Fluke 289 Review

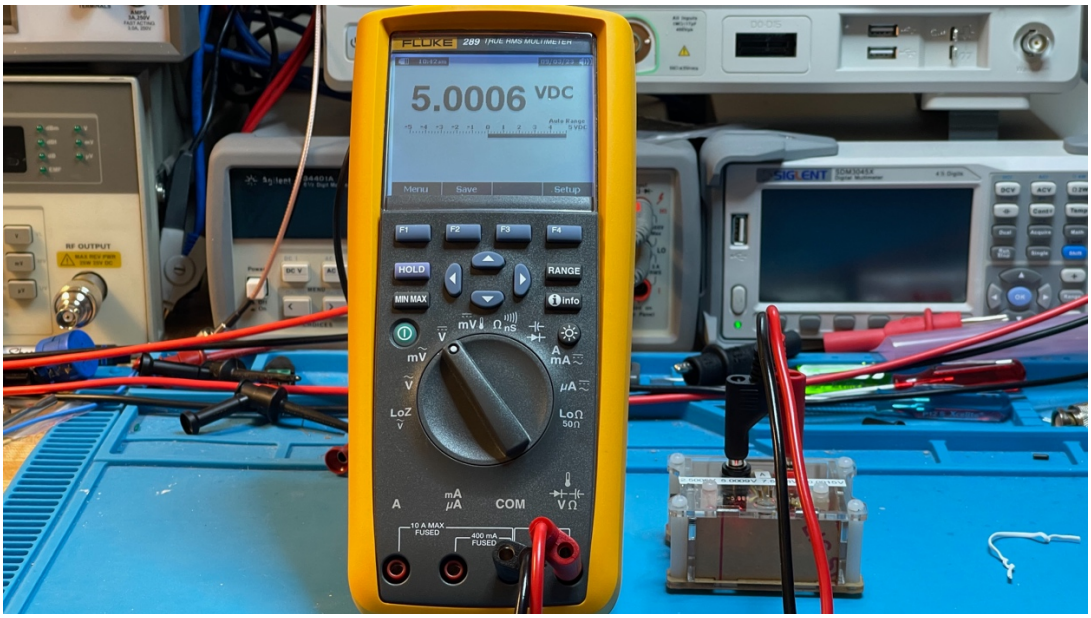
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the Fluke 289 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 289/FVF/IR3000 multimeter that I purchased from TEquipment for $1,057.63. 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.

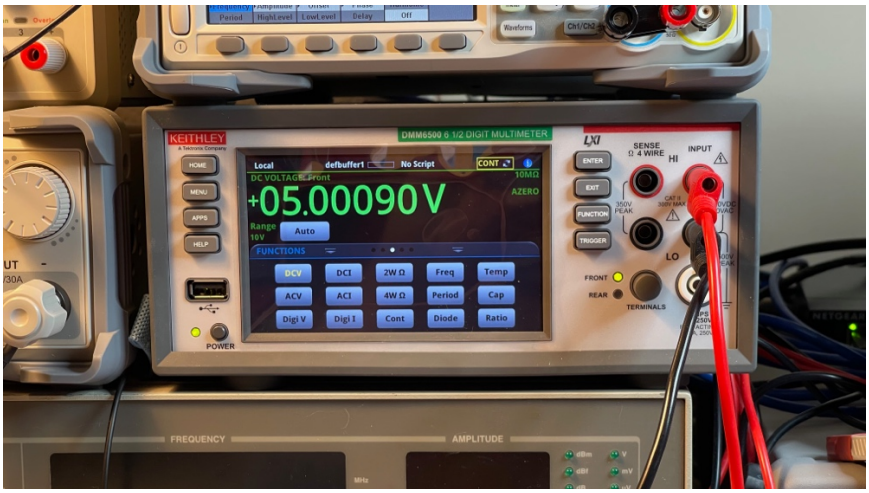
Objectives

This review was produced to help you decide if the Fluke 289 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

