



High Sierra Electronics

Model 5721 Road Moisture Sensor Instruction Manual 60-5721-01(B)

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	General Description:.....	1
1.2	Receiving, Inspection and Unpacking:.....	1
1.3	Specifications:.....	2
2.0	INSTALLATION.....	2
2.1	Materials needed:.....	2
2.2	Sensor Placement:.....	2
3.0	OPERATION.....	3
3.1	Calibration:.....	3
4.0	MAINTENANCE.....	4
5.0	TROUBLESHOOTING.....	4
6.0	RETURNS.....	5
7.0	WARRANTY.....	5
8.0	APPENDIX.....	6
8.1	Wire Diagram.....	6
8.2	Typical data profile.....	8
8.3	13091-01 schematic.....	9
8.4	13303-01 schematic.....	10
8.5	Temperature Vs Resistance Chart.....	11

1.0 INTRODUCTION

1.1 General Description:

The Model 5721 Road Moisture/Temperature sensor is used to monitor road surface conditions. Using conductivity data, the road surface moisture conditions can be determined. When the road surface temperature approaches freezing and the conductivity readings indicate a wet road surface, then road icing could be a concern and anti-icing actions may be necessary.

1.2 Receiving, Inspection and Unpacking:

Many *High Sierra Electronics* products are scientific instruments. Exercise care during unpacking and installation. Remove the contents of the package carefully and compare the contents with the enclosed packing list. Should any items be missing, notify *High Sierra Electronics* Customer Service. Please have your packing list available when you call.

If any of the items are received in damaged condition, immediately notify the carrier and request an inspection. You must notify the carrier within 15 days of shipment. If a claim is not made within that time period, then the carrier will not acknowledge any claim for the lost or damaged goods.

1.3 Specifications:

Power Supply		9 - 30 VDC
Power Consumption		< 25 ma
Moisture Sensor Output		0 - 5 VDC (ID+3)
Temperature Sensor Output		0.3 - 1.5 VDC (ID+4) 4-20mA and 0-5V available
Accuracy		± .2°C (± .37°F)
Range		-40°C to +60°C (-40°F to 140°F) optional -6.6°C to +37.7°C 20°F to 100°F)
Size - Sensor		2.0" X 2.0" X 0.75"
Signal Conditioning	box	6.25" X 6.25" X 3.5"
Cable Length		25 ft standard

2.0 INSTALLATION

The Model 5721 Road Moisture/Temperature Sensor is an Analog sensor to be used with *High Sierra Electronics* 3200 series ALERT transmitters. The sensor is embedded in the shoulder part of the roadway to be monitored and the signal cable is run to the signal conditioning mounted in a weather tight structure (a standpipe for example). This is then connected to the transmitter via the appropriate analog input port.

2.1 Materials needed:

1. ½" conduit (length to be determined)
2. Bedding Compound (concrete or asphalt patching material)
3. Duct Tape
4. Small trowel or putty knife

2.2 Sensor Placement:

The Model 5721 sensor is embedded into the roadbed with the sensor elements flush with the road surface. The sensor cable is run in conduit to the structure in which the signal conditioning and transmitter will be housed.

At the sensor location, on the shoulder of the roadway, dig a 4" X 4" X 1" hole with a shallow trench leading to it. Run conduit to edge of the 4" X 4" hole and secure with straps. Disconnect the sensor from the signal conditioning and run the signal cable inside the conduit leaving the sensor, elements up, in the hole (see Figure 1).

The sensor elements are positioned flush with the road surface and covered with a small piece of Duct tape. Mix up the bedding compound and fill in the cavity around

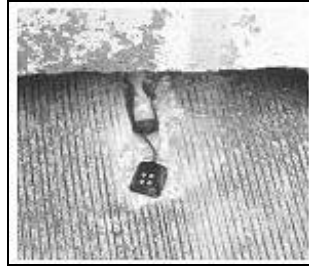


Figure 1: Sensor ready to be embedded in roadway

When the signal conditioning is mounted inside a weatherproof structure, then the sensor signal cable is reconnected. The signal cable with the rotated 4-pin female MS connector is connected to the pressure transducer port on the 3200 series transmitter. The sensor uses ID+3 (road moisture) and ID+4 (temperature), be sure to enable these inputs by removing the jumpers at JB3 and JB4 on the transmitters connector board.

3.0 OPERATION

The road moisture sensor output of 0 - 5 VDC is converted to a 0 - 2047 digital raw data value. This value is not converted to Engineering units but is utilized as is. Outputs are high for dry conditions but when water covers the sensor elements, the output falls to a lower raw data value. As the temperature drops to freezing the raw data value will slowly rise until the liquid freezes, at which time the raw data value will increase to approximately the same value as dry conditions. Due to impurities in water, the actual freezing temperature can be lower than 32°F. Appendix I has a graph showing the relationship between simulated road surface temperatures, precipitation events and conductivity readings.

