SuperSystems
incorporated

SIMPLE DEW
DIGITAL DEW POINT
ANALYZER

OPERATIONS MANUAL

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Introduction

Thank you for selecting Super Systems Inc. and the Simple Dew as your source for accurate dew point measurements. The Simple Dew unit is a digital dew point analyzer for standard range (greater than 0°F or -18°C) measurement. Typical uses of the Simple Dew include measurement of endothermic atmospheres (with endothermic generators) and nitrogen/methanol atmospheres, as well as use with plant air systems.

Carefully unpack the Simple Dew - Dew Point Analyzer. If there are any signs of shipping damage, notify SSi and the shipper immediately.

Specifications

Measurement Range:	0 to +80°F (-18 to +27°C)
Temperature Range:	0 to +120°F (-18 to +49°C)
Power Supply:	115 to 230 VAC (universal input)—for Part No. 13134 24VDC input—for Part No. 13136
Retransmission Output:	0-1 Volt (range is –50 to +80°F)
Size (Closed Case):	15.25" x 9" x 6.25" (approximately)
Weight:	8.2 lbs (3.7 kg)

Warnings

Although it is intended for use in an industrial environment, the Simple Dew is a sensitive piece of analysis equipment. Care should be taken not to drop the analyzer or to operate it in a manner inconsistent with its intended use.

- Open all sample ports and remove all soot and/or moisture from the lines prior to attaching the sample tubing for the first time.

- The analyzer should be stored at ambient temperature (65-80°F or 18-27°C) for at least two hours prior to operation.

- If the unit is to be returned to SSi for service or any other reason, protect the instrument with at least four inches of foam or other impact-absorbing material on all sides and place it in an appropriately sized cardboard box.

- This unit is not designed to measure the dew points in corrosive gases, such as Ammonia, $S0_3$, Chlorine, and HCL.

- Please read and understand this Product Manual before operating the unit.

Failure to comply with these conditions may cause damage to the unit that will not be covered under the warranty. Super Systems Inc. is not responsible for damage to this unit caused by disregard of these warnings, neglect, or misuse.

Startup

The Simple Dew unit was calibrated before it was shipped from Super Systems Inc. You can begin typical operation as soon as the unit has been allowed to stabilize in a temperature similar to the temperature in the heat treating department. This stabilization is particularly important for units that may have been sitting overnight in a delivery vehicle in freezing

weather. Rapid temperature change can cause condensation on the sensor which will cause the unit to temporarily display inaccurate readings.

Operation

The use of the Simple Dew is somewhat dependent upon the application. For connection to an endothermic generator, no pump is required since the sample gas is under positive pressure. If this instrument is to be used on a furnace or other non-positive pressure application, an external sample pump will be required to deliver the gas to the sensor.

Be sure that the filter (mounted to the bottom of the instrument) is clean and functional, since high accumulations of soot can hold moisture and influence the dew point measurement. It will also prevent soot and other contaminants from entering the unit and damaging the sensor. The optimum flow rate of the sample gas should be between 1.5 and 2.0 Standard Cubic Feet per Hour (SCFH), although a flow rate as low as 1.0 SCFH is acceptable. If the unit is reading less than 1.0 SCFH, verify that there are no obstructions to the flow such as a clogged sample line or filter, or a poorly adjusted knob on the Simple Dew's flow meter.

Heat Treat Furnace Sampling: A gas sample must be extracted from the process using an external pump. The sample tube from which the sample is taken out of the furnace should extend into the furnace past the HOT face of the refractory. For accurate results, a designated sample port should be used to extract the sample. SSi offers two versions of sample port assemblies (part numbers 20263 and 20264) which are ideal for this purpose. If a designated sample port is not available, then a clean "burn-off" port on a Gold Probe™, an industry leading oxygen sensor for atmosphere control, can be used. Readings taken from the burn-off port on a probe may be artificially high due to the presence of soot in the probe sheath.

Endothermic Generator Sampling: For applications under pressure, the flow is controlled by the small restriction valve on the flow meter. A flow rate between 1.5 and 2.0 SCFH is ideal. The sample should be taken from the endothermic gas manifold after the gas has been cooled. **NOTE: Allow the sample port to blow out any soot and / or water before connecting the sample tube**. Failure to do so will result in inaccurate readings and expose the sensor to potential damage.

Instrument Damage

The main causes of damage to the Simple Dew are the ingestion of soot and the ingestion of water. Both of these contaminants will cause erroneous readings in the short term, and cause long-term damage to the sensor and internal components.

Soot / Particulate Contaminants

When taking a sample from a furnace or a generator, care should be taken to reduce the amount of soot that enters the instrument. The filter will trap these particles, but cleaning the sample line before attaching the Simple Dew will increase the life of the filter. Furnace ports can be burned off by pumping air through them while hot, or by removing them from the heat and mechanically cleaning them. Generator ports should be opened before the instrument is attached to allow any particulate buildup to be blown out. It is also helpful to tap on the port while it is being blown out to eject any loose particles before the instrument is attached.

If soot is allowed to collect on the dew point sensor in the instrument, it could result in higher readings. This soot will also retain moisture than can corrode the sensor over time. The sensor

tip can be cleaned by carefully removing it from the sample block (see Section 2.0 of the Field Calibration instructions) and rinsing it in isopropyl alcohol. The power should be off while this is done, and the power should remain off for at least 30 minutes after this procedure to allow all of the alcohol to completely evaporate.

