Instruction Manual

Digital Multimeter

VOAC7602
VOAC7502

IWATSU TEST INSTRUMENTS CORPORATION

Introduction

- ◇ Thank you for purchasing this instrument. We appreciate your continued patronage of Iwatsu's instrument.
- ◇ Please read this manual carefully before using the instrument, and keep it handy for future reference.
- ◇ This instruction manual describes handling precautions, operating procedures, operating examples, specifications, and various options.
- ◇ In this manual, it explains based on VOAC7602. Especially, handle VOAC7502 based on it as long as it doesn't refuse.

Safety Precautions

To ensure safe operation of this instrument and to prevent personal injury or damage to property, read and carefully observe the warnings and cautions in the following section and associated symbols marked on the panels.

Definitions of warnings and cautions used in this manual

Warning	Incorrect operation or failure to observe warnings may result in death or serious injury.
Caution	Incorrect operation or failure to observe cautions may result in injury or damage to the instrument.

Definitions of panel symbols

General warning	To protect the body and to prevent damage to this instrument, refer to the items described in this manual prior to operation.
Electric shock	This symbol calls attention to protecting the body from high voltages, and indicates that voltages over 1 kV are supplied to the terminals from the inside or outside of the device.

Precautions

- ◇ Parts of the contents of this manual may be changed without notice following improvements in performance and function.
- ◇ Reproduction or reprinting of the contents of this manual without prior permission from Iwatsu is prohibited.
- ◇ Since the display panel of this instrument contains a fluorescent tube, when discarding it, be sure to comply with the appropriate dumping regulations.
- ◇ Microsoft & MS-DOS are trademarks of Microsoft Corporation in the U.S.
- ◇ Windows is registered trademark of Microsoft Corporation in the U.S. and / or other countries.
- ◇ The names of actual companies and instruments mentioned herein may be the trademarks of their respective owners.
- ◇ For questions about this instrument, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors.

Revision History

- ◇ February 2014: 1st edition
- ◇ May 2014: 2nd edition
- ◇ August 2014: 3rd edition
- ◇ December 2014: 4th edition
- ◇ February 2015: 5th edition
- ◇ November 2015: 6th edition

KML090461 A717-722400 (N)

Read the following pages to ensure safety.

Read the next page also.

⚠ Warnings

- **Do not use in a location with explosive gases in the vicinity.**
  This may result in an explosion.

- **In the event of smoke, abnormal odors or abnormal sounds, immediately turn the power off and unplug the power plug from the receptacle.**
  Continued use under these circumstances may result in electric shock or fire. After the power switch has been put in the OFF (the state of “O”; The switch is convex), and the power plug has been disconnected from the power outlet, contact our sales distributors for repair. Repairing the instrument yourself is very dangerous. Do not attempt to repair the instrument under any circumstances.

- **Ensure that water does not get on or inside the instrument.**
  Do not use the instrument if this happens. Failure to observe this precaution may result in electric shock or fire. If water gets on or inside the unit, after the power switch has been put in the OFF (the state of “O”; The switch is convex), and the power plug has been disconnected from the power outlet, contact our sales distributors for repair.

- **Do not touch the power cord plug with wet hands**
  This may result in an electric shock.

- **Do not put any foreign objects, such as metallic or flammable objects through the ventilation port.**
  If any foreign object is put through the ventilation port, this may result in electric shock, fire, and/or malfunction.
  If any foreign object enters the instrument, after the power switch has been put in the OFF (the state of “O”; The switch is convex), and the power plug has been disconnected from the power outlet, and contact our sales distributors for repair.

- **Do not place this instrument in an unstable location such as on an unsteady stand or an inclined place.**
  If the instrument is placed in an unstable location, it may fall or topple over, resulting in electric shock, fire or injury. If this instrument falls or its cover is damaged, after the power switch has been put in the OFF (the state of “O”; The switch is convex), and the power plug has been disconnected from the power outlet, and contact our sales distributors for repair.

- **Do not remove the cover or panels.**
  If any part inside the instrument is touched, this may result in electric shock. Contact our sales distributors for inspections, calibrations.

- **Be careful when taking high-voltage measurements.**
  Coming into contact with high voltages during measurements may result in electric shock.

⚠ Warnings (Continued)

- **Excluding the input terminal for the measurement of this instrument front, always connect the grounding line of the input connector of this instrument to the ground potential level (ground) of an object to be measured.**

  If the grounding line of the above-mentioned input connector of this instrument is connected to a level other than the ground level of an object to be measured, this may result in electric shock (damage to object to be measured, this instrument, or other connected devices).

- **Always use a 3-prong power cord**

  Failing to use a 3-prong power cord may result in electric shock, fire or malfunction.

  ・When supplying power via a two-wire power outlet using a 3-prong to 2-prong conversion adapter, be sure to ground the adapter's earth terminal.

  ・When supplying power via a three-wire power outlet using the 3-prong power cord accessory, ground the cord using the ground wire.

- **Use the instrument at a specified supply voltage.**

Table1 Power supply voltage range

Center voltage	Voltage range
AC 100V	90V - 110V
AC 110V	99V – 121V
AC 220V	198V - 242V
AC 240V	216V - 264V

Using the instrument at a non-specified voltage may result in electric shock, fire or malfunction. The power supply voltages that can be used are shown in Table 1. AC100V, AC220V and AC240V are options. The center voltages are displayed near the AC LINE INPUT on the rear panel.

- **Do not touch the input terminal mid operation.**

  Touching the input terminal mid operation may result in electric shock.

- **Follow the rules below when handling the power cord.**

  Failing to follow these rules may result in electric shock, fire or malfunction. If the power cord is damaged, contact our sales distributors for repair.

  - Do not attempt to modify the power cord.
  - Do not forcibly bend the power cord.
  - Do not twist the power cord.
  - Do not bind the power cord up.
  - Do not yank the power cord.
  - Do not heat the power cord.
  - Avoid getting the power cord wet.
  - Do not place heavy objects on top of the power cord.

- **Confirm that any dust does not adhere to the power plug before inserting surely it into the receptacle. In addition, remove the power plug and the power adapter from the receptacle and check/clean them once a half year or a year.**

  Dust may result in electrical shock, fire, or malfunction.

⚠ Warnings (Continued)

- **Do not attempt to modify the instrument.**
  This may result in electric shock, fire or malfunction. The user cannot repair this instrument. Do not repair this instrument opening it. Also, requests to repair the unit may be refused if unauthorized modifications have been made. Contact our sales distributors for repair. Please note not responding to the repair when the open security seal is removed, the cover is opened or the instrument is modified.

- **The metal etc. must not touch the blade of the power plug.**
  This may cause electric shock, fire or malfunction.

- **Do not use multiple-connection outlets.**
  Power strips and other multiple-connection outlets may cause fire or overheating.

- **Do not place containers of water or chemicals, small metal objects, etc. near this instrument.**
  If the contents are spilled and enter the instrument, it may cause electric shock, fire or malfunction. If water, chemicals, or metal objects enter the instrument, set the power switch to OFF (the state of “O”; The switch is convex), and remove the plug from the outlet, and then contact Iwatsu office or our sales distributors for repair

- **Do not place this instrument in an area where frequent vibrations or impacts occur.**
  If this instrument is dropped or overturned, it may cause a physical injury or malfunction.

- **If this instrument is dropped, it may result in a physical injury or property damage.**
  Before transporting this instrument, remove all devices under testing, probes, and cables, then grasp the center of the unit with both hands and carry it carefully to avoid dropping.

- **Make the POWER switch OFF, and pull out the power plug from the outlet when the thunderbolt to be near is generated.**
  It causes the electric shock, a fire, and the malfunction according to the thunder.

- **Do not use this instrument if it is not functioning correctly.**
  Using a malfunctioning instrument (due to dropping, etc.) may cause an electric shock or a fire. If the instrument is not functioning correctly, set the power switch to OFF (the state of “O”; The switch is convex) and remove the plug from the outlet, and then contact Iwatsu office or our sales distributors for repair.

Read the following pages to ensure safety.

Read the next page also.

⚠ Cautions

- **Always use a 3-core power cord compatible with the power voltage.**
  Using a power cord that is incompatible with the power voltage may result in fire or malfunction. Additionally, using a 2-prong power cord may result in electric shock.
  Unless otherwise specified at purchase, a 100V* power cord is supplied with the instrument. If operating the instrument at 200V**, always use the 3-prong power cord (optional) for 200V systems (rating: 250V) specified by Iwatsu.
  *Center voltage of 100V or 110V (see Table 1 on page III)
  **Center voltage of 220V or 240V (see Table 1 on page III)
- **Do not use the power cord provided with instrument for other instruments.**
  In accordance with electrical safety regulations, the power cord provided with this instrument is not to be used with other electrical equipment.
- **When voltage is being applied to the LO terminal, do not connect it to the ground terminal of another measuring device.**
  The LO terminal is not grounded, and is just floating. If voltage is being applied to the LO terminal, connecting it to the ground terminal of another measuring device may result in fire or damage.
- **Do not apply a voltage between the LO terminal and the ground exceeding the specified voltage.**
  The specified voltage is ±500Vpeak. Applying voltages exceeding this may cause fire or damage.
- **Do not apply a voltage or current to the input terminal exceeding the specified levels.**
  Applying a voltage/current exceeding the stipulated levels may result in fire or damage. The maximum permissible inputs are shown in Table 2 and Table 3.

Table 2. Maximum permissible inputs (Front panel)

Input terminal	Function Note 1	Max. permissible input
INPUT V・Ω・⊣◀ HI-LO	DCV（100mV～100V range） 2WΩ、4WΩ、CONT、DIOD、TEMP Note4	800 Vpeak(continuous), 1100 Vpeak（1 min.）
	DCV（1000V range）	1100 Vpeak（continuous）
	ACV、FREQ	750 Vrms and ± DC 500V or less Note 2
SENSE 4WΩ HI-LO	4WΩ、TEMP(RTD) Note4	200 Vpeak
I-LO	DCI、ACI	3 A (DC or rms, continuous) （250V Note 3）

Note1) Refer to the function of "section 4.3 Measurement function" for the name of the corresponding each function.
Note2) As for the voltage that the alternating-current component is superimposed to the DC component, the maximum permissible input is 1100V in the Vpeak conversion.
Note3) When the open circuit voltage of the instrument circuit exceeds 250V, the electric current cannot be measured.
Note4) VOAC7502 doesn't support the function of TEMP (thermometry).

Table 3. Maximum permissible inputs (Rear panel)

Parts（Standard／Option）	Input terminal	Max. permissible input (Voltage)
Rear panel（Standard equipment）	TRIG IN	0～5 V
Rear panel (When DIO option SC-362 is installed)	INH IN	0～5 V

Read the following pages to ensure safety.

⚠ Cautions (Continued)

- **Do not add the voltage mistaking it to COMPLETE output terminal (BNC) in the back.**
  It causes a fire and the breakdown.
- **Do not add the voltage and current more than regulations to the contact output of DIO option SC-362.**
  It causes a fire and the breakdown. Each contact output of HI, GO, LO, and COMPLETE is the following specification.
  - Resisting voltage between terminals: 42 Vpeak
  - Earth resisting voltage: ±42 Vpeak
  - Maximum allowed current: 100 mA
- **Put the power switch in OFF before connecting or disconnecting the power cord.**
  Connecting or disconnecting the power cord while the power switch is ON may result in electric shock or malfunction.
- **When disconnect the power cord from the receptacle, hold the plug to pull it out.**
  Pulling the power cord may result in electric shock or fire.
- **When connecting the power code or test lead to this instrument, pull them carefully so as to avoid toppling this instrument.**
  Toppling this instrument may result in electric shock, injury or fire.
- **Do not use damaged power cord, test lead or adapter.**
  Using damaged power cord, test lead or adapter may result in electric shock, fire or malfunction.
- **The tip of the test lead is sharp to facilitate measurements. Be careful not to inadvertently prick your finger, etc.**
- **Be careful not to place the finger when the handle of this instrument is removed or is installed.**
  Be careful not to place the finger when the handle is removed or is installed, when the position of the handle is changed, or when the instrument is set on the rack mount. Do not usually remove the handle, except when building it in the equipment such as the racks.
- **Do not place this instrument in a location with excessive humidity or dust.**
  Doing so may result in electric shock, fire or malfunction.
- **Do not stack anything on top of this instrument.**
  Doing so will cause the cover to come into contact with the internal circuitry, which may result in electric shock, fire or malfunction.
- **Use this instrument only within the specified operating ranges.**
  Using this instrument outside of the operating ranges may cause malfunction. The permissible humidity and temperature ranges are as follows.
  Only the indoor use
  Operating temperature : 0°C to +50°C
  Operating humidity : 40℃ and no dew allowed below the moisture amount of 80%RH
  Preservation temperature : -20°C to +60°C
  Preservation humidity : 40℃and no dew allowed below the moisture amount of 90%RH.
- **Do not place this instrument in the location where direct sunshine strikes and the location where humidity is high.**
  Doing so may cause the going up of internal temperature or a fire.

⚠ Cautions (Continued)

- **Use a specified fuse (Accessory: Ratings 3A and 250V) when you exchange fuses. Never use the fuse of another ratings.**
  Doing so may cause a fire or malfunction.
  When an accessory fuse is lost, contact Iwatsu office or our sales distributors.
- **Do not use or store this instrument in a location that is humid (bathroom, etc.) or dusty.**
  Placing it in a humid or dusty location may cause an electric shock, fire or malfunction.
- **Do not place this instrument in a location next to a worktable or humidifier, where it may be exposed to oily smoke or steam.**
  Doing so may cause an electric shock, fire or malfunction.
- **Do not place any object close to the ventilation port or fan of this instrument.**
  If any object is placed close to the ventilation port or fan of this instrument, the air ventilation is blocked and the internal temperature increases, causing a fire or malfunction.
- **Keep an appropriate space at the rear and on both sides of this instrument.**
  If this instrument is put inside the rack mount or on other measuring instrument, carefully check the temperature rise. If the temperature rises excessively, this may cause an operation fault or a specification fault.
- **If this instrument remains unused for a long period, unplug the power cord for safety's sake.**
- **When transporting this instrument, use the original packing materials or comparable materials.**
  Excessive vibration or shock applied to this instrument during transportation may cause it to malfunction, resulting in fire. If you do not have appropriate packing materials or padding, contact Iwatsu office or our sales distributors for advice. When having the unit transported by a shipping company, write "Precision Instrument - Handle With Care" on each side of the packing box.
- **Prior to maintenance, unplug the power plug from the outlet for safety. Use a cloth to wipe away any moisture.**
  Cleaning this instrument while the power plug is connected to the outlet or while the instrument is wet may cause an electric shock or a malfunction.
- **Do not use the instrument without cleaning interior for a long term.**
  Long-term use of an instrument having a dirty or dusty interior may cause a fire or Injury. It is recommended that you contact Iwatsu office or our sales distributors to check and clean the interior, calibrate, etc. about once per year.

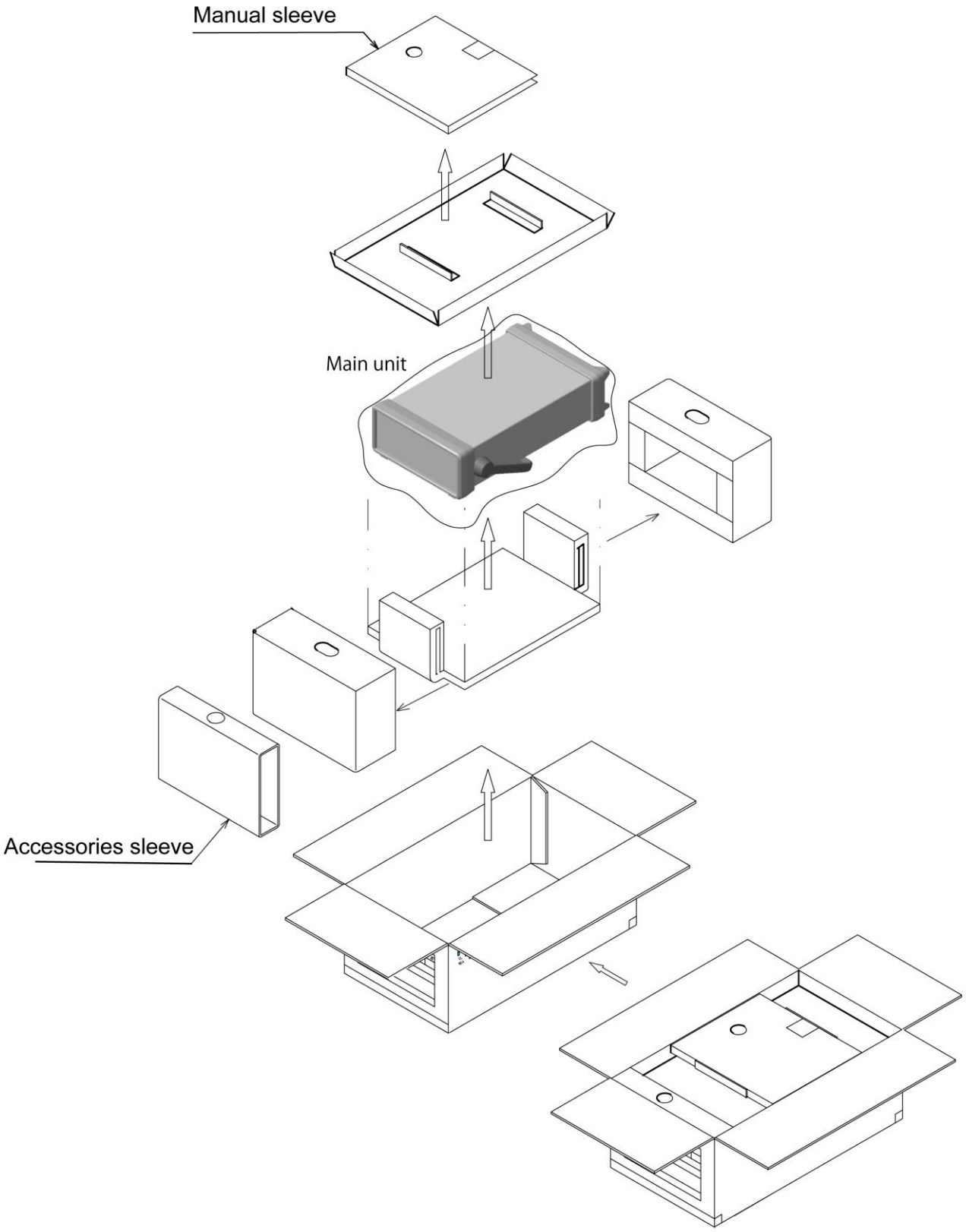
Confirmation of the packaging contents

Once you receive the instrument, check the contents of the package. (Please refer to the figure below for the open bale chart.) If any components are missing or there is damage following transportation, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual, our sales distributors or your local sales representative immediately.

Composition instruments and goods

- Main unit ・・・・・・・・・1
- Accessories
  - Fuses for current measurement ・・・・2 pieces for each(3A, 250V)
  （The above-mentioned accessories are storage in the main unit to another.）
  - Test leads (red, black) ・・・・・・・・・1 couple
  - Power code ・・・・・・・・・1
  - Code strap ・・・・・・・・・1
  - Instruction manual（CD） ・・・・・・・・・1
  - User’s Guide ・・・・・・・・・1
  - Clear file ・・・・・・・・・1

Open bale chart（Main unit ＆ Accessories）



*The lid of the cardboard is opened.

Management of instruments

When this instrument is abandoned, it is necessary to recycle or to abandon it appropriately according to the law in the region and the rule.

Repair and sending of repair goods

Please send it to our service handling place when the breakdown occurs by any chance. Sorry to trouble you, but please describe the name, belonging, and the telephone number etc. of the instrument name, the serial number (The label is pasted to the back of this instrument), and a defective content and the person in charge clearly before sending the repair goods.

Updating version of firmware

Since each software program has suitability to a machine, contact Iwatsu office or our sales distributors for software version update or visit on our Web site (URL : http://www.iti.iwatsu.co.jp). Refer to our company Web site or "4.5.4.1 the FIRMWARE UPDATE menu" for the method of the upgrade of the firmware.

Views and symbols used in this manual

- The operation key that exists in the procedure etc. of each paragraph is shown like the following etc.

  Example: [DCV] key is shown by 

  .

- The function of the SHIFT function is shown on the operation key to the front panel by a blue character (Exclude LOCAL).
  When it explains the function operation of the SHIFT function, it shows like the example of the following. Next, push the key to the correspondence previously pushing the SHIFT key.

  Example: 

  → 

  is［SHIFT］→［DCV(TEMP)］key

  *The example of the above-mentioned shifts to the function of the thermometry.

- It usually explains in the paragraph where it explains the measuring function in order of the function (usage and feature), the connection method, the procedure, Caution! and Memo!, etc.

- To distinguish for convenience' sake, the name is applied like the M1-M6 key to explain the procedure etc.in this book as shown in the figure below about the Menu key under the liquid crystal screen.

- Example of using Caution and Memo

◇ Example of using Caution!

Caution!
Might be dewy by a rapid temperature change when moving to the environment with different temperature and humidity. For this case, use the instrument the temperature after the temperature of the instrument is accustomed enough at a surrounding temperature to change gradually.

◇ Example of using Memo!

Memo!
◇ It is necessary to note when measuring after a high voltage (300Vrms or more) or a high electric current (1A or more) is measured. Refer to ”◇ 7.1 Notes concerning with settling"
◇ About the measurement of the high-resistance and the low-resistance、Refer to "◇ high-resistance measurement" and "◇ low-resistance measurement" of section 7.2.3.

Memo

Instruction Manual

Table of Contents

Memo

1 23456

Chapter 1 Overview

1.1 Application

The digital multimeter VOAC7602/VOAC7502 (hereinafter called “this instrument”) is mainly used for:

- Design and evaluation of analog circuits and digital circuits for wide range of technicians and students (research and development);
- General-purpose instrument for production lines, inspection departments and service-related departments in manufacturing floors;
- Parts of inverter markets such as design and evaluation of power electronics devices.

1.2 Features

1.2.1 Easy to see and understand

This instrument is small-sized but has a relatively large screen which allows clear color display.
In particular, it can display multilateral measurement results in real time with the liquid crystal display and abundant functions as described below:

(1) **Color LCD included**

It includes the 4.3-inch color LCD screen (with LED backlight) with the resolution of 480 dots by 272 dots and abundant color display; i.e. easy to see.

(2) **Menu display in LCD screen**

The lower part on the LCD screen displays the menu corresponding to each function (when pressing the key arranged on the front panel). Items in the menu can be selected by pressing the menu key on the lower part of the LCD screen and submenus on the lower layer are displayed together. (Pressing [CLOSE] key or the Rotary knob allows you to return to the previous screen.)

(3) **Display of measurement results**

Measurement results are displayed in different formats on two display areas; i.e. primary display and secondary display.

(4) **Trend chart display/ histogram chart display**

Use of the relatively large LCD allows measurement results to be displayed in real time in the graph formats which have high visual effects such as trend chart and histogram chart. (Refer to sections 4.9 and 4.10.)

(5) **Dual display (simultaneous display of two measurement functions)**

The result of one measurement function is displayed basically and parts of functions can display two measurement results simultaneously (e.g. alternating current voltage measurement (ACV : section 4.3.2) and frequency measurement (FREQ : section 4.3.10).

(6) **Analog display**

The following function that measurement result can be checked visually in the sense is installed.

① ANALOG METER : Direct a bar scale measurements with marker (▲) in the display area on a secondary display. (Refer to section 4.8.3.)

② ARC SCALE METER : Direct a circular arc scale measurements by the indicator in the display area on a primary display. (Refer to section 4.8.2.)

(7) **NUMERIC display (numeric display of measurement result)**

The font size (NORMAL and LARGE) and fonts (7SEG and NORMAL) can be selected about the NUMERIC display on a primary display. (Refer to sections 2.3.3.1 and 4.8.)

(8) **LIMIT display (judgment result of LIMIT calculation)**

Judgment result (GO/HIGH /LOW) of the LIMIT calculation can be displayed in the display area on a primary display and a secondary display. Especially, display by the large size to improve the visibility on the primary display side. (Refer to sections 2.3.3.4 and 4.6.4.)

1.2.2 Easy to use

The features of this instrument are high operability as described below:

(1) **Menu to allow setting during measurement**

Use of the menu/ submenu displayed on the LCD screen allows setting confirmation, selection of the setting item, and numeric value setting during measurement.

(2) **Setting by rotary switch**

Use of the rotary switch or arrow keys in the upper right on the front panel allows item selection and numeric value setting when setting the item in the submenu. (Refer to section 3.4.)

1.2.3 High speed and high resolution

This instrument uses ΔΣ method ADC and has the high performances as described below:

(1) **High sampling rate**

The high sampling rate; max 30 kS/s is realized in direct current measurement (DCV and DCI) and resistance measurement (2WΩ and 4WΩ). (Refer to section 4.3.)

(2) **High resolution**

VOAC7602 realizes 6-1/2 digits, full-scale (FS) 1199999 counts.

* VOAC7502 realizes 5-1/2 digits, full-scale (FS) 119999 counts.

1.2.4 Abundant convenient functions

The convenient functions are included as described below:

(1) **Trend chart/histogram function included**

This instrument can display the trend chart or histogram chart which processes and analyzes the acquired and stored measurement data and makes it easy to understand visually.

Combination with the limit judgment function allows GO/NOGO judgment to be understood visually. Equipment of DIO option; SC-362 (factory option) allows output of the limit judgment to be externally notified. (Refer to sections 4.9 and 4.10.)

(2) **Logging function**

Equipment of the logging memory allows the long-term interval measurement results to be kept as the data. The measurement data can be saved on the USB memory or read by the external PC. (Refer to section 4.11.)

* Because there is no USB memory on front side connection entrance, VOAC7502 cannot be preserved and read directly in the USB memory.

When the mode of the logging function is switched to bulk (BULK) mode, functions other than acquiring data are not done at all, and this instrument concentrates on data acquisition. The measurement that guarantees the sampling rate is possible. (Refer to section 4.11.2.)

(3) **Off-line browse function**

To display the content of the memory for Logging, the off-line browse function is installed.

When switching to an off-line browse, the measurement operation stops and the content of the LOG memory being memorized now is displayed.

- In the trend chart display, data can be observed in detail by expanding data that adjusts the setting of the horizontal axis and acquires it. (Refer to section 4.9.2.)
- In the histogram chart display, it is possible to display by adjusting a number of bin and central value. (Refer to section 4.10.2.)

1.3 List of installing function

The installing function of this instrument (standard/option) is shown in Table 1.1.

Table 1.1 List of installing

Functions \ Models	VOAC7602	VOAC7502	Remarks
DC voltage measurement (DCV)	○	○	100 mV to 1000 V
AC voltage measurement (ACV)	○	○	100 mV to 750 V
DC current measurement (DCI)	○	○	1 mA to 3 A
AC current measurement (ACI)	○	○	1 A to 3 A
2-terminal resistance measurement (2WΩ)	○	○	100 Ω to 100 MΩ
4-terminal resistance measurement (4WΩ)	○	○	100 Ω to 100 MΩ
Continuity test	○	○	
Diode measurement	○	○	
Frequency measurement (FREQ)	○	○	3 Hz to 300 kHz
Temperature measurement (TEMP)	○	×	Thermocouple (Type-R, K, T, J, E) Resistance temperature detector (Pt100, JPt100)
NULL calculation	○	○	
SMOOTHING	○	○	
STATISTIC calculation	○	○	MAX / MIN / Mean value / Standard deviation
Scaling calculation	○	○	(X-a)*b/c、d/x
dB calculation	○	○	dB、dBm、dBV
Function of LIMIT Judgement	○	○	Hi/Go/Lo
Loging function (Offline browse function)	○	○	There are two kinds of modes the following. NORMAL mode / BULK mode
Interval measurement	○	○	
Trend chart display (Online / Offline)	○	○	
Histogram chart display (Online / Offline)	○	○	
USB host port function (USB memory use)	○	×	Output of data of LOG memory and display, Save / Recall and Update of firmware
Remote interface (USB)	○	○	
Panel setting memory	○	○	Internal memory: 10 pieces
Remote interface (LAN&RS-232)	△	△	The LAN&RS-232 interface option SC-361 are necessary.
DIO output	△	△	DIO option SC-362 is necessary.
Remote interface (GP-IB)	△	△	GP-IB interface option SC-363 is necessary.

Note) ○: Supported with standard equipment.

△: Supported by being equipped with the option (factory option)

×: Not supported

1.4 Options/accessories

This section describes model names and names (partially, specification) of options and accessories below. Refer to section 6.10 accessories and the optional items in section 6.1 of Chapter 6 for details of options and accessories.

Options

SC-361	LAN & RS-232 interface (Factory option[Note1])
SC-362	DIO (Factory option [Note1])
SC-363	GP-IB interface (Factory option [Note1])

Note1) Factory option

If ordered when purchasing the main unit, equipment is done at shipment.

If ordered after purchase, equipment is done after receiving the unit at the factory.

Accessories

* Accessories are not standard accessories of this manual on Ⅶ page, and buy accessories separately.

SC-004	High-resistance shielded cable for 100MΩ or less
SC-0107	Sheath type thermocouple (Type-K) [Note2]
SC-0116	Static surface type thermocouple (Type-K) [Note2]

Note2) Because TEMP (thermometry) function is not supported in VOAC7502, this thermocouple cannot be used.

SC-020	Test lead (for replenishment of accessories)
SC-023	Crocodile clip H for SC-020
SC-026	Arrow type clip for SC-020
SC-028	DC180A, AC130A, current clamp probe
SC-364	Rackmount kit (inch type for one)
SC-365	Rackmount kit (inch type for two)

Instruction manual (CD)

User’s guide (paper)

Memo

1 2 3456

Chapter 2 Name and function of each part

This chapter outlines the name and function of each part of this instrument.
Section 2.1 and Section 2.2 briefly describe names and functions of screens, keys, and input terminals on the front panel and rear panel.
Section 2.3 describes names and displayed contents of the screen configuration.

2.1 Name and outline of each part on front panel

Figure 2.1(a) and Figure 2.1(b) show the front panel of VOAC7602 and VOAC7502, and Table 2.1 on the next page describes names of ① to ⑤, screens, keys, input terminals, and switches being arranged.

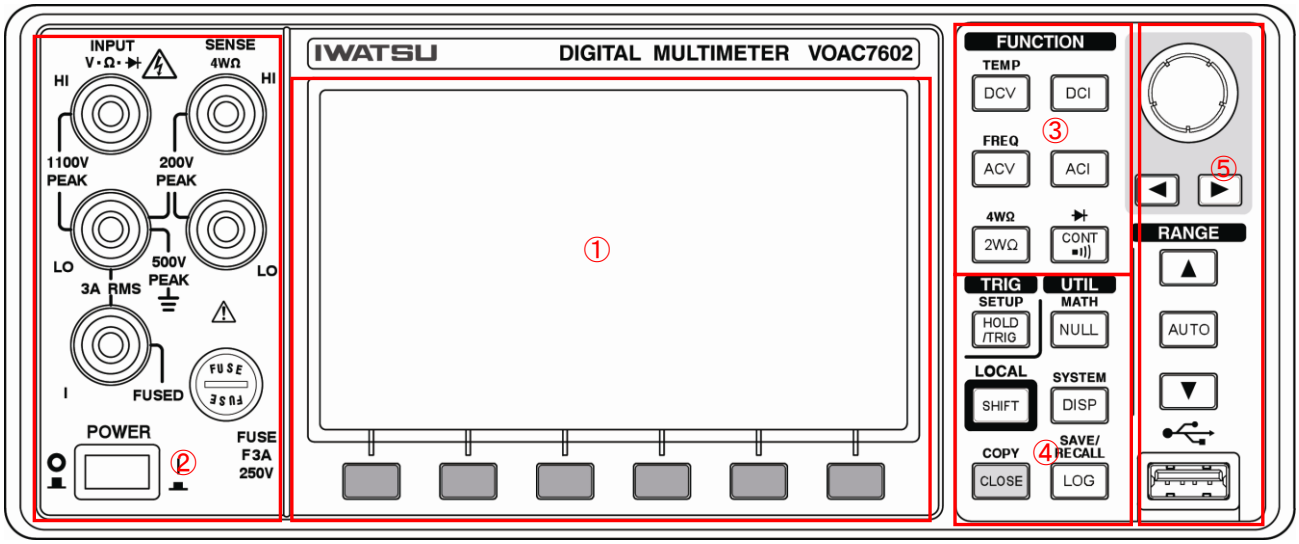


Figure 2.1(a) Front panel of VOAC7602

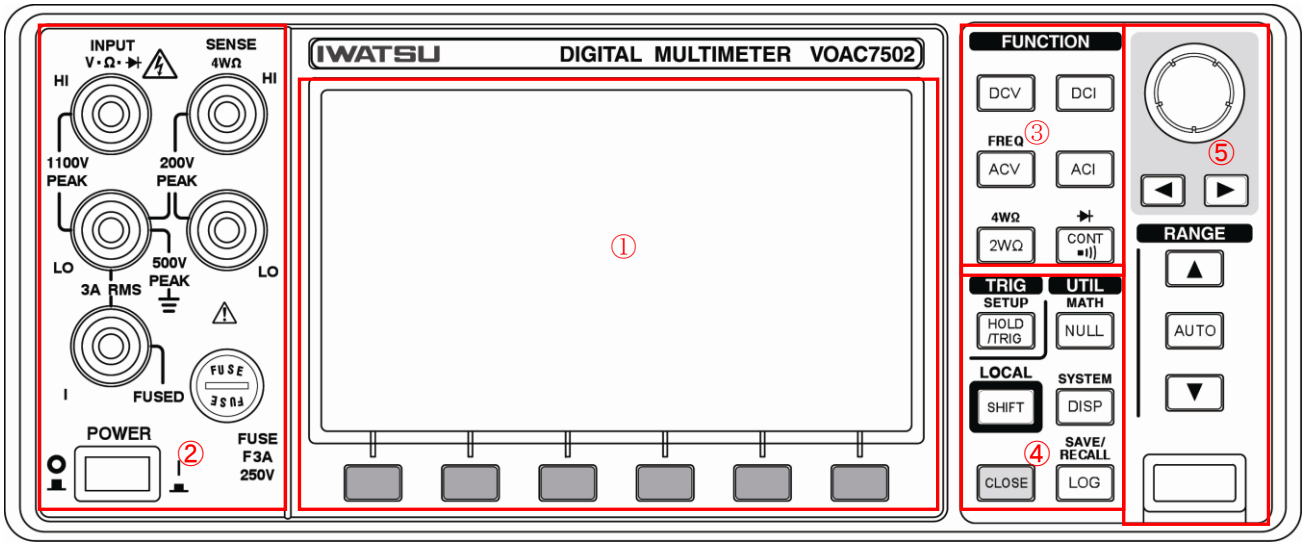


Figure 2.1(b) Front panel of VOAC7502

Table 2.1 Name and arrangement of parts on front panel

№	Name	Arrangement	Refer to
①	Display part	It consists of the LCD screen and menu keys below the screen.	Section 2.1.1
②	Input terminal part	Input terminals to measure voltage, current, resistance, and the others are arranged. There are the fuse holder and POWER switch on the lower side.	Section 2.1.2
③	FUNCTION part	Function keys to set and measure various measurement functions; e.g. voltage, current, resistance, cntinuity test, and diode are arranged.	Section 2.1.3
④	TRIG & UTILITY setting part	Various setting keys; e.g. trigger, display, calculation, log, and system and execution keys; e.g. [SHIFT], [COPY] are arranged.	Section 2.1.4
⑤	Rotary knob &RANGE switching part	The Rotary knob (switch) and arrow keys are arranged on the upper side, [AUTO] key (AUTO RANGE switching) at the center, and the USB memory connection on the lower side. * There is no USB memory connection entrance in VOAC7502.	Section 2.1.5

2.1.1 Display part

Figure 2.2 shows the display part on the front panel and Table 2.2 describes the name and function of each parts.

*Figure 2.2 also shows the location of the display part in the VOAC7602 and VOAC7602 of front panel by enlarging them.

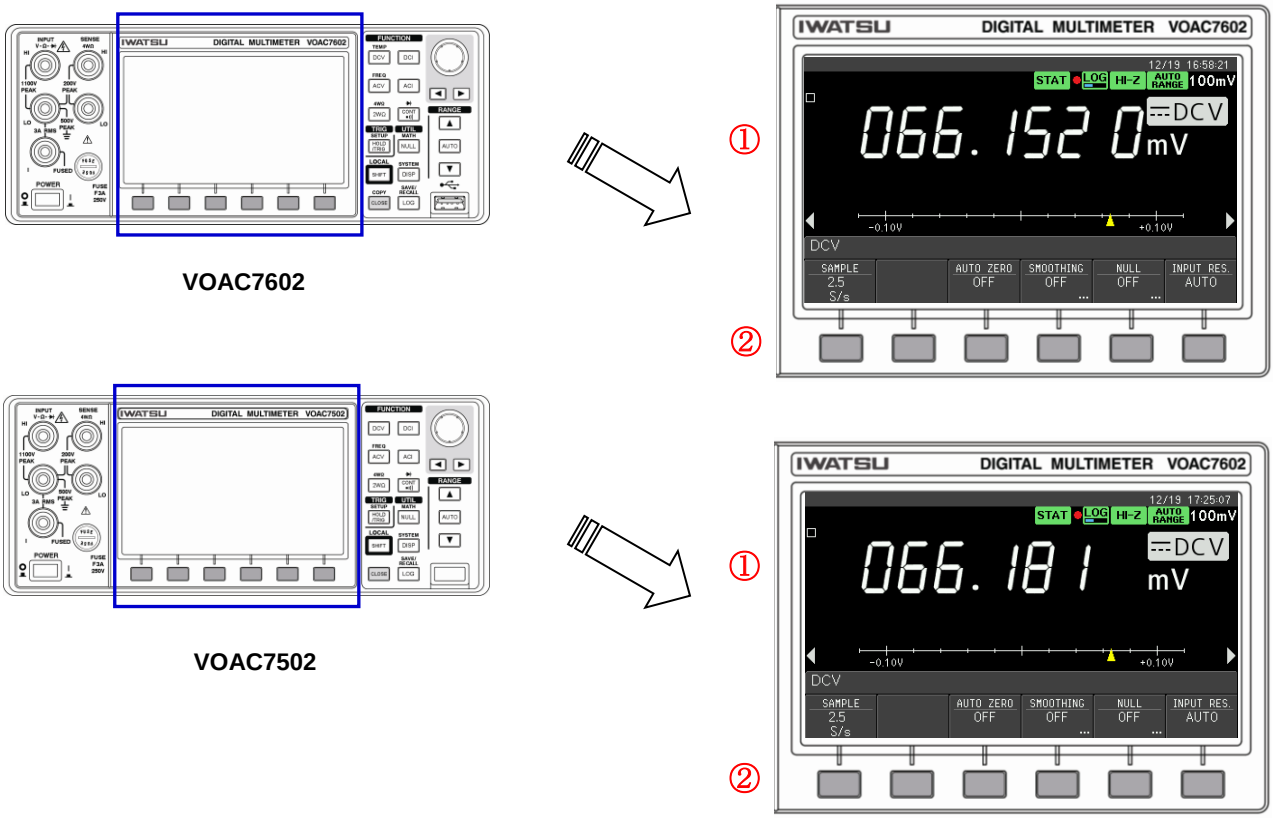


Figure 2.2 Display part

Table 2.2 Contents of display part

№	Name	Contents and functions (outline)	Refer to
①	LCD screen	The screen is the 4.3-inch color LCD (LED backlight). The screen displays the items below from the upper side. • Message and header information • Annunciator (multiple indicators) and range • Primary display : Measurement result of main function Sampling indicator • Secondary display : Measurement result of sub function, various calculation result, histogram information, cursor measurement result • Menu : It sets contends of each functions and functions of TRIG & UTILITY part.	Section 2.3
②	Menu keys	Menu keys (for convenience, this document uses M1 to M6 keys) corresponding to the horizontal sections of the setting menu are arranged below the LCD screen. Pressing of the key allows selection and execution of the menu item and the sub-menu at the lower layer to be opened.	—

2.1.2 Input terminal part

Figure 2.3 shows the input terminal part on the front panel and Table 2.3 describes the name and function of each part. The input terminal part is common in VOAC7602 and VOAC7502.

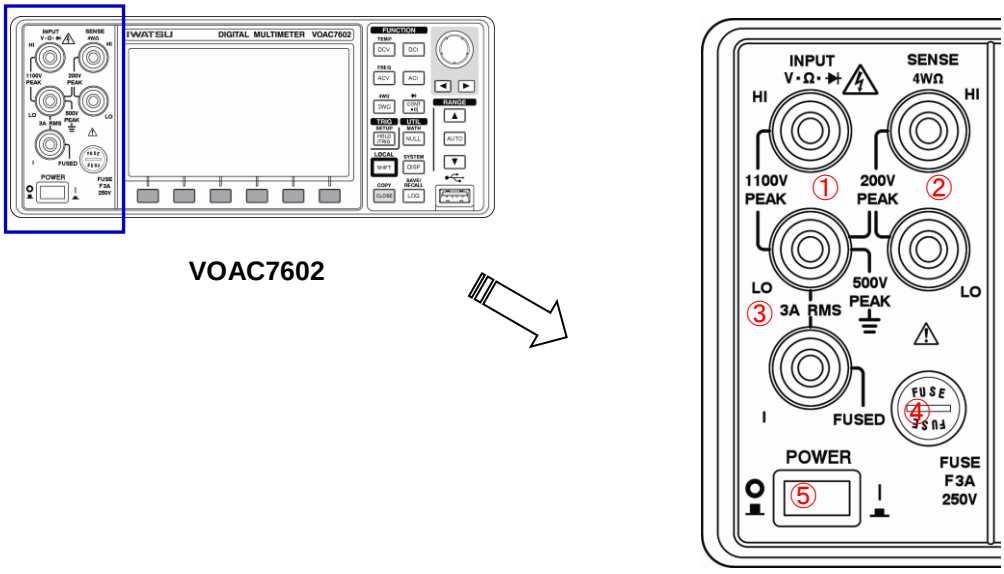


Figure 2.3 Input terminal part

Table 2.3 Input terminal part

№	Name	Contents and functions (outline)	Refer to
①	INPUT V·Ω·⊣◀ HI-LO input terminal	It is the input terminal for measurement of voltage (DCV, ACV), resistance (2WΩ), temperature (TEMP) Note, and diode (⊣◀), and Continuity test (CONT). The attached test lead (pair of red and black leads) or banana terminal is connected to it. Take care of the range and maximum permissible input.	Sections 4.1 & 4.3 Cautions (page V)
②	SENSE 4WΩ HI-LO input terminal	It is used for resistance measurement (4WΩ) and temperature measurement (TEMP, RTD-4Wire). • Max. permissible input: 200 Vpeak for all ranges	Sections 4.1, 4.3.6, 4.3.9 Cautions (page V)
③	I-LO input terminal	It is the input terminal for current measurement (DCI, ACI). • Max. permissible input: 3 A DC or rms (continuous) / 250 V (Open circuit voltage)	Sections 4.1, 4.3.3, 4.3.4 Cautions (page V)
④	FUSE	The fuse is installed for overcurrent protection when measuring current (DCI, ACI). • Fuse specification: F3A, 250 V In addition to the fuse installed in this instrument, two fuses are attached.	Section 5.4
⑤	POWER switch	It is the power switch of this instrument. • ON: I (switch is pressed) • OFF: O (switch is not pressed)	Section 3.2

Note) VOAC7502 doesn't support temperature measurement function (TEMP).

2.1.3 FUNCTION part

Figure 2.4 shows the FUNCTION part on the front panel and Table 2.4 describes the name and function of each part.

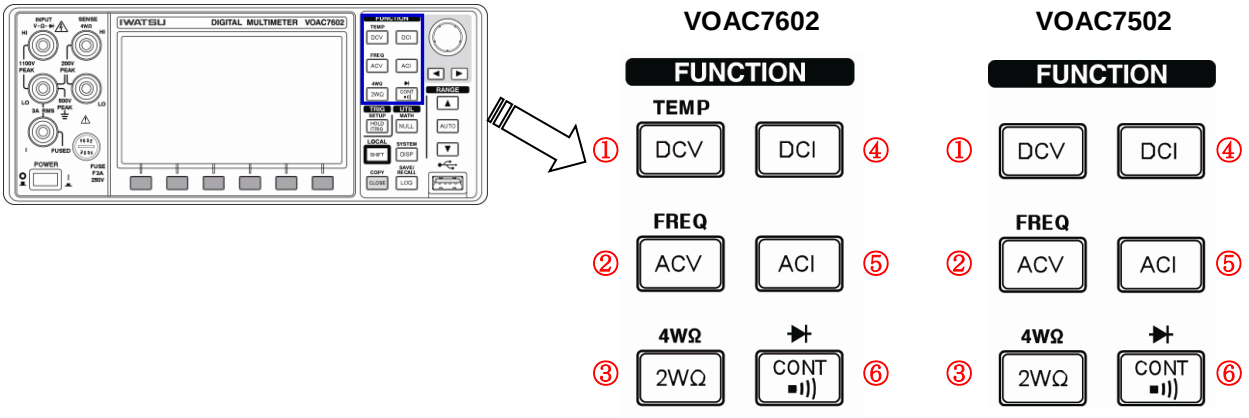


Figure 2.4 FUNCTION part

Table 2.4 Name and function of each part of FUNCTION part

№	Name	Contents and functions (outline)	Refer to
①	DCV (TEMP) key TEMP [Note]	• It selects the DC voltage measurement (DCV). If pressed, the DCV menu opens on the lower part of the screen. • It also selects the temperature measurement (TEMP); i.e. after pressing [SHIFT] key, press it. If pressed, the TEMP menu opens on the lower part of the screen.	Section 4.3.1 Section 4.3.9
②	ACV(FREQ) key FREQ	• It selects the AC voltage measurement. If pressed, the ACV menu opens on the lower part of the screen. • It also selects the frequency measurement; i.e. after pressing [SHIFT] key, press it. If pressed, the FREQ menu opens on the lower part of the screen.	Section 4.3.2 Section 4.3.10
③	2WΩ(4WΩ) key 4WΩ	• It selects the 2-terminal resistance measurement. If pressed, the 2WΩ menu opens on the lower part of the screen. • It also selects the 4-terminal resistance measurement; i.e. after pressing [SHIFT] key, press it. If pressed, the 4WΩ menu opens on the lower part of the screen.	Section 4.3.5 Section 4.3.6
④	DCI key	• It selects the DC current measurement. If pressed, the DCI menu opens on the lower part of the screen.	Section 4.3.3
⑤	ACI key	• It selects the AC current measurement. If pressed, the ACI menu opens on the lower part of the screen.	Section 4.3.4
⑥	CONT(⏭) key ⏭	• It selects the Continuity test. If pressed, the CONT menu opens on the lower part of the screen. • It also selects the diode measurement; i.e. after pressing [SHIFT] key, press it. If pressed, the DIOD menu opens on the lower part of the screen.	Section 4.3.7 Section 4.3.8

Note) VOAC7502 doesn't support temperature measurement function (TEMP).

2.1.4 TRIG & UTILITY setting part

Figure 2.5 shows the TRIG & UTILITY part on the front panel and Table 2.5 describes the name and function of each part.

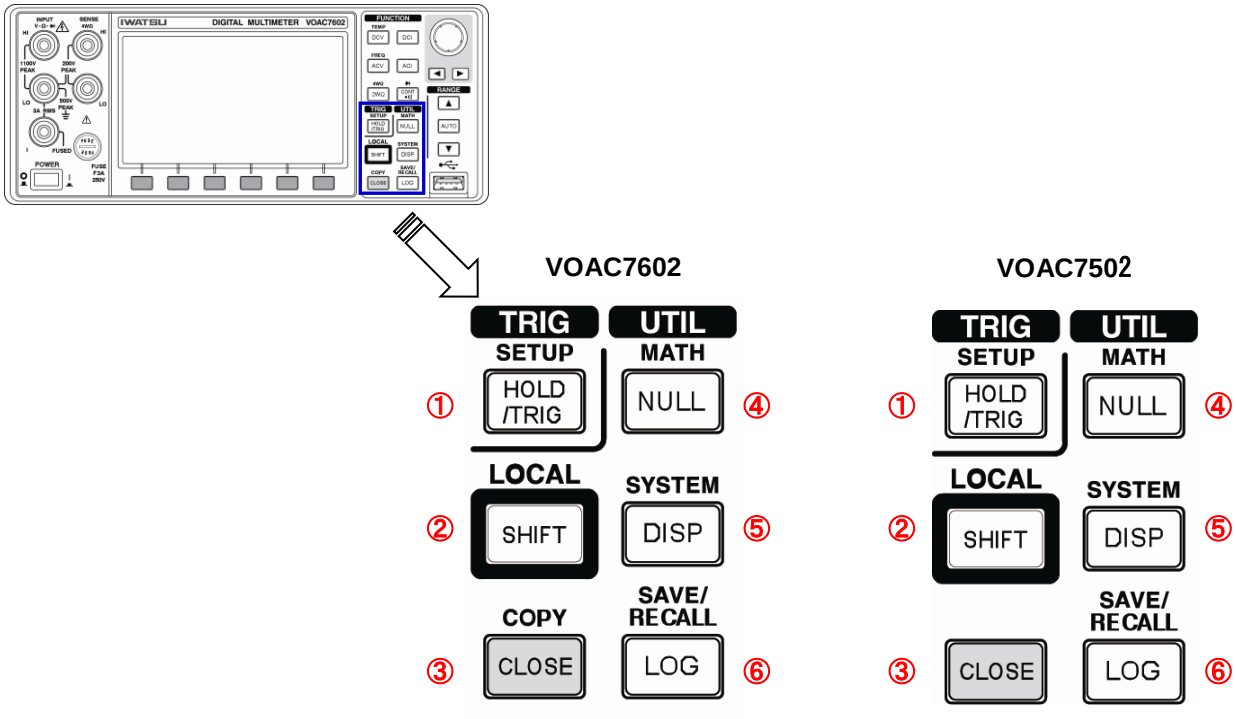


Figure 2.5 TRIG & UTILITY setting part

Table 2.5 Name and function of each part of TRIG & UTILITY setting part

№	Name	Contents and functions (outline)	Refer to
①	HOLD/TRIG (SETUP) key SETUP	• It selects start/stop of measurement when the trigger mode is set to AUTO and is the key for manual trigger when set to SINGLE. When the mark ☐ flashes to indicate the trigger action state on the upper left of the screen when the key is pressed, the state is TRIG action state. On the other hand, when the mark on the left of the screen becomes II when pressed, the state is HOLD. • It also selects the trigger setting (SETUP); i.e. after pressing [SHIFT] key, press it. If pressed, the TRIG menu opens on the lower part of the screen.	Section 4.4
②	SHIFT (LOCAL) key LOCAL	• If pressed once, the mark indicating the shift state is displayed and if pressed again, the shift state is released. • If [SHIFT] key is pressed and the corresponding key is pressed, the measurement function or setting (blue characters) above the key in the FUNCTION part and TRIG & UTILITY setting part on the front panel is available. • The function to select to which of a primary display or a secondary display to switch the measurement screen is provided, too. • If this instrument is remotely controlled, it operates as [LOCAL] key. This instrument changes from the remote state to the local state; i.e. keys on the front panel become available.	Section 3.4
③	CLOSE (COPY) key COPY Note1	• It is normally used to close the menu. Every time it is pressed after moving to the lower layer; i.e. menu to submenu, the menu returns by one layer. • It the setting menu of TRIG & UTILITY setting part opens, the setting menu of TRIG & UTILITY setting part closes when the menu returns to the highest layer and the screen returns the FUNCTION menu currently set. • If [SHIFT] key is pressed and then [CLOSE(COPY)] key is pressed, the screen hard copy (HARD COPY) or data that makes the latest measurement result text can be output to the USB memory.	Section 3.4 Section 4.5, 4.11
④	NULL (MATH) key MATH	• It switches ON/OFF the NULL function (difference calculation function) in each measurement function of FUNCTION part. It is available to the function currently opened. • It is also used to select MATH calculation menu; i.e. if [SHIFT] key is pressed and then [NULL(MATH)] key is pressed, MATH menu opens at the lower part of the screen and setting can be changed.	Sections 4.3.1 to 4.3.6 Section 4.6.2 Section 4.6.3
⑤	DISP (SYSTEM) key SYSTEM	• It selects DISP setting menu; i.e. if pressed, DISPLAY menu opens at the lower part of the screen and setting can be changed. • It is also used to select SYSTEM setting menu. If [SHIFT] key is pressed and then [DISP(SYSTEM)] key is pressed, SYSTEM menu opens at the lower part of the screen and setting can be changed.	Section 4.8 Section 4.5
⑥	LOG (SAVE/RECALL) key SAVE/RECALL Note2	• It sets the log function menu; i.e. if pressed, LOG menu opens at the lower part of the screen and setting can be changed. • It is also used to set Save/Recall of the setting condition. Press [SHIFT] key and then press [LOG(SAVE/RECALL)] key for selection. If the key is pressed, SETUP SAVE/RECALL menu opens at the lower part of the screen and setting and Execution of preservation/recall can be changed.	Section 4.11 Section 4.7

Note1) VOAC7502 doesn't support the COPY function to use the COPY key. Therefore, there is not SYSTEM/COPY menu either.

Note2) VOAC7502 cannot be input and output directly to the USB memory because there is no USB memory connection entrance. Therefore, the Save/Recall function is not supported between the USB memories.

2.1.5 Rotary knob & RANGE switching part

Figure 2.6 shows the Rotary knob & RANGE switching part on the front panel and Table 2.6 describes the name and function of each part.

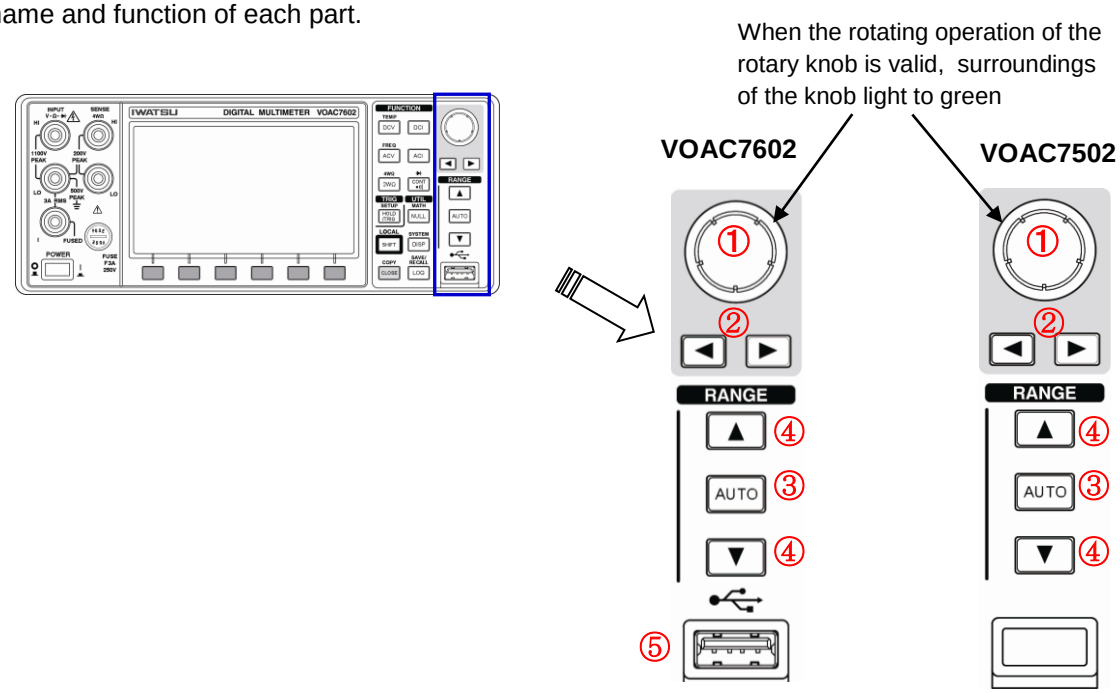


Figure 2.6 Rotary knob & RANGE switching part

Table 2.6 Name and function of each part of Rotary knob & RANGE switching part

№	Name	Contents and functions (outline)	Refer to
①	Rotary knob (switch)	<When surroundings of the rotary knob light > • It is used to select one from multiple setting items in the screen menu. When the periphery of the knob lights up, the function is available. Clockwise or counterclockwise rotation of knob can make selection. Ex. Selection of SAMPLE (sampling rate) of the function • Rotation of the knob allows input of character, numeric value, or symbol, and selection of list, cursor movement. Ex. SETUP NAME is set in SETUP SAVE/RECALL menu. <When surroundings of the rotary knob are turned off > •If the knob is pushed at the highest layer of the menu, the trend chart, histogram chart, and statistic data can be cleared. <Regardless of light/turning off around rotary knob > • It can return the screen menu to the upper layer by one. (The equivalent function to CLOSE key in Section 2.1.4) Every push allows the screen menu to return to the upper layer by one. (It is available regardless of whether the periphery of the knob lights up or not.)	Section 3.4.1.2 Section 3.4.1.4 Section 4.6, 4.9.1, 4.11 Section 2.1.4
②	Arrow key	<When surroundings of the rotary knob light > • It can move the cursor position when selecting a character, numeric value, or symbol. <When surroundings of the rotary knob are turned off > • Usually, push the DISPLAY key to switch the content of the display of secondary /primary by the DISPLAY menu. It is also possible to switch by combining the arrow key and the SHIFT key. Refer to section 3.4.2.2 for details.	Section 3.4.1 Section 3.4.2.2
③	AUTO key	• It switches the range between AUTO/MANUAL of the voltage and current in each function. Each time the key is pushed, the state of AUTO RANGE/MANUAL RANGE is displayed on the annunciator of the screen. • When the trend chart of off-line is displayed, T cursor is displayed and the statistic calculation and the display between T1 cursor and T2 cursor are executed. Use this key when it calculates again and is displayed after T cursor is moved.	- Section 4.9.2.4
④	Range switching key (up arrow/down arrow)	• It manually switches the range of the voltage and current in each function. The up arrow key makes switching to the larger range and the down arrow key makes switching to smaller range. Even if this key is pressed in AUTO RANGE state, the state is changed to MANUAL RANGE and the range can be switched.	—
⑤	USB memory connection Note	• It can connect the USB memory. Output of screen hard copy, save/recall of setting condition or export of log data etc. can be done.	Section 4.7 Section 4.11

Note) In VOAC7502, there is no USB memory connection entrance. Therefore, the function concerning table ⑤ on with the USB memory is not supported.

2.2 Name and function of each part on rear panel

Figure 2.7 (a) shows the rear panel of VOAC7602 (only main unit; no option), Figure 2.7 (b) shows that of VOAC7602 (main unit, SC-361+SC-362), Figure 2.7 (c) shows that of VOAC7602 (main unit, SC-363+SC-362), and Table 2.7 describes names and functions of parts of ① to ⑥. It is only POWER specification of ～ LINE that differs by VOAC7602 and VOAC7502 about the back panel, and VOAC7502 is 14VA MAX.

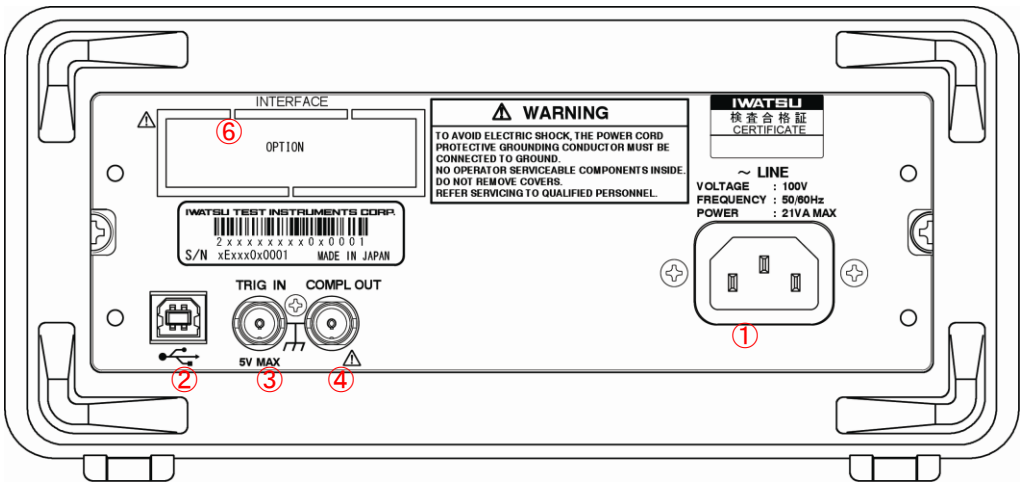


Figure 2.7(a) Rear panel of VOAC7602 (only main unit, no option)

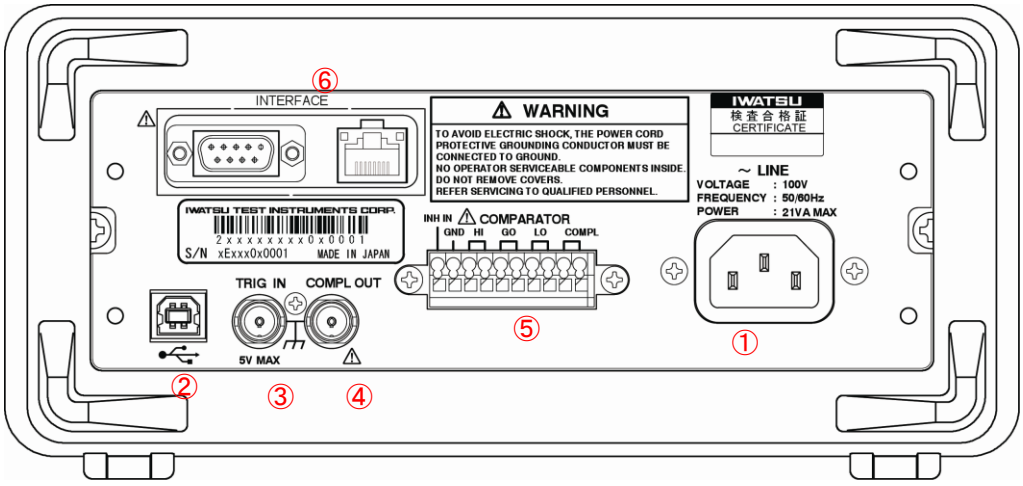


Figure 2.7(b) Rear panel of VOAC7602 (main unit+SC-361+SC-362)

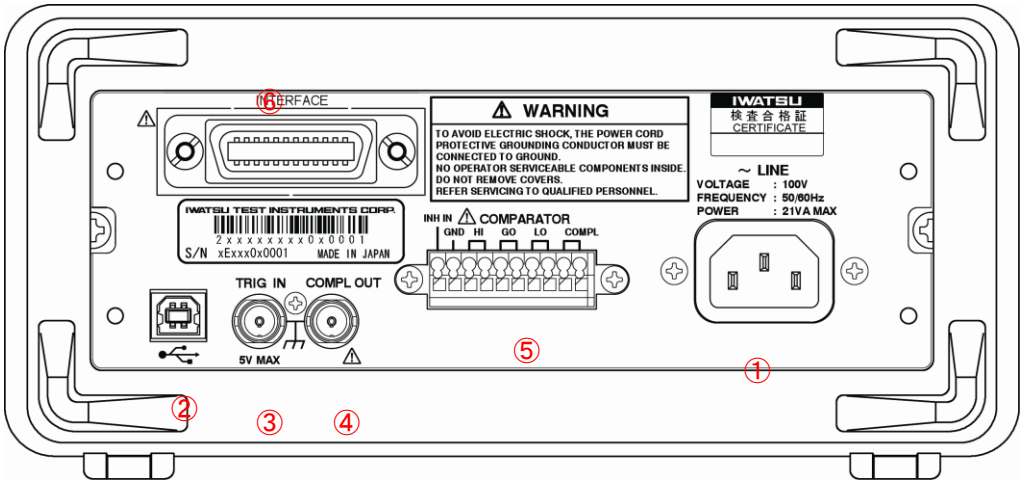


Figure 2.7(c) Rear panel of VOAC7602 (main unit+SC-363+SC-362)

Table 2.7 Name and function of each part on rear panel of VOAC7602 / VOAC7502

№	Name	Contents and functions (outline)	Refer to
①	AC LINE INPUT	• It is the inlet for power supply cord connection. Use the attached power supply cord. • The power supply specification is as follows and is indicated above the inlet. AC100V/110V/220V/240V±10 %, 50 Hz/60 Hz * Other than AC100V is factory option. Power consumption (POWER) is different in the model as follows. a) VOAC7602: 21VA MAX b) VOAC7502: 14VA MAX	Section 3.2.1 Section 6.1
②	USB (device) terminal	• It is the connection terminal for the USB interface (Type A). Connection to the PC allows remote control from the outside. For rules, commands, and use methods, see Remote Control Manual. • Selection of USB in SYSTEM/REMOTE/INTERFACE menu makes the terminal available. For the specifications, see Chapter 6 Specifications at the end of this document.	Remote Control Manual (recorded in CD) Section 4.5 Sections 6.1 & 6.13
③	TRIG IN terminal (BNC)	• It is the input terminal of the external trigger. Use of TRIG/EXT TRIG menu allows selection of use or not and the slope polarity. Maximum permissible input: 5 V MAX (H:2.4 Vmin, L:0.9 Vmax) Input impedance: about 10 kΩ	Section 4.4 Section 6.1
④	COMPL output terminal (compalete, output terminal, BNC)	• It is the pulse output terminal that shows the measurement completion and can be used when synchronizing this instrument with the other equipment. a) TTL level output (H:2.4 Vmin, L:0.4 Vmax) b) Polarity: positive logic * When LIMIT judgment is available, it is originally the same signal as COMPLof SC-362 output in ⑤ below. Because the logic signal is output directly, it is output according to timing that is earlier than the signal of ⑤.	Section 4.6.4 Section 6.1
⑤	DIO option SC-362	• It allows output of the LIMIT judgment result or input of the trigger control signal. (See Figure 2.7(b).) a) Hi/Lo/Go: Output of LIMIT judgment result b) COMPL : Complete output *The output above is the Photo MOS relay contact output. c) INH IN : Trigger inhibit signal input Input impedance: about 10 kΩ H:2.4 Vmin, L:0.9 Vmax	Section 4.4.2 Section 4.6.4 Section 6.1
⑥	Option installation unit SC-361 option or SC-363 option	• Either of two options below can be installed. If installed, the corresponding connector can be seen. If not installed, the cover is done. a) LAN/RS-232 interface SC-361 (See Figure 2.7(b).) b) GP-IB interface SC-363 (See Figure 2.7(c).)	Section 1.3 Section 6.1

2.3 Screen display

This instrument is the multi-meter equipped with the color-display LCD screen. In addition, to improve the operability, there are the setting menus at the lower part on the screen and the menu keys below the LCD screen.

The example of the screens of section 2.3.1to 2.3.5 are explained on VOAC7602 based. The number of digits of set displays of NULL in the submenu, the measured value, the RA W value, the NULL value of VOAC7502 becomes six digit display that is one digit less than the example of the screen.

2.3.1 Screen configuration

Figure 2.8 (a) and Figure 2.8 (b) show the typical examples of the screen configuration of this instrument and Table 2.8 shows the names and display contents.

Figure 2.8(a) Example1 of VOAC7602 (PRIMARY: NUMERIC, SECONDARY：ANALOG METER)

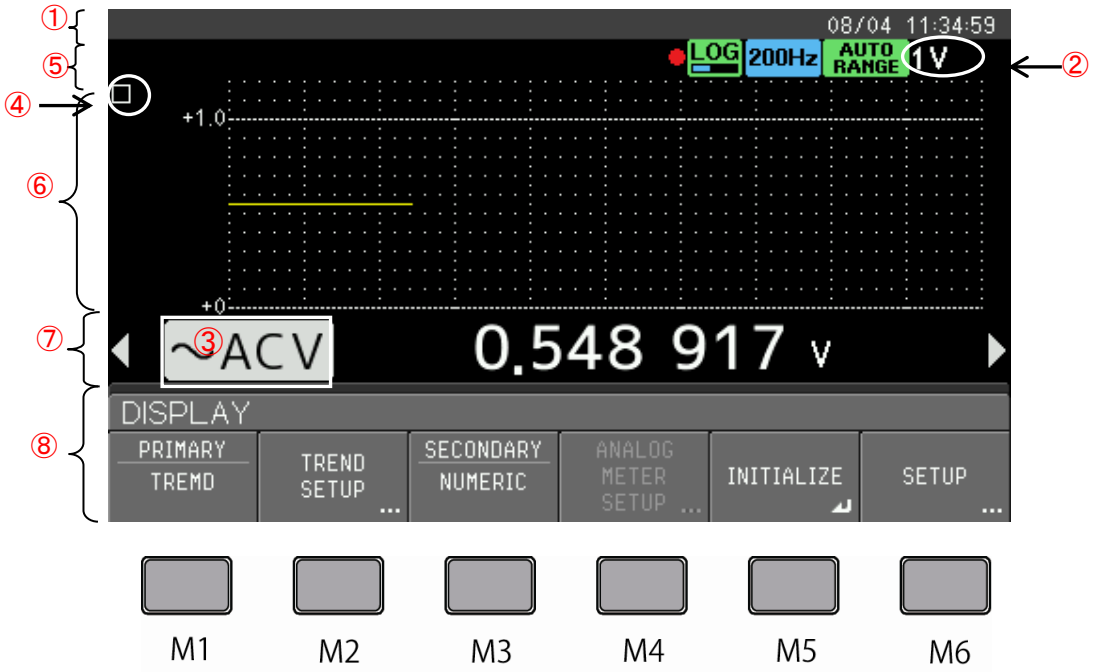


Figure 2.8(b) Example2 of VOAC7602 (PRIMARY:TREND, SECONDARY：NUMERIC)

Table 2.8(a) Names and display contents in each part of screen

№	Name	Display contents	Refer to
①	Message display area	○ The upper left part on the screen shows the message which tells the user event occurrence. The message displayed here is automatically cleared after the elapses of a specified time (about 4sec). Ex. Detection message of USB memory inserted/ removed • "USB memory is connected." • "USB memory is disconnected." ○ The contents displayed on the upper right part on the screen can be selected from 3 types below. It is set by SYSTEM/SETUP/HEADER menu. • OFF：No display • DATETIME: Month, day, and time • SETUPNAME: Setting condition name The preset name is displayed by SETUP SAVE/RECALL/SETUP NAME menu.	Section 2.3.5 Section 4.5.2 Section 4.7
②	Range display (RANGE, in white oval)	○ It displays the range used in measurement of each function. The range is set by AUTO RANGE and MANUAL RANGE (up/down arrow keys)	Section 2.1.5
③	Function display (in white rectangle)	○ It displays the function name selected by the function key in FUNCTION part. • DCV: DC voltage measurement • DCI: DC current measurement • ACV: AC voltage measurement • ACI: AC current measurement • 2WΩ: 2-terminal resistance measurement • 4WΩ: 4-terminal resistance measurement • TEMP: Temperature measurement [Note] • FREQ: Frequency measurement • CONT: Continuity test • ⇥DIOD: Diode measurement	Section 4.3
④	Sampling indicator display (in white circle)	○ If TRIG is set to AUTO It alternately flashes (i.e. □⇔■) depending on SAMPLE (sampling rate) setting of each function. If [HOLD] key is pressed, the indicator turns to ⏸ and the state changes to HOLD state (⏸: sampling stop). ○ If TRIG is set to SINGLE It flashes, and afterwards, enters the state of HOLD when a trigger is activated while data is acquired by the times which is set by the number of samples.	Section 4.4

Note) VOAC7502 doesn't support temperature measurement function (TEMP).

Table 2.8(b) Names and display contents in each part of screen

№	Name	Display contents	Refer to
⑤	Annunciator (multiple indicators display area)	○ It consists of multiple indicators indicating the operating status of the instrument. The maximum number of indicators simultaneously displayed is 10. ○ The indicator to be displayed varies depending on the function. Ex. If ON is set by MATH/STATISTIC menu, **STAT** indicator is displayed.	Section 2.3.2
⑥	Primary display	○ It is the area which displays the measurement result selected by the function. Selection is made from 5 types below by DISPLAY/SECONDARY menu and can be displayed. • NUMERIC : It normally displays the measurement value, suffix, and unit. • TREND : It displays the trend chart indicating the time-changing measurement value. • HISTOGRAM : It displays the histogram chart indicating frequency distribution of measurement values. • LIMIT The judgment result of LIMIT calculation is displayed in colors by the large size. • ARC SCALE METER : Measurements are instructed to a circular arc scale with the needle in the analogue. * Usually though the display is selected by the above-mentioned method, there is a method of switching the display by combining the SHIFT key and the arrow key, too.	Section 2.3.3 Section 4.8 Section 2.3.3.4 Section 2.3.3.5 Section 3.4.2.2
⑦	Secondary display	○ It is the supplement area which displays the measurement result selected by the function. Selection is made from 7 types below by DISPLAY/SECONDARY menu and can be displayed. However, the display type on the secondary display is limited by the type displayed on the primary display. (The type not selected by the menu is displayed in gray.) • NUMERIC : It displays the function, measurement value, suffix, and unit. If the primary display in ⑥ is set to TREND or HISTOGRAM, it can be selected. • ANALOG METER : It displays the position of the measurement value with mark △ showing the range on the horizontal axis. • LIMIT : It displays HIGH/GO/LOW of the LIMIT calculation result. Only if LIMIT judgment is set ON, it can be selected. • STATISTIC : It displays the statistics information. Only if STATISTIC is set ON, it can be selected. • HISTOGRAM : If the primary display in ⑥ is set to HISTOGRAM, numeric values of 6 items related to BIN are displayed. • CURSOR : If the primary display in ⑥ is set to HISTOGRAM, numeric values of 4 items related to the cursor are displayed. • TREND : If the primary display in ⑥ is set to TREND, 3 items related to the time are displayed. * Usually though the display is selected by the above-mentioned method, there is a method of switching the display by combining the SHIFT key and the arrow key, too.	Section 2.3.4 Section 4.8 Section 4.6.4
⑧	Menu display area	○ It displays the menu of each function and TRIG&UTILITY setting menu. Pressing of the menu key or [CLOSE] key below the screen or pressing of the rotary switch allows movement to the menu at the upper or lower layer. ○ TRIG&UTILITY setting menu is brightly gray and displayed on the menu of each function. In the example of Figure 2.8(b), DISPLAY menu is piled on ACV menu.	Section 3.4 Section 2.1.4

2.3.2 Annunciator

The annunciator consists of multiple indicators indicating the operation status of the instrument. The maximum number of indicators simultaneously displayed is 10. Figure 2.9 shows the display example.

Figure 2.9 Example of annunciator and indicators (VOAC7602)

Indicators to be displayed vary depending on the function. Table 2.9 on the next page shows the indicator types, display contents and conditions.

Table 2.9 Indicators and display contents

Type	Action and display	Indicator display and condition
AUTO RANGE	It indicates switching state of the measurement range: Auto or Manual.	• AUTO RANGE : Auto range • MANUAL RANGE : Manual range
IMPEDANCE (DCV) BANDWIDTH (ACV, ACI, FREQ)	It indicates the input impedance state of DC It displays BANDWIDTH (AC filter) setting state of ACV and ACI. At FREQ, the display is 20Hz fixation.	• HI-Z : High impedance • 10MΩ : 10MΩ • 20Hz : BANDWIDTH is set to MID. • 200Hz : BANDWIDTH is set to HIGH.
STATISTIC	It displays ON/OFF of the statistics calculation.	• STAT : Statistics calculation ON • Not displayed: Statistics calculation OFF
AUTO ZERO	It displays ON/OFF of Auto Zero.	• AUTO ZERO : Auto Zero ON • Not displayed: Auto Zero OFF
NULL	It displays ON/OFF of Null calculation.	• NULL : Null calculation ON • Not displayed: Null calculation OFF
SMOOTHING	It displays ON/OFF of SMOOTHING calculation.	• SMTH : SMOOTHING calculation ON • Not displayed: SMOOTHING calculation OFF
MATH	It indicates MATH calculation type.	• dB : dBm/dBV calculation ON • SCLE : Scaling calculation ON • Not displayed: Math calculation OFF
LIMIT	It indicates LIMIT calculation result.	• GO : LOW ≤ measurement result ≦ HIGH • HIGH : HIGH < measurement result • LOW : Measurement result < LOW • ---- : There is no acquisition data. • Not displayed: LIMIT calculation OFF
LOG	It indicates the log function state.	< At NORMAL mode > (The log function is an always running state.) • LOG : No data in the LOG memory • LOG : Some free space in the LOG memory • LOG : No free space in the LOG memory < At BULK mode > • Non-display: Log stop state and no data in the LOG memory • LOG : Log stop state and some free space in the LOG memory • LOG : Log stop state and no free space in the LOG memory • LOG : Log running state and some free space in the LOG memory • LOG : Log running state and no free space in the LOG memory
REMOTE Continuous writing in USB memory	It indicates the remote control state (remote/local). USB memory is continuously written and the functional status is shown by the VALUE TO USBMEM function (CONTINUOUS mode) in the local state.	• Not displayed: Local state and continuous writing in USB memory is OFF. • : Local state and continuous writing in USB memory is ON. • REMOTE : Remote state

∗ 1. Indicators in the table above are for BACKGROUND: BLACK.
For BACKGROUND: WHITE, the character part becomes a white pulling out.

2.3.3 Primary display

It is the main area displaying the measurement result selected by the function.

There are 5 display types; NUMERIC, TREND CHART, LIMIT, ARC SCALE METER and HISTOGRAM CHART, and they can be arbitrarily changed. (Refer to section 4.8 or section 3.4.2.2 for the switching method.)

Figure 2.10 shows the example of NUMERIC display. In addition, NUMERIC, TREND CHART, LIMIT, ARC SCALE METER and HISTOGRAM CHART are described in section 2.3.3.1 to section 2.3.3.5.

