

R7910A SOLA (Hydronic Control) and R7911 SOLA (Steam Control) Systems

INSTALLATION INSTRUCTIONS

APPLICATION

The R7910 SOLA hydronic boiler and the R7911 SOLA steam control systems provide heat control, flame supervision, circulation pump control, and fan control, as well as status and error reporting.

FEATURES

- NTC sensors for measuring and guarding component temperatures.
- R7911—4–20ma Steam Pressure input for header pressure (0–15 or 0–150 psi)
- PWM-driven controlled dc-fan for optimal modulation control.
- 24 Vac (R7910A only) or 120 Vac gas valve models available.
- Pump control—3 outputs available.
- Primary flame safeguard.
- Selectable internal or external ignitor/spark generator.
- Blower or Hot Surface Ignitor selectable output.
- First out expanded annunciator.
- Outdoor reset (R7910 only).
- Time of Day reset.
- UV or flame rod flame detection (R7910A1084 and R7910A1118 are Flame Rod only).
- Stack high limit control.
- ModBus communications.
- R7910A has two temperature loops (CH and DHW).
- PID load control.
- Easy modification of the parameters on three levels:
 - End user.
 - Installer or service mechanic.
 - Manufacturer (OEM).

- For complete application and installation details for the R7910 Hydronic Control and the R7911 Steam Control, see form 66-1171.
- Remote Control (Set Point or Firing Rate)- 4-20mA input

SPECIFICATIONS

(See model list in the Product Data Manual for specific specifications)

Electrical ratings:

120 Vac, 15%/+10% (102 to 132 Vac)
 24 Vac, 16.6%/+25% (20 to 30 Vac)
 Line frequency: 60 Hz, +/- 5% (57 to 63 Hz).

Corrosion:

R7910 and R7911 should not be used in a corrosive environment. The devices meet NEMA 1 standards.

Operating Temperature: -4 F to 150 F (-20 C to 66 C)

Storage/Shipping Temperature: -40 F to 150 F (-40 C to 66 C).

Humidity:

85% relative humidity, noncondensing. Condensing moisture may cause safety shutdown.

Approvals:

Underwriters Laboratories, Inc. (UL)(cUL): File No. MH20613 (MCCZ).

CSD-1 Acceptable.

Meets CSD-1 section CF-300 requirements as a Primary Safety Control.

Meets CSD-1 section CW-400 requirements as a Temperature Operation Control. (R7910 Sola Hydronic Control).

Meets CSD-1 section CW-400 requirements as a Temperature High Limit Control when configured for use with 10k Ohm NTC sensors.

Federal Communications Commission, Part 15, Class B. Emissions.



INSTALLATION

When Installing This Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Refer to the installation manual and wiring diagram provided as part of the appliance or refer to **Product Data manual, form 66-1171 for R7910 and R7911.**
3. Check the ratings given in the instructions and on the product to make sure that the product is suitable for your application.
4. Installer must be a trained, experienced combustion service technician.
5. Disconnect the power supply before beginning installation to prevent electrical shock and equipment damage. More than one disconnect may be involved.
6. All wiring must comply with applicable local electrical codes, ordinances and regulations.
7. After installation is complete, check out product operation as provided in the System Checkout section.

WARNING

Fire or Explosion Hazard. Can cause severe injury, death, or property damage.

To prevent possible hazardous burner operation, verify safety requirements each time a controller is installed on a burner.

WIRING

WARNING

Electrical Shock Hazard. Can cause serious injury, death or property damage.

Disconnect power supply before beginning wiring to prevent electrical shock and equipment damage. More than one disconnect may be involved.

Ground Connection

The ground connection on a R7910 or R7911 controller must not be used as a common ground connection for the 120 Vac connections.

1. Install a common ground terminal next to the R7910 or R7911 controller, close to connector J4 terminal 12.
2. Connect the connector J4 terminal 12 of the R7910 or R7911 controller to the common ground terminal.
3. Connect the ground wires of the main power connector, pumps, and other system components to the common ground terminal.

Electrical Connections

1. Refer to Product Data Sheet 66-1171 for details.
2. Use 18 AWG or larger wires.
3. Wire according to specifications, following all local ordinances and requirements.
4. L1 input (J4 terminal 8) connect L1 (hot) through the boiler master switch to energize the L1 input terminal (J4 terminal 8) on both the 24 Vac and 120 Vac models.

Note that this L1 input is not used as a power source for the Sola controller but as part of the filtering circuit to protect the Sola controller from electrical line transients and other electrical noise.

Device Power Supply, 24 Vac

1. 24 Vac Supply to connector J8 terminal 1.
2. 24 Vac Return to connector J8 terminal 2.
3. Ground to common ground terminal, not to Ground on J4 terminal 12.

