



# CERTIFICATE OF ACCREDITATION

**The ANSI National Accreditation Board**

Hereby attests that

**RMS Quality Services  
A Martin Calibration Company  
1500 S. Sylvania Ave., Suite 115  
Sturtevant, WI 53177**

Fulfills the requirements of

**ISO/IEC 17025:2017**

and national standard

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

In the fields of

**CALIBRATION and DIMENSIONAL MEASUREMENT**

This certificate is valid only when accompanied by a current scope of accreditation document.  
The current scope of accreditation can be verified at [www.anab.org](http://www.anab.org).

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 06 July 2023

Certificate Number: ACT-1265.01



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
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 17025:2017  
AND ANSI/NCSL Z540-1-1994 (R2002)**

**RMS Quality Services  
A Martin Calibration Company**

1500 S. Sylvania Ave., Suite 115

Sturtevant, WI 53177

General Manager: Shane Kincade skinkade@rmsquality.com

**CALIBRATION AND DIMENSIONAL MEASUREMENT**

Valid to: **July 6, 2023**

Certificate Number: **ACT-1265.01**

**CALIBRATION**

**Chemical Quantities**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conductivity Meters <sup>1</sup>	(0.86 to 10) $\mu\text{S/cm}$ (10 to 100) $\mu\text{S/cm}$ (100 to 10 000) $\mu\text{S/cm}$	0.42 $\mu\text{S/cm}$ 0.89 $\mu\text{S/cm}$ 0.42 % of reading	Conductivity Standards
pH Meters <sup>1</sup>	4 pH 7 pH 10 pH	0.016 pH 0.016 pH 0.016 pH	Buffer Solutions

