National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 200886-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Transcat - Portland	**Fields of Calibration**
14058 SW Milton Court Portland, OR 97224 Mr. Marc Jaso Phone: 800-828-1470 x7617 Fax: 503-598-4545 E-mail: mjaso@transcat.com URL: www.transcat.com	Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Electromagnetics – RF/Microwave Thermodynamic This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	**Range**	**Uncertainty (*k*=2)** Note 3	**Remarks**
DIMENSIONAL			
ANGULAR (20/D01)			
Angles	0° to 75° 90°	5.1 as 6.8 as	Sine Plate w/Gage Blocks Master Square
LENGTH & DIAMETER; STEP GAGES (20/D05)			
Micrometers and Calipers – Outside, Inside, Depth Field calibrations available Note 4	0.05 in to 8 in 8 in to 42 in	15 µin + 3.0 µin/in 13 µin + 4.0 µin/in	Comparison to Gage Blocks
Anvil Flatness Field calibrations available Note 4	0 in to 1 in	4.7 µin	Optical Flats
Anvil Parallelism Field calibrations available Note 4	0 in to 1 in	6.1 µin	Optical Parallel
Length Measurement – Single Axis - Inside	0.24 in to 12 in	3 µin + 4.0 µin/in	Horizontal Comparator
Length Measurement – Single Axis – Outside	0.001 in to 10 in	3 µin + 4.0 µin/in	Horizontal Comparator

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	**Range**	**Uncertainty (*k*=2)** [Note 3]	**Remarks**
Height Measuring Equipment (Height Gages, Dial Gages, And Digital Indicators)	0 in to 4 in 4 in to 24 in	10 µin + 3 µin/in 12 µin + 4 µin/in	Comparison to Gage Blocks
Height Measure (Master 1-2-3 Blocks, Caliper Masters, Parallels)	0 in to 6 in 6 in to 24 in	10 µin + 3 µin/in 12 µin + 4 µin/in	Gage Blocks with Amplifier
Parallelism and Straightness	0 in to 12 in	20 µin	Gage Amp & Surface Plate
Dial Indicators Field calibrations available [Note 4]	0 in to 0.1 in 0.1 in to 6 in	4.5 µin 4 µin + 4*L* µin	Gage Blocks /Surface Plate
SURFACE TEXTURE (20/D12)			
Surface Plates Field calibrations available [Note 4]	Where *D* is the diagonal in inches of device under test. 12 in to 168 in	20 µin + √*D* µin	Optodyne LDDM
Surface Plate Repeatability Field calibrations available [Note 4]	0 to ±0.001	32 µin	Supramess
SURVEYING RODS and TAPES (20/D13)			
Steel Rules	0 in to 12 in	320 µin	Vision System
THREADED PLUGS & RINGS (20/D14)			
Inner Pitch Diameter	0 in to 6 in	150 µin	Comparison to Master Plugs
Outer Pitch Diameter	0 in to 6 in	79µin + 1 µin/in	Comparator w/ Thread Wires
TWO DIMENSIONAL GAGES (20/D15)			
Linear Dimension – Two Axis (X-Y)	12 in x 12 in	320 µin	Vision System

