

# I modelli proposti

## Milliohmmetri



	RM3548	RM3545	RM3544	RM3543	RM3542	PME10	PME100
<b>Settori di utilizzo</b>	Verifiche in campo per assistenza e riparazione	Ricerca & Sviluppo, Linea di Produzione, Controllo Qualità		Linee di Produzione ed Integrazione su macchine automatiche per controlli in linea		Test in campo su apparati e connessioni di potenza	
<b>Applicazioni tipiche</b>	Motori, resistori, trasformatori, connettori e cablaggi	Avvolgimenti e resistori di trasformatori e motori, relè, barre di connessione, fusibili		Resistori, bobine, fusibili, schede elettroniche, cablaggi		Barrature elettriche, saldature, settore ferroviario ed aereo, interruttori di potenza	
<b>Tipologia</b>	Portatile	Da banco				Trasportabile	
<b>Misura a 4 terminali</b>	•	•	•	•	•	•	•
<b>Terminali di connessione</b>	Banana Ø4mm			BNC	BNC	Banana Ø4mm	Banana Ø8mm
<b>Risoluzione display</b>	4 ¼ cifre (35000 conteggi)	6 ½ cifre (1.200.000 cont)	5 cifre (99999 conteggi)	6 ½ cifre (1.200.000 conteggi)		3 ½ cifre (1999 conteggi)	
<b>Portate di resistenza</b>	10 portate da 3mΩ a 3MΩ	12 portate da 10mΩ a 1MΩ	9 portate da 30mΩ a 3MΩ	7 portate da 10mΩ a 1000Ω	10 portate da 100mΩ a 100MΩ	6 portate da 2mΩ a 200Ω	7 portate da 200uΩ a 20Ω
<b>Corrente di prova</b>	da 500nA a 1A	da 1uA a 1A	da 500nA a 300mA	da 1mA a 1A	da 100nA a 100mA	da 100uA a 10A	da 1mA a 100A
<b>Precisione base</b>	±0.02%	±0.006%	±0.02%	±0.16%	±0.008%	±0.25%	±0.25%
<b>Risoluzione minima</b>	0.1uΩ	0.01uΩ	1uΩ	0.01uΩ	0.01uΩ	100mΩ	10mΩ
<b>Velocità di risposta</b>	100msec	21msec	21msec	2msec	0.9msec	-	-
<b>Misura a bassa potenza (Low Power)</b>	-	•	•	-	•	-	-
<b>Misura di temperatura</b>	•	•	•	-	-	-	-
<b>Funzione di correzione per temperatura</b>	•	•	•	-	-	-	-
<b>Compensazione offset di tensione (OVC)</b>	•	•	•	•	•	-	-
<b>Funzione di calcolo statistico</b>	-	•	-	•	•	-	-
<b>Funzione comparatore</b>	•	•	•	•	•	-	-
<b>Check in prova del buon contatto</b>	•	•	•	•	•	-	-
<b>Memoria per le condizioni di prova</b>	•	•	•	-	-	-	-
<b>Memoria per i dati misurati</b>	1000 valori	-	-	30000 valori	30000 valori	-	-
<b>Interfaccia EXT I/O</b>	-	•	su RM3544/01	•	•	-	-
<b>Interfaccia RS232</b>	-	•	•	•	•	-	-
<b>Interfaccia USB</b>	•	•	•	-	-	-	-
<b>Interfaccia GP-IB</b>	-	su RM3545/01	-	su RM3543/01	su RM3542/01	-	-
<b>Software per computer</b>	-	•	•	-	X	-	-
<b>Alimentazione</b>	8 batterie LR6	da rete				da rete e batterie interne ricaricabili	

# RM3548

Verifiche in campo su avvolgimenti, connessioni, cablaggi

*Field measurements and tests on windings,  
connections, wirings*

RM3548



Misuratore di resistenza ideale per l'uso in produzione, manutenzione, riparazione e gestione di grandi attrezzature.

Compatto, robusto, palmare, copre un grande spettro di valori resistenza con portate da  $3\text{m}\Omega$  a  $3\text{M}\Omega$  e risoluzione minima  $0.1\text{u}\Omega$  tramite una corrente di prova fino a 1A.

Memoria interna per 1000 valori di prova ed interfaccia USB per download dati.

