



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid to: June 26, 2010

Certificate Number: AC - 1336

I. Electromagnetic – DC / Low Frequency

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Voltage – Source ³	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	7.5 µV/V + 0.4 µV 5 µV/V + 0.7 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4 µV 5 µV/V + 40 µV 6.5 µV/V + 0.4 mV	Fluke 5720A	OSI SOP 20/ OEM
Fixed Values	10 V	2.5 µV	Fluke 732B	
DC Voltage – Measure	(0 to 200) mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1 000) V	5 µV/V + 0.5 µV 3.5 µV/V + 0.2 µV 3.5 µV/V + 0.2 µV 5.5 µV/V + 0.2 µV 5.5 µV/V + 0.5 µV	Fluke 8508A	OSI SOP 20/ OEM
DC Current – Source	(0 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 V µA/A + 7 nA 35 µA/A + 40 nA 45 µA/A + 0.7 µA 80 µA/A + 12 µA	Fluke 5720A	OSI SOP 20/ OEM
DC Current – Measure	(0 to 200) µA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A	12 µA/A + 0.4 nA 12 µA/A + 4 nA 14 µA/A + 0.04 µA 48 µA/A + 0.8 µA 185 µA/A + 16 µA 4 mA/A + 400 µA	Fluke 8508A	OSI SOP 20/ OEM



PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
DC Resistance – Source ³	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	95 μΩ 181 μΩ 230 μΩ 437 μΩ 1.0 mΩ 1.9 mΩ 8.5 mΩ 16.2 mΩ 85 mΩ 162 mΩ 1.1 Ω 2.09 Ω 20 Ω 40 Ω 400 Ω 893 Ω 10 kΩ	Fluke 5720A	OSI SOP 20/ OEM
Fixed Values	1 Ω 10 kΩ	4 μΩ 40 mΩ	Fluke 742-1 Fluke 742-10k	
DC Resistance – Measure	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ	17 μΩ/Ω + 4 μΩ 9.5 μΩ/Ω + 14 μΩ 8 μΩ/Ω + 50 μΩ 8 μΩ/Ω + 0.5 mΩ 8 μΩ/Ω + 5 mΩ 8 μΩ/Ω + 50 mΩ 9 μΩ/Ω + 1 Ω 20 μΩ/Ω + 100 Ω 120 μΩ/Ω + 10 kΩ 1.51 mΩ/Ω + 1 MΩ	Fluke 8508A	OSI SOP 20/ OEM
AC Voltage – Measure	(0 to 200) mV (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz 200 mV to 200 V (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz	140 μV/V + 20 μV 150 μV/V + 20 μV 110 μV/V + 10 μV 135 μV/V + 20 μV 340 μV/V + 41 μV 765 μV/V + 100 μV 115 μV/V + 10 μV 90 μV/V + 10 μV 75 μV/V + 10 μV 110 μV/V + 10 μV 220 μV/V + 20 μV 570 μV/V + 100 μV 300 μV/V + 100 μV	Fluke 8508A	OSI SOP 20/ OEM

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
AC Voltage – Measure (Cont.)	(200 to 1 000) V (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	120 μ V/V + 20 μ V 115 μ V/V + 20 μ V 225 μ V/V + 40 μ V 580 μ V/V + 200 μ V	Fluke 8508A	OSI SOP 20/ OEM
Capacitance – Measuring Equipment Fixed Values (@ 1 kHz)	0.001 μ F 0.01 μ F 0.1 μ F 1 μ F	0.5 mF/F 0.5 mF/F 0.5 mF/F 0.5 mF/F	GenRad 1409-F GenRad 1409-L GenRad 1409-T GenRad 1409-Y	OSI SOP 20/ OEM
Capacitance – Measure (@1 kHz)	1 pF to 10 mF	0.25 mF/F + 30 aF	GenRad 1689 bridge	OSI SOP 20/ OEM
Inductance – Measuring Equipment Fixed Values (@ 1 kHz)	50 μ H 200 μ H 1 mH 2 mH 5 mH 10 mH 50 mH 100 mH 200 mH	5 mH/H 2.5 mH/H 1 mH/H 1 mH/H 1 mH/H 1 mH/H 1 mH/H 1 mH/H 1 mH/H	GenRad 1482-A GenRad 1482-C GenRad 1482-E GenRad 1482-F GenRad 1482-G GenRad 1482-H GenRad 1482-K GenRad 1482-L GenRad 1482-M	OSI SOP 20/ OEM
Inductance – Measure (@1 kHz)	10 μ H to 1 000 H	0.25 mH/H	GenRad 1689 bridge	OSI SOP 20/ OEM
Oscilloscopes Amplitude – DC 50 Ω Load	+888 μ V to +5.56 V 0 V -888 μ V to -5.56 V	0.25 mV/V + 25 μ V 15 μ V 0.25 mV/V + 25 μ V	Wavetek 9500A with 9520 heads	OSI SOP 20/ OEM
1 M Ω Load	+888 μ V to +222.4 V 0 V -888 μ V to -222.4 V	0.25 mV/V + 25 μ V 15 μ V 0.25 mV/V + 25 μ V		