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
VOLTAGE/CURRENT CONVERTERS to 100 MHz (20/E01)				
Sine Wave Flatness Field calibrations available Note 4	0 V to 3 V	10 Hz to 100 Hz 100 Hz to 300 kHz 300 kHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz 30 MHz to 50 MHz 50 MHz to 70 MHz 70 MHz to 80 MHz 80 MHz to 100 MHz	0.070 % 0.071 % 0.13 % 0.21 % 0.22 % 0.48 % 0.75 % 0.89 % 1.0 %	Thermal Voltage Converters
AC RESISTORS AND CURRENT (20/E02)				
AC Current – Measuring Equipment Field calibrations available Note 4	0 µA to 220 µA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.026 % + 16 nA 0.016 % + 10 nA 0.012 % + 8.2 nA 0.029 % + 12 nA 0.11 % + 66 nA	Fluke 5720A
	0.22 mA to 2.2 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.026 % + 41 nA 0.016 % + 36 nA 0.012 % + 36 nA 0.020 % + 0.11 µA 0.11 % + 0.66 µA	
	2.2 mA to 22 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.026 % + 0.41 µA 0.016 % + 0.36 µA 0.012 % + 0.36 µA 0.020 % + 0.56 µA 0.11 % + 5.1 µA	
	22 mA to 220 mA	10 Hz to 20 Hz 20 Hz to 40 Hz	0.026 % + 4.1 µA 0.016 % + 3.6 µA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
		40 Hz to 1 kHz	0.012 % + 2.6 µA	
		1 kHz to 5 kHz	0.020 % + 3.6 µA	
		5 kHz to 10 kHz	0.11 % + 10 µA	
	0.22 A to 2.2 A	20 Hz to 1 kHz	0.027 % + 36 µA	
		1 kHz to 5 kHz	0.046 % + 82 µA	
		5 kHz to 10 kHz	0.70 % + 160 µA	
	2.2 A to 11 A	40 Hz to 1 kHz	0.047 % + 0.17 mA	Fluke 5720A with 5725A
		1 kHz to 5 kHz	0.097 % + 0.39 mA	
		5 kHz to 10 kHz	0.37 % + 0.77 mA	
	11 A to 20.5 A	45 Hz to 100 Hz	0.093 % + 3.9 mA	Fluke 5520A
		100 Hz to 1 kHz	0.12 % + 3.9 mA	
		1 kHz to 5 kHz	2.3 % + 3.9 mA	
	20 A to 100 A	10 Hz to 1 kHz	0.12%	Ohm Labs Shunt with Current Source
Extended Frequency Ranges Field calibrations available Note 4	29 µA to 329.99 µA	10 kHz to 30 kHz	1.2 % + 3 µA	Fluke 5520A
	330 µA to 3.299 mA	10 kHz to 30 kHz	0.78 % + 0.5 µA	
	3.3 mA to 32.99 mA	10 kHz to 30 kHz	0.31 % + 3 µA	
	29 mA to 329.99 mA	10 kHz to 30 kHz	0.31 % + 0.16 mA	
Clamp-on Ammeter Toroidal Type Field calibrations available Note 4	20 A to 150 A	45 Hz to 65 Hz	0.34 % + 35 mA	Fluke 5520A with Wavetek Coil
		65 Hz to 440 Hz	0.95 % + 66 mA	
	150 A to 1000 A	45 Hz to 65 Hz	0.38 % + 0.17 A	
		65 Hz to 440 Hz	1.2 % + 0.35 A	
Clamp-on Ammeter Non-Toroidal Type Field calibrations available Note 4	20 A to 150 A	45 Hz to 65 Hz	0.66 % + 0.26 A	Fluke 5520A with Wavetek Coil
		65 Hz to 440 Hz	1.2 % + 0.29 A	
	150 A to 1000 A	45 Hz to 65 Hz	0.68 % + 1.0 A	
		65 Hz to 440 Hz	1.4 % + 1.2 A	
AC Current – Measure	0 µA to 100 µA	10 Hz to 20 Hz	0.46 % + 30 nA	Agilent 3458A opt 2

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) [Note 3,5]	Remarks
Field calibrations available [Note 4]		20 Hz to 45 Hz	0.17 % + 30 nA	
		45 Hz to 100 Hz	0.072 % + 30 nA	
		100 Hz to 5 kHz	0.072 % + 30 nA	
	100 µA to 1 mA	10 Hz to 20 Hz	0.46 % + 200 nA	
		20 Hz to 45 Hz	0.17 % + 200 nA	
		45 Hz to 100 Hz	0.071 % + 200 nA	
		100 Hz to 5 kHz	0.038 % + 200 nA	
	1 mA to 10 mA	10 Hz to 20 Hz	0.46 % + 2 µA	
		20 Hz to 45 Hz	0.17 % + 2 µA	
		45 Hz to 100 Hz	0.071 % + 2 µA	
		100 Hz to 5 kHz	0.038 % + 2 µA	
	10 mA to 100 mA	10 Hz to 20 Hz	0.46 % + 20 µA	
		20 Hz to 45 Hz	0.17 % + 20 µA	
		45 Hz to 100 Hz	0.071 % + 20 µA	
		100 Hz to 5 kHz	0.038 % + 20 µA	
	100 mA to 1 A	10 Hz to 20 Hz	0.46 % + 200 µA	
		20 Hz to 45 Hz	0.19 % + 200 µA	
		45 Hz to 100 Hz	0.097 % + 200 µA	
		100 Hz to 5 kHz	0.12 % + 200 µA	
	1 A to 3 A	10 Hz to 5 kHz	0.17% + 1.8 mA	Fluke 8846A
	3 A to 10 A	10 Hz to 5 kHz	0.18% + 6 mA	
	10 A to 100 A	10 Hz to 1 kHz	0.12%	Ohm Labs Shunt

