RM3545A-1
RM3545A-2

HIOKI

Startup Guide

RESISTANCE METER

Read carefully before use.
Keep for future reference.

When using the instrument for the first time

Troubleshooting

EN

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RM3545E965-00
600656050

Introduction

Thank you for choosing the Hioki RM3545A-1, RM3545A-2 Resistance Meter. To ensure your ability to get the most out of this instrument over the long term, please read this manual carefully and keep it available for future reference.
RM3545A-2 is provided with multiplexer slots.
The following instruction manuals are supplied with the instrument.

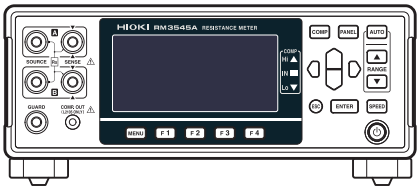
Names of manuals	Description
Instruction Manual (PDF download)	Includes detailed information about the instrument such as operation methods, function descriptions, and specifications. Please download from Hioki' s website. https://www.hioki.com/global/support/download/
Startup Guide (this manual)	This manual provides the information, basic operating procedures, and specifications (excerpt) required to use the instrument safely.
Operating Precautions	This manual provides the information required to use the instrument safely.
Communications Command Instruction Manual (PDF download)	This manual describes the communications commands in order to control the instrument. Please download from Hioki' s website. https://www.hioki.com/global/support/download/

Product registration
Register this product in order to receive important product information.
https://www.hioki.com/global/support/myhioki/registration/

Verifying Package Contents

When you receive the instrument, please inspect it for any damage or other issues prior to use. If you find any damage or discover that the instrument does not perform as indicated in its specifications, please contact your authorized Hioki distributor or reseller.

☐ RM3545A-1 or RM3545A-2 Resistance Meter



☐ Power cord
☐ Z2001 Temperature Sensor
☐ EXT. I/O connector (male)
☐ EXT. I/O connector cover
☐ Spare fuse (F1.6AH/250V)
☐ Startup Guide (this manual)
☐ Operating Precautions (0990A905)

Options

For more information about the measurement leads, see "14.17 Measurement Leads (Options)" in the Instruction Manual.

☐ L2100 Pin Type Lead (for low resistance only) *1
☐ L2101 Clip Type Lead
☐ L2102 Pin Type Lead
☐ L2103 Pin Type Lead
☐ L2104 4-Terminal Lead
☐ L2105 LED Comparator Attachment
☐ Z2001 Temperature Sensor
☐ Z5038 0 ADJ Board
☐ L9637 RS-232C Cable
(9-pin to 9-pin, 3.0 m, crossover cable, double shield)
☐ 9642 LAN Cable
☐ L1002 USB Cable (A-B type)
☐ Z3003 Multiplexer Unit
(RM3545A-2 only)

*1."Low resistance" refers to the following ranges, all of which have a measurement current of at least 100 mA. Other ranges fall outside the scope of the accuracy guarantee.
1000 μΩ range (High, Low), 10 mΩ range (High, Low), 100 mΩ range (High, Low), 1000 mΩ range (High only)

Overview

The instrument uses the 4-terminal method to measure the following resistance values quickly and with a high degree of precision:

- Weld resistance in batteries, motors, and other devices
- Winding resistance in motors, transformers, and other devices
- Contact resistance in relays and switches
- Pattern resistance on printed circuit boards
- DC resistance of fuses, resistors, conductive rubber, and other materials

Since the instrument incorporates a temperature correction function, it is particularly well suited to the measurement of targets whose resistance values vary with temperature. It also provides features such as a comparator function, communications, external control, and a multiplexer*1, allowing it to be used in a wide range of applications, including in development work and on production lines.

*1.The RM3545A-2 can be used for multiplexer-related control.

Symbols and Abbreviations

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

Safety notations

DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury or potential risks of damage to the supported product (or to other property).
	Indicates a prohibited action.
	Indicates an action that must be performed.

Symbols on the instrument

	Indicates the presence of a potential hazard. For more information about locations where this symbol appears on instrument components, see the “Precautions for Use” section, warning messages listed at the beginning of operating instructions, and the accompanying document entitled “Operating Precautions”.

Safety Information

This instrument is designed to conform to International Standard IEC 61010 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 sure to carefully read the following safety precautions.

DANGER

■ Familiarize yourself with the instructions and precautions in this manual before use.

Failure to do so could cause improper use of the instrument, resulting in serious bodily injury or damage to the instrument.

WARNING

■ If you have not used any electrical measuring instruments before, you should be supervised by a technician who has experience in electrical measurement.

Failure to do so could cause the operator to experience an electric shock. Moreover, it could cause serious events such as heat generation, fire, and an arc flash due to a short-circuit.

Precautions for Use

Instrument installation

WARNING

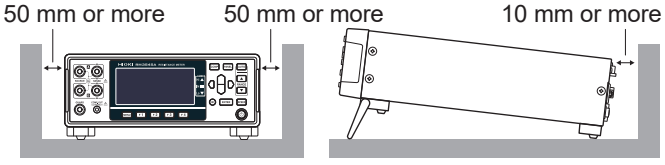
■ Do not install the instrument in locations such as the following:

- In locations where it would be subject to direct sunlight or high temperatures
- In locations where it would be exposed to corrosive or explosive gases
- In locations where it would be exposed to powerful electromagnetic radiation or close to objects carrying an electric charge
- Close to inductive heating devices (high-frequency inductive heating devices, IH cooktops, etc.)
- In locations characterized by a large amount of mechanical vibration
- In locations where it would be exposed to water, oil, chemicals, or solvents
- In locations where it would be exposed to high humidity or condensation
- In locations with an excessive amount of dust

The instrument may be damaged or malfunction, resulting in bodily injury.

■ Be sure to place the instrument with enough space provided around the instrument so that the power can be cut off by unplugging the power in an emergency.

- Leave at least the specified space on every surface to keep the instrument’s temperature from rising.
- Place the instrument with its bottom side.



Pre-Operation Inspection

DANGER

■ **Before use, verify that test lead insulation is not torn and that no metal is exposed.**

■ **Before use, inspect the instrument and verify that it's operating properly.**

Use of the instrument while it is malfunctioning could result in serious bodily injury. If you find any damage, contact your authorized Hioki distributor or reseller.

Before measuring

WARNING

■ **Do not apply voltage to the measurement terminals.**

Doing so could cause damage to the instrument or electric shock accidents.

■ **Perform measurements after turning off the power to the measurement targets being measured.**

Doing so could cause an electrical hazard.

