

Scope of Accreditation

For

American Technical Services Inc.

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In recognition of a successful assessment to ISO/IEC 17025:2005, ANSI Z540-1 and ANSI/NCSL Z540.3 to the following Calibration and Measurement Capabilities, accreditation has been granted to **American Technical Services Inc.** for the following:

Accreditation granted through: **August 17, 2018**

Calibration

Amount of Substance – Particulate

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Particle Counting Efficiency (0.01 to 1) μm	(0 to 100)% of count	3.1% of reading	Condensation Particle Counter and Microsphere CRMs
Particle Sizing	(0.3 to 5) μm	1.1% of reading	Microsphere CRMs

Electrical – Capacitance

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Capacitance Generate	(220 to 400) pF 10 Hz to 10 kHz	8.6 pF	Fluke 5522A/SC1100
	(0.4 to 1.1) nF 10 Hz to 10 kHz	9.3 pF	
	(1.1 to 3.3) nF 10 Hz to 3 kHz	12 pF	
	(3.3 to 11) nF 10 Hz to 3 kHz	14 pF	
	(11 to 33) nF 10 Hz to 1 kHz	29 pF	
	(33 to 110) nF 10 Hz to 1 kHz	72 pF	
	(110 to 330) nF 10 Hz to 1 kHz	0.22 nF	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Capacitance Generate	(0.33 to 1.1) μF (10 to 600) Hz	1.4 nF	Fluke 5522A/SC1100
	(1.1 to 3.3) μF (10 to 300) Hz	4.5 nF	
	(3.3 to 11) μF (10 to 150) Hz	10 nF	
	(11 to 33) μF (10 to 120) Hz	0.06 μF	
	(33 to 110) μF (10 to 80) Hz	0.19 μF	
	(110 to 330) μF (0 to 50) Hz	0.62 μF	
	(0.33 to 1.1) mF (0 to 20) Hz	1.9 μF	
	(1.1 to 3.3) mF (0 to 6) Hz	6.2 μF	
	(3.3 to 11) mF (0 to 2) Hz	19 μF	
	(11 to 33) mF (0 to 0.6) Hz	72 μF	
	(33 to 110) mF (0 to 0.2) Hz	0.36 mF	

Electrical – Current

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Current Source	(29 to 329) μA (10 to 20) Hz	49 nA	Fluke 5522A/SC1100
	(20 to 45) Hz	39 nA	
	45 Hz to 1 kHz	35 nA	
	(1 to 5) kHz	71 nA	
	(5 to 10) kHz	0.18 μA	
	(10 to 30) kHz	0.36 μA	
	(0.33 to 3.3) mA (10 to 20) Hz	0.63 μA	
	(20 to 45) Hz	0.44 μA	
	45 Hz to 1 kHz	0.37 μA	
	(1 to 5) kHz	0.67 μA	
	(5 to 10) kHz	1.5 μA	
	(10 to 30) kHz	3 μA	
	(3.3 to 33) mA (10 to 20) Hz	6.2 μA	
	(20 to 45) Hz	3.9 μA	
	45 Hz to 1 kHz	2.6 μA	
	(1 to 5) kHz	3.6 μA	
	(5 to 10) kHz	7.5 μA	
	(10 to 30) kHz	13 μA	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Current Source	(33 to 330) mA		Fluke 5522A/SC1100
	(10 to 20) Hz	0.06 mA	
	(20 to 45) Hz	0.04 mA	
	45 Hz to 1 kHz	0.03 mA	
	(1 to 5) kHz	0.06 mA	
(5 to 10) kHz	0.13 mA		
(10 to 30) kHz	0.26 mA		
(0.33 to 1.1) A	(10 to 45) Hz	0.54 mA	
	45 Hz to 1 kHz	0.21 mA	
	(1 to 5) kHz	2.3 mA	
	(5 to 10) kHz	10 mA	
(1.1 to 3) A	(45 to 100) Hz	1.6 mA	
	(0.1 to 1) kHz	0.59 mA	
	(1 to 5) kHz	5.9 mA	
	(5 to 10) kHz	25 mA	
(3 to 11) A	(45 to 100) Hz	3 mA	
	(0.1 to 1) kHz	3.9 mA	
	(1 to 5) kHz	72 mA	
(11 to 20.5) A	(45 to 100) Hz	14 mA	
	(0.1 to 1) kHz	17 mA	
	(1 to 5) kHz	0.26 A	
AC Current Measure	(2 to 200) μ A		Fluke 8508A
	(1 to 10) Hz	26 nA	
	10 Hz to 10 kHz	26 nA	
	(10 to 30) kHz	34 nA	
	(30 to 100) kHz	0.1 μ A	
(0.2 to 2) mA	(1 to 10) Hz	0.26 μ A	
	10 Hz to 10 kHz	0.26 μ A	
	(10 to 30) kHz	0.34 μ A	
	(30 to 100) kHz	1 μ A	
AC Current Measure	(2 to 20) mA		
	(1 to 10) Hz	2.6 μ A	
	10 Hz to 10 kHz	2.6 μ A	
	(10 to 30) kHz	3.4 μ A	
	(30 to 100) kHz	10 μ A	
(20 to 200) mA	(1 to 10) Hz	26 μ A	
	10 Hz to 10 kHz	26 μ A	
	(10 to 30) kHz	33 μ A	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Current Measure	(0.2 to 2) A	0.33 mA	Fluke 8508A
	10 Hz to 2 kHz	0.35 mA	
(2 to 10) kHz	0.82 mA		
(10 to 30) kHz			
(2 to 20) A	3.7 mA		
10 Hz to 2 kHz	7.1 mA		
(2 to 10) kHz			
DC Current Source	(0 to 330) μ A	20 nA	Fluke 5522A/SC1100
	(0.3 to 3.3) mA	0.07 nA	
	(3.3 to 33) mA	0.49 μ A	
	(33 to 330) mA	4.9 μ A	
	(0.33 to 1.1) A	52 μ A	
	(1.1 to 3) A	0.36 mA	
	(3 to 11) A	0.84 mA	
	(11 to 20.5) A	9.1 mA	
DC Current Measure	(0 to 200) μ A	0.42 nA	Fluke 8508A
	(0.2 to 2) mA	6.5 nA	
	(2 to 20) mA	67 nA	
	(20 to 200) mA	1.6 μ A	
	(0.2 to 2) A	51 μ A	
	(2 to 20) A	1.2 mA	

