CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

Accura Calibration
2834 West Kingsley Road
Garland, TX 75041

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-2548
Certificate Number

ANAB Approval

Certificate Valid: 10/25/2018-02/01/2020
Version No. 003 Issued: 10/25/2018

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).

ANSI-ASQ National Accreditation Board

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

Accura Calibration

2834 West Kingsley Road
Garland, TX 75041
Dwight Martin 972-278-7878

CALIBRATION

Valid to: **February 1, 2020** Certificate Number: **AC-2548**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torroidal Clamp (45 to 65) Hz	(20 to 300) A (>300 to 600) A (>601 to 1 000) A	11 mA/A + 0.09 A 9.8 m/A + 0.09 A 11 mA/A + 0.09 A	5500A/Coil, 2575A Amplifier, 3458A Multimeter, Current Sources
400 Hz	(20 to 300) A (>300 to 600) A	19 mA/A + 0.1 A 18 mA/A + 0.1 A	
200Hz[1]	(>600 to 1 000) A	18 mA/A + 0.1 A	
Non-Torroidal Clamp (45 to 65) Hz	(20 to 300) A (>300 to 600) A (>600 to 1 000) A	15 mA/A + 0.9 A 14 mA/A + 0.9 A 14 mA/A + 0.9 A	5500A/Coil, 2575A Amplifier, 3458A Multimeter, Current Sources
400 Hz	(20 to 300) A (>300 to 600) A	22 mA/A + 0.9 A 21 mA/A + 0.9 A	
200Hz[1]	(>600 to 1 000) A	22 mA/A + 0.9 A	
DC Amps – Generate and Measure[1]	(>0.1 to 2) mA (>2 to 20) mA (>20 to 200) mA (>200m to 2) A (>2 to 20) A (>20 to 100) A	3.9 mA/A + 0.003 uA 0.41 mA/A + 0.03 uA 0.11 mA/A +0.3 uA 0.2 mA/A + 3 uA 0.2 mA/A + 30 uA 0.5 mA/A + 300 uA	2575A Amplifier, 3458A Multimeter, Current Sources

