



CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board
11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Transcat – Phoenix
8240 S. Kyrene Road, Suite 107
Tempe, AZ 85284

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 (R2002)

while demonstrating technical competence in the field of

CALIBRATION

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

AC-2489.11

Certificate Number


ANAB Approval

Certificate Valid Through: 09/07/2021
Version No. 002 Issued: 05/01/2019



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 Communiqué dated April 2017).



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017 AND
ANSI/NCSL Z540-1-1994 (R2002)

Transcat – Phoenix
8240 S. Kyrene Road, Suite 107
Tempe, AZ 85284
Mr. Ryan Gohl

CALIBRATION

Valid to: **September 7, 2021**

Certificate Number: **AC-2489.11**

Electrical – DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|-------------------|--|---|
| Sine Wave Flatness ¹ (0.3 V to 1 V, 50 Ω) | 10 Hz to 1 MHz | 0.073 % | Agilent 11050A |
| | 1 MHz to 10 MHz | 0.14 % | |
| | 10 MHz to 30 MHz | 0.39 % | |
| | 30 MHz to 50 MHz | 0.79 % | |
| | 50 MHz to 80 MHz | 1.6 % | |
| | 80 MHz to 100 MHz | 2.4 % | |
| (1 V to 3 V, 50 Ω) | 10 Hz to 1 MHz | 0.071 % | Agilent 11049A |
| | 1 MHz to 10 MHz | 0.11 % | |
| | 10 MHz to 30 MHz | 0.21 % | |
| | 30 MHz to 50 MHz | 0.47 % | |
| | 50 MHz to 80 MHz | 0.96 % | |
| | 80 MHz to 100 MHz | 1.3 % | |



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Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|--------------------------|--|---|
| AC Current – Measuring Equipment ¹ | 0 μ A to 220 μ A | | Fluke 5700A-EP |
| | 10 Hz to 20 Hz | 0.027 % + 16 nA | |
| | 20 Hz to 40 Hz | 0.018 % + 10 nA | |
| | 40 Hz to 1 kHz | 0.014 % + 8 nA | |
| | 1 kHz to 5 kHz | 0.029 % + 12 nA | |
| | 5 kHz to 10 kHz | 0.11 % + 65 nA | |
| | 0.22 mA to 2.2 mA | | |
| | 10 Hz to 20 Hz | 0.027 % + 40 nA | |
| | 20 Hz to 40 Hz | 0.017 % + 35 nA | |
| | 40 Hz to 1 kHz | 0.014 % + 35 nA | |
| | 1 kHz to 5 kHz | 0.021 % + 110 nA | |
| | 5 kHz to 10 kHz | 0.11 % + 0.65 μ A | |
| | 2.2 mA to 22 mA | | |
| | 10 Hz to 20 Hz | 0.027 % + 0.4 μ A | |
| | 20 Hz to 40 Hz | 0.018 % + 0.35 μ A | |
| | 40 Hz to 1 kHz | 0.015 % + 0.35 μ A | |
| | 1 kHz to 5 kHz | 0.022 % + 0.55 μ A | |
| | 5 kHz to 10 kHz | 0.11 % + 5 μ A | |
| | 22 mA to 220 mA | | |
| | 10 Hz to 20 Hz | 0.027 % + 4 μ A | |
| 20 Hz to 40 Hz | 0.017 % + 3.5 μ A | | |
| 40 Hz to 1 kHz | 0.014 % + 2.5 μ A | | |



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Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment | |
|---|------------------|--|---|--------------------------------------|
| AC Current – Measuring Equipment ¹ | 1 kHz to 5 kHz | 0.021 % + 3.5 μA | Fluke 5700A-EP | |
| | 5 kHz to 10 kHz | 0.11 % + 10 μA | | |
| | 0.22 A to 2.2 A | | | |
| | 20 Hz to 1 kHz | 0.027 % + 35 μA | | |
| | 1 kHz to 5 kHz | 0.045 % + 80 μA | | |
| | | 5 kHz to 10 kHz | 0.70 % + 0.16 mA | |
| | | 2.2 A to 11 A | | Fluke 5700A-EP with 5725A |
| | | 5 kHz to 10 kHz | 0.36 % + 0.75 mA | |
| | | 2.2 A to 20 A | | Fluke Y5020 with Agilent 3458A opt 2 |
| | | 45 Hz to 100 Hz | 0.021 % | |
| | 100 Hz to 300 Hz | 0.024 % | | |
| | 300 Hz to 1 kHz | 0.033 % | | |
| | 1 kHz to 3 kHz | 0.061 % | | |
| | 3 kHz to 4 kHz | 0.075 % | | |
| | 4 kHz to 5 kHz | 0.088 % | | |
| Extended Frequency Ranges ¹ | 29 μA to 330 μA | | Fluke 5520A | |
| | 10 kHz to 30 kHz | 1.2 % + 0.31 μA | | |
| | 330 μA to 3.3 mA | | | |
| | 10 kHz to 30 kHz | 0.78 % + 0.47 μA | | |
| | 3.3 mA to 33 mA | | | |
| | 10 kHz to 30 kHz | 0.31 % + 3.1 μA | | |



