



QUALITY MANAGEMENT BRANCH

STANDARD OPERATING PROCEDURES

FOR

VERIFICATION OF
ANEMOMETER DRIVES

Standards Laboratory SOP 008

First Edition

MONITORING AND LABORATORY DIVISION

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Approval of Standard Operating Procedures (SOP)

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Section: Quality Assurance

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Prepared by: Jerry Freeman, Air Pollution Specialist

Approval: This SOP has been reviewed and approved by:



Ranjit Bhullar, Manager
Quality Assurance Section
Quality Management Branch

5-28-15

Date



Michael Miguel, Chief
Quality Management Branch

5/28/15

Date

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1.0 Introduction

This standard operating procedure (SOP) describes the verification process of meteorological anemometer drives with respect to precision and accuracy. An anemometer drive is used to evaluate a wind speed anemometer and is operated at precise speeds and measured in revolutions per minute (rpm.)

2.0 Summary of Method

A guest anemometer drive is compared against the Monarch Pocket Laser Tachometer 200 (PLT200) reference standard at five different points spread evenly throughout the guest instrument's range. If the comparison meets the verification criteria, a verification report is issued and no adjustments/corrections are needed before using the data from the display. If the verification criteria are not met, the anemometer is returned to the customer for repair or replacement.

3.0 Summary of Changes to Previous Version

Not Applicable

4.0 Definitions

- **Calibration.** Establishes a correction formula to be used to adjust or correct the display of the candidate instrument. This is determined through a comparison of the candidate instrument to a known, or reference standard.
- **Verification.** Establishes comparability of a candidate instrument to a known, or reference standard; the output of candidate instrument is not to be corrected based upon the results of the verification procedure
- **Reference standard.** It is a concept that has been established by authority, custom, or agreement to serve as a model or rule in the measurement of quantity of the establishment of a practice or procedure.

5.0 Personnel Qualifications

Before new personnel perform this procedure, one or more weeks of training from Standards Laboratory staff is required. They must also demonstrate competency in performing this procedure without assistance.

6.0 Health and Safety

The PLT200 emits a visible beam of laser light. Avoid exposure to the laser radiation. Figure 1 illustrates the feature locations of the PLT200. Figure 2 shows the "Laser in Use" icon.

