



MICRO PRECISION CALIBRATION PTE LTD
BLOCK 5008 ANG MO KIO AVENUE 5 #07-02/03
TECHPLACE II SINGAPORE 569874
65 67484384



Certificate of Calibration

Date: February 18, 2020

Cert No. 551220083477955

Customer:

WATERS PACIFIC PTE LTD
1 SCIENCE PARK ROAD, #02-08 THE CAPRICORN
SINGAPORE SCIENCE PARK II
SINGAPORE 117528

Work Order #: SG-11013266

MPC Control #: MY53002751/95155
Asset ID: N/A
Gage Type: 6 1/2 DIGIT MULTIMETER
Manufacturer: AGILENT
Model Number: 34411A
Size: REFER DATA
Temp/RH: 22.4°C / 49 %
Location: Calibration performed at Customer's facility

Serial Number: MY53002751/95155
Department: N/A
Performed By: YIOK TEE CHUA
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: February 18, 2020
Cal. Interval: 12 MONTHS
Cal. Due Date: February 18, 2021

Calibration Notes:

Performance Tests Passed. See attached data (4 Pages).
Calibration performed at GES SINGAPORE PTE LTD.

Standards Used to Calibrate Equipment

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
FA0003	CALIBRATOR	5500A	6940015	FLUKE	May 28, 2020	551220083035835
DH3876	MULTI-FUNCTION CALIBRATOR	5700A/NAF	6020913	FLUKE	Apr 9, 2020	551220082911745

Procedures Used in this Event

Procedure Name	Description
AGILENT 34410A/11A Rev. FIFTH EDITION	Digital Multimeter, Agilent 34410A/11A, Fifth Edition, Mar-01-2012

Calibrating Technician:

YIOK TEE CHUA

QC Approval:

JUN CALIMAG

Statements of Pass or Fail Conformance: The uncertainty of measurement has been taken into account when determining compliance with specification, as per ILAC-G8:03/2009. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/NCSL Z540.3-2006.

The status of compliance with the acceptance criteria is reported as:

PASS - Compliant with specification.

FAIL - Not compliant with specification.

PASS² - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.

PASS^F - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.

The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated. This calibration report complies with ISO/IEC 17025:2017 and ANSI/NCSL Z540.3 Method 6-Guard Bands based on Test Uncertainty Ratio. Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. The information on this report pertains only to the instrument identified, this may not be reproduced in part or in a whole without the prior written approval of the issuing MP Calibration Laboratory.



