

# S9360A, S9361A, S9380A, S9381A Integrated Boiler Controllers

## INSTALLATION INSTRUCTIONS

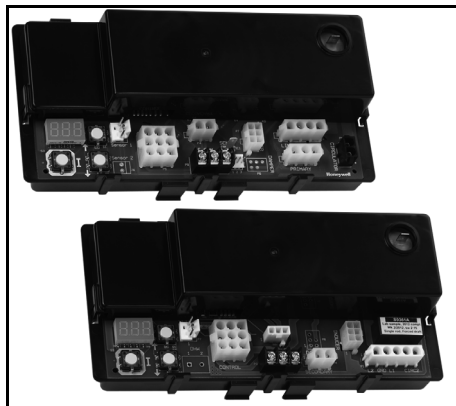
## SPECIFICATIONS

### IMPORTANT:

The specifications given in this publication do not include normal manufacturing tolerances. Therefore, an individual unit may not match the listed specifications exactly. Also, this product is tested and calibrated under closely controlled conditions, and some minor differences in performance can be expected if those conditions are changed.

### Model Numbers

<b>S</b>	Switching Control
<b>9 3</b>	Integrated Hydronic Control Platform
<b>6</b>	Spark Ignition
<b>8</b>	Direct Spark Ignition
<b>0</b>	Remote Display Required
<b>1</b>	Integrated On-Board Display
<b>A</b>	Boiler Control
<b>B</b>	Water Heater Control
<b>C</b>	Pool Heater Control
<b>1</b>	No Circulator
<b>2</b>	On/Off Circulator
<b>3</b>	On/Off Circulator meeting CSD-1



## APPLICATION

These integrated boiler control modules provide ignition sequence, flame monitoring and safety shutoff for intermittent pilot spark ignition, or direct spark ignition heating systems. They also provide limit rated water temperature control with one or two sensors and display interface capability for either "on-board" or remote user interface applications.

- S9360A—Spark Ignition, Intermittent Pilot, Remote Display.
- S9361A—Spark Ignition, Intermittent Pilot, "On board" Display.
- S9380A—Direct Spark Ignition, Remote Display.
- S9381A—Direct Spark Ignition, "On board" Display.
- Enabled with EnviraCOM™ communication capability to support remote monitoring and diagnostics.
- Limit-rated Temperature Sensing Probe.
- Ignitor sensor type
  - two rod (separate ignitor and sensor)
  - one rod (combined ignitor and sensor)

## 2012 DOE Compliance and Operation

Operation of this control may delay the burner operation while the residual heat is circulated out of the boiler.

**NOTE:** This operation may be different than earlier integrated boiler control revisions which did not implement thermal purge.



# Dimensions:

See Fig. 1.

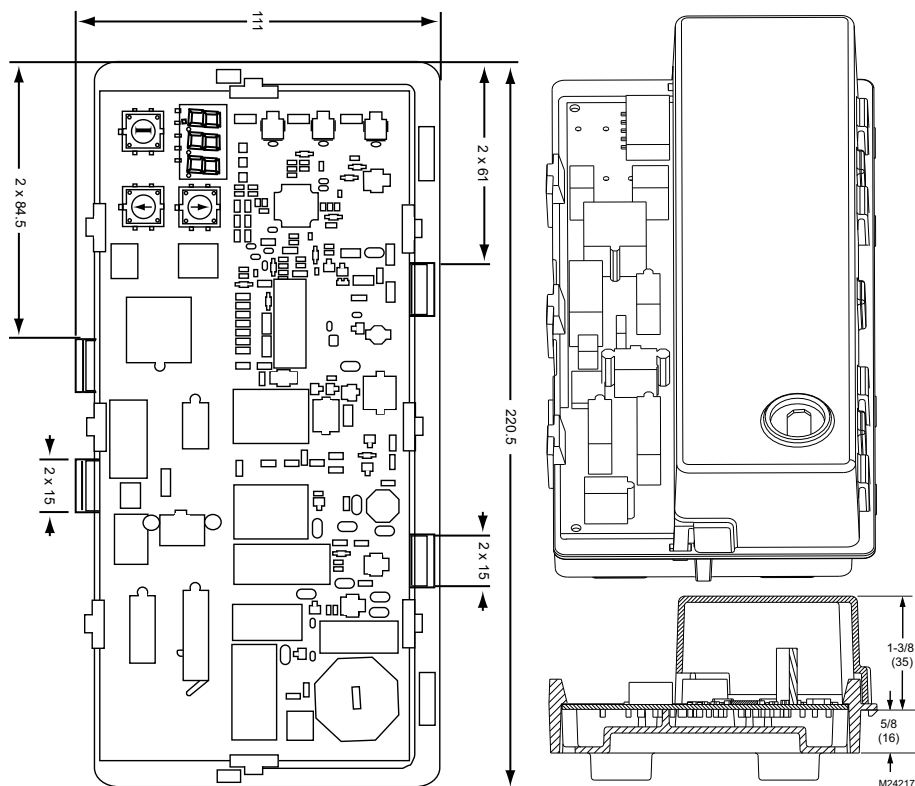


Fig. 1. S936X Integrated Boiler Controller, dimensions in in. (mm).

## Electrical Ratings:

Line Voltage: 120 Vac, 60 Hz.

Transformer:

Nominal 24 Vac (maximum 30 Vac, minimum 18 Vac).

5.0 VA plus external loads (gas valve, vent damper, etc.)

On/Off Circulator:

Full Load: 7.4A at 120 Vac (0.75 to 0.8 power factor [PF]).

Locked Rotor: 44.4A at 120 Vac (0.4 to 0.5 PF).

Inducer (Optional):

Full Load: 6A at 120 Vac (0.75 to 0.8 PF).

Locked Rotor: 17.48A at 120 Vac (0.4 to 0.5 PF).

Vent Damper (Optional):

Full Load: 0.5A at 24 Vac.

In Rush: 1A at 24 Vac.

Main Valve:

Full Load: 2A at 24 Vac (0.5 to 0.6 PF).

In Rush: 6A at 24 Vac (0.5 to 0.6 PF)

Pilot Valve (Optional):

Full Load: 2A at 24 Vac (0.5 to 0.6 PF)

In Rush: 6A at 24 Vac (0.5 to 0.6 PF).

## Ambient Ratings:

Humidity: 0 to 95 percent relative humidity, noncondensing.

Operating Ambient Temperature: -4°F to +150°F.

Shipping Ambient Temperature: -40°F to +175°F.

## Flame Monitoring (May vary by model):

Flame Establishing Period (FEP): Maximum 2 seconds.

Flame Failure Response Time (FFRT):

Maximum: 2 seconds @ 1  $\mu$ A.

