



The American Association for Laboratory Accreditation

World Class Accreditation

## Accredited Laboratory

A2LA has accredited

# MICRO PRECISION CALIBRATION MALAYSIA

*Penang, Malaysia*

for technical competence in the field of

## Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 20th day of October 2009.





President & CEO  
For the Accreditation Council  
Certificate Number 935.14  
Valid to January 31, 2012

*For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.*

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005  
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: January 31, 2012

Certificate Number: 0935.14

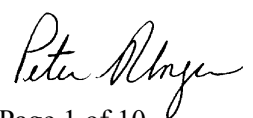
In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Chemical Quantities

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Conductivity <sup>3</sup> – Measure	111 mS 1015 µS 1408 µS	0.51 µS 0.51 µS 0.51 µS	Comparison to standard solutions
pH – Measure <sup>3</sup>	(4, 7, 10) pH unit	0.02 pH unit	Comparison to standard solutions

II. Dimensional

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Calipers & Height Gages <sup>3</sup>	(0.10 to 24) in (0 to 600) mm	(56 µin + 0.6L) µin (1.4 + 0.6L) µm	Mitutoyo gage blocks and length rods



Parameter/Equipment	Range	CMC <sup>2,6</sup> ( $\pm$ )	Comments
Micrometers <sup>3</sup> –  Resolution: 1000 $\mu$ in  100 $\mu$ in	(0.10 to 12) in (0 to 300) mm  (0.10 to 4) in (0 to 100) mm	(55 + 15L) $\mu$ in (1.4 + 0.4L) $\mu$ m  (34 + 15L) $\mu$ in (0.9 + 0.4L) $\mu$ m	Master gage blocks
Surface Plates <sup>3</sup>  Repeatability (Flatness only)	(12x12) in to (72x144) in  (300x300) mm to (1800x3600) mm	40 $\mu$ in  1.0 $\mu$ m	Repeat-o-meter
Diameter, Pin Gages	(0.02 to 1.0) in (0.5 to 25) mm	75 $\mu$ in 2 $\mu$ m	Laser Mike 182
Rules & Tapes	(0 to 1000) mm (0 to 40) in	1 mm 0.04 in	Glass Scale Steel rule
Indicators <sup>3</sup>  Up to 1 in (25 mm)    (1 to 4) in (25 to 100) mm	Resolution(R): 50 $\mu$ in or 1 $\mu$ m  100 $\mu$ in or 2 $\mu$ m  50 $\mu$ in or 1 $\mu$ m  100 $\mu$ in or 2 $\mu$ m	(20 + 0.6R) $\mu$ in (0.5 + 0.6R) $\mu$ m  (20 + 0.3R) $\mu$ in (0.5 + 0.3R) $\mu$ m  (4L + 0.5 R) $\mu$ in (4L + 0.5 R) $\mu$ m  (4L + 0.5 R) $\mu$ in (4L + 0.5 R) $\mu$ m	Indicator Tester    Gage blocks
Tachometer <sup>3</sup>	(5 to 99.9) rpm (100 to 999) rpm (1 000 to 9 999) rpm (10 000 to 50 000) rpm (50 000 to 99 999) rpm	0.6 rpm 1.2 rpm 12 rpm 32 rpm 110 rpm	Tachometer Extech 461895

