



**AdvantagePlus Sequence of Operations**  
**Effective 06/01/09**

**SEQUENCE OF OPERATIONS**

You can identify this product by the bright green label on the access cover. Primary voltage input is 120VAC. The control constantly monitors the water temperature via the thermistor so that the water temperature is within the user-selected temperature range. Control monitors the inputs for fault conditions such as scalding water, low water level in tank, blocked venting, flame rectification and loss of flame signal, and fan speeds.

This is a sealed combustion direct vent water heater. It uses a spark igniter for main burner and uses a pressure switch in the exhaust vent tube to monitor venting. The control makes three ignition attempts for main burner (flame rectification). If there is no burner, the unit will reset and try again after one hour. The control is a continuous retry. This means in the event of a fault, it will always re-attempt ignition every hour as long as there is power to the unit.



Tank is full of water.  
  
 Gas supply is connected.  
  
 Unit is plugged into a 3-prong plug or hard wired inside the electrical connection box.

A local ON/Off switch will be a big help in power control and troubleshooting. Socket must be wired polarity correct with an earth ground. Black wire to brass screw; white wire to silver screw; green wire to ground.



Turn on power to the AdvantagePlus.  
  
 120V is passed to the control at the X-6 bus.  
  
 At power ON and a demand for heat, the control performs a self-test diagnostic routine.

If the self-check fails, the control locks out with an error code on the LED panel.





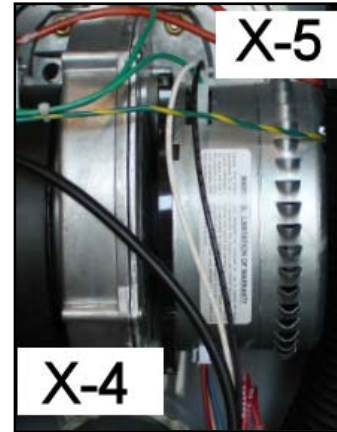
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120V power is present at the blower motor.

There are two Molex plugs on the blower. One is the power feed (X-5) Molex; the other controls the blower motor functions (X-4 Molex).

The control board sends signals to the blower via the X-4 connection. This will cause the blower to operate.

The control is also monitoring low voltage and will display the error code **(LOU)** in the event it does not have the proper voltage.



Call for Heat –

Control checks for three things:

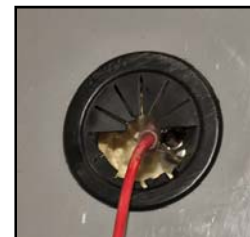
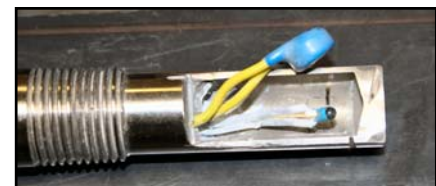
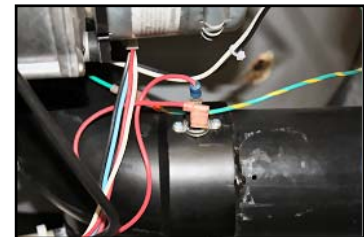
1. a closed vent thermal switch
2. a closed ECO switch (water not too hot)
3. Water temp lower than set point
4. low water cut off is OK

If the vent thermal switch exceeds 190<sup>0</sup>F, then the over-temp switch will activate. IF the thermal switch is OPEN, you will get an error code **(F01)**.

If the ECO senses water temperatures above 194<sup>0</sup>F, you will get an error code **(F00)**.

If there is a problem with the water temperature probe, you will get an error code **(F02)**.

If the water level inside the tank is too low, you will get an error code **(LEO)**.





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The blower motor turns on at a slower speed and will conduct a prepurge to up to 8 seconds.

Exhaust vacuum switch:  
Breaks on pressure rise;  
 $-1.50 \pm .05$  in w.c.

The control is monitoring the NORMALLY CLOSED venting pressure switch. It is looking for a clear vent.

IF the vent is not clear for combustion gases, the switch will OPEN causing an error code (FLU).

