IR4055 IR4055-11
IR4056 IR4056-20 IR4056-21
IR4057 IR4057-20
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HIOKI

Instruction Manual

INSULATION TESTER

EN

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HIOKI

Instruction Manual

INSULATION TESTER

EN

Contents

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

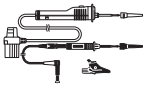
IR4057, IR4058

□ 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")

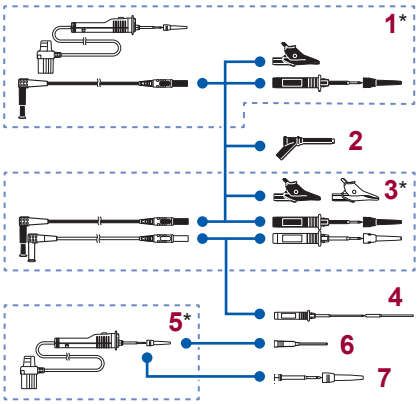


□ Neck strap

* 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

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

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.

Notation

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

⚠ DANGER	Indicates an imminently hazardous situation that will result in death or serious injury to the operator.
⚠ WARNING	Indicates a potentially hazardous situation that may result in death or serious injury to the operator.
⚠ CAUTION	Indicates a potentially hazardous situation that may result in minor or moderate injury to the operator or damage to the instrument or malfunction.
	Indicates a strong magnetic-fi eld hazard. The effects of the magnetic force can cause abnormal operation of heart pacemakers and/or medical electronics.
	Indicates prohibited actions.
	Indicates the action which must be performed.
*	Additional information is presented below.

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).
⚠ >660V ⚠ >~660V	Do not use in distribution systems with voltage higher than 660 V AC.

Symbols for various standards

	Indicates the Waste Electrical and Electronic Equipment Directive (WEEE Directive) in EU member states.
CE	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 alphanumeric characters as follows.

Accuracy

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

rdg.	(reading or displayed value) The value currently being measured and indicated on the measuring instrument.
dgt.	(resolution) The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1" as the least-significant digit.

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 in the U.S. and 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

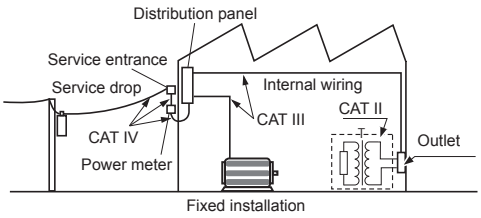
- **Using a measuring instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.**
- **Never use a measuring instrument that lacks category labeling in a CAT II to CAT IV measurement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

⚠ 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.**

⚠ 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 apacemaker 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.

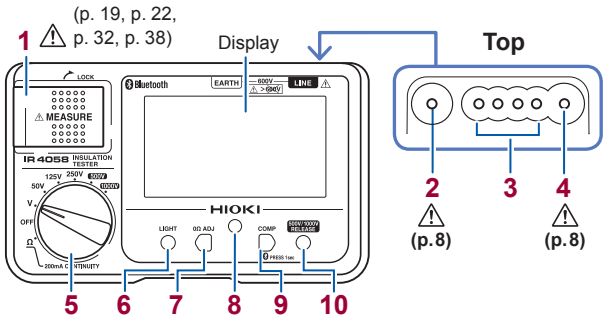
PVΩ measurement function (Model IR4055)

- Insulation resistance can be measured accurately for solar battery panel.

1.2 Names and Functions of Parts

Front

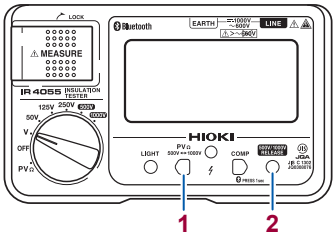
IR4056, IR4057, IR4058 (The figure below is model IR4058)



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.

9	**COMP key**	Sets the comparator's judgment reference value.
	Bluetooth key	Sets the Bluetooth® (p.49) (IR4055, IR4058)
10	**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).

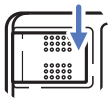
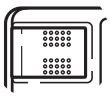
IR4055



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

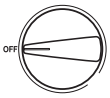
1	**500 V↔1000 V key**	Switches between 500 V and 1000 V when using PVΩ range.
2	**500 V/1000 V RELEASE key**	• Press before measurement to set the instrument to the 500 V or 1000 V range (to prevent erroneous application of the test signal). • Applied voltage is confirmed when PVΩ range is set.

MEASURE key

MEASURE key states			
	Pull*	Press the right portion	Release
Description in this manual	Turn on the **MEASURE** key.		Turn off the **MEASURE** key.

