OMEGA ENGINEERING, INC.

MODEL RHB-1500-C

Portable Dew Point Monitor

OPERATOR'S MANUAL

1 YEAR WARRANTY

MADE IN USA

ISO 9001 CERTIFIED CORPORATE QUALITY
STAMFORD, CT

ISO 9002 CERTIFIED CORPORATE QUALITY
MANCHESTER, UK

Shop Online: omega.com
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TABLE OF CONTENTS

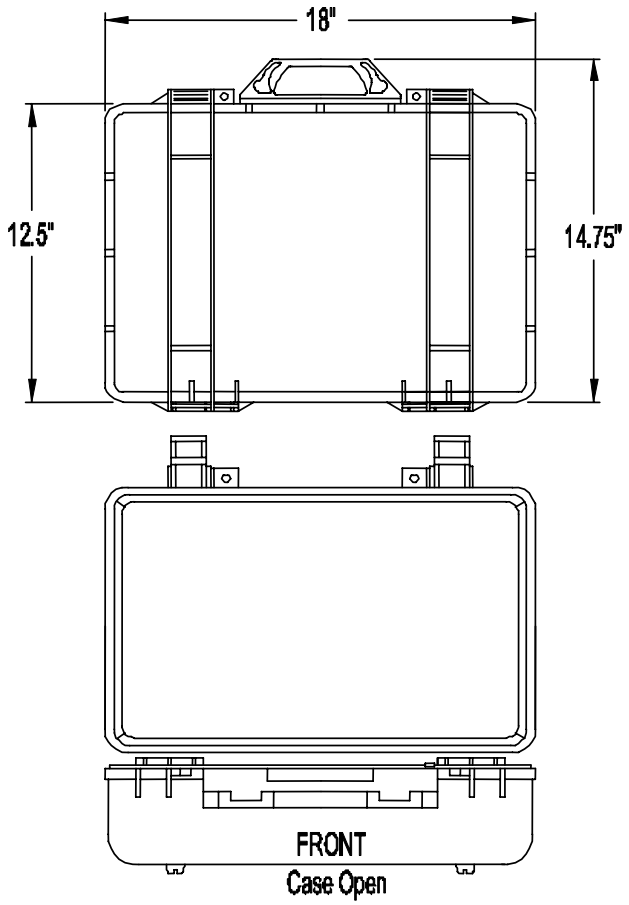
1.0 GENERAL DESCRIPTION

The Model RHB-1500-C Battery Powered DPM is an integrated system including a microprocessor-based instrument, a chilled mirror dew point sensor, a sample flow meter and associated tubing and fittings.

The Standard Instrument includes: (Other options available)

- An eight-digit, alphanumeric, LED display to report the dew point and system status.
- Periodic sensor balance check.
- Programmable Alarm Set Point with visual and contact closure alarm indications.
- Two SPDT (Form C) Alarm Relay.
- 4 - 20mA analog output.

FIGURE 1.1 CASE DIMENSIONS



2.0 SAMPLE CONNECTIONS

2.1 SAMPLE CONNECTIONS

The sample may be brought to the instrument with ¼" copper, stainless steel, or plastic tubing and terminated in a ¼" female fitting.
Connect the sample supply line to the ¼" tubing fitting located on the panel (Figure 2.2).
NOTE: The maximum inlet pressure is 150 PSIG.

Figure 2-2.0 Drawing Model RHB-1500-C1 & Model RHB-1500-C2
Figure 2-2.1 Drawing Model RHB-1500-C1-Sx "underneath"
Figure 2-2.2 Drawing Model RHB-1500-C1-DsX "Insertion Probe"

2.2 ALARM RELAY CONNECTIONS

When the programmed Alarm Set Point conditions are met, the alarm relay will be energized. Before connecting any device to the Alarm Relay contacts, check the contact ratings in the Specifications section.