Electrical – Resistance

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance Source	(0 to 11) Ω	0.83 m Ω	Fluke 5522A/SC1100
	(11 to 33) Ω	1.4 m Ω	
	(33 to 110) Ω	1.8 m Ω	
	(110 to 330) Ω	4 m Ω	
	(0.33 to 1.1) k Ω	8.7 m Ω	
	(1.1 to 3.3) k Ω	39 m Ω	
	(3.3 to 11) k Ω	89 m Ω	
	(11 to 33) k Ω	0.39 Ω	
	(33 to 110) k Ω	0.89 Ω	
	(110 to 330) k Ω	4.3 Ω	
	(0.33 to 1.1) M Ω	9.7 Ω	
(1.1 to 3.3) M Ω	75 Ω		

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance Source	(3.3 to 11) M Ω	0.37 k Ω	Fluke 5522A/SC1100
	(11 to 33) M Ω	4.1 k Ω	
	(0.33 to 110) M Ω	15 k Ω	
	(110 to 330) M Ω	0.33 M Ω	
	(0.33 to 1.1) G Ω	4.2 M Ω	
Resistance Measure	(0 to 2) Ω	7.1 $\mu\Omega$	Fluke 8508A
	(2 to 20) Ω	33 $\mu\Omega$	
	(20 to 200) Ω	0.2 m Ω	
	(0.2 to 2) k Ω	2 m Ω	
	(2 to 20) k Ω	66 m Ω	
	(20 to 200) k Ω	0.2 Ω	
	(0.2 to 2) M Ω	2.8 Ω	
	(2 to 20) M Ω	0.13 k Ω	
	(20 to 200) M Ω	11 k Ω	
(0.2 to 2) G Ω	1.1 M Ω		

Electrical – Voltage

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Voltage Source	(1 to 33) mV	7 μV	Fluke 5522A/SC1100
	(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	14 μV	
	(10 to 45) Hz		
	45 Hz to 10 kHz		
	(10 to 20) kHz		
	(20 to 50) kHz		
	(50 to 100) kHz	45 μV	
	(100 to 500) kHz		
	(0.33 to 3.3) V	0.12 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	1.1 mV		

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Voltage Source	(3.3 to 33) V		Fluke 5522A/SC1100
	(10 to 45) Hz	1.3 mV	
	45 Hz to 10 kHz	0.87 mV	
	(10 to 20) kHz	1.1 mV	
	(20 to 50) kHz	1.4 mV	
	(50 to 100) kHz	3.6 mV	
	(33 to 330) V		
	45 Hz to 1 kHz	6.7 mV	
	(1 to 10) kHz	10 mV	
	(10 to 20) kHz	11 mV	
	(20 to 50) kHz	13 mV	
	50 kHz to 1 GHz	90 mV	
AC Voltage Measure	(330 to 1 020) V		Fluke 8508A
	45 Hz to 1 kHz	0.32 V	
	(1 to 5) kHz	0.31 V	
	(5 to 10) kHz	0.32 V	
	(2 to 200) mV		
	(1 to 10) Hz	18 μ V	
	(10 to 40) Hz	6.7 μ V	
	(40 to 100) Hz	6.3 μ V	
	(0.1 to 2) kHz	4.2 μ V	
	(2 to 10) kHz	6.2 μ V	
	(10 to 30) kHz	14 μ V	
	(30 to 100) kHz	35 μ V	
	(0.2 to 2) V		
	(1 to 10) Hz	0.15 mV	
	(10 to 40) Hz	42 μ V	
	(40 to 100) Hz	38 μ V	
	(0.1 to 2) kHz	34 μ V	
	(2 to 10) kHz	38 μ V	
	(10 to 30) kHz	83 mV	
	(30 to 100) kHz	0.31 mV	
	(100 to 300) kHz	2.7 mV	
	(0.3 to 1) MHz	22 mV	
	(2 to 20) V		
	(1 to 10) Hz	1.5 mV	
(10 to 40) Hz	0.42 mV		
(40 to 100) Hz	0.38 mV		
(0.1 to 2) kHz	0.34 mV		
(2 to 10) kHz	0.38 mV		
(10 to 30) kHz	0.83 mV		
(30 to 100) kHz	3.1 mV		
(100 to 300) kHz	27 mV		
(0.3 to 1) MHz	22 mV		

