



# LCR Meter

ZM2371

ZM2372

ZM2376

■ Maximum speed: 2 ms ■ Basic accuracy: 0.08%

LCR meter series that achieves high-speed,  
high-precision stable measurements



For use in laboratories,  
for use on production lines

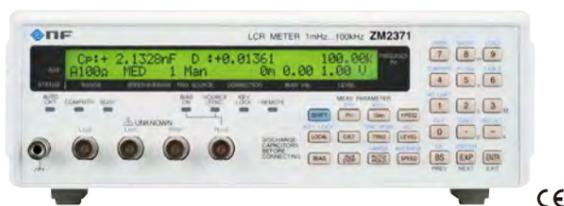
NF Corporation

# LCR meter

NF's ZM series LCR meters cover a wide frequency range, from the low-frequency region of 1 mHz up to 5.5 MHz. Supports a wide range of applications, from materials research to component production lines, by means of high-speed, low measurement fluctuation.

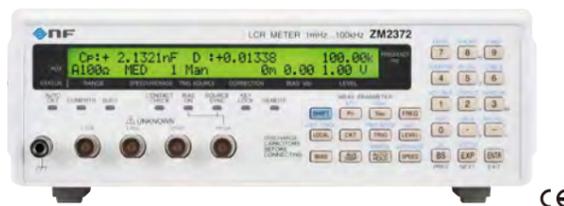
## 1 mHz to 100 kHz

ZM2371



USB RS-232

ZM2372



USB GPIB RS-232

Handler interface Contact check function

## 1 mHz to 5.5 MHz

ZM2376



USB GPIB RS-232 LAN \*Option

Handler interface Contact check function

### Lineup & Comparison sheet of specifications

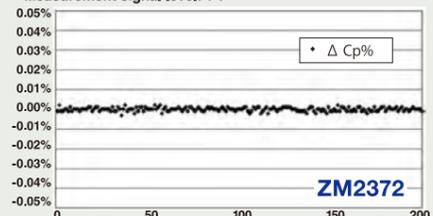
Specifications & functions	ZM2371	ZM2372	ZM2376
Measurement parameters	Primary parameters:  Z ,  Y , L, C, R, G Secondary parameters: Q, D, $\theta$ , X, B, Rs, Rp, G, Lp, Rdc		
Measurement frequency	1mHz to 100kHz		1mHz to 5.5MHz
Basic accuracy	0.08%		
Measurement signal level	10mVrms to 5Vrms, 1 $\mu$ Arms to 200mArms		
Internal DC bias	0 to +2.5V		0 to +5V
Measurement time : 1kHz	Maximum speed: 2ms		
Measurement time : 1MHz	-	-	Maximum speed: 2ms
Constant voltage and Constant current mode (ALC)	○	○	○
Contact check	-	○ (4 terminals)	○
Low capacitance check	-	-	○
Comparator	○ (9 bins)	○ (14 bins)	○ (14 bins)
Multi-measurement	-	-	○ (32 steps)
Handler interface	-	○	○

### Low measurement fluctuation result, excellent accuracy

Result using the ZM2376 and ZM2372 to measure a 1 nF and a 10  $\mu$ F capacitor 200 times under the following conditions. With the ZM2376, the accuracy of the measurement has been improved further.

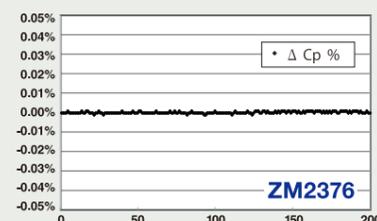
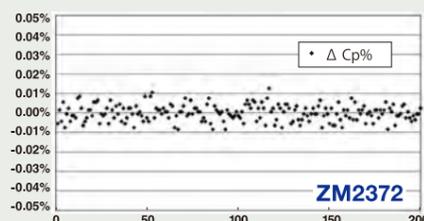
#### Measurement of 10 $\mu$ F capacitor

• Measurement time: 10 ms • Measurement frequency: 120 Hz • Measurement signal level: 1 V



#### Measurement of 1nF capacitor

• Measurement time: 5 ms • Measurement frequency: 100 kHz • Measurement signal level: 1 V



## Supports a wide range of high-speed, high-precision measurements

### Wide measurement frequency range and high-resolution settings

ZM2371 and ZM2372 cover a frequency range of 1 mHz to 100 kHz, while ZM2376 covers frequencies from 1 mHz to 5.5 MHz. The resolution can be set to 5 digits or 6 digits\* making it possible to perform measurements at frequencies actually used for a variety of components, in addition to evaluation of the frequency dependence of the parameters.

