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■ HVAC Controls ■ Electric Actuators ■ Actuated Valves
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It's All About the Curves Choosing the right temperature sensor

There are many temperature sensors on the market and it can be challenging to choose. To simplify, we can break it down into three categories: class, resistance, type or curve.

Class: It can be either a Resistance Temperature Detector (RTD) or a Thermistor. Neptronic uses thermistors, which have a negative temperature coefficient (NTC). This means that when temperature rises, the resistance value decreases.

Resistance: The thermistors are rated with the resistance value when temperature is at 25°C (77°F). Neptronic uses two resistance values: 3.3kΩ and 10kΩ (most products use the 10kΩ thermistor). So when looking at thermistors, a 20kΩ thermistor's resistance value at 25°C (77°F) will be 20,000Ω, a 10kΩ will have a resistance value of 10,000Ω and a 3.3kΩ will have a resistance value of 3,300Ω.

Type or Curve: Each thermistor manufacturer has their own standard for resistance values outside the 25°C (77°F) base line. This means that for a type 3 thermistor, there can be a small difference in resistance values between manufacturers. Neptronic uses the type 3 or G, which have identical curves.

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Where can I find the information?

Neptronic uses two remote temperature sensors; STR1 and STC8. The resistance values are available on the Specification and Installation Instructions for both products. These documents are available on our website. (Click here for: [STR1](#) or [STC8](#))

Sensor table

STC8-11 (10 K Ω)		STC8-13 (3.3 K Ω)	
Temperature	Resistor K Ω	Temperature	Resistor K Ω
-40 °C [-40°F]	239.700	-40 °C [-40°F]	110.914
-35 °C [-31°F]	179.200	-35 °C [-31°F]	80.036
-30 °C [-22°F]	135.200	-30 °C [-22°F]	58.384
-25 °C [-13°F]	102.900	-25 °C [-13°F]	43.034
-20 °C [-4°F]	78.910	-20 °C [-4°F]	32.037
-15 °C [5°F]	61.020	-15 °C [5°F]	24.078
-10 °C [14°F]	47.540	-10 °C [14°F]	18.262
-5 °C [23°F]	37.310	-5 °C [23°F]	13.972
0 °C [32°F]	29.490	0 °C [32°F]	10.779
5 °C [41°F]	23.460	5 °C [41°F]	8.383
10°C [50°F]	18.780	10°C [50°F]	6.569
15°C [59°F]	15.130	15°C [59°F]	5.186
20°C [68°F]	12.260	20°C [68°F]	4.123
25°C [77°F]	10.0	25°C [77°F]	3.3
30°C [86°F]	8.194	30°C [86°F]	2.658
35°C [95°F]	6.752	35°C [95°F]	2.154
40°C [104°F]	5.592	40°C [104°F]	1.757
45°C [113°F]	4.655	45°C [113°F]	1.441
50°C [122°F]	3.893	50°C [122°F]	1.188
55°C [131°F]	3.271	55°C [131°F]	0.985
60°C [140°F]	2.760	60°C [140°F]	0.820
65°C [149°F]	2.339	65°C [149°F]	0.687
70°C [158°F]	1.990	70°C [158°F]	0.578
75°C [167°F]	1.700	75°C [167°F]	0.488
80°C [176°F]	1.458	80°C [176°F]	0.414

Can I use a 10k Ω type 2?

So now that we know the thermistor type required to work with Neptronic controllers (3.3k Ω and 10k Ω type 3 or G), can a 10k Ω type 2 work as well? As mentioned previously, there are some differences between manufacturers within the same type.

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For obvious reasons, there are also differences for different types. To answer the question, the temperature range must be established. If the application is for an office, the chances are the temperature range will be between 15 and 30°C (59 to 86°F).

When looking at the table below, we can see that the resistance values for the selected temperature range is very similar. These differences are negligible and should not offset the room temperature reading. However, we can see that the resistance values start to differ when moving away from the 25°C (77°F) temperature baseline. Therefore, the 10kΩ type 2 would work for this application but it will not fit all applications.

All thermistor manufacturers should have a reference table with resistance values. If you are not sure, you can join the specification and installation instructions of the STC8 or STR1 temperature sensor along with your demand.

STANDARD RTD AND THERMISTOR VALUES (Ohms Ω)

°C	°F	100 Ohm	1000 Ohm	2.2k	3k	10k Type 2	10k Type 3	10k Dale	10k 3A221	10k "G" US	20k	20k "D"	100k
-50	-58	80.306	803.06	154,464	205,800	692,700	454,910	672,300	-	441,200	1,267,600	-	-
-40	-40	84.271	842.71	77,081	102,690	344,700	245,089	337,200	333,562	239,700	643,800	803,200	3,366,000
-30	-22	88.222	882.22	40,330	53,730	180,100	137,307	177,200	176,081	135,300	342,000	412,800	1,770,000
-20	-4	92.160	921.60	22,032	29,346	98,320	79,729	97,130	96,807	78,910	189,080	220,600	971,200
-10	14	96.086	960.86	12,519	16,674	55,790	47,843	55,340	55,252	47,540	108,380	122,400	553,400
0	32	100.000	1000.00	7,373	9,822	32,770	29,588	32,660	32,639	29,490	64,160	70,200	326,600
10	50	103.903	1039.03	4,487	5,976	19,930	18,813	19,900	19,901	18,780	39,440	41,600	199,000
20	68	107.794	1077.94	2,814	3,750	12,500	12,272	12,490	12,493	12,260	24,920	25,340	124,900
25	77	109.735	1097.35	2,252	3,000	10,000	10,000	10,000	10,000	10,000	20,000	20,000	100,000
30	86	111.673	1116.73	1,814	2,417	8,055	8,195	8,056	8,055	8,194	16,144	15,884	80,580
40	104	115.541	1155.41	1,199	1,598	5,323	5,593	5,326	5,324	5,592	10,696	10,210	53,260
50	122	119.397	1193.97	811.5	1,081	3,599	3,894	3,602	3,600	3,893	7,234	6,718	36,020
60	140	123.242	1232.42	561.0	747	2,486	2,763	2,489	2,486	2,760	4,992	4,518	24,880
70	158	127.075	1270.75	395.5	527	1,753	1,994	1,753	1,751	1,990	3,512	3,100	17,510
80	176	130.897	1308.97	284.0	378	1,258	1,462	1,258	1,255	1,458	2,516	2,168	12,560
90	194	134.707	1347.07	207.4	-	919	1,088	917	915	1,084	1,833	1,542	9,164
100	212	138.506	1385.06	153.8	-	682	821	679	678	816.8	1,356	1,134	6,792
110	230	142.293	1422.93	115.8	-	513	628	511	509	623.6	1,016	816	5,108
120	248	146.068	1460.68	88.3	-	392	486	389	388	481.8	770	606	3,894
130	266	149.832	1498.32	68.3	-	303	380	301	299	376.4	591	456	3,006

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