I modelli proposti

Ponti LCR




	IM3536	IM3533/01	IM3533	IM3523
Settori di utilizzo	Analisi e controlli "general purpose", laboratori di prova ed assistenza	Ricerca & Sviluppo, Linea di Produzione, Controllo Qualità		Linee di Produzione ed Integrazione su macchine automatiche
Applicazione tipica	Misure di LCR generiche da DC a 8MHz	Caratterizzazione componenti elettrici ed elettronici, con funzione di scansione in frequenza	Caratterizzazione componenti elettrici ed elettronici	Misura di C-D e ESR su condensatori elettrolitici e L-Q e DCR su induttanze
Oggetto in prova (tipico)	Condensatori e induttanze in generale	Trasformatori, induttori, avvolgimenti, condensatori elettrolitici in alluminio	Trasformatori, induttori, avvolgimenti, componenti elettronici in generale	Condensatori ed induttanze in generale
Campo di Frequenza	4Hz ~ 8MHz	1mHz ~ 200kHz		40Hz ~ 200kHz
Misura di resistenza in DC	SI	SI	SI	SI
Velocità di risposta (base)	1msec	2msec		
Precisione (base)	±0.05%	±0.05%		
Compensazione in temperatura	-	SI	SI	NO
Scansione in frequenza	SI (tramite software)	SI	NO	NO
Classificazione a fine prova (BIN)	SI	SI	SI	SI
Display touch-screen	SI	SI	SI	NO
Misura simultanea	4 parametri	4 parametri		2 parametri
Misura a 4 terminali	•	•	•	•
Z (impedenza [Ω])	10 portate da 100mΩ a 100MΩ	10 portate da 100mΩ a 100MΩ		
Y (ammettenza [Ω])	•	•	•	•
Ø (angolo di fase [°])	•	•	•	•
Rs (resistenza serie =ESR [Ω]	•	•	•	•
Rp (resistenza parallelo [Ω])	•	•	•	•
Rdc (resistenza in DC, freq. zero)	•	•	•	•
X (reattanza [Ω])	•	•	•	•
G (conduttanza [S])	•	•	•	•
B (suscettanza [S])	•	•	•	•
Ls (induttanza serie [H])	•	•	•	•
Lp (induttanza parallelo [H])	•	•	•	•
Cs (capacità serie [F])	•	•	•	•
Cp (capacità parallelo [F])	•	•	•	•
Q (fattore di merito (Q=1/D))	•	•	•	•
D (fattore di perdita [tanδ])	•	•	•	•
N (rapporto spire)	-	•	•	-
M (mutua induttanza)	-	•	•	-
ΔL (induttanza differenziale)	-	•	•	-
ε (costante dielettrica)	•	-	-	-
σ (conduttività)	•	-	-	-
T (temperatura)	-	•	•	-
Memoria per le condizioni di prova	su USB key esterna	su USB key esterna		
Memoria per i dati misurati	32000 valori su memoria interna	32000 valori su memoria interna		
Funzione Comparatore	Hi / IN / Lo (abs, % e Δ%)	Hi / IN / Lo (abs, % e Δ%)		
Check in prova del buon contatto	•	•	•	•
Tensione di misura	da 10 mV a 5V (passi da 1mV)	da 5mV a 5V (passi da 1mV)		
Misura a tensione costante (CV)	•	•	•	•
Corrente di misura	da 10uA a 50mA (passi da 10uA)	da 10uA a 50mA (passi da 10uA)		
Misura a corrente costante (CC)	•	•	•	•
Interfaccia EXT I/O	•	•	•	•
Interfaccia USB per computer	•	•	•	•
Driver per USB key	•	•	•	–
Interfaccia LAN	•	opzionale	opzionale	opzionale
Interfaccia GP-IB	•	opzionale	opzionale	opzionale
Software per computer	•	•	•	•
Alimentazione	da rete	da rete	da rete	da rete





