



PRESSURE AND TEMPERATURE SENSORS FOR THE E340 BOILER ROOM CONTROL

DESCRIPTION

The PS348 and TS348 Series of pressure and temperature sensors are designed for use with the E340 Boiler Room Control System. The pressure sensors (P/N PS348-x) utilize a solid state pressure transducer to indicate steam pressure, oil pressure, and gas pressure. The temperature sensors (P/N TS348-x) utilize a platinum, positive temperature coefficient sensing element to provide indication of water temperature, oil temperature, stack temperature, boiler water temperature of a steam boiler, and outdoor air temperature. Both pressure and temperature sensors are enclosed in a rugged 16 gauge drawn steel housing. The pressure sensors have a maximum overpressure specification of 200% Full Scale Output (800% Burst), and are equipped with a 1/4" NPT fitting. The Immersion Style Temperature Sensors have a 1/2" NPT mounting for the 2" and 8" thermowell probe. The pressure sensors provide a 1-5 VDC control signal to the E340 Control, and the temperature sensors provide a resistive input signal to the E340. No setting or calibration is required for either type of sensor.

The output signal at the pressure sensors is 1 to 5 vdc over its stated range. A constant 1 mA dc current is applied separately to each temperature sensor to maintain accuracy and reduce variability.

The E340 performs a continuous safety check on the operation of all pressure and temperature sensors to insure their safe and proper operation (e.g. detect stuck sensor, open wiring, etc.).



WARNING: The E340 must only be used with the approved pressure and temperature sensors. (e.g.: PS348-1, TS-348-1, etc.). Do not use with any other types of pressure or temperature sensors. UL approval requires these sensors.

ORDERING INFORMATION

P/N	DESCRIPTION
PS348-1	Gas Pressure Sensor 0-16" W.C.
PS348-2	Gas Pressure Sensor 0-32" W.C.
PS348-3	Gas Pressure Sensor 0-160" W.C.
PS348-4	Steam Pressure Sensor 1-17 PSIG
PS348-5	Steam Pressure Sensor 1-33 PSIG
PS348-6	Steam/Oil Pressure Sensor 10-170 PSIG
PS348-7	Steam/Oil Pressure Sensor 10-330 PSIG
PS348-8	Steam Pressure Sensor 50-850 PSIG
TS348-2	Temp. Sensor 32-750°F 2" Probe Length
TS348-4	Temp. Sensor 32-750°F 4" Probe Length
TS348-8	Temp. Sensor 32-750°F 8" Probe Length

GENERAL SPECIFICATIONS

TEMPERATURE SENSORS:

Reference Resistance: 1,000 ohms @ 32°F (0°C)

Temperature Coefficient: 3.85 T/#°C.

Accuracy: #0 1°F @ 70°F

PRESSURE SENSORS:

Power: 10-30VDC (supplied by E340 control)

Accuracy: 1% Full Scale

Maximum over pressure: 200% of full scale

Maximum burst pressure: 800% of full scale

Temperature Limits:

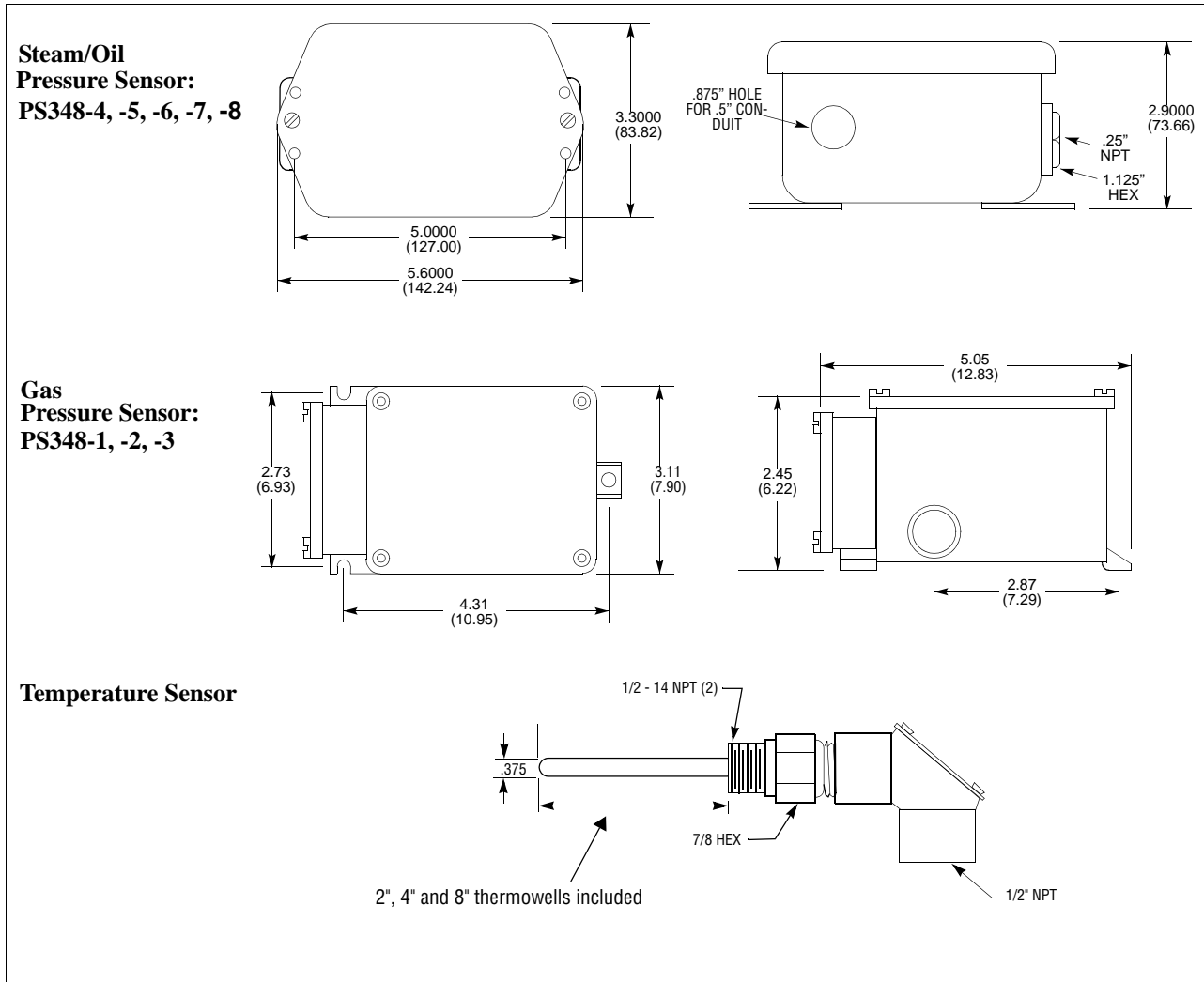
Storage -40°F to 210°F

Operating: -20°F to 185°F

APPROVALS

- Underwriters Laboratories Inc. Listed Section 6L20 of Limit Controls
- Canadian Standards Association (CSA) Certified
- Factory Mutual Approved

FIGURE 1.





WARNING:

1. Read these instructions carefully. Failure to follow them could result in a hazardous or dangerous condition.
2. Insure that the range of the selected sensor is appropriate for the application.
 Note: A general rule to follow when selecting the sensor range is that the expected value of the monitored pressure or sensor should fall between 40-70% of the upper range of the sensor. For example, a steam boiler maintains 20 lbs. pressure, select the PS348-5 Pressure Sensor, with a 1-33 PSIG range
3. The sensors must be located where the ambient temperature will not exceed the maximum ambient operating temperature specified for the sensor.
4. Insure that the pressure range programmed on the E340 Boiler Room Control matches the installed pressure sensor. Refer to Bulletin E-3401.
5. Do not mount any of the sensors where they could be used as a footstep.
6. Installation must be performed by a trained, experienced flame safeguard technician.

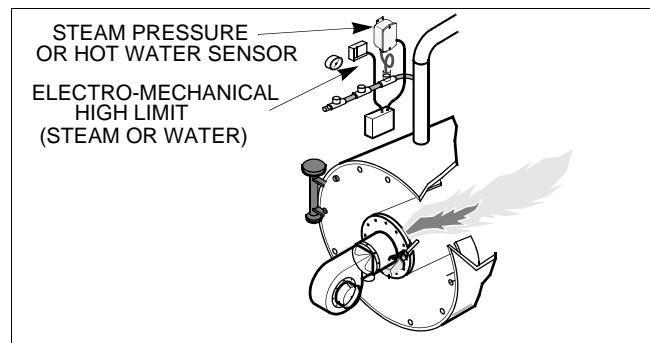
MOUNTING PRESSURE SENSORS

STEAM

Note: Refer to Figure 2.