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate/Measure[1]	(1 to 6 400) pF (>6.4 to 100) nF (>100 to 1 600) nF (>1.6 to 100) uF	1.2 mF/F 3.8 mF/F 8.1 mF/F 5.7 mF/F	GR1689M RLC Bridge with 5500A Multifunction Calibrator, GR1413, 16380A Capacitors
Inductance – Generate & Measure[1] 100 Hz – 1 kHz	1 mH to 11.11 H	2.7 mH/H	GR1689M RLC Bridge, 1490D Inductor
AC Resistance – Generate & Measure[1] 1 kHz	1 Ω to 100 kΩ	0.39 mΩ/Ω	GR 1689M RLC Bridge with HP 16074A Standard Set
AC Amps – Generate/Measure[1] (0.045 to 1) kHz	(>0.1 to 2) mA (>2 to 20) mA (>20 to 200) mA (>0.2 to 2) A (>2 to 20) A (>20 to 100) A	4.1 mA/A + 0.003 uA 1.1 mA/A + 0.03 uA 1 mA/A + 0.3 uA 1 mA/A + 3 uA 1 mA/A + 30 uA 1 mA/A + 150 uA	Valhalla 2575A Amplifier, HP3458A Multimeter, Current Sources
DC Power – Generate[1]	(0.01 to 11) kW	2.1 mW/W	5500A Multifunction Calibrator, HP3458A Multimeter, Valhalla 2575A Amplifier
AC Power – Generate[1] (45 to 65) Hz	(0.01 to 0.1) W (0.33 to 11) kW	2 mW/W 1.8 mW/W	5500A, HP3458A Multimeter, Valhalla 2575A Amplifier
DC Volts– Generate/Measure[1]	Up to 120 mV (>120 m to 1.2) V (>1.2 to 12) V (>12 to 120) V (>120 to 1 050) V	6.1 uV/V + 0.3 uV 5.1 uV/V + 0.3 uV 5.1 uV/V +0.5 uV 7.3 uV/V + 30 uV 7.3 uV/V + 100 uV	3458A/002 Multimeter with Multifunction Calibrator
DC High Voltage Measure	(1 to 60) kV	1.8 mV/V	Ross Engineering VD60-6.2Y-A-LB-AL Voltage Divider and HP3458A Multimeter
AC Volts – Generate/Measure[1]	(>0 to 12) mV (1 to 40) Hz 40 Hz to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.7 mV/V 0.36 mV/V 0.48 mV/V 1.3 mV/V 5.9 mV/V 46 mV/V	3458A/002 Multimeter with multifunction calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Volts – Generate/Measure[1]	12 mV to 12 V (1 to 40) Hz 40 Hz to1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (12 to 120) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (120 to 700) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	 0.13 mV/V 0.11 mV/V 0.22 mV/V 0.37 mV/V 0.95 mV/V 3.6 mV/V 1.2 mV/V 17 mV/V 0.28 mV/V 0.26 mV/V 0.26 mV/V 0.43 mV/V 1.4 mV/V 4.7 mV/V 17 mV/V 0.53 mV/V 0.5 mV/V 0.73 mV/V 1.4 mV/V 3.5 mV/V	3458A/002 Multimeter with multifunction calibrator
AC High Voltage Measure	(1 to 60) kV 60 Hz	5.9 mV/V	Ross Engineering VD60-6.2Y-A-LB-AL Voltage Divider and HP3458A Multimeter
Resistance – Generate/Measure[1]	(0 to 12) Ω (12 to 120) Ω (0.12 to 1.2) kΩ (1.2 to 12) kΩ (1.2 to 120) kΩ (0.120 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (0.12 to 1.2) GΩ	19 uΩ/ Ω + 0.05 mΩ 15 uΩ/ Ω + 0.5 mΩ 13 uΩ/ Ω + 0.5 mΩ 12 uΩ/ Ω + 5 mΩ 13 uΩ/ Ω + 0.05 mΩ 24 uΩ/ Ω + 2 Ω 65 uΩ/ Ω + 100 Ω 0.58 mΩ/ Ω + 1 kΩ 5.8 mΩ/ Ω + 10 kΩ	3458A/002 Multimeter and Multifunction source and decade resistors
Oscilloscopes Level Sinewave Relative to 50kHz – Generate[1]	5 mV to 5.5 V (pp) 50 kHz to 100 MHz 50 kHz to 300 MHz 50 kHz to 600 MHz	 17 mV/V + 100 uV 23 mV/V + 100 uV 46 mV/V + 100 uV	5500A/SC600 Multifunction Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes – Time Marks – Generate[1,2]	2 ns to 20 ms 50 ms to 5s	2.5 us/s (25 + 1 000*t*) us/s	5500A/SC600 Multifunction Calibrator
Oscilloscopes Rise Time - Generate[1]	≤300 ps	+0 ps/-102 ps	5500A/SC600 Multifunction Calibrator
Oscilloscopes Amplitude DC Signal into 50 Ω load	± (1 to 24.999) mV ± (25 to 109.99) mV ± (110 m to 2.2) V ± (2.2 to 6.6) V	2.5 mV/V + 40 µV 2.5 mV/V + 40 µV 2.5 mV/V + 40 µV 2.5 mV/V + 40 µV	5500A/SC600 Multifunction Calibrator
into 1M Ω load	(-130 to 130) V	0.58 mV/V + 40 µV	
Amplitude Squarewave 50 Ω load	±1 mV to 6.6 V p-p 10 Hz to 1 kHz	2.7 mV/V + 40 µV	
1MΩ load	± (1 m to 130) V p-p (10 to 1k) Hz (1 to 10) kHz	 1 mV/V + 40 µV 2.5 mV/V + 40 µV	
Electrical Simulation of Thermocouple Devices – Generate & Measure[1]	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °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	 0.46 °C 0.36 °C 0.36 °C 0.39 °C 0.36 °C 0.32 °C 0.37 °C 0.56 °C 0.9 °C 0.56 °C 0.22 °C 0.21 °C 0.22 °C 0.27 °C	5500A Multifunction Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Devices – Generate & Measure[1]	Type J		5500A Multifunction Calibrator
	(-210 to -100) °C	0.33 °C	
	(-100 to -30) °C	0.22 °C	
	(-30 to 150) °C	0.21 °C	
	(150 to 760) °C	0.23 °C	
	(760 to 1 200) °C	0.29 °C	
	Type K		
	(-200 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.24 °C	
	(-25 to 120) °C	0.22 °C	
	(120 to 1 000) °C	0.32 °C	
	(1 000 to 1 372) °C	0.46 °C	
	Type L		
	(-200 to -100) °C	0.43 °C	
	(-100 to 800) °C	0.32 °C	
	(800 to 900) °C	0.23 °C	
	Type N		
	(-200 to -100) °C	0.46 °C	
	(-100 to -25) °C	0.28 °C	
	(-25 to 120) °C	0.25 °C	
	(120 to 410) °C	0.24 °C	
	(410 to 1 300) °C	0.33 °C	
	Type R		
	(0 to 250) °C	0.63 °C	
	(250 to 400) °C	0.41 °C	
	(400 to 1 000) °C	0.39 °C	
	(1 000 to 1 767) °C	0.46 °C	
	Type S		
	(0 to 250) °C	0.53 °C	
	(250 to 1 000) °C	0.42 °C	
	(1 000 to 1 400) °C	0.43 °C	
	(1 400 to 1 767) °C	0.52 °C	
	Type T		
	(-250 to -150) °C	0.69 °C	
	(-150 to 0) °C	0.3 °C	
	(0 to 120) °C	0.22 °C	
	(120 to 400) °C	0.2 °C	
	Type U		
	(-200 to 0) °C	0.62 °C	
	(0 to 600) °C	0.33 °C	