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
DC RESISTANCE AND CURRENT (20/E05)			
DC Resistance – Measuring Equipment and Measure Field calibrations available Note 4	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	18 μΩ/Ω + 58 μΩ 15 μΩ/Ω + 0.58 mΩ 12 μΩ/Ω + 0.58 mΩ 12 μΩ/Ω + 5.8 mΩ 12 μΩ/Ω + 58 mΩ 19 μΩ/Ω + 2.3 Ω 62 μΩ/Ω + 120 Ω 0.059 % + 1.2 kΩ 0.58 % + 12 kΩ	Agilent 3458A with Decade Resistor
DC Resistance – Measuring Equipment Field calibrations available Note 4	0.33 mΩ 1 mΩ 10 mΩ 100 mΩ	0.047 % 0.037 % 0.013 % 0.012 %	DC Current Shunt
	10 MΩ to 100 MΩ 100 MΩ to 1 GΩ 1 GΩ to 10 GΩ 10 GΩ to 100 GΩ 100 GΩ to 900 GΩ 1 TΩ	0.043 % 0.12 % 0.24 % 0.59 % 0.77 % 1.6 %	Decade Resistor
DC Current – Measuring Equipment and Measure Field calibrations available Note 4	0 μA to 100 μA 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A	26 μA/A + 0.92 nA 26 μA/A + 5.8 nA 26 μA/A + 58 nA 43 μA/A + 0.58 μA 0.013 % + 12 μA	Agilent 3458A with Current Source
	1 A to 10 A 10 A to 100 A 100 A to 300 A	0.013 % 0.048 % 0.062 %	Guildline 9211 with Current Source

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
Clamp-on Ammeter Non-Toroidal Type Field calibrations available Note 4	20 A to 150 A 150 A to 1000 A	0.50 % + 0.14 A 0.52 % + 0.50 A	Fluke 5520A with Wavetek Coil
DC VOLTAGE (20/E06)			
DC Voltage –Measuring Equipment and Measure Field calibrations available Note 4	0 V to 100 mV 100 mV to 10 V 10 V to 100 V 100 V to 500 V 500 V to 800 V 800 V to 1 kV	7.1 µV/V + 0.58 µV 5.1 µV/V + 0.58 µV 7.6 µV/V + 35 µV 11 µV/V + 0.12 mV 16 µV/V + 0.12 mV 21 µV/V + 0.12 mV	Agilent 3458A opt. 2 with Fluke 5720A
DC Voltage – Measure Field calibrations available Note 4	> 1 kV to 2 kV 2 kV to 20 kV	0.05 % + 0.4 V 0.05 % + 4V	Vitrek 4600A
	20 kV to 100 kV	0.42 %	Ross HV Divider w/3458A
DC Voltage – Measuring Equipment Field calibrations available Note 4	0 V to 0.22 V 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 1.1 kV	10 µV/V + 0.71 µV 5.1 µV/V + 0.71 µV 3.7 µV/V + 2.6 µV 3.8 µV/V + 4.1 µV 5.1 µV/V + 41 µV 7.0 µV/V + 0.41 mV	Fluke 5720A Fluke 5720A with 5725A

