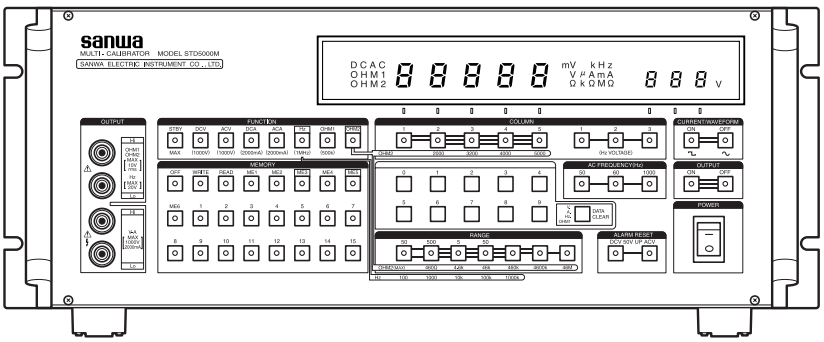
sanwa

STD5000M

CALIBRATOR & STANDARD



INSTRUCTION MANUAL

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[1] SAFETY PRECAUTIONS – Before use, read the following safety precautions.

Thank you for purchasing Multi-Calibrator Model STD500M. This instruction manual explains how to use your multi-calibrator safely. Before use, please read this manual thoroughly. After reading it, keep it together with the product for reference to it when necessary.
The instructions given under "⚠ WARNING" and "⚠ CAUTION" must be followed to prevent accidental burn or electric shock.

1-1 Explanation of Warning/Caution Symbols

The symbols used in this manual and attached to the product are used to inform the user of particularly important information for safety as follows.

◎ The WARNING messages are intended to prevent accidents to operating personnel such as burn and electric shock.
◎ The CAUTION messages are intended to prevent damage to the instrument.
◎ The ⚠ symbol indicates the presence of high voltage. To prevent the danger, do not touch the OUTPUT terminal carrying this symbol.

1-2 Warning/Caution Instructions for Safe Use

⚠WARNING 1
- Confirm that the AC power source to be used matches the AC voltage specified on the rear panel of the instrument.
- Confirm that there is no damage on the exterior or no irregularities in the internal functioning of the instrument.
- If any irregularity is suspected, do not use the instrument.

⚠WARNING 2
- Do not use the instrument if it does not function even after the fuse has been replaced or if the newly replaced fuse is blown.

⚠WARNING 3
- To prevent an electric shock, do not use the instrument with a wet hand, under high atmospheric humidity (80% or more) or when water drops are attached.

⚠WARNING 4
- Do not touch the OUTPUT terminals to prevent an electric shock due to the high voltage that may be output from them.
- When measurement leads are connected to the OUTPUT terminals, be careful in handling of the leads to avoid the risk of electric shock.
- When measurement leads are connected to the OUTPUT terminals and these are generating high voltage, do not place the metallic parts (without the protection covers) on the other ends of the measurement leads on a flammable object with low insulation resistance. Otherwise, a fire hazard may result.

⚠WARNING 5
- Be careful in handling the instrument when the generated voltage is 70 V DC or 33 Vrms AC (46.7 Vpeak) or more. Otherwise, there is a risk of electric shock.

⚠WARNING 6
- Do not use the instrument while its case is uncovered.

⚠WARNING 7
- For safety, calibrate and inspect the instrument at least once a year.

⚠WARNING 8

- Do not allow a pin or similar object enter the ventilation opening.

⚠WARNING 9

- Check the memory contents before using the instrument.
- The memory check should be performed when no individual address (1 to 15) is lit. For the check method, see 6-7 MEMORY.

⚠CAUTION 1

- The operation in the DCA and ACA 2000 mA ranges (particularly at 500 mA or more) should be limited to a short period (less than 30 seconds).

⚠CAUTION 2

- It is not a malfunction even if a figure other than "0" is displayed when the POWER switch is set to ON. In this case, simply press the DATA CLEAR switch to reset the numeric display to "00.000".

⚠CAUTION 3

- Always replace the fuse with the designated fuse.
- The designated fuse is a 2 A/250 V time-lag fuse with dimensions of Ø6.4 x 30 mm.

⚠CAUTION 4

- To ensure stable operation (accuracy), leave the instrument for about 2 hours before use until its temperature becomes equal to the room temperature.
- After setting the POWER switch to ON, warm up the instrument for an additional hour or more.

⚠CAUTION 5

- Be sure to unplug the measurement leads from the OUTPUT terminals before switching the function of the instrument during use.

⚠CAUTION 6

- Before using a high voltage (or current) range, press the DATA CLEAR switch and then enter the desired figures in the display columns.

⚠CAUTION 7

- Do not apply a voltage or current to the OUTPUT terminals. Otherwise, the instrument may be damaged.

⚠CAUTION 8

- Check the memory contents before use.
  [It is dangerous if ⚠ a high voltage (or high current) value is stored.]

⚠CAUTION 9

- If the measurement leads connected to the OUTPUT terminals are unplugged (i.e. the output is opened) during the current function operation, the OUTPUT terminals generate a voltage of more than 10 V.

⚠CAUTION 10

- Do not store the instrument under high temperature (35°C or more), low temperature (5°C or less), high humidity (80% or more) or in a place exposed to direct sunlight.

⚠CAUTION 11

- Do not use the instrument if any part is damaged or otherwise defective.

⚠CAUTION 12

- When not using the memory, store "STBY" and "DC 00.000 mV" in all of the memory addresses.

⚠CAUTION 13

- Do not generate an AC voltage (current) that uses the same frequency as the AC power supply (AC LINE) frequency.

⚠CAUTION 14

- The set voltage (accuracy range) of frequencies is variable depending on the generated waveform and frequency.

