



SCOPE OF ACCREDITATION TO
ISO/IEC 17025:2005 & ANSI/NCSL Z540-1-1994

Tektronix Service Solutions

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CALIBRATION

Valid to: March 30, 2013

Certificate Number: AC-1386

I. Electromagnetic - DC/Low Frequency⁴

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|-----------------------|--|---|---------------------------------|---|
| DC Current - Source | Up to 2 pA (2 to 20) pA (20 to 200) pA 200 pA to 2 nA (2 to 20) nA (20 to 200) nA 200 nA to 2 µA | 4.9 mA/A + 10 fA 4.4 mA/A + 10 fA 2.9 mA/A + 30 fA 800 µA/A + 100 fA 800 µA/A + 1 pA 500 µA/A + 10 pA 300 µA/A + 100 pA | Keithley 263 | OEM and GIDEP Sourced Calibration Procedures |
| | 200 pA to 220 µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A | 40 µA/A + 6 nA 35 µA/A + 7 nA 35 µA/A + 40 nA 60 µA/A + 700 nA 80 µA/A + 12 µA | Fluke 5720A | |
| | (2.2 to 11) A | 360 µA/A + 480 µA | Fluke 5720A with Fluke 5725A | |
| | (11 to 20.5) A | 1 mA/A + 750 µA | Fluke 5520A | |
| Clamp-On Ammeters | Up to 550 A | 3 mA/A + 500 mA | Fluke 5520A with Coil | |
| DC Voltage - Source | Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V 220 V to 1.1 kV | 8 µV/V + 400 nV 5.5 µV/V + 700 nV 4 µV/V + 2.5 µV 4 µV/V + 4 µV 5.5 µV/V + 40 µV 7 µV/V + 400 µV | Fluke 5720A | HP 3458A and Spellman Power Supply with Fluke 80E with Fluke 80KV-40 |
| | (1.1 to 10) kV | 200 µV/V | | |
| | (10 to 40) kV | 12 mV/V | | |



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|--|---|--|---|--|
| DC Resistance - Source | Up to 11 Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 1.1 kΩ (1.1 to 11) kΩ (11 to 110) kΩ 110 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ | 40 μΩ/Ω + 1 mΩ 30 μΩ/Ω + 1.5 mΩ 28 μΩ/Ω + 1.4 mΩ 28 μΩ/Ω + 2 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 200 mΩ 32 μΩ/Ω + 2 Ω 60 μΩ/Ω + 30 Ω 150 μΩ/Ω + 50 Ω 250 μΩ/Ω + 2.5 kΩ 500 μΩ/Ω + 3 kΩ 300 μΩ/Ω + 100 kΩ 15 mΩ/Ω + 500 kΩ | Fluke 5520A | OEM and GIDEP Sourced Calibration Procedures |
| Fixed Points | (1, 10, 100) mΩ (1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9, 10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ | 70 μΩ/Ω 95 μΩ/Ω 23 μΩ/Ω 10 μΩ/Ω 8.5 μΩ/Ω 11 μΩ/Ω 20 μΩ/Ω 21 μΩ/Ω 40 μΩ/Ω 50 μΩ/Ω 100 μΩ/Ω 1.3 mΩ/Ω 2.8 mΩ/Ω 4.6 mΩ/Ω | Honeywell Shunts Fluke 5720A Keithley 263 | |
| Oscilloscopes DC Signal into 50 Ω Load into 1 MΩ Load Amplitude Square Wave 50 Ω Load 1 MΩ Load Leveled Sine Wave - Flatness Relative to 50 kHz 5 mV to 5.5 V 5 mV to 3.5 V | 0 V to ± 6.6 V 0 V to ± 130 V 1 mV to 6.6 V p-p (10 Hz to 10 kHz) 1 mV to 130 V p-p (10 Hz to 10 kHz) 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 600 MHz to 1.1 GHz | 2.5 mV/V + 40 μV 500 μV/V + 40 μV 2.5 mV/V + 40 μV 1 mV/V + 40 μV 15 mV/V + 100 μV 20 mV/V + 100 μV 40 mV/V + 100 μV 50 mV/V + 100 μV | Fluke 5520A/SC1100 | |

