Model 1500 VRSD

Dew Point Analyzer, 9125 Temperature Control System, and Video Recorder with Dew Point Sensor

OPERATIONS MANUAL

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Introduction

The 1500 VRSD (Part Number 13599 and 13671) is an SSi Standard System designed to maintain a consistent atmospheric dew point by monitoring dew point measured by a dew point sensor and using an SSi 9125 Controller to control the process. A 3.5" color touch screen provides a control interface and data logging.

More About Dew Point Analysis

A dew point analyzer measures the amount of moisture present in a gas to determine the theoretical temperature at which the moisture in the gas will condense (the saturation point). Although dew point is related to the temperature and the pressure of the gas, the dew point of a gas remains the same regardless of the actual temperature of the gas. Knowing the dew point of a gas in a heat treating environment can be beneficial in either determining the carbon potential of the gas, or determining the purity level of the incoming process gases.

The SSi dew point sensor in the 1500 VRSD is considered a high range ("standard") sensor; it is designed for gases with temperatures above 0°F (-17.8°C). The sensor uses the relative humidity (%RH) and the gas temperature to perform a calculation to determine dew point.

On a more technical level, 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.

Warnings

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

- Moisture (water) cannot be allowed to enter the unit. If water is present in the sample gas, use an in-line dryer for sample conditioning. In the event that the sensor becomes wet, use an inert gas (Nitrogen or Argon) to dry the inside of the instrument. Under no circumstances should Methane (Natural Gas) be used to dry the unit.

- The analyzer must be stored at ambient temperature (65-80°F) for at least four hours prior to operation.

- An in-line dryer for sample conditioning should be used for exothermic and combustion applications.

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

IMPORTANT!

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.

Specifications

Measurement Range:	0 to +80°F (-17.8 to +27°C)
Temperature Range:	0 to +120°F (-18 to +49°C)
Accuracy:	+/- 1°F (+/- 0.5°C)
Zero and Span Drift:	+/- 1°F (+/- 0.5°C)
Power Supply:	115 VAC 60Hz (Optional 220VDC)
Display Type:	3.5" Color Touch Screen
Display Resolution:	+/- 1°F (+/- 0.1°C)
Digital Communications:	(2) RS485, RS232, Ethernet
Control / Retransmission Output:	4 – 20 mA (2 Outputs)
Alarms:	Up to 3 Alarm Relays
Dimensions:	20" x 16" x 10" (508mm x 406mm x 254mm)
Weight:	34.4 lbs. (15.6 kg)

Dew Point Sensor

Factory Calibration

Factory calibration is recommended every six months if the unit is used regularly. SSi's calibration is NIST traceable and includes a numbered "Certificate of Calibration". This certificate also indicates the accuracy of the analyzer before and after calibration. Please contact Super Systems at (513) 772-0060 for more information regarding this service.

Field Calibration

It is also possible to calibrate the VRSD in the field, which will require the optional calibration kit (Part Number 31030) and a voltmeter that will allow you to measure between 0 and 1 volt DC. Since there is no temperature display on the instrument itself, the voltage from the sensor circuit board will have to be translated into a temperature measurement 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.

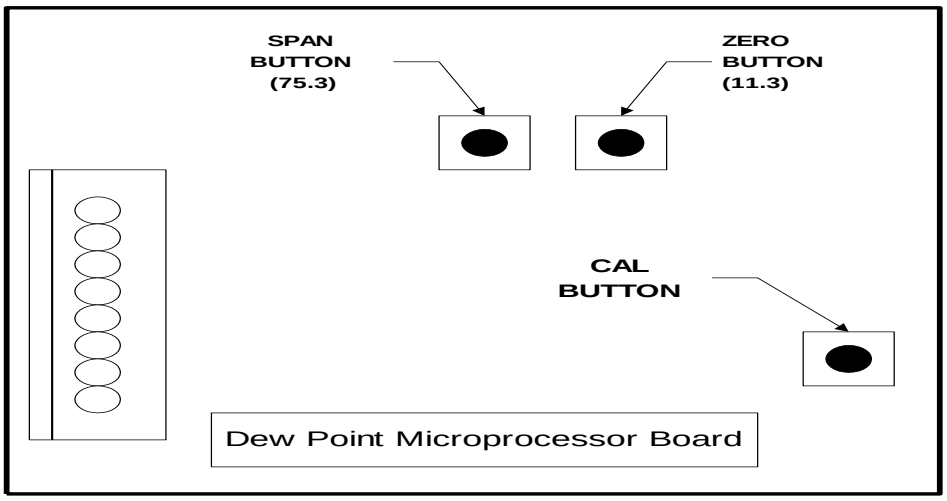
The calibration kit consists of two bottles of saturated salt solution in which each bottle generates a precise relative humidity percentage (R.H.%) value. One bottle is 11.3% R.H., and the other is 75.3% R.H. These two specific calibration points are already pre-programmed into the microprocessor board.

1.0 Open the unit.

1.1 Undo the latches on the side of the enclosure.

2.0 Locate the key components within the unit.

2.1 The **microprocessor board** is located in the front right side of the unit. This 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:



2.2 The **sensor-sampling chamber** is located in the bottom left of the unit. It is the gray rectangular box with brass barb fittings on either side and a black plastic gland protruding from the center.

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

3.0 Remove the sensor probe from the sensor-sampling chamber.

3.1 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.

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

4.1 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.

4.2 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.

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

5.1 With the power to the unit still turned off, 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.

6.0 Begin the 75.3% (Span) calibration process.

6.1 After leaving the sensor in the salt for at least eighteen (18) hours, turn the unit on. The reading on the display is not important at this point.

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

7.0 Verify the 75.3% (Span) calibration.

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

7.2 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.

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

7.2.2 Temporarily record the sensor temperature.

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

7.4 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.

8.0 Determine the acceptability of the reading.

8.1 The value printed on the chart in Appendix A is a theoretical value, and some variation can be expected. When a calibration is performed at SSi, we certify (in writing) that the unit displays within +/- 1 degree of the theoretical

value after it has been calibrated. We would not consider a calibration to be successful unless it is within +/- 1 degree; however, in the case of a field calibration, this degree of accuracy may or may not be required. The degree of accuracy that is acceptable is determined by the policy of the person performing the calibration.

