



# CERTIFICATE OF ACCREDITATION

## ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

**Rothe Development, Inc. Metrology Services Division**  
**4614 Sinclair Road**  
**San Antonio TX 78222**

has been assessed by ANAB  
and meets the requirements of international standard

**ISO/IEC 17025:2005**

and national standard

**ANSI/NCSL Z540-1-1994 (R2002)**

while demonstrating technical competence in the field of

**CALIBRATION**

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations to which this accreditation applies.

AC-1388

Certificate Number

  
ANAB Approval

Certificate Valid: 03/14/2018-04/23/2020  
Version No. 004 Issued: 03/14/2018



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. 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 April 2017).



**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005  
AND ANSI/NCSL Z540-1-1994 (R2002)**

**Rothe Development, Inc. Metrology Services Division**

4614 Sinclair Road  
San Antonio, TX 78222  
Will Wright  
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**CALIBRATION**

Valid to: **April 23, 2020**

Certificate Number: **AC-1388**

**Electrical – DC/Low Frequency**

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage - Source	Up to 220 mV 220 mV to 2.2 V (2.2 V to 11) V (11 V to 22) V (22 V to 220) V 220 V to 1.1 kV	7.5 $\mu\text{V/V} + 0.40 \mu\text{V}$ 5 $\mu\text{V/V} + 0.70 \mu\text{V}$ 3.5 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3.5 $\mu\text{V/V} + 4 \mu\text{V}$ 5 $\mu\text{V/V} + 40 \mu\text{V}$ 6.5 $\mu\text{V/V} + 0.40 \text{ mV}$	Fluke 5720A
DC Voltage - Source Fixed Point	10 V	6 $\mu\text{V/V}$	Fluke 732A
DC Voltage - Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V 200 V to 1 kV	5 $\mu\text{V/V} + 0.1 \mu\text{V}$ 3.5 $\mu\text{V/V} + 0.4 \mu\text{V}$ 3.5 $\mu\text{V/V} + 4 \mu\text{V}$ 5.5 $\mu\text{V/V} + 40 \mu\text{V}$ 5.5 $\mu\text{V/V} + 1 \text{ mV}$	Fluke 8508A Opt 01
DC Current - Source	Up to 220 $\mu\text{A}$ 220 $\mu\text{A}$ to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	40 $\mu\text{A/A} + 6 \text{ nA}$ 35 $\mu\text{A/A} + 7 \text{ nA}$ 35 $\mu\text{A/A} + 40 \text{ nA}$ 45 $\mu\text{A/A} + 0.7 \mu\text{A}$ 80 $\mu\text{A/A} + 12 \mu\text{A}$	Fluke 5720A
	(2.2 to 11) A 11 A to 20.5 A	0.36 mA/A + 0.48 mA 0.78 mA/A + 1.2 mA	with Fluke 5725A Fluke 5520A-PQ 120