[2] GENERAL

This instrument is a universal calibrator capable of setting and output with soft-touch operations of desired DC voltages, AC voltages, DC currents, AC currents, resistance and frequencies with high accuracy and high stability.
It generates voltages (DC, AC) from 0 to 1000 V by selecting one of six ranges, and generates currents (DC, AC) from 0 to 2000 mA by also selecting one of six ranges.
The resistances can be output using two kinds of generation functions, with OHM1 generating 0 to 500 kΩ (10 Ω increments) in a single range, and OHM2 generating 24 fixed resistance values based on 4-block/6-range switching. The generated frequencies are variable depending on the output waveform, but they extend between 1 and 999 Hz from six ranges. The generated voltages are from 0 to 7 V or 11 V.
The STD5000M incorporates the memory function so that the desired function in desired setting can be generated quickly.

[3] MAIN FEATURES

(1) High accuracy: ±0.03% (DCV, DCA)

The factors deciding the accuracy include the accuracies of reference voltage and reference resistance, the temperature coefficient and the drift of the opamp. To improve the accuracy, this instrument adopts a standard voltage IC with thermostat basin as the reference voltage, metal-film and wire-wound resistors with low temperature coefficients as the resistance, and a low-drift IC as the opamp.

(2) Calibration of 6 functions

This instrument incorporates six calibration functions (DCV, ACV, DCA, ACA, OHM, Hz) for use in calibration and maintenance of DMMs, DMTs, DPMs, circuit meters and other industrial meters as well as in research or substitution to sensors.

(3) Speedy, stable settings

All of the front panel switches except the POWER switch use soft-touch pushbutton switches to enable quick settings. The circuit switching is done using semiconductor switches and latch type relays to improve durability.

(4) Overload protection devices

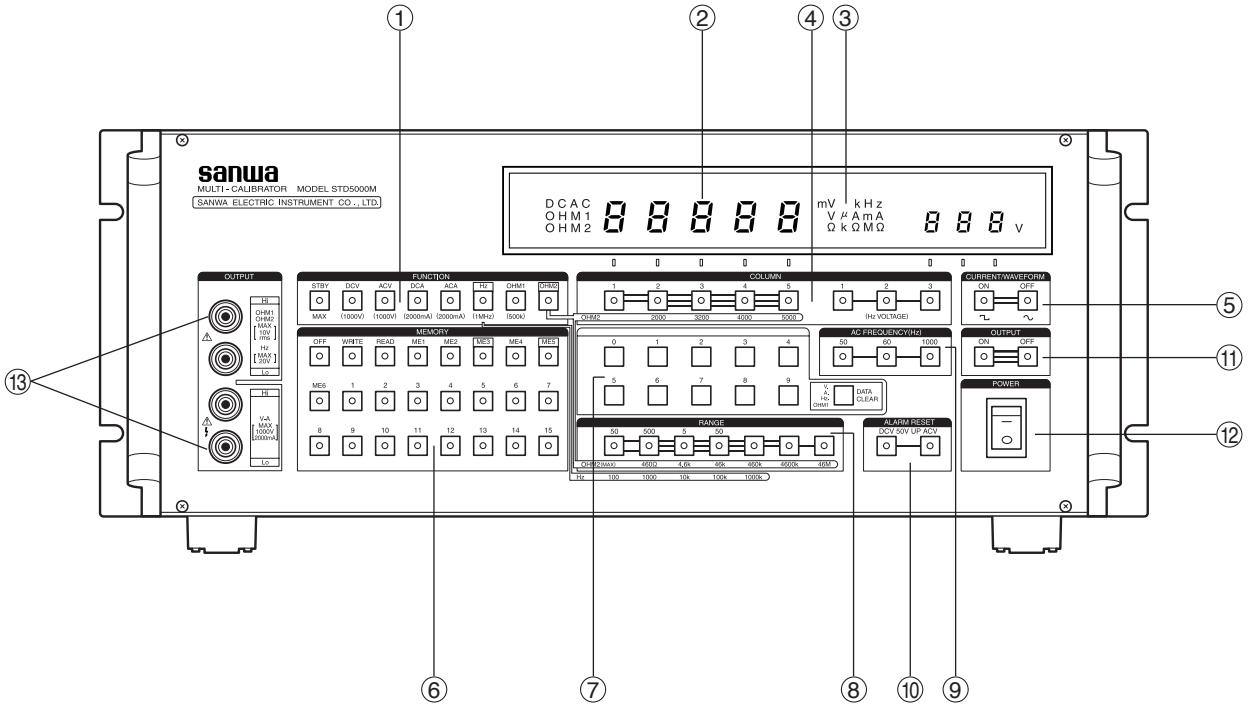
For safety, overloading of low voltages and currents is protected using semiconductor circuitry while that of medium and high voltages is protected by opening the circuitry and output terminals.

(5) 90 memory items

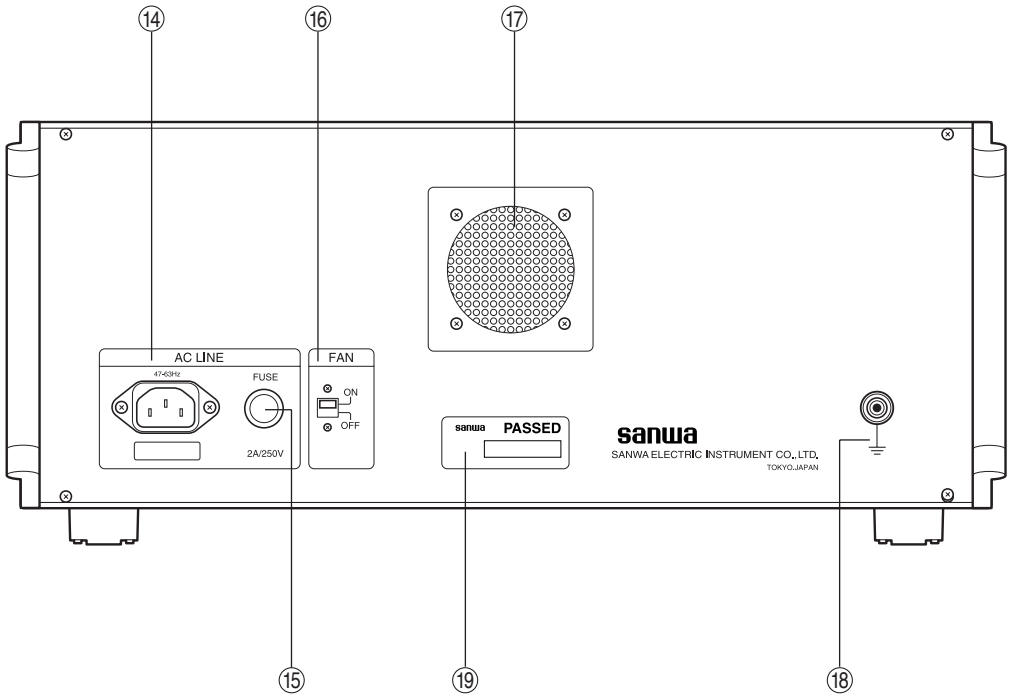
The set functions can be stored in memory and the stored data can be fetched as required.

