ANENG AN870 Review

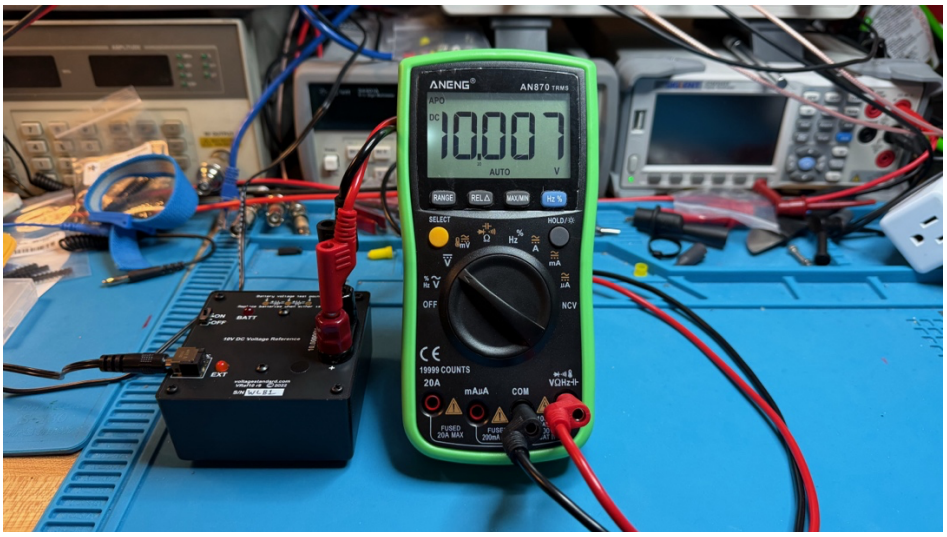
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the ANENG AN870 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 ANENG AN870 multimeter that I purchased from the coolmall18 store on eBay.com for $60.46. It is currently (October 23, 2024) on sale for $42.29 from the beautiful1003 store on eBay.com.

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

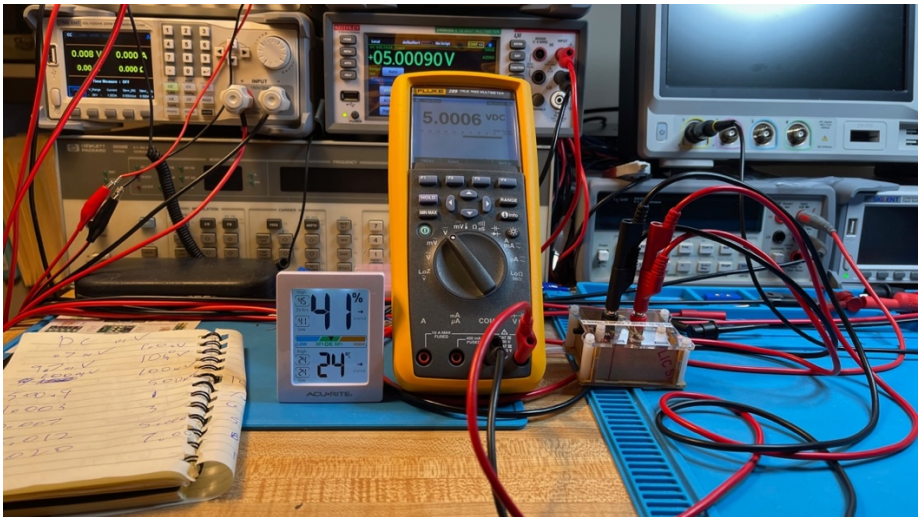
This review was produced to help you decide if the ANENG AN870 multimeter will fit your purpose and budget. This is part of a series of multimeters reviews.
A good multimeter for hobby electronic projects should be able to measure millivolts, volts, microamps, milliamps, amps, ohms, nanofarads and microfarads.
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

- 20,000 Count
- Basic DC Accuracy 0.05%±3
- True RMS
- Data Hold Function
- Delta/REL Function
- Min/Max
- NCV (Non-Contact Voltage Detection)
- 1 Year Warrantee

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.


