



ANSI-ASQ National Accreditation Board/AClass

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

Davis Calibration

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CALIBRATION

Valid to: November 21, 2012

Certificate Number: AC-1121

I. Electromagnetic – DC/Low Frequency⁸

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage – Source ⁵ Fixed Points	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V 220 V to 1.1 kV 10 V	7.5 μ V/V + 400 nV 5 μ V/V + 700 nV 3.5 μ V/V + 2.5 μ V 3.5 μ V/V + 4 μ V 5 μ V/V + 40 μ V 6.5 μ V/V + 400 μ V 4 μ V	Fluke 5720A Opt 03 Fluke 5725A Fluke 732A	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
DC Voltage – Measure ⁵ Fixed Points	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V 200 V to 1.05 kV Up to 120 kV 100 mV 1 V 10 V 100 V 1 000 V	5 μ V/V + 100 nV 3.5 μ V/V + 400 nV 3.5 μ V/V + 4 μ V 5.5 μ V/V + 40 μ V 5.5 μ V/V + 500 μ V 1 mV/V 2 μ V 2.2 μ V 6 μ V 224 μ V 2.34 mV	Fluke 8508A Opt 01 Ross VD120-6.2Y Fluke 732A with 752A and 8508A OPT 01	
DC Current – Source ⁵	Up to 220 μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 3) A (3 to 11) A (11 to 20.5) A	40 μ A/A + 6 nA 35 μ A/A + 7 nA 35 μ A/A + 400 nA 45 μ A/A + 700 nA 80 μ A/A + 12 μ A 380 μ A/A + 40 μ A 360 μ A/A + 480 μ A 1 mA/A + 750 μ A	Fluke 5720A Opt 03 Fluke 5520A Fluke 5725A Fluke 5520A	



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Resistance – Source ⁵ (cont.)	(10 to 100) MΩ (in 10 MΩ steps)	20 μΩ/ Ω	IET HRRS-B-5-10M-5kV	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
	100 MΩ to 1 GΩ (in 100 MΩ steps)	100 μΩ/ Ω		
	(1 to 10) GΩ (in 1 GΩ steps)	200 μΩ/ Ω		
	(10 to 100) GΩ (in 10 GΩ steps)	2 mΩ/ Ω		
	100 GΩ to 1 TΩ (in 100 GΩ steps)	2 mΩ/ Ω		
Fixed Points	0.001 Ω	431 pΩ	L&N 4223-B	
	0.01 Ω	4.31 nΩ	L&N 4222-B	
	0.1 Ω	43.5 nΩ	L&N 4221-B	
	1 Ω	250 nΩ	L&N 4210	
	10 kΩ	2.4 mΩ	ESI SR104	
Resistance – Measure ⁵	Up to 2 Ω	7.2 μΩ/ Ω	Fluke 8508A OPT 01	
	(2 to 20) Ω	3.2 μΩ/ Ω	Fluke 8508A OPT 01	
	(20 to 200) Ω	3.2 μΩ/ Ω	with standard resistors	
	200 Ω to 2 kΩ	2.7 μΩ/ Ω		
	(2 to 20) kΩ	2.7 μΩ/ Ω		
	(20 to 200) kΩ	1.9 μΩ/ Ω		
	200 kΩ to 2 MΩ	8.5 μΩ/ Ω		
	(2 to 20) MΩ	16.4 μΩ/ Ω		
	(20 to 200) MΩ	14.5 μΩ/ Ω		
	200 MΩ to 1 GΩ	500 μΩ/ Ω		
	(1 to 10) GΩ	700 μΩ/ Ω		
	(10 to 100) GΩ	1 mΩ/ Ω		
	100 GΩ to 1 TΩ	2 mΩ/ Ω		
	(1 to 10) TΩ	3 mΩ/ Ω		
	(10 to 100) TΩ	5 mΩ/ Ω		
			Guildline 6500	



