



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

<p>Global Calibration Laboratory at Fluke Biomedical 2 Science Road Glenwood, Illinois 60425 Mr. Richard Abbott Phone: 440-542-3644 Fax: 440-542-3682 E-mail: richard.abbott@flukebiomedical.com URL: www.globalcal.com</p>	<p>Fields of Calibration Electromagnetics - DC/Low Frequency Time and Frequency Thermodynamic</p> <p>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (20/A01)</p>
---	--

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Note 3,5}	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
AC RESISTORS (20/E02)				
AC Current – Measuring Equipment	> 0 μ A to 220 μ A	20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz	0.017 % + 9.8 nA 0.011 % + 7.8 nA 0.027 % + 12 nA	
	0.22 mA to 2.2 mA	20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz	0.016 % + 36 nA 0.011 % + 32 nA 0.019 % + 0.10 μ A	
	2.2 mA to 22 mA	20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz	0.016 % + 0.39 μ A 0.011 % + 0.32 μ A 0.019 % + 0.54 μ A	
	22 mA to 220 mA	20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz	0.016 % + 4.3 μ A 0.011 % + 2.5 μ A 0.019 % + 3.1 μ A	
	0.22 A to 2.2 A	20 Hz to 1 kHz 1 kHz to 5 kHz	0.025 % + 71 μ A 0.039 % + 81 μ A	

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Note 3,5}	Remarks
AC Current -- Measure	2.2 A to 11 A	40 Hz to 1 kHz 1 kHz to 5 kHz	0.036 % + 0.17 mA 0.074 % + 0.31 mA	Fluke 5720A / 5725A
	0.1 A to 15 A	40 Hz to 1 kHz	0.35 % + 70 mA	Current Source Characterized with Fluke 8846A and Shunt
	330 µA to 3.3 mA	45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.12 % + 0.60 µA 0.23 % + 0.62 µA 0.58 % + 0.67 µA 1.2% + 0.90 µA	Fluke 5520A
	Up to 100 µA	20 Hz to 5 kHz 5 kHz to 10 kHz	0.017 % + 69 nA 0.40 % + 0.81 µA	Fluke 8846A
	> 100 µA to 1 mA	20 Hz to 5 kHz 5 kHz to 10 kHz	0.12 % + 0.46 µA 0.23 % + 2.9 µA	
	> 1 mA to 10 mA	20 Hz to 5 kHz 5 kHz to 10 kHz	0.17 % + 6.9 µA 0.40 % + 81 µA	
	> 10 mA to 100 mA	20 Hz to 5 kHz 5 kHz to 10 kHz	0.12 % + 46 µA 0.23 % + 0.29 mA	
	> 100 mA to 400 mA	20 Hz to 1 kHz 1 kHz to 10 kHz	0.12 % + 0.47 mA 0.23 % + 3.2 mA	
> 400 mA to 1 A	20 Hz to 5 kHz 5 kHz to 10 kHz	0.12 % + 0.47 mA 0.40 % + 8.1 mA		

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Note 3,5}	Remarks
	> 1 A to 3 A	20 Hz to 5 kHz 5 kHz to 10 kHz	0.17 % + 2.1 mA 0.40 % + 24 mA	
	> 3 A to 10 A	20 Hz to 5 kHz 5 kHz to 10 kHz	0.17 % + 6.9 mA 0.40 % + 81 mA	
	> 10 A to 25 A	50 Hz to 60 Hz	0.27 A	Fluke 8846A w/Shunt

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3,5}	Remarks	
DC RESISTANCE and CURRENT (20/E05)				
DC Resistance – Measuring Equipment	0 Ω	86 μΩ	Fluke 5720A	
	1 Ω	0.16 mΩ		
	10 Ω	0.29 mΩ		
	100 Ω	1.3 mΩ		
	1 kΩ	8.5 mΩ		
	10 kΩ	88 mΩ		
	100 kΩ	1.1 Ω		
	1 MΩ	19 Ω		
	10 MΩ	0.38 kΩ		
	100 MΩ	12 kΩ		
	0 Ω to 110 Ω	0.012 % +2.3 mΩ		IET Labs 1433-02
	> 0.11 kΩ to 1.111 kΩ	0.012 % +2.4 mΩ		
	0 Ω to 1 MΩ	1.2 % + 58 mΩ		IET Labs HPRS
1 kΩ to 100 kΩ	0.035 % + 23 mΩ	IET Labs HRRS		
> 100 kΩ to 10 MΩ	0.035 %			
> 10 MΩ to 100 MΩ	0.12 %			