[4] NAMES OF PARTS

[Front Panel]



[Rear Panel]



① **[FUNCTION]**

Select the function to be generated.

Eight functions can be generated, including the DC voltage (DCV), AC voltage (ACV), DC current (DCA), AC current (ACA), resistance (OHM1, OHM2), frequency (Hz) and Standby (STBY).

② **[Display]**

The panel shows the figures and functions.

- Functions other than Hz: Displayed using 1 to 5 columns.
- Hz: Displayed using 1 to 3 columns plus 6 to 8 columns.
- "AC", "DC", "OHM1" and "OHM2" indicators are also displayed.

③ **[Unit symbols]**

The indicators for the units of function settings (mV, V, μA, mA, Ω, kΩ, MΩ, k and Hz) are displayed.

④ **[COLUMN]**

Used to set the figure in each column (of 1 up to 8 columns).

- Functions other than Hz and OHM2: Set in 1 to 5 columns.
- Hz: Set in 1 to 3 columns plus 6 to 8 columns.
- OHM2: Set the block in 2 to 5 columns.

⑤ **[CURRENT/WAVEFORM]**

● CURRENT

When a current function is selected, these switches are used to output the approximately zero current or the set current.

- Press OFF to output the approximately zero current.
- Press ON to output the set current.

● WAVEFORM

When the frequency function is selected, these switches are used to select the waveform (sine wave or rectangular wave).

- Press ~ to output a sine wave.
- Press ⎍ to output a rectangular wave.

⑥ **[MEMORY]**

These switches are used to control (OFF, WRITE, READ) the memory and set the memory addresses.

- The items that can be stored in memory include the settings of FUNCTION, DATA, RANGE and AC FREQUENCY.

⑦ **[DATA]**

These switches are used to set a figure between 0 and 9 in each column.

- Press the DATA CLEAR switch to clear the figures in all columns (1 to 8) to "0".
- The figures in the columns may be altered depending on the selected function.

⑧ **[RANGE]**

These switches are used to select the range of the setting value.

- The decimal point and unit symbol are switched according to the selected range.

⑨ **[AC FREQUENCY]**

These switches are used to select the frequency of the generated AC (50 Hz, 60 Hz or 1000 Hz).

⑩ **[ALARM RESET (DCV, 50V UP ACV)]**

These switches are used to reset the overload protection alarm if this is activated during the DCV or 50 V UP ACV operation.

- When the overload protection alarm is generated, the LED (DCV or ACV switch) lights up and the OUTPUT "V-A" terminals and circuitry are opened.

⑪ **[OUTPUT]**

These switches are used to open or connect the OUTPUT terminals from or to the circuitry.

- Press the "OFF" switch to open the connection between the output terminals and circuitry.
- Press the "ON" switch to connect the output terminals to the circuitry.

⑫ **[POWER]**

Use this switch to switch the AC power ON-OFF.

⑬ **[OUTPUT]**

These terminals are used to output the set functions.

- OUTPUT "V-A" terminals: Used for the DCV, ACV, DCA or ACA output.
- OUTPUT "OHM1/OHM2, Hz" terminals: Used for the OHM1, OHM2 or Hz output.

⑭ **[AC LINE]**

- AC power inlet (for the specified power supply)
  Connect the 3-pin AC power cord.

⑮ **[FUSE]**

Use an AC power fuse with a capacity of 250V AC / 2A (time-lag fuse).

⑯ **[FAN]**

This switch is used to switch the fan motor ON-OFF.

- The fan motor radiates the internally generated heat to the outside of the instrument and makes the internal temperature equal to the external atmospheric temperature.

⑰ **[Ventilation opening]**

This hole is used to leak the air inside the instrument to the outside.

- To allow ventilation, do not install the instrument in contact with the wall behind it.

⑱ **[Grounding terminal]**

This terminal is connected to the case of the instrument.

⑲ **[Number sticker]**

This sheet carries the serial number of the instrument.

[5] HANDLING

[1] Operating Environment/Location

For accurate measurement, use the instrument under a room temperature of 23 ±3°C and relative humidity of no more than 70%. Do not use in a place exposed to direct sunlight, under high humidity, near a source of heat, etc. Also take care not to allow dust and metallic objects enter the inside of the instrument.

[2] Preparation

(1) Make sure that the AC power source matches the AC power supply requirement specified on the rear panel of the instrument.
(2) Connect the power cord to the AC LINE inlet of the instrument.
(3) Set the POWER switch to ON (–).
- The following LEDs should light up.
- Display panel (00.000), FUNCTION (STBY), COLUMN (1), AC FREQUENCY (60 Hz), MEMORY (OFF), RANGE (50), CURRENT (OFF), OUTPUT(OFF).
- It is not a malfunction even if a figure other than "0" is displayed when the POWER switch is set to ON. In this case, simply press the DATA CLEAR switch. The display will show "00.000".

(4) Set the FAN switch on the rear panel to ON.

[3] Warm-up Time

(1) To ensure stable operation (accuracy), leave the instrument for about 2 hours before use until its temperature becomes equal to the room temperature.
(2) After setting the POWER switch to ON, warm up the instrument for an additional hour or more.

[6] OPERATION

- When a switch other than the DATA (DATA CLEAR) switches is pressed, its LED lights up.
- When entering a figure in each column, first press the desired COLUMN switch and then press the DATA switches.