\*ZM2371, ZM2372: 5 digits, ZM2376: 6 digits

### High speed measurement

Measurement speed is selectable from 5 levels: RAP (rapid), FAST, MED, SLOW and VSLO (very slow). When set to RAP, high-speed measurement at 2 ms (1 kHz/1 MHz) or 10 ms (120 Hz) can be performed. This high-speed, high-precision LCR meter will help to improve the measurement efficiency of production lines and automatic inspection equipment.

### DC bias voltage

The built-in DC bias power supply of 0 to +2.5 V for ZM2371 and ZM2372, and 0 to +5 V for ZM2376 enables the measurement of polar components such as electrolytic capacitors.

With the ZM2376, high-speed impedance measurements, such as for lithium-ion batteries (single cell), are also possible. (See page 3.)

In addition, the use of an optional DC bias voltage adapter\* makes it possible to apply a bias voltage of  $\pm 40$ V to a sample enabling support for such measurements as the voltage dependence of high-capacity multi-layer ceramic capacitors.



\*Option

### Wide range of test signal and ALC functions

The measurement signal level can be set at a resolution of 3 digits to 10 mVrms to 5 Vrms, or 1  $\mu$ Arms to 200 mArms. In addition, by means of the automatic level control (ALC) functions, constant voltage and constant current mode can be set, making it possible to perform measurements with high reproducibility at a stable signal level that takes into account the voltage and current dependence of the sample.

### High precision

With 0.08% basic accuracy, high-precision measurements with up to 6-digit resolution are achieved. Reliable measurements are essential for improving performance and quality, from the development of state-of-the-art devices to the component sorting on inspection lines.

### DC resistance (DCR) measurement

It is possible to perform DC resistance measurements on the winding resistance of such equipment as coils or transformers.

The measured values of the inductance can be displayed in the primary parameters at the same time as the DC resistance in the secondary parameters.

## Enhanced features for production lines!

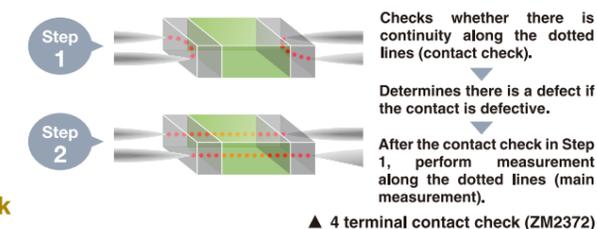
### Contact check function

#### ZM2372 4 terminal contact check

In order to prevent measurement and selection errors due to poor contact between the measurement tip and components, ZM2372 performs a contact check measurement at four terminals to determine defects. This eliminates the output of defective products. (Additional time required for contact check: 4 ms)

#### ZM2376 Contact check and low capacitance check

Detects abnormally low capacitance, abnormal voltage and current, and can detect contact failures with little additional time.



▲ 4 terminal contact check (ZM2372)

### Triggered synchronous drive

This function can be used to drive a sample for a period of time while contact is being made.

When performing measurements of large-capacity capacitors, it is possible to reduce the damage caused by the contact by removing the sample.

For samples with hysteresis characteristics, when measurements are performed in a short period of time, the measured values have larger fluctuations. By using triggered synchronous drive, the relationships between the time and the phase of the drive signal applied to each sample and the acquired signal are made constant. This suppresses deviations of the measured values and makes it possible to significantly reduce the measurement time.

