

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

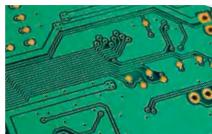
Measure resistance in components and wiring carrying large currents and in connectors where incomplete contact would lead to failure.



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.





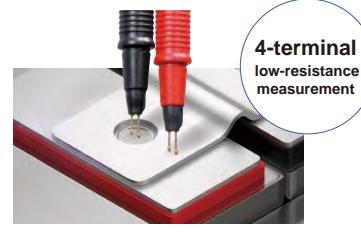
Three key features of Resistance Meter RM3545A

- 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

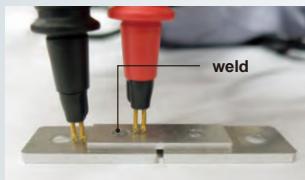
01 Measure low resistance values at high precision and high, 1 nΩ resolution

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 $\mu\Omega$ to 100 $\mu\Omega$. The Resistance Meter RM3545A provides a 1000 $\mu\Omega$ 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.

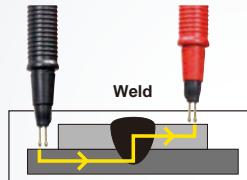


Example: measuring connections in a battery



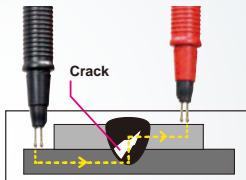
Measuring weld quality

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



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.



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.

Convenient Functionality

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.

Temperature measurement function

When using the Temperature Sensor Z2001, the instrument can measure temperature with a high degree of precision ($\pm 0.5^\circ\text{C}$). It can also accept analog input from a radiation thermometer (0 V to 2 V).

Contact check functionality

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

Temperature conversion (ΔT) function

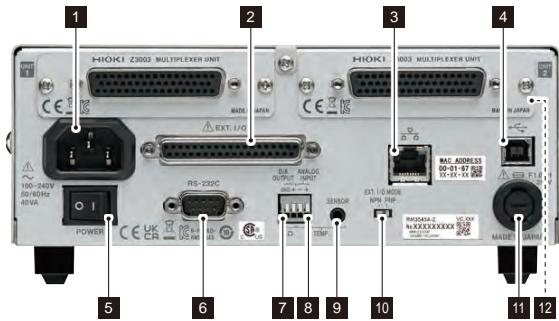
This function converts the resistance value of a temperature-dependent measurement target to the resistance value at a specific temperature (the reference temperature) and displays the result.

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.

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	7	D/A OUTPUT terminal
2	EXT. I/O connector	8	TEMP.ANALOG INPUT terminal
3	LAN connector	9	TEMP. SENSOR
4	USB connector	10	EXT. I/O MODE NPN/PNP switch
5	Main power switch	11	Fuse holder
6	RS-232C connector	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 x 24.5 H x 182 D mm (3.62 W x 0.96 H x 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) x 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 x 5.])	$\frac{1 \times 10^{-9} [A]}{I_{MEAS} [A]} \times 100 [\% \text{ rdg.}]$
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	$A_{fs} \times 0.5 [\% \text{ rdg.}]$
Effect of offset voltage	Add the resistance shown on right to the error when OVC is OFF	$\frac{10 \times 10^{-6} [V]}{I_{MEAS} [A]} [\Omega]$
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

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 $\pm(x\% \text{ rdg.} + y\% \text{ f.s.})$				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 x 1	10 ch	Not supported
Instrument + Z3003 x 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
PR1000 μΩ ¹	High	ON	41	81	74	241
PR10 mΩ ¹	High	OFF	21	41	37	121
PR100 mΩ ¹	N/A	OFF	21	41	37	121
1000 mΩ	High	OFF	3.1	23	20	103
10 Ω	High	OFF	2.3	22	19	102
100 Ω	High	OFF	2.4	23	19	103

Tolerance: $\pm 10\% \pm 0.2$ ms

¹: PR: Pure resistance

Temperature measurement

Add to accuracy when used with Z2001

Temperature range	Accuracy
-10.0°C to 9.9°C	$\pm (0.55 + 0.009 \times t-10) ^\circ\text{C}$
10.0°C to 30.0°C	$\pm 0.50^\circ\text{C}$
30.1°C to 59.9°C	$\pm (0.55 + 0.012 \times t-30) ^\circ\text{C}$
60.0°C to 99.9°C	$\pm (0.92 + 0.021 \times t-60) ^\circ\text{C}$

Standalone accuracy: $\pm 0.2^\circ\text{C}$; t: measurement temperature [°C]

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	$\pm 1\% \text{ rdg.} \pm 3 \text{ mV}$

