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Introduction

Thank you for purchasing the Hioki IR4055-11, IR4056-20, IR4056-21, IR4057-20, IR4058-20 Insulation Tester. To obtain maximum performance from the instrument, please read this Instruction Manual first, and keep it handy for future reference. Hereinafter, the descriptions refer to models without the suffix.

Verifying Package Contents

When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your authorized Hioki distributor or reseller. Confirm that these contents are provided.

- Insulation Tester
  IR4055, IR4056
  IR4057, IR4058

- Instruction Manual

- LR6 Alkaline battery × 4

- Model L9787 Test Lead*
  (Only for the instruments with suffix “-20”)

- Model L9788-11 Test Lead Set with Remote Switch*
  (Only for the instruments with suffix “-11” and “-21”)

- Neck strap

* Model L9787 and L9788-11 are all exclusively designed for the Hioki IR4000 series. Do not use for any other purpose.
Options
The following options are available for the IR4000 series. Contact your authorized Hioki distributor or reseller when ordering.

* Refer to p. 1

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum rated voltage and maximum rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Model L9788-11* Test Lead Set with Remote Switch</td>
<td>CAT III 600 V/CAT II 600 V, 2 A</td>
</tr>
<tr>
<td>2 Model 9804-02 Magnet Adapter (φ11 mm, standard screw: M6 pan head screw)</td>
<td>CAT IV 1000 V, 2 A</td>
</tr>
<tr>
<td>3 Model L9787* Test Lead (1.2 m)</td>
<td>CAT III 600 V/CAT II 600 V, 10 A</td>
</tr>
<tr>
<td>4 Model L9787-91 Breaker Pin</td>
<td>CAT III 600 V, 10 A</td>
</tr>
<tr>
<td>5 Model L9788-10* Test Lead with Remote Switch (Red)</td>
<td>CAT III 600 V/CAT II 600 V, 2 A</td>
</tr>
<tr>
<td>6 Model L9788-92 Breaker Pin</td>
<td>CAT III 600 V, 2 A</td>
</tr>
<tr>
<td>7 Model L9788-90 Tip Pin</td>
<td>CAT III 600 V/CAT II 600 V, 2 A</td>
</tr>
</tbody>
</table>
Safety Information

This instrument is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, using the instrument in a way not described in this manual may negate the provided safety features. Before using the instrument, be certain to carefully read the following safety notes:

⚠️ DANGER

Mishandling during use could result in injury or death, as well as damage to the instrument. Be certain that you understand the instructions and precautions in the manual before use.

⚠️ WARNING

Protective gear
This instrument measures live lines. To prevent electric shock, use appropriate protective insulation and adhere to applicable laws and regulations.
Safety Information

**Notation**

In this document, the risk seriousness and the hazard levels are classified as follows.

<table>
<thead>
<tr>
<th>Notation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>Indicates an imminently hazardous situation that will result in death or serious injury to the operator.</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>Indicates a potentially hazardous situation that may result in death or serious injury to the operator.</td>
</tr>
<tr>
<td><strong>CAUTION</strong></td>
<td>Indicates a potentially hazardous situation that may result in minor or moderate injury to the operator or damage to the instrument or malfunction.</td>
</tr>
<tr>
<td>![Magnetic Field Symbol]</td>
<td>Indicates a strong magnetic-field hazard. The effects of the magnetic force can cause abnormal operation of heart pacemakers and/or medical electronics.</td>
</tr>
<tr>
<td>![Prohibited Action Symbol]</td>
<td>Indicates prohibited actions.</td>
</tr>
<tr>
<td>![Action Symbol]</td>
<td>Indicates the action which must be performed.</td>
</tr>
<tr>
<td>*</td>
<td>Additional information is presented below.</td>
</tr>
</tbody>
</table>
Symbols on the instrument

Indicates cautions and hazards. When the symbol is printed on the instrument, refer to a corresponding topic in the Instruction Manual.

Indicates that dangerous voltage may be present at this terminal.

Indicates a instrument that has been protected throughout by double insulation or reinforced insulation.

Indicates a grounding terminal.

Indicates DC (Direct Current).

Indicates AC (Alternating Current).

Do not use in distribution systems with voltage higher than 660 V AC.

Symbols for various standards


Indicates that the product conforms to regulations set out by the EU Directive.

Indicates that the product incorporates Bluetooth® wireless technology.

Screen Display

The instrument screen displays the alphanumerical characters as follows.

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
| A | b | C | d | E | f | G | h | I | j | k | L | m | n | o | p | q | r | s | t | u | v | w | x | y | z |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
Safety Information

Accuracy

We define measurement tolerances in terms of rdg. (reading) and dgt. (digit) values, with the following meanings:

<table>
<thead>
<tr>
<th>rdg.</th>
<th>(reading or displayed value)</th>
<th>The value currently being measured and indicated on the measuring instrument.</th>
</tr>
</thead>
<tbody>
<tr>
<td>dgt.</td>
<td>(resolution)</td>
<td>The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a &quot;1&quot; as the least-significant digit.</td>
</tr>
</tbody>
</table>

Trademarks

- Bluetooth® is a registered trademark of Bluetooth SIG, Inc. (USA). The trademark is used by HIOKI E.E. CORPORATION under license.
- Android and Google Play are trademarks of Google, Inc.
- IOS is a registered trademark of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.
- iPhone, iPad, iPad mini, iPad Pro, and iPod Touch are trademarks of Apple Inc.
- The App Store is a service mark of Apple Inc.
Measurement Categories

To ensure safe operation of measuring instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories.

⚠️ DANGER

- Using a measuring instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.
- Never use a measuring instrument that lacks category labeling in a CAT II to CAT IV measurement environment. Doing so could result in a serious accident.

This instrument conforms to the safety requirements for CAT III 600 V measuring instruments.

CAT II: When directly measuring the electrical outlet receptacles of the primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)

CAT III: When measuring the primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT IV: When measuring the circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).
Operating Precautions

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

⚠️ DANGER

- For your safe operation, do not connect any test lead to the primary of the distribution panel.
- Do not short-circuit two wires to be measured by bringing the test leads into contact with them. Arcs or such grave accidents are likely to occur.
- To avoid short circuit or electric shock, do not touch the metal part of the connecting test lead tip.
- To avoid electric shock, be careful to avoid shorting live lines with the test leads tip.

- If the test lead or the instrument is damaged, there is a risk of electric shock. Perform the following inspection before using them:
  - Before using the instrument check that the coating of the test leads are neither ripped nor torn and that no metal parts are exposed. Using the instrument under such conditions could result in electric shock. Replace the test leads with those specified by our company.
  - Verify that the instrument operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your authorized Hioki distributor or reseller.
Operating Precautions

WARNING

• To avoid electric shock, short circuits and damage to the instrument, observe the following precautions:
  Check the position of the rotary switch before taking measurements. Disconnect the test leads from the measurement object before switching the rotary switch.

• Do not use the instrument with circuits that exceed its ratings or specifications. Doing so may damage the instrument, resulting in electric shock.

• Use only the specified test leads. Use of any test lead not specified by our company does not allow safe measurements.

• To avoid electrical accidents, remove power from the circuit before connecting the test leads.
  • To avoid electric shock, do not exceed the lower of the ratings shown on the instrument and test leads.
Operating Precautions

[CAUTION]

- The cable is hardened under the 0°C or colder environment. Do not bend or pull it to avoid tearing its shield or cutting cable.
- The protection rating for the enclosure of this device (based on EN60529) is IP40*.

* IP40:
This indicates the degree of protection provided by the enclosure of the device against use in hazardous locations, entry of solid foreign objects, and the ingress of water.

4: Protected against access to hazardous parts with wire measuring 1.0 mm in diameter.
0: The equipment inside the enclosure is not protected against the harmful effects of water.
Installing the instrument

⚠️ WARNING

Installing the instrument in inappropriate locations may cause a malfunction of instrument or may give rise to an accident. Avoid the following locations.

- Exposed to direct sunlight or high temperature
- Exposed to corrosive or combustible gases
- Exposed to a strong electromagnetic field or electrostatic charge
- Near induction heating systems (such as high-frequency induction heating systems and IH cooking equipment)
- Susceptible to vibration
- Exposed to water, oil, chemicals, or solvents
- Exposed to high humidity or condensation
- Exposed to high quantities of dust particles

⚠️ CAUTION

Do not place the instrument on an unstable table or an inclined place. Dropping or knocking down the instrument can cause injury or damage to the instrument.

Precautions when transporting the instrument

During shipment of the instrument, handle it carefully so that it is not damaged due to a vibration or shock.
Handling the Instrument

⚠️ DANGER

Persons wearing electronic medical devices such as a pacemaker should not use model 9804-02 Magnet Adapter. Such persons should avoid even proximity to model 9804-02, as it may be dangerous. Medical device operation could be compromised, presenting a hazard to human life.

⚠️ CAUTION

To avoid damage to the instrument, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.