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3,5}	Remarks
DC Resistance -- Measure	> 100 MΩ to 1GΩ	0.23 %	Shunt Resistor
	0.05 Ω	0.14 mΩ	
	0.10 Ω	0.30 mΩ	
	0.15 Ω	0.50 mΩ	Fluke 5520 and Agilent 3458A
	45 mΩ to 165 mΩ	0.008 % + 0.24 mΩ	
	0.05 Ω	87 μΩ	Fluke 5520A with Fluke 8846A
	0.10 Ω	0.27 mΩ	
	0.15 Ω	0.47 mΩ	
	0 Ω to 100 Ω	0.012 % + 2.3 mΩ	Keithley 2700
	> 0.1 kΩ to 1 kΩ	0.012 % + 7.0 mΩ	
	> 1 kΩ to 10 kΩ	0.012 % + 70 mΩ	
	> 10 kΩ to 100 kΩ	0.012 % + 1.2 Ω	
	> 0.1 MΩ to 1 MΩ	0.012 % + 12 Ω	
	> 1 MΩ to 10 MΩ	0.046 % + 0.12 kΩ	
	> 10 MΩ to 100 MΩ	0.23 % +3.5 kΩ	
0 Ω to 10 Ω	0.012 % + 3.5 mΩ	Fluke 8846A	
> 10 Ω to 100 Ω	0.012 % + 4.6 mΩ		
> 0.1 kΩ to 1 kΩ	0.012 % + 12 mΩ		
> 1 kΩ to 10 kΩ	0.012 % + 0.12 Ω		
> 10 kΩ to 100 kΩ	0.012 % + 1.2 Ω		
> 0.1 MΩ to 1 MΩ	0.012 % + 12 Ω		
> 1 MΩ to 10 MΩ	0.046 % + 0.12 kΩ		
> 10 MΩ to 100 MΩ	0.92 % + 1.2 kΩ		

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3,5}	Remarks
DC Current – Measure	0 μ A to 100 μ A	0.058 % + 29 nA	Fluke 8846A
	> 100 μ A to 1 mA	0.058 % + 58 nA	
	> 1 mA to 10 mA	0.058 % + 2.3 μ A	
	> 10 mA to 100 mA	0.058 % + 5.8 μ A	
	> 100 mA to 400 mA	0.058 % + 40 μ A	
	> 400 mA to 1 A	0.058 % + 0.23 mA	
	> 1 A to 3 A	0.12 % + 0.69 mA	
> 3A to 10 A	0.17 % + 0.93 mA		
DC Current – Generate	0 μ A to 220 μ A	39 μ A/A + 6.6 nA	Fluke 5720A Fluke 5702A/5725A
	> 220 μ A to 2.2 mA	31 μ A/A + 7.6 nA	
	> 2.2 mA to 22 mA	31 μ A/A + 0.37 μ A	
	> 22 mA to 100 mA	39 μ A/A + 0.84 μ A	
	> 100 mA to 220 mA	46 μ A/A + 0.84 μ A	
	> 220 mA to 1 A	62 μ A/A + 34 μ A	
	> 1 A to 2.2 A	0.01 % + 34 μ A	
> 2.2 A to 11 A	0.028 % + 0.38 mA		
DC VOLTAGE (20/E06)			
DC Voltage – Measuring Equipment	0 V to 0.22 V	7.0 μ V/V + 0.70 μ V	Fluke 5720A
	> 0.22 V to 2.2 V	4.7 μ V/V + 1.0 μ V	
	> 2.2 V to 11 V	3.1 μ V/V + 6.7 μ V	
	> 11 V to 22 V	3.1 μ V/V + 58 μ V	
	> 22 V to 220 V	4.7 μ V/V + 0.12 mV	
	>220 V to 1100 V	6.2 μ V/V + 0.82 mV	
DC Voltage Measure	0 V to 0.1 V	0.0043 % + 4.1 μ V	Fluke 8846A Keithley 2700
	> 0.1 V to 1 V	0.0029 % + 8.1 μ V	
	> 1 V to 10 V	0.0028 % + 58 μ V	
	> 10 V to 100 V	0.0044 % + 0.7 mV	
	> 100 V to 1000 V	0.0047 % + 7.0 mV	
	0 V to 0.1 V	0.0035 % + 4.1 μ V	
> 0.1 V to 1 V	0.0035 % + 8.1 μ V		

