
**2010 Site Installation and Calibration Report
Whiteface Mountain Summit, NY
Cloud-water Monitoring Site
Installation and Calibration Report**

Prepared for:

New York State Department of Environmental Conservation

Prepared by:



**1128 NW 39th Drive
Gainesville, FL 32605**

May 2010

Table of Contents

1.0 Site Activities	1
2.0 Modifications and Repairs	1
3.0 Calibration Summary	5
4.0 Results and Recommendations	6

List of Appendices

Appendix 1	Calibration Results
Appendix 2	Transfer Instrument Certifications

List of Tables

Table 1.	Recorded Parameters.....	2
Table 2.	Digital Triggered Event Programs.....	4
Table 3.	Alarm Programs.....	4

List of Acronyms and Abbreviations

ALSC	Adirondack Lake Survey Corporation
DAS	data acquisition system
DEC	Department of Environmental Conservation
EEMS	Environmental, Engineering & Measurement Services, Inc.
m/s	meters per second

1.0 Site Activities

Environmental, Engineering & Measurement Services, Inc. (EEMS) performed site activities on May 27th and 28th, 2010 at the New York State Department of Environmental Conservation (DEC) cloud-water monitoring site, at the Whiteface Mountain Summit Station operated by Adirondack Lake Survey Corporation (ALSC) personnel. The activities for the beginning of the season included the installation and calibration of the site instrumentation and equipment functionality tests.

The permanent junction box again proved to be helpful during the site activation this season. The sensors and collector were mounted on the roof of the station and signals were connected to the data logger via the junction box and signal cable. Air lines were connected from the junction box to the collector lift cylinder and the deionized water wash tank.

2.0 Modifications and Repairs

Rain Sensor

The new rain sensor procured last season was installed. It was initially installed directly to the DAS panel in the instrument rack in order to test and adjust the sensor interface circuit. Following the repair of a loose connection on the sensor input circuit on the rear of the DAS, the rain sensor and other system inputs were functioning properly.

Wind Direction and Wind Speed

The wind direction sensor interface circuit which had been installed in the sensor for last season's operation was removed. The wind direction sensor was returned to the normal wiring and operation using the new Met-Card which had been installed in the DAS during the site deactivation in the fall of 2009.

The replacement bearings were installed in the wind sensor and the starting threshold was tested. The starting threshold of the new bearings was higher than the old bearings. The old bearings were reinstalled and tested. The wind speed starting threshold was 0.5 g-cm with the old bearings and within acceptable limits.

Solar Radiation

The solar radiation sensor interface circuit was removed from the DAS panel in the instrument rack and relocated to the roof of the structure. By making this installation modification the solar

radiation signal is converted from a current signal to a voltage signal prior to routing to the DAS. This change seemed to improve the signal stability and reduce the noise which was previously present. Due to the other repairs undertaken during the site installation, time did not permit the comparison of the signal with the transfer standard, however the system was calibrated at a different location prior to being provided to NY DEC and the output seemed reasonable.

Float Switch

The replacement float switch used to indicate when the sample accumulator is full did not work properly last season. The switch was tested and found to be a normally “open” switch which is opposite from the switch that failed and was removed. The DAS logic was changed to accommodate the operation of the new switch.

DAS Parameters

There were a few changes to the data logger configuration for this season. The wind direction and wind speed signals were moved back to the Met-Card. The solar radiation full-scale was adjusted to the proper level of 1396 w/m² per volt. The float switch logic was corrected, and the unused sample bottle turntable control functions were removed.

The current DAS inputs, alarms, and control configurations are reflected in Tables 1, 2, and 3 below.

Table 1. Recorded Parameters

Parameter	Description	Units
TEMP	temperature	°C
LWC-1	liquid water content	g/m ³
PSA-1	cloud particle size	cm ² /m ³
SR	solar radiation	w/m ²
R-SENSOR	rain sensor	Yes/no
RAIN-HR	calculated, number of minutes of rain per hour	min
CLOUD	triggered by WSP, TEMP, LWC-1, R-SENSOR, and FULL to indicate cloud event	Yes/no
DEPLOY	rolling average (currently 2 min) of CLOUD to deploy collector	Yes/no
CONFIRM	status input from collector in up position	Yes/no

