

# U1730C Series Handheld LCR Meters

Take your expectations higher with the latest LCR meters

## Introduction

The Keysight Technologies, Inc. U1730C Series handheld LCR meters allow you to measure at frequencies as high as 100 kHz—a capability typically found only in benchtop meters. Get measurements done faster using the one-touch automatic identification function button, which displays component type and more detailed component analysis such as Z, ESR, and DCR. Ideal for testing on the go, these LCR meters operate on a battery that lasts up to 16 hours. With the U1730C Series that is built for your convenience, you can perform quick and basic LCR measurements at an affordable price.



# Features

## Key features

- 20,000 counts resolution
- 0.2% basic accuracy
- Wide LCR ranges with three to five selectable test frequencies (up to 100 kHz for U1733C)
- Auto identification (Ai) automatically determines and displays component type and measurements
- Detailed component analysis with DCR, ESR, Z, D, Q, and  $\theta$  functions
- Battery life of 16 hours/AC-powered
- IR-to-USB connectivity for data logging to PC

## Frequency up to 100 kHz

The test frequency now extends as high as 100 kHz, providing more flexibility to test a wider range of components. A higher test frequency, for example, 100 kHz, is useful for testing aluminum electrolytic capacitors in switching power supply circuits.

## Automated identification

With Automated identification (AI), the testing and measuring experience is easy, eliminating unnecessary trial and error time—with just a single push of a button. This unique feature automatically specifies L, C, or R with parallel and series modes without manually changing buttons.

## Detailed component analysis

The handheld LCR meters allow you to test various component types, including secondary components of Dissipation Factor (D), Quality Factor (Q), and Angle Indication of Impedance ( $\theta$ ). This new handheld series also includes other functions that result in a more detailed component analysis. For example, the built-in Equivalent Series Resistance (ESR) function helps you better understand the inherent resistance behavior typically found in capacitors across selected frequencies. DCR is a built-in DC resistance measurement that eliminates using a separate digital multimeter (DMM) for component tests.



**Figure 1.** Automate the recording of continuous readings when you hook the U1731C/U1732C/U1733C to a PC

# Take a Closer Look



Figure 2. Front view of the U1733C

# U1731C/U1732C/U1733C Electrical Specifications

Accuracy is given as  $\pm$  (% of reading + counts of least significant digit) at  $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ , with relative humidity less than 80%. Please refer to the User Guide about the measuring mode specified for each range of L/C/R, series or parallel mode. Measurements performed at the test socket and necessary Open and Short corrections must prior be done. The accuracy is verified by design and specified type tests.

## Impedance/Resistance

Accuracy = AZ + Offset

Range	Resolution	U1731C/U1732C/U1733C			U1732C/U1733C		U1733C
		100 Hz	120 Hz	1 kHz	10 kHz	100 kHz	DCR <sup>1</sup>
2 $\Omega$ <sup>1</sup>	0.0001 $\Omega$	0.7% + 50	0.7% + 50	0.7% + 50	0.7% + 50	1.0% + 50	0.7% + 50
20 $\Omega$ <sup>1</sup>	0.001 $\Omega$	0.7% + 8	0.7% + 8	0.7% + 8	0.7% + 8	0.7% + 8	0.7% + 8
200 $\Omega$ <sup>1</sup>	0.01 $\Omega$	0.2% + 3	0.2% + 3	0.2% + 3	0.2% + 3	0.5% + 5	0.2% + 3
2000 $\Omega$	0.1 $\Omega$	0.2% + 3	0.2% + 3	0.2% + 3	0.2% + 3	0.5% + 5	0.2% + 3
20 k $\Omega$	0.001 k $\Omega$	0.2% + 3	0.2% + 3	0.2% + 3	0.2% + 3	0.5% + 5	0.2% + 3
200 k $\Omega$	0.01 k $\Omega$	0.5% + 5	0.5% + 5	0.5% + 5	0.5% + 5	0.7% + 8	0.5% + 5
2000 k $\Omega$	0.1 k $\Omega$	0.5% + 5	0.5% + 5	0.5% + 5	0.5% + 5	NA	0.5% + 5
20 M $\Omega$	0.001 M $\Omega$	2.0% + 8	2.0% + 8	2.0% + 8	5.0% + 8	NA	2.0% + 8
200 M $\Omega$	0.01 M $\Omega$	6.0% + 80	6.0% + 80	6.0% + 80	NA	NA	6.0% + 80