3.1 Calibration:

The moisture sensor with signal conditioning is preset at the factory and has no external adjustments.

The temperature sensor with signal conditioning is factory calibrated with Zero and Span preset. Once the sensor is embedded into the roadway, Span adjustments are no longer possible. Zero can be adjusted if an accurate road surface temperature is obtained to use as a calibration standard.

Use the *High Sierra Electronics* Model 6708 Test Harness to supply continuous power to the sensor and to read the output on a 4.5 digit multimeter. Take an accurate road surface temperature reading and compute the voltage output for the road temperature sensor. The Formula is: Road Surface Temperature Reading plus the forty degree temperature offset divided by Temperature range (180° F) times Voltage range (1.2 VDC) plus Voltage offset (0.3 VDC) equals Voltage output. Adjust the zero potentiometer for the proper voltage output.

Example: Accurate road temperature measurement equals 40°F.

$$(40^{\circ}\text{F} + 40) / 180^{\circ}\text{F} \times 1.2 \text{ VDC} + 0.3 \text{ VDC} = 0.8333 \text{ VDC Sensor Voltage output}$$

4.0 MAINTENANCE

The moisture sensing elements must be kept clean and uncovered by roadway debris. Oils, chemicals, soil and debris can affect the output of the road moisture sensor. To ensure reliable sensor output, the exposed elements need to be cleaned and the area around the embedded sensor kept free of debris. How often this is done is a variable dependant upon local conditions (number of rain/snow events, amount of road sanding or other anti-icing measures).

5.0 TROUBLESHOOTING

It should be noted that the majority of all failures are due to bad connections. Carefully check all connectors. In some cases just unplugging them and plugging them back in can fix a problem. In following this procedure make sure the sensor is operable; attempt to cause the sensor to fail again by wiggling and jiggling the point where the cable goes into the connector. If intermittent operation results, the cable or the connector should be repaired or replaced as necessary.

For assistance with this product, consult *High Sierra Electronics* technical personnel at: Phone: 1-800-275 2080 or FAX 1-530-273-2089 between 8:00 AM and 5:00 PM Pacific Coast time, Monday thru Friday. To e-mail: info@highsierraelectronics.com.

6.0 RETURNS

If you need to return this product for any reason, call *High Sierra Electronics* at (530) 273-2080 between 8:00 a.m. and 4:00 p.m. Pacific Coast time. Ask for a return Authorization Number (RA#) to be assigned to your unit. Carefully pack the unit so that it will not be further damaged in shipment. Write the RA# on the outside of the box and on any paperwork enclosed with the unit. Please include a written description of the problem and any unique conditions that occurred when the unit failed.

7.0 WARRANTY

All *High Sierra Electronics*' manufactured products are warranted against defects in materials and workmanship for a period of three (3) years from the date of shipment. If the equipment fails due to such defects, *High Sierra Electronics* will, as its option, repair or provide a replacement for the defective part or product. In no case will *High Sierra Electronics* be liable for more than the original purchase price.

