

Fluke 189 Review

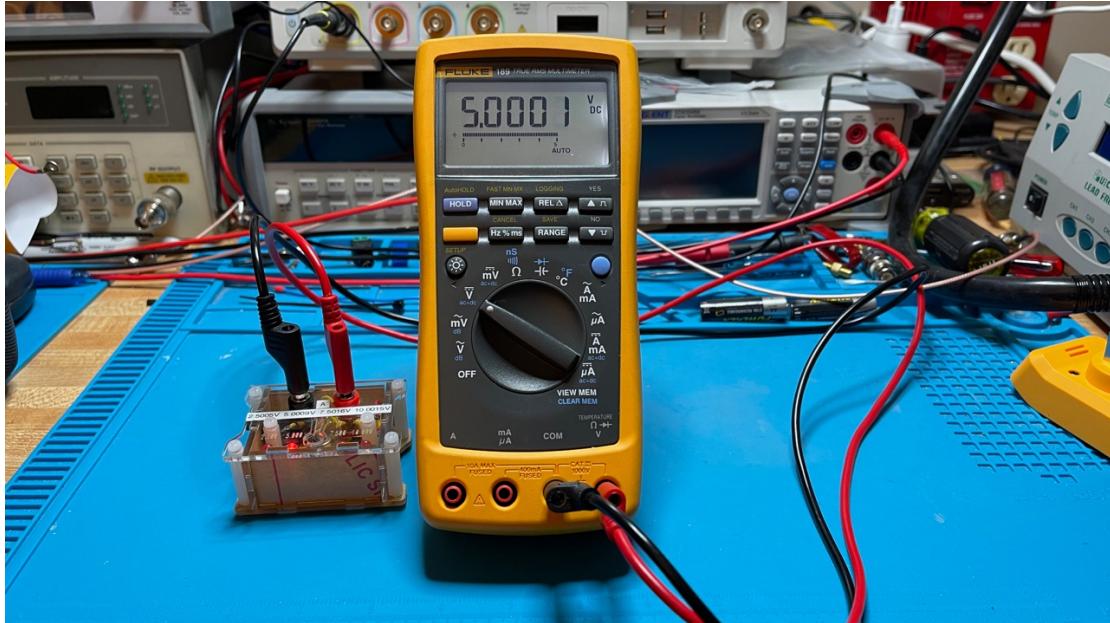
Introduction

Hi, I am Tom, amateur radio call sign N8FDY. This is a review of the Fluke 189 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 189 multimeter that I purchased on Ebay for \$650, it was advertised that the meter was new old stock (NOS) and never sold. 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 30 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 189 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

- Third party safety tested by UL and CSA.
- Meets Category III 1000V and Category IV 600V safety standards.
- True-RMS, 100 KHz bandwidth for precise measurement of nonlinear signals.
- 0.025 % dc accuracy, 1 microvolt resolution.
- Large bright white display with dual parameter readout.
- Built in data logger records reading and time of day for catching intermittent problems.
- View stored readings on the meter.
- MIN / MAX with timestamp to record signal fluctuations.
- Peak capture to measure transients as short as 250 μ S.
- Relative mode to monitor small variations.
- Isolated IR communication port to send data to a PC.
- Auto and Manual ranging.