NOTE: Keep in mind that the VRSD only displays whole numbers, and not tenths of a degree. Therefore, a reading of 65°F could be as low as 64.50 or as high as 65.49.

9.0 Allow the sensor to achieve equilibrium at ambient atmosphere.

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

9.2 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.

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

10.1 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.

10.2 Turn the unit off.

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

11.1 With the power to the unit still turned off, leave the sensor in the calibration salt for a minimum of twenty-four (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.

12.0 Begin the 11.3% (Zero) calibration process

12.1 After leaving the sensor in the salt for at least twenty-four (24) hours, turn the unit on. The reading on the display is not important at this point.

12.2 Simultaneously press the “11.3%” and “Calibration” buttons on the microprocessor board.

13.0 Verify the 11.3% (Zero) calibration

13.1 Leave the sensor in the 11.3%RH calibration salt.

13.2 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.

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

13.2.2 Temporarily record the sensor temperature.

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

13.4 Next to the appropriate sensor 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.

14.0 Determine the acceptability of the reading.

14.1 The value printed on the chart in Appendix A is a theoretical value, and some variation can be expected. When a calibration is performed at SSi, we certify (in writing) that the unit displays within +/- 1 degree of the theoretical value after it has been calibrated. We would not consider a calibration to be successful unless it is within +/- 1 degree, however in the case of a field calibration, this degree of accuracy may or may not be required. The degree of accuracy that is acceptable is determined by the policy of the person performing the calibration.

NOTE: Keep in mind that the VRSD only displays whole numbers, and not tenths of a degree. Therefore, a reading of 18°F could be as low as 17.50 or as high as 18.49.

15.0 Allow the sensor to achieve equilibrium at ambient atmosphere.

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

15.2 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 should take between two and three minutes. You will know when this has been accomplished when the numbers on the display begin to stabilize.

16.0 Re-assemble the unit.

16.1 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 right of the sensor-sampling chamber (at 3:00 if it were the face of a clock.). 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 (the sample flows from right-to-left). In other words, the mirror should face the incoming gas stream.

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

16.3 Verify that the system is leak proof by turning on the pump and placing a finger over the sample inlet port. The flow meter will drop to zero if there are no leaks. If a leak is detected, make sure that all tubing connections are tight, especially the black sensor gland.

16.4 After the unit has passed the leak test, the enclosure door can be closed.

17.0 Make sure that all caps are replaced on the calibration salts, and return the Model1500 VRSD to service.

Controller and Touch Screen

For information on the controller and touch screen operator interface, please reference the 9125 controller operations manual.

Startup

The 1500 VRSD unit has been calibrated before shipment 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 is particularly important for units that may have been sitting overnight in a delivery van in sub-zero weather, since the rapid temperature change can cause condensation on the sensor which will cause the unit to temporarily display inaccurate readings.

Operation

To obtain consistent accurate readings from the unit, be sure that the element in the bowl filter on the side of the instrument is clean and functional. Not only will this ensure that the sample reading is not abnormally high (since soot tends to trap moisture), but 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 a poorly adjusted knob on the 1500 VRSD flow meter.

Heat Treat Furnace Sampling: A gas sample may be extracted from a process using the built-in 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 a sample port assembly (part number 20263) which is ideal for this purpose.

Endothermic Generator Sampling: For applications under pressure, the pump should be switched off and the flow 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" before connecting the sample tube**. Failure to do so will unnecessarily coat the sample tubing assembly and possibly some internal components with soot, resulting in inaccurate readings and exposing the sensor to potential damage.

