

	ZM2371	ZM2372	ZM2376
Measurement parameters			
Primary parameters	Z ,  Y , L, C, R, G For equivalent circuit of L, C, and R, Parallel / Series / Auto Selection are selectable.		
Secondary parameters	Q, D, $\theta$ , X, B, Rs, Rp, G, Lp, Rdc		
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			
Measurement frequency	Setting range: 1mHz to 100kHz, Resolution 5 digits (1mHz when < 10Hz)		Setting range: 1mHz to 5.5MHz, Resolution 6 digits (1mHz when < 100Hz)
	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: $\pm$ (8%+5mV rms) $\leq$ 1MHz, $\pm$ (10%+5mV rms) >1MHz
Constant voltage mode / Constant current mode (ALC)	Voltage setting range: 10mVrms to 5.00Vrms, Resolution: 3 digits (< 100mVrms: 1mVrms) Current setting range: 1 $\mu$ Arms to 200mArms, Resolution: 3 digits (< 10 $\mu$ Arms: 0.1 $\mu$ Arms)		
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
	It can be turned on / off at open output.		
Trigger source	INT: Internal (automatic continuous trigger), MAN: Manual, EXT: Handler interface, BUS: Remote control		
Trigger delay time	Setting range: 0.000s to 999.999s, Resolution: 0.001s (Time after input of trigger until start of signal acquisition)		Setting range: 0.0000s to 999.9999s, Resolution: 0.0001s (Time after input of trigger until start of signal acquisition)
Triggered drive	Selectable: Drive only at measurement / Continuous drive		
Measurement speed	RAPid/FAST/MEDium/SLOW/VerySLOW		
Measurement time (reference)	From trigger in to end of measurement signal *1, *2		
Measurement range	8 ranges (1M $\Omega$ , 100k $\Omega$ , 10k $\Omega$ , 1k $\Omega$ , 100 $\Omega$ , 10 $\Omega$ , 1 $\Omega$ , 100m $\Omega$ )		
Measurement range selection	Auto/Manual		
Measurement accuracy			
Basic accuracy	0.08% Refer to appendix (ZM2371/ ZM2372: P. 5, ZM2376: P. 6)		
Other measurement related functions			
Correction function	Open, Short, Load and Cable Length		
Contact check	—	Detects a contact failure at four contact points Additional time 4ms (reference)	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.	
	Secondary parameters: Upper limit and lower limit comparison. Original measured value / Deviation / Deviation % can be sorted.		
Handler interface	—	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).	
Multi-measurement	—	Execute measurement and limit comparison under multiple conditions for the total comparison. Maximum number of steps: 32	
Monitor display	Voltage value applied to the DUT and current value flowing in the DUT.		
Remote control interface			
USB	USBTMC, USB 1.1 Full-speed		
RS-232	Data rate: 4800bps to 230400bps		
GPIO	—	Conforms to IEEE 488.1 and IEEE 488.2 Standards	
LAN (optional)	—	10BASE-T, 100BASE-TX	
General specifications			
Power supply	Voltage: AC 100V to 230V $\pm$ 10%, but 250V or less		
	Frequency: 50/60Hz, $\pm$ 2Hz		
	Power consumption: 70VA or less	Power consumption: 75VA or less	Power consumption: 75VA or less
	Overvoltage category II		
Environmental conditions	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)		
Settings/correction value memory	32 sets. Settings and correction values can be saved and restore individually or together.		
Resume	Last setting and correction value are restore at power-on.		
External dimensions	260(W) $\times$ 88(H) $\times$ 220(D)mm (not including protuberances)		260(W) $\times$ 88(H) $\times$ 280(D)mm (not including protuberances)
Weight (without accessories)	Approx. 2.0kg	Approx. 2.1kg	Approx. 2.4kg
Accessories	Power code set (3 pole, 2m), Instruction manual, CD-ROM (application software, sample program), LabVIEW driver (ZM2371/ZM2372) IVI drivers (ZM2376).		

**Measurement time (reference) ZM2371, ZM2372 \*1: Appendix**

Measurement frequency	RAP	FAST	MED	SLOW	VSLO
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 time (reference) ZM2376 \*2: Appendix**

Measurement frequency	RAP	FAST	MED	SLOW	VSLO
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

### Measurement accuracy ZM2371/ZM2372

**● Impedance measurement accuracy**

Zr: Measurement range (100mΩ to 1MΩ)  
 Zx: Measured value of impedance magnitude [Z].  
 With the above definitions, the impedance measurement accuracy is obtained as follows:

Accuracy of impedance magnitude  $|Z| \pm Az$  [%]  
 $Az = (A + B \times U + Kz + Ky) \times V \times Kt + Kb \times X$   
 Accuracy of phase angle  $\theta$  of impedance  $\pm Pz$  [°]  $Pz = 0.573 \times Az$

\* The measurement accuracy when Az exceeds 10[%] is a reference.  
 \* The measurement accuracy for the measured value smaller than half the lower limit of each recommended measurement range or larger than twice the upper limit is a reference.  
 Each parameter value in the expression is listed below.