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) Note 3,5	Remarks
LF AC VOLTAGE (20/E09)				
AC Voltage – Measure	0 to 1 mV	100 kHz to 1MHz 1 MHz to 3 MHz 3 MHz to 10 MHz	1.8 % + 2.4 µV 3.5 % + 2.4 µV 9.3 % + 2.4 µV	R&S URE3

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
		10 MHz to 20 MHz	23 % + 2.4 µV	
	1 mV to 3 mV	100 kHz to 1MHz	0.97 % + 2 µV	
		1 MHz to 3 MHz	3.5 % + 2 µV	
		3 MHz to 10 MHz	9.3 % + 2 µV	
		10 MHz to 20 MHz	23 % + 2 µV	
	3 mV to 100 mV	100 kHz to 1MHz	0.91 % + 3 µV	
		1 MHz to 3 MHz	1.8 % + 3 µV	
		3 MHz to 10 MHz	2.9 % + 3 µV	
		10 MHz to 20 MHz	7.0 % + 3 µV	
		20 MHz to 30 MHZ	14 % + 3 µV	
AC Voltage – Measure Field calibrations available Note 4	0 mV to 10 mV	1 Hz to 40 Hz	0.039 % + 3.5 µV	Agilent 3458A opt 2
		40 Hz to 1 kHz	0.028 % + 1.2 µV	
		1 kHz to 20 kHz	0.038 % + 1.2 µV	
		20 kHz to 50 kHz	0.15 % + 1.2 µV	
		50 kHz to 100 kHz	0.59 % + 1.2 µV	
		100 kHz to 300 kHz	4.6 % + 2.3 µV	
		300 kHz to 1 MHz	1.5 % + 5.8 µV	
		1 MHz to 4 MHz	8.1 % + 8.1 µV	
	10 mV to 100 mV	1 Hz to 40 Hz	0.013 % + 4.6 µV	
		40 Hz to 1 kHz	0.0094 % + 2.3 µV	
		1 kHz to 20 kHz	0.017 % + 2.3 µV	
		20 kHz to 50 kHz	0.037 % + 2.3 µV	
		50 kHz to 100 kHz	0.093 % + 2.3 µV	
		100 kHz to 300 kHz	0.36 % + 12 µV	
		300 kHz to 1 MHz	1.2 % + 12 µV	
		1 MHz to 2 MHz	1.9 % + 12 µV	
		2 MHz to 4 MHz	4.7 % + 81 µV	
		4 MHz to 8 MHz	4.7 % + 92 µV	
		8 MHz to 10 MHz	17 % + 120 µV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
	100 mV to 1 V	1 Hz to 40 Hz	0.0098 % + 46 µV	
		40 Hz to 1 kHz	0.0094 % + 23 µV	
		1 kHz to 20 kHz	0.017 % + 23 µV	
		20 kHz to 50 kHz	0.036 % + 23 µV	
		50 kHz to 100 kHz	0.093 % + 23 µV	
		100 kHz to 300 kHz	0.35 % + 0.12 mV	
		300 kHz to 1 MHz	1.2 % + 0.12 mV	
		1 MHz to 2 MHz	1.9 % + 0.12 mV	
		2 MHz to 4 MHz	4.7 % + 0.81 mV	
		4 MHz to 8 MHz	4.7 % + 0.92 mV	
		8 MHz to 10 MHz	17 % + 1.2 mV	
	1 V to 10 V	1 Hz to 40 Hz	0.015 % + 0.46 mV	
		40 Hz to 1 kHz	0.0095 % + 0.23 mV	
		1 kHz to 20 kHz	0.017 % + 0.23 mV	
		20 kHz to 50 kHz	0.036 % + 0.23 mV	
		50 kHz to 100 kHz	0.093 % + 0.23 mV	
		100 kHz to 300 kHz	0.35 % + 1.2 mV	
		300 kHz to 1 MHz	1.2 % + 1.2 mV	
		1 MHz to 2 MHz	1.8 % + 1.2 mV	
		2 MHz to 4 MHz	4.7 % + 8.1 mV	
		4 MHz to 8 MHz	4.7 % + 9.2 mV	
		8 MHz to 10 MHz	17 % + 12 mV	
	10 V to 100 V	1 Hz to 40 Hz	0.024 % + 4.6 mV	
		40 Hz to 1 kHz	0.024 % + 2.3 mV	
		1 kHz to 20 kHz	0.024 % + 2.3 mV	
		20 kHz to 50 kHz	0.041 % + 2.3 mV	
		50 kHz to 100 kHz	0.14 % + 2.3 mV	
		100 kHz to 300 kHz	0.46 % + 12 mV	
		300 kHz to 1 MHz	1.7 % + 12 mV	
	100 V to 700 V	1 Hz to 40 Hz	0.047 % + 46 mV	
		40 Hz to 1 kHz	0.047 % + 23 mV	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
		1 kHz to 20 kHz	0.071 % + 23 mV	
		20 kHz to 50 kHz	0.14 % + 23 mV	
		50 kHz to 100 kHz	0.35 % + 23 mV	
	700 V to 2 kV	20 Hz to 100 Hz	0.1 % + 2 V	Vitrek 4600A
		100 Hz to 400 Hz	0.47 % + 4 V	
	2 kV to 20 kV	20Hz to 100 Hz	0.25 % + 20 V	
	20 kV to 60 kV	60 Hz	1.5 %	Ross HV Divider w/Fluke 87
AC Voltage – Measuring Equipment Field calibrations available Note 4	0 mV to 2.2 mV	10 Hz to 20 Hz	0.036 % + 4.1 µV	Fluke 5720A
		20 Hz to 40 Hz	0.033 % + 4.1 µV	
		40 Hz to 20 kHz	0.033 % + 4.1 µV	
		20 kHz to 50 kHz	0.033 % + 4.1 µV	
		50 kHz to 100 kHz	0.057 % + 5.1 µV	
		100 kHz to 300 kHz	0.13 % + 10 µV	
		300 kHz to 500 kHz	0.2 % + 20 µV	
		500 kHz to 1 MHz	0.31 % + 20 µV	
	2.2 mV to 22 mV	10 Hz to 20 Hz	0.037 % + 4.1 µV	
		20 Hz to 40 Hz	0.026 % + 4.1 µV	
		40 Hz to 20 kHz	0.0099 % + 4.1 µV	
		20 kHz to 50 kHz	0.024 % + 4.1 µV	
		50 kHz to 100 kHz	0.053 % + 5.1 µV	
		100 kHz to 300 kHz	0.11 % + 10 µV	
		300 kHz to 500 kHz	0.14 % + 20 µV	
		500 kHz to 1 MHz	0.28 % + 20 µV	
	22 mV to 220 mV	10 Hz to 20 Hz	0.025 % + 12 µV	
		20 Hz to 40 Hz	0.0093 % + 7.1 µV	
		40 Hz to 20 kHz	0.0082 % + 7.1 µV	
		20 kHz to 50 kHz	0.021 % + 7.1 µV	
		50 kHz to 100 kHz	0.047 % + 17 µV	
		100 kHz to 300 kHz	0.092 % + 20 µV	

