

Scope of Accreditation For CAL TEC LABS, INC.

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In recognition of a successful assessment to ISO/IEC 17025:1999, accreditation is granted to **Cal Tec Labs, Inc.** to perform the following **Calibrations**:

Accreditation granted through: **April 16, 2008**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ^{2,7}	Remarks
Gage Blocks	0.005 in to 4 in	(2.51+3.3L) μin	Compared with Gage block comparator & Gage Blocks
Height Gages	0 in to 24 in	(85+12L) μin	Compared with Height Master
Outside Micrometers ¹	0 in to 48 in	(19+15L) μin	Compared with Gage Blocks, Length Standards
Inside Micrometers ¹	0.5 in to 40 in	(16+14L) μin	Compared with Length Machine & Length Standard
Depth Micrometers ¹	0 in to 12 in	(95+9L) μin	Compared with Depth Master, Gage Blocks
Dial Indicators ^{1,6}	0 in to 2in	61μin	Compared with indicator Calibrator
Length Standards	1 in to 48 in	(41+15L) μin	Compared with Length Std. & Length Std. Calibrator
Calipers ¹	0 in to 24 in	(20+14L) μin	Compared with Cal Master
Thread Plugs ⁶	0 in to 2 in 80TPI to 41/2TPI	42 μin	Compared with SuperMic. Laser attachment & Thread wires
Pin Gages ^{1,6}	0.012 in to 2 in	22 μin	Compared with Laser Micrometer
Plain Plug Gages ^{1,6}	0.012 in to 2 in	22 μin	Compared with Laser Micrometer
Linear Measurement ⁶	0 in to 40i in	22 μin	Compared with Linear Laser System
Surface Roughness Gage	μin/μm	2.3 μin	Compared with Precision Roughness Specimen

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-)^{2,7}	Remarks
Torque ^{1,3}	0 in oz to 100 in oz	1.52 in oz	Compared with Torque Calibrator
Torque ^{1,3}	0 in lb to 100 in lb	2.9 in lb	Compared with Torque Calibrator
Torque ^{1,3}	0 ft lb to 600 ft lb	2.27 ft lb	Compared with Torque Calibrator
Gas Flow Meters ^{1,3,6}	0 SCCM to 20 SCCM	.72 SCCM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	20 SCCM to 100 SCCM	1.45 SCCM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	100 SCCM to 500 SCCM	5.00 SCCM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	0 SLM to 20 SLM	0.023 SLM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	2 SLM to 10 SLM	0.46 SLM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	10 SLM to 50 SLM	1.06 SLM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	50 SLM to 400 SLM	4.14 SLM	Compared with MKS Mass Flow System
Pressure ^{1,3,6}	0 PSI to 300 PSI	1.37 PSI	Compared with Portable Pressure Calibrator
Pressure ^{1,3,6}	100 PSI to 10 000 PSI	0.69 rdg.	Compared with Deadweight pressure system
Lab Balances ^{1,4}	0 g to 5 000g	ASTM E617 Class II Weights	Calibration Methods per NIST Handbook 44 and Cal Tec Labs, Inc. calibration procedures
Bench scales, Floor scales	0 lb to 200 lb	NIST 105 Class F Weights	Calibration Methods per NIST Handbook 44 and Cal Tec Labs, Inc. calibration procedures
Temperature Simulation TC Type E ^{1,6}	-250 °C to + 1 000 °C	1.79 °C	Comparison to Multifunction calibrator
Temperature Simulation TC Type J ^{1,6}	-210 °C to + 1 200 °C	1.74 °C	Comparison to Multifunction calibrator
Temperature Simulation TC Type K ^{1,6}	-250 °C to + 1 372 °C	1.91 °C	Comparison to Multifunction calibrator
Temperature Simulation TC Type T ^{1,6}	-250 °C to + 400 °C	1.53 °C	Comparison to Multifunction calibrator
Temperature Source ^{1,6}	0 °C to +500 °C	0.88 °C	Comparison to Dry Block Calibrator, Fluke Process Calibrator & RTD

