Greenlee DM-820A Review

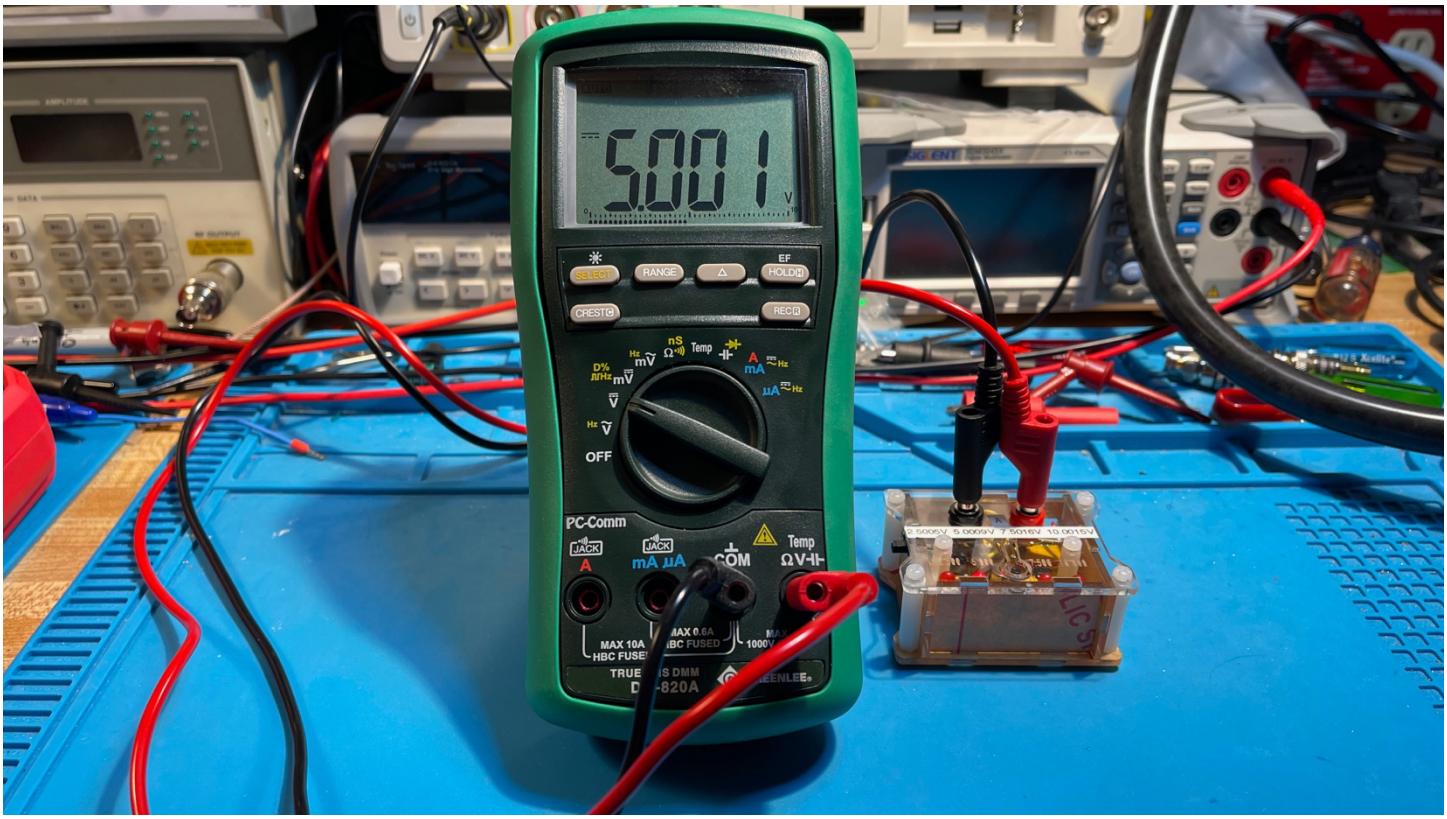
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the Greenlee DM-820A 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 Greenlee DM-820A multimeter that I purchased from Amazon for $201.37. 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.

