HIOKI

RESISTANCE METER RM3545A

NEW

New Heights in 100% Inspection

Market leading precision tests for testing every weld or connection on your production line.

As society embraces electric mobility, manufacturers are offering batteries, motors, electronic components, and other parts that accommodate increasingly large currents and high voltages. Since even minuscule amounts of resistance can have a significant impact on energy efficiency and safety, more accurate quality control focusing on resistance is required.
The Resistance Meter RM3545A makes it easy for anyone to measure resistance with a high degree of precision.
It can be used in a variety of applications, including in development and on production lines.

Two models differentiated by measurement channel count

Single-channel model
Resistance Meter RM3545A-1

Model with a built-in multiplexer (up to 20 channels)
Resistance Meter RM3545A-2

High-precision, low-resistance measurement

Resistance measurement

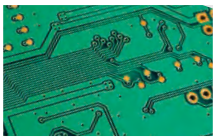
- Measurable range: **1 nΩ to 1200 MΩ**
- Max. resolution: **1 nΩ (1000 μΩ range)**
- Min. measurement range: **1000 μΩ**
- Min. measurement range accuracy: **0.045% rdg.**
- Max. measurement current: **1 A**

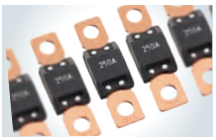
Measurement targets

Measure resistance in components and wiring carrying large currents and in connectors where incomplete contact would lead to failure.


Wiring resistance in motors and transformers


Connection resistance in charging connectors


Pattern resistance on printed circuit boards


DC resistance in fuses and shunt resistors


Connection resistance of battery busbars

Advantages

01

Manage connection quality in welded materials and other parts quantitatively

Quantitatively verify weld quality and weld methods in EV power cables and other parts.

02

Use readings as indicators for thermal design and energy management

Use accurate resistance measurements to simulate heat loss and energy efficiency.

03

Boost productivity by embedding the instrument in automatic test equipment

Embed the instrument in a system without needing to worry about wiring resistance or contact resistance. The instrument is ideal for use in high-speed 100% inspections.

3 year Warranty

Three key features of Resistance Meter RM3545A

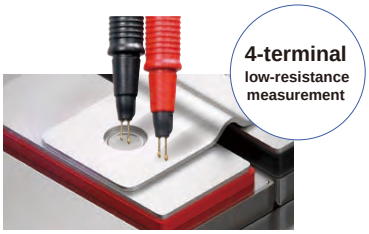
01 Measure low resistance values at high precision and high, 1 nΩ resolution

02 Add multichannel capability in a low-cost, space-saving package

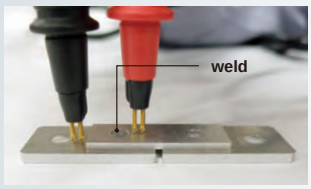
03 Easy to embed in automatic test systems

01 Measure low resistance values at high precision and high, 1 nΩ resolution

Electric resistance is measured by passing a current through a measurement target such as a weld. Pass and fail judgments are generated based on variation in resistance values.
A typical low-resistance weld can have resistance ranging from 10 μΩ to 100 μΩ. The Resistance Meter RM3545A provides a 1000 μΩ range and 1 nΩ resolution, allowing it to measure low resistance values with a high degree of precision. If a weld is insufficient, its resistance value will exceed that of a non-defective weld. Pass and fail results are generated for non-defective and defective welds based on minuscule differences in their resistance values. Weld quality can be managed quantitatively for all welds passing through a production line, ensuring traceability.

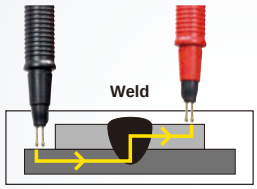


Example: measuring connections in a battery



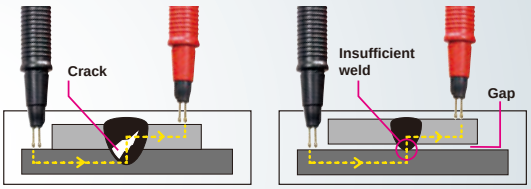
Measuring weld quality

Battery pack busbar weld (laser welding)



Good weld

Resistance of weld is small enabling smooth flow of electricity



Defective weld

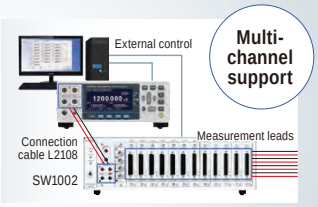
The resistance of the weld increases due to cracks or defects that occur during welding, insufficient melting, or gaps between parts, decreasing the flow of electricity

*This product does not come with a measurement probe. Please purchase the probe you need separately.

