



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

**Tektronix Service Solutions**

9639 Interocean Drive Cincinnati, OH 45246  
Rick Morton Phone: 513-870-4714

**CALIBRATION**

Valid to: June 29, 2012

Certificate Number: AC-1279

**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 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	8 $\mu$ V/V + 600 nV 7 $\mu$ V/V + 1 $\mu$ V 7 $\mu$ V/V + 3.5 $\mu$ V 7 $\mu$ V/V + 6.5 $\mu$ V 8 $\mu$ V/V + 80 $\mu$ V 9 $\mu$ V/V + 500 $\mu$ V	Fluke 5720A	OEM, GIDEP, and Locally Developed Calibration Procedures
DC Voltage - Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V 200 to 1 kV Up to 120 kV	4.5 $\mu$ V/V + 100 nV 3 $\mu$ V/V + 400 nV 3 $\mu$ V/V + 4 $\mu$ V 4.5 $\mu$ V/V + 40 $\mu$ V 4.5 $\mu$ V/V + 500 $\mu$ V 240 $\mu$ V/V	Fluke 8508A Opt 01  Ross VD120-6.2Y	
DC Current - Source	Up to 220 $\mu$ A 220 $\mu$ 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 (20.5 to 1 000) A	50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 8 nA 50 $\mu$ A/A + 80 nA 60 $\mu$ A/A + 800 nA 80 $\mu$ A/A + 25 $\mu$ A 380 $\mu$ A/A + 40 $\mu$ A 500 $\mu$ A/A + 500 $\mu$ A 1 mA/A + 750 $\mu$ A 2.6 mA/A + 50 mA	Fluke 5720A  Fluke 5520A  Fluke 5520A w/ coil	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Current - Measure	(10 to 100) $\mu$ A (100 to 200) $\mu$ A 200 $\mu$ A to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A  (1 to 20) A (20 to 1 000) A	20 $\mu$ A/A + 800 pA 12 $\mu$ A/A + 400 pA 12 $\mu$ A + 4 nA 13 $\mu$ A/A + 40 nA 36 $\mu$ A/A + 800 nA 170 $\mu$ A/A + 16 $\mu$ A 380 $\mu$ A/A + 400 nA  137 $\mu$ A/A 2.5 mA/A	HP 3458A Opt 002 Fluke 8508A Opt 01  HP 3458A Fluke with Y5020 with Current Shunts	OEM, GIDEP, and Locally Developed Calibration Procedures
Resistance - Source	1 $\Omega$ 1.9 $\Omega$ 10 $\Omega$ 19 $\Omega$ 100 $\Omega$ 190 $\Omega$ 1 k $\Omega$ 1.9 k $\Omega$ 10 k $\Omega$ 19 k $\Omega$ 100 k $\Omega$ 190 k $\Omega$ 1 M $\Omega$ 1.9 M $\Omega$ 10 M $\Omega$ 19 M $\Omega$ 100 M $\Omega$	95 $\mu\Omega$ 181 $\mu\Omega$ 280 $\mu\Omega$ 513 $\mu\Omega$ 1.7 m $\Omega$ 3.23 m $\Omega$ 13 m $\Omega$ 24.7 m $\Omega$ 120 m $\Omega$ 228 m $\Omega$ 1.4 $\Omega$ 2.66 $\Omega$ 20 $\Omega$ 40 $\Omega$ 400 $\Omega$ 893 $\Omega$ 11 k $\Omega$	Fluke 5720A	
Resistance - Measure	Up to 2 $\Omega$ (2 to 20) $\Omega$ (20 to 200) $\Omega$ 200 $\Omega$ to 2 k $\Omega$ (2 to 20) k $\Omega$ (20 to 200) k $\Omega$ 200 k $\Omega$ to 2 M $\Omega$ (2 to 20) M $\Omega$ (20 to 200) M $\Omega$ 200 M $\Omega$ to 2 G $\Omega$	15 $\mu\Omega$ / $\Omega$ + 4 u $\Omega$ 9 $\mu\Omega$ / $\Omega$ + 14 u $\Omega$ 7.5 $\mu\Omega$ / $\Omega$ + 50 u $\Omega$ 7.5 $\mu\Omega$ / $\Omega$ + 500 u $\Omega$ 7.5 $\mu\Omega$ / $\Omega$ + 5 m $\Omega$ 7.5 $\mu\Omega$ / $\Omega$ + 50 m $\Omega$ 8.5 $\mu\Omega$ / $\Omega$ + 1 $\Omega$ 15 $\mu\Omega$ / $\Omega$ + 100 $\Omega$ 60 $\mu\Omega$ / $\Omega$ + 10 k $\Omega$ 525 $\mu\Omega$ / $\Omega$ + 1 M $\Omega$	Fluke 8508A Opt 01	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source	<b>Up to 2.2 mV</b>		Fluke 5720A	OEM, GIDEP, and Locally Developed Calibration Procedures
	(10 to 20) Hz	550 $\mu$ V/V + 4.5 $\mu$ V		
	(20 to 40) Hz	210 $\mu$ V/V + 4.5 $\mu$ V		
	40 Hz to 20 kHz	105 $\mu$ V/V + 4.5 $\mu$ V		
	(20 to 50) kHz	370 $\mu$ V/V + 4.5 $\mu$ V		
	(50 to 100) kHz	850 $\mu$ V/V + 7 $\mu$ V		
	(100 to 300) kHz	1.1 mV/V + 13 $\mu$ V		
	(300 to 500) kHz	1.7 mV/V + 25 $\mu$ V		
	500 kHz to 1 MHz	3.4 mV/V + 25 $\mu$ V		
	<b>(2.2 to 22) mV</b>			
	(10 to 20) Hz	550 $\mu$ V/V + 5 $\mu$ V		
	(20 to 40) Hz	210 $\mu$ V/V + 5 $\mu$ V		
	40 Hz to 20 kHz	105 $\mu$ V/V + 5 $\mu$ V		
	(20 to 50) kHz	370 $\mu$ V/V + 5 $\mu$ V		
	(50 to 100) kHz	850 $\mu$ V/V + 7 $\mu$ V		
	(100 to 300) kHz	1.1 mV/V + 12 $\mu$ V		
	(300 to 500) kHz	1.7 mV/V + 25 $\mu$ V		
	500 kHz to 1 MHz	3.4 mV/V + 25 $\mu$ V		
	<b>(22 to 220) mV</b>			
	(10 to 20) Hz	550 $\mu$ V/V + 13 $\mu$ V		
	(20 to 40) Hz	210 $\mu$ V/V + 8 $\mu$ V		
	40 Hz to 20 kHz	105 $\mu$ V/V + 8 $\mu$ V		
	(20 to 50) kHz	320 $\mu$ V/V + 8 $\mu$ V		
	(50 to 100) kHz	850 $\mu$ V/V + 25 $\mu$ V		
(100 to 300) kHz	1.1 mV/V + 25 $\mu$ V			
(300 to 500) kHz	1.7 mV/V + 35 $\mu$ V			
500 kHz to 1 MHz	3.4 mV/V + 80 $\mu$ V			
<b>220 mV to 2.2 V</b>				
(10 to 20) Hz	500 $\mu$ V/V + 80 $\mu$ V			
(20 to 40) Hz	160 $\mu$ V/V + 25 $\mu$ V			
40 Hz to 20 kHz	75 $\mu$ V/V + 6 $\mu$ V			
(20 to 50) kHz	120 $\mu$ V/V + 16 $\mu$ V			
(50 to 100) kHz	250 $\mu$ V/V + 70 $\mu$ V			
(100 to 300) kHz	430 $\mu$ V/V + 130 $\mu$ V			
(300 to 500) kHz	1.1 mV/V + 350 $\mu$ V			
500 kHz to 1 MHz	2.2 mV/V + 850 $\mu$ V			