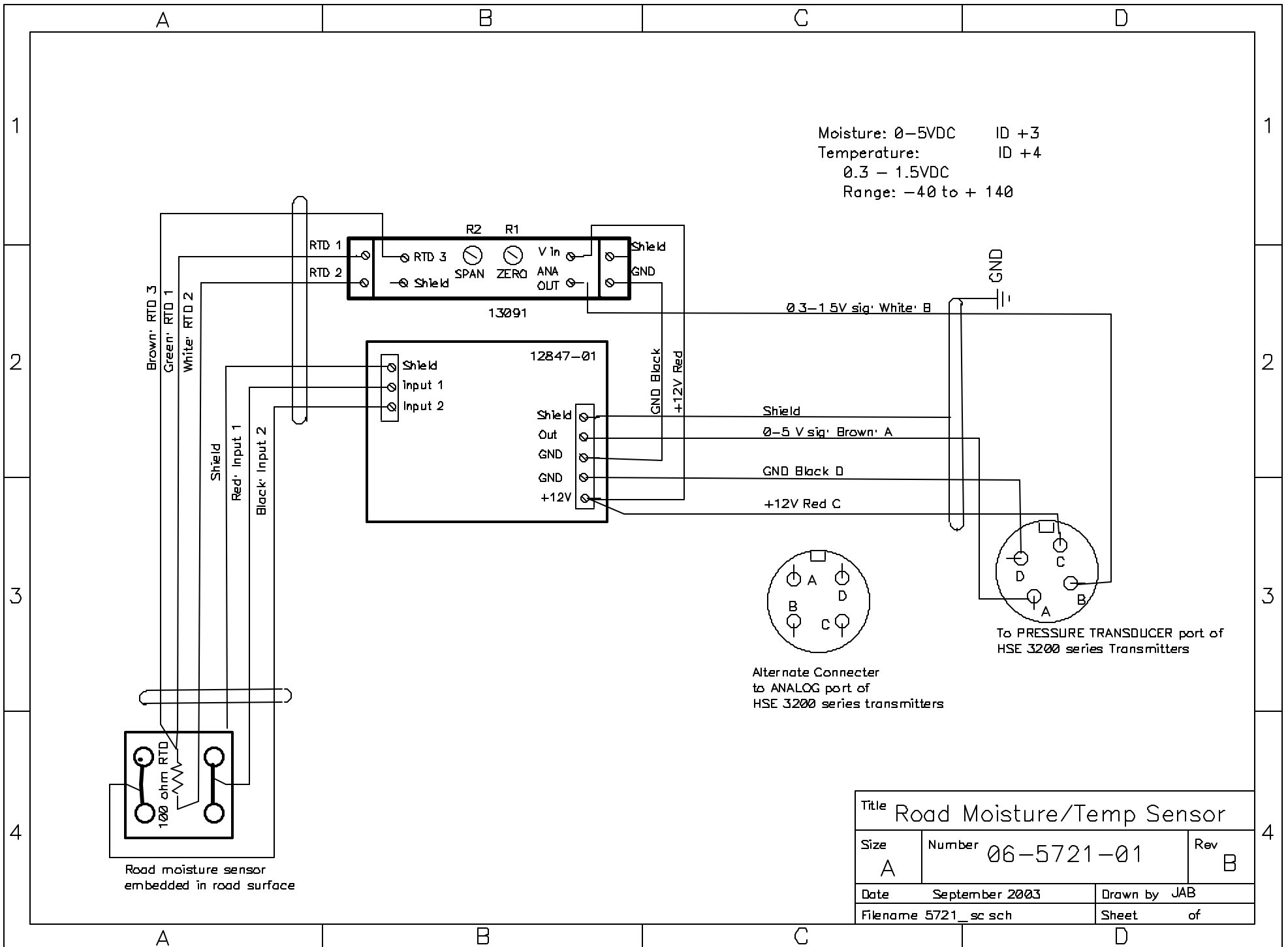
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