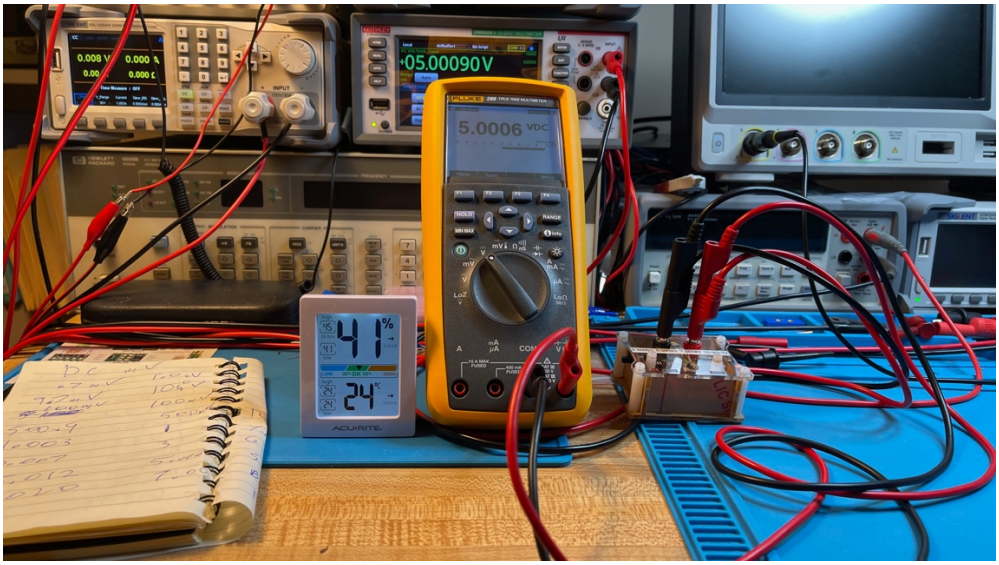
- Third party safety tested by CSA.
- 50,000 count, 1/4 VGA dot matrix display with white backlight.
- 15,000 recorded events memory.
- 50-ohm range.
- True-RMS with 100 kHz bandwidth
- AC+DC RMS.
- AC Low Pass Filter.
- dBm and DBV.
- Measure up to 500 MΩ resistance.
- Real time clock.
- USB PC interface and Bluetooth mobile interface are available.
- Fluke limited lifetime 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 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 ±(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.

