

Instruction Manual

Digital Multimeter

VOAC7520H

VOAC7521H

VOAC7522H

VOAC7523H



IWATSU TEST INSTRUMENTS CORPORATION



Introduction

- ✓ Thank you for purchasing this product. We appreciate your continued patronage of IWATSU measuring instruments.
- ◇ Please read this manual carefully before using the instrument, and keep it handy for future reference.
- ◇ This operation manual describes handling precautions, operating procedures, operating examples, performance, and remote control by RS-232, GP-IB and Ethernet.
- ◇ This manual targets the product of VOAC7520H VOAC7521H VOAC7522H VOAC7523H. Please refer to the manual of the product for VOAC7520/VOAC7521A VOAC7522 VOAC7523.



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 product 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 products mentioned herein may be the trademarks of their respective owners.
- ◇ For questions about this product, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors.

Revision History

- ◇ February 2010 : 1st edition
- ◇ January 2011 : 2nd edition



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 cord.**

Continued use under these circumstances may result in electric shock or fire. Turn off the power, disconnect the plug and contact an Iwatsu service location (see "Service Network listed at the end of this manual or our sales distributors") for repairs. Repairing the product yourself is dangerous, so do not attempt to do so under any circumstances.

- **Ensure that water does not get on or inside the product.**

Do not use the product if this happens. Failure to observe this precaution may result in electric shock or fire. If water gets on or inside the unit, immediately turn off the power, unplug the power cord and contact an Iwatsu service location (see "Service Network listed at the end of this manual or our sales distributors") for repairs.

- **Do not touch the power cord plug with wet hands**

This may result in an electric shock.

- **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, turn off the power, unplug the power cord and contact an Iwatsu service location (see "Service Network listed at the end of this manual or our sales distributors") for repairs.

- **Do not remove the cover or panels.**

The product contains high-voltage components, which if touched, may result in electric shock. Contact an Iwatsu service location (see "Service Network listed at the end of this manual or our sales distributors") when carrying out inspections, calibrations or repairs.

- **Be careful when taking high-voltage measurements.**

Coming into contact with high voltages during measurements may result in electric shock.

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

Failing to use a 3-prong power cord may result in electric shock 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.

**Warnings (Continued)****● Use the product at a specified supply voltage.****Table 1. Power voltage range**

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

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

* AC100V, AC220V and AC240V are options.

● 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 fire or electric shock. If the power cord is damaged, contact an Iwatsu service location (see "Service Network listed at the end of this manual or our sales distributors") for repairs.

- 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.

● Do not attempt to modify the product.

This may result in electric shock, fire or malfunction.

Requests to repair the unit may be refused if unauthorized modifications have been made.

● If lightning occurs in the vicinity, unplug the power plug.

Lightning may cause electric shock, fire or malfunction.

● Ensure that there is no dust, etc., adhered to the power plug prior to plugging it in. In addition, unplug the power plug and adapter every six months to a year to inspect it and clean it.

Neglecting to do may result in electric shock, fire or malfunction.

● Be sure to use the screwdriver supplied with the unit when making adjustments.

Using a metal driver may result in electric shock or malfunction.



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. 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 product. 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)

- **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 $\pm 500\text{V DC}$. 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.

Table 2. Maximum permissible input

Item measured	Input terminal	Range	Max. permissible input
DC voltage measurement	V- Ω \rightarrow $^{\circ}\text{C}$ \cdot Hz HI-LO	50mV* ³ to 5V	$\pm 800\text{V}$ (continuous) $\pm 1100\text{V}$ (1 min.)
		50V to 1000V	$\pm 1100\text{V}$ (continuous)
	V- (CH-B*) HI-LO and CH_A LO_CH-B LO	5V, 50V, 300V	$\pm 300\text{V}$ (continuous)
AC voltage measurement	V- Ω \rightarrow $^{\circ}\text{C}$ \cdot Hz HI-LO	All ranges	780V rms or $\pm 1100\text{V}_{\text{peak}}$ (continuous)
Resistance measurement	V- Ω \rightarrow $^{\circ}\text{C}$ \cdot Hz HI-LO	All ranges	$\pm 500\text{V DC}$
	4W Ω SENSE HI-LO ** ²		
DC current measurement	500mA-LO	5mA to 500mA range	500mA DC or rms/250V (continuous) * ⁴
AC current measurement	10 A-LO	10A range	10 A DC or rms/250V (continuous) * ⁴

*1 VOAC7520H/7523H Only

*2 VOAC7521H/7522H Only

*3 VOAC7522H/7523H Only

*4 If the voltage of the measured circuit is over 250V, the current can not be measured.

- **Turn the switch off prior to connecting/disconnecting the power cord.**

Connecting or disconnecting the cord while the power is on may result in electric shock or malfunction.

- **Prior to attaching an optional unit to this device, be sure to switch the power off and unplug the power cord.**

Attaching an optional unit to the multimeter while the power is on may result in electric shock or malfunction.

Read the following pages to ensure safety.



Cautions (Continued)

- **When unplugging the power cord, pull on the plug itself.**
Pulling the power cord may result in damage, electric shock or fire.
- **When connecting cables to the multimeter, pull them carefully so as to avoid toppling the multimeter.**
Toppling the multimeter may result in electric shock, injury or fire.
- **Do not use damaged cables or adapter.**
Using damaged cables or adapter may result in electric shock or fire.
- **The tip of the measuring lead is sharp to facilitate measurements. Be careful not to inadvertently prick your finger, etc.**
- **Do not use the multimeter if it is damaged.**
Using the multimeter when damaged may result in electric shock or fire. If damaged, contact an Iwatsu service location (see "Service Network listed at the end of this manual or our sales distributors") for repairs.
- **Do not place the multimeter 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 the multimeter.**
Doing so will cause the cover to come into contact with the internal circuitry, which may result in electric shock, fire or malfunction.
- **Use the multimeter only within the specified operating ranges.**
Using the multimeter outside of the operating ranges may cause malfunction. The permissible humidity and temperature ranges are as follows.
Temperature: 0°C to +50°C
Humidity: Max. 80% RH (0°C to +40°C)
Max. 70% RH (+40°C to +50°C)
- **If the multimeter remains unused for a long period, unplug the power cord for safety's sake.**
- **When transporting the multimeter, use the original packing materials or comparable materials.**
Excessive vibration or shock applied to the multimeter during transportation may cause it to malfunction, resulting in fire. If you do not have appropriate packing materials or padding, contact an Iwatsu service location (see "Service Network listed at the end of this manual 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.

Confirmation of the packaging contents

Once you receive the product, check the contents of the package. 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 products and goods

• Main unit	• • • • • • • • • • 1
• Accessories	
Fuses for current measurement	• • • • • • • • • • 2 pieces for each (500mA, 15A)
(The following accessories are storage in the main body to another.)	
Test leads	• • • • • • • • • • 1 couple
Screw drive	• • • • • • • • • • 1
Power code	• • • • • • • • • • 1
Code strap	• • • • • • • • • • 1
Instruction manual (CD)	• • • • • • • • • • 1
User's Guide	• • • • • • • • • • 1
Clear file	• • • • • • • • • • 1

Fuses for current measurement



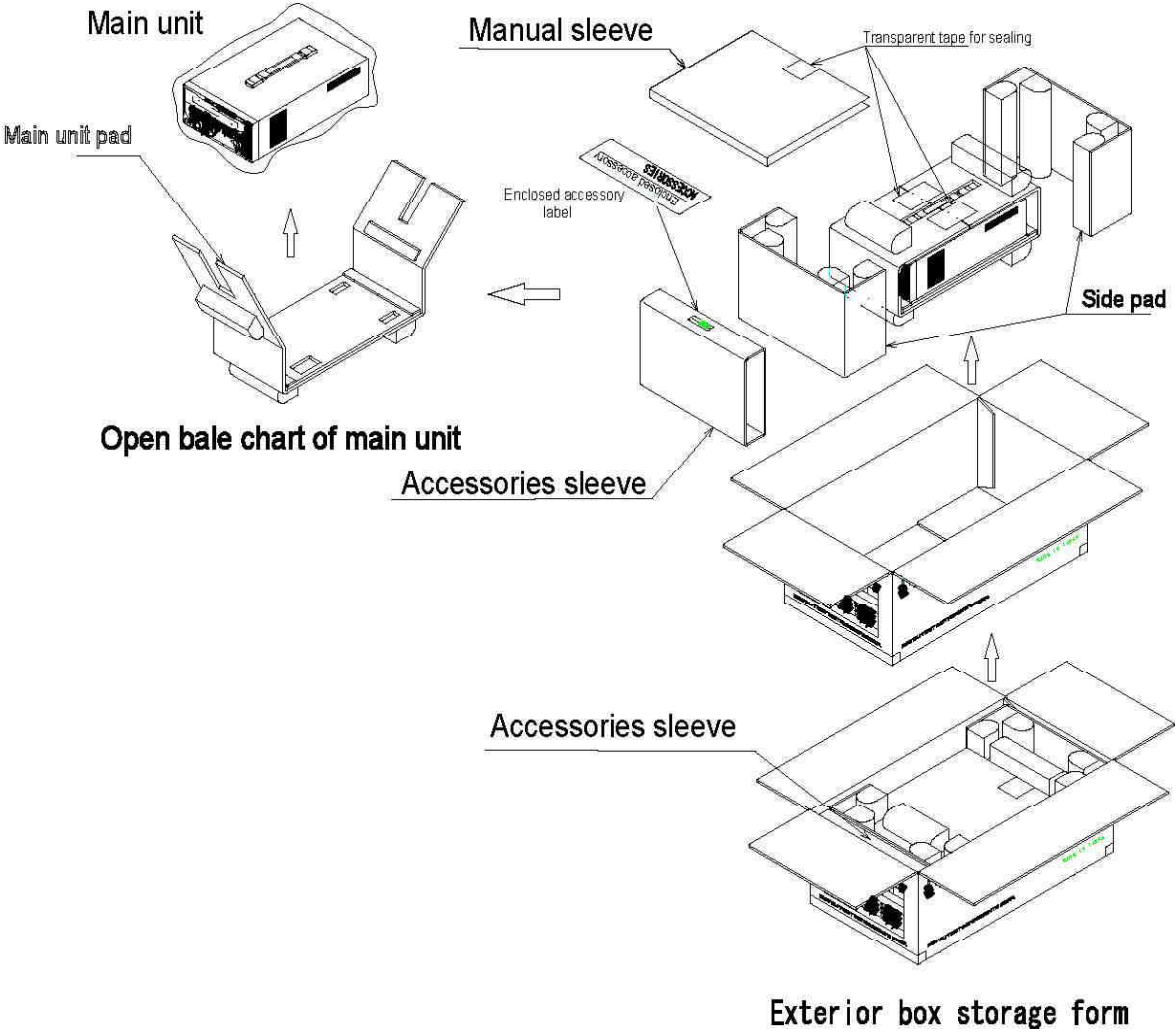
Test leads



Screw drive



Open bale chart (Main unit & Accessories)



Management of products


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

Repair and return of repair goods



Please send it back 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 product name, the serial number (The label is pasted to the back of this product), and a defective content and the person in charge clearly before sending back the repair goods.

