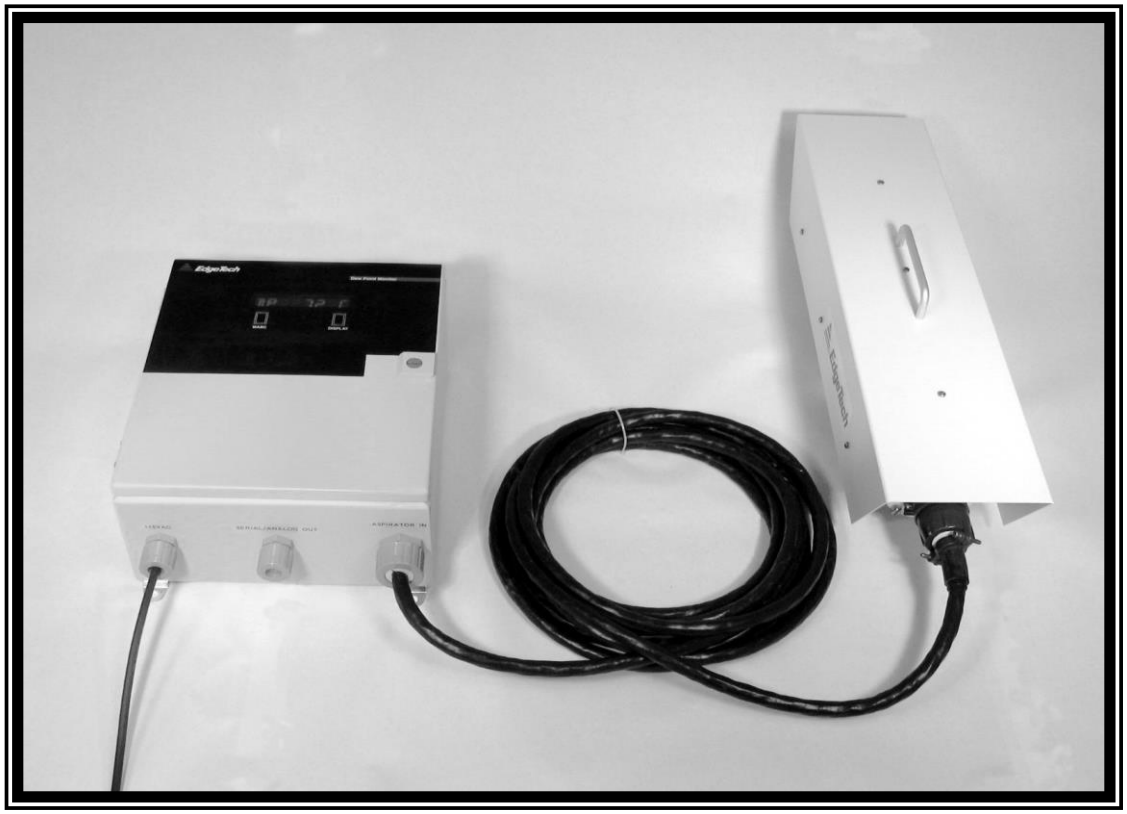
200M

METEOROLOGICAL

HUMIDITY SYSTEM

OPERATORS MANUAL



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200M rev 2 March 2016

Edgetech Instruments **200M**

Safety Advice

The 200M delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

CAUTION	Do not modify the unit. Improper modification can damage the product or lead to malfunction.

CAUTION	The 200M sensor unit has rotating parts Hazard. The 200M has electrical components and connections that pose electrical shock hazard if the power supply is not isolated before any work takes place. Please always follow all local and statutory safety procedures.

QUICK STARTUP GUIDE – Page 1

STARTUP

1. Mount the Aspirator Mounting Bracket and install in outside location. Screw in the large MS connector, attaching the Aspirator Cable to the fitting on the Aspirator.

2. Wire Control Unit electrical outputs and connect to their proper destinations. These may include:
   Analog Output 1 and 2, Alarm Relay, Clean Mirror Relay, Flow Alarm, and Serial Digital Output, depending upon which options were ordered.

3. Connect AC Power to the Control Unit.
   Observe all Local and Statutory safety procedures.

4. The 200M will go through its ABC (Automatic Balance Cycle) for several minutes. At the end of that time, Dew Point information will be seen on the Digital Display.

5. Program desired Alarm Set point if different than Factory default.

6. Choose the desired electrical Analog Output. Default is 4 to 20 mA. 0 to 5 VDC is internally selectable.

7. The Display button can be used to automatically or manually scan multiple humidity parameters, if they were ordered.

8. Program ABC Interval if desired.

QUICK STARTUP GUIDE – Page 2

ROUTINE MAINTENANCE (See Maintenance Section)

MIRROR CLEANING

The Automatic Balance Cycle (ABC) greatly minimizes cleaning requirements of the internal Chilled Mirror Sensor. Contaminants in the air will gradually build up on the mirror, to the point where manual cleaning is eventually required. Periods of 90 days between cleanings are typical, depending on the air contamination. An indication of CLN MIRR (Clean Mirror) on the Display, after an ABC Cycle, will tell the user when cleaning is needed.

(1) Turn off AC power to the Control Unit.

(2) Unscrew the large MS connector from the Aspirator.

(3) Unscrew the four thumbscrews and slide the Sensor Assembly out of the Aspirator housing.

(4) Slide up the black sensor cover, allowing access to the reflective round mirror surface inside.

(5) Use cotton swabs and isopropyl alcohol for mirror cleaning, following the procedure in the manual.

(6) Reverse the instructions in 1, 2, and 3 above, and reinstall.

(7) Reapply AC power to the Control Unit.

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3.0 INTRODUCTION

3.1 GENERAL DESCRIPTION

The Edgetech Instruments Inc. Model 200M Meteorological Hygrometer System is designed to continuously measure ambient Dew Point and Temperature in outside locations. The 200M Microcontroller based system, controls the Optical Chilled Mirror Sensor at the Dew Point, and continuously tracks the Dew Point Temperature.

The Dew Point Temperature and Optional Ambient Temperature are measured by Platinum Resistance Thermometers (PRTs) and then digitized and sent to the Display, and to the Analog and optional Serial Outputs. If the optional RH and AT packages are included, the DP and AT values will be used to calculate Relative Humidity. Dew Point temperature (DP) is available as a 4 – 20mA or 0 – 5VDC analog output. Additional outputs, up to three total, are optionally available.

Figure 3-1. 200M System

The system consists of two main components: The Aspirator Assembly (including the sensor), and the NEMA 4 Control Module. These components are connected by the Interconnecting Cable.

3.2 ASPIRATOR ASSEMBLY

The Aspirator is designed to be mounted outdoors and contains the D-Series sensor, and an air circulation fan to move air through the Aspirator and across the chilled mirror sensor. An optional Air Flow Sensor is available which will alert the user of a failure in the circulation. All internal components are attached to a frame that can be easily removed as a single unit to simplify maintenance.

3.3 CONTROL UNIT

The NEMA 4 Control Unit contains a Main PC Board, an Interconnection PC Board, and a +5 VDC $\pm$12 VDC triple output power supply. The Main PC Board may also include an optional output board and/or an Alarm Relay.

3.3.1 MAIN PC BOARD

The Main Printed Circuit Board includes a Software controlled Microcontroller System, Data Acquisition Circuitry, servo circuitry to maintain the mirror at the Dew Point temperature, PRT signal conditioning circuits for DP and AT, and a multiplexed D/A Converter for Analog Outputs.

3.3.2 INTERCONNECTION TERMINAL BOARDs

The Customer Interconnection TB3 strip provides screw terminal connectors for Power connections. TB1 provides screw connection for the Aspirator cable.

