EEVBlog BM-235 Review

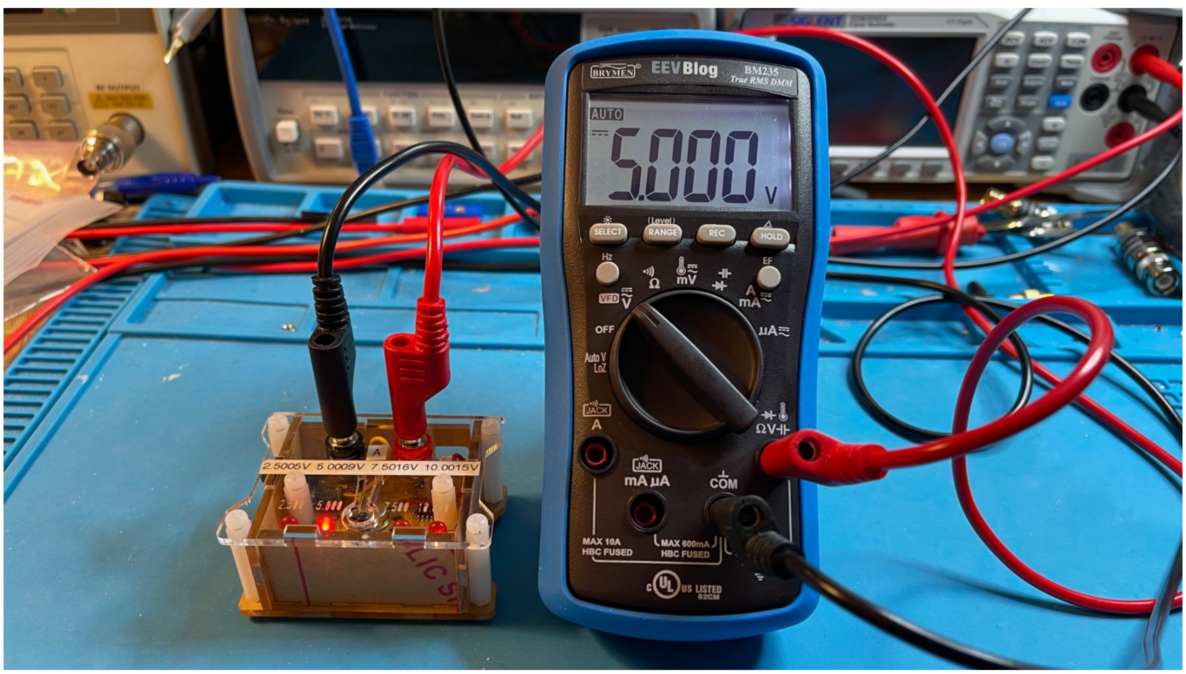
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the EEVBlog BM-235 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 EEVBlog BM-235 multimeter that I purchased from Amazon for $139.00. 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 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.

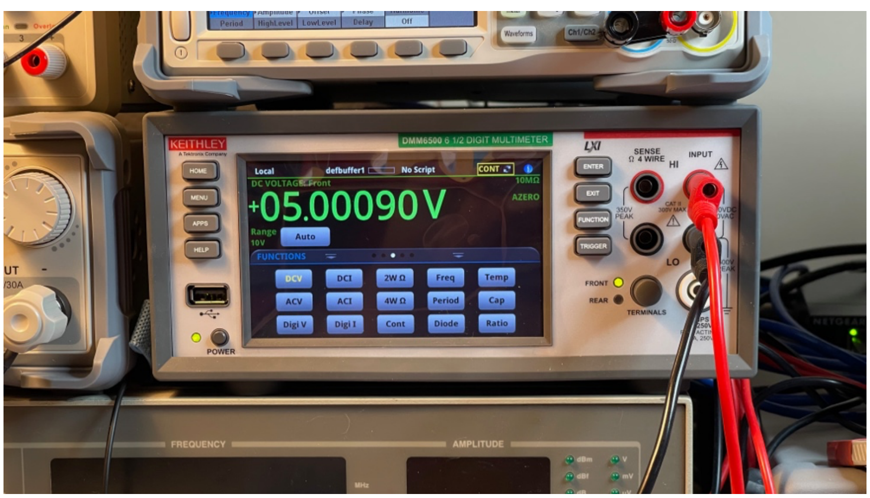
Objectives

This review was produced to help you decide if the EEVBlog BM-235 multimeter will fit your purpose and budget. This is part of a series of multimeters reviews.
A good multimeter for hobby electronics projects should be able to measure millivolts, volts, microamps, milliamps, amps, ohms, nanofarads and microfarads.
If you want to measure picofarads, nanohenrys, microhenrys or reactance you will need an LCR meter. I cover the two LCR meters I own in another review.