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage - Source (cont.)	<b>(2.2 to 22) V</b> (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	500 $\mu$ V/V + 800 $\mu$ V 160 $\mu$ V/V + 250 $\mu$ V 75 $\mu$ V/V + 60 $\mu$ V 120 $\mu$ V/V + 160 $\mu$ V 250 $\mu$ V/V + 350 $\mu$ V 500 $\mu$ V/V + 1.5 mV 1.3 mV/V + 4.3 mV 2.7 mV/V + 8.5 mV	Fluke 5720A	OEM, GIDEP, and Locally Developed Calibration Procedures
	<b>(22 to 220) V</b> (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 <b>220 V to 1.1 kV</b> (15 to 50) Hz 50 Hz to 1 kHz	500 $\mu$ V/V + 8 mV 160 $\mu$ V/V + 2.5 mV 80 $\mu$ V/V + 800 $\mu$ V 220 $\mu$ V/V + 3.5 mV 500 $\mu$ V/V + 8 mV 1.5 mV/V + 90 mV 4.7 mV/V + 90 mV 115 mV/V + 190 mV 400 $\mu$ V/V + 16 mV 80 $\mu$ V/V + 3.5 mV		
AC Voltage - Measure	<b>(1 to 10) mV</b> (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	300 $\mu$ V/V + 3 $\mu$ V 200 $\mu$ V/V + 1.1 $\mu$ V 300 $\mu$ V/V + 1.1 $\mu$ V 1 mV/V + 1.1 $\mu$ V 5 mV/V + 1.1 $\mu$ V 40 mV/V + 2 $\mu$ V 12 mV/V + 5 $\mu$ V 70 mV/V + 7 $\mu$ V 200 mV/V + 8 $\mu$ V	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>(10 to 100) mV</b> (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	72 $\mu\text{V/V} + 5 \mu\text{V}$ 72 $\mu\text{V/V} + 2 \mu\text{V}$ 142 $\mu\text{V/V} + 2 \mu\text{V}$ 302 $\mu\text{V/V} + 2 \mu\text{V}$ 802 $\mu\text{V/V} + 2 \mu\text{V}$ 3 mV/V + 10 $\mu\text{V}$ 10 mV/V + 10 $\mu\text{V}$ 15 mV/V + 10 $\mu\text{V}$ 40 mV/V + 8 $\mu\text{V}$ 150 mV/V + 100 $\mu\text{V}$	HP 3458A Opt 002	
	<b>(100 to 200) mV</b> (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz <b>200 mV to 2 V</b> (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz <b>(2 to 20) V</b> (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	160 $\mu\text{V/V} + 14 \mu\text{V}$ 130 $\mu\text{V/V} + 4 \mu\text{V}$ 110 $\mu\text{V/V} + 4 \mu\text{V}$ 105 $\mu\text{V/V} + 2 \mu\text{V}$ 105 $\mu\text{V/V} + 4 \mu\text{V}$ 305 $\mu\text{V/V} + 8 \mu\text{V}$ 705 $\mu\text{V/V} + 20 \mu\text{V}$ 140 $\mu\text{V/V} + 120 \mu\text{V}$ 105 $\mu\text{V/V} + 20 \mu\text{V}$ 85 $\mu\text{V/V} + 20 \mu\text{V}$ 65 $\mu\text{V/V} + 20 \mu\text{V}$ 85 $\mu\text{V/V} + 20 \mu\text{V}$ 205 $\mu\text{V/V} + 40 \mu\text{V}$ 505 $\mu\text{V/V} + 200 \mu\text{V}$ 3 mV/V + 2 mV 10 mV/V + 20 mV 140 $\mu\text{V/V} + 1.2 \text{ mV}$ 105 $\mu\text{V/V} + 200 \mu\text{V}$ 85 $\mu\text{V/V} + 200 \mu\text{V}$ 65 $\mu\text{V/V} + 200 \mu\text{V}$ 85 $\mu\text{V/V} + 200 \mu\text{V}$ 205 $\mu\text{V/V} + 400 \mu\text{V}$ 505 $\mu\text{V/V} + 2 \text{ mV}$ 3 mV/V + 20 mV 10 mV/V + 200 mV	Fluke 8508A Opt 01	OEM, GIDEP and Locally Developed Calibration Procedures





PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Current - Source	<b>(22 to 220) mA</b>		Fluke 5720A	OEM, GIDEP, and Locally Developed Calibration Procedures
	(10 to 20) Hz	700 µA/A + 4 µA		
	(20 to 40) Hz	350 µA/A + 3.5 µA		
	40 Hz to 1 kHz	140 µA/A + 3.5 µA		
	(1 to 5) kHz	600 µA/A + 40 µA		
	(5 to 10) kHz	1.6 mA/A + 80 µA		
	<b>220 mA to 2.2 A</b>			
	20 Hz to 1 kHz	650 µA/A + 35 µA		
	(1 to 5) kHz	750 µA/A + 80 µA		
	(5 to 10) kHz	8.5 mA/A + 160 µA		
	<b>(2.2 to 3) A</b>		Fluke 5520A	
	(10 to 45) Hz	1.8 mA/A + 100 µA		
	45 Hz to 1 kHz	600 µA/A + 100 µA		
(1 to 5) kHz	6 mA/A + 1 mA			
(5 to 10) kHz	25 mA/A + 5 mA			
<b>(3 to 11) A</b>				
(45 to 100) Hz	600 µA/A + 2 mA			
100 Hz to 1 kHz	10 mA/A + 2 mA			
(1 to 5) kHz	30 mA/A + 2 mA			
<b>(11 to 20.5) A</b>				
(45 to 100) Hz	1.2 mA/A + 5mA			
100 Hz to 1 kHz	1.5 mA/A + 5mA			
(1 to 5) kHz	30 mA/A + 5mA			
<b>(20.5 to 1 000) A</b>				
60 Hz	2.9 mA/A + 90 mA	Fluke 5520A w/Coil		





PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Capacitance - Source 10 Hz to 10 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 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	(190 to 400) pF 400 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	5 mF/F + 10 pF 5 mF/F + 10 pF 5 mF/F + 10 pF 2.5 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 2.5 mF/F + 3 nF 2.5 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 4.5 mF/F + 3 μF 4.5 mF/F + 10 μF 7.5 mF/F + 30 μF 11 mF/F + 100 μF	Fluke 5520A	OEM, GIDEP, and Locally Developed Calibration Procedures
Electrical Simulation of Thermocouple Indicators Type B  Type C  Type E	(600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C  (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  (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C	0.51 °C 0.39 °C 0.35 °C 0.38 °C  0.35 °C 0.3 °C 0.36 °C 0.58 °C 0.97 °C  0.58 °C 0.19 °C 0.16 °C 0.19 °C 0.24 °C		



<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>
Electrical Simulation of Thermocouple Indicators (cont.)				
Type J	(-210 to -100) °C	0.32 °C		
	(-100 to -30) °C	0.19 °C		
	(-30 to 150) °C	0.17 °C		
	(150 to 760) °C	0.2 °C		
	(760 to 1 200) °C	0.27 °C		
Type K	(-200 to -100) °C	0.38 °C		
	(-100 to -25) °C	0.21 °C		
	(-25 to 120) °C	0.19 °C		
	(120 to 1 000) °C	0.3 °C		
	(1 000 to 1 372) °C	0.46 °C		
Type L	(-200 to -100) °C	0.43 °C		
	(-100 to 800) °C	0.3 °C		
	(800 to 900) °C	0.2 °C		
Type N	(-200 to -100) °C	0.46 °C		
	(-100 to -25) °C	0.25 °C		
	(-25 to 120) °C	0.22 °C		
	(120 to 410) °C	0.21 °C		
	(410 to 1 300) °C	0.31 °C		
Type R	(0 to 250) °C	0.66 °C		
	(250 to 400) °C	0.4 °C		
	(400 to 1 000) °C	0.38 °C		
	(1 000 to 1 767) °C	0.46 °C		
			Fluke 5520A	OEM, GIDEP, and Locally Developed Calibration Procedures



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Electrical Simulation of Thermocouple Indicators (cont.) Type S	(0 to 250) °C	0.54 °C	Fluke 5520A	OEM, GIDEP and Locally Developed Calibration Procedures
	(250 to 1 000) °C	0.42 °C		
	(1 000 to 1 400) °C	0.43 °C		
	(1 400 to 1 767) °C	0.53 °C		
Type “T”	(-250 to -150) °C	0.73 °C		
	(-150 to 0) °C	0.28 °C		
	(0 to 120) °C	0.19 °C		
	(120 to 400) °C	0.17 °C		
Type “U”	(-200 to 0) °C	0.65 °C		
	(0 to 600) °C	0.31 °C		
Electrical Simulation of RTDs Pt 385 (100 Ω)	(-200 to 0) °C	0.06 °C		
	(0 to 100) °C	0.08 °C		
	(100 to 300) °C	0.1 °C		
	(300 to 400) °C	0.12 °C		
	(400 to 630) °C	0.14 °C		
	(630 to 800) °C	0.27 °C		
Pt 3926 (100 Ω)	(-200 to 0) °C	0.06 °C		
	(0 to 100) °C	0.08 °C		
	(100 to 300) °C	0.1 °C		
	(300 to 400) °C	0.12 °C		
	(400 to 630) °C	0.14 °C		
Pt 3916 (100 Ω)	(-200 to -190) °C	0.29 °C		
	(-190 to -80) °C	0.05 °C		
	(-80 to 0) °C	0.06 °C		
	(0 to 100) °C	0.07 °C		
	(100 to 260) °C	0.08 °C		
	(260 to 300) °C	0.09 °C		
	(300 to 400) °C	0.1 °C		
	(400 to 600) °C	0.12 °C		
	(600 to 630) °C	0.27 °C		



