HIOKI

Easy to use with high-accuracy

# Resistance Meters for Production Lines and MRO

The Resistance Meters RM3544/RM3548 can measure the winding resistance of devices such as motors and transformers, the contact resistance of power contacts (relays and switches), and the DC resistance of fuses, resistors, and substrates such as conductive rubber and sheets. It does so quickly and at a high level of accuracy using four-terminal measurement.

The RM3544 is well suited to use for adjustment and testing on production lines as well as acceptance inspections, while the RM3548 comprises a portable solution for measuring resistance values ranging in magnitude from microohms to megohms, making it ideal for use in production, maintenance, repair and operation of large equipment.
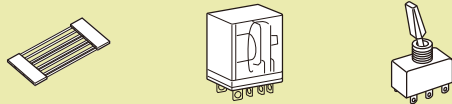
CE 3 year Warranty

Perform resistance measurement with an ideal combination of equipment depending on your component or equipment and test conditions.
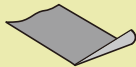
Applications

■Motors, solenoids, choke coils, transformers, wire harnesses
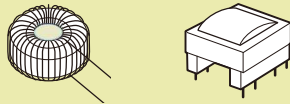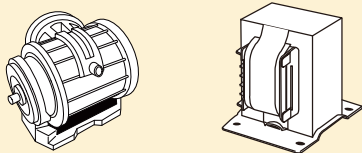
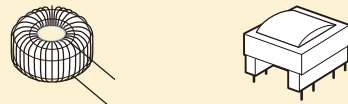■Contacts, wire harnesses, relay contacts, switches

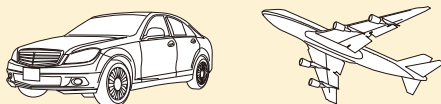■Conductive rubber, paint

■Fuses, resistors, heaters, wires, welds

■Large motors, large transformers

■Temperature rise tests (Motors, choke coils, transformers)

■Vehicle grounding lines, conductivity of aircraft fuselages

Probes suited to manual measurement on production lines

CLIP TYPE LEAD
L2101

4-TERMINAL LEAD
L2104

PIN TYPE LEAD
L2102

PIN TYPE LEAD
L2103

Probes suited to DC measurement of the chassis and bodies of large equipment

CLIP TYPE LEAD
L2107

PIN TYPE LEAD
9465-10
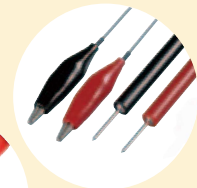
4-TERMINAL LEAD
9453
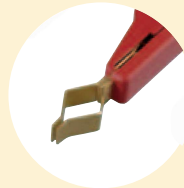
LARGE CLIP TYPE LEAD
9467

PIN TYPE LEAD
9772

A Full Line-up of HIOKI Resistance Meters to Suit Your Measurement Range

	Range	Model		
	1μΩ	RM3544/RM3544-01	3.5MΩ	
	0.1μΩ	RM3548	3.5MΩ	
	0.01μΩ	RM3545	1200MΩ	
	0.01μΩ	RM3543	1.2kΩ	
	0.1μΩ	RM3542	120MΩ	
	1kΩ	SM7120	$2\times10^{19}\Omega$	

Robust specifications in a compact package

High-accuracy bench-top resistance meter
for both manual operation and integration with automatic lines

| RESISTANCE METER RM3544/RM3544-01

Basic accuracy : **0.02%**

Max.resolution : **1µΩ**

Max.measurable current : **300mA**

■ Measure from 0.000 mΩ (@ 300 mA) to 3.5 MΩ
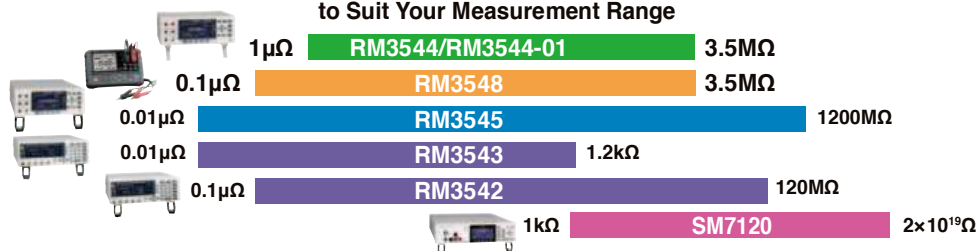■ Probe for guard jack use and increased measurement current yield an instrument that's more resistant to noise.
■ Optional LED COMPARATOR ATTACHMENT and high-volume judgment tones combine to ensure PASS/FAIL judgments are communicated reliably in the noisy environment of the production floor.
■ EXT I/O interface with NPN/PNP support can accommodate a variety of automated production lines (-01 model).