Flame Stabilization Time: 4 seconds. Time from igniting the main burner and detecting loss of flame (the flame current is allowed to be under the flame lost threshold for this time while waiting for burner to stabilize).

Flame Lost Threshold: 0.23  $\mu$ A.

## Accessories (Ordered Separately)

W8735Y1000 Wireless Outdoor Reset Kit

W873ER1000 Wireless Outdoor Reset Module

C7089R1013 Wireless Outdoor Temperature Sensor (requires W8735ER1000)

W8735S1000 AquaReset™ Outdoor Reset Kit (includes 50022037-002 Outdoor Reset Module and C7089U1006 Outdoor Temperature Sensor)

W8735S1008 AquaReset™ Domestic Hot Water Kit (includes 50022037-005 Domestic Hot Water Module and 32003971-003 Sensor)

C7089U1006 Outdoor Temperature Sensor (used with the 50022037-002)

32003971-003 Temperature Sensor (used with 50022037-005)

Sensor (See Table 2).

Sensor Well Clamp 121371AA.

14,000,485-016 1/4 in. (6.35 mm) diameter, 1-1/4 in. (31.75 mm) length glass cartridge Fuse, 1 A, Slow-Blow.  
120650 Heat Conductive Compound.

**Table 1. Wells for Controller.**

Part Number	Spud Size in. (mm)	Insertion in. (mm)	Insulation in. (mm)
123869A	1/2 (12.7) NPT	3 (76.2)	1-1/2 (38.1)
123870A	3/4 (19.05) NPT	3 (76.2)	1-1/2 (38.1)

**Table 2. Sensors for Controller.**

Part Number	Length in. (mm)	Application
50001464-001	12 (304.8)	Well-mounted controls
50001464-003	24 (609.6)	Flush-mounted controls
50001464-004	36 (914.4)	
50001464-005	48 (1219.2)	

**Ignition Cables:**

32004766-012—36-in. standard ignition cable (one end with 90° boot, and other end with 1/4-in. quick connect).

Use cable types recommended in Table 3.

**Table 3. Recommended Ignition Cables.**

Cable Type	Voltage Rating (rms)	Temperature Rating	
		°C	°F
UL Style 3217	10,000	150	302
UL Style 3257	10,000	250	484

**Transformer Requirement:**

Add current ratings of module, pilot valve, main valve, vent damper and any other components of the control system to determine transformer size requirement.

The AT150B1260—commonly used 50 VA transformer.

**Approvals:**

Varies with control model.

ANSI Z21.20 Automatic Gas Ignition Systems and Components.

ANSI Z21.23 Gas Appliance Thermostats.

EN298: Automatic Gas Burner Control Systems

ANSI Z21.87: Automatic Gas Shutoff Devices for Hot Water Supply Systems.

UL353 Limit Controls.

## INSTALLATION

Automatic Ignition Control domestic and commercial boiler systems are used on a wide variety of equipment. Some of these applications may make heavy demands on the controls, either because of frequent cycling, or because of moisture, corrosive chemicals, dust or excessive heat in the environment. In these situations, special steps may be required to prevent nuisance shutdowns and premature control failures. These applications require Honeywell Engineering review; contact your Honeywell Sales Representative for assistance.

## Frequent Cycling

These controls are designed for use on domestic and commercial boiler systems that typically cycle less than 10,000 cycles per year. In an application with significantly greater cycling rates, we recommend monthly checkout because the controls may wear out more quickly.

## Water or Steam Cleaning

Once a module or gas control has been wet, it may operate unreliably and must be replaced. If the appliance is likely to be cleaned with water or steam, the controls and associated wiring should be covered so that water or steam cannot reach them. The controls should be high enough above the bottom of the cabinet so they will not be subjected to flooding or splashing during normal cleaning procedures. If necessary, shield the controls to protect them from splashing water. A NEMA 4 enclosure is recommended.

## High Humidity or Dripping Water

Over time, dripping water or high ambient humidity can create unwanted electrical paths on the module circuit board, causing the module to fail. *Never* install an appliance where water can drip on the controls.

In addition, high ambient humidity can cause the control to corrode and finally fail.

Where the appliance may be installed in a humid atmosphere, make sure air circulation around the module and gas control is adequate to prevent condensation. It is also important to regularly check out the system. A NEMA 4 enclosure may be needed.

## Corrosive Chemicals

Corrosive chemicals can also attack the module and gas control and eventually cause a failure. Where chemicals may be used routinely for cleaning, make sure the cleaning solution cannot reach the controls. Where chemicals are likely to be suspended in the air, as in some industrial and agricultural applications, protect the module from exposure with a NEMA 4 enclosure.

## Dust or Grease Accumulation

Heavy accumulation of dust or grease may cause the controls to malfunction. Where dust or grease may be a problem, provide covers for the module and gas control that limit environmental contamination. A NEMA 4 enclosure is recommended for the module.

## Heat

The controls can be damaged by excessively high temperatures. Make sure the maximum ambient temperature at the control locations will not exceed the rating of the control. If the appliance normally operates at very high temperatures, insulation, shielding, and air circulation may be necessary to protect the controls. Proper insulation or shielding should be provided by the appliance manufacturer; make sure adequate air circulation is maintained when the appliance is installed.

# INSTALLATION AND CHECKOUT

## When Installing This Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure they are suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

## WARNING

**Fire or Explosion Hazard.**

**Can cause severe injury, death or property damage.**

1. The module can malfunction if it gets wet, leading to accumulation of explosive gas.
  - Never install where water can flood, drip or condense on module.
  - Never try to use a module that has been wet—replace it.
2. Liquefied petroleum (LP) gas is heavier than air and will not vent upward naturally.
  - Do not light pilot or operate electric switches, lights, or appliances until you are sure the appliance area is free of gas.
3. If a new gas control is to be installed, turn off gas supply before starting installation. Conduct Gas Leak Test according to gas control manufacturer instructions after the gas control is installed.
4. If module must be mounted near moisture or water, provide suitable waterproof enclosure.

## WARNING

**Electrical Shock Hazard.**

**Can cause severe injury, death or property damage.**

Disconnect power supply before beginning wiring to prevent electrical shock or equipment damage.

## Perform Preinstallation Safety Inspection

The preinstallation checks described in ANSI Standard Z21.71 *must* be done before a replacement module is installed. If a condition which could result in unsafe operation is detected, the appliance should be shut off and the owner advised of the unsafe condition. Any potentially unsafe condition must be corrected before proceeding with the installation.

## Maintenance Requirements in Severe Environments

Regular preventive maintenance is important in any application, but especially so in commercial, agricultural, and industrial applications, because:

1. In such applications, particularly commercial, the equipment can operate 100,000 to 200,000 cycles per year. Such heavy cycling can wear out the gas control in one to two years. A normal boiler application, for which the controls were intended, typically operate fewer than 10,000 cycles per year.
2. Exposure to water, dirt, chemicals, and heat can damage the module or the gas control and shut down the control system. A NEMA 4 enclosure can reduce exposure to environmental contaminants.

