

DMMCheck Plus Measured Values

Calibration Date 9-4-2016

Calibration Temperature 70.0°F

Serial Number P651

Burn-In Duration (Hrs) 1106

DC Voltage Reference 5.0000V

DCV Temp. Coefficient $\approx -3\mu V/^{\circ}F$

DC Current Source 1.0002mA

AC Voltage Reference ** 4.999V

AC Current Source** 1.0002mA

100 Hz Oscillator 100.003953Hz

10K Hz Oscillator 10.000395KHz

100 Hz duty cycle 50.0101%

10K Hz duty cycle 50.0068%

100Ω Resistor 100.043Ω

10KΩ Resistor 10.0009KΩ

1KΩ Resistor 999.72Ω

100KΩ Resistor 100.081KΩ

**measured at 100Hz

Calibration Equipment used:

·Agilent DMM, model 3458A, S/N 2823A25529, Cal due date: 1/21/2017

Keysight Technologies Certificate of Calibration 1-7581424013-1

·Agilent Counter/Timer, model 53220A, S/N MY50004699

·Spectracom 10MHz GPS disciplined oscillator, model SecureSync, S/N 01605; used as external time base for 53220A counter.

·Ambient temperature measured by Oakton Temp 5 digital thermometer

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0.5% accurate, 1.00mA AC RMS, 100Hz current source is produced to check the AC current accuracy of your DMM.

100Hz, 50% DUTY CYCLE SIGNAL SOURCE

The 5VAC voltage reference is generated by firmware that is executing on a microcontroller with a 4.000MHz quartz crystal clock source. The precise frequency and duty cycle are recorded on the included as-measured record. 100Hz is the standard oscillator frequency; if the dual frequency option has been ordered, the precise frequencies and duty cycles are noted on the as-measured record.

DUAL FREQUENCY OPERATION (optional feature, specified at time of placing order)

Here is how you switch between the two frequencies: If the AC/DC switch is in the AC position on power-up or after switching for the first time from DC to AC with the power on, the lower of the two frequencies is generated. While keeping the unit powered-on, slide the AC/DC switch to the DC position and then back to AC- the higher of the two frequencies is then generated. Subsequent switching from AC to DC and back to AC will select the other frequency.

ENCLOSURE OPTION

DMMCheck Plus enclosure option provides a transparent acrylic cover over the circuit board and a plastic enclosure to house the 9V battery. When the battery needs replacing, use a Philips head screwdriver to remove the four screws in the board corners, taking care to not lose the four spacers. Remove the circuit board/battery assembly from the enclosure. The battery is held firmly in place and it may be necessary to use a small flat blade screwdriver to gently pry the battery holder clip away from the end of the battery while pulling the battery up and out of the holder. Replace the battery and re-assemble the unit, taking care to not over tighten the four cover screws.

Recalibration of your DMMCheck Plus is free for the first two years after purchase - just send it back to us and either include \$4.00 in postage stamps or send a \$4.00 PayPal payment to doug@voltagestandard.com for return shipping within USA. After two years the charge is \$15.00 plus shipping. Please contact us for shipping charges to destinations outside the USA.

*DMMCheck Plus is calibrated with a 10M Ω load connected to the voltage output terminals for DCV; 10M Ω is the typical input resistance of most DMM's measuring DCV. 1M Ω load is used for ACV.

Please turn this sheet over to see the DMMCheck Plus Measured Values record for your unit.

Preparation for use

Take anti-static precautions when using your DMMCheck Plus- **the LT1021 is static sensitive!** When possible, discharge any accumulated static charge on your body by briefly touching an electrically grounded object, such as a metal equipment chassis that is plugged into the AC line. Also, avoid touching the components on the circuit board with your fingers and use insulated clip leads when connecting to the output terminals.

If making voltage, current or frequency/duty cycle measurements, slide the On/Off switch to the On position and the Power-On LED should illuminate. Allow the circuitry to stabilize for at least 15 minutes before making measurements. Replace the battery when its voltage decreases to 7.6V. The battery voltage can be measured by placing your voltmeter leads on the two battery holder terminals that are on the component side of the PCB adjacent to the On/Off switch.

DC VOLTAGE measurements*

Slide the AC/DC switch to the DC position, set your DMM to measure DC volts, connect the test leads to the V+ and V- terminals shown in the picture, above, and slide the On/Off switch to the On position. Before shipment, the 5V reference is adjusted for 5.0000V and is guaranteed to remain within 0.007% of this value for a minimum of 6 months. Even though the reference voltage output is able to withstand short circuits, take care to not short circuit the output with the meter leads, as internal heating of the reference chip will affect its stability.

1.000mA DC CURRENT SOURCE

Slide the AC/DC switch to the DC position, set your DMM to measure DC current, connect the test leads to the Current + and Current - terminals shown in the picture, above, and slide the On/Off switch to the On position. The DC current sourced by DMMCheck is guaranteed to be within 0.999mA and 1.001mA, with the precise value recorded on the included as-measured record.