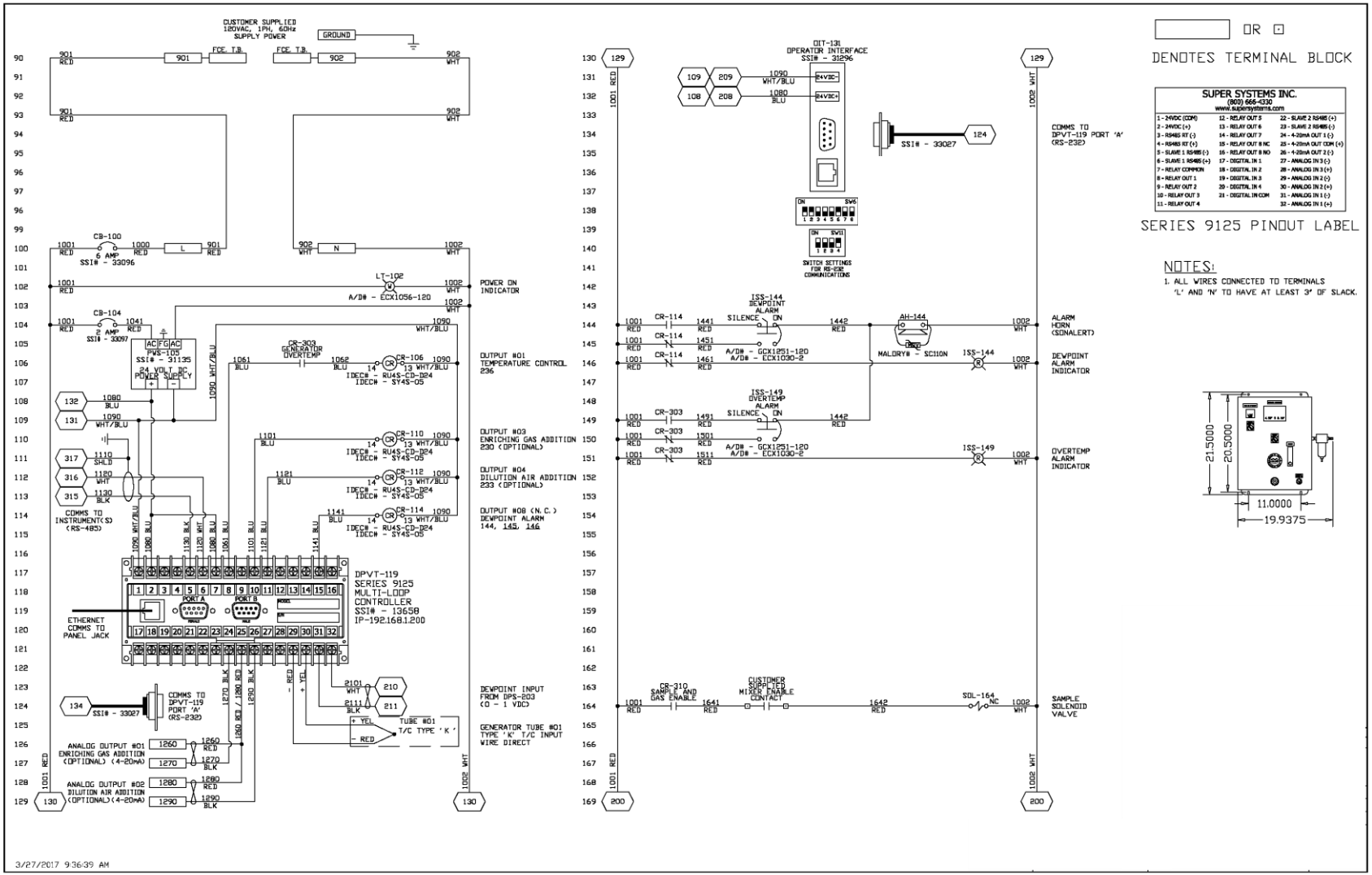
Returning the Unit to SSi

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. for repair. To minimize damage to the mounting feet on the enclosure, it is possible to unscrew them and rotate them 180 degrees (so they point into the enclosure instead of away from it). This will reduce the likelihood that they will be damaged during shipment. 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 unit arrives at SSi undamaged.

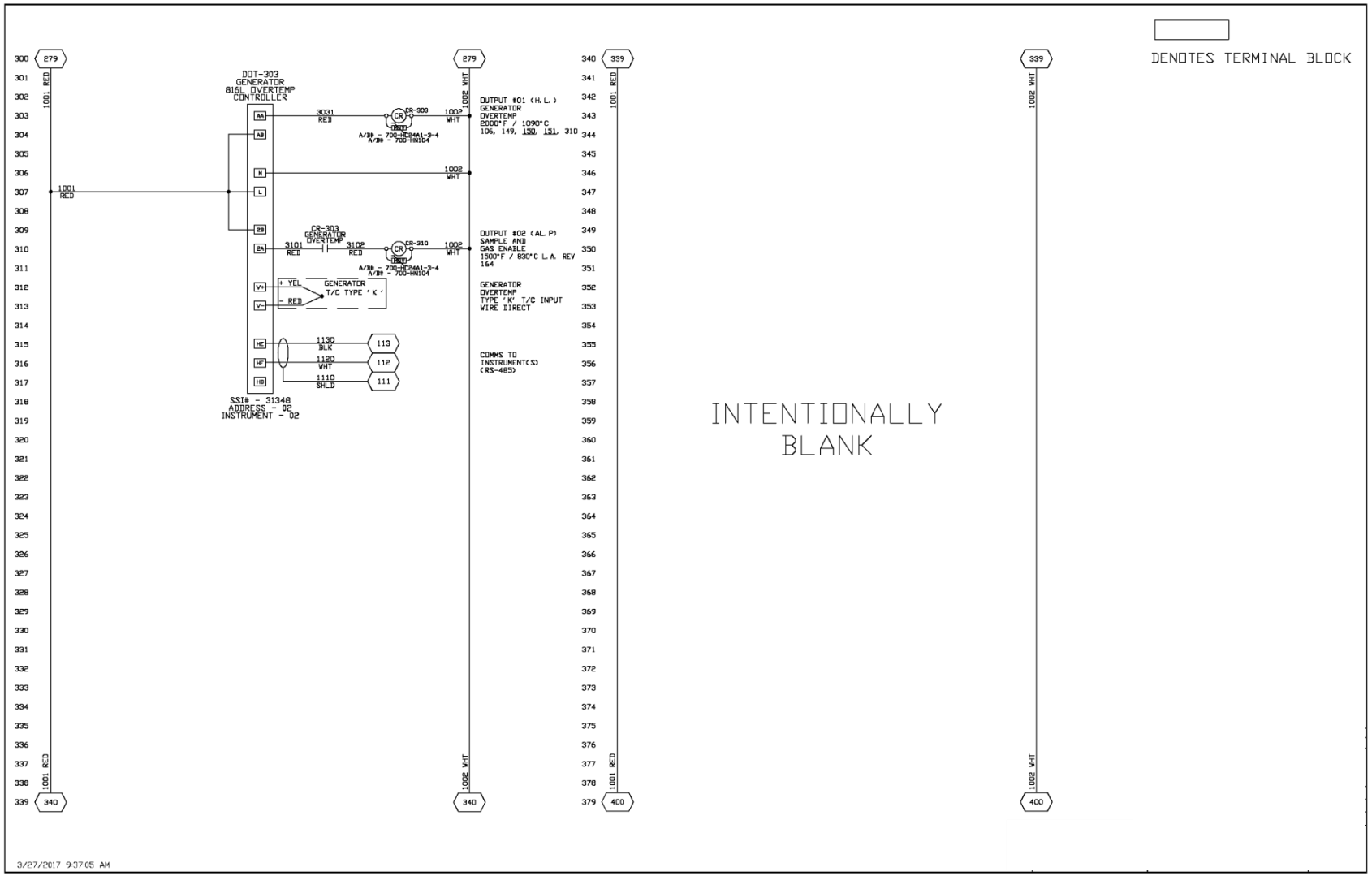
Before shipping the analyzer, please call (513) 772-0060 to receive a Return Materials Authorization (RMA) number. The shipping address that should be used for returns is:

