

# 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-G1, 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
6/18	1.5	Cal

### REPAIR PARTS

Date	Hours	Part Name	Part Number	Failure Description	Cost

### WORK SUMMARY

Failure Description N/A

Repair Action N/A

Calibration Procedure CL-G1, 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

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

Humidity

Performance Specifications

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
Expanded Uncertainty				K=2

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
Expanded Uncertainty				K=2

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:

## Calibration Data Sheet

**Remarks:** The following readings are provided with an expanded uncertainty  $K=2$  with an approximate confidence level of 95%.

Page 1 of 1



# Certificate of Calibration

Page 1 of 1

Report # 051501 W1840062 S.O.# 74327

Instrument Model: HMP235

Instrument Range: 0 to 100%RH

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  $^{\circ}\text{C}$

Calibration Date: 15 May 01

Serial Number: W1840062

Calibration Procedure: 11603019 Rev. F

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  $22\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  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	$\pm 1.00$
+ 11.30	+ 11.50	+ 0.20	$\pm 1.00$
+ 75.44	+ 75.40	- 0.04	$\pm 1.00$
+ 97.60	+ 96.30	- 1.30	$\pm 2.00$

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  $^{\circ}\text{C}$

Technical Operator

Linda Hall

Deputy  
Linda Hall

### Mailing address:

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

11604100



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 Type \_\_\_\_\_

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. Mordale Cal Hrs. \_\_\_\_\_ Repair Hrs. \_\_\_\_\_ Parts Cost \_\_\_\_\_ Temp 73 F Hum. 56 %

Standards Used \_\_\_\_\_

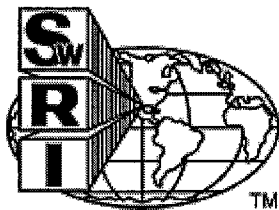
Date Picked Up 6/11/02

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