1. Connect one of the signal wires to the CA (Center Arm) and the other wire to either the NO (Normally Open) or NC (Normally Closed) terminal. Which ever is preferred by the installer.
   (See Figure 2.3)

2.3 ANALOG OUTPUT CONNECTIONS

"4-20mA out". All connections can be made at terminal strip. (See Figure 2.3)

1. Connect the high signal wire to the **"+"** terminal and the low side to the **"-"** terminal.

2.4 SERIAL PORT OUTPUT CONNECTIONS (Optional)

1. "RS232 out". (See Figure 2.3)

FIGURE 2-2.0 TOP & BELOW PANEL LAYOUT

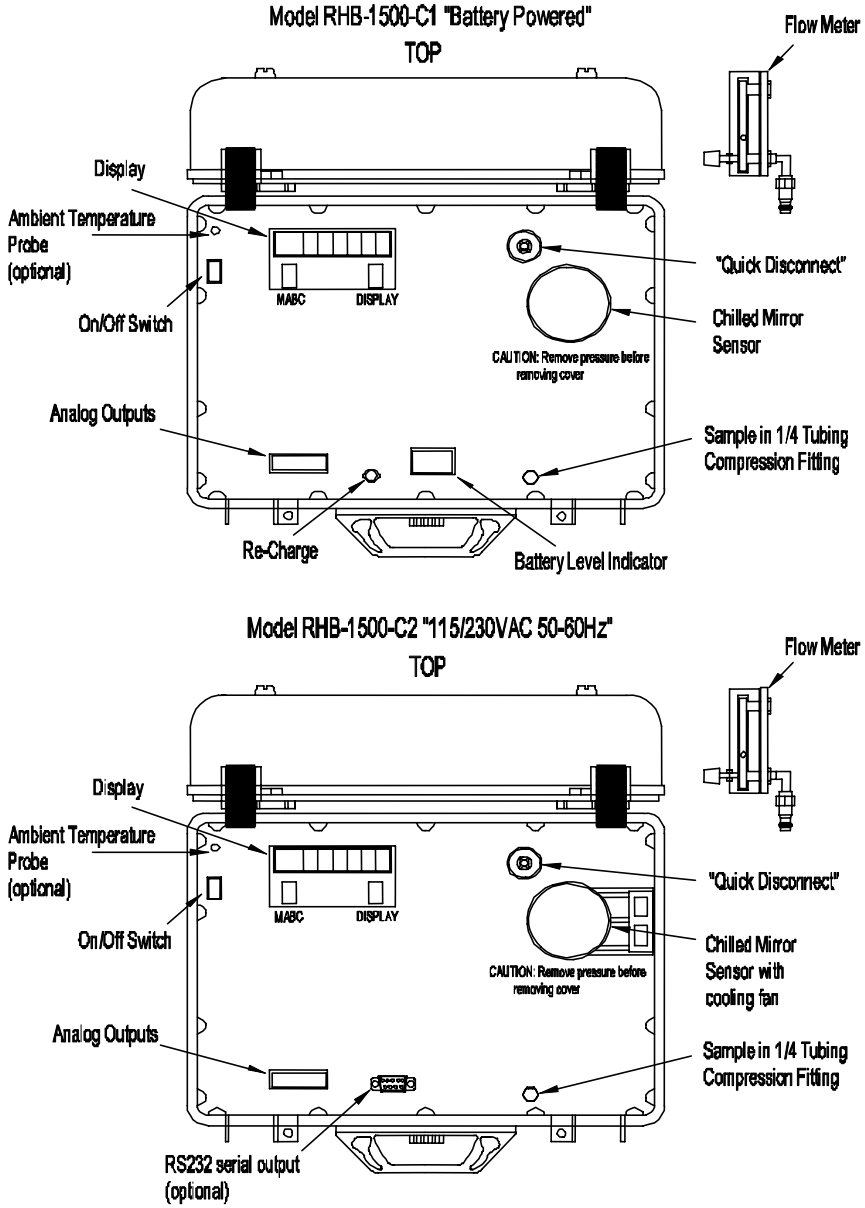
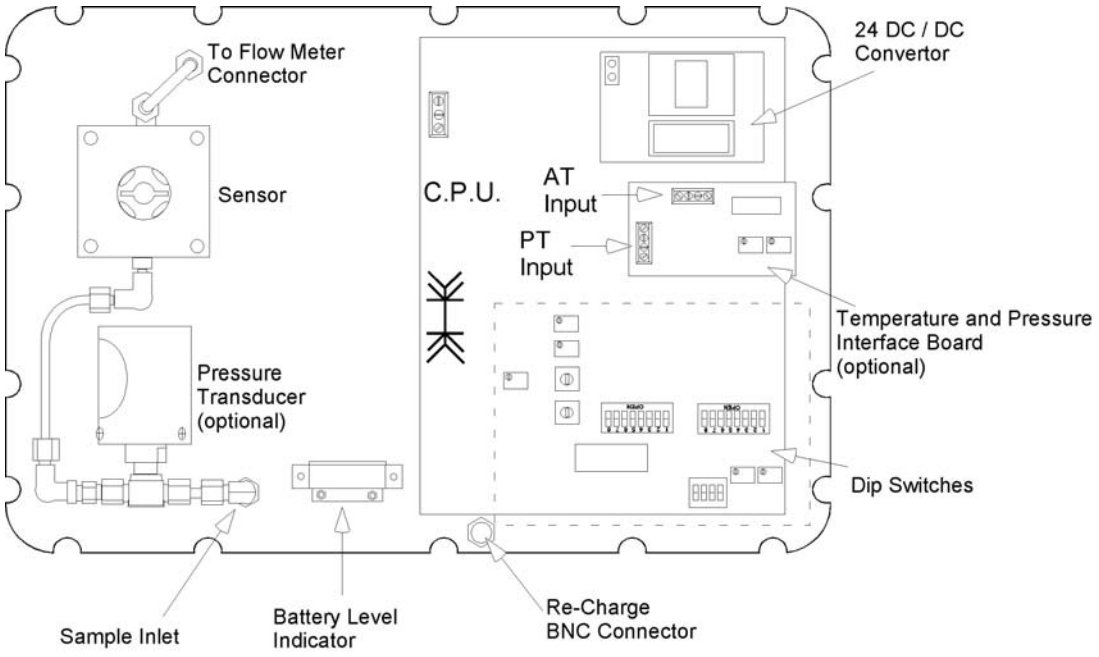