IM3570	IM3590	IM7580	3511/50	AS250
Ricerca & Sviluppo, Linea di Produzione, Controllo Qualità	Ricerca & Sviluppo	Ricerca & Sviluppo	Analisi e controlli "general purpose", laboratori di prova ed assistenza	Laboratori assistenza e riparazione
Misura di risonanza, con funzione di scansione in frequenza	Misura su componenti elettrochimici. Rappresentazione Cole-Cole di batterie e celle a combustibile	Misure in altissima frequenza fino a 300MHz	Misure di LCR a frequenze fisso 120Hz e 1kHz	Misure LCR per indagini sporadiche e veloci
Dispositivi piezoelettrici, condensatori a polimeri, induttanze di potenza	Batterie, celle a combustibile, elettrodi, elettroliti	Condensatori e induttanze in generale	Condensatori e induttanze in generale	Condensatori induttanze e resistenze per applicazioni elettrotecniche
4Hz ~ 5MHz	1mHz ~ 200kHz	1MHz ~ 300MHz	120Hz & 1kHz	100/120Hz, 1/10/100kHz
SI	SI	NO	NO	ord
0.5msec	2msec	0.5msec	5msec	6msec
±0.05%	±0.08%	±0.72%	±0.08%	±2%
NO	SI	-	NO	NO
SI	SI	SI	NO	NO
SI	SI	SI	NO	NO
SI	SI	SI	NO	NO
4 parametri	4 parametri	4 parametri	2 parametri	2 parametri
•	•	–	•	–
12 portate da 100mΩ a 100MΩ	10 portate da 100mΩ a 100MΩ	da 100mΩ a 5kΩ	10 portate da 100mΩ a 100MΩ	-
•	•	•	-	-
•	•	•	•	•
•	•	•	•	8 portate da 200mΩ a 200mΩ
•	•	•	•	•
•	•	•	-	•
•	•	–	-	-
•	•	•	-	-
•	•	•	-	-
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	•	-	-	-
-	•	-	-	-
-	•	-	-	-
su USB key esterna	su USB key esterna	30 set	99 set	-
32000 valori su memoria interna	32000 valori su memoria interna	32000 valori su memoria interna	-	-
Hi / IN / Lo (abs, % e Δ%)	Hi / IN / Lo (abs, % e Δ%)	Hi / IN / Lo (abs, % e Δ%)	Hi / IN / Lo	Δ%
•	-	•	-	-
da 5mV a 5V (passi da 1mV)	da 5mV a 5V (passi da 1mV)	da 4mV a 1V	50mV – 500mV – 1V	•
•	•	–	-	-
da 10uA a 50mA (passi da 10uA)	da 10uA a 50mA (passi da 10uA)	da 0,09mA a 20mA	-	-
•	•	–	-	-
•	•	•	•	-
•	•	•	-	•
•	•	•	-	-
•	•	•	-	-
•	•	opzionale	opzionale	-
•	•	•	•	opzionale
da rete	da rete	da rete	da rete	1 batteria 9V

IM3570

Banda di frequenza estesa 4Hz-5MHz, scansione in frequenza

Extended frequency bandwidth from 4Hz to 5MHz, frequency sweep

Ponte LCR ed analizzatore di impedenza per misure su banda di frequenza estesa da 4 Hz a 5MHz e con segnale di prova regolabile fino a 5V e/o fino a 50mA (tensione costante e corrente costante).

Elevatissima velocità di risposta pari a 0.5msec, misura di resistenza in cc (DCR) e funzione di scansione in frequenza per la caratterizzazione (risonanza) di qualsiasi componente elettrico, elettronico, magnetico, …

Ideale per laboratori di Ricerca e Sviluppo ed in generale per lo studio del comportamento in frequenza di componenti e dispositivi.

LCR meter, and impedance analyzer for measurements on frequency bandwidth extended from 4Hz to 5MHz and with test signal adjustable up to 5V and / or up to 50mA (constant voltage and constant current).

High-speed response up to 0.5msec, DC resistance measure (DCR) and sweep feature for characterizing frequency (resonance) of any electrical component, electronic, magnetic, ...

Ideal for R & D laboratories and in general to study the frequency behavior of components and devices.

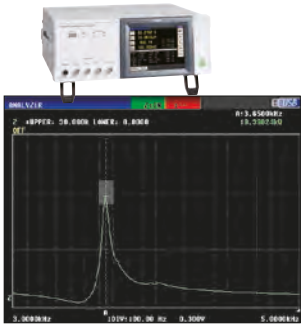
LCR measurement, DCR measurement, and Sweep measurement

Continuous Measurement and High-speed Testing Achieved with One Instrument

IMPEDANCE ANALYZER IM3570

Measurements recommended with IMPEDANCE ANALYZER IM3570

1. Testing the resonance characteristics of piezoelectric elements



Frequency sweep measurement
Z peak comparator screen

LCR mode
Cs display screen (1 kHz measurement)

Reduce Equipment Costs with Just 1 Device!

