



National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 200886-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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| Transcat - Portland 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 | Parameter(s) of Accreditation 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. (NVLAP Code: 20/A01) |

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

| Measured Parameter or Device Calibrated | Range | Uncertainty ($k=2$) ^{Note 3} | Remarks |
|--|----------------------------------|---|---|
| DIMENSIONAL | | | |
| NVLAP Code: 20/D01 ANGULAR Angles | 0° to 75° 90° | 5.1 as 4.9 as | Sine Plate w/Gage Blocks Master Square |
| NVLAP Code: 20/D03 GAGE BLOCKS Steel Blocks Only | 0.05 in to 1 in 1 in to 4 in | Where L is the length in inches of device under test. 2.1 μ in + 1.0 L μ in 0.9 μ in + 2.1 L μ in | Comparison to Gage Blocks |
| NVLAP Code: 20/D05 LENGTH & DIAMETER; STEP GAGES Micrometers and Calipers— Outside, Inside, Depth Field calibrations available ^{Note 4} | 0.05 in to 8 in 8 in to 24 in | 14 μ in + 6.5 L μ in 12 μ in + 7 L μ in | Comparison to Gage Blocks |
| Anvil Flatness Field calibrations available ^{Note 4} | 0 in to 1 in | 4.5 μ in | Optical Flats |
| Anvil Parallelism Field calibrations available ^{Note 4} | 0 in to 1 in | 9.7 μ in | Optical Parallel |

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| Measured Parameter or Device Calibrated | Range | Uncertainty ($k=2$) <small>Note 3</small> | Remarks |
|---|-------------------------------|--|------------------------------------|
| Length Measurement Single Axis | 0.001 in to 10 in | $3 \mu\text{in} + 4.0L \mu\text{in}$ | Horizontal Comparator |
| Height Measuring Equipment (Height Gages, Dial Gages, And Digital Indicators) | 0 in to 4 in 4 in to 24 in | $31 \mu\text{in} + 1L \mu\text{in}$ $26 \mu\text{in} + 3L \mu\text{in}$ | Comparison to Gage Blocks |
| Height Measure (Master 1-2-3 Blocks, Caliper Masters, Parallels) | 0 in to 4 in 4 in to 24 in | $31 \mu\text{in} + 1L \mu\text{in}$ $26 \mu\text{in} + 3L \mu\text{in}$ | Gage Blocks with Amplifier |
| Parallelism and Straightness | 0 in to 12 in | 20 μin | |
| NVLAP Code: 20/D12 SURFACE TEXTURE Surface Plates Field calibrations available <small>Note 4</small> | 12 in to 168 in | Where D is the diagonal in inches of device under test. $19 \mu\text{in} + \sqrt{D} \mu\text{in}$ | Optodyne LDDM |
| NVLAP Code: 20/D13 SURVEYING RODS and TAPES Steel Rules | 0 in to 12 in | 320 μin | Vision System |
| NVLAP Code: 20/D14 THREADED PLUGS & RINGS Inner Pitch Diameter | 0 in to 6 in | 150 μin | Comparison to Master Setting Plugs |
| Outer Pitch Diameter | 0 in to 6 in | 82 μin | Comparator with Thread Wires |
| NVLAP Code: 20/D15 TWO DIMENSIONAL GAGES 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 ($k=2$) <small>Note 3,5</small> | Remarks |
|--|-------------------|---|--|------------------------|
| ELECTROMAGNETICS – DC/LOW FREQUENCY | | | | |
| NVLAP Code: 20/E02 AC RESISTORS AND CURRENT AC Current – Measuring Equipment Field calibrations available <small>Note 4</small> | 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 | 0.028 % + 16 nA 0.019 % + 10 nA 0.015 % + 8 nA 0.030 % + 15 nA 0.11 % + 65 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 | 0.027 % + 40 nA 0.017 % + 35 nA 0.014 % + 35 nA 0.021 % + 110 nA 0.11 % + 650 nA | |
| | 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 | 0.028 % + 400 nA 0.018 % + 350 nA 0.014 % + 350 nA 0.021 % + 0.55 μA 0.11 % + 5 μA | |
| | 22 mA to 220 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 | 0.028 % + 4 μA 0.018 % + 3.5 μA 0.014 % + 2.5 μA 0.022 % + 3.5 μA 0.11 % + 10 μA | |
| | 0.22 A to 2.2 A | 20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz | 0.027 % + 35 μA 0.047 % + 80 μA 0.71 % + 160 μA | |
| | 2.2 A to 11 A | 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz | 0.049 % + 170 μA 0.098 % + 380 μA 0.37 % + 750 μA | Fluke 5720A with 5725A |

