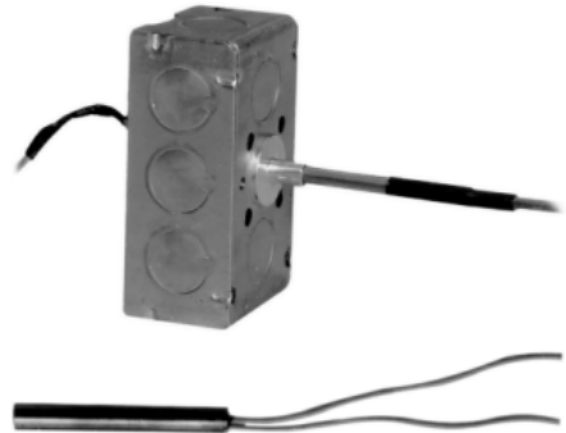


TEP/TEA Series Platinum Temperature Sensors and TQ-6000 Accessory Transmitter

The TEP and TEA Series Platinum Temperature Sensors come in probe (TEP Series) and averaging (TEA Series) configurations with 100-ohm or 1,000-ohm elements. (See Table 2.) These sensors have metal electrical boxes and are designed for use with building automation systems and application specific controllers. Use them also whenever platinum is specified for general purpose temperature sensing applications.

IMPORTANT: The TEP/TEA Series Platinum Temperature Sensors and TQ-6000 Accessory Transmitters are intended to provide an input to equipment under normal operating conditions. Where failure or malfunction of a temperature sensor or transmitter could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory) intended to warn of, or protect against, failure or malfunction of the temperature sensor or transmitter must be incorporated into and maintained as part of the control system.



**Figure 1: TEP/TEA Series Platinum
Temperature Sensors**

Features and Benefits	
<input type="checkbox"/> Probe and Averaging Sensors Available	Covers a wide variety of applications
<input type="checkbox"/> Current Transmitter Option	Allows longer wire runs
<input type="checkbox"/> Metal Electrical Boxes	Provides an alternative to plastic for meeting code requirements
<input type="checkbox"/> Sensor Element Options	Offers choice of 100 or 1,000 ohms

Product Overview

Probe Sensors

The TEP Series Probe Sensors have platinum wire elements in bronze sheaths. Easily field-install them with TE-6001 Hardware Assemblies. These probe sensors work in a wide variety of temperature sensing applications.

Averaging Sensors

The TEA Series Averaging Sensors are complete sensor/hardware assemblies. Each consists of a platinum equivalent averaging-type sensor, either 10 or 20 ft (305 or 610 cm) long, encased in an aluminum sheath attached to a handibox, and shipped with two element holders for easy mounting and wiring.

Transmitter

The TQ-6000 is a 2-wire current loop type transmitter that works with the 100-ohm platinum sensors to send a 4 to 20 mA temperature control signal long distances without the loss of accuracy due to lead wire resistance.

Theory of Operation

The TEP/TEA Series Temperature Sensors employ a platinum (or platinum equivalent) element whose resistance increases with temperature in a known and repeatable manner. (See Table 1.) Because this resistance varies continuously with temperature, these sensors permit tighter control of Heating, Ventilating, and Air Conditioning systems than conventional On/Off thermostats.

The TQ-6000 transmitter operates on 18 VDC (nominal) and accepts an input resistance signal from a 100-ohm platinum sensor. (One DC power supply can operate several transmitters in parallel.) The TQ-6000 converts the resistance signal into a current signal that varies linearly with temperature.

Acting as a variable resistor, the transmitter regulates current over a 4 to 20 mA range. The resulting current signal is independent of the other resistance in the loop (up to a calculated maximum) and relates directly to temperature.

Use the following formula to determine the nominal current output (I_T) at any temperature (T) using a 100-ohm sensor:

$$I_T = 4 \text{ mA} + [(16 \text{ mA} \times T^\circ\text{F})/100^\circ\text{F}]$$

Example: The output at 50°F/10°C is:

$$I_T = 4 \text{ mA} + [(16 \text{ mA} \times 50^\circ\text{F})/100^\circ\text{F}] = 12 \text{ mA}$$

The transmitter needs no other operating power than what comes from the two-wire current loop.