FIGURE 2-2.1



BELOW PANEL

WITH S-TYPE SENSOR

FIGURE 2-2.2 Model RHB-1500-C1-DSx

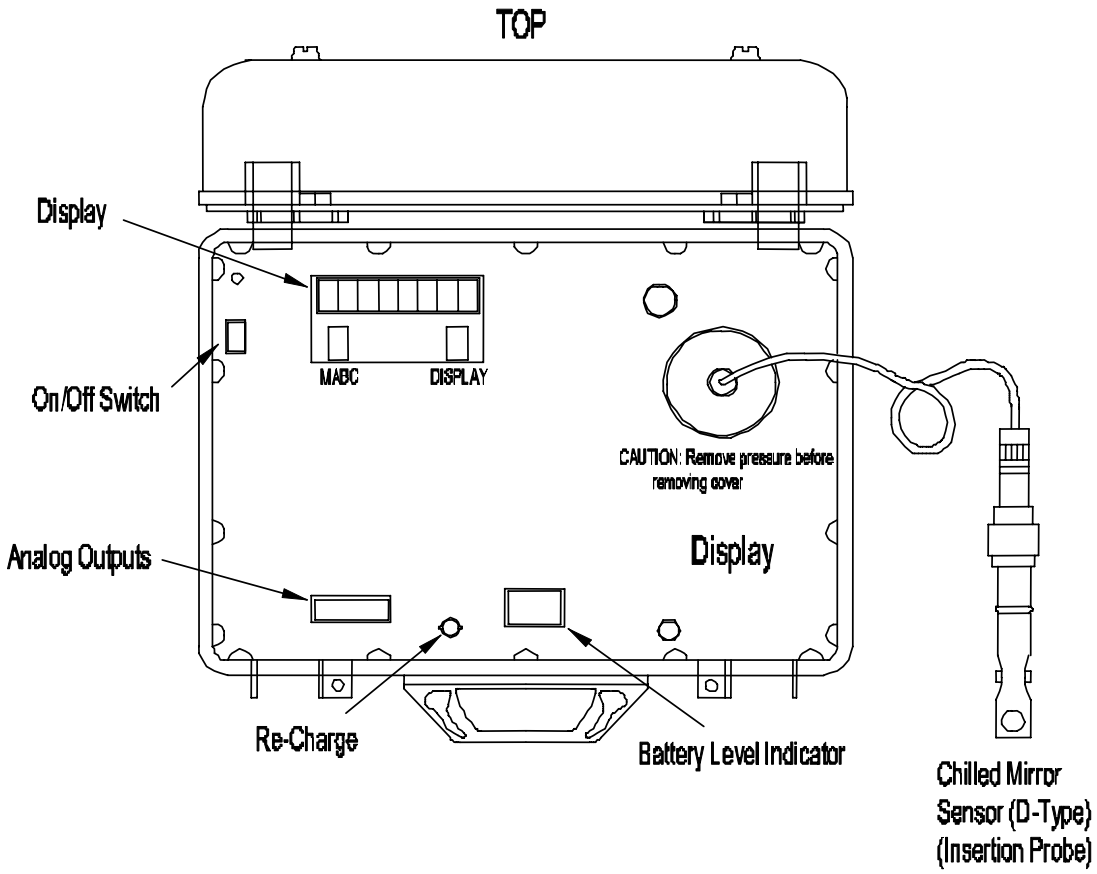
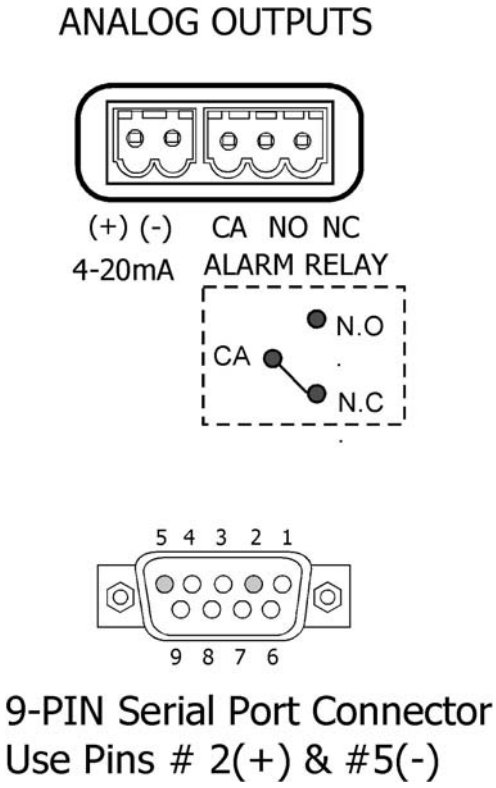


FIGURE 2-3 WIRING CONNECTORS



3.0 FUNCTIONAL DESCRIPTION

The front panel of the Model RHB-1500-C Battery Powered DPM consists of an LED Display and two push-buttons.

1.) **MABC-** Manual Automatic Balance Cycle
2.) **DISPLAY "SCAN"-** Allows viewing of all Parameters or selection of desired measurement.

3.1 Display

The eight character alphanumeric LED display is used to display dew point data and status messages.
Dew point data is displayed as "DP 34.8 F", with the units in degrees C or F. (See Set-Up section)
When a status message is necessary, the display will alternate between the data and the message at about 2 second intervals.
The possible 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 dew point 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 audible alarm and the ALARM display are 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 condition 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 end of the ABC cycle and indicates that the sensor mirror needs a manual cleaning. Perform the "Mirror Cleaning Procedure" in the MAINTENANCE and CALIBRATION 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.