*Resistance meter ideal for use in production, maintenance, repair and operation of large equipment.*

*Compact, rugged, handheld, covers a large spectrum of values with ranges from  $3\text{m}\Omega$  to  $3\text{M}\Omega$  minimum resolution of  $0.1\text{ m}\Omega$  using a test current up to 1A.*

*Internal memory for 1000 test values and USB interface for downloading data.*

## High-precision 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  $\mu\Omega$  (@ 1 A) to 3.5  $M\Omega$
- 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.

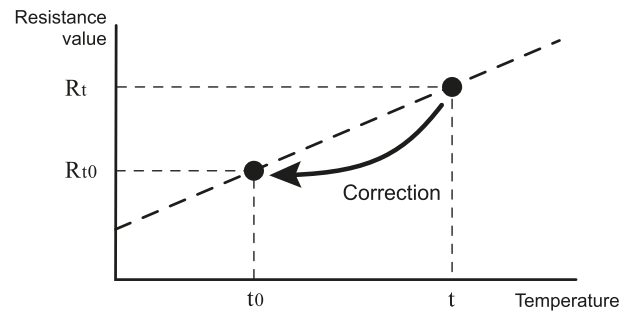
### Temperature correction

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  $R_t$  at the current temperature  $t$  to the resistance value  $R_{t0}$  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-precision portable RESISTANCE METER

measures from  $\mu\Omega$  to  $M\Omega$



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

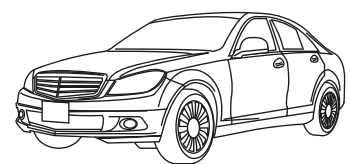
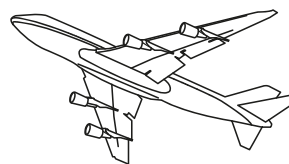
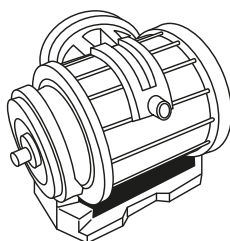
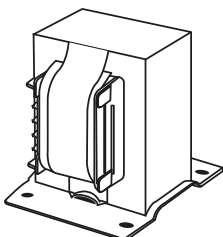
Measure from 0.0  $\mu\Omega$  to 3.5000  $M\Omega$   
0.1  $\mu\Omega$  max. resolution, 0.02% basic accuracy  
Max. measurable current of 1A

### ● 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  $\mu\Omega$  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  $m\Omega$  range).



## Portable, easy to use, and easy to understand

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

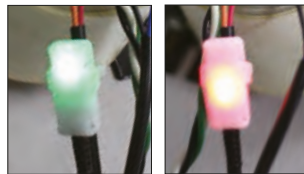
The included strap can be looped around the neck to support the instrument, leaving the operator's hands free to hold probes for measurement. The meter uses eight AA alkaline batteries, which provide enough power for approximately 10 hours of testing under normal operating conditions. (Operating times 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 measured 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 COMPARATOR ATTACHMENT close to a probe, you can capture judgment results without moving your eyes away from the measurement location and probe.



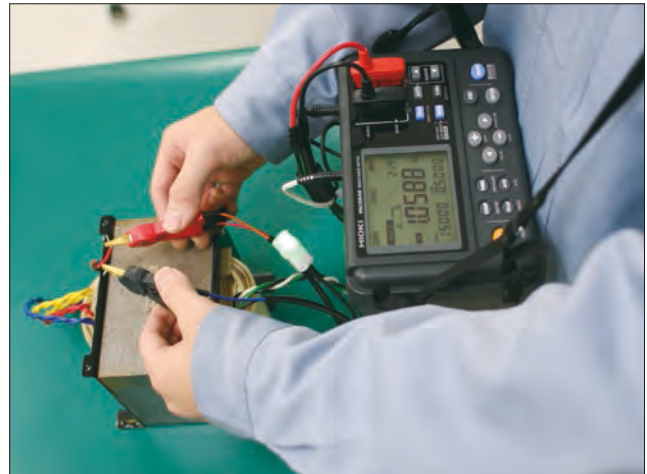
Green light IN state      Red light HI/LO state

### ● 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.

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.