Water / Moisture Contamination

When a furnace or generator is being started up or cooled down, the resulting gases will contain unusually high amounts of CO_2. When these gases cool, moisture will precipitate out and become condensation inside the sample tubing assembly. Even if the furnace or generator is operating normally, residual moisture may still be present in the sample tube or plumbing system. In the same way that the ports are checked for soot (see above) they should be checked for moisture before attaching the instrument. This is especially important when taking a sample from a generator, since the sample port is usually preceded by a significant amount of plumbing. All traces of moisture should be eliminated before attaching the instrument. Failure to do so will result in erroneous measurements and could result in damage to the analyzer.

The first signs of moisture in the instrument will be visible condensation collecting in the bowl filter and an unusually high dew point. The upper range of the sensor is +80°F, so if that value is displayed on the instrument it is probably due to the presence of moisture. If this moisture is not removed, it will cause the sensor tip to corrode and will eventually require the sensor to be replaced.

To remove moisture from the instrument, the filter should be removed from the instrument (since it will probably be wet) and an inert gas such as Nitrogen or Argon should then be flowed through the instrument for as much time as it takes to dry out. This dry-out time will depend on the amount of moisture present in the instrument. The condition of the sensor can be monitored by periodically reading the dew point from the display and watching the value decrease over time. To test if it is operating properly, verify the ambient dew point against a web-based weather station that will report the ambient dew point for your area. If the displayed reading is within three degrees of the reported dew point when the instrument is taken outside, then all of the moisture has probably been successfully removed. The wet filter and sample tubing can be re-attached after they have been completely dried out. The filter element will regain all of its original filtering properties after it has dried out.

To prevent the possibility of moisture damaging the instrument, be sure that the measured dew point is below ambient levels before it is stored. If necessary, Nitrogen or Argon can be used to purge the instrument after use.

What Is Dew Point?

Dew point can be defined as the temperature at which the water vapor pressure of the gas equals the saturated water vapor pressure. In other words, it is the temperature at which condensation will just begin to occur as the gas is cooled. Dew point and relative humidity are not the same measurement. Relative humidity is the amount of water vapor in the air compared to the amount the air could hold if it was totally saturated, and it is expressed as a percentage, not a temperature. To determine dew point, two main variables are required: Relative Humidity and Temperature. The Simple Dew measures both variables to compute the dew point.

How It Works

The dew point sensor is a "dielectric ceramic" that varies its electrical capacitance with changes in relative humidity. The sensor is mounted in a short probe, which is installed in a T-fitting that allows the sample gas to flow past the sensor. The tip of this probe contains the dielectric ceramic relative humidity (RH) sensor, as well as a built in temperature sensor to determine its dry bulb temperature. Information from both of these sensors is used to compute the resultant dew point.

Maintenance/Safety Issues

Maintaining proper sensor temperature will prevent the premature failure of the sensor. The operating temperature of the sensor should remain below 130° F (54°C) at all times. To determine the sensor temperature, measure the voltage between pins 5(+) and 9(-) on the microprocessor board. The voltage will be between 0 and 1VDC. Use the chart in Appendix A to determine the temperature in °F, or use Appendix B to determine the temperature in °C. If this temperature shows in excess of 130°F (54°C), the length of sample tubing should be increased to allow for adequate cooling of the sample before it passes the sensor tip.

Factory Calibration

Calibration of the sensor is recommended annually. SSi's initial calibration is performed in our ISO/IEC 17025 certified laboratory, and includes an NIST traceable "Certificate of Calibration". Any calibration performed at SSi will be NIST traceable and will have documentation of ISO/IEC 17025 certification. The certificate also indicates the accuracy of the analyzer before and after calibration. Please contact Super Systems, Inc. at (513) 772-0060 for more information regarding this service.

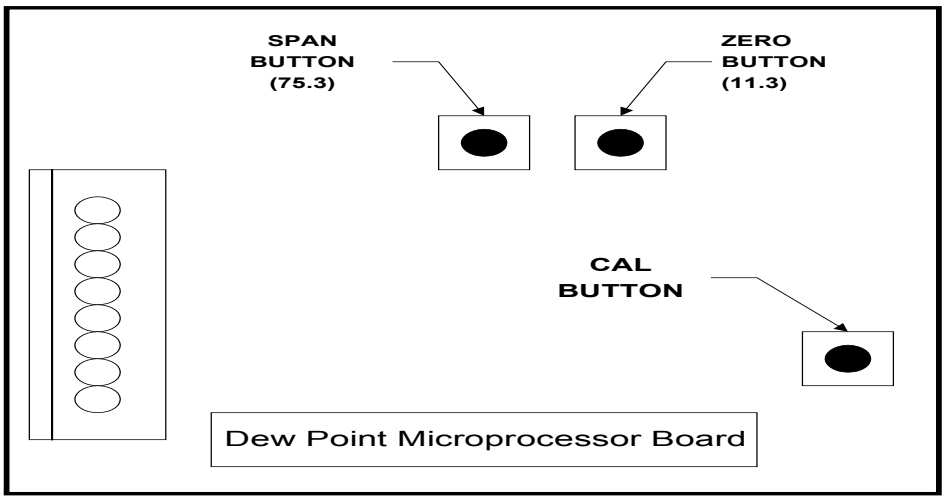
Field Calibration

It is also possible to calibrate the Simple Dew in the field, which will require one of two optional calibration kits. One calibration kit is NIST traceable (Part No. 31425); one kit is non-traceable (Part No. 31030). To perform this calibration, you will need a calibration kit and a voltmeter that will allow you to measure between 0 and 1 volt DC. Since there is no display on the instrument itself, the voltages from the sensor circuit board will have to be translated into temperature and dew point measurements for the purpose of verifying the calibration. The instructions for doing this are contained in this document along with reference charts to aid in the interpretation of the voltages.