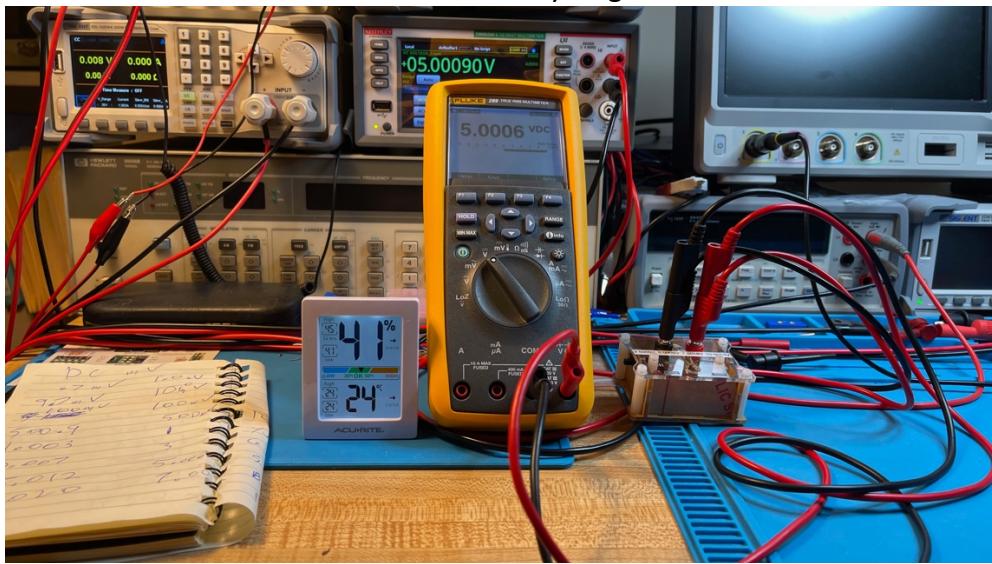
Accuracy



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 V. 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 $\pm(0.025\% \text{ of reading} + 0.0005\% \text{ of range})$.

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					
1.1750	1.184	0.1%+20	0.021184	1.153	1.197
10.1387	10.144	0.1%+20	0.030144	10.108	10.169
25.0486	25.062	0.1%+20	0.045062	25.002	25.095
100.0290	100.03	0.03%+2	0.050009	99.98	100.08
250.040	249.98	0.03%+2	0.094994	249.93	250.15
500.052	499.93	0.03%+2	0.169979	499.86	500.24
V					
0.500016	0.4999	0.025%+10	0.00112498	0.4988	0.5012
1.000041	0.9998	0.025%+10	0.0014999	0.9985	1.0016
2.00026	2.0000	0.025%+10	0.002	1.9982	2.0024
2.50053	2.5000	0.025%+10	0.00225	2.4982	2.5029
3.00110	3.0005	0.025%+10	0.00250025	2.9985	3.0037
4.00047	3.9997	0.025%+10	0.00299985	3.9973	4.0036
5.00021	4.9992	0.025%+10	0.0034996	4.9965	5.0039
5.00091	5.0000	0.025%+10	0.0035	4.9972	5.0046
6.00031	6.000	0.03 % + 3	0.0048	5.9953	6.0053
7.00015	6.999	0.03 % + 3	0.0050997	6.995	7.005
7.50163	7.500	0.03 % + 3	0.00525	7.496	7.507
10.00075	9.999	0.03 % + 3	0.0059997	9.994	10.007
10.00152	9.999	0.03 % + 3	0.0059997	9.995	10.008
15.0007	14.998	0.03 % + 3	0.0074994	14.992	15.009
30.0010	29.995	0.03 % + 3	0.0119985	29.987	30.015
101.2055	101.18	0.1%+2	0.12118	101.07	101.34
198.446	198.41	0.1%+2	0.21841	198.21	198.68
291.321	291.22	0.1%+2	0.31122	290.99	291.65
396.237	396.06	0.1%+2	0.41606	395.80	396.67
499.172	499.02	0.1%+2	0.51902	498.63	499.72
630.943	630.9	0.1%+2	0.8309	630.1	631.8

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 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
Volts 100Hz Squarewave					
4.9987	4.9989	0.4%+40	0.0239956	4.9687	5.0287
60 Hz Sinewave					
mV					
1.0243	1.030	0.4%+40	0.04412	0.980	1.069
5.0284	5.031	0.4%+40	0.060124	4.965	5.092
10.0398	10.051	0.4%+40	0.080204	9.954	10.126
25.0463	25.072	0.4%+40	0.140288	24.891	25.202
50.0256	50.081	0.4%+40	0.240324	49.755	50.296
100.1927	100.30	0.4%+40	0.8012	99.331	101.054
250.803	251.08	0.4%+40	1.40432	249.248	252.358
500.512	501.07	0.4%+40	2.40428	497.807	503.217
Volts					
0.500130	0.4999	0.4%+40	0.0059996	0.4939	0.5071
1.000213	0.9997	0.4%+40	0.0079988	0.9919	1.0097
2.00184	2.0015	0.4%+40	0.012006	1.9873	2.0197
3.01276	2.9976	0.4%+40	0.0159904	2.9800	3.0216
4.01248	3.9958	0.4%+40	0.0199832	3.9750	4.0257
5.01209	5.0085	0.4%+40	0.024034	4.9840	5.0440
6.00816	6.005	0.4%+40	0.06402	5.941	6.082
7.00644	6.999	0.4%+40	0.067996	6.933	7.084

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

ACV 1V 3dB cutoff	222 kHz
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The frequency of the cutoff is very good for audio work.