Limit String and Annunciator Inputs and Safety Load Outputs

1. SOLA wiring to connectors J4, J5, J6 and J7.
2. Line voltage (120 Vac) or low voltage (24 Vac) by model number.

Dry Contacts available for:

1. Pump A: Connector J4 terminals 6 & 7.
2. Pump B: Connector J4 terminals 4 & 5.
3. Pump C: Connector J4 terminals 2 & 3.
4. Blower: Connector J5 terminals 6 & 7.
5. Alarm: Connector J6 terminals 7 & 8.

SOLA Wiring Connectors J2, J8, J9, and J10

Low Voltage Connections (includes NTC Sensors, 4-20 mA input[s], PWM Combustion Blower Motor, Remote and TOD reset, current and voltage outputs)

1. Wire according to specifications, following all local ordinances and requirements.
2. Do not bundle the low voltage wires with the ignition cable or 120 Vac wires.
3. Bundle the wires for the fan and join them with the other 24V low-voltage wires.
4. Bundle the wires for the NTC sensors and the PWM pump control separately.

High Voltage Cable

1. Always use a grommet when placing the high voltage cable through a sheet metal panel.
2. Never bundle the high voltage cable with other wires.

Communications: Connector J3

1. Connect the S7910A display only to the ECOM port, connector J3, terminals 1, 2, and 3. **Do not** connect the S7999B,C display to these connectors.
2. Connect the S7999B,C display to connector J3 Mod-Bus, terminals MB1, or MB2 a, b, c terminals.

Flame Signal: Connector J1

1. Flame Rod: Single Element
 - a. Connect the flame rod for both ignition spark and flame sense to the ignition transformer terminal.
 - b. Install a jumper wire between connector J1, terminals 1 and 2.
 - c. Connect the flame rod ground to connector J1 terminal 3.

2. Flame Rod: Dual Element (separate elements for ignition spark and flame sense)
 - a. Connect the flame rod sense lead to connector J1 terminal 2.
 - b. Connect the flame rod ground to connector J1 terminal 3.
 - c. Do not route the flame rod sense lead wire or ground wire near the ignition spark high-voltage cable or other line voltage wiring.

UV Flame Detection

1. Connect the UV Flame detector sense lead (blue wire) to connector J1 terminal 4.
2. Connect the UV Flame detector ground lead (white wire) to connector J1 terminal 6.
3. Do not route the UV Flame detector wiring near the ignition spark high-voltage cable or other line voltage wiring.

SYSTEM CHECKOUT

This section provides general checkout and troubleshooting procedures for the Primary Safety function of R7910 and R7911 Sola devices.

WARNING

Explosion Hazard.
Can cause serious injury or death.
 Do not allow fuel to accumulate in the combustion chamber for longer than a few seconds without igniting, to prevent danger of forming explosive mixture. Close manual fuel shutoff valve(s) if flame is not burning at end of specified time.

WARNING

Electric Shock Hazard.
Can cause serious injury or death.
 Use extreme care while testing system. Line voltage is present on most terminal connections when power is on.

Open master switch before removing or installing the R7910 or R7911 Sola device or Display Module connector.

Make sure all manual fuel shutoff valves are closed before starting initial lightoff check and Pilot Turndown tests.

Do not put the system in service until you have satisfactorily completed all applicable tests in this section and any others recommended by the original equipment manufacturer.

Limit trial for pilot to 10 seconds. Limit the attempt to light main burner to 2 seconds after the fuel reaches burner nozzle. Do not exceed manufacturer's nominal lightoff time.

CAUTION

Equipment Malfunction or Damage Hazard.
 Each device type is unique. Using existing wiring on a module change can cause equipment damage. Make wiring changes when a module is replaced with a different R7910 or R7911 Sola device to sequence burner.

IMPORTANT

1. If the system fails to perform properly, note the fault code, fault message, equipment status, and sequence time on the display. Then refer to the Fault Code section in the R7910 and R7911 Product Data Sheet form 66-1171.
2. Repeat all required Checkout tests after all adjustments are made. All tests must be satisfied with the flame detector(s) in their final position.

Equipment Recommended

- S7999 Operator Interface Module.
- Volt-ohmmeter (1M ohm/volt minimum sensitivity) with: 0-300 Vac capability, 0-6000 ohm capability, 0-10 Vdc capability.

Checkout Summary

Table 1 provides an overview of checkout steps performed for each applicable system.

See the product data sheet for location of component parts terminal locations.

Table 1. Checkout steps and applicable systems.