The calibration kit consists of two bottles of saturated salt solution in which each bottle generates a precise relative humidity percentage (R.H.%) value. One bottle is 11.3% R.H., and the other is 75.3% R.H. These two specific calibration points are already pre-programmed into the microprocessor board.

1.0 Locate the key components within the unit

1.1 The **microprocessor board** contains three very small buttons that are used for calibration. Two are next to one another, and they are marked "75.3%" and "11.3%", while the other has no label. The unmarked button is the "Calibrate" button. The approximate locations of each button are shown on this diagram:



1.2 The **sensor-sampling chamber** is the gray rectangular box with brass barb fittings on either side with a black plastic gland protruding from the center.

1.3 The **sensor probe** is positioned in the sensor-sampling chamber. It is held in place by the nut on the black plastic gland.

2.0 Remove the sensor probe from the sensor sampling chamber.

2.1 Loosen the black plastic gland nut and slowly slide the sensor probe out through the airtight seal. Care must be taken when removing this sensor probe, since the tip is very delicate and can be easily damaged if it is mishandled. Note that the probe has white mark at the wire entry point, which must be aligned with corresponding white mark in plastic gland when it is re-inserted in the sampling chamber.

3.0 Install the sensor probe into the 75.3% salt solution.

3.1 Slip the black sensor gland (supplied in the calibration kit) over the sensor probe with the sensor tip protruding from the threaded end of the gland and the sensor wires being flush with the top of the rubber o-ring in the gland. Tighten the gland around the sensor. This does not need to be done with a wrench or other tools, but it does need to be tight enough to prevent ambient air from contaminating the humidity level of the sampling chamber.

3.2 Remove the cap of the 75.3% salt solution and install the sensor gland (with the sensor) into the salt solution. To increase the life of the calibration salts, an effort should be made to minimize the amount of time that the salt solution is exposed to the ambient air.

4.0 Allow the sensor to reach equilibrium with the calibration salt.

4.1 Leave the sensor in the calibration salt for a minimum of eighteen (18) hours. It is acceptable to leave the sensor in the salt solution for a longer period of time, even a few days, if desired.

5.0 Begin the 75.3% (Span) calibration process.

5.1 After leaving the sensor in the salt for at least eighteen (18) hours, turn the unit on (if it isn't on already).

5.2 Simultaneously press the "75.3%" and "Calibration" buttons on the microprocessor board.

6.0 Verify the 75.3% (Span) calibration.

6.1 Leave the sensor in the 75.3%RH calibration salt.

6.2 Record the temperature and the dew point of the sensor. Since there is no display on the instrument, you will need to measure the voltage from the microprocessor board and translate that into the appropriate measurement.

6.2.1 To determine the sensor temperature, measure the voltage between pins 5(+) and 9(-) on the microprocessor board. The voltage will be between 0 and 1VDC. Use the chart in Appendix A to determine the temperature in °F, or use Appendix B to determine the temperature in °C.

6.2.2 Temporarily record the sensor temperature.

6.3 Look up this temperature in Appendix "C" (Determining the Dew Point in °F) or Appendix "D" (Determining the Dew Point in °C). Appendix C will show the temperature values in Fahrenheit, and Appendix D will show the temperature values in Celsius.

6.4 Next to the appropriate sensor temperature, note the number in the corresponding column titled "75.3%". This will match the measured dew point, which can be verified wherever the dew point is displayed.

7.0 After the 75.3% (Span) calibration has been completed, remove the sensor from the calibration salt and replace the cap on the salt.

7.1 Leave the sensor probe in the gland and while the unit is still on, allow it to achieve equilibrium at the ambient atmosphere in the room. This is accomplished by simply leaving the sensor exposed to ambient air for between two and three minutes. You will know when this has been accomplished when the numbers on the display begin to stabilize.

8.0 Install the sensor probe into the 11.3% salt solution.

8.1 Remove the cap of the 11.3% salt solution and install the sensor gland (with the sensor) into the salt solution. To increase the life of the calibration salts, an effort should be made to minimize the amount of time that the salt solution is exposed to the ambient air.

9.0 Allow the sensor to reach equilibrium with the calibration salt.

9.1 Leave the sensor in the calibration salt for a minimum of 24 hours. It is acceptable to leave the sensor in the salt solution for a longer period of time, even a few days, if desired.

10.0 Begin the 11.3% (Zero) calibration process

10.1 After leaving the sensor in the salt for at least twenty-four (24) hours, turn the unit on (if it isn't on already).

10.2 Simultaneously press the "11.3%" and "Calibration" buttons on the microprocessor board.

11.0 Verify the 11.3% (Zero) calibration

11.1 Leave the sensor in the 11.3%RH calibration salt

11.2 Record the temperature and the dew point of the sensor. Since there is no display on the instrument, you will need to measure the voltage from the microprocessor board and translate that into the appropriate measurement.

