



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

KEITHLEY INSTRUMENTS GERMANY
 Landsberger Str. 65
 82110 Germering, GERMANY
 Thomas Worm Phone: +49 (89) 84 93 07 -35

CALIBRATION

Valid To: September 30, 2021

Certificate Number: 2611.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,8}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Generate ⁶	(0.001 to 0.004) V (0.004 to 0.01) V	27 µV/V 20 µV/V	Fluke 5720A (based on 90 day specs) into Keithley 262 divider
	(0 to 0.22) V (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	6.0 µV/V + 0.40 µV 3.5 µV/V + 0.70 µV 2.5 µV/V + 2.5 µV 2.5 µV/V + 4.1 µV 3.5 µV/V + 40 µV 4.5 µV/V + 0.40 mV	Fluke 5720A (based on 90 day specs)
Fixed Point	10 V	0.51 µV/V	Fluke 7001
DC Voltage – Generate ³	(0 to 0.2) V (0.2 to 2) V (2 to 20) V (20 to 200) V	23 µV/V + 49 µV 13 µV/V + 52 µV 15 µV/V + 60 µV 26 µV/V + 0.73 mV	Voltage source Keithley 2002

Parameter/Equipment	Range	CMC ^{2, 7} (\pm)	Comments
DC Voltage – Measure ^{5, 6}	(0.001 to 0.1) V (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 1000) V	14 μ V/V + 0.42 μ V 12 μ V/V + 0.42 μ V 12 μ V/V + 0.90 μ V 14 μ V/V + 42 μ V 18 μ V/V + 0.15 mV 28 μ V/V + 0.15 mV	Agilent 3458A
DC Voltage – Measure ³	(0 to 0.2) V (0.2 to 2) V (2 to 20) V (20 to 200) V	23 μ V/V + 19 μ V 13 μ V/V + 20 μ V 15 μ V/V + 24 μ V 26 μ V/V + 0.66 mV	Keithley 2002
DC Current – Generate ^{4, 6}	(0.2 to 2) pA (2 to 20) pA (20 to 200) pA (0.2 to 2) nA (2 to 20) nA (20 to 200) nA (5 to 100) nA (0.1 to 1) μ A (1 to 10) μ A (10 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 1) A (1 to 2.2) A (2.2 to 5) A	0.075 % + 4.1 fA 0.075 % + 4.1 fA 0.021 % + 41 fA 0.021 % + 41 fA 0.018 % + 0.41 pA 0.014 % + 4.1 pA 41 μ A/A + 59 pA 29 μ A/A + 74 pA 29 μ A/A + 0.15 μ A 35 μ A/A + 6.0 nA 30 μ A/A + 7.0 nA 30 μ A/A + 41 nA 40 μ A/A + 0.70 μ A 60 μ A/A + 12 μ A 0.011 % + 12 μ A 0.034 % + 0.48 mA	Keithley 5156, Fluke 5720A (based on 90 day specs) Auxiliary current source characterized with Agilent 3458A Fluke 5720A (based on 90 day specs) Fluke 5720A/5725A

Parameter/Equipment	Range	CMC ^{2, 7} (±)	Comments
DC Current – Generate ³	(0 to 1) pA (1 to 10) pA (10 to 100) pA (0.1 to 1) nA (1 to 10) nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.12 % + 2.2 fA 0.12 % + 2.3 fA 0.024 % + 17 fA 0.012 % + 34 fA 0.012 % + 90 fA 0.012 % + 0.44 pA 0.012 % + 3.9 pA 0.012 % + 37 pA 82 µA/A + 0.30 nA 82 µA/A + 3.0 nA 93 µA/A + 30 nA 0.012 % + 0.30 µA 0.024 % + 5.5 µA	Keithley 2002, Keithley 7177 current source
DC Current – Measure ^{5, 6}	(0.1 to 1) pA (1 to 10) pA (10 to 100) pA (0.1 to 1) nA (1 to 10) nA (10 to 100) nA (0 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1.1) A (1.1 to 5) A	0.075 % + 4.1 fA 0.075 % + 4.1 fA 0.022 % + 41 fA 0.022 % + 42 fA 0.018 % + 0.43 pA 0.015 % + 4.2 pA 41 µA/A + 59 pA 29 µA/A + 59 pA 29 µA/A + 0.13 nA 29 µA/A + 1.1 nA 29 µA/A + 7.0 nA 29 µA/A + 70 nA 47 µA/A + 0.70 µA 0.014 % + 13 µA 69 µA/A + 6.0 µA	Keithley 5156, Agilent 3458A Agilent 3458A KI 2300-RBOX with Agilent 3458A
DC Current – Measure ³	(0 to 1) pA (1 to 10) pA (10 to 100) pA (0.1 to 1) nA (1 to 10) nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.12 % + 2.2 fA 0.12 % + 2.3 fA 0.024 % + 17 fA 0.012 % + 34 fA 0.012 % + 89 fA 0.012 % + 0.43 pA 0.012 % + 3.8 pA 0.012 % + 37 pA 82 µA/A + 0.29 nA 82 µA/A + 2.9 nA 93 µA/A + 29 nA 0.012 % + 0.30 µA 0.024 % + 5.1 µA	Keithley 2002, Keithley 7177