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|--|---|--|---------------------------------|--|-------------|
| Time Marker into 50 Ω Load | 5 s to 50 ms 20 ms to 100 ns (50 to 20) ns 10 ns (5 to 1) ns | (25 + 1 000t) μs/s 2.5 μs/s 2.5 μs/s 2.5 μs/s 2.5 μs/s | Fluke 5520A/SC1100 | OEM and GIDEP Sourced Calibration Procedures | |
| Edge Specs into 50 Ω Load Rise Time | 350 ps | +0 ps/-100 ps | | | |
| Amplitude (p-p) Frequency | 5 mV to 2.5 V 1 kHz to 10 MHz | 20 mV/V + 200 μV 2.5 μs/s of setting | | | |
| Wave Generator - Source: Amplitude (10 Hz to 10 kHz) Square,Sine,Triangle into 1 MΩ Square,Sine,Triangle into 50 MΩ Frequency | 1.8 mV to 55 V p-p 1.8 mV to 2.5 V p-p 10 Hz to 100 kHz | 30 mV/V + 100 μV 30 mV/V + 100 μV 25 μs/s + 15 mHz | | | |
| Bandwidth Amplitude Relative to 50 kHz | 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz | 2.2 % 2.7 % 4.9 % 6 % | | | |
| Rise Time – Measure | Up to 20 GHz | 50 ps | | | |
| Electrical Simulation of Thermocouples Type B | (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C | 0.44 °C 0.34 °C 0.3 °C 0.33 °C | | | Fluke 5520A |
| Type C | (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C | 0.3 °C 0.26 °C 0.31 °C 0.5 °C 0.84 °C | | | |
| Type E | (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C | 0.5 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C | | | |

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| Electrical Simulation of Thermocouples (cont.) | | | | |
| Type J | (-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C | 0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C | | |
| Type K | (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C | 0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °C | | |
| Type N | (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C | 0.4 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C | Fluke 5520A | OEM and GIDEP Sourced Calibration Procedures |
| Type R | (0 to 250) °C (250 to 400) °C (400 to 1 000) °C (1 000 to 1 767) °C | 0.57 °C 0.35 °C 0.33 °C 0.4 °C | | |
| Type S | (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C | 0.47 °C 0.36 °C 0.37 °C 0.46 °C | | |
| Type T | (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C | 0.63 °C 0.24 °C 0.16 °C 0.14 °C | | |
| Type U | (-200 to 0) °C (0 to 600) °C | 0.56 °C 0.27 °C | | |

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| Electrical Simulation of RTDs | | | | |
| Pt 385, 100 Ω | (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C | 0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C 0.23 °C | Fluke 5520A | OEM and GIDEP Sourced Calibration Procedures |
| Pt 3926, 100 Ω | (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C | 0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.1 °C 0.12 °C | | |
| Pt 3916, 100 Ω | (-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C | 0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.1 °C 0.23 °C | | |
| Pt 385, 200 Ω | (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C | 0.04 °C 0.04 °C 0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C | | |
| Pt 385, 500 Ω | (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C | 0.04 °C 0.05 °C 0.05 °C 0.06 °C 0.08 °C 0.08 °C 0.09 °C 0.11 °C | | |



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|---------------------------------------|---|---|------------------------------------|--|
| Electrical Simulation of RTDs (cont.) | | | | |
| Pt 385, 1 kΩ | (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C | 0.03 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.07 °C 0.23 °C | Fluke 5520A | OEM and GIDEP Sourced Calibration Procedures |
| Ni 120, 120 Ω | (-80 to 0) °C (0 to 100) °C (100 to 260) °C | 0.08 °C 0.08 °C 0.14 °C | | |
| Cu 427, 10 Ω | (-100 to 260) °C | 0.3 °C | | |
| DC Voltage - Measure | Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1.1 kV | 6.2 μV/V + 300 nV 5.2 μV/V + 300 nV 5.2 μV/V + 500 nV 7.3 μV/V + 30 μV 7.3 μV/V + 110 μV | HP 3458A Opt 002 | |
| | (1.1 to 10) kV | 140 μV/V | Fluke 80E-10 | |
| | (10 to 20) kV (20 to 35) kV (35 to 40) kV | 23 mV/V 15 mV/V 23 mV/V | Fluke 80K-40 with HP 3458A | |
| DC Current - Measure | 100 pA to 100 μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 500) A | 24 μA/A + 800 pA 24 μA/A + 5 nA 24 μA/A + 50 nA 41 μA/A + 500 nA 130 μA/A + 10 μA 2.9 mA/A | HP 3458A Opt 002 with Shunt | |
| DC Power - Source | Up to 330 W 330 W to 11 kW (11 to 20.5) kW | 2 mW/W 2.1 mW/W 2.3 mW/W | Fluke 5520A | |

