

# INSTRUCTION MANUAL FOR THE ABS-300 ABSOLUTE HUMIDITY SENSOR



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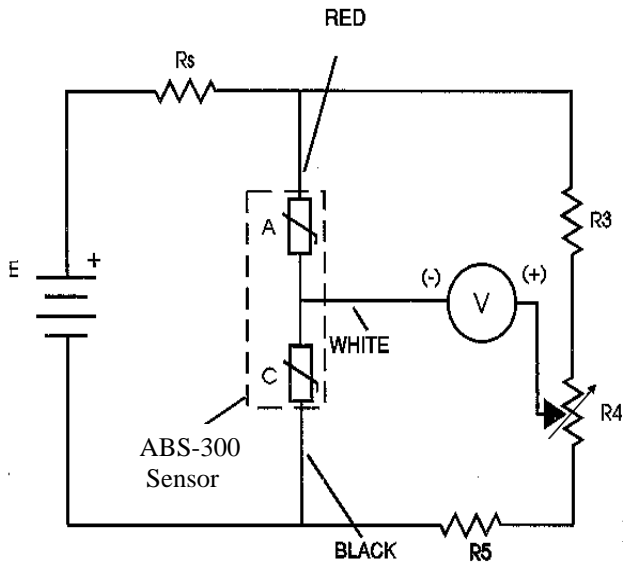
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## ABSOLUTE HUMIDITY SENSOR PRINCIPLE OF OPERATION

Absolute Humidity is the mass of water vapor per volume of air (or other carrier gases) normally expressed in grams/m<sup>3</sup> or grains/ft<sup>3</sup>. When air or gas is dry it has a greater “thermal conductivity” or ability to transfer heat compared to moist air. OHMIC utilizes this principle to measure absolute humidity with the ABS Series sensors.

ABS sensors use two matched thermistors, connected in a bridge circuit, located on a common stainless-steel heat sink. One thermistor (the reference) is glass encapsulated in dry nitrogen while the other thermistor is exposed to the environment. The bridge is balanced at the reference humidity, 0 g/m<sup>3</sup>. When voltage is applied, the thermistors are heated to a high temperature, 200°C or higher; the temperature difference between the thermistors, resulting from humidity level, unbalances the bridge and generates an output voltage proportional to the moisture level of the atmosphere.



A simple bridge circuit (Fig. 1) provides a voltage output of 0-13 mV, equal to a humidity range of 0-130 g/m<sup>3</sup>.

- E = 15 VDC
- Rs = Fixed Resistor for Current Limiter 330Ω
- R3 = Fixed Resistor 10KΩ, (1%)
- R4 = 100Ω Calibration Potentiometer
- R5 = Fixed Resistor 10KΩ, (1%)
- A = Detection Thermistor
- C = Reference Thermistor
- V = High Impedance Voltmeter

Fig. 1

Max mV out @ temp in C.

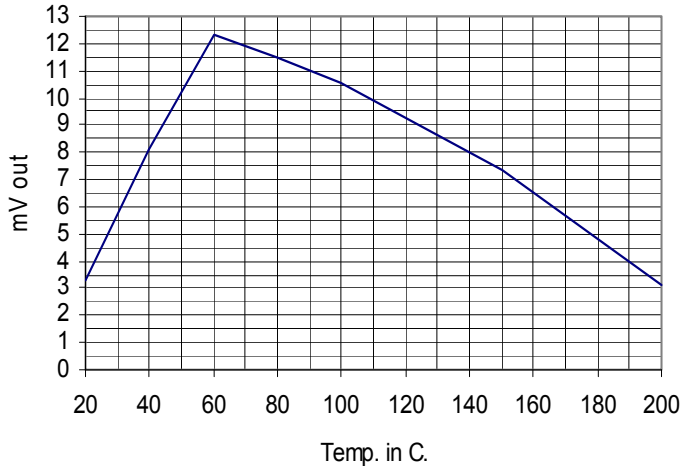


Fig. 2

The sensor's output voltage varies with the temperature (Fig. 2), with a useful range of 25 to 200°C and a maximum scale output at 60°C.