High-accuracy portable resistance meter
measures from µΩ to MΩ

| RESISTANCE METER RM3548

Basic accuracy : **0.02%**

Max.resolution : **0.1µΩ**

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.

■ Temperature correction

Generally, the resistance of copper wiring changes with temperature by 0.4% per degree Celsius. The RM3544/RM3544-01/RM3548 provides a temperature correction function to convert the observed resistance value Rt at the current temperature t to the resistance value Rto at the reference temperature t_0.
Requires temperature sensor (Z2001 or Z2002).

Reference temperature setting range:-10 °C to 99.9 °C
Temperature coefficient setting range:-9,999 ppm to +9,999 ppm
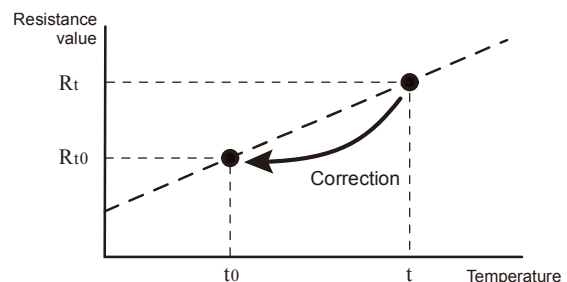
High-accuracy portable RESISTANCE METER
measures from µΩ to MΩ

RM3548

■ Features

- ■ High-precision specs in a portable package (high accuracy of 0.02% rdg.)
- ■ Design is ideal for maintenance and testing/measurement of large equipment.
- ■ No warmup period or zero adjustment required.
- ■ Dramatically improved overvoltage resistance (protection up to 70 V DC)

■ High-precision specs in a portable package

● Expansive range options

Measure from 0.0 µΩ to 3.5000 MΩ
0.1µΩ max. resolution, 0.02% basic accuracy
Max. measurable current of 1A

● Continuity and resistance measurement in large transformers, motors, and power supply equipment

The RM3548 uses a high current of 1 A to measure lower resistance values more reliably at a resolution of 0.1 µΩ in applications including measuring resistance in large transformers and motors as well as wiring, busbars and connections in power supply equipment.

● Verification of continuity of ground lines in automobiles and fuselage welds and caulking in aircraft

The RM3548 can be used to check ground connections* in automobiles and fuselage welds and caulking in aircraft using a measurement current of 300 mA (300 mΩ range).
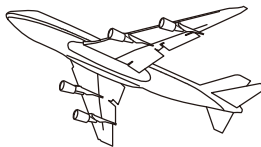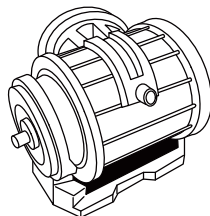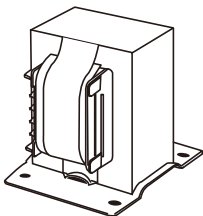
■ Portable, easy to use, and easy to understand

● Design is ideal for maintenance and testing/ measurement of large products

The included strap can be looped around the neck to support the instrument, leaving the operator's hands free to hold probes for measurement. The meter uses eight AA alkaline batteries, which provide enough power for approximately 10 hours of testing under normal operating conditions. (Operating times vary with measurement conditions.)

● Auto-hold and auto-memory functionality

The RM3548 features auto-hold and auto-memory functionality to automatically hold and record data simply by placing the probes in contact with the desired measurement location. This functionality allows me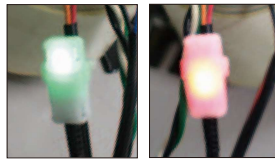asured values to be recorded automatically as soon as they stabilize without the need for the user to operate any switches.

● LED COMPARATOR ATTACHMENT

By installing the LED COMPAR-ATOR ATTACHMENT close to a probe, you can capture judgment results without moving your eyes away from the measurement location and probe.