3.3.3 ANALOG OUTPUT 2 AND SERIAL PC BOARD (OPTIONAL)

The Analog Output PC Board (Options Board) contains circuitry to convert the digital outputs of the Main PCB to 4 - 20 mA or 0 – 5 VDC for each of the outputs. A simplex RS-232 Serial Output is also available on this board.

3.3.4 POWER SUPPLY

The power supply module requires 95 to 265 VAC, 45 Watts, 50-60 Hz input and supplies +5 VDC and ±12 VDC to power the Aspirator and Control Unit.

3.4 INTERCONNECTING CABLE

A weatherproof cable carries the power and signals between the Control Unit and the Aspirator. It is connected to the Aspirator assembly by an MS type weather-resistant connector.

4.0 WARRANTY STATEMENT

All equipment manufactured by Edgetech Instruments Inc. is warranted against defective components and workmanship for repair at their plant in Massachusetts, free of charge, for a period of twelve months. Malfunction due to improper use is not covered in this warranty and Edgetech Instruments disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose and there is no warranty of merchantability. This warranty applies only if (i) the items are used solely under the operating conditions and in the manner recommended in the instruction manual, specifications, or other literature; (ii) the items have not been misused or abused in any manner or repairs attempted thereon; (iii) written notice of the failure within the warranty period is forwarded to Edgetech Instruments and the directions received for properly identifying items returned under warranty are followed; and (iv) the return notice authorizes Edgetech Instruments to examine and disassemble returned products to the extent Edgetech Instruments deems necessary to ascertain the cause for failure. The warranties expressed here are exclusive. There are no other warranties, either expressed or implied, beyond those set forth here, and Edgetech Instruments does not assume any other obligation or liability in connection with the sale or use of these products.

Equipment not manufactured by Edgetech Instruments Inc. is supported only to the extent of the original manufacturer’s warranties

5.0 EDGETECH INSTRUMENTS INC.'S COMMITMENT TO QUALITY

Thank you for purchasing one of our products. At Edgetech Instruments Inc., it is our policy to provide cost-effective products and support services that meet or exceed your requirements, to deliver them on time, and to continuously look for ways to improve both. We all take great pride in the products which we manufacture 100% in the USA.

We want you to be entirely satisfied with your instrument. The information contained in this manual will get you started. It tells you what you need to get your equipment up and running, and introduces its many features.

We always enjoy hearing from the people who use our products. Your experience with our products is an invaluable source of information that we can use to continuously improve what we manufacture. We encourage you to contact or visit us to discuss any issues whatsoever that relate to our products or your application.

The Employees of Edgetech Instruments Inc.

6.0 N.I.S.T. TRACEABILITY – WHAT DOES IT MEAN?

The Model 200M is certified by Edgetech Instruments Inc. to be traceable to N.I.S.T., the National Institute of Standards and Technology (formerly known as the National Bureau of Standards, or NBS), in Gaithersburg, Maryland, U.S.A. You have received a Certificate of Calibration with this instrument. What does N.I.S.T. Traceability mean in terms of this instrument?

The Model 200M measures Dew Point using the Optical Chilled Mirror (OCM) technique, which provides a primary rather then a secondary measurement of Dew Point temperature. In addition, Dew Point is a fundamental measurement of humidity. It is not affected by temperature.

Both the Dew Point temperature and the Air Temperature are measured using Platinum Resistance Thermometers (PRTs). These devices are coils of nearly pure platinum, where the rate of change of resistance with temperature is precisely known. Resistance is accurately measured and is automatically converted to temperature information within the instrument.

Other parameters, such as Percent Relative Humidity, are microprocessor-calculated from the directly measured Dew Point and Temperature information.

TRACEABILITY:

- 1. The precise platinum resistance thermometers are N.I.S.T. traceable by the traceable resistance standards maintained by the PRT manufacturers.

- 2. A multi-point Dew Point calibration is performed on every chilled mirror sensor, using Edgetech Instruments' traceable secondary dew point standard. This instrument, a precise chilled mirror hygrometer, is periodically sent directly to N.I.S.T. for certification against the USA's Dew Point transfer standard, a Two-Pressure Generator.

7.0 GLOSSARY

ABC:	Automatic Balance Control – a method of maintaining accuracy in the presence of contamination and minimizing maintenance requirements.
Alarm Relay	An alarm that may be set at a specific measurement point to provide information that the point has been exceeded.
Analog Out	A voltage or current that tracks changes in a parameter.
Aspirator	A housing with built-in fan to provide continuous air sample to a sensor.
AT	Air Temperature – the temperature inside the test chamber.
Depression	The magnitude of available mirror cooling in the chilled mirror sensor.
DP	Dew Point Temperature – the temperature that moisture in the air *just begins* to condense on a cooled surface.
Hysteresis	The tendency of a sensor to give one set of readings when going up, and a different set of reading when going down.
Mirror	A small metallic reflective surface within the dew point sensor.
NEMA 4	National Electrical Manufacturer's Association Type 4 – Watertight and Dust-tight.
PRT	Platinum Resistance Thermometer, a precise resistor that changes in a known and predictable quantity with temperature.
Relay	A switching device with isolated contacts.
RH	Percent Relative Humidity – the ratio between the *actual* moisture content in the chamber and the *maximum* moisture content if the chamber air was saturated, at a given air temperature.
RS-232	An accepted industry standard for a serial digital interface.
Serial Port	See RS-232.
Slew Rate	The rate of temperature change of the mirror assembly in the chilled mirror dew point sensor.

8.0 INSTALLATION

8.1 ASPIRATOR ASSEMBLY

A 30 inch angle beam and two 0.5 inch bolts are provided with the system. Use the 0.5 inch bolts to secure the angle beam to the Aspirator Assembly mounting block. The opposite end can be configured to accommodate the user's mounting platform or tower.

NOTE: The Aspirator must be mounted a minimum of six (6) feet away from any heat reflecting or heat radiating surface.

Caution Electrical Hazards

8.2 CONTROL UNIT

The Control Unit electronics are housed in a water-tight enclosure meeting NEMA 4 classification. Four 0.3 inch mounting holes are provided at the rear of the enclosure. There are three cable entry ports at the bottom.

Left Opening: 0.86 inch diameter for the power supply cable.

Center Opening: 0.86 inch diameter for the analog output cable.

Right Opening: 1.343 inch diameter for the aspirator interconnecting cable.

Stuffing glands for water-tight cable entry are installed in all three holes. These may be replaced with conduit fittings, if desired.

