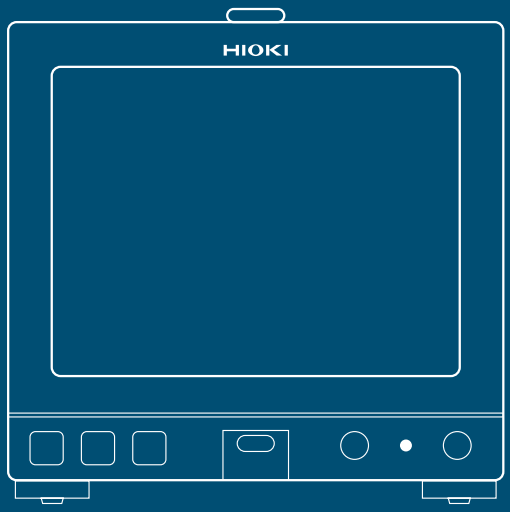
CATALOGO STRUMENTI

Ricerca & Sviluppo

MISURE PRIMARIE

IMPEDENZIMETRI



TECNOLOGIA

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TECNOLOGIE DI MISURA

INDICE

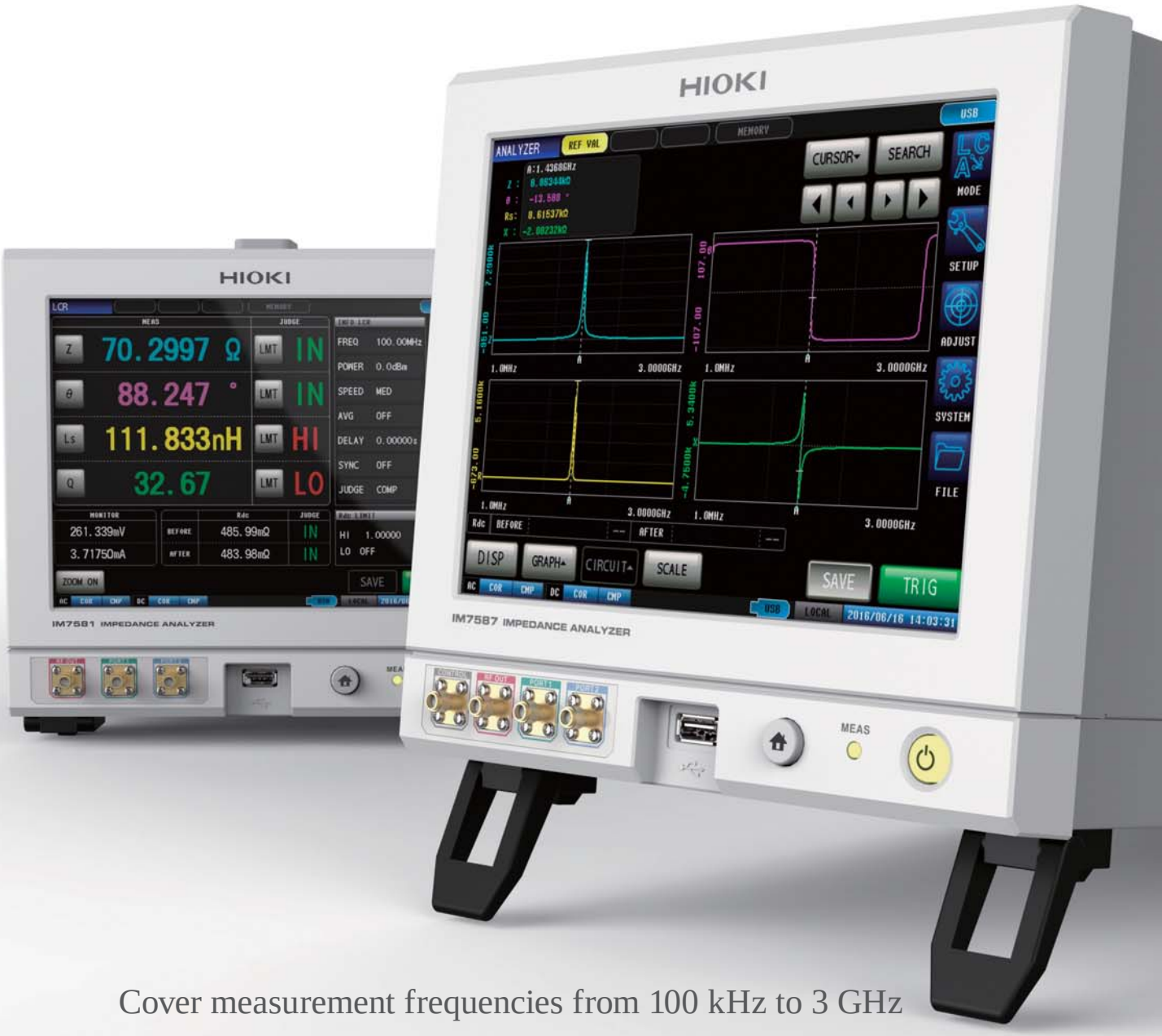
HIOKI

IMPEDANCE ANALYZER
IM7580 Series

NEW

High Performance Reliability

3GHz Is Here



Cover measurement frequencies from 100 kHz to 3 GHz

Choose from 5 Models

CE

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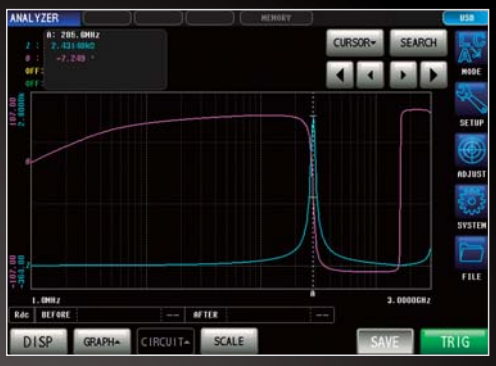
TECNOLOGIE DI MISURA

High-stability Impedance Measurement up to 3 GHz*

Cover a wide range of measurement frequencies, from 1 MHz to 3 GHz, with a single device. High-stability measurement with minimal variability delivers outstanding cost performance for research and development.

* IM7587



High-stability, high-speed sweeping measurement up to 3 GHz

SMD TEST FIXTURE IM9201 (option)

Use the 6-in-1 SMD Test Fixture IM9201 (option) to perform easy and reliable measurements.

Advanced Design for Reliable Testing

Stable measurement across a broad range

Test head for the IM7583, IM7585, and IM7587

To achieve favorable frequency characteristics, we painstakingly carried out design true to our basic principles for the individual circuits, board patterning, and case structure.
We also used numerical analysis and in-depth verification to optimize the shield structure and the shape of the internal board pattern, thus fitting all the technology necessary to achieve optimal frequency characteristics from 100 kHz to 3 GHz into a compact body.
For the test head measurement terminals, in order to improve their measurement accuracy over a wide range, we used 3.5 mm (0.14 in) connectors with a wide frequency range, which also boast better removability than other microwave connectors.

Measurement technology that adds to superior stability

The measurement portion uses a high resolution A/D converter. By controlling the input signal's level and frequency, the A/D converter's dynamic range can be utilized to the fullest, achieving measurement with a wide impedance range and minimum variability.
In the sub FPGA, built into analog circuits, the digital filter applied optimally for each circuit shuts out noise. At the main FPGA, the 64-bit floating point computation is put through a multi-layered pipeline to achieve high-speed computational processing with little margin of error. This helps increase the stability and speed of measurements.

Large solid shield for improved performance

Each section uses a solid shield carved to match the on-board pattern or IC shape, thus reducing internal coupling. The shield also reduces external radiation and improves noise resistance, meeting a high level of EMC, despite being the lightest in its class.

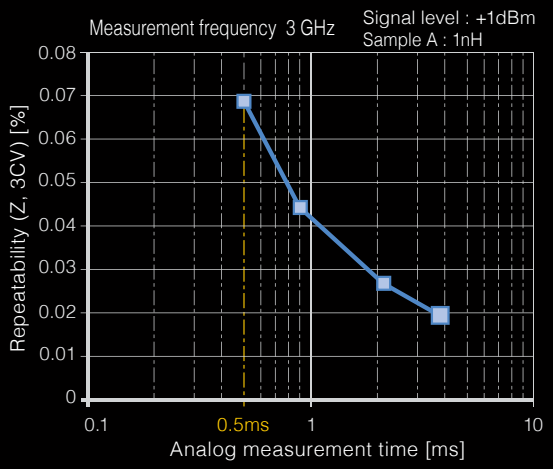
Inside the solid shield

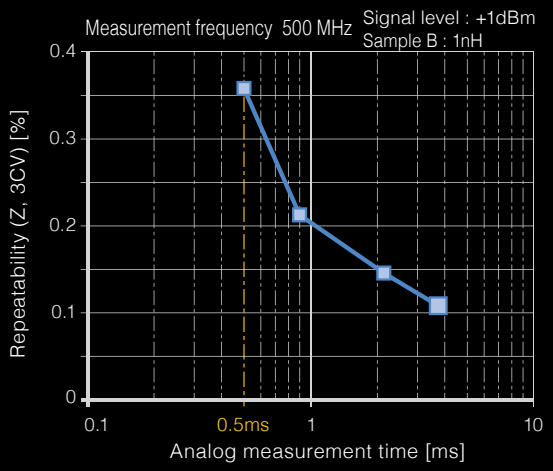
High-speed, highly stable measurement

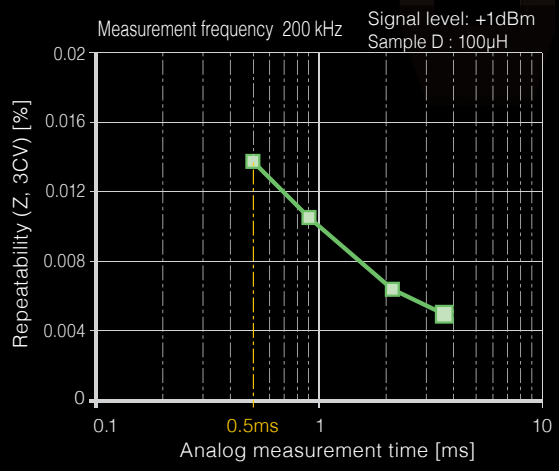
Achieve measurement with both high speed and high stability.
Cut takt time and increase productivity.

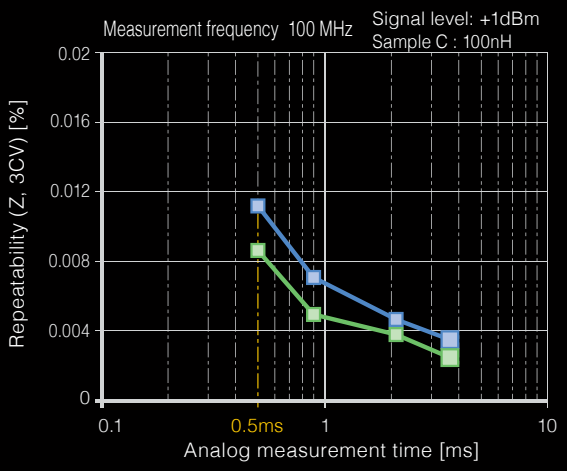
Repeatability and analog measurement time
(Reference data)

IM7583, IM7585, IM7587 IM7580A, IM7581







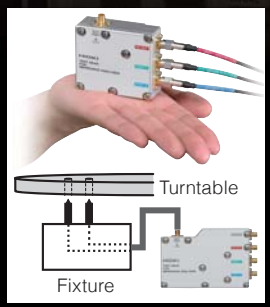


Space-saving Half-rack Size

Compact form factor – 2 analyzers fit side-by-side on a full-size rack. Remarkably lightweight and compact for a measuring instrument of this class.

