SECTION 6: TROUBLESHOOTING

⚠ DANGER	
	
Electrical Shock Hazard	**Severe Injury Hazard**
Disconnect electric before service. **More than one disconnect switch may be required to disconnect electric from equipment.** **Equipment must be properly grounded.**	**Do not enter equipment while in operation.** **Equipment may start automatically.** **Do not operate with door open.** **Installation, operation and service must be done by a trained technician only.**
Failure to follow these instructions can result in death, electrical shock or injury.	

⚠ WARNING				
				
Explosion Hazard	**Fire Hazard**	**Falling Hazard**	**Burn Hazard**	**Cut/Pinch Hazard**
Turn off gas supply to equipment before service.	**Keep all flammable objects, liquids and vapors the minimum required clearances to combustibles away from equipment.** **Some objects will catch fire or explode when placed close to equipment.**	**Use proper safety equipment and practices to avoid falling.** **Do not use any part of equipment as support.**	**Allow equipment to cool before service.** **Internal components of equipment may still be hot after operation.**	**Wear protective gear during installation, operation and service.** **Edges are sharp.**
Failure to follow these instructions can result in death, injury or property damage.				

6.1 Initial Checks

When encountering any abnormal operation or fault conditions of the equipment, all the troubleshooting should start with the following initial checks. If a problem is discovered in these initial checks, it must be corrected before moving on in the troubleshooting.

1. The air handler is equipped with direct-fired gas heat. Several cooling options are also available (DX, chilled water).

2. If the air handler does not include a feature as described in this Troubleshooting Guide, disregard information provided for that feature. (As indicated above in item #1, some features are optional and not included with every air handler.)
3. The following voltages are used for the control circuitry: 120 volts AC, 24 volts AC, 5 volts DC, 0-20 VDC and 0-10 VDC.
4. Refer to the air handler wiring diagram for aid in locating the error.
5. The modulating / regulating valve (direct-fired models) and its associated circuitry is powered by a 0-20 VDC signal. The RAPID® InfinityPro controller provides a 0-10 VDC signal to a signal conditioner, which then converts the signal to 0-20 VDC.

6.2 General Troubleshooting

1. Compare voltage and phase of power supply on site with rating plate information.
2. Review wiring diagram. Do the electrical connections match the supplied wiring diagram?
3. Compare the gas type and supply pressure on site with rating plate information.
4. Check for proper blower rotation on air handler.
   - Blowers paired with a three phase motor can be reversed by swapping any two incoming power legs. For blowers powered by a single phase motor, refer to the motor rating plate for reversing instructions.
5. For additional information on supplemental temperature sensor information, *See Page 56, Section 6.3.9*.

6.2.1 Fuses / Overloads Tripping

Frequent tripping of the electrical safety devices often indicate an electrical or duct design problem.

Investigate carefully to determine the underlying cause, consulting the National Electrical Code as necessary. Possible causes for tripping include:

1. The voltage supply to the air handler is too low. Check the transformer taps. Check wire size and length for excessive voltage drop.
2. The feeder breaker or fuses are undersized. Correct the improper component.
3. Air handler CFM is too high, causing excessive current draw. This occurs when the actual static pressure is significantly less than expected and specified. Consult Rapid Engineering LLC if additional assistance is required.

6.2.2 Flame Relay

The flame relay is equipped with an interrupted pilot. The pilot is extinguished after the main flame is established.

6.3 Alarm Description

There are a number of safety features included with the air handler. If a problem occurs during normal operation, a red alarm light on the handheld keypad will illuminate and an alarm description will appear. This is an indication to the user there is an alarm condition.

To reset the alarm light, push and hold the FN button, then press MUTE. To permanently clear an alarm light, the fault must be corrected. Based on information below, fault can properly be corrected.

6.3.1 Alarm Description: Fan Contactor Not On

This alarm occurs if input number 5 on the controller fails to activate while the fan is commanded to start and the unit is in the occupied period.

   a. Reset the overloads. If the overloads continue to trip, check motor running amperage against motor name plate full load amperage. If greater than full load rating, determine cause of over amperage. (e.g., low service voltage, excessive voltage drop.)

