classification	View type	Contents displayed	Main usage
Graph	V/I waveform	• Input voltage/current waveform • Enlargement/ reduction of vertical and horizontal scales • Peak value reading using cursor	• Checking the input conditions of EUT • Waveform check • Observing large changes • Determining current range
	2D harmonics	• Harmonic current bar graph • Vertical scale enlargement/ reduction	• Order comparison of harmonics current • Limit value comparison • Maximum value search
	3D harmonics	• Harmonic current bar graph • Vertical scale enlargement/ reduction • Time transition observation	• Bar graph time transition • Fluctuation characteristics
	THC	• Meter display • Maximum value retention	• Setting the operating conditions of EUT
List	List	• Basic measurement parameter display • Numeric value display	• Measuring basic characteristics of EUT
	Harmonics list	• Harmonic current value of each order • Limit value display • THD	• Comparing each order of harmonics current • Limit value determination
Graph	Current trend	• Effective value of input current • Time transition	• Time transition • Searching for large-fluctuation timing
	Harmonics trend	• Time transition of harmonics current • Analysis in units of order	• Worst value verification
List	Results list*1	• Test results list • General determination of harmonic current of each order	• Standards conformance determination

*1. Valid after completion of test

3.5.2 Basic Views for Voltage Fluctuation Test

Three basic displays (Vf-test conditions list, Vf- observation and analysis, and Vf-observation and test conditions displays) are available.

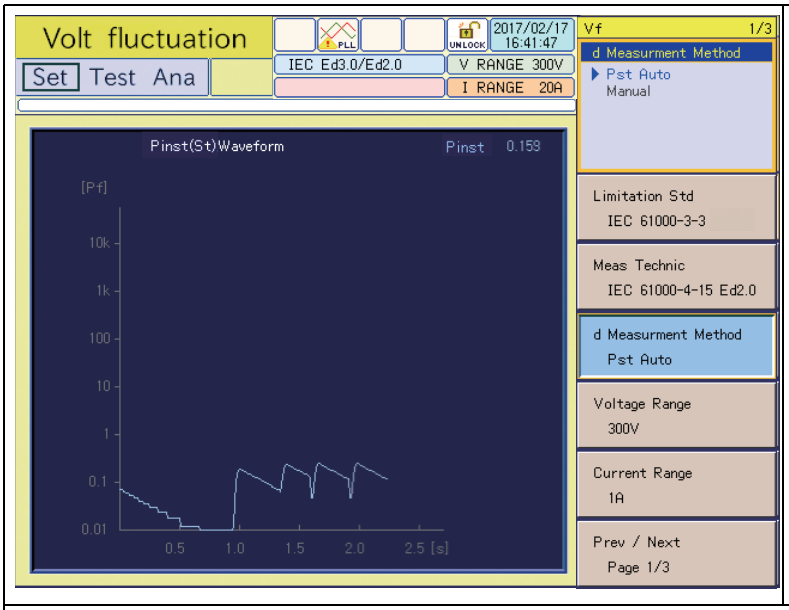
Vf-test conditions list display



- Used to set test conditions
- Specific window pattern
- Menu items are the same as the Vf-observation and test conditions window.

Press the Vf-key to display the Vf-test conditions list display. The Vf key LED illuminates.

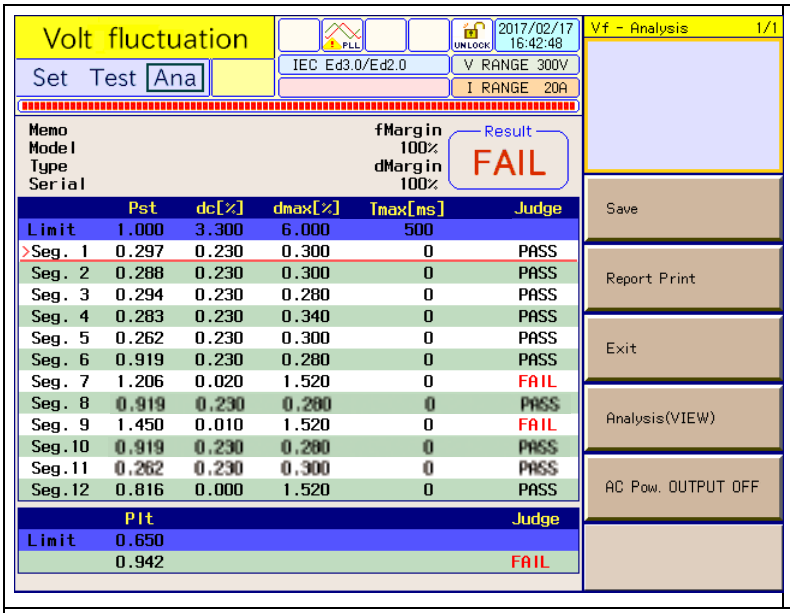
Vf-observation and test conditions display



- Set test conditions while viewing measurement results.
- Display graphs and lists.
- Menu items are the same as the Vf-test conditions list window.

Every time the VIEW key is pressed with the Vf key LED illuminated, the Vf-observation and analysis display (Vf-VIEW) and Vf-observation and test conditions display switch with each other.

Vf-observation and analysis display



- Analyze observation or test results.
- There are 11 types of graph and list displays (Table 3-2).
- Display surface can be divided (by 1, 2, or 4), and display formats can be selectively pasted.

Every time the VIEW key is pressed with the Vf key LED illuminated, the Vf- observation and analysis display (Vf- VIEW) and Vf- observation and test conditions display switch with each other.

Table 3-2 Types of Vf- observation and analysis display (Vf- VIEW)

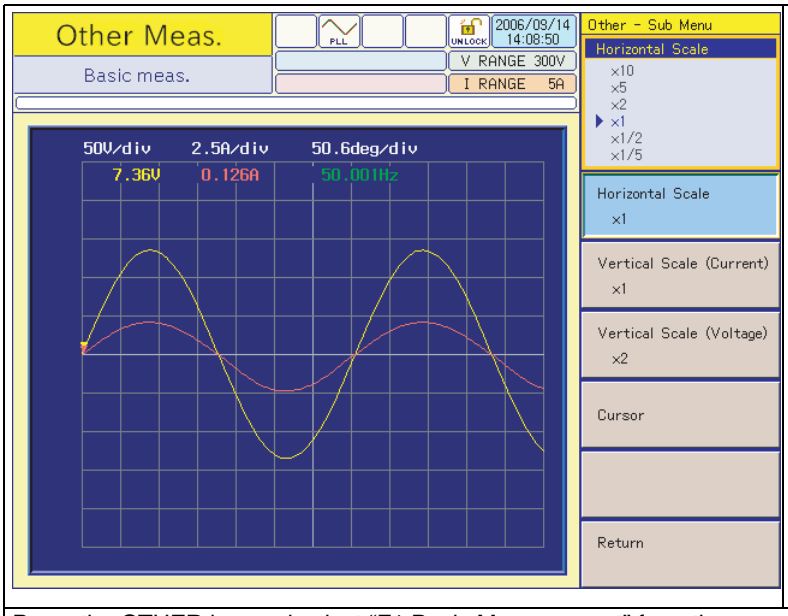
View type		Contents displayed	Main usage
Graph	V/I waveform	• Input voltage/current waveform • Enlargement/reduction of vertical and horizontal scales • Peak value reading using cursor	• Checking the input conditions of EUT • Waveform check • Observing large changes • Determining current ranges
	rms waveform	• Time transition of input voltage effective value	• Observing voltage fluctuations
List	List	• Basic measurement parameter display • Numeric value display	• Measuring the basic characteristics of EUT
Graph	Pinst (St) waveform	• Real-time waveform display of Pinst (St) (momentary flicker value)	• Observing voltage fluctuations (when the d measurement method is Pst Auto)
	CPF waveform	• Displaying the CPF (cumulative probability) graph	• Observing and analyzing voltage fluctuations
	dc waveform	• Waveform display when the dc (relative, constant voltage fluctuations) maximum value is recorded	
	d max waveform	• Waveform display when the dmax (maximum, relative voltage fluctuation) maximum value is recorded	
	Tmax*1 waveform	• Waveform display of section with maximum time length, where d(t) (relative voltage fluctuation) exceeds 3.3 %	
List	Flicker list	• Detailed display for each segment (= time of one Pst measurement)	• Observing and analyzing voltage fluctuations
	Results list	• Test results list • General determination	• Standards conformance determination
	Voltage fluctuation results (manual)	• Maximum and average values of voltage fluctuations for each segment are displayed when the d measurement method is set to “Manual”	• Observing and analyzing voltage fluctuations

*1.Displayed as d(t)>3.3% depending on the selected standard.

3.5.3 Other Measurement Displays

Three basic displays (basic measurement, FFT analyzer, and rush current measurement displays) are available.

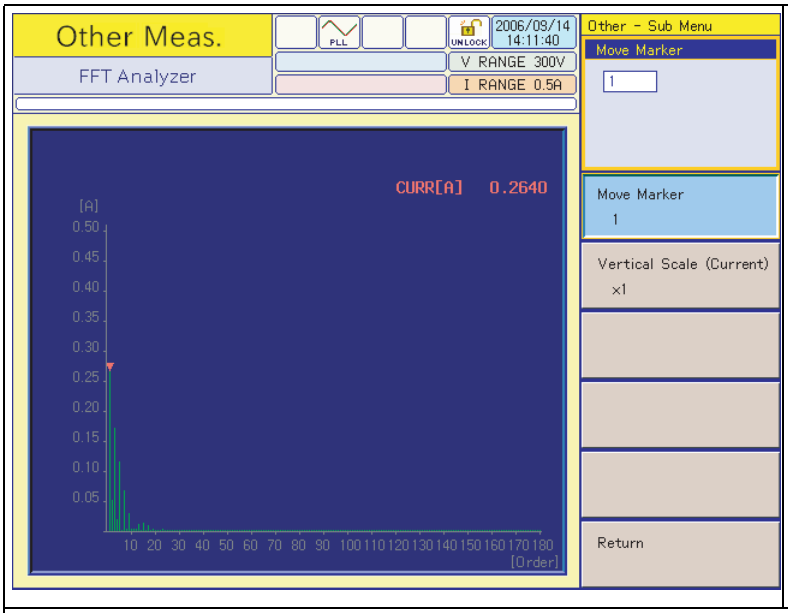
Basic measurement display



- Input voltage/ current waveform
- Specific window pattern according to menu

Press the OTHER key and select “F1 Basic Measurement” from the menu. The waveform display appears.

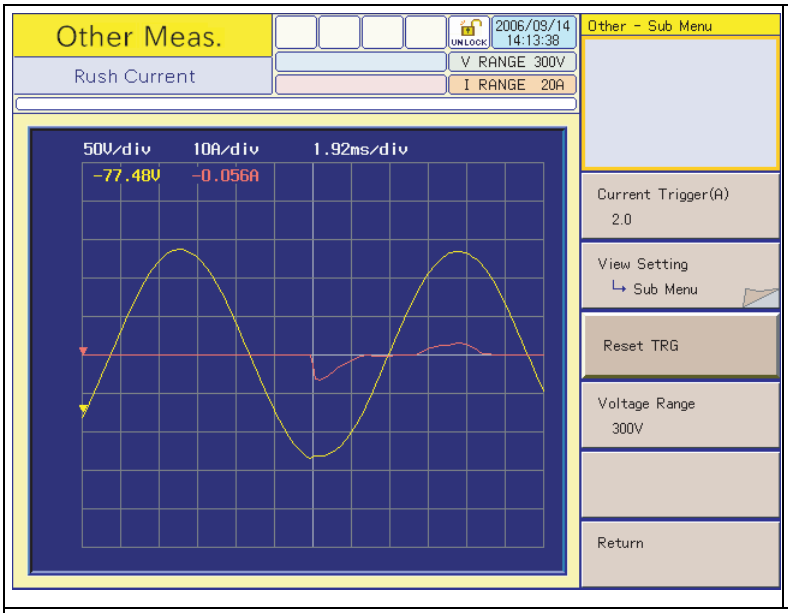
FFT analyzer display



- Specific window pattern according to menu

Press the OTHER key and select “F2 FFT Analyzer” from the menu. The FFT analyzer display appears.

Rush current measurement display

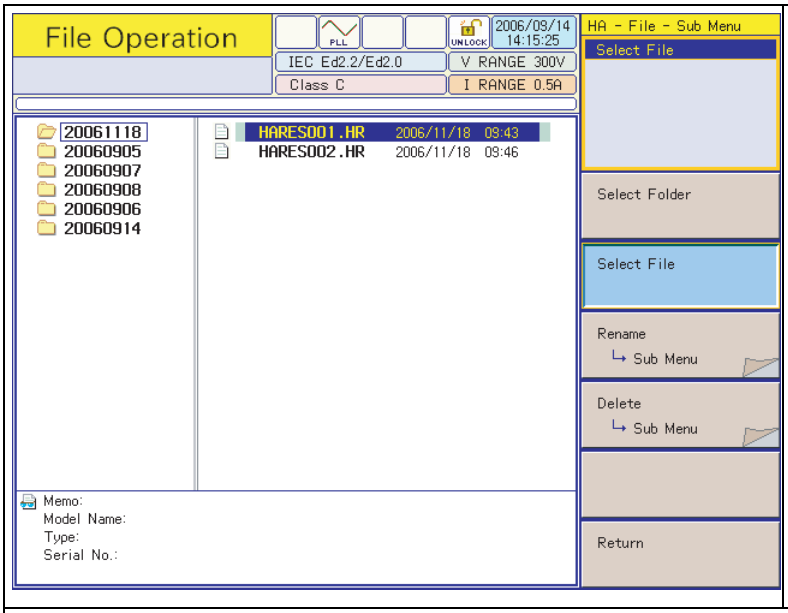


- Specific display pattern according to menu

Press the OTHER key and select “F3 Rush Current Measurement” from the menu. The rush current measurement display appears.

3.5.4 Basic Display for File Operation

File operation display

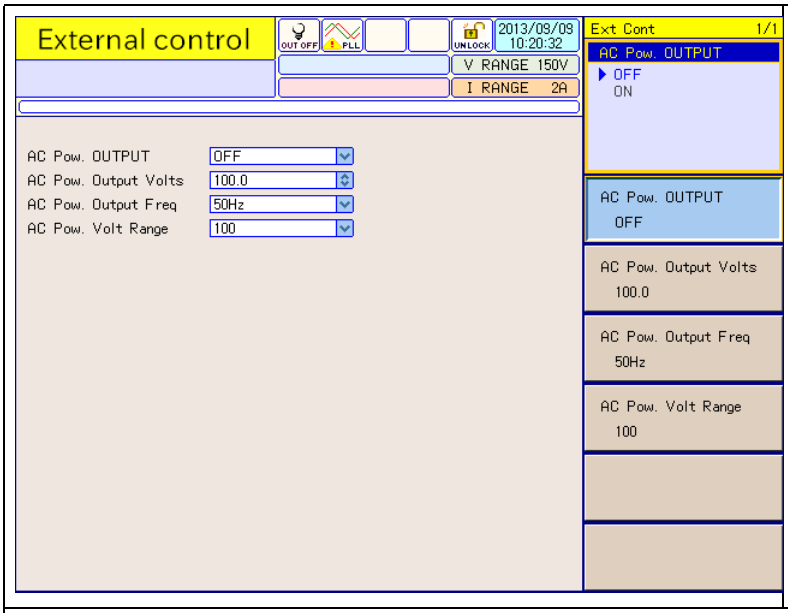


- Used to save and call (load) a test conditions file and to call (load) a test results file.

Press the FILE key to show the file operation display.

3.5.5 Control Display to External Devices

EXT control display

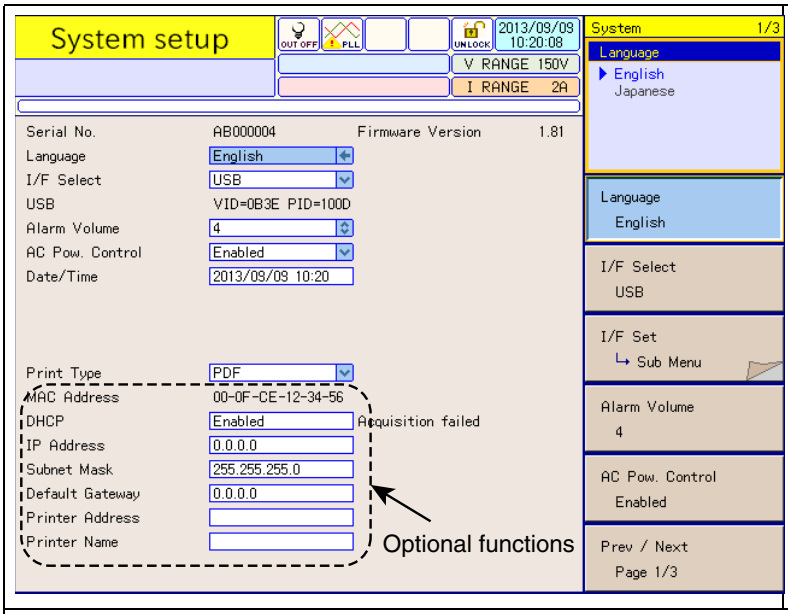


- Used to control the AC Power Supply.

Press the EXT CONT key to show the EXT control display.

3.5.6 System Setting Display

System setting display

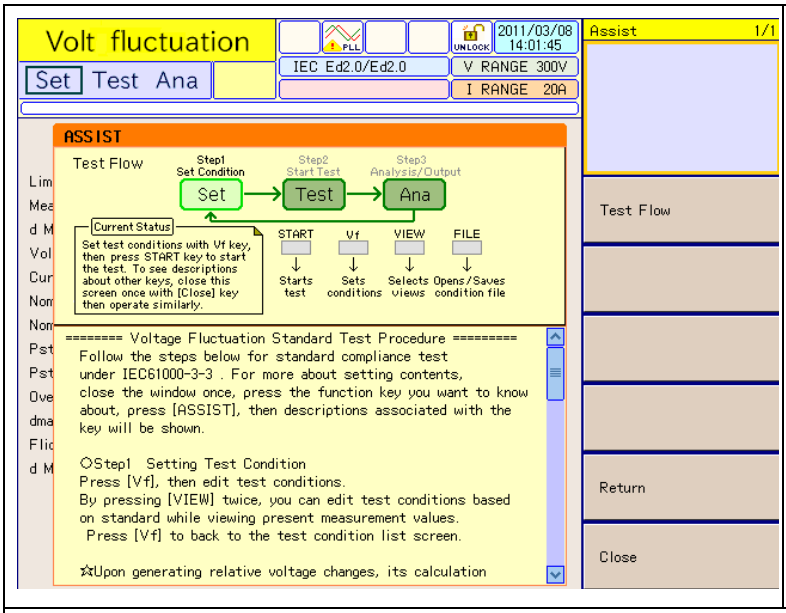


- Used to set the entire test system

Press the SYSTEM key to show the system setting display. (Example of firmware version 1.1x)
The area indicated with dotted lines includes optional functions.

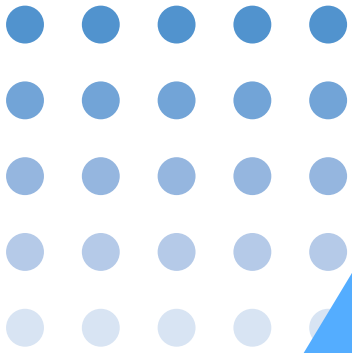
3.5.7 Assist Display

ASSIST display



- This display can be used at any time.
- An explanation corresponding to the current usage is displayed for users who are not EMC experts or are not familiar with test standards. Difficult standards terms can also be referenced.

Press the ASSIST key to show the ASSIST display.



4

Basic Operation

This chapter explains basic operation methods.

4.1 Turning On the Power

4.1.1 Turning on the POWER Switch

When the power is turned on, the firmware version is displayed for several seconds, and if no problems are found by the internal check, the harmonic current test display (HA-test conditions list display) appears. Allow for sufficient warm-up time before starting a test.

1. Check that the POWER switch is OFF (O).
2. Insert the plug from the power cord into the outlet.
3. Turn the POWER switch to ON (|).

   Depress the POWER switch (|). With the startup sound, all LEDs illuminate and the firmware version is displayed.
4. Check the firmware version on the screen.

   After the firmware version shown in Fig.4-1 is displayed for several seconds, the harmonic current test display (HA-Observation and Analysis display) appears.

   When the Ethernet port (factory option) is mounted, “with Ethernet” is displayed under the firmware version.

Fig.4-1 Firmware version example

Status after power-on

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

The HA-observation and analysis display (HA-VIEW) shown in Fig.4-2 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.

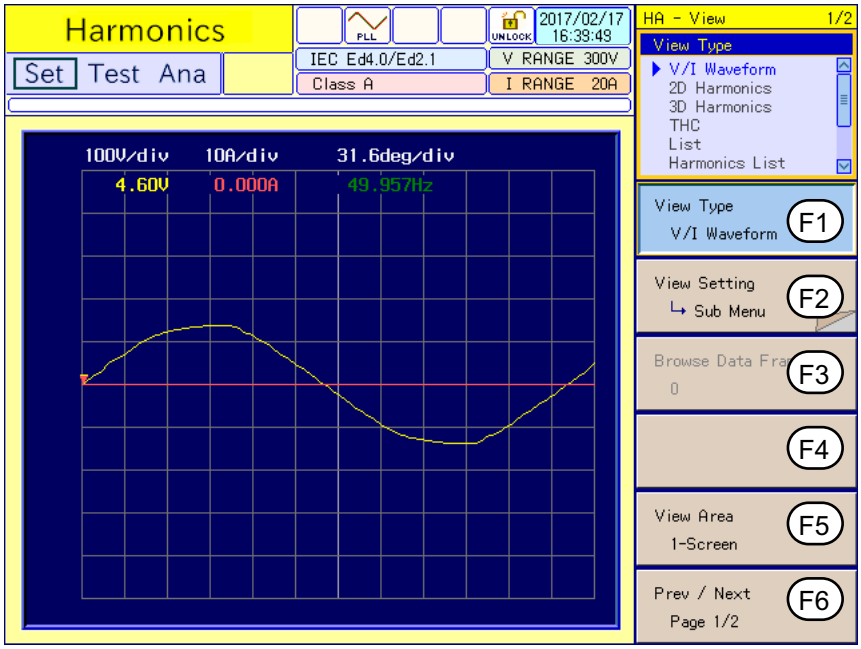


Fig.4-2 HA-observation and analysis display (HA-VIEW)

See Page 4-19

■ Control function to external devices

When the POWER switch is turned on for the first time after purchasing this product, 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. However, the OUTPUT of the AC Power Supply will be turned off.

4.1.2 Turning off the POWER Switch

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

1. Turn the POWER switch of this product to OFF (O).
2. Turn off the POWER switch of the AC Power Supply.

4.2 Power-On of Test System

WARNING • **To prevent an electric shock, do not touch the input power cable of the AC Power Supply and Line Impedance Network. If the power cable is incorrectly connected, immediately turn off the switches on the switchboard.**

There are two methods for turning on/off the power switch.

Table 4-1 Methods for turning on/off the power switch

Method	This product	AC Power Supply	Line Impedance Network	External power switch
Separate ON/OFF	Turn off the POWER switches separately.			Not available
Collective ON/OFF	Lock the POWER switches in the ON position.			Available*1

*1. The customer is requested to prepare the external power switch.

4.2.1 Separate ON/OFF

See Page 4-13

The procedure indicated below is used to control the AC Power Supply from this product, which is the usual method of operation. To ensure proper functioning of the AC Power Supply and to prevent damage to the internal relay contact of the Line Impedance Network, follow the procedure exactly.

If the procedure is not followed correctly, "Disabled" is assumed as the system setting for "AC Pow. Control" of this product. For details on preventing damage to the internal relay contact, refer to the Operation Manual of the Line Impedance Network.

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, KHA1000.
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.

   Perform communication with the AC Power Supply. If communication fails, "Disabled" is automatically assumed as the system setting for "AC Pow. Control" of this product.

Power-off of the test system

1. Turn off the POWER switch of this product.

   If the POWER switch of the AC Power Supply is turned off first, “Disabled” is automatically assumed as the system setting for “AC Pow. Control” of this product. When the POWER switch is turned on the next time, “AC Pow. Control” remains at “Disabled.”

See Page 4-13

   To control the AC Power Supply, set “AC Pow. Control” to “Enabled.”

2. Turn off the POWER switch of the AC Power Supply.

3. Turn off the POWER switch of the Line Impedance Network.

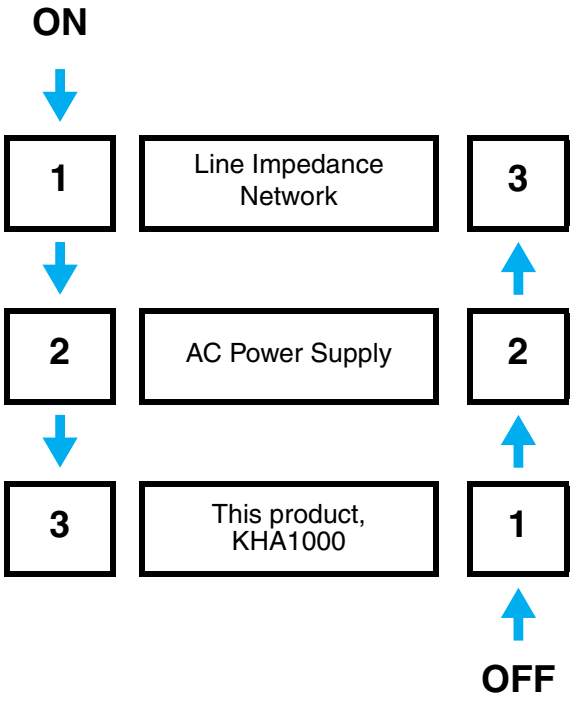


Fig.4-3 Power-on/off sequence of the test system

4.2.2 Collective Power-On/Off

The power supply of the test system is collectively turned on/off using an external power switch. The customer is requested to prepare the external power switch. Use the external power switch with the following or larger rated current.

Table 4-2 Rated current of external power switch

External power switch	Condition of AC input voltage	AC power supply*1		
		PCR1000LE PCR1000LA	PCR2000LE PCR2000LA	PCR4000LE PCR4000LA
Rated current	90 V to 132 V	30 A	50 A	100 A
	170 V to 250 V	15 A	30 A	50 A

*1. For other PCR-LA, PCR-LE, or PCR-LE2 Series AC Power Supply, contact your Kikusui distributor or agent.

Power-on of the test system

1. Turn on the external power switch.

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

   This product communicates with the AC Power Supply. If communication fails, “Disabled” is automatically assumed as the system setting for “AC Pow. Control” of this product.

Power-off of the test system

1. Press the EXT CONT key.

   The EXT CONT display appears.

2. Select OFF in “F1 Key (AC Pow. OUTPUT)” from the menu.

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

3. Turn off the external power switch.

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

4.3 Basics of Menu Operation

This section shows the basics of the menu operation. For actual operations, see "4.4 Settings the Test System", Chapter 5 “Harmonic Current Test,” Chapter 6 "Voltage Changes and Fluctuations and Flicker Test" and Chapter 7 “Other Measurements.”

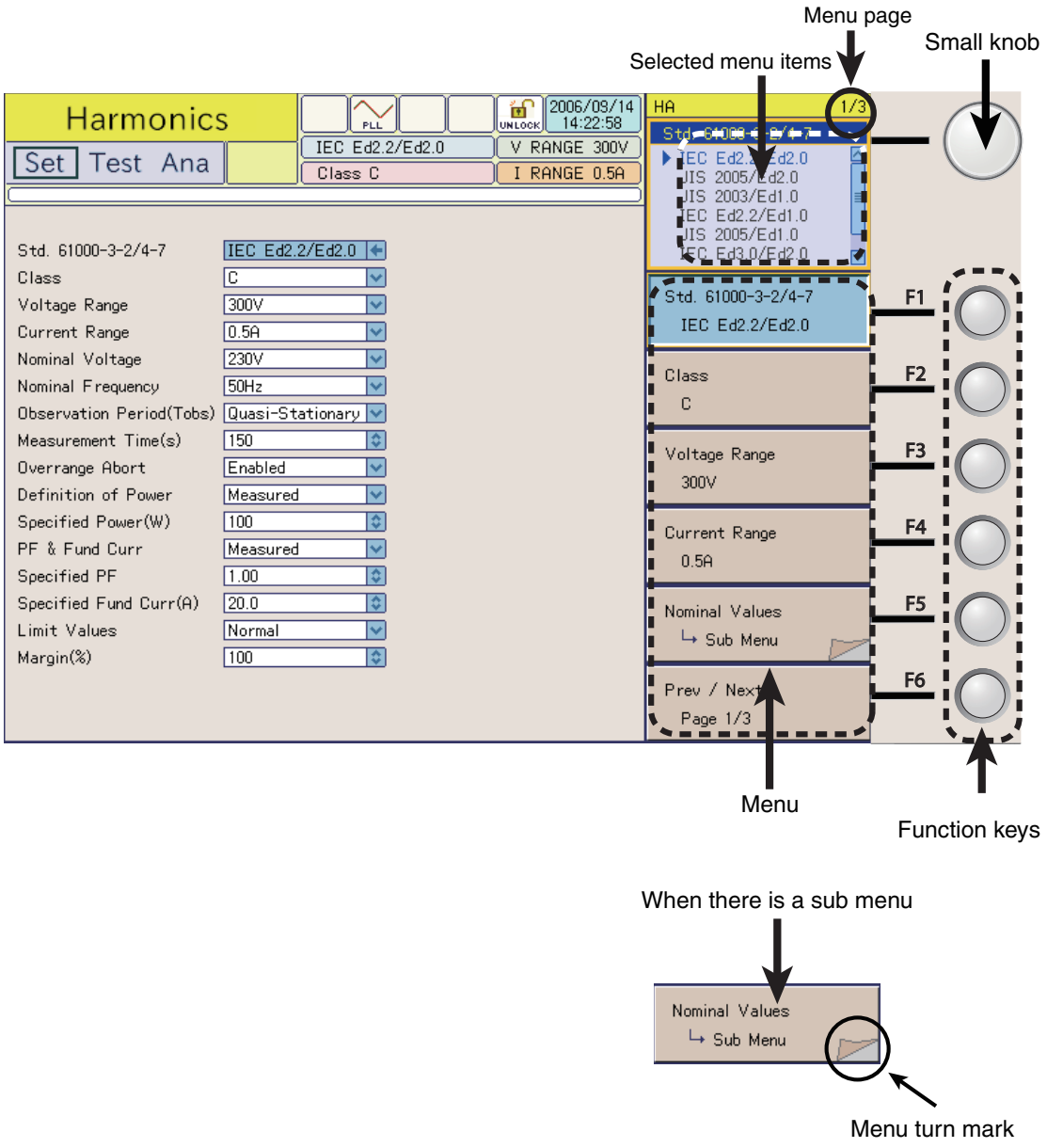


Fig.4-4 Menu selection

4.3.1 Menu Operation

Using 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 item is highlighted 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.

NOTE

- The large knob can be used to enter numeric values or characters.

Pressing the function key again

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 window 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.

Using the ten-key keypad

This keypad is used for items in which a numeric value can be set.

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 ten-key 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.

Selecting pages

This function is used for two or more pages.

1. Press the F6 key.

   The color of the F6 item column in the menu changes.
   The selected menu contents (the top part of the menu) show a page.

2. Press the F6 key again.

   Every time the function key is pressed, another page is selected.
   The selected page is displayed in the menu.
   The selected page number is displayed at the top right end of the display.

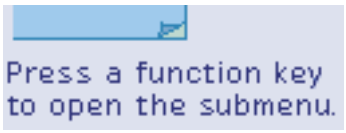
■ Use the small knob to make selections

2. Select a page using the small knob.

   The pages change in response to the operation of the small knob.
   The selected page is displayed in the menu.
   The selected page number is displayed at the top right end of the display.

4.3.2 Sub-menu Operation

“Menu turn mark” is displayed in an item in the menu.



1. Press the function key using “Menu turn mark.”

   A 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 window show the selected item.

■ Select set contents

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 in Fig.4-5 is displayed.

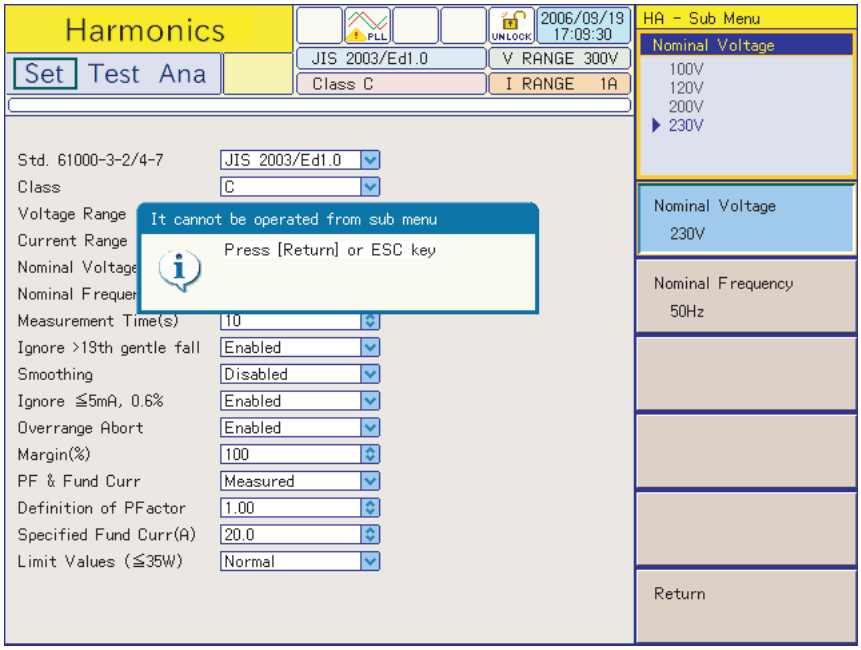


Fig.4-5 Error in moving to upper menu

4.3.3 Directly Setting Voltage/Current Range

The voltage and current ranges can be directly set. Turn the triangle mark upward for each numeric value on the operator panel to raise the sensitivity and turn it downward to lower the sensitivity.

These values cannot be set during test and analysis.

■ Voltage range

For the range to be set, press the SHIFT + 7 (raise sensitivity) keys or the SHIFT + 4 (lower sensitivity) keys.

All ranges are displayed in the upper right part of the display, and the set range is indicated with a triangle mark. Every time the keys are pressed, another range is selected and the triangle mark shifts to it. When the key operation is stopped, the range display automatically disappears.

■ Current range

The operation is the same as for the voltage range.

The SHIFT + 8 (raise sensitivity) or the SHIFT + 5 (lower sensitivity) keys are used.

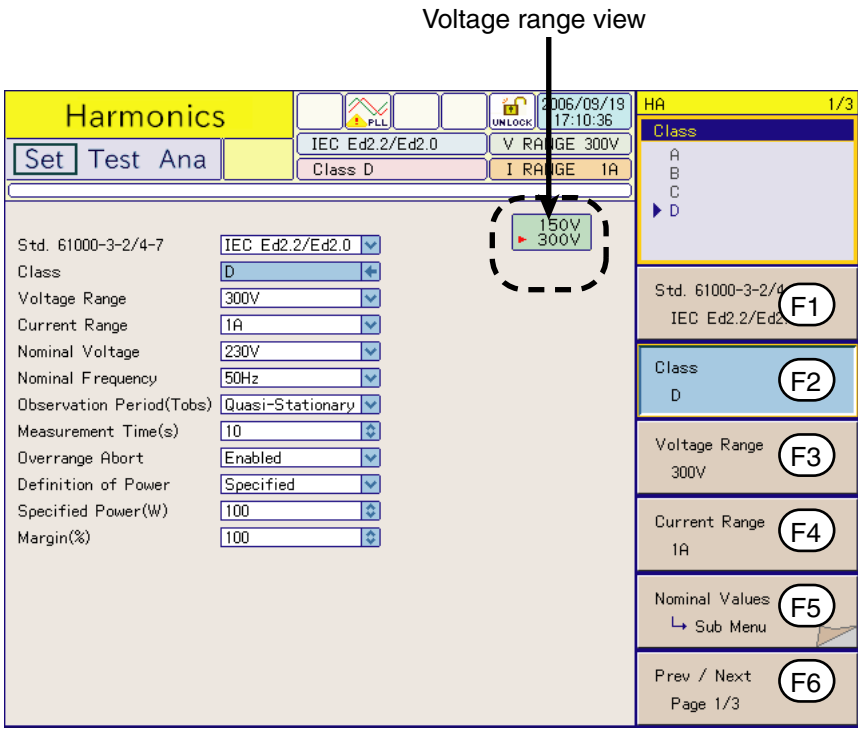


Fig.4-6 Voltage range setting

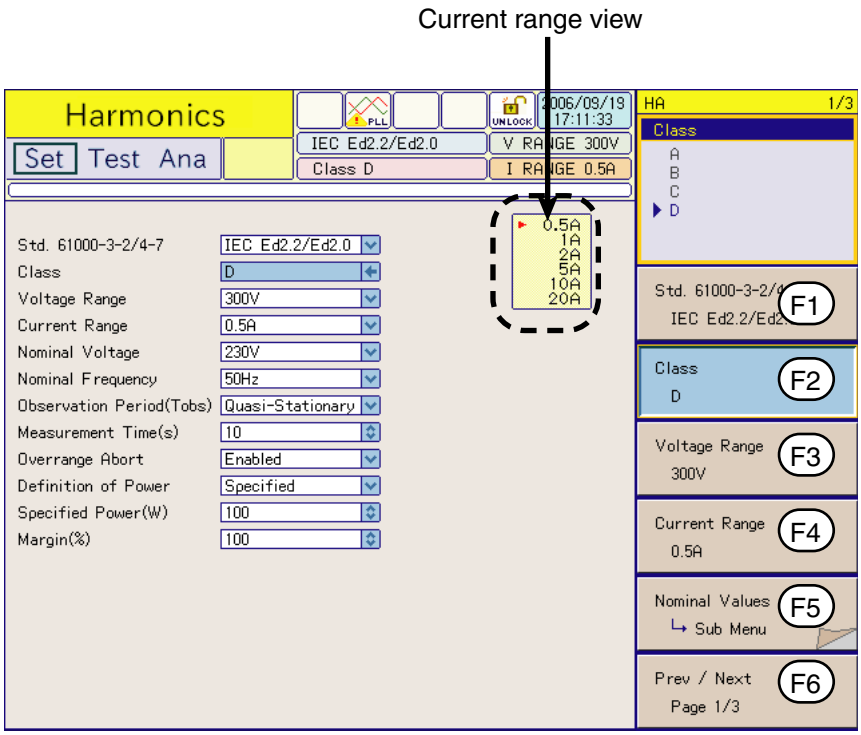


Fig.4-7 Current range setting

4.4 Settings the Test System

This section sets items that are common to the entire system. These items include selecting communication interfaces and setting the alarm volume, AC Pow. Control, and date/time.

Showing the system setting display

1. Press the SYSTEM key.

   The system setting display appears. The serial No. and firmware version are displayed in the upper part of the data view area. (Example of firmware version 1.1x)

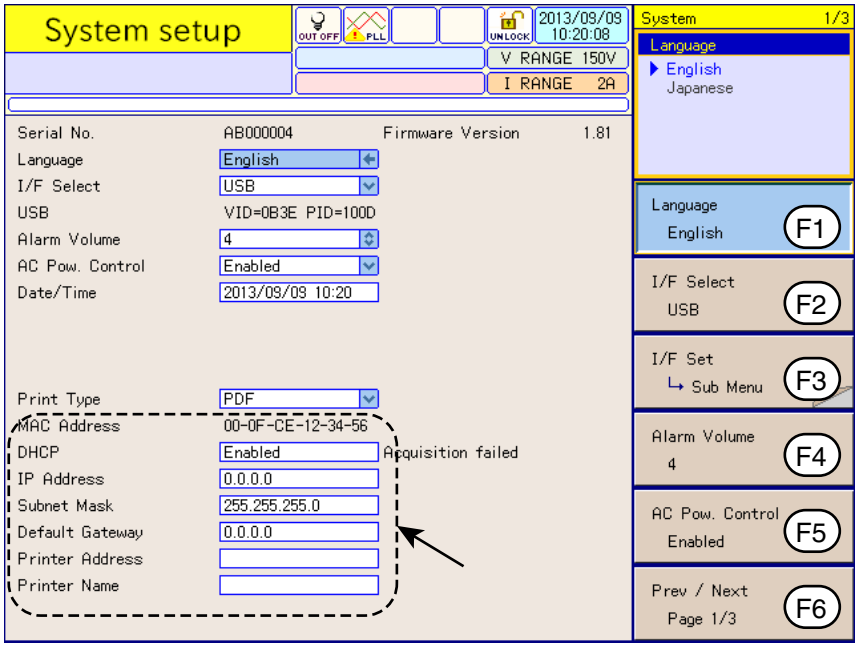


Fig.4-8 System setting display

4.4.1 I/F Selection, I/F Setting, Alarm Volume, and AC Pow. Control

Menu Page 1/3 (F1 F2 F3 F4 F5 F6)

F1	Language	English	Japanese

Select a language to be used. After the power is turned on for the second time, the system starts up in the state (language) in which the POWER switch was last turned off.

