RESISTANCE HiTESTER
RM3542/RM3542-01

Component measuring instruments

The RM3542 and RM3542-01 Resistance HiTESTERs employ the four-terminal DC method to quickly and accurately measure the resistance of components such as resistors and ferrite bead inductors. Both models include advanced contact-check, comparator, and data export functions. The intuitive user interface and superb noise immunity are ideal for use with taping machines and separators.

* including contact checking

Measure in as little as 0.9 ms*
Equipped with Contact Improver and contact check functions
Reliable Resistance Measurement, Ideal for Automated Systems

RESISTANCE HiTESTER
RM3542/RM3542-01

Features

- High speed and accuracy maximize productivity in automated systems.
- Multiple checking functions ensure proper contact for reliable measurements.
- Low-power resistance mode measures chip inductors and EMC suppression components.
- Supports sample inspections during the manufacturing process.

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

- **Ultra Fast, Accurate Resistance Measurements Maximize Productivity**
  With FAST measurement speed selected, measure resistance in as little as 0.9 ms*1 (including contact improvement, contact check and measurement) to decision output. Measure F-class (±1%) resistors at high speed. Use SLOW measurement speed to measure B-class (±0.1%) resistors in sync with the mains frequency.
  *1. In 100 or 1000 Ω measurement range, FAST speed, with low-power function disabled.

- **Comparator Functions**
  Compare measurements against a specified reference value or range, with decision results available as signal outputs. User-friendly entry of comparator numerical values ensures smooth and reliable setting operations.

- **Store and Export Measured**
  Up to 30,000 measurements can be stored in internal memory. Stored data can be exported to a computer as a batch, or used for statistical calculations.

- **Seven-Digit High-Resolution Display (“1,200,000”)**
  Perform high-resolution measurements on all E192-series resistance values, including B-class resistor testing.

- **Multiple Interfaces**
  The RM3542 and RM3542-01 include an EXT I/O handler interface, RS-232C and Settings Monitor connections to easily connect to automated systems. Model RM3542-01 also includes GP-IB for building high-end measurement systems.
2. Positive contact assures reliable measurements.

- **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).

- **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.

- **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.

- **Retry Function Re-Measures After Faults**
  The Retry function automatically retries measurement when a fault occurs due to probe chatter. This can decrease the contact error rate and contribute to productivity improvement.

- **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.

- **Settings Monitor Function Minimizes Risk of Human Error**
  When using two instruments, a difference in settings disables TRIG input and causes warning notification. This function eliminates setting mistakes caused by human error.
Ultra Fast and Accurate Resistance Measurement

3. HIOKI’s core technology achieves ultra fast and accurate measurements.

Fast Measurements with Excellent Reproducibility

Comparison of actual data scatter at slow, medium and fast measurement speeds, showing only slight differences from the reproducibility of the slow setting.

Minimal scattering achieves ultra-accurate resistance measurements suiting the 1,200,000 digit display while maximizing reproducibility.

Auto Compensation Function Supports Accurate Measurements

- **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 low resistances where the detection voltage is small, and during low-power resistance measurements, OVC is essential to maintain accuracy.

- **Self-Calibration**
  To maintain accuracy, self-calibration automatically corrects for offset voltage and gain drift of the internal circuitry, and minimizes the effect of changes in ambient temperature and other time-dependent variables. Self-calibration is performed every ten minutes starting when the instrument is turned on, and whenever measurement settings are changed. Triggers occurring during self-calibration are automatically delayed until calibration is finished. When measuring at the time self-calibration is to be performed, calibration is delayed until the measurement is finished. By syncing with the EOM signal, measurements can continue without disruption by the calibration process.

Power Engineering Supports High Precision Measurements

- **Strong immunity to noise and mains voltage fluctuations!**
  Measurement values are unaffected even in the presence of ±1.5kV power line noise. The floating measurement circuit design is highly impervious to electrical noise, minimizing the effect on measured values even in noisy environments, such as near large switching inductors. The free-range AC input (90 to 264 V) is practically unaffected by voltage fluctuations, so stable measurements are possible even in poor power environments.

- **Auto-Sensed Power Line Frequency**
  Measuring in sync with the power line frequency is important for achieving accurate measurements. To avoid measurement problems from incorrect setting, the power line frequency is automatically sensed and selected (50 or 60 Hz).
Low-Power Resistance Measurement Mode Included
For ranges from 1000 mΩ to 1000 Ω, low-power resistance measurement is provided to minimize measurement current. Low-power resistance measurement provides accurate measurements using the thermal EMF compensation (OVC) function. Stable measurements are available even of components that are otherwise difficult to measure with high current, such as ferrite-bead and multilayer inductors.*

* Inductors cannot be measured in the 1000 Ω to 100 MΩ ranges (Low-Power mode is disabled).