**● U: Ratio coefficient**

Zx	U
> 100Ω	Zx/Zr (1 when Zx / Zr < 1)
≤ 100Ω	Zr/Zx (1 when Zr / Zx < 1)

**● A (upper row): Basic coefficient[%]**

B (lower row): Proportional coefficient[%]  
 \* Each values in column "Left side" is FAST Mode, "Right side" is MED/SLOW/VSLO Mode.  
 \* At RAP Mode: Measurement frequency ≤ 250Hz: Use FAST value, > 250Hz: Multiply FAST value by 1.3.

Measurement range Zr	Measurement frequency Hz																	
	0 (DC)	99.999 ↑ 1m	999.99 ↑ 100	1k	1.9884k ↑ 1.0001k	10k ↑ 1.9885k	20k ↑ 10.001k	50k ↑ 20.001k	100k ↑ 50.001k									
1 MΩ	0.14 0.02	0.14 0.02	0.30 0.30	0.15 0.025	0.15 0.025	0.12 0.03	0.10 0.03	0.15 0.03	0.15 0.03	0.25 0.03	0.25 0.03	0.25 0.03	0.25 0.03	0.25 0.03	—	—	—	—
100kΩ	0.12 0.01	0.12 0.01	0.25 0.04	0.25 0.04	0.15 0.02	0.15 0.02	0.09 0.01	0.09 0.01	0.10 0.015	0.10 0.015	0.20 0.025	0.20 0.025	0.25 0.03	0.25 0.03	0.30 0.03	0.30 0.03	0.80 0.03	0.80 0.03
10kΩ	0.09 0.01	0.09 0.01	0.20 0.03	0.20 0.03	0.15 0.02	0.15 0.02	0.08 0.01	0.07 0.01	0.09 0.01	0.09 0.01	0.16 0.015	0.16 0.015	0.20 0.02	0.20 0.02	0.25 0.03	0.25 0.03	0.80 0.03	0.80 0.03
1kΩ	0.09 0.01	0.09 0.01	0.20 0.03	0.20 0.03	0.15 0.02	0.15 0.02	0.08 0.01	0.07 0.01	0.09 0.01	0.09 0.01	0.16 0.015	0.16 0.015	0.20 0.02	0.20 0.02	0.25 0.03	0.25 0.03	0.30 0.03	0.30 0.03
100Ω	0.09 0.01	0.09 0.01	0.20 0.03	0.20 0.03	0.15 0.02	0.15 0.02	0.08 0.01	0.07 0.01	0.09 0.01	0.09 0.01	0.16 0.015	0.16 0.015	0.20 0.03	0.20 0.03	0.25 0.03	0.25 0.03	0.30 0.03	0.30 0.03
10Ω	0.12 0.02	0.12 0.02	0.25 0.03	0.25 0.03	0.17 0.02	0.17 0.02	0.13 0.015	0.12 0.01	0.15 0.02	0.15 0.015	0.20 0.02	0.20 0.017	0.40 0.08	0.40 0.03	0.45 0.08	0.50 0.05	0.50 0.08	0.50 0.06
1Ω	0.14 0.05	0.14 0.05	0.40 0.06	0.40 0.06	0.30 0.02	0.30 0.02	0.22 0.025	0.20 0.02	0.25 0.03	0.25 0.02	0.35 0.03	0.35 0.02	0.60 0.20	0.60 0.03	0.70 0.20	0.70 0.08	0.90 0.20	0.90 0.10
100mΩ	0.14 0.30	0.14 0.30	0.60 0.40	0.60 0.40	0.30 0.15	0.30 0.10	0.30 0.06	0.30 0.04	0.30 0.06	0.30 0.04	0.40 0.06	0.40 0.03	0.80 0.08	0.60 0.06	1.0 0.10	0.90 0.10	1.0 0.80	0.90 0.10

The measurement range "—" is not used.