Control Unit mounting Details

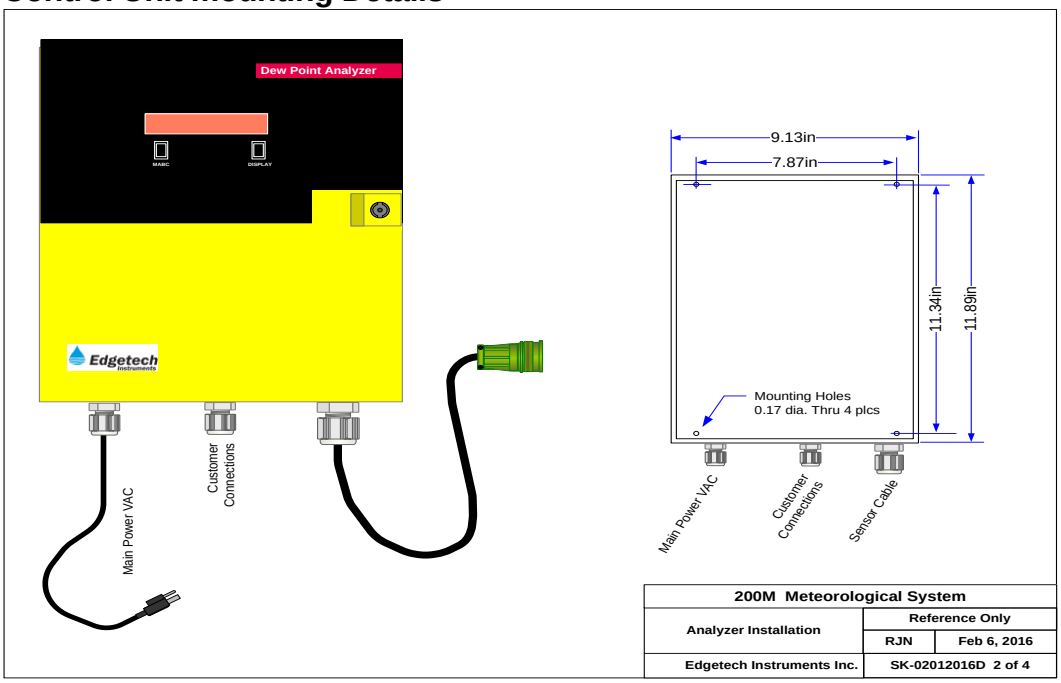

Figure 8-1 Physical connection and mounting details

8.3 ASPIRATOR INTERCONNECTING CABLE

See Figure 8-2. The Aspirator interconnecting cable is attached to the electronics module when shipped from the factory. If the cable is to be routed through conduit or small openings, it may be necessary to disconnect it from the module. To do so, open the water-tight front cover and the front panel. Disconnect the cable from terminals TB1, A and B on the Interconnection PCB, and remove the nut and bushing from the stuffing box. When reconnecting the cable, be sure that all wires are connected to their proper terminals. All wires are labeled with numbers or letters corresponding to letters and numbers on the PCB.

Caution

1. It is important to make sure the heavy wires "A" and "B" are correctly connected to TB1, since a reversal of these wires may cause permanent damage to the cooler elements in the sensor. They are shown Figure 8-2.

2. For a reliable long-life installation, provide strain relief for the Aspirator Interconnecting Cable by tying it down to supports, using electrical tape, tie-wraps, or equivalent.

8.4 POWER CONNECTIONS

Caution: Be sure that the Power Cable is <u>not</u> live before attempting to connect it to the Control Unit. Do <u>not</u> apply power until the installation has been completed. Once power has been applied to the system, exercise caution if the front panel has been opened for any reason.

Connect the Power Cable to TB3 on the Interconnect PCB, as follows:

Green wire – Connect to Terminal # 1 G (Ground)
White wire – Connect to Terminal # 2 N (Neutral)
Black wire – Connect to Terminal # 3 H (Hot)

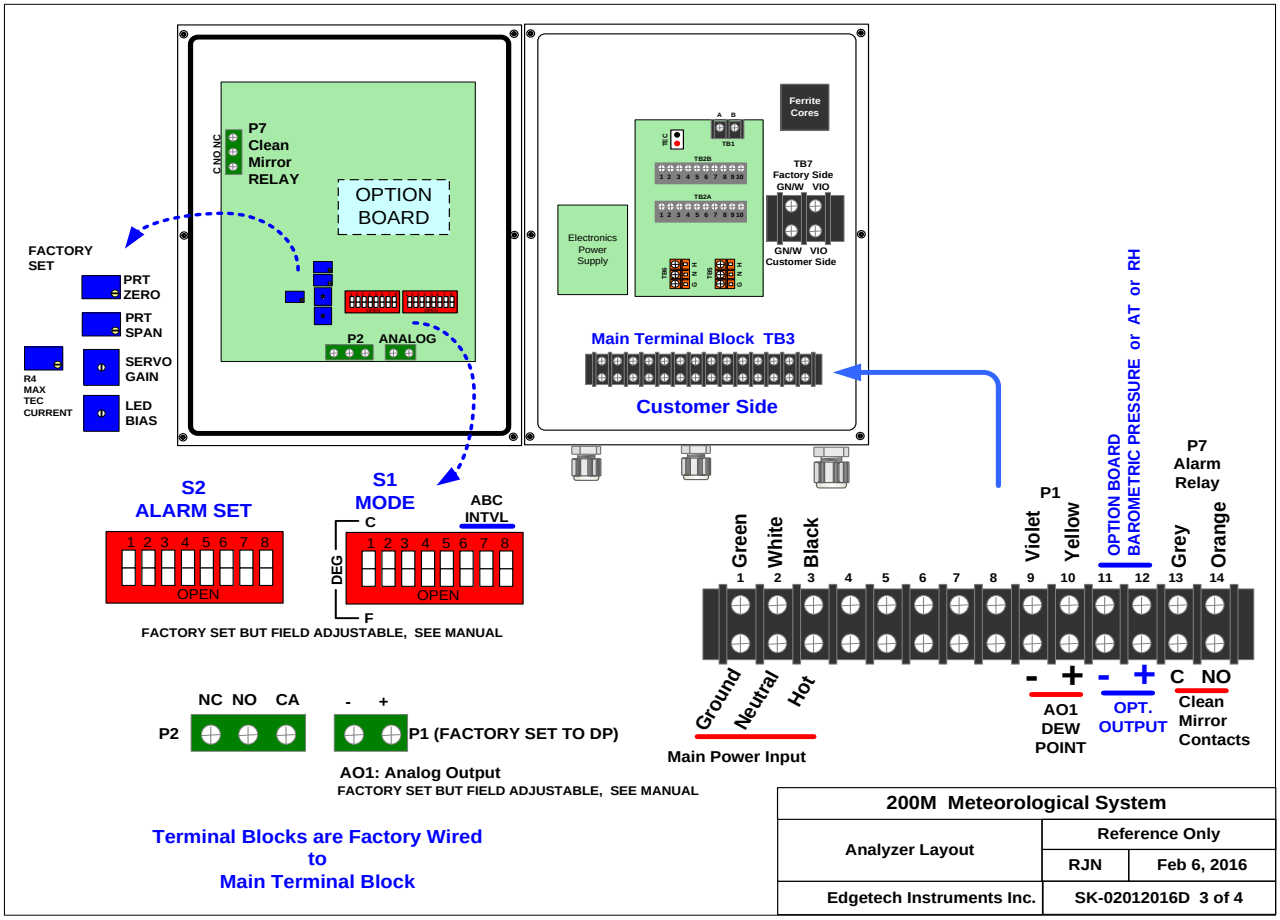

Figure 8-2 PCB layout and connection details

TB	PIN	WIRE COLOR	REF PIN
TB2A	1	RED	1
TB2A	2	RED/ WHITE	2
TB2A	3	BROWN	3
TB2A	4	ORN	4
TB2A	5	GREEN	5
TB2A	6	BLUE	6
TB2A	7	ORN/ BLACK	7
TB2A	8	BLUE/ WHITE	8
TB2A	9	ORN/ RED	9
TB2A	10	RED/ GREEN	10

TB	PIN	WIRE COLOR	REF PIN
TB2B	1	YELLOW	11
TB2B	2	BLK/ WHITE	12
TB2B	3	GREY	13
TB2B	4	GREEN/ BLK	14
TB2B	5	YEL/ WHITE	15
TB2B	6	BLK-SHIELDS	16
TB2B	7		17
TB2B	8		18
TB2B	9	GREEN	19
TB2B	10	BLACK	20

INTERCONNECT PCB

TB	PIN	WIRE COLOR	REF PIN
TB7	A	GN/ W	P10-1
TB7	B	VIO	P10-2

TEC POWER

TB	PIN	WIRE COLOR	REF PIN
TB3	1	GROUND	MAINS
TB3	2	NEUTRAL	MAINS
TB3	3	HOT	MAINS
TB3	9	NEGATIVE	AO1
TB3	10	POSITIVE	AO1
TB3	11	NEGATIVE	OPTION
TB3	12	POSITIVE	OPTION
TB3	13	COMMON	C.M.
TB3	14	N. OPEN	C.M.

