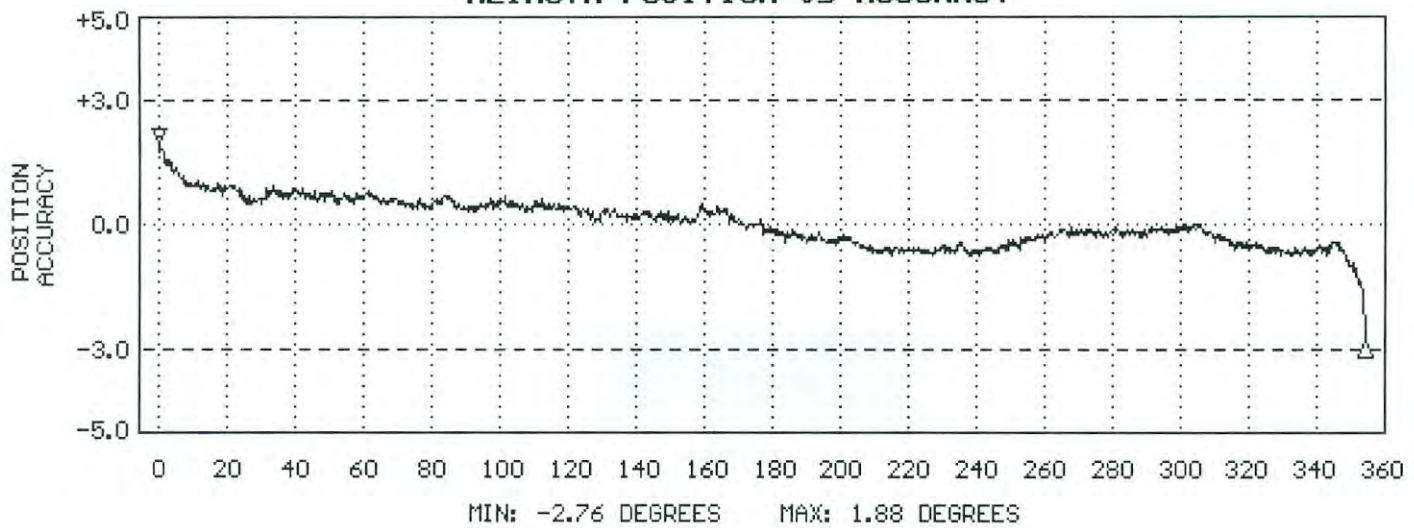


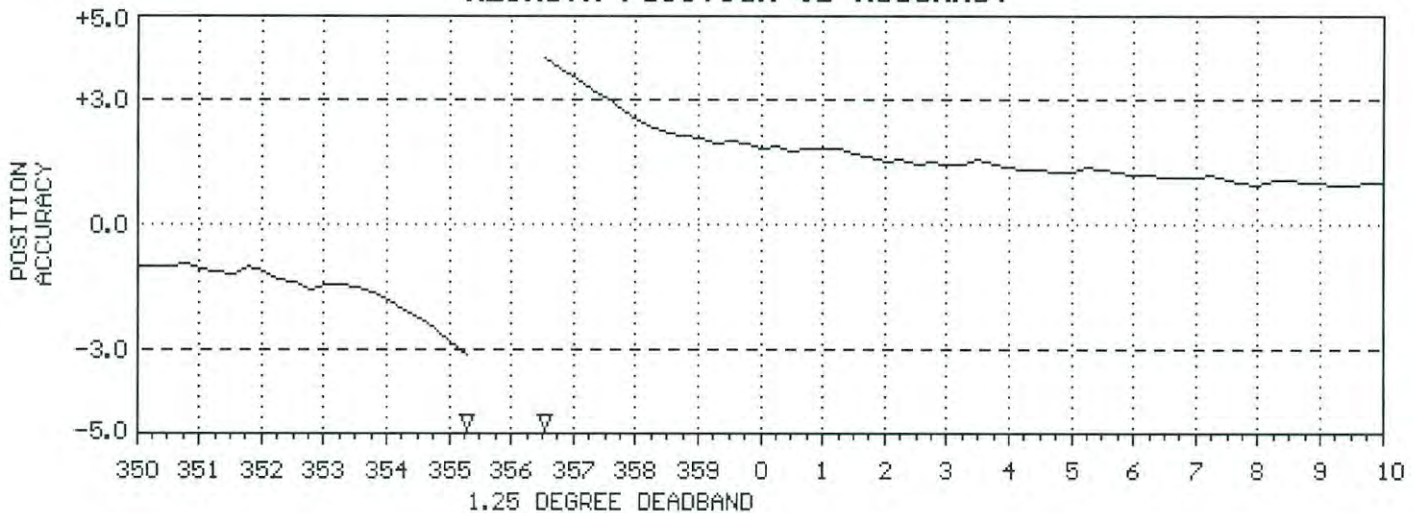
R. M. YOUNG COMPANY WIND SENSOR CALIBRATION CERTIFICATE