Parameter/Equipment	Range	CMC ^{2, 7} (±)	Comments	
DC Resistance – Generate ^{4, 6} Fixed Points	1 Ω	0.69 μΩ/Ω	Fluke 742A-1	
	10 kΩ	1.4 μΩ/Ω	Fluke 742A-10k	
	900 MΩ	0.032 %	Keithley 2001-758D	
	1 GΩ	0.018 %	Keithley 5156-1G	
	10 GΩ	0.021 %	Keithley 5156-10G	
	100 GΩ	0.073 %	Keithley 5156-100G	
	0 Ω	40 μΩ	Fluke 5720A (based on 90 day specs)	
	(1, 1.9) Ω	80 μΩ/Ω		
	(10, 19) Ω	21 μΩ/Ω		
	(100, 190) Ω	9.0 μΩ/Ω		
	(1, 1.9) kΩ	7.5 μΩ/Ω		
	(10, 19) kΩ	7.5 μΩ/Ω		
	(100, 190) kΩ	9.0 μΩ/Ω		
	1 MΩ	15 μΩ/Ω		
	1.9 MΩ	16 μΩ/Ω		
10 MΩ	32 μΩ/Ω			
19 MΩ	39 μΩ/Ω			
100 MΩ	95 μΩ/Ω			
DC Resistance – Measure ⁵	(0 to 2) Ω	17 μΩ/Ω + 4.0 μΩ		Fluke 8508A
	(2 to 20) Ω	9.5 μΩ/Ω + 15 μΩ		
	(20 to 200) Ω	8.0 μΩ/Ω + 50 μΩ		
	(0.2 to 2) kΩ	8.0 μΩ/Ω + 0.51 mΩ		
	(2 to 20) kΩ	8.0 μΩ/Ω + 5.0 mΩ		
	(20 to 200) kΩ	8.0 μΩ/Ω + 50 mΩ		
	(0.2 to 2) MΩ	9.0 μΩ/Ω + 1.0 Ω		
	(2 to 20) MΩ	20 μΩ/Ω + 0.10 kΩ		
	(20 to 200) MΩ	0.012 % + 10 kΩ		
	(0.2 to 2) GΩ	0.16 % + 1.0 MΩ		

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Current – Generate ⁶			
(10 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.023 % + 16 nA 0.014 % + 10 nA 0.011 % + 8.0 nA 0.025 % + 12 nA 0.090 % + 65 nA	Fluke 5720A (based on 90 day specs)
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	0.023 % + 41 nA 0.014 % + 35 nA 0.011 % + 35 nA 0.018 % + 0.11 µA 0.090 % + 0.65 µA	
(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	0.023 % + 0.41 µA 0.014 % + 0.36 µA 0.011 % + 0.35 µA 0.018 % + 0.55 µA 0.090 % + 5.0 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	0.023 % + 4.0 µA 0.014 % + 3.6 µA 0.011 % + 2.5 µA 0.018 % + 3.5 µA 0.090 % + 10 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 36 µA 0.039 % + 81 µA 0.60 % + 0.16 mA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.040 % + 0.18 mA 0.085 % + 0.38 mA 0.33 % + 0.75 mA	w/ Fluke 5725A (based on 90 day specs)
AC Current – Measure ⁶			
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 35 nA 0.18 % + 35 nA 0.069 % + 35 nA 0.069 % + 35 nA	Agilent 3458A (based on 2 year specs)
(0.1 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 0.24 µA 0.18 % + 0.23 µA 0.069 % + 0.23 µA 0.035 % + 0.23 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 2.3 µA 0.18 % + 2.3 µA 0.069 % + 2.3 µA 0.035 % + 2.3 µA	