MAIN TERMINAL BLOCK

Note: AO1 = Analog Output, Field Configurable

200M Meteorological System		
Customer Wiring Points Analyzer	Reference Only	
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Figure 8-3. AC Power Connections

9.0 BASIC BLOCK DIAGRAM THEORY OF OPERATION

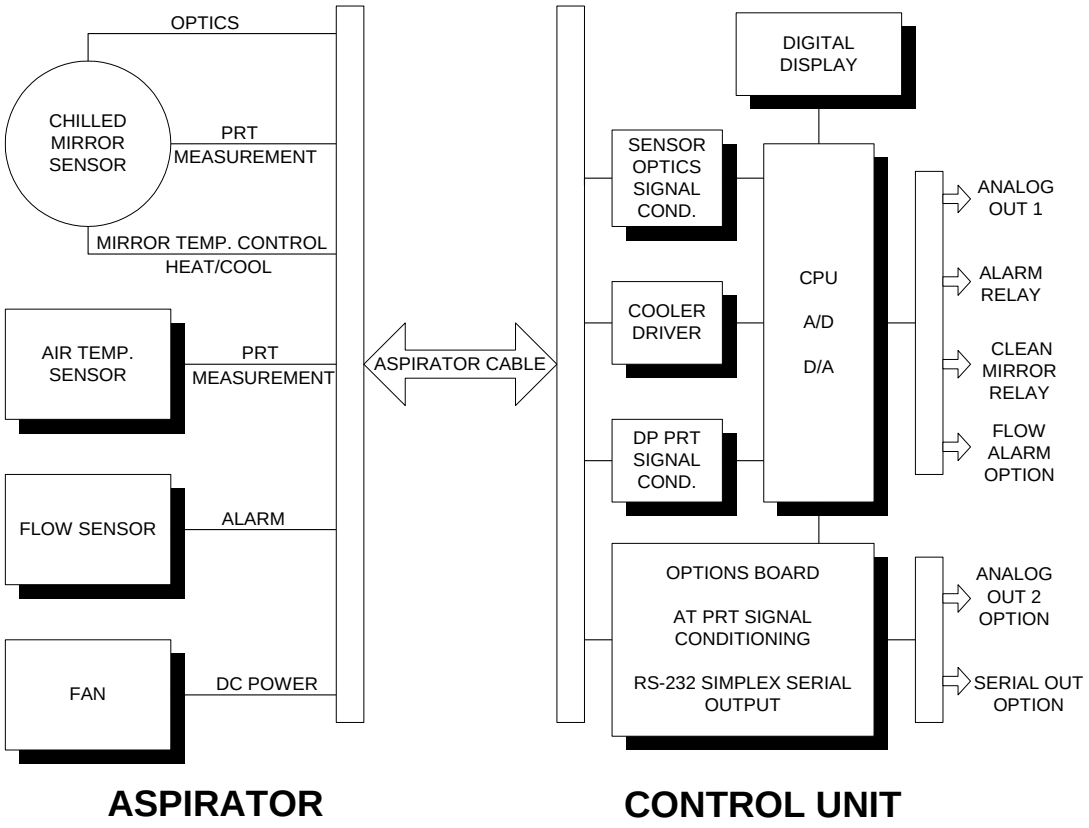


Figure 9-1. 200M Basic Block Diagram

9.1 ASPIRATOR BLOCK DIAGRAM

The weatherproof Aspirator Unit houses the Chilled Mirror Dew Point Sensor, and an Air Temperature Sensor (optional) and Flow Sensor (optional). A built-in fan keeps a continuous sample of outside air flowing past the sensors. The purpose is twofold – to provide the latest sample of outside air as ambient conditions change, and to remove any heat generated by the electronics. If the incoming sample air flow is lost for any reason, the Flow Alarm will provide an indication to the operator. The Dew Point Sensor is easily removed for periodic maintenance.

9.2 CONTROL UNIT BLOCK DIAGRAM

The Control Unit contains all the electronics required to support the aspirated sensors, and to provide information to the operator. This includes:

9.2.1 OPTICAL SYSTEM

The Chilled Mirror Dew Point Sensor contains two optical devices, an LED light transmitter and a Phototransistor light receiver. As described in Chapter 12, the Chilled Mirror Dew Point Sensor, the phototransistor optical signal varies as a dew layer forms on the chilled mirror, which causes the light from the LED to be scattered. Signal conditioning circuitry on the Main PC Board detects and amplifies the optical signal.

9.2.2 COOLER DRIVER

The solid-state thermoelectric cooler in the Dew Point Sensor, which cools the mirror, is driven by current from the Cooler Driver. A servo loop, which receives an input from the optical signal described above in 9.2.1, controls the chilled mirror temperature via the Cooler Driver, such that a thin layer of dew is maintained on the surface at all times. As the ambient Dew Point varies, the optical signal, and therefore the driver current, also varies. The result is that the mirror temperature tracks the Dew Point up and down as it changes.

9.2.3 DEW POINT PRT SIGNAL CONDITIONING

Since the mirror temperature tracks the Dew Point temperature as described above in 9.2.2, measuring the mirror temperature provides information directly in Dew Point. The PRT (Platinum Resistance Thermometer) is built into the mirror block. Precise signal conditioning circuitry measures the resistance of the PRT. This information is amplified, digitized, and provides Dew Point information to the CPU.

9.2.4 OPTIONS BOARD

An Air Temperature PRT option is available. When mounted in the Aspirator, it precisely measures the Ambient Air Temperature. Signal conditioning circuits on the Options Board amplify this signal, which is also digitized and provided to the CPU. Once both the Dew Point and Air Temperature are known, the 200M has all the information to read out the ambient Percent Relative Humidity, which is calculated by the software-controlled microprocessor.

Another available option in the 200M is a simplex RS-232C Serial Port. This port enables the user to have a remote digital signal providing Dew Point, Air Temperature, Percent Relative Humidity, or other internally calculated humidity parameters. It may be fed to a remote data terminal, computer, or digital data acquisition system. The Option Board contains the Serial Port circuits.

9.2.5 CENTRAL PROCESSING UNIT (CPU)

The Analog-to-Digital (A/D) and Digital-to-Analog (D/A) circuits and the software-controlled CPU provide all of the control, calculation, and processing of the input signals from the Aspirator. They also provide the Analog Outputs. The CPU also drives the Digital Display on the Control Unit front panel.

OUTPUT SIGNALS

The Customer connection terminal TB3 provides the following outputs:

1. Analog Output 1
2. Alarm Relay
3. Clean Mirror Relay
4. Flow Alarm Option
5. Analog Output 2

9.2.6 DIGITAL DISPLAY

A large, readable LED digital display is built into the Control Unit cover. Selected humidity parameters, and well as alarm conditions, may be alternately shown for operator information. The Digital Display is controlled by the CPU.

9.3 ASPIRATOR CABLE

The Aspirator Cable carries all of the controlling and measuring signals between the Aspirator and the Control Unit. This heavy-duty shielded cable is a critical and integral part of the 200M.

10.0 DESCRIPTION

The front panel of the Model 200M includes an LED Digital Display and two pushbuttons.

10.1 DIGITAL DISPLAY

The eight-character alphanumeric LED display is used to display DP, AT, and RH data and status messages. Dew point data is displayed as “DP 34.8 F”, with the units in degrees C or F. When a status message is necessary, the display will alternate between the data and the message at about 2 second intervals.

Figure 10-1 Digital Display

The various status messages and their meanings are:

ABC CYCL
Indicates that an Automatic Balance Cycle is in progress.

During an ABC Cycle:

The mirror is heated above the ambient temperature for a period of 1 to 3 minutes as determined by the last measured dew point. After sufficient time has elapsed to ensure that the mirror is dry, the reflected light level of the mirror is measured and, if necessary, adjusted to the reference level. After the adjustment is made, the instrument will begin cooling and seeking the dew point. When a stable lock on the dew point is achieved, the ABC CYCL message will disappear, and normal operation will resume.