11.2.1 To determine the sensor temperature, measure the voltage between pins 5(+) and 9(-) on the microprocessor board. The voltage will be between 0 and 1VDC. Use the chart in Appendix A to determine the temperature in °F, or use Appendix B to determine the temperature in °C.

11.2.2 Temporarily record the sensor temperature.

11.3 Look up this temperature in Appendix "C" (Determining the Dew Point in °F) or Appendix "D" (Determining the Dew Point in °C). Appendix C will show the temperature values in Fahrenheit, and Appendix D will show the temperature values in Celsius.

11.4 Next to the appropriate temperature, note the number in the corresponding column titled "11.3%". This will match the measured dew point, which can be verified wherever the dew point is displayed.

12.0 After the 11.3% (Zero) calibration has been completed, remove the sensor from the calibration salt and replace the cap on the salt.

12.1 After the 11.3% (Zero) calibration has been completed, remove the sensor from the calibration salt and replace the cap.

13.0 Re-assemble the unit

13.1 After the calibration process has been completed, remove the sensor probe from the gland and return it to the sensor-sampling chamber, taking care to position it properly. The white mark on the sensor probe should face towards the inlet tubing. If the white mark is not visible, then it should be placed so the sample flow directly strikes the face of the mirror on the sensor tip. In other words, the mirror should face the incoming gas stream.

13.2 Hand-tighten the black sensor gland to prevent air from leaking out of the sampling chamber.

14.0 Make sure that all caps are replaced on the calibration salts, and return the instrument to service.

Replacement Parts

Description	Part Number
Factory Calibration	65010
Calibration Kit (non-traceable)	31030
Calibration Kit (NIST traceable)	31425
Bowl Filter	37048
Bowl Filter Element	31027
Dew Point Sensor	31038
Sensor Sampling Block	20192
Sample Tube	20263
Sample Tube (With High-Temp Filter)	20264
Complete Units	
Simple Dew Unit (with Power Supply)	13134
Simple Dew Unit (without Power Supply)	13136

Returning the Unit to SSi

This analyzer contains some components that may require periodic replacement based on the amount of use that the unit experiences and the methods in which it is used. If service on the unit is necessary, it should be sent back to Super Systems, Inc. in the original packaging for repair. If the original packaging is not available, the analyzer should be surrounded by impact-absorbing materials and placed in a box. It is the responsibility of the shipper to ensure that the Simple Dew arrives at SSi undamaged.

Before shipping the analyzer, please call (513) 772-0060 to receive a Return Materials Authorization (RMA) number. The shipping address that should be used for returns is:

Super Systems, Inc.
ATTN: RMA #XXXX
7205 Edington Drive
Cincinnati, OH 45249

Warranty

Limited Warranty for Super Systems Products:

The Limited Warranty applies to new Super Systems Inc. (SSI) products purchased direct from SSI or from an authorized SSI dealer by the original purchaser for normal use. SSI warrants that a covered product is free from defects in materials and workmanship, with the exceptions stated below.

The limited warranty does not cover damage resulting from commercial use, misuse, accident, modification or alteration to hardware or software, tampering, unsuitable physical or operating environment beyond product specifications, improper maintenance, or failure caused by a product for which SSI is not responsible. There is no warranty of uninterrupted or error-free operation. There is no warranty for loss of data—you must regularly back up the data stored on your product to a separate storage product. There is no warranty for product with removed or altered identification labels. SSI DOES NOT PROVIDE ANY OTHER WARRANTIES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OF IMPLIED WARRANTIES, SO THIS LIMITATION MAY NOT APPLY TO YOU. SSI is not responsible for returning to you product which is not covered by this limited warranty.

If you are having trouble with a product, before seeking limited warranty service, first follow the troubleshooting procedures that SSI or your authorized SSI dealer provides.

SSI will replace the PRODUCT with a functionally equivalent replacement product, transportation prepaid after PRODUCT has been returned to SSI for testing and evaluation. SSI may replace your product with a product that was previously used, repaired and tested to meet SSI specifications. You receive title to the replaced product at delivery to carrier at SSI shipping point. You are responsible for importation of the replaced product, if applicable. SSI will not return the original product to you; therefore, you are responsible for moving data to another media before returning to SSI, if applicable. Data Recovery is not covered under this warranty and is not part of the warranty returns process. SSI warrants that the replaced products are covered for the remainder of the original product warranty or 90 days, whichever is greater.

Revision History

Rev.	Description	Date	MCO#
-	First Release	03-06-2009	N/A
A	Manual updated to current standard format. Introduction updated. Specifications updated to include power requirements specified based on Simple Dew unit. Calibration instructions updated to include two calibration kit options. Replacement parts list updated, including the addition of two calibration kits and two complete units.	04-13-2015	2158