**● KB: DC bias coefficient**

Internal DC bias	Measurement range Zr	Kb [%]		
		Frequency ≤ 1kHz	1kHz < Frequency ≤ 10kHz	Frequency > 10kHz
Disabled	Full range	0	0	0
	1MΩ	0.005	0.02	0.02
	100kΩ	0.002	0.003	0.01
Enabled**	100Ω, 1kΩ, 10kΩ	0.001	0.002	0.01
	10Ω	0.01	0.01	0.02
	100mΩ, 1Ω	0.05	0.1	0.2

\*\* : When open compensation and short compensation are performed at the conditions of internal DC bias enabled and the bias voltage 0V.  
 At all times, KB=0 for the direct-current resistance Rdc.

**● KT: Temperature-dependent coefficient**

Ambient temperature (T°C)	Kt
0 to +18	1 + 0.1 × (18 - T)
+18 to +28	1
+28 to +40	1 + 0.1 × (T - 28)

**● Ky: Residual admittance coefficient**

Frequency range	Ky [%]
DC, frequency ≤ 120Hz	Zx [Ω] / (3 × 10 <sup>6</sup> )
120Hz < frequency ≤ 100kHz	Zx [Ω] × frequency [kHz] / (3 × 10 <sup>7</sup> )

**● V: Signal level coefficient**

Measurement signal level [Vrms]	V(Zr=1MΩ, 100kΩ (>20kHz))	V(Zr=100kΩ (≤20kHz), 10kΩ, 1kΩ, 100Ω)	V(Zr=10Ω, 1Ω)	V(Zr=100mΩ)
2<Level≤5	1.3 1.3 1.3	1.3 1.3 1.3	1.3 1.3 1.3	3 2 1.3
1<Level≤2	1.2 1.2 1.2	1.2 1.2 1.2	1.2 1.2 1.2	1.8 1.5 1.2
1	1 1 1	1 1 1	1 1 1	1 1 1
0.5<Level<1	1.4 1.2 1.2	1.4 1.2 1.2	1.5 1.5 1.2	2.5 2 1.2
0.2<Level≤0.5	1.4 1.3 1.3	1.4 1.3 1.3	2.5 2.2 1.3	3 3 1.3
0.1<Level≤0.2	2.2 2.2 1.4	1.4 1.4 1.4	3.5 3.5 1.4	×(0.5Vrms/ Measurement signal level [Vrms])
0.05<Level≤0.1	2.5 2.5 1.6	1.8 1.6 1.6	×(0.2Vrms/ Measurement signal level [Vrms])	
0.02<Level≤0.05	×(0.1Vrms/ Measurement signal level [Vrms])	4 2.8 2		
0.01≤Level≤0.02		8 5 3		

Three coefficients in each column are applied to the measurement speeds RAP, FAST, MED from the left in order. The coefficient for measurement speeds SLOW and VSLO is same as MED.  
 For FAST, the coefficient of MED is applied when measurement frequency ≤ 40Hz.  
 For RAP, the coefficient of FAST when measurement frequency ≤ 250Hz, or that of MED when measurement frequency ≤ 40Hz is applied.  
 The coefficient varies depending on the frequency when measurement range Zr = 100kΩ.  
 At all times, V = 1 for the direct-current resistance Rdc.

**● Kz: Residual impedance coefficient**

Frequency range	Kz [%]
DC, frequency ≤ 120Hz	(0.003 + Kc) / Zx [Ω]
120Hz < frequency ≤ 1kHz	(0.005 + Kc) / Zx [Ω]
1kHz < frequency ≤ 10kHz	(0.005 + 0.002 × frequency [kHz] + Kc) / Zx [Ω]
10kHz < frequency ≤ 100kHz	(0.0025 × frequency [kHz] + Kc) / Zx [Ω]

Cable length coefficient Kc = 0.001 × Frequency [kHz] × (Cable length [m])<sup>2</sup>

**● Other conditions**

- Warm-up: 30 min or more
- Zero correction: Execute open correction and short correction
- Cable length correction: Execute according to the connection cable length.
- Calibration cycle 1 year

Cable length	Applicable frequency range
0m, 1m	Full range including DC
2m	DC, frequency ≤ 20kHz
4m	DC, frequency ≤ 1kHz

The measurement accuracy is not guaranteed for frequencies out of these ranges.

**<Recommended measurement range>**

Measurement range	Recommended range	Measurement range
1MΩ	1MΩ to 11MΩ	≥ 900kΩ
100kΩ	100kΩ to 1.1MΩ	≥ 90kΩ
10kΩ	10kΩ to 110kΩ	≥ 9kΩ
1kΩ	1kΩ to 11kΩ	≥ 0.9kΩ
100Ω	9Ω to 1.1kΩ	No limitation
10Ω	0.9Ω to 10Ω	≤ 11Ω
1Ω	90mΩ to 1Ω	≤ 1.1Ω
100mΩ	9mΩ to 100mΩ	≤ 110mΩ