The maintenance program should include regular checkout of the system as outlined under Checkout.

## WARNING

**Fire or Explosion Hazard.**

**Can cause severe injury, death or property damage.**

Do not attempt to take the module apart or to clean it. Improper reassembly and cleaning may cause unreliable operation, leading to an accumulation of explosive gas.

Maintenance frequency must be determined individually for each application. Some considerations are:

*Cycling frequency.* Appliances that may cycle more than 10,000 times annually should be checked monthly.

*Intermittent use.* Appliances that are used seasonally should be checked before shutdown and again before the next use.

*Consequence of unexpected shutdown.* Where the cost of an unexpected shutdown would be high, the system should be checked more often.

*Dusty, wet, or corrosive environment.* Since these environments can cause the controls to deteriorate more rapidly, the system should be checked more often.

Any control should be replaced if it does not perform properly on checkout or troubleshooting. In addition, replace any module if it is wet or looks like it ever has been wet. Protective enclosures as outlined under Planning the Installation are recommended regardless of checkout frequency.

## Mount Module

Select a location close enough to the burner to allow a short (3 ft. [0.9 m] maximum), direct cable route to the igniter. Ambient temperature at the module must be within the range listed under Specifications. The module must be protected from water, moisture, corrosive chemicals and excessive dust and grease. Refer to Fig. 2 and 3 for recommended slot/hole pattern in appliance.

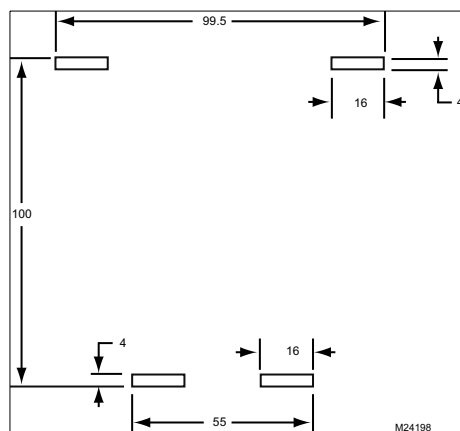


Fig. 2. Recommended slot/hole pattern in appliance (in mm).

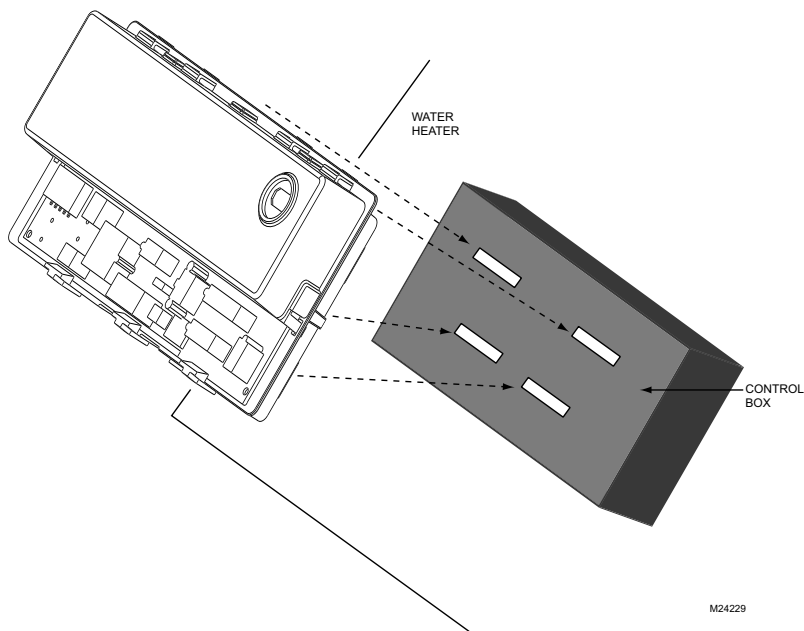


Fig. 3. Align module with slots in manufacturer's control box.

## WIRING

### WARNING

#### Electrical Shock Hazard.

**Can cause severe injury, death or property damage.**

Disconnect the power supply before making wiring connections to prevent electrical shock or equipment damage.

Check the wiring diagram furnished by the appliance manufacturer for circuits differing from the wiring hookup shown in Fig. 4. Carefully follow any special instructions affecting the general procedures outlined below.

#### IMPORTANT

1. All wiring must comply with applicable local electrical codes and ordinances.
2. When installing a hot surface igniter, the leadwires should be kept as short as possible and should not be allowed to rest against grounded metal surfaces.
3. A common ground is required for the S93XX and the main burner. The 24V "secondary" plug internally grounds one side of the transformer. Any auxiliary controls or limits must not be in the grounded leg. In addition, the appliance should be earth-grounded.
4. Make sure the transformer has adequate VA. The ignition module requires at least 0.2A at 24 Vac. Add the current draws of all other devices in the control circuit, including the gas control, and multiply by 24 to determine the total VA requirements of these components. Add this total to 5.0 VA (for the module). The result is the minimum transformer VA rating. Use a Class II transformer if replacement is required.
5. Check that L1 (hot) and L2 (neutral) are wired to the proper terminals.

### Connect Ignition Cable (S936AXXXX, S938AXXXX)

Use Honeywell ignition cable or construct an ignition cable that conforms to suitable national standards, such as Underwriters Laboratories Inc. See Specifications section. To construct a cable, fit one end (the module end) with 1/4 in. connector receptacle and the other with a connector to match the pilot assembly. Protect both ends with insulated boots.

**NOTE:** Cable length must be 36 in. (0.9 m) or less. The cable must not be in continuous contact with a metal surface or spark voltage will be greatly reduced. Use ceramic or plastic standoff insulators as required.

1. Connect one end of the cable to the male quick-connect SPARK terminal on the module.
2. Connect the other end of the cable to the igniter or igniter-sensor stud on the pilot burner/igniter-sensor.

## S938X Direct Spark Ignition (DSI) Versions

See Fig. 5 for direct spark ignition wiring details.

### Connect Inducer (Inducer Models)

An inducer can be used with modules provided with an inducer plug connector. The Molex<sup>®</sup> plug provided simplifies wiring connections.

To connect the inducer, follow the wiring diagrams supplied with the inducer for typical connections.

### Connect Remaining Module Connectors

Connect remaining system components to the ignition module terminals as shown in the appropriate wiring diagrams, Fig. 4.

### Connect Gas Control

Use No. 18 AWG solid or stranded wire. Connect to gas control terminals as shown in wiring diagrams, using terminals appropriate to the gas control.