Precautions during measurement

DANGER

■ **Do not use the instrument for measurements on circuits that exceed the ratings or specifications of the instrument.**

Doing so could cause damage to the instrument or overheating, resulting in serious bodily injury.

Providing power to the instrument

WARNING

■ **Connect the power cord to a grounded, two-prong power outlet.**

Connecting the product to an ungrounded power outlet could cause the operator to experience an electric shock.

■ **Ensure that the insulation on the cables are undamaged and that no bare conductors are improperly exposed before use.**

Any damage to the instrument leads to electric shock. Contact your authorized Hioki distributor or reseller.

CAUTION

■ **Before connecting the power cord, make sure the supply voltage to be used falls inside the voltage range indicated on the power connector of the instrument.**

Supplying a voltage that falls outside the specified range to the instrument could damage the instrument, causing bodily injury.

Measurement leads

DANGER

■ **Do not use test leads whose insulation is damaged or whose metal portion is exposed.**

Doing so could cause serious bodily injury.

■ **Do not short wires carrying a voltage with the tips of the test leads.**

Doing so could cause a short-circuit, resulting in serious bodily injury.

WARNING

■ **When using the instrument while connected to test leads, use the lower of the ratings indicated on the instrument and on the test leads.**

Using the product to make measurements that exceed either rating could cause the operator to experience an electric shock.

■ **Cut off power to measurement lines before connecting them to measurement terminals.**

Failure to do so this can cause electric shock or a short-circuit.

The analog output thermometer

WARNING

■ **Since the temperature measurement circuit is grounded, connect the TEMP.ANALOG INPUT terminal on the rear panel with the analog output thermometer isolated from the ground.**

Failure to do so could cause the operator to experience an electric shock or damage the instrument.

The multiplexer unit

See: Instruction Manual "2.5 Installing the Multiplexer Unit" and "7 Multiplexer"

WARNING

■ **Turn off the product and disconnect any cables before inserting or removing any multiplexer unit.**

Failure to do so could cause the operator to experience an electric shock or damage the instrument or multiplexer unit.

■ **When connecting a measurement target with electromotive force (a battery or power supply), take steps to protect against short-circuits.**

Failure to do so could cause damage to the instrument or measurement targets or cause fire.

■ **If not connecting a multiplexer unit, attach the blank panel.**

Failure to do so could cause the operator to experience an electric shock or damage the instrument.

D/A Output

See: Instruction Manual "8 D/A Output"

WARNING

■ **Before connecting a device to the D/A output terminal, turn off the main power switches on the instrument and the device being connected, and disconnect the measurement leads from the measurement target.**

Failure to do so could cause the operator to experience an electric shock or damage the device.

External Control (EXT. I/O)

See: Instruction Manual "9 External Control (EXT. I/O)"

DANGER

■ **Do not apply voltage (current) to the EXT. I/O connector that exceeds the maximum input voltage (current).**

Doing so could cause damage to the instrument, resulting in serious bodily injury.

WARNING

■ **Do not supply external power to the instrument's EXT. I/O connector.**

External power cannot be supplied to the instrument's EXT. I/O connector. The ISO_5V pin of the EXT. I/O connector is a 5 V (NPN)/ −5 V (PNP) power output terminal. Doing so could damage the product.

■ **When connecting a device to the instrument's EXT. I/O connector, use screws to secure the connector.**

During operation, a connector becoming dislocated and contacting another conductive object could cause an electric shock.

■ **Follow the steps below before wiring the EXT. I/O connector.**

1. Turn off the instrument and the device being connected.
2. Remove any static electricity charged on your body.
3. Confirm that the signals do not exceed the rating for the external I/O.
4. Properly isolate the instrument and the device being connected.

Communications functionality

See: Instruction Manual "10 Communications (USB/RS-232C/ LAN Interface)"

WARNING

■ **Turn off all devices before connecting or disconnecting interface connectors.**

Failure to do so could cause the operator to experience an electric shock.

Removing the lithium battery

See: Instruction Manual "13.4 Disposing of the Instrument"

WARNING

■ **Before removing the lithium battery, turn off the instrument's main power switch and disconnect the cords and leads from the measurement target.**

Failure to do so could cause the operator to experience an electric shock.

■ **Store the removed lithium battery out of reach of children.**

Failure to do so could allow children to accidentally ingest battery.

Rack Mounting

See: Instruction Manual "14.18 Rack Mounting"

WARNING

■ **When installing the rack mounting plate on the sides or the bottom, do not allow the screws to intrude more than 3.5 mm inside the instrument.**

Doing so could damage the instrument, causing the operator to experience an electric shock.

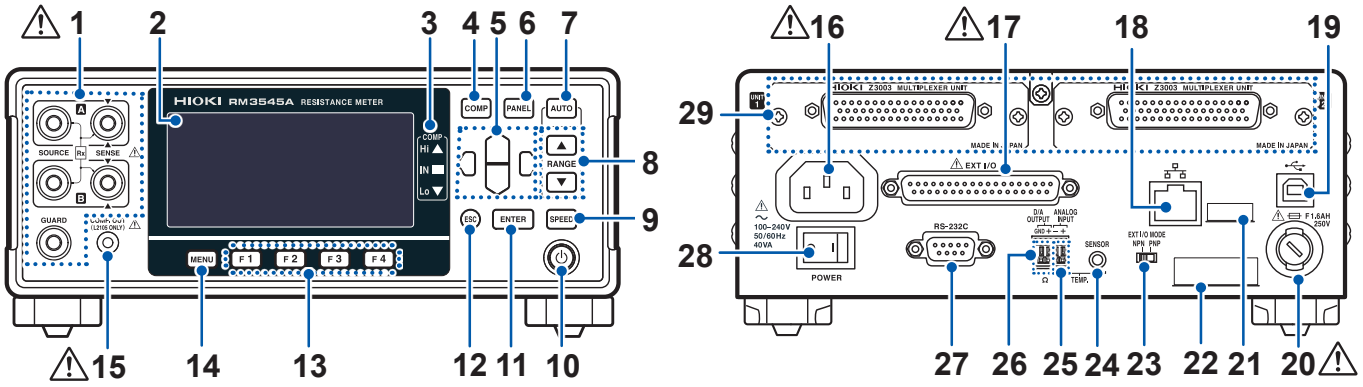
■ **When installing the rack mounting plate on the instrument, use the specified screws. (M4 × 8 mm)**

■ **When removing the rack mounting plate to return the instrument to standalone use, reuse the same screws that were installed originally.**
(Feet: M3 × 6 mm, sides: M4 × 6 mm)

Fixing with other screws could cause damage to the instrument, resulting in bodily injury. If you lose or damage the screws, contact your authorized Hioki distributor or reseller.