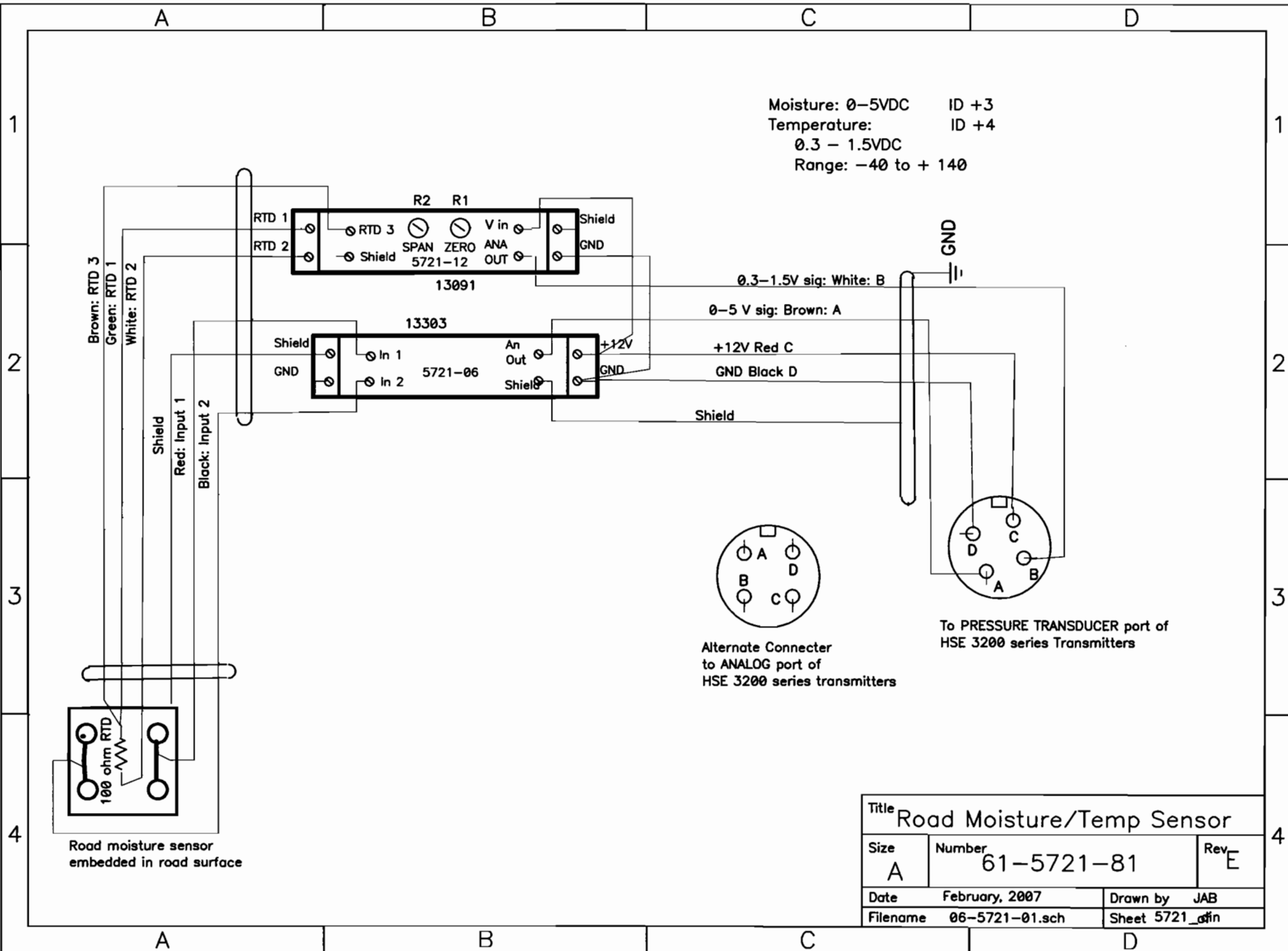
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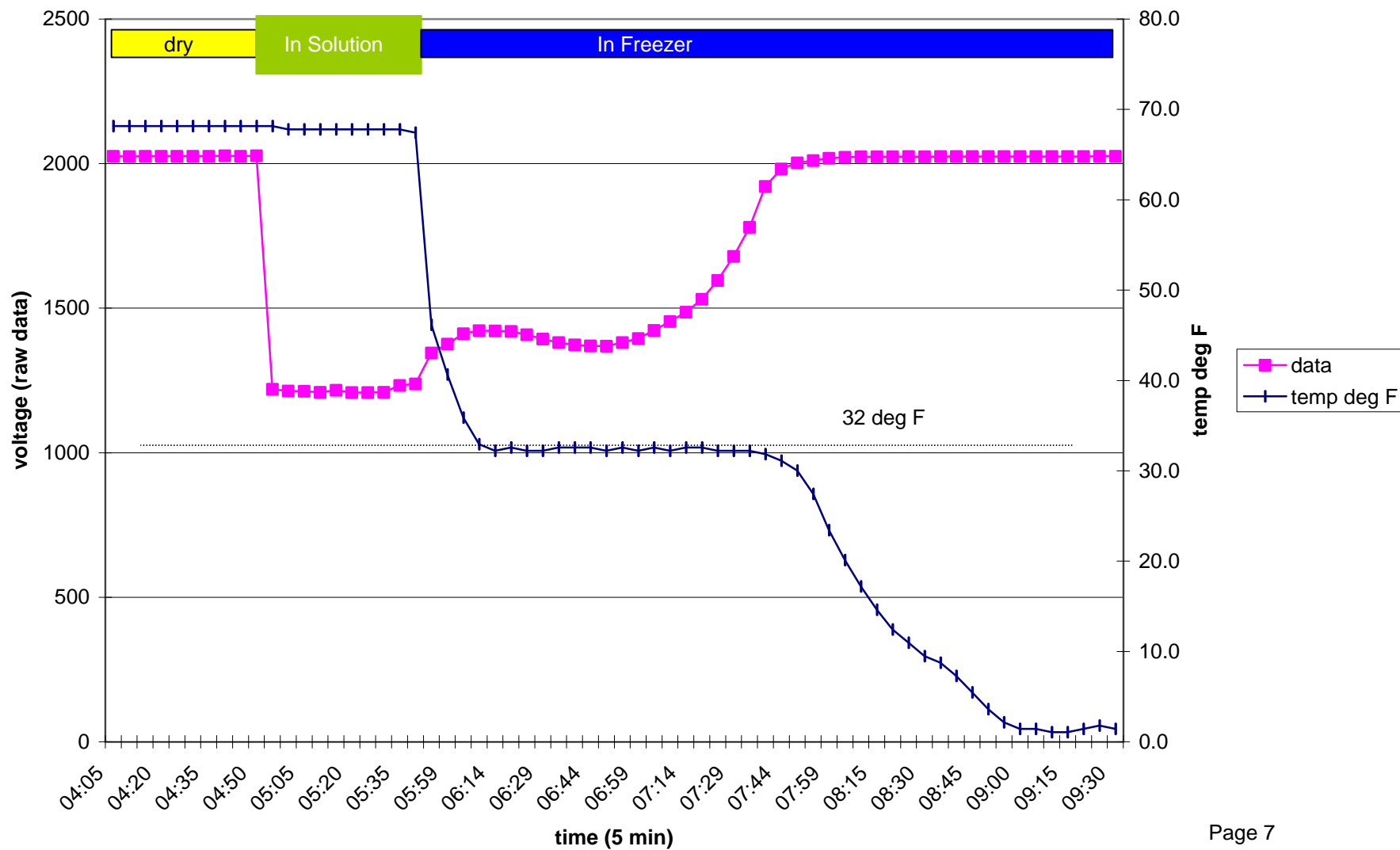