Views and symbols used in this manual

- The operation key that exists in the operating procedure etc. of each paragraph is shown by the image data.

Example : [DCV]key is shown by  .

- The function of 2nd function is shown under the operation key in the front panel by a blue character. When the function operation of 2nd function key is explained, it shows like the example of the following. Previously push [2nd] key, next, the key to the correspondence is pushed.

Example :  + 

- Like the example of the following in the paragraph where it explains the measurement function in order of the function (usage and feature) and the connection method, the operating procedure, and attention, etc is usually explained.

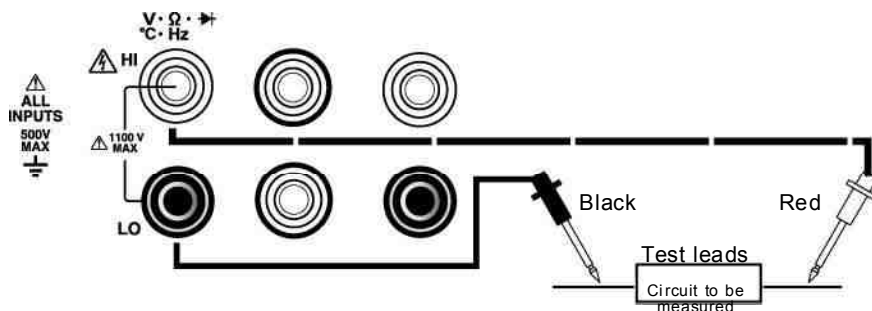
Example : Direct current voltage measurement(DCV)

The measurement range of the direct current voltage becomes five ones (VOAC7522H/7523H is six ones from 50mV to 1000V) from 500mV to 1000V.

◆ Pre-operation preparation





Connection

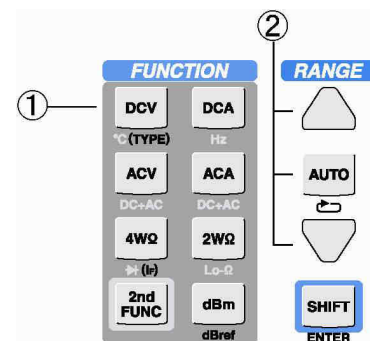
Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the black measuring lead to the LO terminal and the circuit being measured.
- Connect the red measuring lead to the V·Ω·Hz·°C·Hz terminal and the circuit being measured.

Operating procedure

- Press the  key to cause it to light up.
- Press the  key or the  and  keys to select the optimum range.



CAUTION!!

- ◇ In low voltage (500mV range or below) measurements, sensitivity is high. Therefore, sufficient attention must be paid to noise and thermo electromotive force in the measurement system.

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Chapter 1 Overview

1.1 Features

Simple operation

The VOAC7520 / VOAC7521A / VOAC7522H / VOAC7523H are 5-1/2 digit multimeters.

Frequently used operations can easily be performed by one-touch operation.

Logging function

The long interval measuring function and timestamp function make monitoring over a long interval possible.

Measurement data is stored internally, and can be read by the multimeter itself or an external PC.

Various calculation functions

Solutions such as standard deviation, screening and monitoring of data following unit conversion (V to A etc.) by scaling, statistics and comparator calculation functions can only be rendered by the main unit.

An external alarm (LED or lamp) can be driven by the comparator results by attaching a DIO board.

Ethernet interface

An Ethernet environment enables a long-range distributed system to be created – something not possible with GP-IB.

GP-IB SC-303A compatible mode

The multimeter has an SC-303A compatible mode that makes use of the GP-IB program used in previous models, making them easily replaceable.

1.2 Comparison of functions between series

The following table shows a comparison of the functions between the VOAC7520H, VOAC7521A, VOAC7522H and VOAC7523H digital multimeters.

Function \ Model	VOAC7521H VOAC7522H	VOAC7520H VOAC7523H
DC voltage measurements (DCV) *2)	○	○
AC voltage measurements (ACV, (DC+AC) V) *3)	○	○
DC current measurements (DCA)	○	○
AC current measurements (ACA, (DC+AC) A)	○	○
Two terminal resistance measurements (2WΩ) and low power resistance measurements (Lo-Ω)	○	○
Four terminal resistance measurements (4WΩ)	○	—
Temperature measurements (°C)	○	○
CH-B DC voltage measurements	—	○
Frequency measurements (Hz)	○	○
Diode measurements	○	○
dB measurements	○	○

Note 1) ○ : Supported — : Not supported

2) DCV measurement ranges can be selected from 50 mV to 1000V for

VOAC7522H/7523H and from 500 mV to 1000 V for VOAC7520H/7521H.

- 3) ACV measurement is ensured under the limits of 300 kHz for VOAC7522H/7523H, and under the limits of 100 kHz for VOAC7520H/7521H.

1.3 Options and accessories (Details will be explained in Chapter 7)

Options

Ethernet unit	SC-351 (mountable in SLOT A)
Digital I/O unit	SC-352 (mountable in SLOT B)
GP-IB unit	SC-353 (mountable in SLOT A)
D/A converter unit	SC-354 (mountable in SLOT B)

Accessories

SC-003	30kV DC high-voltage probe (usable in DMM $Z_{in} = 10M\Omega$ range)
SC-004	Shielded cable for high-resistances of $100M\Omega$ or less
SC-005	Four-terminal resistance measurement cable
SC-011	200A DC, 150A AC clamp-on current probe
SC-0107	Sheathed thermocouple (Type-K)
SC-0116	Static surface thermocouple (Type-K)
SC-020	Test leads (replacement for standard accessory, 1 red and 1 black lead per set)
SC-021	Arrow-shaped clips for use with SC-020
SC-022	Alligator clips for use with SC-020
SC-023	Alligator clips (H) for use with SC-020
SC-026	Arrow-shaped clips (SC-020 exclusive use)
SC-525	USB-RS convertor
	Instruction manual (Paper medium)

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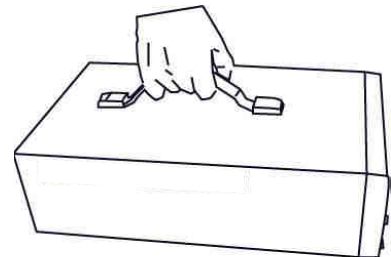
Chapter 2 Basic Operation

2.1 Operating precautions

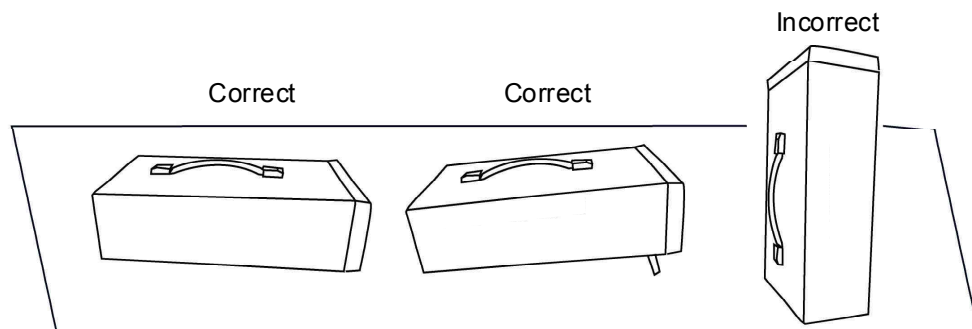
2.1.1 Prior to use

Prior to using this product, confirm the following items:

- **Operate the multimeter within the specified operating range.**
Operating the multimeter outside the specified range may cause it to malfunction. The permissible temperature and humidity ranges are as follows.
Indoor use only:
Temperature: 0°C to +50°C (condensation not permitted)
Humidity: Max. 80% RH (0°C to +40°C); max. 70% RH in 40°C to 50°C range
- **Do not place the multimeter 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 the multimeter.**
Doing so may cause the cover to come into contact with the internal circuitry, which may result in electric shock, fire or malfunction.
- **Do not place objects near the vents.**
Doing so will trap heat inside the multimeter, which may result in fire or malfunction.
- **Maintain space around the rear and sides of the multimeter.**
When placing the multimeter in a rack mount or on top of other measuring devices, be careful of a rise in temperature. This may adversely affect operability and function. For further information, contact IWATSU TEST INSTRUMENTS CORPORATION listed at the end of this manual or our sales distributors.
- **If the multimeter falls, the impact may cause personal injury or damage to the unit.**
When carrying the multimeter, always disconnect the cables and grip the center of the handle firmly to avoid dropping it.



- **Installation of the multimeter**
Always install the instrument horizontally or using the stand as shown in the figures below. When using the stand, pull the legs toward the front panel and lock them as shown in the figure below. Do not place the multimeter on its side.



2.2 Turning the power on and completing measurements

Caution

- ◆ When connecting the power cord, be sure to obey the following to prevent danger:
 - Use with the power voltage set to the center voltage displayed near the AC LINE INPUT on the rear panel of the multimeter.
 - Use the 3-prong power cord supplied with the unit.
 - When using a 200V power system, use a 3-prong power cord (option) for 200V systems (250V rating).

- ◆ When turning the power on:
 - ① Make sure that the power switch is off.
 - ② Insert the power cord plug in the inlet at the back of the unit.
 - ③ Insert the power cord power plug into an AC outlet.
 - ④ Turn the power switch on.

- ◆ When turning the power off:
 - Do not turn the power off while the voltage and current is being applied to the measuring terminals. Turn the power switch off.

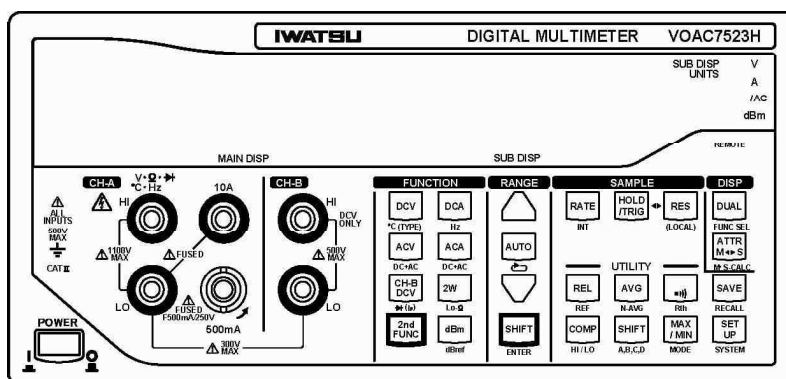
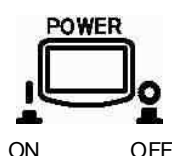
A brief note

The multimeter's panel settings can be configured to the factory default settings or the previous settings when the unit was switched off immediately after turning the power on (see 4.9, System settings).

Turn the POWER switch ON.

The message, "VOAC752XH x.xxx" will be displayed.

"x.xxx" represents the software version and X represents the last number of model numbers.



