IR4056
IR4057

HIOKI

Instruction Manual

INSULATION TESTER

EN

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IR4056A981-05 16-09H

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Contents

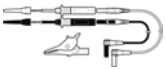
Introduction

Thank you for purchasing the HIOKI Model IR4056, IR4057 Insulation Tester. To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference. The “instrument” in this manual means IR4056 or IR4057.

Verifying Package Contents

- When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. If damage is evident, or if it fails to operate according to the specifications, contact your authorized Hioki distributor or reseller.
- When transporting the instrument, use the original packing materials in which it was shipped, and pack in a double carton. Damage occurring during transportation is not covered by warranty.

Package Contents

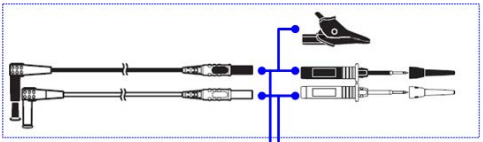
Model	Name	IR4056, IR4057 Insulation Tester  	
	Version	-20	-21
Accessories		L9787 Test Lead * ..... 1 	L9788-11 Test Lead Set with Remote Switch * .....1 
		Instruction manual..... 1 	
		LR6 alkaline battery ..... 4 	
		Neck strap..... 1	

* L9787 Test Lead and L9788-11 Test Lead Set with Remote Switch 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. Ask your authorized Hioki distributor or reseller when ordering.

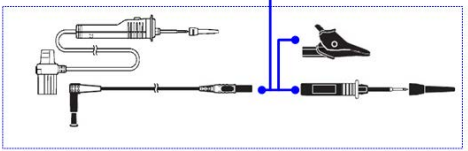
L9787 Test Lead * (1.2 m)



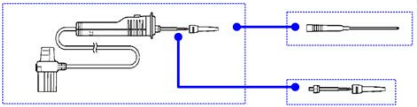
L9787-91 Breaker Pin

9804-02 Magnetic Adapter
(11 mm Corresponding standard screw:
M6 Button head screw)

L9788-11 Test Lead Set with Remote Switch



L9788-10 Test Lead with Remote Switch (Red) * (1.2 m)



L9788-90 Tip Pin
(Pin length 123 mm and 65 mm from the tip has width 2.6 mm.)

L9788-90 Tip Pin

* L9787 Test Lead, L9788-10 Test Lead with Remote Switch (Red) and L9788-11 Test Lead Set with Remote Switch are all exclusively designed for the HIOKI IR4000 series. Do not use for any other purpose.

Safety Information

⚠ DANGER

This instrument is designed to comply with IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the instrument. Using the instrument in a way not described in this manual may negate the provided safety features. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from instrument defects.

Safety Symbols

This manual contains information and warnings essential for safe operation of the instrument and for maintaining it in safe operating condition. Before using it, be sure to carefully read the following safety precautions.

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the instrument. The ⚠ symbol printed on the instrument indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
	Indicates that dangerous voltage may be present at this terminal.
	Indicates a double-insulated device.
	Indicates a grounding terminal.
	Indicates DC (Direct Current).
	Indicates AC (Alternating Current).
	DO NOT USE IN DISTRIBUTION SYSTEMS WITH VOLTAGES HIGHER THAN 660 V AC.

The following symbols in this manual indicate the relative importance of cautions and warnings.

⚠DANGER	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
⚠WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
⚠CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the instrument.
NOTE	Indicates advisory items related to performance or correct operation of the instrument.

Symbols for Various Standards

CE	This symbol indicates that the product conforms to regulations set out by the EC Directive.
	WEEE marking: This symbol indicates that the electrical and electronic appliance is put on the EU market after August 13, 2005, and producers of the Member States are required to display it on the appliance under Article 11.2 of Directive 2002/96/EC (WEEE).

Other Symbols

	Indicates a prohibited action.
(p.)	Indicates the location of reference information.
*	Indicates that descriptive information is provided below.

The screen of this instrument displays characters in the following manner.

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.

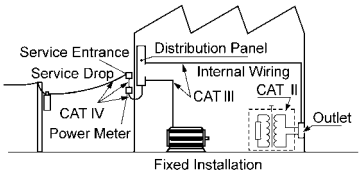
rdg. (reading or displayed value)
The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a "1" as the least-significant digit.

Measurement categories

This instrument complies with CAT III safety requirements.
To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories.

CAT II:	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.) CAT II covers directly measuring electrical outlet receptacles.
CAT III:	Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.
CAT IV:	The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Using a measurement 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.
Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.



Operating Precautions

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

Preliminary Checks

Before using the instrument for the first time, 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.

⚠WARNING

To prevent an electric shock accident, confirm that the white or red portion (insulation layer) inside the cable is not exposed. If a color inside the cable is exposed, do not use the cable.

Setting up the Instrument

Operating temperature and humidity (p.30)
Accuracy guarantee for temperature and humidity (p.31)

Avoid the following locations that could cause an accident or damage to the instrument.