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					
2.067530907	2.0635	0.5%+40	0.0143175	2.0491	2.0859
3.356147086	3.3525	0.5%+40	0.0207625	3.3311	3.3812
3.36282066	3.3600	0.5%+40	0.0208	3.3402	3.3855
4.73159436	4.7261	0.5%+40	0.0276305	4.7015	4.7617

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

dBm

This meter can measure dBm (decibel-milliwatts) using a selected impedance value from 1 to 1999.

Typical 600 reference impedance ranges: -52 dB to +60 dB

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC 100Hz mA Squarewave					
0.999676	1.006	0.75 % + 20	0.027545	0.971	1.029
DC μ A					
0.89670	0.98	0.25%+20	0.20245	0.69	1.10
9.21432	9.30	0.25%+20	0.22325	8.99	9.44
99.0083	99.10	0.25%+20	0.44775	98.51	99.51
131.886	131.99	0.25%+20	0.529975	131.30	132.48
DC mA					
1.009104	1.007	0.15%+10	0.0115105	0.997	1.021
9.99308	9.994	0.15%+10	0.024991	9.966	10.021
99.4450	99.43	0.15%+2	0.169145	99.25	99.64
DC Amps					
1.000272	1.0004	0.5%+10	0.006002	0.9938	1.0067
2.000836	2.0013	0.5%+10	0.0110065	1.9887	2.0130
3.000514	3.0017	0.5%+10	0.0160085	2.9829	3.0181

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

A Shunt Resistance	0.055 Ω
mA Shunt Resistance	1.856 Ω
μ A Shunt Resistance	100.89 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
Ohms					
1.030	1.05	0.05%+10	0.100525	0.93	1.13
10.10	10.08	0.05%+10	0.10504	9.99	10.21
100.09	100.13	0.05%+10	0.150065	99.93	100.25
kΩ					
1.00026	1.0009	0.05%+2	0.00070045	0.9995	1.0010
10.0025	10.008	0.05%+2	0.005204	9.996	10.009
100.04	100.10	0.05%+2	0.05025	99.98	100.10
MΩ					
0.9941	0.9942	0.15%+4	0.0069652	0.9870	1.0012
9.964	9.978	1.0%+4	0.12978	9.830	10.098
100	99.6	3.0%+2	3.188	96.6	103.4

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

Resistance Test Voltage	
Low Range	5.161 V
Medium Range	0.995 V
High Range	2.166 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
0.9941	1.00	1%+5	0.0105	0.97	1.02
9.935	9.95	1%+5	0.1495	9.74	10.13
99.50	99.6	1%+5	1.496	97.5	101.5
μF					
1.0084	1.008	1%+5	0.01508	0.988	1.029
10.818	10.9	1%+5	0.129	10.6	11.0
112.91	113	1%+5	3.13	109	117
1000	996	1%+5	11.96	983	1017

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

Diode

Max Diode Voltage	5.1613 V
Max Diode Current	0.9990 mA

This lit the LEDs I tested, but it does not chirp on a good LED. The Schottky, Small Signal and Power diodes measured correctly and the meter chirps to confirm a good diode. The meter also beeps when the diode is shorted.

Continuity

It is fast and latches; the backlight also flashes.

Test Leads

The test leads were a soft silicone type. 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.

It has a large display with big numbers. The backlight is medium brightness and evenly lit except for two hotspots on the right.

The following functions are modifiable when you press the yellow button and the backlight button simultaneously to enter setup mode:

Option	
Temperature offset adjust	Used to calibrate temperature measurements
Log interval	Set logging interval from 1 second to 99 minutes, HH:MM
dB type	Set dB measurements to V for Volt or m for milliwatt
dBm reference	Sets the dBm reference impedance to use for dBm reading
Beeper	Disable beeper
Display digits	Switch between 3½ and 4½ digits display
Backlight time out	Set backlight timeout, HH:MM, 00:00 makes it stay on all the time
Power off time out	Set power off timeout, HH:MM, 00:00 makes it stay on all the time
24-hour clock	Set the time HH:MM
Line/Main frequency	Set the power line frequency 50 Hz or 60 Hz
Restore factory defaults	Reset all custom settings