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Current - Measure	Up to 200 $\mu$ A	12 $\mu$ A/A + 0.4 nA	Fluke 8508A Opt 01
	200 $\mu$ A to 2 mA	12 $\mu$ A/A + 4 nA	
	(2 to 20) mA	14 $\mu$ A/A + 40 nA	
	(20 to 200) mA	48 $\mu$ A/A + 0.8 $\mu$ A	
	200 mA to 2 A	0.19 mA/A + 16 $\mu$ A	
Resistance - Source	(2 to 20) A	0.4 mA/A + 0.4 mA	Fluke 5720A
	1 $\Omega$	95 $\mu\Omega/\Omega$	
	1.9 $\Omega$	95 $\mu\Omega/\Omega$	
	10 $\Omega$	23 $\mu\Omega/\Omega$	
	19 $\Omega$	23 $\mu\Omega/\Omega$	
	100 $\Omega$	10 $\mu\Omega/\Omega$	
	190 $\Omega$	10 $\mu\Omega/\Omega$	
	1 k $\Omega$	8.5 $\mu\Omega/\Omega$	
	1.9 k $\Omega$	8.5 $\mu\Omega/\Omega$	
	10 k $\Omega$	8.5 $\mu\Omega/\Omega$	
	19 k $\Omega$	8.5 $\mu\Omega/\Omega$	
	100 k $\Omega$	11 $\mu\Omega/\Omega$	
	190 k $\Omega$	11 $\mu\Omega/\Omega$	
	1 M $\Omega$	20 $\mu\Omega/\Omega$	
	1.9 M $\Omega$	21 $\mu\Omega/\Omega$	
	10 M $\Omega$	40 $\mu\Omega/\Omega$	
	19 M $\Omega$	47 $\mu\Omega/\Omega$	
100 M $\Omega$	100 $\mu\Omega/\Omega$		
Resistance - Source	(100 to 330) M $\Omega$ (330 M $\Omega$ to 1.1 G $\Omega$ )	2.3 m $\Omega/\Omega$ + 78 k $\Omega$ 11.6 m $\Omega/\Omega$ + 0.39 M $\Omega$	Fluke 5520A-PQ 120
	1 $\Omega$	8 $\mu\Omega/\Omega$	Fluke 742A-1
	10 k $\Omega$	4 $\mu\Omega/\Omega$	Fluke 742A-10K
Resistance - Measure	Up to 2 $\Omega$	17 $\mu\Omega/\Omega$ + 4 $\mu\Omega$	Fluke 8508A Opt 01
	(2 to 20) $\Omega$	9.5 $\mu\Omega/\Omega$ + 14 $\mu\Omega$	
	(20 to 200) $\Omega$	8 $\mu\Omega/\Omega$ + 50 $\mu\Omega$	
	200 $\Omega$ to 2 k $\Omega$	8 $\mu\Omega/\Omega$ + 0.5 m $\Omega$	
	(2 to 20) k $\Omega$	8 $\mu\Omega/\Omega$ + 5 m $\Omega$	
	(20 to 200) k $\Omega$	8 $\mu\Omega/\Omega$ + 50 m $\Omega$	
	200 k $\Omega$ to 2 M $\Omega$	9 $\mu\Omega/\Omega$ + 1 $\Omega$	
	(2 to 20) M $\Omega$	17 $\mu\Omega/\Omega$ + 1 k $\Omega$	
	(20 to 200) M $\Omega$	65 $\mu\Omega/\Omega$ + 10 k $\Omega$	
	200 M $\Omega$ to 2 G $\Omega$	0.18 m $\Omega/\Omega$ + 0.1 M $\Omega$	
(2 to 20) G $\Omega$	1.51 m $\Omega/\Omega$ + 1 M $\Omega$		



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage - Source	Up to 2.2 mV		Fluke 5720A
	(10 to 20) Hz	240 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	(20 to 40) Hz	90 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	40 Hz to 20 kHz	80 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	(20 to 50) kHz	0.20 mV/V + 4 $\mu\text{V}$	
	(50 to 100) kHz	0.50 mV/V + 5 $\mu\text{V}$	
	(100 to 300) kHz	1.1 mV/V + 10 $\mu\text{V}$	
	(300 to 500) kHz	1.4 mV/V + 20 $\mu\text{V}$	
	500 kHz to 1 MHz	2.7 mV/V + 20 $\mu\text{V}$	
	(2.2 to 22) mV		
	(10 to 20) Hz	240 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	(20 to 40) Hz	90 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	40 Hz to 20 kHz	80 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$	
	(20 to 50) kHz	0.2 mV/V + 4 $\mu\text{V}$	
	(50 to 100) kHz	0.5 mV/V + 5 $\mu\text{V}$	
	(100 to 300) kHz	1.1 mV/V + 10 $\mu\text{V}$	
	(300 to 500) kHz	1.4 mV/V + 20 $\mu\text{V}$	
	500 kHz to 1 MHz	2.7 mV/V + 20 $\mu\text{V}$	
	(22 to 220) mV		
	(10 to 20) Hz	0.24 mV/V + 12 $\mu\text{V}$	
	(20 to 40) Hz	90 $\mu\text{V}/\text{V}$ + 7 $\mu\text{V}$	
	40 Hz to 20 kHz	80 $\mu\text{V}/\text{V}$ + 7 $\mu\text{V}$	
	(20 to 50) kHz	0.20 mV/V + 7 $\mu\text{V}$	
	(50 to 100) kHz	0.46 mV/V + 17 $\mu\text{V}$	
(100 to 300) kHz	0.9 mV/V + 20 $\mu\text{V}$		
(300 to 500) kHz	1.4 mV/V + 25 $\mu\text{V}$		
500 kHz to 1 MHz	2.7 mV/V + 45 $\mu\text{V}$		
220 mV to 2.2 V			
(10 to 20) Hz	0.24 mV/V + 40 $\mu\text{V}$		
(20 to 40) Hz	90 $\mu\text{V}/\text{V}$ + 15 $\mu\text{V}$		
40 Hz to 20 kHz	45 $\mu\text{V}/\text{V}$ + 8 $\mu\text{V}$		
(20 to 50) kHz	75 $\mu\text{V}/\text{V}$ + 10 $\mu\text{V}$		
(50 to 100) kHz	0.11 mV/V + 30 $\mu\text{V}$		
(100 to 300) kHz	0.42 mV/V + 80 $\mu\text{V}$		
(300 to 500) kHz	1 mV/V + 0.2 mV		
500 kHz to 1 MHz	1.7 mV/V + 0.3 mV		