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| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|--|---|---|-------------------------------|
| Extended Frequency Ranges Field calibrations available <small>Note 4</small> | 11 A to 20.5 A | 45 Hz to 1 kHz 1 kHz to 5 kHz | 0.092 % + 3.9 mA 2.3 % + 3.9 mA | Fluke 5520A |
| Clamp-on Ammeter Toroidal Type Field calibrations available <small>Note 4</small> | 29 μA to 329.99 μA 330 μA to 3.299 mA 3.3 mA to 32.99 mA 29 mA to 329.99 mA | 10 kHz to 30 kHz 10 kHz to 30 kHz 10 kHz to 30 kHz 10 kHz to 30 kHz | 1.2 % + 3 μA 0.78 % + 0.5 μA 0.31 % + 3 μA 0.31 % + 0.16 mA | Fluke 5520A |
| Clamp-on Ammeter Non-Toroidal Type Field calibrations available <small>Note 4</small> | 20 A to 150 A 150 A to 1000 A | 45 Hz to 65 Hz 65 Hz to 440 Hz 45 Hz to 65 Hz 65 Hz to 440 Hz | 0.34 % + 35 mA 0.95 % + 66 mA 0.38 % + 0.17 A 1.2 % + 0.35 A | Fluke 5520A with Wavetek Coil |
| AC Current – Measure Field calibrations available <small>Note 4</small> | 0 μA to 100 μA 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA | 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz | 0.46 % + 30 nA 0.17 % + 30 nA 0.072 % + 30 nA 0.072 % + 30 nA 0.46 % + 200 nA 0.17 % + 200 nA 0.071 % + 200 nA 0.038 % + 200 nA 0.46 % + 2 μA 0.17 % + 2 μA 0.071 % + 2 μA 0.038 % + 2 μA 0.46 % + 20 μA 0.17 % + 20 μA 0.071 % + 20 μA | Agilent 3458A opt 2 |

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| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|---------------|-----------------|---|---------|
| | | 100 Hz to 5 kHz | 0.038 % + 20 μ A | |
| | 100 mA to 1 A | 10 Hz to 20 Hz | 0.46 % + 200 μ A | |
| | | 20 Hz to 45 Hz | 0.19 % + 200 μ A | |
| | | 45 Hz to 100 Hz | 0.097 % + 200 μ A | |
| | | 100 Hz to 5 kHz | 0.12 % + 200 μ A | |

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

| Measured Parameter or Device Calibrated | Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|--|--|-------------------------------------|
| NVLAP Code: 20/E05 DC RESISTANCE AND CURRENT DC Resistance – Measuring Equipment and Measure Field calibrations available <small>Note 4</small> | 0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 k Ω 1 k Ω to 10 k Ω 10 k Ω to 100 k Ω 100 k Ω to 1 M Ω 1 M Ω to 10 M Ω 10 M Ω to 100 M Ω 100 M Ω to 1 G Ω | 17 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 13 $\mu\Omega/\Omega$ + 500 $\mu\Omega$ 11 $\mu\Omega/\Omega$ + 500 $\mu\Omega$ 12 $\mu\Omega/\Omega$ + 5 m Ω 13 $\mu\Omega/\Omega$ + 50 m Ω 19 $\mu\Omega/\Omega$ + 2 Ω 53 $\mu\Omega/\Omega$ + 100 Ω 560 $\mu\Omega/\Omega$ + 1 k Ω 0.58 % + 10 k Ω | Agilent 3458A with Decade Resistor |
| DC Resistance – Measuring Equipment Field calibrations available <small>Note 4</small> | 0.33 m Ω 1 m Ω 10 m Ω 100 m Ω 10 M Ω to 100 M Ω 100 M Ω to 1 G Ω 1 G Ω to 10 G Ω 10 G Ω to 100 G Ω 100 G Ω to 900 G Ω 1 T Ω | 0.023 % 0.017 % 0.012 % 0.007 % 0.035 % 0.12 % 0.24 % 0.58 % 0.77 % 1.6 % | DC Current Shunt Decade Resistor |