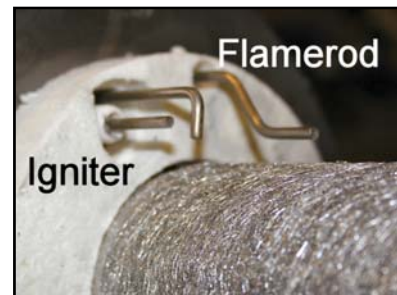


Ignition attempt

Control will send @ 10,000 DC current to the spark igniter.

You may be able to hear the unit sparking.

Visually verify the spark igniter inside the combustion chamber

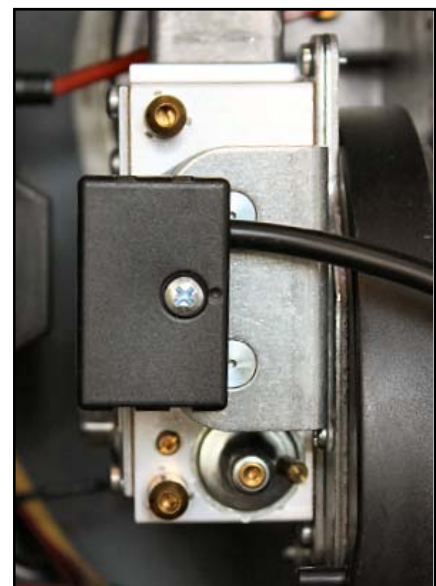


Gas valve opens.

You may hear an audible noise when the gas valve solenoids engage.

Visually verify main burner flame is present.

You can measure inlet gas pressure with the brass nipple fitting at the top of the gas valve (7" - 14" w.c.)

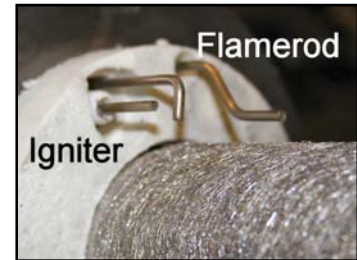




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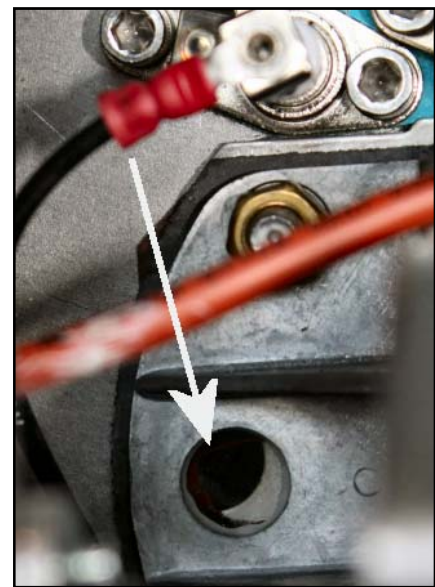
Flame is rectified.  
  
 There is always a flame rectification circuit check (@9 micro amps) while the main burner is operating.

After flame has been recognized (rectified), the igniter will turn off.  
  
 IF the main burner fails during heating, the unit will recycle and attempt ignition.



Water heats to thermostat setting.  
  
 Control is monitoring water heater with:  
  
 ECO monitoring water temperature. Trips at 194°F.  
  
 Blower motor venting thermal safety switch trips at 190°F.  
  
 Low water cut-off and ECO are monitoring water conditions inside the tank.

