

System 350™ SET189A Series Temperature Sensors

The SET189A Series of temperature sensing products is designed to measure temperature in System 350 Control applications. An outdoor air sensor kit is available, as well as several accessories, which allow easy tailoring of the temperature sensor to a variety of mounting configurations. Applications include indoor, outdoor, duct, immersion well, averaging, and series parallel sensing.

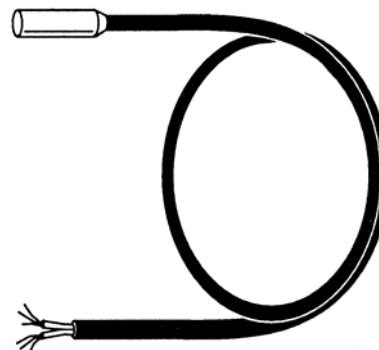
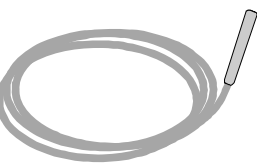


Figure 1: The SET189A Series Temperature Sensors

Features and Benefits	
☐ Variety of Lead Lengths	Encompasses most application requirements
☐ Assortment of Mounting Hardware Available	Allows user to customize every installation
☐ Sensor can be Mounted up to 800 ft. Away from the Control	Increases versatility; tailors to a variety of system configurations
☐ Accuracy of 1F° @ 77°F (0.56°C @ 25°C)	Provides suitable performance for a wide variety of System 350 applications

Product Overview



Part Number	Lead Size
SET189A-600R	9 in. (229 mm)
SET189A-607R	6 ft (1.8 m)
SET189A-605R	10 ft (3 m)
SET189A-606R	15 ft (4.6 m)

Figure 2: SET189A Sensors Available

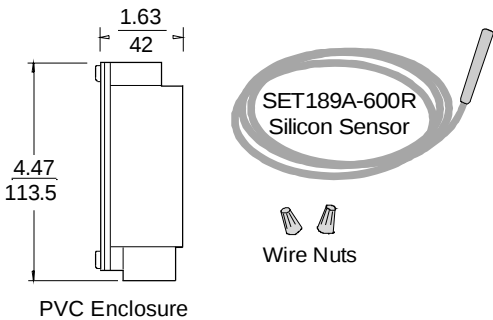


Figure 3: SET189A-600R Kit (in./mm) Items Included

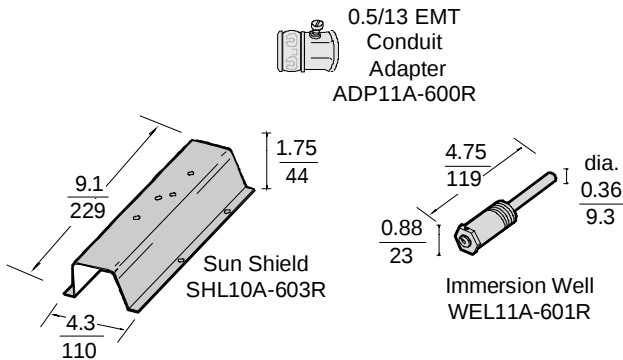


Figure 4: Additional Items Available (in./mm)

Operation

IMPORTANT: SET189A Series Sensors are designed for use only with operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory) that protect against or warn of control failure.

The SET189A Sensor is a PTC (positive temperature coefficient) silicon sensor. The sensor's resistance increases with a corresponding increase in temperature. The sensor has a reference resistance of 1035 ohms at 77°F (25°C); see Figure 7.

Application Information

The SET189A Series was designed to accommodate a variety of temperature sensing applications including the following:

- indoor
- outdoor
- duct
- duct averaging
- series parallel
- immersion

See Tables 2 and 3 for specific for a list of items needed in each type of application.

When averaging is required, multiple sensors can be connected in a series parallel arrangement. This can only be accomplished with 4, 9, 16, etc. sensors. Wiring hookups for averaging are shown in Figure 5.

