

Resistance Meter for Ultra-low and Low Shunt Resistance

Measuring 0.1 mΩ with a High Accuracy of $\pm 0.16\%$ and High Resolution of 0.01 $\mu\Omega^*$

The RM3543 and RM3543-01 Resistance HiTESTERs can measure DC resistance such as a low shunt resistance with high speed and high accuracy using the DC four-terminal method. Shunt resistance of 0.1 mΩ can be measured with an accuracy of $\pm 1\%$. The resistance meters provide advanced contact-check, comparator, and data export functions. In addition, its intuitive user interface and strong noise immunity are suitable for use in automated systems.

* When 10 mΩ range, measurement speed SLOW, and average 16 times are set

Shunt Resistance Meters Capable of Measuring 0.1 mΩ

RESISTANCE HiTESTER RM3543, RM3543-01



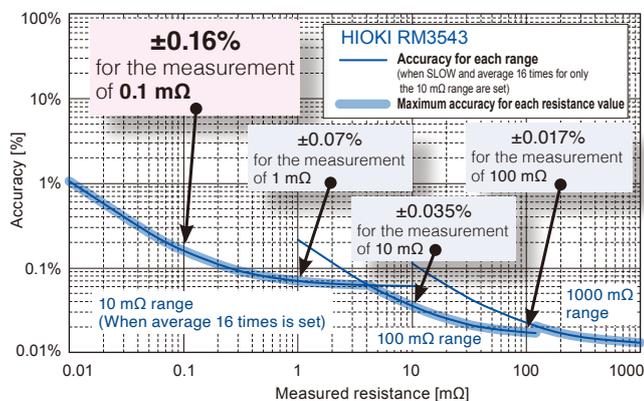
Features

- Measure 0.1 mΩ with a high accuracy of $\pm 0.16\%$
- Superb repeatable measurement accuracy
- User-friendly operability

1. Ultra-accurate and high-resolution resistance meter ideal for incorporation in automated systems.

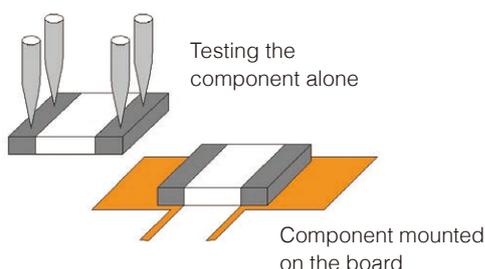
● Advanced Enough to Measure 0.1 mΩ $\pm 1\%$ Shunts with Room to Spare

The shunt resistance meters provide higher efficiency and accuracy. Using the AVERAGE function, 0.1 mΩ $\pm 1\%$ shunts can be measured at a high $\pm 0.16\%$ accuracy and high resolution of 0.01 $\mu\Omega$



● Scaling Function Corrects Differences to Simulate Testing Component Mounted on Board

The scaling function can correct the differences in the measurement resistance values between the component alone and the component mounted on the board. The function is useful in testing a current detection resistor for low resistances such as a shunt resistance.



● OVC (Offset Voltage Compensation)

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 shunt resistances and low resistances where the detection voltage is small, OVC is essential to maintain accuracy.

● Maximum Measurement Current of 1 A and Pulse Application Function Reduce Heat Generation of Samples

A pulse application function that applies current only during measurement reduces heat generation that may cause unstable resistance measurement values. In addition, the maximum measurement current of 1 A, a thermal electromotive force cancellation function, and an ultra-low noise measurement circuit minimize the variation in the measurement values.

● Easy Setup Using Numerical Keypad

The user-friendly interface features a high-contrast graphic LCD display, function keys and numerical keypad. Numbers can be input from the numerical keypad easily and speedily to configure the settings for the comparator.



Contact Improver and Check Functions

2. Positive contact assures reliable measurements

Select contact-check and make other adjustments to ensure accurate measurement and the best performance.

