

**INSULATION RESISTANCE TESTER FOR
PHOTOVOLTAIC SYSTEMS**

MSEI-200C

INSTRUCTION MANUAL

Thank you for your purchasing our model MSEI-200C
INSULATION RESISTANCE TESTER FOR DC CURRENT
CIRCUIT OF PHOTOVOLTAIC SYSTEMS.

Before use the instrument, read this instruction manual
thoroughly and operate it correctly.

Keep this instruction manual carefully to take out whenever
you need.

MULTI MEASURING INSTRUMENT CO., LTD.
Akihabara Murai Bldg. 7F, 1-26 Kanda Sakuma-cho,
Chiyoda-ku, Tokyo 101-0025 JAPAN

TEL: +81-3-3251-7013

FAX: +81-3-3253-4278

Website: <http://www.multimic.com>

E-mail: multi@multimic.com

SAFETY SUMMARY

observe by all means

- To use this instrument safely, read this "SAFETY SUMMARY" carefully and apply the instrument correctly.
- The CAUTIONs and WARNINGs which appear on the following pages are stated to prevent the operator & other people from the dangers and their properties from the damages beforehand.

- △ WARNING : This symbol indicates the contents "Possibilities of the death or the serious wound can be supposed" caused from mis-operations.
- △ CAUTION : This symbol indicates the contents "Possibilities of the injury or only the material damage can be supposed" caused from mis-operations.

○ OPERATION ENVIRONMENT

△ CAUTION

- Do not use or storage this instrument under the condition of direct rays of the sun, high temperature & humidity and or condensation, as it may cause the deformation and or the isolation defect of the instrument.
- Do not use this instrument in the environment influenced by acids, alkalis, organic solutions, corrosive gas, etc.
- Do not use or storage this instrument where the mechanical vibration can be directly transmitted, as it may cause defect of the instrument.
- Do not use this instrument nearby the appliances which generate strong magnetic field and or electric field, as it may cause mis-movement of the instrument.
- This instrument does not have the water/dust-proof structure. Do not use this instrument in the environment with a lot of dust and drops of water, as it may cause defect of the instrument.

○ OPERATION CONDITION & CONNECTION

△ WARNING

POSSIBLE ELECTRICAL SHOCK

- This instrument is for the use of low voltage circuit.
- Do not make measurements of power lines carrying more than DC 1000V. Before use, check and confirm the voltage of circuit to be measured.

POSSIBLE ELECTRICAL SHOCK OR ACCIDENT

- Do not handle the instrument in the rain, at humid place, with a drop of water and or with wet hands.

1. GENERAL

This insulation resistance tester (MSEI-100C) can measure insulation resistance of DC current circuit in PV systems (between PV module and power conditioner) on the live line and can distinguish the deteriorated part between Power Phase, Neutral Phase, P/N Phase and or PV modules.

2. BEFORE USE

After opening the package, check the appearance of instrument and confirm if there is no lack of accessories. If any damage and or any lack has been found, contact the dealer you bought this instrument.

《Accessories》

Voltage Input Connector (Red, Black, and, Green)	1 set
Instruction Manual	1 pce.
Carrying Case	1 pce.
Battery (LR6)	4 pcs.