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1 020) V	21 $\mu\text{V/V} + 1 \mu\text{V}$ 11 $\mu\text{V/V} + 2 \mu\text{V}$ 13 $\mu\text{V/V} + 20 \mu\text{V}$ 18 $\mu\text{V/V} + 150 \mu\text{V}$ 18 $\mu\text{V/V} + 1.5 \text{ mV}$	Fluke 5522A Multiproduct Calibrator
DC Voltage – Measure	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	12 $\mu\text{V/V} + 0.3 \mu\text{V}$ 10 $\mu\text{V/V} + 0.3 \mu\text{V}$ 10 $\mu\text{V/V} + 0.5 \mu\text{V}$ 12 $\mu\text{V/V} + 30 \mu\text{V}$ 13 $\mu\text{V/V} + 100 \mu\text{V}$	Keysight 3458A Multimeter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source	Up to 330 $\mu$ A 330 $\mu$ A to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20) A	151 $\mu$ A/A + 20 nA 101 $\mu$ A/A + 50 nA 101 $\mu$ A/A + 250 nA 102 $\mu$ A/A + 2.5 $\mu$ A 201 $\mu$ A/A + 40 $\mu$ A 386 $\mu$ A/A + 40 $\mu$ A 504 $\mu$ A/A + 0.5 mA 1 mA/A + 0.75 mA	Fluke 5522A Multiproduct Calibrator
DC Current – Measure	(10 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	29 $\mu$ A/A + 0.8 nA 27 $\mu$ A/A + 5 nA 28 $\mu$ A/A + 50 nA 46 $\mu$ A/A + 0.5 $\mu$ A 121 $\mu$ A/A + 10 $\mu$ A	Keysight 3458A Multimeter
AC Voltage – Source	Up 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 (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	806 $\mu$ V/V + 6 $\mu$ V 176 $\mu$ V/V + 6 $\mu$ V 220 $\mu$ V/V + 6 $\mu$ V 12 mV/V + 6 $\mu$ V 3.5 mV/V + 12 $\mu$ V 8 mV/V + 50 $\mu$ V  302 $\mu$ V/V + 8 $\mu$ V 148 $\mu$ V/V + 8 $\mu$ V 163 $\mu$ V/V + 8 $\mu$ V 353 $\mu$ V/V + 8 $\mu$ V 804 $\mu$ V/V + 32 $\mu$ V 2 mV/V + 70 $\mu$ V  302 $\mu$ V/V + 50 $\mu$ V 153 $\mu$ V/V + 60 $\mu$ V 192 $\mu$ V/V + 60 $\mu$ V 302 $\mu$ V/V + 50 $\mu$ V 703 $\mu$ V/V + 125 $\mu$ V 2.4 mV/V + 0.6 mV  302 $\mu$ V/V + 650 $\mu$ V 153 $\mu$ V/V + 600 $\mu$ V 242 $\mu$ V/V + 600 $\mu$ V 353 $\mu$ V/V + 600 $\mu$ V 903 $\mu$ V/V + 1.6 mV	Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source	(33 to 330) V		Fluke 5522A Multiproduct Calibrator
	45 Hz to 1 kHz	194 $\mu\text{V/V} + 2 \text{ mV}$	
	(1 to 10) kHz	204 $\mu\text{V/V} + 6 \text{ mV}$	
	(10 to 20) kHz	253 $\mu\text{V/V} + 6 \text{ mV}$	
	(20 to 50) kHz	314 $\mu\text{V/V} + 6 \text{ mV}$	
	(50 to 100) kHz	2 mV/V + 50 mV	
AC Voltage – Measure	(330 to 1 020) V		Keysight 3458A Multimeter
	45 Hz to 1 kHz	302 $\mu\text{V/V} + 10 \text{ mV}$	
	(1 to 5) kHz	252 $\mu\text{V/V} + 10 \text{ mV}$	
	(5 to 10) kHz	302 $\mu\text{V/V} + 10 \text{ mV}$	
	Up to 10 mV		
	(1 to 40) Hz	300 $\mu\text{V/V} + 3 \mu\text{V}$	
40 Hz to 1 kHz	219 $\mu\text{V/V} + 1.1 \mu\text{V}$		
(1 to 20) kHz	324 $\mu\text{V/V} + 1.1 \mu\text{V}$		
(20 to 50) kHz	1.01 mV/V + 6 $\mu\text{V}$		
(50 to 100) kHz	5.1 mV/V + 1.1 $\mu\text{V}$		
(100 to 300) kHz	41 mV/V + 2 $\mu\text{V}$		
(10 to 100) mV			
(1 to 40) Hz	70 $\mu\text{V/V} + 4 \mu\text{V}$		
40 Hz to 1 kHz	83.8 $\mu\text{V/V} + 2 \mu\text{V}$		
(1 to 20) kHz	157 $\mu\text{V/V} + 2 \mu\text{V}$		
(20 to 50) kHz	308 $\mu\text{V/V} + 2 \mu\text{V}$		
(50 to 100) kHz	878 $\mu\text{V/V} + 2 \mu\text{V}$		
(100 to 300) kHz	3.08 mV/V + 10 $\mu\text{V}$		
300 kHz to 1 MHz	10 mV/V + 10 $\mu\text{V}$		
(1 to 2) MHz	15 mV/V + 10 $\mu\text{V}$		
100 mV to 1 V			
(1 to 40) Hz	70 $\mu\text{V/V} + 40 \mu\text{V}$		
40 Hz to 1 kHz	80.7 $\mu\text{V/V} + 20 \mu\text{V}$		
(1 to 20) kHz	154 $\mu\text{V/V} + 20 \mu\text{V}$		
(20 to 50) kHz	327 $\mu\text{V/V} + 20 \mu\text{V}$		
(50 to 100) kHz	825 $\mu\text{V/V} + 20 \mu\text{V}$		
(100 to 300) kHz	3.1 mV/V + 0.1 mV		
300 kHz to 1 MHz	10 mV/V + 0.1 mV		
(1 to 2) MHz	15 mV/V + 0.1 mV		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	(1 to 10) V		Keysight 3458A Multimeter
	(1 to 40) Hz	77 $\mu$ V/V + 400 $\mu$ V	
	40 Hz to 1 kHz	81 $\mu$ V/V + 200 $\mu$ V	
	(1 to 20) kHz	154 $\mu$ V/V + 200 $\mu$ V	
	(20 to 50) kHz	324 $\mu$ V/V + 200 $\mu$ V	
	(50 to 100) kHz	816 $\mu$ V/V + 200 $\mu$ V	
	(100 to 300) kHz	3.1 mV/V + 1 mV	
	300 kHz to 1 MHz	10 mV/V + 1 mV	
	(1 to 2) MHz	15 mV/V + 1 mV	
	(10 to 100) V		
	(1 to 40) Hz	200 $\mu$ V/V + 4 mV	
	40 Hz to 1 kHz	205 $\mu$ V/V + 2 mV	
	(1 to 20) kHz	215 $\mu$ V/V + 2 mV	
	(20 to 50) kHz	358 $\mu$ V/V + 2 mV	
	(50 to 100) kHz	1.2 mV/V + 2 mV	
	(100 to 300) kHz	4 mV/V + 2 mV	
	300 kHz to 1 MHz	15 mV/V + 10 mV	
	AC Current – Measure	Up to 100 $\mu$ A	
(10 to 20) Hz		4 mA/A + 30 nA	
(20 to 45) Hz		1.5 mA/A + 30 nA	
(45 to 100) Hz		605 $\mu$ A/A + 30 nA	
100 Hz to 1 kHz		610 $\mu$ A/A + 30 nA	
100 $\mu$ A to 1 mA			
(10 to 20) Hz		4 mA/A + 0.2 $\mu$ A	
(20 to 45) Hz		1.5 mA/A + 0.2 $\mu$ A	
(45 to 100) Hz		605 $\mu$ A/A + 0.2 $\mu$ A	
100 Hz to 5 kHz		325 $\mu$ A/A + 0.2 $\mu$ A	
(5 to 20) kHz		605 $\mu$ A/A + 0.2 $\mu$ A	
(20 to 50) kHz		4 mA/A + 0.4 $\mu$ A	
(50 to 100) kHz		5.5 mA/A + 1.5 $\mu$ A	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure	(1 to 10) mA		Keysight 3458A Multimeter
	(10 to 20) Hz	4 mA/A + 2 $\mu$ A	
	(20 to 45) Hz	1.5 mA/A + 2 $\mu$ A	
	(45 to 100) Hz	605 $\mu$ A/A + 2 $\mu$ A	
	100 Hz to 5 kHz	325 $\mu$ A/A + 2 $\mu$ A	
	(5 to 20) kHz	605 $\mu$ A/A + 2 $\mu$ A	
	(20 to 50) kHz	4 mA/A + 4 $\mu$ A	
	(50 to 100) kHz	5.5 mA/A + 15 $\mu$ A	
	(10 to 100) mA		
	(10 to 20) Hz	4 mA/A + 20 $\mu$ A	
	(20 to 45) Hz	1.5 mA/A + 20 $\mu$ A	
	(45 to 100) Hz	605 $\mu$ A/A + 20 $\mu$ A	
	100 Hz to 5 kHz	325 $\mu$ A/A + 20 $\mu$ A	
	(5 to 20) kHz	605 $\mu$ A/A + 20 $\mu$ A	
	(20 to 50) kHz	4 mA/A + 40 $\mu$ A	
	(50 to 100) kHz	5.5 mA/A + 150 $\mu$ A	
	100 mA to 1 A		
	(10 to 20) Hz	4 mA/A + 0.2 mA	
(20 to 45) Hz	1.6 mA/A + 0.2 mA		
(45 to 100) Hz	805 $\mu$ A/A + 0.2 mA		
100 Hz to 5 kHz	1 mA/A + 0.2 mA		
(5 to 20) kHz	3 mA/A + 0.2 mA		
(20 to 50) kHz	10 mA/A + 0.4 mA		
AC Current – Source	(29 to 330) $\mu$ A		Fluke 5522A Multiproduct Calibrator
	(10 to 20) Hz	2 mA/A + 0.1 $\mu$ A	
	(20 to 45) Hz	1.5 mA/A + 0.1 $\mu$ A	
	45 Hz to 1 kHz	1.3 mA/A + 0.1 $\mu$ A	
	(1 to 5) kHz	3 mA/A + 0.15 $\mu$ A	
	(5 to 10) kHz	8 mA/A + 0.2 $\mu$ A	
	(10 to 30) kHz	16 mA/A + 0.4 $\mu$ A	
	(0.33 to 3.3) mA		
	(10 to 20) Hz	2 mA/A + 0.15 $\mu$ A	
	(20 to 45) Hz	1.3 mA/A + 0.15 $\mu$ A	
	45 Hz to 1 kHz	1 mA/A + 0.15 $\mu$ A	
	(1 to 5) kHz	2 mA/A + 0.2 $\mu$ A	
	(5 to 10) kHz	5.1 mA/A + 0.3 $\mu$ A	
	(10 to 30) kHz	10 mA/A + 0.6 $\mu$ A	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source	(3.3 to 33) mA		Fluke 5522A Multiproduct Calibrator
	(10 to 20) Hz	1.8 mA/A + 2 $\mu$ A	
	(20 to 45) Hz	910 $\mu$ A/A + 2 $\mu$ A	
	45 Hz to 1 kHz	423 $\mu$ A/A + 2 $\mu$ A	
	(1 to 5) kHz	813 $\mu$ A/A + 2 $\mu$ A	
	(5 to 10) kHz	2 mA/A + 3 $\mu$ A	
	(10 to 30) kHz	4.1 mA/A + 4 $\mu$ A	
	(33 to 330) mA		
	(10 to 20) Hz	1.8 mA/A + 20 $\mu$ A	
	(20 to 45) Hz	909 $\mu$ A/A + 20 $\mu$ A	
	45 Hz to 1 kHz	417 $\mu$ A/A + 20 $\mu$ A	
	(1 to 5) kHz	1 mA/A + 50 $\mu$ A	
	(5 to 10) kHz	2 mA/A + 100 $\mu$ A	
	(10 to 30) kHz	4.1 mA/A + 200 $\mu$ A	
	(0.33 to 1.1) A		
	(10 to 45) Hz	1.8 mA/A + 100 $\mu$ A	
	45 Hz to 1 kHz	512 $\mu$ A/A + 100 $\mu$ A	
	(1 to 5) kHz	6 mA/A + 1 mA	
	(5 to 10) kHz	25 mA/A + 5 mA	
	(1.1 to 3) A		
	(10 to 45) Hz	1.8 mA/A + 100 $\mu$ A	
	45 Hz to 1 kHz	664 $\mu$ A/A + 100 $\mu$ A	
	(1 to 5) kHz	6 mA/A + 1 mA	
	(5 to 10) kHz	25 mA/A + 5 mA	
(3 to 11) A			
(45 to 100) Hz	1.8 mA/A + 100 $\mu$ A		
100 Hz to 1 kHz	664 $\mu$ A/A + 100 $\mu$ A		
(1 to 5) kHz	6 mA/A + 1 mA		
(11 to 20.5) A			
(45 to 100) Hz	1 mA/A + 5 mA		
100 Hz to 1 kHz	1.5 mA/A + 5 mA		
(1 to 5) kHz	30 mA/A + 5 mA		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source	Up to 11 $\Omega$	36 $\mu\Omega/\Omega$	Fluke 5522A Multiproduct Calibrator
	(11 to 33) $\Omega$	26 $\mu\Omega/\Omega$	
	(33 to 110) $\Omega$	23 $\mu\Omega/\Omega$	
	(110 to 330) $\Omega$	23 $\mu\Omega/\Omega$	
	330 $\Omega$ to 1.1 k $\Omega$	23 $\mu\Omega/\Omega$	
	(1.1 to 3.3) k $\Omega$	23 $\mu\Omega/\Omega$	
	(3.3 to 11) k $\Omega$	23 $\mu\Omega/\Omega$	
	(11 to 33) k $\Omega$	23 $\mu\Omega/\Omega$	
	(33 to 110) k $\Omega$	24 $\mu\Omega/\Omega$	
	(110 to 330) k $\Omega$	26 $\mu\Omega/\Omega$	
	330 k $\Omega$ to 1.1 M $\Omega$	26 $\mu\Omega/\Omega$	
	(1.1 to 3.3) M $\Omega$	42 $\mu\Omega/\Omega$	
	(3.3 to 11) M $\Omega$	110 $\mu\Omega/\Omega$	
	(11 to 33) M $\Omega$	201 $\mu\Omega/\Omega$	
	(33 to 110) M $\Omega$	400 $\mu\Omega/\Omega$	
(110 to 330) M $\Omega$	2.5 m $\Omega/\Omega$		
330 M $\Omega$ to 1.1 G $\Omega$	12 m $\Omega/\Omega$		
Resistance – Measure	100 $\mu\Omega$ to 10 $\Omega$	20 $\mu\Omega/\Omega$ + 50 $\mu\Omega$	Keysight 3458A Multimeter
	(10 to 100) $\Omega$	17 $\mu\Omega/\Omega$ + 5 $\mu\Omega$	
	100 $\Omega$ to 1 k $\Omega$	15 $\mu\Omega/\Omega$ + 500 $\mu\Omega$	
	(1 to 10) k $\Omega$	15 $\mu\Omega/\Omega$ + 5 m $\Omega$	
	(10 to 100) k $\Omega$	15 $\mu\Omega/\Omega$ + 50 m $\Omega$	
	100 k $\Omega$ to 1 M $\Omega$	20 $\mu\Omega/\Omega$ + 2 $\Omega$	
	(1 to 10) M $\Omega$	83 $\mu\Omega/\Omega$ + 100 $\Omega$	
(10 to 100) M $\Omega$	820 $\mu\Omega/\Omega$ + 1 k $\Omega$		
Capacitance – Source	10 Hz to 10 kHz		Fluke 5522A Multiproduct Calibrator
	(220 to 400) pF	6.4 mF/F + 10 pF	
	(0.4 to 1.1) nF	5.3 mF/F + 10 pF	
	10 Hz to 3 kHz		
	(1.1 to 3.3) nF	5.1 mF/F + 10 pF	
	10 Hz to 1 kHz		
	(3.3 to 11) nF	2.6 mF/F + 10 pF	
	(11 to 33) nF	2.6 mF/F + 100 pF	
	(33 to 110) nF	2.6 mF/F + 100 pF	
	(110 to 330) nF	2.6 mF/F + 300 pF	
	(10 to 600) Hz		
	(0.33 to 1.1) $\mu$ F	2.6 mF/F + 1 nF	
(10 to 300) Hz			
(1.1 to 3.3) $\mu$ F	2.6 mF/F + 3 nF		
(10 to 150) Hz			
(3.3 to 11) $\mu$ F	2.6 mF/F + 10 nF		