Exposed to direct sunlight
Exposed to high temperature

In the presence of corrosive or explosive gases

Exposed to water, oil, other chemicals, or solvents
Exposed to high humidity or condensation

Exposed to strong electromagnetic fields
Near electromagnetic radiators

Exposed to high levels of particulate dust

Near induction heating systems (e.g., high-frequency induction heating systems and IH cooking utensils)

Subject to vibration

⚠ DANGER

- The maximum rated voltage between input terminals and ground is 600 V DC/AC (CAT III). Attempting to measure voltages exceeding 600 V DC/AC with respect to ground could damage the instrument and result in personal injury.
- 1000 V or 600 V may be labeled depending on the supplied test leads, but this is the rating of the test lead and not the rating performance of this instrument. Please refer to the Specifications for the rating performance of this instrument.
- Before attaching to or removing the test lead from the instrument, please remove the Test Lead from the tested objected and turn the rotary selector to OFF.
- Test leads should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- Persons wearing electronic medical devices such as a pacemaker should not use the 9804-02 Magnetic Adapter with magnet (option). Such persons should avoid even proximity to the 9804-02, as it may be dangerous. Medical device operation could be compromised, presenting a hazard to human life.

⚠ WARNING

- Please only use batteries for electrical supply. Any other electrical supply may damage the instrument and tested object and cause electric shock.
- To avoid electric shock, do not exceed the lower of the ratings shown on the instrument and test leads.

⚠CAUTION

- If the 9804-02 is brought near a magnetic memory device such as a floppy disk, credit/debit card, or pre-paid card or ticket, the device may become unusable due to data corruption. It can also cause damage if brought near a precision electronic device such as a computer, TV, or electronic wristwatch.
- This instrument is designed for use indoors. It can be operated at temperatures between -25°C to 65°C without degrading safety.
- For safety reasons, when taking measurements, only use the L9787 or optional test lead provided with the instrument.
- To avoid breaking the test lead, do not bend or pull them.
- To avoid damage to the instrument, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock from dropping.
- Do not bring the tips of test leads into contact with the control terminal that is used to connect a test lead with a remote control switch. Doing so may damage the instrument.
- Do not slant the instrument or place it on top of an uneven surface. Dropping or knocking down the device can cause injury or damage to the instrument.
- If the protective functions of the instrument are damaged, either remove it from service or mark it clearly so that others do not use it inadvertently.
- Although this instrument is dust resistant, it is not completely dust- or waterproof. To prevent possible damage, avoid using in dusty or wet environments.
- 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. The equipment inside the enclosure is protected against entry by solid foreign objects larger than 1.0 mm in diameter.
0: The equipment inside the enclosure is not protected against the harmful effects of water.

NOTE The battery indicator flashes when the remaining battery capacity is low. In this case, measurement is not possible. Replace the batteries. (p.41)

Overview Chapter 1

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 ST5520 Insulation Tester.

1.2 Features

- **High-speed response**
  Since the instrument delivers dramatically improved response speeds compared to previous models, it can be used as a pointer-type device.

- **Enhanced comparator function**
  Since the process from the start of measurement to a PASS/FAIL judgment is extremely fast, the instrument is suitable for tester continuity check use. The display will turn red when a FAIL judgment results.

- **Low variation in measured values**
  The instrument generates little variation in measured values when used in a typical measuring environment.

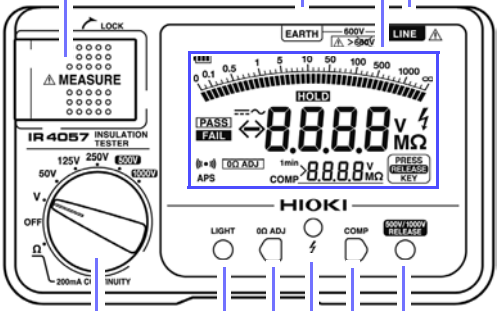
- **Easy-to-view display**
  The instrument uses an LCD with a wide viewing angle and a backlight driven by a high-brightness white LED.

- **High-accuracy voltage measurement function**
  Since 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.

1.3 Names and Functions of Parts

Front Panel

*This figure is model IR4057.



Display: IR4057 (p.11), IR4056 (p.12)

Measure key
Press to measure insulation resistance.

EARTH terminal
Connect the black test lead.

LINE terminal
Connect the red test lead.

Rotary selector
Select measurement functions.

LIGHT key
Press this key to turn on and off the light.

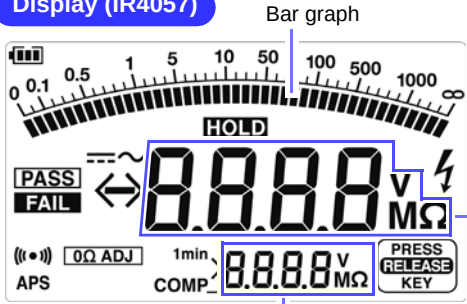
0Ω ADJ key
Press this key to perform zero-adjustment for the low resistance range.

Live circuit indicator
Lights up when voltage remains between input terminals

COMP key
Press this key to set the comparator's judgment reference value.

RELEASE key
Press this key before measurement to set the instrument to the 500 V or 1,000 V range (to prevent erroneous application of the test signal).

Display (IR4057)



	Indicates the remaining battery life as one of three levels. The battery mark outline will flash when the remaining battery life reaches 0, at which point the instrument will no longer perform measurement.
⎓	Turns on when the voltage measured with the V range is DC.
∼	Turns on when the voltage measured with the V range is AC.
<	Flashes when the measured value is less than the minimum display value.
>	Flashes when the measured value is greater than the maximum display value.
HOLD	Lights up when the measured value is held.
PASS	Turns on when the comparator judgment is PASS (good). See: "2.3.1 Setting the Comparator"(p.16)
FAIL	Turns on when the comparator judgment is FAIL (defective). See: "2.3.1 Setting the Comparator"(p.16)
↯	Flashes when a dangerous voltage exists between the measurement terminals.