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage – Source ⁵	<p>Up to 2.2 mV</p> <p>(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz</p> <p>(2.2 to 22) mV</p> <p>(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz</p> <p>(22 to 220) mV</p> <p>(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz</p> <p>220 mV to 2.2 V</p> <p>(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz</p>	<p>240 $\mu\text{V/V} + 4 \mu\text{V}$ 90 $\mu\text{V/V} + 4 \mu\text{V}$ 80 $\mu\text{V/V} + 4 \mu\text{V}$ 200 $\mu\text{V/V} + 4 \mu\text{V}$ 500 $\mu\text{V/V} + 5 \mu\text{V}$ 1.1 $\text{mV/V} + 10 \mu\text{V}$ 1.4 $\text{mV/V} + 20 \mu\text{V}$ 2.7 $\text{mV/V} + 20 \mu\text{V}$</p> <p>240 $\mu\text{V/V} + 4 \mu\text{V}$ 90 $\mu\text{V/V} + 4 \mu\text{V}$ 80 $\mu\text{V/V} + 4 \mu\text{V}$ 200 $\mu\text{V/V} + 4 \mu\text{V}$ 500 $\mu\text{V/V} + 5 \mu\text{V}$ 1.1 $\text{mV/V} + 10 \mu\text{V}$ 1.4 $\text{mV/V} + 20 \mu\text{V}$ 2.7 $\text{mV/V} + 20 \mu\text{V}$</p> <p>240 $\mu\text{V/V} + 12 \mu\text{V}$ 90 $\mu\text{V/V} + 7 \mu\text{V}$ 80 $\mu\text{V/V} + 7 \mu\text{V}$ 200 $\mu\text{V/V} + 7 \mu\text{V}$ 460 $\mu\text{V/V} + 17 \mu\text{V}$ 900 $\mu\text{V/V} + 20 \mu\text{V}$ 1.4 $\text{mV/V} + 25 \mu\text{V}$ 2.7 $\text{mV/V} + 45 \mu\text{V}$</p> <p>240 $\mu\text{V/V} + 40 \mu\text{V}$ 90 $\mu\text{V/V} + 15 \mu\text{V}$ 45 $\mu\text{V/V} + 8 \mu\text{V}$ 75 $\mu\text{V/V} + 10 \mu\text{V}$ 110 $\mu\text{V/V} + 30 \mu\text{V}$ 420 $\mu\text{V/V} + 80 \mu\text{V}$ 1 $\text{mV/V} + 200 \mu\text{V}$ 1.7 $\text{mV/V} + 300 \mu\text{V}$</p>	Fluke 5720A Opt 03	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage – Source ⁵ (cont.)	(2.2 to 22) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (220 to 1 100) V (15 to 50) Hz 50 Hz to 1 kHz	240 μV/V + 400 μV 90 μV/V + 150 μV 45 μV/V + 50 μV 70 μV/V + 100 μV 100 μV/V + 200 μV 275 μV/V + 600 μV 1 mV/V + 2 mV 1.5 mV/V + 3.2 mV 240 μV/V + 4 mV 90 μV/V + 1.5 mV 52 μV/V + 600 μV 80 μV/V + 1 mV 150 μV/V + 2.5 mV 900 μV/V + 16 mV 4.4 mV/V + 40 mV 8 mV/V + 80 mV 300 μV/V + 16 mV 70 μV/V + 3.5 mV	Fluke 5720A Opt 03	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
AC Voltage – Measure ⁵	(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 1MHz (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 μV/V + 3 μV 200 μV/V + 1.1 μV 300 μV/V + 1.1 μV 1 mV/V + 1.1 μV 5 mV/V + 1.1 μV 40 mV/V + 2 μV 12 mV/V + 5 μV 70 mV/V + 7 μV 200 mV/V + 8 μV 72 μV/V + 4 μV 72 μV/V + 2 μV 142 μV/V + 2 μV 302 μV/V + 2 μV 802 μV/V + 2 μV 3 mV/V + 10 μV 10 mV/V + 10 μV 15 mV/V + 10 μV 40 mV/V + 8 μV 150 mV/V + 100 μV	HP 3458A Opt 002	