+05.00090V
5.0006 VDC
41%
24°
ACURITE

DC Volts

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
mV DC					
1.0404	1.044	0.05%+3	0.003522	1.036	1.044
10.0107	10.015	0.05%+3	0.0080075	10.002	10.019
25.0727	25.08	0.05%+3	0.04254	25.03	25.12
100.0251	100.04	0.05%+3	0.08002	99.94	100.11
250.039	250.1	0.05%+3	0.42505	249.6	250.5
500.053	500.2	0.05%+3	0.5501	499.5	500.6
V DC					
0.500060	0.5002	0.05%+3	0.0005501	0.4994	0.5007
1.000789	1.0010	0.05%+3	0.0008005	0.9999	1.0017
2.00021	2.002	0.05%+3	0.004001	1.996	2.004
2.50057	2.501	0.05%+3	0.0042505	2.496	2.505
3.00015	3.002	0.05%+3	0.004501	2.996	3.005
4.00013	4.003	0.05%+3	0.0050015	3.995	4.005
5.00040	5.001	0.05%+3	0.0055005	4.995	5.006
5.00091	5.004	0.05%+3	0.005502	4.995	5.007
6.00050	6.005	0.05%+3	0.0060025	5.994	6.007
7.00021	7.006	0.05%+3	0.006503	6.993	7.007
7.50158	7.507	0.05%+3	0.0067535	7.495	7.509
8.00096	8.007	0.05%+3	0.0070035	7.994	8.008
9.00011	9.008	0.05%+3	0.007504	8.992	9.008
10.00104	10.009	0.05%+3	0.0080045	9.993	10.009
15.0006	15.015	0.05%+3	0.0105075	14.989	15.012
30.0019	30.01	0.05%+3	0.045005	29.95	30.05
100.8744	100.92	0.05%+3	0.08046	100.78	100.96
200.024	200.0	0.05%+3	0.4	199.6	200.4
300.564	300.6	0.05%+3	0.4503	300.1	301.0
400.708	400.7	0.05%+3	0.50035	400.2	401.2
530.030	530.0	0.05%+3	0.565	529.4	530.6
616.690	617.1	0.05%+3	0.60855	615.9	617.5
1039.1	1039.8	0.05%+3	0.8199	1037.9	1040.3

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

VDC Input	11 MΩ
mVDC input	10 MΩ

VDC and mVDC inputs are 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 Square Wave					
4.99879	4.972	0.3%+3	0.017916	4.975	5.023
mV AC 60 Hz Sinewave					
1.0218	1.022	0.3%+3	0.006066	1.015	1.029
5.0222	5.023	0.3%+3	0.018069	5.001	5.043
10.0346	10.032	0.3%+3	0.033096	9.995	10.074
25.0935	25.10	0.3%+3	0.1053	24.97	25.21
50.0505	50.07	0.3%+3	0.18021	49.84	50.26
100.0387	100.10	0.3%+3	0.3303	99.65	100.43
250.481	0L				
502.202	0L				
V AC 60 Hz Sinewave					
0.502289	0.5025	0.3%+3	0.0018075	0.4999	0.5047
1.002317	1.0029	0.3%+3	0.0033087	0.9981	1.0065
2.00153	2.003	0.3%+3	0.006309	1.991	2.012
3.01191	3.015	0.3%+3	0.009345	2.998	3.026
4.01145	4.016	0.3%+3	0.012348	3.994	4.029
5.00994	5.016	0.3%+3	0.018048	4.986	5.034
6.00688	6.014	0.3%+3	0.021042	5.979	6.035
7.00454	7.014	0.3%+3	0.024042	6.973	7.036
10.00716	10.020	0.3%+3	0.03306	9.965	10.049
19.9949	20.00	0.3%+3	0.09	19.86	20.13
25.0187	25.03	0.3%+3	0.10509	24.87	25.17
49.9758	50.02	0.3%+3	0.18006	49.74	50.22
75.1494	75.22	0.3%+3	0.25566	74.82	75.48
100.2650	100.36	0.3%+3	0.33108	99.84	100.69
140.2736	140.42	0.3%+3	0.45126	139.44	141.11