(•)	When the comparator is enabled, the buzzer will sound when the judgment result (PASS or FAIL) for which this mark is lit up is encountered.
APS	The auto power save function will activate 30 seconds after this mark starts flashing. See: "2.8 Auto power save (power-saving function)"(p.28)
0Ω ADJ	Lights up when zero adjustment is made during low resistance measurement. See: "2.7 Low Resistance Measurement"(p.26)
1min	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). See: "2.4.3 Displaying 1-min. Values (IR4057 Function)"(p.22)
COMP	Lights up when the comparator function is enabled. See: "2.3 Configuring the Comparator"(p.15)
PRESS RELEASE KEY	Turns on when the instrument is set to the 500 V range or the 1,000 V range. Pressing RELEASE turns off the indicator and enables insulation measurement.

Display (IR4056)

REF	Lights up when the criterion for the comparator function is indicated.

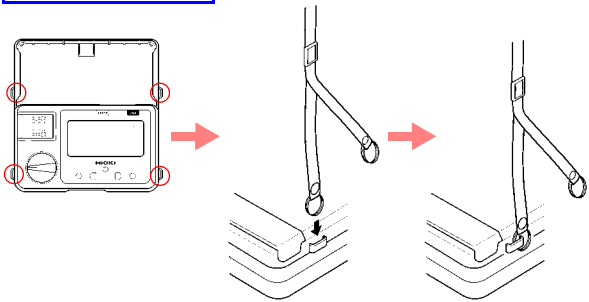
For more information about other display elements, see " Display (IR4057)" (p.11).

Measurement Procedures Chapter 2

2.1 Measurement Preparations

1. Attach the strap.
2. Insert the batteries. (p.41)
3. Connect the test lead (connect the black test lead to the EARTH terminal, and the red test lead to the LINE terminal)

Attaching the strap



Pass the ring on both ends of the supplied strap through each of the four holes in the instrument.

⚠CAUTION

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

2.2 Pre-measurement inspection

Checking the remaining battery life

Isn't the battery exhausted?

Set the rotary selector away from OFF and confirm the battery indicator.

The battery indicator is flashing.

Replace the batteries.
See:(p.41)

There is battery life remaining.

Checking the test lead

Isn't 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 replacements.

No Exposed

1. Use the rotary selector to select Insulation Resistance.
2. Short the test lead tips.
3. Press the **MEASURE** key. Does the display show 0 MΩ?

No

The following issues may be occurring:
- The test lead has not been inserted all the way.
  → Insert the test lead all the way.
- There is a broken connection in the test lead.
  → Replace with the designated test lead.

Yes

Inspection complete

2.3 Configuring the Comparator

The instrument provides a comparator function that can be used with the insulation resistance and low resistance ranges. Use of the comparator function simplifies the process of obtaining a PASS/FAIL judgment.

The comparator function generates PASS (good) and FAIL (defective) judgments depending on whether the measured value is greater than or less than a previous set value. The instrument notifies the user of the judgment result with the buzzer and backlight (which turns red for a FAIL judgment). Furthermore, you can view judgment results more closely at hand by using the L9788-10 Test Lead with Remote Switch (Red). (The L9788-10 incorporates an LED that turns green for PASS judgments and red for FAIL judgments.)

For more information about valid comparator settings, see "Valid judgment reference values"(p.17).

In the insulation resistance range, measured values that are greater than or equal to the judgment reference value result in a PASS judgment. The buzzer will sound in the event of a FAIL result.
In the low resistance range, measured values that are less than or equal to the judgment reference value result in a PASS judgment. The buzzer will sound in the event of a PASS result.

Comparator settings for each range will be saved, even if the instrument is turned off.

NOTE The comparator cannot be used with voltage ranges.

2.3.1 Setting the Comparator

1. Select a judgment reference from the table on p.17.
2. Set the rotary selector to the range for which you wish to set the judgment reference.
3. Pressing COMP causes "**COMP**" to flash and displays the resistance value that will be used as the judgment reference.
   The IR4056 will display "**REF**."
   Press ΩΩ ADJ or COMP to select the judgment reference.
4. If you do nothing for about 2 seconds after you select the desired judgment reference, the comparator will be set, and the "**COMP**" mark will light up on the display.

2.3.2 Canceling the Comparator

Press the COMP several times to select "**oFF**." If you do nothing for about 2 seconds in this state, "**COMP**" will go out, and the comparator function will be canceled.

Valid judgment reference values

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	2	3	4	5		
	10						
	(Default setting: 1 MΩ)						
125 V	0.1	0.2	0.3	0.4	0.5		
	1	2	3	4	5		
	10	20					
	(Default setting: 1 MΩ)						
250 V	0.1	0.2	0.3	0.4	0.5		
	1	2	3	4	5		
	10	20	30	40	50		
	(Default setting: 1 MΩ)						
500 V	0.1	0.2	0.3	0.4	0.5		
	1	2	3	4	5		
	10	20	30	40	50		
	100						
	(Default setting: 1 MΩ)						
1000 V	1	2	3	4	5		
	10	20	30	40	50		
	100	200	300	400	500		
	(Default setting: 10 MΩ)						
Ω	0.1	0.2	0.3	0.4	0.5	0.6	Ω
	1	2	3	4	5	6	
	10	20	30	40	50	60	
	100	200					
	(Default setting: 20 Ω)						

2.4 Insulation Resistance Measurement

The instrument is used to measure insulation resistance in the electric circuit or in the appliance in order to inspect the insulation performance. When measuring insulation resistance, you have to select the voltage applied to the object to be measured.