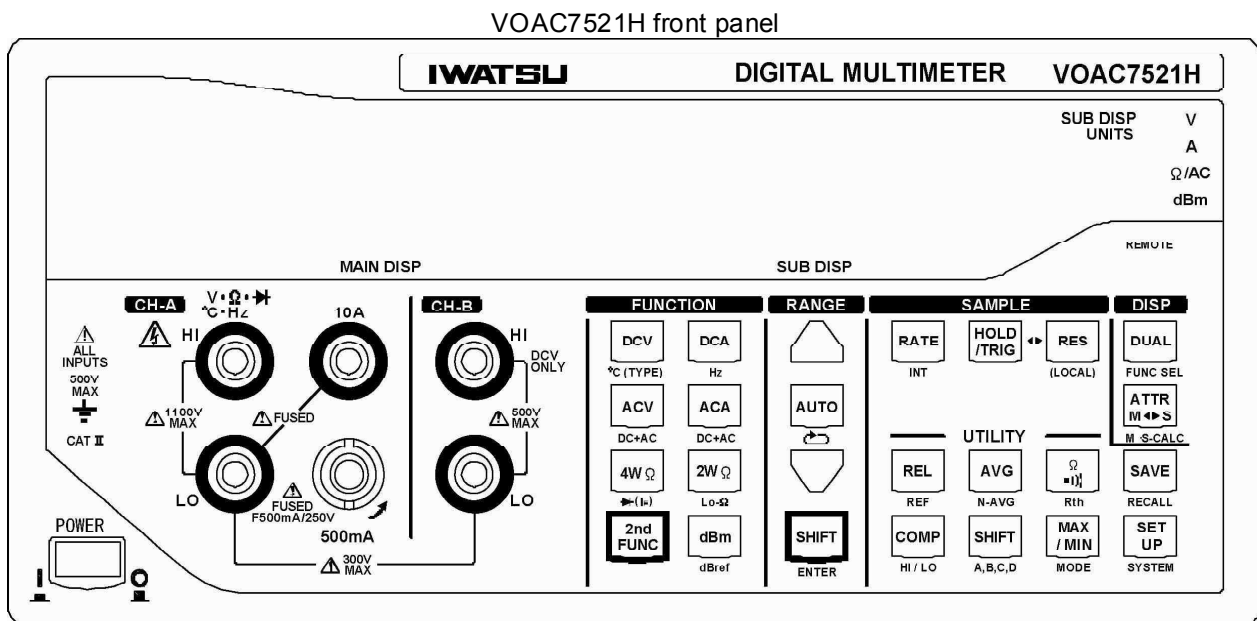
2.3 Panel description and key operations

This section describes the multimeter's panel and key operations. Below, we describe the labels, operations and functions on the front and rear panels.

2.3.1 Front panel (VOAC7521H/7522H)

The figure below shows the front panel of the VOAC7521H. The display is located at the top of the front panel. Connection terminals are located to the left, and keys are located to the right.

This section gives an overview of the name, operation and function of RANGE and FUNCTION for each key on the front panel.



RANGE

◆DOWN, UP & AUTO

These keys are used to select the measurement ranges for DC voltage/current, AC voltage/current and resistance.

Selecting auto range:



Press the key and it will light up and the optimum range for the input signal will be selected. If key is pressed again in this state, it will switch off, and the range will revert to manual range.

Selecting manual range:





Press the key. When in auto range, the key will switch off, and the range will increase one step and then revert to manual range.



Press the key. When in auto range, the key will switch off, and the range will decrease one step and then revert to manual range.

*For temperature and diode measurements, the range is fixed. For frequency measurements, the range is fixed by auto range.

- When manually configuring an unknown value, press the  key several times until it reaches the maximum range and then press the  key successively to select the optimum range.

SAMPLE



◆HOLD/TRIG: Hold/Trigger

This key holds a measurement operation. Pressing the  (TRIG) key once while in hold mode causes a single measurement to be made.

◆RES (LOCAL): Reset/Local


This cancels the measurement operation hold. While in GP-IB remote mode, this key operates as the LOCAL key. However, when operating under the LLD (Local Lockout) mode, the unit will not return to local mode.

◆RATE/INT

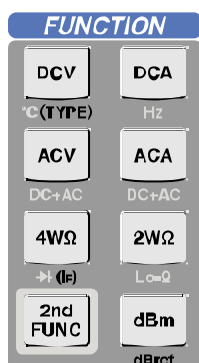


Each time this key is pressed, the sample rate (i.e., the number of samples per second) changes from SLOW to MID to FAST.



(INT) Pressing the INT key while the  key is flashing enables the measurement interval (0 to 3000 sec) to be set.


FUNCTION



◆DCV, ACV, 2WΩ, 4WΩ, DCA, ACA, dBm

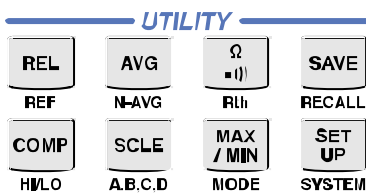
The function currently being used lights up.

◆2nd FUNC

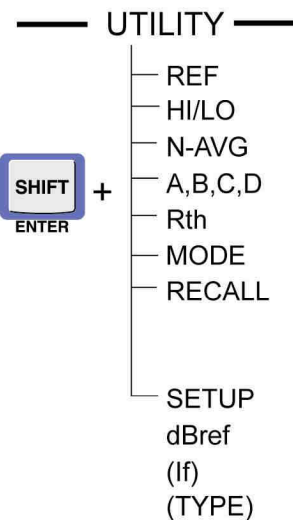
By pressing a function key after lighting the  key up, the multimeter will operate according to the function in white text (i.e., °C, Hz, (DC+AC) V, diode and Lo-Ω).

Basic Operation

UTILITY



There is a rugged item from which the UTILITY menu has been described to be described to each key to the above figure under the item and the key by a blue character.



◆SHIFT



The **SHIFT** key is used to change to shift mode (UTILITY menu). The content of the UTILITY menu set in the shift mode has the one in a right picture. The function can be selected by pushing the key that

corresponds with **SHIFT** key has blinked.



By pressing the **SHIFT** (ENTER) key, the multimeter will revert to normal mode from shift mode.

◆REL/REF

The REL (relative value) calculation outputs data for the measurement value and reference value differential. REF sets the reference value.

◆AVG/N-AVG

AVG switches the AVG calculation on and off.
N-AVG: It sets the average frequency.

◆Ω buzzer sound/Rth

This key is used to carry out a continuity test when using the 2WΩ/4WΩ function for a resistance measurement. .
Rth sets the reference resistance value at which the buzzer sounds.

◆SAVE/RECALL

SAVE saves the measurement data. The light shuts off when the data has been saved.
RECALL recalls saved data.

◆COMP/HI/LO

COMP compares the setting range or allowable setting range previously set by the user with the measurement value X.
HI/LO sets the setting range or allowable setting range of a comparator calculation.

◆SCLE/A, B, C, D

SCLE carries out calculations of $((X-A) * B / C \text{ or } D/X)$ between the constants A, B, C and D previously set by the user and the measurement value X.

A, B, C, D configures the constants A, B, C and D.

◆MAX/MIN/MODE

MAX/MIN obtains the maximum, minimum, average and standard deviation for the measurement results of the specified number or the calculation results.

MODE specifies the number of data samples and the measurement mode (single, repeat, continuous and OFF).

◆SETUP/SYSTEM

SETUP implements save/recall and initialize in the setup menu

SYSTEM enables the multimeter's panel settings and output conditions to be configured via the SYSTEM menu immediately after turning the power on.

◆dBref

- Panel settings immediately after the power is switched on
- The interval setting until the unit switches to power-saving mode
- Remote control I/F setting
- Beep sound setting
- Optional I/F setting
- Auto range settings of Voltage and Resistance measurements
- Voltage check settings of the resistance circuit measurements

This enables dBm/dBV calculations by DCV, ACV, $DC + ACV$. The reference value at this time can be changed according to the application.

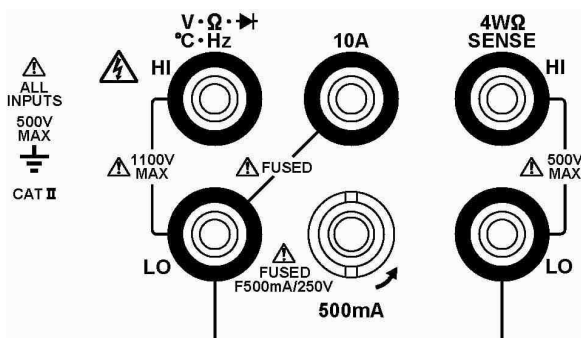
◆(IF)

Selects the forward current (If) during a diode measurement

◆(TYPE)

Specifies the type of thermocouple when taking a temperature measurement (°C)

Measurement terminals



Basic Operation

◆LO

These are shared measurement terminals for input signals. Connect the black test lead. When making $4W\Omega$ measurements, this is the Lo side terminal source of the measurement current.

◆V· Ω · \rightarrow · $^{\circ}C$ ·Hz

This is a shared measuring terminal for voltage, resistance, diode, temperature and frequency measurements. When making $4W\Omega$ measurements, this terminal is the HI side terminal source of the measurement current.

◆500mA/10A

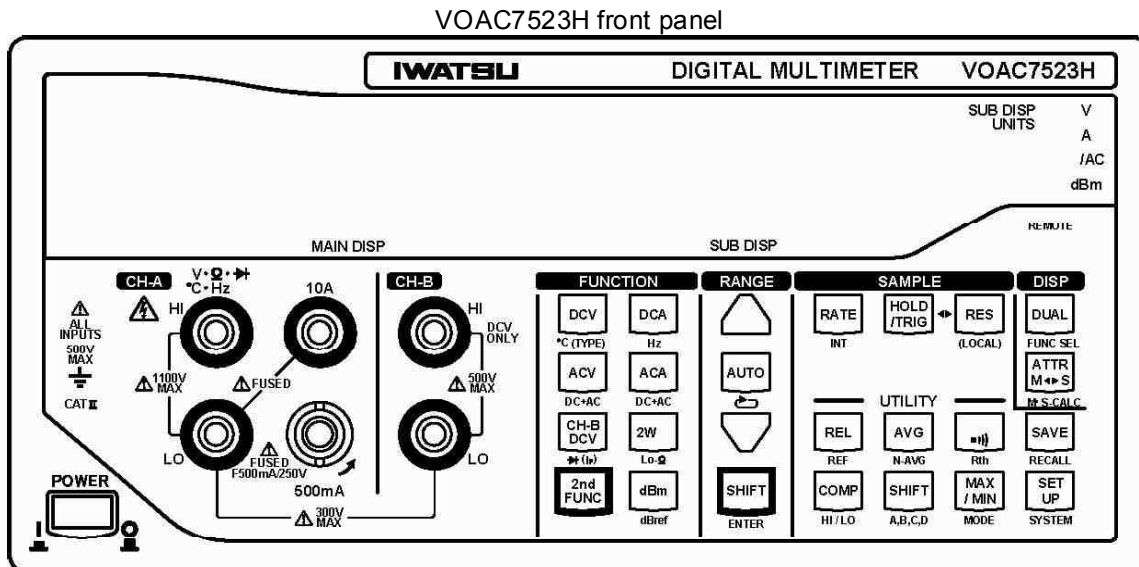
This terminal is the HI terminal for current measurements. When using the current measurement function, this terminal is protected by 500mA/15A fuses.

