Greenlee DM-510A Review

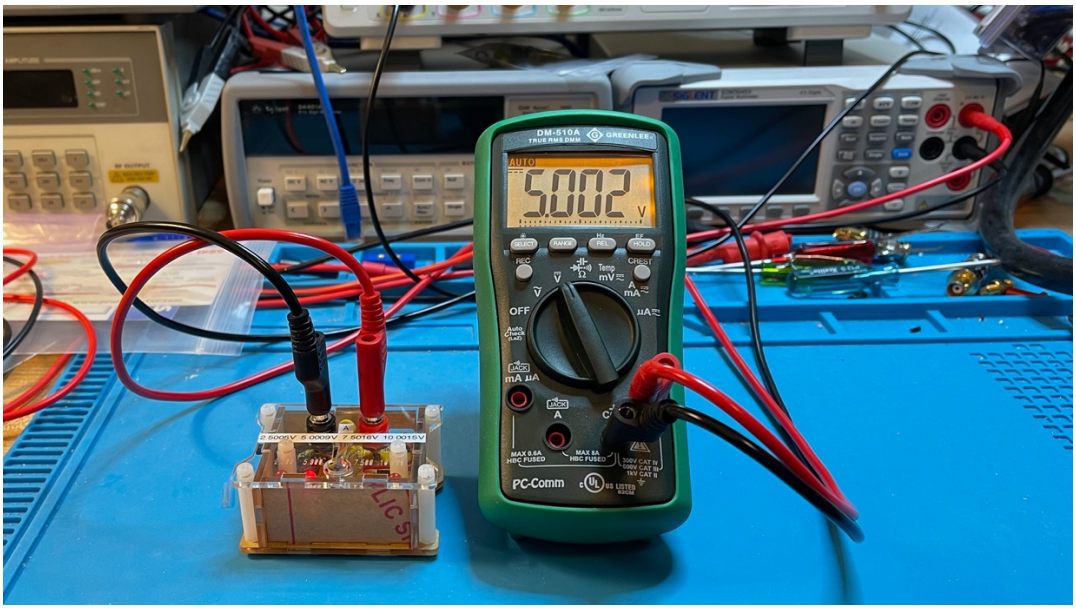
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the Greenlee DM-510A 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-510A multimeter that I purchased from Amazon for $148.99. 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 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-510A 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.