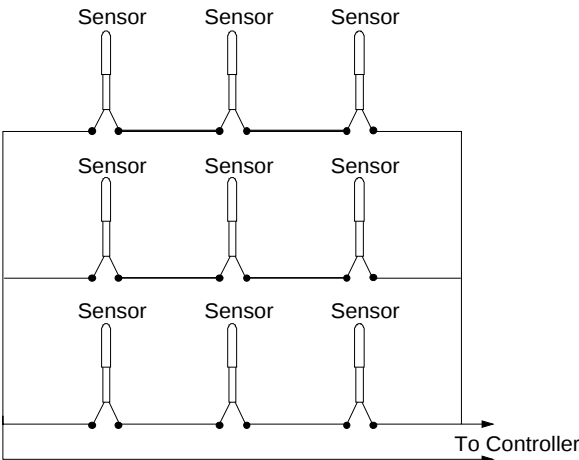


Figure 5: Nine Sensors Wired in a Series Parallel Arrangement

Location Considerations

To ensure proper operation of the SET189A Series Sensors, consider the following before mounting:

- Mount the sensors in any position. (They are not position sensitive.)
- Mount sensors in areas where sufficient air mixing has occurred.
- Avoid areas subject to excessive vibration or electrical noise.
- Avoid areas where the sensor will be exposed to direct sunlight. The north side of a building is preferred. If this is not possible, install sun shield No. SHL10A-603R
- Avoid areas where excess moisture could collect on the sensor.
- Keep conductors as short as possible to minimize temperature error. Wire resistance will cause a shift in the nominal value by adding to the sensor reading. Follow Table 1 values to keep error at less than $1F^{\circ}$ (4.3Ω)
- Shielded cable is not generally required for sensor wiring on runs of less than fifty feet, but is recommended for lengths greater than fifty feet. When using shielded cable, isolate and tape the shield at the sensor. Connect the shield to the "COM" sensor terminal on the control.

Note: At the maximum cable lengths listed in Table 1, no more than $1F^{\circ}$ ($0.5C^{\circ}$) error in the sensed temperature will result due to wire resistance.

Table 1: Recommended Sensor Cable Lengths

Wire Gauge	Shielded Cable Length	
	Feet	Meters
14 AWG	800	244
16 AWG	500	152
18 AWG	310	94
20 AWG	200	60
22 AWG	124	38

Installation and Wiring

Mounting using Immersion Well

1. Select the mounting location in the pipe line; a 1/2 in., 14 NPT opening is required.
2. Install well WEL11A-601R containing thermal transfer compound. Tighten securely using a straight-slot screwdriver.
3. Thread the spring, then the bushing onto the sensor lead. Push both down the lead to the sensor.
4. Insert sensor, spring, and bushing into well, so that at least 1/2 of the bushing is inserted into the well (bushing will compress spring).
5. Tighten set screws.

Mounting using PVC Enclosure

The PVC enclosure can be mounted in a variety of ways. When mounting the PVC enclosure, note the *Location Considerations* to the left and the following:

- To prevent false readings caused by air movement through the conduit hole, block the hole (with foam packing or similar material).
- If connection to conduit is required, snap the conduit adapter into the sensor enclosure and tighten the set screw on the adapter.

Wiring



WARNING: Disconnect the power supply before wiring connections are made to avoid possible electrical shock or damage to equipment.

See Figure 6 for a typical wiring scheme in a System 350 temperature control application.

Note: Sensor wiring is low voltage and must be installed to conform to the National Electrical Code and local regulations. Use copper conductors only.

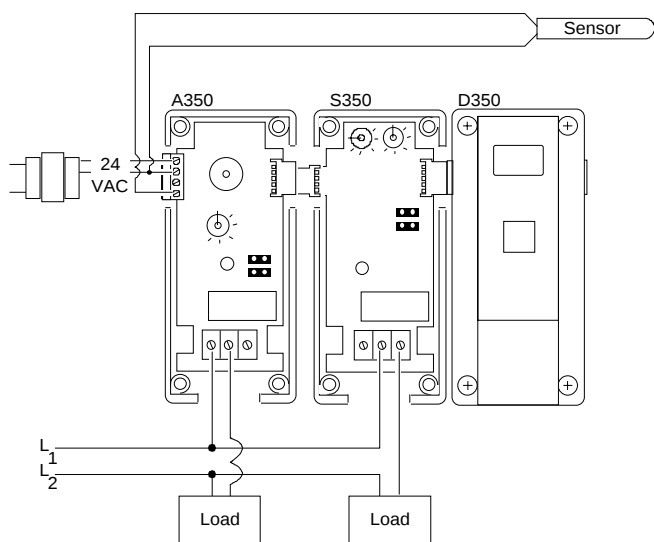


Figure 6: Temperature Control System Powered by an External Class 2 Transformer

Checkout Procedure

Before applying power, make sure installation and wiring connections are according to job specifications. After necessary adjustments and electrical connections have been made, put the system in operation and observe at least three complete operating cycles before leaving the installation.