The following equation (Fig. 3) shows the relationship between Absolute humidity (grams/m<sup>3</sup>), Relative Humidity (%) and Temperature (°C):

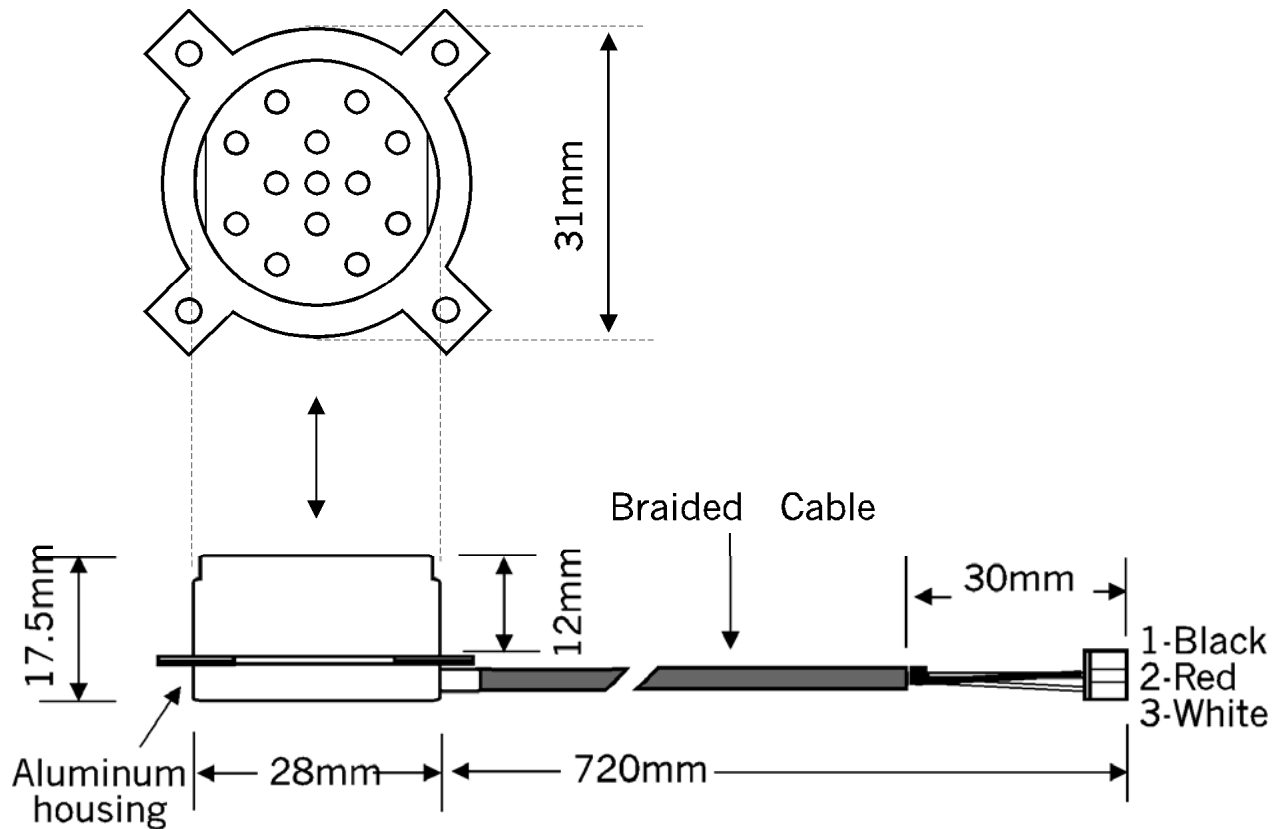
$$RH = \frac{(AbsH)(273.3+T)}{13.243e^{[17.269T \div (237.16+T)]}}$$

### APPLICATIONS

Absolute Humidity Sensors are widely used in appliances such as clothes dryers and microwave ovens. There has been an increase in the number of industrial and process

applications for absolute humidity detectors **due to their ability to operate at high temperatures, recover from condensation and their excellent immunity to many chemical and physical contaminants.** Absolute humidity measurement is an economical way of monitoring and controlling many industrial processes such as drying, fuel cell operation, combustion, catalytic converters, material curing, catalyst production, cooking, sterilization, desiccant heat recovery, etc. Due to the low signal levels from the sensor Ohmic has developed a chopper stabilized amplifier circuit to provide control signals. Model AHT-200-01, produces a 0-5 or 0-10 Vdc output and the AHT-200-02 produces a 4-20 mA current output. Data sheets for both can be viewed at [www.ohmicinstruments.com](http://www.ohmicinstruments.com).