Checkout Step	Piloted Systems	DSI Systems	Flame Rod Systems	Ultraviolet Flame Detectors
Preliminary Inspection	X	X	X	X
Flame Signal Measurement	X	X	X	X
Initial Lightoff Check for Proved Pilot	X			
Initial Lightoff Check for Direct Spark Ignition		X		
Pilot Turndown Test	X			
Ignition Interference Test			X	
Hot Refractory Hold-in Test				X
Ignition Spark Pickup				X
Response to Other Ultraviolet Sources				X
Flame Signal with Hot Combustion Chamber	X	X	X	X
Safety Shutdown Tests	X	X	X	X

Preliminary Inspection

Perform the following inspections to avoid common problems. Make certain that:

1. Wiring connections are correct and all screws are tight.
2. Flame detector(s) is clean, installed and positioned properly. Consult the applicable Instructions.
3. Combination connector J1 wiring and flame detector(s) are correctly used. See product data sheet for wiring.
4. Burner is completely installed and ready to fire; consult equipment manufacturer's instructions. Fuel lines are purged of air.
5. Combustion chamber and flues are clear of fuel and fuel vapor.
6. Power is connected to the system disconnect switch (master switch).
7. Lockout is reset (reset button) only if the R7910 or R7911 Sola Module is powered.
8. System is in STANDBY condition. STANDBY message is displayed in the S7999 Operator Interface Module.
9. All limits and interlocks are reset.

Flame Signal Measurement

Install a DC voltmeter in the Sola test jacks. Observe polarity when connecting meter leads.

INITIAL LIGHTOFF CHECKS

Proved Pilot Systems

Perform this check on all installations that use a pilot. It should immediately follow the preliminary inspection.

NOTE: Low fuel pressure limits, if used, could be open. If so, bypass them with jumpers during this check.

1. Open the master switch.
2. Make sure that the manual main fuel shutoff valve(s) is closed. Open the manual pilot shutoff valve. If the pilot takeoff is downstream from the manual main fuel shutoff valve(s), slightly open the manual main valve to supply pilot gas flow. Make sure the main fuel is shut off just upstream from the burner inlet, or disconnect power from the automatic main fuel valve(s).
3. Close the master switch and start the system with a call for heat by raising the setpoint of the operating controller; see the R7910 and R7911 Sola Module sequence. The R7910 or R7911 Sola Module should start the INITIATE sequence.
4. Let the sequence advance to PILOT IGN (status is displayed on the S7999 Operator Interface Module, if used). The PILOT valve energizes, ignition spark should occur, and the pilot flame should light. If the pilot ignites, the FLAME LED is energized. Go to step 7.
5. If the pilot flame is not established during the PFEP (pilot flame establishing period), safety shutdown occurs. Let the sequence complete its cycle.
6. Push the reset pushbutton and let the system recycle once. If the pilot flame still does not ignite, make the following ignition/pilot adjustments:

EXTERNAL IGNITION SOURCE

- a. Open the master switch and remove the R7910 and R7911 Sola Module connector J5.
- b. Ensure that both the manual pilot shutoff valve and the manual main shutoff valves are closed.

- c. On connector J5, jumper power to the ignition terminal J5 terminal 4. Disconnect the leadwire to the pilot valve if it is connected to the same terminal.
- d. Close the master switch to energize only the ignition transformer.
- e. If the ignition spark is not strong and continuous, open the master switch and adjust the ignition electrode spark gap setting to the manufacturer's recommendation.
- f. Make sure the ignition electrodes are clean.
- g. Close the master switch and observe the spark.
- h. After a continuous spark is obtained, open the master switch and add a jumper on the Connector J5 terminal 2 or reconnect the pilot valve lead wire if it was disconnected in step b.
- i. Open the manual pilot shutoff valve.
- j. Close the master switch to energize both the ignition transformer and the pilot valve.
- k. If the pilot flame does not ignite and if the ignition spark is still continuous, adjust the pilot gas pressure regulator until a pilot flame is established.
- l. When the pilot flame ignites properly and stays ignited, open the master switch and remove the jumper(s) from the J5 terminals.
- m. Check for adequate bleeding of the fuel line.
- n. Reinstall the J5 connector onto the R7910 or R7911 Sola Module, close the master switch and return to step 4.

INTERNAL IGNITION SOURCE

To check the internal ignition, the R7910 or R7911 controller will need to be cycled:

- a. Open the master switch and remove connector J5.
- b. Ensure both the manual pilot shutoff valve and the manual main fuel shutoff valves are closed.
- c. Cycle the R7910 or R7911 controller and observe the ignition spark. (To provide a longer ignition period, additional time can be added to the pre-ignition time parameter.)
- d. If the ignition spark is not strong and continuous, open the master switch and adjust the ignition electrodes spark gap setting to the manufacturer's recommendation.
- e. Make sure that the ignition electrodes are clean.
- f. Close the master switch and cycle the R7910 or R7911 controller and observe the spark.
- g. After obtaining a strong spark, open the master switch, remove the main valve wire from connector J5 terminal 3 and re-install connector J5 to the R7910 or R7911 controller.
- h. Open the manual pilot shutoff valve.
- i. Close the master switch and change the pre-ignition time parameter back to the original value if you changed it in step C.
- j. Cycle the R7910 or R7911 controller to energize both the ignition transformer and the pilot valve.
- k. If the pilot flame does not ignite and if the ignition spark is still continuous, adjust the pilot gas pressure regulator until a pilot flame is established.
- l. When the pilot flame ignites properly and stays ignited, open the master switch and reconnect the main valve to the connector J5 terminal 3 (if removed in step g).
- m. Close the master switch and return to Step 4.