### Comparator

A maximum of 14\* primary parameters can be classified in bins, and measurement results can be sorted on a set of upper and lower limits that have been set by secondary parameters. Sorting is possible by measured value, deviation or deviation %, and the comparator results can be output to the handler interface\*. In addition, a beeper can be turned on depending on the comparator results.

Using the limit determination function with the remote control interface, is also possible to determine the upper and lower limits (for each one set) of the primary parameters and secondary parameters.

\*ZM2371: 9 classifications max. Not equipped with handler interface.

### Deviation display

When measuring a component, a preset value can be set and the deviation and the deviation % of the measured value compared with the preset can be displayed.

This can be useful for making acceptance judgments against standard component tolerance values as well as for temperature characteristic tests.

### Multi-measurement ZM2376

Multi-measurement is a function used for overall acceptance judgments by performing up to 32 steps for each sample. Multiple measurement conditions can be set for each step such as measurement frequency, measurement signal level, internal DC bias, and measurement parameters.

Measurements and limit determinations can be performed based on the set of upper and lower limits of the primary parameters and the set of upper and lower limits of the secondary parameters.

\*This function available only on ZM2376.

## Interfaces

Equipped with various standard interfaces for remote control. Integrates into production lines and automatic inspection systems without any additional options.

Interfaces	ZM2371	ZM2372	ZM2376
USB	○	○	○
RS-232	○	○	○
GPIB	-	○	○
LAN	-	-	○ (optional)
Handler	-	○	○



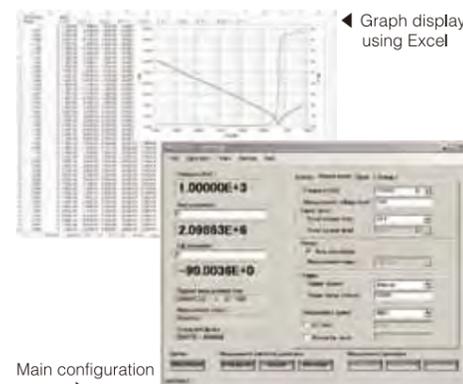
## Other features

- Correction functions (Open correction, short correction, load correction, cable length correction)
- Setting and correction value memory (32 sets, switchable to be saved to non-volatile memory)
- Monitor display (voltage and current) ● Discharge protection ● Sample program (C #, VB.NET) included
- LabVIEW driver included (ZM2371 and ZM2372)
- IVI instrument drivers included (LabVIEW drivers automatically generated on the LabVIEW system) (ZM2376)

## Application software (included as standard accessories)

Software capable of setting various measurement conditions and acquiring and displaying measurement data is included. Measurement data can be acquired in CSV file format, making it convenient to process very large amounts of data for research and development. In addition, measurement of impedance frequency characteristics is supported by means of frequency sweep measurement.

### Main operation screen

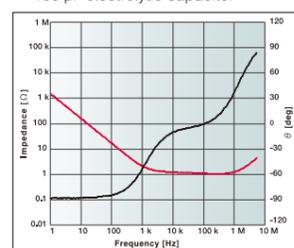


Graph display using Excel

Main configuration screen

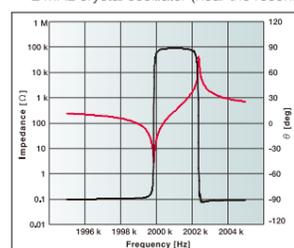
### Measurement example

▼ 100 μF electrolytic capacitor



— Impedance — Phase

▼ 2 MHz crystal oscillator (near the resonance point)



\*Measured in a small frequency interval

### Operating environment

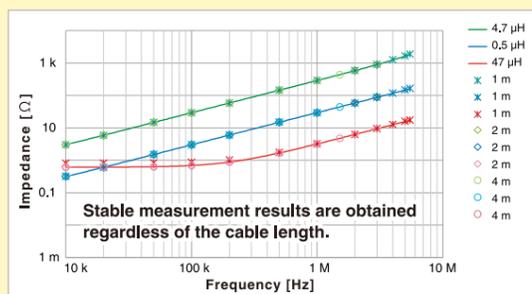
- OS: Windows 7 (32-bit version and 64-bit version), Windows XP (32-bit version), Windows Vista (32-bit version)
  - Interface: USB
- To be able to save settings and measurement data in XLS format, Microsoft Excel 97 or later is required.