Appendix A: Determining the Sensor Temperature in °F

When the DC voltage between 5(+) and 8(-) is:	Then the sensor temperature (°F) is:
0.3472	**67.0**
0.3478	**67.2**
0.3483	**67.4**
0.3489	**67.6**
0.3494	**67.8**
0.3500	**68.0**
0.3506	**68.2**
0.3511	**68.4**
0.3517	**68.6**
0.3522	**68.8**
0.3528	**69.0**
0.3533	**69.2**
0.3539	**69.4**
0.3544	**69.6**
0.3550	**69.8**
0.3556	**70.0**
0.3561	**70.2**
0.3567	**70.4**
0.3572	**70.6**
0.3578	**70.8**
0.3583	**71.0**
0.3589	**71.2**
0.3594	**71.4**
0.3600	**71.6**
0.3606	**71.8**
0.3611	**72.0**
0.3617	**72.2**
0.3622	**72.4**
0.3628	**72.6**
0.3633	**72.8**
0.3639	**73.0**
0.3644	**73.2**
0.3650	**73.4**
0.3656	**73.6**
0.3661	**73.8**
0.3667	**74.0**
0.3672	**74.2**
0.3678	**74.4**
0.3683	**74.6**
0.3689	**74.8**
0.3694	**75.0**
0.3700	**75.2**
0.3706	**75.4**
0.3711	**75.6**
0.3717	**75.8**
0.3722	**76.0**
0.3728	**76.2**
0.3733	**76.4**
0.3739	**76.6**
0.3744	**76.8**
0.3750	**77.0**
0.3756	**77.2**
0.3761	**77.4**
0.3767	**77.6**
0.3772	**77.8**
0.3778	**78.0**
0.3783	**78.2**
0.3789	**78.4**
0.3794	**78.6**
0.3800	**78.8**
0.3806	**79.0**
0.3811	**79.2**
0.3817	**79.4**
0.3822	**79.6**
0.3828	**79.8**
0.3833	**80.0**
0.3839	**80.2**
0.3844	**80.4**
0.3850	**80.6**
0.3856	**80.8**
0.3861	**81.0**
0.3867	**81.2**
0.3872	**81.4**
0.3878	**81.6**
0.3883	**81.8**
0.3889	**82.0**
0.3894	**82.2**
0.3900	**82.4**
0.3906	**82.6**
0.3911	**82.8**
0.3917	**83.0**
0.3922	**83.2**
0.3928	**83.4**
0.3933	**83.6**
0.3939	**83.8**
0.3944	**84.0**
0.3950	**84.2**
0.3956	**84.4**
0.3961	**84.6**
0.3967	**84.8**
0.3972	**85.0**
0.3978	**85.2**
0.3983	**85.4**
0.3989	**85.6**
0.3994	**85.8**
0.4000	**86.0**
0.4006	**86.2**
0.4011	**86.4**
0.4017	**86.6**
0.4022	**86.8**
0.4028	**87.0**
0.4033	**87.2**
0.4039	**87.4**
0.4044	**87.6**
0.4050	**87.8**
0.4056	**88.0**
0.4061	**88.2**
0.4067	**88.4**
0.4072	**88.6**
0.4078	**88.8**
0.4083	**89.0**
0.4089	**89.2**
0.4094	**89.4**
0.4100	**89.6**
0.4106	**89.8**
0.4111	**90.0**
0.4117	**90.2**
0.4122	**90.4**
0.4128	**90.6**
0.4133	**90.8**
0.4139	**91.0**
0.4144	**91.2**
0.4150	**91.4**
0.4156	**91.6**
0.4161	**91.8**
0.4167	**92.0**
0.4172	**92.2**
0.4178	**92.4**
0.4183	**92.6**
0.4189	**92.8**
0.4194	**93.0**
0.4200	**93.2**
0.4206	**93.4**
0.4211	**93.6**
0.4217	**93.8**
0.4222	**94.0**
0.4228	**94.2**
0.4233	**94.4**
0.4239	**94.6**
0.4244	**94.8**
0.4250	**95.0**
0.4256	**95.2**
0.4261	**95.4**
0.4267	**95.6**
0.4272	**95.8**
0.4278	**96.0**
0.4283	**96.2**
0.4289	**96.4**
0.4294	**96.6**
0.4300	**96.8**
0.4306	**97.0**
0.4311	**97.2**
0.4317	**97.4**
0.4322	**97.6**
0.4328	**97.8**
0.4333	**98.0**
0.4339	**98.2**
0.4344	**98.4**
0.4350	**98.6**
0.4356	**98.8**
0.4361	**99.0**
0.4367	**99.2**
0.4372	**99.4**
0.4378	**99.6**
0.4383	**99.8**
0.4389	**100.0**
0.4394	**100.2**
0.4400	**100.4**
0.4406	**100.6**
0.4411	**100.8**
0.4417	**101.0**
0.4422	**101.2**
0.4428	**101.4**
0.4433	**101.6**
0.4439	**101.8**
0.4444	**102.0**
0.4450	**102.2**
0.4456	**102.4**
0.4461	**102.6**
0.4467	**102.8**