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| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|--|------------------|--|---|
| Extended Frequency Ranges ¹ | 33 mA to 330 mA | | Fluke 5520A |
| | 10 kHz to 30 kHz | 0.31 % + 0.16 mA | |
| Clamp-on Ammeter Toroidal Type ¹ Transformer Type | 20 A to 150 A | | Fluke 5520A with 5500A/Coil |
| | 45 Hz to 65 Hz | 0.35 % + 30 mA | |
| | 65 Hz to 440 Hz | 0.94 % + 50 mA | |
| | 150 A to 1000 A | | |
| | 45 Hz to 65 Hz | 0.34 % + 0.13 A | |
| | 65 Hz to 440 Hz | 1.2 % + 0.23 A | |
| Clamp-on Ammeter Non-Toroidal Type ¹ Hall Effect Sensor | 20 A to 150 A | | Fluke 5520A with 5500A/Coil |
| | 45 Hz to 65 Hz | 0.68 % + 0.29 A | |
| | 65 Hz to 440 Hz | 1.2 % + 0.29 A | |
| | 150 A to 1 000 A | | |
| | 45 Hz to 65 Hz | 0.66 % + 1 A | |
| | 65 Hz to 440 Hz | 1.4 % + 1.1 A | |
| AC Current – Measure ¹ | 0 μA to 100 μA | | Agilent 3458A opt 2 |
| | 10 Hz to 20 Hz | 0.46 % + 35 nA | |
| | 20 Hz to 45 Hz | 0.17 % + 35 nA | |
| | 45 Hz to 100 Hz | 0.072 % + 35 nA | |
| | 100 Hz to 5 kHz | 0.072 % + 35 nA | |
| | 100 μA to 1 mA | | |
| | 10 Hz to 20 Hz | 0.46 % + 0.23 μA | |
| | 20 Hz to 45 Hz | 0.17 % + 0.23 μA | |

Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|-----------------------------------|------------------|--|---|
| AC Current – Measure ¹ | 45 Hz to 100 Hz | 0.071 % + 0.23 μA | Agilent 3458A opt 2 |
| | 100 Hz to 5 kHz | 0.038 % + 0.23 μA | |
| | 1 mA to 10 mA | | |
| | 10 Hz to 20 Hz | 0.46 % + 2.3 μA | |
| | 20 Hz to 45 Hz | 0.17 % + 2.3 μA | |
| | 45 Hz to 100 Hz | 0.071 % + 2.3 μA | |
| | 100 Hz to 5 kHz | 0.038 % + 2.3 μA | |
| | 10 mA to 100 mA | | |
| | 10 Hz to 20 Hz | 0.46 % + 23 μA | |
| | 20 Hz to 45 Hz | 0.17 % + 23 μA | |
| | 45 Hz to 100 Hz | 0.07 % + 23 μA | |
| | 100 Hz to 5 kHz | 0.037 % + 23 μA | |
| | 100 mA to 1 A | | |
| | 10 Hz to 20 Hz | 0.46 % + 0.23 mA | |
| | 20 Hz to 45 Hz | 0.19 % + 0.23 mA | |
| | 45 Hz to 100 Hz | 0.097 % + 0.23 mA | |
| | 100 Hz to 5 kHz | 0.12 % + 0.23 mA | |
| | 1 A to 20 A | | Fluke Y5020 with Agilent 3458A opt 2 |
| | 50 Hz to 100 Hz | 0.021 % | |
| | 100 Hz to 300 Hz | 0.024 % | |
| 300 Hz to 1 kHz | 0.033 % | | |
| | 1 kHz to 3 kHz | 0.061 % | |



Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|--|------------------|--|---|
| AC Current – Measure ¹ | 3 kHz to 4 kHz | 0.075 % | Fluke Y5020 with Agilent 3458A opt 2 |
| | 4 kHz to 5 kHz | 0.088 % | |
| DC Resistance – Measuring Equipment and Measure ¹ | 0 Ω to 10 Ω | 18 μΩ/Ω + 58 μΩ | Agilent 3458A with Decade Resistor |
| | 10 Ω to 100 Ω | 15 μΩ/Ω + 0.58 mΩ | |
| | 100 Ω to 1 kΩ | 13 μΩ/Ω + 0.58 mΩ | |
| | 1 kΩ to 10 kΩ | 12 μΩ/Ω + 5.8 mΩ | |
| | 10 kΩ to 100 kΩ | 13 μΩ/Ω + 58 mΩ | |
| | 100 kΩ to 1 MΩ | 21 μΩ/Ω + 2.3 Ω | |
| | 1 MΩ to 10 MΩ | 62 μΩ/Ω + 0.12 kΩ | Extended Arm Bridge |
| | 10 MΩ to 100 MΩ | 0.012 % + 0.28 kΩ | |
| | 100 MΩ to 1 GΩ | 0.012 % + 9.7 kΩ | |
| | 1 GΩ to 10 GΩ | 0.012 % + 0.42 MΩ | |
| | 10 GΩ to 100 GΩ | 0.012 % + 45 MΩ | |
| | 100 GΩ to 300 GΩ | 0.016 % + 45 MΩ | |
| | 300 GΩ to 700 GΩ | 0.016 % + 0.11 GΩ | |
| | 700 GΩ to 1 TΩ | 0.016 % + 0.49 GΩ | |
| DC Resistance – Measuring Equipment ¹ | 10 μΩ | 0.4 % | Fixed Resistor |
| | 100 μΩ | 0.046 % | |
| | 1 mΩ | 0.046 % | |
| | 10 mΩ | 35 μΩ/Ω | |
| | 100 mΩ | 67 μΩ/Ω | |
| | 1 Ω | 96 μΩ/Ω | Fluke 5720A |



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| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|-----------------|--|---|
| DC Resistance – Measuring Equipment ¹ | 1.9 Ω | 95 μΩ/Ω | Fluke 5720A |
| | 10 Ω | 19 μΩ/Ω | |
| | 19 Ω | 24 μΩ/Ω | |
| | 100 Ω | 11 μΩ/Ω | |
| | 190 Ω | 11 μΩ/Ω | |
| | 1 kΩ | 10 μΩ/Ω | |
| | 1.9 kΩ | 10 μΩ/Ω | |
| | 10 kΩ | 9.7 μΩ/Ω | |
| | 19 kΩ | 12 μΩ/Ω | |
| | 100 kΩ | 11 μΩ/Ω | |
| | 190 kΩ | 13 μΩ/Ω | |
| | 1 MΩ | 23 μΩ/Ω | |
| | 1.9 MΩ | 21 μΩ/Ω | |
| | 10 MΩ | 42 μΩ/Ω | |
| | 19 MΩ | 49 μΩ/Ω | |
| 100 MΩ | 121 μΩ/Ω | | |
| DC Current – Measuring Equipment and Measure ¹ | 0 μA to 100 μA | 26 μA/A + 0.92 nA | Agilent 3458A with Current Source |
| | 100 μA to 1 mA | 26 μA/A + 5.8 nA | |
| | 1 mA to 10 mA | 26 μA/A + 58 nA | |
| | 10 mA to 100 mA | 41 μA/A + 0.58 μA | |
| | 100 mA to 1 A | 130 μA/A + 12 μA | |
| | 1 A to 20 A | 36 μA/A | Fluke Y5020 with Agilent 3458A opt 2 |