**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
Capacitance – Source	(10 to 120) Hz (11 to 33) $\mu$ F	4.1 mF/F + 30 nF	Fluke 5522A Multiproduct Calibrator		
	(10 to 80) Hz (33 to 110) $\mu$ F	4.7 mF/F + 0.1 $\mu$ F			
	(0 to 50) Hz (110 to 330) $\mu$ F	4.6 mF/F + 0.3 $\mu$ F			
	(0 to 20) Hz (0.33 to 1.1) mF	4.6 mF/F + 1 $\mu$ F			
	(0 to 6) Hz (1.1 to 3.3) mF	4.5 mF/F + 3 $\mu$ F			
	(0 to 2) Hz (3.3 to 11) mF	4.5 mF/F + 10 $\mu$ F			
	(0 to 0.6) Hz (11 to 33) mF	7.5 mF/F + 30 $\mu$ F			
	(0 to 0.2) Hz (33 to 110) mF	11 mF/F + 100 $\mu$ F			
	Electrical Simulation of Thermocouple Indicators <sup>1</sup>	Type B (600 to 800) $^{\circ}$ C		0.44 $^{\circ}$ C	Fluke 5522A Multiproduct Calibrator
		(800 to 1000) $^{\circ}$ C		0.34 $^{\circ}$ C	
(1000 to 1550) $^{\circ}$ C		0.3 $^{\circ}$ C			
(1550 to 1820) $^{\circ}$ C		0.33 $^{\circ}$ C			
Type C (0 to 150) $^{\circ}$ C		0.3 $^{\circ}$ C			
(150 to 650) $^{\circ}$ C		0.26 $^{\circ}$ C			
(650 to 1000) $^{\circ}$ C		0.31 $^{\circ}$ C			
(1000 to 1800) $^{\circ}$ C		0.5 $^{\circ}$ C			
(1800 to 2316) $^{\circ}$ C		0.84 $^{\circ}$ C			
Type E (-250 to -100) $^{\circ}$ C		0.5 $^{\circ}$ C			
(-100 to -25) $^{\circ}$ C		0.16 $^{\circ}$ C			
(-25 to 350) $^{\circ}$ C		0.14 $^{\circ}$ C			
(350 to 650) $^{\circ}$ C		0.16 $^{\circ}$ C			
(650 to 1000) $^{\circ}$ C		0.21 $^{\circ}$ C			
Type J (-210 to -100) $^{\circ}$ C		0.27 $^{\circ}$ C			
(-100 to -30) $^{\circ}$ C		0.16 $^{\circ}$ C			
(-30 to 150) $^{\circ}$ C		0.14 $^{\circ}$ C			
(150 to 760) $^{\circ}$ C		0.17 $^{\circ}$ C			
(760 to 1200) $^{\circ}$ C		0.23 $^{\circ}$ C			