The analog output is held to the last measured value just before the cycle started, until the completion of the ABC cycle.

If an alarm condition is present when the ABC cycle begins, the ALARM display is disabled but the Alarm Relay remains energized.

ALARM
The Alarm Set Point has been exceeded. The Alarm Relay will be energized.

CLN MIRR
During an ABC Cycle, the reflectivity of the sensor mirror and optics are analyzed and a correction is made for changes in the reflectivity since the last cycle. If the mirror reflectivity has *decreased* beyond the automatic correction range, this message will appear at the completion of the ABC cycle, indicating

that the sensor mirror needs a manual cleaning. Perform the Mirror Cleaning Procedure in the Maintenance section.

> **Note:** The instrument may *appear* to operate normally with this message present, but the data should not be relied upon until the appropriate maintenance is performed.

CHK SNSR
If, during the ABC Cycle, the reflectivity has increased significantly due to excessive drift of the optics or abnormal circuit performance, this message will appear. To determine the cause, take the following steps:

- Run one or more MABC Cycles.
- Clean the mirror. See the Maintenance section.
- Check the Aspirator for proper flow.
- Check for loose connections or components on the printed circuit board and sensor.

If the condition cannot be resolved with these checks, contact Edgetech Instruments for service.

NO FLOW
If the FLOW ALARM option is installed, the Display will flash this message, indicating that the air circulation in the Aspirator is not adequate. If the optional Flow Alarm Relay is installed, it will energize. The alarm Condition will remain until the cause is found and corrected.

10.2 MABC BUTTON

Pressing the MABC Button (**M**anual **A**utomatic **B**alance **C**ycle) at any time will initiate an ABC Cycle.

10.3 DISPLAY BUTTON

If multiple parameters are ordered, this button allows the user to select the parameter to be displayed continuously, or set the display to automatically SCAN the available parameters at two to three second intervals. If the system is DP only, the button is inactive. For each press of the button, the displayed parameter will be advanced to the next parameter.

When the message SCAN appears, the display will automatically increment the parameter every 2 to 3 seconds.

When an ABC CYCLE is started either manually or automatically, the display will revert to DP for the duration of the Cycle.

When the Cycle is complete, the display will return to the pre-ABC state.

10.4 ANALOG OUTPUT

The analog output is field programmable for either a 4 to 20 ma, 0 – 20 mA, 0 – 24 mA, or 0 – 5 VDC output. The standard range is set at the factory for –58 to 122 °F (-50 to +50 °C). Other ranges are available from the factory.

During an ABC Cycle, the analog output is held constant at the dew point prior to the start of the cycle. When the cycle is completed, the output is released and will resume tracking the Dew Point.

10.5 CLEAN MIRROR RELAY

The Clean Mirror Relay is a SPDT (Form C) relay that is energized whenever maintenance to the mirror is required. During an ABC cycle, all alarm functions, including the relay, are disabled. However, if an ABC Cycle is initiated when an alarm condition is present, the relay will remain energized until the cycle is complete. At the end of the cycle the relay will remain energized if the Clean Mirror condition is still present, or be de-energized if the alarm condition has passed.

10.6 FACTORY DEFAULTS

The standard Model 200M is shipped from the Factory with the following default options and settings.

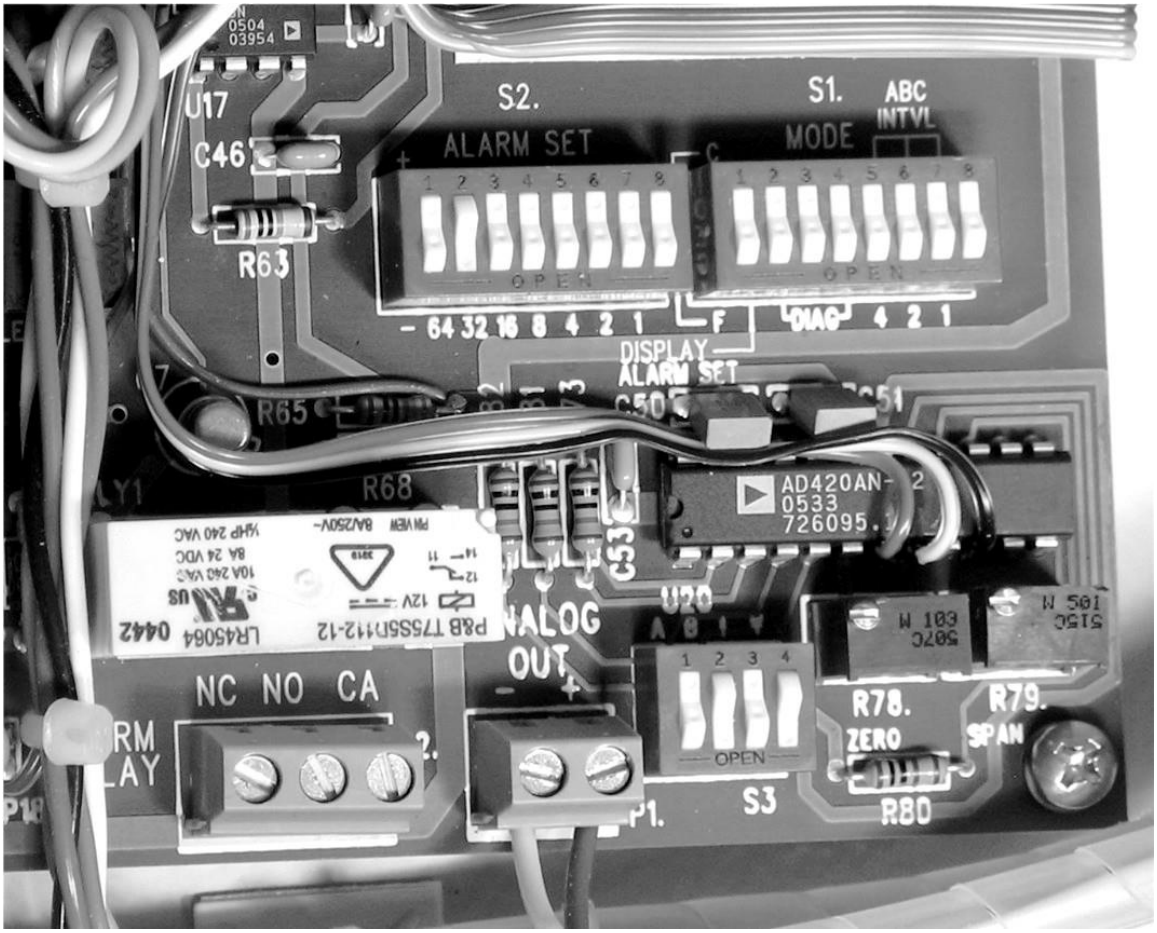
Aspirator Cable -	25 feet (7.6 meters) standard. Other lengths are available.
Dew Point Sensor -	Two Stage Chilled mirror for low dew points.
Air Temp. Sensor -	Optional (For Temperature or %RH readings)
Display Units -	Degrees C is standard. Degrees F is field selectable.
Air Flow Alarm Relay -	Optional
Analog Output -	One output is standard. A second output is optional. 4 to 20 mA is standard. 0 to 5 VDC or other current ranges are field programmable. Range: -50 to +50^{o}C (-58 to 122^{o}F) is standard. Other ranges are optional.
Alarm Relay -	Standard, field programmable
ABC Interval -	24 hours, field programmable

11.0 OPERATION

11.1 DISPLAY UNITS

The system temperature display units are normally set at the factory to degrees C. The units are selected by setting Dipswitch S1, Position 1, to ‘C’ or ‘F’.

