STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME II

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX AA

METEOROLOGICAL PARAMETER PROCEDURES

FOR

INSIDE/OUTSIDE TEMPERATURE SENSORS

MONITORING AND LABORATORY DIVISION

JUNE 1996

TABLE OF CONTENTS

APPENDIX AA

METEOROLOGICAL PARAMETER PROCEDURES FOR INSIDE/OUTSIDE TEMPERATURE SENSORS

TABLE OF CONTENTS (cont'd)

APPENDIX AA

METEOROLOGICAL PARAMETER PROCEDURES FOR INSIDE/OUTSIDE TEMPERATURE SENSORS

APPENDIX AA

METEOROLOGICAL PARAMETER PROCEDURES
FOR
INSIDE/OUTSIDE TEMPERATURE SENSORS

FIGURES

Page

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE SECTION

VOLUME II

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX AA.1

STATION OPERATOR'S PROCEDURES

FOR

INSIDE/OUTSIDE TEMPERATURE SENSORS

MONITORING AND LABORATORY

JUNE 1996

AA.1.0 GENERAL INFORMATION

AA.1.0.1 THEORY OF OPERATION

The measurement of temperature for air quality applications is generally thought of as air temperature, T, or a difference between two temperature measurements, delta T. Temperature instruments are made up of three important parts: Transducers, signal conditioning, and aspirated radiation shields.

The California Air Resources Board (CARB) uses either thermistors (Met-One) or resistance temperature detectors, RTD's (Rotronic), to measure outside temperature. CARB uses an RTD (Hy-Cal) or (Met-One) thermistors to measure inside station temperature. In each of these systems, the resistance of the transducer varies with temperature.

The effect of solar radiation and wind can severely affect the performance of temperature sensors. For this reason, a forced or convection aspiration radiation shield is essential to any temperature measurement system.

AA.1.0.2 SYSTEM DESCRIPTION

1. Met One 060 Temperature Sensor

   a. The Met One 060 temperature sensors are precision, extended-range thermistors. The solid state thermistor produces a large resistance change per degree of temperature change allowing the use of normal voltage without self-heating of the sensor. When used with the Met One signal conditioning module, the resultant output is a precise analog voltage. The sensor probe body is made of anodized aluminum with an epoxy bond for connections and cabling. The sensor is used with the Met One Translator Module.

   b. The Met One Translator Module converts the frequency signal from the temperature sensor into a standardized voltage/current output signal. There are built-in zero and full-scale test switches and input and output test points in the front of the translator module. Also located on the front panel is a three-position range switch, which selects the full-scale velocity. Two analog output signals are available from the output of the translator module.

2. Rotronic MP-100F Temperature Sensor

The Rotronic MP-100F is a combined humidity-temperature probe designed primarily for outdoor applications. The MP-100F features fast and precise sensor response with an accuracy of +/- 0.5 degrees Centigrade. It operates over a temperature range of -30 to 70 degrees Centigrade and measures temperature with a precision pt 100 RTD.

3. Hy-Cal Temperature Sensor

The Hy-Cal temperature sensor consists of a model BA-500-A linearized bridge amplifier and a resistance temperature sensor. The bridge amplifier uses a three-wire platinum sensor and has no operating controls or indicators. The sensor operates over a temperature range of 0 to 50 degrees Centigrade and is accurate to better than 0.5 degrees Centigrade.