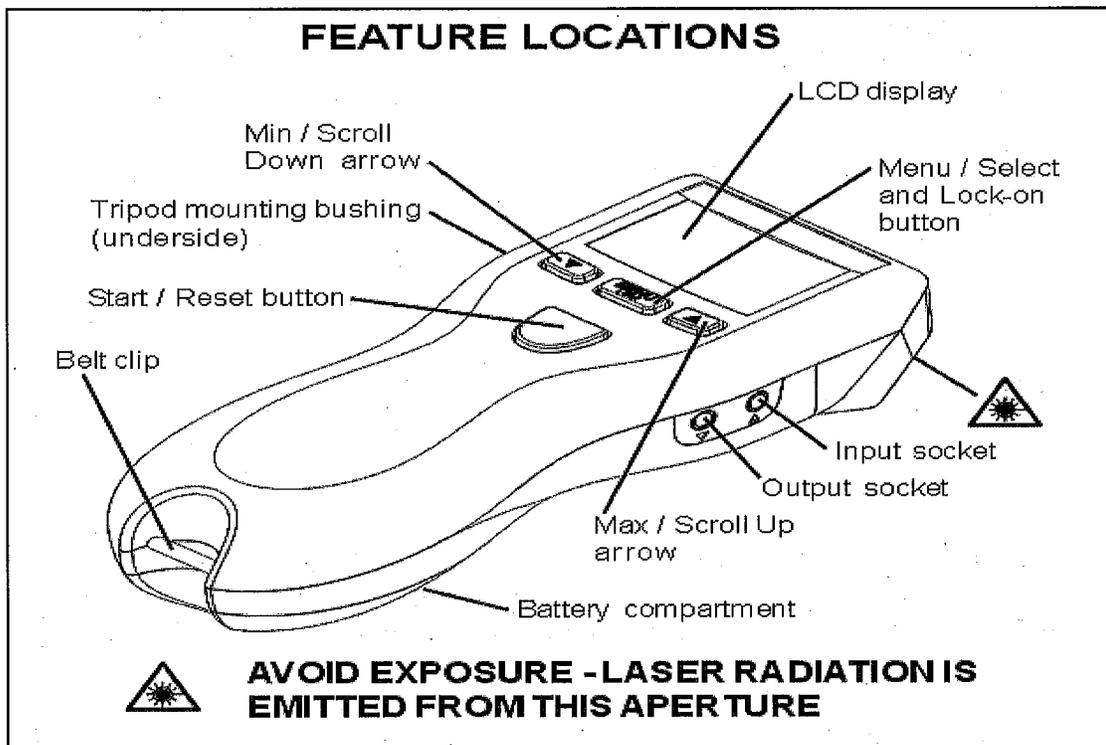


Figure 1: PLT200 Feature Locations

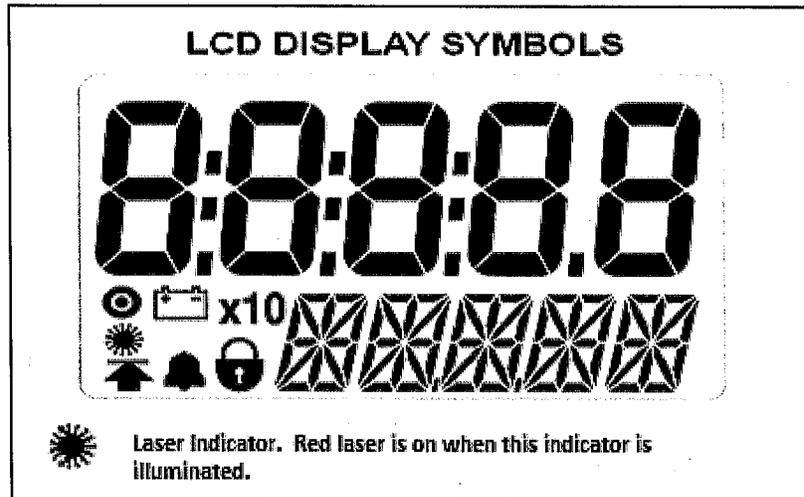


Figure 2: LCD Display, "Laser in Use" Icon

7.0 Cautions while using the PLT200

- The laser beam should not be intentionally aimed at people or animals.
- Use of controls or adjustments or performance of procedures other than those specified may result in hazardous radiation exposure. Read and follow all instructions in the owner's manual carefully, and retain it for future reference.

8.0 Interferences

While operating a guest anemometer drive, if possible, use an AC Adapter as a power source instead of relying solely on the internal batteries.

9.0 Equipment and Supplies

- Monarch Pocket Laser Tachometer 200
- Reflective Tape
- Finger Coupler

10.0 Instrument Siting Requirements. A laboratory environment with stable temperature controlled between 20 °C to 27 °C is acceptable.

11.0 Pretest Setup Procedures

- 11.1 Setup the PLT200 to perform non-contact tachometer measurements using rpm.
 Follow the instructions outlined in Figure 3.

NOTE: Unit will remember these settings (including lock on/off) even if turned off and back on.