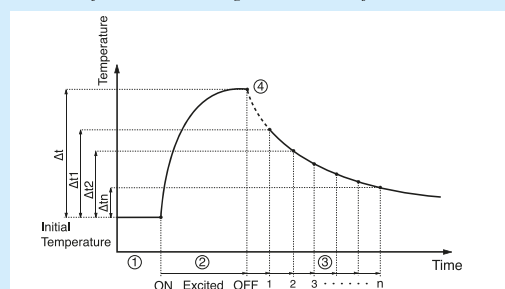
\*Since the RM3548 provides a mass storage class (read-only) USB interface, there is no need to install special driver software on the computer

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

Temperature increase ( $\Delta t$ ) 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 ( $\Delta t_1$  to  $\Delta t_n$ ) from the resistance ( $r_t$ ) measured at each specific time ( $t$ ), and the ambient temperature.
- ④ Project the curve through the collected temperature data ( $\Delta t_1$  to  $\Delta t_n$ ) to estimate the maximum temperature increase ( $\Delta t$ ).



## Measurement accuracy

### Resistance measurement accuracy

#### Conditions of guaranteed accuracy

- Temperature & humidity: 23 °C ±5 °C, 80% rh or less (non-condensating)
- Guaranteed Accuracy Period: 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 <sup>*1,2</sup>	FAST	MED/SLOW	Measurement Current <sup>*3</sup>	Open-Circuit Voltage
30mΩ	35.000 mΩ	0.030+0.080	0.030+0.070	300mA	5.5V <sub>max.</sub>
300mΩ	350.00 mΩ	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	
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	100μA	
300kΩ	350.00 kΩ	0.040+0.010	0.040+0.007	5μA	
3MΩ	3.500 0 MΩ	0.200+0.010	0.200+0.007	500nA	

\*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 <sup>*4,5</sup>	Accuracy <sup>*6</sup>	Measurement Current <sup>*7</sup>	Open-Circuit Voltage
3mΩ	3.500 0 mΩ	0.100 + 0.200 (0.100 + 0.020)	1A	5.5V <sub>max.</sub>
30mΩ	35.000 mΩ			
300mΩ	350.00 mΩ	0.100 + 0.010 (0.100 + 0.010)	300mA	
		0.020 + 0.020 (0.020 + 0.010)	100mA	
3Ω	3.500 0 Ω	0.020 + 0.007 (0.020 + 0.007)	100mA	
30Ω	35.000 Ω	0.020 + 0.007 (0.020 + 0.007)	10mA	
300Ω	350.00 Ω	0.020 + 0.007 (0.020 + 0.007)	1mA	
3kΩ	3.500 0 kΩ	0.020 + 0.007		
30kΩ	35.000 kΩ	0.020 + 0.007	100μA	
300kΩ	350.00 kΩ	0.040 + 0.007	5μA	
3MΩ	3.500 0 MΩ	0.200 + 0.007	500nA	

\*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. [°C]  
 $t$  : Ambient temperature. [°C]  
 $\Delta t$  : Temperature. measurement accuracy  
 $\alpha_{t0}$  : Temperature. coefficient at  $t_0$  is [1/°C]

### 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

t: Temperature measurement values [°C]

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

Temperature	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 instrument accuracy: ± 0.2 °C

	RM3544/RM3544-01	RM3548
Measurement types	Resistance measurement: 0.000mΩ (30mΩ range) to 3.500 0MΩ (3MΩ range), 9 ranges Temperature measurement (thermistor): -10.0 to 99.9°C	Resistance measurement: 0.0000mΩ (3mΩ range) to 3.500 0MΩ (3MΩ 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: -9,999 ppm/°C to +9,999 ppm/°C	
Zero-adjustment	Within -3% to 50% f.s. of each range. (f.s.= 30,000 dgt.)	Within ±3% f.s. of each range (f.s.= 30,000 dgt.)
Trigger	RM3544: Internal trigger, RM3544-01: Internal or external	Internal trigger
Measurement speed	FAST (50Hz:21 ms, 60Hz:18 ms) / MED (101 ms) / SLOW (401 ms)	Fixed
Display refresh rate	N/A	Without OVC: approx. 100ms, With OVC: approx. 230ms
Delay	N/A	Internal fixed value: / 10 to 1000ms (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/50Hz/60Hz), 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 Panel save parameters: resistance measurement ranges, measurement speed, average, comparator, judgment sound, scaling, temperature correction(TC), auto hold, zero-adjust	9
Memory storage	N/A	Manual, Auto memory, interval memory Number of blocks: 10 Number of recordable data points: (manual/auto) Up to 1,000, (interval) Up to 6,000 Interval: 0.2 to 10.0s (0.2s 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: 115,200 / 38,400 / 19,200 / 9,600 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 3,600 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°C, 80% rh or less (non-condensating)	
Storage temperature and humidity	-10 to 40°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 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	5 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 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, extra 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, extra fuse ×1	CLIP TYPE LEAD 9287-10 ×1, TEMPERATURE SENSOR Z2002 ×1, LR6 alkaline battery ×8, instruction manual ×1, USB cable(A-to-mini B type) ×1, strap ×1, extra 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