⚠WARNING

Observe the following to avoid electric shock, short circuits and damage to the instrument:

- When measuring insulation resistance, dangerous voltage is applied to the measurement terminals. To avoid electric shock, do not touch the metal part of the test leads.
- Never touch the object being measured immediately after measuring. There is danger of electric shock from the charge accumulated during high voltage testing.
- Discharge the subject conductor after measurement. (p.23)
- Do not attempt to measure insulation resistance on a live conductor. Doing so could damage the instrument or cause an accident that might result in injury or death. Always turn off power to the conductor being measured before starting.

NOTE

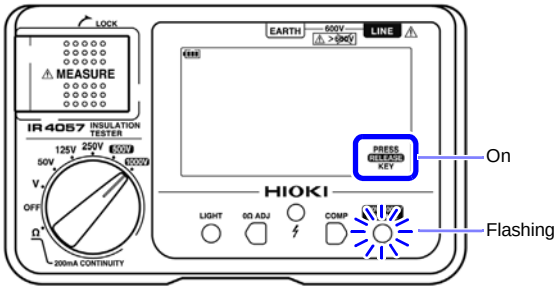
- Insulation resistance is the ratio of leakage current to applied voltage, and is therefore unstable. Depending on the specific object being measured, the indicated value may not stabilize, this does not necessarily indicate a malfunction.
- Press the **MEASURE** key fully down until a live circuit indicator lights up. If the button is not pressed down fully, a proper measurement cannot be made.
- After use, please turn the rotary selector to OFF.
- When inspecting on an electric power circuit including an appliance whose withstand voltage is lower than the test voltage or including an appliance or components whose withstand voltage is unknown, it is recommendable to remove that from the circuit for measurement.

2.4.1 Lock Function

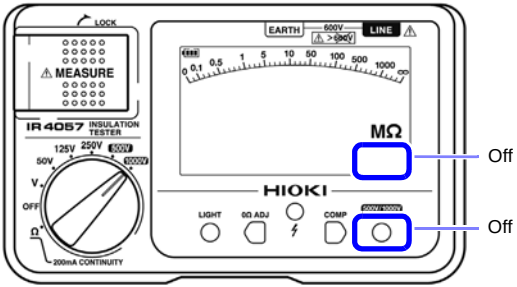
In order to prevent the inadvertent application of 500 V or 1,000 V to a low-voltage device, the instrument provides a lock function. This function will prevent the test voltage from being output even if the **MEASURE** key is pressed while the rotary selector is set to the 500 V or 1,000 V range.

Releasing the lock

1. Setting the rotary selector to the 500 V or 1,000 V range will cause PRESS RELEASE KEY (IR4057) or PRESS RELEASE KEY (IR4056) to light up, and 500V/1000V RELEASE will flash yellow.



2. Press 500V/1000V RELEASE to turn off PRESS RELEASE KEY or PRESS RELEASE KEY as well as 500V/1000V RELEASE, disabling the lock. The display will also change to the measurement screen.

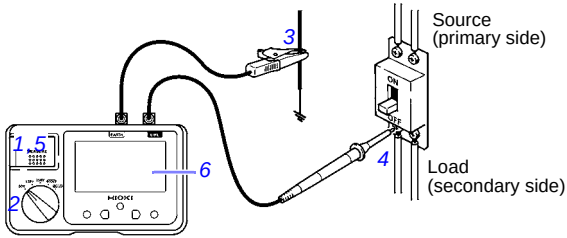


The instrument will return to the state described in Step *1.* when 1 minute elapses after the last measurement or operation. Press 500V/1000V RELEASE to release the lock.

2.4.2 Measuring Insulation Resistance

⚠CAUTION

Always turn off the breaker of the measurement line.



Ex. When measuring the insulation resistance between circuit and ground

1. If the **MEASURE** key is in the raised position, push it down.
2. Set the rotary selector to a test voltage of 50 V to 1,000 V.

   In the 500 V or 1,000 V range, press 500V/1000V RELEASE to release the lock.
3. Connect the black test lead to the ground side of the object being measured.
4. Connect the red test lead to the line to be measured.
5. Press the **MEASURE** key. (To make continuous measurements, pull the button up.)
6. Read the value after the indicator has stabilized.
7. Turn off the **MEASURE** key while the test leads are connected to the measurement object.

8. The final measured value will be displayed along with **HOLD**, and discharge will start.

9. When ⚡ disappears, measurement is complete.

NOTE
- During measuring, do not selector over to the other function.
- The instrument will return to the locked state when about 1 minute of no operation elapses during measurement in the 500 V and 1,000 V ranges. To continue measurement, push 500V/1000V RELEASE again to release the lock.

2.4.3 Displaying 1-min. Values (IR4057 Function)

The IR4057 provides functionality for automatically holding the measured value obtained 1 minute after the start of measurement (after pressing the **MEASURE** key). The measured value that is held will be shown on the bottom of the display. No value is shown if less than 1 minute has elapsed since the start of measurement. Regardless of the selected display mode, 1-min. values are always displayed in 1,000 count display mode.

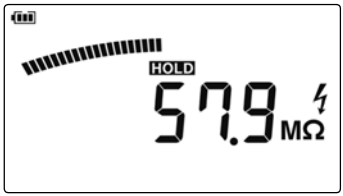
Use this function when measuring targets that include a capacitance component.

NOTE This function is enabled only when the comparator is set to "off."