⚠CAUTION

- This instrument generates a voltage of up to 1000 V (AC or DC) and a current of up to 2000 mA (AC or DC). Careless handling is extremely dangerous and may lead to damage.
- To prevent accidental generation of an unnecessary high voltage or current, be sure to press the DATA CLEAR switch immediately after a high voltage or current operation without leaving the instrument in the high voltage/current setting.
- Before using the 1000 V (or 2000 mA) range, press the DATA CLEAR switch to reset all columns to "0" and then gradually increase the voltage (or current) value.
- When using the memory, be sure to check the memory contents before using the OUTPUT terminals.

6-1 Generating a Voltage (DCV, ACV)

(1) Set the POWER switch to ON (–).
(2) Press the FUNCTION “DCV” or “ACV” switch.
  • When ACV is selected, also select the AC FREQUENCY “60 Hz”, “50 Hz” or “1000 Hz” switch.
  • Do not select the same AC frequency as the AC LINE (AC power source) frequency of the instrument.
(3) Set the range according to the voltage to be generated.
(4) Enter the value of the voltage to be generated in the columns.
(5) Confirm that the function generated with this instrument matches the function of the calibration target instrument.
(6) Use the OUTPUT “V-A” terminals.
(7) Press the OUTPUT “ON” switch.
(8) The generated voltage accuracy is variable depending on the generated frequency. Check the accuracy.

⚠CAUTION

- After finishing generation of a high voltage (50 V or higher range), immediately press the DATA CLEAR switch.
- Before using the 1000 V (or 2000 mA) range, press the DATA CLEAR switch to reset all columns to “0” and then gradually increase the voltage (or current) value.
- Note that the accuracy is affected by the connected load.
- Be careful against overloading or short-circuiting of output terminals.
- When all columns are set to “0” in the 1000 V DC or AC range, it takes a certain time until the DC voltage drops below 0.3 V or the AC voltage drops below 0.4 V.
- When the AC voltage setting is changed, it takes a certain time until the set voltage is reached.
- In case the LED of an ALARM RESET (DCV, 50V UP ACV) switch lights due to overload, remove the load and press the lighted switch.
- Avoid applying a voltage to the OUTPUT “V-A” terminals.

6-2 Generating a Current (DCA, ACA)

(1) Set the POWER switch to ON (–).
(2) Press the FUNCTION “DCA” or “ACA” switch.
  • When ACA is selected, also select the AC FREQUENCY “60 Hz”, “50 Hz” or “1000 Hz” switch.
  • Do not select the same AC frequency as the AC LINE (AC power source) frequency of the instrument.
(3) Set the range according to the voltage to be generated.
(4) Enter the value of the current to be generated in the columns.
(5) Confirm that the function generated with this instrument matches the function of the calibration target instrument.
(6) The load that can be connected to this instrument is determined. Check it.
(7) Use the OUTPUT “V-A” terminals.
(8) Press the OUTPUT “ON” switch.
(9) Press the CURRENT “ON” switch.
(10) The generated current accuracy is variable depending on the generated frequency. Check the accuracy.
(11) The minimum generated current for the lowest range of ACA is determined.

⚠CAUTION

- Before generating a high current, press the DATA CLEAR switch to reset all columns to “0” and then gradually increase the current value.
- The operation in the high current range (500 mA or more) should be limited to a short period (less than 30 seconds).
- When the OUTPUT terminals are opened during the current generation operation, the OUTPUT terminals output a voltage of a few tens of volts.
- Avoid applying a voltage to the OUTPUT “V-A” terminals.

6-3 Generating OHM1 Resistance

(1) Set the POWER switch to ON (–).
(2) Press the FUNCTION “OHM1” switch.
(3) The range is fixed with this function (no range LED lights up).
(4) Enter the value of the resistance to be generated in the columns.
(5) Confirm that the function generated with this instrument matches the function of the calibration target instrument.
(6) Use the OUTPUT “OHM1/OHM2, Hz” terminals.
(7) Capacitance is included in parallel with the resistors.
(8) Press the OUTPUT “ON” switch.

⚠CAUTION

- Note that the maximum operating voltages usable with the internal fixed resistances are as follows.
  - Column 5 (10-90 Ω): Max. 2 V DC
  - Column 4 (100-900 Ω): Max. 20 V DC
  - Column 3 (1-9 kΩ): Max. 50 V DC
  - Column 2 (10-90 kΩ): Max. 50 V DC
  - Column 1 (100-500 kΩ): Max. 50 V DC
- When a high resistance value is generated, the reading of the calibration target instrument may become unstable due to inductance, etc. If this happens, reduce the measurement lead length or use a shield wire.

6-4 Generating OHM2 Resistance

(1) Set the POWER switch to ON (–).
(2) Press the FUNCTION “OHM2” switch.
(3) Select the block (column) according to the resistance to be generated.
(4) Select the range according to the resistance to be generated.
(5) Confirm that the function generated with this instrument matches the function of the calibration target instrument.
(6) Use the OUTPUT “OHM1/OHM2, Hz” terminals.
(7) Capacitance is included in parallel with the resistors.
(8) Press the OUTPUT “ON” switch.

⚠CAUTION

- Note that the maximum operating voltages usable with the internal fixed resistances are as follows.
  - Max. 460 Ω range: Max. 9 V DC
  - Max. 4.6 kΩ range: Max. 28 V DC
  - Max. 46 kΩ range: Max. 90 V DC
  - Max. 460 kΩ range: Max. 100 V DC
  - Max. 4600 kΩ range: Max. 100 V DC
  - Max. 46 MΩ range: Max. 100 V DC
- When a high resistance value is generated, the reading of the calibration target instrument may become unstable due to inductance, etc. If this happens, reduce the measurement lead length or use a shield wire.

6-5 Generating a Frequency (Hz)

(1) Set the POWER switch to ON (–).
(2) Press the FUNCTION “Hz” switch.
(3) Select the range according to the frequency to be generated.
(4) Enter the frequency value of the frequency to be generated in columns 1 to 3.
(5) Enter the voltage value of the frequency to be generated in columns 6 to 8.
(6) Confirm that the function generated with this instrument matches the function of the calibration target instrument.
(7) Select the sine wave or rectangular wave with the WAVEFORM switches.
(8) Use the OUTPUT “OHM1/OHM2, Hz” terminals.
(9) Press the OUTPUT “ON” switch.