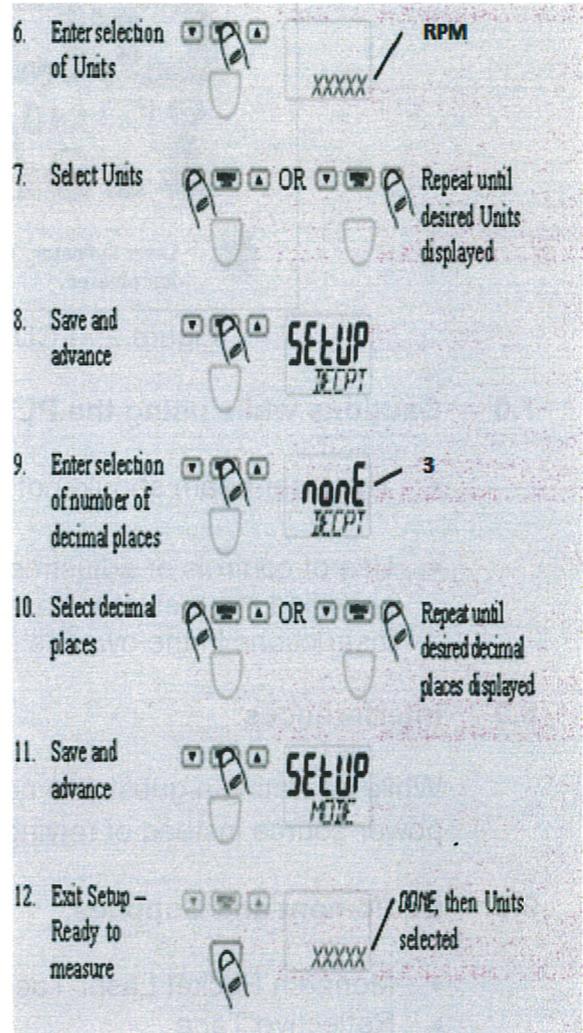
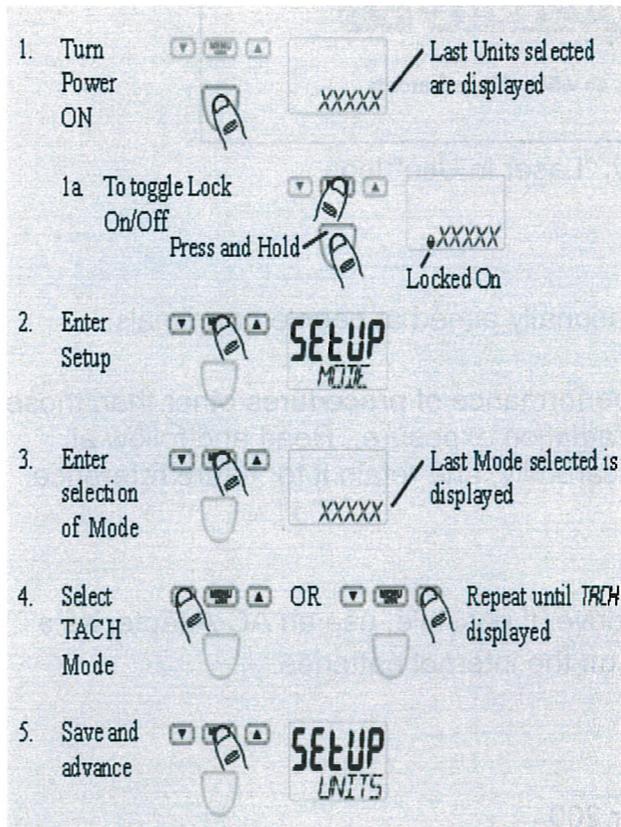


Figure 3: Setup of PLT200

11.2 The PLT200 is now ready to perform non-contact measurements by using the optical tachometer mode. Figure 4 illustrates the PLT200 being used in the hand-held configuration. Figure 5 demonstrates the reflective tape installation on a finger coupler.

NOTE: A spare finger coupler is located in the PLT200 container in the event that one was not provide with the anemometer drive being verified.

