Keysight U1242C Review

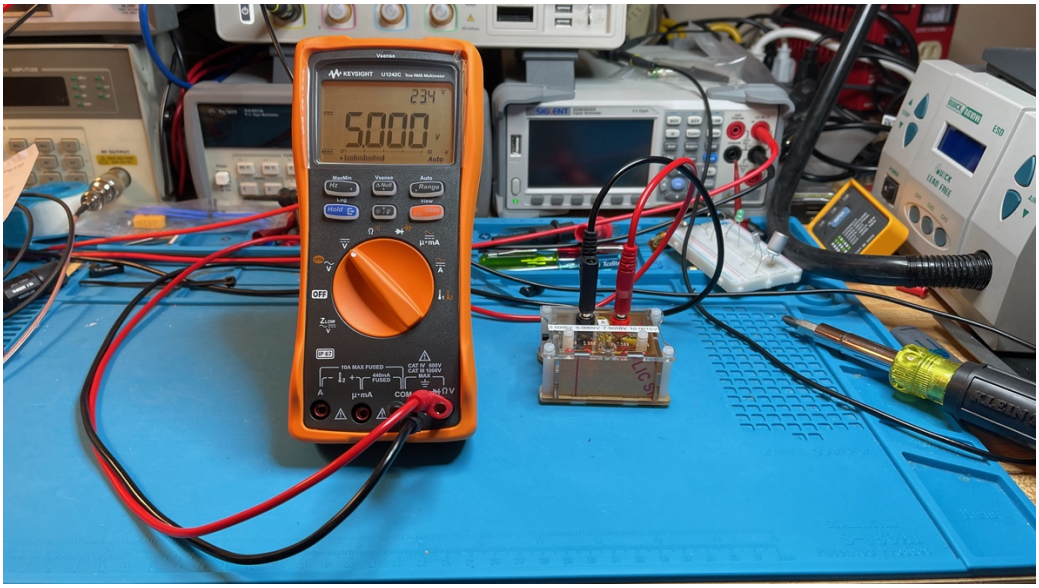
Introduction

Hi, I am Tom, amateur radio call sigh N8FDY. This is a review of the Keysight U1242C 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 Keysight U1242C multimeter that I purchased from TEquipment.com for $433.34.

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.