Figure 2.10 Example of primary display (VOAC7602)

2.3.3.1 NUMERIC display

Figure 2.11 (a) to (d) shows the example of NUMERIC display.

◇ **When FONT SIZE is NORMAL**

Figure 2.11(a) Example of NUMERIC display (FONT :7SEG, VOAC7602)

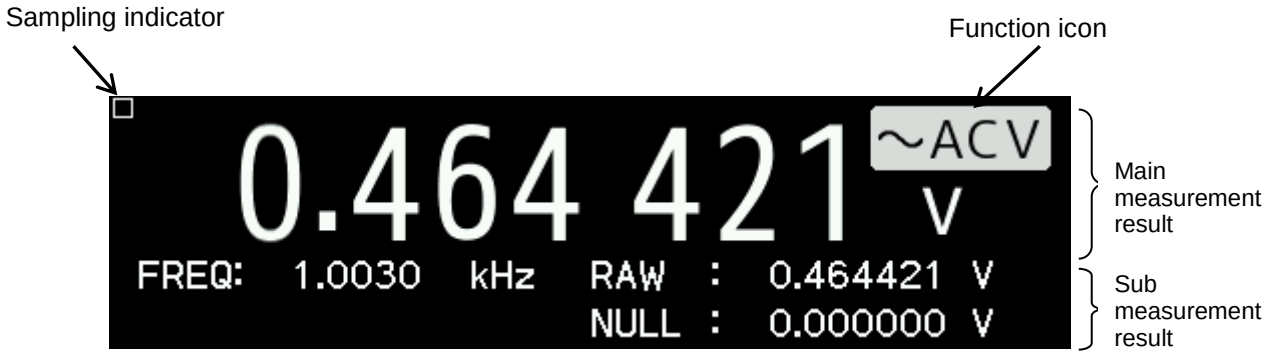


Figure 2.11(b) Example of NUMERIC display (FONT :NORMAL, VOAC7602)

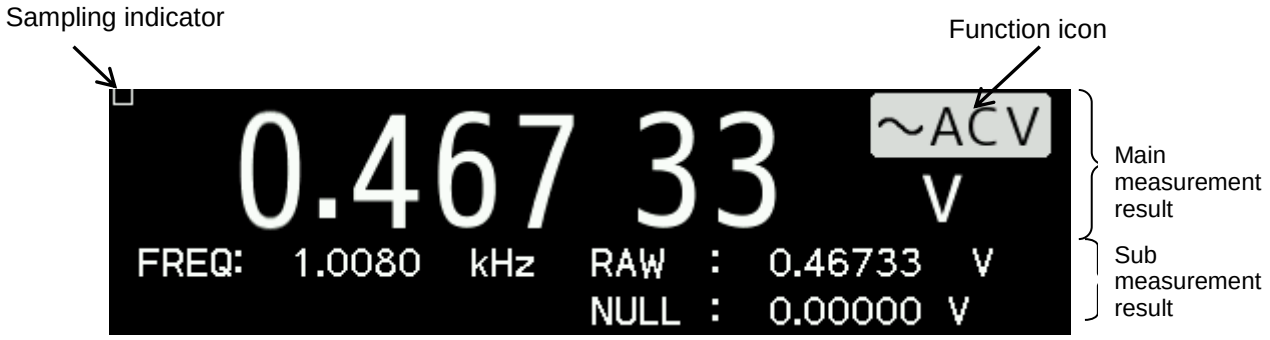


Figure 2.11(c) Example of NUMERIC display (FONT :NORMAL, VOAC7502)

The sub measurement result displays the numeric value information accompanied with the main measurement result. Table 2.10 shows the function supported by the displayed item and its displayed contents.

Table 2.10 Display contents of sub measurement result

Display item	Supported function	Contents
RAW	Function other than CONT and DIODE	If NULL or MATH calculation (dB/SCALING) is set ON, the raw data before calculation is displayed. *RAW data is after SMOOTHING calculation.
NULL	Function other than CONT and DIODE	If NULL calculation is set ON, NULL value is displayed.
ACV	Only FREQ function	ACV voltage value is displayed.
FREQ	Only ACV function	The frequency is displayed.
CONT	Only CONT function	SHORT state of the Continuity test is displayed.

◇ **When FONT SIZE is LARGE**

Figure 2.11(d) Example of NUMERIC display（FONT :7SEG, VOAC7602）

Figure 2.11(e) Example of NUMERIC display（FONT :NORMAL, VOAC7602）

Figure 2.11(f) Example of NUMERIC display（FONT :NORMAL, VOAC7502）

It displays measurement (numerical value and measurement result), suffix of the function and measurement, and the unit in a main measurement result.

2.3.3.2 Trend chart display

Figure 2.12 shows the example of trend chart display.

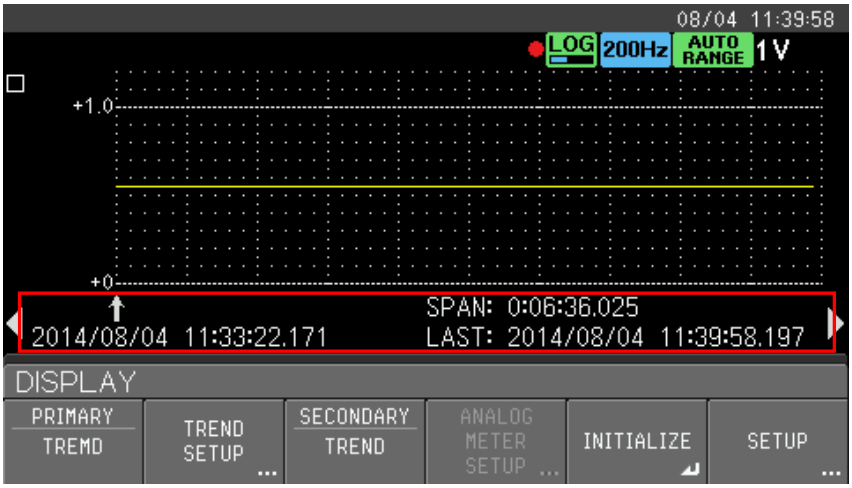


Figure 2.12 Example of online trend chart display

- ↑ : Displays the date and time when the beginning data displayed on the chart is acquired.
- SPAN : Displays the elapsed time after the measurement start time.
- LAST : Displays the date and time when the latest measurement result is acquired.

* For off-line trend chart display, refer to Section 4.9.2.

2.3.3.3 Histogram chart display

Figure 2.13 shows the example of histogram chart display.

* As for the bin in this section, refer to section 4.10.1.

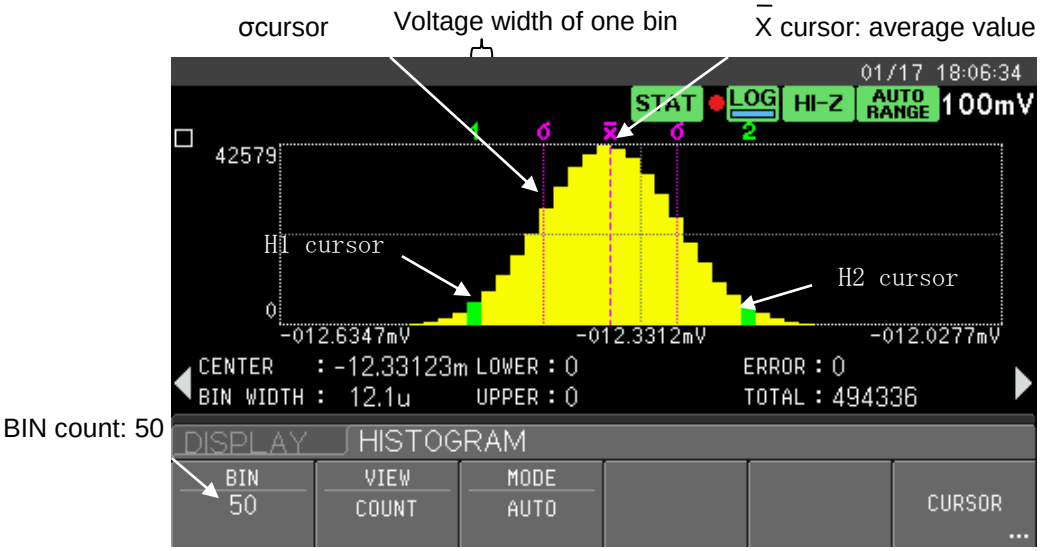


Figure 2.13 Example of online histogram chart display

When the primary display shows the histogram chart, the histogram information below can be displayed. X̄ cursor and the σ cursor are displayed only when the statistic calculation is ON.

- CENTER: Measurement value at the center of histogram display (voltage, current, and resistance)
- BIN WIDTH: Width of one BIN (see the diagram above)
- LOWER: No. of data pieces the measurement value or less on the left end of the histogram chart
- UPPER: No. of data pieces of the measurement value or more on the right end of the histogram chart
- ERROR: No. of data pieces which exceeds the range or whose calculation result is invalid.
- TOTAL : No. of total data pieces
- X̄ cursor: Average value of distributed measurement value and cursor (dotted line)
- σ cursor: It changes the average value of the distributed measurement values to the standard deviation (solid line). For σ, 1 (about 68%), 2 (about 95%), or 3 (about 99.7%) can be selected.
- H1, H2 cursors: Two green cursors in the diagram above can be displayed.

Press of the arrow key allows the displayed content of the statistical information on the secondary display can be changed.

- H1, H2 values : Can display the voltage range and degree of the BIN of each green cursor on the diagram above.
- H1 - H2 values : Can display the voltage range and degree of the BIN between green cursors on the diagram. In addition, it displays the ratio (%) of measurement data between H1 and H2 cursors to the all measurement values.

* For off-line trend chart display, refer to Section 4.10.2.

2.3.3.4 LIMIT display

Figure 2.14(a) to (d) shows examples of LIMIT judgment results displayed on the primary display.

Figure 2.14(a) Display example of LIMIT judgment result (for GO)

Figure 2.14(b) Display example of LIMIT judgment result (for HIGH)

Figure 2.14(c) Display example of LIMIT judgmentresult (for LOW)

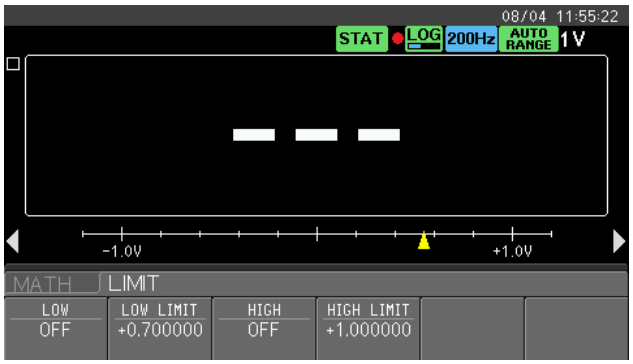


Figure 2.14(d) Display example of LIMIT judgment result (for"- - -")

If HIGH and LOW of LIMIT calculation in MATH menu are enabled and if LIMIT is selected in PRIMARY of DISPLAY menu, the judgment results in Figure 2.14(a), (b), (c) are displayed.

To improve visual recognition of the judgment result on the primary display, display of it should be greatly larger than that of the secondary display.

- Display items on primary display
  - ① Judgment result: HIGH/ LOW/ GO/ "－－－" display
    - ∗ For detailed display conditions of each judgment result, refer to Section 4.6.4.
  - ② Sampling indicator

  Note 1) Even NULL calculation is set ON and FREQ is set ON, NULL value, RAW value, and frequency are not displayed.

  Note 2) The function icon is not displayed. However, if NUMERIC is selsected on the secondary display, the small icon is displayed on the left of the secondary display.
- Display color of judgment result
  - ① HIGH, LOW: red
  - ② GO: green

∗ For LIMIT calculation, refer to Section 4.6.4. For settings of LIMIT display on the primary display, refer to Section 4.8.

2.3.3.5 ARC SCALE METER display

Figure 2.15 shows the example of ARC SCALE METER displayed on the primary display.

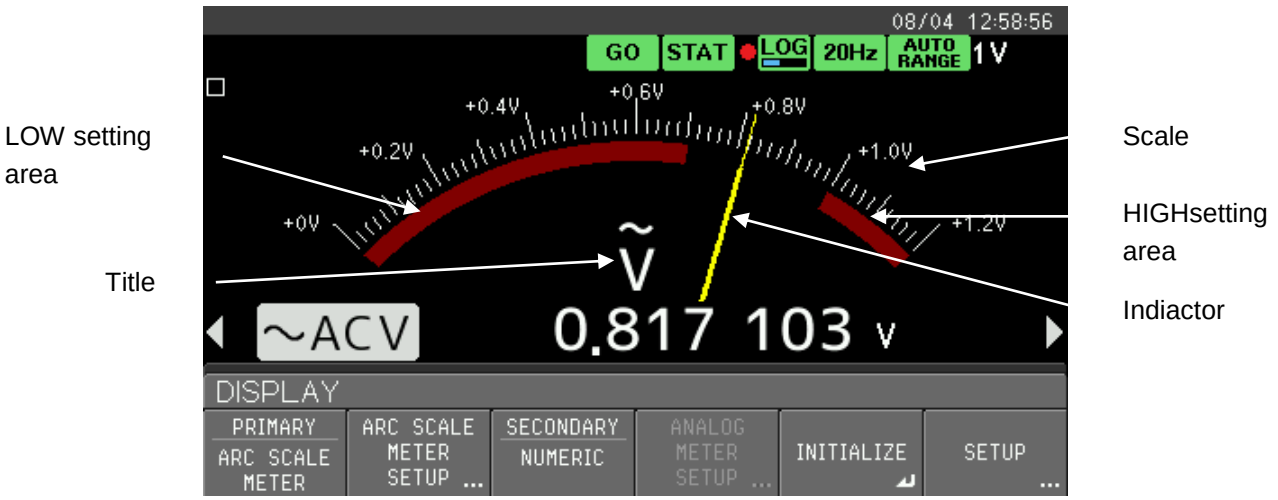


Figure 2.15 Display example of ARC SCALE METER (NUMERIC)

If ARC SCALE METER is selected in PRIMARY of DISPLAY menu, ARC SCALE METER is displayed as shown in Fugure 2.15.

ARC SCALE METER indicates the measurement value on the scales of the arc with the indicator.

- Display items on primary display

(1) Scales on arc

(2) Indicator

(3) TITLE

One item is selected from the following and is displayed in the center of the LCD screen.

① UNIT: Function unit

② BLANK: Non-display

③ TEXT: Up to 8 characters (including numbers and symbols) can be set.

(4) Setting area of HIGH/ LOW of LIMIT calculation is displayed with the red arc band.

The scale can be set by making selection on AUTO/ FULL SCALE/ MANUAL (specifying range and offset)/ LOG (maximum and minimum values) of DISPLAY/ARC SCALE METER SETUP menu. The LIMIT area (the red part on Figure 2.15) can be displayed as shown in the example.

∗ For setting of ARC SCALE METER display on the primary display, refer to Section 4.8.2.

2.3.4 Secondary display

It is the supplement area displaying the measurement result selected by the function.
It can be selected by DISPLAY/SECONDARY menu (or [SHIFT] key or arrow keys) and can be displayed.
(Refer to section 4.8 or section 3.4.2.2 for the switching method.)
Figure 2.16 shows the display example.

Figure 2.16 Example of secondary display

The display type is described in Section 2.3.4.1 to Section 2.3.4.4.

2.3.4.1 ANALOG METER display

Figure 2.17 shows the display example.

Figure 2.17 Example of ANALOG METER display

The analog meter shows the latest measurement value with △ mark on the horizontal axis.
FULL SCALE or MANUAL (range and offset are specified) can be selected for the scale by DISPLAY/ANALOG METER SETUP menu. As shown in the example, LIMIT area (red part in Figure 2.17) can be displayed.

2.3.4.2 LIMIT calculation result display

Figure 2.18 shows the display example.

Figure 2.18 Example of LIMIT calculation result display (VOAC7602)

HIGH/GO/LOW of the calculation result is displayed. 3 display contents are as follows. HIGH LIMIT value and LOW LIMIT value are set by MATH/LIMIT menu. (Refer to section 4.6.4.)

- HIGH : For measurement value > HIGH LIMIT value
- GO : For HIGH LIMIT value ≥ measurement value ≥ LOW LIMIT value
- LOW : For LOW LIMIT value > measurement value
- ― ― ― : When there is no acquisition data in the setting of the LIMIT calculation

Note) For VOAC7502, the number of display digits of the HIGH LIMIT value, measurements or LOW LIMIT value is less than the example of the above-mentioned by one digit.

2.3.4.3 STATISTIC (statistic information) display

Figure 2.19 shows the display example.

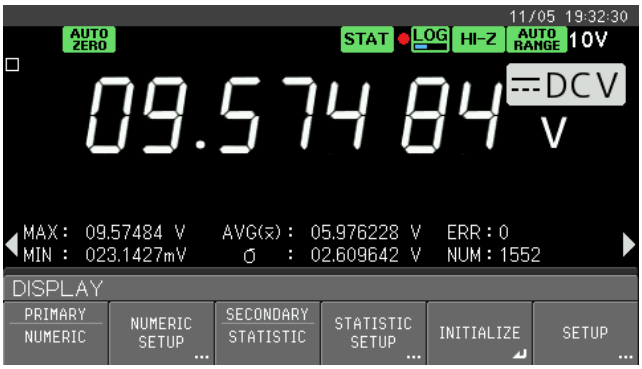


Figure 2.19 Example of STATISTIC calculation result display (VOAC7602)

The statistics information are as follows.

- MAX : Maximum value
- MIN : Minimum value
- AVG : Average value
- σ : Standard deviation (It is possible to select within the range of 1σ-6σ)
- ERR* : Number of error data*

  * The error data is invalid data as a target of statistical calcuation like the overload and the overflow, etc. and is not included in the number of samples.
- NUM : Number of samples

  * For VOAC7502, the number of display digits of MAX, MIN, AVG, or σ is less than the example of the above-mentioned by one digit.

2.3.4.4 NUMERIC (numeric value) display

Figure 2.20 shows the display example.

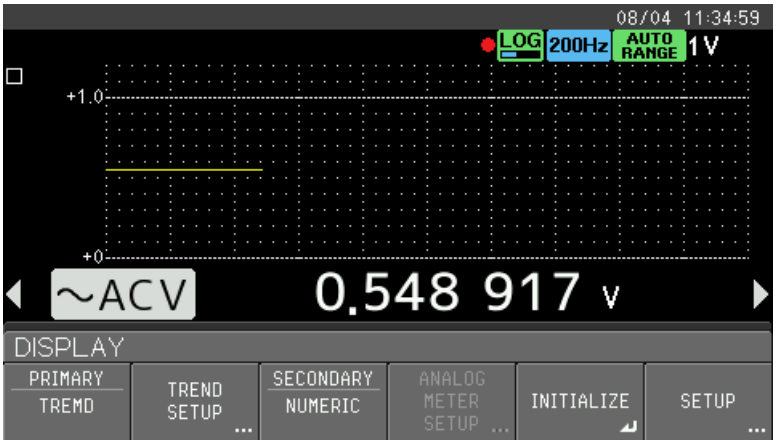


Figure 2.20 Example of NUMERIC display (VOAC7602)

It is possible to display, except for the NUMERIC display of five kinds of of a primary display. As shown in the example, the function icon, measurement value, and unit are displayed.

Note) The number of measurements of display digits decreases more than the example of Figure 2.20 for VOAC7502 by one digit.

2.3.5 Message display

Messages in Table 2.11(a) and (b) are displayed at the top of the LCD screen of this instrument.

If an error occurs in the output from the USB memory or the internal memory (saving or writing), the error messages in Table 2.11(a) are displayed.

Table 2.11(a) Error message and display contents

Error message	Display contents (condition, factor)	Measures
Error: No result	No measurement result	• Execute measurement.
Error: No USB memory	USB memory not installed	• Insert USB memory.
Error: Disk full	USB memory capacity is full and output cannot be done.	• Reduce the information in USB memory or change USB memory.
Error: File access	Access error to USB memory	• Release inhibition of reading/writing of USB memory. • Check that there are proper directory (folder name) and file.
Error: Read-only file	When writing is tried in the read-only memory.	• Change the file attribute to “Write possible” or specify the other file name.

Status messages in Table 2.11 (b) are displayed by key operation.

Table 2.11(b) Status message and display contents

Status message	Display contents (condition, factor)
Acquisition buffer was initialized.	When the internal data buffer for the trend and histogram is cleared.
Remote setup was saved. Reboot now.	When re-powering-on is required because of changing remote setting parameter
• Line frequency update completed. • Line frequency update failed.	• When power supply frequency is manually detected • If detection of power supply frequency fails
Screen image was dumped to “file name.”	When screen hard copy is done
”Add Text to “file name.”	If one-line logging data is output to USB memory
Setup initialization completed.	If initialization of setting condition is completed
Read from USB → Erasing ...→ Write to flash → Verifying ...→ Check flash	When the version of firmware is updated Message change in each phase.
CAL data saved to flash ROM.	When the calibration data is saved in the internal flash memory
Log data deleted.	When the LOG memory data is cleared by LOG menu/CLEAR LOG menu
Log data exported to “file name.”	When the contents of LOG memory is written in USB memory
Setup saved to “file name.”	When setting condition is saved
Setup recalled from “file name.”	When setting condition is recalled
Default setting recalled.	When factory setting condition is recalled
Log data empty, ENTER OFFLINE BROWSE disabled.	If the log data is empty when executing ENTER OFFLINE BROWSE menu, this message is displayed; i.e. the browser cannot be offline.
This operation isn’t enable while in offline browse.	If the operation which cannot be executed in the offline browse status is executed in the offline browse status, this message is displayed; i.e. the operation is invalid.
This operation isn’t enable while in bulk- logging.	If other operation than [STOP LOG] key is done when executing the bulk-log measurement, this message is displayed; i.e. the operation is invalid.
Can't start while EXT TRIG is disabled.	When the external trigger setting is invalid, and the stop event is "EXT TRIG"
Can't start while both HIGH and LOW LIMIT are OFF.	When stop events are "LIMIT-HIGH" or "LIMIT-NOGO" and both HIGH and LOW of the limit operation are OFF
Can't start while HIGH LIMIT is OFF.	When stop events are "LIMIT-HIGH" or "LIMIT-NOGO" and HIGH of the limit operation is OFF
Can't start while LOW LIMIT is OFF.	When stop events are "LIMIT-LOW" and LOW of the limit operation is OFF
MANUAL settings are updated.	When succeeding in the reflection in the MANUAL mode set value in APPLY TO MANUAL
Can't apply to MANUAL settings while no data.	When failing in the reflection in the MANUAL mode set value in APPLY TO MANUAL Example) When APPLY TO MANUAL is executed to no measurement or nor clearing measurements by a present measurement function
Calculating…	When you calculate the STATISTIC calculation again with off-line browse

Memo

123456

Chapter 3 Basic operation

This chapter describes the basic operation of this instrument.

3.1 Installation of instrument

Before using this instrument, install it in the location and environment conditions in accordance with “3.1.1 Installation conditions” below. In addition, it is recommended to read warnings and cautions in “Safety Precautions” at the beginning of this document.

When installing it, see “3.1.2 Installation state.”

3.1.1 Installation conditions

☆ **Flat and horizontal location**

Install this instrument on the stable location and keep it horizontal in all directions. Use of it on the unstable location may result in falling-down; i.e. cause of injury or failure.

If installing it on the rack, remove the handle and protectors. Use the rack accommodating the outside size of this instrument (width: 213 mm; height: 88 mm; depth: 356 mm, options are accommodated in this instrument; excluding projections such as protectors, handle, and connectors).

* It provides with rackmount kit SC-364 (inch type for one) and SC-365 (inch type for two) only for this product. In the order, contact contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors.

☆ **Well-ventilated location**

This instrument has the air hole on each side. To prevent the temperature in it from rising, keep the enough spaces around it and do not block the holes.

☆ **Range of operation guarantee temperature and humidity, and range of storage temperature and humidity**

Range of operation guarantee temperature and humidity:

0°C to +50°C (no dew condensation)
80%RH or less in the range of 0°C to +40°C
70%RH or less in the range of 40°C to +50°C

Range of storage temperature and humidity:

−20°C to +60°C (no dew condensation)
70%RH or less

Note!

Movement to the environment with different temperature and humidity may result in dew condensation because of rapid temperature change.

In such a case, use it after adapting it to the ambient temperature sufficiently so that the temperature changes gradually.

3.1.2 Installation state

This instrument may be installed horizontally or slantingly with the handle as shown in Figure 3.1(a) and (b).

When moving the handle, extend it outward at the connection of it and the instrument to keep the handle location in any of (a), (b), and (c) in Figure 3.1 and lock it by inserting it inward.

> **Note!**
> When changing the handle location, care should be taken not to sandwich fingers.

The state in Figure 3.1(c) (the back on the bottom) should be the temporary position; **do not use this state for measurement.**

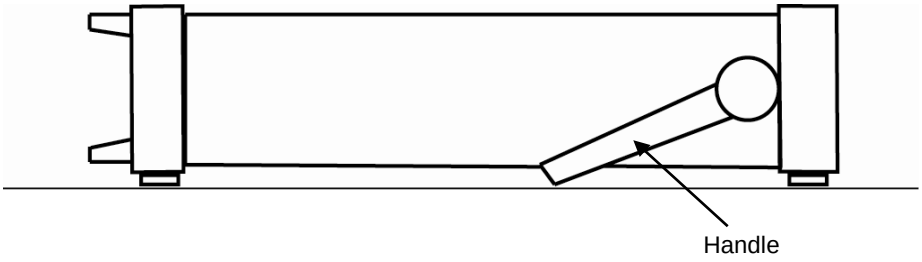


Figure 3.1(a) Installation state A (horizontal)

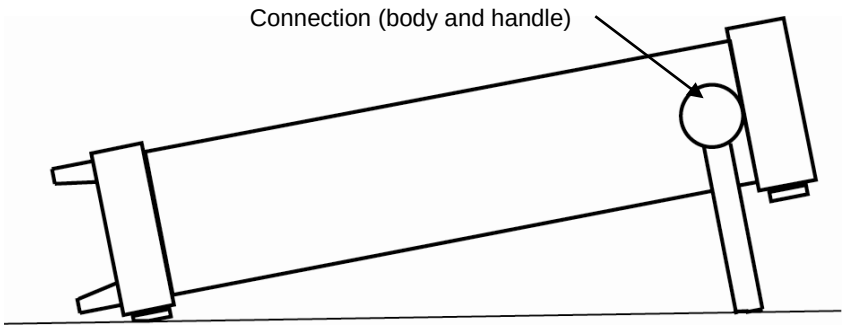
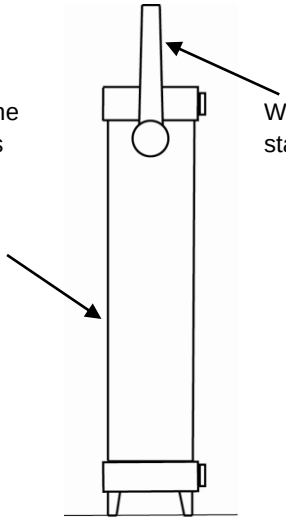


Figure 3.1(b) Installation state B (slanting state using handle)

Do not use this state for measurement. The performance cannot be ensured. Use this position for storage and temporary state. Care should be taken not to fall down by vibration or shock.



When carrying this instrument, use this state and hold it with hands.

Figure 3.1(c) State C (back on the bottom)

3.2 Power supply connection and powering on

This section describes procedures up to display of the initial screen; i.e. connection of power supply, powering-on, and connection of the measured device. ① to ④ in Section 3.2.1 and Section 3.2.2 below describes the procedures.

3.2.1 Connecting power supply cord

For warnings and cautions for power supply connection and the power supply cord, see page III to V at the beginning of this document. Before connecting the power supply, be sure to read them. ① and ② below describes the procedure of connecting the power supply cord.

① Check that POWER switch on the lower left of the front panel is OFF (O state: switch is convex).

② Insert the plug of the attached power supply cord into the AC LINE INPUT terminal on the rear panel (see Figure 3.2).

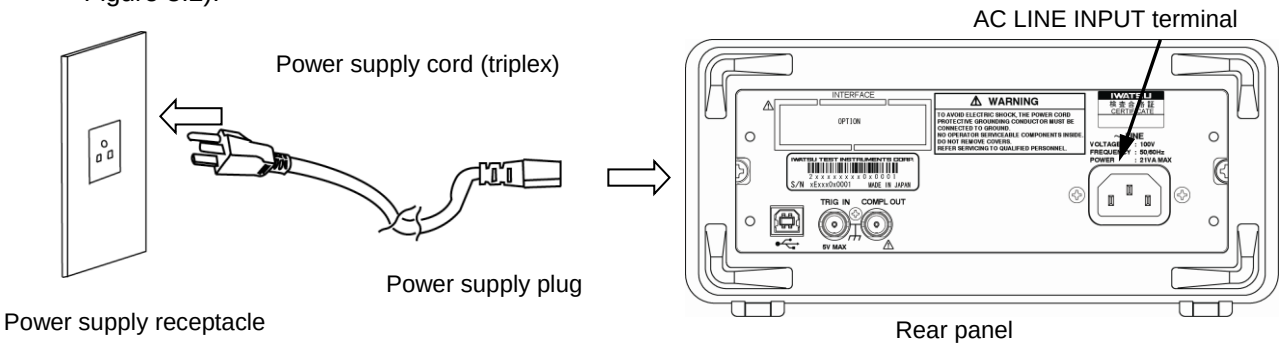
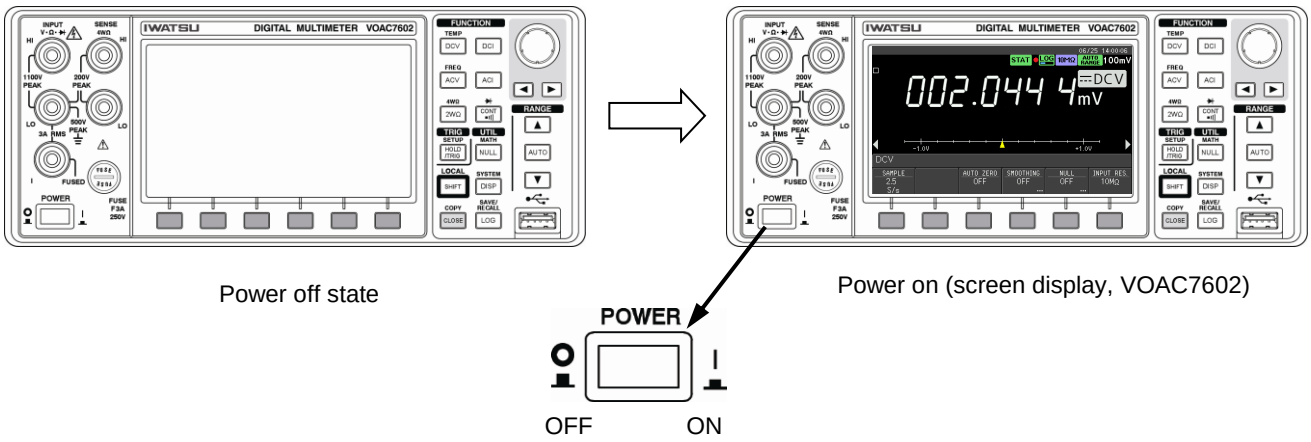


Figure 3.2 Connection of power cord

3.2.2 Powering-on / off

③ Press POWER switch on the lower left of the front panel (in Figure 3.3) to turn it ON (**I** state: switch is concave). The initial setting state screen (factory setting state at the first powering-on after deliverry) appears several seconds after powring-on. After that, if the previous settings are to be memorized at powering-on, select LAST in SETUP SAVE/RECALL/POWER ON RECALL/MODE menu (see Section 4.7).

④ To power OFF, press POWER switch (O state: switch is convex).



Power off state

Power on (screen display, VOAC7602)

Figure 3.3 Powering-on/off

3.3 Setting that wants to know

For easy use, settings in the sections below should be made before use of this instrument.

• Section 3.3.1: Basic setting of screen • Section 3.3.2: Setting at powering-on • Section 3.3.3: System setting

3.3.1 Setting of screen

At first powering-on of this instrument after unpacking it, settings are DEFAULT (factory settings). It is possible to make basic settings of the screen in accordance with user's usage environment and preference.

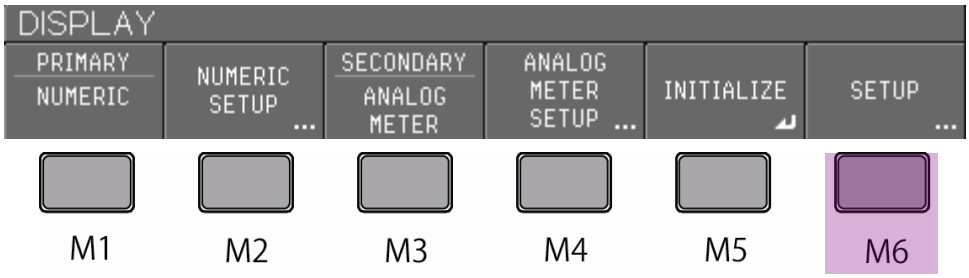
Figure 3.4 Screen display at startup (VOAC7602)

Operation procedure

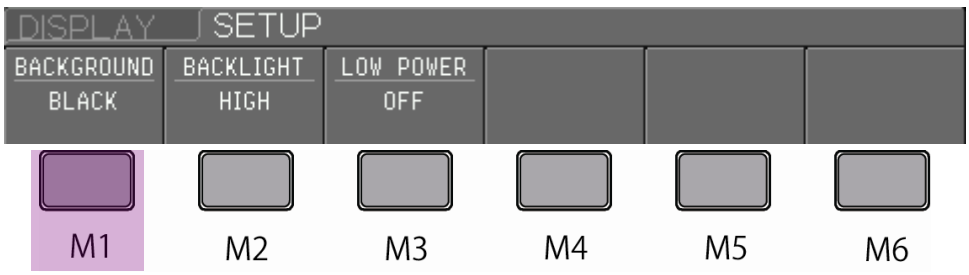
The example of the procedure shows change from the default setting to settings of BACKGROUND: WHITE, BACKLIGHT: LOW, and LOW POWER: 5 minutes. (If setting is not required, change is not necessary.)

- BACKGROUND: It selects WHITE or BLACK (default) for the background color of the screen.
- BACKLIGHT: It selects LOW or HIGH (default) for the brightness of the backlight in the LCD screen.
- LOW POWER: It makes switch to LOW POWER mode and the turns LCD OFF if key operation is not done within the setting time below. Selections are OFF (default), 1, 5, 10, 30, 60 minutes.

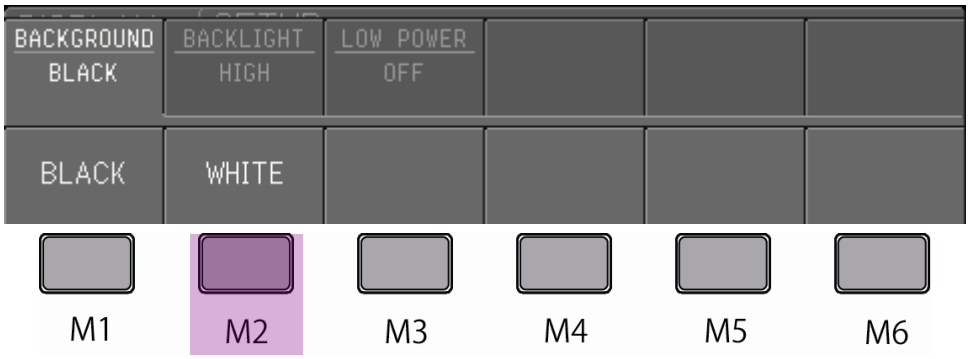
① Press [DISP] key. DISPLAY menu below opens.



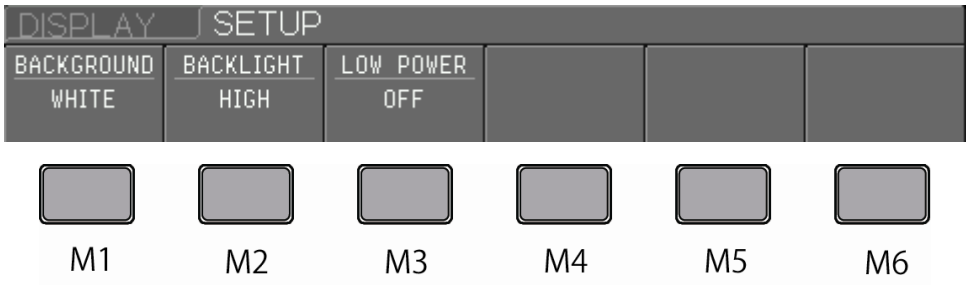
② Press M6 key in ① to select SETUP submenu. SETUP below opens.
Press M1 key to set BACKGROUND (background color) white.



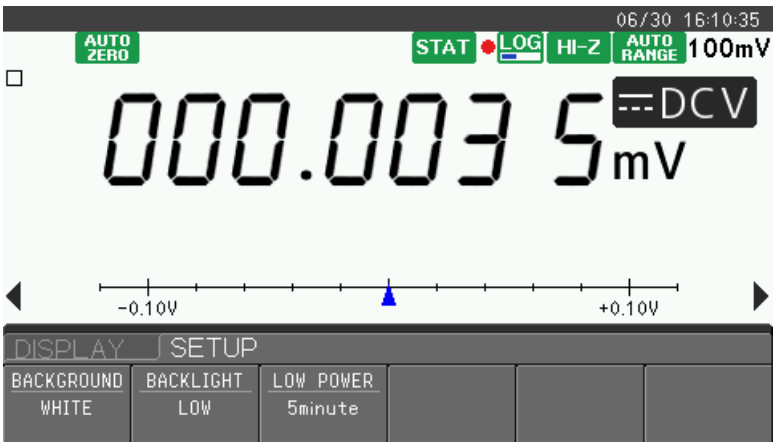
③ BACKGROUND submenu below opens. Press M2 key to select WHITE.



④ BACKGROUND: WHITE is set as shown below.



⑤ After that, the same procedure as ① to ④ above is used for BACKLIGHT and LOW POWER. Settings are changed to BACKGROUND: WHITE, BACKLIGHT: LOW, LOW POWER: 5 minutes as shown below and the background color of the screen is changed to WHITE.



3.3.2 Setting at powering-on

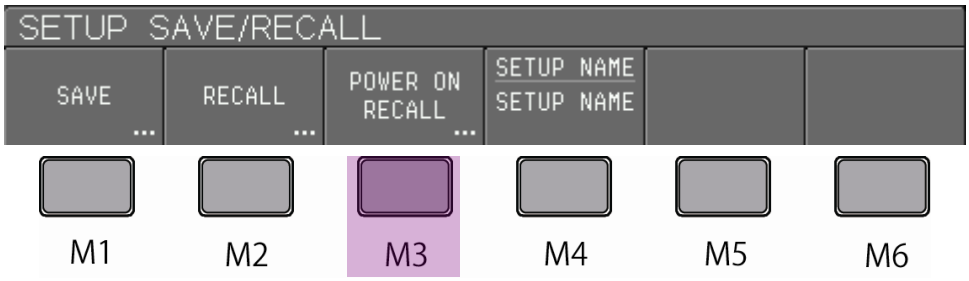
The power may be turned off after using this instrument or by interrupting measurement. In the initial default setting state, next powering-on uses the default settings. In the following setting, it is possible to stand up by a set content when cutting power off. For details, see Section 4.7.

Operation procedure

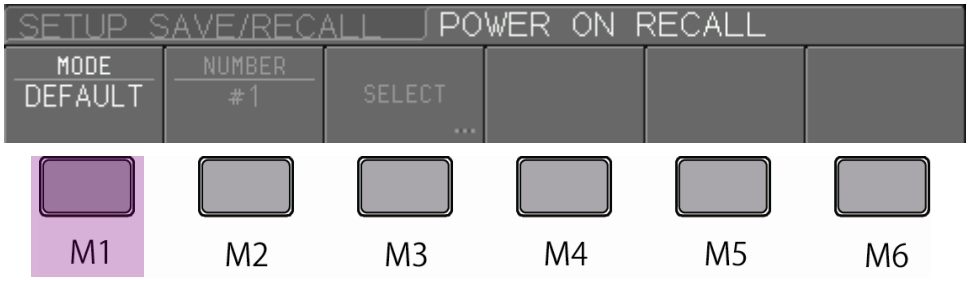
For example, the procedure to change to MODE: LAST in SETUP SAVE/RECALL/POWER ON RECALL menu is described.

If LAST is set, the setting conditions at powering-off are kept; i.e. that setting conditions are used for next powering-on.

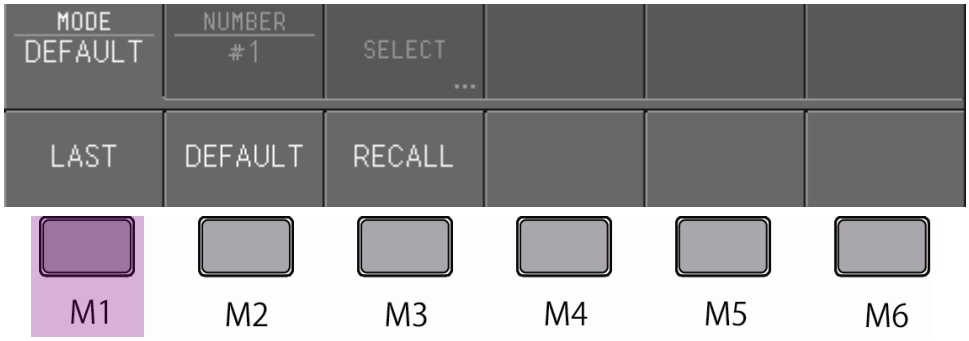
① Press [SHIFT]→ [LOG(SAVE/RECALL)] key. SETUP SAVE/RECALL menu opens.



② Press M3 key in SETUP SAVE/RECALL menu in ① to select POWER ON RECALL menu. POWER ON RECALL menu opens.



③ Press M1 key in POWER ON RECALL menu in ② to select MODE menu. MODE menu opens.



④ Press M1 key in POWER ON RECALL menu in ③ to select MODE:LAST. MODE:LAST is set as shown below. In this setting, the last setting conditions are used at powering-on.

3.3.3 System setting

For convenient use of this instrument, the contents of SYSTEM menu ([SHIFT]→[DISP(SYSTEM)] key) should be set at the early stage. In particular, the contents below are recommended to be set early or as required.

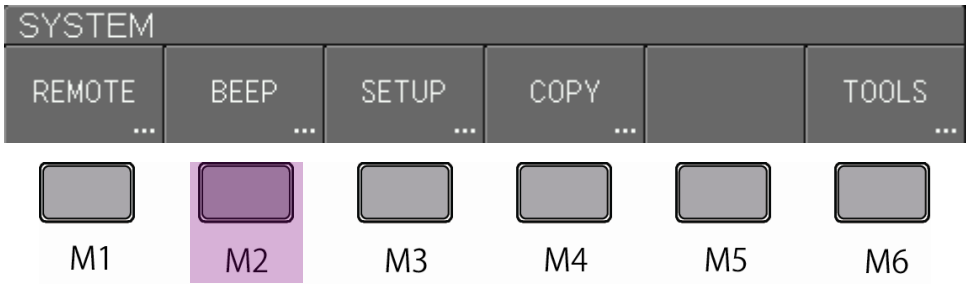
For details of system setting (SYSTEM), see Section 4.5.

○ SYSTEM/BEEP menu

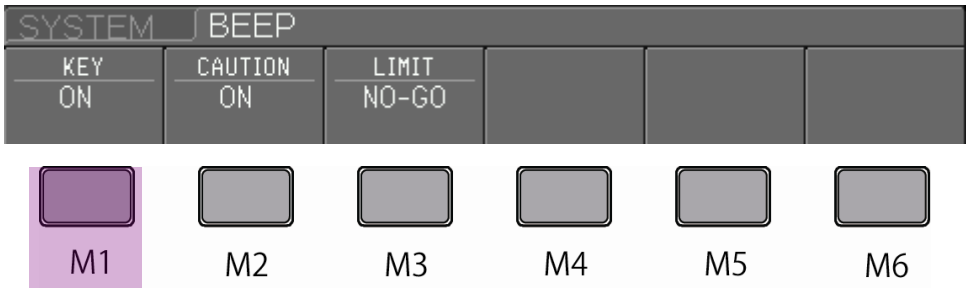
- KEY : ON (default) /OFF of sound generated when pressing key

Operation procedure 1. Setting of sound generated when pressing KEY (ON⇒OFF)

① Press [SHIFT]→[DISP(SYSTEM)] key. SYSTEM menu opens.



② Press M2 key in SYSTEM menu in ① to select BEEP menu. BEEP menu opens.



③ Press M1 key in BEEP menu in ② to set KET menu OFF. KEY: OFF is indicated as shown below and the key sound is generated when the key on the front panel is pressed.

3.3.4 Saving / recalling of setting conditions

If setting conditions about the user's target measurement have been set, it is recommended to collect them in a set and to save it in the internal memory or USB memory. If the setting conditions are saved, the setting conditions according to the measurement purpose can be recalled quickly.

Note!
For setting contents to be saved and recalled, see Section 4.12; Table 4.1(a) to (c).
Setting contents not to be saved and recalled in Section 4.12; Table 4.2 cannot be saved.

In addition, the summary of the setting condition saved for measurement by SETUP SAVE/RECALL/SAVE or RECALL/SELECT menu. The diagram below shows SETUP SUMMARY (setting conditions summary).

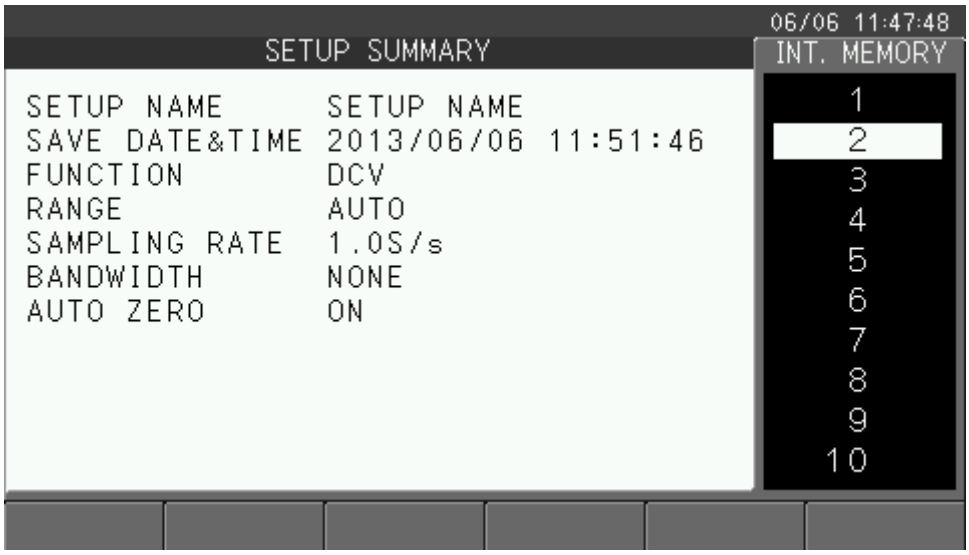


Figure 3.5 SETUP SUMMARY (setting conditions summary)

3.4 Basic operation by menu/key / Rotary knob

The following describes the basic operation for general measurement using this instrument.

The operation is roughly classified into operation mainly using menus displayed at the lower part of the screen and the compound operation with keys and the Rotary knob (switch).

- 3.4.1 Basic operation of menu
- 3.4.2 Operation by keys/Rotary knob (switch)

3.4.1 Basic operation of menu

The menu is basically used for measurement by functions and setting of each function. This section describes the basic operation of menu for each purpose.

3.4.1.1 Opening / closing menu

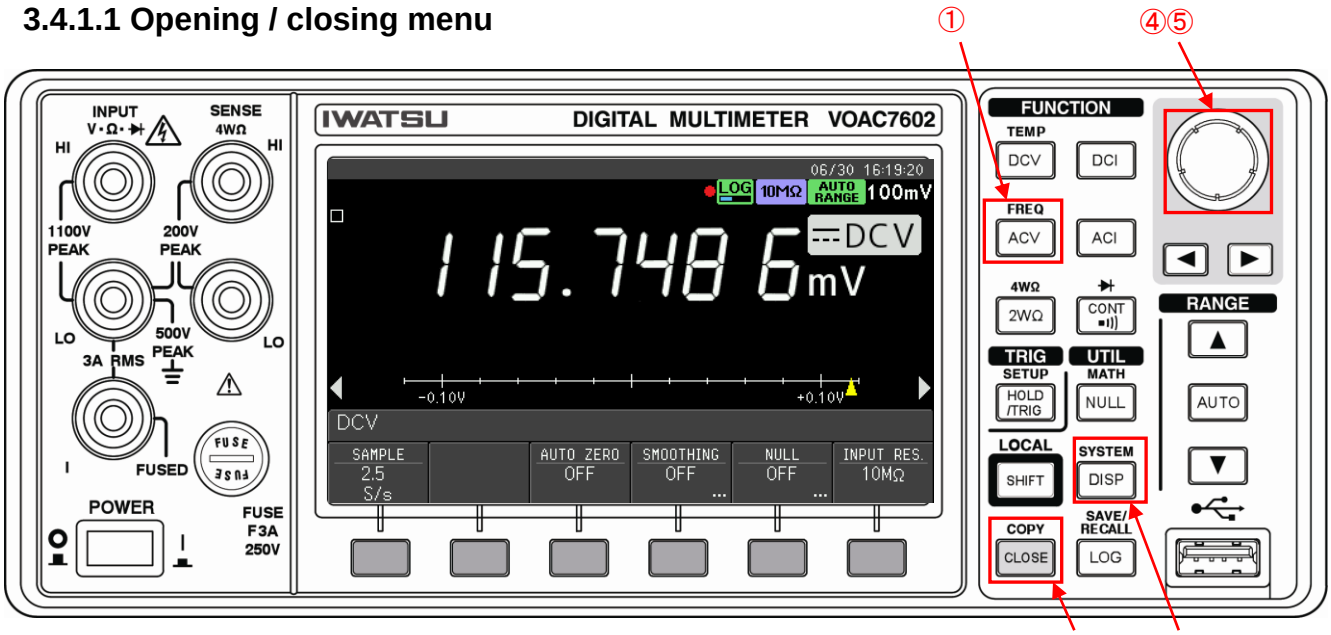


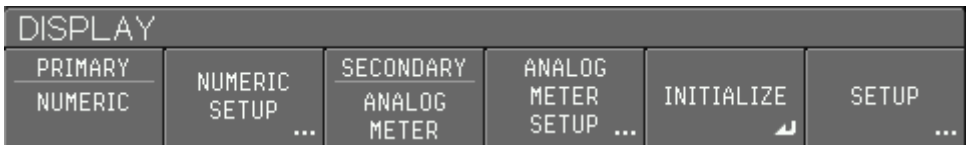
Figure 3.6 Example of screen display (VOAC7602)

Operation procedure 1. Open function or TRIG&UTILITY menu.

The following describes the operation procedure of the menu using the screen example of DCV measurement in Figure 3.6.

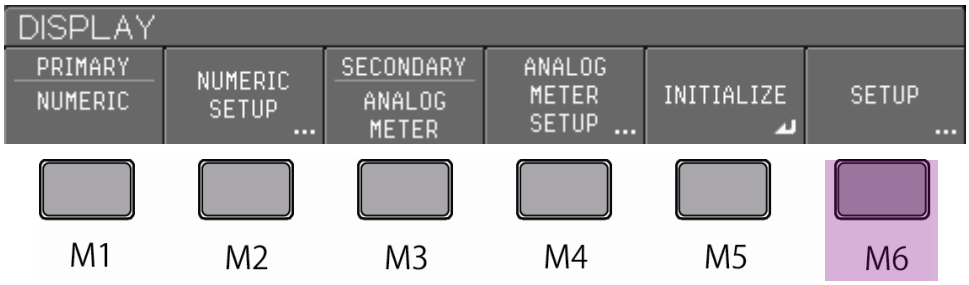
① Press [DCV] key in the red frame ①. DCV menu below opens.

② Press [DISP] key in the red frame of Figure 3.5 when ① is displayed. DISPLAY menu opens as shown below. (TRIG&UTILITY menu is in light gray.)



Operation procedure **2. Open submenu.**

③ Next, press M6 key in the DISPLAY menu below.

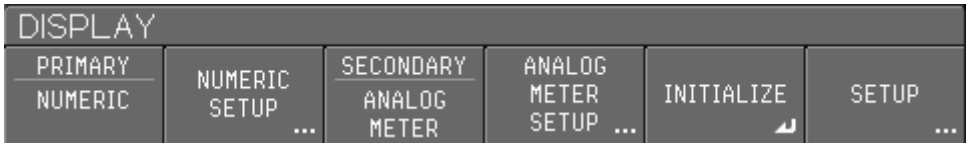


SETUP submenu opens as shown below.

Operation procedure **3. Close submenu.**

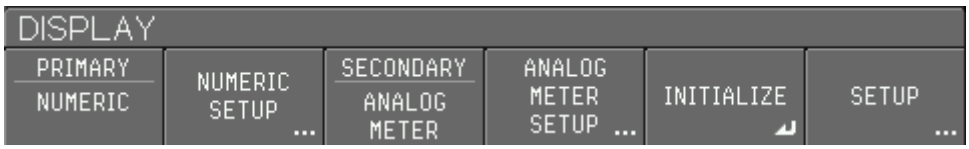
④ Press [CLOSE] key in the red frame on Figure 3.6 in DISPLAY/SETUP menu below.
Or, press the Rotary knob in Figure 3.6.

The screen returns to DISPLAY menu below.



Operation procedure **4. Close the function and TRIG&UTILITY menu.**

⑤ Next, press [CLOSE] key in the red frame on Figure 3.6 of the former page in DISPLAY menu below.
Or, press the Rotary knob in Figure 3.6.



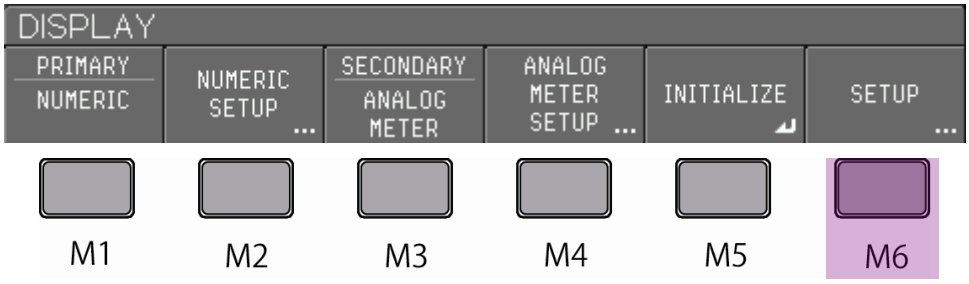
Return to DCV menu below.

3.4.1.2 Selecting item in the menu

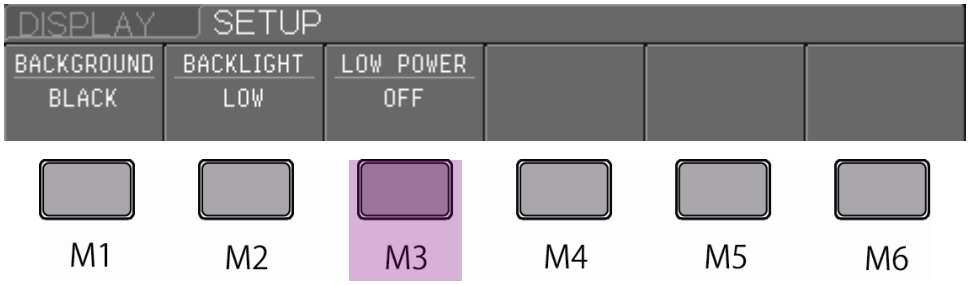
The example describes setting to DISPLAY/SETUP/LOW POWER: 10 minute.
In this setting, if nothing is done within 10 minutes after the last operation, the instrument enters LOW POWER mode and the backlight of the LCD screen turns OFF. Any operation in LOW POWER mode allows the screen to return to the normal screen. When the backlight turns OFF in LOW POWER mode, LED around the Rotary knob flashes slowly.

Operation procedure **1. Select item in the menu.**

① Press M6 key in DISPLAY menu below. SETUP menu in Figure ② opens.



② Press M3 key in SETUP submenu to select LOW POWER menu.
LOW POWER submenu of Figure ③ opens.



③ Press M4 key in LOW POWER to select 10 minute.

Setting is made to ISPLAY/SETUP/LOW POWER: 10 minute as shown below.

3.4.1.3 Numeric value setting by item in menu

The setting example of ACV/SMOOTHING/Length: 20 is shown below.

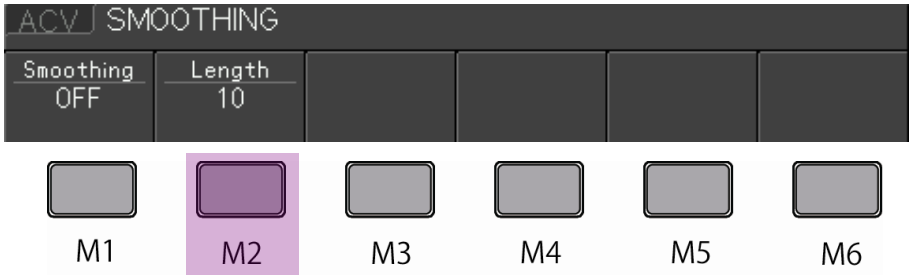
In the default setting, SMOOTHING is set to OFF for any function.

If setting to ON, the average number of times is 10 in default.

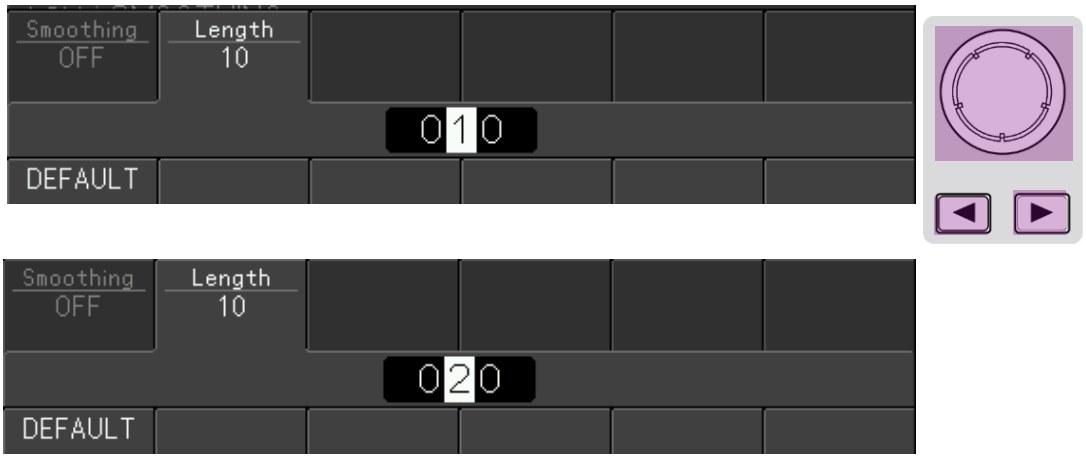
Operation procedure **1. Set the numeric value for the item in the menu. (The average number of times is changed from 10 to 20.)**

① Press M4 key in ACV menu below. SMOOTHING submenu in below ② opens.

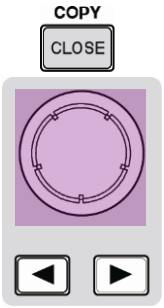
② Press M2 in SMOOTHING submenu to select Length (average number of times) submenu.



③ Length submenu opens. Using the Rotary knob and the left/right arrow keys, setting is made to 20.

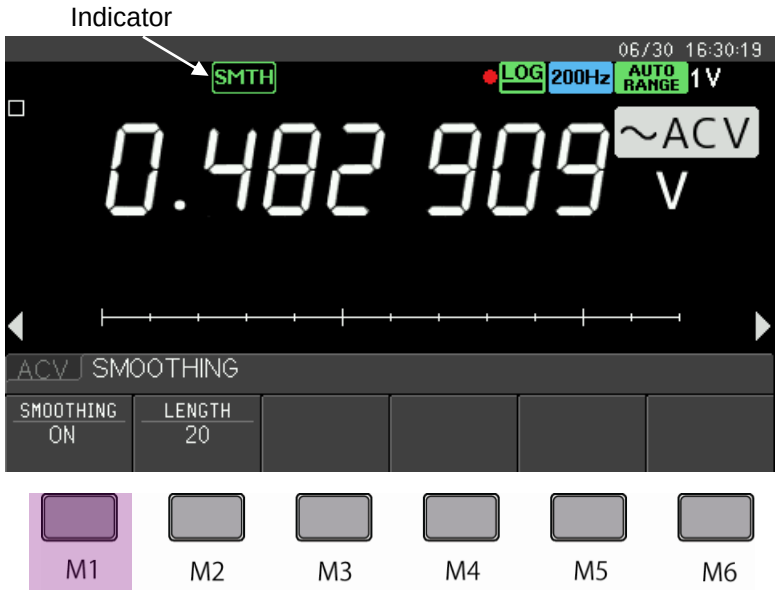


④ Press [CLOSE] key or the Rotary knob (switch) to return to SMOOTHING menu below.



⑤ Press M1 key to turn SMOOTHING (moving average) ON.

SMOOTHING indicator appears at the top of the screen below.



If the preset samples are acquired, the indicator changes to the mark below.

3.4.1.4 Setting name to the item in the menu

When saving the setting condition or LOG data in the external memory (e.g. USB memory), it is necessary to edit the directory.

This instrument has the default settings (predetermined names) for the directory (folder name) and file name and therefore, whenever only the file name is preserved, serial number automatically is updated.

Ex. SETUP SAVE RECALL/SAVE menu

- DIRECTORY :SETUP
- FILENAME :STUP0000～

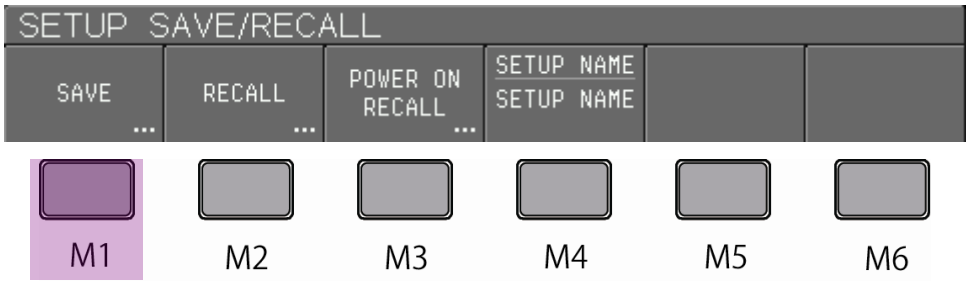
This instrument has the limitation for the character types and the number of characters of the directory (folder name) and file name but a preferred name can be set by operation in the menu. This section describes the example of name setting.

Operation procedure **1. Saving setting condition in USB memory**

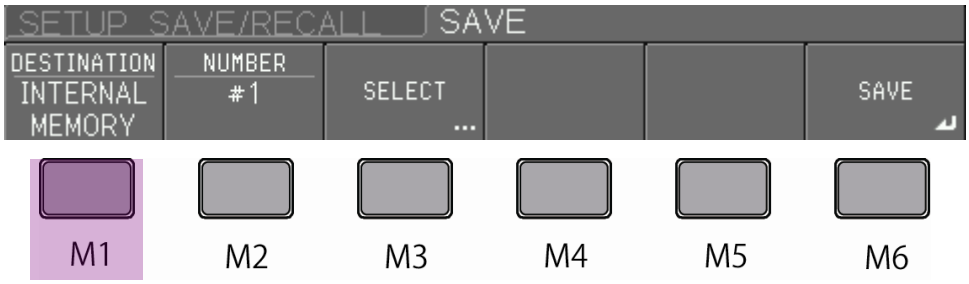
Ex. SETUP SAVE RECALL/SAVE menu

- DIRECTORY:SET_A
- FILENAME:SETA0000～

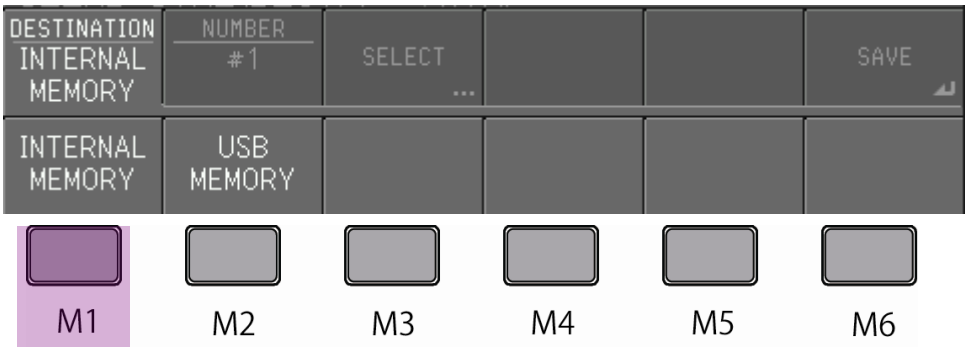
① Press [SHIFT]→ [LOG(SAVE/RECALL)] key. SETUP SAVE/RECALL menu below opens.



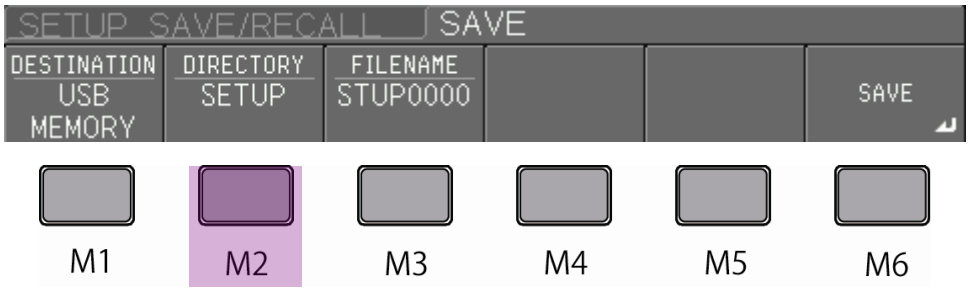
② Press M1 key in ① and select SAVE menu. SAVE menu below opens.



③ Press M1 key in ② and select DESTINATION menu. DESTINATION menu below opens.

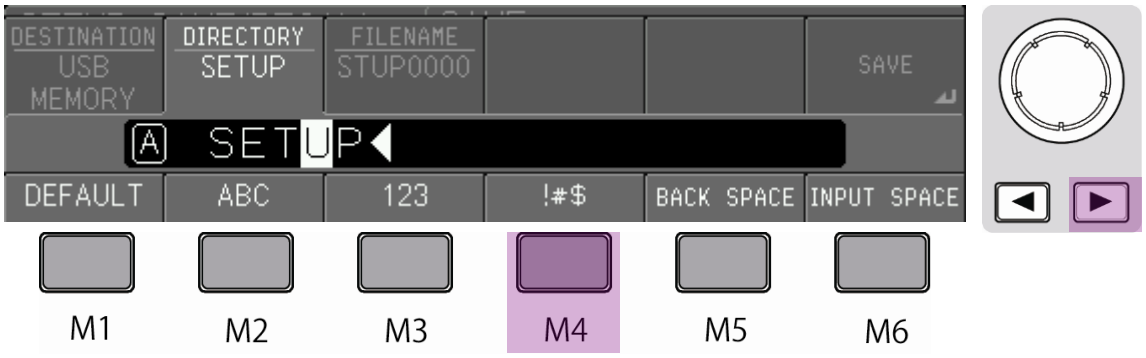


④ Press M1 key in ③ to select USB MEMORY for storage destination. The screen returns to SAVE menu below.

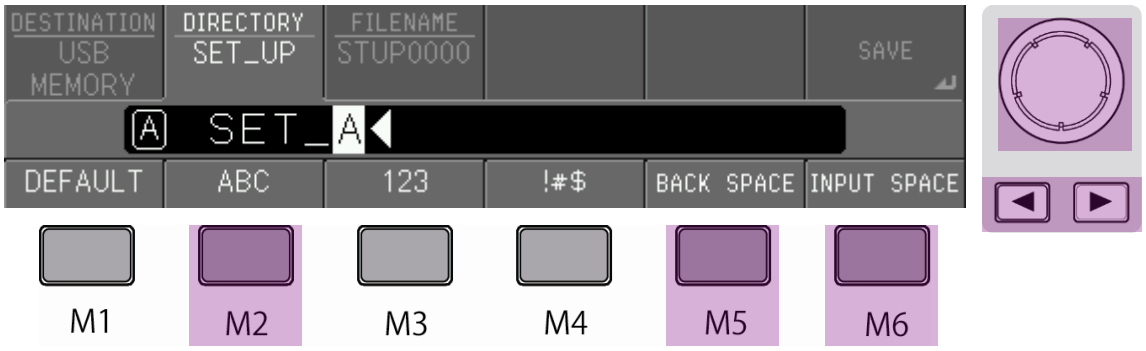


⑤ Press M2 key in ④ to select DIRECTORY(directory). DIRECTORY menu below opens.

⑥ Press the right arrow key below the Rotary knob to move the arrow to the character to be set. Press M4 key to select the symbol [!#$] below the menu.

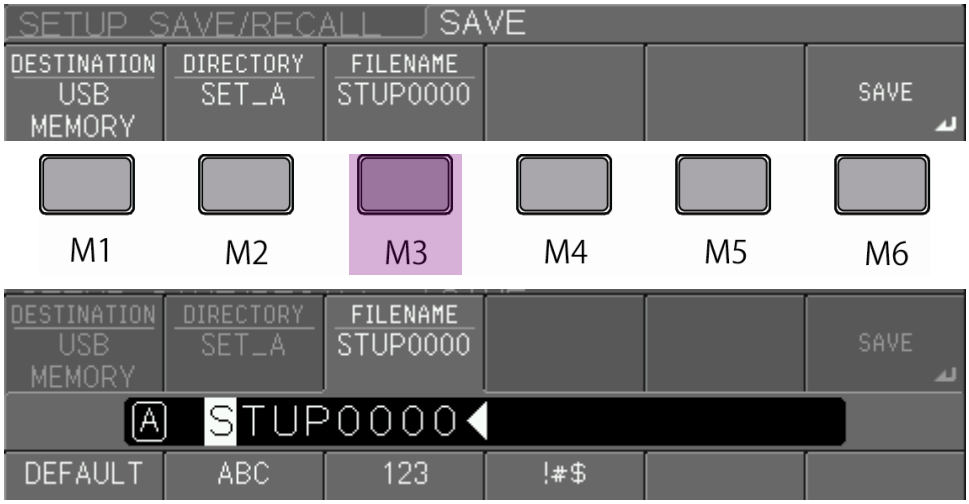


After that, use the Rotary knob, arrow keys, and menu keys to make edition as shown below.

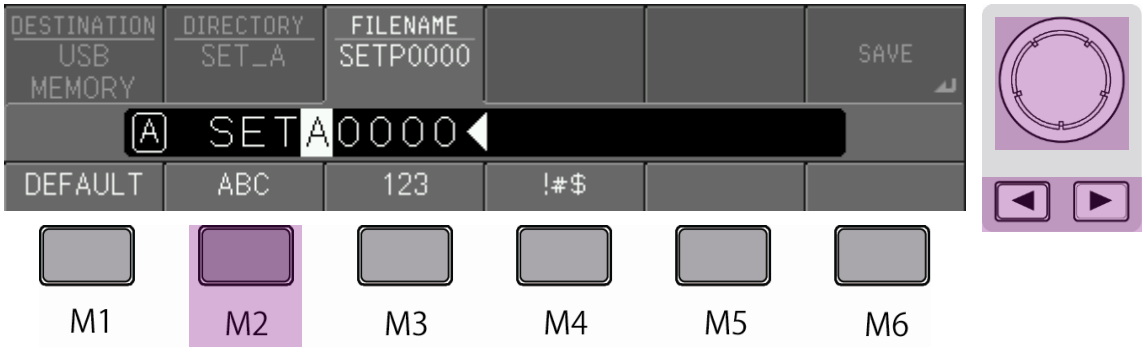


⑦ If edition is completed in ⑥, press [CLOSE] key. The edited directory name appears in DIRECTORY menu below.

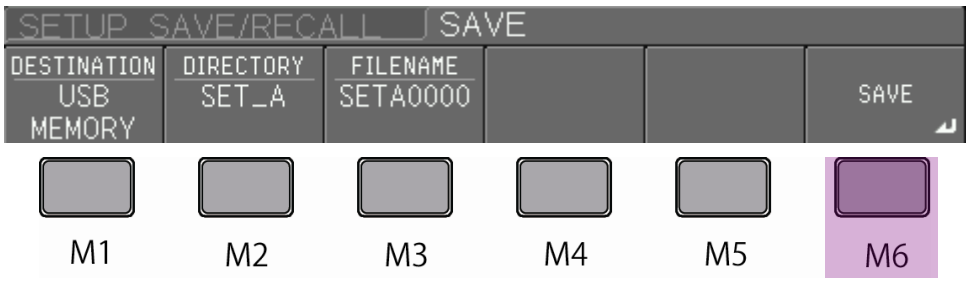
⑧ Press M3 key in the diagram below to open FILENAME menu below.



⑨ As described in ⑥, use the Rotary knob, arrow keys, and menu keys to make edition as shown below.



⑩ If edition is completed in ⑨, press [CLOSE] key. The screen returns to SAVE menu below.



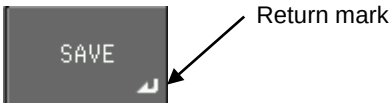
⑪ Press M6 key in ⑩ to save the setting condition with the edited directory and file name in the USB memory.

3.4.1.5 Executing setting item in the menu

The menu of each setting function in TRIG&UTILITY has several menu items which is executed by pressing the key.

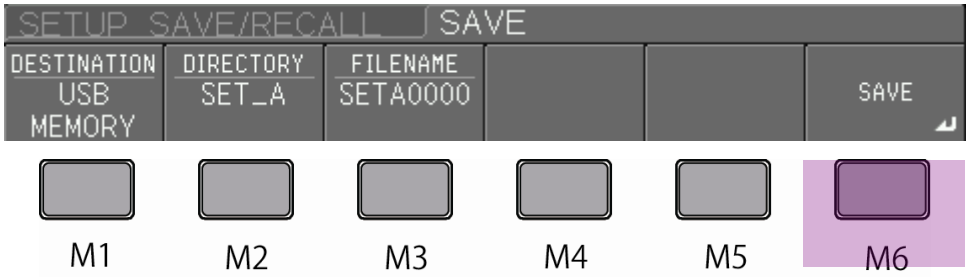
For SAVE menu and RECALL menu in Section 3.4.1.4, pressing of the menu key (M1 to M6) when the procedure is completed allows execution.

The return mark is always displayed as shown in the example of SAVE execution menu as the characteristics of menu display.

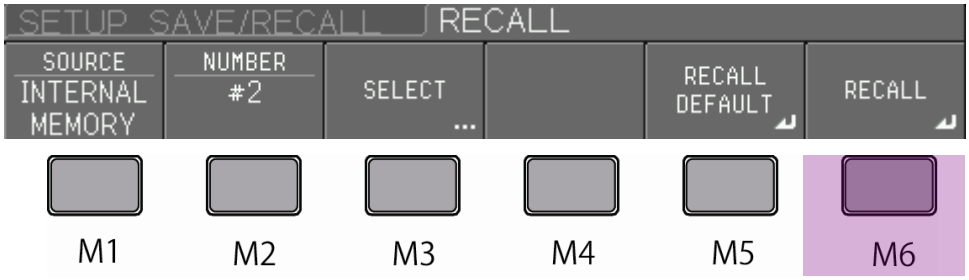


The following are the examples of the menu items to be executed.

Ex.1 SAVE execution menu



Ex.2 RECALL execution menu



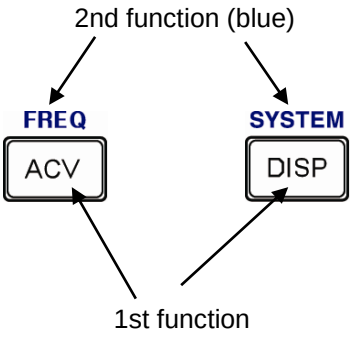
3.4.2 Operation by key / Rotary knob (switch)

The following describes the combined operation of keys and Rotary knob (switch) for each purpose which is already used in “3.4.1 Basic operation of menu” and partially described.

3.4.2.1 Switching 1st / 2nd functions

As “2.1.3 FUNCTION part” and “2.1.4 TRIG & UTILITY setting part” already describe operation of menu keys, the inner part and upper part on the function key on the right and setting key write 1st/2nd functions as shown below.