Appendix B: Determining the Sensor Temperature in °C

When the DC voltage between 5(+) and 8(-) is:	Then the sensor temperature (°C) is:
0.3472	**19.4**
0.3478	**19.6**
0.3483	**19.7**
0.3489	**19.8**
0.3494	**19.9**
0.3500	**20.0**
0.3506	**20.1**
0.3511	**20.2**
0.3517	**20.3**
0.3522	**20.4**
0.3528	**20.6**
0.3533	**20.7**
0.3539	**20.8**
0.3544	**20.9**
0.3550	**21.0**
0.3556	**21.1**
0.3561	**21.2**
0.3567	**21.3**
0.3572	**21.4**
0.3578	**21.6**
0.3583	**21.7**
0.3589	**21.8**
0.3594	**21.9**
0.3600	**22.0**
0.3606	**22.1**
0.3611	**22.2**
0.3617	**22.3**
0.3622	**22.4**
0.3628	**22.6**
0.3633	**22.7**
0.3639	**22.8**
0.3644	**22.9**
0.3650	**23.0**
0.3656	**23.1**
0.3661	**23.2**
0.3667	**23.3**
0.3672	**23.4**
0.3678	**23.6**
0.3683	**23.7**
0.3689	**23.8**
0.3694	**23.9**
0.3700	**24.0**
0.3706	**24.1**
0.3711	**24.2**
0.3717	**24.3**
0.3722	**24.4**
0.3728	**24.6**
0.3733	**24.7**
0.3739	**24.8**
0.3744	**24.9**
0.3750	**25.0**
0.3756	**25.1**
0.3761	**25.2**
0.3767	**25.3**
0.3772	**25.4**
0.3778	**25.6**
0.3783	**25.7**
0.3789	**25.8**
0.3794	**25.9**
0.3800	**26.0**
0.3806	**26.1**
0.3811	**26.2**
0.3817	**26.3**
0.3822	**26.4**
0.3828	**26.6**
0.3833	**26.7**
0.3839	**26.8**
0.3844	**26.9**
0.3850	**27.0**
0.3856	**27.1**
0.3861	**27.2**
0.3867	**27.3**
0.3872	**27.4**
0.3878	**27.6**
0.3883	**27.7**
0.3889	**27.8**
0.3894	**27.9**
0.3900	**28.0**
0.3906	**28.1**
0.3911	**28.2**
0.3917	**28.3**
0.3922	**28.4**
0.3928	**28.6**
0.3933	**28.7**
0.3939	**28.8**
0.3944	**28.9**
0.3950	**29.0**
0.3956	**29.1**
0.3961	**29.2**
0.3967	**29.3**
0.3972	**29.4**
0.3978	**29.6**
0.3983	**29.7**
0.3989	**29.8**
0.3994	**29.9**
0.4000	**30.0**
0.4006	**30.1**
0.4011	**30.2**
0.4017	**30.3**
0.4022	**30.4**
0.4028	**30.6**
0.4033	**30.7**
0.4039	**30.8**
0.4044	**30.9**
0.4050	**31.0**
0.4056	**31.1**
0.4061	**31.2**
0.4067	**31.3**
0.4072	**31.4**
0.4078	**31.6**
0.4083	**31.7**
0.4089	**31.8**
0.4094	**31.9**
0.4100	**32.0**
0.4106	**32.1**
0.4111	**32.2**
0.4117	**32.3**
0.4122	**32.4**
0.4128	**32.6**
0.4133	**32.7**
0.4139	**32.8**
0.4144	**32.9**
0.4150	**33.0**
0.4156	**33.1**
0.4161	**33.2**
0.4167	**33.3**
0.4172	**33.4**
0.4178	**33.6**
0.4183	**33.7**
0.4189	**33.8**
0.4194	**33.9**
0.4200	**34.0**
0.4206	**34.1**
0.4211	**34.2**
0.4217	**34.3**
0.4222	**34.4**
0.4228	**34.6**
0.4233	**34.7**
0.4239	**34.8**
0.4244	**34.9**
0.4250	**35.0**
0.4256	**35.1**
0.4261	**35.2**
0.4267	**35.3**
0.4272	**35.4**
0.4278	**35.6**
0.4283	**35.7**
0.4289	**35.8**
0.4294	**35.9**
0.4300	**36.0**
0.4306	**36.1**
0.4311	**36.2**
0.4317	**36.3**
0.4322	**36.4**
0.4328	**36.6**
0.4333	**36.7**
0.4339	**36.8**
0.4344	**36.9**
0.4350	**37.0**
0.4356	**37.1**
0.4361	**37.2**
0.4367	**37.3**
0.4372	**37.4**
0.4378	**37.6**
0.4383	**37.7**
0.4389	**37.8**
0.4394	**37.9**
0.4400	**38.0**
0.4406	**38.1**
0.4411	**38.2**
0.4417	**38.3**
0.4422	**38.4**
0.4428	**38.6**
0.4433	**38.7**
0.4439	**38.8**
0.4444	**38.9**
0.4450	**39.0**
0.4456	**39.1**
0.4461	**39.2**
0.4467	**39.3**

Appendix C: Determining the Dew Point in °F

Sensor	Percent RH	
Temp (°F)	11.3%	75.3%
67.0	11.38	58.94
67.2	11.54	59.13
67.4	11.69	59.32
67.6	11.85	59.52
67.8	12.00	59.71
68.0	12.16	59.90
68.2	12.31	60.09
68.4	12.47	60.29
68.6	12.63	60.48
68.8	12.78	60.67
69.0	12.94	60.86
69.2	13.09	61.06
69.4	13.25	61.25
69.6	13.40	61.45
69.8	13.56	61.64
70.0	13.71	61.83
70.2	13.87	62.03
70.4	14.02	62.22
70.6	14.18	62.41
70.8	14.33	62.60
71.0	14.49	62.80
71.2	14.65	62.99
71.4	14.80	63.18
71.6	14.96	63.38
71.8	15.11	63.57
72.0	15.27	63.76
72.2	15.42	63.96
72.4	15.58	64.15
72.6	15.73	64.34
72.8	15.89	64.54
73.0	16.04	64.73
73.2	16.20	64.92
73.4	16.35	65.11
73.6	16.51	65.31
73.8	16.66	65.50
74.0	16.82	65.69
74.2	16.97	65.89
74.4	17.13	66.08
74.6	17.28	66.27
74.8	17.44	66.47
75.0	17.59	66.66
75.2	17.75	66.85
75.4	17.90	67.04