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

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

Continuous measurement screen

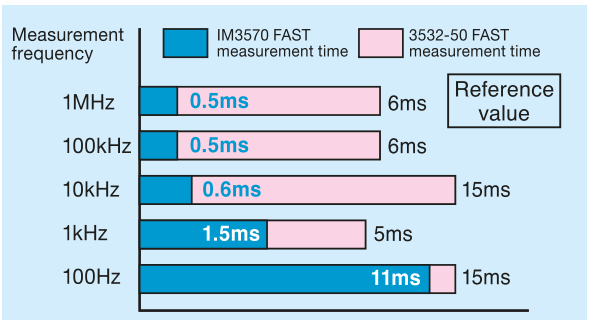
High Speed and High Accuracy

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

Advantage #1 -- Measurement time shortened

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

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



Comparison of measurement time of IM3570 and 3532-50

Perfect Impedance Analyzer for Production Lines

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

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

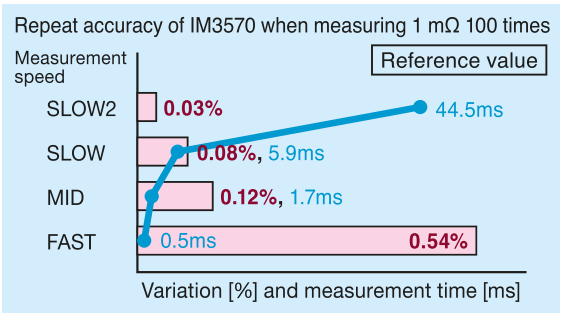
LCR mode
Rs display screen (100 kHz measurement)

Continuous measurement screen

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

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

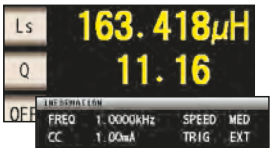
Advantage #2 -- Low-impedance measurement accuracy improved



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

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

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



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

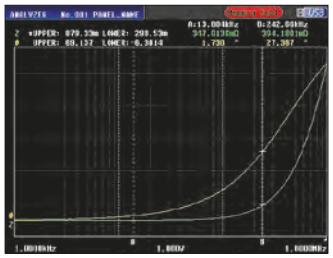
DCR display screen
(DC measurement)

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

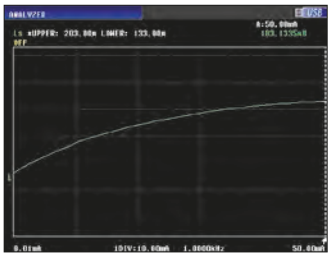
The instrument can continuously measure L-Q (1 kHz, 1mA constant current) and DCR, and display the numerical values on the same screen. Current dependent elements such as coils incorporating cores for which the inductance value varies depending on the applied current can be measured with a constant current (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°.



Frequency sweep measurement
Z-θ measurement screen



CC value sweep measurement
Ls measurement screen

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

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

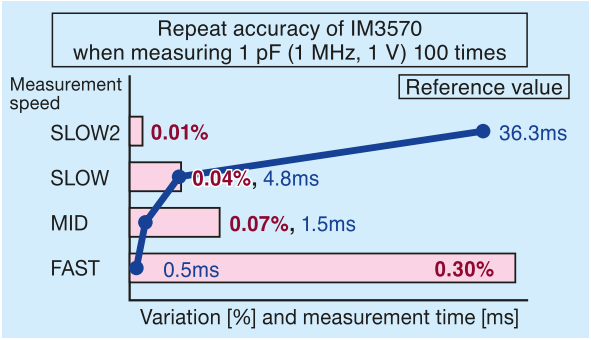
Test Efficiency Improved by High-speed and High-accuracy Measurements

Features of IM3570

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

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

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



● Wide setting range for measurement frequency

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

● 15 parameters measured

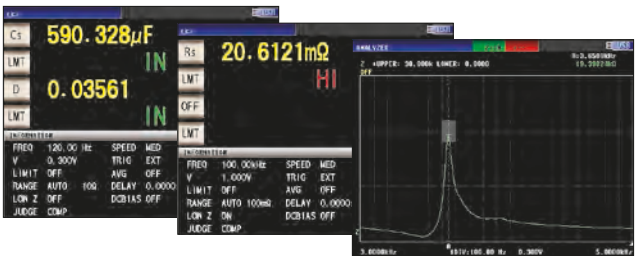
The following parameters can be measured and selected parameters can be captured by a computer: Z, Y, θ, Rs (ESR), Rp, Rdc (DC resistance), X, G, B, Ls, Lp, Cs, Cp, D (tanδ), and Q.