3.0 FUNCTIONAL DESCRIPTION (CONTINUED)

- **"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.

  -Clean the mirror.
  -Initiate an MABC Cycle.
  -Check the sample system 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 Omega for service.

3.2 MABC Button

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

3.3 Clean Mirror Relay Output

The Clean Mirror Relay is a SPDT 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.

3.4 Flow Control Valve

The sample flow rate is adjusted using this valve. Although the sample flow rate is not critical for proper operation, the recommended rate is 1 – 2 SCFH (**S**tandard **C**ubic **F**eet per **H**our).

3.5 Alarm Relay Output

The Alarm Relay is a SPDT relay that is energized whenever the dew point exceeds the Alarm Set Point.
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 alarm condition is still present or be de-energized if the alarm condition has passed.

3.6 Analog Output

The analog output is a 4 to 20mA output, proportional to the dew point, and scaled at the factory for –58 to 122 °F (-50 to 50 °C).
During an ABC Cycle, the output is "held" at the dew point until the cycle is completed.

3.7 Display "SCAN" Button

Display feature allows the viewing of select parameter or scanning of all three parameters at 3-second intervals.

4.0 SETUP

4.1 Alarm Set Point (Figure 4.1)

The alarm set point temperature is set by DIP switch S2 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 4.1 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.

NOTE: S1-1 determines whether C or F is displayed 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 to 'closed'.

