



# PERRY JOHNSON LABORATORY ACCREDITATION, INC.

## Certificate of Accreditation

*Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:*

### **Precision Measurements**

**20 Hagerty Boulevard, Suite #1, West Chester, PA 19382**

*(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:*

### **ISO/IEC 17025:2017**

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

***Calibration of Chemical, Dimensional, Electrical, Pressure, Mechanical, Temperature, Thermodynamic Measuring and Test Equipment, Weights and Scales***  
*(As detailed in the supplement)*

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen  
President

Perry Johnson Laboratory  
Accreditation, Inc. (PJLA)  
755 W. Big Beaver, Suite 1325  
Troy, Michigan 48084

*Initial Accreditation Date:*

June 6, 2008

*Revision Date:*

December 15, 2021

*Issue Date:*

January 30, 2021

*Accreditation No.:*

62582

*Expiration Date:*

February 28, 2023

*Certificate No.:*

L21-77-R1

*The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: [www.pjilabs.com](http://www.pjilabs.com)*



# Certificate of Accreditation: Supplement

## Precision Measurements

20 Hagerty Boulevard, Suite #1, West Chester, PA 19382  
 Contact Name: Jackie Perry Phone: 610-436-9703

*Accreditation is granted to the facility to perform the following calibrations:*

### Chemical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Equipment to measure Conductivity <sup>FO</sup>	100 $\mu$ S/cm	2.9 $\mu$ S/cm	Conductivity Solutions QAI-A02
	1 413 $\mu$ S/cm	10.5 $\mu$ S/cm	
	5 000 $\mu$ S/cm	35.9 $\mu$ S/cm	
	10 000 $\mu$ S/cm	56.4 $\mu$ S/cm	
	100 000 $\mu$ S/cm	726 $\mu$ S/cm	

### Dimensional

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED	
Outside Micrometers <sup>FO</sup>	0.05 in to 4 in	(60 + 0.052L) $\mu$ in	Gage Blocks QAI-MXX procedures	
	4 in to 40 in	(730 + 0.018L) $\mu$ in		
Height Gages <sup>FO</sup>	0.05 in to 4 in	(86 + 0.052L) $\mu$ in		
	4 in to 40 in	(360 + 0.18L) $\mu$ in		
Depth Gages <sup>FO</sup>	0.05 in to 4 in	(180 + 0.052L) $\mu$ in		
Calipers <sup>FO</sup>	0.05 in to 4 in	(310 + 0.052L) $\mu$ in		
	4 in to 40 in	(730 + 0.018L) $\mu$ in		
Dial Indicators <sup>FO</sup>	0.000 5 in to 4 in	(36 + 0.052L) $\mu$ in		
Length – Inside Diameter <sup>F</sup>	0.65 in to 1.2 in	(8.2 + 0.007 6L) $\mu$ in		Ring Gages P&W Labmaster OEM manual
Length – Outside Diameter <sup>F</sup>	0.05 in to 4 in	(3.7 + 0.000 13L) $\mu$ in		Gage Blocks P&W Labmaster OEM manual
	4 in to 8 in	(13 + 0.000 13L) $\mu$ in		



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Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type E <sup>FO</sup>	-250 °C to -100 °C	0.56 °C	Fluke 5520A Electrical Simulation of Thermocouple Output GIDEP procedures OEM procedures
	-100 °C to -25 °C	0.19 °C	
	-25 °C to 350 °C	0.17 °C	
	350 °C to 650 °C	0.19 °C	
	650 °C to 1 000 °C	0.24 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type J <sup>FO</sup>	-210 °C to -100 °C	0.31 °C	
	-100 °C to -30 °C	0.19 °C	
	-30 °C to 150 °C	0.17 °C	
	150 °C to 760 °C	0.20 °C	
	760 °C to 1 200 °C	0.26 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type K <sup>FO</sup>	-200 °C to -100 °C	0.37 °C	
	-100 °C to -25 °C	0.21 °C	
	-25 °C to 120 °C	0.19 °C	
	120 °C to 1 000 °C	0.29 °C	
	1 000 °C to 1 372 °C	0.45 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type N <sup>FO</sup>	-200 °C to -100 °C	0.45 °C	
	-100 °C to -25 °C	0.25 °C	
	-25 °C to 120 °C	0.22 °C	
	120 °C to 410 °C	0.21 °C	
	410 °C to 1 300 °C	0.31 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type R <sup>FO</sup>	0 °C to 250 °C	0.63 °C	
	250 °C to 400 °C	0.39 °C	
	400 °C to 1 000 °C	0.37 °C	
	1 000 °C to 1 767 °C	0.45 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type S <sup>FO</sup>	0 °C to 250 °C	0.52 °C	
	250 °C to 1 000 °C	0.40 °C	
	1 000 °C to 1 400 °C	0.41 °C	
	1 400 °C to 1 767 °C	0.51 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type T <sup>FO</sup>	-250 °C to -150 °C	0.7 °C	
	-150 °C to 0 °C	0.27 °C	
	0 °C to 120 °C	0.19 °C	
	120 °C to 400 °C	0.17 °C	



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Temperature Calibration, Indication and Control Equipment used with RTD Pt 385, 100 $\Omega$ <sup>FO</sup>	-200 °C to -80 °C	0.05 °C	Fluke 5520A Electrical Simulation of RTD Output GIDEP procedures OEM procedures
	-80 °C to 0 °C	0.05 °C	
	0 °C to 100 °C	0.04 °C	
	100 °C to 300 °C	0.08 °C	
	300 °C to 400 °C	0.09 °C	
	400 °C to 630 °C	0.11 °C	
	630 °C to 800 °C	0.19 °C	
Temperature Calibration, Indication and Control Equipment used with RTD Pt 385, 200 $\Omega$ <sup>FO</sup>	-200 °C to -80 °C	0.04 °C	
	-80 °C to 0 °C	0.04 °C	
	0 °C to 100 °C	0.04 °C	
	100 °C to 260 °C	0.05 °C	
	260 °C to 300 °C	0.1 °C	
	300 °C to 400 °C	0.1 °C	
	400 °C to 600 °C	0.12 °C	
Temperature Calibration, Indication and Control Equipment used with RTD Pt 385, 500 $\Omega$ <sup>FO</sup>	-200 °C to -80 °C	0.04 °C	
	-80 °C to 0 °C	0.05 °C	
	0 °C to 100 °C	0.05 °C	
	100 °C to 260 °C	0.06 °C	
	260 °C to 300 °C	0.07 °C	
	300 °C to 400 °C	0.07 °C	
	400 °C to 600 °C	0.08 °C	
Temperature Calibration, Indication and Control Equipment used with RTD Pt 385, 1 k $\Omega$ <sup>FO</sup>	-200 °C to -80 °C	0.03 °C	
	-80 °C to 0 °C	0.03 °C	
	0 °C to 100 °C	0.04 °C	
	100 °C to 260 °C	0.05 °C	
	260 °C to 300 °C	0.06 °C	
	300 °C to 400 °C	0.06 °C	
	400 °C to 600 °C	0.07 °C	
600 °C to 630 °C	0.19 °C		



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Temperature Calibration, Indication and Control Equipment used with RTD Pt 3916, 100 $^{\circ}$ F <sup>o</sup>	-200 $^{\circ}$ C to -190 $^{\circ}$ C	0.2 $^{\circ}$ C	Fluke 5520A Electrical Simulation of RTD Output GIDEP procedures OEM procedures
	-190 $^{\circ}$ C to -80 $^{\circ}$ C	0.05 $^{\circ}$ C	
	-80 $^{\circ}$ C to 0 $^{\circ}$ C	0.05 $^{\circ}$ C	
	0 $^{\circ}$ C to 100 $^{\circ}$ C	0.07 $^{\circ}$ C	
	100 $^{\circ}$ C to 260 $^{\circ}$ C	0.07 $^{\circ}$ C	
	260 $^{\circ}$ C to 300 $^{\circ}$ C	0.08 $^{\circ}$ C	
	300 $^{\circ}$ C to 400 $^{\circ}$ C	0.09 $^{\circ}$ C	
	400 $^{\circ}$ C to 600 $^{\circ}$ C	0.1 $^{\circ}$ C	
Temperature Calibration, Indication and Control Equipment used with RTD Pt 3926, 100 $\Omega$ $^{\circ}$ F <sup>o</sup>	-200 $^{\circ}$ C to -80 $^{\circ}$ C	0.06 $^{\circ}$ C	
	-80 $^{\circ}$ C to 0 $^{\circ}$ C	0.06 $^{\circ}$ C	
	0 $^{\circ}$ C to 100 $^{\circ}$ C	0.07 $^{\circ}$ C	
	100 $^{\circ}$ C to 300 $^{\circ}$ C	0.09 $^{\circ}$ C	
	300 $^{\circ}$ C to 400 $^{\circ}$ C	0.09 $^{\circ}$ C	
Temperature calibration, Indication and Control Equipment used with RTD Ni 385, 120 $\Omega$ $^{\circ}$ F <sup>o</sup>	-80 $^{\circ}$ C to 0 $^{\circ}$ C	0.07 $^{\circ}$ C	
	0 $^{\circ}$ C to 100 $^{\circ}$ C	0.07 $^{\circ}$ C	
	100 $^{\circ}$ C to 260 $^{\circ}$ C	0.12 $^{\circ}$ C	
Temperature calibration, Indication and Control Equipment used with RTD Cu 427, 10 $\Omega$ $^{\circ}$ F <sup>o</sup>	-100 $^{\circ}$ C to 260 $^{\circ}$ C	0.4 $^{\circ}$ C	
Equipment to Measure DC Voltage $^{\circ}$ F <sup>o</sup>	0 mV to 330 mV	20 $\mu$ V/V + 1.8 $\mu$ V	Fluke 5520A QAI-EXX procedures OEM procedures
	330 mV to 3.3 V	11 $\mu$ V/V + 11 $\mu$ V	
	3.3 V to 33 V	11 $\mu$ V/V + 23 $\mu$ V	
	33 V to 330 V	18 $\mu$ V/V + 1.1 mV	
	330 V to 1 000 V	18 $\mu$ V/V + 4 mV	
Equipment to Output DC Voltage $^{\circ}$ F <sup>o</sup>	0 mV to 200 mV	6.3 $\mu$ V/V + 0.5 $\mu$ V	Fluke 8508A QAI-EXX procedures OEM procedures
	200 mV to 2 V	3.7 $\mu$ V/V + 0.3 $\mu$ V	
	2 V to 20 V	3.7 $\mu$ V/V + 1 $\mu$ V	
	20 V to 200 V	5.8 $\mu$ V/V + 10 $\mu$ V	
	200 V to 1 000 V	5.9 $\mu$ V/V + 0.1 mV	
	1 kV to 10 kV	0.4 mV/V + 40 mV	Vitrek 4700 QAI-EXX procedures OEM procedures
	10 kV to 40 kV	27 mV/V + 0.1 V	



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Equipment to Measure DC Current <sup>FO</sup>	0 $\mu$ A to 330 $\mu$ A	120 $\mu$ A/A + 16 nA	Fluke 5520A QAI-EXX procedures OEM procedures
	330 $\mu$ A to 3.3 mA	78 $\mu$ A/A + 60 nA	
	3.3 mA to 33 mA	78 $\mu$ A/A + 0.5 $\mu$ A	
	33 mA to 330 mA	78 $\mu$ A/A + 10 $\mu$ A	
	330 mA to 1.1 A	160 $\mu$ A/A + 40 $\mu$ A	
	1.1 A to 3 A	300 $\mu$ A/A + 0.23 mA	
	3 A to 11 A	390 $\mu$ A/A + 0.9 mA	
	11 A to 20.5 A	780 $\mu$ A/A + 2.5 mA	
Equipment to Output DC Current <sup>FO</sup>	0 nA to 100 nA	43 $\mu$ A/A + 48 pA	HP 3458A QAI-EXX procedures OEM procedures
	100 nA to 1 $\mu$ A	32 $\mu$ A/A + 48 pA	
	1 $\mu$ A to 10 $\mu$ A	30 $\mu$ A/A + 0.12 nA	
	10 $\mu$ A to 100 $\mu$ A	30 $\mu$ A/A + 0.96 nA	
	100 $\mu$ A to 2 mA	14 $\mu$ A/A + 4.1 nA	Fluke 8508A QAI-EXX procedures OEM procedures
	2 mA to 20 mA	15 $\mu$ A/A + 41 nA	
	20 mA to 200 mA	52 $\mu$ A/A + 0.81 $\mu$ A	
	200 mA to 2 A	190 $\mu$ A/A + 17 $\mu$ A	
	2 A to 20 A	410 $\mu$ A/A + 0.4 mA	
Equipment to Measure Resistance <sup>FO</sup>	0 $\Omega$ to 11 $\Omega$	32 $\mu\Omega/\Omega$ + 0.8 m $\Omega$	Fluke 5520A QAI-EXX procedures OEM procedures
	11 $\Omega$ to 33 $\Omega$	24 $\mu\Omega/\Omega$ + 1.3 m $\Omega$	
	33 $\Omega$ to 110 $\Omega$	22 $\mu\Omega/\Omega$ + 1.3 m $\Omega$	
	110 $\Omega$ to 330 $\Omega$	22 $\mu\Omega/\Omega$ + 2.9 m $\Omega$	
	330 $\Omega$ to 1.1 k $\Omega$	22 $\mu\Omega/\Omega$ + 7 m $\Omega$	
	1.1 k $\Omega$ to 3.3 k $\Omega$	22 $\mu\Omega/\Omega$ + 42 m $\Omega$	
	3.3 k $\Omega$ to 11 k $\Omega$	22 $\mu\Omega/\Omega$ + 0.12 $\Omega$	
	11 k $\Omega$ to 33 k $\Omega$	22 $\mu\Omega/\Omega$ + 0.42 $\Omega$	
	33 k $\Omega$ to 110 k $\Omega$	22 $\mu\Omega/\Omega$ + 1.2 $\Omega$	
	110 k $\Omega$ to 330 k $\Omega$	25 $\mu\Omega/\Omega$ + 3.3 $\Omega$	
	330 k $\Omega$ to 1.1 M $\Omega$	25 $\mu\Omega/\Omega$ + 11 $\Omega$	
	1.1 M $\Omega$ to 3.3 M $\Omega$	47 $\mu\Omega/\Omega$ + 48 $\Omega$	
	3.3 M $\Omega$ to 11 M $\Omega$	110 $\mu\Omega/\Omega$ + 0.27 k $\Omega$	
	11 M $\Omega$ to 33 M $\Omega$	200 $\mu\Omega/\Omega$ + 3.2 k $\Omega$	
	33 M $\Omega$ to 110 M $\Omega$	390 $\mu\Omega/\Omega$ + 19 k $\Omega$	
	110 M $\Omega$ to 330 M $\Omega$	2.4 m $\Omega/\Omega$ + 0.11 M $\Omega$	
330 M $\Omega$ to 1.1 G $\Omega$	12 m $\Omega/\Omega$ + 1.1 M $\Omega$		





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Equipment to Output Resistance <sup>FO</sup>	15 $\mu\Omega$ to 2 $\Omega$	20 $\mu\Omega/\Omega$ + 4 $\mu\Omega$	Fluke 8508A QAI-EXX procedures OEM procedures
	2 $\Omega$ to 20 $\Omega$	11 $\mu\Omega/\Omega$ + 15 $\mu\Omega$	
	20 $\Omega$ to 200 $\Omega$	8.5 $\mu\Omega/\Omega$ + 51 $\mu\Omega$	
	200 $\Omega$ to 2 k $\Omega$	8.3 $\mu\Omega/\Omega$ + 510 $\mu\Omega$	
	2 k $\Omega$ to 20 k $\Omega$	8.2 $\mu\Omega/\Omega$ + 5.1 m $\Omega$	
	20 k $\Omega$ to 200 k $\Omega$	8.6 $\mu\Omega/\Omega$ + 51 m $\Omega$	
	200 k $\Omega$ to 2 M $\Omega$	11 $\mu\Omega/\Omega$ + 1 $\Omega$	
	2 M $\Omega$ to 20 M $\Omega$	20 $\mu\Omega/\Omega$ + 10 $\Omega$	
	20 M $\Omega$ to 200 M $\Omega$	66 $\mu\Omega/\Omega$ + 1 k $\Omega$	
	200 M $\Omega$ to 2 G $\Omega$	190 $\mu\Omega/\Omega$ + 0.1 M $\Omega$	
2 G $\Omega$ to 20 G $\Omega$	1.6 m $\Omega/\Omega$ + 1 M $\Omega$		
Equipment to Measure Capacitance <sup>FO</sup>	0.19 nF to 0.4 nF	3.9 mF/F + 8.1 pF	Fluke 5520A QAI-EXX procedures OEM procedures
	0.4 nF to 1.1 nF	3.9 mF/F + 8.2 pF	
	1.1 nF to 3.3 nF	3.9 mF/F + 8.7 pF	
	3.3 nF to 11 nF	2 mF/F + 11 pF	
	11 nF to 33 nF	2 mF/F + 81 pF	
	33 nF to 110 nF	2 mF/F + 0.11 nF	
	110 nF to 330 nF	2 mF/F + 0.32 nF	
	330 nF to 1.1 $\mu$ F	2 mF/F + 1.1 nF	
	1.1 $\mu$ F to 3.3 $\mu$ F	2 mF/F + 3.2 nF	
	3.3 $\mu$ F to 11 $\mu$ F	2 mF/F + 13 nF	
	11 $\mu$ F to 33 $\mu$ F	3.2 mF/F + 37 nF	
	33 $\mu$ F to 110 $\mu$ F	3.5 mF/F + 0.16 $\mu$ F	
	110 $\mu$ F to 330 $\mu$ F	3.5 mF/F + 0.45 $\mu$ F	
	330 $\mu$ F to 1.1 mF	3.5 mF/F + 1.1 $\mu$ F	
	1.1 mF to 3.3 mF	3.5 mF/F + 2.6 $\mu$ F	
	3.3 mF to 11 mF	3.5 mF/F + 8.3 $\mu$ F	
11 mF to 33 mF	5.9 mF/F + 25 $\mu$ F		
33 mF to 110 mF	8.6 mF/F + 90 $\mu$ F		



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Equipment to Output Capacitance <sup>FO</sup>	1 pF to 10 pF	1 mF/F + 7.8 fF	Fluke PM6304 QAI-EXX procedures OEM procedures
	10 pF to 100 pF	1 mF/F + 95 fF	
	0.1 nF to 1 nF	1 mF/F + 0.6 pF	
	1 nF to 10 nF	1 mF/F + 7.7 pF	
	10 nF to 100 nF	1 mF/F + 77 pF	
	0.1 $\mu$ F to 1 $\mu$ F	1 mF/F + 1.3 nF	
	1 $\mu$ F to 10 $\mu$ F	1 mF/F + 13 nF	
	10 $\mu$ F to 100 $\mu$ F	1 mF/F + 0.13 $\mu$ F	
Equipment to Output Inductance <sup>FO</sup>	0.1 mH to 1 mH	1 mH/H + 1.5 $\mu$ H	HP 3458A QAI-EXX procedures OEM procedures
	1 mH to 10 mH	1 mH/H + 15 $\mu$ H	
	10 H to 100 H	1 mH/H + 0.15 mH	
	0.1 H to 1 H	1 mH/H + 1.4 mH	
	1 H to 10 H	1 mH/H + 15 mH	
	10 H to 100 H	1 mH/H + 0.17 H	
	0.1 H to 1 kH	5 mH/H + 1.9 H	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
1 Hz to 40 Hz	0.1 mV to 10 mV	350 $\mu$ V/V + 3.5 $\mu$ V	
40 Hz to 1 kHz	0.1 mV to 10 mV	240 $\mu$ V/V + 1.3 $\mu$ V	
1 kHz to 20 kHz	0.1 mV to 10 mV	350 $\mu$ V/V + 1.3 $\mu$ V	
20 kHz to 50 kHz	0.1 mV to 10 mV	1.2 mV/V + 1.3 $\mu$ V	
50 kHz to 100 kHz	0.1 mV to 10 mV	5.8 mV/V + 16 $\mu$ V	
100 kHz to 300 kHz	0.1 mV to 10 mV	47 mV/V + 25 $\mu$ V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			
1 Hz to 40 Hz	10 mV to 100 mV	81 $\mu$ V/V + 4.8 $\mu$ V	
40 Hz to 1 kHz	10 mV to 100 mV	81 $\mu$ V/V + 2.6 $\mu$ V	
1 kHz to 20 kHz	10 mV to 100 mV	170 $\mu$ V/V + 2.5 $\mu$ V	
20 kHz to 50 kHz	10 mV to 100 mV	350 $\mu$ V/V + 2.5 $\mu$ V	
50 kHz to 100 kHz	10 mV to 100 mV	930 $\mu$ V/V + 2.5 $\mu$ V	
100 kHz to 300 kHz	10 mV to 100 mV	3.5 mV/V + 12 $\mu$ V	
300 kHz to 1 MHz	10 mV to 100 mV	12 mV/V + 390 $\mu$ V	





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Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
1 Hz to 40 Hz	100 mV to 1 V	81 $\mu$ V/V + 47 $\mu$ V	
40 Hz to 1 kHz	100 mV to 1 V	81 $\mu$ V/V + 24 $\mu$ V	
1 kHz to 20 kHz	100 mV to 1 V	170 $\mu$ V/V + 77 $\mu$ V	
20 kHz to 50 kHz	100 mV to 1 V	350 $\mu$ V/V + 140 $\mu$ V	
50 kHz to 100 kHz	100 mV to 1 V	930 $\mu$ V/V + 300 $\mu$ V	
100 kHz to 300 kHz	100 mV to 1 V	3.5 mV/V + 540 $\mu$ V	
300 kHz to 1 MHz	100 mV to 1 V	12 mV/V + 1.4 mV	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	200 mV to 2 V	160 $\mu$ V/V + 121 $\mu$ V	
10 Hz to 40 Hz	200 mV to 2 V	130 $\mu$ V/V + 21 $\mu$ V	
40 Hz to 100 Hz	200 mV to 2 V	110 $\mu$ V/V + 21 $\mu$ V	
100 Hz to 2 kHz	200 mV to 2 V	80 $\mu$ V/V + 21 $\mu$ V	
2 kHz to 10 kHz	200 mV to 2 V	120 $\mu$ V/V + 21 $\mu$ V	
10 kHz to 30 kHz	200 mV to 2 V	230 $\mu$ V/V + 41 $\mu$ V	
30 kHz to 100 kHz	200 mV to 2 V	600 $\mu$ V/V + 210 $\mu$ V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
1 Hz to 40 Hz	0.1 V to 1 V	70 $\mu$ V/V + 40 $\mu$ V	
40 Hz to 1 kHz	0.1 V to 1 V	70 $\mu$ V/V + 20 $\mu$ V	
1 kHz to 20 kHz	0.1 V to 1 V	140 $\mu$ V/V + 20 $\mu$ V	
20 kHz to 50 kHz	0.1 V to 1 V	300 $\mu$ V/V + 20 $\mu$ V	
50 kHz to 100 kHz	0.1 V to 1 V	800 $\mu$ V/V + 20 $\mu$ V	
100 kHz to 300 kHz	0.1 V to 1 V	3 mV/V + 0.1 mV	
300 kHz to 1 MHz	0.1 V to 1 V	10 mV/V + 0.1 mV	
1 MHz to 2 MHz	0.1 V to 1 V	15 mV/V + 0.1 mV	



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## Precision Measurements

20 Hagerty Boulevard, Suite #1, West Chester, PA 19382  
 Contact Name: Jackie Perry Phone: 610-436-9703

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### Electrical

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Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
1 Hz to 40 Hz	1 V to 10 V	70 $\mu$ V/V + 400 $\mu$ V	
40 Hz to 1 kHz	1 V to 10 V	70 $\mu$ V/V + 200 $\mu$ V	
1 kHz to 20 kHz	1 V to 10 V	140 $\mu$ V/V + 200 $\mu$ V	
20 kHz to 50 kHz	1 V to 10 V	300 $\mu$ V/V + 200 $\mu$ V	
50 kHz to 100 kHz	1 V to 10 V	800 $\mu$ V/V + 200 $\mu$ V	
100 kHz to 300 kHz	1 V to 10 V	3 mV/V + 1 mV	
300 kHz to 1 MHz	1 V to 10 V	10 mV/V + 1 mV	
1 MHz to 2 MHz	1 V to 10 V	15 mV/V + 1 mV	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	2 V to 20 V	160 $\mu$ V/V + 1.3 mV	
10 Hz to 40 Hz	2 V to 20 V	130 $\mu$ V/V + 210 $\mu$ V	
40 Hz to 100 Hz	2 V to 20 V	97 $\mu$ V/V + 210 $\mu$ V	
100 Hz to 2 kHz	2 V to 20 V	81 $\mu$ V/V + 210 $\mu$ V	
2 kHz to 10 kHz	2 V to 20 V	120 $\mu$ V/V + 210 $\mu$ V	
10 kHz to 30 kHz	2 V to 20 V	230 $\mu$ V/V + 410 $\mu$ V	
30 kHz to 100 kHz	2 V to 20 V	580 $\mu$ V/V + 2.1 mV	
100 kHz to 300 kHz	2 V to 20 V	3.1 mV/V + 20 mV	
300 kHz to 1 MHz	2 V to 20 V	11 mV/V + 0.2 V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	20 V to 200 V	160 $\mu$ V/V + 13 mV	
10 Hz to 40 Hz	20 V to 200 V	130 $\mu$ V/V + 2.1 mV	
40 Hz to 100 Hz	20 V to 200 V	97 $\mu$ V/V + 2.1 mV	
100 Hz to 2 kHz	20 V to 200 V	79 $\mu$ V/V + 2.1 mV	
2 kHz to 10 kHz	20 V to 200 V	120 $\mu$ V/V + 2.1 mV	
10 kHz to 30 kHz	20 V to 200 V	230 $\mu$ V/V + 4.1 mV	
30 kHz to 100 kHz	20 V to 200 V	580 $\mu$ V/V + 21 mV	
100 kHz to 300 kHz	20 V to 200 V	3.1 mV/V + 200 mV	
300 kHz to 1 MHz	20 V to 200 V	11 mV/V + 2 V	



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Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
1 Hz to 40 Hz	10 V to 100 V	0.2 mV/V + 4 mV	
40 Hz to 1 kHz	10 V to 100 V	0.2 mV/V + 2 mV	
1 kHz to 20 kHz	10 V to 100 V	0.2 mV/V + 2 mV	
20 kHz to 50 kHz	10 V to 100 V	0.35 mV/V + 2 mV	
50 kHz to 100 kHz	10 V to 100 V	1.2 mV/V + 2 mV	
100 kHz to 300 kHz	10 V to 100 V	4 mV/V + 10 mV	
300 kHz to 1 MHz	10 V to 100 V	15 mV/V + 10 mV	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			
1 Hz to 40 Hz	100 V to 1 000 V	0.4 mV/V + 40 mV	
40 Hz to 1 kHz	100 V to 1 000 V	0.4 mV/V + 20 mV	
1 kHz to 20 kHz	100 V to 1 000 V	0.6 mV/V + 0.2 V	
20 kHz to 50 kHz	100 V to 1 000 V	1.2 mV/V + 20 mV	
50 kHz to 100 kHz	100 V to 1 000 V	3 mV/V + 20 mV	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	200 V to 1 000 V	1.6 mV/V + 71 mV	
10 Hz to 40 Hz	200 V to 1 000 V	130 $\mu$ V/V + 21 mV	
40 Hz to 10 kHz	200 V to 1 000 V	170 $\mu$ V/V + 21 mV	
10 kHz to 30 kHz	200 V to 1 000 V	400 $\mu$ V/V + 41 mV	
30 kHz to 100 kHz	200 V to 1 000 V	670 $\mu$ V/V + 0.2 V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			VitreK 4700 QAI-EXX procedures OEM procedures
10 mHz to 10 Hz	1 kV to 10 kV	1.4 mV/V + 0.2 V	
10 Hz to 65 Hz	1 kV to 10 kV	1.4 mV/V + 0.2 V	
65 Hz to 200 Hz	1 kV to 10 kV	1.4 mV/V + 0.2 V	
200 Hz to 450 Hz	1 kV to 10 kV	4.7 mV/V + 0.2 V	



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Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	1 $\mu$ A to 100 $\mu$ A	4 $\mu$ A/A + 30 nA	
20 Hz to 45 Hz	1 $\mu$ A to 100 $\mu$ A	1.5 $\mu$ A/A + 30 nA	
45 Hz to 100 Hz	1 $\mu$ A to 100 $\mu$ A	0.6 $\mu$ A/A + 30 nA	
100 Hz to 1 kHz	1 $\mu$ A to 100 $\mu$ A	0.6 $\mu$ A/A + 30 nA	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Agilent 34401A QAI-EXX procedures OEM procedures
3 Hz to 5 kHz	100 $\mu$ A to 3 A	2 mA/A + 1.2 mA	
5 kHz to 10 kHz	100 $\mu$ A to 3 A	2 mA/A + 1.2 mA	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	20 $\mu$ A to 200 $\mu$ A	510 $\mu$ A/A + 20 nA	
10 Hz to 10 kHz	20 $\mu$ A to 200 $\mu$ A	560 $\mu$ A/A + 20 nA	
10 kHz to 30 kHz	20 $\mu$ A to 200 $\mu$ A	750 $\mu$ A/A + 20 nA	
30 kHz to 100 kHz	20 $\mu$ A to 200 $\mu$ A	4.1 mA/A + 20 nA	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	200 $\mu$ A to 2 mA	340 $\mu$ A/A + 0.2 $\mu$ A	
10 Hz to 10 kHz	200 $\mu$ A to 2 mA	320 $\mu$ A/A + 0.2 $\mu$ A	
10 kHz to 30 kHz	200 $\mu$ A to 2 mA	720 $\mu$ A/A + 0.2 $\mu$ A	
30 kHz to 100 kHz	200 $\mu$ A to 2 mA	4.1 mA/A + 0.2 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	0.1 mA to 1 mA	4 mA/A + 0.2 $\mu$ A	
20 Hz to 45 Hz	0.1 mA to 1 mA	1.5 mA/A + 0.2 $\mu$ A	
45 Hz to 100 Hz	0.1 mA to 1 mA	0.6 mA/A + 0.2 $\mu$ A	
100 Hz to 5 kHz	0.1 mA to 1 mA	0.3 mA/A + 0.2 $\mu$ A	
5 kHz to 20 kHz	0.1 mA to 1 mA	0.6 mA/A + 0.2 $\mu$ A	
20 kHz to 50 kHz	0.1 mA to 1 mA	4 mA/A + 0.4 $\mu$ A	
50 kHz to 100 kHz	0.1 mA to 1 mA	5.5 mA/A + 1.5 $\mu$ A	



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Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	1 mA to 10 mA	4 mA/A + 2 $\mu$ A	
20 Hz to 45 Hz	1 mA to 10 mA	1.5 mA/A + 2 $\mu$ A	
45 Hz to 100 Hz	1 mA to 10 mA	0.6 mA/A + 2 $\mu$ A	
100 Hz to 5 kHz	1 mA to 10 mA	0.3 mA/A + 2 $\mu$ A	
5 kHz to 20 kHz	1 mA to 10 mA	0.6 mA/A + 2 $\mu$ A	
20 kHz to 50 kHz	1 mA to 10 mA	4 mA/A + 4 $\mu$ A	
50 kHz to 100 kHz	1 mA to 10 mA	5.5 mA/A + 15 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	2 mA to 20 mA	340 $\mu$ A/A + 2 $\mu$ A	
10 Hz to 10 kHz	2 mA to 20 mA	340 $\mu$ A/A + 2 $\mu$ A	
10 kHz to 30 kHz	2 mA to 20 mA	730 $\mu$ A/A + 2 $\mu$ A	
30 kHz to 100 kHz	2 mA to 20 mA	4.1 mA/A + 2 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	10 mA to 100 mA	4 mA/A + 20 $\mu$ A	
20 Hz to 45 Hz	10 mA to 100 mA	1.5 mA/A + 20 $\mu$ A	
45 Hz to 100 Hz	10 mA to 100 mA	0.6 mA/A + 20 $\mu$ A	
100 Hz to 5 kHz	10 mA to 100 mA	0.3 mA/A + 20 $\mu$ A	
5 kHz to 20 kHz	10 mA to 100 mA	0.6 mA/A + 20 $\mu$ A	
20 kHz to 50 kHz	10 mA to 100 mA	4 mA/A + 40 $\mu$ A	
50 kHz to 100 kHz	10 mA to 100 mA	5.5 mA/A + 150 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
1 Hz to 10 Hz	20 mA to 200 mA	340 $\mu$ A/A + 20 $\mu$ A	
10 Hz to 10 kHz	20 mA to 200 mA	320 $\mu$ A/A + 20 $\mu$ A	
10 kHz to 30 kHz	20 mA to 200 mA	640 $\mu$ A/A + 20 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			
10 Hz to 2 kHz	200 mA to 2 A	630 $\mu$ A/A + 0.2 mA	
2 kHz to 10 kHz	200 mA to 2 A	940 $\mu$ A/A + 0.2 mA	
10 kHz to 30 kHz	200 mA to 2 A	3.1 mA/A + 0.2 mA	



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Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			HP 3458A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	0.1 A to 1 A	4 mA/A + 0.2 mA	
20 Hz to 45 Hz	0.1 A to 1 A	1.6 mA/A + 0.2 mA	
45 Hz to 100 Hz	0.1 A to 1 A	0.8 mA/A + 0.2 mA	
100 Hz to 5 kHz	0.1 A to 1 A	1 mA/A + 0.2 mA	
5 kHz to 20 kHz	0.1 A to 1 A	3 mA/A + 0.2 mA	
20 kHz to 50 kHz	0.1 A to 1 A	10 mA/A + 0.4 mA	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 45 QAI-EXX procedures OEM procedures
20 Hz to 50 Hz	1 A to 10 A	10 mA/A + 10 mA	
50 Hz to 2 kHz	1 A to 10 A	20 mA/A + 10 mA	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 8508A QAI-EXX procedures OEM procedures
10 Hz to 2 kHz	2 A to 20 A	830 $\mu$ A/A + 2 mA	
2 kHz to 10 kHz	2 A to 20 A	2.7 mA/A + 2 mA	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 5520A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	29 $\mu$ A to 330 $\mu$ A	1.6 mA/A + 90 nA	
20 Hz to 45 Hz	29 $\mu$ A to 330 $\mu$ A	1.2 mA/A + 90 nA	
45 Hz to 1 kHz	29 $\mu$ A to 330 $\mu$ A	980 $\mu$ A/A + 90 nA	
1 kHz to 5 kHz	29 $\mu$ A to 330 $\mu$ A	2.4 mA/A + 140 nA	
5 kHz to 10 kHz	29 $\mu$ A to 330 $\mu$ A	6.3 mA/A + 180 nA	
10 kHz to 30 kHz	29 $\mu$ A to 330 $\mu$ A	13 mA/A + 370 nA	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			
10 Hz to 20 Hz	330 $\mu$ A to 3.3 mA	1.6 mA/A + 0.4 $\mu$ A	
20 Hz to 45 Hz	330 $\mu$ A to 3.3 mA	980 $\mu$ A/A + 0.4 $\mu$ A	
45 Hz to 1 kHz	330 $\mu$ A to 3.3 mA	780 $\mu$ A/A + 0.3 $\mu$ A	
1 kHz to 5 kHz	330 $\mu$ A to 3.3 mA	1.6 mA/A + 0.4 $\mu$ A	
5 kHz to 10 kHz	330 $\mu$ A to 3.3 mA	3.9 mA/A + 0.5 $\mu$ A	
10 kHz to 30 kHz	330 $\mu$ A to 3.3 mA	7.8 mA/A + 0.8 $\mu$ A	





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Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 5520A QAI-EXX procedures OEM procedures
10 Hz to 20 Hz	3.3 mA to 33 mA	1.4 mA/A + 6 $\mu$ A	
20 Hz to 45 Hz	3.3 mA to 33 mA	0.7 mA/A + 6 $\mu$ A	
45 Hz to 1 kHz	3.3 mA to 33 mA	320 $\mu$ A/A + 4 $\mu$ A	
1 kHz to 5 kHz	3.3 mA to 33 mA	630 $\mu$ A/A + 4 $\mu$ A	
5 kHz to 10 kHz	3.3 mA to 33 mA	1.6 mA/A + 5 $\mu$ A	
10 kHz to 30 kHz	3.3 mA to 33 mA	3.2 mA/A + 7 $\mu$ A	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			
10 Hz to 20 Hz	33 mA to 330 mA	1.4 mA/A + 50 $\mu$ A	
20 Hz to 45 Hz	33 mA to 330 mA	0.7 mA/A + 50 $\mu$ A	
45 Hz to 1 kHz	33 mA to 330 mA	320 mA/A + 30 $\mu$ A	
1 kHz to 5 kHz	33 mA to 330 mA	770 mA/A + 50 $\mu$ A	
5 kHz to 10 kHz	33 mA to 330 mA	1.6 mA/A + 90 $\mu$ A	
10 kHz to 30 kHz	33 mA to 330 mA	2.4 mA/A + 170 $\mu$ A	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			
10 Hz to 45 Hz	330 mA to 1.1 A	1.4 mA/A + 170 $\mu$ A	
45 Hz to 1 kHz	330 mA to 1.1 A	390 $\mu$ A/A + 120 $\mu$ A	
1 kHz to 5 kHz	330 mA to 1.1 A	4.7 $\mu$ A/A + 820 $\mu$ A	
5 kHz to 10 kHz	330 mA to 1.1 A	20 mA/A + 4 mA	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			
10 Hz to 45 Hz	1.1 A to 3 A	1.4 mA/A + 450 $\mu$ A	
45 Hz to 1 kHz	1.1 A to 3 A	470 $\mu$ A/A + 280 $\mu$ A	
1 kHz to 5 kHz	1.1 A to 3 A	4.7 $\mu$ A/A + 830 $\mu$ A	
5 kHz to 10 kHz	1.1 A to 3 A	20 mA/A + 3.9 mA	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			
45 Hz to 100 Hz	3 A to 11 A	470 $\mu$ A/A + 2.5 mA	
100 Hz to 1 kHz	3 A to 11 A	780 $\mu$ A/A + 2 mA	
1 kHz to 5 kHz	3 A to 11 A	24 mA/A + 7.3 mA	



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Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 5520A QAI-EXX procedures OEM procedures
45 Hz to 100 Hz	11 A to 20 A	940 $\mu$ A/A + 5.9 mA	
100 Hz to 1 kHz	11 A to 20 A	1.2 mA/A + 5.9 mA	
1 kHz to 5 kHz	11 A to 20 A	24 mA/A + 28 mA	
Equipment to Measure RF Power (at the listed frequencies) <sup>FO</sup>			HP 3325B opt 001 GIDEP procedures
0.001 Hz to 100 kHz	4 nW to 100 mW	48 mW/W	
100 kHz to 10 MHz	4 nW to 100 mW	150 mW/W	
Equipment to Measure RF Power (at the listed frequencies) <sup>FO</sup>			Agilent E8257D Opt 1E1, 532, UNT GIDEP procedures
10 MHz to 2 GHz	1 pW to 10 mW	210 mW/W	
2 GHz to 20 GHz	100 $\mu$ W to 100 mW	210 mW/W	
	100 pW to 100 $\mu$ W	231 mW/W	
	1 pW to 100 pW	260 mW/W	
20 GHz to 31.8 GHz	100 pW to 100 mW	260 mW/W	
	1 pW to 100 pW	590 mW/W	
Equipment to Output RF Power (at the listed frequencies) <sup>FO</sup>			Agilent E4416A Agilent N8482A HP N8481A HP 8485A HP 8481D GIDEP procedures
100 kHz to 26.5 GHz	10 $\mu$ W to 1 W	35 mW/W	
10 MHz to 18 GHz	100 pW to 10 $\mu$ W	46 mW/W	
Equipment to Output RF Attenuation - TRFL (at the listed frequencies) <sup>FO</sup>			HP 8902A GIDEP procedures
2.5 MHz to 1.3 GHz (200 Hz BW) <sup>FO</sup>	100 $\mu$ W to 1 mW	12 mW/W	
	10 $\mu$ W to 100 $\mu$ W	17 mW/W	
	1 $\mu$ W to 10 $\mu$ W	21 mW/W	
	100 nW to 1 $\mu$ W	26 mW/W	
	10 nW to 100 nW	40 mW/W	
	1 nW to 10 nW	45 mW/W	
	100 pW to 1 nW	50 mW/W	
	10 pW to 100 pW	55 mW/W	
	1 pW to 10 pW	70 mW/W	
	100 fW to 1 pW	74 mW/W	



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1.3 GHz to 26.5 GHz (200 Hz BW) <sup>FO</sup>	100 $\mu$ W to 1 mW	12 mW/W	HP 8902A HP 11793A Agilent E8257D GIDEP procedures
	10 $\mu$ W to 100 $\mu$ W	17 mW/W	
	1 $\mu$ W to 10 $\mu$ W	21 mW/W	
	100 nW to 1 $\mu$ W	26 mW/W	
	10 nW to 100 nW	40 mW/W	
	1 nW to 10 nW	45 mW/W	
	100 pW to 1 nW	50 mW/W	
	10 pW to 100 pW	55 mW/W	
	1 pW to 10 pW	115 mW/W	
100 fW to 1 pW	120 mW/W		
Oscilloscopes Leveled Sine Wave			Fluke 5520A-SC1100 QAI-E04
Amplitude 5 mVp-p to 5 Vp-p <sup>FO</sup>	50 kHz	20 mV/V + 0.3 mV	
Flatness (relative to 50 kHz, Reference) 5 mVp-p to 5 Vp-p <sup>FO</sup>	50 kHz to 100 MHz	15 mV/V + 0.1 mV	
	100 MHz to 300 MHz	20 mV/V + 0.1 mV	
	300 MHz to 600 MHz	40 mV/V + 0.1 mV	
	600 MHz to 1.1 GHz	76 mV/V + 440 $\mu$ V	
Square, Sine & Triangle Wave Frequency Range 10 Hz to 100 kHz <sup>FO</sup>			
Terminated into 1 M $\Omega$	1.8 mV to 5.5 Vp-p	30 mV/V + 0.1 mV	
Terminated into 50 $\Omega$	1.8 mV to 2.5 Vp-p	30 mV/V + 0.1 mV	
Time Marker Output	2 ns to 20 ms	2.5 $\mu$ s/s	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 5520A GIDEP procedures OEM procedures
10 Hz to 45 Hz	1 mV to 33 mV	630 $\mu$ V/V + 10 $\mu$ V	
45 Hz to 10 kHz	1 mV to 33 mV	120 $\mu$ V/V + 6 $\mu$ V	
10 kHz to 20 kHz	1 mV to 33 mV	160 $\mu$ V/V + 6 $\mu$ V	
20 kHz to 50 kHz	1 mV to 33 mV	780 $\mu$ V/V + 8 $\mu$ V	
50 kHz to 100 kHz	1 mV to 33 mV	2.8 mV/V + 14 $\mu$ V	
100 kHz to 500 kHz	1 mV to 33 mV	6.3 mV/V + 48 $\mu$ V	



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Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 5520A GIDEP procedures OEM procedures
10 Hz to 45 Hz	33 mV to 330 mV	240 $\mu$ V/V + 59 $\mu$ V	
45 Hz to 10 kHz	33 mV to 330 mV	120 $\mu$ V/V + 13 $\mu$ V	
10 kHz to 20 kHz	33 mV to 330 mV	130 $\mu$ V/V + 13 $\mu$ V	
20 kHz to 50 kHz	33 mV to 330 mV	280 $\mu$ V/V + 18 $\mu$ V	
50 kHz to 100 kHz	33 mV to 330 mV	630 $\mu$ V/V + 35 $\mu$ V	
100 kHz to 500 kHz	33 mV to 330 mV	1.6 mV/V + 110 $\mu$ V	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
10 Hz to 45 Hz	330 mV to 3.3 V	240 $\mu$ V/V + 550 $\mu$ V	
45 Hz to 10kHz	330 mV to 3.3 V	120 $\mu$ V/V + 90 $\mu$ V	
10 kHz to 20 kHz	330 mV to 3.3 V	150 $\mu$ V/V + 90 $\mu$ V	
20 kHz to 50 kHz	330 mV to 3.3 V	240 $\mu$ V/V + 170 $\mu$ V	
50 kHz to 100kHz	330 mV to 3.3 V	550 $\mu$ V/V + 270 $\mu$ V	
100 kHz to 500kHz	330 mV to 3.3 V	1.9 mV/V + 1.3 mV	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
10 Hz to 45 Hz	3.3 V to 33 V	240 $\mu$ V/V + 5.5 mV	
45 Hz to 10 kHz	3.3 V to 33 V	120 $\mu$ V/V + 1 mV	
10 kHz to 20 kHz	3.3 V to 33 V	190 $\mu$ V/V + 1 mV	
20 kHz to 50 kHz	3.3 V to 33 V	280 $\mu$ V/V + 1.7 mV	
50 kHz to 100 kHz	3.3 V to 33 V	0.7 mV/V + 3 mV	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
45 Hz to 1 kHz	33 V to 330 V	150 $\mu$ V/V + 12 mV	
1 kHz to 10 kHz	33 V to 330 V	160 $\mu$ V/V + 13 mV	
10 kHz to 20 kHz	33 V to 330 V	0.2 mV/V + 13 mV	
20 kHz to 50 kHz	33 V to 330 V	240 $\mu$ V/V + 35 mV	
50 kHz to 100 kHz	33 V to 330 V	1.6 mV/V + 144 mV	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
45 Hz to 1 kHz	330 V to 1 020 V	240 $\mu$ V/V + 40 mV	
1 kHz to 5 kHz	330 V to 1 020 V	200 $\mu$ V/V + 40 mV	
5 kHz to 10 kHz	330 V to 1 020 V	240 $\mu$ V/V + 40 mV	



# Certificate of Accreditation: Supplement

## Precision Measurements

20 Hagerty Boulevard, Suite #1, West Chester, PA 19382  
 Contact Name: Jackie Perry Phone: 610-436-9703

*Accreditation is granted to the facility to perform the following calibrations:*

### Mass, Force and Weighing Devices

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Scales and Balances <sup>FO</sup>	1 mg to 500 mg	5.8 $\mu$ g/g + 5.9 $\mu$ g	Class 1 Weights QAI-A04
	1 g to 1 kg	2.1 $\mu$ g/g + 64 $\mu$ g	
	1 kg to 10 kg	3.3 $\mu$ g/g + 23 mg	
Load Cells/Force Gauges <sup>FO</sup>	1 lbf to 600 lbf	0.001 3 % of reading + 0.006 6 lbf	Class F Weights QAI-M11
Load Cells <sup>FO</sup> (Tension, Compression)	500 N to 5 000 N	2.4 mN/N	Deadweights Class F QAI-M11
	200 N to 2 N	5 mN/N	
	20 N to 1 779 N	5 mN/N	
Weights <sup>F</sup>	1 mg to 500 mg	3.4 $\mu$ g	Class 0 Weights Sartorius CCE106 CCE1004 OIML R111 ABBA
	500 mg to 5 g	3.4 $\mu$ g	
	10 g	6.8 $\mu$ g	
	20 g	8.7 $\mu$ g	
	50 g	16 $\mu$ g	
	100 g	31 $\mu$ g	
	200 g	150 $\mu$ g	
	500 g	220 $\mu$ g	
	1 kg	330 $\mu$ g	



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### Mechanical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Equipment to measure Pressure <sup>FO</sup>	-15 psig to 25 psig	0.008 % of reading + 0.001 6 psig	Ruska 7250-xi QAI-P01
	25 psig to 500 psig	0.01 % of reading + 0.000 9 psig	
	0 psia to 40 psia	0.008 % of reading + 0.001 6 psia	
	40 psia to 515 psia	0.01 % of reading + 0.000 9 psia	
	100 psig to 2 000 psig	0.008 % of reading + 0.064 psig	Ruska 7250 QAI-P01
Equipment to measure Pressure <sup>FO</sup>	200 psig to 10 000 psig	0.000 83 % of reading + 0.006 psig	GE 3100 DWT QAI-P01
	-1 inH <sub>2</sub> O to 1 inH <sub>2</sub> O	0.001 6 inH <sub>2</sub> O	Additel ADT761-LLP QAI-P01
	-10 inH <sub>2</sub> O to 10 inH <sub>2</sub> O	0.012 inH <sub>2</sub> O	
Equipment to measure Torque <sup>FO</sup>	1 lbf·in to 100 lbf·in	0.011 % of reading + 0.000 58 lbf·in	Class F Weights/Torque Arm NAVAIR 17-20MU-52
	0.2 lbf·ft to 1 000 lbf·ft	0.011 % of reading + 0.005 8 lbf·ft	
Equipment to Source Torque <sup>FO</sup>	2 ozf·in to 20 ozf·in	0.63 % of reading + 0.001 ozf·in	Mountz BMX20Z QAI –M04
	1 lbf·in to 10 lbf·in	0.63 % of reading + 0.001 lbf·in	Mountz BMX10i QAI –M04
	25 lbf·in to 250 lbf·in	0.6 % of reading + 0.01 lbf·in	Mountz BMX250i QAI –M04
	10 lbf·ft to 100 lbf·ft	0.63 % of reading + 0.005 8 lbf·ft	Mountz BMX100F QAI –M04
	25 lbf·ft to 250 lbf·ft	0.7 % of reading + 0.01 lbf·ft	Mountz BMX 250F QAI –M04
Equipment to Source Torque <sup>F</sup>	10 lbf·in to 100 lbf·in	0.12 % of reading + 0.02 lbf·in	AKO TDS QAI –M04
	100 lbf·ft to 1 000 lbf·ft	0.12 % of reading + 0.2 lbf·ft	
Equipment to measure Mass Flow, Liquids <sup>FO</sup>	0.3 kg/m to 1 000 kg/m	0.05 % of reading + 0.005 8 kg/min	Rosemount D100 Flow Sensor Endress Hauser 83F
Equipment to measure Gas Flow <sup>F</sup>	1 SCCM to 10 SCCM	0.4 % of reading + 0.000 58 SCCM	MolBloc System GIDEP Procedures OEM Procedures
	10 SCCM to 100 SCCM	0.4 % of reading + 0.005 8 SCCM	
	100 SCCM to 1 000 SCCM	0.4 % of reading + 0.058 SCCM	
	1 SLPM to 10 SLPM	0.4 % of reading + 0.58 SCCM	
	2.5 SLPM to 25 SLPM	0.47 % of reading + 5.8 SCCM	
	10 SLPM to 100 SLPM	0.5 % of reading + 5.8 SCCM	
	50 SLPM to 500 SLPM	0.47 % of reading + 15 SCCM	





