Uni-T UT161E Review

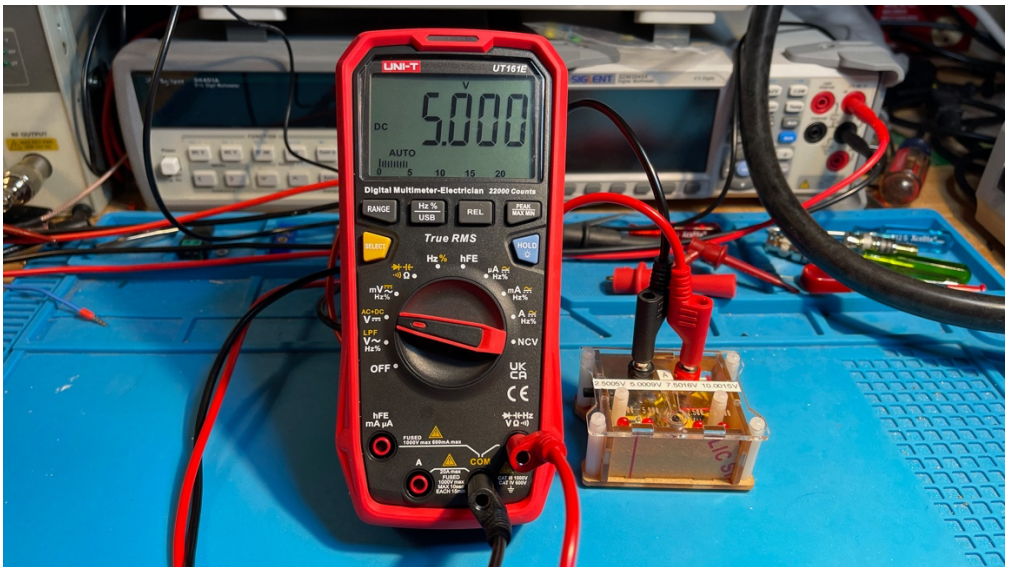
Introduction

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



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.

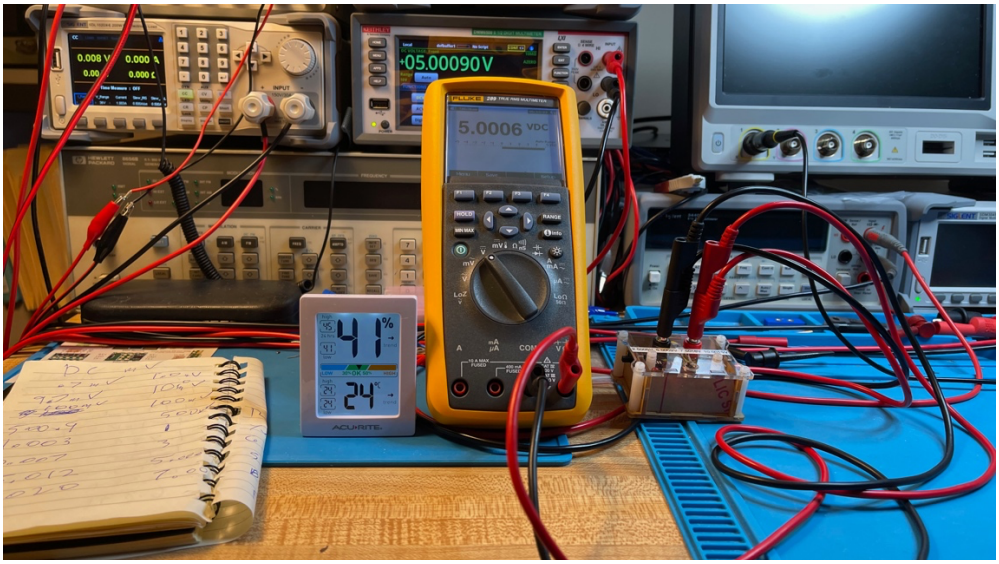
Features

- 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
- 1 GΩ Input Impedance for the mV range
- Four AAA Batteries Included
- 18 Month Warranty (if purchased from Uni-T Direct Store at Amazon.com)

Accuracy

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.



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	See below

VDC input has over 10 MΩ resistance, which is good, so the meter is less likely to load down a high impedance circuit when checking voltage. The mVDC input was too high to measure on any of my meters. The manual states that it is “About 1GΩ for mV range”. 1GΩ is very good for the mV range.

