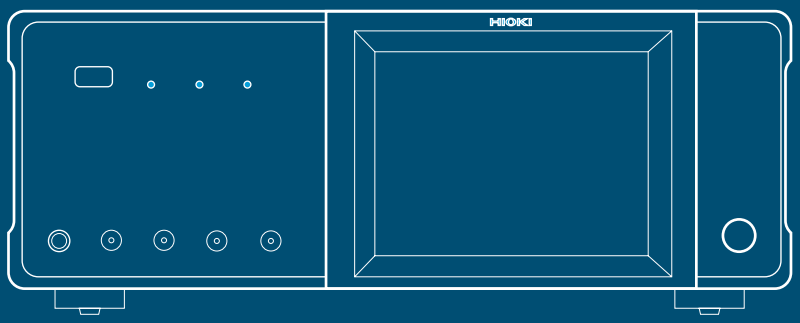
CATALOGO STRUMENTI

Ricerca & Sviluppo

MISURE PRIMARIE

PONTI LCR



TECNOLOGIA

HIOKI

asita

TECNOLOGIE DI MISURA

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HIOKI

LCR HiTESTER 3511-50

Minimum measurement time of 5 ms, built-in comparator and ±0.08% measurement accuracy

Improved for even faster and more efficient measurements !

The 3511-50 LCR HiTESTER features both high performance, highspeed measurements with a low prices.
The minimum measurement time of 5 ms and basic accuracy of ±0.08% makes the instrument suitable for use on production lines and laboratories. The built-in high-speed comparator significantly reduces production line tact time and allows the construction of automatic production lines.
The very compact body features a clearly visible LED display that facilitates easy operation and allows settings to be confirmed at a glance.
With its high-speed measurement, highly accurate measurement capabilities and great cost performance, this LCR measurement instrument is bound to satisfy the needs of a variety of users.

CE

Better Speed, Better Accuracy

Powerful Functions for Greater Line Efficiency

■ Minimum measurement time of 5 ms

Three sampling rates can be selected: FAST, NORMAL and SLOW. The minimum measurement time of 5 ms (with 1 kHz/|Z| display) gives rapid sampling for improved production line efficiency.
(Differs with the measurement frequency and display parameters.)

■High resolution and high measurement accuracy

The measurement resolution provides a full five digits, and the basic measurement accuracy is ±0.08%.

■ RS-232C interface as standard feature

With the exception of turning the power on or off, all the basic functions can be controlled from a PC. Use of a PC enables efficient data management, processing, and setting of measurement conditions, plus a variety of other functions. A GP-IB interface can also be installed as an option.

■ RS-232C interface specifications

Transmission method: Start-stop synchronization. Transmission speed: 9600 bps. Data length: 8 bits. Parity: None. Stop bit: 1 bit. Delimiter: CR+LF. Handshake: Hardware. Connector shape: D-sub 9pin (male). Connecting cable: Reverse cable

an automatic instrument where comparator results, measurement-completed signals, etc., can be output to an external device.

■ Comparator function

Upper limit and lower limit values can be set for both the main parameters (any of Z or C or L or R) and sub-parameters (any of θ or D or Q). The measurement results are signaled by a buzzer and LED indication and can also be output to an external source. The output is separated into main- and sub-parameter measurement results together with AND.

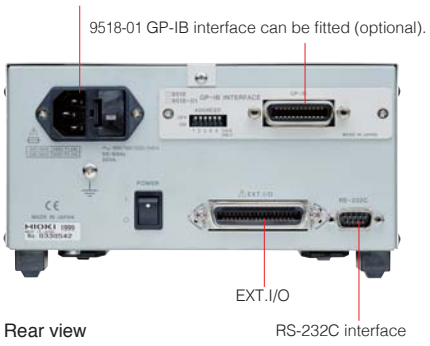
■ Memory for 99 sets of measurement conditions

Up to 99 sets of measurement conditions, including comparator values, provide rapid response to constantly changing components on flexible production lines.
These conditions can also be externally switched via the EXT.I/O.

■ Compact size

The small dimensions, 210 (W) × 100 (H) × 168 (D) mm, approximately 2.5 kg (4.00"W × 8.30"H × 6.60"D; 88 oz. approx.), make it easy to incorporate the instrument into production lines.

The AC power supply voltage is selectable :
100 V, 120 V, 220 V or 240 V AC.



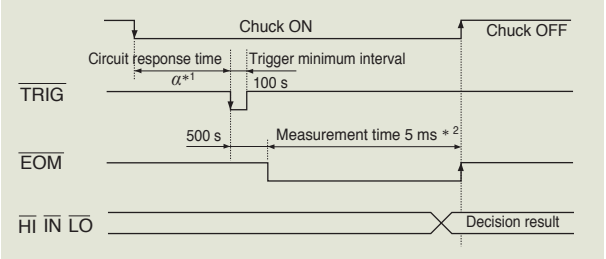
Timing chart for EXT. I/O sequencing

The following chart shows the timing sequence of the trigger (TRIG), and end-of-measurement (EOM) signals from the EXT. I/O connector.

EXT. I/O signals

● Outputs
- Internal DC power (+5 V output)
- Comparator result (main-/sub-parameters together with AND output)
- Analog measurement completion
- End-of-measurement

● Inputs
- External DC power supply (+5 V to +24 V can be supplied by external device)
- External trigger signal
- Memory setting selection (including comparator conditions)



*1 α depends on the sample and trigger delay.
*2 Reference value for 1 kHz measurement frequency, FAST mode, |Z| measurement.
Measurement time differs with measurement conditions.

... and Better Size !

Basic Performance

■ Seven parameters measured

The seven parameters |Z|, R, θ, C, L, D, and Q can be measured. The main- and sub-displays can be combined in five ways: |Z|-θ, C-D, L-D, L-Q, R.

■ Easy operation by simple selections and LED display

To operate, simply select from the items displayed on the panel. Selected measurement conditions are indicated by illuminated LEDs allowing settings to be checked at a glance. Measurement results are also displayed by LED indication that makes it easy to check the values even in dark locations.

■ DC bias measurement

Using the optional 9268/9269 DC BIAS UNIT, voltage and current bias measurements are simple. The 9268 can be used for voltages up to a maximum of DC±40 V. The 9269 can be used for currents up to a maximum of DC±2 A.

Example of connecting the 9262 and 9268 / 9269

■ Measurement signals

Measurement frequency: 120 Hz/1 kHz. Signal level: 50 mV, 500 mV, 1 Vrms settable.

■ Printer output

Measurement values and comparator results can be printed out on the optional 9442 Printer by connecting this via the standard RS-232C interface. This is convenient for attaching data to inspection reports, etc.
(The optional 9444 Connection Cable and AC adapter are necessary for connecting the printer.)

Printout example

```
Cs 984.16n F     D  0.00017
Cs 984.14n F     D  0.00017
Cs 984.10n F     D  0.00017
Cs 984.20n F     D  0.00034

Cs 983.91n F    LO   D  0.00052     HI
Cs 983.89n F    LO   D  0.00034     IN
Cs 984.03n F    IN   D  0.00017     LO
Cs 983.89n F    LO   D  0.00052     HI
Cs 983.95n F    LO   D  0.00034     IN
Cs 983.95n F    LO   D  0.00052     HI
```

■ 9442 PRINTER specifications

●Printing method : Thermal serial dot printer●Recording width : 112 mm (4.41")●Printing speed : 52.5 cps●Power supply : 9443 AC ADAPTER or supplied Ni-MH battery pack (prints 3000 lines on full charge from 9443 AC ADAPTER)●Dimensions and mass: 160W × 66.5H × 170D mm; 580 g approx. (6.30"W × 2.62"H × 6.70"D; 20.46 oz. approx.)

Resulting measurement data can be output not only to a printer, but also other media such as a PC or sequencer. Using the RS-232C interface makes transferring the inspection data simple and convenient.

■ Specifications (Accuracy guaranteed for 6 months, Post-adjustment accuracy guaranteed for 6 months)

Measurement parameters	|Z|, C, L, R, θ, D, Q * Five possible display combinations: |Z|-θ, C-D, L-D, L-Q, R.	
Measurement frequency (±0.01%)	120 Hz	1 kHz
Measurement time (typical values for displaying |Z|) Excluding time for open/short circuit compensation, evaluation.	FAST : 13 ms, NORMAL : 80 ms, SLOW : 400 ms	FAST : 5 ms, NORMAL : 60 ms, SLOW : 300 ms
Measurement ranges |Z|, R	10 mΩ to 200.00 MΩ	
C	9.40 pF to 999.99 mF	0.940 pF to 99.999 mF
L	14.00 μH to 200.00 kH	1.600 μH to 20.000 kH
θ	-90.00° to +90.00°	
D	0.0001 to 1.9900	
Q	0.85 to 999.99	
Basic accuracy	Z : ±0.08% rdg. θ ± 0.05°	
Measurement signal levels	50 mV/500 mV/1 V rms (±10% ±5 mV)	
Equivalent circuit mode	Serial- and parallel equivalent circuit mode, automatic/manual	
Output impedance	50 Ω	
Display method/Max. count	LED (5-digit display, full-scale count depends on range)	
No. of measurement condition memory retention	Max. 99 (including comparator conditions)	
Comparator comparison method	Any of the main parameters (any of |Z| or C or L or R) and sub-parameters (any of θ or D or Q) can be set to upper limit and lower limit value settings. The measurement results are signaled by LED indication and a buzzer and EXT.I/O output (main- and sub-parameter evaluation results, AND output).	
DC bias	Possible when the optional 9268 (±40 V max.) or 9269 (±2 A max.) is used.	
External printer	9442 PRINTER (option)	
External interfaces	RS-232C, (GP-IB is option), EXT.I/O for sequence use.	

Measurement range (Auto/Hold range, 5-digit display)
|Z|, R : 100 m/1/10/100/1 k/10 k/100 k/1 M/10 M/200 MΩ
C (120 Hz) : 145 p/1.45 n/14.5 n/145 n/1.45 μ/14.5 μ/145 μ/1.45 m/14.5 m/1 F
C (1 kHz) : 17 p/170 p/1.7 n/17 n/170 n/1.7 μ/17 μ/170 μ/1.7 m/100 mF
L (120 Hz) : 130 μ/1.3 m/13 m/130 m/1.3/13/130/1.3 k/13 k/200 kH
L (1 kHz) : 15.5 μ/155 μ/1.55 m/15.5 m/155 m/1.55/15.5/155/1.55 k/20 kH
Dimensions, mass : 210H × 100W × 168D mm, 2.5 kg approx. (8.30"H × 4.00"W × 6.60"D ; 88 oz. approx.)
Power supply : 100 V/120 V/220 V/ 240 V AC ± 10% (selectable), 50/60 Hz
Max. rated power : 20 VA max.
Supplied accessories : Power cord, spare fuse for power supply (in accordance with the ordered power specifications, either 100/120 VAC 1 A, 220/240 VAC 0.5 A)
Conformity : EMC EN61326-1:1997+A1:1998
EN61000-3-2:1995+A1:1998+A2:1998
EN61000-3-3:1995
Safety EN61010-1:1993+A2:1995
Power supply; Pollution degree 2 Overvoltage Category II (anticipated transient overvoltage 2500 V)
Test terminals; Pollution degree 2 Overvoltage Category I (anticipated transient overvoltage 330 V)

Measurement accuracy and range

Conditions of guaranteed accuracy :

Temperature and humidity 23°C±5°C (73°F±9°F), less than 80% RH (no condensation), following 60 min. warm-up after power is turned ON, after open/shut calibration, use of 9261 Test Fixture, measurement signal level 1 Vrms, measurement speed set to SLOW.
The various accuracy specifications presume that θ< ±6°C for R, D≦0.1 for C-D, D≦0.1 for L-D, Q≧10 for L-Q.
Q accuracy is defined by the calculation of 1/D.
Measurement range and accuracy differ with the used Test Fixture, measurement signal level and measurement speed.

	Frequency (|Z|-θ and R have common frequency)	Range									
		100 mΩ	1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ	1 MΩ	10 MΩ	200 MΩ
|Z|-θ	|Z|	± (1.00+0.15/ZL)%	±1.80%	±0.35%	±0.08%	±0.08%	±0.11%	±0.14%	±0.30%	±(0.15+0.16×ZH)%	±(2.00+0.11×ZH)%
	θ	±(0.10+0.09/ZL)°	±1.00°	±0.18°	±0.08°	±0.05°	±0.08°	±0.10°	±0.19°	±(0.10+0.09×ZH)°	±(0.70+0.08×ZH)°
R	-	±(1.00+0.21/RL)%	±2.10%	±0.39%	±0.10%	±0.09%	±0.13%	±0.16%	±0.34%	±(0.15+0.20×RH)%	±(2.00+0.16×RH)%
	120 Hz	1 F	14.5 mF	1.45 mF	145 µF	14.5 µF	1.45 µF	145 nF	14.5 nF	1.45 nF	145 pF
	1 kHz	100 mF	1.7 mF	170 µF	17 µF	1.7 µF	170 nF	17 nF	1.7 nF	170 pF	20 pF
C-D	C	±(0.60+1.50×f×CH)%	±2.10%	±0.39%	±0.10%	±0.09%	±0.13%	±0.16%	±0.34%	±{0.17+30/(f×CL)}%	±{1.70+30/(f×CL)}%
	D	±(0.0015+0.0108×f×CH)	±0.0179	±0.0034	±0.0016	±0.0011	±0.0016	±0.0020	±0.0036	±{0.0020+0.264/(f×CL)}	±{0.0120+0.25/(f×CL)}
	120 Hz	130 µH	1.3 mH	13 mH	130 mH	1.3 H	13 H	130 H	1.3 kH	13 kH	200 kH
	1 kHz	15.5 µH	155 µH	1.55 mH	15.5 mH	155 mH	1.55 H	15.5 H	155 H	1.55 kH	20 kH
L-D	L	±{0.90+30/(f×LL)}%	±2.10%	±0.39%	±0.10%	±0.09%	±0.13%	±0.16%	±0.34%	±(0.17+1.17×f×LH)%	±(2.00+1.00×f×LH)%
	D	±{0.0021+0.264/(f×LL)}	±0.0179	±0.0034	±0.0016	±0.0011	±0.0016	±0.0020	±0.0036	±(0.0020+0.0110×f×LH)	±(0.0120+0.0100×f×LH)

* ZL is the sample impedance [Ω], ZH is the sample impedance [MΩ], RL is the sample resistance [Ω], RH is the sample resistance [MΩ], CH is the sample capacitance [mF], CL is the sample capacitance [pF], LL is the sample inductance [µH], LH is the sample inductance [kH], and f is the measurement frequency [kHz]. (|Z|, R, C, L : ± %rdg.)

GP-IB
RS-232C
CE

Model : LCR HiTESTER 3511-50

Model No. (Order Code)	(Note)
3511-50	(Measurement frequencies: 120 Hz and 1 kHz)

Accessories: Instruction manual ×1, Power cord ×1, Spare fuse ×1 (1 A for 100/120 V AC rating, 0.5 A for 220/240 V AC rating)

■ Options for a wide range of applications

PC communication

GP-IB INTERFACE 9518-01
Built into rear panel

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

Probe and Test fixtures

SMD TEST FIXTURE IM9110
Direct connection two-terminal measurement type for measuring SMDs, DC to 1 MHz, measurable sample sizes: 008004 (EIA)

SMD TEST FIXTURE IM9100
Direct connection type, For measuring SMDs with electrodes on the bottom, DC to 8 MHz, measurable sample sizes: 01005 to 0402 (EIA), 0402 to 1005 (JIS)

PINCHER PROBE L2001
Cable length 73 cm (28.74 ft), DC to 8 MHz, impedance characteristics of 50 Ω, 4-terminal pair configuration, tip electrode spacing: 0.3 (0.01 in) to 6 mm (0.24 in)

CONTACT TIPS IM9901
To replace the tip on the L2001, regular size, bundled with the L2001

CONTACT TIPS IM9902
To replace the tip on the L2001, small size

SMD TEST FIXTURE 9699
Direct connection type, For measuring SMDs with electrodes on the bottom; DC to 120 MHz, test sample dimensions: 1.0 mm (0.04 in) to 4.0 mm (0.16 in) wide, max. 1.5 mm (0.06 in) high

SMD TEST FIXTURE 9677
Direct connection type, For measuring SMDs with electrodes on the side; DC to 120 MHz, test sample dimensions: 3.5 mm ±0.5 mm (0.14 in ±0.02 in)

SMD TEST FIXTURE 9263
Direct connection type, DC to 8 MHz, test sample dimensions:1 mm (0.04 in) to 10 mm (0.39 in)

TEST FIXTURE 9262
Direct connection type, DC to 8 MHz, measurable conductor diameter: ø0.3 (0.01 in) to 2 mm (0.08 in)

TEST FIXTURE 9261
DC to 8 MHz, 1 m (3.28 ft) length, impedance characteristics of 75 Ω

4-TERMINAL PROBE 9140
DC to 100 kHz, 1 m (3.28 ft) length, impedance characteristics of 75 Ω

Note: The 9268-01 cannot be used with the 3511-50, use with the 9268/9269, Not CE marked

DC BIAS CURRENT UNIT 9269
42 Hz to 100 kHz, Max. allowable current: ±2A DC

DC BIAS VOLTAGE UNIT 9268
42 Hz to 5 MHz, Max. allowable voltage: ± 40 V DC

CONNECTION CORD 9166
Metal BNC to clip, 1.5 m (4.92 ft) length

CONNECTION CORD 9165
Cord has metallic BNC connectors at both ends, use at metallic terminal, 1.5 m (4.92 ft) length

Printer options

PRINTER 9442
For printing numerical values 112 mm (4.41 in) paper width

AC ADAPTER 9443-02
For the Printer 9442, EU type

CONNECTION CABLE 9444
For the Printer 9442, 9 pin - 9 pin, 1.5 m (4.92 ft) length

RECORDING PAPER 1196
For the Printer 9442, 112 mm (4.41 in) × 25 m (82.03 ft), 10 rolls/set

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LCR METER IM3536

NEW

DC, 4 Hz to 8 MHz

Measurement frequency

The new standard

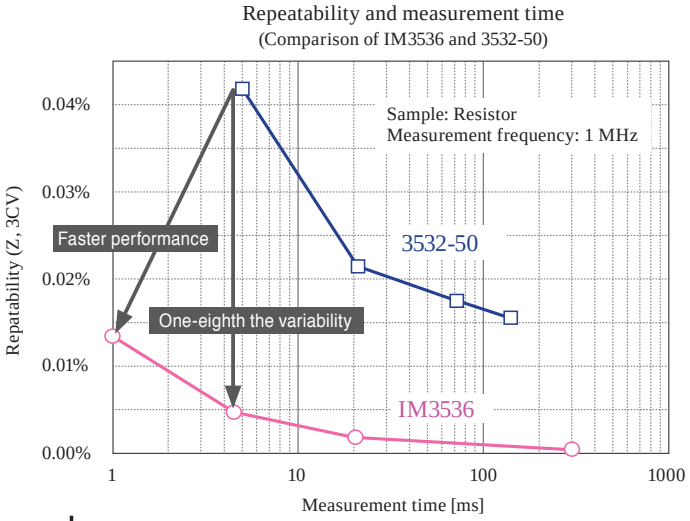
Introducing an LCR meter that brings exceptional specifications and cost performance to a wide range of applications, from R&D to production lines

Test fixtures and probes sold separately. Photograph depicts IM3536 used in combination with the SMD Test Fixture 9677.

One-eighth the precision variability and five times the measurement speed of legacy models means dramatically improved productivity.

High speed

Stability



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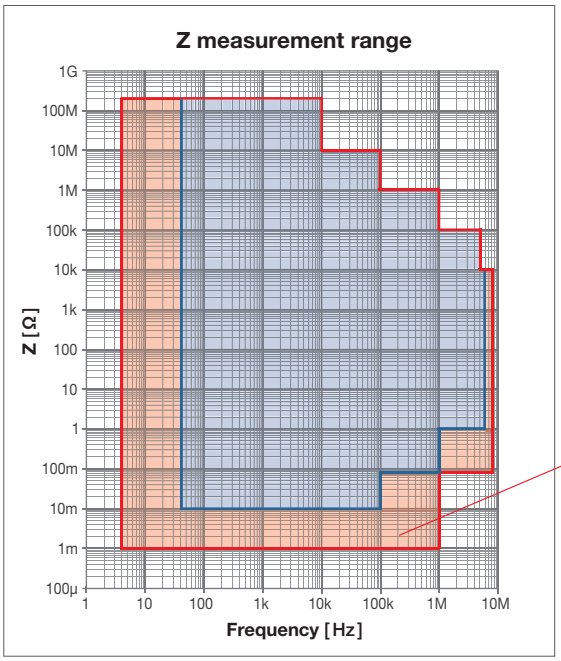
Raising the Bar for Basic Performance

High accuracy ±0.05% rdg.

High speed 1 ms (fastest time)

Guaranteed accuracy range from 1 mΩ

The IM3536 delivers a guaranteed accuracy range that starts at 1 mΩ. Furthermore, the frequency band has been expanded to 8 MHz, broadening the array of measurement targets with which it can be used compared to legacy products.



: Hioki legacy model (3532-50)

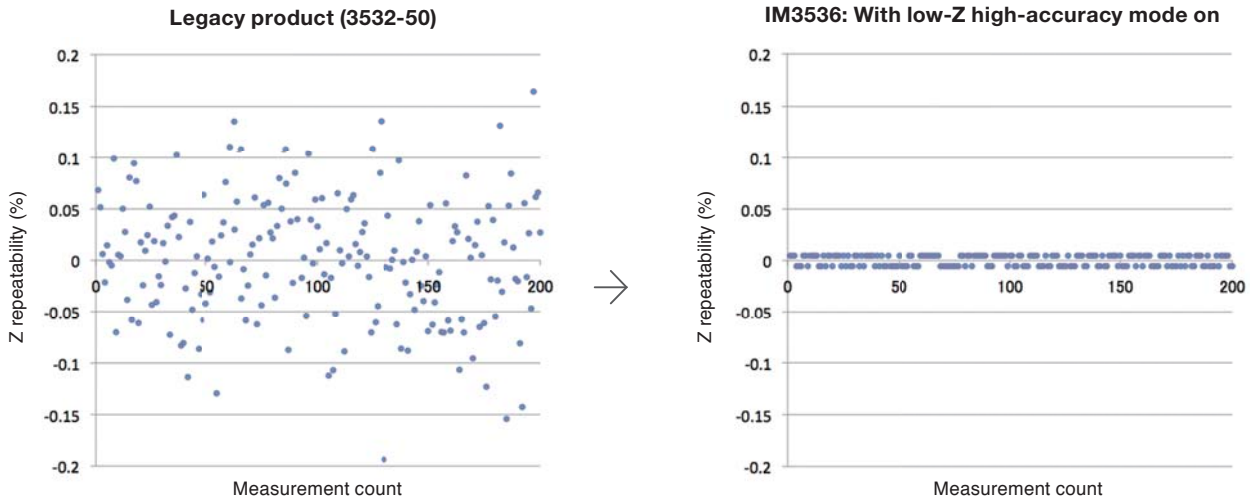
Expanded range

: IM3536

For more information about L and C measurable ranges, see page 14.