F2	I/F select	GPIB	RS232C	USB

See Page 4-7

Select a communication interface to be used. To fix the set contents, turn off the POWER switch once and then turn it back on again.

F3	I/F Set → Sub Menu	GPIB Address	RS232C Baudrate

■ I / F setting → Sub Menu

F1	GPIB Address	Numeric value	
		Set the GPIB address of this product. The setting range is from 1 to 30.	
F2	RS232C Baudrate	9600 bps	19200 bps
		Set the RS232C baud rate of this product.	

To fix the set contents of the GPIB address and RS232C baud rate, turn off the POWER switch once and then turn it back on again.

F4	Alarm Volume	Numeric value

Set the sound to be heard when a key is pressed and the sound volume to be heard when the system is started up or a test is finished. The setting range is from 0 to 8. In a quiet environment, 2 or 3 is recommended.

F5	AC Pow. Control	Disabled	Enabled

Specify whether or not to control the AC Power Supply.

NOTE

- When "Enabled" is selected for the AC Power Supply, it may return to "Disabled" several seconds later. This occurs when communication with the AC Power Supply is not established.
- To establish communication with the AC Power Supply, set the communication parameters from the AC power supply panel as shown below.

PCR-LE or PCR-LE2 series

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-LAseries

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.

4.4.2 Setting the Date/Time, TCP/IP (Network Protocol) and Printer

F1	Date/time → Sub Menu	Year	Month	Day	Hour	Minute

Set the items in the sub-menu.

■ Date/time → Sub Menu

F1	Year	Numeric value
F2	Month	
F3	Date	
F4	Hour	
F5	Minute	

The current time of the internal clock is displayed in the menu. Set the time by pressing the function key of the item to be set. Enter numeric values for all items.

F4	TCP / IP → Sub Menu	DHCP	IP Address → Sub Menu	Sub-net Mask → Sub Menu	Default Gateway → Sub Menu

See Page 1-6

This menu is an optional function for connection to a network printer. It is a factory option. When the optional function is not installed, a light-color display is applied.

NOTE

- The MAC address (00-0F-CE-00-01-23) displayed in the view is specific to this product (differs with products) and is assigned for using Ethernet communication.

■ TCP / IP → Sub Menu

F1	DHCP	Disable	Enable
		When you log in to the network, specify whether to enable or disable the DHCP function.	
F2	IP Address → Sub Menu	Input 1-char	Delete 1-char
		Set the IP address of this product.	

F3	Subnet Mask → Sub Menu	Input 1-char	Delete 1-char
		Set a mask value to be used to find a subnet network address from the IP address of this product.	
F4	Default Gateway → Sub Menu	Input 1-char	Delete 1-char
		Set the default gateway of this product. Usually, if only the default gateway is set in each node, appropriate routing is enabled by that gateway.	

NOTE

- The “Acquisition failed” may appear to the right of the DHCP of the system setting display. In this case, there is a possibility that the DHCP is not found or the LAN cable is not connected. Check the network connection status. The “Acquisition failed” is turned off when the network connection is complete.

■ IP Address, Sub-net Mask, and Default Gateway → Sub Menu

F1	Input 1-char	Press
		A character entry dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a square frame, press this key. The selected character is displayed where the cursor is blinking.
F2	Delete 1-char	Press
		The character to the left of where the cursor is blinking is deleted.

Press the ENTER key to fix.

F5	Printer → Sub Menu	Print Type	Printer Address → Sub Menu	Printer Name → Sub Menu	Test Print

Menu items other than the print type are optional functions for connection to a network printer. They are factory options. When the optional functions are not installed, a light-color display is applied.

■ Print → Sub Menu

F1	Print Type	PDF	Text(File)	Text (Printer)	ESC/Page	PostScript
		Select a print type. It is used as the file format to save to a compact flash card.		Select a description format for printing with a network printer.		
				Text format	Page description format expanded for page printers in printer control code recommended by SEIKO EPSON	PostScript format
F2	Printer Address → Sub Menu	Input 1-char	Delete 1-char			
		Set the IP address of the network printer.				
F3	Printer Name → Sub Menu	Input 1-char	Delete 1-char			
		Set the name of the network printer.				
F4	Test Print	Press				
		“KHA1000 Test Print” is printed with the network printer.				

NOTE

- If the test printing fails, see “F4 TCP/IP and F5 Printer” → “Sub Menu” → “F1 Print Type” in page 2/3 of the Menu.

■ Printer Address and Name → Sub Menu

F1	Input 1-char	Press A character entry dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a square frame, press this key. The selected character is displayed where the cursor is blinking.
F2	Delete 1-char	Press The character to the left of where the cursor is blinking is deleted.

Press the ENTER key to fix.

Operation-verified printer

Product name	Manufacturer name	Page printer description language
LP-8900	Seiko Epson Corporation	ESC/Page
LP-8300		ESC/Page
LP-8700 PS3		PostScript

Print server for parallel port printer with verified operation

Product name	Manufacturer name
ET-FPS1L	I-O Data Device Inc.

4.4.3 Version-up and Maintenance

F4	Version up	Yes	No	Cancel

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

When "Yes" is selected, the dialog box "Disk error: Media detection failed." is usually displayed. Because version-up is not possible, press the OK function key to return to the previous state.

F5	Maintenance	Input 1-char	Delete 1-char	Change char type

This menu is used for the servicemen conducting maintenance.

F1	Input 1-char	Press		
		A character entry dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a square frame, press this key. The selected character is displayed where the cursor is blinking. Up to 20 alphanumeric characters and up to 10 katakana characters can be entered.		
F2	Delete 1-char	Press		
		The character to the left of where the cursor is blinking is deleted.		
F3	Change char type	Alphanumeric	Hiragana	Katakana
		Every time the key is pressed, another character type is selected.		

4.5 Control to External Devices

This function is used to control the AC Power Supply. To enable it, select “Enabled” for AC Pow. Control in the menu in the system setting display. When “Disabled” is selected, all menus are displayed in a light-color and cannot be operated.

Showing External Control Display

Press the EXT CONT key.

The External control display appears.

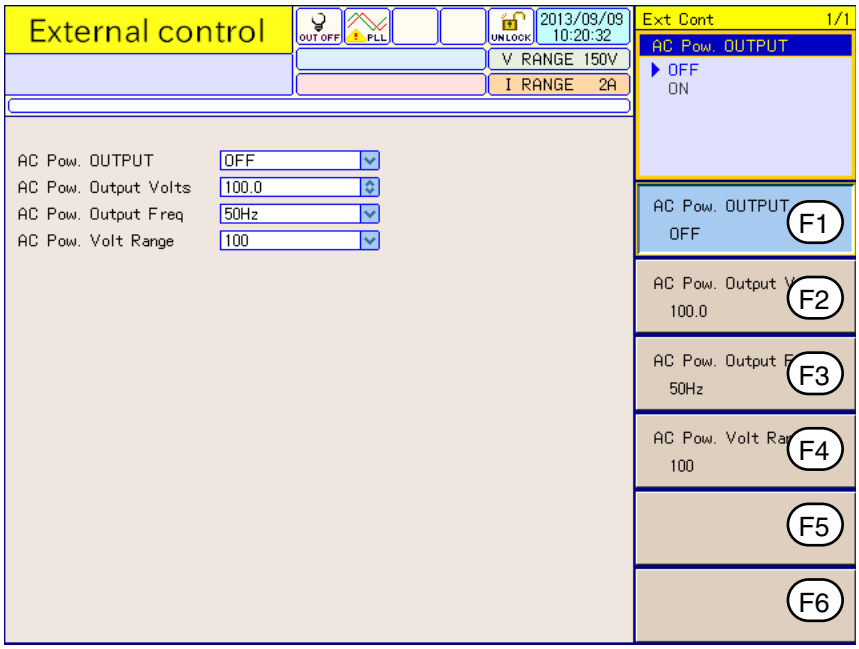


Fig.4-9 External control display

Turning on the OUTPUT of the AC Power Supply using this product

Turn on the OUTPUT of the AC Power Supply and prepare for starting a test.

1. Press the F4 key (AC Pow. Voltage Range) and set the AC Power Supply output voltage range.
   The setting should be in accordance with the rated power voltage of the EUT.
2. Press the F2 key (AC Pow. Output Volts) and set the AC Power Supply output voltage.
   The setting should be in accordance with the rated power voltage of the EUT.
3. Press the F3 key (AC Pow. Output Freq) and set the AC Power Supply output frequency.
   The setting should be in accordance with the rated power frequency of the EUT.
4. Press the F1 key (AC Pow. OUTPUT) to turn on the AC Power Supply OUTPUT.
   The icon in the upper part of the display shows a turned-on light bulb, and the AC Power Supply OUTPUT goes on.

⚠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.**

4.5.1 AC Pow. OUTPUT, AC Pow. Output Voltage, AC Pow. Output Frequency, and AC Pow. Voltage Range

F1	AC Pow. OUTPUT	ON	OFF

This menu turns on/off the AC Power Supply OUTPUT.

See Page 4-13

In the ON state, the icon in the upper part of the display shows a turned-on light bulb.

F2	AC Pow. Output Volts	numeric value

This menu sets the AC Power Supply output voltage. The setting range is from 0.0 V to 305.0 V. It corresponds to the F4 AC Pow. Voltage Range. The setting should be in accordance with the power rating of the EUT.

F3	AC Pow. Output Freq	50 Hz	60 Hz

This menu sets the AC Power Supply output frequency. Select 50 Hz or 60 Hz according to the power rating of the EUT.

F4	AC Pow. Voltage Range	100 V	200 V

This menu sets the AC Power Supply output voltage range.

The 100 V range is used when the output voltage setting range is from 0 V to 152.5 V.

The 200 V range is used when the output voltage setting range is from 0 V to 305.0 V.

4.6 File Operation

See Page 4-27

This function is used to save and call (load) a test conditions file and to call (load) a test results file. The saving and call target is a compact flash card.

This function allows you to operate files that correspond to the currently used test mode (harmonic current test or voltage fluctuation test).

This function is also used to format the compact flash card.

Showing the File Operation display

See Page 4-27

1. Insert a compact flash card in a MEMORY slot on the front panel.
2. Press the FILE key.

   A dialog box is displayed, showing the File Operation display.

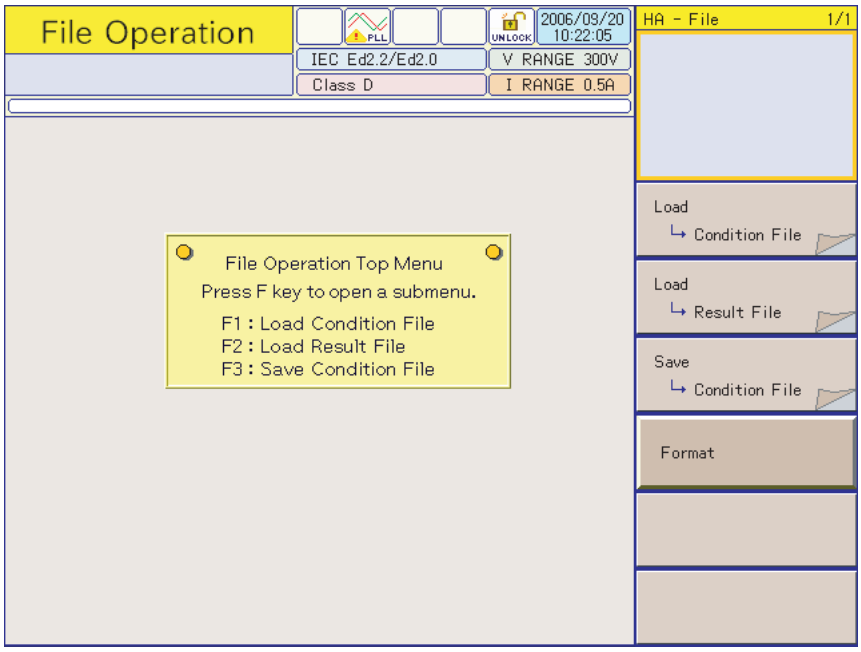


Fig.4-10 File Operation display

4.6.1 Selecting File Operation

Before operating files, insert a compact flash card.

If a compact flash card is not found, the buzzer sounds and the dialog box “Media could not be detected” is displayed. When the dialog box is displayed, press the F1 key (OK) in the menu and insert a compact flash card.

F1	Load → Conditions File	Select Folder	Select File	Rename → Sub Menu	Delete → Sub Menu

See Page 4-23

Call (load) a test conditions file from a specific folder of the currently used test mode.

The file name can be changed.

F2	Load → Results File	Select Folder	Select File	Rename → Sub Menu	Delete → Sub Menu

See Page 4-24

Call (load) a test results file from a specific folder of the currently used test mode.

The file name can be changed.

F3	Save → Conditions File	Yes	No	Cancel

See Page 4-25

Save a test conditions file to a specific folder of the currently used test mode. It can be saved in the “Setting” state. It cannot be saved in the “Test” or “Analysis” states.

A dialog box is displayed. A file name is automatically assigned and the conditions file is saved to the compact flash card.

F4	Format	Yes	No	Cancel

This menu is used to format the compact flash card.

When the compact flash card is formatted, all of its files are deleted.

4.6.2 Loading a Test Condition File

Sub-menu Page 1/1 (F1 F2 F3 F4 F5 F6)

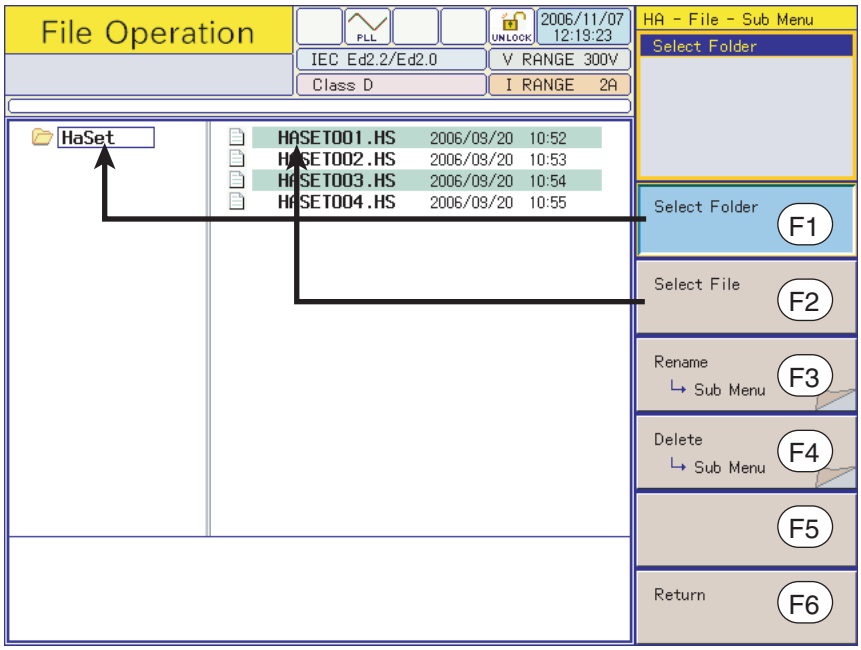


Fig.4-11 File Operation sub-menu

■ Load → Conditions file

F1	Select Folder	Numeric value displayed in the folder mark icon is assigned in order starting from 1.		
		Select a saved folder. The selected folder appears within a frame. Press the ENTER key to fix.		
F2	Select File	Numeric value displayed in the file mark icon is assigned in order starting from 1.		
		Select a saved file. The background color of the selected file is reversed. Press the ENTER key to fix.		
F3	Rename → Sub Menu	Input 1-char	Delete 1-char	
F4	Delete → Sub Menu	Yes	No	Cancel

Up to 50 folders and files can be displayed respectively.

■ Rename → Sub Menu

F1	Input 1-char	Press A character entry dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a square frame, press this key. The selected character is displayed where the cursor is blinking. Up to 8 characters can be entered.
F2	Delete 1-char	Press The character to the left of where the cursor is blinking is deleted.

This menu is used to change the name of a selected file.

Press the ENTER key to fix.

■ Delete → Sub Menu

F1	Yes
F2	No
F3	Cancel

This menu is used to delete a selected file.

4.6.3 Loading a Test Results File into This Product

See Page 4-18

You can load the test result file saved by this product or the product equipped with a previous version of firmware.

NOTE

- You can not load the test result file saved by the product equipped with later version from the version equipped in this product. The firmware version needs to be updated to load the test result. For details, contact your Kikusui distributor or agent.

Sub-menu Page 1/1 F1 F2 F3 F4 F5 F6

■ Load → Results File

F1	Select Folder	Numeric value in the selected menu items is assigned in order starting from 1. Select a saved folder. The selected folder appears within a frame. Press the ENTER key to fix.

F2	Select File	Numeric value in the selected menu items is assigned in order starting from 1.		
		Select a saved file. The background color of the selected file is reversed. Press the ENTER key to fix.		
F3	Rename → Sub Menu	Input 1-char	Delete 1-char	
F4	Delete → Sub Menu	Yes	No	Cancel

Up to 50 folders and files can be displayed respectively.

■ Rename → Sub Menu

F1	Input 1-char	Press	
		A character entry dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a square frame, press this key. The selected character is displayed where the cursor is blinking. Up to eight characters can be entered.	
F2	Delete 1-char	Press	
		The character to the left of where the cursor is blinking is deleted.	

This menu is used to change the name of a selected file.

Press the ENTER key to fix.

■ Delete → Sub Menu

F1	Yes
F2	No
F3	Cancel

This menu is used to delete a selected file.

4.6.4 Saving a Test Conditions File

■ Save → Conditions file

F1	Yes
F2	No
F3	Cancel

4.6.5 Format

■ **Format**

F1	Yes
F2	No
F3	Cancel

This menu is used to format a compact flash card.

4.7 Other Operations

4.7.1 Key Lock and Release

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

   The key icon in the upper part of the display is locked and key operation is prevented. The function key for selecting a display menu is also prevented from being operated.

2. Press the KEY LOCK key again.

   The key icon in the upper part of the display is unlocked and the key operation is released.

4.7.2 HOLD Key

Press the HOLD key.

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

4.7.3 Hard Copy

Press the HARD COPY key.

The hard copy dialog box is displayed. The display is saved to the external memory compact flash card. A file name is automatically created.

When the saving is finished, the hard copy dialog box disappears.

4.7.4 Setting the Brightness of View

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

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

4.7.5 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.

4.8 External Memory (Compact Flash 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 with 512 MB or more cannot be used.
- A micro-drive is not supported.
- This product operates in 3.3 V True IDE mode.

⚠CAUTION

- Insert only a compact flash 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 compact flash card may fail.

For details on formatting the compact flash card, see "Format" on page 4-22.

4.8.1 Insertion and Removal

■ Insertion

1. Push the cover for the MEMORY slot on the front panel in order to open the slot.
2. Ensure that the connector part of the compact flash card is facing this product and insert it with the label surface positioned as shown 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.

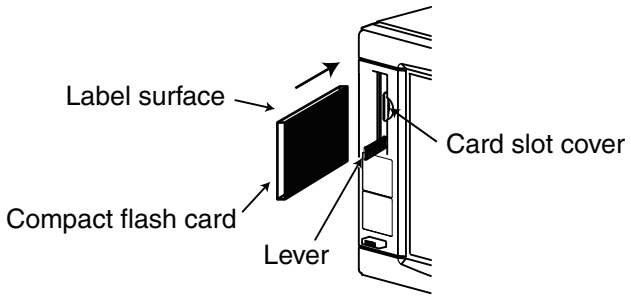


Fig.4-12 Insertion

■ Removal

⚠CAUTION • While a file is being manipulated or a report is being output, do not remove the compact flash card. Doing so may delete or damage data.

1. Push the lever.
   The lever head comes out toward you.
2. Push the lever again.
   The compact flash card comes out toward you.

4.8.2 Operation-verified Compact Flash Card

Using a compact flash card from the list below (Table 4-3), check that a test conditions file is saved and loaded into this product.

Check that:

- The test conditions file can be normally loaded.
- A screen hard copy can be normally saved.

Table 4-3 Verified compact flash card

Type	Manufacturer name	Model No.*1	Capacity
Compact flash	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 compact flash card may not operate because of a difference in the year model and version.
*2. SD memory card used: Buffalo RSDC-128M

4.8.3 Folder and File Configurations

By connecting the compact flash card to a computer, the folder and file configurations on the compact flash card can be viewed (Fig.4-13).

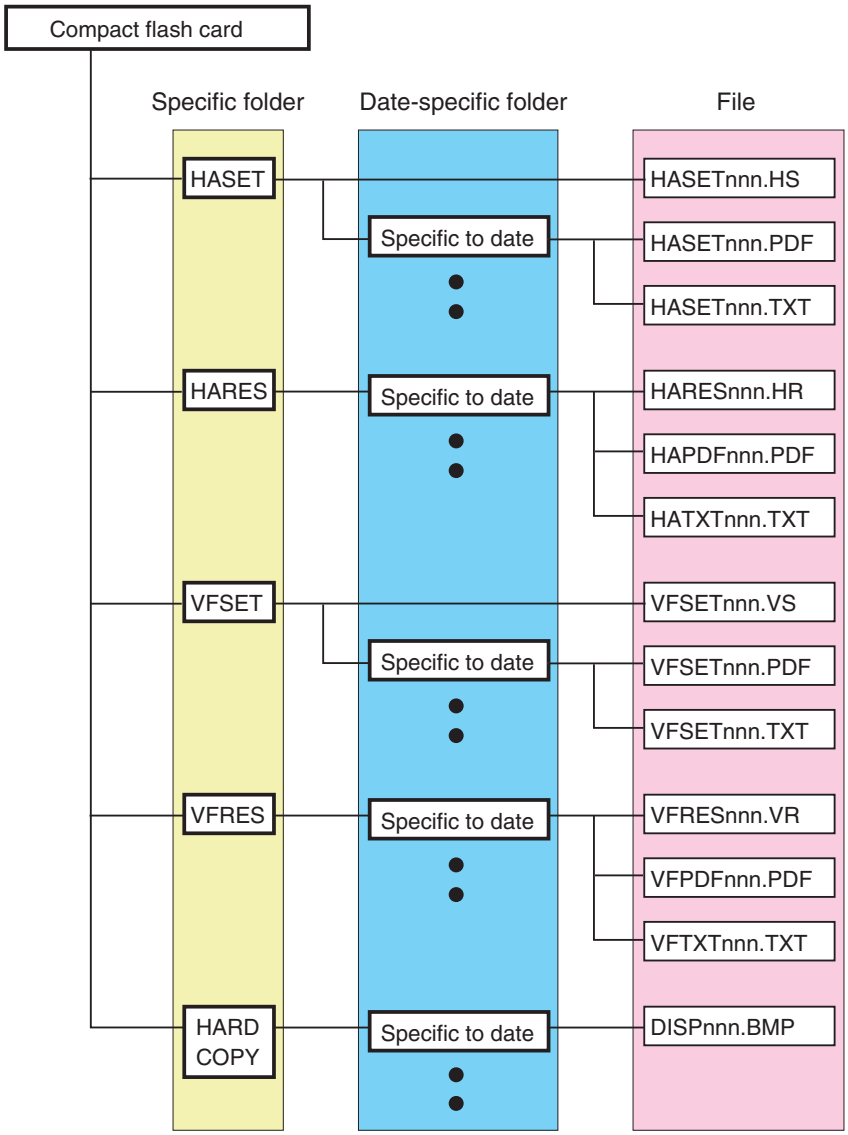


Fig.4-13 Folder and file configurations

Folder

A folder system consists of five specific folders.

- HASET (for saving test conditions for harmonic current test)
- HARES (for saving results files and printed reports for harmonic current test)
- VFSET (for saving test conditions for voltage fluctuation test)
- VFRES (for saving results files and printed reports for voltage fluctuation test)
- HARDCOPY (for saving screen hard copy)

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 (page 4-14).

■ Date format of date-specific folder

Folder type	Date-specific folder
Folder name	yyyymmdd
	yyyy indicates the year (automatically assigned).
	mm indicates the month (automatically assigned).
	dd indicates the day (automatically assigned).

File

When a file is saved, another folder 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 (Fig.4-13).

The format for PDF files or TEXT files is set by Printer → Sub Menu → Print Type (page 4-16).

See Page 4-23

The file name can be changed.

■ File to be created in HASET folder (for saving test conditions for harmonic current test)

File format	(Conditions file) dedicated to this product*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 not in a date-specific folder but in the HASET folder.

■ File to be created in HARES folder (for saving result files and printed reports for harmonic current test)

File format	(Result file) dedicated to this product	PDF (For printing reports)	Text
File name	HARESnnn	HAPDFnnn	HATXTnnn
	nnn is automatically assigned (001 to 999).		
Extension	.HR	.PDF	.TXT

■ File to be created in VFSET folder (for saving test conditions for voltage fluctuation test)

File format	(Conditions file) dedicated to this product*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 a date-specific folder.

■ File to be created in VFRES folder (for saving results files and printed reports for voltage fluctuation test)

File format	(Result file) dedicated to this product	PDF (For printing reports)	Text
File name	VFRESnnn	VFPDFnnn	VFTXTnnn
	nnn is automatically assigned (001 to 999).		
Extension	.VR	.PDF	.TXT

■ File to be created in HARDCOPY folder (for saving screen hard copy)

File format	Bit map
File name	DISPnnn
	nnn is automatically assigned (001 to 999).
Extension	.BMP

4.9 Factory Default Settings

Turn on the POWER switch with the ENTER key pressed to set to the factory default settings (Table 4-4). Press the ENTER key until the following display (Fig.4-14) appears.

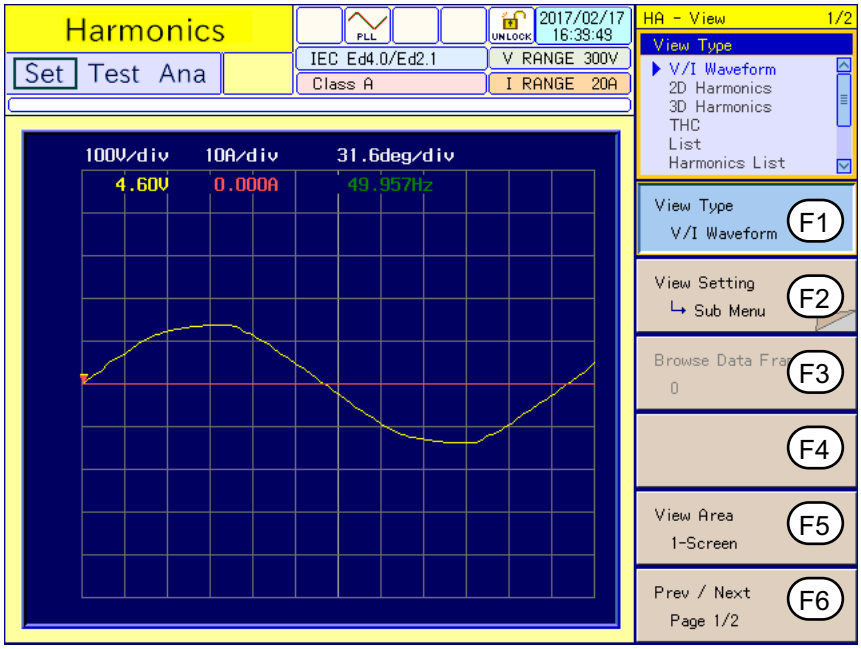


Fig.4-14 Factory default settings display

Table 4-4 Factory default settings

Item		Factory default settings
Test mode		Harmonics measurement mode
View	Screen type	HA-observation and analysis display
	View type	V/I waveform
	View area	1-Screen
HA-VIEW	View type	V/I waveform
	Horizontal scale	×1
	Vertical scale (Current)	×1
	Vertical scale (Voltage)	×1
	Cursor	Left end
	View area	1-Screen
HA-setting	Standard	IEC Ed2.0/Ed2.0
	Class	A
	Voltage range	300 V
	Current range	20 A
	Nominal voltage	230 V
	Specified Nominal Volt	230 V
	Nominal frequency	50 Hz

Item		Factory default settings
HA setting	Tobs (observation period)	Quasi-stationary
	Measurement time (seconds)	150
	Over-range abort	Enabled
	Power defined	Measured value
	Power specified (W)	100
	PF and fundamental current	Measured value
	PF specified	1.00
	Fundamental current specified (A)	20.0
	Applied limit value	Limit value
	Applied limit value (35 W or less)	Limit value
	600 W air conditioner	No
	Smoothing	Disabled
	Ignore over 19th if slight drop	Enabled
	Ignore 5 mA or below, 0.6 % or below	Enabled
	Ignore 75 W or below	Enabled
	Margin	100 %
	Reference Impedance	Unuse
Vf-setting	Standard	IEC Ed2.0/Ed1.1
	d measurement method	Pst Auto
	Voltage range	300 V
	Current range	20 A
	Nominal voltage	230 V
	Nominal frequency	50 Hz
	Pst measurement time (seconds)	600
	Pst measurement count	12
	d measurement time (seconds)	60
	‘d’ measurement count	24
	Ends when Over-range	Enabled
	dmax limit value	6 %
	Flicker margin	100 %
	d margin	100 %
Vf-VIEW	View type	V/I waveform
	Horizontal scale	×1
	Vertical scale (Current)	×1
	Vertical scale (Voltage)	×1
	Cursor	Left end
	View area	1-screen view

Item		Factory default settings
OTHER-basic measurement	View select	Waveform view
	Horizontal scale	×1
	Vertical scale (Current)	×1
	Vertical scale (Voltage)	×1
	Cursor	Left end
	Auto range	OFF
	Voltage range	300 V
	Current range	20 A
	LPF	6 kHz
	AC coupling	DC
OTHER-FFT analyzer	Cursor	1
	Vertical scale (Current)	×1
OTHER- rush current measurement	Current trigger level (A)	0.1
	Horizontal scale	×1
	Vertical scale (Current)	×1
	Vertical scale (Voltage)	×1
	Cursor	Left end
	Voltage range	300 V
EXT control	AC Pow. OUTPUT	OFF
	AC Pow. output voltage	0.0
	AC Pow. output frequency	50 Hz
	AC Pow. voltage range	100
System setting	I/F selection	GPIB
	GPIB address	1
	RS232C baud rate	19200 bps
	Alarm volume	4
	AC Pow. Control	Disabled
	Year	Current year
	Month	Current month
	Day	Current day
	Hour	Current time (hour)
	Minute	Current time (minute)
	Print type	PDF
	Language	English

5

Harmonic Current Test

This chapter explains harmonic current tests, and describes the setup for test conditions, analysis, and report printout for the respective standards.

5.1 Setting IEC 61000-3-2 (Ed 2.2/Ed 3.0/Ed 4.0) Test Conditions

Set test conditions in the HA Test Conditions List display. The conditions thus set are also used for the HA Observation and Test Conditions display.

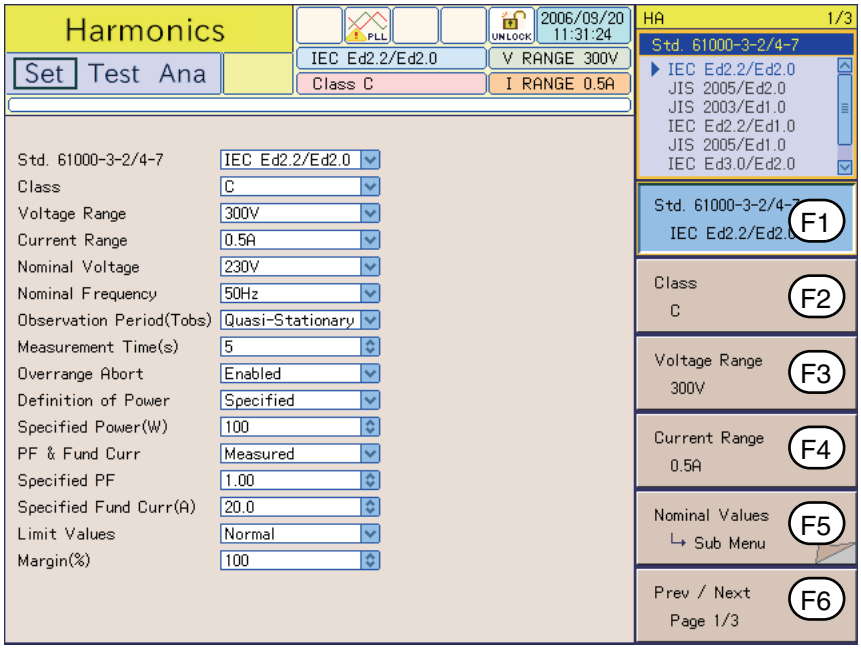


Fig.5-1 HA Test Conditions List display IEC Ed2.2/Ed2.0

Showing the HA Test Conditions List Display

Press the HA key.

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

While the test status shown on the upper left of the display is “Test” or “Analysis,” the mode cannot be changed. The dialog box message “Can’t execute during test/ analysis. Please operate it after ending” is displayed.

In this case, press the VIEW key to turn off its LED. Select “Exit” from the displayed menu.

Test conditions can be set during measurement.

See Page 3-10

Set test conditions in the HA Observation and Test Conditions display. The measurement display is set in the HA Observation and Analysis display (HA-VIEW) and uses the same menu as in the HA Test Conditions List display.

■ View selection and transition

1. Press the HA key.

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

2. Press the VIEW key.

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

3. Press the VIEW key again.

The VIEW key LED turns off, and the HA Observation and Test Conditions display appears.

Pressing the VIEW key toggles the HA Observation and Analysis display (HA-VIEW) and HA Observation and Test Conditions display.

5.1.1 Standards, Classes, Voltage and Current Ranges, and Nominal Values

F1	Standard	IEC Ed2.2/ Ed2.0	JIS 2005/ Ed2.0	JIS 2003/ Ed1.0	IEC Ed2.2/ Ed1.0	JIS 2005/ Ed1.0	IEC Ed3.0/ Ed2.0	IEC Ed3.0/ Ed1.0
		IEC Ed4.0 Ed2.1	IEC Ed4.0/ Ed1.0	JIS 2011/ Ed2.0	JIS 2011/ Ed1.0			

See Page 1-2

To measure harmonic groups out of harmonic waves and interharmonic waves, select IEC Ed4.0/Ed2.1, IEC Ed3.0/Ed2.0 or IEC Ed2.2/Ed2.0; otherwise, select IEC Ed4.0/Ed1.0, Ed3.0/Ed1.0 or IEC Ed2.2/Ed1.0.

F2	Class	A	B	C	D

See Fig.5-1

Select the class of the EUT.

The criteria for standards conformance judgment indicate the limit values corresponding to the classes.

Table 5-1 Device classes

Class	Type of EUT
A	Balanced 3-phase equipment, household electric appliances (excluding Class D), electrically operated tools (excluding portable types), incandescent lamp dimmers, audio devices, and other devices not belonging to other classes
B	Portable electrically operated tools and general-purpose arc welders
C	Lighting fixtures
D	600 W or lower personal computers, monitors for personal computers, and TVs

F3	Voltage Range	150 V	300 V

Indicated above are the voltage ranges of this product. Select one according to the rated power supply voltage of the EUT. Here, select 300 V.

F4	Current Range	0.5 A	1 A	2 A	5 A	10 A	20 A

Indicated above are the current ranges of this product. Select one according to the input current of the EUT.

Normally, set the maximum value in the operating cycle of the EUT. The peak current that can be measured is four times the value in the 0.5 A to 10 A range and 2.5 times the value in the 20 A range.

⚠CAUTION

- The maximum value of input current is 50 Apeak. 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.

The peak current of the EUT is believed to be reached at maximum power or THC. Keep in mind the entire operation cycle of the EUT.

F5	Nominal Values → Sub Menu	Nominal Voltage	Specified Nominal Volt	Nominal Frequency

These are the nominal values (general values) of test voltages and frequencies. Select them according to the ratings of EUT.

■ Nominal Values → Sub Menu

F1	Nominal Voltage	230 V	Specified
F2	Specified Nominal Volt	Numeric value	
		Enter a specified value from 100 V to 300 V. This becomes valid when the specified value is selected in F1.	
F3	Nominal Frequency	50 Hz	60 Hz

- When Specified Nominal Volt is not 230 V, the “Type of test” column for report printing indicates an IEC standard number only. The EN standard number is indicated in an underlined blank.
- Limit values are not subject to voltage conversion (in reference to 230 V) for the specified value of the nominal voltage.

5.1.2 Observation Period, Measuring Time, End at Over-range, Specifying Power, and Class Options

Menu Page 2/3 (F1 F2 F3 F4 F5 F6)

F1	Observation Period (Tobs)	Quasi-Stationary	Short Cycle	Random	Long Cycle

See "4.3 Basics of Menu Operation"

Use this menu for selecting a device operation type to set the observation period (measuring time). The content is used for the report printout. It does not directly affect measurements.

■ Device operation types

Quasi-Stationary	Tobs (observation period) to be set has a continuation period long enough to satisfy a repeatability request to device operation type “Quasi-stationary.”
Short Cycle	Tobs (observation period) to be set has 10 or more fundamental cycles or a continuation period long enough to satisfy a repeatability request to device operation type “Short cycle.” It is very close to an integer multiple of the device operation cycle.
Random	Tobs (observation period) to be set has a continuation period long enough to satisfy a repeatability request to device operation type “Random.”
Long Cycle	Tobs (observation period) to be set is the total program cycle of a device to device operation type “Long cycle” or 2.5 minutes that is typically assumed as the operation period in which the maximum THC is generated.

F2	Measurement Time (s)	Numeric value

Use this menu for setting the measuring time. The setting range is 1 to 9600 seconds. Set the value, in view of the operation cycle of the EUT and the device operation type that is selected using the F1 key.

If you set the standard to IEC Ed4.0/Ed2.1 or IEC Ed4.0/Ed1.0, select Class C, and set the limit values to 3rd/5th/Current Wave, the measurement time will be 0.2 seconds. The Measurement Time setting will be disabled.

F3	Overrange Abort	Enabled	Disabled

See Page 5-45

Use this menu to specify whether to end or continue a test when a measured value exceeds the set voltage or current range.

Enabled	If an over-range occurs, an error message (current or voltage over-range) is displayed, and the measurement is aborted. In this case, analysis can be performed on the data stored prior to when the over-range occurred. The judgment will be FAIL.
Disabled	Even if an over-range occurs, the test is not suspended. After a test is finished, even if every judgment for each harmonic order is PASS, the final test result will be FAIL.

F4	Definition of Power → Sub Menu	Definition of Power	Specified Power (W)

Use this menu to specify how to handle the power value of the EUT. Select the measured or specified value in the sub-menu. Enter a numeric value in the power specification value (W).

■ Definition of Power → Sub Menu

F1	Definition of Power	Measured	Specified
F2	Specified Power (W)	Numeric value	
		Selecting Specified of the Definition of Power lets you enter a value. The input range is 0 W to 4,000 W.	

F5	Class Options → Sub Menu

Selecting the Class C lets you enter the Class Options.

Specify how to handle the power factor and fundamental current of the EUT. Select the measured or specified value in the sub-menu. Enter a numeric value as the specified value.

■ Class options → Sub Menu

F1	PF & Fund Curr	Measured	Specified		
F2	Specified PF	Numeric value			
		Enter a specified value. The input range is 0.00 to 1.00. Selecting Specified of the PF & Fund Curr lets you enter a value.			
F3	Specified Fund Curr (A)	Numeric value			
		Enter a specified value. The input range is 0.00 A to 20.0 A. Selecting Specified of the PF & Fund Curr lets you enter a value.			
F4	Limit Values	Normal	Class A	Class D	3rd/5th/ Current Wave*1
		• Normal Class-C limit value. Select this value for a lamp that exceeds 25 W. • Class-A Select this value for an incandescent lamp with a dimmer that exceeds 25 W. • Class-D Select this value for a discharge lamp of 25 W or lower. • 3rd/5th/Current Wave Select this value for a discharge lamp of 25 W or lower.			