(Accessories: Power cord x1, CLIP TYPE LEAD L2101 x1, instruction manual x1, extra fuse x1)

### RESISTANCE METER RM3544-01

(EXT I/O, with communication interface)

(Accessories: Power Cord x1, CLIP TYPE LEAD L2101 x1, male EXT I/O connector x1, instruction manual x1, applications disc x1, USB cable (A-to-B type) x1, extra fuse x1)



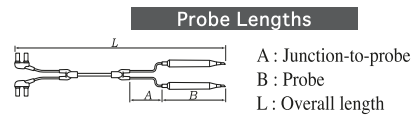
### RESISTANCE METER RM3548

(Accessories : CLIP TYPE LEAD 9287-10 x1, TEMPERATURE SENSOR Z2002 x1, LR6 alkaline battery x8, instruction manual x1, USB cable (A-to-mini B type) x1, strap x1, extra fuse x1)

#### Shared option



**LED COMPARATOR ATTACHMENT L2105**  
2 m (6.56 ft.)



\*Since the L2101 to L2104 leads can be separated into two units, length A is not noted

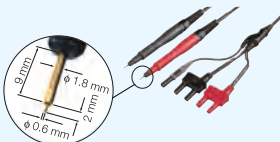
#### Options for RM3544/RM3544-01



**CLIP TYPE LEAD L2101**  
(Bundled accessory)  
B:83 mm (3.27 in.), L:1.5 m (4.92 ft.)



**4 -TERMINAL LEAD L2104**  
B:118 mm (4.65 in.), L:1.5 m (4.92 ft.)



**PIN TYPE LEAD L2102**  
B:140 mm (5.51 in.), L:1.5 m (4.92 ft.)



**PIN TYPE LEAD L2103**  
B:138 mm (5.43 in.), L:1.5 m (4.92 ft.)



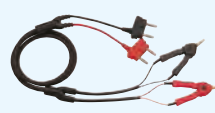
**TEMPERATURE SENSOR Z2001**  
1.75 m (5.74 ft.)

#### PC Communication (for RM3544-01)

**RS-232C CABLE 9637**  
for PC connection, 9pin - 9pin,  
cross, 1.8 m (5.91 ft.)

**RS-232C CABLE 9638**  
for PC connection, 9pin - 25pin,  
cross, 1.8 m (5.91 ft.)

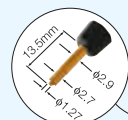
#### Options for RM3548



**CLIP TYPE LEAD 9287-10**  
(Bundled accessory)  
A:130 mm (5.12 in.), B:83 mm (3.27 in.),  
L:1.1 m (3.61 ft.)



**FOUR TERMINAL LEAD 9453**  
A:280 mm (11.02 in.), B:118 mm (4.65 in.),  
L:1.36 m (4.46 ft.)



**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: 1.88 m (6.17 ft.)



**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: 1.78 m (5.84 ft.)



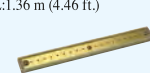
**TEMPERATURE SENSOR Z2002**  
(Bundled accessory)  
100 mm (3.94 in.)



**LARGE CLIP TYPE LEAD 9467**  
A:300 mm (11.81 in.), B:116 mm (4.57 in.),  
L:1.36 m (4.46 ft.)



(Storage Example)  
**CARRYING CASE C1006**



**ZERO ADJUSTMENT BOARD 9454**  
for 9465-10