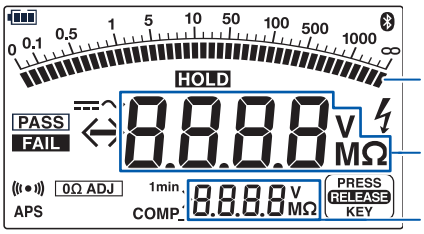
*: Convenient way for performing measurement repeatedly

Power OFF

Rotary switch state	
Description in this manual	Turn off the rotary switch.

Display

IR4057, IR4058 (The figure below is model IR4058)



Bar graph

Measured value

Comparator judgment reference value or 1-minute value

	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.
	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)

1min	Displaying 1-minute values (p.35) • Turns on when 1 minute has passed since the start of insulation resistance measurement. • 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).
COMP	Turns on when the comparator function is enabled. (p.29)
PRESS RELEASE KEY	Turns on when the instrument is set to the 500 V range or the 1000 V range. Pressing 500V/1000V RELEASE turns off the indicator and enables insulation measurement.
	Displays Bluetooth® function state. • Bluetooth® function ON: Turns on • Bluetooth® function OFF: Turns off • Bluetooth® Communicating: Blinks

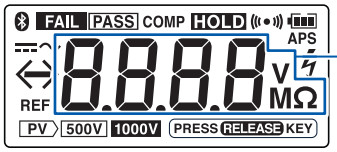
IR4056

Measured value
or comparator reference value

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

REF	Turns on when the reference value is indicated by the comparator function.

IR4055



Measured value
or comparator reference value

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

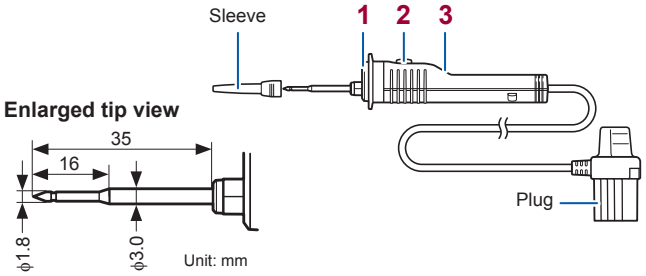
PV	Turns on when PVΩ measurement mode is selected.
500V	Turns on when selecting 500 V range in the PVΩ measurement mode.
1000V	Turns on when selecting 1000 V range in the PVΩ measurement mode.

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)



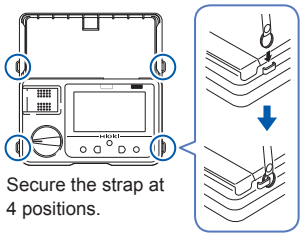
1	Light	Lights up interlocked with the backlight of the instrument.
2	**MEASURE** key	• Starts insulation resistance measurement. • Lights up in red interlocked with the live wire warning indicator of the instrument.
3	Judgment display	Lights up in accordance with the comparator judgment result. • PASS: Green • FAIL: Red

2 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.

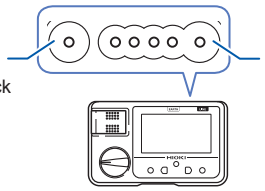
1 **Attach the strap.**



Secure the strap at 4 positions.

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.

2.1 Replacing Batteries or Fuse

⚠WARNING

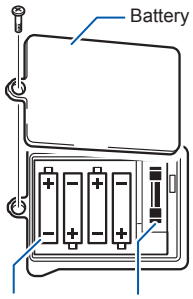
- **To avoid electric shock, turn off the MEASURE key, remove the test leads from the measuring object and replace the primary battery or fuse.**
- **After replacing the batteries, reattach the cover and secure the screw before using the instrument.**
- **Battery may explode if mistreated. Do not shortcircuit, 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 no 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.

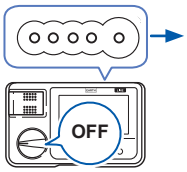


1. **Turn off the rotary switch and remove the test lead from the instrument.**
2. **Loosen the fastening screw at the rear of the instrument and remove the battery cover.**
3. **Replace all four batteries or the fuse.**
4. **Slide the battery cover back into place and tighten the screw.**

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

Pre-measurement inspection

1 **Turn off the rotary switch.**



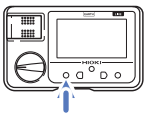
2 **Fully insert the L9788-10 plug into the line terminal of the instrument.**

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.

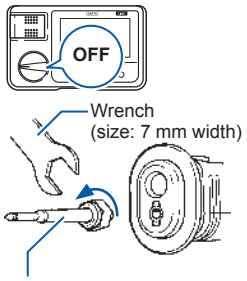
6 **Press** LIGHT ◯.



Check that the L9788-10 tip lamp lights up.

Replacing the Tip Pin (optional) for Model L9788-10

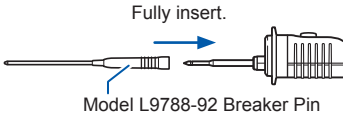
When the tip pin of model L9788-10 Test Lead with Remote Switch (Red) is worn out or broken, it can be replaced. The tip pin can be purchased via authorized Hioki distributor or reseller.