3. CONNECTION & OPERATION OF CONNECTOR CORD & ACCESSORIES

△WARNING

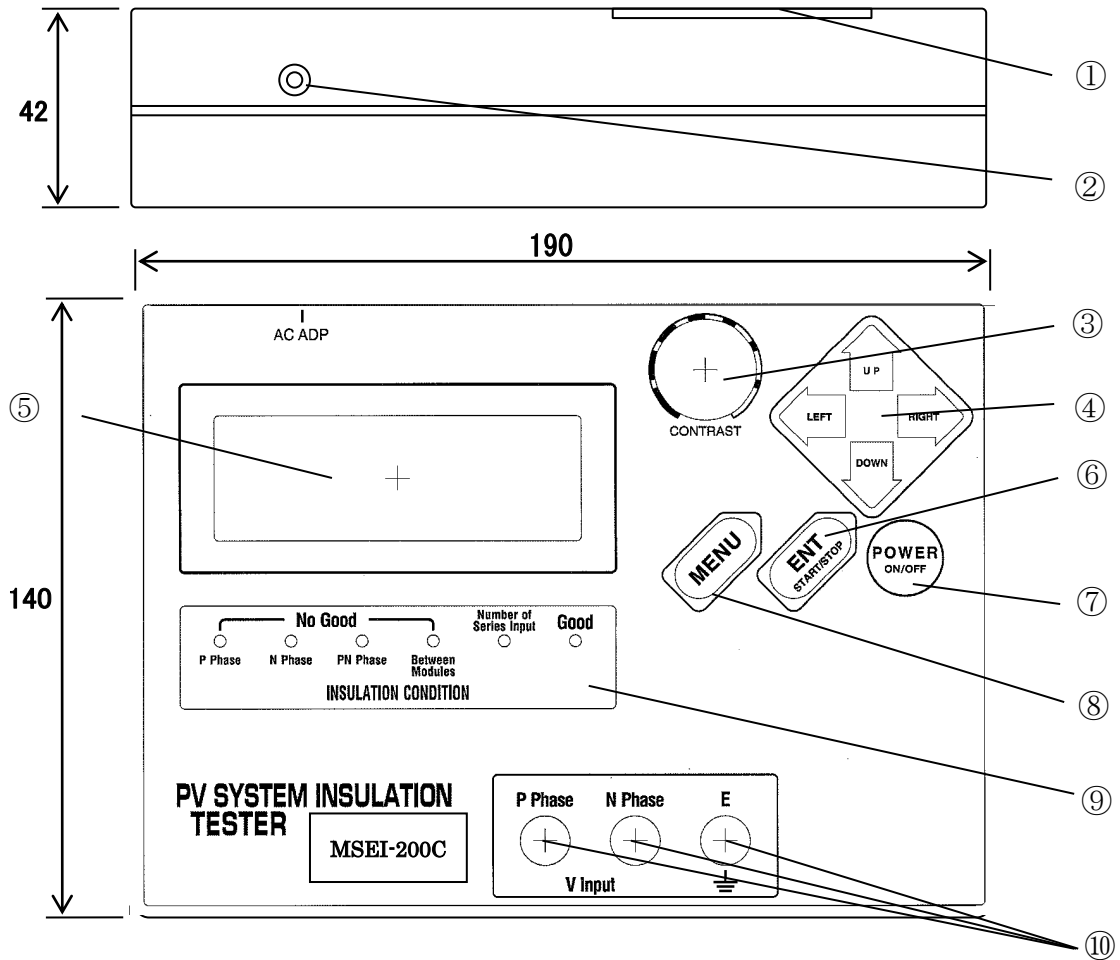
- ◆ Connect voltage input cords to the live lines after connected to the instrument.
- ◆ Be careful that the short circuit and or electric shock accident might be caused from slip off of the clips and touch of them between 2 lines.
- ◆ Before use, check the connecting cables (including AC adaptor) about disconnection, contact failure, breakage of coating conductor, etc. In case of finding any unusual point after inspection, do not use these accessories.

△CAUTION

For the safe operation

- ◆ Do not drop and or give the hand shock to the instrument.
- ◆ Do not put heavy material to each cable and do not modify it.

4. NAME OF PART & EXPLANATION



(Name of Part & Explanation)

① Battery Case	: For battery installation
② AC ADP Jack	: For connecting AC adaptor(option)
③ Contrast Volume	: For adjusting display contrast
④ Left, Right, Up, Down Switch	: For moving cursor on display and setting value
⑤ Display (LCD)	: 20 letters/characters x 4 lines LCD, for displaying settings item for measuring condition and numeral values.
⑥ Input Switch (ENT)	: For inputting measurement condition or value
⑦ Power Switch (POWER)	: For switching ON and OFF. Automatically off in approx. after 40 minutes
⑧ Menu Switch	: For returning to initial screen
⑨ Insulation Resistance Lamp	: For displaying judgment for insulation condition by LED
⑩ Voltage Input Terminal	: For connecting Red lead to P Phase, Black lead to N Phase, and Green lead to E Phase.