Ex. [ACV(FREQ)] key, [DISP(SYSTEM)] key



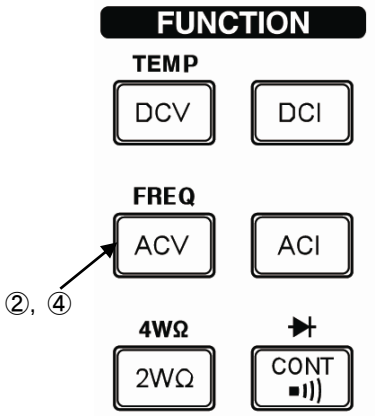


Figure 3.7 FUNCTION part

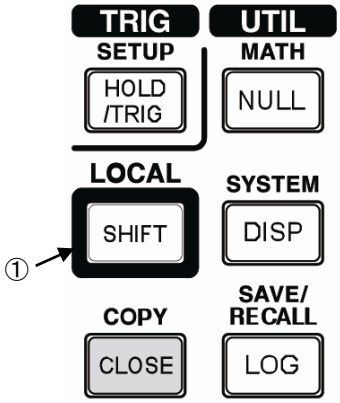
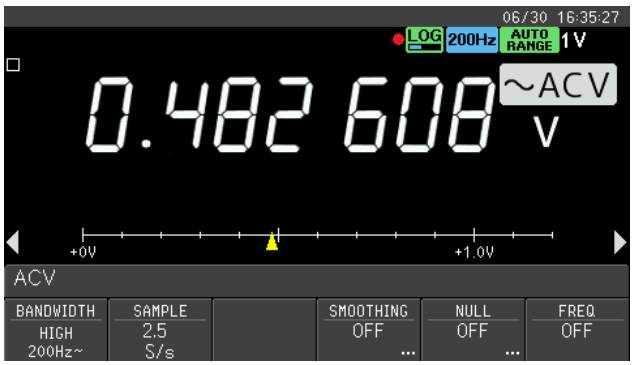


Figure 3.8 TRIG & UTILITY setting part

Operation procedure **Switching 1st function / 2nd function**

The example describes switching from AC voltage measurement (ACV) to the frequency measurement (FREQ) as shown in the example above.

① Press [SHIFT] key in Figure 3.8. The blue indicator SHIFT lights up on the upper right of the screen.
② Press [ACV(FREQ)] key in Figure 3.7.
③ The screen of AC voltage measurement (ACV) in Figure 3.9(a) changes to the screen of frequency measurement (FREQ) in Figure 3.9(b).
④ Press [ACV(FREQ)] to return to AC voltage measurement (ACV) screen.



① ②

④

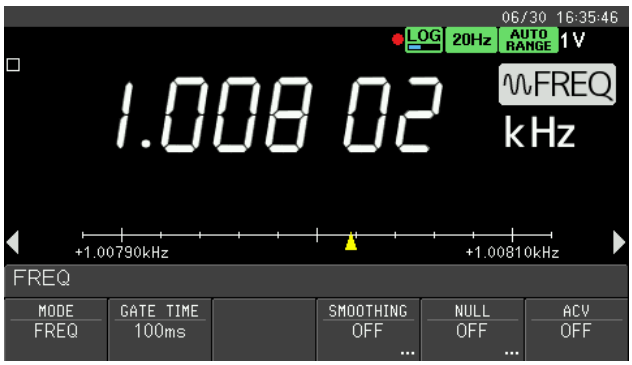


Figure 3.9(a) AC voltage measurement

Figure 3.9(b) Frequency measurement (FREQ) screen

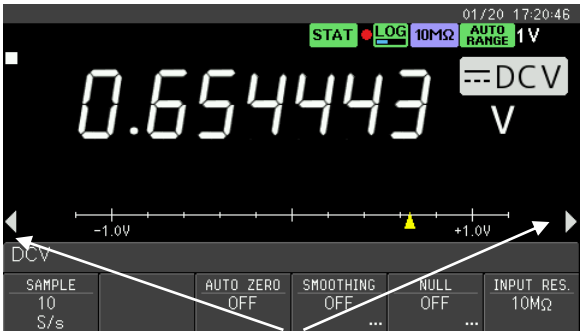
3.4.2.2 Switching primary display / secondary display

Section 2.3 describes the screen configuration of this instrument. The following describes switching between the primary display and secondary display.

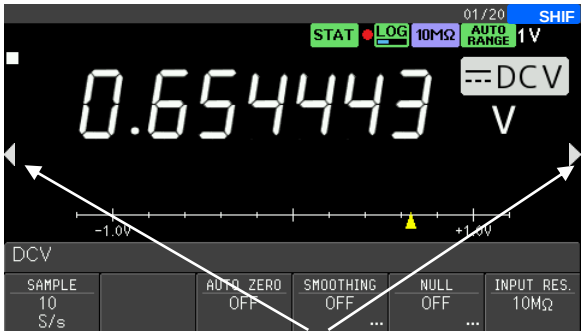
Operation procedure **1. Switching primary display**

The example describes switching of NUMERIC display ⇒ trend chart display ⇒histogram display in the DCV function.

① Press [SHIFT] key in the left state in the diagrams below. As shown in the right state in the diagrams below, SHIFT indicator (blue) is displayed at the top of the screen and the cursor marker moves to the primary display on the upper side.

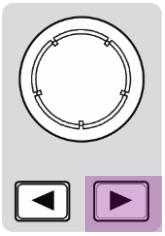


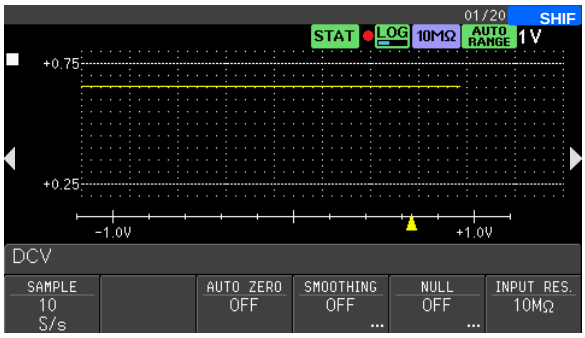
Cursor marker



Cursor marker

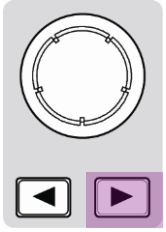
② Press the right arrow key below the Rotary knob once. As shown below, the primary display changes to the trend chart display.

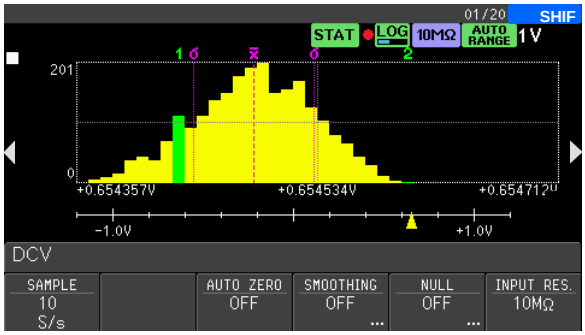




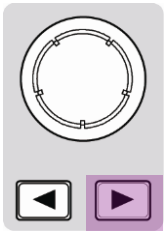
Memo!
Even if the left arrow key is pressed, display is changed in the different order (i.e. order of ①⇒③⇒②⇒①)

③ Press the right arrow key below the Rotary knob as described in ②.
The primary display changes to the histogram chart display.

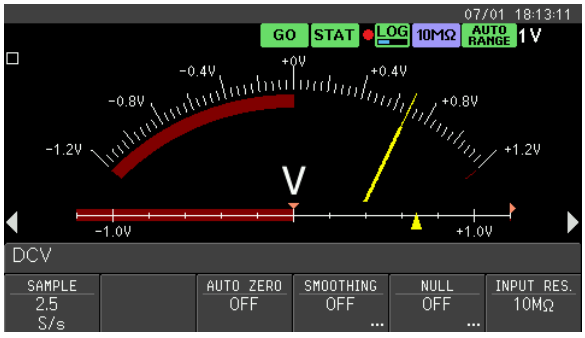




④ More similarly, a primary display sequentially cuts in LIMIT display ⇒ARC SCALE METER display as shown in the figure below, sequentially whenever you push the right arrow under rotary knob key once. It returns to the NUMERIC display when the right arrow key is pushed once at the ARC SCALE METER display.



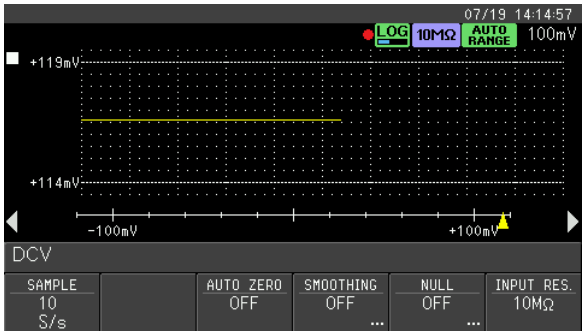
LIMIT display



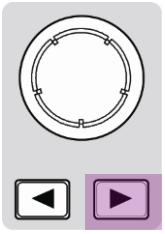
ARC SCALE METER display

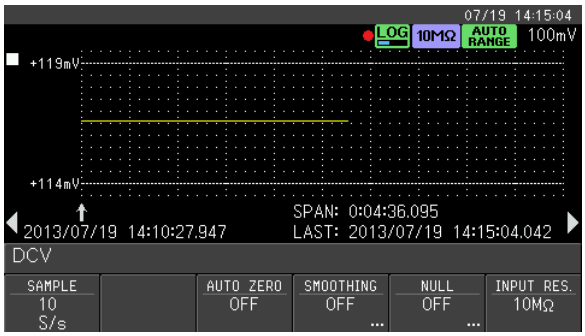
Operation procedure **2. Switching secondary display**

The example uses the case where the primary display shows the trend chart.



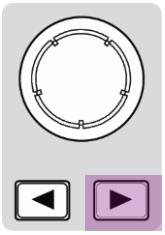
① Press the right arrow key below the Rotary knob once. As shown below, the secondary display changes from the analog meter to the time information of the trend chart.

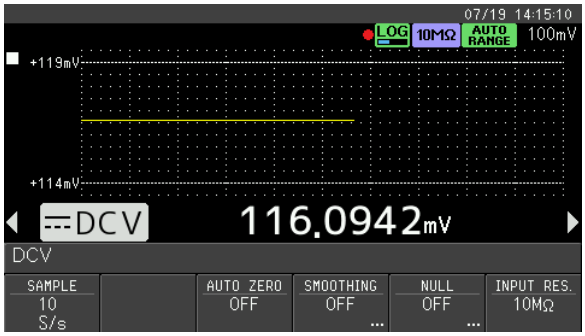




Memo!
If the left arrow key is pressed, display is changed to NUMERIC display of ② below.

② Press the right arrow key below the Rotary knob once.
The display changes from the time information of the trend chart to NUMERIC display.





After that, every time the right arrow key below the Rotary knob is pressed, the display changes in the order of NUMERIC ⇒ ANALOG METER ⇒ time information of trend chart.

123**4**56

Chapter 4 Measurement and function setting

This chapter describes each function and its settings.

4.1 Important notices before measurement

Warning ⚠

4.1.1 Cautions when connecting test lead

● **Failure to observe the following may result in electric shock or damage to this instrument or measured items.**

- Be sure to confirm that the input terminal connecting the function and the test lead is proper for measurement before measurement.
- Be sure to remove the test lead from the measured circuit before function switching.
- Never do enter the signal exceeding the maximum input voltage or current. Various warnings (see the table below) are displayed at the input terminals on the front panel as shown below:

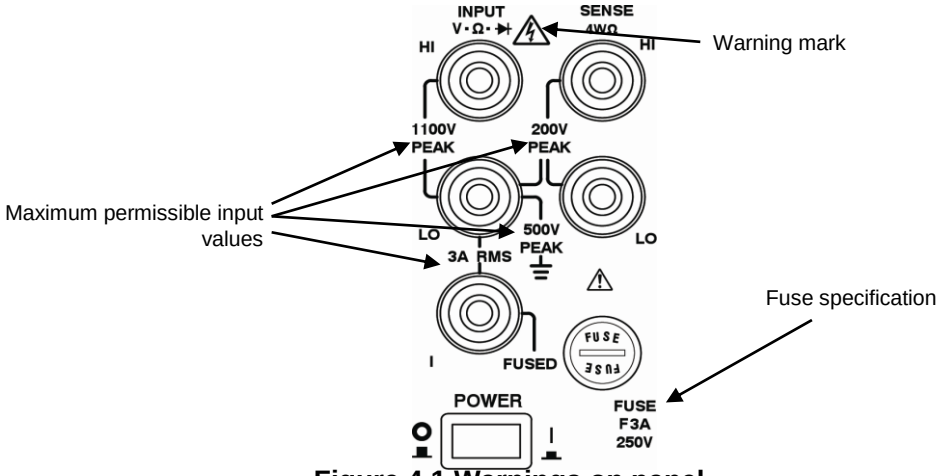


Figure 4.1 Warnings on panel

4.1.2 About input signals

● Do not apply a voltage or current exceeding the specification to the input terminal.
If not, fire or failures may occur. The table below shows the maximum permissible inputs.

Input terminal	Function Note 1	Max. permissible input
INPUT V・Ω・⊣| HI-LO	DCV (100mV ～ 100V range) 2WΩ、4WΩ、CONT、DIOD、TEMP Note 4	800 Vpeak (continuous), 1100 Vpeak (1 min.)
	DCV (1000V range)	1100 Vpeak (continuous)
	ACV、FREQ	750 Vrms and ± DC 500V or less Note 2
SENSE 4WΩ HI-LO	4WΩ、TEMP (RTD) Note 4	200 Vpeak
I-LO	DCI、ACI	3 A (DC or rms, continuous) (250V Note 3)

Note 1) Refer to the function of "section 4.3 Measurement function" for the name of the corresponding each function.
Note 2) As for the voltage that the alternating-current component is superimposed to the DC component, the maximum permissible input is 1100V in the Vpeak conversion.
Note 3) When the open circuit voltage of the instrument circuit exceeds 250V, the electric current cannot be measured.
Note 4) VOAC7502 does not support temperature measurement (TEMP).

Caution!

- All ranges are common to the I-LO input, and the maximum permissible input is continuous 3ADC or 3Arms continuous (Protect it with 3A fuse). Do not input an excessive electric current. (See section 6.2.3 for the detailed specification.)
- If the protection fuse (3 A) for the current measurement terminal of this instrument is blown, the current on the measured circuit which makes the voltage exceeding 250 V between measured terminals cannot be measured. It may result in a failure.

4.2 Before starting measurement

Processes from measurement preparation up to completion differ when using this instrument for measurement depending on user conditions. This section describes the example of the measurement process for each user status.

◆ **For user who has used this instrument for measurement and wants to use the previous settings for measurement**

- ○ Installation of this instrument and confirmation of power supply cord connection (see section 3.1 and 3.2)
  If installation and connection are already done, proceed to the next.
- ○ Powering on (see section 3.2)
  It is convenient to have made setting below with SETUP SAVE/RECALL menu.
  • POWER ON RECALL: LAST
  This instrument starts with the settings at last powering-off. **For setting method, see section 3.3.2.**

◆ **For user who uses this instrument and wants to make measurement with various setting conditions changed**

- ○ Installation of this instrument and confirmation of power supply cord connection (see section 3.1 and 3.2)
  If installation and connection are already done, proceed to the next.
- ○ Powering on (see section 3.2)
  It is convenient to have made setting below with SETUP SAVE/RECALL menu.
  • POWER ON RECALL: RECALL
  This instrument start with the settings saved in the internal memory.
  For saving/calling setting conditions, see section 4.7.
- ○ Changing setting conditions
  SETUP SAVE/RECALL/RECALL menu is used to call and change the setting conditions.
  For calling setting conditions, see section 4.7.

Caution!

Since connection to the input terminal of this instrument may differ depending on functions, enough care should be taken. If connection method is different, use the procedure below:

- Disconnect connection of the measurement signal.
  Remove the test lead, probe, cable, and others from this instrument.
- Use SETUP SAVE/RECALL menu to call setting condition of the next function.
- Connect the measurement signal of the next function to the proper location.
  For connection method of each function, see Section 4.3.1 to 4.3.10.

◆ **For beginner who uses this instrument for measurement**

It is recommended that each function in section 4.3 is prepared and measurement is done by referring to the measurement flow below. The diagram below is the flow which does not specify a particular function

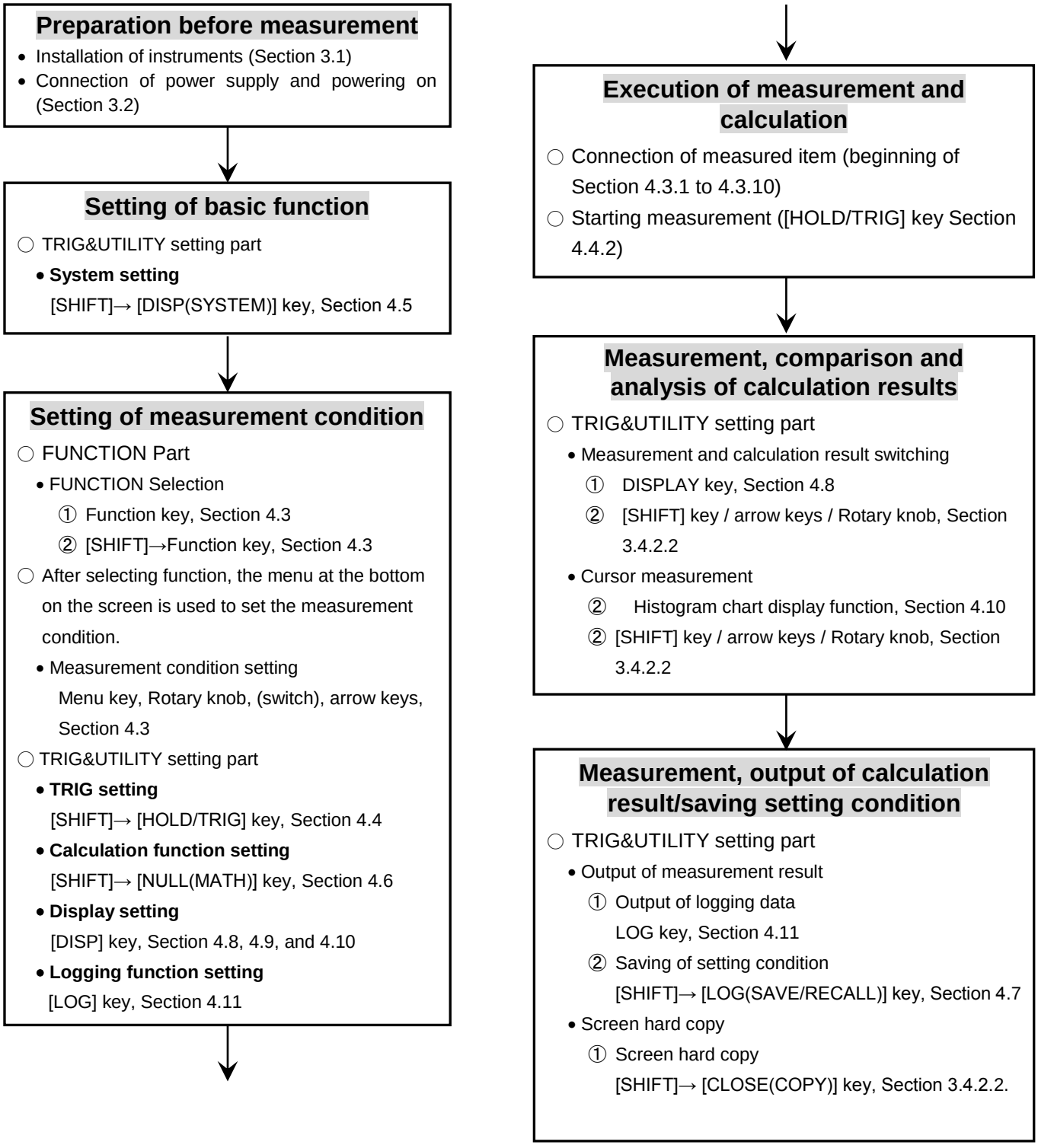


Figure 4.2 Measurement flow

4.3 Measurement function

This section describes 10 functions in FUNCTION part.

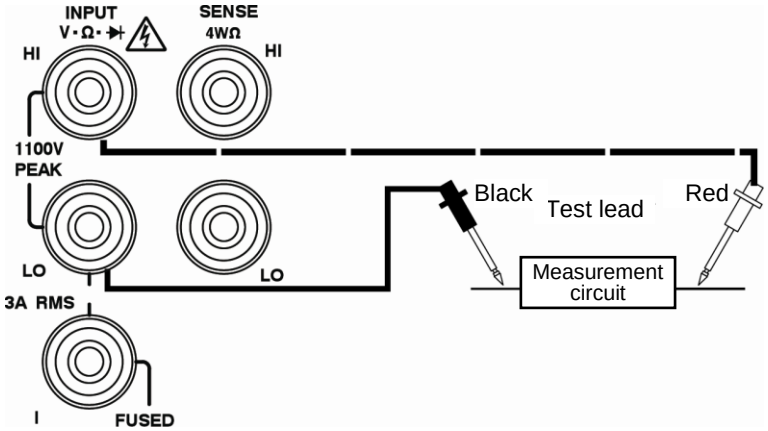
4.3.1 DC voltage measurement (DCV)

DC voltage measurement includes 5 ranges from 100 mV to 1000 V.

(For detailed specification, see section 6.2.1 for VOAC7602, and section 6.3.1 for VOAC7502.)

Connection· method

Caution! See “4.1.1 Cautions when connecting test lead.”



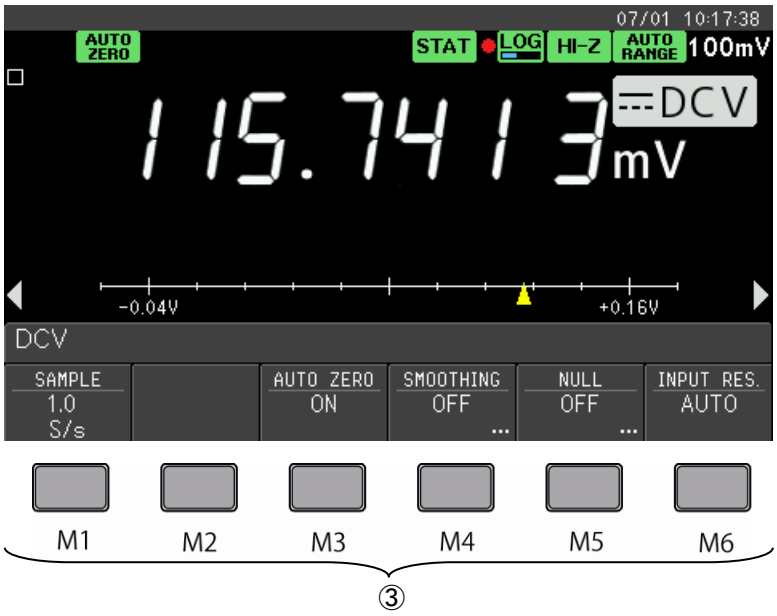
- Connect the black side of the test lead to INPUT V·Ω·⊣◀ LO terminal and the measured circuit.
- Connect the red side of the test lead to INPUT V·Ω·⊣◀ HI terminal and the measured circuit.

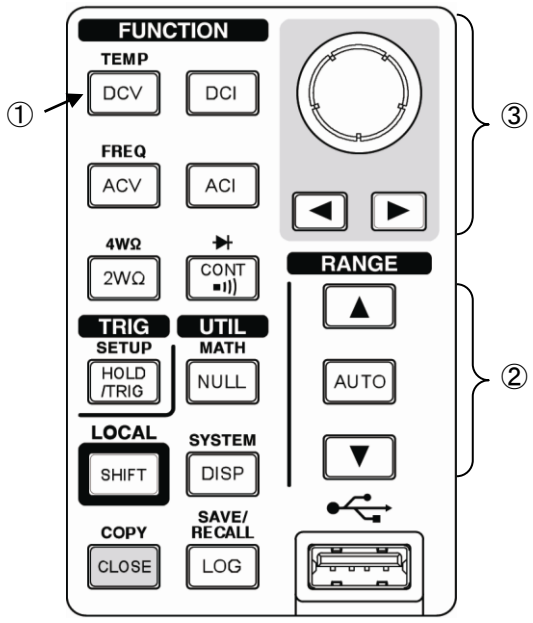
Operation·procedure

① Press [DCV] key and specify DCV measurement.

② Select the suitable range by pressing [AUTO] key or the Up/ down key in the manual operation.

③ DCV measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the DCV menu, see “◆ **DCV menu items and settings**” on the next page.





◆DCV menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency and ON/OFF setting of AUTOZERO. For details, see ◆ **SAMPLE (sampling rate)** on the next page.		**Setting is done by selection method of 5 sampling rate.**	6.2.1 6.3.1
	• **DEFAULT**	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	—
	• **20PLC（24PLC）**	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• **5PLC（6PLC）**	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• **1PLC**	• 1PLC (at 50 or 60Hz) is set.	
	* **Numeric selection**	* The described sampling rate can be selected in the table of SAMPLE by rotating the Rotary knob.	
AUTOZERO		**3 settings below are selected:**	7.3
	• **OFF**	• AutoZero is executed once when switching the function and that value is applied to the subsequent measurement.	—
	• **ONCE**	• AutoZero is executed once when pressing ONCE key and that value is applied to the subsequent measurement. As a setting value of AUTO ZERO, OFF is displayed.	
	• **ON**	• Every time measurement is done, automatic zero setting is done.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• **SMOOTHING**	• OFF The average processing is not executed.	—
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• **LENGTH**	• DEFAULT Average number of times is set to 10.	
		* Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done for each function.**	4.6.2
	• **NULL**	• OFF The difference calculation processing is not executed.	—
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• **NULL VAL**	• DEFAULT The default of the NULL value (i.e. +0.000000 V) is used.	
		• GET VAL The current measured value (RAW) is set as NULL value.	
		• + / − The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 to 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		* Numeric selection NULL value is set by arrow keys and the Rotary knob.	
INPUT RES.		**The input impedance of the input terminal is selected and set.**	6.2.1 6.3.1
	• **10MΩ**	• The input impedance is fixed to 10MΩ.	—
	• **AUTO**	• HI-Z is set as an input impedance for a possible measurement range of HI-Z (10V or less). Besides, 10MΩ are set.	

◆SAMPLE (sampling rate)

In the sampling rates lower than 100 S/s, selections of SAMPLE change depending on the power supply frequency and ON/OFF of AUTO ZERO as shown in the table below.

In the sampling rates of 100 S/s or higher, selections of SAMPLE do not change depending on ON/OFF of AUTO ZERO as shown in the table below but the PLC conversion value changes between 50Hz and 60Hz of the power supply frequency. If Auto Zero is set to ON/OFF in the sampling rates of 100 S/s or higher, the same action is executed as AUTO ZERO is set to ONCE; i.e. Auto Zero is executed once and that value is applied to the subsequent measurement. (For details of AUTO ZERO function, see section 7.3.)

50Hz		60Hz		Displayed number of digits	Remarks
SAMPLE (S/s, sampling rate*1) Screen display	PLC conversion value*2	SAMPLE (S/s, sampling rate*1) Screen display	PLC conversion value*2		
2.5(1)	20	2.5(1)	24	6 and 1/2 digits for VOAC7602 5 and 1/2 digits for VOAC7502	( ) shows values for AUTOZERO ON or 4WΩ.
10(4)	5	10(4)	6		
50(20)	1	60(20)	1		
100	0.5	100	0.6	5 and 1/2 digits for VOAC7602 4 and 1/2 digits for VOAC7502	SAMPLE on the left is displayed as the selection regardless of ON/OFF setting of AUTOZERO (except for 4WΩ).
500	0.1	500	0.12		
1k	0.05	1k	0.06		
2k	25m	2k	0.03		
7.5k	6.67m	7.5k	8m		
15k	3.33m	15k	4m		
30k	1.67m	30k	2m		

*1. It is not guaranteed to take data without coming off at a set cycle of the sampling rate at the time of measure usually. Set MODE of the log function to BULK to acquire the continuous data that doesn't come off and take it. (Refer to section 4.11.2.)

*2. PLC conversion value: Value corresponding to sampling cycle/power supply cycle

Memo!

◇ If INPUT RES. (input impedance) is AUTO and if “Free Run” is set when the input terminal is opened, the measurement value may become larger gradually or “OVERLOAD” may be displayed. It is not a failure.

◇ For measurements for low level voltages, see Section 7.2.1“**◇ Measurement of low level voltage (100 mV range or less)**”in Chapter 7 Measurement Guideline at the end.

◇ Caution is required for measurement after high voltage (300Vrms or more) measurement of high current (1A or more) measurement. See **Section 7.1 “◇ Precaution on settling.”**

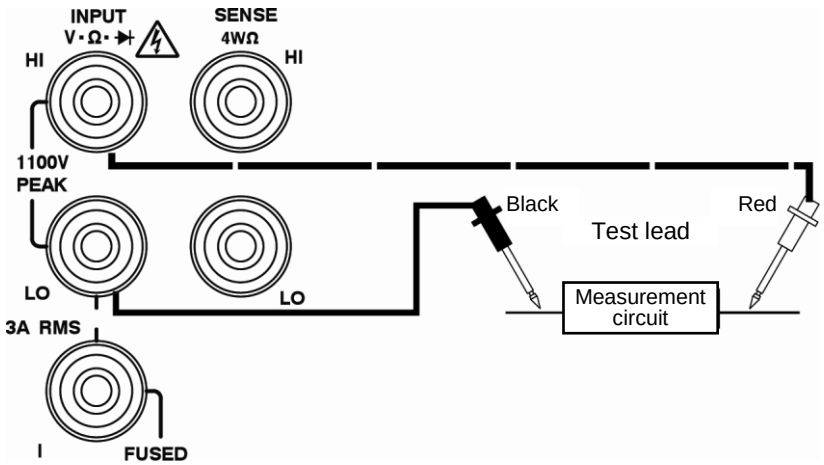
4.3.2 AC voltage measurement (ACV)

AC voltage measurement includes 5 ranges from 100 mV to 750 V.

This function allows TRUE RMS (true root mean squared value) to be used for measurement; i.e. true root mean squared value such as sine wave, triangle wave, SCR waveform, and square wave can be measured (For detailed specification, see section 6.2.2 for VOAC7602, and section 6.3.2 for VOAC7502.).

Connection· method

Caution! See "4.1.1 Cautions when connecting test lead."



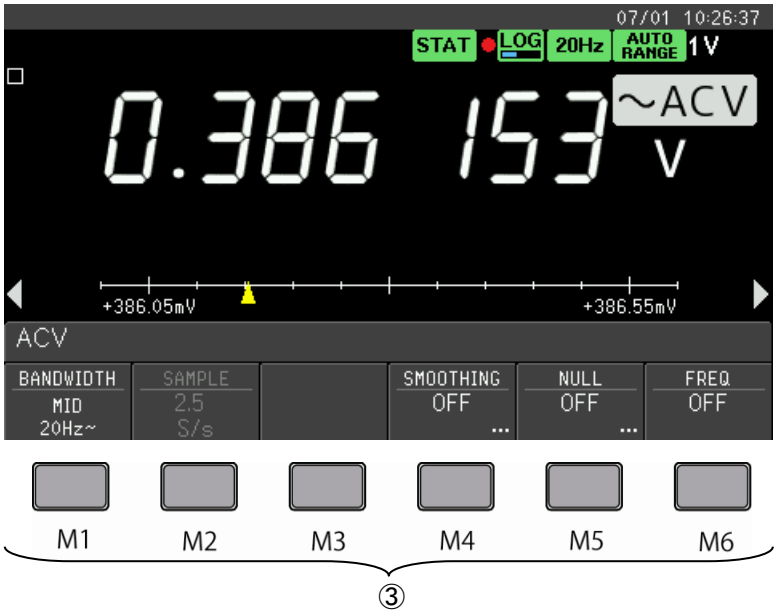
- Connect the black side of the test lead to INPUT V·Ω·⊣◀ LO terminal and the measured circuit.
- Connect the red side of the test lead to INPUT V·Ω·⊣◀ HI terminal and the measured circuit.

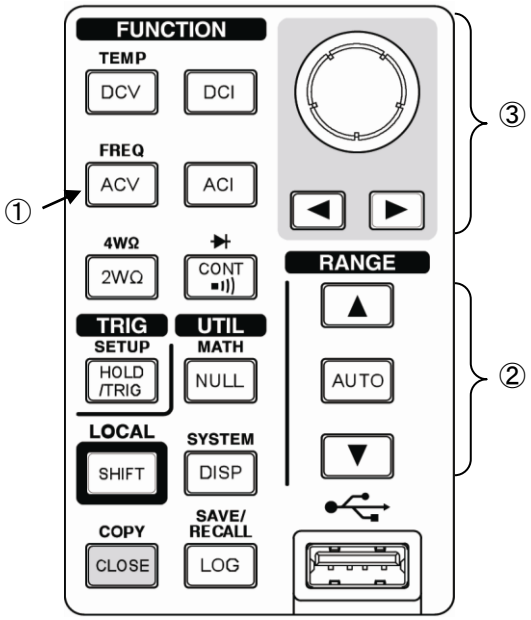
Operation·procedure

① Press [ACV] key and specify ACV measurement.

② Select the suitable range by pressing [AUTO] key or the Up/ down key in the manual operation.

③ ACV measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see "Section 3.4.1 Basic operation of menu." For settings of the ACV menu, see "◆ **ACV menu items and settings**"on the next page.





◆ **ACV menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
BANDWIDTH		**Two frequency ranges below are selected.**	6.2.2 6.3.2
	• **MID**	• 20 Hz-300 kHz (750V range: 20 Hz-100 kHz) for VOAC7602 20 Hz-100 kHz (All range) for VOAC7502	7.2.2
	• **HIGH**	• 200 Hz-300 kHz (750V range: 200 Hz-100 kHz) for VOAC7602 200 Hz-100 kHz (All range) for VOAC7502	
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency and ON/OFF setting of BANDWIDTH. For details, see ◆ **SAMPLE (sampling rate)** in next page.		**Setting is done by selection method of 5 sampling rate below.** **(The following set value is for BANDWIDTH:HIGH.)**	6.2.2 6.3.2
	• **DEFAULT**	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	–
	• **20PLC (24PLC)**	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• **5PLC (6PLC)**	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• **1PLC**	• 1PLC (at 50 or 60Hz) is set.	
	∗**Numeric selection**	∗ The described sampling rate can be selected in the table of ◆ SAMPLE in next page by rotating the Rotary knob.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• **SMOOTHING**	• OFF The average processing is not executed.	–
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• **LENGTH**	• DEFAULT Average number of times is set to 10.	
		∗ Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done for each function.**	4.6.2
	• **NULL**	• OFF The difference calculation processing is not executed.	–
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• **NULL VAL**	• DEFAULT: Adjust the NULL value to +0.000000 the V. Note) The default value is +0.00000 V for VOAC7502.	
		• GET VAL When the numerical value is set with the rotary knob and the arrow key, and the M2 key is pushed, measurements (RAW) are set as NULL value.	
		• + / − The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 t o 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		∗ Numeric setting Set the NULL value with the Rotary knob and arrow keys.	
FREQ		**Select and set on/off whether to display the frequency in the sub-measurement result by the measurement result of A CV measurement.**	2.3.3.1
	• **OFF**	• Do not display the frequency.	–
	• **ON**	• Display the frequency in the sub-measurement result.	

Memo! ◇ For measurements for low level frequency, see Section 7.2.2 "◇ **Voltage measurement/current measurement of low frequency**" in Chapter 7 Measurement Guideline at the end.
◇ Caution is required for measurement after high voltage (300Vrms or more) measurement of high current (1A or more) measurement. See Section 7.1 "◇ **Precaution on settling and large current.**"

◆ **SAMPLE (sampling rate)**

Power supply frequency	**50Hz**		**60Hz**	
BANDWIDTH setting	**HIGH**	**MID**	**HIGH**	**MID**
SAMPLE (sampling rate)	2.5 S/s(20PLC)	2.5 S/s (20PLC) fixed	2.5 S/s(24PLC)	2.5 S/s(24PLC) fixed
	10 S/s(5PLC)		10 S/s(6PLC)	
	50 S/s(1PLC)		60 S/s(1PLC)	

Fill the sampling rate in the table above with the following display digits.

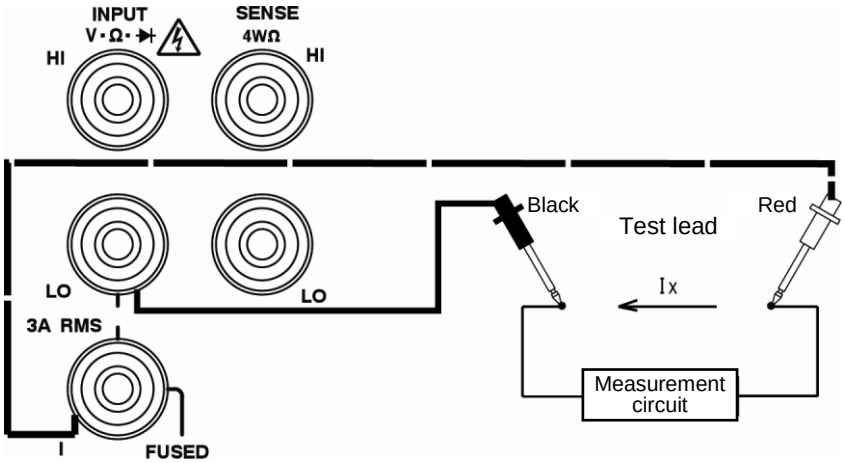
- Display digit of VOAC7602: 6 and 1/2 digits
- Display digit of VOAC7502: 5 and 1/2 digits

4.3.3 DC current measurement (DCI)

DC current measurement includes 5 ranges from 1 mA to 3A.
(For detailed specification, see section 6.2.3 for VOAC7602, and section 6.3.3 for VOAC7502.).

Connection· method

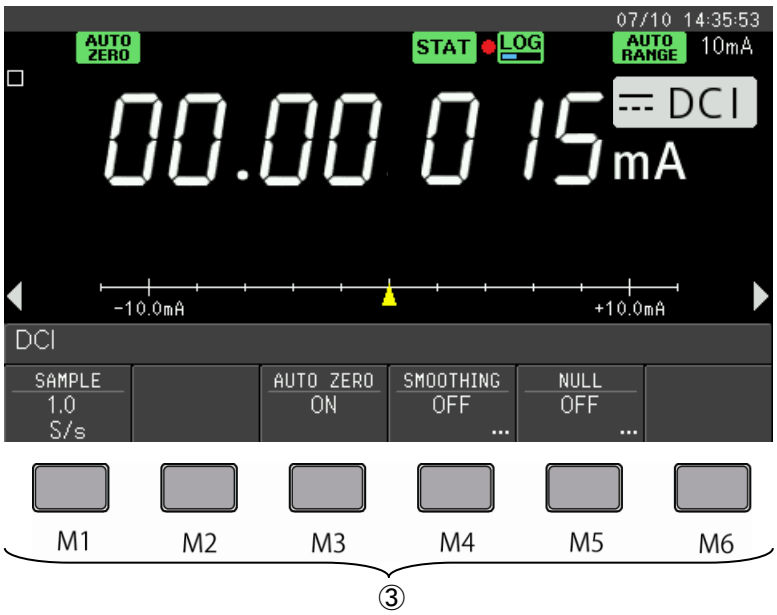
Caution! See “4.1.1 Cautions when connecting test lead.”

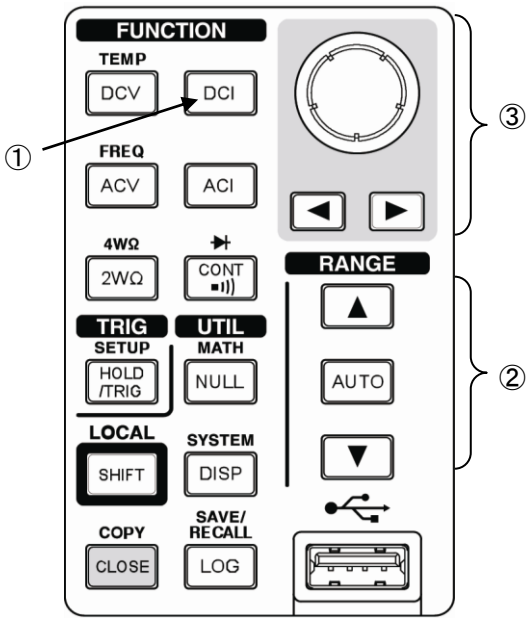


- Connect the black side of the test lead to LO terminal and the red side to 3A terminal.
- Disconnect the measured circuit and connect the tip of the test lead to the circuit in series.

Operation·procedure

① Press [DCI] key and specify DCI measurement.
② Select the suitable range by pressing [AUTO] key or the Up/ down key in the manual operation.
③ DCI measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the DCI menu, see “◆ **DCI menu items and settings**” on the next page.





◆ **DCI menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency and ON/OFF setting of AUTOZERO. For details, see ◆ **SAMPLE (sampling rate)** of section 4.3.1.		**Setting is done by selection method of 5 sampling rate below.**	6.2.3 6.3.3
	• DEFAULT	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	4.3.1
	• 20PLC（24PLC）	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• 5PLC（6PLC）	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• 1PLC	• 1PLC (at 50 or 60Hz) is set.	
	* Numeric selection	* The described sampling rate can be selected in the table of SAMPLE by rotating the Rotary knob.	
AUTOZERO		**3 settings below are selected:**	7.3
	• OFF	• AutoZero is executed once when switching the function and that value is applied to the subsequent measurement.	—
	• ONCE	• AutoZero is executed once when pressing ONCE key and that value is applied to the subsequent measurement. As a setting value of AUTO ZERO, OFF is displayed.	
	• ON	• Every time measurement is done, automatic zero setting is done.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• SMOOTHING	• OFF The average processing is not executed.	—
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• LENGTH	• DEFAULT Average number of times is set to 10.	
		* Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done for each function.**	4.6.2
	• NULL	• OFF The difference calculation processing is not executed.	—
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• NULL VAL	• DEFAULT The default of the NULL value (i.e. +0.000000 A) is used. Note) The default value is +0.00000 A for VOAC7502.	
		• GET VAL The current measurement value (RAW) is set to the NULL value.	
		• ＋ / － The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 to 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		* Numeric selection NULL value is set by arrow keys and the Rotary knob.	

Note!

◇ All ranges are common to the I-LO input, and the maximum permissible input is continuous 3ADC or 3Arms continuous (Protect it with 3A fuse). Do not input an excessive electric current. (For the detailed specification, refer to section 6.2.3 for VOAC7602, and section 6.3.3 for VOAC7502.)

◇ The circuit which generates the voltage exceeding 250V between the measurement terminals can not be measured if the protection fuse (3A) at the current measurement terminal of this instrument is blown. It may result in a failure.

Memo!

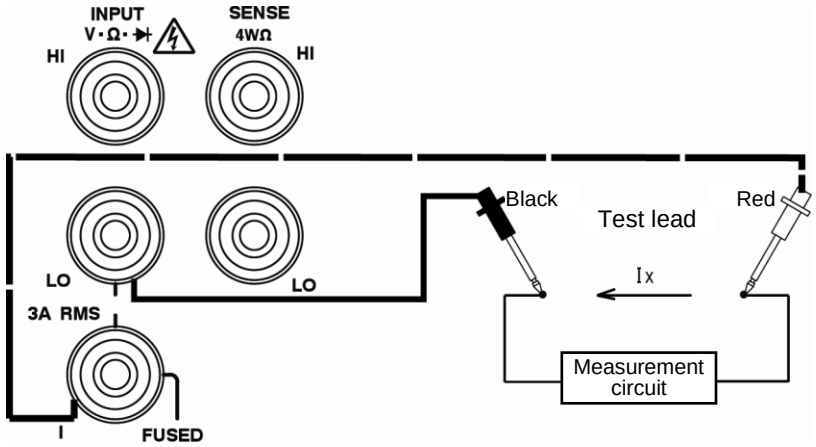
◇ Caution is required for measurement after high voltage (300Vrms or more) measurement of high current (1A or more) measurement. See Section 7.1 "**◇ Precaution on settling.**"

4.3.4 AC current measurement (ACI)

The AC current measurement includes 2 ranges; 1 A and 3 A. This function allows the analog calculation type TRUE RMS (true root mean squared value) to measure the AC current; i.e. true root mean squared value such as sine wave, triangle wave, SCR waveform, and square wave can be measured. (For detailed specification, see section 6.2.4 for VOAC7602, and section 6.3.4 for VOAC7502.)

Connection method

Caution! See "4.1.1 Cautions when connecting test lead."



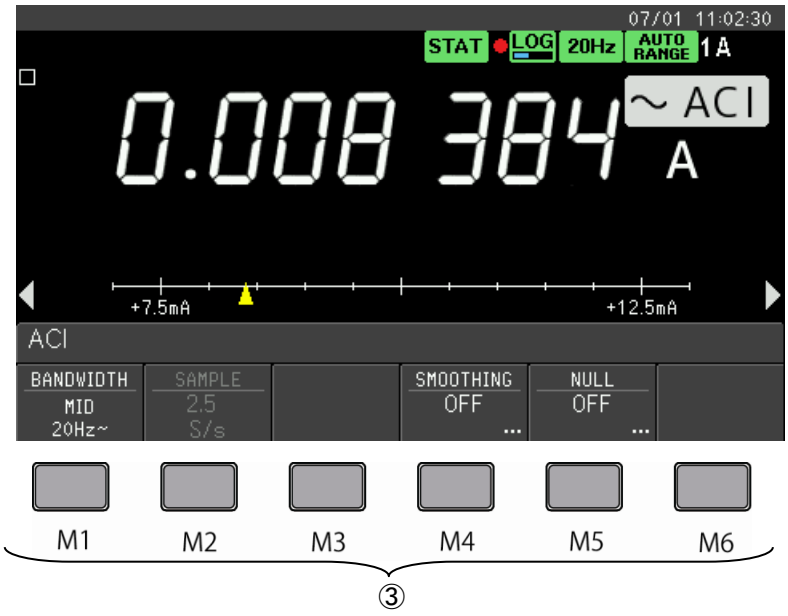
- Connect the black side of the test lead to LO terminal and the red side to 3A terminal.
- Disconnect the measured circuit and connect the tip of the test lead to the circuit in series.

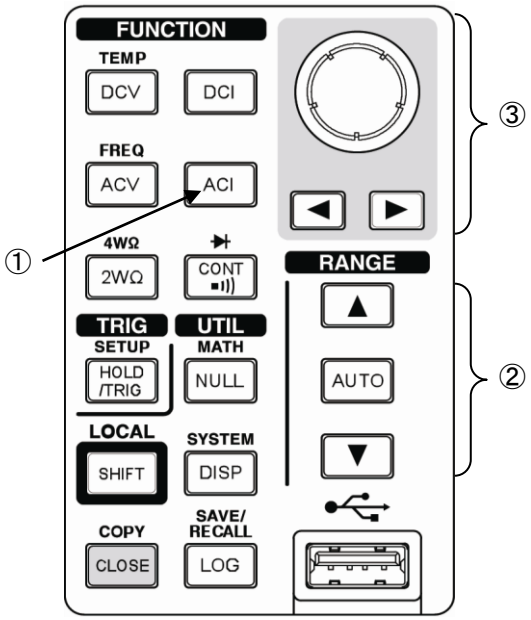
Operation procedure

① Press [ACI] key and specify ACI measurement.

② Select the suitable range by pressing [AUTO] key or the Up/ down key in the manual operation.

③ ACI measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see "Section 3.4.1 Basic operation of menu." For settings of the ACI menu, see "◆ **ACI menu items and settings**" on the next page.





◆ **ACI menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
BANDWIDTH		**Select either of two frequency actions below.**	6.2.4 6.3.4
	• MID	• 20 Hz to 5 kHz	7.2.2
	• HIGH	• 200 Hz to 5 kHz	
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency and setting of BANDWIDTH. For details, see ◆ **SAMPLE (sampling rate)** of section 4.3.2.		**Setting is done by selection method of 5 sampling rate below.** (**The following set value is for BANDWIDTH:HIGH.)**	6.2.4 6.3.4
	• DEFAULT	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	4.3.2
	• 20PLC（24PLC）	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• 5PLC（6PLC）	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• 1PLC	• 1PLC (at 50 or 60Hz) is set.	
	* Numeric selection	* The described sampling rate can be selected in the table of SAMPLE by rotating the Rotary knob.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• SMOOTHING	• OFF The average processing is not executed.	—
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• LENGTH	• DEFAULT Average number of times is set to 10.	
		* Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done for each function.**	4.6.2
	• NULL	• OFF The difference calculation processing is not executed.	—
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• NULL VAL	• DEFAULT The default of the NULL value (i.e. +0.000000 A) is set. Note) The default value is +0.00000 A for VOAC7502.	
		• GETVAL The current measurement value (RAW) is set to the NULL value.	
		• + / − The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 to 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		* Numeric selection NULL value is set by arrow keys and the Rotary knob.	

Note !

◇ All ranges are common to the I-LO input, and the maximum permissible input is continuous 3ADC or 3Arms continuous (Protect it with 3A fuse). Do not input an excessive electric current. (For the detailed specification, refer to section 6.2.4 for VOAC7602, and section 6.3.4 for VOAC7502.)

◇ The circuit which generates the voltage exceeding 250V between the measurement terminals can not be measured if the protection fuse (3A) at the current measurement terminal of this instrument is blown. It may result in a failure.

Memo !

◇ For measurements for low frequencies, see Section 7.2.2 "**◇Voltage measurement/current measurement of low frequency"** in Chapter 7 Measurement Guideline at the end.

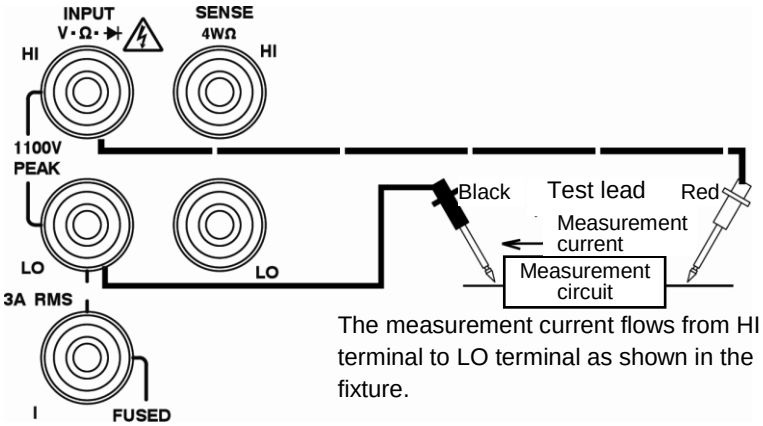
◇ Caution is required for measurement after high voltage (300Vrms or more) measurement of high current (1A or more) measurement. See Section 7.1 "**◇ Precaution on settling."**

4.3.5 2-terminal resistance measurement (2WΩ)

This function measures the resistance using two test leads. The 2-terminal resistance measurement includes 7 ranges from 100Ω to 100MΩ. The measurement value includes an error between the resistance of the test lead itself and the contact resistance. The error can be canceled when making measurement by shorting the tip of the test lead in advance and turning on the NULL calculation. (See section 4.6.2. The NULL value is obtained by GET VAL when shorting.)
(For detailed specification, see section 6.2.5 for VOAC7602, and section 6.3.5 for VOAC7502.)

Connection method

Caution! See "4.1.1 Cautions when connecting test lead."

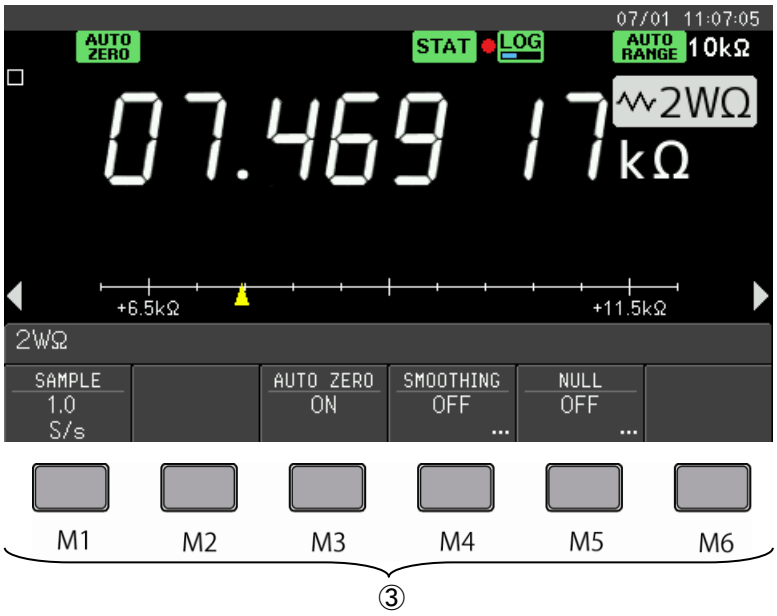


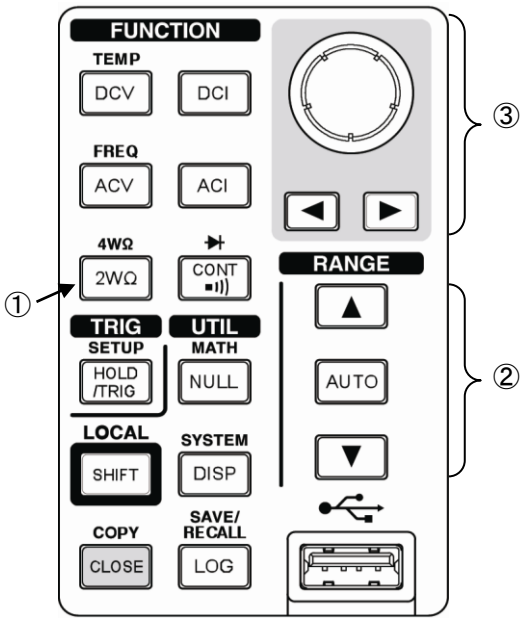
The measurement current flows from HI terminal to LO terminal as shown in the fixture.

- Connect the black side of the test lead to INPUT V·Ω·⊣◀ LO terminal and the measured resistance.
- Connect the red side of the test lead to INPUT V·Ω·⊣◀ LO terminal and the measured resistance.

Operation procedure

① Press [2WΩ] key and specify 2WΩ measurement.
② Select the suitable range by pressing [AUTO] key or the Up/ down key in the manual operation.
③ 2WΩ measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen (outside). For the operation, see "Section 3.4.1 Basic operation of menu." For settings of the 2WΩ menu, see "◆ 2WΩ **menu items and settings**" on the next page.





◆ 2WΩ menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency and ON/OFF setting of AUTOZERO. For details, see ◆ **SAMPLE (sampling rate)** of 4.3.1.		**Setting is done by selection method of 5 sampling rate below.**	6.2.5 6.3.5
	• DEFAULT	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	4.3.1
	• 20PLC（24PLC）	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• 5PLC（6PLC）	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• 1PLC	• 1PLC (at 50 or 60Hz) is set.	
	* Numeric selection	* The described sampling rate can be selected in the table of SAMPLE by rotating the Rotary knob.	
AUTOZERO		**3 settings below are selected:**	7.3
	• OFF	• AutoZero is executed once when switching the function and that value is applied to the subsequent measurement.	—
	• ONCE	• AutoZero is executed once when pressing ONCE key and that value is applied to the subsequent measurement. As a setting value of AUTO ZERO, OFF is displayed.	
	• ON	• Every time measurement is done, automatic zero setting is done.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• SMOOTHING	• OFF The average processing is not executed.	—
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• LENGTH	• DEFAULT Average number of times is set to 10.	
		* Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done for each function.**	4.6.2
	• NULL	• OFF The difference calculation processing is not executed.	—
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• NULL VAL	• DEFAULT The default of the NULL value (i.e. +0.000000 Ω) is set. Note) The default value is +0.00000 Ω for VOAC7502.	
		• GET VAL The current measurement value (RAW) is set to the NULL value.	
		• ＋ / － The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 t o 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		* Numeric selection NULL value is set by arrow keys and the Rotary knob.	

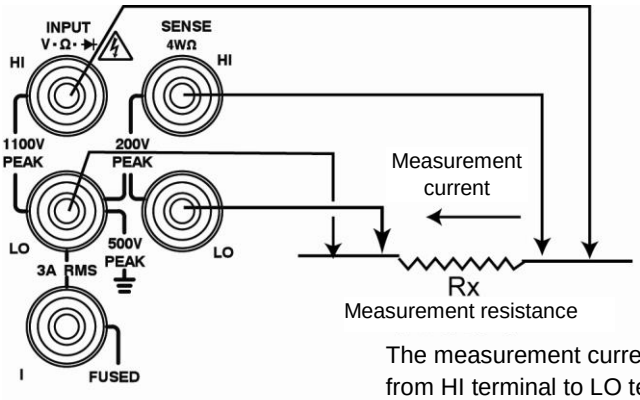
Memo!
◇ For measurement of high and low resistance, see **Section 7.2.3 "◇ High resistance measurement" and "◇ Low resistance measurement. "**

4.3.6 4-terminal resistance measurement (4WΩ)

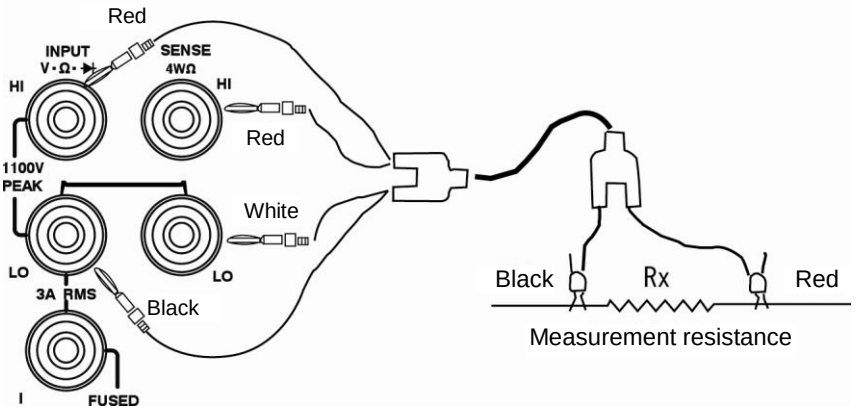
This function measures the resistance using four test leads. The 4-terminal resistance measurement includes 7 ranges from 100Ω to 100MΩ. This function can make stable measurement for the low resistance by deleting the resistance of the test lead itself and the contact resistance between the measured resistance and the test lead. (For details, see section 6.2.5 for VOAC7602, and section 6.3.5 for VOAC7502.)

Connection method

Caution! See "4.1.1 Cautions when connecting test lead."



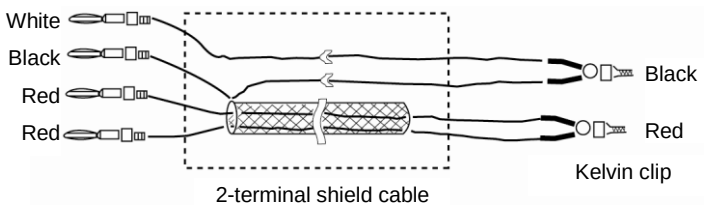
The measurement current flows from HI terminal to LO terminal.



◇ Connection method when using 4-terminal resistance measurement cable

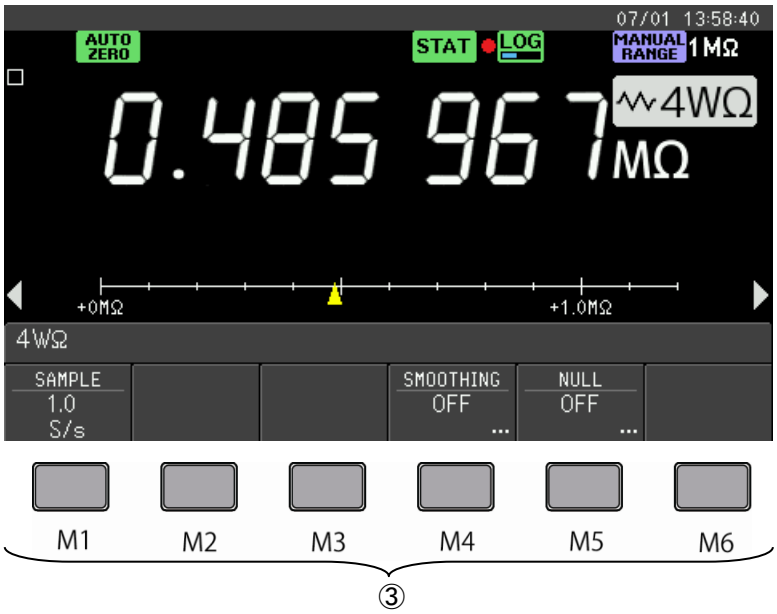
- Connect the red banana terminals to INPUT V·Ω·⊣◀ HI terminal and SENSE 4WΩHI terminal.
- Connect the white banana terminal to SENSE 4WΩLO terminal and the black banana terminal to INPUT V·Ω·⊣◀LO terminal.
- Connect the red Kelvin clip to one side of the measured resistance.
- Connect the black Kelvin clip to the other side of the measured resistance.

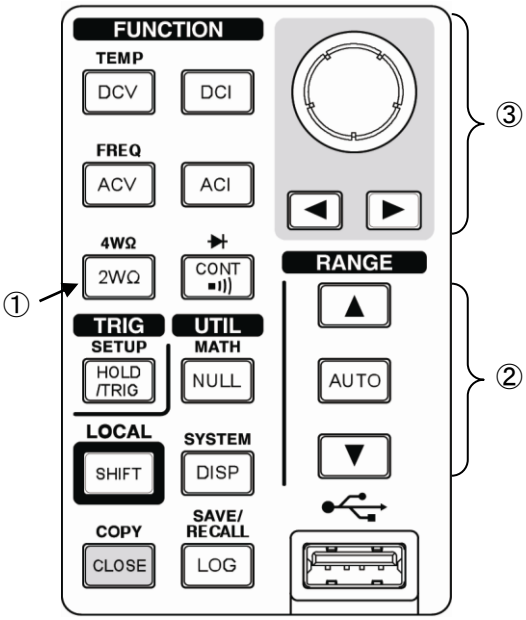
◇ Internal wiring of 4-terminal resistance measurement cable (example)



Operation procedure

① Press [SHIFT]→[2WΩ(4WΩ)] key and specify 4WΩ measurement.
② Select the suitable range by pressing [AUTO] key or the Up/down key in the manual operation.
③ 4WΩ measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen (outside). For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the 4WΩ menu, see “◆4WΩ m**enu items and settings**” on the next page.





◆ **4WΩ menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency. For details, see section 4.3.1◆ **SAMPLE (sampling rate).**		**Setting is done by selection method of 5 sampling rate below.**	6.2.5 6.3.5
	• DEFAULT	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	4.3.1
	• 20PLC（24PLC）	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• 5PLC（6PLC）	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• 1PLC	• 1PLC (at 50 or 60Hz) is set.	
	∗ Numeric selection	∗ The described sampling rate can be selected in the table of SAMPLE by rotating the Rotary knob.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• SMOOTHING	• OFF The average processing is not executed.	—
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• LENGTH	• DEFAULT Average number of times is set to 10.	
		∗ Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done for each function.**	4.6.2
	• NULL	• OFF The difference calculation processing is not executed.	—
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• NULL VAL	• DEFAULT The default of the NULL value (i.e. +0.000000 Ω) is set. Note) The default value is +0.00000 V for VOAC7502.	
		• GET VAL The current measurement value (RAW) is set to the NULL value.	
		• ＋ / － The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 t o 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		∗ Numeric selection NULL value is set by arrow keys and the Rotary knob.	

∗ For 4WΩ function, AUTO ZERO function is in ON state. For AUTO ZERO function, see section 7.3.

Memo!
◇ For measurement of high and low resistance, see Section 7.2.3 **“◇ High resistance measurement” and “◇ Low resistance measurement. ”**

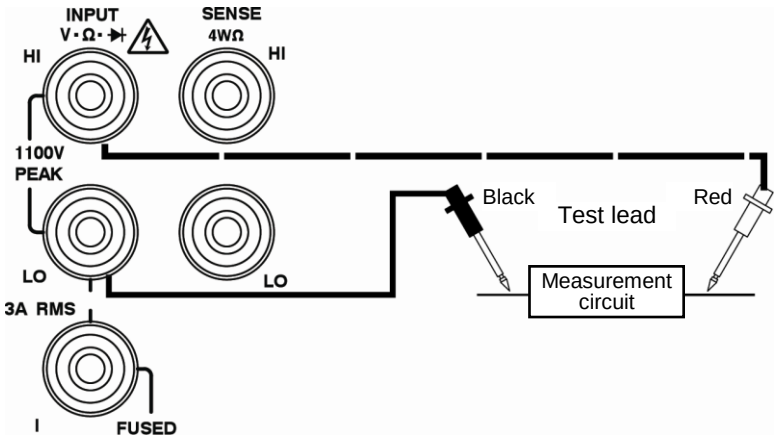
4.3.7 Continuity test (CONT ■))

This function can execute the Continuity test while measuring the resistance value. Since the built-in electronic buzzer sounds when shorting the circuit and it does not sound when disconnecting the circuit, the conduction of the circuit can be checked. Conduction judgment uses the user-setting threshold value (THRESHOLD); i.e. using “measurement value < threshold value.”

The Continuity test uses 1kΩ range of the resistance measurement. The range of the threshold values is from 1Ω to 1000Ω (default: 10Ω). (For details, see section 6.2.6 for VOAC7602, and section 6.3.6 for VOAC7502.)

Connection method

Caution! See “4.1.1 Cautions when connecting test lead.”

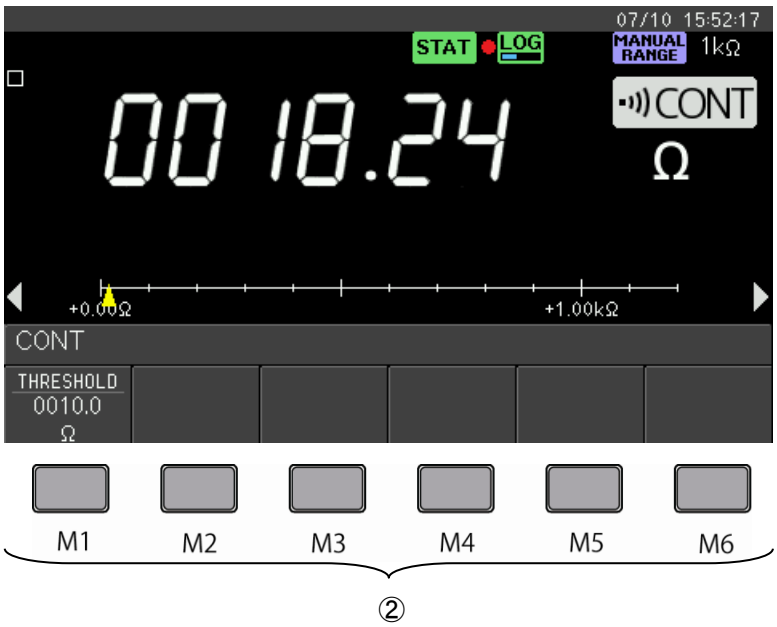


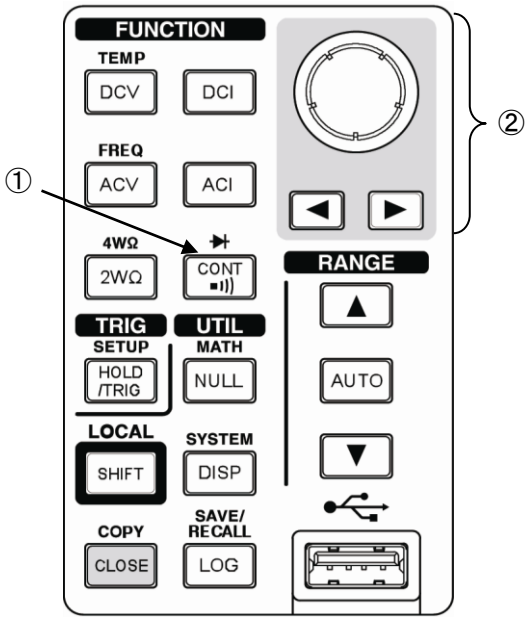
- Connect the black side of the test lead to INPUT V·Ω·⊣◀ LO terminal and the measured resistance.
- Connect the red side of the test lead to INPUT V·Ω·⊣◀ HI terminal and the measured resistance.

Operation procedure

① Press [CONT ■)) (⊣◀)] key and specify Continuity test.
∗ The range is fixed to 1kΩ and the range key is invalidated.

② Continuity test measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen (outside). For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the Continuity test menu, see “◆ CONT ■)) **menu items and settings**” on the next page.





◆ CONT **menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
THRESHOLD		**Sets the threshold value of the Continuity test.**	6.2.6 6.3.6
	• DEFAULT	• The default value is set to 10Ω	—
	• GET VAL	• Set current measurement value as a threshold. Note) Do not set it for the OPEN display. Set it as 1Ω below 1Ω.	
	* Numeric setting	• Set 1.0Ω-1000.0Ω threshold with the rotary knob and the arrow keys.	

The measurement example below shows that the Continuity test is executed with 10Ω of the threshold value (THRESHOLD), the resistance value is 7.73Ω, the buzzer sounds, and the display part of the sub-measurement result indicates “SHORT.”

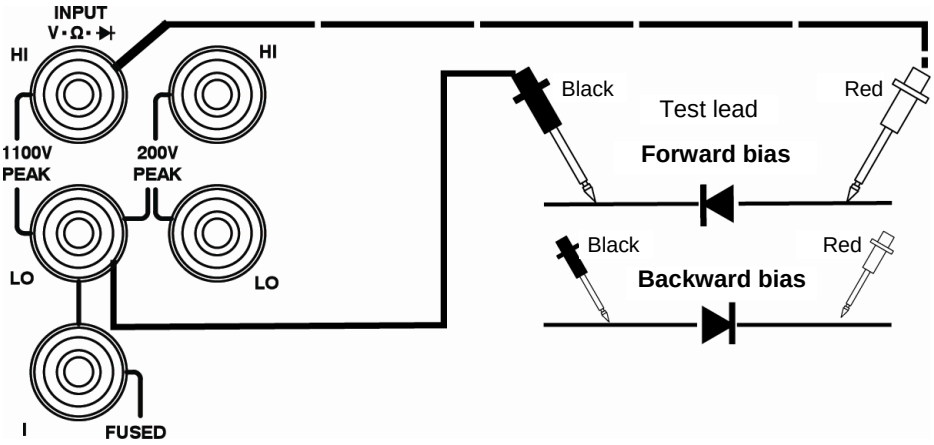
"OPEN" is displayed when resistance is 1000Ω or more.

4.3.8 Diode measurement（ ⊳| ）

The function checks the polarity of the diode and diagnoses its failure. It measures and displays the forward voltage of the diode in the forward bias. In the backward bias, the normal diode shows the over-range.
The diode measurement uses 1 V range of the DC voltage measurement. The measurement current is about 1mA and the measurement range is from 0.1mV to 1.1999V. (For details, see section 6.2.7 for VOAC7602, and section 6.3.7 for VOAC7502.)

Connection method

Caution! See “4.1.1 Cautions when connecting test lead.”



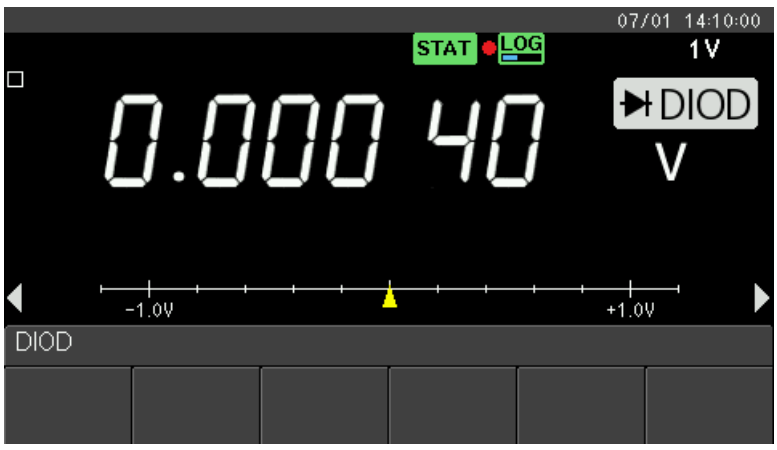
- Connect the black side of the test lead to INPUT V·Ω·⊳| LO terminal and the one side of diode.
- Connect the red side of the test lead to INPUT V·Ω·⊳| HI terminal and the other side of diode.

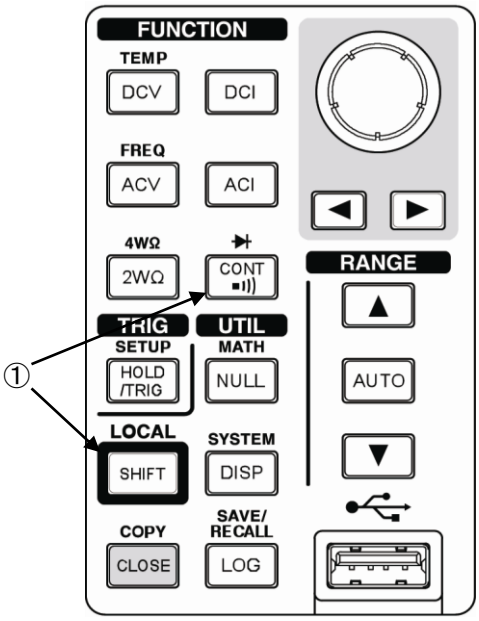
Operation procedure

① Press [SHIFT] → [CONT ■)) (⊳|)] key, specify diode measurement.

∗ The range is fixed to 1V and doesn’t move by pressing the range key.
In addition, DIOD menu does not have the setting item.
(See the screen example below.)

The screen example below shows measurement of the forward voltage of the diode.





4.3.9 Temperature measurement (TEMP)

* VOAC7502 doesn't support the function of temperature measurement (TEMP).

This function can make direct measurement for the temperature by connecting the sensor.

Used sensors can include the thermocouple and the resistance temperature detector (RTD (2W): 2-lead type), the resistance temperature detector (RTD (4W): 4-lead type). (For detailed specification, see section 6.2.8 and section 6.2.9.)

◆About thermocouple

Select R, K, T, J, or E of the thermocouple types.

The measurement using the thermocouple in principle measures the voltage caused by the difference between the temperature at the measurement terminal of this instrument and that of the item measured by the thermocouple. The temperature at the measurement terminal of this instrument is called “cold junction temperature” and to improve the measurement accuracy, this instrument requires the customer to enter the temperature of the measurement terminal.

<How to set the cold junction temperature>

Measure the temperature-known item using the thermocouple to be used and set the cold junction temperature so that this instrument indicates that temperature. In addition, when setting the cold junction temperature, this instrument should be installed in the environment where the temperature is actually measured.

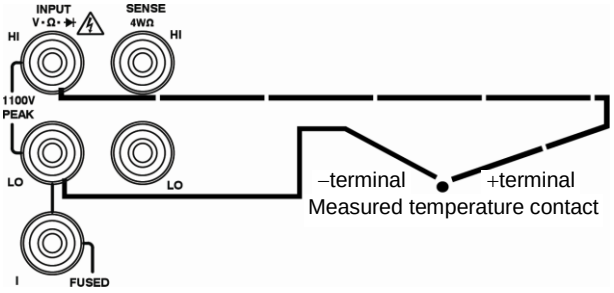
◆About resistance temperature detector

Select the sensor from RTD(2W): 2-lead type and RTD(4W): 4-lead type and select the new standard Pt100 or the old standard JPt100 from the menu.

Connection method

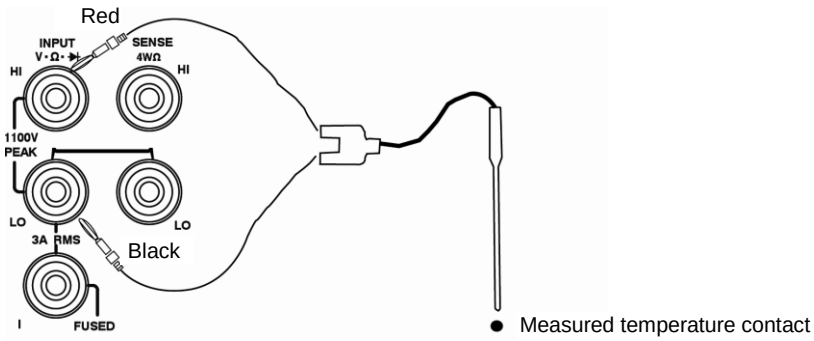
Caution! See “4.1.1 Cautions when connecting test lead.”

◇ Connection method using the thermocouple



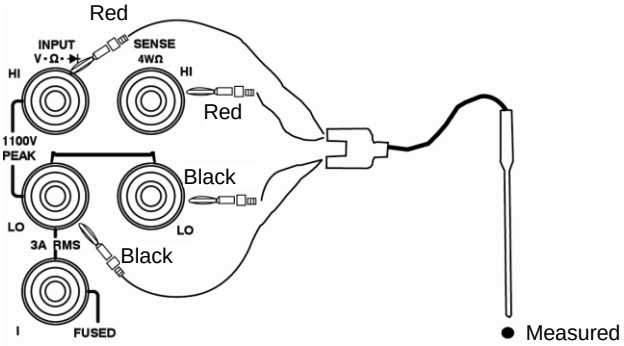
- Connect + terminal of the thermocouple to INPUT V･Ω･⊣◀ HI terminal.
- Connect – terminal of the thermocouple to INPUT V･Ω･⊣◀ LO terminal.
- Connect the tip of the thermocouple (temperature contact) to the measured temperature contact.

◇ Connection method using the resistance temperature detector (RTD(2W): 2-lead type)(example)



- Connect the red banana terminal of the resistance temperature detector to INPUT V･Ω･⊣◀ HI terminal.
- Connect the black banana terminal of the resistance temperature detector to INPUT V･Ω･⊣◀ LO terminal.
- Connect the tip of the resistance temperature detector to the measured temperature contact.