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| DC Resistance - Measure | 100 mΩ to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1.2 GΩ | 19 μΩ/Ω + 50 μΩ 15 μΩ/Ω + 500 μΩ 13 μΩ/Ω + 500 μΩ 13 μΩ/Ω + 5 mΩ 13 μΩ/Ω + 50 mΩ 24 μΩ/Ω + 2 Ω 65 μΩ/Ω + 100 Ω 580 μΩ/Ω + 1 kΩ 5.8 mΩ/Ω + 10 kΩ | HP 3458A Opt 002 | OEM and GIDEP Sourced Calibration Procedures |
| | (1 to 20) GΩ (20 to 200) GΩ 200 GΩ to 2 TΩ (2 to 20) TΩ (20 to 200) TΩ | 2.8 mΩ/Ω + 100 kΩ 4.4 mΩ/Ω + 1 MΩ 5.3 mΩ/Ω + 10 MΩ 13 mΩ/Ω + 100 MΩ 15 mΩ/Ω + 1 GΩ | Keithley 6517 | |
| AC Voltage - Source | | | | |
| 200 μV to 2.2 mV | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 240 μV/V + 4 μV 90 μV/V + 4 μV 80 μV/V + 4 μV 200 μV/V + 4 μV 500 μV/V + 5 μV 1.1 mV/V + 10 μV 1.4 mV/V + 20 μV 2.7 mV/V + 20 μV | Fluke 5720A | OEM and GIDEP Sourced Calibration Procedures |
| (2.2 to 22) mV | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 240 μV/V + 4 μV 90 μV/V + 4 μV 80 μV/V + 4 μV 200 μV/V + 4 μV 500 μV/V + 5 μV 1.1 mV/V + 10 μV 1.4 mV/V + 20 μV 2.7 mV/V + 20 μV | | |
| (22 to 220) mV | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 240 μV/V + 12 μV 90 μV/V + 7 μV 80 μV/V + 7 μV 200 μV/V + 7 μV 500 μV/V + 17 μV 1.1 mV/V + 20 μV 1.4 mV/V + 25 μV 2.7 mV/V + 45 μV | | |

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|-----------------------------|--|--|---------------------------------|--|
| AC Voltage - Source (cont.) | | | | |
| 220 mV to 2.2 V | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 240 µV/V + 40 µV 90 µV/V + 15 µV 45 µV/V + 8 µV 75 µV/V + 10 µV 110 µV/V + 30 µV 420 µV/V + 80 µV 1 mV/V + 200 µV 1.7 mV/V + 300 µV | Fluke 5720A | OEM and GIDEP Sourced Calibration Procedures |
| (2.2 to 22) V | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 240 µV/V + 400 µV 90 µV/V + 150 µV 45 µV/V + 50 µV 75 µV/V + 100 µV 100 µV/V + 200 µV 280 µV/V + 600 µV 1 mV/V + 200 µV 1.5 mV/V + 320 µV | | |
| (22 to 220) V | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 240 µV/V + 4 mV 90 µV/V + 1.5 mV 52 µV/V + 600 µV 80 µV/V + 1 mV 150 µV/V + 2.5 mV 900 µV/V + 16 mV 4.4 mV/V + 40 mV 8 mV/V + 80 mV | | |
| (220 to 750) V | 30 Hz to 50 kHz (50 to 100) kHz | 600 µV/V + 11 mV 2.3 mV/V + 45 mV | | |
| 220 V to 1.1 kV | (15 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz | 300 µV/V + 16 mV 90 µV/V + 4 mV 170 µV/V + 6 mV 600 µV/V + 11 mV | | |



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| AC Current - Source | | | Fluke 5720A with Fluke 5725A | OEM and GIDEP Sourced Calibration Procedures |
| (9 to 220) µA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 250 µA/A + 16 nA 160 µA/A + 10 nA 120 µA/A + 8 nA 280 µA/A + 12 nA 1.1 mA/A + 65 nA | | |
| 220 µA to 2.2 mA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 250 µA/A + 40 nA 160 µA/A + 35 nA 12 µA/A + 35 nA 200 µA/A + 10 nA 1.1 mA/A + 650 nA | | |
| (2.2 to 22) mA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 250 µA/A + 400 nA 160 µA/A + 350 nA 120 µA/A + 350 nA 200 µA/A + 600 nA 1.1 mA/A + 5 µA | | |
| (22 to 220) mA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 250 µA/A + 4 µA 160 µA/A + 3.5 µA 120 µA/A + 2.5 µA 200 µA/A + 3.5 µA 1.1 mA/A + 10 µA | | |
| 220 mA to 2.2 A | 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 260 µA/A + 35 µV 450 µA/A + 80 µV 7 mA/A + 160 µV | | |
| (2.2 to 11) A | 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 460 µA/A + 170 µV 950 µA/A + 380 µV 3.6 mA/A + 750 µV | | |
| Clamp-On Ammeters Up to 110 A | (65 to 440) Hz | 3.2 mA/A + 500 mA | Fluke 5520A with Coil | |
| Up to 550 A | (45 to 65) Hz | 3.8 mA/A + 500 mA | | |

