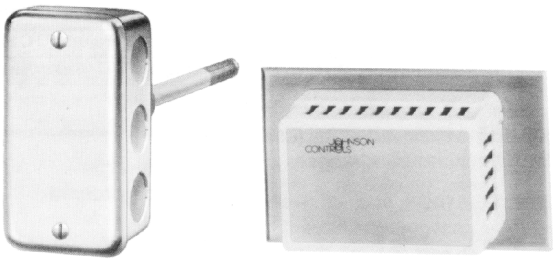
JOHNSON CONTROLS

TE-6100 Series Temperature Sensors and Completed Sensor/Hardware Assemblies

TE-6100 completed assemblies are used in a wide variety of temperature sensing applications. In addition to these completed units, there are various other sensing elements and hardware configurations that may be field assembled, depending on the application. Refer to the TE-6000 Temperature Sensing Elements Product Bulletin *for available temperature sensing elements and the* TE-6001 Hardware Assemblies for TE-6000 Temperature Elements Product/Technical Bulletin *for available hardware configurations.*



TE-6100-3 **TE-6100-8, -960, -961 (with T-4000 Cover)**

Figure 1: TE-6100 Completed Assemblies

Features and Benefits	
❑ **Nickel and Silicon Sensor Elements**	Provide multiple resistance ranges for a variety of applications
❑ **Phone Jack Connectors on Room Temperature Sensors TE-6100-11 and -12**	Allow connection to controllers and test panel via standard or plenum rated telephone cable
❑ **Optional Mounting Assemblies**	Provide easy mounting through the use of a mounting bracket or wallplate

Part No. 24-4034-42, Rev. C
Code No. LIT-216310

Models

TE-6100-1 through -8 temperature sensing assemblies are designed for use with Cybertronic® temperature controllers, GQ-4000 Indication Systems, and Metasys® analog inputs. The sensing portion of these assemblies is a nickel or silicon element, which varies its resistance with temperature changes.

TE-6100-1 and -2

The TE-6100-1 and -2 averaging element assemblies have 17 and 8 ft (5.2 and 2.4 m) elements respectively and are suitable for duct mounting as well as other applications.

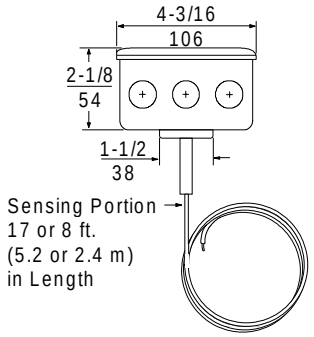


Figure 2: TE-6100-1, -2 Averaging Elements Dimensions (in./mm)

TE-6100-3

The TE-6100-3 duct insertion assembly is designed for temperature control and/or indication. This assembly has a dual wound nickel wire element that consists of an element winding on each of two concentric tubes. The outer tube thermally insulates the inner tube and its winding to produce a time lag in sensing temperature changes. When used in a control system, this element provides an effect similar to rate action, which will prevent cycling caused by sudden large temperature changes.

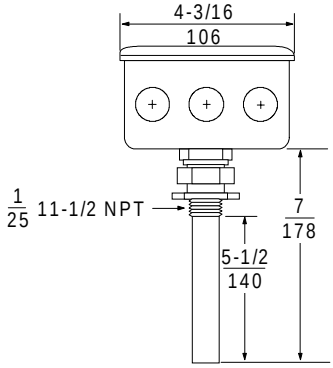


Figure 3: TE-6100-3 Dual Wound Duct Insertion Element Dimensions (in./mm)

TE-6100-4

The TE-6100-4 high temperature well insertion assembly is used for control or indication of steam or hot water temperatures up to 550°F (288°C) in pipes and tanks. This assembly uses a rigid rod on which nickel wire is wound. The sensor has a resistance tolerance of ± 1.0%. A WZ-1000-4 stainless steel immersion well must be used with this assembly in all applications.

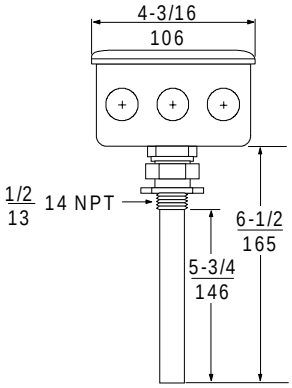


Figure 4: TE-6100-4 High Temperature Well Insertion Element Dimensions (in./mm)

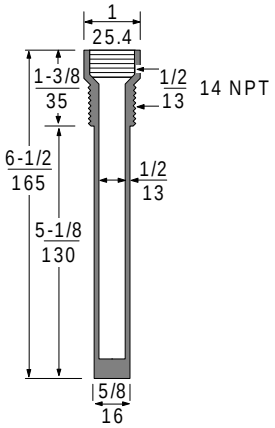


Figure 5: WZ-1000-4 Immersion Well Dimensions (in./mm)

TE-6100-8

The TE-6100-8 room element assembly consists of a nickel wire sensor, setpoint adjustment, wallplate adaptor, and mounting bracket. A T-4000 cover is required and must be ordered separately. (See Table 6 for available covers.)