Features

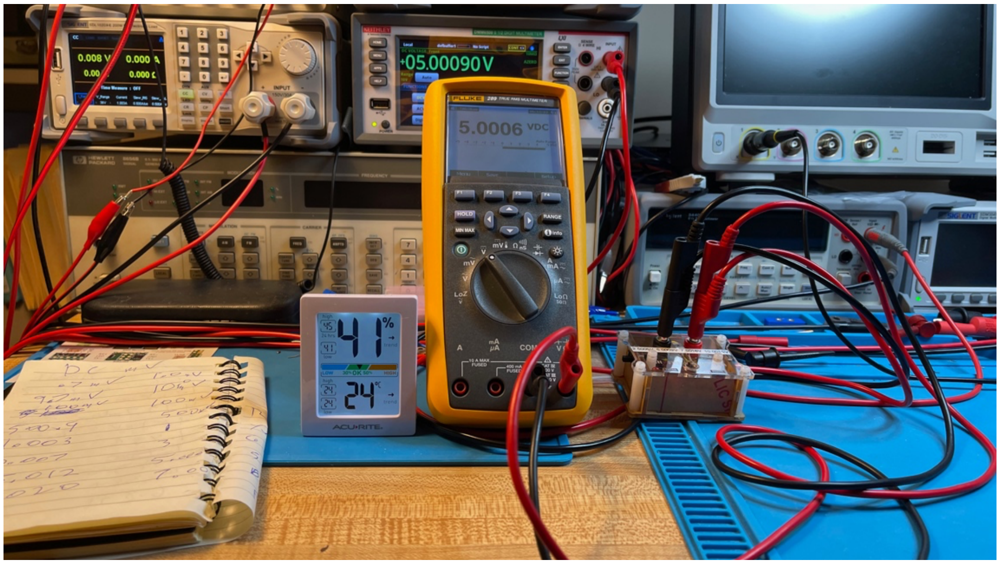
- UL C USA Listed
- CAT II 1000V, CAT III 600V, CAT IV 300V
- 6,000 Count
- Basic DC Accuracy ±(0.3% + 2)
- True-RMS
- Min/Max/Avg (Rec button)
- Hold
- Rel
- Non-Contact EF-Detection (NCV) With Hi/Lo Selectable Sensitivities
- AutoV LoZ Feature
- VFD Variable-Frequency-Drives (Low Pass Filter)
- K-Type Thermocouple
- Fuse Access from Battery Compartment
- 240-Hour Battery Life
- 1-Year Limited Warranty
- 2 AAA Batteries Included

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 use the meter under test to 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
1 mVDC	1.01	0.3% + 2	0.02303	0.97344	1.02656
10 mVDC	10.00	0.3% + 2	0.05	9.9462	10.0538
100 mVDC	100.0	0.3% + 2	0.5	99.4935	100.5065
500 mVDC	500.1	0.3% + 2	1.7003	498.2812	501.7188
1 VDC	1.000	0.3% + 2	0.005	0.99497	1.00503
3 VDC	3.000	0.3% + 2	0.011	2.988875	3.011125
5.009 VDC	5.000	0.3% + 2	0.017	4.99182478	5.02617523
7 VDC	7.00	0.4% + 2	0.048	6.951775	7.048225
10.00148 VDC	10.01	0.4% + 2	0.06004	9.94114	10.06182
103.3765 VDC	103.3	0.2% + 2	0.40660	102.96516	103.78784
203.467 VDC	203.5	0.2% + 2	0.60700	202.84586	204.08814
299.603 VDC	299.5	0.2% + 2	0.79900	298.78602	300.41998
406.850 VDC	406.7	0.2% + 2	1.01340	405.81433	407.88567
508.078 VDC	508.1	0.2% + 2	1.21620	506.83548	509.32052
631.894 VDC	632.2	0.2% + 2	1.46440	630.39832	633.38968

The meter met its accuracy specifications for all the DC voltages I tested. The DC millivolts and volts accuracy specifications are average for this group of 6,000 count meters.

VDC Input	11 MΩ
mVDC input	10 MΩ

Both VDC and mVDC inputs have 10 MΩ or greater 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
100Hz Squarewave					
4.999 VAC	4.959	2% + 3	0.1030	4.8960	5.1020
60 Hz Sinewave					
1.02 mVAC	1.00	1% + 3	0.04	0.949388	1.090612
10 mVAC	10.00	1% + 3	0.13	9.834	10.166
100.7 mVAC	100.0	1% + 3	1.3	99.30958	102.09042
500 mVAC	500.6	1% + 3	5.306	494.094	505.906
1.000 VAC	1.000	0.7% + 3	0.01	0.9891	1.0109
3.012 VAC	3.012	0.7% + 3	0.024084	2.9831088	3.0408912
5.010 VAC	5.010	0.7% + 3	0.03807	4.965924	5.054076
7.003 VAC	7.01	0.7% + 3	0.07907	6.9167282	7.0892718

The meter met its accuracy specifications for all the AC voltages that I tested. The AC volts for 60 Hz accuracy specifications are above average for this group of meters. The AC millivolts accuracy specifications are average for this group of meters.