02 Multi-channel, one unit: made possible by installed multiplexer of RM3545A-2

The RM3545A-2 can be equipped with up to two optional Z3003 Multiplexer Units, allowing it to measure up to 20 channels (using the 4-terminal method). Furthermore, the instrument can accommodate up to 132 channels (using the 4-terminal method) when combined with the Switch Mainframe SW1002. Responding to market demand for low-cost and space-saving

Z3003: Up to 20 channels



SW1002: Up to 132 channels

03 Embed in an automatic test system without needing to worry about wiring resistance or contact resistance

Thanks to its characteristic higher path resistance tolerance, the RM3545A can be embedded in other systems without prompting concerns about wiring resistance or contact resistance. The instrument also ships standard with a LAN interface so that it can easily exchange data with other devices like computers and PLCs. Further, it features a fast measurement speed (21 ms) that will speed up the tests and thus the speed of production.

LAN connectivity
Path resistance tolerance: 3.5 Ω
(with measurement current of 1 A)

Convenient Functionality

No need for zero adjustment

Accuracy is guaranteed without the zero adjustment or instrument warm-up. Simply power up the instrument and get down to work.

Offset voltage correction function (OVC)

With the OVC function, the RM3545A automatically corrects for thermal electromotive force and its own internal offset voltage to reduce measurement error.

Contact check functionality

This function detects erroneous measurement due to incomplete contact, reducing the risk of faulty judgments or mistaken inspection results.

Command monitor function

This function displays responses from communications commands and queries. It can significantly reduce the number of debugging man-hours when building systems.

Temperature measurement function

When using the Temperature Sensor Z2001, the instrument can measure temperature with a high degree of precision (±0.5°C). It can also accept analog input from a radiation thermometer (0 V to 2 V).

Temperature correction (TC) function

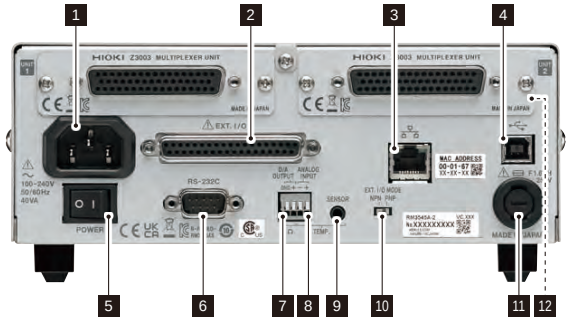
This function converts the resistance value of a temperature-dependent measurement target to the resistance value at a specific temperature (the reference temperature) and displays the result.

Temperature conversion (ΔT) function

This function calculates and displays temperature rise from the measured resistance value and ambient temperature.

USB keyboard mode (HID)

This function allows the instrument to automatically enter measurement results in Excel® or a text editor, freeing the operator from troublesome data entry work.



Interfaces

1 Power inlet
2 EXT. I/O connector
3 LAN connector
4 USB connector
5 Main power switch
6 RS-232C connector
7 D/A OUTPUT terminal
8 TEMP.ANALOG INPUT terminal
9 TEMP. SENSOR
10 EXT. I/O MODE NPN/PNP switch
11 Fuse holder
12 Multiplexer unit slot (only RM3545A-2)

Multichannel measurement options

Measurement cables for multichannel measurement must be prepared by the user based on each application's needs.