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

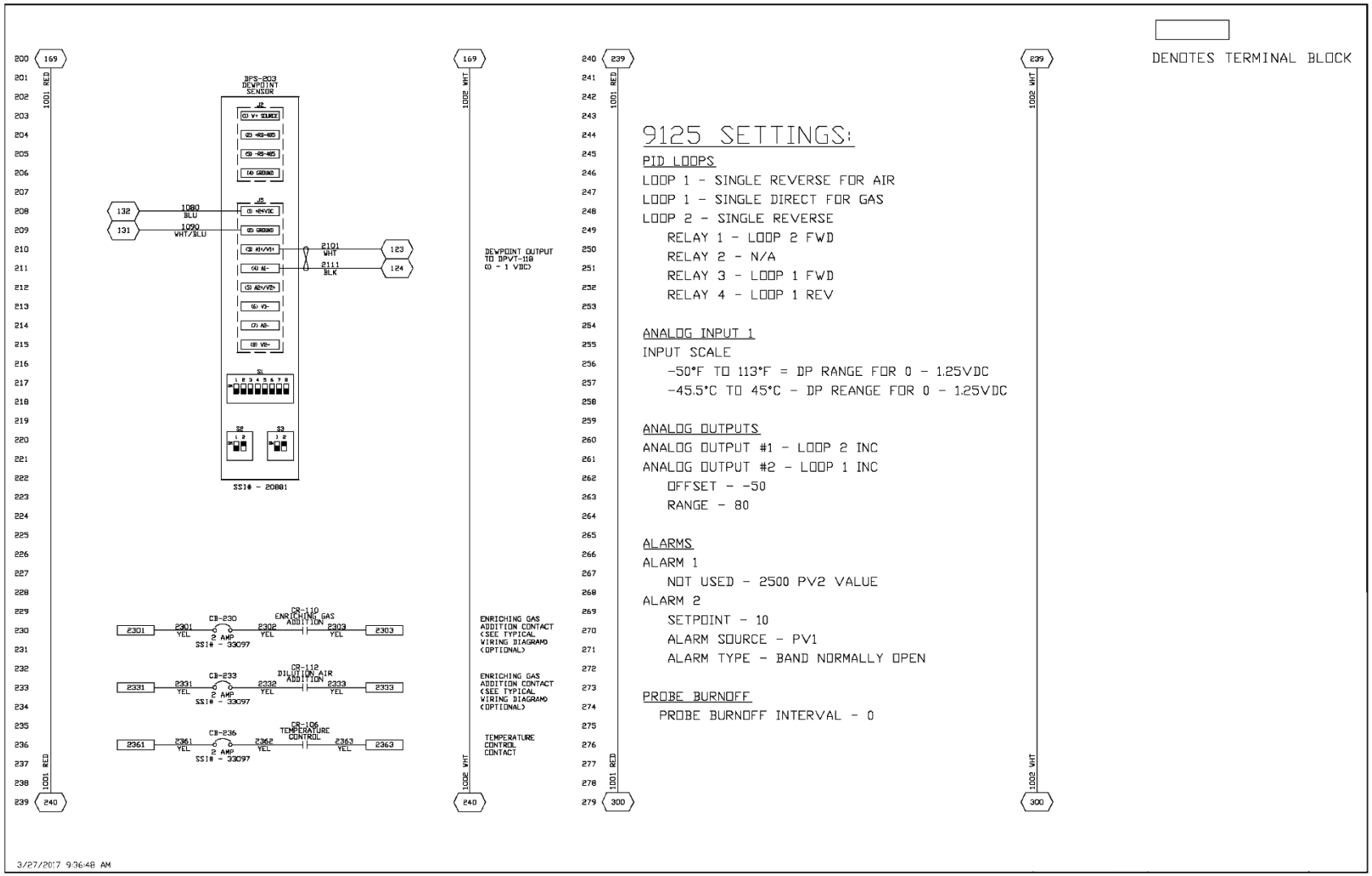
Equipment Drawings – Part Number 13599 (Model 1500 VRSD for single-tube generator)