*1. This is enabled when you select the IEC Ed4.0/Ed2.1 standard or the IEC Ed4.0/Ed1.0 standard. If you select this option, you cannot make a report printout of the test results.

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 7.3, “Limits for Class C equipment” and “b) Active input power ≤ 25 W” of IEC 61000-3-2 Ed4.0 are performed.

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.

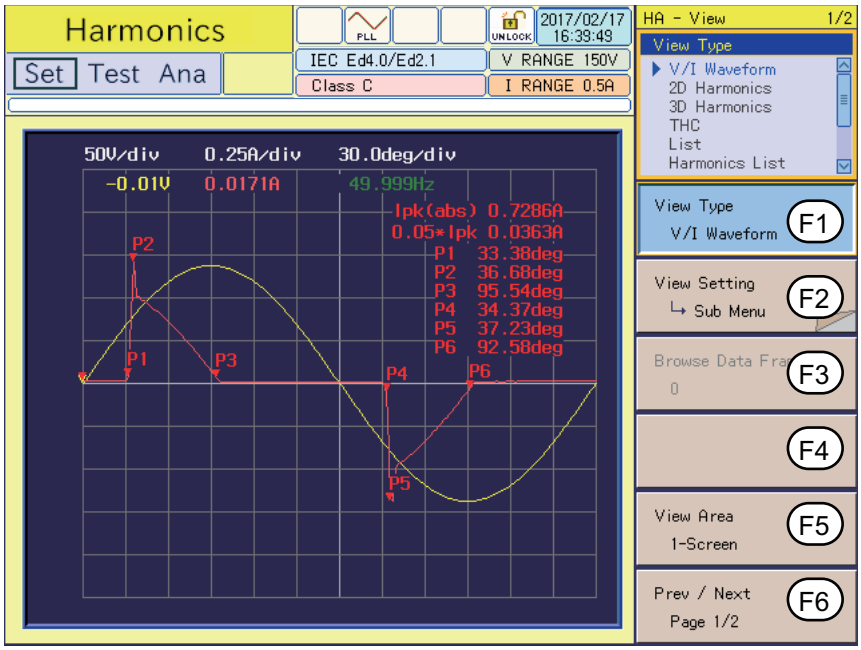


Fig.5-2 V/I waveform screen

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

5.1.3 Margins and Printout of Setting Values

F1	Margin (%)	Numeric value

Use this menu to set the standard limit value to 100. The setting range is 10 to 100. Select 80, for example, when 80 % of the standard limit value is selected.

This value cannot be set during test and analysis.

Table 5-2 Color identification and judgment in graph or list window

Color identification	Measured value	Judgment
Green (Graphs only)	Up to the margin setting value	PASS
Yellow	Greater than the margin setting value up to the limit value	WARN
Red	Greater than the limit value	FAIL

F5	Print	Press

See Page 4-16

This menu is for outputting the setting value using a specified printout format.

■ Saving the setting values to a test conditions file

See Page 4-25

Save the setting values by file manipulation. See Section 4.6.4 “Saving a Test Conditions File.” A test conditions file can be saved to the specific folder of the harmonic test mode. It can be saved in the “Setting” state but not in the “Test” or “Analysis” states.

5.2 Setting JIS C61000-3-2 (2005) and JIS C61000-3-2 (2011)Test Conditions

Set these conditions in the HA Test Conditions List display. The contents set are shared by the HA Observation and Test Conditions display.

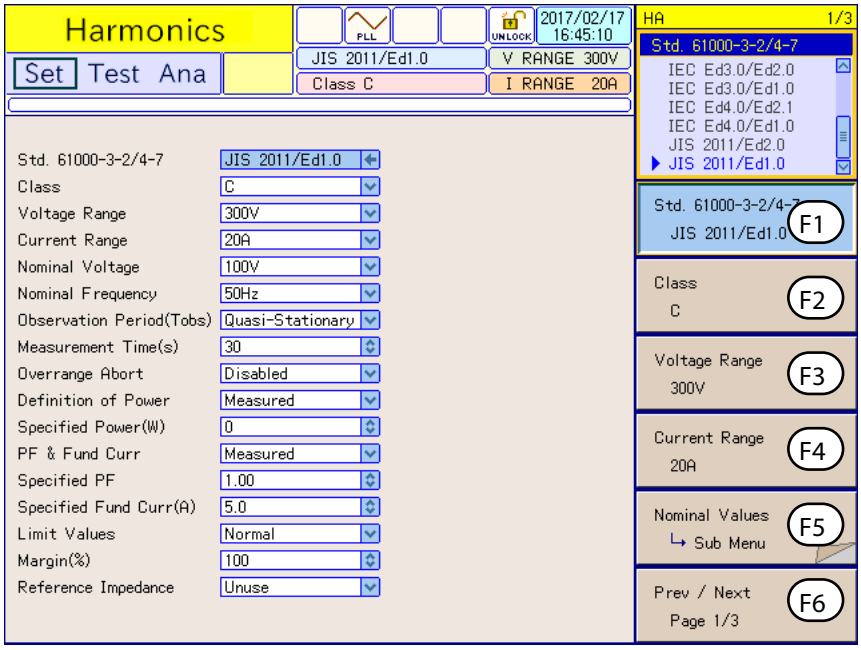


Fig.5-3 HA Test Conditions List display JIS 2011/Ed1.0

Showing the Test Conditions List Display

Press the HA key.

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

While the test status shown on the upper left of the display is “Test” or “Analysis,” the mode cannot be changed. The dialog box message “Can’t execute during test/ analysis. Please operate it after ending” is displayed.

In this case, press the VIEW key to turn off its LED. Select “Exit” from the displayed menu.

Test conditions can be set during measurement

See Page 3-10

Set test conditions in the HA Observation and Test Conditions display. The measurement display is set in the HA Observation and Analysis display (HA-VIEW) and uses the same menu as in the HA Test Conditions List display.

■ View selection and transition

1. Press the HA key.

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

2. Press the VIEW key.

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

3. Press the VIEW key again.

The VIEW key LED illuminates and the HA Observation and Test Conditions display appears.

Pressing the VIEW key toggles the HA Observation and Analysis display (HA-VIEW) and HA Observation and Test Conditions display.

5.2.1 Standards, Classes, Voltage and Current Ranges, and Nominal Values

F1	Standard	IEC Ed2.2/ Ed2.0	JIS 2005/ Ed2.0	JIS 2003/ Ed1.0	IEC Ed2.2/ Ed1.0	JIS 2005/ Ed1.0	IEC Ed3.0/ Ed2.0	IEC Ed3.0/ Ed1.0
		IEC Ed4.0 Ed2.1	IEC Ed4.0 Ed1.0	JIS 2011/ Ed2.0	JIS 2011/ Ed1.0			

See Page 1-2

To measure harmonic groups out of harmonic waves and interharmonic waves, select JIS 2005/Ed2.0 or JIS 2011/Ed2.0; otherwise, select JIS 2005/Ed1.0 or JIS 2011/Ed1.0.

F2	Class	A	B	C	D

See Fig.5-1

Select the class of the EUT.

The criteria for standards conformance judgment indicate the limit values corresponding to the classes.

Table 5-3 Device classes

Class	Type of EUT
A	Balanced 3-phase equipment, household electric appliances (excluding Class D), electrically operated tools (excluding portable types), incandescent lamp dimmers, audio devices, and other devices not belonging to other classes
B	Portable electrically operated tools and general-purpose arc welders
C	Lighting fixtures
D	600 W or lower personal computers, monitors for personal computers, and TVs

F3	Voltage Range	150 V	300 V

Indicated above are the voltage ranges of this product. Select one according to the rated power voltage of EUT.

F4	Current Range	0.5 A	1 A	2 A	5 A	10 A	20 A

Indicated above are the current ranges of this product. Select one according to the input current of the EUT.

Select an estimated maximum value in the operation cycle of the EUT. The peak current that can be measured is four times the value in the 0.5 A to 10 A range and 2.5 times the value in the 20 A range.

⚠CAUTION

- The maximum value of the input current is 50 Apeak. Exceeding this value may cause overheating of the current detector.
- If the current detector overheats, the OHP icon is displayed in the upper part of the window. In this case, immediately shut off the power to the EUT to cut the input current of this product. Restart the test after the OHP icon disappears.

The peak current of the EUT is believed to be reached at maximum power or THC. Keep in mind the entire operation cycle of the EUT.

F5	Nominal Value → Sub Menu	Nominal Voltage	Nominal Frequency

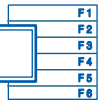
Nominal value (general value) of test voltage. Select one according to the rating of the EUT.

■ Nominal value → Sub Menu

F1	Nominal Voltage	100 V	120 V	200 V	230 V
F2	Nominal Frequency	50 Hz	60 Hz		

5.2.2 Observation Period, Measuring Time, End at Over-range, Specifying Power, and Class Options

Menu Page 2/3



F1	Observation Period (Tobs)	Quasi-Stationary	Short Cycle	Random	Long Cycle

Use this menu for selecting a device operation type to set the observation period (measuring time). The content is used for report printout. It does not directly affect measurements.

■ Device operation types

Quasi-Stationary	Tobs (observation period) to be set has a continuation period long enough to satisfy a repeatability request to device operation type “Quasi-stationary.”
Short Cycle	Tobs (observation period) to be set has 10 or more fundamental cycles and a continuation period long enough to satisfy a repeatability request to device operation type “Short cycle.” It is very close to an integer multiple of the device operation cycle.
Random	Tobs (observation period) to be set has a continuation period long enough to satisfy a repeatability request to device operation type “Random.”
Long Cycle	Tobs (observation period) to be set is the total program cycle of a device to device operation type “Long cycle” or 2.5 minutes that is typically assumed as the operation period in which the maximum THC is generated.

F2	Measurement Time (s)	Numeric value

Use this menu to set the measuring time. The setting range is 1 to 9600 seconds. Set the value, in view of the operation cycle of the EUT and the device operation type that is selected using the F1 key.

If you set the standard to JIS 2011/Ed2.0 or JIS 2011/Ed1.0, select Class C, and set the limit values to 3rd/5th/Current Wave, the measurement time will be 0.2 seconds. The Measurement Time setting will be disabled.

F3	Overrange Abort	Enabled	Disabled

See Page 5-45

Use this menu to specify whether to end or continue a test when a measured value exceeds the set voltage or current range.

Enabled	If an over-range occurs, an error message (current or voltage over-range) is displayed, and the measurement is aborted. In this case, analysis can be performed on the data stored prior to when the over-range occurred. The judgment will be FAIL.
Disabled	Even if an over-range occurs, the test is not suspended. After a test is finished, even if every judgment for each harmonic order is PASS, the final test result will be FAIL.

F4	Definition of Power → Sub Menu	Definition of Power	Specified Power (W)

Use this menu to specify how to handle the power value of the EUT. Select the measured or specified value in the sub-menu. Enter a numeric value in the power specification value (W).

■ Definition of Power specification → Sub Menu

F1	Definition of Power	Measured	Specified
F2	Specified Power (W)	Numeric value	
		Selecting Specified of the Definition of Power lets you enter a value. The input range is 0 W to 4,000 W.	

F5	Class Options → Sub Menu

■ Class Options → Sub Menu

- Menu when Class A is selected

F1	600 W Air Conditioner	No	Yes

Select "Yes" for an air conditioner with actual input power exceeding 600 W.

- Menu when Class C is selected

Use this menu to specify how to handle the power factor and fundamental current of the EUT. Select the measured value or specified value in the sub-menu. Enter a numeric value in the specified value.

F1	PF & Fund Curr	Measured	Specified		
F2	Specified PF	Numeric value			
		Enter the specified value. The input range is 0.00 to 1.00. Selecting Specified of the PF & Fund Curr lets you enter a value.			
F3	Specified Fund Curr (A)	Numeric value			
		Enter a specified value. The input range is 0.00 A to 20.0 A. Selecting Specified of the PF & Fund Curr lets you enter a value.			
F4	Limit Values	Normal	Class A	Class D	3rd/5th/ Current Wave*1
		• Normal: Limit value of Class C. Select this for a lighting fixture that exceeds 25 W (35 W for household lighting fixture). • Class A: Select this value for an incandescent lamp lighting fixture with a dimmer that exceeds 25 W (35 W for household lighting fixture). • Class D: Select this value for a 25 W or lower discharge lamp lighting fixture and a fluorescent lamp that is higher than 25 W to 35 W (3 years after the date of standard issuance). • 3rd/5th/Current Wave Refer to the IEC 61000-3-2 Ed4.0 for detail.			

*1. If you select this option, you cannot make a report printout of the test results.

5.2.3 Margins and Printout of Setting Values

F1	Margin (%)	Numeric value

Use this menu to set the standard limit value as 100. The setting range is 10 to 100. Select 80, for example, when 80 % of the standard limit value is selected.

This value cannot be set during test and analysis.

Table 5-4 Color identification and judgment in graph or list window

Color identification	Measured value	Judgment
Green (Graphs only)	Up to the margin setting value	PASS
Yellow	Greater than the margin setting value up to the limit value	WARN
Red	Greater than the limit value	FAIL

F2	Reference Impedance	Unuse	Use

Set whether to use the reference impedance.

F5	Print	Press

See Page 4-16

This menu is for outputting the setting value using a specified printout format.

■ Saving the setting values to a test conditions file

See Page 4-25

Save setting values by file manipulation. See Section 4.6.4 “Saving a Test Conditions File.” A test conditions file can be saved to the specific folder of the harmonic test mode. It can be saved in the “Setting” state but not in the “Test” or “Analysis” states.

5.3 Setting JIS C61000-3-2 (2003) Test Conditions

Set these conditions in the HA Test Conditions List display. The contents set are shared by the HA Observation and Test Conditions display.

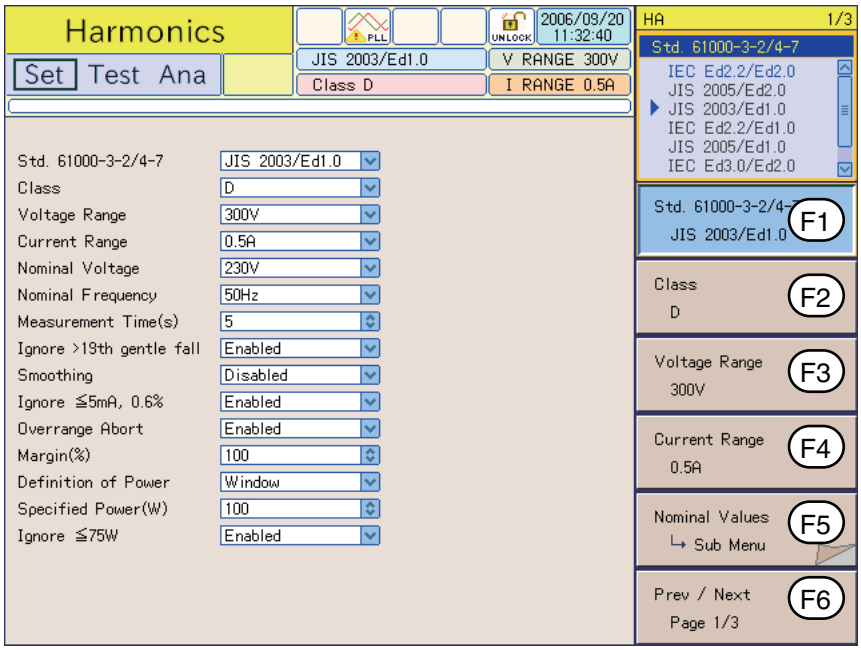


Fig.5-4 HA Test Conditions List display JIS 2003/Ed1.0

Showing the Test Conditions List display

Press the HA key.

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

While the test status shown on the upper left of the display is “Test” or “Analysis,” the mode cannot be changed. The dialog box message “Can’t execute during test/analysis. Please operate it after ending” is displayed.

In this case, press the VIEW key to turn off its LED. Select “Exit” from the displayed menu.

Test conditions can be set during measurement

See Page 3-10

Set test conditions in the HA Observation and Test Conditions display. The measurement display is set in the HA Observation and Analysis display (HA-VIEW) and uses the same menu as in the HA Test Conditions List display.

■ View selection and transition

1. Press the HA key.

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

2. Press the VIEW key.

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

3. Press the VIEW key again.

The VIEW key LED turns off and the HA Observation and Test Conditions display appears.

Pressing the VIEW key toggles the HA Observation and Analysis display (HA-VIEW) and HA Observation and Test Conditions display.

5.3.1 Standards, Classes, Voltage and Current Ranges, and Nominal Values

F1	Standard	IEC Ed2.2/ Ed2.0	JIS 2005/ Ed2.0	JIS 2003/ Ed1.0	IEC Ed2.2/ Ed1.0	JIS 2005/ Ed1.0	IEC Ed3.0/ Ed2.0	IEC Ed3.0/ Ed1.0
		IEC Ed4.0 Ed2.1	IEC Ed4.0 Ed1.0	JIS 2011/ Ed2.0	JIS 2011/ Ed1.0			

See Page 1-2

Select JIS 2003/Ed1.0.

F2	Class	A	B	C	D

See Fig.5-4

Select the class of the EUT.

The criteria for standards conformance judgment indicate the limit values corresponding to the respective classes.

Table 5-5 Device classes

Class	Type of EUT
A	Balanced 3-phase equipment and other devices not belonging to other classes
B	Portable electrically operated tools
C	Lighting fixtures
D	600 W or lower devices with special input waveforms

F3	Voltage Range	150 V	300 V

Indicted above are the voltage ranges of this product. Select one according to the rated power voltage of EUT.

F4	Current Range	0.5 A	1 A	2 A	5 A	10 A	20 A

Indicted above are the current ranges of this product. Select one according to the input current of the EUT.

Select an estimated maximum value in the operation cycle of the EUT. The peak current that can be measured is four times the value in the 0.5 A to 10 A range and 2.5 times the value in the 20 A range.

⚠CAUTION

- The maximum value of the input current is 50 Apeak. Exceeding this value may cause overheating of the current detector.
- If the current detector overheats, the OHP icon is displayed in the upper part of the window. In this case, immediately shut off the power to the EUT to cut input current of this product. Restart the test after the OHP icon disappears.

The peak current of the EUT is believed to be reached at maximum power. Keep in mind the entire operation cycle of the EUT.

F5	Nominal Values → Sub Menu	Nominal Voltage	Nominal Frequency

Nominal values (general values) of test voltage and frequency. Select them according to the rating of the EUT.

■ Nominal value → Sub Menu

F1	Nominal Voltage	100 V	120 V	200 V	230 V
F2	Nominal Frequency	50 Hz	60 Hz		

5.3.2 Measuring Time, Ignore Over 19th If Dropping, Smoothing, and Wave Check/Envelope

F2	Measuring Time (s)	Numeric value

Set the measuring time. The setting range is 1 to 150 seconds. Set this value, taking into consideration the operation cycle of the EUT.

F3	Ignore > 19th gentle fall	Enabled	Disabled

If harmonic current above the 19th is dropping slightly, up to the 19th is to be judged.

F4	Smoothing	None	1.5 s	Average 4

None	Select when harmonic current is stable.
1.5 s	Select when harmonic current is fluctuating. This is the most general method of using 1.5 second smoothing filter.
Average 4	Select when harmonic current is fluctuating. This is a simplified smoothing function.

F5	Wave Check/ Envelope → Sub Menu	Press

Use this menu to check the waveform of Class D. It displays the ratio (%) that is included in the envelope for judgment. It also displays other voltage values and the peak current of the current value in both the positive and negative direction.

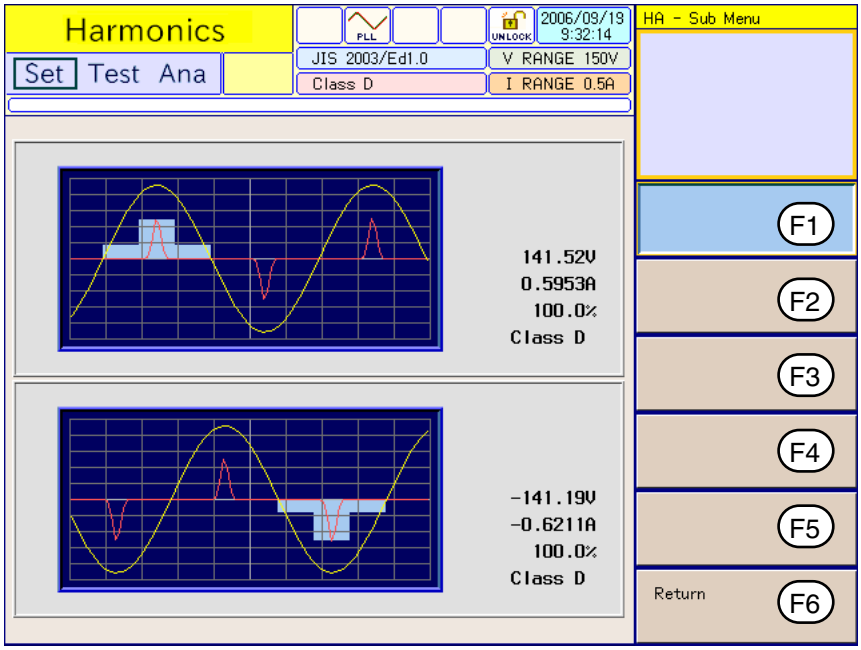


Fig.5-5 Wave check/envelope display

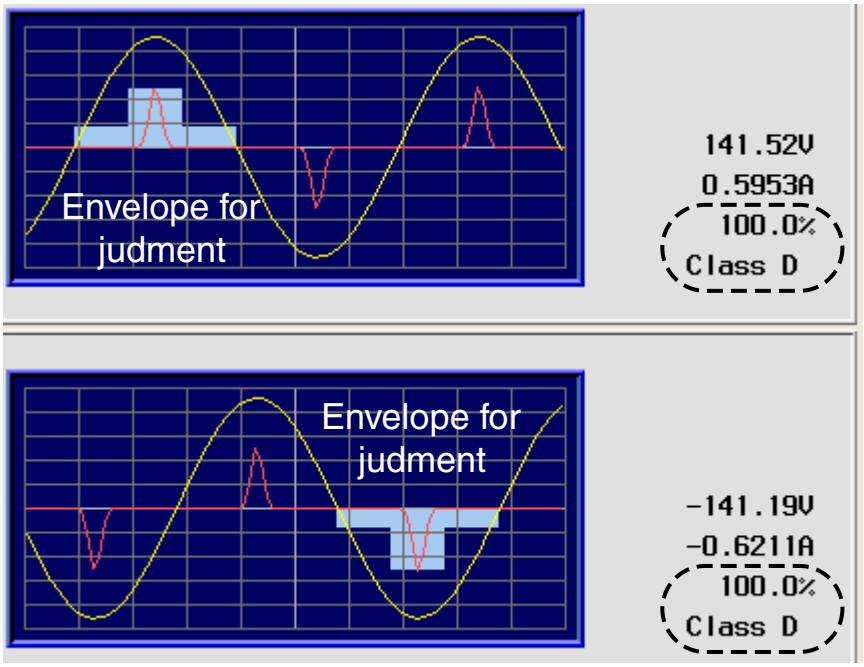


Fig.5-6 Enlarged envelope section

The center of the envelope for judgment is automatically set to the peak current value. It is set every half cycle of the current. If the current waveform is within the envelope for at least 95% of each half cycle, Class D is assumed.

5.3.3 Ignore 5 mA or Below, 0.6 % or Below, End at Over-range, Margins and Printout of Setting Values, and Class Options

F1	Ignore 5 mA ≤ 0.6 %	Enabled	Disabled

Use this menu to compare 0.6 % of the input current with 5 mA and specify whether or not to ignore a harmonic current that is less than the larger of the two. To allow for consideration of values up to the smaller current, select “Disabled.”

F2	Overrange Abort	Enabled	Disabled

See Page 5-45

Use this menu to specify whether to end or continue a test when a measured value exceeds the set voltage or current range.

Enabled	If an over-range occurs, an error message (current or voltage over-range) is displayed, and the measurement is aborted. In this case, analysis can be performed on the data stored prior to when the over-range occurred. The judgment will be FAIL.
Disabled	Even if an over-range occurs, the test is not suspended. After a test is finished, even if every judgment for each harmonic order is PASS, the final test result will be FAIL.

F3	Margin (%)	Numeric value

This menu sets the standard limit value as 100. The setting range is 10 to 100. Select 80, for example, when 80 % of the standard limit value is selected.

This value cannot be set during test and analysis.

Table 5-6 Color identification and judgment in graph or list view

Color identification	Measured value	Judgment
Green (Graphs only)	Up to the margin setting value	PASS
Yellow	Greater than the margin setting value up to the limit value	WARN
Red	Greater than the limit value	FAIL

F4	Print	Press

See Page 4-16

This menu is for outputting the setting value using a specified printout format.

■ Saving the setting values to a test conditions file

See Page 4-25

Save setting values by file manipulation. See Section 4.6.4 “Saving a Test Conditions File.” A test conditions file can be saved to the specific folder of the harmonic test mode. It can be saved in the “Setting” state but not in the “Test” or “Analysis” states.

F5	Class Options → Sub Menu

■ Class option → Sub Menu

- Menu when Class A is selected

F1	600 W Air Conditioner	No	Yes

Select “Yes” for an air conditioner with actual input power exceeding 600 W.

- Menu when Class C is selected

Use this menu to specify how to handle the power factor and fundamental current of the EUT. Select the measured value or specified value in the sub-menu. Enter a numeric value in the specified value.

F1	PF & Fund Curr	Measured	Specified	
F2	Specified PF	Numeric value		
		Enter a specified value. The input range is 0.00 to 1.00. Selecting Specified of the PF & Fund Curr lets you enter a value.		
F3	Specified Fund Curr (A)	Numeric value		
		Enter a specified value. The input range is 0.00 A to 20.0 A. Selecting Specified of the PF & Fund Curr lets you enter a value.		
F4	Limit Values (≤ 35 W)	Normal	Class D	Ignore
		In the standard, limit values are not applied but the following menus can be selected: • Normal Limit value of Class C. Select this when 35 W or lower is also evaluated with a limit value of Class C. • Class D Limit value of Class D. Select this for a 35 W or lower fluorescent lamp. • Ignore Limit values are ignored. This is normal usage.		

- Menu when Class D is selected

<table>
<tr><td rowspan="2">F1</td><td rowspan="2">Definition of Power</td><td>Window</td><td>Average</td><td>Specified</td></tr>
<tr><td colspan="3">Select the actual input power used to calculate limit values. Normally, use “Window” or “Average” Specified values are not defined in the standard.
• Window
Maximum value of actual power for each window
• Average
Average value of actual power in entire test period
• Specified
Specified value for manufacturers</td></tr>
<tr><td rowspan="2">F2</td><td rowspan="2">Specified Power (W)</td><td>Numeric value</td><td colspan="2"></td></tr>
<tr><td colspan="3">Selecting Specified of the PF & Fund Curr lets you enter a value. The entry range is 0 W to 4 000 W.</td></tr>
<tr><td>F3</td><td>Ignore ≤ 75 W</td><td>Enabled</td><td>Disabled</td><td></td></tr>
</table>

5.4 Using the HA Observation and Analysis Display (HA-VIEW)

View types and main usage

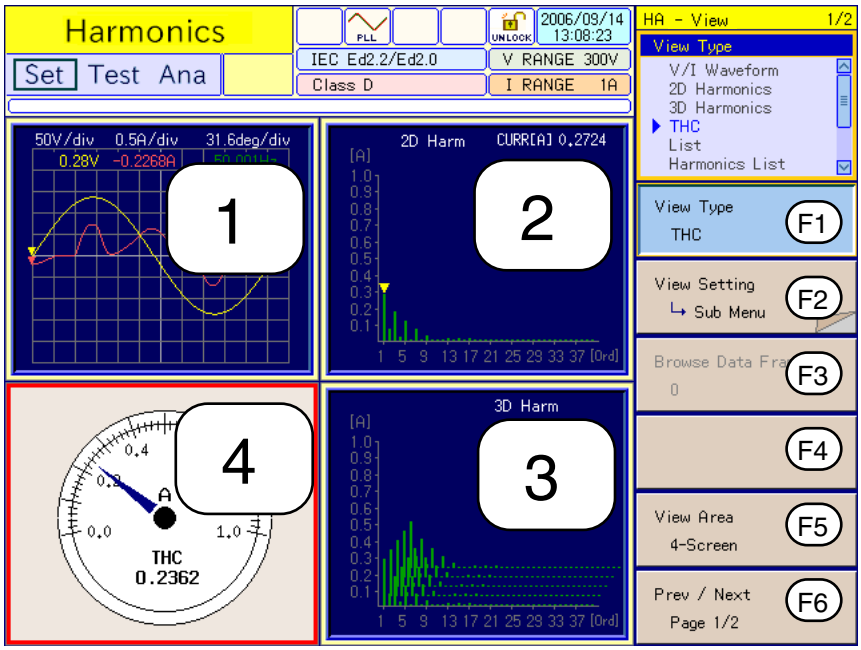


Fig.5-7 HA Observation and Analysis display (HA-VIEW) 1 (Example of 4-screen)

Explanation No.	View type	Content displayed	Usage
1	V/I Waveform	• Input voltage/current waveform • Enlargement and reduction of vertical and horizontal scales • Reading peak value using the cursor	[Setting, Test, and Analysis] • Checking input conditions of EUT • Waveform check • Observing large changes • Selecting current range
2	2D Harmonics	• Harmonic current bar graph • Enlargement and reduction of vertical scale	[Setting, Test, and Analysis] • Comparing orders of harmonic current • Limit value comparison • Search for maximum value
3	3D Harmonics	• Harmonic current bar graph • Enlargement and reduction of vertical scale • Time transition observation	[Setting, Test, and Analysis] • Bar graph time transition • Change characteristics
4	THC	• Meter indication • Retention of maximum values	[Setting, Test, and Analysis] • Setting operation conditions of EUT

[Setting, Test, and Analysis] indicates the state that can be used.

- [Setting]: While test conditions are set
- [Test]: During testing
- [Analysis]: During post-test analysis

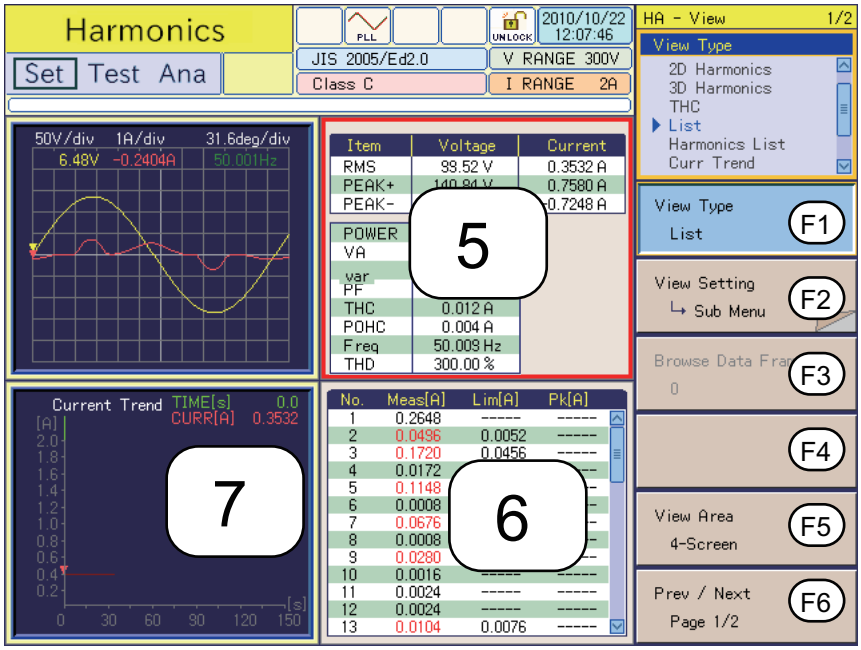


Fig.5-8 HA Observation and Analysis display (HA-VIEW) 2 (Example of 4-screen)

Explanation No.	View type	Content displayed	Usage
5	List	• Displaying basic measurement parameters • Numeric display • THD	[Setting, Test, and Analysis] • Analysis
6	Harmonics List	• Harmonic current of each order • Displaying limit values	[Setting and Analysis] • Comparing orders of harmonic current • Limit value judgment
7	Current Trend	• Actual value of input current • Time transition	[Setting, Test, and Analysis] • Time transition • Search for large-change timing

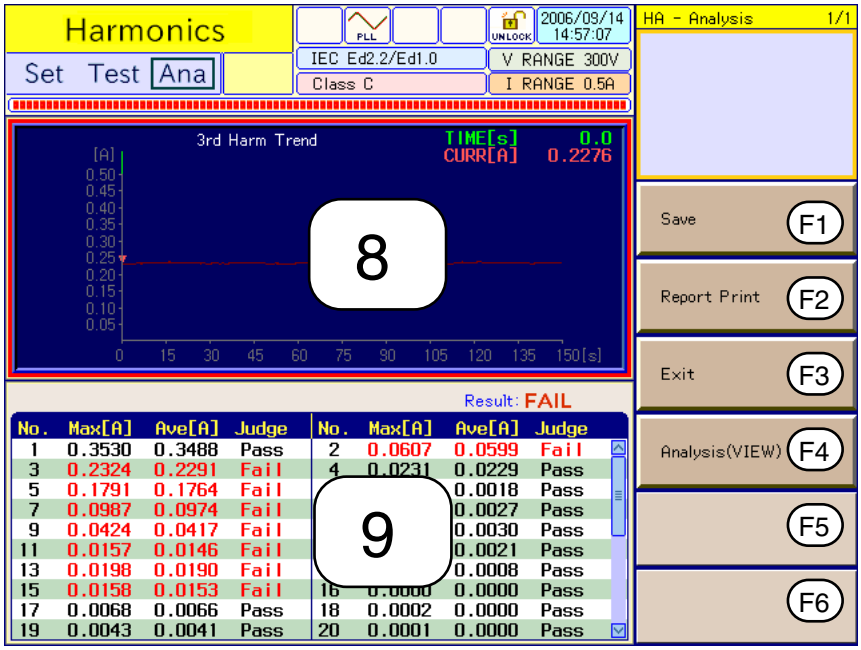


Fig.5-9 HA Observation and Analysis display (HA-VIEW) 3 (Example of 2-screen)

Explanation No.	View type	Content displayed	Usage
8	Harmonics trend	• Time transition of harmonic current • Order-unit analysis	[Setting, test, and analysis] • Verifying worst values
9	Results list	• Test results list • Final test result of harmonic current of each order	[Analysis] • Standards conformance judgment

Selecting view types in HA Observation and Analysis display (HA-VIEW)

1. Press the HA key.

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

2. Press the VIEW key.

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

   Press the VIEW key again. The VIEW key LED turns off and the HA Observation and Test Conditions display is displayed.

3. Press F1 (view type) and select the view type to be displayed.

   The menu that corresponds to the view type appears.

4. Use arrow keys (up, down, left, right) to select the window to be set.

   The selected window is displayed with a red frame.

5.4.1 View Types, View Setting, Data Frame Shift and View Area

See "4.3 Basics of Menu Operation"

F1	View Type	V/I Waveform	2D Harmonics	3D Harmonics	THC	List	Harmonics List
		Current Trend	Harmonic Trend	Results List			

Use this menu to select the view type.

F2	View Setting → Sub Menu	Menu corresponding to view type

See Page 5-28, Page 5-30, Page 5-32

A different sub-menu is displayed for each view type selected.

F3	Browse Data Frame	Numeric value

This menu enables setting during post-test analysis. Before a test is executed, it is displayed in a pale color and not selectable. Select the measurement display to be analyzed. The setting range is proportional to the measuring time. Numeric values set commonly affect all view types.

The time for each data frame depends on the measuring time, a test condition. The longer the time, the larger the value will be (the setting for resolution is lowered).

Table 5-7 Time for each data frame

Standard name notation	Measuring time (T)						
	T ≤ 150 s	150 s < T ≤ 300 s	300 s < T ≤ 600 s	600 s < T ≤ 1200 s	1200 s < T ≤ 2400 s	2400 s < T ≤ 4800 s	4800 s < T ≤ 9600 s
IEC Ed4.0/Ed2.1 IEC Ed3.0/Ed2.0 IEC Ed2.2/Ed2.0 JIS 2005/Ed2.0 JIS 2011/Ed2.0	0.2 s	0.4 s	0.8 s	1.6 s	3.2 s	6.4 s	12.8 s
IEC Ed4.0/Ed1.0 IEC Ed3.0/Ed1.0 IEC Ed2.2/Ed1.0 JIS 2005/Ed1.0 JIS 2011/Ed1.0	0.32 s (50 Hz) or 0.266 s (60 Hz)	0.64 s (50 Hz) or 0.532 s (60 Hz)	1.28 s (50 Hz) or 1.06 s (60 Hz)	2.56 s (50 Hz) or 2.13 s (60 Hz)	5.12 s (50 Hz) or 4.25 s (60 Hz)	10.24 s (50 Hz) or 8.51 s (60 Hz)	20.48 s (50 Hz) or 17.02 s (60 Hz)
JIS 2003/Ed1.0		Not applicable					

Example: When the measuring time is set to 150 seconds in IEC Ed4.0/Ed2.1, IEC Ed3.0/Ed2.0, IEC Ed2.2/Ed2.0, JIS 2005/Ed2.0 and JIS 2011/Ed2.0, the data frame is set to 0 to 750. Five data frames per second is assumed.

NOTE

- The measuring time is divided into data frames. The display, which is selected by View Setting → Sub Menu, shows the contents of each data frame (excluding current and harmonic trend displays). This is useful for analyzing the details on transition from the beginning of a test.

F5	View Area	1-Screen	2-Screen	4-Screen

To select divided windows, use the arrow keys (up, down, left, right).

The selected window is indicated with a red frame. It is automatically selected in the 1-screen view.

View Setting → Sub Menu

A different sub-menu is displayed depending on the view type selected. The sub-menus for the V/I waveform, 2D and 3D harmonics, THC, and list are shown below.

■ V/I waveform

F1	Horizontal Scale	×10	×5	×2	×1
		×1/2	×1/5		
		Select the magnification to enlarge or reduce a view. About one cycle is displayed by “1x.” The magnification can be set before a test is executed. After the test is executed, it is displayed in a pale color and not selectable. In the window display, deg/div indicates the phase angle/div.			
F2	Vertical Scale (Current)	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			
F3	Vertical Scale (Voltage)	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			
F4	Cursor	Turn the small or large knob to move the cursor within the window. The voltage and current values at the cursor are displayed.			

■ 2D harmonics and 3D harmonics

F1	Vertical Scale (Current)	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			
F2	Cursor	The cursor can be used for 2D harmonics. Turn the small or large knob to move the cursor within the window. The current value at the cursor position (harmonic order) is displayed.			
F3	Show Limit Values	Yes	No		
		The values can be used for 2D harmonics. The limit value display (white mark above a bar graph) is turned on/off. If a limit value does not exist, it is not displayed even by selecting “Yes.” For details on view conditions, see "Screen display for judgment (PASS / FAIL / WARN, N/A)" on page 5-34.			

- 2D harmonics
  This menu displays harmonic current values up to the 40th order in a bar graph. A white mark above the bar graph indicates the limit value. Measured values that are greater than 100% of the limit value are displayed in red. Measured values up to the margin setting value are displayed in green, and those above the margin setting value to 100% of the limit value are displayed in yellow.
  The limit value is not displayed when it exceeds the maximum value of the vertical scale. To display the limit value within the vertical scale, reduce the magnification of the vertical scale in the test conditions setting state. The view can also be enabled by increasing the current range.

- 3D harmonics
  This menu makes it possible to monitor the time transition of harmonic current. The latest data is displayed in the innermost position, and the older data comes forward in order. The color identification is the same as for the 2D harmonics.

■ THC

F1	Peak Reset	The maximum value (red view) of THC is retained. This value is reset. It cannot be reset during analysis.

See Page 5-29

This menu uses a bar graph to display THC and input current with an analog meter. The maximum value (peak) of THC is displayed in red.

The main usage of the peak reset is given below.

- Because the current range is changed, the values held to this point are nullified.
- The values held to this point are reset to search for the maximum value of THC.

■ List

F1	View Item	RMS	PEAK+	PEAK-	POWER
		VA	var	PF	THC
		POHC	Freq	THD	
		Place a check mark by pressing the ENTER key. The corresponding value is displayed. To remove the check mark, press the ENTER key again (toggle operation).			