Part Names and Functions

Example: The RM3545A-2 is shown.



1	**Measurement terminals**	Connect the measurement leads.
2	**Display screen**	Monochrome graphical LCD.
3	**COMP indicator LEDs**	Indicate the judgment result of the measured value when using the comparator function.
4	**COMP key**	Sets the comparator function.
5	**Cursor key**	Moves among items shown on the screen.
6	**PANEL key**	Saves or loads the settings. (Panel Save function, Panel Load function)
7	**AUTO key**	Switches between the auto range and the manual range.
8	**RANGE key**	Switches the measurement range when the manual range is selected.
9	**SPEED key**	Switches the measurement speed.
10	**STANDBY key**	Unlit: Power off (when no power supplied) Red light: Standby state (while power is supplied) Green light: Power on
11	**ENTER key**	Confirms the settings displayed on the screen.
12	**ESC key**	Cancels the settings displayed on the screen.
13	**F keys**	Selection of settings displayed on the screen.
14	**MENU key**	Displays the Settings screen or switches the pages.
15	**COMP.OUT terminal**	Connect the L2105 LED Comparator Attachment.
16	**Power inlet**	Connect the included power cord.
17	**EXT. I/O connector**	Allows external control of the instrument.
18	**LAN connector**	Allows control of the instrument with a PC or PLC*1.
19	**USB connector**	Allows control of the instrument with a PC or PLC*1.
20	**Fuse holder**	For replacement of the fuse.
21	**MAC address**	MAC address of LAN
22	**Manufacturing number**	Production control number
23	**EXT. I/O MODE NPN/ PNP switch**	Allows you to change the type of PLC*1 to be connected with the EXT. I/O connector. Left: Current sink (NPN) Right: Current source (PNP)
24	**TEMP.SENSOR terminal**	Connect the Z2001 Temperature Sensor.
25	**TEMP.ANALOG INPUT terminal**	Connect an analog output thermometer.
26	**D/A OUTPUT terminal**	Outputs a voltage level that correspond to the resistance value. (Connect a device that can accept voltage input, for example, a Memory HiCorder.)
27	**RS-232C connector**	Allows control of the instrument with a PC or PLC*1.
28	**Main power switch**	Switches On/Off the main power supply of the instrument.
29	**Multiplexer unit slot (RM3545A-2 only)**	Install the Z3003 Multiplexer Unit. (Max. 2)

*1. Programmable controller

Pre-Operation Inspection

Before use, inspect the instrument and verify that it is operating properly.
See: Instruction Manual "2.1 Pre-Operation Inspection"

☐	The insulation of the power cord and test leads is not broken. No metal is exposed.
☐	No evident damage to the instrument.
☐	When turning power on The STANDBY key lights up in red or green.
☐	After the completion of the self-test (when the model number is shown on the screen), the Measurement screen is displayed.

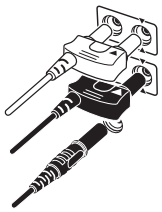
Measurement Process

1 **Inspect the instrument before the measurement.**

2 **Install a multiplexer unit. (RM3545A-2 only; as necessary)**
See: Instruction Manual "2.5 Installing the Multiplexer Unit"

3 **Plug the power cord into the power outlet.**

4 **Connect measurement leads to the measurement terminals.**



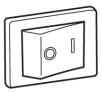
(When using a multiplexer unit, connect the connector.)

5 **Connect the temperature sensor or infrared thermometer. (When using the temperature correction function or ΔT)**

6 **Connect the external interface.**
- LAN, USB, or RS-232C
- EXT. I/O
- D/A Output
- The printer

7 **Turn on the instrument and cancel the standby state.**
The STANDBY key will change from red to green.

Main power switch: Rear



ON(|)

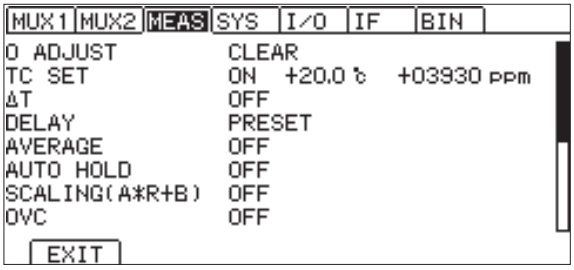
STANDBY key: Front

Lights up in green

To obtain precise high-accuracy measurements, provide about 60 minutes warm-up after turning power on.

8 **Check the measurement target.**
Weld resistance, Signal contacts, Power contacts, Temperature-rise test, etc.

9 **Make instrument settings.**
- Measurement range
- Measurement speed
- Settings in accordance with the measurement target
  To carry out proper resistance measurement, change the measurement conditions appropriately according to the measurement target. (Low-power mode, measurement currents, TC/ ΔT, OVC, pure resistance mode, contact check, etc.)
  See: Instruction Manual "3 Basic Measurements" and "4 Customizing Measurement Conditions"



10 **(as needed) Perform zero adjustment.**
- Always perform zero adjustment in the 2- terminal measurement.
- Zero adjustment is not required for the four-terminal measurement.
- If the OVC function is set to on, the zero point adjustment is included in the correction and zero adjustment is not required.

11 **Perform measurement.**
Connect the measurement leads to the measurement target.

12 **Check the measured values.**

13 **When finished measuring, turn the power off.**
Use the STANDBY key (by pressing and holding it for 1 s) or the main power switch to turn off the instrument. (If you press and hold the STANDBY key while the main power switch remains in the ON position, the instrument's internal circuitry will remain energized. To turn off power to the internal circuitry, place the main power switch in the OFF position.)

Specifications

Operating environment	Indoor use, pollution degree 2, altitude up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Standards	Safety EN 61010 EMC EN 61326 Class A
Power supply	Rated supply voltage: Commercial power supply 100 V to 240 V AC (Voltage fluctuations of ±10% from the rated supply voltage are taken into account) Rated power-supply frequency: 50 Hz/60 Hz Anticipated transient overvoltage: 2500 V Maximum rated power: 40 VA Normal power consumption (reference value): 16 W (measurement current 1 A, LCD on)
Dimensions	Approx. 215W × 80H × 306.5D mm (8.46W × 3.15H × 12.07D in.) (except protruding parts)
Weight	Approx. 2.7 kg (6.0 lbs) (RM3545A-1) Approx. 3.4 kg (7.5 lbs) (RM3545A-2)

Product warranty duration	3 years
Fuse	F1.6AH 250 V (installed inside the main body, replaceable)
Measurement items	Resistance, temperature
Measurement range	
Resistance	