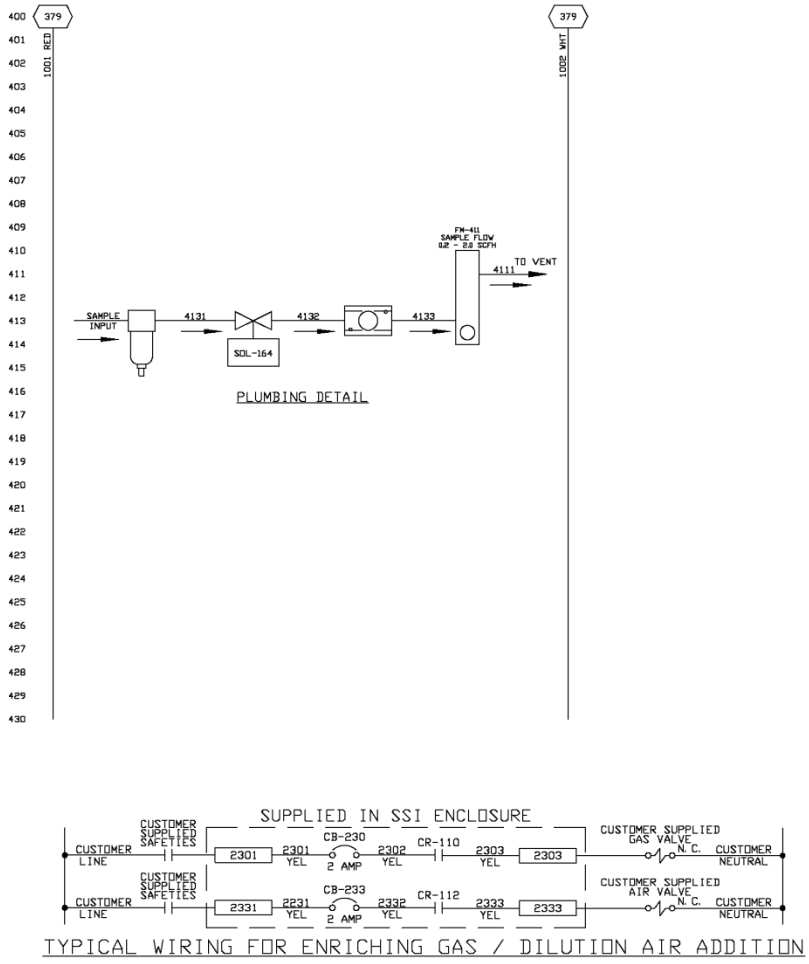
Wiring (PN 13599) – Page 1



Wiring (PN 13599) – Page 2

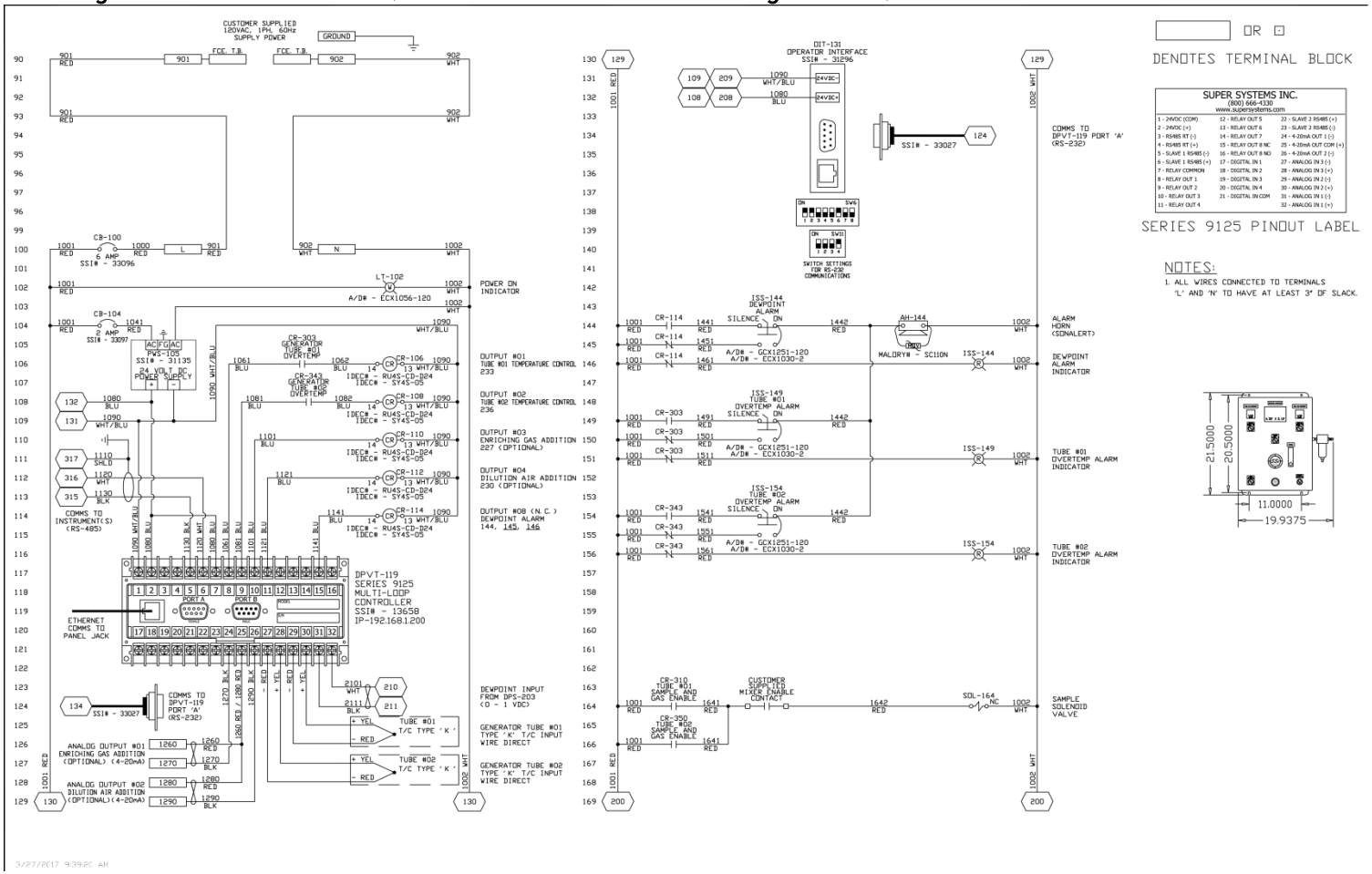


Wiring (PN 13599) – Page 3

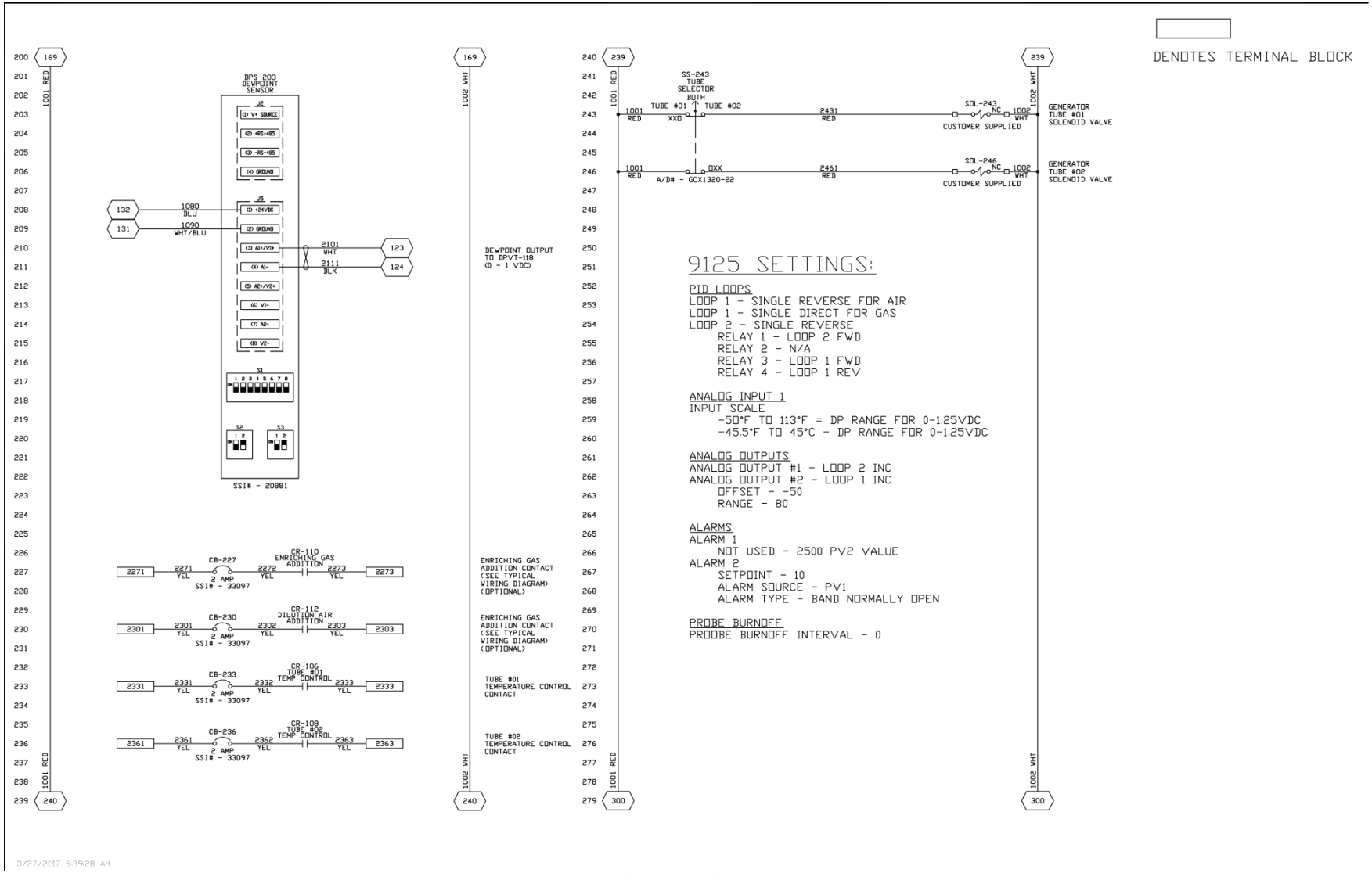


