



# CERTIFICATE OF ACCREDITATION

**ANSI National Accreditation Board**  
11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

**Arrega Tecnologia, SAPI, de CV/Arrega Industrial**  
**Blvd. Tercera Oeste No. 17524, Fracc. Garita de Otay**  
**Tijuana, Baja California Mexico**

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

**ISO/IEC 17025:2017**

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 activities to which this accreditation applies

ACT-2077

Certificate Number

  
ANAB Approval

Certificate Valid Through: 09/07/2020  
Version No. 004 Issued: 07/18/2019



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)**

**ARREGA TECNOLOGÍA, SAPI, DE CV/ ARREGA INDUSTRIAL**

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**CALIBRATION AND DIMENSIONAL MEASUREMENT**

Valid to: **September 7, 2020**

Certificate Number: **ACT-2077**

**CALIBRATION**

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage - Source	(3.3 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (30 to 330) V 100 V to 1.1 kV	5.4 $\mu$ V/V + 0.19 $\mu$ V 9.1 $\mu$ V/V + 0.4 $\mu$ V 10 $\mu$ V/V + 3.9 $\mu$ V 15 $\mu$ V/V + 29 $\mu$ V 15 $\mu$ V/V + 0.3 mV	Fluke 5522A Multi-Product Calibrator
DC Voltage - Measure	(10 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V 100 V to 1 kV	2.8 $\mu$ V/V + 0.08 $\mu$ V 2 $\mu$ V/V + 0.08 $\mu$ V 2 $\mu$ V/V + 0.13 $\mu$ V 2.5 $\mu$ V/V + 7.5 $\mu$ V 2.5 $\mu$ V/V + 25 $\mu$ V	Agilent-3458A Opt. 002 Digital Multimeter
DC Voltage - Measure	(Up to 5) kV (5 to 10) kV (10 to 20) kV (20 to 30) KV (30 to 40) kV (40 to 50) kV	0.11 mV/V + 0.3 V 0.11 mV/V + 0.3 V 0.11 mV/V + 0.3 V 0.11 mV/V + 1.6 V 0.13 mV/V + 3.5 V 0.13 mV/V + 6.1 V	Vitrek 4700 High Voltage meter
DC Current - Source	(0 to 330) mA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A	29 $\mu$ A/A + 4 nA 22 $\mu$ A/A + 10 nA 34 $\mu$ A/A + 49 nA 33 $\mu$ A/A + 0.49 $\mu$ A 54 $\mu$ A/A + 8 $\mu$ A 81 $\mu$ A/A + 8 $\mu$ A	Fluke 5522A Multi-Product Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source	(1.1 to 3) A (3 to 11) A (11 to 20.5) A	81 $\mu$ A/A + 8 $\mu$ A 0.16 mA/A + 0.1 mA 0.4 mA/A + 0.15 mA	Fluke 5522A Multi-Product Calibrator
DC Current – Source	(10 to 550) A (550 to 1 025) A	2 mA/A + 0.13 A 2 mA/A + 0.13 A	Fluke 5522A Multi-Product Calibrator Fluke 50 Turn Coil
DC Current - Measure	Up to 100 $\mu$ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	20 $\mu$ A/A + 0.13 nA 17 $\mu$ A/A + 0.83 nA 17 $\mu$ A/A + 8.3 $\mu$ A 24 $\mu$ A/A + 0.08 $\mu$ A 54 $\mu$ A/A + 1.7 $\mu$ A	Agilent-3458A Opt. 002 Digital Multimeter
DC Current - Measure	(Up to 1 000) A	6 mA/A + 0.06 A	Agilent-3458A Opt. 002 Digital Multimeter Empro B-1000-100 Shunt
Resistance - Source (Fixed Values)	2 $\Omega$ 11 $\Omega$ 12 $\Omega$ 19 $\Omega$ 30 $\Omega$ 33 $\Omega$ 110 $\Omega$ 120 $\Omega$ 190 $\Omega$ 300 $\Omega$ 330 $\Omega$ 1.1 k $\Omega$ 1.2 k $\Omega$ 1.9 k $\Omega$ 3.0 k $\Omega$ 3.3 k $\Omega$ 11 k $\Omega$ 12 k $\Omega$ 19 k $\Omega$ 30 k $\Omega$ 33 k $\Omega$ 110 k $\Omega$ 120 k $\Omega$ 190 k $\Omega$ 300 k $\Omega$	0.27 m $\Omega$ 0.44 m $\Omega$ 1.8 m $\Omega$ 0.49 m $\Omega$ 0.64 m $\Omega$ 0.57 m $\Omega$ 1.2 m $\Omega$ 1.3 m $\Omega$ 1.7 m $\Omega$ 2.4 m $\Omega$ 2.7 m $\Omega$ 7.7 m $\Omega$ 12 m $\Omega$ 16 m $\Omega$ 24 m $\Omega$ 38 m $\Omega$ 85 m $\Omega$ 0.12 $\Omega$ 0.18 $\Omega$ 0.26 $\Omega$ 0.27 $\Omega$ 0.79 $\Omega$ 1.3 $\Omega$ 1.9 $\Omega$ 2.9 $\Omega$	Fluke 5522A Multi-Product Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Resistance - Source (Fixed Values)	330 kΩ	3 Ω	Fluke 5522A Multi-Product Calibrator	
	1.1 MΩ	12 Ω		
	1.2 MΩ	22 Ω		
	1.90 MΩ	38 Ω		
	3 MΩ	55 Ω		
	3.3 MΩ	61 Ω		
	11 MΩ	0.3 kΩ		
	12 MΩ	1.1 kΩ		
	19 MΩ	1.6 kΩ		
	30 MΩ	2.3 kΩ		
	33 MΩ	4 kΩ		
	110 MΩ	25 kΩ		
	120 MΩ	92 kΩ		
	290 MΩ	0.2 MΩ		
400 MΩ	1.3 MΩ			
640 MΩ	2 MΩ	Fluke 5522A Multi-Product Calibrator		
1.1 GΩ	3.5 MΩ			
Resistance - Measure	Up to 10 Ω		9.6 μΩ/Ω + 9.7 μΩ	Agilent-3458A Opt. 002 Digital Multimeter
	(10 to 100) Ω		9.2 μΩ/Ω + 97 Ω	
	(0.1 to 10) kΩ		8 μΩ/Ω + 97 Ω	
	(1 to 10) kΩ		8 μΩ/Ω + 0.97 mΩ	
	(10 to 100) kΩ		8 μΩ/Ω + 9.7 mΩ	
	(0.1 to 1) MΩ		8.7 μΩ/Ω + 0.39 Ω	
	(1 to 10) MΩ		18 μΩ/Ω + 0.19 kΩ	
	(10 to 100) MΩ		0.27 mΩ/Ω + 0.19 kΩ	
AC Voltage - Source	Up to 33 mV		Fluke 5522A Multi-Product Calibrator	
	(10 to 45) Hz			180 μV/V + 1.2 μV
	45 Hz to 10 kHz			91 μV/V + 1.2 μV
	(10 to 20) kHz			91 μV/V + 1.2 μV
	(20 to 50) kHz	0.23 mV/V + 1.2 μV		
	(50 to 100) kHz	0.7 mV/V + 2.3 μV		
	(100 to 500) kHz	1.8 mV/V + 9.7 μV		
	(33 to 330) mV	Fluke 5522A Multi-Product Calibrator		
	(10 to 45) Hz			66 μV/V + 1.6 μV
	45 Hz to 10 kHz			38 μV/V + 1.6 μV
	(10 to 20) kHz			45 μV/V + 1.6 μV
	(20 to 50) kHz			80 μV/V + 1.6 μV
	(50 to 100) kHz			170 μV/V + 6.2 μV
	(100 to 500) kHz			700 μV/V + 14 μV