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| Measured Parameter or Device Calibrated | Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|--|--|---|--|
| DC Current – Measuring Equipment and Measure Field calibrations available <small>Note 4</small> | 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 1 A to 10 A 10 A to 100 A 100 A to 300 A Clamp-on Ammeter Non-Toroidal Type Field calibrations available <small>Note 4</small> | 26 μA/A + 0.8 nA 26 μA/A + 5 nA 26 μA/A + 50 nA 43 μA/A + 500 nA 130 μA/A + 10 μA 0.01 % 0.046 % 0.062 % 20 A to 150 A 150 A to 1000 A | Agilent 3458A with Current Source Guildline 9211 with Current Source Fluke 5520A with Wavetek Coil |
| NVLAP Code: 20/E06 DC VOLTAGE DC Voltage –Measuring Equipment and Measure Field calibrations available <small>Note 4</small> | 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 | 8.1 μV/V + 0.5 μV 5.2 μV/V + 0.5 μV 7.9 μV/V + 30 μV 12 μV/V + 100 μV 17 μV/V + 100 μV 21 μV/V + 100 μV | Agilent 3458A opt. 2 with Fluke 5720A |
| DC Voltage – Measure Field calibrations available <small>Note 4</small> | > 1 kV to 2 kV 2 kV to 20 kV 20 kV to 100 kV | 0.05 % + 0.4 V 0.05 % + 4V 0.42 % | Vitrek 4600A |
| DC Voltage – Measuring Equipment Field calibrations available <small>Note 4</small> | 220 V to 1.1 kV | 9.5 μV/V + 500 μV | Ross HV Divider w/3458A Fluke 5720A with 5725A |

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| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|-----------|--|--|----------|
| NVLAP Code: 20/E09 LF AC VOLTAGE 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 ($k=2$) <small>Note 3,5</small> | Remarks |
|--|-----------------|--------------------|---|---------------------|
| AC Voltage – Measure Field calibrations available <small>Note 4</small> | 1 mV to 3 mV | 10 MHz to 20 MHz | 23 % + 2.4 μ V | |
| | | 100 kHz to 1MHz | 0.97 % + 2 μ V | |
| | | 1 MHz to 3 MHz | 3.5 % + 2 μ V | |
| | | 3 MHz to 10 MHz | 9.3 % + 2 μ V | |
| | 3 mV to 100 mV | 10 MHz to 20 MHz | 23 % + 2 μ V | |
| | | 100 kHz to 1MHz | 0.91 % + 3 μ V | |
| | | 1 MHz to 3 MHz | 1.8 % + 3 μ V | |
| | | 3 MHz to 10 MHz | 2.9 % + 3 μ V | |
| | | 10 MHz to 20 MHz | 7.0 % + 3 μ V | |
| | 0 mV to 10 mV | 20 MHz to 30 MHZ | 14 % + 3 μ V | |
| | | 1 Hz to 40 Hz | 0.039 % + 3 μ V | |
| | | 40 Hz to 1 kHz | 0.028 % + 1 μ V | |
| | | 1 kHz to 20 kHz | 0.038 % + 1 μ V | |
| | | 20 kHz to 50 kHz | 0.15 % + 1 μ V | |
| | | 50 kHz to 100 kHz | 0.59 % + 1 μ V | |
| | 10 mV to 100 mV | 100 kHz to 300 kHz | 4.6 % + 2 μ V | Agilent 3458A opt 2 |
| | | 1 Hz to 40 Hz | 0.013 % + 4 μ V | |
| | | 40 Hz to 1 kHz | 0.0094 % + 2 μ V | |
| | | 1 kHz to 20 kHz | 0.017 % + 2 μ V | |
| | | 20 kHz to 50 kHz | 0.037 % + 2 μ V | |
| | | 50 kHz to 100 kHz | 0.093 % + 2 μ V | |
| | | 100 kHz to 300 kHz | 0.36 % + 10 μ V | |
| | 100 mV to 1 V | 300 kHz to 1 MHz | 1.2 % + 10 μ V | |
| | | 1 Hz to 40 Hz | 0.0098 % + 40 μ V | |
| | | 40 Hz to 1 kHz | 0.0094 % + 20 μ V | |
| | | 1 kHz to 20 kHz | 0.017 % + 20 μ V | |
| | | 20 kHz to 50 kHz | 0.036 % + 20 μ V | |
| | | 50 kHz to 100 kHz | 0.093 % + 20 μ V | |
| | | 100 kHz to 300 kHz | 0.35 % + 100 μ V | |
| | | 300 kHz to 1 MHz | 1.2 % + 100 μ V | |