5. OPERATION PROCEDURE

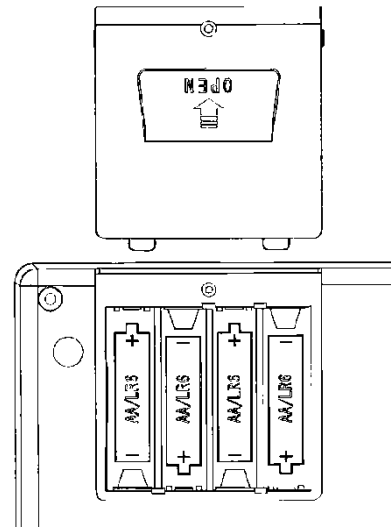
5.1 Preparation before use

1) Place the battery

1. Unscrew and slide a battery cover to remove a battery cover(as shown at right)

2. Place the battery observing correct polarity as indicated in the battery compartment. Use four LR-6(AAA) batteries.

3. Install the battery cover and tighten the screws.



▲WARNING

It may cause electric shock.

- ◆ Never replace the battery during a measurement.
- ◆ Be sure to set back the battery cover to original position. Never make measurement when left the battery cover opened.

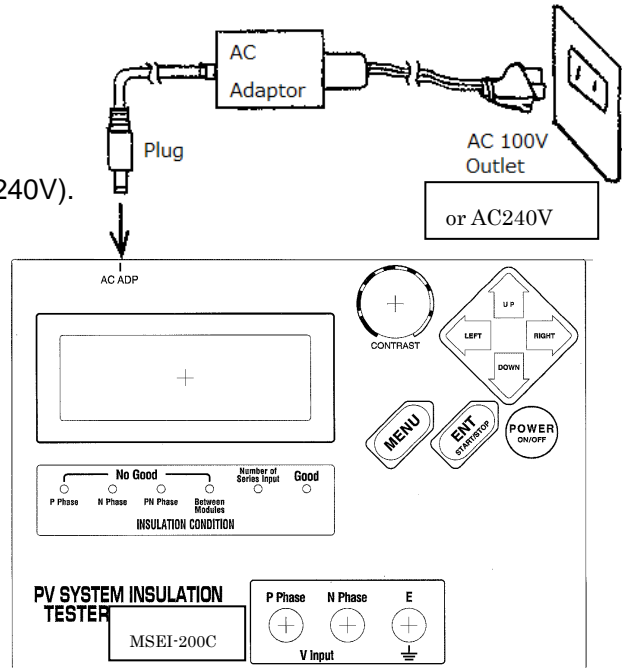
▲CAUTION

It may cause malfunction.

- ◆ When the instrument will not be in use for a long period, place it in storage after removing the batteries.
- ◆ Do not mix old and new batteries.
- ◆ Do not use the battery not specified in the instruction.

2) Use AC adaptor for long time use.

1. Insert the plug of AC adaptor to the jack of the instrument body(AC ADP).
2. Connect AC adaptor to the outlet(AC 100-240V).



Built-in battery is supplementary for unexpected power failure. Normally, use AC adaptor included in the package.

⚠WARNING

- ◆ Do not input power to AC adaptor except the indication, as it may cause a fire.
- ◆ Do not touch the plug with wet hands or in the condition of water drops, as it may cause electrical shock.
- ◆ Do not use AC adaptor (options) other than accessory, as it may cause damage of instrument and or electrical accident.

⚠CAUTION

Protection of Standard Resistor

MSE-200C has the standard resistor internally and the protection circuit is installed, as the power to be loaded to the standard resistor will exceed the rating in case of lower insulation resistance. In case that the protection circuit works during operation, the measurement will be proceeded with “over” on measuring voltage display and “0S” on the remaining time display. When the protection circuit operating, the calculation of insulation resistance values will be done by fixing V_{rp} & V_{rn} to 400.0V.