7. When the pilot flame ignites, measure the flame signal. If the pilot flame signal is unsteady or approaching the flame threshold value (see flame threshold parameter), adjust the pilot flame size or detector sighting to provide a maximum and steady flame signal.
8. Recycle the system to recheck lightoff and pilot flame signal.
9. When the MAIN Valve energizes, make sure the automatic main fuel valve is open; then smoothly open the manual main fuel shutoff valve(s) and watch for main burner flame ignition. When the main burner flame is established, go to step 16.
10. If the main burner flame is not established within 5 seconds or the normal lightoff time specified by the equipment manufacturer, close the manual main fuel shutoff valve(s).
11. Recycle the system to recheck the lightoff and pilot flame signal.
12. Smoothly open the manual fuel shutoff valve(s) and try lightoff again. (The first attempt may have been required to purge the lines and bring sufficient fuel to the burner.)
13. If the main burner flame is not established within 5 seconds or the normal lightoff time specified by the equipment manufacturer, close the manual main fuel shutoff valve(s). Check all burner adjustments.
14. If the main burner flame is not established after two attempts:
 - a. Check for improper pilot flame size.
 - b. Check for excess combustion air at low fire.
 - c. Check for adequate low fire fuel flow.
 - d. Check for proper gas supply pressure.
 - e. Check for proper valve operation.
 - f. Check for proper pilot flame positioning.
15. Repeat steps 8 and 9 to establish the main burner flame; then go to step 16.
16. With the sequence in RUN, make burner adjustments for flame stability and Btu input rating.
17. Shut down the system by opening the burner switch or by lowering the setpoint of the operating controller. Make sure the main flame goes out. There may be a delay due to gas trapped between the valve(s) and burner. Make sure all automatic fuel valve(s) close.
18. Restart the system by closing the burner switch and/or raising the setpoint of the operating controller. Observe that the pilot flame is established during PILOT IGN and the main burner flame is established during MAIN IGN within the normal lightoff time.
19. Measure the flame signal. Continue to check for the proper flame signal through the RUN period. Check the flame signal at both High and Low Firing Rate positions and while modulating, if applicable.
20. Run the burner through another sequence, observing the flame signal for:
 - a. Pilot flame alone.
 - b. Pilot and main flame together.
 - c. Main flame alone (unless monitoring an intermittent pilot). Also observe the time it takes to light the main flame. Ignition of main flame should be smooth.
21. Make sure all readings are in the required ranges before proceeding.
22. Return the system to normal operation.

NOTE: After completing these tests, open the master switch and remove all test jumpers from the connector terminals, limits/controls or switches.

Direct Burner Ignition (DBI) Systems

This check applies to gas and oil burners not using a pilot. It should immediately follow the preliminary inspection. Refer to the appropriate sample block diagram of field wiring for the ignition transformer and fuel valve(s) hookup.

NOTE: Low fuel pressure limits, if used, could be open. If so, bypass them with jumpers during this check.

1. Open the master switch.
2. Complete the normal ready-to-fire checkout of the fuel supply and equipment as recommended by the equipment manufacturer.
3. Close all manual main fuel shutoff valve(s). Check that the automatic fuel valve(s) is closed. Make sure fuel is not entering the combustion chamber.
4. Close the master switch and start the system with a call for heat by raising the setpoint of the operating controller; see R7910 and R7911 Sola Module sequencing. The program sequence should start the INITIATE sequence.
5. Let the sequence advance through PREPURGE (if applicable). Ignition spark should turn on during the ignition trial period. Listen for the click of the fuel solenoid valve(s). The R7910 or R7911 Sola Module locks out and the ALARM LED turns on.
6. Let the R7910 or R7911 Sola Module complete its cycle.
7. Open the manual fuel shutoff valve(s).
8. Push the reset button and the module recycles the program sequence through PREPURGE (if applicable).
9. When the fuel valve turns on during the ignition period, make sure that the main burner flame is established. If it is, go to step 14.
10. If the main burner flame is not established within 4 seconds or within the normal lightoff time specified by the equipment manufacturer, close the manual fuel shutoff valve(s), and open the master switch.
11. Wait about three minutes. Close the master switch, open the manual fuel shutoff valve(s), and try to lightoff the burner again. The first attempt may be required to purge the lines and bring sufficient fuel to the burner. If it is not established on the second attempt, proceed to step 13.
12. Check all burner adjustments.
13. Make the following ignition and main burner adjustments:

INTERNAL IGNITION SOURCE

To check the internal ignition, the R7910 or R7911 controller will need to be cycled:

 - a. Open the master switch and remove connector J5.
 - b. Ensure both the manual main valve shutoff valve and the manual main fuel shutoff valves are closed.
 - c. Cycle the R7910 or R7911 controller and observe the ignition spark. (To provide a longer ignition period, additional time can be added to the pre-ignition time parameter.)
 - d. If the ignition spark is not strong and continuous, open the master switch and adjust the ignition electrodes spark gap setting to the manufacturer's recommendation.
 - e. Make sure the ignition electrodes are clean.
 - f. Close the master switch and cycle the R7910 or R7911 controller and observe the spark.
 - g. After obtaining a strong spark, open the master switch, re-install connector J5 to the R7910 or R7911 controller.
 - h. Open the manual main valve shutoff valve.

- i. Close the master switch and change the pre-ignition time parameter back to the original value if you changed it in step C.
- j. Cycle the R7910 or R7911 controller to energize both the ignition transformer and the main fuel valve.
- k. If the main flame does not ignite and if the ignition spark is still continuous, adjust the main burner gas pressure regulator until a main flame is established.
- l. Check the main flame signal and ensure it is above the threshold level and within the manufacturer's recommendation.
- m. Return to Step 8.

EXTERNAL IGNITION SOURCE

- a. Open the master switch and remove the R7910 or R7911 Sola module connector J5.
 - b. Ensure that the manual main burner fuel shutoff valve is closed.
 - c. On connector J5, jumper power to the ignition terminal, J5 terminal 4.
 - d. Close the master switch to energize only the ignition source.
 - e. If the ignition spark is not strong and continuous, open the master switch and adjust the ignition electrode spark gap to the manufacturer's recommendation.
 - f. Make sure electrodes are clean.
 - g. Close the master switch and observe the spark.
 - h. After obtaining a strong and continuous spark, open the master switch; remove the jumper between power and J5 terminal 4. Re-install the connector J5 to the R7910 or R7911 controller.
 - i. Open the manual main burner fuel shutoff valve.
 - j. Close the master switch.
 - k. Cycle the R7910 or R7911 controller to energize both the ignition source and the main fuel valve.
 - l. If the main flame does not ignite and if the ignition spark is still continuous, adjust the main burner gas pressure regulator until a main flame is established.
 - m. Check the main flame signal and insure it is above the threshold level and within the manufacture's recommendations.
 - n. Return to step 8.
14. When the main burner flame is established, the sequence advances to RUN. Make burner adjustments for flame stability and input rating.
 15. Shut down the system by opening the burner switch or by lowering the setpoint of the operating controller. Make sure the burner flame goes out and all automatic fuel valves close.
 16. If used, remove the bypass jumpers from the low fuel pressure limit.
 17. Restart the system by closing the burner switch and/or raising the setpoint of the operating controller. Observe that the main burner flame is established during Main Ignition, within the normal lightoff time specified by the equipment manufacturer.
 18. Measure the flame signal. Continue to check for the proper signal through the RUN period. Check the signal at both high and low firing rate positions and while modulating. Any pulsating or unsteady readings require further attention.
 19. Make sure all readings are in the required ranges before proceeding.

NOTE: On completing these tests, open the master switch and remove all test jumpers, limits/controls or switches.

20. Return the system to normal operation.

PILOT TURNDOWN TEST (ALL INSTALLATIONS USING A PILOT)

Perform this check on all installations that use a pilot. The purpose of this test is to verify that the main burner can be lit by the smallest pilot flame that can hold in the flame amplifier and energize the FLAME LED. Clean the flame detector(s) to make sure that it detects the smallest acceptable pilot flame.

NOTE: Low fuel pressure limits, if used, could be open. If so, bypass them with jumpers during this test.

1. Open the master switch.
2. Close the manual main fuel shutoff valve(s).
3. Connect a manometer (or pressure gauge) to measure pilot gas pressure during the turndown test.
4. Open the manual pilot shutoff valve(s).
5. Close the master switch
 - Go to the S7999 Operator Interface Module.
 - Select Diagnostics Test button at the bottom of the display.
 - Select Diagnostics test button at the bottom of this new screen.
 - Select Pilot Test at the bottom of this new screen.
 - Select Start Test at the bottom of this screen.
6. Start the system with a call for heat. Raise the setpoint of the operating controller. The R7910 or R7911 Sola sequence should start, and PREPURGE (if applicable) should begin. The sequence will hold in the pilot flame establishing period and the FLAME LED comes on when the pilot flame ignites.

NOTE: If the sequence does not stop, reset the system and make sure that you selected the Pilot Test.

