

Calibration Certificate



Certificate Number: 2023000048

Customer:

COGWELL, INC
1700 Wyatt Dr.
Ste 1
Santa Clara CA 95054
USA

Calibration Lab:

COGWELL, INC
1700 Wyatt Dr.
Ste 1
Santa Clara CA 95054
USA

Job Number		ID	CX000303
Number		Description	HP 3458A 8 1/2 Digit Multimeter
Technician	Tong La	Manufacturer	HP
Temperature	21.79	Model Number	3458a
Humidity	31.7	Serial Number	2823a17098
WO Results	Pass	Service Date:	3/1/2023
Received	In Tolerance	Due Date:	3/1/2024

COGWELL, INC certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Work Order Notes:

REVIEWED by:



Standards Used

Description	Service Date	Due Date	ID
Fluke 5730A Multifunction Calibrator	8/25/2022	8/25/2024	CX000018
Fluke 5790A AC Measurement Standard	8/30/2022	8/30/2023	CX000027
Fluke 732B DC Standard	11/17/2022	11/17/2023	CX000028
Agilent 33250A Arb. Waveform Generator	11/30/2022	11/30/2023	CX000032
ESI SR104 10k Resistance Standard	11/9/2022	11/9/2023	CX000235
HP 3458A 8 1/2 Digit Multimeter, 001/002	1/11/2023	1/11/2024	CX000267

HP 3458A: Verification Procedure						
MET/CAL Results	Pass	As Left		CAL10	Status	TSR
Test Description	True Value	Lower Limit	Test Results	Upper Limit		

* UUT IDENTIFICATION *

Manufacture Model Number: HP3458A

Firmware Rev: 8,2

Number of Calibrations: 60

* Set Up for Option 002 *

* Temperature *

(TCal =40.1 Temp(59) =40.4377726) Pass

(TCal =40.1 Temp(60) =40.467899) Pass

* DC VOLTAGE TEST *

OFFSET

100 mV Range Front Zero

0.000000 mV	0.0000000 mV	-0.000900 mV	-0.000091 mV	0.000900 mV	Pass
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1V Range Front Zero

0.000000 mV	0.0000000000 V	-0.000001000 V	-0.000000116 V	0.000001000 V	Pass
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10V Range Front Zero

0.0000000 V	0.00000000 V	-0.0000020 V	-0.0000003 V	0.0000020 V	Pass
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100V Range Front Zero

0.000000 V	0.0000000 V	-0.000030 V	-0.000030 V	0.000030 V	Pass
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1000V Range Front Zero

0.00000 V	0.000000 V	-0.00010 V	-0.00003 V	0.00010 V	Pass
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DC Voltage Gain Tests

100 mV DC Range

100.00000 mV	100.000000 mV	99.99880 mV	100.00108 mV	100.00120 mV	Pass
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100.00000 mV	-100.000000 mV	-100.00120 mV	-100.00068 mV	-99.99880 mV	Pass
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Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
1V DC Range						
1.00000000 V	1.000000000 V	0.99999170 V	1.00000098 V	1.00000830 V	Pass	
1.00000000 V	-1.000000000 V	-1.00000830 V	-1.00000173 V	-0.99999170 V	Pass	
10V DC Range, 1V readings						
1.00000000 V	-1.000000000 V	-1.00000805 V	-0.99999843 V	-0.99999195 V	Pass	
1.00000000 V	1.000000000 V	0.99999195 V	1.00000053 V	1.00000805 V	Pass	
10V DC Range						
10.0000000 V	10.00000000 V	9.9999195 V	10.0000026 V	10.0000805 V	Pass	
10.0000000 V	-10.00000000 V	-10.0000805 V	-10.0000030 V	-9.9999195 V	Pass	
100V DC Range						
100.000000 V	100.0000000 V	99.998970 V	100.000109 V	100.001030 V	Pass	
100.000000 V	-100.0000000 V	-100.001030 V	-100.000114 V	-99.998970 V	Pass	
1000V Range						
1000.00000 V	1000.000000 V	999.98990 V	999.99972 V	1000.01010 V	Pass	
1000.00000 V	-1000.000000 V	-1000.01010 V	-999.99693 V	-999.98990 V	Pass	
* AC CURRENT TESTS *						
100uA Range ACI 1kHz SYNC MODE						
100.000 μ A @ @1KH	100.0000 μ A	99.910 μ A	99.996 μ A	100.090 μ A	Pass	
1mA Range ACI 1kHz SYNC						
1.00000 mA @ @1KH	1.000000 mA	0.99950 mA	0.99994 mA	1.00050 mA	Pass	
10mA Range ACI 1kHz SYNC						
10.0000 mA @ @1KH	10.00000 mA	9.9950 mA	9.9993 mA	10.0050 mA	Pass	
100mA Range ACI 1kHz SYNC						
100.000 mA @ @1KH	100.0000 mA	99.950 mA	99.995 mA	100.050 mA	Pass	
1A Range ACI 1kHz SYNC						
1.00000 A @ @1KH	1.000000 A	0.99950 A	0.99991 A	1.00050 A	Pass	
100mV Range AC Analog Mode						
100.00 mV @ @20KH	100.000 mV	99.81 mV	100.01 mV	100.19 mV	Pass	

Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
1V Range AC Analog Mode						
1.0000 V @ @50KH	1.00000 V	0.9981 V	0.9997 V	1.0019 V	Pass	
1.0000 V @ @1MH	1.00000 V	0.9300 V	1.0111 V	1.0700 V	Pass	
10V Range AC Analog Mode						
10.000 V @ @10H	10.0000 V	9.958 V	9.976 V	10.042 V	Pass	
10.000 V @ @200H	10.0000 V	9.997 V	10.000 V	10.003 V	Pass	
10.000 V @ @500H	10.0000 V	9.997 V	10.000 V	10.003 V	Pass	
10.000 V @ @50kH	10.0000 V	9.981 V	9.997 V	10.019 V	Pass	
10.000 V @ @1MH	10.0000 V	9.300 V	10.084 V	10.700 V	Pass	
10mV Range AC Sync Mode						
10.000 mV @ @1KH	10.0000 mV	9.598 mV	10.000 mV	10.402 mV	Pass	
10mV Range AC Sync Mode						
10 mV @ @20KH	10.0 mV	10 mV	10 mV	10 mV	Pass	
10mV Range AC Sync Mode						
10 mV @ @100KH	10.0 mV	10 mV	10 mV	10 mV	Pass	
10mV Range AC Sync Mode						
10.000 mV @ @300KH	10.0000 mV	9.598 mV	9.811 mV	10.402 mV	Pass	
100mV Range AC Sync Mode						
100.00 mV @ @1KH	100.000 mV	99.98 mV	100.00 mV	100.02 mV	Pass	
100.00 mV @ @20KH	100.000 mV	99.98 mV	99.99 mV	100.02 mV	Pass	
100.00 mV @ @100KH	100.000 mV	99.92 mV	99.99 mV	100.08 mV	Pass	
100.00 mV @ @300KH	100.000 mV	96.40 mV	99.78 mV	103.60 mV	Pass	
1V Range AC Sync Mode						
1.0000 V @ @1KH	1.00000 V	0.9997 V	1.0000 V	1.0003 V	Pass	
1.0000 V @ @20KH	1.00000 V	0.9997 V	1.0000 V	1.0003 V	Pass	
1.0000 V @ @50KH	1.00000 V	0.9981 V	1.0001 V	1.0019 V	Pass	
1.0000 V @ @100KH	1.00000 V	0.9932 V	1.0002 V	1.0068 V	Pass	
1.0000 V @ @300KH	1.00000 V	0.9694 V	1.0022 V	1.0306 V	Pass	

Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
1.0000 V @ @500KH	1.00000 V	0.9640 V	1.0056 V	1.0360 V	Pass	
10V Range AC Sync Mode - 1, 3V, 10V inputs						
10.000 V @ @1kH	1.0000 V	0.994 V	1.000 V	1.006 V	Pass	
3.0000 V @ @100kH	3.00000 V	2.9740 V	2.9993 V	3.0260 V	Pass	
10.000 V @ @10H	10.0000 V	9.958 V	10.000 V	10.042 V	Pass	
10.000 V @ @20H	10.0000 V	9.958 V	10.000 V	10.042 V	Pass	
10.000 V @ @40H	10.0000 V	9.983 V	10.000 V	10.017 V	Pass	
10.000 V @ @1kH	10.0000 V	9.997 V	10.000 V	10.003 V	Pass	
10.000 V @ @10kH	10.0000 V	9.997 V	10.000 V	10.003 V	Pass	
10.000 V @ @20kH	10.0000 V	9.997 V	10.000 V	10.003 V	Pass	
10.000 V @ @50kH	10.0000 V	9.981 V	10.000 V	10.019 V	Pass	
10.000 V @ @100kH	10.0000 V	9.932 V	9.998 V	10.068 V	Pass	
10.000 V @ @300kH	10.0000 V	9.640 V	9.991 V	10.360 V	Pass	
10.000 V @ @500kH	10.0000 V	9.640 V	10.004 V	10.360 V	Pass	
10.000 V @ @1MH	10.0000 V	9.300 V	10.078 V	10.700 V	Pass	
100V Range AC Sync Mode						
100.00 V @ @1kH	100.000 V	99.96 V	100.00 V	100.04 V	Pass	
100.00 V @ @20kH	100.000 V	99.96 V	100.00 V	100.04 V	Pass	
100.00 V @ @50kH	100.000 V	99.81 V	100.00 V	100.19 V	Pass	
100.00 V @ @100kH	100.000 V	99.32 V	99.98 V	100.68 V	Pass	
1000V Range AC Sync Mode						
700.00 V @ @1kH	700.000 V	699.44 V	699.93 V	700.56 V	Pass	
10mV AC Range, High Frequency, 1MHz						
10.00 mV @ @1MH	10.000 mV	9.29 mV	9.95 mV	10.71 mV	Pass	
10mV AC range, High Frequency, 4MHz						
10.00 mV @ @4MH	10.000 mV	7.99 mV	9.71 mV	12.01 mV	Pass	
100mV AC Range, High Frequency, 1MHz						
100.0 mV @ @1MH	100.00 mV	99.0 mV	99.5 mV	101.0 mV	Pass	

Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
100mV AC Range, High Frequency, 4MHz						
100.0 mV @ @4MH	100.00 mV	95.9 mV	99.9 mV	104.1 mV	Pass	
100mV AC Range, High Frequency, 8MHz						
100.0 mV @ @8MH	100.00 mV	95.9 mV	100.2 mV	104.1 mV	Pass	
100mV AC Range, High Frequency, 10MHz						
100.0 mV @ @10MH	100.00 mV	84.9 mV	99.0 mV	115.1 mV	Pass	
1V AC Range, High Frequency						
1V AC Range, High Frequency, 1MHz						
1.0000 V @ @1MH	1.00000 V	0.9593 V	0.9985 V	1.0407 V	Pass	
1V AC Range, High Frequency, 4MHz						
1.0000 V @ @4MH	1.00000 V	0.9592 V	1.0021 V	1.0408 V	Pass	
10V Range High Frequency, 1V Signal						
1V AC Range, High Frequency, 8MHz						
1.0000 V @ @8MH	1.00000 V	0.8490 V	0.9959 V	1.1510 V	Pass	
1V AC Range, High Frequency, 10MHz						
1.0000 V @ @10MH	1.00000 V	0.8490 V	0.9655 V	1.1510 V	Pass	
10V AC Range, High Frequency, 3V Signal, 2MHz						
1.0000 V @ @2MH	3.00000 V	2.8779 V	2.9954 V	3.1221 V	Pass	
10V AC Range, High Frequency, 3V Signal, 4MHz						
10.000 V @ @4MH	3.0000 V	2.878 V	3.049 V	3.122 V	Pass	
10V AC Range, High Frequency, 3V Signal, 8MHz						
10.000 V @ @8MH	3.0000 V	2.547 V	2.999 V	3.453 V	Pass	
10V AC Range, High Frequency, 3V Signal, 10MHz						
10.000 V @ @10MH	3.0000 V	2.547 V	2.903 V	3.453 V	Pass	
DC Current Offset Tests						
100uA Range Front Zero						
100.00000 µA	0.000000 µA	-0.00080 µA	-0.00007 µA	0.00080 µA	Pass	

Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
1mA Range Front Zero						
0.00000000 mA	0.00000000 mA	-0.00000500 mA	-0.00000047 mA	0.00000500 mA	Pass	
10mA Range Front Zero						
0.00000000 mA	0.00000000 mA	-0.00000500 mA	-0.00000023 mA	0.00000500 mA	Pass	
100mA Range Front Zero						
100.000000 mA	0.00000000 mA	-0.00000500 mA	-0.00000006 mA	0.00000500 mA	Pass	
1A Range Front Zero						
1.000000000 A	0.000000000 A	-0.000010000 A	-0.000001306 A	0.000010000 A	Pass	
DC Current Gain Tests						
100 uA DC Range						
99.999915360 µA	100.000000000 µA	99.99720000 µA	99.99991536 µA	100.00280000 µA	Pass	
-99.999790970 µA	-100.000000000 µA	-100.00280000 µA	-99.99979097 µA	-99.99720000 µA	Pass	
1mA DC Range						
0.99999869320 mA	1.0000000000 mA	0.9999750000 mA	0.9999986932 mA	1.0000250000 mA	Pass	
1.000000000 mA	-1.000000000 mA	-1.000025000 mA	-0.99999804 mA	-0.999975000 mA	Pass	
10mA DC Range						
10.00000000 mA	10.00000000 mA	9.99972000 mA	9.9999825 mA	10.00028000 mA	Pass	
10.00000000 mA	-10.00000000 mA	-10.00025000 mA	-9.9999191 mA	-9.99975000 mA	Pass	
100mA DC Range						
-100.00000000 mA	100.00000000 mA	99.9960000 mA	100.0029011 mA	100.0040000 mA	Pass	
100.00000000 mA	-100.00000000 mA	-100.0040000 mA	-100.0028492 mA	-99.9960000 mA	Pass	
1A DC Range						
1.000000000 A	1.000000000 A	0.99988000 A	1.00000231 A	1.00012000 A	Pass	