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| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|--|-----------------|--|---|
| DC Current – Measure | 20 A to 100 A | 0.046 % | L & N 4361 with Agilent 3458A opt 2 |
| Clamp-on Ammeter Non-Toroidal Type ¹ Hall Effect Sensor | 20 A to 150 A | 0.53 % + 0.17 A | Fluke 5520A with 5500A/Coil |
| | 150 A to 1000 A | 0.52 % + 0.58 A | |
| DC Voltage – Measuring Equipment ¹ | 0 mV to 220 mV | 9.6 μV/V + 0.4 μV | Fluke 5700A-EP |
| | 220 mV to 2.2 V | 5.6 μV/V + 0.7 μV | |
| | 2.2 V to 11 V | 4.1 μV/V + 2.5 μV | |
| | 11 V to 22 V | 4.1 μV/V + 4 μV | |
| | 22 V to 220 V | 5.9 μV/V + 40 μV | |
| | 220 V to 1100 V | 7.6 μA/V + 0.40 mV | Fluke 5700A-EP w/5725A |
| DC Voltage – Measure | 0 mV to 100 mV | 8.3 μV/V + 0.35 μV | Agilent 3458A opt 2 |
| | 100 mV to 10 V | 5.3 μV/V + 0.35 μV | |
| | 10 V to 100 V | 7.6 μV/V + 35 μV | |
| | 100 V to 500 V | 11 μV/V + 0.12 mV | |
| | 500 V to 700 V | 14 μV/V + 0.12 mV | |
| | 700 V to 1000 V | 21 μV/V + 0.12 mV | |
| | 1 kV to 10 kV | 0.041 % + 0.26 V | Vitretek 4700A |
| | 10 kV to 35 kV | 0.047 % + 2.4 V | Vitretek 4700A/HVL-35 |
| | 35 kV to 50 kV | 0.056 % + 2.4 V | Vitretek 4700A/HVL-70 |
| | 50 kV to 70 kV | 0.088 % + 2.4 V | Vitretek 4700A/HVL-70 |
| | 70 kV to 100 kV | 0.17 % + 2.5 V | Vitretek 4700A/HVL-100 |



Electrical - DC/Low Frequency

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|--|------------------|--|--|
| AC High Voltage – Measure ¹ | 700 V to 5 kV | | Vitrek 4700A Vitrek 4700A with HVL-35 Vitrek 4700A |
| | 0.01 Hz to 10 Hz | 0.15 % + 0.17 V | |
| | 10 Hz to 30 Hz | 0.013 % + 0.29 V | |
| | 30 Hz to 200 Hz | 0.11 % + 0.37 V | |
| AC High Voltage – Measure ¹ | 200 Hz to 450 Hz | 0.48% + 0.17 V | Vitrek 4700A with HVL-35 |
| | 450 Hz to 600 Hz | 0.88% + 0.17 V | |
| | 5 kV to 30 kV | | |
| | 0.01 Hz to 10 Hz | 0.20 % + 2.4 V | |
| | 10 Hz to 30 Hz | 0.15 % + 2.4 V | |
| | 30 Hz to 200 Hz | 0.12% + 2.4 v | |
| | 200 Hz to 450 Hz | 0.71 % + 2.4 V | |
| | 450 Hz to 600 Hz | 1.4% + 2.4 V | |
| | 30 kV to 50 kV | | |
| | 0.01 Hz to 10 Hz | 0.25 % + 2.5 V | |
| | 10 Hz to 30 Hz | 0.19% + 2.5 V | |
| | 30 Hz to 70 Hz | 0.14% + 2.5 V | |
| 70 Hz to 200 Hz | 0.70% + 2.5 V | | |
| 200 Hz to 450 Hz | 2.9% + 2.5 V | | |
| AC High Voltage – Measure ¹ | 50 kV to 70 kV | | Vitrek 4700A with HVL-35 |
| | 0.01 Hz to 10 Hz | 0.37% + 2.6 V | |
| | 10 Hz to 30 Hz | 0.27 % + 2.6 V | |
| | 30 Hz to 70 Hz | 0.18 % + 2.6 V | |
| | 70 Hz to 200 Hz | 1.2% + 2.6V | |
| | 200 Hz to 450 Hz | 1.7% + 2.6V | |
| AC Voltage – Measure ¹ | 0 mV to 10 mV | | Agilent 3458A opt 2 |
| | 1 Hz to 40 Hz | 0.039 % + 3.5 μV | |
| | 40 Hz to 1 kHz | 0.028 % + 1.3 μV | |
| | 1 kHz to 20 kHz | 0.038 % + 1.3 μV | |
| | 20 kHz to 50 kHz | 0.12 % + 1.3 μV | |