- RMS (Actual value rms): Actual value of input voltage and current
- PEAK+: Positive amplitude peak value of input voltage and current
- PEAK–: Negative amplitude peak value of input voltage and current
- POWER (actual power): Actual power W of EUT
- VA (apparent power): Apparent power VA of EUT
- var (reactive power): Reactive power var of EUT
- PF (power factor): Power factor of EUT
- THC: Total harmonic current of input current and actual value of 2nd to 40th harmonic current components
- POHC: Partial odd-order harmonic current of input current and actual value of harmonic current component of odd orders from 21st to 39th
- Freq (frequency): Input frequency measured at input voltage
- THD (total harmonic distortion): Total harmonic distortion of the input current. The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

View Setting → Sub Menu

A different sub-menu is displayed for each view type selected. The sub-menus of the harmonics list and the current and harmonic trends are given below.

■ Harmonic list

F1	Item	Average	Max
		Select the current view of each harmonic order.	
F2	Scroll	Used to view a hidden part. Turn the small knob to vertically scroll over the display. This is used when the display is divided into two or four screens. In the 1-screen view, it is displayed in a pale color.	

- Average: Average value from the beginning of the test (A)
- Max: Maximum value from the beginning of the test (A)

See Page 5-34

● Explanation of display items

Display item	Explanation
No.	Harmonic order
Meas(A)	Harmonic current (A) • Measured values that exceed 100 % of the limit value are displayed in red. • Measured values that exceed the margin setting value to 100 % of the limit value are displayed in yellow.
Ave(A)	Average value from test start (A) • Average value from the beginning of the test. It has no color change. • "....." is displayed in the test conditions setting state (real-time measurement).
Pk(A)	Maximum value from test start (A) • Maximum value from the beginning of the test. It has no color change. • "....." is displayed in the test conditions setting state (real-time measurement).
Lim(A)	Limit value (A) In the following case, a limit value may be indicated in "....." • There is no limit value • A calculated limit value is less than 0.0001 A (0.001 A in the range of 10 A or more)

■ Current trend

F1	Vertical Scale (Current)	×10	×5	×2	×1
		×1/2	×1/4		
		Set the magnification to enlarge or reduce a view.			
F2	Peak search	Search for a maximum value. The cursor moves to the maximum value. The current value at the cursor position and the time has passed since the test start time are displayed.			
F3	Bottom search	Search for a minimum value. The cursor moves to the minimum value. The current value at the cursor position and the time has passed since the test start time are displayed.			

■ Harmonics trend

F1	Order	Numeric value			
		Set the order of harmonic current to be observed. The setting range is 1 to 40.			
F2	Vertical Scale (Current)	×10	×5	×2	×1
		×1/2	×1/4		
		Set a view multiplication factor to enlarge or reduce a view.			
F3	Peak search	Search for a maximum value. The cursor moves to the maximum value. The current value at the cursor position and the time has passed since the test start time are displayed.			
F4	Bottom search	Search for a minimum value. The cursor moves to the minimum value. The current value at the cursor position and the time has passed since the test start time are displayed.			

View Setting → Sub Menu

A different sub-menu is displayed for each view type selected. The sub-menus of a results list are given below.

■ Results list

F1	Item	100 %	Margin		
		Limit value	Value set as margin		
F2	Comment Input → Sub Menu	Memo → Sub Menu	Model name → Sub Menu	Type → Sub Menu	Serial No. → Sub Menu
F5	Scroll	Used to view a hidden part. Turn the small knob to vertically scroll over the display. This is used when the display is divided into two or four windows. In the 1-screen, it is displayed in a pale color.			

- Items (100 % and margin) are displayed in JIS 2003/Ed1.0. In other standards, they are displayed in a pale color. Standard judgment is made at the ratio of time (accumulated value in entire test period) in which the selected value (100 % or margin) is exceeded, against the entire test period.

● Explanation of display items

See Page 5-34

Display item	Description
No.	Harmonic order
Max(A)	Maximum value (A) during test period • Part in which the maximum value exceeds 150 % of the limit value is displayed in red. • This differs from the harmonics list (part in which 100 % of the limit value is exceeded is displayed in red).
Ave(A)	Average value (A) during entire test period • Part in which the average value in the entire test period exceeds 100 % of the limit value is displayed in red.
100 % or margin %	100 % is the ratio (%) of time in which limit values (accumulated value of entire test period) are exceeded, against the entire measurement time. Margin % is displayed as follows when the limit value replaces the set value of the margin: • The part in which the ratio (%) of time (accumulated value of entire test period) in which measured values exceed 100 % of the limit value up to 150 % of that limit value, against the entire test period, exceeds 10 % is displayed in red.
Judge	Judgment of each harmonic order (PASS/FAIL/WARN) • WARN is displayed when the margin is exceeded. "N/A" is displayed when limit values are not applied in the following cases: • When there is not limit value • When the measured value of harmonic current is smaller than 0.6 % of input current or 5 mA, whichever is larger.
Margin---%	Margin to limit value • Displayed in 1-screen view only
Result	Final test result (PASS/FAIL/WARN) • WARN is displayed when the margin is exceeded.
POHC	Maximum value of POHC in test period • Displayed in red when POHC exceeds POHCLim
POHCLim	POHC calculated from limit value applied
Lim2:200 %	Displayed when 200 % of the limit value is applied.

■ Comment Input → Sub Menu

F1	Memo → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter the comments to be displayed in “Memo” in the report.		
F2	Model name → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter the comments to be displayed in “Model Name” in the report.		
F3	Type → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter the comments to be displayed in “Type” in the report.		
F4	Serial No. → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter the comments to be displayed in “Serial No.” in the report.		

■ Memo, Model Name, Type, Serial No. → Sub Menu

F1	Input 1-char	Press		
		A character input dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a frame, press this key. The selected character is displayed where the cursor is blinking. Up to 20 alphanumeric characters and up to 10 hiragana characters and 10 katakana characters can be input.		
F2	Delete 1-char	Press		
		The character to the left of where the cursor is blinking is deleted.		
F3	Change char type	Alphanumeric	Hiragana	Katakana
		Every time the key is pressed, another character type is selected.		

F1 to F3: Press the ENTER key after making your decision.

See Page 5-48

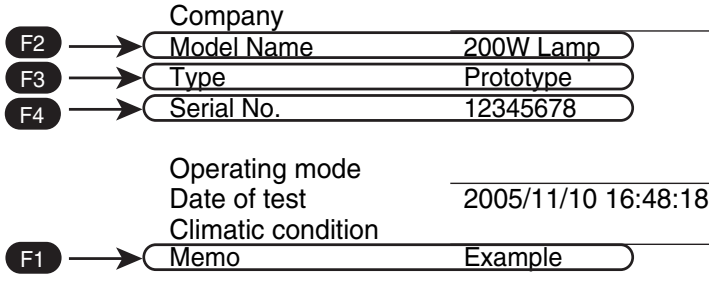


Fig.5-10 Characters displayed on the report (example)

Screen display for judgment (PASS / FAIL / WARN, N/A)

The display color and judgment (PASS/FAIL/WARN) of graphs or numeric values are summarized below.

Color identification, which is displayed in a test conditions setting state (real-time measurement) and test, is not a final test result. It is a state that is compared with the limit value or margin at that time. The final test result is made by the test execution results.

Table 5-8 Display colors of graphs and numeric values, and their judgment

<table>
<tr><th colspan="3">View type</th><th>IEC Ed4.0/Ed2.1
IEC Ed4.0/Ed1.0
IEC Ed3.0/Ed2.0
IEC Ed2.2/Ed2.0
IEC Ed3.0/Ed1.0
IEC Ed2.2/Ed1.0</th><th>JIS 2005/Ed2.0
JIS 2005/Ed1.0
JIS 2011/Ed2.0
JIS 2011/Ed1.0</th><th>JIS 2003/Ed1.0</th></tr>
<tr><td colspan="2">2D harmonics
(graph display)</td><td rowspan="3">Display color</td><td colspan="3" rowspan="3">[Red] Greater than 100 % of the limit value (graph and numeric value displays)
[Yellow] Greater than the margin setting value up to 100 % of the limit value (graph and numeric value displays)
[Green] Up to the margin setting value (graph display)
[Black] Up to the margin setting value (numeric value display)</td></tr>
<tr><td colspan="2">3D harmonics
(graph display)</td></tr>
<tr><td rowspan="4">Harmonics list
(Numeric value display)</td><td>Meas(A)
Harmonic current</td></tr>
<tr><td>Ave(A)
Average value from the beginning of test</td><td rowspan="2">Display color or “----”</td><td colspan="3" rowspan="2">No color change
[----] Numeric values are not displayed in test conditions setting state (real-time display)</td></tr>
<tr><td>Pk(A)
Maximum value from the beginning of test</td></tr>
<tr><td>Lim(A)
Limit value</td><td>“----”</td><td colspan="3">[----] Numeric values are not displayed in the following cases
• There is no limit value
• A calculated limit value is less than 0.0001 A (0.001 A in the range of 10 A or more)</td></tr>
<tr><td rowspan="4">Results list
(Numeric value display)</td><td>Max(A)
Maximum value in test period</td><td>Display color</td><td colspan="3">[Red] Greater than 150 % of the limit value
* Differs in display color from harmonics list (part in which 100 % of limit value is exceeded is displayed in red).</td></tr>
<tr><td>Ave(A)
Average value in test period</td><td>Display color</td><td colspan="2">[Red] The average value in entire test period exceeds 100 % of limit value</td><td>Not displayed</td></tr>
<tr><td>100 %</td><td>Display color</td><td colspan="2">Not displayed</td><td>[Red]
Ratio (%) of times (accumulated value in entire test period) in which measured values above 100 % to 150 % of that value, to the total test time exceeds 10 %</td></tr>
<tr><td>Margin %</td><td>Display color</td><td colspan="2">Not displayed</td><td>[Red]
Ratio (%) of times (accumulated value in entire test period) in which measured values above the margin to 1.5 times that margin, to the total test time exceeds 10 %</td></tr>
</table>

Continued on next page

View type			IEC Ed4.0/Ed2.1 IEC Ed4.0/Ed1.0 IEC Ed3.0/Ed2.0 IEC Ed2.2/Ed2.0 IEC Ed3.0/Ed1.0 IEC Ed2.2/Ed1.0	JIS 2005/Ed2.0 JIS 2005/Ed1.0 JIS 2011/Ed2.0 JIS 2011/Ed1.0	JIS 2003/Ed1.0
Results list (Numeric value display)	Judge	Display color	[Yellow] Warning [Red] FAIL		
		"N/A"	[N/A] Indicates that limit values are not applied in the following conditions • There is no limit value • The measured value of harmonic current is smaller than 0.6 % of input current or 5 mA, whichever is larger • Actual power is 75 W or less in classes A, B, and D		
	Result	Display color	[Green] PASS [Yellow] WARN [Red] FAIL		
	POHC	Display color	[Red] FAIL POHC exceeds POHCLim		Not applicable

5.4.2 Checking AC Power Supply and Repeatability

F4	Check AC Power Supply → Sub Menu

Use this menu to check the performance of the AC power supply for a test. Check the voltage, voltage distortion factor, and frequency using the LOAD terminal of this product. When the connection cable to the EUT is long, standard requirements may not be satisfied because of an increase in voltage drop and inductance.

Judgment results are displayed as "PASS" or "FAIL." Depending on the requirements of the standard, the judgment timing is as shown below.

Table 5-9 AC Power supply check timing

Standard name notation	Description
IEC Ed4.0/Ed2.1 IEC Ed4.0/Ed1.0 IEC Ed3.0/Ed2.0 IEC Ed2.2/Ed2.0 IEC Ed3.0/Ed1.0 IEC Ed2.2/Ed1.0 JIS 2005/Ed2.0*1 JIS 2005/Ed1.0*1 JIS 2011/Ed2.0*1 JIS 2011/Ed1.0*1	The judgment is performed on the measured values during the test.
JIS 2005/Ed2.0*2 JIS 2005/Ed1.0*2 JIS 2011/Ed2.0*2 JIS 2011/Ed1.0*2	Realtime measurement and judgment is performed when tests are not being executed. When you select these standards, you have to perform judgments with the EUT turned off before you start the test.

*1. When Reference Impedance is set to Unuse.
*2. When Reference Impedance is set to Use.

⚠WARNING

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

■ Select View Items → Sub Menu

F1	Select View Items	Measured Values	Recorded Values
F2	Record	Press this to record the current measured value. The recorded value will be retained until you turn the power off.	

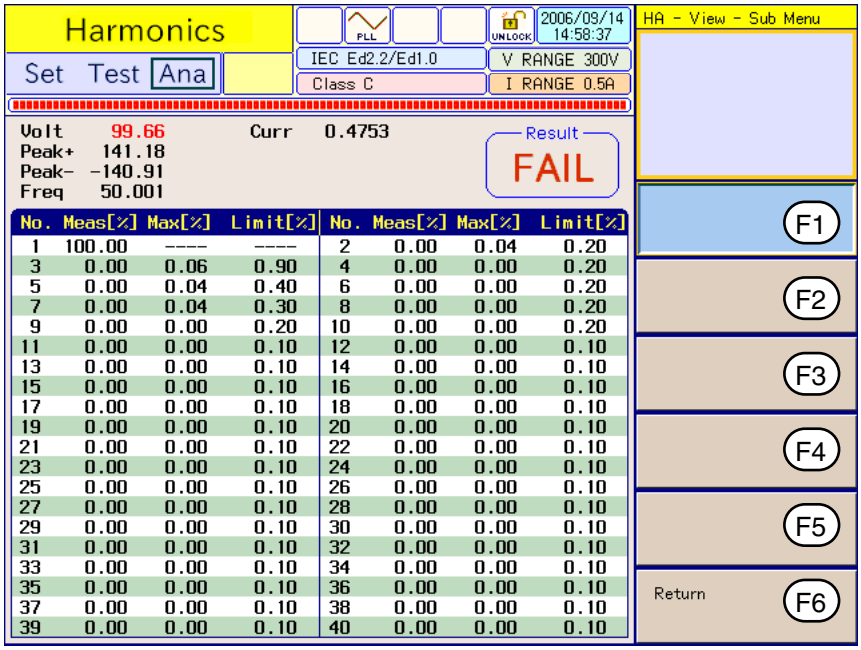


Fig.5-11 Check display for AC power supply (IEC 61000-3-2 (Ed2.2))

- Explanation of view items

Volt : Actual voltage (V)

Peak+ : Positive peak voltage (V)

Peak- : Negative peak voltage (V)

Freq : Frequency (Hz)

Curr : Actual current (A)

Result : Final test result (PASS/FAIL)

No. : Harmonic order

Table 5-10 Relationship between items and standards

Item	IEC Ed4.0/Ed2.1 IEC Ed4.0/Ed1.0 IEC Ed3.0/Ed2.0 IEC Ed2.2/Ed2.0 IEC Ed3.0/Ed1.0 IEC Ed2.2/Ed1.0 JIS 2005/Ed2.0*1 JIS 2005/Ed1.0*1 JIS 2011/Ed2.0*1 JIS 2011/Ed1.0*1	JIS 2005/Ed2.0*2 JIS 2005/Ed1.0*2 JIS 2011/Ed2.0*2 JIS 2011/Ed1.0*2	JIS 2003/Ed1.0
Meas(%)	Distortion factor of currently input voltage (%). Constant measurement state in test conditions. Indicates the measured value at the end of the test period during analysis		
Max(%)	Worst value of distortion factor in test	Not displayed	
Limit(%)	Limit value of distortion factor (%)		
Result	Judgment result for limit value (PASS/FAIL)		

*1. When Reference Impedance is set to Unuse.

*2. When Reference Impedance is set to Use.

■ Checking the AC power supply → Sub Menu

F6	Return

Press the F6 key to end the check of the AC power supply.

F5	Repeatability Checking → Sub Menu	Comparison With Past Data → Sub Menu

This menu can be set after an analysis and test are executed. Before the test is executed, the menu is displayed in a pale color and not selectable.

Test results are compared and checked under the same conditions using the same test system. One of the past test results files is selected and compared with the current test results.

■ Repeatability check → Sub Menu

F1	Comparison With Past Data → Sub Menu	Select Folder	Select File	Rename → Sub Menu	Delete → Sub Menu
		Select a file in the view for selecting past test results files. The name of the selected file can be changed or deleted.			

The customer is requested to manage the test conditions for past test results files. When a test results file is saved, the name and conditions of the file to be automatically created should be recorded.

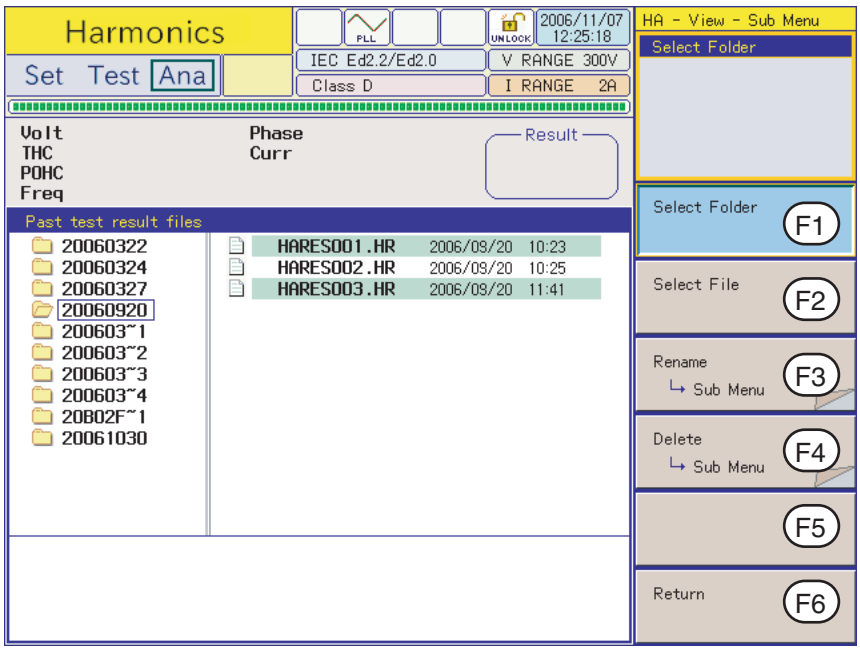


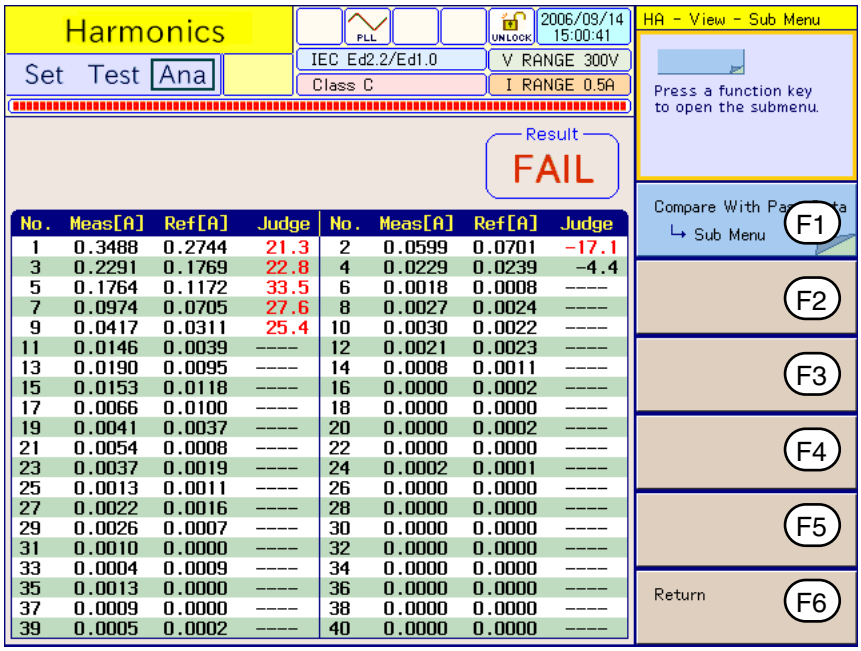
Fig.5-12 Display for selecting past test results files

■ Comparison with past tests → Sub Menu

F1	Select Folder	Numeric value displayed in the folder mark icon is assigned in order starting from 1.		
		Select the folder in which the file is saved. The selected folder is displayed within a frame.		
F2	Select File	Numeric value displayed in the file mark icon is assigned in order starting from 1.		
		Select the file that is saved. The background color of the selected folder is reversed.		
F3	Rename → Sub Menu	Input 1-char	Delete 1-char	
F4	Delete → Sub Menu	Yes	No	Cancel

Select a file for comparison with the contents currently tested and press the ENTER key.

The repeatability check display shown in Fig.5-13 appears. Compare the values for each harmonic order and check that they are within ±5 %.



No.	Meas[A]	Ref[A]	Judge	No.	Meas[A]	Ref[A]	Judge
1	0.3488	0.2744	21.3	2	0.0599	0.0701	-17.1
3	0.2291	0.1769	22.8	4	0.0229	0.0239	-4.4
5	0.1764	0.1172	33.5	6	0.0018	0.0008	----
7	0.0974	0.0705	27.6	8	0.0027	0.0024	----
9	0.0417	0.0311	25.4	10	0.0030	0.0022	----
11	0.0146	0.0039	----	12	0.0021	0.0023	----
13	0.0190	0.0095	----	14	0.0008	0.0011	----
15	0.0153	0.0118	----	16	0.0000	0.0002	----
17	0.0066	0.0100	----	18	0.0000	0.0000	----
19	0.0041	0.0037	----	20	0.0000	0.0002	----
21	0.0054	0.0008	----	22	0.0000	0.0000	----
23	0.0037	0.0019	----	24	0.0002	0.0001	----
25	0.0013	0.0011	----	26	0.0000	0.0000	----
27	0.0022	0.0016	----	28	0.0000	0.0000	----
29	0.0026	0.0007	----	30	0.0000	0.0000	----
31	0.0010	0.0000	----	32	0.0000	0.0000	----
33	0.0004	0.0009	----	34	0.0000	0.0000	----
35	0.0013	0.0000	----	36	0.0000	0.0000	----
37	0.0009	0.0000	----	38	0.0000	0.0000	----
39	0.0005	0.0002	----	40	0.0000	0.0000	----

Fig.5-13 Repeatability check display

- Explanation of display items

  No : Harmonic order

  Meas(A) : Harmonic current (A)

  Ref(A) : Harmonic current of file compared as reference (A)

  Judge : Ratio of current test results to reference value {(Meas-Ref)/Ref} × 100 %

In IEC Ed4.0/Ed2.1, this is
"{(Meas-Ref)/Limit Values} × 100 %."
If there are no limit values, this calculation is not performed.

Result : Judgment result (PASS/FAIL)

■ Rename → Sub Menu

F1	Input 1-char	Press A character input dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a frame, press this key. The selected character is displayed where the cursor is blinking. Up to 8 characters can be input.
F2	Delete 1-char	Press The character to the left of where the cursor is blinking is deleted.

Use this menu to change the name of a selected file.

Press the ENTER key when finished.

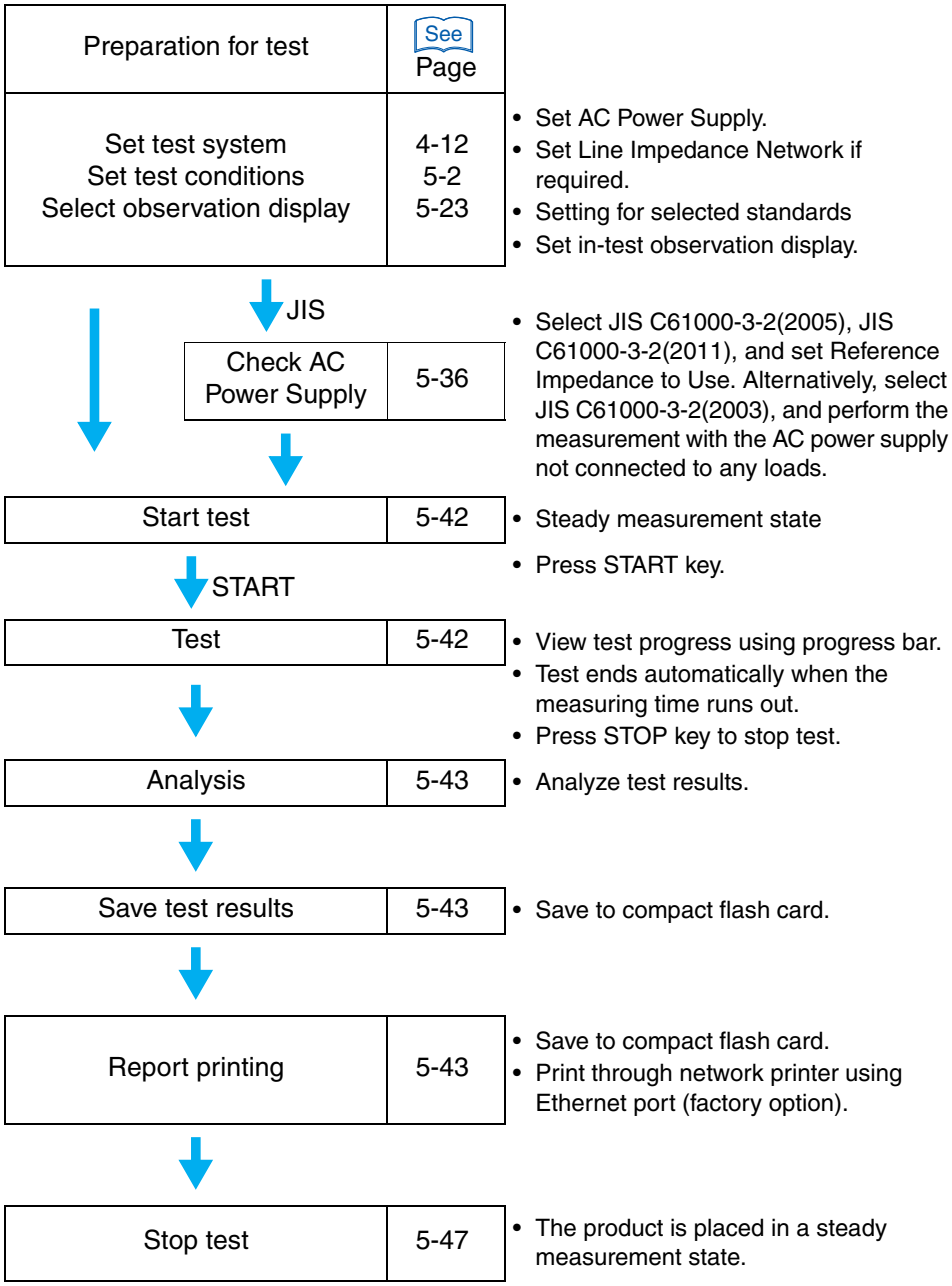
■ Delete → Sub Menu

F1	Yes
F2	No
F3	Cancel

Use this menu to delete a selected file.

5.5 Test Execution

This section shows the steps from setting the test conditions to printing reports.



⚠WARNING

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

5.5.1 From Setting the Test Conditions to Printing Reports

From setting the test system to optimizing the test conditions

1. Set the test conditions of the test system and EUT.

See Page 4-24

2. If the same conditions of a test executed in the past are applied, load and use the test conditions file.

⚠CAUTION

- Set the output voltage and frequency of the AC Power Supply to match the power rating of the EUT.

3. If you select a JIS standard, measure the AC power supply with no loads connected to it.
4. Turn on the power of the EUT.
5. Show the HA View/Analysis (HA-VIEW) display.

   A constant measurement state is entered. The current measured values are shown in the display.

   When synchronizing with the AC power frequency is entered, the triangular wave in the PLL icon in the upper part of the display becomes still. If not synchronizing and the triangular wave in the PLL icon does not become still, check that AC power is correctly output. Check that the plug for the voltage-sensing terminal is mounted and wired to the rear-side VOLTAGE SENSING terminal.

   The PLL lock frequency range is 45 Hz to 65 Hz.

■ Optimizing the current range before starting the test

6. Select V/I waveform and THC in the view type.

   Maximize the input current by changing the operating conditions of the EUT.

7. Set the current range.

   Select the current range so that the V/I and current waveforms are not saturated. If the input current state is a short interval at maximum, it becomes difficult to check whether the current waveforms are saturated. Therefore, Steps 5 and 6 should be repeated after the current range is selected.

From test start to end

■ Selecting the display to be observed

8. Select the view type to be observed.

   To observe the harmonic current of each order, select 2D harmonics. Some displays cannot be selected until the test ends.

9. Press the START key.

   A confirmation dialog box for the line impedance network is displayed.

NOTE

- This product does not directly control the line impedance network. For details on selecting line impedance, refer to the line impedance network operation manual.

10. After checking the impedance status or setting, select the menu F1 key (OK).

Selecting the menu F2 key (Cancel) ignores the presence of impedance. To start the test, press the START key again.

The test is started. The test status display shown in the display changes from “Setting” to “Test.”

The remaining time of the test is displayed.

The progress bar in the display extends from left to right. When it reaches the right end, the test is finished.

During the test, the HA View/Analysis display (HA-VIEW) appears. Observation can be made in the display that was set in Step 7.

■ Finishing and judging the test

When the measuring time runs out, the buzzer sounds and the test is finished. An ending dialog box is displayed. The test status display in the view changes to “Analysis.” The progress bar in the window extends to the right end.

The ending dialog box shows “PASS,” if the final test result is acceptable. The dialog box shows “WARN,” if the final test result is acceptable but the margin is exceeded. The dialog box shows “FAIL,” if the final test result is not acceptable. The color of the progress bar is green for PASS, yellow for WARN, and red for FAIL.

From analysis to saving test results, and printing reports

11. Press the menu F1 key (OK).

The test ending menus are displayed and the buzzer stops.

The test ending menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

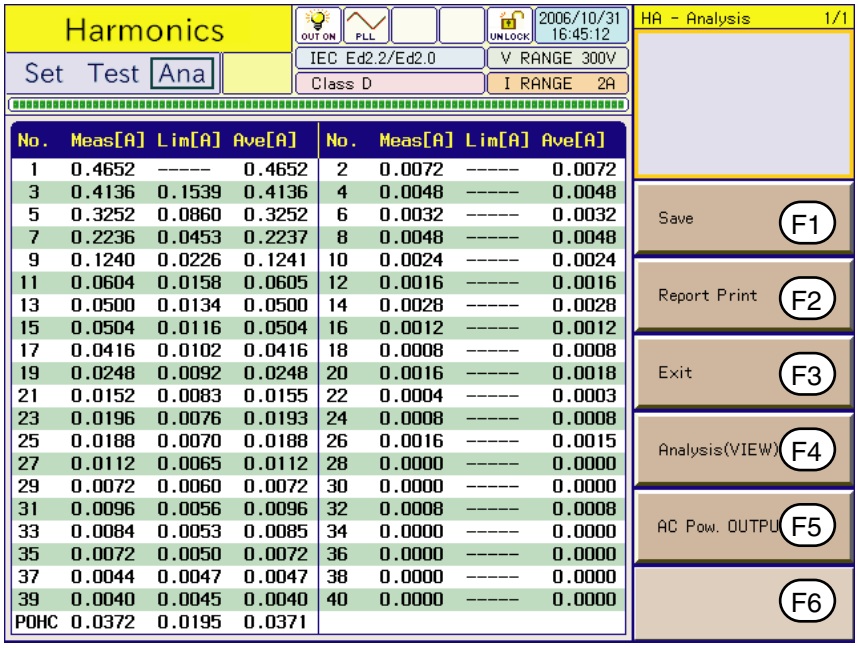


Fig.5-14 Test ending menus F1 to F5

See Page 4-13

Menu F5 AC Pow. OUTPUT OFF is a menu in the system setting display. It is displayed when AC Pow. Control “Enabled” is selected.

■ Saving Test Results

12. Press the menu F1 key (Save).

A dialog box is displayed. A file name is automatically assigned, and the results file is saved to the compact flash card.

When the saving ends, the menu “Save” is displayed in a pale color, and the menu function key is disabled.

NOTE

- If you forget to input or change comments about the EUT, load the saved results file into this product. Select the results list as the view type in the post-loading display and input the comments in the view setting menu.
- For details on file manipulation, see "File Operation" on page 4-21. For details on the results list, see "Comment Input → Sub Menu" on page 5-33.

■ Print Report

13. Press the menu F2 key (Report Print).

Reports are saved to the compact flash card. When the report printing ends, the menu “Report Print” is displayed in a pale color. The menu function key is disabled.

When the optional Ethernet port is mounted, reports can be output to a network printer.

See Page 4-14

NOTE

- If you set the standard to IEC Ed4.0/Ed2.1 or IEC Ed4.0/Ed1.0, select Class C, and set the limit values to 3rd/5th/Current Wave, you will not be able to produce report printouts.

■ Analysis (VIEW)

14. Press the menu F4 key (Analysis (VIEW)).

See Page 5-23

Analyze test results using the HA View/Analysis display (HA-VIEW).

Press the START key in analysis state to return to Step 8 and restart the test. In this case, the data that was loaded last is cleared.

Press the VIEW or HA key in analysis state to display the test ending menus (becomes state after Step 10 is operated).

■ Ending Test

15. Press the menu F3 key (Exit).

The test ends. The test status display shown in the display changes from “Analysis” to “Setting” and the progress bar disappears.

When the menu F1 key (Save) is not executed, a dialog box and menu are displayed.

Wish to save?	F1	Yes
	F2	No
	F3	Cancel

5.5.2 Aborting a Test

1. Press the STOP key during the test.

   The test state display in the display changes to “Analysis.” The progress bar in the display extends to the right end.

   Menus, F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF, are displayed.

   Menu F5 AC Pow. OUTPUT OFF is a menu in the system setting. It is displayed when AC Pow. Control “Enabled” is selected.

■ Saving Test Results

2. Press the menu F1 key (Save).

   A dialog box is displayed. A file name is automatically assigned and the results file is saved to the compact flash card.

   When the saving ends, the menu “Saving Test Results” is displayed in a pale color, and the menu function key is disabled.

■ Print Report

3. Press the menu F2 key (Report Print).

   Reports are saved to the compact flash card. When the report printing ends, the menu “Report Print” is displayed in a pale color, and the menu function key is disabled.

   When the optional ethernet port is mounted, reports can be output to a network printer.

See Page 4-14

NOTE

- If you set the standard to IEC Ed4.0/Ed2.1 or IEC Ed4.0/Ed1.0, select Class C, and set the limit values to 3rd/5th/Current Wave, you will not be able to produce report printouts.

■ Analysis (VIEW)

4. Press the menu F4 key (Analysis (VIEW)).

   Analyze test results using the HA View/Analysis display (HA-VIEW).

   Press the START key in analysis state to restart the test. In this case, the data that was loaded last is cleared.

   Press the VIEW or HA key in analysis state to display the test ending menus.

See Page 5-23

■ Ending Test

5. Press the menu F3 key (Exit).

   The test ends. The test state display in the window changes from “Analysis” to “Setting.” The progress bar disappears.

   When the menu F1 key (Save) is not executed, a dialog box and menu are displayed.

Wish to save?	F1	Yes
	F2	No
	F3	Cancel

■ Test may be interrupted

An abend dialog box is displayed. The test status display shown in the display changes to “Analysis” and the progress bar in the display moves to the right end.

The menu “Save,” “Report Print,” “Exit,” or “Analysis (VIEW)” is displayed.

For details on the operation procedure, see "Aborting a Test" on page 5-45.

⚠CAUTION

- When measured values exceed the voltage or current range with “Overrange Abort” selected as a test condition, the test is suspended.

5.5.3 Loading and Analyzing the Results File

This section explains how to load and analyze a result file. The result file can be saved with an alias after it is analyzed. The loaded file cannot be overwritten.

The results file can be loaded in the “Setting” state. It cannot be loaded in the “Test” or “Analysis” states.

■ Loading the results file

See Page 4-22

1. Press the FILE key.
2. Press the menu F2 key (Load → Results File).

   The folder and the results file, which are stored on the compact flash card, are displayed.
3. Select a results file using menu F1 and F2 keys.

   The background color of the selected file is reversed.
4. Press the ENTER key to fix your selection.

   The selected file is loaded into this product, and the display is updated. Becoming an analysis state lets you analyze according to the menus.

■ Printing reports

1. Press the HA or VIEW key.

   The menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

See Page 4-13

   Menu F5 AC Pow. OUTPUT OFF is a menu in the system setting display. It is displayed when AC Pow. Control “Enabled” is selected.

NOTE

- If you set the standard to IEC Ed4.0/Ed2.1 or IEC Ed4.0/Ed1.0, select Class C, and set the limit values to 3rd/5th/Current Wave, you will not be able to produce report printouts.

2. Press the menu F2 key (Report Print).

   Reports are saved to the compact flash card. When the report printing ends, the menu “Report Print” is displayed in a pale color, and the function key is disabled.

See Page 4-14

   When the optional ethernet port is mounted, reports can be output to a network printer.

■ Saving

1. Press the HA or VIEW key.

   The menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

2. Press the menu F1 key (Save).

   A dialog box is displayed. A file name is automatically assigned, and the results file is saved to the compact flash card.

   When the saving ends, the menu “Save” is displayed in a pale color, and the menu function key is disabled.

■ Ending Analysis

1. Press the HA or VIEW key.

   The menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

2. Press the menu F3 key (Exit).

   The test ends. The test ending display in the display changes from “Analysis” to “Setting.” The progress bar disappears.

   When menu F1 key (Save) is not executed, a dialog box and menu are displayed.

Wish to save?	F1	Yes
	F2	No
	F3	Cancel

5.5.4 Ending the Operation of the Test System

■ Turning off the OUTPUT of the AC Power Supply

1. Turn off the power switch of the EUT.

2. Turn off the OUTPUT of the AC Power Supply.

   When AC Pow. Control “Enabled” is selected in the menu of the system setting display, menu F5 AC Pow. OUTPUT OFF is displayed.

   In this case, press the menu F5 key (AC Pow. OUTPUT OFF).

   When AC Pow. Control “Disabled” is selected in the menu of the system setting display, press the OUTPUT key of the AC Power Supply.

   The AC Power Supply OUTPUT is turned off. The icon in the upper part of the display shows a turned-off light bulb.

5.6 Printing Format

5.6.1 Printing Reports

See Page 4-29

Fig.5-15, Fig.5-16, and Fig.5-17 show the formats for printing reports. Items differ with device classes or power values specified.

Each item in the figure is explained in Table 5-11. The numbers in the table correspond to those in the figures. Standard numbers are abbreviated.