5.2 OPERATION PROCEDURE

1) Once press POWER switch ⑦

[MSEI-200C Ver.] appears on the display and [ZERO setting] will be displayed for a few seconds after lightening LED of display judgment.

Then, [Top Menu](initial display) will appear.

Initial Screen

(Top Menu)

■ Measure

Operate Memory

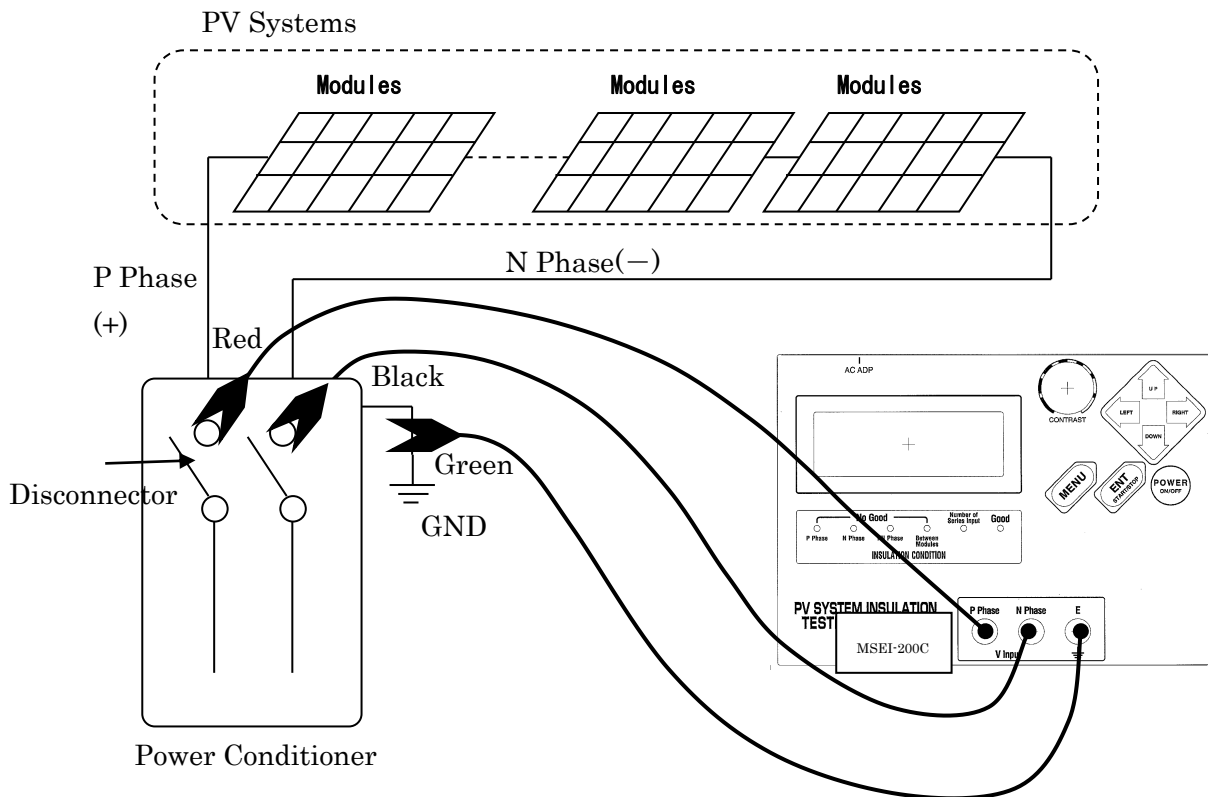
Set Configuration

* In several seconds during [ZERO setting] on the display after power on, zero adjustment is automatically done in the internal MSEI-200C. Do not operate voltage input by test leads during these seconds. Connect each voltage input lead clip to respective measuring point after [Top Menu] (initial display) appeared.

2) Connection of Test Leads (Standard Accessory)

Connect test lead(Red) to P phase, (Black) to N phase and (Green) to E of the instrument body.

Connect alligator clip of each test lead to measuring point.



※Make off the disconnector between PV panels and power conditioner.

3) Display before measurement

Set the cursor to Measure and press ENT switch ⑥ once.