Low-impedance measurement with unmatched repeatability

The IM3536 delivers repeatability that is an order of magnitude better than that of previous products. This level of performance makes the instrument ideal for use in applications such as electrolytic capacitor low-ESR measurement and power supply coil impedance testing, the latter of which demands excellent frequency characteristics.



Graphs illustrate the results of measuring a resistance of 1 mΩ 200 times under the following conditions:
- Frequency: 1 kHz
- Measurement speed: FAST
- Measurement range: 100 mΩ

From measurement to analysis

Applications in development evaluation and research

Ideal for use in R&D work requiring a wide range of measurement conditions and for evaluation of devices under conditions of actual use

The IM3536 enables measurement conditions to be varied over a wide range, for example to analyze a coil's resonance point while varying the frequency or to perform measurement while changing the measurement signal during evaluation of a sample that exhibits signal dependency.

Variable frequency
DC, 4 Hz to 8 MHz

Variable voltage
10 mV to 5 V
(V mode/CV mode)

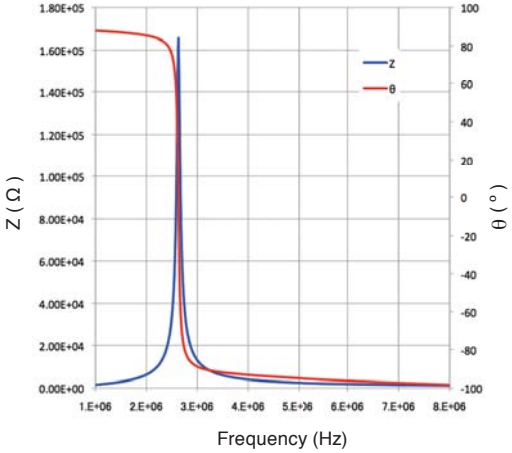
Variable current
10 μA to 100 mA
(CC mode)

Example of measurement while varying the frequency from 1 MHz to 8 MHz

The IM3536 ships standard with application software that can save measurement data as an Excel file while sweeping through a range of frequencies pre-configured on a computer.

For more information, see page 5.

Graph created using a spreadsheet



DC bias function: Measure under conditions simulating actual use or in accordance with industry standards

Internal DC bias (capacitor only)

A DC voltage can be superposed onto the measurement signal while measuring a capacitor.

The generated voltage can be varied from 0 V to 2.50 V DC (10 mV resolution).
(Low-Z high-accuracy mode: 0 V to 1 V)

External DC bias
(with support for L or C measurement, depending on the unit)

Requires a separate external DC bias power supply.

DC BIAS VOLTAGE UNIT 9268-10

Measurement frequency range: 40 Hz to 8 MHz
Maximum applied voltage: ±40 V DC

DC BIAS CURRENT UNIT 9269-10

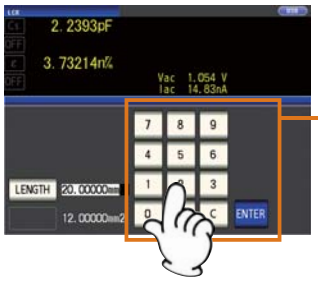
Measurement frequency range: 40 Hz to 2 MHz
Maximum applied current: 2 A DC

* An internal 300μH inductance is connected in parallel to the DUT.

Calculate conductivity and the dielectric constant

The conditions used to calculate conductivity and the dielectric constant can be set easily using the instrument's touch screen.

Enter the following parameters:
Conductor length (LENGTH)
Conductor cross-sectional area (AREA)

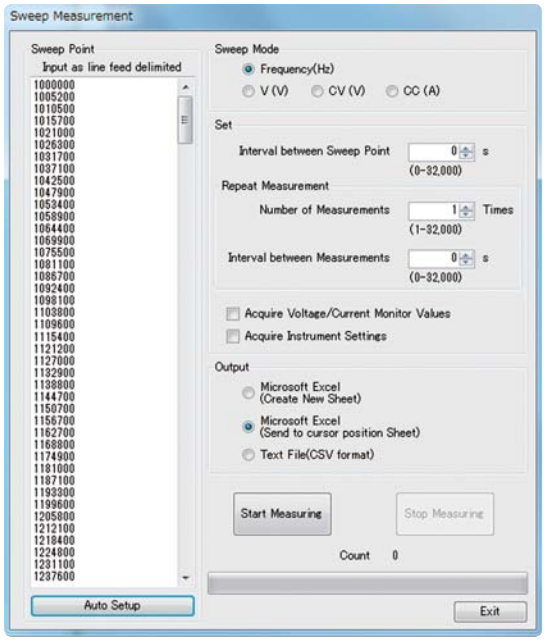


The instrument's touch keypad makes it easy to enter numbers.

Evaluate samples that exhibit signal dependence using free application software

The bundled application allows you to save measurement data from the LCR meter as a Microsoft Excel or text file (CSV format) using the instrument's USB, LAN, GP-IB, or RS-232C interface.

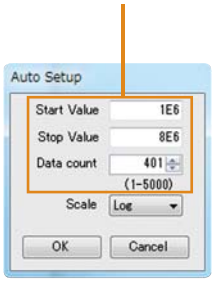
Standard accessory



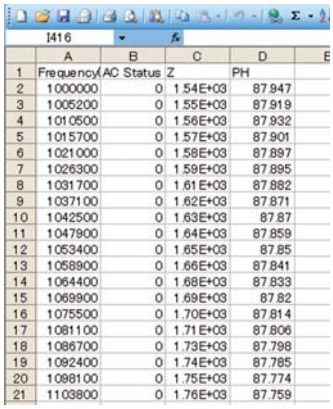
- Frequency characteristics (measurement while varying the frequency)
- Voltage characteristics (measurement while varying the voltage)
- Current characteristics (measurement while varying the current)
- Time interval measurement (measurement at a specified time interval)
- Capture measured value when the RETURN key is pressed (one-off measurement)

Simple, automatic configuration of sweep points

Sweep points are generated automatically once you set the start value, end value, and number of intermediate data points.



Data saved in CSV format



	A	B	C	D
1	Frequency	AC Status	Z	PH
2	1000000	0	1.54E+03	87.947
3	1005200	0	1.55E+03	87.919
4	1010500	0	1.56E+03	87.932
5	1015700	0	1.57E+03	87.901
6	1021000	0	1.58E+03	87.897
7	1026300	0	1.59E+03	87.895
8	1031700	0	1.61E+03	87.882
9	1037100	0	1.62E+03	87.871
10	1042500	0	1.63E+03	87.87
11	1047900	0	1.64E+03	87.859
12	1053400	0	1.65E+03	87.85
13	1058900	0	1.66E+03	87.841
14	1064400	0	1.68E+03	87.833
15	1069900	0	1.69E+03	87.82
16	1075500	0	1.70E+03	87.814
17	1081100	0	1.71E+03	87.806
18	1086700	0	1.73E+03	87.798
19	1092400	0	1.74E+03	87.785
20	1098100	0	1.75E+03	87.774
21	1103800	0	1.76E+03	87.759

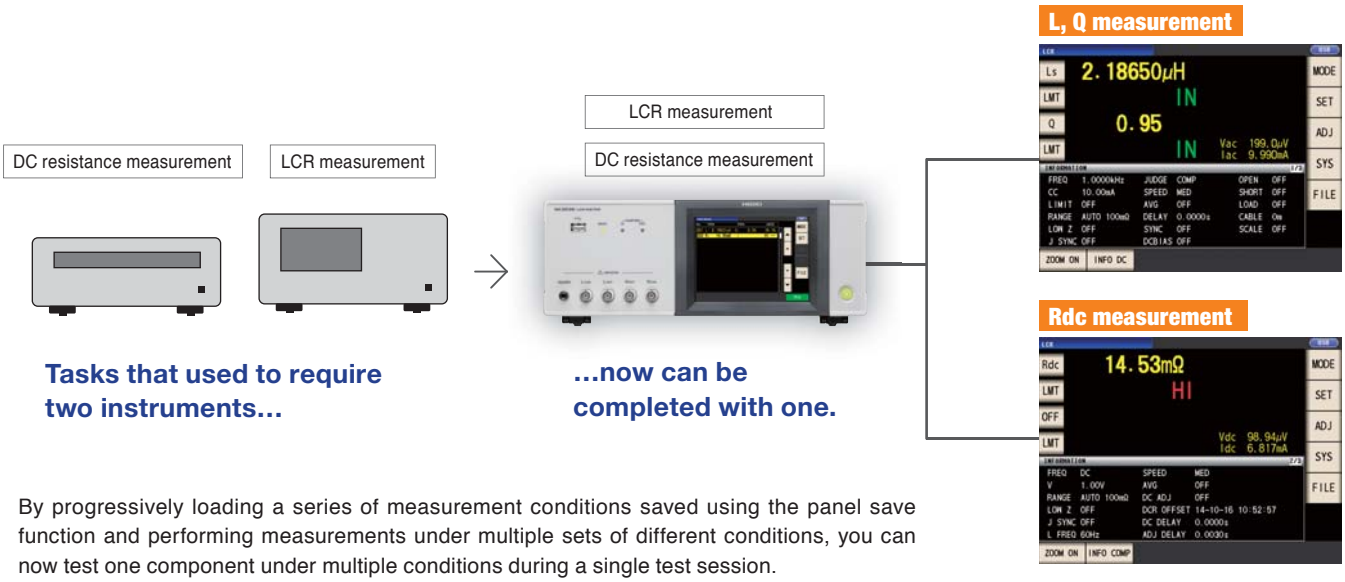
Simplifying the process of building production lines

Increase convenience and efficiency

Perform two jobs with one instrument to save space and speed up the process of building a system

Continuous measurement function

Suppose you wish to test power supply inductance L-Q at 1 kHz plus DC resistance (Rdc). The IM3536 steps up by delivering high-speed, continuous measurement of different conditions with a single instrument.



By progressively loading a series of measurement conditions saved using the panel save function and performing measurements under multiple sets of different conditions, you can now test one component under multiple conditions during a single test session.

Display saved panels as a list and load them quickly

Panel save and load functions

Save and load measurement conditions and compensation values.

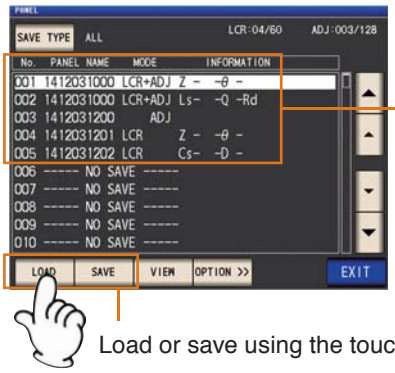
Ensure reliable application of settings during setup changes

Target A: Measurement conditions and judgment standards

- Measurement parameters: Ls, Q, Rdc
- Measurement frequency: 1 kHz
- Constant current: 1 mA

Target B: Measurement conditions and judgment standards

- Measurement parameters: Z, θ
- Measurement frequency: 1.5 kHz
- Constant current: 0.5 mA



Easy-to-view list display
Filename
Measurement parameter name

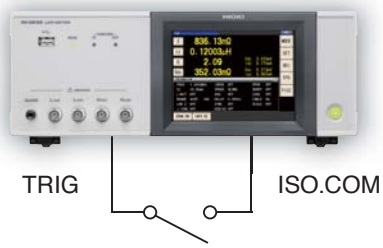
Load or save using the touch screen keys

Analyze the data you need on a computer quickly and easily

Memory function and USB flash drive support

Save 32000 measurement results, copy them to a USB flash drive, and load them onto a computer. You can then open the measurement data using a spreadsheet to analyze variations and manage test data.

Even if both hands are full



Select [External trigger] as the trigger setting and then control instrument operations such as measurement and saving of data from an external device such as a foot switch via the EXT. I/O terminal's TRIG signal.

Measure and save multiple test results

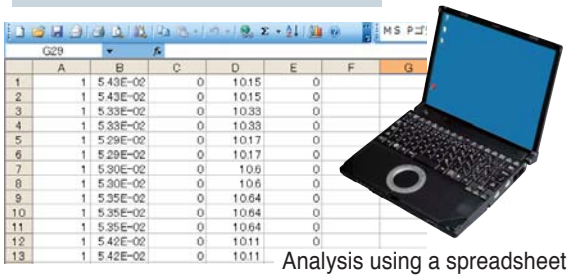
Measure the test target.

Save the results to the instrument's internal memory.

Number of tests: n

Copy the saved data to a USB flash drive.

Load the data onto a computer.



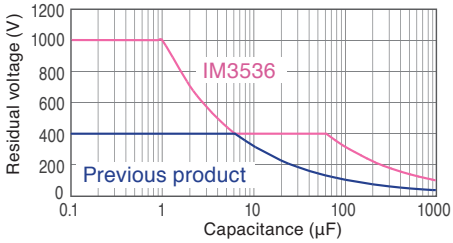
Analysis using a spreadsheet

Improved protective functionality to reduce maintenance downtime

Residual charge protection function

The IM3536 features an enhanced residual charge protection function that is designed to protect the instrument's internal circuitry from a capacitor discharge voltage in the event a charged capacitor is inadvertently connected to a measurement terminal.

Relationship between the capacitance from which LCR meters can be protected and residual voltage values



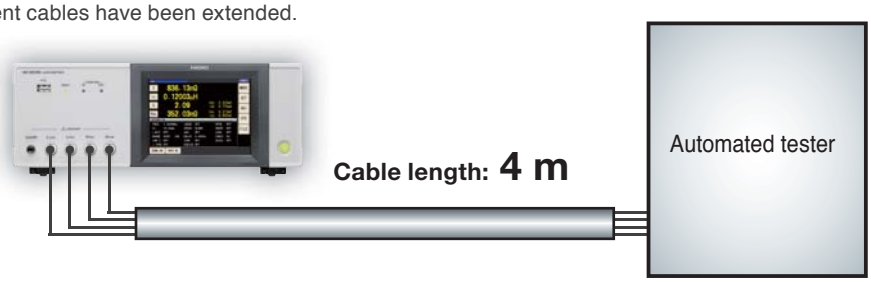
Functionality supporting more accurate measurement

Delivering reliability for production-line testing

Compensate for anticipated errors

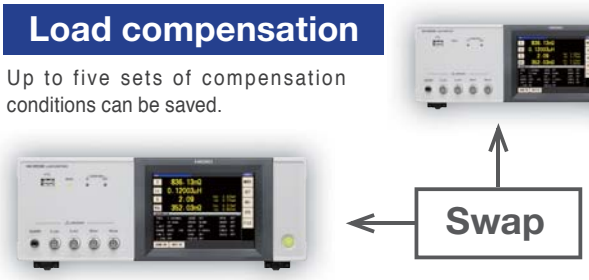
Cable length compensation

Select from cable length settings of 0 m, 1 m, 2 m, and 4 m, guaranteeing accuracy even when measurement cables have been extended.



Load compensation

Up to five sets of compensation conditions can be saved.



Measured values are compensated according to the reference sample, ensuring compatibility of measured values from multiple devices on production lines and when swapping out devices, for example when a unit needs to be calibrated.

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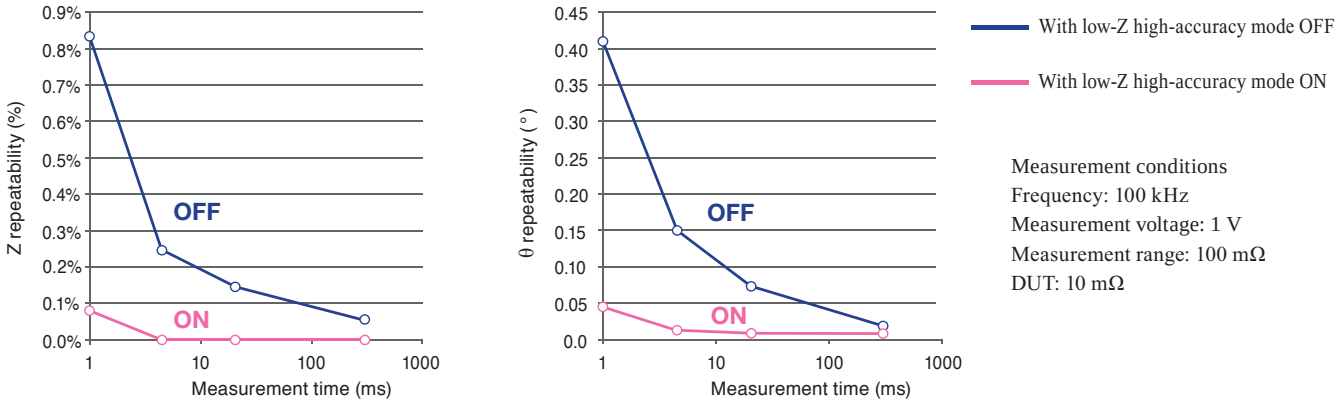
Low-Z high-accuracy mode for increasing the maximum applied current

When using low-Z high-accuracy mode, the output resistance changes to 10 Ω, allowing more current to flow to the sample being measured so that high-precision measurement is guaranteed.

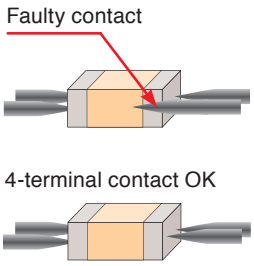


Measurement conditions
Frequency: 100 kHz
Measurement voltage: 1 V
Measurement range: 100 mΩ
DUT: 10 mΩ

Low-Z high-accuracy mode can be used with the 100 mΩ, 1 Ω, and 10 Ω ranges.
This mode is especially effective when performing low-inductance L measurement of power supplies and ESR measurement of aluminum electrolytic capacitors.

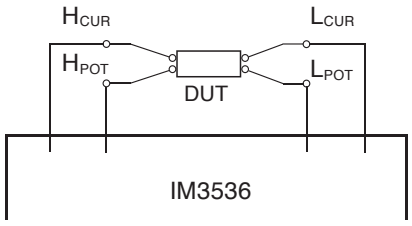
Contact check function

Detect faulty contact with the sample during four-terminal measurement.



The contact check function measures the contact resistance between L_{POT} and L_{CUR} and between H_{POT} and H_{CUR} and displays an error if the readings are greater than or equal to a preset threshold.

H_{CUR} terminal: Current generation terminal
H_{POT} terminal: HI voltage detection terminal
L_{POT} terminal: LO voltage detection terminal
L_{CUR} terminal: Current detection terminal

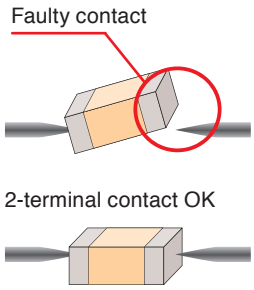


Set threshold values

Contact resistance
Approx. 1,000 Ω
Approx. 500 Ω
Approx. 100 Ω
Approx. 50 Ω
Approx. 20 Ω

Hi-Z reject function

Detect contact errors during two-terminal measurement.



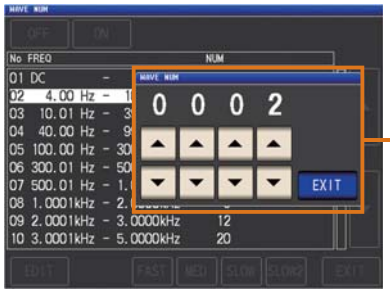
The Hi-Z reject function outputs an error if the measurement result exceeds a preset judgment standard. This capability enables the instrument to detect poor contact when performing measurement using a two-terminal fixture.

The judgment standard is calculated based on the measurement range and judgment reference value (valid setting range: 0% to 30,000%).

The instrument's touch keypad makes it easy to enter judgment reference values.

Improve measurement precision with the waveform averaging function

The IM3536's waveform averaging function lets you set the number of measured waveforms for each frequency band determined by the measurement speed setting (FAST, MED, SLOW, SLOW2).



