

Standards Laboratory Calibration Report

DATE 03 Feb 2017 CALIBRATION NO. 1-8568439ITEM Multimeter MODEL 3458A Option 002IDENT. 2823A MFR. Keysight TechnologiesTEST ENVIRONMENT 22.3°C 40% R.H. LABORATORY ALTITUDE 5048 FEET

All data tested to 90 day specs

This lab is ANAB accredited to ISO/IEC 17025:2005, cert# AC-1813.

The performance of this HP 3458A was evaluated by connecting NIST traceable standards to its front input terminals.

Each MEASURED value indicated is the difference between the readings with a nominal input and zero applied to the input terminals. Ohms data was taken in the 4-wire configuration. The instruments' published specifications apply equally for OCOMP ON and OCOMP OFF measurements. OCOMP ON automatically performs the equivalent of a 'reversal' measurement to remove the external error created by offset voltages present in the users' cabling, connections or resistor under test. The user is responsible for eliminating or accounting for these non-instrument errors when performing high-accuracy Ohms measurements with OCOMP OFF.

ACAL ALL was performed before data was taken.

The guard was connected to low using the front panel switch.

The following 3458A parameter settings were used:

NPLC 100 for DCV & Ohms	ACBAND 10, 1E7 for 10 mV @ 1 MHz
OCOMP ON for <= 100 k Ohms	and all ACV @ >1 MHz
OCOMP OFF for > 100 k Ohms	ACBAND 10, 1E6 for all other ACV
DELAY 1 for all Ohms readings	ACBAND 10, 1E4 for all ACI
SETACV SYNC for ACV	LFILTER ON for ACV <=50 kHz
RES .001 for all ACV	LFILTER OFF for ACV above 50 kHz

Type A & B uncertainties are R.S.S. combined with a coverage factor of 2 (K=2). Procedures 144 and 154 were used.

Calibrated by

INTERNAL TEMPERATURE of 3458A 36.6 SERIAL# 2823A

3458A DC VOLTS, OHMS, & DC CURRENT DATA (AS FOUND/AS COMPLETED)

<u>CAL POINT</u>	<u>LOW LIMIT</u>	<u>MEASURED</u>	<u>HIGH LIMIT</u>	<u>UNCERTAINTY</u>	<u>STATUS</u>
100mV ZERO	-.00000100	.00000048	.00000100	.00000004	
1V ZERO	-.00000100	.00000042	.00000100	.00000005	
10V ZERO	-.00000200	.00000010	.00000200	.00000018	
.1V DC	.09999935	.10000011	.10000065	.00000010	
-.1V DC	-.10000065	-.10000015	-.09999935	.00000010	
1V DC	.99999966	.99999998	1.0000034	.00000003	
-1V DC	-1.0000034	-.9999989	-.9999966	.00000003	
10V DC	9.9999735	9.9999987	10.0000265	.00000014	
-10V DC	-10.0000265	-9.9999984	-9.9999735	.00000014	
1V 10VRNG	.9999969	.9999999	1.0000031	.00000003	
-1V 10VRNG	-1.0000031	-1.0000007	-.9999969	.00000003	
100V DC	99.99952	99.99990	100.00048	.00006	
-100V DC	-100.00048	-99.99991	-99.99952	.00006	
1000V DC	999.98340	999.99860	1000.01660	.00146	
-1000V DC	-1000.01660	-999.99877	-999.98340	.00146	
ZERO OC ON	-.0000550	.0000014	.0000550	.0000134	
ZERO OC OFF	-.0000550	-.0000028	.0000550	.0000186	
1 ohm	.9999279	1.0000037	1.0000721	.0000133	
10 ohm	9.9997922	10.0000240	10.0002078	.0000158	
100 ohm	99.99842	100.00002	100.00158	.00015	
1k ohm	999.99135	999.99535	1000.00865	.00058	
10k ohm	9999.914	9999.956	10000.086	.004	
100k ohm	99999.141	99999.772	100000.859	.093	
1M ohm	999985.9	999998.1	1000014.1	3	
10M ohm	9999399.2	10000042.3	10000600.8	110	
100M ohm	99948984	100003289	100051016	2700	
1G ohm	994989100	1000432330	1005010900	197000	
100nA DC	99.9520E-9	100.031517E-09	100.0480E-9	8.3E-12	
-100nA DC	-100.0480E-9	-999.751585E-10	-99.9520E-9	8.3E-12	
1uA DC	.999940E-6	1.000016E-6	1.000060E-6	7.3E-12	
-1uA DC	-1.000060E-6	-1.000004E-6	-.999940E-6	7.3E-12	
10uA DC	9.99974E-6	1.000010E-5	1.00003E-5	5.4E-11	
-10uA DC	-1.00003E-5	-1.000002E-5	-9.99974E-6	5.4E-11	
100uA DC	99.9976E-6	10.000060E-5	10.0002E-5	2.0E-10	
-100uA DC	-10.0002E-5	-10.000030E-5	-99.9976E-6	2.0E-10	
1mA DC	.999979E-3	.100000E-2	1.000021E-3	1.4E-09	
-1mA DC	-.100002E-2	-.100000E-2	-9.999794E-4	1.4E-09	
10mA DC	.00999979	.01000004	.01000021	.00000001	
-10mA DC	-.01000021	-.01000003	-.00999979	.00000001	
100mA DC	.0999964	.1000006	.1000036	.00000014	
-100mA DC	-.1000036	-.1000016	-.0999964	.00000014	
1A DC	.999889	.999989	1.000111	.0000029	
-1A DC	-1.000111	-.999988	-.999889	.0000029	

3458A FREQUENCY DATA

<u>CAL POINT</u>	<u>LOW LIMIT</u>	<u>MEASURED</u>	<u>HIGH LIMIT</u>	<u>UNCERTAINTY</u>	<u>STATUS</u>
1 Hz	.999500	.999999	1.000500	.000013	
1 kHz	.999900	1.000000	1.000100	.000002	
10 MHz	9.99900	10.000003	10.001000	.000017	

Passed () - The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the the measured values were in specification.