Low-Resistance Measurement
Measure small resistances such as shunts and PTC thermistors. The 100 mΩ range provides 100 nΩ measurement resolution.

High-Speed Data Output and Large Memory
Measurement data can be transferred at 5 ms per value using the RS-232C interface and the data output (export) function. Values are sent automatically at the end of triggered measurements. Up to 30,000 values can be stored, and for quality control, all data can be downloaded at the end of measuring each reel. This function is ideal for system setup, debugging and process management.

Auto-Memory Function
In chip resistor manufacturing, the auto-memory function is convenient for sample inspections after screen printing. Measured values are automatically acquired and simultaneously subjected to statistical calculation as soon as they stabilize. When the specified number of measurements is acquired, a beep sounds and memory storage stops. Press PRINT to print measured values and statistical calculation results. (Printing requires the optional printer. The probe shown at the right is the optional, special-purpose Pin Type Lead 9771.)

Statistical Calculation Functions
To facilitate observation of process conditions, the mean (x), maximum (Max), minimum (Min), overall standard deviation (σ), standard deviation of sample (s), and process productivity indices (Cp: dispersion, CpK: bias) can be calculated using up to the maximum of 30,000 stored measurements.

Data Printing
Measurement values, measurement values including judgment decisions, and statistical calculation results can be printed with the optional Printer 9670.
6. Engineered with the speed and accuracy required for automated systems

● Total Productivity Supported by Fast and Accurate Measurements

• Provides the speed and accuracy required for automated systems

  Contact to decision output in as little as 0.9 ms. Contact improvement, measurement and contact checking, and decision output are all completed within this interval.

• All data can be imported in real time using the 36.4-kbps RS-232C interface.

  Model RM3542-01 also includes a GP-IB interface.

● Measurement Times

(1) With Low Power disabled

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

<table>
<thead>
<tr>
<th>Range</th>
<th>Measurement Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAST</td>
</tr>
<tr>
<td>100mΩ</td>
<td>3.8</td>
</tr>
<tr>
<td>1000mΩ</td>
<td>2.0</td>
</tr>
<tr>
<td>10Ω</td>
<td>1.6</td>
</tr>
<tr>
<td>100Ω</td>
<td>0.9</td>
</tr>
<tr>
<td>1000Ω</td>
<td>0.9</td>
</tr>
<tr>
<td>10kΩ</td>
<td>1.0</td>
</tr>
<tr>
<td>100kΩ</td>
<td>1.3</td>
</tr>
<tr>
<td>1000kΩ</td>
<td>2.5</td>
</tr>
<tr>
<td>1MΩ</td>
<td>5.3</td>
</tr>
<tr>
<td>10MΩ</td>
<td>22 (26)</td>
</tr>
</tbody>
</table>

Tolerance: ±10% ±0.2 ms

(2) With Low Power enabled

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

<table>
<thead>
<tr>
<th>Range</th>
<th>Measurement Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAST</td>
</tr>
<tr>
<td>1000mΩ</td>
<td>2.5</td>
</tr>
<tr>
<td>10Ω</td>
<td>2.5</td>
</tr>
<tr>
<td>100Ω</td>
<td>1.7</td>
</tr>
<tr>
<td>1000Ω</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Tolerance: ±10% ±0.2 ms

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

● EXT I/O Handler Interface

For noise immunity, the EXT I/O handler interface is isolated from the measurement and control circuits.

● Example of Typical EXT I/O Timing

<table>
<thead>
<tr>
<th>Contact Condition</th>
<th>TRIG</th>
<th>INDEX</th>
<th>EOM</th>
<th>ERR_CE_HI</th>
<th>CE_LO</th>
<th>PRB_SHORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

0: Trigger pulse on time; at least 0.1 ms
1: Trigger pulse off time; at least 0.1 ms
2: Delay 2; 0 to 100 ms (per setting)
3: Delay 3; 0 to 100 ms (per setting)
4: Measurement time; 0.1 to 100 ms (per sampling speed, OVC on/off, delay, and line frequency)
5: Calculation time; 0.1 ms
6: EOM pulse width; 1 to 100 ms (per setting)

● EXT I/O Input and Output Circuits

**Input Circuit**

- RM3542
- Internally Isolated 5 V
- 2kΩ
- 10kΩ
- ISO_COM
- Internally Isolated Common

**Output Circuit (open-collector)**

- RM3542
- ISO_5V
- 100Ω
- Output
- Max. 50 mA DC
- Zener voltage = 30 V
- ISO_COM
- Internally Isolated Common

### Example of Typical EXT I/O Timing

**Input Signals**

- TRIG: External trigger
- HOLD: Hold
- KEY_LOCK: Key-Lock
- ADJ: Zero-Adjust
- PRINT: Print
- CAL: Self-Calibration
- PRB_CHECK: Probe Short-Circuit Detection

**Output Signals**

- HI: Comparator Hi
- IN: Comparator IN
- LO: Comparator Lo
- EOM: End of Measurement
- INDEX: End of Import
- ERR: Measurement Fault Output
- PRB_SHORT: Probe short-circuit error
- CE_HI: (HI sense) contact error
- CE_LO: (LO sense) contact error
- ISO_5V: Internally Isolated 5 V
- ISO_COM: Internally Isolated Common

### EXT I/O Electrical Specifications

**Inputs:**

- Photocoupler isolation: Non-voltage contact inputs
- Assert: 0 to 1 V (with 3 mA input)
- De-assert: Open, or 5 to 30 V

**Outputs:**

- Photocoupler isolation: Open-collector NPN
- Max. 30 V and 50 mA per ch.
- Residual voltage: Max. 1.5 V @ 50 mA,
  or 1 V @ 10 mA.

**Accessory Power Out (internally powered):**

- 4.5 to 5 V DC @ 100 mA max.
- Isolated from protective ground and measurement circuitry
Multiple Test Fixture Options

- Various fixtures available to suite the type of components to measure

Noise-suppressing BNC-type measurement jacks are employed. Ready availability and easy assembly ensure smooth system setup. A variety of test fixtures for HIOKI LCR HiTESTERs can also be used.

Recommended Measurement Cable Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor resistance</td>
<td>500 mΩ/m or less</td>
</tr>
<tr>
<td>Capacitance</td>
<td>150 pF/m or less</td>
</tr>
<tr>
<td>Length</td>
<td>2 m or less</td>
</tr>
<tr>
<td>Specific examples</td>
<td>JIS std. 3C-2V and 1.5D-2V,</td>
</tr>
<tr>
<td></td>
<td>MIL std. RG-58A/U</td>
</tr>
</tbody>
</table>

RM3542 Measurement Accuracy

(1) Resistance Measurement (Low-Power OFF) [1-year accuracy (@23 ±5°C, 80% RH or less)]

Accuracy = ±(% rdg. + % f.s.)

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

<table>
<thead>
<tr>
<th>Range</th>
<th>Maximum display Value</th>
<th>Resolution</th>
<th>FAST</th>
<th>MEDIUM</th>
<th>SLOW</th>
<th>Measurement Current</th>
<th>Open-Circuit Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mΩ</td>
<td>120.0000mΩ</td>
<td>100mΩ</td>
<td>0.015+0.008</td>
<td>0.015+0.003</td>
<td>0.015+0.002</td>
<td>100mA</td>
<td>20Vmax*1/4</td>
</tr>
<tr>
<td>1000mΩ</td>
<td>1200.0000mΩ</td>
<td>1µΩ</td>
<td>0.012+0.003</td>
<td>0.012+0.002</td>
<td>0.012+0.001</td>
<td>100mA</td>
<td></td>
</tr>
<tr>
<td>10Ω</td>
<td>12.00000Ω</td>
<td>10µΩ</td>
<td>0.008+0.002</td>
<td>0.008+0.001</td>
<td>0.008+0.001</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>100Ω</td>
<td>120.0000Ω</td>
<td>100µΩ</td>
<td>0.007+0.002</td>
<td>0.007+0.001</td>
<td>0.007+0.001</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>1000Ω</td>
<td>1200.0000Ω</td>
<td>1mΩ</td>
<td>0.006+0.002</td>
<td>0.006+0.001</td>
<td>0.006+0.001</td>
<td>1mA</td>
<td></td>
</tr>
<tr>
<td>10kΩ</td>
<td>120.0000kΩ</td>
<td>100mΩ</td>
<td>0.007+0.002</td>
<td>0.007+0.001</td>
<td>0.007+0.001</td>
<td>100µA</td>
<td></td>
</tr>
<tr>
<td>100kΩ</td>
<td>1200.0000kΩ</td>
<td>1Ω</td>
<td>0.008+0.002</td>
<td>0.008+0.001</td>
<td>0.008+0.001</td>
<td>10µA</td>
<td></td>
</tr>
<tr>
<td>10MΩ</td>
<td>120.0000MΩ</td>
<td>10Ω</td>
<td>0.030+0.004</td>
<td></td>
<td></td>
<td>1µA</td>
<td></td>
</tr>
<tr>
<td>100MΩ</td>
<td>1200.0000MΩ</td>
<td>100Ω</td>
<td>0.100+0.020</td>
<td></td>
<td></td>
<td>100µA</td>
<td></td>
</tr>
</tbody>
</table>

*1. Negative values can be up to 10% of positive full scale.
*2. Measurement current accuracy is ±5%.
*3. 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).
*4. With the sum of resistances of the cables, sample, and contacts less than (open-circuit voltage) / (measurement current).

Example. 100 mA measurement current can be used when the sum of resistances of the cables, sample, and contacts is no more than 20 Ω.

Resistance Measurement (Low-Power ON) [1-year accuracy (@23 ±5°C, 80% RH or less)]

<table>
<thead>
<tr>
<th>Range</th>
<th>Maximum display Value</th>
<th>Resolution</th>
<th>FAST</th>
<th>MEDIUM</th>
<th>SLOW</th>
<th>Measurement Current</th>
<th>Open-Circuit Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000mΩ</td>
<td>1200.0000mΩ</td>
<td>1µΩ</td>
<td>0.010+0.008</td>
<td>0.008+0.003</td>
<td>0.008+0.002</td>
<td>10mA</td>
<td>20Vmax*1/4</td>
</tr>
<tr>
<td>10Ω</td>
<td>12.00000Ω</td>
<td>10µΩ</td>
<td>0.008+0.003</td>
<td>0.008+0.002</td>
<td>0.008+0.001</td>
<td>1mA</td>
<td></td>
</tr>
<tr>
<td>100Ω</td>
<td>120.0000Ω</td>
<td>100µΩ</td>
<td>0.008+0.002</td>
<td>0.008+0.001</td>
<td>0.008+0.001</td>
<td>1mA</td>
<td></td>
</tr>
<tr>
<td>1000Ω</td>
<td>1200.0000Ω</td>
<td>1mΩ</td>
<td>0.020+0.003</td>
<td>0.008+0.002</td>
<td>0.008+0.001</td>
<td>100µA</td>
<td></td>
</tr>
</tbody>
</table>

*1. Negative values can be up to 10% of positive full scale.
*2. Measurement current accuracy is ±5%.
*3. 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).
*4. With the sum of resistances of the cables, sample, and contacts less than (open-circuit voltage) / (measurement current).

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

Conditions of Guaranteed Accuracy

- After 30-minute warm-up time
- Add ±(0.1% measurement accuracy)/ºC to the above between 0 and 18°C, and between 28 and 40°C, respectively
- Temperature variation after self-calibration must be within ±2°C.
**RM3542 Specifications**

| Measurement types | Four-terminal resistance measurement  
|                   | 0.0000 mΩ (100 mΩ range) to 120.0000 MΩ  
|                   | Low-power four-terminal resistance measurement  
|                   | 0.000 mΩ (1000 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-Adjust | 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 | 0.1 to 100.0 ms, PLC 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 = 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, statistical calculations, key-lock, comparator (relative tolerance or absolute range modes), EOM pulse width setting, data export, export data format, auto-memory  
| 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 RM5342-01)  
| RS-232C bit rates | 9,600, 19,600, or 38,400 bps  

*1. Settable for each range independently  

**RM3542 General Specifications**

| Operating temperature and humidity | 0 to 40°C, 80% RH or less (non-condensing)  
| Storage temperature and humidity | 10 to 50°C, 80% RH or less (non-condensing)  
| Temperature and humidity range for guaranteed accuracy | 23 ±5°C, 80% RH or less (non-condensing)  
| Operating environment | Indoors, Pollution Degree 2, up to 2,000 m ASL  
| Rated mains supply voltage | 100 to 240 V AC ±10%  
| Rated mains supply frequency | 50 / 60 Hz  
| Power consumption | 30 VA  
| Insulation withstand potential | 1.69 kV AC for 15s, with 10 mA cutoff current  
| Between all mains supply terminals and protective ground, interfaces, and measurement jacks |  
| Dimensions | Approx. 260W × 88H × 300D mm (without projections)  
| Weight | Approx. 2.9 kg  
| Accessories | One each power cord, EXT I/O male plug  
| Applicable Standards | Safety  
|                 | EN61010-1  
|                 | EMC  
|                 | EN61326  
|                 | EN61000-3-2  
|                 | EN61000-3-3  

**Odering information**

RESISTANCE HiTESTER RM3542  
RESISTANCE HiTESTER RM3542-01 (with GP-IB interface)  

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

**Optional accessories**

FOUR-TERMINAL PROBE 9140  
TEST FIXTURE 9262 (direct connection type)  
SMD TEST FIXTURE 9263 (direct connection type)  
GP-IB CONNECTION CABLE 9151-02 (2m)  
PRINTER 9670  
AC ADAPTER 9671 (for 9670)  
BATTERY PACK 9672 (for 9670)  
BATTERY CHARGER 9673 (for 9672)  
RECORDING PAPER 9237 (80 mm × 25 m, 4 rolls)  
RS-232C CABLE 9638 (9pin-25pin/cross/1.8m)

**HIOKI E.E. CORPORATION**

99 Washington Street  
Melrose, MA 02176  
Phone 781-665-1400  
Toll Free 1-800-517-8431

Visit us at www.TestEquipmentDepot.com

All information correct as of Nov. 18, 2009. All specifications are subject to change without notice.