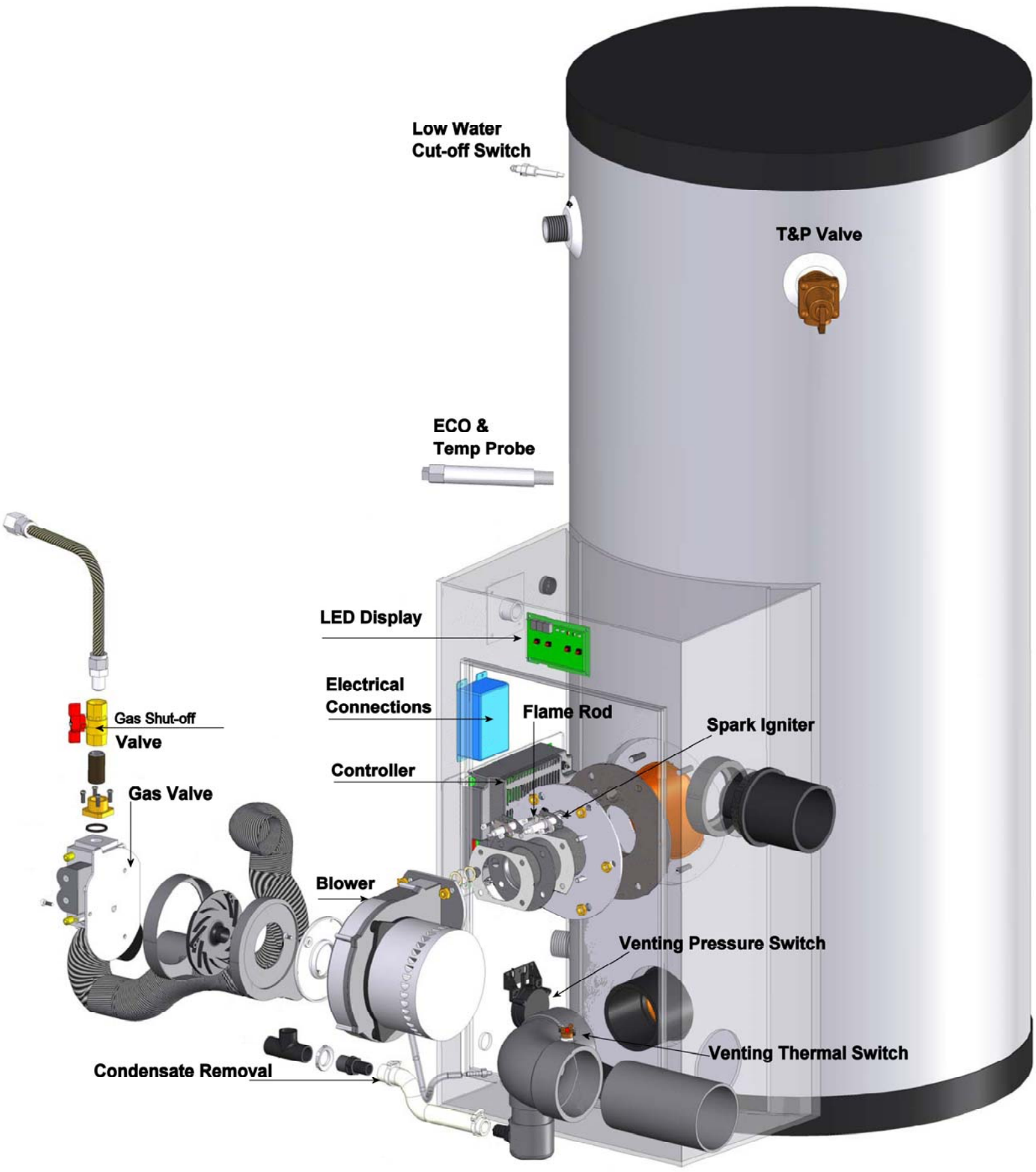
You can observe the flame thru the sight glass window directly beneath the flame rod.



Water is heated.  
  
 Control module shuts off all power to the gas valve.  
  
 Blower continues a 20 second post purge to vent excess heat and combustion gases.  
  
 Unit is in stand-by mode.

In stand-by mode, the control module constantly monitors the water temperature via the thermistor to ensure the water inside the tank is within the user-selected range.  
  
 Unit monitors control health, other fault conditions.