Test leads

⚠️ CAUTION

• Removable sleeves are attached to the metal pins at the end of the test leads. To prevent a short circuit accident, be sure to use the test leads with the sleeves attached when performing measurements in the CAT III measurement category. Remove the sleeves before starting CAT II measurements. You can use the test leads with the sleeve removed for primary side of the circuit breakers turned off. (See “Measurement Categories” (p. 7))
• If the sleeves are inadvertently removed during measurement, stop the measurement. (p. 1)
1 Overview

1.1 Product Overview

This instrument is an insulation ohmmeter that shortens work times associated with insulation testing. It is not designed for use on manufacturing lines and should not be used in such applications. For manufacturing line applications, use the model ST5520 Insulation Tester.

High-speed response

• Considerably improved response time compared to previous models.
• The instrument can be used like models with a meter needle.

Enhanced comparator function

• Can be used similarly to the continuity check with a tester due to judgment after the start of measurement being extremely short.
• The backlight lights up in red for a FAIL judgment (defective).

Low variation in measured values

• The instrument generates little variation in measured values when used in a typical measuring environment.

Easy-to-view display

• Backlight source is a white high-intensity LED.
• Wide viewing angle LCD

High-accuracy voltage measurement function

• The instrument incorporates a DC/AC voltmeter with the same accuracy as a card tester.
• There is no need to switch to a card tester when you need to measure voltage.

PVΩ measurement function (Model IR4055)

• Insulation resistance can be measured accurately for solar battery panel.
1.2 Names and Functions of Parts

Front
IR4056, IR4057, IR4058 (The figure below is model IR4058)

1 MEASURE key (p.16) Starts insulation resistance measurement.
2 Earth terminal Connects the black test lead.
3 Control terminal Controls model L9788-10 Test Lead with Remote Switch (Red)
4 Line terminal Connects the red test lead.
5 Rotary switch Selects measurement functions.
6 LIGHT key Turns on and off the light.
7 0Ω ADJ key Performs zero-adjustment for the low resistance range.
8 Live circuit indicator Lights up when voltage remains between input terminals.
### Names and Functions of Parts

<table>
<thead>
<tr>
<th></th>
<th><strong>COMP key</strong></th>
<th>Sets the comparator’s judgment reference value.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Bluetooth key</strong></td>
<td>Sets the Bluetooth® (p. 49) (IR4055, IR4058)</td>
</tr>
<tr>
<td></td>
<td><strong>RELEASE key</strong></td>
<td>Press before measurement to set the instrument to the 500 V or 1000 V range (to prevent erroneous application of the test signal).</td>
</tr>
</tbody>
</table>

#### IR4055

- **500 V↔1000 V key**: Switches between 500 V and 1000 V when using PVΩ range.
- **500 V/1000 V RELEASE key**
  - Press before measurement to set the instrument to the 500 V or 1000 V range (to prevent erroneous application of the test signal).
  - Applied voltage is confirmed when PVΩ range is set.

(Other functions are the same as IR4056, IR4057, and IR4058.)
**Names and Functions of Parts**

**MEASURE key**

<table>
<thead>
<tr>
<th>MEASURE key states</th>
<th>Pull*</th>
<th>Press the right portion</th>
<th>Release</th>
</tr>
</thead>
</table>

Description in this manual

- Turn on the **MEASURE** key.
- Turn off the **MEASURE** key.

*: Convenient way for performing measurement repeatedly

**Power OFF**

<table>
<thead>
<tr>
<th>Rotary switch state</th>
<th>Turn off the rotary switch.</th>
</tr>
</thead>
</table>

Description in this manual

- Turn off the rotary switch.
Display

IR4057, IR4058 (The figure below is model IR4058)