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1100) V	20 $\mu\text{V}/\text{V}$ + 1 $\mu\text{V}$ 11 $\mu\text{V}/\text{V}$ + 2 $\mu\text{V}$ 12 $\mu\text{V}/\text{V}$ + 20 $\mu\text{V}$ 18 $\mu\text{V}/\text{V}$ + 150 $\mu\text{V}$ 18 $\mu\text{V}/\text{V}$ + 1500 $\mu\text{V}$	Fluke 5500A
DC Voltage <sup>3</sup> – Measure	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1000) V	13 $\mu\text{V}/\text{V}$ + 3.0 $\mu\text{V}$ 17 $\mu\text{V}/\text{V}$ + 0.3 $\mu\text{V}$ 13 $\mu\text{V}/\text{V}$ + 0.5 $\mu\text{V}$ 15 $\mu\text{V}/\text{V}$ + 30 $\mu\text{V}$ 27 $\mu\text{V}/\text{V}$ + 100 $\mu\text{V}$	HP 3458A
DC Current <sup>3</sup> – Generate	(0 to 330) $\mu\text{A}$ 330 $\mu\text{A}$ to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 3 A (3 to 10) A (11 to 20.5) A	0.15 mA/A + 20 nA 0.10 mA/A + 50 nA 0.10 mA/A + 0.25 $\mu\text{A}$ 0.10 mA/A + 2.5 $\mu\text{A}$ 0.38 mA/A + 40 $\mu\text{A}$ 0.50 mA/A + 500 $\mu\text{A}$ 1.0 mA/A + 750 $\mu\text{A}$	Fluke 5500A
DC Current <sup>3</sup> – Measure	Up to 100 nA 100 nA to 1 $\mu\text{A}$ (1 to 10) $\mu\text{A}$ (10 to 100) $\mu\text{A}$ 100 $\mu\text{A}$ to 10 mA (10 to 100) mA 100 mA to 1 A	35 $\mu\text{A}/\text{A}$ + 400 $\mu\text{A}$ 25 $\mu\text{A}/\text{A}$ + 40 $\mu\text{A}$ 25 $\mu\text{A}/\text{A}$ + 10 $\mu\text{A}$ 25 $\mu\text{A}/\text{A}$ + 5 $\mu\text{A}$ 25 $\mu\text{A}/\text{A}$ + 5 $\mu\text{A}$ 40 $\mu\text{A}/\text{A}$ + 5 $\mu\text{A}$ 0.012 % + 10 $\mu\text{A}$	HP 3458A
High DC Current <sup>3</sup>	(1 to 200) A (100 to 1000)A	0.22 % of rdg 0.28 % of rdg	Shunt monitored with multimeter
DC Power <sup>3</sup> – @ 1000 V	Up to 11 A at 1000 V	0.14 % rdg + 0.45 $\mu\text{W}$	Fluke 5500A
Resistance <sup>3</sup> – Measure	(0 to 10) $\Omega$ (10 to 100) $\Omega$ 100 $\Omega$ to 100 k $\Omega$ 100 k $\Omega$ to 1 M $\Omega$ (1 to 10) M $\Omega$ (10 to 100) M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$	19 parts in $10^6$ + 0.06 m $\Omega$ 13 parts in $10^6$ + 0.6 m $\Omega$ 10 parts in $10^6$ + 0.6 m $\Omega$ 15 parts in $10^6$ + 2.4 $\Omega$ 59 parts in $10^6$ + 120 $\Omega$ 0.058 % + 1.2 k $\Omega$ 1.8 % + 10 k $\Omega$	HP 3458A

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Resistance <sup>3</sup> – Generate Variable Values	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	0.12 % + 0.008 Ω 0.17 % 0.018 % 0.024 % 0.009 % + 0.06 Ω 0.024 % 0.009 % + 0.6 Ω 0.012 % 0.011 % + 6 Ω 0.013 % 0.015 % + 55 Ω 0.019 % 0.016 % 0.041 % 0.058 % 0.37 % 1.8 %	Fluke 5500A
	100MΩ to 100 GΩ	0.58 %	Standard Resistors
Electrical Calibration of Thermocouple Indicators <sup>3</sup> –			
Type E	-250 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.56 °C 0.54 °C 0.53 °C	Fluke 5500A
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.48 °C 0.45 °C 0.43 °C	
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.48 °C 0.44 °C 0.46 °C 0.47 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.48 °C 0.47 °C 0.54 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.56 °C 0.52 °C 0.58 °C	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Electrical Calibration of RTDs <sup>3</sup> –			
Pt 385, 1 kΩ	-200 °C to 100 °C 100 °C to 260 °C 260 °C to 600 °C 600 °C to 630 °C	0.03 °C 0.05 °C 0.07 °C 0.23 °C	Fluke 5500A
PtNi 385, 100 Ω	-80 °C to 100 °C 100 °C to 260 °C	0.08 °C 0.14 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.3 °C	