Parameter	Description	Units
CLOUD-HR	calculated, number of minutes sampler deployed per hour	min
FULL	float switch input, minutes accumulator was full per hour	Min-left
TB-RAIN	tipping bucket rain gauge	inches
WSP	scalar wind speed	m/s
V-WSP	vector averaged wind speed	m/s
V-WDR	vector averaged wind direction	degrees
SIG-T	calculated, Sigma Theta (wind direction variation)	degrees
LWC-2	liquid water content – second Gerber	g/m ³
PSA-2	cloud particle size – second Gerber	cm ² /m ³
TEMP	temperature	°C
LWC-1	liquid water content	g/m ³
PSA-1	cloud particle size	cm ² /m ³
SR	solar radiation	w/m ²
R-SENSOR	rain sensor	Yes/no
RAIN-HR	calculated, number of minutes of rain per hour	min

With the exception of the SIG-T parameter, one minute and hourly averaged data for all input parameters are stored by the DAS. This year the storage space allotted for minute-average data continues to be four days of stored data. As in previous years, hourly data are stored for nine days on the DAS.

Polling of the DAS is required at least every four days to download site data and populate the database maintained by the DEC. The DAS can also be polled locally by the site computer running the ESC polling software. Polling one minute averaged data will permit more discrete correlation of sample chemistry with sample collection properties and aid in the data validation process.

The SIG-T parameter calculates hourly averages of the variation in vector wind direction (Sigma Theta) using 15 minute averages as input values. The calculation equation can be found in the ESC data logger manual.

The RAIN-HR and CLOUD-HR parameters are summations of the minutes from the R-SENSOR and CONFIRM parameters for each hour, or the total time of rain and cloud sampling per hour.

The SAMPLE parameter monitors the CLOUD-HR parameter each hour and assigns either a “0” if there are no minutes of sampling, or a “1” if any sampling occurred.

Control Functions

Alarm programs monitor individual or multiple input parameters for assigned data values. When the data value for the designated average period of the monitored parameter(s) match the assigned level within each program, the control output switching occurs. Multiple “high” and “low” alarm levels and multiple switches can be used to allow complex control. Table 2 summarizes the Digital Triggered Event Programs and Table 3 summarizes the Alarm Programs.

Table 2. Digital Triggered Event Programs

Program	Description
CLOUD	monitors WSP, TEMP, LWC-1, R-SENSOR, and FULL alarm status to send signal to CLOUD parameter
FILL	opens the valve to drain the accumulator into the sample bottle if a sample was collected
RAIN	monitors the R-SENSOR status and switches sample line to waste, turns on rain sensor heater, and signals CLOUD parameter if rain event

Table 3. Alarm Programs

Program	Description
RAIN	monitors R-SENSOR parameter for low value to signal the CLOUD event status
DEPLOY	monitors DEPLOY parameter for a high value
SAMPLE	monitors CLOUD-HR parameter for a high value
COLLECT	monitors CONFIRM parameter for a high value to switch from waste to accumulator after the sample line is conditioned
DELAY-S	monitors CONFIRM parameter for a high value to condition the line and allow rinse water to go to waste, before switching to accumulator

Program	Description
SPRAY	monitors CONFIRM parameter for a low value to wash the collector after it lowers
FULL	monitors FULL parameter for a high value to switch the sample line to waste and signal the CLOUD event status
TEMP	monitors the TEMP parameter for a high value (currently 1 °C) to signal the CLOUD event status
LWC	monitors the LWC-1 parameter for a high value (currently 0.05 g/m ³) to signal the CLOUD event status
WSP	monitors the WSP parameter for a high value (currently 2.5 m/s) to signal the CLOUD event status

The program is designed to match the operation of the old system as closely as possible, however all recorded parameters, triggered events, and alarm programs can be modified to achieve more efficient, or other goals if desired. Alarm levels can be changed to collect more discrete samples differentiated by wind direction, temperature, LWC, or other parameters. Collection time can be altered to automatically discard samples collected during short events with low LWC. The flexibility of the system and availability of the expanded database will allow more comprehensive use of the data by various researchers.

3.0 Calibration Summary

Since the site was not operational upon arrival, all calibration results are submitted as adjusted (or as-left) results. Adjustments were made to the sensor interfaces as necessary, which corrected the signal outputs with comparison to the transfer standards. The differences between the site response and the transfer response are presented with the calibration results in Appendix 1. These are within normal acceptable ranges for the operation of this type of equipment.

Certification results of the transfer instruments used during the site activities are included in Appendix 2. These are provided as a means to trace the site calibration results to a higher standard.