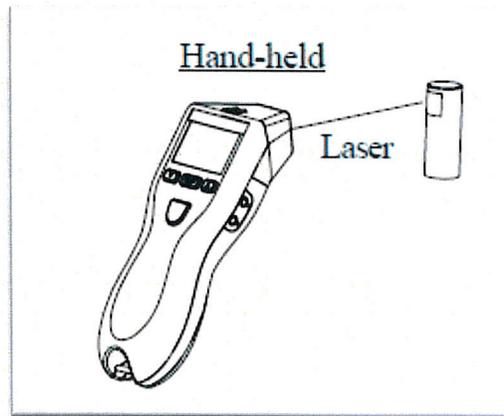


Figure 4: PLT200 in "TACHometer" Mode

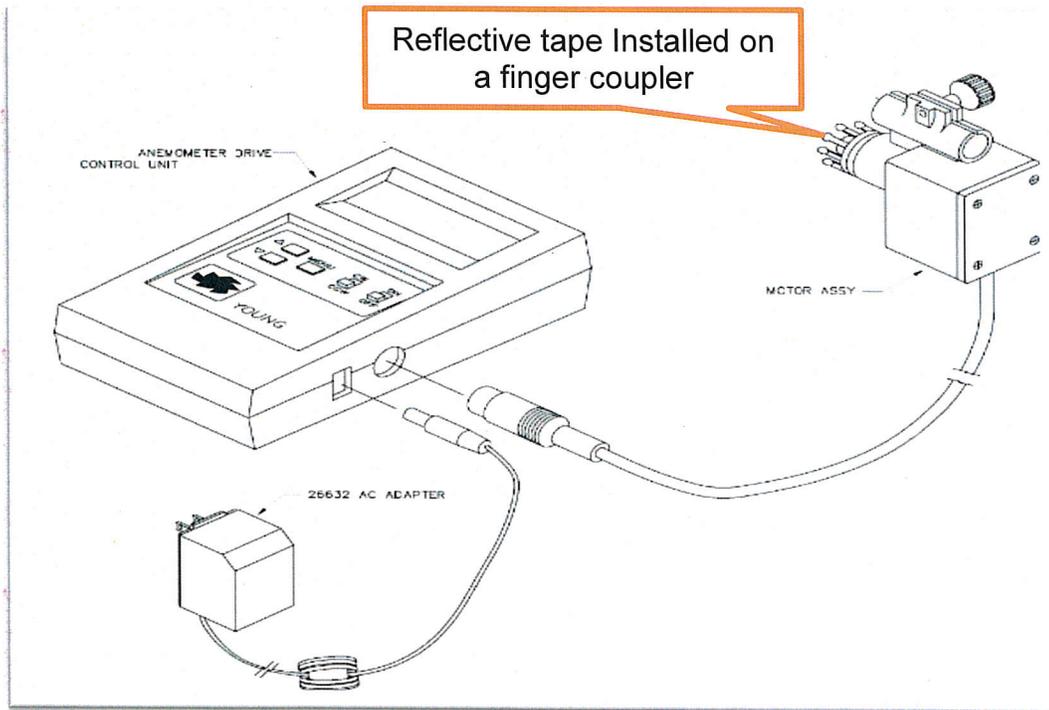


Figure 5: Reflective Tape Installation

12.0 Verification Procedure

12.1 Enter the guest instrument information into the Anemometer Log as shown in Figure 6. The log is located at: "X:\DASPS\Standards Laboratory\Equipment Logs\Log.mdb\Anemometer".

Anemometer						
Date	Log Numbr	Property Numl	Owner	Pass	Fail	Remarks
				<input checked="" type="checkbox"/>	<input type="checkbox"/>	
11/8/2010	2010 295	20004616	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12/20/2011	2011 242	105851	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12/20/2011	2011 243	20071253	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12/20/2011	2011 244	20005460	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van X
12/20/2011	2011 245	20020799	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1/27/2012	2012 022	20004616	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4/17/2012	2012 109	105989	Imperial County APCD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4/20/2012	2012 115	105991	AM - North, Jamie	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12/11/2012	2012 332	20005460	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van X
12/28/2012	2012 355	20112257	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van E
12/28/2012	2012 356	20020799	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van C
12/28/2012	2012 357	20102968	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1/9/2013	2013 012	20112412	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1/9/2013	2013 013	20112413	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1/9/2013	2013 014	20112414	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1/9/2013	2013 016	20071253	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van E
1/18/2013	2013 033	20003897	Special Purpose Monitoring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1/18/2013	2013 034	106017	Special Purpose Monitoring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7/19/2013	2013 207	105989	Imperial County APCD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
11/8/2013	2013 296	105991	AM - North	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12/19/2013	2013 363	20005460	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van X
12/19/2013	2013 366	20112257	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Van E
12/30/2013	2013 373	20071253	Quality Assurance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2/7/2014	2014 052	106017	Standards Laboratory	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Figure 6: Anemometer Log Entries