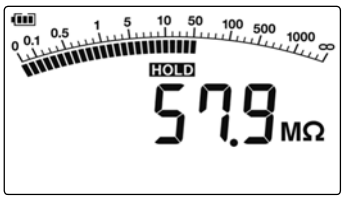
2.5 Discharging Function

When measuring an insulation resistance that contains a capacitance element, a charge proportional to the measurement voltage accumulates, and if undischarged could lead to an electric shock accident.

1. Without removing the test leads from the item being measured, release the **MEASURE** key.
2. The built-in discharge circuit automatically discharges the item.
   On the IR4057, the amount of remaining bar graph will decrease when the instrument is discharged.



3. The discharge will end when the ⚡ disappears.
   (The time required for discharge depends on the capacitance value.)



2.6 Voltage Measurement 

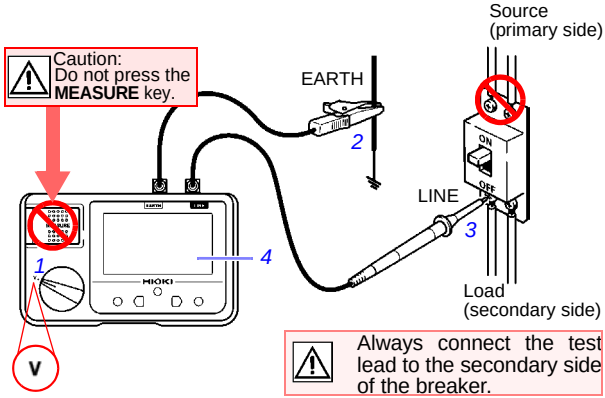
This instrument can measure the AC of commercial power.
It is also useful to make sure the subject conductor is not live before measuring insulation resistance.

⚠DANGER

- Test leads should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- The maximum input voltage is 600 V DC/AC.
  Attempting to measure voltage in excess of the maximum input could destroy the instrument and result in personal injury or death.
- The maximum rated voltage between input terminals and ground is 600V DC/AC (CAT III). Attempting to measure voltages exceeding 600 V with respect to ground could damage the instrument and result in personal injury.
- To avoid electrical shock, be careful to avoid shorting live lines with the test leads.

⚠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.



Ex. When measuring the voltage between circuit and ground

1. Use the rotary selector to select the V function.
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. Read the value after the indicator has stabilized.

NOTE

- During measuring, do not selector over to the other function.
- For waveforms other than sine waves, some errors may occur.

2.7 Low Resistance Measurement

⚠WARNING

Do not measure under a live circuit condition.

Before measurement, always perform zero adjustment to cancel the test leads' wiring resistance and other potentially problematic quantities. Accurate measurement will not be possible if zero adjustment is not performed.

1. Set the rotary selector to the Ω function.
2. Short circuit the tip of the test lead.
3. Pull up the **MEASURE** key.
4. Turn off the **MEASURE** key to hold the measured value.
5. Press  .
6. Connect the test lead to the ground side of the object being measured.
7. Press the **MEASURE** key and read the indicated value.
8. Turn off the **MEASURE** key after using.

NOTE

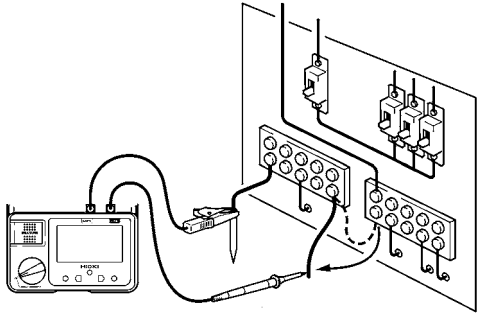
Zero adjustment can be performed with readings of up to a maximum of 3 Ω. When the reading exceeds 3 Ω, "Err 1" will be displayed, and zero adjustment will not be possible. Wire the instrument so that the wiring resistance is 3 Ω or less.

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

The comparator function can be used during low resistance measurement.

See: "2.3 Configuring the Comparator" (p.15)



Ex. Checking the continuity of ground wiring

⚠CAUTION

If an additional operating circuit is connected in parallel to the circuit under measurement, the measurement error may occur due to the effects of impedance of the circuit connected in parallel or transient currents.

2.8 Auto power save (power-saving function)

NOTE To avoid battery depletion, turn the rotary selector OFF after use (the Auto Power Save feature consumes a small amount of current).

When the rotary selector is not at OFF, the power save function kicks in 10 minutes after the last time the **MEASURE** key is pressed.

Disabling the power-saving function

Turn on the instrument while holding down LIGHT.

Reviving from power save

Turn off the rotary selector and then return it to the original position.

2.9 Auto-backlight-off

The instrument's backlight will automatically turn off once approximately 3 minutes pass since the last operation. The auto-backlight-off function can be disabled as described below when working continuously in a dark location:

Disabling the auto-backlight-off function

While the backlight is off, press and hold LIGHT for about 2 minutes until a continuous beep-beep-beep sound is heard.

Repeat this procedure after turning the instrument off.

Specifications Chapter 3

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.

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 AC voltage measurement rectification method: Average responding type Available effective battery voltage indicator: Built-in battery power indicator
Live circuit indicator	Lights up when voltage is detected between LINE terminal and EARTH terminal
Automatic electric discharge	Automatically discharges the electric charge still present in the capacitance of the test object after the Insulation resistance measurement test.
Auto Power Save	The power will go off automatically 10 minutes after the last operation. Can be displayed using the power supply activation options.
Indicator	Indicator: Semi-transmissive FSTN LCD, positive Backlight • Colors: 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.