4. The auxiliary contact is defective.

   a. Replace the fan contactor (built in)

5. Check for loose wiring between terminals

6. Defective contactor.

   a. Check for voltage (120 volts) at the contactor coil. If there is voltage and the contactor does not pull in, the energizing coil is defective. If the contactor pulls in but does not start the fan, the contacts are defective. Replace the contactor.

7. An interlock (smoke detector) is open and power to the control circuit has been interrupted.

   a. Check appropriate interlock.

6.3.2 Alarm Description: Fan Contactor On When It Should Be Off

This alarm occurs when input 5 at the controller is on when it should be off. It indicates the supply fan contactor has been activated before the fan has been commanded on or after the fan has been commanded off. Since this contactor should not be powered when the fan is not commanded to be on, an alarm is reported.

1. The auxiliary contact to the starter is jumped and/or shorted.

   a. Remove jumper or replace auxiliary contact on starter.

2. The motor contactor has failed closed.

   a. Replace the contactor.

3. The fan motor initiate relay is wired incorrectly or defective.

   a. Verify the wiring is connected to the relay coil and contacts as is illustrated on the wiring diagram. Rewire relay if necessary.

   b. If the normally open contacts on the relay have failed closed, replace the fan motor initiate relay.

4. The fan relay on output relay is wired incorrectly or has failed closed.

   a. Verify the wiring is connected to the relay coil and contacts as is illustrated in air handler wiring diagram. Rewire relay if necessary.

   b. If the normally open contacts on the relay have failed closed, replace the fan relay on output relay.

6.3.3 Alarm Description: Damper for Heat Air Not Open

This alarm occurs when the end switch in the heat air damper fails to close on input number 4 at the controller.

1. A mechanical problem is preventing the damper from opening.

   a. Check for and remove any obstructions (ice formations) that may be preventing the damper from opening when powered.

   b. Disconnect the linkage and manually operate the damper to determine the cause of binding. Clean, lubricate, adjust, and repair as necessary.

2. The wiring for the heat air damper or the limit switch is loose or defective.

   a. Trace the voltage from the output relay to the motor and back to the input relay and repair the problem.

3. The heat air damper limit switch is defective or needs adjustment.

a. Observe the limit switch response to successively energizing and de-energizing the damper motor. Adjust the limit switch for appropriate response to operation of the motor. If the switch is unable to be adjusted properly, replace the motor.

4. The heat air damper output relay or limit switch input relay are defective.
    a. Verify wiring is connected to the relay coil and contacts as is illustrated in air handler wiring diagram.
    b. Check proper contact operation as damper should open and close when relay is energized and de-energized. Replace relay if necessary.
5. The heat air damper motor is defective.
    a. If the motor fails to open when power is applied, (and the damper operation is not restricted) replace the motor.
6. An interlock (smoke detector or access door) is open and power to the control circuit has been interrupted.
    a. Check appropriate interlock.

6.3.4 Alarm Description: Damper for Heat Air Not Closed

This alarm occurs when input number 4 on the controller remains open and the heat air inlet damper should be closed. The damper for the heat inlet air fails to close when the fan is shut off. The damper remains open when fan is off. The heat air damper actuator is a power open spring return actuator.

1. A mechanical problem is preventing the damper from closing.
    a. Check for and remove any obstructions (ice formations) that may be preventing the damper from opening when powered.
    b. Disconnect the linkage and manually operate the damper to determine the cause of binding. Clean, lubricate, adjust, and repair as necessary.
2. The heat air damper limit switch is defective or needs adjustment.
    a. The damper is closed but the limit switch in the actuator is still made.
    b. Adjust the switch or replace the actuator as needed.
3. The heat air damper output relay has failed
    a. Check proper contact operation as damper should open and close when relay is energized and de-energized. Replace relay if necessary.

6.3.5 Alarm Description: Burner Lockout Or Safety SW Not Made

This alarm occurs when input number 6 on the controller drops out or is not made when there is a call for heat. Prior to generating this alarm, the normal start-up sequence includes a time delay of 120 seconds from the time the heat start relay, output 3, is energized. There are a number of safety devices wired in series with each other, if any of them open during a call for heat, the burner is de-energized and this alarm is generated. See below for possible causes.

1. Possible Cause of Burner Lockout or Safety SW Not Made: Airflow

An airflow switch on the air handler measures the pressure drop across the burner to ensure proper air velocity for combustion. The switch is pre-set to open if the airflow is low and the pressure drops fall below 0.2" w.c.. The switch additionally includes a pre-set to open if the airflow is too high and the pressure drop across the burner exceeds 1.35" w.c.. The target standard operating pressure drop is 0.9" w.c.. This can be measured by connecting a monometer to airflow switch pitot tubes.