● Incorporates contact check function (open-circuit check)

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

● Comparator and BIN functions

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



● Segment setting

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

● Memory function

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

● Wide setting range for measurement voltage and current

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

● DC bias can be generated internally

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

● High resolution with up to 7-digit display

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

● Four-terminal probe allows for use at DC to 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

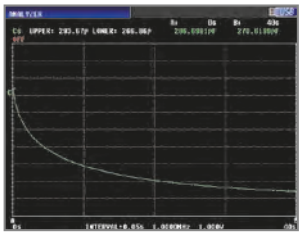
Accuracy is guaranteed at the measurement cable lengths of 0, 1, 2, and 4 meters. This makes wiring automated machinery simple. (The frequency range for which accuracy is guaranteed differs depending on the cable length. The probe needs to be provided by the customer.)

● 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

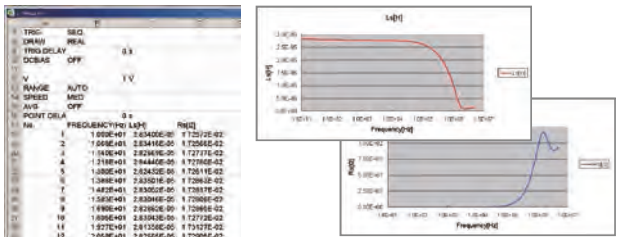
In order to, for example, confirm the temporal changes of an element from the response of a sensor, parameter time variations can be measured for up to 801 points at a specified interval (100 μs to 10,000s), and then the data can be displayed in a graph or list.



Interval setting screen

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

Effective for Acquisition and Analysis of Measurement Data

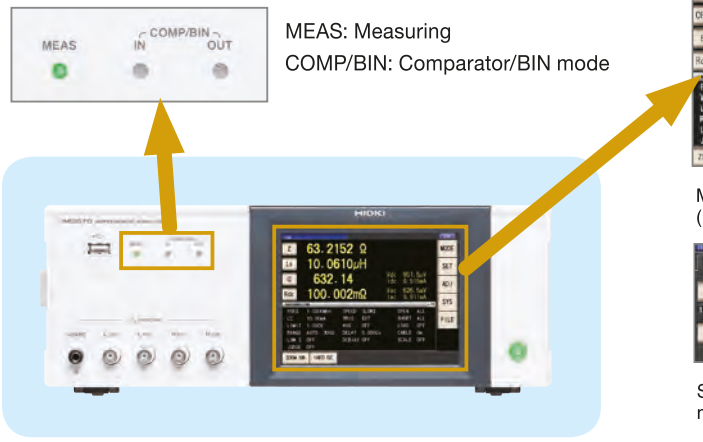


● PC application

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.



MEAS: Measuring
COMP/BIN: Comparator/BIN mode

● Intuitive operation with touch panel

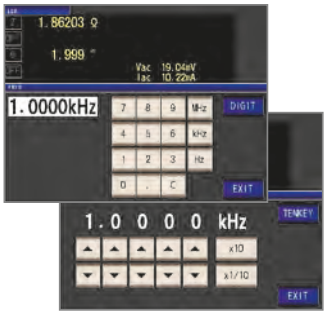
A touch panel display with intuitive operation is inherited from previous models. Furthermore, the incorporation of a color LCD means the display is easy to view, and outstanding operability which ensures you intuitively know what to do helps improve work efficiency.

Measurement screen (LCR 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 and up/down input)

Saving and reading data via front-loading USB port

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

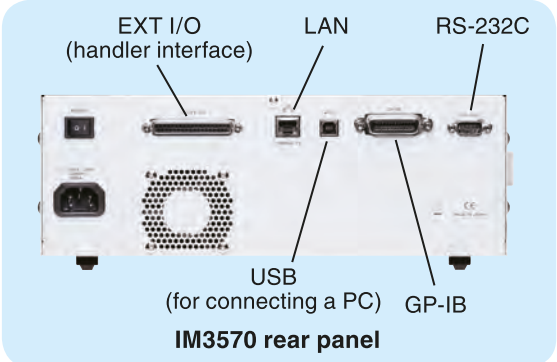
(The USB port on the front panel is specifically for a USB flash drive. Batch save all measurement results to a USB flash drive after saving them to the internal memory of IM3570. Some USB flash drives may not be able to be used due to incompatibility issues.)