Measurement Report Agilent 34411A Digital Multimeter

1 year specifications

Procedure: 34411A AGILENT

Order Number: SG-11013266

ID Number: MY53002751/95155

Calibration Date: 18-02-20

Section 1 - Zero Offset Verification

Front panel input terminals

Function/Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
DCV / 100 mV	0.0000 mV	-0.0035 mV	0.0004 mV	0.0004 mV	0.0035 mV	PASS	0.000058 mV
DCV / 1 V	0.000000 V	-0.000007 V	0.000001 V	0.000001 V	0.000007 V	PASS	0.00000058 V
DCV / 10 V	0.00000 V	-0.00005 V	0.00000 V	0.00000 V	0.00005 V	PASS	0.0000058 V
DCV / 100 V	0.0000 V	-0.0006 V	0.0000 V	0.0000 V	0.0006 V	PASS	0.000058 V
DCV / 1000 V	0.000 V	-0.006 V	-0.001 V	-0.001 V	0.006 V	PASS	0.00058 V
DCI / 100 µA	0.0000 µA	-0.0250 µA	0.0000 µA	0.0000 µA	0.0250 µA	PASS	0.000058 µA
DCI / 1 mA	0.000000 mA	-0.060000 mA	0.000002 mA	0.000002 mA	0.060000 mA	PASS	0.00000058 mA
DCI / 10 mA	0.00000 mA	-0.00200 mA	0.00000 mA	0.00000 mA	0.00200 mA	PASS	0.0000058 mA
DCI / 100 mA	0.0000 mA	-0.0050 mA	0.0000 mA	0.0000 mA	0.0050 mA	PASS	0.000058 mA
DCI / 1 A	0.000000 A	-0.000100 A	0.000000 A	0.000000 A	0.000100 A	PASS	0.00000058 A
DCI / 3 A	0.00000 A	-0.00060 A	0.00000 A	0.00000 A	0.00060 A	PASS	0.0000058 A
4-Wire / 100 Ω	0.0000 Ω	-0.0040 Ω	0.0006 Ω	0.0006 Ω	0.0040 Ω	PASS	0.000058 Ω
4-Wire / 1 kΩ	0.000000 kΩ	-0.000010 kΩ	0.000001 kΩ	0.000001 kΩ	0.000010 kΩ	PASS	0.00000058 kΩ
4-Wire / 10 kΩ	0.00000 kΩ	-0.00010 kΩ	0.00000 kΩ	0.00000 kΩ	0.00010 kΩ	PASS	0.0000058 kΩ
4-Wire / 100 kΩ	0.0000 kΩ	-0.0010 kΩ	0.0000 kΩ	0.0000 kΩ	0.0010 kΩ	PASS	0.000058 kΩ
4-Wire / 1 MΩ	0.000000 MΩ	-0.000010 MΩ	0.000000 MΩ	0.000000 MΩ	0.000010 MΩ	PASS	0.00000058 MΩ
4-Wire / 10 MΩ	0.00000 MΩ	-0.00010 MΩ	0.00000 MΩ	0.00000 MΩ	0.00010 MΩ	PASS	0.0000058 MΩ
4-Wire / 100 MΩ	0.0000 MΩ	-0.0010 MΩ	0.0000 MΩ	0.0000 MΩ	0.0010 MΩ	PASS	0.000058 MΩ
2-Wire / 100 Ω	0.0000 Ω	-0.0040 Ω	0.0000 Ω	0.0000 Ω	0.0040 Ω	PASS	0.000058 Ω
2-Wire / 1 kΩ	0.000000 kΩ	-0.000010 kΩ	0.000000 kΩ	0.000000 kΩ	0.000010 kΩ	PASS	0.00000058 kΩ
2-Wire / 10 kΩ	0.00000 kΩ	-0.00010 kΩ	0.00000 kΩ	0.00000 kΩ	0.00010 kΩ	PASS	0.0000058 kΩ
2-Wire / 100 kΩ	0.0000 kΩ	-0.0010 kΩ	0.0000 kΩ	0.0000 kΩ	0.0010 kΩ	PASS	0.000058 kΩ
2-Wire / 1 MΩ	0.000000 MΩ	-0.000010 MΩ	0.000000 MΩ	0.000000 MΩ	0.000010 MΩ	PASS	0.00000058 MΩ
2-Wire / 10 MΩ	0.00000 MΩ	-0.00010 MΩ	0.00000 MΩ	0.00000 MΩ	0.00010 MΩ	PASS	0.0000058 MΩ
2-Wire / 100 MΩ	0.0000 MΩ	-0.0010 MΩ	0.0000 MΩ	0.0000 MΩ	0.0010 MΩ	PASS	0.000058 MΩ

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Section 1 - Zero Offset Verification (continued)