## For integrating into component production lines and automatic sorting devices.

With measurements at a maximum speed of 2 ms and with small deviation, correction functions to suppress the influence of the cable connecting to the sample, comparator and contact check \* functions, as well as handler interfaces\* for automatic sorting, this LCR meter supports a variety of line needs.

\*ZM2371 is not equipped.

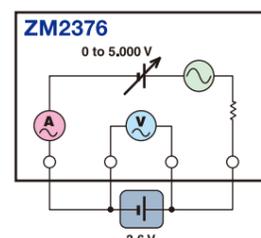
Inductor measurement example (Cable length 1 m, 2 m, 4 m)



## For high-speed impedance measurements of lithium-ion batteries.

The internal DC bias voltage of ZM2376 can be set up to +5 V, enabling electromotive force of more than 3 V to be measured in lithium-ion batteries (single cell).

In addition, since measurements can be performed from a low frequency of 1 mHz, a detailed assessment of the internal impedance of the battery is possible.



	ZM2371	ZM2372	ZM2376
Measurement parameters	[Z], [Y], L, C, R, G For equivalent circuit of L, C, and R, Parallel / Series / Auto Selection are selectable.		
Primary parameters	Q, D, $\theta$ , X, B, Rs, Rp, G, Lp, Rdc		
Secondary parameters	Primary parameters (including equivalent circuit) and secondary parameters can be selected automatically.		
Auto parameter selection	Primary parameters (including equivalent circuit) and secondary parameters can be selected automatically.		
Measured value display range	*Actual measurement and display ranges of respective parameters are restricted by the measurement range or frequency.		
Z	0.000m $\Omega$ to 999.999M $\Omega$		
R (Rs, Rp, Rdc), X	0 $\Omega$ , $\pm$ (0.001m $\Omega$ to 999.999M $\Omega$ )		
Y	0.00nS to 9.99999kS		
G, B	0S, $\pm$ (0.01nS to 9.99999kS)		
C (Cp, Cs)	0F, $\pm$ (0.00001pF to 999.999kF)	0F, $\pm$ (0.00001pF to 99.9999kF)	
L (Ls, Lp)	0H, $\pm$ (0.001nH to 99.9999GH)	0H, $\pm$ (0.00001nH to 9.99999GH)	
Q, D	0, $\pm$ (0.00001 to 99999.9)		
$\theta$	$\pm$ 180.000deg		
Measurement conditions	Setting range: 1mHz to 100kHz, Resolution 5 digits (1mHz when < 10Hz) : Setting range: 1mHz to 5.5MHz, Resolution 6 digits (1mHz when < 100Hz)		
Measurement frequency	Accuracy: $\pm$ 0.01%		
Measurement signal level	Setting range: 10mVrms to 5.00Vrms, Resolution 3 digits (1mVrms when < 100mVrms), RMS values at open output. (ZM2376: Limited by frequency and DC bias.) Accuracy: $\pm$ (10%+5mV rms) : Accuracy: $\pm$ (8%+5mV rms) $\leq$ 1MHz, $\pm$ (10%+5mV rms) > 1MHz		
Constant voltage mode / Constant current mode (ALC)	Constant voltage mode / Constant current mode / Disabled		
Output impedance	5 $\Omega$ /25 $\Omega$ /100 $\Omega$ Automatically selected according to the measurement range.	6 $\Omega$ /25 $\Omega$ /100 $\Omega$ Automatically selected according to the measurement range.	
Internal DC bias	Setting range: 0V to +2.50V, Resolution: 0.01V, Accuracy: $\pm$ (5%+3mV) : Setting range: 0V to +5V, Resolution: 1mV, Limited by the signal level		
Trigger source	It can be turned on / off at open output.		
Trigger delay time	INT: Internal (automatic continuous trigger), MAN: Manual, EXT: Handler interface, BUS: Remote control		
Triggered drive	Setting range: 0.000s to 999.999s, Resolution: 0.001s : Setting range: 0.0000s to 999.9999s, Resolution: 0.0001s (Time after input of trigger until start of signal acquisition) : (Time after input of trigger until start of signal acquisition)		
