

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

WORK ORDER

Processed by RCRUZ at 9:31:33AM on 6/14/01

||||| ||||| ||||| ||||| ||||| ||||| ||||| |||||

Work Order 444044064

Arrived 6/14/01

Asset No. 008769 Manufacturer VAISALA

Model HMP235

Instrument Type/Class HUMIDITY/TEMP TRANSMITTER

Serial No. W1840062

Accessory No.

Calibration Procedure CL-61, 6/99

Location

Div/Client DIV20

Custodian JIM PRIKRYL

Mail Stop B57

Tel. X5667

Charge/Project No. 00751.006 1.20

Delivered By / Telephone

IN4CAL

Special Instructions _____

WORK NOTES

Date	Hours	Remarks/Notes
<u>6/18</u>	<u>1.5</u>	<u>Cal</u>

REPAIR PARTS

Date	Hours	Part Name	Part Number	Failure Description	Cost

WORK SUMMARY

Failure Description N/A

Repair Action N/A

Calibration Procedure CL-61, 6/99 Temp 79 F Hum. 42 %

Tech R Dykster Totals Cal Hours 1.5 Repair Hours _____ Parts Cost _____

Standards Used GA04, 0219, 0144, 0658

Date Picked Up 6/22/01

Picked Up By

James D. Pyle

44064

Measurement uncertainty Budget for Visaila Temperature/Humidity transmitter model HMP235.

UUT Characteristics

Performance Specifications

Humidity

Range: 0 to 100 %RH

Tolerance: 1.0%RH.(0 to 90), 2%RH (90 to 100)

Temperature

Tolerance: 0.2 Degree C @ 20 Degree C

The following are assumptions and estimates used in the measurement uncertainty budget.

a.) The formula for %R.H. is (mAmp reading - 4) * 6.25. The accuracy of the Amp meter is +/- (0.2% of reading + 2 counts.) @ +15 to 40 degree C Worst case using Tektronics DM501 meter.

1.) The indication at 25 % RH is 8 mA. The accuracy is +/- 0.018 mA. This would correspond to 0.1125 % RH.

2.) The indication at 50 % RH is 12 mA. The accuracy is +/- 0.026 mA. This would correspond to 0.1625 % RH.

3.) The indication at 75 % RH is 16 mA. The accuracy is +/- 0.032 mA. This would correspond to 0.20 % RH.

b.) The formula for %R.H. is (mAmp reading - 4) * 12.5. The accuracy of the Amp meter is +/- (0.2% of reading + 2 counts.) @ +15 to 40 degree C Worst case using Tektronics DM501 meter.

1.) The indication at 20 Degree C is 7.2 mA. The accuracy is +/- 0.016 mA. This would correspond to 0.20 % RH.

UUT Tolerance

1 % RH

Measurement uncertainty Budget for Relative Humidity at 25 % RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Standard Accuracy for Ind.	0.1125	Rectangular	Sqrt 3	0.06
Combined Uncertainty			RSS	0.26
Expanded Uncertainty			K=2	0.52

TUR 1.9 to 1

UUT Tolerance

1 % RH

Measurement uncertainty Budget for Relative Humidity at 50% RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Standard Accuracy for Ind.	0.1625	Rectangular	Sqrt 3	0.09
Combined Uncertainty			RSS	0.27
Expanded Uncertainty			K=2	0.53

TUR 1.87 to 1

UUT Tolerance

1 % RH

Measurement uncertainty Budget for Relative Humidity at 75% RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Standard Accuracy for Ind.	0.2	Rectangular	Sqrt 3	0.12
Combined Uncertainty	RSS			0.28
Expanded Uncertainty	K=2			0.55

TUR 1.82 to 1

UUT Tolerance

0.2 Degree C

Measurement uncertainty Budget for temperature @ 20 Deg C.

Source of uncertainty	Value +/- Deg C	Distribution	Divisor	Standard Uncertainty Deg C
Standard	0.03	Rectangular	Sqrt 3	0.02
Chamber uniformity	0.1	Rectangular	Sqrt 3	0.06
Standard Accuracy for Ind.	0.2	Rectangular	Sqrt 3	0.12
Combined Uncertainty	RSS			0.13
Expanded Uncertainty	K=2			0.3

TUR .7 to 1

Prepared By: R Dykstra

Date: 6/18/01

Verified By:

Date:



Certificate of Calibration

Behind A# 007455

Report # 051501 W1840062 S.O.# 74327

Calibration Date: 15 May 01

Instrument Model: HMP235

Serial Number: W1840062

Instrument Range: 0 to 100%RH

Calibration Procedure: 11603019 Rev. F

Accuracy: Relative Humidity: $\pm 1\%RH$ (0 to 90%RH), $\pm 2\%RH$ (90 to 100%RH).

Accuracy: Temperature; $\pm 0.2\text{ }^\circ\text{C}$ @ 20 $^\circ\text{C}$

Recommended calibration due date 15 May 02

Customer: SOUTHWEST RESEARCH INST.