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|-----------------------------------|---------------------|--|---|
| AC Voltage – Measure ¹ | 50 kHz to 100 kHz | 0.59 % + 1.3 μV | Agilent 3458A opt 2 |
| | 100 kHz to 300 kHz | 4.6 % + 2.3 μV | |
| | 10 mV to 100 mV | | |
| | 1 Hz to 40 Hz | 0.013 % + 5.1 μV | |
| | 40 Hz to 1 kHz | 0.009 4 % + 2.3 μV | |
| | 1 kHz to 20 kHz | 0.017 % + 2.3 μV | |
| | 20 kHz to 50 kHz | 0.035 % + 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 | 1.8 % + 12 μV | |
| | 100 mV to 1 V | | |
| | 1 Hz to 40 Hz | 0.009 8 % + 46 μV | |
| | 40 Hz to 1 kHz | 0.009 4 % + 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 | 1.8% + 1.2 mV | |
| 1 V to 10 V | | | |
| 1 Hz to 40 Hz | 0.009 5 % + 0.46 mV | | |



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Electrical - DC/Low Frequency

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|-----------------------------------|--------------------|--|---|
| AC Voltage – Measure ¹ | 40 Hz to 1 kHz | 0.009 5 % + 0.23 mV | Agilent 3458A opt 2 |
| | 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 | 1.7 % + 1.2 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 | 0.47 % + 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 | |
| | 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 | |



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|---|--------------------|--|---|
| AC Voltage – Measuring Equipment ¹ | 0 mV to 2.2 mV | | Fluke 5700A-EP |
| | 10 Hz to 20 Hz | 0.1 % + 4 μV | |
| | 20 Hz to 40 Hz | 0.077 % + 4 μV | |
| | 40 Hz to 20 kHz | 0.077 % + 4 μV | |
| | 20 kHz to 50 kHz | 0.077 % + 4 μV | |
| | 50 kHz to 100 kHz | 0.13 % + 5 μV | |
| | 100 kHz to 300 kHz | 0.24 % + 10 μV | |
| | 300 kHz to 500 kHz | 0.34 % + 20 μV | |
| | 500 kHz to 1 MHz | 0.52 % + 20 μV | |
| | 2.2 mV to 22 mV | | |
| | 10 Hz to 20 Hz | 0.041 % + 4 μV | |
| | 20 Hz to 40 Hz | 0.028 % + 4 μV | |
| | 40 Hz to 20 kHz | 0.015 % + 4 μV | |
| | 20 kHz to 50 kHz | 0.026 % + 4 μV | |
| | 50 kHz to 100 kHz | 0.056 % + 5 μV | |
| | 100 kHz to 300 kHz | 0.11 % + 10 μV | |
| | 300 kHz to 500 kHz | 0.15 % + 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 | 0.009 6 % + 7 μV | |
| | 40 Hz to 20 kHz | 0.008 6 % + 7 μV | |



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Electrical - DC/Low Frequency

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|---|--------------------|--|---|
| AC Voltage – Measuring Equipment ¹ | 20 kHz to 50 kHz | 0.02 % + 7 μV | Fluke 5700A-EP |
| | 50 kHz to 100 kHz | 0.046 % + 17 μV | |
| | 100 kHz to 300 kHz | 0.091 % + 20 μV | |
| | 300 kHz to 500 kHz | 0.14 % + 25 μV | |
| | 500 kHz to 1 MHz | 0.27 % + 45 μV | |
| | 220 mV to 2.2 V | | |
| | 10 Hz to 20 Hz | 0.024 % + 40 μV | |
| | 20 Hz to 40 Hz | 0.009 2 % + 15 μV | |
| | 40 Hz to 20 kHz | 0.004 8 % + 8 μV | |
| | 20 kHz to 50 kHz | 0.007 7 % + 10 μV | |
| | 50 kHz to 100 kHz | 0.011 % + 30 μV | |
| | 100 kHz to 300 kHz | 0.042 % + 80 μV | |
| | 300 kHz to 500 kHz | 0.1 % + 0.2 mV | |
| | 500 kHz to 1 MHz | 0.17 % + 0.3 mV | |
| | 2.2 V to 22 V | | |
| | 10 Hz to 20 Hz | 0.024 % + 0.4 mV | |
| | 20 Hz to 40 Hz | 0.009 2 % + 0.15 mV | |
| | 40 Hz to 20 kHz | 0.004 9 % + 50 μV | |
| | 20 kHz to 50 kHz | 0.007 8 % + 0.1 mV | |
| | 50 kHz to 100 kHz | 0.011 % + 0.2 mV | |
| | 100 kHz to 300 kHz | 0.028 % + 0.6 mV | |
| 300 kHz to 500 kHz | 0.1 % + 2 mV | | |



