



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Acculab Measurement Standards, Inc.

40B Cherry Hill Drive Danvers, MA 01923

Jim Jezowski, Jr. Phone: 978-750-4555

CALIBRATION

Valid to: June 29, 2013

Certificate Number: AC-1280

I. Electromagnetic - DC / Low Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage - Source	Up to 120 mV 120 mV to 1.2 V (1.2 to 12) V (12 to 120) V 120 V to 1 kV	5 µV/V + 360 nV 4 µV/V + 300 nV 4 µV/V + 500 nV 6 µV/V + 36 µV 6 µV/V + 100 µV	Fluke 5700A w/ HP 3458A Opt 002	OEM or GIDEP Sourced Procedures
Fixed Values *	1 V, 1.018 V 10 V	25 µV/V 7 µV/V	Fluke 732A	
DC Voltage - Measure	Up to 120 mV 120 mV to 1.2 V (1.2 to 12) V (12 to 120) V 120 V to 1 kV	5 µV/V + 360 nV 4 µV/V + 300 µV 4 µV/V + 500 nV 6 µV/V + 36 µV 6 µV/V + 100 µV	HP 3458A Opt 002	
AC Voltage - Source	<b>Up to 12 mV</b> (10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz <b>(12 to 120) mV</b> (10 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	300 µV/V + 3 µV 300 µV/V + 11 µV 250 µV/V + 6 µV 2.5 mV/V + 6 µV 5 mV/V + 54 µV 40 mV/V + 405 µV  70 µV/V + 12 µV 70 µV/V + 12 µV 140 µV/V + 13 µV 300 µV/V + 20 µV 800 µV/V + 85 µV 3 mV/V + 312 µV 10 mV/V + 1.1 mV	Fluke 5700A-03, HP 3458A Opt 002	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source (cont.)	<b>120 mV to 1.2 V</b> (10 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 <b>(1.2 to 12) V</b> (10 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 <b>(12 to 120) V</b> (10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz <b>220 V to 1.1 kV</b> 50 Hz to 1 kHz	70 µV/V + 105 µV 70 µV/V + 105 µV 140 µV/V + 174 µV 300 µV/V + 335 µV 800 µV/V + 834 µV 3 mV/V + 3.1 mV 10 mV/V + 11 mV  70 µV/V + 1.3 mV 70 µV/V + 1.1 mV 140 µV/V + 1.8 mV 300 µV/V + 3.3 mV 800 µV/V + 8.4 mV 3 mV/V + 31.5 mV 10 mV/V + 102 mV  200 µV/V + 23 mV 200 µV/V + 23 mV 200 µV/V + 23 mV 350 µV/V + 39 mV 1.2 mV/V + 124 mV  400 µV/V + 108 mV	Fluke 5700A-03, HP 3458A Opt 002	OEM or GIDEP Sourced Procedures
AC Voltage - Measure	<b>Up to 12 mV</b> (10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz <b>(12 to 120) mV</b> (10 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 <b>120 mV to 1.2 V</b> (10 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	300 µV/V + 7 µV 200 µV/V + 6 µV 300 µV/V + 6 µV 1 mV/V + 6 µV 5 mV/V + 54 µV 40 mV/V + 405 µV  70 µV/V + 12 µV 70 µV/V + 12 µV 140 µV/V + 13 µV 300 µV/V + 20 µV 800 µV/V + 85 µV 3 mV/V + 312 µV 10 mV/V + 1.1 mV  70 µV/V + 105 µV 70 µV/V + 105 µV 140 µV/V + 174 µV 300 µV/V + 335 µV 800 µV/V + 834 µV 3 mV/V + 3.1 mV 10 mV/V + 11 mV	HP 3458A Opt 002	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Measure (cont.)	<b>(1.2 to 12) V</b> (10 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 <b>(12 to 120) V</b> (10 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 <b>(120 to 700) V</b> (10 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	70 µV/V + 1.3 mV 70 µV/V + 1.1 mV 140 µV/V + 1.8 mV 300 µV/V + 3.3 mV 800 µV/V + 8.4 mV 3 mV/V + 31.5 mV 10 mV/V + 102 mV  200 µV/V + 4.8 mV 200 µV/V + 2.4 mV 200 µV/V + 2.4 mV 350 µV/V + 2.4 mV 1.2 mV/V + 2.4 mV 4 mV/V + 12 mV 15 mV/V + 12 mV  400 µV/V + 24 mV 400 µV/V + 24 mV 600 µV/V + 24 mV 1.2 mV/V + 39 mV 3 mV/V + 309 mV	HP 3458A Opt 002	OEM or GIDEP Sourced Procedures
Resistance - Source	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ	4.1 µΩ 210 µΩ 1.8 mΩ 10.6 mΩ 41 mΩ 1.06 Ω 17.2 Ω 720 Ω	Guildline 9330-1 Guildline 9330-10 Guildline 9330-100 Guildline 9330-1k Guildline 9330-10k Guildline 9330-100k Guildline 9330-1M Guildline 9330-10M	