* RESISTANCE PERFORMANCE TESTS *

10 Ohm Range Zero - Two Wire Front Connectors (no null)

0.00000 Ohm	0.000000 Ohm	-0.05000 Ohm	-0.00361 Ohm	0.05000 Ohm	Pass	
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10 Ohm Range Zero - Four Wire Front Connectors

Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
0.00000 Ohm	0.000000 Ohm	-0.00005 Ohm	0.00001 Ohm	0.00005 Ohm	Pass	
10 Ohm Range Zero - Two Wire Rear Connectors						
0.00000 Ohm	0.000000 Ohm	-0.05000 Ohm	0.01357 Ohm	0.05000 Ohm	Pass	
10 Ohm Range Zero - Four Wire Rear Connectors						
0.00000 Ohm	0.000000 Ohm	-0.00005 Ohm	-0.00001 Ohm	0.00005 Ohm	Pass	
10 Ohm Range						
9.9994673140 Ohm	9.9994204174 Ohm	9.999220426 Ohm	9.999467314 Ohm	9.999620409 Ohm	Pass	
100 Ohm Range						
99.996131670 Ohm	99.997200000 Ohm	99.99550003 Ohm	99.99613167 Ohm	99.99889997 Ohm	Pass	
1k Ohm Range						
1.000000290 kOhm	0.999998156 kOhm	0.99998216 kOhm	1.00000029 kOhm	1.00001416 kOhm	Pass	
10k Ohm Range						
9.9998361090 kOhm	9.9998052173 kOhm	9.999645220 kOhm	9.999836109 kOhm	9.999965214 kOhm	Pass	
100k Ohm Range						
99.999215770 kOhm	99.999221210 kOhm	99.99811622 kOhm	99.99921577 kOhm	100.00032620 kOhm	Pass	
1M Ohm Range						
0.99995506380 MOhm	0.99995991177 MOhm	0.9999429124 MOhm	0.9999550638 MOhm	0.9999769112 MOhm	Pass	
10M Ohm Range 4W						
9.9981256420 MOhm	9.9981918755 MOhm	9.997591966 MOhm	9.998125642 MOhm	9.998791785 MOhm	Pass	
10M Ohm Range 2W						
9.9984006540 MOhm	9.9981918755 MOhm	9.997591966 MOhm	9.998400654 MOhm	9.998791785 MOhm	Pass	
100M Ohm Range 2W						
100.01175820 MOhm	100.01713685 MOhm	99.9661283 MOhm	100.0117582 MOhm	100.0681454 MOhm	Pass	
1G Ohm Range						
1000.000 MOhm	1003.8200 MOhm	998.791 MOhm	1003.278 MOhm	1008.849 MOhm	Pass	
* FREQUENCY TESTS *						
1.00000 Hz	1.000000 Hz	0.99950 Hz	1.00001 Hz	1.00050 Hz	Pass	

Test Description	True Value	Lower Limit	Test Results	Upper Limit	Status	TSR
2.00000 Hz	2.000000 Hz	1.99950 Hz	2.00001 Hz	2.00050 Hz	Pass	
100.000 Hz	100.0000 Hz	99.995 Hz	100.001 Hz	100.005 Hz	Pass	
1.00000 kHz	1.000000 kHz	0.99950 kHz	1.00001 kHz	1.00050 kHz	Pass	
10.0000 kHz	10.00000 kHz	9.9950 kHz	10.0001 kHz	10.0050 kHz	Pass	
100.000 kHz	100.0000 kHz	99.950 kHz	100.001 kHz	100.050 kHz	Pass	
1.00000 MHz	1.000000 MHz	0.99950 MHz	1.00001 MHz	1.00050 MHz	Pass	
10.0000 MHz	10.00000 MHz	9.9950 MHz	10.0001 MHz	10.0050 MHz	Pass	

Verification Complete

Cogwell, Inc.

Santa Clara, CA

-- End of measurement results--