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-)^{2,7}	Remarks
Temperature Measure ^{1,6}	-200 °C to +500 °C	0.88 °C	Comparison to Dry Block Calibrator, Fluke Process Calibrator & RTD
Oscilloscope Functions ^{1,3,6} Bandwidth	50 kHz to 600 MHz	1.9 % of rdg.	Reference set at 50 KHz Comparison performed with Multifunction calibrator
Risetime	5 ns to 100ms	2.9 % applied	Comparison performed with Multifunction calibrator
Timing	10 ns to 5s	1.6 % applied	Comparison performed with multifunction calibrator.
DC Voltage-Source ^{1,3,5}	0 mV to 320 mV 320 mV to 3.2 V 3.2 V to 32 V 32 V to 320 V 320 V to 1000 V	34.8 μV + 4.16 μV/V 193 μV + 41.6 μV/V 209 μV + 416 μV/V 20.9 mV + 4.48 mV/V 69 mV + 19.95 mV/V	Comparison to multifunction calibrator
DC Voltage –Measure ^{1,3,5}	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 000 V	7 μV + 1 μV/V 4 μV + 0.6 μV/V 3 μV + 0.1 μV/V 6 μV + 0.6 μV/V 6 μV + 0.6 μV/V	Comparison to long scale DMM
DC Current- Source ^{1,3,5}	0 μA to 320 μA 320 μA to 3.2 mA 3.2 mA to 32.0 mA 32 mA to 320 mA .320 A to 3.2 A 3.2 A to 10.5 A 10.5 A to 20 A 20 A to 750 A	292 nA + 11 nA/A 5.3 μA + 83 nA/A 45 μA+ 900 nA/A 513 μA + 9.6 μA/A 22 mA + 118 μA/A 60 mA + 940 μA/A 111mA + 4.5 mA/A	Comparison to multifunction calibrator
		1.26 % applied V	Wavetek 50 turn coil

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ^{2,7}	Remarks
DC Current-Measure ^{1,3,5}	0 μ A to 100 μ A 100 μ A to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A	26 μ A + 2 μ A/A 26 μ A+2 μ A/A 25 μ A+2 μ A/A 50 μ A + 5 μ A/A 150 μ A + 10 μ A/A	Comparison to long scale DMM
Resistance-Source ^{1,3,5}	0 Ω to 40 Ω 40 Ω to 4 k Ω 4 k Ω to 40 k Ω 40 k Ω to 400 k Ω 400 k Ω to 4 M Ω 4 M Ω to 40 M Ω 40 M Ω to 400 M Ω	62 m Ω + 500 $\mu\Omega/\Omega$ 99 m Ω + 150 $\mu\Omega/\Omega$ 802 m Ω + 150 $\mu\Omega/\Omega$ 59 Ω + 180 $\mu\Omega/\Omega$ 116 Ω + 200 $\mu\Omega/\Omega$ 24 k Ω +500 $\mu\Omega/\Omega$ 96 k Ω +600 $\mu\Omega/\Omega$	Comparison to multifunction calibrator
Resistance - Measure	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 k Ω 1 k Ω to 10 k Ω 10 k Ω to 100 k Ω 100 k Ω to 1 M Ω 1 M Ω to 10 M Ω 10 M Ω to 100 M Ω 100 M Ω to 1 G Ω	13 $\mu\Omega$ + 2 $\mu\Omega/\Omega$ 9 $\mu\Omega$ + 3 $\mu\Omega/\Omega$ 6 m Ω + 0.3 m $\Omega/k\Omega$ 6 m Ω + 0.8 m $\Omega/k\Omega$ 6 m Ω + 0.8 m $\Omega/k\Omega$ 10 Ω + 1.2 $\Omega/M\Omega$ 4 Ω + 20 $\Omega/M\Omega$ 45 Ω + 200 $\Omega/M\Omega$ 45 Ω + 200 $\Omega/M\Omega$	Comparison to long scale DMM
AC Voltage – Source ^{1,3,5} 0 V to 10mV	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	20.9 μ V + 384 μ V/V 20.9 μ V + 512 μ V/V 7.8 μ V + 960 μ V/V 11.9 μ V + 1.92 mV/V 20.6 μ V + 512 mV/V	Comparison to multifunction calibrator
10mV to 32mV	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	13.1 μ V + 96 μ V/V 13.1 μ V + 128 μ V/V 9.7 μ V + 240 μ V/V 28.9 μ V + 480 μ V/V 64 μ V + 1.6 mV/V	Comparison to multifunction calibrator




Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-)^{2,7}	Remarks
32mv to 320mV	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	143.4 μV + 19.2 μV/V 143.4 μV + 25.6 μV/V 192.3 μV + 48 μV/V 288.9 μV + 96 μV/V 640.1 μV + 256 μV/V	Comparison to multifunction calibrator
320mV to 3.2V	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	64.7mV+192μV/V 64.7 mV + 256 μV/V 11.3 mV + 480 μV/V 22.4 mV + 960 μV/V 12.8 mV + 2.56 μV/V	Comparison to multifunction calibrator
3.2V to 32V	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	14.3 mV + 1.96 mV/V 20.3 mV + 2.56 mV/V 25.6 mV + 4.8 mV/V 48.1 mV + 9.6 mV/V 112.1 mV + 32 mV/V	Comparison to multifunction calibrator
32V to 105V	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	47.1 mV + 6.3 mV/V 66.5 mV + 8.4 mV/V 84.1 mV + 15.8 mV/V 158.2 mV + 31.5 mV/V 367.6 mV + 105 mV/V	Comparison to multifunction calibrator
105V to 320V	40 Hz to 1 kHz 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	666.2 mV + 19.2 mV/V 666.2 mV + 19.2 mV/V 279 mV + 32 mV/V 443.4 mV + 48 mV/V 492.6 mV + 64 mV/V	Comparison to multifunction calibrator
320V to 800V	40 Hz to 1 kHz 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	2.0 V + 63 mV/V 2.13 V + 63 mV/V 3.0 V + 105 mV/V 960 mV + 158 mV/V 3.18 V + 210 mV/V	Comparison to multifunction calibrator