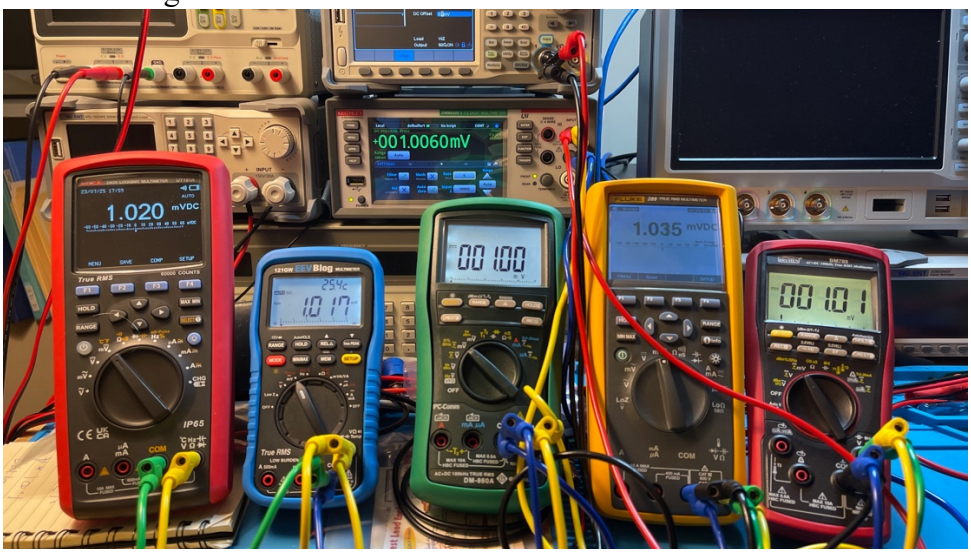


DC Volts

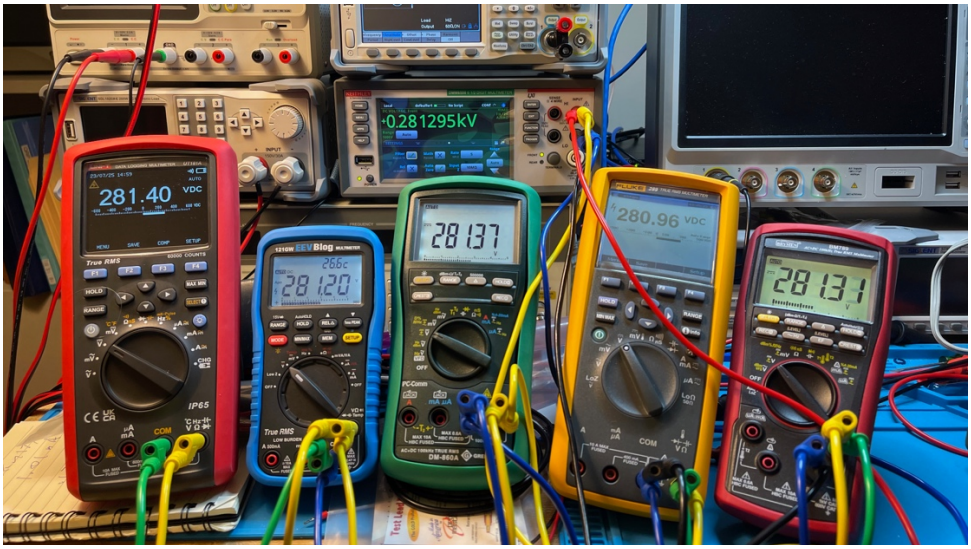
Source	Reading	Specification	Uncertainty	Low Bound	High Bound
mV					
1.0060	1.035	0.05% + 20	0.0205175	0.9851	1.0269
10.0012	10.013	0.05% + 20	0.0250065	9.9755	10.0269
100.0187	100.01	0.025% + 2	0.0450025	99.9703	100.0671
500.097	500.03	0.025% + 2	0.1450075	499.9335	500.2605
V					
1.000909	1.0009	0.025% + 2	0.00045023	1.0004	1.0014
2.00013	1.9999	0.025% + 2	0.00069998	1.9993	2.0009
2.50054	2.5004	0.025% + 2	0.0008251	2.4996	2.5015
3.00134	3.0013	0.025% + 2	0.00095033	3.0003	3.0024
4.00001	3.9989	0.025% + 2	0.00119973	3.9987	4.0014
5.00030	5.0000	0.025% + 2	0.00145	4.9987	5.0019
5.00091	5.0005	0.025% + 2	0.00145013	4.9993	5.0025
6.00142	6.003	0.025% + 2	0.00350075	5.9977	6.0051
7.00018	7.000	0.025% + 2	0.00375	6.9962	7.0042
7.50167	7.501	0.025% + 2	0.00387525	7.4976	7.5058
10.00153	10.001	0.025% + 2	0.00450025	9.9967	10.0063
97.7528	97.73	0.03% + 2	0.049319	97.6990	97.8066
191.276	191.25	0.03% + 2	0.077375	191.1850	191.3670
281.295	280.86	0.03% + 2	0.104258	281.1735	281.4165
381.899	381.61	0.03% + 2	0.134483	381.7432	382.0548
490.268	489.68	0.03% + 2	0.166904	490.0755	490.4605
601.023	601.0	0.03% + 2	0.3803	600.6106	601.4354

The meter met its accuracy specifications for most of the DC voltages I tested. It missed the 1 mV reading by 8.1µV. It missed 281 volt, 381 volt and 490 volt readings by 313.5 mV, 133.2 mV and 395.5 mV respectively. The high DC volts ranges accuracy specification is the highest for this group of meters.