Display will become as under:

Internal Standard Resistance→	Rr : *. ***kΩ	05/17	} Present Time
Generated Voltage→	V : ***. * V	13 : 38	
P Phase Voltage→	Vrp : ***. * V	30S	} Measuring Time
N Phase Voltage→	Vrn : ***. * V	30S	

4) Start of Measurement

Press again ENT switch ⑥ and then, measurement will start.

Vrp and Vrn are measured at the point of OS by decreasing each measuring time.

Display Example of Measurement

Rr : 4. 966kΩ	05/17	
V : 300. 0 V	13 : 40	
Vrp : -497. 1m V	0S	
Vrn : ***. * V	28S	L0

Display for Low Battery
(Replace the batteries in this case)

- To stop the measurement on the way, press ENT switch ⑥ once.
- To start the measurement again, press ENT switch ⑥ once again.
- Top Menu display will appear before or during measurement in case of press MENU switch ⑧.

5) Display of Measurement Result

Measurement will be made at respective points by measuring time. Respective insulation resistance values are displayed and the insulation condition lamp lightens.

(1) Good (Green) Lamp Lightening

Display Example of Measurement Result

Generated Voltage→	V : 300. 0 V	05/17
P Phase Insulation Resistance→	R p : 10. 00MΩ	13 : 43
N Phase Insulation Resistance→	R n : 10. 00MΩ	

Green lamp lightens when Rp (P phase insulation resistance), Rn (N phase insulation resistance) & Rpn (insulation resistance between PN phase and PV modules), all are more than 1MΩ.

(2) No good (Red) Lamp Lightening

In case that the judgment is as no good, the corresponding lamp (P phase failure, N phase failure, PN phase failure) lightens.

- To start the measurement again, press ENT switch ⑥ once again,
- Top Menu display will appear before or during measurement in case of press MENU switch ⑧.

(3) Series Panels Numbers Input (Orange) Lamp Lightening

Display Example of Measurement Result

Generated Voltage→	V : 300.0 V	05/17
P Phase Insulation Resistance→	R p : 0.20MΩ	13 : 51
N Phase Insulation Resistance→	R n : 0.50MΩ	
PV Module Numbers→	Set Module : 12	

In case that there is insulation resistance failure, [Serial Panel Number Input Lamps] (Orange) lightens and [Set Module] is displayed on LCD. In case that the alteration for PV module numbers requires, the change of numbers can be made by UP↑ & DOWN↓ switch ④. The setting limit is 2~28.

After setting, press ENT switch ⑥ and the judgment result is displayed.

- In case that the judgment is good, [Good] lamp lightens.
- In case that the judgment is no good, the corresponding lamp (P Failure, N Failure, PN Failure, Rpn Failure) lightens.

In case of Rpn Failure, Rpn lamp (Red) lightens and the failure point is displayed on LCD at the same time.

Display Example of Judgment Result

Generated Voltage→	V : 300.0 V	05/17
P Phase Insulation Resistance→	R p : 0.96MΩ	13 : 57
N Phase Insulation Resistance→	R n : 5.02MΩ	
Insulation Resistance between Modules→	Rpn : 0.63MΩ	PS : 6 ←Module Failure Point

PS: ※※ is the number from P direction. In case of 1, it means insulation failure between 1 and 2 and in case of 6, between 6 and 7.

- To start the measurement again, press ENT switch ⑥ once again.
- Top Menu display will appear before and during measurement in case of press MENU switch ⑧.

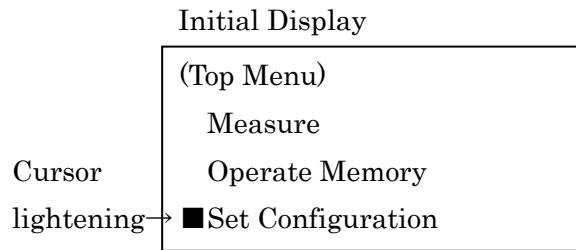
5.3 FUNCTION SETTING

1) Measurement Time Setting (Set Timer)

Measuring time means the time after the connection of instrument internal standard resistor to each phase to measure voltage between standard resistors. The setting times are 30 sec., 180 sec., 300 sec., 600 sec., and 900 sec.