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		300 kHz to 500 kHz	0.14 % + 26 µV	
		500 kHz to 1 MHz	0.28 % + 46 µV	
	220 mV to 2.2 V	10 Hz to 20 Hz	0.025 % + 41 µV	
		20 Hz to 40 Hz	0.0093 % + 15 µV	
		40 Hz to 20 kHz	0.0046 % + 8.2 µV	
		20 kHz to 50 kHz	0.0077 % + 10 µV	
		50 kHz to 100 kHz	0.011 % + 31 µV	
		100 kHz to 300 kHz	0.043 % + 82 µV	
		300 kHz to 500 kHz	0.10 % + 200 µV	
		500 kHz to 1 MHz	0.17 % + 0.31 mV	
	2.2 V to 22 V	10 Hz to 20 Hz	0.025 % + 0.41 mV	
		20 Hz to 40 Hz	0.0092 % + 0.15 mV	
		40 Hz to 20 kHz	0.0046 % + 51 µV	
		20 kHz to 50 kHz	0.0078 % + 0.10 mV	
		50 kHz to 100 kHz	0.010 % + 0.20 mV	
		100 kHz to 300 kHz	0.028 % + 0.61 mV	
		300 kHz to 500 kHz	0.10 % + 2.0 mV	
		500 kHz to 1 MHz	0.15 % + 3.3 mV	
	22 V to 220 V	10 Hz to 20 Hz	0.025 % + 4.1 mV	
		20 Hz to 40 Hz	0.0092 % + 1.5 mV	
		40 Hz to 20 kHz	0.0053 % + 0.61 mV	
		20 kHz to 50 kHz	0.0082 % + 1.0 mV	
		50 kHz to 100 kHz	0.015 % + 2.5 mV	
	220 V to 750 V	30 kHz to 50 kHz	0.061 % + 11 mV	Fluke 5720A/5725A
		50 kHz to 100 kHz	0.24 % + 46 mV	
	220 V to 1100 V	40 Hz to 1 kHz	0.011 % + 4.1 mV	
		1 kHz to 20 kHz	0.017 % + 6.1 mV	
		20 kHz to 30 kHz	0.061 % + 11 mV	