Example of abbreviation

IEC Ed4.0/Ed2.1, IEC Ed4.0/Ed1.0, IEC Ed3.0/Ed2.0, IEC Ed3.0/Ed1.0,

IEC Ed2.2/Ed2.0, IEC Ed2.2/Ed1.0 → IEC

JIS 2005/Ed2.0, JIS 2005/Ed1.0, JIS 2011/Ed2.0, JIS 2011/Ed1.0 → JIS2005

JIS 2003/Ed1.0 → JIS2003

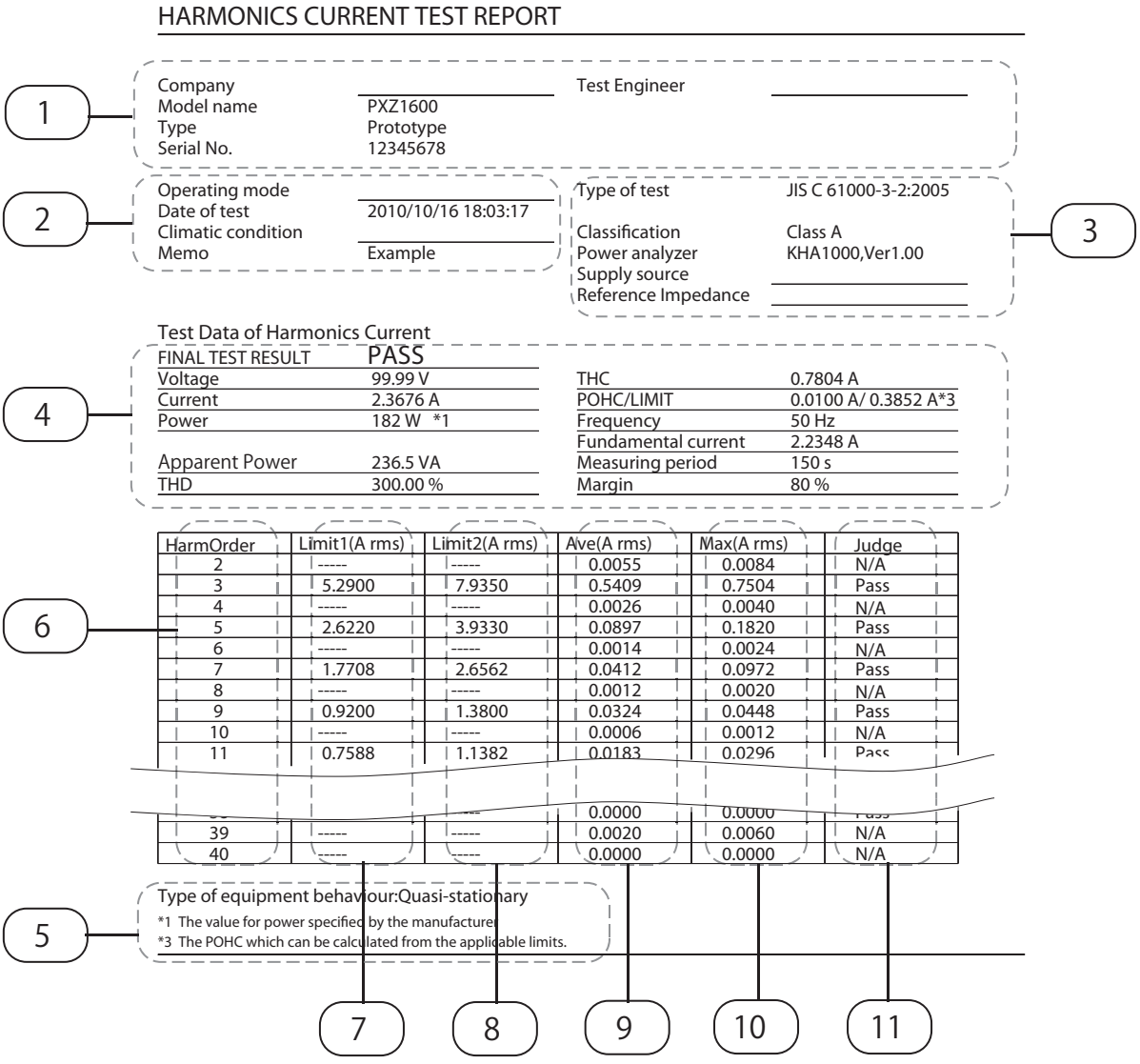


Fig.5-15 Example of report printout (JIS C61000-3-2 (2005) Class A)

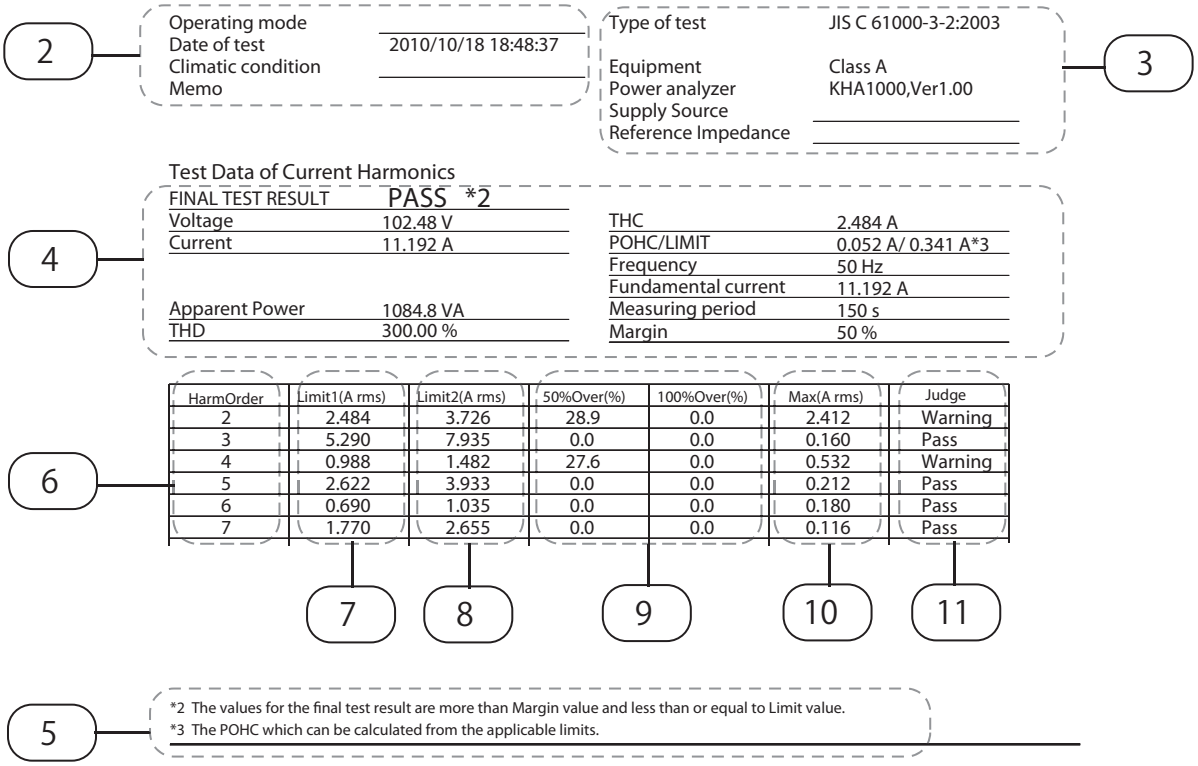


Fig.5-16 Example of report printout
(JIS C61000-3-2 (2003) Class A abstract)

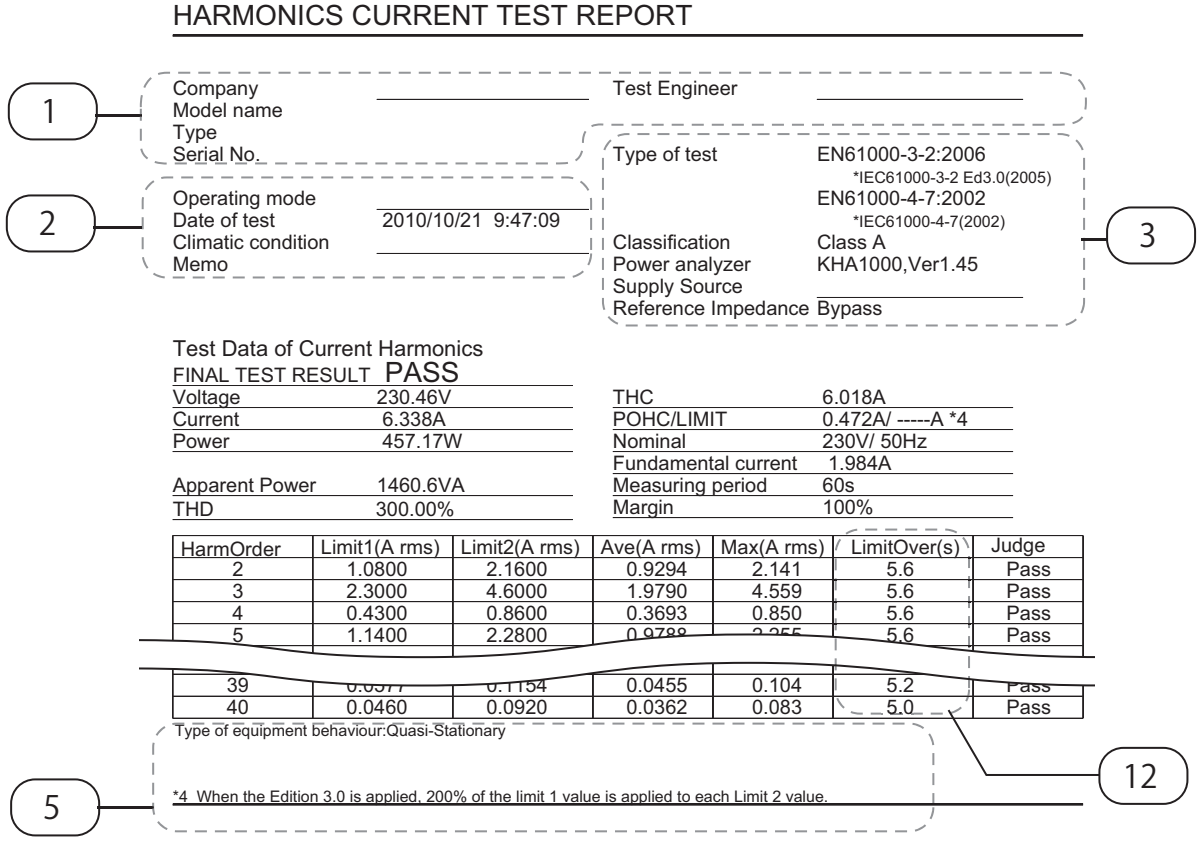


Fig.5-17 Example of report printout
(IEC 61000-3-2 (Ed 3.0) abstract)

Table 5-11 Explanation of report items

Explanation No.	Item	Content	Explanation
1	Company	Optional descriptions such as company names (underlined)	Description column after forms output
	Test Engineer	Optional descriptions such as test engineers(underlined)	
	Model Name	Model name of EUT	Data input by view type of HA View/Analysis display → results list → view setting
	Type	Type of EUT	
	Serial No.	Serial No. of EUT	
2	Operating mode	Optional descriptions such as operating mode of EUT (underlined)	Description column after forms output
	Date of test	Test execution date/time	Data input by date/time setting in system setting display
	Climatic condition	Optional climatic descriptions such as temperature (underlined)	Description column after forms output
	Memo	Memo	Data input by view type of HA View/Analysis display → results list → view setting
3	Type of test	Test standard	Data input when setting the test conditions When Specified Nominal Volt is not 230 V, the EN standard number is indicated in an underlined blank.
	Classification	Class of EUT. Class A or C displays values to be applied according to test conditions settings (table numbers displayed are those specified in standards).	Classes and class options entered when setting the test conditions
	Power analyzer	Information about measuring instrument used in tests	Model name and firmware version of this product
	Supply source	Optional descriptions such as information about AC power supply for tests. (underlined)	Description column after forms output
	Reference Impedance	Optional descriptions such as information about standard impedance. Note that they are displayed as “Bypass” in IEC Ed2.2/Ed2.0, IEC Ed2.2/Ed1.0, IEC Ed3.0/Ed2.0, IEC Ed3.0/Ed1.0, IEC Ed4.0/Ed2.1, and IEC Ed4.0/Ed1.0 (underlined).	
4	FINAL TEST RESULT	Final test result: PASS or FAIL Even in the case of PASS, *2 is displayed if the value exceeds the margin.	
	Voltage	Voltage value: Maximum value in test period	IEC JIS2005 JIS2003
	Current	Current value: Maximum value in test period	IEC JIS2005 JIS2003

Explanation No.	Item	Content	Explanation
4	Power	Power value: Specified value or maximum value in test period. Specified values are displayed as *1.	IEC JIS2005
		Power value: Specified value, maximum or maximum value in test period. Specified values are displayed as *1.	JIS2003 Class D
	Power factor	Power factor: Specified value or maximum value in test period. Displayed when Class C is selected.	IEC JIS2005 JIS2003
	Apparent Power	Apparent power value: Maximum value in test period	
	THC	Total harmonic current: Maximum value in test period	
	POHC/LIMIT	POHC: Partial, odd-order harmonic current value: Maximum value in test period LIMIT: POHC calculated from limit value applied	IEC JIS2005
	Frequency	Specified value	IEC JIS2005 JIS2003
	Fundamental current	Fundamental current: Maximum value in test period. Specified values are displayed as *1.	
	Measuring period	Measuring period (= test period)	
	Margin	Margin	
5	Type of equipment behaviour	Type of equipment behavior (Tobs input when setting the test conditions)	IEC JIS2005
	The value for power specified...	*1 is displayed when manufacturers specify power values.	IEC JIS2005
	The values for the final test result are more than Margin value and less than or equal to Limit value.	*2 is displayed when PASS is assumed but margin is exceeded.	IEC JIS2005 JIS2003
	When the POHC value dose not exceed the POHC Limit value, each odd order 21st-39th Limit 1 value is relax to the value of Limit 2.	When the POHC value dose not exceed the POHC Limit value (*3 is always displayed).	IEC JIS2005
	When the Ed3.0 is applied, 200% of the Limit 1 value is applied to each Limit 2 value.	*4 is displayed when POHC/LIMIT is not applied.	IEC Ed3.0
6	HarmOrder	Harmonic current order	IEC JIS2005 JIS2003

Explanation No.	Item	Content	Explanation
7	Limit1(A rms)	Limit value: If POHC equals to POHC LIMIT or is less, odd-order harmonics from the 21st to the 39th indicate 1.5 times the limit value.	IEC JIS2005
		"----": There is no limit value or a calculated limit value is less than 0.0001 A (0.001 A in the range of 10 A or more).	IEC JIS2005 JIS2003
8	Limit2(A rms)	150 % of limit value: Display format is the same as Limit 1.	
		200 % of limit value	IEC Ed3.0 Class A
9	Ave(A rms)	Harmonic current: Average value in entire test period.	IEC JIS2005
	100 %Over(%)	Ratio (%) of time (accumulated value in entire test period) in which measured values are above 100 % to 150 % of that limit value, against the total test time	JIS2003
	....%Over(%)	Ratio (%) of time (accumulated value in entire test period) in which measured values are above the margin setting value "----"% to 150 % of that value, against the total test time	
10	Max (A rms)	Harmonic current: Maximum value during the total test time	
11	Judge	Limit value judgment for each order PASS/FAIL/WARNING: WARNING is displayed when a margin is exceeded. N/A: When limit values are not applied	
12	LimitOver(s)	Time (accumulated value in entire test period) in which measured values are above 150 % to 200 % of that limit value*1	IEC Ed3.0

*1. The time ratio (%) is determined by calculating the ratio of the number of data frames in which measurement value exceeds the specified against the total number of data frames in the period of testing time. Due to the condition of measurement, the calculation error of the time ratio would be up to maximum of 1 second, since the time of total number of data frames may take the same or longer than the setting value of test time.

5.6.2 Printout of Setting Values (Test Conditions)

This section indicates the printout format for setting values (test conditions). Items differ depending on the test conditions with device classes or power values specified. Table 5-12 explains each item in the graph. Standard numbers are abbreviated.

Example of abbreviation

IEC Ed4.0/Ed2.1, IEC Ed4.0/Ed1.0, IEC Ed3.0/Ed2.0, IEC Ed3.0/Ed1.0,

IEC Ed2.2/Ed2.0, IEC Ed2.2/Ed1.0 → IEC

JIS 2005/Ed2.0, JIS 2005/Ed1.0, JIS 2011/Ed2.0, JIS 2011/Ed1.0 → JIS2005

JIS 2003/Ed1.0 → JIS2003

Harmonics Current Test Condition Report

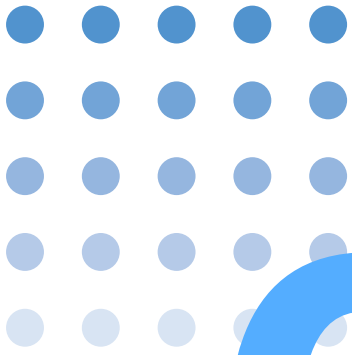
Memo	
Model name	
Type	
Serial No.	
Std. 61000-3-2/4-7	IEC Ed2.2/Ed2.0
Class	C
Voltage Range	300 V
Current Range	2 A
Observation Period(Tobs)	Quasi-stationary
Measurement Time(s)	10 s
Overrange Abort	Enabled
Definition of Power	Specified
Specified Power(W)	100 W
Margin(%)	50 %
Nominal Voltage	230 V
Nominal Frequency	50 Hz
PF & Fund Curr	Specified
Specified PF	1.00
Specified Fund Curr(A)	20.0 A
Limit values	Normal

Fig.5-18 Example of test conditions printout (IEC 61000-3-2 (Ed2.2))

Table 5-12 Explanation of test conditions items

Item	Content	Explanation	
Memo	Memo	Data input by view type of HA-Observation and Analysis View → results list → view setting	IEC JIS2005 JIS2003
Model Name	Name of EUT		
Type	Type of EUT		
Serial No.	Serial No. of EUT		
Std. 61000-3-2/4-7	Test standard	Standards input when setting the test conditions	
Class	Class of EUT	Classes input when setting the test conditions	
Voltage Range	Voltage range	Voltage range input when setting the test conditions	
Current Range	Current range	Current range input when setting the test conditions	
Observation Period (Tobs)	Type of equipment behavior	Tobs input when setting the test conditions	IEC JIS2005

Item	Content	Explanation	
Measurement Time(s)	Measuring time (= test period)	Measuring time input when setting the test conditions	IEC JIS2005 JIS2003
Overrange Abort	Specify whether to apply End at over-range.	Specify whether to apply End at over-range when setting the test conditions.	
Definition of power	Select power value, measured value, or specified value.	Specify power input when setting the test conditions.	IEC JIS2005
Specified Power(W)	Power value	Format value set by Definition of power	IEC JIS2005 JIS2003 Class D
PF & Fund Curr	Select measured or specified value for power factor and input current value	Format of power factor and input current value input in testing conditions set	IEC JIS2005 Class C
Specified PF	Power factor	Format value set by PF & Fund Curr	
Specified Fund Curr (A)	Input current value		
Limit value IEC	Limit value	Limit value applied, input by test conditions class option setting	IEC Class C
Limit value JIS2011			JIS2005 Class C
Limit value JIS2005			
Limit value JIS2003			JIS2003 Class C
Nominal voltage	Nominal voltage	Nominal voltage input when setting the test conditions	JIS2005 JIS2003
Nominal frequency	Nominal frequency	Nominal frequency input when setting the test conditions	
600 W Air conditioner	Air-conditioner with input power exceeding 600 W	Class A option input when setting the test conditions	JIS2005 JIS2003 Class A
19th over mono.dec.	Ignore over 19th if dropping slightly	Specify whether to apply “Ignore over 19th if dropping slightly” input when setting the test conditions.	JIS2003
Smoothing	Smoothing	Smoothing input when setting the test conditions	
Below 5 mA,0.6 %	Ignore ≤ 5 mA 0.6 %	Specify whether to apply “Ignore ≤ 5 mA, 0.6 %” input when setting the test conditions.	
Below 75 W	Ignore ≤ 75 W	Class D option input when setting the test conditions	JIS2003 Class D
Def.electric power	Specifying power		
Margin(%)	Margin	Margin input when setting the test conditions	IEC JIS2005 JIS2003



6

Voltage Changes and Fluctuations and Flicker Test

This chapter explains voltage change, voltage fluctuation, and flicker tests, and describes the steps from setting the test conditions to analysis and printing reports.

6.1 Setting IEC 61000-3-3 Test Conditions

Set test conditions in the Vf-Test Conditions List display. The conditions are also used for the Vf-Observation and Test Conditions displays.

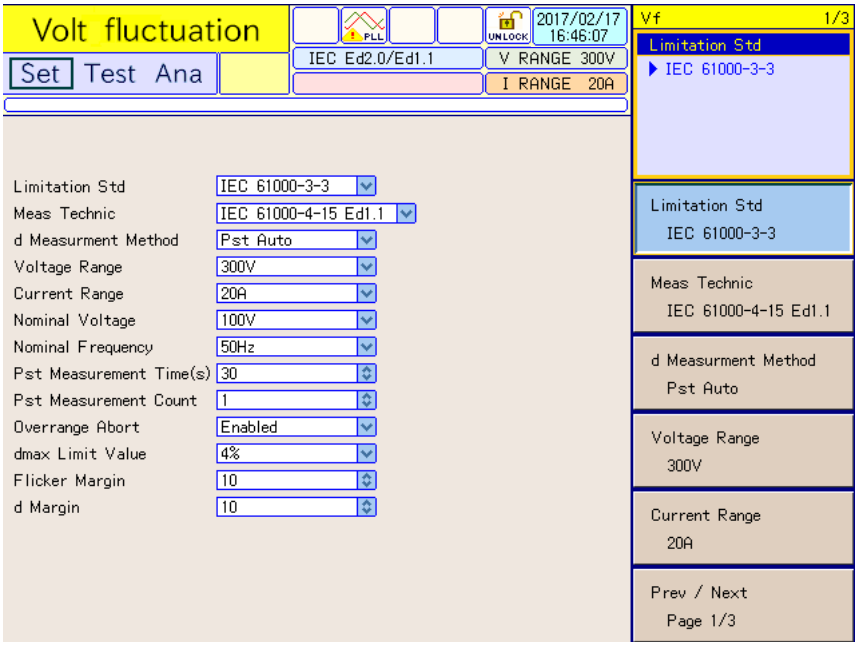


Fig.6-1 Vf-Test Conditions List View IEC Ed2.0/Ed1.1

Showing the Vf-Test Conditions List display

Press the Vf key.

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

While the test status shown on the upper left of the display is “Test” or “Analysis,” the mode cannot be changed. The dialog box message “Can’t execute during test/analysis. Please operate it after ending” is displayed.

In this case, press the VIEW key to turn off its LED. Select “Exit” from the displayed menu.

Test conditions can be set during measurement.

See Page 3-10

Set test conditions in the Vf-Observation and Test Conditions display. The measurement display is set in the Vf-Observation and Analysis display (Vf-VIEW) and use the same menu in the Vf-Test Conditions List window.

■ View selection and transition

1. Press the Vf key.

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

2. Press the VIEW key.

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

3. Press the VIEW key again.

The VIEW key LED turns off, and the Vf-Observation and Test Conditions display appears.

Pressing the VIEW key toggles the Vf-Observation and Analysis display (Vf-VIEW) and Vf-Observation and Test Conditions displays.

6.1.1 Limitation Std, Meas Technic, and Measuring Methods, Voltage and Current Ranges

F1	Limitation Std	IEC 61000-3-3

The limitation standard that is set depends on the selection of the standard for measurement techniques.

If IEC 61000-4-15:Ed1.1 is selected for the standard for measurement techniques, the limitation standard is set to IEC 61000-3-3:Ed2.0(2008). If IEC 61000-4-15:Ed2.0 is selected, the limitation standard is set to IEC 61000-3-3:Ed3.0(2013).

F2	Meas Technic	IEC 61000-4-15 Ed1.1	IEC 61000-4-15 Ed2.0

Set the standard for measuring techniques to IEC 61000-4-15 Ed1.1 (2003) or IEC 61000-4-15 Ed2.0 (2010).

F3	d Measurement Method	Pst Auto	Manual

- Pst Auto: d measurement and Pst and Plt (flicker) measurements are performed concurrently. The results of the d measurement (dmax, Tmax*, dc) displays the maximum value for each Pst measurement segment time. *Displayed as d(t)>3.3% depending on the selected standard.
- Manual: A test is conducted by the method conforming to “Test conditions and procedure for measuring d max. voltage changes caused by manual switching” specified in Appendix B of IEC61000-3-3 Amd1 (2001). This product uses an arithmetic average of 22 measured values, excluding the maximum and minimum values from those obtained by up to 24 measurements.

F4	Voltage Range	150 V	300 V

Voltage range of this product. Select one according to the rated power supply voltage of the EUT.

F5	Current Range	0.5 A	1 A	2 A	5 A	10 A	20 A

Current range of this product. Select one according to the input current of the EUT.

Set the maximum value as a guide in the operating cycle of the EUT. The peak current that can be measured is four times the value in the 0.5 A to 10 A range and 2.5 times the value in the 20 A range.

⚠CAUTION

- The maximum value of input current is 50 Apeak. Exceeding this value may burn 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.

The peak current of the EUT is believed to be reached at maximum power. Keep in mind the entire operation cycle of the EUT.

6.1.2 Nominal Voltage and Frequency, Pst / d Measurement Time or Count, Over-range Abort

F1	Nominal Voltage	100 V	120 V	200 V	230 V

Nominal test voltage (typical value). Select one according to the rating of the EUT.

F2	Nominal Frequency	50 Hz	60 Hz

Nominal test frequency (typical value). Select one according to the rating of the EUT.

F3	Pst Measurement time (s)	Numeric value
	d Measurement time (s)	

For a flicker test, set the Pst (short-time flicker value) measurement time or d measurement time in seconds.

- Pst Measurement time (s): Selecting Pst Auto F1 of menu page 1/3 lets you enter a value. The setting range is 30 to 900 (seconds). The standard specifies “measurement time = 10 minutes.” Normally, therefore, set it to 600 seconds.
- d Measurement time (s): Selecting Manual at F1 of menu page 1/3 lets you enter a value. The setting range is 30 to 180 (seconds). In the case of Manual, the standard specifies “measurement time = 1 minute.” Normally, therefore, set it to 60 seconds.

F4	Pst Measurement Count	Numeric value
	d Measurement Count	

Set the Pst measurement count or d measurement count for Plt (long-time flicker value) evaluation.

- Pst Measurement Count: Selecting Pst Auto at F1 of menu page 1/3 lets you enter a value. The setting range is 1 to 12.
- d Measurement Count: Selecting Manual at F1 of menu page 1/3 lets you enter a value. The setting range is 3 to 24.

Although the standard specifies "Plt measurement time = 2 hours," the actual measurement time is decided according to the operating cycle time of the EUT.

Example: For equipment with an operating cycle of 45 minutes, set the Pst Measurement Count to 5 and the Pst Measurement Time (s) to 10 minutes.

F5	Overrange Abort	Enabled	Disabled

See Page 6-19

This menu specifies whether to end or continue a test when a measured value exceeds the set voltage or current range.

Enabled	If an over-range occurs, an error message (current or voltage over-range) is displayed, and the measurement is aborted. In this case, analysis can be conducted on the data stored prior to when the over-range occurred. The judgment will be FAIL.
Disabled	Even if an over-range occurs, the test is not suspended. After a test is finished, even if the judgment of voltage fluctuation and flicker in one-segment time is PASS, the final test result will be FAIL.

6.1.3 dmax Limit Value, Margins and Printout of Setting Values

Menu → Page 3/3 (F1 F2 F3 F4 F5 F6)

F1	d max Limit Value	4 %	6 %	7 %

Set the dmax (maximum relative voltage change) limit value for d measurement (voltage fluctuation test).

The limit value varies depending on the EUT.

4 %	No additional conditions
6 %	Manual switching equipment. Manual switching equipment with switching frequency more than twice per day, which assumes delayed restart (20-30 seconds delay or more) or manual restart.
7 %	Equipment (dryer, vacuum cleaner, electric drill, lawn mower, mixer, etc.) with switching during operation. The equipment is automatically switched on and off once or twice per day or intended for manual switching, and is subjected to delayed restart (20-30 seconds delay or more) or manual restart after power off.

F2	Margin (%) → Sub Menu	Flicker Margin (%)	d Margin (%)

■ Margin → Sub Menu

F1	Flicker Margin (%)	Numeric value	
		Set the margin for the Pst and Plt limit values.	
F2	d Margin (%)	Numeric value	
		Set the margin for the dc, dmax, and Tmax* limit values.	

This menu sets the standard limit value to 100. The setting range is 10 to 100. Select 80, for example, so that 80 % of the standard limit value is selected. For Tmax*, set the margin for the limit value while Tmax* is exceeded.
*Displayed as d(t)>3.3% depending on the selected standard.

This value cannot be set during test and analysis.

Table 6-1 Color identification and judgment in graph or list view

Color identification	Measured value	Judgment
Green (Graphs only)	Up to the margin setting value	PASS
Yellow	Greater than the margin setting value up to the limit value	WARN
Red	Greater than the limit value	FAIL

F5	Print	Press

See Page 4-16

This menu is for outputting the setting value using a specified printout format.

■ Saving the setting values to the test conditions file

See Page 4-25

Save the setting values by file manipulation. See Section “4.6.4 Saving a Test Conditions File.” A test conditions file can be saved to the specific folder of the Volt fluctuation test mode. It can be saved in the “Setting” state but not in the “Test” or “Analysis” states.

6.2 Using Vf-Observation and Analysis Display (Vf-VIEW)

View types and main usage

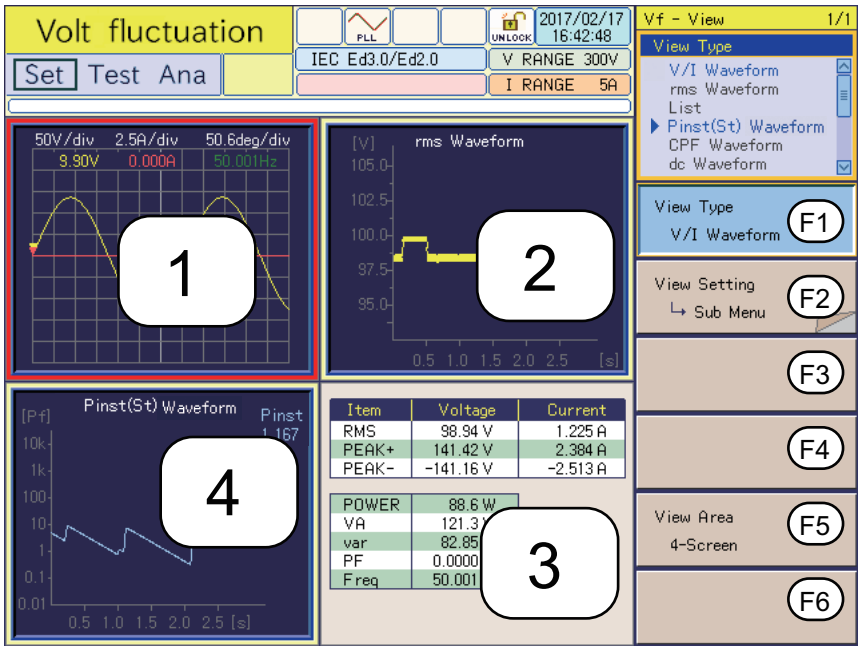


Fig.6-2 Vf-Observation and Analysis display (Vf-VIEW) 1 (Example of 4-screen)

Explanation No.	View type	Content displayed	Usage
1	V/I Waveform	• Input voltage/current waveform • Enlargement and reduction of vertical and horizontal scales • Reading peak value using the cursor	[Setting and test] • Checking input conditions of EUT • Waveform check • Observing large changes • Selecting current range
2	rms Waveform	• Transition of actual value of input voltage over time	[Setting and test] • Observing voltage fluctuations
3	List	• Basic measurement parameters • Numeric display	[Setting and test] • Checking test conditions
4	Pinst (St) Waveform	• Pinst (St) (momentary flicker value) real-time waveform • Pinst (St) waveforms are measured only when the d measurement method is Pst Auto. • When Manual is selected, the graph is not updated because measurement is not performed.	[Setting and test] • Observing voltage fluctuations

[Setting/test/analysis] indicates the state that can be used.
- [Setting]: When test conditions are set
- [Test]: During testing

- [Analysis]: Post-test analysis

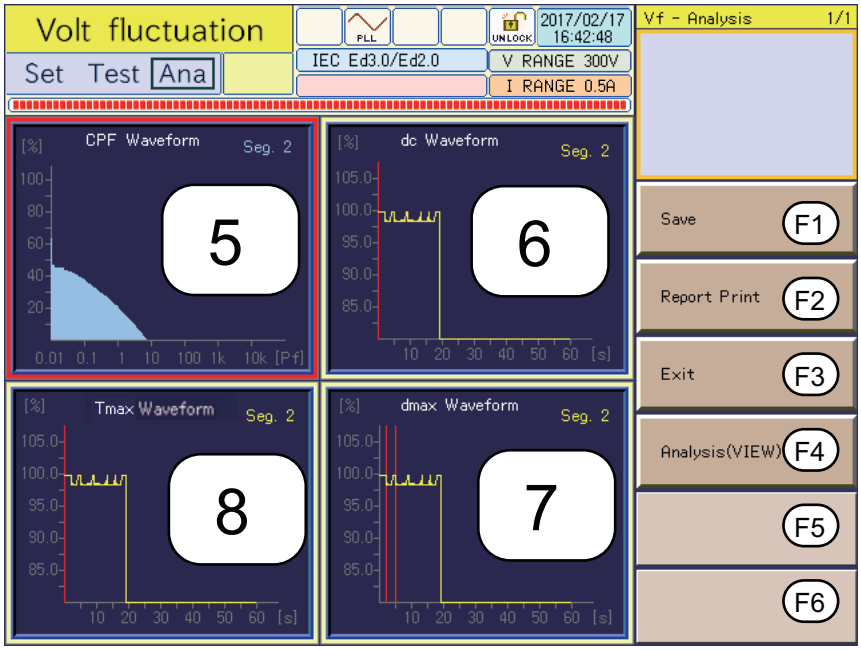


Fig.6-3 Vf-Observation and Analysis display (Vf-VIEW) 2 (Example of 4-screen)

Explanation No.	View type	Content displayed	Usage
5	CPF Waveform	• CPF (cumulative probability) graph	[Test and analysis] • Observing and analyzing voltage fluctuations
6	dc Waveform	• Waveform when the maximum value of dc (relative steady-state voltage change) is recorded	
7	d max Waveform	• Waveform when the maximum value of d max (maximum relative voltage change) is recorded	
8	Tmax*1 Waveform	• Waveform in the longest period among those where d(t) (relative voltage change) exceeds 3.3 %	

*1.Displayed as d(t)>3.3% depending on the selected standard.

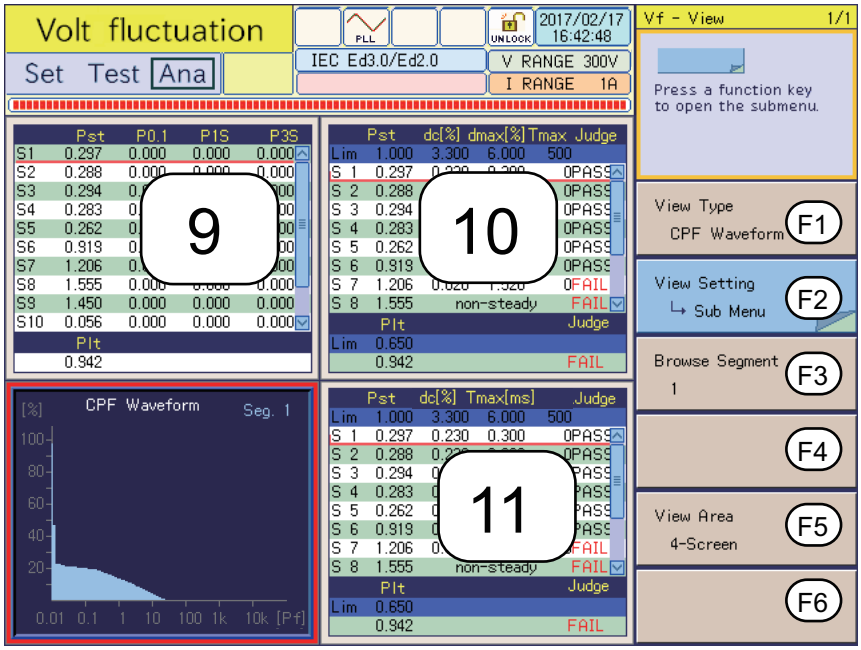


Fig.6-4 Vf-Observation and Analysis display (Vf-VIEW) 3 (Example of 4-screen)

Explanation No.	View type	Content displayed	Usage
9	Flicker List	• Pst, P0.1, P1s, P3s, P10s, and P50s for each segment (= time for one Pst measurement session) • Pst, P0.1, P1s, and P3s are displayed in the 4-screen.	[Test and analysis] • Observing and analyzing voltage fluctuations
10	Results List	• Test results list • Final test result	[Analysis] • Standards conformance judgment
11	VF List (manual)	• Maximum and average values of voltage fluctuations for each segment while the d measurement method is set to “Manual”	[Test and analysis] • Observing and analyzing voltage fluctuations

Selecting the view type in the Vf-Observation and Analysis display (Vf-VIEW)

1. Press the Vf key.

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

2. Press the VIEW key.

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

   Press the VIEW key again. The VIEW key LED turns off, and the Vf-Observation and Test Conditions display appears.

3. Press the F1 (view type) and select the view type to be displayed.

   A menu that corresponds to the view type is displayed.

4. Use arrow keys (up, down, left, right) to select the view to be set.

   The selected display appears with a red frame.

6.2.1 View Types, View Setting, Segment Browse, and View Area

See "4.3 Basics of Menu Operation"

F1	View Type	V/I Waveform	rms Waveform	List	Pinst (St) Waveform	CPF Waveform	dc Waveform
		dmax Waveform	Tmax*1 Waveform	Flicker List	Results List	VF List (Manual)	

*1.Displayed as d(t)>3.3% depending on the selected standard.

Select a view type.

F2	View Setting → Sub Menu	Menu corresponding to the view type

See Page 6-11, Page 6-12

The sub-menu varies depending on the selected view type. For details, see "View Setting –> Sub Menu" on page 6-11.

F3	Browse Segment	Numeric value

Use this menu for analysis when the view type is CPF Waveform, dc Waveform, dmax Waveform, Tmax* Waveform, Flicker List, Results List, or Voltage Fluctuation List (Manual). It is used to switch/select a segment (= time for one Pst measurement session).

*Displayed as d(t)>3.3% depending on the selected standard.

See Page 6-3

The input range is 1 to 12 when the d measurement method is Pst Auto, or 1 to 24 when the d measurement method is Manual. When the view area is divided, a common value is set for all windows.

F5	View Area	1-Screen	2-Screen	4-Screen

To select divided windows, use the arrow keys (up, down, left, right).

The selected window is indicated with a red frame. It is automatically selected in the 1-screen.

View Setting –> Sub Menu

A different sub-menu is displayed depending on the view type selected. The sub-menus for the V/I waveform, rms waveform, and list are shown below. There is no sub-menu for the Pinst (St) waveform.

■ V/I waveform

F1	Horizontal Scale	×10	×5	×2	×1
		×1/2	×1/5		
		Select the magnification to enlarge or reduce a view. About one cycle is displayed by “1x.” The magnification can be set before a test is executed. After the test is executed, it is displayed in a pale color and not selectable. In the window display, deg/div indicates a phase angle/div.			
F2	Vertical Scale (Current)	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			
F3	Vertical Scale (Voltage)	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			
F4	Cursor	Turn the small or large knob to move the cursor within the window. The voltage and current values at the cursor are displayed.			

■ rms waveform

F3	Vertical Scale (Voltage)	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			

■ List

F1	View Items	RMS	PEAK+	PEAK-	POWER
		VA	var	PF	Freq
		Place a check mark by pressing the ENTER key. The corresponding value is displayed. To remove the check mark, press the ENTER key again (toggle operation).			

- RMS (Actual value rms): Actual value of input voltage and current
- PEAK+: Positive amplitude peak value of input voltage and current
- PEAK–: Negative amplitude peak value of input voltage and current
- POWER (actual power): Actual power W of EUT
- VA (apparent power): Apparent power VA of EUT
- var (reactive power): Reactive power var of EUT
- PF (power factor): Power factor of EUT
- Freq (frequency): Input frequency measured at input voltage

View Setting → Sub Menu

A different sub-menu is displayed depending on the view type selected. The sub-menus for the CPF Waveform, dc Waveform, dmax Waveform, Tmax* Waveform, Flicker List, Results List, and Voltage Fluctuation List (Manual) are shown below.

*Displayed as d(t)>3.3% depending on the selected standard.

■ CPF Waveform

F3	Browse Segment	Numeric value

See Page 6-3

Move the segment (= time for one Pst measurement session) location along the time axis in the CPF (cumulative probability) graph. The input range is 1 to 12 when the d measurement method is Pst Auto.

When the d measurement method is Manual, Pst is not measured. Although 1 to 24 can be input, no CPF waveform is displayed (“No waveform data is available” is displayed).

■ dc Waveform, dmax Waveform, and Tmax*1 Waveform

F1	Axis X	×10	×5	×2	×1
		×1/2	×1/5		
		Select the magnification to enlarge or reduce a view.			
F2	Y-axis Scale	×10	×5	×2	×1
		×1/2	×1/4		
		Select the magnification to enlarge or reduce a view.			
F3	Browse Segment	Numeric value			
		For dc Waveform, dmax Waveform, and Tmax*1 Waveform, move the segment (= time for one Pst measurement session) location along the time axis on an individual basis.			
F4	Time Axis Scroll	Move along the time axis in the display by turning the small or large knob.			

*1.Displayed as d(t)>3.3% depending on the selected standard.

■ Flicker List

F5	Scroll	Used to view a hidden part. Turn the small knob to vertically scroll over the windows. This is used when the display is divided into two or four screens.

■ Results List and Voltage Fluctuation List (Manual)

F1	Memo → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter in “Memo” in report comments to be displayed.		
F2	Model name → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter in “Model Name” in report comments to be displayed.		
F3	Type → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter in “Type” in report comments to be displayed.		
F4	Serial No. → Sub Menu	Input 1-char	Delete 1-char	Change char type
		Enter in “Serial No.” in report comments to be displayed.		
F5	Scroll	Used to view a hidden part. Turn the small knob to vertically scroll over the windows. This is used when the display is divided into two or four screens.		