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| AC Power - Source 45 to 65 Hz, PF = 1 | (10 to 100) mW 100 mW to 890 W 890 W to 3 kW (3 to 11) kW (11 to 20.5) kW | 2.3 mW/W 1.4 mW/W 1.3 mW/W 1.5 mW/W 1.3 mW/W | Fluke 5520A | OEM and GIDEP Sourced Calibration Procedures |
| AC Level Flatness 500 mV, 1V, 3V | 10 Hz 100 Hz 10 kHz 30 kHz 100 kHz 300 kHz 1 MHz 3 MHz 8 MHz 10 MHz 20 MHz 30 MHz 50 MHz 70 MHz 80 MHz 100 MHz | 0.034 % 0.019 % 0.019 % 0.019 % 0.021 % 0.025 % 0.025 % 0.17 % 0.17 % 0.17 % 0.35 % 0.35 % 0.91 % 1.3 % 1.5 % 1.6 % | Precision Measurements Thermal Converters with HP 3458A and Fluke 5700A | |
| AC Resistance - Source 10 Ω | DC to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 1.3 mΩ/Ω 1.4 mΩ/Ω 1.7 mΩ/Ω 1.9 mΩ/Ω 2.6 mΩ/Ω 6.6 mΩ/Ω 10 mΩ/Ω | HP 42030A Resistance Set | |
| 100 Ω | DC to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 1.3 mΩ/Ω 1.4 mΩ/Ω 1.7 mΩ/Ω 1.4 mΩ/Ω 1.7 mΩ/Ω 3.4 mΩ/Ω 4.6 mΩ/Ω | | |
| 1 kΩ | DC to 3 MHz (3 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 900 μΩ/Ω 1.1 mΩ/Ω 2.8 mΩ/Ω 4.1 mΩ/Ω | | |
| (10, 100) kΩ | DC to 1 MHz | 900 μΩ/Ω | | |

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| AC Voltage - Measure 3 µV to 10 mV | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz | 300 µV/V + 3 µV 200 µV/V + 1.1 µV 300 µV/V + 1.1 µV 1.2 mV/V + 1.1 µV 5.8 mV/V + 1.1 µV 46 mV/V + 2 µV | HP 3458A Opt 002 | OEM and GIDEP Sourced Calibration Procedures |
| (10 to 100) mV | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz | 80 µV/V + 4 µV 80 µV/V + 2 µV 200 µV/V + 2 µV 300 µV/V + 2 µV 900 µV/V + 2 µV 3.5 mV/V + 10 µV 12 mV/V + 10 µV 17 mV/V + 10 µV | | |
| 100 mV to 1 V | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz | 80 µV/V + 40 µV 80 µV/V + 20 µV 200 µV/V + 20 µV 300 µV/V + 20 µV 900 µV/V + 20 µV 3.5 mV/V + 100 µV 12 mV/V + 100 µV 17 mV/V + 100 µV | | |
| (1 to 10) V | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz | 80 µV/V + 400 µV 80 µV/V + 200 µV 200 µV/V + 200 µV 300 µV/V + 200 µV 900 µV/V + 200 µV 3.5 mV/V + 1 mV 12 mV/V + 1 mV 17 mV/V + 1 mV | | |
| (10 to 100) V | (1 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz | 200 µV/V + 4 mV 200 µV/V + 2 mV 400 µV/V + 2 mV 1.4 mV/V + 2 mV 4.6 mV/V + 10 mV 17 mV/V + 10 mV | | |
| (100 to 700) V | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz | 500 µV/V + 40 mV 500 µV/V + 20 mV 700 µV/V + 20 mV 1.4 mV/V + 20 mV 3.5 mV/V + 20 mV | | |