◆4W Ω SENSE HI/LO

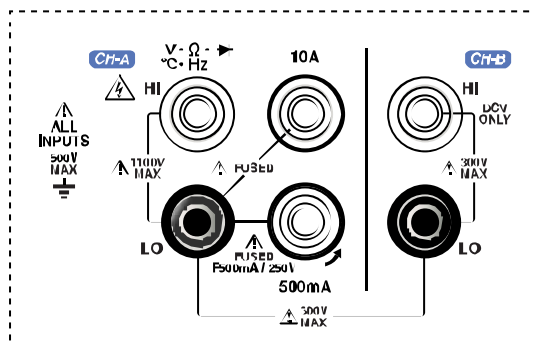
These are the HI/LO side terminals for sensing $4W\Omega$ measurements.

2.3.2 Front panel (VOAC7520H/7523H)

The figure below shows the front panel of the VOAC7523H. A differences with the front panel of the VOAC7520H / 7521H in section 2.3.1 is that **CH-B DCV** replaces the **4WΩ**. The operations are the same, including the **2nd FUNC**.



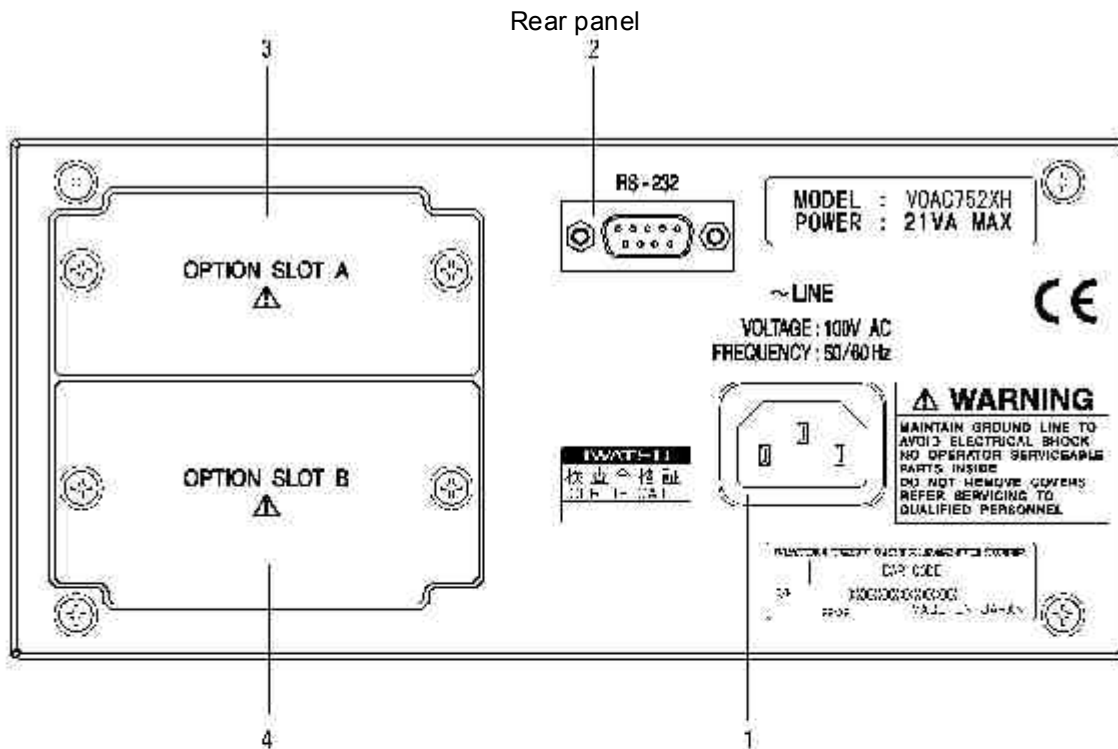
Measurement terminals



◆CH-B DCV ONLY HI/LO

CH-B DC voltage measurements use the HI/LO side terminals.

2.3.3 Rear panel (VOAC7520H / VOAC7521H / VOAC7522H / VOAC7523H)

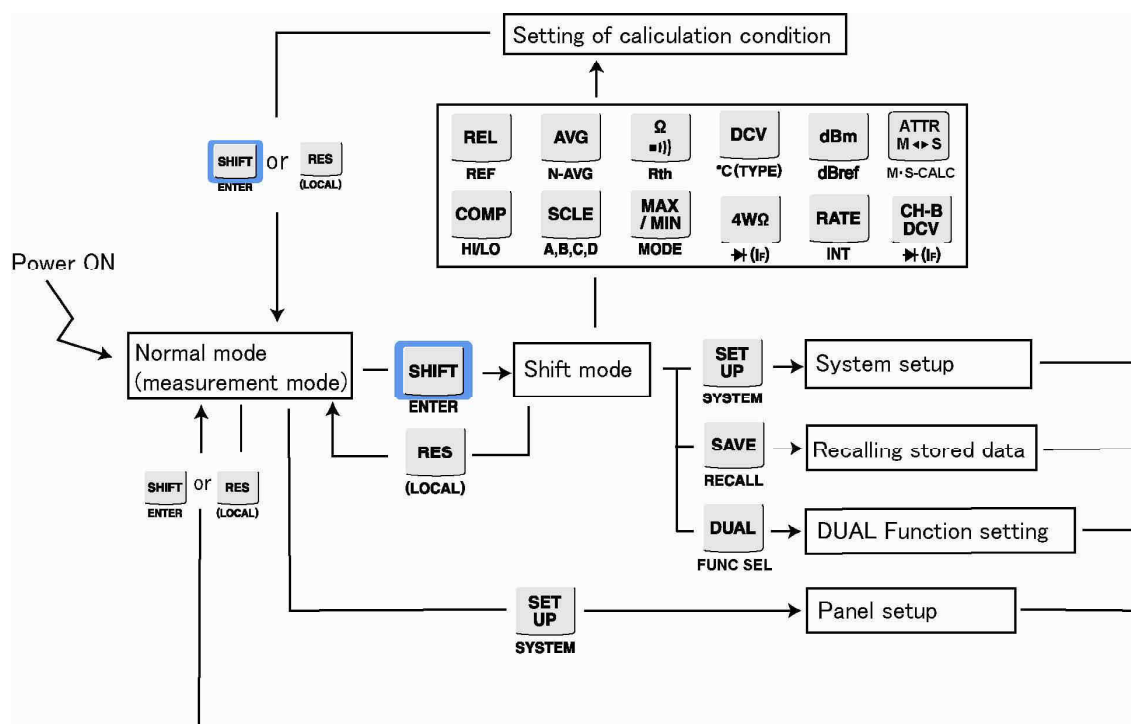


- 1 AC LINE INPUT
Inlet for connecting power cord
- 2 RS-232 connector
- 3 OPTION SLOT A
GP-IB unit, SC-353, or Ethernet unit, SC-351
- 4 OPTION SLOT B
For DIO unit SC-352 (Ext-Trig Comp-Out) or D/A converter SC-354

2.3.4 Operating modes and key operations

Basic operations

- ◆ This product consists of configuring calculation conditions from normal mode and shift mode, recalling stored data, and the operating mode for system setup and panel setup.
- ◇ Figure showing the transitions in state when each key is pressed



◆ Normal mode

This is the mode for carrying out normal measurements. The multimeter enters this mode when the power is switched on. Operations are done using the “one key, one action” keys in black text (see 4.2 Measurement functions).

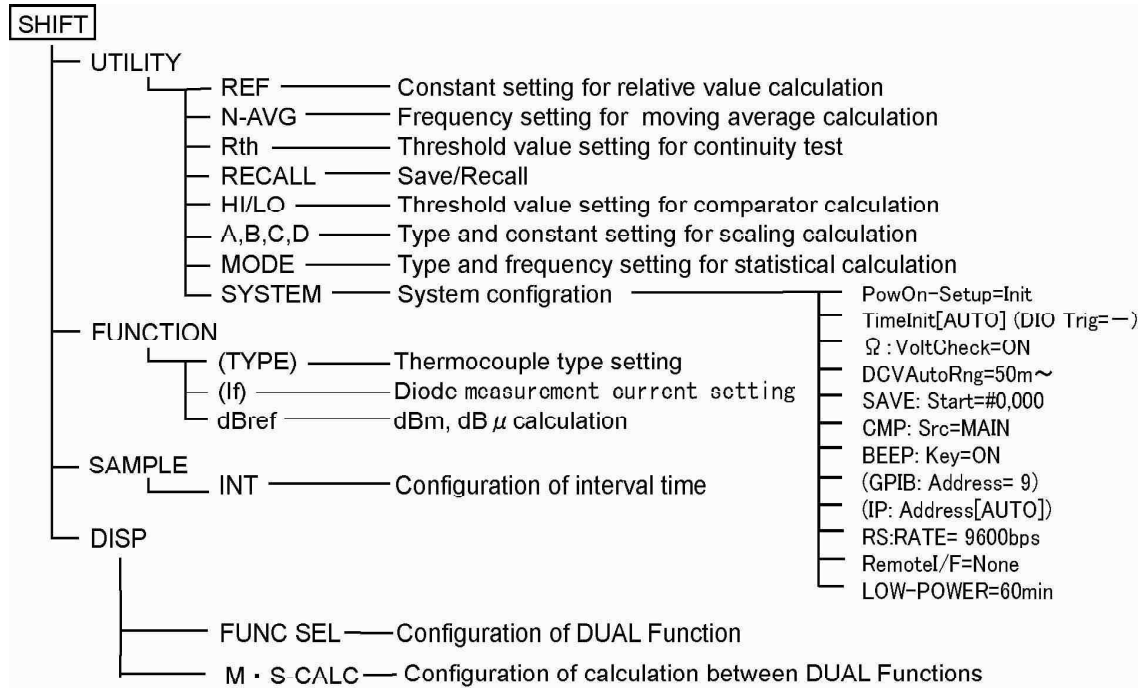
◆ Shift mode

The shift mode is used in configuring calculation conditions, setting up the system setup, and recalling stored data.

RES (LOCAL) Pressing the **SHIFT ENTER** key enables the keys in blue text (see 4.5 Sampling configuration and 4.6 Calculation functions)

Basic Operation

◆ Shift mode menu



2.4 Display

2.4.1 SINGLE / DUAL display

There are two kinds of methods of displaying measurements as follows. Please refer to section 4.3, 4.4 for detailed explanations.

Single FUNCTION : One FUNCTION and the attribute information (FUNCTION, RANGE, and time stamp) are displayed.

Dual FUNCTION : Two functions of MAIN and SUB function (The example: AC voltage and frequency, etc.) are displayed simultaneously.