◇ Connection method using the resistance temperature detector (RTD(4W): 4-lead type) (example)



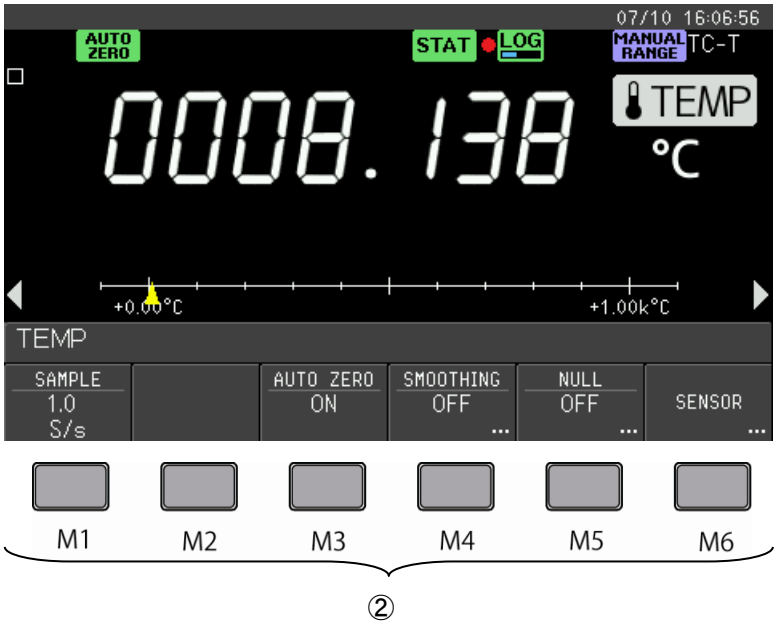
- Connect the red banana terminal of the resistance temperature detector to INPUT V·Ω·⊣◀ HI terminal.
- Connect the black banana terminal of the resistance temperature detector to INPUT V·Ω·⊣◀ LO terminal.
- Connect the red banana terminal of the resistance temperature detector to the HI terminal of SENSE 4WΩ.
- Connect the black banana terminal of the resistance temperature detector to the LO terminal of SENSE 4WΩ.
- Connect the tip of the resistance temperature detector to the measured temperature contact.

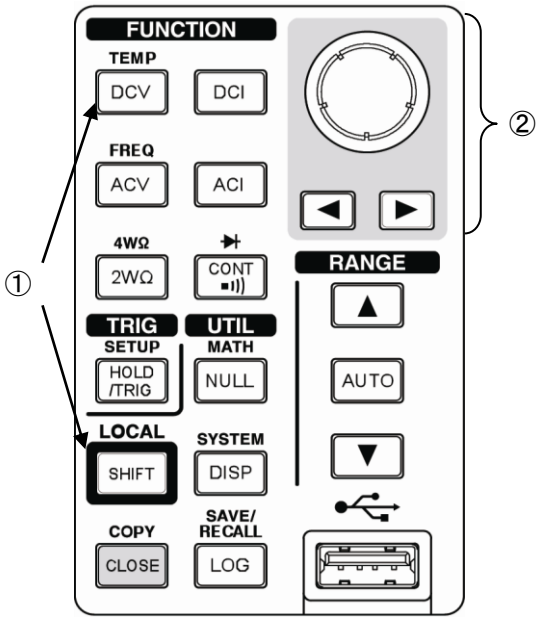
Operation procedure

① Press [SHIFT] →[DCV(TEMP)] key, specify temperature measurement.

∗ There is no range selection which is included in voltage/current measurement. Select the sensor type after ②.

② Temperature measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen (outside). For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the tenperature measurement menu, see “◆ TEMP **menu items and settings**” on the next page.





◆TEMP menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SAMPLE Note) Selections of the sampling rate differ depending on the power supply frequency and ON/OFF setting of AUTOZERO. For details, see ◆ **SAMPLE (sampling rate)** of section 4.3.1.		**Setting is done by selection method of 5 sampling rate below.**	6.2.8
	• DEFAULT	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	4.3.1
	• 20PLC（24PLC）	• 20PLC (at 50Hz) or 24PLC (at 60Hz) is set.	
	• 5PLC（6PLC）	• 5PLC (at 50Hz) or 6PLC (at 60Hz) is set.	
	• 1PLC	• 1PLC (at 50 or 60Hz) is set.	
	• Numeric value selection	* The described sampling rate can be selected in the table of SAMPLE by rotating the Rotary knob.	
AUTOZERO		**3 settings below are selected.**	7.3
	• OFF	• AutoZero is executed once when switching the function and that value is applied to the subsequent measurement.	—
	• ONCE	• AutoZero is executed once when pressing ONCE key and that value is applied to the subsequent measurement.	
	• ON	• Every time measurement is done, automatic zero setting is done.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• SMOOTHING	• OFF The average processing is not executed.	—
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• LENGTH	• DEFAULT: Average number of times is set to 10.	
		* Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done independently for each function.**	4.6.2
	• NULL	• OFF The difference calculation processing is not executed.	—
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• NULL VAL	• DEFAULT The default of the NULL value (i.e. +0.000000°C) is set.	
		• GET VAL The current measurement value (RAW) is set to the NULL value.	
		• + / − The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 to 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		* Numeric selection NULL value is set by arrow keys and the Rotary knob.	
SENSOR		**Refer to "◆ Items and setting contents of SENSOR menu" on next page.**	-

◆ Items and setting contents of SENSOR menu

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SENSOR（TC）		**It is the menu when the thermocouple (TC) is selected for the sensor (SENSOR). Select TC TYPE and COLD JUNCTION (cold junction temperature) below.**	6.2.8
	・TC TYPE	● Select it from R, K, T, J, and E.	–
	・COLD JUNCTION	● DEFAULT If selected, setting is made to +0000.000°C.	
		∗ Numeric value setting Numeric value is set within the range of −50.0°C to +100.0°C by the Rotary knob and arrow keys.	
RTD(4W)		**It is the menu when the resistance temperature detector RTD(4W) is selected for the sensor. Select RTD TYPE below.**	6.2.9
	・RTD TYPE	● Pt100 (new standard) ● JPt100 (old standard)	–
RTD(2W)		**It is the menu when the resistance temperature detector RTD(2W) is selected for the sensor. Select RTD TYPE below.**	6.2.9
	・RTD TYPE	● Pt100 (new standard) ● JPt100 (old standard)	–

Memo !

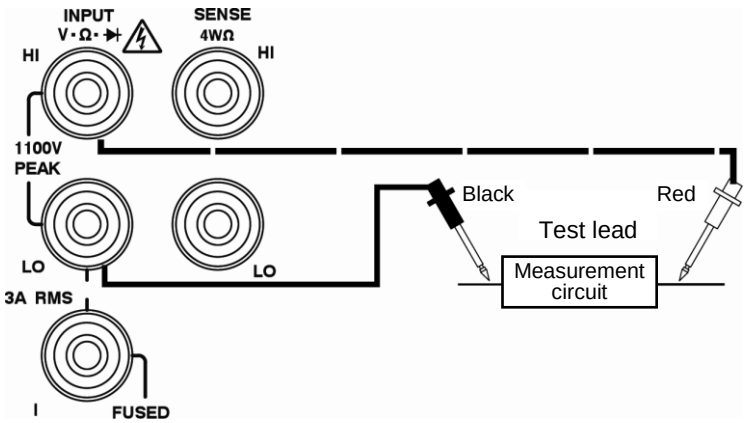
◇ For the exact measurement, see Section 7.2.4 “◇ **For accurate temperature measurement.”**

4.3.10 Frequency measurement (FREQ)

It measures the frequency of the signal applied to the signal input terminal using the reciprocal method. The measurement range of the AC coupling is from 3 Hz to 300 kHz. The number of displayed digits varies depending on the gate time (GATE TIME).
(For details, see section 6.2.10 for VOAC7602, and section 6.3.8 for VOAC7502.)

Connection method

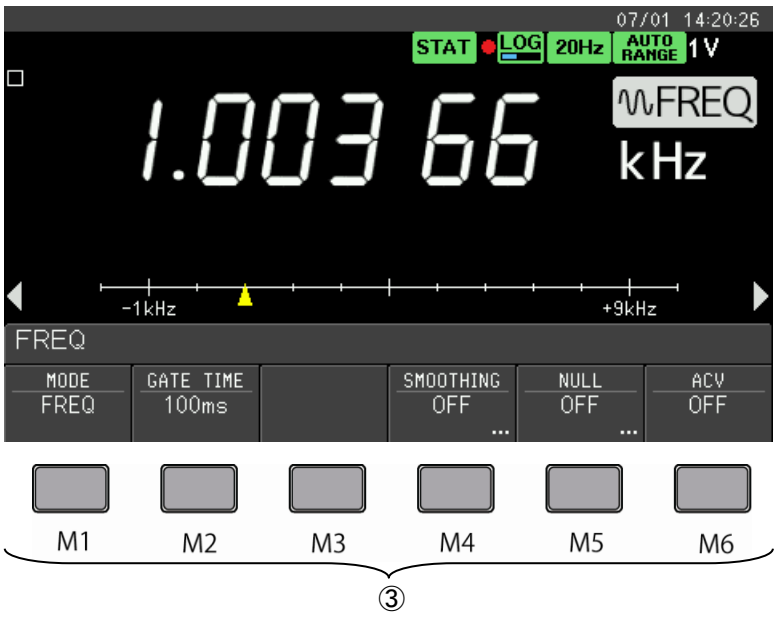
Caution! See "4.1.1 Cautions when connecting test lead."

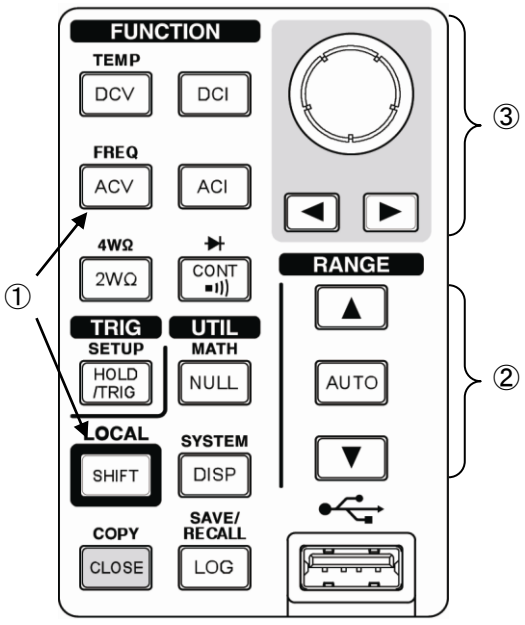


- Connect the black side of the test lead to INPUT V·Ω·⊣◀ LO terminal and the one side of the measured circuit.
- Connect the red side of the test lead to INPUT V·Ω·⊣◀ HI terminal and the other side of the measured circuit.

Operation procedure

① Press [SHIFT]→ [ACV(FREQ)] key and specify frequency measurement.
② Select the suitable range by pressing [AUTO] key or the Up/ down key in the manual operation.
③ FREQ measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see "Section 3.4.1 Basic operation of menu." For settings of the FREQ menu, see "◆ FREQ **menu items and settings**" on the next page.





◆FREQ menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
MODE		**Setting is done by selection method of 2 mode below.**	6.2.10 6.3.8
	• FREQ	• This displays the result of measurement with the frequency.	–
	• PERIOD	• This displays the result of measurement with the frequency.	
GATE TIME		**4 gate times below are selected:**	6.2.10
	• 1 ms	• Setting is made to 1 ms (measurement: about 20 times, display: 4 digits).	–
	• 10 ms	• Setting is made to 10 ms (measurement: about 10 times, display: 5 digits).	
	• 100 ms	• Setting is made to 100 ms (measurement: about 4 times/second, display: 6 digits).	
	• 1 s	• Setting is made to 1 s (measurement: about 0.5 times/second, display: 7 digits). Note) In VOAC7502, this 1s cannot be set.	
SMOOTHING		**Moving average processing is set.** **Two items below set ON/OFF and the average times.**	4.6.1
	• SMOOTHING	• OFF The average processing is not executed.	–
		• ON The average processing is executed with the setting number of times of LENGTH below.	
	• LENGTH	• DEFAULT Average number of times is set to 10.	
		* Numeric value setting Average number of times is set to an integral number from 2 to 100 by the Rotary knob and arrow keys.	
NULL		**The difference calculation is executed between NULL calculation setting value (NULL VAL) and the measurement value (RAW). The measurement result should be the result of difference calculation. Setting can be done independently for each function.**	4.6.2
	• NULL	• OFF The difference calculation processing is not executed.	–
		• ON The difference calculation is executed with the NULL value being set by NULL VAL below.	
	• NULL VAL	• DEFAULT The default of the NULL value (i.e.+0.000000 Hz) is set. Note) The default value is +0.00000 Hz for VOAC7502.	
		• GET VAL The current measurement value (RAW) is set to the NULL value.	
		• + / – The sign of + or - can be set by pushing the M3 key.	
		• Selecting -9 to +9 or 0 to 9 It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
		* Numeric selection NULL value is set by arrow keys and the Rotary knob.	
ACV		**It sets ON/OFF of the ACV measurement result display for the FREQ sub-measurement result.**	2.3.3.1
	• OFF	• It does not display the ACV measurement result.	–
	• ON	• It displays the ACV measurement result.	

4.4 Trigger setting (TRIG)

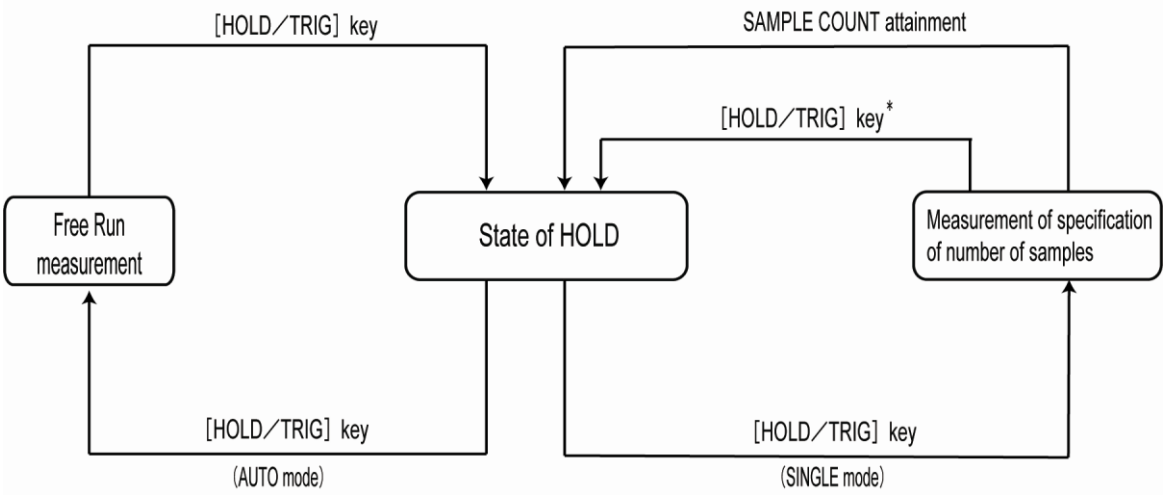
This instrument sets trigger mode, intervals after trigger is input, setting time of interval and setting of external trigger in the TRIG menu to the generalization target.

This section describes the setting method of the trigger actions and settings of TRIG menu. For the specification related to trigger, see Chapter 6, section 6.4.

4.4.1 Trigger mode (AUTO / SINGLE)

In each function, measure it on the condition set in TRIG menu and by set sampling rate.

Figure 4.3 simply shows the state transition among these actions.



・HOLD : The state of the measurement stop and waiting for the measurement beginning event (pushing the HOLD/TRIG key /External trigger)

・Free Run measurement : The state of repeating the measurement continuously according to the sampling rate and INTERVAL

・Measurement of specification of number of samples

: The state of repeating the measurement continuously and measuring number of samples according to the sampling rate and INTERVAL

* When HOLD/TRIG key is pushed during measurement in the state of SINGLE mode, the measurement is interrupted and changed to the state of HOLD even if it doesn't reach the number of SAMPLE COUNT.

Figure 4.3 Transition of Free Run measurement / state of HOLD

These actions and states can be manually changed by key operation below.

The trigger mode includes AUTO mode and SINGLE mode.

○ AUTO mode

This mode allows repeated measurement which automatically generates TRIG in accordance with the preset sampling rate and setting value of interval time. Use of [HOLD/TRIG] key can start measurement and return the instrument to the Hold state.

○ SINGLE mode

This mode makes single measurement for the preset samples each time the external TRIG[Note] is received or HOLD/TRIG key is pressed, and returns the instrument to the Hold state.

Note) External TRIG is received in the state of HOLD. In this case, it becomes SINGLE mode measurement.

Operation procedure

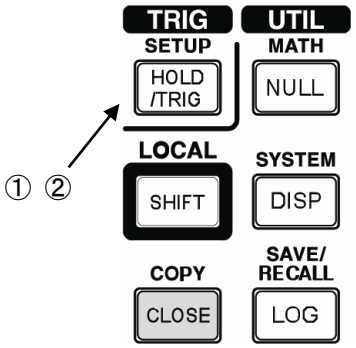
① In Free Run action, press [HOLD/TRIG] key shown on the right

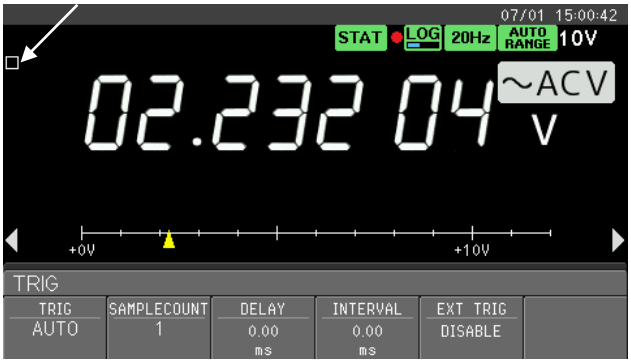
The instrument changes to the Hold state, the sampling indicator on the left screen disappears, and the finally measured result is displayed.

② In Hold state in ①, press [HOLD/TRIG] key.

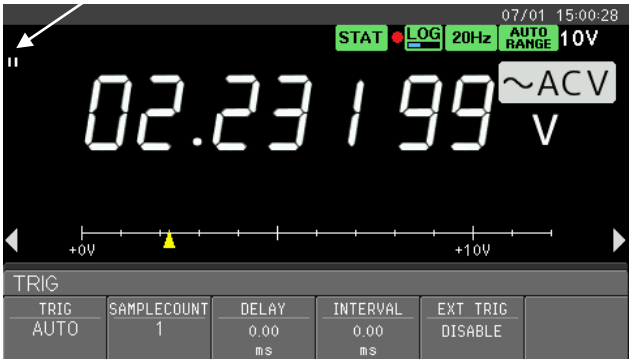
The instrument changes to Free Run action (AUTO or SINGLE).

The sampling indicator flashes. ⏸ mark





Free Run action



Hold state

Besides the trigger with the [HOLD/TRIG] key, the instrument has the method to enter the external trigger into TRIG IN terminal on the rear panel and the remote trigger by the remote control. (For setting method, see 4.4.2.)

4.4.2 TRIG menu setting

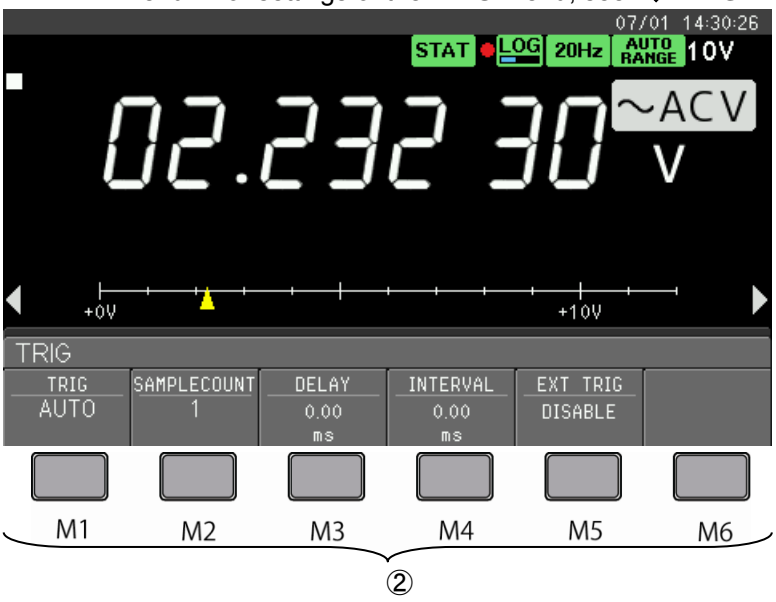
The following describes the setting method of the trigger action and settings of TRIG menu.

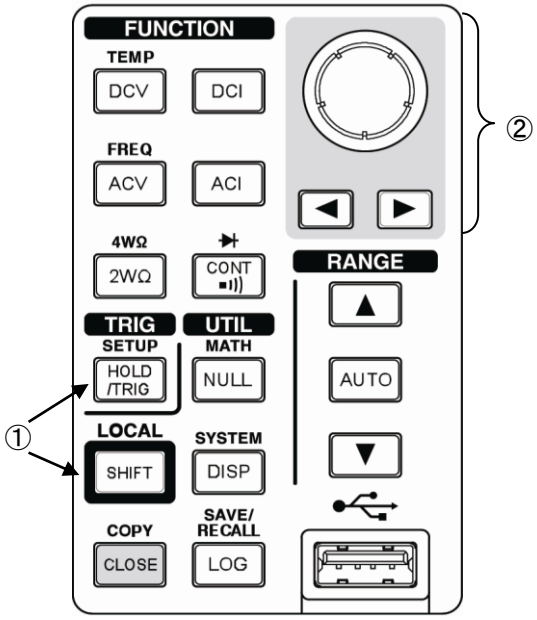
Operation procedure

① Press [SHIFT]→[HOLD/TRIG] key. TRIG menu appears below the screen.

② Set the trigger mode, trigger source, delay after trigger input, and interval time in each item of TRIG menu.

TRIG measurement condition is set by the menu below the screen; i.e. use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the TRIG menu, see “◆ **TRIG menu items and settings**” on the next page.





◆ **TRIG menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
TRIG		**Select either of two trigger actions below.**	Section 6.4
	• AUTO	• It automatically makes repeated measurement according to the sampling rate preset in each function and the setting value of interval time.	–
	• SINGLE	• Measure times of SAMPLE COUNT with the trigger of one time.	
SAMPLE COUNT		**It sets the number of times of continuous data measurement for each trigger.**	Section 6.4
	• DEFAULT	• Number of setting times: 1	–
	∗ Numeric value setting	• It sets the numeric value with the Rotary knob and arrow keys.Setting range: 1 to 100,000 (times, positive integral number)	
DELAY		**It sets the delay time after TRIG input up to the initial data measurement.**	Section 6.4
	• DEFAULT	• Setting time: 0.00 ms	–
	∗ Numeric value setting	• Setting range: 0.00 ms to 3,600 s • Setting resolution: 10 µs	
INTERVAL		**It sets the interval of the sampling measurement.** ∗1. It is disregarded at a setting that is shorter than the sampling rate. The measuring period is decided by this set value at a setting that is longer than the sampling rate. In that case, the sampling rate only influences the accuracy of the measurement. ∗2. If the filter setting is MID for AC voltage measurement (ACV) or AC current measurement (ACI), set the interval to 0.00ms or the time longer than 1.1s. (If a value less than 1.1s other than 0.00ms is set, the interval time of 1,1s is used.)	Section 6.4
	• DEFAULT	• Setting time：0.00 ms	–
	∗ Numeric value setting	• Setting range：0.00 ms to 3,600 s • Setting resolution：10 µs	
EXT TRIG		**It sets possible/ impossible to execute trigger when inserting the external trigger into TRIG terminal on the rear panel. If the external trigger can be executed, the rising edge or falling edge of the slope should be selected.**	Section 6.1
	• DISABLE	• Trigger action cannot be done by the external trigger.	–
	• POS SLOPE	• Trigger action can be done by the external trigger at the rising edge.	
	• NEG SLOPE	• Trigger action can be done by the external trigger at the falling edge.	
INHIBIT **∗ When DIO option (SC-362) is installed**		**It sets inhibition (permission) of the trigger action (measurement).** If the input signal in INHIBIT input terminal is Vin>2.4V, Hi is set and if Vin<0.9V, Lo is set. ∗ The menu is displayed when DIO option (SC-362) is installed on the rear panel.	Section 6.1 Section 6.4
	• POSITVIVE	If Hi is set in the positive logic action above, TRIG input is inhibited.	–
	• NEGATIVE	If Lo is set in the negative logic action above, TRIG input is inhibited.	

4.5 System setting (SYSTEM)

SYSTEM menu can make settings below for each item.

○ REMOTE

- Selection of remote interface, setting of various interfaces

○ BEEP

- Key sound, warning tone when the measurement result is erroneous, tone for LIMIT judgment of GO/NO-GO, setting of ON/OFF for sounding

○ SETUP

- Basic settings such as header display contents and power supply frequency

○ COPY

- Settings related to the output data to the USB memory (USB connection on the front panel)
  * VOAC7502 doesn't have the USB connection entrance, and does not support this function.

○ TOOLS

- Display of version information on instrument software, setting of panel lock ON/OFF, version update, initialization of setting conditions, and execution of calibration

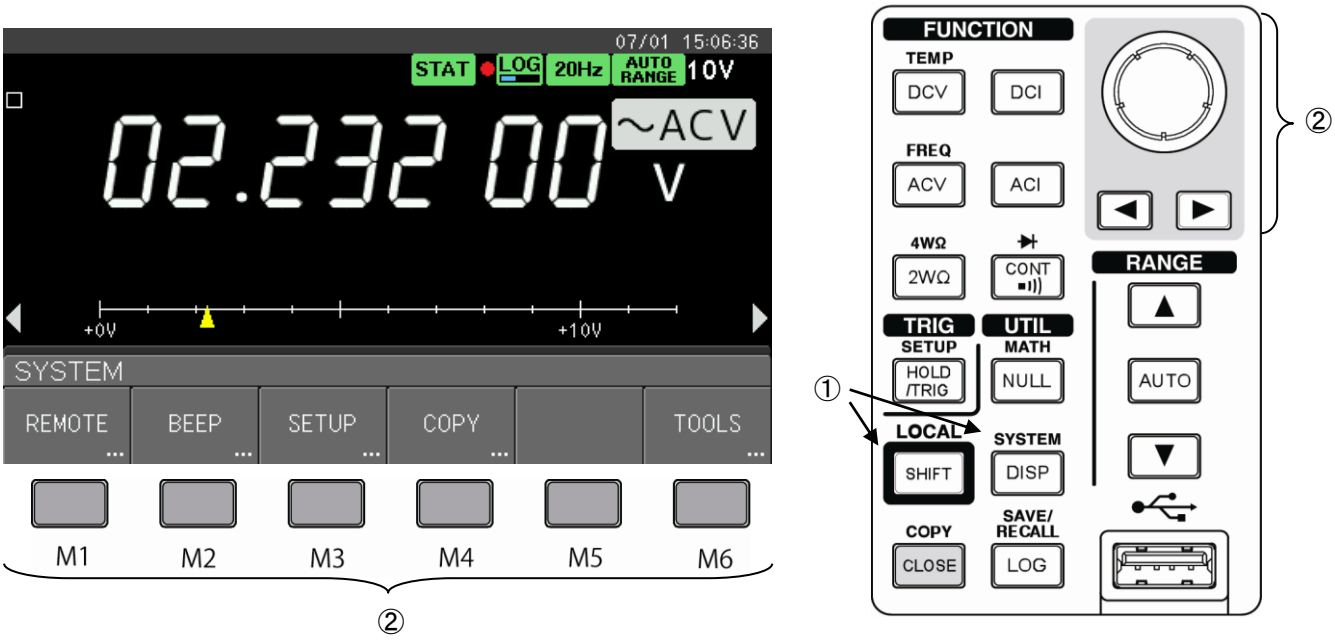
The following describes the setting method of the system and settings of SYSTEM menu.

Operation procedure

① Press [SHIFT]→[DISP(SYSTEM)] key. SYSTEM menu appears below the screen.

② Set the function of each item on SYSTEM menu.

Use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see “Section 3.4.1 Basic operation of menu.” For settings of the SYSTEM menu, see “**◆ SYSTEM menu items and settings**” on the next page.



* VOAC7502 does not display the COPY menu in the screen in the above figure.

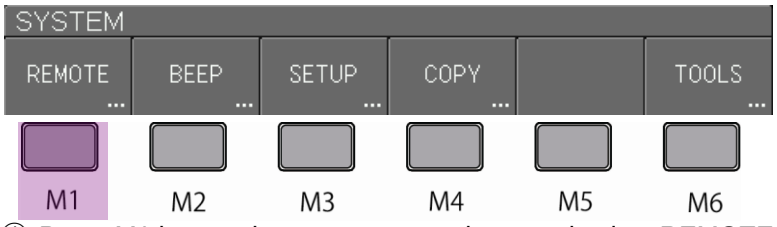
◆ **SYSTEM menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
REMOTE		**The menu items shown on the left vary depending on installation status of this instrument's options; i.e. LAN & RS-232(SC-361) and GP-IB (SC-363).**	Section 4.5.1
	• USB	• If option is not installed Only USB • If LAN & RS-232(SC-361) option is installed USB、TCP/IP、RS232 • If GP-IB(SC-363) option is installed USB、GPIB	—
	• GPIB		
	• TCP/IP		
	• RS232		
BEEP		**It sets ON/OFF of sounding for the tone when a key is pressed, warning tone for an erroneous measurement result, and tone for LIMIT judgment of GO/NO-GO.**	Section 6.13
	• KEY	• OFF If the key on the front panel is pressed, the sound is not generated.	—
		• ON If the key on the front panel is pressed, the sound is generated.	
	• CAUTION	• OFF If the measurement result is erroneous (e.g. calculation overflow and LIMIT calculation setting error), the sound is not generated.	—
		• ON If the measurement result is erroneous (e.g. calculation overflow and LIMIT calculation setting error), the sound is generated.	
	• LIMIT	• OFF The sound is not generated for LIMIT judgment (GO/NO-GO).	—
		• GO The sound is generated for LIMIT judgment (GO).	
		• NO-GO The sound is generated for LIMIT judgment (NO-GO).	
SETUP		**See "4.5.2 Setting of SYSTEM/SETUP menu."**	Section 4.5.2
COPY		**See "4.5.3 Setting of SYSTEM/COPY menu."** Note) VOAC7502 does not support this function.	Section 4.5.3
TOOLS		**See "4.5.4 Setting of SYSTEM/TOOLS menu."**	Section 4.5.4

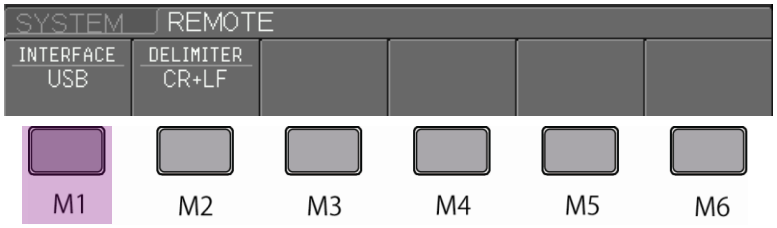
4.5.1 Setting of SYSTEM/REMOTE menu

The interface is selected with the operation procedure below. After interface selection, setting should be done according to the description for each interface on the next pages

Operation procedure



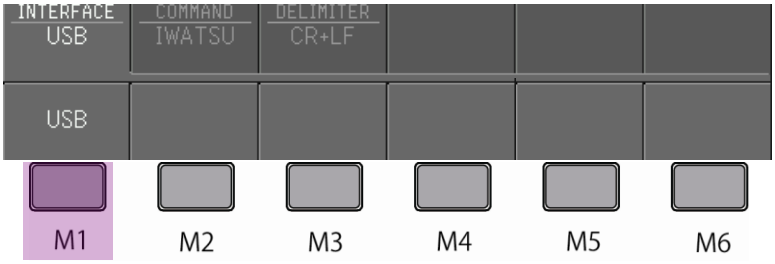
① Press M1 key on the menu screen above and select REMOTE. REMOTE menu below opens.



② Press M1 key on the menu screen above and select INTERFACE. Any of menu items (a, b, and c below) is displayed depending on installation status of this instrument's option; LAN & RS-232(SC-361) and GP-IB(SC-363).

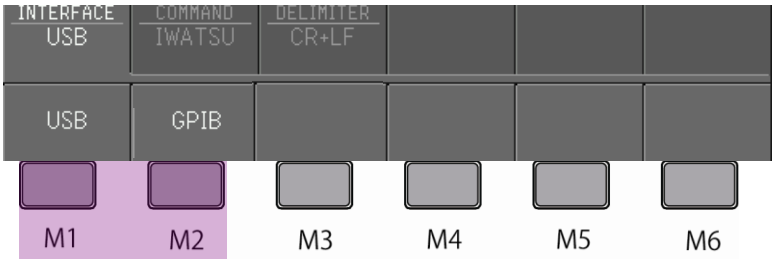
a) If the interface option is not installed

Press M1 key or the Rotary knob.



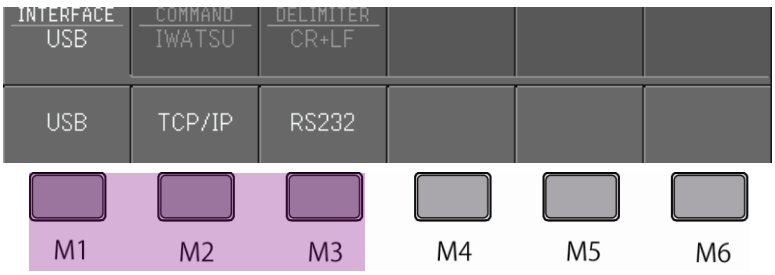
b) If GP-IB interface (SC-363) option is installed

Press M2 or M3 key to select the interface.



c) If LAN & RS-232 interface (SC-361) option is installed

Press M1 to M3 key to select the interface.



◆ **INTERFACE: USB**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
REMOTE(USB)		**If USB is selected for INTERFACE, set the items below;**	Section 6.13
	• INTERFACE	• If USB is selected and set	–
	• COMMAND	Select the command Note system from the following. Note) Refer to the remote control manual collected to CD of the attachment.	
		• IWATSU Select it when you use peculiar to the equipment of the VOAC752x interchangeable series that this instrument has command. • SCPI Select it when you use the SCPI conforming command.	
	• DELIMITER	• CR+LF: The delimiter is set to CR+LF. • LF: The delimiter is set to LF.	

◆ **INTERFACE: GPIB**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
REMOTE(GPIB)		**If GPIB is selected for INTERFACE, set the items below;**	Section 6.13
	• INTERFACE	• If GPIB is selected and set	–
	• COMMAND	Select the command Note system from the following. Note) Refer to the remote control manual collected to CD of the attachment.	
		• IWATSU Select it when you use peculiar to the equipment of the VOAC752x interchangeable series that this instrument has command. • SCPI Select it when you use the SCPI conforming command.	
	• DELIMITER	• CR+LF: The delimiter is set to CR+LF. • LF: The delimiter is set to LF.	
	• GPIB CONFIG	• DEFAULT: It sets the address to the default setting (9) ∗ Numeric value setting: Rotate the Rotary knob to set the address to 0 to 31.	

◆ **INTERFACE: TCP/IP**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
REMOTE(TCP/IP)		**If TCP/IP is selected for INTERFACE, set the items below;**	Section 6.13
	• INTERFACE	• If TCP/IP is selected and set	–
	• COMMAND	Select the command Note system from the following. Note) Refer to the remote control manual collected to CD of the attachment.	
		• IWATSU Select it when you use peculiar to the equipment of the VOAC752x interchangeable series that this instrument has command. • SCPI Select it when you use the SCPI conforming command.	
	• DELIMITER	• CR+LF: The delimiter is set to CR+LF. • LF: The delimiter is set to LF.	
	• TCP/IP CONFIG	○DHCP • ON If ENTER is selected, ADDRESS, GATEWAY, and SUBNET MASK are acquired from DHCP server. If ENTER is pressed when setting to DHCP ON, re-powering-on is required. After re-powering-on, the address is automatically acquired. • OFF Operation is done with assigned ADDRESS, GATEWAY, SUBNET MASK.	
		○ADDRESS • DEFAULT It sets the address to the default setting. ∗ Numeric value setting Rotate the Rotary knob to set the address.	
		○GATEWAY • DEFAULT It sets the address to the default setting. ∗ Numeric value setting Rotate the Rotary knob to set the address.	
		○SUBNET MASK • DEFAULT It sets the address to the default setting. ∗ Numeric value setting Rotate the Rotary knob to set the address.	
		○ENTER • It updates TCP/IP setting. Demand the power supply reopening when you execute ENTER. After the reboot, a new setting becomes effective. Note: Even if setting of DHCP, ADDRESS, GATEWAY, and SUBNET MASK is changed, the change is not reflected if ENTER is not executed.	

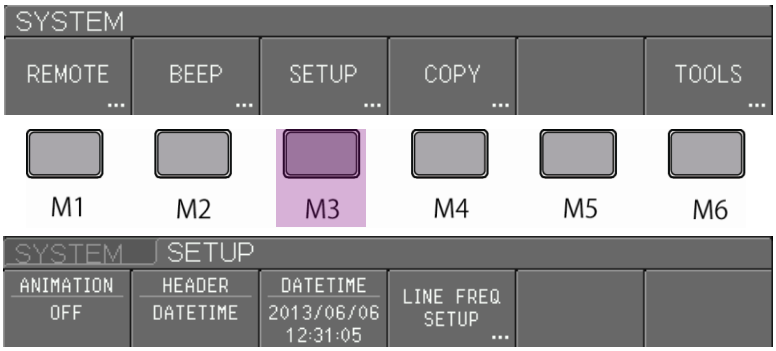
◆ **INTERFACE: RS232**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
REMOTE(RS232)		**If** RS232 **is selected for INTERFACE, set the items below;**	Section 6.13
	• INTERFACE	• If RS232 is selected and set	–
	• COMMAND	Select the command Note system from the following. Note) Refer to the remote control manual collected to CD of the attachment.	
		• IWATSU Select it when you use peculiar to the equipment of the VOAC752x interchangeable series that this instrument has command. • SCPI Select it when you use the SCPI conforming command.	
	• DELIMITER	• CR+LF The delimiter is set to CR+LF. • LF The delimiter is set to LF.	
	• RS232 CONFIG	○BIT RATE • DEFAULT It sets the bit rate to the default setting (i.e. 38400 bps) ∗ Numeric value setting Rotate the Rotary knob to set the bit rate to any of 38400, 19200, 9600, 4800, 2400, 1200, 600, and 300.	
		○PARITY • Use the menu keys M1 to M3 to select any of NONE, ODD, and EVEN.	
		○STOP BIT • Use the menu keys M1 and M2 to select 1 bit or 2 bit.	

4.5.2 Setting of SYSTEM/SETUP menu

The following describes settings of SYSTEM/SETUP menu. (For specification, see section 6.13.)

Press M3 key on the SYSTEM menu below to open SETUP menu.



◆SYSTEM/SETUP menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
ANIMATION		**Select the menu operation when the item is selected.**	Section 6.13
	• OFF	• It is menu operation which changes the menu when the item is selected.	-
	• ON	• It is menu operation which changes the menu by moving it upward from the bottom of the screen when the item is selected.	
HEADER		**Select the content of the display of the top on the right of the screen.**	Section 6.13
	• DATE TIME	• It sets display of the header area at the top right of the screen to date and time.	-
	• SETUP NAME	• It displays SETUP name preset by SETUP SAVE/RECALL menu in the header area at the top right of the screen.	
	• OFF	• It displays nothing in the header area at the top right of the screen.	
DATETIME		**Edit the content of the date and time.**	Section 6.13
	• ENTER	• It updates the year/month/day, time to the setting below. Note: Even if the numeric value is set, update is not done if ENTER is not done.	-
	∗ Numeric value setting	• It sets the numeric value of year (Christian Era), month/day, time (hour, minute, second).	
	• CANCEL	• It closes DATE TIME menu.	
LINE FREQ SETUP		**Set the power frequency that this instrument uses.**	Section 6.13
	• MODE	• AUTO（default setting） It automatically detects the power supply frequency which drives this instrument when starting and sets it.	-
		• MANUAL It manually sets the power supply frequency which drives this instrument.	
	• LINE FREQ UPDATE (MODE：at AUTO)	• If operation is done by M2 key when setting MODE above to AUTO, automatic detection of power supply frequency is updated.	
	• MANUAL (MODE : MANUAL: at manual)	• 50 Hz If it is selected when setting MODE above to MANUAL, the power supply frequency is set to 50 Hz.	
		• 60 Hz If it is selected when setting MODE above to MANUAL, the power supply frequency is set to 60 Hz.	
	• CURRENT (50 Hz/60 Hz)	• It displays the current power frequency to be set. Note: It only displays the frequency; i.e. not sets/ executes.	

4.5.3 Setting of SYSTEM/COPY menu

The following describes settings of SYSTEM/COPY menu. (For specification, see section 6.13.)

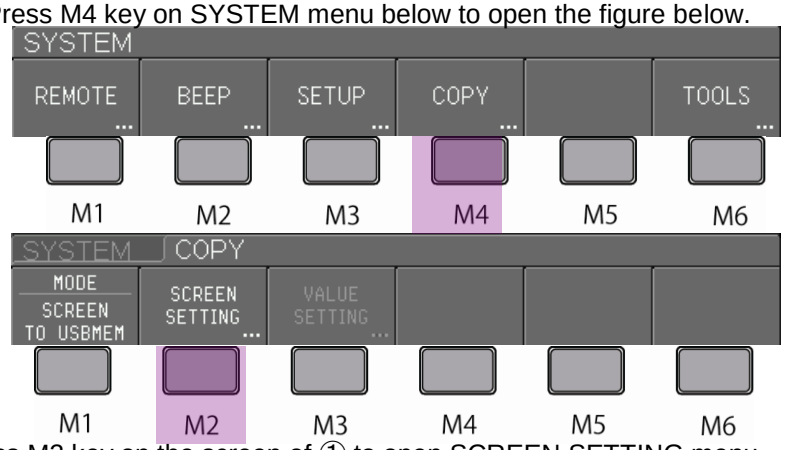
* VOAC7502 doesn't support the COPY output function, and not have the COPY menu.

4.5.3.1 SCREEN TO USBMEM menu

This instrument can output the screen hard copy data into the USB memory. The following describes the setting method, menu items, and settings at the output.

Operation procedure

①-a) Press M4 key on SYSTEM menu below to open the figure below.



② Press M2 key on the screen of ① to open SCREEN SETTING menu.

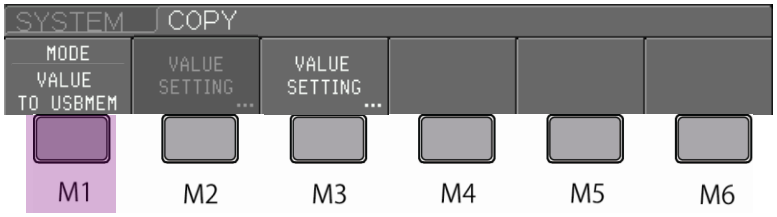
For the subsequent operation, see "◆ Items and settings of SYSTEM/COPY/SCREEN SETTING menu" on the next page.

③ After setting each menu item, press [SHIFT]→[CLOSE (COPY)] key to make output to the USB memory. To prevent the superscription when succeeding in preserving the hard copy, one increases the value of the last 4 digits of the file name.

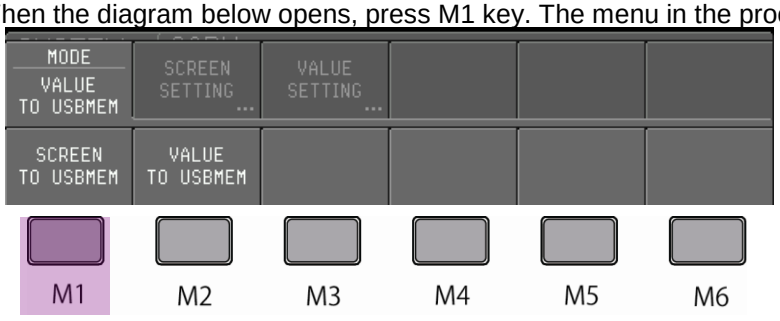
<If MODE：SCREEN TO USBMEM is not set>

If MODE：VALUE TO USBMEM is set in the procedure ① above, it is necessary to change to MODE：SCREEN TO USBMEM as shown in the procedure below.

① -b) If MODE：VALUE TO USBMEM is set, press M4 key in ① -a) above to open the diagram below and press M1 key.



①-c) When the diagram below opens, press M1 key. The menu in the procedure ② above opens.



◆ **SYSTEM/COPY/SCREEN SETTING menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
FORMAT		• **It selects the file format of the screen data to be output to the USB memory.**	Section 6.13
	• PNG (COLOR)	• It sets the color file format with the extension of.png.	—
	• BMP (COLOR)	• It sets the color file format with the extension of.bmp.	
	• TIFF (COLOR)	• It sets the color file format with the extension of.tiff.	
	• PNG (B&W)	• It sets the monocolor file format with the extension of.png.	
	• BMP (B&W)	• It sets the monocolor file format with the extension of.bmp.	
	• TIFF (B&W)	• It sets the monocolor file format with the extension of.tiff.	
DIRECTORY		• **For output of the screen data to the USB memory, it edits the directory (folder name) in the USB memory.**	Section 6.13
	• DEFAULT (COPY)	• If DEFAULT is selected, the folder name is set to “COPY.”	—
	• ABC	• If ABC key is pressed, the alphabet character can be selected with the rotary knob.	
	• 123	• If 123 key is pressed, the figure (0 to 9) can be selected with the rotary knob.	
	• !#$	• If !#$ key is selected, the symbol can be selected with the rotary knob.	
	• BACK SPACE	• If BACK SPACE key is pressed, the character, figure, or symbol just prior to the cursor position is deleted.	
	• INPUT SPACE	• If INPUT SPACE key is pressed, “_” is displayed; a space is inserted.	
FILE NAME		• **It edits the file name to be saved in the directory (folder) in the USB memory when outputting the screen data in the USB memory.**	Section 6.13
	• DEFAULT	• If DEFAULT is selected, the folder name is set to “COPY0000.”	—
	• ABC	• If ABC key is pressed, the alphabet character can be selected with the rotary knob.	
	• 123	• If 123 key is pressed, the figure (0 to 9) can be selected with the rotary knob.	
	• !#$	• If !#$ key is selected, the symbol can be selected with the rotary knob.	

4.5.3.2 VALUE TO USBMEM menu

VALUE TO USBMEM is a function to output the measurement result, the time stamp (date and time), and attribute information (function, calculation setting, and LIMIT calculation result) to the USB memory by the text format.

- ONE TIME

  In this setting, this instrument converts the latest one measurement result into one line's worth of a text every time [SHIFT] → [CLOSE(COPY)] key is pushed, and add a postscript to the specified file.

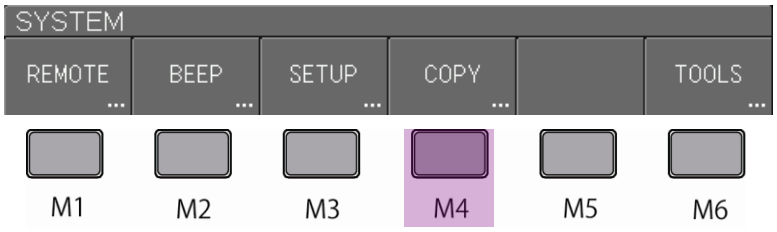
- CONTINUOUS

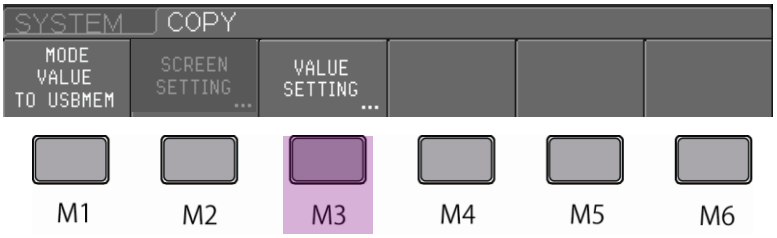
  In this setting, this instrument switches starting / stopping of continuous writing in the USB memory every time [SHIFT] → [CLOSE(COPY)] key is pushed. Afterwards, this instrument converts into one line's worth of a text every time a new measurement result is acquired when starting a continuous writing, and adds a postscript to the specified file.

In each operation, the conversion method to the text is the same as EXPORT of the log function. (Refer to 4.11.3 Log data.)

Operation procedure

① -a) Press M4 key on SYSTEM menu below to open the figure below.





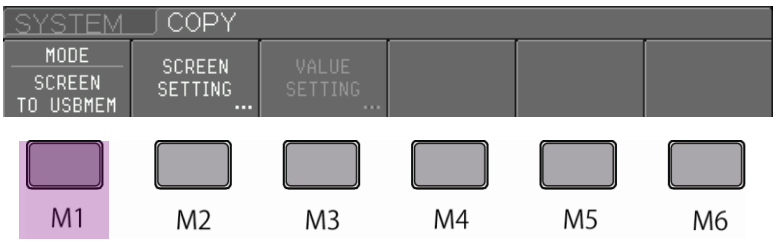
② Press M3 key on the screen above to open VALUE SETTING menu.
For the subsequent operation, see "◆SYSTEM/COPY/MODE: VALUE SETTING menu items and settings" on the next page.

③ After each menu item is set, push [SHIFT] → [CLOSE (COPY)] key.
When ACTION is set to ONE TIME, the latest measurement result in operated point is converted to one lines worth of a text and added a postscript to the file.
When ACTION is set to CONTINUOUS, the continuous writing starts in the USB memory. When pushing [SHIFT] → [CLOSE (COPY)] key again, it stops.

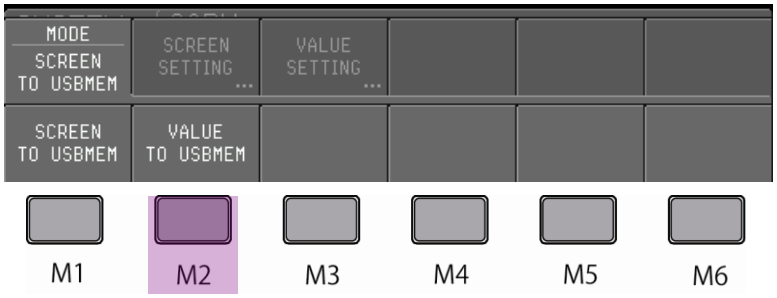
<If MODE：VALUE TO USBMEM is not set>

If MODE：SCREEN TO USBMEM is set in the procedure ① above, it is necessary to change to MODE：VALUE TO USBMEM as shown in the procedure below.

① -b) If MODE:SCREEN TO USBMEM is set, press M4 key in ① -a) above to open the diagram below and press M1 key.



② -c) When the diagram below opens, press M2 key. The menu in the procedure ② above opens.



◆**SYSTEM/COPY/MODE:VALUE SETTING menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
ACTION		• **It sets the operating of VALUE TO USBMEM.**	Section 6.13
	• ONE TIME	• Every time [SHIFT] → [CLOSE (COPY)] key is pushed, the latest one measurement result is converted to one line's worth of a text, and added a postscript to the specified file.	Section 4.5.3.3
	• CONTINUOUS	• Every time [SHIFT] → [CLOSE (COPY)] key is pushed, the continuous writing in the USB memory starts and stopps. When the continuous writing starts, the measurement result is converted to one line's worth of a text every time the measurement is executed and is added a postscript to the specified file.	
DIRECTORY		• **It edits the directory (folder name) of output destination in the USB memory.**	Section 6.13
	• DEFAULT (COPY)	• If DEFAULT is selected, the folder name is set to "TEXT."	–
	• ABC	• If ABC key is pressed, the alphabet character can be selected with the rotary knob.	
	• 123	• If 123 key is pressed, the figure (0 to 9) can be selected with the rotary knob.	
	• !#$	• If !#$ key is selected, the symbol can be selected with the rotary knob.	
	• BACK SPACE	• If BACK SPACE key is pressed, the character, figure, or symbol just prior to the cursor position is deleted.	
	• INPUT SPACE	• If INPUT SPACE key is pressed, "_" is displayed; a space is selected.	
FILE NAME		• **It edits the file name to be ouput in the USB memory.**	Section 6.13
	• DEFAULT	• If DEFAULT is selected, the folder name is set to "COPY0000."	–
	• ABC	• If ABC key is pressed, the alphabet character can be selected with the rotary knob.	
	• 123	• If 123 key is pressed, the figure (0 to 9) can be selected with the rotary knob.	
	• !#$	• If !#$ key is selected, the symbol can be selected with the rotary knob.	
TIME STAMP		• **It sets whether or not time stamp information is added when outputting in the USB memory.**	Section 6.13
	• ON	• Time stamp information is added in the output text (default setting).	–
	• OFF	• Time stamp information is not added in the output text.	
ATTRIBUTE		• **It sets whether or not ATTRIBUTE information below is added when outputting in the USB memory.** **a) Function name** **b) NULL (NULL ON: NULL displayed; NULL OFF: blank)** **c) Calculation name (The valid one in SCALING, dBm, and dBv is displayed.)** **d) Judgement result of LIMIT calculation or error type**	Sections 6.13 & 4.11.2
	• ON	• ATTRIBUTE information above is included in the output text data (default setting)	–
	• OFF	• ATTRIBUTE information above is not included in the output text data.	

4.5.3.2 Continuous writing function in USB memory by VALUE TO USBMEM menu

The continuous writing is a function executing continuously the operation which converts the measurement result to one line's worth of a text and adds a postscript to the file. By using USB MEMORY with large capacity, a lot of data can be saved as the LOG memory (100,000 pieces or less) in the main unit is far. This function is available when the record of a long time is left at a comparative low-speed measuring period.

Example) When the measurement at 1S/s period is continued for one year, 31 million 536 thousand measurement results are acquired.

Setting of output text data		Maximum size of one-line text (per one measurement result)	Free space necessary for USB memory
Time stamp	Attribute information		
X	X	15 byte	About 473 MB
X	○	52 byte	About 1,640 MB
○	X	44 byte	About 1,388 MB
○	○	81 byte	About 2,554 MB

< Setting method >

Set MODE (SYSTEM/COPY) of COPY to VALUE TO USBMEM.

Set ACTION setting (SYSTEM/COPY/VALUE SETTING) of VALUE TO USBMEM to CONTINUOUS.

Additionally, execute the file setting at the output destination and the setting of the text conversion as well as the case of ONE TIME for the ACTION setting.

Additionally, execute the file setting at the output destination and the setting of the text conversion as well as the case of ONE TIME for the ACTION setting.

More over, it is impossible to change these settings while executing the continuous writing in the USB memory.

< Starting and Stopping >

When [SHIFT] → [CLOSE (COPY)] key is pushed, the continuous writing in the USB memory starts. The icon of the USB memory type is displayed in the annunciator while executing the continuous writing in the USB memory.

Moreover, the message of "Don' t remove USB Memory." and the message of "Push COPY key to stop VALUE TO USBMEM." are alternately blinked and displayed by the line of the status message.

Example of screen display while executing the continuous writing in the USB memory

When [SHIFT] → [CLOSE (COPY)] key is pushed again while executing the continuous writing, the continuous writing is stopped.

Caution!

1) **Do not turn off the power supply, and do not pull out the USB memory while executing the continuous writing in the USB memory. Serious damage might be given to the USB memory as data is lost.**
2) **If it keeps executing the continuous writing for a long time, the size of the output file grows, too. Start the writing after confirming there is an enough free space beforehand. Moreover, the continuous writing stops automatically when the free space is lost.**

< Operation limitation >

In the following states, the continuous writing function in the USB memory cannot be started.

- Remote state
- While acquiring log data in the BULK mode
- Off-line browse state

Oppositely, the following functions cannot be used while executing a continuous writing.

- All setting changes below SYSTEM/COPY menu
- Starting acquiring log data in the BULK mode
- Off-line browse
- EXPORT of log function
- Execution of calibrating
- Save of setup in USB memory
- All setup recalls
  - Recall from USB memory
  - Recall from the internal memory
  - Recall of default setup
  - External control function of SETUP RECALL

Besides this, this instrument stops a continuous writing compulsorily when the transition to Remote state is generated while executing a continuous writing.

< About file output>

The size of the output text file is limited to 8MB in maximums. Newly make the file of one it as for value of the last 4 digits of which increased number, and output the following to this when this is exceeded. Note that a continuous writing stops automatically when the value of the last 4 digits exceeds 9999.

< About writing speed >

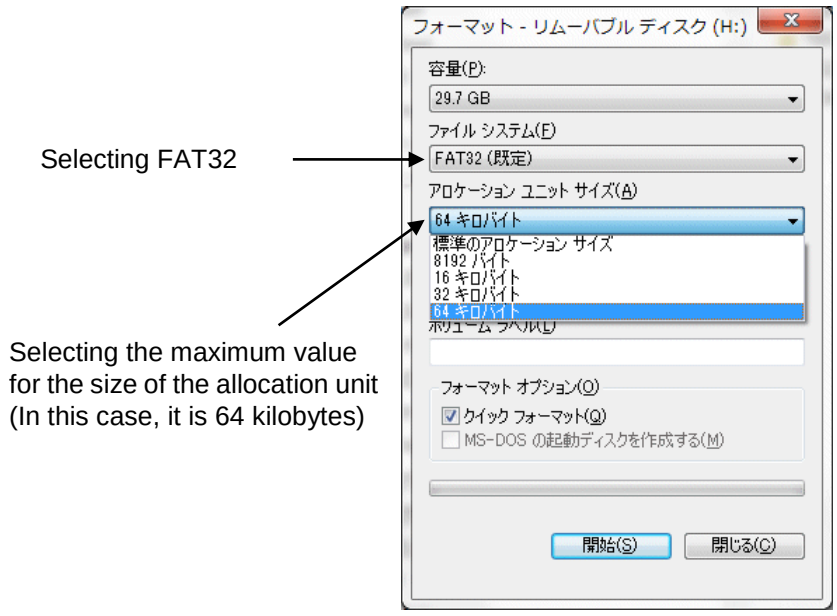
The writing speed in the USB memory is far low-speed compared with the LOG memory in the main unit and changes greatly by the kind and the state of the used memory. Therefore in this instrument, it is not guaranteed to preserve all of the acquired data without dropping data even if this instrument operates by a low-speed sampling rate.

Dropping data can be reduced by the following ingenious methods.

- Using an empty USB memory which is formatted
- Taking the size of the allocation* unit as greatly as possible when formatting USB memory.

  * Note that the use efficiency of the memory worsens instead of the writing speed's improving if you greatly take the size of the allocation unit.

Format the USB memory with a general personal computer. The file system that this instrument corresponds is FAT or FAT32.

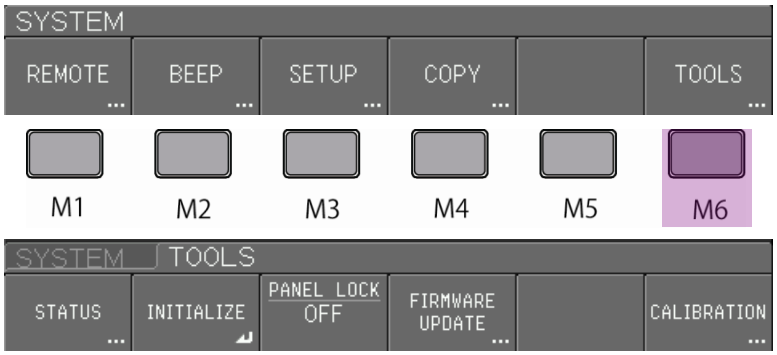


Example of formatter screen (Windows7)

4.5.4 Setting of SYSTEM/TOOLS menu

The following describes settings of SYSTEM/TOOLS menu. (For specification, see section 6.13.)

Press M6 key on the SYSTEM menu below to open TOOLS menu.



* VOAC7502 doesn't have the FIRMWARE UPDATE menu in the above figure.

For the subsequent operation, see "◆ SYSTEM/TOOLS menu items and settings" on the next page.

◆**SYSTEM/TOOLS menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
STATUS		• **If M1 key is pressed, the screen changes to TOOLS STATUS screen. The information on this instrument is displayed as shown in the examples below.**	Section 6.13
		• Model name VOAC7602 • Firmware Description Firmware for VOAC76xx series • Version 1.00 • Build Date & Time June 17 2013 09:41:28 • Product ID 48554F5E13565F9D • Serial Number BD137130001	—
INITIALIZE		• **If M2 key is pressed, message "Do you initialize system?" is displayed in the menu. It initializes the setting conditions of this instrument to the factory setting.**	Section 4.7
	• OK	• If M2 key is pressed, the setting conditions of this instrument are initialized to the factory setting and this instrument is restarted. Only current setting conditions should be initialized; i.e. the information saved in INTERNAL MEMORY and USB memory should not be deleted.	—
	• CANCEL	• If M6 key is pressed, the inquiry menu for initialization closes.	
PANEL LOCK		• **It sets ON/OFF of the function to lock key operation on the front panel.**	Section 6.13
	• OFF	• If M3 key is pressed when ON is displayed in the menu, the lock function of the panel is set to OFF. Key operation is enabled.	—
	• ON	• If M3 key is pressed when OFF is displayed in the menu, the function is set to ON; i.e. the panel is locked and key operation is disabled. The key tone indicating it is generated.	
FIRMWARE UPDATE		• **The menu updates the software in the instrument. Note) VOAC7502 doesn't support this function, and not display this menu.**	This section
	• SELECT	• It displays the file to be updated on the screen. The file is selected by rotating the Rotary knob. The operation procedure is described in this section.	—
	• UPDATE	• If M2 key is pressed after selecting the file in SELECT above, the software in this instrument is updated. It takes several minutes to complete the update. The operation procedure is described in this section.	
CALIBRATION		• **It enters calibrating (adjustment) menu of this instrument.** • **If M6 key is pressed, message "Do you enter CALIBRATION menu?" is displayed in the menu.** • **For contents and operation procedure of calibration, see section 5.2.**	Section 5.2
	• OK	• If M1 key is pressed, enter the calibration menu.	—
	• CANCEL	• If M6 key is pressed, close the inquiry menu.	

4.5.4.1 FIRMWARE UPDATE menu

* VOAC7502 doesn't support the firmware update from the USB memory, and this menu is not displayed.

This section describes update of the software in this instrument.

When updating the software, follow the preparation and cautions below.

○Preparation

- Stop signal input to the terminals on the front and rear panels and remove the test leads, cables, and adapters.

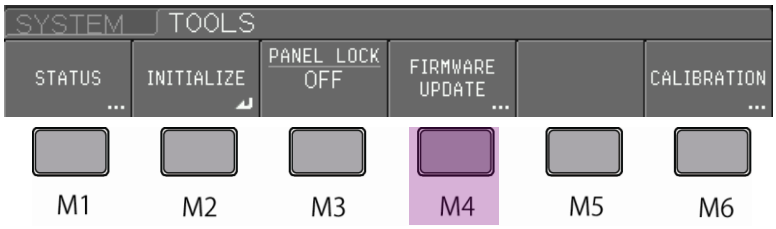
Note!

1) Do not turn off the power and remove the USB memory when updating the software of this instrument.
2) At the restart after completion of updating the software of this instrument, the internal hardware may be updated. In this case, Never do turn off the power during updating.
3) For updating the version of the software of this instrument, inquire of the sales staff or our Web site about adaptability to each instrument. (Contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this guide or our sales distributors.)
4) If the software of this instrument is updated, a large part of internal settings is initialized. Necessary SETUP (setting conditions) should be saved in the internal memory and USB memory by SAVE function (see section 4.7) in SAVE/RECALL menu. For initialization, see Default settings in Section 4.12.
5) Be sure to save the software of this instrument in “FIRMWARE” folder in the USB memory. If not, the software file cannot be recognized.

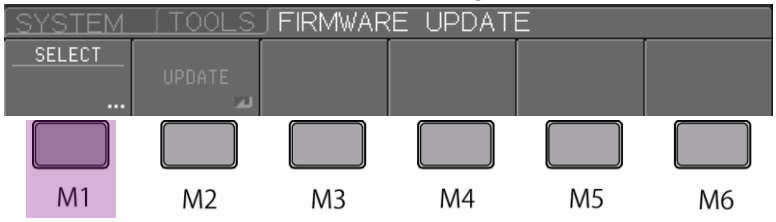
Operation procedure

① Connect the USB memory including the update file to the USB memory connection on the front panel.

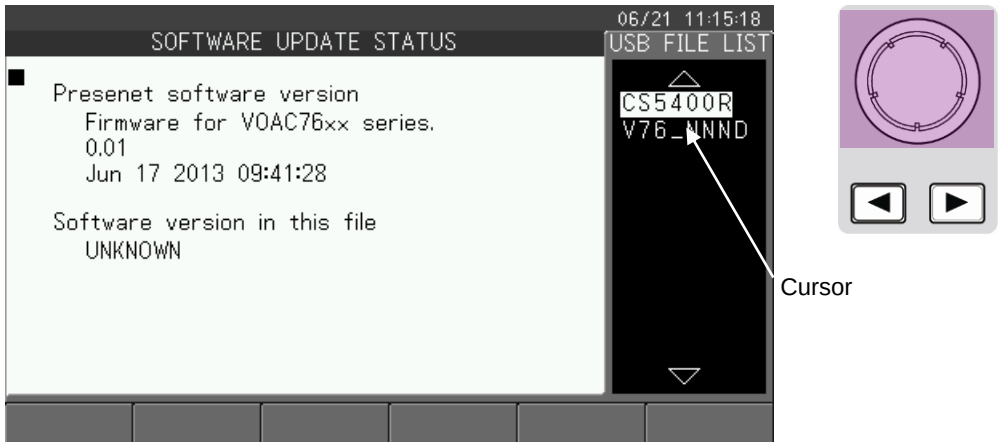
② When the diagram of TOOLS menu below opens, press M4 key and open the FIRMWARE UPDATE menu of ③.



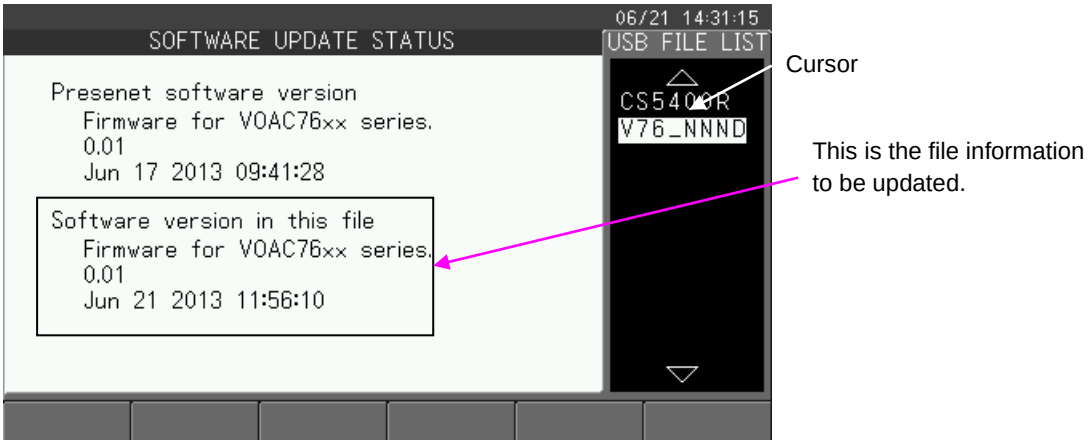
③ When the diagram of FIRMWARE UPDATE menu below opens, press M1 (SELECT menu) key and open the SOFTWARE UPDATE STATUS diagram of ④.



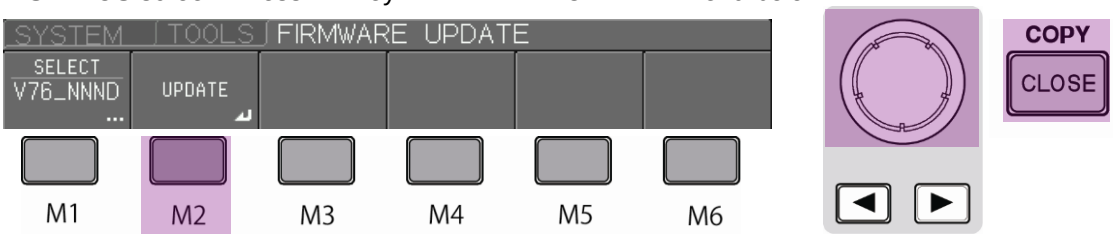
④ Rotate the Rotary knob on SOFTWARE UPDATE STATUS screen below and move the cursor to the file to be updated. (See the cursor in ⑤.)



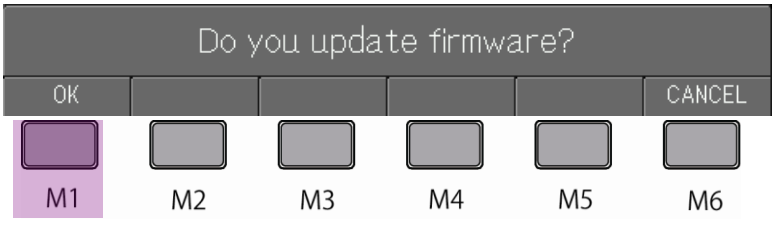
⑤ In SOFTWARE UPDATE STATUS screen below, the upper file information indicates the current software of this instrument and the lower information indicates the file information to be updated. Check that the file is normal.



⑥ After checking the contents in ⑤, press [CLOSE] key or the Rotary knob to close SOFTWARE UPDATE STATUS screen. Press M2 key in FIRMWAE UPDATE menu below.



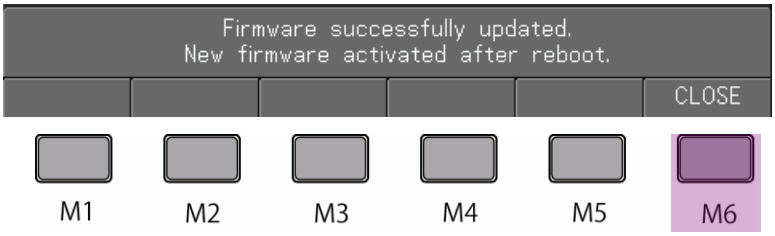
⑦ The inquiry screen below appears. Press M1 key to execute UPDATE.



During execution of update, several kinds of the blue bars indicating the progress are displayed at the top of the screen. It may take several minutes to complete the update.

⑧ If update is normally completed, the message below appears.

Press M6 key to close the message screen.

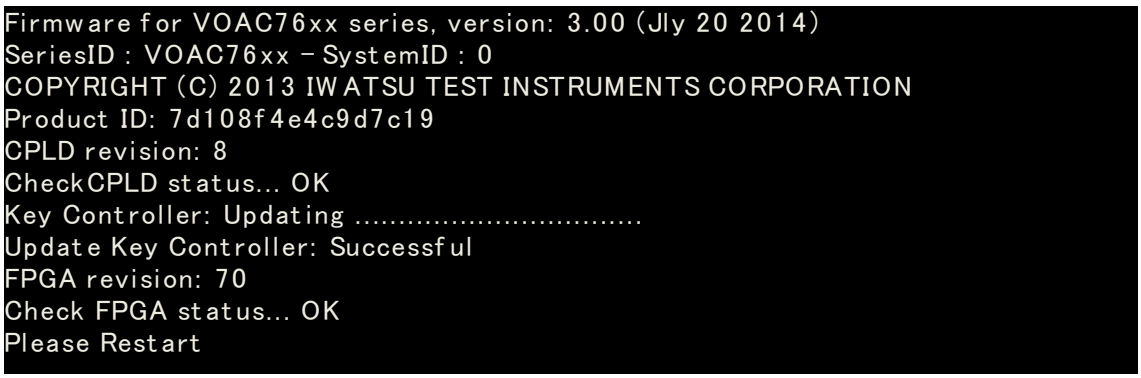


⑨ Turn off POWER switch and restart the power.

⑩ Advance to ⑪ at time that is not the following screen.

Advance to ⑪ at time that is the following screen after executing the following procedures.

This hardware in the instrument might be renewed to the during starting first time after it updates according to the content of the upgrade. In this case, the update situation is displayed on the liquid crystal screen in not a usual start screen but the text. (The figure below is the one example.)



At this time, do not turn off the power supply until "Please Restart"is displayed to the line in the under. Cut the POWER switch, and reactivate the power supply because it is an update end if "Please Restart" is displayed.

⑪ Open SYSTEM/TOOLS/STATUS menu. TOOLS STATUS screen below appears. Check that the version has been updated.

4.6 Calculation function (NULL/MATH)

If roughly classified, this instrument has 6 calculation functions as shown below.
Each calculation can be set simultaneously as an independent function. However, **SCALING calculation and dB calculation cannot be selected simultaneously.**

○ Calculations preset by the menu of each function

(1) SMOOTHING calculation: It executes the moving average processing and the number of averages can be selected from 2 to 100 (positive integral number; default: 10). The measurement data after SMOOTHING of measurements is operated is maintained as RA W value. (When SMOOTHING calculation is off, measurements are maintained as RAW value.) ···· For details, see section 4.6.1.

(2) NULL calculation: It executes the difference calculation processing below:
Measurement result = RAW value – NULL value
The measurement and the numerical value can be set to the NULL value by the NULL menu of each function.
···· For details, see section 4.6.2.

○ Calculation individually set by MATH menu

(3) CALCULATE calculation: There are two calculations of following ① and ②.

① SCALING calculation: Scaling calculation
It makes selection from two calculation expressions, sets the constant in each calculation expression, displays the result of the calculation as the measurement result. ···· For details, see section 4.6.3.1.

② dB calculation: dB calculation
It makes selection from dBm or dBV and displays the result of the dB calculation as the measurement result.
···· For details, see section 4.6.3.2.

(4) LIMIT calculation: Limit calculation
It sets two arbitrary threshold values; i.e. HIGH and LOW and judges 3 zones. ···· For details, see section 4.6.4.

(5) STATISTIC calculation: Statistics calculation
It calculates the maximum value, minimum value, average, and standard deviation of the measurement result and displays the value in the secondary display. ···· For details, see section 4.6.5.

The calculation of this instrument is executed like following A ⇒ B ⇒ C, and the measurement result, the judgment result, and statistical information are obtained.

- A: Measurements → SMOOTHING calculation → The measurement data is maintained as RAW value. → NULL calculation → SCALING calculation / dB calculation → The measurement result
- B: The measurement result of A → LIMIT calculation →Judgment result
- C: The measurement result of A → STATISTIC calculation →Statistic information

The following describes the setting method and settings for each calculation.

4.6.1 SMOOTHING (Moving average) calculation

The SMOOTHING calculation executes the processing of the moving average acquired measurements.

The function that can be the SMOOTHING calculation is DCV, ACV, DCI, ACI, 2WΩ, 4WΩ, FREQ, and TEMP (CONT and DIOD are improper. VOAC7502 does not support TEMP function.). There is SMOOTHING menu in each function. In the SMOOTHING menu, on/off of the calculation and LENGTH (average frequency) can be set by the integer value of 2 to 100.

<lindicator in the upper part of screen >

The display of the indicator changes as follows by the process of acquiring measurements.

○ BACKGROUND (Background color of screen): For BLACK

- Until it reaches set LENGTH (average frequency) : 

- Indicator after it reaches set LENGTH (average frequency) : 

○ BACKGROUND (Background color of screen): For WHITE

- Until it reaches set LENGTH (average frequency) : 

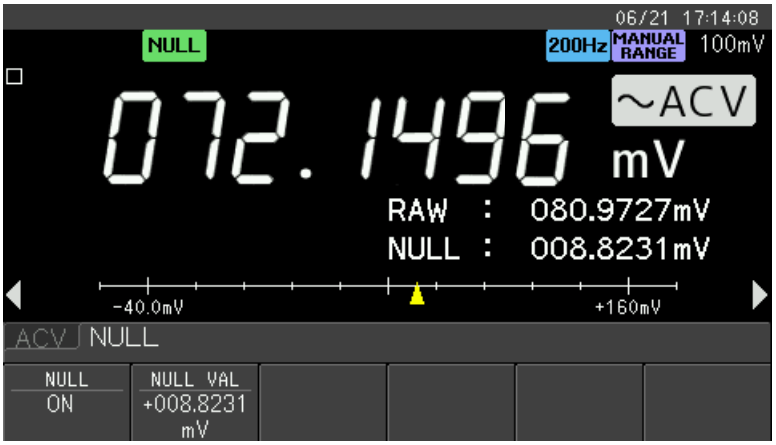
- Indicator after it reaches set LENGTH (average frequency) : 

4.6.2 NULL calculation

It sets the target numeric value of the difference calculation as the NULL value and uses the measurement value as the RAW value, and executes the difference calculation using the expression below and can display the difference calculation result in the measurement result. The RAW value is a measurement data in the section 4.6.1 after SMOOTHING of a passage is calculated.

Measurement result = RAW value – NULL value

The functions to be used by NULL calculation are DCV, ACV, DCI, ACI, 2WΩ, 4WΩ, TEMP, and FREQ (CONT and DIOD are improper. VOAC7502 does not support TEMP function.). The example below shows the measurement of AC current measurement ACV.



- RAW value : 80.9727 mV
- NULL value : 8.8231 mV
- Measurement result :72.1496 mV

○ Setting of NULL value

Set the NULL value by combining the following five methods.

- Setting of default value
  DEFAULT (default value: 0.000000 for VOAC7602, 0.00000 for VOAC7502) is selected in NULL/NULL VAL menu of each function.
- Setting by measurement value
  GET VAL is selected in NULLVAL/NULL VAL menu of each function and setting is made by acquiring the measurement value at that time.
- Setting of sign (+,-)
  If +/- (M3) key is pushed, it becomes a sign opposite to a present sign.
- Selection of setting range of 0 to 9 / 9 tc +9
  It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected.
  It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.
- Arbitrary manual setting
  The numeric value is set to NULL VAL in NULL/NULL VAL menu of each function using the Rotary knob or arrow keys.

  ∗ For the operation procedures of setting, see ◆ Menu items and settings for each function in section 4.3.1 to 4.3.10 and “ 3.4.1 Basic operation of menu.”

