Fluke 117 Review

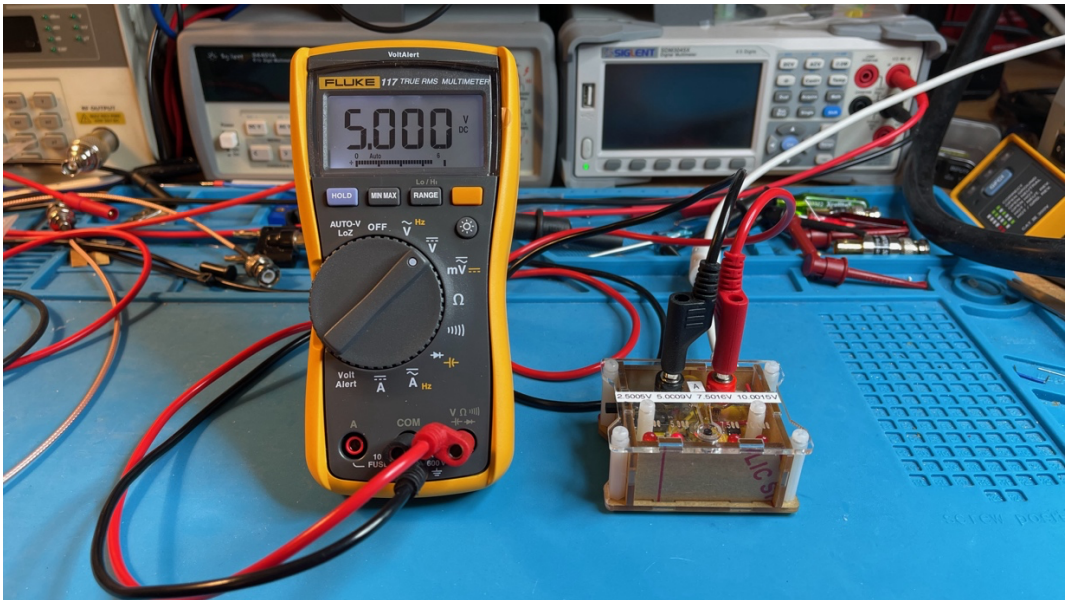
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the Fluke 117 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 Fluke 117 multimeter that I purchased from the from Lowe's for $159.31 in September of 2023, the price at Lowe's is $281.99. The cheapest I could find it today was at Amazon for $235.99.

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.

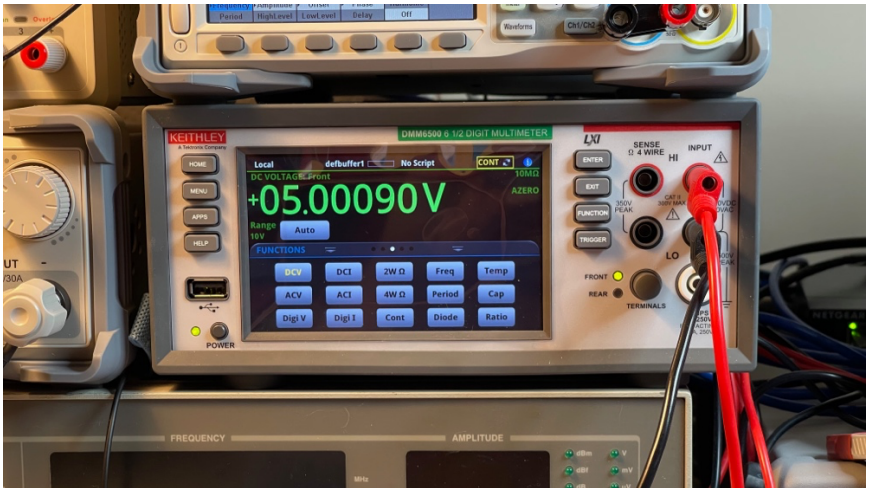
Objectives

This review was produced to help you decide if the Fluke 117 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

