

# 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

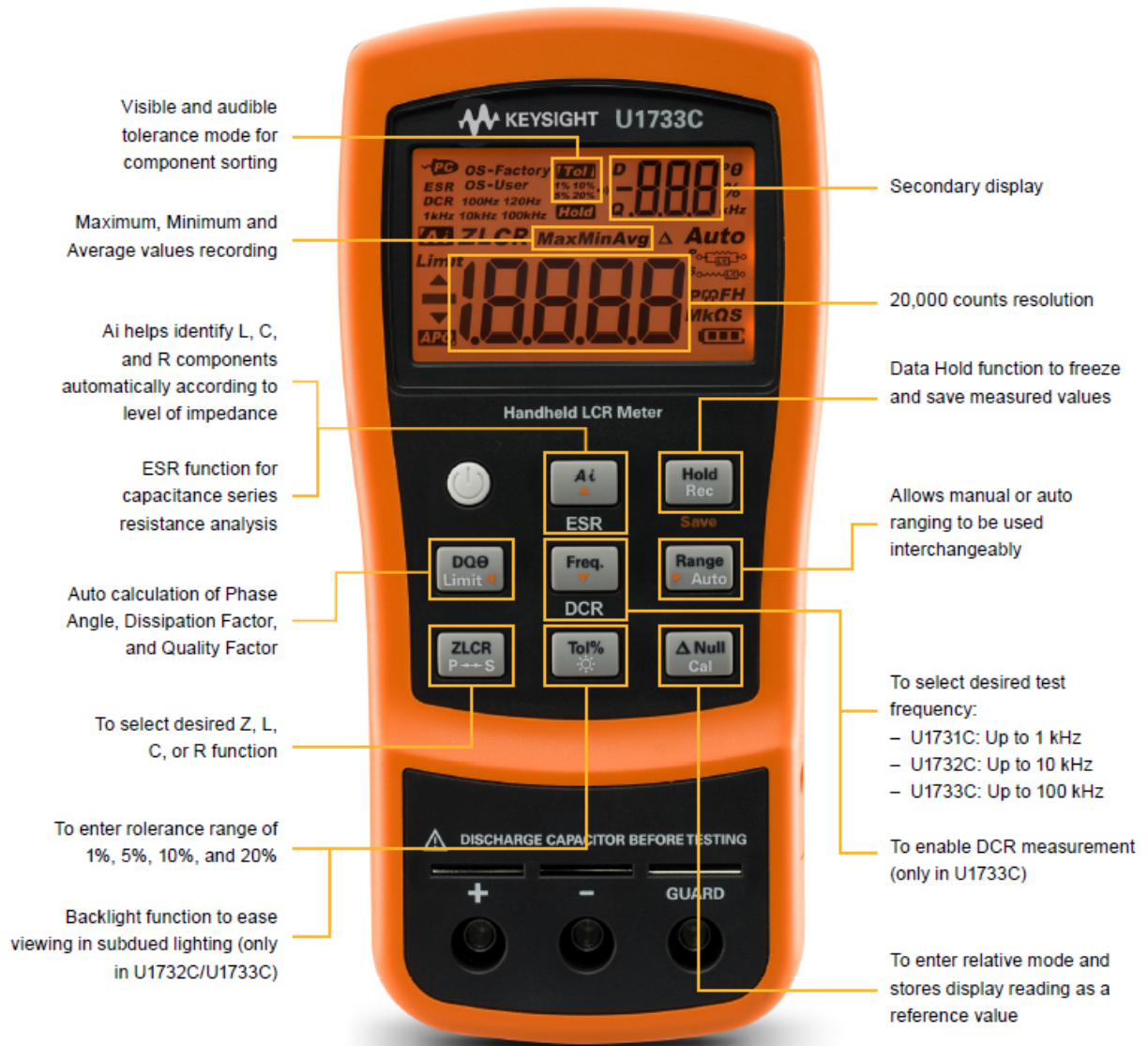


Figure 2. Front view of the U1733C

# 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 Ω at a frequency of 100 Hz |            |                                   |                |            |
| Impedance  | Zx         | AZ                                | Offset         | $\theta_e$ |
| 1999.9 Ω   | 19999      | 0.2%                              | 3              | ± 0.12°    |
| 199.9 Ω  | 1999       | 0.2%                              | 3              | ± 0.20°    |
| 19.9 Ω   | 199        | 0.2%                              | 3              | ± 0.98°    |
| 1.9 Ω  | 19         | 0.2%                              | 3              | ± 9.16°    |

### 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 "π" 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 µF at a frequency of 100 Hz. |           |                                   |                |            |
| Capacitance   | Cx        | AC                                | Offset         | De         |
| 88.88 µF  | 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 µF for the range of 200 µF.
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 counts<br>Secondary display: Maximum display 999 counts<br>Automatic polarity indication   |                               |  |
| Test frequency<br>(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:<br><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<br><br>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<br>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).