Rear panel input terminals

Function/Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
DCV / 100 mV	0.0000 mV	-0.0035 mV	0.0002 mV	0.0002 mV	0.0035 mV	PASS	0.000058 mV
DCV / 1 V	0.000000 V	-0.000007 V	0.000001 V	0.000001 V	0.000007 V	PASS	0.0000058 V
DCV / 10 V	0.00000 V	-0.00005 V	0.00000 V	0.00000 V	0.00005 V	PASS	0.0000058 V
DCV / 100 V	0.0000 V	-0.0006 V	0.0000 V	0.0000 V	0.0006 V	PASS	0.000058 V
DCV / 1000 V	0.000 V	-0.006 V	0.000 V	0.000 V	0.006 V	PASS	0.00058 V
DCI / 100 µA	0.0000 µA	-0.0250 µA	0.0006 µA	0.0006 µA	0.0250 µA	PASS	0.000058 µA
DCI / 1 mA	0.000000 mA	-0.060000 mA	0.000002 mA	0.000000 mA	0.060000 mA	PASS	0.0000058 mA
DCI / 10 mA	0.00000 mA	-0.00200 mA	0.00002 mA	0.00000 mA	0.00200 mA	PASS	0.0000058 mA
DCI / 100 mA	0.0000 mA	-0.0050 mA	-0.0001 mA	-0.0001 mA	0.0050 mA	PASS	0.000058 mA
DCI / 1 A	0.000000 A	-0.000100 A	0.000000 A	0.000000 A	0.000100 A	PASS	0.0000058 A
DCI / 3 A	0.00000 A	-0.00060 A	0.00000 A	0.00000 A	0.00060 A	PASS	0.0000058 A
4-Wire / 100 Ω	0.0000 Ω	-0.0040 Ω	0.0005 Ω	0.0005 Ω	0.0040 Ω	PASS	0.000058 Ω
4-Wire / 1 kΩ	0.000000 kΩ	-0.000010 kΩ	0.000000 kΩ	0.000000 kΩ	0.000010 kΩ	PASS	0.0000058 kΩ
4-Wire / 10 kΩ	0.00000 kΩ	-0.00010 kΩ	0.00000 kΩ	0.00000 kΩ	0.00010 kΩ	PASS	0.0000058 kΩ
4-Wire / 100 kΩ	0.0000 kΩ	-0.0010 kΩ	0.0000 kΩ	0.0000 kΩ	0.0010 kΩ	PASS	0.000058 kΩ
4-Wire / 1 MΩ	0.000000 MΩ	-0.000010 MΩ	0.000000 MΩ	0.000000 MΩ	0.000010 MΩ	PASS	0.0000058 MΩ
4-Wire / 10 MΩ	0.00000 MΩ	-0.00010 MΩ	0.00000 MΩ	0.00000 MΩ	0.00010 MΩ	PASS	0.0000058 MΩ
4-Wire / 100 MΩ	0.0000 MΩ	-0.0010 MΩ	0.0000 MΩ	0.0000 MΩ	0.0010 MΩ	PASS	0.000058 MΩ
2-Wire / 100 Ω	0.0000 Ω	-0.0040 Ω	0.0000 Ω	0.0000 Ω	0.0040 Ω	PASS	0.000058 Ω
2-Wire / 1 kΩ	0.000000 kΩ	-0.000010 kΩ	0.000000 kΩ	0.000000 kΩ	0.000010 kΩ	PASS	0.0000058 kΩ
2-Wire / 10 kΩ	0.00000 kΩ	-0.00010 kΩ	0.00000 kΩ	0.00000 kΩ	0.00010 kΩ	PASS	0.0000058 kΩ
2-Wire / 100 kΩ	0.0000 kΩ	-0.0010 kΩ	0.0000 kΩ	0.0000 kΩ	0.0010 kΩ	PASS	0.000058 kΩ
2-Wire / 1 MΩ	0.000000 MΩ	-0.000010 MΩ	0.000000 MΩ	0.000000 MΩ	0.000010 MΩ	PASS	0.0000058 MΩ
2-Wire / 10 MΩ	0.00000 MΩ	-0.00010 MΩ	0.00000 MΩ	0.00000 MΩ	0.00010 MΩ	PASS	0.0000058 MΩ
2-Wire / 100 MΩ	0.0000 MΩ	-0.0010 MΩ	0.0000 MΩ	0.0000 MΩ	0.0010 MΩ	PASS	0.000058 MΩ

