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 (DCR), 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.
LCR measurement, DCR measurement, and Sweep measurement

**Continuous Measurement and High-speed Testing**
**Achieved with One Instrument**

**IMPEDEANCE ANALYZER IM3570**

**Measurements recommended with IMPEDANCE ANALYZER IM3570**

1. Testing the resonance characteristics of piezoelectric elements

**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.

**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

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

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

The instrument can continuously measure L-Q (1 kHz, 1mA constant current) and DCR, 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 DCR 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°.

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, 0, 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 % 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 5 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.
**Link with computer via USB, LAN, RS-232C, or GP-IB**

**Effective for Acquisition and Analysis of Measurement Data**

- **PC application**
  Basic software capable of frequency characteristics, level characteristics, and continuous measurement is provided. Connecting a PC to the RS-232C, USB, or LAN port on the rear panel enables you to easily operate the instrument from the PC and acquire data. The software includes simple command send functions that can be used to save effort in the measurement sequence and confirm interface command operations.

- **Instrument mode indicators**
  Indicators allow you to identify the operating state of the instrument even when the LCD display is off.

- **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.

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**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.)

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**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.
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

```
Contact state  TRG  INDEX  EOM
            Open  ON    OFF
            ON    ON    OFF
            ON    ON    ON
```

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

*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

#### 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 ±9,999,999 [unit]
- **Rs**: ±0.000000 to ±9,999,999
- **Q**: ±0.00 to 999999.99
- **D**: ±(0.0000% to 99.9999%)

#### Basic accuracy
- **Measurement frequency**: 4 Hz to 5 MHz (10 mHz to 100 Hz steps)
- **Normal mode**: 0 VDC to 1.00 VDC (10 mV steps)
- **Low impedance high accuracy mode**: 0 VDC to 2.50 VDC (10 mV steps)

#### Interface
- **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**
- **-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
### 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
- **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

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

#### Basic accuracy

<table>
<thead>
<tr>
<th>Range</th>
<th>Guaranteed accuracy range</th>
<th>DC</th>
<th>4 Hz to 99.9 Hz</th>
<th>100 Hz to 999.9 Hz</th>
<th>1 kHz to 10 kHz</th>
<th>10.01 kHz to 100 kHz</th>
<th>100.1 kHz to 1 MHz</th>
<th>1.001 MHz to 5 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>100MΩ</td>
<td>8MΩ to 200MΩ</td>
<td>A=3</td>
<td>B=2</td>
<td>A=5</td>
<td>B=8</td>
<td>A=6</td>
<td>B=5</td>
<td>A=3</td>
</tr>
<tr>
<td>10MΩ</td>
<td>800kΩ to 100MΩ</td>
<td>A=1</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=1</td>
</tr>
<tr>
<td>1MΩ</td>
<td>80kΩ to 10MΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>100kΩ</td>
<td>24kΩ to 1MΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>30kΩ</td>
<td>8k to 30kΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>10kΩ</td>
<td>2.4kΩ to 100kΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>3kΩ</td>
<td>800Ω to 30kΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>1kΩ</td>
<td>240Ω to 10kΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>300Ω</td>
<td>8Ω to 300Ω</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>10Ω</td>
<td>800Ω to 10Ω</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>1Ω</td>
<td>80mΩ to 1Ω</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
<tr>
<td>100mΩ</td>
<td>1mΩ to 100mΩ</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
<td>B=0</td>
<td>A=0</td>
</tr>
</tbody>
</table>

#### 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.
  
  \[
  Z(x) \approx 10^{-\left(\theta \approx -90^\circ\right)} \approx \frac{10^{-\left(\theta \approx 0^\circ\right)}}{2 \pi \times \text{Measurement frequency} [\text{Hz}]} \]

#### Guaranteed accuracy range (measurement signal level)

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

<table>
<thead>
<tr>
<th>Range</th>
<th>DC</th>
<th>4 Hz to 99.9 Hz</th>
<th>100 Hz to 999.9 Hz</th>
<th>1 kHz to 10 kHz</th>
<th>10.01 kHz to 100 kHz</th>
<th>100.1 kHz to 1 MHz</th>
<th>1.001 MHz to 5 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>100MΩ</td>
<td>0.1 V to 2.5 V</td>
<td>0.101 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
</tr>
<tr>
<td>10MΩ</td>
<td>0.1 V to 2.5 V</td>
<td>0.050 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
</tr>
<tr>
<td>1MΩ</td>
<td>0.1 V to 2.5 V</td>
<td>0.025 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
</tr>
<tr>
<td>100kΩ</td>
<td>0.1 V to 2.5 V</td>
<td>0.005 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
</tr>
<tr>
<td>10kΩ</td>
<td>0.1 V to 2.5 V</td>
<td>0.002 V to 2 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
</tr>
<tr>
<td>1kΩ</td>
<td>0.1 V to 2.5 V</td>
<td>0.001 V to 2 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
<td>0.501 V to 5 V</td>
</tr>
</tbody>
</table>

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 0.01 V to 5 V when DC bias.
**OPTION**

**FOUR-TERMINAL PROBE L2000**
DC to 5 MHz
Characteristic impedance: 50 Ω
4-terminal structure
Test sample dimensions: 5mm or less
* The cable length is 1 m.

**TEST FIXTURE 9262**
DC to 5 MHz

**SMD TEST FIXTURE 9263**
DC to 5 MHz
Test sample dimensions: 1mm (0.04” in) to 10mm (0.39” in)

**SMD TEST FIXTURE 9677**
Electrodes on side for SMD
DC to 120 MHz
Test sample dimensions: 3.5mm ±0.5mm (0.14” ±0.02” in)

**SMD TEST FIXTURE 9699**
Electrodes on bottom for SMD
DC to 120 MHz
Test sample dimensions: 1.0mm (0.04”) to 4.0mm (0.16”) wide, maximum 1.5mm (0.06”) high

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**IMPEDANCE ANALYZER IM3570**
(Standard accessories: power cord)
Test fixtures are not supplied with the unit. Select an optional test fixture or probe when ordering.

**Print Example**

<table>
<thead>
<tr>
<th>Z</th>
<th>1.85223 ohm</th>
<th>2.011 deg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>1.84567 ohm</td>
<td>2.024 deg</td>
</tr>
</tbody>
</table>

---

**Other High Performance HIOKI LCR Meters**

**LCR HITESTER 3522-50**
(DC, 1mHz to 100kHz)
**LCR HITESTER 3532-50**
(42Hz to 5MHz)

- **Printer 9670**
  - Print method: Thermal line dot
  - Print width: 72 mm
  - Print speed: 47.5 mm/s
  - Power: AC Adapter 9671 or Battery Pack 9672
  - Dimensions: Approx. 119 x 77 x 174 mm
  - Mass: Approx. 500 g

  Printer operation requires RS-232C Cable 9638 and AC Adapter 9671, and battery operation requires Battery Pack 9672 and Battery Charger 9673.

- **Optional accessories**
  - LCR HiTESTER 3522-50 (DC, 1mHz to 100kHz)
  - LCR HiTESTER 3532-50 (42Hz to 5MHz)

- **Print Example**
  - Z: 1.85223 ohm
  - Z: 1.84567 ohm

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**IM3570E1-07E-05K**

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All information correct as of Jul. 23, 2010. All specifications are subject to change without notice.