General Specifications

Guaranteed accuracy period	1 year
Operating temperature and humidity	-25°C to 40°C (-13°F to 104°F) 90%RH or lower (non-condensating) 40°C to 65°C (104°F to 149°F), at 65°C and below relative with linear decrease up to 25%RH
Operating environment	Indoors, Pollution Degree 2 Altitude up to 2000 m (6562-ft.)
Nominal circuit voltage *	600 V AC/DC max.
Storage temperature and humidity	-25°C to 65°C (-13°F to 149°F) 90%RH or lower (non-condensating)
Degree of protection	IP40
Maximum rated voltage to terminal	600 V AC/DC (Voltage measurement)
Maximum rated voltage to earth	600 V AC/DC, Measurement Category III, Anticipated Transient Overvoltage: 6000 V
Dielectric strength	7060 V AC, 50/60 Hz, Measurement terminals - electrical enclosure, 1 min, current sensitivity 1 mA
Power source	Rated supply voltage: 1.5 V DC × 4 LR6 alkaline battery × 4
Maximum rated power	3 VA
Continuous operating time	Approx. 20 hours (Comparator off, backlight off, 500 V range, no load)
Drop proof	On concrete: 1 m
Fuse (Replacements)	FF0.5AH/1000V (70 172 40.0.500: SIBA) (Very fast acting, arc extinction type, high rupturing capacity type)
Dimensions	Approx. 159W×177H×53D mm (6.26"W×6.97"D×2.09"D)(excluding protrusions)
Mass	IR4056: Approx. 600g (21.2 oz.) IR4057: Approx. 640g (22.6 oz.) (including battery, excluding test lead)

* The nominal circuit voltage refers to the nominal voltage of an electric distribution circuit that can be measured by this measuring instrument (based on EN 61557).

Accessories	Refer to " Package Contents" (p.1)
Options	Refer to " Options" (p.2)

Standards	EN61326 (EMC) EN61557-1/-2/-4*/-10

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

Measurement functions

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

Insulation Resistance Measurement					
Rated output voltage (DC)	50 V	125 V	250 V	500 V	1000 V
Effective maximum indicated value	100 MΩ	250 MΩ	500 MΩ	2000 MΩ	4000 MΩ
Effective medium 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	±2%rdg.±2dgt.				
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	±5%rdg.				
Other measuring range [MΩ]	0 to 0.199				
Accuracy	±2%rdg.±6dgt.				

Insulation Resistance Measurement						
Rated output voltage (DC)		50 V	125 V	250 V	500 V	1000 V
Range configuration	Display range	1 MΩ	1 MΩ	1 MΩ	1 MΩ	1 MΩ
	Maximum indicated 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 indicated 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 indicated 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 indicated 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 indicated value				2000 MΩ	4000 MΩ
	Resolution				10 MΩ	10 MΩ

Effect	1st effective measuring range	2nd effective measuring range	Other measuring range
Temperature*	±4%rdg. (0°C to 50°C) ±8%rdg. (less than -25°C to 0°C, 50°C to 65°C)	±8%rdg. (0°C to 50°C) ±16%rdg. (less than -25°C to 0°C, 50°C to 65°C)	±2%rdg.±6dgt. (0°C to 50°C) ±4%rdg. ±12dgt. (less than -25°C to 0°C, 50°C to 65°C)
Humidity	±4%rdg. and within allowance	±8%rdg. and within allowance	±2%rdg.±6dgt.
Magnetic field	±2.4%rdg.		
Supply voltage	±4%rdg. and within allowance	±8%rdg. and within allowance	±2%rdg.±6dgt. within allowance

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

Insulation Resistance Measurement					
Rated output voltage (DC)	50 V	125 V	250 V	500 V	1000 V
Possible number of measure-ments	1000 times or more				
Overload protection	600 VAC (10 s)				660 VAC (10 s)
Display update interval	IR4057: Within 0.6 s (no update during response) IR4056: Within 1.0 s (no update during response)				
Measurement terminal voltage characteristic					
Open-circuit voltage	1 to 1.2 times of nominal output voltage				
Lower limit resistance value to be maintained nominal output voltage	0.05 MΩ	0.125 MΩ	0.25 MΩ	0.5 MΩ	1 MΩ
Rated current	1 to 1.2 mA				
Short-circuit current	1.2 mA or less				
Response time	IR4057: Within 0.6 s (with resistance load) IR4056: Within 1.0 s (with resistance load)				
Judgment time	IR4057: Within 0.3 s, IR4056: Within 0.8 s (When switching from an open state to 10 times the default judgment reference value)				

<table>
<tr><th colspan="6">Resistance Measurement</th></tr>
<tr><td colspan="2">Open-circuit voltage</td><td colspan="4">4.0 to 6.9 V</td></tr>
<tr><td colspan="2">Measuring current</td><td colspan="4">200 mA or more (at 6 Ω or less*1)</td></tr>
<tr><td colspan="2">Effect of temperature*2</td><td colspan="4">±3%rdg.±2dgt.
(applicable to the operating temperature range other than 18°C to 28°C.)</td></tr>
<tr><td colspan="2">Effect of supply voltage*2</td><td colspan="4">±3%rdg.±2dgt. and within allowance</td></tr>
<tr><td colspan="2">Response time</td><td colspan="4">Within 1 s (measurement terminal open → short)</td></tr>
<tr><td colspan="2">Possible number of measurements</td><td colspan="4">200 times or more</td></tr>
<tr><td colspan="2">Overload protection</td><td colspan="4">600 VAC (10 s, by Fuse)</td></tr>
<tr><td colspan="2">Zero adjustment range</td><td colspan="4">0 to 3 Ω</td></tr>
<tr><td colspan="2">Display update interval</td><td colspan="4">Within 1 s</td></tr>
<tr><td rowspan="5">Range configuration</td><td>Display range (Auto range)</td><td>Maximum indicated value</td><td>Resolution</td><td colspan="2">Accuracy*2 (after zero adjustment)</td></tr>
<tr><td rowspan="2">10 Ω</td><td rowspan="2">10.00 Ω</td><td rowspan="2">0.01 Ω</td><td>0 to 0.19 Ω
: ±3dgt.</td></tr>
<tr><td>0.20 to 10.00 Ω
: ±3%rdg.±2dgt.</td></tr>
<tr><td>100 Ω</td><td>100.0 Ω</td><td>0.1 Ω</td><td colspan="2" rowspan="2">±3%rdg.±2dgt.</td></tr>
<tr><td>1000 Ω</td><td>1000 Ω</td><td>1 Ω</td></tr>
</table>