### Ground Control System

The igniter, flame sensor and module must share a common ground with the main burner. Use AWM insulated wire with a minimum rating of 105°C (221°F) for the ground wire; asbestos insulation is not acceptable. If necessary, use a shield to protect the wire from radiant heat generated by the burner.

The burner serves as the common grounding area. If there is not a good metal-to-metal contact between the burner and ground, run a lead from the burner to ground.

**NOTE:** "Earth" ground is not required.

Transformer: Add current ratings of module, gas control, vent damper and any other components of the control system to determine transformer size requirements.

**Table 4. Specific Ignition Timings.**

<b>Model</b>	<b>Ignition Type</b>	<b>Draft Type</b>	<b>No. of Ignition Trials</b>	<b>Igniter/Sensor Type</b>	<b>Automatic Restart Time<sup>e</sup></b>	<b>Ignition Activation Period<sup>a</sup></b>	<b>Prepurge Timing<sup>b</sup></b>	<b>Postpurge Timing<sup>b</sup></b>
S9360A, S9361A	Intermittent Pilot - Spark	Induced	6	Separate/Combined <sup>c</sup>	1 hour	N/A	30	15
S9360A, S9361A	Intermittent Pilot - Spark	Atmospheric	6	Separate/Combined <sup>c</sup>	1 hour	N/A	1	5
S9361A2095 <sup>d</sup>	Intermittent Pilot - Spark	Atmospheric	Continuous	Combined	1 hour	N/A	0	0
S9381A	Direct Spark	Induced	3	Combined	1 hour	N/A	15	15

<sup>a</sup> Ignition Activation Period is the time that the hot surface igniter remains powered after the gas valve opens.

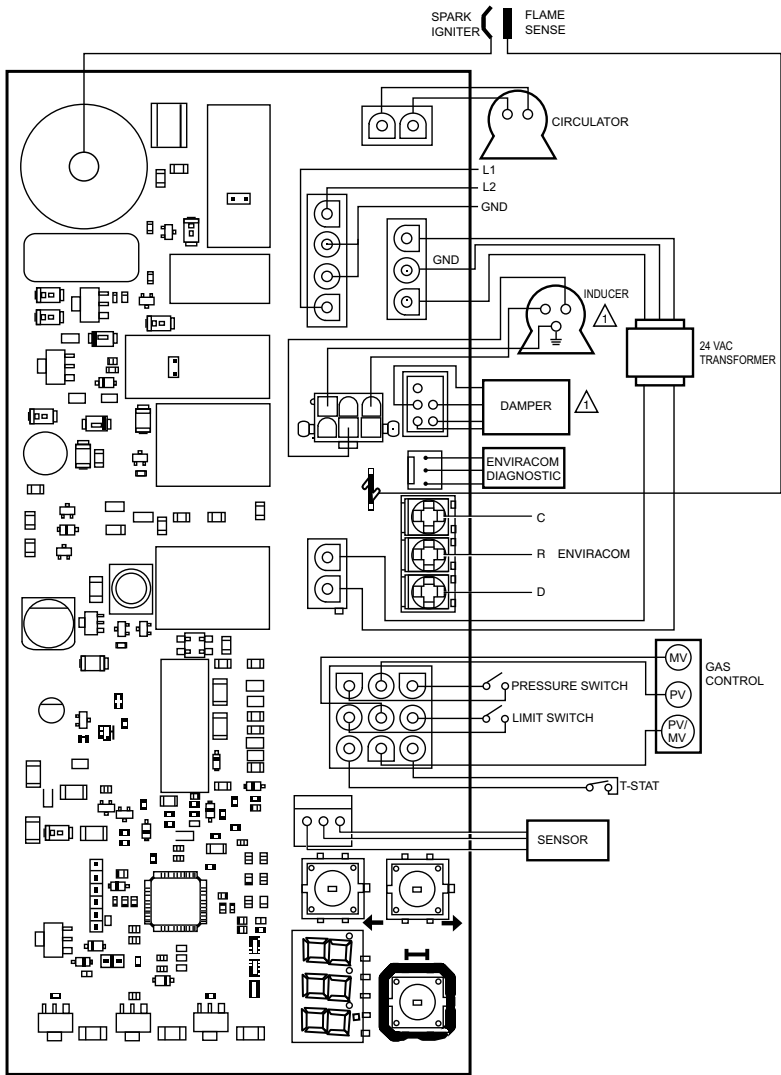
<sup>b</sup> Purge Timing specified in seconds.

<sup>c</sup> Models available in both—separate and combined igniter/sensor type.

<sup>d</sup> 90 second Trial for Ignition. Continuous Recycles/Retries.

<sup>e</sup> S3961A2095 has a 1 minute retry delay and a 5 minute recycle delay. Other lockouts will automatically clear after 1 hour.

Wiring Detail



 OPTIONAL BASED ON MODEL.

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Fig. 4. Spark-to-Pilot Ignition Wiring (S936X), 2-rod (separate ignitor and sensor).



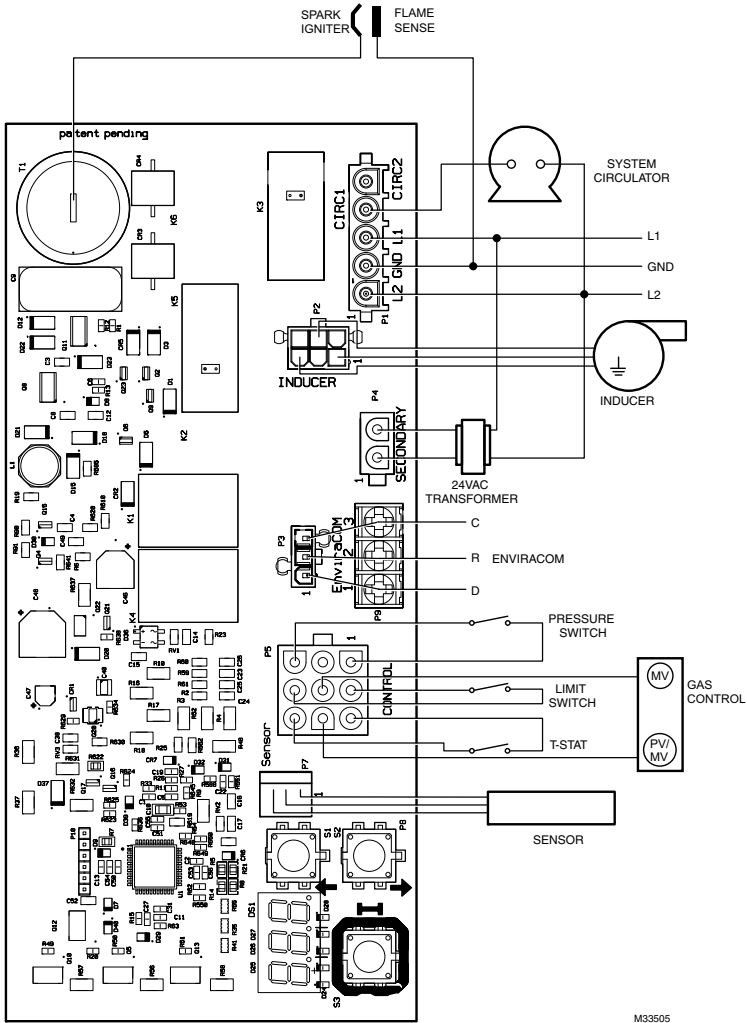


Fig. 5. Direct Spark Ignition (DSI) Wiring (S938X), 1-rod (combined ignitor and sensor).