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage – Measure ⁵ (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 40Hz 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 (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	72 $\mu\text{V/V} + 40 \mu\text{V}$ 72 $\mu\text{V/V} + 20 \mu\text{V}$ 142 $\mu\text{V/V} + 20 \mu\text{V}$ 302 $\mu\text{V/V} + 20 \mu\text{V}$ 802 $\mu\text{V/V} + 20 \mu\text{V}$ 3 mV/V + 100 μV 1 mV/V + 100 μV 15 mV/V + 100 μV 40 mV/V + 800 μV 150 mV/V + 1 mV 72 $\mu\text{V/V} + 400 \mu\text{V}$ 72 $\mu\text{V/V} + 200 \mu\text{V}$ 142 $\mu\text{V/V} + 200 \mu\text{V}$ 302 $\mu\text{V/V} + 200 \mu\text{V}$ 802 $\mu\text{V/V} + 200 \mu\text{V}$ 3 mV/V + 1 mV 1 mV/V + 1 mV 15 mV/V + 1 mV 40 mV/V + 8 mV 150 mV/V + 10 mV 200 $\mu\text{V/V} + 4 \text{ mV}$ 200 $\mu\text{V/V} + 2 \text{ mV}$ 200 $\mu\text{V/V} + 2 \text{ mV}$ 350 $\mu\text{V/V} + 2 \text{ mV}$ 1.2 mV/V + 2 mV 4 mV/V + 10 mV 15 mV/V + 10 mV 400 $\mu\text{V/V} + 40 \text{ mV}$ 400 $\mu\text{V/V} + 20 \text{ mV}$ 600 $\mu\text{V/V} + 20 \text{ mV}$ 1.2 mV/V + 20 mV 3 mV/V + 20 mV 135 $\mu\text{V/V} + 4 \mu\text{V}$ 340 $\mu\text{V/V} + 8 \mu\text{V}$ 765 $\mu\text{V/V} + 20 \mu\text{V}$	HP 3458A Opt 002	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Current - Measure (cont.)	250 mA Range		Holt HCS-1	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
	(10 to 400) Hz	205 μ A/A		
	400 Hz to 1 kHz	48 μ A/A		
	(1 to 20) kHz	53 μ A/A		
	(20 to 50) kHz	87 μ A/A		
	500 mA Range			
	(10 to 400) Hz	205 μ A/A		
	400 Hz to 1 kHz	48 μ A/A		
	(1 to 20) kHz	53 μ A/A		
	(20 to 50) kHz	91 μ A/A		
	1 A Range			
	(10 to 400) Hz	206 μ A/A		
	400 Hz to 1 kHz	53 μ A/A		
(1 to 20) kHz	68 μ A/A			
(20 to 50) kHz	128 μ A/A			
2.5 A Range				
(10 to 400) Hz	212 μ A/A			
400 Hz to 1 kHz	73 μ A/A			
(1 to 20) kHz	77 μ A/A			
(20 to 50) kHz	137 μ A/A			
5 A Range				
(10 to 400) Hz	212 μ A/A			
400 Hz to 1 kHz	73 μ A/A			
(1 to 20) kHz	87 μ A/A			
(20 to 50) kHz	185 μ A/A			
10 A Range				
(10 to 400) Hz	216 μ A/A			
400 Hz to 1 kHz	82 μ A/A			
(1 to 20) kHz	102 μ A/A			
(20 to 50) kHz	147 μ A/A			
20 A Range				
(10 to 400) Hz	222 μ A/A			
400 Hz to 1 kHz	97 μ A/A			
(1 to 20) kHz	122 μ A/A			
(20 to 50) kHz	171 μ A/A			
AC Phase – Source	(1 to 100) kHz	0.01 deg	Clarke Hess 5500-2	
AC Phase – Measure	10 Hz to 50 kHz	0.01 deg	K-H 6610	



PARAMETER/ EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Capacitance – Source ⁵ 1 kHz 1 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz Up to 50 Hz Up to 20 Hz Up to 6 Hz Up to 2 Hz Up to 0.6 Hz Up to 0.2 Hz	100 pF 1 nF 190 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 μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF 330 μF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.00059 pF 0.0048 pF 5 mF/F + 10 pF 2.6 mF/F + 10 pF 2.6 mF/F + 100 pF 2.5 mF/F + 300 pF 2.6 mF/F + 1 nF 2.5 mF/F + 3 nF 2.6 mF/F + 10 nF 4 mF/F + 30 nF 4.5 mF/F + 100 nF 4.5 mF/F + 300 nF 4.5 mF/F + 1 μF 5 mF/F + 10 pF 5 mF/F + 10 pF 5 mF/F + 3 μF 5 mF/F + 10 μF 8 mF/F + 30 μF 11 mF/F + 100 μF	Genrad 1404B Genrad 1404A Fluke 5520A	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
Capacitance -- Measure up to 1 kHz	Up to 10 pF (10 to 100) pF (100 to 1 000) pF (1 to 10) nF (10 to 100) nF (100 to 1 000) nF	140 μF/F 140 μF/F 140 μF/F 410 μF/F 410 μF/F 420 μF/F	Genrad 1689M Digibridge	
Inductance – Source Fixed Points up to 1 kHz	100 μH 1 mH 10 mH 100 mH 10 H	22.6 nH 226 nH 3 μH 30 μH 2.26 mH	Genrad 1482-B Genrad 1482-E Genrad 1481-D Genrad 1482-L Genrad 1482-T	
Inductance – Measure Up to 1 kHz	Up to 1 mH (1 to 100) mH 100 mH to 1 H (1 to 10) H	210 μH/H 210 μH/H 510 μH/H 2 mH/H	Genrad 1689M Digibridge	