7. Turn down the pilot gas pressure very slowly, reading the manometer (or pressure gauge) as it drops. Stop instantly when the FLAME LED goes out. Note the pressure reading. The pilot flame is at the minimum turndown position. Immediately turn up the pilot pressure until the FLAME LED comes on again or the flame signal increases to above the flame threshold value. (See flame threshold parameter).

NOTE: If there is no flame for 15 seconds in the TEST position, the R7910 or R7911 Sola Module locks out.

8. Repeat step 7 to verify the pilot gas pressure reading at the exact point the FLAME LED light goes out.
9. Increase the pilot gas pressure immediately until the FLAME LED comes on, and then turn it down slowly to obtain a pressure reading just above the dropout point or until the flame signal increases to above the flame threshold value (See flame threshold parameter).
10. Turn the pilot hold test OFF and allow the R7910 or R7911 controller to start a burner cycle. During the Main Flame Establishing Period, make sure the automatic main fuel valve(s) opens; then smoothly open the manual main fuel shutoff valve(s) (or any other man-

ually-opened safety shutoff valve(s), if used) and watch for main burner ignition. If the lightoff is not rough and the main burner flame is established, go to step 18.

NOTE: This step requires two people, one to open the manual valve(s) and one to watch for ignition.

11. If the main burner flame is not established within 5 seconds, or within the normal lightoff time specified by the equipment manufacturer, close the manual main fuel shutoff valve(s) and open the master switch. If the lightoff is rough, the pilot flame size is too small.
12. Close the master switch and perform another pilot hold test (see step 5).
13. Increase the pilot flame size by increasing its fuel flow until a smooth main flame lightoff is accomplished.
14. Reposition the flame rod or the flame scanner sight tube or use orifices until the pilot flame signal voltage is in the range of 0.7 Vdc above the flame threshold value.
15. When the main burner lights reliably with the pilot at turndown, disconnect the manometer (or pressure gauge) and turn up the pilot gas flow to that recommended by the equipment manufacturer.
16. If used, remove the bypass jumpers from the terminals, limits/controls, or switches.
17. Run the system through another cycle to check for normal operation.
18. Return the system to normal operation.

IGNITION INTERFERENCE TEST (FLAME RODS)

Ignition interference can subtract from (decrease) or add to (increase) the flame signal. If it decreases the flame signal enough, it causes a safety shutdown. If it increases the flame signal, it could cause the FLAME LED to come on when the true flame signal is below the minimum acceptable value.

Start the burner and measure the flame signal with both ignition and pilot (or main burner) on, and then with only the pilot (or main burner) on. Any significant difference (greater than 0.5 Vdc) indicates ignition interference.

To Eliminate Ignition Interference

1. Make sure there is enough ground area.
2. Be sure the ignition electrode and the flame rod are on opposite sides of the ground area.
3. Check for correct spacing on the ignition electrode. (See manufacturer's recommendation.)
4. Make sure the leadwires from the flame rod and ignition electrode are not too close together.
5. Replace any deteriorated leadwires.
6. If the problem cannot be eliminated, consider changing the system to an ultraviolet flame detection system.

HOT REFRACTORY HOLD-IN TEST (ULTRAVIOLET DETECTORS)

This condition can delay response to flame failure and also can prevent a system restart if hot refractory is detected.

The ultraviolet detector can respond to hot refractory above 2300 F (1371 C).

1. When the maximum refractory temperature is reached, close all manual fuel shutoff valves, or open the electrical circuits of all automatic fuel valves.
2. Visually observe when the burner flame or FLAME LED goes out. If this takes more than 3 seconds, the detector is sensing hot refractory.
3. Immediately terminate the firing cycle. Lower the setpoint to the operating controller, or set the Fuel Selector Switch to OFF. Do not open the master switch.

NOTE: Some burners continue to purge oil lines between the valves and nozzles even though the fuel valves are closed. Terminating the firing cycle (instead of opening the master switch) allows purging of the combustion chamber. This reduces buildup of fuel vapors in the combustion chamber caused by oil line purging.

4. If the detector is sensing hot refractory, correct the condition by one or more of the following procedures:
 - a. Add an orifice plate in front of the cell to restrict the viewing area of the detector.
 - b. Resight the detector at a cooler, more distant part of the combustion chamber. Make sure the detector properly sights the flame.
 - c. Try lengthening the sight pipe or decreasing the pipe size (diameter).

For details, refer to the detector Instructions and the equipment Operating Manual. Continue adjustments until hot refractory hold-in is eliminated.