○ ON/OFF of NULL calculation by [NULL] key

ON/OFF of the NULL calculation is set with NULL key. ON/OFF of NULL calculation can be switched by [NULL] key when making measurement of each function of DCV, ACV, DCI, ACI, 2WΩ, 4WΩ, TEMP (VOAC7502 does not support TEMP menu.), FREQ

- NULL setting; OFF⇒ON
  Setting of NULL calculation is changed from OFF to ON and the first acquired measurement value after [NULL] key operation is set to NULL value.
- NULL setting; ON⇒OFF
  It is the same as ON ⇒OFF of NULL setting for each function’s menu.

4.6.3 CALCULATE (Scaling / dB) calculation

The following describes the calculation contents, setting items, and CALCULATE calculations (SCALING / dB) described at the beginning of section 4.6.

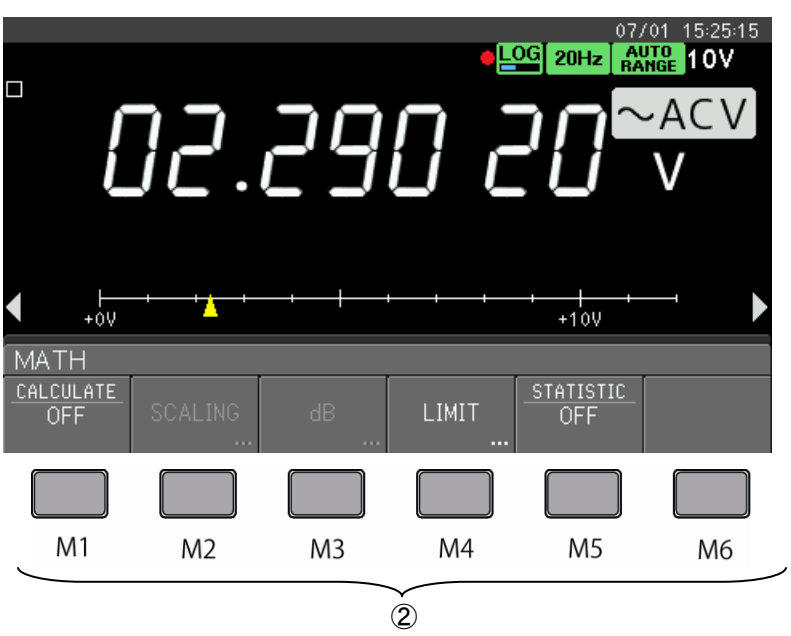
The following description is up to opening MATH menu and display of each calculation menu.

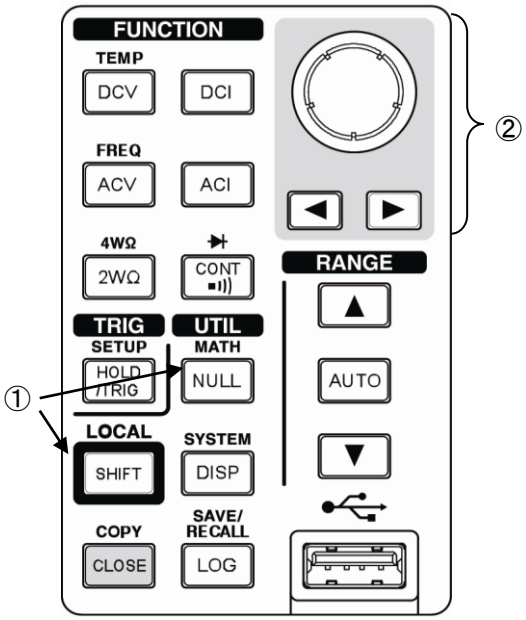
Operation procedure

① Press [SHIFT]→[NULL(MATH)] key on the screen below to open MATH menu.

② Use each item of MATH menu to set various functions.

Use the menu keys (M1 to M6) and the Rotary knob below the screen. For the operation, see “Section 3.4.1 Basic operation of menu.” For MATH menu setting, see “◆ MATH menu items and settings” on the next page.





<MATH menu when selecting SCALING calculation>

<MATH menu when selecting dB calculation>

◆ **MATH menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
CALCULATE		• **It selects ON/OFF of CALCULATE calculation function, two SCALING calculations, or dB calculation.**	6.5
	• OFF	• It sets MATH calculation function OFF. LIMIT calculation and STATISTIC calculation can be set ON/OFF independent of ON/OFF of MATH calculation.	–
	• SCALING	• It sets SCALING calculation function ON. SCALING menu can also be set.	
	• dB	• It sets dB calculation function ON. The dB menu can also be set. It is possible to select it only at DCV and ACV.	
SCALING		**See "4.6.3.1 SCALING calculation."**	6.5.3 4.6.3.1
dB		**See "4.6.3.2 dB calculation."**	6.5.4 4.6.3.2
LIMIT		• **It opens the menu to set HIGH/LOW of LIMIT calculation, HIGH value, and LOW value.**	6.5.6 4.6.4
	• LOW	• It sets ON/OFF of LOW value judgment of LIMIT calculation.	–
	• LOW LIMIT	It sets LOW value of LIMIT calculation. ○DEFAULT It sets the default value -999.9999T to LOW value. Note) The default value of VOAC7502 is -999.999T. ○GET VAL It sets the measurement value when pressing M2 key to LOW value. ∗ Numeric value setting It allows the Rotary knob or arrow keys to set the numeric value to LOW value.	
	• HIGH	• It sets ON/OFF of HIGH value judgment of LIMIT calculation.	
	• HIGH LIMIT	It sets HIGH value of LIMIT calculation. ○DEFAULT It sets the default value +999.9999T to HIGH value. Note) The default value of VOAC7502 is +999.999T. ○GET VAL It sets the measurement value when pressing M2 key to HIGH value. ∗ Numeric value setting It allows the Rotary knob or arrow keys to set the numeric value to HIGH value.	
	DIO ∗ DIO option (SC-362) installed	It sets ON/OFF of judgment output of LIMIT calculation. ∗ Only when DIO option (SC-362) is installed on the rear panel, the menu is displayed. For the specification and signal timing, see section 6.1. ○ON It outputs LIMIT judgment. ○OFF It does not output LIMIT judgment.	6.1
STATISTIC		• **The menu sets ON/OFF of STATISTIC calculation.**	6.5.5 & 4.6.5
	• OFF	• It sets the statistics calculation function OFF.	–
	• ON	• It sets the statistics calculation function ON.	

4.6.3.1 SCALING function

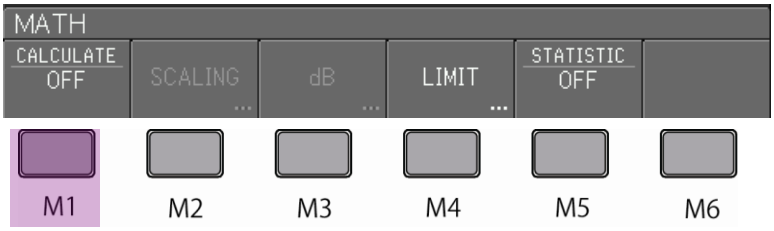
The scaling function is used for conversion into the user-defined unit.
SCALING/MODE menu is used to select two calculation expressions below:

(1) Displayed value = (measurement value −A)∗B/C
(2) Displayed value = D/measurement value

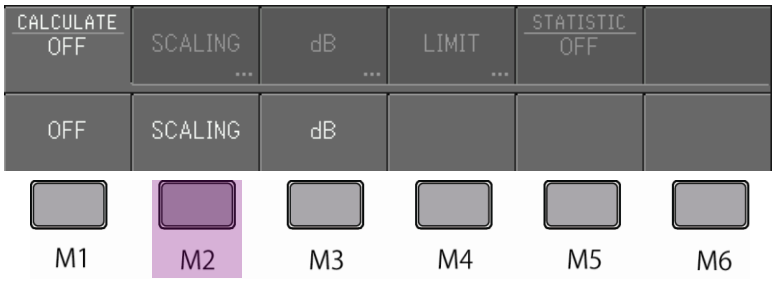
- The 7-digit valid number is set for the constant A, B, C, or D by SCALING menu.
- A, B, and D do not have a unit. They are the constants with the multiplier and only one value is set for them regardless of the measurement function. The multiplier corresponds to 8 types (T, G, M, k, m, μ, n, and p).
- Rotating of the Rotary knob while aligning the cursor with the multiplier when setting the constant allows the numeric value part to be multiplied by 10 times by clockwise rotation and 1/10 times by counterclockwise rotation.
- The scaling calculation and dB calculation cannot be set simultaneously.

Operation procedure

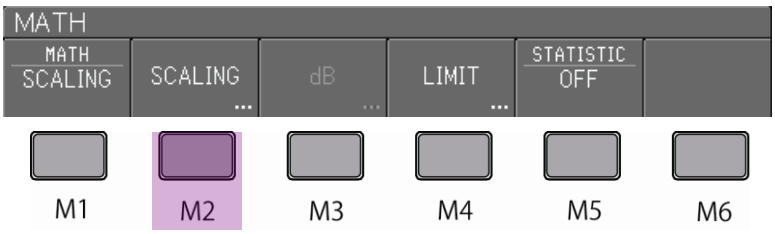
① Press [SHIFT]→[NULL(MATH)] key to open MATH menu.



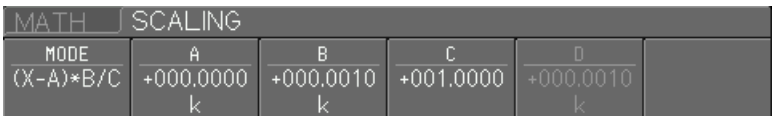
② Press M1 key in ① menu and open CALCULATE menu.



③ Press M2 key in ② menu and select SCALING. SCALING is set to CALCULATE.



④ Press M2 key in③ menu and open SCALING of the following diagram.



For settings of SCALING menu, see "◆SCALING menu items and settings" on the next page. Use the menu keys (M1 to M6) and the Rotary knob below the screen." For the operation, see "Section 3.4.1 Basic operation of menu."

◆SCALING menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
MODE		• **It selects the MODE of SCALING calculation from two calculation expressions below.**	Section 6.5.3
	• (X-A)∗B/C	• By pressing M1 key, the calculation expression on the left is selected. The constant A, B, or C is set by the menu item below.	—
	• D/X	• By pressing M2 key, the calculation expression on the left is selected. The constant D is set by the menu item below.	
A ∗ When (X-A)∗B/C MODE is selected		• **By the calculation expression above; (X-A)*B/C, the constant A is set.**	Section 6.5.3
	• DEFAULT	• By pressing M1 key, the default value; ＋000.0000 is set to A. Note） The default value of VOAC7502 is -＋000.000.	—
	∗Numeric value setting	• By the Rotary knob and arrow keys, the numeric value is set to A.	
	• GET VAL	• By pressing M2 key, the measurement value excluding the unit at that time is set to A.	
B ∗When (X-A)∗B/C MODE is selected		• **By the calculation expression above; (X-A)*B/C, the constant B is set.**	Section 6.5.3
	• DEFAULT	• By pressing M1 key, the default value; ＋000.1000 is set to B. Note） The default value of VOAC7502 is -＋000.100.	—
	∗ Numeric value setting	• By the Rotary knob and arrow keys, the numeric value is set to B.	
	• GET VAL	• By pressing M2 key, the measurement value excluding the unit at that time is set to B.	
C ∗ When (X-A)∗B/C MODE is selected		• **By the calculation expression above; (X-A)*B/C, the constant C is set.** **Note: The value 0 cannot be set to C.**	Section 6.5.3
	• DEFAULT	• By pressing M1 key, the default value; ＋000.1000 is set to C. Note） The default value of VOAC7502 is -＋000.100.	—
	∗ Numeric value setting	• By the Rotary knob and arrow keys, the numeric value is set to C.	
	• GET VAL	• By pressing M2 key, the measurement value excluding the unit at that time is set to C.	
D ∗ When D/X MODE is selected		• **By the calculation expression D/X above, the constant D is set.**	Section 6.5.3
	• DEFAULT	• By pressing M1 key, the default value; ＋000.1000 is set to D. Note） The default value of VOAC7502 is -＋001.000.	—
	∗ Numeric value setting	• By the Rotary knob and arrow keys, the numeric value is set to D.	
	• GET VAL	• By pressing M2 key, the measurement value excluding the unit at that time is set to D.	

4.6.3.2 dB calculation

The dB calculation displays the measurement value which is converted into dB.

Two dB conversion expressions below are selected by dB/MODE menu.

(1) dBm

This calculation sets the voltage which allows the standard resistance to consume 1 mW to 0 dBm.

$$dBm = 10 \cdot \log_{10} \left(\frac{\text{Measurement value}^2 / \text{Standard resistance}}{1.0 \times 10^{-3}[W]} \right)$$

The standard resistance value can be selected from the numeric values below by using REF-R menu (default value: 600 Ω)

4, 8, 16, 32, 50, 75, 93, 110, 124, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000, 1200, 8000 Ω

(2) dBV

This is the logarithm calculation of the voltage measurement value for the standard voltage.

$$dBV = 20 \cdot \log_{10} \frac{|\text{Measurement value}|}{\text{Standard voltage}[V]}$$

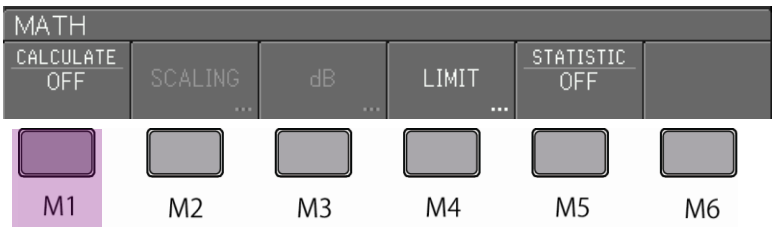
The standard voltage can be selected from 1.0 μV (default value), 1.0 mV, and 1.0 V by REF-V menu.

The dB calculation has the functions and restrictions below:

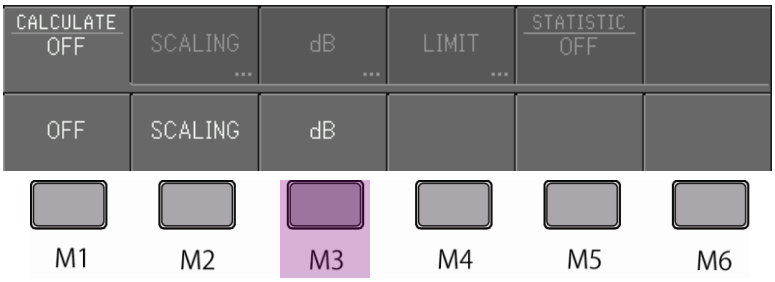
- The calculation can be used for only DCV and ACV functions.
- The scaling calculation and dB calculation cannot be set simultaneously.
- When NULL calculation is set ON, DB calculation should be done after executing NULL processing for the raw data before DB calculation.
- The dB REL calculation can be done for dBm and dBV. The dB REL calculation is the function which displays the difference value obtained by subtracting the dB standard value from the dB calculation result. The dB/REL menu is used to set it ON/OFF.
- The setting range and the multiplier of the dB standard value are as follows:
  Setting range: 7-digit valid number with the multiplier is set.
- Rotating of the Rotary knob while aligning the cursor with the multiplier when setting the constant allows the numeric value part to be multiplied by 10 times by clockwise rotation and 1/10 times by counterclockwise rotation.

Operation procedure

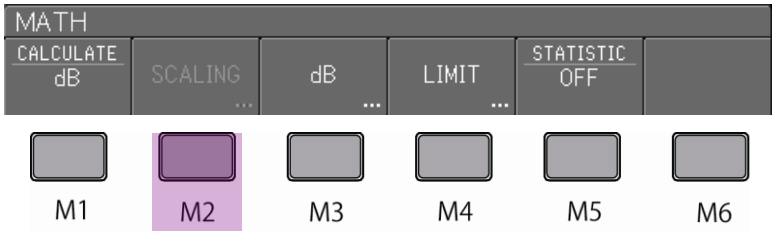
①Press [SHIFT]→[NULL(MATH)] key on the screen below to open MATH menu.



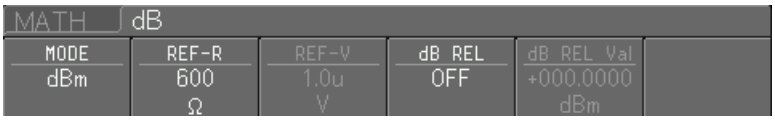
②Press M1 key in ① menu and open MATH menu. Press M3 key on the diagram below and select dB.



③ The dB is set to CALCULATE as shown below:



④ Press M2 key in ③ menu to open dB menu below.



For the subsequent operation, see the following "◆ dB menu Items and settings" on the next page. Use the menu keys M1 to M6 below the screen (outside) and Rotary knob for operation. For the operation, see "Section 3.4.1 Basic operation of menu."

◆ dB menu Items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
MODE		• **It selects the MODE of dB calculation from two calculation expressions below.**	Section 6.5.4
	• dBm	• By pressing M1 key, the calculation expression on the left is selected. The calculation expression is (1) on the previous page.	—
	• dBV	• By pressing M2 key, the calculation expression on the left is selected. The calculation expression is (2) on the previous page.	
REF-R **∗ dBm is selected by MODE above**		• **By the calculation expression dBV above, the standard resistance is set.**	Section 6.5.4
	• DEFAULT	• Press M1 key to set default value 600Ω to REF-R.	—
	∗ Numeric value setting	• By rotating the Rotary knob, select REF-R value to set the numeric value.	
REF-V **∗ dBV is selected by MODE above**		• **By the calculation expression dB REL above, the standard voltage is set.**	Section 6.5.4
	• 1.0 V	• Press M1 key to set 1.0 V to REF-V.	—
	• 1.0 mV	• Press M2 key to set 1.0 mV to REF-V.	
	• 1.0 μV	• Press M3 key to set 1.0 μV to REF-V.	
dB REL		• **It sets ON/OFF of the dB REL calculation.**	Section 6.5.4
	• OFF	• Press M4 key to set dB REL calculation ON.	—
	• ON	• Press M4 key to set dB REL calculation OFF.	
dB-REL Val		• **When dB REL is set ON, it sets dB REL Val value (dB standard value).**	Section 6.5.4
	• DEFAULT	• Press M1 key to set the default value (+000.0000dBm: MODE:dBm selected; +000.0000dB: MODE: dBV selected)to dB REL Val. Note) The default value of VOAC7502 is +000.000 d Bm, +000.000 d B	—
	∗ Numeric value setting	• With the Rotary knob and arrow keys, it sets the numeric value of dB REL Val value.	
	• GET VAL	• By pressing M2 key, it sets the measurement value at that time to dB REL Val.	

4.6.4 LIMIT calculation

The function judges which zone includes the measurement result by setting HIGH and LOW threshold values.

For explanation of LIMIT menu, refer to section 4.6.3 "◆Items and settings of MATH menu."

For the trend chart display, HIGH and LOW threshold value lines are displayed and dots higher and lower than the threshold values are displayed in red. (For trend chart display, refer to section 4.9.)

The histogram chart display displayes the threshold values. However, since the threshold value of the LIMIT calculation is normally not consistent with the edge of BIN, the BIN color is not changed. (For the histogram display, refer to section 4.10.)

◇ **Display of LIMIT judgment result**

LIMIT judgement result (GO/HIGH/LOW) is displayed in the following three places.

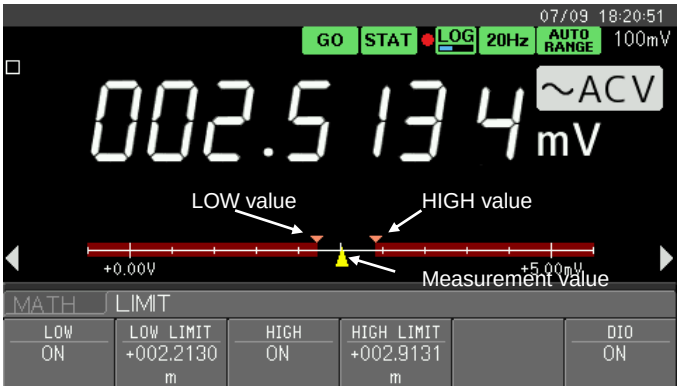
- Limit indicator of annunciator
- Primary display (when selecting "LIMIT")
- Secondary display (when selecting "LIMIT")

The displayed contents are as follows:

- GO : LOW ≤ Measurement result ≤ HIGH
- HIGH : HIGH < Measurement result
- LOW : Measurement result < LOW
- ––– : When the measurement result is invalid as objects of the LIMIT calculations of the overload and the overflow, etc.
- Non-display : If HIGH: OFF and LOW: OFF* in LIMIT menu
  * In a primary display, it becomes ––– display by the LIMIT menu for HIGH: OFF and LOW: OFF.

If either of HIGH and LOW is ON in LIMIT menu, judgment is made only for ON.

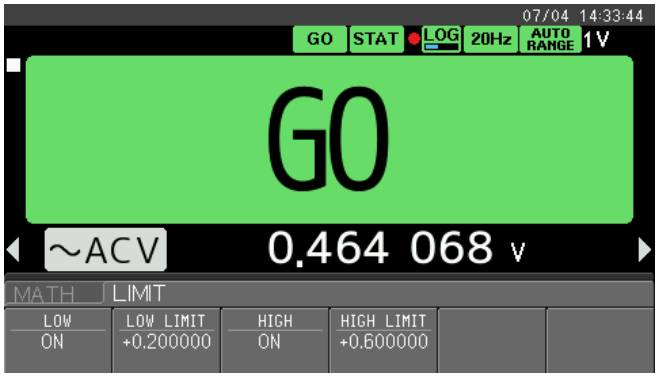
The following shows the display example of the judgment result on the secondary display.



- Fucntion: ACV
- LOW value: 2.2130 mV
- HIGH value: 2.9131mV
- Measurement result: 2.5134 mV, 2.5135 mV
- Judgment result: GO judgment because of LOW value < measurement value < HIGH value

If the secondary display shows LIMIT judgment as shown in the example above (right), HIGH and LOW threshold values and judgment result are displayed. As shown in the example above (left), the measurement value is displayed with △ mark for the analog meter display and HIGH/ LOW threshold values are with ▽ mark.

On the other hand, the primary display shows the larger judgment result (refer to the example of the judgment result). For detail of display, refer to section 2.3.3.4.



- LOW value:0.200000 V • HIGH value: 0.600000 V
- Judgment result: GO judgment because of LOW value < measurement value < HIGH value
- Measurement value: 0.464068 V

Note) Example of VOAC7602

- HIGH: ON and LOW: ON and the measurement result is invalid.

The relationship among OFF and GO, NO-GO, and LOW/ GO / HIGH SYSTEM/ BEEP / LIMIT menus is as follows:

- OFF : BEEP does not sound regardless of LIMIT judgment result.
- GO : BEEP sounds if LIMIT judgment result is GO∗.
- NO-GO : BEEP sounds if LIMIT judgment result is LOW or HIGH∗.

∗ ON/ OFF setting of BEEP sound, refer to section 4.5.

◇ About LIMIT judgment output

The table below shows LIMIT judgment output condition when DIO option (SC-362) is included.

Judgment result / terminal	HI	GO	LO
HIGH	S	O	O
GO	O	S	O
LOW	O	O	S

S: terminal pair is shorted. O: terminal pair is open.

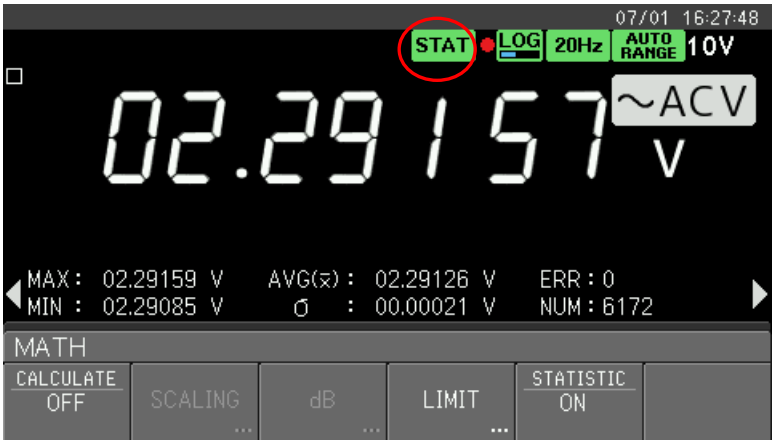
However, since the limit calculation is not done in the cases below, all HI/ GO/ LO terminal pair is open.

- HIGH and LOW of LIMIT calculation are set to OFF.
- LIMIT setting error (i.e. LOW LIMIT > HIGH LIMIT)
- Measurement value error (overload or overflow)
- The number of samples in SMOOTHING calculation is not reached.

In addition, if the number of samples in SMOOTHING calculation is not reached, CMPL terminal is not output.

4.6.5 STATISTIC calculation

It calculates the maximum value (MAX), minimum value (MIN), average (AVG), and standard deviation (σ) for the measurement results. If ON is set on MATH/STATISTIC menu, the annunciator shows the STAT indicator. The calculation result selects, and displays STAITSTIC on a secondary display. The following is the measurement example.



- ERR: Number of data invalid as objects of statistical calculations of overload and overflow, etc.
- NUM: Number of samples of statistical calculations (number of calculated data)

A statistical calculation is executed lasting long until the calculation result is cleared.
However, stop the calculation of the average value and σ when the number of samples exceeds two billion, and do not update the value at the following. (The maximum and minimum value are updated.)
Refer to section 7.4 for the timing at which the result of a statistical calculation is cleared.

The data below should not be calculated as the statistics. As for such data, only the count is done as ERR.

- Overloaded data
- Data for moving average which is collected before the first value is calculated
- Erroneous data which cannot acquire the correct value; e.g. overflow of scaling calculation

4.7 Save/recall of setting conditions (SETUP SAVE/RECALL)

The following can be set and executed for each item in SETUP SAVE/RECALL menu.

○ SAVE

- It saves the setting condition (SETUP).
- The storage can be selected from the internal memory (INTERNAL MEMORY) or USB memory* (USB MEMORY).

  * The save of the setting condition in the USB memory cannot be executed while executing a continuous writing in the USB memory by the VALUE TO USB function.
  VOAC7502 corresponds only to save to an internal memory.
  Refer to "Correspondence USB memory" at the USB memory connection entrance of 6.1 common specifications to in Chapter 6 for the USB memory that can be used.

○ RECALL

- It recalls the setting conditions.
- The source can be selected from the internal memory (INTERNAL MEMORY) or USB memory* (USB MEMORY).

  * The recall of the setting condition in the USB memory cannot be executed while executing a continuous writing in the USB memory by the VALUE TO USB function.
  VOAC7502 corresponds only to recall to an internal memory.
  Refer to "Correspondence USB memory" at the USB memory connection entrance of 6.1 common specifications to in Chapter 6 for the USB memory that can be used.

○ POWER ON RECALL

- It presets the setting conditions at powering-on and uses them at start.
- It selects any of the factory initial settings, setting conditions at final powering-off, and setting conditions saved in the internal memory in advance.

○ SETUP NAME

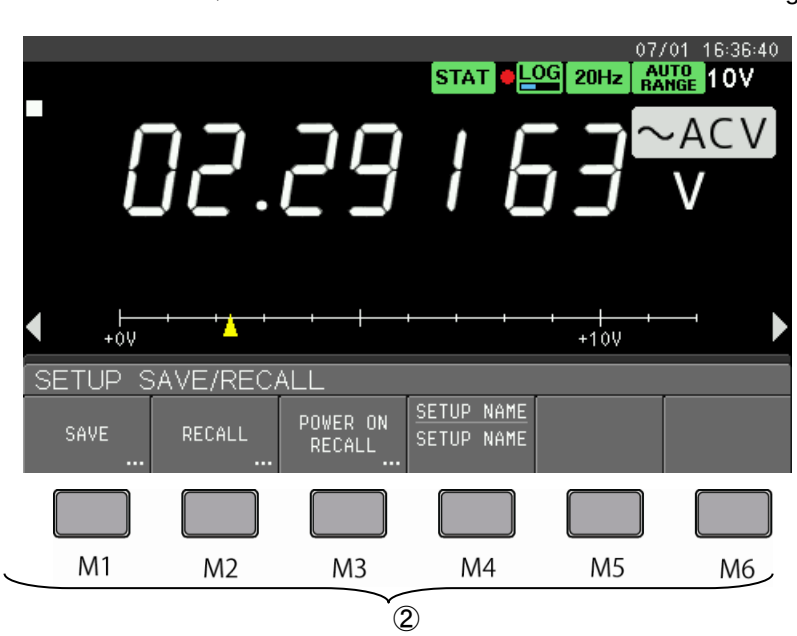
- It can add the name to the setting conditions (with alphanumeric characters, symbols, spaces).

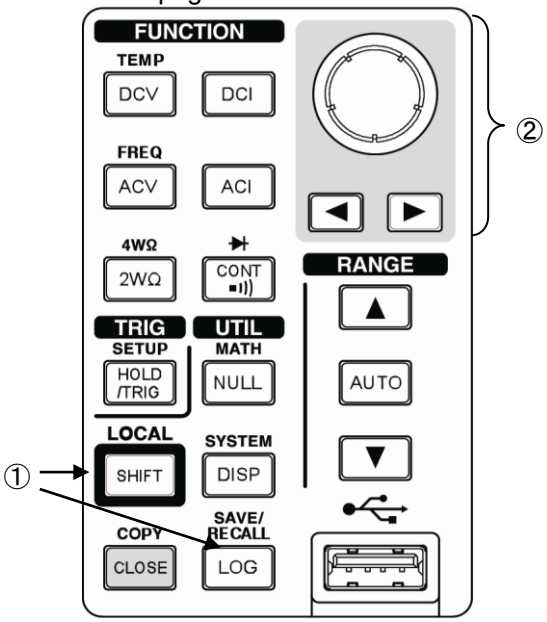
Memo! Use of SETUP NAME
The name added to the item of SETUP NAME menu can be displayed. Naming is convenient when an important setting condition should be remembered or settings are too many to discriminate them. In addition, the summary of the setting conditions (SETUP SUMMARY) can be displayed in SAVE or RECALL operation and SETUP NAME is displayed at the first line. In addition, current SETUPNAME can be displayed in the upper right of the measurement screen.

The following describes setting methods of setting condition saving/recalling and settings of SETUP SAVE/RECALL menu.

Operation procedure

① Press [SHIFT]→ [LOG(SAVE/RECALL)] key. SETUP SAVE/RECALL menu opens.
② Use each item of SETUP SAVE/RECALL menu to set various functions.
Use the menu keys M1 to M6 below the screen (outside) and Rotary knob for operation. For the operation, see “Section 3.4.1 Basic operation of menu.” For SETUP SAVE/RECALL menu setting, see “◆ SETUP SAVE/RECALL menu items and settings” on the next page.





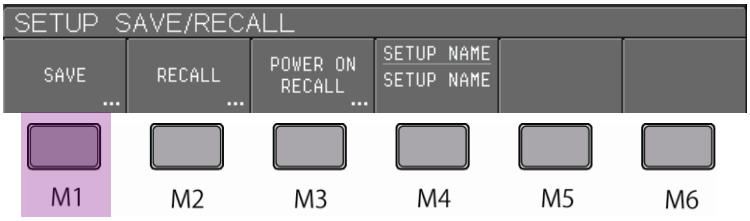
◆**SETUP SAVE/RECALL menu items and settings**

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Sections
SAVE		**See "4.7.1 Setting of SAVE menu."**	4.7.1
RECALL		**See "4.7.2 Setting of RECALL menu."**	4.7.2
POWER ON RECALL		• **The instrument starts with the preset setting conditions when powered on. The conditions are set by MODE, NUMBER, and SELECT below.**	6.12
	• MODE	Any 3 modes below is selected for POWER ON RECALL • LAST The instrument starts with the setting condition when it is finally powered off (POWER switch off). Press M1 key to select it. • DEFAULT The instrument starts with the factory setting conditions. Press M2 key to select it. • RECALL It starts with the setting conditions preset by NUMBER or SELECT below.	—
	• NUMBER ∗Only when MODE above is RECALL	• Make selection from the setting conditions in the internal memories from #1 to #10. Rotate the Rotary knob to select # number. Note: It is necessary to save the setting conditions of #1 to #10 in advance by SAVE menu. If the internal memory which does not include any setting condition is set, the instrument starts with the factory initial settings.	—
	• SELECT ∗Only when MODE above is RECALL	• The # number of the internal memory (INTERNAL MEMORY) is displayed on the right of the screen and the cursor is displayed on the selected number. SETUP SUMMARY of the selected # number is displayed on the left of the screen. • Select #1 to #10 of the internal memory from the setting conditions. Rotate the Rotary knob to select # number.	
SETUP NAME		• **It sets the name to a present setting condition. The setting condition is preserved by SAVE with the name, and can be confirmed with the name in list display (SETUP SUMMARY). The name is set at the cursor position on the SETUP NAME creation plate by Input/ delete menu.** • **The name consists of up to 15 characters and up to 8 characters can be displayed in the menu.**	—
	• ABCabc	• Uppercase and lowercase alphabets can be entered at the cursor position on the SETUP NAME creation plate. M1 key is used to select it and the uppercase and lowercase input format is displayed at the beginning on the SETUP NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close SETUP NAME menu.	—
	• 123	• It can enter the number from 0 to 9 at the cursor position on the SETUP NAME creation plate. M2 key is used to select it and the character input format is displayed at the beginning on the SETUP NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close SETUP NAME menu.	
	• **!#$**	• It can enter the symbol (e.g. space and symbol) at the cursor position on the SETUP NAME creation plate. M3 key is used to select it and the character input format is displayed at the beginning on the SETUP NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close SETUP NAME menu.	
	• DELETE	• It deletes the character, number, or symbol at the cursor position on the SETUP NAME creation plate. Press M4 key to delete it.	
	• BACK SPACE	• It deletes the character, number, or symbol just prior to the cursor position on the SETUP NAME creation plate. Press M5 key to delete it.	
	• INPUT SPACE	• It enters the space at the cursor position on the SETUP NAME creation plate. Press M6 key to enter it.	

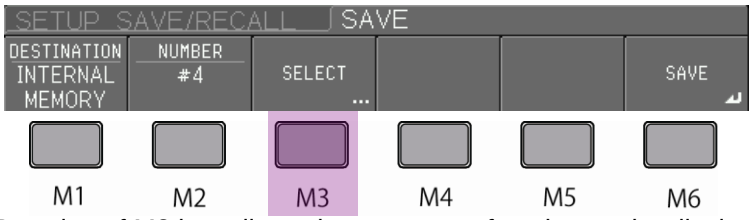
4.7.1 Setting of SAVE menu

The following describes the setting items and settings of SETUP SAVE/RECALL/SAVE menu.

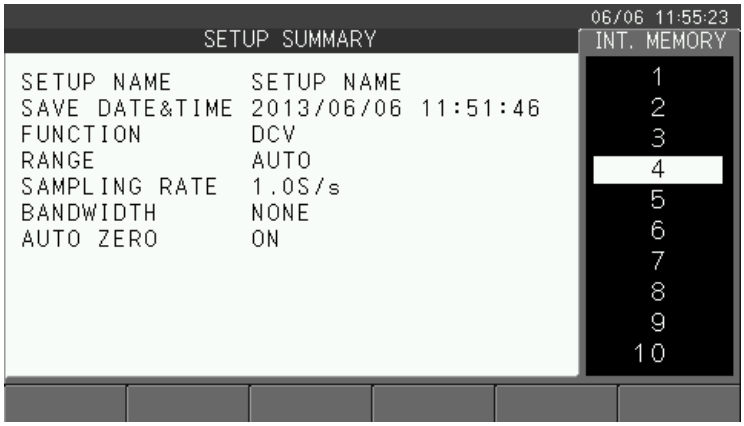
Press M1 key on the following diagram of SETUP SAVE/RECALL menu to open SAVE menu. (to (1) or (2))



(1) If the internal memory is selected for storage



Pressing of M3 key allows the summary of settings to be displayed by SETUP SUMMARY (the following is example of #4) of the internal memory specified by the cursor position. See "◆ Items and settings of SAVE (storage: internal memory) setting menu" below.



(2) If the USB memory is selected for storage (VOAC7502 cannot select USB MEMORY.)

For the following, see "◆ Items and settings of SAVE (storage: USB memory)"on the next page.

◆Items and settings of SAVE (storage: internal memory) setting menu

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
DESTINATION		• **It selects the storage of the setting conditions from the following.**	Section 6.12
	• INTERNAL MEMORY	• It selects the internal memory of this instrument.	–
	• USB MEMORY	• It selects the USB memory.	
NUMBER		• It selects the internal memory number #1 to #10 by pressing M2 key and rotating the Rotary knob.	Section 6.12
SELECT		• It selects the internal memory number #1 to #10 by pressing M3 key and rotating the Rotary knob. • It displays SETUP SUMMARY (setting condition summary) of the memory number at the cursor position.	–
SAVE		• It makes saving to the specified storage with the name preset in above. Press M6 key to execute it.	–

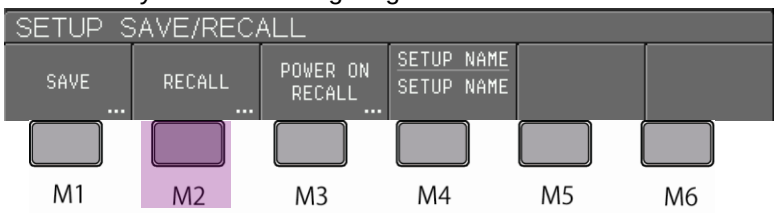
◆Items and settings of SAVE (storage: USB memory, VOAC7502 doesn't support this content.)

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
DESTINATION		• **It selects the storage of the setting conditions from the following.**	Section 6.8
	• INTERNAL MEMORY	• It selects the internal memory of this instrument.	–
	• USB MEMORY	• It selects the USB memory.	
DIRECTORY		• **It sets the directory name in the USB memory. It sets the name at the cursor position on the DIRECTORY creation plate with Input/Delete menu.** • **The name consists of up to 8 characters and up to 8 characters are displayed in the menu.**	–
	• DEFAULT	• It sets the DIRECTORY in “SETUP” format.	–
	• ABC	• Uppercase alphabets can be entered at the cursor position on the DIRECTORY creation plate. M1 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	• 123	• It can enter the number from 0 to 9 at the cursor position on the DIRECTORY creation plate. M3 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	• !@$	• It can enter the symbol (e.g. space and symbol) at the cursor position on the DIRECTORY NAME creation plate. M4 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	• BACK SPACE	• It deletes the character, number, or symbol just prior to the cursor position on the DIRECTORY creation plate. Press M5 key to delete it.	
	• INPUT SPACE	• It enters the space at the cursor position on the DIRECTORY creation plate. Press M6 key to enter it.	
FILE NAME		• **It sets the setting condition file name to be saved in the USB memory. The name is set at the cursor position on the FILE NAME creation plate with the input menu below.** • **The name is 8-character long fixed.**	–
	• DEFAULT	• FILE NAME is set in the “STUPXXXX” format. ∗ “XXXX”: numeric value (initial value: 0000)	–
	• ABC	• Uppercase alphabets can be entered at the cursor position on the FILE NAME creation plate. (Note) It doesn't change except a numeric input when there is a cursor in the part of above-mentioned FILE NAME "XXXX". The character input format is displayed at the beginning on the FILE NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close FILE NAME menu.	
	• 123	• It can enter the number from 0 to 9 at the cursor position on the FILE NAME creation plate. M3 key is used to select it and the character input format is displayed at the beginning on the FILE NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close FILE NAME menu.	
	• !@$	• It can enter the symbol at the cursor position on the FILE NAME creation plate. (Note) It doesn't change except a numeric input when there is a cursor in the part of above-mentioned FILE NAME "XXXX". M4 key is used to select it and the character input format is displayed at the beginning on the FILE NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close FILE NAME menu.	
SAVE		• **It makes saving in the specified storage with the name preset in above.Press M6 key to execute it. To prevent the superscription when succeeding in save, one increases the value of the FILENAME last 4 digits.**	–

4.7.2 Setting of RECALL menu

The following describes the setting items of SETUP SAVE/RECALL/ RECALL menu.

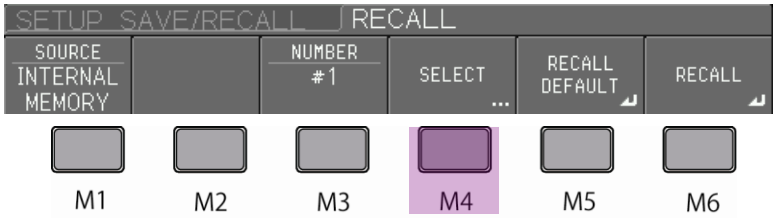
Press M2 key on the following diagram of SETUP SAVE/RECALL menu to open RECALL menu to (1) or(2).



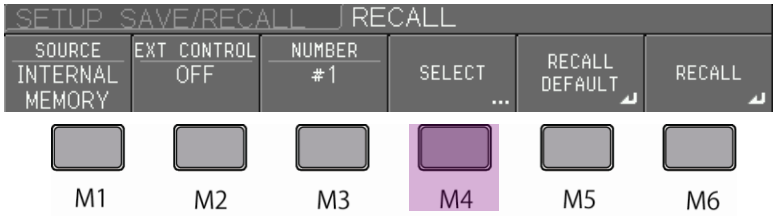
(1) If the internal memory (INTERNAL MEMORY) is selected for the source

The menu display (①, ②) are displayed depending on LAN & RS-232 interface option (SC-361) included or not.

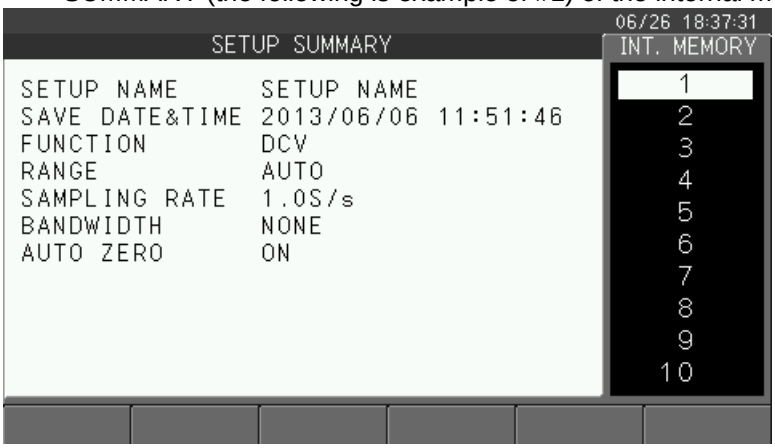
① If LAN & RS-232 interface option (SC-361) is not included



② If LAN & RS-232 interface option (SC-361) is included and EXT CONTROL: OFF



In ① and ② above, pressing of M4 key allows the summary of settings to be displayed by SETUP SUMMARY (the following is example of #1) of the internal memory specified by the cursor position.



For the following, see "◆ Items and settings of RECALL (source: internal memory) setting menu" on the next page.

◆ Items and settings of RECALL (source: internal memory) setting menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
SOURCE		**・It selects the recall source of the setting conditions from the following:**	6.12
	・INTERNAL MEMORY	・It selects the internal memory of this instrument.	–
	・USB MEMORY	・It selects the USB memory.	
EXT CONTROL * Displayed only when LAN & RS-232 Interface option (SC-361) is included.		**・It selects whether the external control is used for recalling the setting condition as shown below:**	–
	・ON	・External connection is made for control. For the example, see section4.7.3.	4.7.3
	・OFF	・Key operation is used to recall the setting condition of this instrument from the internal memory. For other than external control, OFF should be set.	–
NUMBER		**・When EXT CONTROL is OFF, press M2 key and select the internal memory number #1 to #10 by rotating the rotary knob.**	6.12 4.7.3
SELECT		**・Press M3 key and select the internal memory number #1 to #10 by rotating the rotary knob.** **・It displays SETUP SUMMARY (setting condition summary) of the memory number at the cursor position.**	–
RECALL DEFAULT		**・Press M5 key to recall the factory setting conditions.**	–
RECALL		**・It makes recall from the specified source with the setting condition specified above. Press M6 key to execute it.**	–

(2) If USB memory is selected for the source

* VOAC7502 does not support this content (2) because VOAC7502 cannot select the USB memory in the call origin.

For the following, see "◆ Items and settings of RECALL(source: USB memory) setting menu" on the table below.

◆Items and settings of RECALL(source: USB memory) setting menu

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
SOURCE		• **It selects the storage of the setting conditions from the following.**	Section 6.12
	•INTERNAL MEMORY	• It selects the internal memory of this instrument.	—
	•USB MEMORY	• It selects the USB memory.	
DIRECTORY		• **It sets the directory name in the USB memory. It sets the name at the cursor position on the DIRECTORY creation plate with Input/Delete menu.** • **The name consists of up to 8 characters and up to 8 characters are displayed in the menu.**	—
	• DEFAULT	• It sets the DIRECTORY in "SETUP" format.	—
	• ABC	• Uppercase alphabets can be entered at the cursor position on the DIRECTORY creation plate. M2 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	• 123	• It can enter the number from 0 to 9 at the cursor position on the DIRECTORY creation plate. M3 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	• ! @ $	• It can enter the symbol (e.g. space and symbol) at the cursor position on the DIRECTORY NAME creation plate. M4 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	• BACK SPACE	• It deletes the character, number, or symbol just prior to the cursor position on the DIRECTORY creation plate. Press M5 key to delete it.	
	• INPUT SPACE	• It enters the space at the cursor position on the DIRECTORY creation plate. Press M6 key to enter it.	
FILE NAME		• **It sets the setting condition file name to be saved in the USB memory.** • **Press M4 key and rotate the Rotary knob to select the displayed FILE LIST file name.**	—
RECALL DEFAULT		• **Press M5 key to recall the factory setting conditions.**	—
RECALL		• **It recalls the setting condition from the specified source with the name set in above. Press M6 key to execute it.**	—

4.7.3 External control function of SETUP RECALL

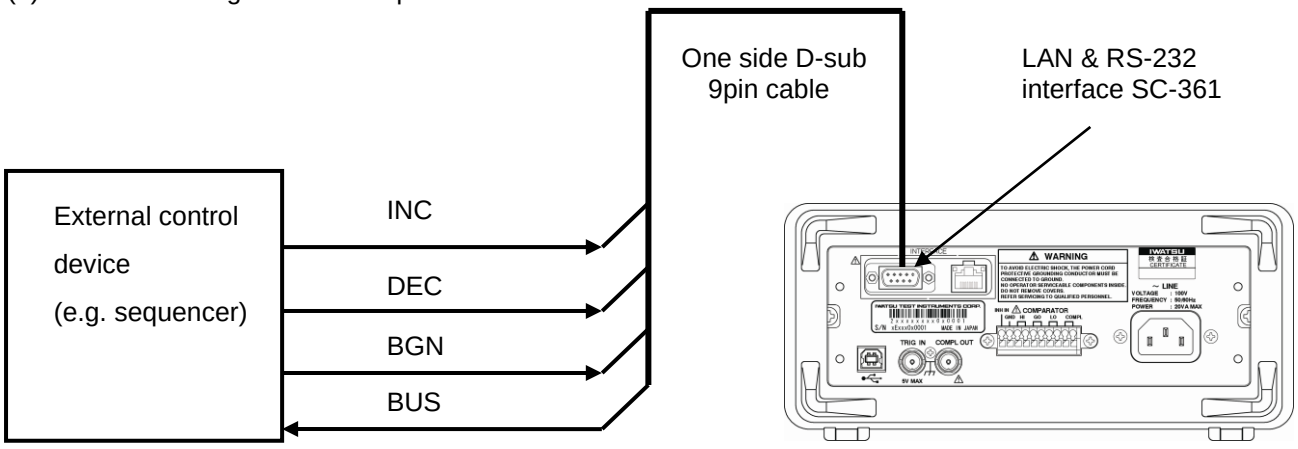
* This function requires the LAN &RS-232 interface SC-361 option.

This instrument can be controlled remotely through connection with PC.

On the other hand, if it is connected with the external control device (e.g. sequencer) without connection with PC and the setting condition is saved in the internal memory of this instrument in advance, the setting condition can be easily recalled from the external control device (e.g. sequencer) for measurement.

The example of device configuration to realize this function, usage condition, and measurement example are described.

(1) Device configuration example



<External control device>

・E.g.sequencer

<Interface, acceptable connector>

This function requires the LAN &RS-232 interface SC-361 (factory option).

D-sub 9pin surgical knife side (The pin number of the signal used must be to refer to the table for next page.)

(2) Usage condition

① In the following states, this function cannot be used. At this time, this instrument outputs "H" to the terminal BUSY of SC-361 (Pin #7 of the D-sub 9pin connector).

- The remote control state
- The state of executing the log function in the BULK mode
- The state of offline browse
- The state of the continuous writing in the USB memory by VALUE TO USBMEM function
- The state of executing the calibration (adjustment).

② The internal memory of this instrument is used. Up to 10 setting conditions can be used.

③ Make the connection as shown in the device configuration example above and execute the sequence control in accordance with the table on the next page.

The input/ output signal level and pulse width are specified as shown below:

・Input signal

H: 2.4 Vmin, L: 0.6 Vmax

Maximum rating: ±15 V

Pulse width: 10 ms or more (The logic of the signal can be reversed by the setting.)

・Output signal

H: +5.0 Vmin, L: -5.0 Vmax

Signal name	PIN No. of this instrument	Action
INC	**#1**	When recalled, the memory number (#) of the setting condition is incremented.
GND	**#5**	Earth GND
DEC	**#6**	When recalled, the memory number (#) of the setting condition is decremented.
BGN	**#9**	When recalled, the memory number (#) of the setting condition is returned to the first number.
BUSY	**#7**	If the control pulse cannot be received; e.g. the previous recall action is not completed, this instrument outputs “H” to the external control device and if not, “L” is output. Care should be taken when continuously sending the control pulse to this instrument.

If increment is done when setting to the last number (END NOTE), setting to the first number (BEGIN NOTE) is made. Contrarily, if decrement is done when setting to the first number (BEGIN), setting to the last number (END) is made.

Note) Refer to the table of " ◆ Items and settings of RECALL (source: internal memory) setting menu ” of next page for the memory number of END and BEGIN.

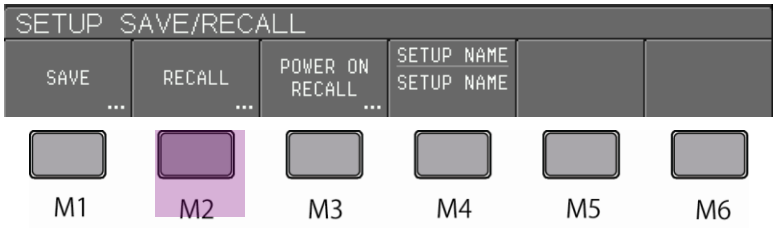
(3) Setting method

The SETUP SAVE/RECALL/ RECALL sub menu is set as shown below:

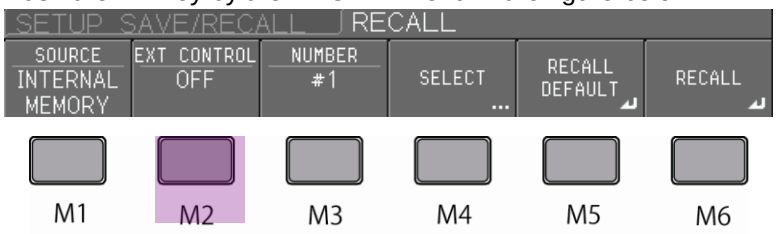
- SOURCE : INTERNAL MEMORY
- EXT CONTROL : ON
- POLARITY :POSITIVE or NEGATIVE is selected.

Operation procedure

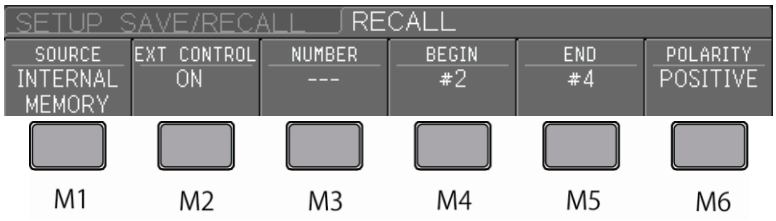
a) Push the M2 key by the SETUP SAVE/RECALL menu in the figure below.



b) Push the M2 key by the RECALL menu in the figure below.



c) EXT CONTROL is turned on.



Refer to "◆ Items and settings of RECALL (source: internal memory,) setting menu" of next page for the content of detail from now on set.

◆ Items and settings of RECALL (source: internal memory, EXT CONTROL＝ON) setting menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
SOURCE		**・It selects the recall source of the setting conditions from the following:**	Section 6.12
	・INTERNAL MEMORY	・It selects the internal memory of this instrument.	–
	・USB MEMORY	・It selects the USB memory. Note) For VOAC7502, this item can not be selected.	
EXT CONTROL		**・It selects whether the external control is used for recalling the setting condition as shown below:**	–
	・ON	・External connection is made for control. For the example, see this section.	–
	・OFF	・Key operation is used to recall the setting condition of this instrument from the internal memory. For other than external control, OFF should be set.	–
NUMBER		**・When EXT CONTROL is ON, key operation is inactive. For external control, the current setting condition is displayed.**	Section 6.12
BEGIN		**・Press M4 key to open the sub menu and rotate the rotary knob to specify the first memory number to be recalled.**	
END		**・Press M5 key to open the sub menu and rotate the rotary knob to specify the last memory number to be recalled.** **・For external control, the last setting condition is displayed.**	
POLARITY		**・For external control, increment the setting condition and select the polarity of the control signal to be recalled. Press M6 key to open the sub menu and to select the polarity from the following:**	
	・POSITIVE	・Press M1 key in the sub menu to select it. If selected, the setting condition is incremented with the positive polarity (pulse) of the control signal and recalled.	
	・NEGATIVE	・Press M2 key in the sub menu to select it. If selected, the setting condition is incremented with the negative polarity (pulse) of the control signal and recalled.	

(4) Measurement example

The diagram below shows the example of external control of the setting condition for this instrument.

① ② ③ ④

① NUMBER : Setting condition number currently used for measurement (NUMBER)

② BEGIN : First setting condition number (NUMBER)

③ END : Last setting condition number (NUMBER)

④ POLARITY : Polarity selection of control signal

By inputting the pulse of "H" to the INC signal, switch the setting condition to measure like # 3→#4 →#5 → #6 →#3.

4.8 Display setting (DISP)

The display of the LCD screen of this instrument is described in “2.3 Screen display” and display operation is described in “3.4.2 Operation by key/ Rotary knob (switch)”. This section mainly describes settings of DISPLAY menu. DISPLAY menu can set and execute the following for each item.

O PRIMARY

- It selects the contents displayed on the primary display among NUMERIC (numeric value display), TREND, HISTOGRAM, LIMIT and ARC SCALE METER.
  It always operates internally based on each setting about the display that has not been selected.

O PRIMARY SETUP

- It selects the settings for the display selected in PRIMARY above.
  However, there is no setting concerning the display when LIMIT has been selected. Refer to section 4.6.4 LIMIT calculation for the setting of LIMIT calculation.

O SECONDARY

- Selection for the secondary display changes depending on the contents displayed on the primary display.
- The content to be displayed on the secondary display should be selected among NUMERIC (numeric value display), ANALOG METER (analog meter display), LIMIT (limit calculation) display, STATISTIC (statistics calculation) display, time display of trend display, and numeric value display of HISTOGRAM and CURSOR.

○ SETUP of SECONDARY

- It selects the settings for the display selected in SECONDARY above.
  However, only when ANALOG METER and STATISTIC have been selected as for there is a setting concerning the display of SECONDARY. There is no setting concerning the display when things except these have been selected.

O INITIALIZE

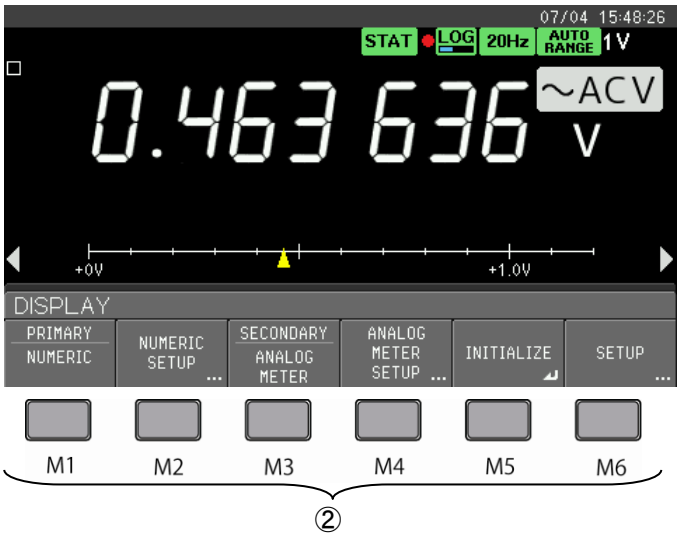
- It clears all the data displayed on each display of PRIMARY and SECONDARY.
  Also, it clears the LOG memory and the data of a statistical calculation at the same time.

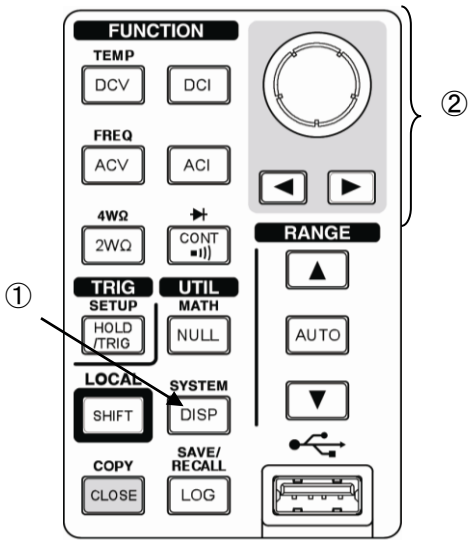
O SETUP

- It sets the background of LCD screen, brightness of the backlight, and the low-power mode of the power supply. (Refer to section 3.3.1 for the setting example.)

Operation procedure

① Press [DISP] key to open DISPLAY menu.
② Use each item of DISPLAY menu to set various functions.
Use the menu keys M1 to M6 below the screen (outside) and Rotary knob for operation. For the operation, see “Section 3.4.1 Basic operation of menu.” For MATH SETUP SAVE/RECALL menu setting, see “◆ DISPLAY menu items and settings” on the next page.



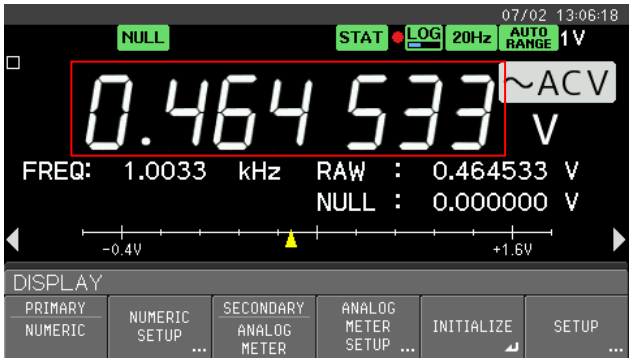


◆DISPLAY menu items and settings

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
PRIMARY		• **It selects and sets the contents displayed on the primary display from the following.**	Sections 2.3
	• NUMERIC	• It displays the numeric value of the measurement result.	—
	• TREND	• It displays the trend chart indicating the time progress of the measurement result.	
	• HISTOGRAM	• It displays the histogram chart indicating the probability distribution of the measurement result in the vertical axis range.	
	• LIMIT	• It executes the LIMIT calculation from measurements, and displays the judgment result.	
	• ARC SCALE METER	• It directs a circular arc scale measurements by the indicator.	
SETUP ∗ SETUP designated by PRIMARY above		• **It sets the setting conditions in the display format specified in PRIMARY above.**	—
	• NUMERIC	• **See "4.8.1 Setting of NUMERIC SETUP menu."**	Section 4.8.1
	• TREND	• **See "4.9 Trend chart display function."**	Section 4.9.1
	• HISTOGRAM	• **See "4.10 Histogram chart display function."**	Section 4.10.1
	• ARC SCALE METER	• **See "4.8.2 Setting of ARC SCALE METER SETUP menu."**	Section 4.8.2
SECONDARY		• **It selects the display contents on the secondary display from the following.**	Sections 4.10 & 4.6
	• NUMERIC	• It displays the numeric value of the measurement result. When displaying it in PRIMARY excluding NUMERIC, this menu becomes available. The setting content of MASKING of the NUMERIC SETUP menu of a primary display is applied.	—
	• ANALOG METER	• It displays the measurement result in the analog meter format.	
	• LIMIT	• It displays the judgment result of LIMIT calculation in MATH calculation. If MATH/LIMIT/LOW or MATH/LIMIT/HIGH menu is on, this menu becomes available.	
	• STATISTIC	• It displays the numeric values of the maximum value (MAX), minimum value (MIN), average (AVG), and standard deviation (σ) of STATISTIC calculation in MATH calculation. If MATH/STATISTIC menu is on, this menu becomes available.	
	• HISTOGRAM	• It displays the numeric value acquired from the histogram chart display. ∗ If HISTOGRAM display is set in PRIMARY, this menu is available.	Section 2.3.3.3
	• CURSOR	• It displays the numeric value acquired from the histogram chart display and the cursor. ∗ If HISTOGRAM display is set in PRIMARY, this menu is available.	Section 2.3.3.2 2.3.3.3
	• TREND	• It displays the start time, SPAN, and LAST acquired from the trend chart display. ∗ If TREND display is set in PRIMARY, this menu is available.	Section 2.3.3.2
SETUP ∗ SETUP designated by SECODARY above	• ANALOG METER	**See "4.8.3 Setting of ANALOG METER SETUP menu."**	Section 4.8.3
	• STATISTIC	**See "4.8.4 Setting of STATISTIC SETUP menu."**	Section 4.8.4
INITIALIZE		• **It deletes the measurement result displayed on PRIMARY and SECONDARY display once and starts the measurement from the beginning. At that time, the statistics calculation data is also cleared simultaneously.**	—
SETUP		• **It sets items for LCD screen and the low power mode of the power supply.**	—
	• BACKGROUND	It selects the background color of the LCD screen from the following. ○WHITE (default setting): White is set for the background color. ○BLACK：Black is set for the background color.	—
	• BACKLIGHT	It selects the brightness of the backlight of the LCD screen. ○LOW (default setting): LOW is set for brightness. ○HIGH：HIGH is set for brightness.	
	• LOW POWER	To save the power, the instrument enters the low power mode a specified time after the last key operation. In the low power mode, the LCD backlight turns off and LED of the Rotary knob flashes slowly. Selection is made from the specified times below. ○OFF (default setting) Not enter the low power mode ○1minute, 5minute, 10minute, 30minute, 60minute 1, 5, 10, 30, or 60 minutes is selected.	

4.8.1 NUMERIC SETUP menu setting (Primary display)

NUMERIC display allows the measurement result of each function to be displayed in the numeric value. The following shows the display example (in red frame).



NUMERIC display example of primary display

For details of display, refer to section 2.3.3.1.

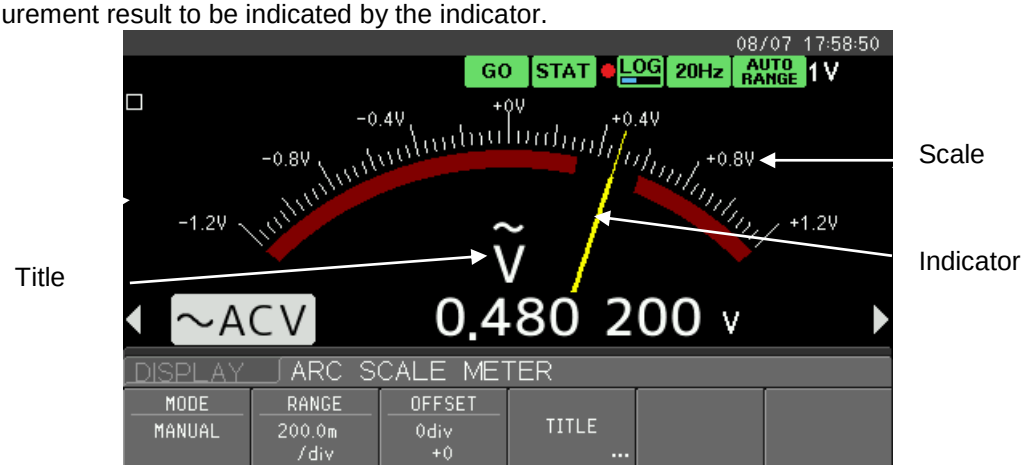
The primary display allows the size and font of the characters to be selected and the lower digits to be masked. For settings of NUMERIC SETUP menu of the primary display, refer to "◆Items and settings of NUMERIC SETUP menu" below. For the operation, refer to "3.4.1 Basic operation of menu."

◆ Items and settings of NUMERIC SETUP menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu item)	Refer to
MASKING		It selects whether to mask the lower digits for measurement value to be displayed in NUMERIC. If masked, select the digits to be displayed from 3 types below. * The MASKING setting is reflected on NUMERIC display on the secondary display.	–
	• **OFF (default)**	• Not masked; i.e. normally displayed	–
	• **nnnnnn-**	• It displays by six digits, and the digit less than it is masked. Note) VOAC7502 does not support this sub menu.	
	• **nnnnn-**	• It displays by five digits, and the digit less than it is masked.	
	• **nnnn-**	• It displays by four digits, and the digit less than it is masked.	
FONT SIZE		**It selects the character size of the measurement value to be displayed in NUMERIC from the following.**	2.3.3.1
	• **NORMAL**	• Normal character size is displayed.	–
	• **LARGE**	• The large character size is displayed. Position of the measurement function and unit moves to the lower than NORMAL position. NULL value, RAW value, FREQ numeric value are not displayed.	
FONT		**It selects the character font of the measurement value to be displayed in NUMERIC from the following.**	2.3.3.1
	• **7SEG**	• 7-segment is displayed.	–
	• **NORMAL**	• Gothic type is displayed.	

4.8.2 Setting of ARC SCALE METER SETUP menu (Primary display)

The function indicates sensibly (with indicator in the analog method) what value is the measurement value in the preset range by setting the arbitrary arc range. The example is shown below. The arc scale meter allows the measurement result to be indicated by the indicator.



- MOD: MANUAL
- OFFSE: 0 div (+0)
- RANG: 200 m /div
- Measurement result (value): 0.480200 V

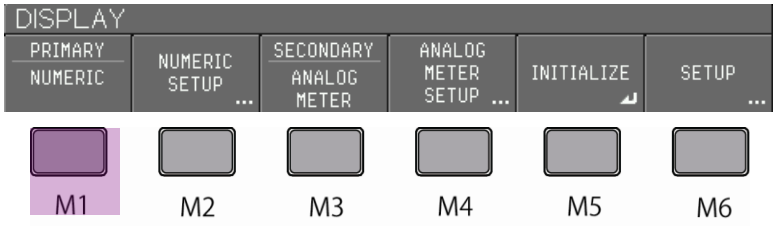
Memo!

Four modes of AUTO/FULLSCALE/MANUAL/LOG are provided as a function of the arc scale meter. The range of the display of the meter doesn't consider the measurement range excluding FULLSCALE mode. Therefore, the range of the display of the meter might be set more widely than the upper limit or lower limit of the measurement range. Even if the overload is generated by the measurement range at this time, the upper limit value or the lower limit of the measurement range can be indicated, and the needle of the meter be shaken off.

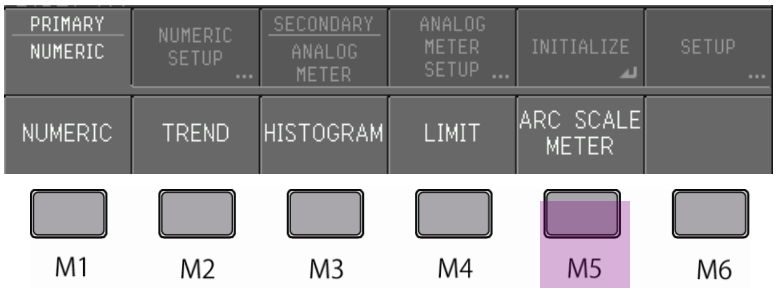
The following describes setting method of the arc scale meter and settings of ARC SCALE METER SETUP menu.

Operation procedure

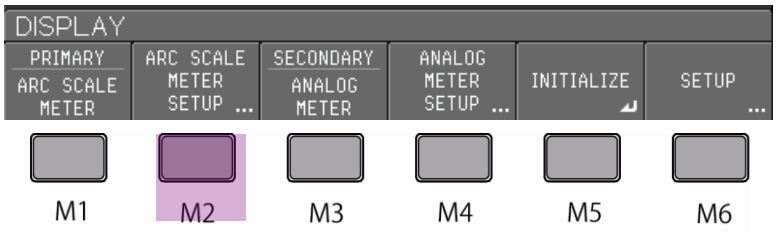
① Press M1 key in DISPLAY menu below to open PRIMARY menu (②).



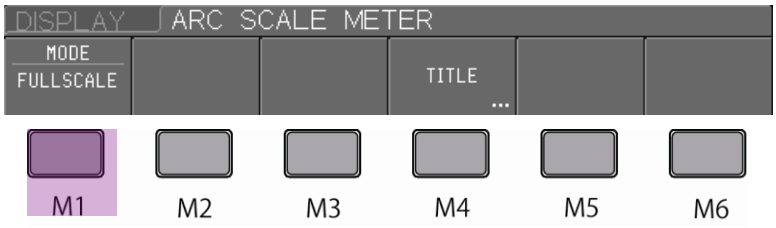
② Press M5 key in the following and to select ARC SCALE METER to return to DISPLAY menu (③)



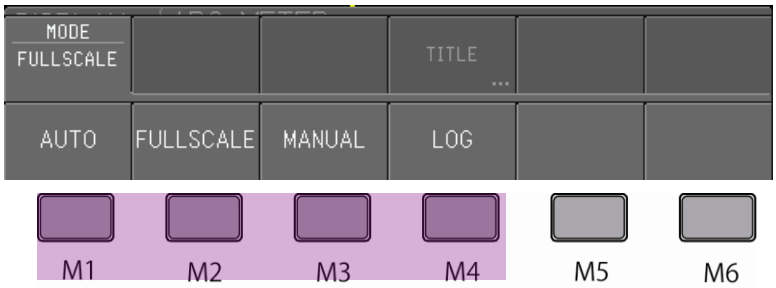
③ Press M2 key in MODE menu below to select ARC MERTER SETUP menu (④).



④ Press M1 key in ARC SCALE METER menu below to open MODE menu (⑤).



⑤ Press any of M1 to M4 keys in MODE menu below to select MODE.



For settings of ARC SCALE METER SETUP menu, refer to "◆ Items and settings of ARC SCALE METER SETUP menu" and "◆ Items and settings of ARC SCALE METER SETUP/ TITLE menu" on the next pages. For the operation, refer to "3.4.1 Basic operation of menu."

◆ Items and settings of ARC SCALE METER SETUP menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu item)	Sections
MODE		**It selects MODE of ARC SCALE METER from the following.**	2.3.3.5
	• **AUTO**	• The acquired data is used to automatically set the range and offset.	6.10
	• **FULLSCALE**	• The maximum value in the acquired data is displayed while the the measurement rage to be displayed is set to FULLSCALE. However, it cannot be selected for FREQ measurement.	
	• **MANUAL**	• The range and offset are set by RANGE menu and OFFSET menu below.	
	• **LOG**	• The acquired data is displayed in the logarithm scale. The maximum and minimum values of LOG scale are set by LOG MAX menu and LOG MIN menu below. • If the acquired data is minus, the absolute value is displayed. • The relationship between LOG MIN and LOG MAX is as follows: ① It is necessary to set LOG MAX larger than 10^1 times of LOG MIN. ② It is necessary to set the difference between LOG MAX and LOG MIN within 10^6 times. ③ If the setting does not satisfy ① and ② above, the other setting is automatically adjusted to satisfy ① and ②.	
APPLY TO MANUAL ∗ Only if AUTO is selected in MODE above.		**The range and offset automatically set in AUTO mode is copied to the setting of MANUAL mode.** Memo:• If APPLY TO MANUAL is executed before executing the setting in the MANUAL mode, it might become easy to operate. • Even if APPLY TO MANUAL is executed, the mode is AUTO. Switch the mode by hand power. • This function is invalid when there is no measurement data (A function change and clear data just behind).	6.10
RANGE ∗ Only if MANUAL is selected in MODE above.		**This menu is displayed if MANUAL is selected in MODE above.The 2 methods below are used to set the range manually.**	6.10
	• **DEFAULT**	• 1.0 / div	–
	∗ **Numeric value selection**	• Rotate the rotary knob to select the range. Setting range: 1.0p / div to 500.0T / div（1-2-5 step）	
OFFSET ∗ Only if MANUAL is selected in MODE above.		**This menu is displayed if MANUAL is selected in MODE above. Two methods below are used to set the offset.**	6.10
	• **DEFAULT**	• 000000div (+0)	–
	• **GET VAL**	• It takes the latest measurements when the GET VAL(M2) key is pushed.	
	• ＋ / －	• The sign of + or - can be set by pushing the M3 key.	
	• **Selection of range of numerical value** (−9 to ＋9／0 to 9)	• It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. • It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
	∗ **Numeric value selection**	• Rotate the rotary knob to select the numeric value. Setting range: −100000 div to +100000 div (−100.000kdiv to +100.000kdiv)	
LOG MIN ∗ Only if LOG is selected in MODE above.	∗ **Numeric value selection**	**This menu is displayed if LOG is selected in MODE above. Rotate the rotary knob to set the minimum value of the LOG scale.** • Setting range: 1.0p / div to 10.0T / div (10-time step)	6.10
LOG MAX ∗ Only if LOG is selected in MODE above.	∗ **Numeric value selection**	**This menu is displayed if LOG is selected in MODE above. Rotate the rotary knob to set the maximum value of the LOG scale.** • Setting range: 10.0p / div to 100.0T / div (10-time step)	6.10

For TITLE menu of each MODE, refer to "◆Items and settings of ARC SCALE METER SETUP/ TITLE menu" on the next page.

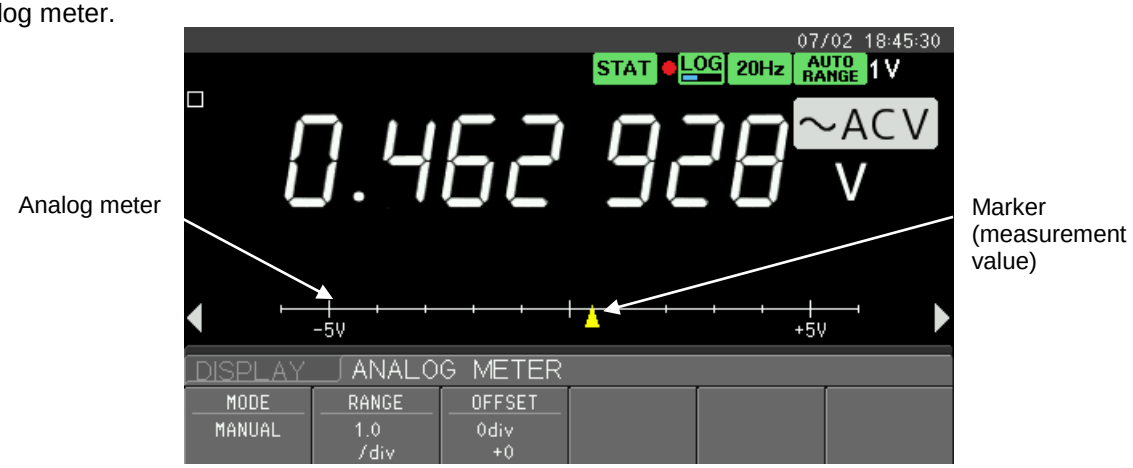
◆ **Items and settings of ARC SCALE METER SETUP/ TITLE menu**

The title can be displayed at the center of ARC SCALE METER. It is convenient when the measurement value can be converted into the other unit by combining with SCALING calculation (e.g. RPM conversion). TITLE is commonto each MODE and can be set and displayed.

Menu item (1st)	Menu item (2nd)	Settings (detailed menu item)	Refer to
MODE		**Selects the content to be displayed as the title at the center of LCD screen from 3 types below.**	2.3.3.5 6.10
	• **UNIT**	• It displays the unit corresponding to the function being measured. If the function is selected, the unit is automatically set.	—
	• **BLANK**	• Nothing is displayed.	
	• **TEXT**	• The name set by TEXT menu below is displayed as the title. Up to 8 characters (upper- and lower-case alphabet, number, and sysmbol) can be set and displayed as the title.	
TEXT		**If TEXT is selected in MODE above, the content to be displayed in TITLE can be entered.** Up to 8 characters (upper- and lower-case alphabet, number, and sysmbol) can be set.	2.3.3.5 6.10
	• **ABCabc**	• It can enter the number from 0 to 9 at the cursor position on the TITLE creation plate. M1 key is used to select it and the character input format is displayed at the beginning on the TITLE creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close SETUP NAME menu.	—
	• **123**	• The number 0 to 9 can be entered at the cursor position on TITLE creation plate. M2 key is used for selection and the number input type is displayed at the beginning of TITLE creation plate. Rotation of the rotary knob allows the number to change and press of the knob allow TEXT menu to close.	—
	• **! # $**	• The symbol (e.g. space and symbol) can be entered at the cursor position on TITLE creation plate. M3 key is used for selection and the symbol input type is displayed at the beginning of TITLE creation plate. Rotation of the rotary knob allows the symbol to change and press of the knob allow TEXT menu to close.	—
	• **DELETE**	• The character at the cursor position on TITLE creation plate is deleted. M4 key is used for deletion.	—
	• **BACK SPACE**	• The character, number, or symbol one character before the cursor position on TITLE creation plate is deleted. M5 is pressed for deletion.	—
	• **INPUT SPACE**	• The space is entered at the cursor position on TITLE creation plate. M6 is pressed for input.	—

4.8.3 Setting of ANALOG METER SETUP menu (Secondary display)

It sets the arbitrary range and displays what value is indicated by the measurement value in that range (analog meter). The example is shown below. The measurement result is indicated by the marker in the analog meter.