Green light
IN state

Red light
HI/LO state

● Offset Voltage Compensation(OVC)

Thermal EMF occurs at the contact point of different metals. This voltage affects measurements, and if large enough, can cause measurement errors. The offset voltage compensation function minimizes the effect of thermal EMF to maintain measurement accuracy. Particularly when measuring low resistances where the detection voltage is small, and during low-power resistance measurements, OVC is essential to maintain accuracy.

● Length conversion function

By setting a resistance value per meter, it is possible to convert resistance values into lengths. This capability is useful when managing cable inventory or estimating PCB pattern lengths.
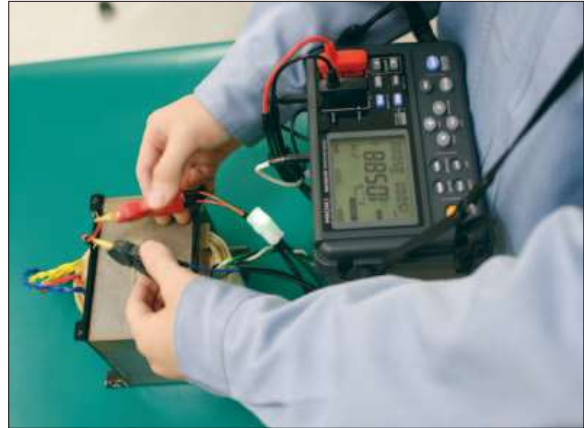
● No zero adjustment

Accuracy is defined without any need to perform zero-adjustment. Measurement can be performed as soon as the instrument is turned on.

● Dramatically improved overvoltage resistance

Protection is provided against overvoltage input of up to 70 V, preventing damage caused by connecting the instrument to an electrical charge or by the effects of the counter-EMF from inductance.

PrtCt

Circuit protection detection state
(Alerts the operator to overvoltage input with a screen display and an audible warning.)

● Acquire measured values recorded in the instrument's memory over a USB connection

By connecting the RM3548 to a computer with a USB cable*, you can download measured values stored in the instrument's memory.
*Since the RM3548 provides a mass storage class (read-only) USB interface, there is no need to install special driver software on the computer

■ Temperature conversion function and interval measurement: Useful in temperature-rise testing

Temperature increase (Δt) is obtained and displayed by converting resistance measurements and ambient temperature. The maximum temperature increase needs to be determined when current is applied especially for verifying motor windings or transformers.The interval measurement function can be used to take measurements at a user-specified interval from the start of measurement. Since measured values can be recorded in the instrument's memory, the maximum temperature can be easily estimated.

*The temperature conversion function cannot be used simultaneously with the temperature correction function and length conversion function.

① When a motor or coil has thermally stabilized at room temperature, measure the resistance (r_0) and ambient temperature (t_0) before applying current.
② Excite the coil, and when the temperature increase appears to saturate, remove the excitation.
③ After removing excitation, determine the temperature (Δt_1 to Δt_n) from the resistance (r_t) measured at each specific time (t), and the ambient temperature.
④ Project the curve through the collected temperature data (Δt_1 to Δt_n) to estimate the maximum temperature increase (Δt).
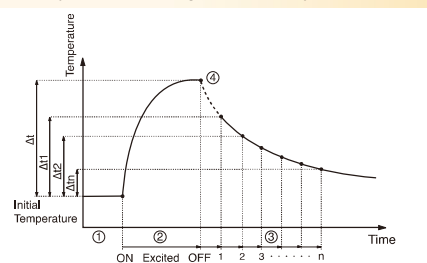
■Measurement accuracy

■ Resistance measurement accuracy
● Conditions of guaranteed accuracy

• Temperature & humidity: 23 ℃ ±5 ℃, 80% rh or less (non-condensating)
• Accuracy guaranteed for 1 year, Post-adjustment accuracy guaranteed for 1 year
• From 0°C to 18°C and from 28°C to 40°C, add (temperature coefficient ±[1/10 measurement accuracy] / °C).