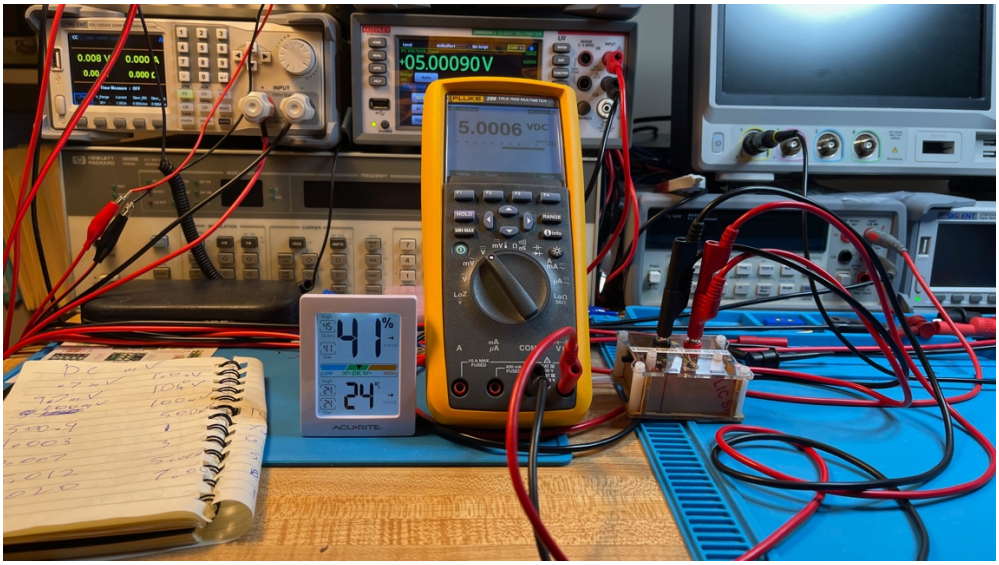
Features

- UL C USA Listed
- CAT II 1000V, CAT III 600V, CAT IV 300V
- 6,000 Count
- Basic DC Accuracy ±(0.2% + 3)
- True-RMS
- 24 Segment Analog Bar-graph Updates 40/Sec
- AutoCheck Feature (Automatic DCV, ACV & Ohms Selection)
- Lo-Z Volts Drain Ghost Voltages (AutoCheck Feature)
- Min/Max (Rec button)
- Hold
- Rel
- Non-Contact EF-Detection (NCV)
- K-Type Thermocouple
- Fuse Access Door
- Lifetime Limited Warranty
- Two 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	0.4% + 5	0.05404	0.94243	1.05757
10 mVDC	10.00	0.4% + 5	0.09	9.9062	10.0938
100 mVDC	100.0	0.2% + 3	0.5	99.4935	100.5065
500 mVDC	500.2	0.2% + 3	1.3004	498.6811	501.3189
1 VDC	1.001	0.2% + 3	0.005002	0.994968	1.005032
3 VDC	3.001	0.2% + 3	0.009002	2.990873	3.009127
5.009 VDC	5.002	0.2% + 3	0.013004	4.99582078	5.02217923
7 VDC	7.00	0.2% + 3	0.044	6.955775	7.044225
10.00148 VDC	10.00	0.2% + 3	0.05000	9.95118	10.05178
101.9299 VDC	101.8	0.2% + 3	0.50360	101.42162	102.43818
200.992v VDC	200.9	0.2% + 3	0.70180	200.27616	201.70784
294.984 VDC	295.0	0.2% + 3	0.89000	294.07620	295.89180
400.789 VDC	400.9	0.2% + 3	1.10180	399.66517	401.91283
500.32 VDC	500.6	0.2% + 3	1.30120	498.99279	501.64721
625.034 VDC	625.9	0.2% + 3	1.55180	623.45120	626.61680

The meter met its accuracy specifications for all the DC voltages I tested. The DC voltage accuracy specification is average for this group of 6,000 count meters.

VDC Input	11 MΩ
mVDC input	5 MΩ

The VDC input is 10 MΩ or greater resistance, which is good, so the meter is less likely to load down a high-impedance circuit when checking voltage. The mVDC input is 5 MΩ which is the lowest in this group of 6,000 count meters tested.

AC Volts

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
100Hz Squarewave					
4.999 VAC	4.980	1% + 5	0.0550	4.9440	5.0540
1.02 mVAC	1.02	1% + 5	0.0602	0.929188	1.110812
10 mVAC	10.04	1% + 5	0.1504	9.8136	10.1864
100.7 mVAC	100.5	1% + 5	1.505	99.10458	102.29542
500 mVAC	499.2	1% + 5	5.492	493.908	506.092
1.000 VAC	1.004	1% + 5	0.01504	0.98406	1.01594
3.012 VAC	3.015	1% + 5	0.03515	2.9720428	3.0519572
5.010 VAC	5.002	1% + 5	0.05502	4.948974	5.071026
7.003 VAC	7.04	1% + 5	0.1204	6.8753982	7.1306018

The meter met its accuracy specifications for all the AC voltages that I tested. The AC volts accuracy specification is average for this group of meters.

ACV 1V 3dB cutoff	8.4 kHz

The low frequency of the cutoff is little above the usual for low-cost meters.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC 100Hz Squarewave					
0.999 mA	1.01	1% + 3	0.0400	0.9590	1.0390
DC					
0.896 µA	0.9	0.5% + 5	0.5045	0.3905968	1.4014032
9.217 µA	9.2	0.5% + 5	0.546	8.66635235	9.76764765
99.03 µA	99.0	0.5% + 5	0.995	97.9854365	100.074564
131.86 µA	131.8	0.5% + 5	1.159	130.641613	133.078387
1.0088 mA	1.00	0.5% + 5	0.055	0.95329604	1.06430396
9.9917 mA	9.99	0.5% + 5	0.09995	9.88925166	10.0941483
99.415 mA	99.4	0.5% + 3	0.797	98.593117	100.236883
1.000 A	1.001	1.2% + 6	0.018012	0.981538	1.018462
3.000 A	3.005	1.2% + 6	0.04206	2.95632	3.04368

The meter met its accuracy specifications for all the current values I tested. AC and DC microamps and milliamps specifications are above average. The DC amps specification is below average, and the AC amps specification is average.

A Shunt Resistance	0.075 Ω
mA Shunt Resistance	2.63 Ω
µA Shunt Resistance	102.67 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	0.5% + 4	0.405	0.60011454	1.41068546
10.007 Ω	10.0	0.5% + 4	0.45	9.55594941	10.4580506
100.07 Ω	100.0	0.5% + 4	0.9	99.1594941	100.980506
1.0011 kΩ	1.001	0.5% + 4	0.009005	0.99201392	1.01018608
10.001 kΩ	10.01	0.5% + 4	0.09005	9.91013993	10.0918601
100.01 kΩ	100.1	0.5% + 4	0.9005	99.1009993	100.919001
0.9936 MΩ	0.994	0.7% + 4	0.010958	0.98253664	1.00466336
9.97 MΩ	9.97	1.2% + 4	0.15964	9.806272	10.133728

The meter met its accuracy specifications for all the resistance values I tested. The accuracy specification for the resistance ranges is average for this group of 6,000 count meters.