Accuracy Specifications Within the Group of Fluke Meters

Value	Fluke 17B MAX	Fluke 117	Fluke 177	Fluke 87V	Fluke 87V MAX	Fluke 189	Fluke 289
Price	\$139.97	\$219.99	\$382.50	\$433.25	\$530.10	\$650.00	\$744.25
Count	6,000	6,000	6,000	6,000	6,000	50,000	50,000
DC mV Low	1%+10	0.5%+2	0.09%+2	0.1%+1	0.1%+1	0.1%+20	0.05%+20
DC mV High	1%+10	0.5%+2	0.09%+2	0.1%+1	0.1%+1	0.03%+2	0.025%+2
DC V Low	0.5%+3	0.5%+2	0.09%+2	0.05%+1	0.05%+1	0.025%+10	0.025%+2
DC V High	0.5%+3	0.5%+2	0.15%+2	0.05%+1	0.05%+1	0.1%+2	0.03%+2
AC mV	3%+3	1.0%+3	1.0%+3	0.7%+4	0.7%+4	0.4%+40	0.3%+25
AC V	1%+3	1.0%+3	1.0%+3	0.7%+2	0.7%+2	2%+80	0.3%+25
AC V + DC V	N/A	N/A	N/A	N/A	N/A	0.5%+40	0.5%+80
DC μ A	1.5%+3	N/A	N/A	0.2%+4	0.2%+4	0.25%+20	0.075%+20
DC mA	1.5%+3	N/A	1.0%+3	0.2%+4	0.2%+4	0.15%+10	0.15%+2
DC A	1.5%+3	1.0%+3	1.0%+3	0.2%+4	0.2%+4	0.5%+10	0.3%+10
AC μ A	1.5%+3	N/A	N/A	1%+2	1%+2	0.75%+20	0.6%+20
AC mA	1.5%+3	N/A	1.5%+3	1%+2	1%+2	0.75%+20	0.6%+5
AC A	1.5%+3	1.5%+3	1.5%+3	1%+2	1%+2	1.5%+20	1.5%+20
Ω	0.5%+3	0.9%+2	0.9%+2	0.2%+2	0.2%+2	0.05%+10	0.05%+10
Low k Ω	0.5%+2	0.9%+1	0.9%+1	0.2%+1	0.2%+1	0.05%+2	0.05%+20
High k Ω	0.5%+2	0.9%+1	0.9%+1	0.6%+1	0.2%+1	0.05%+2	0.05%+15
Low M Ω	0.5%+2	0.9%+1	0.9%+1	0.6%+1	0.2%+1	1.0%+4	0.15%+4
High M Ω	1.5%+3	5%+2	1.5%+3	1%+3	1%+1	10.0%+2	3.0%+2
Low nF	2%+5	N/A	N/A	1%+2	1%+2	2%+5	1%+5
High nF	2%+5	1.9%+2	1.2%+2	1%+2	1%+2	1%+5	1%+5
Low μ F	5%+5	1.9%+2	1.2%+2	1%+2	1%+2	1%+5	1%+5
High μ F	5%+5	1.9%+2	10%	1%+2	1%+2	1%+5	1%+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.

Comparing all the accuracy specification of the Flukes I own is a mixed bag, You definitely have to pay for higher accuracy specifications. If you have an 87V MAX and a 289 you have almost all the ranges covered with the best specified accuracy Fluke meter.