SENSOR: 05106 WIND MONITOR-MA  
SENSOR SERIAL NUMBER: WM44604  
BEARINGS: SEALED/WATERPROOF GREASE  
DATE: JAN 29 2013  
WIND SPEED THRESHOLD TEST: PASS  
LOW WIND SPEED AMPLITUDE/FREQUENCY TEST: PASS  
HIGH WIND SPEED AMPLITUDE/FREQUENCY TEST: PASS  
VANE TORQUE TEST: PASS  
SPECIAL NOTES:  
SPECIAL NOTES:

AZIMUTH POSITION vs ACCURACY



AZIMUTH POSITION vs ACCURACY



NOTE: Azimuth Position vs Accuracy graphs are accurate to within 0.5 degrees. The accuracy shown in the potentiometer deadband region between 355 and 0 degrees is the result of no resistance change while position changes. The gap represents the actual deadband (open circuit).



**R.M. Young Company**  
 2801 Aero Park Drive  
 Traverse City, Michigan 49686 USA



**CALIBRATION REPORT**  
**Wind Speed**

Customer: *University of Hawaii*

Test Number: 3128-01W                      Customer PO: Z10020870  
 Test Date: 28 January 2013              Sales Order: 3142

Test Sensor:  
 Anemometer: 05106 Wind Monitor              Propeller: 08234  
 Serial Number: WM44604                      Serial Number: 51154

Report of calibration comparison with National Institute of Standards and Technology calibrated anemometer in the R.M. Young Company 50 x 75 cm rectangular test section open return wind tunnel. The following data describe the relationship between test section wind speed, as determined by the NIST calibrated standard anemometer, and test anemometer rpm, as determined by its output. Indicated wind speed is calculated using anemometer's published formula.

Wind Speed According to Standard Anemometer		Wind Speed According to Test Anemometer			
Model:	05103 / 08234	Anem:	05106	Prop:	08234
Serial #:	00005	Serial #:	WM44604	Serial #:	51154
Nominal Speed m/s	Actual Speed m/s (1)	100 Second Pulse Count	Output Frequency	Propeller RPM (2)	Indicated Speed m/s (3)
30	30.0	30704	307.0	6141	30.1
25	25.0	25564	255.6	5113	25.1
20	20.0	20382	203.8	4076	20.0
16	16.0	16266	162.7	3253	15.9
14	14.0	14222	142.2	2844	13.9
12	12.0	12182	121.8	2436	11.9
10	10.0	10120	101.2	2024	9.9
8	8.0	8038	80.4	1608	7.9
6	6.0	6004	60.0	1201	5.9
5	5.0	4975	49.8	995	4.9
4	4.0	3970	39.7	794	3.9
3	3.0	2948	29.5	590	2.9
2	2.1	1888	18.9	378	1.9
1	1.1	810	8.1	162	0.8

National Institute of Standards and Technology Reference  
 Calibrated Standard Anemometer (4)  
 Test #: TN251034  
 Date: 9 Nov 1992  
 Model: 08234    Serial #: 00005

Environmental Conditions  
 Barometric Pressure (hPa): 986  
 Temperature (C): 23.0  
 Relative Humidity (%): 48.0

- (1) Actual wind speed determined by relationship between tunnel fan rpm and NIST calibrated standard propeller rpm.
- (2) Wind Monitor output is three (3) pulses per revolution:  $Rpm = Hz / 3 \times 60 \text{ sec.}$
- (3) Published calibration:  $Wind \text{ speed (m/s)} = 0.00490 \times \text{propeller rpm.}$
- (4) NIST Calibration accuracy is within 1%.

Tested By 



**R.M. Young Company**  
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 Traverse City, Michigan 49686 USA

**CALIBRATION REPORT**  
**Wind Speed (page 2)**

Test Number: 3128-01W

Linear Regression

A linear regression is performed on the calibration data to determine the best fit straight line representing the relationship between propeller rpm and actual wind speed as determined by the NIST calibrated standard anemometer.

Slope: 0.00485 meters per second per RPM  
 Intercept: 0.20 meters per second  
 Pitch: 29.08 centimeters per revolution  
 Correlation Coefficient: 0.99999

Wind Speed =	Slope	x RPM +	Intercept	Slope	x Hz +	Intercept
m/s	= 0.00485	x RPM +	0.20	0.09693	x Hz +	0.20
mph	= 0.01084	x RPM +	0.45	0.21682	x Hz +	0.45
knots	= 0.00941	x RPM +	0.39	0.18828	x Hz +	0.39
km/hr	= 0.01745	x RPM +	0.72	0.34894	x Hz +	0.72

Threshold Measurements

	New Instrument	As Found	As Left
Start:		0.3 m/s	0.5 m/s
	n/a		
Stop:		0.2 m/s	0.4 m/s