## ABS- 300 Sensor Dimensions



### ABS-300 Sensor and AHT-200 User Instructions.

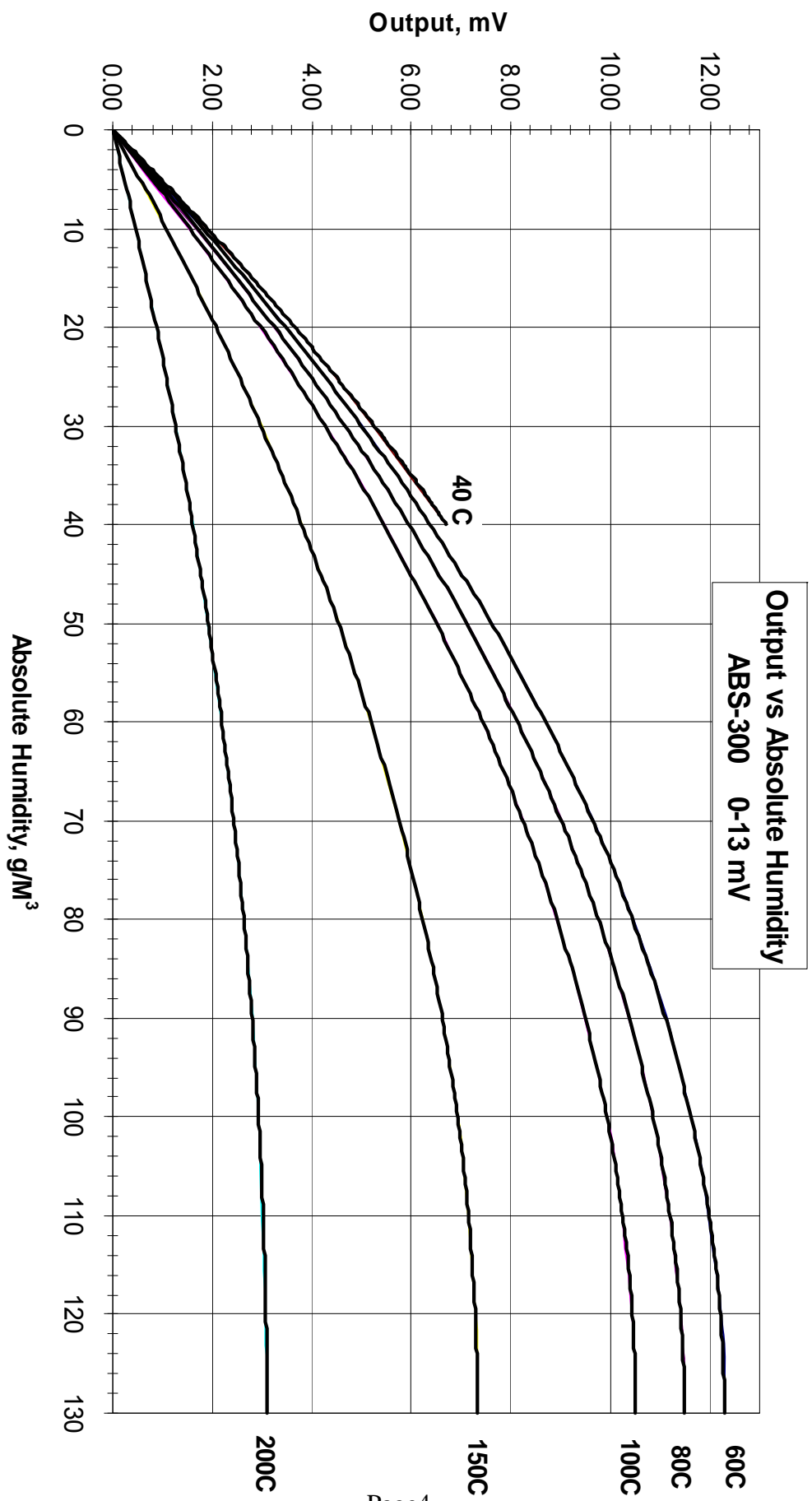
The maximum mV output is at 130 g/m<sup>3</sup> at 60 Deg. C. The output will be a lower value for other temperatures. The max AH out (130 g/m<sup>3</sup>) is at 60 Deg. C. and above. The AH is lower at temperatures below 60 Deg. C. (< 130 g/m<sup>3</sup>)