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators <sup>1</sup>	Type K		Fluke 5522A Multiproduct Calibrator
	(-200 to -100) °C	0.33 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.16 °C	
	(120 to 1000) °C	0.26 °C	
	(1000 to 1372) °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 1300) °C	0.27 °C	
	Type R		
	(0 to 250) °C	0.57 °C	
	(250 to 400) °C	0.35 °C	
	(400 to 1000) °C	0.33 °C	
	(1000 to 1767) °C	0.4 °C	
Type S			
(0 to 250) °C	0.47 °C		
(250 to 400) °C	0.36 °C		
(400 to 1000) °C	0.37 °C		
(1000 to 1767) °C	0.46 °C		
Type T			
(-250 to -150) °C	0.63 °C		
(-150 to 0) °C	0.24 °C		
(0 to 120) °C	0.16 °C		
(120 to 400) °C	0.14 °C		
Type U			
(-200 to 0) °C	0.56 °C		
(0 to 600) °C	0.27 °C		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators <sup>1</sup>	Pt 385, 100 Ω		
	(-200 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	(630 to 800) °C	0.23 °C	
	Pt 3926, 100 Ω		
	(-200 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.07 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.25 °C	
	(-190 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.09 °C	
	(400 to 600) °C	0.1 °C	
	(600 to 630) °C	0.23 °C	
	Pt 385, 200 Ω		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.04 °C	
	(0 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		
Fluke 5522A Multiproduct Calibrator			