FIGURE 4-1SETUP

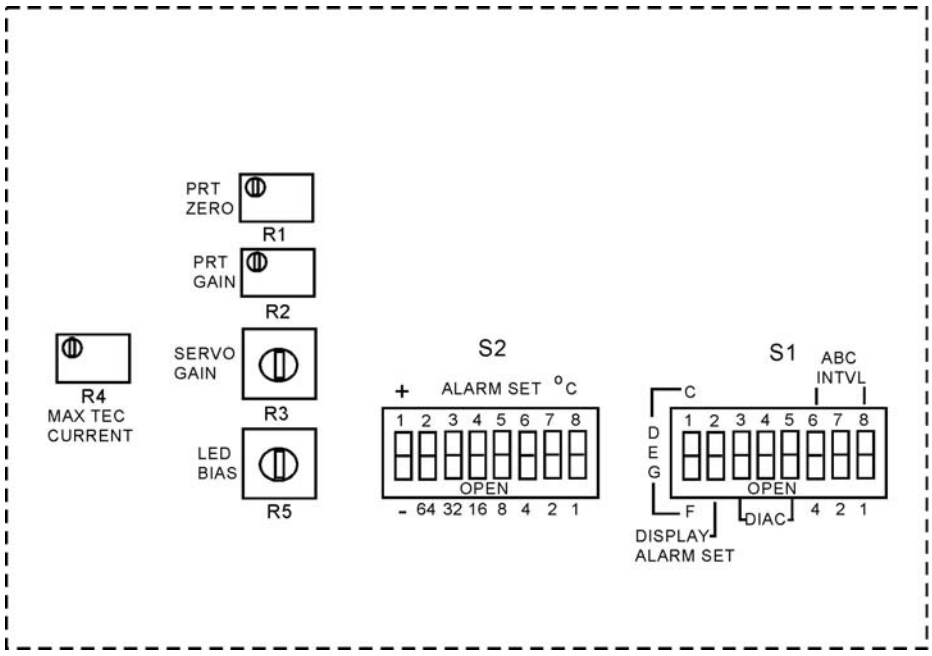


TABLE 4.1 SETUP

C	F	BINARY		C	F	BINARY
-50.0	-58.0	10110010		0.0	32.0	00000000
-49.0	-56.0	10110001		1.0	33.0	00000001
-48.0	-54.0	10110000		2.0	35.0	00000010
-47.0	-52.0	10101111		3.0	37.0	00000011
-46.0	-50.0	10101110		4.0	39.0	00000100
-45.0	-49.0	10101101		5.0	41.0	00000101
-44.0	-47.0	10101100		6.0	42.0	00000110
-43.0	-45.0	10101011		7.0	44.0	00000111
-42.0	-43.0	10101010		8.0	46.0	00001000
-41.0	-41.0	10101001		9.0	48.0	00001001
-40.0	-40.0	10101000		10.0	50.0	00001010
-39.0	-38.0	10100111		11.0	51.0	00001011
-38.0	-36.0	10100110		12.0	53.0	00001100
-37.0	-34.0	10100101		13.0	55.0	00001101
-36.0	-32.0	10100100		14.0	57.0	00001110
-35.0	-31.0	10100011		15.0	59.0	00001111
-34.0	-29.0	10100010		16.0	60.0	00010000
-33.0	-27.0	10100001		17.0	62.0	00010001
-32.0	-25.0	10100000		18.0	64.0	00010010
-31.0	-23.0	10011111		19.0	66.0	00010011
-30.0	-22.0	10011110		20.0	68.0	00010100
-29.0	-20.0	10011101		21.0	69.0	00010101
-28.0	-18.0	10011100		22.0	71.0	00010110
-27.0	-16.0	10011011		23.0	73.0	00010111
-26.0	-14.0	10011010		24.0	75.0	00011000
-25.0	-13.0	10011001		25.0	77.0	00011001
-24.0	-11.0	10011000		26.0	78.0	00011010
-23.0	-9.0	10010111		27.0	80.0	00011011
-22.0	-7.0	10010110		28.0	82.0	00011100
-21.0	-5.0	10010101		29.0	84.0	00011101
-20.0	-4.0	10010100		30.0	86.0	00011110
-19.0	-2.0	10010011		31.0	87.0	00011111
-18.0	0.0	10010010		32.0	89.0	00100000
-17.0	1.0	10010001		33.0	91.0	00100001
-16.0	3.0	10010000		34.0	93.0	00100010
-15.0	5.0	10001111		35.0	95.0	00100011
-14.0	6.0	10001110		36.0	96.0	00100100
-13.0	8.0	10001101		37.0	98.0	00100101
-12.0	10.0	10001100		38.0	100.0	00100110
-11.0	12.0	10001011		39.0	102.0	00100111
-10.0	14.0	10001010		40.0	104.0	00101000