The example of Over range in single function

The example of Fullscale in single function

The example of Fullscale in dual function

- The 5.5 digit full scale is 509999 counts.
- Functions other than 1000V DC, AC/DC \pm 750V AC range and V, A and Ω are excluded.
- Auto range adjusts the range up when the display exceeds 509999 and adjusts the range down when the display is less than 045000.

2.4.2 Display selection

Single FUNCTION and Dual FUNCTION change whenever  key is pushed.

For details, refer to section 4.3, 4.4.

Memo

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Chapter 3 Operating Principles

3.1 Input signal converter

The VOAC752XH series block diagram is shown below.

The input signal converter converts the input signal of each function into a DC voltage, and sends it to the A/D converter. A frequency measurement involves detecting the input signal and then sending it to the Hz measurement circuit.

The A/D converter converts the input signal to a digital value using a special-purpose LSI and integrator. The controller processes the signal from the A/D LSI and outputs it to the display or an external device. It also processes switch controls and control signals from optional devices.

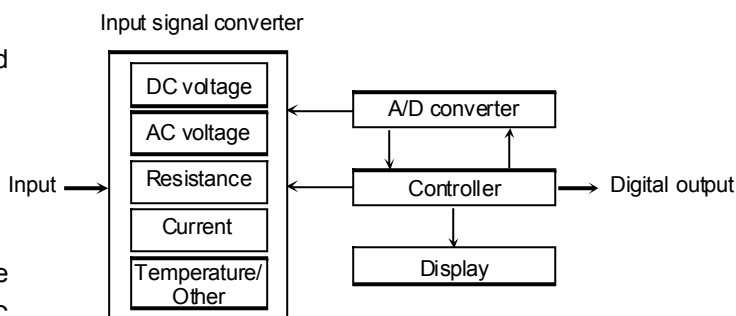
DC voltage input

The DC voltage input is attenuated or amplified to the proper level by a high-precision attenuator and drift compensation amplifier.

AC voltage input

After being attenuated or amplified, AC voltage input is converted to DC voltage by an AC/DC conversion circuit. The VOAC752XH

series AC/DC conversion circuit utilizes a True RMS (root mean square) system. This system obtains true rms values using analog arithmetic processing, enabling high-precision measurements even for highly distorted, non-sinusoidal waveforms, including triangular waves, SCR waves and square waves.



Resistance input

Resistance input is converted to DC voltage by a resistance-DC voltage conversion circuit. This circuit mainly passes a constant current to the resistance being measured, and converts the resistance value to a proportional DC voltage. Even if a voltage is mistakenly applied to the input terminal, there is a protection circuit to prevent damage.

The measurement current is reduced by means of the Lo- Ω function, enabling measurements to be made by slight drops in voltage. When measuring resistance that is connected across a semiconductor (silicon junction), the junction will not switch on, thus enabling measurements to be made as is without isolating the circuit (i.e., in-circuit resistance measurement).

Current input

The DC or AC current to be measured is routed through an internal reference resistor (shunt resistor) for conversion into a DC or AC voltage.

Temperature measurement

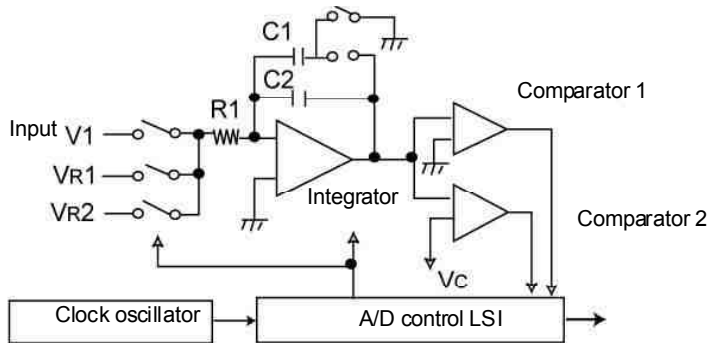
The thermocouple output and the temperature sensor output of the input terminal are linearized by the CPU and converted to temperature after A/D conversion.

3.2 Principles of A/D conversion

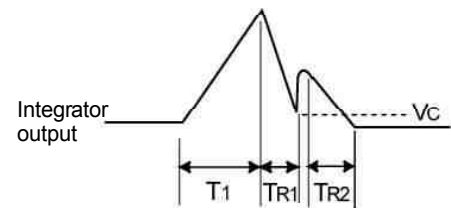
The VOAC752XH series use a new triple integration method, which has all the advantages of double integration, and offers an even larger dynamic range and increased measurement speed. Control is carried out by a microcomputer.

The block diagram is shown below.

Block diagram



Operating waveform



The input voltage (V_1) is integrated for a fixed time period by the integration capacitors (C_1+C_2). Then, the input voltage and the reverse polarized first reference voltage, V_{R1} , are integrated.

After the integrator output drops to the appropriate level, the entire electric charge of the first integration capacitor, C_1 , is transferred to the second integration capacitor, C_2 , increasing the integrator output by a factor of $(C_1+C_2)/C_2$.

Once the electrical charge has been transferred, C_1 is isolated and the second reference voltage, V_{R2} , is integrated. The conversion is completed the instant that the integrator output is sensed to have reached the initial level. The operating waveform is shown in the figure above.

If the integration time of the input voltage (V_1) is T_1 , the integration time of the first reference voltage (V_{R1}) is T_{R1} , the integration time of the second reference voltage (V_{R2}) is T_{R2} , and the integration resistance is R_1 , the electrical charge Q stored in the integration capacitors (C_1+C_2) for time T_1 is,

$$Q = V_1/R_1 \cdot T_1 \dots \dots \dots (1)$$

the electrical charge Q_1 discharged for time T_{R1} is,

$$Q_1 = V_{R1}/R_1 \cdot T_{R1} \dots \dots \dots (2)$$

and the electrical charge Q_2 discharged for time T_{R2} is,

$$Q_2 = V_{R2}/R_1 \cdot T_{R2} \dots \dots \dots (3)$$

and since

$$Q = Q_1 + Q_2 \dots \dots \dots (4)$$

then,

$$V_1 = - (V_{R1} \cdot T_{R1} - V_{R2} \cdot T_{R2}/T_1) \dots \dots (5)$$

The input voltage can be measured by calculating the clock pulse of time T_{R1} and T_{R2} from equation (5) and weighting the reference voltage.

In principle, T_{R1} does not depend on the comparator properties and can therefore be sufficiently accelerated. In addition, since the integrator output is increased by a factor of $(C_1+C_2)/C_2$, it is possible to take extremely precise measurements in the T_{R2} time period.

Integrator drift, etc., is eliminated by the drift compensation circuit of the auto zero circuit shown in the block diagram above. In this way, the multimeter converts input signals to digital quantities, and completely compensates for the drift of active elements involved in conversion.

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Chapter 4 Measurement Methods

◆ Summary

This chapter describes functions and operations.

4.1 Prior to taking measurements

4.1.1 Precautions when connecting test leads

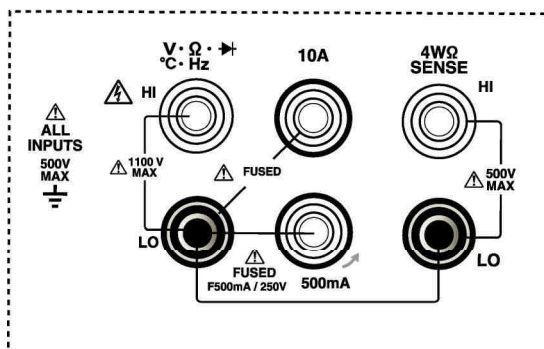
Warning



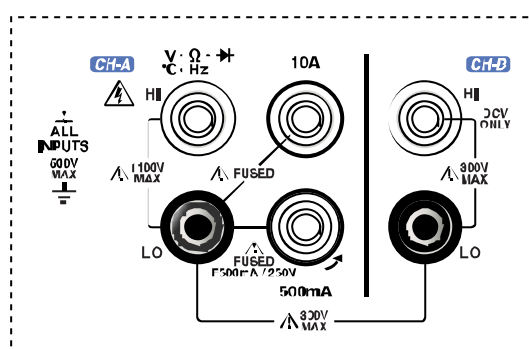
There is a possibility of damage to the multimeter or the device being measured

- Prior to measurement, it is essential to check that the input terminals that connect the function switch and test leads are inserted in the proper position according to the measurement objective.
- When changing the function switch, disconnect the test leads from the circuit being measured.
- Do not input signals that exceed the maximum input voltage or current.

Panel warnings



(VOAC7520H / 7521H)



(VOAC7520H / 7523H)

- **Do not apply voltages or currents to the input terminals that exceed the stipulated level.**

Applying a voltage or current that exceeds the stipulated level may result in fire or malfunction. The maximum permissible inputs are shown in the following table.

Measurement Parameter	Input terminal	Range	Maximum permissible input
DCV measurement	V · Ω · \rightarrow · °C · Hz HI-LO	50mV ^{*3} to 5V range 50V to 1000V range	±800V (continuous), ±1100V (1 minute) ±1100V (continuous)
	V (CH-B*1) HI-LO and CH-A LO ~ CH-BLO	5V, 50V, 300V	±300V (continuous)
ACV measurement frequency	V · Ω · \rightarrow · °C · Hz HI-LO	All ranges	780V rms or ±1100 V peak (continuous)
DCA measurement	500mA-LO	5mA to 500mA range	500mA DC or rms / 250V (continuous) ^{*4}
ACA measurement	10A-LO	10A range	10A DC or rms / 250V (continuous) ^{*4}
Resistance measurement \rightarrow	V · Ω · \rightarrow · °C · Hz HI-LO ^{*2} 4WΩ SENSE HI-LO	All range	±500V DC

*1 : VOAC 7520H / 7523H Only

*2 : VOAC7521H / 7522H Only

*3 : VOAC7522H/7523H Only

*4 : If the voltage of the measured circuit is over 250V, the current can not be measured.

4.2 Measurement functions (FUNCTION)

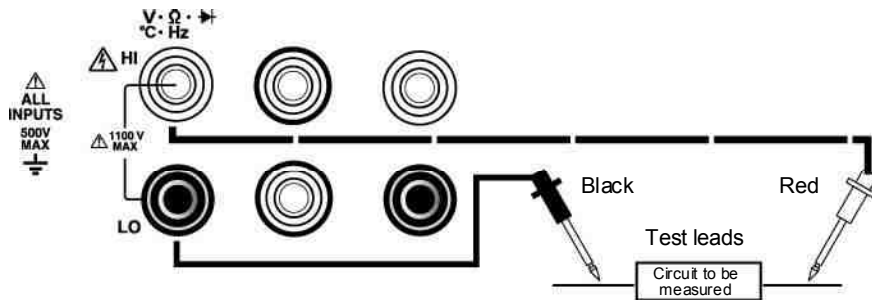
4.2.1 DC voltage measurement (DCV)

Five DCV measurement ranges can be selected from 500mV to 1000V. (from 50mV to 1000V for only VOAC7522H/7523H)

◆ Pre-operation preparation

Connection method

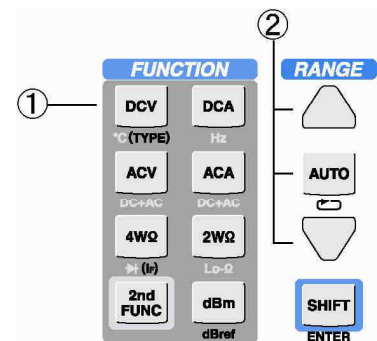
Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the black measuring lead to the LO terminal and the circuit being measured.
- Connect the red measuring lead to the V·Ω·Hz terminal and the circuit being measured.