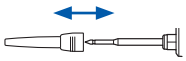
1. **Turn off the rotary switch and disconnect the L9788-10.**
2. **Remove the tip pin by rotating with a wrench.**
3. **Attach the new tip pin to the L9788-10 by rotating with a wrench.**
   (Tightening torque: 0.3 N·m)
4. **Check the operation.**
   Measure a measuring object of known values and use 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.



Removing and attaching the test lead sleeves



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

Removing the sleeves	Attaching the sleeves
Gently hold the bottom of the sleeves and pull the sleeves off.	Insert the metal pins of the test leads into the holes of the sleeves, and firmly push them all the way in.

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?

Not 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.

Displayed

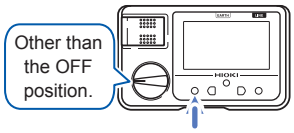
Inspection complete

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



Turn on the instrument while holding down LIGHT.

Recovering from auto power save state

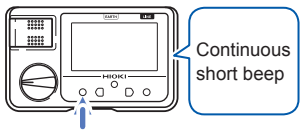
Turn off the rotary switch and then turn on the power again.

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



Press for approx. 2 seconds.

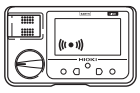
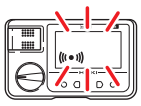
With the backlight off, press LIGHT for approx. 2 seconds until the instrument beeps continuously.

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

	PASS (good) judgment		FAIL (defective) judgment	
LED display				
	Backlight: No change	Lights up in green*	Backlight: Lights up in red	Lights up in red*

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

Type of measurements that can be judged

Function	PASS judgment		FAIL judgment	
	State of measured value	Buzzer	Backlight	Buzzer
Insulation Resistance	Criterion or higher	Short beep	Lights up in red	Long beep
Low resistance	Criterion or lower	Long beep		Short beep
PVΩ	Criterion or higher	Short beep		Long beep
Voltage	Comparator cannot be set.			

Setting the Comparator

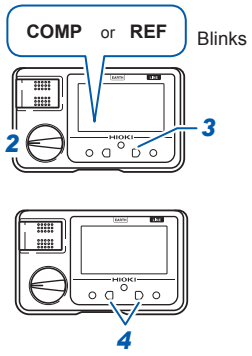
1 Select a judgment reference from the table below.

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

*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.

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

Range	Operation
500 V 1000 V	Press 500V/1000V RELEASE to release the lock.
PVΩ	Press PVΩ 500V ↔ 1000V to select the applied voltage and press 500V/1000V RELEASE to release the lock.



3 **Press COMP.**

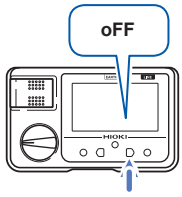
[COMP] or **[REF]** blinks and the resistance value that will be used as the judgement reference is displayed.

IR4057, IR4058: **COMP**
IR4055, IR4056: **REF**

4 **Press 0Ω 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.

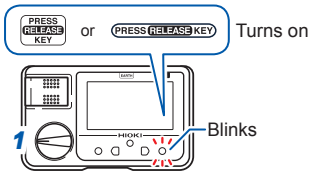
- **Do not attempt to measure insulation resistance on alive conductor. Doing so could damage the instrument or cause an accident that might result in injury or death. Always turn off power to the measurement target before starting.**
- **When measuring insulation resistance, dangerous voltage is applied 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.

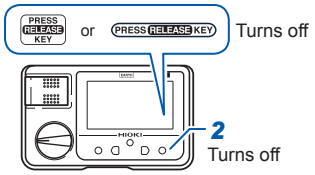
Lock Function

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** 500V/1000V RELEASE **.**
Pressing this key unlocks the instrument and switches to the measurement screen.

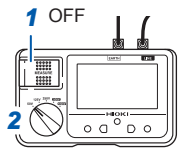
The screen is locked 1 minute after the last measurement or operation again.

Measuring Insulation Resistance

⚠ CAUTION

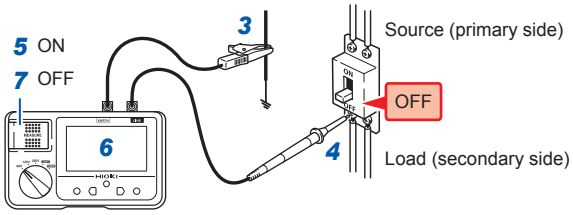
To avoid electric shock, turn off the measuring line breaker.