Low Water  
Cut-off Switch

T&P Valve

ECO &  
Temp Probe

LED Display

Electrical  
Connections

Gas Shut-off  
Valve

Gas Valve

Blower

Condensate Removal

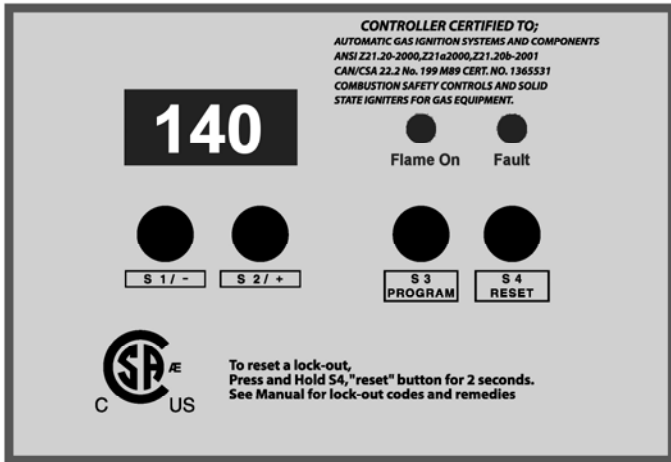
Flame Rod

Spark Igniter

Controller

Venting Pressure Switch

Venting Thermal Switch



To adjust temperature of the stored water press and hold **S3** for 2 seconds. The first item is: **DU** Water Temperature Set Point – factory set at 119°F, adjustable down by pressing **S1** key to 70°F and adjustable up by pressing the **S2** key up to 159°F. The **S3** key is then pressed again momentarily to display **DH**, the differential which is factory set at 7°F and adjustable down to 1°F by pressing the **S1** key and up to 18°F by pressing the **S2** key. The **S3** key is pressed again momentarily to display the choice of Fahrenheit “F” factory default or Celcius by pressing the **S1** key. When finished, press the **S3** key one final time to place unit back into operation. The control automatically re-starts if no key is pressed for 2 minutes.

#### TEST MODE (When in the TEST mode, the unit will go to main burner.)

This function is intended to simplify the gas valve adjustment if needed. Listed below are the recommended limits on each Water Heater and the Combustion Settings. Automatic modulation does not take place when the controller is in Test mode, only temperature limitation based on the AdvantagePlus set point. The user will be allowed to increase or decrease the fan speed by pressing in either the **S1/-** or **S2/+** keys.

To activate the Test mode simply press the **S2/+** and **S3/Program** key together for 1 second. Once activated, you will see in the display **Ser** and the actual fan speed. The measurement of the combustion levels should always be taken at the highest and lowest fan speed. After 10 minutes, the Test mode stops automatically. To exit Test Mode press **S1/-** and **S2/+** key together for 1 second.

When in the TEST mode, the unit will go to main burner

#### STATUS MENU

Installers are also able to check the current status of the AdvantagePlus parameters by pressing **S4/RESET** key for 3 seconds. Once activated, the display will show **d1** alternating value of the actual upper supply tank temperature. Actual values are displayed for each function. To view the next value simply press the **S/4** key to go to the next displayed value. Listed below are the values which can be displayed. These values cannot be changed. To exit this menu, simply press **S3/Program** key to resume normal operation.

#### Function Value

- d1 — Actual Temperature from tank sensor
- d2 — Actual Temperature from tank sensor
- d3 — **(Not used)**
- d4 — **(Not used)**
- d5 — **(Not used)**
- d6 — Actual Fan speed multiplied by 10  
(Example: If fan speed displayed is  
410 x 10 = 4100 actual fan speed)
- d7 — Actual **microamp** current read from Flame Rectification probe
- d8 — **(Not used)**
- d9 — **1** = Call for Heat **0** = Standby
- d10 — Actual Status bus communication  
**co** = connected, **nc** = not connected
- d11 — **(Not used)**
- d12 — Power On Hours (Example:Hours x 1000  
Ex. 0.1 = 100 hrs. or 1.0 = 1000 hrs.)
- d13 — Total Water Heating Hours (TW – Hrs. x 1000)
- d14 — **(Not used)**
- d15 — Passed Ignition Attempts (Passed ignition x 1000)