LP*1	PR*2	100 MΩ range High-precision	Measuring range and full scale	Number of ranges
OFF	–	OFF	000.000 μΩ (1000 μΩ range) to 1200.0 MΩ (1000 MΩ range) 10 MΩ range or less: full scale = 1,000,000 digits 100 MΩ range or greater: full scale = 10,000 digits	13
		ON	000.000 μΩ (1000 μΩ range) to 120.000 0 MΩ (100 MΩ range) Full scale = 1,000,000 digits	12
ON	OFF	–	0.00 mΩ (1000 mΩ range) to 1200.00 Ω (1000 Ω range) Full scale = 100,000 digits	4

*1. Low-power mode
*2. Pure resistance mode

Temperature	−10.0°C to 99.9°C
Measurement signal	Constant current
Measurement method	DC four-terminal method
Measurement current	1 A, 100 mA, 10 mA, 1 mA, 500 μA, 100 μA, 50 μA, 10 μA, 5 μA, 1 μA, 1 μA or less, 100 nA Depends on the measurement ranges. For more information, see resistance measurement accuracy table in “Measurement accuracy” in the Instruction Manual.

EXT. I/O

Connector	Female 37-pin D-sub, with #4-40 Screw lock	
Input	Input type	Photocoupler-isolated no-voltage contact input (current sink/source output compatible)
	Input asserted (ON)	Residual voltage: 1 V or less (Input ON current: 4 mA (reference value))
	Input asserted (OFF)	Open (shutoff current: 100 μA or less)
	Response time	ON edge: Max. 0.1 ms OFF edge: Max. 1.0 ms
Output	Output type	Photocoupler-isolated open-drain output (non-polar)
	Maximum load voltage	DC 30 V
	Residual voltage	1 V or less (load current: 50 mA) 0.5 V or less (load current: 10 mA)
	Maximum output current	50 mA/channel
Service power supply output	Output voltage	For sink output: 5.0 V ±10% For source output: −5.0 V ±10%, 100 mA max.
	Isolation	Floating from protective ground potential and measurement circuit
	Insulation rating	Line to ground voltage 50 V DC, or 30 V AC rms and 42.4 V AC peak or less

For other specifications, see “12 Specifications” in the Instruction Manual.

Function Specifications

(1) Resistance range switching
See: Instruction Manual "12.3 Function Specifications (1) Resistance range switching"

(2) 100 MΩ range high-precision mode
See: Instruction Manual "4.14 Increasing the Precision of the 100 MΩ Range (100 MΩ Range High-precision Mode)"

(3) Number of measurement digits selection
See: Instruction Manual "4.7 Changing the Number of Measured Value Digits"

(4) Pure resistance mode (PR)
See: Instruction Manual "4.9 Switching to Pure Resistance Mode (PR)"

(5) Low-power mode (LP)
See: Instruction Manual "4.1 Switching to Low-power Mode (LP)"

(6) Switching Measurement Currents
See: Instruction Manual "4.2 Switching Measurement Currents (100 mΩ to 100 Ω range)"

(7) Measurement speed setting
See: Instruction Manual "3.3 Setting the Measurement Speed"

(8) Set the power frequency
See: Instruction Manual "6.3 Power Line Frequency Manual Setting"

(9) Zero adjustment
See: Instruction Manual "4.3 Performing Zero Adjustment"

(10) Averaging
See: Instruction Manual "4.4 Stabilizing Measured Values (Averaging Function)"

(11) Delay setting
See: Instruction Manual "4.10 Setting Pre-Measurement Delay (Delay Function)"

(12) Temperature measurement settings
See: Instruction Manual "12.3 Function Specifications (12) Temperature measurement settings"

(13) Temperature correction function (TC)
See: Instruction Manual "4.5 Correcting for the Effects of Temperature (Temperature Correction [TC])"

(14) Offset voltage compensation
See: Instruction Manual "4.8 Compensating for Thermal EMF Offset (OVC Function)"

(15) Scaling

See: Instruction Manual "4.6 Correcting Measured Values and Displaying Physical Properties Other than Resistance Values (Scaling Function)"

(16) Self-calibration

See: Instruction Manual "4.13 Maintaining Measurement Precision (Self-Calibration)"

(17) Contact improvement function

See: Instruction Manual "4.12 Improving Probe Contact (Contact Improvement Function)"

(18) Measurement fault detection

See: Instruction Manual "Confirming measurement faults"

(19) Comparator

See: Instruction Manual "4.15 Judging Measured Values (Comparator Function)"

(20) BIN

See: Instruction Manual "4.16 Classifying Measurement Results (BIN Measurement Function)"

(21) Judgment beeper setting

See: Instruction Manual "Checking judgments using sound (judgment sound setting function)"

(22) Auto hold

See: Instruction Manual "Holding measured values" and "12.3 Function Specifications (22) Auto hold"

(23) Temperature conversion (ΔT)

See: Instruction Manual "4.18 Performing Temperature Rise Test (Temperature Conversion Function [ΔT])"

(24) Statistical calculation

See: Instruction Manual "4.17 Performing Statistical Calculations on Measured Values"

(25) Panel Save, Panel Load

See: Instruction Manual "5 Saving and Loading Panels (Saving and Loading Measurement Conditions)"

(26) Clock

See: Instruction Manual "6.6 Setting the Clock" and "12.3 Function Specifications (26) Clock"

(27) Reset the instrument

See: Instruction Manual "6.7 Initializing (Reset)"

(28) Self-test

See: Instruction Manual "2.6 Turning the Power On and Off", "7.6 Performing the Multiplexer Unit Test", and "12.3 Function Specifications (28) Self-test"

Maintenance and Service

Repair and Inspection

⚠ WARNING

■ Do not attempt to modify, disassemble, or try to repair the instrument.

Doing so could cause serious bodily injury or fire.

Cleaning

⚠ CAUTION

■ If the instrument becomes dirty, wipe the instrument clean with a soft cloth moistened with water or a neutral detergent.

Never use solvents such as benzene, alcohol, acetone, ether, ketone, thinners or gasoline. Doing so could deform and discolor the instrument.

Wipe the LCD gently with a soft, dry cloth.

Replacing the Measurement Circuit's Protective Fuse

⚠ WARNING

■ Use only fuses of the designated type, characteristics, rated current, and voltage. Specified fuse: F1.6AH/250V (non-arcing) 20 mm × 5 mm dia.

■ Do not use any other fuse (particularly not a fuse with a higher rated current).

■ Do not use the product with the fuse holder's terminals shorted.

Doing so could cause damage to the instrument, resulting in bodily injury.

