



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: September 30, 2024

Certificate Number: 3630.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 7}:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Steel Gauge Blocks	Up to 1 in (> 1 to 4 in)	8.6 µin (7.2 + 1.5L) µin	Gauge block comparator, master blocks
	Up to 20 mm (> 20 to 100 mm)	0.22 µm (0.19 + 0.0014L) µm	
Gauge Block Comparator	(0.1 ± 0.000 05) in	2.2 µin	Master gauge blocks
Electronic Gaging Unit	± 0.01 in	7 µin	Gauge blocks
Check Master Length ⁹	Up to 24 in	(46 + 2.3L) µin	Precision height gauge, gauge blocks
Parallelism	Up to 24 in (Height)	11 µin	Precision height gauge
Parallelism (Micrometer)	Anvil & Spindle	10 µin	Optical flat

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Hand Tools ^{3,9} –			
Calipers (OD/ID/Depth)	Up to 40 in (1000 mm)	320 μin (8.2 μm)	Gauge blocks
Depth Gages	Up to 24 in (600 mm)	300 μin (7.7 μm)	Gauge blocks
Height Gages	Up to 40 in (1000 mm)	(62 + 2.2L) μin	Gauge blocks
Dial Indicators	Up to 4 in (100 mm)	(5.7 + 20L) μin	ULM
	(> 4 to 12) in (300 mm)	(10 + 44L) μin	Gauge blocks
Thickness Gage	Up to 8 in (200 mm)	(6.5 + 1.5L) μin	Gauge blocks
Micrometers OD	Up to 24 in (600 mm)	(12 + 4.1L) μin	Gauge blocks
Micrometers ID	Up to 24 in (600 mm)	(60 + 2.1L) μin	ULM, gauge blocks
Micrometers Depth	Up to 24 in (600 mm)	(34 + 3.6L) μin	Gauge blocks
Bore Gauge Tri Micrometer	Up to 4 in (100 mm)	70 μin	Secondary ring gauges

II. Dimensional Testing¹¹

Parameter/Equipment	Range	CMC ^{2,4,8} (±)	Comments
Flatness ^{3,9} – Anvils & Spindles	Up to 0.001 in	10 μin	Optical flat
Plain Ring Gauges ⁹	Up to 8 in (200 mm) (> 8 to 12) in (300 mm)	18 μin 45 μin	ULM, gauge blocks
Plain Plug Gauges	Up to 24 in (600 mm)	(7.5 + 3.4L) μin (0.18 + 0.0034L) μm	ULM, gauge blocks
Length – 1D ⁹ Measure	Up to 24 in (600 mm)	(7.5 + 3.4L) μin (0.18 + 0.0034L) μm	ULM, gauge blocks

Parameter/Equipment	Range	CMC ^{2, 4} (\pm)	Comments
Surface Plate ³	Up to 12x12 ft (204 in diagonal)	$(24 + 0.06L) \mu\text{in}$ (diagonal length)	Laser interferometer
Precision Linear Height Gauge ³	Up to 48 in	$(32 + 2.9L) \mu\text{in}$	Gauge blocks

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 5} (\pm)	Comments
DC Voltage – Measure & Generate, Fixed Points	100 mV 1 V 10 V 100 V 1000 V	0.70 $\mu\text{V/V}$ 0.46 $\mu\text{V/V}$ 0.40 $\mu\text{V/V}$ 0.46 $\mu\text{V/V}$ 0.70 $\mu\text{V/V}$	732C, 752A, 845AB, 5720A or 5730A, 3458A
DC Voltage – Measure	0 V (0 to 202) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1050) V (0 to 202) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1050) V (0 to 120) mV (0.12 to 1.2) V (1.2 to 12) V (12 to 120) V (120 to 1000) V (0 to 10) kV (10 to 140) kV	0.01 μV 0.79 $\mu\text{V/V} + 0.2 \mu\text{V}$ 0.62 $\mu\text{V/V} + 0.3 \mu\text{V}$ 0.63 $\mu\text{V/V} + 0.5 \mu\text{V}$ 0.67 $\mu\text{V/V} + 5 \mu\text{V}$ 0.83 $\mu\text{V/V} + 50 \mu\text{V}$ 7.5 $\mu\text{V/V} + 0.2 \mu\text{V}$ 2.9 $\mu\text{V/V} + 0.3 \mu\text{V}$ 2.9 $\mu\text{V/V} + 0.5 \mu\text{V}$ 4.3 $\mu\text{V/V} + 30 \mu\text{V}$ 4.4 $\mu\text{V/V} + 0.5 \text{ mV}$ 10 $\mu\text{V/V} + 0.34 \mu\text{V}$ 9.1 $\mu\text{V/V} + 0.34 \mu\text{V}$ 9.1 $\mu\text{V/V} + 0.57 \mu\text{V}$ 11 $\mu\text{V/V} + 34 \mu\text{V}$ $(11 + (14V/1000)^2) \mu\text{V/V} + 110 \mu\text{V}$ 0.034 % + 0.034 V 0.091 % + 0.8 V	Copper short 732C, 752A, 8588A 8588A 3458A $V=\text{voltage}$ Vitretek 4700 w/ HVL-150 probe