Accuracy Specifications Within the Group of 50,000 to 60,000 Count Meters

Value	EEVblog Brymen BM786	Brymen BM789	Brymen BM869s	EEVblog 121GW	Greenlee DM-860A	Uni-T UT181A	Fluke 189	Fluke 289
Cost	\$154.11	\$171.62	\$206.60	\$225.00	\$368.63	\$400.99	\$650.00	\$744.25
Count	60,000	60,000	50,000	50,000	50,000	60,000	50,000	50,000
DC mV Low	0.03%+2	0.03%+2	0.02%+2	0.1%+10	0.02%+2	0.025%+20	0.1%+20	0.05%+20
DC mV High	0.03%+2	0.03%+2	0.02%+2	0.1%+10	0.02%+2	0.025%+5	0.03%+2	0.025%+2
DC V Low	0.03%+2	0.03%+2	0.02%+2	0.05%+5	0.02%+2	0.025%+5	0.025%+10	0.025%+2
DC V High	0.05%+5	0.05%+5	0.04%+2	0.1%+10	0.04%+2	0.03%+5	0.1%+2	0.03%+2
AC mV	0.5%+30	0.5%+30	0.3%+20	0.8%+10	0.3%+20	0.6%+60	0.4%+40	0.3%+25
AC V	0.5%+30	0.5%+30	0.4%+30	0.3%+10	0.3%+30	0.3%+30	2%+80	0.3%+25
AC V + DC V	0.7%+40	1.2% + 40	0.7%+80	1.0% + 10	0.5% + 80	1% + 80	0.5%+40	0.5% + 80
DC μ A	0.075%+20	0.075%+20	0.15%+20	1.5%+15	0.15%+2	0.08%+20	0.25%+20	0.075%+20
DC mA	0.15%+20	0.15%+20	0.15%+20	0.25%+5	0.15%+20	0.15%+10	0.15%+10	0.15%+2
DC A	0.3%+20	0.3%+20	0.5%+20	0.75%+15	0.5%+2	0.5%+10	0.5 %+10	0.3%+10
AC μ A	0.9%+20	0.9%+20	0.5%+50	2.0%+20	0.5%+50	0.6%+40	0.75%+20	1%+20
AC mA	0.9%+20	0.9%+20	0.5%+50	1.0%+5	0.5%+50	0.8%+40	0.75%+20	0.6%+5
AC A	1%+30	1%+30	0.5%+50	1.5%+15	0.5%+50	1%+20	1.5%+20	0.8%+20
Ω	0.085%+10	0.085%+10	0.07%+10	0.5%+20	0.07%+1	0.05%+10	0.05%+10	0.15% + 20
Low k Ω	0.085%+4	0.085%+4	0.07%+2	0.2%+5	0.07%+2	0.05%+2	0.05%+2	0.05%+2
High k Ω	0.15%+4	0.15%+4	0.1%+2	0.2%+5	0.1%+2	0.05%+2	0.05%+2	0.05%+15
Low M Ω	1.5%+5	1.5%+5	0.3%+6	0.3%+5	0.3%+6	0.3%+10	1.0%+4	0.15%+4
High M Ω	2.0%+5	2.0%+5	2%+6	1.2%+20	2%+6	2%+10	10.0%+2	3.0%+2
Low nF	1%+10	1%+10	0.8%+3	2.5%+5	0.8%+3	3%+10	2%+5	1%+5
High nF	1%+2	1%+2	0.8%+3	2.5%+5	0.8%+3	2%+5	1%+5	1%+5
Low μ F	1%+2	1%+2	1.5%+3	2.5%+5	1.5%+3	2%+5	1%+5	1%+5
High μ F	1.8%+4	1.8%+4	5% + 5	3.0%+5	5% + 5	5% + 5	1%+5	1%+5

The accuracy specifications are from the meters' respective manuals. Red lettering for the meter's name indicates the meter has failed to meet an accuracy specification. The red lettering in the accuracy specification indicates that one, or more meter readings did not meet this accuracy specification. 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.

Battery

The meter uses four AA batteries accessible from the back by removing the battery door. The battery door has two quarter turn plastic screws.



Fuses

The fuses are accessible from the battery compartment.



The manual states the fuses are:

Fuse, 0.44 A (44/100 A, 440 mA), 1000 V, FAST Fluke part number 943121

Fuse, 11 A, 1000 V FAST Fluke part number 803293

Pros

- This meter is at least 16-year-old and all measurements taken met the accuracy specification.
- Don't have to turn the meter off to get to setup mode.
- Has almost as much customization as the EEVBlog 121GW.

Cons

- Discontinued around 2008, can only buy used or NOS (New Old Stock).
- PC Interface an extra cost option.

Conclusion

I do not recommend the Fluke 189, don't get me wrong I like this meter a lot and I am keeping it. But for your first meter it is too expensive, eBay prices range from \$350 for a beat-up looking unit to \$800 for NOS (New Old Stock) unit from Japan. I bought my unit as NOS from a company in Texas (May 2023) and it works great. If you are willing to spend up to \$800, here are some other meters to consider.

Meter	Count	Basic DC Accuracy	Price
Fluke 289	50,000	0.025%+2	\$744.25
Uni-T UT181A	60,000	0.025%+5	\$400.99
Greenlee DM-860A	50,000	0.02%+2	\$368.63
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
EEVblog Brymen BM786	60,000	0.03%+2	\$154.11