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 500V/1000V RELEASE 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 **Turn on 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)

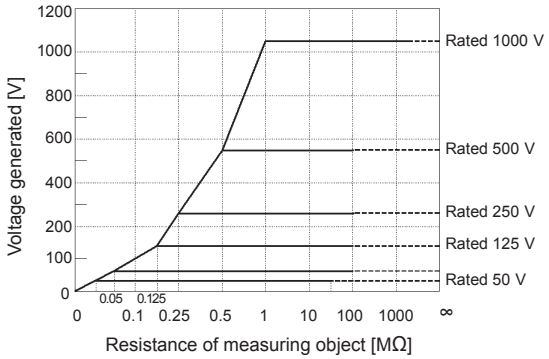
Displaying 1-minute Values (Model IR4057, IR4058)

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.

Retained measured value

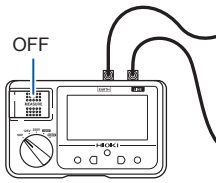
- Use this function when measuring objects that include a capacitance component.
- Value is not displayed when the comparator function is enabled.

Voltage Characteristics of Measurement Terminals

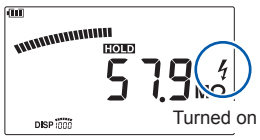


3.6 Discharging Function

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 ϟ may not be cleared.



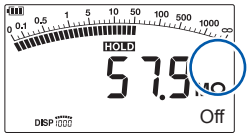
Without removing the test leads from the measurement object, turn off the MEASURE key.



Discharging

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.



Discharged

When the discharge is completed, ϟ is turned off.

The time required for discharge depends on the capacitance value.

3.7 Voltage Measurement

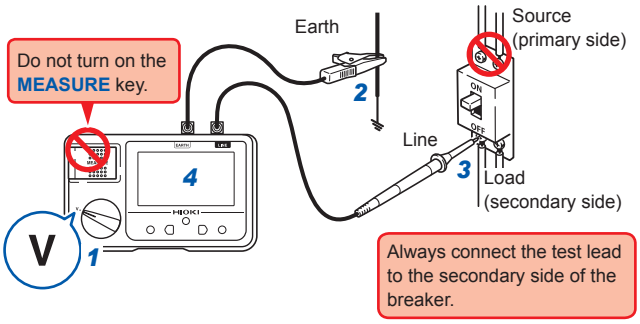
This instrument can measure the AC voltage of commercial power. The instrument can check to ensure that the measuring object is not live before measuring insulation resistance.

⚠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



1 **Set the rotary switch to V.**

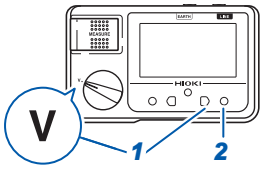
2 **Connect the black test lead to the ground side of the object being measured.**

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 COMP.**

The **[–]** and **[V]** blinks and **[ON]** or **[OFF]** is displayed.

2 **Press 500V/1000V RELEASE to switch between ON and OFF.**

ON (Factory setting)	When the voltage is −1 V or lower, red and white of the backlight blinks alternately.
OFF	Disabled

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.

3.8 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.

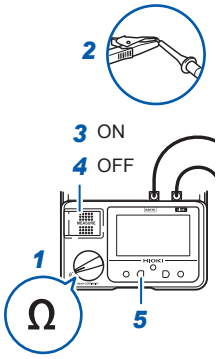
The comparator function can be used during low resistance measurement. See “3.4 Comparator Function” (p. 29)

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



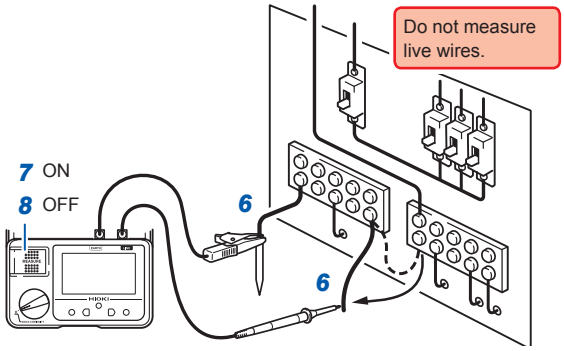
1 Set the rotary switch to the Ω.

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 ADJ.



6 Connect the test lead to the measurement object.

7 Turn on the MEASURE key to check the displayed value.

8 Turn off the MEASURE key after use.

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.

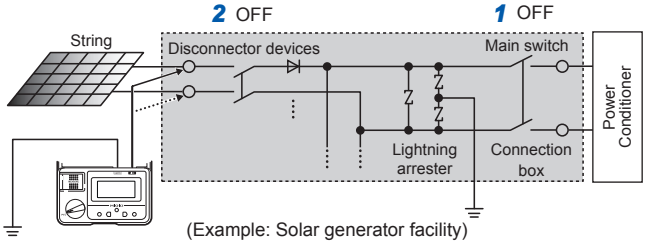
- **Turn off any disconnector devices and separate from the power conditioner before starting the measurements for the solar battery panel.**
- **Do not attempt to measure insulation resistance on alive conductor. Doing so could damage the instrument or cause an accident that might result ininjury or 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)

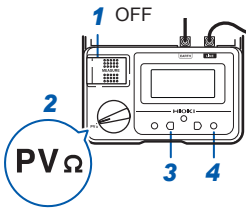
Measurement preparation 1

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.