Parameter/Equipment	Range	CMC ^{2, 5, 6} (\pm)	Comments
DC Voltage ³ – Generate	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	1.1 μ V/V + 0.2 μ V 1.0 μ V/V + 0.59 μ V 0.43 μ V/V + 2.1 μ V 0.40 μ V/V + 4 μ V 1.1 μ V/V + 40 μ V 1.2 μ V/V + 210 μ V	732C,752A,5720A or 5730A
	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	5.4 μ V/V + 0.39 μ V 3.1 μ V/V + 0.62 μ V 2.3 μ V/V + 2.3 μ V 2.3 μ V/V + 3.9 μ V 3.1 μ V/V + 39 μ V 4.7 μ V/V + 390 μ V	5720A or 5730A
	(0 to 329.9999) mV (0.33 to 3.299 999) V (3.3 to 32.999 99) V (33 to 329.9999) V (330 to 1020.000) V	15 μ V/V + 0.76 μ V 8.4 μ V/V + 1.5 μ V 9.1 μ V/V + 15 μ V 14 μ V/V + 110 μ V 14 μ V/V + 1.1 mV	552X series calibrator
DC Current ³ – Generate & Measure	(0 to 2) pA (0 to 20) pA (0 to 200) pA (0 to 2) nA (0 to 20) nA (0 to 200) nA (0 to 2) μ A (0 to 20) μ A	0.28 % + 0.39 aA 0.11 % + 3.9 aA 0.08 % + 39 aA 0.033 % + 0.39 aA 78 μ A/A + 3.9 fA 18 μ A/A + 39 fA 12 μ A/A + 0.39 pA 10 μ A/A + 3.9 pA	Standard resistors, 5720A or 5730A, Keithley 487
DC Current ³ – Measure	0 A (0 to 20) μ A (0 to 2) mA (0 to 10) mA (0 to 20) mA (0 to 100) mA (0 to 0.5) A (0 to 3) A (0 to 30) A (0 to 100) A (0 to 10) A (10 to 20) A	14 pA 7.5 μ A/A + 21 pA 3.1 μ A/A + 21 pA 3.2 μ A/A + 200 pA 3.2 μ A/A + 2 nA 3.2 μ A/A + 20 nA 3.4 μ A/A + 200 nA 6.0 μ A/A + 2 μ A 12 μ A/A + 5.1 μ A 24 μ A/A + 200 μ A 33 μ A/A + 20 μ A 66 μ A/A + 20 μ A	Open input 742A-10k, 8588A 742A-1k, 8588A 742A-100, 8588A 742A-10, 8588A 742A-1, 8588A VFP-4 (0.1), 8588A 9230-0.04, 8588A CS-100, 8588A Y5020, 8588A

Parameter/Equipment	Range	CMC ^{2, 5, 6} (\pm)	Comments
DC Current ³ – Measure (cont)	(0 to 20.2) μ A (20.2 to 202) μ A (0.202 to 2.02) mA (2.02 to 20.2) mA (20.2 to 202) mA (0.202 to 2.02) A (2.02 to 20.2) A (20.2 to 30.2) A	27 μ A/A + 0.4 nA 9.8 μ A/A + 0.4 nA 9.2 μ A/A + 4 nA 14 μ A/A + 40 nA 57 μ A/A + 1 μ A 140 μ A/A + 0.1 mA 240 μ A/A + 0.4 mA 560 μ A/A + 4.4 mA	8588A
	(0 to 120) nA (0.12 to 1.2) μ A (1.2 to 12) μ A (12 to 120) μ A (0.12 to 1.2) mA (1.2 to 12) mA (12 to 120) mA (0.12 to 1.05) A	34 μ A/A + 45 pA 23 μ A/A + 45 pA 23 μ A/A + 110 pA 23 μ A/A + 0.91 nA 23 μ A/A + 5.7 nA 23 μ A/A + 57 nA 40 μ A/A + 0.57 μ A 120 μ A/A + 11 μ A	3458A
	(0 to 500) A	0.56 % + 0.04 A	34401A
DC Current ³ – Generate	(0 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A	33 μ A/A + 5.4 nA 27 μ A/A + 6.2 nA 27 μ A/A + 39 nA 35 μ A/A + 0.62 μ A 54 μ A/A + 12 μ A 260 μ A/A + 370 μ A	5720A or 5730A w/ 5725A
	(0 to 329.999) μ A (0.330 to 3.299 99) mA (3.3 to 32.9999) mA (33 to 329.999) mA (0.33 to 1.099 99) A (1.1 to 2.999 99) A (3 to 10.9999) A (11 to 20.5) A	110 μ A/A + 0.015 μ A 76 μ A/A + 0.038 μ A 76 μ A/A + 0.19 μ A 76 μ A/A + 1.9 μ A 150 μ A/A + 30 μ A 290 μ A/A + 30 μ A 380 μ A/A + 380 μ A 760 μ A/A + 570 μ A	552X series calibrator
Clamp-on Meters	(20 to 149.999) A (150 to 549.999) A (550 to 1025) A	0.58 % + 0.17 A 0.58 % + 0.58 A 0.59 % + 0.58 A	552X series w/ 5500A/coil

Parameter/Equipment	Range	CMC ^{2, 5} (\pm)	Comments
Resistance – Measure/Generate	0 Ω	47 n Ω	Copper short
	(0.1 to 1) Ω 1 Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω 10 k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω (10 to 100) M Ω	0.50 $\mu\Omega/\Omega$ 0.30 $\mu\Omega/\Omega$ 0.35 $\mu\Omega/\Omega$ 0.40 $\mu\Omega/\Omega$ 0.45 $\mu\Omega/\Omega$ 0.35 $\mu\Omega/\Omega$ 0.30 $\mu\Omega/\Omega$ 0.60 $\mu\Omega/\Omega$ 0.90 $\mu\Omega/\Omega$ 2.9 $\mu\Omega/\Omega$ 12 $\mu\Omega/\Omega$	MI 6242D bridge with standard resistors
	(0 to 2.02) Ω (2.02 to 20.2) Ω (20.2 to 202) Ω 202 Ω to 2.02 k Ω (2.02 to 20.2) k Ω (20.2 to 202) k Ω 202 k Ω to 2.02 M Ω (2.02 to 20.2) M Ω (20.2 to 202) M Ω 202 M Ω to 2.02 G Ω (2.02 to 20.2) G Ω	17 $\mu\Omega/\Omega + 4 \mu\Omega$ 10 $\mu\Omega/\Omega + 14 \mu\Omega$ 9.2 $\mu\Omega/\Omega + 50 \mu\Omega$ 9.1 $\mu\Omega/\Omega + 0.5 \text{ m}\Omega$ 9.2 $\mu\Omega/\Omega + 5 \text{ m}\Omega$ 9.3 $\mu\Omega/\Omega + 50 \text{ m}\Omega$ 11 $\mu\Omega/\Omega + 1 \Omega$ 17 $\mu\Omega/\Omega + 10 \Omega$ 68 $\mu\Omega/\Omega + 1 \text{ k}\Omega$ 230 $\mu\Omega/\Omega + 0.1 \text{ M}\Omega$ 0.14 % + 10 M Ω	8588A with 552X series calibrator or standard resistors
Resistance – Measure Fixed Points	1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	6.9 $\mu\Omega/\Omega$ 2.6 $\mu\Omega/\Omega$ 1.4 $\mu\Omega/\Omega$ 1.4 $\mu\Omega/\Omega$ 1.4 $\mu\Omega/\Omega$ 1.9 $\mu\Omega/\Omega$ 2.8 $\mu\Omega/\Omega$ 4.4 $\mu\Omega/\Omega$ 20 $\mu\Omega/\Omega$	742A-1, 8588A 742A-10, 8588A 742A-100, 8588A 742A-1k, 8588A 742A-10k, 8588A Ohm-Labs 105, 8588A Ohm-Labs 106, 8588A 742A-10M, 8588A 9330-100M, 8588A

