United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 201065-0

SET Y GAD SAS METROLOGY LABORATORY

Bogota
Colombia

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Calibration Laboratories

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 Communique dated January 2009).

2023-12-18 through 2024-12-31

Effective Dates

For the National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 201065-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

SET Y GAD SAS METROLOGY LABORATORY	**Fields of Calibration**
CARRERA 48 # 101A - 69 Bogotá, Colombia Mr. Steven Mesa Phone: 57 1 6019156316 E-mail: steven.mesa@setgad.com	Electromagnetics - DC/Low Frequency Time and Frequency Mechanical Electromagnetics – RF/Microwave Thermodynamic

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
AC RESISTANCE and CURRENT (20/E02)				
AC Current Source	5 mA to 10.0 mA	60 Hz	0.018 mA	Keithley 6221 & Fluke 8846A
	> 10.0 mA to 30.0 mA	60 Hz	0.092 mA	
	33 µA to < 330 µA	10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.16 % + 78 nA 0.097 % + 78 nA 0.23 % + 0.12 µA 0.62 % + 0.16 µA 1.2 % + 0.31 µA	Fluke 5522A
	0.33 mA to < 3.3 mA	10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.16 % + 0.12 µA 0.078 % + 0.12 µA 0.16 % + 0.16 µA 0.39 % + 0.23 µA 0.78 % + 0.47 µA	
	3.3 mA to < 33 mA	10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.14 % + 1.6 µA 0.031 % + 1.6 µA 0.062 % + 1.6 µA 0.16 % + 2.3 µA 0.31 % + 3.1 µA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
	33 mA to < 330 mA	10 Hz to 45 Hz	0.14 % + 16 µA	
		45 Hz to 1 kHz	0.031 % + 16 µA	
		1 kHz to 5 kHz	0.078 % + 39 µA	
		5 kHz to 10 kHz	0.16 % + 78 µA	
		10 kHz to 30 kHz	0.31 % + 0.16 mA	
	0.33 A to < 1.1 A	10 Hz to 45 Hz	0.14 % + 78 µA	
		45 Hz to 1 kHz	0.039 % + 78 µA	
		1 kHz to 5 kHz	0.47 % + 0.78 mA	
		5 kHz to 10 kHz	1.9 % + 3.9 mA	
	1.1 A to < 3 A	10 Hz to 45 Hz	0.14 % + 78 µA	
		45 Hz to 1 kHz	0.047 % + 78 µA	
		1 kHz to 5 kHz	0.47 % + 0.78 mA	
		5 kHz to 10 kHz	1.9 % + 3.9 mA	
	3 A to < 11 A	45 Hz to 100 Hz	0.047 % + 1.6 mA	
		100 Hz to 1 kHz	0.078 % + 1.6 mA	
		1 kHz to 5 kHz	2.3 % + 1.6 mA	
	11 A to 20.5 A	45 Hz to 100 Hz	0.093 % + 3.9 mA	
		100 Hz to 1 kHz	0.12 % + 3.9 mA	
		1 kHz to 5 kHz	2.3 % + 3.9 mA	
	9 µA to < 220 µA	10 Hz to 20 Hz	0.023 % + 16 nA	Fluke 5730A
		20 Hz to 40 Hz	0.016 % + 9.3 nA	
		40 Hz to 1 kHz	0.0093 % + 7.8 nA	
		1 kHz to 5 kHz	0.027 % + 12 nA	
		5 kHz to 10 kHz	0.10 % + 62 nA	
	0.22 mA to < 2.2 mA	10 Hz to 20 Hz	0.023 % + 39 nA	
		20 Hz to 40 Hz	0.016 % + 31 nA	
		40 Hz to 1 kHz	0.0093 % + 31 nA	
		1 kHz to 5 kHz	0.019 % + 0.10 µA	
		5 kHz to 10 kHz	0.10 % + 0.62 µA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
	2.2 mA to < 22 mA	10 Hz to 20 Hz	0.023 % + 0.39 µA	
		20 Hz to 40 Hz	0.016 % + 0.31 µA	
		40 Hz to 1 kHz	0.0093 % + 0.31 µA	
		1 kHz to 5 kHz	0.019 % + 0.54 µA	
		5 kHz to 10 kHz	0.10 % + 4.7 µA	
	22 mA to < 220 mA	10 Hz to 20 Hz	0.023 % + 3.9 µA	
		20 Hz to 40 Hz	0.016 % + 3.1 µA	
		40 Hz to 1 kHz	0.0093 % + 2.3 µA	
		1 kHz to 5 kHz	0.019 % + 3.1 µA	
		5 kHz to 10 kHz	0.10 % + 9.3 µA	
	0.22 A to 2.2 A	20 Hz to 1 kHz	0.023 % + 31 µA	
		1 kHz to 5 kHz	0.039 % + 78 µA	
		5 kHz to 10 kHz	0.062 % + 0.16 mA	
	2.2 A to 11 A	40 Hz to 1 kHz	0.036 % + 0.13 mA	Fluke 5730A/5725A
		1 kHz to 5 kHz	0.074 % + 0.29 mA	
		5 kHz to 10 kHz	0.28 % + 0.58 mA	
	0.22 A to < 2.0 A	40 Hz to 1 kHz	0.0085 % + 47 µA	Fluke 5730A/52120A
		1 kHz to 5 kHz	0.040 % + 78 µA	
		5 kHz to 10 kHz	1.6 % + 62 mA	
	2.0 A to < 20 A	40 Hz to 1 kHz	0.0085 % + 0.47 mA	
		1 kHz to 5 kHz	0.040 % + 0.78 mA	
		5 kHz to 10 kHz	6.6 % + 93 mA	
	20 A to 120 A	40 Hz to 1 kHz	0.0085 % + 2.8 mA	
		1 kHz to 5 kHz	0.040 % + 4.7 mA	
		5 kHz to 10 kHz	3.1 % + 0.70 A	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
Closed Clamp Non-Toroidal	0.33 mA to < 3.3 mA	45 Hz to 65 Hz	0.39 % + 25 µA	Fluke 5730A/5522A and 5500A Coil
		65 Hz to 440 Hz	0.70 % + 26 µA	
	3.3 mA to < 33 mA	45 Hz to 65 Hz	0.39 % + 38 µA	
		65 Hz to 440 Hz	0.70 % + 49 µA	
	33 mA to < 330 mA	45 Hz to 65 Hz	0.39 % + 0.18 mA	
		65 Hz to 440 Hz	0.70 % + 0.29 mA	
	0.33 A to < 1.1 A	45 Hz to 65 Hz	0.30 % + 0.20 A	
