

## 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

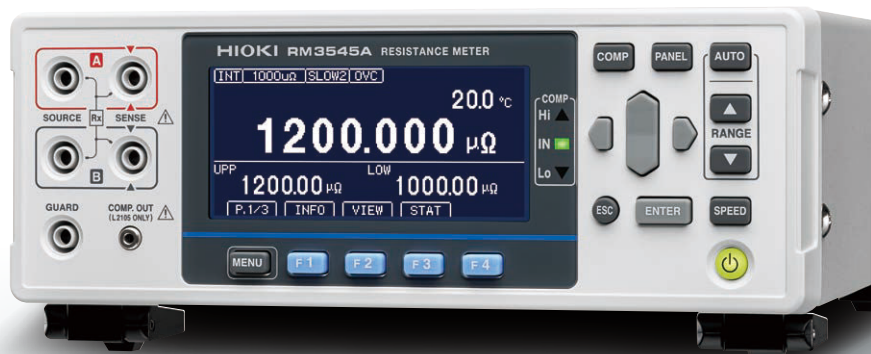
Measurable range: **1 nΩ to 1200 MΩ**

Max. resolution: **1 nΩ (1000 μΩ range)**

Min. measurement range: **1000 μΩ**

Min. measurement range accuracy: **0.045% rdg.**

Max. measurement current: **1 A**



Product page of Resistance Meter RM3545A

[https://www.hioki.com/global/products/resistance-meters/resistance/id\\_1266279](https://www.hioki.com/global/products/resistance-meters/resistance/id_1266279)



### Measurement targets

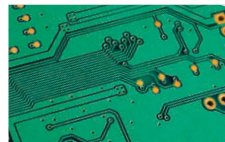
Measure resistance in components and wiring carrying large currents and in connectors where incomplete contact would lead to failure.



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.

## Product Datasheet - Technical Specifications



More information in our Web-Shop at ► [www.meilhaus.com](http://www.meilhaus.com)

### Your contact

Technical and commercial sales, price information,  
quotations, demo/test equipment, consulting:

Tel.: +49 - (0)81 41 - 52 71-0

E-Mail: [sales@meilhaus.com](mailto:sales@meilhaus.com)

**Meilhaus Electronic GmbH**  
Am Sonnenlicht 2  
82239 Alling/Germany

Tel. +49 - (0)81 41 - 52 71-0 E-  
Mail [sales@meilhaus.com](mailto:sales@meilhaus.com)

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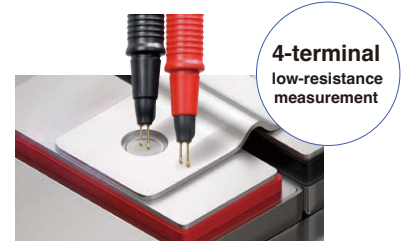


## Three key features of Resistance Meter RM3545A

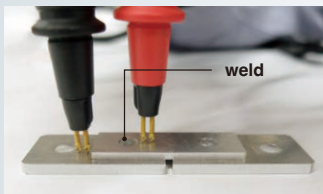
- 01 Measure low resistance values at high precision and high, 1 nΩ resolution
- 02 Add multichannel capability in a low-cost, space-saving package
- 03 Easy to embed in automatic test systems

### 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.

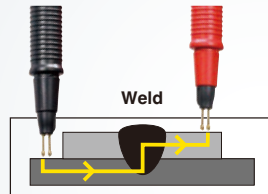


Example: measuring connections in a battery



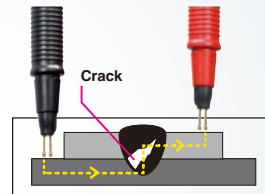
Measuring weld quality

Battery pack busbar weld (laser welding)