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LF CAPACITANCE (20/E10)				
Capacitance – Measuring Equipment Field calibrations available Note 4	0.19 nF to 1.1 nF	10 Hz to 10 kHz	0.39 % + 7.8 pF	Fluke 5520A
	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	0.20 % + 7.8 pF	
	11 nF to 110 nF	10 Hz to 1 kHz	0.20 % + 78 pF	
	110 nF to 330 nF	10 Hz to 1 kHz	0.20 % + 0.23 nF	
	330 nF to 1.1 µF	10 Hz to 600 Hz	0.20 % + 0.78 nF	
	1.1 µF to 3.3 µF	10 Hz to 300 Hz	0.20 % + 2.3 nF	
	3.3 µF to 11 µF	10 Hz to 150 Hz	0.20 % + 7.8 nF	
	11 µF to 33 µF	10 Hz to 120 Hz	0.31 % + 23 nF	
	33 µF to 110 µF	10 Hz to 80 Hz	0.35 % + 78 nF	
	110 µF to 330 µF	DC to 50 Hz	0.35 % + 0.23 µF	
	330 µF mF to 1.1 mF	DC to 20 Hz	0.35 % + 0.78 µF	
	1.1 mF to 3.3 mF	DC to 6 Hz	0.35 % + 2.3 µF	
	3.3 mF to 11 mF	DC to 2 Hz	0.35 % + 7.8 µF	
	11 mF to 33 mF	DC to 0.6 Hz	0.58 % + 23 µF	
	33 mF to 110 mF	DC to 0.2 Hz	0.86 % + 78 µF	
LF POWER/ENERGY (20/E12)				
Power – Measuring Equipment				
DC Power				
0.33 mA to 3.3 mA	11 µW to 3.4 W	DC	0.024 %	Fluke 5520A
3.3 mA to 33 mA	0.11W to 34 W		0.012 %	
33 mA to 330 mA	1.1 mW to 340 W		0.0093 %	
330 mA to 1.1 A	11 mW to 3.4 kW		0.026 %	
1.1 A to 3 A	36 mW to 3.1 kW		0.033 %	
3 to 11 A	0.99 W to 11 kW		0.064 %	
AC Power Note 8 (PF = 1)				
3.3 mA to 9 mA	0.11 mW to 9.2 W	45 Hz to 65 Hz	0.089 %	
9 mA to 33 mA	3 mW to 34W		0.061 %	
33 mA to 90 mA	1.1 mW to 92 W		0.089 %	
90 mA to 330 mA	3.0 mW to 340W		0.061 %	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
0.33 A to 1.1 A	11 mW to 1.1 kW		0.071 %	
1.1 A to 3.0 A	36 mW to 3.1 kW		0.064 %	
3.0 A to 5.4 A	99 mW to 5.5 kW		0.11 %	
5.4 A to 11 A	180 mW to 11 kW		0.084 %	
11 A to 15 A	360 mW to 15 kW	45 Hz to 100 Hz	0.14 %	
11 A to 15 A	360 mW to 15 kW	100 Hz to 1 kHz	0.16%	
15 A to 20.5 A	500 mW to 21 kW	45 Hz to 100 Hz	0.13 %	
15 A to 20.5 A	500 mW to 21 kW	100 Hz to 1 kHz	0.13 %	
PHASE METERS (20/E15)				
LF Phase – Measuring Equipment Field calibrations available Note 4	0° to 90°	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	0.11° 0.20° 0.39° 1.9° 3.9° 7.8°	Fluke 5520A