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3,5}	Remarks
	> 1 V to 10 V	0.0035 % + 58 μ V	
	> 10 V to 100 V	0.0052 % + 1.0 mV	
	> 100 V to 500 V	0.0058 % + 10 mV	
	> 500 V to 1000 V	0.0069 % + 10 mV	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Note 3,5}	Remarks
LF AC VOLTAGE (20/E09)				
AC Voltage Measuring Equipment	22 mV to 220 mV	40 Hz to 20 kHz	78 μ V/V + 6.3 μ V	Fluke 5720A
		> 20 kHz to 50 kHz	0.019 % + 6.2 μ V	
		> 50 kHz to 100 kHz	0.047 % + 16 μ V	
		> 100 kHz to 300 kHz	0.085 % + 19 μ V	
	220 mV to 2.2 V	40 Hz to 20 kHz	40 μ V/V + 11 μ V	
		> 20 kHz to 50 kHz	70 μ V/V + 12 μ V	
		> 50 kHz to 100 kHz	0.010 % + 32 μ V	
		> 100 kHz to 300 kHz	0.039 % + 88 μ V	
	2.2 V to 22 V	40 Hz to 20 kHz	40 μ V/V + 0.12 mV	
		> 20 kHz to 50 kHz	70 μ V/V + 0.21 mV	
		> 50 kHz to 100 kHz	93 μ V/V + 0.37 mV	
		> 100 kHz to 300 kHz	0.025 % + 0.81 mV	
	22 V to 220 V	40 Hz to 20 kHz	50 μ V/V + 0.99 mV	
		> 20 kHz to 50 kHz	78 μ V/V + 2.4 mV	
		> 50 kHz to 100 kHz	0.014 % + 4.0 mV	
		> 100 kHz to 300 kHz	0.085 % + 16 mV	
220 V to 1000 V	40 Hz to 1 kHz	70 μ V/V + 6.1 mV	Fluke 5720A/5725A	
	> 1 kHz to 20 kHz	0.13 % + 9.0 mV		

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Note 3,5}	Remarks
AC Voltage – measure	220 V to 750 V	> 20 kHz to 30 kHz	0.47 % + 12 mV	Fluke 8846A
		30 kHz to 50 kHz	0.047 % + 8.6 mV	
		> 50 kHz to 100 kHz	0.18 % + 35 mV	
	5 mV to 100 mV	40 Hz to 20 kHz	0.069 % + 46 μV	
		> 20 kHz to 50 kHz	0.14 % + 58 μV	
		> 50 kHz to 100 kHz	0.69 % + 92 μV	
		> 100 kHz to 300 kHz	4.6 % + 0.58 mV	
	0.1 V to 1 V	40 Hz to 20 kHz	0.069 % + 0.35 mV	
		> 20 kHz to 50 kHz	0.14 % + 0.58 mV	
		> 50 kHz to 100 kHz	0.69 % + 0.92 mV	
> 100 kHz to 300 kHz		4.6 % + 5.8 mV		
1 V to 10 V	40 Hz to 20 kHz	0.069 % + 3.5 mV		
	> 20 kHz to 50 kHz	0.14 % + 5.8 mV		
	> 50 kHz to 100 kHz	0.69 % + 9.2 mV		
	> 100 kHz to 300 kHz	4.6 % + 58 mV		
10 V to 100 V	40 Hz to 20 kHz	0.069 % + 35 mV		
	> 20 kHz to 50 kHz	0.14 % + 58 mV		
	> 50 kHz to 100 kHz	0.69 % + 92 mV		
	> 100 kHz to 300 kHz	4.6 % + 0.58 V		
100 V to 1000 V	40 Hz to 20 kHz	0.069 % + 0.26 V		
	> 20 kHz to 30 kHz	0.14 % + 0.43 V		

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



**National Voluntary
Laboratory Accreditation Program**



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Note: The parameters listed in this scope of accreditation are for the calibration of electrical analyzers used in the biomedical field and do not apply to other devices.

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3,5}	Remarks
LF POWER/ENERGY (20/E12)			
LF Energy -- Measure	0.1 J to 400 J	0.28 % + 0.044 J	Agilent 3458A, Reference Resistor, Reference Divider
LF Energy -- Generate	0.1 J to 400 J	0.28 % + 0.14 J	Impulse 7000 "Gold Std"
TIME & FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Frequency	1 Hz to 10 Hz 10 Hz to 100 kHz	0.027 % 0.011 %	Keithley 2700
THERMODYNAMIC			
PRESSURE (20/T05)			
Pneumatic Gauge Pressure -- Measure	0 psi to 10 psi	0.0032 psi	Heise HQS-2
Pneumatic Gauge Pressure - Source	> -15 psi to -2 psi > -2 psi to < -1 psi > -1 psi to 1 psi > 0 psi to 2 psi > 1 psi to 2 psi > 2 psi to 10 psi > 10 psi to 15 psi > 15 psi to 50 psi > 50 psi to 75 psi > 75 psi to 100 psi > 100 psi to 150 psi	0.0065 psi 0.00070 psi 0.00064 psi 0.00070 psi 0.00070 psi 0.0013 psi 0.0026 psi 0.0067 psi 0.011 psi 0.013 psi 0.018 psi	Mensor APC 600
END			

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200566-0

Notes

Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory’s customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory’s scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

Note 3a: The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer’s device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

Note 3b: As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

Note 3c: As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory’s customers under *normal conditions*. However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory’s scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory’s scope of accreditation apply. These requirements are set out in Annex A.5. of NIST Handbook 150, Procedures and General Requirements.

Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

2018-11-30 through 2019-09-30

Effective dates

For the National Voluntary Laboratory Accreditation Program