Plumbing (PN 13599)

Equipment Drawings – Part Number 13671 (Model 1500 VRSD for two-tube generator)



Wiring (PN 16371) - Page 1



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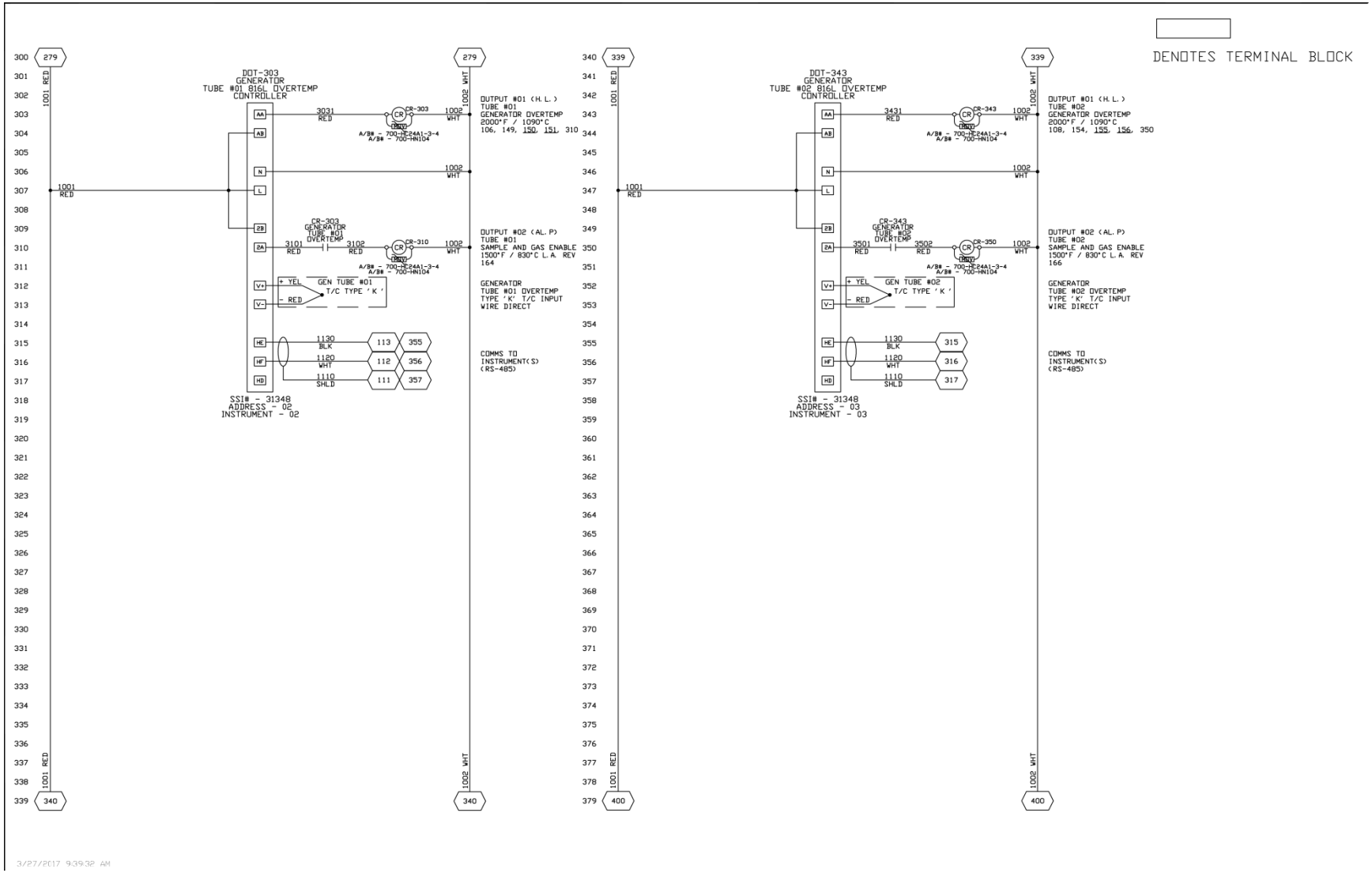