Compact body for greater mobility

The half-rack compact body is light and fit not only for line use, but also when measuring various sites on the go.



Test head fits in the palm of your hand

The slim profile of the test head lets you install it close to the measurement target to help minimize influence from noise and other effects and enabling more accurate measurement.

Large display for easy operation

Customize the large screen according to desired brightness, color, and text size to fit your environment.
Highly responsive touch screen makes measurement settings and adjustments even easier.

Number of display digits (3/4/5/6)

Customizable text size

Customizable display color (Background and display colors)

Select Your Testing Frequency from 5 Models

Photo: IM7581

IMPEDANCE ANALYZER IM7580A

Measurement frequency	1 MHz to 300 MHz
Measurement range	L : 0.0531 nH to .795 mH C : 0.1061 pF to i.59 µF (Depending on the measurement frequency)
Measurement signal level	-40.0 dBm to +7.0 dBm
Basic accuracy	Z : 0.72% rdg. θ: 0.41°

IMPEDANCE ANALYZER IM7581

Measurement frequency	100 kHz to 300 MHz
Measurement range	L : 0.0531 nH to 7.95 mH C : 0.1061 pF to 15.9 µF (Depending on the measurement frequency)
Measurement signal level	-40.0 dBm to +7.0 dBm
Basic accuracy	Z : 0.72% rdg. θ: 0.41°

IMPEDANCE ANALYZER IM7583

Measurement frequency	1 MHz to 600 MHz
Measurement range	L : 0.0265 nH to 0.795 mH C : 0.0531 pF to 1.59 µF (Depending on the measurement frequency)
Measurement signal level	-40.0 dBm to +1.0 dBm
Basic accuracy	Z : 0.65% rdg. θ: 0.38°

Photo: IM7585

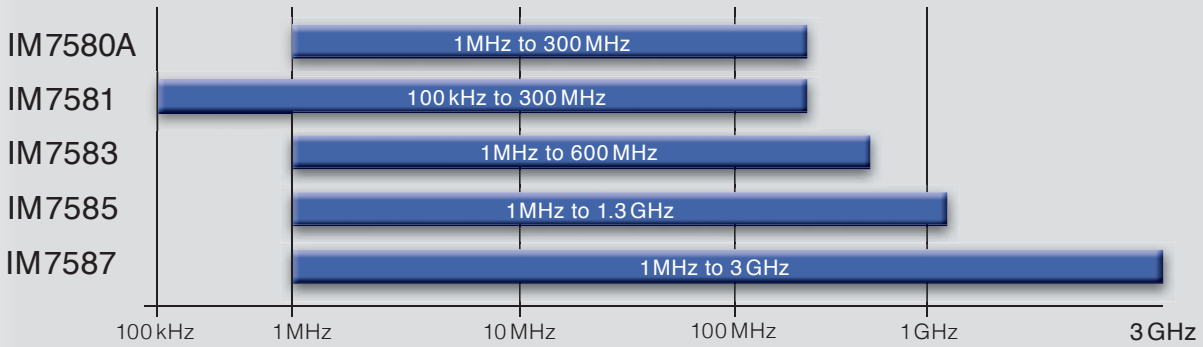
IMPEDANCE ANALYZER IM7585

Measurement frequency	1 MHz to 1.3 GHz
Measurement range	L : 0.0123 nH to 0.795 mH C : 0.0245 pF to 1.59 µF (Depending on the measurement frequency)
Measurement signal level	-40.0 dBm to +1.0 dBm
Basic accuracy	Z : 0.65% rdg. θ: 0.38°

IMPEDANCE ANALYZER IM7587

Measurement frequency	1 MHz to 3 GHz
Measurement range	L : 0.0053 nH to 0.795 mH C : 0.011 pF to 1.59 µF (Depending on the measurement frequency)
Measurement signal level	-40.0 dBm to +1.0 dBm
Basic accuracy	Z : 0.65% rdg. θ: 0.38°

5 models support a wide variety of applications



Dual measurement modes

Display up to four measurement parameters simultaneously.

Z	Impedance	G	Conductance	Rp	Equivalent parallel resistance	Cp	Equivalent parallel capacitance
Y	Admittance	B	Susceptance	Ls	Equivalent series inductance	D	Loss factor tan δ
θ	Phase angle	Q	Q-factor	Lp	Equivalent parallel inductance	V	Monitor voltage*
X	Reactance	Rs	Equivalent series resistance (ESR)	Cs	Equivalent series capacitance	I	Monitor current*

*Analyzer mode only

LCR Mode

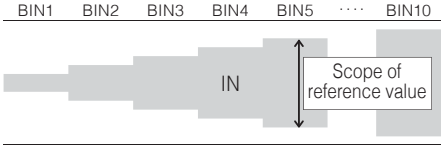
Use LCR Mode to make measurements by applying the desired frequency and level signal to the component being measured. This mode is ideal for evaluating passive samples such as capacitors and coils.

Comparator measurement : Yield a PASS/FAIL judgment for the target sample based on a single judgment criterion.

Upper limit - HI is displayed
Reference value - IN is displayed
Lower limit - LO is displayed

Upper and lower limit judgment: Set the upper and lower limits.
Percentage judgment: Set the upper and lower limits as percentages of the reference value.
Deviation percentage judgment: Set the upper and lower limits as percentages of the reference value. The impedance analyzer will display deviation of the measured value from the reference value (Δ%).

Bin measurement : Rank samples using multiple judgment criteria.



Set upper and lower limits for each bin. The impedance analyzer will rank components using up to 10 categories.
*Upper and lower limit settings are the same as for comparator measurement.

Display zoom function

Display measured values using larger text for better visibility on production lines and in other field applications.

Monitor function

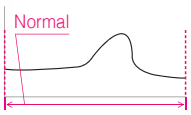
Display the measurement signal level being applied to components in real time.

Monitor voltage : 0.0 mV to 1000.0 mV
Monitor current : 0.000 mA to 20.000 mA

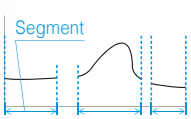
Analyzer Mode

Use Analyzer Mode to perform measurement while sweeping through a range of measurement frequencies and measurement signal levels. This mode is ideal for checking frequency characteristics and level characteristics.

Normal / segment sweep operation : Discover sample characteristics by sweeping through a range of frequencies and levels.



Perform measurement after setting the sweep parameter (frequency or level), sweep range, number of sweep points, and measurement conditions.



Set the sweep parameter, sweep range, number of sweep points, and measurement conditions on a segment-by-segment basis.

Sweep parameters	Frequency/signal level (power, voltage, current)
Number of sweep points/segments	Up to 801 points / Up to 20 segments (with a total of 801 points)
Measurement condition settings	Frequency, level, speed, average

Interval sweep operation : Discover element characteristics over time under set conditions.

Measurement condition settings	Frequency, level, speed, average
Time interval	0 sec. to 1,000 sec.
Number of sweep points/segments	Up to 801 points / Up to 20 segments (with a total of 801 points)

Display

The graph display can be switched based on the type of measurement being performed.
(with a total of 7 layouts available)

Sweep graph display (1-graph/4-graph display),
XY graph display (1-graph/2-graph display),
Multi-display (simultaneous display of sweep and XY),
List display, Peak display

Intelligent measurement and analysis

Convenient functionality for performing measurement, reviewing measurement results, and judging measured values.

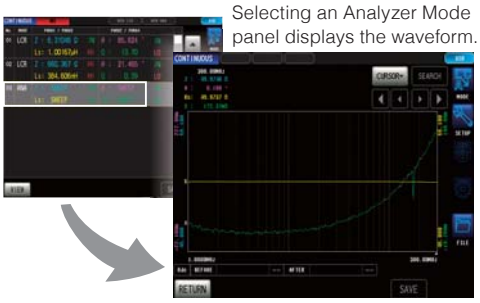
■ Functions available in analyzer mode
● Functions available in LCR mode

Continuous measurement function ■ ●

Perform continuous measurement in the order of the measurement conditions saved with the panel save function.
Measurements can combine LCR and Analyzer Mode measurement conditions.

A: Panel numbers set for continuous measurement;
B: Measured values; C: Parameter judgment results

Continuous measurement can be performed using up to 46 measurement condition combinations, and can be implemented from EXT I/O.



Selecting an Analyzer Mode panel displays the waveform.

Panel save and load function

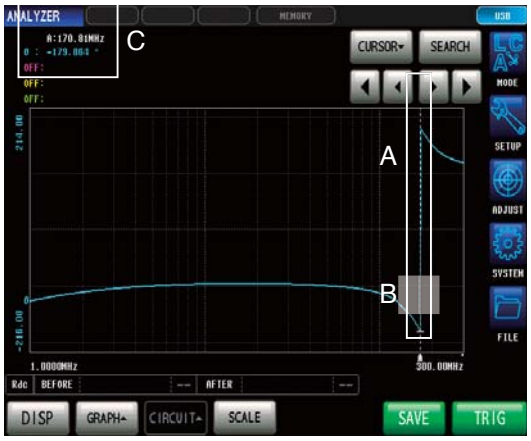
Save or load the measurement conditions, compensation values, and compensation conditions set in LCR mode or analyzer mode.

Number of panels that can be saved

LCR Mode measurement conditions	30
Analyzer Mode measurement conditions	16

Measured value search function ■

The cursor can be moved automatically to a user-selected measured value point for one set of sweep measurement results.



A: Cursor; B: Search result point; C: Measured values at result point

Search options

Maximum value	Moves the cursor to the maximum value.
Minimum value	Moves the cursor to the minimum value.
Target	Moves the cursor to a user-set measured value.
L-Max value	Moves the cursor to the local maximum value (a filter can be set).
L-Min value	Moves the cursor to the local minimum value (a filter can be set).

Auto search function

Move the cursor automatically according to user-configured settings once sweep measurement is complete.

Area and peak comparison functions

Check whether measured values fall inside a previously configured judgment area. These functions are ideal for use in verifying non-defective products.

Peak judgment screen

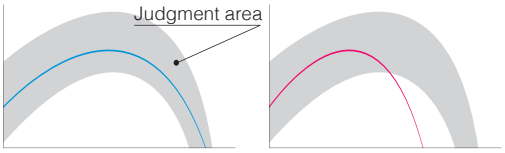
Area judgment screen

Spot judgment screen

Area judgment

Obtaining an overall judgment for each sweep

Define a range by setting upper and lower limits and display the judgment results as IN or NG.



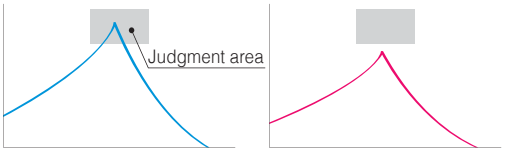
IN judgment: Inside area

NG judgment: Outside area

Peak judgment

Identifying resonance points

Define a range by setting upper, lower, left, and right limits and display the judgment results as IN or NG.