Note: Sensor and setpoint are wired in series for use with Cybertronic and R48 Series controllers.

TE-6100-11 and -12

The TE-6100-11 and -12 room sensor assemblies consist of a 1000-ohm nickel sensor, an 8-pin phone jack for field wiring to Metasys VAV and UNT controllers, a 6-pin phone jack to connect to a test panel, and a setpoint potentiometer (-12 only). A T-4000 cover and TE-1800-9600 Wall Box Mounting Adaptor Kit must be ordered separately. Connections are also provided for a TE-6001-961 Override Switch (ordered separately).

TE-6100-960 and -961

The TE-6100-960 and -961 are used with room sensing applications. These assemblies consist of a PTC (Positive Temperature Coefficient) silicon sensor, setpoint adjustment (-960 only), wallplate adaptor, and mounting bracket. The TE-6100-960 has five wires and the TE-6100-961 has three wires. A T-4000 cover is required and must be ordered separately.

Table 1: TE-6100-960 Setpoint Potentiometer Calibration

°C	°F	% Of Supply	Reference Voltage
10.0	**50**	**72.4**	**3.620**
11.1	**52**	**70.0**	**3.500**
12.8	**55**	**66.3**	**3.314**
15.0	**59**	**61.3**	**3.063**
15.6	**60**	**60.1**	**3.003**
18.3	**65**	**53.8**	**2.689**
20.0	**68**	**50.0**	**2.500**
21.1	**70**	**47.5**	**2.374**
23.9	**75**	**41.2**	**2.059**
25.0	**77**	**38.7**	**1.935**
26.7	**80**	**34.9**	**1.747**
28.9	**84**	**30.0**	**1.500**
30.0	**86**	**27.6**	**1.380**

Note: The reference voltages are meaningless if the supply voltage is not 5 volts. Use percentage of supply to calculate output for other input voltages.

TE-6100-962

The TE-6100-962 averaging element assembly is used in duct insertion applications. This assembly consists of a PTC silicon element mounted in a metal tube.

Table 2: Temperature vs. Resistance

Temperature		Nominal Resistance (ohms)		
°F	°C	-1, -2, -3, -8, -11, -12	-4	-960, -961, -962
-50	-46	674	-	-
-40	-40	699	-	605
-30	-34	725	-	633
-20	-29	751	-	665
-10	-23	777	-	698
0	-18	803	-	732
10	-12	830	-	768
20	-7	858	-	804
30	-1	885	-	842
40	4	914	-	881
50	10	942	-	921
60	16	971	-	962
70	21	1000	1000	1005
77	25	1021	1021	1035
80	27	1030	1031	1048
90	32	1060	1062	1093
100	38	1090	1094	1139
110	43	1121	1126	1186
120	49	1152	1159	1234
130	54	1184	1192	1283
140	60	1216	1225	1333
150	66	1248	1259	1385
160	71	1281	1293	1437
170	77	1314	1328	1491
180	82	1348	1363	1546
190	88	1382	1398	1602
200	93	1417	1434	1659
210	99	1452	1471	1718
220	104	1487	1507	-
230	110	1524	1544	-
240	116	1560	1580	-
250	121	1597	1617	-
275	135	-	1709	-
300	149	-	1801	-
325	163	-	1901	-
350	177	-	2006	-
375	191	-	2121	-
400	204	-	2241	-
425	218	-	2368	-
450	232	-	2498	-
475	246	-	2635	-
500	260	-	2775	-
525	274	-	2919	-
550	288	-	3066	-

Operation

The TE-6100 nickel wire or silicon resistance type sensor provides a varying resistance to a controller. When the temperature at the sensor changes, the resistance of the sensor changes. The sensor will exhibit a positive resistance change with temperature.

The silicon sensor changes 0.42% per F° (0.75% per C°), with a reference resistance of 1035 ohms at 77°F (256°C). The nickel sensor changes 3 ohms/F° (5.4 ohms/C°) with a reference resistance of 1000 ohms at 70°F (21°C).

Mounting

TE-6100-1 and -2

To support the averaging tube and ensure correct minimum bend radius, use TE-6001-8 Mounting Brackets to secure the averaging elements of TE-6100-1 and -2 assemblies in duct applications.