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Resistance – Measure	(0 to 2.02) Ω	5 μΩ/Ω + 4 μΩ	742A-1, 8588A
	(2.02 to 20.2) Ω	2.5 μΩ/Ω + 14 μΩ	742A-10, 8588A
	(20.2 to 202) Ω	1.6 μΩ/Ω + 49 μΩ	742A-100, 8588A
	202 Ω to 2.02 kΩ	1.1 μΩ/Ω + 0.47 mΩ	742A-1k, 8588A
	(2.02 to 20.2) kΩ	1.1 μΩ/Ω + 4.8 mΩ	742A-10k, 8588A
	(20.2 to 202) kΩ	1.6 μΩ/Ω + 36 mΩ	Ohm-Labs 105, 8588A
	202 kΩ to 2.02 MΩ	2.8 μΩ/Ω + 0.81 Ω	Ohm-Labs 106, 8588A
	(2.02 to 20.2) MΩ	6.5 μΩ/Ω + 9.1 Ω	742A-10M, 8588A
	(20.2 to 202) MΩ	15 μΩ/Ω + 720 Ω	9330-100M, 8588A
	1 GΩ	60 μΩ/Ω	9330-100M, 5720A, Keithley 487
	10 GΩ	140 μΩ/Ω	
	(1 to 10) MΩ	0.029 %	Guidline 9520
	(10 to 100) MΩ	0.040 %	
100 MΩ to 1 GΩ	0.057 %		
(1 to 10) GΩ	0.080 %		
(10 to 100) GΩ	0.11 %		
100 GΩ to 1 TΩ	0.23 %		
Resistance ³ – Measure	(0 to 12) Ω	17 μΩ/Ω + 57 μΩ	3458A
	(12 to 120) Ω	14 μΩ/Ω + 0.57 mΩ	
	120 Ω to 1.2 kΩ	11 μΩ/Ω + 0.57 mΩ	
	(1.2 to 12) kΩ	11 μΩ/Ω + 5.7 mΩ	
	(12 to 120) kΩ	11 μΩ/Ω + 57 mΩ	
	120 kΩ to 1.2 MΩ	17 μΩ/Ω + 2.3 Ω	
	(1.2 to 12) MΩ	57 μΩ/Ω + 110 Ω	
	(12 to 120) MΩ	570 μΩ/Ω + 1.1 kΩ	
	120 MΩ to 1.2 GΩ	0.57 % + 11 kΩ	

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments	
Resistance ³ – Generate Fixed Points	100 μΩ	0.57 %	50MV-500A	
	1 mΩ	25 μΩ/Ω	CS-100	
	10 mΩ	34 μΩ/Ω	Y5020	
	100 mΩ	10 μΩ/Ω	VFP4	
	1 Ω	0.33 μΩ/Ω	742A-1	
	10 Ω	0.37 μΩ/Ω	742A-10	
	25 Ω	0.93 μΩ/Ω	101-T	
	100 Ω	0.42 μΩ/Ω	742A-100	
	200 Ω	1.1 μΩ/Ω	VHA516-200	
	400 Ω	0.77 μΩ/Ω	VHA516-400	
	1 kΩ	0.51 μΩ/Ω	742A-1k	
	10 kΩ	0.39 μΩ/Ω	742A-10k	
	100 kΩ	1.3 μΩ/Ω	Ohm-Labs 105	
	1 MΩ	2.0 μΩ/Ω	Ohm-Labs 106	
	10 MΩ	3.0 μΩ/Ω	742A-10M	
	100 MΩ	14 μΩ/Ω	9330-100M	
	1 GΩ	150 μΩ/Ω	GT1 (1G)	
	10 GΩ	220 μΩ/Ω	GT1 (10G)	
	100 GΩ	0.16 %	GT1 (100G)	
	1 TΩ	0.23 %	GT1 (1T)	
		0 Ω	39 μΩ	5720A or 5730A
		1 Ω	74 μΩ/Ω	
		1.9 Ω	74 μΩ/Ω	
		10 Ω	19 μΩ/Ω	
		19 Ω	19 μΩ/Ω	
		100 Ω	8.5 μΩ/Ω	
		190 Ω	8.5 μΩ/Ω	
		1 kΩ	7.0 μΩ/Ω	
		1.9 kΩ	7.0 μΩ/Ω	
		10 kΩ	7.0 μΩ/Ω	
		19 kΩ	7.0 μΩ/Ω	
		100 kΩ	8.5 μΩ/Ω	
		190 kΩ	8.5 μΩ/Ω	
		1 MΩ	14 μΩ/Ω	
	1.9 MΩ	15 μΩ/Ω		
	10 MΩ	29 μΩ/Ω		
	19 MΩ	36 μΩ/Ω		
	100 MΩ	85 μΩ/Ω		

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Resistance ³ – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω 110 Ω to 1.099 999 kΩ (1.1 to 10.999 99) kΩ (11 to 109.9999) kΩ 110 kΩ to 1.099 999 MΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	30 μΩ/Ω + 0.76 mΩ 23 μΩ/Ω + 1.1 mΩ 21 μΩ/Ω + 1.1 mΩ 21 μΩ/Ω + 1.5 mΩ 21 μΩ/Ω + 15 mΩ 21 μΩ/Ω + 0.15 Ω 24 μΩ/Ω + 1.5 Ω 46 μΩ/Ω + 23 Ω 99 μΩ/Ω + 38 Ω 190 μΩ/Ω + 1.9 kΩ 380 μΩ/Ω + 2.3 kΩ 0.23 % + 76 kΩ 1.1 % + 380 kΩ	552X series calibrator