Figure 11-1. Dipswitches S1, S2, and S3



11.2 ALARM SETPOINT (See Table 11.1)

Dipswitch S2 sets the Alarm Set point temperature as an integer. The switch setting represents an eight bit binary number in degrees C with position 8 as the least significant bit (LSB) and position 2 as the most significant bit (MSB). Position 1 is the sign bit. An ‘open’ switch is a ‘1’ and ‘closed’ is a ‘0’. If the desired set point is in degrees F, convert it to Celsius before proceeding.

Set the switches as follows:

1. Convert the desired set point temperature from degrees C to its eight bit binary equivalent code. Table 11.1 is provided to convert F to C and the equivalent eight bit binary code.

2. Set S1-1 ‘closed’ and S1-2 ‘open’. The alarm temperature setting will be displayed in degrees C.

NOTES: **S1-1 selects either C or F to display in both the measurement and alarm set modes.**

S1-2 will switch the display between the Dew Point and the Alarm setting.

3. Set S2, positions 1 through 8 according to the eight bit binary number determined in Step 1. A ‘1’ is ‘open’, and a ‘0’ is ‘closed’.

4. The display should now read the Set point temperature in degrees Celsius.

5. If Fahrenheit units are desired, set S1-1 to ‘open’.

6. Return to Dew Point display by setting S1-2 ‘closed’.

Table 11.1 Alarm Set point Switch Positions

ALARM TEMP		S2 POSITION
C	F	12345678
-50.0	-58.0	10110010
-49.0	-56.2	10110001
-48.0	-54.4	10110000
-47.0	-52.6	10101111
-46.0	-50.8	10101110
-45.0	-49.0	10101101
-44.0	-47.2	10101100
-43.0	-45.4	10101011
-42.0	-43.6	10101010
-41.0	-41.8	10101001
-40.0	-40.0	10101000
-39.0	-38.2	10100111
-38.0	-36.4	10100110
-37.0	-34.6	10100101
-36.0	-32.8	10100100
-35.0	-31.0	10100011
-34.0	-29.2	10100010
-33.0	-27.4	10100001
-32.0	-25.6	10100000
-31.0	-23.8	10011111
-30.0	-22.0	10011110
-29.0	-20.2	10011101
-28.0	-18.4	10011100
-27.0	-16.6	10011011
-26.0	-14.8	10011010
-25.0	-13.0	10011001
-24.0	-11.2	10011000
-23.0	-9.4	10010111
-22.0	-7.6	10010110
-21.0	-5.8	10010101
-20.0	-4.0	10010100
-19.0	-2.2	10010011
-18.0	-0.4	10010010
-17.0	1.4	10010001
-16.0	3.2	10010000
-15.0	5.0	10001111
-14.0	6.8	10001110
-13.0	8.6	10001101
-12.0	10.4	10001100
-11.0	12.2	10001011
-10.0	14.0	10001010
-9.0	15.8	10001001
-8.0	17.6	10001000
-7.0	19.4	10000111
-6.0	21.2	10000110
-5.0	23.0	10000101
-4.0	24.8	10000100
-3.0	26.6	10000011
-2.0	28.4	10000010
-1.0	30.2	10000001
0.0	32.0	00000000

ALARM TEMP		S2 POSITION
C	F	12345678
0.0	32.0	00000000
1.0	33.8	00000001
2.0	35.6	00000010
3.0	37.4	00000011
4.0	39.2	00000100
5.0	41.0	00000101
6.0	42.8	00000110
7.0	44.6	00000111
8.0	46.4	00001000
9.0	48.2	00001001
10.0	50.0	00001010
11.0	51.8	00001011
12.0	53.6	00001100
13.0	55.4	00001101
14.0	57.2	00001110
15.0	59.0	00001111
16.0	60.8	00010000
17.0	62.6	00010001
18.0	64.4	00010010
19.0	66.2	00010011
20.0	68.0	00010100
21.0	69.8	00010101
22.0	71.6	00010110
23.0	73.4	00010111
24.0	75.2	00011000
25.0	77.0	00011001
26.0	78.8	00011010
27.0	80.6	00011011
28.0	82.4	00011100
29.0	84.2	00011101
30.0	86.0	00011110
31.0	87.8	00011111
32.0	89.6	00100000
33.0	91.4	00100001
34.0	93.2	00100010
35.0	95.0	00100011
36.0	96.8	00100100
37.0	98.6	00100101
38.0	100.4	00100110
39.0	102.2	00100111
40.0	104.0	00101000
41.0	105.8	00101001
42.0	107.6	00101010
43.0	109.4	00101011
44.0	111.2	00101100
45.0	113.0	00101101
46.0	114.8	00101110
47.0	116.6	00101111
48.0	118.4	00110000
49.0	120.2	00110001
50.0	122.0	00110010

11.3 ABC INTERVAL

The ABC Interval is the time between the automatic initiation of an ABC Cycle. In typical applications, an interval of 24 hours is recommended and set at the Factory. However, in cases where ambient conditions are more variable, or the sample gas is higher in contaminants, a shorter interval may be required. The times listed below are approximate.

The interval is adjustable in 4 hour increments from 4 to 28 hours. Switch positions S1-6, -7, and -8 represent a three bit binary code with a weight of 4 hrs. per unit. To set the interval, set S1-6, S1-7, and S1-8 according to the binary number from Table 11.2 below. The factory default is 24 hrs.

ABC INTERVAL	S1 - 6	S1 - 7	S1 - 8
OFF	0	0	0
4 hrs.	0	0	1
8 hrs.	0	1	0
12 hrs.	0	1	1
16 hrs.	1	0	0
20 hrs.	1	0	1
24 hrs.	1	1	0
28 hrs.	1	1	1

POSITION '0' = CLOSED; '1' = OPEN

Table 11.2 ABC Interval Switch Settings

11.4 ANALOG OUTPUT 1

The user can change the output type from the factory default. However, the factory stated accuracy might be slightly degraded. The 4-position dipswitch S3, located at the lower right corner of the Main PCB is used to select the output type. Table 11.3 below lists the settings for each type.

OUTPUT	1	2	3	4
0 – 5 VDC	0	0	1	0
4 – 20 MA	0	1	0	1
0 – 20 MA	1	0	0	1
0 – 24 MA	1	1	0	1

POSITION '0' = CLOSED; '1' = OPEN

Table 11.3 Analog Output Dipswitch S3 Settings

11.5 ANALOG OUTPUT 2

If the optional second Analog Output has been ordered, the setup is similar to Analog Output 1. See Table 11-3 above. The location of the switches for this output is on the Option Board.

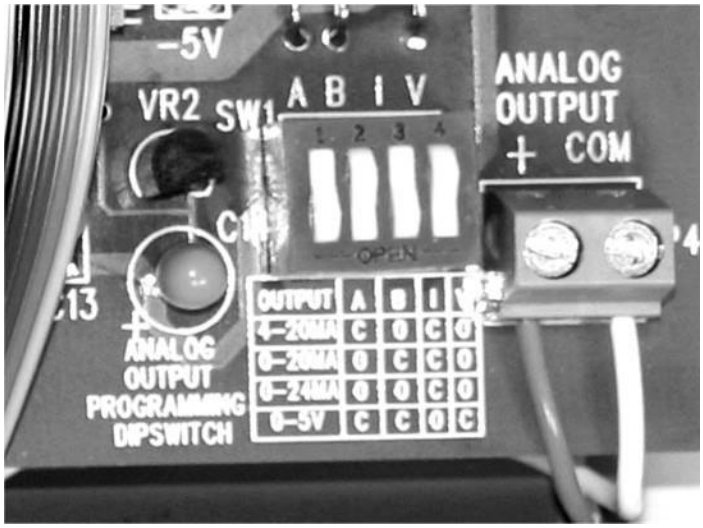
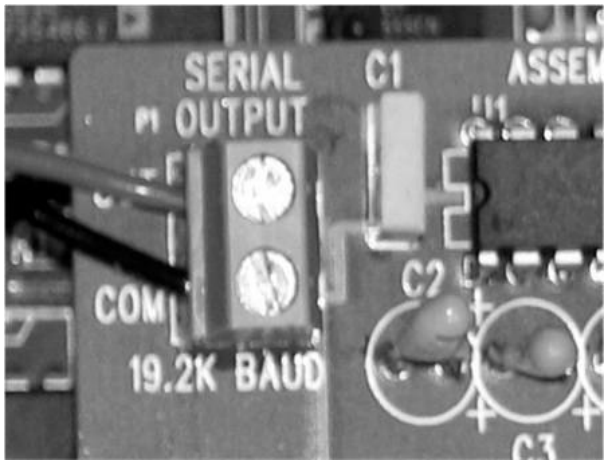