4.0 Results and Recommendations

At the conclusion of the site activities on May 28, 2010, all of the cloud monitoring and support instrumentation was calibrated, tested, and functioning properly to the satisfaction of EEMS and ALSC personnel. The operational tests included the review of the various meteorological sensor outputs for reasonable values. Several tests of the up/down motion of the cloud collector and corresponding response when simulating a rain event and a full accumulator event were conducted.

It is suggested that the wind sensor be refurbished after this season. This should include a new potentiometer and both wind speed and wind direction bearings. EEMS will perform this service in order to ensure that replacement sensor bearings are within acceptable limits prior to site installation for next season.

EEMS is available to assist ALSC personnel via telephone and e-mail during the 2010 sampling season to evaluate and troubleshoot the system. EEMS personnel will also be available at the end of the sampling season to perform an instrument calibration check to document that the operation of the equipment remained within specifications. EEMS is pleased to provide any assistance that the DEC might have with regards to the recommended repairs and the continued or improved operation of the cloud-water monitoring site at Whiteface Mountain Summit.

Appendix 1

Calibration Results

Temperature Audit Information

Site: Whiteface Mountain Summit, NY

Date: 5/27/2010

site system

sensor manufacturer	RM Young
sensor s/n	13707

DAS s/n	4876
---------	------

transfer system

RTD manufacturer	Eutechnic
RTD s/n	eems# 01230

transfer slope	0.99928
transfer intercept	0.03889
transfer correlation coefficient	1.00000
certification date	1/5/2010

RTD deg C	RTD corrected deg C	site response (from DAS) volts dc	site response (from DAS) deg C	difference deg C
0.14	0.10	0.4987	-0.13	-0.23
17.44	17.41	0.6715	17.15	-0.26
39.80	39.79	0.8957	39.57	-0.22
26.70	26.68	0.7641	26.41	-0.27
average	20.9963		20.75	-0.25

Wind System Audit Information

Site: Whiteface Mountain Summit, NY

Date: 5/27/2010

site system	
sensor manufacturer	RM Young
sensor s/n	49822
model	RE
prop s/n	77056
prop correction factor	0.0051
NYS #	138498
DAS s/n	4876
prop torque	0.5 g-cm
vane torque	12 g-cm

transfer system	
motor mfg:	RM Young
model	18802
motor s/n	CA02777
EEMS #	01262
certification date:	1/13/2010
tranist # 192034	
certification date:	1/15/2010
MD -14.5	SR pipe = 173

wind direction

	direction degrees	site response (from DAS) volts dc	site response (from DAS) degrees	difference degrees	absolute
	° True				
crossarm	263		261	-2	2
crossarm	83		88	5	5
	360		360	0	0
	90		88	-2	2
	180		179	-1	1
	270		270	0	0
	average				1.7

wind speed

input rpm	equivalent m/s	site response volts	site response m/s	%diff	difference m/s
0	< 0.2	0.0068	0.10		N/A
200	1.02	0.0247	1.10		0.074
400	2.05	0.0456	2.10		0.048
800	4.10	0.0855	4.09		-0.004
1800	9.22	0.1828	9.08	-1.5%	-0.13
3800	19.46	0.3785	19.06	-2.0%	-0.40
8800	45.06	0.8673	44.01	-2.3%	-1.05
	average				-0.24

Tipping Bucket Audit Information

Site: Whiteface Mountain Summit, NY

Date: 5/27/2010

site system

DAS manufacturer	ESC
DAS model	8816
DAS s/n	4876
gauge manufacturer	Texas Elec
gauge s/n	36011-505

transfer system

manufacturer	PMP
model	EW-06134-50
	calibrated 250 ml
EEMS #	01250

input ml	input inches	DAS response inches	difference inches	%
231.5	0.50	0.48	-0.02	-4.0%
231.5	0.50	0.49	-0.01	-2.0%

average error **-0.02**

average % difference **-3.0%**

Appendix 2

Transfer Instrument Certifications

1420 75th St. SW
 Everett, Washington 98203
 USA



Calibration Certificate

NQA ISO 9000:2000 (10100/2)