**Electrical – DC/Low Frequency**

<b>Parameter / Equipment</b>	<b>Range</b>	<b>Expanded Uncertainty of Measurement (+/-)</b>	<b>Reference Standard, Method and/or Equipment</b>
AC Voltage - Source	(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	0.24 mV/V + 0.4 mV 90 μV/V + 0.15 mV 45 μV/V + 50 μV 75 μV/V + 0.1 mV 0.1 mV/V + 0.2 mV 0.28 mV/V + 0.6 mV 1 mV/V + 2 mV 1.5 mV/V + 3.2 mV	Fluke 5720A
AC Voltage - Source	(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 V to 1.1 kV (15 to 50) Hz 50 Hz to 1 kHz 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.24 mV/V + 4 mV 90 μV/V + 1.5 mV 52 μV/V + 0.6 mV 80 μV/V + 1 mV 0.15 mV/V + 2.5 mV 0.9 mV/V + 16 mV 4.4 mV/V + 40 mV 8 mV/V + 80 mV 0.3 mV/V + 16 mV 70 μV/V + 3.5 mV 90 μV/V + 4 mV 0.17 mV/V + 6 mV 0.6 mV/V + 11 mV	Fluke 5720A with Fluke 5725A
AC Voltage – Measure	Up to 200 mV (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	0.17 mV/V + 14 μV 0.14 mV/V + 4 μV 0.12 mV/V + 4 μV 0.11 mV/V + 2 μV 0.14 mV/V + 4 μV 0.34 mV/V + 8 μV 0.77 mV/V + 20 μV	Fluke 8508A



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage – Measure	200 mV to 2 V		Fluke 8508A
	(1 to 10) Hz	0.15 mV/V + 0.12 mV	
	(10 to 40) Hz	0.12 mV/V + 20 μV	
	(40 to 100) Hz	90 μV/V + 20 μV	
	100 Hz to 2 kHz	75 μV/V + 20 μV	
	(2 to 10) kHz	0.11 mV/V + 20 μV	
	(10 to 30) kHz	0.22 mV/V + 40 μV	
	(30 to 100) kHz	0.57 mV/V + 0.2 mV	
	(100 to 300) kHz	3 mV/V + 2 mV	
	300 kHz to 1 MHz	10 mV/V + 20 mV	
	(2 to 20) V		
	(1 to 10) Hz	0.15 mV/V + 1.2 mV	
	(10 to 40) Hz	0.12 mV/V + 0.2 mV	
	(40 to 100) Hz	90 μV/V + 0.2 mV	
	100 Hz to 2 kHz	75 μV/V + 0.2 mV	
	(2 to 10) kHz	0.11 mV/V + 0.2 mV	
	(10 to 30) kHz	0.22 mV/V + 0.4 mV	
	(30 to 100) kHz	0.57 mV/V + 2 mV	
	(100 to 300) kHz	3 mV/V + 20 mV	
	300 kHz to 1 MHz	10 mV/V + 0.2 V	
	(20 to 200) V		
	(1 to 10) Hz	0.15 mV/V + 12 mV	
	(10 to 40) Hz	0.12 mV/V + 2 mV	
	(40 to 100) Hz	90 μV/V + 2 mV	
	100 Hz to 2 kHz	75 μV/V + 2 mV	
	(2 to 10) kHz	0.11 mV/V + 2 mV	
	(10 to 30) kHz	0.22 mV/V + 4 mV	
	(30 to 100) kHz	0.57 mV/V + 20 mV	
(100 to 300) kHz	3 mV/V + 0.2 V		
300 kHz to 1 MHz	10 mV/V + 2 V		
200 to 1 kV			
(1 to 10) Hz	0.15 mV/V + 70 mV		
(10 to 40) Hz	0.12 mV/V + 20 mV		
40 Hz to 10 kHz	0.12 mV/V + 20 mV		
(10 to 30) kHz	0.23 mV/V + 40 mV		
(30 to 100) kHz	0.58 mV/V + 0.2 V		



