Uni-T UT161E Review

# Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the Uni-T UT161E multimeter for use in hobby electronics projects primarily related to amateur radio.

# Disclaimer

I am not a professional, I am a hobbyist. This review is not sponsored; I bought this multimeter with my own money. I only used and tested this multimeter in CAT I and CAT II environments. I do not have a way to review or test the safety of this meter. I leave the CAT III and CAT IV environments to trained and licensed professionals. It may seem like I am a Fluke fan boy, but I recognize their flaws along with their advantages. There may be unintended mistakes and/or errors in this review.

# Overview

A digital multimeter with wires

Description automatically generated

I am testing and demonstrating this Uni-T UT161E multimeter that I purchased from the Uni-T Direct Store at Amazon.com for $128.77. **If you want the Unit-T Direct USA 18-month warrantee, the receipt must show that it was sold by: UNI-T Direct.**

I only used it in CAT I and CAT II environments. CAT I is for measurements on circuits not directly connected to mains. For example, battery operated electronics, or radio gear connected to a 13V DC power supply.

CAT II is for measurements performed on circuits directly connected to the 120V (240V in some countries) power outlets at least 15 feet from the distribution panel. For example, your 120V AC to 13V DC power supply or a vintage piece of ham radio gear we lovingly call “boat anchors” that plug into a 120V AC outlet.

First, we will look at the features of the multimeter, then we will look at the accuracy of the meter. We will then go over the ergonomics. We will wrap up with the pros, cons and conclusion.

I will not be using the test leads that came with the meter. I have not liked any test leads that came with multimeters except the Fluke TL175 TwistGuard® test leads that were bundled with the Fluke 87V MAX. I also use Probe Master Series 8000 Test Leads.

# Objectives

This review was produced to help you decide if the Uni-T UT161E multimeter will fit your purpose and budget. This is part of a series of multimeters reviews.

A good multimeter for hobby electronic projects should be able to measure millivolts, volts, microamps, milliamps, amps, ohms, nanofarads and microfarads.

If you want to measure picofarads, nanohenry, microhenry or reactance you will need an LCR meter. I cover the two LCR meters I own in another review.

# Features

* ETL C US Listed
* CAT IV 600V
* CAT III 1000V
* 22,000 Count
* Basic DC Accuracy ±(0.05%+5)
* 46 Segment Bar Graph
* True-RMS
* Min/Max
* Rel/Delta
* Low Pass Filter
* Four AAA Batteries Included
* 18 Month Warranty (if purchased from Uni-T Direct Store at Amazon.com)

# Accuracy

Close-up of a digital device

Description automatically generated with medium confidence

I do not have reference standards. Instead, I use a Keithley DMM6500 6.5 digit bench multimeter that was calibrated recently to measure voltages, currents, resistances and capacitances. I take a reading from the Keithley and based on the Keithley stated tolerance for that range and reading, I compute the lowest and highest value the reading could be, then I take the meter under test and take a reading. I calculate the meter-under-test reading uncertainty value and subtract it from the lowest value and add it to the highest value. If the reading is within the range of the lower and higher limits, it meets meter-under-test accuracy specification.

For example, I have a voltage source that is 5 Volts. I take a reading with the Keithley and I get a value of 5.00090 and based on the Keithley specifications for that range **±**( 0.0025% of reading + 0.0005% of range), that value could be anywhere from 5.00072 to 5.00108. I then use the meter under test (for this example my Fluke 289, my most accurate hand-help meter) reading of 5.0006. The Fluke 289’s accuracy at this range is **±**(0.025% of reading + 2 least significant digits) for an uncertainty value of 0.00145015 Volts. So, subtracting this from the lowest value the Keithley reading gives us 4.99927V for the low value limit and adding to the highest value the Keithley gives us 5.00253V for the high value limit. The meter under test reading (5.0006) is within the limits, so the meter under test meets its accuracy target for 5 volts.