Temperature Sensor Z2001 specifications

Measurement range: -10.0°C to 99.9°C

Measurement speed: Approx. 2 s

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								
Measurement method		NEW RM3545A-2		NEW RM3545A-1	RM3545-02	RM3545, RM3545-01							
Measurement	Resistance measurement ranges (13 ranges) *High mode	DC 4-terminal method (constant-current)			DC 4-terminal method (constant-current)								
		Maximum display	Resolution	Measurement current	Maximum display	Resolution	Measurement current						
		1000 $\mu\Omega$	1200.000 $\mu\Omega$,	1 n Ω , 1 A	N/A	N/A	N/A						
		10 m Ω	12.000 00 m Ω ,	10 n Ω , 1 A	12.000 00 m Ω ,	10 n Ω ,	1 A						
		100 m Ω	120.000 0 m Ω ,	100 n Ω , 1 A	120.000 0 m Ω ,	100 n Ω ,	1 A						
		1000 m Ω	1200.000 0 m Ω ,	1 $\mu\Omega$, 100 mA	1200.000 m Ω ,	1 $\mu\Omega$,	100 mA						
		10 Ω	12.000 00 Ω ,	10 $\mu\Omega$, 10 mA	12.000 00 Ω ,	10 $\mu\Omega$,	10 mA						
		100 Ω	120.000 0 Ω ,	100 $\mu\Omega$, 10 mA	120.000 0 Ω ,	100 $\mu\Omega$,	10 mA						
		1000 Ω	1200.000 0 Ω ,	1 m Ω , 1 mA	1200.000 Ω ,	1 m Ω ,	1 mA						
		10 k Ω	12.000 00 k Ω ,	10 m Ω , 1 mA	12.000 00 k Ω ,	10 m Ω ,	1 mA						
		100 k Ω	120.000 0 k Ω ,	100 m Ω , 100 $\mu\Omega$	120.000 0 k Ω ,	100 m Ω ,	100 $\mu\Omega$						
		1000 k Ω	1200.000 k Ω ,	1 Ω , 10 $\mu\Omega$	1200.000 k Ω ,	1 Ω ,	10 $\mu\Omega$						
		10 M Ω	12.000 00 M Ω ,	10 Ω , 1 $\mu\Omega$	12.000 00 M Ω ,	10 Ω ,	1 $\mu\Omega$						
		100 M Ω *100 M Ω range high-precision mode	120.000 0 M Ω ,	100 Ω , 100 nA	120.000 0 M Ω ,	100 Ω ,	100 nA						
		1000 M Ω	1200.0 M Ω ,	100 k Ω , 1 $\mu\Omega$ or less	1200.0 M Ω ,	100 k Ω ,	1 $\mu\Omega$ or less						
		1000 $\mu\Omega$ range	$\pm 0.045\%$ rdg. $\pm 0.010\%$ f.s.		N/A								
		10 m Ω range	$\pm 0.045\%$ rdg. $\pm 0.001\%$ f.s.		$\pm 0.060\%$ rdg. $\pm 0.001\%$ f.s.								
		100 m Ω range	$\pm 0.045\%$ rdg. $\pm 0.001\%$ f.s.		$\pm 0.060\%$ rdg. $\pm 0.001\%$ f.s.								
		(High mode, OVC function enabled, SLOW2, no zero adjustment)	$\pm 0.012\%$ rdg. $\pm 0.001\%$ f.s.		$\pm 0.012\%$ rdg. $\pm 0.001\%$ f.s.								
		1000 Ω range	$\pm 0.006\%$ rdg. $\pm 0.001\%$ f.s.		$\pm 0.006\%$ rdg. $\pm 0.001\%$ f.s.								
		See table on page 3			See RM3545 product specifications								
Measurement times													
Path resistance tolerance (reference values)		Range: 100 m Ω or less (PR mode off)											
Path resistance between SOURCE B and SOURCE A (other than measurement target)		Range: 100 m Ω or less (PR mode on)											
Maximum open-terminal voltage		Range: 1000 Ω or less, 10 k Ω or greater											
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							
Interfaces	LAN RS-232C USB GP-IB EXT. I/O Analog output	Switching time	11 ms			11 ms							
		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							
		Contact check	✓	✓	✓	✓							
		Zero adjustment (within each range $\pm 50\%$ f.s.) (Zero adjustment forcibly disabled for 100 M Ω or greater)	✓	✓	✓	✓							
		Zero-adjustment-free accuracy guaranteed	✓	✓	✓	✓							
Functionality	OVC function Contact improvement function (max. applied voltage: 5 V; max. applied current: 10 mA) Low-power mode (maximum open voltage: 20 mV) Auto-hold function Comparator Temperature measurement function Temperature conversion (ΔT) function Statistical calculation function Delay function Averaging function Saving panels (saving of measurement conditions) Data memory function Command monitor function (display of send/receive status of commands and queries)	OVC function	✓	✓	✓	✓							
		Contact improvement function (max. applied voltage: 5 V; 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	-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							
Standards compliance	Power supply Dimensions Weight	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	✓	✓	✓	✓							
		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							
Options	PIN TYPE LEAD L2100 PIN TYPE LEAD L2102 PIN TYPE LEAD L2103 About lead length	Dimensions	215W x 80H x 306.5D mm (8.46W x 3.15H x 12.07D in.)			215W x 80H x 306.5D mm (8.46W x 3.15H x 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.)							
		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: 84 mm (3.31 in.) L: 1.5 m (4.92 ft.)	USB CABLE (A-B) L1002	1 m (3.28 ft.)						
		PIN TYPE LEAD L2102	A: 250 mm (9.84 in.) B: 178 mm (7.01 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.)	RS-232C CABLE L9637	9-pin/9-pin, 3 m (9.84 ft.) Only RM3545A is supported.						
		PIN TYPE LEAD L2103	A: 250 mm (9.84 in.) B: 176 mm (6.93 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.)	LAN CABLE 9642	Straight-through Ethernet cable, 5 m (16.40 ft.), supplied with straight-through-to-crossover conversion adapter Only RM3545A is supported.						
		About lead length	A: from junction to probe B: probe length L: overall length	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.)	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.)						

Note: company names and product names appearing in this brochure are trademarks or registered trademarks of various companies.

HIOKI
HIOKI E. E. CORPORATION

DISTRIBUTED BY

www.itm.com

information@itm.com

1.800.561.8187