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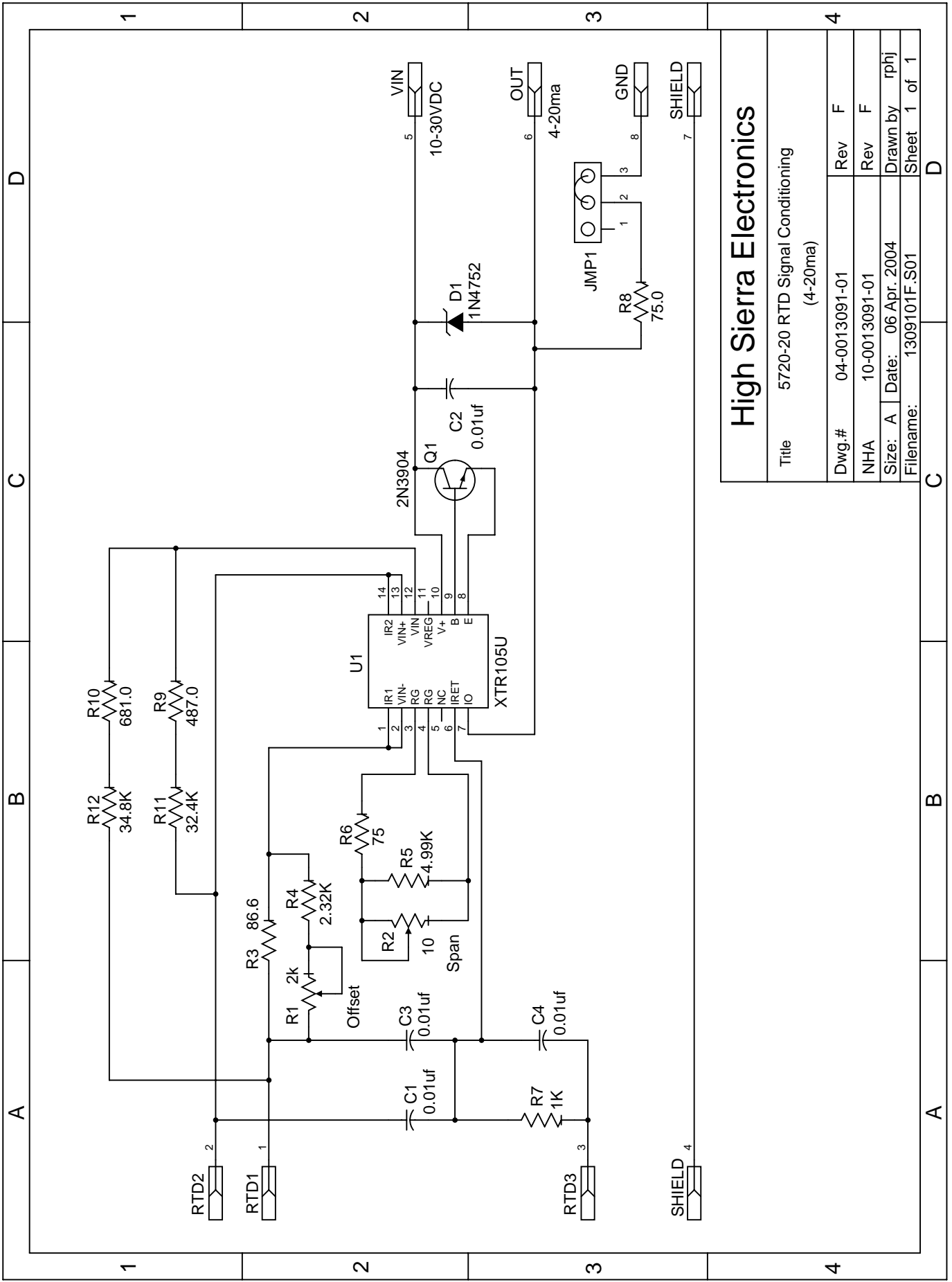




