

Uni-T UT161D Review

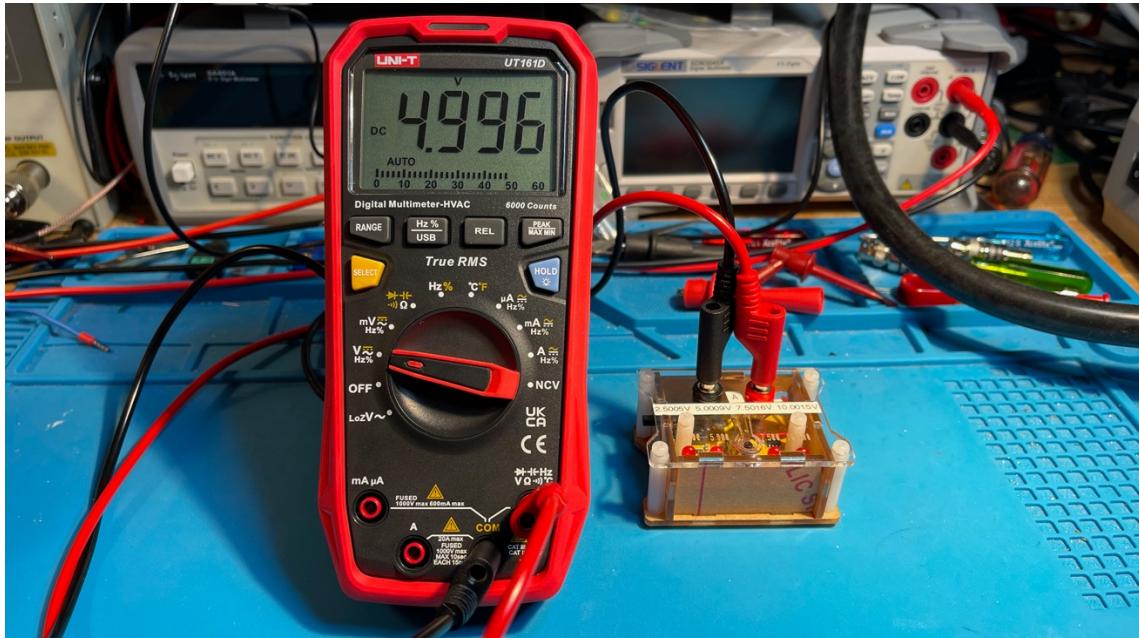
Introduction

Hi, I am Tom, amateur radio call sign N8FDY. This is a review of the Uni-T UT161D 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 UT161D multimeter that I purchased from the Uni-T Direct Store at Amazon.com for \$89.98. **If you want the Unit-T Direct USA 18-month warranty, 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 UT161D 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
- 6,000 Count
- Basic DC Accuracy $\pm(0.5\% + 3)$
- 31 Segment Bar Graph
- True-RMS
- Min/Max
- Rel/Delta
- K-Type Thermocouple
- LoZ AC Voltage
- Four AAA Batteries Included
- 18 Month Warranty (if purchased from Uni-T Direct Store at Amazon.com)