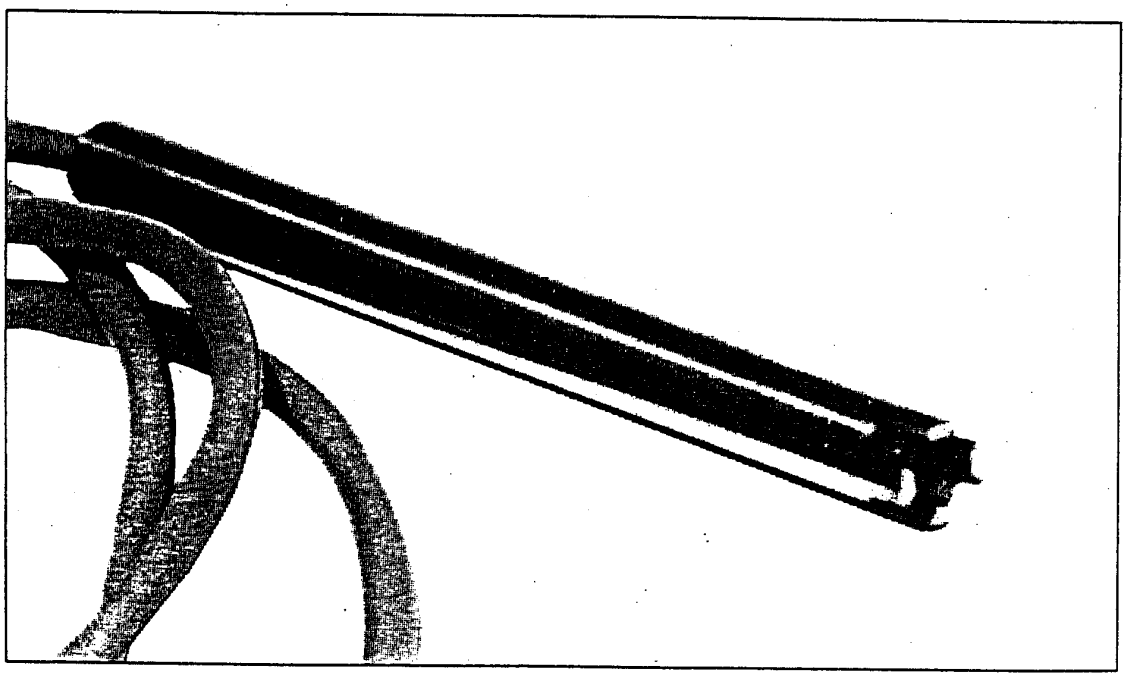

Figure AA.1.0.1
Met One 060 Temperature Sensor

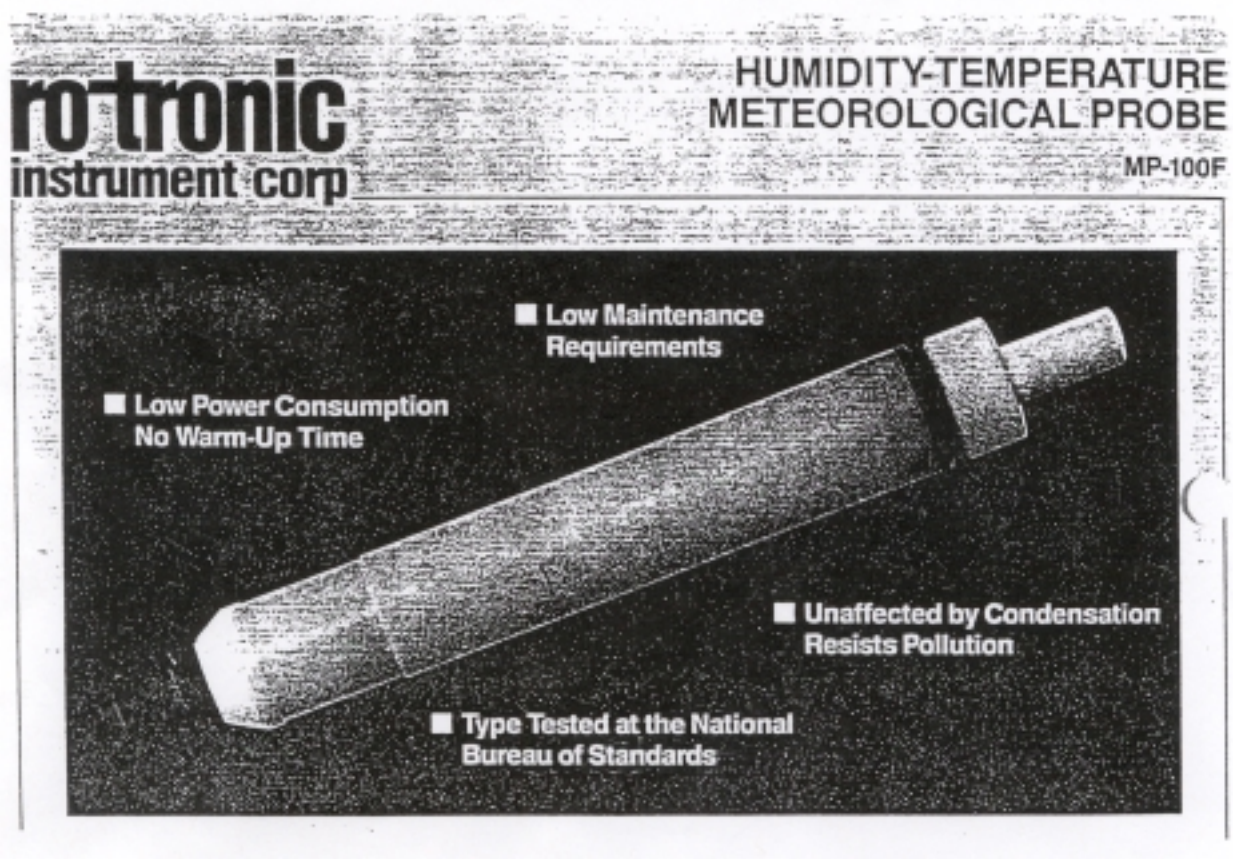

Figure AA.1.0.2
Rotronic MP-100F Humidity/Temperature Sensor

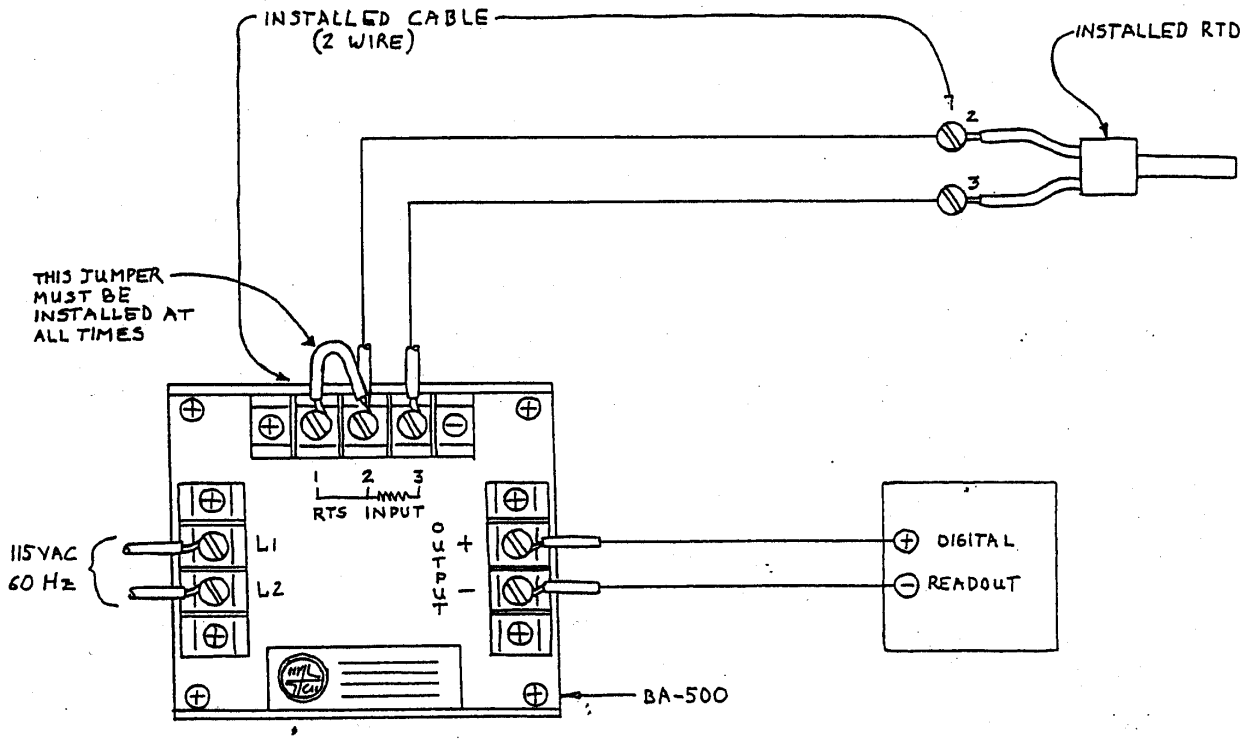

Figure AA.1.0.3
Hy-Cal Temperature Sensor

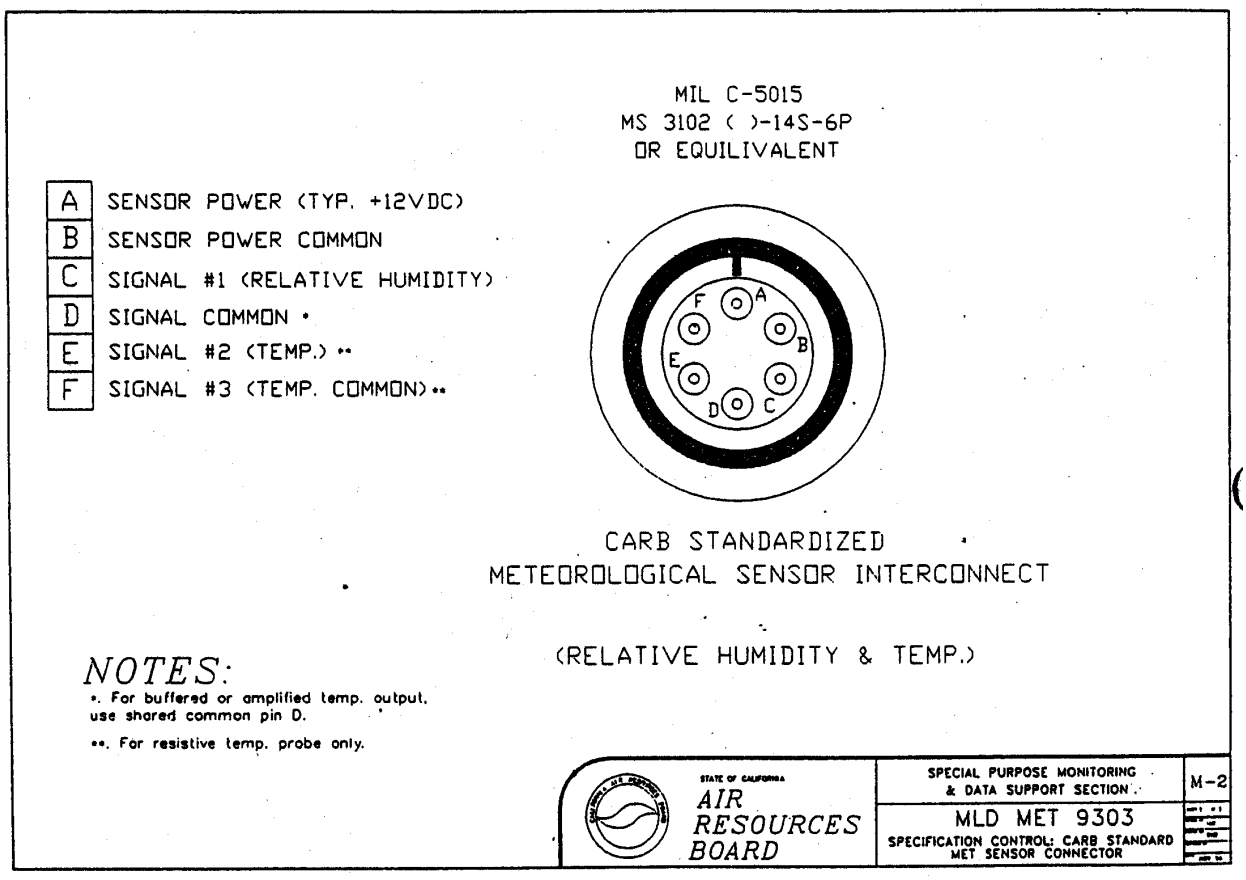

Figure AA.1.0.4
CARB Standardized Meteorological Sensor Interconnect

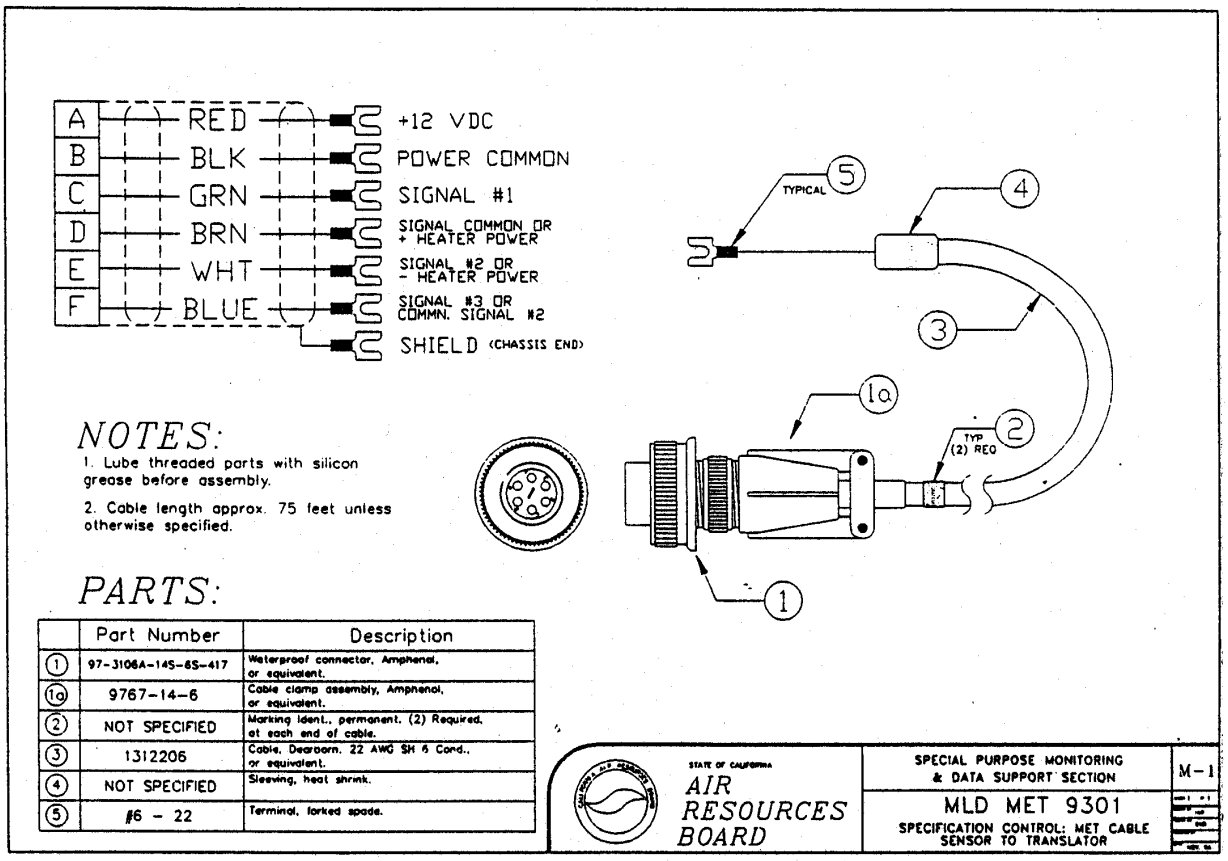

Figure AA.1.0.5
CARB Meteorological Sensor Cable

AA.1.1 INSTALLATION PROCEDURES

AA.1.1.1 PHYSICAL INSPECTIONS

Upon receiving the temperature systems, unpack and check for any signs of shipping damage.

AA.1.1.2 INITIAL SET-UP/INSTALLATION

Proper operation of any meteorological sensor is directly related to the siting of the sensor. An ideal installation is one where the operator can safely access the sensor, perform a test adjacent to the electronics and recorder, and reinstall the sensor in a timely manner. Station operators should read the CARB Air Monitoring Quality Assurance Standard Operating Procedures for Air Quality Monitoring, Volume II, Section 2.0.4 (Siting Criteria for Meteorological Equipment); the United States Environmental Protection Agency (U.S. EPA), Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV; and U.S. EPA Prevention of Significant Deterioration (PSD) guidelines to get a more detailed description of siting requirements. The CARB Air Monitoring Quality Assurance Standard Operating Procedures for Air Quality Monitoring, Volume II will be referred to as the CARB SOP for Air Quality Monitoring, Volume II for the rest of this document.