--- Battery indicator (three levels) (p.27)

~~~ Turns on when the voltage measured with the V range is DC.

~ Turns on when the voltage measured with the V range is AC.

< Blinks when the measured value is less than the minimum display value.

> Blinks when the measured value is greater than the maximum display value.

**HOLD** Turns on when the measured value is retained.

**PASS** Turns on when the comparator judgment is PASS (good). (p.29)

**FAIL** Turns on when the comparator judgment is FAIL (defective). (p.29)

⚡ Blinks when a dangerous voltage exists between the measurement terminals.

환 Judgment result buzzer (only when comparator is set) (p.29)

**APS** The auto power save function will activate 30 seconds after this mark starts turning on. (p.28)

**0Ω ADJ** Turns on when zero adjustment is made during low resistance measurement. (p.40)
### Names and Functions of Parts

<table>
<thead>
<tr>
<th>1min</th>
<th>Displaying 1-minute values (p.35)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Turns on when 1 minute has passed since the start of insulation resistance measurement.</td>
</tr>
<tr>
<td></td>
<td>• Indicates that the resistance value on the bottom of the display is a 1-minute value (the measured value 1 minute after the start of measurement).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMP</th>
<th>Turns on when the comparator function is enabled. (p.29)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Turns on when the instrument is set to the 500 V range or the 1000 V range.</td>
</tr>
<tr>
<td></td>
<td>Pressing 📷 turns off the indicator and enables insulation measurement.</td>
</tr>
</tbody>
</table>

|      | Displays Bluetooth® function state. |
|      | • Bluetooth® function ON: Turns on |
|      | • Bluetooth® function OFF: Turns off |
|      | • Bluetooth® Communicating: Blinks |

### IR4056

<table>
<thead>
<tr>
<th>Measured value or comparator reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Other functions are the same as IR4057 and IR4058.)</td>
</tr>
</tbody>
</table>

| REF | Turns on when the reference value is indicated by the comparator function. |
Names and Functions of Parts

IR4055

Measured value
or comparator reference value

(Other functions are the same as
IR4056, IR4057, and IR4058.)

<table>
<thead>
<tr>
<th>PV</th>
<th>Turns on when PVΩ measurement mode is selected.</th>
</tr>
</thead>
<tbody>
<tr>
<td>500V</td>
<td>Turns on when selecting 500 V range in the PVΩ measurement mode.</td>
</tr>
<tr>
<td>1000V</td>
<td>Turns on when selecting 1000 V range in the PVΩ measurement mode.</td>
</tr>
</tbody>
</table>
Names and Functions of Parts

Model L9788-10 Test Lead with Remote Switch (Red)

⚠️ CAUTION

The MEASURE key of the instrument is enabled even when the L9788-10 is connected to an insulation resistance tester. Note that the testing voltage is output when the MEASURE key of the instrument is turned ON while the L9788-10 is connected.

Refer to “Attaching the L9788-92 Breaker Pin” (p. 26)

Enlarged tip view

1 Light

- Lights up interlocked with the backlight of the instrument.

2 MEASURE key

- Starts insulation resistance measurement.
- Lights up in red interlocked with the live wire warning indicator of the instrument.

3 Judgment display

- Lights up in accordance with the comparator judgment result.
  - PASS: Green
  - FAIL: Red
Preparing for Measurement

⚠️ CAUTION
Attach the strap securely to the four fittings on the instrument. If insecurely attached, the instrument may fall and be damaged when carrying.

1 Attach the strap.
Slightly extend each of the four double-loop split rings and pass the ring through a lug-hole on the instrument.

2 Insert the batteries. (p. 22)

3 Connect the test leads to the terminals.

   Earth terminal
   Connect the black test lead.

   Line terminal
   Connect the red test lead.

4 Attach each test pin or alligator clip to a lead.
   Fully insert the test lead to the test pin or alligator clip.
2.1 Replacing Batteries or Fuse

⚠️ WARNING

- To avoid electric shock, turn off the MEASURE key, remove the test leads from the measuring object and replace the primary battery or fuse.
- After replacing the batteries, reattach the cover and secure the screw before using the instrument.
- Battery may explode if mistreated. Do not shortcircuit, recharge, disassemble or dispose of in fire.
- Replace the fuse only with one of the specified type, characteristics, rated current, and rated voltage. Do not use fuses other than those specified (especially, do not use a fuse with higher-rated current) or do not short circuit and use the fuse holder. Doing so may damage the instrument and result in bodily injury.

Fuse type: FF0.5 AH/1000 V (70 172 40.0.500: SIBA GmbH) (Fast blow, arc-extinguishing material included, and high breaking capacity)
The fuses can be purchased via authorized Hioki distributor or reseller. (Fuse replacement not required for the IR4055)
- To prevent instrument damage or electric shock, use only the screw for securing the battery cover in place that are originally installed. If you have lost a screw or find that a screw is damaged, please contact your authorized Hioki distributor or reseller.
CAUTION

Poor performance or damage from battery leakage could result. Observe the cautions listed below.

- Do not mix old and new batteries, or different types of batteries.
- Be careful to observe the battery polarity during installation.
- Do not use batteries after their recommended expiry date.
- Do not leave depleted batteries inside the instrument.
- Replace batteries only with the specified type.
- The operating temperature of the batteries included in the shipment is −10°C to 45°C (14°F to 113°F). When using this device outside this temperature range, use batteries that can support such a low or high temperature range.

- The battery indicator blinks when the remaining battery capacity is low. (p.27)
- Handle and dispose of batteries in accordance with local regulations.
Replacing Batteries or Fuse

1. Turn off the rotary switch and remove the test lead from the instrument.

2. Loosen the fastening screw at the rear of the instrument and remove the battery cover.

3. Replace all four batteries or the fuse.

4. Slide the battery cover back into place and tighten the screw.

Batteries: (LR6 ×4)
Check the polarity.

Fuse: FF0.5 AH/1000 V (70 172 40.0.500: SIBA GmbH)
2.2 Using the Model L9788-10 Test Lead with Remote Switch (Red)

Pre-measurement inspection

1. Turn off the rotary switch.

2. Fully insert the L9788-10 plug into the line terminal of the instrument.

3. Short the test lead tips each other.

4. Set the rotary switch to insulation resistance range.

5. Turn on the MEASURE key of the L9788-10. Check the red indicator of the MEASURE key of L9788-10 and display 0 MΩ interlocked with the live wire warning indicator of the instrument.

6. Press \( \text{L} \). Check that the L9788-10 tip lamp lights up.
Replacing the Tip Pin (optional) for Model L9788-10

When the tip pin of model L9788-10 Test Lead with Remote Switch (Red) is worn out or broken, it can be replaced. The tip pin can be purchased via authorized Hioki distributor or reseller.

1. Turn off the rotary switch and disconnect the L9788-10.

2. Remove the tip pin by rotating with a wrench.

3. Attach the new tip pin to the L9788-10 by rotating with a wrench. (Tightening torque: 0.3 N·m)

4. Check the operation. Measure a measuring object of known values and use after checking that the resistance is correct.

Attaching the L9788-92 Breaker Pin

Remove the sleeve of the L9788-10 and attach the breaker pin. Fully insert.

Removing and attaching the test lead sleeves

Safely store the removed sleeves so as not to lose them. (p. 12)

<table>
<thead>
<tr>
<th>Removing the sleeves</th>
<th>Attaching the sleeves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gently hold the bottom of the sleeves and pull</td>
<td>Insert the metal pins of the test leads into the holes of</td>
</tr>
<tr>
<td>them off.</td>
<td>the sleeves, and firmly push them all the way in.</td>
</tr>
</tbody>
</table>
3 Measurement

3.1 Pre-measurement Inspection

Before using the instrument, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your authorized Hioki distributor or reseller.

Checking the remaining battery charge

Is the battery level adequate?
Set the rotary switch away from OFF and confirm the battery indicator.

- Blinks
  - Replace the batteries. (p.22)

- Turns on

Checking the test lead

Is the white portion (insulation layer) inside the cable exposed?

- Exposed
  - Do not use if damage is present as you could receive an electric shock. Contact your authorized Hioki distributor or reseller for replacement.

- Not Exposed

1. Set the rotary switch to insulation resistance range.
2. Short the test lead tips.
3. Is 0 MΩ displayed when the MEASURE key is turned on?

- Displayed
  - The following issues may be occurring:
    • The test lead has not been inserted all the way.
    → Insert the test lead all the way in.
    • There is a broken connection in the test lead.
    → Replace them with those specified by our company.

- Not displayed

Inspection complete

Please read the “Operating Precautions” (p. 8) before use.
3.2 Auto Power Save (Power-Saving Function)

When the rotary switch is not in the OFF position, the instrument changes to the auto power save state 10 minutes after the last operation or live wire warning indication.

To avoid battery depletion, turn off the rotary switch after use (the auto power save consumes a small amount of current).

Canceling the auto power save

Other than the OFF position.

Turn on the instrument while holding down LIGHT.

Recovering from auto power save state

Turn off the rotary switch and then turn on the power again.

3.3 Auto Backlight-off (Automatic Light-off Function)

The backlight of the instrument will automatically turn off after approx. 3 minutes has passed since the last operation.

The automatic light-off function can be canceled when working continuously in a dark location.

Canceling the automatic light-off function

Backlight: OFF

Continuous short beep

Press for approx. 2 seconds.

With the backlight off, press LIGHT for approx. 2 seconds until the instrument beeps continuously.

Repeat this procedure after turning off the rotary switch.
### 3.4 Comparator Function

This function compares the measured value with the preset value and judges whether the result is PASS (good) or FAIL (defective). Comparator settings for each range will be saved, even if the rotary switch is turned off. See the table on the next page for criteria that can be set.

#### Indication lights up

<table>
<thead>
<tr>
<th>LED display</th>
<th>PASS (good) judgment</th>
<th>FAIL (defective) judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Backlight: No change</td>
<td>Backlight: Lights up in red*</td>
</tr>
<tr>
<td></td>