City, State: SAN ANTONIO, TX

This unit was calibrated by adjusting its reading at 0% against dry nitrogen and at 75% against reference humidity and temperature instrument, Vaisala model HMP233. Additional instrument verification checkpoints were made against HMP233 reference at 11%RH and 97%RH. Calibration and instrument verification sequences utilize dry nitrogen and a set of controlled aqueous salt solutions Vaisala model HMK13B. Laboratory ambient conditions are maintained at a temperature of 22 $^\circ\text{C} \pm 1\text{ }^\circ\text{C}$ with relative humidity level of 50%RH $\pm 5\%RH$. The calibration uncertainty is presented at 95% confidence level, k=2. The calibration uncertainty is $\pm 0.6\%RH$.

Calibration Data

Temperature Calibration ($^\circ\text{C}$)

Reference	Unit Under Test	Error	Tolerance
+ 22.22	+ 22.40	+ 0.18	$\pm 0.20\text{ }^\circ\text{C}$

Humidity Calibration (%RH)

Reference	Unit Under Test	Error	Tolerance
+ 0.10	+ 0.10	0.00	± 1.00
+ 11.30	+ 11.50	+ 0.20	± 1.00
+ 75.44	+ 75.40	- 0.04	± 1.00
+ 97.60	+ 96.30	- 1.30	± 2.00

The results of this calibration is traceable to the National Institute of Standards and Technology through NIST Test Report Number TN 264532 dated 02-Nov-00. Vaisala's calibration system has been established to meet the requirements of ANSI/NCS Z540-1-1994. This certificate can not be reproduced except in full, without the expressed written consent of Vaisala.

Calibration Equipment Used: Workstation 9

Model	Serial Number	Calibrate Date	Due Date
Power Supply	134169	27-Nov-00	27-Nov-02
Fluke 45	6565002	01-Sep-00	01-Sep-01
HMK13B	P3940000	04-May-01	04-Nov-01
HMP233	V4310012	30-Apr-01	30-Jul-01

Ambient Conditions
Humidity: 50.5%RH
Temperature: 22.2' C

Technical Operator
Linda Hall

Deputy
Linda Hall

Mailing address:

Vaisala Inc. Tel. (781) 933-4500
100 Commerce Way Fax (781) 933-8029
Woburn, MA 01801-1068 <http://www.vaisala.com>



Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
(210) 522-5215
Department of Quality Assurance
Calibration Laboratory



Certificate #
0972-01

Certificate of Calibration

19 June 2001

Issued to: JIM PRIKRYL DIV20 B57
Manufacturer/Model: VAISALA HMP235
Description: HUMIDITY/TEMP TRANSMITTER
Serial Number: W1840062
Asset Number: 008769
Work Order Number: 444044064

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCCL Z540-1-1994. The results of this calibration relate only to the individual item as described above. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results of this calibration certificate were determined in accordance with the terms of accreditation unless stated otherwise below.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

Ambient Conditions: Temperature: 79.0 Degrees Fahrenheit Humidity: 42 % RH

Calibration Date: 19 Jun 01 **Calibration Procedure:** CL-61, 6/99

Condition as Received: SEE REMARKS

Condition as Released: SEE REMARKS

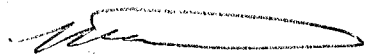
Remarks: SEE ATTACHED DATA SHEET FOR UNCERTAINTY

Approved by:



Walt Hill, Supervisor
Institute Calibration Laboratory

Measurements performed by:



Roger Dykstra, Technician

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

WORK ORDER

Received by AANDERSON, 6/3/02 1:10:15PM



Arrived 6/3/02

Work Order **444048826**

Asset No. 008769 Manufacturer VAISALA

Model HMP235

Equipment Type HUMIDITY/TEMP TRANSMITTER

Serial No. W1840062

Accessory No.

Interval 12 M

Calibration Procedure CL-61, 6/99

Location

Div/Client DIV20

Custodian JIM PRIKRYL

Mail Stop B57

Tel 5667

IN LINE

Special Instructions _____

Notify before adjustments or repairs. () Provide data with certificate () Certificate Typ _____

Charge/Project No. 00751.006 1.20

Requester / Telephone JIM PRIKRYL

This information is correct for the work requested.

WORK NOTES

Date	Hours	Remarks/Notes
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Date	Hours	Part Name	Part Number	Failure Description	Cost
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

WORK SUMMARY

Failure Description _____

Repair Action _____

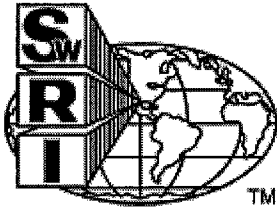
Tech U. Moore Cal Hrs. _____ Repair Hrs. _____ Parts Cost _____ Temp 73 F Hum. 56 %

Standards Used _____

Date Picked Up 6/11/02

Picked Up By James D. Pyl

48826



Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
(210) 522-5215
Department of Quality Assurance
Calibration Laboratory

Certificate of Calibration

7 June 2002

Issued to: JIM PRIKRYL DIV20 B57
Manufacturer/Model: VAISALA HMP235
Description: HUMIDITY/TEMP TRANSMITTER
Serial Number: W1840062
Asset Number: 008769
Work Order Number: 444048826

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

Ambient Conditions: Temperature: 73.0 Degrees Fahrenheit Humidity: 56 % RH

Calibration Date: 5 Jun 02 **Calibration Procedure:** CL-61, 6/99

Condition as Received: SEE ATTACHED DATA

Condition as Returned: SEE ATTACHED DATA

Remarks:

Approved by:

Walt Hill, Metrology Group Leader
Institute Calibration Laboratory

Measurements performed by:

Vince Morales, Technician