(1) Press DOWN switch twice at the initial display (Top Menu) and set the cursor to Set Configuration and then, press ENT switch.

※Operate Memory cannot be used



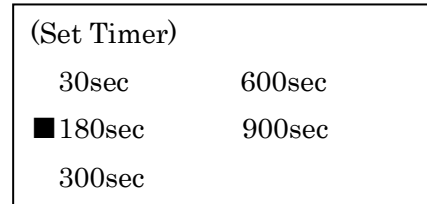
(2) Set Timer 30 sec. is displayed and Press ENT switch.

↓ ENT Switch



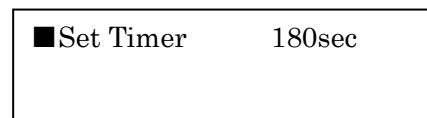
(3) Using UP↑ & DOWN↓ switch ④. Set the cursor to appropriate point and then, Press ENT switch once.

↓ ENT Switch



(4) Measuring Time will be set.

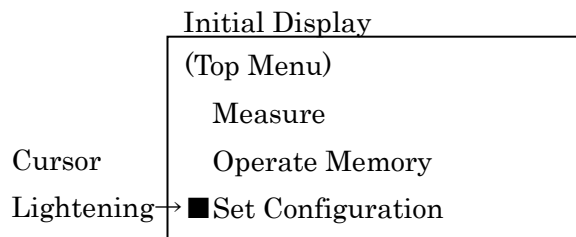
↓ ENT Switch



2) Present Time Setting (Now Time)

(1) Press DOWN switch twice at the initial display (Top Menu) and set the cursor to set Configuration and then, press ENT switch.

※Operate Memory cannot be used.



↓ ENT Switch

(2) Set Timer 30 sec. is displayed and press DOWN↓ switch.

■Set Timer	30sec
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↓ DOWN Switch

(3) Now Time (System) is displayed. Press ENT switch and set the present time.

■Now Time(System)
2013/05/17 14:26

↓ ENT switch

(4) By UP↑ switch and DOWN↓ switch, set the numerical value and by RIGHT switch, move the underline () to the right. After adjusted minute, press ENT switch according to the time-signal.

(Now Time)
2013/05/17 14:26

• After finished all setting, press MENU switch once and return to initial display (Top Menu).

●Replace of Batteries

When [Lo] is displayed, replace the batteries (page), as the voltage of batteries are getting low.

●When the display does not appear even by pressing Power Switch.

• The display may get thinner at the adjustment of CONTRAST. Adjust the display contrast by turning the contrast knob to the left.

• Check the voltage of batteries.

▲WARNING

Voltage Input

◆ Do not input voltage by test lead during a few second displaying “ZERO Setting” on LCD after power-on, as zero-adjustment is being done automatically at the inside of instrument.

Apply the clips of each voltage input lead to the measuring point after appeared 「Top Menu」 (initial display) on LCD.

6. SPECIFICATIONS

6.1 MEASUREMENT SPECIFICATIONS

1) Detection Method	: DC Voltage measurement between the earth by standard resistor.
2) Measurement Items	: Generated Voltage (DCV), P Phase Insulation Resistance, N Phase Insulation Resistance, PN Phase Insulation Resistance, Insulation Resistance between modules, Standard Resistance Value.
3) Measuring Range	: Generated Voltage (V): DC0.01V~599.9V (5 range auto) Insulation Resistance (MΩ): 0.01 MΩ~19.99 MΩ, OVER (exceeded 19.99 MΩ) { • P Phase Insulation Resistance (Rp) • N Phase Insulation Resistance (Rn) • Insulation Resistance between P Phase, N Phase and Module (Rpn) } ※Insulation resistance values are calculated by the formula.
4) Judgment Method	When the insulation resistance value is getting lower than 1.00 MΩ, LED of failure point lightens. In case that there is no problem for insulation resistance value, [Good] LED lightens. LED Color: Good LED-Green No Good LED-Red • Judgment whether PN Phase or between modules is made by calculation from numbers of module.
5) Display Part	: 20 letters/characters x 4 lines. LCD
6) Actual Time Display	: Year, month, date & time on the display
7) Actual Time Accuracy	: ±200ppm±10 sec. (at 25°C)
8) Measurement Accuracy	: Generated Voltage: ±1%rdg±10dgt Insulation Resistance 0.01MΩ~10MΩ: ±5%rdg 10.01 MΩ~19.99 MΩ: ±10%rdg