Constants: a = -0.00067742    b = 0.17704445    c = -000017156  
                   d = -0.00088115    e = 1.11463            f = 1.062806

Output equations: AH is in g/m<sup>3</sup> and T is temp. in Deg. C

For ABS-300 circuit use:

$$0-13 \text{ mV out} = (a * AH * AH + b * AH) * (c * T * T + d * T + e) * f$$



### mV out given Temp in C. and AH in g/m<sup>3</sup>

AH g/m <sup>3</sup>	0C	5c	10c	15C	20C	25C	30C	35C	40C	45C	50C	60C	70C	80C	90C	100C	150C	200C
1.0	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.17	0.16	0.11	0.05
2.0	0.42	0.41	0.41	0.41	0.41	0.40	0.40	0.40	0.39	0.39	0.38	0.37	0.36	0.35	0.33	0.32	0.22	0.09
3.0	0.62	0.62	0.62	0.61	0.61	0.60	0.60	0.59	0.59	0.58	0.57	0.56	0.54	0.52	0.50	0.48	0.33	0.14
4.0	0.83	0.82	0.82	0.81	0.81	0.80	0.80	0.79	0.78	0.77	0.76	0.74	0.72	0.69	0.66	0.63	0.44	0.19
5.0	SAT	1.02	1.02	1.01	1.01	1.00	0.99	0.98	0.97	0.96	0.95	0.92	0.89	0.86	0.83	0.79	0.55	0.23
6.0		1.22	1.22	1.21	1.21	1.19	1.18	1.17	1.16	1.15	1.13	1.10	1.07	1.03	0.99	0.94	0.66	0.28
7.0		SAT	1.42	1.41	1.40	1.39	1.38	1.36	1.35	1.33	1.32	1.28	1.24	1.20	1.15	1.10	0.76	0.32
8.0			1.61	1.60	1.59	1.58	1.57	1.55	1.54	1.52	1.50	1.46	1.41	1.36	1.31	1.25	0.87	0.37
9.0			1.81	1.79	1.78	1.77	1.75	1.74	1.72	1.70	1.68	1.64	1.58	1.53	1.47	1.40	0.98	0.41
10.0			SAT	1.99	1.97	1.96	1.94	1.92	1.90	1.88	1.86	1.81	1.75	1.69	1.62	1.55	1.08	0.46
11.0				2.18	2.16	2.15	2.13	2.11	2.09	2.06	2.04	1.98	1.92	1.85	1.78	1.70	1.18	0.50
12.0				2.36	2.35	2.33	2.31	2.29	2.27	2.24	2.21	2.15	2.09	2.01	1.93	1.84	1.28	0.54
13.0				SAT	2.53	2.51	2.49	2.47	2.45	2.42	2.39	2.32	2.25	2.17	2.08	1.99	1.39	0.59
14.0					2.72	2.70	2.67	2.65	2.62	2.59	2.56	2.49	2.42	2.33	2.23	2.13	1.49	0.63
15.0					2.90	2.88	2.85	2.83	2.80	2.77	2.73	2.66	2.58	2.49	2.38	2.27	1.59	0.67
16.0					3.08	3.06	3.03	3.00	2.97	2.94	2.90	2.83	2.74	2.64	2.53	2.42	1.69	0.71
17.0					3.26	3.24	3.21	3.18	3.15	3.11	3.07	2.99	2.90	2.79	2.68	2.56	1.78	0.75
18.0					SAT	3.41	3.38	3.35	3.32	3.28	3.24	3.15	3.06	2.95	2.83	2.70	1.88	0.80
19.0						3.59	3.56	3.52	3.49	3.45	3.41	3.32	3.21	3.10	2.97	2.83	1.98	0.84
20.0						3.76	3.73	3.69	3.66	3.62	3.57	3.48	3.37	3.25	3.12	2.97	2.07	0.88
21.0						3.93	3.90	3.86	3.82	3.78	3.73	3.63	3.52	3.40	3.26	3.11	2.17	0.92
22.0						4.10	4.07	4.03	3.99	3.94	3.90	3.79	3.67	3.54	3.40	3.24	2.26	0.96
23.0						4.27	4.23	4.19	4.15	4.11	4.06	3.95	3.82	3.69	3.54	3.37	2.35	1.00
24.0						SAT	4.40	4.36	4.31	4.27	4.21	4.10	3.97	3.83	3.68	3.51	2.45	1.03
25.0							4.56	4.52	4.48	4.43	4.37	4.25	4.12	3.97	3.81	3.64	2.54	1.07
26.0							4.73	4.68	4.63	4.58	4.53	4.41	4.27	4.12	3.95	3.77	2.63	1.11
27.0							4.89	4.84	4.79	4.74	4.68	4.56	4.41	4.26	4.08	3.89	2.72	1.15
28.0							5.05	5.00	4.95	4.89	4.83	4.70	4.56	4.40	4.22	4.02	2.81	1.19
29.0							5.20	5.16	5.10	5.05	4.99	4.85	4.70	4.53	4.35	4.15	2.89	1.22
30.0							5.36	5.31	5.26	5.20	5.14	5.00	4.84	4.67	4.48	4.27	2.98	1.26
31.0							SAT	5.46	5.41	5.35	5.28	5.14	4.98	4.80	4.61	4.40	3.07	1.30
32.0								5.62	5.56	5.50	5.43	5.28	5.12	4.94	4.74	4.52	3.15	1.33
33.0								5.77	5.71	5.64	5.58	5.43	5.26	5.07	4.86	4.64	3.24	1.37
34.0								5.91	5.85	5.79	5.72	5.57	5.39	5.20	4.99	4.76	3.32	1.40
35.0								6.06	6.00	5.93	5.86	5.70	5.53	5.33	5.11	4.88	3.40	1.44
36.0								6.21	6.14	6.08	6.00	5.84	5.66	5.46	5.24	4.99	3.48	1.47
37.0								6.35	6.29	6.22	6.14	5.98	5.79	5.58	5.36	5.11	3.56	1.51
38.0								6.49	6.43	6.36	6.28	6.11	5.92	5.71	5.48	5.22	3.64	1.54

