



The American Association for Laboratory Accreditation

World Class Accreditation

# Accredited Laboratory

A2LA has accredited

## PRE-CAL SERVICES, INC.

*Apollo, PA*

for technical competence in the field of

### Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. 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 8 January 2009*).

Presented this 11<sup>th</sup> day of December 2009.



A handwritten signature in black ink, reading "Peter Abney".

President & CEO  
For the Accreditation Council  
Certificate Number 1853.01  
Valid to January 31, 2012

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



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

PRE-CAL SERVICES, INC.  
 1123 Route 380 West  
 Apollo, PA 15613  
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CALIBRATION

Valid To: January 31, 2012

Certificate Number: 1853.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
DC Voltage – Generate <sup>3</sup>	(0.001 to 320) mV (0.32 to 3.2) V (3.2 to 32) V (32 to 320) V (320 to 1050) V	0.007 % + 4.2 μV 0.007 % + 42 μV 0.0075 % + 420 μV 0.0075 % + 4.5 mV 0.007 % + 20 mV	Datron 9100
DC Voltage – Measure <sup>3</sup>	(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V  (100 to 1000) V	6.2 μV/V + 3 μV 5.2 μV/V + 0.3 μV 5.2 μV/V + 0.5 μV 7.2 μV/V + 30 μV  7.2 μV/V + 100 μV + 12 (V <sub>IN</sub> /1000) <sup>2</sup> μV	HP 3458A w/ option 002
DC Current – Generate <sup>3</sup>	(0.001 to 320) nA (0.32 to 3.2) mA (3.2 to 32) mA (32 to 320) mA (0.32 to 3.2) A (3.2 to 10) A	0.019 % + 11 nA 0.019 % + 83 nA 0.019 % + 900 nA 0.021 % + 9.6 μA 0.07 % + 120 μA 0.06 % + 940 μA	Datron 9100

Parameter/Equipment	Range	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
DC Current – Measure <sup>3</sup>	(10 to 100) nA 100 nA to 1 $\mu$ A (1 to 10) $\mu$ A (10 to 100) $\mu$ A 100 $\mu$ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	34 $\mu$ A/A + 0.04 nA 24 $\mu$ A/A + 0.04 nA 24 $\mu$ A/A + 0.1 nA 24 $\mu$ A/A + 0.8 nA 24 $\mu$ A/A + 5 nA 24 $\mu$ A/A + 50 nA 39 $\mu$ A/A + 0.5 $\mu$ A 0.012 % + 10 $\mu$ A	HP 3458A
Resistance – Generate <sup>3</sup>	0.1 m $\Omega$ to 40 $\Omega$ (40 to 400) $\Omega$ (0.4 to 4) k $\Omega$ (4 to 40) k $\Omega$ (40 to 400) k $\Omega$ 400 k $\Omega$ to 4 M $\Omega$ (4 to 40) M $\Omega$ (40 to 400) M $\Omega$	0.03 % + 10 m $\Omega$ 0.025 % + 20 m $\Omega$ 0.02 % + 80 m $\Omega$ 0.025 % + 800 m $\Omega$ 0.025 % + 8 $\Omega$ 0.055 % + 100 $\Omega$ 0.16 % + 2 k $\Omega$ 0.27 % + 40 k $\Omega$	Datron 9100
Resistance – Measure <sup>3</sup>	10 m $\Omega$ to 10 $\Omega$ (10 to 100) $\Omega$ 100 $\Omega$ to 1 k $\Omega$ (1 to 10) k $\Omega$ (10 to 100) k $\Omega$ 100 k $\Omega$ to 1 M $\Omega$ (1 to 10) M $\Omega$ (10 to 100) M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$	20 $\mu\Omega/\Omega$ + 0.05 m $\Omega$ 17 $\mu\Omega/\Omega$ + 0.5 m $\Omega$ 15 $\mu\Omega/\Omega$ + 0.5 m $\Omega$ 15 $\mu\Omega/\Omega$ + 5 m $\Omega$ 15 $\mu\Omega/\Omega$ + 0.05 $\Omega$ 20 $\mu\Omega/\Omega$ + 2 $\Omega$ 55 $\mu\Omega/\Omega$ + 100 $\Omega$ 0.051 % + 1 k $\Omega$ 0.51 % + 10 k $\Omega$	HP 3458A
Electrical Calibration of RTD Indicating Systems <sup>3</sup> –  Pt 385, 100 $\Omega$ and Pt 392, 100 $\Omega$	(-200 to -100) $^{\circ}$ C (-100 to 100) $^{\circ}$ C (100 to 630) $^{\circ}$ C (630 to 850) $^{\circ}$ C	0.2 $^{\circ}$ C 0.15 $^{\circ}$ C 0.25 $^{\circ}$ C 0.35 $^{\circ}$ C	Datron 9100

