

Brymen BM525s Review

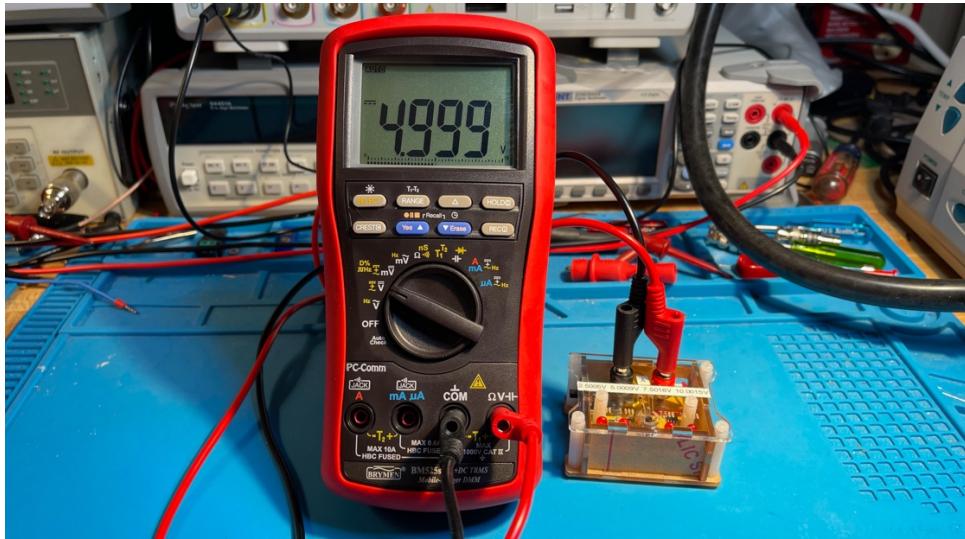
Introduction

Hi, I am Tom, amateur radio call sign N8FDY. This is a review of the Brymen BM525s 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 Brymen BM525s multimeter that I purchased from Welectron, Germany for 158.82 €, \$171.62 US.

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 Brymen BM525s 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