NOTE: To obtain specific information regarding the installation of temperature sensors, read the sensor operating manual.

1. Met One 060 Temperature Sensor

   a. Attach the Met One aspirated solar radiation shield directly on the tower side or on a boom, which will protrude horizontally from the tower side. In either configuration, the orifice of the shield should be facing down. The shield should be positioned at two meters above the tower base and should not be located over any surfaces which can affect the ambient temperature (asphalt or exhaust vents).

   b. Connect the CARB meteorological sensor cable to the keyed receptacle on the aspirated solar radiation shield and tie wrap it to the mounting arm.

   c. Open the bottom of the shield and slide the temperature sensor into the plastic brackets. Close the bottom of the shield.

d. Connect the leads of the CARB meteorological sensor cable to the appropriate points on the Met One translator module.

2. Rotronic MP100-F Humidity/Temperature Sensor

a. Attach the Rotronic aspirated solar radiation shield directly on the tower side or on a boom, which will protrude horizontally from the tower side. In either configuration, the orifice of the shield should be facing down. The shield should be positioned at two meters and should not be located over any surfaces which can affect the ambient temperature (asphalt or exhaust vents).

b. Connect the CARB meteorological sensor cable to the keyed receptacle and tie wrap it to the mounting arm.

c. Open the bottom of the shield and slide the temperature sensor into the plastic brackets. Close the bottom of the shield.

3. Hy-Cal Temperature Sensor

a. Attach the bridge assembly to any metal which is a proper chassis ground for all the analyzers (inside the chart recorder is a good place). If not grounded properly, the Bristol chart recorder will load the output which leads to different chart readings from datalogger readings.

b. Secure the temperature sensor near the manifold on the equipment racks. The sensor should not be against any metal or out in the open where AC or heat could directly affect the sensor.

AA.1.2 ROUTINE SERVICE CHECKS

AA.1.2.1 GENERAL INFORMATION

Perform the following checks on temperature sensors at the intervals specified in the service schedule. The checks may be performed more frequently but should be performed at least at the prescribed intervals. Document all results and maintenance on the Monthly Quality Control Maintenance Checksheet, MLD-111 (Figure AA.1.2.1).

AA.1.2.2 DAILY CHECKS*

1. Review datalogger and strip chart data for correct operation of the temperature sensor (inside and outside).

2. Data editing for temperature (inside and outside) data must be in accordance with the CARB SOP for Air Quality Monitoring, Volume II, Section 2.0.2.8 (Specific Criteria for Data Validity).