A picture containing electronics, electronic engineering, electrical wiring, computer hardware

Description automatically generated

# DC Volts

| **Source** | **Reading** | **Specification** | **Uncertainty** | **Low Bound** | **High Bound** |
| --- | --- | --- | --- | --- | --- |
| mV DC |  |  |  |  |  |
| 1.0878 | 1.10 | 0.1%+5 | 0.0511 | 1.04 | 1.14 |
| 10.1123 | 10.13 | 0.1%+5 | 0.06013 | 10.05 | 10.17 |
| 25.0348 | 25.06 | 0.1%+5 | 0.07506 | 24.96 | 25.11 |
| 100.0086 | 100.03 | 0.1%+5 | 0.15003 | 99.86 | 100.16 |
| 250.067 | 250.0 | 0.1%+5 | 0.75 | 249.3 | 250.8 |
| 500.010 | 500.0 | 0.1%+5 | 1 | 499.0 | 501.0 |
| V DC |  |  |  |  |  |
| 1.000675 | 1.0006 | 0.05%+5 | 0.0010003 | 0.9996 | 1.0018 |
| 2.00054 | 2.0004 | 0.05%+5 | 0.0015002 | 1.9989 | 2.0021 |
| 2.50052 | 2.500 | 0.05%+5 | 0.00625 | 2.494 | 2.507 |
| 3.00059 | 3.001 | 0.05%+5 | 0.0065005 | 2.994 | 3.007 |
| 4.00025 | 4.000 | 0.05%+5 | 0.007 | 3.993 | 4.007 |
| 5.00010 | 5.000 | 0.05%+5 | 0.0075 | 4.992 | 5.008 |
| 5.00089 | 5.001 | 0.05%+5 | 0.0075005 | 4.993 | 5.009 |
| 6.00087 | 6.001 | 0.05%+5 | 0.0080005 | 5.993 | 6.009 |
| 7.00088 | 7.000 | 0.05%+5 | 0.0085 | 6.992 | 7.010 |
| 7.50159 | 7.502 | 0.05%+5 | 0.008751 | 7.493 | 7.511 |
| 10.00030 | 10.001 | 0.05%+5 | 0.0100005 | 9.990 | 10.011 |
| 15.0002 | 15.000 | 0.05%+5 | 0.0125 | 14.986 | 15.014 |
| 30.0003 | 30.00 | 0.05%+5 | 0.065 | 29.93 | 30.07 |
| 96.8832 | 96.87 | 0.05%+5 | 0.098435 | 96.78 | 96.99 |
| 188.940 | 188.93 | 0.05%+5 | 0.144465 | 188.78 | 189.10 |
| 276.573 | 276.6 | 0.1%+5 | 0.7766 | 275.8 | 277.4 |
| 376.567 | 376.6 | 0.1%+5 | 0.8766 | 375.7 | 377.5 |
| 473.549 | 473.8 | 0.1%+5 | 0.9738 | 472.6 | 474.5 |
| 601.737 | 601.8 | 0.1%+5 | 1.1018 | 600.6 | 602.9 |

The meter met its accuracy specifications for all the DC voltages I tested.

|  |  |
| --- | --- |
| VDC Input | 11 MΩ |
| mVDC input | 13 MΩ |

Both VDC and mVDC input have over 10 MΩ resistance, which is good, so the meter is less likely to load down a high impedance circuit when checking voltage.