IN judgment: Inside area

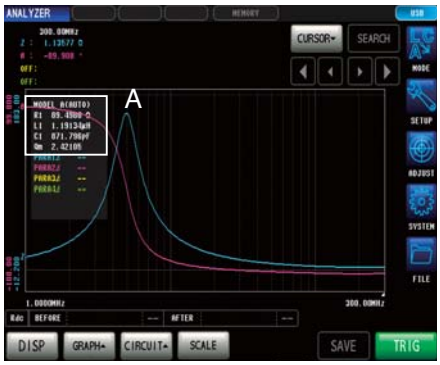
NG judgment: Outside area

Spot judgment

For multiple-frequency simultaneous judgments

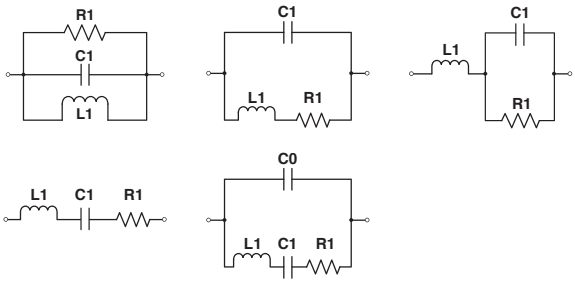
This function makes a judgment at a pre-set point during sweeping. (Up to 16 points)

Equivalent circuit analysis function



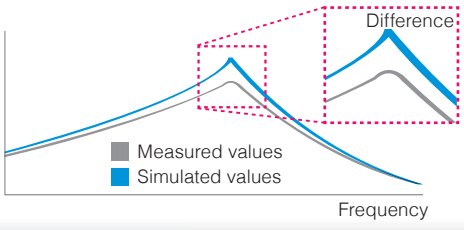
A: Analysis results

Analyze individual component values (L/C/R) for elements in the following five circuits based on measurement results.



Simulation function/residual error display

Perform simulations based on the result of equivalent circuit analyses, compare that to actual measured values, and check the validity of the analysis result.
Display the residual error to check the gap between the actual measurement and simulation numerically.

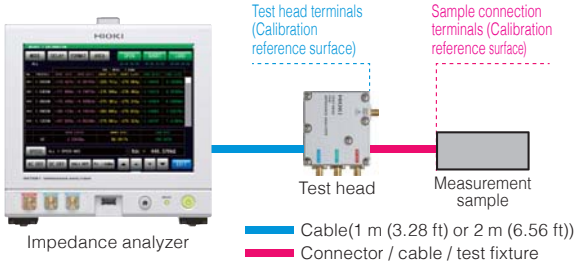


Functions for Efficient, Accurate Measurement

Fully equipped with a range of built-in functions necessary for accurate and stable measurement.

Compensation function

To truly measure accurately, all analyzers should first be set up to their optimal state.



Open, short, and load calibration

The compensation process involves calibrating the measurement setup, from the impedance analyzer to the reference surface (either the test head terminals or the sample connection terminals). Connect the calibration kit (standard for open, short, and load), measure each piece of calibration data, and remove the cause of the margin of error.

Electrical length compensation

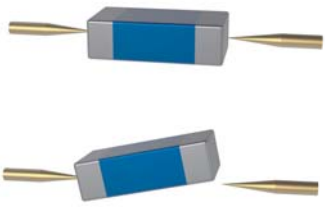
Enter the length of the electrical connection between the reference surface and the measurement sample connection surface to allow compensation of error caused by phase shift.
If mounting a fixture on the test head, it is necessary to enter the fixture's electrical length.

Open and short compensation

Eliminate the causes of errors (such as fixtures or measurement cables) from the calibration standard surface to the sample connection terminal.

Contact check

Monitor the connection between the measurement terminals and the sample.



Contact check / Hi-Z reject function

DCR measurement

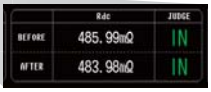
DCR measurement

Checking contact before and after measurement

This capability is ideal for carrying out contact checks of inductive components with low DC resistance values such as inductors, ferrite cores, and common-mode filters.

Judgments based on user-configured upper and lower contact resistance limits

Guaranteed accuracy range	0.1 Ω to 100 Ω
Measurement timing	Before measurement, after measurement, or before and after measurement
Output format	Screen display / EXT I/O Output



Measured value > Upper limit: Displays "HI."
Upper limit ≥ Measured value ≥ Lower limit: Displays "IN."
Measured value < Lower limit: Displays "LO."

Hi-Z reject function

Judging the contact state based on measurement results

Activate this function in order to output a measurement terminal contact error if the impedance measured value is greater than a user-configured reference value.

Valid setting range	1 Ω to 10000 Ω
Output format	Screen error display or EXT I/O error output

Waveform judgment function

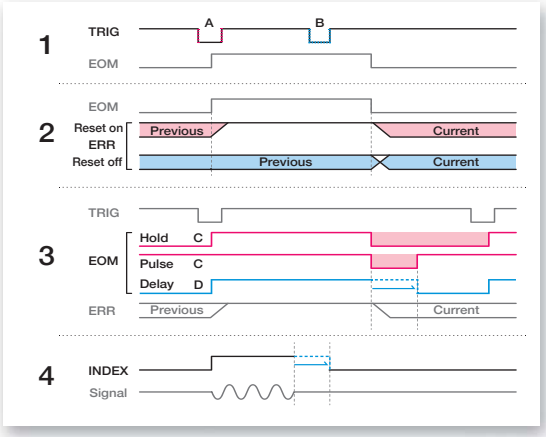
Detecting chatter during measurement

Verify that components and terminals are in contact during measurement. The impedance analyzer will output an error if fluctuations in the RMS value exceed a user-configured range that has been set using the initially acquired RMS value waveform as the reference value.

Valid setting range	0.01% to 100.0% of the reference value
Output format	Screen error display or EXT I/O error output

Handler Interface

Perform intricate external control.



1. Trigger input

Timing and enable/disable settings

A Choose to enable or disable trigger input during measurement. By disabling input, you can prevent erroneous input caused by chatter.

B Select whether to base input timing on the trigger's rising edge or falling edge.

2. Reset judgment result

You can set the timing at which judgment results are reset.
On: Reset the previous judgment results at the measurement complete signal's rising edge.
Off: Retain previous judgment until next judgment is output.

3. Measurement complete signal

Output method and output delay

C Select whether to use pulse or hold output for the measurement complete signal.
Pulse: You can set the duration for which the measurement complete signal is placed in the "on" state.
Hold: The measurement complete signal switches from "on" to "off" at trigger input.

D You can set the duration of the delay from output of judgment results to output of the measurement complete signal.

4. Analog measurement signal

Output delay

When using trigger-synchronized output, you can ensure that the analog measurement signal is only output once the measurement signal has turned off.

Trigger-synchronized output: The measurement signal is only applied to the sample during measurement.

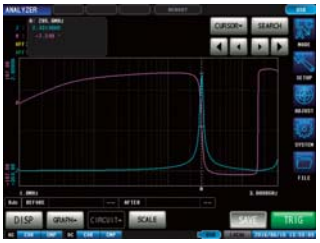
Software Full Keyboard

The touch screen is equipped with a full keyboard function. Comfortably and reliably perform various input operations.

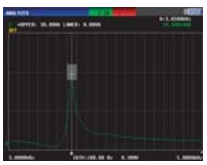
Large Screen for Better Viewing and Control

Larger touch screen than legacy models for improved readability and comfort.

Screen size comparison for the IM3570 and IM7580 at the same ratio



IM7580s screen

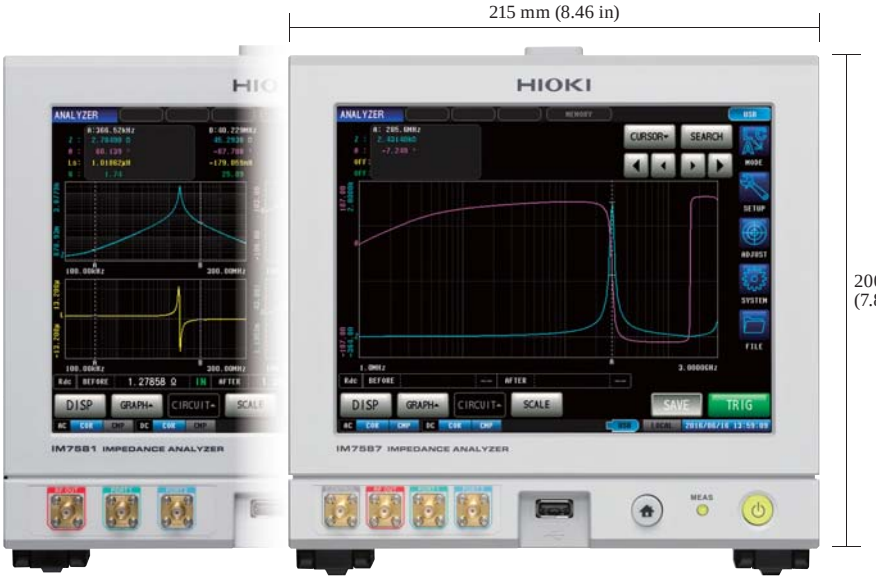


IM3570 screen

Fast Measurement and Easy Screen Display

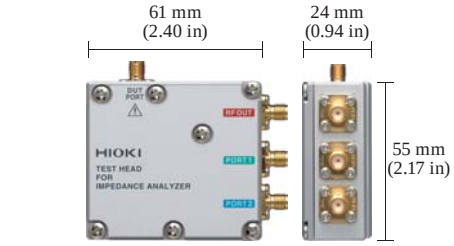
The multicore CPU achieves both high-speed measurement and high-speed communication, as well as easy screen operation. It is equipped with a display mode that, even with the measurement screen displayed, achieves the same high-speed response as if the screen were off.

Expansive Interface

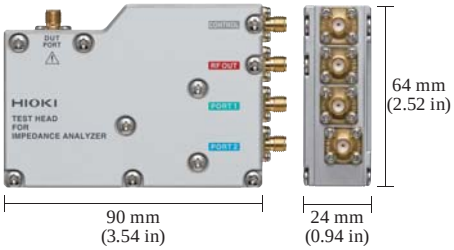


IM7581 Main unit front
(Same as IM7580A)

IM7587 Main unit front
(Same as IM7583 / IM7585)



Test head included with the IM7580A / IM7581



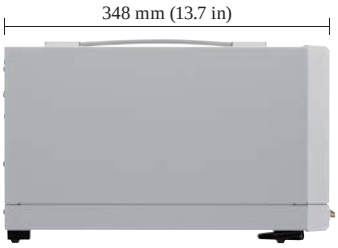
Test head included with the IM7583 / IM7585 / IM7587

Main unit rear
(Interface are the same for all five models)

GP-IB INTERFACE Z3000

RS-232C INTERFACE Z3001

IM7580A / IM7581 Main unit side



IM7583 / IM7585 / IM7587 Main unit side

Save measurement conditions and results in a USB flash drive

Use the front USB terminal to save the measurement data, screen shots, or measurement conditions saved to the unit's internal memory to a USB drive.

Extensive range of interfaces for external control

Use the IM7580's LAN, USB, GP-IB, RS-232C, and EXT I/O interfaces to control the instrument from an external device.

*The GP-IB and RS-232C INTERFACE are optional

LAN

Connector	RJ-45 connector
Transmission method	10Base-T, 100Base-Tx, 1000Base-T
Protocol	TCP/IP

USB (for PC connectivity)

Connector	USB Type B
Electrical specifications	USB 2.0 (High Speed)

GP-IB (optional)

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

RS-232C (optional)

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

EXT I/O

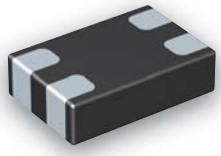
Connector	D-sub 37-pin
	Female #4-40 inch thread
Compatible connectors	DC-37P-ULR (solder)
	DCSP-JB37PR (crimp)
	Japan Aviation Electronics Industry, Ltd.

*For more information, see page 15.

Applications

Common-mode filter measurement Panel save and continuous measurement

Carry out measurement smoothly, automatically switching compensation values and measurement conditions, such as when measuring a single part with two different measurement methods, or when using different compensation values/measurement conditions for each measurement point.