(Example: Solar generator facility)

Measurement preparation 2



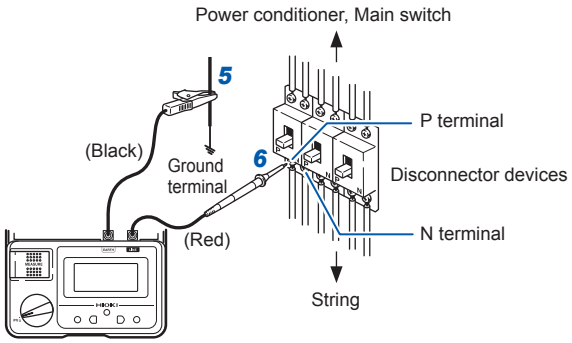
1. **Check that the MEASURE key is turned off.**
   If the **MEASURE** key is on, turn it off. (p. 16)
2. **Set the rotary switch to PVΩ.**
3. **Press PVΩ 500V ⇔ 1000V to set 500 V or 1000 V as the test voltage.**
4. **Press 500V/1000V RELEASE to release the lock.**

Start Measuring

⚠WARNING

Observe the following to avoid damage to the measuring object.

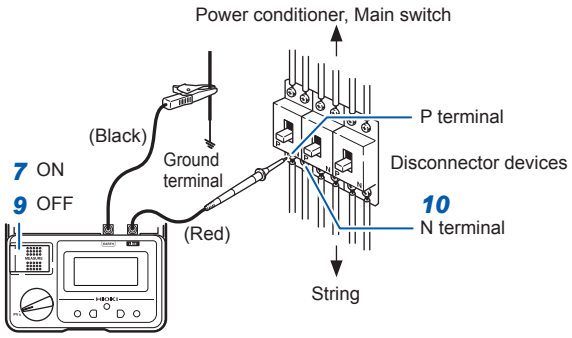
- **If the insulation has deteriorated between the terminal P and the ground, do not measure between the terminal N and the ground.**
- **Connect the red test lead to the string side of the disconnector device.**



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.



7 **Turn on 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 ϟ blinks. The icon ϟ 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 PRESS RELEASE KEY turns on and the **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)**

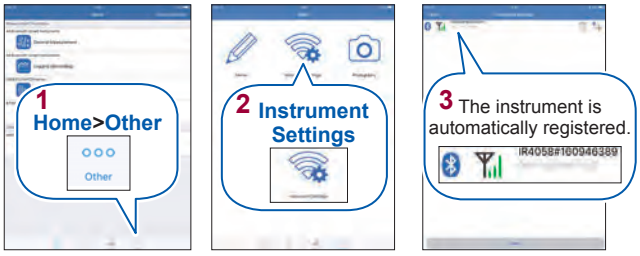
4. **Select the general measurement.**

Installing the Smartphone App GENNECT Cross

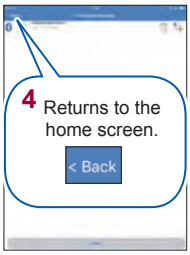
Search for “GENNECT Cross” on the App Store from your iPhone, iPad or other Apple device, or on Google Play™ from your Android™ device. Then download and install the GENNECT Cross. You will need an Apple ID to download the app from the App Store, or a Google account to download the app from Google Play™. 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



- 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 Specifications

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
Live circuit indicator	Turns on when voltage is detected between the line terminal and the earth terminal
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

Guaranteed accuracy period	1 year
Guaranteed accuracy period from adjustment made by Hioki	1 year
Product warranty period	3 years
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)

Degree of protection	IP40
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)

Standards	EN61326 (EMC) EN61557-1 EN61557-2 EN61557-4[*1 *2] EN61557-10[*2] JISC1302 (Insulation resistance testers)[*3]

*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

Insulation Resistance Measurement					
Rated measurement voltage (DC)	50 V	125 V	250 V	500 V	1000 V
Effective maximum displayed value	100 MΩ	250 MΩ	500 MΩ	2000 MΩ	4000 MΩ
Medium displayed value	2 MΩ	5 MΩ	10 MΩ	50 MΩ	100 MΩ
1st effective measuring range [MΩ]	0.200 to 10.00	0.200 to 25.0	0.200 to 50.0	0.200 to 500	0.200 to 1000
Accuracy (Limit deviation tolerance)	±2% rdg. ±2 dgt. (Model IR4055: ±4% rdg.)				
2nd effective measuring range [MΩ]	10.1 to 100.0	25.1 to 250	50.1 to 500	501 to 2000	1010 to 4000
Accuracy (Limit deviation tolerance)	±5% rdg. (IR4055: ±8% rdg.)				
Other measuring range [MΩ]	0 to 0.199				
Accuracy (Limit deviation tolerance)	±2% rdg. ±6 dgt.				