⚠CAUTION

- Avoid applying a voltage to the OUTPUT “OHM1/OHM2, Hz” terminals.
- Note that the setting frequency and voltage are limited depending on the selected waveform.
- Note that the accuracy is affected by the connected load.
- Be careful against overloading or short-circuiting of output terminals.
- The accuracy of the generated voltage is dependent on the generated frequency range.

6-6 Standby Operation (STBY)

(1) Press the FUNCTION “STBY” switch.
(2) The range is set to the “50 (mV)” position.

⚠CAUTION

- Avoid applying a voltage or current to the OUTPUT terminals (all terminals).
- Do not press a switch other than the FUNCTION “STBY” switch.

6-7 Memory Operation (MEMORY)

● **The items that can be stored in memory include FUNCTION, DATA, RANGE and AC FREQUENCY.**

(1) Set the POWER switch to ON (–).
(2) Press the OUTPUT "OFF" and CURRENT "OFF" switches.
(3) Do not connect anything to the OUTPUT terminals (all terminals).
(4) Check the entire memory contents.
  ① Press the "ME1" block address switch.
  ② Press the "READ" switch.
  ③ Press one of the block address switches ("ME1" to "ME6").
  ④ Press one of the individual address switches ("1" to "15") and check the item stored in it.
  ⑤ Check the contents of a total of 90 addresses by repeating steps ③ and ④ for each of them.
(5) To write an item in memory:
  ① Press the "ME1" block address switch.
  ② Press the "WRITE" switch.
  ③ Set the instrument ready for the voltage, current, OHM1 or Hz operation.
  When the OHM2 operation is set, the column data is not stored in memory.
  ④ Press one of the block address switches ("ME1" to "ME6").
  ⑤ Press one of the individual address switches ("1" to "15").
  ⑥ Items can be stored in up to 90 memory addresses by repeating steps ③ to ⑤ for each.

● How to check default setting
- Set the POWER switch to ON (–).
- Press the OUTPUT "OFF" and CURRENT "OFF" switches.
- Do not connect anything to the OUTPUT terminals (all terminals).
- Check the memory content.
  Note that the memory content is generated at the same time as it is checked.
  ① Press the "ME1" block address switch.
  ② Press the "READ" switch.
  ③ Press one of the block address switches ("ME1" to "ME6").
- The memory content should be: Function "STBY"; Range "50"; AC frequency "60"; Displayed figures "00.000".
  (If the memory content is other than the above, change it.)
  ④ The LEDs of the individual address switches ("1" to "15") should not be lit.

● **How to change default setting**

① Press the MEMORY "OFF" switch and then press the "ME1" block address switch.
② Set the Function to "STBY", Range to "50", AC frequency to "60" and Displayed figures to "00.000".
③ Press the "WRITE" switch.
④ Store the same content in block addresses ME1 to ME6 by pressing one of the block address switches ("ME1" to "ME6") and the FUNCTION "STBY" switch alternately.
Be sure not to press the individual address switches ("1" to "15").

⚠CAUTION

- The settings of the “OUTPUT” and “CURRENT” switches cannot be stored in memory.
- When a high voltage or current is stored in memory, be careful in handling of the instrument during memory operation to avoid danger.
- When the OHM2 setting is stored in memory, do not press the COLUMN switches because the column setting is not stored in memory. However, the range of the columns is stored in memory.

6-8 Generating an AC FREQUENCY

(1) Set the POWER switch to ON (–). The AC FREQUENCY is set automatically to “60 Hz”.
(2) When it is required to output a specified frequency, press the AC FREQUENCY switch for the desired frequency (“50 Hz”, “1000 Hz” or “60 Hz”).

⚠CAUTION

- When the AC frequency setting is changed, it takes a certain time until the output AC voltage (current) is reached. (It takes about 2 minutes.)

6-9 Generating a CURRENT

(1) Set the POWER switch to ON (–). The CURRENT is set automatically to “OFF”.
(2) When the CURRENT “OFF” switch is selected, the output current becomes the approximately-zero current.
(3) When the CURRENT “ON” switch is selected, the output current becomes the set current.

⚠CAUTION

- Before generating a high current, press the DATA CLEAR switch to reset all columns to “0” and then gradually increase the current value.
- The operation in the high current ranges (500 mA or more) should be limited to a short period (less than 30 seconds).
- When the OUTPUT terminals are opened during the current generation operation, the OUTPUT terminals output a voltage of a few tens of volts.

6-10 OUTPUT Switch Operation

(1) Set the POWER switch to ON (–). The OUTPUT is set automatically to “OFF”.
(2) Press the “ON” or “OFF” switch as required to switch the output from the OUTPUT terminals ON-OFF.
(3) When the OUTPUT “ON” switch is selected, the “ON” LED lights and the output terminals are connected to the circuitry.
(4) When the OUTPUT “OFF” switch is selected, the “OFF” LED lights and the connection between the output terminals and circuitry is opened.

⚠CAUTION

- Avoid switching ON-OFF when a high voltage or current is generated.

6-11 ALARM RESET (DCV, 50V UP ACV) Operation

(1) When the output current exceeds about 10 mA during the voltage (AC or DC) generation in a range of 50 V or higher, the overload protection circuit is activated to open the connection between the OUTPUT terminals and the circuitry and light the LED of the “DCV” or “50 V UP ACV” switch.
(2) To reset the alarm status, remove the load and press the ALARM RESET “DCV” or “50 V UP ACV” switch. The LED of the pressed switch is extinguished.

6-12 OUTPUT Terminal Operation

(1) Use either set of OUTPUT terminals according to the generated function.
  • OUTPUT “V-A” terminals: Used for the voltage or current output.
  • OUTPUT “OHM1/OHM2, Hz” terminals: Used for the resistance 1/2 or frequency output.
(2) When the provided output terminal adapter is connected to the OUTPUT terminals, test pins or banana plugs can be connected.

⚠CAUTION

● The OUTPUT terminals carry the ϟ and ⚠ symbols. As their handling is dangerous, read the Instruction Manual carefully before use.