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|--|---------------------|--|---|
| AC Voltage – Measuring Equipment ¹ | 500 kHz to 1 MHz | 0.15 % + 3.2 mV | Fluke 5700A-EP |
| | 22 V to 220 V | | |
| | 10 Hz to 20 Hz | 0.024 % + 4 mV | |
| | 20 Hz to 40 Hz | 0.009 3 % + 1.5 mV | |
| | 40 Hz to 20 kHz | 0.005 6 % + 0.6 mV | |
| | 20 kHz to 50 kHz | 0.008 3 % + 1 mV | |
| | 50 kHz to 100 kHz | 0.016 % + 2.5 mV | |
| | 100 kHz to 300 kHz | 0.09 % + 16 mV | |
| | 300 kHz to 500 kHz | 0.44 % + 40 mV | |
| | 500 kHz to 1 MHz | 0.8 % + 80 mV | |
| AC Voltage – Measuring Equipment ¹ | 220 V to 1100 V | | Fluke 5700A-EP/5725A |
| | 40 Hz to 1 kHz | 0.011 % + 4 mV | |
| | 1 kHz to 20 kHz | 0.017 % + 6 mV | |
| | 20 kHz to 30 kHz | 0.06 % + 11 mV | |
| | 220 V to 750 V | | |
| | 30 kHz to 50 kHz | 0.061 % + 11 mV | |
| 50 kHz to 100 kHz | 0.23 % + 45 mV | | |
| Capacitance – Measuring Equipment ¹ | 0.19 nF to < 1.1 nF | | Fluke 5520A |
| | 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 | |

Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|--|--|--|---|
| Capacitance – Measuring Equipment ¹ | 3.3 nF to < 11 nF 10 Hz to 1 kHz | 0.21 % + 7.8 pF | Fluke 5520A |
| | 11 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 | |
| | 0.33 μF to < 1.1 μF 10 Hz to 600 Hz | 0.21 % + 0.78 nF | |
| | 1.1 μF to < 3.3 μF 10 Hz to 300 Hz | 0.21 % + 2.3 nF | |
| | 3.3 μF to < 11 μF 10 Hz to 150 Hz | 0.21 % + 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 | |
| | 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 6 Hz | 0.35 % + 2.3 μF | | |



Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|-----------------------------------|--|---|
| Capacitance – Measuring Equipment ¹ | 3.3 mF to < 11 mF DC to 2 Hz | 0.35 % + 7.8 μF | Fluke 5520A |
| | 11 mF to < 33 mF DC to 0.6 Hz | 0.58 % + 23 μF | |
| | 33 mF to < 110 mF DC to 0.2 Hz | 0.85 % + 78 μF | |
| Electrical Calibration of Thermocouple Devices ¹ Type E | -250 °C to -100 °C | 0.39 °C | Fluke 5520A |
| | -100 °C to -25 °C | 0.12 °C | |
| | -25 °C to 350 °C | 0.11 °C | |
| | 350 °C to 650 °C | 0.12 °C | |
| | 650 °C to 1000 °C | 0.16 °C | |
| Type J | -210 °C to -100 °C | 0.21 °C | |
| | -100 °C to -30 °C | 0.13 °C | |
| | -30 °C to 150 °C | 0.11 °C | |
| | 150 °C to 760 °C | 0.13 °C | |
| | 760 °C to 1200 °C | 0.18 °C | |
| Type K | -200 °C to -100 °C | 0.26 °C | |
| | -100 °C to - 25 °C | 0.14 °C | |
| | -25 °C to 120 °C | 0.13 °C | |
| | 120 °C to 1000 °C | 0.2 °C | |
| | 1000 °C to 1372 °C | 0.31 °C | |