1. The steam pressure sensors (PS348-4, -5, -6, -7, -8) provide a 1/4" NPT female fitting for connection to the steam header.
2. Make sure the boiler is shut down and zero steam pressure exists in the boiler vessel.
3. Disconnect power to the boiler controller so the boiler cannot sequence during installation of the steam pressure sensor.
4. Always mount the steam pressure sensor *above the water line* of the boiler.
5. Locate the pressure sensors where the ambient temperature will not exceed 185°F
6. Use only a small amount of pipe compound to seal the connection joints. Excess pipe compound may clog the fitting and prevent proper operation of the sensor.

FIGURE 2.



7. Although the unit can withstand substantial vibration without damage or significant output effects, it is good practice to mount the pressure sensor where there is minimum vibration.
8. A steam trap (siphon loop) *must be connected* between the boiler and the pressure sensor to prevent boiler scale and corrosive vapors from affecting the pressure sensor element.
9. Make all pipe connections in accordance with approved standards.
10. When tightening the sensor, apply a wrench to the hex flats located just above the pressure fitting. **DO NOT** tighten by using a pipe wrench on the housing. Do not tighten the pressure sensor by hand.

SHARED SENSOR - LEAD/LAG OPERATION: When two steam boilers are set up for lead/lag operation, one steam pressure sensor can be mounted in the common header of both boilers and provide the steam pressure signal to both E340 controls. See Wiring Pressure Sensors.



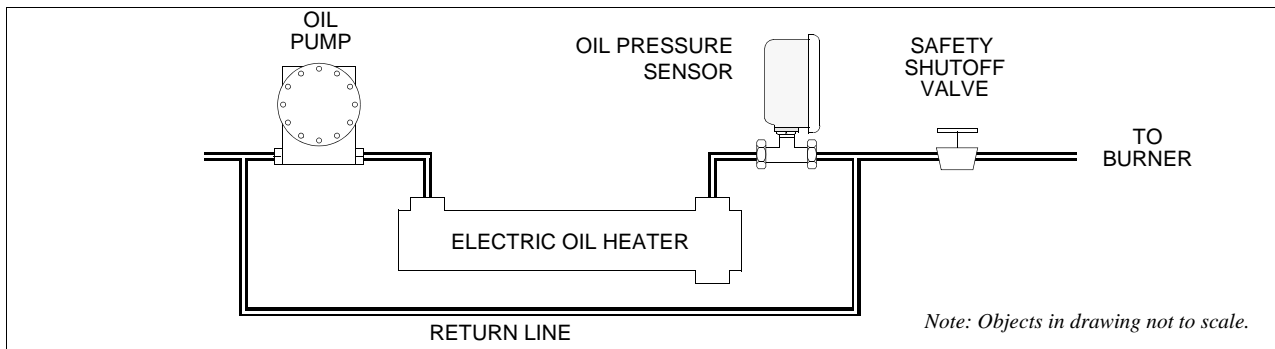
WARNING: The electro-mechanical high steam pressure limit **MUST REMAIN** in the running interlock circuit of the flame safeguard control.

OIL

Note: Refer to Figure 3.

1. The oil pressure sensors (PS348-6, -7) provide a $\frac{1}{4}$ " NPT female fitting for connection to the fuel oil supply line.
2. Disconnect power to the boiler controller so the boiler cannot sequence during installation of oil pressure sensor.
3. Shut off the oil supply at the upstream manual shutoff valve.
4. Mount the oil pressure sensor upstream of the automatic safety shutoff valve.
5. Locate the pressure sensor where the ambient temperature will not exceed 185°F. Mounting the sensor in a dead end pipe off of the main supply line or use of a siphon loop are acceptable approaches to help limit the temperature to 185°F.
6. Use only a small amount of pipe compound to seal the connection joints. Excess pipe compound may clog the fitting and prevent proper operation of the sensor.
7. Although the unit can withstand substantial vibration without damage or significant output effects, it is good practice to mount the pressure sensor where there is minimum vibration.
8. Make all pipe connections in accordance with approved standards.
9. When tightening the sensor, apply a wrench to the hex flats located just above the pressure fitting. **DO NOT** tighten by using a pipe wrench on the housing. Do not tighten the pressure sensor by hand.