Multiplexer Unit Z3003

Supported model: RM3545A-2

Measurement targets	4-wire method: 10 locations (if using 2 units, 20 locations) 2-wire method: 21 locations (if using 2 units, 42 locations)
Measurement current/frequency	Measurement current: when equipped with Z3003, 1 A DC or less Externally connected device: 1 A DC or less, 100 mA AC or less Measurement frequency: DC, 10 Hz to 1 kHz
Contact specifications	Contact type: mechanical relay Maximum permissible voltage: 33 V RMS and 46.7 V peak or 70 V DC Maximum permissible power: 30 W (DC, resistive load) Contact service life: 50 million cycles for 4-wire method (reference value)* 5 million cycles for 2-wire method (reference value)
Channel switching time	30 ms (without switching range or LP mode)
External dimensions	Approx. 92 W × 24.5 H × 182 D mm (3.62 W × 0.96 H × 7.17 D in.) (excluding protruding parts)
Connectors used	D-sub 50-pin receptacle
Accessories	User Documentation, D-sub 50-pin connector (pin header, solder cup)

*If used 24 hours a day on a production line moving at the rate of 1 unit per second, the approximate service life would be 1.5 years.

Example scan times

Range	Number of channels	Measure-ment speed	Delay	Time from TRIG input to judgment results output (if measurement current is high)
1000 mΩ	10	FAST	0 ms	Approx. 300 ms
1000 mΩ	10	FAST	Preset	Approx. 800 ms

Total scan time: (Switching time + measurement time, including delay) × number of channels

Additional accuracy

Effects of leak current	Add a reading error shown on right depending on the measurement current (when using guarding) (With humidity of less than 70% RH. [If the humidity is greater than or equal to 70% RH, add the following rdg. error × 5.])	$\frac{1\times10^{-9}[\mathrm{A}]}{I_{MEAS}[\mathrm{A}]}\times100$ [% rdg.]
Effect of measurement speed	Add the f.s. error component shown on right when the integration time is not a whole-number multiple of the power supply cycle	$A_{fs}\times0.5$ [% rdg.]
Effect of offset voltage	Add the resistance shown on right to the error when OVC is OFF	$\frac{10\times10^{-6}[\mathrm{V}]}{I_{MEAS}[\mathrm{A}]}$ [Ω]
Effect of offset resistance fluctuations	When using a 2-wire setup, add the wiring resistance shown on right to the error component	0.1 Ω
Temperature coefficient	From 0°C to 18°C (32°F to 64.4°F) and 28°C to 40°C (82.4°F to 104°F), add a temperature coefficient of ±(1/10 of additional accuracy) / °C.	

I_{MEAS} : measurement current A_{fs} : full scale error component for instrument with the Z3003

Switch Mainframe SW1002

Supported models: RM3545A-1, RM3545A-2

	Switch Mainframe S1001, SW1002
Number of slots	3 slots (SW1001), 12 slots (SW1002)
Supported RM3445A module	Multiplexer module SW9001 (2-wire, 4-wire)
Maximum input voltage	DC 60 V, AC 30 V RMS, 42.4 V peak
Interfaces	LAN, USB, RS-232C (host use), RM-232C (command transfer function use)
EXT. I/O	SCAN input, SCAN_RESET input, CLOS output (scan control use)

	Multiplexer Module SW9001
Wiring method	2-wire or 4-wire
Number of channels	22 channels (2-wire method), 11 channels (4-wire method)
Contact method	Mechanical relay
Channel switching time	11 ms (not including measurement time)
Maximum permissible voltage	DC 60 V, AC 30 V RMS, 42.4 V peak
Maximum permissible current	DC 1 A, AC 1 A RMS
Connectors used	D-sub 50-pin pin header

Influence by range/setting (LP off, OVC on)

Range	Measurement speed setting Add to accuracy ±(x% rdg. + y% f.s.)				Measurement current setting
	FAST	MED	SLOW1	SLOW2	
1000 µΩ	0.005 + 0.05	0.005 + 0.01		0.005 + 0.005	N/A
10 mΩ	0.005 + 0.007	0.005 + 0.002		0.005 + 0.001	High
100 mΩ	0.024 + 0.012	0.024 + 0.004			High
1000 mΩ	0.005 + 0.012	0.005 + 0.004			High
10 Ω	0.004 + 0.012	0.004 + 0.003			High
100 Ω	0.003 + 0.020	0.003 + 0.003			High
1000 Ω	0.003 + 0.020	0.003 + 0.004			High
10 kΩ	0.006 + 0.020	0.005 + 0.008			High
100 kΩ	0.024 + 0.020	0.023 + 0.008			High