<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>
Electrical Simulation of RTDs (cont.)				
Pt 385 (200 Ω)	(-200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.05 °C 0.06 °C 0.14 °C 0.15 °C 0.16 °C 0.18 °C	Fluke 5520A	OEM, GIDEP, and Locally Developed Calibration Procedures
Pt 385 (500 Ω)	(-200 to 080) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.05 °C 0.06 °C 0.07 °C 0.09 °C 0.1 °C 0.13 °C		
Pt 385 (1 000 Ω)	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.03 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.27 °C		
PtNi 120 (120 Ω)	(-80 to 100) °C (100 to 260) °C	0.09 °C 0.16 °C		



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Oscilloscopes 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	Fluke 5520A/SC 1100	OEM, GIDEP, and Locally Developed Calibration Procedures
Amplitude Squarewave 50 Ω Load	±1 mV to ±6.6 V p-p 10 Hz to 10 kHz	2.5 mV/V + 40 μV		
1 MΩ Load	±1 mV to ±130 V p-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 to 1100) MHz	15 mV/V + 100 μV 20 mV/V + 100 μV 40 mV/V + 100 μV 50 mV/V + 100 μV		
Time Marker into 50 Ω Load-Source	5 s to 50 ms 20 ms to 2 ns	(25 + 1 000t) parts in 10 <sup>6</sup> 2.5 parts in 10 <sup>6</sup>		
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 Square, Sine, Triangle into 50 Ω	1.8 mV to 55 Vp-p 1.8 mV to 2.5 Vp-p	30 mV/V + 100 μV 30 mV/V + 100 μV		



## II. Electromagnetic - RF/Microwave

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Power - Source	(+13 to -120) dBm 10 kHz to 1.28 GHz (-120 to -130) dBm 10 kHz to 1.28 GHz	1.1 dB 3.1 dB	HP 8663A	OEM, GIDEP, and Locally Developed Calibration Procedures
RF Power -Measure	(+30 to -20) dBm 100 kHz to 2 GHz (2 to 26.5) GHz (+20 to -30) dBm 100 kHz to 4.2 GHz 50 MHz to 26.5 GHz (+35 to -10) dBm 10 MHz to 18 GHz (-20 to -70) dBm 10 MHz to 18 GHz	0.07 dB 0.08 dB 3.4 % 3.4 % 3.5 % 3.9 %	HP 8902A w/ HP 11722A HP 8902A w/HP 11792A and HP 11793A  HP 438A w/ HP 8482A HP 438A w/ HP 8485A  HP 438A w/ HP 8481H  HP 438A w/ HP 8484H	
RF Attenuation - Measure (0 to -10) dBm (-10 to -40) dBm (-40 to -50) dBm (-50 to -80) dBm (-80 to -90) dBm (-90 to -110) dBm (-110 to -127) dBm	2.5 MHz to 26.5 GHz 2.5 MHz to 26.5 GHz 2.5 MHz to 26.5 GHz 2.5 MHz to 26.5 GHz 2.5 MHz to 26.5 GHz 2.5 MHz to 26.5 GHz 2.5 MHz to 26.5 GHz	0.02 dB 0.05 dB 0.12 dB 0.15 dB 0.25 dB 0.27 dB 0.42 dB	HP 8902A w/ HP 11722A, HP 11792A and HP 11793A	
Phase Modulation - Measure Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz	150 kHz to 10 MHz 10 MHz to 26.5 GHz	4.2 % + 1 digit 3.3 % + 1 digit	HP 8902A w/ HP 11722A, HP 11792A and HP 11793A	
Amplitude Modulation – Measure Rate: 50 Hz to 10 kHz Depths: (5 to 99) % Rate: 20 Hz to 10 kHz Depths: (5 to 99) % Rate: 50 Hz to 50 kHz Depths: (5 to 99) % Rate: 20 Hz to 100 kHz Depths: (5 to 99) %	150 kHz to 10 MHz 150 kHz to 10 MHz 10 MHz to 1.3 GHz (1.3 to 26.5) GHz 10 MHz to 26.5 GHz	2 % + 1 digit 3.1 % + 1 digit 1 % + 1 digit 1.5 % + 1 digit 3.1 % + 1 digit	HP 8902A w/ HP 11722A HP 8902A w/ HP 11722A  HP 8902A w/ HP 11722A, HP 11793A, HP 11792A HP 8902A w/ HP 11722A, HP 11793A, HP 11792A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Frequency Modulation - Measure				
Rate: 20 Hz to 10 kHz	250 Hz to 10 MHz	2.1 % + 1 digit	HP 8902A w/ HP 11722A	OEM, GIDEP, and Locally Developed Calibration Procedures
Deviation: ≤40 kHz peak				
Rate: 50 Hz to 100 kHz	10 MHz to 1.3 GHz	1.1 % + 1 digit	HP 8902A w/ HP 11722A	
Deviation: ≤400 kHz peak				
Rate: 20 Hz to 200 kHz	10 MHz to 26.5 GHz	5.1 % + 1 digit	HP 8902A w/ HP 11722A,	
Deviation: ≤400 kHz peak			HP 11793A, HP 11792A	
Rate: 50 Hz to 100 kHz	10 MHz to 26.5 GHz	1.1 % + 1 digit		
Deviation: ≤400 kHz peak				