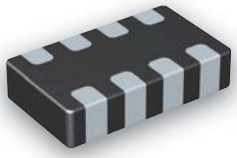


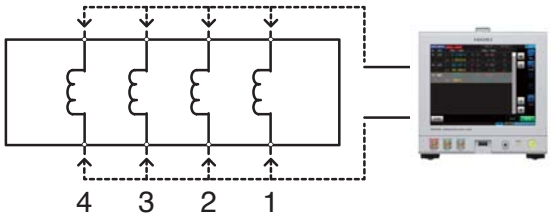
If measuring a single part with two measurement methods.

Halve cycle times by using two instruments…

Compact design that fits two instruments into a full-size rack.Using two impedance analyzers simultaneously can dramatically reduce cycle times.

When compensation values and measurement conditions differ for each measurement point





Progressive switching of compensation values and measurement conditions

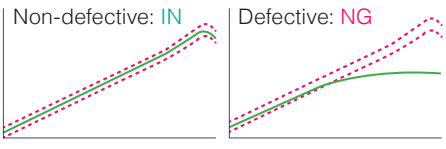
1 → 2 → 3 → 4

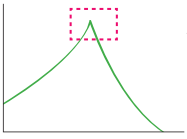
PASS/FAIL judgments of power inductors Comparator function

By using the comparator function's area and peak judgment functions, you can easily differentiate between defective and non-defective components.

Area judgment

Set the judgment area and then check whether component measurement results fall inside that area. This approach is well suited to differentiating between defective and non-defective components.





As illustrated to the left, you can set a range around the peak value and use it to make judgments.

Exclusive Options

SMD TEST FIXTURE IM9201
CALIBRATION KIT IM9905

All-in-One Fixture for 6 SMD Sizes - Definitive 3GHz High Frequency Analysis Made Easy.

SMD measurement procedure

Instrument / Options

The following provisions are required when using the test fixture with the Hioki IM7580 series.

SMD TEST FIXTURE IM9201

TEST FIXTURE STAND IM9200
(includes magnifying glass)

ADAPTER
(3.5 mm to 7 mm)
IM9906

CALIBRATION KIT IM9905

Specifications

Frequency range	DC to 3 GHz
Compatible package sizes (EIA)	0201, 0402, 0603, 0805, 1206, 1210
Electrode structure	Bottom electrodes
Maximum voltage	±42 Vpeak (AC+DC)
Additional uncertainty	Impedance : ±Ze [%] Phase : ±0.58 × Ze [°] Ze = Ae + (Zse / Zx + Yoe × Zx) × 100 Zx : Measured impedance value [Ω] Ae : 4 × f^2 [%] Zse : (100 + 500 × f) / 1000 [Ω] Yoe : (10 + 100 × f) / 1000000 [S] f [GHz]

Product / Order code

Product name	Order code
SMD TEST FIXTURE IM9201	IM9201
TEST FIXTURE STAND IM9200	IM9200
ADAPTER(3.5 mm to 7 mm) IM9906	IM9906
CALIBRATION KIT IM9905	IM9905

Measurement parameters and measurement conditions

Measurement modes	LCR mode: Measurement using a single set of conditions Analyzer mode: Sweep measurement and equivalent circuit analysis Continuous measurement mode: Continuous measurement using previously saved conditions
Measurement parameters	Z Impedance, Y Admittance, θ Phase angle, X Reactance, G Conductance, B Susceptance, Q Q-factor Rs Equivalent series resistance (ESR), Rp Equivalent parallel resistance, Ls Equivalent series inductance, Lp Equivalent parallel inductance, Cs Equivalent series capacitance, Cp Equivalent parallel capacitance, D Loss factor tan δ
Display range	Z 0.00 m to 9.99999 GΩ Y 0.000 n to 9.99999 GS θ ±(0.000° to 180.000°) X ±(0.00 m to 9.99999 GΩ) G ±(0.000 n to 9.99999 GS) B ±(0.000 n to 9.99999 GS) Q ±(0.00 to 9999.99) Rs ±(0.00 m to 9.99999 GΩ) Rp ±(0.00 m to 9.99999 GΩ) Ls ±(0.00000 n to 9.99999 GH) Lp ±(0.00000 n to 9.99999 GH) Cs ±(0.00000 p to 9.99999 GF) Cp ±(0.00000 p to 9.99999 GF) D ±(0.00000 to 9.99999) Δ% ±(0.000 to 999.999%)
Measurable range	100 mΩ to 5 kΩ
Output impedance	Approx. 50 Ω
Measurement frequency – Range	IM7580A 1 MHz to 300 MHz IM7581 100 kHz to 300 MHz IM7583 1 MHz to 600 MHz IM7585 1 MHz to 1.3 GHz IM7587 1 MHz to 3 GHz
Measurement frequency – Resolution	IM7580A 1.0000 MHz to 9.9999 MHz ..... 100 Hz steps 10.000 MHz to 99.999 MHz ..... 1 kHz steps 100.00 MHz to 300.00 MHz ..... 10 kHz steps IM7581 100.00 kHz to 999.99 kHz ..... 10 Hz steps (1.0000 MHz to 300.00 MHz same as IM7580A) IM7583 / IM7585 / IM7587 ..... 100 kHz steps
Measurement frequency – Accuracy	±0.01% of setting or less
Measurement signal level – Range	IM7580A / IM7581 Power : -40.0 dBm to +7.0 dBm Voltage : 4 mV to 1001 mV rms Current : 0.09 mA to 20.02 mA rms IM7583 / IM7585 / IM7587 Power : -40.0 dBm to +1.0 dBm Voltage : 4 mV to 502 mV rms Current : 0.09 mA to 10.04 mA rms *User-configured power, voltage, and current
Measurement signal level – Resolution	0.1 dB steps
Measurement signal level – Accuracy	±2 dB(23 °C±5 °C), ±4 dB(0 °C to 40 °C)

LCR mode

Measurements	Bin measurement: 10 categories for 4 measurement parameters
	Comparator measurement: Hi, IN, and Lo judgments for 4 parameters
Functionality	Monitor function Monitor voltage range: 0.0 mV to 1000.0 mV Monitor current range: 0.000 mA to 20.000 mA
Display	Zoom display function: Enlarged display of measured values

Analyzer mode

Measurements	Sweep measurement Up to 801 sweep points with user-configurable point delay Normal sweep: Measurement of up to 801 points Segment sweep: Up to 20 segments (with a total of 801 points)
	Time interval measurement Interval of 0.00000 sec. to max. 1,000.00 sec., 801 points
Functionality	Equivalent circuit analysis: 5 circuit models Cursor function: Automatically search for maximum and minimum values, target, local maximum and minimum values Comparator function: Area, peak and spot judgment
Display	List display graph display, XY graph display, judgment results display Scaling: Linear or logarithmic

Continuous measurement mode

Measurements	Continuous measurement using up to 46 combinations of the following measurement conditions: 30 LCR mode measurement conditions and 16 analyzer mode measurement conditions

Speed and accuracy

Measurement speed (analog measurement)	FAST	MED	SLOW	SLOW2
	0.5 ms	0.9 ms	2.1 ms	3.7 ms
Averaging	Valid setting range: 1 to 256 (in steps of 1)			
Basic accuracy	IM7580A / IM7581..... Z : 0.72% rdg. θ : 0.41° IM7583 / IM7585 ..... Z : 0.65% rdg. θ : 0.38°			
Guaranteed accuracy range	100 mΩ to 5 kΩ(impedance)			
Accuracy guaranteed	1 year, Post-adjustment accuracy guaranteed for 1 year			
Terminal design	2-terminal design			

Supplementary functionality

Trigger function	User-selectable internal or external trigger (EXT I/O, interface, manual) Trigger delay: 0 sec. to 9 sec. Trigger-synchronized output: Stabilization wait time of 0 sec. to 9 sec. INDEX signal delay time of 0 sec. to 0.1 sec. Trigger types: Sequential, repeat, step*1
Compensation function	Open/short/load calibration: From Main unit to test head Open/load compensation: Compensation of fixture component Electrical length compensation: 0 mm to 100 mm Correlation compensation: Compensation of display values based on user-input compensation coefficient
Contact check	DCR measurement, Hi-Z reject function, waveform judgment function

*1 Analyzer mode only

Recording and interface

Number of measured values that can be stored in memory	LCR Mode: 32000 Analyzer Mode: 100 sweeps
Panel save and load functions	Measurement conditions: 30 sets for LCR mode, 16 sets for Analyzer mode Compensation values only: 30 sets for LCR mode
Interfaces	HANDLER, USB, LAN, GP-IB (optional), RS-232C (optional)
Command	HIOKI unique SCPI

Display and sound

Key lock function	Lock operation of the instrument using the panel. Unlock by entering a passcode
Beep tone	Enable or disable for judgment results and key operation
Warm-up function	The instrument will display a message 60 minutes after it is powered on
Selection of number of display digits	3, 4, 5, or 6 digits
Display settings	LCD display on/off Backlight brightness adjustment Measurement screen background color (white or black) Switchable parameter colors
Display	8.4-inch color TFT with touch panel

Other

Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 20% RH to 80% RH, non-condensing
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 20% RH to 80% RH, non-condensing
Operating environment	Use indoors at an elevation of 2,000 m or less in an environment with a maximum pollution level of 2
Power supply and maximum rated power	100 V to 240 V AC (50/60 Hz), 70 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	IM7580A / IM7581 Approx. 215 W×200 H×268 D mm (8.46 W×7.87 H ×10.55 D in), approx. 6.5 kg (229.3 oz) IM7583 / IM7585 / IM7587 Approx. 215 W×200 H×348 D mm (8.46 W×7.87 H ×13.7 D in), approx. 8.0 kg (282.3 oz)
Accessories	Power cord ×1, Instruction manual ×1, Impedance analyzer application disc ×1

Measurement accuracy

$$Z : \pm (Ea + Eb)\ [\%] \qquad \theta : \pm 0.58 \times (Ea + Eb)\ [\ ^\circ\ ]$$

Conditions

Guaranteed accuracy temperature and humidity range	0°C to 40°C (32°F to 104°F), 20% rh to 80% rh (non-condensing) However, must be within ±5°C of the temperature at the time of calibration.
Guaranteed accuracy period	1 year (with open/short/load calibration enabled)
Open/short/load calibration enabled period	Within 24 hours after calibration
Warm-up time	At least 60 min.
Measurement conditions	Frequency, power, and speed points at which open, short, and load calibration have been performed

IM7580A / IM7581

Ea = 1.0 + Er (Frequency : 100kHz to 999.99kHz)
Ea = 0.5 + Er (Frequency : 1MHz to 300MHz)

Frequency	Signal level	Er	α			
			FAST	MED	SLOW	SLOW2
100 kHz to 999.99 kHz	-7 dBm to +7 dBm	α	0.24	0.18	0.15	0.12
	-40 dBm to -7.1 dBm	$3 \times 10^{(-0.043P + \alpha)}$	-1.3	-1.4	-1.5	-1.6
1 MHz to 100 MHz	-7 dBm to +7 dBm	α	0.09	0.06	0.036	0.03
	-40 dBm to -7.1 dBm	$3 \times 10^{(-0.046P + \alpha)}$	-1.8	-2	-2.15	-2.3
100.01 MHz to 300 MHz	-7 dBm to +7 dBm	α	0.108	0.078	0.039	0.036
	-40 dBm to -7.1 dBm	$3 \times 10^{(-0.048P + \alpha)}$	-1.75	-1.9	-2.1	-2.25