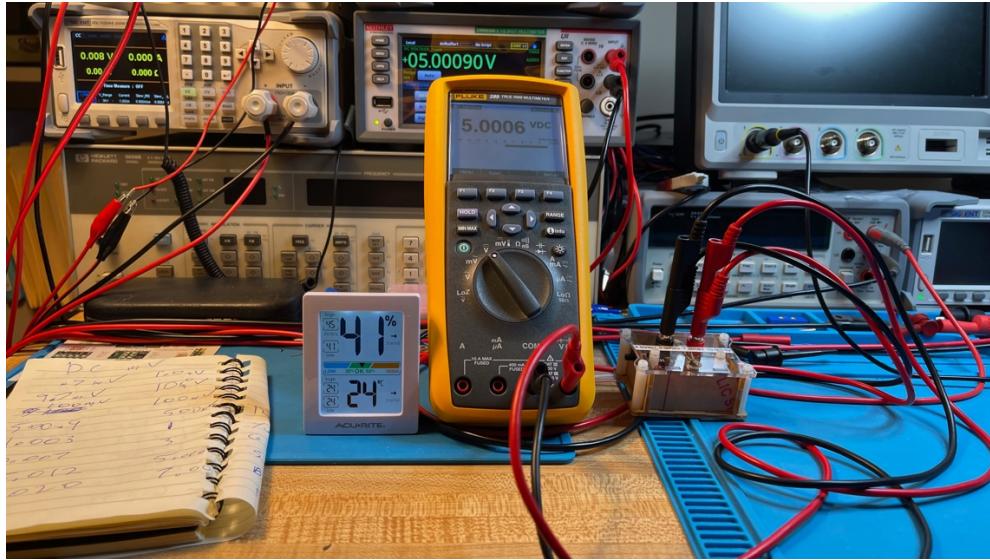
- UL C US Listed
- CAT IV 1000V
- 10,000 Count
- Basic DC Accuracy $\pm(0.08\%+2)$
- 41 Segment Bar Graph
- True-RMS
- Min/Max
- Crest (Peak Hold)
- Rel/Delta
- Stand-Alone Data-Logging
- Optional PC Logging
- Lo-Z Volts
- AutoCheck™ Feature (Automatic DCV, ACV, Lo-Z Volts, & Ohms Selection)
- One 9 Volt Batteries Included
- 1 Year 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 $\pm(0.0025\% \text{ of reading} + 0.0005\% \text{ of range})$, 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	1.09	0.12%+2	0.021308	1.07	1.11
10.1123	10.12	0.12%+2	0.032144	10.08	10.15
25.0348	25.03	0.12%+2	0.050036	24.98	25.09
100.0086	99.9	0.06%+2	0.07994	99.9	100.1
250.189	250.1	0.06%+2	0.35006	249.8	250.6
500.070	500.0	0.06%+2	0.5	499.6	500.6
V DC					
1.000675	1.000	0.08%+2	0.0028	0.998	1.004
2.00054	1.999	0.08%+2	0.0035992	1.997	2.004
2.50052	2.499	0.08%+2	0.0039992	2.496	2.505
3.00059	2.999	0.08%+2	0.0043992	2.996	3.005
4.00025	3.999	0.08%+2	0.0051992	3.995	4.006
5.00010	4.998	0.08%+2	0.0059984	4.994	5.006
5.00089	4.999	0.08%+2	0.0059992	4.995	5.007
6.00087	5.999	0.08%+2	0.0067992	5.994	6.008
7.00088	6.998	0.08%+2	0.0075984	6.993	7.009
7.50159	7.499	0.08%+2	0.0079992	7.493	7.510
10.00030	9.998	0.08%+2	0.0099984	9.990	10.011
15.0002	14.99	0.08%+2	0.031992	14.97	15.03
30.0003	29.98	0.08%+2	0.043984	29.95	30.05
96.8832	96.7	0.08%+2	0.27736	96.6	97.2
188.940	188.7	0.08%+2	0.35096	188.6	189.3
276.573	276.3	0.08%+2	0.42104	276.1	277.0
376.567	376.1	0.08%+2	0.50088	376.0	377.1
473.549	473.1	0.08%+2	0.57848	472.9	474.2
601.737	601.1	0.08%+2	0.68088	601.0	602.4

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

VDC Input	10 MΩ
mVDC input	10 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	5.003	1.0%+4	0.05403	4.939	5.059
mV AC 60 Hz Sinewave					
1.0300	1.04	0.5%+3	0.0352	0.99	1.07
5.0168	5.03	0.5%+3	0.05515	4.96	5.07
10.0338	10.03	0.5%+3	0.08015	9.95	10.12
25.0934	25.12	0.5%+3	0.1556	24.92	25.26
50.0430	50.12	0.5%+3	0.2806	49.73	50.35
100.334	99.90	0.5%+3	0.5295	99.74	100.92
250.445	250.7	0.5%+3	1.5535	248.7	252.1
502.229	503.1	0.5%+3	2.8155	499.1	505.3
V AC 60 Hz Sinewave					
0.502214	0.504	0.5%+3	0.00552	0.496	0.508
1.002205	1.005	0.5%+3	0.008025	0.993	1.011
2.00141	2.001	0.5%+3	0.013005	1.984	2.019
3.01210	3.015	0.5%+3	0.018075	2.989	3.035
4.01152	4.019	0.5%+3	0.023095	3.983	4.040
5.00980	5.018	0.5%+3	0.02809	4.976	5.044
6.00672	6.014	0.5%+3	0.03307	5.967	6.046
7.00465	7.015	0.5%+3	0.038075	6.959	7.050

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

ACV 1V 3dB cutoff	20.8 kHz
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The cutoff frequency is low but good enough for audio measurements..

AC+DC

This meter has an AC+DC measurement mode.

The formula for measuring True-RMS with AC and DC components:

$$V_{rms} = \sqrt{V_{ac}^2 + V_{dc}^2}$$

A meter with AC+DC calculates this for you.