3. Verify that the radiation shield fan for the outside temperature sensor is operating.

* or each day the operator services the station

AA.1.2.3 BIWEEKLY CHECKS

1. Perform a visual inspection of the temperature sensor (inside and outside) to ensure that it is not damaged.

2. Record the datalogger outputs on the Monthly Quality Control Maintenance Checksheet.

3. Perform the zero and full-scale checks on the Met One translator module (Met One only).

AA.1.2.4 MONTHLY CHECKS

1. Complete and submit the Monthly Quality Control Maintenance Checksheet to your supervisor.

2. Review the temperature sensor data (inside and outside). Check for excess zero and span drifts, non-characteristic traces, or "dead" traces. Forward the strip charts to your supervisor.

AA.1.2.5 SEMIANNUAL CHECKS

Calibrations should be completed every six months on outside temperature sensors. The station operators should check to ensure that the calibration is not overdue. If the calibration is overdue, the station operators should notify their supervisor.

AA.1.2.6 ANNUAL CHECKS

Calibrations should be completed annually on inside temperature sensors. The station operators should check to ensure that the calibration is not overdue. If the calibration is overdue, the station operators should notify their supervisor.

CALIFORNIA AIR RESOURCES BOARD
MONTHLY QUALITY CONTROL MAINTENANCE Checksheet
METEOROLOGICAL INSTRUMENTATION

Location:_____ Month/Year:_____
Station Number:_____ Technician:_____

Resultant Wind Speed					Resultant Wind Direction				
Date	Translator Check (Knots)		Datalogger		Translator Check (Deg.)		Datalogger		Visual Check
	Zero	Full	Knots	Volts	Zero	Half	Deg.	Volts	

Outside Temperature							Inside Temperature			
Date	Ref	Translator Check (EC)		Chart	Datalogger		Ref	Chart	Datalogger	
	EC	Zero	Full	EC	EC	Volts	EC	EC	EC	Volts

Percent Relative Humidity							Solar Radiation			
Date	Translator Check (%RH)		Chart	Reference RH Sensor	Datalogger		Translator Check (W/m^2)		Datalogger	
	Zero	Full	%RH	%RH	%RH	Volts	Zero	Half	W/m^2	Volts

MLD-111 1 of 2 (9/94)

Figure AA.1.2.1
Monthly Quality Control Maintenance Checksheet

OPERATOR INSTRUCTIONS:

1. Daily Checks: Review datalogger and strip charts.

2. Bi-Weekly Checks: Record datalogger and strip chart readings.
   Record translator check readings (MET ONE ONLY).
   RWS: Visually inspect sensor cups or propeller for damage.
   RWD: Visually inspect wind vane for damage and record estimated wind direction (N, SW, NE, etc.).
   Verify mast orientation (Relative to True North).
   RH: Check station sensor versus reference %RH sensor.
   OTEMP/RH: Radiation shield fan operating.
   SOL. RAD: Radiation sensor not shaded.

3. Monthly Checks: Complete monthly maintenance checksheet.
   SOL. RAD: Clean radiation sensor element.

4. Semi-Annual Checks: Calibration (Last Cal. Date:_____)

5. As needed checks: Inspect and lubricate sensor cable connections with silicon based grease. Clean radiation shield housing.

NOTE: Resultant Wind Speed (RWS) and Resultant Wind Direction (RWD) datalogger readings will fluctuate, so operator should watch output for 15 - 20 seconds and record the average reading in the space provided. This value should be approximately ± 5 knots (RWS) and ± 30 degrees (RWD) of visual estimates.

Generally, %RH exceeds 70% during nighttime and early morning hours. Considering that the instruments are generally most accurate between 20% and 80% of their range. QC checks should be made sometime during the day when %RH is below 80%. If the difference between station RH sensor and the reference RH sensor (GT-L Hygroskop or Pyschro-dyne) is greater than 10% RH, then a problem may exist and the operator should troubleshoot to correct the problem. Station sensor filter cover may be excessively dirty.

Date	Comments or Maintenance Performed

MLD-111 2 of 2 (9/94) Reviewed by:_____ Date:_____

Figure AA.1.2.1 (cont'd)
Monthly Quality Control Maintenance Checksheet

AA.1.3 DETAILED MAINTENANCE PROCEDURES

General maintenance requirements for the temperature sensors are provided below. Refer to the sensor operating manual for detailed instructions on maintenance procedures.

1. Inside Temperature Sensors

    a. Inspect the sensor and cable connections. Remove any corrosion, using standard connector cleaning techniques. Replace any connectors that can not be cleaned to a shiny surface, or whose contacts are pitted, cracked, or broken.

    b. Remove any dust, spider webs, or insects, which can accumulate on the sensor.

    c. Record any maintenance, malfunctions, repairs, and actions taken to prevent recurrence of malfunction on the Monthly Quality Control Maintenance Checksheet.

2. Outside Temperature Sensors

    a. Inspect the sensor and cable connections. Remove any corrosion, using standard connector cleaning techniques. Replace any connectors that can not be cleaned to a shiny surface, or whose contacts are pitted, cracked, or broken.

    b. Remove any dust, spider webs, or insects which will accumulate in the intake orifice of the radiation shield.

    c. Record any maintenance, malfunctions, repairs, and actions taken to prevent recurrence of malfunction on the Monthly Quality Control Maintenance Checksheet.

AA.1.4 TROUBLESHOOTING

AA.1.4.1 GENERAL INFORMATION

Before starting any troubleshooting procedure, refer to the sensor operating manual for specific information pertaining to troubleshooting. Record malfunctions, repairs, and actions taken to prevent recurrence of any malfunction on the Monthly Quality Control Maintenance Checksheet (Figure AA.1.2.1).