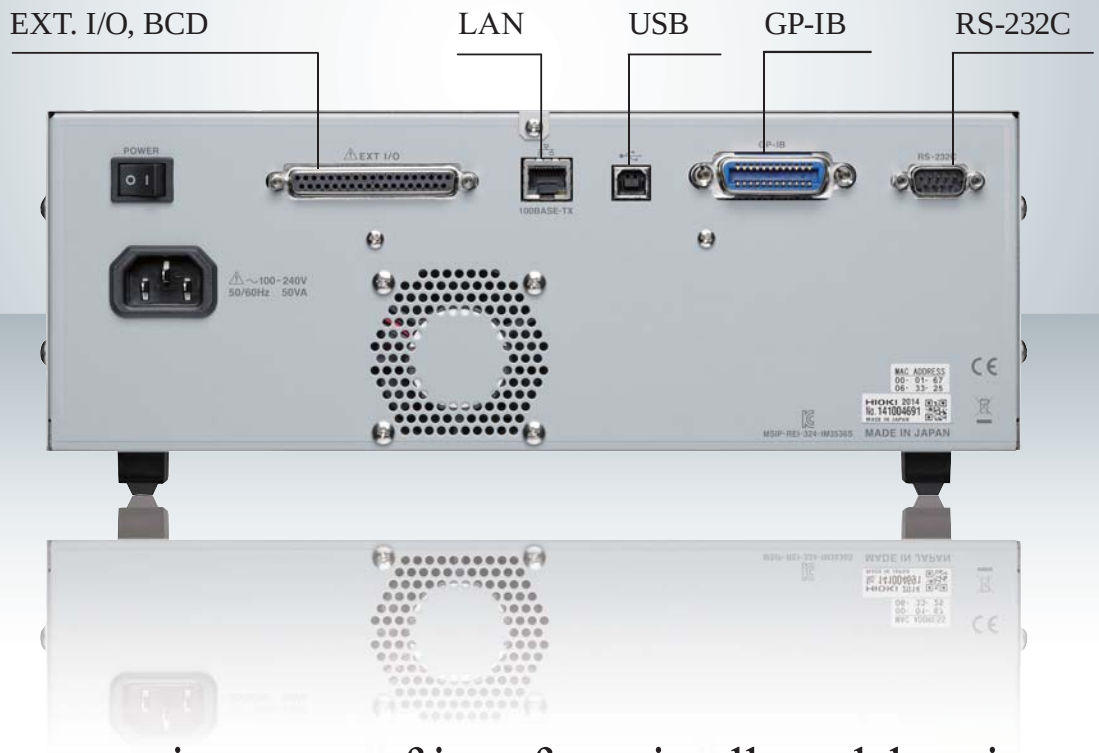
Number of waveforms → Many (increased measurement precision)

▲

Normal (FAST, MED, SLOW, SLOW2) number of waveforms

▼

Number of waveforms → Few (higher measurement speed)

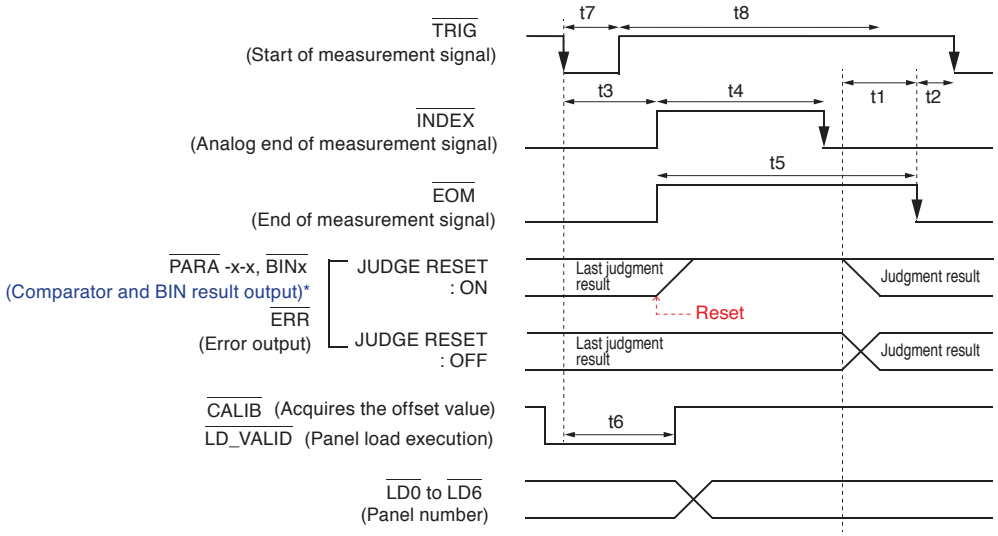


Access an extensive range of interfaces in all model variants

EXT. I/O

EXT. I/O allows you to output the measurement complete signal and judgment results signal and to control the instrument by inputting signals such as a measurement trigger signal. All signal lines are isolated from the instrument's measurement and control circuitry for maximum noise resistance.

■ Example of EXT I/O timing (LCR mode)



*: PARAx-HI, PARAx-IN, PARAx-LO, AND, BINx, OUT_OF_BINS

t1: From Comparator, BIN Judgement Result to EOM (LO): Setting value for delay time *1 (Settable range: 0.0000 s to 0.9999 s) ; 40 µs
t2: From EOM width (LO) to TRIG (LO): Minimum time from end of measurement to next trigger *2 ; 400 µs
t3: From TRIG (LO) to INDEX (HI): Time from trigger to circuit response *3 ; 400 µs
t4: INDEX width (HI): Analog measurement time (=Minimum chuck time), switching chuck with INDEX (LO) is possible *4 ; 1 ms
t5: EOM width (HI): Measurement time *4 ; 1.5 ms
t6: From TRIG width (LO) to LD-VALID (HI), CALIB (HI): Time to panel load execution and DC adjustment request signal detection: at least t3
t7: Trigger pulse width (LO time) ; At least 100 µs
t8: Trigger off (HI time) ; At least 100 µs

*1. There is an apporoximate error of 100 µs in the delay time entered for Judgement Result ↔ EOM for the setting value. t1 is the reference value for when the setting value is 0.0000 s.
*2. t2 is the reference value for when trigger input for during measurement is disabled.
*3. Additional time is required when loading panel numbers using the panel load function.
*4. Reference value for Measurement frequency: 1 kHz, Measurement speed: FAST, Range: HOLD

■ EXT. I/O signal list

● Input signals

$\overline{\text{TRIG}}$	: External trigger
$\overline{\text{LD0}}$ to $\overline{\text{LD6}}$	: Select panel number
$\overline{\text{LD\_VALID}}$	: Execute panel load
$\overline{\text{C1}}$ $\overline{\text{C2}}$	: During BCD output, toggle between high-order and low-order digits : During BCD output, toggle between the No. 1 and No. 3 parameters
$\overline{\text{CALIB}}$	: DC adjustment request

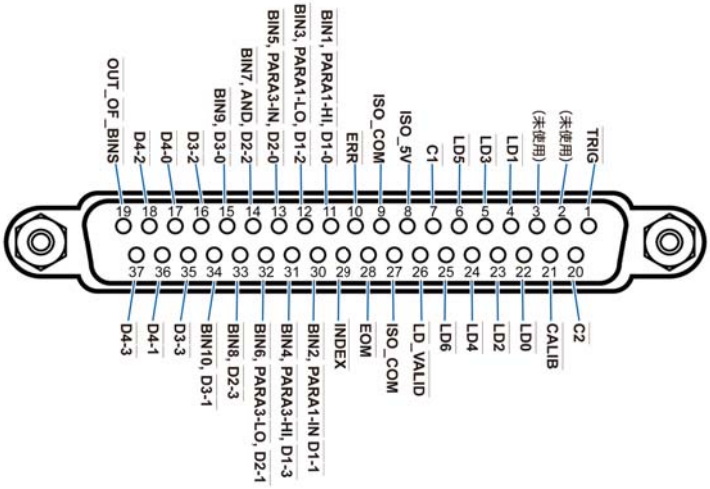
● Output signals

$\overline{\text{EOM}}$	: End of measurement
$\overline{\text{INDEX}}$	: End of capture
$\overline{\text{ERR}}$	: Measurement error output
ISO_5V	: Isolated 5V power output
ISO_COM	: Isolated common signal ground

● Output signals (common signal line)

$\overline{\text{PARAx-HI}}$, $\overline{\text{PARAx-IN}}$, $\overline{\text{PARAx-LO}}$ (x=1,3), $\overline{\text{AND}}$	: Comparator judgment result output
$\overline{\text{BIN1}}$ to $\overline{\text{BIN10}}$, $\overline{\text{OUT\_OF\_BINS}}$	: BIN judgment result output
$\overline{\text{D1-0}}$ to $\overline{\text{D1-3}}$ $\overline{\text{D2-0}}$ to $\overline{\text{D2-3}}$ $\overline{\text{D3-0}}$ to $\overline{\text{D3-3}}$ $\overline{\text{D4-0}}$ to $\overline{\text{D4-3}}$	: BCD output signal

■ IM3536 connector signal assignment (LCR mode operation)



Signal assignment is different during continuous measurement mode.
Signal logic is 0 V to 0.9 V for LO level and 5 V to 24 V for HI level.

■ Connectors

Connectors to use (unit side)	: 37-pin D- sub female connector with #4-40 inch screws
Compliant connectors	: DC-37P-ULR (solder type) and DCSP-JB37PR (pressure weld type) For information on where to obtain connectors, consult your nearest HIOKI distributor.

■ Electrical specifications

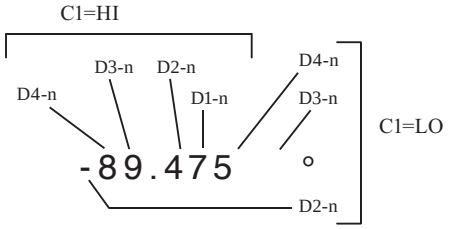
Input signals	Input type	Optocoupler-isolated, non-voltage contact inputs (current sink, active-low)
	Input asserted (on) voltage	0.9 V or less
	Input de-asserted (off) voltage	OPEN or 5 V to 24 V
	Input asserted (on) current	3 mA/ch
	Maximum applied voltage	30 V
Output signals	Output type	Isolated NPN open-collector outputs (current sink, active-low)
	Maximum load voltage	30V
	Maximum output current	50 mA/ch
	Residual voltage	1 V (10 mA), 1.5 V (50 mA)
Internally isolated power supply	Output voltage	4.5 V to 5.0 V
	Maximum output current	100 mA
	External power input	none

BCD

LCR mode output signals operate in two modes: judgment mode and BCD mode. In BCD mode, measured values for the No. 1 parameter and the No. 3 parameter are output using the BCD signals. *LCR mode only

The BCD high-order digit and low-order digit (polarity and ERR information) can be switched with the C1 signal.

$\overline{\text{C1}}$	$\overline{\text{D4}}$	$\overline{\text{D3}}$	$\overline{\text{D2}}$	$\overline{\text{D1}}$
HI (high-order)	No. 6 digit data	No. 5 digit data	No. 4 digit data	No. 3 digit data
LO (low-order)	No. 2 digit data	No. 1 digit data	Polarity	ERR



Interfaces

Control the instrument with communication commands from a computer via the USB, LAN, GP-IB, or RS-232C interfaces.

USB

Connector	USB Type B receptacle
Electrical specifications	USB2.0 (High Speed)

LAN

Connector	RJ-45 connector
Transmission method	10Base-T/100Base-T automatic detection
Protocol	TCP/IP

GP-IB

Connector	24-pin Centronics type connector
Standard	IEEE-488.1 1987
Reference standard	IEEE-488.2 1987
Terminator	LF, CR+LF

RS-232C

Connector	D-sub 9-pin connector
Flow control	Hardware/Software
Transmission speed	9600 bps, 19200 bps, 38400 bps, 57600 bps

Measurement parameters and measurement conditions

Measurement parameters	Z	Impedance	Rs	Equivalent series resistance (ESR)
	Y	Admittance	Rp	Equivalent parallel resistance
	θ	Phase angle	Ls	Equivalent series inductance
	X	Reactance	Lp	Equivalent parallel inductance
	G	Conductance	Cs	Equivalent series capacitance
	B	Susceptance	Cp	Equivalent parallel capacitance
	Q	Q-factor	D	Loss factor tan δ
	Rdc	DC resistance	σ	Conductivity
			ε	Permittivity
Display range	Z	0.00 m to 9.99999 GΩ	Rs	±(0.00 m to 9.99999 GΩ)
	Y	0.000 n to 9.99999 GS	Rp	±(0.00 m to 9.99999 GΩ)
	θ	±(0.000° to 180.000°)	Ls	±(0.00000 µ to 9.99999 GH)
	X	±(0.00 m to 9.99999 GΩ)	Lp	±(0.00000 µ to 9.99999 GH)
	G	±(0.000 n to 9.99999 GS)	Cs	±(0.0000 p to 9.99999 GF)
	B	±(0.000 n to 9.99999 GS)	Cp	±(0.0000 p to 9.99999 GF)
	Q	±(0.00 to 9999.99)	D	±(0.00000 to 9.99999)
	Rdc	±(0.00 m to 9.99999 GΩ)	Δ%	±(0.000% to 999.999%)
			σ	±(0.00000 to 999.999 G)
			ε	±(0.00000 to 999.999 G)
Measurable range	1 mΩ to 200 MΩ			
Output impedance	Normal mode: 100 Ω, Low impedance high accuracy mode: 10Ω			
Measurement frequency	Range	4 Hz to 8 MHz		
	Resolution	4.00 Hz to 999.99 Hz ..... 10 mHz steps 1.0000 kHz to 9.9999 kHz ..... 100 mHz steps 10.000 kHz to 99.999 kHz ..... 1 Hz steps 100.00 kHz to 999.99 kHz ..... 10 Hz steps 1.0000 MHz to 8.0000 MHz ..... 100 Hz steps		
	Accuracy	±0.01% of setting or less		
Measurement signal level [V mode] [CV mode]	Range	[Normal mode] 4 Hz to 1.0000 MHz: 10 mV to 5 V (maximum 50 mA) 1.0001 MHz to 8 MHz: 10 mV to 1 V (maximum 10mA) [Low impedance high accuracy mode] 4 Hz to 1.0000 MHz: 10 mV to 1 V (maximum 100 mA)		
	Resolution	10 mV to 1.000 V ..... 1 mV steps		
Measurement signal level [CC mode]	Range	[Normal mode] 4 Hz to 1.0000 MHz: 10 µA to 50 mA (maximum 5 V) 1.0001 MHz to 8 MHz: 10 µA to 1 mA (maximum 1 V) [Low impedance high accuracy mode] 4 Hz to 1.0000 MHz: 10 µA to 100 mA (maximum 1 V)		
	Resolution	10 µA steps		
Monitor function	Monitor voltage range: 0.000 V to 5.000 V Monitor current range: 0.000 mA to 100.0 mA			
DC resistance measurement	Measurement signal level: Fixed at 1 V			
DC bias measurement	Generating range: DC voltage 0 V to 2.50 V (10mV resolution) In low Z high accuracy mode: 0 V to 1 V (10 mV resolution)			

Measurement modes

Measurement modes	LCR mode: Measurement using a single set of conditions. Continuous measurement mode: Continuous measurement using previously saved conditions

LCR mode

Measurements	Bin measurement: 10 categories for 2 measurement parameters Judgment method: Set as absolute values, percentage, or deviation percentage
	Comparator measurement: Hi, IN, and Lo judgments for 2 parameters Judgment method: Set as absolute values, percentage, or deviation percentage
Display	Zoom display function: Enlarged display of measured values Number of display digits setting: Allows you to set the number of display digits for measured values for each measurement parameter. (Valid setting range: 3 to 6 digits)

Continuous measurement mode

Measurements	Performs continuous measurement using measurement conditions that have been saved using the panel save function. Measurement is started by an external trigger (any of the three types described below)
Maximum number of measurements	60

Speed and accuracy

Measurement speed	FAST/MED/SLOW/SLOW2
Averaging	Valid setting range: 1 to 256 (in steps of 1)
Basic accuracy	Z: ±0.05% rdg. θ: ±0.03° (representative value)
Guaranteed accuracy range	1 mΩ to 200 MΩ (impedance)
Guaranteed accuracy period	1 year
Warm-up time	60 minutes
Terminal structure	4-terminal structure

Supplementary functionality

Trigger function	Uses a specific signal to time the start of measurement. [Trigger types] Internal trigger: Automatically generates a trigger signal internally to repeat measurement. External trigger: Allows you to control the instrument's measurement operation by inputting a trigger signal from an external device (trigger sources: manual, communications commands, EXT. I/O). [Trigger delay] Sets the delay time from trigger input to measurement. Setting range: 0.0000 s to 9.9999 s [Trigger synchronous output] Outputs the measurement signal after trigger input and applies it to the sample during measurement only. Allows you to set a wait time until data is acquired. Setting range: 0.0000 s to 9.9999 s
Compensation function	[Open/short compensation] [Load compensation] Number of sets of compensation conditions: Up to 5 [Cable length compensation] Cable length settings: 0 m, 1 m, 2 m, 4 m [Correlation compensation] Compensation of display values based on user-input compensation coefficient
Contact check	[4-terminal contact check] Performs a contact (disconnection) check between H_{CUR} and H_{POT} and between L_{CUR} and L_{POT}. [High-Z reject function] Detection of OPEN state during 2-terminal measurement.

Recording and interface

Memory function	Measurement result items (maximum 32000 items) can be saved to the instrument. Memory can be read using communications commands or a USB flash drive.
Panel save and load functions	Measurement conditions: Up to 60 Compensation values: Up to 128
Interfaces	EXT. I/O(HANDLER) ,USB, USB flash drive, LAN, GP-IB, RS-232C
BCD output	[Output from EXT. I/O connector] Generates BCD output for the No.1 and No.3 parameter measured values. *Input and output signals are set to BCD mode (selection with judgment output).

Display and sound

Key lock function	Lock operation of the instrument using the touch screen. Unlock by entering a passcode.
Beep tone	Enable or disable for judgment results and key operation.
Display settings	LCD display on/off Off: The display turns off 10 sec. after the touch panel is last touched.
Display	5.7-inch color TFT with touch panel

Other

Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80% RH, non-condensing
Storage temperature and humidity	-10°C to 50°C (14°F to 122°F), 80% RH, non-condensing
Operating environment	Indoors, Pollution Degree 2, altitude up to 2000 m (6562-ft.)
Power supply and maximum rated power	100 V AC to 240 V AC (50/60 Hz), 50 VA
Dielectric strength	1.62 kV AC for 1 min. between power line and ground line
Standards compliance	EMC: EN 61326, EN 61000 Safety: EN 61010
Dimensions and Mass	Approx. 330 W × 119 H × 230 D mm (12.99 W × 4.69 H × 9.06 D in) , approx. 4.2 kg (148.1 oz.)
Accessories	Power cord ×1, Instruction manual ×1, LCR application disc (Communications user manual) ×1

Measurement accuracy

Measurement accuracy is calculated based on the following equation:

Measurement accuracy = Basic accuracy × C × D × E × F × G

[C: Level coefficient] V: Setting value (corresponds to when V mode) [V]

Measurement level	1 V
Coefficient (DC resistance measurement)	1

Measurement level	0.010 V to 0.999 V	1 V	1.001 V to 5 V
Coefficient (AC measurement)	1+0.2/V	1	1+0.2/V

[D: Measurement speed coefficient]

	Measurement speed	FAST	MED	SLOW	SLOW2
Coefficient	DC resistance measurement	4	3	2	1
	AC measurement	8	4	2	1

[E: Measurement cable length coefficient]

	0 m	1 m	2 m	4 m
Coefficient	1	1.5	2	3

Settable range for frequency
0 m: Up to 8 MHz, 1 m: 8 MHz, 2 m: Up to 2 MHz, 4 m: Up to 1MHz

[F: DC bias coefficient]

DC bias coefficient	OFF	ON
Coefficient	1	2

[G: Temperature coefficient]

Operating temperature	t [°C]
Coefficient	1+0.1×|t-23|

When the operating temperature (t) is 23°C±5°C, use a coefficient of 1.

Basic accuracy

Accuracy is calculated based on coefficients A and B from the basic accuracy chart shown below.

1 kΩ range or higher

$$\text{Basic accuracy} = \pm \left(A + B \times \left| \frac{10 \times Zx}{\text{Range}} - 1 \right| \right)$$

100 Ω range or lower

$$\text{Basic accuracy} = \pm \left(A + B \times \left| \frac{\text{Range}}{Zx} - 1 \right| \right)$$

Zx : Impedance of the measurement conductor
A: Noted in basic accuracy chart. (Upper value: Z accuracy [% rdg.]; lower value: θ accuracy [°])
B: Noted in basic accuracy chart. (Upper value: Z accuracy [% rdg.]; lower value: θ accuracy [°])

A is the accuracy of R when DC (± % rdg.)
B is the coefficient for the resistance of the sample

Free software for calculating accuracy

(LCR application disc)

Automatically calculate measurement accuracy based on user-entered measurement conditions and measurement results. Free download from the Hioki website.

Conditions Temperature and humidity ranges: 23°C ± 5°C, 80% RH or less (no condensation), at least 60 minutes after power ON, after performing open and short compensation

Basic accuracy

Range	Guaranteed accuracy rang	DC	4Hz to 99.99Hz	100Hz to 999.99Hz	1kHz to 10kHz	10.001kHz to 100kHz	100.01kHz to 1MHz	1.0001MHz to 8MHz
100MΩ	8MΩ to 200MΩ	A=1 B=1	A=6 B=5 A=5 B=3	A=3 B=2 A=2 B=2	A=3 B=2 A=2 B=2			
10MΩ	800kΩ to 10MΩ	A=0.5 B=0.3	A=0.8 B=1 A=0.8 B=0.5	A=0.5 B=0.3 A=0.4 B=0.2	A=0.5 B=0.3 A=0.4 B=0.2	A=2 B=1 A=2 B=1		
1MΩ	80kΩ to 1MΩ	A=0.2 B=0.1	A=0.4 B=0.08 A=0.3 B=0.08	A=0.3 B=0.05 A=0.2 B=0.02	A=0.3 B=0.05 A=0.2 B=0.02	A=0.5 B=0.1 A=0.6 B=0.1	A=3 B=0.5 A=3 B=0.5	
100kΩ	8kΩ to 100kΩ	A=0.1 B=0.01	A=0.3 B=0.03 A=0.2 B=0.02	A=0.2 B=0.03 A=0.1 B=0.02	A=0.2 B=0.03 A=0.1 B=0.02	A=0.25 B=0.04 A=0.2 B=0.02	A=1 B=0.3 A=1 B=0.3	A=2 B=0.5 A=2 B=0.3
10kΩ	800Ω to 10kΩ	A=0.1 B=0.01	A=0.3 B=0.03 A=0.3 B=0.01	A=0.2 B=0.02 A=0.1 B=0.02	A=0.05 B=0.02 A=0.03 B=0.02	A=0.3 B=0.02 A=0.2 B=0.02	A=0.5 B=0.05 A=0.5 B=0.05	A=2 B=0.5 A=1.5 B=0.3
1kΩ	80Ω to 1kΩ	A=0.1 B=0.01	A=0.3 B=0.02 A=0.2 B=0.02	A=0.2 B=0.02 A=0.1 B=0.02	A=0.2 B=0.02 A=0.1 B=0.02	A=0.2 B=0.02 A=0.15 B=0.02	A=0.4 B=0.02 A=0.4 B=0.02	A=1.5 B=0.2 A=1.5 B=0.2
100Ω	8Ω to 100Ω	A=0.1 B=0.02	A=0.3 B=0.02 A=0.2 B=0.01	A=0.2 B=0.02 A=0.15 B=0.01	A=0.2 B=0.02 A=0.1 B=0.01	A=0.2 B=0.02 A=0.15 B=0.02	A=0.5 B=0.03 A=0.5 B=0.03	A=1.5 B=0.2 A=1.5 B=0.2
10Ω	800mΩ to 10Ω	A=0.2 B=0.15	A=0.5 B=0.1 A=0.3 B=0.1	A=0.4 B=0.05 A=0.3 B=0.03	A=0.4 B=0.05 A=0.3 B=0.03	A=0.4 B=0.05 A=0.3 B=0.03	A=0.8 B=0.1 A=0.5 B=0.05	A=2 B=1.5 A=2 B=1
1Ω	80mΩ to 1Ω	A=0.3 B=0.3	A=1.5 B=1 A=0.8 B=0.5	A=1 B=0.3 A=0.5 B=0.2	A=1 B=0.3 A=0.5 B=0.2	A=1 B=0.3 A=0.5 B=0.2	A=1.5 B=1 A=0.7 B=0.5	A=3 B=3 A=3 B=2
100mΩ	1mΩ to 100mΩ	A=1 B=1	A=8 B=8 A=5 B=4	A=5 B=4 A=3 B=2	A=3 B=2 A=2 B=1.5	A=2 B=2 A=2 B=1.5	A=4 B=3 A=3 B=4	

● Method of determining basic accuracy

- Calculate the basic accuracy from the sample impedance, measurement range, and measurement frequency and the corresponding basic accuracy A and coefficient B from the table above.
- The calculation expression to use differs for each of the 1 kΩ range and above and 100 Ω range and below.
- For C and L, obtain basic accuracy A and coefficient B by determining the measurement range from the actual measurement value of impedance or the approximate impedance value calculated with the following expression.

$$Zx\ (\Omega) \approx \omega L\ (H)\ \ (\theta \approx 90°)$$
$$\approx \frac{1}{\omega C\ (F)}\ \ (\theta \approx -90°)$$
$$\approx R\ (\Omega)\ (\theta \approx 0°)$$

(ω: 2 x π x Measurement frequency [Hz])

● Calculation example

Impedance Zx of sample: 500 Ω (actual measurement value)
Measurement conditions: When frequency 10 kHz and range 1 kΩ

Insert coefficient A = 0.2 and coefficient B = 0.02 for the Z basic accuracy from the table above into the expression.

$$\text{Z basic accuracy} = 0.2 + 0.02 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.28\ (\pm\ \%\text{rdg.})$$

Similarly, insert coefficient A = 0.1 and coefficient B = 0.02 for the θ basic accuracy, as follows:

$$\theta\ \text{basic accuracy} = 0.1 + 0.02 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.18\ (\pm\ \text{deg.})$$

Guaranteed accuracy measurement level range

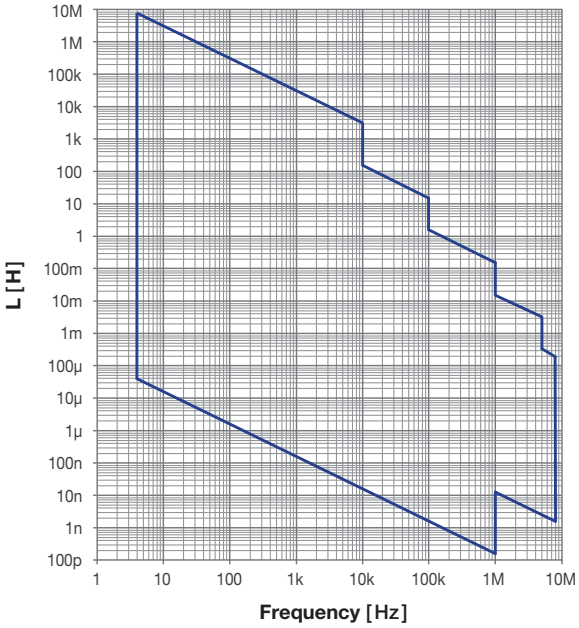
The range of measurement levels for which accuracy is guaranteed varies with the setting conditions.