Operating procedure

- ① Press the **DCV** key to cause it to light up.
- ② Press the **AUTO** key or the and keys to select the optimum range.



CAUTION!!

- ◇ In low voltage (500mV range or below) measurements, sensitivity is high. Therefore, sufficient attention must be paid to noise and thermo electromotive force in the measurement system.
- ◇ The effects of noise can be reduced by anchoring, shielding and reducing the length of the leads and using the AVG calculation.
- ◇ The signal input terminals of this product are made of copper. Connecting leads made of a different material (e.g., iron) will generate thermoelectromotive forces, which may result in imprecise measurements. Therefore, be sure to use copper leads. Even if copper leads are used, thermoelectromotive forces may be generated when thermal equilibrium cannot be attained immediately after connecting to the input terminals. Allow sufficient time after connecting to the input terminals prior to changing settings.
- ◇ The 50mV and 500mV ranges of the DCV function are accurate after REL is switched on. Consequently, when performing measurements of 1μV or less, use the cables included with the product or copper leads, adjust the settings after shorting the input and switch REL on prior to testing.

(The details of the caution note for this section are still described on the following page.)

Measurement Methods

- ◇ When switching to DC measurements after testing currents of 2A or above, adjust the settings after leaving the product on standby until stable at the minimum input (i.e., shorted). Caution is particularly necessary when performing high-sensitivity measurements.
- ◇ In contrast to the response time of about 0.25 seconds/sample for SLOW samples in the 500mV-1000V DC range, the 2 seconds/sample response in the 50mV DC range for the VOAC7522H/7523H is slow. When the 50mV range is unnecessary and a high-speed AUTO range response is necessary, the DC 50mV range can be omitted from the AUTO range. See section 4.10.11 for details.

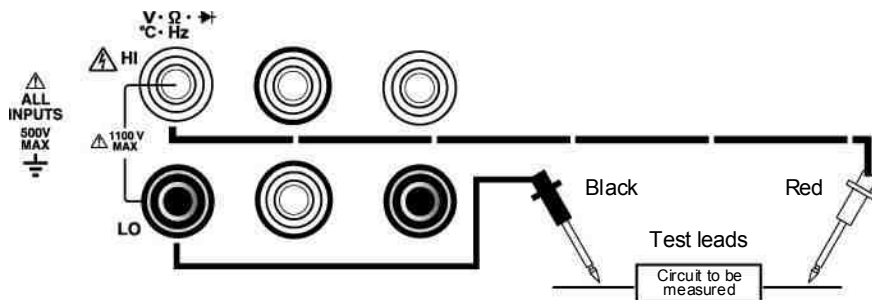
4.2.2 AC Voltage measurements (ACV) and (DC+AC) Voltage measurement (DC+AC) V

Five ACV measurement ranges can be selected from 500mV to 750V and ACV measurements can be made by True RMS (root mean square). This function enables the root mean square of sine waves, triangular waves, SCR waves and square waves to be measured.

◆ Pre-operation preparation

Connection method

Refer to the precautions related to connecting the test leads in 4.1.1

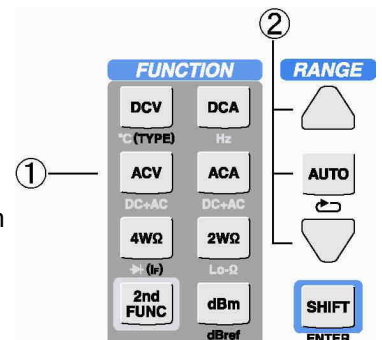


- Connect the black measuring lead to the LO terminal and the circuit being measured. .
- Connect the red measuring lead to the V·Ω·C·Hz terminal and the circuit being measured.

Operating procedure

ACV

- Press the **ACV** key so that it flashes.
- Press the **AUTO** key or the and keys to select the optimum range.



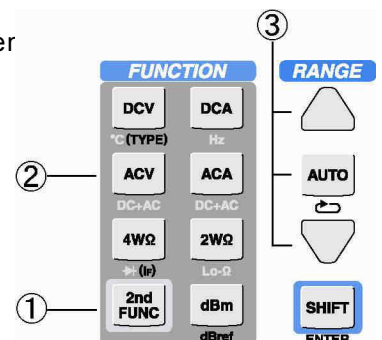
(DC+AC) V

AC voltages superimposed with DC voltages (DC+AC) can be measured.

It is possible to switch between five ranges from 500mV to 750V, and measure RMS (root mean square).

Operating procedure

- Press the **2nd FUNC** key. The key will flash.
- Press the **ACV** key to cause it to light up, and specify (DC+AC) voltage measurements.
- Press the **AUTO** key or the and keys to select the optimum range.



(The details of the caution note for this section are still described on the following page.)

CAUTION!! *Procedure for measuring low-frequency voltages and currents*

- ◇ When the sample rate is SLOW, the time (Settling time) to wait for the stabilization of the internal circuit can be shortened by selecting the appropriate AC filter according to the frequency of the measurement signal. If the AC filter is set to "200Hz —" when the frequency of the measurement signal is 200Hz or more, the change of the range and Function becomes high-speed. Please refer to section 4.10.12 for details. Still, when the sample rate is MID/FAST, the AC filter is fixed to "200Hz —".
- ◇ The display might be uneven according to the input signal though it is enough in regulated accuracy in the measurement of a low frequency (about 15Hz-40Hz). In this case, a steady measurement can be done by averaging the unevenness in using the AVG calculation. Please set the AVG frequency as required.
- ◇ When switching to DC measurements after testing currents of 2A or above, adjust the settings after leaving the product on standby until stable at the minimum input (i.e., shorted). Adequate caution is particularly necessary when taking high-sensitivity measurements.

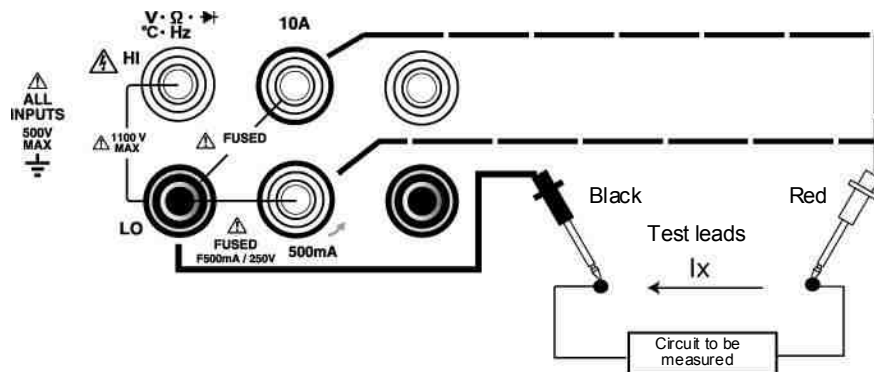
4.2.3 DC current measurements (DCA)

Three DC current measurements ranges can be selected from 5mA to 500mA. In addition, the 10A range enables DC currents to be measured by switching the input terminals.

◆ Pre-operation preparation

Connection method

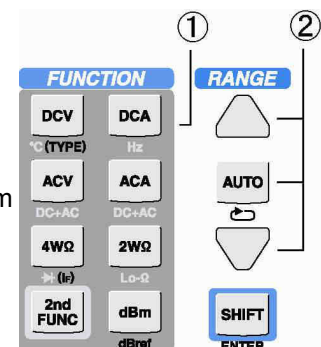
Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the black measuring lead to the LO terminal and the red lead to the 500mA terminal or the 10A terminal.
- Turn off the circuit being measured and serially connect the tips of the test leads to the circuit.

Operating procedure

- ① Press the **DCA** key to cause it to light up and specify **DCA**.
- ② Press the **AUTO** key or the and keys to select the optimum range.



CAUTION!

- ◇ Be aware that the permissible input current differs according to the measurement range.
- ◇ The input terminals for the 5mA to 500mA range and the 10A range differ, so make sure that test lead connections are consistent with the range setting.
- ◇ The input terminals for the 5mA to 500mA range and the 10A range differ, so auto range operations can not be done among these ranges. The auto range measurements can be done only for the 5 mA to 500mA range. If the 10A range is setted, the auto range measurements can not be done.
- ◇ For inputs of 2A or higher, the temperature of the input terminals and inside the device rises, possibly affecting other functions. When measuring after measuring currents of 2A or higher, particularly high-sensitivity measurements, take measurements using the following guidelines.
 - Current measurements should be taken after keeping the multimeter in standby until with the terminals open.
- ◇ If the voltage of the measured circuit is over 250V, the current can not be measured.

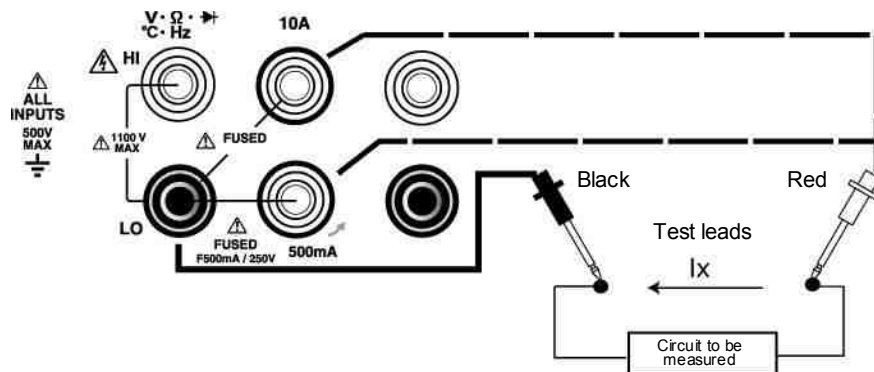
Measurement Methods

4.2.4 AC current measurements (ACA) and (DC+AC) current measurements ((DC+AC)A)

Three ACA measurement ranges can be selected from 5mA to 500mA. In addition, the 10A range enables AC currents to be measured by switching the input terminals and using True RMS (root mean square) in the analog calculation mode. This function enables the root mean square of sine waves, triangular waves, SCR waves and square waves to be measured.

Connection method

Refer to the precautions related to connecting the test leads in 4.1.1

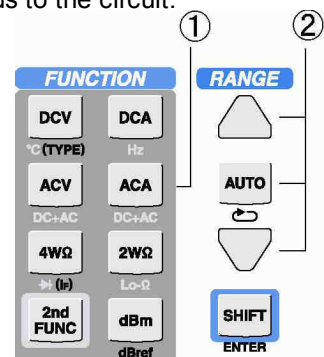


- Connect the black measuring lead to the LO terminal and the red lead to the 500 mA terminal.
- Turn off the circuit being measured, and serially connect the tips of the test leads to the circuit.