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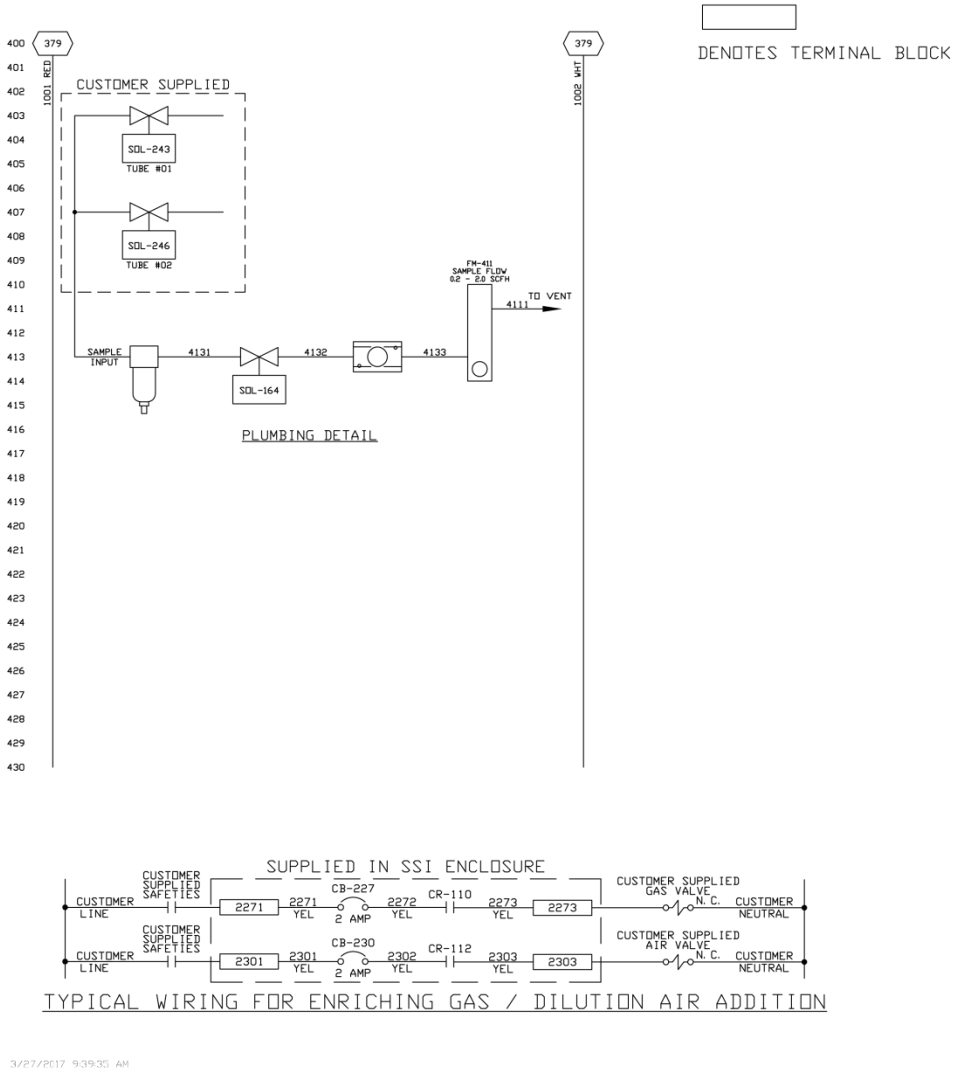

Plumbing (PN 13671)

Replacement Parts List

Part Number	Item
33097	Circuit Breaker
31135	Power Supply
13658	9125 Temperature Controller
32123	Relay, 4-pole, 24VDC coil
32117	Relay, Base Socket
33027	Cable, DB9M-DB9F
31296	3.5" Touch Screen
31604	SD Card, 2 gigabyte
37137	Valve, 1/8, 2-way, 110VAC
37050	Bowl Filter
37051	Bowl Filter Element
20192	Sample Block
34488	Fitting, Liquid Tight
34444	Tubing, Plastic
20393	Label, System Information Tag
34169	Nipple, 1/8 Close Brass
31038	Standard Range Dew Point Sensor
34325	Standoff, Nylon Hex #4-40 x ½
34326	Nut, Nylon Hex #4-40
20665	Solenoid Valve Bracket
Complete Unit	
13599	Model 1500 VRSD (110V) for single-tube generator
1359922	Model 1500 VRSD (220V) for single-tube generator
13671	Model 1500 VRSD (110V) for two-tube generator
1367122	Model 1500 VRSD (220V) for two-tube generator

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	3-18-2015	2152
A	Changed wiring diagrams	5-11-2017	2213

APPENDIX "A" – Determining the Dew Point in °F

Theoretical Dew Point Values For Calibration Verification (Fahrenheit)

Temp (°F)	Percent RH	
	11.3%	**75.3%**
69.00	12.94	60.86
69.10	13.01	60.96
69.20	13.09	61.06
69.30	13.17	61.16
69.40	13.25	61.25
69.50	13.33	61.35
69.60	13.40	61.45
69.70	13.48	61.54
69.80	13.56	61.64
69.90	13.63	61.74
70.00	13.71	61.83
70.10	13.79	61.93
70.20	13.87	62.03
70.30	13.95	62.12
70.40	14.02	62.22
70.50	14.10	62.32
70.60	14.18	62.41
70.70	14.26	62.51
70.80	14.33	62.60
70.90	14.41	62.70
71.00	14.49	62.80
71.10	14.57	62.89
71.20	14.65	62.99
71.30	14.72	63.09
71.40	14.80	63.18
71.50	14.88	63.28
71.60	14.96	63.38
71.70	15.03	63.47
71.80	15.11	63.57
71.90	15.19	63.67
72.00	15.27	63.76
72.10	15.34	63.86
72.20	15.42	63.96
72.30	15.50	64.05
72.40	15.58	64.15
72.50	15.65	64.25
72.60	15.73	64.34