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage - Source	(0.33 to 3.3) V		Fluke 5522A Multi-Product Calibrator
	(10 to 45) Hz	66 $\mu\text{V/V} + 9.7 \mu\text{V}$	
	45 Hz to 10 kHz	37 $\mu\text{V/V} + 12 \mu\text{V}$	
	(10 to 20) kHz	44 $\mu\text{V/V} + 12 \mu\text{V}$	
	(20 to 50) kHz	71 $\mu\text{V/V} + 9.7 \mu\text{V}$	
	(50 to 100) kHz	1500 $\mu\text{V/V} + 24 \mu\text{V}$	
	(100 to 500) kHz	0.6 mV/V + 120 $\mu\text{V}$	
	(3.3 to 33) V		
	(10 to 45) Hz	65 $\mu\text{V/V} + 0.13 \text{ mV}$	
	45 Hz to 10 kHz	38 $\mu\text{V/V} + 0.12 \text{ mV}$	
	(10 to 20) kHz	56 $\mu\text{V/V} + 0.12 \text{ mV}$	
	(20 to 50) kHz	92 $\mu\text{V/V} + 0.12 \text{ mV}$	
	(50 to 100) kHz	200 $\mu\text{V/V} + 0.31 \text{ mV}$	
	(33 to 330) V		
	45 Hz to 1 kHz	46 $\mu\text{V/V} + 0.39 \text{ mV}$	
	(1 to 10) kHz	52 $\mu\text{V/V} + 1.2 \text{ mV}$	
	(10 to 20) kHz	93 $\mu\text{V/V} + 1.2 \text{ mV}$	
(20 to 50) kHz	150 $\mu\text{V/V} + 1.2 \text{ mV}$		
(50 to 100) kHz	540 $\mu\text{V/V} + 9.7 \text{ mV}$		
330 V to 1.02 kV			
45 Hz to 1 kHz	69 $\mu\text{V/V} + 1.9 \text{ mV}$		
(1 to 5) kHz	64 $\mu\text{V/V} + 1.9 \text{ mV}$		
(5 to 10) kHz	78 $\mu\text{V/V} + 1.9 \text{ mV}$		
AC Voltage – Measure	Up to 10 mV		Agilent-3458A Opt. 002 Digital Multimeter
	40 Hz to 1 kHz	290 $\mu\text{V/V} + 0.3 \mu\text{V}$	
	(1 to 20) kHz	310 $\mu\text{V/V} + 0.3 \mu\text{V}$	
	(20 to 100) kHz	2 mV/V + 0.3 $\mu\text{V}$	
	(100 to 300) kHz	12 mV/V + 0.5 $\mu\text{V}$	
	(10 to 100) mV		
	40 Hz to 1 kHz	61 $\mu\text{V/V} + 0.5 \mu\text{V}$	
	(1 to 20) kHz	88 $\mu\text{V/V} + 0.5 \mu\text{V}$	
	(20 to 100) kHz	430 $\mu\text{V/V} + 0.5 \mu\text{V}$	
	(100 to 300) kHz	1 mV/V + 2.5 $\mu\text{V}$	
	(0.1 to 1) V		
	40 Hz to 1 kHz	54 $\mu\text{V/V} + 5 \mu\text{V}$	
	(1 to 20) kHz	79 $\mu\text{V/V} + 5 \mu\text{V}$	
	(20 to 50) kHz	150 $\mu\text{V/V} + 5 \mu\text{V}$	
	(50 to 100) kHz	300 $\mu\text{V/V} + 5 \mu\text{V}$	
	(100 to 300) kHz	1 mV/V + 25 $\mu\text{V}$	
	(300 to 500) kHz	3 mV/V + 25 $\mu\text{V}$	