# AC Volts

| **Source** | **Reading** | **Specification** | **Uncertainty** | **Low Bound** | **High Bound** |
| --- | --- | --- | --- | --- | --- |
| **V AC 100Hz Squarewave** | |  |  |  |  |
| 4.99870 | 5.008 | 0.8%+10 | 0.050064 | 4.943 | 5.055 |
| **mV AC 60 Hz Sinewave** | |  |  |  |  |
| 1.0300 | 1.02 | 1.0%+10 | 0.1102 | 0.92 | 1.14 |
| 5.0168 | 5.01 | 1.0%+10 | 0.1501 | 4.86 | 5.17 |
| 10.0338 | 10.01 | 1.0%+10 | 0.2001 | 9.83 | 10.24 |
| 25.0934 | 25.07 | 1.0%+10 | 0.3507 | 24.73 | 25.46 |
| 50.0430 | 50.01 | 1.0%+10 | 0.6001 | 49.41 | 50.67 |
| 100.334 | 99.98 | 1.0%+10 | 1.0998 | 99.17 | 101.49 |
| 250.445 | 250.4 | 1.0%+10 | 3.504 | 246.8 | 254.1 |
| 502.229 | 502.2 | 1.0%+10 | 6.022 | 495.9 | 508.6 |
| **V AC 60 Hz Sinewave** | |  |  |  |  |
| 0.502214 | 0.5022 | 0.8%+10 | 0.0050176 | 0.4966 | 0.5078 |
| 1.002205 | 1.0021 | 0.8%+10 | 0.0090168 | 0.9923 | 1.0121 |
| 2.00141 | 2.0020 | 0.8%+10 | 0.017016 | 1.9802 | 2.0226 |
| 3.01210 | 3.012 | 0.8%+10 | 0.034096 | 2.973 | 3.051 |
| 4.01152 | 4.013 | 0.8%+10 | 0.042104 | 3.964 | 4.059 |
| 5.00980 | 5.011 | 0.8%+10 | 0.050088 | 4.954 | 5.066 |
| 6.00672 | 6.009 | 0.8%+10 | 0.058072 | 5.942 | 6.071 |
| 7.00465 | 7.005 | 0.8%+10 | 0.06604 | 6.931 | 7.078 |

The meter met its accuracy specifications for all the AC voltages I tested.

|  |  |
| --- | --- |
| ACV 1V 3dB cutoff | 778 kHz |

The cutoff frequency is good for under $150 meter.

# Current

| **Source** | **Reading** | **Specification** | **Uncertainty** | **Low Bound** | **High Bound** |
| --- | --- | --- | --- | --- | --- |
| AC mA 100Hz Squarewave | | |  |  |  |
| 0.999652 | 0.999 | 1.2%+10 | 0.021988 | 0.976 | 1.023 |
| DC µA |  |  |  |  |  |
| 0.89491 | 0.91 | 0.5%+10 | 0.10455 | 0.79 | 1.00 |
| 9.21686 | 9.25 | 0.5%+10 | 0.14625 | 9.07 | 9.37 |
| 99.0167 | 99.02 | 0.5%+10 | 0.5951 | 98.37 | 99.66 |
| 131.940 | 131.95 | 0.5%+10 | 0.75975 | 131.12 | 132.76 |
| DC mA |  |  |  |  |  |
| 1.009040 | 1.011 | 0.5%+10 | 0.015055 | 0.993 | 1.025 |
| 9.99244 | 9.993 | 0.5%+10 | 0.059965 | 9.930 | 10.055 |
| 99.4254 | 99.42 | 0.5%+10 | 0.5971 | 98.80 | 100.05 |
| 250.737 | 252.0 | 0.5%+10 | 2.26 | 248.4 | 253.1 |
| 500.978 | 502.0 | 0.5%+10 | 3.51 | 497.3 | 504.7 |
| DC Amps |  |  |  |  |  |
| 1.000886 | 1.001 | 1.2%+50 | 0.062012 | 0.938 | 1.063 |
| 2.000386 | 2.001 | 1.2%+50 | 0.074012 | 1.925 | 2.076 |
| 3.000046 | 3.001 | 1.2%+50 | 0.086012 | 2.912 | 3.088 |

The meter met its accuracy specifications for all the current values I tested. .

|  |  |
| --- | --- |
| A Shunt Resistance | .02 Ω |
| mA Shunt Resistance | 5.89 Ω |
| µA Shunt Resistance | 491.36 Ω |

It is always good to know how much resistance you are adding to your circuit when you make current measurements. The µA shunt resistance is higher than usual, most meter are around 100 ohms.