Figure 11-2. Analog Output 2 Programming

11.6 SERIAL OUTPUT



An optional, simplex RS-232 Serial Output is available. The BAUD Rate is 19.2K and the fixed output interval is one second. The connections are made to P1 on the Option Board. P1-1 is the output and P1-2 is common.

Figure 11-3. Serial Output Connections

11.7 POWER UP

Before applying power to the system, check that all connections have been made correctly, especially the heavy wires to Terminals A and B of TB1. These wires carry the cooler current and a polarity reversal could cause damage to the sensor. Ensure all connections are made and firmly tighten to avoid any electrical arcing and premature failure

12.0 THE CHILLED MIRROR DEW POINT SENSOR

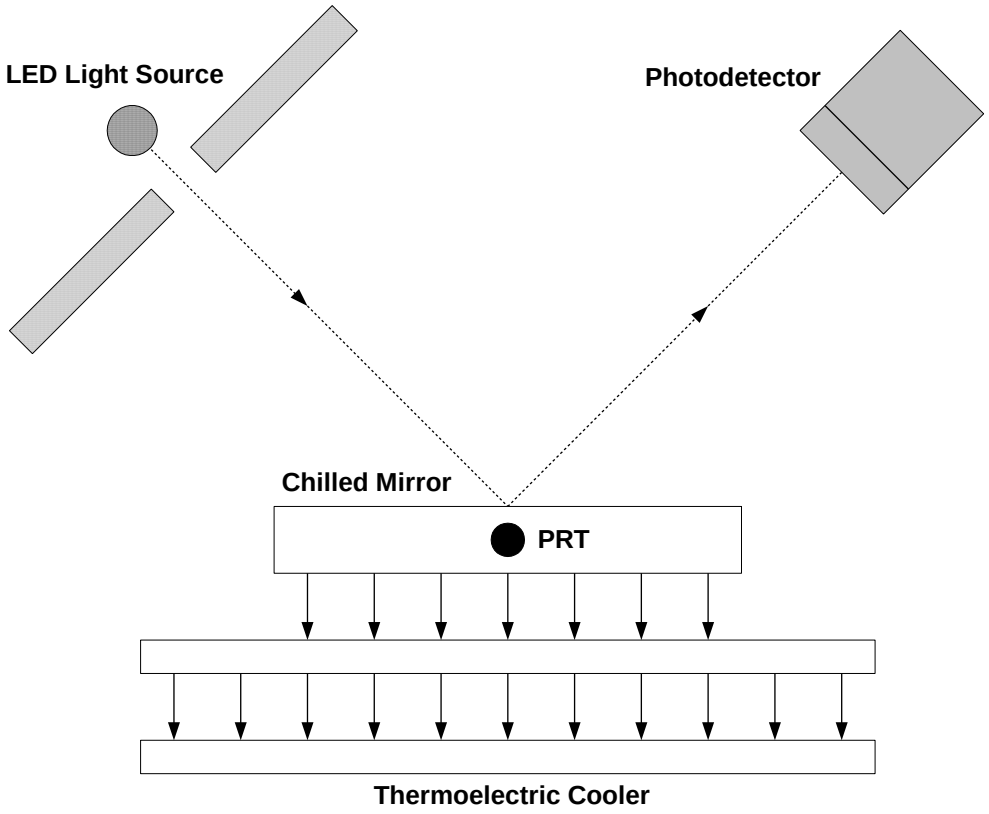


Figure 12-1. Chilled Mirror Block Diagram

12.1 THEORY OF OPERATION

Dew Point is defined as *the temperature that moisture <u>just begins</u> to condense on a surface*. The chilled mirror dew point sensor measures this parameter directly. A highly reflective *chromium plated mirror* is mounted to a solid state heat pump, or thermoelectric cooler. A *light source* (LED) is reflected off the *mirror* onto an opposing *photodetector*. The mirror is cooled thermoelectrically to the temperature at which condensation (dew or frost) first begins to form. This condensate causes the *light source* to be refracted, resulting in a reduction of light as seen by the *photodetector.* This signal is sent to a servo amplifier which controls power to the thermoelectric cooler, automatically controlling the mirror at whatever temperature is required to maintain a very thin film of water droplets (or frost) on the surface at all times. This is the dew point (frost point when below 0^{o}C) by definition.

Since the mirror surface is always at the dew point, measuring the mirror temperature provides actual dew point temperature. Temperature data is received from a PRT (platinum resistance thermometer) embedded directly beneath the *chilled mirror* surface. The PRT is very tightly thermally coupled to the mirror surface, in order to minimize measurement error.

The advantages of the Chilled Mirror are:

- It provides a *primary*, as opposed to a *secondary* measurement of dew point.
- Measurement is continuous, accurate and repeatable.
- Results are traceable to N.I.S.T., supporting ISO 9000 and military test requirements.
- No hysteresis.
- No drift.
- Dew point accuracy of +/- 0.2^{o}C

These advantages make the Chilled Mirror sensor the technology of choice for Edgetech Instruments Dew Point Hygrometers.

12.2 MIRROR AUTOMATIC BALANCE CYCLE (ABC)

The Automatic Balance Cycle is an important electronic feature of this instrument that allows much longer operation of the system without any maintenance. At least 90 days is typical. As contamination from the air sample gradually builds up on the mirror surface, an error in the indicated dew point reading could eventually occur. In order to eliminate this potential source of error, the system periodically reprograms itself by correcting for the loss in reflectivity caused by the contaminants on the surface, allowing the mirror to operate at the actual dew point temperature once again. This is called b*alancing.* The user should always use the ABC feature, because it greatly minimizes mirror cleaning requirements.

When you first turn on the instrument, the Automatic Balance Cycle is initiated. It can also be programmed to be initiated automatically with selectable intervals, or initiated manually at any time by depressing the MABC (Manual Automatic Balance Cycle) button.

The ABC first heats the mirror surface above the dew point, causing the condensate layer to evaporate, leaving only the contamination on the surface. The amount of light received from the dry mirror is then measured, and a correction in the servo loop is made, normalizing the system (balancing) and compensating for the contaminant layer. The balance cycle only takes a few minutes, and at the end of that period the mirror resumes tracking the actual dew point temperature.

12.3 CARE AND MAINTENANCE OF THE CHILLED MIRROR SENSOR

Although the ABC greatly minimizes the requirement for mirror cleaning, eventually the system will have to be shut down and the mirror cleaned. A CLN MIRR (Clean Mirror) indication displayed at the end of the ABC tells the user when cleaning is required. See the Maintenance chapter for detailed instructions in mirror cleaning.

13.0 MAINTENANCE

Caution electrical shock, rotating parts and sharp edge Risks.

13.1 MIRROR MAINTENANCE

It is recommended that the automatic ABC be on and set to an interval of at least 12 hours. If preferred, a Manual Automatic Balance Cycle can be initiated at any time that is convenient or if a problem is suspected.