AA.1.4.2 TROUBLESHOOTING

Troubleshooting should attempt to isolate the source of the malfunction and reduce maintenance time. The following items should be checked if a problem exists:

1. Visually inspect the temperature sensor (inside and outside) and check for signs of damage.

2. Check for loss of voltage supply.

3. Verify that the cable connections to the outside temperature sensor and the radiation shield motor are secure.

4. Measure the outputs from the outside temperature sensor, radiation shield motor and/or translator using the voltmeter.

5. Verify proper datalogger initialization.

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE SECTION

VOLUME II

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX AA.2

ACCEPTANCE TEST PROCEDURES

FOR

INSIDE/OUTSIDE TEMPERATURE SENSORS

MONITORING AND LABORATORY DIVISION

JUNE 1996

AA.2.0 ACCEPTANCE TEST PROCEDURES

AA.2.0.1 GENERAL INFORMATION

Before beginning acceptance testing of the temperature system, read the sensor operating manual thoroughly. Initiate an Acceptance Test Log (Figure AA.2.0.1) and an Acceptance Test "Mini" Report (Figure AA.2.0.2). Record the dates of the individual tests, problems, contacts with the manufacturer, and any other pertinent information on the Acceptance Test Log.

AA.2.0.2 PHYSICAL INSPECTION

Unpack the temperature system and check for physical damage. Verify that the system is complete and includes all options and parts required by the purchase order.

AA.2.0.3 OPERATIONAL CHECKS

Operational checks should assure that the temperature sensors meet or exceed performance specifications stated by the vendor. Verify that the temperature sensors meet Prevention of Significant Deterioration (PSD) guidelines for temperature: ACCURACY $\pm$0.5 degree Centigrade**.** Perform the following operational checks using a voltmeter, and/or datalogger and record the results on the Acceptance Test "Mini" Report. Tests must be run in the range normally used in field operations.

1. Translator Test - Connect a recorder or voltmeter to the output of the translator. In accordance with the sensor operating manual, verify that the translator correctly converts temperature to voltage. Verify proper operation of the zero and full/half scale switches (Met One only).

2. Linearity - Verify that the translator voltage outputs are linear $\pm$1% across the full scale at a minimum of five points. Enter the results on the Acceptance Test "Mini" Report linearity chart.

3. Range Test - Verify that the temperature system operates over the full scale as stated in the vendor’s specifications.

4. Accuracy - Verify that the temperature system accuracy meets or exceeds the vendors specifications.

Make_____ Model_____ Serial_____

ACCEPTANCE TEST LOG

Date	Action

Figure AA.2.0.1
Acceptance Test Log

ACCEPTANCE TEST "MINI" REPORT

Make_____ Model_____ Date_____

Serial_____CARB #_____ By _____

Reviewed _____

		Pass	Fail	Comments
I.	Physical Inspection	____	____	_____
	A. Shipping damage	____	____	_____
	B. Electrical wiring	____	____	_____
	C. Completeness	____	____	_____
II.	Operational Test	____	____	_____
	A. Translator	____	____	_____
	B. Linearity	____	____	_____
	C. Starting Threshold	____	____	_____
	D. Range	____	____	_____
	E. Accuracy	____	____	_____
III.	Special Test	____	____	_____
IV.	Maintenance Performed	____	____	_____

LINEARITY FULL SCALE _____

%FS	True Voltage	Indicated Voltage	Diff. True-Ind.	Comments
0				
.25				
.50				
.75				
1.00				

Abs. Value Average Difference _____

Average Diff. True - Ind. must be less than 1% of Full Scale (.01V)

Linear Regression Slope_____ Intercept_____ Correlation _____

Figure AA.2.0.2
Acceptance Test "Mini" Report

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME II

STANDARD OPERATING PROCEDURES

FOR

AIR QUALITY MONITORING

APPENDIX AA.3

CALIBRATION PROCEDURES

FOR

INSIDE/OUTSIDE TEMPERATURE SENSORS

MONITORING AND LABORATORY DIVISION

JUNE 1996

AA.3.0 OVERVIEW

AA.3.0.1 THEORY

Inside and outside air temperature sensor accuracy calibrations are performed to determine if the station temperature sensors correctly convert temperature to resistance. The resistance is converted by the sensors's translator to a representative voltage. This voltage is displayed as degrees Centigrade by the datalogger.

Calibration of outside temperature sensors should be completed once every six (6) months, or more frequently in corrosive environments. Calibrations are performed to assure that a sensor's accuracy is still within PSD guidelines. Inside temperature sensor calibrations should be completed at least once a year.

Normally, sensors are only removed from the aspirated shielding or housing to be calibrated. Therefore, sensors should be found in the same condition as they were when last calibrated. Before beginning calibration, document the "AS IS" condition on the Inside/Outside Temperature Calibration Datasheet (Figure AA.3.1.1). This will provide data to verify the validity of data between calibration periods. If any adjustments or repairs are needed, a "FINAL" Calibration Datasheet should also be completed. A Calibration Report (Figure AA.3.1.2) and Calibration Graph (Figure AA.3.1.3) should be completed after all calibrations. This report should become a permanent part of the station records.

AA.3.0.2 CALIBRATION EQUIPMENT

1. Handheld digital thermometer or National Institute Standards and Technology (NIST) glass thermometer (hereafter referred to as traceable thermometer).

2. Two glass reference thermometers (range 0-50EC @ 0.1EC graduations).

3. Three, two-liter beakers or Dewars containers for thermal water baths.

4. Hot plate.

5. Crushed ice, distilled water, and paper towels.

6. Inside/Outside Temperature Calibration Datasheet (Figure AA.3.1.1).

AA.3.1 CALIBRATION PROCEDURES

AA.3.1.1 GENERAL INFORMATION

Calibrations of indoor and outdoor temperature sensors are performed by removing the sensors from their mounting, immersing them in water baths of three different temperatures, and recording the temperature measurements in degrees Centigrade (°C). A digital or NIST-traceable glass thermometer should be used as a standard.