- MODE : MANUAL
- RANGE : 1.0 /div
- OFFSET: 0 div(+0)
- Measurement result (value): 0.462928 V

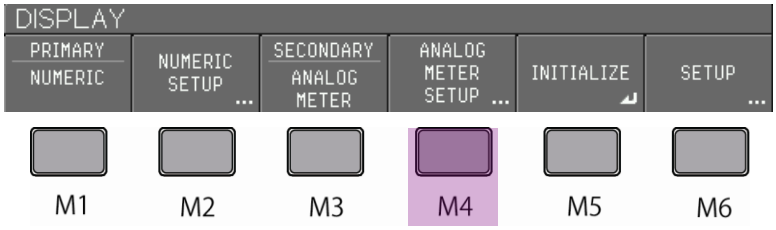
Memo!

Four modes of AUTO/FULLSCALE/MANUAL/LOG are provided as a function of the analog meter. The range of the display of the meter doesn't consider the measurement range excluding FULLSCALE mode. Therefore, the range of the display of the meter might be set more widely than the upper limit or lower limit of the measurement range. Even if the overload is generated by the measurement range at this time, the upper limit value or the lower limit of the measurement range can be indicated, and the needle of the meter be shaken off.

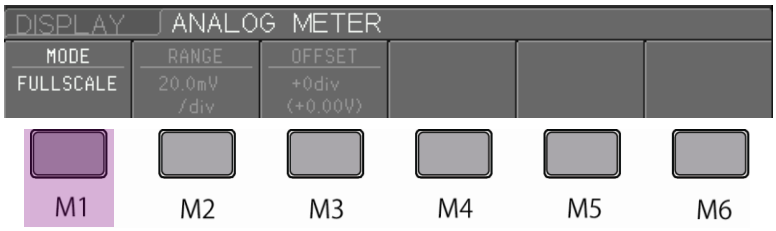
The following describes the setting items and settings of ANALOG METER SETUP menu.

Operation procedure

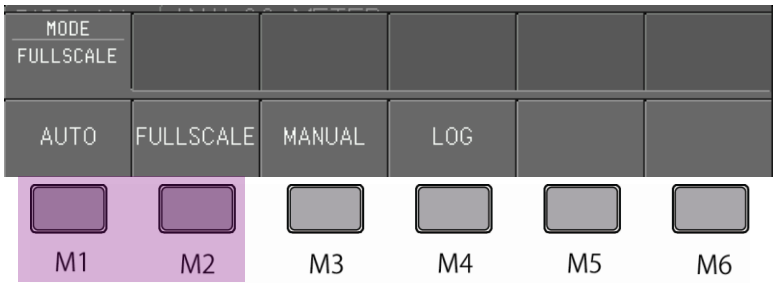
① Press M4 key on DISPLAY menu of the diagram below to open ②ANALOG METER SETUP menu.



② Press M1 key on the diagram below and select ③ MODE menu to open MODE menu.



③ Press M1 or M4 key on the diagram below and select MODE.



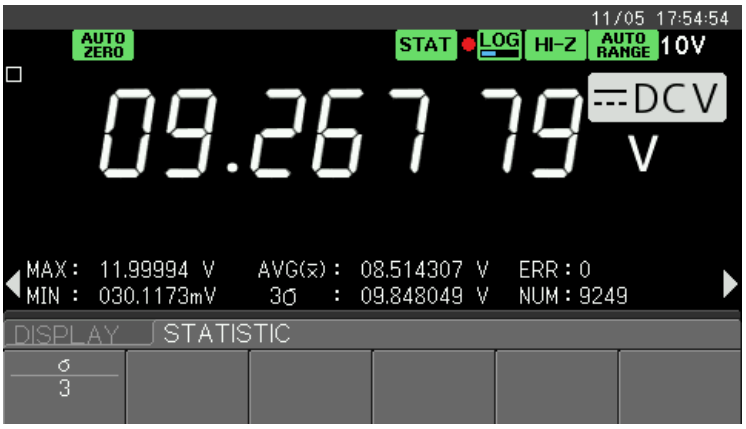
For the subsequent operation of ANALOG METER SETUP menu, see "◆ ANALOG METER SETUP menu Items and settings" on the next page. For the operation, see "Section 3.4.1 Basic operation of menu."

◆ Items and settings of ANALOG METER SETUP menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu item)	Sections
MODE		**It selects MODE of ANALOG METER from the following.**	6.11 2.3.4.1
	• **AUTO**	• The acquired data is used to automatically set the range and offset.	—
	• **FULLSCALE**	• The maximum value in the acquired data is displayed while the the measurement rage to be displayed is set to FULLSCALE. However, it cannot be selected for FREQ measurement.	
	• **MANUAL**	• The range and offset are set by RANGE menu and OFFSET menu below.	
	• **LOG**	• The acquired data is displayed in the logarithm scale. The maximum and minimum values of LOG scale are set by LOG MAX menu and LOG MIN menu below. • If the acquired data is minus, the absolute value is displayed. • The relationship between LOG MIN and LOG MAX is as follows: ① It is necessary to set LOG MAX larger than 10^1 times of LOG MIN. ② It is necessary to set the difference between LOG MAX and LOG MIN within 10^6 times. If the setting does not satisfy ① and ② above, the other setting is automatically adjusted to satisfy ① and ②.	
APPLY TO MANUAL ∗ Only if AUTO is selected in MODE above.		**The range and offset automatically set in AUTO mode is copied to the setting of MANUAL mode.** Memo: • If APPLY TO MANUAL is executed before executing the setting in the MANUAL mode, it might become easy to operate. • Even if APPLY TO MANUAL is executed, the mode is AUTO. Switch the mode by hand power. • This function is invalid when there is no measurement data (A function change and clear data just behind).	—
RANGE ∗ Only if MANUAL is selected in MODE above.		**This menu is displayed if MANUAL is selected in MODE above. The 2 methods below are used to set the range manually.**	6.11 2.3.4.1
	• **DEFAULT**	• 1.0 / div	—
	∗ **Numeric value selection**	• Rotate the rotary knob to select the range. Setting range: 1.0p / div to 500.0T / div (1-2-5 step)	
OFFSET ∗ Only if MANUAL is selected in MODE above.		**This menu is displayed if MANUAL is selected in MODE above. Two methods below are used to set the offset.**	6.11 2.3.4.1
	• **DEFAULT**	• 000000div (+0)	—
	• **GET VAL**	• It takes the latest measurements when the GET VAL(M2) key is pushed.	
	• ＋ / －	• The sign of + or - can be set by pushing the M3 key.	
	• **Selection of range of numerical value** (−9 to ＋9／0 to 9)	• It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. • It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
	∗ **Numeric value selection**	• Rotate the rotary knob to select the numeric value. Setting range: −100000 div to ＋ 100000 div (−100.000kdiv to ＋100.000kdiv)	
LOG MIN ∗ Only if LOGL is selected in MODE above.	∗ **Numeric value selection**	**This menu is displayed if LOG is selected in MODE above. Rotate the rotary knob to set the minimum value of the LOG scale.** • Setting range:1.0p / div to 10.0T / div (10-time step)	6.11 2.3.4.1
LOG MAX ∗ Only if LOGL is selected in MODE above.	∗ **Numeric value selection**	**This menu is displayed if LOG is selected in MODE above. Rotate the rotary knob to set the maximum value of the LOG scale.** • Setting range: 10.0p / div to 100.0T / div (10-time step)	6.11 2.3.4.1

4.8.4 Setting of STATISTIC SETUP menu (Secondary display)

The STATISTIC display on a secondary display displays the result of STATISTIC calculation.



Example of the STATISTIC display on a secondary display

The display contents of statistical information are the followings.

- MAX: Maximum value
- MIN: Minimum value
- AVG: Average value
- σ : Standard deviation
- NUM: Number of samples
- ERR: Number of error data*

  * The error data is invalid data as a target of statistical calcuation like the overload and the overflow, etc.

The display of standard deviation (σ) can be selected within the range of 1σ-6σ.

◆ Item and settings of STATISTIC SETUP menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu item)	Sections
σ		**Select the display of standard deviation (σ) in the STATISTIC display on a secondary display within the range of 1σ-6σ.** *** This setting is common with the setting of the σ cursor in the HISTOGRAM display on a primary display. When this setting is changed, it is reflected in the σ cursor setting.**	-
	・DEFAULT	Set it to default value (3σ).	4.6.5 4.10.1.1
	✱Numeric value selection	Turn the rotary knob, and set standard deviation (σ) in the STATISTIC display within the range of 1σ-6σ.	

4.9 Trend chart display function

The trend chart display divides into the display method of online and off-line roughly separately. The online trend chart display in real time displays the measured data. The offline trend chart display displays the content of the LOG memory being stored now. Refer to section 4.11 Logging function for the LOG memory. Features and possible contents are shown by the table below about online trend chart display function/offline trend chart display function.

Features and possible contents are shown by the table below about online trend chart display function/offline trend chart display function. Refer to section 4.9.1 and 4.9.2 for the detailed explanation of each trend chart display function of online/offline.

Features and possible contents about online trend chart display function

	Features	Possible contents
1	Real-time display	- Displaying the latest measurement result in real time
2	Single-engined can be measured.	- Whenever the HOLD(TRIG) key is pushed, the measurement data can be acquired, and be displayed while measuring by SINGLE mode (TRIG setting).
3	Display method	- Displaying to display all data while changing the magnification until the number of data reaches 100,000 pieces Deleting data old at the same time as the fresh data's being added, and always display as much as the latest 100,000 data after reaching 100,000 pieces (At this time, becoming a display to which the waveform sideways scrolls)
4	Clearness of data	- The data to be displayed is deleted and is an incorporation and is displayed from the beginning. 1) INITIALIZE is executed by the DIASPLAY menu. 2) When rotary knob is pressed. Etc. (Refer to section 7.4 for the list of the clear conditions.)
5	Display of time stamp	- Display time stamp of the data of the head and end of the trend chart when you assume a secondary display to be TREND.

Features and possible contents about offline trend chart display function

	Features	Possible contents
1	Display of data of LOG memory	- Display of the data of stored LOG memory
2	Display method	- It is possible to change the display magnification of the horizontal axis arbitrarily and to display the whole compressing and the part expanding.
3	Cursor display	- Movement of T1 and T2 cursor and information display < Primary display > Display of T1 and T2 cursor < Secondary display > 1) Measurement values in each cursor and the maximum and minimum values of two or more data compressed into cursor position in display 2) Display of time difference and the number of data between address value, time stamp of cursor, and cursor 3) Display of statistical data within the range placed with two cursors
4	Search function	- It can be moved to the place of the condition specifying T1 and T2 cursors.

4.9.1 Online trend chart display

The following is the example of the trend chart display.

○ **Primary display**

: trend chart display

+2.37080 V to +2.37130 V

Main functions and features of the online trend chart display are as follows:
(For details specifications, see Section 6.6; Trend chart display function.)

◇ Measurement action and display method

- The measurement data is first displayed from the left along time progress.
  If [HOLD(TRIG)] key is pressed to move to the HOLD state, the measurement and display are interrupted. If [HOLD(TRIG)] key is pressed again, the measurement starts and the display is continued.
  If MODE is changed in TREND/VERTICAL/MODE menu, the data is deleted and the measurement is executed from the beginning and displayed from the left.
- In measurement of SINGLE mode of TRIG setting, every time [HOLD/TRIG] key is pressed, the measurement data is displayed.
- If the data reaches the right end on the screen, give the compressibility to display all data, and draw again. Scroll the compressibility waveform to the left, and one by one display the fresh data on a right edge after compression is done until 100k data is displayed on one screen.
- How to clear data
  Timing in which the measurement result is cleared is at the time of the following operations and handling operations.
  a) Change in function
  b) Operation of clear data
  At the time of pushing operation of rotary knob when only top menu of function is displayed or when INITIALIZE key is pressed in DISPLAY menu.
  c) ON / OFF of SMOOTHING calculation
  d) ON / OFF of NULL calculation / NULL value setting
  e) ON / OFF of the mode of calculation function, SCALING calculation and dB calculation or the change of parameter
  Moreover, refer to section 7.4 for another of the data of the trend chart and the list of the clear condition of each data of a log memory, histogram chart, and statistic calculation.
- Display specification
  a) Amount of displayed data : Max. 100 k data
  b) Horizontal axis : 401 dots (10 div)
  c) Vertical axis : 121 dots (12 div)

◇ Vertical axis mode (MODE)

As shown in TREND/VERTICAL menu, the vertical mode is selected from 3 types below.

- AUTO : It automatically sets the range and offset from the acquired data.
- FULLSCALE : FULLSCALE of the measurement range is assumed to be the maximum value and minimum value of a vertical axis.
  Moreover, when the data measured by a different range exists together on the trend chart, the highest in that range becomes FULLSCALE.
- MANUAL : The range and offset can be set in VERTICAL menu.

Memo!
In the trend chart display function (commonness in online/off-line), FULLSCAL E mode is excluded, and a vertical axis of the trend chart doesn't consider the measurement range.
Therefore, the range of the display might be set more widely than the upper limit or lower limit of the measurement range.
When the overload is generated by the measurement range at this time, it is plotted as a value in which it sticks in the upper limit value or the lower limit of the measurement range on the trend chart.

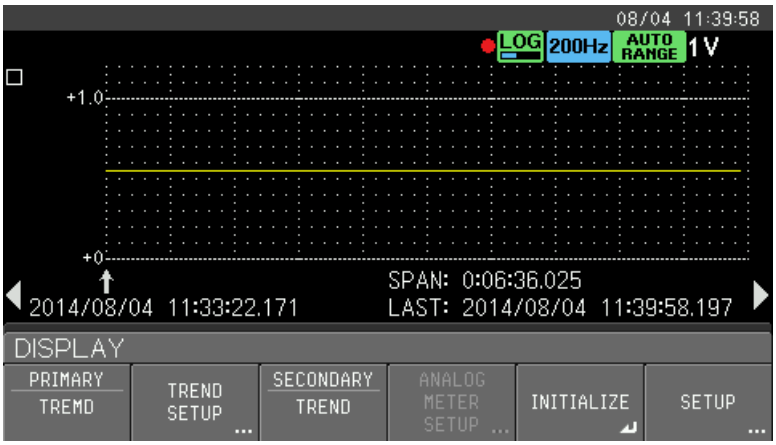
◇ Combination with secondary display

If the primary display shows the online trend chart, the contents of secondary display can be selected from 5 types below.

(1) NUMERIC: Numeric value display
It displays the latest measurement data and function name.

(2) ANALOG METER: Analog meter display
It displays the measurement data with the marker on the horizontal axis. (See section 4.8.1.)

(3) TREND: Trend chart information display
As shown in the measurement example, 3 time stamps (date and time) are displayed.



○Secondary display

- ↑ : Time stamp on the left of the screen
- SPAN : Time difference between the data on the left of the screen and the latest data time stamp
- LAST : Time stamp of the latest data

∗ The time is measured and displayed in up to ms.

Note!
The sampling rate indicates the approximate measurement rate; i.e. not ensure the sampling interval.
It is greatly affected by the calculation function such as statistics calculation and limit judgment.
For the time of the trend chart, the time on the secondary display should be used as a standard.
Use the BULK mode of section 4.11.2 when you want to take it by an accurate sampling rate.

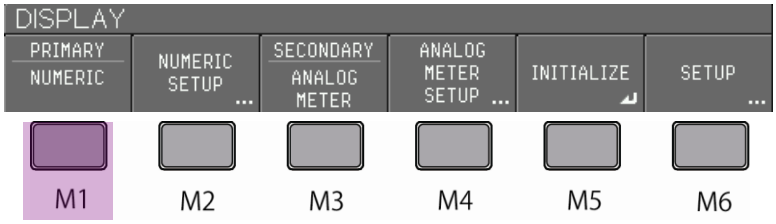
(4) STATISTIC: Display of statistics information (selectable only if STATISTIC: ON)
The maximum value (MAX), minimum value (MIN), average (AVG), standard deviation (σ),the number of samples (NUM), the number of error times (ERR) are displayed. (See section 4.6.2.4 or 2.3.4.3.)

(5) Display of LIMIT judgment result (selectable only if LIMIT judgment junction is ON)
Any of LOW, GO, and HIGH and LOW LIMIT value and HIGH LIMIT value are displayed. (See section 4.6.4 or 2.3.4.2.)

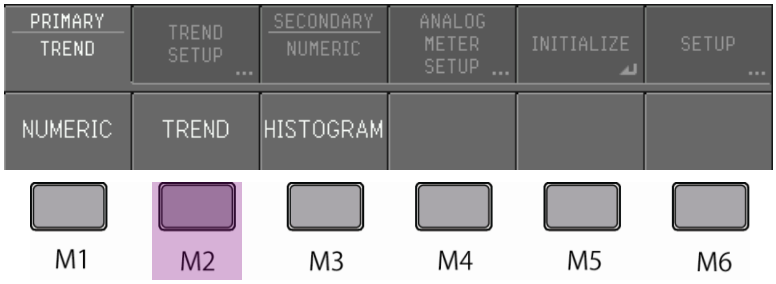
The following describes how to set the online trend chart display and settings of TREND SETUP menu.

Operation procedure

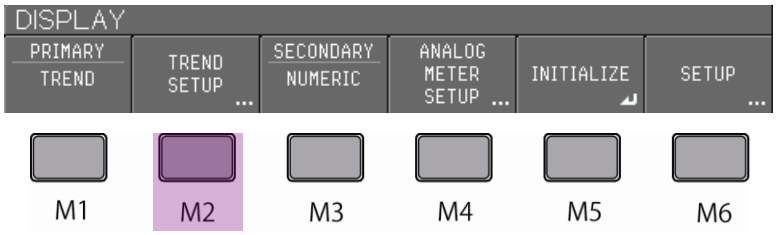
① Press M1 key in DISPLAY menu below to open PRIMARY menu in ②.



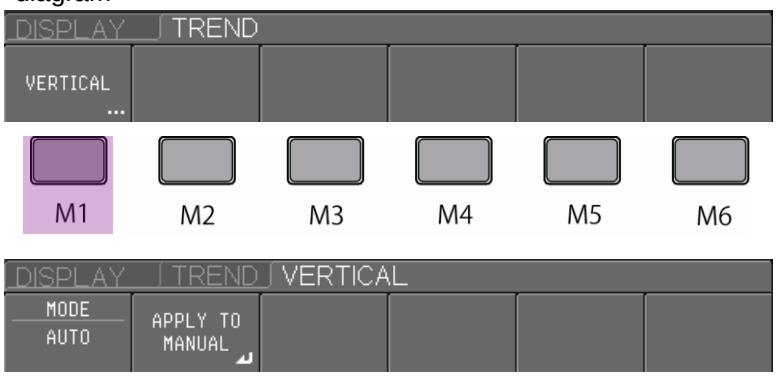
② Press M2 key in the diagram below to select TREND. DISPLAY menu in ③ opens.



③ Press M2 key in the diagram below to select TREND SETUP. TREND SETUP menu in ④ opens.



④ Press M1 key on the diagram below and select VERTICAL to open VERTICAL menu on the next diagram



For the subsequent operation of TREND SETUP(DISPLAY/TREND/VERTICAL)menu, see "◆ TREND SETUP(DISPLAY/TREND/VERTICAL) menu Items and settings" on the next page. For the operation, see "Section 3.4.1 Basic operation of menu."

◆ TREND SETUP (DISPLAY/TREND/VERTICAL) menu Items and settings

<MODE: AUTO>

<MODE: FULLSCALE>

<MODE:MANUAL>

Menu items (1st)	Menu items (2nd)	Settings (detailed menu items)	Refer to
MODE		**Make selection from 3 vertical axis modes below.**	Section 6.8
	• **AUTO**	• It automatically sets the range and offset from the acquired data.	—
	• **FULL SCALE**	• It displays the maximum value in the data being acquired in the range where the measurement range possible to be displayed is set to FULLSCALE.	
	• **MANUAL**	• It sets the range and offset by the RANGE menu and OFFSET menu below.	
APPLY TO MANUAL ∗ When AUTO is selected by MODE above		**It copies the content of the range and the offset set in the AUTO mode automatically to the MANUAL mode.** **Memo)** • If APPLY TO MANUAL is executed before executing the setting in the MANUAL mode, it might become easy to operate. • Even if APPLY TO MANUAL is executed, the mode is AUTO. Switch the mode by hand power. • This function is invalid when there is no measurement data (A function change and clear data just behind).	—
RANGE ∗ When MANUAL is selected by MODE above		**It is displayed if MANUAL is selected in MODE above.** **Use two methods below to select the range.**	Section 6.8
	• **DEFAULT**	• Press M1 key to set the range of 1.0 / div.	—
	∗ **Numeric value setting**	• Rotate the Rotary knob to select the range. Setting range: 1.0 p / div to 500.0 T / div	
OFFSET ∗ When MANUAL is selected by MODE above		**It is displayed if MANUAL is selected in MODE above.** **Use two methods below to select the offset.**	Section 6.8
	• **DEFAULT**	• Press M1 key to set the offset of +0 div(+0).	—
	• **GET VAL**	• It takes the latest measurements when the GET VAL(M2) key is pushed.	
	• ＋/－	• The sign of + or - can be set by pushing the M3 key.	
	• **Selection of range of numerical value** (−9 to ＋9／0 to 9)	• It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. • It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
	∗ **Numeric value setting**	• Use the Rotary knob and arrow keys to manually set the offset. Setting range: −100,000 div to +100,000 div	

4.9.2 Offline trend chart display

The offline trend chart displays the contents currently saved in the LOG memory. By changing the horizontal setting, the waveform data can be expanded for observation.

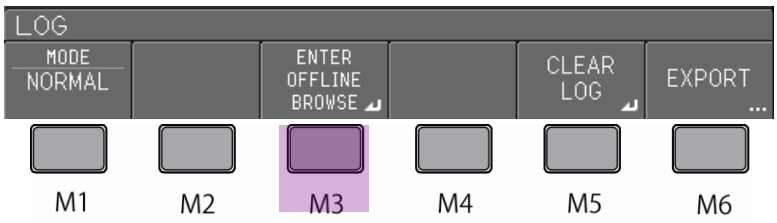
The operation is limited only to the function of offline mode when switching to offline mode (offline trend chart display and offline histogram chart display).

It is necessary to push the LOG→EXIT OFFLINE BROWSE button or to switch pushing the HOLD/TRIG button to return to a usual mode (online mode).

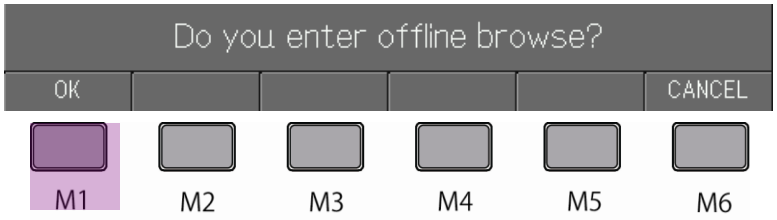
This section describes the switching method to the offline trend chart display and settings of TREND SETUP menu. Section 4.9.2.1 to 4.9.2.5 describes functions special to the offline trend chart display in the trend chart display.

Operation procedure

① Press [LOG] key to open the LOG menu below. Press M3 key in the LOG menu below.



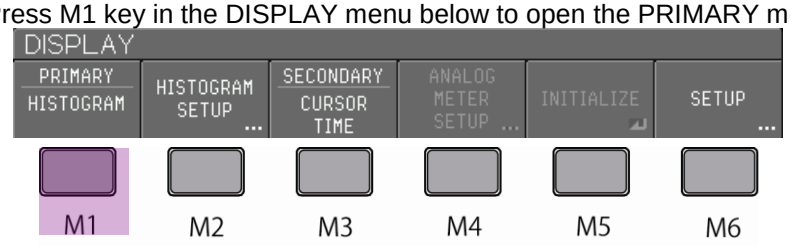
② The screen below opens. Press M1 key in the diagram below and select OK.



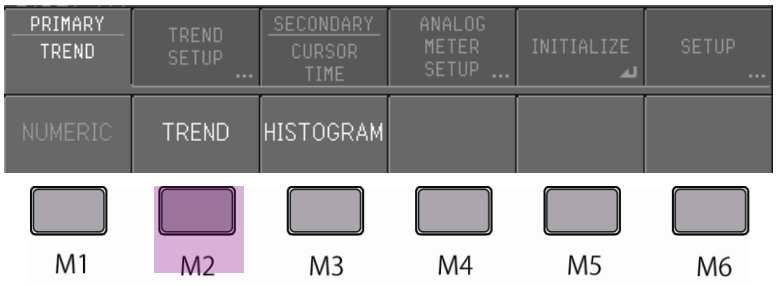
③ The screen switches to the offline browse screen.

④ Press [DISP] key to open the DISPLAY menu below.

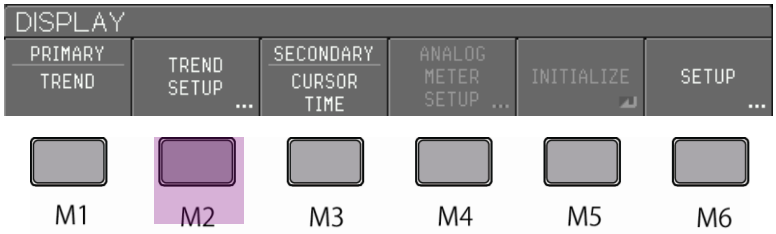
Press M1 key in the DISPLAY menu below to open the PRIMARY menu (⑤).



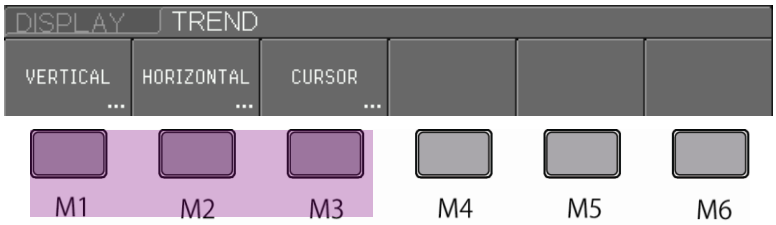
⑤ Press M2 key in the diagram below to select TREND. The DISPLAY menu (⑥) opens.



⑥ Press M2 key in the diagram below to select TREND SETUP. The TREND SETUP menu (⑦) opens.



⑦ Press any of M1 to M3 keys in the diagram below to select VERTICAL/ HORIZONTAL/ CURSOR menu to open the menu.



For the settings of the TREND SETUP (DISPLAY/ TREND) menu, see "●Items and settings of TREND SETUP (DISPLAY/ TREND) menu" on the next pages. For operation, see "3.4.1 Basic operation of menu".

●Items and settings of TREND SETUP (DISPLAY/ TREND) menu

○TREND SETUP (DISPLAY/ TREND/ VERTICAL)

The settings are the same as the online trend chart display

See Section 4.9.1; "◆Items and settings of TREND SETUP(DISPLAY/ TREND/ VERTICAL) menu".

○TREND SETUP (DISPLAY/ TREND/ HORIZONNTAL) menu

See this section; "◆Items and setting of TREND SETUP(DISPLAY/ TREND/ HORIZONTAL) menu".

○TREND SETUP (DISPLAY/ TREND/ CUROSOR) menu

See this section; "◆Items and settings of TREND SETUP(DISPLAY/ TREND/ CURSOR) menu".

◆Items and settings of TREND SETUP(DISPLAY/ TREND/ HORIZONTAL) menu

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
Readings /div		**It sets the resolution of the waveform data in the horizontal axis direction.** **Setting uses the data amount per 1div.**	6.8
	*Numerical value setting	・Rotate the rotary knob to select the numerical value in the setting range below. Setting range: 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k	–
CENTER ADDR		**It sets the center of the entire waveform in the horizontal axis direction when displaying the waveform data using the address value.**	6.8
	*Numerical value setting	・Use the rotary knob or the arrow key to select the numerical value. Setting range: 0 to (NUM-1) NUM: Data amount between T1 and T2 cursors	–
SHOW ALL		**It sets Readings/div and CENTER ADDRESS automatically so that the entire LOG memory is displayed.**	6.8

◆Items and settings of TREND SETUP(DISPLAY/ TREND/ CURSOR) menu

The rotary knob becomes available, and the cursor set with KNOB moves when the CURSOR menu is

* This table continues to next page.

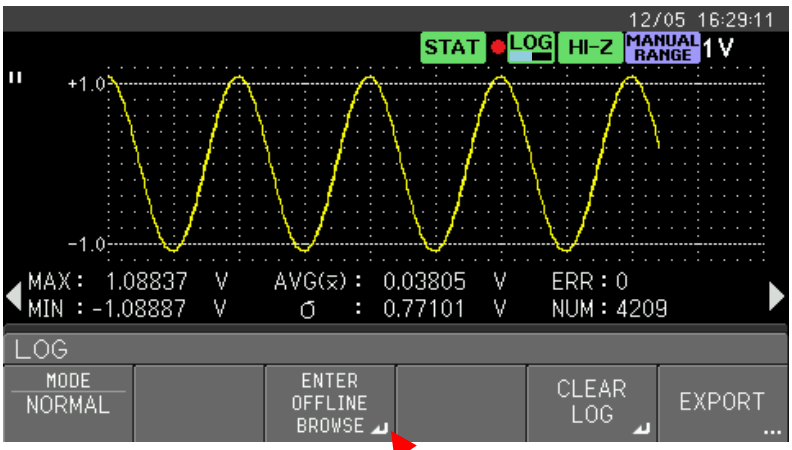
displayed.**Menu**	**Menu item (2nd)**	**Settings (detailed menu items)**	**Sections**
KNOB		**It selects one of 3 cursors below to be moved when rotating the rotary knob or operating the search function. The selected cursor is displayed by the solid line, and the non-selected cursor is displayed in the dotted line.**	6.8 4.9.2.3
	・TCURSOR1	・T1 cursor moves.	–
	・TCURSOR2	・T2 cursor moves.	
	・TRACK	・Both of T1 and T2 cursors move.	
SEARCH MODE		**It selects one of 8 search methods below when operating the search function by rotating the rotary knob.**	6.8 4.9.2.3
	・OFF	・The search function does not operate (default).	–
	・LIMIT GO	・Point where LIMIT judgment moves to GO	
	・LIMIT NOGO	・Point where LIMIT judgment moves to NOGO	
	・LIMIT HIGH	・Point where LIMIT judgment moves to HIGH	
	・LIMIT LOW	・Point where LIMIT judgment moves to LOW	
	・EDGE POSITIVE	・Point where the specified level is crossed upward	
	・EDGE NEGATIVE	・Point where the specified level is crossed downward	
	・EDGE BOTH	・Point where the specified level is crossed regardless of direction	
EDGE VALUE		**It sets the level using a numerical value when selecting EDGE POSITIVE, EDGE NEGATIVE, or EDGE BOTH for SEARCH MODE when operating the search function.**	6.8 4.9.2.3
	・DEFAULT	・＋000.0000 is set. Note) The default value for VOAC7502 is ＋000.000.	–
	・＋/－	• The sign of + or - can be set by pushing the M3 key.	
	・Selection of range of numerical value (−9 to ＋9／0 to 9)	• It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. • It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
	* Numeric value setting	・Use the rotary knob and arrow keys to select EDGE VALUE. Note) It is the specification for VOAC7502 in the following ( ). Setting range: -999.9999 T to ＋999.9999T (-999.999 T to ＋999.999T) * Suffix adheres to the digit in the right of seven digits (six digits) Minimum resolution: 0.0000001p (0.000001p)	
TCUESOR1		**It moves the T1 cursor to the specified address below and displays the address in the menu.**	6.8 4.9.2.3
	・TOP	・Address position of the first data obtained in the measurement data	–
	・BOTTOM	・Address position of the last data obtained in the measurement data	
	・DISP CENTER	・Center position of the displayed area	
	・STOP EVENT	・This function operates only for the data measured by the BULK mode. The T1 cursor moves to the position with the setting made in LOG/ BULK SETTING/ STOP EVENT.	
	* Numeric value setting	・Use the rotary knob and arrow keys to set the numerical value of the TCURSOR1 address. Setting range: 0 to 99999	

TCUESOR2		**It moves the T2 cursor to the specified address below and displays the address in the menu.**	6.8 4.9.2.3
	・TOP	・Address position of the first data obtained in the measurement data	–
	・BOTTOM	・Address position of the last data obtained in the measurement data	
	・DISP CENTER	・Center position of the displayed area	
	・STOP EVENT	・This function operates only for the data measured by the BULK mode. The T2 cursor moves to the position with the setting made in LOG/ BULK SETTING/ STOP EVENT.	
	* Numeric value setting	・Use the rotary knob and arrow key to set the numerical value of TCURSOR2 address. Setting range: 0 to 99999	
SET DISP POSITION		**If the cursor set by KNOB is T1 or T2, the waveform moves to the display position so that the cursor moves to the center of the screen. If the cursor set by KNOB is TRUCK, setting to the expansion ratio is made so that both of T1 and T2 cursors are included in the screen and the waveforms move so that the center of T1 and T2 cursors is at the center of the screen.**	6.8 4.9.2.3

4.9.2.1 Switching to offline trend chart display (offline browse function)

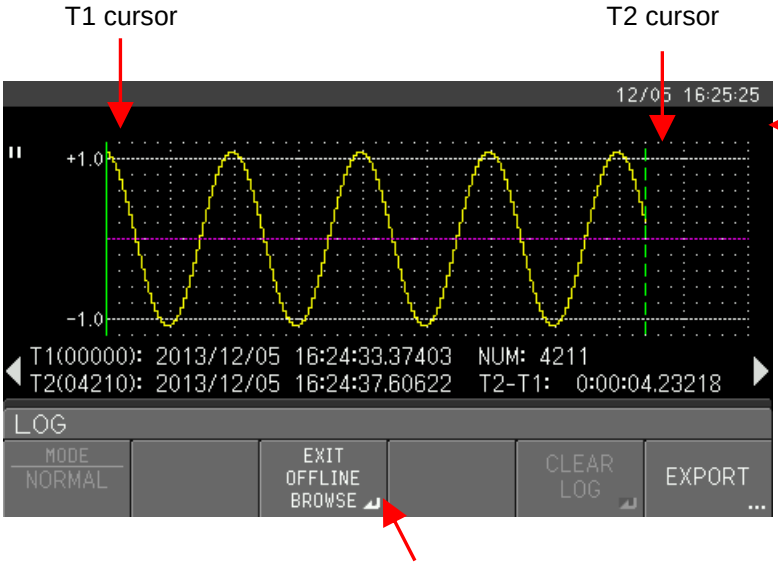
To switch from online to offline in the trend chart display, press [LOG] key, select LOG/ ENTER OFFLINE BROWSE menu, and execute it. The diagram below shows the example of switching from online to offline.

Example of online trend chart display



If ENTER OFFLINE BROWSE is selected in LOG menu, the screen switches to the offline browse screen below (press M3 key).

Example of offline trend chart display



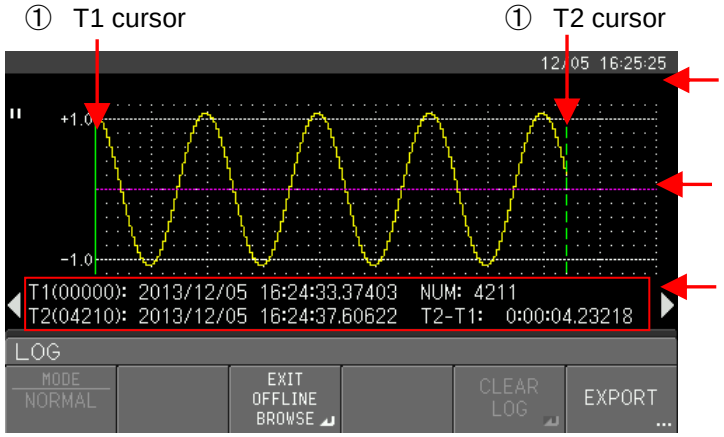
Annunciator; e.g. data capture on the upper right of the screen disappears.

If EXIT OFFLINE BROWSE is selected in LOG menu, the screen switches to the online browse screen above (press M3 key).

- T cursor : When switching to the offline browse screen, T1 and T2 cursors are always positioned at the each side of the waveform as shown in the diagram above.
- Annunciator : The annunciator on the upper right of the screen disappears (nothing is displayed).

4.9.2.2 Screen display

The following shows the screen example of the offline trend chart display to explain the offline-specific display.



(1) Primary display

① T1 and T2 cursor : They are positioned at each side of the waveform data just after entering the offline trend chart display. (green solid line and dotted line)

② EDGE VALUE : It is displayed when any of EDGE POSITIVE, EDGE NEGATIVE, and EDGE BOTH is selected in the SEARCH MODE of the T cursor search function.

③ Annunciator : Not displayed

(2) Secondary display

Switch content ④, ⑤, and ⑥ on a secondary display with the right and left arrow keys.

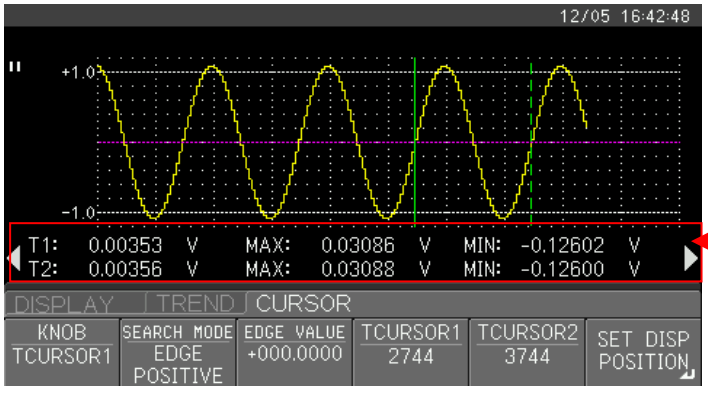
④ CURSOR TIME (Measurement at time of T cursor: in red frame in the diagram above)

- The time stamp of each cursor are displayed in the minimum unit of 10μs.
- For the numeric value in ( ); e.g. T1 (04210), the address in the LOG data is displayed.
- NUM : Data amount between T1 and T2 cursors is displayed.
- T2-T1 : Time difference between T1 and T2 cursors is displayed.

⑤ CURSOR VALUE (T cursor voltage measurement: in red frame in the diagram below)

Pressing of the right arrow key on the screen above causes the screen to switch to the display in the diagram below.

- T1 : e.g. 0.00353 V : Voltage at the address specified by each cursor
- MAX : 0.03086; MIN : e.g. -0.12602 V : The maximum and minimum values in the row displayed by the cursor are displayed for compressed display.



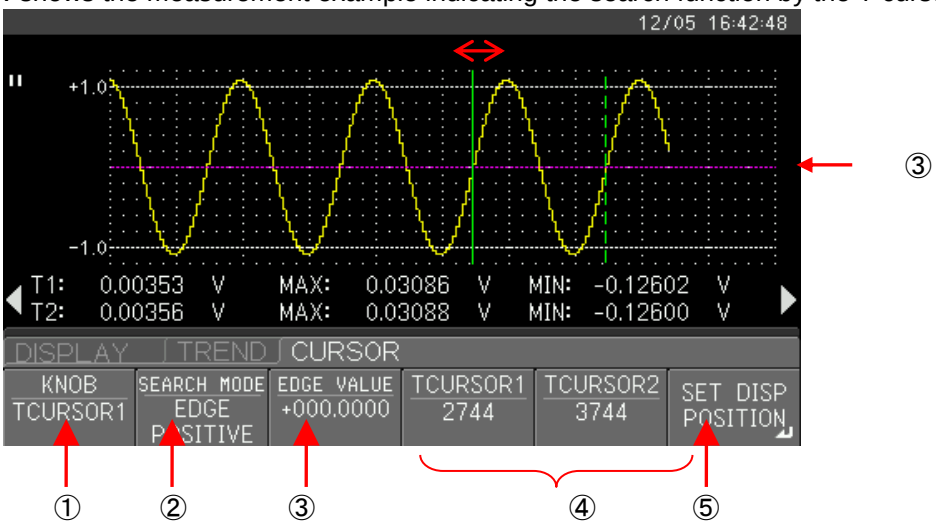
⑥ Re-calculation and display of statistical data

Pressing of the right arrow key on the screen above causes the statistical data to be displayed. (See section 4.9.2.4.)

4.9.2.3 Search function by T cursor

The offline trend chart display can display the voltage by moving the T cursor to the position that agrees with condition for the measured waveform. This function is called the search function.

The diagram below shows the measurement example indicating the search function by the T cursor.



The measurement example shows that the voltage value, maximum (MAX) and minimum (MIN) values at the address specified by the cursor are displayed by moving T1 cursor (green solid line).

The search function is set by DISPLAY/ TREND/ CURSOR menu (screen above) as described below.

① KNOB: The timing when the rotary knob is rotated and the cursor used for search are specified. **The** specified **cursor is displayed by the solid line, and the non-** specified **cursor is displayed in the dotted line.**

- ・TCURSOR1 : T1 cursor is specified. ・TCURSOR2: T2 cursor is specified.
- ・TRACK : T1 and T2 cursors are specified while keeping the interval between both. Clockwise rotation causes the T2 to move to the search point; counterclockwise rotation causes the T1 to the search point.

② SEARCH MODE: It specifies one of 8 search methods below. Object cursor moves to the address where the object cursor agrees with waveform both ends and the following condition by turning the rotary knob when the search function is set besides turning off.

- ・OFF : The search function does not operate; i.e. the specified cursor moves simply.
- ・LIMIT GO : Point where LIMIT judgment moves to GO
- ・LIMIT NOGO : Point where LIMIT judgment moves to NOGO
- ・LIMIT HIGH : Point where LIMIT judgment moves to HIGH
- ・LIMIT LOW : Point where LIMIT judgment moves to LOW
- ・EDGE POSITIVE : Point where the specified level is crossed upward
- ・EDGE NEGATIVE : Point where the specified level is crossed downward
- ・EDGE BOTH : Point where the specified level is crossed regardless of direction

③ EDGE VALUE: It specifies the voltage level for edge search (pink solid line in the measurement example).

Only if the search method of EDGE POSITIVE/ EDGE NEGATIVE/ EDGE BOTH in ② is selected, the numeric value can be set and it displays the voltage level on the screen by the solid line of the pink color.

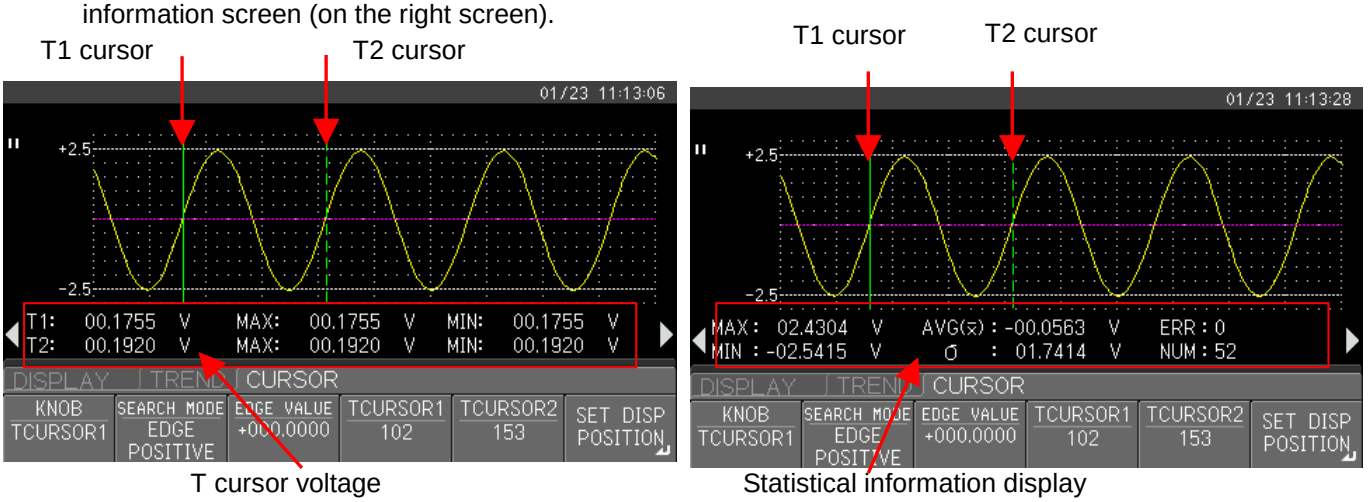
④ TCURSOR1/ TCURSOR2: The addresses of T1 and T2 cursor positions are displayed in the menu. TOP/ BOTTOM/ DISP CENTER/ TRIG can be selected in the sub menu and if the corresponding menu key (M1 to M4) is selected, T1 and T2 cursors move.

⑤ SET DISP POSITION : If the cursor set by KNOB is T1 or T2, the waveforms move to the display position so that the cursor moves to the center of the screen. If the cursor set by KNOB is TRUCK, setting to the expansion ratio is made so that both of T1 and T2 cursors are included in the screen and the waveforms move so that the center of T1 and T2 cursors is at the center of the screen.

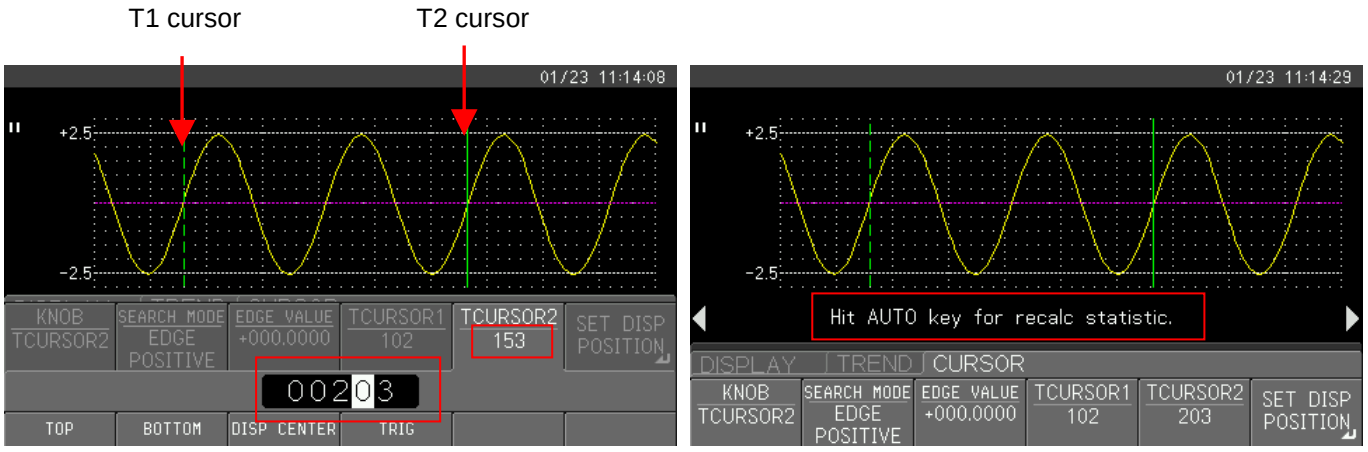
4.9.2.4 Statistical function by T cursor

The statistical function in the offline browse is calculated for data within the range placed with two T cursors of the offline trend chart. Therefore, the statistical information display should become invalid when either (or, both) T1 or T2 cursor positions are changed, and the AUTO key be pushed and it need to be calculated again. The process is described below.

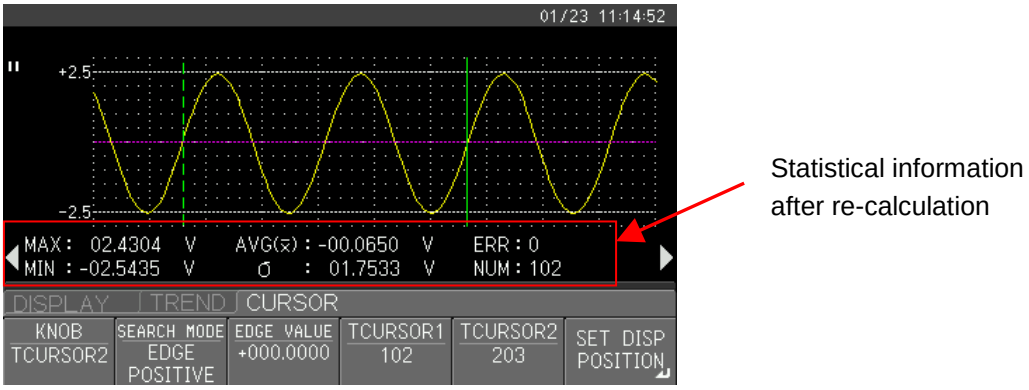
(1) The data in LOG memory is displayed in the offline trend chart (on the left screen). Press the right arrow key and switch the secondary display from T cursor voltage measurement screen to the statistic information screen (on the right screen).



(2) Select CURSOR/ TCURSOR2 menu and move T2 cursor by clockwise-rotating the rotary knob (153 to 203 in this example). Use [CLOSE] key to close TCURSOR2 menu (on the lower right screen).



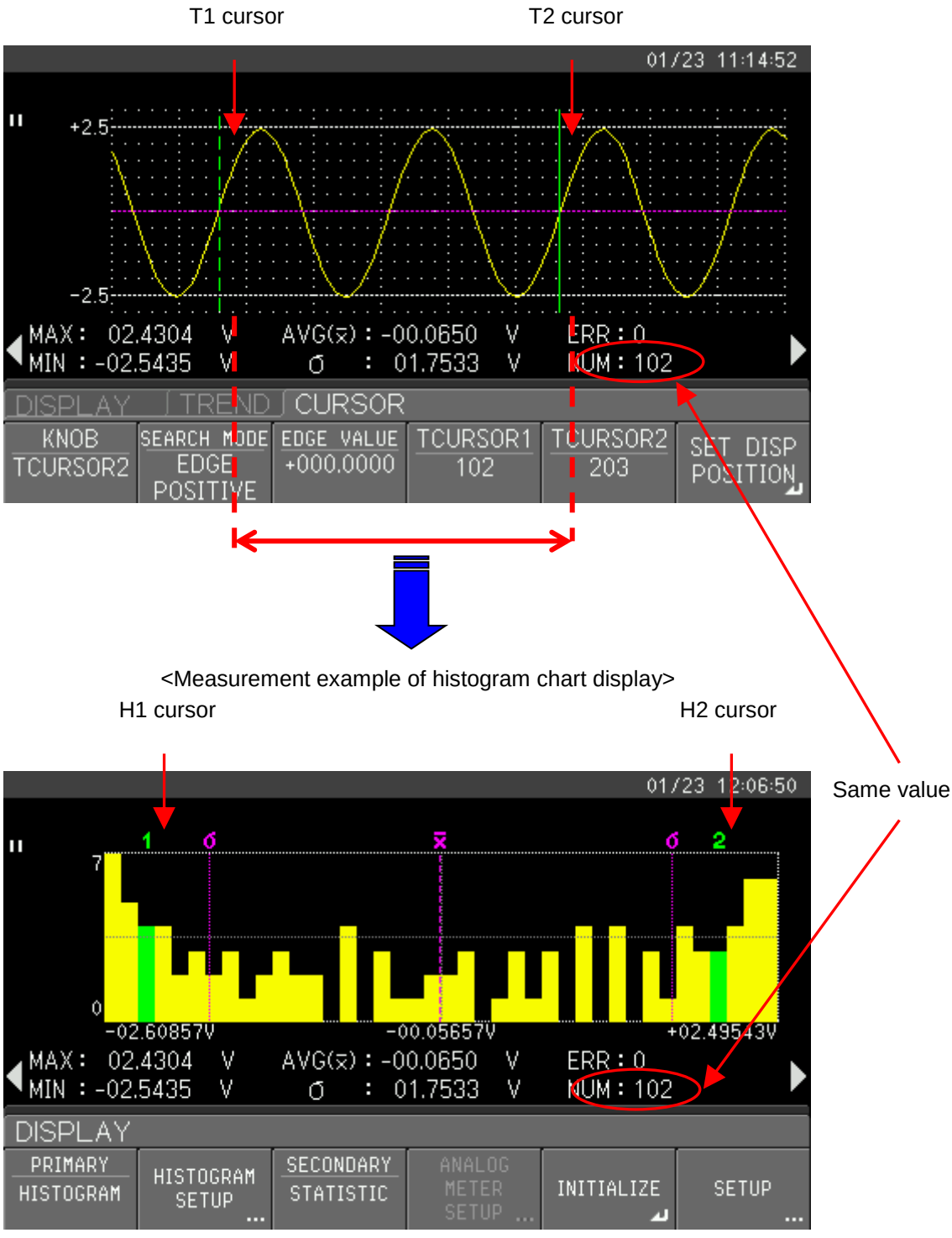
(3)When “Hit AUTO key for recall statistic.”is displayed at the center of the right screen in (2), press [AUTO] key to re-calculate the statistical information. The re-calculated statistical information screen below is displayed.



4.9.2.5 Relationship between offline trend chart display and histogram chart display

The data in the range enclosed by T cursors in the offline trend chart display is the data to be displayed on the offline histogram chart display (see section 4.10). As described in section, 4.9.2.4, when T cursor is moved, the distribution status, data amount, and the statistical information change too. The diagram below shows the measurement example.

<Measurement example of trend chart display>



4.10 Histogram chart display function

It displays the bar graph where the range of the measurement result is shown in the horizontal axis and the appearance frequency is in the vertical axis.
The histogram chart display is partially described in “2.3.3.3 Histogram chart display” and the display operation is described in “3.4.2 Operation by keys/ Rotary knob (switch).” For the instrument specification, see Section 6.9 Histogram chart display function.
The histogram chart display function is roughly classified into online and offline display methods. The online histogram chart displays the measured data in real time. It generates the histogram from 2,000,000,000 data. The offline histogram chart display displays the result of generation from data within the range placed with T cursor of the trend chart among the LOG memories being stored now. Refer to section 4.11 Logging function for the LOG memory. Features and possible contents are shown by the table below about online histogram chart display function/offline histogram chart display function.

Features and possible contents about online histogram chart display function

	Features	Possible contents
1	Real-time display	- The incorporation and the display of the measurement data can be interrupted, and be restarted freely.
2	Single-engined can be measured.	- Whenever the HOLD(TRIG) key is pushed, the measurement data can be acquired, and be displayed while measuring by SINGLE mode (TRIG setting).
3	Cursor display	- Display of mean value X cursor, σ cursor, H1 and H2 cursors, movementof cursors and information displays < Secondary display > 1) Harmony of width and frequency within the range placed with two bottles specified with cursor 2) Displaying the range of the measurement and the frequency of the bin specified with each cursor 3) Display of statistical data (at the setting of ON for MATH/STATISTIC)
4	Clearness of data	- The data to be displayed is deleted and and is an incorporation and is displayed from the beginning. 1) INITIALIZE is executed by the DIASPLAY menu. 2) When rotary knob is pressed. etc. (Refer to 7.4 sections for the list of a clear condition.)

* Refer to section 4.10.1 for the bin in this table.

Features and possible contents about offline histogram chart display function

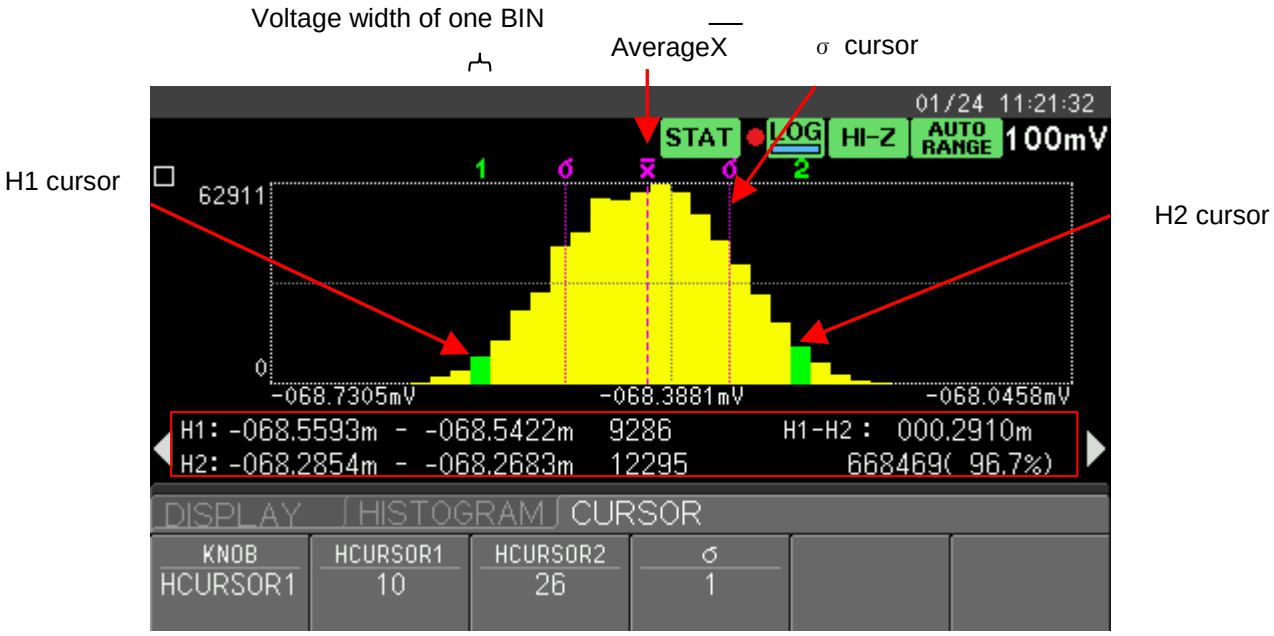
	Features	Possible contents
1	Display of data of LOG memory	- Current display of the data of stored LOG memory 1) The histogram can be generated by changing even degrees such as the number of bin, the mode setting, and ranges of data.
2	Cursor display	- (This content is similar in online histogram chart display above)

* Refer to section 4.10.1 for the bin in this table.

4.10.1 Common functions of online/ offline histogram chart display

This section describes the common functions to online/ offline histogram chart display.

4.10.1.1 Screen display



The histogram chart displays the frequency distribution of the entire measurement and is displayed as shown in the bar graph as shown in the above figure. Each bar is called bin. Each bin has width, and has the width of voltage for the voltage measurement and the width of current for the current measurement. The above-mentioned figure is an example of histogram chart display in DCV measurement.

① The number of bins can be selected from 2, 4, 5, 10, 20, 40, 50, 100, 200, and 400 in BIN menu. The width of one bin is decided from the width of the entire histogram and the number of bins.

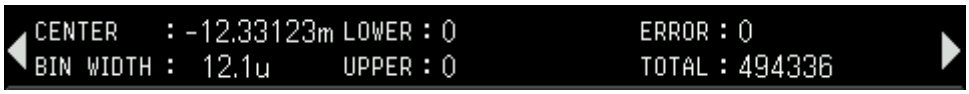
② The label of the longitudinal axis displayed at the left of the graph can be selected from two kinds frequency (COUNT) and percentage (PERCENT) by the VIEW menu. Also, these settings are applied to the frequency display of H cursor measurement display on a secondary display.

③ The range of the histogram (center value and whole width) is decided by the display mode (AUTO/FULLSCALE/MANUAL). The display mode is set by the MODE menu. Refer to section 4.10.1.2 Display mode (MODE) for details.

④ The quadrature axis label under the graph shows the range of the histogram decided by the display mode setting. It is understood that it is CENTER: -12.3312 mV, LOWER: -12.6347 mV and UPPER: -12.0277 mV from the value of the label for the above figure

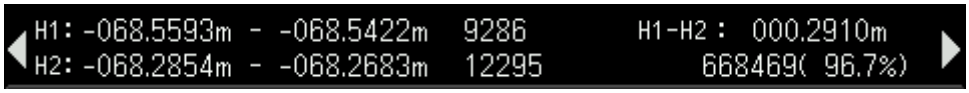
For each sub menu of HISTOGRAM, see “4.10.1.4 HISTOGRAM SETUP menu”.

When setting a secondary display to HISTOGRAM, the information on the histogram like the width of the bin, the entire number and number of data outside the range can be displayed on a secondary display



Refer to section 2.3.3.3 Histogram chart display for details of the displayed content.

H1 and H2 cursors that specifiy the bin are displayed in the histogram chart. The bin specified with the cursor is drawn in green. When setting a secondary display to CURSOR, the information on the appearance frequency of specified bin and the range placed with both cursors can be displayed on a secondary display.



Refer to section 2.3.3.3 Histogram chart display for details of the displayed content.

Also, $\overline{X}$ (average value) cursor and σ (standard deviation) cursors that show the result of STATISTIC calculation are displayed in the histogram. (Only when setting MATH/STATISTIC to ON at online.)
$\overline{X}$ cursor is showing of the position of the average value (dotted line) in the histogram. The σ cursor is showing of the position of "Average value ± nσ" (solid line). Here, "Nσ" means "nσ = n ×σ". The value of n can be changed by selecting σ on the CURSOR menu and turning the rotary knob.
This setting is common with the setting of σ in STATISTIC display on a secondary display.

Moreover, the standard deviation is an amount in which the difference level of the sample is shown. It is known that the probability that a certain sample enters the range of average value ± nσ becomes as follows by the value of n. (When the population takes normal distribution.)

n=1: About 68.27 %
n=2: About 95.45 %
n=3: About 99.73 %
n=4: About 99.994 %
n=5: About 99.99994 %
n=6: About 99.999997%

4.10.1.2 Display mode (MODE)

Three kinds (AUTO, FULLSCALE, and MANUAL) can be selected as for how to take (center value and width) within the range of the histogram. The data of the histogram is cleared when the setting of display mode (MODE) is changed at online.

◇AUTO mode

It decides the range of the histogram from the measurement automatically.

It changes the range of the histogram properly every time measuring according to the measurement at online. It is convenient for the case when the range of measuring value is not understood. For instance, it is convenient when the data is measured for the first time.etc.

The offline histogram chart is a method of deciding the maximum value and the minimum value of the quadrature axis of the screen so that the log data (data within the range placed with T cursor of the trend chart) that becomes an object may enter a full screen.

◇FULLSCALE mode

It decides the range of the histogram according to the measurement range.

At online, It changes the range of the histogram according to a present measurement range. Because the range of the histogram changes when the measurement range is changed, the data of the histogram is cleared along with it.

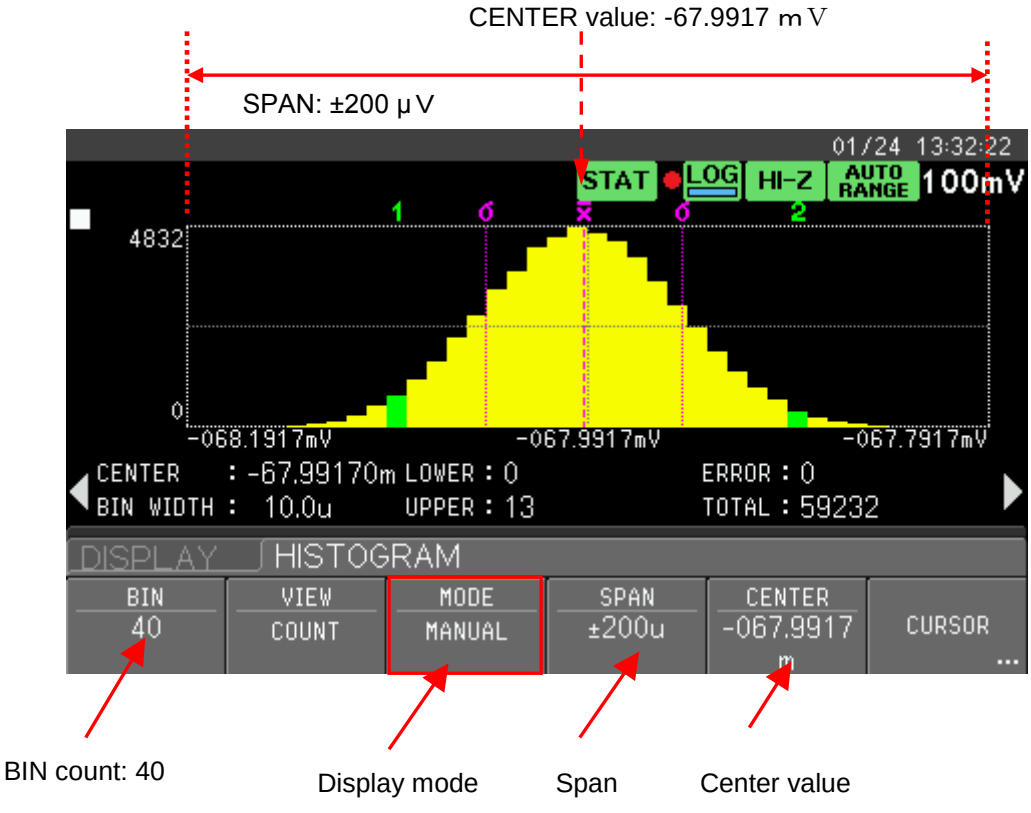
At offline, It searches out the largest range of ranges used to measure the log data (data within the range placed with T cursor of the trend chart) that becomes an object, and decides the range of the histogram based on this.

◇MANUAL mode

It sets the range of the histogram by hand power.

The setting contents are the center value (CENTER) and width (SPAN) of the histogram and are set respectively on CENTER and SPAN menu.

The following shows the measurement example in the MANUAL mode.



4.10.1.3 Operation of Online HISTOGRAM

The histogram chart is always renewed at online. This operation begins to look for the measurement result is in the range of which bin every time the measurement is done. And, the frequency of the appearance of the data of the bin is improved counting. Repeating this makes the histogram chart of the entire measurement.
The data of the histogram chart is continuously accumulated until being cleared by the change of the measurement condition and the data clearness operation.etc. (However, it stops when the number of data of totals exceeds two billion.)

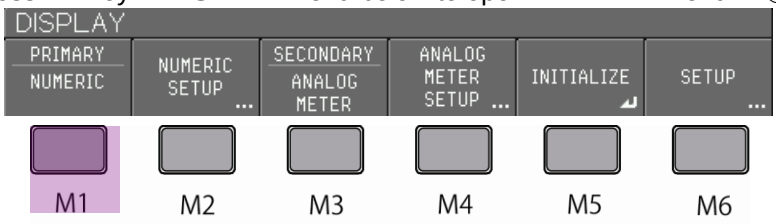
Refer to section 7.4 for the timing when clearing the data of the histogram chart.

4.10.1.4 HISTOGRAM SETUP menu

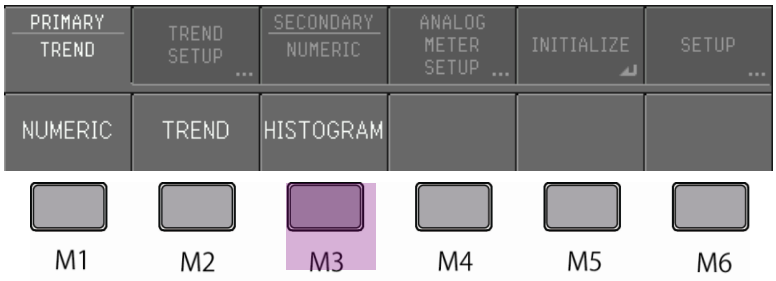
This page describes how to set the histogram chart display and settings of HISTOGRAM SETUP menu.

Operation procedure

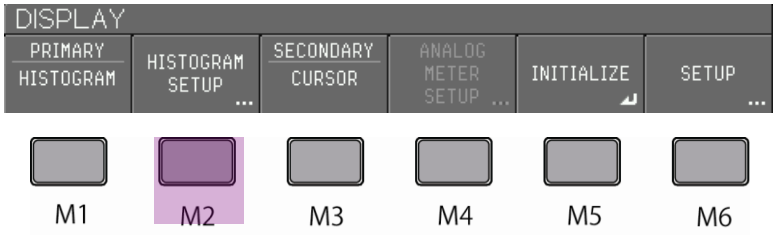
① Press M1 key in DISPLAY menu below to open PRIMARY menu in ②.



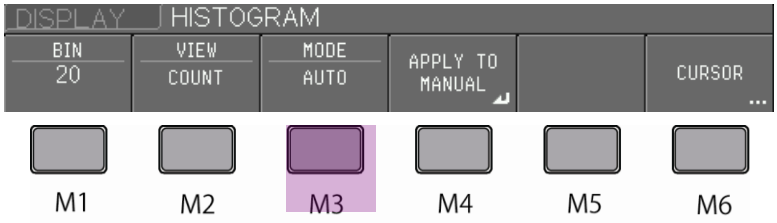
② Press M3 key in the diagram below to select HISTOGRAM. DISPLAY menu in ③ opens.



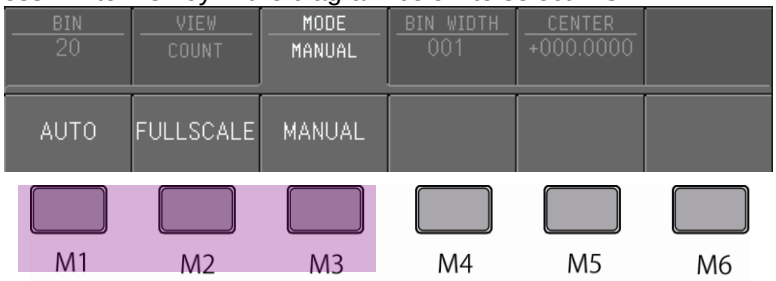
③ Press M2 key in the diagram below to select HISTOGRAM SETUP. HISTOGRAM SETUP menu in ④ opens.



④ Press M3 key in the diagram below to select MODE. MODE menu in ⑤ opens.



⑤ Press M1 to M3 key in the diagram below to select MODE.



For the settings of HISTOGRAM SETUP menu, see ◆HISTOGRAM SETUP menu Items and settings" on the next page. For the operation, see "Section 3.4.1 Basic operation of menu."

◆ **HISTOGRAM SETUP menu Items and settings (1/2)**

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
BIN		**By using two following methods, the BIN number is selected and set.**	4.10.1.2
	・DEFAULT	・Press M1 key to set BIN:20.	—
	*** Numeric value setting**	・Rotate the rotary knob to the numeric value of the BIN count. Setting range: 2, 4, 5, 10, 20, 40, 50, 100, 200, 400	
VIEW		**It selects the vertical axis of the histogram from either of items below.**	4.10.1.2
	・COUNT	・Press M1 key to set COUNT (frequency).	—
	・PERCENT	・Press M2 key to set PERCENT (%).	
MODE		**It selects the method of deciding the range of the horizontal axis of the histogram from 3 modes below.**	4.10.1.2
	・AUTO	・The measurement data is used to automatically set the center value and span.	—
	・FULL SCALE	・The center value and span of the histogram are decided by the maximum value and minimum value in the measurement range.	
	・MANUAL	・The span and center value are set by SPAN menu and CENTER menu below.	
APPLY TO MANUAL ＊When AUTO is selected by MODE above		**It copys the content of the range and the offset set in the AUTO mode automatically to the MANUAL mode.** Memo) • If APPLY TO MANUAL is executed before executing the setting in the MANUAL mode, it might become easy to operate. • Even if APPLY TO MANUAL is executed, the mode is AUTO. Switch the mode by hand power. Also, note that data is cleared when changing the mode. • Because a setting resolution of SPAN is different in the AUTO mode and the MANUAL mode, the copied content is not corresponding. It is rounded according to a setting resolution of MANUAL • This function is invalid when there is no measurement data (A function change and clear data just behind).	—
SPAN *** Displayed only when MANUAL is selected in the MODE above.**		**The span is set by selecting either of two methods below.** **It is displayed only when MANUAL is selected in the MODE above.**	4.10.1.2
	・DEFAULT	・Press M1 key to set ±10 for the span.	—
	*** Numeric value setting**	・Use the rotary knob and arrow keys to select the SPAN. Setting range: ±100p to ±500T (100p, 200p, 500p・・・500T)	
CENTER *** Displayed only when MANUAL is selected in the MODE above.**		**The center value is set by selecting either of two methods below.**	4.10.1.2
	・DEFAULT	・Press M1 key to set +000.0000. Note) The default value for VOAC7502 is ＋000.000.	—
	・GET VAL	・It takes the latest measurements when the GET VAL(M2) key is pushed.	
	・＋/－	・The sign of + or - can be set by pushing the M3 key.	
	・Selection of range of numerical value (-9 to ＋9／0 to 9)	・ It is possible to set to step over the value of 0 from negative to positive value or positive to negative value by turning the rotary knob when -9 to +9 is selected. ・ It is possible to set not to step over the value of 0 from 0 to 9 by turning the rotary knob when 0 to 9 is selected.	
	*** Numeric value setting**	・Use the rotary knob and arrow keys to select EDGE VALUE. Note) It is the specification for VOAC7502 in the following ( ). Setting range: -999.9999 T to ＋999.9999T (-999.999 T to ＋999.999T) ＊Suffix adheres to the digit in the right of seven digits (six digits) Minimum resolution: 0.0000001p (0.000001p)	

It continues to the table of ◆HISTOGRAM SETUP menu Items and settings (2/2) on next page.

◆ **HISTOGRAM SETUP menu Items and settings (2/2)**

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
CURSOR		**H cursor is used to set movement selection and position andσ is used to select the numeric value.**	4.10.1.1
	・KNOB	○ Select the cursor that moves when the rotary knob is turned from three kinds of the following. It pushes the M1 key to open the KNOB submenu. It selects the following cursor with the key to the correspondence. ・HCURSOR1: H1 cursor moves. ・HCURSOR2: H2 cursor moves. ・TRACK : Both cursors move while keeping interval between them.	–
	・HCURSOR1	○ It pushes the M2 key to open the submenu of HCURSOR1. The leftmost bin is 0 ・DEFAULT: It selects by M1 key. Default value is 0. * Numeric value setting: It sets by the rotary knob and the arrow key. The integral value within the range of 0- BIN (Set it at the head of the table of last page) can be set.	
	・HCURSOR2	○ It pushes the M3 key to open the submenu of HCURSOR1. The leftmost bin is 0 ・DEFAULT: It selects by M1 key. The default value is the maximum value of the bin set with BIN (head of the table of last page). * Numeric value setting: It sets by the rotary knob and the arrow key. The integral value within the range of 0- BIN (Set it at the head of the table of last page) can be set.	
	・σ	○ After pressing M4 key, rotate the rotary knob to set standard deviation (σ) displayed with the σ cursor of the histogram within the range of 1σ-6σ. If DEFAULT is selected, σ=3. ・DEFAULT: It selects by M1 key. The default value is 3 (Standard deviation is 3σ) * Numeric value setting: It sets by the rotary knob to select the following value. 0, 1, 2, 3, 4, 5, 6 This setting is common with the setting of standard deviation (σ) in the STATISTIC display on a secondary display. When this setting is changed, it is reflected in the STATISTIC display.	

4.10.2 Offline histogram chart display

TIn the off-line histogram chart display, this instrument makes the histogram from the content stored in the LOG memory. The target log data in the LOG memory for the histogram is data within the range placed with two T cursors of the trend chart. Therefore, the histogram within the arbitrary range can be created by setting T cursor.
Refer to section 4.9.2.5 Relationship between offline trend chart display and histogram chart display for the range specification with T cursor.

At online, when the settings of the number of bins and the mode, etc. are changed, the data of the histogram is cleared. On the contrary, because the recalculation is possible in offline, it is possible to change even by degrees how many.
Refer to "4.10.1.4 HISTOGRAM SETUP menu" for the setting of histogram of the number of bins and the mode, etc.

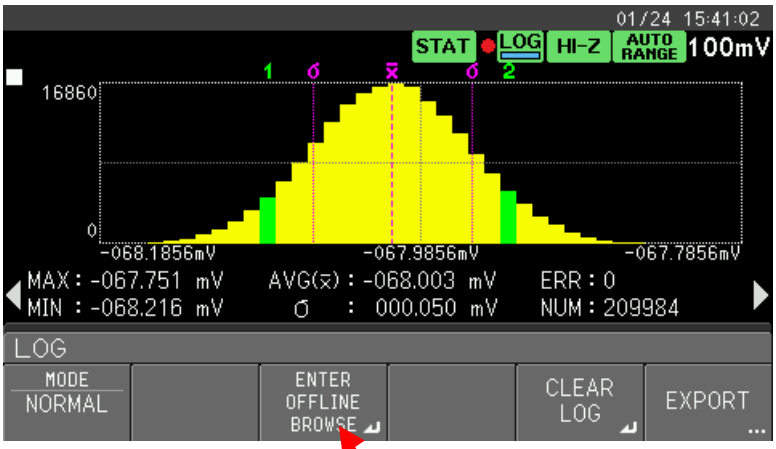
Thus, a detailed analysis of the measurement result becomes possible by the range specification with T cursor and the setting change of the histogram in the offline histogram chart.

Section 4.10.2.1 describes switching method from the online histogram chart display to the offline histogram chart display.
Section 4.10.2.2 describes functions to re-display the offline histogram chart.

4.10.2.1 Switching to offline histogram chart display (offline browse function)

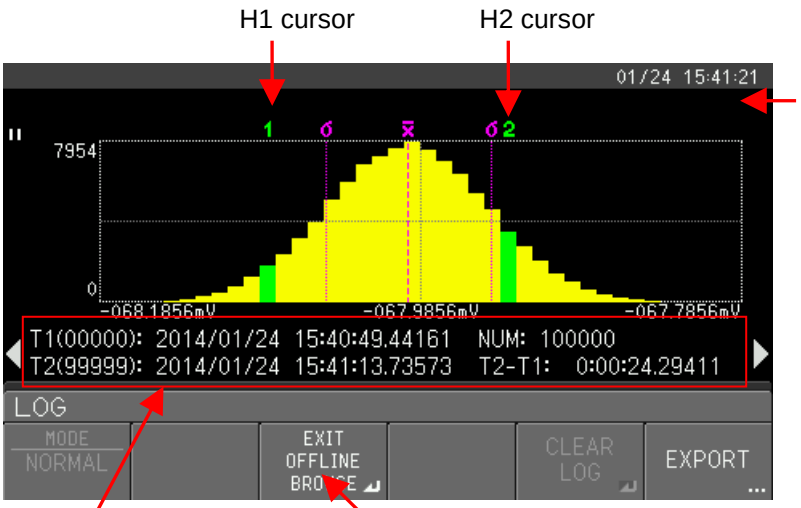
To switch from the online histogram chart display to the offline histogram chart display, press [LOG] key, select the LOG/ ENTER OFFLINE BROWSE menu, and execute it. The diagram below shows the example of switching from online to offline.