# Resistance

| **Source** | **Reading** | **Specification** | **Uncertainty** | **Low Bound** | **High Bound** |
| --- | --- | --- | --- | --- | --- |
| Ω |  |  |  |  |  |
| 1.020 | 1.02 | 0.5+10 | 0.1051 | 0.91 | 1.13 |
| 10.004 | 10.06 | 0.5+10 | 0.1503 | 9.85 | 10.16 |
| 100.08 | 100.02 | 0.5+10 | 0.6001 | 99.47 | 100.69 |
| kΩ |  |  |  |  |  |
| 1.00020 | 1.0002 | 0.5+10 | 0.006001 | 0.9941 | 1.0063 |
| 10.0023 | 9.999 | 0.5+10 | 0.059995 | 9.941 | 10.063 |
| 100.045 | 100.01 | 0.5+10 | 0.60005 | 99.44 | 100.65 |
| MΩ |  |  |  |  |  |
| 0.99425 | 0.9941 | 0.8%+10 | 0.0089528 | 0.9852 | 1.0033 |
| 9.968 | 9.969 | 1.5%+10 | 0.159535 | 9.804 | 10.132 |
| 99.80 | 99.68 | 3%+50 | 3.4904 | 96.11 | 103.49 |

The meter met its accuracy specifications for all the resistance values I tested. The accuracy values are average for this group of 6,000 count meters.

|  |  |
| --- | --- |
| Resistance Test Voltage | |
| Low Range | 3.20 V |
| Medium Range | 1.21 V |
| High Range | 0.61 V |

# Capacitance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **Reading** | **Specification** | **Uncertainty** | **Low Bound** | **High Bound** |
| nF |  |  |  |  |  |
| 1.01 | 1.016 | 3%+5 | 0.03548 | 0.961 | 1.059 |
| 9.966 | 9.936 | 3%+5 | 0.30308 | 9.613 | 10.319 |
| 99.45 | 99.97 | 3%+5 | 3.0491 | 95.90 | 103.00 |
| µF |  |  |  |  |  |
| 1.0077 | 1.0134 | 3%+5 | 0.035402 | 0.9673 | 1.0481 |
| 10.882 | 11.035 | 3%+5 | 0.33605 | 10.492 | 11.272 |
| 113.40 | 112.25 | 4.0%+5 | 4.54 | 108.31 | 118.49 |
| 1000 | 1010.2 | 4.0%+5 | 40.908 | 953.6 | 1046.4 |

The meter met its accuracy specifications for all of the capacitance values I tested

# Diode

|  |  |
| --- | --- |
| Max Diode Voltage | 2.98 V |
| Max Diode Current | 755 µA |

This will light some LEDs, for those who test LEDs with multimeters. The meter will sound a short beep when the diode voltage drop is in the normal range. I will continuously beep if the diode is shorted.

# Continuity

It is fast and it latches.

If you hold the short for more than a second, a green light at the front top of the meter will light.