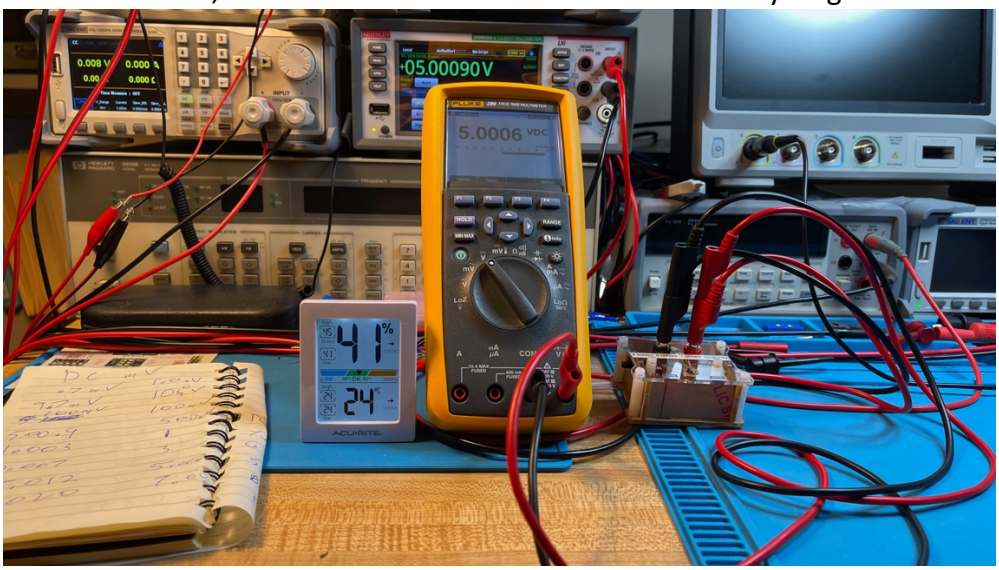
- Third-party safety tested by CSA for Canada and US.
- CAT III 600 Volts.
- 6000 count True-RMS with basic DC accuracy of 0.5%+2.
- 33 segments bar graph that updates 32 times a second.
- Battery life is 400 hours typical, without backlight.
- IP42 rated.
- VoltAlert™ non-contact AC voltage detection.
- AutoVolt automatic AC/DC selection
- Included one nine-volt battery.
- 3 years Warranty.

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					
0.9864	1.0	0.5%+2	0.205	0.8	1.2
9.9859	10.0	0.5%+2	0.25	9.7	10.2
25.0568	25.1	0.5%+2	0.3255	24.7	25.4
100.0217	100.0	0.5%+2	0.7	99.3	100.7
250.066	250.0	0.5%+2	1.45	248.6	251.5
500.088	500.0	0.5%+2	2.7	497.4	502.8
V DC					
0.500044	0.500	0.5%+2	0.0045	0.495	0.505
1.001176	1.001	0.5%+2	0.007005	0.994	1.008
2.00040	2.000	0.5%+2	0.012	1.988	2.013
2.50053	2.500	0.5%+2	0.0145	2.486	2.515
3.00046	3.000	0.5%+2	0.017	2.983	3.018
4.00043	4.000	0.5%+2	0.022	3.978	4.023
5.00020	4.999	0.5%+2	0.026995	4.973	5.027
5.00090	5.000	0.5%+2	0.027	4.974	5.028
6.00091	6.000	0.5%+2	0.032	5.969	6.033
7.00062	7.00	0.5%+2	0.055	6.95	7.06
7.50163	7.50	0.5%+2	0.0575	7.44	7.56
10.00172	10.00	0.5%+2	0.07	9.93	10.07
10.00154	10.00	0.5%+2	0.07	9.93	10.07
15.0007	15.00	0.5%+2	0.095	14.90	15.10
30.0008	30.00	0.5%+2	0.17	29.8	30.2
100.4141	100.4	0.5%+2	0.702	99.7	101.1
196.181	196.1	0.5%+2	1.1805	195.0	197.4
285.861	285.8	0.5%+2	1.629	284.2	287.5
389.282	389.2	0.5%+2	2.146	387.1	391.4
490.581	490.5	0.5%+2	2.6525	487.9	493.3
620.764	620.7	0.5%+2	3.3035	617.4	624.1
1037.2	0L				