■ Memo, Model Name, Type, Serial No. → Sub Menu

F1	Input 1-char	Press		
		A character input dialog box is displayed. Select a character using the small or large knob or an arrow key. When the character selected appears within a frame, press this key. The selected character is displayed where the cursor is blinking. Up to 20 alphanumeric characters and up to 10 hiragana characters and 10 katakana characters can be input.		
F2	Delete 1-char	Press		
		The character to the left of where the cursor is blinking is deleted.		
F3	Change char type	Alphanumeric	Hiragana	Katakana
		Every time the key is pressed, another character type is selected.		

F1 to F3: Press the ENTER key to fix your selection.

See Page 6-22

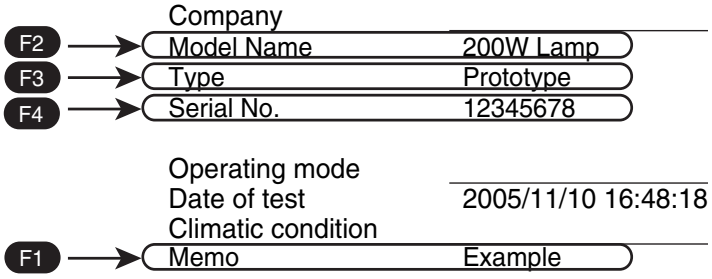


Fig.6-5 Characters displayed on the report (example)

See Page 6-13

● Explanation of view items

View items	Explanation
Pst	Short-time flicker value in one-segment time • Limit: Limit value
dc (%)	The maximum value of relative steady-state voltage change in one-segment (Seg1 -) time • Limit: Limit value
dmax (%)	The maximum value of maximum relative voltage change in one-segment (Seg1 -) time • Limit: Limit value
Tmax*1 (ms)	The maximum value of time while d(t) exceeded 3.3 % in one-segment (Seg1 -) time • Limit: Limit value
Judge	Evaluation (PASS/FAIL/WARN) for each segment • WARN is displayed if the margin is exceeded.
Plt	Long-time flicker value in all-segment (Seg1 -) time (set by the Pst measurement count) • Limit: Limit value • Measurement: Measured value
Plt---Judge	Evaluation (PASS, FAIL, or WARN) of voltage fluctuation and flicker in one-segment time (Seg1 -) • WARN is displayed if the margin is exceeded.
fMargin---%	Margin for Pst and Plt limit values • Only displayed in the 1-screen view
dMargin---%	Margin for dc, dmax, Tmax*1 • Only displayed in the 1-screen view
Result	Final test result (PASS, FAIL, or WARN) • WARN is displayed if the margin is exceeded.
Seg.1 -	Pst measurement time corresponds to one-segment (Seg1 -) time.
dmax (%) in Manual mode	dmax (%) value of all-segment (Seg1 -) time (set by the d measurement count) • Limit: Limit value • Average:Average measured value excluding the maximum and minimum values
dc (%) in Manual mode	dc(%) value of all-segment (Seg1 -) time (set by the d measurement count) • Limit: Limit value • Maximum: Maximum value
Tmax*1 (ms) in Manual mode	Tmax*1 (ms) time of all-segment (Seg1 -) time (set by the d measurement count) • Limit: Limit value • Maximum: Maximum value
S1 - in Manual mode	d measurement time corresponds to one-segment (S1 -) time.

*1.Displayed as d(t)>3.3% depending on the selected standard.

6.3 Test Execution

This section shows the steps from setting the test conditions to printing reports.

	See Page	
Preparation for test		
Set test system Set test conditions Select observation display	4-12 6-2 6-7	• Set AC Power Supply. • Set Line Impedance Network. • Setting for standards • Set in-test observation display.
↓		
Start test	6-16	• Steady measurement state
↓ START		• Press START key.
Test	6-16	• View test progress using progress bar. • Test ends automatically when the measuring time runs out. • Press STOP key to stop test.
↓		
Analysis	6-17	• Analyze test results.
↓		
Save test results	6-17	• Save to compact flash card.
↓		
Report printing	6-17	• Save to compact flash card. • Print through network printer using Ethernet port (factory option).
↓		
Stop test	6-21	• The product is placed in a steady measurement state.

⚠WARNING

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

6.3.1 From Setting the Test Conditions to Printing Reports

From setting the test system to optimizing the test conditions

1. Set the test conditions of the test system and EUT.

See Page 4-24

2. If the same conditions of a test executed in the past are applied, load and use the test conditions file.

⚠CAUTION

- Set the output voltage and frequency of the AC Power Supply to match the power rating of the EUT.

3. Turn on the power of the EUT.

4. Showing the Vf-Observation and Analysis display (Vf-VIEW).

   Constant measurement state is entered. The current measured values are displayed in the display.

   When synchronizing with the AC power frequency, the triangular wave in the PLL icon in the upper part of the display gets still. If the synchronous state is not entered and the triangular wave in the PLL icon does not gets still, check that the AC power is correctly output. Check that the plug for the voltage sensing terminal is mounted and wired to the rear-side VOLTAGE SENSING terminal.

   The PLL lock frequency range is 45 Hz to 65 Hz.

■ Optimizing the current range before starting the test

5. Select the V/I waveform in the view type.

   Maximize the input current by changing the operating conditions of the EUT.

6. Set a current range.

   Select the current range so that the V/I and current waveforms are not saturated. If the input current state is a short interval at maximum, it becomes difficult to check whether the current waveforms are saturated. Therefore, Steps 5 and 6 should be repeated after the current range is selected.

From test start to end

■ Selecting the display to be observed

7. Select a view type to be observed.

   To observe Pinst (St) (momentary flicker value) real-time waveform, select Pinst (St) waveform. Some displays cannot be selected until the test ends. Pinst (St) waveforms are measured only when the d measurement method is Pst Auto.

   When Manual is selected, the graph is not updated because measurement is not performed.

8. Press the START key.

   A confirmation dialog box for the line impedance network is displayed.

NOTE

- This product does not directly control the line impedance network. For details on selecting line impedance, refer to the line impedance network operation manual.

9. If the impedance is set, select menu F1 key (OK).

Selecting the menu F2 key (Cancel) ignores the presence of impedance. To start the test, press the START key again.

The test is started. The test conditions display in the view changes from “Setting” to “Test.”

The remaining time of the test is displayed.

The progress bar in the display extends from left to right. When it reaches the right end, the test is finished.

During the test, the Vf-Observation and Analysis display (Vf-VIEW) appears. Observation can be made in the display that was set in Step 7.

■ Finishing and judging the test

When the measuring time runs out, the buzzer sounds and the test is finished. An ending dialog box is displayed. The test status display shown in the display changes to “Analysis” and the progress bar in the display moves to the right end.

The ending dialog box shows “PASS,” if the final test result is acceptable. The dialog box shows “WARN,” if the final test result is acceptable but the margin is exceeded. The dialog box shows “FAIL,” if the final test result is not acceptable. The color of the progress bar is green for PASS, yellow for WARN, and red for FAIL.

If the d measuring method is “Pst Auto,” and if a steady state is not entered at least two times within the time of one segment, a dialog box “d measurement of a segment without a steady state was not performed” is displayed.

From analysis to saving test results, and printing reports

10. Press the menu F1 key (OK).

The test ending menus are displayed and the buzzer stops.

The test ending menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

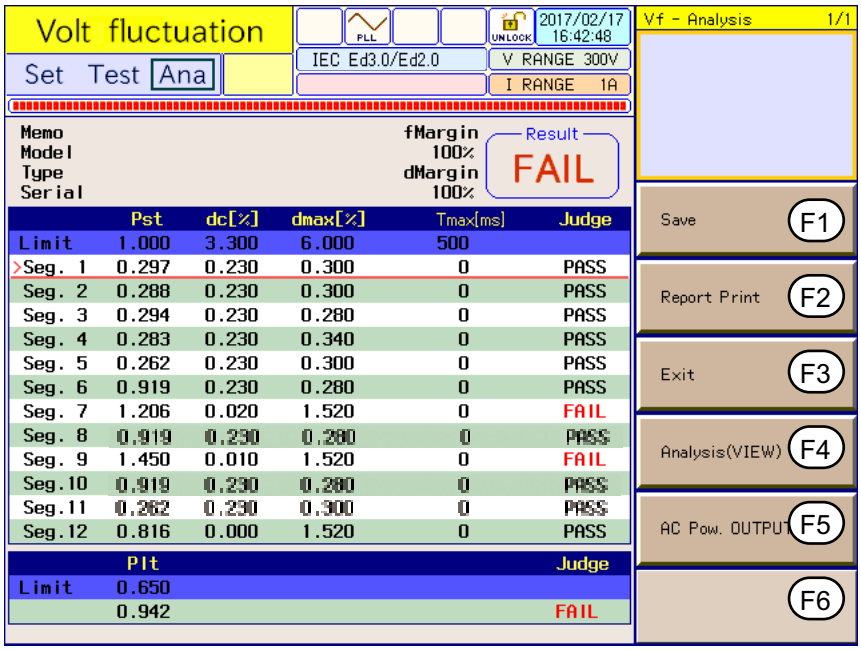


Fig.6-6 Test ending menus F1 to F5

See Page 4-13

Menu F5 AC Pow. OUTPUT OFF is a menu in the system setting display. It is displayed when AC Pow. Control “Enabled” is selected.

■ Saving Test Results

11. Press the menu F1 key (Save).

A dialog box is displayed. A file name is automatically assigned, and the results file is saved to the compact flash card.

When the saving ends, the menu “Save” is displayed in a pale color, and the menu function key is disabled.

NOTE

- If you forget to input comments about the EUT, load the saved results file into this product. Select the results list as the view type in the display after load file and input the comments in the view setting menu.
- For details on file manipulation, see "File Operation" on page 4-21. For details on the results list, see "Comment Input → Sub Menu" on page 5-33.

■ Print Report

12. Press the menu F2 key (Report Print).

Reports are saved to the compact flash card. When the report printing ends, the menu “Report Print” is displayed in a pale color. The menu function key is disabled.

See Page 4-14

When the optional Ethernet port is mounted, reports can be output to a network printer.

■ Analysis (VIEW)

13. Press the menu F4 key (Analysis (VIEW)).

See Page 6-7

Analyze test results using the Vf-Observation and Analysis display (Vf-VIEW).

Press the START key in analysis state to return to Step 8 and restart the test. In this case, the data that was loaded last is cleared.

Press the VIEW or Vf key in analysis state to display the test ending menus (becomes state after Step 10 is operated).

■ Ending Test

14. Press the menu F3 key (Exit).

The test ends. The test status display shown in the display changes from “Analysis” to “Setting” and the progress bar disappears.

When menu F1 key (Save) is not executed, a dialog box and menu are displayed.

Wish to save?	F1	Yes
	F2	No
	F3	Cancel

6.3.2 Aborting a Test

1. Press the STOP key during the test.

   The test status display shown in the display changes to “Analysis” and the progress bar in the display moves to the right end.

   The menus F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF, are displayed.

   Menu F5 AC Pow. OUTPUT OFF is a menu in the system setting display. It is displayed when AC Pow. Control “Enabled” is selected.

■ Saving Test Results

2. Press the menu F1 key (Save).

   A dialog box is displayed. A file name is automatically assigned and the results file is saved to the compact flash card.

   When the saving ends, the menu “Save” is displayed in a pale color, and the menu function key is disabled.

■ Print Report

3. Press the menu F2 key (Report Print).

   Reports are saved to the compact flash card. When the report printing ends, the menu “Report Print” is displayed in a pale color, and the menu function key is disabled.

   When the optional ethernet port is mounted, reports can be output to a network printer.

See Page 4-14

■ Analysis (VIEW)

4. Press the menu F4 key (Analysis (VIEW)).

   Analyze test results using the Vf-Observation and Analysis display (VF-VIEW).

   Press the START key in analysis state to restart the test. In this case, the data that was loaded last is cleared.

   Press the VIEW or Vf key in analysis state to display the test ending menus.

See Page 6-7

■ Ending Test

5. Press the menu F3 key (Exit).

   The test ends. The test status display shown in the display changes from “Analysis” to “Setting” and the progress bar disappears.

   When menu F1 key (Save) is not executed, a dialog box and menu are displayed.

Wish to save?	F1	Yes
	F2	No
	F3	Cancel

■ Test may be suspended

An abend dialog box is displayed. The test status display shown in the display changes to “Analysis” and the progress bar in the display moves to the right end.

The menu “Save,” “Report Print,” “Exit,” or “Analysis (VIEW)” is displayed.

For details on the operation procedure, see "Aborting a Test" on page 6-19.

⚠CAUTION • When measured values exceed the voltage or current range with “Overrange Abort” selected as a test condition, the test is suspended.

6.3.3 Loading and Analyzing the Results File

This section explains how to load and analyze a result file. The result file can be saved with an alias after it is analyzed. The loaded file cannot be overwritten.

The results file can be loaded in the “Setting” state. It cannot be loaded in the “Test” or “Analysis” states.

■ Loading the results file

See Page 4-22

1. Press the FILE key.
2. Press the menu F2 key (Load → Results File).

   The folder and file of a results file, which are stored on the compact flash card, are displayed.
3. Select a results file using the menu F1 and F2 keys.

   The background color of the selected file is reversed.
4. Press the ENTER key to fix your selection.

   The selected file is loaded into this product, and the view is updated. Because an analysis state is entered, analysis can be made according to the menus.

■ Printing report

1. Press the Vf or VIEW key.

   The menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

See Page 4-13

   Menu F5 AC Pow. OUTPUT OFF is a menu in the system setting display. It is displayed when AC Pow. Control “Enabled” is selected.
2. Press the menu F2 key (Report Print).

   Reports are saved to the compact flash card. When the report printing report ends, the menu “Report Print” is displayed in a pale color, and the function key is disabled.

See Page 4-14

   When the optional ethernet port is mounted, reports can be output to a network printer.

■ Saving

1. Press the Vf or VIEW key.

   The menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

2. Press the menu F1 key (Save).

   A dialog box is displayed. A file name is automatically assigned, and the results file is saved to the compact flash card.

   When the saving ends, the menu “Save” is displayed in a pale color, and the menu function key is disabled.

■ Ending analysis

1. Press the Vf or VIEW key.

   The menus include: F1 Save, F2 Report Print, F3 Exit, F4 Analysis (VIEW), and F5 AC Pow. OUTPUT OFF.

2. Press the menu F3 key (Exit).

   The test ends. The test status display shown in the display changes from “Analysis” to “Setting” and the progress bar disappears.

   When the menu F1 key (Save) is not executed, a dialog box and menu are displayed.

Wish to save?	F1	Yes
	F2	No
	F3	Cancel

6.3.4 Ending the Operation of the Test System

■ Turning off the OUTPUT of the AC Power Supply

1. Turn off the power switch of the EUT.

2. Turn off the OUTPUT of the AC Power Supply.

   When AC Pow. Control “Enabled” is selected in the menu of the system setting display, menu F5 AC Pow. OUTPUT OFF is displayed.

   In this case, press the menu F5 key (AC Pow. OUTPUT OFF).

   When AC Pow. Control “Disabled” is selected in the menu of the system setting display, press the OUTPUT key of the AC Power Supply.

   The AC Pow. OUTPUT is turned off. The icon in the upper part of the display shows a turned-off light bulb.

6.4 Report Printout Format

6.4.1 Printing Reports

See Page 4-29

The following figures show the formats for printing reports. Fig.6-7 shows an example of d measurement and concurrent measurement of Pst and Plt (flicker). Fig.6-8 shows an example of the method complying with the "Test conditions and procedure for measuring d max voltage changes caused by manual switching." Items differ depending on whether the nominal voltage is 230 V or 100 V.

Each item in the figure is explained in Table 6-2. The numbers in the table correspond to those in Fig.6-7 and Fig.6-8.

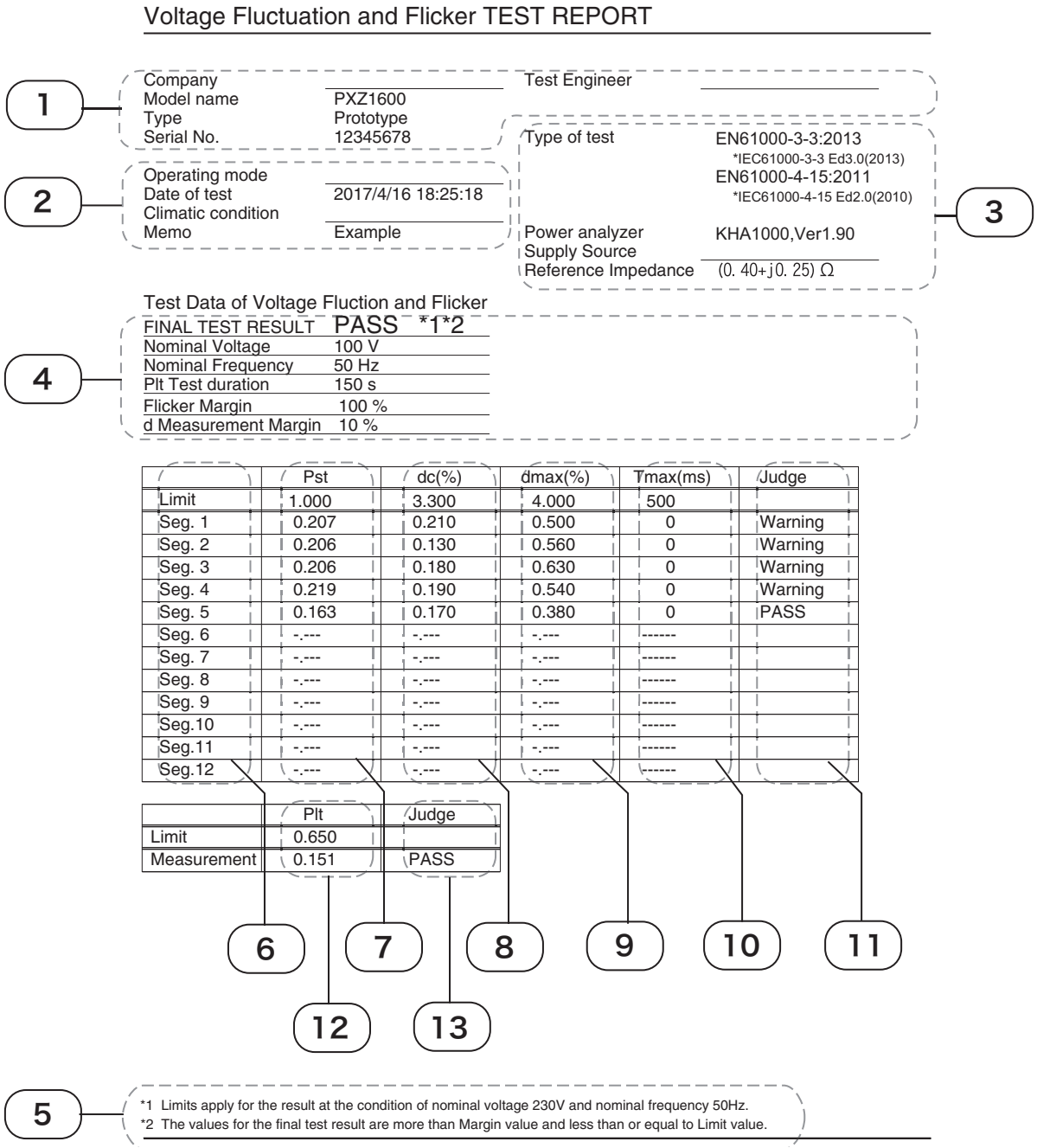


Fig.6-7 Example of report printout (d measurement and concurrent measurement of Pst and Plt (flicker))

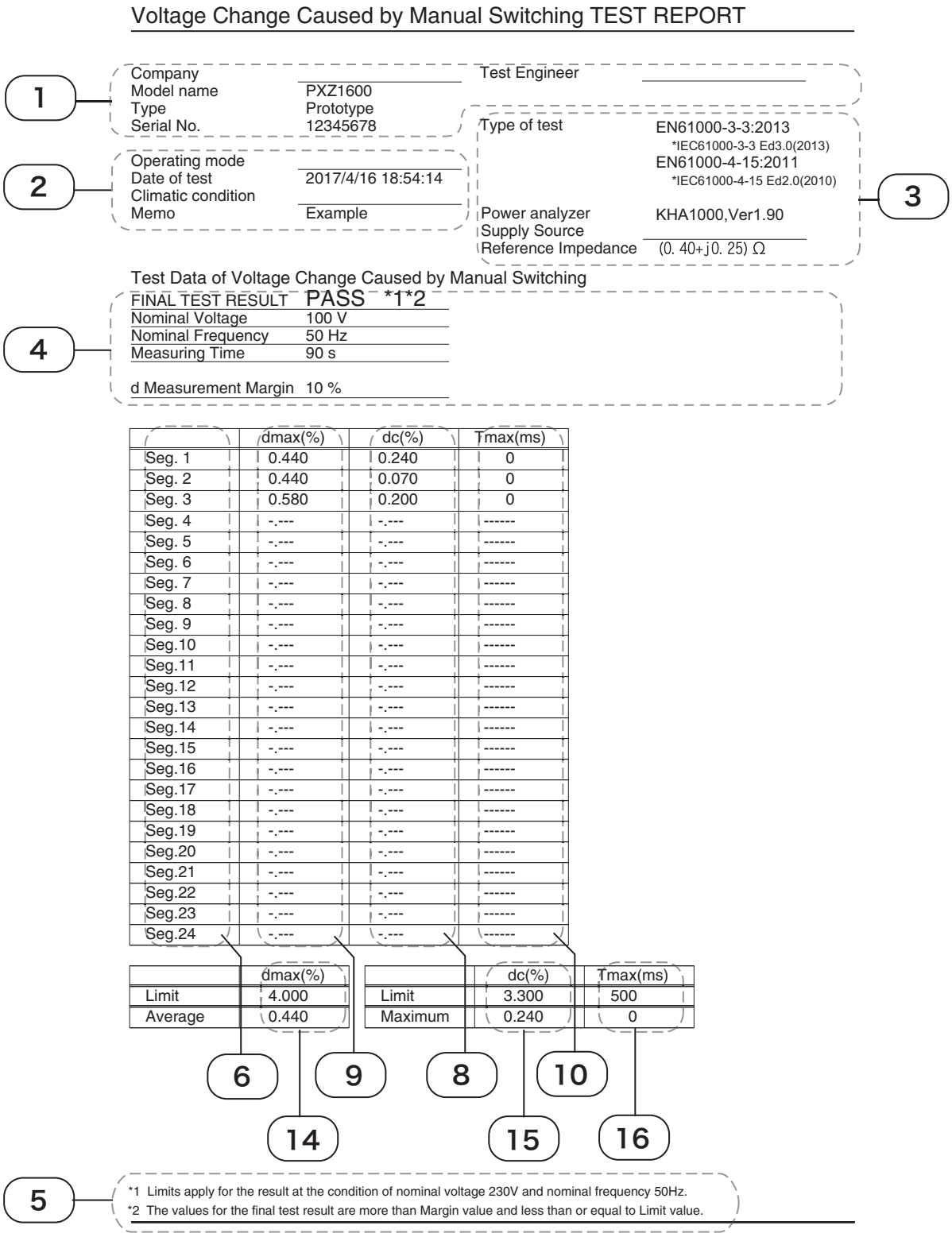


Fig.6-8 Example of report printout (measurement of voltage changes caused by manual switching)

Table 6-2 Explanation of report items

Explanation No.	Item	Content	Explanation
1	Company	Optional descriptions such as company names (underlined)	Description column after forms output
	Test Engineer	Optional descriptions such as test engineers (underlined)	
	Model Name	Model name of EUT	Data input by view type of Vf-Observation and Analysis display → results list, voltage fluctuation list (manual) → view setting
	Type	Type of EUT	
	Serial No.	Serial No. of EUT	
2	Operating mode	Optional descriptions such as operating mode of EUT (underlined)	Description column after forms output
	Date of test	Test execution date/time	Data input when setting date/time in system setting display
	Climatic condition	Optional climatic descriptions such as temperature (underlined)	Description column after forms output
	Memo	Memo	Data input by view type of Vf-Observation and Analysis display → results list, voltage fluctuation list (manual) → view setting
3	Type of test	Test standard	Data input when setting the test conditions
	Power analyzer	Information about measuring instrument used in tests	Model name and firmware version of this product
	Supply source	Optional descriptions such as information about AC power supply for tests. (Underlined).	Description column after forms output
	Reference Impedance	Information on reference impedance: fixed to (0.40 + j0.25) ohms	
4	FINAL TEST RESULT	Final judgment result: PASS or FAIL Even in the case of PASS, *2 is displayed if the value exceeds the margin.	
	Nominal voltage	Nominal voltage	Nominal voltage input when setting the test conditions
	Nominal frequency	Nominal frequency	Nominal frequency input when setting the test conditions
	Plt Test duration	Total measuring time (= total test period)	Pst measurement time × Pst measurement count input when setting the test conditions
	Measuring Time		d measurement time × d measurement count input when setting the test conditions
	Flicker Margin	Flicker margin	Margin for the Pst and Plt limit values input when setting the test conditions
	d Measurement Margin	d margin	Margin for the dc, dmax, and Tmax*1 limit values input when setting the test conditions
5	Limits apply for the result...	*1 is displayed when the limit value at nominal voltage 230 V and nominal frequency 50 Hz is applied.	
	The values for the final test result are more than Margin value and less than or equal to Limit value.	*2 is displayed when the margin is exceeded even in the case of PASS.	
6	Seg	Pst measurement time or d measurement time corresponds to one-segment (Seg1 -) time.	Pst measurement time or d measurement time input when setting the test conditions
7	Pst	Short-time flicker value in one-segment (Seg1 -) time • Limit: Limit value	

Explanation No.	Item	Content	Explanation
8	dc (%)	The maximum value of relative steady-state voltage change in one-segment (Seg1 -) time • Limit: Limit value	
9	dmax (%)	The maximum value of maximum relative voltage change in one-segment (Seg1 -) time • Limit: Limit value	
10	Tmax*1 (ms)	The maximum value of time during which d (t) exceeded 3.3 % in one-segment (Seg1 -) time • Limit: Limit value	
11	Judge	Judgment of voltage fluctuation and flicker in one-segment (Seg1 -) time PASS, FAIL, or WARNING: WARNING is displayed if the margin is exceeded.	
12	Plt	Long-time flicker value in all-segment (Seg1 -) time (set by the Pst measurement count) • Limit: Limit value • Measurement: Measured value	
13	Judge	Judgment of Plt (long-time flicker value) PASS, FAIL, or WARNING: WARNING is displayed if the margin is exceeded.	
14	dmax (%)	dmax (%) value in all-segment (Seg1 -) time (set by the d measurement count) • Limit: Limit value • Average: Average measured value excluding the maximum and minimum values	
15	dc (%)	dc (%) value in all-segment (Seg1 -) time (set by the d measurement count) • Limit: Limit value • Maximum: Maximum value	
16	Tmax*1 (ms)	Tmax*1 (ms) time in all-segment (Seg1 -) time (set by the d measurement count) • Limit: Limit value • Maximum: Maximum value	

*1.Displayed as d(t)>3.3% depending on the selected standard.

6.4.2 Printout of Setting Values (Test Conditions)

This section indicates the printout format for the setting values (test conditions). Items differ depending on the test conditions.

Voltage Fluctuation and Flicker Test Condition Report

Memo	
Model name	
Type	
Serial No.	
d measuring method	Pst Auto
Voltage Range	300 V
Current Range	20 A
Nominal voltage	230 V
Nominal frequency	50 Hz
Overrange Abort	Enabled
dmax limit value	6 %
Flicker Margin	100 %
d Margin	100 %
Pst Measurement Time(s)	600 s
Pst Measurement Count	12 times

Fig.6-9 Example of test conditions printout

Table 6-3 Explanation of test conditions items

Item	Content	Explanation
Memo	Memo	Data input by view type of HA-Observation and Analysis window → Results List, Voltage Fluctuation List → View Setting
Model Name	Model name of EUT	
Type	Type of EUT	
Serial No.	Serial No. of EUT	
d measuring method	d measurement method	d measurement method input when setting the test conditions
Voltage Range	Voltage range	Voltage range input when setting the test conditions
Current Range	Current range	Current range input when setting the test conditions
Nominal voltage	Nominal voltage	Nominal voltage input when setting the test conditions
Nominal frequency	Nominal frequency	Nominal frequency input when setting the test conditions
Overrange Abort	Setting of Ends when over-range	Whether or not to “Overrange Abort” specified when setting the test conditions
dmax limit value	dmax limit value	dmax limit value input when setting the test conditions
Time of d meas.	1-segment measurement time for d measurement in Manual mode	d measurement time input when setting the test conditions
Number of d meas.	1-segment measurement count for d measurement in Manual mode	d measurement count input when setting the test conditions
Flicker Margin	Flicker margin	Margin for the Pst and Plt limit values input when setting the test conditions
d Margin	d margin	Margin for the limit values of dc, dmax, and Tmax*1 input when setting the test conditions
Pst Measurement Time(s)	Pst measurement time	Pst measurement time input when setting the test conditions
Pst Measurement Count	Pst measurement count	Pst measurement count input when setting the test conditions

*1.Displayed as d(t)>3.3% depending on the selected standard.

Other Measurements

This chapter explains measurements for other than harmonic current and voltage fluctuation tests.

7.1 Measurement Items

Three measurement items are applicable:

- Basic measurement
- FFT analyzer
- In-rush current measurement

See Page 4-12

Start measurement after setting up the test system.

Opening to the Other Measurement view

Press the OTHER key.

The OTHER key LED illuminates and the Measurement Item Selection display appears with a message.

While the test status displayed on the upper left of the display is “Test” or “Analysis,” the mode cannot be changed. The dialog box message “Can’t execute during test/analysis. Please operate it after ending.” is displayed.

In this case, press the VIEW key to turn off the VIEW key LED. Select “Exit” from the displayed menu.

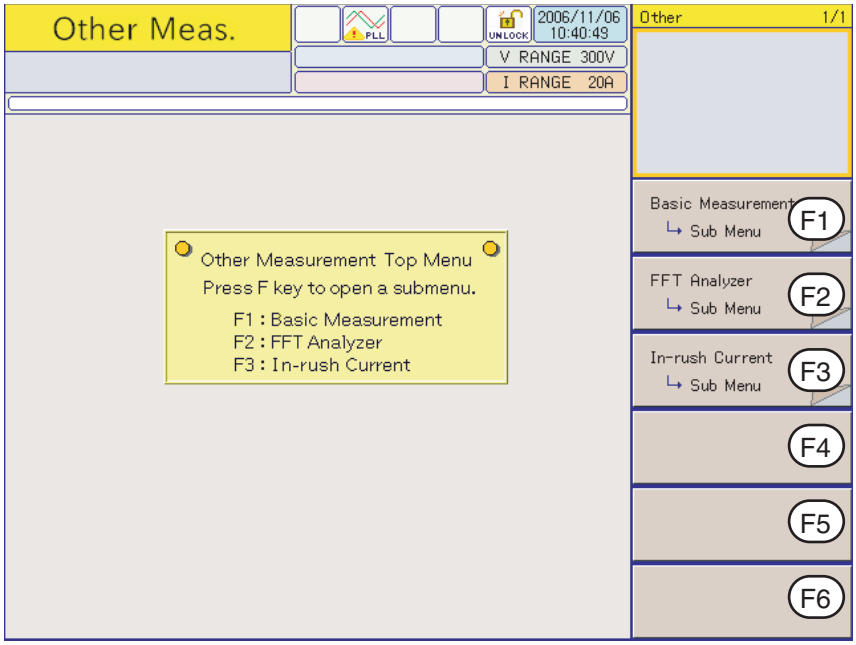
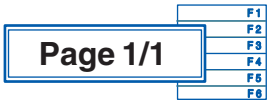


Fig.7-1 Measurement Item Selection display

7.1.1 Basic Measurement, FFT Analyzer, and In-rush Current Measurement

Menu 

F1	Basic Measurement → Sub Menu	Page 1/3	View Select	View Setting → Sub Menu	
		Page 2/3	Auto Range	Voltage Range	Current Range
		Page 3/3	LPF	AC Coupling	

See Section 7.2 “Basic Measurement” for the Sub Menu.

F2	FFT Analyzer → Sub Menu	Move Marker	Vertical Scale (Current)

See Section 7.3 “FFT Analyzer” for the Sub Menu.

F3	In-rush Current → Sub Menu	Current Trigger (A)	View Setting → Sub Menu	Reset TRG	Voltage Range
				Abort (Wait for TRG)	

See Section 7.4 “In-rush Current Measurement” for the Sub Menu.

7.2 Basic Measurement

In Basic Measurement mode, voltage and current waveforms are observed. They are constantly measured.

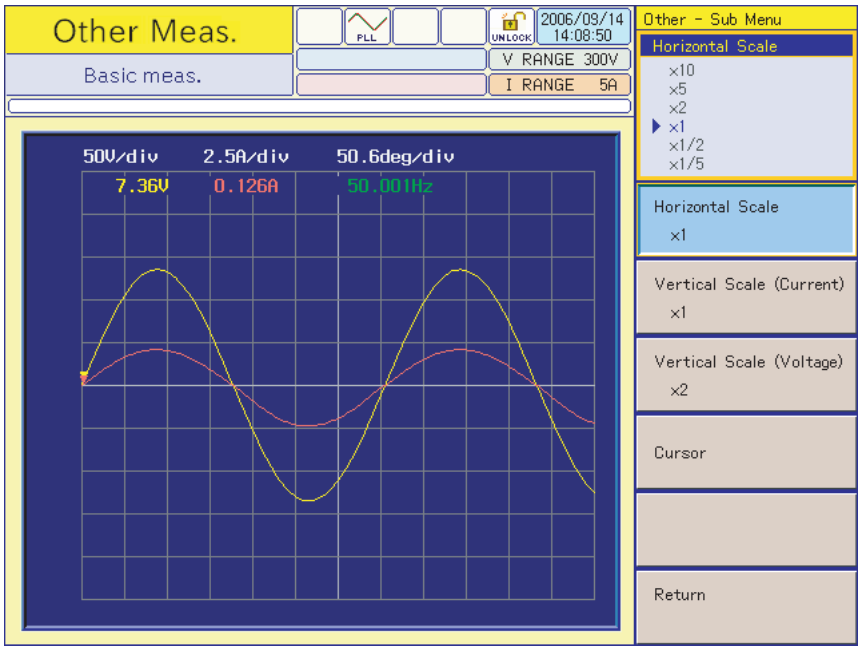


Fig.7-2 Basic Measurement display of voltage and current

7.2.1 View Selection and View Setting

Sub-Menu Page 1/3 F1 F2 F3 F4 F5 F6

■ Basic Measurement → Sub Menu

F1	View Select	Waveform View	List View	2-Screen View
		Select the view mode: waveform view, list view, or concurrent display of these views (2-screen view).		
F2	View Setting → Sub Menu	A different sub-menu is displayed for each view type selected. The 2-Screen View displays the waveform and list views at a time. The sub-menu is displayed depending on the selected window using the up, down, left, and right keys.		

■ View Setting → Sub Menu

● Waveform, 2-screen (waveform window)

F1	Horizontal Scale	×10	×5	×2	×1
		×1/2	×1/5		
		Set the view magnification. The view can be enlarged or reduced. The same magnification produces one-cycle of the waveform.			
F2	Vertical Scale (Current)	×10	×5	×2	×1
		×1/2	×1/4		
		Set the view magnification. The view can be enlarged or reduced.			
F3	Vertical Scale (Voltage)	×10	×5	×2	×1
		×1/2	×1/4		
		Set the view magnification. The view can be enlarged or reduced.			
F4	Cursor	Move the cursor within the display by turning the small or large knob. The voltage or current value at the cursor position is displayed.			

The settings are also applied to those in Sections 7.3 “FFT Analyzer” and 7.4 “In-rush Current Measurement.”

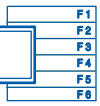
● List, 2-screen (List window)

F1	View Item	RMS	PEAK+	PEAK-	POWER
		VA	var	PF	THC
		POHC	Freq		
		Place a check mark by pressing the ENTER key. The corresponding value is displayed. To remove the check mark, press the ENTER key again (toggle operation).			

- RMS (Actual value rms): Actual value of input voltage and current
- PEAK+: Positive amplitude peak value of input voltage and current
- PEAK-: Negative amplitude peak value of input voltage and current
- POWER (actual power): Actual power W of EUT
- VA (apparent power): Apparent power VA of EUT
- var (reactive power): Reactive power var of EUT
- PF (power factor): Power factor of EUT
- THC: Actual value of total harmonic current of input current and 2nd to 40th harmonic current components
- POHC: Actual value of partial odd-order harmonic current of input current and harmonic current component of odd orders from 21st to 39th
- Freq (frequency): Input frequency measured at input voltage
- THD (total harmonic distortion): Total harmonic distortion of the input current. The ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

7.2.2 Auto Range, Voltage Range, and Current Range

Sub-Menu Page 2/3



■ Basic Measurement → Sub Menu

F1	Auto Range	OFF	ON		
		Select ON to enable Auto Range for voltage and current.			
F2	Voltage Range	150 V	300 V		
		Select the voltage range. The scale sensitivity is displayed on the upper part of the graph according to the selected range.			
F3	Current Range	0.5 A	1 A	2 A	5 A
		10 A	20 A		
		Select the current range. Select it according to the input current of the EUT. The scale sensitivity is displayed on the upper part of the graph according to the selected range.			

The settings are also applied to those in Sections 7.3 “FFT Analyzer” and 7.4 “In-rush Current Measurement.” Note, however, that Auto Range is not applied.

The peak current that can be measured is four times the range value in the 0.5 to 10 A range and 2.5 times in the 20 A range.

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.

⚠CAUTION

- The maximum value of input current is 50 Apeak. Exceeding this value may burn the current detector.
- If the current detector overheats, the OHP icon appears on the upper part of the display. Immediately shut down the power to the EUT to cut the input current of this product. Restart the test after the OHP icon disappears.

7.2.3 LPF and AC Coupling

Sub-Menu 

■ Basic Measurement → Sub Menu

F1	LPF	6 kHz	15 kHz	Bypass
		Select the cutoff frequency of the anti-aliasing filter. Select “Bypass” when no filter is used.		
F2	AC Coupling	DC	AC	
		Select the input coupling for voltage and current measurements. DC means DC coupling and AC means AC coupling.		

The settings are also applied to those in Section 7.3 “FFT Analyzer.”

7.3 FFT Analyzer

See Page 4-10

This function monitors up to 180 orders of harmonic current. It performs constant monitoring. The setting in Section 7.2 “Basic Measurement” applies to the current range. The current range and voltage range can also be set directly.

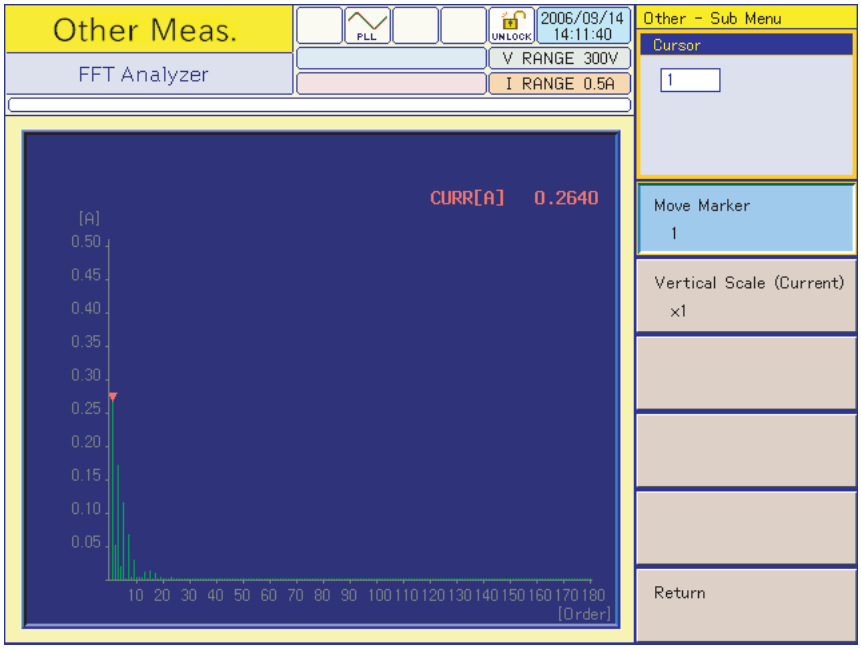


Fig.7-3 FFT Analyzer display

7.3.1 Cursor and Vertical Scale

Sub-Menu Page 1/1 F1 F2 F3 F4 F5 F6

■ FFT Analyzer → Sub Menu

F1	Cursor	Numeric value		
		Set the harmonic order. The specified order is marked with a triangular cursor. The current value at the cursor position is displayed on the upper part of the graph.		
F2	Vertical Scale (Current)	×10	×5	×2
		×1	×1/2	×1/4
		Select the vertical scale of the graph. Small values can be magnified. Values beyond the scale are restricted within a certain limit.		