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC+DC					
2.0675	2.070	0.7% + 6	0.02049	2.043	2.092
3.3561	3.367	0.7% + 6	0.029569	3.322	3.390
3.3628	3.363	0.7% + 6	0.029541	3.331	3.394
4.7316	4.722	0.7% + 6	0.039054	4.690	4.773

The meter met its accuracy specifications for all the AC+DC values I tested.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC mA 100Hz Squarewave					
0.999652	1.01	0.8%+4	0.04808	0.95	1.05
DC μA					
0.89491	0.8	0.2%+4	0.4016	0.5	1.3
9.21686	9.1	0.2%+4	0.4182	8.8	9.6
99.0167	99.1	0.2%+4	0.5982	98.4	99.7
131.940	131.8	0.2%+4	0.6636	131.2	132.7
DC mA					
1.009040	1.00	0.2%+4	0.042	0.97	1.05
9.99244	9.98	0.2%+4	0.05996	9.93	10.05
99.4254	99.4	0.2%+4	0.5988	98.80	100.05
250.737	250.5	0.2%+4	0.901	249.78	251.69
500.978	500.4	0.2%+4	1.4008	499.38	502.58
DC Amps					
1.000886	1.000	0.2%+4	0.006	0.994	1.007
2.000386	2.000	0.2%+4	0.008	1.991	2.010
3.000046	3.001	0.2%+4	0.010002	2.988	3.012

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

A Shunt Resistance	0.02 Ω
mA Shunt Resistance	2.06 Ω
μ A Shunt Resistance	84.10 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	1.1	0.1%+3	0.0311	1.0	1.1
10.004	10.0	0.1%+3	0.31	9.7	10.3
100.08	100.1	0.1%+3	0.4001	99.7	100.5
$k\Omega$					
1.020	1.1	0.1%+3	0.0311	1.0	1.1
10.004	10.0	0.1%+3	0.31	9.7	10.3
100.08	100.1	0.1%+3	0.4001	99.7	100.5
$M\Omega$					
0.99425	0.994	0.4%+3	0.006976	0.987	1.001
9.968	9.97	1.5%+5	0.19955	9.76	10.17
99.80	N/A				

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

Resistance Test Voltage	
Low Range	1.22 V
Medium Range	0.86 V
High Range	0.46 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
1.01	1.03	0.8%+3	0.03824	0.96	1.06
9.966	9.98	0.8%+3	0.10984	9.81	10.13
99.45	99.90	0.8%+3	0.8292	98.12	100.78
μF					
1.0077	1.011	1%+3	0.01311	0.990	1.026
10.882	11.00	2%+3	0.25	10.58	11.19
113.40	113.3	3.5%+5	4.4655	108.4	118.4
1000	1004	5%+5	55.2	939	1061

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

Diode

Max Diode Voltage	3.19 V
Max Diode Current	375 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.

Accuracy Specifications Comparison

Value	Uni-T UT161D	EEVBlog Brymen BM235	Uni-T U161E	Greenlee DM-510A	EEVblog Brymen BM786	Brymen BM525s	Brymen BM789	Greenlee DM-820	Uni-T UT181A
Price	\$89.98	\$114.69	\$128.77	\$148.99	\$154.11	\$171.62	\$171.62	\$187.66	\$400.99
Count	6,000	6,000	22,000	6,000	60,000	10,000	60,000	10,000	60,000
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
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
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
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
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
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
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
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
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
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
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
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
AC A	2%+5	1%+3	1.2%+10	1.2%+6	1%+30	0.8%+6	1%+30	0.8%+6	1%+20
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
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
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
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
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
Low nF	3%+5	1.5%+8	3%+5	2%+5	1%+10	0.8%+3	1%+10	0.8%+3	3%+10
High nF	3%+5	1.5%+8	3%+5	2%+5	1%+2	0.8%+3	1%+2	0.8%+3	2%+5
Low μ F	3%+5	1.5%+2	3%+5	1.5%+5	1%+2	1%+3	1%+2	1%+3	2%+5
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

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-\$180 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 semi soft type, and the tips appear gold plated.

Ergonomics

The rotary switch is easy to turn and firmly clicks into place.