1. Belts are loose, sheaves are worn.

a. Tighten or replace belts per Rapid Engineering LLC specifications and belt manufacturer's recommendations. NOTE: Never replace only one belt in a set, as belts will elongate. Replace entire set if necessary.

b. Check for worn drive sheaves and replace as needed.

2. Filters are dirty, preventing adequate airflow.

   a. Replace the filters.

3. Airflow switch tubing is plugged, preventing it from closing.

   a. Clear the tubing.

4. Fan rotation is reversed.

   a. Turn off disconnect switch and reverse two power wires, preferably at the line side of the disconnect. (High importance for two speed motors) The wires on the load side of the disconnect may be reversed for single speed.

5. Airflow switch is defective and has failed to close.

   a. Measure the pressure drop across the burner and compare it to the set point of the airflow switch to determine if the switch is bad. Replace switch if necessary.

6. Supply or discharge damper is not open.

   a. Check linkage and repair.

7. Access door is open.

   a. Close the door.

8. Fan is overloaded.

   a. Verify and compare the actual external static installed (ductwork) to design external static (ESP) to make sure the fan is not overloaded.

   b. Consult Rapid Engineering LLC for additional information.

2. Possible Cause of Burner Lockout or Safety SW Not Made: High Gas Pressure Switch

The high gas pressure switch is a normally closed switch that opens on a pressure rise to protect the equipment from over firing. The factory set point is 1.5" w.c above the high fire gas pressure set point. FM manifolds are manual reset type, XL and ANSI manifolds are automatic reset type.

1. The burner high fire gas pressure is set to high.

   a. Compare the actual high fire gas pressure to the rating plate on the air handler. Adjust the actual gas pressure as needed.

2. The utility gas pressure exceeded the air handler's rating, overpowering the modulating / regulating valve's pressure regulator.

   a. Install an additional pressure regulator to reduce the incoming pressure to the air handler's rating.

3. The modulating / regulating valve's pressure regulator has failed.

   a. Replace the regulator.

4. The high gas pressure switch is set too low.

   a. Adjust the gas pressure switch setting to 1.5" w.c above the high fire setting.

5. The high gas pressure switch is defective.

   a. Measure gas pressure at switch. Determine if gas pressure is actually lower than the high gas pressure switch set point. Replace the switch if necessary.

3. Possible Cause of Lockout or Safety SW Not Made: Low Gas Pressure Switch

The low gas pressure switch is a normally closed switch that opens on a pressure fall to protect equipment from under firing and potentially deliver unburned fuel to the conditioned space. Consult the equipment data plate for the proper setting. FM manifolds are manual reset type, XL and ANSI manifolds are automatic reset type.

1. The manual gas valve is closed.
    a. Open manual gas valve
2. The utility inlet gas pressure dropped lower than the minimum inlet supply gas pressure required for the air handler.
    a. Investigate causes for low supply gas pressure. Possible causes could be a valve closed down-stream or insufficient pipe sizing to air handler.
    b. Close manual gas valve and remove any obstructions found in gas line.
3. The switch is not set properly.
    a. The switch should be set to the minimum inlet gas pressure setting as indicated on the air handler rating plate.
4. The low gas pressure switch is defective
    a. Verify the supply inlet gas pressure is higher than switch set point. If switch will not close, replace it.

4. Possible Cause of Lockout or Safety SW Not Made: High Temperature Limit Switch Tripped

The supply air high temperature limit switch is a normally closed switch factory set at 150 degrees Fahrenheit. The switch opens when the supply air exceeds the set point of the switch. The high temperature limit switch is a manual reset. The purpose of the high temperature limit switch is to prevent damage to the air handler fan motor and drive.

1. The maximum discharge temperature set point is set to high.
    a. Set the maximum discharge air temperature set point to 95 degrees Fahrenheit.
2. The modulating regulating valve high fire gas pressure regulator is set to high.
    a. Setup the modulating regulating valve to meet the factory specifications for the air handler.
3. The high temperature limit switch is set too low.
    a. Set the switch for 150 degrees Fahrenheit.
4. The high temperature limit switch is defective.
    a. Replace the switch.