Range configuration						
	Display range	1 MΩ	1 MΩ	1 MΩ	1 MΩ	1 MΩ
	Maximum displayed value	1.000 MΩ	1.000 MΩ	1.000 MΩ	1.000 MΩ	1.000 MΩ
	Resolution	0.001 MΩ	0.001 MΩ	0.001 MΩ	0.001 MΩ	0.001 MΩ
	Display range	10 MΩ	10 MΩ	10 MΩ	10 MΩ	10 MΩ
	Maximum displayed value	10.00 MΩ	10.00 MΩ	10.00 MΩ	10.00 MΩ	10.00 MΩ
	Resolution	0.01 MΩ	0.01 MΩ	0.01 MΩ	0.01 MΩ	0.01 MΩ
	Display range	100 MΩ	100 MΩ	100 MΩ	100 MΩ	100 MΩ
	Maximum displayed value	100.0 MΩ	100.0 MΩ	100.0 MΩ	100.0 MΩ	100.0 MΩ
	Resolution	0.1 MΩ	0.1 MΩ	0.1 MΩ	0.1 MΩ	0.1 MΩ
	Display range	–	250 MΩ	500 MΩ	1000 MΩ	1000 MΩ
	Maximum displayed value	–	250 MΩ	500 MΩ	1000 MΩ	1000 MΩ
	Resolution	–	1 MΩ	1 MΩ	1 MΩ	1 MΩ
	Display range	–	–	–	2000 MΩ	4000 MΩ
	Maximum displayed value	–	–	–	2000 MΩ	4000 MΩ
	Resolution	–	–	–	10 MΩ	10 MΩ

Insulation Resistance Measurement			
	1st effective measuring range	2nd effective measuring range	Other measuring range
Effect of temperature (E_3)*	±4% rdg. (0°C to 50°C)	±8% rdg. (0°C to 50°C)	±2% rdg.±6 dgt. (0°C to 50°C)
	±8% rdg. (less than -25°C to 0°C, 50°C to 65°C) (Only for IR4056, IR4057, IR4058)	±16% rdg. (less than -25°C to 0°C, 50°C to 65°C) (Only for IR4056, IR4057, IR4058)	±4% rdg.±12 dgt. (less than -25°C to 0°C, 50°C to 65°C) (Only for IR4056, IR4057, IR4058)
Effect of humidity	±4% rdg.and within allowance	±8% rdg.and within allowance	±2% rdg.±6 dgt.
Effect of magnetic field	±2.4% rdg.	–	–
Effect of supply voltage (E_2)	±4% rdg.and within allowance	±8% rdg.and within allowance	±2% rdg.±6 dgt.and within allowance
Effect of positioning (E_1)	Not applicable		

*Effect of temperature (E_3) is applicable to the operating temperature range other than 18°C to 28°C.

Rated measurement voltage (DC)	50 V	125 V	250 V	500 V	1000 V
Possible number of measurements	1000 times or more				
Overload protection	600 V AC (10 sec.)				660 V AC (10 sec.)
	660 V AC (10 sec.), 1200 V DC (10 sec.) (Only for IR4055)				
Display update interval	IR4057, IR4058: Within 0.6 sec. (no update during response) IR4055, IR4056: Within 1.0 sec. (no update during response)				

Measurement functions

Measurement terminal voltage characteristic	Open-circuit voltage	1 to 1.2 times of rated measurement voltage				
	Lower limit resistance value to be maintained rated measurement voltage	0.05 MΩ	0.125 MΩ	0.25 MΩ	0.5 MΩ	1 MΩ
	Rated current	1 mA to 1.2 mA				
	Short-circuit current	1.2 mA or less				
Response time		IR4057, IR4058: Within 0.6 sec. IR4055, IR4056: Within 1.0 sec. (with resistance load)				
Judgment time		IR4057, IR4058: Within 0.3 sec. IR4055, IR4056: Within 0.8 sec. (When switching from an open state to 10 times the default judgment reference value)				

Low Resistance Measurement				
Open-circuit voltage	4.0 V to 6.9 V			
Measuring current	200 mA or more (at 6 Ω or less*1)			
Effect of temperature*2	±3% rdg. ±2 dgt. (applicable to the operating temperature range other than 18°C to 28°C)			
Effect of supply voltage*2	±3% rdg.±2 dgt. and within allowance			
Response time	Within 1 sec. (measurement terminal open → short)			
Possible number of measurements	200 times or more			
Overload protection	600 V AC (10 sec., by fuse protection)			
Zero adjustment range	0 Ω to 3 Ω			
Display update interval	Within 1 sec.			
Range configuration	Display range (Auto range)	Maximum displayed value	Resolution	Accuracy*2 (after zero adjustment)
	10 Ω	10.00 Ω	0.01 Ω	0 to 0.19 Ω : ±3 dgt. 0.20 Ω to 10.00 Ω : ±3% rdg. ± 2 dgt.
	100 Ω	100.0 Ω	0.1 Ω	±3% rdg. ±2 dgt.
	1000 Ω	1000 Ω	1 Ω	

