



RESISTANCE METER RM3545

Featuring super-high accuracy and multi-channel capabilities

(20 channels with 4-terminal measurement)

■ Basic accuracy: 0.006% ■ No. of display digits: Max. 6.5

Max.resolution : 0.01μΩ (LP) 0.01mΩ



RESISTANCE METER RM3544

High-accuracy bench-top meter ideal for production lines

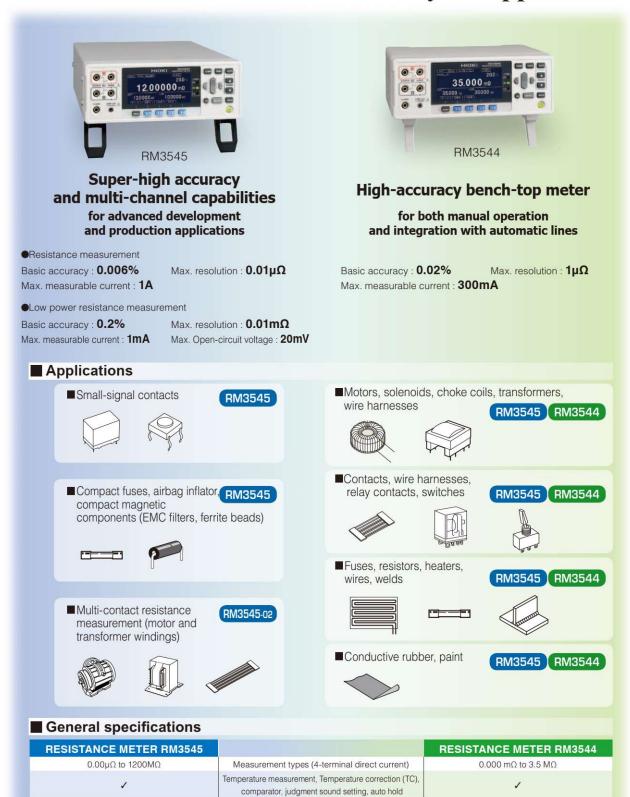
Basic accuracy: 0.02% No. of display digits: Max. 4.5

Max.resolution : 1μΩ





Choose from two models based on your application



Low power resistance measurement (LP)

Temperature rise (Temperature conversion (ΔT)
Offset voltage compensation (OVC)

D/A output

Multiplexer

✓ RM3545-02 : Max. 20ch

N/A N/A

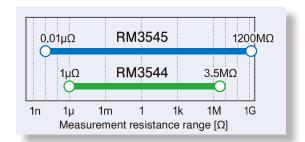
N/A N/A

N/A

Simplifying high-accuracy resistance measurement

■ Standard features of the high-accuracy Resistance Meter RM3545 and RM3544

Convenient wide range options RM3545 RM3544







Integrate into automated inspection systems

Overview of the RM3544

Manual testing on production lines

Overview of the RM3545

Measure from $0.00\mu\Omega$ to $1200.0M\Omega$ 0.01μΩ max. resolution, 0.006% basic accuracy

RM3545

Max.measurable current of 1A

The RM3545 can perform resistance measurement with a 6.5-digit, 1,200,000-count display at a maximum resolution of 0.01 $\mu\Omega$. It delivers more than enough capabilities to be used in applications requiring highresolution resistance measurement, for example in testing inverter motor windings.

High-resistance materials such as conductive sheets and conductive rubber are often used in electronic components. The RM3545 can measure resistance values of up to 1,200 M Ω . It also delivers maximum accuracy of 0.006%, enabling researchers to test state-of-the-art current sensing resis-

RM3545

HIOKI offers a line of probes designed to accommodate the full range of measurement targets. Flex resistance has been dramatically improved (based on

RM3544

RM3544

As inverter-equipped power supply equipment uses increasingly high currents and frequencies, increasingly low-resistance and low-loss inductors are being incorporated in their circuitry, prompting a need for the ability to measure lower resistance levels with a high level of stability. With a resolution of 1 $\mu\Omega$, the RM3544/RM3544-01 satisfy these needs.

Measure from $0.000m\Omega$ to $3.5000M\Omega$

Max.measurable current of 300mA

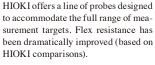
 $1\mu\Omega$ max. resolution, 0.02% basic accuracy

Electronic components make extensive use of high-resistance substrates such as conductive sheets and rubber, and the RM3544/RM3544-01 deliver the ability to measure up to 3.5 M Ω .