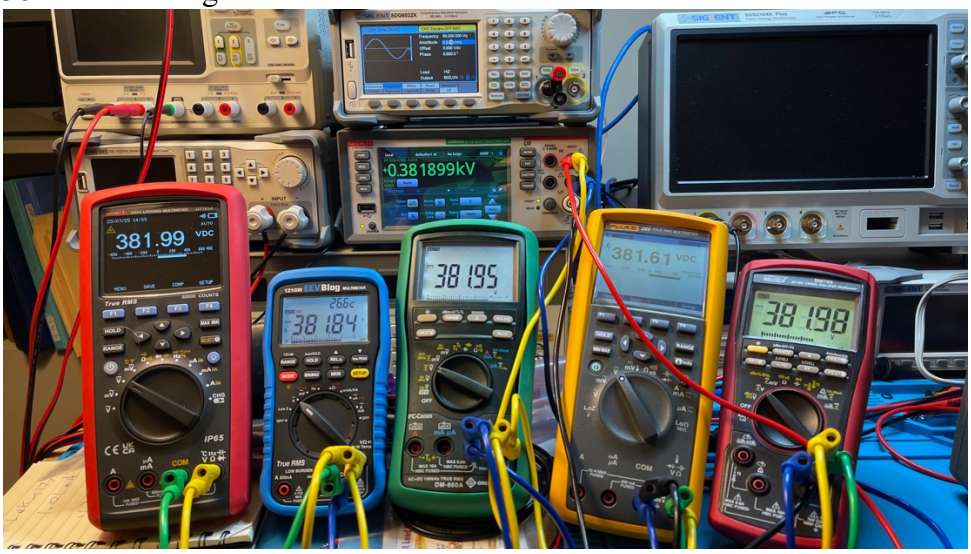
1mV Reading:



281 Volt reading:



381 Volt reading:



490 Volt reading:

VDC Input	10.9 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					
4.99906	5.0004	0.6% + 25	0.0325024	4.9606	5.0376
60 Hz Sinewave					
mV					
1.0335	1.012	0.3%+25	0.028036	1.0048	1.012
10.0397	10.034	0.3%+25	0.055102	9.9785	10.034
100.0742	100.05	0.3%+25	0.55015	99.4640	100.05
250.565	250.58	0.3%+25	1.00174	249.4126	250.58
500.110	500.20	0.3%+25	1.7506	498.0590	500.20
Volts					
0.500130	0.4994	0.3%+25	0.0039982	0.4955	0.5047
1.000213	0.9999	0.3%+25	0.0054997	0.9938	1.0066
2.00184	2.0024	0.3%+25	0.0085072	1.9891	2.0145
3.01276	3.0135	0.3%+25	0.0115405	2.9964	3.0291
4.01248	4.0136	0.3%+25	0.0145408	3.9925	4.0324
5.01209	5.0133	0.3%+25	0.0175399	4.9885	5.0356
6.00816	6.002	0.3%+25	0.043006	5.9585	6.0578
7.00644	7.000	0.3%+25	0.046	6.9532	7.0596

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

ACV 1V 3dB cutoff	200 kHz

The frequency of the cutoff was the lowest for this group of meters.

AC+DC

This meter has an AC+DC measurement mode.
The formula for measuring True-RMS with AC and DC components:

$$Vrms = \sqrt{\mathrm{Vac}^2 + \mathrm{Vdc}^2}$$

A meter with AC+DC calculates this for you.