ACV 1V 3dB cutoff	3 kHz

The low frequency of the cutoff is typical of low-cost meters.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC 100Hz Squarewave					
0.999 mA	0.98	1.0% + 3	0.0400	0.9590	1.0390
DC					
0.896 µA	0.9	1.0% + 3	0.309	0.5860968	1.2059032
9.217 µA	9.2	1.0% + 3	0.392	8.82035235	9.61364765
99.03 µA	98.9	1.0% + 3	1.289	97.6914365	100.368564
131.86 µA	131.8	1.0% + 3	1.618	130.182613	133.537387
1.0088 mA	1.00	0.7% + 3	0.037	0.97129604	1.04630396
9.9917 mA	9.99	0.7% + 3	0.09993	9.88927166	10.0941283
99.415 mA	99.4	0.7% + 3	0.9958	98.394317	100.435683
1.000 A	1.000	0.7% + 3	0.01	0.98955	1.01045
3.000 A	3.001	0.7% + 3	0.024007	2.974373	3.025627

The meter met its accuracy specifications for all the current values I tested. AC milliamps and amps accuracy specifications are above average. The other accuracy specifications are average for this group of meters.

A Shunt Resistance	0.030 Ω
mA Shunt Resistance	2.45 Ω
µA Shunt Resistance	101.67 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
1.0054 Ω	1.0	0.3% + 3	0.303	0.70211454	1.30868546
10.007 Ω	10.0	0.3% + 3	0.33	9.67594941	10.3380506
100.07 Ω	99.9	0.3% + 3	0.5997	99.4597941	100.680206
1.0011 kΩ	0.999	0.3% + 3	0.005997	0.99502192	1.00717808
10.001 kΩ	9.99	0.5% + 3	0.07995	9.92023993	10.0817601
100.01 kΩ	99.9	0.5% + 3	0.7995	99.2019993	100.818001
0.9936 MΩ	0.994	0.9% + 2	0.010946	0.98254864	1.00465136
9.97 MΩ	9.97	0.9% + 2	0.10973	9.856182	10.083818

The meter met its accuracy specifications for all the resistance values I tested. The accuracy specifications for the resistance ranges 600 Ω, 6 kΩ and 60 MΩ are above average for this group of 6,000 count meters. The other ranges' accuracy specifications are average for this group of meters.

Resistance Test Voltage	
Low Range	1.70 V
Medium Range	1.5 V
High Range	0.102 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
0.0093 nF	0.02	1.5% + 8	0.0803	0	0.0946744
0.1024 nF	0.11	1.5% + 8	0.08165	0.0149308	0.1898692
1.008 nF	1.02	1.5% + 8	0.0953	0.899636	1.116364
9.941 nF	9.95	1.5% + 8	0.22925	9.661986	10.220014
99.45 nF	99.3	1.5% + 8	2.2895	96.6627	102.2373
1.00081 µF	1.012	1.5% + 2	0.03518	0.9678876	1.0483124
10.916 µF	11.12	1.5% + 2	0.1868	10.675536	11.156464
113.83 µF	113.2	1.5% + 2	1.898	111.37668	116.28332
986.5 µF	1009	1.5% + 2	17.135	959.4325	1013.5675

The meter met its accuracy specifications for all the capacitance values I tested. The uncertainty for the 10pF and 100pF is so large that the readings are not meaningful. The accuracy specification for capacitance is average for this group of 6,000 count meters.

Diode

Max Diode Voltage	3.24 V
Max Diode Current	0.324 mA

This lit the LEDs I tested.

Continuity

It is fast and latches and backlight blinks.

Test Leads

The test leads were a flexible silicon type with gold plated tips. The meter also came with a thermocouple for measuring temperature. I did not test temperature measurements.

Ergonomics

The rotary switch is easy to turn and firmly clicks into place.
The meter is slippery when using the bail on a smooth surface.
The display is big with big numbers. The backlight is bright and even, except for a hotspot on the right side.

Battery

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

Fuses

The fuses are accessible from the battery compartment. The manual states the fuses are Fuse F1 for µA & mA current input: 400mA/1000V DC/AC, IR 10kA FAST fuse or better; Dimension: 6 x 32 mm; Fuse F2 for A current input: 11A/1000V DC/AC, IR 20kA FAST fuse or better; Dimension: 10 x 38mm

Pros

- Under $150
- Third-party safety tested by UL
- All measurements met accuracy specification
- Above average accuracy AC volts
- Above average accuracy AC milliamps & amps
- Above average accuracy 600Ω, 6 kΩ, 6 MΩ and 60 MΩ ranges

- Fuses accessible from battery compartment
- 1-year warranty

Cons

- Capacitance readings below 1nF are not useful
- Must send to Taiwan for warranty service

Conclusion

I think the EEVBlog BM-235 is one of the two meters in the sweet spot of price vs performance in this group of 6,000 count meters.
The only drawback is sending the meter to Taiwan for warranty work. You may be able to send it to EEVBlog for warranty repair, but that is in Australia.
In the group of 6,000 count meters I reviewed, this is the lowest-cost one I would recommend.