It has a large display with big numbers on the primary display and small numbers on the secondary display. The backlight is bright and evenly lit except for a hotspot on the left.

The following functions are enabled when you hold down a button when you turn on the meter:

Button	Power On Action
Range	Disable beep tone
SELECT	Disable Auto Power Off (APO)

Logging

This meter can standalone log 43,000 data point in dual display mode or 87,000 in single display mode.

You can buy (from Welectron, Germany for 33.53 €, \$35.56 US) an optional optically isolated USB connection and software on a CD or download the free PC software from Brymen.com to connect to the meter.



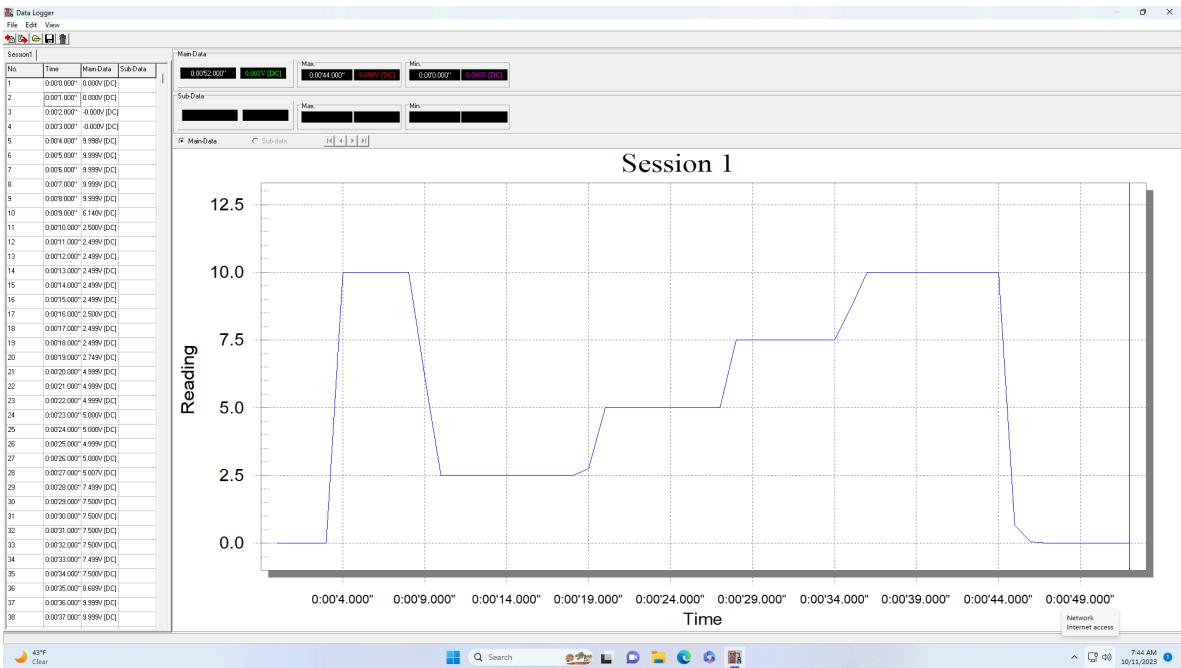
The interface is attached to the back of the meter.



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



You can load the standalone data collected in the meter to the PC.