5. Possible Cause of Lockout or Safety SW Not Made: Burner Control Safety Lockout

The flame safety burner control defaults into safety lockout during certain conditions. The flame relay utilizes LEDs to signify what step in the process it is at - for more information on the flame relay refer to Bananza B-Series Operation and Maintenance manual.

1. No flame signal present during the trial for ignition period.
    a. Check that the supply gas pressure meets that air handler specifications.
    b. Make sure all of the manual shut off valves are open.
    c. Check the pilot line gas pressure at the "T" in the pilot line down stream of the pilot valve solenoid and the pilot regulator. Typical pilot line gas pressure is approximately 2" w.c differential resulting in a pilot flame about the size of a baseball. If no pressure is present either the pilot regulator or pilot solenoid valve may be defective.
    d. Check the igniter, clean or replace if needed.

e. Remove and clean the flame rod.

f. Check the ignition transformer; make sure the wiring to the igniter is good and not grounded out.

2. The flame signal is lost during the main flame establishing period or during the run period.

   a. Make sure the burner orifices are clean.

   b. Remove and clean the flame rod.

   c. Check the burner low fire setting. The flame length at a minimum firing rate must be long enough for the flame rod be enveloped by the flame.

   d. Make sure the primary and block gas valves are opening during the main flame establishing period.Optimum low-fire flame length setting is 1" - 2". Ensure that there is a continuous ribbon of flame with no gaps. Gaps are most likely to occur at "T" intersections on the burner.

6.3.6 Alarm Description: Low Supply Air Temp Shutdown

This alarm occurs when the supply air temperature drops below the Fan Off If Supply Air Temp Below setting for more than 5 minutes and there is a call for heat.

1. Heat system failure.

   a. The control module detects problems with other areas of operation, it will not allow the burner to light. This, in turn, may allow the supply air to fall below the low temperature set point for 5 minutes.

   b. Check the Alarms log to see if another code has preceded it by 5 minutes and follow that alarm code's explanation of possible trouble.

2. The burner requires maintenance.

   a. Make sure the burner orifices are clean.

   b. Check burner gas pressure and compare it to the unit rating tag, adjust if needed.

3. The manual gas valve is closed or there is a blockage in the gas line.

   a. Open the valve or open the dirt leg cap and remove any blockage.

4. The discharge sensor, its cable or its connection to the control module is off or defective.

   a. Verify proper discharge sensor operation and cable connections and repair as necessary.

5. The connection from the control module to the modulating valve is defective or off.

   a. Repair the connector or cable as necessary.

6. Low limit set point is set too high. (Factory default is 40 degrees Fahrenheit.)

   a. Adjust the low limit set point to an appropriate value.

7. The modulating gas valve does not open to allow high fire. The valve should modulate progressively more open as the voltage from the controller rises above 5 volts DC, and continue opening until the voltage exceeds 15-19 volts DC.

   a. Repair or replace the valve and adjust high and low-fire flames as needed.

8. Ignition did not occur.

   a. The igniter is defective, fouled or shorting against the burner end plate. Check that it is properly installed, has a clean (no carbon) gap of about 1/8" (3.2mm) and no cracks in the ceramic. Clean the electrode with a wire brush if necessary.

   b. The ignition transformer is not receiving power or putting out the proper (6000V) voltage. Determine the cause and repair.

   c. If spark is present in the test above, air may be present in the gas line. Purging of air in a new line may be required. An LP system may need purging if the tank ran out of gas before refilling.

9. The flame verification signal is not present. Possible causes include:
    a. Dirty Flame Rod. Clean the flame rod.
    b. Flame Rod not secured firmly to mount. Tighten retaining screw.
    c. Defective Flame Rod. Replace the Flame Rod.
    d. Loose or defective Flame Rod wiring. Determine the location of the problem and repair.
    e. A defective flame relay. Replace the defective component.
10. Pilot manual valve is closed.
    a. Open valve.
11. Pilot solenoid valve is defective.
    a. Replace solenoid
12. Low pilot flame.
    a. Increase pilot gas pressure by adjusting pilot regulator. The outlet pressure at the pilot regulator should be about 2" w.c, resulting in a pilot flame about the size of a baseball.
13. The airflow switch setting is too low, causing frequent flame relay power cycling.
    a. Set the switch properly per the Service Technician Manual.
14. Wires on flame relay terminals are disconnected or loose
    a. Remove the relay from its base and check.
15. Ignition wire is broken or grounded against unit.
    a. Repair the wire or isolate from ground.
16. The primary, block or vent valve actuator is defective.
    a. Replace the faulty actuator.