5.2 FUNCTION SPECIFICATIONS

1) Measuring Time Setting	: 30 sec., 180 sec., 300 sec., 600 sec., and 900 sec.								
2) Time Function	: can set the present time								
3) Module Number Setting	: can specify the insulation failure point between which modules by input of PV module numbers, in case that there is insulation failure between modules, Setting Module Numbers: 2~28								
4) Protection of Standard Resistor	<p>The protection circuit is installed internally, as the power will be loaded to the standard resistor will exceed the rating in case of lower insulation resistance. In case that the protection circuit works during operation, the measurement will be proceeded with “over” on measuring voltage display and “0S” on the remaining time display. When protection circuit working, the insulation resistance value will be calculated by fixing Vrp & Vrn to 400.0V.</p> <table border="1"> <thead> <tr> <th><u>Generated Voltage</u></th> <th><u>Insulation Resistance Value (Vrp&Vrn)</u></th> </tr> </thead> <tbody> <tr> <td>1000V</td> <td>7.5K Ω</td> </tr> <tr> <td>800V</td> <td>5.0K Ω</td> </tr> <tr> <td>600V</td> <td>2.5K Ω</td> </tr> </tbody> </table> <p>V=generated voltage Rp: P phase insulation resistance Rn: N phase insulation resistance</p> <p>The protection circuit will work when $V/(Rp+5000)>0.08$ during Vrp measurement and when $V/(Rn+5000)>0.08$ during Vrn measurement.</p>	<u>Generated Voltage</u>	<u>Insulation Resistance Value (Vrp&Vrn)</u>	1000V	7.5K Ω	800V	5.0K Ω	600V	2.5K Ω
<u>Generated Voltage</u>	<u>Insulation Resistance Value (Vrp&Vrn)</u>								
1000V	7.5K Ω								
800V	5.0K Ω								
600V	2.5K Ω								
5) Auto Power-off Function	: After final switch operation, automatically power of in approx. 40 minutes.								
6) Contrast Knob	: Knob to adjust the depth of display on LCD.								

5.3 GENERAL SPECIFICATIONS

1) Operation Circuit	: DC1000V PV generation circuit
2) Operation Temperature	: 0°C~50°C, less than RH85% without condensation
3) Storage Temperature	: -10°C~60°C, less than RH80% without condensation
4) Withstanding Voltage	: AC2200V(50/60Hz)/1 minute between voltage terminal and housing case
5) Insulation Resistance	: more than 100MΩ by DC1000V insulation resistance tester between voltage input terminal and housing case
6) Power Supply Source	: 1) AA alkaline battery LR-6x4 2) AC adaptor (option)
7) Current Consumption	: Approx. 30mA
8) Dimension & Weight	: 190(W) x140 (H) x42 (D), approx. 600gs
9) Accessories	: Voltage Input Cable 1 set (One each Red, Black, Green) Carrying Case 1 pce. Instruction Manual 1 pce. AA alkaline battery LR-6x4

7. Repair Service

When requesting for repair service, please bring the instrument directly to the dealer where you bought.

When mailing the instrument, always pack it in its original or equivalent packing materials to avoid any damage during the transportation and also put together with documents showing your name, address, phone number and defect point.

8. Warranty

This instrument is sent out from our factory after the sufficient internal inspections but if you find any defect due to the fault in our workmanship or the original parts, please contact the dealer where you bought the instrument.

The warranty period is 12 months from the date of purchase and instrument shall be repaired at free of charge, provided that we judge the cause of defect is obviously resulted from our responsibility.