		65 Hz to 440 Hz	0.54 % + 0.20 A	
	1.1 A to < 3.0 A	45 Hz to 65 Hz	0.28 % + 0.20 A	
		65 Hz to 440 Hz	0.49 % + 0.20 A	
	3.0 A to < 11 A	45 Hz to 65 Hz	0.32 % + 83 mA	
		65 Hz to 440 Hz	0.57 % + 93 mA	
	11 A to < 20.0 A	45 Hz to 65 Hz	0.20 % + 0.12 A	
		65 Hz to 440 Hz	0.35 % + 0.16 A	
	20.0 A to < 150 A	45 Hz to 65 Hz	0.0068 % + 0.26 A	
		65 Hz to 440 Hz	0.013 % + 0.31 A	
	150 A to 1025 A	45 Hz to 65 Hz	0.0073 % + 0.95 A	
		65 Hz to 440 Hz	0.013 % + 1.4 A	
	0 A to 6000 A	10 Hz to 1 kHz	0.54 % + 0.87 A	Fluke 52120A/COIL 5730A/52120A and 6KA
		1 kHz to 3 Hz	0.62 % + 1.1 A	
	0 A to 1250 A	3 kHz to 6 kHz	1.2 % + 1.1 A	
	0 A to 650 A	6 kHz to 10 kHz	3.9 % + 0.60 A	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
Current Clamp Toroidal	0.33 mA to < 3.3 mA	45 Hz to 65 Hz 65 Hz to 440 Hz	0.20 % + 3.1 µA 0.55 % + 4.4 µA	Fluke 5730A/5522A and 5500A Coil
	3.3 mA to < 33 mA	45 Hz to 65 Hz 65 Hz to 440 Hz	0.19 % + 11 µA 0.55 % + 23 µA	
	33 mA to < 330 mA	45 Hz to 65 Hz 65 Hz to 440 Hz	0.19 % + 97 µA 0.55 % + 0.21 mA	
	0.33 A to < 1.1 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.15 % + 20 mA 0.43 % + 23 mA	
	1.1 A to < 3.0 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.14 % + 22 mA 0.39 % + 28 mA	
	3.0 A to < 11 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.16 % + 77 mA 0.45 % + 96 mA	
	11 A to < 20.0 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.10 % + 95 mA 0.28 % + 0.15 A	
	20.0 A to < 150 A	45 Hz to 65 Hz 65 Hz to 100 Hz	0.0037 % + 0.13 A 0.011 % + 0.21 A	
	150 A to 1025 A	45 Hz to 65 Hz 100 Hz to 440 Hz	0.0033 % + 0.72 A 0.010 % + 1.2 A	
	0 A to 6000 A	10 Hz to 1 kHz 1 kHz to 3 Hz	0.54 % + 0.87 A 0.62 % + 1.1 A	Fluke 52120A/COIL 5730A/52120A and 6KA
	0 A to 1250 A	3 kHz to 6 kHz	1.2 % + 1.1 A	
	0 A to 650 A	6 kHz to 10 kHz	3.9 % + 0.60 A	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
AC Current Measure note 4	0.1 A to 1 A	10 Hz to 1 kHz	0.031 A	Fluke 8846A and Agilent 34330A
	> 1 A to 10 A	10 Hz to 1 kHz	0.049 A	
	> 10 A to 30 A	10 Hz to 1 kHz	0.11 A	
	0.3 µA to 100 µA	3 Hz to 10 Hz	0.27 % + 0.047 µA	Fluke 8846A
		10 Hz to 5 kHz	0.12 % + 0.047 µA	
		5 kHz to 10 kHz	0.27 % + 0.54 µA	
	> 0.1 mA to 1 mA	3 Hz to 10 Hz	0.23 % + 0.31 µA	
		10 Hz to 5 kHz	0.077 % + 0.31 µA	
		5 kHz to 10 kHz	0.15 % + 1.9 µA	
	> 1 mA to 10 mA	3 Hz to 10 Hz	0.27 % +4.7 µA	
		10 Hz to 5 kHz	0.12 % + 4.7 µA	
		5 kHz to 10 kHz	0.27 % + 54 µA	
	>10 mA to 100 mA	3 Hz to 10 Hz	0.23 % + 31 µA	
		10 Hz to 5 kHz	0.078 % + 31 µA	
		5 kHz to 10 kHz	0.16 % + 0.19 mA	
	>100 mA to 400 mA	3 Hz to 10 Hz	0.23 % + 0.31 mA	
		10 Hz to 5 kHz	0.078 % + 0.31 mA	
		5 kHz to 10 kHz	0.16 % + 2.2 mA	
	> 0.4 A to 1 A	3 Hz to 10 Hz	0.23 % + 0.31 mA	
		10 Hz to 5 kHz	0.078 % + 0.31 mA	
		5 kHz to 10 kHz	0.27 % + 5.4 mA	
	> 1 A to 3 A	3 Hz to 10 Hz	0.27 % + 1.4 mA	
		10 Hz to 5 kHz	0.12 % + 1.4 mA	
		5 kHz to 10 kHz	0.27 % + 16 mA	
	> 3 A to 10 A	3 Hz to 10 Hz	0.27 % + 4.7 mA	
		10 Hz to 5 kHz	0.12 % + 4.7 mA	
		5 kHz to 10 kHz	0.27 % + 54 mA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
	0.1 µA to 10 µA	1 Hz to 2 kHz 2 Hz to 10 kHz 10 kHz to 30 kHz	2.0 % + 2.5 nA 0.20 % + 2.5 nA 0.20 % + 2.5 nA	Fluke 8588A
	> 10 µA to 100 µA	1 Hz to 2 kHz 2 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	0.026 % + 5.0 nA 0.051 % + 5.0 nA 0.072 % + 5.0 nA 0.40 % + 10 nA	
	> 0.1 mA to 1 mA	1 Hz to 2 kHz 2 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	0.026 % + 50 nA 0.051 % + 50 nA 0.072 % + 50 nA 0.40 % + 0.10 µA	
	> 1 mA to 10 mA	1 Hz to 2 kHz 2 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	0.026 % + 0.50 µA 0.051 % + 0.50 µA 0.072 % + 0.50 µA 0.40 % + 1.0 µA	
	>10 mA to 100 mA	1 Hz to 2 kHz 2 Hz to 10 kHz 10 kHz to 30 kHz	0.026 % + 5.0 µA 0.050 % + 5.0 µA 0.070 % + 5.0 µA	
	> 0.1 A to 1 A	1 Hz to 2 kHz 2 Hz to 10 kHz 10 kHz to 30 kHz	0.026 % + 0.10 mA 0.051 % + 0.10 mA 0.071 % + 0.10 mA	
	> 1 A to 10 A	1 Hz to 2 kHz 2 Hz to 10 kHz	0.080 % + 0.50 mA 0.080 % + 0.50 mA	
	> 10 A to 30 A	1 Hz to 2 kHz 2 Hz to 10 kHz	0.080 % + 12 mA 0.12 % + 12 mA	
	> 10 A to 30 A	5 Hz to 10 Hz	0.28 % + 68 mA	Fluke 8846A,