7.4 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 current range is fixed to 20 A. The scale sensitivity is displayed on the upper part of the graph according to the selected menu.

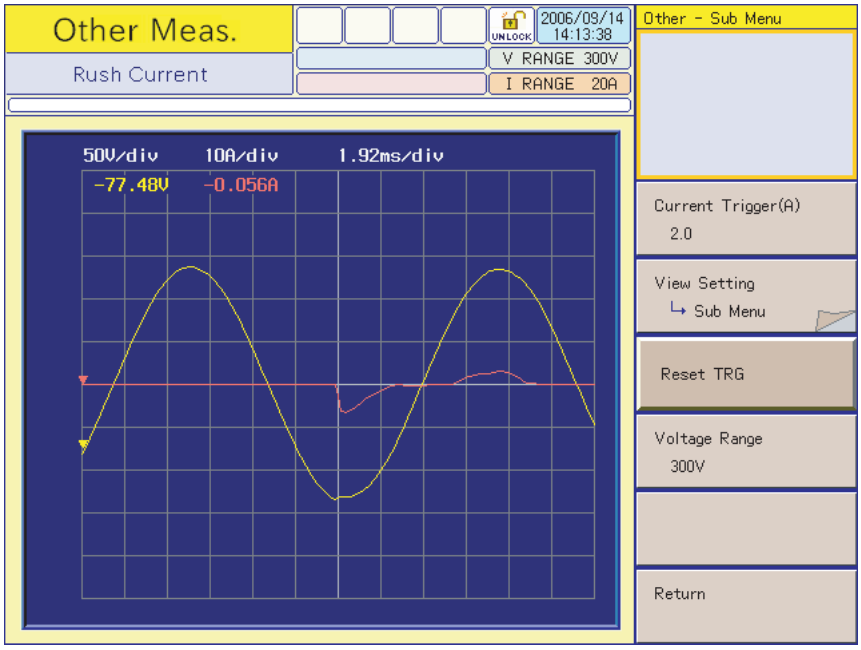


Fig.7-4 In-rush Current Measurement display

7.4.1 Current Trigger Level, View Setting, Reset Trigger/Abort, and Voltage Range

Sub-Menu Page 1/1 (F1 F2 F3 F4 F5 F6)

■ In-rush Current Measurement → Sub Menu

F1	Current Trigger (A)	Numeric value			
		Set the current trigger level. The trigger levels that can be set range from 0.1 to 80.0. The numeric value corresponds to the approximate current value (A).			
F2	View Setting → Sub Menu	Horizontal Scale	Vertical Scale (Current)	Vertical Scale (Voltage)	Cursor
F3	Reset TRG	Press Reset Trigger to wait for the next trigger. Press Abort (waiting for trigger) to cancel Reset Trigger (waiting for trigger).			
	Abort (Wait for TRG)				
F4	Voltage Range	150 V	300 V		
		Select the voltage range. The scale sensitivity is displayed on the upper part of the graph according to the selected range.			

1. Press the F1 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 display.

2. Press the F4 key and set the voltage range.

   Set the voltage range according to the input voltage. The current range is fixed to 20 A.

3. Press the F3 key (Reset TRG).

   The menu changes to Abort (Wait for TRG). To cancel triggers, follow the procedure for “Canceling triggers” 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.

5. Press the F2 key (View Setting).

   The relevant sub-menu appears.

6. Press sub-menu F4 (Cursor).

   While moving the cursor with the large knob, read the current values. You can also use the small knob to move the cursor.

■ Canceling triggers

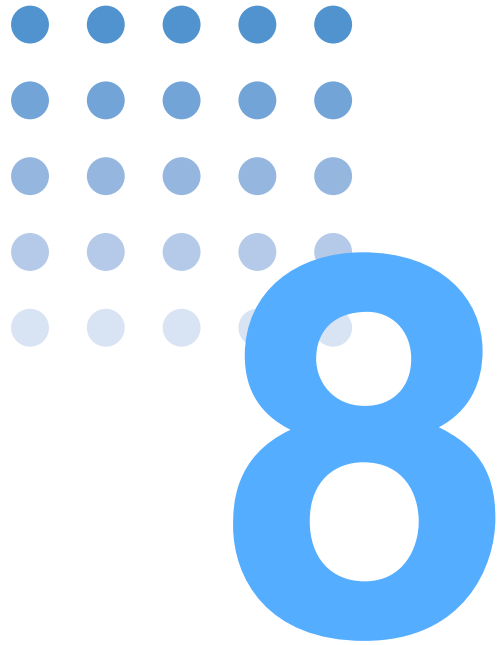
1. Confirm that the F3 key menu is Abort (Wait for TRG).

2. Press the F3 key.

   Pressing the F3 key cancels Reset Trigger and inhibits triggers. The display keeps displaying the current waveform. The F3 key menu changes to Reset TRG. To enable triggers again, do as instructed in Step 3.

■ View Setting → Sub Menu

<table>
<tr><td rowspan="3">F1</td><td rowspan="3">Horizontal Scale</td><td>×10</td><td>×5</td><td>×2</td><td>×1</td></tr>
<tr><td>×1/2</td><td>×1/5</td><td colspan="2"></td></tr>
<tr><td colspan="4">Set the view magnification. The view can be enlarged or reduced. The same magnification produces one-cycle of the waveform. The setting changes after a trigger is generated. The setting cannot be changed while the waveform is being held.</td></tr>
<tr><td rowspan="3">F2</td><td rowspan="3">Vertical Scale (Current)</td><td>×10</td><td>×5</td><td>×2</td><td>×1</td></tr>
<tr><td>×1/2</td><td>×1/4</td><td colspan="2"></td></tr>
<tr><td colspan="4">Set the view magnification. The view can be enlarged or reduced.</td></tr>
<tr><td rowspan="3">F3</td><td rowspan="3">Vertical Scale (Voltage)</td><td>×10</td><td>×5</td><td>×2</td><td>×1</td></tr>
<tr><td>×1/2</td><td>×1/4</td><td colspan="2"></td></tr>
<tr><td colspan="4">Set the view magnification. The view can be enlarged or reduced.</td></tr>
<tr><td>F4</td><td>Cursor</td><td colspan="4">Move the cursor within the display by turning the small or large knob. The current or voltage value at the cursor position is displayed.</td></tr>
</table>



Remote Control

This chapter explains how to connect the remote interface and how to control it using SCPI commands.

8.1 Outline

This product can be operated through the front panel and also remotely through the following interfaces:

- GPIB interface
- RS232C interface
- USB interface

Select the interface type on the panel.

The remote interfaces complies with IEEE Std 488.2-1992 and SCPI Specification 1999.0.

The supported IEEE Std 488.2 common commands are as follows:

*CLS	*ESE	*ESE?	*ESR?	*IDN?
*OPC	*OPC?	*OPT?	*RST	*SRE
*SRE?	*STB?	*TRG	*TST?	*WAI

See Page 8-9

Before using SCPI commands, make sure that you understand the SCPI command syntax for this product.

8.2 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

8.3 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.

8.4 Interface

This product is shipped from the factory with GPIB set as the remote control interface.

GPIB, RS232C, and USB cannot be used concurrently.

8.4.1 GPIB Interface

GPIB connection

This product is connected to the computer using an IEEE 488 standard cable.

Setting the GPIB address

See Page 4-12

GPIB address is set to 1 by factory default.

The GPIB address can be set to 1 through 30.

1. Press the SYSTEM key.
   The System Setting display appears.
2. Press the F2 key (I/F Select) a few times or turn the small knob to select GPIB.
3. Press the F3 key (I/F Select → Sub Menu).
   The Sub Menu appears.
4. Press the F1 key (GPIB Address).
5. Press the F1 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 fixed.

GPIB functions

Table 8-1 GPIB functions

Function	Subset	Content
Source handshake	SH1	All functions supported
Acceptor handshake	AH1	All functions supported
Talker	T6	Function supported
Listener	L4	Function supported
Service request	SR1	All functions supported
Remote/local	RL1	All functions supported
Parallel poll	PP0	Function unsupported
Device clear	DC1	All functions supported
Device trigger	DT1	All functions supported
Controller	C0	Function unsupported
Electrical interface	E1	Open collector driver

IEEE 488.1 get, dcl, sdc, llo, and gtl commands

Command		Function
get	Group Execute Trigger	Functions as a software trigger for starting the measurement. (Equivalent to the *TRG command)
dcl/sdc	Device Clear/ Selected Dvice Clear	Aborts measurement and clears the command buffer.
llo	Local Lockout	Locks out the local key of this product.
gtl	Go to Local	Restores the local operation mode of the front panel of this product.

Service Request

Service Request and Serial Polling functions are installed.

8.4.2 RS232C Interface

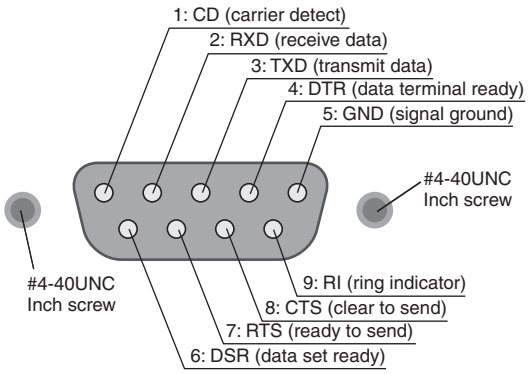
RS232C connection

The RS232C port on the KHA1000 is a standard D-sub 9-pin male connector.

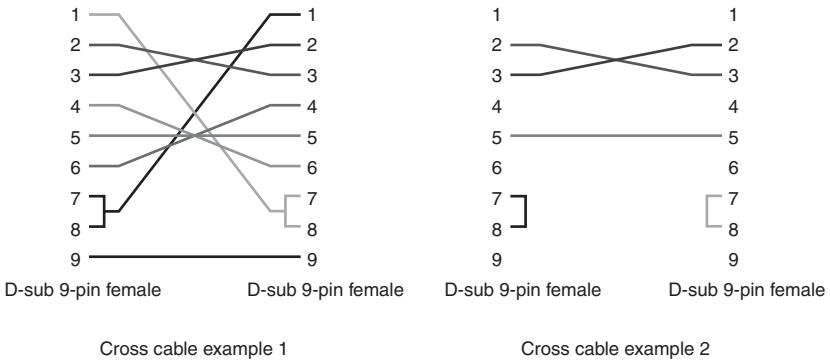
Check that the POWER switches of the KHA1000 and computer are off, and connect the KHA1000 to the computer using a standard cross cable (null modem cable).

Use a D-sub 9-pin female-to-female AT type for the cross cable. Fig.8-1 shows the connector pin arrangement.

The KHA1000 does not use hardware handshaking (as shown in the cross cable example 2).



Facing the KHA1000 rear panel



Cross cable example 1

Cross cable example 2

Fig.8-1 9-pin AT-type connector

RS232C setting

See Page 4-12

1. Press the SYSTEM key.

   The System Setting display appears.

2. Press the F2 key (I/F Select) a few times or turn the small knob to select RS232C.

3. Press the F3 key (I/F Select → Sub Menu).

   The Sub Menu appears.

4. Press the F2 key (RS232C baud rate).

5. Press the F2 key (RS232C baud rate) a few times or turn the small knob to set the baud rate.

6. Turn off the POWER switch and turn it on again.

   The I/F selection and RS232C baud rate are set.

Protocol

Table 8-2 lists the details of the RS232C protocol.

The underlined part indicates the default setting before shipment from the factory.

Table 8-2 RS232C protocol

Parameter	Setting
Connector	9-pin D-sub terminal on the rear panel
Baudrate	9600 bps/19200 bps
Data length	Fixed to 8
Stop bit	Fixed to 1
Parity	Fixed to none
Flow control	Fixed to X-Flow

Break signal

The break signal functions as an alternative for the IEEE 488.1 dcl/sdc (Device Clear, Selected Device Clear) message.

RS232C communication

Use flow control for RS232C communication. DC (device control) codes are used as control codes.

Transmission/reception may not work correctly through unilateral transmission.

Table 8-3 DC codes

Code	Function	ASCII code
DC1 (Xon)	Request to send	11H
DC3 (Xoff)	Transmission stop request	13H

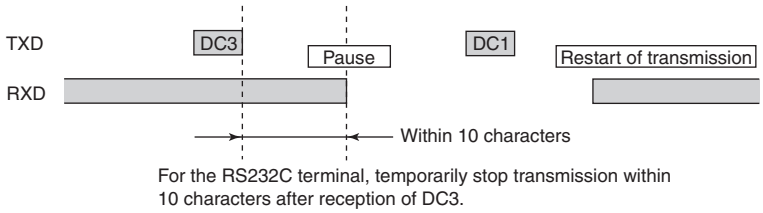


Fig.8-2 Control of transmission between RS232C and this product

8.4.3 USB Interface

Setting the USB

See Page 4-12

1. Press the SYSTEM key.
   The System Setting display appears.
2. Press the F2 key (I/F Select) a few times or turn the small knob to select USB.
3. Turn off the POWER switch and turn it on again.
   The I/F selection is set.

Service Request

Service Request and Serial Polling functions are installed.

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): 0x100D

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 web site)
- NI-VISA 3.3.0 or later
  (Can be downloaded from the web site of National Instruments)
- Keysight VISA (Keysight IO Libraries) Suite 14.1 or later
  (Can be downloaded from the web site of Keysight Technologies)

8.5 Overview of Messages

The information transferred between the controller (computer) and this product (KHA1000) 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.

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 headers	Parameters
SENSe:	
CURRent	
:RANGe	
[:UPPer]	<numeric>
:AUTO	<bool>
VOLTage	
:RANGe	
[:UPPer]	<numeric>
:AUTO	<bool>

SENSe is the root node. CURRent and VOLTage are the second-level nodes, RANGe is the third-level node, and UPPer and AUTO are the fourth-level nodes. 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.

8.5.1 Command Syntax

In this manual, SCPI commands are indicated in the following format:

```
MEASure[:SCALar]:CURRent:AC?
```

Each SCPI command has an abbreviated form. The abbreviated (short) form is the uppercase string of each SCPI command coded in this manual.

SCPI commands can be sent in either the long form or short form. Because the SCPI commands are not case sensitive, CURR, Curr, and curr are all accepted as a short form of CURRent. Long forms CURRENT, Current, and current are all accepted.

- Space must be inserted between the program header part and parameter part.
- When two or more parameters are used, join them with a comma (,).
- Join commands with a semicolon (;) (compound command).

  ```
  HARMonic:STANdard "JIS:2005:ED20";CLASs "C"
  ```

  Root node HARMonic is omitted from the second command. This is because HARMonic:STANdard "JIS:2005:ED20" of the first command specifies the HARMonic path.

  This compound command means the same as the following commands:

  ```
  HARMonic:STANdard "JIS:2005:ED20"
  HARMonic:CLASs "C"
  ```

  An error results if a node that is not defined for the current path is specified.

  Colons and semicolons can be used together to connect commands in different subsystems.

  ```
  SENSe:CURRent:RANGe Maximum;:INITiate
  ```

  This compound command includes two root nodes SENSe and INITiate. When the second or subsequent command begins with a colon, the path specified by the previous command is cleared.
- Up to 255 bytes of characters can be sent on one line.

Special symbols

The special symbols used to code SCPI commands in this manual are defined as follows:

- Characters or numbers delimited by "|" in { } means that one of them should be selected.
  Do not include { } in the actual programs.
- <> indicates program data.
  Do not include <> in the actual programs.
- [] indicates optional data.
  If it is not sent with the program, the default value is used.
  Do not include [] in the 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.

```
SENSe:CURRent:RANGe? MINimum
```

■ Response

A response is made for a query. A response is a message that is always sent from the device to the computer. The status of a device and measured values are posted to the computer.

NOTE

- When two queries are sent in separate lines, read the response to the first query before transmitting the second line after reading the first response.
- GPIB, USB

  If two lines of queries are sent at the same time, an SCPI error (-410, “Query INTERRUPTED”) may occur.
- RS232C

  If two lines of queries are sent at the same time, an incomplete response may be received and then a complete response may be received.

String termination

Every command must be terminated with a valid terminator.

Terminators include <new line> (ASCII 0x0A) and EOI (end or identify). When either one is specified, it works as a terminator.

Always use <new line> for the RS232C because EOI is not available.

EOI is not available for USB either. However, a terminator other than <new line> is automatically assigned. <new line> may or may not be assigned.

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

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.

8.5.2 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

■ 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.

```
FUNCtion "HARM"
```

To use a quotation mark as a character string, code two quotation marks without a character inserted between the two.

■ 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.

```
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.

```
SENSe:CURRent:RANGe:AUTO {ON|OFF|1|0}
```

Numeric parameters

■ NR1

NR1 indicates an integer.

Details are given in the “IEEE Standard 488.2 Programmable Instrument Standard Digital Interface.”

■ NR2

NR2 indicates a real (floating-point number).

Details are given in the “IEEE Standard 488.2 Programmable Instrument Standard Digital Interface.”

■ NR3

NR3 indicates a real (exponent).

Details are given in the “IEEE Standard 488.2 Programmable Instrument Standard Digital Interface.”

■ NRf

NRf is a generic term that includes NR1, NR2, and NR3. Any notation, such as integer or real, can be used, but MINimum and MAXimum, which are used in Numeric parameters, are not supported.

■ Numeric

Numeric parameters including 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 W.

If a value that cannot be set is specified, the device rounds it to the nearest numeric.

```
VOLTage:RANGe 350
```

Because the voltage range that can be set is 150 or 300, 300 is returned in response to VOLT:RANG?

Alternative

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:

- V (voltage)
- A (current)
- S (seconds)
- PCT (%)
- HZ (frequency)
- DEG (degree)
- W (power)

The following optional symbols are supported:

- M (milli)
- K (kilo)
- U (micro)

NOTE

- The SI unit system includes lowercase letters in unit symbols. The IEEE standard specifies uppercase letters. SCPI does not distinguish between uppercase and lowercase letters.
- Values are accepted regardless of whether or not a measurement unit is specified.
- Use "U" instead when coding "μ" in the data.

8.5.3 Default Conditions

See Page 8-17

When *RST, MEAS? is sent or the power is turned on, parameters are set as shown in Table 8-4.

Table 8-4 Default states

Content of setting	Parameter value			Unit	Function
	*RST	MEAS?*1	Power-on		
FUNC	"HARM"	–	Setting immediately before the POWER switch is turned off	V	Operating mode
CURR:COUP VOLT:COUP	DC	DC		A	Input coupling
CURR:FILT:FREQ VOLT:FILT:FREQ	6000	6000		Hz	Cutoff frequency of anti-aliasing filter
CURR:PROT:STAT VOLT:PROT:STAT	1/ON	–		–	Detection of overcurrent or overvoltage
CURR:RANG:AUTO VOLT:RANG:AUTO	0/OFF	0/OFF		–	Enable or disable Auto Range of current range and voltage range
CURR:RANG	20	20		A	Current range
VOLT:RANG	300	300		V	Voltage range
HARM:STAN	"IEC:ED30A 2:ED20A1"	No change		–	Harmonic current test standard
HARM:CLAS	"A"			–	Class of EUT
HARM:FREQ:NOM VF:FREQ:NOM	50			Hz	Nominal frequency
HARM:VOLT:NOM VF:VOLT:NOM	230			V	Nominal voltage
HARM:MARGin	100			%	Margin
HARM:OPT:CONS600	0/OFF			–	Air conditioning exceeding real power 600 W
HARM:OPT:IGN19	1/ON			–	Ignore over 19th
HARM:OPT:IGN75	1/ON			–	Ignore 75 W or below

Content of setting	Parameter value			Unit	Function
	*RST	MEAS?*1	Power-on		
HARM:OPT:IGN06|IGN5	1/ON	No change	Setting immediately before the POWER switch is turned off	–	Ignore 5 mA or below, 0.6 % or below
HARM:OPT:LVAL	NORMal			–	Applied limit value
HARM:OPT:POW:DEF	MEASured			–	Type of power value
HARM:OPT:POW	100			W	Specified power value
HARM:OPT:FUMD:DEF	MEASured			–	Basic wave current value and power factor type
HARM:OPT:FUND:CARR	20			A	Specified value of basic wave current
HARM:OPT:FUND:PFAC	1			–	Specified value of power factor
HARM:SMO	NONE			–	Smoothing
HARM:TOBS	QSTationary			–	Equipment operation type
HARM:TTIM	150			s	Measurement time
HARM:LIN:STAT	0/OFF			s	Reference Impedamce
VF:STAN:LIM	“IEC61000-3-3 Ed2.0”			–	Voltage fluctuation test standard, Limitation Values
VF:STAN:MTEC	“IEC61000-4-15 Ed1.1”			–	Voltage fluctuation test standard, Measuring technic
VF:FREQ:NOM	50			Hz	Nominal frequency
VF:VOLT:NOM	230			V	Nominal voltage
VF:METH	AUTO			–	d measurement method
VF:DMAR	100			%	d margin
VF:DMAX	6			–	dmax limit value
VF:DCO	24			–	d measurement count
VF:DTIM	60			s	d measurement time
VF:FMAR	100			%	Flicker margin
VF:PSTC	12			–	Pst measurement count
VF:PSTT	600			s	Pst measurement time
INIT:CONT	0/OFF		0/OFF	–	Sequence operation automatic continuation mode
INIT:CONT:NAME	0/OFF		0/OFF	–	Sequence operation automatic continuation mode
TRIG:SOUR TRIG:ACQ:SOUR	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:SEQ3:SOUR TRIG:TEST:SOUR	IMM	IMM	IMM	–	d measurement and manual switching trigger

*1. MEAS:<meter_fn>?

8.6 SCPI and IEEE-488.2 Common Commands

*CLS

See Page 8-50

Clears all event registers including the status bytes, event status, and error queue.

Cancels the completion wait operation by *OPC/*OPC?

Command

```
*CLS
```

*ESE

See Page 8-50

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 in response to *ESE?.

*ESR

See Page 8-50

Queries the event status register.

Command

```
*ESR?
```

Response

Returns the value of the event status register in the <NR1> format and clears the register in response to *ESR?.

*IDN

Queries the model name of this product and the firmware version.

Command

```
*IDN?
```

Response

Returns the model name of this product in response to *IDN? as shown in the following example:

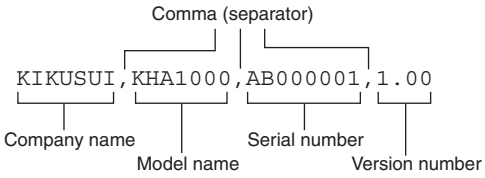


Fig.8-3 Response to *IDN?
(Example of Serial No. AB000001 and Version No. 1.00)

*OPC

Sets the OPC bit (bit 0) of the event status register when the processing of all commands standing by is complete.

See
See Section 12.5.3 in IEEE 488.2-1992.

Command

```
*OPC
*OPC?
```

Response

Returns 1 when the processing of all commands standing by is complete in response to *OPC?.

*OPT

Queries the options installed in this product.

Command

```
*OPT?
```

Response

Returns the option names in response to *OPT?

*RST

Aborts the measurement operation and initializes this product to factory default condition.

See Table 8-4 for the commands that are affected by *RST.

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 in response to *SRE?.

*STB

See Page 8-50

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 in response to *STB?.

*TRG

See
See Section 6.1.4.2.5 in IEEE 488.2-1992.

Trigger command.

This command is the same as the Group Execute Trigger command defined in IEEE 488.1.

Command

```
*TRG
```

*TST

Because this product does not have a built-in self-diagnostic function, “0” is always returned in response to this query.

Command

```
*TST?
```

Response

Returns “0” in response to *TST?

*WAI

Prevents this product from executing any subsequent commands and queries until every type of operation in standby is complete.

Command

```
*WAI
```

8.7 SCPI Commands Used for This Product

8.7.1 Measurements in General

FUNC

Selects the operation mode.

Command

```
[SENSe:]FUNCtion[:ON]
 "{HARMonic|VF|OTHer:BASic|OTHer:FFT|OTHer:RUSH}"
[SENSe:]FUNCtion[:ON]?
```

Parameter

Value:	"HARMonic"	Harmonic current test (Default)
	"VF"	Voltage fluctuation test
	"OTHer:BASic"	Basic measurement
	"OTHer:FFT"	FFT analyzer
	"OTHer:RUSH"	In-rush current measurement

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the present operation mode as character string data.

Returns OTH when the top page of other measurements is displayed.

Returns " " (blank) when the system setup or EXT control page is displayed.

CURR:COUP
VOLT:COUP

Sets the input coupling. Executing either command to set a value automatically sets the other command to the same value.

Command

```
[SENSe:]CURRent:COUPling {AC|DC}
[SENSe:]VOLTage:COUPling {AC|DC}
[SENSe:]CURRent:COUPling?
[SENSe:]VOLTage:COUPling?
```

Parameter

Value:	AC	Alternate current coupling
	DC	Direct current coupling (Default)

When *RST or MEAS:<meter_fn>? is sent, settings are made as shown in Table 8-4.

Response

Returns the setting for the input coupling.

CURR:FILT:FREQ
VOLT:FILT:FREQ

Sets the anti-alias filter. It sets the cutoff frequency of the filter. Executing either command to set a value automatically sets the other command to the same value.

Command

```
[SENSe:]CURRent:FILTer:FREQuency {<numeric>|MIN|MAX}
[SENSe:]VOLTage:FILTer:FREQuency {<numeric>|MIN|MAX}
[SENSe:]CURRent:FILTer:FREQuency?
[SENSe:]VOLTage:FILTer:FREQuency?
```

Parameter

Value:	0 (bypass) 6000 (Default) 15000
Unit:	Hz

When *RST or MEAS:<meter_fn>? is sent, settings are made as shown in Table 8-4.

Response

Returns the cutoff frequency of the anti-alias filter in the <NR3> format.

CURR:PROT:STAT
VOLT:PROT:STAT

Enables or disables overcurrent or overvoltage detection. Executing either CURR:PROT:STAT or VOLT:PROT:STAT to set a value automatically sets the other command to the same value.

Command

```
[SENSe:]CURRent:PROTection:STATe {ON|OFF|1|0}
[SENSe:]VOLTage:PROTection:STATe {ON|OFF|1|0}
[SENSe:]CURRent:PROTection:STATe?
[SENSe:]VOLTage:PROTection:STATe?
```

Parameter

Value:	ON (1)	Enable (Default)
	OFF (0)	Disable

When *RST or MEAS:<meter_fn>? is sent, settings are made as shown in Table 8-4.

Response

Returns whether or not overcurrent was detected in the <NR1> format.

CURR:RANG

Sets the current range.

Command

```
[SENSe:]CURRent:RANGe[:UPPer] {<numeric>|MIN|MAX}
[SENSe:]CURRent:RANGe[:UPPer]?
```

Parameter

Value: 0.5, 1, 2, 5, 10, 20 (The default is 20.)

Unit: A

When *RST or MEAS:<meter_fn>? is sent, settings are made as shown in Table 8-4.

Response

Returns the current range value in the <NR3> format.

VOLT:RANG

Sets the voltage range.

Command

```
[SENSe:]VOLTage:RANGe[:UPPer] {<numeric>|MIN|MAX}
[SENSe:]VOLTage:RANGe[:UPPer]?
```

Parameter

Value: 150, 300 (The default is 300.)

Unit: V

When *RST or MEAS:<meter_fn>? is sent, settings are made as shown in Table 8-4.

Response

Returns the voltage range value in the <NR3> format.

CURR:RANG:AUTO
VOLT:RANG:AUTO

Enables or disables the auto range function for the current or voltage range.

Executing either CURR:RANG:AUTO or VOLT:RANG:AUTO to set a value automatically sets the other command to the same value.

Command

```
[SENSe:]CURRent:RANGe:AUTO {ON|OFF|1|0}
[SENSe:]VOLTage:RANGe:AUTO {ON|OFF|1|0}
[SENSe:]CURRent:RANGe:AUTO?
[SENSe:]VOLTage:RANGe:AUTO?
```

Parameter

Value:	ON (1)	Enable Auto Range.
	OFF (0)	Disable Auto Range (Default)

When *RST or MEAS:<meter_fn>? is sent, settings are made as shown in Table 8-4.

Response

Returns whether the auto range is enabled or disabled in the <NR3> format.

8.7.2 Harmonic Measurement Mode

HARM:STAN

Sets the test standard.

Command

```
HARMonic:STANdard
  "{IEC:ED30A2:ED20A1|IEC:ED30A2:ED10|IEC:ED22:ED20|JI
  S:2003:ED10|JIS:2005:ED20|IEC:ED22:ED10|JIS:2005:ED1
  0|IEC:ED30:ED20|IEC:ED30:ED10|JIS:2011:ED10|JIS:2011
  :ED20}"
HARMonic:STANdard?
```

Parameter

Value:	"IEC:ED30A2:ED20A1"	IEC Ed3.0A2/Ed2.0A1 (Default)
	"IEC:ED30A2:ED10"	IEC Ed3.0A2/Ed1.0
	"IEC:ED22:ED20"	IEC Ed2.2/Ed2.0
	"JIS:2003:ED10"	JIS 2003/Ed1.0
	"JIS2005:ED20"	JIS 2005/Ed2.0
	"IEC:ED22:ED10"	IEC Ed2.2/Ed1.0
	"JIS2005:ED10"	JIS 2005/Ed1.0
	"IEC:ED30:ED20"	IEC Ed3.0/Ed2.0
	"IEC:ED30:ED10"	IEC Ed3.0/Ed1.0
	"JIS:2011:ED10"	JIS 2011/Ed1.0
	"JIS:2011:ED20"	JIS 2011/Ed2.0

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns a test standard.

NOTE

- To perform a test based on the IEC61000-3-2 Ed4.0 standard, select "IEC:ED30A2:ED20A1" (with interharmonics measurement) or "IEC:ED30A2:ED10" (without interharmonics measurement). The standard is set to IEC 61000-3-2 Ed4.0 in test conditions, on the KHA1000 display, and in reports. The measurement requirements of the IEC 61000-3-2 Ed4.0 standard are the same as those of IEC 61000-3-2 Ed3.0 A2.

HARM:CLAS

Sets the class of EUT.

The reference value for determining conformance to the standard is the limit value corresponding to the class.

Command

```
HARMonic:CLASs "{A|B|C|D}"
HARMonic:CLASs?
```

Parameter

Value:	"A"	Class A (Default)
	"B"	Class B
	"C"	Class C
	"D"	Class D

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the class of EUT.

HARM:FREQ:NOM

Sets the nominal frequency. Set the nominal frequency according to the rating of the EUT.

Executing this command simultaneously sets VF:FREQeuncy:NOMinal to the same value.

Command

```
HARMonic:FREQuency:NOMinal {50|60}
HARMonic:FREQuency:NOMinal?
```

Parameter

Value: 50 or 60 (The default is 50.)

Unit: Hz

When *RST is sent, settings are made as shown in Table 8-4.
When HARM:STAN "{IEC:ED22:ED20 | IEC:ED22:ED10 | IEC:ED30:ED20 | IEC:ED30:ED10}" is sent, the nominal frequency is set to 50.

Response

Returns the nominal frequency in the <NR3> format.

HARM:VOLT:NOM

Sets the nominal voltage. Set the nominal frequency according to the rating of the EUT.

Executing this command simultaneously sets VF:VOLTage:NOMinal to the same value.

Command

```
HARMonic:VOLTage:NOMinal <NRf>
HARMonic:VOLTage:NOMinal?
```

Parameter

Value: 100, 120, 200, or 100 to 300
IEC Ed3.0/Ed2.0, IEC Ed2.2/Ed2.0, IEC Ed3.0/Ed1.0, IEC Ed2.2/Ed1.0, JIS 2005/Ed2.0, JIS 2005/Ed1.0, JIS 2011/Ed2.0, JIS 2011/Ed1.0 (The default is 230)

Value: 100, 120, 200, or 230
JIS 2003/Ed1.0 (The default is 230)

Unit: V

When *RST is sent, settings are made as shown in Table 8-4.
When HARM:STAN "{IEC:ED22:ED20 | IEC:ED22:ED10 | IEC:ED30:ED20 | IEC:ED30:ED10}" is sent, the nominal voltage is set to 230.

Response

Returns the nominal voltage value in the <NR3> format.

HARM:MARGin

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

```
HARMonic:MARGin {<numeric>|MIN|MAX}
HARMonic:MARGin?
```

Parameter

Value: 10 to 100 (The default is 100.)

Unit: PCT

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the margin in the <NR3> format.

HARM:OPT:CONS600

Sets when the EUT is Class A under test standard JIS 2011/Ed2.0, JIS 2011/Ed1.0, JIS 2005/Ed2.0, JIS 2005/Ed1.0 or JIS 2003/Ed1.0.

Selects whether or not an air conditioner exceeds effective input power of 600 W.

Command

```
HARMonic:OPTion:CONSider600{ON|OFF|1|0}
HARMonic:OPTion:CONSider600?
```

Parameter

Value:	ON (1)	Yes
	OFF (0)	No (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns whether or not the air conditioner exceeds effective input power of 600 W in the <NR1> format.

HARM:OPT:IGN19

Sets under test standard JIS 2003/Ed1.0. Specify whether or not to target up to the 19th order (ignore over 19th) for judgment when harmonic current exceeding the 19th order is dropping slightly.

Command

```
HARMonic:OPTion:IGNore19{ON|OFF|1|0}
HARMonic:OPTion:IGNore19?
```

Parameter

Value:	ON (1)	Yes (Default)
	OFF (0)	No

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns whether or not to target up to the 19th order (ignore over 19th) top judgment in the <NR1> format.

HARM:OPT:IGN75

Sets when the EUT is Class D under test standard JIS 2003/Ed1.0. Specifies whether or not to ignore effective input power of 75 W or less.

Command

```
HARMonic:OPTion:IGNore75{ON|OFF|1|0}
HARMonic:OPTion:IGNore75?
```

Parameter

Value:	ON (1)	Yes (Default)
	OFF (0)	No

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns whether or not effective input power of 75 W or less is ignored in the <NR1> format.

HARM:OPT:IGN06|IGN5

Sets under test standard JIS 2003/Ed1.0. Specifies whether or not to ignore smaller harmonic current comparing 0.6 % of the input current and 5 mA.

Command

```
HARMonic:OPTion:IGNore06|IGNore5{ON|OFF|1|0}
HARMonic:OPTion:IGNore06|IGNore5?
```

Parameter

Value:	ON (1)	Yes (Default)
	OFF (0)	No

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns whether or not to ignore smaller harmonic current comparing 0.6 % of the input current and 5 mA in the <NR1> format.

HARM:OPT:LVAL

Sets the limit value to be applied to standard criteria.

Command

```
HARMonic:OPTion:LVALues {NORMal|CLASSA|CLASSD|IGNore}
HARMonic:OPTion:LVALues?
```

Parameter

Value:	NORMal	Normal limit value
	CLASSA	Class A limit value (Invalid in JIS 2003/Ed1.0)
	CLASSD	Class D limit value
	IGNore	No limit value is set. (Invalid in IEC Ed3.0A2/Ed2.0A1, IEC Ed3.0A2/Ed1.0, IEC Ed3.0/Ed2.0, IEC Ed2.2/Ed2.0, IEC Ed3.0/Ed1.0, IEC Ed2.2/Ed1.0, JIS 2005/Ed2.0, JIS 2005/Ed1.0, JIS 2011/Ed2.0, or JIS 2011/Ed1.0)
	WJUDge	3rd/5th/Current Wave (not valid for IEC Ed3.0A2/Ed2.0A1, IEC Ed3.0A2/Ed1.0, JIS 2011/Ed2.0, or JIS 2011/Ed1.0)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the limit value to be applied.

HARM:OPT:POW:DEF

Sets the type of power value for Class D. The type and the default of the value vary corresponding to the test standard.

Command

```
HARMonic:OPTion:POWer:DEFinition
  {AVERage|MEASured|SPECified|WINDow}
HARMonic:OPTion:POWer:DEFinition?
```

Parameter

Value:	AVERage	Average value
	MEASured	Measured value
	SPECified	Specified value
	WINDow	Value for each window

Test standards and values

Test standard	IEC Ed2.2/ Ed2.0	IEC Ed2.2/ Ed1.0	JIS 2005/ Ed2.0	JIS 2005/ Ed1.0	IEC Ed3.0/ Ed2.0	IEC Ed3.0/ Ed1.0	IEC Ed3.0A2/ Ed2.0A1	IEC Ed3.0A2/ Ed1.0	JIS 2011/ Ed2.0	JIS 2011/ Ed1.0	JIS 2003/ Ed1.0
Default	MEASured										WINDow
Value	MEASured SPECified										WINDow AVERage SPECified

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the type of power value.

HARM:OPT:POW

Sets the specified value of the power.

Command

```
HARMonic:OPTion:POWer[:LEVel]{<numeric>|MIN|MAX}
HARMonic:OPTion:POWer[:LEVel]?
```

Parameter

Value: 0 to 4000 (The default is 100.)

Unit: W

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the value specified for the power in the <NR3> format.

HARM:OPT:FUND:DEF

Sets the fundamental current value and the type of power factor for Class C.

Command

```
HARMonic:OPTion:FUNDamental:DEFinition
  {MEASured|SPECified}
HARMonic:OPTion:FUNDamental:DEFinition?
```

Parameter

Value:	MEASured	Measured value (Default)
	SPECified	Specified value

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the fundamental current value and the type of power factor.

HARM:OPT:FUND:CURR

Sets the specified value of the fundamental current for Class C.

Command

```
HARMonic:OPTion:FUNDamental:CURRent{<numeric>|MIN|MAX}
HARMonic:FUNDamental:CURRent?
```

Parameter

Value: 0.0 to 20.0 (The default is 20.0.)

Unit: A

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the specified value of the fundamental current in the <NR3> format.

HARM:OPT:FUND:PFAC

Sets the specified value of the power factor for Class C.

Command

```
HARMonic:OPTion:FUNDamental:PFACtor{<numeric>|MIN|MAX}
```

```
HARMonic:FUNDamental:PFACtor?
```

Parameter

Value: 0.00 to 1.00 (The default is 1.00.)

Unit: None

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the specified value of the power factor in the <NR3> format.

HARM:SMO

Sets the type of smoothing under test standard JIS 2003/Ed1.0.

Command

```
HARMonic:SMOothing {NOME|TCONst|AVERage}
HARMonic:SMOothing?
```

Parameter

Value:	NONE	No (Default)
	TCONst	Time constant 1.5 s
	AVERage	Average value

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the type of smoothing.

HARM:TOBS

Sets the type of equipment operation for setting the observation period (measurement time).

Command

```
HARMonic:TOBServation
  {QSTationary|SCYClic|RANDom|LCYClic}
HARMonic:TOBServation?
```

Parameter

Value:	QSTationary	Quasi stationary (Default)
	SCYClic	Short cyclic
	RANDom	Random
	LCYClic	Long cyclic

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the type of equipment operation for setting the observation period (measurement time).

HARM:TTIM

Sets the measurement time.

Command

```
HARMonic:TTIMe{<numeric>|MIN|MAX}
HARMonic:TTIMe?
```

Parameter

Value: 1 to 9600 (The default is 150.)

Value: 1 to 150 (Under test standard JIS:2003:ED10)

Unit: S

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the measurement time in the <NR3> format.

HARM:LIN:STAT

Sets whether to use the reference impedance.

Command

```
HARMonics:LIN:STATe (ON|OFF|1|0)
HARMonics:LIN:STATe?
```

Parameter

Value:	OFF(0)	The reference impedance is not used (default).
	ON(1)	The reference impedance is used.

Response

Returns whether the reference impedance is being used in <NR1> format.

8.7.3 Voltage Fluctuation Measurement Mode

VF:STAN:LIM

Sets the limitation standard.

Command

```
VF:STANdard:LIMitation[:NAME] "IEC 61000-3-3 Ed2.0"
VF:STANdard:LIMitation[:NAME]?
```

Parameter

Value: "IEC 61000-3-3 Ed2.0" (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the limitation standard.

NOTE

- To perform a test based on the IEC61000-3-3 Ed3.0 standard, set the VF:STAN:MTEC command parameter to “IEC 61000-4-15 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 Ed3.0 in test conditions, on the KHA1000 display, and in reports. The measuring instrument requirements of the IEC 61000-3-3 Ed3.0 standard are specified in IEC 61000-4-15 Ed2.0.

VF:STAN:MTEC

Sets the standard for measuring techniques.

Command