### Notes:

1. The accuracy for ranges 2  $\Omega$  to 200  $\Omega$  is specified after Null function which is used to subtract the resistance of test leads and the contact resistance
2. For ranges of 20 M $\Omega$  and 200 M $\Omega$ , the R.H is specified for < 60%
3. Resistance is specified to  $Q < 10$  and  $D > 0.1$ , otherwise the accuracy is  $(AZ+Offset) \times \sqrt{1+Q^2}$
4. Equivalence Series Resistance (ESR) measurement is determined by impedance measurement and range. The maximum display is up to 199.99 k $\Omega$  and accuracy is  $(AZ+Offset) \times \sqrt{1+Q^2}$

## Capacitance<sup>3</sup>

Accuracy = AC + Offset

Range	Resolution	U1731C/U1732C/U1733C			U1732C/U1733C		U1733C
		100 Hz	120 Hz	1 kHz	10 kHz	100 kHz	
20 mF	0.001 mF	0.5% + 8	0.5% + 8	NA	NA	NA	
2000 $\mu$ F	0.1 $\mu$ F	0.5% + 5	0.5% + 5	0.5% + 8	NA	NA	
200 $\mu$ F	0.01 $\mu$ F	0.3% + 3	0.3% + 3	0.5% + 5	0.5% + 8	NA	
20 $\mu$ F	0.001 $\mu$ F	0.2% + 3	0.2% + 3	0.2% + 3	0.5% + 5	5.0% + 10	
2000 nF	0.1 nF	0.2% + 3	0.2% + 3	0.2% + 3	0.2% + 3	0.7% + 10	
200 nF	0.01 nF	0.2% + 3	0.2% + 3	0.2% + 3	0.5% + 3	0.7% + 10	
20 nF	0.001 nF	0.5% + 5	0.5% + 5	0.2% + 3	0.5% + 3	0.7% + 10	
2000 pF <sup>1</sup>	0.1 pF	0.5% + 10	0.5% + 10	0.5% + 5	0.5% + 3	2.0% + 10	
200 pF <sup>1</sup>	0.01 pF	NA	NA	0.5% + 10	0.8% + 10	2.0% + 10	
20 pF <sup>1</sup>	0.001 pF	NA	NA	NA	1.0% + 20	2.5% + 10	

1. The accuracy for ranges 20 pF – 2000 pF is specified after Null function which is used to subtract the stray capacitances of test leads.
2. The accuracy for the ceramic capacitor will be influenced depending on the dielectric constant (K) of the material used to make the ceramic capacitor. For related influence factors, please refer to the Component dependency factors section in the Impedance Measurement Handbook, download able for free at <http://www.keysight.com/find/lcrmeters>
3. Capacitance is specified to  $Q > 0.1$  and  $D < 10$ , otherwise the accuracy is  $(AZ+Offset) \times \sqrt{1+D^2}$

# U1731C/U1732C/U1733C Electrical Specifications

## Inductance<sup>2</sup>

		Accuracy = AL + Offset				
Range	Resolution	U1731C/U1732C/U1733C			U1732C/U1733C	U1733C
		100 Hz	120 Hz	1 kHz	10 kHz	100 kHz
20 µH <sub>1</sub>	0.001 µH	NA	NA	NA	1.0% + 5	2.5% + 20
200 µH <sub>1</sub>	0.01 µH	NA	NA	1.0% + 5	0.7% + 3	2.5% + 20
2000 µH <sub>1</sub>	0.1 µH	0.7% + 10	0.7% + 10	0.5% + 3	0.5% + 3	0.8% + 20
20 mH	0.001 mH	0.5% + 3	0.5% + 3	0.2% + 3	0.3% + 3	0.8% + 10
200 mH	0.01 mH	0.5% + 3	0.5% + 3	0.2% + 3	0.2% + 3	1.0% + 10
2000 mH	0.1 mH	0.2% + 3	0.2% + 3	0.2% + 3	0.5% + 5	1.0% + 10
20 H	0.001 H	0.2% + 3	0.2% + 3	0.5% + 5	1.0% + 5	2.0% + 10
200 H	0.01 H	0.7% + 5	0.7% + 5	1.0% + 5	2.0% + 8	NA
2000 H	0.1 H	1.0% + 5	1.0% + 5	2.0% + 8	NA	NA