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
AC Current Measure Note 11	0.0 mA to 300 mA	10 Hz to 1 kHz @ 510 kHz Nominal	0.28 % + 68 mA 0.52 % + 0.17 mA	Agilent 34330A Pearson Current Monitor
	300 mA to 3.0 A 3.0 A to 7.0 A	@ 510 kHz Nominal @ 510 kHz Nominal	0.52 % + 1.7 mA 0.33 % + 17 mA	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
DC RESISTANCE and CURRENT (20/E05)			
Resistance – Source	0.1 Ω to 1 Ω 0.1 Ω to 10 Ω 0.1 Ω to 100 Ω 0.1 Ω to 1 kΩ 0.1 Ω to 10 kΩ 0.1 Ω to 100 kΩ 0.1 Ω to 1 MΩ (0.1 Ω Increments) 10 MΩ to 100 MΩ 10 MΩ to 1 GΩ (10 MΩ Increments) 1 Ω 10 Ω 25 Ω 100 Ω 200 Ω 400 Ω 10 kΩ 1 GΩ 10 GΩ	0.011 % + 2.4 mΩ 0.036 % + 2.5 mΩ 0.048 % + 6.2 mΩ 0.047 % + 54 mΩ 0.047 % + 0.54 Ω 0.047 % + 5.4 Ω 0.049 % + 54 Ω 0.63 % + 3.2 kΩ 1.7 % + 0.63 MΩ 0.42 µΩ 3.5 µΩ 8.8 µΩ 24 µΩ 56 µΩ 0.11 mΩ 2.1 mΩ 27 kΩ 0.52 MΩ	Decade Resistors IET LABS - SRL

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
	0.0 Ω	39 μΩ	Fluke 5730A
	1.0 Ω	85 μΩ	
	1.9 Ω	0.15 mΩ	
	10 Ω	0.21 mΩ	
	19 Ω	0.40 mΩ	
	100 Ω	0.93 mΩ	
	190 Ω	1.8 mΩ	
	1.0 kΩ	6.2 mΩ	
	1.9 kΩ	12 mΩ	
	10 kΩ	62 mΩ	
	19 kΩ	0.12 Ω	
	100 kΩ	0.78 Ω	
	190 kΩ	1.8 Ω	
	1.0 MΩ	12 Ω	
	1.9 MΩ	31 Ω	
	10 MΩ	0.36 kΩ	
	19 MΩ	0.81 kΩ	
	100 MΩ	9.3 kΩ	
Variable Resistance – Source	0 Ω to < 11 Ω	0.0031 % + 0.78 mΩ	Fluke 5522A
	11 Ω to < 33 Ω	0.0023 % + 1.2 mΩ	
	33 to < 110 Ω	0.0022 % + 1.1 mΩ	
	110 to < 330 Ω	0.0022 % + 1.6 mΩ	
	330 Ω to < 1.1 kΩ	0.0022 % + 1.7 mΩ	
	1.1 kΩ to < 3.3 kΩ	0.0022 % + 16 mΩ	
	3.3 kΩ to < 11 kΩ	0.0022 % + 17 mΩ	
	11 kΩ to < 33 kΩ	0.0022 % + 0.16 Ω	
	33 kΩ to < 110 kΩ	0.0022 % + 0.17 Ω	
	110 kΩ to < 330 kΩ	0.0025 % + 1.6 Ω	
	330 kΩ to < 1.1 MΩ	0.0025 % + 1.7 Ω	
	1.1 MΩ to < 3.3 MΩ	0.0047 % + 23 Ω	
	3.3 MΩ to < 11 MΩ	0.010 % + 39 Ω	
	11 MΩ to < 33 MΩ	0.019 % + 1.9 kΩ	
	33 MΩ to < 110 MΩ	0.039 % + 2.3 kΩ	
	110 MΩ to < 330 MΩ	0.23 % + 78 kΩ	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
	330 MΩ to 1.1 GΩ	1.2 % + 0.39 MΩ	
Resistance Measure note 4	0 Ω to 10 Ω	0.0078 % + 2.3 mΩ	Fluke 8846A
	> 10 Ω to 100 Ω	0.0078 % + 3.1 mΩ	
	> 100 Ω to 1 kΩ	0.0078 % + 7.8 mΩ	
	> 1 kΩ to 10 kΩ	0.0077 % + 78 mΩ	
	> 10 kΩ to 100 kΩ	0.0077 % + 0.78 Ω	
	> 100 kΩ to 1 MΩ	0.0078 % + 7.8 Ω	
	> 1 MΩ to 10 MΩ	0.031 % + 78 Ω	
	> 10 MΩ to 100 MΩ	0.62 % + 7.8 kΩ	
	> 100 MΩ to 1 GΩ	0.78 % + 78 kΩ	
	0 Ω to 1.0 Ω	0.0011 % + 4.0 μΩ	Fluke 8588A
	> 1.0 Ω to 10 Ω	0.00077 % + 14 μΩ	
	> 10 Ω to 100 Ω	0.00071 % + 47 μΩ	
	> 100 Ω to 1 kΩ	0.00071 % + 0.47 mΩ	
	> 1 kΩ to 10 kΩ	0.00071 % + 4.7 mΩ	
	> 10 kΩ to 100 kΩ	0.00073 % + 47 mΩ	
	> 100 kΩ to 1 MΩ	0.00082 % + 1.0 Ω	
	> 1 MΩ to 10 MΩ	0.0011 % + 0.10 kΩ	
	> 10 MΩ to 100 MΩ	0.0039 % + 10 kΩ	
	> 100 MΩ to 1 GΩ	0.051 % + 1.0 MΩ	
	> 1 MΩ to 10 MΩ	0.0015 % + 0.010 kΩ	Fluke 8588A - HV
	> 10 MΩ to 100 MΩ	0.0060 % + 1.0 kΩ	
	> 100 MΩ to 1 GΩ	0.015 % + 0.10 MΩ	
	> 1 GΩ to 10 GΩ	0.052 % + 10 MΩ	
Resistive Simulation of Temperature Probes Note 7			Fluke 8846A
YSI 400	20 °C to 44 °C (2.814 kΩ to 1.023 kΩ)	0.0035 % + 0.0031 ºC (0.0049 % + 0.16 Ω)	
YSI 700T1	20 °C to 44 °C (7.496 kΩ to 2.726 kΩ)	0.0040 % + 0.0021 ºC (0.0049 % + 0.29 Ω)	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
YSI 700T2	20 °C to 44 °C (37.30 kΩ to 13.80 kΩ)	0.0038 % + 0.0027 ºC (0.0049 % + 1.8 Ω)	
Resistive Simulation of Cardiac Output at: Note 8			Fluke 8846A
0 °C and 2 °C Injectate	2.5 L/min (14.50 kΩ) 3.0 L/min (14.47 kΩ) 5.0 L/min (14.350 kΩ) 7.0 L/min (14.395 kΩ) 10.0 L/min (14.2448 kΩ)	0.0032 L/min (1.9 Ω) 0.0039 L/min (1.9 Ω) 0.0065 L/min (1.9 Ω) 0.0091 L/min (1.9 Ω) 0.013 L/min (1.9 Ω)	
24 °C and 20 °C Injectate	2.5 L/min (14.30 kΩ) 3.0 L/min (14.50 kΩ) 5.0 L/min (14.2235 kΩ) 7.0 L/min (14.50 kΩ) 10.0 L/min (14.1414 kΩ)	0.0032 L/min (1.9 Ω) 0.0039 L/min (1.9 Ω) 0.0065 L/min (1.9 Ω) 0.0091 L/min (1.9 Ω) 0.013 L/min (1.9 Ω)	
DC Current Source	0.0 µA to < 330 µA 0.33 mA to < 3.3 mA 3.3 mA to < 33 mA 33 mA to < 330 mA 0.33 A to < 1.1 A 1.1 A to < 3 A 3.0 A to < 11 A 11 A to 20.5 A	0.012 % + 0.016 µA 0.0077 % + 0.039 µA 0.0077 % + 0.20 µA 0.0077 % + 2.0 µA 0.015 % + 32 µA 0.029 % + 32 µA 0.039 % + 0.39 mA 0.078 % + 0.58 mA	Fluke 5522A
	0.0 µA to < 220 µA 0.22 mA to < 2.2 mA 2.2 mA to < 22 mA 22 mA to < 100 mA 100 mA to < 220 mA 0.22 A to < 1.0 A 1.0 A to 2.2 A	0.0039 % + 5.4 nA 0.0031 % + 6.2 nA 0.0031 % + 39 nA 0.0039 % + 0.62 µA 0.0039 % + 0.62 µA 0.0070 % + 12 µA 0.0087 % + 12 µA	Fluke 5730A
	2.2 A to 11 A	0.028 % + 0.37 mA	Fluke 5730A/5725A