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

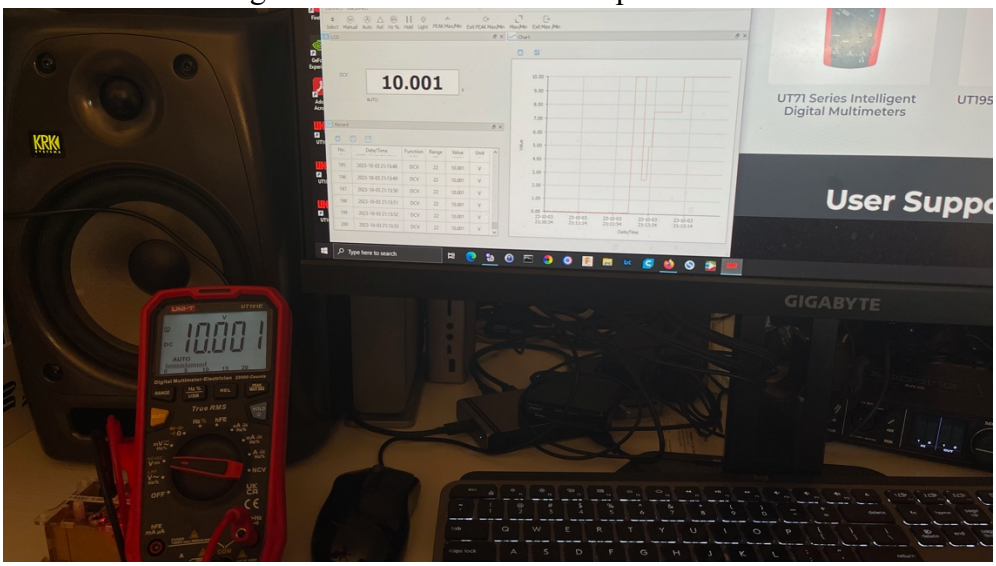
The rotary switch is easy to turn. The rotary switch beeps every time you change it and the meter beeps when you press any of the buttons.

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

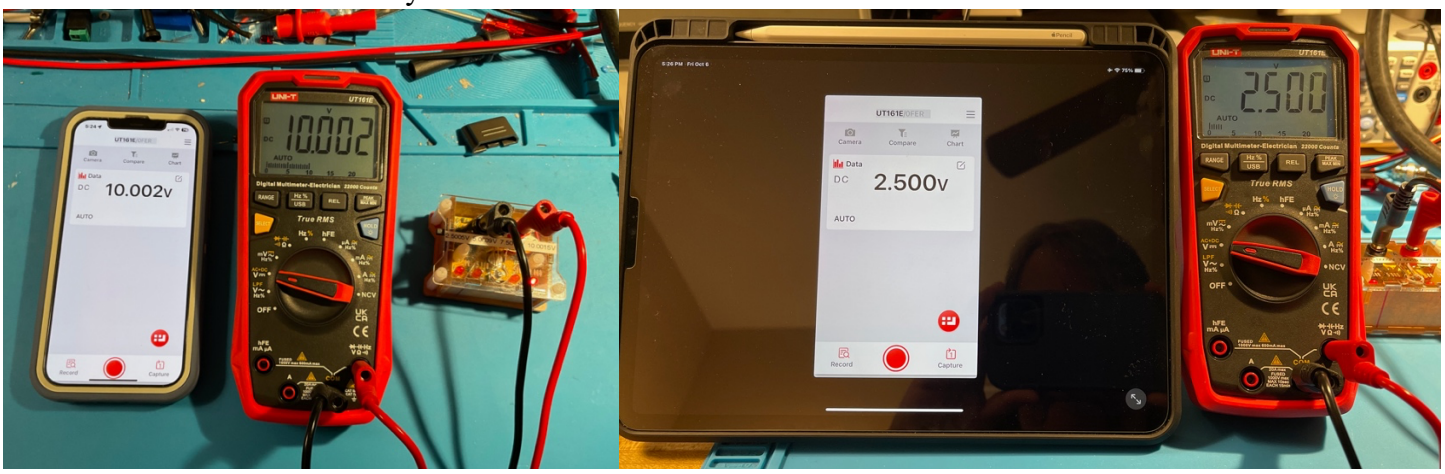
The meter comes with an optically isolated USB connection and PC software can be downloaded from the Uni-T site to connect to the meter.

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



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

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.



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.

Fuses

The fuses are accessible from the battery compartment.

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.
- 1 GΩ Input Impedance for the mV range.
- 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.

Revision History

Version 1.0 8-October-2023: Initial Version.
Version 1.1 8-April-2024: Fixed mistake on page 4, mV input resistance. On page 2 added feature “1 GΩ Input Impedance for the mV range”. On page 11 added Pro “1 GΩ Input Impedance for the mV range”. Added revision history.