Configuration Screen (MISC)

| | | | | | | |
|-------------|-------|------------|--------|------|-----|--------|
| TRIG RANGE | SPEED | ADJ | COM | LOCK | PLC | MEAS |
| INT 10mΩ | FAST | OFF | ON | OFF | OFF | RETURN |
| 10.01211 mΩ | REF | 10.0000 mΩ | MEAS | | | |
| + 0.121 % | UPP | +1.000 % | DATA | | | |
| | LOW | -1.000 % | SYSTEM | | | |

Measurement Configuration Screen (MEAS)

Configure the settings for various types of contact-check and fine-tune the measurement timing.

| | | |
|----------------------|-------------------|--------|
| MEAS SETTINGS : 10mΩ | | RETURN |
| DELAY1 | 0.0 ms :ALL RANGE | ↑ |
| DELAY2 | 0.0 ms | |
| SCALING | OFF | |
| (A#R+B) | A: 1.00000 | |
| | B: +0.00000mΩ | ↓ |
| MEAS SETTINGS : 10mΩ | | NUM |
| INT(FAST) | 2.0 ms | ms |
| INT(MED) | 5.0 ms | PLC |
| INT(SLOW) | 1PLC | |
| AVERAGE | ON 16Times | |
| MEAS SETTINGS : 10mΩ | | RETURN |
| AVERAGE | ON 16Times | ↑ |
| CONT CHECK | ON 100% | OFF |
| CONT IMP | ON 35mA | |
| VOLT MONITOR | ON NORMAL | |
| CURRENT MODE | PULSE | |

● Always-On Contact Checking

High-speed, reliable measurements are achieved by performing contact checks while measuring (instead of before and after, as done until now).

● Contact Improver Function Makes Reliable Contacts Quickly

The “Contact Improver” function improves bad contacts between probes and test samples. Contacts errors are reduced by penetrating oxidation and impurities between probes and samples.

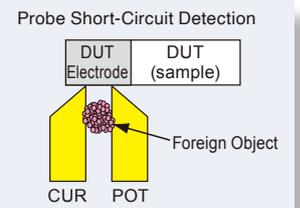
Reducing contact errors can increase productivity and quality. The intensity of the Contact Improver function can be adjusted to suit the probe type.

● Voltage Monitor Function Monitors Contact Condition Changes

The Voltage Monitor function detects large voltage fluctuations due to changes in current terminal contact resistance or noise from mechanical vibrations as contact errors. This increases the reliability of the measured values.

● Probe Short-Circuit Detection Function Ensures Reliable Four-Terminal Measurements

A conductive foreign object between the POT and CUR probe tips inhibits reliable four-terminal measurements. Short-circuited probe anomalies are detected by checking the resistance between these tips when not measuring.



3. Speed and functions required for automated systems have been achieved

● Strong Noise Immunity Meeting the IEC Standard Requirements Ensures Stable Operation in an Industrial Noise Environment

The noise immunity meets the requirements for the IEC61326, 61000-3-2, and 61000-3-3 standards. Even if noise is generated by the on-off operation of a large inductor nearby, the impact on the measurement values is minimized.

● Settings Monitor Function Minimizes Risk of Human Error

When using two instruments, a difference in settings disables TRIG input and causes a warning notification. This function eliminates setting mistakes caused by human error.



● High-speed Data Export and Data Memory Functions

High-speed processing of measured values enables high-speed export to the external interfaces. (RS-232C: 2 ms and GP-IB: 1 ms) Furthermore, the memory function to store 30,000 records enables batch transfer. Statistical calculation and data printing functions useful for production control are also available.