Section 2 - DC Voltage Gain Verification Test

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 mV	100.0000 mV	99.9915 mV	99.9990 mV	99.9990 mV	100.0085 mV	PASS	0.0017 mV
100 mV	-100.0000 mV	-100.0085 mV	-99.9990 mV	-99.9990 mV	-99.9915 mV	PASS	0.0017 mV
1 V	1.000000 V	0.999958 V	0.999980 V	0.999980 V	1.000042 V	PASS	0.0000098 V
10 V	10.00000 V	9.99965 V	9.99986 V	9.99986 V	10.00035 V	PASS	0.000043 V
10 V	-10.00000 V	-10.00035 V	-9.99989 V	-9.99989 V	-9.99965 V	PASS	0.000043 V
100 V	100.0000 V	99.9954 V	99.9973 V	99.9973 V	100.0046 V	PASS	0.00065 V
1000 V	1000.000 V	999.954 V	999.980 V	999.980 V	1000.046 V	PASS	0.0061 V

Section 3 - DC Current Gain Verification Test

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 µA	100.0000 µA	99.9250 µA	100.0000 µA	100.0000 µA	100.0750 µA	PASS	0.010 µA
1 mA	1.000000 mA	0.999440 mA	0.999900 mA	0.999900 mA	1.000560 mA	PASS	0.000043 mA
10 mA	10.00000 mA	9.99300 mA	10.00000 mA	10.00000 mA	10.00700 mA	PASS	0.00041 mA
100 mA	100.0000 mA	99.9450 mA	100.0001 mA	100.0001 mA	100.0550 mA	PASS	0.0053 mA
1 A	1.000000 A	0.998900 A	0.999900 A	0.999900 A	1.001100 A	PASS	0.000094 A
3 A	2.00000 A	1.99640 A	1.99980 A	1.99980 A	2.00360 A	PASS	0.00018 A

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Section 4 - AC Voltage Gain Verification Test

Range Frequency	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 mV / 1 kHz	100.0000 mV	99.9100 mV	99.9750 mV	99.9750 mV	100.0900 mV	PASS	0.015 mV
100 mV / 50 kHz	100.0000 mV	99.8500 mV	99.9994 mV	99.9994 mV	100.1500 mV	PASS	0.027 mV
100 mV / 300 kHz	100.0000 mV	98.3000 mV	99.9955 mV	99.9955 mV	101.7000 mV	PASS	0.11 mV
1 V / 1 kHz	1.000000 V	0.999100 V	0.999801 V	0.999801 V	1.000900 V	PASS	0.000053 V
1 V / 50 kHz	1.000000 V	0.998500 V	1.000433 V	1.000433 V	1.001500 V	PASS	0.000085 V
1 V / 300 kHz	1.000000 V	0.983000 V	0.994578 V	0.994578 V	1.017000 V	PASS	0.00050 V
10 V / 10 Hz	10.00000 V	9.99097 V	9.99712 V	9.99712 V	10.00903 V	PASS	0.0028 V
10 V / 1 kHz	10.00000 V	9.99100 V	10.00326 V	10.00326 V	10.00900 V	PASS	0.00050 V
10 V / 50 kHz	10.00000 V	9.98500 V	9.99384 V	9.99384 V	10.01500 V	PASS	0.00085 V
10 V / 300 kHz	10.00000 V	9.83000 V	10.00344 V	10.00344 V	10.17000 V	PASS	0.0034 V
100 V / 1 kHz	100.0000 V	99.9100 V	100.0120 V	100.0120 V	100.0900 V	PASS	0.0046 V
100 V / 50 kHz	100.0000 V	99.8500 V	100.0211 V	100.0211 V	100.1500 V	PASS	0.0076 V
100 V / 300 kHz	50.0000 V	48.9000 V	49.9805 V	49.9805 V	51.1000 V	PASS	0.015 V
750 V / 1 kHz	750.000 V	749.010 V	750.371 V	750.371 V	750.990 V	PASS	0.056 V
750 V / 50 kHz	210.000 V	209.415 V	210.122 V	210.122 V	210.585 V	PASS	0.016 V
750 V / 300 kHz	70.000 V	65.410 V	71.365 V	71.365 V	74.590 V	PASS	0.020 V