P : Power setting [dBm]

$$Eb = \left(\frac{Zs}{|Zx|} + Yo \cdot |Zx| \right) \times 100\ [\%] \quad (\ |Zx|\ : \text{Z measured value in } [\Omega]\ )$$

$$Zs = \frac{(\ Zsk + Zsr + 0.5 \times F\ )}{1000}\ [\Omega] \quad (\ F : \text{measurement frequency [MHz]}\ )$$

Frequency	Zsk
100 kHz to 999.99 kHz	50
1 MHz to 300 MHz	20

Frequency	Signal level	Zsr	α			
			FAST	MED	SLOW	SLOW2
100 kHz to 999.99 kHz	-7 dBm to +7 dBm	α	36	27	21	15
	-40 dBm to -7.1 dBm	$3 \times 10^{(-0.042P + \alpha)}$	0.9	0.8	0.7	0.6
1 MHz to 300 MHz	-7 dBm to +7 dBm	α	13.5	9	5.1	3.9
	-40 dBm to -7.1 dBm	$3 \times 10^{(-0.048P + \alpha)}$	0.36	0.2	0	-0.15

P : Power setting [dBm]

$$Yo = \frac{(\ Yok + Yor + 0.15 \times F\ )}{1000000}\ [S] \quad (\ F : \text{measurement frequency [MHz]}\ )$$

Frequency	Yok
100 kHz to 199.99 kHz	120
200 kHz to 300 MHz	30

Frequency	Signal level	Yor	α			
			FAST	MED	SLOW	SLOW2
100 kHz to 999.99 kHz	-7 dBm to +7 dBm	α	15	12	6.6	5.4
	-40 dBm to -7.1 dBm	$6 \times 10^{(-0.043P + \alpha)}$	0.6	0.5	0.4	0.3
1 MHz to 300 MHz	-7 dBm to +7 dBm	α	7.5	5.7	3.3	2.4
	-40 dBm to 7.1 dBm	$3 \times 10^{(-0.046P + \alpha)}$	0.1	0	-0.2	-0.4

P : Power setting [dBm]

IM7583 / IM7585 / IM7587

Ea :

Frequency	Signal level	Ea			
		FAST	MED	SLOW	SLOW2
1 MHz to 100 MHz	+1 dBm	0.581	0.557	0.532	0.524
	-22.9 dBm to +0.9 dBm	1.005	0.815	0.71	0.63
	-40 dBm to -23 dBm	3.622	2.501	1.7	1.43
100.1 MHz to 500 MHz	+1 dBm	0.652	0.634	0.621	0.616
	-22.9 dBm to +0.9 dBm	0.858	0.769	0.71	0.678
	-40 dBm to -23 dBm	1.72	1.336	1.06	0.85
500.1 MHz to 1300 MHz	+1 dBm	0.86	0.841	0.823	0.818
	-22.9 dBm to +0.9 dBm	1.093	0.988	0.92	0.881
	-40 dBm to -23 dBm	2.068	1.625	1.31	1.16
1300.1 MHz to 1800 MHz	+1 dBm	2.066	2.037	2.025	2.02
	-22.9 dBm to +0.9 dBm	2.381	2.228	2.128	2.113
	-40 dBm to -23 dBm	5.773	4.156	3.423	3.133
1800.1 MHz to 3000 MHz	+1 dBm	4.539	4.5	4.46	4.437
	-22.9 dBm to +0.9 dBm	4.867	4.753	4.608	4.547
	-40 dBm to -23 dBm	9.748	7.682	6.468	5.874

$$Eb = \left(\frac{Zs}{|Zx|} + Yo \cdot |Zx| \right) \times 100 \ [\%] \quad (|Zx| : \text{Z measured value in } [\Omega])$$

$$Zs = \frac{(Zsr + 0.5 \times F)}{1000} \ [\Omega] \quad (F : \text{measurement frequency [MHz]})$$

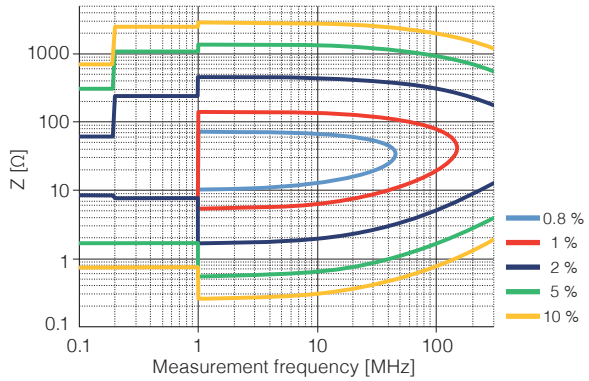
Frequency	Signal level	Zsr			
		FAST	MED	SLOW	SLOW2
1 MHz to 300 MHz	+1 dBm	41.7	37.6	34.3	32.3
	-22.9 dBm to +0.9 dBm	75.4	62.9	49.4	43.1
	-40 dBm to -23 dBm	495.66	293.25	185.7	142.05
300.1 MHz to 1000.0 MHz	+1 dBm	61.7	57.6	54.3	52.3
	-22.9 dBm to +0.9 dBm	95.4	82.9	69.4	63.1
	-40 dBm to -23 dBm	515.66	313.25	205.7	162.05
1000.1 MHz to 1300 MHz	+1 dBm	111.7	107.6	104.3	102.3
	-22.9 dBm to +0.9 dBm	145.4	132.9	119.4	113.1
	-40 dBm to -23 dBm	565.66	363.25	255.7	212.05
1300.1 MHz to 1800 MHz	+1 dBm	112.8	108.7	104.7	103.9
	-22.9 dBm to +0.9 dBm	145.4	132.9	119.4	113.1
	-40 dBm to -23 dBm	565.66	363.25	255.7	212.05
1800.1 MHz to 3000 MHz	+1 dBm	212.8	208.7	204.7	203.9
	-22.9 dBm to +0.9 dBm	245.4	232.9	219.4	213.1
	-40 dBm to -23 dBm	665.66	463.25	355.7	312.05

$$Yo = \frac{(Yor + 0.15 \times F)}{1000000} \ [S] \quad (F : \text{measurement frequency [MHz]})$$

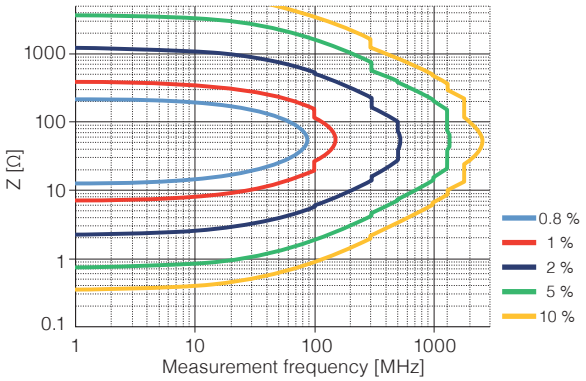
Frequency	Signal level	Yor			
		FAST	MED	SLOW	SLOW2
1 MHz to 300 MHz	+1 dBm	15.6	13.8	12.3	11.8
	-22.9 dBm to +0.9 dBm	48	35.6	25.5	21.7
	-40 dBm to -23 dBm	277.15	193.45	122.5	87.1
300.1 MHz to 1000.0 MHz	+1 dBm	35.6	33.8	32.3	31.8
	-22.9 dBm to +0.9 dBm	68	55.6	45.5	41.7
	-40 dBm to -23 dBm	297.15	213.45	142.5	107.1
1000.1 MHz to 1300 MHz	+1 dBm	45.6	43.8	42.3	41.8
	-22.9 dBm to +0.9 dBm	78	65.6	55.5	51.7
	-40 dBm to -23 dBm	307.15	223.45	152.5	117.1
1000.1 MHz to 1300 MHz	+1 dBm	75.6	73.8	72.3	71.8
	-22.9 dBm to +0.9 dBm	108	95.6	85.5	81.7
	-40 dBm to -23 dBm	337.15	253.45	182.5	147.1
1000.1 MHz to 1300 MHz	+1 dBm	143.2	140.2	135.9	134.6
	-22.9 dBm to +0.9 dBm	168	155.6	145.5	141.7
	-40 dBm to -23 dBm	397.15	313.45	242.5	207.1

Basic measurement confirmation table

IM7580A / IM7581 (For -7dBm to +7dBm, SLOW2.)

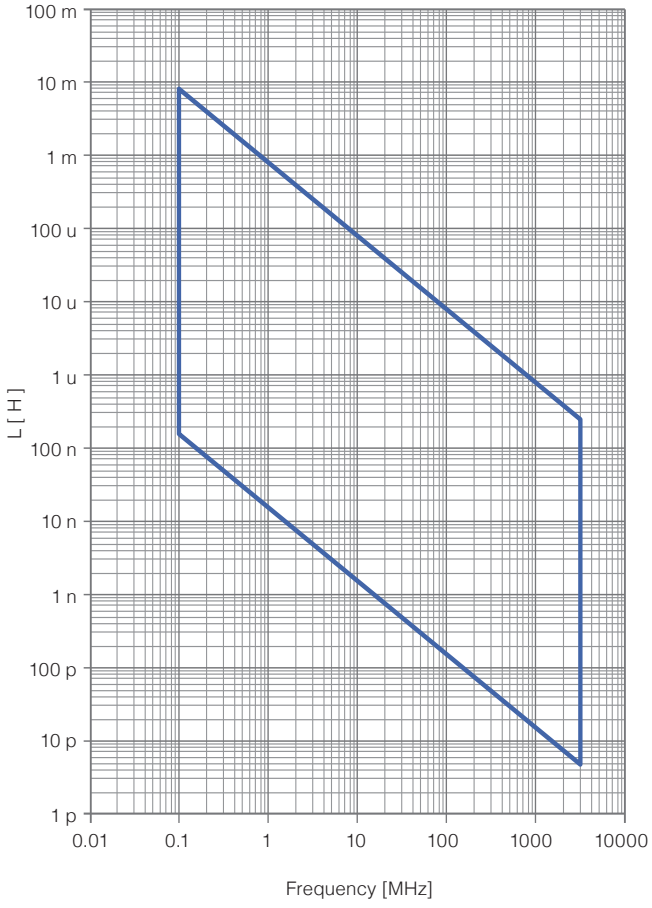


IM7583 / IM7585 / IM7587 (For +1dBm, SLOW2.)