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Electrical Simulation of Thermocouple Indicators ⁵	Type B	(600 to 800) °C	0.44 °C	Fluke 5520A/SC 1100 Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
		(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	
	Type E	(1 800 to 2 316) °C	0.84 °C	
		(-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	
	Type J	(650 to 1 000) °C	0.21 °C	
		(-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	
	Type K	(760 to 1 200) °C	0.23 °C	
		(-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	
	Type L	(1 000 to 1 372) °C	0.4 °C	
		(-200 to -100) °C	0.37 °C	
		(-100 to 800) °C	0.26 °C	
	Type N	(800 to 900) °C	0.17 °C	
		(-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		
Type R	(410 to 1 300) °C	0.27 °C		
	(0 to 250) °C	0.51 °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		



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Electrical Simulation of Thermocouple Indicators ⁵ (cont.) Type S	(0 to 250) °C (250 to 1 000) °C (1 000 to 1400) °C (1 400 to 1 767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	Fluke 5520A/SC 1100	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C		
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C		
Electrical Simulation of RTDs ⁵ Pt 385 (100 Ω)	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.23 °C		
Pt 3926 (100 Ω)	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C		
Pt 3916 (100 Ω)	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.1 °C 0.23 °C		

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Electrical Simulation of RTDs (cont.) ⁵			Fluke 5520A/SC 1100	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
Pt 385 (200 Ω)	(-200 to 100) °C	0.04 °C		
	(100 to 260) °C	0.05 °C		
	(260 to 300) °C	0.12 °C		
	(300 to 400) °C	0.13 °C		
	(400 to 600) °C	0.14 °C		
	(600 to 630) °C	0.16 °C		
Pt 385 (500 Ω)	(-200 to -80) °C	0.04 °C		
	(-80 to 100) °C	0.05 °C		
	(100 to 260) °C	0.06 °C		
	(260 to 400) °C	0.08 °C		
	(400 to 600) °C	0.09 °C		
	(600 to 630) °C	0.11 °C		
Pt 385 (1 000 Ω)	(-200 to 0) °C	0.03 °C		
	(0 to 100) °C	0.04 °C		
	(100 to 260) °C	0.05 °C		
	(260 to 300) °C	0.06 °C		
	(300 to 600) °C	0.07 °C		
	(600 to 630) °C	0.23 °C		
PtNi 120 (120 Ω)	(-80 to 100) °C	0.08 °C		
	(100 to 260) °C	0.14 °C		
CU 427 (10 Ω)	(-100 to 260) °C	0.3 °C		



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Calibration of Oscilloscopes ⁵			Fluke 5520A/SC 1100	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
Amplitude DC Signal into 50 Ω Load into 1 MΩ Load	(-6.6 to 6.6) V (-130 to 130) V	2.5 mV/V + 40 μV 500 μV/V + 40 μV		
Amplitude Squarewave 50 Ω Load	±1 mV to ±6.6 Vp-p 10 Hz to 10 kHz	2.5 mV/V + 40 μV		
1 MΩ Load	±1 mV to ±130 Vp-p 10 Hz to 1 kHz (1 to 10) kHz	1 mV/V + 40 μV 2.5 mV/V + 40 μV		
Rise Time	≤300 ps	+0 ps/ -100 ps		
Leveled Sine Wave Relative to 50 kHz [5 mV to 5.5 V] p-p	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 600 MHz to 1.1 GHz	35 μV/V + 300 μV 40 μV/V + 300 μV 60 μV/V + 300 μV 70 μV/V + 300 μV		
Time Marker into 50 Ω Load - Source	5 s to 50 ms 20 ms to 1 ns	(25 + 1000t) μs/s 2.5 μs/s		
Edge Specs into 50 Ω Load - Source Rise Time 50 Ω load Range (p-p)	≤ 350 ps 5 mV to 2.5 V	(0 /-100) ps 20 mV/V + 200 μV		
Wave Generator – Source Amplitude (10 Hz to 10 kHz)				
Square, Sine, Triangle into 1 MΩ	1.8 mV to 55 Vp-p	30 mV/V + 100 μV		
Square, Sine, Triangle into 50 Ω	1.8 mV to 2.5 Vp-p	30 mV/V + 100 μV		