Note: Element may be bent and placed in any desired position within a duct or other area in which sensing is desired.

> ⚠ CAUTION: **Equipment Damage Hazard.** A 3-inch minimum bend radius must be maintained.

TE-6100-3 and -4

The dual wound element of the TE-6100-3 assembly should be attached to a duct with No. 6 sheet metal screws or a threaded mounting flange. A WZ-1000-4 stainless steel immersion well must be used with TE-6100-4 assemblies.

TE-6100-8, -11, -12, -960, and -961

Locate TE-6100-8, -11, -12, -960, and -961 assemblies on a wall where air is free to circulate around the element, but away from nonrepresentative air conditions such as drafts or heat radiation. Mount these assemblies 5 to 6 ft (1.5 to 1.8m) above the floor on a standard electrical wallbox. A mounting bracket and wallplate adaptor are furnished with these assemblies.

The TE-6100-11 temperature sensor and TE-6100-12 temperature sensor with setpoint are designed for surface mounting in either the vertical or the horizontal position.

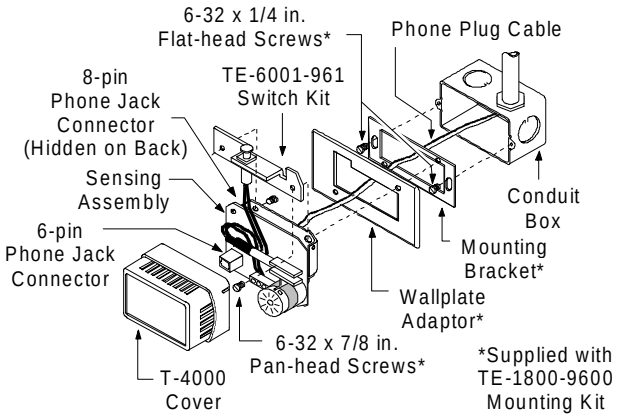


Figure 6: TE-6100-11 and -12 Installation on a Handi-box with TE-1800-9600 Mounting Kit (Horizontal Mounting Shown)

TE-6100-962

The TE-6100-962 assembly is attached to a duct with four No. 6 sheet metal screws. The tube may be shortened up to 8 in. by removing the end cap, cutting the tube, and reinstalling the end cap.

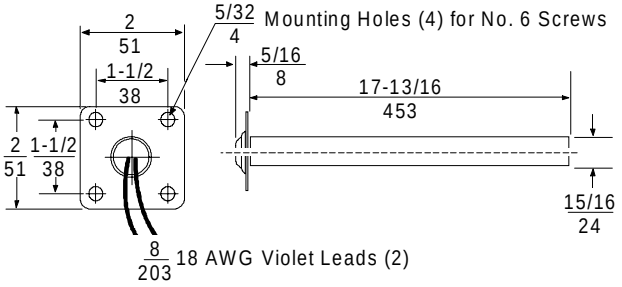


Figure 7: TE-6100-962 Dimensions (in./mm)

Wiring

CAUTION:	**Equipment Damage Hazard.** Check all wiring connections before applying power to the system. Short-circuited or improperly connected wires will result in permanent damage to the equipment.

IMPORTANT:	Make all wiring connections in accordance with the National Electrical Code and all local regulations.

Sensor wiring to controllers may be run in the same conduit as AC power as long as the power consumption is continuous. Transient voltages generated during power switching may be induced into the sensor wiring, causing upsets or failures in the connected components. Since transients are generally caused by inductive loads, do not combine sensor wiring with any relay or motor control circuits that are frequently interrupted, nor with frequently switched lighting loads.

If the wiring is to be routed through electrically noisy environments such as motor control centers, relay panels, or lighting panel boards, it may be necessary to use shielded cable to minimize the effects of transient voltages and other sources of electromagnetic interference.

Recommended installation practices with controllers include:

1. Separate conduit is required for sensors where line voltage switched power is present.
2. Separate conduit is necessary when switched low voltage loads of 50 VA or more are present.
3. Separate conduit is needed when sensor wiring and AC power wiring exceed 300 ft (91m) to avoid AC pickup, which may disrupt proper controller operation.
4. Maintain as much physical separation as possible where AC power and sensor wiring exist in a common panel.
5. Use twisted shielded cable for sensor leads if Steps 1 through 4 cannot be followed. Trim back shield at sensor and tape to prevent grounding. See appropriate controller technical bulletin for proper shield termination techniques.