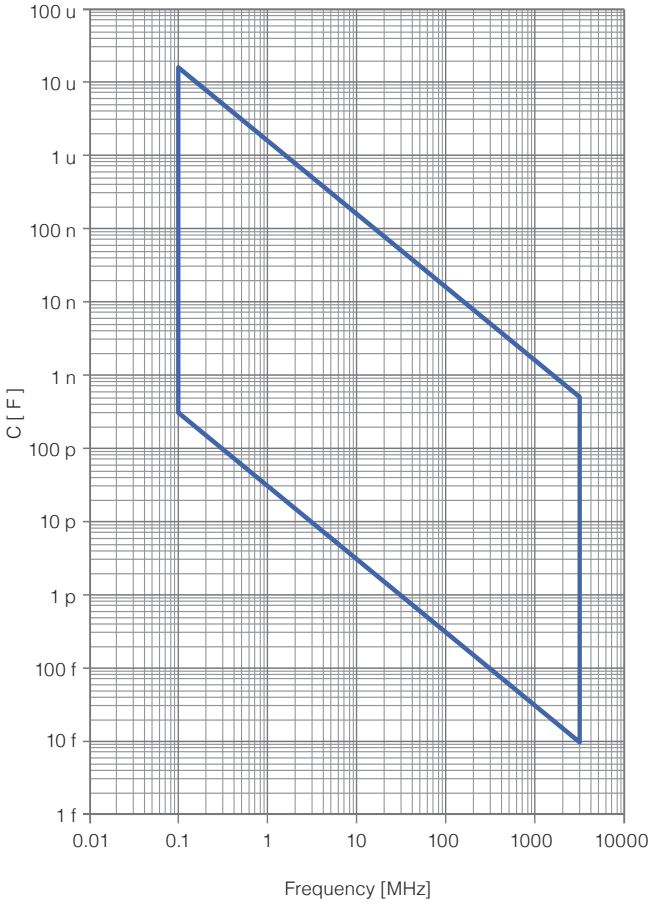


Range of measurements

Range of measurements L



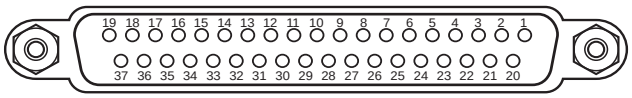
Range of measurements C



External control

List of EXT I/O handler interface signals

Pin	I/O	Signal
1	IN	TRIG
2	IN	Unused
3	IN	Unused
4	IN	LD1
5	IN	LD3
6	IN	LD5
7	IN	Unused
8	-	ISO_5V
9	-	ISO_COM
10	OUT	ERR
11	OUT	PARA1-HI,BIN1,PARA1-NG
12	OUT	PARA1-LO,BIN3,PARA2-NG
13	OUT	PARA2-IN,BIN5,PARA3-NG
14	OUT	AND,BIN7
15	OUT	PARA3-IN,BIN9,PARA4-IN
16	OUT	PARA4-HI
17	OUT	PARA4-LO
18	OUT	Unused
19	OUT	OUT_OF_BINS,CIRCUIT_NG
20	IN	Unused
21	IN	Unused
22	IN	LD0
23	IN	LD2
24	IN	LD4
25	IN	LD6
26	IN	LD_VALID
27	-	ISO_COM
28	OUT	EOM
29	OUT	INDEX
30	OUT	PARA1-IN,BIN2,PARA1-IN
31	OUT	PARA2-HI,BIN4,PARA2-IN
32	OUT	PARA2-LO,BIN6,PARA3-IN
33	OUT	PARA3-HI,BIN8,PARA4-NG
34	OUT	PARA3-LO,BIN10
35	OUT	PARA4-IN
36	OUT	Unused
37	OUT	Unused



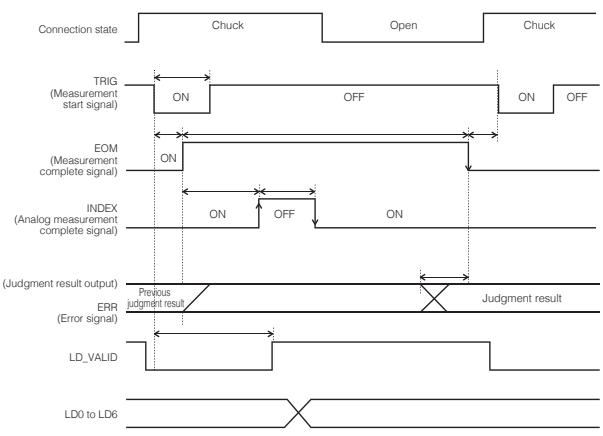
Signal	Function
TRIG	External trigger
LD0 to LD6	Panel number selection
EOM	Measurement complete signal
INDEX	Analog measurement complete signal
ERR	Detection level error
LD_VALID	Panel load
ISO_5V	Isolated power supply 5 V input
ISO_COM	Isolated power supply common
PARA1-HI to PARA4-HI	Comparator judgment result: HI judgment
PARA1-IN to PARA4-IN	Comparator judgment result: IN judgment
PARA1-LO to PARA4-LO	Comparator judgment result: LO judgment
OUT_OF_BINS	Bin measurement result
BIN1-BIN10	Bin judgment allocation: Bin 1 to Bin 10
CIRCUIT_NG	Equivalent circuit analysis: Comparator judgment result
PARA1-NG to PARA4-NG	Peak judgment result
PARA1-IN to PARA3-IN	Peak judgment result
AND	Result of applying a logical AND operation to judgment results for measured values for four parameters (output when all judgment results are IN)

Connector used	D-sub 37-pin	Compatible connectors	DC-37P-ULR (solder)
	Female #4-40 inch thread		DCSP-JB37PR (crimp)
			Japan Aviation Electronics Industry, Ltd.

Electrical specifications	Input signals	Photocoupler-isolated, no-voltage contact input
		Input “on” voltage: 0 V to 0.9 V / input “off” voltage: open or 5 V to 24 V
	Output signals	Isolated NPN open collector output
		Maximum load voltage: 30 V / maximum output current: 50 mA/channel
		Residual voltage: 1 V or less (10 mA) or 1.5 V or less (50 mA)
	Built-in isolated power supply	Voltage: 4.5 V to 5 V / maximum output current: 100 mA
		Floating relative to protective ground potential and measurement circuit

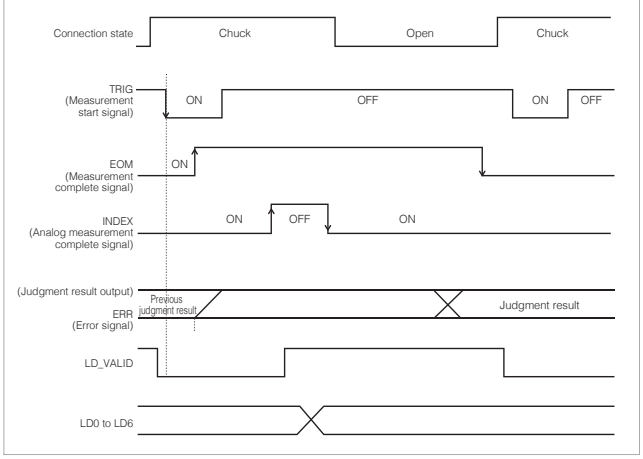
Timing chart

Example of LCR Mode measurement timing



*In this example, the TRIG signal's active edge is the falling edge (ON).

Example of Analyzer Mode measurement timing



EOM: Off from trigger input to end of measurement processing
INDEX: Off during probe chuck (probe cannot be removed from target)

Instrument

Photo: IM7581

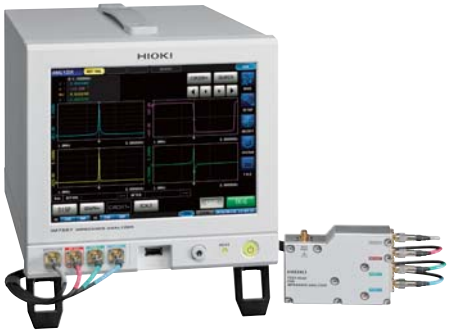


Photo: IM7587

Product / Order code

Model (Measurement frequency)	Connection cable length	Order code
IMPEDANCE ANALYZER **IM7580A** (1 MHz to 300 MHz)	1 m (3.28 ft)	IM7580A - 1
	2 m (6.56 ft)	IM7580A - 2
IMPEDANCE ANALYZER **IM7581** (100 kHz to 300 MHz)	1 m (3.28 ft)	IM7581 - 01
	2 m (6.56 ft)	IM7581 - 02
IMPEDANCE ANALYZER **IM7583** (1 MHz to 600 MHz)	1 m (3.28 ft)	IM7583 - 01
	2 m (6.56 ft)	IM7583 - 02
IMPEDANCE ANALYZER **IM7585** (1 MHz to 1.3 GHz)	1 m (3.28 ft)	IM7585 - 01
	2 m (6.56 ft)	IM7585 - 02
IMPEDANCE ANALYZER **IM7587** (1 MHz to 3 GHz)	1 m (3.28 ft)	IM7587 - 01
	2 m (6.56 ft)	IM7587 - 02

Composition : Main unit, Test Head, Connection cable

Accessories : Power cord, Instruction manual,
Impedance analyzer application disc

Test fixtures or probes are not included with the main unit.
Dedicated test fixture required.
(See page 14 in this catalog.)

Accuracy calculation with included software

Free software for automatically calculating measurement accuracy based on user-entered measurement conditions and measurement results can be downloaded from Hioki's website.

Options

Interfaces

GP-IB INTERFACE Z3000

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

RS-232C INTERFACE Z3001

RS-232C CABLE 9637
Cable length : 1.8 m (5.91 ft)

*Any interlink-compatible cross-cable can be used as the RS-232C CABLE.

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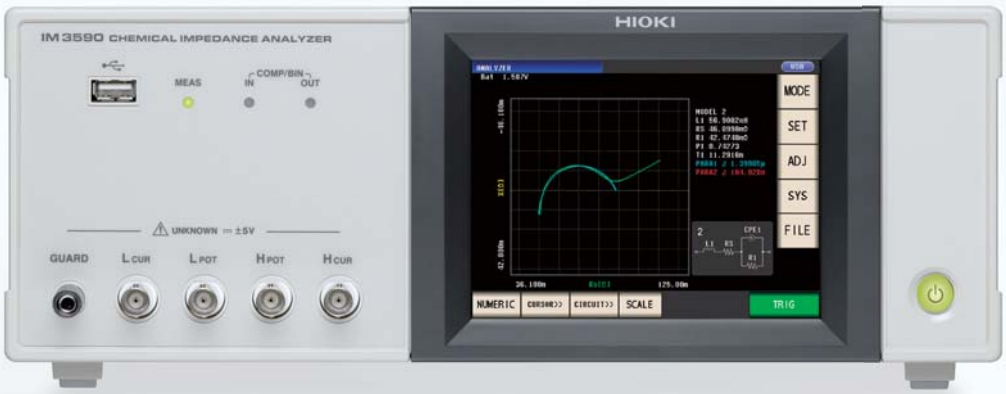
HIOKI

CHEMICAL IMPEDANCE ANALYZER IM3590



Ideal for Measuring Electrochemical Impedance

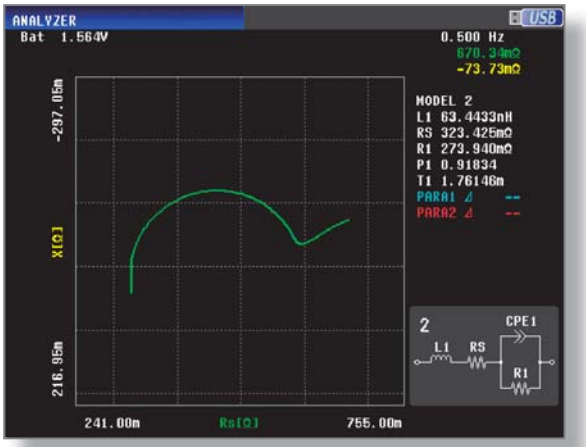
Hioki's **Chemical Impedance Analyzer IM3590** is designed to perform impedance (LCR) measurement of electrochemical components and materials. It offers functionality such as Cole-Cole plot generation and equivalent circuit analysis with a broad measurement frequency range of 1 mHz to 200 kHz, measurement speeds as high as 2 ms, and basic accuracy of ±0.05%. With the advanced display and analysis functionality required for research and development work and LCR measurement capability for standard electronic components, the instrument provides a single-device solution for a broad range of measurement applications.