```
VF:STANdard:MTEChnique[:NAME] "{IEC 61000-4-15
 Ed1.1|IEC 61000-4-15 Ed2.0"
VF:STANdard:MTEChnique[:NAME]?
```

Parameter

Value: "IEC 61000-4-15 Ed1.1" (Default)
"IEC 61000-4-15 Ed2.0"

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the standard for measuring techniques.

NOTE

- To perform a test based on the IEC61000-3-3 Ed3.0 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 Ed3.0 in test conditions, on the KHA1000 display, and in reports. The measuring instrument requirements of the IEC 61000-3-3 Ed3.0 standard are specified in IEC 61000-4-15 Ed2.0.

VF:FREQ:NOM

Sets the nominal frequency. Set the nominal frequency according to the rating of the EUT. Executing this command automatically sets the HARM:FREQ:NOM value to the same value.

Command

```
VF:FREQuency:NOMinal {50|60}
VF:FREQuency:NOMinal?
```

Parameter

Value: 50 or 60 (The default is 50.)
Unit: Hz

When *RST is sent, settings are made as shown in Table 8-4.

When HARM:STAN “{IEC:ED22:ED20 | IEC:ED22:ED10 | IEC:ED30:ED20 | IEC:ED30:ED10 | IEC:ED30A2:ED20A1 | IEC:ED30A2:ED10}” is sent, the nominal frequency is set to 50.

Response

Returns the nominal frequency in the <NR3> format.

VF:VOLT:NOM

Sets the nominal voltage value. Set the nominal voltage value according to the EUT.

Executing this command automatically sets the HARM:VOLT:NOM value to the same value.

Command

```
VF:VOLTage:NOMinal <NRf>
VF:VOLTage:NOMinal?
```

Parameter

Value: 100, 120, 200, or 230 (The default is 230.)

Unit: V

When *RST is sent, settings are made as shown in Table 8-4.

When HARM:STAN "{IEC:ED22:ED20 | IEC:ED22:ED10 | IEC:ED30:ED20 | IEC:ED30:ED10 | IEC:ED30A2:ED20A1 | IEC:ED30A2:ED10}" is sent, the nominal voltage is set to 230.

Response

The nominal voltage value is returned in the <NR3> format.

VF:METH

Sets the d measurement method.

Command

```
VF:METHod {AUTO|MANual}
VF:METHod?
```

Parameter

Value:	AUTO	Pst Auto (Default)
	MANual	Manual

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the d measurement method.

VF:DMAR

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

```
VF:DMARgin {<numeric>|MIN|MAX}
VF:DMARgin?
```

Parameter

Value: 10 to 100 (The default is 100.)

Unit: PCT

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the margin for the limit value of dc, dmax, or Tmax (d(t) > 3.3 %) in the <NR3> format.

VF:DMAX

Sets the limit value of dmax (maximum relative voltage fluctuation) in d measurement (voltage fluctuation test).

Command

```
VF:DMAXlimit {4|6|7}
VF:DMAXlimit?
```

Parameter

Value: 4, 6, or 7 (The default is 6.)

Unit: PCT

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the limit value of dmax (maximum relative voltage fluctuation) in d measurement (voltage fluctuation test) in the <NR3> format.

VF:DCO

Sets the d measurement count.

Command

```
VF:DCOunt <NRf>
VF:DCOunt?
```

Parameter

Value: 3 to 24 (The default is 24.)

Unit: None

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the d measurement count in the <NR3> format.

VF:DTIM

Sets the d measurement time.

Command

```
VF:DTIMe{<numeric>|MIN|MAX}
VF:DTIMe?
```

Parameter

Value: 30 to 180 (The default is 60.)

Unit: S

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the d measurement time in the <NR3> format.

VF:FMAR

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

```
VF:FMARgin {<numeric>|MIN|MAX}
VF:FMARgin?
```

Parameter

Value: 10 to 100 (The default is 100.)

Unit: PCT

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the margin for the limit value of Pst or Plt in the <NR3> format.

VF:PSTC

Sets the Pst measurement count.

Command

```
VF:PSTCount <NRf>
VF:PSTCount?
```

Parameter

Value: 1 to 12 (The default is 12.)

Unit: None

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the Pst measurement count in the <NR3> format.

VF:PSTT

This command sets the Pst measurement time.

Command

```
VF:PSTTime{<numeric>|MIN|MAX}
VF:PSTTime?
```

Parameter

Value: 30 to 900 (The default is 600.)

Unit: S

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the Pst measurement time in the <NR3> format.

8.7.4 Measurement Functions

■ <meter_fn>

This product has 15 measurement functions for measuring current, harmonic current, flicker, frequency, power, power factor, and voltage.

In this manual, a third-level node of FETC?, READ?, or MEAS? may be written as <meter_fn>. Refer to Table 8-5 and replace <meter_fn> with the necessary measurement method and code it.

Table 8-5 Specified value of <meter_fn>

<meter_fn.>	Measured value	Response unit	Enable/disable mode (○: Enable, ×: Disable)				
			HA*1	VF*1	BASIC	FFT	RUSH
CURRent:AC	Alternate current	A	○	○	○	○	×
CURRent:AMPLitude:MAXimum	Maximum current	A	○	○	○	○	×
CURRent:AMPLitude:MINimum	Minimum current	A	○	○	○	○	×
CURRent:HARMonic[:AMPLitude]	Harmonic current	A	○	×	×	○	×
CURRent:HARMonic:POHC	POHC	A	○	×	×	×	×
CURRent:HARMonic:THC	THC	A	○	×	×	×	×
FLICker:ST	Momentary flicker	–	×	○	×	×	×
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	Alternate current voltage	V	○	○	○	○	×
VOLTage:AMPLitude:MAXimum	Maximum voltage	V	○	○	○	○	×
VOLTage:AMPLitude:MINimum	Minimum voltage	V	○	○	○	○	×

*1. Disabled during testing or analysis in the test status (setting, test, or analysis).

Symbols used in Enable mode

- HA: Harmonic measurement mode
- VF: Voltage fluctuation measurement mode
- BASIC: Basic measurement
- FFT: FFT analyzer
- RUSH: In-rush current measurement

The response data is generated after waiting until the measurement is complete for the FETC: <meter_fn>?, READ: <meter_fn>?, or MEAS: <meter_fn>? query immediately after transmission of the INIT command or READ: <meter_fn>? / MEAS: <meter_fn>? query.

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 <meter_fn> is not specified, the value set by previous FETC?, READ?, or MEAS:<meter_fn>? is used.

See Table 8-5

Command

```
FETCh[:SCALar][:<meter_fn>]?
```

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 <meter_fn> is not specified, the value set by previous FETC?, READ?, or MEAS:<meter_fn>? is used.

See Table 8-5

Command

```
READ[:SCALar][:<meter_fn>]?
```

Response

Returns measurement data in the <NR3> format in response to READ?.

MEAS

MEAS? queries measurement data after starting measurement operation.

MEAS:<meter_fn>? works the same as the ABOR command issued in combination with the READ? query.

Refer to Table 8-4 for the affected commands.

See Table 8-5

Command

```
MEASure[:SCALar]:<meter_fn>?
```

Response

Returns measurement data in the <NR3> format in response to MEAS:<meter_fn>?.

FETC:CURR:AC
READ:CURR:AC
MEAS:CURR:AC

Each of these commands queries the measured value of the alternate current (rms).

Command

```
FETCh[:SCALar]:CURRent:AC?
READ[:SCALar]:CURRent:AC?
MEASure[:SCALar]:CURRent:AC?
```

Effective modes are HA, VF, BASIC, and FFT.

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[:SCALar]:CURRent:AMPLitude:MAXimum?
READ[:SCALar]:CURRent:AMPLitude:MAXimum?
MEASure[:SCALar]:CURRent:AMPLitude:MAXimum?
```

Effective modes are HA, VF, BASIC, and FFT.

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 minimum current (negative amplitude peak value).

Command

```
FETCh[:SCALar]:CURRent:AMPLitude:MINimum?
READ[:SCALar]:CURRent:AMPLitude:MINimum?
MEASure[:SCALar]:CURRent:AMPLitude:MINimum?
```

Effective modes are HA, VF, BASIC, and FFT.

Response

Returns the measured value of the minimum current (negative amplitude peak value) in the <NR3> format.

Unit: A

FETC:CURR:HARM
READ:CURR:HARM
MEAS:CURR:HARM

Each queries the measured value of the harmonic current.

Command

```
FETCh[:SCALar]:CURRent:HARMonic[:AMPLitude]? {ALL|<NRf>}
READ[:SCALar]:CURRent:HARMonic[:AMPLitude]? {ALL|<NRf>}
MEASure[:SCALar]:CURRent:HARMonic[:AMPLitude]? {ALL|<NRf>}
```

Effective modes are HA and FFT.

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:POHC
READ:CURR:HARM:POHC
MEAS:CURR:HARM:POHC

Each queries the measured value of POHC (partial odd-order harmonic current).

Command

```
FETCh[:SCALar]:CURRent:HARMonic:POHC?
READ[:SCALar]:CURRent:HARMonic:POHC?
MEASure[:SCALar]:CURRent:HARMonic:POHC?
```

Effective mode is HA.

Response

Returns the measured value of POHC (partial odd-order harmonic current) in the <NR3> format.

Unit: A

FETC:CURR:HARM:THC
READ:CURR:HARM:THC
MEAS:CURR:HARM:THC

Each queries the measured value of THC (total harmonic current).

Command

```
FETCh[:SCALar]:CURRent:HARMonic:THC?
READ[:SCALar]:CURRent:HARMonic:THC?
MEASure[:SCALar]:CURRent:HARMonic:THC?
```

Effective mode is HA.

Response

Returns the measured value of THC (total harmonic current) in the <NR3> format.
Unit: A

FETC:CURR:HARM:THD
READ:CURR:HARM:THD
MEAS:CURR:HARM:THD

Queries the measured THD (total harmonic displacement).

Command

```
FETCh[:SCALar]:CURRent:HARMonic:THD?
READ[:SCALar]:CURRent:HARMonic:THD?
MEASure[:SCALar]:CURRent:HARMonic:THD?
```

Effective mode is HA.

Response

Returns the measured THD (total harmonic displacement) in <NR3> format.
Unit: %

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:HARMonic:THDI?
READ[:SCALar]:CURRent:HARMonic:THDI?
MEASure[:SCALar]:CURRent:HARMonic:THDI?
```

Effective mode is HA.

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:HARMonic:THDF?
READ[:SCALar]:CURRent:HARMonic:THDF?
MEASure[:SCALar]:CURRent:HARMonic:THDF?
```

Effective mode is HA.

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:FLIC:ST
READ:FLIC:ST
MEAS:FLIC:ST

Each queries a momentary flicker value.

Command

```
FETCh[:SCALar]:FLICker:ST?
READ[:SCALar]:FLICker:ST?
MEASure[:SCALar]:FLICker:ST?
```

Effective mode is VF.

Response

Returns the momentary flicker value in the <NR3> format.

FETC:FREQ
READ:FREQ
MEAS:FREQ

Each queries the set value of the frequency.

Command

```
FETCh[:SCALar]:FREQuency?
READ[:SCALar]:FREQuency?
MEASure[:SCALar]:FREQuency?
```

Effective modes are HA, VF, BASIC, and FFT.

Response

Returns the set value of the frequency in the <NR3> format.
Unit: Hz

FETC:POW:AC
READ:POW:AC
MEAS:POW:AC

Each queries the measured value of the real power.

Command

```
FETCh[:SCALar]:POWer:AC[:REAL]?
READ[:SCALar]:POWer:AC[:REAL]?
MEASure[:SCALar]:POWer:AC[:REAL]?
```

Effective modes are HA, VF, BASIC, and FFT.

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[:SCALar]:POWer:AC:APParent?
READ[:SCALar]:POWer:AC:APParent?
MEASure[:SCALar]:POWer:AC:APParent?
```

Effective modes are HA, VF, BASIC, and FFT.

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[:SCALar]:POWer:AC:REACtive?
READ[:SCALar]:POWer:AC:REACtive?
MEASure[:SCALar]:POWer:AC:REACtive?
```

Effective modes are HA, VF, BASIC, and FFT.

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[:SCALar]:POWer:AC:PFACtor?
READ[:SCALar]:POWer:AC:PFACtor?
MEASure[:SCALar]:POWer:AC:PFACtor?
```

Effective modes are HA, VF, BASIC, and FFT.

Response

Returns the power factor in the <NR3> format.

FETC:VOLT:AC
READ:VOLT:AC
MEAS:VOLT:AC

Each queries the measured value of the AC voltage (effective value).

Command

```
FETCh[:SCALar]:VOLTage:AC?
READ[:SCALar]:VOLTage:AC?
MEASure[:SCALar]:VOLTage:AC?
```

Effective modes are HA, VF, BASIC, and FFT.

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[:SCALar]:VOLTage:AMPLitude:MAXimum?
READ[:SCALar]:VOLTage:AMPLitude:MAXimum?
MEASure[:SCALar]:VOLTage:AMPLitude:MAXimum?
```

Effective modes are HA, VF, BASIC, and FFT.

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[:SCALar]:VOLTage:AMPLitude:MINimum?
READ[:SCALar]:VOLTage:AMPLitude:MINimum?
MEASure[:SCALar]:VOLTage:AMPLitude:MINimum?
```

Effective modes are HA, VF, BASIC, and FFT.

Response

Returns the measured value of the minimum voltage (negative amplitude peak value) in the <NR3> format.

Unit: V

8.7.5 Trigger Function

This section explains the commands that set trigger functions. Sequence 1 indicates the constant measurement state (ACQuire) before start of testing.

INIT
INIT:NAME

Starts the trigger function. The command is invalid if issued during analysis in the test execution state. In the relevant sequence group, measurement begins immediately in the case of TRIG:SOUR:IMM. In the case of TRIG:SOUR:BUS, measurement begins after a software trigger is received. After measurement begins, the MEAS bit of the OPER register is set, and is reset upon completion.

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)

```
INITiate[:IMMediate][:SEQuence[1]]
INITiate[:IMMediate]:NAME {ACQuire}
```

Parameter

Value:	ACQuire	Sequence 1: Constant measurement state before start of testing

INIT:CONT

Sets the automatic continuation mode of sequence operation for Sequence 1. The command is invalid if issued during analysis in the test execution state.

- When the automatic continuation mode of sequence operation is set to ON

  When the parameter of the trigger source of Sequence 1 is IMM, the system immediately begins measurement. After the measurement is finished, the next measurement automatically begins.

  When the parameter is BUS, the system waits for a software trigger and then begins measurement. After the measurement is finished, the system waits for another trigger.

- When the automatic continuation mode of sequence operation is set to OFF

  The measurement currently in progress is continued unless ABOR is sent. New measurements are not automatically continued. The command works the same as INIT:CONT:NAME.

Command (Sequence 1)

```
INITiate:CONTinuous[:SEQuence[1]] {ON|OFF|1|0}
INITiate:CONTinuous[:SEQuence[1]]?
```

Parameter

Value:	ON (1)	Automatic continuation mode ON
	OFF (0)	Automatic continuation mode OFF (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the setting of the automatic continuation mode of sequence operation in the <NR1> format in response to INITiate:CONTinuous[:SEQuence[1]]?.

INIT:CONT:NAME

Sets the automatic continuation mode of sequence operation for Sequence 1.

The command works the same as INIT:CONT.

Command

```
INITiate:CONTinuous:NAME {ACQuire},{ON|OFF|1|0}
INITiate:CONTinuous:NAME?{ACQuire}
```

Parameter `Character`

Value:	ACQuire	Sequence 1

Parameter

Value:	ON (1)	Automatic continuation mode ON
	OFF (0)	Automatic continuation mode OFF (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the setting of the automatic continuation mode of sequence operation in the <NR1> format in response to INIT:CONT:NAME.

INIT:SEQ2
INIT:NAME RUSH

Each of these commands starts in-rush current measurement.

Command

```
INITiate[:IMMediate]:SEQuence2
INITiate[:IMMediate]:NAME {RUSH}
```

Parameter

Value: NAME

When *RST is sent, settings are made as shown in Table 8-4.

INIT:SEQ3
INIT:NAME TEST

Each of these commands starts testing for d measurement (voltage fluctuation test) in MANual mode.

Command

```
INITiate[:IMMediate]:SEQuence3
INITiate[:IMMediate]:NAME {TEST}
```

Parameter

Value: TEST

When *RST is sent, settings are made as shown in Table 8-4.

TRIG:SOUR
TRIG:ACQ:SOUR

Each sets the conditions (trigger source) for actually starting measurement after reception of the INIT command.

Command (Sequence 1)

```
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 Execute Trigger)).
	IMMediate	Start measurement immediately (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the current setting of the trigger source.

TRIG:SEQ2:SOUR
TRIG:RUSH:SOUR

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)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the setting of the internal trigger.

TRIG:SEQ2:LEV
TRIG:RUSH:LEV

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

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the current trigger level in the <NR3> format.

TRIG:SEQ3:SOUR
TRIG:TEST:SOUR

Each sets the conditions for actually starting measurement for test operation after reception of the INIT:SEQ3 command.

Command

```
TRIGger:SEQuence3:SOURce {BUS|INTernal}
TRIGger:SEQuence3:SOURce?
TRIGger:TEST:SOURce {BUS|INTernal}
TRIGger:TEST:SOURce?
```

Parameter

Value:	BUS	Start measurement after waiting for a software trigger (*TRG, IEEE488.1 get (Group Execute Trigger)).
	IMMediate	Start measurement immediately (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns the current setting of the trigger source.

To start the second or a subsequent test in MANual mode set by the VF:METH command (d measurement, voltage fluctuation test), use a software trigger (*TRG, IEEE 488.1 get) regardless of the setting of TRIG:SEQ3:SOUR (TRIG:TEST:SOUR).

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]
```

8.7.6 System setting

This section explains the commands for making the system settings of this product.

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 error information 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: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: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:BEEP:VOL

Sets the alarm volume.

Command

```
SYSTem:BEEPer:VOLume {<numeric>|MIN|MAX}
```

```
SYSTem:BEEPer:VOLume?
```

Parameter

Value: 0 to 8 (The default is 4.)

Response

Returns the alarm volume in the <NR3> format.

SYST:DATE

Sets the date (year, month, and day).

Command

```
SYSTem:DATE {<NRf>,<NRf>,<NRf>}
SYSTem:DATE?
```

Parameter

Value: Year (2000 to 2099), month, day

Response

Returns the date (year, month, and day) in the <NR1>, <NR1>, <NR1> format.

SYST:TIME

Sets the time (hours, minutes, and seconds).

Command

```
SYSTem:DATE {<NRf>,<NRf>,<NRf>}
SYSTem:DATE?
```

Parameter

Value: Hours, minutes, seconds

Response

Returns the time (hours, minutes, and seconds) in the <NR1>, <NR1>, <NR1> format.

SYST:CONF:PCRL:STATe

Specifies whether or not to enable AC Pow. Control.

Command

```
SYST:CONFigure:PCRL:STATe{ON|OFF|1|0}
SYST:CONFigure:PCRL:STATe?
```

Parameter

Value:	ON (1)	Enable
	OFF (0)	Disable (Default)

When *RST is sent, settings are made as shown in Table 8-4.

Response

Returns information on whether or not to enable AC Pow. Control in the <NR1> format.

8.8 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.

Fig.8-4 shows the SCPI status register structure. “+” indicates the logical sum of register bits. Table 8-6 to 8-9 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 rules 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.

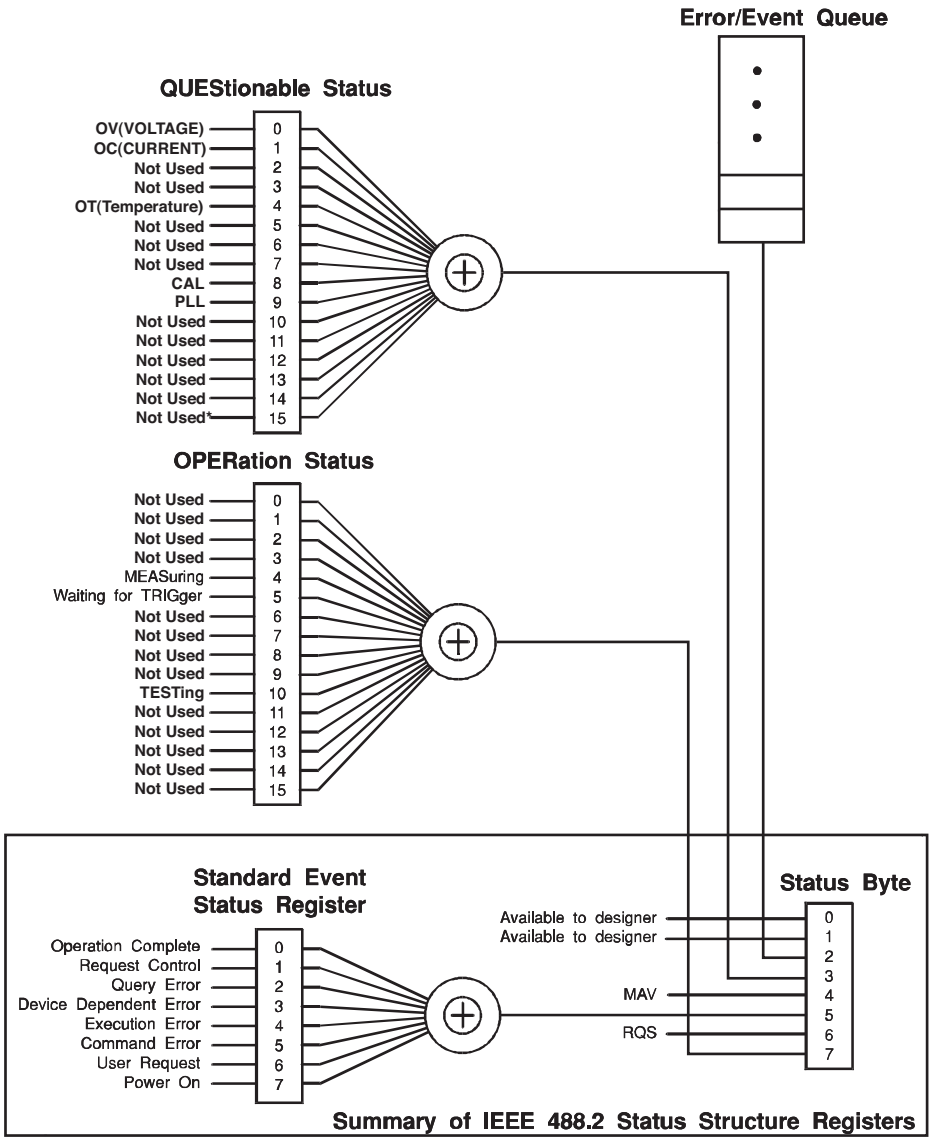
Transition filters

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.



* 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.

Fig.8-4 SCPI status register

8.8.1 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.

Table 8-6 Status byte register

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	—

IEEE 488.2 status event command

Refer to Section 8.6 “SCPI and IEEE-488.2 Common Commands.”

Event status register

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?.

Table 8-7 Event status register (Standard Event Status Resister)

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)	Not used
8-15		Reserved	Not used

8.8.2 SCPI Register Model

OPERation status register

The OPERation status register is a 16-bit register containing information on a certain part of normal operation of this product.

Table 8-8 OPERation status register (STATus: OPERation)

Bit	Bit weight	Bit name	Description
0	1	NOT USED	-
1	2	NOT USED	-
2	4	NOT USED	-
3	8	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	-
7	128	NOT USED	-
8	256	NOT USED	-
9	512	NOT USED	-
10	1024	TESTing	Test in progress
11	2048	NOT USED	-
12	4096	NOT USED	-
13	8192	NOT USED	-
14	16384	NOT USED	-
15	32768	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:CONDtion?
```

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 <NR1>
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 <NR1>
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 <NR1>
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

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.

Table 8-9 QUEStionable status register (STATus: QUEStionable)

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	Not Used	-
3	8	Not Used	-
4	16	Over-Temp	Overheating is detected.
5	32	Not Used	-
6	64	Not Used	-
7	128	Not Used	-
8	256	Calibration failed	Calibration failure
9	512	PLL unlocked	PLL is unlocked*1
10	1024	Not Used	-
11	2048	Not Used	-
12	4096	Not Used	-
13	8192	Not Used	-
14	16384	Not Used	-
15	32768	Not Used	-

*1. PLL is constantly unlocked for in-rush current measurement among other measurements.

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 <NR1>
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 <NR1>
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 <NR1>
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.

8.8.3 Preset Status

STAT:PRES

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.

Table 8-10 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

Command

```
STATus:PRESet
```

8.9 Error Messages

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.

Table 8-11 Command error list

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 the KHA1000.
-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 the KHA1000.
-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.

Table 8-12 Execution error list

Error code		Explanation of error message
-200	Execution error (generic)	A generic error for this PAT
-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 the PAT.
-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.

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.

Table 8-13 Query error list

Error code		Explanation of error message
-400	Query error (generic)	A generic query error of this product that is used when other type 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: SYST:ERR? is received after a *IDN? query and a semicolon separator.)

List of errors specific to this product

Table 8-14 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.

Maintenance

This chapter explains maintenance including cleaning, inspection, calibration, and responses to operation failures.

9.1 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.

9.1.1 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

9.1.2 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 as shown in Fig.9-1.
   Fuse rating: 250 VAC, 2.5 A (T)

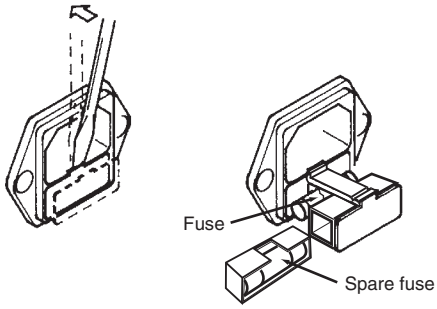


Fig.9-1 Removing the fuse holder

9.2 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.

9.3 Troubleshooting

If you think the product is in failure, check for the following items. You may be able to easily solve the problem.

If you find an applicable item, follow the corresponding corrective action. If the problem persists, contact your Kikusui agent or distributor.

Power-on failure

Symptom	Check	Corrective action	See
The POWER switch does not work.	• Is the power cord correctly connected to the outlet? • Is the power cord correctly connected to the AC INPUT connector on the rear panel?	• Connect the power cord correctly.	2-18
	• Is the power fuse blown?	• Replace the fuse. • If the fuse blows again, request repair.	9-3

Key operation failure

Symptom	Check	Corrective action	See
Panel key operation does not work.	• Is the key icon on the upper part of the screen LOCK?	• Panel operation is locked. Unlock panel operation.	4-26
	• 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.	4-27
Menu operation does not work.	• Did you enter another test mode during menu operation? • Is the “I cannot be operated from submenu” dialog box displayed?	• Press the “Return” function key to exit from the submenu.	4-9

Measurement failure

Symptom	Check	Corrective action	See
EUT does not work.	• Is OUTPUT of the AC power supply set to ON?	• Check the control signal cable of AC power supply.	2-14
	• Is the control signal cable of the AC power supply connected?	• Check the control signal cable of AC power supply.	2-14
	• Are the settings of the test system or the control settings for external equipment correct?	• Make valid settings for the test system or external equipment control.	4-12 4-19
	• Is the test system power-on procedure correct?	• Retry power-on of the test system.	4-2

Symptom	Check	Corrective action	See
EUT does not work.	• The connection to the AC power supply or line impedance network could be incomplete.	• Connect the cable correctly.	2-13
Measured values are not constant.	• Synchronization with the AC power supply is probably not established. • Is the triangular waveform of the PLL icon still on the screen?	• Cable the AC power supply correctly. • Turn on OUTPUT of the AC power supply. • Set the correct frequency for the AC power supply.	2-13 4-19
	• Is the voltage sensing terminal wired?	• Wire the voltage sensing terminal correctly.	2-11

Reports cannot be printed using the network printer.

Symptom	Check	Corrective action	See
Communication with the printer is disabled.	• Is the option function installed? • Is an Ethernet port provided on the rear panel?	• The option function is a factory option. Contact your Kikusui agent or distributor.	1-6
	• Is the communication cable connected to the Ethernet port?	• Connect the communication cable to the Ethernet port.	2-15
	• Are the Ethernet communication settings correct?	• Check the settings of the network protocol.	4-14
Data is stored in the compact flash card.	• Is the print type in the printer settings set to the compact flash card?	• Set the print type in the printer settings to the network printer.	4-16

10

Specifications

This chapter explains the specifications of this product.

10.1 Specifications

The specifications are based on the following settings and conditions unless otherwise specified:

- The warm-up time is 30 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	Continuous	300 Vrms/560 Vpeak (CAT I), 250 Vrms (CAT II)
Maximum input current	Continuous	24 Arms/50 Apeak
	Within 20 ms	80 Apeak
Voltage input impedance		About 4.7 MΩ
Instrument loss (between SOURCE and LOAD)		6 mΩ or less
Coupling mode	HA/Vf mode	Fixed to DC coupling
	OTHER mode	DC or AC coupling (optional)*1

*1. The accuracy of this specification is not specified for AC coupling.

Voltage measurement function

Item		Specifications
Range*1		150 V/300 V
Allowable crest factor *1		2
Display item*2		TrueRMS and ± peak
Accuracy*3		± (0.4 % of rdng+0.04 % of range)
Resolution	150 V range	0.01 V
	300 V range	0.02 V
Effective input range*4		60 % to 110 % of the range
Excess input display		"Over" is displayed when the peak value exceeds the display range.
Fundamental wave frequency range		45 Hz to 65 Hz

*1. Up to ± 560 Vpeak
*2. Accuracy is not specified for ± Peak.
*3. Accuracy is not specified for ± Peak. PLL is in the Lock state, in the effective input range, and with anti-alias filter cutoff frequency 6 kHz.
*4. Accuracy is not specified for outside of range.

Current measurement function

Item			Specifications
Range			0.5 A/1 A/2 A/5 A/10 A/20 A
Allowable crest factor	0.5 A – 10 A range		4 (0.5 A – 10 A range)
	20 A range*1		2.5 (20 A range)
Display item*2			TrueRMS and ± peak
Accuracy*3	45 Hz – 65 Hz	0.5 A range	± (0.5 % of rdng + 0.2 % of range)
		1 A – 20 A range	± (0.5 % of rdng + 0.1 % of range)
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
Effective input range*4	0.5 A range		50 % to 110 % of rated range
	1 A – 20 A range		20 % to 110 % of rated range
Display of excess input	0.5 A – 5 A range		“Over” is displayed when the peak value exceeds the display range or the RMS value exceeds 6.5000 Arms.
	10 A,20 A range		“Over” is displayed when the peak value exceeds the display range or the RMS value exceeds 24.050 Arms.

*1. In-rush current measurement is excluded.
*2. Accuracy is not specified for ± Peak.
*3. Accuracy is not specified for ± Peak. PLL is in the Lock state, in the effective input range, and with anti-alias filter cutoff frequency 6 kHz.
*4. Accuracy is not specified for the outside of range.

Power measurement function

Item		Specifications
Display item*1	Real power (W)	---
	Apparent power (VA)*2	VA = V × A
	Reactive power (var)*1	var = $\sqrt{(VA)^2 - W^2}$
	Power factor (PF)*1	PF = W/(VA)
Accuracy of active power*3	P ≥ 150 W	± 1 % of range
	P < 150 W	± 1.5 W

*1. The range is indicated by the maximum effective input voltage or maximum effective input current.
*2. Calculated from voltage, current, and active power. Accuracy follows that of voltage, current, or real power.
*3. Frequency: 45 Hz to 65 Hz, voltage and current: sine wave, in the effective input range, power factor 1.00.

Frequency measurement function

Item	Specifications
Measurement range*1	45 Hz – 65 Hz
Accuracy*1	± (0.15 % of rdng + 2 digit)

*1. Applicable only in PLL lock mode.

Harmonic current measurement function

Item			Specifications
Conforming standard			IEC 61000-3-2 Ed4.0 (2014), IEC 61000-3-2 Ed2.2 (2004), IEC 61000-3-2 Ed3.0 (2005), JIS C61000-3-2 (2003), JIS C61000-3-2 (2005), JIS C61000-3-2 (2011)
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 – 65 Hz	0.5 A range	± (0.5 % of rdng + 0.2 % of range)
		1 A – 20 A range	± (0.5 % of rdng + 0.1 % of range)
	66 Hz – 2.4 kHz	0.5 A range	± ((0.5+0.417 × n kHz)% of rdng + 0.2 % of range) : n is frequency.
		1 A – 20 A range	± ((0.5+0.417 × n kHz)% of rdng + 0.1 % of range) : n is frequency.
	2.4 kHz – 9 kHz		Accuracy not specified
Resolution	0.5 A – 20 A range		Same as current measurement function
Interharmonics processing*4			IEC 61000-4-7 Ed2.1 (2009)
Window function			Rectangular
Window width	10-wave (50 Hz)		IEC 61000-4-7 Ed2.1 (2009)
	12-wave (60 Hz)		
	16-wave (50/60 Hz)		IEC 61000-4-7 Ed1.0 (1991)
Number of sampling points			Fixed to 8 192
Sampling rate*5			Up to 106.5 ksps
Anti-alias 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.
Class D judgment support function*6			Class D is assumed when 95 % or more of both positive and negative current waveforms are in the special waveform envelope curve.

*1 The current range is 1 to 20 A. Adapted if it is within the specification range.
*2 When the FFT analyzer function is used.
*3 At minimum current value = 3 % of range or more and fundamental wave current input in the effective input range.
*4 The interharmonics processing is selectable under IEC 61000-3-2 Ed2.2 (2004)/IEC 61000-3-2 Ed3.0 (2005)/JIS C61000-3-2 (2005) standard,however the interharmonics processing is not selectable under JIS C61000-3-2 (2003) standard.
*5 Varies in synchronization with the AC power frequency.
*6 JIS C61000-3-2 (2003) standard only.

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 (Typ value)*1	150 V range	± ((0.4 + 0.417 × n kHz)% of rdng + 0.04 % of range + 1digit) : n is frequency.
	300 V range	± ((0.4 + 0.417 × n kHz)% of rdng + 0.04 % of range + 2digit) : n is frequency.

*1. Reference wave frequency: 45 Hz to 65 Hz; PLL is locked in the effective input range.

Flicker/voltage fluctuation analysis function

Item		Specifications
Conforming standard		Conforming to IEC 61000-3-3 Ed3.0 (2013)
Requirements for measuring instrument*1		Conforming to IEC 61000-4-15 Ed1.1(2003), 61000-4-15 Ed2.0(2010)
Anti-alias filter		Cutoff frequency = 6 kHz 4th Butterworth type
Flicker	Pst accuracy*2	1 ± 5 %
	Pst measurement time	30 s to 900 s
	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 80 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.

Communication interface

Item		Specifications
GPIB		SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1
RS232C		9600bps, 19200bps
USB		USB Specification 2.0 (Full Speed)
Ethernet*1	Standard	IEEE802.3
	Support protocol	TCP/IP, LPR
	Transmission rate	10 Mbps
	IP address acquisition method	Automatic (DHPC client), manual
	Connector shape	RJ-45 type with 8 poles

*1. Factory option

External storage

Item	Specifications
Support media	Compact flash card (CF card)

External equipment control function

Item		Specifications
AC Power Supply control	Setup item	Voltage, frequency, range, OUTPUT on/off
	RS232C communication speed	9600 bps

General specifications

Item		Specifications
AC input	Nominal input rating	100 V – 240 V, 50 Hz – 60 Hz
	Voltage range	90 V – 250 V
	Maximum power consumption	250 VA or less
Withstanding voltage	AC input ⇔ chassis	No abnormality should occur at 1500 Vac for one minute.
	Test terminal ⇔ chassis	No abnormality should occur at 1830 Vac for one minute.
Insulation resistance	AC input ⇔ chassis	500 Vdc, 100 MΩ or higher
	Test terminal ⇔ chassis	
Earth continuity		25 Aac/0.1 Ω or less

Item		Specifications
Environment	Operating environment	Indoor, overvoltage category II
	Operating temperature range	0 °C to 40 °C (+32 °F to +104 °F)
	Specification-guaranteed temperature range	23 °C ± 5 °C (73±41 °F)
	Storage temperature range	-20 °C to 70 °C (-4 °F to +158 °F)
	Operating humidity range	20 %rh to 80 %rh (no condensation)
	Specification-guaranteed humidity range	20 %rh to 80 %rh (no condensation)
	Storage humidity range	90 %rh or less (no condensation)
	Altitude	Up to 2000 m
Safety		Conforming to the following standard requirements: IEC 61010-1:2001 Class I*1 Pollution degree 2*2
Outside dimensions		Refer to Section 10.2 “Outside Dimensions.”
Weight		Approx. 8 kg (17.6 lb)
Accessories	Power cord	1
	Voltage sensing terminal plug	1 (product shipped with this plug installed)
	Voltage sensing terminal short-circuit wire kit	1 set (two wires: product shipped with these wires attached to the voltage sensing terminal)
	Voltage sensing terminal plug screwdriver	1
	Spare fuse 2.5 A (T) 250 Vac	1 (in the power supply fuse holder)
	Operation manual	1

*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.

10.2 Outside Dimensions

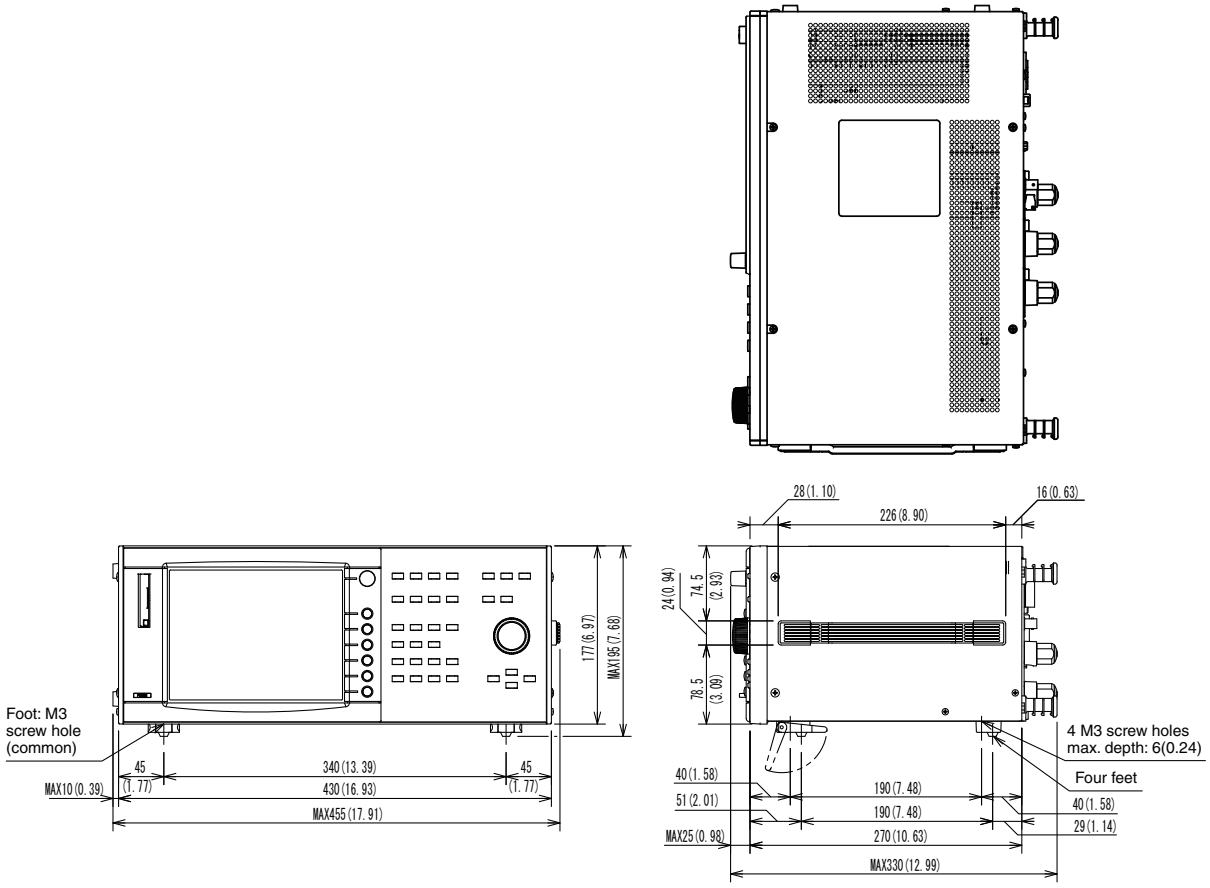


Fig.10-1 Outline diagram

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