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## Precision Measurements

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### Thermodynamic

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Temperature measurement with RTD <sup>FO</sup>	-196 °C	0.04 °C	Kaye IRTD Liquid Nitrogen Dry Ice Temperature Baths QAI-T01
	-80 °C	0.04 °C	
	-40 °C to 125 °C	0.04 °C	
	125 °C to 300 °C	0.04 °C	
Relative Humidity <sup>FO</sup>	0 % RH to 25 % RH	1.3 % RH	Edgetech RH-Cal QAI-T08
	25 % RH to 75 % RH	0.77 % RH	
	75 % RH to 95 % RH	1.3 % RH	
Liquid-In-Glass Thermometers <sup>FO</sup>	-40 °C to 125 °C	0.07 °C	Kaye IRTD Temperature Bath QAI-T02
	125 °C to 300 °C	0.07 °C	
Infrared Temperature <sup>FO</sup>	20 °C to 500 °C	0.55 % of reading + 0.074 °C	Fluke 4181 QAI-T07

### Time and Frequency

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Equipment to Measure Frequency <sup>FO</sup>	10 mHz to 120 Hz	2.5 $\mu$ Hz/Hz + 10 mHz	Fluke 5520A GIDEP procedures OEM procedures
	120 Hz to 1.2 kHz	2.5 $\mu$ Hz/Hz + 0.1 Hz	
	1.2 kHz to 12 kHz	2.5 $\mu$ Hz/Hz + 1 Hz	
	12 kHz to 120 kHz	2.5 $\mu$ Hz/Hz + 10 Hz	
	120 kHz to 1.2 MHz	2.5 $\mu$ Hz/Hz + 0.1 kHz	
	1.2 MHz to 2 MHz	2.5 $\mu$ Hz/Hz + 1 kHz	
Equipment to Output Frequency <sup>FO</sup>	1 Hz to 100 Hz	0.6 nHz	Agilent 53132A GIDEP procedures OEM procedures
	100 Hz to 1 kHz	51 nHz	
	1 kHz to 10 kHz	760 nHz	
	10 kHz to 100 kHz	5.01 $\mu$ Hz	
	100 kHz to 1 MHz	50.1 $\mu$ Hz	
	1 MHz to 10 MHz	510 $\mu$ Hz	
	10 MHz to 100 MHz	5.01 mHz	
	100 MHz to 1 GHz	50.1 mHz	
1 GHz to 3 GHz	101 mHz		
Stopwatch / Period measuring devices <sup>FO</sup>	Up to 100 sec/day	0.051 sec/day	Timometer QAI-K01



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## Precision Measurements

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### Time and Frequency

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ( $\pm$ )	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Phase Modulation <sup>F</sup>	150 kHz to 10 MHz	4 % of reading + 0.5 rad	HP 8902A GIDEP procedures OEM procedures
	10 MHz to 1.3 GHz	3 % of reading + 0.5 rad	
	1.3 GHz to 26.5 GHz	4 % of reading + 0.5 rad	
Amplitude Modulation <sup>F</sup> Depths: 5 % to 99 %	150 kHz to 10 MHz	2.1 % of reading + 0.012 % AM	
Amplitude Modulation <sup>F</sup> Depths: to 99 %	150 kHz to 10 MHz	3.1 % of reading + 0.012 % AM	
Amplitude Modulation <sup>F</sup> Depths: 5 % to 99 %	10 MHz to 1.3 GHz	1.1 % + 0.012 % AM	
Amplitude Modulation <sup>F</sup> Depths: to 99 %	10 MHz to 1.3 GHz	3.1 % + 0.012 % AM	
Amplitude Modulation <sup>F</sup> Depths: 5 % to 99 %	1.3 GHz to 26.5 GHz	2.1 % + 0.012 % AM	
Amplitude Modulation <sup>F</sup> Depths: to 99 %	1.3 GHz to 26.5 GHz	3.1 % + 0.012 % AM	
Frequency Modulation <sup>F</sup> Rate: 20 Hz to 200 kHz	250 kHz to 10 MHz	20 mHz/Hz + 0.12 kHz	
	10 MHz to 1.3 GHz	51 mHz/Hz + 20 Hz	
Frequency Modulation <sup>F</sup> Rate: 50 Hz to 100 kHz	10 MHz to 1.3 GHz	11 mHz/Hz + 20 Hz	
Frequency Modulation <sup>F</sup> Rate: 20 Hz to 200 kHz	1.3 GHz to 26.5 GHz	51 mHz/Hz + 20 Hz	
Frequency Modulation <sup>F</sup> Rate: 50 Hz to 100 kHz	1.3 GHz to 26.5 GHz	11 mHz/Hz + 20 Hz	
Rotating Motion <sup>FO</sup>	9 rpm to 90 000 rpm	0.000 6 % of reading + 0.000 07 rpm	HP 3325B GIDEP procedures OEM procedures
Period Totalization <sup>FO</sup>	0 to 3600 s	11 $\mu$ s/s + 8.2 ms	Stop Watch Control Company GIDEP procedures OEM procedures



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## Precision Measurements

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*Accreditation is granted to the facility to perform the following calibrations:*

1. The CMC (Calibration and Measurement Capability) stated for calibrations included on this scope of accreditation represents the smallest measurement uncertainty attainable by the laboratory when performing a more or less routine calibration of a nearly ideal device under nearly ideal conditions. It is typically expressed at a confidence level of 95 % using a coverage factor  $k$  (usually equal to 2). The actual measurement uncertainty associated with a specific calibration performed by the laboratory will typically be larger than the CMC for the same calibration since capability and performance of the device being calibrated and the conditions related to the calibration may reasonably be expected to deviate from ideal to some degree.
2. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.
3. The presence of a superscript F means that the laboratory performs calibration of the indicated parameter at its fixed location. Example: Outside Micrometer<sup>F</sup> would mean that the laboratory performs this calibration at its fixed location.
4. The presence of a superscript FO means that the laboratory performs calibration of the indicated parameter both at its fixed location and onsite at customer locations. Example: Outside Micrometer<sup>FO</sup> would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.
5. Measurement uncertainties obtained for calibrations performed at customer sites can be expected to be larger than the measurement uncertainties obtained at the laboratories fixed location for similar calibrations. This is due to the effects of transportation of the standards and equipment and upon environmental conditions at the customer site which are typically not controlled as closely as at the laboratories fixed location.
6. The term  $L$  represents liters as appropriate to the uncertainty statement.