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
	0.22 A to < 2.0 A	0.012 % + 0.16 mA	Fluke 5730A/52120A
	2.0 A to < 20 A	0.012 % + 1.6 mA	
	20 A to 120 A	0.012 % + 9.3 mA	
Current Clamp Non-Toroidal	0.33 mA to < 3.3 mA	0.25% + 5.9 µA	Fluke 5730A/5522A and 5500A Coil
	3.3 mA to < 33 mA	0.35 % + 14 µA	
	33 mA to < 330 mA	0.35 % + 0.14 mA	
	0.33 A to < 1.1 A	0.26 % + 1.4 mA	
	1.1 A to < 3.0 A	0.25 % + 4.3 mA	
	3.0 A to < 11.0 A	0.27 % + 13 mA	
	11.0 A to < 20.0 A	0.18 % + 44 mA	
	20.0 A to < 150 A	0.34 % + 0.20 A	
	150 A to 1025 A	0.33 % + 1.1 A	
	0 A to 6000 A	0.54 % + 0.87 A	Fluke 5730A/52120A and 52120A/COIL 6KA
Current Clamp Toroidal	0.33 mA to < 3.3 mA	0.085 % + 5.8 µA	Fluke 5730A/5522A and 5500A Coil
	3.3 mA to < 33 mA	0.17 % + 8.6 µA	
	33 mA to < 330 mA	0.17 % + 86 µA	
	0.33 A to < 1.1 A	0.12 % + 0.87 mA	
	1.1 A to < 3.0 A	0.12 % + 2.2 mA	
	3.0 A to < 11.0 A	0.13 % + 8.3 mA	
	11.0 A to < 20.0 A	0.092 % + 24 mA	
	20.0 A to < 150 A	0.17 % + 89 mA	
	150 A to 1025 A	0.15 % + 0.68 A	
	0 A to 6000 A	0.54 % + 0.87 A	Fluke 5730A/52120A and 52120A/COIL 6KA
DC Current Measure note 4	0 µA to 100 µA	0.039 % + 0.020 µA	Fluke 8846A
	> 0.1 mA to 1.0 mA	0.039 % + 0.039 µA	

CALIBRATION LABORATORIES **NVLAP LAB CODE 201065-0**

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
	> 1.0 mA to 10.0 mA	0.039 % + 1.6 µA	
	> 10 mA to 100 mA	0.039 % + 3.9 µA	
	> 100 mA to 400 mA	0.039 % + 16 µA	
	> 0.4 A to 1.0 A	0.039 % + 0.16 mA	
	> 1.0 A to 3.0 A	0.078 % + 0.47 mA	
	> 3.0 A to 10 A	0.12 % + 0.62 mA	
	> 10.0 A to 30 A	0.23 % + 35 mA	Fluke 8846A, Agilent 34330A
	0 µA to 10 µA	0.0022 % + 0.43 nA	Fluke 8588A
	> 10 µA to 100 µA	0.00085 % + 0.39 nA	
	> 0.1 mA to 1.0 mA	0.00078 % + 3.9 nA	
	> 1.0 mA to 10.0 mA	0.00085 % + 39 nA	
	> 10 mA to 100 mA	0.0033 % + 1.0 µA	
	> 0.1 A to 1.0 A	0.010 % + 0.10 mA	
	> 1.0 A to 10 A	0.017 % + 0.40 mA	
	> 10 A to 30 A	0.049 % + 4.4 mA	
DC VOLTAGE (20/E06)			
DC Voltage Measure note 4	0 mV to 100 mV	0.0029 % + 2.7 µV	Keithley 2700
	> 0.1 V to 1.0 V	0.0019 % + 5.5 µV	Fluke 8846A
	> 1.0 V to 10.0 V	0.0019 % + 39 µV	
	> 10 V to 100 V	0.0029 % + 0.47 mV	
	> 100 V to 1000 V	0.0032 % + 7.8 mV	
	> 1 kV to 10 kV	2.1 % + 23 V	Fluke 8846A and
	> 10 kV to 40 kV	0.58 % + 0.23 kV	Fluke 80K-40
	0 mV to 100 mV	0.00035 % + 0.22 µV	Fluke 8588A
	> 0.1 V to 1.0 V	0.00021 % + 0.28 µV	
	> 1.0 V to 10.0 V	0.00022 % + 0.42 µV	
	> 10 V to 100 V	0.00032 % + 23 µV	
	> 100 V to 1000 V	0.00033 % + 0.39 mV	

CALIBRATION LABORATORIES **NVLAP LAB CODE 201065-0**

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
Electrical Simulation of Blood Pressure Note 9	-10 mmHg to 400 mmHg (-0.5 mV to 20 mV)	0.0025 % + 0.062 mmHg (0.0025 % + 3.1 µV)	Conversion Factor is 20 mmHg/mV at 10 VDC Exciter Voltage (Power Supply and Voltage Meter)
DC Voltage Source	0 mV to < 330 mV 0.33 V to < 3.3 V 3.3 V to < 33 V 33 V to < 330 V 330 V to 1020 V	0.0013 % + 1.7 µV 0.00083 % + 2.2 µV 0.00093 % + 17 µV 0.0014 % + 0.13 mV 0.0014 % + 1.3 mV	Fluke 5522A
	0 mV to < 220 mV 0.22 V to < 2.2 V 2.2 V to < 11 V 11 V to < 22 V 22 V to < 220 V 220 V to 1100 V	0.00051 % + 0.42 µV 0.00046 % + 0.64 µV 0.00031 % + 2.4 µV 0.00031 % + 3.9 µV 0.00046 % + 39 µV 0.00062 % + 0.39 mV	Fluke 5730A