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Inductance <sup>3</sup> – Generate, Fixed Points, @ 1 kHz	1.0 mH 50 mH 100 mH 1 H	0.054 % of rdg 0.065 % of rdg 0.059 % of rdg 0.075 % of rdg	Genrad 1482 series
AC Voltage <sup>3</sup> – Generate			Fluke 5500A
(0 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.08 mV/V + 6 μV 0.15 mV/V + 6 μV 0.2 mV/V + 6 μV 1.0 mV/V + 6 μV 3.5 mV/V + 12 μV 8.0 mV/V + 50 μV	
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.3 mV/V + 8 μV 0.15 mV/V + 8 μV 0.16 mV/V + 8 μV 0.35 mV/V + 8 μV 0.8 mV/V + 32 μV 2.0 mV/V + 70 μV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.3 mV/V + 50 μV 0.15 mV/V + 60 μV 0.19 mV/V + 60 μV 0.3 mV/V + 50 μV 0.7 mV/V + 130 μV 2.4 mV/V + 600 μV	

Parameter/Range	Frequency	CMC <sup>2,4,5</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.3 mV/V + 650 $\mu$ V 0.15 mV/V + 600 $\mu$ V 0.24 mV/V + 600 $\mu$ V 0.35 mV/V + 600 $\mu$ V 0.9 mV/V + 1600 $\mu$ V	Fluke 5500A
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.19 mV/V + 2000 $\mu$ V 0.2 mV/V + 6000 $\mu$ V 0.25 mV/V + 6000 $\mu$ V 0.3 mV/V + 6000 $\mu$ V 0.9 mV/V + 50 000 $\mu$ V	
(330 to 1100) V	45 Hz to 10 kHz	0.3 mV/V + 10 000 $\mu$ V	
AC Voltage <sup>3</sup> – Measure			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.3 mV/V + 3 $\mu$ V 0.2 mV/V + 2 $\mu$ V 0.3 mV/V + 2 $\mu$ V 1.2 mV/V + 2 $\mu$ V 5.8 mV/V + 2 $\mu$ V 46 mV/V + 2 $\mu$ V	HP 3458A
10 mV to 10 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	80 $\mu$ V/V + 0.4 mV 80 $\mu$ V/V + 0.2 mV 0.2 mV/V + 0.2 mV 0.3 mV/V + 0.2 mV 0.9 mV/V + 0.2 mV 3.5 mV/V + 1 mV 12 mV/V + 1 mV 17 mV/V + 1 mV	
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.2 mV/V + 4 mV 0.2 mV/V + 2 mV 0.4 mV/V + 2 mV 1.4 mV/V + 2 mV 4.6 mV/V + 10 mV	
(10 to 100) V	300 kHz to 1 MHz	17 mV/V + 10 mV	

Parameter/Range	Frequency	CMC <sup>2,4,5</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)  (100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.5 mV/V + 40 mV 0.5 mV/V + 20 mV 0.7 mV/V + 20 mV 1.4 mV/V + 20 mV 3.5 mV/V + 20 mV	HP 3458A
AC High Voltage <sup>3</sup> – Measure	(0 to 25) kV	2.0 % of rdg	TEK 6015A voltage probe
AC Power – Generate <sup>3</sup>  Up to 1000 V @ 60 Hz	Up to 11 A	0.18 % rdg + 0.16 mW 0.45 % rdg + 0.16 mW	Fluke 5500a PF = 1 PF = 0.8
AC Current <sup>3</sup> – Generate  (1 to 220) µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A  (3.2 to 32) A  (32 to 200) A  (16 to 160) A  (160 to 1000) A	40 Hz to 1 kHz      (60 to 100) Hz (100 to 440) Hz  (60 to 100) Hz (100 to 440) Hz  (60 to 100) Hz  (60 to 100) Hz	0.09 % of rdg 0.024 % of rdg 0.026 % of rdg 0.093 % of rdg  0.4 % + 0.013 A 0.98 % + 0.054 A  0.41 % + 0.18 A 0.87 % + 0.5 A  0.4 % + 0.065 A  0.41 % + 0.91 A	Fluke 5500A     9100 Wavetek Using 10 coil turn    Using 50 turn coil
AC Current <sup>3</sup> – Measure  Up to 100 µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.46 % + 0.03 µA 0.18 % + 0.03 µA 0.078 % + 0.03 µA	HP 3458A