        NOTE: The flame safeguard relay is reset every time the air handler is turned off and then returned to the On or Auto mode.

6.3.7 Alarm Description: Dirty Filters

1. The filters are dirty or the belts are loose.
    a. Change the filters
    b. Check the fan belts replace or tighten per the maintenance manual.
2. Motor or fan sheaves are worn
    a. Replace the worn sheaves with new. Confirm replacement sheaves are the correct size consult factory if necessary.
3. The clogged filter switch has failed.
    a. Verify the pressure drop across the filters and compare it to the set point of the clogged filter switch to determine if the switch is working correctly.

6.3.8 Alarm Description: Low Building Pressure

This alarm occurs when there is a call for heat and the air handler is operating in the Occupied Heating setting with Auto Room Pressure heating type. The air handler has been unable to maintain a positive building pressure within .01" w.c. of the pressure set point for 10 consecutive minutes. As a result, the program has placed the outside air dampers in the minimum outside air position and the air handler in the Unoccupied Setback Temp setting. This setting will be maintained until the situation causing the lack of building pressure has been corrected or after a maximum of 20 minutes. Once either of these conditions has occurred, the program will then return the air handler to the Occupied Heating setting with Auto Room Pressure heating type.

The cycle will restart again in 10 minutes if the situation that caused the building pressure drop has not been corrected. This alarm occurs only if the heating control type has been configured for the Low Building Pressure option. This alarm is a report of the Low Building Pressure condition, there is no problem with the software or hardware.

1. Determine why the building pressure is less then set point.
    a. Most common cause is open over head garage doors
    b. Close the doors

6.3.9 Supplemental Temperature Sensor Information

The thermistor temperature sensors change resistance to the Control Module proportionally to the temperature, with 10,000 ohms representing 77 °F. Each 1 °F drop in temperature causes an approximately 250 ohm increase. The simplest way to check their performance is by using the temperature / resistance chart on *Page 57, Table 9*. The display may indicate that a temperature sensor is "seeing" a very cold temperature that is much colder than the actual temperature.

1. The sensor wiring is damaged or connected improperly.
    a. Inspect all cabling for the sensor and repair as necessary.
    b. Inspect all terminations and plug connections; make sure that they are making good electrical contact.
2. The sensor is defective.
    a. Replace the sensor.

For burner equipped direct-fired air handlers which circulate room air, if the room or discharge air temperature sensors are defective, the RAPID® InfinityPro logic for temperature rise control will allow the burner to light, but it will remain at low fire. Replace the defective sensor in order to restore proper operation.

Table 9: Thermistor Performance

Temperature Fahrenheit	Ohms	Temperature Celsius	Ohms
0	85,350	-17.5	84,106
5	72,910	-15.0	72,910
10	62,480	-12.5	62,523
15	53,640	-10.0	55,408
20	46,230	-7.5	48,453
25	39,910	-5.0	42,438
30	34,560	-2.5	37,235
35	30,000	0.0	32,736
40	26,100	2.5	28,830
45	22,760	5.0	25,432
50	19,900	7.5	22,474
55	17,440	10.0	19,900
60	15,310	12.5	17,686
65	13,480	15.0	15,736
70	11,880	17.5	14,029
75	10,500	20.0	12,520
80	9,298	22.5	11,190
85	8,250	25.0	10,019
90	7,331	27.5	8,984
95	6,532	30.0	8,066
100	5,826	32.5	7,251
105	5,209	35.0	6,532
110	4,663	37.5	5,897
115	4,182	40.0	5,332
120	3,757	42.5	4,827
125	3,381	45.0	4,374

NOTE: This table is applicable for the standard RAPID® temperature sensor, which is a thermistor. The purpose of this table is to assist a service technician in diagnosing sensor related problems. Without precision temperature measurement and a clear understanding of the accuracy specifications for these sensors, it will be impossible to exactly duplicate the table data. Normal service test equipment, however, used in conjunction with the table should indicate whether the sensor is operating properly.