12.2 The anemometer test configuration is illustrated in Figure 7

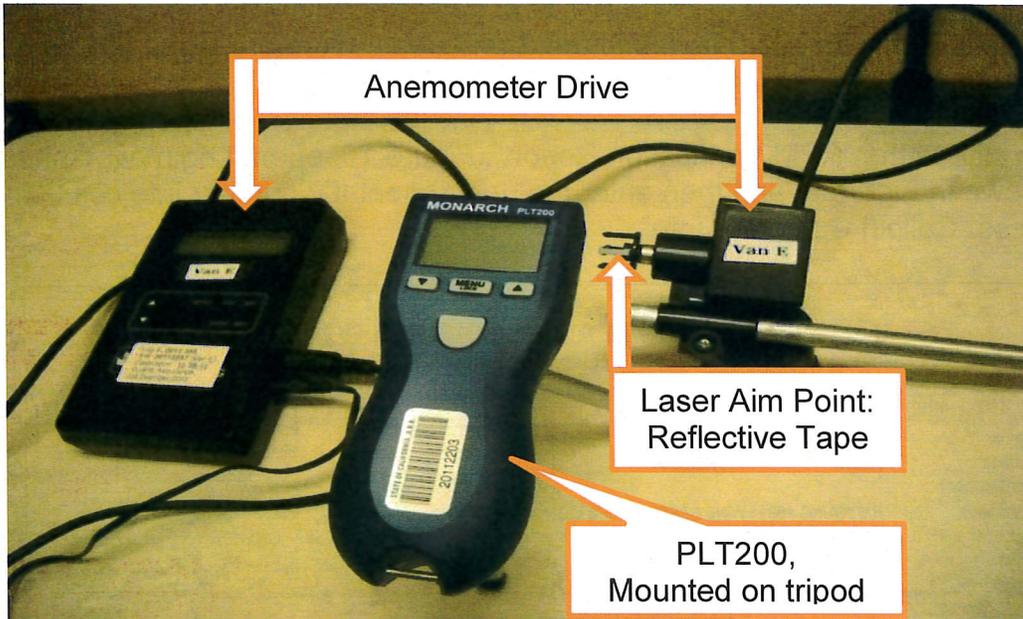


Figure 7: Anemometer Drive Test Configuration

13.0 Data Acquisition and Storage

13.1 Follow the displayed data path and open the “X:\DASPS\Standards Laboratory\calibration forms\Misc Cals.xlsm workbook”. See Figure 8.

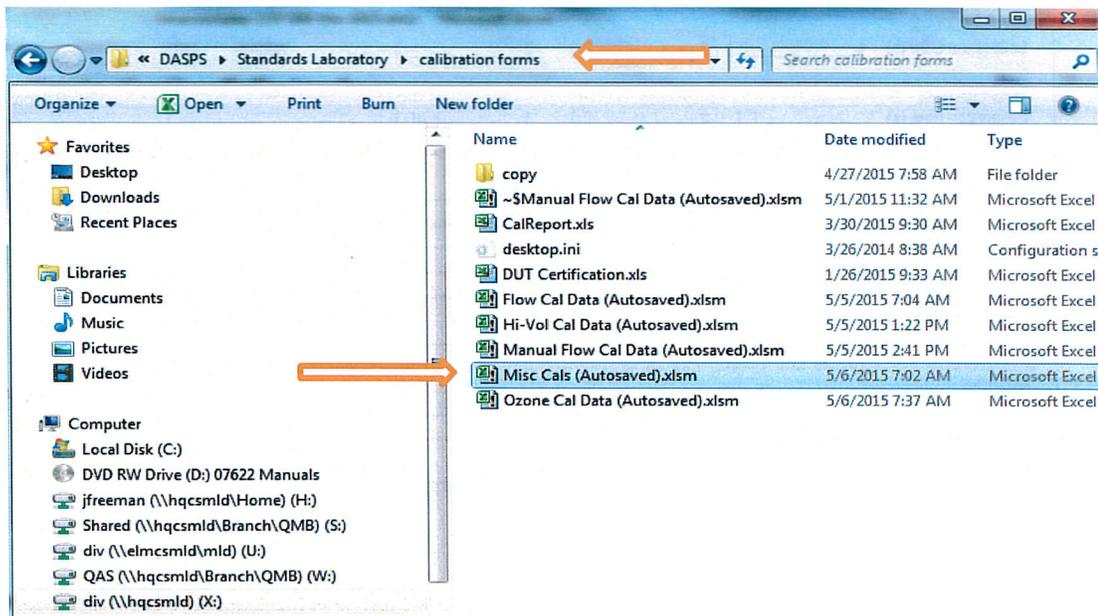


Figure 8: “Misc Cals.xlsm” workbook

- 13.2 Open "Login" worksheet as shown in Figure 9.
- 13.3 To initially log an instrument into the Standards Laboratory, enter the "Instrument ID" number into cell G4. Then press "LOGIN".
- 13.4 To initiate the "RPM Verification Report", Figure 10, open "Login" worksheet as shown in Figure 9, and then enter the "Instrument ID" number into cell G4. Then press "Collect Customer Info".