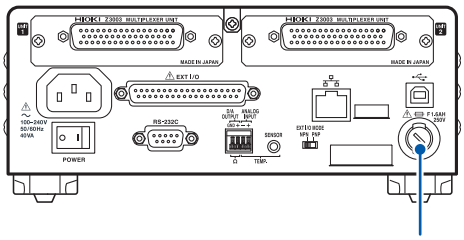
■ Before replacing the fuse, turn off the instrument's main power switch and disconnect the cords and leads from the measurement target.

Failure to do so could cause the operator to experience an electric shock.

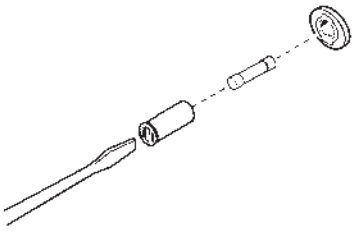
1 **Confirm that the instrument's main power switch (rear panel) is off (○), and disconnect the power cord.**

2 **Unlock the fastener on the fuse holder on the rear panel using a slotted screwdriver, and remove the fuse holder.**

Rear



Fuse holder



3 **Replace the fuse with a rated fuse.**

4 **Reset the fuse holder.**

Troubleshooting

If damage is suspected, read the “Before Returning for Repair” section to remedy the problem. If this does not help you, contacting your authorized Hioki distributor or reseller.

Before Returning for Repair

General issues

Issue	Items to check		Possible causes	Solutions
The instrument cannot be turned on. (The display shows nothing.)	Color of the STANDBY key	Green	The display settings have not been configured correctly.	Adjust the backlight brightness and contrast.
		Red	The instrument is in the standby state.	Press the STANDBY key.
		None (Off)	The instrument is not receiving power.	• Check the continuity of the power cord. • Verify that a circuit breaker has not been tripped. • Turn on the main power switch (on the back of the instrument).
			The supply voltage or frequency is incorrect.	Check the power supply ratings (100 V to 240 V, 50/60 Hz).
The keys are unresponsive.	Display	**[LOCK]**	The key lock function is active.	• Cancel the key lock function. • Turn OFF the EXT. I/O KEY_LOCK signal.
		[RMT]	The instrument is in the remote state.	Cancel the remote state.
		Panel name is shown.	A panel load operation has been triggered by the EXT. I/O.	Turn off the EXT. I/O’s LOAD signal.
		[LOCK] or **[RMT]**, and no panel name display	Certain functions cannot be used simultaneously.	See "List of functional limitations" (p. 19).
The instrument’s comparator lamp will not turn on.	Measured values	Displayed	The comparator function is OFF.	Turn ON the comparator function.
		Not displayed (Display other than value)	If the measured value is not being displayed, no judgment will be made, and the lamp will not turn on.	
The LED Comparator Attachment will not turn on.	Instrument’s comparator lamp	On	The attachment is not properly connected.	Connect the LED Comparator Attachment properly to the COMP. OUT terminal.
			There is a broken connection.	Replace the LED Comparator Attachment.
		Off	See "The instrument’s comparator lamp will not turn on." (p. 11).	
The beeper is not audible.	Key beeper is disabled		The function is off.	Turn on the function.
	Judgment beeper is disabled		The function is off.	Turn on the function.
You wish to change the beeper volume.	The instrument’s beeper volume cannot be changed.		–	

Measurement issues

Issue	Items to check		Possible causes	Solutions
Measured values are unstable.	Noise may be affecting measurement.		See: Instruction Manual "4.9 Switching to Pure Resistance Mode (PR)"	
	Measurement leads	Clip-type leads	See: Instruction Manual "14.7 Unstable Measured Values" (3)	
		Wiring becomes two-terminal wiring in middle.	See: Instruction Manual "14.7 Unstable Measured Values" (12)	
	Measurement target	Wide or thick	See: Instruction Manual "14.7 Unstable Measured Values" (4)	
		Temperature is unstable (just manufactured, just opened, being held by hand, etc.).	See: Instruction Manual "14.7 Unstable Measured Values" (5)	
		Low heat capacity	See: Instruction Manual "14.7 Unstable Measured Values" (6)	
		Transformer, motor, choke coil, solenoid	See: Instruction Manual "14.7 Unstable Measured Values" (9) and (10) Instruction Manual "14.9 Mitigating Noise" (1)	
	TC	ON	The temperature sensor is not appropriately positioned.	• Move the temperature sensor closer to the measurement target. • Position the temperature sensor so that it is not exposed to wind. • If the response to the measurement target's temperature change is slower than the temperature sensor's response, increase the response time by covering the temperature sensor with something. The temperature sensor's response time is about 10 minutes (reference value).
		OFF	The measurement target's resistance value is changing due to the temperature, for example because the room temperature has not stabilized.	Turn ON temperature correction (TC).
	OVC	OFF	The measurement is affected by thermal EMF.	Turn ON the OVC function.
	Using multiplexer unit to perform scan measurement		Delay is inadequate.	Set the delay longer.
Measured values differ from expected values. (A negative value is shown.)	Zero adjustment	ON	Zero adjustment is not accurate.	Perform zero adjustment again.
		OFF	Values are being affected by route resistance or thermoelectric power due to two-terminal measurement.	Perform zero adjustment.
	Scaling function	ON	The offset setting is incorrect.	Turn scaling off, or reconfigure the setting properly.
	Measurement leads		The measurement leads are not connected properly.	Check the connections.
	See "Measured values are unstable." (p. 12).			

Issue	Items to check		Possible causes	Solutions
No measured value is displayed. (Concerning the display of measured value faults, see "Confirming measurement faults" in the Instruction Manual.)	Measured values	**[- - - - - - -]**	There is a break in the measurement leads.	Replace the measurement leads.
			The contact resistance is too high (for user-made leads).	• Increase the contact pressure. • Clean or replace the probe tips. • Use a range with a low measurement current or set the measurement current to low.
			The route resistance is too high (for user-made leads).	• Make the wiring thicker and shorter. • Use a range with a low measurement current or set the measurement current to low.
		[CONTACT TERM.A], **[CONTACT TERM.B]**	• The probe is worn. • There is a break in the measurement leads.	Replace the measurement leads.
			The probe is not coming into contact with the measurement target.	Place the probe in proper contact with the target.
			The resistance value between the SENSE and SOURCE is high because the measurement target is conductive paint, conductive rubber, or a similar material.	Turn the contact check function off.
		[OvrRng]	The measurement range is low.	Select a high-resistance range or use auto-ranging.
		[SW.ERR ERR:061]	A multiplexer relay hot-switching prevention function error has occurred.	The relay cannot be switched because the current from the measurement target has not decreased. Increase the delay setting since the measurement circuit may be being influenced by back EMF from a transformer or other device. Do not apply any current or voltage to the measurement terminals.
		[NO UNIT]	No multiplexer unit has been inserted.	Insert the unit properly. Do not allocate units that have not been inserted to channels.
		Nothing is shown.	Auto-ranging is not selecting a range.	See "Auto-ranging is not selecting a range. (The range is not appropriate.)" (p. 14)