-9.0	15.0	10001001		41.0	105.0	00101001
-8.0	17.0	10001000		42.0	107.0	00101010
-7.0	19.0	10000111		43.0	109.0	00101011
-6.0	21.0	10000110		44.0	111.0	00101100
-5.0	23.0	10000101		45.0	113.0	00101101
-4.0	24.0	10000100		46.0	114.0	00101110
-3.0	26.0	10000011		47.0	116.0	00101111
-2.0	28.0	10000010		48.0	118.0	00110000
-1.0	30.0	10000001		49.0	120.0	00110001
0.0	32.0	00000000		50.0	122.0	00110010

4.2 ABC Interval

The ABC Interval is the time between the automatic initiation of ABC Cycles. 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 4.2 below. The factory default is 24 hrs.

NOTE: 'CLOSED' is a zero and 'OPEN' is a one.

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

Table 4.2 converts the required interval in hours to a three bit binary number.

5.0 MAINTENANCE

5.1 ROUTINE MAINTENANCE

To ensure the maximum in accurate and reliable operation of any optical chilled mirror system, a periodic maintenance program should be established.

5.2 MIRROR CLEANING SCHEDULE

Over time particulates and other matter present in the sample gas and not captured by filters build up on the mirror. The result of the buildup of contaminants on the mirror surface is reduced dry mirror reflectivity and a change in the optical reference point. The ABC Cycle will automatically readjust the optics to the reference point periodically, but eventually the adjustment range will be exceeded and a manual cleaning of the mirror may be necessary. When the contamination becomes too much to be adjusted automatically an error will be displayed at the end of the ABC Cycle.

Normally, intervals of 90 days between routine mirror cleanings can be easily achieved. However, if the sample gas contaminants are particularly high, more frequent mirror cleanings may be required.