Table 1: Temperature vs. Resistance

Temperature		Resistance (ohms)
°F	°C	
-50	-46	82.07
-40	-40	84.27
-30	-34	86.47
-20	-29	88.66
-10	-23	90.85
0	-18	93.03
10	-12	95.22
20	-7	97.39
30	-1	99.57
32	0	100.00
40	4	101.74
50	10	103.90
60	16	106.07
70	21	108.23
80	27	110.38
90	32	112.53
100	38	114.68
110	43	116.83
120	49	118.97
130	54	121.11
140	60	123.24
150	66	125.37
160	71	127.50
170	77	129.62
180	82	131.74
190	88	133.86
200	93	135.97
210	99	138.08
220	104	140.19
230	110	142.29
240	116	144.39
250	121	146.48
260	127	148.57
270	132	150.66
275	135	151.70

Note: Resistance values in this table are for the 100-ohm probe sensor (TEP-J000000). Values for the 1,000-ohm sensor (TEP-L000000) are ten times these values.

Ordering Information

Contact the nearest Johnson Controls representative to order a TEP/TEA Series Platinum Temperature Sensor or a TQ-6000 Accessory Transmitter TEP Probe Sensor, a TEA Averaging Sensor, or a TE-6001-8 Averaging Sensor Element Holder (accessory). Specify the desired product code number from Table 2.

Table 2: Models and Accessories

Product Code Number	Description		
TEP-J000000	Probe Temperature Sensor		100 ohms at 32°F (0°C)
TEP-L000000	Probe Temperature Sensor		1,000 ohms at 32°F (0°C)
TEA-J000000	Averaging Temperature Sensor	10 ft (3.5 m) Sensor Length	100 ohms at 32°F (0°C)
TEA-K000000	Averaging Temperature Sensor	20 ft (6.1 m) Sensor Length	100 ohms at 32°F (0°C)
TEA-L000000	Averaging Temperature Sensor	10 ft (3.5 m) Sensor Length	1,000 ohms at 32°F (0°C)
TEA-M000000	Averaging Temperature Sensor	20 ft (6.1 m) Sensor Length	1,000 ohms at 32°F (0°C)
TQ-6000-1	Transmitter	2-wire	4 to 20 mA
TE-6001-8	Temperature Element Holder for Use with All Averaging Sensors (Nickel and Platinum)		

Technical Specifications

Product		TEP/TEA Temperature Sensing Elements
Elements	Platinum (or Equivalent) Resistance Type	
Accuracy	±1F° at 70°F (±0.56C° at 21.1°C)	
Reference Resistance at 32°F (0°C)	100 ohms:	TEP-J000000, TEA-J000000, TEA-K000000
	1,000 ohms:	TEP-L000000, TEA-L000000, TEA-M000000
Temperature Range	-50 to 275°F (-46 to 135°C)	
Product		TQ-6000 Temperature Transmitter
Output	4 to 20 mA DC Scaled over the 0 to 100°F (-18 to 38 °C) Sensor Range	
Sensing Element	Requires 100 ohms (TEP/TEA Series Platinum or Equivalent)	
Calibration Accuracy	±0.1% of Span at Calibration Temperature [32°F (0°C)]	
Adjustments	Zero and Span	±5% of Span
Supply Voltage	8.5 to 35 VDC	
	Voltage Effect:	±0.001% of Span per Volt
Warmup Drift	±0.1% of Span Maximum, Assuming $V_{supply} = 24$ VDC and $R_{loop} = 250$ ohms: Stable within 30 Minutes	
Loop Resistance	The maximum allowable resistance of the signal carrying loop (with load resistor R_{LOAD} and extension wires) is calculated with the following formula: $R_{loop\ maximum} = (V_{supply} - 8.5\ V)/0.02\ A$	
Linearity	Referenced to Actual Sensor Temperature (±0.1% of Span)	
Ambient Operating Temperature	32 to 122°F (0 to 50°C) Calibrated at 75°F/23.9°C; Drift Less than ±0.007% of span per 1°F (±0.13% of span per 1°C) Change in Ambient Temperature Over Usable Range	
Storage Temperature	-67 to 212°F/-55 to 100°C	
Shipping Weight	TEP-J/L000000	0.2 lb (0.09 kg)
	TEA-J/L000000	1.0 lb (0.45 kg)
	TEA-K/M000000	1.1 lb (0.5 kg)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



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