6-13 FAN Switch Operation

(1) Set the FAN switch to ON to blow the internal air to the outside of the instrument.

⚠CAUTION

● To prevent danger, do not allow a pin or similar object enter the ventilation opening.

[7] GROUNDING TERMINAL (Case Guard Terminal)

During the DCV and DCA operations, the OUTPUT “V-A” “Lo” terminal and the grounding terminal (guard terminal) are in the floating status.
During the ACV and ACA operations, the OUTPUT “V-A” “Lo” terminal and the grounding terminal (guard terminal) are in the single-end status and connected to the COM terminal of the circuitry.

⚠CAUTION

● The OUTPUT “OHM1/OHM2, Hz” “Lo” terminal is connected to the COM terminal of the circuitry. It is in the single-end status with respect to the grounding terminal (guard terminal).

[8] GENERAL SPECIFICATIONS

[1]	**Generated functions**	DC voltage (DCV), AC voltage (ACV), DC current (DCA), AC current (ACA), Resistance (OHM1), Resistance (OHM2), Frequency (Hz).
[2]	**Set values**	50000 (except for 1000 V, 2000 mA, OHM2 and Hz). 99900 11.0: Frequency (Hz) only.
[3]	**Max. display**	50099
[4]	**Operating environment**	5°C to 40°C, No more than 70%RH (without condensation).
[5]	**Accuracy guaranteed environment**	23°C ±3°C,No more than 70%RH (without condensation).
[6]	**Preheating time**	Approx. 1 or more hour after switch ON.
[7]	**Protection devices**	DC and 50 V or higher AC ranges: Overload protection device with reset switch.DC and 5 V or lower AC ranges: Overload protection circuitry.
[8]	**Power supply**	100 V ±8%, 50/60 Hz (100 V specification model), 220 V ±8%, 50/60 Hz (220 V specification model).
[9]	**Fuse**	2 A/250 V (100 V model), 1 A/250 V (220 V model).
[10]	**Power consumption**	Approx. 30 VA
[11]	**Dimensions & weight**	480(W) x 180(H) x 580(D) mm, 25 kg.

[9] PERFORMANCE

- The performance described in this chapter can be achieved on condition that the temperature is 23°C ±3°C; the relative humidity is no more than 70% without condensation, and about 1 hour or more after the POWER switch is set to ON.
- When a certain value is generated, the accuracy can be improved by increasing the number of columns used to specify it.

[1] DC Voltage (DCV)

1. Generation ranges

Range	Generation range	Minimum resolution
0.05	0-50.000 mV	1 μV
0.5	0-500.00 mV	10 μV
5	0-5.0000 V	100 μV
50	0-50.000 V	1 mV
500	0-500.00 V	10 mV
1000	0-1000.0 V	100 mV

2. Accuracy

(1) Accuracy-guaranteed load

Range	Accuracy	Accuracy-guaranteed load
0.05	±[0.05% of setting + 30 μV]	1 mA
0.5	±[0.03% of setting + 30 μV]	1 mA
5	±[0.03% of setting + 200 μV]	1 mA
50	±[0.03% of setting + 2 mV]	1 mA
500	±[0.03% of setting + 20 mV]	1 mA
1000	±[0.05% of setting + 0.3 V]	1 mA

(2) Maximum load accuracy

Range	Accuracy	Maximum load
0.05	±[0.1% of setting + 30 μV]	10 mA
0.5	±[0.05% of setting + 30 μV]	10 mA
5	±[0.05% of setting + 200 μV]	10 mA
50	±[0.05% of setting + 2 mV]	10 mA
500	±[0.05% of setting + 20 mV]	10 mA
1000	±[0.1% of setting + 0.3 V]	10 mA

3. Power fluctuation

Within ±0.01% of the maximum setting when the AC supply voltage fluctuates by ±8%.
(Within ±0.02% at 1000 V)

4. Stability

The variation for the 8-hour period beginning from 1 hour after setting the POWER switch to ON should be within ±0.01% of the maximum setting.
(Within ±0.02% at 1000 V).

5. Temperature coefficient
   Within ±0.005%/°C under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation).
   (Within ±0.01%/°C at 1000 V)

[2] AC Voltage (ACV)

1. Generation ranges

Range	Generation range	Minimum resolution
0.05	0-50.000 mV	1 μV
0.5	0-500.00 mV	10 μV
5	0-5.0000 V	100 μV
50	0-50.000 V	1 mV
500	0-500.00 V	10 mV
1000	0-1000.0 V	100 mV

2. Accuracy
   (1) Accuracy-guaranteed load
   • The following is not applicable to the AC LINE frequency.

Range	Accuracy (50/60 Hz)	Accuracy (1000 Hz)	Accuracy guaranteed load
0.05	±[0.1% of setting + 0.05 mV]	±[0.2% of setting + 0.08 mV]	1 mA
0.5	±[0.06% of setting + 0.1 mV]	±[0.1% of setting + 0.1 mV]	1 mA
5	±[0.06% of setting + 0.4 mV]	±[0.1% of setting + 0.4 mV]	1 mA
50	±[0.06% of setting + 4 mV]	±[0.1% of setting + 4 mV]	1 mA
500	±[0.06% of setting + 40 mV]	±[0.1% of setting + 40 mV]	1 mA
1000	±[0.1% of setting + 0.4 V]	±[0.2% of setting + 0.4 V]	1 mA

   (2) Maximum load accuracy
   • The following is not applicable to the AC LINE frequency.

Range	Accuracy (50/60 Hz)	Accuracy (1000 Hz)	Max. load
0.05	±[0.2% of setting + 0.05 mV]	±[0.3% of setting + 0.08 mV]	10 mA
0.5	±[0.1% of setting + 0.1 mV]	±[0.2% of setting + 0.1 mV]	10 mA
5	±[0.1% of setting + 0.4 mV]	±[0.2% of setting + 0.4 mV]	10 mA
50	±[0.1% of setting + 4 mV]	±[0.2% of setting + 4 mV]	10 mA
500	±[0.1% of setting + 40 mV]	±[0.2% of setting + 40 mV]	10 mA
1000	±[0.2% of setting + 0.4 V]	±[0.2% of setting + 0.4 V]	10 mA

3. Calibration method
   The effective value is calibrated with the mean value.

4. Frequency characteristic
   The same frequency as the frequency of the power supply in use cannot be used.

5. Response time
   Within 10 seconds in the generation range of 50% to 100% of the maximum setting.
   The above refers to the time until the generated value enters ±0.1% of the maximum setting.

