



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

J & M Instrument Service, Inc.

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CALIBRATION

Valid to: June 19, 2012

Certificate Number: AC - 1334

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 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1.02 kV	60 µV/V + 3 µV 50 µV/V + 5 µV 50 µV/V + 50 µV 55 µV/V + 500 µV 55 µV/V + 1.5 mV	Fluke 5500A	GIDEP & OEM Sourced and Locally Developed Procedures
DC Voltage - Measure	(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	11 µV/V + 300 µV 10 µV/V + 300 µV 10 µV/V + 500 µV 12 µV/V + 30 µV 22 µV/V + 100 µV	HP 3458A	
DC Current - Source	Up to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 11) A	130 µA/A + 50 nA 100 µA/A + 250 nA 100 µA/A + 3.3 µA 300 µA/A + 44 µA 600 µA/A + 330 µA	Fluke 5500A	
DC Current - Measure	100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	25 µV/V + 5 nA 25 µV/V + 50 nA 40 µV/V + 500 nA 115 µV/V + 10 µA	HP 3458A	
AC Voltage - Source	(1 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	3.5 mV/V + 20 µV 1.5 mV/V + 20 µV 2 mV/V + 20 µV 2.5 mV/V + 20 µV 3.5 mV/V + 33 µV 10 mV/V + 60 µV	Fluke 5500A	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source (cont.)	(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 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 (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 (33 to 330) V 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz 330 V to 1.02 kV 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.5 mV/V + 50 μV 500 μV/V + 20 μV 1 mV/V + 20 μV 1.6 mV/V + 40 μV 2.4 mV/V + 170 μV 37 mV/V + 330 μV 1.5 mV/V + 250 μV 300 μV/V + 60 μV 800 μV/V + 60 μV 1.4 mV/V + 300 μV 2.4 mV/V + 1.7 mV 5 mV/V + 3.3 mV 1.5 mV/V + 2.5 mV 400 μV/V + 600 μV 800 μV/V + 2.6 mV 1.9 mV/V + 5 mV 2.4 mV/V + 17 mV 500 μV/V + 6.6 mV 800 μV/V + 15 mV 900 μV/V + 33 mV 500 μV/V + 80 mV 2 mV/V + 100 mV 2 mV/V + 500 mV	Fluke 5500A	GIDEP & OEM Sourced and Locally Developed Procedures
AC Current - Source	(29 to 330) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 330 μA to 3.3 mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.5 mA/A + 150 nA 1.25 mA/A + 150 nA 1.25 mA/A + 250 nA 4 mA/A + 150 nA 12.5 mA/A + 150 nA 2 mA/A + 300 nA 1 mA/A + 300 nA 1 mA/A + 300 nA 2 mA/A + 300 nA 6 mA/A + 300 nA		



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Current - Source (cont.)	(3.3 to 33) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (33 to 330) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz 330 mA to 2.2 A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (2.2 to 11) A (45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	2 mA/A + 3 μ A 1 mA/A + 3 μ A 900 μ A/A + 3 μ A 2 mA/A + 3 μ A 6 mA/A + 3 μ A 2 mA/A + 30 μ A 1 mA/A + 30 μ A 900 μ A/A + 30 μ A 2 mA/A + 30 μ A 6 mA/A + 30 μ A 2 mA/A + 300 μ A 1 mA/A + 300 μ A 7.5 mA/A + 300 μ A 600 μ A/A + 2 mA 1 mA/A + 2 mA 3.3 mA/A + 2 mA	Fluke 5500A	GIDEP & OEM Sourced and Locally Developed Procedures
AC Voltage - Measure	(1 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 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (10 to 100) 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 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	300 μ V/V + 3 mV 200 μ V/V + 1.1 mV 300 μ V/V + 1.1 mV 1 mV/V + 1.1 mV 5 mV/V + 1.1 mV 40 mV/V + 2 mV 12 mV/V + 5 μ V 70 mV/V + 7 μ V 200 mV/V + 8 μ V 72 μ V/V + 5 mV 72 μ V/V + 2 mV 142 μ V/V + 2 mV 302 μ V/V + 2 mV 802 mV/V + 2 mV 3 mV/V + 10 mV 10 mV/V + 10 mV 15 mV/V + 10 mV 40 mV/V + 8 μ V 150 mV/V + 100 μ V	HP 3458A	

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AC Voltage - Measure (cont.)	100 mV to 1 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 4) MHz (4 to 8) MHz (8 to 10) MHz (1 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 4) MHz (4 to 8) MHz (8 to 10) MHz (10 to 100) 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 100 V to 1 kV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	72 µV/V + 40 µV 72 µV/V + 20 µV 142 µV/V + 20 µV 302 µV/V + 20 µV 802 µV/V + 20 µV 3 mV/V + 100 µV 10 mV/V + 100 µV 15 mV/V + 100 µV 40 mV/V + 800 µV 150 mV/V + 1 mV 72 µV/V + 40 µV 72 µV/V + 20 µV 142 µV/V + 20 µV 302 µV/V + 20 µV 802 µV/V + 20 µV 3 mV/V + 100 µV 10 mV/V + 100 µV 15 mV/V + 100 µV 40 mV/V + 800 µV 150 mV/V + 1 mV 200 µV/V + 4 mV 200 µV/V + 2 mV 200 µV/V + 2 mV 350 µV/V + 2 mV 1.2 mV/V + 2 mV 4 mV/V + 10 mV 150 mV/V + 10 mV 400 µV/V + 40 mV 400 µV/V + 20 mV 600 µV/V + 20 mV 1.2 mV/V + 20 mV 3 mV/V + 20 mV	HP 3458A	GIDEP & OEM Sourced and Locally Developed Procedures