# TROUBLESHOOTING

**Table 6-1: 926 Control Board Error Codes**

Code	Description	Remedy
<b>F00</b>	High temperature switch limit exceeded (194°F [90°C])	<ol style="list-style-type: none"> <li>1. Try reset, if F00 repeats, create a demand for hot water (<b>▲ DANGER: use caution to prevent burn injury</b>) <u>If water is above 194°F (90°C)</u> test temperature sensor with an ohmmeter. (Refer to resistance chart, this section.) Replace bad sensor. <u>If water is below 194° (90°C)</u> test high temperature switch and wiring with ohmmeter. Switch should be closed at this point, if not, replace switch.</li> <li>2. If unit did reset successfully, let the unit run and go into the status menu to check the temperature sensor. If reading displayed does not make sense, check sensor with ohmmeter. (Refer to resistance chart this section.) Replace bad sensor. Do an OHMs reading on sensor to check continuity.</li> </ol>
<b>F01</b>	Vent temperature limit exceeded	<ol style="list-style-type: none"> <li>1. Inspect all flue piping. If the flue is damaged or shows signs of overheating then repair or replace the flue parts as necessary before proceeding.</li> <li>2. If the flue piping system is intact, not damaged and there is no sign of the flue overheating such as discoloration or melting, then push the red reset button on the flue switch.</li> <li>3. Be sure the unit is connected to a water supply and full of water.</li> <li>4. Push the RESET button on the unit control panel. The appliance should light. If the appliance lights proceed to step 5. If the appliance does not light and the display again begins to flash F01, inspect the wiring to the flue switch, repairing or replacing as necessary. If the wiring is intact, replace the flue switch using care to mount the new flue switch in the same position and mounting holes as the old one. If the display flashes a code other than F01, follow the troubleshooting guide for that code.</li> <li>5. Observe operation for 5 minutes. Place the probe of an exhaust analyzer into the flue system within 6 feet of the unit appliance. The exhaust temperature should not rise above 190°F (88°C) after several minutes of operation.</li> <li>6. If the flue temperature is below 190°F (88°C) and the appliance again goes into lockout displaying F01, replace the flue switch using care to mount the new flue switch in the same position and mounting holes as the old one. If the display flashes a code other than F01, follow the troubleshooting guide for that code.</li> <li>7. If the flue temperature increases to over 190°F (88°C), Consult the AdvantagePlus factory for further assistance.</li> </ol>
<b>F02</b>	Interrupted or shorted temperature sensor	Check the electrical connection to the temperature sensor, if connection is okay, replace bad sensor.
<b>F05</b>	Temperature sensor exceeds 194°F (90°C)	If water in tank is not greater than 190°F (88°C), check wiring and repair if faulty. If the wiring is okay, check sensor with ohmmeter and compare to reading in resistance chart. If reading does not agree with water temperature, replace bad sensor.
<b>F09</b>	No flame detected – The unit will make three attempts at ignition before the control goes into this lockout condition. Will reset in 1 hour.	<ol style="list-style-type: none"> <li>1. Watch the igniter through the observation window provided.</li> <li>2. If there is no spark, check the spark electrode for the proper ¼" (0.64 cm) gap.</li> <li>3. Remove any corrosion from the spark electrode and flame rectifier probe.</li> <li>4. If there is a spark but no flame, check the gas supply to the water heater.</li> <li>5. If there is a flame, check the flame sensor.</li> <li>6. Check any flue blockage or condensate blocks.</li> </ol>
<b>F10</b>	Loss of Flame Signal – The unit will relight 4 times before the control goes into this lockout condition. Will reset in 1 hour.	<ol style="list-style-type: none"> <li>1. Monitor the gas pressure to the unit while in operation.</li> <li>2. Assure that the flame is stable when lit.</li> <li>3. Check to see if the green light on the display module is out while the water heater is running.</li> <li>4. If the green light doesn't come on or goes off during operation check the flame signal on the status menu.</li> <li>5. If the signal reads less than 1 microampere, clean the flame rectifier probe.</li> <li>6. If the flame rectifier probe continues to read low, replace it.</li> </ol>
<b>F11</b>	False Flame Signal – The water heater will lock out if it senses a flame signal when there should be none present.	<ol style="list-style-type: none"> <li>1. Turn the gas off to the unit at the service valve.</li> <li>2. If the flame signal is still present replace the igniter.</li> <li>3. If the flame signal is not present after turning off the gas supply, check the gas valve electrical connection.</li> <li>4. If there is no power to the gas valve, remove the valve and check for obstruction in the valve seat or replace the gas valve.</li> <li>5. Turn the gas on at the service valve after corrective action is taken.</li> </ol>
<b>F13</b>	Combustion Fan Speed Incorrect – The water heater will lock out if it senses that the fan speed is less than 70% of expected rate for more than 60 seconds.	<ol style="list-style-type: none"> <li>1. Check the combustion air fan wiring.</li> <li>2. Replace the combustion air fan.</li> <li>3. Replace the control board.</li> </ol> <p><b>Test: Disconnect X-4 Molex from the blower. This will separate it from the control board. The blower motor should run full speed. If not, replace the blower.</b></p>