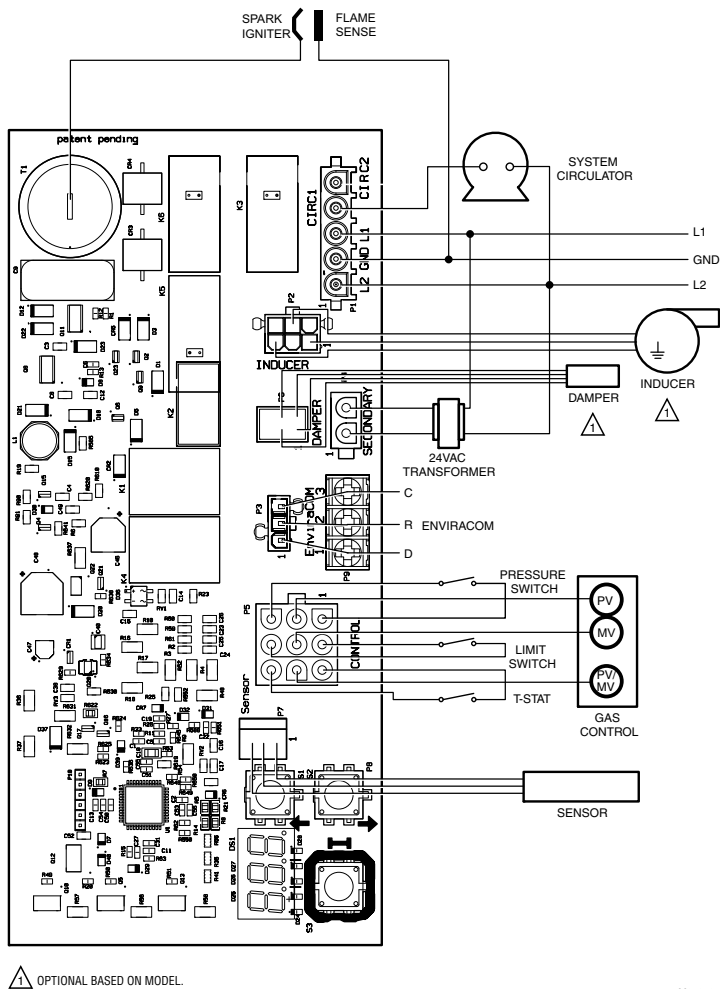


Fig. 6. Spark to Pilot Ignition (S936X), 1-rod (combined ignitor and sensor).

## State Code Definitions

For induced draft - state codes from 1–17;

For atmospheric - state codes from 1–21

**Table 5. State Code Definitions.**

State	State code	Specific Description	General Description
Idle	1	The boiler is in standby-no call for heat	Standby
Run circulator		Heat request present but boiler temp sufficiently high to run circulator pump only (no ignition sequence)	
Wait for pressure switch to open	2	The inducer is off and the control waits for the pressure switch to open. This is checked at the beginning of a heat cycle before turning on the inducer. If the pressure switch doesn't open in 60 seconds, the control goes to state 11.	
Wait for pressure switch to close	3	The inducer is turned on. The control is waiting for the pressure switch to close at the beginning of a cycle. If the pressure switch doesn't close within 60 seconds, the control goes to state 12 3 seconds safety relay test delay time when status 4 or 6 is interrupted pressure switch to open. Then control goes to state 12	
Prepurge (includes PV short diagnostics)	4	System is purging before ignition trial-safety relay diagnostics followed safety relay switch-on during last 2 seconds this state	
Spark, Ignition activation	6	System is sparking permanently 13 seconds whilst main valve relay is turned on	
Prove Flame	7	System is proving flame signal, typically 2 seconds	
Running	8	System is in running mode, flame signal must be present.	
Postpurge	9	System is purging at the end of a call for heat	
Inter-purge (Retry/ Recycle Delay)	10	If the control loses flame signal during state 7 or 8, it will recycle through the 30 seconds purge time and last 2 seconds part of prepurge time	Re-Start delay due to flame failure
Wait for pressure switch to open - failed closed	11	The inducer is still off, and the pressure switch has not opened at the beginning of the heat cycle. An alarm message is sent but the control is not in lockout.	
Wait for pressure SW to close - failed open	12	The inducer is still on, waiting time for pressure switch to close expired. An alarm message is sent but the control is not in lockout.	
Soft Lockout	13	System is shutdown and will re-start following an enforced delay	
Hard Lockout - non-volatile	14	System is locked out. A manual reset is required to be able to light off again	
Wait for Limit to Close	15	There may be a call for heat from the thermostat, but the limit switch is open.	
flame out of sequence - before trial	16	Flame signal sensed before trial for ignition. Appropriate alarm is sent	Flame present out of sequence
flame out of sequence - after trial		Flame out of sequence during postpurge. Appropriate alarm is sent	
Wait for flame loss		Flame signal still present when not expected. Appropriate alarm is sent	
Leakage Detection	17	HW self check, check of connected periphery, it is performed at start up, in the beginning of the heat cycle and in the "Wait For Recovery" state	Self Test
Wait For Recovery		There is an external error and the control is waiting to recover, no lockout	Self Test

Table 5. State Code Definitions. (Continued)

State	State code	Specific Description	General Description
Wait for vent damper to open	18	Damper actuator is energized and the system waits for damper to close	
Wait for vent damper to close	19	Damper actuator is de-energize and the system waits for damper to open	
Wait for vent damper to open – failed closed	20	Damper actuator is energized, system waits for damper to open, but the damper is stuck in closed position (damper end switch is open)	
Wait for vent damper to close – failed open	21	Damper actuator is de-energized, system waits for damper to close, but the damper is stuck in open position (damper end switch is closed)	

Temperature Control

Temperature control setpoint on the module can be adjusted as described in the following sections. Some modules with temperature control also include a three-digit display on the printed circuit board to facilitate adjustments and troubleshooting.

For modules that do not include temperature control on the module refer to the Honeywell Installation Instructions for the specific interface module or the appliance manufacturer’s instructions. A separate automatic gas shutoff device is not required in a system that uses this control to meet requirements for CSA International ANSI Z21.87 and UL 353.