Battery

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



Fuses

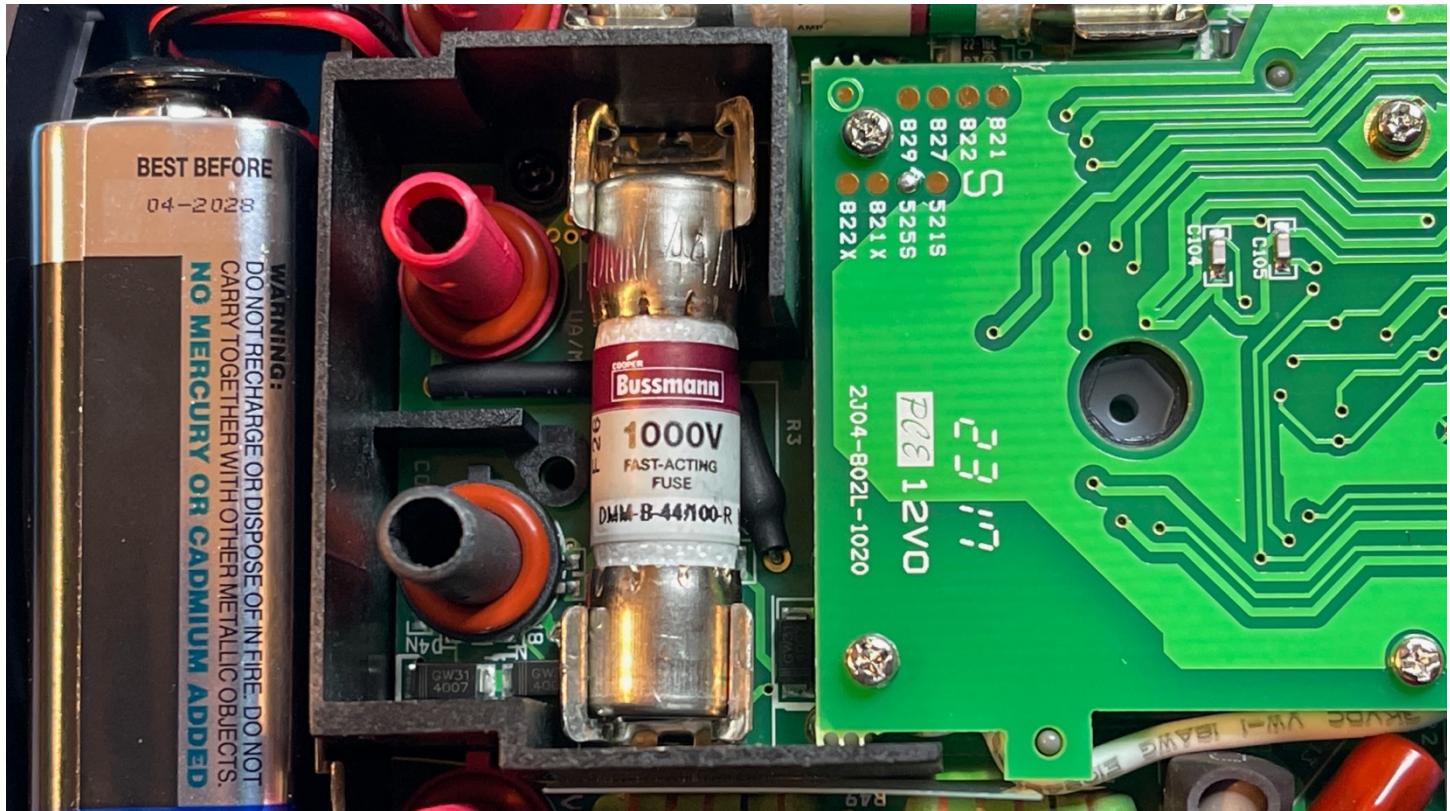
You must disassemble the meter to change the fuses. Remove the battery cover then unscrew four self-tapping captive screws and pull the case apart.



The manual states the fuses are as follows.

Fuse (FS1) for μ A/mA current input:

0.44A/1000Vac & Vdc, IR 10kA or better, F fuse; Dimension: 10 x 38 mm



Fuse (FS2) for A current input:

11A/1000Vac & Vdc, IR 20kA or better, F fuse; Dimension: 10 x 38 mm



Pros

- Third-party safety testing by UL to meet US and Canada standards.
- All the measurements taken met the accuracy specifications as stated in the manual.
- Good accuracy specifications for a 10,000-count meter.
- Stand-Alone Data-Logging for 43,000 data point in dual display mode.
- Optional PC USB interface with free software.

Cons

- The backlight only stays on for 32 seconds.
- No Bluetooth interfaces.
- Must send to Taiwan for service.

Conclusion

This is a good 10,000-count meter with stand-alone logging. It also has an optional USB connection with freely downloadable windows software to access the stored data in the meter.