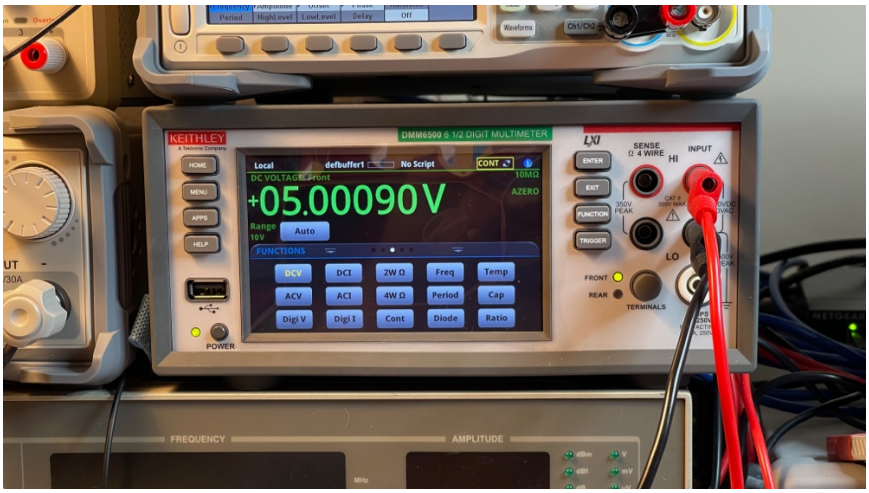
Objectives

This review was produced to help you decide if the Greenlee DM-820A 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

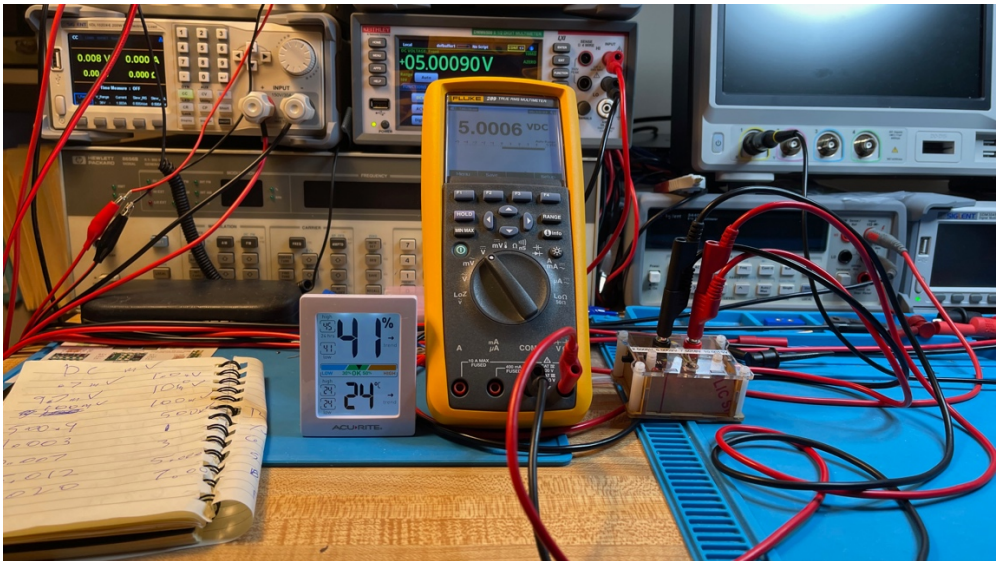
- UL C US Listed
- CAT IV 1000V
- 10,000 Count
- Basic DC Accuracy ±(0.08%+2)
- 41 Segment Bar Graph
- True-RMS
- Min/Max/Avg (Rec)
- Crest (Peak Hold)
- Rel/Delta
- Optional PC Logging
- One 9 Volt Batteries Included
- Lifetime Limited Warranty

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					
1.0878	1.09	0.12%+2	0.021308	1.07	1.11
10.1123	10.13	0.12%+2	0.032156	10.08	10.15
25.0348	25.04	0.12%+2	0.050048	24.98	25.09
100.0086	100.0	0.06%+2	0.08	99.93	100.09
250.189	250.2	0.06%+2	0.17012	250.01	250.37
500.070	500.1	0.06%+2	0.32006	499.73	500.41
V DC					
1.000675	1.0000	0.08%+2	0.001	0.9996	1.0018
2.00054	2.0010	0.08%+2	0.0018008	1.9986	2.0024
2.50052	2.5010	0.08%+2	0.0022008	2.4982	2.5028
3.00059	3.0010	0.08%+2	0.0026008	2.9979	3.0033
4.00025	4.0010	0.08%+2	0.0034008	3.9967	4.0038
5.00010	5.0020	0.08%+2	0.0042016	4.9957	5.0045
5.00089	5.0020	0.08%+2	0.0042016	4.9965	5.0053
6.00087	6.0030	0.08%+2	0.0050024	5.9957	6.0061
7.00088	7.003	0.08%+2	0.0076024	6.993	7.009
7.50159	7.504	0.08%+2	0.0080032	7.493	7.510
10.00030	10.00	0.08%+2	0.028	9.97	10.03
15.0002	15.00	0.08%+2	0.032	14.97	15.03
30.0003	30.01	0.08%+2	0.044008	29.95	30.05
96.8832	96.8	0.08%+2	0.27744	96.6	97.2
188.940	188.8	0.08%+2	0.35104	188.6	189.3
276.573	276.4	0.08%+2	0.42112	276.1	277.0
376.567	376.4	0.08%+2	0.50112	376.0	377.1
473.549	473.4	0.08%+2	0.57872	472.9	474.2
601.737	601.7	0.08%+2	0.68136	601.0	602.5