Various measurement results and settings

Save to USB flash drive

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

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



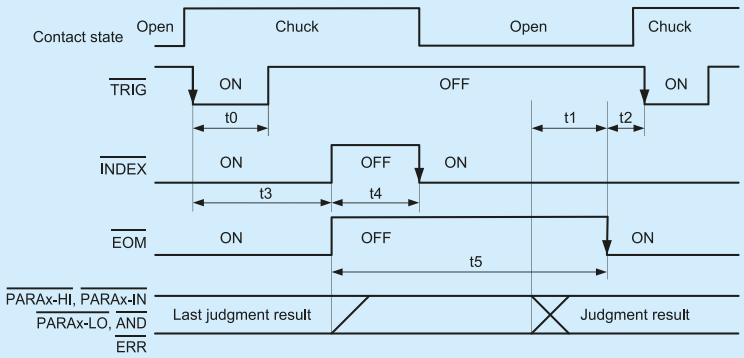
IM3570 rear panel

EXT I/O

Handler (EXT I/O) interface

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

■ Example of representative EXT I/O timing



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

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

■ Connectors

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

IM3570 specifications

Measurement modes	LCR mode: Measurement with single condition Analyzer mode: Sweeps with measurement frequency and measurement level (Measurement points: 1 to 801, Measurement method: normal sweep or segment sweep, Display: List display or graph display) Continuous measurement mode: Measures under saved conditions continuously (maximum of 32 sets)
Measurement parameters	Z Impedance Y Admittance θ Phase angle Rs(ESR) Series-equivalent resistance = ESR Rp Parallel-equivalent resistance Rdc DC resistance X Reactance G Conductance B Susceptance Cs Series-equivalent static capacitance Cp Parallel-equivalent static capacitance Ls Series-equivalent inductance Lp Parallel-equivalent inductance D(tanδ) Loss coefficient = tan δ (δ= delta) Q Q factor (Q = 1/D)
Measurement range	100 mΩ to 100 MΩ, 12 ranges (All parameters are determined according to Z)
Display range	Z, Y, Rs, Rp, Rdc, X, G, B, Ls, Lp, Cs, Cp : ±(0.000000 [unit] to 9.999999G [unit] Absolute value display for Z and Y only θ : ±(0.000° to 999.999°) D : ±(0.000000 to 9.999999) Q : ±(0.00 to 99999.99) Δ % : ±(0.0000% to 999.9999%)
Basic accuracy	Z : ±0.08%rdg. θ: ±0.05°
Measurement frequency	4Hz to 5MHz (10 mHz to 100 Hz steps)
Measurement signal level	Normal mode: V mode/CV mode: 5 mV to 5 Vrms (up to 1 MHz), 10 mV to 1 Vrms (1 MHz to 5 MHz), 1 mVrms steps CC mode: 10 µA to 50 mArms (up to 1 MHz), 10 µA to 10 mArms (1 MHz to 5 MHz), 10 µArms steps Low impedance high accuracy mode: V mode/CV mode: 5 mV to 1 Vrms (up to 100 kHz), 1 mVrms steps CC mode:10 µA to 100 mArms (100 mΩ and 1Ω ranges of up to 100 kHz), 10 µArms steps

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

IM3570 measurement accuracy

Conditions

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

Basic accuracy (Z, θ) calculation expression

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

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

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

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

1 kΩ range and above:

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

300 Ω range and below:

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

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

The measurement accuracy is calculated based on the following equation.

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

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

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

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

1V to 5V : 1

[D: Measurement speed coefficient]

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

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

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

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

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

DC bias setting OFF : 1

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

[G: Temperature coefficient] t: Operating temperature

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

Basic accuracy

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

● Method of determining basic accuracy

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

Zx (Ω) ≒ ωL (H) (θ ≒ 90°)

≒ $\frac{1}{\omega C\ (F)}$ (θ ≒ -90°)

≒ R (Ω) (θ ≒ 0°) (ω: 2 x π x Measurement frequency [Hz])

● Calculation example

Impedance Zx of sample: 500 Ω (actual measurement value)

Measurement conditions: When frequency 10 kHz and range 1 kΩ

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

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

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

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

Guaranteed accuracy range (measurement signal level)