FIGURE 3.

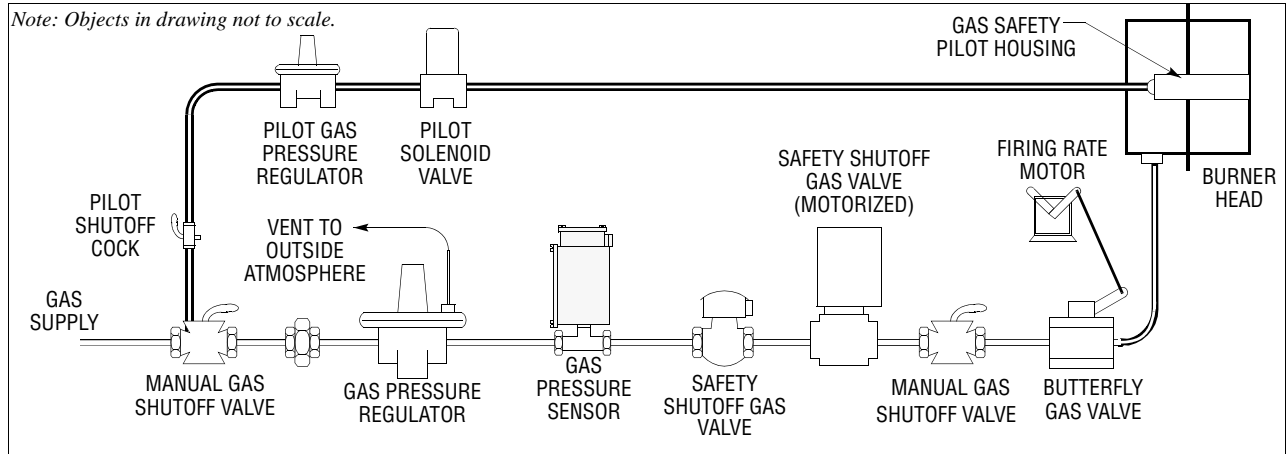


GAS

Note: Refer to Figure 4

The gas pressure sensor must be mounted immediately downstream from the gas pressure regulator to insure that a burner start-up is not initiated in a gas starved condition.

FIGURE 4.



GAS

1. The gas pressure sensors (PS348-1, -2, -3) provide a $\frac{1}{4}$ " NPT female fitting for connection to the fuel gas supply line.
2. Disconnect power to the boiler controller so the boiler cannot sequence during installation of the gas pressure sensor.
3. Shut off the gas supply at the upstream manual shutoff valve.
4. Mount the gas pressure sensor immediately downstream from the gas pressure regulator.

Note: Pipe the gas pressure line to be measured to the connection marked HIGH on the gas pressure sensor. If any connection is piped to the LOW side of the gas pressure sensor, it will cause the sensor to measure the differential pressure between the HIGH and LOW connections. See item #10.

5. Locate the pressure sensors where the ambient temperature will not exceed 160°F.
6. Use only a small amount of pipe compound to seal the connection joints. Excess pipe compound may clog the fitting and prevent proper operation of the sensor.
7. Although the unit can withstand substantial vibration without damage or significant output effects, it is always good practice to mount the pressure sensor where there is minimum vibration.
8. Make all pipe connections in accordance with approved standards.
9. When tightening the sensor, apply a wrench to the hex flats located just above the pressure fitting. DO NOT tighten by using a pipe wrench on the housing. Do not tighten the pressure sensor by hand.
10. Due to the inherent design of the pressure sensor, it may not be necessary to pipe a vent line for the gas pressure sensor. The gas pressure sensor has a metal diaphragm which provides substantial resistance against a rupture. The "High" connection of the gas pressure sensor is fitted with an orifice restrictor less than .011" in diameter to restrict gas flow in accordance with UL Standard 353, paragraph 34.5. Underwriters Laboratories does not require the gas pressure sensor to be vented. Always refer to local code requirements.

High Gas Pressure Alarm

The E340 does not check for a High Gas Pressure Alarm (**HGP ALRM**) or High Gas Pressure Marginal Alarm (**HGP MARG**) until approximately ten (10) seconds after the Main Fuel Valve is detected open.