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	5.007	1%+4	0.05407	4.939	5.059
mV AC 60 Hz Sinewave					
1.0300	1.04	0.5%+3	0.0352	0.99	1.07
5.0168	5.04	0.5%+3	0.0552	4.96	5.08
10.0338	10.02	0.5%+3	0.0801	9.95	10.12
25.0934	25.13	0.5%+3	0.15565	24.92	25.26
50.0430	50.13	0.5%+3	0.28065	49.73	50.35
100.334	99.9	0.5%+3	0.7995	99.5	101.2
250.445	250.9	0.5%+3	1.5545	248.7	252.2
502.229	503.3	0.5%+3	2.8165	499.1	505.3
V AC 60 Hz Sinewave					
0.502214	0.505	0.5%+3	0.005525	0.496	0.508
1.002205	1.005	0.5%+3	0.008025	0.993	1.011
2.00141	2.003	0.5%+3	0.013015	1.984	2.019
3.01210	3.017	0.5%+3	0.018085	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	6.019	0.5%+3	0.033095	5.967	6.046
7.00465	7.020	0.5%+3	0.0381	6.959	7.050

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

ACV 1V 3dB cutoff	20.6 kHz

The cutoff frequency is low but good enough for audio measurements..

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	1.0	0.2%+4	0.402	0.5	1.3
9.21686	9.3	0.2%+4	0.4186	8.8	9.6
99.0167	99.1	0.2%+4	0.5982	98.4	99.7
131.940	132.0	0.2%+4	0.664	131.2	132.7
DC mA					
1.009040	1.01	0.2%+4	0.04202	0.97	1.05
9.99244	10.00	0.2%+4	0.06	9.93	10.05
99.4254	99.4	0.2%+4	0.5988	98.8	100.0
250.737	250.7	0.2%+4	0.9014	249.8	251.7
500.978	500.8	0.2%+4	1.4016	499.4	502.6
DC Amps					
1.000886	1.002	0.2%+4	0.006004	0.994	1.007
2.000386	2.001	0.2%+4	0.008002	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	0.01 Ω
mA Shunt Resistance	2.01 Ω
µA Shunt Resistance	84.03 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	0.1%+3	0.301	0.7	1.3
10.004	10.0	0.1%+3	0.31	9.7	10.3
100.08	100.0	0.1%+3	0.4	99.7	100.5
kΩ					
1.00020	1.001	0.1%+3	0.004001	0.996	1.004
10.0023	10.00	0.1%+3	0.04	9.96	10.04
100.045	100.1	0.1%+3	0.4001	99.6	100.5
MΩ					
0.99425	0.995	0.4%+3	0.00698	0.987	1.001
9.968	9.98	1.5%+5	0.1997	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	1.23 V
Medium Range	0.86 V
High Range	0.46 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
1.01	1.07	1%+10	0.1107	0.89	1.13
9.966	9.98	1%+10	0.1998	9.72	10.22
99.45	99.7	1%+2	1.197	97.8	101.1
µF					
1.0077	1.008	1%+2	0.01208	0.991	1.025
10.882	10.98	1.8%+4	0.23764	10.59	11.17
113.40	113.0	1.8%+4	2.434	110.4	116.4
1000	998	1.8%+4	21.964	973	1027

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

Diode

Max Diode Voltage	3.18 V
Max Diode Current	509 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-820A	Uni-T UT181A
Price	$89.98	$114.69	$128.77	$148.99	$154.11	$171.62	$171.62	$191.77	$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 µA	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 µA	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 kΩ	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 kΩ	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 MΩ	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 MΩ	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 µF	3%+5	1.5%+2	3%+5	1.5%+5	1%+2	1%+3	1%+2	1%+3	2%+5
High µF	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-$190 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

You can buy (DMSC-9U from Amazon.com for $77.99) 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.