NOTE: It is recommended that a digital thermometer be used in the field. This reduces the possibility of breaking the NIST glass thermometers. The digital thermometer must be certified to a NIST temperature standard prior to calibration.

The three water baths consist of an ice bath (0°C), an ambient bath (25°C), and a hot bath (45°C). A traceable thermometer is placed in the three water baths within one inch of the station temperature sensor. The temperatures are compared, recorded, and the difference calculated. In accordance with U.S. EPA Volume IV, the difference between the traceable thermometer and the station outside temperature sensor must not exceed $\pm$0.5°C. The difference between the traceable thermometer and the inside temperature sensor must not exceed $\pm$1.0°C. If the station sensor cannot be immersed in water, a waterproof bag can be placed over the sensor prior to immersion. The traceable thermometer will also need to be placed in the bag as well.

NOTE: Calibrator should verify, prior to calibration, that zero and full-scale readings are within specs. To calibrate sensors as accurately as possible, look for problems, which could effect the operation of the sensor, such as dirty components and loose, worn, or broken parts. Correct and document any problems noted on the Inside/Outside Temperature Calibration Datasheet.

NOTE: The temperature channel of the datalogger should be disabled. If percent relative humidity is measured by the sensor, disable the percent relative humidity channel as well. Set the data logger to "REPEAT READ" the temperature channel. Also, be observant of problems, which could effect the operation of the sensor such as dirty components and loose, worn, or broken parts. Document and correct any problems noted.

AA.3.1.2 BATH PREPARATION

The water baths should be prepared when you first arrive at the site. The ice bath will take about 30 minutes to equilibrate and the hot bath can take up to 2 hours.

1. Ice Bath

   a. Fill the glass beaker or dewar with crushed ice.

   b. Fill the beaker with enough distilled water to cover the ice.

   c. Allow the ice bath to equilibrate for 30 minutes. Check the temperature with the reference thermometer. The water bath temperature should be 0.0°C $\pm$0.1. If it is above this temperature, add more crushed ice and wait for further equilibration.

2. Hot Bath

   a. Place the hot plate on a flat, stable surface, and plug the connector into a power source.

   b. Fill the beaker 3/4 full with distilled water.

   c. Place the beaker on the hot plate. Insert the reference thermometer in the bath to monitor the temperature. Turn on the hot plate and heat the water in the beaker to 45°C, then turn the temperature of the hot plate down to maintain that temperature.

3. Ambient Temperature

   a. Fill the beaker 3/4 full with distilled water.

   b. Set the beaker inside the station and allow to equilibrate to room temperature. Insert the reference thermometer to monitor the temperature. The temperature should be near 25°C. Add a little hot or cold water to obtain a temperature of approximately 25°C.

AA.3.1.3 INSIDE TEMPERATURE CALIBRATION

NOTE: The inside temperature channel on the datalogger should be disabled. Set the datalogger to "REPEAT READ" the inside station temperature channel.

1. Remove the inside station temperature sensor from its mounting. Immerse the station sensor and the traceable thermometer into the ice bath. The two sensors should be within one inch of each other.

2. When the readings from both the station sensors and the traceable thermometer are stable (minimum of five minutes) record the readings on Inside/Outside Temperature Calibration Datasheet. Take an average of three readings. Remember that the traceable thermometer readings must be corrected for slope and intercept.

3. Move the sensors to the ambient bath. Repeat step 2.

4. Move the sensors to the hot bath. Repeat step 2.

5. If any of the average temperature differences are greater than $\pm$1.0 degrees Centigrade, adjust the bridge assembly and recalibrate. Adjust the bridge assembly in accordance with the Hy-Cal sensor operating manual.

AA.3.1.4 OUTSIDE TEMPERATURE CALIBRATION

1. Remove the station outside temperature sensor from the radiation shield. Immerse the station temperature sensor and the traceable thermometer into the ice bath. The Rotronic sensor cannot be directly immersed in water, so it must be protected from coming in contact with the water. Place the Rotronic sensor and the traceable thermometer in a plastic bag that has been leak-checked. The plastic bag is then placed in the water bath.

2. The station temperature sensor and the traceable thermometer should be within one inch of each other in the water bath.

3. When readings from the station sensor and the traceable thermometer are stable (minimum of five minutes in the bath), record the datalogger and traceable thermometer temperatures on the Inside/Outside Temperature Calibration Datasheet. Take at least three sets of readings to ensure stability. Remember that the digital traceable thermometer readings must be corrected for slope and intercept.

4. Move the station sensor and the traceable thermometer to the ambient bath. Repeat steps 2 and 3.

5. Move the station sensor and the traceable thermometer to the hot bath. Repeat steps 2 and 3.

6. If there is a difference of greater than $\pm$0.5 degrees between the station sensor and the correct traceable thermometer readings, the station sensor should be replaced. Rotronics temperature sensors have "MAX" and "MIN" potentiometers, which are used to adjust the temperature readings. These potentiometers are adjusted in accordance with the Rotronics sensor operating manual. Recalibrate the Rotronics sensor after adjustment. If sensor cannot be adjusted, replace sensor and return the malfunctioning sensor to the Air Quality North Instrument Support Section.

CALIFORNIA AIR RESOURCES BOARD
INSIDE/OUTSIDE TEMPERATURE CALIBRATION DATASHEET

DATE_____ CALIBRATION: AS IS _____ FINAL_____

SITE: Name_____ Number_____Last Cal. Date_____

INSTRUMENT DESCRIPTION: (ITEMP ONLY)

Bridge or Electronics Assembly:
Manufacturer_____Model_____Serial_____

Sensor:
Manufacturer_____Model_____Serial_____
Reporting Units_____Range_____Sensor Height_____

CALIBRATION EQUIPMENT:

Digital Thermometer:
Manufacturer_____Model_____Serial_____

RTD Probe:
Manufacturer_____Model_____Serial_____

Digital Thermometer Assembly:
Slope =_____ Intercept =_____Last Cal.=_____

CALIBRATION:

NOTE: TRUE temperature readings below are Digital readings corrected for slope and intercept of Digital Thermometer Assembly. (If Ave. Diff. of any bath is more than 0.5°C (OTEMP) or 1.0°C (ITEMP), correct or replace sensor.)