Range	Sample's impedance	DC	4 Hz to 99.99 Hz	100 Hz to 999.99 Hz	1 kHz to 10 kHz	10.001 Hz to 100 kHz	100.01 kHz to 1 MHz	1.0001 MHz to 5 MHz	5.0001 MHz to 8 MHz
100 MΩ	8 MΩ to 200 MΩ	1V (fixed)	0.101 V to 5 V						
10 MΩ	10 MΩ to 100 MΩ								
	800 kΩ to 10 MΩ					0.501 V to 5 V			
1 MΩ	1 MΩ to 10 MΩ								
	80 kΩ to 1 MΩ		0.050 V to 5 V			0.101 V to 5 V	0.501 V to 5 V		
100 kΩ	100 kΩ to 1 MΩ								
	8 kΩ to 100 kΩ							0.101 V to 1 V	
10 kΩ	10 kΩ to 100 kΩ		0.010 V to 5 V				0.050 V to 5 V		
	800 Ω to 10 kΩ							0.050 V to 1 V	0.101 V to 1 V
1 kΩ	1 kΩ to 10 kΩ								
	80 Ω to 1 kΩ								
100 Ω	8 Ω to 100 Ω								
10 Ω	800 mΩ to 10 Ω		0.050 V to 5 V					0.101 V to 1 V	
1 Ω	80 mΩ to 1 Ω						0.101 V to 5 V	0.501 V to 1 V	
100 mΩ	1 mΩ to 100 mΩ		0.101 V to 5 V				0.501 V to 5 V		

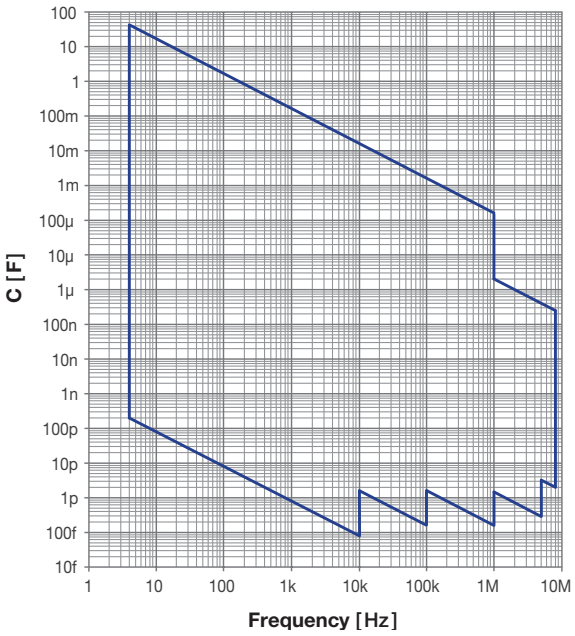
The guaranteed accuracy range during DC bias operation is 10 mΩ or greater. The accuracy for DC resistance (Rdc) measurement is guaranteed only when offset values are acquired. The guaranteed accuracy range varies with the sample's impedance.

Measurable ranges

L measurement range



C measurement range



Note: Test fixtures are not supplied with the instrument.
Select optional test fixtures or probes when ordering.

LCR METER IM3536

Standard accessories

- Power Cord
- Instruction manual
- LCR Application Disc (Communication commands user manual)

Free software for calculating accuracy

(LCR application disc)

Automatically calculate measurement accuracy based on user-entered measurement conditions and measurement results. Free download from the Hioki website.

Options

RS-232C CABLE 9637

For the PC, 9pin - 9pin, cross, 1.8m (5.91 ft) length

GP-IB CONNECTOR CABLE 9151-02

2 m (6.56 ft) length

DC BIAS VOLTAGE UNIT 9268-10

Measurement frequency range: 40 Hz to 8 MHz
Maximum applied voltage: ±40 V DC

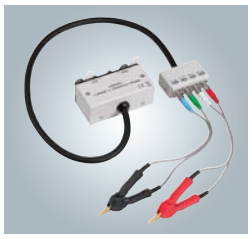
DC BIAS CURRENT UNIT 9269-10

Measurement frequency range: 40 Hz to 2 MHz
Maximum applied current: 2 A DC

* An internal 300µH inductance is connected in parallel to the DUT.

Probes and Test Fixtures for Lead Components

4-TERMINAL PROBE L2000



Measurable range: DC to 8 MHz
Measurable terminal diameter:
0.3 mm (0.01 in) to 5 mm (0.2 in)
Cord length: 1 m (3.28 ft)

4-TERMINAL PROBE 9140-10

Measurable range: DC to 200 kHz
Measurable terminal diameter:
0.3 mm (0.01 in) to 5 mm (0.2 in)
Cord length: 1 m (3.28 ft)

TEST FIXTURE 9262

Measurable range: DC to 8 MHz
Measurable terminal diameter:
0.3 mm (0.01 in) to 2 mm (0.08 in)
Direct connection type

TEST FIXTURE 9261-10

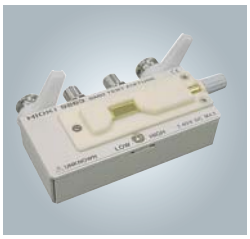
Measurable range: DC to 8 MHz
Measurable terminal diameter:
0.3 mm (0.01 in) to 1.5 mm (0.06 in)
Cord length: 1 m (3.28 ft)

Test Fixtures for SMDs

4-TERMINAL PROBE 9500-10

Measurable range: DC to 200 kHz
Measurable terminal diameter:
0.3 mm (0.01 in) to 2 mm (0.08 in)
Cord length: 1 m (3.28 ft)

SMD TEST FIXTURE 9263



Measurable range: DC to 8 MHz
For SMD with electrodes on side
Measurable sample sizes:
0805 to 2220 (EIA)
2012 to 5750 (JIS)
Direct connection type

SMD TEST FIXTURE 9699

Measurable range: DC to 120 MHz
For SMD with electrodes on bottom
Measurable sample sizes:
0608 to 0805 (EIA)
1608 to 2012 (JIS)
Direct connection type

SMD TEST FIXTURE 9677

Measurable range: DC to 120 MHz
For SMD with electrodes on side
Measurable sample sizes:
0402 to 0603 (EIA)
1005 to 1608 (JIS)
Direct connection type

SMD TEST FIXTURE IM9110*

NEW

Measurable range: DC to 1 MHz
For SMD with electrodes on side
Measurable sample sizes:
008004 (EIA), 0201 (JIS)
Please contact Hioki for information about other sizes.
Direct connection type

SMD TEST FIXTURE IM9100*

Measurable range: DC to 8 MHz
For SMD with electrodes on bottom
Measurable sample sizes:
01005 to 0402 (EIA)
0402 to 1005 (JIS)
Direct connection type

PINCHER PROBE L2001*

Measurable range: DC to 8 MHz
Replaceable tips
Measurable sample sizes:
IM9901: 0603 to 2220 (EIA)
1608 to 5750 (JIS)
IM9902: 0201 to 2220 (EIA)
0603 to 5750 (JIS)
Cord length: Approx. 730 mm (28.74 in)
*Ships standard with one set of IM9901

Options for L2001
Replaceable contact tips

CONTACT TIPS IM9901

CONTACT TIPS IM9902

*For more information, please see individual product catalogs.

LCR Meter Series Full Product Lineup

Model (Order Code)	Measurement speed (Basic value)	Measurement frequency range / Applications and measurement object
LCR METER IM3536	 1ms	DC — 4Hz — 8MHz General-purpose LCR meter up to 8 MHz Measure electronic components such as capacitors and inductors
LCR METER IM3533	 2ms	DC — 1mHz — 200kHz Capable of special measurements of transformers including turn ratio and mutual inductance IM3533-01: High-end model of the IM3523 and IM3533 with sweep measurement
	IM3533 **IM3533-01**	
LCR METER IM3523	 2ms	DC — 40Hz — 200kHz Extremely cost-effective model suitable for production lines including integration into automated machinery For C-D and ESR measurement of electrolytic capacitors and L-Q and Rdc measurement of inductors
LCR HiTESTER 3511-50	 5ms	120Hz — 1kHz Compact LCR meter with single function For production lines of aluminum electrolytic capacitors
C METER 3506-10	 1.5ms	1kHz — 1MHz C meter for low-capacity capacitors For production of MLCC and film capacitors
C HiTESTER 3504	 2ms	120Hz — 1kHz C meter for large-capacity MLCCs For sorting machines of large-capacity MLCCs (3504-50/60) and taping machines (3504-40)
	3504-40 **3504-50** **3504-60**	
IMPEDANCE ANALYZER IM7580A	 0.5ms	1MHz — 300MHz High-frequency measurement up to 300 MHz Ideal for production lines of ferrite beads and inductors
IMPEDANCE ANALYZER IM3570	 0.5ms	DC — 4Hz — 5MHz LCR meter integrated with impedance analyzer Measure the frequency characteristics of piezo-electric devices, functional polymer capacitors, and power inductors
CHEMICAL IMPEDANCE ANALYZER IM3590	 2ms	DC — 1mHz — 200kHz Supports LCR impedance measurements for Cole-Cole plots and equivalent-circuit analyses Measure electrochemical components, materials, batteries, and electric double-layer capacitors (EDLCs)

HIOKI
HIOKI E.E. CORPORATION

HIOKI

LCR METER IM3523, IM3533

From Production Lines to Research and Development

A New Series of LCR Meters to Meet Your Applications

LCR METER Models IM3523, IM3533, and IM3533-01 are highly cost-effective testers that provide greater performance and better functionality than previous HIOKI models, such as a high basic accuracy of ±0.05%, a wide measurement frequency from 1 mHz (40 Hz for the IM3523) to 200 kHz, high-speed measurement of up to 2 ms, highly reliable measurement using the contact-check function, and measurement of turn ratio and mutual inductance. Select the best model according to your application, from production lines to research and development.

CE

For Production Lines
The Perfect Impedance Analyzer

Product Lineup


IM3523


IM3533,IM3533-01

*1 The check and double-check marks in the "Usage" rows indicate the recommendation level. The double-check mark represents a highly recommended application.

Model		LCR METER IM3523	LCR METER IM3533	LCR METER IM3533-01
Usage *1	Research and development	✔	✔	✔✔
	Transformer and coil production	✔	✔✔	✔✔
	LCR component production	✔✔	✔✔	✔✔
Measurement items	Basic measurement items	Z (impedance [Ω]) Y (admittance [S]) θ (phase angle [°]) Rs (equivalent series resistance = ESR [Ω]) Rp (parallel resistance [Ω]) X (reluctance [Ω]) G (conductance [S]) B (susceptance [S]) Ls (series inductance [H]) Lp (parallel inductance [H]) Cs (series capacitance [F]) Cp (parallel capacitance [F]) Q (Q factor (Q = 1/D)) D (loss coefficient = tanδ)		
	Rdc (direct current resistance)	✓	✓ (with temperature compensation function)	
	Transformer measurement	–	**N (turn radio)** **M (mutual inductance)** **ΔL (inductance difference)**	
	Temperature T	–	✓	
Basic accuracy		±0.05%rdg.		
Measurement frequency		40 Hz to 200 kHz	**1 mHz** to 200 kHz	
Measurement voltage		5 mV to 5 V	5 mV to 5 V/**2.5 V** *2	
Measurement time		2 ms	2 ms	
Comparator		2 items: HI/IN/LO, ABS/%/Δ%		
BIN measurement		Main item: 10 categories Sub-item: 1 category	**2 items: 10 categories**	
Cable length		0 m/1 m	0 m/1 m	0 m/1 m/**2 m/4 m**
Contact check		4-terminal contact check (threshold change) / Hi-Z reject		
Internal DC bias measurement		–	**–5 V to 5 V**	
Sweep measurement		–	–	**Frequency 2 to 801 points**
Display		Monochrome LCD	**Color TFT 5.7-inch LCD touch panel**	
Interface	EXT I/O, USB	✓	✓	
	USB flash drive	–	✓	
	RS-232C, GP-IB, LAN	Option (select one)		

Highlighted functions in bold-type in the IM3533 and IM3533-01 section are more advanced than those of the IM3523.

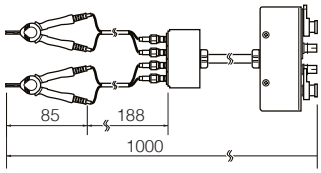
*2 2.5 V in the low impedance high accuracy mode

For Lead Components and Surface Mounted Devices (SMDs)

Probes & Test Fixtures

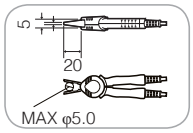
Please use the probes specified below. All probes are constructed with a 1.5D-2V coaxial cable.

Probes and Test Fixtures for Lead Components



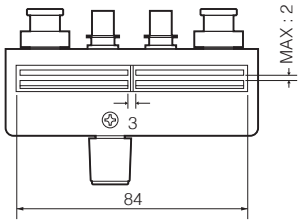
FOUR-TERMINAL PROBE L2000

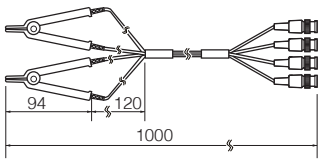
Cable length 1 m (3.28 ft), DC to 8 MHz, impedance characteristics of 50 Ω, 4-terminal pair configuration, measurable conductor diameter: ø0.3 mm (0.01 in) to ø5 mm (0.20 in) max.



TEST FIXTURE 9262

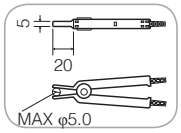
Direct connection type, DC to 8 MHz, measurable conductor diameter: ø0.3 mm (0.01 in) to ø2 mm (0.08 in) max.

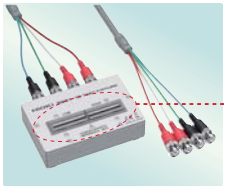




FOUR-TERMINAL PROBE 9140-10

Cable length 1 m (3.28 ft), DC to 200 kHz, impedance characteristics of 50 Ω, 4-terminal pair configuration, measurable conductor diameter: ø0.3 mm (0.01 in) to ø5 mm (0.20 in) max.





TEST FIXTURE 9261-10

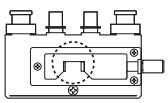
Cable length 1 m (3.28 ft), DC to 8 MHz, impedance characteristics of 50 Ω, 4-terminal pair configuration, measurable conductor diameter: ø0.3 mm (0.01 in) to ø1.5 mm (0.06 in) max.

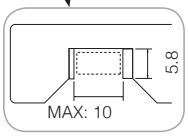
Test Fixtures for SMDs

✓ : Measurable
✓*: May not be measurable depending on the shape.

Applicable SMD size

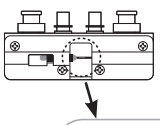
SMD type JIS CODE	SMD type EIA CODE	Length L (mm)	Width W (mm)	9263	9677	9699	L2001	IM9100	IM9110
0201	008004	0.25	0.125						✓
0402	01005	0.40	0.20					✓	
0603	0201	0.60	0.30		✓*		✓	✓	
1005	0402	1.00	0.50		✓		✓	✓	
1608	0603	1.60	0.80	✓*	✓	✓	✓		
2012	0805	2.00	1.25	✓	✓*	✓	✓		
3216	1206	3.20	1.60	✓		✓*	✓		
3225	1210	3.20	2.50	✓		✓*	✓		
4532	1812	4.50	3.20	✓			✓		
5750	2220	5.70	5.00	✓			✓		

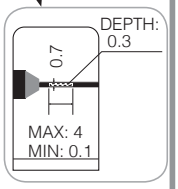




SMD TEST FIXTURE 9263

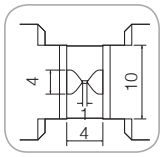
Direct connection type, DC to 8 MHz, Test sample dimensions:1 mm (0.04 in) to 10 mm (0.39 in)





SMD TEST FIXTURE 9677

Direct connection type, Electrodes on side for SMD, DC to 120 MHz, Test sample dimensions: 3.5 mm ±0.5 mm (0.14 in ±0.02 in)



SMD TEST FIXTURE 9699

Direct connection type, Electrodes on bottom for SMD, DC to 120 MHz, Test sample dimensions: 1.0 mm (0.04 in) to 4.0 mm (0.16 in) wide, maximum 1.5 mm (0.06 in) high

SMD TEST FIXTURE IM9100

Measurable range: DC to 8 MHz, For SMD with electrodes on bottom, Measurable sample sizes: 01005 to 0402 (EIA) 0402 to 1005 (JIS) , Direct connection type

SMD TEST FIXTURE IM9110

Measurable range: DC to 1 MHz, For SMD with electrodes on side , Measurable sample sizes: 008004 (EIA), 0201 (JIS), Please contact Hioki for information about other sizes, Direct connection type

PINCHER PROBE L2001

Cable length 730 mm (2.40 ft), DC to 8 MHz, characteristic impedance of 50 Ω, tip electrodes featuring 2-terminal design (4-terminal pair design between electrode and measurement unit), tip electrode spacing of 0.3 to approx. 6 mm (0.01 to approx. 0.24 in)
*Ships standard with one set of IM9901

Options for L2001
Replaceable contact tips

CONTACT TIPS IM9901
Compatible chip sizes: 1608 to 5750 (JIS)

CONTACT TIPS IM9902
Compatible chip sizes: 0603 to 5750 (JIS)

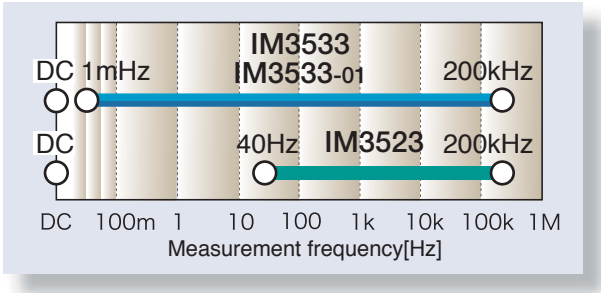
Features
High-Speed, High-Accuracy, and Easy-to-Use

Basic Performance

IM3523 IM3533 IM3533-01

● Wide measurement frequency range

The measurement frequency can be freely set to DC or any value in the 1 mHz (40 Hz for the IM3523) to 200 kHz range at high resolution (five-digit resolution [1 mHz resolution for less than 100 Hz]). This makes it possible to measure the resonant frequency and perform measurement and evaluation under conditions close to actual conditions.



● Wide setting range for measurement voltage and current

In addition to normal open-loop signal generation, these models enable voltage/current dependent measurement in constant voltage/current modes.
The signal levels can be set over wide ranges from 5 mV to 5 V and from 10 µA to 50 mA. (The setting range of measurement signal levels varies depending on the frequency and measurement mode.)

● Basic accuracy ±0.05%

The basic accuracy of Z is ±0.05%. This fits a wide array of applications ranging from the inspection of parts to research and development measurements.

● Accuracy guaranteed at measurement cables of up to 4 meters

Four-terminal pair configuration reduces the influence of measurement cables and accuracy is guaranteed at the measurement cable lengths of up to 4 meters. This simplifies the wiring of automated machinery. With models IM3523 and IM3533, accuracy is guaranteed at measurement cable lengths of up to 4 meters with the cable length correction set to 1 meter. (The frequency range for which accuracy is guaranteed varies depending on the cable length.)

● 15 parameters can be measured

The following parameters can be measured and selected parameters can be imported to a computer: Z, Y, θ, Rs (ESR), Rp, Rdc (DC resistance), X, G, B, Ls, Lp, Cs, Cp, D (tanδ), and Q.

● Fastest measurement time 2 ms

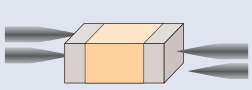
The fastest measurement time of 2 ms at a measurement frequency of 1 kHz and the measurement speed FAST improves the inspection throughput used in automated machinery.

Functions and Features for LCR Measurements on Production Lines

IM3523 IM3533 IM3533-01

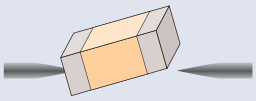
● Contact check function incorporated

The contact check function for four-terminal measurement and the Hi-Z reject function for two-terminal measurement ensure the measurement electrode is in contact with the measurement object during measurement.