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Electrical - DC/Low Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|--------------------|--|---|
| Electrical Calibration of Thermocouple Devices ¹ Type T | -250 °C to -150 °C | 0.49 °C | Fluke 5520A |
| | -150 °C to 0 °C | 0.19 °C | |
| | 0 °C to 120 °C | 0.13 °C | |
| | 120 °C to 400 °C | 0.11 °C | |
| Type R | 0 °C to 250 °C | 0.44 °C | |
| | 250 °C to 400 °C | 0.27 °C | |
| | 400 °C to 1000 °C | 0.26 °C | |
| | 1000 °C to 1767 °C | 0.31 °C | |
| Type S | 0 °C to 250 °C | 0.37 °C | |
| | 250 °C to 1000 °C | 0.28 °C | |
| | 1000 °C to 1400 °C | 0.29 °C | |
| | 1400 °C to 1767 °C | 0.36 °C | |
| Type 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 | |

Electrical - RF/Microwave

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|--|-----------------|--|---|
| Power – Measuring Equipment DC Power 0.33 mA to 330 mA | 11 μW to 1.1 mW | 0.024 % | Fluke 5520A |



Electrical - RF/Microwave

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment | |
|--|-----------------------------------|--|---|-------------|
| Power – Measuring Equipment DC Power 0.33 mA to 330 mA | 1.1 mW to 110 mW | 0.027 % | Fluke 5520A | |
| | 0.11W to 110 W | 0.024 % | | |
| | 110 W to 330 W | 0.018 % | | |
| 0.33 A to 3 A | 11 W to 110 mW | 0.044 % | | |
| | 0.11 W to 990 W | 0.053 % | | |
| | 1 W to 3 kW | 0.009 6 % | | |
| 3 A to 20.5 A | 0.099 W to 0.99 W | 0.088 % | | |
| | 0.99 W to 6.8 kW | 0.07 % | | |
| | 6.8 W to 20.5 kW | 0.04 % | | |
| AC Power ³ (PF = 1) 3.3 mA to 9 mA | 0.11 mW to 3 mW 10 Hz to 65 Hz | 0.13 % | | Fluke 5520A |
| | 3 mW to 9 W 10 Hz to 65 Hz | 0.077 % | | |
| | 0.3 mW to 10 mW 10 Hz to 65 Hz | 0.089 % | | |
| 9 mA to 33 mA | 10 mW to 33 W 10 Hz to 65 Hz | 0.077 % | | |
| | 1 mW to 30 mW 10 Hz to 65 Hz | 0.071 % | | |
| 33 mA to 90 mA | 30 mW to 90 W 10 Hz to 65 Hz | 0.057 % | | |



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Electrical - RF/Microwave

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|-----------------------------------|--|---|
| 90 mA to 330 mA | 3 mW to 100 mW 10 Hz to 65 Hz | 0.089 % | Fluke 5520A |
| | 100 mW to 300 W 10 Hz to 65 Hz | 0.078 % | |
| 0.33 A to 0.9 A | 11 mW to 300 mW 10 Hz to 65 Hz | 0.071 % | |
| | 300 mW to 900 W 10 Hz to 65 Hz | 0.081 % | |
| 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 % | |
| Phase Meters – Measure Equipment ¹ | 0° to 179.99° | | Fluke 5520A |
| | 10 Hz to 65 Hz | 0.11° | |



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Electrical - RF/Microwave

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|------------------|--|---|
| Phase Meters – Measure Equipment ¹ | 65 Hz to 500 Hz | 0.2° | Fluke 5520A |
| | 500 Hz to 1 kHz | 0.4° | |
| | 1 kHz to 5 kHz | 1.9° | |
| | 5 kHz to 10 kHz | 3.9° | |
| | 10 kHz to 30 kHz | 7.8° | |

Length – Dimensional Metrology

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ⁵ | Reference Standard, Method and/or Equipment |
|---|-------------------|--|---|
| Micrometers – Outside, Inside, Depth ¹ | 0.05 in to 0.4 in | 27 μin | Comparison to Gage Blocks |
| | 0.4 to 40 in | (19 + 10L) μin | |
| Calipers – Outside, Inside, Depth ¹ | 0.05 in to 0.4 in | 60 μin | Comparison to Gage Blocks |
| | 0.4 to 40 in | (19 + 60L) μin | |
| Anvil Flatness ¹ | 0 in to 1 in | 4.7 μin | Optical Flats |
| Dial Indicators ¹ | 0.01 in to 0.4 in | 7 μin | Gage Blocks with Surface Plate |
| | 0.45 in to 3 in | (5.3 + 17L) μin | |
| Height Measuring Equipment | 0.01 in to 8 in | (3.4 + 17L) μin | Gage Blocks with Surface Plate |
| | 8 in to 40 in | (4.3 + 15L) μin | |
| Height Measure | 0.01 in to 6 in | (2.6 + 24L) μin | Gage Blocks with Surface Plate |
| | 6 in to 12 in | (4.4 + 14L) μin | |