Moreover, the instruments' maximum accuracy of 0.02% allows them to be used in testing current detectors with a precision of 0.1%.

High-durability probes







• Guaranteed accuracy with no warm up or zero-adjustment RM3545 RM3544

For the RM3545/RM3544, accuracy is guaranteed* immediately after startup, without any warm up or zero-adjustment.

*When performing measurement with the RM3545 in a temperature and humidity environment that satisfies the guaranteed accuracy conditions, an even higher level of accuracy (full accuracy) is guaranteed.

Offset Voltage Compensation (OVC) RM3545

Thermal EMF occurs at connections between different metals. This force can affect measurement and, if large enough, introduce a measurement error. The RM3545's offset voltage correction (OVC) function reduces the effects of thermal EMF to enable more precise measurement.

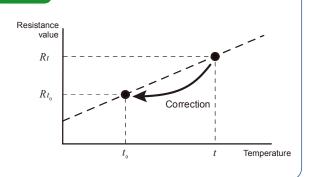
Temperature correction

RM3545 TRM3544

Generally, the resistance of copper wiring changes with temperature by 0.4% per degree Celsius. The RM3544/RM3545 provide a temperature correction function to convert the observed resistance value Rt at the current temperature t to the resistance value Rt_0 at the reference temperature t_0 .

*Requires the Temperature Sensor Z2001 or a thermometer capable of generating analog voltage output (an infrared thermometer or similar instrument).

Types of temperature input	RM3544: Temperature Sensor (Z2001) RM3545: Temperature Sensor (Z2001), Analog voltage input (from an infrared thermometer, etc.)		
Reference temperature setting range	-10.0 to 99.9 ℃		
Temperature coefficient setting range	RM3544: -9,999 to 9,999 ppm/°C RM3545: -99,999 to 99,999 ppm/°C		



Easy-to-use RESISTANCE METER

suits both manual operation and integration with automatic lines

High-intuitive advanced functionality

RM3545 RM3544



Guard terminals

Minimize the effects of external noise on measurements.

*GUARD terminal is the shield potential.

This terminal is not for guarding network resistance measurements.

Simple control over basic settings

Range and measurement speed can be controlled directly.



LED COMPARATOR ATTACHMENT (Option)

The LED Comparator Attachment indicates judgment results with green and red LEDs, eliminating the need to look at the instrument's screen and increasing work efficiency. Since the lamps do not light up when the measurement leads are open, the attachment can also be Green light used to verify the connection status. IN state



Red light HI/LO state



The RM3544 indicates results with a high-volume judgment tone of 85 dB or greater to ensure it is audible near noisy machinery.

Both the RM3545 and RM3544 feature user-selectable judgment tones so workers don't confuse judgment results on lines where multiple resistance meters are being used.

Functionality for saving and loading panels

The RM3545 (RM3544) can save and load up to 30* (10) sets of range, comparator, and other settings. Naming each set of panel data lets you make setup changes among production lots and lines smoothly and ef-

*When using the multiplexer terminals, up to 8.

(6) Material-and temperature-independent temperature correction function

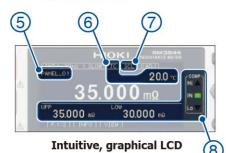
The temperature correction function can be used to convert resistance values that vary with the ambient temperature to a reference value at a reference temperature using the Temperature Sensor Z2001 and a userspecified resistance temperature coefficient.



Scaling

The scaling function can be used to convert resistance values into physical properties such as length.

> Conversion formula : $Rs = A \times R + B$ A. B: Constants, R: Measurement value Rs : Resistance value





Comparator Function

The comparator function compares measured values to a previously set reference value or range and then displays and outputs the judgment result. The RM3545 and RM3544-01 can also output this information using EXT I/O.

High-precision specs in a compact package

RM3544



Footprint of just 215 x 166 mm

Compared to the previous model (HIOKI 3540), the RM3544/RM3544-01 take up approximately 25% less installation space.

This space-saving design frees up space in front of the instrument and lets you build compact production lines.