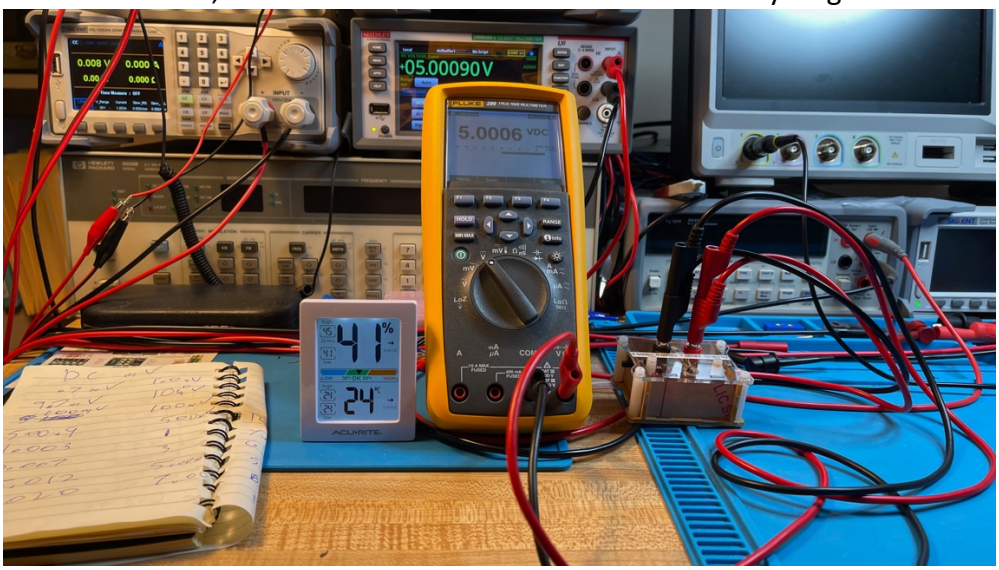
Features

- Third party safety tested by CSA for Canada and US.
- CAT IV 600V, CAT III 1000V.
- 10000-count.
- IP 67 rated for dust and water resistance.
- 3-meter drop tested.
- 0.09% DC basic accuracy.
- ZLOW, low impedance mode.
- Vsense for non-contact voltage detection.
- Harmonic ratio measurement.
- T1 – T2 differential temperature measurement.
- Includes IR-to-USB adapter with free downloadable PC (Windows 10) software.
- Built-in flashlight.
- 400-hour battery life using included four AAA batteries.
- 3-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 ±(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					
1.0777	1.07	0.09%+2	0.020963	1.06	1.10
10.0128	10.02	0.09%+2	0.029018	9.98	10.04
25.0192	25.02	0.09%+2	0.042518	24.98	25.06
100.0554	100.04	0.09%+2	0.110036	99.94	100.17
250.085	250.0	0.09%+2	0.425	249.6	250.5
499.993	499.8	0.09%+2	0.64982	499.3	500.7
V DC					
0.500015	0.4998	0.09%+2	0.00064982	0.4993	0.5007
1.000161	0.9997	0.09%+2	0.00109973	0.9990	1.0013
2.00055	1.999	0.09%+2	0.0037991	1.997	2.004
2.50055	2.500	0.09%+2	0.00425	2.496	2.505
3.00061	2.999	0.09%+2	0.0046991	2.996	3.005
4.00056	3.999	0.09%+2	0.0055991	3.995	4.006
5.00026	4.998	0.09%+2	0.0064982	4.994	5.007
5.00092	4.999	0.09%+2	0.0064991	4.994	5.008
6.00057	5.998	0.09%+2	0.0073982	5.993	6.008
7.00055	6.997	0.09%+2	0.0082973	6.992	7.009
7.50163	7.499	0.09%+2	0.0087491	7.493	7.511
8.00024	7.997	0.09%+2	0.0091973	7.991	8.010
9.00043	8.996	0.09%+2	0.0100964	8.990	9.011
10.00006	9.996	0.09%+2	0.0109964	9.989	10.011
10.00154	9.998	0.09%+2	0.0109982	9.990	10.014
15.0009	14.99	0.09%+2	0.033491	14.97	15.04
30.0010	29.99	0.09%+2	0.046991	29.95	30.06
100.031	99.99	0.09%+2	0.109991	99.91	100.15
200.359	200.2	0.09%+2	0.38018	200.0	200.8
300.282	300.1	0.09%+2	0.47009	299.8	300.8
400.064	399.9	0.09%+2	0.55991	399.5	400.6
531.219	531.0	0.09%+2	0.6779	530.5	531.9
610.521	610.2	0.09%+2	0.74918	609.5	611.5
1041.7	1041.7	0.09%+2	1.13753	1040.2	1043.2

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 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					
4.99907	5.010	1.0%+3	0.0531	4.940	5.058
mV AC 60 Hz Sinewave					
1.0199	0.97	1.0%+3	0.0397	0.98	1.06
5.0874	5.07	1.0%+3	0.0807	5.00	5.17
10.0218	10.02	1.0%+3	0.1302	9.89	10.16
25.0361	25.08	1.0%+3	0.2808	24.74	25.33
50.0721	50.14	1.0%+3	0.5314	49.51	50.63
100.0764	100.2	1.0%+3	1.302	98.7	101.4
250.511	250.6	1.0%+3	2.806	247.6	253.5
500.126	499.3	1.0%+3	5.293	494.5	505.7
V AC 60 Hz Sinewave					
0.500150	0.5009	1.0%+3	0.005309	0.4942	0.5061
1.000266	1.0002	1.0%+3	0.010302	0.9891	1.0115
2.00210	2.006	1.0%+3	0.02306	1.975	2.029
3.01286	3.018	1.0%+3	0.03318	2.975	3.051
4.01253	4.019	1.0%+3	0.04319	3.964	4.061
5.01075	5.018	1.0%+3	0.05318	4.952	5.070
6.00782	6.015	1.0%+3	0.06315	5.938	6.078
7.00495	7.010	1.0%+3	0.0731	6.925	7.085
10.03867	10.04	1.0%+3	0.1304	9.90	10.18
20.1011	20.12	1.0%+3	0.2312	19.83	20.37
25.1474	25.20	1.0%+3	0.282	24.82	25.47
50.0653	50.14	1.0%+3	0.5314	49.47	50.66
75.0776	75.15	1.0%+3	0.7815	74.22	75.93
100.3239	100.32	1.0%+3	1.0332	99.20	101.45
140.3370	140.5	1.0%+3	1.705	138.2	142.4

This meter missed it accuracy specification for the 1 mV reading. I rechecked this reading many times and it was always too low. The meter met the accuracy specifications for all the higher AC voltages I tested.