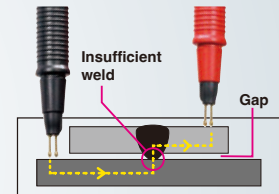
Good weld

Resistance of weld is small enabling smooth flow of electricity



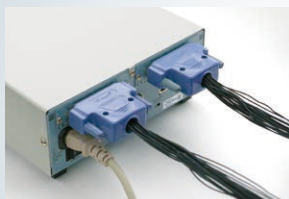
Defective weld

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

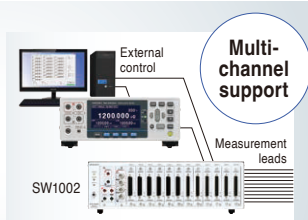


### 02 Multi-channel, one unit: made possible by installed multiplexer of RM3545A-2

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

Multi-channel support

### 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.



System interoperation

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

#### 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.

#### 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).

#### 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 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.

#### Contact check functionality

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

#### Temperature conversion ( $\Delta T$ ) function

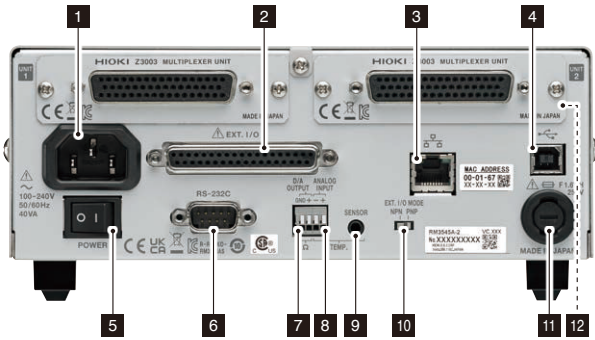
This function calculates and displays temperature rise from the measured resistance value and ambient temperature.

#### 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
- 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 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	Measurement 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	$A_B \times 0.5 [\% \text{ rdg.}]$
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
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     $A_B$ : 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	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

	RM3545A-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 (RM3545A-1, RM3545A-2)

### Measurement time (representative value)

Range	Measurement current	OVC	Measurement speed (unit: ms)			
			FAST	MED 50Hz 60Hz	SLOW1	SLOW2
PR1000 μΩ <sup>-1</sup>	High	ON	41	81 74	241	441
PR10 mΩ <sup>-1</sup>	High	OFF	21	41 37	121	221
PR100 mΩ <sup>-1</sup>	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 x  t-10 ) °C
10.0°C to 30.0°C	± 0.50 °C
30.1°C to 59.9°C	± (0.55 + 0.012 x  t-30 ) °C
60.0°C to 99.9°C	± (0.92 + 0.021 x  t-60 ) °C

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

### Temperature Sensor Z2001 specifications


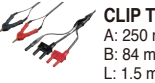







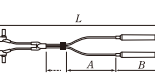

Measurement range	-10.0°C to 99.9°C
Measurement speed	Approx. 2 s

### 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						
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)	Range: 100 mΩ or less (PR mode off)		2.6 Ω			1.5 Ω		
Path resistance between SOURCE B and SOURCE A (other than measurement target)	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	<small>*LabVIEW Driver is the trademark or registered trademark of National Instruments.</small>	✓	✓	✓	✓			
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	 <b>PIN TYPE LEAD L2100</b> A: 300 mm (11.81 in.) B: 172 mm (6.77 in.) L: 1.4 m (4.59 ft.)	 <b>CLIP TYPE LEAD L2101</b> A: 250 mm (9.84 in.) B: 84 mm (3.31 in.) L: 1.5 m (4.92 ft.)	 <b>USB CABLE(A-B) L1002</b> 1 m (3.28 ft.)	 <b>TEMPERATURE SENSOR Z2001</b> Included accessory, 1.75 m (5.74 ft.)
	 <b>PIN TYPE LEAD L2102</b> A: 250 mm (9.84 in.) B: 178 mm (7.01 in.) L: 1.5 m (4.92 ft.)	 <b>4-TERMINAL LEAD L2104</b> A: 280 mm (11.02 in.) B: 149 mm (5.87 in.) L: 1.5 m (4.92 ft.)	 <b>RS-232C CABLE L9637</b> 9-pin/9-pin, 3 m (9.84 ft.) <small>Only RM3545A is supported.</small>	 <b>LED COMPARATOR ATTACHMENT L2105</b> 2 m (6.56 ft.)
	 <b>PIN TYPE LEAD L2103</b> A: 250 mm (9.84 in.) B: 176 mm (6.93 in.) L: 1.5 m (4.92 ft.)	 <b>About lead length</b> A: from junction to probe B: probe length L: overall length	 <b>LAN CABLE 9642</b> Straight-through Ethernet cable, 5 m (16.40 ft.), supplied with straight-through-to-crossover conversion adapter <small>Only RM3545A is supported.</small>	

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