Easy integration into automatic testing equipment (RM3545/-01/-02, RM3544-01)

RM3545 | RM3544

Ability to extend measurement cable length

The new instruments feature better wiring resistance tolerances than previous models (the 3541 and 3540). Wiring resistance can now be as high as 1.5 Ω for the RM3545 and 2 Ω for the RM3544.

High-speed, comprehensive productivity support

- The RM3545 and RM3544-01 deliver the speed demanded by automatic testing equipment at a sophisticated level. The entire process from the start of measurement to outputting of the judgment result takes as little as 2.2 ms*1 (RM3545) and 18 ms (RM3544-01). One cycle of operation, lasting from measurement to judgment output, completes within this *1 When the measurement current is set to "High"
- . The instrument's USB interface can also be used.

- The RM3545 and RM3544-01 support RS-232C data communications at up to 115.2 kbps*2.
- The EXT I/O output mode can be switched between judgment mode and BCD mode.
- *2 With some computers, large error components may prevent fast transfer speeds (baud rates) from being used. In this case, change the speed to a lower setting.

Handler (EXT I/O) interface

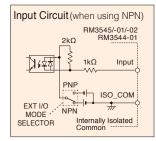
The handler interface (EXT I/O) is isolated from measurement circuitry, control circuitry, and the protective ground (chassis ground), providing a high level of noise resistance.

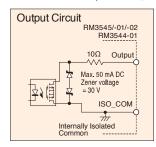
■ EXT I/O Input and Output Circuits

A switch on the rear panel is used to toggle the input signal polarity between NPN (sink output support) and PNP (source output support) settings depending on the PLC common polarity.



EXT I/O polarity (Select NPN/PNP)





When designing a control system using the EXT I/O interface, be sure to read the instruction manual and check the necessary

technical information.

■ EXT I/O Electrical Specifications

Inputs:

Photocoupler isolation: Non-voltage contact inputs (support for current sink output) Input ON: Residual voltage: Max. 1 V @4 mA Input OFF: Open Max. 100 µA

Outputs:

Photocoupler-isolated open drain output (no-polarity) DC30Vmax, DC50mAmax/ch Residual voltage: Max. 1 V @50 mA, or 0.5 V @10 mA

External power output:

Output voltage: Sink output support: 5.0V±10%, Source output support: -5.0V±10% Max. output current: 100mA

EXT I/O Signal List

● RM3545 Input Signals: RM3545

TRIG(IN0), CAL, KEY_LOCK, 0ADJ, PRINT(IN1), MUX, SCN_STEP, LOAD0 to LOAD5, BCD_LOW

Output Signals:

[Judgment mode] EOM, ERR, INDEX, HI, IN, LO, T ERR, T PASS,

T_FAIL, BIN0 to BIN9, OB, OUT0 to OUT2 [BCD mode] EOM, ERR, IN, HILO, BCDm n', RNG OUT0 to RNG OUT3 Indicates the nth bit of the mth digit.

■ RM3544-01

RM3544

Input Signals:

TRIG(IN0), KEY_LOCK, 0ADJ, PRINT(IN1), LOAD0 to LOAD3, BCD_LOW

Output Signals:

[Judgment mode] EOM, ERR, INDEX, HI, IN, LO, OUT0 to OUT2 [BCD mode] EOM, ERR, IN, HILO, BCDm_n', RNG_OUT0 to RNG_OUT3 * Indicates the nth bit of the mth digit.

Communications Monitor Function for smooth systems development

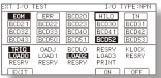
The Communications Monitor Function displays communications data (received commands and sent data) on the screen, providing valuable support for programming of programmable logic controllers (PLCs).

Functionality for verifying the EXT I/O connection status and testing EXT I/O

In addition to allowing you to check EXT I/O signal input on the instrument's screen, this functionality allows you to turn output signals on or off as desired. This capability simplifies verification work during PLC programming.