Four-terminal contact check

High contact resistance is determined to be an error. The threshold of contact resistance can be changed.



Hi-Z reject function

Significantly high impedance is determined to be a Hi-Z error.

● Continuous measurement under different measurement conditions

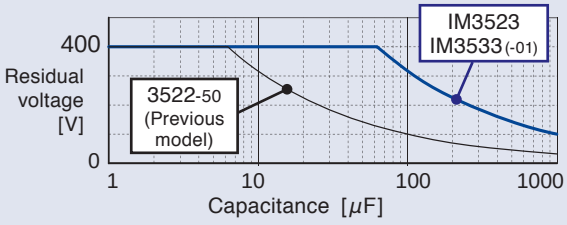
Different measurement items can be measured continuously under different measurement conditions (frequency, level, and mode).

● Protection against charged capacitors*

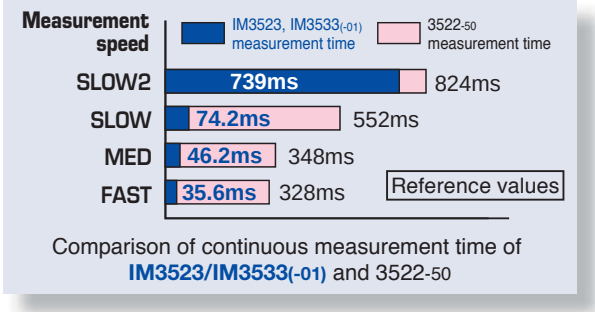
To address situations when a charged capacitor is incorrectly connected to the measurement terminal, the protection function* has been improved to 10 times of the amount of residual charge of the previous model 3522-50.

* This function does not guarantee the measurement of charged capacitors. Be sure to discharge the capacitor before measuring it.

Relationship between capacitance and residual voltage against which the LCR meter can be protected



Advantage #1



Comparison of continuous measurement time of **IM3523/IM3533(-01)** and 3522-50

With continuous measurement under varying measurement conditions such as C-D + ESR measurement of capacitors, the total measurement time has been shortened significantly from the previous HIOKI model 3522-50. In addition to the reduction of the time required for individual measurements, the time required to change ranges such as a frequency range has been reduced significantly.

Features of LCR Meter Model IM3523
Integration into Production Lines and Automated Machinery

● Easy setup using a numeric keypad on a simple, easy-to-read monochrome LCD

IM3523

A simple user interface is provided with a high-contrast graphic LCD display, function keys, and numeric keypad. For numeric value settings such as the comparator setting, the numeric keypad can be used to enter numbers easily and quickly.

● General specifications of the IM3523

Measure-ment items	Basic measure-ment items	Z,Y,θ,Rs,Rp,X,G,B,Ls,Lp,Cs,Cp,Q,D
	Rdc	✓
	Transformer measurement	–
	Temperature T	–
Basic accuracy		±0.05%rdg.
Measurement frequency		40 Hz to 200 kHz
Measurement voltage		5 mV to 5 V
Measurement time		2 ms
Comparator		2 items: HI/IN/LO, ABS/%/Δ%
BIN measurement		10 main classifications/1 sub-classification
Cable length		0 m/1 m
Contact check		4-terminal contact check (threshold change) / Hi-Z reject
Internal DC bias measurement		–
Sweep measurement		–
Display		Monochrome LCD
Interface	EXT I/O, USB	✓
	USB flash drive	–
	RS-232C, GP-IB, LAN	Option (select one)

● Compact size ideal for integration into production lines and automated machinery

IM3523

The size is the same as that of compact measuring instruments for bench use - smaller than the previous model - fitting easily into automated machinery and production processes.

● Comparator

IM3523

In LCR mode, the meter allows for Hi, IN, and Lo judgments of two types from the measurement items. For the judgment method, % setting and Δ% setting are available in addition to absolute value setting. If continuous measurement is used, judgments which span over multiple measurement conditions and measurement items are possible.

● BIN measurement

IM3523

With the IM3523, the main item can be classified into 10 categories and out of range, and the sub-item into 1 category and out of range.

Functions and Features Suitable for Measurements and Inspection on Production Lines

IM3523 IM3533 IM3533-01

● Auto-range control function

When a measurement object crosses over multiple ranges, measurement can be tailored by controlling the moving-range of the auto-range. Measurement can be performed by taking advantage of both the wide measurement range of the auto-range and the reduction of the measurement time achieved by completing a search only in the specified range.

● Individual items of two continuous measurements can be output from EXT I/O

For two types of continuous measurement judgment items, individual judgment results can be captured from EXT/IO. This makes it possible to perform more detailed inspections and sorting.

Functions and Features to Reduce the Time Needed to Prepare for Measurement

IM3523 IM3533 IM3533-01

● Limit-linked range setting and range-linked setting function

The optimal range is automatically set according to the set reference value or range. In addition, the measurement conditions can be automatically set to be optimized according to the change in the range, reducing the preparation time.

● OPEN/SHORT compensation area setting function

When the measurement frequency range is limited, OPEN/SHORT compensation can be executed by limiting the compensation area to the actual frequency range being measured. The time required to execute OPEN/SHORT compensation is then significantly reduced compared to the time needed to compensate the entire range.

Features of LCR Meter Model IM3533

Winding, Coil and Transformer Production

● General specifications of the IM3533

Measurement items	Basic measurement items	Z,Y,θ,Rs,Rp,X,G,B,Ls,Lp,Cs,Cp,Q,D
	Rdc	✓ (with temperature compensation function)
	Transformer measurement	N,M,ΔL
	Temperature T	✓
Basic accuracy		±0.05%rdg.
Measurement frequency		1 mHz to 200 kHz
Measurement voltage		5 mV to 5 V/2.5 V *1
Measurement time		2 ms
Comparator		2 items: HI/IN/LO, ABS/%/Δ%
BIN measurement		2 items: 10 classifications
Cable length		0 m/1 m
Contact check		4-terminal contact check (threshold change) / Hi-Z reject
Internal DC bias measurement		-5 V to 5 V
Sweep measurement		–
Display		Color TFT 5.7-inch LCD touch screen
Interface	EXT I/O, USB	✓
	USB flash drive	✓
	RS-232C, GP-IB, LAN	Option (select one)

*1 2.5 V in the low impedance high accuracy mode

● Transformer measurement

IM3533 IM3533-01

Turn ratio N, mutual inductance M, and inductance difference ΔL can be measured on the transformer measurement screen.

● Rdc measurement with temperature compensation*2

IM3533 IM3533-01

For Rdc measurement of inductor and transformer windings, measurement can be performed while compensating for temperature.

*2 Temperature Probe 9478 (option) is required for Rdc measurement with temperature compensation.

● Simultaneously display 4 parameters (for normal measurement)

IM3533 IM3533-01

For normal measurement, four parameters can be displayed simultaneously. This makes it easy to check parameters by comparing them with each other.

● Internal DC bias -5 V to 5 V

IM3533 IM3533-01

The instruments can perform measurements alone by applying a DC bias of up to ±5 V. This is reassuring when measuring polar capacitors such as a tantalum capacitor.

● BIN measurement: Two items are classified into 10 categories

IM3533 IM3533-01

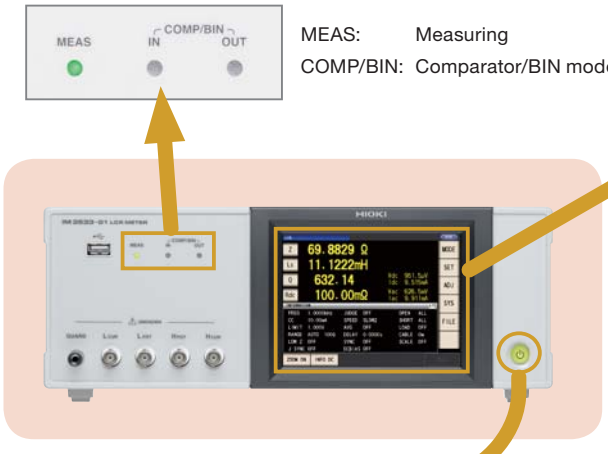
Two items can be classified into 10 categories and out of range. This function is useful for sorting out composite parts and performing advanced sorting.

Functions and Features to Simplify the Operation of LCR Measurements

IM3533 IM3533-01

● Instrument mode indicators

Indicators allow you to identify the operating conditions of the instrument even when the touch screen is off.



MEAS: Measuring
COMP/BIN: Comparator/BIN mode

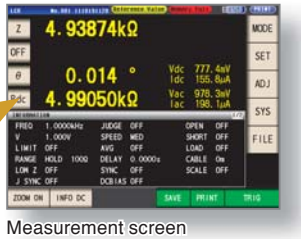
● Power indicator

The power indicator allows you to identify the on/off status of the LCR meter even when integrated into automated machinery or the LCD display is off.

Power on: green
Standby: red

● Easy touch screen operation

A touch screen with intuitive operation is inherited from previous models. Furthermore, the incorporation of a color LCD means the display is easy to view, and outstanding, easy-to-understand operability helps improve work efficiency.

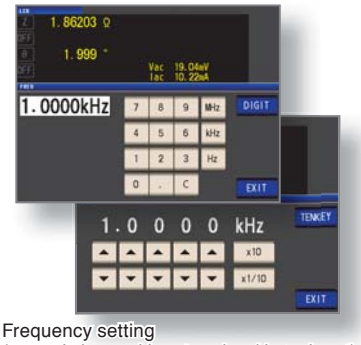


Measurement screen (LCR mode)

Measurement parameter input screen

Setting items of basic measurement conditions

Easily change the measurement conditions such as the measurement frequency and measurement signal level while you monitor the measurement values.



Frequency setting (numeric keypad input and up/down input)

Features of LCR Meter Model IM3533-01

Research and Development and Electrochemistry

● General specifications of the IM3533-01

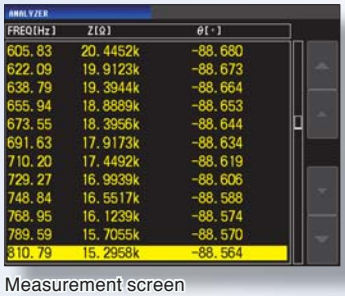
Measurement items	Basic measurement items	Z,Y,θ,Rs,Rp,X,G,B,Ls,Lp,Cs,Cp,Q,D
	Rdc	✓ (with temperature compensation function)
	Transformer measurement	N,M,ΔL
	Temperature T	✓
Basic accuracy		±0.05%rdg.
Measurement frequency		1mHz to 200kHz
Measurement voltage		5mV to 5V/2.5V *1
Measurement time		2ms
Comparator		2 items: HI/IN/LO, ABS/%/Δ%
BIN measurement		2 items: 10 classifications
Cable length		0m/1m/2m/4m
Contact check		4-terminal contact check (threshold change) / Hi-Z reject
Internal DC bias measurement		-5V to 5V
Sweep measurement		Frequency 2 to 801 points
Display		Color TFT 5.7-inch LCD touch screen
Interface	EXT I/O, USB	✓
	USB flash drive	✓
	RS-232C, GP-IB, LAN	Option (select one)

*1 2.5 V in the low impedance high accuracy mode

● Frequency sweep

IM3533-01

Measurements can be performed automatically at up to 801 frequency points by specifying the frequency range or in the frequency list mode. The measurement results can be saved to a USB flash drive or to a computer via an interface, which then can be used to perform frequency analysis of samples.



Measurement screen
(frequency sweep)

● Cable length setting to 0m/1m and 2m/4m with guaranteed accuracy

IM3533-01

The cable length can be set to 0m/1m (common for the series) and to 2m/4m for the IM3533-01. Even when the measurement cable needs to be extended in laboratories and for automated machinery, the maximum performance can be ensured and the maximum accuracy can be guaranteed. When using an extension cable, be sure to refer to the instruction manual.

Functions and Features for LCR Measurements in Research and Development

IM3533 IM3533-01

● Measurable from low frequencies from 1 mHz

Measurements can be performed from low frequencies from 1 mHz at 1 mHz resolution*2. The function can be used for the basic measurements of electrochemical applications.

*2 Five-digit resolution at 100 Hz or more.

● Low impedance high accuracy mode

Low impedance high accuracy mode can be used at 100 mΩ and in the 1Ω range. Output resistance of 25 Ω can increase the measured current and thus improve the measurement accuracy. (The maximum applied current is 100 mA and the maximum applied voltage is 2.5 V)

This mode is useful during L measurement of low-inductance inductors for power supplies and ESR measurement of aluminum electrolytic capacitors.

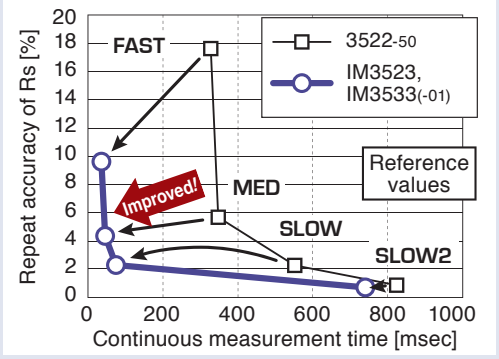
Advantage #2

Low impedance high accuracy mode improves repeat accuracy

The IM3523 and IM3533(-01) provide a low impedance high accuracy mode that improves repeat accuracy in low-impedance measurements.
Compared to the previous HIOKI model 3522-50, the measurement speed of C-D + ESR continuous measurement in FAST and MED modes has increased by one digit and the repeat accuracy (variation) of Rs has also been improved.

Continuous measurement time and repeat accuracy of Rs in C-D + ESR continuous measurement at 100 kHz

(Sample: aluminum electrolyte capacitor 1.5 µF)



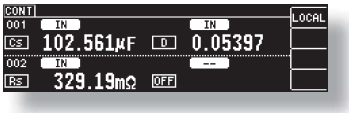
Capacitors and Inductors

C-D + ESR Measurement of Capacitors

IM3523 IM3533 IM3533-01

LCR mode [IM3523]
Cs and D display screen
(120 Hz measurement)

LCR mode [IM3523]
Rs display screen
(100 kHz measurement)



Continuous measurement screen [IM3523]

Continuous measurement can be performed with high speed under multiple conditions!

C-D (120 Hz) and low ESR (100 Hz) measurement can be performed for functional polymer capacitors. Different measurement items can be measured continuously under different measurement conditions (frequency, level, and mode).

C Measurement of Polar Capacitors

IM3533 IM3533-01

LCR mode
When DC bias is set

Enlarged view of bias settings

A DC bias voltage may sometimes be applied to measure polar capacitors such as an electrolytic capacitor.
The IM3533(-01) can perform C-D measurement by applying a DC bias voltage of -5 V to 5 V without using an optional DC bias unit.

Rdc and L-Q Measurement of Inductors (Coils and Transformers)

IM3523 IM3533 IM3533-01

L and Q display screen
(1 kHz, 1 mA constant current measurement)

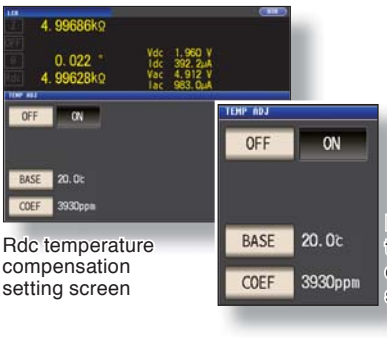
Rdc display screen
(DC measurement)

L, Q and Rdc continuous measurement screen

L and Q (1 kHz, 1 mA constant current measurement) and Rdc (DC measurement) display screen

L-Q (1 kHz, 1 mA constant current) and Rdc can be measured continuously and the measurement results can be displayed on the same screen.
Measurement with a constant current (CC) can be performed for current dependent elements such as coils incorporating cores, the inductance value of which varies depending on the applied current.
With the IM3533(-01), repeat accuracy during low impedance measurements has been improved from previous HIOKI models to ensure stable measurement of Rdc.

Advantage #3



Rdc temperature compensation setting screen

Enlarged view of temperature compensation setting

Rdc measurement with temperature compensation*

The IM3533-01 provides Rdc measurement with temperature compensation, which makes it possible to manage winding resistance more accurately.
The low impedance high accuracy mode allows you to measure low-inductance inductors and low-Rdc inductors more accurately than previous HIOKI models.

* Temperature Probe 9478 (option) is required for Rdc measurement with temperature compensation.

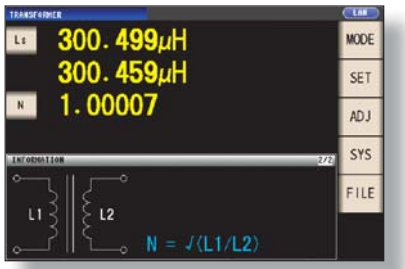
Transformer Winding and Sweep Measurements

Variety of Transformer Winding Measurement Functions

IM3533 IM3533-01

In addition to the L-Q and Rdc measurements, the IM3533 and IM3533-01 enable you to measure the turn ratio N, mutual inductance M, and inductance difference ΔL that are required for the measurement of transformers.*

* Connections must be switched manually or a selector such as a scanner unit is required separately.

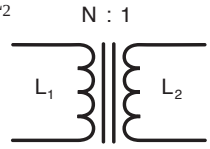


Transformer measurement mode
Turn ratio measurement (information) screen

N Turn ratio N measurement

(1) Measure L (L_1) on the primary side
(2) Measure L (L_2) on the secondary side
(3) Calculate turn ratio N from L_1 and L_2

$$N = \sqrt{L_1/L_2}$$

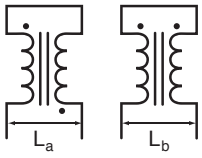


Transformer measurement mode
Turn ratio measurement and judgment screen

M Mutual inductance M measurement

(1) Measure L (L_a) connected in series and in phase
(2) Measure L (L_b) connected in series and in anti-phase
(3) Calculate M from L_a and L_b

$$M = (L_a - L_b)/4$$



Transformer measurement mode
Mutual inductance measurement screen

ΔL Inductance difference ΔL measurement

(1) Measure L (L_1) on the primary side
(2) Measure L (L_2) on the secondary side
(3) Calculate difference L from L_1 and L_2

$$\Delta L = L_1 - L_2$$

Transformer measurement mode
Inductance difference measurement screen

Sweep Measurement

IM3533-01

The IM3533-01 provides a frequency sweep measurement function that allows you to measure the inductance (L), capacitance (C), and frequency characteristics of samples such as composite components. The function is useful in research and development.
The bundled LCR sample application can be used to display a frequency characteristic list and graph on a computer screen.

Sweep measurement

USB flash drive

USB connection

Sweep measurement results list and graph screens as shown in the bundled LCR sample application

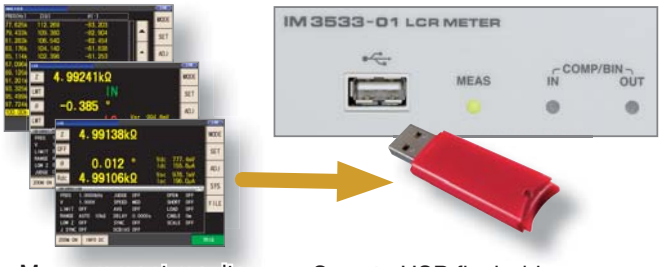
Linking to PC
Capturing Measurement Data

● Saving and loading data via front USB port

IM3533 IM3533-01

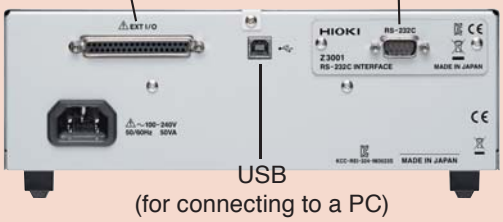
Measurement results and settings can be saved to a commercially available USB flash drive connected to the front USB port.

(The USB port on the front panel is specifically for a USB flash drive. Batch save all the measurement results to a USB flash drive after saving them to the internal memory of the IM3533(-01). Some USB flash drives may not be supported due to incompatibility issues.)

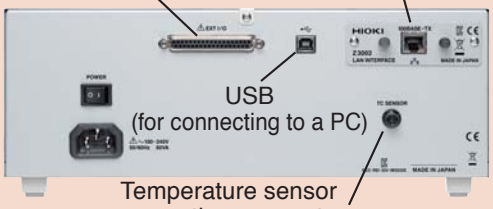


Measurement results and settings

Save to USB flash drive



IM3523 rear panel



IM3533(-01) rear panel

● Connecting to a PC via USB

IM3523 IM3533 IM3533-01

The rear panel is standard equipped with a USB port.

(The USB port on the rear panel is specifically for connecting to a PC.)

Control the various functions of the IM3523 and IM3533(-01) from a PC and download measurement results.

(Excluding turning the power on/off and configuring some interface settings.)

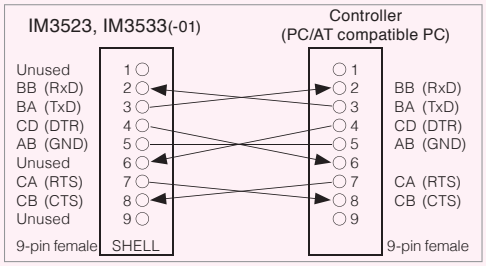
● Connecting to a PC or PLC via RS-232C, LAN, or GP-IB (select one option) connection

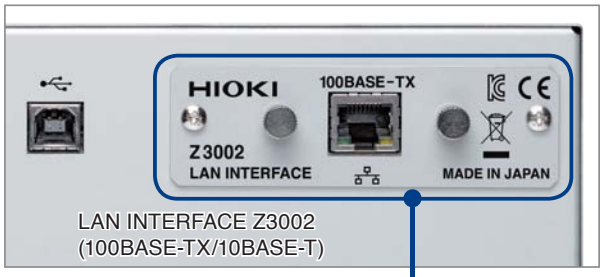
IM3523 IM3533 IM3533-01

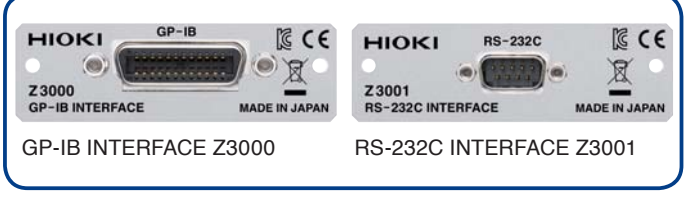
When you need an RS-232C, LAN, or GP-IB interface, you can select any one option.

Control the various functions of the IM3523 and IM3533(-01) from a PC and download measurement results. (Excluding turning the power on/off and configuring some interface settings.)

Use an appropriate RS-232C cable in accordance with the connection method shown in the figure below. A crossover cable for interconnection can be used.