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| AC Resistance - Measure 1 Ω to 1 MΩ | 10 Hz to 1 MHz | 500 μΩ/Ω | Quad Tech 7600 | OEM and GIDEP Sourced Calibration Procedures |
| AC Current - Measure | | | | |
| (5 to 100) μA | (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz | 4.6 mA/A + 30 nA 1.7 mA/A + 30 nA 700 μA/A + 30 nA 700 μA/A + 30 nA | HP 3458A Opt 002 | |
| 100 μA to 1 mA | (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz | 5 mA/A + 20 nA 1.7 mA/A + 20 nA 700 μA/A + 20 nA 400 μA/A + 20 nA | | |
| (1 to 10) mA | (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz | 4.6 mA/A + 2 μA 1.7 mA/A + 2 μA 700 μA/A + 2 μA 400 μA/A + 2 μA | | |
| (10 to 100) mA | (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz | 4.6 mA/A + 20 μA 1.7 mA/A + 20 μA 700 μA/A + 20 μA 400 μA/A + 20 μA | | |
| 100) mA to 1 A | (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz | 4.6 mA/A + 200 μA 1.8 mA/A + 200 μA 900 μA/A + 200 μA 1.2 mA/A + 200 μA | | |
| Capacitance - Source | | | | |
| 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (10 to 50) Hz (10 to 20) Hz | 190 pF to 1.1 nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF 330 nF to 1.1 μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF 330 μF to 1.1 mF | 5.4 mF/F + 10 pF 5.4 mF/F + 10 pF 3.2 mF/F + 10 pF 2.7 mF/F + 100 pF 2.7 mF/F + 300 pF 2.7 mF/F + 1 nF 2.7 mF/F + 3 nF 2.9 mF/F + 10 nF 4.6 mF/F + 30 nF 5.1 mF/F + 100 nF 5.4 mF/F + 300 nF 6.2 mF/F + 1 μF | Fluke 5520A | |
| 100 Hz to 1 kHz | 1 pF to 1 nF | 1 mF/F | GenRad 1413 | |

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|--|--|--|---------------------------------|--|
| Capacitance - Source Fixed Values 1 pF | 100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 620 µF/F 720 µF/F 830 µF/F 990 µF/F 1.6 mF/F 2.2 mF/F 6.8 mF/F 10 mF/F | Fluke 5520A | OEM and GIDEP Sourced Calibration Procedures |
| 10 pF | 100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 620 µF/F 660 µF/F 750 µF/F 760 µF/F 830 µF/F 950 µF/F 1.5 mF/F 1.8 mF/F | | |
| 100 pF | 100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 730 µF/F 660 µF/F 750 µF/F 760 µF/F 830 µF/F 950 µF/F 1.5 mF/F 1.8 mF/F | | |
| 1 000 pF | 100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz | 620 µF/F 720 µF/F 830 µF/F 990 µF/F 1.3 mF/F 1.6 mF/F 3.5 mF/F 4.8 mF/F | | |
| (10, 100) nF | (100 to 120) Hz 120 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz | 630 µF/F 620 µF/F 640 µF/F 710 µF/F | | |
| 1 µF | (100 to 120) Hz 120 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz | 670 µF/F 620 µF/F 670 µF/F 910 µF/F | | |



| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|---|---|--|---------------------------------|--|
| Capacitance - Measure 0.1 pF to 1 mF | 10 Hz to 1 MHz | 500 μF/F | Quad Tech 7600 | OEM and GIDEP Sourced Calibration Procedures |
| Inductance - Source 100 Hz to 1 kHz | 100 μH 1 mH to 1 H 1 H 10 H | 1 mH/H 300 μH/H 500 μF/F 2 mH/H | GenRad 1482 series | |
| Inductance - Measure 100 μH to 10 H | 10 Hz to 1 MHz | 500 μH/H | Quad Tech 7600 | |
| Phase - Source (0 to 180)° | (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz | 0.14° 0.28° 0.52° 3° 5.4° 11° | Fluke 5520A | |

II. Electromagnetic - RF/Microwave³

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|--|---------------------|--|--|--|
| RF Power - Source (-56 to +24) dBm | 0.01 Hz to 20 MHz | 0.52 dB | HP 3325B | OEM and GIDEP Sourced Calibration Procedures |
| (-110 to +13) dBm | 10 MHz to 20 GHz | 0.2 dB | HP83630B with HP8902A, HP11722A and HP11792A | |
| (-110 to +10) dBm | (20 to 26.5) GHz | 0.2 dB | HP83630B with HP8902A, HP11722A, HP11792A and HP11793A | |
| RF Power - Measure (-20 to +30) dBm | 100 kHz to 26.5 GHz | 2.1 % | HP8902A with HP11722A and HP11792A | |
| (-70 to +20) dBm | (2.6 to 26.5) GHz | 2.9 % | HP8485A or HP8487D with HP436A | |