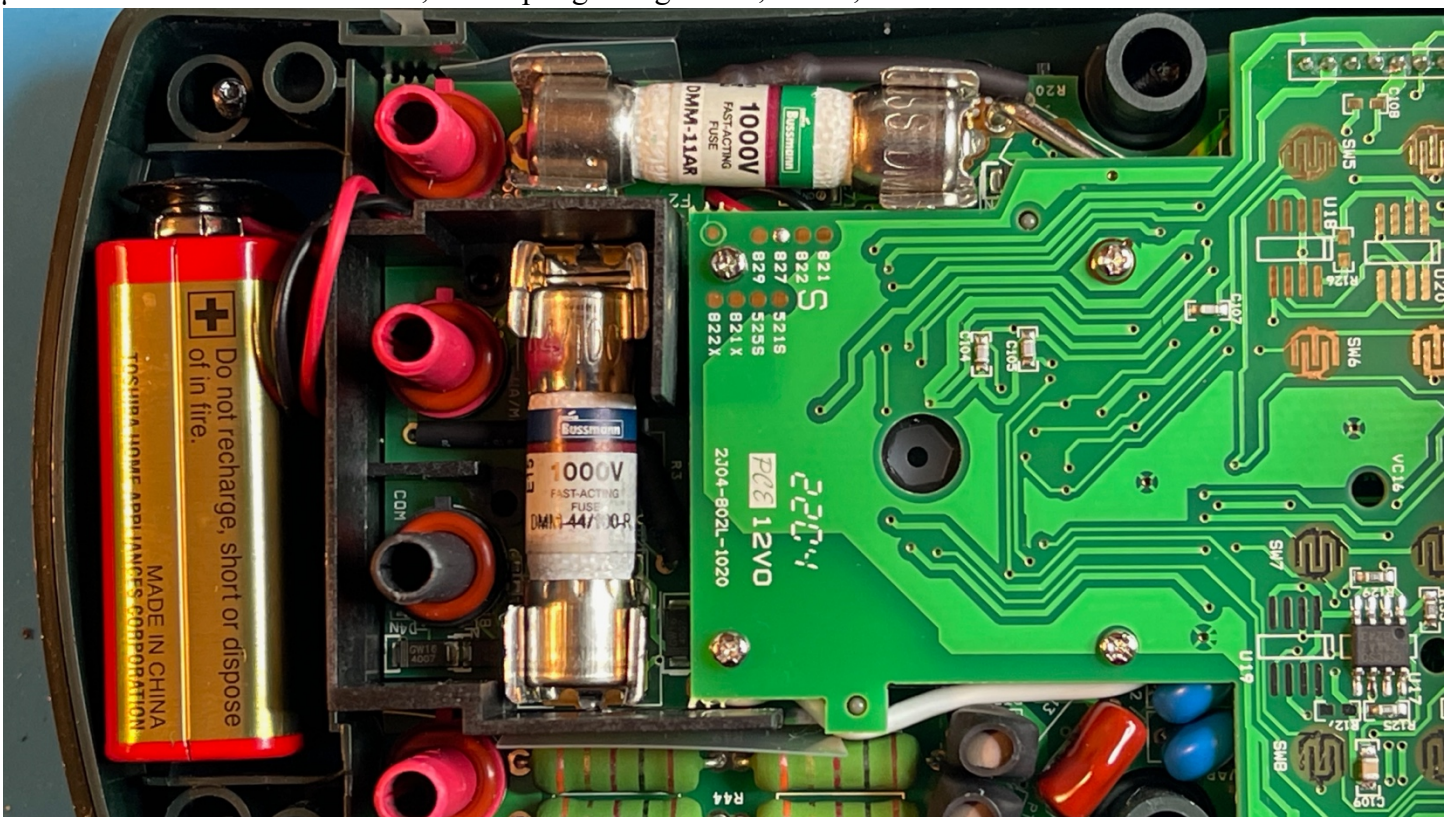
Battery

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.
A: 11 A / 1000 V fuse, interrupting rating 20 kA, F fuse, 13/32" x 1-1/2"
µA and mA: 0.44 A/1000 V fuse, interrupting rating 10 kA, F fuse, 13/32" x 1-1/2"



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.
- Optional PC USB interface with free software.
- Limited lifetime warranty with USA support

Cons

- The backlight only stays on for 32 seconds.
- No Bluetooth interface.

Conclusion

If you want a 10,000-count meter with US support and can use the PC based data logging this is a good choice. The DM-820A is more expensive than the BM-525s (that has more features), but you get the Greenlee limited lifetime warranty.