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Mass

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|---|---------------------------|--|---|
| Force Measuring Equipment – Tension and Compression | 1 lbf to 50 lbf | 0.013 % | Dead Weight |
| | 50 lbf to 250 lbf | 0.004 4 % + 0.006 5 lbf | |
| | 1 gf to 4 kgf | 0.013 % | |
| Torque – Measure ¹ | 20 ozf·in to 600 lbf·ft | 1 % | Torque Calibrator |
| Balances – Metric ¹ | 2 kg | 6 mg | Class S Weights |
| | 1 kg | 2.9 mg | |
| | 500 g | 1.4 mg | |
| | 200 g | 0.58 mg | |
| | 100 g | 0.29 mg | |
| | 50 g | 0.14 mg | |
| | 20 g | 86 µg | |
| | 10 g | 86 µg | |
| | 5 g | 63 µg | |
| | 2 g | 63 µg | |
| | 1 g | 63 µg | |
| Balances – Avoirdupois ¹ | 1 lb to 400 lb | 0.012 % | NIST Class F Weights |
| Absolute Pressure – Source (Pneumatic) | 0 psia to 25 psia | 0.001 9 psia | Ruska 7250xi |
| | 25 psia to 500 psia | 0.006 5 % + 0.001 psia | |
| Gage Pressure – Source (Pneumatic) ¹ | -15 psig to 25 psig | 0.0017 psig | Ruska 7250xi |
| | 25 psig to 500 psig | 0.006 5 % | |
| Gage Pressure – Source (Hydraulic) ¹ | 0 psig to 1 500 psig | 0.36 psi | Fluke RPM4-E-DWT |
| | 1 500 psig to 15 000 psig | 0.023 % | |



Thermodynamic

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) | Reference Standard, Method and/or Equipment |
|--|------------------|---|---|
| Temperature – Measuring Equipment ¹ | 0 °C to 100 °C | 0.023 °C | Hart 5628 w/Dry Block |
| Temperature – Measure ¹ | -195 °C to 0 °C | 0.012 °C | Hart 5628 |
| | 0 °C to 420 °C | 0.026 °C | |
| | 420 °C to 600 °C | 0.036 °C | |
| Infrared Temperature – Measuring Equipment | -15 °C to 0 °C | 0.79 °C | Fluke Black Body |
| | 0 °C to 50 °C | 0.54 °C | |
| | 50 °C to 100 °C | 0.67 °C | |
| | 100 °C to 120 °C | 0.74 °C | |
| | 120 °C to 200 °C | 0.95 °C | |
| | 200 °C to 350 °C | 1.7 °C | |
| | 350 °C to 500 °C | 2.2 °C | |

Time and Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|--------------------------------|--------------------|--|---|
| Frequency – Source and Measure | 10 MHz | 6.4 x 10 ⁻¹⁰ Hz/Hz | SRS FS725 |
| In-Lab | | | |
| Field ¹ | 10 MHz | 3.8 x 10 ⁻⁹ Hz/Hz | Agilent 8648C |
| Total Harmonic Distortion | 0.01 % to 100 % | 13 % | Agilent 339A |
| | 20 Hz to 20 kHz | | |
| | 20 kHz to 50 kHz | | |
| | 50 kHz to 100 kHz | | |
| | 100 kHz to 500 MHz | | 37 % |



Time and Frequency

| Parameter / Equipment | Range | Expanded Uncertainty of Measurement (+/-) ² | Reference Standard, Method and/or Equipment |
|-----------------------------------|----------------|--|---|
| Rise Time – Generate ¹ | 250 ps nominal | 51 ps ^{Note 4} | Fluke 5520A SC1100 |
| Rise Time – Measure | ≥ 800 ps | 0.13 % + 0.17 ns | Tektronix TDS 510A |

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ($k=2$), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. Values listed with percent (%) are percent of reading or generated value unless otherwise noted.
3. 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 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.
4. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 250 ps. In the typical application of measuring rise time of an oscilloscope, this value is one of the contributing factors, but other factors are derived from the DUT.
5. L = Length in inches
6. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.11.



Vice President