Measurement speed	Selectable: Drive only at measurement / Continuous drive		
Measurement time (reference)	RAPid/FAST/MEDium/SLOW/VerySLOW		
Measurement range	From trigger in to end of measurement signal *1, *2		
Measurement range selection:	8 ranges (1M $\Omega$ , 100k $\Omega$ , 10k $\Omega$ , 1k $\Omega$ , 100 $\Omega$ , 10 $\Omega$ , 1 $\Omega$ , 100m $\Omega$ )		
Measurement accuracy	Auto/Manual		
Basic accuracy	0.08% Refer to appendix (ZM2371/ ZM2372: P. 5, ZM2376: P. 6)		
Other measurement related functions	Open, Short, Load and Cable Length		
Contact check	Detects a contact failure at four contact points : Detects of an abnormally low capacitance or abnormal voltage/current		
Averaging	1 to 256 times		
Deviation measurement	Primary parameters/Secondary parameters: Deviation and deviation % from reference value can be displayed.		
Comparator	Primary parameters: Max. 9 bins Original measured value / Deviation / Deviation % can be sorted.	Primary parameters: Max. 14 bins Original measured value / Deviation / Deviation % can be sorted.	
Handler interface	Secondary parameters: Upper limit and lower limit comparison. Original measured value / Deviation / Deviation % can be sorted.		
Multi-measurement	Signal isolation: All I/O signals are optically isolated (withstand voltage $\pm$ 42V) Input signal: Trigger, Key lock, Settings/correction value memory designation. Output signal: Comparison result BIN1 to BIN11, NC / BIN12, PHI / BIN13, PLO / BIN14, OUT OF BINS, S-NG, ERR, INDEX, EOM (when BIN10 - BIN14 are used, NC, PHI, and PLO cannot be used).		
Monitor display	Execute measurement and limit comparison under multiple conditions for the total comparison. Maximum number of steps: 32		
Remote control interface	Voltage value applied to the DUT and current value flowing in the DUT.		
USB	USBTCM, USB1.1 Full-speed		
RS-232	Data rate: 4800bps to 230400bps		
GPIB	Conforms to IEEE 488.1 and IEEE 488.2 Standards		
LAN (optional)	10BASE-T, 100BASE-TX		
General specifications	Voltage: AC 100V to 230V $\pm$ 10%, but 250V or less		
Power supply	Frequency: 50/60Hz, $\pm$ 2Hz		
Environmental conditions	Power consumption: 70VA or less	Power consumption: 75VA or less	Power consumption: 75VA or less
Settings/correction value memory	Overvoltage category II		
Resume	Operation: Temperature: 0 to +40°C. Humidity: 5 to 85%RH. (Absolute humidity 1 to 25g/m <sup>3</sup> , non-condensing.) Storage: Temperature: -10 to +50°C. Humidity: 5 to 95%RH. (Absolute humidity 1 to 29g/m <sup>3</sup> , non-condensing.) Pollution degree 2 (indoor use)		
External dimensions	32 sets. Settings and correction values can be saved and restore individually or together.		
Weight (without accessories)	Last setting and correction value are restore at power-on.		
Accessories	260(W) $\times$ 88(H) $\times$ 220(D)mm (not including protuberances)	260(W) $\times$ 88(H) $\times$ 280(D)mm (not including protuberances)	
Measurement time (reference) ZM2371, ZM2372 *1: Appendix	Approx. 2.0k g	Approx. 2.1k g	Approx. 2.4k g
Measurement time (reference) ZM2376 *2: Appendix	Power code set (3 pole, 2m), Instruction manual, CD-ROM (application software, sample program), LabVIEW driver (ZM2371/ZM2372) IVI drivers (ZM2376).		