ACV 1V 3dB cutoff	279.2 kHz

The cutoff frequency is high and will cover audio frequencies and some lower IF frequencies. The meter did not make it down to the 3dB cutoff, it just stoped showing any voltage values for frequencies above 279.2 kHz. It showed 0.9 volts at 279 kHz.

Current

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
AC mA 100Hz Squarewave					
0.99966	1.001	1.0%+3	0.01301	0.985	1.014
DC µA					
0.89353	0.8	0.1%+2	0.2008	0.7	1.1
9.21310	9.0	0.1%+2	0.209	9.0	9.4
99.0701	98.8	0.1%+2	0.2988	98.7	99.4
131.953	131.7	0.1%+2	0.3317	131.5	132.4
DC mA					
1.009166	1.009	0.1%+2	0.003009	1.006	1.013
9.99356	9.992	0.1%+2	0.011992	9.979	10.008
99.4423	99.37	0.2%+2	0.21874	99.20	99.69
250.821	250.7	0.2%+2	0.7014	250.1	251.6
501.044	501.0	0.2%+2	1.202	499.6	502.4
DC Amps					
1.000066	1.000	0.3%+5	0.008	0.992	1.009
2.000439	2.000	0.3%+5	0.011	1.988	2.013
3.000097	3.000	0.3%+5	0.014	2.984	3.016

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

A Shunt Resistance	0.03 Ω
mA Shunt Resistance	1.80 Ω
µA Shunt Resistance	31.37 Ω

It is always good to know how much resistance you are adding to your circuit when you make current measurements. This meter has the lowest µA Shunt Resistance I have measured. This is very good for a handheld meter. Most meters have around 100 Ω for the µA Shunt Resistance.

Resistance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
Ω					
1.00	0.98	0.2%+5	0.05196	0.95	1.05
10.07	10.04	0.2%+5	0.07008	10.00	10.14
100.25	100.4	0.2%+5	0.7008	99.5	101.0
kΩ					
1.00037	1.000	0.2%+2	0.004	0.996	1.004
10.0022	10.00	0.2%+2	0.04	9.96	10.04
100.05	100.0	0.2%+2	0.4	99.6	100.5
MΩ					
0.9944	0.994	0.2%+2	0.003988	0.990	0.998
9.964	9.96	0.8%+2	0.09968	9.86	10.07
99.94	99.79	3%+3	3.0237	96.71	103.17

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

Resistance Test Voltage	
Low Range	2.35 V
Medium Range	2.10 V
High Range	0.77 V

Capacitance

Source	Reading	Specification	Uncertainty	Low Bound	High Bound
nF					
0.9994	1.00	1.0%+5	0.06	0.93	1.07
9.934	9.9	1.0%+5	0.599	9.3	10.6
99.45	99.6	1.0%+5	1.496	97.5	101.4
µF					
1.0080	1.0074	1.0%+5	0.010574	0.9924	1.0236
10.832	11.077	1.0%+5	0.11577	10.663	11.001
113.23	112.83	1.2%+5	1.40396	111.27	115.19
1000	998.2	1.2%+5	12.4784	982.0	1018.0

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

Diode

Max Diode Voltage	3.15 V
Max Diode Current	1.26 mA

All three LEDs lit up and displayed the forward voltage. If the leads are shorted the meter will beep. The meter will sound a short beep (chirp) when the diode voltage drop is in the normal range for the small signal diode and the rectifier diode, but the meter did not chirp for the Schottky diode which does have a litter higher forward voltage then the small signal and rectifier diodes.

Continuity

It is fast and it latches.

Accuracy Specifications Comparison

This is a group of 10,000 to 22,000 count meters that are third party safety tested.