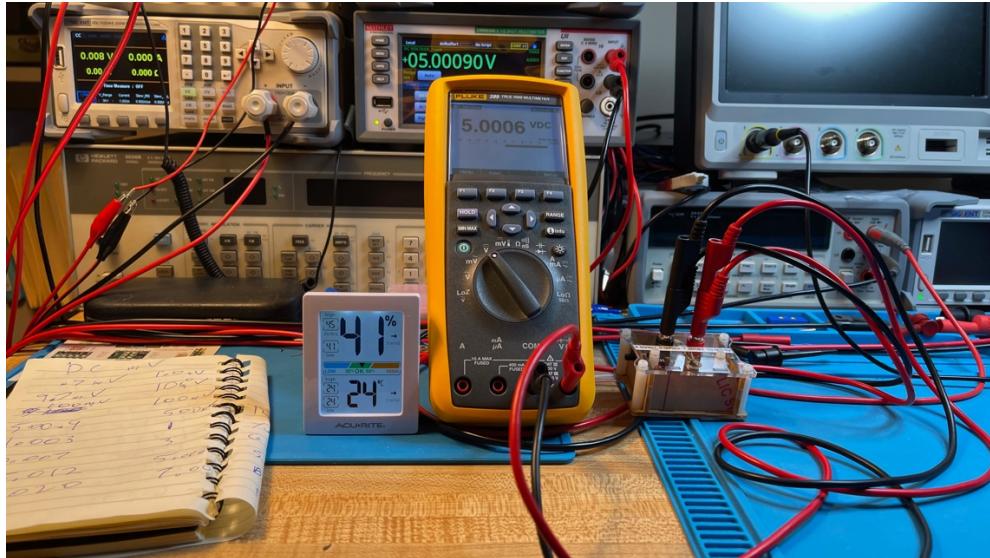
Accuracy



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 $\pm(0.0025\% \text{ of reading} + 0.0005\% \text{ of range})$, 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 $\pm(0.025\% \text{ of reading} + 2 \text{ least significant digits})$ 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	0.8%+5	0.0588	1.03	1.15
10.1123	10.13	0.8%+5	0.13104	9.98	10.24
25.0348	25.02	0.8%+5	0.25016	24.78	25.29
100.0086	99.90	0.8%+3	0.9992	99.01	101.01
250.189	250.0	0.8%+3	2.2	247.98	252.40
500.070	499.8	0.8%+3	4.1984	495.85	504.29
V DC					
1.000675	0.999	0.5%+3	0.007995	0.993	1.009
2.00054	1.998	0.5%+3	0.01299	1.987	2.014
2.50052	2.497	0.5%+3	0.015485	2.485	2.516
3.00059	2.997	0.5%+3	0.017985	2.982	3.019
4.00025	3.996	0.5%+3	0.02298	3.977	4.023
5.00010	4.994	0.5%+3	0.02797	4.972	5.028
5.00089	4.995	0.5%+3	0.027975	4.973	5.029
6.00087	5.993	0.5%+3	0.032965	5.97	6.03
7.00088	6.99	0.5%+3	0.06495	6.94	7.07
7.50159	7.49	0.5%+3	0.06745	7.43	7.57
10.00030	9.98	0.5%+3	0.0799	9.92	10.08
15.0002	14.97	0.5%+3	0.10485	14.89	15.11
30.0003	29.96	0.5%+3	0.1798	29.82	30.18
96.8832	96.6	0.5%+3	0.783	96.10	97.67
188.940	188.4	0.5%+3	1.242	187.68	190.20
276.573	275.8	0.5%+3	1.679	274.88	278.27
376.567	375.6	0.5%+3	2.178	374.37	378.77
473.549	472.4	0.5%+3	2.662	470.86	476.24
601.737	600.2	0.5%+3	3.301	598.40	605.07

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	4.949	1.0%+5	0.05249	4.940	5.057
mV AC 60 Hz Sinewave					
1.0300	1.02	1.2%+5	0.06224	0.97	1.09
5.0168	5.01	1.2%+5	0.11012	4.90	5.13
10.0338	10.02	1.2%+5	0.17024	9.86	10.21
25.0934	25.07	1.2%+5	0.35084	24.73	25.46
50.0430	49.99	1.2%+5	0.64988	49.36	50.72
100.334	99.9	1.2%+5	1.6988	98.6	102.1
250.445	250.3	1.2%+5	3.5036	246.8	254.1
502.229	501.8	1.2%+5	6.5216	495.4	509.1
V AC 60 Hz Sinewave					
0.502214	0.501	1.0%+5	0.00801	0.494	0.511
1.002205	1.001	1.0%+5	0.01301	0.988	1.016
2.00141	1.999	1.0%+5	0.02299	1.974	2.029
3.01210	3.010	1.0%+5	0.0331	2.974	3.050
4.01152	4.007	1.0%+5	0.04307	3.963	4.060
5.00980	5.004	1.0%+5	0.05304	4.951	5.069
6.00672	5.999	1.0%+5	0.06299	5.937	6.076
7.00465	6.99	1.0%+5	0.0999	6.90	7.11