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

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

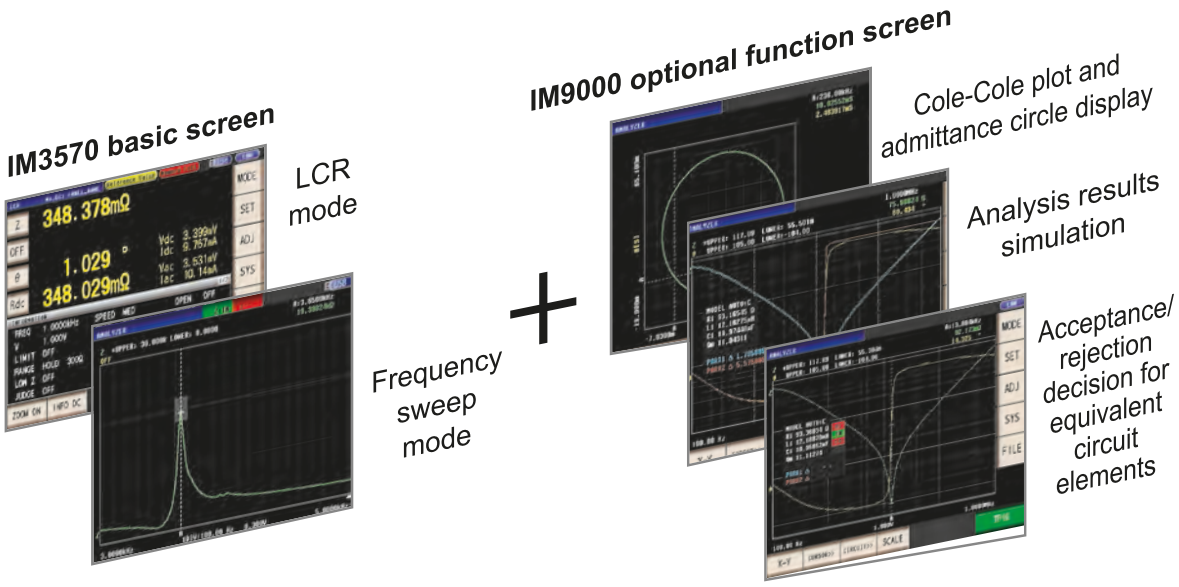
The above voltages are the voltage setting values correspond to when in V mode.

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

IM9000

Firmware per analisi dei circuiti equivalenti

Equivalent circuits analysis firmware



Tramite questo firmware opzionale è di sponibile l'analisi del circuito equivalente relativo all'oggetto in prova secondo 5 modelli di circuito equivalente tipico, con cui utilizzare il risultato di analisi per calcolare le caratteristiche ideali di frequenza e verificare le differenze rispetto ai valori misurati.

Con IM9000 installato, lo strumento IM3570 permette di v isualizzare a di splay il diagramma Cole-Cole plot (relazione dielettrica tramite diagramma di Nyquist), il cerchio di ammettenza (analisi della stabilità tramite grafico di Smith), e altri specifici grafici di analisi.

This optional firmware allow to perform analysis of the equivalent circuit for the object under test in accordance with 5 typical equivalent circuit models.

The analysis result can be used to calculate the ideal frequency characteristics and check differences compared with the nominal values.

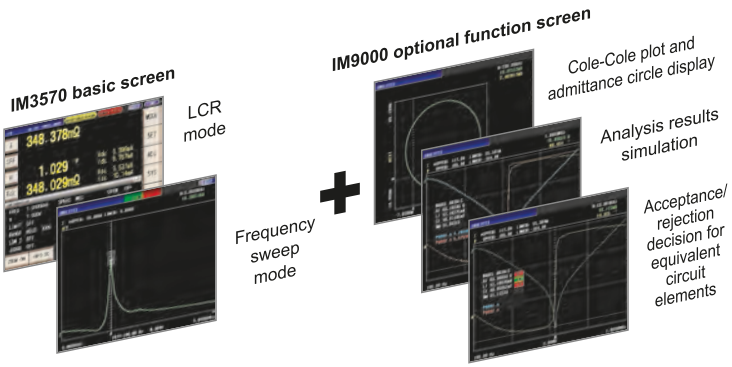
Installing IM9000, IM3570 allows to show on display the Cole-Cole plot diagram (Nyquist diagram dielectric relationship), the admittance circle (Smith chart stability analysis), and other specific analysis charts.

Enabling Simple Circuit Analysis and Detailed Acceptance/Rejection Decision-Making

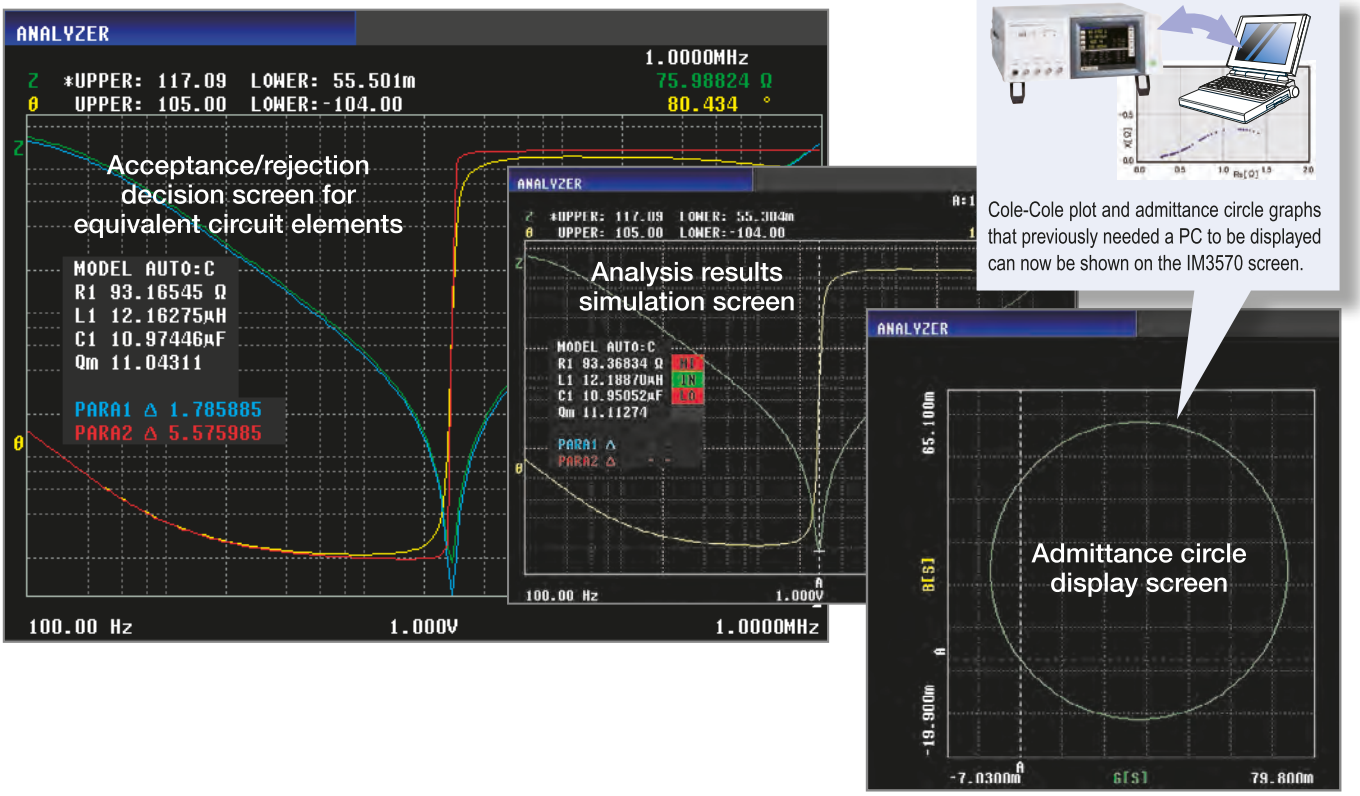
The **Equivalent Circuit Analysis Firmware IM9000** is an optional function that enables equivalent circuit analysis using the **Impedance Analyzer IM3570**. Five typical equivalent circuit analysis models and the analysis results can be used to calculate the ideal frequency characteristics and check the differences from the measured values. Furthermore, Cole-Cole plot, admittance circle, and other graphs can be displayed.

Impedance Analyzer IM3570

■ The Equivalent Circuit Analysis Firmware IM9000 Provides an Optional Function to Perform a Variety of Equivalent Circuit Analysis and Display Graphs



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



Features

● Simple:
Automatic Selection of Equivalent Circuit Model

The **IM9000** can automatically select the equivalent circuit model from the five typical models to minimize the differences between the measured values and the ideal frequency characteristics derived from the analysis results.

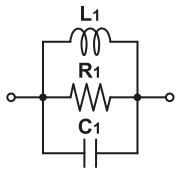
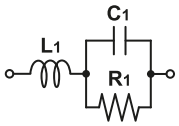
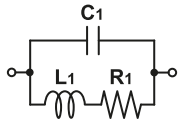
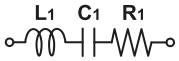
● Detailed:
Acceptance/Rejection Decision for Elements Comprising Part

An acceptance/rejection decision can be made for the L, C, and R elements comprising a part and the resonance sharpness (mechanical quality coefficient). A detailed decision can be made on the elements using the resonance of a piezoelectric element or inductor.

Equivalent Circuit Analysis Firmware IM9000 Specifications

● Equivalent Circuit Model and Measurement Items

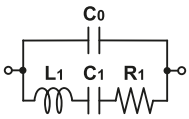
■ Three-element model

A		**Coil:** Core loss is large while ESR is small	C		**Capacitor:** Impact of the leakage resistance is large **Resistance:** Resistance is large and impact of the floating capacitance is large
B		**Coil:** ESR is relatively large **Resistance:** Resistance is small and impact of the wire inductance is large	D		**Capacitor:** General capacitor

■ Measurement items (Three-element model)

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

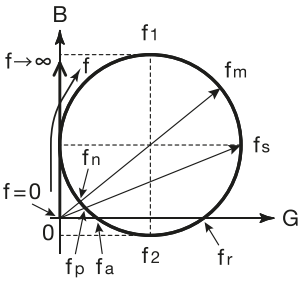
■ Four-element model

E		Pizoelectric element

■ Measurement items (Four-element model)

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

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



Parameters of the 4-element model

● Other functions

Circuit model selection	AUTO (automatic selection) / HOLD (fixed)
Estimation execution	AUTO (estimation is executed after frequency sweep ends) / MANUAL (estimation is executed by the user)
Sweep range using estimation	**Normal sweep:** Analysis is performed in the sweep range from the analysis start frequency to the analysis end frequency **Segment sweep:** Analysis is performed in the sweep range of the set segment number
Simulation	Enables displaying and comparing the ideal frequency characteristics graph derived from the analysis results or the values specified by the user

Comparator	Runs a comparator on the analysis results and outputs the decision results to LCD, EXT. I/O **R1, L1, C1, C0, Qm:** HI/IN/LO, absolute value setting
Display position of estimation results	Select the display position from upper, lower, left or right
X-Y display	**Cole-Cole plot:** Set Rs to the first measurement item, X to the third measurement item, reverse the polarity of the third measurement item, and set correction coefficient A =-1 for scaling correction **Admittance circle display:** Set G to the first measurement item and B to the third measurement item

EQUIVALENT CIRCUIT ANALYSIS FIRMWARE IM9000

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

Customers who have purchased the **Impedance Analyzer IM3570** can add the **Equivalent Circuit Analysis Firmware IM9000** function.
Please contact your local HIOKI representative.

Ponti LCR

		Sonde e fixture accessorie per ponti LCR (opzionali)	
	**9140/10**	Sonda a 4 terminali	DC → 200kHz, 50Ω
	**9143/10**	Sonda con terminali a pin	DC → 5MHz, 50Ω
	**9261/10**	Fixture di prova	DC → 8MHz, 50Ω
	**9262**	Fixture di prova	DC → 8MHz, 50Ω
	**9263**	Fixture di prova SMD	DC → 8MHz, 50Ω
	**9268/10**	Unità Bias di tensione	±40VDC: 40Hz → 8MHz
	**9269/10**	Unità Bias di corrente	±2ADC: 40Hz → 2MHz
	**9478**	Sonda temperatura	PT100: -10.0°C → +99.9°C
	**9500/10**	Sonda a 4 terminali	DC → 200kHz, 50Ω
	**9677**	Fixture di prova SMD	DC → 120MHz
	**9699**	Fixture di prova SMD	DC → 120MHz
	**IM9100**	Fixture di prova SMD	DC → 8MHz, 50Ω
	**IM9200**	Fixture di prova	---
	**IM9201**	Fixture di prova SMD	---
	**IM9906**	Adattatore da 3.5mm a 7mm	---
	**L2000**	Sonda a 4 terminali	DC → 5MHz, 50Ω
	**L2001**	Sonda con terminali a pin	DC → 8MHz, 50Ω

NOTA: gli accessori per 3511/50 e AS230 sono riportati alle specifiche pagine di prodotto







IM3536	IM3533/01	IM3533	IM3523	IM3570	IM3590	IM7580
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