Resistance - Measure	Up to 12 Ω (12 to 120) Ω 120 Ω to 1.2 kΩ (1.2 to 12) kΩ (12 to 120) kΩ 120 Ω to 1.2 MΩ (1.2 to 12) MΩ (12 to 120) MΩ	15 µΩ/Ω + 60 µΩ 12 µΩ/Ω + 600 µΩ 10 µΩ/Ω + 600 µΩ 10 µΩ/Ω + 6 mΩ 10 µΩ/Ω + 60 mΩ 15 µΩ/Ω + 2.4 Ω 60 µΩ/Ω + 120 Ω 5.01 mΩ/Ω + 1.2 kΩ	HP 3458A Opt 002	
DC Current - Source	Up to 120 µA 120 µA to 1.2 mA (1.2 to 12) mA (12 to 120) mA 120 mA to 1 A	20 µA/A + 960 pA 20 µA/A + 6 nA 20 µA/A + 60 nA 35 µA/A + 600 nA 100 µA/A + 10 µA	HP3458A Opt 002 Fluke 5700A	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Current - Measure	Up to 120 µA 120 µA to 1.2 mA (1.2 to 12) mA (12 to 120) mA 120 mA to 1 A	20 µA/A + 960 pA 20 µA/A + 6 nA 20 µA/A + 60 nA 35 µA/A + 600 nA 100 µA/A + 10 µA	HP 3458A Opt 002	OEM or GIDEP Sourced Procedures
AC Current - Source	<b>Up to 120 µA</b> (10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	4 mA/A + 30 nA 1.5 mA/A + 30 nA 600 µA/A + 30 nA	Fluke 5700A-03 HP 3458A Opt 002	
	<b>120 µA to 1.2 mA</b> (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	4. mA/A + 200 nA 1.5 mA/A + 200 nA 600 µA/A + 200 nA 300 µA/A + 200 nA 600 µA/A + 200 nA		
	<b>(1.2 to 12) mA</b> (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	4. mA/A + 200 nA 1.5 mA/A + 200 nA 600 µA/A + 200 nA 300 µA/A + 200 nA 600 µA/A + 200 nA		
AC Current - Source	<b>(12 to 120) mA</b> (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	4. mA/A + 200 nA 1.5 mA/A + 200 nA 600 µA/A + 200 nA 300 µA/A + 200 nA 600 µA/A + 200 nA		
	<b>120 mA to 1 A</b> (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	1.6 mA/A + 20 µA 800 µA/A + 20 µA 1 mA/A + 20 µA		
	<b>(1 to 11) A</b> (45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	600 µA/A + 2 mA 1 mA/A + 2 mA 3.3 mA/A + 2 mA	Fluke 5500A	
AC Current - Measure	<b>(10 to 120) µA</b> (20 to 45) Hz 45 Hz to 5 kHz <b>120 µA to 1.2 mA</b> (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz <b>(1.2 to 12) mA</b> (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	1.5 mA/A + 36 nA 600 µA/A + 36 nA  1.5 mA/A + 240 nA 600 µA/A + 240 nA 300 µA/A + 240 nA 600 µA/A + 240 nA  1.5 mA/A + 2.4 µA 600 µA/A + 2.4 µA 300 µA/A + 2.4 µA 600 µA/A + 2.4 µA	HP 3458A Opt 002	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Current – Measure (cont.)	<b>(12 to 120) mA</b> (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz <b>120 mA to 1 A</b> (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	1.5 mA/A + 24 µA 600 µA/A + 24 µA 300 µA/A + 24 µA 600 µA/A + 24 µA  1.6 mA/A + 240 µA 800 µA/A + 240 µA 1 mA/A + 240 µA	HP 3458A Opt 002	OEM or GIDEP Sourced Procedures
Electrical Simulation of Thermocouple Indicators	<b>Type K</b> (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C <b>Type J</b> (-200 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C <b>Type E</b> (-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C <b>Type T</b> (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C <b>Type C</b> (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C <b>Type B</b> (600 °C to 800) °C (800 °C to 1 000) °C (1 000 °C to 1 550) °C (1 550 °C to 1 820) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °C  0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C  0.5 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C  0.63 °C 0.24 °C 0.16 °C 0.14 °C  0.3 °C 0.26 °C 0.31 °C 0.5 °C 0.84 °C  0.44 °C 0.34 °C 0.33 °C 0.33 °C	Fluke 5500A	