6. Power fluctuation
   Within ±0.01% of the maximum setting when the AC supply voltage fluctuates by ±8%.
   (Within ±0.02% at 1000 V)

7. Stability
   The variation for the 8-hour period beginning from 1 hour after setting the POWER switch to ON should be within ±0.01% of the maximum setting.
   (Within ±0.02% at 1000 V)

8. Temperature coefficient
   Within ±0.005%/°C under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation)
   (Within ±0.01%/°C at 1000 V)

9. Frequency (Hz)
   Generated frequencies (sine wave): 50 Hz, 60 Hz, 1000 Hz
   Accuracy: Within ±1%

[3] DC current (DCA)

1. Generation ranges

Range	Generation range	Minimum resolution
0.05	0-50.000 μA	1 nA
0.5	0-500.00 μA	10 nA
5	0-5.0000 mA	100 nA
50	0-50.000 mA	1 μA
500	0-500.00 mA	10 μA
1000 (2000)	0-2000.0 mA	100 μA

2. Accuracy
   (1) Accuracy
   Use an output load that does not cause the output load to exceed 5 V DC.

Range	Accuracy	No-load output voltage
0.05	±[0.05% of setting + 30 nA]	Approx. 13 V DC
0.5	±[0.05% of setting + 30 nA]	Approx. 13 V DC
5	±[0.05% of setting + 200 nA]	Approx. 13 V DC
50	±[0.05% of setting + 2 μA]	Approx. 13 V DC
500	±[0.05% of setting + 20 μA]	Approx. 13 V DC
1000 (2000)	±[0.1% of setting + 0.3 mA] **(Operation time should be no more than 30 seconds.)**	Approx. 13 V DC

3. Power fluctuation
   Within ±0.01% of the maximum setting when the AC supply voltage fluctuates by ±8%.
   (Within ±0.02% at 2000 mA)

4. Stability
   The variation for the 8-hour period beginning from 1 hour after setting the POWER switch to ON should be within ±0.01% of the maximum setting.
   (Within ±0.02% at 2000 mA)

5. Temperature coefficient
   Within ±0.005%/°C under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation).
   (Within ±0.01%/°C at 2000 mA)

[4] AC current (ACA)

1. Generation ranges

Range	Generation range	Minimum resolution
0.05	5 μA -50.000 μA	1 nA
0.5	0-500.00 μA	10 nA
5	0-5.0000 mA	100 nA
50	0-50.000 mA	1 μA
500	0-500.00 mA	10 μA
1000(2000)	0-2000.0 mA	100 μA

2. Accuracy
   Use an output load that does not cause the output load to exceed 3.5 V DC.

   (1) Accuracy-guaranteed load (50/60 Hz)
   • The following is not applicable to the AC LINE frequency.

Range	Accuracy	No-load output voltage
0.05	±[0.12% of setting + 0.08 μA]	Approx. 13 V AC
0.5	±[0.12% of setting + 0.08 μA]	Approx. 13 V AC
5	±[0.1% of setting + 0.5 μA]	Approx. 13 V AC
50	±[0.1% of setting + 5 μA]	Approx. 13 V AC
500	±[0.1% of setting + 50 μA]	Approx. 13 V AC
1000 (2000)	±[0.15% of setting + 0.5 mA] **(Operation time should be no more than 30 seconds.)**	Approx. 13 V AC

(2) Accuracy-guaranteed load (1000 Hz)

Use an output load that does not cause the output load to exceed 3.5 V DC.

• The following is not applicable to the AC LINE frequency.

Range	Accuracy	No-load output voltage
0.05	±[0.2% of setting + 0.1 μA]	Approx. 13 V AC
0.5	±[0.2% of setting + 0.08 μA]	Approx. 13 V AC
5	±[0.15% of setting + 0.5 μA]	Approx. 13 V AC
50	±[0.15% of setting + 5 μA]	Approx. 13 V AC
500	±[0.15% of setting + 50 μA]	Approx. 13 V AC
1000 (2000)	±[1% of setting + 1 mA] **(Operation time should be no more than 30 seconds.)**	Approx. 13 V AC

3. Calibration method
   The effective value is calibrated with the mean value.

4. Frequency characteristic
   The same frequency as the frequency of the power supply in use cannot be used.

5. Response time
   Within 5 seconds in the generation range of 50% to 100% of the maximum setting.
   The above refers to the time until the generated value enters ±0.1% of the maximum setting.

6. Power fluctuation
   Within ±0.01% of the maximum setting when the AC supply voltage fluctuates by ±8%.
   (Within ±0.02% at 2000 mA)

7. Stability
   The variation for the 8-hour period beginning from 1 hour after setting the POWER switch to ON should be within ±0.01% of the maximum setting.
   (Within ±0.02% at 2000 mA)

8. Temperature coefficient
   Within ±0.005%/°C under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation).
   (Within ±0.01%/°C at 2000 mA)

9. Frequency (Hz)
   Generated frequencies (sine wave): 50 Hz, 60 Hz, 1000 Hz
   Accuracy: Within ±1%

[5] Resistance (OHM1)

1. Generation range

Range	Generation range	Minimum resolution
Fixed	0-500.00 kΩ	10 Ω

2. Accuracy

Range	Accuracy
Fixed	±[0.05% of setting + 10 Ω] (The range is fixed.)