When the internal thermoelectromotive force is stable

Maximum number of channels

	RM34545A-2	RM3545A-1
Instrument only	1 ch	1 ch
Instrument + Z3003 × 1	10 ch	Not supported
Instrument + Z3003 × 2	20 ch	Not supported
Instrument + SW1001	33 ch	33 ch
Instrument + SW1002	132 ch	132 ch

Conditions: measurement using 4 terminals and all channels

Other specifications (RM3455A-1, RM3545A-2)

Measurement time

(representative value)

Range	Measurement current	OVC	Measurement speed (unit: ms)				
			FAST	MED		SLOW1	SLOW2
				50Hz	60Hz		
PR1000 µΩ*1	High	ON	41	81	74	241	441
PR10 mΩ*1	High	OFF	21	41	37	121	221
PR100 mΩ*1	N/A	OFF	21	41	37	121	221
1000 mΩ	High	OFF	3.1	23	20	103	203
10 Ω	High	OFF	2.3	22	19	102	202
100 Ω	High	OFF	2.4	23	19	103	203

Tolerance: ±10% ±0.2 ms *1: PR: Pure resistance

Temperature measurement

Add to accuracy when used with Z2001

Temperature range	Accuracy
-10.0°C to 9.9°C	± (0.55 + 0.009 × |t-10|)°C
10.0°C to 30.0°C	± 0.50°C
30.1°C to 59.9°C	± (0.55 + 0.012 × |t-30|)°C
60.0°C to 99.9°C	± (0.92 + 0.021 × |t-60|)°C

Standalone accuracy: ±0.2°C; t: measurement temperature [°C]

Temperature Sensor Z2001 specifications

Measurement range	-10.0°C to 99.9°C
Measurement speed	Approx. 2 s

Analog temperature measurement input

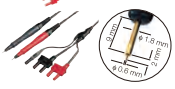
Accuracy guaranteed range	0 V to 2 V
Maximum permissible input	2.5 V
Resolution	1 mV
Display range	-99.9°C to 999.9°C
Measurement cycle (speed)	Approx. 50 ms, no moving average
Accuracy	±1% rdg. ±3 mV

These specifications provide representative values.
Actual performance will vary with measurement conditions.
For more information, please see the User Documentation.