### Notes:

1. The accuracy for ranges 20 uH – 2000 uH is specified after Null function, which is used to subtract the inductances of test leads.
2. Inductance is specified to  $Q > 0.1$  and  $D < 10$ ; the accuracy is  $(AL+Offset) \times \sqrt{1+D^2}$

## Phase Angle of Impedance

Range	Resolution	Accuracy ( $\theta_e$ )	Condition	
-180° ~180°	0.1°/1°	$(AZ + Offset/Zx) \times 180/\pi$	D < 1 or Q > 1	
An example of the calculation shown below refers to the Impedance function with a Range of 2000 $\Omega$ at a frequency of 100 Hz				
Impedance	Zx	AZ	Offset	$\theta_e$
1999.9 $\Omega$	19999	0.2%	3	$\pm 0.12^\circ$
199.9 $\Omega$	1999	0.2%	3	$\pm 0.20^\circ$
19.9 $\Omega$	199	0.2%	3	$\pm 0.98^\circ$
1.9 $\Omega$	19	0.2%	3	$\pm 9.16^\circ$

### Notes:

1. Specifications are applicable to all models (U1731C, U1732C, and U1733C) unless otherwise specified.
2. The "AZ" and Offset are the accuracy specifications for impedance measurement.
3. The " $\pi$ " is approximately 3.14159.
4. The Zx is the display count of the reading.

## Dissipation/Quality Factor

Function	Range	Accuracy (De)	Condition	
Z	0.001~999	$AZ + Offset/Zx \times 100\% + 3$	D < 1 or Q > 1	
L	0.001~999	$AL + Offset/Lx \times 100\% + 3$	D < 1 or Q > 1	
C	0.001~999	$AC + Offset/Cx \times 100\% + 3$	D < 1 or Q > 1	
An example of the calculation shown below refers to the Capacitance function with a Range of 200 $\mu\text{F}$ at a frequency of 100 Hz.				
Capacitance	Cx	AC	Offset	De
88.88 $\mu\text{F}$	8888	0.3%	3	0.334% + 3

### Notes:

1. Specifications are applicable to all models (U1731C, U1732C, and U1733C) unless otherwise specified.
2. The "AZ, AL, AC" and Offset are the accuracy specifications for Impedance, Inductance, and Capacitance measurement, respectively.
3. The Zx, Lx, and Cx are the display counts of the reading. For example, the Cx is 8888 as if the capacitance is 88.88  $\mu\text{F}$  for the range of 200  $\mu\text{F}$ .
4. The Quality Factor is the reciprocal of the Dissipation Factor.

# U1731C/U1732C/U1733C Electrical Specifications

## Test Signal

Model	Selection	Test signal level		Test frequency	
		Level	Accuracy	Frequency	Accuracy
U1731C/U1732C/U1733C	100 Hz	0.74 Vrms	0.05 Vrms	100 Hz	± 0.01%
	120 Hz	0.74 Vrms	0.05 Vrms	120.481 Hz	± 0.01%
	1 kHz	0.74 Vrms	0.05 Vrms	1 kHz	± 0.01%
U1732C/1733C	10 kHz	0.70 Vrms	0.05 Vrms	10 kHz	± 0.01%
U1733C	100 kHz	0.70 Vrms	0.05 Vrms	100 kHz	± 0.01%
	DCR	+1.235 V	0.05 V	NA	NA