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage – Measure/Generate			
(0.6 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	1300 μV/V + 0.99 μV 560 μV/V + 0.99 μV 320 μV/V + 0.99 μV 620 μV/V + 1.5 μV 910 μV/V + 1.9 μV 1800 μV/V + 3.0 μV 2000 μV/V + 6.1 μV 3800 μV/V + 6.1 μV	5790B with 5720A or 5730A
(1.9 to 7) 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	650 μV/V + 0.99 μV 280 μV/V + 0.99 μV 160 μV/V + 0.99 μV 310 μV/V + 1.5 μV 460 μV/V + 1.9 μV 910 μV/V + 3.0 μV 1100 μV/V + 6.1 μV 2700 μV/V + 6.1 μV	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage – Measure/Generate (cont)			
(6 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	220 μV/V + 0.99 μV 140 μV/V + 0.99 μV 84 μV/V + 0.99 μV 160 μV/V + 1.5 μV 240 μV/V + 1.9 μV 620 μV/V + 3.0 μV 760 μV/V + 6.1 μV 2000 μV/V + 6.1 μV	5790B with 5720A or 5730A
(19 to 70) mV	(9.5 to 10) Hz (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	760 μV/V + 1.1 μV 180 μV/V + 1.1 μV 99 μV/V + 1.1 μV 53 μV/V + 1.1 μV 99 μV/V + 1.5 μV 200 μV/V + 1.9 μV 400 μV/V + 3.0 μV 520 μV/V + 6.1 μV 990 μV/V + 6.1 μV	
(60 to 220) mV	(9.5 to 10) Hz (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	760 μV/V + 1.1 μV 160 μV/V + 1.1 μV 66 μV/V + 1.1 μV 33 μV/V + 1.1 μV 56 μV/V + 1.5 μV 120 μV/V + 1.9 μV 210 μV/V + 3.0 μV 300 μV/V + 6.1 μV 910 μV/V + 6.1 μV	
(190 to 700) mV	(9.5 to 10) Hz (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	760 μV/V + 1.1 μV 160 μV/V + 1.1 μV 59 μV/V + 1.1 μV 29 μV/V + 1.1 μV 43 μV/V + 1.5 μV 64 μV/V + 1.9 μV 160 μV/V + 3.0 μV 260 μV/V + 6.1 μV 910 μV/V + 6.1 μV	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage – Measure/Generate (cont)			
(0.6 to 2.2) V	(9.5 to 10) Hz (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	760 µV/V 150 µV/V 53 µV/V 22 µV/V 40 µV/V 58 µV/V 150 µV/V 240 µV/V 910 µV/V	5790B with 5720A or 5730A
(1.9 to 7) V	(9.5 to 10) Hz (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	760 µV/V 150 µV/V 53 µV/V 22 µV/V 40 µV/V 67 µV/V 170 µV/V 360 µV/V 1100 µV/V	
(6 to 22) V	(9.5 to 10) Hz (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	760 µV/V 150 µV/V 53 µV/V 24 µV/V 40 µV/V 65 µV/V 170 µV/V 360 µV/V 1100 µV/V	
(19 to 70) V	(9.5 to 10) Hz (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	760 µV/V 150 µV/V 55 µV/V 30 µV/V 48 µV/V 84 µV/V 170 µV/V 390 µV/V 1100 µV/V	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage – Measure/Generate (cont)			
(60 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	150 µV/V 55 µV/V 29 µV/V 59 µV/V 84 µV/V 200 µV/V 530 µV/V	5790B with 5720A or 5730A
(190 to 700) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	150 µV/V 84 µV/V 36 µV/V 110 µV/V 650 µV/V	
(600 to 1050) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	150 µV/V 84 µV/V 33 µV/V 110 µV/V 650 µV/V	
AC Voltage ³ – Measure			
(1 to 12.12) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	290 µV/V + 1.1 µV 370 µV/V + 1.1 µV 380 µV/V + 1.1 µV 0.3 % + 1.1 µV 1 % + 4 µV 2 % + 4 µV	8588A
(1 to 121.2) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	88 µV/V + 0.5 µV 130 µV/V + 0.5 µV 230 µV/V + 1 µV 530 µV/V + 5 µV 0.21 % + 30 µV 1.1 % + 0.1 mV 1.6 % + 0.5 mV 4.1 % + 1 mV 8.4 % + 1 mV 16 % + 1 mV	