● Measurement Times ^{*1,*2}

Values in parenthesis are for 50 Hz (where timing depends on line frequency), units are in milliseconds

| Range | Measurement Speed | | |
|-----------------|-------------------|-----|---------|
| | FAST | MED | SLOW |
| 10 mΩ | 11 | 17 | 40 (47) |
| 100 mΩ (1 A) | 5.0 | 13 | 36 (43) |
| 100 mΩ (100 mA) | 3.8 | 13 | 36 (43) |
| 1000 mΩ | 2.0 | 6.4 | 35 (41) |
| 10 Ω | 1.6 | 6.0 | 34 (41) |
| 100 Ω | 1.6 | 4.0 | 34 (41) |
| 1000 Ω | 1.6 | 4.0 | 34 (41) |

Tolerance: ±10% ±0.2 ms

*1. Under default settings except those specified, without retries.

*2. The measurement time for the average n times is obtained by multiplying the above measurement time by a factor of n.

Example: The measurement time for the 10 mΩ range, SLOW, and the average 16 times is 640 (752) ms.

RM3543 Measurement Accuracy

Conditions of Guaranteed Accuracy (Accuracy guaranteed for 1 year)

- After 30-minute warm-up time. ● Add $\pm(0.1\% \text{ measurement accuracy})/^\circ\text{C}$ to the accuracy specifications below between 0 and 18°C, and between 28 and 40°C
- Temperature variation after self-calibration must be within $\pm 2^\circ\text{C}$.

Resistance Measurement [1-year accuracy (@23 $\pm 5^\circ\text{C}$, 80% RH or less)]

Accuracy = $\pm(\% \text{ rdg.} + \% \text{ f.s.})$

(f.s. = calculated 1,000,000 dgt., where 0.001% f.s. = 10 dgt.)

Example. 0.015 + 0.008 0.015% rdg. + 0.008% f.s.

| Range | Maximum display value ^{*1} | Resolution | FAST | MEDIUM | SLOW | Measurement current ^{*2} | OVC | Open-Circuit voltage |
|--|-------------------------------------|------------|-------------|-------------|---------------------------|-----------------------------------|-----|--------------------------|
| 10 mΩ (Average 16 times ^{*3}) | 12.00000 mΩ | 10 nΩ | 0.060+0.005 | 0.060+0.003 | 0.060+0.001 ^{*3} | 1 A | ON | 20 Vmax ^{*4,*5} |
| 10 mΩ | | | | | 0.060+0.002 | | | |
| 100 mΩ (1 A) | 120.0000 mΩ | 100 nΩ | 0.060+0.003 | 0.060+0.002 | 0.060+0.001 | 1 A | ON | |
| 100 mΩ (100 mA) | 120.0000 mΩ | 100 nΩ | 0.015+0.008 | 0.015+0.003 | 0.015+0.002 | 100 mA | ON | |
| 1000 mΩ | 1200.000 mΩ | 1 μΩ | 0.012+0.003 | 0.012+0.002 | 0.012+0.001 | 100 mA | ON | |
| 10 Ω | 12.00000 Ω | 10 μΩ | 0.010+0.003 | 0.008+0.002 | 0.008+0.001 | 10 mA | ON | |
| 100 Ω | 120.0000 Ω | 100 μΩ | 0.009+0.003 | 0.007+0.002 | 0.007+0.001 | 10 mA | ON | |
| 1000 Ω | 1200.000 Ω | 1 mΩ | 0.008+0.003 | 0.006+0.002 | 0.006+0.001 | 1 mA | ON | |

*1. Negative values can be up to 10% of positive full scale. *2. Measurement current precision is $\pm 5\%$.

*3. When the average ON 16 times or more is set (SLOW is specified only for the 10 mΩ range, other specifications not dependent on AVERAGE setting.)

*4. Voltage when not measuring is 20 mV or less, with current mode set at PULSE and Contact Improver Setting set at OFF/PULSE (measured with a voltmeter having 10 MΩ).

*5. With the sum of resistances of the cables, sample, and contacts less than (open-circuit voltage) / (measurement current).

Example: 1 A measurement current can be used when the sum of resistances of the cables, sample, and contacts is no more than 2 Ω.