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3,5	Remarks
TIME AND FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Frequency – Measuring Equipment and Measure Note 9			
In – Lab	10 MHz	4.1×10^{-12} Hz	58503A GPS Receiver
Field Service Note 4	10 MHz	2.1×10^{-7} Hz	HP 53131A (010) Counter

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3,5	Remarks
OSCILLATOR CHARACTERIZATION (20/F03)			
Total Harmonic Distortion (0 dB to – 100 dB)	20 Hz to 20 kHz 20 kHz to 100 kHz	1.2 dB 2.3 dB	HP 8903B
Harmonic Distortion	100 kHz to 100 MHz	1.7 dB	Agilent 8592L
Total Harmonic Distortion 5 Hz to 600 kHz Field calibrations available Note 4			
Input Voltage Range < 30 V			Agilent 334A
100 % to 0.3 %	10 Hz to 1 MHz 1 MHz to 3 MHz	3 % 6 %	
0.1 %	10 Hz to 20 Hz 20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz	12 % 6 % 3 % 6 % 12 %	
Input Voltage Range > 30 V			
100 % to 0.3 %	10 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 3 MHz	3 % 6 % 12 %	
0.1 %	20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz	12 % 3 % 6 % 12 %	
PULSE WAVEFORM (20/F04)			
Rise time - Measuring Equipment	≥ 300 ps	2.1 %	Fluke 5520A SC1100

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3,5	Remarks
MECHANICAL			
FORCE (20/M06)			
Force Measuring Equipment	10 gf to 100 gf	0.04 %	ASTM Class 2 Weights
	0.2 lbf to 500 lbf	0.025 % + 0.001 lbf	NIST Class F Weights
	> 500 lbf to 1000 lbf	0.58 lbf	Load Cell
MASS DETERMINATION (20/M08)			
Mass Measure	1 g to 1 kg 1 kg to 5.1 kg	18 mg 180 mg	Mettler PR5003 DR
TORQUE (20/M15)			
Torque – Measure Field calibrations available Note 4	15 ozf-in to 200 ozf-in 1.0 lbf-ft to 12.5 lbf-ft 12.5 lbf-ft to 600 lbf-ft 600 lfb-ft to 2000 lbf-ft	0.44 % + 0.3 ozf-in 0.44 % 0.34 % 1.3 %	Torque calibrator
Torque – Measuring Equipment Field calibrations available Note 4	15 ozf-in to 80 ozf-in 0.42 lbf-ft to 50 lbf-ft	0.058 % 0.058 %	Torque Wheels with Weight
	> 50 lbf-ft to 2000 lbf-ft	0.058 %	Torque Arm with Weight
WEIGHING INSTRUMENTS (20/M16)			
Mass – Measuring Equipment Field calibrations available Note 4	5 kg 2 kg 1 kg 500 g 300 g 200 g 100 g 50 g 30 g	14 mg 5.9 mg 3.1 mg 1.8 mg 1.5 mg 0.31 mg 0.14 mg 0.09 mg 0.09 mg	ASTM Class 1 Weights