Sensor	Percent RH	
Temp (°F)	11.3%	75.3%
75.6	18.06	67.24
75.8	18.21	67.43
76.0	18.37	67.62
76.2	18.52	67.82
76.4	18.68	68.01
76.6	18.83	68.20
76.8	18.99	68.40
77.0	19.14	68.59
77.2	19.30	68.78
77.4	19.45	68.97
77.6	19.61	69.17
77.8	19.76	69.36
78.0	19.91	69.55
78.2	20.07	69.75
78.4	20.22	69.94
78.6	20.38	70.13
78.8	20.53	70.33
79.0	20.69	70.52
79.2	20.84	70.71
79.4	21.00	70.90
79.6	21.15	71.10
79.8	21.31	71.29
80.0	21.46	71.48
80.2	21.61	71.68
80.4	21.77	71.87
80.6	21.92	72.06
80.8	22.08	72.25
81.0	22.23	72.44
81.2	22.39	72.64
81.4	22.54	72.83
81.6	22.70	73.03
81.8	22.85	73.22
82.0	23.00	73.41
82.2	23.16	73.60
82.4	23.31	73.80
82.6	23.47	73.99
82.8	23.62	74.18
83.0	23.77	74.38
83.2	23.93	74.57
83.4	24.08	74.76
83.6	24.24	74.95
83.8	24.39	75.15
84.0	24.55	75.34

Sensor	Percent RH	
Temp (°F)	11.3%	75.3%
84.1	24.70	75.53
84.2	24.85	75.73
84.3	25.01	75.92
84.4	25.16	76.11
84.5	25.32	76.30
85.2	25.47	76.50
85.4	25.63	76.69
85.6	25.78	76.88
85.8	25.94	77.07
86.0	26.09	77.27
86.2	26.24	77.46
86.4	26.40	77.65
86.6	26.55	77.85
86.8	26.70	78.04
87.0	26.86	78.23
87.2	27.01	78.42
87.4	27.17	78.62
87.6	27.32	78.81
87.8	27.47	79.00
88.0	27.63	79.19
88.2	27.78	79.39
88.4	27.93	79.58
88.6	28.09	79.77
88.8	28.24	79.97
89.0	28.39	80.16
89.2	28.55	80.35
89.4	28.70	80.54
89.6	28.85	80.74
89.8	29.01	80.93
90.0	29.16	81.12
90.2	29.32	81.31
90.4	29.47	81.51
90.6	29.62	81.70
90.8	29.78	81.89
91.0	29.93	82.09
91.2	30.08	82.28
91.4	30.24	82.47
91.6	30.39	82.66
91.8	30.54	82.86
92.0	30.69	83.05
92.2	30.85	83.24
92.4	31.00	83.43
92.6	31.15	83.63

Sensor	Percent RH	
Temp (°F)	11.3%	75.3%
92.8	31.31	83.82
93.0	31.46	84.01
93.2	31.61	84.21
93.4	31.77	84.40
93.6	31.92	84.59
93.8	32.07	84.78
94.0	32.23	84.98
94.2	32.38	85.17
94.4	32.53	85.36
94.6	32.69	85.55
94.8	32.84	85.75
95.0	32.99	85.94
95.2	33.14	86.13
95.4	33.30	86.32
95.6	33.45	86.52
95.8	33.60	86.71
96.0	33.76	86.90
96.2	33.91	87.09
96.4	34.06	87.29
96.6	34.21	87.48
96.8	34.37	87.67
97.0	34.52	87.87
97.2	34.67	88.06
97.4	34.82	88.25
97.6	34.98	88.44
97.8	35.13	88.64
98.0	35.28	88.83
98.2	35.44	89.02
98.4	35.59	89.21
98.6	35.74	89.41
98.8	35.89	89.60
99.0	36.05	89.79
99.2	36.20	89.98
99.4	36.35	90.18
99.6	36.50	90.37
99.8	36.66	90.56
100.0	36.81	90.75
100.2	36.96	90.95
100.4	37.11	91.14
100.6	37.27	91.33
100.8	37.42	91.52
101.0	37.57	91.72
101.2	37.72	91.91