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Voltage Measure	(2 to 200) V (1 to 10) Hz (10 to 40 Hz) (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	15 mV 4.2 mV 3.8 mV 3.4 mV 3.8 mV 8.3 mV 31 mV 0.27 V 2.2 V	Fluke 8508A
	(200 to 1 050) V (1 to 10) Hz (10 to 40 Hz) 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.1 V 44 mV 41 mV 85 mV 0.32 V	
DC Voltage Source	(0 to 330) mV	1.3 μ V	Fluke 5522A/SC1100
	(0.33 to 3) V	0.2 mV	
	(3 to 30) V	0.05 mV	
	(30 to 300) V	0.6 mV	
	(300 to 1 020) V	3.2 mV	
DC Voltage Measure	(0 to 200) mV	0.1 μ V	Fluke 8508A
	(0.2 to 2) V	1 μ V	
	(2 to 20) V	10 μ V	
	(20 to 200) V	0.1 mV	
	(200 to 1 000) V	1.4 mV	
Thermocouple millivolt simulation Type B	(600 to 800) °C	0.34 °C	Fluke 5522A/SC1100
	(800 to 1 000) °C	0.26 °C	
	(1 000 to 1 550) °C	0.23 °C	
	(1 550 to 1 820) °C	0.26 °C	
Thermocouple millivolt simulation Type C	(0 to 150) °C	0.23 °C	Fluke 5522A/SC1100
	(150 to 650) °C	0.2 °C	
	(650 to 1 000) °C	0.24 °C	
	(1 000 to 1 800) °C	0.39 °C	
	(1 800 to 2 316) °C	0.65 °C	
Thermocouple millivolt simulation Type E	(-250 to -100) °C	0.39 °C	Fluke 5522A/SC1100
	(-100 to -25) °C	0.12 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Thermocouple millivolt simulation Type J	(-210 to -100) °C	0.21 °C	Fluke 5522A/SC1100
	(-100 to -30) °C	0.12 °C	
	(-30 to 150) °C	0.11 °C	
	(150 to 760) °C	0.13 °C	
	(760 to 1 000) °C	0.18 °C	
Thermocouple millivolt simulation 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 1 000) °C	0.2 °C	
	(1 000 to 1 372) °C	0.31 °C	
Thermocouple millivolt simulation Type L	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.2 °C	
	(800 to 900) °C	0.13 °C	
Thermocouple millivolt simulation 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	
Thermocouple millivolt simulation 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	
Thermocouple millivolt simulation Type S	(0 to 250) °C	0.36 °C	
	(250 to 400) °C	0.28 °C	
	(400 to 1 000) °C	0.29 °C	
	(1 000 to 1 767) °C	0.36 °C	
Thermocouple millivolt simulation 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	
Thermocouple millivolt simulation Type U	(-200 to 0) °C	0.43 °C	
	(0 to 600) °C	0.21 °C	

Mass – Pressure and Low Vacuum

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Pressure Gages and Transducers (gas)	(0 to 15) psi	0.001 psi	Mensor CPC6050 calibration system
	(>15 to 60) psi	0.002 psi	
	(>60 to 200) psi	0.006 psi	
	(>200 to 1 000) psi	0.021 psi	

Time and Frequency – Frequency/Period

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Frequency Generate	(0.01 to 120) Hz	20 mHz	Fluke 5522A/SC1100
	(120 to 1 200) Hz	0.2 Hz	
	(1.2 to 12) kHz	2 Hz	
	(12 to 120) kHz	20 Hz	
	(120 to 1 200) kHz	200 Hz	
	(1.2 to 2) MHz	2 kHz	

Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Voltage 50 Ω 1 MΩ	6.6 V	1.4 mV	Fluke 5522A/SC1100
	130 V	4.3 mV	
	Square Wave Source 50 Ω 1 MΩ	6.6 V _{pp}	
130 V _{pp}		8.6 mV	
Levelled Sine Wave 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (0.6 to 1.1) GHz	5 mV to 5.5 V	15 mV	
		17 mV	
		26 mV	
		31 mV	
Time Marker (50 Ω)	1 nS to 5 S	2 fS	
Wave Generator 10 Hz to 100 kHz 50 Ω (peak to peak) 1 MΩ (peak to peak)	1.8 mV to 2.5 V	0.12 mV _{pp}	
	1.8 mV to 55 V	0.12 mV _{pp}	
Edge Spec -Rise Time (50 Ω)	1 kHz to 10 MHz	0.4 pS	

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and remarks. 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%.

Approved by: 
R. Douglas Leonard
 Chief Technical Officer

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