Parameter/Range	Frequency	CMC ^{2, 7} (±)	Comments
AC Current – Measure ⁶ (cont.)			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 23 µA 0.18 % + 23 µA 0.069 % + 23 µA 0.035 % + 23 µA	Agilent 3458A (based on 2 year specs)
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 0.24 mA 0.19 % + 0.23 mA 0.092 % + 0.23 mA 0.12 % + 0.23 mA	
AC Voltage – Generate ^{4, 6}			
(1 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	0.022 % + 4.1 µV 85 µV/V + 4.0 µV 75 µV/V + 4.0 µV 0.018 % + 4.0 µV 0.046 % + 5.0 µV 0.090 % + 10 µV 0.12 % + 20 µV 0.25 % + 20 µV	Fluke 5720A (based on 90 day specs)
(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	0.022 % + 4.1 µV 85 µV/V + 4.0 µV 75 µV/V + 4.0 µV 0.018 % + 4.0 µV 0.046 % + 5.0 µV 0.090 % + 10 µV 0.12 % + 20 µV 0.25 % + 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	0.022 % + 12 µV 85 µV/V + 7.2 µV 75 µV/V + 7.0 µV 0.018 % + 7.0 µV 0.042 % + 17 µV 0.075 % + 20 µV 0.12 % + 25 µV 0.25 % + 45 µV	
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	0.022 % + 41 µV 80 µV/V + 17 µV 40 µV/V + 8.0 µV 70 µV/V + 10 µV 0.011 % + 30 µV 0.034 % + 81 µV 0.090 % + 0.20 mV 0.15 % + 0.30 mV	

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
AC Voltage – Generate ^{4,6} (cont.)			
(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	0.022 % + 0.41 mV 80 μV/V + 0.17 mV 40 μV/V + 51 μV 70 μV/V + 0.10 mV 95 μV/V + 0.20 mV 0.026 % + 0.60 mV 0.090 % + 2.0 mV 0.13 % + 3.2 mV	Fluke 5720A (based on 90 day specs)
(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	0.022 % + 4.0 mV 80 μV/V + 1.7 mV 47 μV/V + 0.60 mV 75 μV/V + 1.0 mV 0.013 % + 2.5 mV 0.080 % + 16 mV 0.42 % + 40 mV 0.70 % + 80 mV	
For the 1100 V Range:			
(220 to 250) V	(15 to 40) Hz	0.026 % + 16 mV	
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	80 μV/V + 4.1 mV 0.013 % + 6.0 mV 0.036 % + 11 mV	Fluke 5720A/5725A (based on 90 day specs)
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.036 % + 11 mV 0.13 % + 45 mV	
AC Voltage – Measure ^{5,6}			
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz	83 μV/V + 0.46 mV 83 μV/V + 0.23 mV 0.017 % + 0.23 mV	Agilent 3458A (based on 2 year specs)

II. Time & Frequency

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Frequency – Measuring Equipment ^{4,6}	(1 to 10) Hz 10 Hz to 1 kHz 1 kHz to 20 MHz	6.7 μHz/Hz 5.8 μHz/Hz 5.8 μHz/Hz	Agilent 33220A / spectrum TM4
Fixed Point	10 MHz	49 mHz	GPS oscillator spectrum TM4

¹ This laboratory offers commercial and field calibration service.

² Calibration and Measurement Capability Uncertainty (CMC) 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 or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found 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 actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

⁴ This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMC is expressed as either a specific value that covers the full range or as a fraction of the reading plus floor specification.

⁵ This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMC is expressed as either a specific value that covers the full range or as a combination of the fraction of the reading /output plus a range specification.

⁶ CMC is [$\mu X/X$ of Reading] + offset (where listed) for the ranges indicated in the Parameter/Equipment column of table, where "X" equals V, Ω , A or Hz.

⁷ In the statement of CMC, percentages are percentages of reading, unless otherwise indicated.

⁸ This scope meets A2LA's P112 Flexible Scope Policy.



Accredited Laboratory

A2LA has accredited

KEITHLEY INSTRUMENTS GERMANY

Germering, GERMANY

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets R205 – Specific Requirements: Calibration Laboratory Accreditation Program. 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*).



Presented this 3rd day of January 2020.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2611.01
Valid to September 30, 2021

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.