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AC Current - Measure	<p>(5 to 100) µA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz</p> <p>100 µA to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz</p> <p>(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz</p> <p>(10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz</p> <p>100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz</p>	<p>4 mA/A + 30 nA 1.5 mA/A + 30 nA 600 µA/A + 30 nA 600 µA/A + 30 nA</p> <p>4 mA/A + 200 µA 1.5 mA/A + 200 µA 600 µA/A + 200 µA 300 µA/A + 200 µA 600 µA/A + 400 µA 4 mA/A + 400 µA 5.5 mA/A + 1.5 mA</p> <p>4 mA/A + 2 mA 1.5 mA/A + 2 mA 600 µA/A + 2 mA 300 µA/A + 2 mA 600 µA/A + 2 mA 4 mA/A + 4 mA 5.5 mA/A + 15 mA</p> <p>4 mA/A + 20 mA 1.5 mA/A + 20 mA 600 µA/A + 20 mA 300 µA/A + 20 mA 600 µA/A + 20 mA 4 mA/A + 40 mA 5.5 mA/A + 150 mA</p> <p>4 mA/A + 200 mA 1.6 mA/A + 200 mA 800 µA/A + 200 mA 1 mA/A + 200 mA 3 mA/A + 200 mA 10 mA/A + 400 mA</p>	HP 3458A	GIDEP & OEM Sourced and Locally Developed Procedures



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Resistance - Source	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω 330 k Ω to 1.1 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω	120 $\mu\Omega/\Omega$ + 8 m Ω 120 $\mu\Omega/\Omega$ + 15 m Ω 90 $\mu\Omega/\Omega$ + 15 m Ω 90 $\mu\Omega/\Omega$ + 15 m Ω 90 $\mu\Omega/\Omega$ + 60 m Ω 90 $\mu\Omega/\Omega$ + 60 m Ω 90 $\mu\Omega/\Omega$ + 600 m Ω 90 $\mu\Omega/\Omega$ + 600 m Ω 110 $\mu\Omega/\Omega$ + 6 Ω 120 $\mu\Omega/\Omega$ + 6 Ω 150 $\mu\Omega/\Omega$ + 55 Ω 150 $\mu\Omega/\Omega$ + 55 Ω 600 $\mu\Omega/\Omega$ + 550 Ω 1 m Ω/Ω + 550 Ω 5 m Ω/Ω + 5.5 k Ω 5 m Ω/Ω + 16.5 k Ω	Fluke 5500A	GIDEP & OEM Sourced and Locally Developed Procedures
Resistance - Measure	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	18 $\mu\Omega/ \Omega$ + 50 $\mu\Omega$ 13 $\mu\Omega/ \Omega$ + 500 $\mu\Omega$ 11 $\mu\Omega/ \Omega$ + 500 $\mu\Omega$ 11 $\mu\Omega/ \Omega$ + 5 m Ω 11 $\mu\Omega/ \Omega$ + 50 m Ω 15 $\mu\Omega/ \Omega$ + 2 Ω 53 $\mu\Omega/ \Omega$ + 100 Ω 503 $\mu\Omega/ \Omega$ + 1 k Ω 5 m Ω/ Ω + 10 k Ω		
Capacitance - Measure	DC and 50 Hz to 1 kHz (330 to 500) pF 500 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF 330 nF to 1.1 μ F (1.1 to 3.3) μ F DC and (50 to 400) Hz (3.3 to 11) μ F (11 to 33) μ F DC and (50 to 200) Hz (33 to 110) μ F DC and (50 to 100) Hz (110 to 330) μ F 330 μ F to 1.1 mF	5 mF/F + 10 pF 5 mF/F + 10 pF 5 mF/F + 10 pF 5 mF/F + 10 pF 2.5 mF/F + 100 pF 2.5 mF/F + 100 pF 2.5 mF/F + 300 pF 2.5 mF/F + 1 nF 3.5 mF/F + 3 nF 3.5 mF/F + 10 nF 4 mF/F + 30 nF 5 mF/F + 100 nF 7 mF/F + 300 nF 10 mF/F + 300 nF	HP 3458A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Electrical Simulation of Thermocouple Indicators	Type B			
	(600 to 800) °C	0.44 °C		
	(800 to 1 000) °C	0.34 °C		
	(1 000 to 1 550) °C	0.3 °C		
	(1 550 to 1 820) °C	0.33 °C		
	Type C			
	(0 to 150) °C	0.3 °C		
	(150 to 650) °C	0.26 °C		
	(650 to 1 000) °C	0.31 °C		
	(1 000 to 1 800) °C	0.5 °C		
	(1 800 to 2 316) °C	0.84 °C		
	Type E			
	(-250 to -100) °C	0.5 °C		
	(-100 to -25) °C	0.16 °C		
	(-25 to 350) °C	0.14 °C		
	(350 to 650) °C	0.16 °C		
	(650 to 1 000) °C	0.21 °C		
	Type J			
	(-210 to -100) °C	0.27 °C		
	(-100 to -30) °C	0.16 °C		
	(-30 to 150) °C	0.14 °C		
	(150 to 760) °C	0.17 °C		
	(760 to 1 200) °C	0.23 °C		
	Type K			
	(-200 to -100) °C	0.33 °C		
	(-100 to -25) °C	0.18 °C		
	(-25 to 120) °C	0.16 °C		
(120 to 1 000) °C	0.26 °C			
(1 000 to 1 372) °C	0.4 °C			
Type L				
(-200 to -100) °C	0.37 °C			
(-100 to 800) °C	0.26 °C			
(800 to 900) °C	0.17 °C			
Type N				
(-200 to -100) °C	0.4 °C			
(-100 to -25) °C	0.22 °C			
(-25 to 120) °C	0.19 °C			
(120 to 410) °C	0.18 °C			
(410 to 1 300) °C	0.27 °C			
Type R				
(0 to 250) °C	0.57 °C			
(250 to 400) °C	0.35 °C			
(400 to 1 000) °C	0.33 °C			
(1 000 to 1 767) °C	0.4 °C			
			Fluke 5500A	GIDEP & OEM Sourced and Locally Developed Procedures