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators <sup>1</sup>	Pt 385, 500 Ω		Fluke 5522A Multiproduct Calibrator
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.05 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 600) °C	0.09 °C	
	(600 to 630) °C	0.11 °C	
	Pt 385, 1000 Ω		
	(-200 to -80) °C	0.03 °C	
	(-80 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 400) °C	0.07 °C	
(400 to 600) °C	0.07 °C		
(600 to 630) °C	0.23 °C		
PtNi 385, 120 Ω, (Ni120)			
(-80 to 0) °C	0.08 °C		
(0 to 100) °C	0.08 °C		
(100 to 260) °C	0.14 °C		
Cu 427, 10 Ω			
(100 to 260) °C	0.3 °C		
Oscilloscopes			Fluke 5522A / SC1100 Multiproduct Calibrator
Square Wave Signal, 1 kHz in	(1 to 25) mV	2.5 mV/V + 40 μV	
to 50 Ω – Source	(25 to 110) mV	2.5 mV/V + 40 μV	
	110 mV to 2.2 V	2.5 mV/V + 40 μV	
	(2.2 to 6.6) V	2.5 mV/V + 40 μV	
Square Wave Signal, 1 kHz in	(1 to 25) mV	1.1 mV/V + 40 μV	
to 1 MΩ – Source	(25 to 110) mV	1 mV/V + 40 μV	
	110 mV to 2.2 V	1 mV/V + 40 μV	
	(2.2 to 11) V	1 mV/V + 40 μV	
	(11 to 130) V	1 mV/V + 40 μV	
Leveled Sine Wave	50 kHz REF	20 mV/V + 300 μV	
Amplitude	50 kHz to 100 MHz	35 mV/V + 300 μV	
	(100 to 300) MHz	40 mV/V + 300 μV	
	(300 to 600) MHz	60 mV/V + 300 μV	
	600 MHz to 1.1 GHz	70 mV/V + 300 μV	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes	50 kHz to 100 MHz	17mV/V + 100 μV	Fluke 5522A / SC1100 Multiproduct Calibrator
Leveled Sine Wave Flatness (relative to 50 kHz)	(100 to 300) MHz	22 mV/V + 100 μV	
	(300 to 600) MHz	41mV/V + 100 μV	
	600 MHz to 1.1 GHz	51 mV/V + 100 μV	
Time Marker (in to 50 Ω)	5 ns to 20 ms	2.5 μs/s	
	50 ms to 5 s	1 ms/s + 25 μs	
Rise Time	< 300 ps	+ 0 / - 100 ps	