Operating procedure

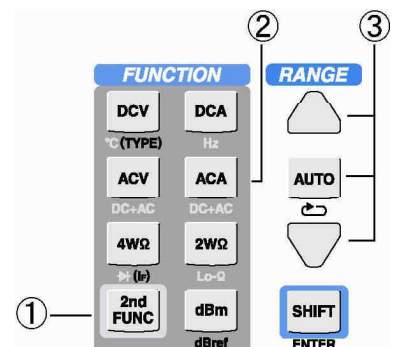
AC A

- Press the **ACA** key to cause it to light up, and specify **DC+AC**.
- Press the **AUTO** key or the and keys to select the optimum range.



(DC+AC) A

- Press the **2nd FUNC** key. The key will flash.
- Press the **ACA** (DC+AC) key so that the **DC+AC** and **2nd FUNC** keys light up and specify (DC+AC) current measurements.
- Press the **AUTO** key or the and keys to select the optimum range.



(The details of the caution note for this section are still described on the following page.)

CAUTION!!

- ◇ Be aware that the permissible input current differs according to the measurement range.
- ◇ The input terminals for the 5mA to 500mA range and the 10A range differ, so make sure that connection of the test leads is consistent with the range setting.
- ◇ The input terminals for the 5mA to 500mA range and the 10A range differ, so auto range operations can not be done among these ranges. The auto range measurements can be done only for the 5 mA to 500mA range. If the 10A range is setted, the auto range measurements can not be done.
- ◇ For inputs of 2A or higher, the temperature of the input terminals and inside the device rises, and may affect other functions. When measuring after measuring currents of 2A or higher, particularly high-sensitivity measurements, take measurements after the temperature inside the multimeter has stabilized. Current measurements should be taken after keeping the multimeter in standby until with the terminals open.
- ◇ If the voltage of the measured circuit is over 250V, the current can not be measured.
Procedure for measuring low-frequency voltages and currents
- ◇ When the sample rate is SLOW, the time (Settling time) to wait for the stabilization of the internal circuit can be shortened by selecting the appropriate AC filter according to the frequency of the measurement signal. If the AC filter is set to "200Hz—" when the frequency of the measurement signal is 200Hz or more, the change of the range and Function becomes high-speed. Please refer to section 4.10.12 for details. Still, when the sample rate is MID/FAST, the AC filter is fixed to "200Hz—".
- ◇ The display might be uneven according to the input signal though it is enough in regulated accuracy in the measurement of a low frequency (about 15Hz-40Hz). In this case, a steady measurement can be done by averaging the unevenness in using the AVG calculation. Please set the AVG frequency as required.

Measurement Methods

4.2.5 Resistance measurements

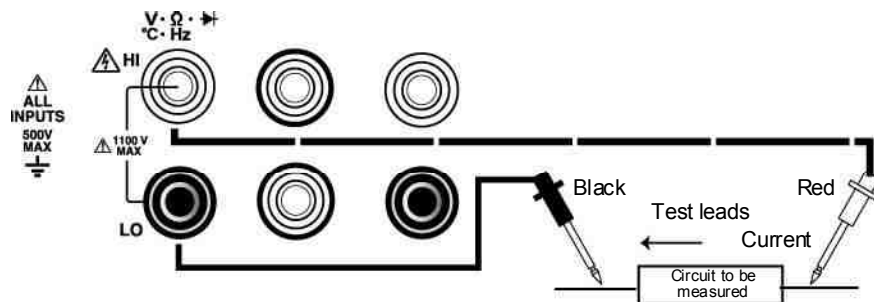
4.2.5.1 Two-terminal resistance measurements (2W Ω) & low-power resistance measurements (Lo- Ω)

This function measures resistance using two test leads. Measurements can be taken by switching between eight ranges in the 50 Ω to 500M Ω range. Measurement values contain errors due to resistance from the test leads themselves and contact resistance. Such errors can be cancelled by shorting the tips of the test leads beforehand and carrying out the measurements with the relative value calculation on.

◆ Pre-operation preparation

Connection method

Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the black measuring lead to the LO terminal and to one side of the resistor to be measured.
- Connect the red measuring lead to the V· Ω ·Hz·°C·Hz terminal and to the other side of the resistor to be measured.
- The current passes from the HI terminal to the LO terminal.

Operating procedure

2W Ω

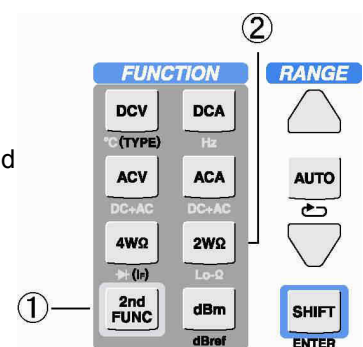
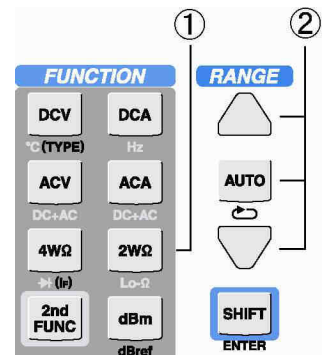
① Press the **2W Ω** key to cause it to light up and specify 2W Ω .

② Press the **AUTO** key or the and keys to select the optimum range.

Lo- Ω

① Press the **2nd FUNC** key to that it flashes.

② Press the **2W Ω** key to cause the **2nd FUNC** and **2W Ω** keys to light up and specify Lo- Ω .



(The details of the warning and caution note for this section are still described on the following page.)

Warning

- ◇ Applying voltage to the resistance measurement terminal immediately after switching to the resistance measurement function from another function may result in damage. Therefore, use adequate caution.

To prevent damage, this product has a protective function that automatically measures the voltage under (DC+AC)V and displays a message if it detects a high voltage. The default setting for this voltage check function is ON. To switch this function off, change the VoltCheck system setting to OFF. Refer to section 4.10.10 for details and the procedure for switching the function off.

If a voltage exceeding approximately 100V is detected by the (DC+AC)V function, “!Voltage_Detect” will be displayed and the product will forcefully return to the original function. However, this protective operation is not guaranteed for voltages with high frequencies or large peaks that are not guaranteed by (DC+AC)V. In addition, measurements cannot be taken correctly under conditions in which voltage is applied to the resistance being tested. Therefore, when measuring resistance within a circuit, make sure that voltage is not being applied to the resistance being tested.

CAUTION!!

- ◇ Anchor the test leads when measuring high resistances. The AVG calculation and the shortening and shorting of the cables are effective in minimizing the effects of humming noise.
- ◇ The product is subject to the effects of contact resistance from the test leads and thermoelectromotive forces from the input terminals in low-resistance measurements. Therefore, use the product after the measurement readout has stabilized following connection.
- ◇ When switching to a resistance measurement after measuring a current of 2A or above, do so after leaving the product on standby until stable at the minimum input (i.e., shorted). Caution is particularly necessary when taking high-sensitivity measurements.
- ◇ In contrast to a response time of about one second for SLOW samples of 50Ω - $50M\Omega$ for $2W\Omega$, the 5 seconds response in the $500M\Omega$ range is slow. When the $500M\Omega$ range is unnecessary and a high-speed AUTO range response is necessary, the $500M\Omega$ range can be omitted from the AUTO range. See section 4.10.10 for details.

Measurement Methods

4.2.5.2 Four-terminal resistance measurement (4WΩ, VOAC7521H / 7522H only)

This function measures resistance using four test leads. Measurements can be taken by switching between eight ranges in the 50Ω to 500MΩ range. This measurement function enables low resistance values to be stably measured by eliminating the effects of resistance from the test leads themselves resistance, as well as the effects of contact resistance between the resistor to be measured and the test leads.

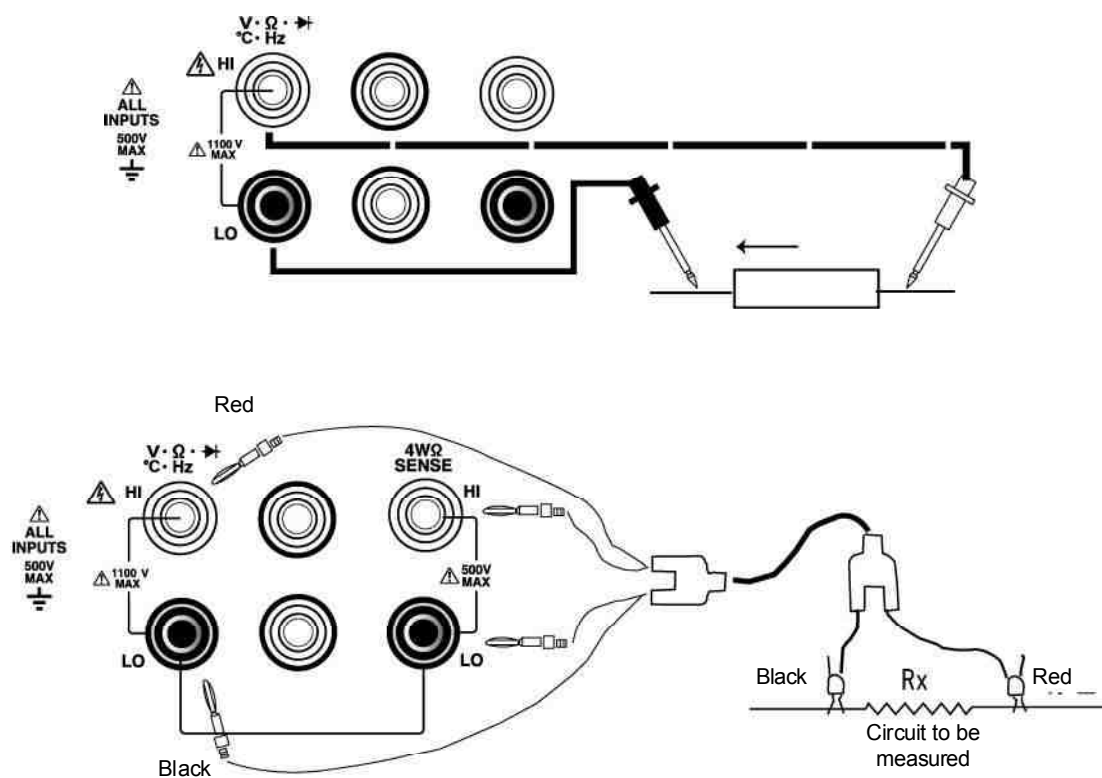
◆ Pre-operation preparation

Connection method

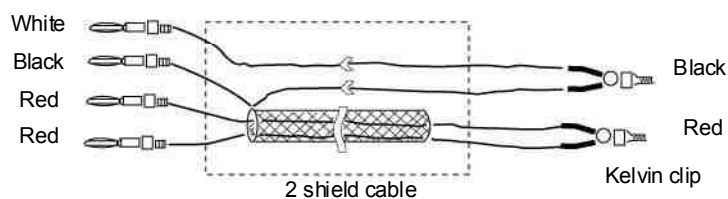
Refer to the precautions related to connecting the test leads in 4.1.1

Connection method when using the four-terminal resistance measurement cable, SC-005 (optional)








- Connect the red banana terminals to the $V \cdot \Omega \cdot \text{Hz}$ terminal and the 4WΩ SENSE HI terminal.
- Connect the white banana terminal to the 4WΩ SENSE LO terminal and the black banana terminal to the LO terminal (SOURCE LO).
- Connect the red Kelvin clip to one side of the resistor to be measured.
- Connect the black Kelvin clip to the other side of the resistor to be measured.