Temp (°F)	Percent RH	
	11.3%	**75.3%**
72.70	15.81	64.44
72.80	15.89	64.54
72.90	15.97	64.63
73.00	16.04	64.73
73.10	16.12	64.82
73.20	16.20	64.92
73.30	16.28	65.02
73.40	16.35	65.11
73.50	16.43	65.21
73.60	16.51	65.31
73.70	16.59	65.40
73.80	16.66	65.50
73.90	16.74	65.60
74.00	16.82	65.69
74.10	16.90	65.79
74.20	16.97	65.89
74.30	17.05	65.98
74.40	17.13	66.08
74.50	17.21	66.18
74.60	17.28	66.27
74.70	17.36	66.37
74.80	17.44	66.47
74.90	17.52	66.56
75.00	17.59	66.66
75.10	17.67	66.76
75.20	17.75	66.85
75.30	17.83	66.95
75.40	17.90	67.04
75.50	17.98	67.14
75.60	18.06	67.24
75.70	18.14	67.33
75.80	18.21	67.43
75.90	18.29	67.53
76.00	18.37	67.62
76.10	18.44	67.72
76.20	18.52	67.82
76.30	18.60	67.91

Temp (°F)	Percent RH	
	11.3%	**75.3%**
76.40	18.68	68.01
76.50	18.75	68.11
76.60	18.83	68.20
76.70	18.91	68.30
76.80	18.99	68.40
76.90	19.06	68.49
77.00	19.14	68.59
77.10	19.22	68.69
77.20	19.30	68.78
77.30	19.37	68.88
77.40	19.45	68.97
77.50	19.53	69.07
77.60	19.61	69.17
77.70	19.68	69.26
77.80	19.76	69.36
77.90	19.84	69.46
78.00	19.91	69.55
78.10	19.99	69.65
78.20	20.07	69.75
78.30	20.14	69.84
78.40	20.22	69.94
78.50	20.30	70.04
78.60	20.38	70.13
78.70	20.46	70.23
78.80	20.53	70.33
78.90	20.61	70.42
79.00	20.69	70.52
79.10	20.76	70.61
79.20	20.84	70.71
79.30	20.92	70.81
79.40	21.00	70.90
79.50	21.07	71.00
79.60	21.15	71.10
79.70	21.23	71.19
79.80	21.31	71.29
79.90	21.38	71.39
80.00	21.46	71.48

APPENDIX "B" – Determining the Dew Point in °C

Theoretical Dew Point Values For Calibration Verification (Celsius)

Temp (°C)	Percent RH 11.3%	75.3%
20.56	-10.59	16.03
20.61	-10.55	16.09
20.67	-10.51	16.14
20.72	-10.46	16.20
20.78	-10.42	16.25
20.83	-10.37	16.31
20.89	-10.33	16.36
20.94	-10.29	16.41
21.00	-10.24	16.47
21.06	-10.21	16.52
21.11	-10.16	16.57
21.17	-10.12	16.63
21.22	-10.07	16.68
21.28	-10.03	16.73
21.33	-9.99	16.79
21.39	-9.94	16.84
21.44	-9.90	16.89
21.50	-9.86	16.95
21.56	-9.82	17.00
21.61	-9.77	17.06
21.67	-9.73	17.11
21.72	-9.68	17.16
21.78	-9.64	17.22
21.83	-9.60	17.27
21.89	-9.56	17.32
21.94	-9.51	17.38
22.00	-9.47	17.43
22.06	-9.43	17.48
22.11	-9.38	17.54
22.17	-9.34	17.59
22.22	-9.29	17.64
22.28	-9.26	17.70
22.33	-9.21	17.76
22.39	-9.17	17.81
22.44	-9.12	17.86
22.50	-9.08	17.92
22.56	-9.04	17.97

Temp (°C)	Percent RH 11.3%	75.3%
22.61	-8.99	18.02
22.67	-8.95	18.08
22.72	-8.91	18.13
22.78	-8.87	18.18
22.83	-8.82	18.23
22.89	-8.78	18.29
22.94	-8.73	18.34
23.00	-8.69	18.39
23.06	-8.65	18.45
23.11	-8.61	18.51
23.17	-8.56	18.56
23.22	-8.52	18.61
23.28	-8.48	18.67
23.33	-8.43	18.72
23.39	-8.39	18.77
23.44	-8.35	18.83
23.50	-8.31	18.88
23.56	-8.26	18.93
23.61	-8.22	18.99
23.67	-8.18	19.04
23.72	-8.13	19.09
23.78	-8.09	19.15
23.83	-8.04	19.20
23.89	-8.01	19.26
23.94	-7.96	19.31
24.00	-7.92	19.36
24.06	-7.87	19.42
24.11	-7.83	19.47
24.17	-7.79	19.52
24.22	-7.74	19.58
24.28	-7.70	19.63
24.33	-7.66	19.68
24.39	-7.62	19.74
24.44	-7.57	19.79
24.50	-7.53	19.84
24.56	-7.49	19.90
24.61	-7.44	19.95

Temp (°C)	Percent RH 11.3%	75.3%
24.67	-7.40	20.01
24.72	-7.36	20.06
24.78	-7.32	20.11
24.83	-7.27	20.17
24.89	-7.23	20.22
24.94	-7.19	20.27
25.00	-7.14	20.33
25.06	-7.10	20.38
25.11	-7.06	20.43
25.17	-7.02	20.49
25.22	-6.97	20.54
25.28	-6.93	20.59
25.33	-6.88	20.65
25.39	-6.84	20.70
25.44	-6.80	20.76
25.50	-6.76	20.81
25.56	-6.72	20.86
25.61	-6.67	20.92
25.67	-6.63	20.97
25.72	-6.59	21.02
25.78	-6.54	21.08
25.83	-6.50	21.13
25.89	-6.46	21.18
25.94	-6.41	21.24
26.00	-6.37	21.29
26.06	-6.33	21.34
26.11	-6.28	21.40
26.17	-6.24	21.45
26.22	-6.20	21.51
26.28	-6.16	21.56
26.33	-6.11	21.61
26.39	-6.07	21.67
26.44	-6.03	21.72
26.50	-5.98	21.77
26.56	-5.94	21.83
26.61	-5.90	21.88
26.67	-5.86	21.93

APPENDIX "C" – 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

When the DC voltage between 5(+) and 8(-) is:	Then the sensor temperature (°F) is:
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

When the DC voltage between 5(+) and 8(-) is:	Then the sensor temperature (°F) is:
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 "D" – 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

When the DC voltage between 5(+) and 8(-) is:	Then the sensor temperature (°C) is:
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

When the DC voltage between 5(+) and 8(-) is:	Then the sensor temperature (°C) is:
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