Issue	Items to check		Possible causes	Solutions
No measured value is displayed. (Concerning the display of measured value faults, see "Confirming measurement faults" in the Instruction Manual.)		No measured value is shown, even if the measurement leads are shorted.	The fuse may have tripped.	• Cycle the instrument's power and then perform the self-test to check whether the fuse has tripped. • When using the multiplexer, if the measured value is not displayed after replacing the measurement fuse, the multiplexer unit's fuse may have tripped. Request repair.
			The measurement and guard terminals may be shorted.	Check whether the measurement leads are damaged.
Auto-ranging is not selecting a range. (The range is not appropriate.)	Measurement target is a transformer or motor.		Auto-ranging is not able to select a range for measurement targets that have high inductance.	Use a fixed range.
	Noise may be affecting measurement.		See: Instruction Manual "4.9 Switching to Pure Resistance Mode (PR)"	
It is impossible to perform zero adjustment.	Measured values before zero adjustment exceed −1% to 50% of each range full scale, or a measurement fault has occurred.		There is a problem with the wiring.	Repeat zero adjustment with the correct wiring. Since zero adjustment cannot be performed if the resistance value is too high, for example with a user-made cable, work to minimize the route resistance.
The auto-hold function is not working (hold operation is not being canceled).	Measured values	Are unstable.	See "Measured values are unstable." (p. 12)	
		Do not change.	An appropriate range has not been selected.	Select an appropriate range or use auto-ranging.
Measured temperature is displayed incorrectly.	Temperature sensor and thermometer connection		The temperature sensor or thermometer is not properly connected.	Connect the temperature sensor by inserting the plug all the way.
			The settings have been improperly configured.	Check the settings.
			A temperature sensor other than that specified is used.	9451 Temperature Probe is not supported.

EXT. I/O issues

The EXT. I/O test function can be used to more easily check operation.
See: Instruction Manual "9.5 Checking External Control"

Issue	Items to check	Possible causes	Solutions
The instrument is not operating at all.	The IN and OUT values displayed on the instrument's EXT. I/O test do not agree with the controller.	The wiring is incorrect. • The connector is loose. • The pin number is incorrect. • The ISO-COM terminal is not connected properly. • The NPN/ PNP setting is not configured correctly. • Contact (or open collector) control is not enabled (voltage control is being used). • No power is being supplied to the controller. (Power does not need to be supplied to the instrument.)	See: Instruction Manual "9 External Control (EXT. I/O)"
The trigger has not activated.	The trigger source is set to the internal trigger (INT).	If the internal trigger setting is being used, the TRIG signal will not serve as a trigger.	Select the external trigger setting.
	The TRIG ON time is less than 0.1 ms.	The TRIG on time is too short.	Ensure that the on time is at least 0.1 ms.
	The TRIG OFF time is shorter than 1 ms.	The TRIG off time is too short.	Ensure that the off time is at least 1 ms.
	The TRIG/PRINT signal filter function is ON.	A longer signal control time is required.	• Increase the signal on time. • Turn off the filter function.
	The `:INIT:CONT` command is OFF.	The instrument is not in the trigger wait state.	Send the "`:INIT`" or "`:READ?`" command.
Unable to print.	The interface is not set to the printer.	Set the interface to the printer.	
	The TRIG/PRINT signal filter function is ON.	A longer signal control time is required.	Turn off the function.
Unable to load panel.	No panel has been saved using the panel number that you are trying to load.	The instrument cannot load a panel that has not been saved.	Change the LOAD signal or resave the panel before the LOAD signal is asserted.
The channels cannot be switched with the LOAD signal.	The channel numbers have not been set. The channels have been disabled. The scan function has been turned off.	The scan settings have been improperly configured.	Configure the scan settings correctly.

Issue	Items to check		Possible causes	Solutions
EOM is not being output.	The measured value is not being updated.		See "The trigger has not activated." (p. 15)	
	EOM signal logic		The EOM signal turns on when measurement completes.	
	EOM signal setting	Pulse	The pulse width is too narrow, and the EOM signal is not being read while it is on.	Increase the EOM signal's pulse width setting or set the EOM signal setting to "hold."
		Hold	The measurement time is too short, and the interval during which the EOM signal is off cannot be detected.	Change the EOM signal setting to "pulse."
The Hi, IN and Lo signals are not being output.	The instrument's comparator lamp is off.		See "The instrument's comparator lamp will not turn on." (p. 11)	
	The output mode is set to BCD.		Change to judgment mode (in BCD mode, the result of a logical OR operation applied to Hi and Lo is output from one signal line).	
T_PASS, T_FAIL, The T_ERR signal is not being output.	The scan function is off. Measurement of all channels has not completed.		The scan settings have been improperly configured.	Check the scan settings.
The BCD signal is not being output.	The output mode is set to JUDGE.		Change to BCD mode.	
	The BCD_LOW signal is not being controlled.		Control the BCD_LOW signal (failure to do so will cause only the upper digits to be output).	
The RANGE_OUT signal is not being output.	The BCD_LOW signal is not being controlled.		Control the BCD_LOW signal (failure to do so will cause the RANGE_OUT signal not to be output).	
The multiplexer channels cannot be switched with the LOAD signal.	The MUX signal is not on.		Turn on the MUX signal.	

Communications issues

The communications monitor function can be used to more easily check operation.
See: Instruction Manual "Displaying communications commands (command monitor function)"

Issue	Items to check		Possible causes	Solutions
The instrument is not responding at all.	Display	**[RMT]** is not being displayed.	No connection has been established.	• Check whether the connector has been connected. • Check whether the interface settings have been configured properly. • (USB) Install the driver on the control device. • (RS-232C) Use a cross cable. • (USB, RS-232C) Check the COM port number on the control device. • (RS-232C) Use the same communications speed for the instrument and the control device. • (LAN) Check that the IP address does not overlap with that of other network instruments. The initial IP address for the instrument is “0.0.0.0”.
An error is being encountered.	Display	Command error	The command isn’t being recognized as a valid instruction.	• Check the spelling of the command (space: x20H). • Do not append a question mark to commands that are not queries. • (RS-232C) Use the same communications speed for the instrument and the control device.
			The input buffer (256 bytes) is full.	Insert a dummy query after sending several lines of commands. Example: Send "**`*OPC?`**" → Receive "**`1`**"
		Execution error	Receive 1 The command string is correct, but the instrument is not able to execute it. Example • When set during scanning • The data portion was spelled incorrectly. "**`:SAMP:RATE SLOW3`**"	Check the specifications of the command(s) in question.
			The input buffer (256 bytes) is full.	Insert a dummy query after sending several lines of commands. Example: Send "**`*OPC?`**" → Receive "**`1`**"
The instrument fails to respond to queries.	On the command monitor	No response	The **`:TRIG:SOUR EXT`** setting is being used, and the instrument is waiting for the trigger after **`:READ?`** transmission.	Check the command specifications.
		Response	There is a mistake in the program.	Check the receive portion of the program.
Unable to switch the multiplexer channel. Unable to load multiplexer.	Measurement leads are connected to the measurement terminals on the front of the instrument.		Do not connect measurement leads to the measurement terminals on the front of the instrument when using the multiplexer.	