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| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|--|--|---|---|---|
| AC Voltage – Measuring Equipment Field calibrations available <small>Note 4</small> | 1 V to 10 V 10 V to 100 V 100 V to 700 V 700 V to 2 kV 2 kV to 20 kV 20 kV to 60 kV 0 mV to 2.2 mV | 1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 20 Hz to 100 Hz 100 Hz to 400 Hz 20Hz to 100 Hz 60 Hz 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz | 0.0095 % + 400 μ V 0.0095 % + 200 μ V 0.017 % + 200 μ V 0.036 % + 200 μ V 0.093 % + 200 μ V 0.35 % + 1 mV 1.2 % + 1 mV 0.024 % + 4 mV 0.024 % + 2 mV 0.024 % + 2 mV 0.041 % + 2 mV 0.14 % + 2 mV 0.46 % + 10 mV 1.7 % + 10 mV 0.047 % + 40 mV 0.047 % + 20 mV 0.071 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV 0.1 % + 2 V 0.47 % + 4 V 0.25 % + 20 V 1.4 % 0.04 % + 4 μ V 0.03 % + 4 μ V 0.08 % + 4 μ V 0.03 % + 4 μ V 0.06 % + 5 μ V 0.13 % + 10 μ V 0.2 % + 20 μ V | Vitrek 4600A Ross HV Divider w/Fluke 87 Fluke 5720A |