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Electrical Simulation of Thermocouple Indicators (cont.)	<b>Type N</b> (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C <b>Type R</b> (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C <b>Type S</b> (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C	0.4 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C 0.57 °C 0.35 °C 0.33 °C 0.4 °C 0.47 °C 0.36 °C 0.37 °C 0.46 °C	Fluke 5500A	OEM or GIDEP Sourced Procedures
Electrical Simulation of RTDs	<b>Pt 385, 100 Ω</b> (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C <b>Pt 3926, 100 Ω</b> (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C <b>Pt 385, 120 Ω</b> (-80 to 0) °C (0 to 100) °C (100 to 260) °C <b>Pt 385, 100 Ω</b> (-200 to 800) °C	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.14 °C 0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.08 °C 0.08 °C 0.09 °C 0.0025 % of Resistance	Fluke 5500A HP 3458A Opt 002	
Capacitance: @1 kHz	100 nF	500 μF/F	GenRad 1409-T	
Inductance: @1 kHz	100 mH	1.25 mH/H	GenRad 1482-L	

## II. Time & Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Time and Frequency * - Source	100 kHz, 1 MHz, 5 MHz, 10 MHz	6 parts in 10 <sup>-12</sup>	Spectracom 8160	OEM or GIDEP Sourced Procedures
Time and Frequency * - Measure	Up to 100 MHz 100 MHz to 1.3 GHz	5.9 parts in 10 <sup>-9</sup> 5.9 parts in 10 <sup>-9</sup>	HP 5334A / Spectracom 8160 Fluke 7220A / Spectracom 8160	

## III. Mechanical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Balances / Scales	Up to 200 mg	0.000016 g	Rice Lake ASTM Class 1 and Troemner ASTM Class 1	OEM or GIDEP Sourced Procedures
	(200 to 500) mg	0.000016 g		
	500 mg to 2g	0.000041 g		
	(2 to 5) g	0.000041 g		
	(5 to 10) g	0.00006 g		
	(10 to 20) g	0.000089 g		
	(20 to 50) g	0.00014 g		
	(50 to 100) g	0.00029 g		
	(100 to 200) g	0.0006 g		
	(200 to 300) g	0.00088 g		
	(300 to 500) g	0.0014 g		
	500 g to 1 kg	0.003 g		
	(1 to 2) kg	0.006 g		
(2 to 4) kg	0.015 g			
(4 to 5) kg	0.018 g			
(5 to 10) kg	0.03 g			
(10 to 20) kg	0.13 g			
Pressure	(1 to 100) psi	0.019 psi	Princo PPS-500 Ametek T-100 Ametek T-100	OEM or GIDEP Sourced or Laboratory Developed Procedures
	(100 to 1 000) psi	0.23 psi		
	(1000 to 10000) psi	2.31 psi		
Torque	0 to 100 lb-in 100 lb-in to 600 lb-ft	0.51 lb-in 0..32 lb-ft	AKO 650-B	