CE

Measure Electrochemical Components and Materials, Batteries, and EDLCs*

*Electric double-layer capacitors

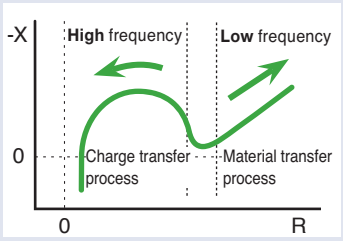
Cole-Cole plot



Cole - Cole plot screen (manganese battery)

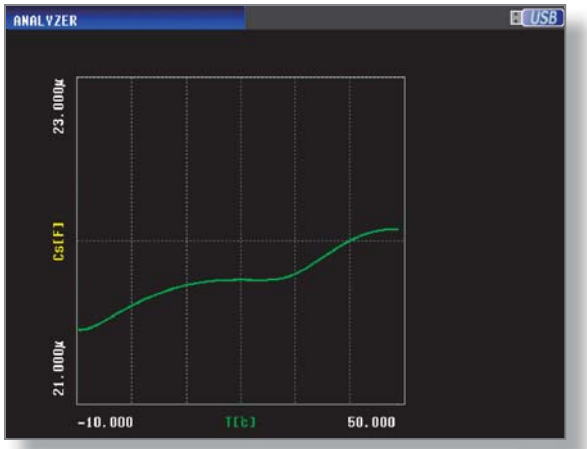
In measurement of electrochemical components and materials, Cole-Cole plots are used to ascertain electrode, electrolyte ion, and other characteristics. The IM3590 can perform frequency sweep measurement using up to 801 points and display the results as a Cole-Cole plot.

Cole-Cole plot loci and measurement frequency



Measurement at low frequencies is necessary in order to measure characteristics such as ion behavior, and the IM3590 can conduct measurements at 1 mHz. The instrument's upper limit frequency is 200 kHz, allowing it to measure solution resistance.

Temperature measurement and time interval measurement



X–Y display screen
(Temperature characteristics of multi-layer ceramic capacitor capacitance)

When used in conjunction with an optional temperature probe, the IM3590 can display graphs that include measured temperatures. By assigning temperature to one axis on the X-Y display, it is possible to display a temperature characteristics graph. The instrument can also perform time interval measurement at up to 801 points, and can display graphs illustrating variation over time, including temperature measurement.

Interval measurement illustrating variation over time
(Variation of laminated ceramic capacitor capacitance)

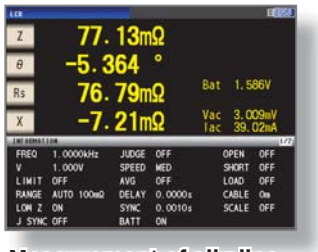
The temperature sensor (Sheath Type Temperature Probe 9478) has a waterproof sheath, allowing it to be directly inserted into solutions.

Sheath material: SUS316
Water-proof property: EN60529:1991, IP67

Advantage

Battery measurement function

The IM3590's battery measurement function simplifies the process of measuring battery impedance characteristics in a no-load state by automatically measuring the battery voltage and superimposing the same voltage from the instrument as DC bias.



Measurement of alkaline batteries

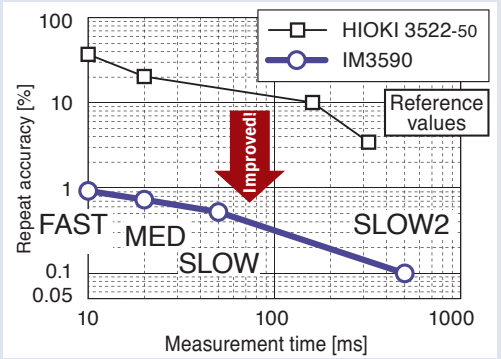
Supported battery specifications

Internal impedance : 10 mΩ to 10 Ω

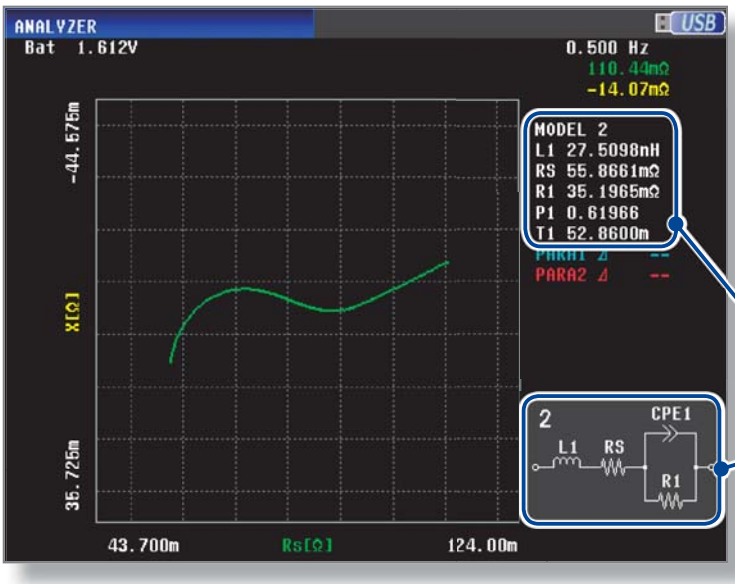
Battery voltage : 5 V max

Measurement time and Z repeatability during low-resistance measurement

(Measurement frequency: 100Hz; Sample: 10mΩ Resistance)



Electrochemical equivalent circuit analysis



Equivalent circuit analysis screen (alkaline battery)

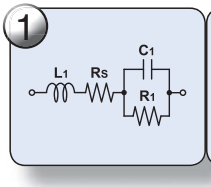
The ability to measure electrochemical components and materials makes possible evaluation by estimating equivalent circuits, facilitating a deeper understanding of reaction, electrode, and electrolyte characteristics. The IM3590 provides electrochemical component and material equivalent circuit models, allowing evaluation of solution resistance, charge transfer resistance, and electric double-layer capacitance.

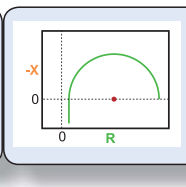
Equivalent circuit analysis result

Equivalent circuit model

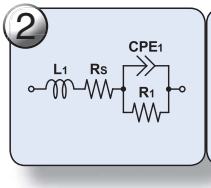
● Equivalent circuit models and measurement parameters

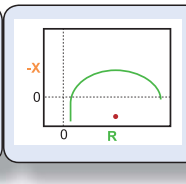
Unipolar models





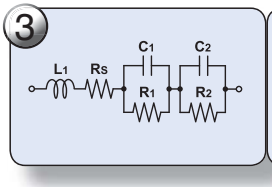
Unipolar, or all poles have the same reaction, and the center of the capacitive semicircle lies on the real axis

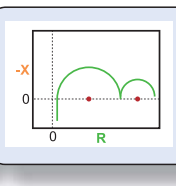




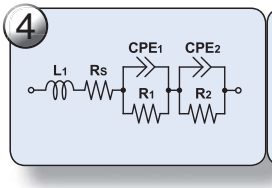
Unipolar, or all poles have the same reaction, and the center of the capacitive semicircle does not lie on the real axis

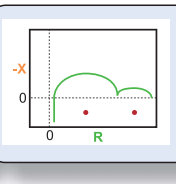
Polar models





Different poles have different reactions, and the center of the capacitive semicircle lies on the real axis



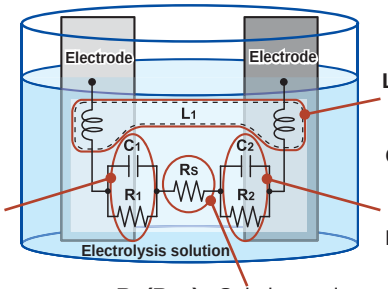


Different poles have different reactions, and the center of the capacitive semicircle does not lie on the real axis

Measurement parameters

Rs (Solution resistance)
R1, R2 (Charge transfer resistance)
C1, C2 (Electric double layer capacitance)
CPE1, CPE2 (Constant Phase Element)
L1 (Inductance)

Internal structure of a standard electrochemical cell



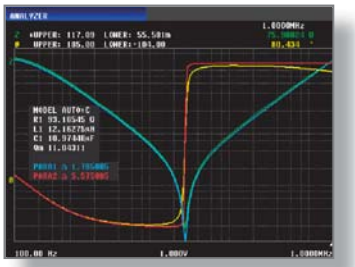
C1(CPE1) : Electric double layer capacitance
R1 : Charge transfer resistance

L1 : Electrode and wiring inductance
C2 (CPE2) : Electric double layer capacitance
R2 : Charge transfer resistance

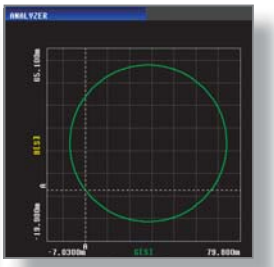
Rs (Rsol) : Solution resistance

Electronic Components
(LCR Elements and Piezoelectric and Resonant Elements)

Sweep function (Frequency and signal level)



Frequency characteristics and analysis results simulation screen



Admittance circle display screen

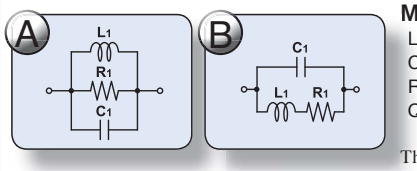
The IM3590 can perform sweep measurement of the frequency characteristics of standard LCR components such as electronic components and piezoelectric elements (resonant components). The ability to display frequency characteristics, admittance circles, and Cole-Cole plots makes it easy to assess characteristics. The instrument can also perform signal level (V/CV/CC) and DC bias voltage sweep operation.

Equivalent circuit analysis of electronic components

The IM3590 offers five equivalent analysis circuits for circuit components, allowing the instrument to be used to estimate and evaluate standard LCR components such as electronic components and piezoelectric elements (resonant components).

● Equivalent Circuit Model and Measurement Items

Three-element model



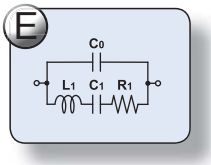
Measurement items

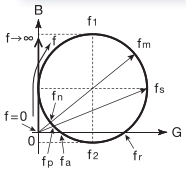
L1 (Inductance)
C1 (Capacitance)
R1 (Resistance)
Qm (Resonance sharpness)

The following measurement items can be captured via PC communication.

fr (Resonance frequency)
fa (Anti-resonance frequency)

Four-element model





Measurement items

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

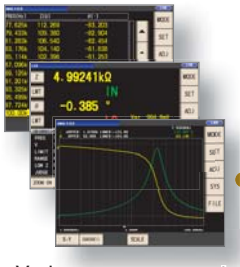
The following measurement items can be captured via PC communication.

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 IM3590. Some USB flash drives may not be supported due to incompatibility issues.)



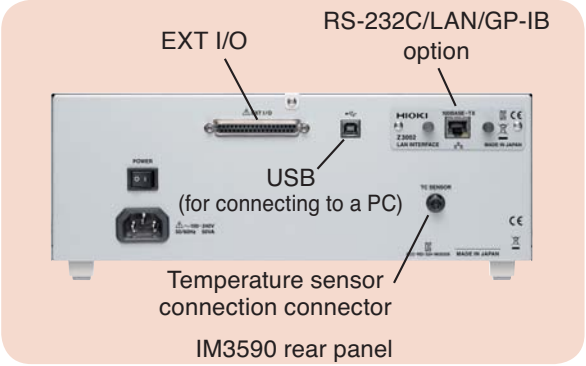
Various measurement results and settings

Save to USB flash drive

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

Users can also select an optional RS-232C, LAN, or GP-IB interface if needed. IM3590 functions can be controlled from a PLC or computer, and measurement results can be downloaded. (Certain functions, including instrument power on/off and interface configuration, cannot be controlled remotely.)
Download the LabView driver from the HIOKI website at http://www.hioki.com.

External I/O can be used to output measurement complete and judgment result signals and to receive measurement trigger and other signals in order to facilitate control of the instrument.