II. Electromagnetic - RF/Microwave⁹

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Power – Source ⁵ 50 Ω load	1 dB 1 Hz to 100 kHz	0.1 dB	HP 3325B	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
	100 kHz to 20 MHz	0.4 dB		
	(2 to 8) dB 1 Hz to 100 kHz	0.2 dB	HP 83630A w/ 8902A, 11722A, 11792A and 11793A	
	100 kHz to 10 MHz	0.5 dB		
	(2 to 4) dB 100 kHz to 10 MHz	0.6 dB		
	(10 to 20) MHz	0.9 dB		
	(5 to 8) dB 100 kHz to 10 MHz	0.6 dB		
	(10 to 20) MHz	0.9 dB		
	(+10 to -110) dBm (10 to 50) MHz	0.91 dB		
	50 MHz to 2.6 GHz	0.61 dB		
	(2.6 to 18) GHz	0.48 dB		
	(18 to 20) GHz	0.74 dB		
	(20 to 26.5) GHz	0.93 dB		
(+10 to -10) dBm (20 to 40) GHz	0.9 dB	HP 83650A		
(+2.5 to -10) dBm (40 to 50) GHz	1.7 dB			
(-10 to -60) dBm (20 to 40) GHz	1.2 dB			
(40 to 50) GHz	2.0 dB			
(-60 to -110) dBm (20 to 40) GHz	1.7 dB			
(40 to 50) GHz	2.5 dB			

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Power Measure ⁵ 50 Ω load	(+10 to -20) dBm 10 MHz to 2.6 GHz (2.6 to 18) GHz (18 to 20) GHz (20 to 26.5) GHz	0.07 dBm 0.06 dBm 0.06 dBm 0.1 dBm	HP 8902A w/ 11793A, 11722A, and 11792A Sensors	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
	(+10 to +20) dBm 10MHz to 18GHz (18 to 26.5)GHz	0.08 dBm 0.12 dBm	HP 436A w/ 8481A HP 436A w/ 8485A	
	(-20 to -70) dBm 10MHz to 6GHz (6 to 15) GHz (17 to 18) GHz	0.17 dBm 0.13 dBm 0.15 dBm	HP 436A w/ 8481D	
	(-30 to +20) dBm 100 kHz to 4.2 Hz	0.23 dBm	HP 436A w/ 8482A	
	(+30 to -20) dBm (26.5 to 50) GHz	2.9 %	HP 437B w/ 8487A	
	(-20 to -70) dBm (26.5 to 50) GHz	3.3 %		
Power Reference (1 mW) ⁵	50 MHz	3.7 μW	HP 478-H76 Thermistor Mount	



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Phase Modulation – Measure ⁵ Carrier Frequency: 150 kHz to 10 MHz 10 MHz to 26.5 GHz	200 Hz to 10 kHz 200 Hz to 20 kHz	5 % 4 %	HP 8902A w/ 11722A HP 8902A w/ 11793A	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
Amplitude Modulation - Source ⁵ Rate: 50 Hz to 10 kHz Depths: 5 % to 99 %	100 MHz to 1.28 GHz	2.3 %	HP 8902A w/ 8663A	
Rate: 1 kHz Depths: 30 %	10 MHz to 50 GHz	5.8 %	HP 83650A	
Rate: DC to 10 kHz Depths: 0 % to 90 %	(26.5 to 50) GHz	2.3 %	HP 83650A	
Amplitude Modulation -- Measure ⁵ Rate: 20 Hz to 10 kHz, to 99 % 50 Hz to 10 kHz (5 to 99) % 20 Hz to 10 kHz, to 99 % 50 Hz to 10 kHz (5 to 99) %	150 kHz to 10 MHz 150 kHz to 10 MHz 10 MHz to 1.3 GHz 10 MHz to 1.3 GHz	3.5 % 2.3 % 3.5 % 1.2 %	HP 8902A w/ 11722A HP 8902A w/ 11793A	
Frequency Modulation - Source ⁵ Modulation Rate: 20 Hz to 10 kHz 50 Hz to 100 kHz 20 Hz to 200 kHz Rate: 100 kHz to 8 MHz Dev.: < 10 MHz	250 kHz to 10 MHz 10 MHz to 1.3 GHz 10 MHz to 1.3 GHz (26.5 to 50) GHz	2.4 % 1.3 % 5.8 % 10 %	HP 8902A w/ 8663A HP83650A	