●RM3544/RM3544-01

Accuracy = ±(% 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[*1,*2]	FAST	MED/SLOW	Measurement Current[*3]	Open-Circuit Voltage
30 mΩ	35.000 mΩ	0.030+0.080	0.030+0.070	300 mA	
300 mΩ	350.00 mΩ	0.025+0.017	0.025+0.014	300 mA	
3 Ω	3.500 0 Ω	0.025+0.017	0.025+0.014	30 mA	
30 Ω	35.000 Ω	0.020+0.010	0.020+0.007	10 mA	
300 Ω	350.00 Ω	0.020+0.010	0.020+0.007	1 mA	5.5 Vmax.
3 kΩ	3.500 0 kΩ	0.020+0.010	0.020+0.007	1 mA	
30 kΩ	35.000 kΩ	0.020+0.010	0.020+0.007	100 µA	
300 kΩ	350.00 kΩ	0.040+0.010	0.040+0.007	5 µA	
3 MΩ	3.500 0 MΩ	0.200+0.010	0.200+0.007	500 nA	

*1 For negative values, to -10% f.s.
*2 The maximum display range is 99,999dgt.
*3 Measurement current accuracy is ±5%.

●RM3548

Accuracy = ±(% 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[*4,*5]	Accuracy[*6]	Measurement Current[*7]	Open-Circuit Voltage
3 mΩ	3.500 0 mΩ	0.100 + 0.200 (0.100 + 0.020)	1 A	
30 mΩ	35.000 mΩ	0.100 + 0.020 (0.100 + 0.010)		
300 mΩ	350.00 mΩ	0.100 + 0.010 (0.100 + 0.010)	300 mA	
		0.020 + 0.020 (0.020 + 0.010)	100 mA	
3 Ω	3.500 0 Ω	0.020 + 0.007 (0.020 + 0.007)	100 mA	
30 Ω	35.000 Ω	0.020 + 0.007 (0.020 + 0.007)	10 mA	5.5 Vmax.
300 Ω	350.00 Ω	0.020 + 0.007 (0.020 + 0.007)	1 mA	
3 kΩ	3.500 0 kΩ	0.020 + 0.007		
30 kΩ	35.000 kΩ	0.020 + 0.007	100 µA	
300 kΩ	350.00 kΩ	0.040 + 0.007	5 µA	
3 MΩ	3.500 0 MΩ	0.200 + 0.007	500 nA	

*4 For negative values, to -10% f.s.
*5 The maximum display range is the same as the maximum measurement range.
*6 Measurement accuracy values assume offset voltage correction (OVC) is ON.
*7 Measurement current accuracy is ±5%.

* During temperature correction, the value calculated below is added to the rdg. error for resistance measurement accuracy:

$$\frac{-\alpha_{t0}\Delta t}{1+\alpha_{t0}\times(t+\Delta t-t_0)} \times 100 \quad [\%]$$

t_0 : Reference temperature. [℃]
t : Ambient temperature. [℃]
Δt : Temperature. measurement accuracy
α_{t0} : Temperature. coefficient at t_0 is [1/℃]

●Temperature measurement accuracy

• Temperature Sensor Z2001 (for RM3544/RM3544-01)
• Temperature Sensor Z2002 (for RM3548)

• Temperature Sensor Z2001 and RM3544/RM3544-01 combined accuracy
• Temperature Sensor Z2002 and RM3548 combined accuracy

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

t: Temperature measurement values [℃]