Printer issues

Issue	Possible causes	Solutions
No data is being printed.	The instrument and printer are not connected properly.	• Check whether the connector has been connected. • Check whether the interface settings have been configured properly. • If using the PRINT signal, see "Unable to print." (p. 15)
Printed text is garbled.	The printer and instrument settings do not match.	Check the printer settings again.

Multiplexer issues

Issue	Display	Possible causes	Solutions
It is not possible to switch to the multiplexer inputs.	**[ERR:60]**	Measurement leads are connected to the measurement terminals on the front of the instrument.	Do not connect any measurement leads to the measurement terminals on the front of the instrument. If **[ERR:60]** is displayed even though no measurement leads are connected, turn off the instrument and remove the Z3003. If **[ERR:60]** is not displayed after removing the Z3003, the Z3003 could be broken. Request repair.
Channels cannot be switched by operating the instrument's keys.	**[CH]** is not being displayed.	The front terminals are being used as the measurement terminals.	Set the measurement terminals to MUX.
	Scan display (list display)	The scan function is set to auto or step.	Set the scan function to off in order to switch channels with key operation.
		The set unit number and the unit number in which the Z3003 is installed differ.	Check the settings and the unit on the back of the instrument.
	[RMT]	The instrument is in remote mode, in which it is controlled by communications functionality.	Operate the instrument after canceling remote mode.
Channels cannot be switched with EXT. I/O.	–	The MUX signal is not on.	Turn on the MUX signal.
Measured values are unstable.	–	See "Measured values are unstable." (p. 12)	
The measured value differs from the expected resistance value.	–	The wrong channel is being measured.	Check the current channel and the channel setting.
	–	The wiring is shorted.	Exercise care to avoid shorted wires.
	–	The route resistance is too high.	For 2-wire connection, the route resistance affects the measured value directly. Perform zero adjustment.
	–	Measurement leads are connected to the measurement terminals on the front of the instrument.	Do not connect measurement leads to the measurement terminals on the front of the instrument when using the multiplexer.

Issue	Display	Possible causes	Solutions
No measured value is displayed.	–	The wrong channel is being measured.	Check the current channel and the channel setting.
	[NO UNIT]	The set unit number and the unit number in which the Z3003 is installed differ.	Check the settings and rear of the unit.
		The connected device is set to an external device.	Set the connected device to the RM3545A.
	–	The relays are worn.	Perform the multiplexer unit test. If it yields a FAIL result, request repair of the Z3003.
	–	The wiring is shorted.	Check the wiring.
	–	See "No measured value is displayed." (p. 19)	
	–	A fuse is blown.	Please ensure connections have been made properly. If you are still unable to perform measurement, the internal protective fuse may have blown. Request repair of the Z3003.
Zero adjustment values are not being applied.	–	Zero adjustment has not been performed for each channel.	Check whether zero adjustment has been performed for each channel on the Multiplexer Basic Measurement screen. Zero adjustment is performed separately for the front terminals and for each channel, so you will need to perform it for each channel (scanning zero adjustment can also be performed).
Zero adjustment cannot be performed.	–	The route resistance is too high. (Measured values before zero adjustment exceed −1% to 50% of each range full-scale, or a measurement fault has occurred.)	Zero adjustment cannot be performed when the route resistance is too high. Modify your setup so that the route resistance is less than 50% of the measurement target.
	–	The connected device is set to an external device.	Zero adjustment cannot be performed for channels whose connected device is an external device. Set the connected device to the RM3545A.
The unit test generates a FAIL result.	–	• The relays are worn. • The fuse in the unit is blown out.	Request repair of the Z3003.
Switching is too slow.	–	The relay hot switching prevention function is being triggered because back EMF is remaining when measuring a transformer.	Use a high-resistance range or lower the measurement current, for example by using the low current switching setting.

List of functional limitations

✓: Compatible, −: Incompatible

	COMP	TC	ΔT	BIN	MUX	STAT	AUTO RANGE, RANGE change
COMP		✓	–	–	✓	✓	–
TC	✓		–	✓	✓	✓	✓
ΔT	–	–		–	✓	–	✓
BIN	–	✓	–		–	✓	–
MUX	✓	✓	✓	–		–	✓
STAT	✓	✓	–	✓	–		✓
AUTO RANGE, RANGE change	–	✓	✓	–	✓	✓	

- When low-power mode is on, OVC will be fixed to on and contact improvement will be fixed to off. During SLOW2 operation, two-iteration averaging is used even if the averaging function is off.
- When the multiplex scan function is set to auto or step, the trigger source is automatically set to EXT. In addition, the communications function's memory function will not be available for use.
- When using the multiplexer in 2-wire mode, the contact check function is disabled. In addition, the ranges of 1000 mΩ and less will not be available for use.