**IV. Dimensional**

<b>PARAMETER / EQUIPMENT</b>	<b>RANGE</b>	<b>CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]</b>	<b>REFERENCE STANDARD OR EQUIPMENT</b>	<b>METHOD(S)</b>
Micrometer	Up to 1 in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in (6 to 8) in (8 to 14) in (14 to 20) in (20 to 24) in	15.7 µin 30.3 µin 45.1 µin 59.9 µin 75.3 µin 90.1 µin 119.8 µin 209.2 µin 298.6 µin 358.3 µin	Grade 1 Gage Blocks	OEM or GIDEP Sourced Procedures
Calipers	Up to 8 in (8 to 14) in (14 to 20) in (20 to 24) in	280.7 µin 338.7 µin 391.3 µin 440.6 µin		
Test Indicators	Up to 6 in	50.5 µin	Grade 1 Gage Blocks Grade AA Surface Plate	
Height Gage	Up to 6 in (6 to 12) in (12 to 18) in (18 to 24) in	114.6 µin 192.9 µin 278 µin 365.2 µin		
Ring Gage, Plain *	Up to 1 in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in	22.3 µin 33.8 µin 47.6 µin 61.9 µin 76.7 µin 91.3 µin	Trimos Tulum 210 Grade 1 Gage Blocks	
Pin Gages	Up to 1 in 1 to 2 in	22 µin 23.2 µin	Trimos Tulum 210	
Thread Wires	Up to 0.5 in	21 µin	Trimos Tulum 210	
Cylindrical Plugs	Up to 1 in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in (6 to 7) in (7 to 8) in (8 to 9) in (9 to 10) in	22.4 µin 22.8 µin 23.4 µin 24.2 µin 26 µin 27 µin 28.1 µin 29.2 µin 30.4 µin 31.7 µin		



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Thread Plug Gage * - Pitch Diameter  (4 to 80) Threads per Inch and (0.25 to 6) mm	Up to 1 in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in (6 to 7) in (7 to 8) in (8 to 9) in (9 to 10) in	53.5 µin 59.3 µin 67.9 µin 78.4 µin 90 µin 102.5 µin 115.5 µin 128.9 µin 142.6 µin 156.5 µin	Trimos Tulum 210, SPI thread wires	
Thread Plug Gage * - Major Diameter	Up to 1 in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in (6 to 7) in (7 to 8) in (8 to 9) in (9 to 10) in	22.3 µin 22.8 µin 23.4 µin 24.1 µin 26 µin 27 µin 28 µin 29.2 µin 30.4 µin 31.7 µin	Trimos Tulum 210	

### V. Thermodynamic

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Humidity *	11.31 %RH 43.15 %RH 75.47 %RH	0.37 %RH 0.41 %RH 0.28 %RH	Salt Solutions	OEM or GIDEP Sourced Procedures

**Notes:**

1. Calibration and Measurement Capabilities (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of  $k=2$ .
2. This laboratory offers calibration services in its laboratory and on-site at customer-designated locations. Since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
3. Capabilities denoted by an asterisk (\*) are performed in the laboratory only and are not available for on-site calibration activity
4. The use of (L) signifies Length in inches.
5. The use of (R) indicates Resolution of the unit under test.
6. This scope is part of and must be included with the Certificate of Accreditation No. AC-1280.

*Karl Greenway*

Vice-President