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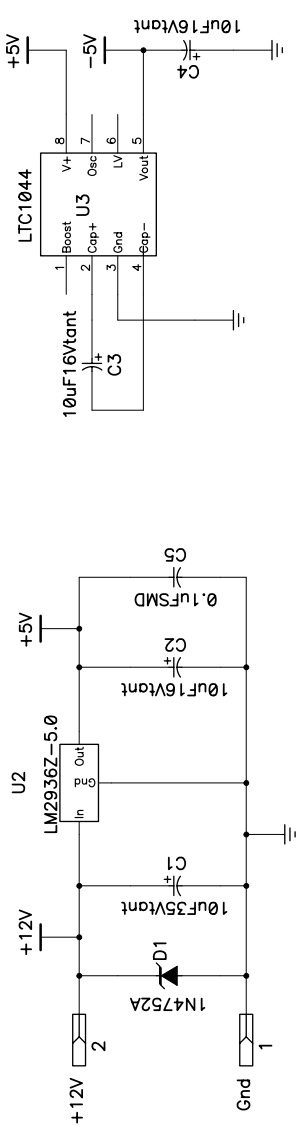
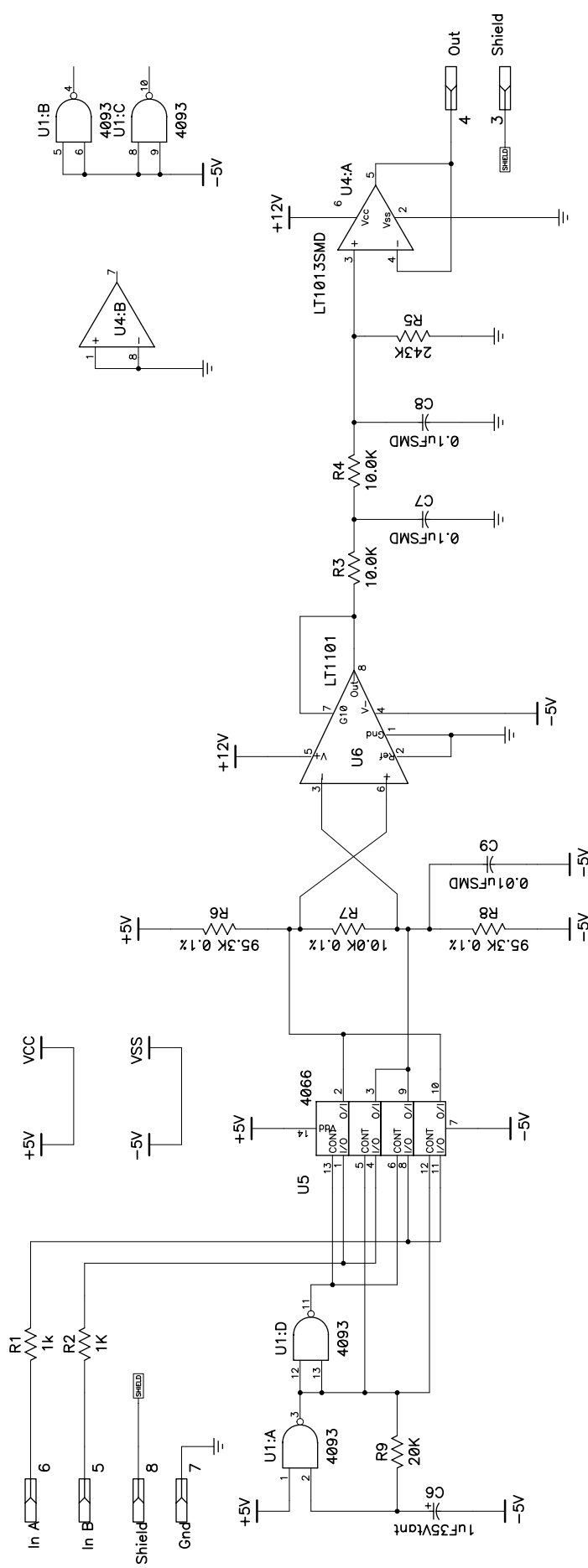