CALIFORNIA AIR RESOURCES BOARD

STANDARDS LABORATORY
PROJECT CHECK LIST

Agency:	STANDARDS LABORATORY		Customer ID	<input type="text" value="73"/>	Owner ID	Instrument ID
Contact:	JERRY FREEMAN					<input type="text" value="106017"/>
Year&Number				Prev. Log. #	<input type="text" value="2013034"/>	
Instrument:	RM YOUNG 18811 WIND SPEED CALIBRATOR					
Bar Code:	106017				SN:	CA03197
PHONE #:	916-324-1845			Date:	4/18/2014	
Log Number:	2014052					<input type="text"/>
Select Service:	<input type="checkbox"/> Calibration (C)	<input checked="" type="checkbox"/> Verification (V)	Enter Letter selection: <input type="text" value="V"/>		<input type="button" value="Collect Customer Information (3)"/>	
OZONE:	Calibration Date (s)					
	1 <input type="text"/>	2 <input type="text"/>	3 <input type="text"/>			
	4 <input type="text"/>	5 <input type="text"/>	6 <input type="text"/>			
FLOWS:	Calibration Date (s)					
POS 1	<input type="text"/>	2 <input type="text"/>	3 <input type="text"/>	4 <input type="text"/>		
POS 2	<input type="text"/>	2 <input type="text"/>	3 <input type="text"/>	4 <input type="text"/>		
POS 3	<input type="text"/>	2 <input type="text"/>	3 <input type="text"/>	4 <input type="text"/>		
POS 4	<input type="text"/>	2 <input type="text"/>	3 <input type="text"/>	4 <input type="text"/>		
HIVOLL ORIFICE	Calibration Date (s)					
	1 <input type="text"/>	2 <input type="text"/>	3 <input type="text"/>			
TEMPERATURE	Calibration Date (s)					
	<input type="text"/>	2 <input type="text"/>	3 <input type="text"/>			
PRESSURE	Calibration Date (s)					
	1 <input type="text"/>	2 <input type="text"/>	3 <input type="text"/>			
RELATIVE HUMIDITY	Calibration Date (s)					
	1 <input type="text"/>	2 <input type="text"/>	<input type="text"/>			
ANNEMOMETER	Calibration Date (s)					
	1 <input type="text"/>	2 <input type="text"/>	3 <input type="text"/>			
Remarks:	<input type="text"/>					
	<input type="text"/>					
	<input type="text"/>					

Figure 9: Instrument Login

- 13.5 There are two anemometer drive models currently being used. Table 1 illustrates the differences between the models and lists the suggested set points.

Model 18802 Range 200-15,000 RPM Set Points	Model 18811 Range 20-990 RPM Set Points
200	200
400	400
600	500
1000	700
1400	900

Table 1: Anemometer Set Points

- 13.6 Open the "RPM Verification Report." Using Table 1, select the test points for the guest anemometer under test and enter the five test points in the column marked "Candidate Set Points". Dial in the first point into the anemometer drive. Press and momentarily hold the "Start" button on the PLT200. Record the reading from the PLT200 in the "Standard's Response" column. Repeat this process for the next four set points. The Excel spreadsheet will calculate the Pass/Fail criteria. To pass, the standard's response must be less than 2 percent of the candidate's set point. See Figure 10.

If a "Fail" is indicated, a retest is performed to confirm the failure. If the failure is validated, inform the owner of the failure and initiate a Standard Failure Notification report. The automated report is located at: X:\DASPS\Standards Laboratory\Working Access Tables; imsdatabase1.accdb; Forms; "Failure Query."