Value	**UNI-T UT161E**	**Brymen BM525s**	**Greenlee DM-820**	**Keysight U1242C**
Cost	128.77	169.86	201.37	461.00
Count	22,000	10,000	10,000	10,000
DC mV	0.1%+5	0.06%+2	0.06%+2	0.09%+2
DC V	0.05%+5	0.08%+2	0.08%+2	0.09%+2
AC mV	1%+10	0.5%+3	0.5%+3	1.0%+3
AC V	0.8%+10	0.5%+3	0.5%+3	1.0%+3
DC µA	0.5%+10	0.2%+4	0.2%+4	0.1%+2
DC mA	0.5%+10	0.2%+4	0.2%+4	0.2%+2
DC A	1.2%+50	0.2%+4	0.2%+4	0.3%+5
AC µA	0.8%+10	0.6%+3	0.6%+3	1.0%+3
AC mA	1.2%+10	1.0%+3	1%+3	1.0%+3
AC A	1.2%+10	0.8%+6	0.8%+6	1.2%+5
Ω	0.5%+10	0.1%+3	0.1%+3	0.2%+5
Low kΩ	0.5%+10	0.1%+3	0.1%+3	0.2%+2
High kΩ	0.5%+10	0.1%+3	0.1%+3	0.2%+2
Low MΩ	1.5%+10	0.4%+3	0.4%+3	0.2% +2
High MΩ	3%+50	1.5%+5	1.5%+5	0.8% +2
Low nF	3%+5	0.8%+3	0.8%+3	1.0%+5
High nF	3%+5	0.8%+3	0.8%+3	1.0%+5
Low µF	3%+5	1%+3	1%+3	1.0%+5
High µF	4%+5	5%+5	3.5%+5	1.2%+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.

Accuracy Specifications Comparison for the two IP67 meters

Value	**Keysight U1242C**	**Fluke 87V MAX**
Cost	461.00	$500.99
Count	10,000	6,000
DC mV	0.09%+2	0.1%+1
DC V	0.09%+2	0.05%+1
AC mV	1.0%+3	0.7%+4
AC V	1.0%+3	0.7%+2
DC µA	0.1%+2	0.2%+4
DC mA	0.2%+2	0.2%+4
DC A	0.3%+5	0.2%+4
AC µA	1.0%+3	1%+2
AC mA	1.0%+3	1%+2
AC A	1.2%+5	1%+2
Ω	0.2%+5	0.2%+2
Low kΩ	0.2%+2	0.2%+1
High kΩ	0.2%+2	0.2%+1
Low MΩ	0.2%+2	0.2%+1
High MΩ	0.8%+2	1%+1
Low nF	1.0%+5	1%+2
High nF	1.0%+5	1%+2
Low µF	1.0%+5	1%+2
High µF	1.2%+5	1%+2

Test Leads

The test leads were a hard plastic type and are not gold plated. If you buy this meter you should upgrade the test leads to gold plate with silicon insulation.

Ergonomics

This meter looks and acts just slightly different than most of the meters I have tested. The meter has a build in thermometer that is shown in the secondary display most of the time.
The rotary switch is slightly harder to turn then other meters and them it firmly clicks into place. The feeling of the rotary swath is unlike other meters I tested but it worked fine.
The display has some small symbols on it that are hard for me to read but for normal vision people I am sure its fine. The numbers on the primary and secondary display were readable. The backlight is orange with medium brightness with a slight hint of a hotspot on the right. The six buttons are also backlight in orange. I find the orange ESC and Shift button difficult to read, but that just me.
The strangest UI of this meter is by default there is no mV range. The Volts ranges do resolve down to 0.1 mV but they are not very accurate on the low end of the range. When I investigate this in the *Keysight_U1241C_U1242C_User_Guide* on page 59 it states, “It is recommended to use the mV function when

measuring low voltages.", so I used the optional mV ranges for best accuracy. You must go into the setup menu (see function CoUP)

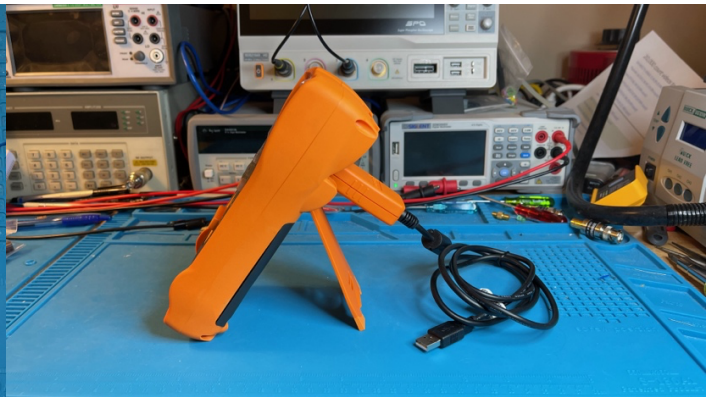
and disable external temperature measurements so the meter will use the temperature position of the rotary switch to measure millivolts.
The following functions are enabled when you hold down the Orange ESC and Shift button when you turn on the meter:

Function	**Description (x.E enable, x.d disable)**
AH	Set the AutoHold threshold count from 001 to 1999 (multiplied by 10). (E or d)
tiME	Set the smooth time from 001 to 1999. (E or d)
AoFF	Set the auto power off timer period from 1 to 99 minutes. (E or d)
bLit	Set the auto power off timer period from 1 to 99 minutes. (E or d)
b-L	Set the LCD and keypad backlight brightness level of low (Lo), 2, 3, medium (ME), 5, 6, or high (Hi).
tLit	Set the LCD flashlight timeout period from 1 to 99 seconds. (E or d)
t-L	Set the LCD flashlight brightness level of low (Lo), 2, 3, medium (ME), 5, 6, or high (Hi).
tyPE	Set the multimeter's data logging option (HAnd: manual log, AUto: interval log, or triG: event log).
tiME	Set the logging duration for interval logs from 1 to 19999 seconds.
CoUP	Set the multimeter's thermocouple type (type J or type K) or mV measurement for the T1 input.
Unit	Set the multimeter's temperature unit (Celsius/Fahrenheit, Celsius, Fahrenheit/Celsius, or Fahrenheit).
bEEP	Set the multimeter's beep frequency from 3200 Hz to 4267 Hz. You can also disable this feature (oFF).
SoUn	Set the multimeter's startup sound to melody (MELo) or beep (bEEE). You can also disable this feature (oFF).
tyPE	Set the multimeter's continuity type to short (SHor), open (oPEn), or tone (tonE).
Horn	Set the multimeter's alert type to beeper (bE.--), flashing red LED (--.rL), both at once (bE.rL), or none (--.--).
bAt	Change the battery selection from primary (Pri) to secondary (SEC).
rSe	Reset the multimeter to its factory default settings.