Shielded wire is not required for connection to GQ-4100 indication bridges. However, the conditions for using shield and separate conduit with controllers apply to GQ-4100 bridges when they are used with a CQ-2200 Alarm Unit.

TE-6100-1 through -4

TE-6100-1 through -4 assemblies are equipped with an electrical enclosure and 18 AWG pigtail leads for wiring connections. The leads of the elements are white except for one set of leads on the dual wound element. The leads of the outer winding are black. The leads of the inner winding are white.

In wiring a TE-6100-4 to a controller or bridge, always use high temperature wire.

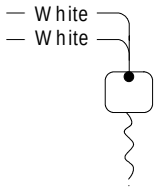


Figure 8: TE-6100-1 and TE-6100-2 Application and Drawing Identification

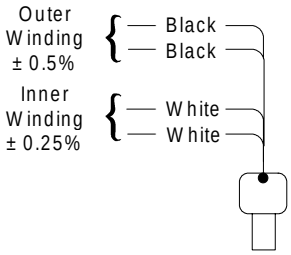


Figure 9: TE-6100-3 Application and Drawing Identification

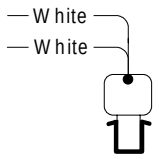


Figure 10: TE-6100-4 Application and Drawing Identification

TE-6100-8

The TE-6100-8 room element assembly has 6 in. (152 mm) white and violet leads for connection with system wiring. Connections are made in the wallbox with wire nuts or other approved connectors.

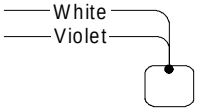


Figure 11: TE-6100-8 Application and Drawing Identification

TE-6100-11 and -12

An 8-pin phone jack connector is mounted on the back surface of the sensor circuit board for connection to the controller via 8-conductor standard or plenum rated telephone cable. In order to minimize error due to line loss (at 1°F), cable length must be limited to 55 ft (16.7m).

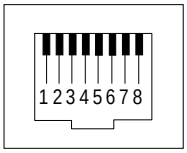


Figure 12: TE-6100 8-pin Phone Jack

Table 3: Signal Designations for 8-pin Phone Jack

Pin	Signal
1	AI-3 (Heating)
2	AI-2 (CLG, Warm/Cool)
3	AI-1 (Sensor)
4	AI-1 Sensor Common
5	24 VAC
6	24 VAC/Zone Bus Common
7	AI-2/3 Common
8	Zone Bus

When used with a Metasys VAV or UNT controller, the TE-6100-11 and -12 Temperature Sensors must be assigned an input address using the HVAC PRO for Windows™ Configuration Tool. A 6-pin phone jack connector is supplied on the sensor circuit board for connection to the configuration tool via standard 6-conductor telephone cable.

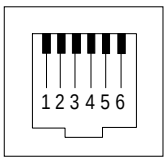


Figure 13: TE-6100 6-pin Phone Jack

Table 4: Signal Designations for 6-pin Phone Jack

Pin	Signal
1	Not Used
2	24 VAC
3	24 VAC/Zone Bus Common
4	Not Used
5	Zone Bus
6	Not Used

TE-6100-960 and-961

The TE-6100-960 and -961 have color-coded 18 AWG wires. Connections are made in the wallbox with wire nuts or other approved connectors.

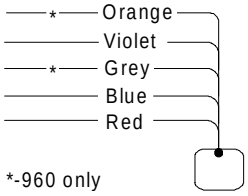


Figure 14: TE-6100-960 and TE-6100-961 Application and Drawing Identification

Figure 15: TE-6100-960 and TE-6100-961 Wiring Color Code

TE-6100-962

The TE-6100-962 averaging assembly has 18 AWG violet pigtail leads for wiring connections.

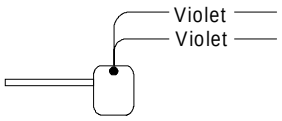


Figure 16: TE-6100-962 Application and Drawing Identification

Checkout Procedure

After installation, wiring, and configuration of the TE-6100-11 or -12 are complete, turn on the power supply and make an operational check as shown in the appropriate controller instructions.

Field Adjustments

The TE-6100-12 temperature sensor includes a warmer/cooler setpoint knob as shown in Figure 17. The setpoint is a 2000-ohm potentiometer mechanically restricted to a nominal span of 333 to 1695 ohms.

Note: The UNT and VAV controllers cannot accept a signal > 2000 ohms and may read in error if the nominal value drifts higher.

To adjust the setpoint higher for warmer room temperature, turn the knob Clockwise (CW) so that more red shows through the setpoint window.

To adjust the setpoint lower for cooler room temperature, turn the knob Counterclockwise (CCW) so that more blue shows through the setpoint window.