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ^{2,7}	Remarks
800V to 1050V	40 Hz to 1 kHz 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz	2.4 V + 126 mV/V 2.5 V + 126 mV/V 1.56 V + 210 mV/V 2.0 V + 315 mV/V	Comparison to multifunction calibrator
AC Voltage – Measure ^{1,3,5} 0V to 100mV	1 Hz to 10 Hz 10 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	121 μV + 70 μV/V 121 μV + 20 μV/V 101 μV + 20 μV/V 101 μV + 10 mV/V 101 μV + 20 mV/V 301 μV + 40 mV/V 701 μV + 100 mV/V	Comparison to long scale DMM
1V to 100V	1 Hz to 10 Hz 10 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	100 μV + 60 μV/V 100 μV + 10 μV/V 80 μV + 25 μV/V 60 μV + 10 mV/V 80 μV + 10 mV/V 200 μV + 20 mV/V 500 μV + 100 mV/V 0.78 % + 0.1 % applied V 1.41 % + 1.41 % applied V	Comparison to long scale DMM
100V to 1000V	1 Hz to 10 Hz 10 Hz to 40 Hz 40Hz to 10kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	100 μV + 70 μV/V 100 μV + 20 μV/V 80 μV + 20 μV/V 200 μV + 40 mV/V 500 μV + 200 mV/V	Comparison to long scale DMM
AC Current – Source ^{1,3,5} 0A to 32μA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	66 μA + 900 nA/A 66 μA + 1.9 μA/A 25 μA + 6 μA/A 35 μA + 9 μA/A	Comparison to multifunction calibrator

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ^{2,7}	Remarks
32µA to 320µA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	66 µA + 300 nA/A 66 µA + 600 nA/A 25 µA + 2 µA/A 35 µA + 3 µA/A	Comparison to multifunction calibrator
320µA to 32mA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	66 µA + 3.2 µA/A 66 µA + 6.4 µA/A 23 µA + 12.8 µA/A 34 µA + 9.6 µA/A	Comparison to multifunction calibrator
32mA to 320mA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	696 µA + 32 µA/A 721 µA + 48 µA/A 650 µA + 64 µA/A 830 µA + 96 µA/A	Comparison to multifunction calibrator
320mA to 3.2A	10 Hz to 3 kHz 3 kHz to 10 kHz	7.3 mA + 480 µA/A 8.2 mA + 2.56 mA/A	Comparison to multifunction calibrator
3.2A to 10.5A	10 Hz to 3 kHz 3 kHz to 10 kHz	212 mA + 3 mA/A 64 mA + 10 mA/A	Comparison to multifunction calibrator
10.5A to 20A	10 Hz to 3 kHz 3 kHz to 10 kHz	406 mA + 6.9 mA/A 70 mA + 23 mA/A	Comparison to multifunction calibrator
20A to 750A	10 Hz to 30 kHz	1.15 % applied	Comparison to multifunction calibrator and 50 turn coil
AC Current – Measure ^{1,3,5}			
0µA to 100µA	10 Hz to 5 kHz	214 µA + 100 µA/A	Comparison to long scale DMM
100µA to 1mA	10 Hz to 5 kHz	214 µA + 100 µA/A	
1mA to 10mA	10 Hz to 5 kHz	200 µA + 100 µA/A	
10mA to 100mA	10 Hz to 5 kHz	200 µA + 100 µA/A	
100mA to 1A	10Hz to 1kHz	500 µA + 200 µA/A	
Frequency – Source ^{1,6}	10 Hz to 300 MHz	1.33 % applied	Comparison to Multifunction calibrator
Frequency - Source ^{1,6}	100 MHz to 3 200 MHz	1.52 % applied	Comparison to Frequency Generator
Frequency – Measure	10 Hz to 3 200 MHz	1.78 % rdg.	Comparison to Frequency Counter

Notes:

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
- 2) Best uncertainties, expressed as a percentage of the applied test load, represent expanded uncertainties at approximately the 95% confidence level using a coverage factor of $k=2$.
- 3) When ranges overlap the uncertainty for the overlapping specifications will be the lower of the 2 uncertainties
- 4) The uncertainty associated when calibrating a balance/scale is dependant on local conditions, such as the resolution of the unit being calibrated and the environment, which the balance/scale is operating in. Therefore, a statement of the best measurement capability can be misleading. The class of the weights used by the laboratory for each range is identified in the BMC column to clarify the measurement being made by the laboratory.
- 5) Uncertainties stated as fractional part of reading plus floor.
- 6) Uncertainty value applies to entire range identified for these measurements
- 7) L = length in inches, D = diameter in inches

Approved by:  Date: April 16, 2005
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Revised: 5/18/04
Re-Issued: 4/16/05