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC+DC	2.0665	0.5%+80	0.0183	2.0451	2.0900
2.067530907	3.3569	0.5%+80	0.0248	3.3270	3.3853
3.356147086	3.363	0.5%+80	0.0248	3.3362	3.3895
3.36282066	4.7218	0.5%+80	0.0316	4.6975	4.7657
4.73159436	2.0665	0.5%+80	0.0183	2.0451	2.0900

The meter met its accuracy specifications for all the AC+DC values I tested. The accuracy specifications for the AC+DC ranges is the best for this group of meters.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC 100Hz Squarewave					
0.999694	0.977	0.6% + 20	0.025862	0.9724	1.0270
DC µA					
0.89695	0.90	0.075% + 20	0.200675	0.6954	1.0985
9.21851	9.23	0.075% + 20	0.2069225	9.0069	9.4301
99.0500	99.03	0.075% + 20	0.2742725	98.7262	99.3738
131.913	131.90	0.075% + 20	0.298925	131.5542	132.2718
DC mA					
1.008954	1.010	0.05% + 10	0.010505	0.9979	1.0200
9.99241	9.992	0.05% + 10	0.014996	9.9749	10.0099
99.4213	99.41	0.15% + 2	0.169115	99.2273	99.6153
100.7828	100.77	0.15% + 2	0.171155	100.5865	100.9791
200.666	200.60	0.15% + 2	0.3209	200.2648	201.0672
DC Amps					
0.500068	0.5000	0.3% + 10	0.0025	0.4973	0.5028
1.000128	1.0000	0.3% + 10	0.004	0.9957	1.0046
2.000383	2.0002	0.3% + 10	0.0070006	1.9923	2.0085
3.000047	2.9999	0.3% + 10	0.0099997	2.9884	3.0117

The meter met its accuracy specifications for all the current values I tested. The DC current ranges have the highest accuracy specifications for this group of meters.

A Shunt Resistance	0.033 Ω
mA Shunt Resistance	1.48 Ω
µA Shunt Resistance	100.48 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					
1.004105	1.030	0.15% + 20	0.021545	0.9823	1.0259
10.00762	10.008	0.15% + 20	0.035012	9.9716	10.0437
100.0731	100.05	0.05% + 10	0.150025	99.9126	100.2336
Kiloohms					
1.000200	1.0004	0.05% + 2	0.0007002	0.9994	1.0010
10.00230	10.005	0.05% + 2	0.0070025	9.9945	10.0101
100.0375	100.06	0.05 % + 15	0.20003	99.8294	100.2456
Megaohms					
0.993891	0.9938	0.15 % + 4	0.0018907	0.9919	0.9959
9.96999	9.968	0.15 % + 4	0.018952	9.9470	9.9930
100.1114	100.0	8% + 2	8.2	91.7082	108.5146

The meter met its accuracy specifications for all but one of the resistance values I tested. The meter missed the 1 Ω reading by 4 mΩ. The accuracy specifications for the high ohms range, lower kiloohm ranges and megaohm ranges are the highest for this group of meters.

Resistance Test Voltage	
Low Range	5.4 V
Medium Range	3.5 V
High Range	1.8 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
0.0149	N/A				
0.1040	0.103	1%+5	0.00603	0.0921	0.1159
1.0073	1.01	1%+5	0.0601	0.9341	1.0805
9.940	9.95	1%+5	0.1495	9.7407	10.1393
99.48	99.5	1%+5	1.495	97.4871	101.4729
µF					
1.0083	1.009	1%+5	0.01509	0.9882	1.0284
10.841	10.92	1%+5	0.1592	10.6284	11.0536
112.81	112	1%+5	6.12	106.1388	119.4812
1005.5	999	1%+5	14.99	984.9825	1026.0175

The meter met its accuracy specifications for all the capacitance values I tested. The 10pF capacitor could not be read. The accuracy specification for the high megaohm ranges were the best in this group of meters.

Diode

Max Diode Voltage	5.36 V
Max Diode Current	1 mA

This lit the LEDs I tested and the Schottky, Small Signal and Power diodes measured correctly.