Electrical Simulation of RTD Devices – Generate & Measure	Pt 385 (100 ohm)		5500A Multifunction Calibrator
	(-200 to -80) °C	0.06 °C	
	(-80 to 0) °C	0.06 °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 ohm)		
	(-200 to -80) °C	0.06 °C	
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 300) °C	0.1 °C	
	(300 to 400) °C	0.11 °C	
	(400 to 630) °C	0.13 °C	
	Pt 3916 (100 ohm)		
	(-200 to -190) °C	0.26 °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	0.11 °C	
	(600 to 630) °C	0.23 °C	
	Pt 385 (200 ohm)		
	(-200 to -80) °C	0.05 °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	0.13 °C	
	(300 to 400) °C	0.14 °C	
	(400 to 600) °C	0.15 °C	
	(600 to 630) °C	0.17 °C	
	Pt 385 (500 ohm)		
	(-200 to -80) °C	0.05 °C	
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.09 °C	
	(400 to 600) °C	0.10 °C	
	(600 to 630) °C	0.12 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Devices – Generate & Measure	Pt 385 (1000 ohm) (-200 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 PtNi 385 (120 ohm) (-80 to 0) °C (0 to 100) °C (100 to 260) °C Cu 427 (10 ohm), (-100 to 260) °C	 0.04 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.08 °C 0.24 °C 0.09 °C 0.09 °C 0.15 °C 0.31 °C	5500A Multifunction Calibrator

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF/Microwave Power – Generate & Measure[1]	(-30 to +20) dBm 100 kHz to 4.2 GHz	0.13 dBm	8482A Power Sensor, E4418B Power Meter, Signal Generator
	(-30 to +20) dBm 10 MHz to 26.5 GHz	0.11 dBm	8485A Power Sensor, E4418B Power Meter, Signal Generator
	(-70 to -20) dBm 10 MHz to 18 GHz	0.13 dBm	8481D Power Sensor, E4418B Power Meter, Signal Generator
Attenuation – Measure or Tuned RF Power 2.5 MHz to 18 GHz	(0 to 10) dB (-10 to 0) dB (-20 to -10) dB (-30 to -20) dB (-40 to -30) dB (-50 to -40) dB (-60 to -50) dB (-70 to -60) dB (-80 to -70) dB	0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.17 dB 0.17 dB 0.2 dB	8902A Measuring Receiver and 11793A Power Sensor

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Measure or Tuned RF Power 2.5 MHz to 18 GHz	(-90 to -80) dB (-100 to -90) dB (-110 to -100) dB (-120 to -110) dB (-127 to -120) dB	0.22 dB 0.22 dB 0.33 dB 0.43 dB 0.43 dB	8902A Measuring Receiver and 11793A Power Sensor
Amplitude Modulation - Measure 150 kHz to 10 MHz 10 MHz to 1.3 GHz 10 MHz to 1.3 GHz (1.3 to 26.5) GHz (1.3 to 26.5) GHz	 Rate: 50 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: Up to 99 % Rate: 20 Hz to 100 kHz Depths: 5 % to 99 % Rate: 20 Hz to 100 kHz Depths: Up to 99%	 2.3 % of reading 1.2 % of reading 3.5 % of reading 1.8 % of reading 3.5 % of reading	Agilent 8902A Measuring Receiver
Frequency Modulation - Measure Carrier Frequency 250 kHz to 10 MHz 10 MHz to 1.3 GHz	 Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	 2.3 % of reading 5.8 % of reading	Agilent 8902A Measuring Receiver
Frequency Modulation - Measure Carrier Frequency (1.3 to 26.5) GHz	 Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak	 5.8 % of reading	Agilent 8902A Measuring Receiver
Phase Modulation - Measure 10 MHz to 1.3 GHz 1.3 GHz to 26.5 GHz	 Rate: 200 Hz 20 kHz Dev.: .1 to 400 rad Rate: 200 Hz 20 kHz Dev.: > .1 to 400 rad	 3.5 % of reading 4.6 % of reading	HP 8902A Measuring Receiver with 11722A and 11792A Power Sensors