RM3543 Specifications

| | |
|---|--|
| Measurement types | Resistance: 0.00000 mΩ (10 mΩ range) to 1200.000 Ω |
| Measurement method | Four-terminal, constant-current DC Measurement terminals: 22-mm BNC female jacks |
| Range switching | Comparator on: Auto-range setting according to comparator reference or upper threshold setting. Comparator off: Manual range setting |
| Zero-Adjustment | Range: -1 to 10 Ω (wiring resistance compensation for two-terminal measurements) |
| Trigger | Internal or External |
| Sampling | Fast, Medium, and Slow |
| Integration time setting function ^{*1} | 0.1 to 100.0 ms, PLC ^{*2} setting available 1 to 5 PLC @ 50 Hz, 1 to 6 PLC @ 60 Hz *2. One PLC = one power line cycle (mains waveform period) |
| Delay | DELAY1 = Set to allow for mechanical delay of trigger input and probing (affects all ranges), from 0.0 to 100.0 ms DELAY2 ^{*1} = Set to allow for measurement object response (each range independently), from 0.0 to 100.0 ms |
| Functions | Self-calibration, probe short-circuit detection, Contact Improver, current mode setting, OVC (offset voltage compensation), settings monitor, retry, average (OFF, 2 to 32 times), scaling, statistical calculations, key-lock, comparator (relative tolerance or absolute range modes), EOM pulse width setting, data export, binary data output, auto-memory |

*1. Settable for each range independently

| | |
|---------------------------------------|--|
| Measurement fault detection functions | Out-of-range detection, contact check, current monitor, voltage monitor |
| Memory storage | 30,000 values (volatile memory, no backup) |
| Interfaces | EXT I/O, RS-232C, Printer, Settings Monitor Functional terminals (SET MONITOR) GP-IB (Model RM3543-01) |
| RS-232C bit rates | 9,600, 19,200, or 38,400 bps |

RM3543 General Specifications

| | |
|------------------------------------|---|
| Operating temperature and humidity | 0°C (32°F) to 40°C (104°F), 80% RH or less (non-condensating) |
| Storage temperature and humidity | 10°C (50°F) to 50°C (122°F), 80% RH or less (non-condensating) |
| Operating environment | Indoors, Pollution Degree 2, up to 2,000 m (6,562 ft) ASL |
| Rated mains supply voltage | 100 to 240 V AC $\pm 10\%$ |
| Rated mains supply frequency | 50 / 60 Hz |
| Power consumption | 40 VA |
| Insulation withstand potential | 1.62 kV AC for 15 s, with 10 mA cutoff current Between all mains supply terminals and protective ground, interfaces, and measurement jacks |
| Dimensions | Approx. 260 mm (10.24 in) W × 88 mm (3.46 in) H × 300 mm (11.81 in) D (without projections) |
| Mass | Approx. 3.0 kg (105.8 oz) |
| Accessories | Power cord ×1, EXT I/O male connector ×1, Operation manual ×1, Operation guide ×1 |
| Applicable Standards | Safety: EN61010 EMC: EN61326, EN61000-3-2, EN61000-3-3 |

Ordering information

Model : RESISTANCE HiTESTER RM3543

Model No. (Order Code) (Note)

RM3543

RM3543-01 (Built in GP-IB interface)

Test fixtures are not supplied with the unit. Select an optional test fixture when ordering.

Optional accessories

4-TERMINAL PROBE 9140 (1 m (3.28 ft))

TEST FIXTURE 9262 (direct connection type)

SMD TEST FIXTURE 9263 (direct connection type)

4-TERMINAL PROBE 9500 (1 m (3.28 ft))

GP-IB CONNECTION CABLE 9151-02 (2 m (6.56 ft))

RS-232C CABLE 9637 (9-pin to 9-pin crossed cable / 1.8 m (5.91 ft))

RS-232C CABLE 9638 (9-pin to 25-pin crossed cable / 1.8 m (5.91 ft))

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