<td>Lights up in green*</td>
<td>Lights up in red*</td>
</tr>
</tbody>
</table>

* When using the model L9788-10 Test Lead with Remote Switch (Red)

#### Type of measurements that can be judged

<table>
<thead>
<tr>
<th>Function</th>
<th>PASS judgment</th>
<th>FAIL judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>State of measured value</td>
<td>Buzzer</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>Criterion or higher</td>
<td>Short beep</td>
</tr>
<tr>
<td>Low resistance</td>
<td>Criterion or lower</td>
<td>Long beep</td>
</tr>
<tr>
<td>PVΩ</td>
<td>Criterion or higher</td>
<td>Short beep</td>
</tr>
<tr>
<td>Voltage</td>
<td>Comparator cannot be set.</td>
<td></td>
</tr>
</tbody>
</table>
## Setting the Comparator

1. Select a judgment reference from the table below.

<table>
<thead>
<tr>
<th>Range</th>
<th>Reference value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 V</td>
<td>0.01 0.02 0.03 0.04 0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 0.2 0.3 0.4 0.5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1*1 2 3 4 5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>10 – – – –</td>
<td>–</td>
</tr>
<tr>
<td>125 V</td>
<td>0.1 0.2 0.3 0.4 0.5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1*1 2 3 4 5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>10 20 – – –</td>
<td>–</td>
</tr>
<tr>
<td>250 V</td>
<td>0.1 0.2 0.3 0.4 0.5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1*1 2 3 4 5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>10 20 30 40 50</td>
<td>–</td>
</tr>
<tr>
<td>500 V/PVΩ 500 V</td>
<td>0.1 0.2*2 0.3 0.4 0.5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1*1 2 3 4 5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>10 20 30 40 50</td>
<td>–</td>
</tr>
<tr>
<td>1000 V*3/PVΩ 1000 V</td>
<td>0.1 0.2 0.3 0.4*2 0.5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>10*1 20 30 40 50</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>100 200 300 400 500</td>
<td>–</td>
</tr>
<tr>
<td>Ω</td>
<td>0.1 0.2 0.3 0.4 0.5 0.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 20*1 30 40 50 60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100 200 – – –</td>
<td></td>
</tr>
</tbody>
</table>

*1: Factory default setting
*2: Factory default setting when PVΩ function is selected.
*3: Reference values 0.1 to 0.5 are only for model IR4055.
Comparator Function

2 Set the rotary switch to the range for which you wish to set the judgement reference.

<table>
<thead>
<tr>
<th>Range</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 V</td>
<td>Press [500/1000V] RELEASE to release the lock.</td>
</tr>
<tr>
<td>1000 V</td>
<td>Press [PV] to select the applied voltage and press [PV] to release the lock.</td>
</tr>
</tbody>
</table>

3 Press COMP.

[COMP] or [REF] blinks and the resistance value that will be used as the judgement reference is displayed.

IR4057, IR4058: COMP
IR4055, IR4056: REF

4 Press [ADJ] or [COMP] to select the judgement reference.

If you do nothing about 2 seconds after you select the judgment reference, the comparator will be set, and [COMP] or [REF] will light up.

Canceling the Comparator

Press COMP several times to select [oFF].

If you do nothing for about 2 seconds after you select, [COMP] or [REF] will go out, and the comparator function will be canceled.
3.5 Insulation Resistance Measurement

The instrument is used to measure the insulation resistance to determine the insulation performance of circuits and equipment. Before starting a measurement, the voltage to be applied to the measuring object needs to be selected.

**WARNING**

Observe the following to avoid electric shock, short circuit, or damage to the instrument.

- Do not attempt to measure insulation resistance on alive conductor. Doing so could damage the instrument or cause an accident that might result in injury or death. Always turn off power to the measurement target before starting.
- When measuring insulation resistance, dangerous voltage is applied to the measurement terminals. To avoid electric shock, do not touch the test leads.
- Do not touch the measuring object immediately after measurement. Doing so may cause electric shock due to a highly charged voltage.
- Discharge the measuring object with the discharge function of the instrument after a measurement. (p. 37)

- Insulation resistance is the ratio of applied voltage to leakage current. Displayed value may not stabilize depending on the measuring object, but it is not a failure of the instrument.
- Press the MEASURE key fully down until a live circuit indicator lights up. If the button is not pressed down fully, a proper measurement cannot be made.
- After use, turn off the rotary switch.
- Disconnection of any equipment having a lower withstanding voltage than the test voltage, or equipment or parts having an unknown withstanding voltage connected to the circuit to be measured is recommended.
Lock Function

This function is used to avoid applying high voltage such as 500 V or 1000 V to equipment having a lower withstanding voltage. This function will prevent the test voltage from being output even if the MEASURE key is pressed while the rotary switch is set to the 500 V, 1000 V or PVΩ range.

Releasing the lock

1. Set the rotary switch to the 500 V, 1000 V or PVΩ range.

2. Press .

Pressing this key unlocks the instrument and switches to the measurement screen.

The screen is locked 1 minute after the last measurement or operation again.
Measuring Insulation Resistance

CAUTION

To avoid electric shock, turn off the measuring line breaker.

Example: When measuring the insulation resistance between the circuit and the ground

1. Turn off the MEASURE key.
2. Set the rotary switch to a test voltage of 50 V to 1000 V.
   In the 500 V or 1000 V range, press the lock release button to release the lock. (p.33)
3. Connect the black test lead to the ground side of the object being measured.
4. Connect the red test lead to the measurement object.
   If there is any remaining voltage on the measuring object, red and white blink alternately on the backlight.
5. Press and hold the MEASURE key.
   To make continuous measurements, pull up the MEASURE key. (p.16)
6. Check the value after the indicator has stabilized.
7 Turn off the **MEASURE** key with the test leads connected to the measuring object.

The last measured values and **HOLD** are displayed and starts discharging. (p.37)

- Do not switch the function to other function or rated voltage when the measurement is in progress.
- The instrument will return to the locked state when about 1 minute of no operation elapses during measurement in the 500 V and 1000 V ranges. To continue measurement, release the lock. (p.33)

**Displaying 1-minute Values (Model IR4057, IR4058)**

This function automatically retains the measured value (1-minute value) 1 minute after the start of measurement (after the **MEASURE** key is turned on).

No value is shown if less than 1 minute has elapsed since the start of measurement.

- Use this function when measuring objects that include a capacitance component.
- Value is not displayed when the comparator function is enabled.

Retained measured value
Voltage Characteristics of Measurement Terminals

![Graph showing voltage characteristics](image)

- Rated 1000 V
- Rated 500 V
- Rated 250 V
- Rated 125 V
- Rated 50 V

Voltage generated [V] vs. Resistance of measuring object [MΩ]
3.6 Discharging Function

After measurements are completed, discharge the measuring object. When objects with capacitance component are measured, a charge equivalent to the rated measurement voltage remains in the object that may cause electric shock. Even when the solar panel is discharged after measurement, a generated voltage from the solar panel is detected that ⚡ may not be cleared.

Without removing the test leads from the measurement object, turn off the MEASURE key.

The built-in discharge circuit automatically discharges the item.

In models IR4057 and IR4058, the bar graph level decreases according to discharge. However, measuring objects with smaller capacitance component discharge quickly and the bar graph level may not change.

When the discharge is completed, ⚡ is turned off.

The time required for discharge depends on the capacitance value.
3.7 Voltage Measurement

This instrument can measure the AC voltage of commercial power. The instrument can check to ensure that the measuring object is not live before measuring insulation resistance.

**WARNING**

• Never press the MEASURE key while measuring voltage. Doing so could damage the circuitry or cause an accident that might result in injury or death.

• During measuring, do not switchover to other functions.
• For waveforms other than sine waves, some errors may occur.

Example: When measuring the voltage between the circuit and ground

Do not turn on the MEASURE key.

Always connect the test lead to the secondary side of the breaker.
1 Set the rotary switch to V.

2 Connect the black test lead to the ground side of the object being measured.

3 Connect the red test lead to the line side of the breaker.

4 Check the value after the indicator has stabilized.

Negative Voltage Notification Function (Model IR4055)

You can check whether P and N are connected in reverse while measuring the open voltage of solar battery string.

1 Set the rotary switch to V while pressing \( \text{COMP} \).

The \([-]\) and \( [V] \) blinks and \( [\text{ON}] \) or \( [\text{OFF}] \) is displayed.

2 Press \( \text{RELEASE} \) to switch between ON and OFF.

<table>
<thead>
<tr>
<th></th>
<th>When the voltage is (-1 \text{ V}) or lower, red and white of the backlight blinks alternately.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>(Factory setting)</td>
</tr>
<tr>
<td>OFF</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

If there is no operation for 2 seconds after ON or OFF is selected, the setting is confirmed, and the screen changes to measurement screen.
### Low Resistance Measurement (Model IR4056, IR4057, IR4058)

**WARNING**

Do not measure under a live circuit condition.

**CAUTION**

If active circuits are connected to the measuring object circuit in parallel, the impedance and transient current of the parallel circuit could cause measurement errors.

The comparator function can be used during low resistance measurement. See “3.4 Comparator Function” (p. 29)

For accurate measurements, be sure to perform zero adjustment before measuring, to cancel the wire resistance of the test leads.

Zero adjustment can be performed with readings of up to a maximum of 3 Ω. When the reading exceeds 3 Ω, [Err 1] will be displayed, and zero adjustment will not be possible.

Wire the instrument so that the wiring resistance is less than 3 Ω.

In the following circumstances, repeat the zero adjustment procedure:
- After changing test leads
- When the ambient temperature changes by 1°C or more
- After replacing the fuse