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	20 g	59 µg	
	10 g	41 µg	
	5 g	41 µg	
	3 g	41 µg	
	2 g	41 µg	
	1 g	41 µg	
	500 mg	17 µg	
	200 mg	17 µg	
	100 mg	17 µg	
	50 mg	17 µg	
	20 mg	17 µg	
	10 mg	17 µg	
	5 mg	17 µg	
	2 mg	17 µg	
	1 mg	17 µg	
Avoirdupois Field calibrations available Note 4	50 lb	2.3 g	NIST Class F Weights
	30 lb	1.4 g	
	20 lb	0.91 g	
	10 lb	0.45 g	
	5 lb	0.23 g	
	3 lb	0.14 g	
	2 lb	91 mg	
	1 lb	45 mg	
ELECTROMAGNETICS – RF/MICROWAVE			
RF/MICROWAVE POWER (20/R17)			
Bandwidth Field calibrations available Note 4	50 kHz to 100 MHz	1.7 % + 100 µV	Fluke 5520A SC1100
	100 MHz to 300 MHz	2.2 % + 100 µV	
	300 MHz to 600 MHz	4.1 % + 100 µV	
	600 MHz to 1.1 GHz	5.1 % + 100 µV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
THERMODYNAMIC			
HUMIDITY (20/T02)			
Relative Humidity	10 % RH to 95 % RH	0.50 % RH	Thunder Scientific 2500
LABORATORY THERMOMETERS, DIGITAL AND ANALOG (20/T03)			
Temperature – Measuring Equipment	-20 °C to 120 °C 120 °C to 600 °C	0.028 °C 0.13 °C	Liquid Bath with RTD Dry Block Calibrator
Temperature – Measure	-195 °C to 660 °C	0.021 °C	
PRESSURE (20/T05)			
Pneumatic			
Absolute Pressure Source	0 psi to 30 psi 30 psi to 1000 psi	0.0024 psi 0.0066 % + 0.00048 psi	DHI RPM 4
Gage Pressure Source Field calibrations available Note 4	0 psi to 0.072 psi 0.14 psi to 25 psi -15 psi to 30 psi 30 psi to 1000 psi	43 µpsi 0.017 % + 44 µpsi 0.0021 psig 0.0066 % + 0.0001 psig	Micro tektor Ametek RK-1100 WC DHI RPM 4
Hydraulic			
Gage Pressure Source Field calibrations available Note 4	5 psi to 1500 psi 1500 psi to 15 000 psi	0.0080 % 0.0080 %	Ametek T-150
RADIATION THERMOMETRY (20/T06)			
Infrared Temperature – Measuring Equipment	-15 °C to 0 °C 0 °C to 50 °C 50 °C to 100 °C 100 °C to 120 °C 120 °C to 200 °C 200 °C to 350 °C 350 °C to 500 °C 500 °C to 1000 °C	0.98 °C 0.67 °C 0.71 °C 0.77 °C 1.0 °C 1.7 °C 2.3 °C 4.8 °C	Hart Black Body Omega Black Body

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
TEMPERATURE INDICATORS (20/T08)			
Electrical Substitution			Thermocouple Half Junctions
TYPE			
J	-210 °C to 1200 °C	0.10 °C	
K	-270 °C to 1372 °C	0.10 °C	
T	-270 °C to 400 °C	0.10 °C	
E	-270 °C to 1000 °C	0.10 °C	
R	0 °C to 250 °C	0.45 °C	Fluke 5520A
	250 °C to 400 °C	0.29 °C	
	400 °C to 1000 °C	0.27 °C	
	1000 °C to 1767 °C	0.32 °C	
S	0 °C to 250 °C	0.38 °C	
	250 °C to 400 °C	0.29 °C	
	400 °C to 1000 °C	0.30 °C	
	1000 °C to 1767 °C	0.37 °C	
B	600 °C to 800	0.35 °C	
	800 °C to 1000	0.29 °C	
	1000 °C to 1550	0.26 °C	
	1550 °C to 1820	0.28 °C	
N	-200 °C to -100 °C	0.31 °C	
	-100 °C to -25 °C	0.17 °C	
	-25 °C to 120 °C	0.15 °C	
	120 °C to 410 °C	0.14 °C	
	410 °C to 1300 °C	0.21 °C	
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.1.h. 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: See NIST Handbook 150 for further explanation of these notes.
Note 8: The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one, but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
Note 9: Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise and gating errors.

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