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

VDC Input	11 MΩ
mVDC input	10 MΩ

Both VDC and mVDC input have 10 MΩ or more 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	4.990	1%+3	0.0529	4.940	5.058
mV AC 60 Hz Sinewave					
1.0283	0.0	1%+3	0.03	1.0	1.1
5.0206	5.1	1%+3	0.351	4.7	5.4
10.1524	10.2	1%+3	0.402	9.7	10.6
25.0932	25.1	1%+3	0.551	24.5	25.7
50.0598	50.1	1%+3	0.801	49.2	50.9
100.0330	100.0	1%+3	1.3	98.7	101.4
250.486	250.5	1%+3	2.805	247.5	253.4
500.059	500.1	1%+3	5.301	494.5	505.7
V AC 60 Hz Sinewave					
0.500036	0.500	1%+3	0.008	0.4914	0.5086
1.00014	1.000	1%+3	0.013	0.986	1.014
2.00129	2.002	1%+3	0.02302	1.974	2.029
3.01185	3.012	1%+3	0.03312	2.974	3.050
4.01172	4.012	1%+3	0.04312	3.963	4.060
5.01052	5.011	1%+3	0.05311	4.951	5.070
6.00707	6.007	1%+3	0.06307	5.937	6.077
7.00529	7.01	1%+3	0.1001	6.90	7.11
10.00695	10.01	1%+3	0.1301	9.87	10.15
20.4254	20.43	1%+3	0.2343	20.15	20.70
25.03750	25.04	1%+3	0.2804	24.71	25.36
50.00720	50.01	1%+3	0.5301	49.42	50.60
75.0690	75.1	1%+3	1.051	73.9	76.2
100.3803	100.4	1%+3	1.304	98.99	101.77
140.1246	140.1	1%+3	1.701	138.04	142.21

The meter met its accuracy specifications for all but one of the AC voltages I tested. It failed to meet specifications on the 1mV reading.

ACV 1V 3dB cutoff	8.1 kHz

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					
0.999676	0	1.5 %+3	3	-2	4
DC µA					
0.89710	N/A				
9.21853	N/A				
99.0501	N/A				
131.931	N/A				
DC mA					
1.009102	1	1%+3	3.01	-2	4
9.99278	10	1%+3	3.1	7	13
99.4435	99	1%+3	3.99	95.4	103.5
250.195	250	1%+3	5.5	245	256
500.164	500	1%+3	8	492	508
DC A					
1.000331	1.000	1%+3	0.013	0.987	1.014
2.000799	2.001	1%+3	0.02301	1.977	2.025
3.000319	3.001	1%+3	0.03301	2.966	3.035

The meter met its accuracy specifications for all the current values I was able to get a reading on. Note that the meter only has an A range, so milliamps are read as fractional of amps. For example, the 1 mA reading shows on the meter as 0.001 A, the 250 mA reading shows on the meter as 0.250 A. The uncertainty value for the 1 mA reading is too large for a meaningful reading. The meter can't read any microamps values. The meter also could not read 1 mA AC 100 Hz Square Wave.

A Shunt Resistance	.02 Ω
mA Shunt Resistance	N/A
µA Shunt Resistance	N/A

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					
1.00026	1.2	0.9%+2	0.2108	0.8	1.2
10.0025	10.2	0.9%+2	0.2204	9.9	10.3
100.04	100.2	0.9%+2	1.1018	99.0	101.2
kΩ					
1.00026	1.001	0.9%+1	0.010009	0.990	1.010
10.0025	10.00	0.9%+1	0.1	9.90	10.10
100.04	100.0	0.9%+1	1	99.03	101.05
MΩ					
0.9941	0.992	0.9%+1	0.009928	0.984	1.004
9.964	9.95	5%+2	0.5175	9.44	10.49

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

Resistance Test Voltage	
Low Range	2.51 V
Medium Range	0.99 V
High Range	0.49 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
0.9941	1.000	1.9%+2	0.021	0.960	1.028
9.935	10.00	1.9%+2	0.21	9.68	10.19
99.50	100.0	1.9%+2	2.1	96.9	102.1
µF					
1.0084	1.009	1.9%+2	0.021	0.982	1.035
10.818	11.1	1.9%+2	0.233	10.53	11.10
112.91	113	1.9%+2	4.147	108	118
1000	1007	1.9%+2	21.133	973	1027

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

Diode

Max Diode Voltage	2.51 V
Max Diode Current	0.860 mA

This will light the red and yellow LED and dimly lights the green LED. The meter will sound a short beep when the diode (but not LED) voltage drop is in the normal range. I will continuously beep if the diode is shorted.