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Oscilloscopes (Cont.)				
Amplitude – Square Wave				
50 Ω Load	(35.52 to 1 000) μV (1 to 22) mV (21 to 556) mV 556 mV to 5.56 V 0 V	@≤10 kHz 10 mV/V + 10 μV 1 mV/V + 15 μV 1 mV/V + 1 μV 0.5 mV/V + 1 μV 15 μV	Wavetek 9500A with 9520 heads	OSI SOP 20/ OEM
1 MΩ Load	(35.52 to 1 000) μV (1 to 22) mV (21 to 556) mV 556 mV to 5.56 V 0 V	10 mV/V + 10 μV 1 mV/V + 15 μV 1 mV/V + 1 μV 0.5 mV/V + 1 μV 15 μV		
Oscilloscopes (cont.)				
Amplitude – Leveled Sine (into 50 Ω)	50 kHz to 10 MHz	1.5 %		
Time Marker	450 ps to 55 s	10 parts in 10 ⁶		
Rise Time (into 50 Ω)	150 ps	19 ps		
Level Sine Flatness (into 50 Ω and 1 MΩ)	100 mHz to 100 MHz (100 to 550) MHz (0.55 to 1.1) GHz	1.5 % 3 % 4 %		



II. Electromagnetic – RF/Microwave

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
RF Power (Absolute) – Measure Power Reference 1 mW, Type-N(f), 50 Ω (+20 to -30) dBm	50 MHz 10 MHz to 18 GHz	3.5 μW 2.1 %	HP 432B with 478A-H76 HP 436A with 8481A	OSI SOP 20/ OEM
Phase Modulation – Source (@ 1 kHz)	(0.1 to 2 115) MHz	5 % + 0.09 rad	HP 8642B	OSI SOP 20/ OEM
Phase Modulation – Measure	(10 to 1 300) MHz 200 Hz to 20 kHz rate	3 % of reading	HP 8901A	OSI SOP 20/ OEM
Amplitude Modulation – Measure	(10 to 1 300) MHz 50 Hz to 50 kHz rate	1 % of reading	HP 8901A	OSI SOP 20/ OEM
Frequency Modulation – Source	(0.1 to 2115) MHz 20 to 100 kHz rate	5 % + 10 Hz	HP 8642B	OSI SOP 20/ OEM
Frequency Modulation – Measure	(10 to 1 300) MHz 50 Hz to 100 kHz rate	1 % of reading	HP 8901A	OSI SOP 20/ OEM

III. Time & Frequency

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Frequency – Measure	20 kHz to 10 MHz (20 kHz harmonic) 1 mHz to 26 GHz	1 part in 10 ¹¹ per day 1 part in 10 ⁸	Kenometrics 60-TF WWVB HP 5342A, 5316A, 5328A	OSI SOP 20/ OEM

IV. Thermodynamic

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Temperature – Source and Measure	(-55 to 140) °C	0.026 °C	Isotech 2140 bath with Hart Scientific PRT and Fluke 8508A	OSI SOP 20/ OEM
Humidity	(10 to 95) %	0.5 %RH	Thunder Scientific 2500	OSI SOP 20/ OEM

V. Mechanical

PARAMETER / EQUIPMENT	RANGE	BEST MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
Rotational Speed (rpm) -- Source	(55 to 40 000) rpm	0.0001 rpm/rpm	GEC H224-837837	OSI SOP 20/ OEM
Rotational Speed (rpm) – Measure	(5 to 99 999) rpm	0.0018 rpm/rpm	Photo Strobe 461825	OSI SOP 20/ OEM
Pressure	(0 to 2 500) psi	0.0001 psi/psi	Ruska 7250XI	OSI SOP 20/ OEM

Notes:

1. This laboratory offers commercial calibration service.
2. “Best Uncertainty” is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer’s device, to the environment (if the calibration is performed in the field) and to influences from the circumstances of the specific calibration.
3. On-site calibration service is available for this calibration. The uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.
4. Where ranges are not specified, the best uncertainty stated is for the cardinal points only.
5. The measurands stated are generated with the Fluke 5720A and 5500A. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Best measurement uncertainty is read as output plus one-year floor specifications where defined.
6. The measurands stated are measured with the Fluke 8508A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Best measurement uncertainty is based upon one-year floor specifications and is read as output plus range.
7. This scope is part of and must be included with the Certificate of Accreditation No. AC - 1336

Karl Greenway

Vice President

