

ICL CALIBRATION LABORATORIES, INC.



CERT. 526.01 CALIBRATION

ISO/IEC 17025 and ANSI/NCSL Z540-1 accredited
The specialists in ASTM and laboratory thermometers & hydrometers
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1501 Decker Avenue Suite 118 Stuart, FL 34994 USA
Tel: 772 286 7710 **1-800-713-6647**
Fax: 772 286 8737 E-mail: sales@iclib.com
Internet: www.iclib.com

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Report No. U185901 SO: 123456
Client: SAMPLE CUSTOMER
Date report issued: 05-16-2011
Page 1 of 3 pages

CALIBRATION REPORT FOR PRT & READOUT

THE INSTRUMENT DESCRIBED BELOW WAS EXAMINED AND TESTED IN ICL'S ISO/IEC 17025 ACCREDITED CALIBRATION LABORATORY, USING NIST TRACEABLE REFERENCE STANDARDS, IN ACCORDANCE WITH ICL'S ISO/IEC 17025 CALIBRATION PROCEDURE REFERENCED BELOW. THIS CALIBRATION MEETS THE REQUIREMENTS OF ISO/IEC 17025, ANSI/NCSL Z540-1-1994, (WHICH SUPERCEDED AND REPLACED MIL-STD 45662A), AND THE ISO-9000 AND QS-9000 SERIES OF QUALITY STANDARDS.

CUSTOMER INFORMATION

SAMPLE CUSTOMER
STREET ADDRESS
CITY, STATE ZIP

PURCHASE ORDER NUMBER: NOT AVAILABLE

SUBMITTED BY: SAMPLE COMPANY

DATES

DATE CALIBRATED: 05-16-2011

NEXT DUE (SPECIFIED BY CLIENT): May 16, 2012

INSTRUMENT DESCRIPTION

SENSOR INFORMATION:

MANUFACTURER: HART SCIENTIFIC
MODEL NO: 5614
SERIAL NO: XXXXXX
DESCRIPTION: 4 wire 100 Ohm secondary standard PRT
TEMPERATURE RANGE: -196/420C
ACCURACY TOLERANCE: +/- SEE BELOW
SENSOR IMMERSION: Minimum 6 inches recommended

READOUT DEVICE INFORMATION:

MANUFACTURER: HART SCIENTIFIC
MODEL NO: 1502A
SERIAL NO: XXXXXX
READOUT RESOLUTION: .001
ACCURACY TOLERANCE: +/- SEE BELOW
'AS FOUND' READOUT CALIBRATION CONSTANTS: Cal0: 0.0002 Cal100: -0.0009 Cal400: 0.0011
NO CHANGES WERE MADE TO THESE CONSTANTS.

NOTE: THE ACCURACY TOLERANCE FOR THIS SYSTEM CALIBRATION (SENSOR AND READOUT) IS THE ROOT SUM SQUARE OF THE ACCURACY TOLERANCE OF THE SENSOR AND THE ACCURACY TOLERANCE OF THE READOUT DEVICE.

SCALE TESTED: °C

RESULTS OF PHYSICAL EXAMINATION

THE PHYSICAL CONDITION OF THIS INSTRUMENT WAS SATISFACTORY AND IT APPEARED THAT ALL SYSTEMS WERE FUNCTIONAL. NO INSULATION RESISTANCE TEST WAS PERFORMED ON THIS SENSOR.

THE CONDITION OF THIS INSTRUMENT WAS SATISFACTORY WITH NO VISUALLY APPARENT DEFECTS, UNLESS NOTED BELOW.

CALIBRATION PROCEDURE USED ICL Procedure 05, which is drawn from ASTM E-77, ASTM E-644 and ASTM E-1137.



RESULTS OF CALIBRATION

Note: the 'As Found' readings were observed using coefficients resident in the non-volatile memory of the client's readout, which were:

RTPW: 100.027 a4: -7.52805E-04 b4: -3.02112E-05 a8: -7.44288E-04 b8: -8.80212E-05

'AS FOUND' VALUES:

NOMINAL TEST TEMPERATURE	ACTUAL TEST TEMPERATURE	READING OF UUT	CORRECTION	ACCEPT LIMIT* (+ or -)	P/M/F	MEASUREMENT UNCERTAINTY k=2
0.010°C	0.010°C	0.019°C	-0.009°C	0.0160°C	PASS	0.002°C
400.000°C	399.996°C	400.028°C	-0.032°C	0.0319°C	MARG**	0.020°C
200.000°C	199.996°C	200.010°C	-0.014°C	0.0190°C	PASS	0.013°C
-38.834°C	-38.833°C	-38.825°C	-0.008°C	0.0111°C	PASS	0.010°C
-196.000°C	-195.645°C	-195.653°C	0.008°C	0.0257°C	PASS	0.006°C
0.010°C	0.010°C	0.018°C	-0.008°C	0.0160°C	PASS	0.002°C

AS CAN BE DETERMINED FROM THE INFORMATION PRESENTED IN THE TABLE ABOVE, ONE OR MORE OF THE 'AS FOUND' READINGS OF THIS DEVICE WERE EITHER BEYOND THE 'ACCEPT LIMIT', RESULTING IN A DECLARATION OF 'MARGINAL', OR WERE BEYOND THE ACTUAL TOLERANCE. ACCORDINGLY, AN ADJUSTMENT WAS UNDERTAKEN.