Example of online histogram chart display



If ENTER OFFLINE BROWSE is selected in the LOG menu, switching to the offline browse screen below is done (press M3 key).

Example of offline histogram chart display



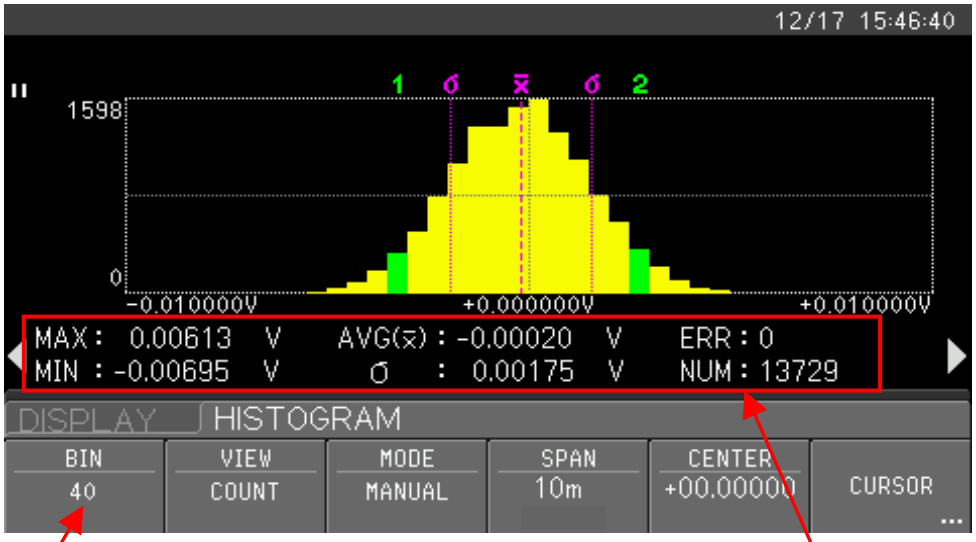
Annunciator; e.g. data capture on the upper right of the screen disappears.

If EXIT OFFLINE BROWSE is selected in LOG menu, the screen switches to the online browse screen above (press M3 key).

About T cursor time measurement display on the secondary display
Since, for the offline trend chart display, the measurement data in the range specified by T cursor is displayed on the histogram chart, T cursor time measurement display can be selected (see section 4.9.2.5).

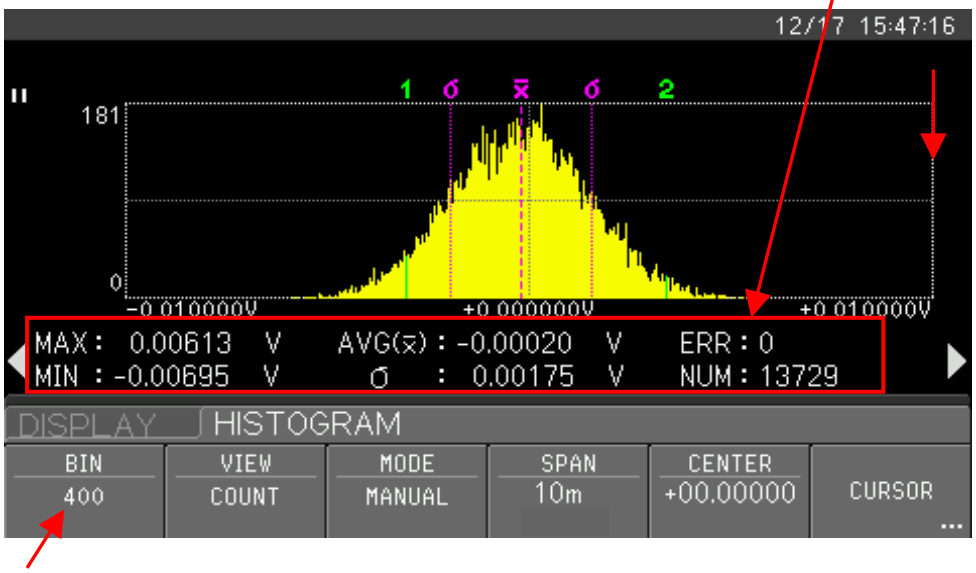
4.10.2.2 Re-display of offline histogram chart display

The offline histogram chart display can modify settings of number of BINs and mode many times by changing the condition in the HISTOGRAM menu; i.e. resulting in detailed observation of the waveform data. For example, if the setting of number of BINs of the measured histogram distribution is changed, the distribution can be observed detailedly as shown in the example below.



No. of BINs: 40

Statistical information is not different because of the same data.



No. of BINs: 400

Manual change of H1 or H2 cursor measurement, span, or center value is the same as online; i.e. common to Section 4.10.1.3 HISTOGRAM SETUP (DISPLAY/ HISTOGRAM) menu. See "◆HISTOGRAM SETUP menu items and settings".

4.11 Log function (LOG)

The function can memorize up to 100,000 pieces of data: The target data is as follows

- Measurement data
- Measurement date and time
- Attribute information (measurement function, setting of NULL calculation, setting of MATH calculation, error type)

◇ Mode of Logging function

The logging function has two modes below which are selected in the LOG menu for measurement. Store the logged measurement data in the log memory. The outline of the Logging operation to the log memory is shown in the following according to the mode. (Refer to < NORMAL mode > below and < BULK mode > of next page for details.)

○ NORMAL mode
- It always operates while measuring.

○ BULK mode
- It operates by the STARTLOG key pressing.
- It stops by the STOP LOG key pressing or the STOP EVENT generation.

It does not do the operation of the display of the measurement data etc. to guarantee the sampling rate when the BULK mode operates.

<NORMAL mode>

It accumulates data in the LOG memory at the same time as displaying the screen when measuring.
It stores continuing Logging data as long as the log data is not cleared.
When the number of data pieces reaches 100,000, the oldest data is deleted and new data is saved.
Refer to "◇ Clearness of log data" on next page for timing in which the log data is cleared.
Any of indicators below is always displayed on the upper of the screen depending on the states (It displays the figure of BACKGROUND: BLACK.)

: It indicates that logging data does not exist.

: It indicates that less than 100,000 pieces of logging data is saved.

: It indicates that the number of logging data pieces reaches 100,000 and the oldest data is deleted, and new data is saved.

<BULK mode>

Measurement is done while the other than measurement data acquisition is stopped. Therefore, logging can be done while ensuring the sampling rate up to 30 kS/s. For details of measurement actions and setting menu, see section 4.11.2.
Any of indicators below is always displayed on the upper of the screen depending on the states.
(It displays the figure of BACKGROUND: BLACK.)

- Not displayed : It indicates that logging data does not exist. Just after changing to the BULK mode or clearing the logging data, it is not displayed.

: There is no log data yet after pushing the START LOG key.

: Logging shows the state stored by less than number of Logging data set by the BULK SETTING menu.The screen indicates display of measurement in the BULK mode.

: Logging data reaches the number of Logging data set to the LOG memory by the BULK SETTING menu, the oldest data is deleted, and store the fresh data. The screen indicates display of measurement in the BULK mode.

: Logging shows the state that has stopped by less than number of Logging data set by the BULKSETTING menu.

: Logging shows the state that has stopped by number of Logging data set by the BULKSETTING menu.

◇ **Clearness of log data**

Timing in which the log data is cleared is at the time of the following operations and handling operations.

a) Change in function

b) Operation of clear data

At the time of pushing operation of rotary knob when only top menu of function is displayed or when INITIALIZE key is pressed in DISPLAY menu.

c) ON / OFF of SMOOTHING calculation

d) ON / OFF of NULL calculation / NULL value setting

e) ON / OFF of the mode of calculation function, SCALING calculation and dB calculation or the change of parameter

f) Log clearness (LOG CLEAR) execution

g) Mode change of Logging

h) Beginning of log in bulk mode

i) Memory length change in bulk mode

Moreover, refer to section 7.4 for another of the data of the trend chart and the list of the clear condition of each data of a log memory, histogram chart, and statistic calculation.

The LOG menu includes the **OFFLINE BROWSE function** which displays the contents currently saved in the LOG memory. It displays the content of the LOG memory being stored now with the trend chart or the histogram chart. For details of each display, see section 4.9.2 and section 4.10.2. Online display in the NORMAL mode is always logged and online measurement in the BULK mode is not logged until LOG is started (LOG indicator is not displayed or only LOG indicator without red circle is displayed).

The data saved by the logging function can be outputted in the USB memory by specifying USB directory (folder) name and file name in EXPORT menu.

Note) VOAC7502 cannot output to the USB memory. Therefore, there is no LOG/EXPORT menu.

The menu can set whether to output the measurement date/time and attribute information. (See Section 4.11.1 "◆ EXPORT menu items and settings".) For specifications about logging, see section 6.6.

Refer to 4.11.3 Logging data (CSV form) for the content of the output data.

4.11.1 Log measurement in NORMAL mode

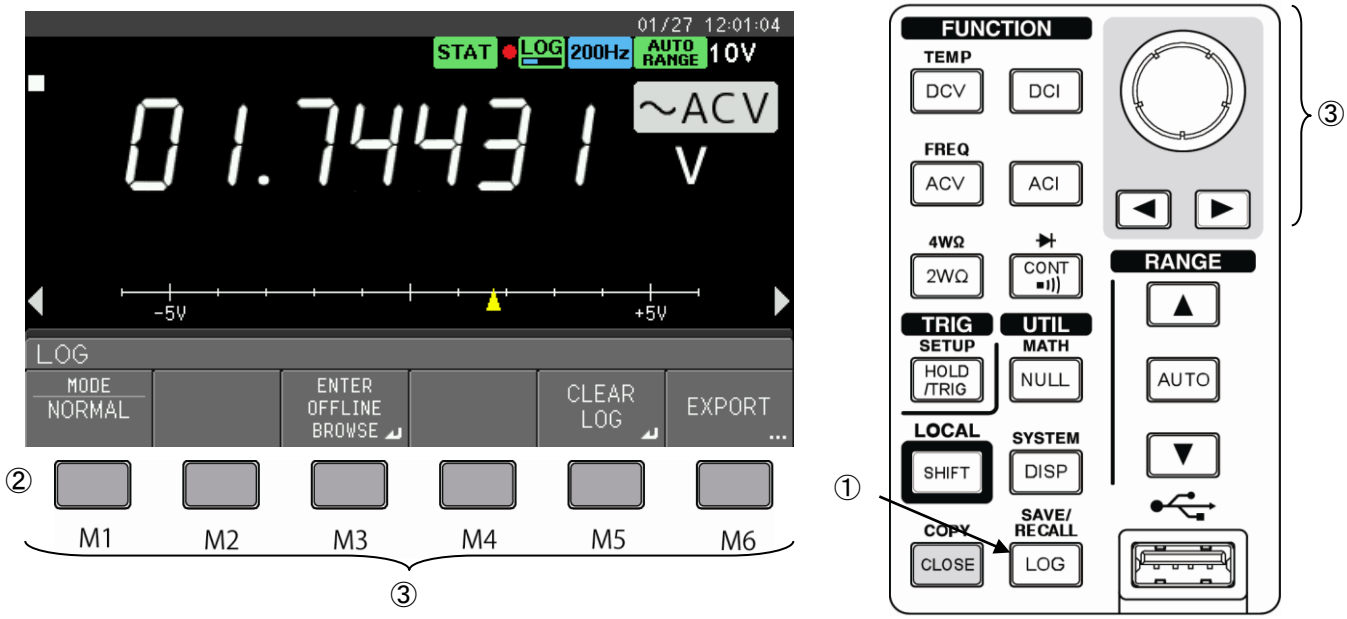
The following describes the setting method of the logging function and settings of the LOG menu in the NORMAL mode.

Operation procedure

① Press [LOG] key to open LOG menu.

② Press M1 key in the LOG menu to open the MODE menu.
Press M1 key in the MODE menu to select the NORMAL mode.

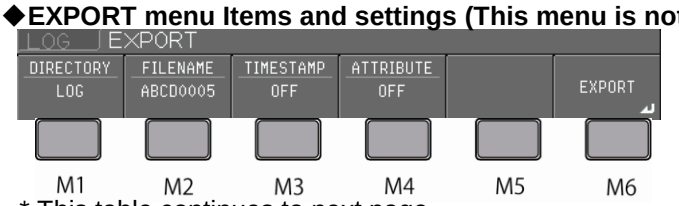
③ Set each item of LOG menu in the NORMAL mode.
Use menu keys M1 to M6 and the Rotary knob under the screen (outside) for operation. For the operation, see “Section 3.4.1 Basic operation of menu.” For the subsequent setting of LOG menu, see “◆ LOG menu Items and settings” in NORMAL mode on the next page.



◆NORMAL モードの LOG メニューの項目と設定内容

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
MODE		**It selects either of two modes below.**	6.6
	・NORMAL	Press M1 key (default setting).	4.11
	・BULK	Press M2 key. For settings of the BULK mode, see section 4.11.2.	4.11 4.11.2
ENTER OFFLINE BROWSE		**If M3 key is pressed, the message“Do you enter offline browse?”is displayed on the menu screen. Select either of the following to set whether to change to the offline browse function.**	4.9.2 4.10.2 4.11
	・OK	Press M1 key to switch to the offline browse screen. If LOG memory includes the data, the measurement data is displayed.	–
	・CANCEL	Press M5 key to return to the initial LOG menu.	–
CLEAR LOG		**Press M5 key to delete the logging data. If measurement is continued, the logging data is saved just after clearing.**	6.6
EXPORT		**Press M6 key to store the log data to USB memory. See “◆ Items and settings of EXPORT menu” in the table on the next page Note) VOAC7502 does not support this function because VOAC7502 doesn't have connected entrance of the USB memory.**	6.6

◆EXPORT menu Items and settings (This menu is not displayed in VOAC7502.)



* This table continues to next page.

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
DIRECTORY		**・It sets the directory name of the storage in USB memory. It sets the name at the cursor position on the DIRECTORY creation plate by Input/ delete menu below.** **・The name consists of up to 8 characters and displayed in EXPORT menu.**	6.6
	・DEFAULT	・It sets DIRECTORY in “LOG” format.	–
	・ABC	・Uppercase alphabets can be entered at the cursor position on the DIRECTORY creation plate. M2 key is used to select it and the character input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close DIRECTORY menu.	
	・123	・Numbers 0 to 9 can be entered at the cursor position on the DIRECTORY creation plate. M3 key is used to select it and the number input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the numbers and press the knob to close DIRECTORY menu.	
	・ ! @ $	・Symbols (space, symbol, etc.) can be entered at the cursor position on the DIRECTORY creation plate. M4 key is used to select it and the symbol input format is displayed at the beginning on the DIRECTORY creation plate. And then, rotate the Rotary knob to change the symbols and press the knob to close DIRECTORY menu.	
	・BACK SPACE	・It deletes the character, number, or symbol just prior to the cursor position on the DIRECTORY creation plate. Press M5 key to delete it.	
	・INPUT SPACE	・It enters the space at the cursor position on the DIRECTORY creation plate. Press M6 key to enter it.	
FILE NAME		**・It sets the file name of the logging data saved in the USB memory. The name is set at the cursor position on the FILE NAME creation plate with the input menu below.** **・The name consists of up to 8characters and displayed in EXPORT menu.**	6.6
	・DEFAULT	・FILE NAME is set in “LOGDXXXX” format by pressing M1 key. *” XXXX”: numeric value (initial value: 0000)	–
	・ABC	・Uppercase alphabets can be entered at the cursor position on the FILE NAME creation plate. (Note) It doesn't change except a numeric input when the cursor is in above-mentioned XXXX a part. M2 key is used to select it and the character input format is displayed at the beginning on the FILE NAME creation plate. And then, rotate the Rotary knob to change the alphabets and press the knob to close FILE NAME menu.	
	・123	・It can enter the number from 0 to 9 at the cursor position on the FILE NAME creation plate. M3 key is used to select it and the number input format is displayed at the beginning on the FILE NAME creation plate. And then, rotate the Rotary knob to change the numbers and press the knob to close FILE NAME menu.	

	・ ! @ $	・It can enter the symbol at the cursor position on the FILE NAME creation plate. (Note) It doesn't change except a numeric input when the cursor is in above-mentioned XXXX a part. M4 key is used to select it and the symbol input format is displayed at the beginning on the FILE NAME creation plate. And then, rotate the Rotary knob to change the symbols and press the knob to close FILE NAME menu.	
TIME STAMP		**・It sets ON/OFF for whether to save the measurement data/ time in the USB memory. M3 key is used.**	6.6
	・OFF	・The measurement date/time is not saved in the USB memory (default setting).	—
	・ON	・The measurement date/time is saved in the USB memory.	
ATTRIBUTE		**・It sets ON/OFF for whether to save the attribute information (measurement function, NULL calculation setting, MATH calculation setting, and error type) in the USB memory. M4 key is used.**	6.6
	・OFF	・The attribute information is not saved in the USB memory (default setting).	—
	・ON	・The attribute information is saved in the USB memory.	
EXPORT		**・It saves the logging data in the USB memory with the folder name and file name set in above. Press M6 key for execution.** **・Refer to section 4.11.3 for the format of Logging data.**	6.6 4.11.3

4.11.2 Log measurement in BULK mode

The measurement in the BULK stops the other functions than measurement data acquisition when measurement is done. Therefore, logging can be done while ensuring the sampling rate of up to 30 kS/s Section 4.11.2.1 to 4.11.2.2 describes the measurement action, settings, and characteristics.

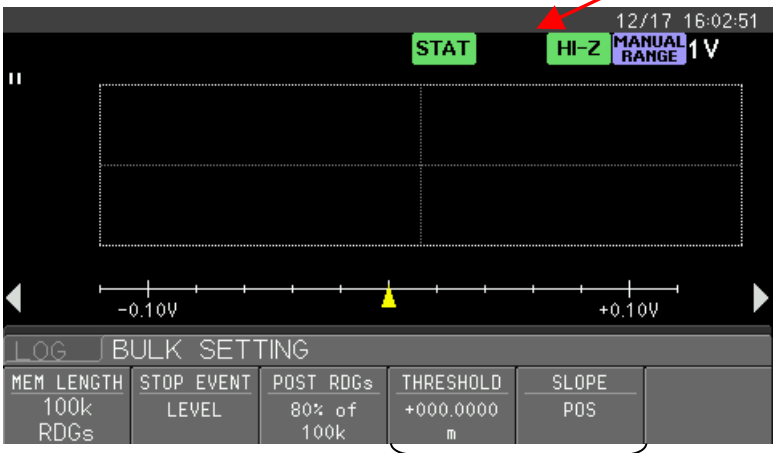
4.11.2.1 Log measurement in BULK mode

First, switch the mode to BULK by the LOG menu and set the acquisition condition of the BULK mode by the BULK SETTING menu. The explanation below uses the setting example.

<Setting example>

Change NORMAL mode to BULK by LOG menu.

When changing to BULK mode, LOG mark



① ② ③ ④

① MEM LENGTH : Select the specified memory length from 1k, 2k, 5k, 10k, 20k, 50k, and 100k (unit: Readings).

② STOP EVENT : Select the stop event from EXT TRIG / LEVEL (Data value specification) / LIMIT (limit judgment result).

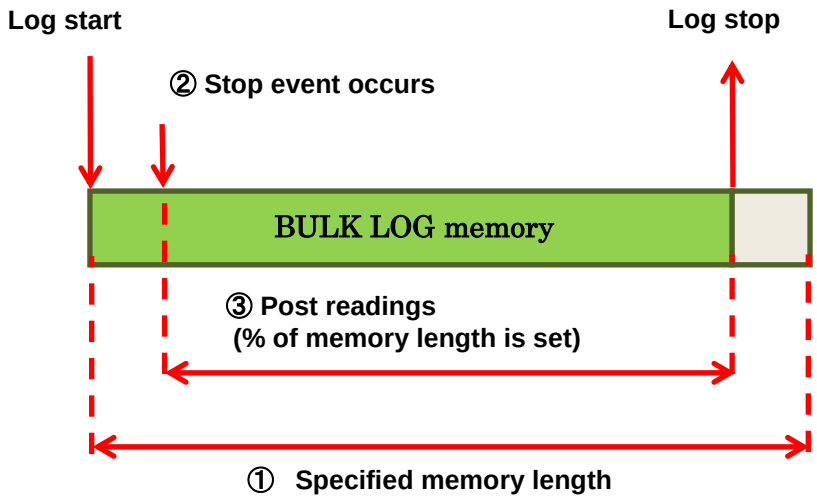
* EXT TIRG: An external trigger input alone is valid, and doesn't stop in the TRIG key on the front panel.

③ POST Rdgs : Specify 0 to 100% for post readings.

④ THRESHOULD / SLOPE / LIMIT

: If ② is LEVEL, set the numeric value for the threshold and select POS/ NEG for SLOPE. If ② is LIMIT, select from GO/ NOGO/ HI/ LOW.

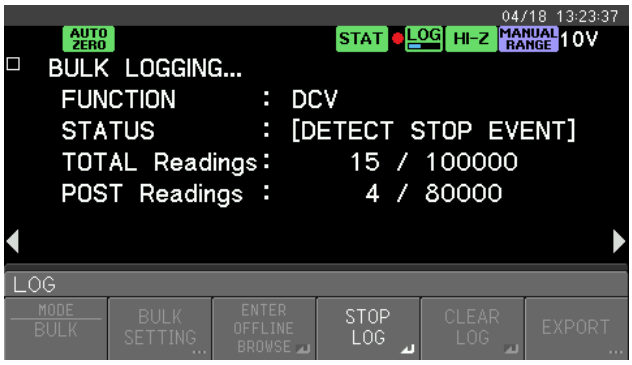
<Image of acquisition of bulk mode measurement and saving in the log memory>



Press START LOG key to start the BULK mode measurement. The screen changes to the BULK mode measurement screen (below) and measurement starts. (However, it is not possible to begin while executing a continuous writing in the USB memory by the VALUE TO USB function.)

Screen to wait the stop event

Screen after stop event occurs



The measurement stops when either of the following occurs.

- After the event set by STOP EVENT in the BULK SETTEING menu occurs, logging with the amount of data set by POST Readings is completed.
- STOP LOG execute (M4) key in the LOG menu is pressed.

The screen returns to the original screen several seconds after the BULK mode measurement is completed. Since the data is saved in the LOG memory with the condition set by the BULK SETTING menu, the trend chart and histogram chart display is used to observe the waveform and distribution status.

All the following functions become invalid (Or, fixation set it) while measuring in the BULK mode.

- Screen display: State display of bulk log
- AUTO range: OFF (MANUAL range)
- SMOOTHING: OFF
- Trigger operation: AUTO
- Trigger deLay: 0.00 ms
- Screen display of LIMIT calculation result: off
- DIO output of LIMIT calculation result: OFF
- BEEP rumbling by LIMIT calculation result: OFF
- BEEP rumbling of CONT measurement: OFF
- The back COMPL output: OFF

4.11.2.2 Setting of LOG menu in BULK mode

The following describes the setting method of the logging function in the BULK mode and settings of the LOG menu.

Operation procedure

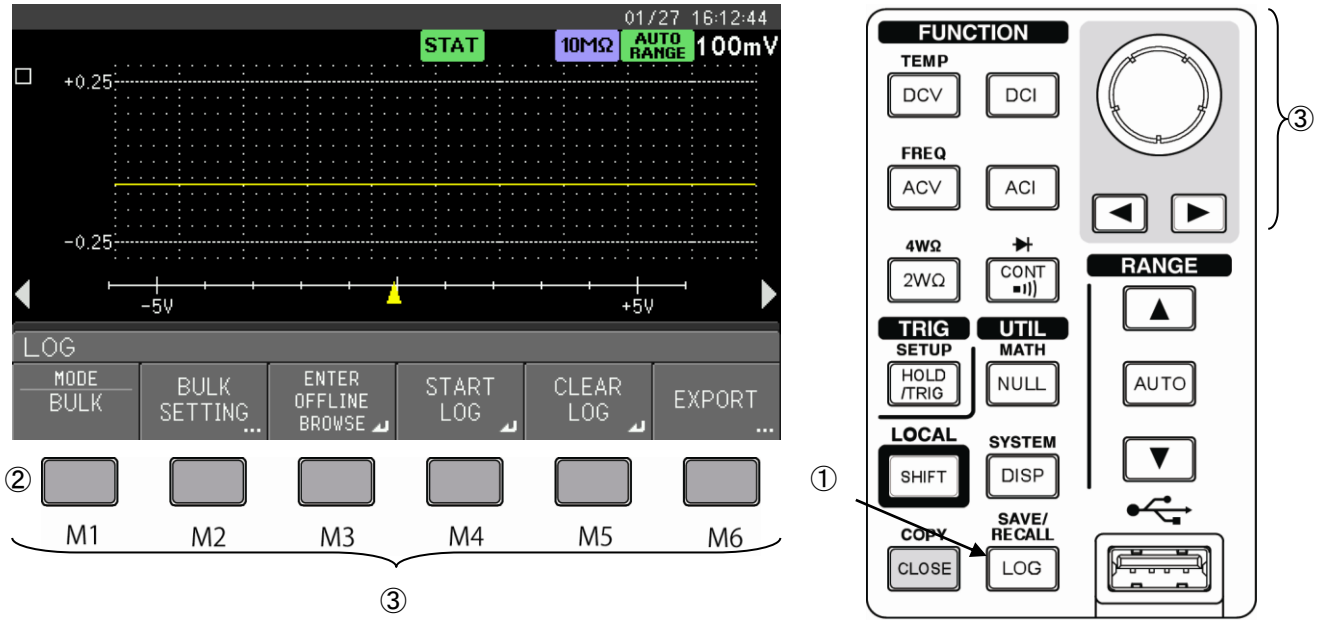
① Press [LOG] key to open the LOG menu.

② Press M1 key in the LOG menu to open the MODE menu.

Press M2 key in the MODE menu to select the BULK mode.

③ Set each item of the LOG menu in the BULK mode.

Use the menu keys M1 to M6 and the rotary key under the screen (outside) for operation. For the operation, see “3.4.1 Basic operation of menu.” For the subsequent setting of the LOG menu, see “◆LOG menu items and settings in BULK mode” on the next pages.



◆LOG menu items and settings in BULK mode

Menu item (1st)	Menu item (2nd)	Settings (detailed menu items)	Refer to
MODE		**It selects either of two modes below.**	6.6
	・NORMAL	Press M1 key to select it. (default setting).	4.11
	・BULK	Press M2 key to select it. For settings of the BULK mode, see this table.	4.11 This table
BULK SETTING *** Displayed only when BULK is selected in the MODE above.**		**Press M2 key to open the BULK SETTING menu. The setting conditions for log measurement in the BULK mode are specified using 6 items below.**	4.11.2.1
	・MEM LENGTH	Specify the memory length in the MEM LENGTH menu. ・DEFAULT : Press M1 key (default: 1k Readings) * Numeric value setting : rotate the rotary knob. 1k, 2k, 5k, 10k, 20k, 50k, and 100k (unit: Readings)	—
	・STOP EVENT	Specify the condition of the stop event in the STOP EVENT menu. ・NONE: Continue Logging until STOP LOG is pushed ・EXT TRIG: It is effective only when there is an external trigger input. ・LEVEL : When crossing occurs at the numeric value set by THRESHOULD below ・LIMIT : When judgment result specified by LIMIT below occurs	—
	・POST Rdgs	Numerical value specify the number of data acquired from the generation of the stop event by the POST Rdgs menu to the log stop at the rate of the data length set with MEM LENGTH. ・Numeric value selection : Press M1 to M5 key for specification. Setting range: 0, 25, 50, 75, 100 (%) * Numeric value setting: Use the rotary knob and arrow keys for specification. Setting range: 0 to 100% (integral number)	—
	・THRESHOULD * Displayed only when LEVEL is selected in the STOP EVENT above.	Use THRESHOULD menu to specify the numeric value for threshold where the stop event occurs. Note) It is the specification for VOAC7502 in the following ( ). ・DEFAULT: Press M1 key for selection default: value: +000.0000 (+000.000) ・GET VAL: Press M2 key for selection. The latest measurement value is entered as a setting value. * Numeric value setting: Use the rotary knob and arrow keys for specification. Setting range: -999.9999T to +999.9999T (-999.999T to +999.999T)	—
	・SLOPE * Displayed only when LEVEL is selected in the STOP EVENT.	Use SLOPE menu to specify the direction in which the value specified by THRESHOULD is crossed; i.e. POS (rising) or NEG (falling).	—
	・LIMIT * Displayed only when LEIMIT is selected in the STOP EVENT.	Use LIMIT menu to specify any of 4 types below for the setting for the LIMIT judgment set by the stop event ・GO : Press M1 key. ・NO-GO : Press M2 key. ・HIGH : Press M3 key. ・LOW : Press M4 key.	—
ENTER OFFLINE BROWSE		**If M3 key is pressed, the message "Do you enter offline browse?"is displayed on the menu screen. Select either of the following to set whether to switch to the offline browse function.**	4.9.2 4.10.2 4.11
	・OK	Press M1 key to switch to the offline browse screen. If the LOG memory includes the data, the measurement data is displayed.	—
	・CANCEL	Press M5 key to return to the initial LOG menu.	—
START LOG		**Press M4 key to start the log measurement in the BULK mode.**	4.11.2.1
STOP LOG		**Press M4 key during the log measurement in the BULK mode to stop the log measurement and to return to the original screen.**	4.11.2.1
CLEAR LOG		**Press M5 key to delete the logging data.**	6.6 4.11.2.1
EXPORT		**Set pushing the M6 key, the opening of the EXPORT menu, and the output of Logging data.** **See Section 4.11.1 "◆EXPORT menu items and settings".** **To prevent the superscription when succeeding in EXPORT, one increases the value of the last 4 digits of FILENAME.**	6.6 4.11.1

4.11.3 Logging data (CSV format)

Logging data stored in the LOG memory of this instrument is set by the EXPORT menu that is explained by section 4.11.1, and is output with the EXPORT key.
For VOAC7602, the format of the logging data saved in the USB memory is delimited by commas as shown below. Details of each item are shown in the table on the next page.

◇ In case of VOAC7502

VOAC7502 cannot output Logging data to the USB memory. VOAC7502 stores data as follows by a remote control. Unite software by the command supported by this instrument, and store Logging data by a remote control. Refer to "VOAC7602_7502 Remote-J.pdf" collected to CD for a detailed command of a remote control.

<The format of Logging data (VOAC7602) >

- When TIME STAMP: ON and ATTRIBUTE: ON
  Measurement data, measurement date/time (second), measurement date/time (μs), measurement function, NULL calculation, MATH calculation, error type (or LIMIT judgement result)
- TIME STAMP: ON、ATTRIBUTE: OFF
  Measurement data, measurement date/time (second), measurement date/time (μsecond)
- TIME STAMP: OFF、ATTRIBUTE: ON
  Measurement data, measurement function, NULL calculation, MATH calculation, error type (or LIMIT judgement result)
- TIME STAMP: OFF、ATTRIBUTE: OFF
  Measured data

Measurement data

Item		Value or setting	Output example
Measurement data		7-digit index format	+9.474861E−03
		Overload or overflow	+9.910000E+37
Measurement date/time (TIME STAMP)	Measurement date/time (second)	Year/month/day Hour: minute: second	“2013/07/01 17:38:52”
	Measurement date/time (μsecond)	Part less than 1 second	119771
Attribute information (ATTRIBUTE)	Measurement function	DCV	“DCV”
		ACV	“ACV”
		DCI	“DCI”
		ACI	“ACI”
		2WΩ	“2WOHM”
		4WΩ	“4WOHM”
		CONT	“CONT”
		DIOD	“DIOD”
		TEMP	“TEMP”
		FREQ	“FREQ”
	NULL calculation	ON	“NULL”
		OFF	Blank
	MATH calculation	SCALING	“SCALING”
		dBm	“dBm”
		dBV	“dBV”
		OFF	Blank
	Error type / LIMIT judgement result	No error, LIMIT calculation OFF	Blank
		GO	“GO”
		HIGH	“HIGH”
		LOW	“LOW”
		LIMIT calculation error	“LIMITERR”
		−overload	“−OVERLOAD”
		+overload	“OVERLOAD”
		−overflow	“−OVERFLOW”
		+overflow	“OVERFLOW”

The example below shows that log data output to the USB memory is read by text editter. The example below is output by the setting of TIME STAMP：ON、ATTRIBUTE：ON.

<Log data example (for VOAC7602)>

+7.335470E-03,"2014/03/28 19:19:19",319622,"DCV",,,
+7.335962E-03,"2014/03/28 19:19:19",719614,"DCV",,,
+7.319702E-03,"2014/03/28 19:19:20",119608,"DCV",,,
+7.291430E-03,"2014/03/28 19:19:20",519601,"DCV",,,
+7.299925E-03,"2014/03/28 19:19:20",919596,"DCV",,,
+7.285633E-03,"2014/03/28 19:19:21",319586,"DCV",,,
+7.310477E-03,"2014/03/28 19:19:21",719577,"DCV",,,
. . . . ,,,
. . . . ,,,
. . . . ,,,
. . . . ,,,

Memo!
If the file itself of the logging data is read by MICROSOFT EXCEL, do the following settings properly.
- The display digit of the measurement data is acquired up to seven digits (VOAC7602) or six digits (VOAC7502) below the point in the exponential type.
- The second may not be displayed in the line of date/time. At that time, setting should be changed so that the second can be displayed in the cell display format.

4.12 Default settings of function/ features

Default (factory) settings of setting items in each function and each feature are shown in Table4.1 Default settings to be saved/ recalled and Table 4.2 Default settings not to be saved/ recalled.

Table 4.1(a) Default settings to be saved/recalled

Class	Menu hierarchy	Item name	Default setting
FUNCTION	-	Function	DCV
FUNCTION/DCV	RANGE	Range	AUTO
	SAMPLE	Sampling rate	1.0 S/s
	AUTO ZERO	Auto Zero	ON
	SMOOTHING	Smoothing	OFF
	SMOOTHING/LENGTH	Number of smoothing times	10
	NULL	NULL calculation	OFF
	NULL/VAL Note	NULL value	0.000000(0.00000)
	INPUT RES.	Input impedance	AUTO
FUNCTION/DCI	RANGE	Range	AUTO
	SAMPLE	Sampling rate	1.0 S/s
	AUTO ZERO	Auto Zero	ON
	SMOOTHING	Smoothing	OFF
	SMOOTHING/LENGTH	Number of smoothing times	10
	NULL	NULL calculation	OFF
	NULL/VAL Note	NULL value	0.000000(0.00000)
FUNCTION/ACV	RANGE	Range	AUTO
	BANDWIDTH	AC filter	MID(20Hz～)
	SAMPLE	Sampling rate	2.5 S/s
	SMOOTHING	Smoothing	OFF
	SMOOTHING/LENGTH	Number of smoothing times	10
	NULL	NULL calculation	OFF
	NULL/VAL Note	NULL value	0.000000(0.00000)
	FREQ	Frequency display	OFF
FUNCTION/ACI	RANGE	Range	AUTO
	BANDWIDTH	AC filter	MID(20Hz～)
	SAMPLE	Sampling rate	2.5 S/s
	SMOOTHING	Smoothing	OFF
	SMOOTHING/LENGTH	Number of smoothing times	10
	NULL	NULL calculation	OFF
	NULL/VAL Note	NULL value	0.000000(0.00000)
FUNCTION/2WΩ	RANGE	Range	AUTO
	SAMPLE	Sampling rate	1.0 S/s
	AUTO ZERO	Auto zero	ON
	SMOOTHING	Smoothing	OFF
	SMOOTHING/LENGTH	Number of smoothing times	10
	NULL	NULL calculation	OFF
	NULL/VAL Note	NULL value	0.000000(0.00000)

Note) As for marked set items of the correspondence, they are default values of VOAC7502 setting in ( ).

Table 4.1(b) Default settings to be saved/recalled

Class	Menu hierarchy	Item name	Default setting	Remarks
FUNCTION/4WΩ	RANGE	Range	AUTO	—
	SAMPLE	Sampling rate	1.0 S/s	—
	SMOOTHING	Smoothing	OFF	—
	SMOOTHING/LENGTH	Number of smoothing times	10	—
	NULL	NULL calculation	OFF	—
	NULL/VAL Note	NULL value	0.000000 (0. 00000)	—
FUNCTION/CONT	THRESHOLD	Threshold value resistance	10.0Ω	—
FUNCTION/TEMP	SAMPLE	Sampling rate	1.0 S/s	VOAC7502 doesn't have the default setting for non-installing.
	AUTO ZERO	Auto zero	ON	
	SMOOTHING	Smoothing	OFF	
	SMOOTHING/LENGTH	Number of smoothing times	10	
	NULL/STAT	NULL calculation	OFF	
	NULL/VAL	NULL value	0.000000	
	SENSOR/TYPE	Type of sensor	TC	
	SENSOR/TC TYPE	Type of thermo-couple	K	
	SENSOR/COLD JUNCTION	Cold junction temperature	0.0℃	
	SENSOR/RTD TYPE	Type of resistance temperature sensor	Pt100	
FUNCTION/FREQ	RANGE	Range	AUTO	—
	MODE	Mode	FREQ	—
	GATE TIME	Gate time	100 ms	—
	SMOOTHING/STAT	Smoothing	OFF	—
	SMOOTHING/LENGTH	Number of smoothing times	10	—
	NULL/STAT	NULL calculation	OFF	—
	NULL/VAL Note	NULL value	0.000000(0.00000)	—
	ACV	ACV measurement value display	OFF	—
TRIGGER	TRIG	Trigger mode	AUTO	—
	SAMPLE COUNT	No. of samples/ trigger	1	—
	DELAY	Delay time	0.0 ms	—
	INTERVAL	Interval time	0.0 ms	—
	EXT TRIGGER	External trigger	DISABLE	—
	INHIBIT	Polarity at inhibit	POSITIVE	DIO(SC-362)
MATH	MATH	—	OFF	—
	SCALING/MODE	Scaling calculation mode	(X-A)*B/C	—
	SCALING/A Note	Scaling calculation constant A	0.0000(0.000)	—
	SCALING/B Note	Scaling calculation constant B	1.0000(1.000)	—
	SCALING/C Note	Scaling calculation constant C	1.0000(1.000)	—
	SCALING/D Note	Scaling calculation constant D	1.0000(1.000)	—
	dB/MODE	dB calculation mode	dBm	—
	dB/RE-R	dB calculation, standard resistance	600Ω	—
	dB/RE-V	dB calculation, standard voltage	1.0 uV	—
	dB/REL	dB difference calculation	OFF	—
	dB/REL/VAL	dB standard value	0.0000 dB	—

Note) As for marked set items of the correspondence, they are default values of VOAC7502 setting in ( ).

Table 4.1(c) Default settings to be saved/recalled

Class	Menu hierarchy	Item name	Default setting	Remarks
MATH	LIMIT/LOW	LOW setting of LIMIT calculation	OFF	—
	LIMIT/LOW LIMIT Note	LOW setting value of LIMIT calculation	−999.9999T(-999.999T)	—
	LIMIT/HIGH	HIGH setting of LIMIT calculation	OFF	—
	LIMIT/HIGH LIMIT Note	HIGH setting value of LIMIT calculation	+999.9999T(+999.999T)	—
	LIMIT/DIO	DIO output of LIMIT calculation	OFF	DIO(SC-362)
	STATISTIC	Statistics calculation	ON	—
DISPLAY	PRIMARY	Primary display	NUMERIC	—
	NUMERIC/MASKING	Mask of numeric value display	OFF	—
	NUMERIC/FONTSIZE	Font size of numeric value display	NORMAL	
	NUMERIC/FONT	Font of numeric value display	7SEG	
	TREND/VERTICAL/MODE	Vertical axis of trend chart	FULLSCALE	—
	TREND/VERTICAL/RANGE	Range setting of vertical axis (for MANUAL)	1.0/div	—
	TREND/VERTICAL/OFFSET	Offset setting of vertical axis (for MANUAL)	0 div	—
	TREND/CURSOR/KNOB	Kind of cursor of trend chart	TCURSOR1	—
	TREND/SEARCH MODE	Search mode of trend chart	OFF	—
	TREND/EDGE VALUE Note	Level voltage of edge of search mode	0.000000(0.00000)	—
	HISTOGRAM/BIN	No. of bins of histogram chart	20	—
	HISTOGRAM/VIEW	Vertical axis setting	COUNT	—
	HISTOGRAM/MODE	Mode setting	AUTO	—
	HISTOGRAM / MANUAL SPAN	Width of span	±10	—
	HISTOGRAM/CENTER Note	Center value for MANUAL	0.0000(0.000)	—
	HISTOGRAM/CURSOR/KNOB	Kind of cursor of histogram chart	HCURSOR1	—
	HISTOGRAM/CURSOR/HCURSOR1	Position of H1 cursor	0	—
	HISTOGRAM/CURSOR/HCURSOR1	Position of H2 cursor	0	—
	HISTOGRAM/CURSOR/σ STATISTIC／σ	Coefficient concerning distribution of standard deviation	3	Sharing the setting by two menus
	SECONDARY	Secondary display	ANALOG METER	—
	ANALOG METER/MODE	Analog meter mode	FULLSCALE	—
	ANALOG METER/RANGE	Range setting of analog meter (MANUAL)	1.0/div	—
	ANALOG METER/OFFSET	Offset setting of analog meter (MANUAL)	0 div	—
	ANALOG METER/LOG MIN	Minimum value of LOG scale of analog meter (LOG)	1.0 /div	—
	ANALOG METER/LOG MAX	Maximum value of LOG scale of analog meter (LOG)	10.0 /div	—
	ARC SCALE METER/MODE	Mode of arc scale meter	FULL SCALE	—
	ARC SCALE METER/MANUAL RANGE	Range setting of arc scale meter (MANUAL)	1.0 /div	—
	ARC SCALE METER/MANUAL OFFSET	Offset setting of arc scale meter (MANUAL)	0 div	—
	ARC SCALE METER/LOG MIN	Minimum value of LOG scale of arc scale meter (LOG)	1.0 /div	—
	ARC SCALE METER/LOG MAX	Maximum value of LOG scale of arc scale meter (LOG)	10.0 /div	—
	ARC SCALE METER/TITLE/MODE	Title display form of arc scale meter	UNIT	—
	ARC SCALE METER/TITLE/TEXT	Title input form of arc scale meter	“VOAC”	—

Table 4.1(d) Default settings to be saved/recalled

Class	Menu hierarchy	Item name	Default setting	Remarks
LOG	MODE	Mode of log measurement	NORMAL	–
	BULK/MEM LENGTH	Memory length in BULK mode	1k Readings	–
	BULK/STOP EVENT	Condition of stop event	NONE	–
	BULK/POST/Rdgs	Ratio of data to memory length	50	–
	BULK/THRESHOULD Note	Threshold when stop event is generated	0.000000(0.00000)	–
	BULK/SLOPE	The direction where value set with THRESHOULD intersects	POSITIVE	–
	BULK/LIMIT	Content of LIMIT judgment set in stop event	GO	–
SETUP SAVE/RECALL	SETUP NAME	Setting condition name	"SETUP NAME"	–

Note) As for marked set items of the correspondence, they are default values of VOAC7502 setting in ( ).

* The timing of initialization of items to be saved/ recalled is as follows:

- Initialization is done when executing RECALL DEFAULT in SETUP SAVE/RECALL/RECALL menu.
- Initialization is done at every startup in DEFAULT setting of SETUP SAVE/RECALL/POWER ON RECALL menu.
- Initialization is done when executing INITIALIZE in SYSTEM/TOOLS menu.

Table 4.2 (a) Default settings not to be saved/recalled

Class	Menu hierarchy	Item name	Default setting	Remarks
SYSTEM	REMOTE/INTERFACE	Remote interface	USB	—
	REMOTE/COMAND	Classification of remote command	SCPI	—
	REMOTE/DELIMITER	Delimiter setting	CR+LF	—
	REMOTE/GPIB/ADDRESS	Address setting	9	GPIB(SC-363)
	REMOTE/TCP/IP/DHCP	DHCP setting	OFF	LAN&RS-232(SC-361)
	REMOTE/TCP/IP/ADDRESS	Address setting	010.102.102.102	LAN&RS-232(SC-361)
	REMOTE/TCP/IP/SUBNET MASK	Subnet mask setting	255.255.255.0	LAN&RS-232(SC-361)
	REMOTE/TCP/IP/GATEWAY	Gateway setting	010.102.102.100	LAN&RS-232(SC-361)
	REMOTE/RS232/BIT RATE	Bit rate setting	38400bps	LAN&RS-232(SC-361)
	REMOTE/RS232/PARITY	Parity setting	NONE	LAN&RS-232(SC-361)
	REMOTE/RS232/BIT RATE	Stop bit setting	1bit	LAN&RS-232(SC-361)
	BEEP/KEY	Beep tone of key	ON	—
	BEEP/CAITION	Caution tone	ON	—
	BEEP/LIMIT	Beep tone at LIMIT judgment	NO-GO	—
	SETUP/ANIMATION	Animation setting	ON	—
	SETUP/HEADER	Header setting	DATETIME	—
	SETUP/LINE FREQ	Detection setting of power supply frequency	AUTO	—
	COPY/MODE	Copy output setting	SCREEN TO USB	VOAC7502 doesn't have the default setting for non-installing.
	COPY/SCREEN/FORMAT	File format of screen output data	PNG(COLOR)	
	COPY/SCREEN/DIRECTORY	Directory name of output data destination	"¥COPY"	
	COPY/SCREEN/FILE NAME	File name of output data	"COPY0000"	
	COPY／VALUE／ACTION	Operation of VALUE TO USBME	ONE TIME	
	COPY/VALUE/DIRECTORY	Directory name of text output destination	"¥TEXT"	
	COPY/VALUE/FILE NAME	File name of l text output data	"TEXT0000"	
	COPY/VALUE/TIME STAMP	Date/ time information of text output	ON	
	COPY/VALUE/ATTRIBUTE	Valid calculation of text output	ON	
	PANEL LOCK	Key operation on front panel	OFF	—
FUNCTION／DISPLAY	SETUP/BACK GROUND	Screen background color	BLACK	—
	SETUP/BACK LIGHT	Screen backlight brightness	HIGH	—
	SETUP/LOW POWER	Power supply low power mode	OFF	—
LOG	EXPORT/DIRECTORY	Directory name of logging output destination	"¥LOG"	VOAC7502 doesn't have the default setting for non-installing.
	EXPORT/FILENAME	File name of logging output data	"LOGD0000"	
	EXPORT/TIMESTAMP	Date/ time of logging output	ON	
	EXPORT/ATTRIBUTE	Valid calculation of logging output	ON	
SETUP SAVE/RECALL	POWER ON RECALL/MODE	Setting condition at powering on	DEFAULT	—
	SAVE/DESTINATION	Storage of setting conditions	INTERNAL MEMORY	—
	SAVE/NUMBER	Internal memory number of storage	#1	—
	SAVE/DIRECTORY	Directory name of USB memory	"¥SETUP"	VOAC7502 doesn't have the default setting for non-installing.
	SAVE/FILE NAME	File name of saved data	"STUP0000"	
	RECALL/SOURCE	Recalling source of setting conditions		—
	RECALL/NUMBER	Internal memory number of recalling source	#1	—
	RECALL/DIRECTORY	Directory name of USB memory	"¥SETUP"	VOAC7502 doesn't have the default setting for non-installing.
	RECALL/FILE NAME	File name of recalling source data	"STUP0000"	
	RECALL/EXIT CONTROL	ON/OFF of external control	OFF	LAN&RS-232(SC-361)
	RECALL/EXIT BEGIN	Number of the first setting condition	＃1	
	RECALL/EXIT END	Number of the last setting condition	＃10	
	RECALL/EXIT POLARITY	Polarity of control signal	POSITIVE	

Table 4.2 (b) Default settings not to be saved/recalled

Class	Menu hierarchy	Item name	Default setting	Remarks
DISPLAY	TREND/HORIZONTAL/Readings/div	Resolution capability of waveform data in direction of the horizontal axis of trend chart	— (∗2)	—
	TREND/HORIZONTAL/CENTER ADDR	Center address in direction of the horizontal axis of the entire shape of waves of trend chart	— (∗2)	—
	TREND/CURSOR/TCURSOR1	Address of T1 cursor of trend chart	— (∗2)	—
	TREND/CURSOR/TCURSOR2	Address of T1 cursor of trend chart	— (∗2)	—

∗1. The timing of initialization of items not to be saved/ recalled is as follows:
- Initialization is done when executing INITIALIZE in SYSTEM／TOOLS menu.

∗2. Whenever an offline browse starts, it is set automatically.

1234 5 67

Chapter 5 Daily check and calibration

This chapter describes check, maintenance, and calibration (adjustment) when using this instrument.

5.1 Daily cleaning

> **Note!**
> Since the electric shock may occur, be sure to remove the power supply cord before cleaning.

Softly wipe the dirt on the exterior with soft cloth including a small amount of water or thinned neutral detergent.
Use of inhibited solvent or detergent for cleaning may result in discoloration or unexpected failure.
The solvent or detergent should be selected as shown below:

- Solvent and detergent to be used: Water, neutral detergent (thinned)
- Solvent and detergent not to be used: Alcohol, gasoline, acetone, lacquer, ether, thinner, and detergent including ketone

5.2 Calibration

For this instrument to make accurate measurement, the regular calibration (after receiving it, charged calibration and adjustment are executed at our site) is recommended.
For the regular calibration for the entire instrument, contact our service center (below). **The regular calibration is recommended once a year.**
Note that the life of the battery for data backup is 5 years in the normal temperature. The battery cannot be replaced by the customer. Contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors..

■Contacts

Address : 7-41 Kugayama 1-chome Suginami-ku Tokyo, 168-8511 Japan
Phone : +81 3 5370 5483
Facsimile : +81 3 5370 5492
Homepage : http://www.iti.iwatsu.co.jp

In addition, the customer can make CALIBRATION (calibration and adjustment) for this instrument with SYSTEM/TOOLS/CALIBRATION menu.
The performance of each function has the standard range and there may be deviation from the range because of temporal change. CALIBRATION is done in such a case.
Section 5.3 describes the calibration (adjustment) by CALIBRATION menu.

5.3 Calibration (adjustment) by CALIBRATION menu

5.3.1 Outline

For correct measurement, the good measurement accuracy of this instrument needs to be kept. This instrument can make reliable measurement by executing regular check and calibration. This section describes the calibration (adjustment) by CALIBRATION menu executed by the user.

After completion of calibration, it is recommended to clearly write the execution date and the next calibration time on the card or sticker for management.

5.3.2 Cautions before execution

Care should be taken for preparation and cautions below when the customer makes calibration (adjustment).

Note!

1) Calibration (adjustment) should be done when this instrument is properly installed.
2) Check that the power supply voltage of this instrument is within ±10% of the voltage indicated on the rear panel and the power supply frequency is 50Hz or 60Hz.
3) Calibration (adjustment) should be done in the environment of 23°C±5°C of temperature and 80%RH or less of humidity.
4) This instrument requires the warm-up operation of one hour or more after powering on. For other calibration equipments than this instrument, the warm-up operation of proper time (see instruction manual of them) should be done.
5) Before calibration (adjustment) of this instrument, connect the calibrator, test lead, and cables.
6) **Never do power off the instruments and remove the test lead and cable during calibration (adjustment).**

5.3.3 Equipments used for calibration (adjustment)

◆Measurement Equipments

Used Equipments	Specificaions (input/ output level, range)	Required accuracy	Equivalent manufacturer and model name
DC voltage (DCV) generator	±1100V	11ppm	FLUKE 5700A
DC current (DCA) generator	±0.1A	0.02%	FLUKE 5700A
	±10A	0.05%	FLUKE 5700A + FLUKE 5725A or 5220A
AC voltage (ACV) generator	5mVrms to 750Vrms		FLUKE 5700A + FLUKE 5725A or 5205A
	15Hz to 45Hz	0.1%	
	45Hz to 100Hz	0.02%	
	100Hz to 50kHz	0.02%	
	50kHz to 100kHz	0.05%	
	100kHz to 300kHz	0.2%	
AC current (ACA) generator	1A/1kHz	0.04%	FLUKE 5700A
	10A/1kHz	0.05%	FLUKE 5700A + FLUKE 5725A or 5220A
Standard resistance	100Ω	50ppm	FLUKE 5700A or FLUKE 5450A
	1.0kΩ	50ppm	
	10kΩ	50ppm	
	100kΩ	50ppm	
	1.0MΩ	50ppm	
	10MΩ	0.05%	
	100MΩ	0.1%	

Note: Measurement Equipments above can be substituted by those with equal or more performances.

◆Cables and others

Prepare cables and plugs below:

- Cable with banana terminal at each end (2 sets of red and black)
- BNC cable
- BNC female ⇔ double-banana plug

5.3.4 Preparation before calibration (adjustment)

For preparation before calibration (adjustment), see Section 5.3.4.1 to Section 5.3.4.3.
Section 5.3.4.2 describes the basic operation in CALIBRATION menu.

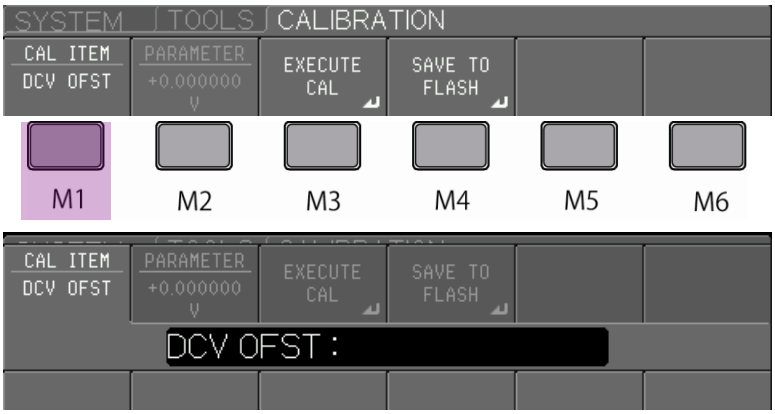
5.3.4.1 Warm up

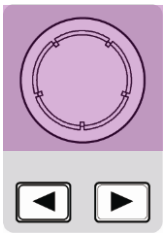
Before calibration (adjustment), warm-up operation of one hour or more is required.
After warm-up operation of one hour or more, if non-applying time just before adjustment is 3 minutes or less, warm-up operation of one minute or more is required.

5.3.4.2 Common operation of calibration (adjustment)

- To select the calibration (adjustment) item, press M1 key in CALIBRATION menu to select CAL ITEM and rotate the Rotary knob to specify the item. Press the Rotary knob to decide the selection.
  * If the rotary knob is turned even if the CAL ITEM menu is not open, the item can be selected.

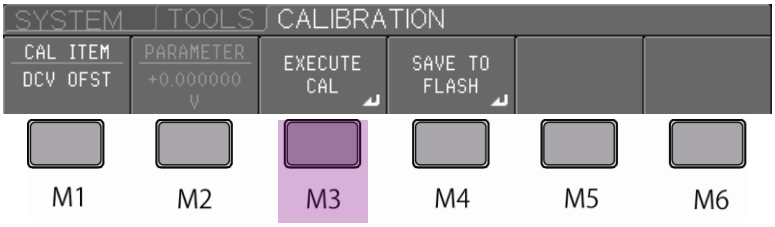
Ex.





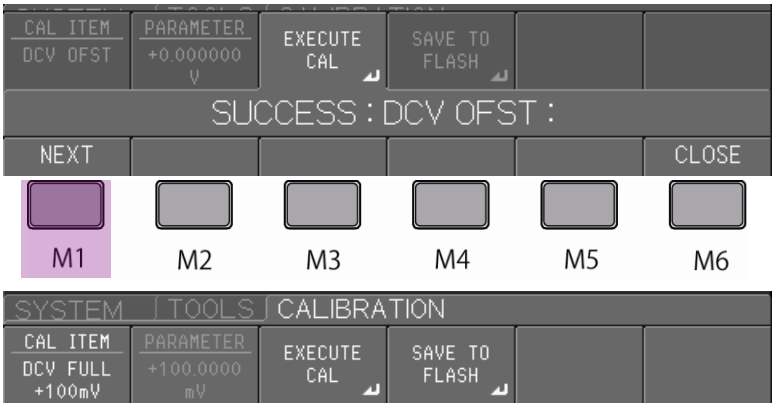
- To execute calibration (adjustment), press M3 key in CALIBRATION menu to execute EXECUTE CAL.

Ex.



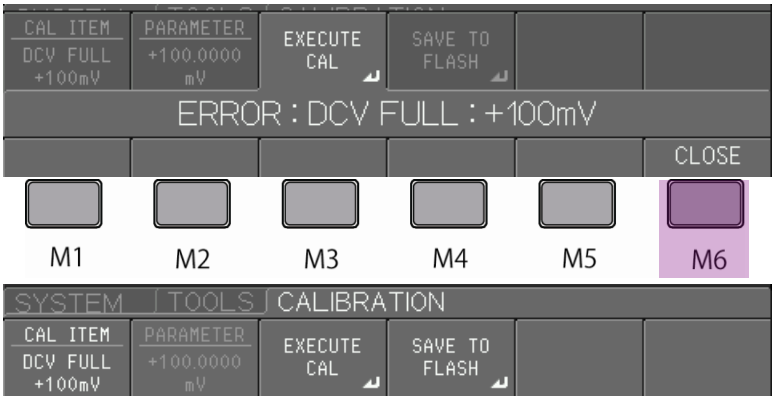
- If the calibration (adjustment) result is SUCCESS (succeeds), press M1 key to select NEXT to automatically move to the next adjustment item.

Ex.



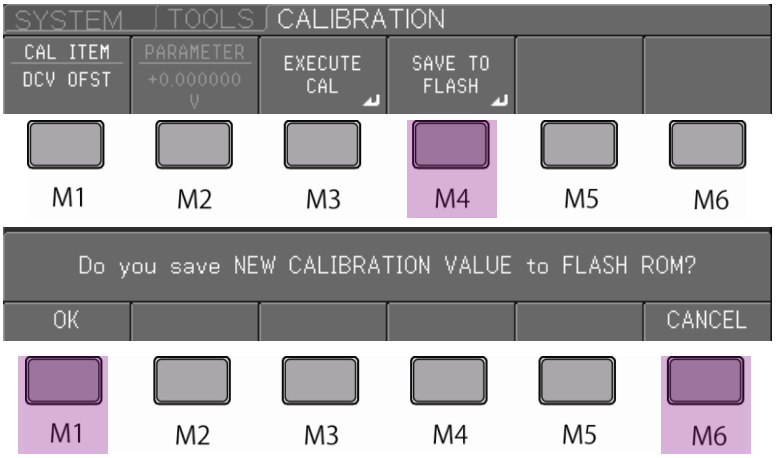
- If the calibration (adjustment) result is ERROR, press M6 key to select CLOSE to automatically return to the current adjustment item.

Ex.



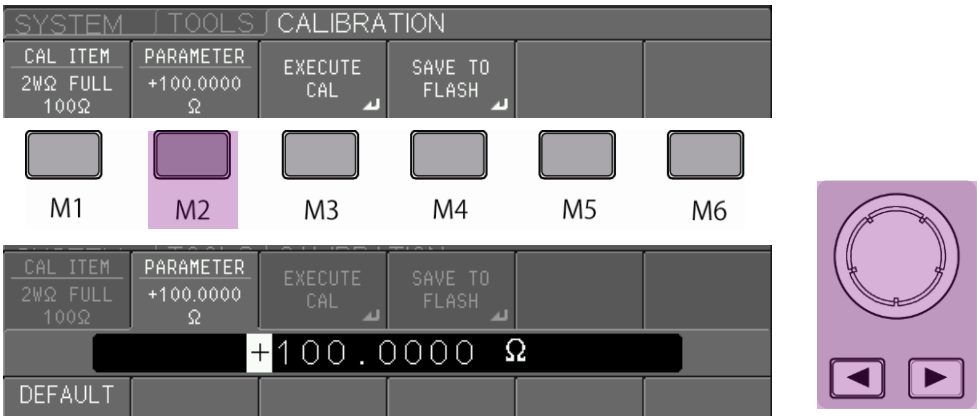
- To write the calibration (adjustment) value in the memory, press M4 key in CALIBRATION menu to select SAVE TO FLASH. If the confirmation screen appears, press M1 key to write it and select [OK]. If not writing, press M6 key to select CANCEL.

Ex.



- To return from the calibration (adjustment) mode to the normal measurement mode, press [CLOSE] key several times.
- To enter the numeric value in the calibration (adjustment) item of the resistance measurement (2WΩ or 4WΩ), press M2 key in CALIBRATION menu to select PARAMETER and use < and > to select the digit, and rotate the Rotary knob to change the numeric value. Press the Rotary knob to decide the numeric value.

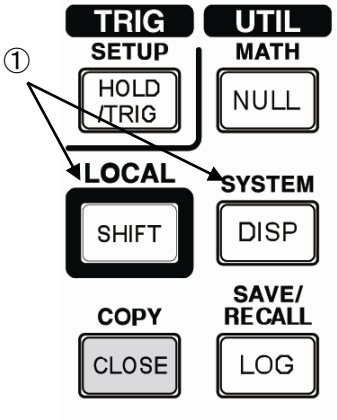
Ex.

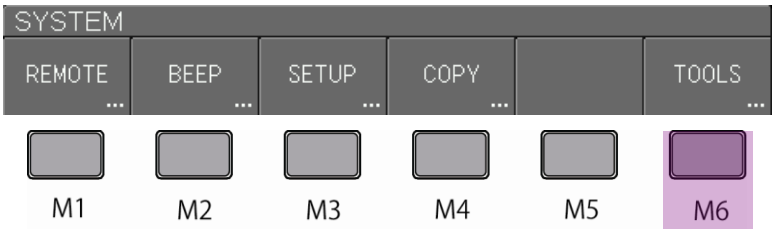


5.3.4.3 To enter CALIBRATION menu

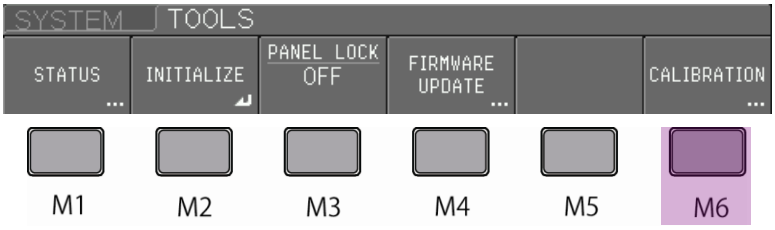
Operation procedure

① Press [SHIFT]→ [DISP(SYSTEM)] key on the right diagram to open SYSTEM menu below.

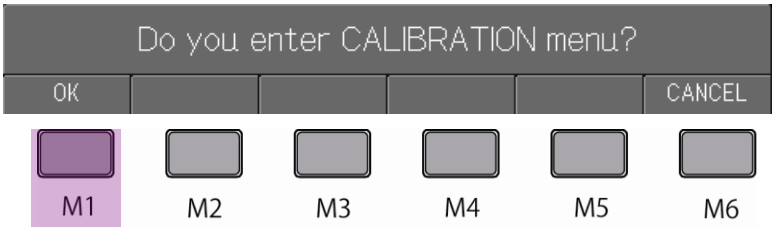




② Press M6 key in ① to open TOOLS menu below.



③ Press M6 key in ② to open CALIBRATION menu below.



If exiting from CALIBRATION menu for some reason, press M6 key in the diagram above to return to TOOLS menu in ②

④ To execute CALIBRATION, Press M1 key in ③. The menu below opens.

5.3.5 Execution of calibration (adjustment)

This section describes the calibration using the example of FLUKE 5700A＋FLUKE 5725A.
Section 5.3.5.1 to Section 5.3.5.7 describes execution of calibration (adjustment) of each function.

- If all calibration (adjustment) items are executed, execute it in the order of Section 5.3.5.1 to Section 5.3.5.7.
- If a part of calibration (adjustment) items is executed, only the corresponding item in Section 5.3.5.1 to Section 5.3.5.7 is executed.
- After completion of the calibration, write the data in the memory referring to Section 5.3.4.2 ”Writing calibration (adjustment) value in memory.”

5.3.5.1 DC voltage measurement (DCV)

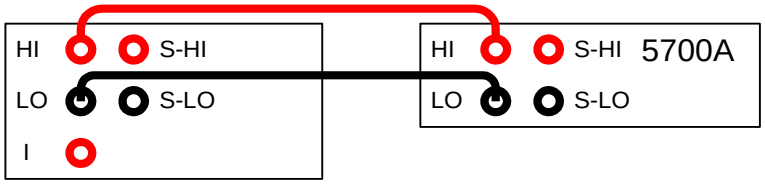
It executes the calibration of DC voltage measurement (DCV).

5.3.5.1.1 DCV offset calibration (adjustment)

It executes the offset calibration (adjustment) for all ranges of DCV circuit.

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V･Ω･⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
DCV OFST	0V	

◆Calibration (adjustment) procedure

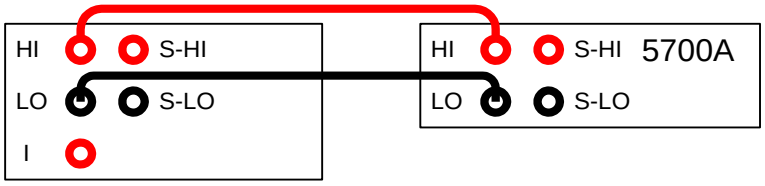
① Set the output of the voltage generator (Ex. 5700A) to 0V.
② Select DCV OFST in CALIBRATION menu of this instrument and execute EXECUTE CAL.
＊ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.
③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.1.2 DCV gain calibration (adjustment)

It executes the calibration (adjustment) of the gain for all ranges of the DCV circuit.

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V·Ω·⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
DCV FULL: +100mV	+100mV	
DCV FULL: −100mV	−100mV	
DCV FULL: +1.00V	+1.00V	
DCV FULL: −1.00V	−1.00V	
DCV FULL: +10.0V	+10.0V	
DCV FULL: −10.0V	−10.0V	
DCV FULL: +100V	+100V	
DCV FULL: −100V	−100V	
DCV FULL: +1000V	+1000V	
DCV FULL: −1000V	−1000V	

◆Calibration (adjustment) procedure

① Set the output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

∗ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.2 AC voltage measurement (ACV)

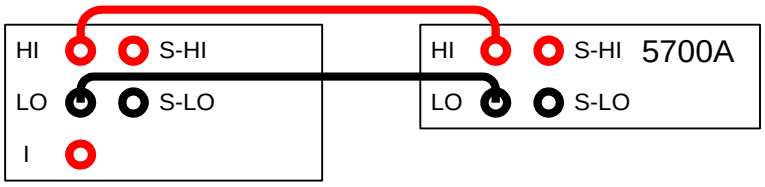
It executes calibration (adjustment) of the AC voltage measurement (ACV).

5.3.5.2.1 ACV range calibration (adjustment)

It executes calibration (adjustment) for all ranges.

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V·Ω·⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
ACV 5%: 100mV	5mV 1kHz	
ACV FULL: 100mV	100mV 1kHz	
ACV 5%: 1.00V	50mV 1kHz	
ACV FULL: 1.00V	1V 1kHz	
ACV 5%: 10.0V	500mV 1kHz	
ACV FULL: 10.0V	10V 1kHz	
ACV 5%: 100V	5V 1kHz	
ACV FULL: 100V	100V 1kHz	
ACV 5%: 750V	37.5V 1kHz	
ACV FULL: 750V	750V 1kHz	

◆Calibration (adjustment) procedure

① Set the frequency and output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

∗ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

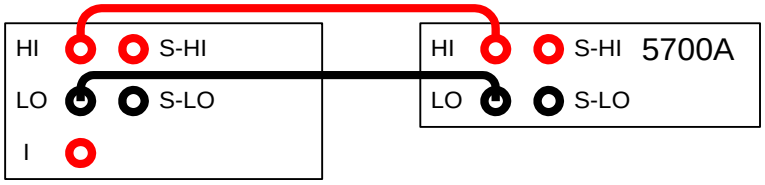
③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.2.2 Calibration (adjustment) of ACV frequency characteristics

It executes calibration (adjustment) of the frequency characteristics.

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V·Ω·⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
ACV 100kHz: 100mV	100mV 100kHz	
ACV 100kHz: 1.00V	1.00V 100kHz	
ACV 100kHz: 10.0V	10.0V 100kHz	
ACV 100kHz: 100V	100V 100kHz	
ACV 100kHz: 750V	750V 100kHz	

◆Calibration (adjustment) procedure

① Set the frequency and output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

∗ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

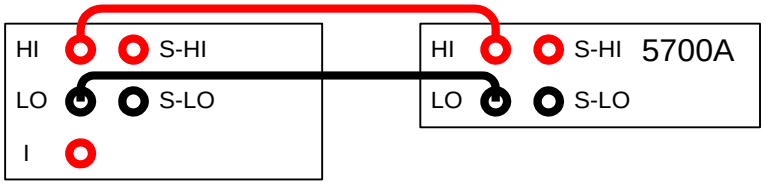
③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.3 Calibration (adjustment) of frequency measurement (FREQ)

It executes calibration (adjustment) of the frequency measurement (FREQ).

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V·Ω·⊣◀ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibratoin (adjustment) item

CAL ITEM	Input	Remark
FREQ 1kHz: 10.00V	10.00V 1kHz	

◆Calibration (adjustment) procedure

① Set the frequency and output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

＊ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.4 Calibration (adjustment) of 2-wire resistance measurement (2WΩ)

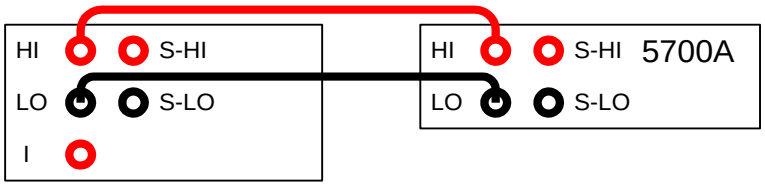
It executes calibration (adjustment) of 2-wire resistance measurement (2WΩ).

5.3.5.4.1 Calibration (adjustment) of offset of 2WΩ

It executes calibration (adjustment) of offset for all ranges.

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V·Ω·⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibratoin (adjustment) item

CAL ITEM	Input	Remark
2WΩ OFST: 100Ω	0Ω	2 wire Comp: ON (internal resistance is canceled)
2WΩ OFST: 1kΩ	0Ω	2 wire Comp: ON (internal resistance is canceled)
2WΩ OFST: 10kΩ	0Ω	2 wire Comp: ON (internal resistance is canceled)
2WΩ OFST: 100kΩ	0Ω	2 wire Comp: OFF
2WΩ OFST: 1MΩ	0Ω	2 wire Comp: OFF
2WΩ OFST: 10MΩ	0Ω	2 wire Comp: OFF

Note: Setting of 2 wire Comp: ON, 2 wire Comp: OFF in the remarks of the table above is setting contents of 5700A.
If the other calibration equipment is used, setting should be made so that the resistance in the instrument is canceled.

◆Calibration (adjustment) procedure

① Set the output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

∗ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

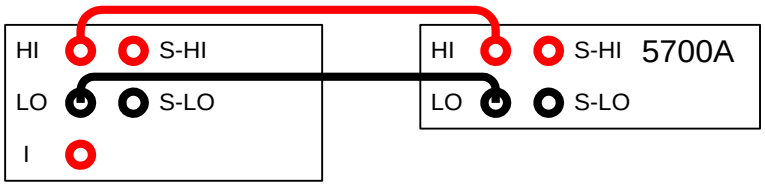
③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.4.2 Calibration (adjustment) of gain of 2WΩ

It executes calibration (adjustment) for gain for all ranges.

◆Connection method

As shown in the diagram below, connect HI terminal and LO terminal of INPUT V·Ω·⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
2WΩ FULL: 100Ω	100Ω	2 wire Comp: ON
2WΩ FULL: 1kΩ	1kΩ	2 wire Comp: ON
2WΩ FULL: 10kΩ	10kΩ	2 wire Comp: ON
2WΩ FULL: 100kΩ	100kΩ	2 wire Comp: OFF
2WΩ FULL: 1MΩ	1MΩ	2 wire Comp: OFF
2WΩ FULL: 10MΩ	10MΩ	2 wire Comp: OFF
2WΩ : 100MΩ	10MΩ	2 wire Comp: OFF

Note: Setting of 2 wire Comp: ON、2 wire Comp: OFF in the remarks of the table above is setting contents of 5700A.
If the other calibration equipment is used, the range with 2 wire Comp: ON in the remarks should be set so that the resistance in the instrument is cancelled.

◆Calibration (adjustment) procedure

① Set the output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Selection is made in CALIBRATION/PARAMETER menu of this instrument in accordance with the calibration (adjustment) item table above and the resistance value in the input column above is set in PARAMETER menu.

③ Use CALIBRATION menu of this instrument to execute EXECUTE CAL.

＊ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

④ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.5 Calibration (adjustment) of 4-wire resistance measurement (4WΩ)

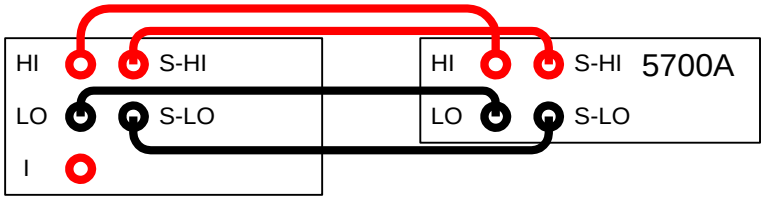
It executes calibration (adjustment) of 4-wire resistance measurement (4WΩ).

5.3.5.5.1 Calibration (adjustment) of offset of 4WΩ

It executes calibration (adjustment) of offset for all ranges.

◆Connection method

- As shown in the diagram below, connect HI terminal and LO terminal of INPUT V･Ω･⇥ on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).
- As shown below, connect HI terminal and LO terminal of SENSE 4WΩ of this instrument to S-HI terminal (HI terminal of SENSE) and S-LO terminal (LO terminal of SENSE) of the voltage generator (Ex. 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
4WΩ OFST: 100Ω	0Ω	2 wire Comp: OFF、EX SNS : ON
4WΩ OFST: 1kΩ	0Ω	2 wire Comp: OFF、EX SNS : ON
4WΩ OFST: 10kΩ	0Ω	2 wire Comp: OFF、EX SNS : ON
4WΩ OFST: 100kΩ	0Ω	2 wire Comp: OFF、EX SNS : ON
4WΩ OFST: 1MΩ	0Ω	2 wire Comp: OFF、EX SNS : ON
4WΩ OFST: 10MΩ	0Ω	2 wire Comp: OFF、EX SNS : ON

Note: Settings of 2 wire Comp: ON, 2 wire Comp: OFF, EX SNS: ON, and EX SNS: OFF in the remarks of the table above is the setting contents of 5700A. If the other calibration equipment is used, the range with 2 wire Comp: ON, EX SNS: ON in the remarks should be set so that the resistance in the instrument is canceled.

◆Calibration (adjustment) procedure

① Set the output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

∗ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

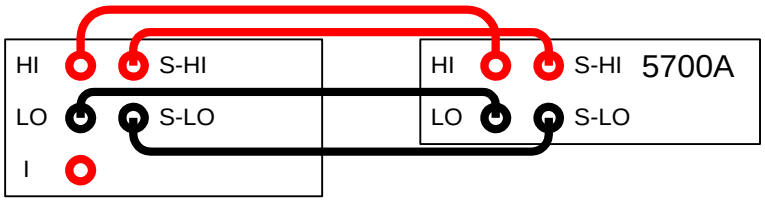
③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.5.2 Calibration (adjustment) of gain of 4WΩ

It executes calibration (adjustment) for gain of all ranges.

◆Connection method

- As shown in the diagram below, connect HI terminal and LO terminal of INPUT V･Ω･⇥| on this instrument to HI terminal and LO terminal of the voltage generator (example below: 5700A).
- As shown below, connect HI terminal and LO terminal of SENSE 4WΩ of this instrument to S-HI terminal (HI terminal of SENSE) and S-LO terminal (LO terminal of SENSE) of the voltage generator (Ex. 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
4WΩ FULL: 100Ω	100Ω	2 wire Comp: OFF、EX SNS : ON
4WΩ FULL: 1kΩ	1kΩ	2 wire Comp: OFF、EX SNS : ON
4WΩ FULL: 10kΩ	10kΩ	2 wire Comp: OFF、EX SNS : ON
4WΩ FULL: 100kΩ	100kΩ	2 wire Comp: OFF、EX SNS : ON
4WΩ FULL: 1MΩ	1MΩ	2 wire Comp: OFF、EX SNS : ON
4WΩ FULL: 10MΩ	10MΩ	2 wire Comp: OFF、EX SNS : ON

Note: Settings of 2 wire Comp: ON, 2 wire Comp: OFF, EX SNS: ON, and EX SNS: OFF in the remarks of the table above is the setting contents of 5700A. If the other calibration equipment is used, the range with 2 wire Comp: ON, EX SNS: ON in the remarks should be set so that the resistance in the equipment is canceled.

◆Calibration (adjustment) procedure

① Set the output of the voltage generator (Ex. 5700A) in accordance with the calibration (adjustment) item table above.

② Selection is made in CALIBRATION/PARAMETER menu of this instrument in accordance with the calibration (adjustment) item table above and the resistance value in the input column above is set in PARAMETER menu.

③ Use CALIBRATION menu of this instrument to execute EXECUTE CAL.