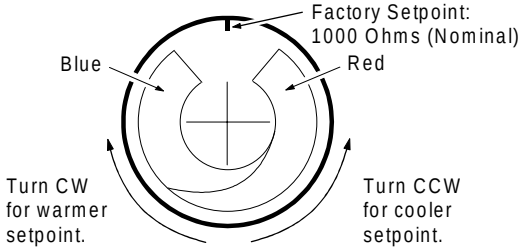


Figure 17: TE-6100-12 Setpoint Knob

Table 5: Models

TE-6100-	Description
1, 2	Averaging Nickel Wire Elements with Handi-box
3	Dual Wound Nickel Wire Element with Handi-box
4	High Temperature Well Insertion Nickel Wire Element with Handi-box
8	Room Temperature Nickel Element with Setpoint
11	Room Temperature Nickel Sensor
12	Room Temperature Nickel Sensor with Setpoint
960*	Room Temperature PTC Silicon Element with Setpoint
961*	Room Temperature PTC Silicon Element without Setpoint
962*	Averaging PTC Silicon Element with Duct Insertion Tube
* Order T-4000 cover separately. (See Table 6.)	

Table 6: Accessories/Repair Parts

Product Code Number		Description
T-275-100		Mounting Clips for use with Averaging Sensors
TE-1800-9600		Electrical Wall Box Mounting Adaptor Kit Includes: Wallplate Adaptor, Mounting Bracket and Screws
TE-6001-8		Mounting Bracket for use with Averaging Sensors
TE-6001-961		Pushbutton Switch for use with TE-6100-11, -12, -960, and -961
TE-6001-962		Toggle Switch for use with TE-6100-11, -12, -960, and -961
WZ-1000-4		Stainless Steel Immersion Well for use with TE-6100-4. 1/2 in. (13 mm) I.D., 1/2 in. NPT, Less Thermal Compound, 600°F and 400 psig (316°C and 2756 kPa)
Aluminum Faceplate T-4000-	Gold and Brown Faceplate T-4000-	Horizontal
2139	2639	Without Setpoint Window or Thermometer, with Johnson Controls Logo
2140	2640	Without Setpoint Window, with °F/°C Thermometer and Johnson Controls Logo
2141	-	Exposed Setpoint, without Thermometer, with Johnson Controls Logo
2640	2642	Exposed Setpoint, with °F/°C Thermometer and Johnson Controls Logo
		Horizontal or Vertical
2138	-	Without Setpoint Window, Thermometer, or Johnson Controls Logo
		Vertical
2144	2644	Without Setpoint Window or Thermometer, with Johnson Controls Logo
2145	2645	Exposed Setpoint, without Thermometer, with Johnson Controls Logo
2146	-	Exposed Setpoint, with °F/°C Thermometer and Johnson Controls Logo

Specifications

Product	TE-6100 Series Temperature Sensors and Completed Sensor/Hardware Assemblies	
Models	See Table 5.	
Elements	**TE-6100-1 through -12**	Nickel Resistance Type
	TE-6100-960, -961, -962	PTC Silicon
Reference Resistances	**TE-6100-1 through -12**	1000 ohms @ 70°F (21°C)
	TE-6100-960, -961, -962	1035 ohms @ 77°F (25°C)
Temperature Coefficient	**TE-6100-1 through -12**	Positive, Approximately 3 ohms/F° (5.4 ohms/C°)
	TE-6100-960, -961, -962	Positive, Approximately 4.3 ohms/F° (7.7 ohms/C°)
Resistance Tolerances	**TE-6100-1, -2, -3, -4, -8**	±1.0% @ 70°F (21°C)
	TE-6100-11, -12	±0.25% @ 70°F (21°C)
	TE-6100-960, -961, -962	+0.05% to 0.15% @ 77°F (25°C)
Ambient Operating Environment	**TE-6100-1, -2, -3**	-50 to 250°F (-46 to 121°C)
	TE-6100-4	Up to 550°F (288°C)
	TE-6100-8	0 to 130°F (-18 to 54°C)
	TE-6100-11, -12, -960, and -961	32 to 104°F (0 to 40°C), 10 to 90% RH, Non-Condensing, Limited by an 85°F (29°C) Dew Point
	TE-6100-962	-40 to 216°F (-40 to 102°C)
Setpoint Range	**TE-6100-8**	55 to 85°F (13 to 29°C), °F and °C Scales Furnished
	TE-6100-11	None
	TE-6100-12	Warmer/Cooler Scale
	TE-6100-960	50 to 85°F (10 to 29°C), °F and °C Scales Furnished

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.

JOHNSON CONTROLS

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Printed in U.S.A.