Communications Monitor screen



FXT I/O test function screen

■ RM3545/RM3544 Specifications (Accuracy guaranteed for 1 year, Post-adjustment accuracy guaranteed for 1 year)

	RM3545	RM3544		
	Resistance measurement: 0.000 00mΩ (10mΩ range) to			
	1200.0M Ω (1000M Ω range), 12 ranges Resistance measurement: 0.000m Ω (30m			
Measurement types	Low power resistance measurement: 0.00 m Ω (1000 m Ω range) to	$3.500 \text{OM}\Omega (\text{3M}\Omega \text{range})$, 9 ranges		
	1200.00 Ω (1000 Ω range), 4 ranges Temperature measurement (thermistor): -10.0 to 99.9°C	Temperature measurement (thermistor): -10.0 to 99.9°C		
	Temperature measurement (analog input): -99.9 to 999.9°C			
Measurement method	4-terminal direct current (constant curren			
Range switching	Auto or M			
Temperature correction	Reference temperature setting range: -10°C to 99.9°C, Temperature coefficient setting range: -99,999 ppm/°C to 99,999 ppm/°C	Reference temperature setting range: -10°C to 99.9°C, Temperature coefficient setting range: -9,999 ppm/°C to 9,999 ppm/°C		
Zero-adjustment	By range, by step (RM3545-02 only) Within $\pm 50\%$ f.s. of each range. (Zero-adjustment is not required for $100 \text{ M}\Omega$ or greater ranges.)	Within -3% to 50% f.s. of each range. (f.s.= 30,000 dgt.)		
Trigger	Internal or external	RM3544: Internal trigger, RM3544-01: Internal or external		
Measurement speed	FAST / MED / SLOW1 / SLOW2	FAST / MED / SLOW		
Delay	Internal fixed value: / 0 to 9999 ms (1ms step)	N/A		
Functions	Temperature correction, Temperature conversion, Self-calibration, offset voltage compensation (OVC), comparator (ABS/REF%), BIN, key-lock (OFF, menu lock, all lock), display digit count selection function (7 digits/6 digits/5 digits), automatic power supply frequency settings (AUTO/50Hz/60Hz), scaling, judgment sound setting, auto hold, statistical calculations, clock,	Temperature correction, comparator (ABS/REF%), keylock (OFF, menu lock, all lock), display digit count selection function (5 digits/4 digits), automatic power supply frequency settings (AUTO/50Hz/60Hz), scaling, judgment sound setting, auto hold, L2105 LED Comparater Attachment output		
Measurement fault	Self-test, L2105 LED Comparater Attachment output			
detection functions	Contact check, over detection, current fault detection	Over detection, current fault detection		
Averaging	OFF, 2 to 100 averaging iterations 30 (Front terminals), 8 (MUX (multiplexer))	i i		
Panel store,	Panel save parameters: save time and date, resistance measure-	10		
panel load	ment ranges, measurement speed, comparator, BIN setting, mul-	Panel save parameters: resistance measurement ranges		
	tiplexer setting, etc.	measurement speed, comparator, etc.		
Multiplexer	Number of installed units: Max. 2 Measurement terminal settings: Front terminals / MUX (multiplexer) When using the MUX setting, the measurement leads cannot be connected to the front measurement terminals Support unit: Z3003 Number of channels that can be set: 42, switching time 30 ms (reference value)	eannot N/A		
	Output: resistance measured value			
D/A output	Output voltage: 0V DC to 1.5V DC Output impedance: 1kΩ	N/A		
EVI I/O	Number of bits: 12bit	DM2544 or TDIC and advan DCD		
EXT I/O Communication	TRIG and other, BIN, BCD Select from GP-IB*, RS-232C, PRINTER(RS-232C), or USB	RM3544-01: TRIG and other, BCD RM3544-01:		
interfaces	*RM3545-01 only	Select from RS-232C, PRINTER(RS-232C), or USB		
Communication	Remote function, communications monitor function, data output	Remote function, communications monitor function, data		
interfaces	function, memory (50 data)	output function		
RS-232C	Bit rates: 115,200 / 38,400 / 19,200 / 9,600 bps			
USB	Class: CDC (COM mode), HID (USB keyboar			
Printer (RS-232 port)	Printed data: Resistance measurement values, temperature measurement values, judgment results, measurement conditions, statistical results Operation: Prints at PRINT signal or PRINT key inpu Interval: ON/OFF. Interval times: 1 to 3.600 s (variable)	Printed data: Resistance measurement values, temperature measurement values, judgment results, measurement conditions t. e in 1 s steps), Number of print columns per row: 1 or 3		
Operating temperature and humidity	0 to 40°C, 80% rh or less	* **		
Storage temperature and humidity	-10 to 50°C, 80% rh or less (non-condensating)			
Operating environment	Indoors, Pollution Degree 2, up to 2,000 m ASL			
Power supply	Rated supply voltage: 100 to 240 VAC ±10			
Rated power consumption	40 VA	15 VA		
Insulation withstand potential	1.62 kV AC for 1 min. (with 10 mA cutoff current), between all mains supply terminals and protective ground, interfaces, and measurement te			
Dimensions	Approx. $215W \times 80H \times 306.5D$ mm (8.46"W \times 3.15"H \times 12.07"D) (without projections)			
Mass	RM3545, RM3545-01: Approx. 2.5 kg (88.2 oz)	RM3544: Approx. 0.9 kg (31.7 oz) RM3544-01:Approx. 1.0 kg (35.3 oz)		
Accessories	RM3545-02:Approx. 3.2 kg (112.9 oz) (not including Z3003) Power cord ×1, CLIP TYPE LEAD L2101 ×1, temperature sensor Z2001 ×1, male EXT I/O connector ×1, instruction manual ×1, application disc ×1, USB cable (A-to-B type) ×1, spare fuse ×1	Power cord ×1, CLIP TYPE LEAD L2101 ×1, male EXT I/O connector* ×1, instruction manual ×1, application disc* ×1, USB cable (A-to-B type)* ×1, spare fuse ×1		
Applicable standards	*Included with RM3544-01. Safety: EN61010, EMC: EN61326, EN61000-3-2, EN61000-3-3			
Applicable stallualus	Safety, Emotivio, EMC: EMO1320, EM01000-3-2, EM01000-3-3			