# Accuracy Specifications Comparison

| **Value** | **Uni-T UT161D** | **EEVBlog Brymen BM235** | **Uni-T UT161E** | **Greenlee DM-510A** | **EEVblog Brymen BM786** | **Brymen BM525s** | **Brymen BM789** | **Greenlee DM-820** | **Uni-T UT181A** | **Fluke 87V** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Price | $89.98 | $114.69 | $128.77 | $148.99 | $154.11 | $171.62 | $171.62 | $187.66 | $400.99 | $ 433.25 |
| Count | 6,000 | 6,000 | 22,000 | 6,000 | 60,000 | 10,000 | 60,000 | 10,000 | 60,000 | 6,000 |
| DC mV Low | 0.8%+3 | 0.3%+2 | 0.1%+5 | 0.4%+5 | 0.03%+2 | 0.12%+2 | 0.03%+2 | 0.06%+2 | 0.025%+20 | 0.1%+1 |
| DC mV High | 0.8%+3 | 0.3%+2 | 0.1%+5 | 0.4%+5 | 0.03%+2 | 0.06%+2 | 0.03%+2 | 0.06%+2 | 0.025%+5 | 0.1%+1 |
| DC V Low | 0.5%+3 | 0.4%+2 | 0.05%+5 | 0.2%+3 | 0.03%+2 | 0.08%+2 | 0.03%+2 | 0.08%+2 | 0.025%+5 | 0.05%+1 |
| DC V High | 0.5%+3 | 0.4%+2 | 0.05%+5 | 0.2%+3 | 0.05%+5 | 0.08%+2 | 0.05%+5 | 0.08%+2 | 0.03%+5 | 0.05%+1 |
| AC mV | 1.2%+5 | 1%+3 | 1%+10 | 1%+5 | 0.5%+30 | 0.5%+3 | 0.5%+30 | 0.5%+3 | 0.6%+60 | 0.7%+4 |
| AC V | 1%+3 | 0.7%+3 | 0.8%+10 | 1%+5 | 0.5%+30 | 0.5%+3 | 0.5%+30 | 0.5%+3 | 0.3%+30 | 0.7%+2 |
| AC V + DC V | N/A | N/A | N/A | N/A | 0.7%+40 | 0.7% + 6 | 0.7% + 40 | N/A | 1% + 80 | N/A |
| DC µA | 1%+2 | 1%+3 | 0.5%+10 | 0.5%+5 | 0.075%+20 | 0.2%+4 | 0.075%+20 | 0.2%+4 | 0.08%+20 | 0.2%+4 |
| DC mA | 1%+3 | 0.7%+3 | 0.5%+10 | 0.5%+5 | 0.15%+20 | 0.2%+4 | 0.15%+20 | 0.2%+4 | 0.15%+10 | 0.2%+4 |
| DC A | 1.2%+5 | 0.7%+3 | 1.2%+50 | 1.2%+6 | 0.3%+20 | 0.2%+4 | 0.3%+20 | 0.2%+4 | 0.5%+10 | 0.2%+4 |
| AC µA | 1.2%+5 | 1.5%+3 | 0.8%+10 | 1%+3 | 0.9%+20 | 0.6%+3 | 0.9%+20 | 0.6%+3 | 0.6%+40 | 1%+2 |
| AC mA | 1.5%+5 | 1%+3 | 1.2%+10 | 1%+3 | 0.9%+20 | 1.0%+3 | 0.9%+20 | 1%+3 | 0.8%+40 | 1%+2 |
| AC A | 2%+5 | 1%+3 | 1.2%+10 | 1.2%+6 | 1%+30 | 0.8%+6 | 1%+30 | 0.8%+6 | 1%+20 | 1%+2 |
| Ω | 1.2%+2 | 0.3%+3 | 0.5%+10 | 0.5%+4 | 0.085%+10 | 0.1%+3 | 0.085%+10 | 0.1%+3 | 0.05%+10 | 0.2%+2 |
| Low kΩ | 1%+2 | 0.3%+3 | 0.5%+10 | 0.5%+4 | 0.085%+4 | 0.1%+3 | 0.085%+4 | 0.1%+3 | 0.05%+2 | 0.2%+1 |
| High kΩ | 1%+2 | 0.5%+3 | 0.5%+10 | 0.5%+4 | 0.15%+4 | 0.1%+3 | 0.15%+4 | 0.1%+3 | 0.05%+2 | 0.6%+1 |
| Low MΩ | 1.2%+2 | 0.9%+2 | 1.5%+10 | 0.7%+4 | 1.5%+5 | 0.4%+3 | 1.5%+5 | 0.4%+3 | 0.3%+10 | 0.6%+1 |
| High MΩ | 2%+5 | 0.9%+2 | 3%+50 | 1.2%+4 | 2%+5 | 1.5%+5 | 2%+5 | 1.5%+5 | 2%+10 | 1%+3 |
| Low nF | 3%+5 | 1.5%+8 | 3%+5 | 2%+5 | 1%+10 | 0.8%+3 | 1%+10 | 0.8%+3 | 3%+10 | 1%+2 |
| High nF | 3%+5 | 1.5%+8 | 3%+5 | 2%+5 | 1%+2 | 0.8%+3 | 1%+2 | 0.8%+3 | 2%+5 | 1%+2 |
| Low µF | 3%+5 | 1.5%+2 | 3%+5 | 1.5%+5 | 1%+2 | 1%+3 | 1%+2 | 1%+3 | 2%+5 | 1%+2 |
| High µF | 10%+5 | 4.5%+10 | 4%+5 | 2%+5 | 1.8%+4 | 5%+5 | 1.8%+4 | 3.5%+5 | 5% + 5 | 1%+2 |