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	(1 to 10) V		Agilent-3458A Opt. 002 Digital Multimeter
	(1 to 40) Hz	56 $\mu$ V/V + 100 $\mu$ V	
	40 Hz to 1 kHz	53 $\mu$ V/V + 50 $\mu$ V	
	(1 to 20) kHz	78 $\mu$ V/V + 50 $\mu$ V	
	(20 to 50) kHz	150 $\mu$ V/V + 50 $\mu$ V	
	(50 to 100) kHz	260 $\mu$ V/V + 15 $\mu$ V	
	(100 to 300) kHz	1 mV/V + 0.25 mV/V	
	(300 to 500) kHz	2 mV/V + 0.25 mV/V	
	500 kHz to 1 MHz	3 mV/V + 0.25 mV/V	
	(10 to 100) V		
40 Hz to 1 kHz	100 $\mu$ V/V + 0.5 mV/V		
(1 to 20) kHz	130 $\mu$ V/V + 0.5 mV/V		
(20 to 50) kHz	170 $\mu$ V/V + 0.5 mV/V		
(50 to 100) kHz	0.46 mV/V + 0.5 mV/V		
(100 to 1 000) V			
(50 to 60) Hz	0.25 mV/V + 0.5 V		
(100 to 1 000) V			
(100 to 450) Hz	6.3 mV/V + 0.6 V		
AC Voltage – Measure	(1 to 9) kV (50 to 60) Hz	0.38 mV/V + 0.5 V	Vitrek 4700 High Voltage meter
AC Current - Source	(33 to 330) $\mu$ A		Fluke 5522A Multi-Product Calibrator
	(10 to 20) Hz	0.4 mA/A + 19 nA	
	(20 to 45) Hz	0.3 mA/A + 19 nA	
	45 Hz to 1 kHz	0.26 mA/A + 19 nA	
	(1 to 5) kHz	0.59 mA/A + 0.029 $\mu$ A	
	(5 to 10) kHz	1.6 mA/A + 0.039 $\mu$ A	
	(10 to 30) kHz	3.1 mA/A + 0.078 $\mu$ A	
	(0.33 to 3.3) mA		
	(10 to 20) Hz	0.4 mA/A + 0.029 $\mu$ A	
	(20 to 45) Hz	0.25 mA/A + 0.029 $\mu$ A	
	45 Hz to 1 kHz	0.21 mA/A + 0.029 $\mu$ A	
	(1 to 5) kHz	0.4 mA/A + 0.039 $\mu$ A	
	(5 to 10) kHz	0.98 mA/A + 0.058 $\mu$ A	
(10 to 30) kHz	2 mA/A + 0.12 $\mu$ A		