## mV out given Temp in C. and AH in g/m<sup>3</sup>

AH g/m <sup>3</sup>	0C	5c	10c	15C	20C	25C	30C	35C	40C	45C	50C	60C	70C	80C	90C	100C	150C	200C
39.0								6.64	6.57	6.49	6.42	6.24	6.05	5.83	5.60	5.34	3.72	1.57
40.0								SAT	6.71	6.63	6.55	6.37	6.18	5.96	5.71	5.45	3.80	1.61
41.0									6.84	6.77	6.68	6.50	6.30	6.08	5.83	5.56	3.88	1.64
42.0									6.98	6.90	6.82	6.63	6.43	6.20	5.95	5.67	3.96	1.67
43.0									7.11	7.03	6.95	6.76	6.55	6.32	6.06	5.78	4.03	1.70
44.0									7.24	7.16	7.08	6.89	6.67	6.43	6.17	5.89	4.11	1.74
45.0									7.37	7.29	7.20	7.01	6.79	6.55	6.28	5.99	4.18	1.77
46.0									7.50	7.42	7.33	7.13	6.91	6.66	6.39	6.10	4.25	1.80
47.0									7.63	7.55	7.45	7.25	7.03	6.78	6.50	6.20	4.33	1.83
48.0									7.76	7.67	7.58	7.37	7.14	6.89	6.61	6.30	4.40	1.86
49.0									7.88	7.79	7.70	7.49	7.26	7.00	6.72	6.40	4.47	1.89
50.0									8.00	7.91	7.82	7.61	7.37	7.11	6.82	6.50	4.54	1.92
51.0									8.12	8.03	7.94	7.72	7.48	7.22	6.92	6.60	4.61	1.95
52.0									SAT	8.15	8.05	7.84	7.59	7.32	7.03	6.70	4.67	1.98
53.0										8.27	8.17	7.95	7.70	7.43	7.13	6.80	4.74	2.00
54.0										8.39	8.28	8.06	7.81	7.53	7.23	6.89	4.81	2.03
55.0										8.50	8.40	8.17	7.92	7.63	7.32	6.99	4.87	2.06
56.0										8.61	8.51	8.28	8.02	7.74	7.42	7.08	4.94	2.09
57.0										8.72	8.62	8.39	8.13	7.84	7.52	7.17	5.00	2.11
58.0										8.83	8.73	8.49	8.23	7.93	7.61	7.26	5.06	2.14
59.0										8.94	8.83	8.60	8.33	8.03	7.70	7.35	5.13	2.17
60.0										9.05	8.94	8.70	8.43	8.13	7.80	7.44	5.19	2.19
61.0										9.15	9.04	8.80	8.53	8.22	7.89	7.52	5.25	2.22
62.0										9.26	9.14	8.90	8.62	8.31	7.98	7.61	5.31	2.24
63.0										9.36	9.25	9.00	8.72	8.41	8.06	7.69	5.37	2.27
64.0										9.46	9.35	9.09	8.81	8.50	8.15	7.77	5.42	2.29
65.0										9.56	9.44	9.19	8.90	8.59	8.24	7.86	5.48	2.32
66.0										SAT	9.54	9.28	8.99	8.67	8.32	7.94	5.54	2.34
67.0											9.63	9.38	9.08	8.76	8.40	8.02	5.59	2.36
68.0											9.73	9.47	9.17	8.84	8.48	8.09	5.65	2.39
69.0											9.82	9.56	9.26	8.93	8.57	8.17	5.70	2.41
70.0											9.91	9.64	9.34	9.01	8.64	8.24	5.75	2.43
71.0											10.00	9.73	9.43	9.09	8.72	8.32	5.80	2.45
72.0											10.09	9.82	9.51	9.17	8.80	8.39	5.85	2.48
73.0											10.17	9.90	9.59	9.25	8.87	8.46	5.90	2.50
74.0											10.26	9.98	9.67	9.33	8.95	8.53	5.95	2.52
75.0											10.34	10.06	9.75	9.40	9.02	8.60	6.00	2.54
76.0											10.42	10.14	9.83	9.48	9.09	8.67	6.05	2.56
77.0											10.50	10.22	9.90	9.55	9.16	8.74	6.10	2.58