The accuracy specifications are from the meters’ respective manuals. The background color code shows the extreme low and high accuracy specifications. Green is the highest, yellow is lowest, and white is everything in-between.

In general, the higher cost of the meter corresponds with higher accuracy specifications with notable exceptions of the AC+DC ranges and the high megaohm range.

# Test Leads

If you are in the market for an under-$150 meter, you probably will not buy $40 Probe Master test leads to use with it, so I looked at the included test leads. The test leads were a rigid plastic type, but the tips appear gold plated.

# Ergonomics

The rotary switch is easy to turn. The rotary switch beeps every time you change it and the meter beeps when you press any of the buttons.

The meter is a little wobbly and slippery when using the bail on a smooth surface.

The display is big with big easy-to-read numbers. The backlight is dim but evenly lit with not hotspots.

The meter will auto power off after 15 minutes. You can override the auto power off by holding down the Select button while turning the meter on.

# Logging

The meter comes with an optically isolated USB connection and PC software can be downloaded from the Uni-T site to connect to the meter.

A black usb cable with a cord

Description automatically generated

PC software running on Windows 10. You can plot and save data from the meter.

A computer monitor with a calculator and keyboard

Description automatically generated

I also bought a Bluetooth adapter for the meter from the Uni-T Direct Store at Amazon.com for $ 29.99.

A black and gold adapter in a package

Description automatically generated

I tried the software for IOS and Android. I could not get the Android software to work on my Android tablet. The IOS software worked on my iPhone and iPad.

A device with a screen and a phone on a blue surface

Description automatically generatedA device with a screen on it

Description automatically generated

# Battery

The meter uses four AAA batteries accessible from the back by removing the battery cover. The battery cover has one captured Philips screw that mates with a brass insert.

A red and black device with batteries and a screwdriver

Description automatically generated

# Fuses

The fuses are accessible from the battery compartment.

A battery in a red case

Description automatically generated

The manual states the fuses are as follows.

A input terminal protection: (CE) 11A 1000V fast-acting fuse, Φ10x38mm.

mA/μA input terminal protection: (CE) 600mA 1000V fast-acting fuse, Φ6x32mm

# Pros

* Third-party safety testing by ETL to meet US and Canada standards.
* Lowest cost meter with .05+5 DC Volts accuracy.
* All the measurements taken met the accuracy specifications as stated in the manual.
* Includes USB interface with free software downloadable from the Uni-T website.
* $30 Bluetooth adapter available with free IOS and Android software.

# Cons

* The µA shunt resistance is higher than usual.
* Beeps every time you move the rotary switch.
* Can’t measure temperature.

# Conclusion

So far, the Uni-T UT161E is the lowest cost 22,000 count meter that I can recommend without reservations. If you are just starting out with you first digital multimeter or replacing or supplementing your old analog meter this is a good meter to get started with. This is also the lowest cost 22,000 count meter that has a PC interface and has an optional Bluetooth adapter. Many higher cost meters don’t have any PC or mobile interface available.

For voltage and current accuracy specifications this is an improvement over the UT161D for an about $39 increase in cost and all you give up is temperature measurements.

If you need higher accuracy specifications or more resolution, you will have to look at higher cost meters.