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment	
AC Current - Source	(9 to 220) $\mu$ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.25 mA/A + 16 nA 0.16 mA/A + 10 nA 0.12 mA/A + 8 nA 0.28 mA/A + 12 nA 1.1 mA/A + 65 nA	Fluke 5720A	
	220 $\mu$ A to 2.2 mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.25 mA/A + 40 nA 0.16 mA/A + 35 nA 0.12 mA/A + 35 nA 0.20 mA/A + 0.11 $\mu$ A 1.1 mA/A + 0.65 $\mu$ A		
	(2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.25 mA/A + 0.4 $\mu$ A 0.16 mA/A + 0.35 $\mu$ A 0.12 mA/A + 0.35 $\mu$ A 0.2 mA/A + 0.55 $\mu$ A 1.1 mA/A + 5 $\mu$ A		
	(22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.25 mA/A + 4 $\mu$ A 0.16 mA/A + 3.5 $\mu$ A 0.12 mA/A + 2.5 $\mu$ A 0.2 mA/A + 3.5 $\mu$ A 1.1 mA/A + 10 $\mu$ A		
	220 mA to 2.2 A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.26 mA/A + 35 $\mu$ A 0.45 mA/A + 80 $\mu$ A 7 mA/A + 0.16 mA		
	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.46 mA/A + 0.17 mA 0.95 mA/A + 0.38 mA 3.6 mA/A + 0.75 mA		Fluke 5720A with Fluke 5725A
	11 A to 20.5 A 45 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz	0.93 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA		Fluke 5520A-PQ 120



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current - Measure	Up to 200 $\mu$ A		Fluke 8508A Opt 01
	(1 to 10) Hz	0.31 mA/A + 20 nA	
	10 Hz to 10 kHz	0.3 mA/A + 20 nA	
	(10 to 30) kHz	0.71 mA/A + 20 nA	
	(30 to 100) kHz	4 mA/A + 20 nA	
	200 $\mu$ A to 2 mA		
	(1 to 10) Hz	0.31 mA/A + 0.2 $\mu$ A	
	10 Hz to 10 kHz	0.3 mA/A + 0.2 $\mu$ A	
	(10 to 30) kHz	0.71 mA/A + 0.0 $\mu$ A	
	(30 to 100) kHz	4 mA/A + 0.2 $\mu$ A	
	(2 to 20) mA		
	(1 to 10) Hz	0.31 mA/A + 2 $\mu$ A	
	10 Hz to 10 kHz	0.3 mA/A + 2 $\mu$ A	
	(10 to 30) kHz	0.71 mA/A + 2 $\mu$ A	
(30 to 100) kHz	4 mA/A + 2 $\mu$ A		
(20 to 200) mA			
(1 to 10) Hz	0.31 mA/A + 20 $\mu$ A		
10 Hz to 10 kHz	0.29 mA/A + 20 $\mu$ A		
(10 to 30) kHz	0.63 mA/A + 20 $\mu$ A		
200 mA to 2 A			
10 Hz to 2 kHz	0.62 mA/A + 0.2 mA		
(2 to 10) kHz	0.73 mA/A + 0.2 mA		
(10 to 30) kHz	3 mA/A + 0.2 mA		
(2 to 20) A			
10 Hz to 2 kHz	0.82 mA/A + 2 mA		
(2 to 10) kHz	2.5 mA/A + 2 mA		
Thermocouple - Source and Measure	Type B		Fluke 5500A - SC300
	(600 to 800) $^{\circ}$ C	0.34 $^{\circ}$ C	
	(800 to 1 000) $^{\circ}$ C	0.26 $^{\circ}$ C	
	(1 000 to 1 550) $^{\circ}$ C	0.23 $^{\circ}$ C	
	(1 550 to 1 820) $^{\circ}$ C	0.26 $^{\circ}$ C	
	Type C		
	(0 to 150) $^{\circ}$ C	0.23 $^{\circ}$ C	
	(150 to 650) $^{\circ}$ C	0.20 $^{\circ}$ C	
	(650 to 1 000) $^{\circ}$ C	0.24 $^{\circ}$ C	
	(1 000 to 1 800) $^{\circ}$ C	0.39 $^{\circ}$ C	
(1 800 to 2 316) $^{\circ}$ C	0.65 $^{\circ}$ C		