Example: Checking continuity of grounding wire

1. Set the rotary switch to the Ω.
2. Short circuit the tip of the test lead.
3. Turn on the MEASURE key.
4. Turn off the MEASURE key to retain the measured value.
5. Press 

6. Connect the test lead to the measurement object.
7. Press and hold the MEASURE key to check the displayed value.
   To make continuous measurements, pull up the MEASURE key.
8. Turn off the MEASURE key after use.

Do not measure live wires.
3.9 PVΩ Measurement Function (Model IR4055)

This function allows accurate insulation resistance measurements between the solar panel and ground without any influence from power generation. For measurements between the coupling box output terminals and ground or between power conditioner and ground, use the normal insulation resistance range. See “Appx. 1 Measurement Principles” (p. Appx.1) “Appx. 3 Insulation Resistance Measurements for Solar Cell Array” (p. Appx.3)

⚠️ DANGER

Do not short-circuit two wires to be measured by bringing the test leads into contact with them. Arcs or such grave accidents are likely to occur.

⚠️ WARNING

Observe the following to avoid electric shock, shortcircuit, or damage to the instrument.

- When measuring insulation resistance, dangerous voltage is applied to the measurement terminals. To avoid electric shock, do not touch the test leads.
- Check that the connection of the measurement terminals has been secured. If the terminal is loose, the contact resistance will increase, resulting in overheating, equipment burnout, or fire.
- Do not touch the measuring object immediately after measurement. A highly charged voltage may cause electric shock.
- Discharge the measuring object with the discharge function of the instrument after a measurement. (p.37)
WARNING

Observe the following to avoid electric shock, short circuit, or damage to the instrument.

• Turn off any disconnector devices and separate from the power conditioner before starting the measurements for the solar battery panel.
• Do not attempt to measure insulation resistance on alive conductor. Doing so could damage the instrument or cause an accident that might result in injury or death. Always turn off power to the measurement target before starting.
• Do not touch any metal parts such as connection box and disconnector devices directly with bare hands. Doing so may cause electric shocks due to the voltage of the generator.
• Maximum rated voltage between terminals of the IR4055 is 1000 V DC/600 V AC. Do not use the instrument for equipment with rated voltage over 1000 V DC or 600 V AC. Doing so may cause electric shock or failure.
• Use an insulation resistance range other than PVΩ to perform measurements by shorting P and N.
• Perform measurements by shorting P and N when the solar battery panel is not generating power, such as during the night.
• If the bypass diode of the solar battery panel has failed, do not perform any insulation resistant measurement. Doing so may damage the solar battery panel.
• Insulation resistance is the ratio of applied voltage to leakage current. Displayed value may not stabilize depending on the measuring object, but it is not a failure of the instrument.

• Press the **MEASURE** key fully down until a live circuit indicator turns on. If the button is not pressed down fully, a proper measurement cannot be made.

• Turn off the rotary switch after use.

• Disconnection when measuring is recommended of any equipment having a lower withstanding voltage than the test voltage, or equipment or parts having an unknown withstanding voltage connected to the circuit to be measured.

• The ground capacitance of the solar battery panel is high, therefore the measured values may take some time to stabilize.

• The PVΩ measurement function does not comply with EN61557 requirements. To perform measurements in conformity with EN61557, select the insulation resistance range.

• Accurate measurements are not possible when open voltage of the solar battery string is higher than the test voltage. Use the PVΩ 500 V range for open voltage less than 500 V and PVΩ 1000 V range for open voltage less than 1000 V.

• If a voltage higher than the test voltage is detected, the buzzer sounds and measurement is not possible.

• For the PVΩ measurement function, the output voltage is divided by the 1 MΩ resistor and the resistor connected between measurement terminals because a 1 MΩ current limiting resistor is connected to the earth terminal.

Example: When a 10 MΩ resistor is measured, the voltage is divided by 1 MΩ and 10 MΩ.
The method to measure the insulation resistance between the solar battery panel and ground without shorting P and N will be explained. See “Appx. 3 Insulation Resistance Measurements for Solar Cell Array” (p. Appx.3)

**Measurement preparation 1**

1. Turn off the main switch of the connection box to be disconnected from the power conditioner.
2. Turn off all the disconnector devices of the strings.
3. Disconnect lightning arresters from the measuring circuit. Disconnection is not required for the figure (solar generator facility) shown below because a lightning arrester is not present at the string side of the disconnector device.

![Diagram of measurement preparation 1](image)

**Measurement preparation 2**

1. Check that the **MEASURE** key is turned off. If the **MEASURE** key is on, turn it off. (p.16)
2. Set the rotary switch to **PVΩ**.
3. Press [500V/1000V] to set 500 V or 1000 V as the test voltage.
4. Press [REL] to release the lock.
Start Measuring

**WARNING**

Observe the following to avoid damage to the measuring object.

- If the insulation has deteriorated between the terminal P and the ground, do not measure between the terminal N and the ground.
- Connect the red test lead to the string side of the disconnector device.

5 Connect the black test lead to the ground terminal.

6 Connect the red test lead to the terminal P of the string side.

If a voltage is detected between the P and the ground terminals, the insulation may have deteriorated. When there is a voltage on the measuring object, the voltage detection function makes the backlight light in red and white alternately.
PVΩ Measurement Function (Model IR4055)

7 Pless and hold the MEASURE key.
   To make continuous measurements, pull up the MEASURE key.

   Do not remove any test leads from the terminals until the resistance is displayed. Doing so results in incorrect measurements.

8 Check the resistance displayed after 4 seconds.
   Subsequently, the resistance will be updated every second.

   If there is any deteriorated insulation and the resistance is lower than the reference value, do not measure the terminal N of procedure 10. Doing so may damage the solar battery panel. Check the reference insulation resistance with safety regulations.

9 Turn off the MEASURE key.
   If the MEASURE key is on, turn it off. (p. 16)

   Discharge starts and the icon ⚡ blinks. The icon ⚡ may not be cleared even if the discharge is completed because a voltage is generated by the solar battery.

10 When measuring terminal P and insulation has not deteriorated, connect the red test lead to the terminal N of the string side and repeat the procedures 7 to 9.
After Measurements

1. After measuring insulation resistance for all the strings, remove the black test lead from the ground terminal.

2. Reconnect the lightning arrester connection if disconnected.

3. Turn on all the disconnector devices of the strings.

4. Turn on the main switch of the connection box.

1 minute after the last measurement or operation, the \textbf{PRESS RELEASE K E Y} turns on and the \textbf{500 V/1000 V RELEASE} key blinks. Press the key to release the lock.
3.10 Bluetooth® Communication Function

Models IR4055 and IR4058 support the Bluetooth® (Bluetooth® low energy).
When the Bluetooth® function is enabled, you can review measurement data and create measurement reports on mobile devices (iPhone, iPad, iPad Mini, iPad Pro, iPod Touch, and Android™ devices). For more information about this functionality, see the help function in the application software GENNECT Cross.

1. Install the GENNECT Cross on your mobile device. (p.50)

2. Enable the Bluetooth® function on model IR4055 or IR4058.

3. Launch the GENNECT Cross and pair it with model IR4055 or IR4058. (p.51)

4. Select the general measurement.
Installing the Smartphone App GENNECT Cross

Search for “GENNECT Cross” on the App Store from your iPhone, iPad or other Apple device, or on Google Play™ from your Android™ device. Then download and install the GENNECT Cross. You will need an Apple ID to download the app from the App Store, or a Google account to download the app from Google Play™. For more information about how to register an account, contact the store at which you purchased your device.

- Because model IR4055 and IR4058 emit radio waves, use in a country or region where they have not been approved may be subject to fines or other penalties as a violation of applicable laws or regulations. For more information, see the attached “Precautions Concerning Use of Equipment That Emits Radio Waves” or go to our website.
- Model IR4055 and IR4058 availability are limited to certain countries. For more information, contact your authorized Hioki distributor or reseller.
- Bluetooth® communications range varies greatly with distance from obstructions (walls, metal obstruction, etc.) as well as distance from the floor or ground. To ensure stable measurement, verify adequate signal strength.
- Although this app is provided free of charge, downloading or use of the app may incur Internet connection charges. Such charges are the sole responsibility of the user.
- This app is not guaranteed to operate on all mobile devices.
Pairing the App

1. Home>Other
2. Instrument Settings
3. The instrument is automatically registered.
4. Returns to the home screen.

- When the app is launched for the first time (before being paired with any instrument), the connection setup screen will be displayed.
- While the mobile device is displaying the connection setup screen, simply move it close to model IR4055 or IR4058 to automatically pair it with the instrument (the app can be paired with up to 8 instruments).
- Allow about 5 to 30 seconds for the instrument to pair with the app after being turned on. If the instrument fails to pair within 1 minute, relaunch GENNECT Cross and cycle the instrument’s power.
- Instruments that have been registered do not require to be registered again.
Making Measurements with the Bluetooth® Function

On the home screen, select the standard measurement function from the options, standard measurement, logging and waveform display, to start a measurement. For more information about each function, see the help function in the GENNECT Cross. The values displayed by the instrument may be different from the values displayed by the application software due to communication delays or differences in the update timing.