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| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|-----------------|--------------------|---|---------|
| | | 500 kHz to 1 MHz | 0.31 % + 20 μ V | |
| | 2.2 mV to 22 mV | 10 Hz to 20 Hz | 0.04 % + 4 μ V | |
| | 2.2 mV to 22 mV | 20 Hz to 40 Hz | 0.03 % + 4 μ V | |
| | 2.2 mV to 22 mV | 40 Hz to 20 kHz | 0.015 % + 4 μ V | |
| | 2.2 mV to 22 mV | 20 kHz to 50 kHz | 0.032 % + 4 μ V | |
| | 2.2 mV to 22 mV | 50 kHz to 100 kHz | 0.06 % + 5 μ V | |
| | 2.2 mV to 22 mV | 100 kHz to 300 kHz | 0.066 % + 10 μ V | |
| | 2.2 mV to 22 mV | 300 kHz to 500 kHz | 0.17 % + 20 μ V | |
| | 2.2 mV to 22 mV | 500 kHz to 1 MHz | 0.31 % + 20 μ V | |
| | 22 mV to 220 mV | 10 Hz to 20 Hz | 0.029 % + 12 μ V | |
| | 22 mV to 220 mV | 20 Hz to 40 Hz | 0.011 % + 7 μ V | |
| | 22 mV to 220 mV | 40 Hz to 20 kHz | 0.009 % + 7 μ V | |
| | 22 mV to 220 mV | 20 kHz to 50 kHz | 0.021 % + 7 μ V | |
| | 22 mV to 220 mV | 50 kHz to 100 kHz | 0.048 % + 17 μ V | |
| | 22 mV to 220 mV | 100 kHz to 300 kHz | 0.094 % + 20 μ V | |
| | 22 mV to 220 mV | 300 kHz to 500 kHz | 0.15 % + 25 μ V | |
| | 22 mV to 220 mV | 500 kHz to 1 MHz | 0.28 % + 45 μ V | |
| | 220 mV to 2.2 V | 10 Hz to 20 Hz | 0.028 % + 40 μ V | |
| | 220 mV to 2.2 V | 20 Hz to 40 Hz | 0.010 % + 15 μ V | |
| | 220 mV to 2.2 V | 40 Hz to 20 kHz | 0.005 % + 8 μ V | |
| | 220 mV to 2.2 V | 20 kHz to 50 kHz | 0.008 % + 10 μ V | |
| | 220 mV to 2.2 V | 50 kHz to 100 kHz | 0.012 % + 30 μ V | |
| | 220 mV to 2.2 V | 100 kHz to 300 kHz | 0.044 % + 80 μ V | |
| | 220 mV to 2.2 V | 300 kHz to 500 kHz | 0.10 % + 200 μ V | |
| | 220 mV to 2.2 V | 500 kHz to 1 MHz | 0.18 % + 300 μ V | |
| | 2.2 V to 22 V | 10 Hz to 20 Hz | 0.028 % + 0.4 mV | |
| | 2.2 V to 22 V | 20 Hz to 40 Hz | 0.010 % + 0.15 mV | |
| | 2.2 V to 22 V | 40 Hz to 20 kHz | 0.005 % + 0.05 mV | |
| | 2.2 V to 22 V | 20 kHz to 50 kHz | 0.008 % + 0.1 mV | |
| | 2.2 V to 22 V | 50 kHz to 100 kHz | 0.012 % + 0.2 mV | |
| | 2.2 V to 22 V | 100 kHz to 300 kHz | 0.03 % + 0.6 mV | |
| | 2.2 V to 22 V | 300 kHz to 500 kHz | 0.10 % + 2 mV | |

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|---|-----------------|-------------------|---|-------------------|
| | | 500 kHz to 1 MHz | 0.17 % + 3.2mV | |
| | 22 V to 220 V | 10 Hz to 20 Hz | 0.028 % + 4 mV | |
| | | 20 Hz to 40 Hz | 0.010 % + 1.5 mV | |
| | | 40 Hz to 20 kHz | 0.0057 % + 0.6 mV | |
| | | 20 kHz to 50 kHz | 0.0095 % + 1 mV | |
| | | 50 kHz to 100 kHz | 0.017 % + 2.5 mV | |
| | 220 V to 750 V | 30 kHz to 50 kHz | 0.061 % + 11 mV | |
| | | 50 kHz to 100 kHz | 0.25 % + 45 mV | Fluke 5720A/5725A |
| | 220 V to 1100 V | 40 Hz to 1 kHz | 0.011 % + 4 mV | |
| | | 1 kHz to 20 kHz | 0.017 % + 6 mV | |
| | | 20 kHz to 30 kHz | 0.061 % + 11 mV | |

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| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|-------------------|-----------------|---|---------|
| NVLAP Code: 20/E10 LF CAPACITANCE Capacitance – Measuring Equipment Field calibrations available <small>Note 4</small> | | | | |
| | 0.19 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 | 0.21 % + 7.8 pF | |
| | 11 nF to 33 nF | 10 Hz to 1 kHz | 0.21 % + 78 pF | |
| | 33 nF to 110 nF | 10 Hz to 1 kHz | 0.21 % + 78 pF | |
| | 110 nF to 330 nF | 10 Hz to 1 kHz | 0.21 % + 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 | 0.32 % + 23 nF | |
| | 33 µF to 110 µF | 10 Hz to 80 Hz | 0.36 % + 78 nF | |
| | 110 µF to 330 µF | DC to 50 Hz | 0.36 % + 0.23 µF | |
| | 330 µF 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 | |