Parameter/Range	Frequency	CMC ^{2, 5} (\pm)	Comments
AC Voltage ³ – Measure (cont)			
(0.01 to 1.212) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	76 μ V/V + 5 μ V 130 μ V/V + 5 μ V 230 μ V/V + 10 μ V 530 μ V/V + 50 μ V 0.21 % + 0.3 mV 1 % + 1 mV 1.5 % + 5 mV 4 % + 10 mV 8.2 % + 10 mV 16 % + 10 mV	8588A
(0.1 to 12.12) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	76 μ V/V + 50 μ V 130 μ V/V + 50 μ V 230 μ V/V + 100 μ V 530 μ V/V + 500 μ V 0.21 % + 3 mV 1 % + 10 mV 1.5 % + 50 mV 4 % + 100 mV 8.2 % + 100 mV 16 % + 100 mV	
(1 to 121.2) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	90 μ V/V + 0.5 mV 110 μ V/V + 0.5 mV 230 μ V/V + 1 mV 590 μ V/V + 5 mV 0.37 % + 50 mV 1.1 % + 0.5 V	
(10 to 1050) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	110 μ V/V + 25 mV 110 μ V/V + 25 mV 230 μ V/V + 25 mV 590 μ V/V + 100 mV	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage ³ – Measure (cont)			
(1 to 12) 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	0.034 % + 3.4 μV 0.023 % + 1.2 μV 0.034 % + 1.2 μV 0.11 % + 1.2 μV 0.57 % + 1.2 μV 4.5 % + 2.3 μV	3458A
(10 to 120) 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	0.0079 % + 4.5 μV 0.0079 % + 2.3 μV 0.016 % + 2.3 μV 0.034 % + 2.3 μV 0.091 % + 2.3 μV 0.34 % + 11 μV 1.1 % + 11 μV 1.7 % + 11 μV	
(0.10 to 1.2) 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	0.0079 % + 45 μV 0.0079 % + 23 μV 0.016 % + 23 μV 0.034 % + 23 μV 0.091 % + 23 μV 0.34 % + 110 μV 1.1 % + 110 μV 1.7 % + 110 μV	
(1 to 12) 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	0.0079 % + 0.45 mV 0.0079 % + 0.23 mV 0.016 % + 0.23 mV 0.034 % + 0.23 mV 0.091 % + 0.23 mV 0.34 % + 1.1 mV 1.1 % + 1.1 mV 1.7 % + 1.1 mV	
(10 to 120) 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	0.023 % + 4.5 mV 0.023 % + 2.3 mV 0.023 % + 2.3 mV 0.04 % + 2.3 mV 0.14 % + 2.3 mV 0.45 % + 11 mV 1.7 % + 11 mV	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage ³ – Measure (cont)			
(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	0.045 % + 45 mV 0.045 % + 23 mV 0.068 % + 23 mV 0.14 % + 23 mV 0.34 % + 23 mV	3458A
(0 to 10) kV (10 to 100) kV	60 Hz 60 Hz	0.14 % + 0.11 V 0.57 % + 1.1 V	Vitretek 4700 w/ HLV-150 probe
AC Voltage ³ – Generate			
(0.2 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	210 μV/V + 3.9 μV 81 μV/V + 3.9 μV 70 μV/V + 3.9 μV 180 μV/V + 3.9 μV 420 μV/V + 4.7 μV 930 μV/V + 9.3 μV 1200 μV/V + 19 μV 2400 μV/V + 19 μV	5720A or 5730A w/ 5725A
(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	210 μV/V + 3.9 μV 81 μV/V + 3.9 μV 70 μV/V + 3.9 μV 180 μV/V + 3.9 μV 420 μV/V + 4.7 μV 930 μV/V + 9.3 μV 1200 μV/V + 19 μV 2400 μV/V + 19 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	210 μV/V + 12 μV 81 μV/V + 6.2 μV 70 μV/V + 6.2 μV 180 μV/V + 6.2 μV 420 μV/V + 16 μV 700 μV/V + 19 μV 1200 μV/V + 23 μV 2200 μV/V + 47 μV	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage ³ – Generate (cont)			
(0.22 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	210 μV/V + 39 μV 78 μV/V + 16 μV 36 μV/V + 7.8 μV 66 μV/V + 9.3 μV 97 μV/V + 31 μV 330 μV/V + 78 μV 850 μV/V + 190 μV 1400 μV/V + 470 μV	5720A or 5730A w/ 5725A
(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	210 μV/V + 390 μV 78 μV/V + 160 μV 36 μV/V + 54 μV 66 μV/V + 93 μV 89 μV/V + 190 μV 240 μV/V + 620 μV 850 μV/V + 1900 μV 1200 μV/V + 3100 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	210 μV/V + 3.9 mV 78 μV/V + 1.6 mV 47 μV/V + 0.54 mV 74 μV/V + 0.93 mV 130 μV/V + 2.3 mV 780 μV/V + 16 mV 4000 μV/V + 39 mV 7000 μV/V + 78 mV	
(220 to 1100) V	(15 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz (30 to 50) kHz (50 to 100) kHz	62 μV/V + 3.1 mV 62 μV/V + 3.1 mV 97 μV/V + 4.7 mV 280 μV/V + 8.5 mV 280 μV/V + 8.5 mV 1000 μV/V + 35 mV	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage – Generate (cont)			
(1 to 32.999) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	610 μV/V + 4.6 μV 110 μV/V + 4.6 μV 150 μV/V + 4.6 μV 760 μV/V + 4.6 μV 2700 μV/V + 9.1 μV 6100 μV/V + 38 μV	552X series calibrator
(33 to 329.999) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	230 μV/V + 6.1 μV 110 μV/V + 6.1 μV 120 μV/V + 6.1 μV 270 μV/V + 6.1 μV 610 μV/V + 24 μV 1500 μV/V + 53 μV	
(0.33 to 3.299 99) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	230 μV/V + 38 μV 110 μV/V + 46 μV 140 μV/V + 46 μV 230 μV/V + 38 μV 530 μV/V + 95 μV 1800 μV/V + 460 μV	
(3.3 to 32.9999) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	230 μV/V + 490 μV 110 μV/V + 460 μV 180 μV/V + 460 μV 270 μV/V + 460 μV 680 μV/V + 1200 μV	
(33 to 329.999) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	140 μV/V + 1500 μV 150 μV/V + 4600 μV 190 μV/V + 4600 μV 230 μV/V + 4600 μV 1500 μV/V + 38 000 μV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	230 μV/V + 7600 μV 190 μV/V + 7600 μV 230 μV/V + 7600 μV	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Voltage ³ – Generate (cont) Wideband AC Voltage Flatness:			
1.1 mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.23 % 0.078 % 0.16 % + 2.3 μV 0.31 % + 2.3 μV 0.47 % + 2.3 μV 1.2 % + 12 μV	5720A wideband
3 mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.23 % 0.078 % 0.078 % + 2.3 μV 0.23 % + 2.3 μV 0.39 % + 2.3 μV 1.2 % + 2.3 μV	
11 mV to 3.5 V	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.23 % 0.078 % 0.078 % + 2.3 μV 0.16 % + 2.3 μV 0.31 % + 2.3 μV 0.78 % + 2.3 μV	
AC Voltage Flatness Relative to 1 kHz – Measure/Generate			
(0.6 to 2.2) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.11 % 0.057 % 0.080 % + 1.1 μV 0.19 % + 1.1 μV 0.34 % + 1.1 μV 0.80 % + 2.3 μV 1.1 % + 2.3 μV	5790B & 5720A wideband

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Voltage Flatness Relative to 1 kHz – Measure/Generate (cont)			
(1.9 to 7) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.11 % 0.057 % 0.080 % + 1.1 μV 0.11 % + 1.1 μV 0.19 % + 1.1 μV 0.42 % + 1.1 μV 0.57 % + 1.1 μV	5790B & 5720A wideband
(6 to 22) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.11 % 0.057 % 0.080 % 0.11 % 0.19 % 0.42 % 0.68 %	
(19 to 70) mV	(10 to 30) Hz 30 Hz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.11 % 0.057 % 0.11 % 0.17 % 0.40 % 0.68 %	
(60 to 220) mV	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.11 % 0.046 % 0.057 % 0.11 % 0.17 % 0.40 % 0.68 %	
190 mV to 7 V	(10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.11 % 0.034 % 0.057 % 0.11 % 0.17 % 0.40 % 0.68 %	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (\pm)	Comments
AC Voltage Flatness Relative to 50 kHz – Measure/Generate 5 mV _{p-p} to 5.5 V _{p-p}	9 kHz to 1.2 GHz (> 1.2 to 18) GHz	0.62 % 1.7 %	E9304A or E9304A- H18 w/ signal generator
AC Current – Measure/Generate (10 to 70) μ A 70 μ A to < 0.33 A (0.33 to 20) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 30) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 30) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 10 kHz	320 μ A/A 250 μ A/A 190 μ A/A 210 μ A/A 190 μ A/A 120 μ A/A 100 μ A/A 110 μ A/A 190 μ A/A 120 μ A/A 110 μ A/A	5790A + AC shunts & 5720A or 5730A w/ 5725A or 552X series calibrator
AC Current ³ – Measure (0.1 to 20) A (0.202 to 20.2) μ A (20.2 to 202) μ A (0.202 to 2.02) mA (2.02 to 20.2) mA	(40 to 310) Hz 310 Hz to 1 kHz (1 to 3) kHz (3 to 5) kHz 1 Hz to 2 kHz (2 to 10) kHz 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz 1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	240 μ A/A + 42 μ A 330 μ A/A + 40 μ A 600 μ A/A + 35 μ A 870 μ A/A + 26 μ A 0.21 % + 2.5 nA 0.21 % + 2.5 nA 280 μ A/A + 5 nA 530 μ A/A + 5 nA 740 μ A/A + 5 nA 280 μ A/A + 50 nA 530 μ A/A + 50 nA 740 μ A/A + 50 nA 280 μ A/A + 0.5 μ A 530 μ A/A + 0.5 μ A 740 μ A/A + 0.5 μ A	Y5020, 8588A 8588A