# ANSI National Accreditation Board

## 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 Multi-Product Calibrator
	(10 to 20) Hz	0.38 mA/A + 0.39 $\mu$ A	
	(20 to 45) Hz	0.2 mA/A + 0.39 $\mu$ A	
	45 Hz to 1 kHz	0.19 mA/A + 0.39 $\mu$ A	
	(1 to 5) kHz	0.23 mA/A + 0.39 $\mu$ A	
	(5 to 10) kHz	0.5 mA/A + 0.58 $\mu$ A	
	(10 to 30) kHz	0.81 mA/A + 0.78 $\mu$ A	
	(33 to 330) mA		
	(10 to 20) Hz	0.38 mA/A + 3.9 $\mu$ A	
	(20 to 45) Hz	0.2 mA/A + 3.9 $\mu$ A	
	45 Hz to 1 kHz	0.11 mA/A + 3.9 $\mu$ A	
	(1 to 5) kHz	0.22 mA/A + 10 $\mu$ A	
	(5 to 10) kHz	0.41 mA/A + 19 $\mu$ A	
	(10 to 30) kHz	0.81 mA/A + 39 $\mu$ A	
	(0.33 to 1.1) A		
	(10 to 45) Hz	0.37 mA/A + 19 $\mu$ A	
	45 Hz to 1 kHz	0.16 mA/A + 19 $\mu$ A	
	(1 to 5) kHz	1.4 mA/A + 190 $\mu$ A	
	(5 to 10) kHz	4.9 mA/A + 0.97 mA	
	(1.1 to 3) A		
(10 to 45) Hz	0.36 mA/A + 19 $\mu$ A		
45 Hz to 1 kHz	0.16 mA/A + 19 $\mu$ A		
(1 to 5) kHz	1.3 mA/A + 0.19 mA		
(5 to 10) kHz	5 mA/A + 0.97 mA		
(3 to 11) A			
(45 to 100) Hz	0.2 mA/A + 0.39 mA		
100 Hz to 1 kHz	0.25 mA/A + 0.39 mA		
(1 to 5) kHz	2.3 mA/A + 0.39 mA		
(11 to 20.5) A			
(45 to 100) Hz	0.3 mA/A + 0.97 mA		
100 Hz to 1 kHz	0.4 mA/A + 0.97 mA		
(1 to 5) kHz	5.9 mA/A + 0.97 mA		
AC Current – Source	(16.5 to 55) A		Fluke 5522A Multi-Product Calibrator Fluke 50 Turn Coil
	(45 to 65) Hz	2.1 mA/A + 0.13 mA	
	(65 to 440) Hz)	2.1 mA/A + 0.13 mA	
	(55 to 150) A		
	(45 to 65) Hz	2.1 mA/A + 0.13 mA	
(65 to 440) Hz	2.1 mA/A + 0.13 mA		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source	(150 to 550) A (45 to 65) Hz (65 to 440) Hz (550 to 1 000) A (45 to 65) Hz (65 to 440) Hz	1.9 mA/A + 0.13 mA 2.1 mA/A + 0.13 mA 1.9 mA/A + 0.14 mA 1.9 mA/A + 0.14 mA	Fluke 5522A Multi-Product Calibrator Fluke 50 Turn Coil
AC Current – Measure	Up to 10 µA 1 kHz (10 to 100) µA 1 kHz (0.1 to 1) mA 1 kHz (1 to 10) mA 1 kHz (10 to 100) mA 1kHz (0.1 to 1) A 1 kHz	0.78 mA/A + 1 nA 0.35 mA/A + 6 nA 0.14 mA/A + 0.04 µA 0.2 mA/A + 0.4 µA 0.2 mA/A + 4 µA 0.29 mA/A + 40 µA	Agilent-3458A Opt. 002 Digital Multimeter
AC Current – Measure	Up to 1 000 A (60 to 100) Hz	6.1 mA/A + 0.6 A	Agilent-3458A Opt. 002 Digital Multimeter Empro B1000-100 Shunt
Electrical Simulation of Thermocouple Indicators	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 18 20) °C Type 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 Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C	0.54 °C 0.49 °C 0.38 °C 0.39 °C 0.38 °C 0.25 °C 0.28 °C 0.44 °C 0.7 °C 0.43 °C 0.19 °C 0.18 °C 0.19 °C 0.22 °C	Fluke 5522A Multi-Product Calibrator





ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators	Type J		Fluke 5522A Multi-Product Calibrator
	(-210 to -100) °C	0.26 °C	
	(-100 to -30) °C	0.19 °C	
	(-30 to 150) °C	0.18 °C	
	(150 to 760) °C	0.2 °C	
	(760 to 1 200) °C	0.24 °C	
	Type K		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.22 °C	
	(-25 to 120) °C	0.21 °C	
	(120 to 1 000) °C	0.27 °C	
	(1 000 to 1 372) °C	0.36 °C	
	Type L		
	(-200 to -100) °C	0.33 °C	
	(-100 to 800) °C	0.25 °C	
	(800 to 900) °C	0.2 °C	
	Type N		
	(-200 to -100) °C	0.41 °C	
	(-100 to -25) °C	0.31 °C	
	(-25 to 120) °C	0.3 °C	
	(120 to 410) °C	0.29 °C	
	(410 to 1 300) °C	0.34 °C	
	Type R		
	(0 to 250) °C	0.62 °C	
	(250 to 400) °C	0.37 °C	
	(400 to 1 000) °C	0.36 °C	
	(1 000 to 1767) °C	0.41 °C	
	Type S		
(0 to 250) °C	0.45 °C		
(250 to 1 000) °C	0.38 °C		
(1 000 to 1400) °C	0.39 °C		
(1 400 to 1767) °C	0.44 °C		
Type T			
(-250 to -150) °C	0.54 °C		
(-150 to 0) °C	0.27 °C		
(0 to 120) °C	0.17 °C		
(120 to 400) °C	0.16 °C		
Type U			
(-200 to 0) °C	0.49 °C		
(0 to 600) °C	0.24 °C		





# ANSI National Accreditation Board

## Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators	Pt 385, 100 $\Omega$		Fluke 5522A Multi-Product Calibrator
	(-200 to -80) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(-80 to 0) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(0 to 100) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$	
	(100 to 300) $^{\circ}\text{C}$	0.11 $^{\circ}\text{C}$	
	(300 to 400) $^{\circ}\text{C}$	0.11 $^{\circ}\text{C}$	
	(400 to 630) $^{\circ}\text{C}$	0.13 $^{\circ}\text{C}$	
	(630 to 800) $^{\circ}\text{C}$	0.21 $^{\circ}\text{C}$	
	Pt 385, 200 $\Omega$		
	(-200 to -80) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(-80 to 0) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(0 to 100) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(260 to 300) $^{\circ}\text{C}$	0.13 $^{\circ}\text{C}$	
	(300 to 400) $^{\circ}\text{C}$	0.14 $^{\circ}\text{C}$	
	(400 to 600) $^{\circ}\text{C}$	0.16 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.17 $^{\circ}\text{C}$	
	Pt 385, 500 $\Omega$		
	(-200 to -80) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(-80 to 100) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
	(0 to 100) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$	
	(100 to 260) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$	
	(260 to 300) $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	
	(300 to 400) $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	
	(400 to 600) $^{\circ}\text{C}$	0.11 $^{\circ}\text{C}$	
	(600 to 630) $^{\circ}\text{C}$	0.12 $^{\circ}\text{C}$	
	Pt 385, 1 000 $\Omega$		
	(-200 to -80) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$	
(-80 to 100) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$		
(0 to 100) $^{\circ}\text{C}$	0.08 $^{\circ}\text{C}$		
(100 to 260) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$		
(260 to 300) $^{\circ}\text{C}$	0.09 $^{\circ}\text{C}$		
(300 to 400) $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$		
(400 to 600) $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$		
(600 to 630) $^{\circ}\text{C}$	0.2 $^{\circ}\text{C}$		



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicators	Pt 3926, 100 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.08 °C 0.08 °C 0.09 °C 0.11 °C 0.11 °C 0.13 °C	Fluke 5522A Multi-Product Calibrator
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 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz	(220 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	15 mF/F + 1.9 pF 4.5 mF/F + 1.9 pF 2.4 mF/F + 1.9 pF 0.9 mF/F + 1.9 pF 0.87 mF/F + 1.9 pF 0.88 mF/F + 1.9 pF 0.9 mF/F + 5.8 pF 0.9 mF/F + 0.2 pF 0.9 mF/F + 0.6 pF 0.9 mF/F + 1.9 pF 1.1 mF/F + 5.8 pF 1.6 mF/F + 19 pF	Fluke 5522A Multi-Product Calibrator
Capacitance Measure 1 kHz	(10 to 100) pF (10 to 100) pF (100 to 1 000) pF (1 to 100) nF (0.1 to 1) mF	3.2 mF/F + 0.02 pF 3.2 mF/F + 0.02 pF 2.6 mF/F + 0.02 nF 2.6 mF/F + 0.2 pF 2.7 mF/F + 2.04 nF	Fluke PM6303 RCL Meter
Inductance - Source 100 Hz to 10 kHz	100 μH 1 mH 100 mH	0.39 μH 2.3 μH 0.1 mH	Genrad 1482B, 1482E, 1482L Inductors
DC Power Source	Up to 3060 W (3.06 to 20.9) kW	310 μW/W + 0.03 W 0.89 mW/W + 0.62 W	Fluke 5522A Multi-Product Calibrator
AC Power Source (45 to 65 Hz)	Up to 336.6 W (0.336 to 1.12) kW (1.12 to 3.06) kW (3.06 to 11.22) kW (11.2 to 20.91) kW	0.14 mW/W + 4 mW 0.18 mW/W + 0.02 W 0.18 mW/W + 0.02 W 0.21 mW/W + 0.41 W 0.31 mW/W + 1 W	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase	(0 to 90) ° (65 to 500) Hz (500 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.5 ° 1.5 ° 1.6 ° 1.9 ° 2.7 °	Fluke 5522A Multi-Product Calibrator
Oscilloscopes Amplitude Square Wave (50 Ω)	1 kHz Up to 5 mV (5 to 11) mV (11 to 45) mV (45 to 110) mV (0.11 to 0.45) V (0.45 to 1.09) V	1.8 mV/V + 6.2 μV 2 mV/V + 14 μV 2 mV/V + 56 μV 2 mV/V + 140 μV 2 mV/V + 0.56 mV 2 mV/V + 1.4 mV	Fluke 5502A Multi-Product Calibrator
Leveled Sine Wave	10 Hz (1.09 to 2.2) V 100 Hz (1.09 to 2.2) V 1 kHz (1.09 to 2.2) V	2 mV/V + 5.5 mV 2 mV/V + 2.8 mV 2 mV/V + 2.8 mV	
Amplitude Square Wave (1 MΩ)	1 kHz Up to 5 mV (5 to 20) mV (20 to 89) mV (89 to 219) mV (219 to 890) mV (0.89 to 6.5) V 10 Hz (6.5 to 55) V 100 Hz (6.5 to 55) V 1 kHz (6.5 to 55) V 10 kHz (6.5 to 55) V	2.2 mV/V + 0.01 μV 2 mV/V + 0.03 μV 2 mV/V + 110 mV 2 mV/V + 0.27 mV 2 mV/V + 1.1 mV 2 mV/V + 8 mV 2 mV/V + 140 mV 2 mV/V + 69 mV 2 mV/V + 69 mV 4 mV/V + 69 mV	



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Leveled Sine Wave	10 mV to 5.5 V 50 kHz to 100 MHz 100 kHz to 300 MHz	28 mV/V + 58 mV/V 33 mV/V + 58 mV/V	Fluke 5502A Multi-Product Calibrator
Time Marker into 50Ω	2 ns to 50 ms 50 ms to 5 s	4.9 μs/s 14 μs/s	

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers <sup>2</sup>	Up to 12 in (12 to 40) in (40 to 80) in	(290 + 2.9L) μin (200 + 9.6L) μin (110 + 12L) μin	Grade 0 Gage Blocks and Bars
OD Micrometers <sup>2</sup>	Up to 12 in	(35 + 9.8L) μin	
ID Micrometers <sup>2</sup>	Up to 12 in (12 to 40) in	(35 + 9.8L) μin (5.4 + 13L) μin	
Dial Indicators <sup>2</sup>	Up to 4 in	(27 + 7.4L) μin	
Test Indicators <sup>2</sup>	Up to 0.05 in	(29 + 0.12L) μin	
Height Gages <sup>2</sup>	Up to 12 in (12 to 40) in	(110 + 6L) μin (43 + 12L) μin	
Optical Comparator <sup>2</sup> Microscope <sup>2</sup>	(0 to 50) mm (0 to 50.8) mm	(2.5 + 0.004N) μm (1.7 + 0.023N) μm	172-116 / 172-117 Glass Scale
Protractor/Angle	(30 to 90) °	1.8 arc min	Angle Block Set
Outside Diameter <sup>2</sup>	(1 to 60) mm	(1 + 0.004 3D) μm	Micrometer Laser
Micrometer Laser <sup>2</sup>	1 mm to 25 mm	(0.5 + 0.004D) mm	Cylindrical Plug Gages Class XX ASME B.89.1.5-1998
Micrometer Laser <sup>2</sup>	(1 to 60) mm	(1 + 0.004 3D) μm	Mitutoyo Calibration Gage Set 02AGD170
Gage Block	Up to 1.0 in (1.0 to 4.0) in	(6.7+ 5.3L) μin (4.3 + 7.9L) μin	LabMaster Universal Gage Block Grade 00

**Length – Dimensional metrology**

<b>Parameter/Equipment</b>	<b>Range</b>	<b>Expanded Uncertainty of Measurement (+/-)</b>	<b>Reference Standard, Method, and/or Equipment</b>
Gage Block	(4.0 to 6.0) in (6.0 to 12.0) in	(2.7 + 9.6L) μin (5.6 + 9.3L) μin	Gage Block Grade 0
Length Standards	Up to 1.0 in (1.0 to 4.0) in	(6.7+ 5.3L) μin (4.3 + 7.9L) μin	LabMaster Universal Gage Block Grade 00
Length Standards	(4.0 to 6.0) in	(2.7 + 9.6L) μin	Gage Block Grade 0 Quick Vision QVT1- X404PIL
Length Standards	(6.0 to 12.0) in	(5.6 + 9.3) μin	Gage Block Grade 0 Faro Arm EDGE 14000
Cylindrical Pin & Plug Gages	Up to 1.0 in (1.0 to 4.0) in	(6.7+ 5.3L) μin (4.3 + 7.9L) μin	LabMaster Universal Gage Block Grade 00
Cylindrical Pin & Plug Gages	Up to 1 in	(12 + 2.5L) μin	Plug Gages XX
Ring Gages	Up to 0.5 in (0.5 to 1.0) in (1.0 to 4.0) in	(17 + 1.7L) μin (17 + 4.4L) μin (12 + 8.1L) μin	LabMaster Universal Gage Block Grade 00 Ring Gage XX
Thread Wires (4 – 80) TPI	(0.005 to 0.2) in	(5.1 + 7.5L) μin	LabMaster Universal Gage Block Grade 00
Thread Plug Gages 60° Threads Pitch Diameter Major Diameter	(0.05 to 4) in (0.05 to 4) in	(34 + 2.2L) μin (36 + 2.1L) μin	LabMaster Universal Gage Block Grade 00
Fixed Internal Thread Ring Gages Pitch Diameter Major Diameter	(0.05 to 4) in (0.05 to 4) in	(34 + 2.2L) μin (36 + 2.1L) μin	LabMaster Universal Gage Block Grade 00
Coordinate Measuring Machines (CMM'S) Linear measurement (Axis X, Axis Y, Axis Z)	Up to 2 in (2.0 to 4.0) in (4.0 to 6.0) in (6.0 to 12.0) in (12.0 to 20) in	(3.4 + 5.8L) μin (3.7 + 5.8L) μin (2.3 + 6.2L) μin (7. + 5.7L) μin (14 + 5.6L) μin	Gage Block Set Grade 00 Gage Blocks Grade 0
Vision Measuring System (non-Contact) Linear measurement (Axis X, Axis Y, Axis Z)	Up to 2 in (2.0 to 4.0) in (4.0 to 6.0) in (6.0 to 12.0) in (12.0 to 20) in	(15 + 2.8L) μin (12 + 4.6L) μin (8.7 + 5.6L) μin (11 + 5.5L) μin (16 + 5.5L) μin	Gage Block Set Grade 0 Gage Blocks Grade 0 Standard Scale 50 mm Standard Scale 2.0 in Standard Scale 6.0 in