REFERENCE BATH	DATALOGGER Degree C	DIGITAL Degree C	TRUE Degree C	DIFFERENCE True-Logger	AVERAGE Difference
COLD					
AMBIENT					
HOT					

Linear Regression: Slope=_____Intercept=_____Correlation=_____
Comments:_____
_____

Calibrated by_____Checked by_____

MLD-130 (08/02/95)

Figure AA.3.1.1
Inside/Outside Temperature Calibration Datasheet

CALIFORNIA AIR RESOURCES BOARD
CALIBRATION REPORT

TO: Michael Spears, Manager
Air Monitoring, Special Purpose Monitoring

LOG NUMBER: N/A
CALIBRATION DATE: 10/03/94
REPORT DATE: 10/04/94

FROM: Reginald Smith, Air Pollution Specialist

IDENTIFICATION

Instrument: Rotronics Humidity-Temperature	Site Name: Sonora
Model Number: MP-100C	Site Number: 55-930
Property Number: N.A	Site: ARB
Serial Number: 27513	Location: 251 S. Barretta St.
Previous Calibration Log Number: N/A	Instrument Property of: ARB
Elevation: 1796ft |Site Temperature: 23°C	Barometric Pressure: N/A "Hg

CALIBRATION STANDARDS

Standard	I.D. Number	Certification Date	Certified Value Or Factor
Omega 460-ATH Digital Thermometer	94050166	Aug 94	1.0022 (IND) -0.0595

CALIBRATION RESULTS

Component		Outside Temperature	
Instrument Range, degrees centigrade		-50 to +50	
AS-IS Ice Bath Difference, degrees centigrade		0.14	
FINAL Ice Bath Difference, degrees centigrade		N/A	
AS-IS Ambient Bath Difference, degrees centigrade		0.03	
FINAL Ambient Bath Difference, degrees centigrade		N/A	
AS-IS Hot Bath Difference, degrees centigrade		-0.27	
FINAL Hot Bath Difference, degrees centigrade		N/A	
Best Fit Linear Regression	Slope	1.0103	
	Intercept	-.174 9	
	Correlation	.9999	

Comments:
Calibrated By Reginald Smith Checked By_____
MLD-25 (11/90)

Figure AA.3.1.2
Sample Calibration Report

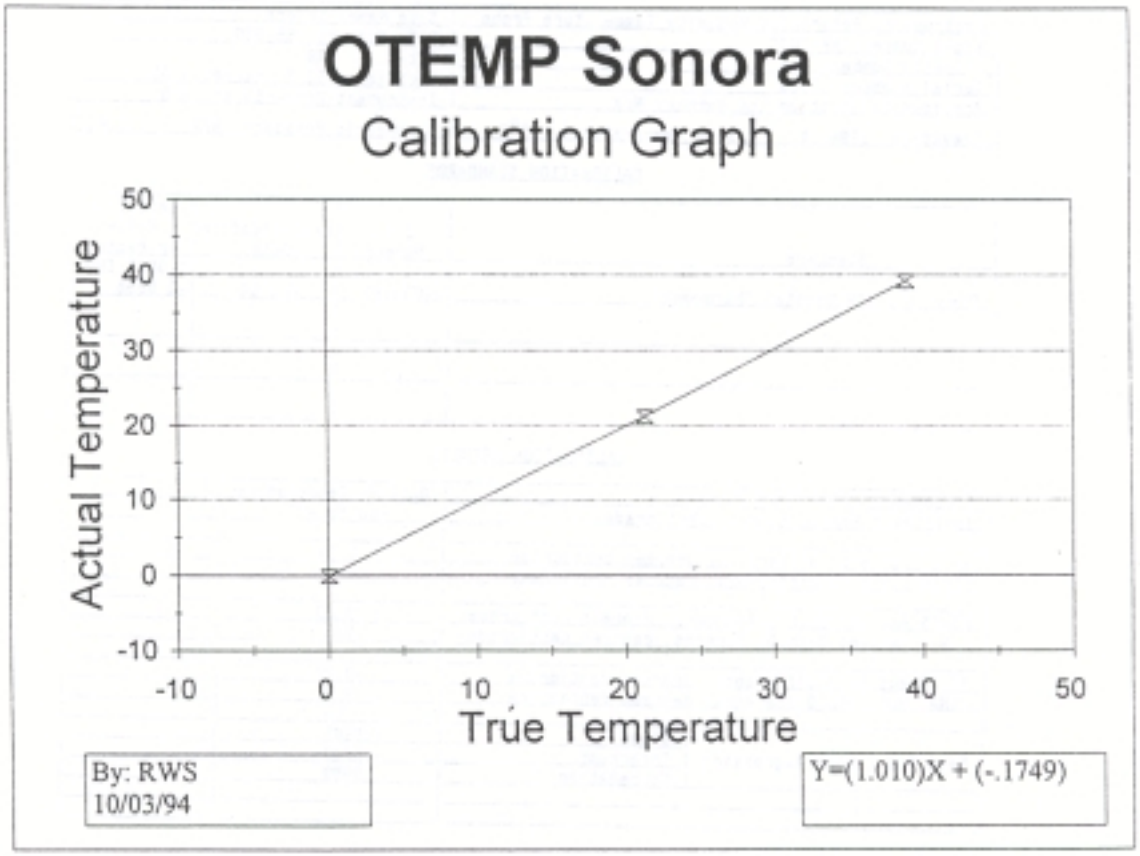

Figure AA.3.1.3
Sample Calibration Graph