PRECISION RESISTORS:

100 Ω , 1K Ω , 10K Ω , and 100K Ω 0.1%, 10ppm/ $^{\circ}$ C resistors (Vishay type PTF56), connected in series are available to check the resistance function of your DMM. Depending on how you connect your meter leads, many different resistance values are available. The resistors are guaranteed accurate within 0.1% of their stated values, but the actual value obtained with a 4-wire (Kelvin) measurement using our calibrated HP 3458A is provided on the included as-measured record.

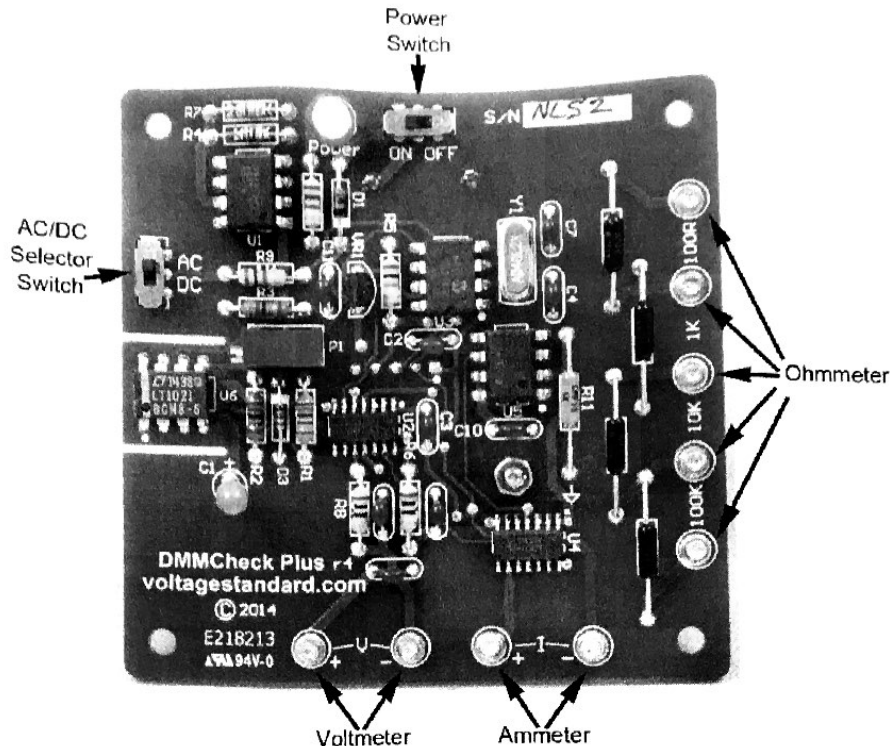
5.00VAC RMS VOLTAGE REFERENCE*

Slide the AC/DC switch to the AC position, set your DMM to measure AC voltage, connect the test leads to the Voltage terminals shown in the picture, above, and slide the On/Off switch to the On position. A 0.1% accurate, 5.00VAC RMS, 100HZ voltage source is produced to check the AC voltage accuracy of your DMM. It can also be used to check the compensation of oscilloscope probes. Note that true RMS-reading DMM's such as Fluke 87, 287, 289 or Extech 540 and 570 will agree with the AC voltage shown on the included "Measured Values" table, below. Less expensive DMM's are average responding and are calibrated for sine waves, not square waves. The result is that average responding meters read 1.11 times higher than true RMS meters when measuring a square wave such as the one produced by DMMCheck Plus. The bottom line is that an average responding meter, when measuring a 5.00V RMS square wave, will display 5.55V and a RMS responding meter will display 5.00V.

1.00mA AC RMS CURRENT SOURCE

Slide the AC/DC switch to the AC position, set your DMM to measure AC current, connect the test leads to the Current terminals shown in the picture, above, and slide the On/Off switch to the On position. A

DMMCheck Plus Usage and Care



Thank you for your purchase. With proper care, your DMMCheck Plus should provide many years of useful service. Please read and follow all of the guidelines on this sheet to help insure success.

DMMCheck Plus is a battery powered device that is used to check seven important functions on a Digital Multi-Meter (DMM) – AC and DC Voltage, AC and DC current, Resistance, Frequency, and Duty Cycle. It consists of the following circuits:

Resistance : Four series –connected 0.1%, 10ppm precision resistors: 100 Ω , 1.00K Ω , 10.00K Ω , and 100.0K Ω

DC voltage : 5V, $\pm 0.007\%$ voltage reference*

DC current : 1mA, $\pm 0.1\%$ current source

AC voltage : 5V RMS, $\pm 0.1\%$ voltage source*

AC current : 1mA RMS, $\pm 0.5\%$ current source

Frequency : 100Hz, $\pm 0.02\%$ signal source standard; dual frequency option, if ordered, as noted in as-measured record

Duty Cycle : 100Hz, 5V RMS, signal source has 50% $\pm 0.05\%$ duty cycle

The included 9V battery makes the unit self-contained and easily transported. An on-board on/off switch allows you to maximize battery life when not in use. Reverse polarity protection is included, so even if the battery is placed in the holder backwards no damage will result. When the AC/DC slide switch is in the AC position, AC voltage and AC current reference signals are present at the "V" and "I" terminals. When in the DC position, DC voltage and DC current reference signals are produced. A red LED indicates when the DMMCheck Plus is powered-up. All reference voltages and currents are derived from a Linear Technology LT1021BCN8-5 buried Zener voltage reference IC.