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Current ³ – Measure (cont)			
(20.2 to 202) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	280 µA/A + 5 µA 520 µA/A + 5 µA 740 µA/A + 5 µA	8588A
(0.202 to 2.02) A	1 Hz to 2 kHz (2 to 10) kHz	300 µA/A + 0.1 mA 550 µA/A + 0.1 mA	
(2.02 to 20.2) A	10 Hz to 2 kHz (2 to 10) kHz	840 µA/A + 0.5 mA 840 µA/A + 0.5 mA	
(20.2 to 30.2) A	10 Hz to 2 kHz (2 to 10) kHz	840 µA/A + 12 mA 0.13 % + 12 mA	
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.45 % + 0.034 µA 0.17 % + 0.034 µA 0.068 % + 0.034 µA	3458A
(0.05 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.45 % + 0.23 µA 0.17 % + 0.23 µA 0.068 % + 0.23 µA 0.034 % + 0.23 µA	
(0.5 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.45 % + 2.3 µA 0.17 % + 2.3 µA 0.068 % + 2.3 µA 0.034 % + 2.3 µA	
(5 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.45 % + 23 µA 0.17 % + 23 µA 0.068 % + 23 µA 0.034 % + 23 µA	
(0.05 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.45 % + 230 µA 0.18 % + 230 µA 0.091 % + 230 µA 0.11 % + 230 µA	
(1 to 100) A	60 Hz	110 µA/A + 0.5 mA	CS-100, 8588A

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Current ³ – Generate			
220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	220 µA/A + 16 nA 140 µA/A + 9.3 nA 100 µA/A + 7.8 nA 250 µA/A + 12 nA 850 µA/A + 62 nA	5720A or 5730A w/ 5725A
2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	220 µA/A + 39 nA 140 µA/A + 31 nA 100 µA/A + 31 nA 170 µA/A + 100 nA 850 µA/A + 620 nA	
22 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	220 µA/A + 390 nA 140 µA/A + 310 nA 100 µA/A + 310 nA 170 µA/A + 540 nA 850 µA/A + 4700 nA	
220 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	220 µA/A + 3.9 µA 140 µA/A + 3.1 µA 100 µA/A + 2.3 µA 170 µA/A + 3.1 µA 850 µA/A + 9.3 µA	
2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	230 µA/A + 31 µA 360 µA/A + 78 µA 5400 µA/A + 160 µA	
11 A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	310 µA/A + 130 µA 660 µA/A + 290 µA 2600 µA/A + 580 µA	
(29 to 329.99) µA	(10 to 20) Hz (20 to 45) Hz 45 to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.15 % + 0.076 µA 0.11 % + 0.076 µA 0.095 % + 0.076 µA 0.23 % + 0.11 µA 0.61 % + 0.15 µA 1.2 % + 0.3 µA	552X series calibrator

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Current ³ – Generate (cont)			
(0.33 to 3.2999) mA	(10 to 20) Hz (20 to 45) Hz 45 to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.15 % + 0.11 µA 0.095 % + 0.11 µA 0.076 % + 0.11 µA 0.15 % + 0.15 µA 0.38 % + 0.23 µA 0.76 % + 0.46 µA	552X series calibrator
(3.3 to 32.999) mA	(10 to 20) Hz (20 to 45) Hz 45 to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 1.5 µA 0.068 % + 1.5 µA 0.03 % + 1.5 µA 0.061 % + 1.5 µA 0.15 % + 2.3 µA 0.3 % + 3 µA	
(33 to 329.99) mA	(10 to 20) Hz (20 to 45) Hz 45 to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 15 µA 0.068 % + 15 µA 0.03 % + 15 µA 0.076 % + 38 µA 0.15 % + 76 µA 0.3 % + 150 µA	
(0.33 to 1.099 99) A	(10 to 45) Hz 45 to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 76 µA 0.038 % + 76 µA 0.46 % + 760 µA 1.9 % + 3800 µA	
(1.1 to 2.999 99) A	(10 to 45) Hz 45 to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 76 µA 0.046 % + 76 µA 0.46 % + 760 µA 1.9 % + 3800 µA	
(3 to 10.9999) A	(45 to 100) Hz 100 to 1 kHz (1 to 5) kHz	0.046 % + 1500 µA 0.076 % + 1500 µA 2.3 % + 1500 µA	
(11 to 20.5) A	(45 to 100) Hz 100 to 1 kHz (1 to 5) kHz	0.091 % + 3800 µA 0.11 % + 3800 µA 2.3 % + 3800 µA	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Current ³ – Generate (cont) Clamp-On Meters: Toroidal Type: (20 to 54.999) A (55 to 149.999) A (150 to 1025) A (20 to 54.999) A (55 to 149.999) A (150 to 400) A Non-Toroidal Type: (20 to 149.999) A (150 to 549.999) A (550 to 1025) A (20 to 149.999) A (150 to 400) A	 (45 to 65) Hz (65 to 440) Hz (45 to 65) Hz (65 to 440) Hz	 0.31 % + 0.054 A 0.34 % + 0.042 A 0.34 % + 0.13 A 0.93 % + 0.054 A 0.94 % + 0.046 A 1.2 % + 0.22 A 0.65 % + 0.30 A 0.66 % + 1.1 A 0.65 % + 1.1 A 1.2 % + 0.30 A 1.4 % + 1.1 A	 552X series w/ 5500A/coil
Capacitance – Measure ¹² 1 pF 10 pF 100 pF 400 pF to 25 μF 100 μF 1000 μF	12 Hz to 100 kHz	4.6 % 0.47 % 0.057 % 0.024 % 0.057 % 0.47 %	Genrad 1689 CMC is stated at 1kHz ¹³