04-0013091-01 REV. F



High Sierra Electronics

Title	5720-20 RTD Signal Conditioning (4-20ma)		
Dwg.#	04-0013091-01	Rev	F
NHA	10-0013091-01	Rev	F
Size:	A	Date:	06 Apr. 2004
Filename:	1309101F.S01		



Model 5720 Temperature to Resistance chart

1 degree C increment

degs F	degs C	ohms	degs F	degs C	ohms
-40.0	-40.0	84.27	68.0	20.0	107.79
-38.2	-39.0	84.67	69.8	21.0	108.18
-36.4	-38.0	85.06	71.6	22.0	108.57
-34.6	-37.0	85.46	73.4	23.0	108.96
-32.8	-36.0	85.85	75.2	24.0	109.35
-31.0	-35.0	86.25	77.0	25.0	109.73
-29.2	-34.0	86.64	78.8	26.0	110.12
-27.4	-33.0	87.04	80.6	27.0	110.51
-25.6	-32.0	87.43	82.4	28.0	110.90
-23.8	-31.0	87.83	84.2	29.0	111.28
-22.0	-30.0	88.22	86.0	30.0	111.67
-20.2	-29.0	88.62	87.8	31.0	112.06
-18.4	-28.0	89.01	89.6	32.0	112.45
-16.6	-27.0	89.40	91.4	33.0	112.83
-14.8	-26.0	89.80	93.2	34.0	113.22
-13.0	-25.0	90.19	95.0	35.0	113.61
-11.2	-24.0	90.59	96.8	36.0	113.99
-9.4	-23.0	90.98	98.6	37.0	114.38
-7.6	-22.0	91.37	100.4	38.0	114.77
-5.8	-21.0	91.77	102.2	39.0	115.15
-4.0	-20.0	92.16	104.0	40.0	115.54
-2.2	-19.0	92.55	105.8	41.0	115.93
-0.4	-18.0	92.95	107.6	42.0	116.31
1.4	-17.0	93.34	109.4	43.0	116.70
3.2	-16.0	93.73	111.2	44.0	117.08
5.0	-15.0	94.12	113.0	45.0	117.47
6.8	-14.0	94.52	114.8	46.0	117.85
8.6	-13.0	94.91	116.6	47.0	118.24
10.4	-12.0	95.30	118.4	48.0	118.62
12.2	-11.0	95.69	120.2	49.0	119.01
14.0	-10.0	96.09	122.0	50.0	119.40
15.8	-9.0	96.48	123.8	51.0	119.78
17.6	-8.0	96.87	125.6	52.0	120.16
19.4	-7.0	97.26	127.4	53.0	120.55
21.2	-6.0	97.65	129.2	54.0	120.93
23.0	-5.0	98.04	131.0	55.0	121.32
24.8	-4.0	98.44	132.8	56.0	121.70
26.6	-3.0	98.83	134.6	57.0	122.09
28.4	-2.0	99.22	136.4	58.0	122.47
30.2	-1.0	99.61	138.2	59.0	122.86
32.0	0.0	100.00	140.0	60.0	123.24
33.8	1.0	100.39	141.8	61.0	123.62
35.6	2.0	100.78	143.6	62.0	124.01
37.4	3.0	101.17	145.4	63.0	124.39
39.2	4.0	101.56	147.2	64.0	124.77
41.0	5.0	101.95	149.0	65.0	125.16
42.8	6.0	102.34	150.8	66.0	125.54
44.6	7.0	102.73	152.6	67.0	125.92
46.4	8.0	103.12	154.4	68.0	126.31
48.2	9.0	103.51	156.2	69.0	126.69
50.0	10.0	103.90	158.0	70.0	127.07
51.8	11.0	104.29	159.8	71.0	127.45
53.6	12.0	104.68	161.6	72.0	127.84
55.4	13.0	105.07	163.4	73.0	128.22
57.2	14.0	105.46	165.2	74.0	128.60
59.0	15.0	105.85	167.0	75.0	128.98
60.8	16.0	106.24	168.8	76.0	129.37
62.6	17.0	106.63	170.6	77.0	129.75
64.4	18.0	107.02	172.4	78.0	130.13
66.2	19.0	107.40	174.2	79.0	130.51
			176.0	80.0	130.89