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

Standalone instrument accuracy: ± 0.2 ℃

■RM3544/RM3544-01/RM3548 Specifications

	RM3544/RM3544-01	RM3548
Measurement types	Resistance measurement: 0.000 mΩ (30 mΩ range) to 3.500 0 MΩ (3 MΩ range), 9 ranges Temperature measurement (thermistor): -10.0 to 99.9°C	Resistance measurement: 0.0000 mΩ (3 mΩ range) to 3.500 0 MΩ (3 MΩ range), 10 ranges Temperature measurement (thermistor): -10.0 to 99.9°C
Measurement method	4-terminal direct current (constant current), banana plug,with guard terminal	4-terminal direct current (constant current), banana plug
Range switching	Auto or Manual	
Temperature correction	Reference temperature setting range: -10°C to 99.9°C, Temperature coefficient setting range: -9999 ppm/°C to +9999 ppm/°C	
Zero-adjustment	Within -3% to 50% f.s. of each range. (f.s.= 30000 dgt.)	Within ±3% f.s. of each range (f.s.= 30000 dgt.)
Trigger	RM3544: Internal trigger, RM3544-01: Internal or external	Internal trigger
Measurement speed	FAST (50 Hz:21 ms, 60 Hz:18 ms) / MED (101 ms) / SLOW (401 ms)	Fixed
Display refresh rate	N/A	Without OVC: approx. 100 ms, With OVC: approx. 230 ms
Delay	N/A	Internal fixed value: / 10 to 1000 ms (7 settings)
Functions	Temperature correction, comparator (ABS/REF%), key-lock (OFF, menu lock, all lock), display digit count selection function (5 digits/4 digits), automatic power supply frequency settings (AUTO/50 Hz/60 Hz), scaling, judgment sound setting, auto hold	Temperature correction, temperature conversion, offset voltage compensation (OVC), comparator (ABS/REF%), length conversion, judgment sound setting, auto hold, auto power save (APS)
Measurement fault detection functions	Over-range detection, current fault detection, fuse trip detection	Over-range detection, current fault detection, circuit protection detection function, fuse trip detection
Averaging	OFF, 2 to 100 averaging iterations (variable in 1-iteration steps)	OFF, 2/5/10/20 averaging iterations
Panel store, panel load	10	9
	Panel save parameters: resistance measurement ranges, measurement speed, average, comparator, judgment sound, scaling, temperature correction(TC), auto hold, zero-adjust	
Memory storage	N/A	Manual, Auto memory, interval memory Number of blocks: 10 Number of recordable data points: (manual/auto) Up to 1000, (interval) Up to 6000 Interval: 0.2 to 10.0 s (0.2 s steps) Acquisition of data from memory: display, USB mass storage (CSV, TXT files)
Interfaces	RM3544-01: EXT I/O, Communication interface	Communication interface
Communication interfaces	RM3544-01: Select from RS-232C, PRINTER(RS-232C), or USB	USB
Communication function	Remote function, communications monitor function, data output function	N/A
RS-232C	Bit rates: 115200 / 38400 / 19200 / 9600 bps	N/A
USB	Class: CDC (COM mode), HID (USB keyboard mode)	Class: USB mass storage class (read-only)
Printer	Operation: Prints at PRINT signal or PRINT key input. Printed data: Resistance measurement values, temperature measurement values, judgment results, measurement conditions Interval: ON/OFF Interval times: 1 to 3600 s (variable in 1 s steps) Number of print columns per row: 1 or 3	N/A

■General specifications

	RM3544/RM3544-01	RM3548
Operating temperature and humidity	0 to 40℃, 80% rh or less (non-condensating)	
Storage temperature and humidity	–10 to 40℃, 80% rh or less (non-condensating)	
Operating environment	Indoors, Pollution Degree 2, up to 2000 m ASL	
Power supply	Rated supply voltage: 100 to 240 VAC ±10% Rated supply frequency: 50/60 Hz	DC1.5V × 8 (LR6 alkaline battery × 8)
Continuous operating time	N/A	1 s measurements over 10 s in 3 mΩ range: Approx. 10 hours (when using new alkaline batteries)
Rated power consumption	15 VA max.	5 VA max.
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 jacks	N/A
Dimensions	Approx. 215W × 80H × 166D mm (8.46"W × 3.15"H × 6.54"D) (without projections)	Approx. 192W × 121H × 55D mm (7.56"W × 4.76"H × 2.17"D) (without projections)
Mass	RM3544: Approx. 0.9 kg (31.7 oz) RM3544-01:Approx. 1.0 kg (35.3 oz)	Approx. 0.77 kg (27.2 oz.)
Accessories	RM3544: Power cord ×1, CLIP TYPE LEAD L2101 ×1, instruction manual ×1, spare fuse ×1 RM3544-01: 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	CLIP TYPE LEAD L2107 ×1, TEMPERATURE SENSOR Z2002 ×1, LR6 alkaline battery ×8, instruction manual ×1, USB cable(A-to-mini B type) ×1, strap ×1, spare fuse ×1
Applicable standards	Safety: EN61010 EMC: EN61326, EN61000-3-2, EN61000-3-3	Safety: EN61010 EMC: EN61326

■ Model Configurations and Options

RESISTANCE METER **RM3544**

USB2.0
RM3544-01

RS-232C
RM3544-01

CE

3 year Warranty

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 ×1, Clip type lead L2101 ×1, Instruction manual ×1, Spare fuse ×1, [RM3544-01] 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

Caution when considering the use of probes without guard terminals

Proper operation of the 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 mΩ HiTester 3540. Please use the test leads indicated in the RM3544 accessory and option documentation.