Low Gas Pressure Alarm - Start Check (STRT CHK) Setpoint

When **STRT CHK** is programmed YES, the E340 will ignore the High Gas Pressure Alarm until approximately 10 seconds after the main fuel valve is detected open.

When **STRT CHK** is programmed NO, the gas pressure must be BELOW the High Gas Pressure Alarm immediately after the E340 operating control (terminals 52 and 53) is commanded closed, or the E340 will open its safety circuit (terminals 50 and 51).



CAUTION: The start check (STRT CHK) setpoint should always be programmed YES.

MOUNTING TEMPERATURE SENSORS

The immersion style temperature sensors have a $\frac{1}{2}$ " NPT mounting for the 2", 4" and 8" thermowell probes, and a $\frac{1}{2}$ " conduit fitting.

HOT WATER

Note: Refer to Figure 2

1. Disconnect power to the boiler controller so the boiler cannot sequence during installation of the hot water temperature sensor.
2. The thermowell must be mounted where it is always exposed to the circulation of the hot water.
3. If the water system is full, drain the system below the point where the thermowell will be installed.
4. Tap an appropriate size fitting. (2", 4" and 8" thermowell have $\frac{1}{8}$ " NPT fitting).
5. Insert the appropriate thermowell (2", 4", or 8") and tighten.
6. Fill the system to check for leakage.

LEAD/LAG OPERATION: When two hot water boilers are set-up for lead/lag operation, a hot water temperature sensor must be installed **for each boiler**.



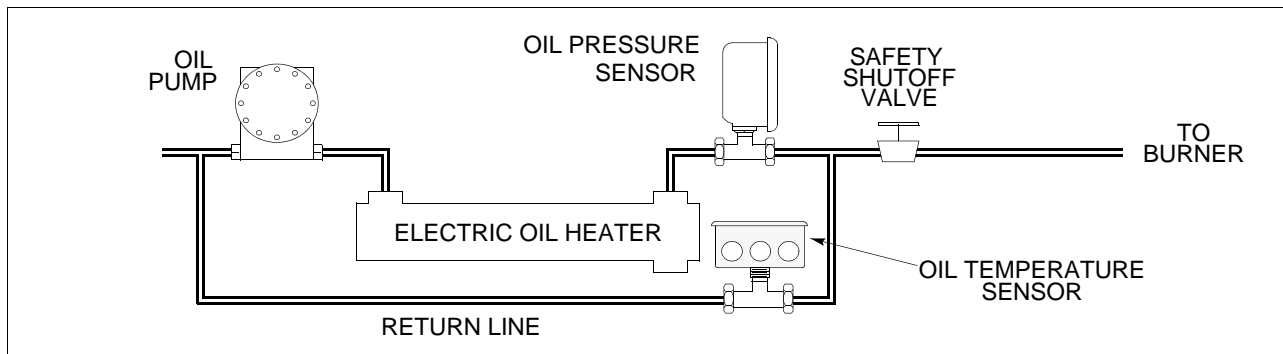
WARNING: The electro-mechanical high hot water temperature **MUST REMAIN** in the running interlock circuit of the flame safeguard control.

OIL

Note: Refer to Figure 5

1. Disconnect power to the boiler controller so the boiler cannot sequence during installation of the oil temperature sensor.
2. The thermowell must be mounted where it is always exposed to the circulation of the oil.
3. Close the upstream manual shutoff valve to stop the flow of fuel oil.
4. Bleed the fuel oil line downstream of where the assembly tapping will be mounted. The sensor should be mounted in the fuel oil return line, after leaving the fuel oil controller.
5. Tap an appropriate size fitting (2", 4" and 8" thermowells have $\frac{1}{8}$ " fittings).
6. Insert the appropriate thermowell (2", 4", or 8") and tighten.
7. Fill the system to check for leakage.

FIGURE 5.



STANDBY WATER TEMPERATURE

1. Disconnect power to the boiler controller so the boiler cannot sequence during installation of the standby temperature sensor.



WARNING: Location of the temperature sensor to monitor boiler water temperature of a steam boiler is critical. The sensor should be mounted where it is always exposed to the circulation of the boiler water, not too close to a hot or cold inlet or steam coil. Consult the boiler manufacturer for guidance on the sensor location.