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
LF AC VOLTAGE (20/E09)				
AC Voltage – Source	0 mV to < 33 mV	10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz	0.061 % + 4.9 µV 0.011 % + 4.9 µV 0.015 % + 4.9 µV 0.077 % + 4.9 µV 0.27 % + 9.4 µV 0.62 % + 39 µV	Fluke 5522A
	33 mV to < 330 mV	10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz	0.023 % + 6.4 µV 0.011 % + 6.4 µV 0.012 % + 6.4 µV	

CALIBRATION LABORATORIES **NVLAP LAB CODE 201065-0**

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
		20 kHz to 50 kHz	0.027 % + 6.4 µV	
		50 kHz to 100 kHz	0.062 % + 25 µV	
		100 kHz to 500 kHz	0.16 % + 54 µV	
	0.33 V to < 3.3 V	10 Hz to 45 Hz	0.023 % + 39 µV	
		45 Hz to 10 kHz	0.012 % + 47 µV	
		10 kHz to 20 kHz	0.015 % + 47 µV	
		20 kHz to 50 kHz	0.023 % + 39 µV	
		50 kHz to 100 kHz	0.054 % + 97 µV	
		100 kHz to 500 kHz	0.19 % + 0.47 mV	
	3.3 V to < 33 V	10 Hz to 45 Hz	0.023 % + 0.50 mV	
		45 Hz to 10 kHz	0.012 % + 0.47 mV	
		10 kHz to 20 kHz	0.019 % + 0.47 mV	
		20 kHz to 50 kHz	0.027 % + 0.47 mV	
		50 kHz to 100 kHz	0.070 % + 1.2 mV	
	33 V to < 330 V	45 Hz to 1 kHz	0.015 % + 1.6 mV	
		1 kHz to 10 kHz	0.016 % + 4.7 mV	
		10 kHz to 20 kHz	0.019 % + 4.7 mV	
		20 kHz to 50 kHz	0.023 % + 4.7 mV	
		50 kHz to 100 kHz	0.16 % + 39 mV	
	330 V to 1020 V	45 Hz to 1 kHz	0.023 % + 7.8 mV	
		1 kHz to 5 kHz	0.019 % + 7.8 mV	
		5 kHz to 10 kHz	0.023 % + 7.8 mV	
	0.22 mV to < 2.2 mV	10 Hz to 20 Hz	0.023 % + 3.9 µV	Fluke 5730A
		20 Hz to 40 Hz	0.0089 % + 3.9 µV	
		40 Hz to 20 kHz	0.0077 % + 3.9 µV	
		20 kHz to 50 kHz	0.019 % + 3.9 µV	
		50 kHz to 100 kHz	0.046 % + 4.7 µV	
		100 kHz to 300 kHz	0.10 % + 9.3 µV	
		300 kHz to 500 kHz	0.13 % + 19 µV	