Thermocouple - Source and Measure	Type E		
	(-250 to -100) °C		0.21 °C
	(-100 to -25) °C		0.12 °C
	(-25 to 350) °C		0.11 °C
	(350 to 650) °C		0.13 °C
	(650 to 1 000) °C		0.18 °C
	Type J		
	(-210 to -100) °C		0.21 °C
	(-100 to -30) °C		0.12 °C
	(-30 to 150) °C		0.11 °C
	(150 to 760) °C		0.13 °C
	(760 to 1 200) °C		0.18 °C
	Type K		
	(-200 to -100) °C		0.26 °C
	(-100 to -25) °C		0.14 °C
	(-25 to 120) °C		0.12 °C
	(120 to 1000) °C		0.20 °C
	(1 000 to 1 372) °C		0.31 °C
	Type L		
	(-200 to -100) °C		0.29 °C
	(-100 to 800) °C		0.2 °C
	(800 to 900) °C		0.13 °C
	Type N		
	(-200 to -100) °C		0.31 °C
	(-100 to -25) °C		0.17 °C
	(-25 to 120) °C		0.15 °C
	(120 to 410) °C		0.14 °C
	(410 to 1 300) °C		0.21 °C
	Type R		
	(0 to 250) °C		0.44 °C
(250 to 400) °C		0.27 °C	
(400 to 1 000) °C		0.26 °C	
(1 000 to 1 767) °C		0.31 °C	
Type S			
(0 to 250) °C		0.36 °C	
(250 to 1 000) °C		0.28 °C	
(1 000 to 1 400) °C		0.29 °C	
(1 400 to 1 767) °C		0.36 °C	
Type T			
(-250 to -150) °C		0.49 °C	
(-150 to 0) °C		0.19 °C	
(0 to 120) °C		0.12 °C	
(120 to 400) °C		0.11 °C	
			Fluke 5500A - SC300



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Thermocouple - Source and Measure	Type U (-200 to 0) °C (0 to 600) °C	0.43 °C 0.21 °C	Fluke 5500A - SC300
Electrical Simulation of RTDs	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 Pt 3926 (100 Ω) (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °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 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	0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C 0.04 °C 0.05 °C 0.05 °C 0.08 °C 0.09 °C 0.19 °C 0.03 °C 0.04 °C 0.05 °C 0.05 °C 0.06 °C 0.15 °C 0.08 °C 0.18 °C 0.03 °C 0.04 °C 0.09 °C 0.10 °C 0.11 °C 0.12 °C	Fluke 5500A - SC300