Error displays

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

Display		Description	Remedy
+OvrRng/-OvrRng		Over-range	Select the appropriate range.
CONTACT TERM.A (CONTACT A, CA)		Measurement terminal A-side wiring contact error	Check for cable breakage and worn out probes.
CONTACT TERM.B (CONTACT B, CB)		Measurement terminal B-side wiring contact error	Check for cable breakage and worn out probes.
SW.ERR		See ERR:061.	
NO UNIT		No multiplexer unit has been inserted.	Insert the unit properly. Do not allocate units that have not been inserted to channels.
ERR:001	**LOW limit is higher than UPP limit.**	Cannot set because the lower limit value is larger than the upper limit value.	Set an upper limit value that is larger than the lower limit value.
ERR:002	**REF setting is zero.**	Cannot set because the reference value setting is zero.	Set a reference value that is larger than zero.
ERR:003	**Cannot switch ranges. (comparator or bin is ON)**	Cannot switch ranges when the comparator or BIN is ON.	• Set the range after turning the comparator or BIN off. • Select the range to use on the Comparator Settings screen or BIN Number Settings screen.
ERR:004	**Cannot turn auto-ranging ON. (comparator or bin is ON)**	Cannot turn auto-ranging ON while the comparator or BIN is ON.	Turn off the comparator or BIN.
ERR:010	**0 ADJ error. Must not exceed 50% or −1% f.s.**	Out of zero adjustment range. The reading must be within −1% to 50% of range full-scale.	Check the zero adjustment procedure.
ERR:011	**Temp. sensor error. Cannot calculate.**	Cannot perform calculations due to a temperature sensor or thermometer error.	Check the temperature sensor or thermometer.
ERR:012	**Comparator is invalid. (Delta T or BIN is ON)**	The comparator cannot be turned on while the ΔT or BIN function is on.	Turn off the ΔT and BIN functions.
ERR:013	**0 ADJ is invalid. (Must be lower than 10MΩ range)**	Zero adjustment can be performed only for the 10 MΩ or lower ranges.	Zero adjustment cannot be performed for 100 MΩ and greater ranges.
ERR:020	**Undo not available.**	Statistics functions allow only one undo operation.	−
ERR:030	**Command error.**	Command Error.	Check for incorrect commands.
ERR:031	**Execution error. (Parameter error)**	Execution Error. The parameter value is out of range.	Check whether the parameter range is correct.
ERR:032	**Execution error.**	Execution Error.	Check whether any command has resulted in execution error conditions.
ERR:060	**Cannot enable MUX function. Disconnect cable from front terminal.**	Unable to use MUX.	When using MUX, disconnect the measurement leads from the terminals on the front of the instrument.
ERR:061	**MUX switching error.**	A multiplexer relay hot-switching prevention function error has occurred.	The relay cannot be switched because the current from the measurement target has not decreased. Increase the delay setting since the measurement circuit may be being influenced by back EMF from a transformer or other device. Do not apply any current or voltage to the measurement terminals.
ERR:090	**ROM check sum error.**	Program ROM checksum error	The instrument is malfunctioning. Request repair.

Display		Description	Remedy
ERR:091	**RAM error.**	CPU RAM error	The instrument is malfunctioning. Request repair.
ERR:092	**Memory access failed.** **Main power off, restart after 10s.**	A communications error occurred while attempting to access the memory.	Turn off the main power switch, wait at least 10 seconds, and turn it back on.
ERR:093	**Memory read/write error.**	Memory read/write test error	The instrument is malfunctioning. Request repair.
ERR:095	**Adjustment data error.**	Adjustment data error	The instrument is malfunctioning. Request repair.
ERR:096	**Backup data error.**	Settings backup error	Settings were reinitialized. Reconfigure measurement conditions and other settings.
ERR:097	**Power line detection error.** **Select power line cycle.**	Power frequency detection error	Set the frequency to match that of the power being supplied to the instrument.
ERR:098	**Blown FUSE or measurement lead is broken.**	The fuse has been tripped.	Replace the fuse. If the fuse is not blown out, the measurement and guard terminals may be shorted. Disconnect the measurement leads and check whether or not the error occurs. If the error still occurs, request repair of the instrument. Furthermore, be sure to use a Hioki-specified fuse for replacement. Specified fuse: F1.6AH/250 V (non arcing) 20 mm × 5 mm dia.
ERR:099	**Clock is not set.** **Reset?(13-01-01 00:00:00)** **Press F2”**	The clock is not set, so pressing F2 **[OK]** displays the initialized time 13-01-01 00: 00: 00.	The backup battery needs to be replaced. Contact your authorized Hioki distributor or reseller.
ERR:100	**MUX unit error.**	The MUX unit experienced an error.	The instrument is malfunctioning. Request repair of the instrument.

Message displays

The following table lists LCD messages and associated solutions.

Display		Description
INFO:001	**Panel load. OK?**	Panel data will be loaded. Continue?
INFO:002	**Panel loading...**	Panel data is being loaded.
INFO:003	**Enter panel name. ESC: CANCEL, ENTER: SAVE EXEC**	Enter a name for the panel being saved. Cancel the save operation with the **ESC** key or save the panel with the **ENTER** key.
INFO:004	**Enter panel name. Panel is used, will be overwritten. ESC: CANCEL, ENTER: SAVE EXEC**	Enter a name for the panel being saved. The specified name already exists and will be overwritten if you proceed. Cancel the save operation with the **ESC** key or save the panel with the **ENTER** key.
INFO:005	**Panel saving...**	Panel data is being saved.
INFO:006	**Clear panel. OK?**	Panel data will be cleared. Continue?
INFO:007	**Panel clearing...**	Panel data is being cleared.
INFO:008	**Printing...**	Printing in progress.
INFO:010	**Start interval print.**	Interval printing started.
INFO:011	**Stop interval print.**	Interval printing stopped.
INFO:020	**Performing 0 adjustment. OK?**	Zero adjustment will be performed. Continue?
INFO:021	**Clear 0 adjustment data. OK?**	Zero adjustment values will be cleared. Continue?
INFO:022	**Cleared 0 adjustment data.**	Zero adjustment data was cleared.
INFO:023	**0 ADJ warning. Adjust within 1% f.s.**	Zero adjustment data values are large. (Warning) →It is recommended that values be within 1% of range full-scale.
INFO:025	**Undo statistical calculations.**	One statistical calculation was undone.
INFO:026	**Self-calibrating...**	Self-calibration measurement in progress.
INFO:030	**Reset? NORMAL RESET (without panel clear) / SYSTEM RESET (with panel clear) / MUX RESET (only CH settings)**	The instrument will be initialized.
INFO:035	**MUX CH settings will be reset. Change setting?**	The MUX channel settings will be initialized when switching between 4-terminal and 2-terminal measurement.
INFO:036	**0 adjusting...**	Zero adjustment is being performed with MUX scanning.
INFO:037	**Short-circuit pin No.1 to No.42, OK?**	To perform the unit test, short all the pins numbered 1 to 42.
INFO:038	**Testing MUX units...**	The multiplexer unit test is being performed.
INFO:040	**Enter password for Adjustment Mode.**	Enter the password for adjustment mode.
INFO:041	**Password is wrong.**	The adjustment mode password is incorrect. Please enter the correct password.
INFO:080	**Self-calibration is set to "manual".**	Self-calibration measurement is set to MANU.

Warranty Certificate

HIOKI

Model	Serial number	Warranty period Three (3) years from date of purchase (___ / ___)

Customer name: _____

Customer address: _____

Important

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

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

Warranty terms

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

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