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque - Measure	(5 to 50) ozf·in	0.13 % of reading	CDI Torque Transducers
	(5 to 50) lbf·in	0.12 % of reading	
	(40 to 400) lbf·in	0.13 % of reading	
	(100 to 1 000) lbf·in	0.21 % of reading	
	(25 to 250) lbf·ft	0.14 % of reading	
Torque - Source	(100 to 1 000) lbf·ft	0.13 % of reading	CDI Torque Calibration Radius Arms and Masses
	(5 to 50) ozf·in	0.066 % of reading	
	(5 to 50) lbf·in	0.066 % of reading	
	(40 to 400) lbf·in	0.044 % of reading	
	(100 to 1 000) lbf·in	0.044 % of reading	
Force - Measure Tension and Compression	(25 to 250) lbf·ft	0.025 % of reading	Weight Class F
	(100 to 1 000) lbf·ft	0.034% of reading	
Force - Measure Tension and Compression	(0.002 to 100) lbf	0.013 % of reading	Futek Indicator, Load Cell
	(100 to 500) lbf	0.05 % of reading	
	(200 to 1 000) lbf	0.37 % of reading	
Analytical Scales <sup>2</sup>	(1 000 to 5 000) lbf	0.28 % of reading	Class 1 Weights ASTM
	Up to 200 g	0.37 mg + 0.6R	
Scales / Balances <sup>2</sup>	Up to 1 000 g	0.52 mg + 0.6R	Class F Weights
	Up to 50 g	0.04 mg + 0.6R	
	(50 to 200) g	2.3 mg + 0.6R	
	200 g to 10 kg	8.5 mg + 0.6R	
Pressure - Measure	(25 to 500) kg	7.6 g + 0.6R	Fluke 3130 Pressure Calibrator
	(-12 to 0) psi	0.025 psi	
	(0 to 300) psi	(1.7 E <sup>-03</sup> + 4.7 E <sup>-04</sup> P) psi	
Low Pressure – Measure <sup>2</sup>	(-1 to 1) psig	0.000 2 psi	Fluke 750 Process Calibrator, 750 series Pressure Modules
	Up to 1 000 psig	0.44 psi	
High Pressure - Measure	(1 000 to 10 000) psig	(1.5 + 3.3P) psi	Fluke 721-PD2 (PORT 1) Pressure Calibrator
	(-13.75 to 0) psig	0.007 5 psi	
Pressure Source	(0 to 36) psig	(1.8 <sup>E-03</sup> + 4.1 <sup>E-04</sup> P) psi	Fluke 2700G-G70M Pressure Gauge
	(20 to 1 434) psig	0.06 % of reading	
Flow Measurement <sup>2</sup>	(200 to 10 000) psig	0.17 % of reading	Dead weight pressure generation (Piston Cylinder and Masses)
	(3 to 30) sccm	(0.032 + 7.8 <sup>E-03</sup> X) ccm	
	(30 to 300) sccm	(0.037 + 8.4 <sup>E-03</sup> X) ccm	
Flow Measurement <sup>2</sup>	(0.1 to 1) lpm	(5.1 <sup>E-4</sup> + 8 <sup>E-03</sup> X) lpm	CME DIVISION 60B-75-.03-1000(SP) Flowmeter



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass	1 mg	0.17 mg	Rice Lake Class F Weights and Balances
	2 mg	0.18 mg	
	5 mg	0.23 mg	
	10 mg	0.27 mg	
	20 mg	0.33 mg	
	50 mg	0.43 mg	
	100 mg	0.52 mg	
	200 mg	0.64 mg	
	500 mg	0.84 mg	
	1 g	1.1 mg	
	2 g	1.3 mg	
	5 g	1.8 mg	
	10 g	2.3 mg	
	20 g	4.7 mg	
	50 g	12 mg	
	100 g	23 mg	
	200 g	46 mg	
	500 g	81 mg	
	1 kg	0.12 g	
2 kg	0.23 g		
5 kg	0.58 g		
25 kg	2.9 g		
Mass	1/32 oz	1 mg	Rice Lake Class F Weights and Balances
	1/16 oz	1.3 mg	
	1/8 oz	1.5 mg	
	1/4 oz	2 mg	
	1/2 oz	3.3 mg	
	1 oz	6.3 mg	
	2 oz	13 mg	
	4 oz	27 mg	
	8 oz	52 mg	
	1 lb	81 mg	
	2 lb	0.11 g	
	5 lb	0.27 g	
	10 lb	0.52 g	
20 lb	60 mg		





Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Hardness	22.9 HRC	0.43 HRC	Block Hardness Standards
	33.1 HRC	0.42 HRC	
	43.6 HRC	0.42 HRC	
	54.4 HRC	0.42 HRC	
	60.7 HRC	0.36 HRC	
	62.9 HRC	0.36 HRC	
	43.6 HR30N	0.38 HR30N	
	53.7 HR30N	0.38 HR30N	
	62.6 HR30N	0.36 HR30N	
	76.1 HR30N	0.38 HR30N	
79.3 HR30N	0.37 HR30N		

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity	(0 to 100) %RH	1.2 %RH	Vaisala MI70/HMP76B Thermohygrometer
Temperature – Source (Black Body)	35 °C	0.65 °C	Fluke 4181 IR Calibrator $\lambda = (8 \text{ to } 14) \mu\text{m}$ , $\epsilon = (0.9 \text{ to } 1.0)$
	100 °C	0.67 °C	
	200 °C	0.72 °C	
	350 °C	0.84 °C	
	500 °C	1 °C	
Temperature Measurement-Source	(-200 to 0) °C	0.03 °C	Fluke 1523 W/ 5628 PRT Fluke 9144 Field Metrology Well
	(0 to 100) °C	0.03 °C	
	(100 to 300) °C	0.05 °C	
	(300 to 420) °C	0.11 °C	
	(429 to 650) °C	0.12 °C	

Time and Frequency

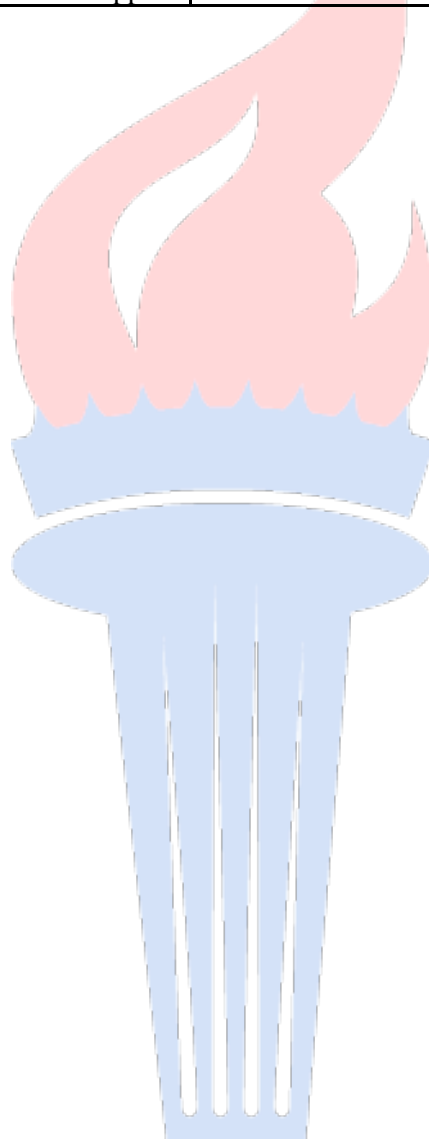
Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stop-Watch	(1 to 86 400) s	0.07 s	Agilent 53132A Frequency Counter
Frequency Measure <sup>2</sup>	1 MHz to 225 MHz	$6.4 \times 10^{-05} \text{ Hz} + 2R$	Agilent 53132A Frequency Counter
	DC to 3 GHz	$6.2 \times 10^{-3} \text{ Hz} + 2R$	



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## Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency - Source	50 kHz @ 5.5 V 500 kHz @ 5.5 V 5 MHz @ 5.5 V 50 MHz @ 5.5 V 300 MHz @ 2 Vpp	0.21 Hz 0.32 Hz 3.1 Hz 31 Hz 190 Hz	Fluke 5502A Multi-Product Calibrator



**DIMENSIONAL MEASUREMENT**

**1 Dimensional**

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Linear	(0 to 1 500) mm	41 $\mu$ m	Articulated Arm Coordinate Measuring Machines (AACMM) Faro Customer Drawings
Linear Optical Measurement	X=320 mm Y= 320 mm Z= 150 mm	5.3 $\mu$ m	CNC Vision Measuring System, Mitutoyo QVT1-L404Z1L-D Quick Vision Active Customer Drawings

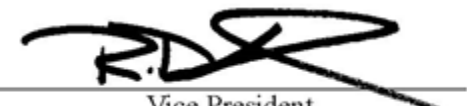
**3 Dimensional**

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Volumetric Performance	Up 1.8 m	52 $\mu$ m	Articulated Arm Coordinate Measuring Machines (AACMM) Faro Customer Drawings

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.  $D$  = diameter in millimeters,  $L$  = length in inches,  $N$  = length in millimeters,  $P$  = pressure in psi,  $R$  = resolution of unit under test,  $X$  = indicated value.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-2077.



Vice President