CALIBRATION LABORATORIES **NVLAP LAB CODE 201065-0**

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
		500 kHz to 1 MHz	0.26 % + 19 µV	
	2.2 mV to < 22 mV	10 Hz to 20 Hz	0.023 % + 3.9 µV	
		20 Hz to 40 Hz	0.0089 % + 3.9 µV	
		40 Hz to 20 kHz	0.0077 % + 3.9 µV	
		20 kHz to 50 kHz	0.019 % + 3.9 µV	
		50 kHz to 100 kHz	0.047 % + 4.7 µV	
		100 kHz to 300 kHz	0.10 % + 9.3 µV	
		300 kHz to 500 kHz	0.13 % + 19 µV	
		500 kHz to 1 MHz	0.26 % + 19 µV	
	22 V to < 220 mV	10 Hz to 20 Hz	0.023 % + 12 µV	
		20 Hz to 40 Hz	0.0089 % + 6.2 µV	
		40 Hz to 20 kHz	0.0054 % + 6.2 µV	
		20 kHz to 50 kHz	0.012 % + 6.2 µV	
		50 kHz to 100 kHz	0.031 % + 16 µV	
		100 kHz to 300 kHz	0.062 % + 19 µV	
		300 kHz to 500 kHz	0.13 % + 23 µV	
		500 kHz to 1 MHz	0.26 % + 47 µV	
	0.22 V to < 2.2 V	10 Hz to 20 Hz	0.023 % + 39 µV	
		20 Hz to 40 Hz	0.0085 % + 16 µV	
		40 Hz to 20 kHz	0.0037 % + 7.8 µV	
		20 kHz to 50 kHz	0.0062 % + 9.3 µV	
		50 kHz to 100 kHz	0.0078 % + 31 µV	
		100 kHz to 300 kHz	0.031 % + 78 µV	
		300 kHz to 500 kHz	0.093 % + 0.19 mV	
		500 kHz to 1 MHz	0.16 % + 0.31 mV	
	2.2 V to < 22 V	10 Hz to 20 Hz	0.023 % + 0.39 mV	
		20 Hz to 40 Hz	0.0085 % + 0.16 mV	
		40 Hz to 20 kHz	0.0037 % + 54 µV	
		20 kHz to 50 kHz	0.0062 % + 93 µV	
		50 kHz to 100 kHz	0.0078 % + 0.19 mV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
		100 kHz to 300 kHz	0.023 % + 0.62 mV	
		300 kHz to 500 kHz	0.093 % + 1.9 mV	
	22 V to < 220 V	10 Hz to 20 Hz	0.023 % + 3.9 mV	
		20 Hz to 40 Hz	0.0085 % + 1.6 mV	
		40 Hz to 20 kHz	0.0050 % + 0.54 mV	
		20 kHz to 50 kHz	0.0078 % + 0.93 mV	
		50 kHz to 100 kHz	0.014 % + 2.3 mV	
		100 kHz to 300 kHz	0.085 % + 16 mV	
		300 kHz to 500 kHz	0.42 % + 39 mV	
		10 Hz to 20 Hz	0.78 % + 78 mV	
	220 V to 1100 V	15 Hz to 50 Hz	0.028 % + 16 mV	
		50 Hz to 1 kHz	0.0066 % + 3.1 mV	
	220 V to 750 V	30 kHz to 50 kHz	0.047 % + 8.5 mV	Fluke 5730A/5725A
		50 kHz to 100 kHz	0.18 % + 35 mV	
	220 V to 1100 V	40 Hz to 1 kHz	0.0070 % + 3.1 mV	
		1 kHz to 20 kHz	0.013 % + 4.7 mV	
		20 kHz to 30 kHz	0.047 % + 8.5 mV	
AC Voltage - Measure note 4	5.0 mV	60 Hz	0.037 mV	Keithley 2700
	0.0 mV to 0.1 V	5 Hz to 10 Hz	0.27 % + 31 µV	Fluke 8846A
		10 Hz to 20 kHz	0.046 % + 31 µV	
		20 kHz to 50 kHz	0.093 % + 39 µV	
		50 kHz to 100 kHz	0.47 % + 62 µV	
		100 kHz to 300 kHz	3.1 % + 0.39 mV	
	> 0.1 V to 1.0 V	5 Hz to 10 Hz	0.27 % + 0.23 mV	
		10 Hz to 20 kHz	0.047 % + 0.23 mV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
		20 kHz to 50 kHz	0.093 % + 0.39 mV	
		50 kHz to 100 kHz	0.47 % + 0.62 mV	
		100 kHz to 300 kHz	3.1 % + 3.9 mV	
	> 1.0 V to 10 V	5 Hz to 10 Hz	0.27 % + 2.3 mV	
		10 Hz to 20 kHz	0.047 % + 2.3 mV	
		20 kHz to 50 kHz	0.093 % + 3.9 mV	
		50 kHz to 100 kHz	0.47 % + 6.2 mV	
		100 kHz to 300 kHz	3.1 % + 39 mV	
	> 10 V to 100 V	5 Hz to 10 Hz	0.27 % + 23 mV	
		10 Hz to 20 kHz	0.047 % + 23 mV	
		20 kHz to 50 kHz	0.093 % + 39 mV	
		50 kHz to 100 kHz	0.47 % + 62 mV	
		100 kHz to 300 kHz	3.1 % + 0.39 V	
	> 100 V to 1000 V	5 Hz to 10 Hz	0.27 % + 0.17 V	
		10 Hz to 20 kHz	0.047 % + 0.17 V	
		20 kHz to 50 kHz	0.093 % + 0.29 V	
		50 kHz to 100 kHz	0.47 % + 0.47 V	
		100 kHz to 300 kHz	3.1 % + 2.9 V	
	> 1 kV to 10 kV	50/60 Hz	5.2 % + 58 V	Fluke 8846A and Fluke 80K-40
	10 kV to 40 kV	50/60 Hz	4.3 % + 0.58 kV	
	> 1.0 mV to 10 mV	1 Hz to 2 kHz	0.025 % + 1.1 µV	Fluke 8588A
		2 kHz to 10 kHz	0.033 % + 1.1 µV	
		10 kHz to 30 kHz	0.034 % + 1.1 µV	
		30 kHz to 100 kHz	0.30 % + 0.79 µV	
		100 kHz to 300 kHz	1.0 % + 3.9 µV	
		300 kHz to 1 MHz	2.0 % + 3.9 µV	
	> 10 V to 100 mV	1 Hz to 2 kHz	0.0068 % + 0.53 µV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
		2 kHz to 10 kHz	0.011 % + 0.53 µV	
		10 kHz to 30 kHz	0.021 % + 1.0 µV	
		30 kHz to 100 kHz	0.051 % + 5.0 µV	
		100 kHz to 300 kHz	0.20 % + 31 µV	
		300 kHz to 1 MHz	1.0 % + 0.10 mV	
	> 0.1 V to 1.0 V	1 Hz to 2 kHz	0.0064 % + 5.0 µV	
		2 kHz to 10 kHz	0.011 % + 5.0 µV	
		10 kHz to 30 kHz	0.021 % + 10 µV	
		30 kHz to 100 kHz	0.051 % + 50 µV	
		100 kHz to 300 kHz	0.20 % + 0.31 mV	
		300 kHz to 1 MHz	0.10 % + 1.0 mV	
	> 1.0 V to 10 V	1 Hz to 2 kHz	0.0064 % + 50 µV	
		2 kHz to 10 kHz	0.011 % + 50 µV	
		10 kHz to 30 kHz	0.021 % + 0.10 mV	
		30 kHz to 100 kHz	0.051 % + 0.50 mV	
		100 kHz to 300 kHz	0.20 % + 3.1 mV	
		300 kHz to 1 MHz	0.10 % + 10 mV	
	> 10 V to 100 V	1 Hz to 2 kHz	0.0070 % + 0.50 mV	
		2 kHz to 10 kHz	0.0090 % + 0.50 mV	
		10 kHz to 30 kHz	0.021 % + 1.0 mV	
		30 kHz to 100 kHz	0.051 % + 5.0 mV	
		100 kHz to 300 kHz	0.35 % + 47 mV	
		300 kHz to 1 MHz	V * 1.0 % + 0.50 V	
	> 100 V to 1000 V	1 Hz to 2 kHz	0.0090 % + 25 mV	
		2 kHz to 10 kHz	0.0090 % + 25 mV	
		10 kHz to 30 kHz	0.021 % + 25 mV	
		30 kHz to 100 kHz	0.051 % + 0.10 V	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
LF CAPACITANCE (20/E10)				
Capacitance – Source	220 pF to < 400 pF	10 Hz to 10 kHz	0.39 % + 7.8 pF	Fluke 5522A
	0.4 nF to < 1.1 nF	10 Hz to 10 kHz	0.39 % + 7.8 pF	
	1.1 nF to < 3.3 nF	10 Hz to 3 kHz	0.39 % + 7.8 pF	
	3.3 nF to < 11 nF	10 Hz to 1 kHz	0.19 % + 7.8 pF	
	11 nF to < 33 nF	10 Hz to 1 kHz	0.19 % + 7.8 pF	
	33 nF to < 110 nF	10 Hz to 1 kHz	0.19 % + 7.8 pF	
	110 nF to < 330 nF	10 Hz to 1 kHz	0.19 % + 0.023 pF	
	0.33 µF to < 1.1 µF	10 Hz to 600 Hz	0.19 % + 0.78 nF	
	1.1 µF to < 3.3 µF	10 Hz to 300 Hz	0.19 % + 2.3 nF	
	3.3 µF to < 11 µF	10 Hz to 150 Hz	0.19 % + 7.8 nF	
	11 µF to < 33 µF	10 Hz to 120 Hz	0.31 % + 0.023 µF	
	33 µF to < 110 µF	10 Hz to 80 Hz	0.35 % + 0.078 µF	
	110 µF to < 330 µF	DC to 50 Hz	0.35 % + 0.23 µF	
	0.33 mF to < 1.1 mF	DC to 20 Hz	0.35 % + 0.78 µF	
	1.1 mF to < 3.3 mF	DC to 2 Hz	0.35 % + 2.3 µF	
	3.3 mF to < 11 mF	DC to 6 Hz	0.35 % + 7.8 µF	
	11 mF to < 33 mF	DC to 0.6 Hz	0.58 % + 0.023 mF	
	33 mF to 110 mF	DC to 0.2 Hz	0.85 % + 0.078 mF	
Capacitance – Measure	0.1 nF to 1.0 nF	10 Hz to 10 kHz	0.10 % + 1.0 pF	Fluke 8588A
	> 1.0 nF to 10 nF	10 Hz to 1 kHz	0.061 % + 2.0 pF	
	> 10 nF to 100 nF	10 Hz to 1 kHz	0.049 % + 10 pF	
	> 0.1 µF to 1.0 µF	10 Hz to 600 Hz	0.041 % + 0.10 nF	
	> 1.0 µF to 10 µF	10 Hz to 150 Hz	0.042 % + 1.0 nF	
	> 10 µF to 100 µF	10 Hz to 80 Hz	0.061 % + 10 nF	
	> 0.1 mF to 1.0 mF	DC to 20 Hz	0.061 % + 0.10 µF	
	> 1.0 mF to 10 mF	DC to 6 Hz	0.071 % + 1.0 µF	
	> 10 mF to 100 mF	DC to 0.2 Hz	0.071 % + 10 µF	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
LF POWER/ENERGY (20/E12)				
AC Power – Measurement Note 11	1 W to 500 W	@ 510 kHz	0.043 % + 0.29 W	Power dissipation in load resistance
AC Power – Source	1.0 mW to 20910 W (3 mA to 20.5 A; 0.333 V to 1020 V)	@ 45 Hz to 100 Hz	0.11 % + 0.71 mW	Fluke 5522A
	66 W to 122.4 kW (20 A to 120.0 A; 0.333 V to 1020 V)	@ 45 Hz to 100 Hz	0.012 % + 7.7 mW	Fluke 5522A/ 5730A/52120A and 52120A
	400 W to 6.12 MW (100 A to 6000.0 A; 0.333 V to 1020 V)	@ 45 Hz to 100 Hz	0.55 % + 90 W	Fluke 5522A/ 5730A/52120A and 52120A/COIL 6KA