Continuity

Slow but it does latch.

Accuracy Specifications Comparison

Model	Uni-T UT161D	Klein MM720	EEVBlog Brymen BM235	Fluke 17B MAX	Greenlee DM-510A	Fluke 117	Fluke 177	Fluke 87V	Fluke 87V MAX
Cost	$89.98	$99.99	$114.69	$139.97	$148.99	$235.99	$382.50	$433.25	$530.10
Count	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
DC mV Low	0.8%+3	0.5%+5	0.3%+2	1%+10	0.4%+5	0.5%+2	0.09%+2	0.1%+1	0.1%+1
DC mV High	0.8%+3	0.5%+5	0.3%+2	1%+10	0.4%+5	0.5%+2	0.09%+2	0.1%+1	0.1%+1
DC V Low	0.5%+3	0.5%+5	0.4%+2	0.5%+3	0.2%+3	0.5%+2	0.09%+2	0.05%+1	0.05%+1
DC V High	0.5%+3	0.8%+3	0.4%+2	0.5%+3	0.2%+3	0.5%+2	0.15%+2	0.05%+1	0.05%+1
AC mV	1.2%+5	1.0%+3	1%+3	3%+3	1%+5	1.0%+3	1.0%+3	0.7%+4	0.7%+4
AC V	1%+3	1.0%+3	0.7%+3	1%+3	1%+5	1.0%+3	1.0%+3	0.7%+2	0.7%+2
DC µA	1%+2	1.0%+3	1%+3	1.5%+3	0.5%+5	N/A	N/A	0.2%+4	0.2%+4
DC mA	1%+3	1.0%+3	0.7%+3	1.5%+3	0.5%+5	N/A	1.0%+3	0.2%+4	0.2%+4
DC A	1.2%+5	1.5%+3	0.7%+3	1.5%+3	1.2%+6	1.0%+3	1.0%+3	0.2%+4	0.2%+4
AC µA	1.2%+5	1.0%+5	1.5%+3	1.5%+3	1%+3	N/A	N/A	1%+2	1%+2
AC mA	1.5%+5	1.0%+5	1%+3	1.5%+3	1%+3	N/A	1.5%+3	1%+2	1%+2
AC A	2%+5	2.0%+3	1%+3	1.5%+3	1.2%+6	1.5%+3	1.5%+3	1%+2	1%+2
Ω	1.2%+2	1.2%+5	0.3%+3	0.5%+3	0.5%+4	0.9%+2	0.9%+2	0.2%+2	0.2%+2
Low kΩ	1%+2	1.2%+5	0.3%+3	0.5%+2	0.5%+4	0.9%+1	0.9%+1	0.2%+1	0.2%+1
High kΩ	1%+2	1.2%+5	0.5%+3	0.5%+2	0.5%+4	0.9%+1	0.9%+1	0.6%+1	0.2%+1
Low MΩ	1.2%+2	1.2%+5	0.9%+2	0.5%+2	0.7%+4	0.9%+1	0.9%+1	0.6%+1	0.2%+1
High MΩ	2%+5	2.0%+10	0.9%+2	1.5%+3	1.2%+4	5%+2	1.5%+3	1%+3	1%+1
Low nF	3%+5	3.5%+10	1.5%+8	2%+5	2%+5	N/A	N/A	1%+2	1%+2
High nF	3%+5	3.0%+5	1.5%+8	2%+5	2%+5	1.9%+2	1.2%+2	1%+2	1%+2
Low µF	3%+5	3.0%+5	1.5%+2	5%+5	1.5%+5	1.9%+2	1.2%+2	1%+2	1%+2
High µF	10%+5	3.5%+5	4.5%+10	5%+5	2%+5	1.9%+2	10%	1%+2	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 high megaohm range.

The Fluke 117 has below average accuracy specifications, but not the worst except in the High Megaohm range, for this group of 6000 count meters.

LowZ

The meter has a LowZ position on the rotary switch. It measures AC or DC voltage with 3 kΩ 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 $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 and are not gold plated.

Ergonomics

The screen is easy to read and has a medium brightness backlight. The rotary dial is easy to turn and the meter is designed so you could hold it in you left hand and move the rotary dial with you left thumb for one handed operation.

Power-Up Options

If you hold down one of the buttons listed below while turning on the meter the associated options will be activated.