IM3590 rear panel

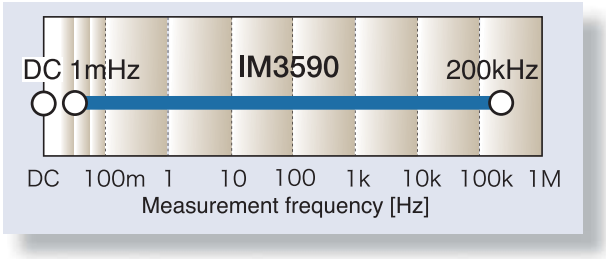
High-speed, High-precision, Easy-to-use Operation

Basic performance

●Wide setting range for measurement frequency

IM3590 allows DC or a frequency band within the range of 1 mHz to 200 kHz to be set with five-digit resolution (testing at less than 100 Hz has a 1 mHz resolution). This enables the measurement of resonance frequency and measurement and evaluation in a state close to that of actual operating conditions.

The IM3590's frequency range extends from the low frequencies that are required for electrochemical impedance measurement in order to assess phenomena such as ion behavior to high frequencies that allow measurement of solution resistance.



●Wide setting range for measurement voltageand 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. (The setting range of measurement signal levels differs depending on the frequency and measurement mode.)

●Measurement times as short as 2 ms

The IM3590 can perform measurements in as little as 2 ms using the FAST measurement speed setting with a measurement frequency of 1 kHz.

●Basic accuracy of ±0.05%

Thanks to Z basic accuracy of ±0.05%, the IM3590 offers a level of accuracy that is ideal for use in applications ranging from component testing to research and development.

●Guaranteed accuracy at measurement cable lengths of up to 4 m

A 4-terminal pair configuration reduces the influence of measurement cables, allowing accuracy to be guaranteed to a length of 4 m and simplifying connections to large samples as well as wiring of automated equipment. (The frequency range over which accuracy is guaranteed varies with the cable length.)

●Measure 18 parameters, including dielectric constant and conductivity

In addition to Z, Y, θ, Rs (ESR), Rp, Rdc (DC resistance), X, G, B, Ls, Lp, Cs, Cp, D (tan σ), Q, and T, the IM3590 can measure the dielectric constant (ε) and conductivity (σ). Parameters can be captured by computer as required.

Measurable parameters

Z (impedance[Ω])	Ls (series inductance[H])
Y (admittance[S])	Lp (parallel inductance[H])
θ (phase angle[°])	Cs (series capacitance[F])
Rs (Equivalent series resistance = ESR[Ω])	Cp (parallel capacitance[F])
Rp (Parallel resistance[Ω])	Q (Q factor (Q = 1/D))
Rdc (DC resistance[Ω])	D (loss coefficient = tanδ)
X (reluctance[Ω])	T (temperature[°C])
G (conductance[S])	σ (conductivity[S/m])
B (susceptance[S])	ε (dielectric constant[F/m])

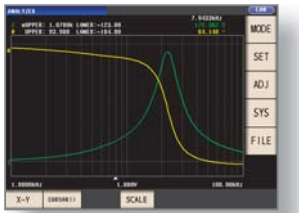
Functions and Features to Simplify the Operation of LCR Measurements

●Intuitive operation with touch panel

A touch panel display with intuitive operation is inherited from previous models. Furthermore, the incorporation of a color LCD means the display is easy to view, and outstanding operability which ensures you intuitively know what to do helps improve work efficiency.

●Simultaneous display of four parameters (during normal measurement)

The IM3590 can display four parameters simultaneously during normal measurement, making it easy to check among parameters.



Measurement screen (Analyzer mode)

Measurement parameter input screen

Setting items of basic measurement conditions

Measurement conditions such as the measurement frequency and measurement signal level can be changed while you monitor the measurement values.

Frequency setting (numeric keypad input)

IM3590 measurement accuracy

Conditions

At least 60 minutes after power-on, after performing open and short compensation, with a temperature and humidity range of 23˚C ±5˚C and relative humidity of 80% or less (non-condensing) (Outside the range of 23˚C ±5˚C, accuracy can be calculated from 0˚C to 40˚C by multiplying the basic accuracy by the temperature coefficient G.)

Basic accuracy (Z, θ) calculation expression

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

In the 1 kΩ range and above and 100 Ω range and below, the calculation expression of basic accuracy differs as shown below. For details, refer to the following calculation examples.

1 kΩ range and above:

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

100 Ω range and below:

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

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]

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]

Except 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]

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

[E: Measurement cable length coefficient]

Up to 200kHz(no limitations)
0m: 1; 1m: 1.2; 2m: 1.5; 4m: 2
Use a coaxial cable (1.5D-2V) with a characteristic impedance of 50 Ω in a 4-terminal pair configuration.

[F: DC bias coefficient]

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

[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

Guaranteed accuracy period: 1 year

When all coefficients by which the basic accuracy is multiplied (signal level of 1 V or Rdc measurement, measurement speed of SLOW2, measurement cable length of 0 m [when using Test Fixture 9262 or similar], DC bias setting of OFF, and operating temperature of 23˚C ±5˚C) are 1, the basic accuracy is the measurement accuracy.

Range	Guaranteed accuracy range	DC(Rdc)	0.001Hz to 99.999Hz	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

● Method for 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.

$$Zx\ (\Omega) \approx \omega L\ (H) \quad (\theta \approx 90°)$$
$$\approx \frac{1}{\omega C\ (F)} \quad (\theta \approx -90°)$$
$$\approx R\ (\Omega) \quad (\theta \approx 0°)\ (\omega: 2 \times \pi \times \text{Measurement frequency [Hz]})$$

● Calculation example

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

Insert coefficient A = 0.15 and coefficient B = 0.02 for the Z basic accuracy from the table above into the expression.

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

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

$$\theta\ \text{basic accuracy} = 0.08 + 0.002 \times \left| \frac{10 \times 500}{10^3} - 1 \right| = 0.16\ (\pm\text{deg.})$$

IM3590 measurement accuracy

Guaranteed accuracy range (measurement signal level)

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

Range	DC	0.001Hz to 99.999Hz	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 (Guaranteed accuracy of 0.501 V to 5 V when DC bias.)				
100mΩ		0.501 V to 5 V (Guaranteed accuracy of 1 V to 5 V when DC bias.)				

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

In the 10 MΩ to 1 kΩ range, the guaranteed accuracy range is as follows when measured values (impedance values) exceed the range.

Range	DC	0.001Hz to 99.999Hz	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			0.050 V to 5 V	0.101 V to 5 V
1kΩ						

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

Specifications

Product warranty: 1 year

Measurement modes	LCR mode: Measurement with single condition Continuous measurement mode: Measures under saved conditions continuously LCR mode (maximum of 60 sets) Analyzer mode (maximum of 2 sets) Analyzer mode:Measurement frequency or measurement level sweep operation, temperature characteristics, equivalent circuit analysis (Measurement points: 2 to 801, Measurement method: normal sweep or segment sweep, Display: List display or graph display)
Measurement parameters	Z, Y, θ, Rs(ESR), Rp, Rdc(DC resistance), X, G, B, Cs, Cp, Ls, Lp, D(tanδ), Q, T, σ, ε
Measurement range	100 mΩ to 100 MΩ, 10 ranges (All parameters are determined according to Z) Guaranteed accuracy range:10 mΩ to 200 MΩ
Display range	Z, Y, Rs, Rp, Rdc, X, G, B, Ls, Lp, Cs, Cp, σ, ε: ±(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 9999.99) Δ % : ±(0.000% to 999.999%) T : -10.0 °C to 99.9 °C σ, ε: ±(0.00000f [unit] to 999.999G [unit])
Basic accuracy	Z : ±0.05%rdg. θ: ±0.03°
Measurement frequency	1 mHz to 200 kHz (1 mHz to 10 Hz steps)
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 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 With battery measurement function ON: V mode: 101 mV to 1.25 Vrms, 1 mVrms steps CV mode: 5 mV to 1.25 Vrms, 1 mVrms steps CC mode: 2 mA to 50 mArms, 10 µArms steps
Output impedance	Normal mode: 100 Ω Low impedance high accuracy mode: 25 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 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 VDC (10 mV steps) Low impedance high accuracy mode: -2.50 V to 2.50 V (10 mV steps)
Rdc (DC resistance) measurement	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
Temperature measurement function	Temperature Probe: Sheath Type Temperature Probe 9478 (option) Measurement range: -10°C to 99.9°C Sampling cycle: Around 640ms
Comparator	LCR mode: Hi/IN/Lo for 2 parameters
BIN measurement	10 classifications and out of range for 2 parameters
Compensation	Open/short/load/correlation compensation Cable length: 0, 1, 2 and 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), USB flash drive Option: RS-232C, GP-IB, LAN (10BASE-T/100BASE-TX), Only 1 Optional Interface can be installed at any one time
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 55°C (131 °F), 80% RH or less, no condensation
Power supply	100 to 240 V AC, 50/60 Hz, 50 VA max.
Dimensions and mass	Approx. 330 W x 119 H x 168 D mm, approx. 3.1 kg Approx. 12.99" W x 4.69" H x 6.61" D, approx. 109.3 oz.
Accessories	Power Cord × 1, Instruction Manual × 1, CD-R (Communication Instruction Manual and Sample Software [Communications Control, Accuracy Calculation, and Screen Capture Functionality]) × 1
Applicable standards	EMC: EN61326-1, EN61000-3-2, EN61000-3-3 Safety standard: EN61010

Model : CHEMICAL IMPEDANCE ANALYZER IM3590

Model No. (Order Code) (Note)

IM3590 (For electrochemical components)

Standard accessories: Power Cord, Instruction Manual, CD-R (Communication Instruction Manual and Sample Software [Communications Control, Accuracy Calculation, and Screen Capture Functionality])

Test fixtures are not supplied with the unit. Select an optional test fixture or probe when ordering. Probes are constructed with a coaxial cable with 50Ω impedance characteristics.

Options

INTERFACE UNIT (Only 1 can be installed at any one time)

GP-IB INTERFACE
Z3000

RS-232C INTERFACE
Z3001*

LAN INTERFACE
Z3002

*RS-232C cable

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

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

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).

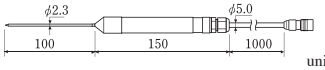
* An internal 300µH inductance is connected in parallel to the DUT.

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

TEMPERATURE PROBE

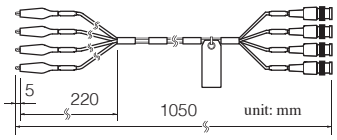
SHEATH TYPE TEMPERATURE PROBE 9478

Pt100, tip ø2.3 mm (0.09 in), cord length 1 m (3.28 ft), water-proof structure,
water-proof property: EN60529:1991, IP67



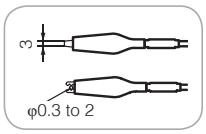
unit: mm

For Electrochemical Measurement

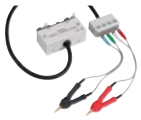


FOUR-TERMINAL PROBE 9500-10

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)



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 5 mm (0.20 in)

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 1.5 mm (0.06 in)

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 5 mm (0.20 in)

TEST FIXTURE 9262

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

Test Fixtures for SMD

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

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 9263

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

HIOKI

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.
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100 brevetti depositati all'anno
1200 prodotti a catalogo
800.000 pezzi venduti all'anno
50 ppm (pezzi per milione) indice di difettosità
10.000 prove di apertura e chiusura per testare la durata dei toroidi
1 metro di caduta per testare la resistenza degli strumenti

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