The overall range of the setpoint is model-dependent but is within 130°F to 240°F (54°C to 116°C). Select devices may have different ranges.

Adjusting Settings for Models with “On-Board” Display

To discourage unauthorized changing of settings, a procedure to enter the adjustment mode is required. To enter the adjustment mode, press the **UP**, **DOWN**, and **I** buttons (see Fig. 1) simultaneously for three seconds. Press and release the **I** button until the parameter requiring adjustment is displayed.

Then press the **UP** or **DOWN** button until the parameter has reached the desired value. After 60 seconds without any button inputs, the control will automatically return to the **READ** mode.

Display

In the **RUN** mode, status items and parameters are viewable.

To read settings, press and release the **I** key to find the parameter of interest. For example, press and release **I** until setpoint (**sp**) is displayed, followed by a three-digit number, i.e., 220, followed by °F or °C. See Display Readout, Fig. 7.

TEXT	DESCRIPTION	DISPLAY SHOWS
STA	STATUS (SEE STATUS NUMBERS)	StA
BT	BOILER TEMPERATURE	bT
SP	OPERATING SETPOINT	SP
HL	HIGH LIMIT SETPOINT	HL
HdF	DIFFERENTIAL SETPOINT	HdF
FLA	FLAME CURRENT	FLA
RUN	RUN TIME HOURS	run
CYC	BOILER CYCLES	[YC
ERR	ERROR (SEE ERROR NUMBERS)	Err

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Fig. 7. Display readout parameters.

## Integrated Boiler Control Model Displays

See Table 6 for the IBC display screens.

Table 6. 7-Segment LED Display - Installer Mode Options.

3-Digit 7-Segment Display			Default	Range	Description
1st Screen	2nd Screen	3rd Screen			
HL_	<High Limit>	°F or °C	180	130 to 220 °F	Adjust High Limit Setting
HdF	<High Limit Differential>	°F or °C	15	10 to 30 °F	Adjust High Limit Differential
Or_	<Pump Overrun Time>	SEC	60	0-120 seconds	Pump Overrun Time
oEtH	<ODR maximal temp.>	°F or °C	55	40 to 70 °F	Maximal outdoor temperature
oEtL	<ODR minimal temp.>	°F or °C	0	-40 to 40 °F	Minimal outdoor temperature
bEtL	<minimal water temp.>	°F or °C	140	130 to 150 °F	Minimal boiler temperature
tPL	<minimal boiler temp.>	°F or °C	140	OFF, 120 to 160 °F	Thermal purging minimal temperature (Parameter is available only if outdoor temperature is invalid)
tPt	<maximal delay>	Min	2	1 to 10 minutes	Maximal Thermal Purge time (Parameter is available only if outdoor temperature is invalid)
rSt	On or OFF		NA	NA	Reset Lockout
F-C	°F or °C		F	F or C	Select degrees F or C Mode

## Boiler Temperature Controller

When the water temperature reaches setpoint, the controller ends the heating cycle. When the water temperature drops below the setpoint minus the differential, the control restarts a heat cycle to re-heat the tank of water.

If the water temperature exceeds the max allowed temperature, the control enters a manual reset lockout state. For models that have reset capability, press any on-board button (when present), cycle power, or use the local ("rSt") to reset.

## CHECKOUT

Put the system into operation and observe operation through at least one complete cycle to make sure that the controller operates properly. See Troubleshooting section to assist in determining system operation.

## LOCATION AND MOUNTING

### Sensing Bulb(s)

The boiler manufacturer usually provides a tapping for the sensing bulb at a point where average water temperature can be measured. See Fig. 8. Follow the boiler manufacturer instructions.

The sensing bulb can be installed in an immersion well. Wells and fittings must be ordered separately. See 68-0040.

When an immersion well is used, the sensor should fit snugly and should touch the bottom of the well for best temperature response. Use heat-conductive compound (Honeywell part no. 107408) to fill the space between the bulb and the well to improve heat transfer characteristics (optional). Make sure the sensor is held firmly in the well.

## WIRING

### IMPORTANT:

*For maximum trouble free operation, run the sensor leadwires separately from any other current-carrying wires.*

All wiring must comply with local codes and ordinances. Disconnect power supply before beginning wiring. Connect according to water heater manufacturer instructions.

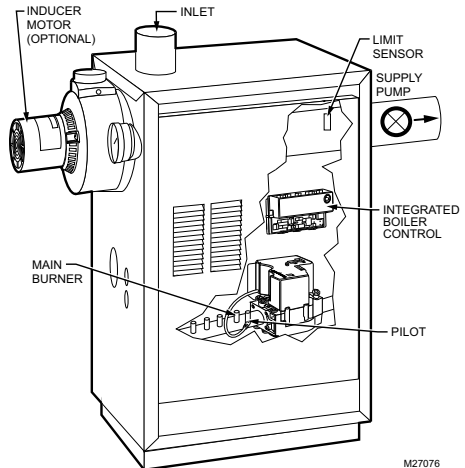


Fig. 8. Typical location of limit function sensor and control module.

## Mounting Sensor and Thermowell

The remote upper temperature sensor is installed in an immersion well (Fig. 9) that extends into the supply water side of the boiler.

### Immersion Well Fitting

The immersion well must snugly fit the sensing bulb for good thermal response. Install as follows:

1. Use tapping provided by tank manufacturer, if possible, or select an area where typical water temperature is best measured.
2. If tank is filled, drain to below point where bulb will be installed.
3. Screw well into tank.
4. Insert bulb into well, pushing wires until bulb bottoms in well.
5. Attach mounting clamp end of well spud.
6. With mounting clamp attached to well spud (make sure jaws of clamp hook over ridge at end of spud, as shown at points A in Fig. 9), adjust sensing lead-wire to fit through mounting clamp groove, as shown at point B in Fig. 9.
7. Tighten draw nut until mounting clamp is firmly attached to well spud and wires are held securely in place.



### CAUTION

Do not secure draw nut so tightly that mounting clamp collapses tubing.

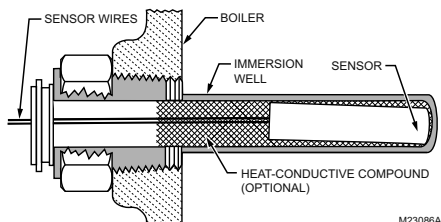


Fig. 9. Immersion well fitting for sensor.

## Wiring

Disconnect power supply before installation to prevent electrical shock or equipment damage. All wiring must comply with local codes and ordinances regarding wire size, type of insulation, enclosure, etc.