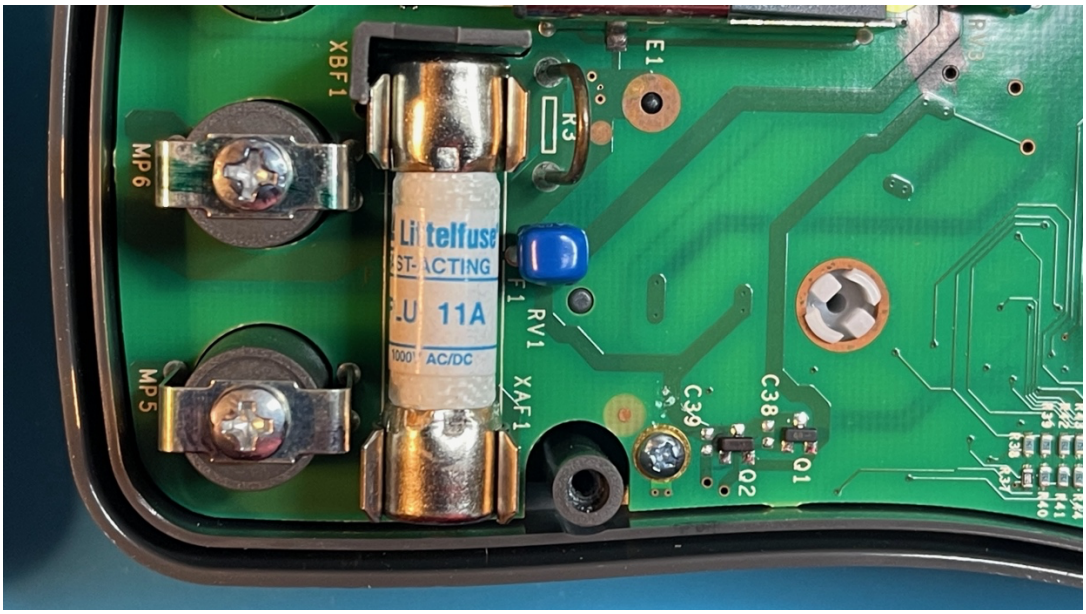
Button	Power-Up Options
Hold	Turns on all display segments until button is released.
Min/Max	Disables beeper. bEEP shows when enabled.
Range	Enables low impedance capacitance measurements. LCAP shows when enabled.
Yellow	Disables Battery SaverTM (Sleep mode). PoFF shows when enabled.
Backlight	Disables auto backlight off. LoFF is displayed when enabled.

Battery

The meter uses one 9-volt battery accessible from the back by removing the battery cover. The battery cover has one non-captured Philips screw that mates with a brass insert.

Fuses

You must open the meter by removing two self-taping screws to access the fuse.



The manual states the fuse is the follows.
11 A, 1000 V, FAST fuse having a minimum interrupt rating of 17,000 A. Use only Fluke PN 803293.

Pros

- Third-party safety testing by CSA.
- Most readings taken met the accuracy specifications as stated in the manual.
- You can disable the auto backlight off function.
- The lowest amp range has 1 mA resolution so you can accurately measure 10 mA and higher.

Cons

- No milliamp or microamp ranges.
- 1 millivolt AC reading shows as 0.
- No better accuracy specifications then lower cost meters.
- Does not have the Fluke Limited-Lifetime Warranty, only 3 years.

Conclusion

I believe the Fluke 117 is a very good meter for it intended market of electricians.
I do not recommend this meter for electronic projects because it is missing milliamps and microamps ranges. If you want a Fluke meter for electronic projects, I recommend the Fluke 87V Max or the Fluke 87V. If you want a lower cost 6000 count meter I would recommend the Greenlee DM-510A or the EEVBlog Brymen BM-235. For about the same price as the Fluke 117 or less consider these meters.

Meter	Count	Basic DC Accuracy	Price
EEVblog 121GW	50,000	0.05%+5	$225.00
Brymen BM869s	50,000	0.02%+2	$206.60
Brymen BM789	60,000	0.03%+2	$171.62
Brymen BM525s	10,000	0.08%+2	$171.62
EEVblog Brymen BM786	60,000	0.03%+2	$154.11
Uni-T UT161E	22,000	0.05%+5	$128.77