Resistance Test Voltage	
Low Range	0.49 V
Medium Range	0.49 V
High Range	0.24 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
0.0093 nF	0.01	2% + 5	0.0502	0	0.0645744
0.1024 nF	0.11	2% + 5	0.0522	0.0443808	0.1604192
1.008 nF	1.05	2% + 5	0.071	0.923936	1.092064
9.941 nF	10.03	2% + 5	0.2506	9.640636	10.241364
99.45 nF	99.9	2% + 5	2.498	96.4542	102.4458
1.00081 µF	1.011	1.5% + 5	0.020165	0.9829026	1.0332974
10.916 µF	10.96	1.5% + 5	0.2144	10.647936	11.184064
113.83 µF	114.1	1.5% + 5	2.2115	111.06318	116.59682
986.5 µF	1026	2% + 5	25.52	951.0475	1021.9525

The meter met its accuracy specifications for all but one of 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	1.533 V
Max Diode Current	0.456 mA

The LEDs I tested did not light or show a voltage drop. The Schottky, Small Signal and Power diodes measured correctly.

Continuity

It is fast and latches.

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

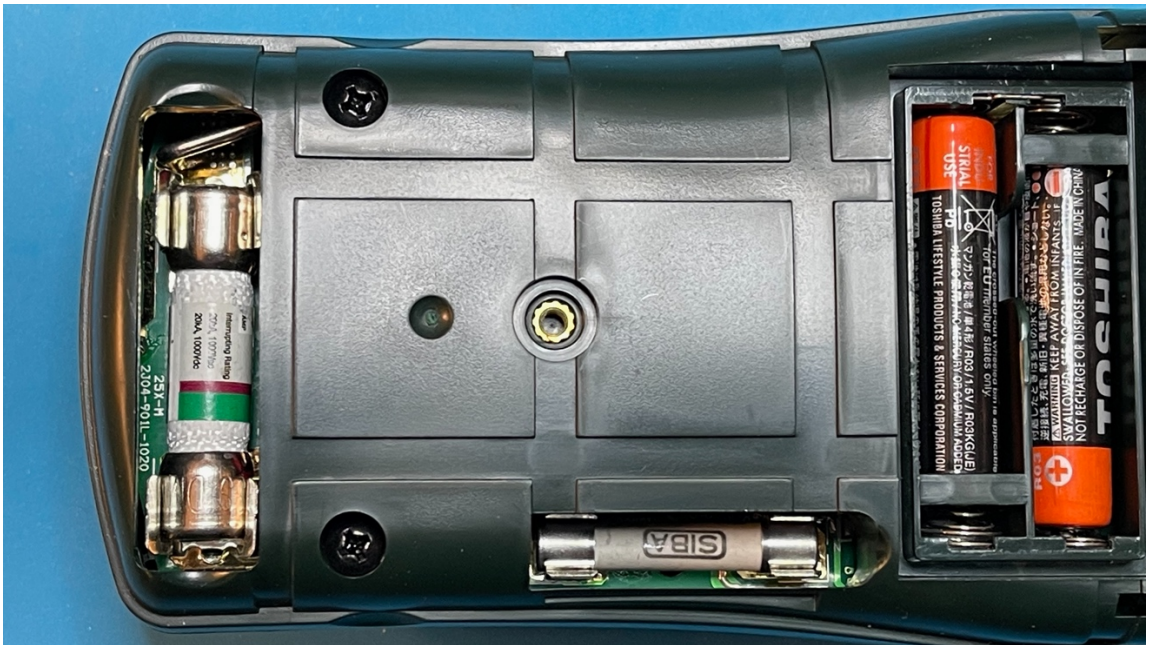
The rotary switch is easy to turn and firmly clicks into place.
The meter is slippery when using the bail on a smooth surface.
The display is big with big numbers. The backlight has an orangish color, is medium bright and evenly lit, except for a hotspot on the right side. The backlight stays on for only thirty seconds.

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 µA and mA:
0.4 A/1000 V DC/AC rms fuse, interrupting rating 30 kA, 1/4" x 1-1/4"; A: 11 A/1000 V DC/AC rms fuse, interrupting rating 20 kA, 13/32" x 1-1/2"



Limited Lifetime Warranty

The Greenlee DM-510A manual states “Greenlee Tools, Inc. warrants to the original purchaser of these goods for use that these products will be free from defects in workmanship and material for their useful life, excepting normal wear and abuse. This warranty is subject to the same terms and conditions contained in Greenlee Tools, Inc.’s standard one-year limited warranty.”

Pros

- Under $150
- Third-party safety tested by UL
- All but one measurement met accuracy specification
- Fuses accessible from battery compartment
- Limited lifetime warranty

Cons

- Capacitance readings below 1nF are not useful
- A little off specification for 1000 µF reading
- Lower than average DC amps accuracy specification
- Lower than average mVDC input impedance
- Backlight turn off after thirty seconds

Conclusion

I think the Greenlee DM-510A 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 below average DC amps range accuracy specification.
In this group of 6,000 count meters I reviewed, this is the second lowest-cost one I would recommend.