**NOTE:** IF YOU REPLACE A PART TO REMEDY A FAULT, IT IS RECOMMENDED THAT YOU CYCLE THE UNIT AT LEAST THREE OR FOUR TIMES TO ASSURE THE FAULT HAS BEEN RESOLVED.

**Table 6-2: AdvantagePlus Resistance Table for Supply Temperature Sensor**

High/Low Temp. Sensor Temp.	Resistance (ohms)
32°F (0°C)	32550
41°F (5°C)	25340
50°F (10°C)	19870
59°F (15°C)	15700
68°F (20°C)	12490
77°F (25°C)	10000
86°F (30°C)	8059
95°F (35°C)	6535
104°F (40°C)	5330
113°F (45°C)	4372
122°F (50°C)	3605
131°F (55°C)	2989
140°F (60°C)	2490
149°F (65°C)	2084
158°F (70°C)	1753
167°F (75°C)	1481
176°F (80°C)	1256
185°F (85°C)	1070
194°F (90°C)	915
202°F (95°C)	786
212°F (100°C)	667

Control board keeps error codes even if there is a power loss.

"F" codes are hard lockout codes; press S4 to reset.

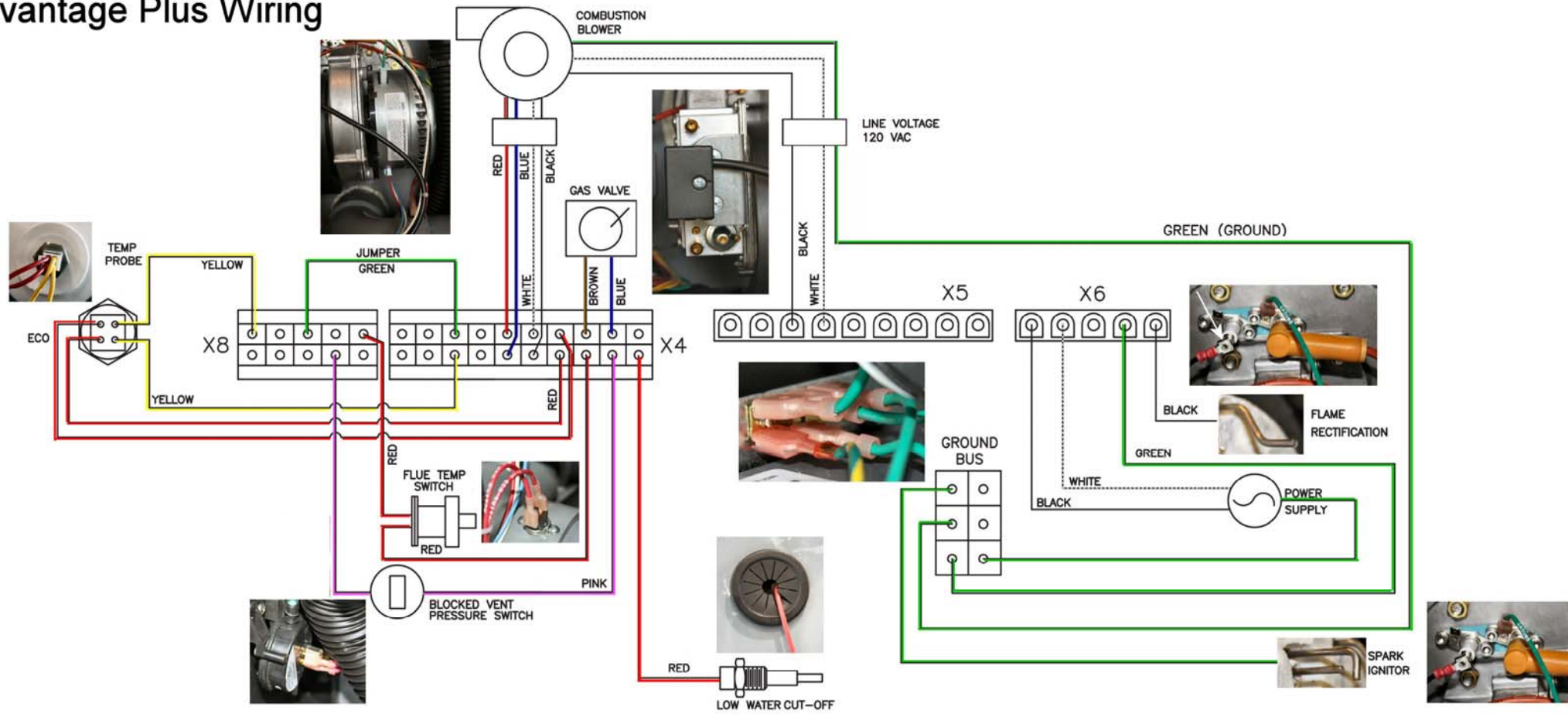
"E" codes are soft lockout codes; they will reset once condition clears.

**Table 6-3: 926 Control Board Error Codes**

Code	Description	Duration	Corrective Action
<b>E13</b>	Combustion Fan Speed Low. The combustion air fan speed less than 70% of expected.	60 Sec.	<ol style="list-style-type: none"> <li>1. Check the combustion air fan wiring.</li> <li>2. Replace the combustion air fan.</li> <li>3. Replace the control board.</li> </ol>
<b>NC</b>	Power dropped below 77 VAC; or no neutral line.	Until Corrected	Check and repair as necessary. This is a power problem.