*The L2101 is bundled with the RM3544 series

Measurement Leads / Input scanner

CLIP TYPE LEAD L2101
A: Variable length up to 1.1 m (3.61 ft) Max., B:83 mm (3.27 in), L:1.5 m (4.92 ft)

φ9 mm / φ1.8 mm / φ0.6 mm / 2 mm

PIN TYPE LEAD L2102
A: Variable length up to 1.1 m (3.61 ft) Max., B:178 mm (7.01 in), L:1.5 m (4.92 ft)

9 mm / 2.2 mm / 0.2 mm

PIN TYPE LEAD L2103
A: Variable length up to 1.1 m (3.61 ft) Max., B:176 mm (6.93 in), L:1.5 m (4.92 ft)

4 -TERMINAL LEAD L2104
A: Variable length up to 1.1 m (3.61 ft) Max., B:118 mm (4.65 in), L:1.5 m (4.92 ft)

TEMPERATURE SENSOR Z2001
1.75 m (5.74 ft) length

LED COMPARATOR ATTACHMENT L2105
2 m (6.56 ft) length

About probe length

A: From junction to probe
B: Probe part
L: Whole length

Note: The L2101 to L2104 leads are variable length from junction to probe part (A), up to 1.1 m (3.61 ft) Max.

PC Communication

*For the RM3544-01

RS-232C CABLE 9637
For the PC, 9pin - 9pin, cross, 1.8m (5.91 ft) length

RS-232C CABLE 9638
For the PC, 9pin - 25pin, cross, 1.8m (5.91 ft) length

RESISTANCE METER **RM3548**

USB2.0

CE

3 year Warranty

Model : RESISTANCE METER RM3548

Model No. (Order Code)

RM3548

Accessories: Clip type lead L2107 ×1, Temperature sensor Z2002 ×1, LR6 Alkaline battery ×8, Instruction manual ×1, USB Cable(A-to-mini B type) ×1, Strap ×1, Spare fuse ×1

*The L2107, Z2002 are bundled with the RM3548

Measurement Leads

CLIP TYPE LEADS L2107
A: Variable length up to 1.1 m (3.61 ft) Max., B:83 mm (3.27 in), L:1.1 m (3.61 ft), 70 VDC

FOUR TERMINAL LEAD 9453
A:280 mm (11.02 in), B:118 mm (4.65 in), L:1360 mm (4.46 ft), 60V DC

PIN TYPE LEAD 9465-10
A: 80 mm (3.15 in) (red), 140 mm (5.51 in) (black, max. 550 mm (21.65 in)), B: 121 mm (4.76 in), L: 1883 mm (6.18 ft)

13.5mm / φ2.9 / φ2.7 / φ1.27

TIP PIN 9465-90
To replace the tip on the 9465-10, (one piece)

PIN TYPE LEAD 9772
A: 80 mm (3.15 in) (red), 140 mm (5.51 in) (black, max. 550 mm (21.65 in)), B: 118 mm (4.65 in), L: 1780 mm (5.84 ft)

9.15mm / φ1.8 / 1.9 / 4.3mm

TIP PIN 9772-90
To replace the tip on the 9772, L2100, (one piece)

LARGE CLIP TYPE LEAD 9467
A:300 mm (11.81 in), B:116 mm (4.57 in), L:1360 mm (4.46 ft), 50V DC

TEMPERATURE SENSOR Z2002
100 mm (3.94 in)

LED COMPARATOR ATTACHMENT L2105
For RM3544s/3545s/3548, 2 m (6.56 ft)

ZERO ADJUSTMENT BOARD 9454
For the L2100, 9465-10, 9465, 9461

About probe length

A: From junction to probe
B: Probe part
L: Whole length

Note: The L2107 lead is variable length from junction to probe (A), up to 1.1 m (3.61 ft) Max.

Case

CARRYING CASE C1006
For the RM3548

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