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Attenuation – Source (cont.) ⁵ (+10 to -20) dBm (-20 to -70) dBm (-70 to -120) dBm	(26.5 to 50) GHz (26.5 to 50) GHz (26.8 to 40) GHz	2.9 % 3.3 % 4 dB	HP 437B w/8487A HP 437B w/8487D HP 8564E	Surecal 5.0 Software, OEM and GIDEP Sourced Procedures
Distortion – Measure ⁵ Fundamental Frequency	20 Hz to 20 kHz (20 to 100) kHz	1.19 dB 2.38 dB	HP 8903B	

III. Time & Frequency

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Frequency – Measure ⁵ * Note: Datum 9390-6000 GPS Frequency Standard is not used on-site.	10 MHz DC to 500 MHz 500 MHz to 46 GHz	6 parts in 10 ⁸ 6 parts in 10 ⁸ 6 parts in 10 ⁹	Datum 9390-6000 HP 5335A HP 5352B	OEM and GIDEP Sourced Calibration Procedures

IV. Thermodynamic

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Temperature – Source	Ambient to 200 °C (-80 to 100) °C (-40 to 150) °C (20 to 300) °C (60 to 550) °C	0.016 °C 0.018 °C 0.017 °C 0.023 °C 0.031 °C	Hart 5680 SPRT, 1590 and the following baths; Erteo TCS-200-35 Hart 7380 Hart 7341 Hart 6022 Hart 6050	OEM, GIDEP, NIST, and ASTM Sourced Calibration Procedures
Fixed Points	-195 °C -38.83319 °C 231.9278 °C 419.5268 °C	0.004 °C 0.004 °C 0.004 °C 0.004 °C	NBPLN2 Hart T.P. Hg Cell Hart F.P. Sn Cell Hart F.P. Zn Cell	
*Triple Point of Water	0.01 °C	0.0001 °C	Triple Point Cell	



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Temperature - Measure	-190 °C -39 °C 0.01 °C 231 °C 420 °C	0.004 °C 0.009 °C 0.003 °C 0.009 °C 0.018 °C	Hart 5680 SPRT with Hart 1590 Super Thermometer	OEM, GIDEP, NIST, and ASTM Sourced Calibration Procedures
Infrared Non-Contact Temperature - Source	(-20 to 150) °C (150 to 1 000) °C	0.5 °C (0.8 to 1.65) °C	Mikron M340 Blackbody Source Mikron M360A Blackbody Source	
Relative Humidity – Measure	0 to 100 %RH	1.2 %	Vaisala HMI41/HMP46	
Relative Humidity - Source	(10 to 50) %RH (50 to 95) %RH	0.35 % 0.35 %	Thunder Scientific 2500 Humidity Generator	

V. Optical Radiation

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Luminance - Source	(5 to 460) ft-lambert	3.5 % of reading	Labsphere USS-600V System	OEM and GIDEP Sourced Procedures
Fiber Optic Power - Source	(-80 to +3) dBm (1 000 to 1 650) nm	4 % + 50 pW	HP 81521B w/ HP 81533B	
Attenuation (dB)	(0 to 60) dB (1 200 to 1 700) nm	0.05 dB	HP 8156A	
Wavelength (nm)	(700 to 1 650) nm	1.3 parts in 10 ⁶	HP 86120B	
Laser Source (Power Stability)	(1 310 to 1 550) nm (1 450 to 1 590) nm	0.017 dB 0.035 dB	Agilent 81654A HP 8168F	