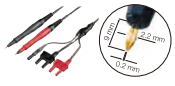
Specifications			New models			Previous models		
			NEW RM3545A-2	NEW RM3545A-1		RM3545-02	RM3545, RM3545-01	
Measurement method			DC 4-terminal method (constant-current)			DC 4-terminal method (constant-current)		
Measurement	Resistance measurement ranges (13 ranges) *High mode		Maximum display	Resolution	Measurement current	Maximum display	Resolution	Measurement current
		1000 µΩ	1200.000 µΩ,	1 nΩ,	1 A	N/A	N/A	N/A
		10 mΩ	12.000 00 mΩ,	10 nΩ,	1 A	12.000 00 mΩ,	10 nΩ,	1 A
		100 mΩ	120.000 0 mΩ,	100 nΩ,	1 A	120.000 0 mΩ,	100 nΩ,	1 A
		1000 mΩ	1200.000 mΩ,	1 µΩ,	100 mA	1200.000 mΩ,	1 µΩ,	100 mA
		10 Ω	12.000 00 Ω,	10 µΩ,	10 mA	12.000 00 Ω,	10 µΩ,	10 mA
		100 Ω	120.000 0 Ω,	100 µΩ,	10 mA	120.000 0 Ω,	100 µΩ,	10 mA
		1000 Ω	1200.000 Ω,	1 mΩ,	1 mA	1200.000 Ω,	1 mΩ,	1 mA
		10 kΩ	12.000 00 kΩ,	10 mΩ,	1 mA	12.000 00 kΩ,	10 mΩ,	1 mA
		100 kΩ	120.000 0 kΩ,	100 mΩ,	100 µA	120.000 0 kΩ,	100 mΩ,	100 µA
		1000 kΩ	1200.000 kΩ,	1 Ω,	10 µA	1200.000 kΩ,	1 Ω,	10 µA
		10 MΩ	12.000 00 MΩ,	10 Ω,	1 µA	12.000 00 MΩ,	10 Ω,	1 µA
		100 MΩ *100 MΩ range high-precision mode	120.000 0 MΩ,	100 Ω,	100 nA	120.000 0 MΩ,	100 Ω,	100 nA
		1000 MΩ	1200.0 MΩ,	100 kΩ,	1 µA or less	1200.0 MΩ,	100 kΩ,	1 µA or less
	Representative accuracy (High mode, OVC function enabled, SLOW2, no zero adjustment)	1000 µΩ range	±0.045% rdg. ±0.010% f.s.			N/A		
		10 mΩ range	±0.045% rdg. ±0.001% f.s.			±0.060% rdg. ±0.001% f.s.		
		100 mΩ range	±0.045% rdg. ±0.001% f.s.			±0.060% rdg. ±0.001% f.s.		
		1000 mΩ range	±0.012% rdg. ±0.001% f.s.			±0.012% rdg. ±0.001% f.s.		
		1000 Ω range	±0.006% rdg. ±0.001% f.s.			±0.006% rdg. ±0.001% f.s.		
Measurement times			See table on page 3			See RM3545 product specifications		
Path resistance tolerance (reference values) Path resistance between SOURCE B and SOURCE A (other than measurement target)		Range: 100 mΩ or less (PR mode off)	2.6 Ω			1.5 Ω		
		Range: 100 mΩ or less (PR mode on)	3.5 Ω			N/A		
		Range: 1000 mΩ, 10 Ω, 100 Ω, 10 kΩ	15 Ω, 150 Ω, 100 Ω, 500 Ω			15 Ω, 150 Ω, 100 Ω, 1 kΩ		
		Range: 100 kΩ or greater	1 kΩ			1 kΩ		
Maximum open-terminal voltage		Range: 1000 Ω or less, 10 kΩ or greater	8.0 V, 20 V			5.5 V, 20 V		
Multiplexer	Multiplexer Unit Z3003 (built-in option)	Number of installable units	Max. 2	N/A		Max. 2	N/A	
		Maximum number of channels (4-wire method, 2-wire method)	20 channels, 42 channels	N/A		20 channels, 42 channels	N/A	
		Switching time	30 ms	N/A		30 ms	N/A	
	Switch Mainframe (external option)	Max. channel count with 4-wire method (SW1001, SW1002)	33 channels, 132 channels			33 channels, 132 channels		
		Switching time	11 ms			11 ms		
Interfaces	LAN	(TCP/IP, 10BASE-T/100BASE-TX)	✓	✓		N/A	N/A	
	RS-232C	(Max. 115,200 bps, also used as printer interface)	✓	✓		✓	✓	
	USB	CDC class (COM mode)	✓	✓		✓	✓	
		HID class (keyboard mode)	✓	✓		✓	✓	
	GP-IB		N/A	N/A		N/A	✓ (RM3545-01 only)	
	EXT. I/O	(D-sub 37-pin)	✓	✓		✓	✓	
	Analog output	(D/A output voltage range)	0 V to 1.5 V DC	0 V to 1.5 V DC		0 V to 1.5 V DC	0 V to 1.5 V DC	
Functionality	Contact check		✓	✓		✓	✓	
	Zero adjustment (within each range ±50% f.s.) (Zero adjustment forcibly disabled for 100 MΩ or greater)		✓	✓		✓	✓	
	Zero-adjustment-free accuracy guaranteed		✓	✓		✓	✓	
	OVC function		✓	✓		✓	✓	
	Contact improvement function (max. applied voltage: 5V; max. applied current: 10 mA)		✓	✓		✓	✓	
	Low-power mode (maximum open voltage: 20 mV)		✓	✓		✓	✓	
	Auto-hold function		✓	✓		✓	✓	
	Comparator		Hi/In/Lo	Hi/In/Lo		Hi/In/Lo	Hi/In/Lo	
	Temperature measurement function	Thermistor sensor (Z2001)	-10.0°C to 99.9°C	-10.0°C to 99.9°C		-10.0°C to 99.9°C	-10.0°C to 99.9°C	
		Analog input (e.g., radiation thermometer)	0 V to 2.0 V DC	0 V to 2.0 V DC		0 V to 2.0 V DC	0 V to 2.0 V DC	
	Temperature correction (TC) function		✓	✓		✓	✓	
	Temperature conversion (ΔT) function		✓	✓		✓	✓	
	Statistical calculation function		Up to 30,000 data sets	Up to 30,000 data sets		Up to 30,000 data sets	Up to 30,000 data sets	
	Delay function		0 ms to 9999 ms	0 ms to 9999 ms		0 ms to 9999 ms	0 ms to 9999 ms	
	Averaging function		2 to 100 times	2 to 100 times		2 to 100 times	2 to 100 times	
	Saving panels (saving of measurement conditions)		30 panels (MUX: 8 panels)	30 panels		30 panels (MUX: 8 panels)	30 panels	
	Data memory function		50 data sets	50 data sets		50 data sets	50 data sets	
	Command monitor function (display of send/receive status of commands and queries)		✓	✓		✓	✓	
	LabVIEW® Driver compatible *LabVIEW Driver is the trademark or registered trademark of National Instruments.		✓	✓		✓	✓	
Standard	Standards compliance		Safety: EN61010; EMC: EN61326 Class A			Safety: EN61010; EMC: EN61326 Class A		
	CE marking		✓	✓		✓	✓	
	UL/CSA standard compliance		✓	✓		✓	✓	
Power supply			100 V to 240 V AC, 50/60 Hz			100 V to 240 V AC, 50/60 Hz		
Dimensions			215W × 80H × 306.5D mm (8.46W × 3.15H × 12.07D in.)			215W × 80H × 306.5D mm (8.46W × 3.15H × 12.07D in.)		
Weight			3.4 kg (7.5 lb.)	2.7 kg (6.0 lb.)		3.2 kg (7.1 lb.)	2.5 kg (5.5 lb.)	