Continuity

It is fast and latches.

dBm

This meter can measure dBm (decibel-milliwatts) using a selected impedance value from 4, 8, 16, 25, 32, 50, 75, 600, and 1000.

Test Leads

The test leads were Fluke TL71 Silicon Test Lead Set. 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 graphics display. The backlight has two levels dim too very dim and is evenly lit.
The meter has a setup function that can be used to change the power off timeout and backlight timeout.

Accuracy Specifications Within the Group

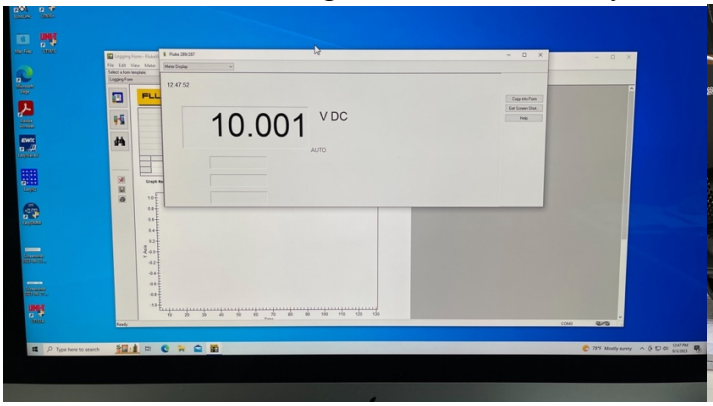
Value	Brymen BM789	EEVblog 121GW	Greenlee DM-860A	Uni-T UT181A	Fluke 289FVF
Cost	$173.52	$225.00	$346.44	$399.75	$876.59
Count	60,000	50,000	50,000	60,000	50,000
DC mV Low	0.03%+2	0.1%+10	0.02%+2	0.025%+20	0.05%+20
DC mV High	0.03%+2	0.1%+10	0.02%+2	0.025%+5	0.025%+2
DC V Low	0.03%+2	0.05%+5	0.02%+2	0.025%+5	0.025%+2
DC V High	0.05%+5	0.1%+10	0.04%+2	0.03%+5	0.03%+2
AC mV	0.5%+30	0.8%+10	0.3%+20	0.6%+60	0.3%+25
AC V	0.5%+30	0.3%+10	0.3%+30	0.3%+30	0.3%+25
AC V + DC V	1.2% + 40	1.0% + 10	0.5% + 80	1% + 80	0.5% + 80
DC µA	0.075%+20	1.5%+15	0.15%+2	0.08%+20	0.075%+20
DC mA	0.15%+20	0.25%+5	0.15%+20	0.15%+10	0.15%+2
DC A	0.3%+20	0.75%+15	0.5%+2	0.5%+10	0.3%+10
AC µA	0.9%+20	2.0%+20	0.5%+50	0.6%+40	1%+20
AC mA	0.9%+20	1.0%+5	0.5%+50	0.8%+40	0.6%+5
AC A	1%+30	1.5%+15	0.5%+50	1%+20	0.8%+20
Ω	0.085%+10	0.5%+20	0.07%+1	0.05%+10	0.15% + 20
Low kΩ	0.085%+4	0.2%+5	0.07%+2	0.05%+2	0.05%+2
High kΩ	0.15%+4	0.2%+5	0.1%+2	0.05%+2	0.05%+15
Low MΩ	1.5%+5	0.3%+5	0.3%+6	0.3%+10	0.15%+4
High MΩ	2.0%+5	1.2%+20	2%+6	2%+10	3.0%+2
Low nF	1%+10	2.5%+5	0.8%+3	3%+10	1%+5
High nF	1%+2	2.5%+5	0.8%+3	2%+5	1%+5
Low µF	1%+2	2.5%+5	1.5%+3	2%+5	1%+5
High µF	1.8%+4	3.0%+5	5% + 5	5% + 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.
The Fluke 289 is in about second place in overall accuracy specifications.

Logging

The Fluke 289 bundle I bought came with a USB optical isolated interface and Windows PC software on a CD. It also came with a Bluetooth interface and the mobile software is a free download.