*1: Display value before zero adjustment

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

Voltage Measurement				
AC/DC automatic detection range		AC detected at 30 V or greater (50/60 Hz)*1		
Effect of temperature		Measurement accuracy per 1°C × 0.1*2		
Overload protection		750 VAC (10 s), 750 VDC (10 s)		
Display update interval		Within 1 s		
Response time		Within 1.2 s (when input voltage is cycled from 0 V to 600 V)		
AC Voltage Measurement	Input resistance	100 kΩ or more (50/60 Hz)		
	Frequency range	50/60 Hz		
	Range configuration			
	Display range (Auto range)	Maximum indicated value	Resolution	Accuracy
	420 V*3	420.0 V	0.1 V	±2.3%rdg.±8dgt*4
	600 V	750 V	1 V	
DC Voltage Measurement	Input resistance	100 kΩ or more		
	Range configuration			
	Display range (Auto range)	Maximum indicated value	Resolution	Accuracy
	4.2 V	4.200 V	0.001 V	±1.3%rdg.±4dgt*4
	42 V	42.00 V	0.01 V	
	420 V	420.0 V	0.1 V	
	600 V	750 V	1 V	

*1: Pulsating currents with an overlapping AC component of 30 V or greater are detected as AC.
*2: Applicable to the operating temperature range other than 18 to 28°C.
*3: Minimum indicated value: 30.0 V
*4: Ranges in excess of 600 V are outside the accuracy guarantee.

Maintenance and Service Chapter 4

4.1 Troubleshooting

⚠WARNING

Touching any of the high-voltage points inside the instrument is very dangerous.
Do not attempt to modify, disassemble or repair the instrument; as fire, electric shock and injury could result.

- If damage is suspected, check the "Before Returning for Repair" (p.37) section before contacting your authorized Hioki distributor or reseller.
- When sending the instrument for repair, remove the batteries and pack carefully to prevent damage in transit. Include cushioning material so the instrument cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during shipment.

Before Returning for Repair

If abnormal operation occurs, check the following items.

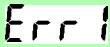
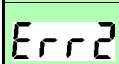
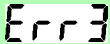
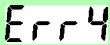
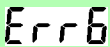
Symptom	Check Items
Unable to perform measurement.	You will not be able to perform measurement if the rotary selector is set while pressing the **MEASURE** key. → Turn off the **MEASURE** key and then press it again.
	You will not be able to perform measurement if there is a voltage of approximately 90 V or more between the measurement terminals before pressing the **MEASURE** key. → Separate the measurement target from all sources of power before performing measurement.

Symptom	Check Items
Unable to perform measurement in 500 V or 1,000 V range.	The 500 V and 1,000 V ranges use double-action to prevent the inadvertent application of the measurement signal. → Press  after setting the rotary selector to the 500 V or 1,000 V range. Pressing  while holding the **MEASURE** key will not disable the lock function.
The measured value is shown as the maximum display value.	There is a broken connection in a test lead. → Check the continuity of the test lead with a tester.
	The test leads are not 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.	You are using nickel-metal-hydride battery or manganese batteries. → Replace the batteries with alkaline batteries.
The instrument won't turn on.	The batteries are dead. → Replace the batteries.
	The batteries have been installed improperly. → Install the batteries in the proper orientation.
The insulation resistance measured value increases over time.	This phenomenon reflects the influence of the measurement target's 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.
There is excessive variation in the measured value.	The variation is caused by induced noise from a charging circuit located near the measurement target. → Disconnect the circuit breaker for any nearby charging circuits. If this is not possible, use the lowest measured value as the measurement result.
	The measurement target has 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.

Symptom	Check Items
A different measured value results each time the same measurement target is measured.	The differences are due to the effects of the insulator's polarity. * → 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.
	The differences are due to the effects of the insulator's temperature characteristics. → Measure the target 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.
When the instrument is calibrated, the accuracy of the insulation resistance range falls outside the device specifications.	The test lead cable insulation resistance is too low. → 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 1,000 V range reaches or exceeds 100 MΩ.
The output voltage polarity is reversed.	The reversal is due to the characteristics of the insulation ohmmeter. This does not represent a malfunction.