California Environmental Protection Agency
AIR RESOURCES BOARD

RPM VERIFICATION REPORT

To: STANDARDS LABORATORY
 JERRY FREEMAN

From: Jerry Freeman
 Operations Planning and Analysis

Log Number: 2015077

Calibration Date: 3/25/2015
 Report Date: 3/25/2015

IDENTIFICATION	LABORATORY SITE LOCATION
Instrument: 18811 Wind Speed Calibrator	California Air Resources Board Monitoring and Laboratory Division Standards Laboratory 1927 13th Street Sacramento, Ca. 95811
Property No.: 106017	
Serial No.: CA03197	
Previous Log No.: 2015008	
Bar Code No.: 106017	
Elevation: 25.00'	
Property of: STANDARDS LABORATORY	Customer ID: 73

CALIBRATION STANDARDS	ID Number
MONARCH INSTRUMENTS	20112203

LINEAR RELATIONSHIP

Component	Wind Speed
Instrument Range (RPM)	1,000
Slope	1.00005
Intercept	-0.0123
Correlation Coefficient	1.00000000
Change From Previous Verification (%)	1%
Date of Last Verification	3/15/2014

The linear relationship table is for informational use only. DO NOT USE THESE VALUES TO CORRECT THE INSTRUMENT DISPLAY.

Candidate Set Point	Reference Standard Response	Pass/Fail
200	199.99	PASS
400	400.02	PASS
500	500.01	PASS
700	700.02	PASS
900	900.03	PASS

Verification Equation: Verification Expires: 3/24/2016

Standard RPM = 0.99995 * (Net Display) + 0.0123

The Correction Equation can be used to correct the instrument display to improve the accuracy of the reading.

Calibrated by: J. Freeman Check by:

Figure 10: RPM Verification Report

NOTE: In the event of a failure, the guest anemometer drive should be returned to the owner for factory repair.

13.7 For a guest anemometer drive that meets the required criteria, print two copies of the "RPM Verification Report." Place one copy with the guest's anemometer and file the other along inside the guest folder. Create an electronic copy by scanning the final report. Save as a PDF file in the following location: X:\DASPS\Standards Laboratory\Calibration Reports, under the Equipment Number.

13.8 Standards Laboratory Criteria for anemometer standard evaluations:

The correlation coefficient must be 0.999 or better.

NOTE: Verification is recommended if the anemometer drive has been repaired, is new, or has been factory calibrated since the last time it was used for testing.

14.0 Quality Control

Biennially, the PLT200 is sent to a vendor for certification.

15.0 Routine Service Checks

Not applicable.

16.0 Preventive Maintenance and Repairs. The only authorized maintenance that should be performed on the PLT200 is a battery replacement. A low battery condition is illustrated in Figure 11.

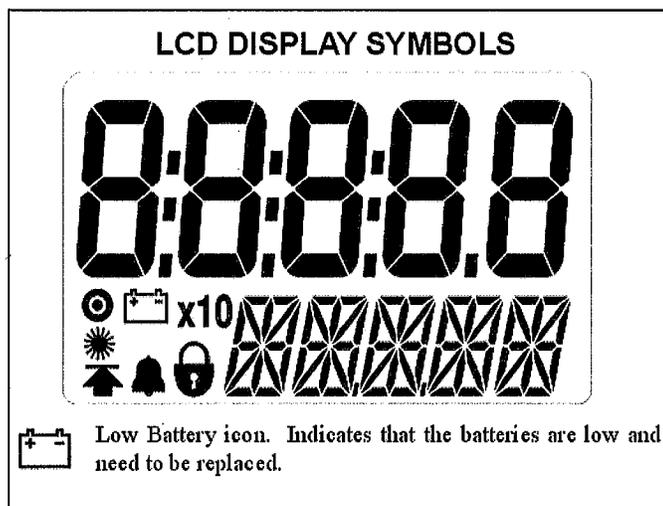


Figure 11: Low Battery Icon

17.0 Troubleshooting. If the PLT200 fails to operate, it must be returned to the manufacturer for repair.

18.0 References

- Meteorological Monitoring Guidance for Regulatory Modeling Applications (EPA-454/R-99-005, February 2000)
- Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV: Meteorological Measurements Version 2.0 (EPA-454/B-08-002, March 2008)
- EPA, QA Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Quality Monitoring Program. (EPA-454/B-08-003)
- Monarch Instrument's Instruction Manual for the PLT200

19.0 Data Calculations

All calculations are performed within the Excel "Misc Cal Data.xlsx" workbook when the calibration data is entered (see section 13). For "PASS" criteria, the Reference Standard Response must be less than 2% of the Candidate Set Point. For a "FAIL" response, the criteria would have exceeded 2%.