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks <sup>2</sup>	(0.01 to 1) in (2 to 3) in 4 in	(1.4 + 1.3L) μin (1 + 1.3L) μin 6.1 μin	Gage Blocks Gage Block Comparator
Gage Blocks <sup>2</sup>	(5 to 12) in (12 to 20) in	(5 + 2L) μin (2 + 2.8L) μin	Horizontal Measuring Machine
Indicators <sup>1,2,4</sup>	(0.000 1 to 4) in	(11 + 2L) μin	Horizontal Measuring Machine
Calipers <sup>1,2,4</sup>	Up to 60 in	(5 + 8L) μin	Gage Blocks
Micrometers <sup>1,2,4</sup>	Up to 12 in	(5 + 8L) μin	Gage Blocks, Optical Parallels
Height Measuring Devices <sup>1,2,4</sup>	Up to 36 in	(60 + 1L) μin	Gage Blocks
External Diameter <sup>1,2</sup>	(0.000 1 to 12) in	(3 + 3L) μin	Horizontal Measuring Machine
Internal Diameter <sup>1,2</sup>	(0.04 to 13) in	(3 + 3L) μin	Horizontal Measuring Machine
Thread Rings (Adjustable) Pitch Diameter Tactile Fit (Set to Plug)	Up to 4 in	See footnote <sup>3</sup>	Thread Setting Plug
Thread Rings Pitch Diameter	Up to 4 in	50 μin	Horizontal Measuring Machine
Thread Rings Minor Diameter	Up to 4 in	50 μin	Horizontal Measuring Machine