GP-IB INTERFACE Z3000

RS-232C INTERFACE Z3001

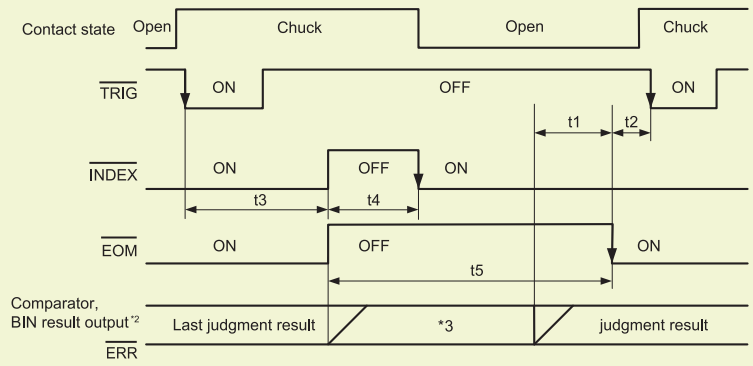
EXT I/O

Handler (EXT I/O) interface

The handler (EXT I/O) interface enables output of an end of measurement signal and measurement result signal, and input of signals such as a measurement trigger signal to control the measuring instrument. Each of the signal lines is isolated from the measurement and control circuits, and the structure is designed to protect against noise.

When designing a control system using the EXT I/O interface, be sure to read the instruction manual and check the necessary technical information.

Example of Typical EXT I/O Timing (LCR Mode)



t1: Delay setting time from comparator and BIN judgment results to $\overline{\text{EOM}}$ (LOW): 40 µs or longer *1
t2: Minimum time from end of measurement to next trigger: 400 µs *1
t3: Time from trigger to response by circuit: 700 µs *1
t4: Minimum chuck time for which the chuck can be switched with $\overline{\text{INDEX}}$ (LOW): 220 µs *1
t5: Measurement time: 600 µs *1

*1: When the measurement speed is FAST and the range is HOLD.
*2: IM3523 : $\overline{\text{MAIN-HI}}$, $\overline{\text{MAIN-IN}}$, $\overline{\text{MAIN-LO}}$, $\overline{\text{SUB-HI}}$, $\overline{\text{SUB-IN}}$, $\overline{\text{SUB-LO}}$, $\overline{\text{AND}}$, $\overline{\text{BINx}}$, $\overline{\text{OUT-OF-BINS}}$, $\overline{\text{SUBNG}}$
IM3533(-01): $\overline{\text{PARAx-HI}}$, $\overline{\text{PARAX-IN}}$, $\overline{\text{PARAx-LO}}$, $\overline{\text{AND}}$, $\overline{\text{BINx}}$, $\overline{\text{OUT\_OF\_BINS}}$
*3: Reset at the same time as $\overline{\text{TRIG}}$: HIGH
Not reset at the same time as $\overline{\text{TRIG}}$: LOW

Approximate measurement speed

(at 1 kHz and when the screen display is OFF *4)

FAST	MED	SLOW	SLOW2
2ms	6ms	21ms	301ms

*4: Add up all the applicable times in the following cases.
- When OPEN/SHORT/LOAD compensation is executed: max 0.4 ms
- When comparator measurement is executed: max 0.4 ms
- When BIN measurement is executed: max 0.8 ms
- When the screen display is ON: max 0.3 ms
- When the memory function is ON: max 0.4 ms

EXT I/O signal list

Input signals

$\overline{\text{TRIG}}$	External trigger
$\overline{\text{LD0}}$ to $\overline{\text{LD6}}$	Panel number selection
$\overline{\text{LD\_VALID}}$	Panel load execution

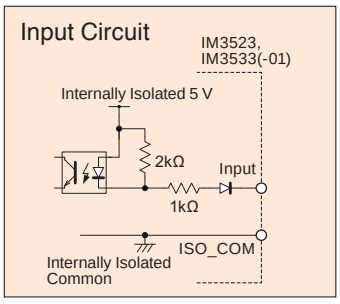
Output signals

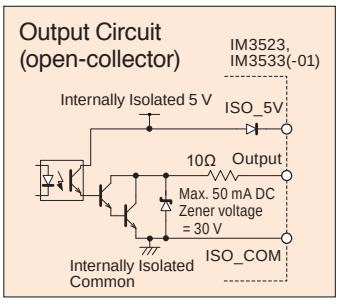
$\overline{\text{EOM}}$	End of measurement
$\overline{\text{INDEX}}$	End of capture
$\overline{\text{ERR}}$	Measurement error output
ISO_5V	Internally isolated 5 V
ISO_COM	Internally isolated common

Output signals (common signal line)

IM3523	IM3533, IM3533-01	
$\overline{\text{MAIN-HI}}$, $\overline{\text{MAIN-IN}}$, $\overline{\text{MAIN-LO}}$, $\overline{\text{SUB-HI}}$, $\overline{\text{SUB-IN}}$, $\overline{\text{SUB-LO}}$, $\overline{\text{AND}}$, $\overline{\text{SUBNG}}$	$\overline{\text{PARAx-HI}}$, $\overline{\text{PARAx-IN}}$, $\overline{\text{PARAx-LO}}$ (x=1,3), $\overline{\text{AND}}$	Comparator judgment result output
$\overline{\text{BINx}}$ (x=1 to 10), $\overline{\text{OUT}}$	$\overline{\text{BINx}}$ (x=1 to 10), $\overline{\text{OUT\_OF\_BINS}}$	BIN judgment result output
$\overline{\text{No.n\_x-HI}}$, $\overline{\text{No.n\_x-IN}}$, $\overline{\text{No.n\_x-LO}}$ (n=1,2; x=MAIN, SUB)	$\overline{\text{No.n\_PARAx-HI}}$, $\overline{\text{No.n\_PARAx-IN}}$, $\overline{\text{No.n\_PARAx-LO}}$ (n=1,2; x=1,3)	Continuous measure-ment result output
————	$\overline{\text{HI}}$, $\overline{\text{IN}}$, $\overline{\text{LO}}$, $\overline{\text{AND}}$	Transformer mode

EXT I/O Input and Output Circuits





EXT I/O Electrical Specifications

Inputs:
Photocoupler isolation: Non-voltage contact inputs (support for current sink output, negative logic)
Assert: 0 to 1 V (with 3 mA input)
De-assert: Open, or 5 to 30 V

Outputs:
Photocoupler isolation: Open-collector NPN (support for current sink output, negative logic)
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

Connectors

Connectors to use (unit side)	: 37-pin D-SUB female connector with #4-40 inch screws
Compliant connectors	: DC-37P-ULR (solder type) and DCSP-JB37PR (insulation-displacement type) For information on where to obtain connectors, consult your nearest HIOKI distributor.

IM3523 / IM3533 Measurement Accuracy (Accuracy guaranteed for 1 year, Post-adjustment accuracy guaranteed for 1 year)

Conditions

Temperature and humidity ranges: 23°C ± 5°C, 80% rh or less (no condensation),
at least 60 minutes after power is turned on, after performing open and short compensation

Measurement accuracy

The measurement accuracy is calculated based on the following equation.
Measurement accuracy = Basic accuracy × C × D × E × F × G

[C: Level coefficient]

V: Setting value (corresponds to V mode or equivalent) [V]

Excluding Rdc	Rdc
0.005V to 0.999V: 1+0.2/V 1V: 1 1.001V to 5V: 1+2/V	2V: 1

[D: Measurement speed coefficient]

Excluding Rdc	Rdc
FAST: 4	FAST: 8
MED: 3	MED: 4
SLOW: 2	SLOW: 2
SLOW2: 1	SLOW2: 1

[F: DC bias coefficient]

DC bias setting OFF: 1
DC bias setting ON: 2

[E: Measurement cable length coefficient]

fm: Measurement frequency [kHz]

Cable length	IM3523, IM3533		IM3533-01
	10kΩ range and below	100kΩ range and above	
0m	1	1	1
1m	1.2	1.2	1.2
2m	1.5 + fm/100	1.5 + fm/20	1.5
4m	2 + fm/50	2 + fm/10	2

Please use a coaxial cable with 50Ω impedance characteristics and 4-terminal pair configuration.

Guaranteed accuracy range (frequency)

Cable length	IM3523, IM3533		IM3533-01
	10kΩ range and below	100kΩ range and above	
0m	Up to 200 kHz	Up to 200 kHz	Up to 200 kHz (No limit)
1m			
2m		Up to 100 kHz	
4m		Up to 10 kHz	

[G: Temperature coefficient] t: Operating temperature

When t is 18°C to 28°C: 1
When t is 0°C to 18°C or 28°C to 40°C: $1+0.1\times|t-23|$

Basic accuracy (Z, θ) calculation expressions

The basic accuracy is calculated by selecting coefficients A and B from the basic accuracy table and using the calculation expressions below.

1 kΩ range and above:

$$\text{Accuracy} = A + B \times \left| \frac{10 \times Zx}{Range} - 1 \right|$$

100 Ω range and below:

$$\text{Accuracy} = A + B \times \left| \frac{Range}{Zx} - 1 \right|$$

In the 1 kΩ range and above and 310 Ω range and below, the calculation expression of basic accuracy differs as shown in the left.
For details, refer to the following calculation examples on page 13.

Zx is the actual impedance measurement value (Z) of the sample.

When temperature compensation is performed during Rdc measurement, add the following value to the calculation expression of basic accuracy.

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

t_0: Reference temperature [°C]
t: Current ambient temperature [°C]
Δt: Temperature measurement accuracy
α_{t0}: Temperature coefficient for t_0 [1/°C]

Basic accuracy table

Coefficients A and B

DC
A is the accuracy of R (± % rdg.)
B is the coefficient for the resistance of the sample

0.001Hz (40 Hz) to 200 kHz
Top A: Basic accuracy of Z (± % rdg.)
B is the coefficient for the impedance of the sample

0.001 Hz (40 Hz) to 200 kHz
Bottom A: Basic accuracy of θ (± % deg.)
B is the coefficient for the impedance of the sample

Range	Guaranteed accuracy range	DC	IM3523 IM3533 IM3533-01 40.000Hz to 99.9999Hz IM3533 IM3533-01 0.001Hz to 99.9999Hz	100.00Hz to 999.99Hz	1.0000kHz to 10.000kHz	10.001kHz to 100.00kHz	100.01kHz to 200.00kHz
100MΩ	8MΩ to 200MΩ	A=1 B=1	A=6 B=5 A=5 B=3	A=3 B=2 A=2 B=2	A=3 B=2 A=2 B=2		
10MΩ	800kΩ to 100MΩ	A=0.5 B=0.3	A=0.8 B=1 A=0.8 B=0.5	A=0.5 B=0.3 A=0.4 B=0.2	A=0.5 B=0.3 A=0.4 B=0.2	A=3 B=2 A=2 B=2	
1MΩ	80kΩ to 10MΩ	A=0.2 B=0.1	A=0.4 B=0.08 A=0.3 B=0.08	A=0.3 B=0.05 A=0.2 B=0.02	A=0.3 B=0.05 A=0.2 B=0.02	A=0.7 B=0.08 A=1.3 B=0.08	A=1 B=0.5 A=3 B=0.5
100kΩ	8kΩ to 1MΩ	A=0.1 B=0.01	A=0.3 B=0.03 A=0.3 B=0.02	A=0.2 B=0.03 A=0.1 B=0.02	A=0.15 B=0.02 A=0.1 B=0.015	A=0.25 B=0.04 A=0.4 B=0.02	A=0.4 B=0.3 A=1.2 B=0.3
10kΩ	800Ω to 100kΩ	A=0.1 B=0.01	A=0.3 B=0.025 A=0.3 B=0.02	A=0.2 B=0.025 A=0.1 B=0.02	A=0.05 B=0.02 A=0.03 B=0.02	A=0.2 B=0.025 A=0.4 B=0.02	A=0.3 B=0.03 A=0.6 B=0.05
1kΩ	80Ω to 10kΩ	A=0.1 B=0.01	A=0.3 B=0.02 A=0.2 B=0.02	A=0.2 B=0.02 A=0.1 B=0.02	A=0.15 B=0.02 A=0.08 B=0.02	A=0.2 B=0.02 A=0.4 B=0.02	A=0.3 B=0.02 A=0.6 B=0.02
100Ω	8Ω to 100Ω	A=0.1 B=0.02	A=0.4 B=0.02 A=0.2 B=0.01	A=0.3 B=0.02 A=0.15 B=0.01	A=0.15 B=0.02 A=0.1 B=0.01	A=0.2 B=0.02 A=0.4 B=0.02	A=0.3 B=0.03 A=0.6 B=0.02
10Ω	800mΩ to 10Ω	A=0.2 B=0.15	A=0.5 B=0.2 A=0.3 B=0.1	A=0.4 B=0.05 A=0.3 B=0.03	A=0.3 B=0.05 A=0.15 B=0.03	A=0.3 B=0.05 A=0.75 B=0.05	A=0.4 B=0.2 A=1.5 B=0.1
1Ω	80mΩ to 1Ω	A=0.3 B=0.3	A=2 B=1 A=1 B=0.6	A=0.6 B=0.3 A=0.5 B=0.2	A=0.4 B=0.3 A=0.25 B=0.2	A=0.4 B=0.3 A=1 B=0.2	A=1 B=1 A=2 B=0.5
100mΩ	10mΩ to 100mΩ	A=3 B=3	A=10 B=10 A=6 B=6	A=3 B=3 A=2 B=2	A=3 B=2 A=2 B=1.5	A=2 B=2 A=2 B=1.5	A=4 B=3 A=3 B=4

Measurement Accuracy

Guaranteed accuracy range (measurement signal level)

The guaranteed accuracy range varies depending on the measurement frequency, measurement signal level, and measurement range.

Range	DC	IM3523 40.000Hz to 99.9999Hz IM3533 IM3533-01 0.001Hz to 99.9999Hz	100.00Hz to 999.99Hz	1.0000kHz to 10.000kHz	10.001kHz to 100.00kHz	100.01kHz to 200.00kHz
100MΩ	2 V	0.101 V to 5 V				
10MΩ					0.501 V to 5 V	
1MΩ		0.050 V to 5 V		0.101 V to 5 V		
100kΩ		0.005 V to 5 V			0.050 V to 5 V	0.101 V to 5 V
10kΩ, 1kΩ, 100Ω						
10Ω		0.050 V to 5 V				
1Ω		0.101 V to 5 V (When DC bias: 1 V to 5 V)				
100mΩ		0.501 V to 5 V (When DC bias: 0.501 V to 5 V)				

The above voltages are the voltage setting values corresponding to V mode or equivalent.

For the 10 MΩ to 1 kΩ range, when the measurement impedance value exceeds the range, the guaranteed accuracy range is as follows.

Range	DC	IM3523 40.000Hz to 99.9999Hz IM3533 IM3533-01 0.001Hz to 99.9999Hz	100.00Hz to 999.99Hz	1.0000kHz to 10.000kHz	10.001kHz to 100.00kHz	100.01kHz to 200.00kHz
10MΩ	2 V	0.101 V to 5 V				
1MΩ					0.501 V to 5 V	
100kΩ		0.050 V to 5 V		0.101 V to 5 V		
10kΩ		0.005 V to 5 V			0.005 V to 5 V	0.101 V to 5 V
1kΩ						

The above voltages are the voltage setting values corresponding to V mode or equivalent.

Method for determining basic accuracy

- Calculate the basic accuracy from the sample impedance, measurement range, measurement frequency, and corresponding basic accuracy A and coefficient B from the table on page 12.
- The calculation expression to use differs for each of the 1 kΩ range and above and 100 Ω range and below.
- For C and L, obtain basic accuracy A and coefficient B by determining the measurement range from the actual measurement value of impedance or the approximate impedance value calculated with the following expression.

$$Zx\ (\Omega) \approx \omega L\ (H) \quad (\theta \approx 90°)$$

$$\approx \frac{1}{\omega C\ (F)} \quad (\theta \approx -90°)$$

$$\approx R\ (\Omega) \quad (\theta \approx 0°) \quad (\omega: 2 \times \pi \times \text{Measurement frequency [Hz]})$$

Basic accuracy can be calculated on a PC

The bundled application software can be used to calculate the basic accuracy. Just enter the measurement conditions and measurement result and the measurement accuracy will be displayed.
The application software allows you to easily evaluate the accuracy for the measurement value.

Application screen

Calculation example 1 (Basic accuracy of impedance Z)

Impedance Zx of sample: 500 Ω (actual measurement value)
Measurement conditions: When frequency 10 kHz and range 1 kΩ

Insert coefficient A = 0.15 and coefficient B = 0.02 for the Z basic accuracy from the table on page 12.

$$\text{Z basic accuracy} = 0.15 + 0.02 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.23\ (\pm\%\text{rdg.})$$

Similarly, insert coefficient A = 0.08 and coefficient B = 0.02 for the θ basic accuracy, as follows:

$$\theta\ \text{basic accuracy} = 0.08 + 0.02 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.16\ (\pm°)$$

Calculation example 2 (Basic accuracy of capacitor Cs = 160 nF)

(1) Measure Z and θ of the sample with measurement range AUTO.

(2) Suppose you have obtained the following Z and θ measurement values.
Z = 1.0144 kΩ, θ = −78.69 °
As Z is 1.0144 kΩ, the range is 10 kΩ.

(3) For the 1 kHz and 10 kΩ range,
insert coefficient A = 0.05 and coefficient B = 0.02 for the Z basic accuracy from the table on page 12.

$$\text{Z basic accuracy} = \pm\left(0.05 + 0.02 \times \left| \frac{10 \times 1.0144 \times 10^3}{10 \times 10^3} - 1 \right|\right) \approx 0.05\ (\pm\%)$$

Insert coefficient A = 0.03 and coefficient B = 0.02 for the θ basic accuracy.

$$\theta\ \text{basic accuracy} = \pm\left(0.03 + 0.02 \times \left| \frac{10 \times 1.0144 \times 10^3}{10 \times 10^3} - 1 \right|\right) \approx 0.03\ (\pm°)$$

(4) Determine the ranges for the Z and θ basic accuracy.
Zmin = 1.0144 kΩ × (1 − 0.05 / 100) = 1.01389 kΩ
Zmax = 1.0144 kΩ × (1 + 0.05 / 100) = 1.01490 kΩ
θmin = −78.69 − 0.03 = −78.72 °
θmax = −78.69 + 0.03 = −78.66 °

(5) Determine the range for Cs from the Z and θ ranges.
Cs min = 1 / (Zmax × ω × sin(θmin)) ≈ 159.907 nF …… −0.06%
Cs max = 1 / (Zmin × ω × sin(θmax)) ≈ 160.100 nF …… +0.06%

Specifications

	IM3523	IM3533	IM3533-01
Measurement modes	LCR mode: Measurement with single condition Continuous measurement mode: Continuous measurement under saved conditions (maximum 2 sets)	LCR mode: Measurement with single condition Transformer measurement mode: N, M, ΔL Continuous measurement mode: Continuous measurement under saved conditions LCR mode (maximum 60 sets)	LCR mode: Measurement with single condition Transformer measurement mode: N, M, ΔL Continuous measurement mode: Continuous measurement under saved conditions LCR mode (maximum 60 sets) Analyzer mode (maximum 2 sets) Analyzer mode: Sweep with measurement frequency (Measurement points: 2 to 801 Sweep method: normal sweep Display: List display)
Measurement parameters	Z, Y, θ, Rs(ESR), Rp, Rdc(DC resistance), X, G, B, Cs, Cp, Ls, Lp, D(tanδ), Q	Z, Y, θ, Rs(ESR), Rp, Rdc(DC resistance), X, G, B, Cs, Cp, Ls, Lp, D(tanδ), Q, N, M, ΔL, T	
Measurement range	100 mΩ to 100 MΩ, 10 ranges (All parameters are determined according to Z)		
Display range	Z, Y, Rs, Rp, Rdc, X, G, B, Ls, Lp, Cs, Cp : ± (0.00000 [unit] to 9.99999G [unit]) Absolute value display for Z and Y only θ: ±(0.000° to 180.000°), D : ±(0.00000 to 9.99999), Q : ±(0.00 to 9.9999.99), Δ% : ±(0.000% to 999.999%)		
	———	T : -10.0 to +99.9 °C	
Basic accuracy	Z : ±0.05%rdg. θ: ±0.03°		
Measurement frequency	40 Hz to 200 kHz (5 digits setting resolution)	1 mHz to 200 kHz (5 digits setting resolution, minimum resolution 1 mHz)	
Measurement signal level	Normal mode: V mode/CV mode: 5 mV to 5 Vrms, 1 mVrms steps CC mode: 10 µA to 50 mArms, 10 µArms steps	Normal mode: V mode/CV mode: 5 mV to 5 Vrms, 1 mVrms steps CC mode: 10 µA to 50 mArms, 10 µArms steps Low impedance high accuracy mode: V mode/CV mode: 5 mV to 2.5 Vrms, 1 mVrms steps CC mode: 10 µA to 100 mArms, 10 µArms steps	
Output impedance	Normal mode: 100 Ω	Normal mode: 100 Ω, Low impedance high accuracy mode: 25 Ω	
Display	Monochrome LCD	5.7-inch color TFT, display can be set to ON/OFF	
Number of display digits setting	The number of display digits can be set from 3 to 6 (initial value: 6 digits)		
Measurement time	2 ms (1 kHz, FAST, display OFF, representative value)		
Measurement speed	FAST/MED/SLOW/SLOW2		
DC bias measurement	———	Normal mode: -5.00 V to 5.00 V (10 mV steps) Low impedance high accuracy mode: -2.50 V to 2.50 V (10 mV steps)	
DC resistance measurement	Measurement signal level: Fixed to 2 V	Measurement signal level: Fixed to 2 V Temperature compensation function: Converted reference temperature is displayed Reference temperature setting range: -10°C to 99.9°C Temperature coefficient setting range: -99,999ppm/°C to 99,999ppm/°C	
Comparator	LCR mode: Hi/IN/Lo for first and third items		
BIN measurement	10 main parameter categories, 1 sub-parameter category, and out of range	10 categories and out of range for 2 items	
Compensation	Open/short/load/correlation compensation Cable length: 0 and 1 m (accuracy is guaranteed for up to 4 m)		Open/short/load/correlation compensation Cable length: 0, 1, 2, 4 m
Residual charge protection function	$V=\sqrt{10/C}$ (C: Capacitance [F] of test sample, V = max. 400 V)		
Trigger synchronous output function	Applies a measurement signal during analog measurement only		
Averaging	1 to 256		
Panel loading/saving	LCR mode: 60; Analyzer mode: 2; Compensation value: 128		
Memory function	Stores 32,000 data items to the memory of the instrument		
Interfaces	EXT I/O (handler), USB (Hi-Speed) Option: Any one of RS-232C, GP-IB, and LAN (10BASE-T/100BASE-TX) can be selected	EXT I/O (handler), USB (Hi-Speed), USB flash drive Option: Any one of RS-232C, GP-IB, and LAN (10BASE-T/100BASE-TX) can be selected	
Operating temperature and humidity ranges	0 °C (32 °F) to 40 °C (104 °F) , 80% rh or less, no condensation		
Storage temperature and humidity ranges	-10°C (14°F) to 50 °C (122°F) , 80% rh or less, no condensation		
Power supply	AC 100 to 240 V, 50/60 Hz, 50 VA max.		
Dimensions and mass	Approx. 260 mm (10.24 in) W × 88 mm (3.46 in) H ×203 mm (7.99 in) D, approx. 2.4 kg (84.7 oz)	Approx. 330 mm (12.99 in) W × 119 mm (4.69 in) H × 168 mm (6.61 in) D, approx. 3.1 kg (109.3 oz)	
Accessories	Power Cord ×1, Instruction Manual ×1, CD-R (Communication Instruction Manual and Sample Software) ×1		
Applicable standards	EMC: EN61326-1, EN61000-3-2, EN61000-3-3, Safety standard: EN61010		