Parameter/Range	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices <sup>3</sup> –			Datron 9100
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1000) °C (1000 to 1200) °C	0.3 °C 0.24 °C 0.26 °C 0.28 °C	
Type K	(-250 to -200) °C (-200 to -100) °C (-100 to 100) °C (100 to 600) °C (600 to 1372) °C	0.62 °C 0.32 °C 0.24 °C 0.28 °C 0.32 °C	
Type T	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 400) °C	0.64 °C 0.32 °C 0.27 °C 0.22 °C	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup>			Datron 9100
(0.001 to 10) mV	10 Hz to 3 kHz (3 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.05 % + 380 μV 0.05 % + 510 μV 0.07 % + 960 μV 0.1 % + 1.9 mV 0.21 % + 5.1 mV	
(10 to 32) mV	10 Hz to 3 kHz (3 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.05 % + 96 μV 0.05 % + 130 μV 0.07 % + 240 μV 0.1 % + 480 μV 0.21 % + 1.3 mV	
(32 to 320) mV	10 Hz to 3 kHz (3 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.05 % + 19 μV 0.05 % + 26 μV 0.07 % + 48 μV 0.1 % + 96 μV 0.21 % + 260 μV	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(0.32 to 3.2) V	10 Hz to 3 kHz (3 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.05 % + 190 μV 0.05 % + 260 μV 0.07 % + 480 μV 0.1 % + 960 μV 0.21 % + 2.6 mV	Datron 9100
(3.2 to 32) V	10 Hz to 3 kHz (3 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.05 % + 1.9 mV 0.07 % + 2.6 mV 0.09 % + 4.8 mV 0.16 % + 9.6 mV 0.36 % + 32 mV	
(32 to 105) V	10 Hz to 3 kHz (3 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.05 % + 6.3 mV 0.07 % + 8.4 mV 0.09 % + 16 mV 0.16 % + 32 mV 0.36 % + 110 mV	
(105 to 320) V	(40 to 100) Hz 100 Hz to 1 kHz (1 to 3) kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.06 % + 19 mV 0.06 % + 19 mV 0.09 % + 19 mV 0.09 % + 32 mV 0.13 % + 48 mV 0.16 % + 64 mV	
(320 to 800) V	(40 to 100) Hz 100 Hz to 1 kHz (1 to 3) kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.06 % + 63 mV 0.06 % + 63 mV 0.09 % + 63 mV 0.09 % + 110 mV 0.13 % + 160 mV 0.16 % + 210 mV	
(800 to 1050) V	(40 to 100) Hz 100 Hz to 1 kHz (1 to 3) kHz (3 to 10) kHz (10 to 20) kHz	0.06 % + 130 mV 0.06 % + 130 mV 0.09 % + 130 mV 0.09 % + 210 mV 0.13 % + 320 mV	

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
0.3 μV to 10 mV	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz	0.41 % + 32 μV 0.16 % + 25 μV 0.07 % + 25 μV 0.03 % + 25 μV 0.16 % + 25 μV 0.71 % + 35 μV 4 % + 70 μV	HP 3458A, AC Synchronous mode, AC band ≤ 2 MHz analog mode
(10 to 100) mV	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz (1 to 2) MHz	0.41 % + 20 μV 0.16 % + 20 μV 0.07 % + 10 μV 0.03 % + 10 μV 0.16 % + 40 μV 0.61 % + 80 μV 2 % + 500 μV 3 % + 600 μV 5 % + 200 μV 10 % + 5 mV	
100 mV to 1 V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz (1 to 2) MHz	0.41 % + 200 μV 0.16 % + 200 μV 0.07 % + 100 μV 0.03 % + 100 μV 0.16 % + 400 μV 0.61 % + 800 μV 2 % + 5 mV 3 % + 6 mV 5 % + 2 mV 10 % + 50 mV	
(1 to 10) V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz (1 to 2) MHz	0.41 % + 2 mV 0.16 % + 2 mV 0.07 % + 1 mV 0.03 % + 1 mV 0.16 % + 4 mV 0.61 % + 8 mV 2 % + 50 mV 3 % + 60 mV 5 % + 20 mV 10 % + 500 mV	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
(10 to 100) V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz	0.41 % + 20 mV 0.16 % + 20 mV 0.07 % + 10 mV 0.04 % + 10 mV 0.16 % + 40 mV 0.61 % + 80 mV 2 % + 500 mV 3 % + 600 mV 5 % + 2 V	HP 3458A, AC Synchronous mode, AC band $\leq$ 2 MHz analog mode
(100 to 1000) V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.43 % + 300 mV 0.18 % + 300 mV 0.09 % + 200 mV 0.07 % + 200 mV 0.16 % + 400 mV 0.61 % + 2 V	
AC Current – Generate <sup>3</sup>			
(0.001 to 32) $\mu$ A	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.08 % + 900 nA 0.11 % + 1.8 $\mu$ A 0.21 % + 6 $\mu$ A 0.26 % + 9 $\mu$ A	Datron 9100
(32 to 320) $\mu$ A	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.08 % + 300 nA 0.11 % + 600 nA 0.21 % + 2 $\mu$ A 0.26 % + 3 $\mu$ A	
320 $\mu$ A to 3.2 mA	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.08 % + 300 nA 0.11 % + 600 nA 0.21 % + 2 $\mu$ A 0.26 % + 3 $\mu$ A	
(3.2 to 32) mA	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.08 % + 3.2 $\mu$ A 0.11 % + 6.4 $\mu$ A 0.21 % + 13 $\mu$ A 0.26 % + 23 $\mu$ A	
(32 to 320) mA	10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (20 to 30) kHz	0.09 % + 32 $\mu$ A 0.11 % + 4.8 $\mu$ A 0.21 % + 64 $\mu$ A 0.26 % + 96 $\mu$ A	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
AC Current – Generate <sup>3</sup> (cont)			
320 mA to 3.2 A	10 Hz to 3 kHz (3 to 10) kHz	0.11 % + 480 $\mu$ A 0.26 % + 2.6 mA	Datron 9100
(3.2 to 10.5) A	10 Hz to 3 kHz (3 to 10) kHz	0.21 % + 3 mA 0.51 % + 10 mA	
AC Current – Measure <sup>3</sup>			
(5 to 100) nA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.41 % + 0.03 $\mu$ A 0.16 % + 0.03 $\mu$ A 0.07 % + 0.03 $\mu$ A 0.07 % + 0.03 $\mu$ A	HP 3458A
100 nA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.41 % + 0.2 $\mu$ A 0.16 % + 0.2 $\mu$ A 0.07 % + 0.2 $\mu$ A 0.04 % + 0.2 $\mu$ A	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.41 % + 2 $\mu$ A 0.16 % + 2 $\mu$ A 0.07 % + 2 $\mu$ A 0.04 % + 2 $\mu$ A	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.41 % + 20 $\mu$ A 0.16 % + 20 $\mu$ A 0.07 % + 20 $\mu$ A 0.04 % + 20 $\mu$ A	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.41 % + 200 $\mu$ A 0.16 % + 200 $\mu$ A 0.09 % + 200 $\mu$ A 0.11 % + 200 $\mu$ A	

II. Mechanical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Pressure <sup>3</sup> –			
Gauge Pressure			
Gas	(0.29 to 0.72) psig (0.72 to 15) psig (15 to 1000) psig (1000 to 10 000) psig	0.00015 psig 0.0032 % reading 0.0025 % reading 0.004 % reading	Deadweight tester
Oil	(20 to 100) psig (100 to 300) psig (300 to 20 000) psig	0.005 psig 0.005 % reading 0.0045 % reading	
Absolute/Vacuum Pressure			
Gas	(1.00 to 776) Torr  (0.72 to 50) psia (50 to 1000) psia	0.0776 Torr  0.0032 % reading 0.0025 % reading + 0.0015 psia	DHI RPM  Deadweight tester
Gas/Oil	(100 to 1000) psia	0.0025 % reading + 0.0015 psia	
Gas/Oil	(1000 to 10 000) psia	0.0040 % reading + 0.0015 psia	
Oil	(10 000 to 20 000) psia	0.0045 % reading + 0.0015 psia	
Differential Pressure			
Gas	0.5 in H <sub>2</sub> O to 5 psig	0.008 % reading	
Mass	(0.1 to 5) g (5 to 20) g (20 to 50) g (50 to 100) g (100 to 200) g (200 to 500) g (500 to 1000) g (1 to 2) kg (2 to 3) kg (3 to 4) kg (4 to 5) kg (5 to 16) kg	0.03 mg 0.05 mg 0.11 mg 0.36 mg 0.5 mg 5.6 mg 5.8 mg 6.9 mg 8.2 mg 12 mg 11 mg 310 mg	Mettler AT250 and Sartorius LC5100S balances, direct comparison to Class 1 weights           Mettler PM16, direct comparison to Class P weights

### III. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Temperature – Measuring Equipment <sup>3,6</sup>	-30 °C to 288 °C	0.062 °C	Hart PRT Hart 1502A

### IV. Time and Frequency

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
Frequency Measuring Equipment <sup>3</sup>	0.5 Hz to 10 MHz	30 parts in 10 <sup>6</sup>	Datron 9100
Frequency – Measure <sup>3</sup>	(1 to 40) Hz 40 Hz to 10 MHz	0.55 % of reading 0.015 % of reading	HP 3458A
Period – Measure <sup>3</sup>	1 s to 25 ms 25 ms to 100 ns	0.055 % of reading 0.015 % of reading	HP 3458A

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service, where noted.

<sup>2</sup> Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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.

<sup>3</sup> 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.

<sup>4</sup> Calibration and Measurement Capability is based upon 1-year specifications for the Datron 9100 and is read as a portion or percent of output plus a floor specification.

<sup>5</sup> Calibration and Measurement Capability is based upon 1-year specifications for the HP 3458A and is read as a portion or percent of reading plus a floor specification.

<sup>6</sup> Typical devices calibrated in the temperature area are RTDs, thermocouples, LiG thermometers, thermistors and PRTs.