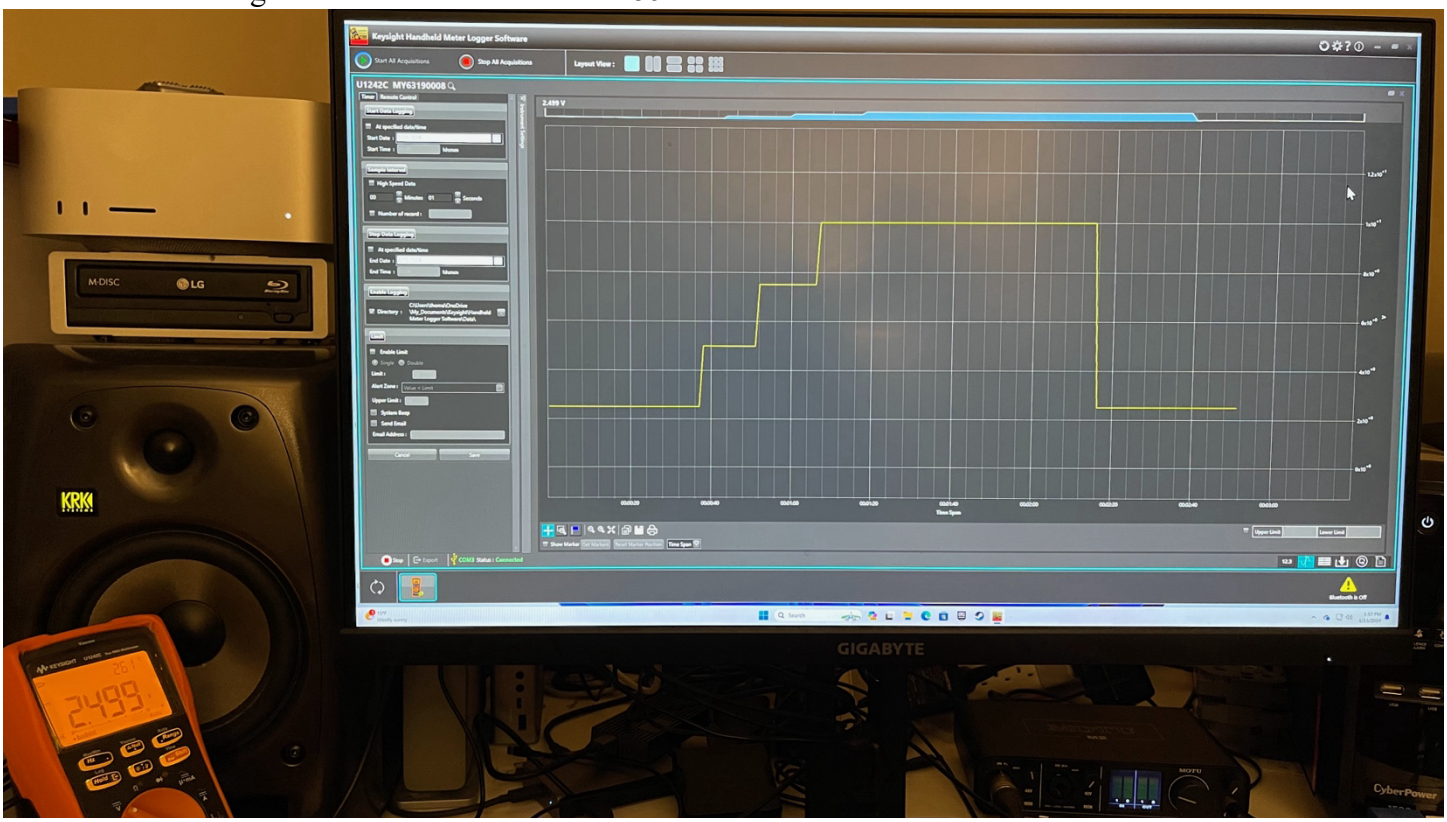
Logging

The meter will log data manually and automatically. It can also communicate with a logging program running on a Windows PC. I was successful running the program on X86 virtual copy of Windows 10 in an Intel iMac running Parallels. The software also installed and work on Windows 11 on AMD X86 hardware. The program installed but would not talk to the meter on an ARM virtual copy of Windows 11 on a Mac Studio running Parallels.

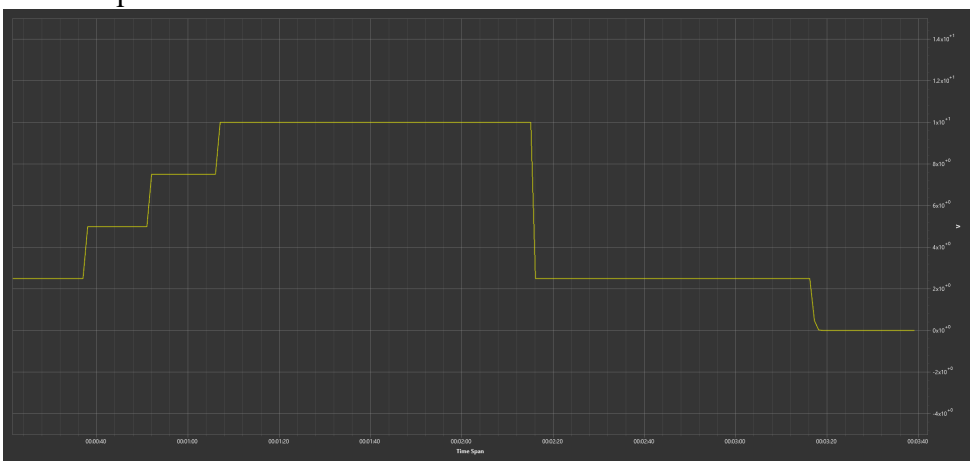
The interface next to the meter on the left photo and the right photo shows the interface attached to the back of the meter.



PC software running on Windows 11 on AMD X86 hardware.