Measurement frequency	RAP	FAST	MED	SLOW	VSL0
120 Hz	10 ms	10 ms	26 ms	126 ms	501 ms
1 kHz	2 ms	5 ms	25 ms	121 ms	501 ms
10 kHz	3 ms	5 ms	25 ms	122 ms	502 ms
100 kHz	3 ms	5 ms	25 ms	122 ms	502 ms

Measurement frequency	RAP	FAST	MED	SLOW	VSL0
120 Hz	10 ms	10 ms	26 ms	126 ms	501 ms
1 kHz	2 ms	5 ms	25 ms	121 ms	501 ms
10 kHz	2 ms	5 ms	25 ms	121 ms	501 ms
100 kHz	2 ms	5 ms	25 ms	121 ms	501 ms
1 MHz	2 ms	5 ms	25 ms	121 ms	501 ms



Test fixture test leads

Accurate and easy-to-perform measurements

A variety of measurement fixtures are available for various applications.  
 \*Measurement frequency range is the recommended measurement range with consideration of an error.

General-purpose components

Test leads provide 4-terminal measurements. Accurate measurement is possible to low impedance. Kelvin clip leads enable one clip to be used for two electrically insulated opposing electrodes.

2-lead terminal connection with a lead shield suitable for high-impedance measurements.



4 terminal alligator clip test leads: **ZM2324**

- Measurement frequency:  $\leq 100$  kHz

Kelvin clip test leads **2325AL, 2325AM**

- Measurement frequency:  $\leq 100$  kHz

Kelvin clip test leads: **ZM2392**

- Measurement frequency:  $\leq 20$  kHz



3-terminal alligator clip test leads: **ZM2391**

- Measurement frequency:  $\leq 20$  kHz

Chip components

Test fixture for measuring surface-mounted components with a 2-terminal connection. Since a cable is not used, stray capacitance and residual impedance are small, enabling accurate open and short correction.

Lead components

Test fixture that makes 4-terminal measurements as easy as inserting the leads into the sample. To match the size of the components, the spacing of the measurement terminals can be adjusted.



Chip test fixture **ZM2394**

- Measurement frequency:  $\leq 2$  MHz
- Supported component size: 0603 (0.3mm thick) to 14 mm (square)

Chip test fixture **ZM2394H**

- Measurement frequency:  $\leq 30$  MHz
- Supported component size: 0603 (0.3mm thick) to 14 mm (square)

Chip test fixture **ZM2393**

- Measurement frequency:  $\leq 1.2$  MHz
- Supported component size: 1608 to 5750



Test fixture **ZM2363**

- Measurement frequency:  $\leq 10$  MHz

Chip component test lead in a 3-terminal configuration with shielded measurement contacts. Stray capacitance is small, enabling easy measurement of small-capacity capacitors.

Adapter

DC bias voltage adapter

Adapter for applying a DC bias voltage of  $\pm 40$  V to the sample. This adapter provides easy connection to the LCR meter and test fixture. (4-terminal pair configuration)



Chip component test leads **ZM2366**

- Measurement frequency:  $\leq 10$  MHz
- Tip spacing: 0 to 8 mm (typ.)

Chip component test leads **ZM2326A**

- Measurement frequency:  $\leq 1.2$  MHz
- Tip spacing: 0 to 8 mm (typ.)



**ZM2329**  
(For ZM2376)



**ZM2328**  
(For ZM2371 and ZM2372)

Ordering information

	Product Name	Model name	Overview	Accessories
Main unit	LCR Meter	ZM2371	1 mHz to 100 kHz	Instruction manual, CD (application software, LabVIEW driver), power cord set (3-pole, 2 m)
	LCR Meter	ZM2372		
	LCR meter	ZM2376	1 mHz to 5.5 MHz	Instruction manual, CD (application software, IVI drivers), power cord set (3-pole, 2 m)
Option	LAN interface	PA-001-2131	For ZM2376 (optional order)	—

\*Note: The contents of this catalog are current as of January 27, 2015.  
 • Product appearance and specifications are subject to change without notice.  
 • Before purchase, contact us to confirm the latest specifications, price and delivery date.

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