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plugs <sup>1,2</sup> Pitch Diameter	Up to 8 in Pitch (0.2 to 5) mm	(84 + 2L) μin	Horizontal Measuring Machine Thread Measuring Wires
Major Diameter	Pitch 90 – 4 TPI Up to 8 in	(52 + 1L) μin	
Optical Comparators <sup>1,2</sup> Linear Accuracy	Up to 6 in 6 to 12 in	(43 + 11L) μin (30 + 7.5L) μin	Glass Scale
Magnification	(5 to 100) X	350 μin	Glass Scale (Sphere)
Surface Plates <sup>1,2</sup> Overall Flatness	Up to 238 inDL	(25 + 2.9L) μin	Laser System
Local Area Flatness	Up to 238 inDL	34 μin	Repeat-O-Meter
Surface Finish Analysis	Up to 500 μin	2.4 μin	Profilometer, Master Patch
Profilometers <sup>1</sup>	Up to 500 μin	3.1 μin	Master Patch
CMMs <sup>1,2</sup>	Linearity	(25 + 2.4L) μin	Laser Measuring System
	Volumetric Repeatability	66 μin 45 μin	Ball Bar, CMM Sphere
VMMs <sup>1,2</sup>	Linearity	(32 + 4.1L) μin	Glass Scales
Horizontal Measuring Systems <sup>1,2</sup>	Up to 8 in 8 to 48 in	(6 + 1.7L) μin (3 + 2.5L) μin	Gage Blocks
Angle	(0.25 to 365) °	0.69 m° (12 μin/ in)	Gage Blocks, Gage Amplifier, Sine Bar
Length Standards <sup>2</sup>	(1 to 60) in	(3.4 + 3.5L) μin	Horizontal Measuring System
Tapered Plugs <sup>2</sup> - Pitch Diameter Major Diameter Step Height	(0.062 5 to 6) in	(136 + 4L) μin 280 μin	Horizontal Measuring System, Sine Block Thread Wires Height Gage
Tapered Rings - Pitch Diameter	(0.0625 to 6) in	160 μin	NPT Master Plug, Electronic Amplifier with Probe
Step Height		48 μin	Height Gage
Thread Wires	Up to 0.2 in	13 μin	Horizontal Measuring Machine



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**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Graduated Scales <sup>1</sup>	Up to 8 in 8 to 24 in	$(147 + 2.5L) \mu\text{in}$ 3 500 $\mu\text{in}$	VMM and Linear Measuring System
Optical Flats Flatness Parallelism	Up to 2 in	3.5 $\mu\text{in}$ 2.7 $\mu\text{in}$	Gage Block Comparator, Master Flat

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pipettes <sup>1</sup>	Up to 1 $\mu\text{L}$ (1 to 5) $\mu\text{L}$ (5 to 10) $\mu\text{L}$ (10 to 20) $\mu\text{L}$ (20 to 50) $\mu\text{L}$ (50 to 100) $\mu\text{L}$ (100 to 200) $\mu\text{L}$ (200 to 500) $\mu\text{L}$ (500 to 1 000) $\mu\text{L}$ (1 000 to 10 000) $\mu\text{L}$ (10 to 20) mL	0.041 $\mu\text{L}$ 0.033 $\mu\text{L}$ 0.028 $\mu\text{L}$ 0.034 $\mu\text{L}$ 0.046 $\mu\text{L}$ 0.061 $\mu\text{L}$ 0.27 $\mu\text{L}$ 0.30 $\mu\text{L}$ 0.79 $\mu\text{L}$ 2.7 $\mu\text{L}$ 5.8 $\mu\text{L}$	Pipette Calibration System
Pressure <sup>1</sup>	(-14.7 to 300) psig (0 to 300) psig (300 to 10 000) psig	0.096 psi 0.21 psi 5.8 psi	Pressure Calibrator
Scales and Balances <sup>1,4,5</sup>	(0.001 to 0.2) lb (0.2 to 5 000) lb	0.014 % of reading 0.012% of reading	Class F Weights
Torque Transducers <sup>1</sup>	0.5 ozf-in to 1 000 lbf-ft	0.08 % of reading	Dead Weight Torque Arms
Torque Tools <sup>1</sup>	(5 to 50) lbf-in (50 to 400) lbf-in (400 to 1 000) lbf-in (80 to 250) lbf-ft (250 to 600) lbf-ft (600 to 1 000) lbf-ft	0.33 % of Reading 0.36 % of Reading 0.4 % of Reading 0.28 % of Reading 0.51 % of Reading 0.75 % of Reading	Torque Tester