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
LF POWER/ENERGY (20/E12)			
LF Energy	0.1 J to 360 J	0.31 % + 0.059 J	Fluke 7000DP Gold
Energy (Watt-Hour) 50 Hz to 60 Hz	1 Wh to 60 kWh	0.34 %	Fluke 5522A
DC Power – Source	1.0 mW to 20910 W (3 mA to 20.5 A; 0.333 V to 1020 V)	0.080 % + 0.58 mW	Fluke 5522A
	66 W to 122.4 kW (20 A to 120.0 A; 0.333 V to 1020 V)	0.012 % + 7.7 mW	Fluke 5522A/ 5730A/52120A and 52120A
	400 W to 5.1 MW (100 A to 5000.0 A; 0.333 V to 1020 V)	0.55 % + 90 W	Fluke 5522A/ 5730A/52120A and 52120A/COIL 6KA

2023-12-18 through 2024-12-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty Note 3,5	Remarks
LF PHASE (20/E15)				
Phase – Source 0.65 V to 330 V	0 ° to 180 °	10 Hz to 65 Hz 65 Hz to 500 Hz 500 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.10 ° 0.21 ° 0.39 ° 2.0 ° 3.9 ° 7.8 °	Fluke 5522A

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
TIME & FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Frequency – Measure	0.1 Hz to 225 MHz	0.00061 % + 0.0069 mHz	Agilent 53131A
Simulation of Heart Rate (beats per minute) Note 10	0.1 Hz to 6.0 Hz (6 BPM to 360 BPM)	0.069 mHz (0.0041 BPM)	60 BPM/Hz
Simulation of Respiration Rate Note 10 (respirations per minute)	0.1 Hz to 2.0 Hz (6 to 120 Resp/Min)	0.059 mHz (0.0036 Resp/min)	60 Res/min per Hz
Frequency – Source	0.01 Hz to 1.0 kHz 1.0 kHz to 100 kHz 100 kHz to 600 MHz	0.00019 % + 0.0058 mHz 0.00019 % + 5.8 mHz 0.00019 % + 0.58 Hz	Fluke 5522A Fluke 5522A / SC600
Revolution – Source	0.6 RPM to 100000 RPM	0.00019 % + 0.014 RPM	Fluke 5522A
Revolution – Measure	0.6 RPM to 100000 RPM	0.00016 % + 3.6 RPM	RPM Meter

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
STOPWATCHES & TIMERS (20/F05)			
Stopwatches & Timers	1 s to 24 hours 1 s to 7 days	0.037 s 0.042 s	NIST SP 960-12 Counter/Generator Method
MECHANICAL			
FLOW RATE (20/M05)			
Gas Flow – Source	0 SLM to < 5 SLM 5 SLM to 100 SLM	0.11% + 0.062 mSLM 0.20% + 0.015 SLM	DHI Molbloc
Air Velocity	0.0 m/s to < 0.6 m/s 0.6 m/s to < 4.0 m/s 4.0 m/s to < 8.0 m/s 8.0 m/s to < 12 m/s 12 m/s to < 16 m/s 16 m/s to 20 m/s	0,061 m/sec 0,063 m/sec 0,070 m/sec 0,080 m/sec 0,092 m/sec 0,11 m/sec	TESTO 435-2
Liquid Flow – Source	0.0 mL to 5.0 mL/h 5.0 mL to 25 mL/h 25 mL to 1000 mL/h	0.015% + 15 µL/h 0.015% + 65 µL/h 0.010% + 0.29 mL/h	HARVARD PUMP
ACOUSTIC (20/M10)			
Sound Level Meters	94 dB, 1 kHz 114 dB, 1 kHz	0.69 dB 0.74 dB	Testo Sound Calibrator
VOLUME and DENSITY (20/M12)			
Volume	1.0 µL to 1.0 mL 1.0 mL to 10 mL 10 mL to 80 mL 80 mL to 200 mL 200 mL to 800 mL 0.8 L to 6.0 L	0.088 µL 0.42 µL 0.44 µL 0.55 µL 2.0 µL 17 µL	Gravimetric Method

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
Volume – Gas Flow Analyzers	20 µL to 100 mL 100 mL to 1000 mL 1000 mL to 3000 mL	0.046 % + 37 µL 0.065 % + 0.21 mL 0.059 % + 1.0 mL	Syringe
WEIGHING INSTRUMENTS (20/M16)			
Balance / Scale Calibration Field calibrations Available Note 4	0.0 g to 6.1 g 0.0 to 21 g 0.0 to 300 g 0.0 g to 1000 g 0.0 g to 10 kg 0.0 g to 30 kg 0.0 g to 100 kg 0.0 g to 250 kg 0.0 g to 500 kg	0.00066 % 0.00021 % 0.000069 % 0.00021 % 0.0018 % 0.0012 % 0.0019 % 0.0019 % 0.0084 %	OIML Class E2 Mass Pieces OIML Class F1 Mass OIML Class M1 Mass
THERMODYNAMIC			
HUMIDITY (20/T02)			
Relative Humidity	10 % RH to < 80 % RH > 80 % RH to 90 % RH	0.81 % RH 0.83 % RH	Environmental Chamber
THERMOMETERS, DIGITAL and ANALOG (20/T03)			
Temperature – Source note 4	-80 °C to < -40.0 °C -40 °C to < -20.0 °C -20 °C to < 0.0 °C 0.0 °C > 0.0 °C to 50 °C > 50 °C to 100 °C > 100 °C to 150 °C > 150 °C to 200 °C > 200 °C to 250 °C > 250 °C to 300 °C	0.0067 °C 0.0063 °C 0.0072 °C 0.0057 °C 0.0069 °C 0.0069 °C 0.0080 °C 0.0081 °C 0.0092 °C 0.011 °C	Fluke 5628 w/ 1586A, precision baths, and dry block