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Capacitance – Measure/Generate	0 F (0 to 2.02) nF (1.8 to 20.2) nF (18 to 202) nF (0.18 to 2.02) μF (1.8 to 20.2) μF	0.23 pF 0.19 % + 1 pF 810 μF/F + 2 pF 490 μF/F + 10 pF 420 μF/F + 0.1 nF 420 μF/F + 1 nF	Open input 8588A w/ 552X series calibrator

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Capacitance – Measure/Generate (cont)	(18 to 202) μF (0.18 to 2.02) mF (1.8 to 20.2) mF (18 to 202) mF	620 μF/F + 10 nF 620 μF/F + 0.1 μF 720 μF/F + 1 μF 720 μF/F + 10 μF	8588A w/ 552X series calibrator
Capacitance – Measure DC Charge Method	200 μF to 110 mF	0.020 %	3458A w/ 5720A or 5730A

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
Capacitance ³ – Generate (0.22 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.999) nF (11 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	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 (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	0.38 % + 7.6 pF 0.38 % + 7.6 pF 0.19 % + 7.6 pF 0.19 % + 76 pF 0.19 % + 230 pF 0.19 % + 0.76 nF 0.19 % + 2.3 nF 0.19 % + 7.6 nF 0.3 % + 23 nF 0.34 % + 76 nF 0.34 % + 230 nF 0.34 % + 0.76 μF 0.34 % + 2.3 μF 0.34 % + 7.6 μF 0.57 % + 23 μF 0.84 % + 76 μF	552X series calibrator
Inductance – Measure ¹³ 100 μH 1 mH to 10 H	100 Hz to 10 kHz	0.13 % 0.024 %	Genrad 1689 CMC is stated at 1kHz ¹³

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Resistance - Measure ¹³			
0.1 Ω	12 Hz to 100 kHz	0.72 %	Genrad 1689 CMC is stated at 1kHz ¹
1 Ω		0.083 %	
6.25 Ω to 410 kΩ		0.024 %	
1 MΩ		0.040 %	
10 MΩ		0.29 %	
100 MΩ		2.8 %	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Simulation of Thermocouples & Thermocouple Indicating Devices ³ –			
Type B	(600 to 800) °C	0.33 °C	552X series calibrator
	(800 to 1000) °C	0.26 °C	
	(1000 to 1550) °C	0.23 °C	
	(1550 to 1820) °C	0.25 °C	
Type E	(-250 to -100) °C	0.38 °C	
	(-100 to -25) °C	0.12 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1000) °C	0.16 °C	
Type J	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.12 °C	
	(-30 to 150) °C	0.11 °C	
	(150 to 760) °C	0.13 °C	
	(760 to 1200) °C	0.18 °C	
Type K	(-200 to -100) °C	0.25 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 120) °C	0.12 °C	
	(120 to 1000) °C	0.2 °C	
	(1000 to 1372) °C	0.3 °C	
Type N	(-200 to -100) °C	0.3 °C	
	(-100 to -25) °C	0.17 °C	
	(-25 to 120) °C	0.14 °C	
	(120 to 410) °C	0.14 °C	
	(410 to 1300) °C	0.21 °C	

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Electrical Simulation of Thermocouples & Thermocouple Indicating Devices ³ – (cont)			
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.43 °C 0.27 °C 0.25 °C 0.30 °C	552X series calibrator
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.36 °C 0.27 °C 0.28 °C 0.35 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.48 °C 0.18 °C 0.12 °C 0.11 °C	
Electrical Simulation of RTD Indicators & Indicating Systems ³ –			
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	0.038 °C 0.038 °C 0.053 °C 0.068 °C 0.076 °C 0.091 °C 0.18 °C	552X series calibrator
Oscilloscopes ³ –			
Amplitude – DC Signal 50 Ω Load	(0 to 6.6) V	0.19 % + 30 μV	552X/SC1100
1 MΩ Load	(0 to 130) V	0.038 % + 30 μV	
Amplitude – Square Wave 50 Ω Load	1 mV to 6.6 V _{p-p} 10 Hz to 10 kHz	0.19 % + 30 μV	
1 MΩ Load	1 mV to 130 V _{p-p} 10 Hz to 10 kHz	0.076 % + 30 μV	

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Oscilloscopes ³ – (cont)			
Bandwidth Flatness	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.1 % + 76 μV 1.5 % + 76 μV 3.0 % + 76 μV 3.8 % + 76 μV	552X/SC1100
Time Marker	5 s to 50 ms 20 ms to 1 ns	19 μs/s + 760 μs/s * t 1.9 μs/s	t = time in seconds
Resistance – Measure	(40 to 60) Ω (0.5 to 1.5) MΩ	0.076 % 0.076 %	
Phase Angle – Measure (0 to 360)°	5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz (50 to 100) kHz (100 to 200) kHz	0.023° 0.034° 0.046° 0.057° 0.11° 0.23°	Clarke-Hess 6000A phase meter
Phase Angle – Generate (0 to 360)°	1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz	0.0057° 0.011° 0.017° 0.046°	Clarke-Hess 5600 phase standard
Rise Time – Measure	25 mV _{p-p} to 2.5 V _{p-p}	10 ps	Tektronix TDS820

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 8} (±)	Comments
RF Power – Generate (+23.9 to -56) dBm	100 kHz to 10 MHz (>10 to 60) MHz (>60 to 80) MHz	0.23 dB 0.43 dB 0.57 dB	Keysight 33611A

Parameter/Range	Frequency	CMC ^{2, 8} (±)	Comments
RF Power – Measure			
Flatness: (-35 to +20) dBm	1 kHz to 100 MHz	0.020 dB	NRP18T + 10dB attenuator
(-60 to +20) dBm	9 kHz to 1.2 GHz	0.054 dB	E9304A / E9304A-H18
	(> 1.2 to 6) GHz	0.15 dB	
	(6 to 18) GHz	0.15 dB	E9304A-H18
Absolute: (-35 to +20) dBm	DC to 100 MHz	0.048 dB	
	100 MHz to 2.4 GHz	0.059 dB	NRP18T
	(2.4 to 8) GHz	0.068 dB	
	(8 to 12.4) GHz	0.080 dB	
	(12.4 to 18) GHz	0.11 dB	

V. Mechanical

Parameter/Equipment	Range	CMC ^{2, 4, 6} (±)	Comments
Mass	0.0009 to 0.05 kg (> 0.05 to 0.2) kg (> 0.2 to 2) kg (> 2 to 30) kg	(0.09 + 1.1M) mg (0.77 + 0.3M) mg (0.77 + 0.72M) mg (12 + 0.4M) mg	ASTM class 1 & 2 weights, mass comparators
Scales & Balances ^{3, 9}	5 mg to 0.0005 kg (> 0.0005 to 10) kg (> 10 to 30) kg	0.014 mg (0.034 + 6.9M) mg (29 + 4M) mg	ASTM Class 1 & 2 weights
	20 mg to 0.1 kg (> 0.1 to 2) kg (> 2 to 29) kg (> 29 to 230) kg	(1 + 150M - 410M ²) mg (16 + 47M - 4.0M ²) mg (27 + 26M - 0.42M ²) mg (2000 + 45M - 0.07M ²) mg	ASTM Class 4, 5 & 6 weights
Dynamometer	(0.5 to 2000) g	(0.11 + 0.0044M) g	ASTM Class 5 weights

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
Hydraulic & Pneumatic Gage Pressure ^{3, 9, 10}	(0 to 40) in H ₂ O (0 to 20) psig (20 to 10 000) psig	0.04 in H ₂ O 0.02 psi 0.10 %	477B-2 Crystal gauge
Hydraulic Gage Pressure ^{9, 10}	(60 to 200) psig (200 to 1500) psig (1500 to 15 000) psig	0.016 psi 0.008 psi + 0.0032 % 0.0028 %	Ruska 2485 DWT
Torque Tools ^{3, 9, 10}	(> 0.875 to 10) lbf·in (> 10 to 100) lbf·in (> 25 to 250) lbf·in (> 5 to 50) lbf·ft (> 25 to 250) lbf·ft (> 100 to 1000) lbf·ft	(5 – 5.3T) % 0.6 % 0.65 % 0.6 % 0.53 % (0.56 – (0.03·10 ⁻³)T) %	HIOS HP-10 50617.LOG 50619.LOG 50836.LOG 50702.LOG 50773.LOG
Pneumatic Absolute/Gage Pressure ^{9, 10}	(1.5 to 15) psia (-50 to 50) in·H ₂ O (0 to 7.5) psig (> 7.5 to 15) psig (-13.2 to 30) psig (> 30 to 100) psig (0 to 300) psig (> 300 to 1000) psig (0 to 900) psig (> 900 to 3000) psig (0 to 3000) psig (> 3000 to 10 000) psig	0.0012 psi 0.005 in·H ₂ O + 0.01 % 0.000 75 psi 0.01 % 0.003 psi 0.01 % 0.03 psi 0.01 % 0.09 psi 0.01 % 0.3 psi 0.01 %	Paroscientific model 745 PM500 BG14K PM500 G100K PM600 A700K PM600 A7M PM600 A20M PM600 A70M
Torque Testers ¹⁰	(0.000 33 to 7.5) lbf·ft	(0.24 – 0.024T) %	Torque Arm, ASTM Class 5 & 6 weights
Force Gauges ^{9, 10}	(0.002 to 400) lbf	0.024 %	ASTM Class 5 & 6 Weights

Parameter/Equipment	Range	CMC ^{2,4,6} (±)	Comments
Load Cells / Force Gauges ¹⁰			
Compression	Up to 1000 lbf (> 1000 to 60 000) lbf	0.43 lbf + 0.026 % 0.75 lbf + 0.053 %	Load cells
Tension	Up to 25 000 lbf (> 25 000 to 60 000) lbf	0.43 lbf + 0.055 % 9.5 lbf + 0.05 %	Load cells
Aircraft Scales ⁹	(500 to 5000) lbf (> 5000 to 25 000) lbf (> 25 000 to 60 000) lbf	2.9 lbf + 0.029 % 1.8 lbf + 0.052 % 10 lbf + 0.052 %	Load cells
Tensiometers ^{9,10}	Up to 50 lbf (> 50 to 900) lbf	1.1 lbf 0.76 lbf + 0.7 %	Class 6 weights, tensiometer calibrator

VI. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Thermocouple Probes (E, J, K, T)	23°C (room temperature)	0.011 °C	5615, 3458A, 8588A, lag bath
Thermocouple Thermometers (E, J, K, T)	23°C (room temperature)	0.032 °C	5615, 3458A, lag bath
Thermometers	(-50 to 20) °C (20 to 300) °C	0.19 °C $0.03 + (0.56 \cdot 10^{-4})T$ °C	Fluke 1502A - RTD
IR Thermometers	(35 to 500) °C	0.25 °C + 0.21 %	Fluke 4181

VII. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Frequency – Measure	0.1 Hz to 3 GHz	470 pHz/Hz	53131A w/ 910R & signal generator
	(1 to 40) Hz 40 Hz to 10 MHz	0.057 % 0.011 %	3458A
Frequency ³ – Measuring Equipment	0.01 Hz to 2 MHz 50 kHz to 1100 MHz	2 µHz/Hz + 3.9 µHz 2 µHz/Hz	Fluke 552X Fluke 552X/SC1100
	1 Hz to 80 MHz	1.2 µHz/Hz	Keysight 33611A
Frequency – Fixed Point	10 MHz	3.9 pHz/Hz	Fluke 910R
Stopwatches & Timers	(1 to 86 400) s	1.8 ms	33611A, 53131A & 910R

¹ This laboratory offers commercial calibration service and field calibration service where noted.

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 of 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. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the Calibration and Measurement Capability Uncertainty (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 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 In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches for imperial units, or in millimeters for metric units. M is the numerical value of the nominal weight measured in kg (Mass, Scales). T is the numerical value of the nominal torque measured in lbf·ft.

⁵ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC’s are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.

⁶ In the statement of CMC, percentages are to be read as percent of reading, unless otherwise noted.

⁷ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁸ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

⁹ The contributions attributed to the repeatability of the "best existing device" are not included in the CMC claim.

¹⁰ The contributions attributed to the resolution of the "best existing device" are not included in the CMC claim.

¹¹ This laboratory meets R205 – Specific Requirements: Calibration Laboratory Accreditation Program for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

¹² Uncertainty components that can be reasonably attributed to the Unit Under Test have not been utilized in the calculation of the CMC value for this measurement parameter.

¹³ Measurement uncertainty at intermediate values is calculated using the Manufacturers Limits of Error Calculator



Accredited Laboratory

A2LA has accredited

PYLON ELECTRONICS INC.

Ottawa, Ontario, CANADA

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 21st day of September 2022.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3630.01
Valid to September 30, 2024

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