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|--|---|---|--|--|
| RF Attenuation - Tuned RF Power Measure 100 kHz to 26.5 GHz | (-0 to -1) dB (-1 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (-110 to -120) dB | 0.008 dB 0.03 dB 0.06 dB 0.08 dB 0.08 dB 0.11 dB 0.14 dB 0.16 dB 0.2 dB 0.22 dB 0.24 dB 0.32 dB 0.37 dB | HP 8902A HP11722A HP11792A HP11793A | OEM and GIDEP Sourced Calibration Procedures |
| Distortion - Measure (50 to 500) kHz, (0 to 99.9) dB ≥ 0.005 % (0.1 to 130) V | 20 Hz to 20 kHz (20 to 100) kHz 10 Hz to 50 kHz (50 to 100) kHz (100 to 500) kHz 500 kHz to 1 MHz | 1.2 dB 2.3 dB 18 % 18 % 18 % 29 % | HP 8903B Krohn-Hite 6900A | |
| Phase Modulation - Measure Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz | 150 kHz to 10 MHz 10 MHz to 1.3 GHz (1.3 to 26.5) GHz | 4 % + 1 digit 3 % + 1 digit 4 % + 1 digit | HP8902A with HP11793A | |
| Amplitude Modulation - Measure Rate: 50 Hz to 10 kHz Depths: 5 % to 99 % Rate: 20 Hz to 10 kHz Depths: to 99 % Rate: 50 Hz to 50 kHz Depths: 5 % to 99 % Rate: 20 Hz to 100 kHz Depths: to 99 % Rate: 50 Hz to 50 kHz Depths: 5 % to 99 % Rate: 20 Hz to 100 kHz Depths: to 99 % | 150 kHz to 10 MHz 150 kHz to 10 MHz 10 MHz to 1.3 GHz 10 MHz to 1.3 GHz (1.3 to 26.5) GHz 10 MHz to 26.5 GHz | 2 % + 1 digit 3 % + 1 digit 1 % + 1 digit 3 % + 1 digit 1.5 % + 1 digit 3 % + 1 digit | HP8902A with HP11722A or HP11793A | |



| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|--|----------------------------------|--|--|--|
| Frequency Modulation - Measure | | | | |
| Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz peak | 250 kHz to 10 MHz | 2 % + 1 digit | HP8902A with HP11722A or HP11793A | OEM and GIDEP Sourced Calibration Procedures |
| Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak | 10 MHz to 1.3 GHz | 1 % + 1 digit | | |
| Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak | 10 MHz to 1.3 GHz | 5 % + 1 digit | | |
| Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz peak | 10 MHz to 26.5 GHz | 1 % + 1 digit | | |
| Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz peak | 10 MHz to 26.5 GHz | 5 % + 1 digit | | |
| Reflection Magnitude | (Into 50 Ω) | | | |
| 0 < Γ ≤ 0.2 | 300 kHz to 3 GHz (3 to 6) GHz | 0.003 Γ 0.009 Γ | HP8753D w/ 7 mm connector Γ refers to the magnitude of the reflection value being read. | |
| 0.2 < Γ ≤ 0.4 | 300 kHz to 3 GHz (3 to 6) GHz | 0.006 Γ 0.012 Γ | | |
| 0.4 < Γ ≤ 0.6 | 300 kHz to 3 GHz (3 to 6) GHz | 0.009 Γ 0.016 Γ | | |
| 0.6 < Γ ≤ 0.8 | 300 kHz to 3 GHz (3 to 6) GHz | 0.011 Γ 0.018 Γ | | |
| 0.8 < Γ ≤ 1 | 300 kHz to 3 G (3 to 6) GHz | 0.013 Γ 0.022 Γ | | |
| Transmission Phase (Into 50 Ω, 0° to 360°) | | | | |
| (10 to 0) dB | 300 kHz to 6 GHz | 1.2 ° | | |
| (0 to -10) dB | | 0.4 ° | | |
| (-10 to -20) dB | | 0.5 ° | | |
| (-20 to -30) dB | | 0.61 ° | | |
| (-30 to -40) dB | | 0.72 ° | | |
| (-40 to -50) dB | | 1 ° | | |
| (-50 to -60) dB | | 2.5 ° | | |
| (-60 to -70) dB | | 6 ° | | |