Model 5720 Temperature to Resistance chart

			1 degree F increment					
degs F	degs C	ohms	degs F	degs C	ohms	degs F	degs C	ohms
-40.0	-40.0	84.27	20.0	-6.7	97.39	81.0	27.2	110.60
-39.0	-39.4	84.49	21.0	-6.1	97.61	82.0	27.8	110.81
-38.0	-38.9	84.71	22.0	-5.6	97.83	83.0	28.3	111.03
-37.0	-38.3	84.93	23.0	-5.0	98.04	84.0	28.9	111.24
-36.0	-37.8	85.15	24.0	-4.4	98.26	85.0	29.4	111.46
-35.0	-37.2	85.37	25.0	-3.9	98.48	86.0	30.0	111.67
-34.0	-36.7	85.59	26.0	-3.3	98.70	87.0	30.6	111.89
-33.0	-36.1	85.81	27.0	-2.8	98.91	88.0	31.1	112.10
-32.0	-35.6	86.03	28.0	-2.2	99.13	89.0	31.7	112.32
-31.0	-35.0	86.25	29.0	-1.7	99.35	90.0	32.2	112.53
-30.0	-34.4	86.47	30.0	-1.1	99.57	91.0	32.8	112.75
-29.0	-33.9	86.69	31.0	-0.6	99.78	92.0	33.3	112.96
-28.0	-33.3	86.91	32.0	0.0	100.00	93.0	33.9	113.18
-27.0	-32.8	87.13	33.0	0.6	100.22	94.0	34.4	113.39
-26.0	-32.2	87.35	34.0	1.1	100.43	95.0	35.0	113.61
-25.0	-31.7	87.56	35.0	1.7	100.65	96.0	35.6	113.82
-24.0	-31.1	87.78	36.0	2.2	100.87	97.0	36.1	114.04
-23.0	-30.6	88.00	37.0	2.8	101.09	98.0	36.7	114.25
-22.0	-30.0	88.22	38.0	3.3	101.30	99.0	37.2	114.47
-21.0	-29.4	88.44	39.0	3.9	101.52	100.0	37.8	114.68
-20.0	-28.9	88.66	40.0	4.4	101.74	101.0	38.3	114.90
-19.0	-28.3	88.88	41.0	5.0	101.95	102.0	38.9	115.11
-18.0	-27.8	89.10	42.0	5.6	102.17	103.0	39.4	115.32
-17.0	-27.2	89.32	43.0	6.1	102.39	104.0	40.0	115.54
-16.0	-26.7	89.54	44.0	6.7	102.60	105.0	40.6	115.75
-15.0	-26.1	89.76	45.0	7.2	102.82	106.0	41.1	115.97
-14.0	-25.6	89.97	46.0	7.8	103.04	107.0	41.7	116.18
-13.0	-25.0	90.19	47.0	8.3	103.25	108.0	42.2	116.40
-12.0	-24.4	90.41	48.0	8.9	103.47	109.0	42.8	116.61
-11.0	-23.9	90.63	49.0	9.4	103.69	110.0	43.3	116.83
-10.0	-23.3	90.85	50.0	10.0	103.90	111.0	43.9	117.04
-9.0	-22.8	91.07	51.0	10.6	104.12	112.0	44.4	117.25
-8.0	-22.2	91.29	52.0	11.1	104.34	113.0	45.0	117.47
-7.0	-21.7	91.50	53.0	11.7	104.55	114.0	45.6	117.68
-6.0	-21.1	91.72	54.0	12.2	104.77	115.0	46.1	117.90
-5.0	-20.6	91.94	55.0	12.8	104.98	116.0	46.7	118.11
-4.0	-20.0	92.16	56.0	13.3	105.20	117.0	47.2	118.33
-3.0	-19.4	92.38	57.0	13.9	105.42	118.0	47.8	118.54
-2.0	-18.9	92.60	58.0	14.4	105.63	119.0	48.3	118.75
-1.0	-18.3	92.82	59.0	15.0	105.85	120.0	48.9	118.97
0.0	-17.8	93.03	60.0	15.6	106.07	121.0	49.4	119.18
1.0	-17.2	93.25	61.0	16.1	106.28	122.0	50.0	119.40
2.0	-16.7	93.47	62.0	16.7	106.50	123.0	50.6	119.61
3.0	-16.1	93.69	63.0	17.2	106.71	124.0	51.1	119.82
4.0	-15.6	93.91	64.0	17.8	106.93	125.0	51.7	120.04
5.0	-15.0	94.12	65.0	18.3	107.15	126.0	52.2	120.25
6.0	-14.4	94.34	66.0	18.9	107.36	127.0	52.8	120.46
7.0	-13.9	94.56	67.0	19.4	107.58	128.0	53.3	120.68
8.0	-13.3	94.78	68.0	20.0	107.79	129.0	53.9	120.89
9.0	-12.8	95.00	69.0	20.6	108.01	130.0	54.4	121.11
10.0	-12.2	95.21	70.0	21.1	108.22	131.0	55.0	121.32
11.0	-11.7	95.43	71.0	21.7	108.44	132.0	55.6	121.53
12.0	-11.1	95.65	72.0	22.2	108.66	133.0	56.1	121.75
13.0	-10.6	95.87	73.0	22.8	108.87	134.0	56.7	121.96
14.0	-10.0	96.09	74.0	23.3	109.09	135.0	57.2	122.17
15.0	-9.4	96.30	75.0	23.9	109.30	136.0	57.8	122.39
16.0	-8.9	96.52	76.0	24.4	109.52	137.0	58.3	122.60
17.0	-8.3	96.74	77.0	25.0	109.73	138.0	58.9	122.81
18.0	-7.8	96.96	78.0	25.6	109.95	139.0	59.4	123.03
19.0	-7.2	97.17	79.0	26.1	110.16	140.0	60.0	123.24
			80.0	26.7	110.38			