Options

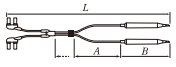
PIN TYPE LEAD L2100
A: 300 mm (11.81 in.)
B: 172 mm (6.77 in.)
L: 1.4 m (4.59 ft.)



PIN TYPE LEAD L2102
A: 250 mm (9.84 in.)
B: 178 mm (7.01 in.)
L: 1.5 m (4.92 ft.)



PIN TYPE LEAD L2103
A: 250 mm (9.84 in.)
B: 176 mm (6.93 in.)
L: 1.5 m (4.92 ft.)



About lead length
A: from junction to probe
B: probe length
L: overall length

CLIP TYPE LEAD L2101
A: 250 mm (9.84 in.)
B: 84 mm (3.31 in.)
L: 1.5 m (4.92 ft.)

4-TERMINAL LEAD L2104
A: 280 mm (11.02 in.)
B: 149 mm (5.87 in.)
L: 1.5 m (4.92 ft.)

FOUR-POINT ARRAY PROBE RM9010-01
A: 1215 mm (47.83 in.)
B: 73.5 mm (2.89 in.)
L: 1.5 m (4.92 ft.)

FOUR-POINT ARRAY PROBE RM9010-02
A: 1120 mm (44.09 in.)
B: 162 mm (6.38 in.)
L: 1.5 m (4.92 ft.)

USB CABLE(A-B) L1002
1 m (3.28 ft.)

RS-232C CABLE L9637
9-pin/9-pin, 3 m (9.84 ft.)
Only RM3545A is supported.

LAN CABLE 9642
Straight-through Ethernet cable, 5 m (16.40 ft.), supplied with straight-through-to-crossover conversion adapter
Only RM3545A is supported.

FUSE SET Z5056
1.6 A/ 250 V Fuse set of 5
RM3544,RM3545A

TEMPERATURE SENSOR Z2001
Included accessory, 1.75 m (5.74 ft.)

LED COMPARATOR ATTACHMENT L2105
2 m (6.56 ft.)

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