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|--|---|--|--|---|
| Transmission Magnitude (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB | (Into 50 Ω) 300 kHz to 3 GHz (3 to 6) GHz | 0.06 dB 0.04 dB 0.05 dB 0.06 dB 0.1 dB 0.12 dB 0.29 dB 0.81 dB 0.12 dB 0.06 dB 0.08 dB 0.09 dB 0.12 dB 0.23 dB 0.48 dB 1.8 dB | HP8753D w/ 7 mm connector | OEM and GIDEP Sourced Calibration Procedures |
| Reflection Phase $0.2 < \Gamma \leq 0.4$ $0.2 < \Gamma \leq 0.4$ | (into 50 Ω, 0° to 360°) 300 kHz to 3 GHz (3 to 6) GHz 300 kHz to 3 GHz (3 to 6) GHz | 1.5° 2.3° 0.95° 1.8 | | |
| Horn Antennas Horizontal /Vertical 1 Meter 3 Meters | (1 to 18) GHz (1 to 18) GHz | 1.5 dB 1.35 dB | Anritsu 68177C HP 8563E Standard Horn Antennas | ANSI C63.5-2006, ANSI C63.5-1998, ANSI C63.5 with SAE ARP958, SAE RP958, Appendix C |
| Current Probes and Bulk Current Injection Probes Insertion Loss Transfer Impedance | 20 Hz to 300 kHz 300 kHz to 1 GHz 20 Hz to 300 kHz 300 kHz to 1 GHz | 0.25 dB 0.17 dB 0.25 dB 0.17 dB | HP 4195A HP 8753D HP 4195A HP 8753D | CISPR 16-1-2 and IEC 61000-4-6 |

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|-----------------------|--------------------------------------|--|---------------------------------|---|
| LISN - Insertion Loss | 9 kHz to 108 MHz | 0.25 dB | HP 4195A | ANSI C63.4, Appendix E |
| Impedance | 9 kHz to 2 MHz 300 kHz to 108 MHz | 0.05 % 0.25 dB | QuadTech 7600 HP 4195A | |
| Monopole/Rod | 9 kHz to 60 MHz | 0.25 dB | HP 4195A | Equivalent Capacitance Substitution Method (ECSM) ANSI C63.5, SAE ARP 958 |

III. Time & Frequency

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|-----------------------|---|--|---|--|
| Time Interval | 1 s to 3 hr | 0.5 s | HP 5345A | OEM and GIDEP Sourced Calibration Procedures |
| Frequency - Source | 10 MHz | 5 parts in 10^{12} | True Time GPS with FTS 1050A | |
| | 0.01 Hz to 20 MHz 20 MHz to 26.5 GHz | 5 parts in 10^{12} 5 parts in 10^{12} | HP 3325B HP 83630B | |
| Frequency - Measure | 10 MHz DC to 26.5 GHz | 5 parts in 10^{12} 5 parts in 10^{12} | True Time GPS with FTS 1050A HP 5345A with Plug-In | |

IV. Thermodynamic

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|-----------------------|---|--|---|--|
| Temperature - Source | (-15 to 123) °C (123 to 300) °C (300 to 400) °C | 0.07 °C 0.77 °C 2.1 °C | Hart 1521 with Hart 5614 RTD, Dry Blocks, and Baths | OEM and GIDEP Sourced Calibration Procedures |
| Temperature - Measure | (-200 to 100) °C (100 to 400) °C | 0.04 °C 0.06 °C | Hart 1521 with Hart 5614 RTD | |

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|-----------------------------|-------------|--|---|--|
| IR Temperature - Source | 35 °C | 0.16 °C | Fluke Hart 4181 Black Body Source | OEM and GIDEP Sourced Calibration Procedures |
| | 100 °C | 0.21 °C | | |
| | 200 °C | 0.27 °C | | |
| | 350 °C | 0.44 °C | | |
| | 500 °C | 0.79 °C | | |
| Relative Humidity - Source | 12 % | 2 %RH | LiCl Solution K ₂ CO ₄ Solution NaCl Solution | OEM and GIDEP Sourced Calibration Procedures |
| | 43 % | 2 %RH | | |
| | 75 % | 2 %RH | | |
| Relative Humidity - Measure | (5 to 95) % | 0.61 %RH | General Eastern, Optica SIM 124, Chilled Mirror | |

V. Mechanical

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|---|------------------|---|---------------------------------|--|
| Scales and Balances | (1 to 10) mg | 0.026 mg | Class 1 Weights | OEM and GIDEP Sourced Calibration Procedures |
| | (10 to 500) mg | 0.043 mg | | |
| | 500 mg to 50 g | 0.15 mg | | |
| | (50 to 300) g | 0.9 mg | | |
| | (300 to 500) g | 1.7 mg | | |
| | 500 g to 1 kg | 3.7 mg | | |
| | (1 to 3) kg | 8 mg | | |
| | (3 to 5) kg | 12 mg | | |
| | (5 to 7.6) kg | 34 mg | | |
| | (1 to 5) lb | 0.0006 lb | | |
| | (5 to 10) lb | 0.001 lb | | |
| | (10 to 25) lb | 0.004 lb | | |
| | (25 to 50) lb | 0.006 lb | | |
| | Pressure | (50 to 100) lb | 0.02 lb | |
| (100 to 400) lb | | 0.02 lb | | |
| (0.23 to 18) psig (2 to 700) psig (6 to 2 400) psig (30 to 12 000) psig (-14.5 to 0) psig | | 0.002 % of reading 0.0022 % of reading 0.0036 % of reading 0.0057 % of reading 0.006 % of reading | | |
| | Up to 2 000 psia | 0.24 psia | Eaton UPC 5000 | |
| Force | (20 to 350) lbf | 0.095 lbf | Class F Weights | |