*1: Display value before zero adjustment

*2: Display value is applicable after zero adjustment
(when the temperature changes more than 1°C, zero adjustment is necessary)

Measurement functions

Voltage Measurement				
AC/DC automatic detection range		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)		
Effect of temperature		Measurement accuracy per 1°C × 0.1 (applicable to the operating temperature range other than 18°C to 28°C)		
Overload protection		750 V AC (10 sec.), 750 V DC (10 sec.) 1200 V DC (10 sec.) (Only for IR4055)		
Display update interval		Within 1 sec.		
Response time		Within 1.2 sec. (when input voltage is cycled from 0 V to 600 V)		
AC Voltage Measurement	Input resistance	100 kΩ or more (50 Hz/60 Hz)		
	Frequency range	50 Hz/60 Hz		
	Range configuration			
	Display range (Auto range)	Maximum displayed value	Resolution	Accuracy
	420 V (minimum displayed value: 30.0 V)	420.0 V	0.1 V	±2.3% rdg. ±8 dgt (ranges in excess of 600 V are outside the accuracy guarantee)
	600 V	750 V	1 V	
DC Voltage Measurement	Input resistance	100 kΩ or more		
	Range configuration			
	Display range (Auto range)	Maximum displayed value	Resolution	Accuracy
	4.2 V	4.200 V	0.001 V	±1.3% rdg. ±4 dgt (ranges in excess of 600 V* are outside the accuracy guarantee)
	42 V	42.00 V	0.01 V	
	420 V	420.0 V	0.1 V	
	IR4056, IR4057, IR4058: 600 V IR4055: 1000 V	IR4056, IR4057, IR4058: 750 V IR4055: 1100 V	1 V	

* 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.

PVΩ Measurement		
Measurement voltage (DC)	PVΩ 500 V	PVΩ 1000 V
Maximum displayed value	2000 MΩ	4000 MΩ
1st effective measuring range [MΩ]	0.200 to 500	0.200 to 1000
Accuracy (Limit deviation tolerance)	±4% rdg.	
2nd effective easuring range [MΩ]	501 to 2000	1010 to 4000
Accuracy (Limit deviation tolerance)	±8% rdg.	
Other measuring range [MΩ]	0 to 0.199	
Accuracy (Limit deviation tolerance)	±2% rdg. ±6 dgt.	
Effect of temperature (E_3)	Accuracy × 1.0 (applicable to the operating temperature range other than 18°C to 28°C)	
Effect of humidity	Accuracy × 1.0 and within allowance	
Effect of magnetic field	Accuracy × 0.5	
Impact of positioning (E_1)	Not applicable	
Effect of supply voltage (E_2)	Accuracy × 1.0 and within allowance	
Effect of superimposing DC voltage	Within ±10%	
Possible number of measurements	1000 times or more	
Overload protection	660 V AC (10 sec.), 1200 V DC (10 sec.)	
Display update interval (no update during response)	Within 1.0 sec.	
Open voltage*	1 to 1.2 times of measurement voltage	
Lower limit resistance value to be maintained rated measurement voltage	20 MΩ ±5%	20 MΩ ±5%
Rated current	0.025 mA ±20%	0.05 mA ±20%
Short-circuit current	1.2 mA or less	
Response time	Within 4.0 s (Measurement start → Display)	

* 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)

Interface	Bluetooth® 4.0LE (Bluetooth®)
Antenna power	Maximum +0 dBm (1 mW)
Communication distance	5 m (line of sight)
Communication profile	GATT (Generic Attribute Profile)
Supported Android™ devices	Android™ 4.3 or later (Bluetooth® low energy enabled devices)
Supported iOS devices	iOS 10 or later (Bluetooth® low energy enabled devices)

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 inaccordance 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.

Symptom	Check Items	Remedy and Reference
Unable to perform measurement.	Are you setting the rotary switch while the **MEASURE** key turned on?	Turn off the **MEASURE** key and then press it again.
	Is the voltage between the measuring terminals over any of the following values before turning on the **MEASURE** key? 50 V to 250 V range: Approx. 90 V 500 V and PVΩ 500 V ranges: Approx. 500 V 1000 V and PVΩ 1000 V ranges: Approx. 1000 V	Separate the measurement object from all sources of power before performing measurement.
During insulation resistance, low resistance, or PVΩ measurement, the live circuit indicator and the display blinks in red, and the buzzer sounds.	Does the voltage applied between the measurement terminals exceed the following values? Insulation resistance, PVΩ: approx. 20 V Low resistance: approx. 5 V	Make save that the measurement target is disconnected from a live circuit. If voltage exists in the measurement target, the live circuit indicator blinks.
Unable to perform measurement in 500 V, 1000 V or PVΩ range.	Is the function to prevent the application of voltage by mistake locked?	Release the lock function. (p. 33)