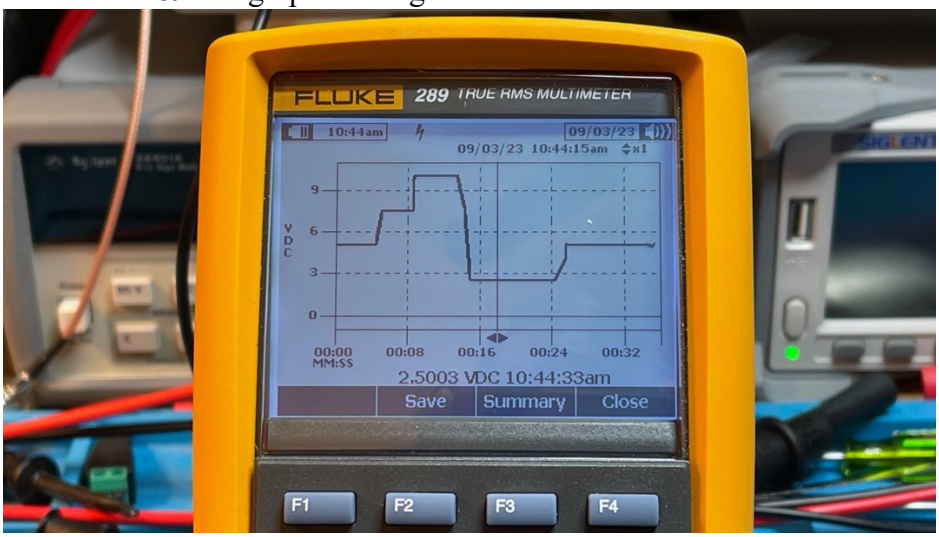
The PC software would not install on Windows 11 Arm on my Mac Studio. I was able to get it to install on Windows 10 Intel running under Parallels on my Intel iMac:



The Bluetooth work in my iPhone, iPad and Android tablet:

Graphing

The Fluke 289 can graph reading taken over a time interval.



Battery

The meter uses six AA batteries accessible from the back by removing the battery door/holder. The battery holder one latch that you rotate 180 degrees to open.

Fuses

The fuses are accessible from the battery compartment.
The manual states the fuses are:
Fuse (F1), 0.440 A, 1000 V, FAST, Interrupt rating 10 kA, Fluke Part # 943121
Fuse (F2), 11 A, 1000 V, FAST, Interrupt rating 20 kA, Fluke Part # 803293

Pros

- Third party safety tested by CSA.
- Best accuracy specifications in this group of 50000 count meters for High DC Volts, AC+DC RMS, DC current, Low kΩ, Low MΩ and High µF ranges.
- Easy access to change fuses.
- Fluke limited lifetime warranty.

Cons

- Did not meet accuracy specifications for 1 reading in the mV range, 3 reading in the high DC voltage range and 1 reading in the low ohms range.
- Worst accuracy specifications in this group of 50000 count meters for the High MΩ range.
- Six AA batteries only provide 100 hours of operation.

Conclusion

The Fluke 289 has lots of features and has the Fluke reputation and limited lifetime warranty. Unlike the 6000 count meters where Fluke dominates the accuracy specifications, the Fluke 289 is in second place compared to the Greenlee DM-860A. I was disappointed that my 289 had 5 readings out of specification, the most in this group of 50000 count meters.
I can't recommend this meter for hobby use, if you need graphing on the meter, consider the Uni-T UT181A. If you only need logging to a PC and mobile device, then consider the Greenlee DM-860A or the almost identical (some specifications are different when comparing the manuals) Brymen BM869s depending on what is available in your country. If you want logging to a microSD card, the only choice is the EEVblog 121GW. If you don't need logging the Bryman BM789 or the slightly lesser (no dBm, lower bandwidth) EEVBlog BM786 depending on what is available in you country.