2. The thermowell must be mounted where it is always exposed to the circulation of the hot water.
3. If the water system is full, drain the system below the point where the thermowell will be installed.
4. Tap an appropriate size fitting (2 $\frac{3}{4}$ " and 8" thermowells have $\frac{1}{2}$ " NPT fitting).
5. Insert the appropriate thermowell (2, 4, or 8") and tighten.

STACK TEMPERATURE

1. Use the existing well connection for the stack temperature sensor if provided by the boiler manufacturer.
2. If no well connection is provided, select an appropriate location for mounting the temperature sensor. Preferably as close to the boiler outlet as possible.

OUTDOOR AIR TEMPERATURE

1. The outdoor air temperature sensor should be mounted on the outside of the building where it will be exposed to representative air temperature, but not to direct sunlight. A sun shield may be required.
2. Mount the temperature sensor high enough so it cannot be covered with snow, leaves, or other debris, or be tampered with. Vents from the building should be avoided.

WIRING PRESSURE SENSORS



CAUTION: Disconnect power supply from the E340 Control before connecting wires to prevent electrical shock and equipment damage.

PRESSURE SENSORS

1. All wiring must be in accordance with National Electrical Code and local codes, ordinances, and regulations.
2. Sensor housing provides connection for $\frac{1}{2}$ " conduit.
3. The pressure sensors require 3 conductor, 18 gauge, shielded cable. Power limited, rated for 300V @ 105°C. Use Belden 9365 or equivalent.
4. The shield should be connected to the earth ground terminal on the wiring base of the E340 Control (Terminal #40). The shield should be taped at the sensor to avoid unintended contact with the sensor housing.
5. All sensor wiring should be in a separate conduit. DO NOT install sensor wiring in any conduit or junction boxes with high voltage wiring.
6. Maximum wiring distance for sensor wiring is 100 feet.



7. See below for wiring terminations.

	GAS*	OIL	STEAM **	
Red	60 *	63	66 **	Power
White	61 *	64	67 **	Return
Green	62 *	65	68 **	Signal

NOTE: For cable runs longer than 20 feet, the PS348-1, -2, -3, gas pressure sensors, may not have enough output drive to compensate for the capacitive loading presented by the cable. In this case, the gas pressure sensor reading may indicate half of the actual pressure reading. To remedy this, it is recommended to add/install a 10 K ohm resistor at the pressure sensor across terminals 61 and 62, signal output to return.

* The terminals of the low gas pressure sensors (PS348-1, -2, -3) are numbered for connection to the appropriate terminals on the E340.

SHARED SENSOR - LEAD/LAG OPERATION: When two steam boilers set up for lead/lag operation share the steam pressure signal from one steam pressure sensor, the signal and return wires (Terminals 67 and 68) are wired to **both** E340 controls, and the power wire (Terminal 66) is wired to **only one** E340 control.

TEMPERATURE SENSORS

1. All wiring must be in accordance with National Electrical Code and local codes, ordinances, and regulations.
2. Sensor housing provides connection for 1/2" conduit.
3. The temperature sensors require 2 conductor, 18 gauge, shielded cable. Power limited, rated for 300V @ 105°C. Use Belden 9318 or equivalent.
4. The shield should be connected to the earth ground terminal on the wiring base of the E340 Control (Terminal #40). The shield should be taped at the sensor to avoid unintended contact with the sensor housing.
5. All sensor wiring should be in a separate conduit. DO NOT install sensor wiring in any conduit or junction boxes with high voltage wiring.
6. Maximum wiring distance for sensor wiring is 100 feet.
7. There is no polarity associated with the temperature sensor wiring. Connect 1 wire each to terminals 69 and 70 (Primary Temp) or 71 and 72 (Auxiliary Temp).

	PRIMARY (Hot Water Supply, Stack, Standby Water, or Outdoor Air Temperature)	AUXILIARY (Oil or Stack Temperature)	
Red	69	71	Signal
Black	70	72	Return



CAUTION: PROGRAM AND SET-UP

The proper operation of the E340 Boiler Room Control and the pressure and temperature sensors requires that the selected pressure ranges are appropriate for the application and **must match the pressure range programmed on the E340 Control**. Insure that the range of the selected sensor is correct for the application and the pressure range programmed on the E340 Boiler Room Control matches the installed pressure sensor. Refer to Bulletin E-3401.



FIREYE™
3 Manchester Road
Derry, New Hampshire 03038 USA
www.fireye.com

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