LCR Meter Series Full Product Lineup

Model	Measurement speed (Basic value)	Measurement frequency range / Applications and measurement object
LCR METER IM3536	 1ms	DC ○ 4Hz ——— 8MHz General-purpose LCR meter up to 8 MHz Measure electronic components such as capacitors and inductors
LCR METER IM3533	 2ms	DC ○ 1mHz ——— 200kHz Capable of special measurements of transformers including turn ratio and mutual inductance IM3533-01: High-end model of the IM3523 and IM3533 with sweep measurement
	IM3533 **IM3533-01**	
LCR METER IM3523	 2ms	DC ○ 40Hz ——— 200kHz Extremely cost-effective model suitable for production lines including integration into automated machinery For C-D and ESR measurement of electrolytic capacitors and L-Q and Rdc measurement of inductors
LCR HiTESTER 3511-50	 5ms	120Hz ○ 1kHz ○ Compact LCR meter with single function For production lines of aluminum electrolytic capacitors
C METER 3506-10	 1.5ms	1kHz ○ 1MHz ○ C meter for low-capacity capacitors For production of MLCC and film capacitors
C HiTESTER 3504	 2ms	120Hz ○ 1kHz ○ C meter for large-capacity MLCCs For sorting machines of large-capacity MLCCs (3504-50/60) and taping machines (3504-40)
	3504-40 **3504-50** **3504-60**	
IMPEDANCE ANALYZER IM7580A	 0.5ms	1MHz ——— 300MHz High-frequency measurement up to 300 MHz Ideal for production lines of ferrite beads and inductors
IMPEDANCE ANALYZER IM3570	 0.5ms	DC ○ 4Hz ——— 5MHz LCR meter integrated with impedance analyzer Measure the frequency characteristics of piezo-electric devices, functional polymer capacitors, and power inductors
CHEMICAL IMPEDANCE ANALYZER IM3590	 2ms	DC ○ 1mHz ——— 200kHz Supports LCR impedance measurements for Cole-Cole plots and equivalent-circuit analyses Measure electrochemical components, materials, batteries, and electric double-layer capacitors (EDLCs)

IM3523

IM3533, IM3533-01

LCR METER

Order Code: **IM3523**
IM3533 (basic model)
IM3533-01 (added more functional model)

This product is not supplied with measurement probes or test fixtures. Please select and purchase the measurement probe or test fixture options appropriate for your application separately. All probes are constructed with a 1.5D-2V coaxial cable.
For an RS-232C connection: A crossover cable for interconnection can be used. You can use the RS-232C CABLE 9637 without hardware flow control.

Options

INTERFACE UNIT

GP-IB INTERFACE Z3000

RS-232C INTERFACE Z3001

LAN INTERFACE Z3002

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

• RS-232C cable

For RS-232C cable, **a crossover cable for interconnection can be used.**
(For details on connection, refer to page 10)
The 9637 RS-232C cable (9-pin to 9-pin, crossed cable) cannot be used for applications involving the flow control of hardware.

DC Bias Unit

DC BIAS VOLTAGE UNIT 9268-10

Direct connection type, 40 Hz to 8 MHz, maximum applied voltage of DC ±40 V.

DC BIAS CURRENT UNIT 9269-10

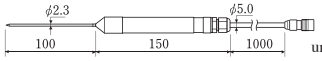
Direct connection type, 40 Hz to 2 MHz, maximum applied current of DC 2 A (maximum applied voltage of DC ±40 V).

* An internal 300µH inductance is connected in parallel to the DUT.

When using the 9268-10 or 9269-10, external constant-voltage and constant-current sources are required.

TEMPERATURE PROBE

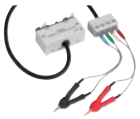
SHEATH TYPE TEMPERATURE PROBE 9478
Pt100, tip ø2.3 mm (0.09 in), cord length 1 m (3.28 ft), water-proof structure



unit: mm

(Used for the temperature compensation function and only available for the IM3533 and IM3533-01)

Probes and Test Fixtures for Lead Components



FOUR-TERMINAL PROBE L2000

Cable length 1 m (3.28 ft), DC to 8 MHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 5 mm (0.01 to 0.20 in)

TEST FIXTURE 9261-10

Cable length 1 m (3.28 ft), DC to 8 MHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 1.5 mm (0.01 to 0.06 in)

FOUR-TERMINAL PROBE 9140-10

Cable length 1 m (3.28 ft), DC to 200 kHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 5 mm (0.01 to 0.20 in)

TEST FIXTURE 9262

Direct connection type, DC to 8 MHz, measurable conductor diameter: 0.3 to 2 mm (0.01 to 0.08 in)

Test Fixtures for SMDs

NEW

SMD TEST FIXTURE IM9110

Measurable range: DC to 1 MHz, For SMD with electrodes on side , Measurable sample sizes: 008004 (EIA), 0201 (JIS), Please contact Hioki for information about other sizes, Direct connection type

SMD TEST FIXTURE IM9100

Measurable range: DC to 8 MHz, For SMD with electrodes on bottom, Measurable sample sizes: 01005 to 0402 (EIA) 0402 to 1005 (JIS) , Direct connection type

SMD TEST FIXTURE 9677

Direct connection type, for SMDs with electrodes on the side, DC to 120 MHz, SMD sizes: 3.5 ±0.5 mm

SMD TEST FIXTURE 9699

Direct connection type, for SMDs with electrode on the bottom, DC to 120 MHz, SMD sizes: 1.0 to 4.0 mm wide, 1.5 mm or less high

SMD TEST FIXTURE 9263

Direct connection type, DC to 8 MHz, SMD sizes: 1 to 10 mm (0.04 to 0.39 in)

PINCHER PROBE L2001
*Ships standard with one set of IM9901

Cable length 730 mm (2.40 ft) , DC to 8 MHz, characteristic impedance of 50 Ω, 4-terminal pair design, 2-terminal electrode, tip electrode spacing of 0.3 to approx. 6 mm (0.01 to approx. 0.24 in)

Options for L2001
Replaceable contact tips

CONTACT TIPS IM9901
Compatible chip sizes: 1608 to 5750 (JIS)

CONTACT TIPS IM9902
Compatible chip sizes: 0603 to 5750 (JIS)

For Electrochemical Measurement

FOUR-TERMINAL PROBE 9500-10

Cable length 1 m (3.28 ft), DC to 200 kHz, impedance characteristics of 50 Ω, 4-terminal pair configuration, measurable conductor diameter: ø0.3 mm (0.01 in) to 2 mm (0.08 in)

HIOKI
HIOKI E.E. CORPORATION

HIOKI

IMPEDANCE ANALYZER IM3570

Single Device Solution for High Speed Testing and Frequency Sweeping

With this new IM3570 Impedance Analyzer, an LCR meter and an impedance analyzer capable of measurement frequencies of 4 Hz to 5 MHz and test signal levels of 5 mV to 5 V have been combined into one measuring instrument. Advanced capabilities include LCR measurement with AC signals, resistance measurement with direct current (Rdc), and sweep measurement which continuously changes the measurement frequency and measurement level.

The IM3570 facilitates high-speed continuous measurement under different measurement conditions and measurement modes, so inspection lines which up to now have required multiple measuring instruments can be equipped with just one device.

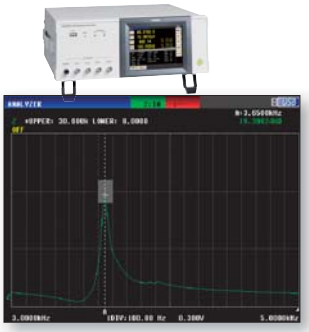
CE

LCR measurement, Rdc measurement, and Sweep measurement

Continuous Measurement and High-speed Testing Achieved with One Instrument

Measurements recommended with IMPEDANCE ANALYZER IM3570

1. Testing the resonance characteristics of piezoelectric elements



Frequency sweep measurement
Z peak comparator screen

LCR mode
Cs display screen (1 kHz measurement)

Reduce Equipment Costs with Just 1 Device!

Frequency sweep measurement can be used to measure the resonance frequency and its impedance, and then the peak comparator function can be used to make a pass/fail judgment on the resonance state.

In LCR mode, you can test capacitance by performing C measurement between 1 kHz and 120 Hz.

Continuous measurement screen

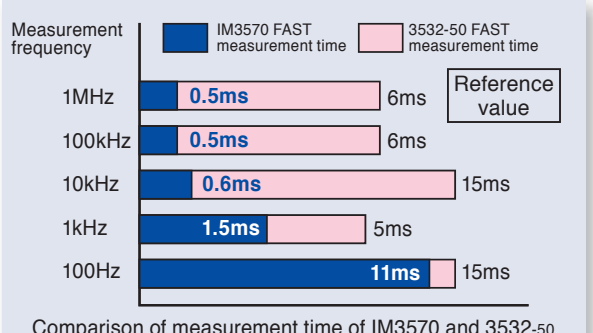
High Speed and High Accuracy

Frequency sweep measurement (impedance analyzer) and C measurement can be performed continuously with one instrument.

Advantage #1 -- Measurement time shortened

The measurement time has been shortened from previous models, achieving maximum speeds of 1.5ms* (1 kHz) and 0.5ms* (100kHz) in LCR mode. This is a significant increase in speed compared with previous Hioki products (3522-50 and 3532-50 with basic speed of 5ms). Faster speed contributes to an increase in test quantities.
Furthermore, sweep measurement, which requires multiple points to be measured, realizes the quick speed of 0.3ms per point.

* When the display is off (time increases by 0.3 ms when the display is on).



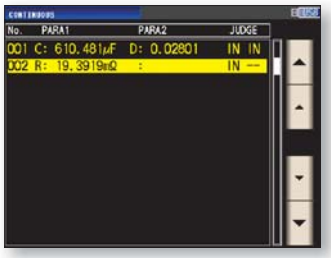
Comparison of measurement time of IM3570 and 3532-50

Perfect Impedance Analyzer for Production Lines

2. C-D and low ESR measurement of functional polymer capacitors

LCR mode
Cs and D display screen (120 Hz measurement)

LCR mode
Rs display screen (100 kHz measurement)

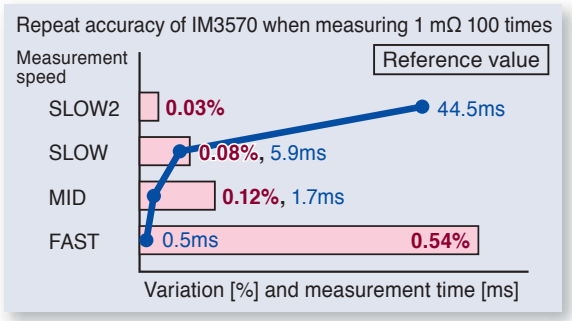


Continuous measurement screen

C-D (120 Hz) and low ESR (100 kHz) measurement can be performed for functional polymer capacitors.

Make continuous tests for different measurement items under different measurement conditions (frequency, level, and mode).

Advantage #2 -- Low-impedance measurement accuracy improved



A one-digit improvement in repeat accuracy during low-impedance measurement has been achieved compared with previous Hioki products.
For example, when the condition is 1 mΩ (1V, 100 kHz) and the measurement speed is MED, stable measurement with a repeat accuracy (variation)* of 0.12% is possible, making this instrument suitable for 100 kHz ESR measurement.

* Repeat accuracy (variation) is calculated based on the difference between the maximum and minimum values.

3. Rdc and L-Q measurement of inductors (coils and transformers)

L/Q display screen
(1 kHz, 1 mA constant current measurement)

Rdc display screen
(DC measurement)

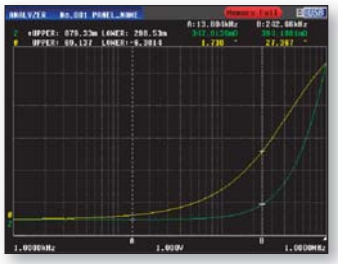
L/Q/ Rdc continuous measurement screen

L/Q (1 kHz, 1 mA constant current measurement) and Rdc (DC measurement) display screen

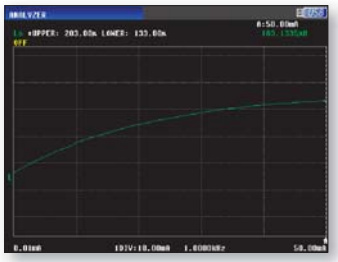
The instrument can continuously measure L-Q (1 kHz, 1mA constant current) and Rdc, and display the numerical values on the same screen.
Current dependent elements such as coils incorporating cores for which the inductance value varies depending on the applied current can be measured with a constant current (CC).
Since there is a one-digit improvement in repeat accuracy during low impedance measurement compared with previous products, stable measurement of Rdc can be expected.

Advantage #3

By improving the measurement accuracy of θ compared with previous Hioki products, measurement with an absolute accuracy and repeat accuracy of one-digit better than before can be performed for high Q and Rs values for which θ is in the vicinity of 90°.



Frequency sweep measurement
Z-θ measurement screen



CC value sweep measurement
Ls measurement screen

The measurement frequency of a coil differs depending on the application. The wide measurement range of 4 Hz to 5 MHz facilitates the measurement of various coils.

Constant current sweep measurement enables a current characteristic graph to be displayed for current dependent elements.

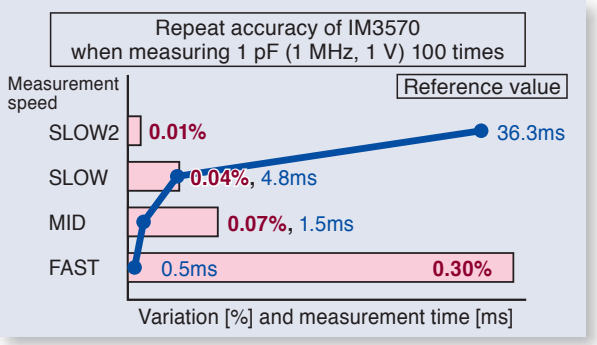
Test Efficiency Improved by High-speed and High-accuracy Measurements

Features of IM3570

Low-capacitance (high-impedance) measurement with improved stability

There is a one-digit improvement in repeat accuracy during low-capacitance (high-impedance) measurement compared with previous Hioki products. For example, when the condition is 1 pF (1 MHz, 1 V) and the measurement speed is SLOW2, stable measurement with a repeat accuracy (variation)* of 0.01% is possible.
At the same time, phase repeat accuracy is also improved, which in turn has improved the stability of D measurement during low-capacitance (high-impedance) measurement.

* Repeat accuracy (variation) is calculated based on the difference between the maximum and minimum values.



Wide setting range for measurement frequency

IM3570 allows DC or a frequency band within the range of 4 Hz to 5 MHz to be set with five-digit resolution (testing at less than 1 KHz has a 0.01 Hz resolution). This enables the measurement of resonance frequency and measurement and evaluation in a state close to that of actual operating conditions.

15 parameters measured

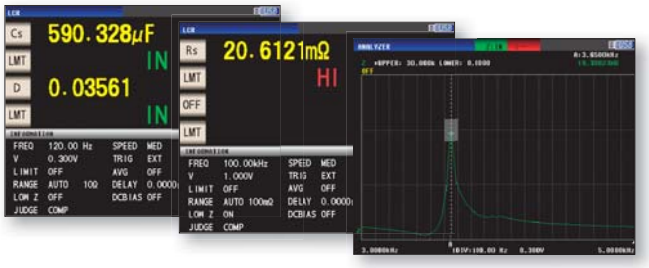
The following parameters can be measured and selected parameters can be captured by a computer: Z, Y, θ, Rs (ESR), Rp, Rdc (DC resistance), X, G, B, Ls, Lp, Cs, Cp, D (tanδ), and Q.

Incorporates contact check function (open-circuit check)

The contact check function for four-terminal measurement (only for low impedance high accuracy mode) and two-terminal measurement prevents measurement in a state in which a measurement electrode is not in contact with the measurement object.

Comparator and BIN functions

In LCR mode, the instrument allows for Hi, IN, and Lo judgments of two types from the measurement items on one screen. For the judgment method, % setting and Δ% setting are available in addition to absolute value setting. If continuous measurement is used, judgments which span over multiple measurement conditions and measurement items are possible. The BIN function can be used to classify two types of measurement items on one screen into 10 categories and out of range. In analyzer mode, the peak comparator for judging whether resonance points pass or fail can be used.



Segment setting

Up to 20 segments with a total of up to 801 points can be set for the sweep range. This is effective for evaluating multiple frequency ranges in detail.

Memory function

Up to 32,000 measurement results can be stored in the memory of the instrument. The saved measurement results can be copied to a USB flash drive, and can also be acquired using a communication command.

Wide setting range for measurement voltage and current

In addition to normal open-loop signal generation, this instrument enables measurement considering voltage/current dependence in constant voltage and constant current modes. The signal levels can be set over wide ranges, from 5 mV to 5 V, and from 10 µA to 50 mA (up to 1 MHz). (The setting range of measurement signal levels differs depending on the frequency and measurement mode.)

DC bias can be generated internally

Up to a 2.5 V DC bias can be applied and then measurement performed with just the unit. This is reassuring when measuring polar capacitors such as a tantalum capacitor. The charge impedance is 100 Ω. (The DC bias unit required with 3522-50 and 3532-50 is not needed for IM3570 within the bias voltage range of 0 to +2.5V. If a larger bias voltage is required, an external option, which is scheduled to be released in the future, is required.)

High resolution with up to 7-digit display

High-resolution measurement with full 7-digit display is possible. The number of display digits can be set from 3 to 7.

Four-terminal probe allows for use at DC to 8 MHz

The L2000 4-terminal probe (option) employs a 4-terminal structure to facilitate 50 Ω characteristic impedance and improved measurement accuracy, and is well suited to the IM3570.

Measurement cable extendable to up to 4 meters

Accuracy is guaranteed at the measurement cable lengths of 0, 1, 2, and 4 meters. This makes wiring automated machinery simple. (The frequency range for which accuracy is guaranteed differs depending on the cable length. The probe needs to be provided by the customer.)

Longer stability

Measurement accuracy is guaranteed for one year. Previous models required calibration every 6 months, but with this model the calibration interval has been extended to one year.

Interval measurement

In order to, for example, confirm the temporal changes of an element from the response of a sensor, parameter time variations can be measured for up to 801 points at a specified interval (100 µs to 10,000s), and then the data can be displayed in a graph or list.

Interval setting screen

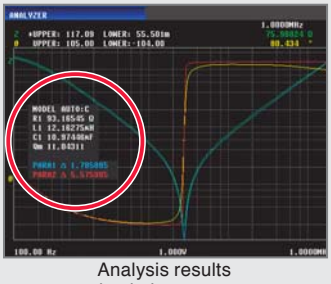
Link with computer via USB, LAN, RS-232C, or GP-IB

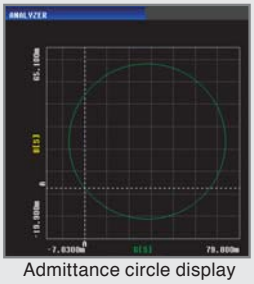
Effective for Acquisition and Analysis of Measurement Data

EQUIVALENT CIRCUIT ANALYSIS FIRMWARE IM9000 (option)

- Five equivalent circuit analysis (Auto/Fixed) patterns
- Acceptance/rejection decision for equivalent circuit elements
- Analysis results simulation
- Cole-Cole plot and admittance circle display

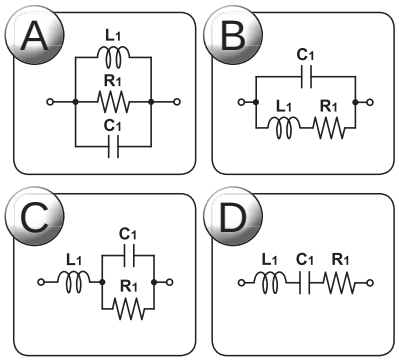

Acceptance/rejection decision screen for equivalent circuit elements


Analysis results simulation screen


Admittance circle display screen

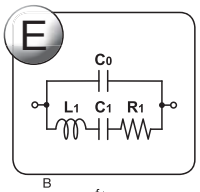
Equivalent Circuit Model and Measurement Items

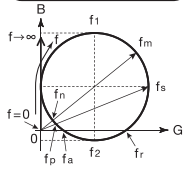
Three-element model



Measurement items
L1 (Inductance)
C1 (Capacitance)
R1 (Resistance)
Qm (Resonance sharpness)
fr (Resonance frequency) /
fa (Anti-resonance frequency)

Four-element model





Parameters of the 4-element model

Measurement items
L1 (Inductance)
C1 (Capacitance)
R1 (Resistance)
C0 (Parallel capacitance)
Qm (Resonance sharpness or mechanical quality coefficient)

fr (Resonance frequency)
fa (Anti-resonance frequency)
fs (Series resonance frequency)
fp (Parallel resonance frequency)
fm (Maximum admittance frequency)
fn (Minimum admittance frequency)
f1 (Maximum susceptance frequency)
f2 (Minimum susceptance frequency)

Saving and reading data via front-loading USB port

Measurement results and settings can be saved to a commercially available USB flash drive connected to the front panel.