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Height Gage[2]	(0 to 24) in	(22 + 13*L*) uin	Grade B Gage Blocks, Height Gage
Micrometer	(0 to 1) in	16 uin/in	Grade B Gage Blocks
Calipers[2]	(0 to 36) in	(345 +5*L*) uin	Grade B Gage Blocks
Caliper – Parallelism	(0.15 to 0.500) in	8.8 uin/in	Pin Gage
Dial/Test Indicator	(0.000 1 to 1) in	143 uin/in	Starrett 716 Indicator Tester
Pin Gages[2]	(0.25 to 1.18) in	(16 +6*L*) uin	Laser Micrometer LS-7010, Pin Gages
	(0.002 to 0.24) in	10 uin	Laser Micrometer LS-7030, Pin Gages

Mass and Mass-Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque –Generate[1]	(40 to 200) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	0.044 % of reading 0.044 % of reading 0.044 % of reading 0.044 % of reading 0.054 % of reading 0.096 % of reading	Calibration Arm, Weights, Weight Hanger, Wheels
Torque –Measure[1]	(40 to 200) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft	0.29% of reading 0.29 % of reading 0.29 % of reading 0.3 % of reading 0.34 % of reading 0.59 % of reading	Calibration Arm, Weights, Weight Hanger, Wheels, Transducers

Mass and Mass-Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass	1g 2g 5g 10g 20g 50g 100g 200g 1kg	0.002 1 mg 0.005 7 mg 0.007 5 mg 0.013 mg 0.019 mg 0.037 mg 0.041 mg 0.1 mg 0.3 mg	Class 1 Masses
Laboratory Balances (0.000 1 g Resolution) (0.001 g Resolution) (0.01 g Resolution)	 (>0 to 60) g (>0 to 210) g (>0 to 3 000) kg	 0.22 mg 2.2 mg 22 mg	Class 1 Masses and Handbook 44
Industrial Scales (0.000 2 lb Resolution) (0.001 lb Resolution) (0.002 lb Resolution) (0.005 lb Resolution) (0.01 lb Resolution) (0.05 lb Resolution) (0.1 lb Resolution) (0.2 g Resolution)	 (>0 to 2) lb (>0 to 35) lb (>0 to 50) lb (>0 to 100) lb (>0 to 100) lb (>0 to 500) lb (>0 to 500) lb (>0 to 25) kg	 0.000 5 lb 0.003 lb 0.006 lb 0.013 lb 0.023 lb 0.12 lb 0.23 lb 0.47 g	Class F Masses and Handbook 44
Force Gages Tension – Generate[1]	(1 to 110) lb	0.06 lb	Class F Weights & Hangers
Durometers Spring Force only Types A, B, O, C, D, DO	(209.04 to 4.079) kg	0.1 mg/g	Class 1 Weights & Triple Point Balance
Pressure – Measure/Generate[1]	(>0 to 5) psi	1 mpsi/psi	Fluke 718-300 Calibrator, 700P03 Module
	(>0 to 300) psi	0.59 mpsi/psi	Fluke 718-300 Calibrator
	(1 to 2 000) psi (2 000 to 5 000) psi (5 000 to 10 000) psi	0.72 mpsi/psi 0.63 mpsi/psi 0.64 mpsi/psi	Condec UPC5200A Calibrator

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Generate/Measure	(-25 to 420) °C	0.04 °C	Blackstack Readout, SPRT
	(>420 to 1 200) °C	0.32°C	Blackstack Readout, Type-S TC
Infrared-Generate[1]	(0 to 500) °C	0.91°C	Fluke 9132A Calibrator $\varepsilon = 0.95$, $\lambda = (8 \text{ to } 14)$ µm
Humidity – Measure[1]	(10 to 90) %RH	0.074 %RH	Thunder Scientific Chamber, Psychrometer

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure and Source	10 Hz to 26.5 GHz	50 pHz/Hz	GPS Disciplined Oscillator, Signal Generators, Counters

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. L = length in inches, t = time in seconds
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2548.