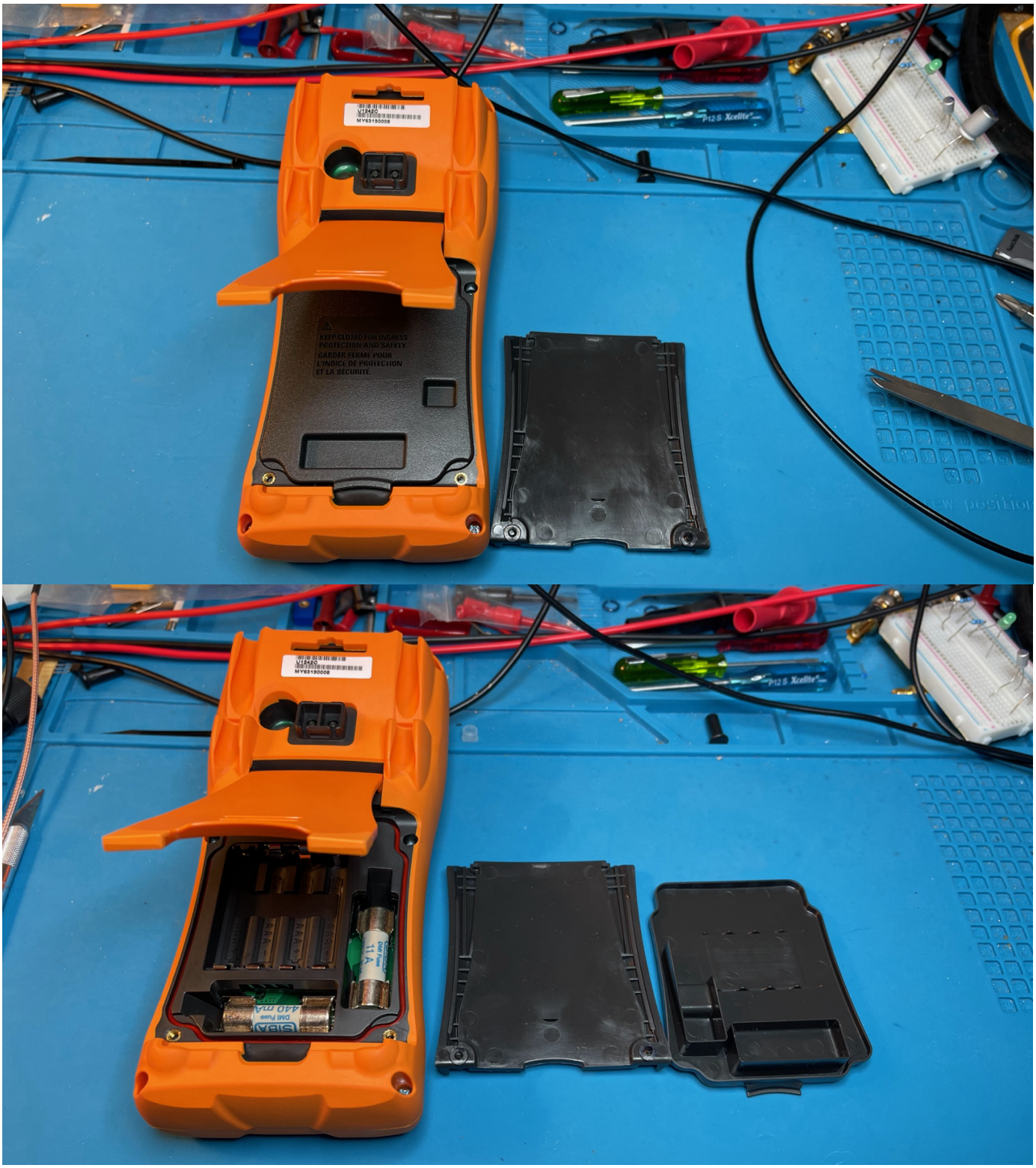


You can plot and save data from the meter.