**Electrical – DC/Low Frequency**

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of RTDs	Pt 385 (500 Ω)		Fluke 5500A - SC300
	(-200 to -80) °C	0.03 °C	
	(-80 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.09 °C	
	Pt 385 (1 000 Ω)		
	(-200 to 0) °C	0.02 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.05 °C	
	(300 to 600) °C	0.05 °C	
	(600 to 630) °C	0.18 °C	
Ni 120 (120 Ω)			
(-80 to 100) °C	0.06 °C		
(100 to 260) °C	0.11 °C		
Cu 427 (10 Ω)			
(-100 to 260) °C	0.23 °C		
Capacitance - Source			Fluke 5500A - SC300
50 Hz to 1 kHz	(330 to 500) pF	3.9 mF/F + 7.8 pF	
50 Hz to 1 kHz	500 pF to 1.1 nF	3.9 mF/F + 7.8 pF	
50 Hz to 1 kHz	(1.1 to 3.3) nF	3.9 mF/F + 7.8 pF	
50 Hz to 1 kHz	(3.3 to 11) nF	3.9 mF/F + 7.8 pF	
50 Hz to 1 kHz	(11 to 33) nF	1.9 mF/F + 78 pF	
50 Hz to 1 kHz	(33 to 110) nF	1.9 mF/F + 78 pF	
50 Hz to 1 kHz	(110 to 330) nF	1.9 mF/F + 0.23 nF	
50 Hz to 1 kHz	330 nF to 1.1 μF	1.9 mF/F + 0.8 nF	
50 Hz to 1 kHz	(1.1 to 3.3) μF	2.7 mF/F + 2.3 nF	
(50 to 400) Hz	(3.3 to 11) μF	2.7 mF/F + 7.8 nF	
(50 to 400) Hz	(11 to 33) μF	3.1 mF/F + 23 nF	
(50 to 200) Hz	(33 to 110) μF	3.9 mF/F + 78 nF	
(50 to 100) Hz	(110 to 330) μF	5.4 mF/F + 0.23 μF	
(50 to 100) Hz	330 μF to 1.1 mF	7.8 mF/F + 0.23 μF	
Scope Voltage - Source			Fluke 5820A
DC Signal			
Into 50 Ω	(0 to ±6.6) V	1.9 mV/V + 31 μV	
Into 1 MΩ	(0 to ±130) V	0.20 mV/V + 0.2 mV	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Scope Voltage - Source Square Wave Into 50 Ω Into 1 MΩ Frequency	1 mV to 6.6 V p-p 1 mV to 130 V p-p 10 Hz to 10 kHz	1.9 mV/V + 31 μV 0.39 mV/V + 3.9 μV 0.26 μHz/Hz	Fluke 5820A
Scope Leveled Sine Wave Source into 50 Ω (5 mV to 5.5 V p-p)  Flatness Relative to 50 kHz  Frequency	50 kHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz  50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz 50 kHz to 600 MHz	16 mV/V + 0.24 mV 27 mV/V + 0.24 mV 31 mV/V + 0.24 mV 43 mV/V + 0.24 mV 47 mV/V + 0.24 mV  12 mV/V + 78 μV 16 mV/V + 78 μV 27 mV/V + 78 μV 31 mV/V + 78 μV 0.30 μHz/Hz	Fluke 5820A
Scope Time Marker Into 50 Ω	5 s to 50 ms 20 ms to 100 ns (50 to 20) ns 10 ns (5 to 2) ns	1.9 μs/s + 3.9 μHz 0.26 μs/s 0.26 μs/s 0.26 μs/s 0.26 μs/s	Fluke 5820A
Scope Edge - Source into 50 Ω Rise Time Amplitude Range Frequency Range	300 ps 4 mV to 2.5 V p-p 1 kHz to 10 MHz	78 ps 15.5 mV/V + 0.16 mV 0.26 μHz/Hz	Fluke 5820A
Scope Wave Generator Square, Sine, Triangle Into 50 Ω Into 1 MΩ Frequency Range	1.8 mV to 2.5 V p-p 1.8 mV to 55 V p-p 0.01 Hz to 100 kHz	23 mV/V + 78 μV 23 mV/V + 78 μV 1.9 μHz/Hz + 3.9 μHz	Fluke 5820A
DC Power - Source 33 mV to 1 000 V	(3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 2.2 A (2.2 to 4.5) A (4.5 to 11) A	0.31 mW/W 0.23 mW/W 0.31 mW/W 0.23 mW/W 0.62 mW/W 0.47 mW/W 0.93 mW/W 0.7 mW/W	Fluke 5500A-SC300



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Power - Source (45 to 65) Hz	(33 to 330) mV		Fluke 5500A-SC300
	(3.3 to 9) mA	3.1 mW/W	
	(9 to 33) mA	1.9 mW/W	
	(33 to 90) mA	2.7 mW/W	
	(90 to 330) mA	1.9 mW/W	
	(330 to 900) mA	2.7 mW/W	
	900 mA to 2.2 A	1.9 mW/W	
	(2.2 to 4.5) A	2.7 mW/W	
	(4.5 to 11) A	1.9 mW/W	
	330 mV to 1.02 kV		
	(3.3 to 9) mA	1.9 mW/W	
	(9 to 33) mA	1.2 mW/W	
	(33 to 90) mA	1.9 mW/W	
	(90 to 330) mA	1.2 mW/W	
	(330 to 900) mA	1.9 mW/W	
	900 mA to 2.2 A	1.2 mW/W	
(2.2 to 4.5) A	1.6 mW/W		
(4.5 to 11) A	1.2 mW/W		

Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Frequency - Source	10 MHz	1 part in 10 <sup>-10</sup> Hz	Novus GPS NR1110

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ( $k=2$ ), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, 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.
2. CMC for Electromagnetic - DC/Low Frequency does not include estimated contributions to uncertainty from a "best available" unit under test.
3. The methods used by the laboratory are adopted from OEM-Sourced, MET-CAL, DOD MIDAS, GIDEP-Sourced, RDMSD and Customer Specific.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1388.

  
 Vice President