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

ACV 1V 3dB cutoff	3.04 kHz

The cutoff frequency is good for under $50 meter.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC mA 100Hz Squarewave					
0.999653	0.995	0.8%+3	0.01096	0.987	1.012
DC µA					
0.89590	0.91	0.5%+3	0.03455	0.86	0.93
9.21814	9.22	0.5%+3	0.0761	9.14	9.30
99.0577	99.06	0.5%+3	0.5253	98.48	99.63
131.948	131.96	0.5%+3	0.6898	131.15	132.75
DC mA					
1.009198	1.010	0.5%+3	0.00805	1.001	1.018
9.99414	9.998	0.5%+3	0.05299	9.939	10.050
99.4269	99.50	0.5%+3	0.5275	98.87	99.98
250.021	251.1	0.5%+3	1.5555	248.4	251.6
500.227	502.3	0.5%+3	2.8115	497.2	503.2
DC Amps					
1.000888	1.0015	0.5%+3	0.0053075	0.9951	1.0066
2.000215	2.011	0.5%+3	0.013055	1.986	2.014
3.000569	3.016	0.5%+3	0.01808	2.981	3.020

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

A Shunt Resistance	0.10 Ω
mA Shunt Resistance	2.78 Ω
µA Shunt Resistance	101.62 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					
1.146	1.13	0.5%+3	0.03565	1.11	1.18
10.15	10.14	0.5%+3	0.0807	10.07	10.23
100.24	100.19	0.5%+3	0.53095	99.70	100.78
kΩ					
1.0003	1.0007	0.2%+3	0.0023014	0.9979	1.0027
10.0022	9.999	0.2%+3	0.022998	9.978	10.026
100.03	100.00	0.2%+3	0.23	99.79	100.27
MΩ					
0.9941	0.9931	1%+3	0.010231	0.9838	1.0044
9.95	9.974	1%+3	0.10274	9.843	10.057
100.0	99.29	5%+5	1.0229	98.77	101.23

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

Resistance Test Voltage	
Low Range	1.03 V
Medium Range	0.93 V
High Range	0.51 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
1.03	1.013	5%+20	0.07065	0.946	1.114
9.96	9.982	5%+20	0.5191	9.391	10.529
99.4	99.73	2%+5	2.0446	96.86	101.94
µF					
1.008	1.005	2%+5	0.0251	0.978	1.038
10.82	11.09	2%+5	0.2718	10.49	11.15
113.1	113.7	2%+5	2.774	109.8	116.4
1003	1013	5%+5	25.26	972	1034

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

Diode

Max Diode Voltage	3.25 V
Max Diode Current	1.86 mA

This meter lit the LEDs I tested, for those who test LEDs with multimeters. The meter does not beep for dios.

Continuity

It is somewhat slow, but it does latch. The slowness comes for a delay in recognizing a break in the connection. Continuity aficionados probably won't like it.