## Source Impedance of Impedance/Resistance Measurement

Range	Typical source impedance					
	U1731C/U1732C/U1733C			U1732C/U1733C		U1733C
	100 Hz	120 Hz	1 kHz	10 kHz	100 kHz	DCR
2 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω
20 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω
200 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω
2000 Ω	1.09 kΩ	1.09 kΩ	1.09 kΩ	1.09 kΩ	1.09 kΩ	1.09 kΩ
20 kΩ	10.1 kΩ	10.1 kΩ	10.1 kΩ	10.1 kΩ	1.09 kΩ	10.1 kΩ
200 kΩ	100 kΩ	100 kΩ	100 kΩ	10.1 kΩ	1.09 kΩ	100 kΩ
2000 kΩ	100 kΩ	100 kΩ	100 kΩ	10.1 kΩ	NA	100 kΩ
20 MΩ	100 kΩ	100 kΩ	100 kΩ	100 kΩ	NA	100 kΩ
200 MΩ	100 kΩ	100 kΩ	100 kΩ	NA	NA	100 kΩ

## Source Impedance of Capacitance Measurement


Range	Typical source impedance					
	U1731C/U1732C/U1733C			U1732C/U1733C		U1733C
	100 Hz	120 Hz	1 kHz	10 kHz	100 kHz	
20 mF	190 Ω	190 Ω	NA	NA	NA	NA
2000 μF	190 Ω	190 Ω	190 Ω	NA	NA	NA
200 μF	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω	NA
20 μF	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω	190 Ω
2000 nF	1.09 kΩ	1.09 kΩ	190 Ω	190 Ω	190 Ω	190 Ω
200 nF	10.1 kΩ	10.1 kΩ	1.09 kΩ	190 Ω	190 Ω	190 Ω
20 nF	100 kΩ	100 kΩ	10.1 kΩ	1.09 kΩ	190 Ω	190 Ω
2000 pF	100 kΩ	100 kΩ	100 kΩ	10.1 kΩ	1.09 kΩ	1.09 kΩ
200 pF	NA	NA	100 kΩ	10.1 kΩ	1.09 kΩ	1.09 kΩ
20 pF	NA	NA	NA	100 kΩ	1.09 kΩ	1.09 kΩ

# U1731C/U1732C/U1733C Electrical Specifications

## Source Impedance of Inductance Measurement

Range	Typical source impedance				
	U1731C/U1732C/U1733C			U1732C/U1733C	U1733C
	100 Hz	120 Hz	1 kHz	10 kHz	190 kHz
20 $\mu$ H	NA	NA	NA	190 $\Omega$	100 $\Omega$
200 $\mu$ H	NA	NA	190 $\Omega$	190 $\Omega$	190 $\Omega$
2000 $\mu$ H	190 $\Omega$	190 $\Omega$	190 $\Omega$	190 $\Omega$	190 $\Omega$
20 mH	190 $\Omega$	190 $\Omega$	190 $\Omega$	190 $\Omega$	190 $\Omega$
200 mH	190 $\Omega$	190 $\Omega$	190 $\Omega$	1.09 k $\Omega$	1.09 k $\Omega$
2000 mH	190 $\Omega$	190 $\Omega$	1.09 k $\Omega$	10.1 k $\Omega$	1.09 k $\Omega$
20 H	1.09 k $\Omega$	1.09 k $\Omega$	10.1 k $\Omega$	10.1 k $\Omega$	1.09 k $\Omega$
200 H	10.1 k $\Omega$	10.1 k $\Omega$	100 k $\Omega$	100 k $\Omega$	NA
2000 H	100 k $\Omega$	100 k $\Omega$	100 k $\Omega$	NA	NA