### III. Time & Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Frequency - Source*	10 MHz	5.2 parts in $10^{-12}$	Datum 9390	OEM, GIDEP, and Locally Developed Calibration Procedures
Frequency - Source	0.01 Hz to 2 MHz	2.6 $\mu$ Hz/Hz + 5 $\mu$ Hz	Fluke 5520A	
Frequency - Measure <sup>7</sup>	150 kHz to 1.3 GHz Up to 200 MHz	0.7 $\mu$ Hz/Hz 0.09 $\mu$ Hz/Hz	HP 8902A HP 5335A	
Frequency - Measure	40 Hz to 10 MHz	100 $\mu$ Hz/Hz	HP 3458A	



#### IV. Thermodynamic

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Temperature - Source*	(-20 to 300) °C	0.025 °C	Rosemount 162N PRT w/ Hart 1502A Tweener in liquid baths	OEM, GIDEP, and Locally Developed Calibration Procedures
Temperature - Measure <sup>7</sup>	(-40 to 420) °C	0.027 °C	Rosemount 162N PRT w/ Hart 1502A Tweener	
Temperature - Measure	(0 to 962) °C	0.6 °C	Hart 5650 Type S T/C w/3458A	
	(0 to 1100) °C	0.95 °C		
	(0 to 1200) °C	1.45 °C		
Temperature - Measure	(0 to 1450) °C	2.85 °C	HygroPalm 2	
	(-10 to 60) °C	0.24 °C		
Humidity - Measure	(0 to 99) %RH	1% of Reading + 1.1 %RH		
Infrared Non-Contact Temperature - Source* <sup>6</sup>	(23 to 500) °C	0.3 °C	Hart 9132 Electro-Optical WS154	
	(480 to 1 204) °C	2.8 °C		

#### V. Mechanical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Pressure - Nitrogen Pressure Standards* <sup>6</sup>	(0.2 to 1 000) psi	0.0015 % of reading	Ruska 2465	OEM, GIDEP, and Locally Developed Calibration Procedures
Pressure Gages* <sup>6</sup>	(100 to 4 000) psi	0.006 % of reading	Ruska 2452 w/ 2413 Separator	
	(100 to 14 000) psi	0.008 % of reading		
Pressure Gages	(0 to 500) psi	0.01 % of full scale	Mensor 5014	
	(0 to 1 000) psia	0.01 % of full scale		
Pressure - Hydraulic Pressure Standards* <sup>6</sup>	(100 to 4 000) psi	0.006 % of reading	Ruska 2452	
	(400 to 40 000) psi	0.008 % of reading		
Pressure Gages	(0 to 500) psi	0.01 % of full scale	Mensor 5014	
	(0 to 1 000) psia	0.01 % of full scale		