IGNITION SPARK RESPONSE TEST (ULTRAVIOLET DETECTORS)

Test to make certain that the ignition spark is not actuating the FLAME LED:

1. Open the master switch.
2. Close the pilot and main burner manual fuel shut-off valve(s).
3. Close the master switch
 - Go to the S7999 Operator Interface Module.
 - Select Diagnostics Test button at the bottom of the display.
 - Select Diagnostics test button at the bottom of this new screen.
 - Select Pilot Test at the bottom of this new screen.
 - Select Start Test at the bottom of this screen.
4. Start the system with a call for heat. Raise the setpoint of the operating controller. The R7910 or R7911 Sola sequence should start and prepurge (if applicable) should begin. The sequence will hold in pilot flame establishing period with only the ignition on. Ignition spark should occur but the flame signal should not be more than 0.5 Vdc.
5. If the flame signal is higher than 0.5 Vdc and the FLAME LED does come on, consult the equipment operating manual and resight the detector farther out from the spark, or away from possible reflection. It may be neces-

sary to construct a barrier to block the ignition spark from the detector view. Continue adjustments until the flame signal due to ignition spark is less than 0.5 Vdc.

NOTE: For R7910 or R7911 controllers with software revision xxxx.2292 or higher, if the above procedures have been attempted and flame signal is still above 0.5 Vdc, use the following procedure:

FOR DIRECT BURNER IGNITION SYSTEMS

- Using the S7999 Operator Interface Module, select the Configure button (lower left corner of the Status page).
- Using the left scroll down function, scroll down to select the System Configuration Parameter page (you will need to be logged in with a password).
- Select Flame Sensor Type parameter.
- Select UV Power Tube with Spark Interference.
- Changing the Flame Sensor Type will require parameter verification.
- Page back one level (upper right screen corner back arrow button).
- Select the Verify button.
- Select Begin.
- Follow the prompts on the Operator Interface.

FOR PILOT SYSTEMS

- Using the S7999 Operator Interface Module, select the Configure button (lower left corner of the Status page).
- Using the left scroll down function, scroll down to select the System Configuration Parameter page (you will need to be logged in with a password).
- Select Flame Sensor Type parameter.
- Select UV Power Tube with Spark Interference.
- Select the Burner Control Ignition Page.
- Select Ignitor On During parameter.
- Select 1st half of PFEP.
- Changing these two parameters will require parameter verification.
- Page back one level (upper right screen corner back arrow button).
- Select the Verify button.
- Select Begin.
- Follow the prompts on the Operator Interface.

Response to Other Ultraviolet Sources

Some sources of artificial light (such as incandescent or fluorescent bulbs, and mercury sodium vapor lamps) and daylight produce small amounts of ultraviolet radiation. Under certain conditions, an ultraviolet detector responds to these sources as if it is sensing a flame. To check for proper detector operation, check the Flame Failure Response Time (FFRT) and conduct Safety Shutdown Tests under all operating conditions.

Flame Signal With Hot Combustion Chamber (All Installations)

- With all initial start-up tests and burner adjustments completed, operate the burner until the combustion chamber is at the maximum expected temperature.
- Observe the equipment manufacturer's warm-up instructions.
- Recycle the burner under these hot conditions and measure the flame signal. Check the pilot alone, the

main burner flame alone, and both together (unless monitoring only the pilot flame when using an intermittent pilot, or only the main burner flame when using DBI). Check the signal at both High and Low Firing Rate positions and while modulating, if applicable.

- Lower the setpoint of the operating controller and observe the time it takes for the burner flame to go out. This should be within four seconds FFRT of the R7910 or R7911 controller.
- If the flame signal is too low or unsteady, check the flame detector temperature. Relocate the detector if the temperature is too high.
- If necessary, realign the sighting to obtain the proper signal and response time.
- If the response time is still too slow, replace the R7910 or R7911 controller.
- If the detector is relocated or resighted, or the R7910 or R7911 controller is replaced, repeat all required Check-out tests.

SAFETY SHUTDOWN TESTS (ALL INSTALLATIONS)

Perform these tests at the end of Checkout, after all other tests are completed. If used, the external alarm should turn on. Press the RESET pushbutton on the R7910 or R7911 Sola Module to restart the system.

- Open a Pre-Ignition Interlock (if PII parameter is enabled) during the STANDBY or PREPURGE period.
 - *Pre-Ignition ILK* fault is displayed on the Operator Interface Module.
 - Safety shutdown occurs.
- Opening a Lockout Interlock during PREPURGE, PILOT IGN, MAIN IGN or RUN period.
 - *Lockout ILK* fault is displayed on the Operator Interface Module.
 - Safety shutdown occurs.
- Detection of flame 240 seconds after entry to STANDBY from RUN. Detection of flame from 10 seconds up to 30 seconds into PREPURGE time.
 - Simulate a flame to cause the flame signal voltage level to rise above the flame threshold value for 240 seconds after entry to STANDBY from RUN and also simulate a flame signal for 10 seconds to 30 seconds for PREPURGE.
 - *Flame Detected out of sequence* fault is displayed on the Operator Interface Module.
 - Safety shutdown occurs.
- Failure to ignite pilot or Main Burner (DBI setup).
 - Close pilot and main fuel manual shutoff valve(s).
 - Cycle burner on.
 - Automatic pilot valve(s) or main valves (DBI) should be energized but the pilot or main burner (DBI) cannot ignite.
 - *Ignition Failure* fault is displayed on the Operator Interface to indicate the fault.
 - Safety shutdown occurs.
- Failure to ignite main (only interrupted pilot application).
 - Open the manual pilot valve(s); leave the main fuel manual shutoff valve(s) closed.
 - Depress the RESET button.
 - Start the system.