＊Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

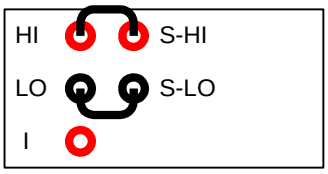
④ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.5.3 Calibration (adjustment) of 100MΩ rang of 4WΩ

It executes calibration (adjustment) for 100MΩ range.

◆Connection method

- As shown in the diagram below, connect HI terminal and HI terminal of SENSE 4WΩ, and LO terminal of INPUT V・Ω・⊣⊢ and LO terminal of SENSE 4WΩ.



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
4WΩ: 100MΩ	None	Calibration device not used

Note: None is entered in the input column since no calibration equipment is used.

◆Calibration (adjustment) procedure

① Make connection as shown above(without calibration equipment).

② Use CALIBRATION menu of this instrument to execute EXECUTE CAL.

＊Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.6 DC current measurement (DCI)

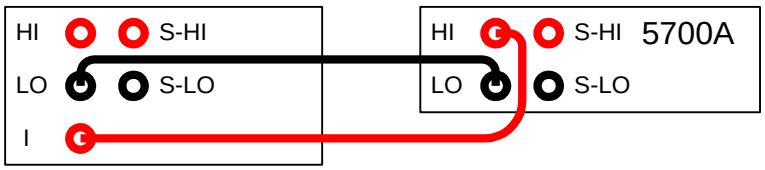
It executes calibration (adjustment) of DC current measurement (DCI).

5.3.5.6.1 Calibration (adjustment) of DCI offset

It executes calibration (adjustment) of offset for DCI circuit.

◆Connection method

- As shown in the diagram below, connect LO terminal of INPUT I on this instrument to LO terminal of the voltage generator.
- As shown in the diagram below, connect HI terminal of INPUT I on this instrument to HI terminal of the voltage generator (example: 5700A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
DCI OFST:	0A	

◆Calibration (adjustment) procedure

① Set the output of the current generator (Ex. 5700A) to 0A.

② Select DCI OFST: in CALIBRATION menu of this instrument to execute EXECUTE CAL.

＊ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

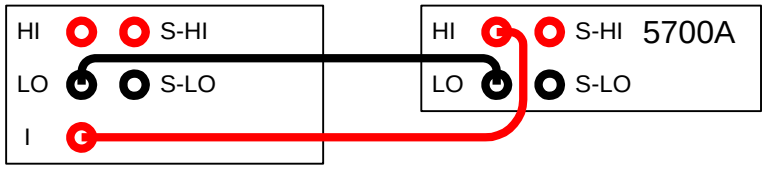
5.3.5.6.2 Calibration (adjustment) of DCI gain

It executes calibration (adjustment) of gain for DCI circuit.

◆Connection method

<Connection for calibration (adjustment) of 1A or less>

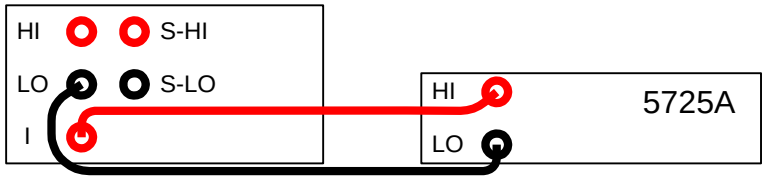
- As shown in the diagram below, connect LO terminal of INPUT I on this instrument to LO terminal of the voltage generator (example: 5700A).
- As shown in the diagram below, connect HI terminal of INPUT I on this instrument to HI terminal of the voltage generator (example: 5700A).



VOAC7602 or VOAC7502

<Connection for calibration (adjustment) of 3A>

- As shown in the diagram below, connect LO terminal of INPUT I on this instrument to LO terminal of the voltage generator (example below: 5725A).
- As shown in the diagram below, connect HI terminal of INPUT I on this instrument to HI terminal of the voltage generator (example below: 5725A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
DCI FULL: +1.00mA	1mA	Connected to 5700A
DCI FULL: −1.00mA	−1mA	Connected to 5700A
DCI FULL: +10.0mA	10mA	Connected to 5700A
DCI FULL: −10.0mA	−10mA	Connected to 5700A
DCI FULL: +100mA	100mA	Connected to 5700A
DCI FULL: −100mA	−100mA	Connected to 5700A
DCI FULL: +1.00A	1A	Connected to 5700A
DCI FULL: −1.00A	−1A	Connected to 5700A
DCI FULL: +3.00A	3A	Connected to 5725A
DCI FULL: −3.00A	−3A	Connected to 5725A

◆Calibration (adjustment) procedure

① Set the output of the voltage generator (Ex. 5700A or 5725A) in accordance with the calibration (adjustment) item table above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

＊ Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.3.5.7 AC current measurement (ACI)

It executes calibration (adjustment) of AC current measurement (ACI).

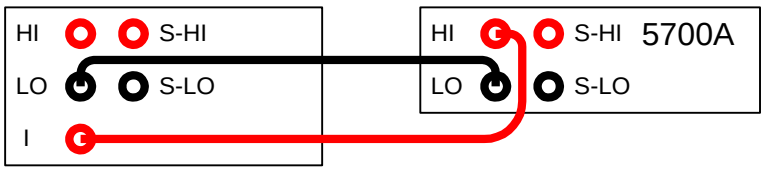
5.3.5.7.1 Calibration (adjustment) of ACI range

It executes calibration (adjustment) for range of ACI circuit.

◆Connection method

<Connection for calibration (adjustment) of 1A or less>

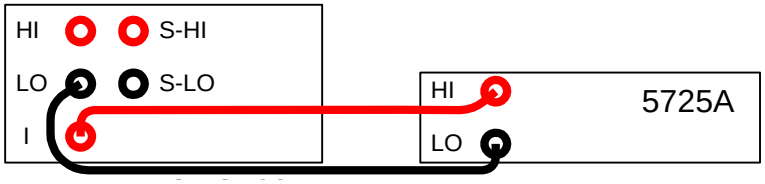
- As shown in the diagram below, connect LO terminal of INPUT I on this instrument to LO terminal of the voltage generator (example below: 5700A).
- As shown in the diagram below, connect HI terminal of INPUT I on this instrument to HI terminal of the voltage generator (example below: 5700A).



VOAC7602 or VOAC7502

<Connection for calibration (adjustment) of 3A>

- As shown in the diagram below, connect LO terminal of INPUT I on this instrument to LO terminal of the voltage generator (example below: 5725A).
- As shown in the diagram below, connect HI terminal of INPUT I on this instrument to HI terminal of the voltage generator (example below: 5725A).



VOAC7602 or VOAC7502

◆Calibration (adjustment) item

CAL ITEM	Input	Remark
ACI 5%: 1.00A	50mA 1kHz	Connected to 5700A
ACI FULL: 1.00A	1A 1kHz	Connected to 5700A
ACI 5%: 3.00A	150mA 1kHz	Connected to 5725A
ACI FULL: 3.00A	3.00A 1kHz	Connected to 5725A

◆Calibration (adjustment) procedure

① Set the output of the current generator (Ex. 5700A or 5725A) to the current value and frequency in the input column of calibration items above.

② Use the CALIBRATION menu of this instrument for selection in accordance with the calibration (adjustment) item table above and execute EXECUTE CAL.

∗Calibration (adjustment) requires several minutes until SUCCESS or ERROR message is displayed.

③ Select NEXT menu to switch the menu, and execute the next item EXECUTE CAL or SAVE TO FLASH.

5.4 Fuse replacement

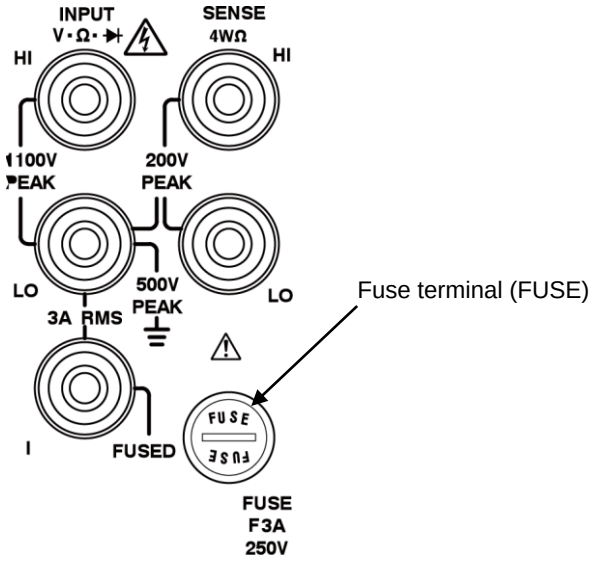
In current measurement, the fuse may be blown because of overcurrent. In such a case, replace the fuse.

Warning

- Since the electric shock may occur, be sure to power off this instrument, remove the power supply cord from the outlet, and remove all cables (e.g. test lead).
  Since this instrument may be damaged, use the attached or specified 2 fuses for replacement. If there is no fuse, Contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors.
- Specified fuse 3A/250V

Operation procedure

① As shown below, press the fuse terminal (FUSE) with the minus driver (-) and rotate it counterclockwise. The fuse holder appears. Remove the fuse with the holder.



② Replace with the specified fuse.

③ Press the fuse holder with new fuse.

④ Press it with the minus driver and rotate it clockwise to lock it.

5.5 Repair and sending of repaired instrument

If a failure occurs, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors for repair If an unexpected failure occurs because of our responsibility in the guarantee instrument, the instrument should be repaired with no charge.

When sending the instrument to be repaired, please write clearly the instrument name, model number, description of the failure, name, division, and telephone number of the responsible person.

To avoid the accident during transportation, use the corrugated carton used for delivery or equivalent. If there is no proper packing box, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors below.

■ Contacts

Address : 7-41 Kugayama 1-chome Suginami-ku Tokyo, 168-8511 Japan
Phone : +81 3 5370 5483
Facsimile : +81 3 5370 5492
Homepage : http://www.iti.iwatsu.co.jp

5.6 Storage and transportation

Do not keep the instrument in locations below.

- Direct sunlight
- Too much dust
- Corrosive gas generated

The following is the condition to keep this instrument.

- Storage temperature: −20 °C to +60 °C
- Storage humidity: 70 %RH or less (no dew condensation)

If transporting this instrument, use the packing material used for delivery or equivalent.

12345 6 7

Chapter 6 Specifications

Section 6.1 and section 6.4 to section 6.15 publishes a common performance of VOAC7602/VOAC7502. The specifications of the basic measuring function of VOAC7602 are published in section 6.2. And, the specifications of the basic measuring function of VOAC7502 are published in section 6.3.

6.1 Common Specifications

Operation system ΔΣADC system

Measuring mode

Trigger setting mode AUTO/SINGLE (switching)

Range Auto range (AUTO RANGE)/Manual range
Selection by (MANUAL RANGE)

AUTO range It exceeds "1199999" ("119999" for VOAC7502) and improves the range.
It downs the range by less than "100000" ("100000" for VOAC7502)

Screen LCD

Size 4.3 inch

Number of dot 480 dots × 272 dots

Color 16bit, 65,536 colors

Drive system TFT active matrix

Back light LED

Measuring cycle ∗Figures in parenthesis below is at 60Hz of power frequency.

<VOAC7602>

DCV, 6 and 1/2 digits 2.5S/s to 50(60)S/s

5 and 1/2 digits 100 S/s to 30 kS/s

ACV, 6 and 1/2 digits MID 2.5 S/s

6 and 1/2 digits HIGH 50(60) S/s

<VOAC7502>

DCV, 5 and 1/2 digits 2.5S/s to 50(60)S/s

4 and 1/2 digits 100 S/s to 30 kS/s

ACV, 5 and 1/2 digits MID 2.5 S/s

4 and 1/2 digits HIGH 50(60) S/s

Sampling rate

Table description thereafter depends on following condition and definition.

Response time : Time that enters into accuracy within each range

DC system (DCV, DCI, 2WΩ, 4WΩ)

Power frequency : 50Hz		Power frequency : 60Hz		Display digit	Remarks
Sampling rate *1 (S/s) Screen display	PLC converted value *2	Sampling rate *1 (S/s) Screen display	PLC converted value *2		
2.5 (1)	20	2.5 (1)	24	For VOAC7602 6 and 1/2 digits, for VOAC7502 5 and 1/2 digits	Figures in ( ) is AUTOZERO ON or at 4WΩ
10 (4)	5	10 (4)	6		
50 (20)	1	60 (20)	1		
100	0.5	100	0.6	For VOAC7602 5 and 1/2 digits, for VOAC7502 4 and 1/2 digits	This setting doesn't exist at 4WΩ.
500	0.1	500	0.12		
1 k	0.05	1 k	0.06		
2 k	25 m	2 k	0.03		
7.5 k	6.67 m	7.5 k	8 m		
15 k	3.33 m	15 k	4 m		
30 k	1.67 m	30 k	2 m		

∗1. The sampling rate is guaranteed only when the mode of the Log function is at the incorporation in the BULK mode.

∗2. PLC converted value: Value corresponding to Sampling cycle/power cycle value

AC system (ACV, ACI)

AC filter	Sampling rate		Display digit	Response time *1
	Power freq.:50Hz	Power freq.:60Hz		
MID	2.5 S/s (20PLC)	2.5 S/s (24PLC)	For VOAC7602 6 and 1/2 digits, for VOAC7502 5 and 1/2 digits	Within 3 sec.
HIGH	2.5 S/s (20PLC)	2.5 S/s (24PLC)		Within 2 sec.
	10 S/s (5PLC)	10 S/s (6PLC)		
	50 S/s (1PLC)	60 S/s (1PLC)		

*1: In 0⇒FS (full-scale) in the same range, the time to the start of ±100 final value counts or less.

Additional error margin ±(% of range) of each PLC

VOAC7602

PLC 50Hz / 60Hz	DCV 0.1V RES 100Ω DCI 1A	DCV 1V,100V RES 1kΩ,10kΩ	DCV 10V,1000V
0.00167 / 0.002	0.1	0.01	0.006
0.00333 / 0.004	0.06	0.006	0.003
0.00667 / 0.008	0.06	0.006	0.0012
0.025 / 0.03	0.03	0.003	0.0006
0.05 / 0.06	0.02	0.002	0.0003
0.1 / 0.12	0.02	0.002	0.0002
0.5 / 0.6	0.001	0.001	0
1 / 1	0.001	0.001	0
5 / 6	0.0005	0	0
20 / 24	0	0	0

VOAC7502

PLC 50Hz / 60Hz	DCV 0.1V RES 100Ω DCI 1A	DCV 1V,100V RES 1kΩ,10kΩ	DCV 10V,1000V
0.00167 / 0.002	0.1	0.01	0.003
0.00333 / 0.004	0.08	0.008	0.003
0.00667 / 0.008	0.08	0.008	0.002
0.025 / 0.03	0.04	0.004	0.001
0.05 / 0.06	0.03	0.003	0.001
0.1 / 0.12	0.02	0.002	0.001
0.5 / 0.6	0.02	0.001	0
1 / 1	0.001	0	0
5 / 6	0.001	0	0
20 / 24	0	0	0

Remote Interface

USB2.0	Standard equipment
LAN&RS-232	SC-361 (Factory option)
GP-IB	SC-363 (Factory option)
DIO	SC-362 (Factory option)
Remote Command	SCPI basis command or our VOAC752XH/VOAC752XH series compatible command

USB memory connection entrance (only for VOAC7602)

Standard	USB2.0
Correspondence USB memory	USB memory formatted with FAT or FAT32 However, it is non-correspondence to the memory with the security functions of the virus check and the fingerprint authentication, etc.

Back input/output (BNC and DIO)

Trigger input (BNC)

Signal level	H: 2.4 Vmin, L: 0.9 Vmax
Maximum input resisting voltage	0 to 5 V
Input impedance	About 10 kΩ
Polarity	Both edges are selectable
Pulse width	1 μs or more
Default delay	Less than 1 μs

COMPLETE output (BNC)

Signal level	H: 2.4 Vmin, L: 0.4 Vmax
Output impedance	About 10 kΩ
Polarity	Positive logic
Output pulse width	
At OFF of LIMIT judge	10 μs
At ON of LIMIT judge	4.0 ms or more

INHIBIT input (DIO option)

Signal level	H: 2.4 Vmin, L: 0.9 Vmax
Maximum input resisting voltage	0 to 5 V
Polarity	POSITIVE (positive logic operation) / NEGATIVE (negative logic operation)
Input impedance	About 10kΩ

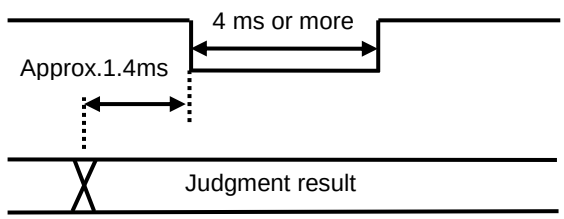
LIMIT judge output (DIO option)

COMPLETE, GO, HI, LO

1) Outputs only at LIMIT judge ON and DIO output ON.
2) This outputs contact signal by PHOTO MOS FET and BNC is outputted with timing delayed from output.

Withstand voltage	42 Vpeak
between terminals	±42 Vpeak
Max.allowable current	100 mA

Signal timing



Warm-up time	1 hour after power up
Installation	Only indoor use
Calculation guaranteed temp./ humid.	0°C to 50°C (40℃ and no dew allowed below the moisture amount of 80%RH.)
Storage temp./humid.	−20°C to +60 °C (40℃ and no dew allowed below the moisture amount of 90%RH.)
Power supply	AC100 V/110 V/220 V/240 V±10%, 50 Hz /60 Hz Option other than AC100 V (factory option)
Power consumption	
VOAC7602	21 VA or less (option included)
VOAC7502	14 VA or less (option included)
Withstand voltage	DC±500 V (between LO terminal and ground earth)
Installation (over voltage) category	Category II (local level, electric product and portable product)
Polution level	2 ∗Do not use it at environment which exists pollutant of electroconductive.
Dimension	225W×100H×366D mm (protuberance such as leg, handle and knob excluded)
Weight	Approx. 3.0kg (protector and option included)
Expected life	
LCD	50% reduction of LED back light brightness around 70,000 hours
Relay	Approx. 10 million times (at normal use condition without overload) Approx. 100, 000 times (at max. overload of 1,000 V applied voltage)
Data backup battery	5 years Note) These attach to the articles of consumption, and the exchange becomes a repair for a fee treatment.

6.2 Specifications of Basic Measuring Function (VOAC7602)

The Specifications after Chapter 6.2 depends on the following condition and definition.
Temp./humid. : 23 ± 5 °C, 80 %RH or less 1 year accuracy: ± (% reading value +% range)
Response time : Time that enters into accuracy within each range

6.2.1 Direct current voltage measurement (DCV)

6.2.1.1 Accuracy and resolution

Unit: ± (% of reading + % of range)

Range	Full scale at 6 and 1/2 digits	Resolution	Accuracy ± (% of reading + % of range)	Temperature coefficient ±(% of reading + % of range)/°C	Input impedance
100mV	119.9999	0.1μV	0.0050 + 0.0035	0.0005 + 0.0005	1GΩ or more or 10MΩ±1%
1V	1.199999	1μV	0.0040 + 0.0007	0.0005 + 0.0001	
10V	11.99999	10μV	0.0035 + 0.0005		
100V	119.9999	0.1mV	0.0045 + 0.0006		10MΩ±1%
1000V	1100.000	1mV	0.0045 + 0.0010		

- Sampling time : 1 S/s
- Maximum allowable voltage
  100 mV to 100 V range : ±800 Vpeak (continuous), ±1100 Vpeak (for 1 minute)
  1000 V range : ±1100 Vpeak (continuous)
- Response time : Within 1 second

6.2.1.2 Noise removal

PLC	NMRR 50Hz/60Hz±0.1%	CMRR 50Hz/60Hz*±0.1% Unbalance resistance1 kΩ
Multiple of 1PLC	55dB	120dB
Other than above	0dB	–

∗50Hz/60Hz: Power frequency

6.2.2 Alternating current voltage (ACV)

6.2.2.1 Resolution and measuring range

True effective value detecting crest factor :<5

Range	Full scale	Resolution	Measuring range		Input impedance
			MID	HIGH	
100mV	119.9999	0.1μV	20Hz to 300kHz	200Hz to 300kHz	Approx. 1MΩ// 100pF or less
1V	1.199999	1μV			
10V	11.99999	10μV			
100V	119.9999	0.1mV			
750V	750.000	1mV	20Hz to 100kHz	200Hz to 100kHz	

6.2.2.2 Accuracy

It specifies at 5% to 100% of each range.

Unit : ± (% of reading + % of range)

Range	Frequency	Accuracy	Temp. coefficient
100.0000mV	20Hz to 45Hz	0.70 + 0.04	0.070 + 0.004
	45Hz to 100Hz	0.20 + 0.04	0.020 + 0.004
	100Hz to 20kHz	0.06 + 0.04	0.005 + 0.004
	20kHz to 50kHz	0.12 + 0.05	0.011 + 0.005
	50kHz to 100kHz	0.60 + 0.08	0.060 + 0.008
	100kHz to 300kHz	4.00 + 0.50	0.200 + 0.020
1.000000V to 750.000V	20Hz to 45Hz	0.70 + 0.03	0.070 + 0.003
	45Hz to 100Hz	0.20 + 0.03	0.020 + 0.003
	100Hz to 20kHz	0.06 + 0.03	0.005 + 0.003
	20kHz to 50kHz	0.11 + 0.05	0.011 + 0.005
	50kHz to 100kHz	0.60 + 0.08	0.060 + 0.008
	100kHz to 300kHz	4.0 + 0.50	0.200 + 0.020

- It is accuracy at sine wave.
- Maximum allowable voltage 750 Vrms or 1100 Vpeak and DC content are ±500 V or less.
- It is limited to 100 kHz or 8×10^7 V*Hz at 750V range.
- Crest factor (CF) guarantees either 5 or smaller of maximum input voltage.

6.2.2.3 Additional tolerance by AC filter setting

Unit: ± (% of reading)

AC filter	20Hz to 40Hz	40Hz to 100Hz	100Hz to 200Hz	200Hz to 1kHz	Over 1kHz
MID	0.22	0.06	0.01	0	0
HIGH		0.73	0.22	0.18	0

6.2.2.4 Additional tolerance by crest factor

Unit: ± (% of range)

Crest factor	Additional tolerance of Crest Factor	Additional tolerance of bandwidth
1-2	0.1	0.00015 × f
2-3	0.3	0.00024 × f
3-4	0.5	0.00060 × f
4-5	1.2	0.00150 × f

- f is basic frequency [Hz] of input signal.

6.2.3 Direct current measurement (DCI)

6.2.3.1 Accuracy and resolution

Unit: ± (% of reading + % of range)

Range	Full scale at 6 and 1/2 digits	Resolution	Accuracy	Temp. coefficient	Shunt resistance
1mA	1.199999	1nA	0.050 + 0.060	0.0020 + 0.0050	90Ω
10mA	11.99999	10nA	0.050 + 0.020	0.0020 + 0.0020	5Ω
100mA	119.9999	100nA	0.050 + 0.005	0.0020 + 0.0005	5Ω
1A	1.199999	1μA	0.100 + 0.010	0.0050 + 0.0010	0.1Ω
3A	3.00000	10μA	0.120 + 0.020	0.0050 + 0.0020	0.1Ω

- Resolution applies to the status 6 and 1/2.
- Maximum allowable current
  Full range: 3 ADC or 3 Arms (continuous, protection by 3 A fuse)

6.2.4 Alternating current measurement (ACI)

6.2.4.1 Resolution and measuring range

True effective value detecting crest factor: <5

Range	Full scale	Resolution	Measuring range		Shunt resistance
			MID	HIGH	
1A	1.199999	1μA	20Hz to 5kHz	200Hz to 5kHz	0.1Ω
3A	3.00000	10μA			

6.2.4.2 Accuracy

It specifies by 5 % to 100 % of each range.

Unit: ±(% of reading + % of range)

Range	Frequency	Accuracy	Temp. coefficient
1A	20Hz to 45Hz	0.70 + 0.04	0.100 + 0.006
	45Hz to 100Hz	0.30 + 0.04	0.035 + 0.006
	100Hz to 5kHz	0.10 + 0.04	0.015 + 0.006
3A	20Hz to 45Hz	0.70 + 0.06	0.100 + 0.006
	45Hz to 100Hz	0.35 + 0.06	0.035 + 0.006
	100Hz to 5kHz	0.15 + 0.06	0.015 + 0.006

- It is accuracy at sine wave.
- Maximum allowable current
  Full range: 3 Arms (continuous, protection by 3A fuse)

6.2.4.3 Additional tolerance by AC filter

Unit: ± (% of reading)

AC filter	20Hz to 40Hz	40Hz to 100Hz	100Hz to 200Hz	200Hz to 1kHz	Over 1kHz
MID	0.22	0.06	0.01	0	0
HIGH		0.73	0.22	0.18	0

6.2.4.4 Additional tolerance by crest factor

Unit: ± (% of range)

Crest factor	Additional tolerance of Crest Factor	Additional tolerance of bandwidth
1-2	0.1	0.00015 × f
2-3	0.3	0.00024 × f
3-4	0.5	0.00060 × f
4-5	1.2	0.00150 × f

• f is basic frequency [Hz] of input signal.

6.2.5 2 terminal resistance measurement (2WΩ)/4 terminal resistance measurement (4WΩ)

6.2.5.1 Resolution, accuracy and measuring current

Unit: ±(% of reading＋ % of range)

Range	Full scale	Resolution	Accuracy	Temp. coefficient	Measuring current
100Ω	119.9999	0.1mΩ	0.010 + 0.004	0.0006 + 0.0005	Approx. 1mA
1kΩ	1.199999	1mΩ	0.010 + 0.001	0.0006 + 0.0001	Approx. 1mA
10kΩ	11.99999	10mΩ	0.010 + 0.001	0.0006 + 0.0001	Approx. 100μA
100kΩ	119.9999	0.1Ω	0.010 + 0.001	0.0006 + 0.0001	Approx. 10μA
1MΩ	1.199999	1Ω	0.010 + 0.001	0.0010 + 0.0002	Approx. 5μA
10MΩ	11.99999	10Ω	0.040 + 0.001	0.0030 + 0.0004	Approx. 500nA
100MΩ	119.9999	100Ω	0.800 + 0.010	0.1500 + 0.0002	Approx.500nA //10MΩ

- This is accuracy by 6 and 1/2 digits resolution for 4 terminal resistance measurement or 2 terminal resistance measurement after zero compensation by NULL calculation. In the case NULL calculation is not performed, 0.2Ω additional tolerance is added to 2 terminal resistance measurement.
- Maximum allowable voltage
  Between Ω-COM terminals : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)
  Between Sense Hi-Lo : 200 Vpeak
- Terminal open voltage <17 V

6.2.6 Continuity test (CONT ■))

6.2.6.1 Accuracy, resolution and measuring current

Unit: ± (% of reading + % of range)

Resist. range	Resolution	Threshold	Accuracy	Temp. coefficient	Measuring current	Sampling rate
1kΩ	10mΩ	1Ω to 1000Ω	0.010 + 0.020	0.001 + 0.002	Approx.1mA	100 S/s

- Sounding of electronics buzzer
- Maximum allowable voltage : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)

6.2.7 Diode (▶|)

6.2.7.1 Accuracy and measuring range

Unit: ± (% of reading + % of range)

Measuring current	Measuring range	Accuracy	Temp. coefficient	Terminal open voltage	Sampling rate
Approx.1mA	0.1mV to 1.1999V	0.010 + 0.020	0.001 + 0.020	<17V	100 S/s

- Maximum allowable voltage : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)

6.2.8 Temperature measurement (TEMP, TC: THERMOCOUPLE)

6.2.8.1 Accuracy and resolution

Unit: ± (% of reading + Digits)

Thermocouple	Measuring range (°C)	Accuracy	Resolution	Max. allowable voltage
R	−50 to 0	0.20 + 70	0.01°C	800 Vpeak (continuous), 1100 Vpeak (for 1 minute)
	0 to +100	0.20 + 50		
	+100 to +1765	0.20 + 30		
K(CA)	−200 to −100	0.15 + 50		
	−100 to 0	0.15 + 35		
	0 to +1370	0.15 + 20		
T(CC)	−200 to −100	0.15 + 50		
	−100 to 0	0.15 + 35		
	0 to +400	0.15 + 20		
J(IC)	−200 to −100	0.15 + 50		
	−100 to 0	0.15 + 35		
	0 to +1200	0.15 + 20		
E(CRC)	−200 to −100	0.15 + 50		
	−100 to 0	0.15 + 35		
	0 to +1000	0.15 + 20		

- The above accuracy does not include thermocouple accuracy.
- Cold junction temperature shall be input by TEMP/SENSOR menu and does not include its tolerance.
- In calculational guarantee temperature 0°C to 18°C and 28°C to 50°C, ±0.1°C/°C is added to all thermocouples.
- It is outside the accuracy guarantee though temperatures that are lower than -200℃ might be displayed as measurements.
- Standard heat electromotive force depends on line graph approximate calculation by JIS C 1602-1995.

6.2.9 Temperature measurement (TEMP, RTD: Resistance temperature detector)

6.2.9.1 Measuring range, accuracy and resolution

RTD	Measuring range (°C)	Accuracy	Temp. coefficient	Resolution
Pt100	−200 to +850	0.06°C	0.003°C	0.01°C
JPt100	−200 to +510			

- This complies with Pt100 : JIS C1604-1997 standards.
- This complies with JPt100 : JIS C1604-1989 standards.
- In 4 lead wire system, accuracy of measuring cable (or probe) is not included.
- Maximum allowable voltage : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)

6.2.10 Frequency measurement (FREQ)

6.2.10.1 Accuracy, display digit number and measuring range

AC coupling, reciprocal system and crest factor<5

Gate time	Display digit number and measuring range	Accuracy (%)	Accuracy (%)	Accuracy (%)	Accuracy (%)
		3 to 5Hz	5 to 10Hz	10 to 40Hz	40 to 300kHz
1s	7 digits :3.000000Hz to 300.0000kHz	0.1	0.05	0.03	0.01
100ms	6 digits:3.00000Hz to 300.000kHz	0.1	0.05	0.03	0.01
10ms	5 digits:3.0000Hz to 300.00kHz	0.1	0.05	0.03	0.01
1ms	4 digits:3.000Hz to 300.0kHz	0.1	0.05	0.03	0.01

- Maximum allowable voltage: 750 Vrms, or 1100 Vpeak (continuous), however DC content are ±500 V or less.
- An input attenuator is the case when 100 mV to 750 V range of ACV is switched automatically or manually.
- An input range is 100 mVrms to 750 Vrms at 3 Hz to 100 kHz.
  ∗ However up to maximum 2.2×10^7[V･HZ] in 100 kHz to 300 kHz
- An input 200 Vrms or more guarantees up to 100 kHz.
- In the input 3Hz or less and more than 300 kHz, measuring and display may be performed but it is out of accuracy guarantee.

6.3 Specifications of Basic Measuring Function (VOAC7502)

6.3.1 Direct current voltage measurement (DCV)

6.3.1.1 Accuracy and resolution

Unit: ± (% of reading + % of range)

Range	Full scale at 5 and 1/2 digits	Resolution	Accuracy ± (% of reading + % of range)	Temperature coefficient ±(% of reading + % of range)/°C	Input impedance
100mV	119.999	1μV	0.018 + 0.003	0.0015 + 0.0004	1GΩ or more or 10MΩ±1%
1V	1.19999	10μV	0.015 + 0.003	0.0015 + 0.0001	
10V	11.9999	100μV	0.012 + 0.001	0.0015 + 0.0001	
100V	119.999	1mV	0.015 + 0.003	0.0020 + 0.0001	10MΩ±1%
1000V	1100.00	10mV	0.015 + 0.003	0.0020 + 0.0001	

- Sampling time : 1 S/s
- Maximum allowable voltage
  100 mV to 100 V range : ±800 Vpeak (continuous),or ±1100 Vpeak (for 1 minute)
  1000 V range : ±1100 Vpeak (continuous)
- Response time : Within 1 second

6.3.1.2 Noise removal

PLC	NMRR 50Hz/60Hz±0.1%	CMRR 50Hz/60Hz*±0.1% Unbalance resistance1 kΩ
Multiple of 1PLC	55dB	120dB
Other than above	0dB	–

∗50Hz/60Hz: Power frequency

6.3.2 Alternating current voltage (ACV)

6.3.2.1 Resolution and measuring range

True effective value detecting crest factor : <3

Range	Full scale	Resolution	Measuring range		Input impedance
			MID	HIGH	
100mV	119.999	1μV	20Hz to 100kHz	200Hz to 100kHz	Approx. 1MΩ// 100pF or less
1V	1.19999	10μV			
10V	11.9999	100μV			
100V	119.999	1mV			
750V	750.00	10mV	20Hz to 100kHz	200Hz to 100kHz	

6.3.2.2 Accuracy

It specifies at 5% to 100% of each range.

Unit : ± (% of reading + % of range)

Range	Frequency	Accuracy	Temp. coefficient
100.0000mV	20Hz to 45Hz	0.70 + 0.04	0.070 + 0.004
	45Hz to 100Hz	0.20 + 0.04	0.020 + 0.004
	100Hz to 20kHz	0.10 + 0.04	0.010 + 0.004
	20kHz to 50kHz	0.20 + 0.05	0.020 + 0.005
	50kHz to 100kHz	0.60 + 0.08	0.060 + 0.008
1.000000V to 750.000V	20Hz to 45Hz	0.70 + 0.04	0.070 + 0.004
	45Hz to 100Hz	0.20 + 0.04	0.020 + 0.004
	100Hz to 20kHz	0.10 + 0.04	0.010 + 0.004
	20kHz to 50kHz	0.20 + 0.05	0.020 + 0.005
	50kHz to 100kHz	0.60 + 0.08	0.060 + 0.008

- It is accuracy at sine wave.
- Maximum allowable voltage 750 Vrms or 1100 Vpeak and DC content are ±500 V or less.
- It is limited to 100 kHz or 8×10^7 V*Hz at 750V range.
- Crest factor (CF) guarantees either 3 or smaller of maximum input voltage.

6.3.2.3 Additional tolerance by AC filter setting

Unit: ± (% of reading)

AC filter	20Hz to 40Hz	40Hz to 100Hz	100Hz to 200Hz	200Hz to 1kHz	Over 1kHz
MID	0.22	0.06	0.01	0	0
HIGH		0.73	0.22	0.18	0

6.3.2.4 Additional tolerance by crest factor

Unit: ± (% of range)

Crest factor	Additional tolerance of Crest Factor	Additional tolerance of bandwidth
1-2	0.1	0.00015 × f
2-3	0.3	0.00024 × f

- f is basic frequency [Hz] of input signal.

6.3.3 Direct current measurement (DCI)

6.3.3.1 Accuracy and resolution

Unit: ± (% of reading + % of range)

Range	Full scale at 5 and 1/2 digits	Resolution	Accuracy	Temp. coefficient	Shunt resistance
1mA	1.19999	10nA	0.050 + 0.002	0.003 + 0.0005	90Ω
10mA	11.9999	100nA	0.050 + 0.002	0.003 + 0.0005	5Ω
100mA	119.999	1μA	0.050 + 0.002	0.005 + 0.0005	5Ω
1A	1.19999	10μA	0.050 + 0.002	0.003 + 0.0005	0.1Ω
3A	3.0000	100μA	0.150 + 0.002	0.005 + 0.0005	0.1Ω

- Resolution applies to the status 5 and 1/2.
- Maximum allowable current
  Full range: 3 ADC or 3 Arms (continuous, protection by 3 A fuse)

6.3.4 Alternating current measurement (ACI)

6.3.4.1 Resolution and measuring range

True effective value detecting crest factor: <3

Range	Full scale	Resolution	Measuring range		Shunt resistance
			MID	HIGH	
1A	1.19999	10μA	20Hz to 5kHz	200Hz to 5kHz	0.1Ω
3A	3.0000	100μA			

6.3.4.2 Accuracy

It specifies by 5 % to 100 % of each range.

Unit: ±(% of reading + % of range)

Range	Frequency	Accuracy	Temp. coefficient
1A	20Hz to 45Hz	0.70 + 0.1	0.100 + 0.01
	45Hz to 100Hz	0.35 + 0.1	0.035 + 0.01
	100Hz to 5kHz	0.50 + 0.1	0.050 + 0.01
3A	20Hz to 45Hz	0.70 + 0.1	0.100 + 0.01
	45Hz to 100Hz	0.35 + 0.1	0.035 + 0.01
	100Hz to 5kHz	0.50 + 0.1	0.050 + 0.01

- It is accuracy at sine wave.
- Maximum allowable current
  Full range: 3 Arms (continuous, protection by 3A fuse)

6.3.4.3 Additional tolerance by AC filter

Unit: ± (% of reading)

AC filter	20Hz to 40Hz	40Hz to 100Hz	100Hz to 200Hz	200Hz to 1kHz	Over 1kHz
MID	0.22	0.06	0.01	0	0
HIGH		0.73	0.22	0.18	0

6.3.4.4 Additional tolerance by crest factor

Unit: ± (% of range)

Crest factor	Additional tolerance of Crest Factor	Additional tolerance of bandwidth
1-2	0.1	0.00015 × f
2-3	0.3	0.00024 × f

• f is basic frequency [Hz] of input signal.

6.3.5 2 terminal resistance measurement (2WΩ)/4 terminal resistance measurement (4WΩ)

6.3.5.1 Resolution, accuracy and measuring current

Unit: ±(% of reading＋ % of range)

Range	Full scale	Resolution	Accuracy	Temp. coefficient	Measuring current
100Ω	119.999	1mΩ	0.020 + 0.003	0.002 + 0.0004	Approx. 1mA
1kΩ	1.19999	10mΩ	0.018 + 0.003	0.002 + 0.0001	Approx. 1mA
10kΩ	11.9999	100mΩ	0.018 + 0.003	0.002 + 0.0001	Approx. 100μA
100kΩ	119.9999	1Ω	0.018 + 0.003	0.0002 + 0.0001	Approx. 10μA
1MΩ	1.19999	10Ω	0.018 + 0.003	0.0002 + 0.0002	Approx. 5μA
10MΩ	11.9999	100Ω	0.250 + 0.005	0.250 + 0.0005	Approx. 500nA
100MΩ	119.999	1kΩ	1.500 + 0.015	0.150 + 0.0010	Approx.500nA //10MΩ

- This is accuracy by 5 and 1/2 digits resolution for 4 terminal resistance measurement or 2 terminal resistance measurement after zero compensation by NULL calculation. In the case NULL calculation is not performed, 0.2Ω additional tolerance is added to 2 terminal resistance measurement.
- Maximum allowable voltage
  Between Ω-COM terminals : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)
  Between Sense Hi-Lo : 200 Vpeak
- Terminal open voltage <17 V

6.3.6 Continuity test (CONT ■))

6.3.6.1 Accuracy, resolution and measuring current

Unit: ± (% of reading + % of range)

Resist. range	Resolution	Threshold	Accuracy	Temp. coefficient	Measuring current	Sampling rate
1kΩ	10mΩ	1Ω to 1000Ω	0.020 + 0.020	0.002 + 0.002	Approx.1mA	100 S/s

- Sounding of electronics buzzer
- Maximum allowable voltage : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)

6.3.7 Diode (▶|)

6.3.7.1 Accuracy and measuring range

Unit: ± (% of reading + % of range)

Measuring current	Measuring range	Accuracy	Temp. coefficient	Terminal open voltage	Sampling rate
Approx.1mA	0.1mV to 1.1999V	0.020 + 0.020	0.002 + 0.002	<17V	100 S/s

- Maximum allowable voltage : 800 Vpeak (continuous), or 1100 Vpeak (for 1 minute)

6.3.8 Frequency measurement (FREQ)

6.3.8.1 Accuracy, display digit number and measuring range

AC coupling, reciprocal system and crest factor<3

Gate time	Display digit number and measuring range	Accuracy (%)	Accuracy (%)	Accuracy (%)	Accuracy (%)
		3 to 5Hz	5 to 10Hz	10 to 40Hz	40 to 300kHz
100ms	6 digits:3.00000Hz to 300.000kHz	0.1	0.05	0.03	0.01
10ms	5 digits:3.0000Hz to 300.00kHz	0.1	0.05	0.03	0.01
1ms	4 digits:3.000Hz to 300.0kHz	0.1	0.05	0.03	0.01

- Maximum allowable voltage: 750 Vrms, or 1100 Vpeak (continuous), however DC content are ±500 V or less.
- An input attenuator is the case when 100 mV to 750 V range of ACV is switched automatically or manually.
- An input range is 100 mVrms to 750 Vrms at 3 Hz to 100 kHz.
  ∗ However up to maximum 2.2×10^7[V·HZ] in 100 kHz to 300 kHz
- An input 200 Vrms or more guarantees up to 100 kHz.
- In the input 3Hz or less and more than 300 kHz, measuring and display may be performed but it is out of accuracy guarantee.

6.4 Trigger function

Trigger mode

AUTO	Measures automatically in accordance with sampling rate and interval.
SINGLE	Measures in accordance with TRIG input.

Trigger source

Back TRIG input terminal (External trigger)	Polarity and valid/invalid are switchable by menu.
HOLD/TRIG key (Manual trigger)	Enters by key manually.
REMOTE	Please refer to the command of Remote control manual (PDF files are stored in CD)

Trigger sample number	Sets the number of continuous data measurement per one trigger.
Setting range	1 to 100,000
Trigger delay	Sets delay time from TRIG input to data measurement.
Setting range	0 00 ms to 3,600 s
Resolution	10 µs
Interval	Measuring interval setting of sampling ∗This is valid when larger value than current sampling rate is set.
Setting range	0 00 ms to 3,600 s
Resolution	10 µs

6.5 Calculation function

Please refer to various operations of the following Sections 6.5.1 to 6.5.6. Simultaneous setting is possible. However combination of scaling calculation and decibel calculation cannot operate and set simultaneously.

6.5.1 SMOOTHING (Moving average) calculation

Average count Is selectable in range of 2 to 100 (positive integer).

∗ In case trigger is SINGLE, after it reaches the set average count, required trigger sample quantity is obtained.

6.5.2 NULL (Difference) calculation

Calculation content Calculation result =RAW value－NULL value

RAW value Measured value of function at that time

NULL value To be by the following NULL value setting.

Setting content

Calculation ON/OFF On/Off are set by［NULL］key or NULL menu of each function.

∗When turning on with the NULL key, the measured value at that time is set to NULL value by each function.

NULL value setting Is set by NULL menu.

NULL value setting

It is possible to set it by three kinds (DEFAULT value, measurements, and a numeric input) when setting according to the NULL menu of each function.

Numerical setting by NULLVAL menu of each function manually.

With multiplier (μ, m, k, M, G, T), effective figures 7 digits

6.5.3 Scaling (SCALING / dB) calculation

∗This cannot be set with section 6.5.4 decibel calculation (dB calculation) simultaneously.

Calculation formula Two kinds of the following can be selected.

- Display value ＝(Measured value -A) ∗B/C
- Display value＝D/Measured value

Constant The 4 constants of A, B, C, D are set.

Valid digit 7

Multiplier 8 types of p, n, μ, m, k, M, G, T

6.5.4 dB calculation

∗This cannot be set with Section 6.5.3 Scaling (SCALING / dB) calculation simultaneously.

Calculation Selection of dBV, dBm

dBm Calculation result ＝$10 \cdot \log_{10}\{(\text{measurements})^2/(\text{Standard resistance})/(1.0\times10^{-3})\}$

Standard resistance value Unit Ω

Selection from 4, 8, 16, 32, 50, 75, 93, 110, 124, 125, 135, 150, 200, 250,300, 500, 600, 800, 900, 1000, 1200, 8000

dBV	Calculation result ＝20・$\log_{10}$（| measurements	/standard voltage）
Standard voltage value	Selection from unit V, 1μV, 1mV, 1V
REL calculation	Is possible to set by above 2 calculations. Display of different value deducted dB standard value from calculation result.
dB standard value	It is possible to set by three kinds (DEFAULT value, measurements, and a numeric input).
Setting range	The range of a numeric input is ±500.0000. (Seven significant digits)
Appropriate function	Valid only for DCV, ACV function

6.5.5 STATISTIC calculation

Calculation	Calculates maximum value (MAX), minimum value (MIN), average value (AVE) and standard deviation (σ).
ON/OFF	Setting by menu
Display	Is possible to display on secondary display. The mean value cursor and the σ cursor are displayed in the histogram chart.

6.5.6 Limit calculation

Judgment	All function
ON/OFF	The upper limit and the lower limit values become independent respectively.
Limit value	The upper limit and the lower limit values are set in seven significant digits with eight kinds of multiplier (p,n,μ,m,k,M,G,T).
HIGH	Measurement value > the upper limit value
LOW	Measurement value < the lower limit value
GO	When either or both HIGH judgment and LOW judgment is ON, the state that is neither HIGH nor LOW.
Setting range	Seven significant digits With eight kinds of multiplier (p,n,μ,m,k,M,G,T)
Display	
Trend chart	Displays HIGH/LOW marks and threshold line in graphics.
Histogram chart	Displays HIGH/LOW marks and threshold line in graphics.
LIMIT judgment	Displays HIGH/GO/LOW on upper part of screen, primary display and secondary display.

6.6 Log function

Log mode	Switchable between 2 modes; i.e. NORMAL and BULK
Data size	
NORAM mode	100 k Readings fixed
BULK mode	Selectable from; 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, and 100 k (Units: Readings)
Saved data	The following are saved: ・Measurement data ・Logged date and time ・Name of each function ・Configuration information of each function * The calculation name is displayed when NULL, dB, or SCALING calculation is set on.
Export function	* VOAC7502 does not support this function. Outputting the measurement data stored in the LOG memory to the USB memory.
File format	Text file
Saved data	Measurement data of function
Logging time	ON/ OFF can be set. * When set ON, the date and time are saved.
Format	YYYY/MM/DD HH:mm:SS, xxxxxx *x: unit of μsec
Attribute information	ON/ OFF can be set. * The calculation name in the ON status (i.e. NULL, dB, or SCALING) is saved.

6.6.1 NORMAL mode

It is a mode stored in the LOG memory while in real time monitoring the measurement data.
The sampling rate is not guaranteed.

After acquiring log data count	When the number of acquired data pieces exceeds 100 k Readings, the mode continues by the FIFO* operation. * FIFO: First In, First Out (First-in data is processed in sequence.)
Log data clear	It is cleared at the following. ・INITIALIZE action by DISPLAY menu (M5 key is pressed) ・PUSH action when the rotary knob is invalid ・Additionally, refer to the clear condition table of each data of section 7.4.

6.6.2 BULK mode

It is a mode that guarantees the sampling rate though the measurement data cannot be in real time monitored.

It cannot operate as the SINGLE mode of the TRIG menu.

LOG start	Data acquisition starts by executing START LOG menu (pressing M4 key).
LOG stop	By 2 methods below ・After the stop event occurs, the data corresponding to the number of post triggers has been completely acquired. ・Executing STOP LOG menu (pressing M4 key)
STOP EVENT	Selectable from 3 kinds below:
NONE	No condition of stop event
EXT TRIG	It makes the external trigger input an event.
LEVEL	It is used as the stop event when the measurement data exceeds a threshold value and sets two parameters below:
THRESHOULD	Setting range: 7-digit significant figure is used for setting(with multiplier)
	Multiplier: 8 types of p, n, μ, m, k, M, G, and T
SLOPE (polarity)	Selectable from Positive / Negative
LIMIT	Selectable from 4 limit judgments of GO/ NOGO (Hi or Lo)/ Hi/ Lo
POST Readings	Settable in the 1% unit of preset MEM LENGTH (log data length)
(Number of post triggers)	0 to 100 % (Resolution: 1 %)
	If an event occurs before the number of pre-triggers is reached, the total data amount is reduced.

6.7 Screen display switching

6.7.1 Primary display

Numeric value display

Size	NORMAL, LARGE
Font	NORMAL (Gothic), 7SEG.

Trend chart display	Refer to 6.8.
Histogram chart display	Refer to 6.9.
Arc scale meter display	Refer to 6.10.
LIMIT display	Displays judgment result of LIMIT calculation.

6.7.2 Secondary display (in online)

Numeric value display	Enabled if the primary display shows other than numeric values.
Analog meter display	Refer to 6.12.
Statistics display	Enabled if statistics calculation is set ON.
LIMIT display	Enabled if LIMIT judgment is set ON. ∗ Enabled if HIGH of LIMIT calculation is ON or LOW is ON.
Time display	Enabled for trend chart display.
BIN information display	Enabled for histogram chart display
Cursor display of histogram chart	Enabled for histogram chart display

6.7.3 Secondary display (in offline)

Time cursor display	Enabled for trend chart display/ histogram chart display
Voltage cursor display	Enabled for trend chart display/ histogram chart display
BIN information display	Enabled for histogram chart display
Cursor display of histogram chart	Enabled for histogram chart display
Statistics display	Enabled for trend chart display/ histogram chart display

6.8 Trend chart display function

6.8.1 Online trend chart display function

Displayed data number	For maximum 100 k Readings
Horizontal axis	401 dots (10div)
Vertical axis	121 dots (12div)
Display method	At first data is displayed from left, and when wave form reached screen right end, compression is displayed. After compression display of 100k, it becomes roll mode display.
Vertical axis	
MANUAL	Is possible to specify range and offset.
Range	1 p / div to 500 T / div (1-2-5 steps) ∗p: pico, T: terra
Offset	−100.000div to +100.000div
Offset setting resolution	1div
AUTO	Displays by updating to scale which is possible to display max/min values of measured data from obtained data automatically.
APPLY TO MANUAL	The content of the range and the offset set automatically is reflected in the MANUAL mode.
FULLSCALE	Max/min values of measuring range is displayed by scale which is possible to display. The following condition is impossible to select FULLSCALE. (If it is set to FULLSCALE, it becomes AUTO.) •In case function is in frequency measurement (FREQ) •In case SCALING calculation (d/X) has been set. * Moreover, when the data measured by a different range exists together on the trend chart, it becomes FULLSCALE of the highest in that range.
Data clear	As for a clear condition of the measurement result, refer to section 4.9.1 or 7.4.

6.8.2 Offline trend chart display function

The case where the trend chart display is selected when the offline browse mode is entered in LOG menu is called the “offline trend chart display.” At that time, the data in the LOG memory is displayed.

VERTICAL (vertical axis) Same setting as online setting can be made.

HORIZONTAL (horizontal axis

Readings/div — Data amount displayed per 1div
1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k

CENTER ADDR — 0 to number of data of LOG memories

SHOW ALL — The entire LOG memory is displayed.

T1, T2 cursor function

KNOB (cursor selection) — It selects the cursor which moves when the rotary knob is rotated.
Selectable from 3 methods below:
TCURSOR1(T1 cursor)/ TCURSOR2 (T2 cursor)/ TRACK

Cursor initial position — Just after the offline trend chart display is entered, T1 cursor moves the address of the beginning data of LOG and T2 cursor moves the address of the last data of LOG.

Histogram relation to statistics calculation
It decides the range of object of statistics calculation and the data range to display the total amount in the offline histogram chart display.

SET DISP POSITION function — It sets the address of the selected cursor at the center on the screen. (Set to CENTER ADDR.)
If the selected cursor is TRACK, RDGs/div is set to the expansion ratio so that both of T1 and T2 cursors are included and CENTER ADDR is the center of T1 and T2 cursors.

SEARCH MODE (edge search) — The function makes jump to the nearest data depending on the condition below in the direction of rotating the rotary knob.

- LIMITGO : GO of LIMIT judgment
- LIMITNOGO : NOGO of LIMIT judgment
- LIMITHIGH : HIGH of LIMIT judgment
- LIMITLOW : LOW of LIMIT judgment
- EDGEPOSITIVE : Data when the edge level is crossed in the positive direction
- EDGENEGATIVE : Data when the edge level is crossed in the negative direction
- EDGEBOTH : Data when the edge level is crossed in both directions

EDGE LEVEL	Settable when EDGEPOSITIVE／EDGENEGATIVE／EDGEBOTH is selected in the edge search function
Setting range	Seven significant digits Multiplier: 8 types of p, n, μ, m, k, M, G, and T
Secondary display	
Time display	Time of points of T1 and T2 cursors Data amount between T1 and T2 cursors Time difference between T1 and T2 cursors
Voltage display	Measurement value of points of T1 and T2 cursors Maximum and minimum values of measurement data which is compressed and displayed in the same row as the cursor point on the screen

6.9 Histogram chart display function

6.9.1 Online histogram chart display function

Vertical axis	BIN with the highest occurrence frequency is displayed as MAX 100 pix.
Display unit	Selectable from COUNT and PERCENT
Horizontal axis	3 types for each mode of MANUAL, AUTO, and FULLSCALE
No. of BINs	Selectable from: 2, 4, 5, 10, 20, 40, 50, 100, 200, and 400
MANUAL	
Center value	An arbitrary value is set by 7-digit significant figure with multiplier Multiplier: 8 types of p, n, μ,m, k, M, G, and T
Span	±100p to ±500T Set by 1-2-5 step with multiplier Multiplier: 8 types of p, n, μ, m, k, M, G, and T
AUTO	By using the maximum and minimum values of the data collected in this period, the center value and span of the histogram are decided.
APPLY TO MANUAL	The content of the range and the offset set automatically is reflected in the MANUAL mode. * However, it is rounded according to the set resolution capability of the MANUAL mode.
FULLSCALE	A central value of the histogram and span are additionally decided full-scale about the measurement range. I t clears the data of the histogram once when the range including an automatic change by an auto range changes. Since the conditions below do not decide the maximum and minimum values of FULLSCALE, this mode is handled as AUTO mode. ・If the function is FREQ or TEMP ・If the scaling (SCALING calculation: d/X) is set ・If dB calculation is set
Data clear	As for a clear condition of the measurement result, refer to section 4.10.1.2 or 7.4.
Statistical cursor	The positions of the average value x and standard deviation σ are indicated by cursors. (Statistics calculation is on.)
Standard deviation σ	Selectable from 1, 2, and 3
H1, H2 cursor function	
KNOB (cursor selection)	When the rotary knob is rotated, the moving cursor can be selected from: HCURSOR1 (H1 cursor)/ HCURSOR2 (H2 cursor)/ TRACK
Secondary display	Range of BIN measurement value of H1 and H2 cursors Count of BIN of H1 and H2 cursors No. of BINs between H1 and H2 cursors Count and ratio (%) between H1 and H2 cursors

6.9.2 Offline histogram chart display function

The case where the histogram chart display is selected when the offline browse mode is entered in LOG menu is called the “offline histogram chart display.” At that time, the data in the LOG memory is displayed. The setting method of the display mode, BIN count, vertical axis, horizontal axis, and cursor function is the same as the online mode. Even if the display condition is changed, redisplay is possible without clearing the LOG memory.

Relation to trend chart display

The target data to be collected and displayed is the data between T1 and T2 cursors in the trend chart display

.

6.10 Arc scale meter (ARC SCALE METER) display function

The function can be set with the parameter independent of the analog meter on the secondary display.

MODE	One item is selected from AUTO/ FULLSCALE/ MANUAL/ LOG. ∗ However, FULLSCALE cannot be selected only for frequency measurement (FREQ).
AUTO	Max. and Min. values of measurement data in the acquired data are automatically displayed. Display is done while updating to the possible scale.
FULLSCALE	FULLSCALE of the measurement range is max. or min. value.
MANUAL	
Range	500 T/div to 1 p/div (can be set with 1-2-5 steps) Displayed with offset of±6 div.
Offset	−100.000 kdiv to 100.000 kdiv
LOG	
LOG MAX	10.0 p/div to 100.0T/div (can be set with 10-time step)
LOG MIN	1.0 p/div to 10.0T/div (can be set with 10-time step)
	Note 1) 10 times or more and 10^6 times or less between LOG MAX and LOG MIN
	Note 2) Absolute value is displayed if the acquired data is the minus value.
	Note 3) Positive value is valid in HIGH/ LOW setting range of LIMIT calculation.
APPLY TO MANUAL	Function to copy AUTO mode range and offset setting to MANUAL mode
TITLE	Function to display characters (alphabets, numbers, symbols) in the center of the meter
Display	Selected from UNIT/ BLANK/ TEXT
UNIT	Function unit is displayed
BLANK	Blank (not displayed)
TEXT	Up to 8 arbitrary characters are displayed.

6.11 Analog meter (ANALOG METER) display function

MODE One item is selected from AUTO/ FULLSCALE/ MANUAL/ LOG

∗ However, FULLSCALE cannot be selected only for frequency measurement (FREQ).

AUTO Max. and Min. values of measurement data in the acquired data are automatically displayed.

Display is done while updating to the possible scale.

APPLY TO MANUAL mode Reflecting automatically set range and offset content on MANUAL

FULLSCALE FULLSCALE of the measurement range is max. or min. value.

MANUAL

Range 500 T/div to 1 p/div (can be set with 1-2-5 steps)

Displayed with offset of±6 div.

Offset −100.000 kdiv to 100.000 kdiv

LOG

LOG MAX 10.0 p/div to 100 .0T/div (can be set with 10-time step)

LOG MIN 1.0 p/div to 10 .0T/div (can be set with 10-time step)

Note 1) 10 times or more and 10^6 times or less between LOG MAX and LOG MIN

Note 2) Absolute value is displayed if the acquired data is the minus value.

Note 3) Positive value is valid in HIGH/ LOW setting range of LIMIT calculation.

APPLY TO MANUAL Function to copy AUTO mode range and offset setting to MANUAL mode.

6.12 Save/ recall setting of SETUP condition

POWER ON RECALL Setting condition when powering on can be selected from:

LAST Setting condition at the last powering off

DEFAULT Factory setting condition

RECALL Setting condition recalled by specifying the number from the data of the internal SETUP memory

SAVE/RECALL

Save destination Internal or USB memory

Note) In VOAC7502, the USB memory is off the subject.

Number of internal memories: 10

External control It internal sets up by an external signal of RS-232 by using the control signal allocated in the pin not used to communicate with PC.

Function to call memory sequentially

(allowed only when LAN & RS-232 interface SC-361 option is equipped)

Input signal

Level H: +2.0 Vmin, L: +0.8 Vmax

Maximum rating ±15 V

Time width Positive polarity, 10 ms or more

INC Recall is done while forwarding SETUP memory number.

DEC Recall is done while SETUP memory number goes back.

BEGIN Recall is done while SETUP memory number goes back to the initial value.

Output signal

BUSY Indicates whether the input signal can be accepted.

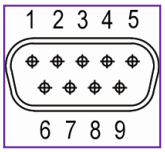
・Acceptable at L level

・Pulse is ignored at H level.

Level H: +5.0 Vmin, L: -5.0 Vmax

Pin number and signal name

Signal names	PIN numbers
INC	1
GND	5
DEC	6
BUSY	7
BEGIN	9



6.13 Setting of System

Remote (REMOTE) The following can be selected.

At GPIB OPTION attached USB, GPIB

At LAN&RS OPTION attached USB, LAN, RS-232

USB IF setting parameter

Delimiter	CR+LF, LF
Command	SCPI, IWATSU (VOAC752X/VOAC752XH series interchangeability)

GPIB IF setting parameter

Address	0 to 30
Delimiter	CR+LF, LF
Command	SCPI, IWATSU (VOAC752X/VOAC752XH series interchangeability)

LAN IF Setting parameter

DHCP	ON/OFF is set.
IP address	Sets by installation environment.
Gateway	Sets by installation environment.
Subnet mask	Sets by installation environment.
Delimiter	CR+LF, LF
Command	SCPI, IWATSU (VOAC752X/VOAC752XH series interchangeability)

RS-232 IF setting parameter

Parity	NONE, EVEN, ODD
Stop bit	1bit, 2bit
Bit rate	Selects from 300, 600, 1200, 2400, 4800, 9600, 19200, 38400bps.
Delimiter	CR+LF, LF
Command	SCPI, IWATSU (VOAC752X/VOAC752XH series interchangeability)

Beep sound (BEEP) The following 3 can be set independently.

KEY ((When the key is operated.)
ON/OFF is set.

CAUTION (When the error occurs.)
ON/OFF is set.

LIMIT judgment ON/OFF/NO-GO is set

Equipment setting (SETUP)

Animation	ON/OFF of animation of menu
Screen header	The following 3 can be set. • DATE TIME : Displays current date and time. • SETUP NAME : Displays name of setting condition. • OFF : No header displayed.
DATE TIME	Sets by YYYY/MM/DD HH:mm.
PLC	Detection display and setting of power frequency
AUTO	Setting by detecting automatically at the time of power-up.
MANUAL	50 Hz/60Hz are switchable manually.

Copy (COPY)	Setting of hard copy relation to USB memory
* VOAC7502 does not support this function.	
Mode	operation when [COPY] key is pressed.
Screen hard copy	
	Saves screen data.
Numerical data	Measured value, date and function are added by 1 line with text file.
Hard copy ouput setting	
Format	
File format	PNG, BMP, TIFF
Color number setting	Color, Gray scale
Directory	Setting of folder name of USB memory
File name	Setting of file name of hard copy data to be saved.
Setting of ouput measurement data	
Action	
ONE TIME	Outputting the latest only one measurement result when pushing [COPY] key
CONTINUOUS	Beginning / Stopping an USB memory continuous writing with the [COPY] key This instrument outputs every time a new measurement result is acquired while executing a continuous writing in the USB memory.
Directory	Setting of folder name of USB memory
File name	Setting of file name of numerical data to be saved
Time stamp	ON/OFF of date information
Attribute	Presence of measurement function, and calculation of NULL, SCALING, and dB
TOOLS	Maintenance related menu of the instrument
Status information display	Displays information such as model name, firmware version, etc.
Setting condition initialization	Sets to setting condition at the time of factory shipment (execution).
Panel lock	ON/OFF of key Calculation when key is pressed.
Firmware updates	Setting on update of firmware
* VOAC7502 does not support this function.	
Calibration	Self-calibration by user

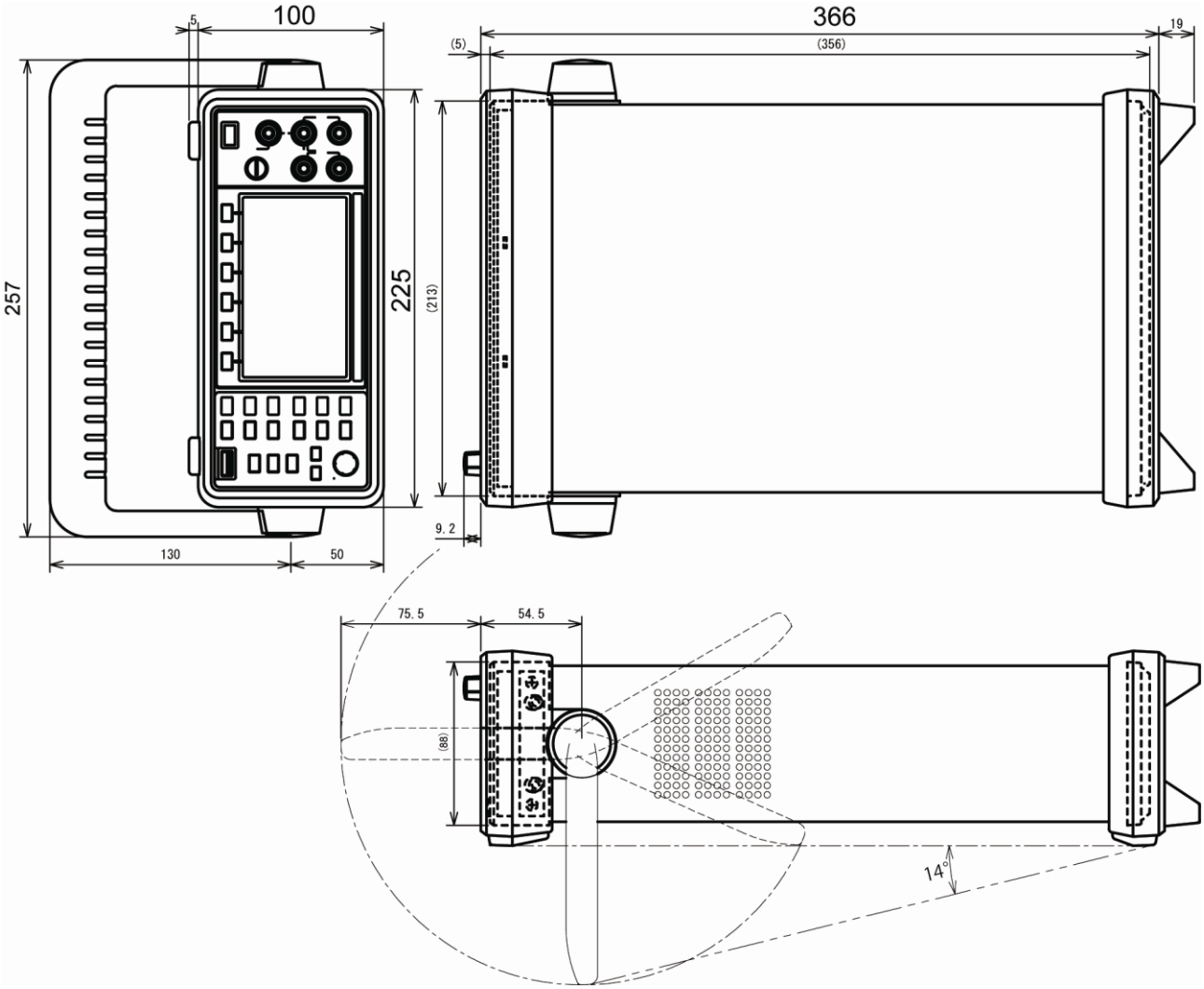
6.14 Accessories

*1 Accessories are not accessories on this book Ⅶ page, and buy accessories separately.

*2 Because VOAC7502 doesn't support temperature measurement function (TEMP), SC-0107/0116 is non-correspondence.

SC-004	Shield cable for high resistance 100 MΩ or less
SC-0107	Sheath type thermocouple (Type-K)
SC-0116	Stationary surface type thermocouple (Type-K)
SC-020	Test lead (for replacement of standard accessory, 1 each of red and black/set)
SC-023	Exclusive for SC-020 alligator clip H (withstand voltage: 600V/10A, CE interaction)
SC-026	Exclusive for SC-020 arrows (AC30/DC60V, DC3A)
SC-028	DC180A, AC130A, electric current clamp probe
SC-364	Rackmount kit (inch type for one)
SC-365	Rackmount kit (inch type for two)
Instruction manual (CD)	
User’s guide (paper media)	

6.15 Appearance drawing



Unit: mm

123456 7

Chapter 7 Guidance of measurement

7.1 Common item of function

◇ **Precaution on settling (Measurement after measuring high voltage (300 Vrms or more) and large current (1 A or more))**

After measuring high voltage (300Vrms or more) or large current (1A or more), temperature of input terminal and main unit will increase and it may affect to measurement accuracy. In case of current measurement and in case of voltage and resistance measurement, please measure after doing the following stanbys.

<In case of current measurement>

For the current measurement, especially high sensitive measurement after measurement of high voltage (300Vrms or more） or large current (1A or more), please measure by referring to the following:

- Measure after waiting until stabilization (for several minutes) at terminal open status.
  - ∗ By waiting for several minutes at the terminal open status, fluctuation of current value being displayed will stabilize.

<In case of voltage and resistance measurement>

For the voltage and resistance measurement, especially high sensitive measurement after measurement of high voltage (300Vrms or more) or large current (1A or more), please measure by referring to the following:

- Measure after waiting until stabilization (for several minutes) at minimum input (short).
  - ∗ By waiting for several minutes at short status, fluctuation of voltage and resistance values being displayed will stabilize.

7.2 Peculiar Item to function

7.2.1 Voltage measurement (DCV, ACV)

◇ Measurement of low level voltage (100 mV range or less)

In the voltage measurement, it can display highest sensitive measuring range 100 mV and 6.5 digits, and resolution is 0.1 μV（For the details, see section 6.2.1 and 6.2.2 for VOAC7602 and section 6.3.1 and 6.3.2 for VOAC7502.）.

In the measurement of low level voltage, a sufficient care should be taken for measuring noise and thermoelectromotive force.

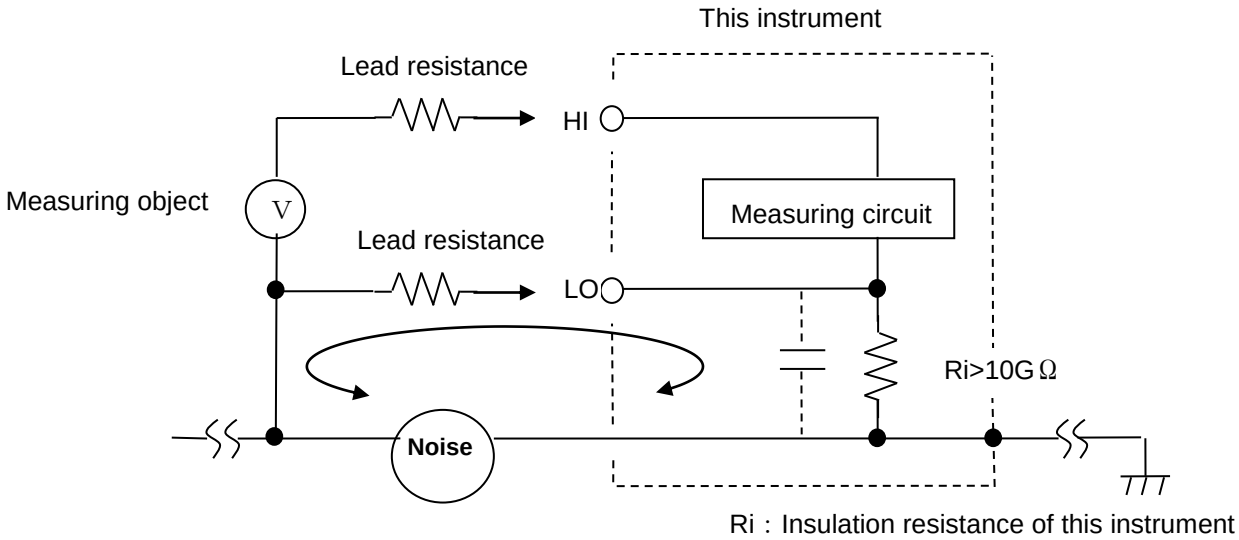
In order to reduce noise affection, the following countermeasures are effective:

- Lead wire should be fixed.
- Lead wire should be shielded.
- Lead wire should be shortened.
- SMOOTHING function in the menu should be set and measured.

The material of the signal input terminal of this instrument is copper system. If different material lead wire (e.g. ferrous) is connected, thermoelectromotive force generates, and accurate measurement may not be achieved. Please always use copper system lead. Even the copper system lead wire is used, thermoelectromotive force may generate if heat balance with input terminal cannot be obtained immediately after connection. Please take a sufficient time for the measurement after connecting with input terminal immediately after connection.

When the voltage is measured with the circuit to which both the case ground of this instrument and the ground of the measuring object are based on the common earth ground, the loop through the ground is formed as shown in the figure below. When the noise and the potential difference are caused between the ground of the measuring object and the case ground of this instrument under such a condition, the electric current flows to the measurement lead and the error margin occurs in the measurement voltage.

In this case, the error margin can be decreased by connecting the power supply ground of this instrument with the same point as the ground of the measuring object, and strengthening between the case side grandeur of the measuring object and this instrument.



Ri：Insulation resistance of this instrument

7.2.2 Alternating current voltage measurement (ACV) / alternating current current measurement (ACI)

◇ Voltage measurement/current measurement with low frequency

Two types of the AC filter bandwidth (BANDWIDTH) can be selected depending on the frequency of the input signal. The time required to stabilize the measurement value can be adjusted by BANDWIDTH setting.

If the input signal frequency is 200Hz or more, the time for stabilization can be reduced by setting HIGH (200Hz or more) for BANDWIDTH. However, trade-off occurs between it and measurement accuracy.

If the input signal frequency is 200Hz or less, set LOW (20Hz or more) for BANDWIDTH. However, the measurement value may not be stable depending on the input signal. In this case, deviation can be averaged; i.e. stable measurement can be done by using SMOOTHING function in the menu. Set LENGTH (average times) as required.

In addition, for the stable time for measurement including range switching, refer to the response time in the item in the table of AC system (ACV, ACI) of 6.1 Common specifications / Sampling rate.

7.2.3 2 terminal resistance measurement (2MΩ) / 4 terminal resistance measurement (4WΩ)

◇ High resistance measurement

In the case high resistance is measured, secure the test lead. In order to reduce an affection of hum noise, further SMOOTHING operation, cable shortening and shielding are also effective.

◇ Low resistance measurement

Since it is affected due to test lead contact resistance and thermoelectromotive force of input terminal section in the low resistance measurement, please use after measuring display is stabilized after connection.

The test lead resistance and contact resistance between test lead and measuring object resistance can also be cancelled by NULL calculation function. Please refer to Section 4.6.1.

7.2.4 Temperature measurement (TEMP)

* VOAC7502 does not support this function.

◇ For accurate temperature measurement

In the case temperature measures accurately, a sufficient care should be taken for the following:

- Sufficiently and thermally connect point at temperature measurement and measuring point of thermocouple.
- It is necessary to thermally balance input terminal HI-LO at the time of temperature measurement. Therefore, it may not stabilize immediately after the thermocouple is installed. Please prevent blowing wind to the input terminal during measurement.
- At the time of temperature measurement of liquid, please measure after stirring liquid well to eliminate unbalanced temperature distribution.
- In order to set more accurate cold junction temperature, provide standard contact temperature compensator, and connect the thermocouple to be used to the standard contact temperature compensator. And then set the cold junction temperature so that an instrument indicates value of the standard contact temperature compensator.

7.3 AUTO ZERO Function

* VOAC7502 doesn't support the temperature measurenment (TEMP, a thermo-couple or RTD(2W)) of the following functions.

The AUTO ZERO function can only set to direct current voltage measurement (DCV), direct current current measurement (DCI), 2 terminal resistance measurement (2WΩ) and temperature measurement (TEMP, thermocouple or RTD(2W)). In 4 terminal resistance measurement (4WΩ) and temperature measurement (TEMP、RTD(4W)), AUTO ZERO always runs ON motion.

Note) In ACV, ACI, FREQ, CONT, and DIODE, functions of AUTO ZERO are not provided.

◆ AUTO ZERO: ON motion

First of all, the operation of AUTO ZERO separates an internal circuit of the equipment from the input signal.and it reads out ZERO value in the instrument.

In the next, it connects the inner circuit of instrument to the input signal, and reads out the input signal value.

Lastly, operation deducting ZERO value from the input signal is performed, and it is to be the measured result.

BY the above motion, very small offset voltage of inner circuit of instrument that will affects to reliability can be removed.

It does this operation at each measurement when AUTO ZERO is ON.

◆AUTO ZERO：OFF motion

When the AUTO ZERO is set to OFF, the ZERO value is read out once, and operation deducting from reading of input hereafter is performed by using the ZERO value. ZERO value is acquired again in case function, range and sampling rate have been changed.

◆AUTO ZERO：ONCE motion

When the AUTO ZERO is set to ONCE, ZERO value is acquired again immediately, and the AUTO ZERO is set to OFF thereafter. The ZERO value is deducted from the reading of input signal thereafter until function, range and sampling rate are changed or AUTO ZERO is set to ONCE again.

In case the integration time is set to 1PLC or less (100 S/s or more), even AUTO ZERO is ON/OFF, AUTO ZERO runs ONCE motion. The ZERO value is acquired by 1PLC (100 S/s), and it is deducted from the reading of input signal in the integration time set.

Note) Even if AUTO ZERO is set to ON when sampling rates are faster than 1PLC, it becomes operation of OFF.

7.4 Clear condition table of each data

The table below shows the condition that each data of the LOG memory, the trend chart, the histogram chart, and the statistic calcuation is cleared.

- ○: Data is cleared.
- ×: Data is not cleared.

Operations	LOG memory	Trend chart	Histogram chart	Statistics calculation result
Function change	○	○	○	○
Setting (ON/OFF, LENGTH) change of SMOOTHING of Function	○	○	○	○
Setting (ON/OFF, NULL VALUE) change of NULL of Function	○	○	○	○
SENSOR setting change of TEMP measurement	○	○	○	○
MODE (frequency/cycle) change in FREQ measurement	○	○	○	○
Change in MATH calculation setting (each parameter of SCALING/dB calculation)	○	○	○	○
Setting change of STATISTIC calculation (Only at the switch of OFF⇒ON)	×	×	○	○
Setting (MODE, number of BIN, CENTER, and SPAN) change of HISTOGRAM	×	×	○	○
Measurement range change (However, when MODE of HISTOGRAM is only FULLSCALE)	×	×	○	○
MODE (NORMAL/BULK) change in LOG measurement	○	○	○	○
MEM LENGTH (memory length) change in BULK MODE of LOG measurement	○	○	○	○
Starting of BULK MODE measurement of LOG measurement	○	○	○	○
Execution of CLEAR LOG	○	×	×	×
Execution of INITIALIZE in DISPLAY menu	○	○	○	○
Execution of INITIALIZE in SYSTEM/TOOLS menu	○	○	○	○
Setting (MODE, FREQ) change of SYSTEM/SETUP/LINE FREQ (power frequency)	○	○	○	○
Setting change of SYSTEM/SETUP/DATETIME (date and time)	○	○	○	○
Execution of CALIBRATION in SYSTEM/TOOLS menu	○	○	○	○
Execution of SETUP RECALL (default, internal memory, and USB)	○	○	○	○
When rotary knob is pressed in most significant hierarchical menu of each function	○	○	○	○

Note) Because VOAC7502 supports neither the SENSOR setting change of the TEMP measurement nor the execution of SETUP RECALL(USB) in the above-mentioned table, it doesn't become the object of a clear condition.

IWATSU TEST INSTRUMENTS CORPORATION

Address : 7-41 Kugayama 1-chome Suginami-ku Tokyo, 168-8511 Japan

Phone : +81 3 5370 5483

Facsimile : +81 3 5370 5492

Homepage : http://www.iti.iwatsu.co.jp