<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>
Vibration* <sup>6</sup>	(5 to 7) Hz (10 to 50) Hz (100 to 160) Hz (300 to 920) Hz (1.5 to 5) kHz (6.3 to 10) KHz	1.3 % 0.9 % 0.7 % 0.8 % 2.1 % 3.4 %	Standard Accelerometers	OEM, GIDEP, and Locally Developed Calibration Procedures
Scales and Balances <sup>7</sup>	Up to 50 g (50 to 100) g (100 to 200) g (200 to 500) g 500 g to 1 kg (1 to 2) kg (2 to 5) kg (5 to 10) kg (10 to 20) kg	0.19 mg 0.29 mg 0.52 mg 1.94 mg 2.93 mg 5.23 mg 19.43 mg 29.3 mg 52.28 mg	Class 1 Weights	
Mass* <sup>6, 7</sup>	1, 2, 3, 5, 10,20, 30, 50, 100, 200 mg 300, 500 mg 1 g 2, 3, 5 g 10 g 20, 30 g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 3 kg 5 kg 10 kg 20 kg	0.01 mg 0.023 mg 0.04 mg 0.21 mg 0.22 mg 0.22 mg 0.24 mg 0.33 mg 2.14 mg 2.21 mg 2.4 mg 3.3 mg 5.9 mg 8.1 mg 12 mg 25 mg 50 mg	Class 1 Weights with Cahn C11 Micro-Balance  Class 1 Weights with Christian Becker 108A Balance  Class 1 Weights with Met-Toledo XP26003L Comparator	



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Sound Level Meters, Type 2 31.5 Hz 63 Hz 125 Hz 250 Hz 500 Hz 1 kHz 2 kHz 4 kHz 8 kHz 12.5 kHz 16 kHz 250 Hz	94/104/114 dB            124 dB	0.47 dB 0.32 dB 0.28 dB 0.24 dB 0.28 dB 0.28 dB 0.28 dB 0.32 dB 0.37 dB 0.42 dB 0.47 dB 0.24 dB	B&K 4226            B&K 4228	OEM, GIDEP, and Locally Developed Calibration Procedures
Gas Flow*	(1 to 10) slpm (10 to 100) slpm (30 to 300) slpm (10 to 3 000 000) sscm	0.67 % of reading 0.63 % of reading 0.47 % of reading 0.57 % of reading	DHI MoBlocs	
Volumetric Flow, Liquids*	(0.01 to 1) gpm (0.03 to 50) gpm (0.04 to 400) gpm	0.17 % of reading 0.16 % of reading 0.17 % of reading	Flow Calibrator	

## VI. Dimensional

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Micrometers	Up to 12 in (12 to 36) in	(30 + 3.1L) $\mu$ in (63 + 4.4L) $\mu$ in	Grade 2 Gage Blocks with Optical Parallels	OEM, GIDEP, and Locally Developed Procedures
Calipers <sup>7</sup>	Up to 12 in (12 to 40) in	(81 + 2L) $\mu$ in (95 + 4L) $\mu$ in	Grade 2 Gage Blocks	
Height Gages	Up to 24 in	(78 + 2.6L) $\mu$ in	Grade 2 Gage Blocks with Surface Plate	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Dial Indicators <sup>7</sup>	Up to 0.2 in	48.6 µin	Indicator Calibrator	OEM, GIDEP, and Locally Developed 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 at the above address, at its facility located at 1 Newmann Way, Cincinnati, OH 45215, on-site at customer-designated locations, and at its satellite site at Sabic Plastics, 1 Lexan Lane, Mt. Vernon, IN 47620.
3. 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.
4. Capabilities denoted by an asterisk (\*) are not available for on-site calibration activity.
5. The use of (L) signifies an expression of Length in inches and (t) signifies an expression of Time in seconds.
6. These calibrations are performed at the laboratory's facility located at 1 Newmann Way, Cincinnati, OH 45215.
7. These calibrations are available at the Sabic Plastics location (see note 2 above).
8. This scope is part of and must be included with the Certificate of Accreditation No. AC-1279.




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Vice President