5.3 MIRROR CLEANING PROCEDURE (Figure 5.1)

When mirror cleaning is required as a periodic maintenance item or the “CLN MIRR” or “CHK SNSR” message appears on the display, proceed as follows.

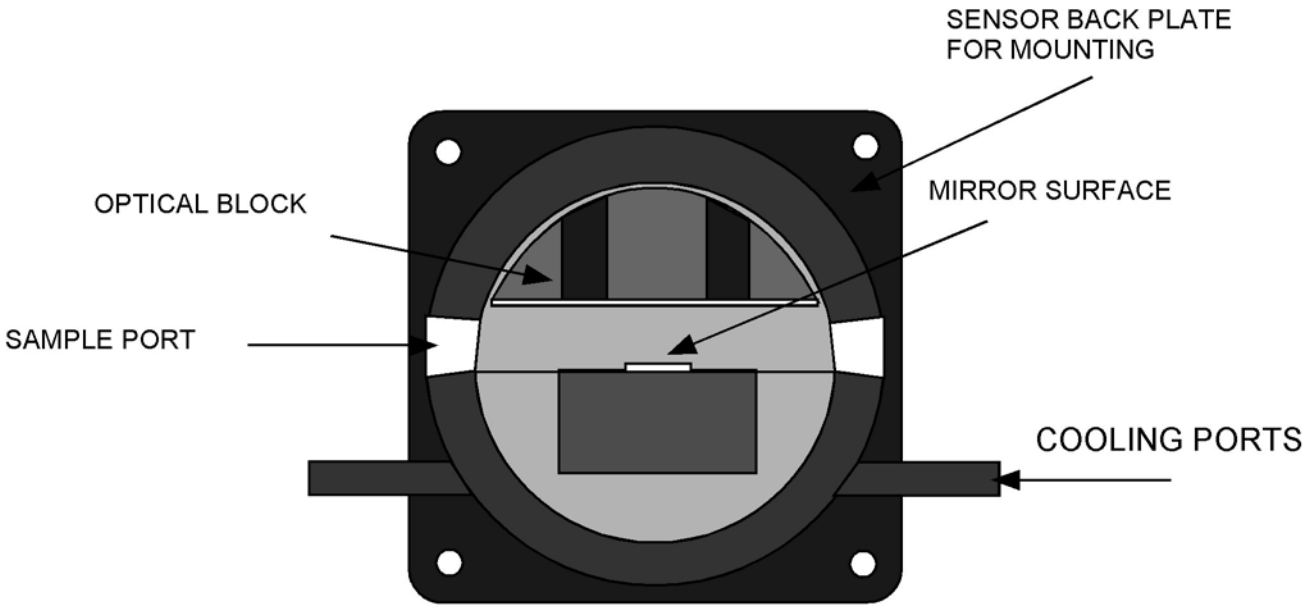
1. Turn power off.

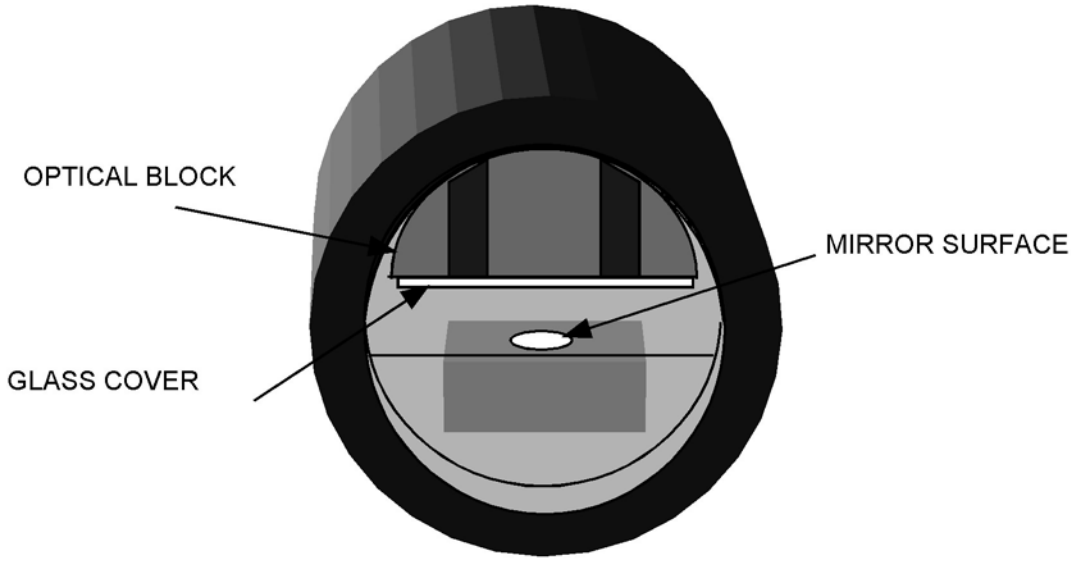
CAUTION !

