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



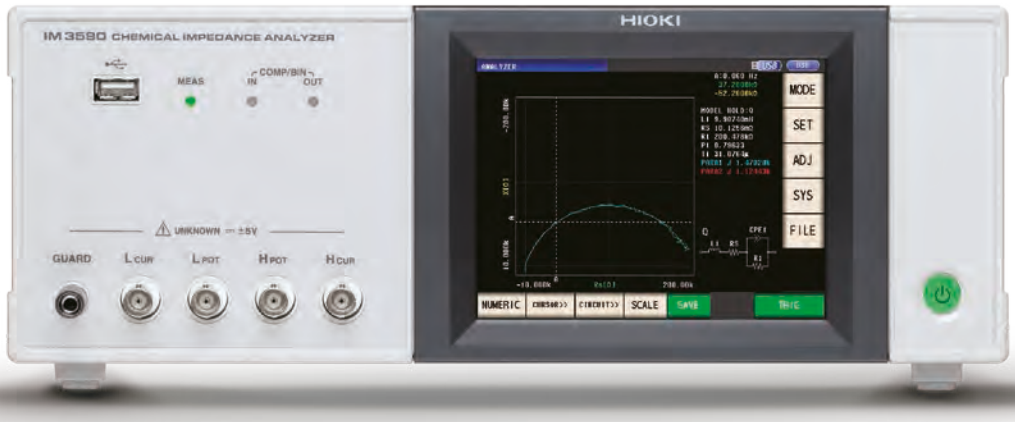


IM3570	IM3590	IM7580	3511/50	AS250
Ricerca & Sviluppo, Linea di Produzione, Controllo Qualità	Ricerca & Sviluppo	Ricerca & Sviluppo	Analisi e controlli "general purpose", laboratori di prova ed assistenza	Laboratori assistenza e riparazione
Misura di risonanza, con funzione di scansione in frequenza	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

IM3590

Analizzatore di impedenza per materiali elettrochimici

Impedance analyzer for electrochemical devices and components



IM3590 è ideale per eseguire misure di impedenza (LCR) su componenti e materiali elettrochimici quali batterie e celle a combustibile.

Funzione di visualizzazione del grafico Cole-Cole plot (relazione dielettrica con diagramma di Nyquist) ed analisi del circuito equivalente su una banda di frequenza da 1mHz a 200kHz, velocità di risposta fino a 2msec, precisione base ±0,05%.

Funzione di s cansione in frequenza per la c aratterizzazione (risonanza) di q ualsiasi componente elettrico, elettronico, magnetico, ...

IM3590 is ideal for making impedance measurements (LCR) of electrochemical components and materials such as batteries and fuel cells.

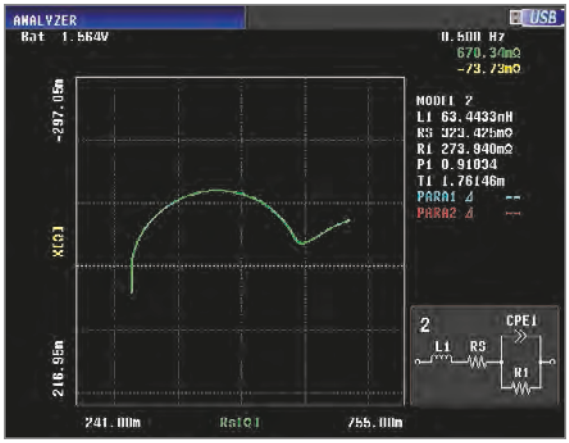
Display function graph Cole-Cole plot (Nyquist diagram dielectric relationship) and equivalent circuit analysis of a frequency bandwidth from 1mHz to 200kHz, response speed up to 2ms, basic accuracy ± 0.05%.

Function of frequency sweep for the characterization (resonance) of any electrical component, electronic, magnetic, ...

Measure Electrochemical Components and Materials, Batteries, and EDLCs*

*Electric double-layer capacitors

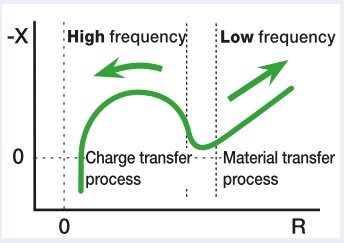
Cole-Cole plot



Cole - Cole plot screen (manganese battery)

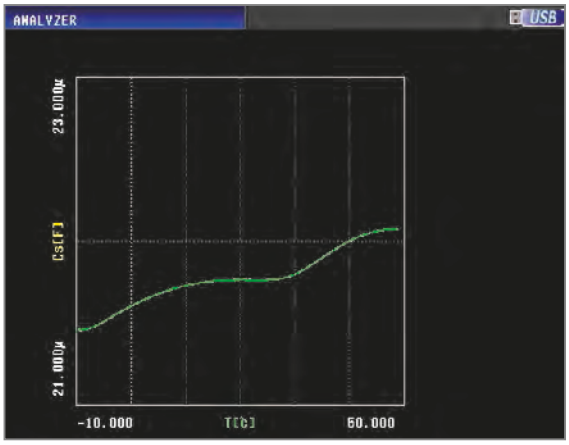
In measurement of electrochemical components and materials, Cole-Cole plots are used to ascertain electrode, electrolyte ion, and other characteristics. The IM3590 can perform frequency sweep measurement using up to 801 points and display the results as a Cole-Cole plot.

Cole-Cole plot loci and measurement frequency



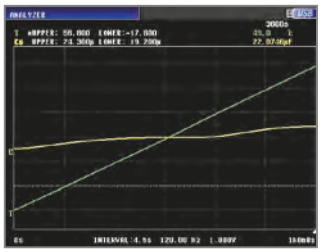
Measurement at low frequencies is necessary in order to measure characteristics such as ion behavior, and the IM3590 can conduct measurements at 1 mHz. The instrument's upper limit frequency is 200 kHz, allowing it to measure solution resistance.

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

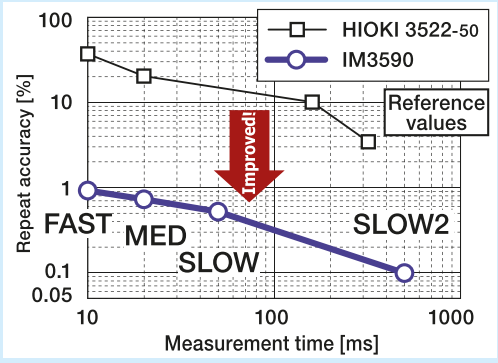
Battery measurement function

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.

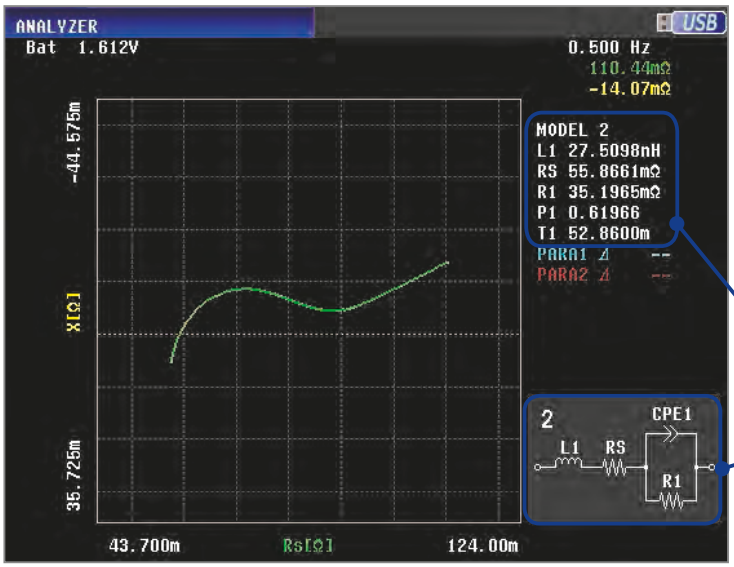
Measurement of alkaline batteries

Supported battery specifications
Internal impedance : up to 10mΩ
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)

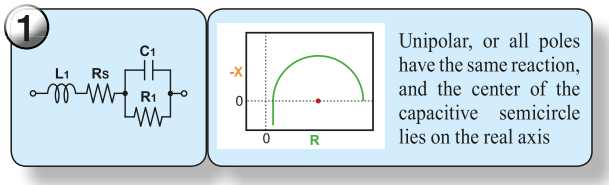
The ability to measure electrochemical components and materials makes possible evaluation by estimating equivalent circuits, facilitating a deeper understanding of reaction, electrode, and electrolyte characteristics. The IM3590 provides electrochemical component and material equivalent circuit models,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

Equivalent circuit analysis result

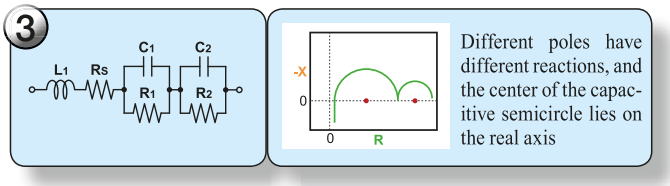
Equivalent circuit model

● Equivalent circuit models and measurement parameters

Unipolar models



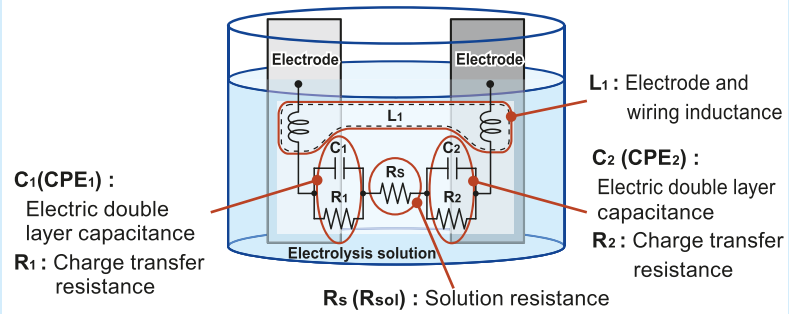
Polar models



Measurement parameters

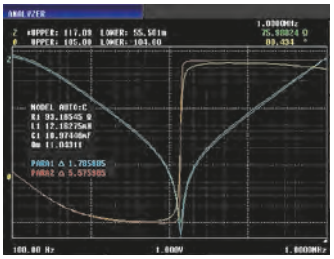
Rs (Solution resistance)
R1, R2 (Charge transfer resistance)
C1, C2 (Electric double layer capacitance)
CPE1, CPE2 (Constant Phase Element)
L1 (Inductance)

Internal structure of a standard electrochemical cell

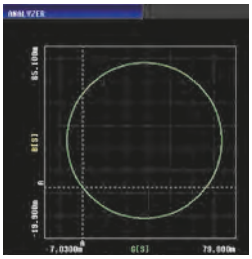


Electronic Components
(LCR Elements and Piezoelectric and Resonant Elements)

Sweep function (Frequency and signal level)



Frequency characteristics and analysis results simulation screen



Admittance circle display screen

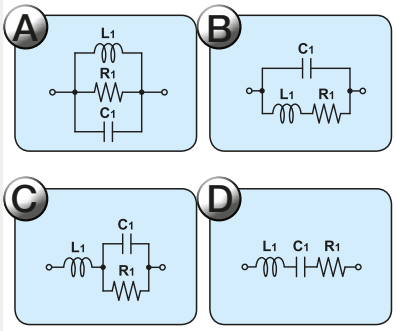
The IM3590 can perform sweep measurement of the frequency characteristics of standard LCR components such as electronic components and piezoelectric elements (resonant components). The ability to display frequency characteristics, admittance circles, and Cole-Cole plots makes it easy to assess characteristics. 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

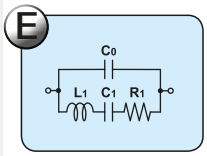


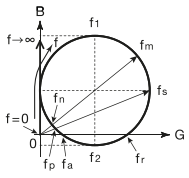
Measurement items

L_1 (Inductance)
C_1 (Capacitance)
R_1 (Resistance)
Q_m (Resonance sharpness)

The following measurement items can be captured via PC communication.
f_r (Resonance frequency)
f_a (Anti-resonance frequency)

Four-element model





Measurement items

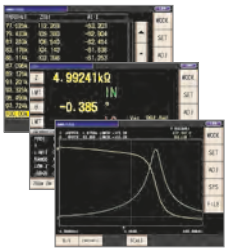
L_1 (Inductance)
C_1 (Capacitance)
R_1 (Resistance)
C_0 (Parallel capacitance)
Q_m (Resonance sharpness or mechanical quality coefficient)

The following measurement items can be captured via PC communication.
f_r (Resonance frequency)
f_a (Anti-resonance frequency)
f_s (Series resonance frequency)
f_p (Parallel resonance frequency)
f_m (Maximum admittance frequency)
f_n (Minimum admittance frequency)
f_1 (Maximum susceptance frequency)
f_2 (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.)



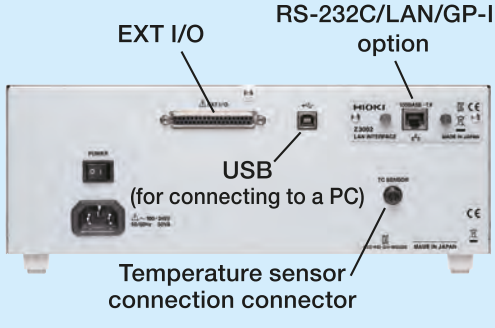
Various measurement results and settings

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. (Release scheduled in November 2012.)

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.



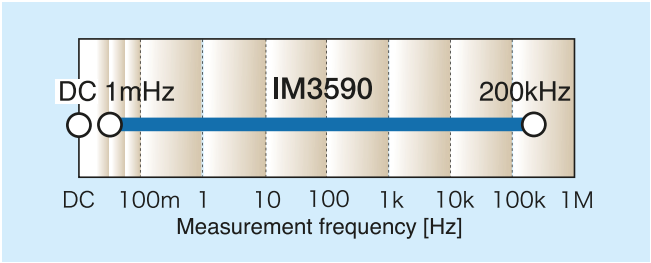
High-speed, High-precision, Easy-to-use Operation

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

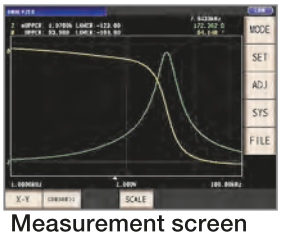
Functions and Features to Simplify the Operation of LCR Measurements

●Intuitive operation with touch panel

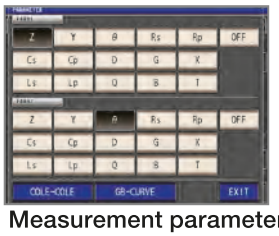
A touch panel display with intuitive operation is inherited from previous models. Furthermore, the incorporation of a color LCD means the display is easy to view, and outstanding operability which ensures you intuitively know what to do helps improve work efficiency.

●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.

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

(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 = 0.15 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			0.501 V to 5 V	
10MΩ						
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			0.501 V to 5 V	
1MΩ						
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: ±(0.000000 [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%) T : -10.0 °C to 99.9 °C
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
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)
DCR (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 weight	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.
Accessory	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

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







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