VI. Mechanical

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pressure	0.025 in H ₂ O (0.05 to 0.3) in H ₂ O 0.4 in H ₂ O 0.5 in H ₂ O 0.6 in H ₂ O 0.7 in H ₂ O 0.8 in H ₂ O 0.9 in H ₂ O 1 in H ₂ O 1.1 in H ₂ O 1.2 in H ₂ O 1.3 in H ₂ O 1.4 in H ₂ O 1.5 in H ₂ O 1.6 in H ₂ O 1.625 in H ₂ O 1.65 in H ₂ O 1.7 in H ₂ O 1.8 in H ₂ O 1.9 in H ₂ O 2.1 in H ₂ O 2.6 in H ₂ O 3.6 in H ₂ O 3.8 in H ₂ O 3.9 in H ₂ O 3.95 in H ₂ O 3.975 in H ₂ O 4 in H ₂ O 4 in H ₂ O 4.025 in H ₂ O 4.05 in H ₂ O 4.1 in H ₂ O 4.2 in H ₂ O 4.3 in H ₂ O 4.5 in H ₂ O 5 in H ₂ O 6 in H ₂ O 9 in H ₂ O 14 in H ₂ O 24 in H ₂ O 44 in H ₂ O 54 in H ₂ O 59 in H ₂ O	0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0004 in H ₂ O 0.0005 in H ₂ O 0.0005 in H ₂ O 0.0005 in H ₂ O 0.0005 in H ₂ O 0.0006 in H ₂ O 0.0007 in H ₂ O 0.0009 in H ₂ O 0.0009 in H ₂ O 0.0009 in H ₂ O 0.0009 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.0009 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.001 in H ₂ O 0.002 in H ₂ O 0.003 in H ₂ O 0.005 in H ₂ O 0.01 in H ₂ O 0.013 in H ₂ O 0.015 in H ₂ O	Ruska V1600/3D Deadweight Tester	OEM and GIDEP Sourced Procedures



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pressure (cont.)	61 in H ₂ O 62 in H ₂ O 63 in H ₂ O 63.5 in H ₂ O 63.7 in H ₂ O 63.8 in H ₂ O 63.9 in H ₂ O 63.95 in H ₂ O 63.975 in H ₂ O 64 in H ₂ O (0.2 to 25) psia (0.2 to 25) psig (25 to 100) psia (25 to 100) psig (100 to 1 000) psia (100 to 1 000) psig (1 to 4) kpsig (4 to 20) kpsig (20 to 40) kpsig	0.016 in H ₂ O 0.016 in H ₂ O 0.016 in H ₂ O 0.017 in H ₂ O 0.017 in H ₂ O 0.017 in H ₂ O 0.017 in H ₂ O 0.017 in H ₂ O 0.017 in H ₂ O 0.015 in H ₂ O 0.003 % 0.002 % 0.003 % 0.002 % 0.003 % 0.002 % 0.004 % 0.01 % 0.018 %	Ruska V1600/3D Deadweight Tester Ruska Deadweight Testers	OEM and GIDEP Sourced Procedures
Vacuum	(-15 to 0) psi	0.009 % of reading	Ruska 7250xi	
Force	Up to 700 lbf	0.13 % of reading	Class F Weights	
Durometers	Type A, B, and O Type C, D, and DO	0.8 Duro 0.5 Duro	Precision Scale or Gage Blocks with RDC-1 Durometer Calibrator	
Torque Wrenches	(5 to 50 in oz) 4 in·lb to 2 000 ft·lb	0.61 % of reading 0.32 % of reading	CDI Suretest Torque Calibration System	
Torque Transducers and Calibrators	(Up to 280) in·oz (5 to 100) in·lb (5 to 290) ft·lb (50 to 2 000) ft·lb	0.34 % of reading 0.16 % of reading 0.03 % of reading 0.06 % of reading	Class F weights w/ 2.5 in. radius wheel 5 in. radius wheel 10 in. radius butterfly 40 in. radius arm	