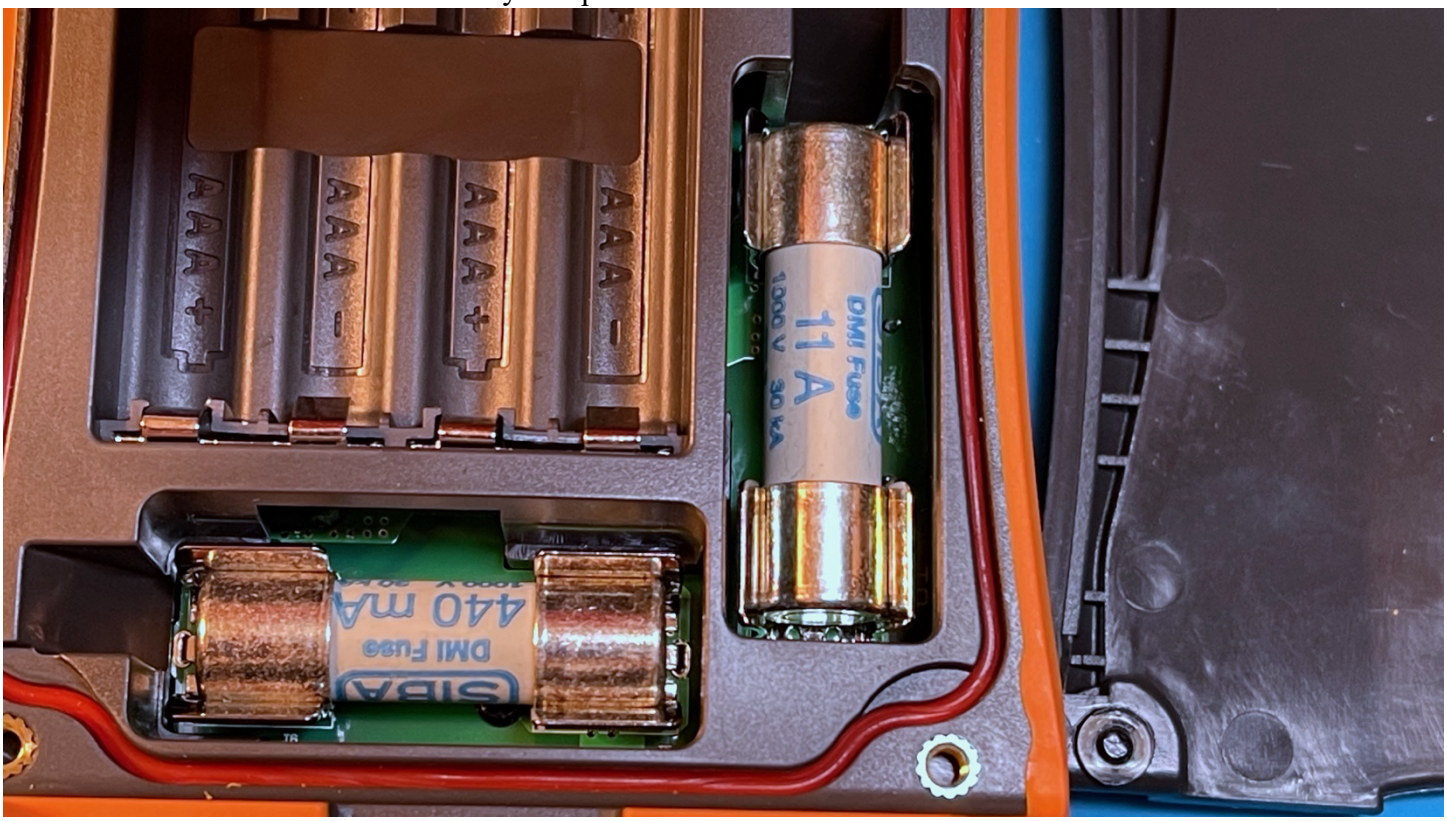
Battery

The meter uses four AAA batteries accessible from the back by removing the battery door then removing the battery cover. The battery door has two captured Philips screw that mates with a brass insert. The battery cover is press fitted in and held down with some pressure from the batter door.



Fuses

The fuses are accusable from the battery compartment.



The Keysight_U1240_Series_Data_Sheet.pdf states the fuses are as follows.
10 x 35 mm, 440 mA / 1000 V, 10 kA minimum fast-acting fuse
10 x 38 mm, 11 A / 1000 V, 20 kA minimum fast-acting fuse

Pros

- Third-party safety testing by CSA for Canada and US.
- Lowest µA Shunt Resistance I have measured.
- All but one reading met the accuracy specifications.
- Extensive customization options.
- IP67 rated and three-meter drop tested.
- Includes IR-to-USB adapter.

Cons

- 1 mV AC reading did not meet accuracy specifications.
- Optional Infrared (IR)-to-Bluetooth adapter is listed as obsolete with no replacement.
- PC logging software has not been updated since 2015.
- The meter will support two thermocouples, but none are provided, they are extra cost optional.
- Must disable external temperature measurements in setup to measure millivolts accurately.

Conclusion

I like and dislike this meter all at the same time. I wonder why there is two different ways to measure millivolts. Why is the least accurate way the default? Why can't the meter measure accurate millivolts and external temperature? There is room on the rotary dial for another position.

What I like:

- Great customization options.
- Fuses are accessible from battery compartment.
- Size and weight.
- Good User Guide.
- Certificate of calibration provided.
- IP 67

What I don't like:

- Default millivolt measurements are inaccurate and must go into options and eliminate external temperature measurements to have dedicated and accurate (except for under 6 mV) millivolt measurements.
- Accuracy specifications are lower than what I expected in a 10,000-count meter.
- Hard copy manual not provided.
- Orange backlight.
- Unconventional rotary switch and button layout and function groupings.
- Very old PC software.

If you want an IP67 meter I would recommend the Fluke 87V MAX. If you want logging and an IP67 in the same meter, then the Keysight U1242C is it, but I would recommend rethinking needing IP67 and logging in the same meter.
I had high expectations for a Keysight meter, but I was disappointed.
The bottom line, I am not keeping this meter and I am not recommending it to anyone either.