Troubleshooting

Check Sensor for Proper Resistance.

1. Take a temperature reading at the sensor location (T_S). Be sure to let the thermometer stabilize before taking a reading.
2. Disconnect the sensor from the control. Using an ohmmeter, measure the resistance across the two sensor leads. Consult the Temperature vs. Resistance Chart (Figure 7) to verify sensor conformance.
3. If the sensor's actual performance deviates substantially from that represented on the chart, the sensor must be replaced.

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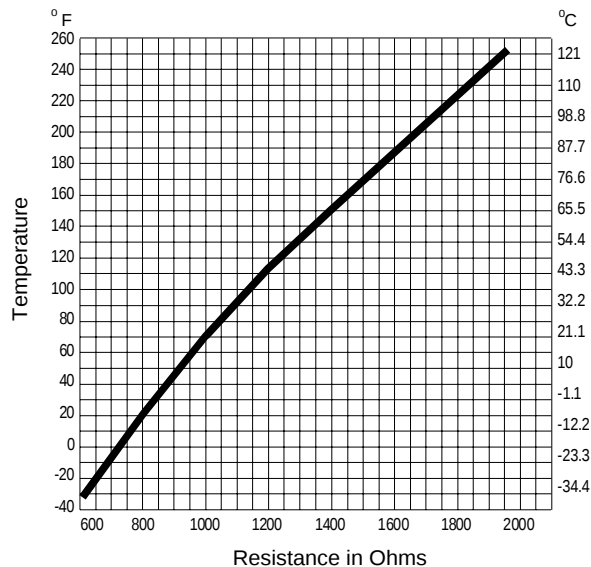


Figure 7: Temperature vs. Resistance Chart for the SET189A Series Sensor

Repairs and Replacement

Field repairs or calibration must not be made. Sensors and replacement controls are available through local Johnson Controls distributors or branch offices. To order replacement parts, see Tables 2 and 3.

Ordering Information

Table 2: SET189A Series Silicon Sensors Available

Silicon Sensors Available	
SET189A-600R	9 in. (229 mm) Leads
SET189A-607R	6 ft. (1.8 m) Leads
SET189A-605R	10 ft. (3 m) Leads
SET189A-606R	15 ft. (4.6 m) Leads

Table 3: Application Specific Items Needed

Application	Recommended Products (in addition to sensor ordered from Table 2)
Indoor	T-4000-2644 Cover TE-6001-4 Mounting Bracket and Wall Plate Adapter
Outdoor	SET189A-608R Kit (includes SET189A-600R Sensor, PVC Enclosure, Wire Nuts)
	ADP11A-600R 1/2 in. Snap-fit Conduit Connector (box of 10)
	SHL10A-603R Metal Sun Shield (optional) or TE-6001-2 Metal Housing
Duct	TE-6001-1 Sensor Holder
Duct Averaging or Series Parallel	Order desired number of SET189A Series Sensors, and see Figure 5 for application example ADP11A-600R 1/2 in. (13 mm) Snap-fit Conduit Connector (box of 10)
Immersion	WEL11A-601R (includes spring, set screws, bushing)

Notes

Notes

Specifications

Product	SET189A Series Silicon Temperature Sensors
Sensing Range	–40 to 250°F (–40 to 121°C)
Power Requirements	Supplied by a System 350 Control
Reference Resistance	1035 ohms @ 77°F (25°C)
Accuracy	1F° @ 77°F (0.56C° @ 25°C)
Sensor Construction	Probe: Copper Bulb with Tin-plate Coating
Sensor Lead Wire Insulation	High-temperature Silicone Rubber
Lead Wiring	22 Gauge Wire
Ambient Operating Conditions	–40 to 250°F (–40 to 121°C); 0 to 95% RH, Non-condensing
Ambient Storage Conditions	–50 to 266°F (–46 to 130°C); 0 to 95% RH, Non-condensing
Shipping Weight	0.4 oz. (11 g)
Accessories	See Tables 2 and 3.

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.



Controls Group
 507 E. Michigan Street
 P.O. Box 423
 Milwaukee, WI 53201

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