CALIBRATION LABORATORIES **NVLAP LAB CODE 600214-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

Additel Corporation	**Fields of Calibration**
2900 Saturn Street Brea, CA 92821 Eric Chavier Phone: 714-998-6899 Fax: 714-998-6999 E-mail: eric.chavier@additel.com URL: http://additel.com	Electromagnetics Thermodynamics Time & Frequency This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)

CALIBRATION AND MEASUREMENT CAPABILITY (CMC) Note 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
ELECTROMAGNETIC - DC/LOW FREQUENCY			
DC RESISTANCE AND CURRENT (20/E05)			
DC Resistance – Generate, Fixed Instrument Based	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	103 μΩ 180 μΩ 250 μΩ 475 μΩ 1.0 mΩ 1.9 mΩ 6.8 mΩ 13 mΩ 68 mΩ 130 mΩ 850 mΩ 1.70 Ω 13.3 Ω 43.7 Ω 420 Ω 917 Ω 13.2 kΩ	Fluke 5730A

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CALIBRATION AND MEASUREMENT CAPABILITY (CMC) Note 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
DC Resistance – Generate, Fixed Resistors	1 Ω 25 Ω 50 Ω 100 Ω 200 Ω 400 Ω 1 kΩ 2 kΩ 4 kΩ 10 kΩ	1.5 μΩ/Ω 1.4 μΩ/Ω 1.5 μΩ/Ω 1.2 μΩ/Ω 1.5μΩ/Ω 1.8 μΩ/Ω 1.2 μΩ/Ω 1.5 μΩ/Ω 1.8 μΩ/Ω 1.2 μΩ/Ω	Additel ADT280-PRS Reference Resistors with Additel ADT286 Ratio mode
DC Resistance – Generate, Variable Instrument Based	10 Ω, 400-Ω Range 100 Ω, 400-Ω Range 400 Ω, 400-Ω Range 10 Ω, 4k Ω Range 100 Ω, 4k Ω Range 400 Ω, 4k Ω Range	12 mΩ 12 mΩ 10 mΩ 230 mΩ 230 mΩ 231 mΩ	Fluke 7526A
DC Resistance - Measure	0 Ω to 10 Ω >10 Ω to 100 Ω >100 Ω to 1 kΩ >1k Ω to 10 kΩ	11.57 μΩ/Ω + 50 μΩ 9.2 μΩ/Ω + 500 μΩ 8.6 μΩ/Ω + 500 μΩ 6.86 μΩ/Ω + 5 mΩ	Agilent 3458A opt 2

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CALIBRATION AND MEASUREMENT CAPABILITY (CMC) Note 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
DC Current - Generate	0 mA to 220 µA > 220 µA to 2.2 mA > 2.2 mA to 22 mA > 22 mA to 220 mA > 220 mA to 2.2 A	40.46 µA/A + 6 nA 45.20 µA/A + 7 nA 45.20 µA/A +40 nA 44.16 µA/A + 0.7 µA 93.04 µA/A + 12 µA	Fluke 5730A
DC Current – Measure	0 to 100 µA > 100 µA to 1.0 mA > 1.0 mA to 10 mA > 10 mA to 100 mA > 100 mA to 1 A	23.77 µA/A + 2.1 nA 21.53 µA/A + 6 nA 21.54 µA/A + 60 nA 26.33 µA/A + 0.6 µA 86.75 µA/A + 12 µA	Agilent 3458A opt 2
DC VOLTAGE (20/E06)			
DC Voltage - Generate	0 mV to 220 mV >220 mV to 2.2 V >2.2 V to 11 V >11 V to 22 V >22V to 220 V >220 to 1100 V	9.19 µV/V + 0.4 µV 5.25 µV/V + 0.7 µV 3.47 µV/V + 2.5 µV 3.47 µV/V + 4 µV 4.92 µV/V + 40 µV 6.38 µV/V + 400 µV	Fluke 5730A
DC Voltage - Measure	0 mV to 100 mV >100 mV to 1 V >1 V to 10 V >10 V to 100 V >100V to 1000 V	7.9 µV/V + 0.4 µV 3.9 µV/V + 0.4 µV 3.83 µV/V + 0.6 µV 24.85 µV/V + 40 µV 14.63 µV/V + 110 µV	Agilent 3458A opt 2

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CALIBRATION AND MEASUREMENT CAPABILITY (CMC) Note 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks

Measured Parameter or Device Calibrated	Range	Frequency	Expanded Uncertainty Note 3,5	Remarks
LF AC VOLTAGE (20/E09)				
AC Voltage - Generate	0 mV to 2.2 mV	10 Hz to 40 Hz	767.27 µV/V + 4.0 µV	Fluke 5730A
		40 Hz to 20 kHz	616.32 µV/V + 4.0 µV	
	>2.2 mV to 22 mV	10 Hz to 40 Hz	312.51 µV/V + 4.0 µV	
		40 Hz to 20 kHz	145.96 µV/V + 4.0 µV	
	>22 mV to 220 mV	10 Hz to 40 Hz	257.70 µV/V + 12.0 µV	
		40 Hz to 20 kHz	72.32 µV/V + 7.0 µV	
	>220 mV to 2.2 V	10 Hz to 40 Hz	241.94 µV/V + 40.0 µV	
		40 Hz to 20 kHz	46.80 µV/V + 8.0 µV	
	>2.2 V to 22 V	10 Hz to 40 Hz	247.90 µV/V + 400 µV	
		40 Hz to 20 kHz	54.34 µV/V + 50 µV	
	>22 V to 220 V	10 Hz to 40 Hz	253.39 µV/V + 4.0 mV	
		40 Hz to 20 kHz	65.83 µV/V + 0.6 mV	
	>220 V to 1100 V	50 Hz to 1 kHz	76.07 µV/V + 3.5 mV	
AC Voltage - Measure	0 mV to 10 mV	1 Hz to 40 Hz	421.20 µV/V + 3.0 µV	Agilent 3458A opt. 2
		40 Hz to 1 kHz	377.58 µV/V + 1.1 µV	
		1 kHz to 20 kHz	403.57 µV/V + 1.1 µV	
	> 10 mV to 100 mV	1 Hz to 40 Hz	79.71 µV/V + 4.0 µV	
		40 Hz to 1 kHz	66.73 µV/V + 2.0 µV	
		1 kHz to 20 kHz	104.10 µV/V + 2.0 µV	
	> 100 mV to 1 V	1 Hz to 40 Hz	56.81 µV/V + 40.0 µV	
		40 Hz to 1 kHz	53.45 µV/V + 20.0 µV	
		1 kHz to 20 kHz	105.72 µV/V + 20.0 µV	
	> 1 V to 10 V	1 Hz to 40 Hz	72.27 µV/V + 400.0 µV	
		40 Hz to 1 kHz	66.05 µV/V + 200.0 µV	
		1 kHz to 20 kHz	104.45 µV/V + 200.0 µV	
	> 10 V to 100 V	1 Hz to 40 Hz	144.63 µV/V + 4.0 mV	
		40 Hz to 1 kHz	144.54 µV/V + 2.0 mV	
		1 kHz to 20 kHz	144.50 µV/V + 2.0 mV	
	> 100 V to 1000 V	40 Hz to 1 kHz	294.34 µV/V + 20.0 mV	

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CALIBRATION AND MEASUREMENT CAPABILITY (CMC) Note 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
TIME & FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Frequency - Generate	> 100 Hz to 50 kHz	1 µHz/ Hz + 2 nHz	Keysight 33512B
Frequency - Measure	> 100 Hz to 50 kHz	1 µHz/ Hz + 2 nHz	Keysight 53220A
THERMODYNAMIC			
PRESSURE (20/T05)			
Absolute Pressure Source - Pneumatic	5 kPa to 360 kPa	0.0011 % + 0.64 Pa	DHI PG7601 (10kPa)
	100 kPa to 7200 kPa	0.0017 % + 6.58 Pa	DHI PG7601 (200kPa)
	2 MPa to 72 MPa	0.0037% + 164 Pa	DHI PG7202 (2MPa)
Gauge Pressure Source – Pneumatic Note 7	0 Pa to 750 Pa	0.12 Pa	Fluke 7250LP
	750 Pa to 7500 Pa	0.01 %	Fluke 7250LP
	5 kPa to 360 kPa	0.0007 % + 0.53 Pa	DHI PG7601 (10kPa)
	100 kPa to 7200 kPa	0.002 % + 6.7 Pa	DHI PG7601 (200kPa)
	2 MPa to 72 MPa	0.0037%+ 164 Pa	DHI PG7202 (2MPa)
Gauge Pressure Source - Differential	-95 kPa to 10 kPa	0.003 % + 0.79 Pa	DHI PG7601 (10kPa)
Gauge Pressure Source - Hydraulic	7 MPa to 275 MPa	0.0053% + 356 Pa	Minyu KY250
	7 MPa to 20 MPa	3.1 kPa	Fluke P3860-PS
	>20 MPa to 415 MPa	0.017%	Fluke P3860-PSI
RESISTANCE THERMOMETRY (20/T07)			
Drywell Calibrators	-40 °C to 0 °C	0.016 °C	Direct Comparison to SPRT
	>0 °C to 50 °C	0.011 °C	
	>50 °C to 155 °C	0.010 °C	
	>155 °C to 300 °C	0.019 °C	
	>300 °C to 450 °C	0.034 °C	
	>450 °C to 550 °C	0.053 °C	
	>550 °C to 660 °C	0.060 °C	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty Note 3,5	Remarks
DryWell Calibrators	25 °C to 100 °C >100 °C to 300 °C >300 °C to 600 °C >600 °C to 900 °C >900 °C to 1210 °C	0.40 °C 0.45 °C 0.50 °C 0.55 °C 0.85 °C	Direct Comparison to Reference grade Type S Thermocouple
TEMPERATURE INDICATORS (20/T08)			
RTD Simulation - Measure	-180 °C to 0 °C >0 °C to 800 °C	0.039 °C 0.24 °C	Fluke 7526A PT385 (100 Ω) Measure Mode
RTD Simulation - Generate	-180 °C to 800 °C	0.057 °C	
Thermocouple Simulation – Generate and Measure Type K	-200 °C to 0 °C > 0 °C to 660 °C > 660 °C to 1300 °C	0.12 °C 0.078 °C 0.10 °C	Fluke 7526A Source and Measure
Triple Point	0.01 ºC	0.8 mK	Triple Point Water Cell with Accumac SPRT
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 3d: CMC expanded uncertainties include repeatability of best existing device (BED).

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: Uncertainty 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: Uncertainty applies to positive and negative pressures.

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