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pipettes	1 µl to 5 ml (5 to 25) ml	0.006 µl 20 µl	M-T MX5 M-T AX205DR With M-T pipette software	OEM and GIDEP Sourced Procedures
Mass Flow of Gases	Up to 100 sccm Up to 1 000 sccm Up to 20 slm Up to 40 slm Up to 80 slm	0.2 % of reading or 0.02 % full scale (whichever is greater)	DHI molbloc/ molbox Mass Flow System	
Air Velocity Air Flow	(0 to 5 000) fpm (0 to 25) mps	1.16 % of reading + 1 digit	Wind tunnel monitored with Ashcroft ATE100 and AQS-1 differential pressure meter w/ Druck DPI 141 Barometer	



VII. Dimensional

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
*Single Axis Dimensional	(0.02 to 4) in	$(2.4 + 1.65L) \mu\text{in}$	P&W Labmaster with Grade 00 Gage Blocks	OEM and GIDEP Sourced Calibration Procedures
Gaging – Inside	(4 to 12) in	$(1.2 + 3.3L) \mu\text{in}$		
*Single Axis Dimensional Gaging – Outside	Up to 4 in (4 to 12) in	$(2.4 + 1.65L) \mu\text{in}$ $(1.2 + 3.3L) \mu\text{in}$		
*Thread Pitch – Outside	Up to 4 in	$(152 + L) \mu\text{in}$	P&W Labmaster with Grade 00 gage blocks and Thread Wires	
Calipers – Inside and Outside	Up to 4 in (4 to 20) in	$(152 + L) \mu\text{in}$ $(758 + 1.1L) \mu\text{in}$		
Micrometers – Inside, Outside, and Depth	Up to 4 in (4 to 20) in	$(86 + 1.7L)\mu\text{in}$ $(111 + 5L)\mu\text{in}$		
Height Gages	Up to 20 in	$(69.4 + 5.3L) \mu\text{in}$	Comparison with Grade 00 Gage Blocks and Surface Plate	
Protractors	(0 to 360) °	36 arc seconds	Angle Blocks, Cylindrical Square	
Rulers	Up to 25 in (0.001 in increments)	$(0.001) (1.2 + 0.02L) \text{ in}$	Max Levy Microrule	

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)		
Coating Thickness Measuring Equipment (Ferrous)	0.22 mil	0.03 mil	NIST Standard Reference Materials	OEM and GIDEP Sourced Procedures		
	0.47 mil	0.11 mil				
	1.04 mil	0.13 mil				
	1.55 mil	0.44 mil				
	1.93 mil	0.2 mil				
	3.39 mil	0.99 mil				
	5.35 mil	0.97 mil				
	7.99 mil	2.23 mil				
	10.08 mil	1.16 mil				
	14.91 mil	0.33 mil				
	18.81 mil	3.25 mil				
	24.01 mil	0.33 mil				
	31.92 mil	0.99 mil				
	40.23 mil	4 mil				
	57.41 mil	6.74 mil				
69.23 mil	6.3 mil					
Gloss Measuring Equipment Micro-TRI-Gloss			Gloss Standards			
	20° SG	51.4 GU			1 GU	
	60° SG	44 GU			1 GU	
	85° SG	19.1 GU			1 GU	
	High Gloss					
		20° HG			92 GU	1 GU
		60° HG			94.8 GU	1 GU
85° HG	99.2 GU	1 GU				

Notes:

1. Best Measurement Capabilities (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of $k=2$.
2. This laboratory's capabilities include in-laboratory and field (on-site) calibration services. Since field conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected in the field than what is reported on the accredited scope.
3. Temperature fixed point cells carry accuracies from 0.0002 °C for the Hg cell to 0.0009 °C for the Zn cell.
4. The accredited corporate site with the above address is also accredited for the following satellite sites: Philips On-Site, 3000 Minuteman Road, Andover, MA, 01810, POC Cheri Mooney, Phone: 978-659-3381 and Goodrich On-Site, 100 Wooster Heights Road, Danbury, CT, 06810, POC Laura Wolken, Phone 203-797-5801.
5. Parameters have been verified and authorized for accredited calibration at the Philips and Goodrich satellite sites.
6. Capabilities denoted with an asterisk (*) cannot be performed on-site.
7. The use of (L) signifies an expression of Length in inches.
8. Electromagnetic – DC/Low Frequency uncertainties do not include possible contributions to uncertainty from the unit under test.
9. RF/Microwave uncertainties do not include possible mismatch contributions to uncertainty.
10. The use of (t) signifies Time in seconds.
11. This scope is part of and must be included with the Certificate of Accreditation No. AC-1121

Karl Greenway

Vice President