**mV out given Temp in C. and AH in g/m<sup>3</sup>**

AH g/m <sup>3</sup>	0C	5c	10c	15C	20C	25C	30C	35C	40C	45C	50C	60C	70C	80C	90C	100C	150C	200C
78.0											10.58	10.30	9.98	9.62	9.23	8.80	6.14	2.60
79.0											10.66	10.37	10.05	9.69	9.30	8.87	6.19	2.62
80.0											10.73	10.45	10.12	9.76	9.36	8.93	6.23	2.63
81.0											SAT	10.52	10.19	9.83	9.43	8.99	6.27	2.65
82.0												10.59	10.26	9.89	9.49	9.05	6.32	2.67
83.0												10.66	10.33	9.96	9.55	9.11	6.36	2.69
84.0												10.73	10.39	10.02	9.61	9.17	6.40	2.70
85.0												10.79	10.46	10.08	9.67	9.23	6.44	2.72
86.0												10.86	10.52	10.14	9.73	9.28	6.48	2.74
87.0												10.92	10.58	10.20	9.79	9.34	6.51	2.75
88.0												10.98	10.64	10.26	9.84	9.39	6.55	2.77
89.0												11.04	10.70	10.32	9.90	9.44	6.59	2.78
90.0												11.10	10.76	10.37	9.95	9.49	6.62	2.80
91.0												11.16	10.81	10.43	10.00	9.54	6.66	2.81
92.0												11.22	10.87	10.48	10.05	9.59	6.69	2.83
93.0												11.27	10.92	10.53	10.10	9.64	6.72	2.84
94.0												11.33	10.97	10.58	10.15	9.68	6.76	2.86
95.0												11.38	11.02	10.63	10.20	9.73	6.79	2.87
96.0												11.43	11.07	10.68	10.24	9.77	6.82	2.88
97.0												11.48	11.12	10.72	10.29	9.81	6.85	2.89
98.0												11.53	11.17	10.77	10.33	9.85	6.87	2.91
99.0												11.57	11.21	10.81	10.37	9.89	6.90	2.92
100.0												11.62	11.26	10.85	10.41	9.93	6.93	2.93
101.0												11.66	11.30	10.89	10.45	9.97	6.95	2.94
102.0												11.70	11.34	10.93	10.49	10.00	6.98	2.95
103.0												11.74	11.38	10.97	10.53	10.04	7.00	2.96
104.0												11.78	11.42	11.01	10.56	10.07	7.03	2.97
105.0												11.82	11.45	11.04	10.59	10.11	7.05	2.98
106.0												11.86	11.49	11.08	10.63	10.14	7.07	2.99
107.0												11.89	11.52	11.11	10.66	10.17	7.09	3.00
108.0												11.92	11.55	11.14	10.69	10.19	7.11	3.01
109.0												11.96	11.58	11.17	10.72	10.22	7.13	3.01
110.0												11.99	11.61	11.20	10.74	10.25	7.15	3.02
111.0												12.02	11.64	11.23	10.77	10.27	7.17	3.03
112.0												12.04	11.67	11.25	10.79	10.30	7.18	3.04
113.0												12.07	11.69	11.28	10.82	10.32	7.20	3.04
114.0												12.09	11.72	11.30	10.84	10.34	7.21	3.05
115.0												12.12	11.74	11.32	10.86	10.36	7.23	3.06
116.0												12.14	11.76	11.34	10.88	10.38	7.24	3.06