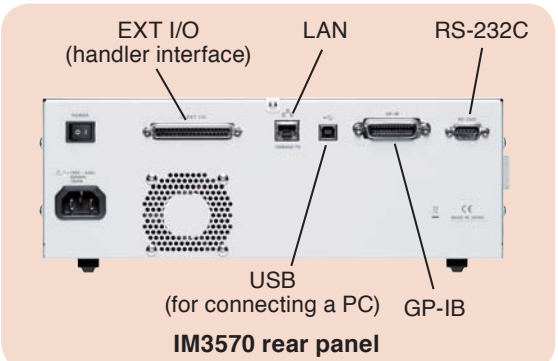
(The USB port on the front panel is specifically for a USB flash drive. Batch save all measurement results to a USB flash drive after saving them to the internal memory of IM3570. Some USB flash drives may not be able to be used due to incompatibility issues.)

Various measurement results and settings

Save to USB flash drive

External control from PC or PLC via USB, LAN, GP-IB, or RS-232C connection

The rear panel is standard equipped with RS-232C, GP-IB, USB and LAN ports. (The USB port on the rear panel is specifically for connecting a PC.)
Various functions of IM3570 can be controlled from a PLC or PC, and measurement results can be acquired. (Excluding turning the power on/off and configuring some interface settings.)
Use of an interface suitable for automated machinery enables you to build the optimal measurement system.



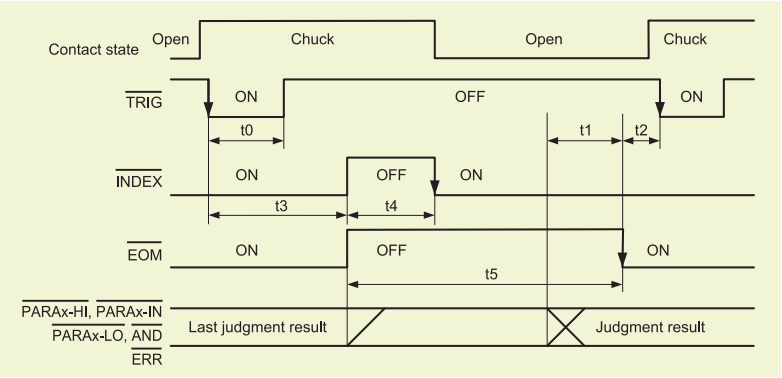
IM3570 rear panel

EXT I/O

Handler (EXT I/O) interface

The handler (EXT I/O) interface enables output of an end of measurement signal and measurement result signal, and input of signals such as a measurement trigger signal to control the measuring instrument. Each of the signal lines is isolated from the control circuit, and the structure is designed to protect against noise.

Example of representative EXT I/O timing



t0: Minimum time for trigger signal: 0.3 ms or longer *1
t1: Delay setting time from comparator and BIN judgment results to EOM (LOW): 0.04 ms or longer *1
t2: Minimum time from end of measurement to next trigger: 0.4 ms *1
t3: Time from trigger to response by circuit: 0.7 ms *1
t4: Minimum chuck time for which chuck can be switched with INDEX (LOW): 0.3 ms *1
t5: Measurement time: 0.5 ms *1

*1: When the measurement speed is FAST and the range is HOLD.

Connectors

Connectors to use (unit side)	: 37-pin D-SUB female connector with #4-40 inch screws
Compliant connectors	: DC-37P-ULR (solder type) and DCSP-JB37PR (insulation-displacement type) For information on where to obtain connectors, consult your nearest HIOKI distributor.

IM3570 specifications

(Accuracy guaranteed for 1 year, Post-adjustment accuracy guaranteed for 1 year)

Measurement modes	LCR mode: Measurement with single condition Analyzer mode: Sweeps with measurement frequency and measurement level (Measurement points: 1 to 801, Measurement method: normal sweep or segment sweep, Display: List display or graph display) Continuous measurement mode: Measures under saved conditions continuously (maximum of 32 sets)
Measurement parameters	Z Impedance Y Admittance θ Phase angle Rs(ESR) Series-equivalent resistance = ESR Rp Parallel-equivalent resistance Rdc DC resistance X Reactance G Conductance B Susceptance Cs Series-equivalent static capacitance Cp Parallel-equivalent static capacitance Ls Series-equivalent inductance Lp Parallel-equivalent inductance D(tanδ) Loss coefficient = tan δ (δ= delta) Q Q factor (Q = 1/D)
Measurement range	100 mΩ to 100 MΩ, 12 ranges (All parameters are determined according to Z)
Display range	Z, Y, Rs, Rp, Rdc, X, G, B, Ls, Lp, Cs, Cp : ±(0.000000 [unit] to 9.999999G [unit] Absolute value display for Z and Y only θ : ±(0.000° to 180.000°) D : ±(0.000000 to 9.999999) Q : ±(0.00 to 99999.99) Δ % : ±(0.0000% to 999.9999%)
Basic accuracy	Z : ±0.08%rdg. θ: ±0.05°
Measurement frequency	4Hz to 5MHz (5 digits setting resolution, minimum resolution 10 mHz)
Measurement signal level	Normal mode: V mode/CV mode: 5 mV to 5 Vrms (up to 1 MHz), 10 mV to 1 Vrms (1 MHz to 5 MHz), 1 mVrms steps CC mode: 10 µA to 50 mArms (up to 1 MHz), 10 µA to 10 mArms (1 MHz to 5 MHz), 10 µArms steps Low impedance high accuracy mode: V mode/CV mode: 5 mV to 1 Vrms (up to 100 kHz), 1 mVrms steps CC mode:10 µA to 100 mArms (100 mΩ and 1Ω ranges of up to 100 kHz), 10 µArms steps

Output impedance	Normal mode: 100 Ω Low impedance high accuracy mode: 10 Ω
Display	5.7-inch color TFT, display can be set to ON/OFF
No. of display digits setting	The number of display digits can be set from 3 to 7 (initial value: 6 digits)
Measurement time	0.5 ms (100 kHz, FAST, display OFF, representative value)
Measurement speed	FAST/MED/SLOW/SLOW2
DC bias measurement	Normal mode: 0 VDC to 2.50 VDC (10 mV steps) Low impedance high accuracy mode: 0 VDC to 1.00 VDC (10 mV steps)
DC resistance measurement	Normal mode Measurement signal level: 100 mVDC to 2.5 VDC (10 mV steps) Low impedance high accuracy mode Measurement signal level: 100 mVDC to 1.00 VDC (10 mV steps)
Comparator	LCR mode: Hi/IN/Lo for first and third items Analyzer mode: Area judgment (Hi/IN/Lo for each point) Peak judgment (Hi/IN/Lo for local maximum and local minimum frequency and absolute values)
BIN measurement	10 classifications and out of range for 2 items
Compensation	Open/short/load/cable length of 0 and 1 m/correlation compensation
Residual charge protection function	$V=\sqrt{10/C}$ (C: Capacitance [F] of test sample, V = max. 400 V)
Trigger synchronous output function	Applies a measurement signal during analog measurement only
Averaging	1 to 256
Interval measurement	100 µs to 10,000 s, max. 801 points
Panel loading/saving	LCR mode: 30; Analyzer mode: 2; Compensation value: 128
Memory function	Stores 32,000 data items to the memory of the instrument
Interfaces	EXT I/O (handler), RS-232C, GP-IB, USB (Hi-Speed/Full-Speed), USB flash drive, LAN (10BASE-T/100BASE-TX)
Operating temperature and humidity ranges	0°C to 40°C, 80% RH or less, no condensation
Storage temperature and humidity ranges	-10°C to 50°C, 80% RH or less, no condensation
Power supply	90 to 264 V AC, 50/60 Hz, 150 VA max.
Dimensions and weight	Approx. 330 (W) x 119 (H) x 307 (D), approx. 5.8 kg
Accessory	Power Cord x 1, Instruction Manual x 1, Communication Instruction Manual (CD) x 1

IM3570 measurement accuracy

Conditions

Temperature and humidity ranges: 23°C ± 5°C, 80% RH or less (no condensation),
at least 60 minutes after power turned on, after performing open and short compensation

Basic accuracy (Z, θ) calculation expression

In the 1 kΩ range and above and 300 Ω range and below, the calculation expression of basic accuracy differs as shown below. For details, refer to the following calculation examples.

Top A: Basic accuracy of Z (± % rdg.)
B is the coefficient for the impedance of the sample

Bottom A: Basic accuracy of θ (± % deg.)
B is the coefficient for the impedance of the sample

A is the accuracy of R when DC (± % rdg.)
B is the coefficient for the resistance of the sample

1 kΩ range and above:

$$\text{Accuracy} = A + B \times \left| \frac{10 \times Zx}{Range} - 1 \right|$$

300 Ω range and below:

$$\text{Accuracy} = A + B \times \left| \frac{Range}{Zx} - 1 \right|$$

Zx is the actual impedance measurement value (Z) of the sample.

The measurement accuracy is calculated based on the following equation.

Measurement accuracy = Basic accuracy × C × D × E × F × G

[C: Level coefficient] V: Setting value (corresponds to when V mode) [V]

0.005V to 0.999V : $1 + \frac{0.1}{V}$ (For measurements other than Rdc, at 30kΩ range or below)

$1 + \frac{0.3}{V}$ (All Rdc ranges, and 100kΩ range and above for measurements other than Rdc)

1V to 5V : 1

[D: Measurement speed coefficient]

FAST : 8, MED : 4, SLOW : 2, SLOW2: 1

[E: Measurement cable length coefficient] fm: Measurement frequency [kHz]

0 m : 1 (DC to 5MHz), 1 m : 1.5 (DC to 5MHz),

2 m : $2 \times \left(1 + \frac{fm}{100}\right)$ (DC to 100kHz), 4 m : $4 \times \left(1 + \frac{fm}{100}\right)$ (DC to 10kHz)

[F: DC bias coefficient] V_{AC}: AC signal voltage setting value [V]

DC bias setting OFF : 1

DC bias setting ON : $2 \times \left(1 + \frac{0.1}{V_{AC}}\right)$, $4 \times \left(1 + \frac{0.1}{V_{AC}}\right)$ (At 10Ω range or below, minimum 100.01 kHz.)

[G: Temperature coefficient] t: Operating temperature

When t is 18°C to 28°C : 1, When t is 0°C to 18°C or 28°C to 40°C : 1+ 0.1 × |t-23 |

Basic accuracy

Range	Guaranteed accuracy range	DC	4 Hz to 99.9 Hz	100 Hz to 999.99 Hz	1 kHz to 10 kHz	10.01 kHz to 100 kHz	100.1 kHz to 1 MHz	1.001 MHz to 5 MHz
100MΩ	8MΩ to 200MΩ	A=4 B=6	A=6 B=5 A=5 B=3	A=3 B=2 A=2 B=2	A=3 B=2 A=2 B=2	A=8 B=4 A=3 B=2	* Set the accuracy to $\frac{(f[MHz]+3)}{4}$ times for 1.001 MHz or above.	
10MΩ	800kΩ to 100MΩ	A=0.5 B=0.3	A=0.8 B=1 A=0.8 B=0.5	A=0.5 B=0.3 A=0.4 B=0.2	A=0.5 B=0.3 A=0.4 B=0.2	A=1 B=0.7 A=1 B=0.2	A=3 B=2 A=3 B=1	
1MΩ	80kΩ to 10MΩ	A=0.2 B=0.1	A=0.4 B=0.08 A=0.3 B=0.08	A=0.3 B=0.05 A=0.2 B=0.02	A=0.3 B=0.05 A=0.2 B=0.02	A=0.3 B=0.08 A=0.3 B=0.08	A=1 B=0.5 A=1 B=0.5	* A=2 B=1 A=2 B=1
100kΩ	24kΩ to 1MΩ	A=0.1 B=0.01	A=0.3 B=0.01 A=0.3 B=0.01	A=0.2 B=0.01 A=0.1 B=0.01	A=0.15 B=0.01 A=0.1 B=0.01	A=0.25 B=0.04 A=0.2 B=0.02	A=0.4 B=0.3 A=0.3 B=0.3	* A=2 B=0.5 A=2 B=0.3
30kΩ	8kΩ to 300kΩ	A=0.1 B=0.01	A=0.3 B=0.01 A=0.3 B=0.01	A=0.2 B=0.005 A=0.1 B=0.003	A=0.12 B=0.005 A=0.08 B=0.003	A=0.25 B=0.01 A=0.15 B=0.005	A=0.4 B=0.05 A=0.3 B=0.03	* A=2 B=0.1 A=2 B=0.1
10kΩ	2.4kΩ to 100kΩ	A=0.1 B=0.01	A=0.3 B=0.01 A=0.3 B=0.01	A=0.2 B=0.01 A=0.1 B=0.005	A=0.12 B=0.005 A=0.08 B=0.002	A=0.2 B=0.02 A=0.08 B=0.02	A=0.3 B=0.03 A=0.2 B=0.05	* A=1.5 B=0.2 A=1 B=0.2
3kΩ	800Ω to 30kΩ	A=0.1 B=0.01	A=0.3 B=0.02 A=0.2 B=0.01	A=0.2 B=0.005 A=0.1 B=0.002	A=0.12 B=0.005 A=0.08 B=0.002	A=0.2 B=0.005 A=0.08 B=0.005	A=0.3 B=0.01 A=0.15 B=0.01	* A=1.5 B=0.02 A=1 B=0.03
1kΩ	240Ω to 10kΩ	A=0.1 B=0.01	A=0.3 B=0.02 A=0.2 B=0.01	A=0.2 B=0.01 A=0.1 B=0.005	A=0.1 B=0.005 A=0.08 B=0.002	A=0.2 B=0.01 A=0.08 B=0.01	A=0.3 B=0.01 A=0.15 B=0.01	* A=1.5 B=0.01 A=1 B=0.01
300Ω	8Ω to 300Ω	A=0.1 B=0.02	A=0.4 B=0.02 A=0.2 B=0.01	A=0.3 B=0.02 A=0.15 B=0.01	A=0.08 B=0.02 A=0.05 B=0.01	A=0.2 B=0.02 A=0.08 B=0.02	A=0.3 B=0.03 A=0.15 B=0.02	* A=1.5 B=0.05 A=1 B=0.05
10Ω	800mΩ to 10Ω	A=0.2 B=0.15	A=0.5 B=0.2 A=0.3 B=0.1	A=0.4 B=0.05 A=0.3 B=0.03	A=0.3 B=0.05 A=0.15 B=0.03	A=0.3 B=0.05 A=0.15 B=0.03	A=0.4 B=0.2 A=0.3 B=0.1	* A=2 B=1.5 A=2 B=1
1Ω	80mΩ to 1Ω	A=0.3 B=0.3	A=2 B=1 A=1 B=0.6	A=0.6 B=0.3 A=0.5 B=0.2	A=0.4 B=0.3 A=0.25 B=0.2	A=0.4 B=0.3 A=0.25 B=0.2	A=1 B=1 A=0.7 B=0.5	* A=3 B=3 A=3 B=2
100mΩ	1mΩ to 100mΩ	A=3 B=2	A=10 B=10 A=6 B=6	A=3 B=3 A=2 B=2	A=3 B=3 A=2 B=1.5	A=2 B=2 A=2 B=1.5	A=4 B=3 A=3 B=4	

● Method of determining basic accuracy

- Calculate the basic accuracy from the sample impedance, measurement range, and measurement frequency and the corresponding basic accuracy A and coefficient B from the table above.
- The calculation expression to use differs for each of the 1 kΩ range and above and 300 Ω range and below.
- For C and L, obtain basic accuracy A and coefficient B by determining the measurement range from the actual measurement value of impedance or the approximate impedance value calculated with the following expression.

$Zx\ (\Omega) \approx \omega L\ (H)\ \ (\theta \approx 90°)$

$\approx \frac{1}{\omega C\ (F)}\ (\theta \approx -90°)$

$\approx R\ (\Omega)\ (\theta \approx 0°)$ (ω: 2 x π x Measurement frequency [Hz])

● Calculation example

Impedance Zx of sample: 500 Ω (actual measurement value)
Measurement conditions: When frequency 10 kHz and range 1 kΩ

Insert coefficient A = 0.1 and coefficient B = 0.005 for the Z basic accuracy from the table above into the expression.

$$\text{Z basic accuracy} = 0.1 + 0.005 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.12\ (\pm\ \%\text{rdg.})$$

Similarly, insert coefficient A = 0.08 and coefficient B = 0.002 for the θ basic accuracy, as follows:

$$\theta\ \text{basic accuracy} = 0.08 + 0.002 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.088\ (\pm\ \text{deg.})$$

Guaranteed accuracy range (measurement signal level)

The guaranteed accuracy range differs depending on the measurement frequency, measurement signal level, and measurement range.

Range	DC	4 Hz to 99.9 Hz	100 Hz to 999.99 Hz	1 kHz to 10 kHz	10.01 kHz to 100 kHz	100.1 kHz to 1 MHz	1.001 MHz to 5 MHz
100MΩ	1 V to 2.5 V	0.101 V to 5 V			0.501 V to 5 V		
10MΩ	0.1 V to 2.5 V	0.050 V to 5 V			0.101 V to 5 V	0.501 V to 5 V	
1MΩ		0.005 V to 5 V			0.050 V to 5 V	0.101 V to 5 V	0.501 V to 1 V
100kΩ						0.050 V to 5 V	0.101 V to 1 V
30kΩ,10kΩ,3kΩ, 1kΩ,300Ω,10Ω							0.050 V to 1 V
1Ω		0.005 V to 5 V *2				0.101 V to 5 V	0.501 V to 1 V
100mΩ	0.1 V to 2.5 V *1	0.101 V to 5 V *3				0.501 V to 5 V *3	

The above voltages are the voltage setting values correspond to when in V mode.

*1 Guaranteed accuracy of 10 mΩ or above, *2 Guaranteed accuracy of 0.101 V to 5 V when DC bias, *3 Guaranteed accuracy of 10 mΩ or above and 1.001 V to 5 V when DC bias

Model : IMPEDANCE ANALYZER IM3570

Model No. (Order Code) (Note)

IM3570

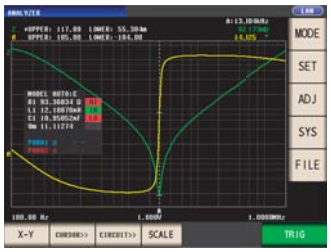
Accessories: Power cord ×1, Instruction manual ×1, PC communication instruction manual (CD-R) ×1

Note: Test fixtures are not supplied with the instrument. Select optional test fixtures or probes when ordering.

Options

EQUIVALENT CIRCUIT ANALYSIS FIRMWARE IM9000

(Factory-installed option)



The Equivalent Circuit Analysis Firmware IM9000 is an optional function for the Impedance Analyzer IM3570. The IM9000 is not included in the standard package. If you want to use the IM9000, specify the option upon purchase.

Customers who have purchased the Impedance Analyzer IM3570 can add the Equivalent Circuit Analysis Firmware IM9000 function.
Please contact your Hioki distributor.

Test Fixtures for SMDs

SMD TEST FIXTURE IM9110

Measurable range: DC to 1 MHz, For SMD with electrodes on side , Measurable sample sizes: 008004 (EIA), 0201 (JIS), Please contact Hioki for information about other sizes, Direct connection type

SMD TEST FIXTURE IM9100

Measurable range: DC to 8 MHz, For SMD with electrodes on bottom, Measurable sample sizes: 01005 to 0402 (EIA) 0402 to 1005 (JIS), Direct connection type

SMD TEST FIXTURE 9677

Direct connection type, for SMDs with electrodes on the side, DC to 120 MHz, SMD sizes: 3.5 ±0.5 mm

PINCHER PROBE L2001

*Ships standard with one set of IM9901

Cable length 730 mm (2.40 ft) , DC to 8 MHz, characteristic impedance of 50 Ω, 4-terminal pair design, 2-terminal electrode, tip electrode spacing of 0.3 to approx. 6 mm (0.01 to approx. 0.24 in)

SMD TEST FIXTURE 9699

Direct connection type, for SMDs with electrode on the bottom, DC to 120 MHz, SMD sizes: 1.0 to 4.0 mm wide, 1.5 mm or less high

SMD TEST FIXTURE 9263

Direct connection type, DC to 8 MHz, SMD sizes: 1 to 10 mm (0.04 to 0.39 in)

Options for L2001

Replaceable contact tips

CONTACT TIPS IM9901

Compatible chip sizes: 1608 to 5750 (JIS)

CONTACT TIPS IM9902

Compatible chip sizes: 0603 to 5750 (JIS)

Probes and Test Fixtures for Lead Components

FOUR-TERMINAL PROBE L2000

Cable length 1 m (3.28 ft), DC to 8 MHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 5 mm (0.01 to 0.20 in)

FOUR-TERMINAL PROBE 9140-10

Cable length 1 m (3.28 ft), DC to 200 kHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 5 mm (0.01 to 0.20 in)

TEST FIXTURE 9262

Direct connection type, DC to 8 MHz, measurable conductor diameter: 0.3 to 2 mm (0.01 to 0.08 in)

TEST FIXTURE 9261-10

Cable length 1 m (3.28 ft), DC to 8 MHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 1.5 mm (0.01 to 0.06 in)

For Electrochemical Measurement

FOUR-TERMINAL PROBE 9500-10

Cable length 1 m (3.28 ft), DC to 200 kHz, characteristic impedance of 50 Ω, 4-terminal pair design, measurable conductor diameter: 0.3 to 2 mm (0.01 to 0.08 in)

DC Bias Unit

DC BIAS VOLTAGE UNIT 9268-10

Direct connection type, 40 Hz to 8 MHz, maximum applied voltage: ±40 V DC

DC BIAS VOLTAGE UNIT 9269-10

Direct connection type, 40 Hz to 2 MHz, maximum applied current 2 A DC (maximum applied voltage: ±40 V DC)

* An internal 300µH inductance is connected in parallel to the DUT.

*When using the 9268-10 or 9269-10, external constant-voltage and constant-current sources are required.

INTERFACE CABLE

GP-IB CONNECTION CABLE 9151-02

2 m (6.56 ft) length

● RS-232C Cable

As RS-232C cable, use an interlink (crossover) cable.
The 9637 RS-232C cable (9-pin to 9-pin, crossed cable) cannot be used for applications involving the hardware flowcontrol.

HIOKI

HIOKI E.E. CORPORATION

TECNOLOGIA

HIOKI

Le tecnologie di misura Hioki sono ampiamente e globalmente utilizzate per manutenzione, controllo qualità, ricerca e sviluppo, in ambito industriale, aziendale e delle infrastrutture, contribuendo alla sicurezza ed alla protezione del nostro vivere quotidiano.
L'azienda supporta inoltre lo sviluppo delle tecnologie di nuova generazione nei settori automotive ed energie rinnovabili, favorendo la diffusione di prodotti di elevata qualità a prezzi competittivi.
La mission di Hioki è di pordurre e divulgare tecnologie di misura volte a proteggere la sicurezza delle persone e consentire, attraverso il supporto alla ricerca, il progresso della scienza e della tecnica.

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