Additional accuracy when using the Z3003

RM3545

When performing measurements using the Z3003, the following uncertainties are added to the RM3545 specifications (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 \times 5.):		I _{MEAS} : Measurement current
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:		$A_{\rm fs} \times 0.5$ [%rdg.]	A _{fs} : f.s. error component for RM3545-02 with
Effect of offset voltage Add the resistance shown on right to the error when OVC is OFF:		$\frac{10\times10^{-6}[\mathrm{V}]}{I_{\mathrm{MEAS}}[\mathrm{A}]}[\Omega]$	Z3003
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	
$ \begin{tabular}{ll} Temperature coefficient & From 0 ^{\circ}C to 18 ^{\circ}C and 28 ^{\circ}C to 40 ^{\circ}C, add a temperature coefficient of \pm (1/10 \text{ of additional accuracy}) / ^{\circ}C. \end{tabular} $			

●RM3544

RM3544

Accuracy = \pm (% rdg. + % f.s.)

• f.s. = calculated 30,000 dgt., where 0.010% f.s. = 3 dgt.

(Example) 0.020 + 0.007 0.020% rdg. + 0.007% f.s.

Range	Max. measurement display*6,*7	FAST	MED/SLOW	Measurement Current*8	Open-Circuit Voltage
$30 \mathrm{m}\Omega$	$35.000~\mathrm{m}\Omega$	0.030+0.080	0.030+0.070	300mA	
$300 \mathrm{m}\Omega$	$350.00~\mathrm{m}\Omega$	0.025+0.017	0.025+0.014	300mA	
3Ω	3.500 0 Ω	0.025+0.017	0.025+0.014	30mA	
30Ω	35.000 Ω	0.020+0.010	0.020+0.007	10mA	
300Ω	350.00 Ω	0.020+0.010	0.020+0.007	1mA	5.5Vmax.
3kΩ	3.500 0 kΩ	0.020+0.010	0.020+0.007	1mA	
30kΩ	35.000 kΩ	0.020+0.010	0.020+0.007	100μΑ	
300kΩ	350.00 kΩ	0.040+0.010	0.040+0.007	5μΑ	
$3M\Omega$	$3.500~0~\mathrm{M}\Omega$	0.200+0.010	0.200+0.007	500nA	

^{*6} For negative values, to -10% f.s.