## OPERATION AND CHECKOUT

### Operation

The S9360A, S9361A, S9380A and S9381A continuously monitor the temperature of the boiler water and enable or disable the burner based on this temperature data. In general, when a "Call for Heat" occurs, the ignition portion of the control module proceeds through the steps

necessary to start the burner and heats the water in the boiler until the setpoint temperature is achieved. At this point the burner is de-activated, the ignition module completes the heating cycle, returns to idle and waits for the temperature to drop again. The circulator is turned on throughout the "Call for Heat."

See Fig. 10 for a graphical representation of a simple control cycle. Note that the setpoint differential may vary based on OS number.

### High Limit Controller

All models include a 3-wire temperature sensor interface, "Sensor 1," which is utilized for High Limit functionality in addition to the thermostatic control of the water heater burner. If the temperature sensor ever indicates a temperature above the maximum limit then the control enters over temperature mode. In over temperature mode no heating will occur.

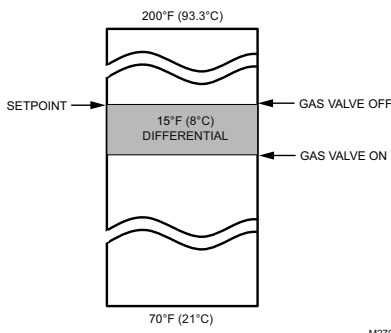


Fig. 10. Basic control algorithm example.

### Thermal Purge Operation

The intent of thermal purge is to insure usable residual heat in the boiler is circulated until it is sufficiently depleted from the system before the burner is allowed to fire. To that end, on a call for heat, the burner is held off while the circulator runs until the boiler temperature drops to the thermal purge temperature limit or a time delay is exceeded. Both of these parameters are adjustable. When the boiler temperature falls below the thermal purge temperature limit or the time delay expires, the burner is allowed to fire.

In addition to the thermal purge temperature and thermal purge time delay parameters, two other conditions release the integrated boiler controller from thermal purge and allow the burner to run in order to maintain comfort in the space:

- The boiler temperature has dropped 10 °F from the boiler water temperature measured at the beginning of the call for heat.
- Boiler temperature is cooling at a rate greater than 5 °F/minute while the circulator is running.

Table 7. Thermal Purge Settings.

Parameter name	Minimum value	Maximum Value	Default
Boiler temperature drop	Not adjustable	Not adjustable	10 °F
Thermal purge temperature limit	120 °F (or OFF)	160 °F	140 °F
Thermal purge temperature rate of drop	Not adjustable	Not adjustable	5 °F/minute
Thermal purge time delay	1 minute	10 minutes	2 minutes

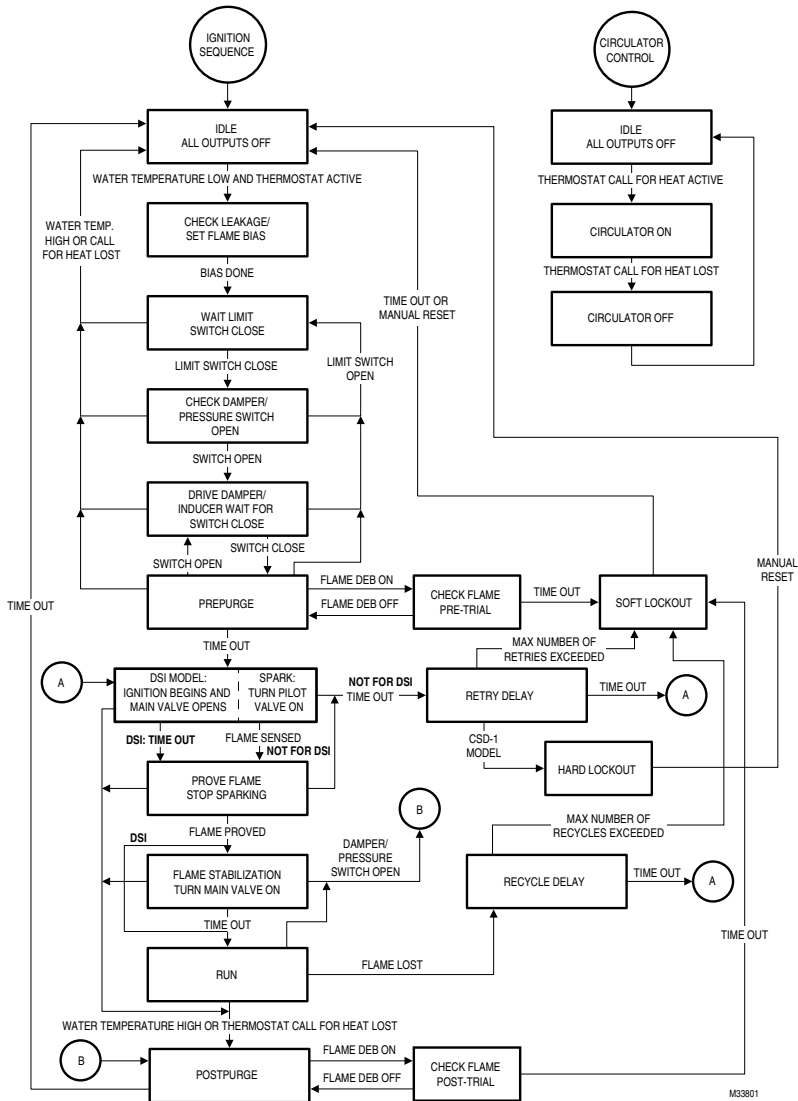


Fig. 11. Operating Sequence.

# TROUBLESHOOTING

## IMPORTANT

1. The following service procedures are provided as a general guide. Follow appliance manufacturer's service instructions if available.
2. On lockout and retry models, meter readings between gas control and ignition module must be taken within the trial for ignition period. Once the ignition module shuts off, lockout models must be reset through the key buttons and display. On retry models, wait for retry or reset at the thermostat.
3. If any component does not function properly, make sure it is correctly installed and wired before replacing it.
4. The ignition module cannot be repaired. If it malfunctions, it must be replaced.
5. Only trained, experienced service technicians should service ignition systems.

Perform the checkout as the first step in troubleshooting. Then check the appropriate troubleshooting guide and the schematic diagram to pinpoint the cause of the problem. If troubleshooting indicates an ignition problem, see Ignition System Checks below to isolate and correct the problem.

Following troubleshooting, perform the checkout procedure again to be sure system is operating normally.

## Intermittent Pilot

### Ignition System Checks

STEP 1: Check ignition cable.

Make sure:

- Ignition cable does not run in contact with any metal surfaces.
- Ignition cable is no more than 36 in. [0.9 m] long.
- Connections to the ignition module and to the igniter or igniter-sensor are clean and tight.
- Ignition cable provides good electrical continuity.

STEP 2: Check ignition system grounding. Nuisance shutdowns are often caused by a poor or erratic ground.