Symptom	Check Items	Remedy and Reference
In the 500 V range, 1000 V range or PVΩ range, turning on the **MEASURE** key enables the lock function that has been released.	Does the battery have sufficient charge? Is alkaline battery used?	Replace the batteries with new alkaline batteries. (p.22)
	Has 1 minute lapsed after the last operation?	Release the lock function again. (p.33)
The **MEASURE** key is not working for the lead with a switch.	Is the plug of the lead with a switch fully inserted?	Fully insert the plug to the limit without any gaps. (p.25)
The measured value is shown as the maximum display value.	Is there a broken connection in a test lead?	Check the continuity of the test lead with a tester.
	Are the test leads securely connected?	Check the connection between the test leads and the instrument, and check the connection of the tips of the test leads.
The batteries run out immediately.	Are you using alkaline batteries?	Replace the batteries with alkaline batteries.(p.22)
The power is not turning on.	Does the battery have sufficient charge?	Replace the batteries. (p.22)
	Have the batteries been installed improperly?	Install the batteries in the proper orientation.(p.22)
The insulation resistance measured value increases over time.	This phenomenon reflects the influence of the measurement object capacitance component. This is not a malfunction or error.	If the measured value fluctuates gradually, wait for it to stabilize and then use that value.

Symptom	Check Items	Remedy and Reference
There is excessive variation in the measured value.	Is a charging circuit located near the measurement object?	Disconnect the circuit breaker for any nearby charging circuits. If this is not possible, use the lowest measured value as the measurement result.
	Does the measurement object have a large capacitance component (capacitor)?	If it is possible to remove the capacitor, do so. If not, use the lowest measured value as the measurement result.
A different measured value results each time the same measurement object is measured.	Is there any impact due to the material of the measuring object?	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*1 increase as the insulation resistance increases.
	Is there any impact due to the temperature/humidity characteristics of the measuring object?	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.

Symptom	Check Items	Remedy and Reference
When the instrument is calibrated, the accuracy of the insulation resistance range falls outside the device specifications.	Has the supplied or optional test lead used?	Use the test leads that came with the instrument or its optional test leads to perform the calibration procedure. With standard wiring, characteristics are affected when the resistance in the 1000 V range reaches or exceeds 100 MΩ.
	Has the insulation of the test lead deteriorated?	Replace the deteriorated test lead with a new one.
The output voltage polarity is reversed.	The reversal is due to the characteristics of the insulation ohmmeter. This does not represent a malfunction.	

*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.

Error Displays and Remedies

When an error is displayed on the LCD screen, repair is necessary.
Please contact your authorized Hioki distributor or reseller.

Display	Description	Remedy and Reference
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)
	The specified fuse has not been installed.	Use only the specified type of fuse. (p.22)
Err2	The settings data has been corrupted.	Repair is required.
Err3	The pre-adjustment data has been corrupted.	
Err4	The measurement circuit is broken	Replace the batteries. If there is no apparent improvement, the instrument needs repair.
Err6	The voltage generation circuit is broken.	
Err8	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.)

Appx. 2 Operation Uncertainty

The operation uncertainty and the variations of measurement value for the respective influence quantity approved by EN/IEC61557 are as follows:

Intrinsic uncertainty/ influence quantity		Operation range	Variation	
			Insulation resistance	Low resistance
A	Intrinsic uncertainty	Reference condition	±5% rdg.	±3% rdg. ±2 dgt.
E_2	Supply voltage	4.5 V to 6.8 V	±4% rdg.	±3% rdg. ±2 dgt.
E_3	Temperature	0°C to 35°C	±4% rdg.	±3% rdg. ±2 dgt.
B	Operation uncertainty		±12% rdg.	±30% rdg.
Guaranteed range of operation uncertainty			1st effective measurement range	0.2 Ω to 2 Ω

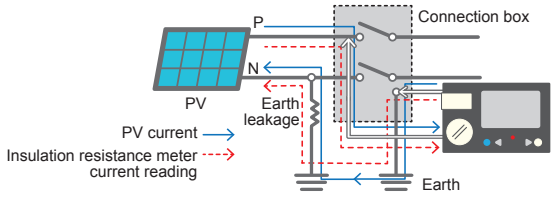
Influencing factor non-applicable for E_1 and E_4 to E_{10}

Appx. 3 Insulation Resistance Measurements for Solar Cell Array

There are two insulation resistance measurements for solar cell arrays. Characteristics of them are as follows:

Measurement with P-N opened

PVΩ 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. PVΩ 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.