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|--|--|----------------------------------|---|-------------|
| | 11 mF to 33 mF 33 mF to 110 mF | DC to 0.6 Hz DC to 0.2 Hz | 0.58 % + 23 μ F 0.85 % + 78 μ F | |
| NVLAP Code: 20/E12 LF POWER/ENERGY Power – Measuring Equipment (for current range listed below) DC Power | | | | |
| 0.33 mA to 330 mA | 11 μ W to 1.1 mW 1.1 mW to 110 mW 0.11W to 110 W 110 W to 330 W | DC DC DC DC | 0.024 % 0.027 % 0.024 % 0.018 % | Fluke 5520A |
| 0.33 A to 3 A | 11 W to 110 mW 0.11 W to 990 W 1 W to 3 kW | DC DC DC | 0.044 % 0.053 % 0.0096 % | |
| 3 A to 20.5 A | 0.099 W to 0.99 W 0.99 W to 6.8 kW 6.8 W to 20.5 kW | DC DC DC | 0.088 % 0.07 % 0.04 % | |
| AC Power <small>Note 8</small> (PF = 1) 3.3 mA to 9 mA | 0.11 mW to 3 mW 3 mW to 9 W | 10 Hz to 65 Hz 10 Hz to 65 Hz | 0.13 % 0.077 % | |
| 9 mA to 33 mA | 0.3 mW to 10 mW 10 mW to 33 W | 10 Hz to 65 Hz 10 Hz to 65 Hz | 0.089 % 0.077 % | |
| 33 mA to 90 mA | 1 mW to 30 mW 30 mW to 90 W | 10 Hz to 65 Hz 10 Hz to 65 Hz | 0.071 % 0.057 % | |
| 90 mA to 330 mA | 3.0 mW to 100 mW 100 mW to 300 W | 10 Hz to 65 Hz 10 Hz to 65 Hz | 0.089 % 0.078 % | |
| 0.33 A to 0.9 A | 11 mW to 300 mW 300 mW to 900 W | 10 Hz to 65 Hz 10 Hz to 65 Hz | 0.071 % 0.081 % | |

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|---|-----------------|-----------------|---|---------|
| 0.9 A to 2.2 A | 30 mW to 720 mW | 10 Hz to 65 Hz | 0.089 % | |
| | 720 mW to 2 kW | 10 Hz to 65 Hz | 0.079 % | |
| | | | | |
| 2.2 A to 4.5 A | 80 mW to 1.4 W | 10 Hz to 65 Hz | 0.088 % | |
| | 1.4 W to 4.5 kW | 10 Hz to 65 Hz | 0.18 % | |
| 4.5 A to 20.5 A | 150 mW to 6.7 W | 10 Hz to 65 Hz | 0.17 % | |
| | 6.7 W to 20 kW | 10 Hz to 65 Hz | 0.17 % | |

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

| Measured Parameter or Device Calibrated | Range | Frequency Range | Uncertainty ($k=2$) <small>Note 3</small> | Remarks |
|--|---------------|---|--|-------------|
| NVLAP Code: 20/E15 PHASE METERS LF Phase – Measuring Equipment Field calibrations available <small>Note 4</small> | 0° to 179.99° | 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 20 kHz | 0.10° 0.25° 0.50° 2.5° 5.0° 10° | Fluke 5520A |

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

| Measured Parameter or Device Calibrated | Range | Uncertainty ($k=2$) <small>Note 3,5</small> | Remarks |
|---|--------|---|--|
| TIME AND FREQUENCY | | | |
| NVLAP Code: 20/F01 FREQUENCY DISSEMINATION Frequency – Measuring Equipment and Measure In – Lab | 10 MHz | 1.0 x 10 ⁻¹⁰ Hz | Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise and gating errors |
| Field Service <small>Note 4</small> | 10 MHz | 2.9 x 10 ⁻⁹ Hz | GPS HP 5328A Counter |

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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 |
|---|--|---|---|
| NVLAP Code: 20/F03 PULSE WAVEFORM OSCILLATOR CHARACTERIZATION Total Harmonic Distortion | 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 | 1.4 dB | Agilent 8592L |
| NVLAP Code: 20/F04 PULSE WAVEFORM Rise time - Measuring Equipment | ≥ 300 ps | 2.1 % | Fluke 5520A SC1100 |
| MECHANICAL | | | |
| NVLAP Code: 20/M06 FORCE Force | 10 gf to 100 gf 0.2 lbf to 10 lbf > 10 lbf to 50 lbf > 50 lbf to 300 lbf > 300 lbf to 1000 lbf | 0.04 % 0.024 % 0.018 lbf 0.16 lbf 1.8 lbf | ASTM Class 2 Weights NIST Class F Weights Load Cell |
| NVLAP Code: 20/M08 MASS Mass – Measuring Equipment Field calibrations available ^{Note 4} | 1 mg to 500 mg > 500 mg to 5 g > 5 g to 10 g > 10 g to 20 g > 20 g to 50 g > 50 g to 100 g > 100 g to 200 g > 200 g to 500 g > 500 g to 1 kg > 1 kg to 2 kg > 2 kg to 5 kg | 0.017 mg 0.034 mg 0.05 mg 0.074 mg 0.12 mg 0.25 mg 0.5 mg 0.12 mg 2.5 mg 5 mg 12 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 |
|---|--|--|---|
| Avoirdupois | 1 lb to 650 lb | 0.01 % | NIST Class F Weights |
| Mass Measure | 1 g to 1 kg 1 kg to 5.1 kg | 18 mg 180 mg | Mettler PR5003 DR |
| NVLAP Code: 20/M15 TORQUE 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 lbf-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 > 50 lbf-ft to 2000 lbf-ft | 0.058 % 0.058 % 0.058 % | Torque Wheels with Weight Torque Arm with Weight |
| ELECTROMAGNETICS – RF/MICROWAVE | | | |
| NVLAP Code: 20/R11 RF-DC VOLTAGE/CURRENT CONVERTER Sine Wave Flatness Field calibrations available ^{Note 4} | 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 | 0.069 % 0.069 % 0.12 % 0.20 % 0.22 % 0.44 % 0.64 % 0.73 % 0.85 % | Thermal Voltage Converters |
| Bandwidth Field calibrations available ^{Note 4} | 50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz 600 MHz to 1.1 GHz | 1.7 % + 100 µV 2.2 % + 100 µV 4.1 % + 100 µV 5.1 % + 100 µV | 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 |
|--|--|--|--|
| THERMODYNAMIC | | | |
| NVLAP Code: 20/T02 HUMIDITY Relative Humidity | 10 % to 95 % | 0.60 % | Thunder Scientific 2500 |
| NVLAP Code: 20/T03 LABORATORY THERMOMETERS, DIGITAL AND ANALOG 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 | |
| NVLAP Code: 20/T05 PRESSURE Absolute Pressure Source | 0 psia to 25 psia 25 psia to 500 psia | 0.0019 psia 0.0065 % + 0.001 psia | Ruska 7250xi |
| Gage Pressure Source Field calibrations available ^{Note 4} | 0 psi to 0.072 psi 0.14 psi to 25 psi 25 psi to 500 psi 500 psi to 15 000 psi | 43 µpsi 0.017 % + 44 µpsi 0.007 % 0.030 % | Micro tekator Ametek RK-1100 WC Ruska 7250xi Ametek T-150 |
| NVLAP Code: 20/T06 RADIATION THERMOMETRY 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 | 0.98 °C 0.67 °C 0.71 °C 0.77 °C 1.0 °C 1.7 °C 2.3 °C | Hart 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 |
|---|--------------------|---|----------------|
| NVLAP Code: 20/T08 | | | |
| TEMPERATURE INDICATORS | | | |
| Electrical Substitution | | | |
| J | -210 °C to 1200 °C | 0.10 °C | Thermocouple |
| K | -270 °C to 1372 °C | 0.10 °C | Half Junctions |
| 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 using a coverage factor, $k = 2$, with a level of confidence of approximately 95 %. 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.

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