- A common ground, usually supplied by the pilot burner bracket, is required for the module and the pilot burner/igniter sensor.
  - Check for good metal-to-metal contact between the pilot burner bracket and the main burner.
  - Check the ground lead from the GND(BURNER) terminal on the module to the pilot burner. Make sure connections are clean and tight. If the wire is damaged or deteriorated, replace it with No. 14-18 gauge, moisture-resistant, thermoplastic insulated wire with 105° C [221° F] minimum rating.
    - Check the ceramic flame rod insulator for cracks or evidence of exposure to extreme heat, which can permit leakage to ground. Replace pilot burner/igniter-sensor and provide shield if necessary.
    - If flame rod or bracket are bent out of position, restore to correct position.

STEP 3: Check spark ignition circuit.

- Disconnect the ignition cable at the SPARK terminal on the module.



## WARNING

The ignition circuit generates over 10,000 volts and electrical shock can result.

Energize the module and listen for the audible sparking noise. When operating normally, there should be a buzzing noise that turns on and off twice per second for a duration of 1–7 seconds, depending on the model.

STEP 4: Check pilot and main burner lightoff.

- Set the system to call for heat by turning the thermostat above room temperature.
- Watch the pilot burner during the ignition sequence. See if:
  - Ignition spark continues after the pilot is lit.
  - The pilot lights and the spark stops, but main burner does not light.
- If so, ensure adequate flame current as follows.
  - Turn off furnace at circuit breaker or fuse box.
  - Clean the flame rod with emery cloth.
  - Make sure electrical connections are clean and tight. Replace damaged wire with moisture-resistant No. 18 wire rated for continuous duty up to 105° C [221° F].
  - Check for cracked ceramic insulator, which can cause short to ground, and replace igniter-sensor if necessary.
  - At the gas valve, disconnect main valve wire from the MV terminal.
  - Turn on power and set thermostat to call for heat. The pilot should light but the main burner will remain off because the main valve actuator is disconnected.
  - Check the pilot flame. Make sure it is blue, steady and envelops 3/8 to 1/2 in. [10 to 13 mm] of the flame rod. See Fig. 12 for possible flame problems and their causes.
  - If necessary, adjust pilot flame by turning the pilot adjustment screw on the gas control clockwise to decrease or counterclockwise to increase pilot flame. Following adjustment, always replace pilot adjustment cover screw and tighten firmly to assure proper gas control operation.
  - Set temperature below room setpoint to end call for heat.
- Recheck ignition sequence as follows.
  - Reconnect main valve wire.
  - Adjust thermostat above room temperature.
  - Watch ignition sequence at burner.
  - If spark still doesn't stop after pilot lights, replace module.
  - If main burner doesn't light or if main burner lights but system locks out, check module, ground wire and gas control as described in appropriate troubleshooting chart.






## Troubleshooting Error Codes

The integrated boiler control uses advanced diagnostic capability to assist in troubleshooting error conditions. Table 8 shows the codes that could arise on the remote or integrated display during a fault. Suggestions are provided in Table 5 for servicing these potential errors.



**Table 8. Error Codes.**

<b>Segment Display</b>	<b>Definition</b>
<b>Err 2</b>	Pressure Switch failed to open (contacts stuck closed).
<b>Err 4</b>	Low flame current
<b>Err 6</b>	Flame sensed out of normal sequence (before opening gas valve or after closing gas valve).
<b>Err 18</b>	Gas valve relays welded 5 consecutive soft lockouts. A manual reset is required.
<b>Err 23</b>	Flame sensed during prepurge (before gas valve signaled opened).
<b>Err 24</b>	Flame sensed during postpurge (before gas valve signaled closed).
<b>Err 29</b>	Pressure Switch failed to close (contacts stuck open).
<b>Err 32</b>	Sensor 1 Error. Temperature sensor or interface failure (open or short connection, increased connection resistance, dual sensor mismatch) or failure of A/D conversion (invalid offset or gain, too many failures during A/D conversion).
<b>Err 55</b>	Atmospheric Damper End Switch failed to close (end switch contacts stuck open).
<b>Err 56</b>	Atmospheric Damper End Switch failed to open (end switch contacts stuck closed).
<b>Err 57</b>	Flame Rod shorted to burner ground.
<b>Err 58</b>	AC line frequency error—signal is too noisy or frequency is incorrect.
<b>Err 59</b>	Line voltage error—voltage out of spec high or low.
<b>Err 60</b>	Thermostat input higher than threshold.
<b>Err 61</b>	Line voltage unstable—possibly too many heavy loads switching on and off cause erratic supply voltage.
<b>Err 62</b>	Soft Lockout—maximum number of retries exceeded. Hard lockout on CSD-1 models.
<b>Err 63</b>	Soft Lockout—maximum number of recycles exceeded.
<b>Err 64</b>	Soft Lockout—electronics failure. Caused by general electronics failure such as relay open or shorted contacts, flame sensing circuit error, or A to D error. Hard lockout on CSD-1 models.
<b>Err 65</b>	Over temperature error. Sensors measured temperature in excess of ECO limit. Hard lockout on CSD-1 models.

APPEARANCE	CAUSE
<p>SMALL BLUE FLAME</p> 	<p>CHECK FOR LACK OF GAS FROM:</p> <ul style="list-style-type: none"><li>• CLOGGED ORIFICE FILTER</li><li>• CLOGGED PILOT FILTER</li><li>• LOW GAS SUPPLY PRESSURE</li><li>• PILOT ADJUSTMENT AT MINIMUM</li></ul>
<p>LAZY YELLOW FLAME</p> 	<p>CHECK FOR LACK OF AIR FROM:</p> <ul style="list-style-type: none"><li>• DIRTY ORIFICE</li><li>• DIRTY LINT SCREEN, IF USED</li><li>• DIRTY PRIMARY AIR OPENING, IF THERE IS ONE</li><li>• PILOT ADJUSTMENT AT MINIMUM</li></ul>
<p>WAVING BLUE FLAME</p> 	<p>CHECK FOR:</p> <ul style="list-style-type: none"><li>• EXCESSIVE DRAFT AT PILOT LOCATION</li><li>• RECIRCULATING PRODUCTS OF COMBUSTION</li></ul>
<p>NOISY LIFTING BLOWING FLAME</p> 	<p>CHECK FOR:</p> <ul style="list-style-type: none"><li>• HIGH GAS PRESSURE</li></ul>
<p>HARD SHARP FLAME</p> 	<p>THIS FLAME IS CHARACTERISTIC OF MANUFACTURED GAS</p> <p>CHECK FOR:</p> <ul style="list-style-type: none"><li>• HIGH GAS PRESSURE</li><li>• ORIFICE TOO SMALL</li></ul>

M3272A

Fig. 12. Examples of unsatisfactory pilot flames.



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