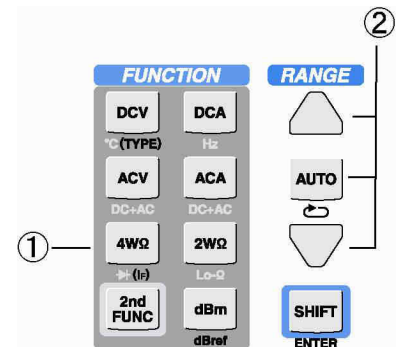


◇ Internal wiring diagram for the four-terminal resistance measurement cable, SC-005



Operating procedure

- ① Press the  key to cause the 4WΩ and  keys to light up.
 - ② Press the  key or the  and  keys to select the optimum range.
- When manually measuring large unknown signals, press the  key several times until the maximum range is reached and then press the  key successively to select the optimum range.



Warning

- ◇ Applying voltage to the resistance measurement terminal immediately after switching to the resistance measurement function from another function may result in damage. Therefore, use adequate caution. To prevent damage, this product has a protective function that automatically measures the voltage under (DC+AC)V and displays a message if it detects a high voltage. The default setting for this voltage check function is ON. To switch this function off, change the VoltCheck system setting to OFF. Refer to section 4.10.10 for details and the procedure for switching the function off.

If a voltage exceeding approximately 100V is detected by the (DC+AC)V function, “!Voltage_Detect” will be displayed and the product will forcefully return to the original function. However, this protective operation is not guaranteed for voltages with high frequencies or large peaks that are not guaranteed by (DC+AC)V. In addition, measurements cannot be taken correctly under conditions in which voltage is applied to the resistance being tested. Therefore, when measuring resistance within a circuit, make sure that voltage is not being applied to the resistance being tested.

CAUTION!!

- ◇ Anchor the test leads when measuring high resistances. The AVG calculation and the shortening and shorting of the cables are effective in minimizing the effects of humming noise.
- ◇ When switching to a resistance measurement after measuring a current of 2A or above, do so after leaving the product on standby until stable at the minimum input (i.e., shorted). Caution is particularly necessary when taking high-sensitivity measurements.
- ◇ In contrast to a response time of about one second for SLOW samples of 50Ω to 50MΩ for 4WΩ, the 5 seconds response in the 500MΩ range is slow. When the 500MΩ range is unnecessary and a high-speed AUTO range response is necessary, the 500MΩ range can be omitted from the AUTO range. See section 4.10.10 for details.

Measurement Methods

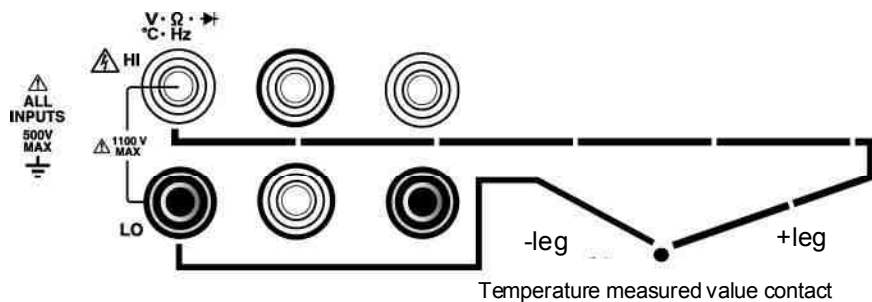
4.2.6 Temperature measurements (°C) & thermocouple type configuration (TYPE)

Connecting a thermocouple enables temperature to be measured directly. Five kinds of thermocouples – R, K (CA), T (CC), J (IC) and E (CRC) – can be used, depending on the measurement.

◆ Pre-operation preparation

Connection method

Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the +leg of the thermocouple to the V·Ω·Hz terminal.
- Connect the –leg of the thermocouple to the LO terminal.
- Connect the tip (temperature contact) of the thermocouple to the point at which the temperature is to be measured.

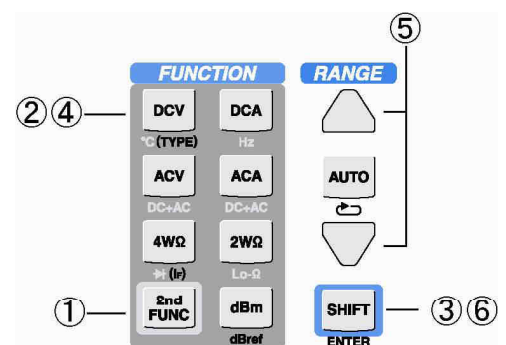
Operating procedure

Selecting the temperature measurement

- ① Select the **2nd FUNC** key so that it flashes.
- ② Press the **°C (TYPE)** (°C (TYPE)) so that the **°C (TYPE)** and **2nd FUNC** keys light up and specify temperature measurement function.

Selecting the thermocouple

- ③ Press the **SHIFT** key so that it flashes.
- ④ Press the **°C (TYPE)** key to display “TC-Type=XXXXX”.
- ⑤ Select the thermocouple type using the **▲** and **▼** range keys.
- ⑥ Press the **SHIFT** (ENTER) key to confirm your selection.



(The details of the warning for this section are still described on the following page.)

Warning

- ◇ When precisely measuring the temperature, pay attention to the following Parameters:
 - Ensure that the point you wish to measure the temperature of and the tip of the thermocouple are in sufficient contact with each other.
 - When measuring the temperature, the temperature of the input terminal HI-LO must be stable. The temperature may become unstable immediately after attaching the thermocouple. Also, ensure that the input terminals are not exposed to drafts during measurement.
 - When measuring a liquid, take the measurement after mixing the liquid well to ensure a uniform temperature.

Measurement Methods

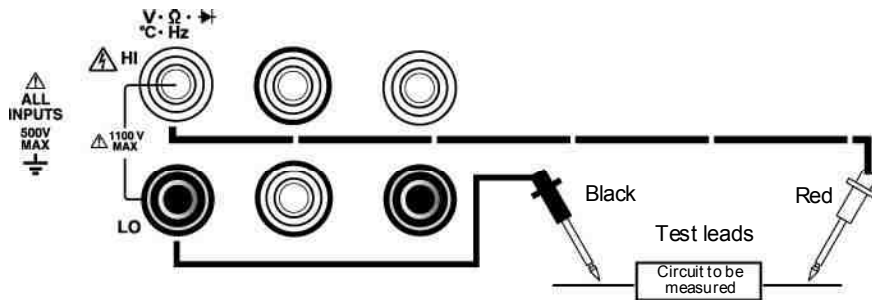
4.2.7 Frequency measurements (Hz)

This function measures the signal frequency applied to the signal input terminal in reciprocal mode. The measurement range with AC coupling is 15Hz to 1MHz. The number of digits displayed varies according to the sample rate (see Chapter 6, Functions).

◆ Pre-operation preparation

Connection method

Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the black measuring lead to the LO terminal and to one side of the circuit being measured.
- Connect the red lead to the $V \cdot \Omega \cdot \text{Hz}$ terminal and to the other side of the circuit being measured.

Operating procedure

① Press the **2nd FUNC** key and it will flash.

② Press the **DCA Hz** (Hz) key and it will flash and specify the frequency (Hz).

- The  and  range keys and the



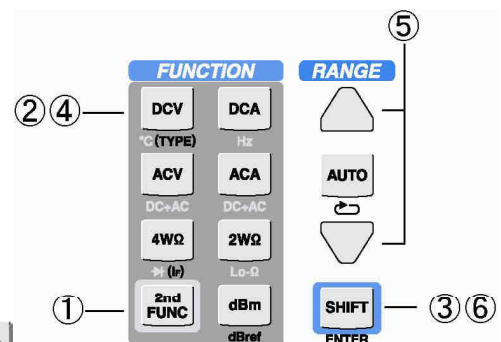
key will not operate.

The auto range is fixed for frequency measurements.

Changing the number of digits displayed:

③ The number of digits displayed will change each time the **RATE INT** key is pressed.

SLOW: 6 digits, MID: 5 digits, FAST: 4 digits

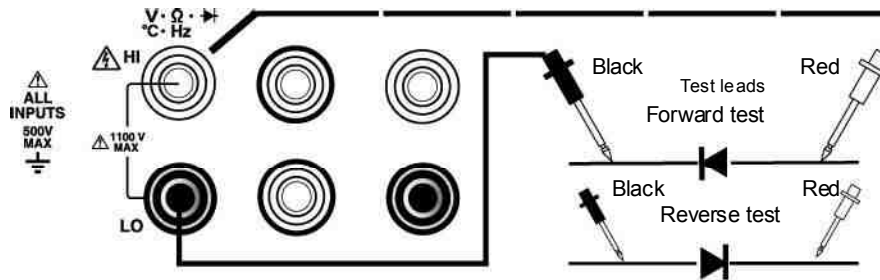


4.2.8 Selecting a diode measurement and measurement current (I_F)

This function confirms the diode polarity and diagnoses malfunctions. During forward bias, the diode's forward direction is displayed. During reverse bias, a normal diode displays the over range.

Connection method

Refer to the precautions related to connecting the test leads in 4.1.1



- Connect the black measuring lead to the LO terminal and to one side of the diode.
- Connect the red lead to the $V \cdot \Omega \cdot \text{Hz}$, $^{\circ}\text{C} \cdot \text{Hz}$ terminal and to the other side of the diode.

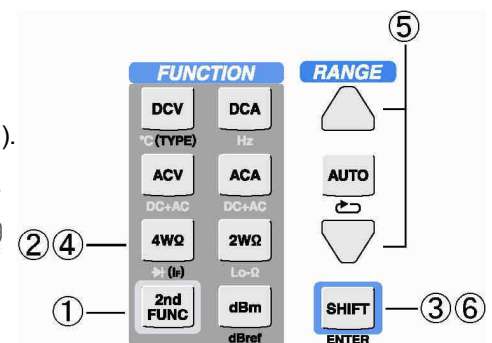
Operating procedure

Specifying a diode measurement

- Press the **2nd FUNC** key so that it flashes.
- Press the **4WΩ** key and specify a diode measurement. The **4WΩ** and **2nd FUNC** keys will light up.
 - The and range keys and the AUTO key will be inoperable, with the range being fixed.

Selecting a measurement current (I_F)

- Press the **SHIFT** key. The key will flash.
- Press the **4WΩ** key and specify the measurement current (I_F). The value of the measured current I_F will flash in the display area.
- Select the measurement current using the and range keys.
- Press the **SHIFT** (ENTER) key to confirm the measurement current (I_F).



(The details of the warning for this section are still described on the following page.)