Description:	TRUE RMS MULTIMETER	Certificate Number:	1567749-86590148:1262607160
Manufacturer:	FLUKE	Date of Calibration:	04 January 2010
Model:	187	Date of Certificate:	04 January 2010
Serial Number:	86590148	Date Due:	04 January 2011
Customer Name:	EEMS	Procedure Name:	FLUKE 187: (1 YEAR) ZCAL VER RS-232 /5520
City, State:	GAINESVILLE, FL	Procedure Revision:	2.0
Customer Item ID:	86590148	Data Type:	FOUND-LEFT
PO Number:	CCS CHARLES K HALBROOK	Temperature:	22.08 °Celsius
RMA Number:	4371587	Relative Humidity:	30 %
Result Summary:	PASS		

The Data type that could be found in this certificate must be interpreted as:

- As-Found - Calibration data collected before the unit is adjusted and/or repaired.
- As-Left - Calibration data collected after the unit is adjusted and/or repaired.
- Found-Left - Calibration data collected without any adjustment and/or repair performed.

This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. The user is obliged to have the object recalibrated at appropriate intervals.

E O H

E Ems

01310

Comments:

Long Le
 Metrology Technician

Traceability Information

For each parameter listed below the calibration was conducted using an unbroken chain of standards to:

DC Voltage

The Voltage Reference standard group, traceable to the Fluke Primary Standards Laboratory, which is traceable to the U.S. representation of the volt, through the internationally accepted value of the Josephson constant $K_j=483597.9$ GHz/V and a 10 Volt Josephson Array Voltage Standard.

Frequency and Period

The GPS-Rubidium Disciplined oscillator frequency standard, traceable to the United States Naval Observatory (USNO), which is traceable to the National Institute of Standards and Technology.

AC Voltage, Resistance, DC Current, AC Current, Capacitance, Inductance, Phase

The Fluke Primary Standards Laboratory, which is traceable to the National Institute of Standards and Technology.

AC Voltage Flatness

The Fluke Primary Standards Laboratory, or Agilent Technologies Standards Laboratory which are traceable to the National Institute of Standards and Technology.

Humidity

The Vaisala Measurement Standards Laboratory Primary Salt calibration bath, with traceability based on the physical phenomena in which the equilibrium relative humidity values associated with certain saturated salt solutions are known.

Rise Time

The Tektronix GmbH Calibration Laboratory which is traceable to the Physikalisch-Technische Bundesanstalt.

Radiation Temperature

The National Institute of Standards and Technology, the Physikalisch-Technische Bundesanstalt, or Hart Scientific.

Contact Temperature

The Fluke Primary Standards Laboratory, Hart Scientific, which are traceable to the National Institute of Standards and Technology.

Gas Flow

The DHI Calibration Laboratory, which is traceable to the National Institute of Standards and Technology.

Pressure

The DHI Calibration Laboratory, which is traceable to the Laboratoire National D'Essais, Physikalisch-Technische Bundesanstalt and National Institute of Standards and Technology, or traceable to the Mensor or Ashcroft Calibration Laboratories, which are traceable to the National Institute of Standards and Technology.

Standards Used

Asset #	Instrument Model	Cal Date	Cal Due
10127	FLUKE 5520A CALIBRATOR	29 May 2009	28 February 2010

End of Report

Certificate of Calibration

Certificate Number
A666628

Customer: EE & MS
1950 NW 39TH PLACE
GAINESVILLE, FL 32605
352-317-2463

P.O. Number: HOLD

ID Number: 01230

Description:	TEMPERATURE INDICATOR	Calibration Date:	1/5/2010
Manufacturer:	EUTECHNICS	Calibration Due:	1/5/2011
Model Number:	4600-1.2.5	Procedure:	TMI-M-THERMOMETER
Serial Number:	01D102193	Rev:	2/1/2005
Technician:	BRANDON BLACK	Temperature:	70 °F
On-Site Calibration:	<input type="checkbox"/>	Humidity:	50 % RH
Comments:		As Found Condition:	IN-TOLERANCE
		Calibration Results:	PASS

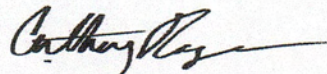
This instrument has been calibrated using standards traceable to the National Institute of Standards and Technology, derived from natural physical constants, ratio measurements or compared to consensus standards. Unless otherwise noted, the method of calibration is direct comparison to a known standard.