Section 5 - AC Current Gain Verification Test

Range Frequency	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 µA / 1 kHz	100.0000 µA	99.8600 µA	100.0064 µA	100.0064 µA	100.1400 µA	PASS	0.020 µA
100 µA / 5 kHz	100.0000 µA	99.8600 µA	100.0620 µA	100.0620 µA	100.1400 µA	PASS	0.040 µA
1 mA / 1 kHz	1.000000 mA	0.998600 mA	1.000810 mA	1.000810 mA	1.001400 mA	PASS	0.00016 mA
1 mA / 5 kHz	1.000000 mA	0.998600 mA	1.000766 mA	1.000766 mA	1.001400 mA	PASS	0.00033 mA
10 mA / 1 kHz	10.000000 mA	9.986000 mA	10.00811 mA	10.00811 mA	10.01400 mA	PASS	0.0016 mA
10 mA / 5 kHz	10.000000 mA	9.976000 mA	9.99730 mA	9.99730 mA	10.02400 mA	PASS	0.0028 mA
100 mA / 1 kHz	100.00000 mA	99.86000 mA	100.0759 mA	100.0759 mA	100.1400 mA	PASS	0.015 mA
100 mA / 5 kHz	100.00000 mA	99.76000 mA	99.9280 mA	99.9280 mA	100.2400 mA	PASS	0.032 mA
1 A / 1 kHz	1.000000 A	0.998600 A	0.999962 A	0.999962 A	1.001400 A	PASS	0.00030 A
1 A / 5 kHz	1.000000 A	0.998600 A	1.000270 A	1.000270 A	1.001400 A	PASS	0.00052 A
3 A / 1 kHz	2.000000 A	1.99520 A	2.00000 A	2.00000 A	2.00480 A	PASS	0.00056 A
3 A / 5 kHz	2.000000 A	1.99520 A	1.99921 A	1.99921 A	2.00480 A	PASS	0.00096 A

Section 6 - Frequency Gain Verification Test

Input Voltage	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
10 mV	40.00000 Hz	39.97200 Hz	39.99922 Hz	39.99922 Hz	40.02800 Hz	PASS	0.0000058 Hz
10 V	10.00000 kHz	9.99930 kHz	9.99991 kHz	9.99991 kHz	10.00070 kHz	PASS	0.0000058 kHz

Section 7 - Ohms Gain Verification Test

4-Wire Ohms, @ 100Mohms Verify only. 2-Wire Ohms.

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 Ω	100.0000 Ω	99.9860 Ω	100.0000 Ω	100.0000 Ω	100.0140 Ω	PASS	0.0011 Ω
1 kΩ	1.000000 kΩ	0.999890 kΩ	1.000002 kΩ	1.000002 kΩ	1.000110 kΩ	PASS	0.0000090 kΩ
10 kΩ	10.000000 kΩ	9.99890 kΩ	9.99997 kΩ	9.99997 kΩ	10.00110 kΩ	PASS	0.000090 kΩ
100 kΩ	100.00000 kΩ	99.9890 kΩ	100.0000 kΩ	100.0000 kΩ	100.0110 kΩ	PASS	0.0014 kΩ
1 MΩ	1.000000 MΩ	0.999870 MΩ	0.999952 MΩ	0.999952 MΩ	1.000130 MΩ	PASS	0.000024 MΩ
10 MΩ	10.000000 MΩ	9.99590 MΩ	9.99947 MΩ	9.99947 MΩ	10.00410 MΩ	PASS	0.00043 MΩ
100 MΩ	100.00000 MΩ	99.99919 MΩ	99.999820 MΩ	99.999820 MΩ	100.000801 MΩ	PASS	0.00084 MΩ

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Section 8 - Capacitance Measurement

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty ($\pm$)
1.0000 μ F	1.0000 μ F	0.9950 μ F	1.0010 μ F	1.0010 μ F	1.0050 μ F	PASS	0.0040 μ F
10.000 μ F	1.000 μ F	0.986 μ F	1.001 μ F	1.001 μ F	1.014 μ F	PASS	0.0040 μ F

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