- d. The pilot should ignite and the flame signal should be above the flame threshold value but the main burner cannot light.
 - e. The flame signal should drop below the flame threshold value within the FFRT after the interrupted pilot goes out.
 - f. *Ignition Failure* fault is displayed on the Operator Interface Module.
 - g. Safety shutdown occurs.
6. Loss of flame during RUN.
- a. Open the main fuel manual shutoff valve(s) and open manual pilot shutoff valve(s).
 - b. Depress the RESET button.
 - c. Start the system. Start-up should be normal and the main burner should light normally.
 - d. After the sequence is in the normal RUN period for at least 10 seconds with the main burner firing, close the manual main fuel shutoff valve(s) to extinguish the main burner flame. (On intermittent pilot applications, also, close the pilot manual shutoff valve.)
 - e. The flame signal should drop below the flame threshold value within the FFRT of the R7910 or R7911 Sola Module after the main flame and/or pilot goes out.
 - f. *Main Flame Fail* fault is displayed on the Operator Interface Module.
 - g. Safety shutdown or recycle, then lock out on failure to light the pilot depending on the configuration the R7910 or R7911 Sola Module.
7. Open a Pre-Ignition Interlock after the first 5 seconds of POSTPURGE.
- a. Open the main fuel manual shutoff valve(s) and open manual pilot shutoff valve(s).
 - b. Depress the RESET button.
 - c. *Pre-Ignition ILK* fault is displayed on the Operator Interface Module.
 - d. Safety shutdown occurs.

IMPORTANT

If the R7910 or R7911 Sola Module fails to shut down on any of these tests, take corrective action; refer to Troubleshooting and the Sola Module diagnostics and return to the beginning of all checkout tests.

When all checkout tests are completed, reset all switches to the original status. Remove any jumpers that you may have installed for testing.

TROUBLESHOOTING

System Diagnostics

Troubleshooting control system equipment failures is easier with the R7910 or R7911 Sola Module self-diagnostics and first-out annunciation. In addition to an isolated spst alarm relay (audible annunciation), the R7910 or R7911 Sola Module provides visual annunciation by displaying a fault

code and fault or hold message at the S7999 Operator Interface Module. The R7910 and R7911 Sola Modules provide many diagnostic and alert messages for troubleshooting the system.

Self-diagnostics of the R7910 and R7911 Sola Modules enables them to detect and annunciate both external and internal system problems. Fault messages, such as interlock failures, flame failures and false flame signals are displayed at the Operator Interface Module and annunciated at the R7910 or R7911 Sola Module by the ALARM LED.

The Operator Interface displays a sequence status message indicating: STANDBY, PURGE, PILOT IGN, MAIN IGN, RUN and POSTPURGE. The selectable messages also provide visual indication of current status and historical status of the equipment such as: Flame Signal, Total Cycles, Total Hours, Fault History, Diagnostic Information and Expanded Annunciator terminal status (if used). With this information, most problems can be diagnosed without extensive trial and error testing.

Diagnostic Information Lockout and Alert History Data are available to assist in troubleshooting the Sola Module.

The module provides diagnostic information to aid the service mechanic in obtaining information when trouble-shooting the system.

Diagnostic Information Index

The R7910 and R7911 Sola Modules monitor digital and analog input/output (I/O) terminals and can display the status of the terminal at the Operator Interface Module. The display shows the actual status of the terminal. If voltage is detected at a digital I/O terminal, the LED turns green next to the terminal energized, but if no voltage is detected at the terminal, the LED will be red. Actual analog I/O values are displayed on the operator interface module.

Historical Information Index

The R7910 and R7911 Sola Modules have nonvolatile memory that allows them to retain historical information for the fifteen most recent lockouts. Each of the fifteen lockout files retains the cycle when the fault occurred, the hour of operation when the fault occurred, a fault code, a fault message and burner status when the fault occurred. In addition to the lockout files, the R7910 and R7911 Sola modules retain fifteen alert files.

SERVICE NOTES:

1. Reset the device module by pressing the RESET push-button on the device or pressing a remote reset push-button wired into connector J10. A power-up reset causes an electrical reset of the module but does not reset a lockout condition.
2. Use the connector screw terminals to check input or output voltage.

Alert and Fault Message information is shown in the appendix of the R7910 and R7911 Product Data Manual.

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