* 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

Display	Description	Remedy
	The instrument was unable to perform zero adjustment. (Low resistance function)	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. This error may occur if a fuse other than the specified type is used. Use only the specified type of fuse.
	The settings data has been corrupted.	Repair is required.
	The pre-adjustment data has been corrupted.	Repair is required.
	The measurement circuit is broken.	Repair is required.
	The voltage generation circuit is broken.	Repair is required.
	There is a broken connection in the protective fuse.	Replace the indicated fuse. **See:** p.42

4.2 Replacing Batteries or Fuse

⚠WARNING

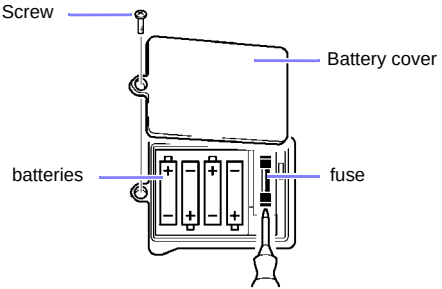
- Replace only the specified fuse. Never use unspecified fuses and never use the instrument after the fuse holder has shorted. This will damage the instrument and cause injury.
  Fuse type: FF0.5AH/1000V (70 172 40.0.500: SIBA)
  (Very fast acting, arc extinction type, high rupturing capacity type)
  Fuses can be purchased from your Hioki distributor.
- To avoid electric shock, turn off the rotary selector and disconnect the test leads from the object to be measured, before replacing the batteries or fuse.
- After replacing the batteries or fuse, replace the cover and screws before using the instrument.
- Battery may explode if mistreated. Do not short-circuit, recharge, disassemble or dispose of in fire.
- Handle and dispose of batteries in accordance with local regulations.

⚠CAUTION

- Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.
- To avoid corrosion and damage to this instrument from battery leakage, remove the batteries from the instrument if it is to be stored for a long time.
- 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.

NOTE Please use LR6 alkaline batteries. Please do not use manganese, nickel-metal hydride or oxyride batteries.

Back of the instrument



1. Turn the rotary selector to OFF and remove the test lead from the instrument as a precaution.
2. Loosen the central fastening screw at the back 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.

4.3 Cleaning

- To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- Wipe the LCD gently with a soft, dry cloth.

Appendix

Measurement Principles

1. Insulation resistance measurement

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

2. Low resistance measurement

The measurement target's resistance Rx is calculated by applying a current I to the measurement target, measuring the voltage V that occurs between the measurement terminals as a result, and dividing the voltage V by the current I.

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.±2dgt.
E_2	Supply voltage	4.5 V to 6.8 V	±4%rdg.	±3%rdg.±2dgt.
E_3	Temperature	0°C to 35°C	±4%rdg.	±3%rdg.±2dgt.
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}

Warranty Certificate

HIOKI

Model	Serial No.	Warranty period Three (3) years from date of purchase (___ / ___)

This product passed a rigorous inspection process at Hioki before being shipped.

In the unlikely event that you experience an issue during use, please contact the distributor from which you purchased the product, which will be repaired free of charge subject to the provisions of this Warranty Certificate. This warranty is valid for a period of three (3) years from the date of purchase. If the date of purchase is unknown, the warranty is considered valid for a period of three (3) years from the product's date of manufacture. Please present this Warranty Certificate when contacting the distributor. Accuracy is guaranteed for the duration of the separately indicated guaranteed accuracy period.

1. Malfunctions occurring during the warranty period under conditions of normal use in conformity with the Instruction Manual, product labeling (including stamped markings), and other precautionary information will be repaired free of charge, up to the original purchase price. Hioki reserves the right to decline to offer repair, calibration, and other services for reasons that include, but are not limited to, passage of time since the product's manufacture, discontinuation of production of parts, or unforeseen circumstances.
2. Malfunctions that are determined by Hioki to have occurred under one or more of the following conditions are considered to be outside the scope of warranty coverage, even if the event in question occurs during the warranty period:
   a. Damage to objects under measurement or other secondary or tertiary damage caused by use of the product or its measurement results
   b. Malfunctions caused by improper handling or use of the product in a manner that does not conform with the provisions of the Instruction Manual
   c. Malfunctions or damage caused by repair, adjustment, or modification of the product by a company, organization, or individual not approved by Hioki
   d. Consumption of product parts, including as described in the Instruction Manual
   e. Malfunctions or damage caused by transport, dropping, or other handling of the product after purchase
   f. Changes in the product's appearance (scratches on its enclosure, etc.)
   g. Malfunctions or damage caused by fire, wind or flood damage, earthquakes, lightning, power supply anomalies (including voltage, frequency, etc.), war or civil disturbances, radioactive contamination, or other acts of God
   h. Damage caused by connecting the product to a network
   i. Failure to present this Warranty Certificate
   j. Failure to notify Hioki in advance if used in special embedded applications (space equipment, aviation equipment, nuclear power equipment, life-critical medical equipment or vehicle control equipment, etc.)
   k. Other malfunctions for which Hioki is not deemed to be responsible

*Requests
- Hioki is not able to reissue this Warranty Certificate, so please store it carefully.
- Please fill in the model, serial number, and date of purchase on this form.

16-01 EN

HIOKI E.E. CORPORATION
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL: +81-268-28-0555
FAX: +81-268-28-0559

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HIOKI

HEADQUARTERS
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 FAX +81-268-28-0568
os-com@hioki.co.jp
(International Sales Department)

www.hioki.com

HIOKI USA CORPORATION
hioki@hiokiusa.com www.hiokiusa.com

HIOKI (Shanghai) Sales & Trading Co.,Ltd.
info@hioki.com.cn www.hioki.cn

HIOKI SINGAPORE PTE. LTD.
info-sg@hioki.com.sg www.hioki.com

HIOKI KOREA CO., LTD.
info-kr@hioki.co.jp www.hiokikorea.com

1604EN

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