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

ACV 1V 3dB cutoff	2.91 kHz
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The low frequency of the cutoff is typical of low-cost meters.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC mA 100Hz Squarewave					
0.999652	0.99	1.5%+5	0.06485	0.93	1.07
DC μ A					
0.89491	0.9	1.0%+2	0.209	0.69	1.10
9.21686	9.2	1.0%+2	0.292	8.92	9.51
99.0167	98.9	1.0%+2	1.189	97.78	100.26
131.940	131.8	1.0%+2	1.518	130.36	133.52
DC mA					
1.009040	1.00	1.0%+3	0.04	0.97	1.05
9.99244	9.98	1.0%+3	0.1298	9.86	10.12
99.4254	99.3	1.0%+3	1.293	98.11	100.74
250.737	250.7	1.0%+3	2.807	247.87	253.60
500.978	501.1	1.0%+3	5.311	495.47	506.49
DC A					
1.000886	0.999	1.2%+5	0.016988	0.983	1.018
2.000386	1.998	1.2%+5	0.028976	1.970	2.030
3.000046	2.997	1.2%+5	0.040964	2.957	3.043

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

A Shunt Resistance	0.02 Ω
mA Shunt Resistance	1.92 Ω
μ A Shunt Resistance	100.88 Ω

It is always good to know how much resistance you are adding to your circuit when you make current measurements.

Resistance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
Ω					
1.020	1.0	1.2%+2	0.212	0.8	1.2
10.004	10.0	1.2%+2	0.32	9.7	10.3
100.08	99.6	1.2%+2	1.3952	98.7	101.5
k Ω					
1.00020	0.999	1%+2	0.01199	0.988	1.012
10.0023	9.99	1%+2	0.1199	9.88	10.12
100.045	99.9	1%+2	1.199	98.8	101.3
M Ω					
0.99425	0.994	1.2%+2	0.013928	0.980	1.008
9.968	9.96	2%+5	0.2492	9.71	10.22

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

Resistance Test Voltage	
Low Range	1.03 V
Medium Range	0.92 V
High Range	0.51 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
1.01	1.05	3%+5	0.0815	0.92	1.10
9.966	10.10	3%+5	0.353	9.56	10.37
99.45	99.8	3%+5	3.494	95.5	103.4
μF					
1.0077	1.008	3%+5	0.03524	0.967	1.048
10.882	11.12	3%+5	0.3836	10.44	11.32
113.40	113.6	3%+5	3.908	108.9	117.9
1000	1020	10%+5	107	888	1113

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

Diode

Max Diode Voltage	3.26 V
Max Diode Current	1.04 mA

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

Not very fast but it does latch.

If you hold the short for more than a second, the beep stops and a red light at the front top of the meter will light then go off and the beep starts again with the light showing green.

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 μ A	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 μ A	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 k Ω	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 k Ω	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 M Ω	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 M Ω	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 μ F	3%+5	1.5%+2	3%+5	1.5%+5	1%+2	1%+3	1%+2	1%+3	2%+5	1%+2
High μ F	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.

LowZ

The meter has a LowZ position on the rotary switch. It measures AC voltage with 3.3 k Ω resistance. It is used by electricians to eliminate ghost voltages when checking a circuit. I did not test this feature.

Test Leads

If you are in the market for an under-\$100 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. The meter also came with a thermocouple for measuring temperature. I did not test temperature measurements.

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 no 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.
- Under \$100 meter that has all the basic functions for electronic projects.
- 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

- Dim backlight
- Unusual continuity behavior
- Beeps every time you move the rotary switch.
- Most ranges have the lowest accuracy specifications in the group, but it is the lowest cost meter in the group.

Conclusion

So far, the Uni-T UT161D is the lowest cost meter that I can recommend without reservations. If you are just starting out with your 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 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.

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