■ Temperature measurement accuracy (RM3544/RM3545)

· Temperature Sensor Z2001 (for RM3544/RM3544-01)

RM3545 RM3544

· Analog Input

RM3545

Range of guaranteed accuracy	-10.0 to 99.9 °C
Display refresh rate	Approx. 2 s
Guaranteed accuracy period	1 year

• Temperature Sensor Z2001 and RM3545/RM3544/RM3544-01 combined accuracy

t: Temperature measurement values [°C]

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

Standalone instrument accuracy: ± 0.2 °C

· Analog Imp	uι
(for RM3545	5)

Guaranteed accuracy range	0 to 2 V
Maximum allowable voltage	2.5V
Resolution	1mV
Display range	-99.9 to 999.9 °C
Measurement period (speed)	Approx. 50 ms, no moving average
Period of guaranteed accuracy	1 year
Accuracy	±1%rdg. ±3 mV

■ Resistance D/A output accuracy (RM3545)

RM3545

Output accuracy	Resistance measurement accuracy ±0.2%f.s., (temperature coefficient ±0.02%f.s./°C)
Response time	Measurement time + Max. 1 ms

Measurement time typical values (RM3545)

RM3545

■ Measurement time (RM3544)

RM3544

	Measurement current	Measurement speed				
Range		FAST	MED		CI OW4	CI OWO
			50Hz	60Hz	SLOW1	SLOW2
10 mΩ	N/A	41	61	58	141	241
100 mΩ	High	41	61	58	141	241
1000 mΩ	High	2.2	22	19	102	202
10 Ω	High	2.2	22	19	102	202
100 Ω	High	2.8	23	20	103	203

Unit: ms, Tolerance: ±10% ±0.2 ms

,					
Measurement speed					
FA	ST	MED	SLOW		
50Hz	60Hz	MED	SLOW		
21	18	101	401		

Unit: ms, Tolerance: ±10% ±2ms

^{*7} The maximum display range is 99,999dgt. *8 Measurement current accuracy is ±5%.

^{*} Shortest time when using an external trigger source or with continuous measurement off (other than free-run). With a delay of $10 \, \mathrm{ms}$, TC on, comparator on, OVC off, and averaging off. Measurement speed varies with the selected range and settings. For more information, please see the Instruction Manual.

^{*} With TC set to ON and the comparator set to ON

■ Model Configurations and Options



Model: RESISTANCE METER RM3545

Model No. (Order Code) (Note)

RM3545

RM3545-01 (with GP-IB interface) RM3545-02 (support for the multiplexer unit)

Accessories: Power cord ×1, Clip type lead L2101 ×1, temperature sensor Z2001 ×1, Male EXT. I/O connector ×1, Instruction manual ×1, Application disc ×1, USB cable (A-to-B type) ×1,

Caution when considering the use of probes without guard terminals

Proper operation of the RM3545 and RM3544 is not guaranteed when using test leads (test probes) that lack guard terminals, for example test leads used with models such as the Resistance HiTester 3541 or m Ω HiTester 3540. Please use the test leads indicated in the RM3545 and RM3544 accessory and option documentation.



Model: RESISTANCE METER RM3544

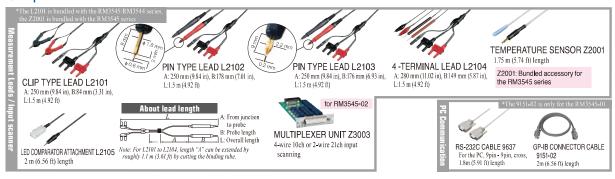
Model No. (Order Code) (Note)

RM3544 (No interfaces)

RM3544-01 (with EXT I/O, RS-232C, USB)

Accessories: [RM3544] Power cord \times 1, Clip type lead 1.2101 \times 1, Instruction manual \times 1, Spare fuse \times 1, [RM3544-01] Power cord \times 1, Clip type lead 1.2101 \times 1, Male EXT. I/O connector \times 1, Instruction manual \times 1, Application disc \times 1, USB cable (A-to-B type) \times 1, Spare fuse \times 1

Options



Related products

Large motors, large transformers





■ Vehicle grounding lines, conductivity of aircraft fuselages





Temperature rise tests (Motors, choke coils, transformers)





High-accuracy portable resistance meter measures from $\mu\Omega$ to $M\Omega$



RESISTANCE METER RM3548

Basic accuracy: 0.02% Max. resolution : $0.1\mu\Omega$

- Max. measurable current : 1A ■ Measure from 0.0 μΩ (@ 1 A) to 3.5 MΩ
- Easily record up to 1,000 data points in memory simply by applying the instrument's probes.
- Smoothly capture temperature-rise test data using interval measurement.
- Portable design is ideal for maintenance and testing of large equipment.

For more information, please visit http://www.hioki.com.

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