3. Temperature coefficient
   Within ±0.005%/°C under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation).

[6] Resistance (OHM2)

1. Generation range

Range	Generation range					
2000	160Ω	1.6k	16k	160k	1600k	16M
3200	260Ω	2.6k	26k	260k	2600k	26M
4000	360Ω	3.6k	36k	360k	3600k	36M
5000	460Ω	4.6k	46k	460k	4600k	46M

2. Accuracy

Range 2000	Range 3200	Range 4000	Range 5000	Accuracy	Max. power	Max. voltage	Temp. coefficient
160Ω	260Ω	360Ω	460Ω	±0.05%	0.5 W	9 V DC	0.004%/˚C
1.6k	2.6k	3.6k	4.6k	±0.05%	0.5 W	28 V DC	0.004%/˚C
16k	26k	36k	46k	±0.05%	0.5 W	90 V DC	0.004%/˚C
160k	260k	360k	460k	±0.05%	0.5 W	100 V DC	0.004%/˚C
1600k	2600k	3600k	4600k	±0.1%	0.5 W	100 V DC	0.01%/˚C
16M	26M	36M	46M	±0.2%	0.5 W	100 V DC	0.02%/˚C

3. Temperature coefficient
   Under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation).

[7] Frequency (Hz)

(A) Frequency (sine and rectangular waves)

1. Generation range

Range	Generation range		Minimum resolution
	Sine wave	(Rectangular wave)	
100	40 Hz – 99.9 Hz	(1 Hz – 99.9 Hz)	0.1 Hz
1k	40 Hz – 999 Hz	(1 Hz – 999 Hz)	1 Hz
10k	40 Hz – 9.99 kHz	(10 Hz – 9.99 kHz)	10 Hz
100k	100 Hz – 99.9 kHz	(100 Hz – 99.9 kHz)	100 Hz
1M		(1 kHz – 999 kHz)	1 kHz

2. Accuracy

Range	Accuracy
100	±[0.1% of setting + 0.1 Hz]
1k	±[0.1% of setting + 1 Hz]
10k	±[0.1% of setting + 10 Hz]
100k	±[0.1% of setting + 100 Hz]
1M	±[0.1% of setting + 1 kHz]

(B) Voltage of frequencies

1. Generation range

Range	Generation range		Minimum resolution
	Sine wave	(Rectangular wave)	
20	0-7.00 V	(0-11.0 V)	0.1 V

2. Accuracy

Range	Generation range	Frequency range
100	±[2% of setting + 0.2 V]	40-99.9 Hz
1k	±[2% of setting + 0.2 V]	90-999 Hz
10k	±[2% of setting + 0.2 V]	0.9-9.99 kHz
100k	±[5% of setting + 0.2 V]	9-99.9 kHz
*1M	Not specified.	90-999 kHz
	* refers to the case of a sine wave.	

3. Calibration method

   The effective value is calibrated with the mean value.

4. Frequency characteristic

   The same frequency as the frequency of the power supply in use cannot be used.

5. Set voltage
   Within 10 seconds in the generation range of 50% to 100% of the maximum setting.
   The above refers to the time until the generated value enters ±0.1% of the maximum setting.

6. Power fluctuation
   Within ±0.01% of the maximum setting when the AC supply voltage fluctuates by ±8%.

7. Stability
   The variation for the 8-hour period beginning from 1 hour after setting the POWER switch to ON should be within ±0.01% of the maximum setting.

8. Temperature coefficient
   Within ±0.005%/°C under an ambient temperature of 23°±10°C (relative humidity no more than 70%, without condensation).

[10] CALIBRATION

The calibration and inspection of the instrument will be conducted by the manufacturer. For more information, please contact the manufacturer.

⚠CAUTION

To maintain high accuracy of the instrument, it is recommended to calibrate it at least once a year.

1. Environmental conditions
   - Temperature: At 23°C ±1°C, in a temperature-controlled room or a place with little temperature changes similar to it.
   - Humidity; 50%RH or less.
   - Very low AC power fluctuation.

2. Measuring instruments required for calibration
   Use the measuring instruments under their specified environmental conditions (to ensure accuracy).

Instrument	Measurement range	Accuracy
DMM	0-1000 V	±0.001% - ±0.005%
DMM	0-1000 mA	±0.001% - ±0.005%
DMM	0-100 MΩ	±0.001% - ±0.005%
Standard resistances	0.1 Ω/1 Ω/10 Ω/100 Ω/1 kΩ	±0.001% - ±0.005%
Frequency meter	0.001 Hz – 10 MHz	±1 - ±10 PPm

DMM: Digital Multi-meter

3. Check the operation of the instrument.
   After setting the POWER switch to ON, warm up the instrument for an hour or more. Check that the functions and ranges can be set normally before proceeding to calibration.

[11] AFTER-SALE SERVICE

1. Warranty and Provision

Sanwa offers comprehensive warranty services to its end-users and to its product resellers. Under Sanwa's general warranty policy, each instrument is warranted to be free from defects in workmanship or material under normal use for the period of one (1) year from the date of purchase. This warranty policy is valid within the country of purchase only, and applied only to the product purchased from Sanwa authorized agent or distributor.

Sanwa reserves the right to inspect all warranty claims to determine the extent to which the warranty policy shall apply. This warranty shall not apply to fuses, disposables batteries, or any product or parts, which have been subject to one of the following causes:

1. A failure due to improper handling or use that deviates from the instruction manual.
2. A failure due to inadequate repair or modification by people other than Sanwa service personnel.
3. A failure due to causes not attributable to this product such as fire, flood and other natural disaster.
4. Non-operation due to a discharged battery.
5. A failure or damage due to transportation, relocation or dropping after the purchase.

2. Before requesting our repair service, check that:

- Poor contact disconnection or wiring disconnection of the AC power cord
- The built-in fuse is not blown out

3. Repair service period

Repair components will be retained in stock for a minimum period of 6 years after the discontinuance of manufacture. We accept your repair request during this period. However, note that some components may become unavailable earlier because of difficulties in purchasing them.

4. Address for sending your STD5000M

- Specify "Failure part" of the repair product or "Calibration", and attach it.
- In order to ensure the safe transportation of the STD5000M, place it in a box which we delivered or which is enough capacities more than it with sufficient pad or filler.
  Mark the box as "Product to be repaired" or "Calibration".

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Sanwa Electric Instrument Co., Ltd.
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5. Information request

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E-mail : exp_sales@sanwa-meter.co.jp
Our website : http://www.sanwa-meter.co.jp

[12] OTHER

The specification or external appearance of a product is subject to change without notice.

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