When operating with a pressurized sampling system, be sure to remove pressure from the Sensor prior to removing the Sensor cover.

2. Remove the spin-off cover from the Sensor to expose the mirror.
3. Moisten a clean cotton swab with isopropyl alcohol. Cotton swabs and cleaning bottle are provided in the Cleaning Kit supplied with the system.
4. Wipe the mirror surface and the optics surface in a circular motion.
5. After cleaning the mirror surface, wipe the surfaces dry with a clean Q-tip.
6. Next, moisten a clean Q-tip with clean, preferably distilled water and wipe the mirror and optics areas.
7. Dry these areas thoroughly with a clean, dry Q-tip.
8. Replace the sensor cover.
9. Re-establish sample pressure and flow.
10. Turn power on.

FIGURE 5.1 S2 WITH COVER REMOVED FOR MIRROR CLEANING





Front View
"Cover Removed"
S1/S2 Sensor

6.0 SPECIFICATIONS

Measurement Range

-Dew/ Frost Point	-50 to 50°C (S2 sensor) -75 to 75°C (S3 sensor)
-Pressure Transducer	0-150 p.s.i.g. (gauge)
-Ambient Temperature Probe	-50°C to 50°C -58°F to 122°F

Measurement Accuracy

-Dew/ Frost Point	±0.25°C (0.45°F) Entire Range
-Pressure Transducer	±0.5% (Full Scale)
-Ambient Temperature Probe	±0.2°C (0.36°F) Entire Range

Functional

Power/ Charger: (Max)	115VAC/60Hz, or 230VAC/50Hz; 40 watts
Operating Temperature:	
Control Unit/Sensor	
S-Type	32 to 122°F (0 to 50°C)
D-Type	32 to 185°F (0 to 85°C)
Sample Connection:	¼ female compression tubing fitting
Sample Flow:	0.5 to 5scfh, Integral flow meter
Sample Pressure:	0 to 150psig max
Analog Output:	4 to 20mA, *Scaled*
Range:	Selectable (See available sensor ranges)
Compliance:	9.0 VDC, 450 ohms
Display:	Eight Digit Alphanumeric LED, 0.5” High.
High dew point Alarm:	
- Visual	Flashing Message on Display
- Relay Contacts	2 Form C, non-latching, 10A @ 240VAC 8A @ 24 VDC ½ HP @ 240VAC

Physical

Dimensions:	14.75”H x 18”L x 7”W
Weight:	C1 (24 lbs.) C2 (14 lbs.)

Standard Features

- Microprocessor Controlled.
- 8 Digit Alphanumeric LED Display.
- Automatic Balance Control.(ABC)
- User settable high alarm limit.
- Alarm Relay, Form C.
- Analog Output, 4 – 20 ma.
- Integral flow meter.
- Visual alarms
- Battery Level Indicator & Charger

Optional Features

- Pressure transducer; required for PPMv
- Rotary Vane Vacuum Pump
- Ambient Temperature; required for %RH
- RS232 Serial Port
- Probe Style Sensor

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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HEATERS

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- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments