

National Institute
of Standards and Technology



National Voluntary
Laboratory Accreditation Program

ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



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CALIBRATION LABORATORIES

NVLAP LAB CODE 200348-0

HART SCIENTIFIC CALIBRATION LABORATORY

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NVLAP Code: 20/A01

ANSI/NCSL Z540-1-1994; Part 1

Compliant

ELECTROMAGNETICS - DC/LOW FREQUENCY

NVLAP Labcode: 20/E05

DC Resistance

Range	Best Uncertainty (\pm) ^{note 1}	Remarks
1 Ω to 10 Ω	0.35 ppm	DC Resistance
10 Ω to 100 Ω	0.45 ppm	DC Resistance
100 Ω to 1000 Ω	0.60 ppm	DC Resistance
1000 Ω to 10000 Ω	0.70 ppm	DC Resistance

September 30, 2005

Effective through

A handwritten signature in black ink, appearing to read 'Tom J. Wiandt', is written over a horizontal line.

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NVLAP Code: 20/E05

Digital Thermometry - Indicators

Readout devices that actually measure resistance

Range	Best Uncertainty (\pm)^{note 1}	Remarks
0.25 to 4.0	0.20 ppm	Ratio Function
1 Ω	5 ppm	Resistance Function
10 Ω	4 ppm	Resistance Function
100 Ω	1 ppm	Resistance Function
10000 Ω	2 ppm	Resistance Function
0 Ω to 400 Ω	4 ppm	Resistance Function
400 Ω to 10 k Ω	8 ppm	Resistance Function
10 k Ω to 100 k Ω	8 ppm	Resistance Function
100 k Ω to 1 M Ω	25 ppm	Resistance Function

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NVLAP Code: 20/E06

Digital Thermometers Indicators

Readout devices that actually measure voltage

<i>Remarks</i>	<i>Best Uncertainty (\pm)^{note 1}</i>	<i>Remarks</i>
0 mV to 50 mV	0.45 μ V	Voltage Function
50 mV to 100 mV	0.75 μ V	Voltage Function

THERMODYNAMICS

NVLAP Code: 20/T07

Resistance Thermometry - Fixed Point Schedule 1

<i>Range</i>	<i>Best Uncertainty (\pm)^{note 1}</i>	<i>Remarks</i>
-197 °C (LN2) (TPAr substitution)	0.6 mK	Direct Comparison
-38.8344 °C (TPHg)	0.4 mK	Fixed Point
0.010 °C (TPW)	0.2 mK	Fixed Point
29.7646 °C (MPGa)	0.4 mK	Fixed Point
156.599 °C (FPIIn)	0.9 mK	Fixed Point
231.928 °C (FPSn)	0.9 mK	Fixed Point
419.527 °C (FPZn)	1.1 mK	Fixed Point

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660.323 °C (FPA1)	2.1 mK	Fixed Point
961.78 °C (FPAg)	10.0 mK	Fixed Point

Resistance Thermometry - Fixed Point Schedule 2

-197 °C (LN2)	1.0 mK	Routine Measurement Capability
-38.8344 °C (TPHg)	0.8 mK	Routine Measurement Capability
0.010 °C (TPW)	0.5 mK	Routine Measurement Capability
29.7646 °C (MPGa)	0.8 mK	Routine Measurement Capability
156.599 °C (FPIn)	1.5 mK	Routine Measurement Capability
231.928 °C (FPSn)	1.5 mK	Routine Measurement Capability
419.527 °C (FPZn)	1.8 mK	Routine Measurement Capability
660.323 °C (FPA1)	3.0 mK	Routine Measurement Capability

Resistance Thermometry Fixed Point Schedule 3

-197 °C (LN2)	2.0 mK	Single Power Calibration - any SPRTs
-38.8344 °C (TPHg)	2.0 mk	Single Power Calibration - any SPRTs
0.010 °C (TPW)	2.0 mk	Single Power Calibration - any SPRTs

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HART SCIENTIFIC CALIBRATION LABORATORY

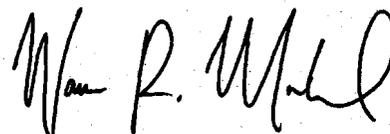
29.7646 °C (MPGa)	2.0 mk	Single Power Calibration - any SPRTs
156.599 °C (FPI _n)	3.0 mk	Single Power Calibration - any SPRTs
231.928 °C (FPS _n)	4.0 mk	Single Power Calibration - any SPRTs
419.527 °C (FPZ _n)	6.0 mk	Single Power Calibration - any SPRTs
660.232 °C (FPA ₁)	8.0 mk	Single Power Calibration - any SPRTs

Resistance Thermometry - Fixed Point Schedule 4 - Single Power Calibration in mini fixed Points

-197 °C (LN ₂)	6.0 mK	High Quality PRTs only
-100 °C	10.0 mK	High Quality PRTs only
-38.8344 °C (TPHg)	6.0 mK	High Quality PRTs only
0.010 °C (TPW)	4.0 mK	High Quality PRTs only
156.599 °C (FPI _n)	6.0 mK	High Quality PRTs only
231.928 °C (FPS _n)	6.0 mK	High Quality PRTs only
419.527 °C (FPZ _n)	9.0 mK	High Quality PRTs only
660.323 °C (FPA ₁)	14.0 mK	High Quality PRTs only

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Resistance Thermometry Comparison Schedule 1 - Single Power Calibration by Comparison

-200 °C	10 mK	High Quality PRTs only
-100 °C to -50 °C	10 mK	High Quality PRTs only
-50 °C to 0 °C	8 mK	High Quality PRTs only
0.010 °C	6 mK	High Quality PRTs only
0 °C to 200 °C	9 mK	High Quality PRTs only
200 °C to 300 °C	12 mK	High Quality PRTs only
300 °C to 400 °C	14 mK	High Quality PRTs only
400 °C to 500 °C	16 mK	High Quality PRTs only

Resistance Thermometry Comparison Schedule 2 - Single Power Calibration by Comparison

-200 °C	25 mK	Any Quality PRTs
-100 to -50 °C	25 mK	Any Quality PRTs
-50 to 0 °C	25 mK	Any Quality PRTs
0 to 100 °C	25 mK	Any Quality PRTs
100 to 300 °C	30 mK	Any Quality PRTs
300 to 420 °C	35 mK	Any Quality PRTs

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420 to 500 °C	45 mK	Any Quality PRTs
-20 °C to 100 °C	1.5 mK	Precision Thermistors
100 °C to 150 °C	3.0 mK	Precision Thermistors
-50 °C to -20 °C	5.0 mK	Thermistors
-20 °C to 120 °C	4.0 mK	Thermistors
120 °C to 150 °C	6.0 mK	Thermistors

Certification of Thermometric Fixed Point Cells

TPHg	0.20 mK	Direct Comparison To Reference Cells
TPW	0.07 mK	Direct Comparison To Reference Cells
MPGa	0.08 mK	Direct Comparison To Reference Cells
FPI _n	0.50 mK	Direct Comparison To Reference Cells
FPS _n	0.60 mK	Direct Comparison To Reference Cells
FPZ _n	0.80 mK	Direct Comparison To Reference Cells
FPAI	1.50 mK	Direct Comparison To Reference Cells

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FPAg	3.50 mK	Direct Comparison To Reference Cells
TPHg	0.25 mK	Direct Comparison to Working Cells
TPW	0.10 mK	Direct Comparison to Working Cells
MPGa	0.10 mK	Direct Comparison to Working Cells
FPIIn	0.70 mK	Direct Comparison to Working Cells
FPSn	0.80 mK	Direct Comparison to Working Cells
FPZn	1.00 mK	Direct Comparison to Working Cells
FPAI	1.80 mK	Direct Comparison to Working Cells
FPAg	4.50 mK	Direct Comparison to Working Cells

NVLAP Code: 20/T08
Thermocouples

Range	Best Uncertainty (\pm)^{note 1,2}	Remarks
Thermocouples - High Quality Thermocouples Only		
156.599 °C (FPIIn)	150 mK	Type S and Type R
231.928 °C (FPSn)	150 mK	Type S and Type R
419.527 °C (FPZn)	150 mK	Type S and Type R

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660.323 °C (FPA1)	150 mK	Type S and Type R
961.78 °C (FPAg)	150 mK	Type S and Type R
Digital Thermometers		
0 °C to 25.0 °C	10 mK	Internal Reference Junction Compensation
Thermocouples - High Quality Thermocouples Only		
0.010 °C (TPW)	10 mK	Au/PT
156.599 °C (FPIn)	20 mK	Au/PT
231.928 °C (FPSn)	20 mK	Au/PT
419.527 °C (FPZn)	20 mK	Au/PT
660.323 °C (FPA1)	20 mK	Au/PT
961.78 °C (FPAg)	20 mK	Au/PT
1000.00 °C (extrapolated)	25 mK	Au/PT

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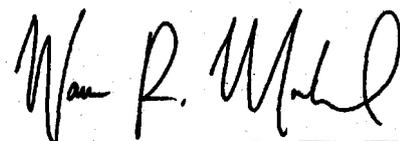
Digital Thermometer with PRT System

-200 °C	10 mK	Comparison or Mini Fixed Points
-100 to 50 °C	10 mK	Comparison or Mini Fixed Points
-50 to 0 °C	8 mK	Comparison or Mini Fixed Points
0.010 °C	5 mK	Comparison or Mini Fixed Points
0 to 200 °C	8 mK	Comparison or Mini Fixed Points
200 to 300 °C	9 mK	Comparison or Mini Fixed Points
300 to 400 °C	10 mK	Comparison or Mini Fixed Points
400 to 550 °C	11 mK	Comparison or Mini Fixed Points
660.323 °C (FPA1)	15.0 mK	Comparison or Mini Fixed Points

1. Represents an expanded uncertainty using a coverage factor, $k=2$.
2. Calibration of used thermocouples may result in larger uncertainties due to increase inhomogeneity.

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