**Standard measurement**

Measured values of multiple channels are saved.
## 4.1 Standard Specifications

| Functions | Insulation Resistance measurement:  
DC voltage supply, current detection  
Low resistance measurement:  
DC current supply, voltage detection  
Voltage measurement: Automatic DC/AC detection  
PVΩ measurement:  
DC voltage supply, current detection  
AC voltage measurement rectification method:  
Mean rectification RMS value indication  
Available effective battery voltage indicator:  
Built-in battery power indicator |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Live circuit indicator</td>
<td>Turns on when voltage is detected between the line terminal and the earth terminal</td>
</tr>
</tbody>
</table>
| Automatic electric discharge | Automatically discharges the electric charge still present in the capacitance of the measuring object after the insulation resistance measurement.  
Maximum capacitive load: 5 μF |
| Auto power save | The power will go off automatically approx. 10 minutes after the last operation.  
Can be canceled using the power supply activation options. |
| Indicator | Indicator: LCD display  
Backlight  
• Color: white, red  
• Light automatic OFF function: 3 min. after last operation  
• Turns red when the comparator judgment result is FAIL.  
• Operation at erroneous input: Alternates white and red |
## 4.2 General Specifications

<table>
<thead>
<tr>
<th><strong>Guaranteed accuracy period</strong></th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Guaranteed accuracy period from adjustment made by Hioki</strong></td>
<td>1 year</td>
</tr>
<tr>
<td><strong>Product warranty period</strong></td>
<td>3 years</td>
</tr>
</tbody>
</table>
| **Operating temperature and humidity (Rated operational conditions)** | • IR4056, IR4057, IR4058  
-25°C to 40°C (-13°F to 104°F),  
90% RH or less (no condensation)  
40°C to 65°C (104°F to 149°F), at 65°C and below relative with linear decrease up to 25% RH  
• IR4055  
0°C to 40°C (32°F to 104°F),  
90% RH or less (no condensation)  
40°C to 50°C (104°F to 122°F), at 50°C and below relative with linear decrease up to 50% RH |
| **Operating environment** | Indoors, Pollution Degree 2, altitude up to 2000 m (6562 ft.) |
| **Nominal circuit voltage** | 600 V AC/DC max.  
*: The nominal circuit voltage refers to the nominal voltage of an electric distribution circuit that can be measured by the instrument (based on EN61557). |
| **Storage temperature and humidity** | • IR4056, IR4057, IR4058  
-25°C to 65°C (-13°F to 149°F),  
90% RH or less (no condensation)  
• IR4055  
-10°C to 50°C (-13°F to 122°F),  
90% RH or less (no condensation) |
### General Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Degree of protection</strong></td>
<td>IP40</td>
</tr>
</tbody>
</table>
| **Maximum rated voltage to terminal** | 600 V AC/DC (Voltage measurement)  
600 V AC/1000 V DC (Voltage measurement, only for IR4055)                                                                 |
| **Maximum rated voltage to earth** | 600 V AC/DC, Measurement Category III, Anticipated Transient Overvoltage: 6000 V                                              |
| **Dielectric strength**       | 7060 V AC, 50 Hz/60 Hz, between measurement terminals and chassis, 1 minute, current sensitivity 1 mA                               |
| **Power supply**              | Rated supply voltage: 1.5 V DC × 4  
LR6 alkaline battery × 4                                                                                                             |
| **Maximum rated power**       | 3 VA                                                                                                                                 |
| **Continuous operating time (at 23°C, as a referential)** | Bluetooth® OFF: Approx. 20 hours  
(Comparator off, backlight off, measured with measurement terminal open at 500 V range)  
Bluetooth® ON: Approx. 10 hours  
(Comparator off, backlight off, measured with measurement terminal open at 500 V range) |
| **Drop proof**                | On concrete: 1 m                                                                                                                     |
| **Fuse (Replacements)**       | FF0.5 AH/1000 V (70 172 40.0.500: SIBA GmbH)  
(Very fast-blow, arc-extinguishing material included, high breaking capacity)                                                              |
| **Dimensions (excluding protrusions)** | Approx. 159W × 177H × 53D mm  
(6.26”W × 6.97”D × 2.09”D)                                                                   |
| **Mass (including battery, excluding test lead)** | • IR4055, IR4056: Approx. 600 g (21.2 oz.)  
• IR4057, IR4058: Approx. 640 g (22.6 oz.)                                               |
| **Accessories**               | Refer to “Verifying Package Contents” (p. 1)                                                                                           |
| **Options**                   | Refer to “Options” (p. 2)                                                                                                             |
### General Specifications

<table>
<thead>
<tr>
<th>Standards</th>
<th>EN61326 (EMC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN61557-1</td>
</tr>
<tr>
<td></td>
<td>EN61557-2</td>
</tr>
<tr>
<td></td>
<td>EN61557-4<em>1</em>2</td>
</tr>
<tr>
<td></td>
<td>EN61557-10*2</td>
</tr>
<tr>
<td></td>
<td>JISC1302 (Insulation resistance testers)*3</td>
</tr>
</tbody>
</table>

*1: Subclause 4.3 of Part 4 (Interchanging of test leads) is not applicable when model L9788-10 is used.

*2: Model IR4055 is not applicable.

*3: Model IR4055 only
### 4.3 Measurement functions

Accuracy guarantee for temperature and humidity:  
23°C±5°C (73°F±9°F), 90% RH or less

<table>
<thead>
<tr>
<th>Insulation Resistance Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated measurement voltage (DC)</strong></td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Effective maximum displayed value</td>
</tr>
<tr>
<td>Medium displayed value</td>
</tr>
<tr>
<td>1st effective measuring range [MΩ]</td>
</tr>
<tr>
<td>Accuracy (Limit deviation tolerance)</td>
</tr>
<tr>
<td>2nd effective measuring range [MΩ]</td>
</tr>
<tr>
<td>Accuracy (Limit deviation tolerance)</td>
</tr>
<tr>
<td>Other measuring range [MΩ]</td>
</tr>
<tr>
<td>Accuracy (Limit deviation tolerance)</td>
</tr>
<tr>
<td>Range configuration</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Maximum displayed value</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
<tr>
<td>Display range</td>
</tr>
<tr>
<td>Maximum displayed value</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
<tr>
<td>Display range</td>
</tr>
<tr>
<td>Maximum displayed value</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
</tbody>
</table>
### Insulation Resistance Measurement

<table>
<thead>
<tr>
<th>Effect of temperature (E₃)*</th>
<th>1st effective measuring range</th>
<th>2nd effective measuring range</th>
<th>Other measuring range</th>
</tr>
</thead>
<tbody>
<tr>
<td>±4% rdg. (0°C to 50°C)</td>
<td>±8% rdg. (0°C to 50°C)</td>
<td>±2% rdg.±6 dgt. (0°C to 50°C)</td>
<td></td>
</tr>
<tr>
<td>±8% rdg. (less than -25°C to 0°C, 50°C to 65°C) (Only for IR4056, IR4057, IR4058)</td>
<td>±16% rdg. (less than -25°C to 0°C, 50°C to 65°C) (Only for IR4056, IR4057, IR4058)</td>
<td>±4% rdg.±12 dgt. (less than -25°C to 0°C, 50°C to 65°C) (Only for IR4056, IR4057, IR4058)</td>
<td></td>
</tr>
<tr>
<td>±4% rdg. and within allowance</td>
<td>±8% rdg. and within allowance</td>
<td>±2% rdg.±6 dgt.</td>
<td></td>
</tr>
<tr>
<td>Effect of magnetic field</td>
<td>±2.4% rdg.</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Effect of supply voltage (E₂)</td>
<td>±4% rdg. and within allowance</td>
<td>±8% rdg. and within allowance</td>
<td>±2% rdg.±6 dgt. and within allowance</td>
</tr>
<tr>
<td>Effect of positioning (E₁)</td>
<td>Not applicable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Effect of temperature (E₃) is applicable to the operating temperature range other than 18°C to 28°C.

<table>
<thead>
<tr>
<th>Rated measurement voltage (DC)</th>
<th>50 V</th>
<th>125 V</th>
<th>250 V</th>
<th>500 V</th>
<th>1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible number of measurements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1000 times or more</td>
</tr>
<tr>
<td>Overload protection</td>
<td></td>
<td>600 V AC (10 sec.)</td>
<td></td>
<td>660 V AC (10 sec.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>660 V AC (10 sec.), 1200 V DC (10 sec.) (Only for IR4055)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display update interval</td>
<td></td>
<td>IR4057, IR4058: Within 0.6 sec. (no update during response)</td>
<td></td>
<td>IR4055, IR4056: Within 1.0 sec. (no update during response)</td>
<td></td>
</tr>
</tbody>
</table>
## Measurement functions

<table>
<thead>
<tr>
<th>Measurement terminal voltage characteristic</th>
<th>1 to 1.2 times of rated measurement voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit voltage</td>
<td></td>
</tr>
<tr>
<td>Lower limit resistance value to be maintained rated measurement voltage</td>
<td>0.05 MΩ</td>
</tr>
<tr>
<td>Rated current</td>
<td>1 mA to 1.2 mA</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>1.2 mA or less</td>
</tr>
<tr>
<td>Response time</td>
<td>IR4057, IR4058: Within 0.6 sec.</td>
</tr>
<tr>
<td></td>
<td>IR4055, IR4056: Within 1.0 sec. (with resistance load)</td>
</tr>
<tr>
<td>Judgment time</td>
<td>IR4057, IR4058: Within 0.3 sec.</td>
</tr>
<tr>
<td></td>
<td>IR4055, IR4056: Within 0.8 sec.</td>
</tr>
<tr>
<td></td>
<td>(When switching from an open state to 10 times the default judgment reference value)</td>
</tr>
</tbody>
</table>
## Measurement functions

### Low Resistance Measurement

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-circuit voltage</td>
<td>4.0 V to 6.9 V</td>
</tr>
<tr>
<td>Measuring current</td>
<td>200 mA or more (at 6 Ω or less&lt;sup&gt;1&lt;/sup&gt;)</td>
</tr>
<tr>
<td>Effect of temperature&lt;sup&gt;2&lt;/sup&gt;</td>
<td>±3% rdg. ±2 dgt. (applicable to the operating temperature range other than 18°C to 28°C)</td>
</tr>
<tr>
<td>Effect of supply voltage&lt;sup&gt;2&lt;/sup&gt;</td>
<td>±3% rdg. ±2 dgt. and within allowance</td>
</tr>
<tr>
<td>Response time</td>
<td>Within 1 sec. (measurement terminal open → short)</td>
</tr>
<tr>
<td>Possible number of measurements</td>
<td>200 times or more</td>
</tr>
<tr>
<td>Overload protection</td>
<td>600 V AC (10 sec., by fuse protection)</td>
</tr>
<tr>
<td>Zero adjustment range</td>
<td>0 Ω to 3 Ω</td>
</tr>
<tr>
<td>Display update interval</td>
<td>Within 1 sec.</td>
</tr>
</tbody>
</table>

### Range Configuration

<table>
<thead>
<tr>
<th>Range (Auto range)</th>
<th>Display range</th>
<th>Maximum displayed value</th>
<th>Resolution</th>