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Durometers Spring Force Types A, B, E, O Types C, D, and DO Types OO, OOO, OOO-S	(1.3 to 8.05) N (4.445 to 44.5) N (0.294 to 1.932) N	0.023 N 0.06 N 0.002 N	Shore Durometer Calibrator Balance
Indenter Angle Indenter Length Indenter Radius	(20 to 40) ° (0.049 to 0.198) in (0.05 to 0.1) in	0.045 ° 220 μin 250 μin	VMM
Rockwell Hardness Testers <sup>1</sup>	HRA Low HRA Middle HRA High  HRBW Low HRBW Middle HRBW High  HRC Low HRC Middle HRC High  HR15N Low HR15N Middle HR15N High  HR15TW Low HR15TW Middle HR15TW High	1.6 HRA 1.6 HRA 1.2 HRA  1.6 HRBW 2.1 HRBW 1.6 HRBW  1.6 HRC 1.6 HRC 1.2 HRC  1.7 HR15N 1.6 HR15N 1.3 HR15N  1.6 HR15TW 1.6 HR15TW 1.6 HR15TW	Indirect Verification to Test Blocks
Brinell Hardness Testers <sup>1</sup>	Repeatability at: 500kgf ≤ 100 HBW ≥ 64 HBW 1 500kgf ≤ 257 HBW ≥ 91 HBW 3 000kgf ≤ 587 HBW ≥ 186 HBW	0.025 mm 0.025 mm  0.025 mm 0.03 mm  0.025 mm 0.025 mm	Indirect Verification to Test Blocks
Force <sup>1</sup> Source and Measure	(0.035 to 16) ozf (1 to 10) lbf (>10 to 50) lbf (>50 to 500) lbf	0.018 % of reading + 0.21 μozf 0.018 % of reading + 0.33 μlbf 0.018 % of reading + 9.3 mlbf 0.036 % of reading + 5.3 mlbf	Dead Weight



### Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force <sup>1</sup> Source and Measure	(500 to 50 000) lbf	0.29 % of reading	Load Cells

### Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Radiation (Infrared) Thermometers	50 °C (50 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C	0.73 °C 1.6 °C 3.2 °C 4.9 °C 6.6 °C 8.5 °C	Blackbody Source (flat plate) Monitored with a PRT $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$
Humidity- Measure <sup>1</sup>	(10 to 40) %RH (40 to 90) %RH (90 to 100) %RH	1.1 %RH 1.3 %RH 1.9 %RH	Humidity Indicator
Temperature – Measure and Source <sup>1</sup>	(-200 to 420) °C	0.029 °C + 0.000 07 °C/°C	Digital Temperature Gage and Drywell
Temperature – Measure Ovens and Chambers	(0 to 1 090) °C	0.53 °C	Probe and Display

### Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency - Source	(0.01 to 120) Hz 120 Hz 120 kHz 120 kHz to 2 MHz 2 MHz to 1.1 GHz	2.66 $\mu\text{Hz}/\text{Hz} + 5 \mu\text{Hz}$ 2.51 $\mu\text{Hz}/\text{Hz} + 5 \mu\text{Hz}$ 2.54 $\mu\text{Hz}/\text{Hz} + 5 \mu\text{Hz}$ 2.5 $\mu\text{Hz}/\text{Hz}$	Fluke 5522A Multiproduct Calibrator
Time	(2 to 86 000) s/day	31 ms/day	Helmut Klein 4500 Timometer

## DIMENSIONAL MEASUREMENT

### 3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Non-contact	(8 x 6 x 5) in	(147 + 2.5L) μin	Vision System
Dimensional Inspection Contact	(47 x 59 x 40)	(96 + 5.5L) μin	Coordinate Measuring Machine

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. The use of (R) signifies the Resolution of the unit under test, the use of (L) represents Length in inches, the use of (D) represents Diameter in inches.
3. The tactile fit of an adjustable thread ring to a thread-setting plug is not a measurement of pitch diameter. The uncertainty for this pitch diameter setting is based on the contributors associated with the thread setting plug and environmental contributors only.
4. Uncertainties listed do not include possible contributions from a “best available” unit under test.
5. The CMC for scales and balances are highly dependent upon the resolution of the unit under test. The uncertainties presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
6. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1265.01.



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