**mV out given Temp in C. and AH in g/m<sup>3</sup>**

AH g/m <sup>3</sup>	0C	5c	10c	15C	20C	25C	30C	35C	40C	45C	50C	60C	70C	80C	90C	100C	150C	200C
117.0												12.16	11.78	11.36	10.90	10.40	7.25	3.07
118.0												12.18	11.80	11.38	10.92	10.41	7.26	3.07
119.0												12.20	11.82	11.40	10.93	10.43	7.27	3.08
120.0												12.21	11.83	11.41	10.95	10.44	7.28	3.08
121.0												12.23	11.85	11.42	10.96	10.45	7.29	3.08
122.0												12.24	11.86	11.44	10.97	10.46	7.30	3.09
123.0												12.25	11.87	11.45	10.98	10.47	7.31	3.09
124.0												12.26	11.88	11.46	10.99	10.48	7.31	3.09
125.0												12.27	11.89	11.47	11.00	10.49	7.32	3.09
126.0												12.28	11.90	11.47	11.01	10.50	7.32	3.10
127.0												12.28	11.90	11.48	11.01	10.50	7.33	3.10
128.0												12.29	11.91	11.48	11.02	10.51	7.33	3.10
129.0												12.29	11.91	11.49	11.02	10.51	7.33	3.10
130.0												12.29	11.91	11.49	11.02	10.51	7.33	3.10

### Absolute Humidity (AH) vs. Relative Humidity (RH%)

AH (g/m <sup>3</sup> )	Absolute Humidity (AH) vs. Relative Humidity (RH%)											
	0C	5C	10C	15C	20C	25C	30C	35C	40C	45C	50C	60C
1.0	20.6	14.7	10.6	7.8	5.8	4.3	3.3	2.5	2.0	1.5	1.2	0.8
2.0	41.3	29.4	21.3	15.6	11.6	8.7	6.6	5.0	3.9	3.1	2.4	1.5
3.0	61.9	44.1	31.9	23.4	17.4	13.0	9.9	7.6	5.9	4.6	3.6	2.3
4.0	82.5	58.9	42.6	31.2	23.1	17.4	13.2	10.1	7.8	6.1	4.8	3.0
5.0	SAT	73.6	53.2	39.0	28.9	21.7	16.5	12.6	9.8	7.7	6.0	3.8
6.0		88.3	63.9	46.8	34.7	26.0	19.8	15.1	11.7	9.2	7.2	4.6
7.0		SAT	74.5	54.6	40.5	30.4	23.1	17.7	13.7	10.7	8.5	5.4
8.0			85.1	62.4	46.3	34.7	26.4	20.2	15.7	12.2	9.7	6.2
9.0			95.8	70.2	52.1	39.1	29.7	22.7	17.6	13.8	10.9	6.9
10.0			SAT	78.0	57.9	43.4	33.0	25.3	19.6	15.3	12.7	7.7
15.0				SAT	86.8	65.1	49.4	37.9	29.3	23.0	18.1	11.6
20.0					SAT	86.8	65.9	50.5	39.1	30.6	24.1	15.4
25.0					SAT	82.4	63.1	48.9	38.3	30.2	23.1	19.3
30.0						98.9	75.8	58.7	45.9	36.2	23.1	
35.0						SAT	88.4	68.5	53.6	42.3	27.0	
40.0							SAT	78.3	61.2	48.3	30.8	
45.0								88.0	68.9	54.3	34.7	
50.0								97.9	76.5	60.4	38.5	
55.0								SAT	84.1	66.4	42.4	
60.0									91.8	72.5	46.2	
65.0									99.4	78.5	50.1	
70.0								SAT		84.5	54.0	
75.0										90.6	57.8	
80.0										96.6	61.7	
85.0										SAT	65.5	
90.0											69.4	
95.0											73.2	
100.0											77.1	
105.0											80.9	
110.0											84.8	
120.0											92.5	
130.0											SAT	