<th>Accuracy&lt;sup&gt;2&lt;/sup&gt; (after zero adjustment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Ω</td>
<td>10.00 Ω</td>
<td>0.01 Ω</td>
<td>0 to 0.19 Ω: ±3 dgt. 0.20 Ω to 10.00 Ω: ±3% rdg. ±2 dgt.</td>
<td></td>
</tr>
<tr>
<td>100 Ω</td>
<td>100.0 Ω</td>
<td>0.1 Ω</td>
<td></td>
<td>±3% rdg. ±2 dgt.</td>
</tr>
<tr>
<td>1000 Ω</td>
<td>1000 Ω</td>
<td>1 Ω</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup>: Display value before zero adjustment  
<sup>2</sup>: Display value is applicable after zero adjustment  
(when the temperature changes more than 1°C, zero adjustment is necessary)
**Voltage Measurement**

<table>
<thead>
<tr>
<th>AC/DC automatic detection range</th>
<th>AC detected at 30 V or greater (50 Hz/60 Hz). (pulsating currents with an overlapping AC component of 30 V or greater are detected as AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of temperature</td>
<td>Measurement accuracy per 1°C × 0.1 (applicable to the operating temperature range other than 18°C to 28°C)</td>
</tr>
<tr>
<td>Overload protection</td>
<td>750 V AC (10 sec.), 750 V DC (10 sec.) 1200 V DC (10 sec.) (Only for IR4055)</td>
</tr>
<tr>
<td>Display update interval</td>
<td>Within 1 sec.</td>
</tr>
<tr>
<td>Response time</td>
<td>Within 1.2 sec. (when input voltage is cycled from 0 V to 600 V)</td>
</tr>
</tbody>
</table>

**AC Voltage Measurement**

- **Input resistance**: 100 kΩ or more (50 Hz/60 Hz)
- **Frequency range**: 50 Hz/60 Hz

**Range configuration**

<table>
<thead>
<tr>
<th>Display range (Auto range)</th>
<th>Maximum displayed value</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>420 V (minimum displayed value: 30.0 V)</td>
<td>420.0 V</td>
<td>0.1 V</td>
<td>±2.3% rdg. ±8 dgt (ranges in excess of 600 V are outside the accuracy guarantee)</td>
</tr>
<tr>
<td>600 V</td>
<td>750 V</td>
<td>1 V</td>
<td></td>
</tr>
</tbody>
</table>

**DC Voltage Measurement**

- **Input resistance**: 100 kΩ or more

**Range configuration**

<table>
<thead>
<tr>
<th>Display range (Auto range)</th>
<th>Maximum displayed value</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR4056, IR4057, IR4058: 600 V</td>
<td>IR4056, IR4057, IR4058: 750 V</td>
<td>IR4056: 1100 V</td>
<td>1 V</td>
</tr>
</tbody>
</table>

* Over 1000 V for model IR4055 only
### 4.4 PVΩ Measurement (Model IR4055)

See explanation for 500 V and 1000 V of the insulation resistance measurement for PVΩ range configuration.

<table>
<thead>
<tr>
<th>PVΩ Measurement</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement voltage (DC)</td>
<td>PVΩ 500 V</td>
<td>PVΩ 1000 V</td>
</tr>
<tr>
<td>Maximum displayed value</td>
<td>2000 MΩ</td>
<td>4000 MΩ</td>
</tr>
<tr>
<td>1st effective measuring range [MΩ]</td>
<td>0.200 to 500</td>
<td>0.200 to 1000</td>
</tr>
<tr>
<td>Accuracy (Limit deviation tolerance)</td>
<td>±4% rdg.</td>
<td></td>
</tr>
<tr>
<td>2nd effective measuring range [MΩ]</td>
<td>501 to 2000</td>
<td>1010 to 4000</td>
</tr>
<tr>
<td>Accuracy (Limit deviation tolerance)</td>
<td>±8% rdg.</td>
<td></td>
</tr>
<tr>
<td>Other measuring range [MΩ]</td>
<td>0 to 0.199</td>
<td></td>
</tr>
<tr>
<td>Accuracy (Limit deviation tolerance)</td>
<td>±2% rdg. ±6 dgt.</td>
<td></td>
</tr>
<tr>
<td>Effect of temperature (E₃)</td>
<td>Accuray x 1.0 (applicable to the operating temperature range other than 18°C to 28°C)</td>
<td></td>
</tr>
<tr>
<td>Effect of humidity</td>
<td>Accuracy x 1.0 and within allowance</td>
<td></td>
</tr>
<tr>
<td>Effect of magnetic field</td>
<td>Accuracy x 0.5</td>
<td></td>
</tr>
<tr>
<td>Impact of positioning (E₁)</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Effect of supply voltage (E₂)</td>
<td>Accuracy x 1.0 and within allowance</td>
<td></td>
</tr>
<tr>
<td>Effect of superimposing DC voltage</td>
<td>Within ±10%</td>
<td></td>
</tr>
<tr>
<td>Possible number of measurements</td>
<td>1000 times or more</td>
<td></td>
</tr>
<tr>
<td>Overload protection</td>
<td>660 V AC (10 sec.), 1200 V DC (10 sec.)</td>
<td></td>
</tr>
<tr>
<td>Display update interval (no update during response)</td>
<td>Within 1.0 sec.</td>
<td></td>
</tr>
<tr>
<td>Open voltage*</td>
<td>1 to 1.2 times of measurement voltage</td>
<td></td>
</tr>
<tr>
<td>Lower limit resistance value to be maintained rated measurement voltage</td>
<td>20 MΩ ±5%</td>
<td>20 MΩ ±5%</td>
</tr>
<tr>
<td>Rated current</td>
<td>0.025 mA ±20%</td>
<td>0.05 mA ±20%</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>1.2 mA or less</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>Within 4.0 s (Measurement start → Display)</td>
<td></td>
</tr>
</tbody>
</table>
* For the PVΩ measurement function, the output voltage is divided by the 1 MΩ resistor and the resistor connected between measurement terminals because a 1 MΩ current limiting resistor is connected to the earth terminal.

Example: If a DMM with input impedance 10 MΩ is used to measure an open voltage, the voltage is divided by 1 MΩ and 10 MΩ.

### 4.5 External Interface Specifications (Model IR4055, IR4058)

<table>
<thead>
<tr>
<th>Interface</th>
<th>Bluetooth® 4.0LE (Bluetooth®)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna power</td>
<td>Maximum +0 dBm (1 mW)</td>
</tr>
<tr>
<td>Communication distance</td>
<td>5 m (line of sight)</td>
</tr>
<tr>
<td>Communication profile</td>
<td>GATT (Generic Attribute Profile)</td>
</tr>
<tr>
<td>Supported Android™ devices</td>
<td>Android™ 4.3 or later (Bluetooth® low energy enabled devices)</td>
</tr>
<tr>
<td>Supported iOS devices</td>
<td>iOS 10 or later (Bluetooth® low energy enabled devices)</td>
</tr>
</tbody>
</table>
5 Maintenance and Service

⚠️ WARNING

Touching any of the high-voltage points inside the instrument is very dangerous. Customers are not allowed to modify, disassemble, or repair the instrument. Doing so may cause fire, electric shock, or injury.

Calibrations

The calibration period varies depending on the status of the instrument or installation environment. We recommend that the calibration period be determined in accordance with the status of the instrument or installation environment. Please contact your Hioki distributor to have your instrument periodically calibrated.

Precautions when transporting the instrument

When transporting the instrument, be sure to observe the following precautions:
• To avoid damage to the instrument, remove the batteries from the instrument. Moreover, be sure to pack in a double carton. Damage that occurs during transportation is not covered by the warranty.
• When sending the instrument for repair, be sure to include details of the problem.

Disposal

Handle and dispose of the instrument in accordance with local regulations.

Cleaning

• To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent.
• Wipe the LCD gently with a soft, dry cloth.
• Wipe the dust from metal parts of alligator clips with a soft cloth to avoid any impact on the measurements.
## 5.1 Troubleshooting

### Before Returning for Repair

If damage is suspected, check the "Troubleshooting" section below before contacting your authorized Hioki distributor or reseller.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Check Items</th>
<th>Remedy and Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>The power is not turning on.</td>
<td>Does the battery have sufficient charge?</td>
<td>Replace the batteries. (p. 22)</td>
</tr>
<tr>
<td></td>
<td>Have the batteries been installed improperly?</td>
<td>Install the batteries in the proper orientation. (p. 22)</td>
</tr>
<tr>
<td>The batteries run out immediately.</td>
<td>Are you using alkaline batteries?</td>
<td>Replace the batteries with alkaline batteries. (p. 22)</td>
</tr>
<tr>
<td>The <strong>MEASURE</strong> key is not working for the lead with a switch.</td>
<td>Is the plug of the lead with a switch fully inserted?</td>
<td>Fully insert the plug to the limit without any gaps. (p. 25)</td>
</tr>
<tr>
<td>During insulation resistance, low resistance, or PVΩ measurement, the live circuit indicator and the display blinks in red, and the buzzer sounds.</td>
<td>Does the voltage applied between the measurement terminals exceed the following values? Insulation resistance, PVΩ: approx. 20 V Low resistance: approx. 5 V</td>
<td>Make save that the measurement target is disconnected from a live circuit. If voltage exists in the measurement target, the live circuit indicator blinks.</td>
</tr>
<tr>
<td>Symptom</td>
<td>Check Items</td>
<td>Remedy and Reference</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Unable to perform measurement.</td>
<td>Are you setting the rotary switch while the <strong>MEASURE</strong> key turned on?</td>
<td>Turn off the <strong>MEASURE</strong> key and then press it again.</td>
</tr>
<tr>
<td></td>
<td>Is the voltage between the measuring terminals over any of the following values before turning on the <strong>MEASURE</strong> key?</td>
<td>Separate the measurement object from all sources of power before performing measurement.</td>
</tr>
<tr>
<td></td>
<td>50 V to 250 V range: Approx. 90 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 V and PVΩ 500 V ranges: Approx. 500 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 V and PVΩ 1000 V ranges: Approx. 1000 V</td>
<td></td>
</tr>
<tr>
<td>Unable to perform measurement in 500 V, 1000 V or PVΩ range.</td>
<td>Is the function to prevent the application of voltage by mistake locked?</td>
<td>Release the lock function. (p.33)</td>
</tr>
<tr>
<td>In the 500 V range, 1000 V range or PVΩ range, turning on the <strong>MEASURE</strong> key enables the lock function that has been released.</td>
<td>Does the battery have sufficient charge? Is alkaline battery used?</td>
<td>Replace the batteries with new alkaline batteries. (p.22)</td>
</tr>
<tr>
<td></td>
<td>Has 1 minute lapsed after the last operation?</td>
<td>Release the lock function again. (p.33)</td>
</tr>
<tr>
<td>The measured value is shown as the maximum display value.</td>
<td>Is there a broken connection in a test lead?</td>
<td>Check the continuity of the test lead with a tester.</td>
</tr>
<tr>
<td></td>
<td>Are the test leads securely connected?</td>
<td>Check the connection between the test leads and the instrument, and check the connection of the tips of the test leads.</td>
</tr>
<tr>
<td>There is excessive variation in the measured value.</td>
<td>Is a charging circuit located near the measurement object?</td>
<td>Disconnect the circuit breaker for any nearby charging circuits. If this is not possible, use the lowest measured value as the measurement result.</td>
</tr>
<tr>
<td>Symptom</td>
<td>Check Items</td>
<td>Remedy and Reference</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Measured values acquired through insulation resistance measurement or PVΩ measurement fluctuate over time.</td>
<td>When the measuring object connected is a capacitor. Does the measurement object have a large capacitance component (capacitor)?</td>
<td>If it is possible to remove the capacitor, do so. If not, use the lowest measured value as the measurement result.</td>
</tr>
<tr>
<td></td>
<td>When the measuring object connected is not a capacitor. This phenomenon reflects the influence of the measurement object capacitance component. This is not a malfunction or error.</td>
<td>Select measured values acquired one minute after the start of the measurement. If a large capacitance component included in the measuring object causes the fluctuation of measured values, select measured values after they have stabilized.</td>
</tr>
<tr>
<td>Symptom</td>
<td>Check Items</td>
<td>Remedy and Reference</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>A different measured value results each time the same measurement object is measured.</td>
<td>Is there any impact due to the material of the measuring object?</td>
<td>Allow an adequate amount of time (about 1 hour to 1 day) to pass after the first measurement before repeating measurement. The effects of polarity increase as the insulation resistance increases.</td>
</tr>
<tr>
<td></td>
<td>Is there any impact due to the temperature/humidity characteristics of the measuring object?</td>
<td>Measure the object under the same temperature and humidity conditions. In general, an insulator’s insulation resistance value will decrease as temperature and humidity increase. Reference: the insulation resistance value of some insulated cables decreases to 1/4 or less when the temperature increases 10°C.</td>
</tr>
<tr>
<td>The output voltage polarity is reversed.</td>
<td>The reversal is due to the characteristics of the insulation ohmmeter. This does not represent a malfunction.</td>
<td>Appx. 2 Operation Uncertainty (p.Appx.2)</td>
</tr>
</tbody>
</table>
### Troubleshooting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Check Items</th>
<th>Remedy and Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>When the instrument is calibrated, the accuracy of the insulation</td>
<td>Has the supplied or optional test lead used?</td>
<td>Use the test leads that came with the instrument or its optional test leads to</td>
</tr>
<tr>
<td>resistance range falls outside the device specifications.</td>
<td></td>
<td>perform the calibration procedure. With standard wiring, characteristics are</td>
</tr>
<tr>
<td></td>
<td></td>
<td>affected when the resistance in the 1000 V range reaches or exceeds 100 MΩ.</td>
</tr>
<tr>
<td></td>
<td>Has the insulation of the test lead deteriorated?</td>
<td>Replace the deteriorated test lead with a new one.</td>
</tr>
</tbody>
</table>

*1 Polarization: A phenomenon whereby a substance’s positive and negative electric charges move in opposite directions when an electric field is applied to it, causing the center position of the positive and negative charges to shift.
When an error is displayed on the LCD screen, repair is necessary. Please contact your authorized Hioki distributor or reseller.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Remedy and Reference</th>
</tr>
</thead>
</table>
| **Err 1** | The instrument was unable to perform zero adjustment. (Low resistance measurement) | • Verify that there is no broken connection in the test leads.  
• Zero adjustment can be performed for readings of up to 3 Ω. Ensure that the wiring resistance is 3 Ω or less. (p. 40) |
| **Err 2** | The settings data has been corrupted. | |
| **Err 3** | The pre-adjustment data has been corrupted. | Repair is required. |
| **Err 4** | The measurement circuit is broken | Replace the batteries. If there is no apparent improvement, the instrument needs repair. |
| **Err 6** | The voltage generation circuit is broken. | |
| **Err 8** | Bluetooth® is broken. | Repair is required. |
| **FUSE** | There is a broken connection in the suprotective fuse. | Replace the indicated fuse. (p. 22) |
| **bAtt** | Low battery voltage | Replace the batteries. (p. 22) |
Appendix

Appx. 1 Measurement Principles

1. Insulation resistance measurement
   The measurement object’s insulation resistance Rx is calculated by applying a voltage V to the object, measuring the leak current I that flows to the object as a result, and dividing the voltage V by the leak current I.

2. Low resistance measurement (Model IR4056, IR4057, IR4058)
   The measurement object’s resistance Rx is calculated by applying a current I to the measurement object, measuring the voltage V that occurs between the measurement terminals as a result, and dividing the voltage V by the current I.

3. PVΩ measurement (Model IR4055)
   The resistance Rx is calculated using the equation (Applied voltage V)/(Leakage current I) by applying a voltage V to the measuring object, and then measuring the leakage current I flowing through the measuring object and applied voltage V. (Voltage and current generated from the measuring object are subtracted.)
The operation uncertainty and the variations of measurement value for the respective influence quantity approved by EN/IEC61557 are as follows:

<table>
<thead>
<tr>
<th>Intrinsic uncertainty/influence quantity</th>
<th>Operation range</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Insulation resistance</td>
</tr>
<tr>
<td>A</td>
<td>Intrinsic uncertainty</td>
<td>Reference condition</td>
</tr>
<tr>
<td>E₂</td>
<td>Supply voltage</td>
<td>4.5 V to 6.8 V</td>
</tr>
<tr>
<td>E₃</td>
<td>Temperature</td>
<td>0°C to 35°C</td>
</tr>
<tr>
<td>B</td>
<td>Operation uncertainty</td>
<td></td>
</tr>
<tr>
<td>Guaranteed range of operation uncertainty</td>
<td>1st effective measurement range</td>
<td></td>
</tr>
</tbody>
</table>

Influencing factor non-applicable for E₁ and E₄ to E₁₀
There are two insulation resistance measurements for solar cell arrays. Characteristics of them are as follows:

**Measurement with P-N opened**

$PV\Omega$ measurement of this manual is explained with this measurement. As solar cell voltage influences the test voltage, the measurement may not be accurate. Incorrect procedure may damage the solar panel. If earth fault is occurred due to earth leakage as shown in the following figure, current being generated influences the insulation resistance meter resulting in inaccurate measurement with a normal insulation resistance meter. $PV\Omega$ measurement mode of the IR4055 allows accurate measurements without the effect from power generation.

**Measurement with P-N shorted**

This measurement allows accurate measurements but is also a highly dangerous method as arc discharge may be generated due to the short circuit. There is also a fire risk depending on the deterioration level of the solar panel.
Warranty Certificate

<table>
<thead>
<tr>
<th>Model</th>
<th>Serial number</th>
<th>Warranty period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Three (3) years from date of purchase (<em><strong>/</strong></em>)</td>
</tr>
</tbody>
</table>

Customer name: ____________________________
Customer address: ____________________________

Important
- Please retain this warranty certificate. Duplicates cannot be reissued.
- Complete the certificate with the model number, serial number, and date of purchase, along with your name and address. The personal information you provide on this form will only be used to provide repair service and information about Hioki products and services.

This document certifies that the product has been inspected and verified to conform to Hioki's standards. Please contact the place of purchase in the event of a malfunction and provide this document, in which case Hioki will repair or replace the product subject to the warranty terms described below.

Warranty terms
1. The product is guaranteed to operate properly during the warranty period (three [3] years from the date of purchase). If the date of purchase is unknown, the warranty period is defined as three (3) years from the date (month and year) of manufacture (as indicated by the first four digits of the serial number in YYMM format).
2. If the product came with an AC adapter, the adapter is warranted for one (1) year from the date of purchase.
3. The accuracy of measured values and other data generated by the product is guaranteed as described in the product specifications.
4. In the event that the product or AC adapter malfunctions during its respective warranty period due to a defect of workmanship or materials, Hioki will repair or replace the product or AC adapter free of charge.
5. The following malfunctions and issues are not covered by the warranty and as such are not subject to free repair or replacement:
   - Malfunctions or damage of consumables, parts with a defined service life, etc.
   - Malfunctions or damage of connectors, cables, etc.
   - Malfunctions or damage caused by shipment, dropping, relocation, etc., after purchase of the product
   - Malfunctions or damage caused by inappropriate handling that violates information found in the instruction manual or on precautionary labeling on the product itself
   - Malfunctions or damage caused by a failure to perform maintenance or inspections as required by law or recommended in the instruction manual
   - Malfunctions or damage caused by fire, storms or flooding, earthquakes, lightning, power anomalies (including voltage, frequency, etc.), war or unrest, contamination with radiation, or other acts of God
   - Damage that is limited to the product's appearance (cosmetic blemishes, deformation of enclosure shape, fading of color, etc.)
   - Other malfunctions or damage for which Hioiki is not responsible
6. The warranty will be considered invalidated in the following circumstances, in which case Hioiki will be unable to perform service such as repair or calibration:
   - If the product has been repaired or modified by a company, entity, or individual other than Hioiki
   - If the product has been embedded in another piece of equipment for use in a special application (aerospace, nuclear power, medical use, vehicle control, etc.) without Hioiki's having received prior notice
7. If you experience a loss caused by use of the product and Hioiki determines that it is responsible for the underlying issue, Hioiki will provide compensation in an amount not to exceed the purchase price, with the following exceptions:
   - Secondary damage arising from damage to a measured device or component that was caused by use of the product
   - Damage arising from measurement results provided by the product
   - Damage to a device other than the product that was sustained when connecting the device to the product (including via network connections)
8. Hioiki reserves the right to decline to perform repair, calibration, or other service for products for which a certain amount of time has passed since their manufacture, products whose parts have been discontinued, and products that cannot be repaired due to unforeseen circumstances.

HIOKI E.E. CORPORATION
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