Reported uncertainties and "test uncertainty ratios" (TUR's) are expressed as expanded uncertainty values at approximately 95% confidence level using a coverage factor of K-2. A TUR of 4:1 is routinely observed between the accuracy of the reference standard and the tolerance of the UUT unless otherwise noted on the certificate. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

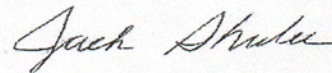
TMI's Quality System complies with the requirements of ISO 9001, ANSI/NC SL Z540-1, ISO 10012 and MIL STD 45662A.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.



Anthony Rogers, Branch Manager



Jack Shuler, Quality Manager

Calibration Standards

<u>Asset Number</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number</u>	<u>Cal Due</u>
30946	FLUKE	5616	30946	11/30/2010
A06118	HART SCIENTIFIC	9103	A06118	2/10/2011
A88072	FLUKE	1502A	A88072	10/11/2010



Technical Maintenance, Inc.

12530 Telecom Drive, Temple Terrace, FL 33637
(813) 978-3054 Fax: (813) 978-3758

www.tmicalibration.com

ISO 9001:2000
ANSI/NC SL Z540-1-1994

INSTRUMENT DATA SHEET

Digital Thermometer/Probe

Asset Number: 01230 Customer: EE & MS
 Date Tested: 5 Jan 2010

<u>Parameter Tested</u>	<u>Nominal Value</u>	<u>Tolerance</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>As Found</u>	<u>Pass/Fail</u>	<u>As Left</u>
Temperature Accuracy							
Deg. C	-0.021	+/- .13	-0.151	0.109	0.000	PASS	AS FOUND
	9.964	+/- .13	9.834	10.094	10.000	PASS	AS FOUND
	19.936	+/- .13	19.806	20.066	19.970	PASS	AS FOUND
	29.951	+/- .13	29.821	30.081	29.990	PASS	AS FOUND
	39.970	+/- .13	39.840	40.100	39.980	PASS	AS FOUND
	49.935	+/- .13	49.805	50.065	49.920	PASS	AS FOUND

Certificate of Calibration

Certificate Number
A666631Customer: EE & MS
1950 NW 39TH PLACE
GAINESVILLE, FL 32605
352-317-2463

P.O. Number: HOLD

ID Number: 01231

Description:	TEMPERATURE PROBE	Calibration Date:	1/5/2010
Manufacturer:	UNKNOWN	Calibration Due:	1/5/2011
Model Number:	SP034-39	Procedure:	TMI-M-THERMOMETER
Serial Number:	01H0060	Rev:	2/1/2005
Technician:	BRANDON BLACK	Temperature:	70 °F
On-Site Calibration:	<input type="checkbox"/>	Humidity:	50 % RH
Comments:		As Found Condition:	IN-TOLERANCE
		Calibration Results:	PASS

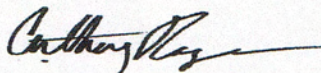
This instrument has been calibrated using standards traceable to the National Institute of Standards and Technology, derived from natural physical constants, ratio measurements or compared to consensus standards. Unless otherwise noted, the method of calibration is direct comparison to a known standard.

Reported uncertainties and "test uncertainty ratios" (TUR's) are expressed as expanded uncertainty values at approximately 95% confidence level using a coverage factor of K-2. A TUR of 4:1 is routinely observed between the accuracy of the reference standard and the tolerance of the UUT unless otherwise noted on the certificate. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

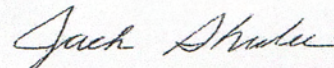
TMI's Quality System complies with the requirements of ISO 9001, ANSI/NCSL Z540-1, ISO 10012 and MIL STD 45662A.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.



Anthony Rogers, Branch Manager



Jack Shuler, Quality Manager

Calibration Standards

<u>Asset Number</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number</u>	<u>Cal Due</u>
30946	FLUKE	5616	30946	11/30/2010
A06118	HART SCIENTIFIC	9103	A06118	2/10/2011
A88072	FLUKE	1502A	A88072	10/11/2010



Technical Maintenance, Inc.