Accuracy Specifications Comparison

Value	KAIWEETS KM601	Thsinde 18 Z-III	Zotek ZT-Y	ANENG AN870	Kaiweets KM601s	KAIWEETS HT118E	OWON B41T+	UNI-T UT61E+
Cost	$34.99	$39.95	$41.99	$42.29	$44.99	$47.99	$79.00	$95.99
Count	10,000	20,000	10,000	20,000	10,000	20,000	22,000	22,000
DC mV	0.5%+3	0.05%+5	0.5%+3	0.05%+3	0.5%±3	0.08%+5	0.1%+5	0.1%+5
DC V	0.5%+3	0.05%+5	0.5%+3	0.05%+3	0.5%±3	0.08%+5	0.1%+2	0.05%+5
AC mV	0.8%+3	0.06%+25	1%+3	0.3%+3	0.8%±3	1%+25	1.0%+10	1%+10
AC V	0.8%+3	0.06%+25	1%+3	0.3%+3	0.8%±3	1%+25	0.8%+10	0.8%+10
DC µA	N/A	0.5%+4	1%+3	0.5%+3	N/A	0.5%+5	0.5%+10	0.5%+10
DC mA	0.8%+3	0.8%+6	1%+3	0.5%+3	0.8%±3	0.5%+5	0.8%+10	0.5%+10
DC A	1.2%+3	1.0%+6	1%+3	0.5%+3	1.2%±3	1%+15	2%+25	1.2%+50
AC µA	N/A	0.5%+4	1.2%+3	0.8%+3	0.8%±3	1%+25	0.8%+10	0.8%+10
AC mA	0.8%+3	0.8%+6	1.2%+3	0.8%+3	0.8%±3	1%+25	1.2%+10	1.2%+10
AC A	1.2%+3	1.0%+6	1.2%+3	0.8%+3	1.2%±3	1.5%+25	1.5%+10	1.2%+10
Ω	1%+5	0.3%+10	1%+3	0.5%+5	1%±5	1%+15	0.5%+10	0.5+10
Low kΩ	1%+5	0.3%+5	0.5%+3	0.2%+3	1%±5	1%+15	0.5%+10	0.5+10
High kΩ	1%+5	0.3%+5	0.5%+3	0.2%+3	1%±5	1%+15	0.5%+10	0.8+10
Low MΩ	1%+5	0.3%+5	1.5%+3	1%+3	1%±5	1%+15	1.5%+10	1.5%+10
High MΩ	2%+10	1.2%+25	3%+5	5%+5	2%±10	3%+25	5%+10	3%+50
Low nF	4%+3	3%+20	5%+20	5%+20	4%±3	4%+50	3%+5	3%+5
High nF	4%+3	3%+20	2%+5	2%+5	4%±3	4%+50	3%+5	3%+5
Low µF	4%+3	3%+20	2%+5	2%+5	4%±3	4%+50	3%+5	3%+5
High µF	4%+3	5%+10	5%+5	2%+5	4%±3	4%+50	4%+10	4%+5

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, it looks like more money does not buy more accuracy. You can stay under $43 and get better accuracy.

Test Leads

If you are in the market for an under-$50 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, and the tips are NOT gold plated.
A second set of test leads are provided that were a little more flexible but were modular and each piece must be connected in sequence to form a complete test lead.

Ergonomics

The rotary switch has a crisp detent, but like almost all these low-cost meters it beeps every time you move the rotary switch. The screen has good contrast, and the backlight is bright enough. The backlight does have a bright hotspot one the left. I can't find a way to override the backlight auto-off. You can override the meter auto-off by pressing the SELECT button while turning the meter on.

Battery

The meter uses two AA batteries, not supplied. The battery door is held in with one non-captured philips screw into a brass insert.

Fuses

The fuses are accessible by opening the case. The four screws are not captured and screw into plastic.

The manual does not state what fuses are used. I observed that the fuse on the left was marked 200mA, 250V and the fuse on the right was marked 20A, 250V.

Pros

- Highest basic DC accuracy (0.05%±3) in this group of under $100 meters.
- Best accuracy specifications in 12 out of 19 ranges in this group of meters.
- Good value for price.

Cons

- Not third-party safety tested (does have CE mark, but that is self-tested).
- Fuses only rated for 250V.
- Must disassemble meter to change fuses.
- 15 VDC reading was 3mV above specification.
- 5V AC 100Hz square wave reading was 3mV below specification.
- Unclear where to get warrantee service.
- Only available from eBay.

Conclusion

This is a typical low cost made in China multimeter. It looks just like the ZOYI ZT-219 except the ANENG has a green boot. Its standout feature is its basic DC accuracy and higher accuracy is most other ranges. It has all the basic features for electronic projects. The two slightly off specification measurements are not a big concern for a $42 meter. Also only use this meter for CAT I or II environments to be safe.

Revision History

Version 1.0 23-October-2024: Initial Version.