Appendix D: Determining the Dew Point in °C

Sensor	Percent RH		Sensor	Percent RH		Sensor	Percent RH		Sensor	Percent RH	
Temp (°F)	11.3%	75.3%	Temp (°F)	11.3%	75.3%	Temp (°F)	11.3%	75.3%	Temp (°F)	11.3%	75.3%
19.4	-11.46	14.97	**24.2**	-7.74	19.58	**28.9**	-4.06	24.18	**33.8**	-0.38	28.79
19.6	-11.37	15.07	**24.3**	-7.66	19.68	**29.0**	-3.97	24.29	**33.9**	-0.30	28.89
19.7	-11.28	15.18	**24.4**	-7.57	19.79	**29.1**	-3.88	24.40	**34.0**	-0.22	29.01
19.8	-11.19	15.29	**24.6**	-7.49	19.90	**29.1**	-3.80	24.51	**34.1**	-0.13	29.11
19.9	-11.11	15.39	**24.7**	-7.40	20.01	**29.2**	-3.71	24.61	**34.2**	-0.04	29.22
20.0	-11.02	15.50	**24.8**	-7.32	20.11	**29.6**	-3.63	24.72	**34.3**	0.04	29.32
20.1	-10.94	15.61	**24.9**	-7.23	20.22	**29.7**	-3.54	24.83	**34.4**	0.13	29.43
20.2	-10.85	15.72	**25.0**	-7.14	20.33	**29.8**	-3.46	24.93	**34.6**	0.21	29.54
20.3	-10.76	15.82	**25.1**	-7.06	20.43	**29.9**	-3.37	25.04	**34.7**	0.29	29.64
20.4	-10.68	15.93	**25.2**	-6.97	20.54	**30.0**	-3.28	25.15	**34.8**	0.38	29.75
20.6	-10.59	16.03	**25.3**	-6.88	20.65	**30.1**	-3.20	25.26	**34.9**	0.47	29.86
20.7	-10.51	16.14	**25.4**	-6.80	20.76	**30.2**	-3.11	25.36	**35.0**	0.55	29.97
20.8	-10.42	16.25	**25.6**	-6.72	20.86	**30.3**	-3.03	25.47	**35.1**	0.63	30.07
20.9	-10.33	16.36	**25.7**	-6.63	20.97	**30.4**	-2.94	25.58	**35.2**	0.72	30.18
21.0	-10.24	16.47	**25.8**	-6.54	21.08	**30.6**	-2.86	25.68	**35.3**	0.81	30.29
21.1	-10.16	16.57	**25.9**	-6.46	21.18	**30.7**	-2.77	25.79	**35.4**	0.89	30.39
21.2	-10.07	16.68	**26.0**	-6.37	21.29	**30.8**	-2.68	25.90	**35.6**	0.98	30.50
21.3	-9.99	16.79	**26.1**	-6.28	21.40	**30.9**	-2.60	26.01	**35.7**	1.06	30.61
21.4	-9.90	16.89	**26.2**	-6.20	21.51	**31.0**	-2.52	26.11	**35.8**	1.14	30.72
21.6	-9.82	17.00	**26.3**	-6.11	21.61	**31.1**	-2.43	26.22	**35.9**	1.23	30.82
21.7	-9.73	17.11	**26.4**	-6.03	21.72	**31.2**	-2.34	26.33	**36.0**	1.32	30.93
21.8	-9.64	17.22	**26.6**	-5.94	21.83	**31.3**	-2.26	26.43	**36.1**	1.40	31.04
21.9	-9.56	17.32	**26.7**	-5.86	21.93	**31.4**	-2.17	26.54	**36.2**	1.48	31.14
22.0	-9.47	17.43	**26.8**	-5.77	22.04	**31.6**	-2.09	26.65	**36.3**	1.57	31.25
22.1	-9.38	17.54	**26.9**	-5.68	22.15	**31.7**	-2.01	26.76	**36.4**	1.66	31.36
22.2	-9.29	17.64	**27.0**	-5.60	22.26	**31.8**	-1.92	26.86	**36.6**	1.74	31.47
22.3	-9.21	17.76	**27.1**	-5.51	22.36	**31.9**	-1.83	26.97	**36.7**	1.82	31.57
22.4	-9.12	17.86	**27.2**	-5.43	22.47	**32.0**	-1.75	27.08	**36.8**	1.91	31.68
22.6	-9.04	17.97	**27.3**	-5.34	22.58	**32.1**	-1.66	27.18	**36.9**	1.99	31.78
22.7	-8.95	18.08	**27.4**	-5.26	22.68	**32.2**	-1.58	27.29	**37.0**	2.08	31.89
22.8	-8.87	18.18	**27.6**	-5.17	22.79	**32.3**	-1.49	27.39	**37.1**	2.16	32.00
22.9	-8.78	18.29	**27.7**	-5.08	22.90	**32.4**	-1.41	27.51	**37.2**	2.25	32.11
23.0	-8.69	18.39	**27.8**	-5.00	23.01	**32.6**	-1.32	27.61	**37.3**	2.33	32.21
23.1	-8.61	18.51	**27.9**	-4.91	23.11	**32.7**	-1.23	27.72	**37.4**	2.42	32.32
23.2	-8.52	18.61	**28.0**	-4.83	23.22	**32.8**	-1.15	27.83	**37.6**	2.50	32.43
23.3	-8.43	18.72	**28.1**	-4.74	23.33	**32.9**	-1.07	27.93	**37.7**	2.59	32.53
23.4	-8.35	18.83	**28.2**	-4.66	23.43	**33.0**	-0.98	28.04	**37.8**	2.67	32.64
23.6	-8.26	18.93	**28.3**	-4.57	23.54	**33.1**	-0.89	28.14	**37.9**	2.76	32.75
23.7	-8.18	19.04	**28.4**	-4.48	23.65	**33.2**	-0.81	28.26	**38.0**	2.84	32.86
23.8	-8.09	19.15	**28.6**	-4.40	23.76	**33.3**	-0.73	28.36	**38.1**	2.93	32.96
23.9	-8.01	19.26	**28.7**	-4.31	23.86	**33.4**	-0.64	28.47	**38.2**	3.01	33.07
24.0	-7.92	19.36	**28.8**	-4.23	23.97	**33.6**	-0.56	28.57	**38.3**	3.09	33.18
24.1	-7.83	19.47	**28.9**	-4.14	24.08	**33.7**	-0.47	28.68	**38.4**	3.18	33.28