THE NEW RESISTANCE AT THE TRIPLE POINT OF WATER (RTPW) VALUE OBSERVED WAS ENTERED INTO THE READOUT DEVICE, AND THE CALIBRATION WAS REPEATED TO OBTAIN THE 'AS LEFT' VALUES SHOWN IN THE FOLLOWING TABLE.

New RTPW (resistance at the triple point of water) value: 100.0305

Revised coefficients used for 'As Left' values:

RTPW: 100.0305 a4: -7.52805E-04 b4: -3.02112E-05 a8: -7.44288E-04 b8: -8.80212E-05

'AS LEFT' VALUES:

NOMINAL TEST TEMPERATURE	ACTUAL TEST TEMPERATURE	READING OF UUT	CORRECTION	ACCEPT LIMIT* (+ or -)	P/M/F	MEASUREMENT UNCERTAINTY k=2
0.010°C	0.010°C	0.010°C	0.000°C	0.0160°C	PASS	0.002°C
400.000°C	399.996°C	400.005°C	-0.009°C	0.0319°C	PASS	0.020°C
200.000°C	199.996°C	199.994°C	0.002°C	0.0190°C	PASS	0.013°C
-38.834°C	-38.834°C	-38.832°C	-0.002°C	0.0111°C	PASS	0.010°C
-196.000°C	-195.645°C	-195.652°C	0.007°C	0.0257°C	PASS	0.006°C
0.010°C	0.010°C	0.009°C	0.001°C	0.0160°C	PASS	0.002°C

*ACCEPT LIMIT(s) The acceptance limit(s) shown above represent a statistical evaluation of the instrument's tolerance relative to the uncertainty of the measurement. If required, the acceptance limit is set to a value smaller than the tolerance. The difference between the tolerance and the acceptance limit is the 'guard band'. The guard band is imposed to reduce the probability of a false acceptance (PFA), or a false failure, to less than 2%.

P/M/F Accordingly, there are three possible calibration outcomes:

1. PASS The calibration result falls within the interval described by the test point + or - (the tolerance MINUS the guard band).
2. MARG** (marginal) The calibration result is 'borderline', or indeterminate; it is therefore statistically and metrologically imprudent to declare that the instrument is definitively either 'in-tolerance' or 'out-of-tolerance'.
3. FAIL The calibration result falls outside the interval described by the test point + or - (the tolerance PLUS the guard band).

The methodology and equations used for determination of guard bands and acceptance limits comply with the requirements of ANSI/NCSL Z540.3

Our best measurement capabilities are: at Liquid Nitrogen (approximately -196C), +/- 6.2 mK; from -80 to 0C, +/- 8.9 mK; at 0C, +/- 3.9 mK; at 0.01C (TPW), +/-1.9 mK; from 0.01 to 100C, +/- 8.5 mK; from 100 to 200C, +/- 9.4 mK; from 200 to 300C, +/- 9.8 mK; from 300 to 420C, +/- 14 mK; from 420 to 500C, +/- 0.034C; from 500 to 700C, +/- 0.26C; from 700 to 1000C, +/- 0.86C. These uncertainties have been calculated utilizing the methods elaborated in NIST Technical Note 1297 and the ANSI-NCSL document Z-540-2 entitled 'Guide to the Expression of Uncertainty in Measurement', commonly referred to as the 'GUM'. A coverage factor of 2 sigma (k=2) has been applied to the standard uncertainty in order to express the expanded uncertainty at approximately a 95% confidence level.

THE UNCERTAINTIES PRESENTED ABOVE IN THE 'RESULTS' TABLE WILL BE LARGER THAN OUR SYSTEM UNCERTAINTIES, AS THE RESOLUTION OF THIS READOUT, 0.001°C, AND OTHER CONTRIBUTIONS HAVE BEEN FACTORED INTO THE CALCULATION.

THE EXPANDED UNCERTAINTIES (K=2) REPORTED HERE DO NOT CONTAIN ESTIMATES FOR (1) ANY EFFECTS THAT MAY BE INTRODUCED BY TRANSPORTATION OF THE INSTRUMENT BETWEEN ICL AND THE USER'S LABORATORY, (2) DRIFT OF THE INSTRUMENT, (3) HYSTERESIS OF THE INSTRUMENT, OR (4) ANY MEASUREMENT UNCERTAINTIES INTRODUCED BY THE USER.