# General Specifications

Parameter	U1731C	U1732C	U1733C
Measurements	Z/L/C/R/D/Q/θ/ESR	Z/L/C/R/D/Q/θ/ESR	Z/L/C/R/D/Q/θ/ESR/DCR
Display	Primary display: Maximum display 19,999 countsSecondary display: Maximum display 999 countsAutomatic polarity indication		
Test frequency (Accuracy = ± 0.1% of actual test frequency)	100 Hz, 120 Hz, 1 kHz	100 Hz, 120 Hz, 1 kHz, 10 kHz	100 Hz, 120 Hz, 1 kHz, 10 kHz, 100 kHz
Backlight	No	Yes	Yes
Test signal level	Selection	Test signal level	Test frequency
	100 Hz	0.74 Vrms	100 Hz
	120 Hz	0.74 Vrms	120.481 Hz
	1 kHz	0.74 Vrms	1 kHz
	10 kHz <sup>1</sup>	0.74 Vrms	10 kHz
	100 kHz <sup>2</sup>	0.74 Vrms	100 kHz
	DCR2	+1.235 V	NA
Tolerance mode	1%, 5%, 10%, 20%		
Ranging mode	Auto and manual		
Measurement rate	1 time/second, nominal		
Response time	Approximately 1 second/DUT (Device Under Test)		
Auto power-off	~0-99 mins without operation		
Power supply	Single standard 9 V battery (alkaline or carbon-zinc) or optional power adaptor		
Power consumption	225 mVA maximum without backlight		
Input protection fuse	Resettable over-current protection		
Battery life	16 hours based on alkaline battery		
Low battery indicator	[  ] will appear when voltage drops below ~7.2 V		
Operating temperature	-10 to 55 °C		
Storage temperature	-20 to 70 °C, 0 to 80% R.H. without battery		
Temperature coefficient	0.1 × (specified accuracy)/°C (from -10 to 18 °C or 28 to 55 °C)		
Relative humidity	Maximum 80% R.H. for temperature up to 30 °C decreasing linearly to 50% R.H. at 55 °C		
Weight	337 grams with battery		
Dimensions (H x W x D)	184 mm x 87 mm x 41 mm		
Safety and EMC Compliance	Refer to Declaration of Conformity for the latest revisions of regulatory compliance at: <a href="http://www.keysight.com/go/conformity">www.keysight.com/go/conformity</a>		
	In compliance with EN61010-1 (IEC61010-1:2001) for low voltage directive and Pollution Degree II Environment. Susceptibility and Emissions (EMC): Commercial Limits per EN61326-1  Note: If used in close proximity to an RF transmitter or when subjected to continuously present electromagnetic phenomena, some recoverable degradation of performance may occur.		
Calibration	One-year calibration cycle recommended		
Warranty	3 years for main unit 3 months for standard shipped accessories		

Notes:

1. Only applicable for U1732C/ U1733C
2. Only applicable for U1733C








# Ordering Information

## Standard shipped items

Standard U1731C, U1732C, and U1733C ordering include:

- Quick start guide
- Certificate of Calibration (CoC)
- Alligator clip leads
- 9 V alkaline battery

## Recommended accessories

U1731P		<p>Combo kit</p> <p>Includes one U1731C Series handheld and four accessories:</p> <ul style="list-style-type: none"> <li>• U5491A soft carrying case</li> <li>• U5481B IR-to-USB cable</li> <li>• U1780A AC adaptor</li> <li>• U1782B SMD tweezer</li> </ul>
U1732P		<p>Combo kit</p> <p>Includes one U1732C Series handheld and four accessories:</p> <ul style="list-style-type: none"> <li>• U5491A soft carrying case</li> <li>• U5481B IR-to-USB cable</li> <li>• U1780A AC adaptor</li> <li>• U1782B SMD tweezer</li> </ul>
U1733P		<p>Combo kit</p> <p>Includes one U1733C Series handheld and four accessories:</p> <ul style="list-style-type: none"> <li>• U5491A soft carrying case</li> <li>• U5481B IR-to-USB cable</li> <li>• U1780A AC adaptor</li> <li>• U1782B SMD tweezer</li> </ul>
U1174A		Soft carrying case
U5481B		IR-to-USB cable
U1782B		SMB tweezer
U1780A		Power adaptor and cord (according to country)
U1781A		Alligator clip leads

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at [www.keysight.com](http://www.keysight.com).