ISO 9001:2000
ANSI/NCSL Z540-1-1994

12530 Telecom Drive, Temple Terrace, FL 33637

(813) 978-3054 Fax: (813) 978-3758

www.tmicalibration.com

INSTRUMENT DATA SHEET

Digital Thermometer/Probe

Asset Number: 01231 Customer: EE & MS
 Date Tested: 5 Jan 2010

<u>Parameter Tested</u>	<u>Nominal Value</u>	<u>Tolerance</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>As Found</u>	<u>Pass/Fail</u>	<u>As Left</u>
Temperature Accuracy							
Deg. C	-0.021	+/- .13	-0.151	0.109	0.000	PASS	AS FOUND
	9.964	+/- .13	9.834	10.094	10.000	PASS	AS FOUND
	19.936	+/- .13	19.806	20.066	19.970	PASS	AS FOUND
	29.951	+/- .13	29.821	30.081	29.990	PASS	AS FOUND
	39.970	+/- .13	39.840	40.100	39.980	PASS	AS FOUND
	49.935	+/- .13	49.805	50.065	49.920	PASS	AS FOUND

TMI
STD
cert date= 1/5/2010

-0.021
9.964
19.936
29.951
39.97
49.935

EEMS
RTD
01230 / 01231

0
10
19.97
29.99
39.98
49.92

slope= 0.999277
intercept= 0.038887

EEMS
RTD
01230 / 01231
raw corrected
0.08 0.04
48.11 48.11
0.09 0.05
35.78 35.77
30.08 30.06
19.7 19.66
10.06 10.02

Thermocouple offset =

slope =
intercept =
correlation =

EEMS
SEG
01237

0.4
48.5
0.4
36.1
30.5
20.1
10.4

-0.6

1.000614
0.371651
0.999998

EEMS
SD
01236

0.3
48.3
0.3
36.1
30.3
19.9
10.1

-0.3

1.000615
0.214493
0.999991

EEMS
EOH
01310

0.2
48.5
0.3
36.1
30.3
19.9
10.1

N/A

1.004334
0.152425
0.999993



CALIBRATION PROCEDURE
18802/18811 ANEMOMETER DRIVE

DWG: CP18802(C)

REV: C101107 PAGE: 4 of 4
 BY: TJT DATE: 10/11/07
 CHK: JC W.C. GAS-12

CERTIFICATE OF CALIBRATION AND TESTING

R. M. Young Company certifies that the equipment listed below was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

MODEL: 18802 / 18811 SERIAL NUMBER: CA02777
 (18802 Comprised of Models 18820A Control Unit & 18830A Motor Assembly)
 (18811 Comprised of Models 18820A Control Unit & 18831A Motor Assembly)

Nominal Motor RPM	27106D Output Frequency (Hz) - (1)	Calculated Rpm (1)	Indicated Rpm (2)
18802		<input checked="" type="checkbox"/> CW / CCW rotation verified	
300	50	300	300
2700	450	2700	2700
5100	850	5100	5100
7500	1250	7500	7500
10,200	1700	10200	10200
12,600	2100	12600	12600
15,000	2500	15000	15000
18811		<input checked="" type="checkbox"/> CW / CCW rotation verified	
30.0	5	30.0	30.0
150.0	25	150.0	150.0
300.0	50	300.0	300.0
450.0	75	450.0	450.0
600.0	100	600.0	600.0
750.0	125	750.0	750.0
990.0	165	990.0	990.0

- (1) Measured frequency output of RM Young Model 27106D standard anemometer attached to motor shaft - 27106D produces 10 pulses per revolution of the anemometer shaft.
- (2) Indicated on the Control Unit LCD display.

* Indicates out of tolerance

No Calibration Adjustments Required As Found As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4863

Date of inspection 1/13/10
 Inspection Interval One Year

Tested By RP



Warren-Knight Instrument Company

2045 Bennett Road

Philadelphia, PA 19116

Phone: 215-464-9300; Fax: 215-464-9303

Web: <http://www.warrenind.com>

CERTIFICATION OF CALIBRATION AND CONFORMANCE

We hereby certify that the equipment below has been manufactured and/or inspected by standards traceable to NIST. Calibration of the specified instrument has been performed in compliance with ANSI Z540-1 requirements. It is warranted that the equipment has been calibrated to be in full conformance with the drawings and specifications of the instrument. Calibration tests were performed on the material specified below and were in accordance with all applicable quality assurance requirements with data on file at our facility.

Customer Name:	EE & MS	#	01270	EOH
Purchase Order #:				
Instrument:	S25 Compass			
Serial Number:	192034			
Quantity:	1			
Calibration Due:	1/2011			

John Noga, Quality Control

January 15, 2010

Measurement Standards:

Theodolite: Wild T-3 S/N 18801/CAL 5/14/97 NIST# 738/229329-83 738/223398

Optical Wedge: K&E 71-7020 S/N 5167/CAL 4/19/01 NIST# 731/244084-89