<b>LEO</b>	Water level in tank is low	Until Corrected	<ol style="list-style-type: none"> <li>1. Be sure all air is bled from system.</li> <li>2. Inspect low level switch and wiring for damage and repair as necessary.</li> </ol>
<b>FLU</b>	Blocked Vent Pressure Switch Open	Until Corrected	<ol style="list-style-type: none"> <li>1. Assure that the vent is not blocked</li> <li>2. Check the blocked vent pressure switch operation by applying a jumper. (If the switch is not functioning properly, replace it.)</li> </ol>
<b>LOU</b>	24 VAC low	Until Corrected	<ol style="list-style-type: none"> <li>1. Check line voltage. Must be between 100-128 VAC.</li> <li>2. If LOU only occurs when burner tries to light, check gas valve for excessive current draw.</li> <li>3. If LOU is present with the low voltage harness disconnected from the 926 control board, replace the 926 control board.</li> <li>4. Remove 10 pin Molex connector from customer connection board. If LOU code clears, then the problem is with external sensor wiring. Examine external sensor wiring for shorts to ground repairing as necessary.</li> <li>5. If LOU code is still present disconnect low water cutoff to see if LOU code clears. Replace faulty part.</li> </ol>
<b>PP</b>	Control board has been programmed; but not reset	Until Corrected	Press S4 to reset
F15 F16 F30 F31 F32 F33	Control board programming or internal faults	Until Corrected	<p>These are un-recoverable errors.</p> <p>Replace control board.</p>



# Advantage Plus Wiring



# Advantage Plus Molex Connections