LABORATORY ENVIRONMENTAL CONDITIONS: TEMPERATURE: 23°C +/- 2°C RELATIVE HUMIDITY: BETWEEN 40% AND 60%

ALL TEMPERATURES GIVEN IN THIS REPORT ARE THOSE DEFINED BY THE INTERNATIONAL TEMPERATURE SCALE OF 1990 (ITS-90)

THIS CALIBRATION WAS PERFORMED BY: J. JEFF KELLY

THE CALIBRATION PERFORMED AND DOCUMENTED BY THIS CALIBRATION REPORT IS A FULL SCALE CALIBRATION AND NO LIMITATIONS OF USE ARE IMPOSED ON THIS INSTRUMENT.

TRACEABILITY INFORMATION

This calibration is traceable to NIST through an unbroken chain of comparisons. The reference standard is used to calibrate the transfer standard, which in turn is used to calibrate the client's instrument. Each step in the chain is fully documented, and measurement uncertainty at each step has been calculated.

Our NIST primary reference thermometer from -196 to 420C is a Rosemount 162CE, 25.5 Ohm SPRT, serial no. 5206, calibrated by NIST on April 1, 2009. NIST GMP-11 recommends a 36 month calibration cycle for SPRTs. Transfer standards PRTs are calibrated against this reference standard annually.

Our primary standard for temperatures above 420C to 1000C is a Hart Scientific model 5624 10 Ohm platinum resistance thermometer, serial number 0105, our MTE-243, calibrated traceable to NIST by Hart Scientific.

COMPARATORS USED IN PERFORMANCE OF THIS CALIBRATION

Nominal Temp	Comparator	MTE#	Manufacturer
0.010°C	TPW Maint bath	311	Hart Scientific
400.000°C	6050H Salt bath	239	Hart Scientific
200.000°C	6050H Salt bath	240	Hart Scientific
-38.834°C	7080 alc bath	023	Hart Scientific
-196.000°C	LN comparator	220	Hart Scientific
0.010°C	TPW Maint bath	311	Hart Scientific

TRANSFER AND CHECK STANDARDS USED IN PERFORMANCE OF THIS CALIBRATION

Nominal Temp	Transfer Standard	MTE#	Manufacturer	Next Due	Position
0.010°C	TPW Cell BG2217	312	Hart Scientific	03/29/12	Standard
400.000°C	5628-15 PRT 0992	252	Hart Scientific	06/01/11	Standard
	5628-15 PRT 1208	269	Hart Scientific	06/01/11	Check standard
200.000°C	5628-15 PRT 0992	252	Hart Scientific	06/01/11	Standard
	5628-15 PRT 1208	269	Hart Scientific	06/01/11	Check standard
-38.834°C	5628-15 PRT 1755	306	Hart Scientific	06/01/11	Standard
	5628-15 PRT 1751	305	Hart Scientific	06/01/11	Check standard
-196.000°C	5628-15 PRT 0541	237	Hart Scientific	06/01/11	Standard
	5628-15 PRT 1100	290	Hart Scientific	06/01/11	Check standard
0.010°C	TPW Cell BG2217	312	Hart Scientific	03/29/12	Standard

THERMOMETER READOUT(S) USED TO READ THIS UUT

All readings of this sensor were observed using customer's readout s/n: XXXXXX

ICL CALIBRATION LABORATORIES, INC.

An ISO/IEC 17025 & ANSI/NCSL Z-540-1 accredited laboratory - American Association for Laboratory Accreditation Certificate #526.01

J. Jeff Kelly, Technical Director
Deborah M. Weber, Quality Deputy

This document prepared by LORI PARR and reviewed by KAREN MANGOLD

DATE CALIBRATED: 05-16-2011 RECALIBRATION DATE SPECIFIED BY CLIENT: May 16, 2012

NIST GMP-11 (Mar '03), 'Good Measurement Practice for Assignment and Adjustment of Calibration Intervals for Standards' cautions that, 'Temperature standards are dynamic with use. Shock, contamination and other factors can cause drift from accepted values'. Table 4 of GMP-11 recommends recalibration of liquid-in-glass thermometers, standard thermistors and PRTs at 12 month intervals. Liquid-in-glass thermometers used for 'Temperature Critical Parameters' should be recalibrated at 6 month intervals. NIST GMP-11 is available for download in Adobe .pdf format on our website at www.icllabs.com Follow the link for 'Downloads'.

The user should be aware that any number of factors may cause this instrument to drift out of calibration before the specified calibration interval has expired.

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