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
	> 300 °C to 400 °C	0.012 °C	
	> 400 °C to 600 °C	0.017 °C	
	> 600 °C to 660.323 °C	0.018 °C	
	-80 °C to < -60.0 °C	0.0040 °C	Fluke 5628 w/ 1586A,
	-60 °C to < -40.0 °C	0.0033 °C	precision baths, and
	-40 °C to < -20.0 °C	0.0025 °C	dry block
	-20 °C to ≤ 0.0 °C	0.0040 °C	
	> 0.0 °C to 50 °C	0.0043 °C	
	> 50 °C to 100 °C	0.0050 °C	
	> 100 °C to 150 °C	0.0064 °C	
	> 150 °C to 200 °C	0.0055 °C	
	> 200 °C to 232 °C	0.0065 °C	
	> 232 °C to 300 °C	0.0070 °C	
	> 300 °C to 400 °C	0.0080 °C	
	> 400 °C to 420 °C	0.0097 °C	
	> 420 °C to 600 °C	0.010 °C	
	> 600 °C to 660.323 °C	0.013 °C	
Temperature –Measure note 4	-196 °C to < 0.01 °C	0.0063 ºC	Fluke 5628 w/ 1586A
	0.01 °C	0.0044 °C	
	> 0.01 °C to 150 °C	0.0063 ºC	
	> 150 °C to 250 °C	0.0073 ºC	
	> 250 °C to 420 °C	0.0094 ºC	
	> 420 °C to 660 °C	0.014 ºC	
Temperature	2 °C to < 10 °C	0.067 °C	Environmental Chamber
	10 °C to ≤ 40.0 °C	0.059 °C	
	> 40 °C to 50 °C	0.075 °C	
IR Temperature	-20 °C to 30 °C	-0.82 % + 1.0 °C	Fluke 1586A and black
	> 30 °C to 500 °C	0.32 % + 0.58 °C	plate

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
RESISTANCE THERMOMETRY (20/T07)			
Calibration by Fixed Point	0.01 °C	0.0021 °C (2.1 mK)	Fluke 5901D-Q
Calibration by Comparison	-80 °C to < -38.83 °C	0.0040 °C	Fluke 5628 w/ 1586A, precision baths, and dry block
	-38. 83 °C to < 0.01 °C	0.0030 °C	
	> 0.01 °C to 29.76 °C	0.0032 °C	
	> 29.76 °C to 156.60 °C	0.0049 °C	
	> 156.60 °C to 231.93 °C	0.0045 °C	
	> 231.93 °C to 419.53 °C	0.0097 °C	
	> 419.53 °C to < 660.32 °C	0.010 °C	
PRESSURE (20/T05)			
Vacuum – Measure Field Calibrations Available Note 4	-15 psi to < 0 psi	-0.0025 % + 0.000013 psi	Mensor Vacuum Sensor
	-2 psi to < -1 psi	-0.0012 % + 0.0000027 psi	
	-1 psi to < 0 psi	-0.00061 % + 0.0000090 psi	
	-10 psi to < 0 psi	0.0019 psi	Fluke 2700G
Gage Pressure – Measure Field Calibrations Available Note 4	0.00080 % + 0.0000090 psi	0.00080 % + 0.0000090 psi	Mensor Pressure Controller
	0.0013 % + 0.0000045 psi	0.0013 % + 0.0000045 psi	
	0.0011 % + 0.000043 psi	0.0011 % + 0.000043 psi	
	0.0013 % + 0.000019 psi	0.0013 % + 0.000019 psi	
	0.0022 % + 0.00011 psi	0.0022 % + 0.00011 psi	
	> 50 psi to 75 psi	0.00012 % + 0.00091 psi	
	> 75 psi to 100 psi	0.0011 % + 0.00035 psi	
	> 100 psi to 150 psi	0.0013 % + 0.00010 psi	
	0 psi to 15 psi	0.00061 psi	Fluke 2700G
	0 psi to 30 psi	0.0037 % + 0.00091 psi	
	0 psi to 300 psi	0.0052 % + 0.0044 psi	
	0 psi to 500 psi	0.0063 % + 0.0016 psi	
	0 psi to 5000 psi	0.0086 % + 0.076 psi	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
	0 mmHg to 517.15 mmHg	0.15 mmHg	Heise HQS-2
	0 psi to 30 psi	0.0037 % + 0.00091 psi	
	0 psi to 100 psi	0.0052 % + 0.0044 psi	
	-0,1084 psi to 0.1084 psi	0.000061 psi	Heise HQS-1
	0 mmHg to 22 mmHg	0.015 mmHg	
	0 mmHg to 110 mmHg	0.076 mmHg	
Absolute Pressure	0.10 psia to 8 psia	0.00039 psia	Mensor Pressure Controller
	8 psia to 9 psia	0.00026 psia	
	9 psia to 12 psia	0.00026 psia	
	12 psia to 20 psia	0.00030 psia	
	20 psia to 25 psia	0.00034 psia	
	25 psia to 60 psia	0.0010 psia	
	60 psia to 85 psia	0.0011 psia	
	85 psia to 110 psia	0.0015 psia	
	110 psia to 160 psia	0.0021 psia	
Barometric Pressure	8 psia to 12 psia	0.00027 psia	Mensor Barometer
	12 psia to 17 psia	0.00027 psia	
END			

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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.

Note 7: Simulation of YSI thermistor probe's output at specified temperature points. This is a resistive measurement, temperature values provided at physiological values for the customer's convenience.

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Notes
Note 8: Simulation of Baxter Edwards, 93a-131-7f type catheter, Abbott and Utah catheters at selected liters per minute (L/min) values at two injectate temperature levels. This is a resistive measurement, L/min values provided at physiological values for the customer's convenience. **Note 9:** Simulation of a transducer output using the expected conversion factor of 20 mmHg per mV at an exciter voltage of 10 VDC. Although this is an electrical measurement in mV, the mmHg values are shown for the convenience of the customer at physiological values. The uncertainty is given in a range that relates nearly linear to the range shown in the range column. **Note 10:** This is a simple conversion to physiological values for the convenience of the customer. Many of the devices calibrated by the lab indicate heartbeat per minute (Lat/min) and respirations per minute (Resp/min). It should be noted that Lat/min stands for "latido por minuto" which is the Spanish translation of beat per minute. **Note 11:** Measurement associated with measurement of electrosurgical analyzers only.