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Electrical Simulation of Thermocouple Indicators (cont.)	Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C 0.63 °C 0.24 °C 0.16 °C 0.14 °C 0.59 °C 0.27 °C	Fluke 5500A	GIDEP & OEM Sourced and Locally Developed Procedures

II. Time & Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Stopwatches & Digital Timers	Up to 24 hr	487 ms	Universal Counter NIST Time Signal	GIDEP & OEM Sourced and Locally Developed Procedures
Tachometers (optical)	(0 to 99,999) rpm	1.3 rpm	Frequency Generator & Counter	

III. Thermodynamic

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Thermometers	0.01 °C Ice Point Reference (-199 to 660) °C	0.11 °C 0.05 °C	Hart TPW Cell PRT w/Black Stack	GIDEP & OEM Sourced and Locally Developed Procedures
Humidity	(10 to 90) %RH	1.49 %RH	Vaisala HMI41/HPM46	

III. Mechanical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pressure - Hydraulic - Pneumatic	(10 to 1 500) psi (1 500 to 15 000) psi (1 to 300) psi (-14.7 to 0) psi +/- 0.36 psi +/- 0.9 psi +/- 2.5 psi +/- 7.5 psi (11 to 17) psi	1.2 psi 6.2 psi 0.085 psi 0.028 psi 0.006 psi 0.009 psi 0.003 psi 0.007 psi 0.01 psi	M&G Deadweight Tester M&G RK-300 Mensor APC600	GIDEP & OEM Sourced and Locally Developed Procedures
Balances / Scales	Up to 1 kg (1 to 2) kg (2 to 18) kg (18 to 60) kg	102.95 mg 209.61 mg 23.1 g 33.37 g	Precision Mass Set Class F Weights	
* Torque Arms * Torque Wheels	2.5 inch 4 inch 10 inch	205.0 µin 205.3 µin 205.3 µin	Gage blocks Dial Indicator Bench Micrometer	
Torque Wrenches	(4 to 50) lb-in (30 to 400) lb-in (80 to 1 000) lb-in (25 to 250) lb-ft	0.17 lb-in 1.0 lb-in 3.5 lb-in 0.87 lb-ft	CDI 2000 Multitest Calibration System	
* Torque Transducers	(4 to 50) lb-in (30 to 400) lb-in (80 to 1 000) lb-in (25 to 250) lb-ft	0.029 lb-in 0.18 lb-in 0.48 lb-in 0.12 lb-ft	Torque Wheels and Arms with Mass	
* Force - Compression & Tension	Up to 500 lbf	0.061 lbf	Class F Weights	

IV. Dimensional

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Calipers	Up to 6 in (6 to 24) in (24 to 48) in	171 μin 338 μin 653 μin	Grade 2 Gage Blocks	GIDEP & OEM Sourced and Locally Developed Procedures
Micrometers	Up to 24 in	249 μin		
Indicators	Up to 1 in	89.9 μin		
Test Indicators	Up to 0.06 in	74.6 μin		
Height Gage	Up to 24 in	267 μin		

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 service 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 laboratory-only, not available for on-site calibration activity.
4. CMCs reported for Electromagnetic - DC/Low Frequency do not include possible contributions to uncertainty from a "best available" unit under test.
5. This scope is part of and must be included with the Certificate of Accreditation No. AC - 1334.



Vice-President