Undetermined (U) - The expanded measurement uncertainty intervals about one or more measured values were in as well as out of specification. Consequently, neither compliance nor non-compliance with specification can be declared based on the stated coverage probability.

Failed (F) - One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.

Incoming guard bands were determined by Z540.3 method 5. Data is tabulated in fixed format; not all digits may be significant.

DATE 03 Feb 2017 TEMP 22.3°C REL HUM 40% C# 1-8568439

INTERNAL TEMPERATURE of 3458A 36.6 SERIAL# 2823A

3458A AC VOLTS & CURRENT DATA (AS FOUND/AS COMPLETED)

<u>CAL POINT</u>	<u>LOW LIMIT</u>	<u>MEASURED</u>	<u>HIGH LIMIT</u>	<u>UNCERTAINTY</u>	<u>STATUS</u>
.01V 1kHz	.00999690	.00999948	.01000310	.00000031	
.01V 20kHz	.00999590	.01000206	.01000410	.00000095	
.01V 100kHz	.00994890	.00997825	.01005110	.00000159	
.01V 300kHz	.00959800	.00981039	.01040200	.00000286	
.01V 1MHz	.00987500	.00996968	.01012500	.00000672	
.1V 1kHz	.0999910	.0999979	.1000090	.0000025	
.1V 20kHz	.0999840	.0999966	.1000160	.0000030	
.1V 100kHz	.0999180	.0999505	.1000820	.0000067	
.1V 300kHz	.0996900	.0997206	.1003100	.0000118	
.1V 1MHz	.0989900	.0994977	.1010100	.0000505	
1V 1kHz	.999910	.999989	1.000090	.000015	
1V 20kHz	.999840	.999923	1.000160	.000016	
1V 50kHz	.999680	.999979	1.000320	.000020	
1V 100kHz	.999180	1.000040	1.000820	.000021	
1V 300kHz	.996900	1.000988	1.003100	.000038	
1V 500kHz	.989900	1.002542	1.010100	.000073	
1V 1MHz	.989900	1.005800	1.010100	.000255	
3V 100kHz	2.99754	2.99907	3.00246	.00007	
10V 10Hz	9.99890	10.00016	10.00110	.00032	
10V 20Hz	9.99890	10.00018	10.00110	.00025	
10V 40Hz	9.99910	10.00004	10.00090	.00023	
10V 1kHz	9.99910	10.00003	10.00090	.00015	
10V 4kHz	9.99840	10.00001	10.00160	.00015	
10V 8kHz	9.99840	9.99973	10.00160	.00015	
10V 10kHz	9.99840	9.99970	10.00160	.00015	
10V 20kHz	9.99840	9.99961	10.00160	.00015	
10V 50kHz	9.99680	9.99968	10.00320	.00023	
10V 100kHz	9.99180	9.99746	10.00820	.00023	
10V 300kHz	9.96900	9.98601	10.03100	.00049	
10V 500kHz	9.89900	9.99365	10.10100	.00086	
10V 1MHz	9.89900	10.04140	10.10100	.00295	
100V 1kHz	99.9780	99.9996	100.0220	.0017	
100V 20kHz	99.9780	99.9976	100.0220	.0019	
100V 50kHz	99.9630	100.0047	100.0370	.0024	
100V 100kHz	99.8780	100.0190	100.1220	.0032	
700V 1kHz	699.706	699.958	700.294	.0164	
700V 20kHz	699.566	699.878	700.434	.0182	
.01V 4MHz	.0092930	.0097252	.0107070	.0000244	
.1V 4MHz	.095930	.100470	.104070	.000234	
.1V 8MHz	.095920	.099088	.104080	.000357	
.1V 10MHz	.084900	.094278	.115100	.000431	
1V 4MHz	.95930	1.00877	1.04070	.00233	
1V 8MHz	.95920	.99693	1.04080	.00357	
1V 10MHz	.84900	.92670	1.15100	.00439	
3V 2MHz	2.87790	3.01957	3.12210	.00681	
3V 4MHz	2.87790	3.08013	3.12210	.00701	
3V 8MHz	2.87760	2.99603	3.12240	.01067	
3V 10MHz	2.54700	2.79718	3.45300	.01318	
10uA 1kHz	9.964E-6	1.001363E-5	10.036E-6	4.8E-09	
100uA 1kHz	99.91E-6	9.997350E-5	100.09E-6	9.6E-09	
1mA 1kHz	.9995E-3	1.000045E-3	1.0005E-3	7.7E-08	
10mA 1kHz	9.995E-3	1.000062E-2	10.005E-3	7.3E-07	
100mA 1kHz	.0999500	.1000093	.1000500	.0000073	
1A 1kHz	.998800	1.000091	1.001200	.000113	