If the display flashes “CLN MIRR”, after an ABC Cycle, press the MABC Button to initiate another ABC Cycle. If the CLN MIRR is still on at the end of the cycle, the mirror needs to be physically cleaned.

For best performance, it is recommended that a mirror cleaning be performed periodically.

13.1.1 CLEANING THE MIRROR

To gain access to the sensor and the mirror, remove the Aspirator Assembly from the Housing as instructed in Section 13.2. Slide the black sensor cover towards the MS connector end of the aspirator approximately 2 inches to allow access to the mirror surface.

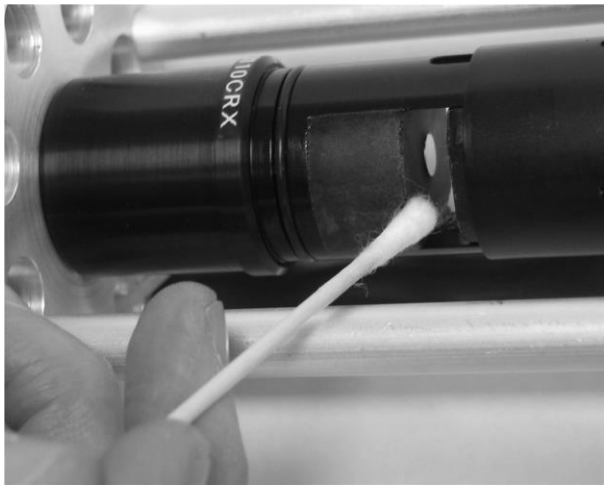


Figure 13-1. Cleaning the Mirror

1. Moisten a clean cotton swab with isopropyl alcohol. Cotton swabs and cleaning bottle are provided in the Cleaning Kit supplied.
2. Wipe the mirror surface and the optics surface in a circular motion.
3. Dry the surface with a clean cotton swab.
4. Next, moisten a clean swab with clean, preferably distilled water and lightly wipe the mirror and optics areas.
5. Dry these areas thoroughly with a clean, dry swab.
6. Slide the sensor cover back into position.

Replace the Aspirator Assembly into its housing as instructed in Section 13.2, Step 5.

13.2 REMOVAL OF SENSOR ASSEMBLY FROM ASPIRATOR

To gain access to the components in the Aspirator Assembly, proceed as follows:

1. Disconnect power from the system.

2. Loosen the 4 captive screws on the end cap with the MS connector.

3. Loosen the stop screw from the bottom of the Aspirator Housing enough to allow the sensor assembly to be pulled out of the housing. The stop screw is located just rear of the mounting bracket.

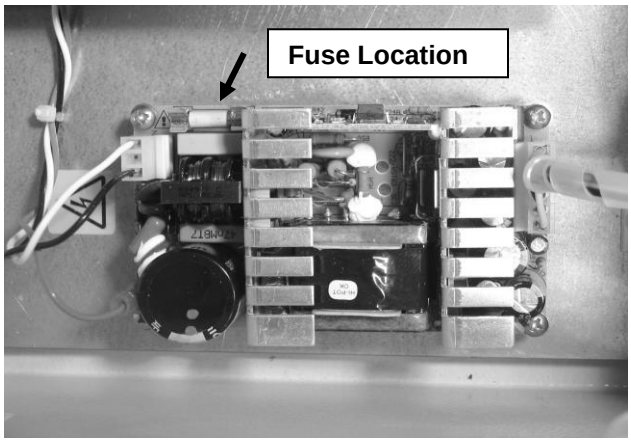
4. Once out of the housing, individual components may be inspected and replaced if necessary. All electrical connections are plug in for easy replacement.

5. To re-assemble the Aspirator Unit, align the guide hole in the connector end cap with the guide pin in the sensor housing. Carefully slide the sensor assembly back into the housing. Tighten the four thumbscrews in the end cap and the stop screw in the bottom of the Aspirator housing.

13.3 REPLACING THE POWER SUPPLY FUSE

Isolate Mains Electrical Power supply before starting any work.

Figure 13-2. System Power Supply Fuse



If AC Power is applied to the 200M and the instrument is non-responsive (digital display does not light up, aspirator fan does not run, etc., the possibility exists that the fuse may be open. To access the fuse, which is located in the Power Supply, proceed as follows:

1. Open the Control Unit cover.

2. Locate the Power Supply module adjacent to the Interconnect Board.

The correct fuse value is 3.15 Amp, 250V, regardless of whether 115 VAC or 230 VAC is applied to the instrument. Do not increase fuse size rating, do not bypass fuse or damage will occur to the PCB.

14.0 SPECIFICATIONS

Measurement Range

Dew/ Frost Point	-58 to 122 °F (-50 to 50 °C) (Stanard DS2 Sensor)
Ambient Temperature	-58 to 122 °F (-50 to 50 °C)

Measurement Accuracy

Dew/ Frost Point	±0.5 °F (±0.28 °C) (Entire Range)
Ambient Temperature	±0.5 °F (±0.28 °C)

Operating Temperature

Sensor	-40 to 160 °F (-40 to 72 °C)
Control Unit	32 to 122 °F (0 to 50 °C)

Analog Outputs (One standard. Consult Factory for additional outputs.)

Dew Point	4 - 20 mA DC, Scaled to –58 to +122 °F (±50 °C) 0 - 20 mA DC 0 - 24 mA DC 0 - 5 VDC
Ambient Temperature	4 - 20 mA DC, Scaled to –58 to +122 °F (±50 °C) 0 - 20 mA DC 0 - 24 mA DC 0 - 5 VDC
%RH	4 - 20 mA DC, Scaled to 0% to 100% RH 0 - 20 mA DC 0 - 24 mA DC 0 - 5 VDC

Consult factory for custom scaling.

Functional

Power:	90-260VAC, 50-400Hz, 40 Watts
Fuse:	3.15 Amp, 250V
Display:	Eight Digit Alphanumeric LED, 0.5” High.

High Dew Point Alarm:

Visual	Flashing Message on Display
Relay Contacts	1 Form C (SPDT), non-latching
Contact Ratings	10A @ 240VAC 8A @ 24 VDC ½ HP @ 240VAC

Physical Description:

NEMA 4 Control Box

Dimensions	13.75“ (34.9 cm) H, 11.75” (29.8 cm) W 6.5“ (16.5 cm) D
Weight (with cable)	27 lbs (12.2 Kg)
Mounting	Wall mount standard
Material	Aluminum

Aspirator

Dimensions	6.5” (16.5 cm) H, 6.5” (16.5 cm) W 27” (68.6 cm) D
Weight	18 lbs (8.2 Kg)
Mounting	Bracket Mounting (mounting bracket provided)
Mounting Bracket Weight	7.5 lbs (3.4 Kg)
Material	Aluminum

Standard Features

Microprocessor Controlled.
Eight Digit Alphanumeric LED Display. 0.5 in. High
Degrees F or C Display
Automatic Balance Control. (ABC)
User settable high alarm limit.
Visual alarm.
Alarm Relay, Form C.
Analog Output, 4 – 20mA.
Wall mountable NEMA 4 Case.

Optional Features

A second Analog Output
Simplex RS-232 Serial Output
Aspirator Flow Alarm

15.0 APPENDIX

(Some documents may be included separate from the Manual binder.)

A.) Conversion Table: Current (voltage) to Temperature or other Psychometric units

B.) Drawing F28566: Aspirator Mechanical Assembly

C.) Drawing D28818: Model 200M Aspirator Assembly, Sheet 1

D.) Drawing C28820: Model 200M Aspirator Assembly, Sheets 1 and 2

E.) Drawing A99001: Model 200M Main PCB Schematic

F.) Drawing A999040 Model 200M Option Analog Output PCB Schematic

G.) Drawing C28815-3: Model 200M Interconnection Diagram

NOTES