Parameter/Range	Frequency	CMC <sup>2,4,5</sup> (±)	Comments
AC Current <sup>3</sup> – Measure (cont)			
100 µA to 100 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 20 µA 0.17 % + 20 µA 0.073 % + 20 µA 0.042 % + 20 µA	HP 3458A
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 200 µA 0.19 % + 200 µA 0.10 % + 200 µA 0.12 % + 200 µA	
Capacitance <sup>3</sup> – Generate			
(0.19 to 3.3) nF (3.3 to 330) nF 330 nF to 3.3 µF (3.3 to 33) µF (33 to 330) µF	50 Hz to 1 kHz	0.5 % + 0.01 nF 0.25 % + 0.3 nF 0.25 % + 3 nF 0.4 % + 30 nF 0.45 % + 0.3 µF	Fluke 5500A
330 µF to 3.3 mF (3.3 to 33) mF (33 to 110) mF	50 Hz to 300 Hz	0.45 % + 3 µF 0.75 % + 30 µF 1.1 % + 100 µF	
Oscilloscopes <sup>3</sup> –			
Level Sine Amp 50 kHz ref.	5 mV to 5 V (V <sub>p-p</sub> )	2.0 % + 300 µV	Fluke 5500A/SC600
Level Sine Flatness 5 mV to 5.5 V relative to 50 kHz reference	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	3.5 % + 300 µV 4.0 % + 300 µV 6.0 % + 300 µV	
Square Wave 1 MΩ, 100 Hz 50 Ω, 1 kHz	1 mV to ± 130 V ± 1 mV to ± 6.6 V	0.1 % + 40 µV 0.25 % + 40 µV	
Time Marker Output Into 50 Ω	2 ns to 20 ms 50 ms to 5 s	(25 + 1000t) parts in 10 <sup>6</sup> 25 parts in 10 <sup>6</sup>	t is the time in seconds
Pulse Rise Time 0.5 V, 1 V <sub>p-p</sub> 1 V <sub>p-p</sub>	10 MHz 1 MHz	100 ps 100 ps	

*Peter Abney*

IV. Mechanical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Pressure <sup>3</sup>	(-15 to 30) psi Up to 1000 psi Up to 10000 psi	0.10 % of rdg 0.09 % of rdg 0.10 % of rdg	Fluke 725, 700PV4, 700P08, 700P31
Torque <sup>3</sup>	(16 - 160) in·oz (0 - 100) in·lb (50 - 500) ft·lb	0.77 % of rdg 0.65 % of rdg 0.71 % of rdg	Mountz torque system
Scales (Platform & Spring) & Balances <sup>3</sup>	Up to 100 kg	1.0 LSVD	Class 1 & F weights LSVD = least significant value digit

V. Optical Quantities

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Optical Comparators & Visual System <sup>3</sup>	Up to 200 mm	210 µm	Glass scale and gage blocks

VI. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Humidity Measuring Equipment <sup>3</sup> – Fixed Points	11 % RH 33 % RH 75.4 % RH 97 % RH	1.6 % RH 1.7 % RH 1.5 % RH 2 % RH	Standard salt solutions
Temperature <sup>3</sup> – Measure	-200 °C to 550 °C 550 °C to 850 °C	0.2 °C 0.35 °C	Heise PTE HQS-RTD1

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Frequency – Measuring Equipment	1 MHz 10 MHz	$5 \times 10^{-12}$ $5 \times 10^{-12}$	HP 58503A, GPS

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.

<sup>2</sup> Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of  $k = 2$ . The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

<sup>3</sup> Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

<sup>4</sup> The measurands stated are generated with the Fluke 5500 series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

<sup>5</sup> The measurands stated are measured with the HP 3458A series of instruments. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

<sup>6</sup> In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in inches.