### Absolute Humidity (AH) vs. Relative Humidity (RH%)

Absolute Humidity (AH) (g/m <sup>3</sup> )	Relative Humidity (RH%)										
	70C	80C	90C	100C	110C	120C	130C	140C	160C	180C	200C
1.0	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0
2.0	1.0	0.7	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.0	0.0
3.0	1.5	1.0	0.7	0.5	0.4	0.3	0.3	0.1	0.1	0.1	0.0
4.0	2.0	1.4	1.0	0.7	0.5	0.4	0.3	0.2	0.1	0.1	0.0
5.0	2.5	1.7	1.2	0.9	0.6	0.4	0.3	0.3	0.2	0.1	0.1
6.0	3.0	2.1	1.4	1.0	0.7	0.5	0.4	0.3	0.2	0.1	0.1
7.0	3.6	2.4	1.7	1.2	0.8	0.6	0.5	0.4	0.2	0.1	0.1
8.0	4.1	2.8	1.9	1.4	1.0	0.7	0.5	0.4	0.2	0.2	0.1
9.0	4.6	3.1	2.2	1.5	1.1	0.8	0.6	0.5	0.3	0.2	0.1
10.0	5.1	3.4	2.4	1.7	1.2	0.9	0.7	0.5	0.3	0.2	0.1
15.0	7.6	5.2	3.6	2.6	1.8	1.3	1.0	0.8	0.5	0.3	0.2
20.0	10.2	6.9	4.8	3.4	2.4	1.8	1.4	1.0	0.6	0.4	0.3
25.0	12.7	8.6	5.8	4.2	3.0	2.2	1.7	1.3	0.8	0.5	0.3
30.0	15.2	10.3	7.2	5.1	3.6	2.7	2.0	1.5	0.9	0.6	0.4
35.0	17.8	12.0	8.4	5.9	4.3	3.1	2.4	1.8	1.1	0.7	0.5
40.0	20.3	13.7	9.6	6.8	4.9	3.6	2.7	2.0	1.2	0.8	0.5
45.0	22.8	15.5	10.7	7.6	5.5	4.0	3.0	2.3	1.4	0.9	0.6
50.0	25.4	17.2	11.9	8.5	6.0	4.5	3.4	2.6	1.6	1.0	0.7
55.0	27.9	18.9	13.1	9.3	6.7	4.9	3.7	2.8	1.7	1.1	0.7
60.0	30.4	20.6	14.3	10.2	7.3	5.4	4.0	3.0	1.9	1.2	0.8
65.0	33.0	22.3	15.5	11.1	7.9	5.8	4.4	3.3	2.0	1.3	0.9
70.0	35.5	24.1	16.7	11.8	8.5	6.3	4.7	3.6	2.2	1.4	0.9
75.0	38.1	25.8	17.9	12.7	9.1	6.7	5.0	3.9	2.3	1.5	1.0
80.0	40.6	27.5	19.1	13.6	9.7	7.2	5.4	4.1	2.5	1.6	1.1
85.0	43.1	29.2	20.3	14.4	10.3	7.6	5.7	4.4	2.7	1.7	1.1
90.0	45.7	30.9	21.4	15.4	10.9	8.1	6.0	4.6	2.8	1.8	1.2
95.0	48.2	32.6	22.6	16.1	11.6	8.5	6.4	4.9	3.0	1.9	1.3
100.0	50.7	34.4	23.8	17.0	12.2	9.0	6.7	5.1	3.1	2.0	1.3
105.0	53.3	36.0	25.1	17.8	12.8	9.4	7.1	5.4	3.3	2.1	1.4
110.0	55.8	37.8	26.2	18.7	13.4	9.9	7.4	5.7	3.4	2.2	1.5
120.0	60.9	41.2	28.7	20.4	14.6	10.8	8.1	6.2	3.7	2.4	1.6
130.0	66.0	44.7	31.0	22.1	15.8	11.7	8.7	6.7	4.0	2.6	1.7