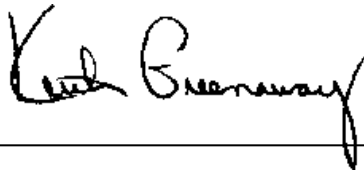
| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|---|--|--|--|--|
| Torque Wrenches | (10 to 100) in-oz | 0.32 % | CDI 950-DT With 1001-O-TPP | OEM and GIDEP Sourced Calibration Procedures |
| | (5 to 50) in-lb | 0.3 % | With TTPM-41 | |
| | (50 to 250) in-lb | 0.3 % | | |
| | (200 to 1 000) in-lb | 0.3 % | | |
| | (25 to 250) ft-lb | 0.3 % | | |
| (250 to 600) ft-lb | 0.3 % | With 6004-F-TTP | | |
| Torque Transducers | 40 in-oz to 600 in-lb | 0.12 % | Torque Arms and Class F Weights | |
| Vacuum | (0 to 30) inHg | 0.01 inHg | Druck DPI 610 | |
| Vibration (1 to 45 G pk) (9.806 to 441.3) pC/m/s ² | 4 Hz to 2 kHz (2 to 10) kHz (10 to 20) kHz | 1.4 % 2 % 4.6 % | Bouche Labs 5000C | |
| Conductivity | (45, 450, 1 500, 4 500) µS | 1.2 % | Standard Solutions | |
| pH Meters | (4, 7, and 10) pH units | 0.02 pH units | Standard pH Solutions | |
| Pipettes | 1 µL | 0.021 µL | Mettler/Toledo XP26PC Micro-Balance w/ OMEGA DP24-E Process Indicator and Labtronics Pipette Software | |
| | 2 µL | 0.031 µL | | |
| | 5 µL | 0.041 µL | | |
| | 10 µL | 0.061 µL | | |
| | 20 µL | 0.081 µL | | |
| | 50 µL | 0.101 µL | | |
| | 100 µL | 0.202 µL | | |
| | 200 µL | 0.403 µL | | |
| | 500 µL | 1.0054 µL | | |
| | 1000 µL | 1.515 µL | | |
| | 2000 µL | 2.043 µL | | |
| 5000 µL | 4.13 µL | | | |
| 10 000 µL | 6.35 µL | | | |
| 20 000 µL | 9.017 µL | | | |
| Viscosity | (488, 5040, 12 880) cSt | 1.2 % of reading | Standard Solutions | |

VI. Dimensional

| PARAMETER / EQUIPMENT | RANGE | CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)] | REFERENCE STANDARD OR EQUIPMENT | METHOD(S) |
|--------------------------------------|---------------------------------|--|---------------------------------|--|
| Micrometers, Height, and Depth Gages | (0 to 36) in (300 to 500) mm | (67 + 1.6L) μin (3.2 + 1.6L) μm | Gage Blocks | OEM and GIDEP Sourced Calibration Procedures |
| Calipers | (0 to 36) in (300 to 500) mm | (700 + 1.6L) μin (33 + 1.6L) μm | | |
| Indicators | (0 to 2) in | (67 + 1.6L) μin | | |
| Gage Pins | (0.05 to 10) in | (140 + 1.6L) μin | Lasermicrometer | |
| Feeler Gages | Up to 2 in | 100 μin | Starrett 673x Bench Micrometer | |

Notes:

1. Calibration and Measurement Capabilities (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of $k=2$.
2. This laboratory offers calibration services in its laboratory and on-site at customer-designated locations. 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.
3. CMC listed for Electromagnetic-RF/Microwave do not include possible contributions to uncertainty induced by mismatch.
4. CMC listed for Electromagnetic-DC/Low Frequency may not include the resolution of a "best available" Unit Under Test.
5. The use of (t) signifies an expression of Time in seconds.
6. The use of (L) signifies an expression of Length in inches.
7. CMC displayed as percentage (%) are percent of reading unless indicated otherwise.
8. This scope is part of and must be included with the Certificate of Accreditation No. AC-1386.



Vice President