



Table 8. Minimum Filter Pump Flow Rates For Spas.

NOTE: Maximum Spa Temperature Is Assumed To Be 100°F (38°C).

3. Spas are excellent for relaxation, body-conditioning and for arthritic and rheumatic problems, but can be hazardous.

SECTION 7. Maintenance

7.1 System Maintenance

1. Lubricate the system water-circulating pump, if required, per the instructions on the pump.
2. Inspect the venting system for obstruction or leakage at least once a year. Periodically clean the inlet air filter and the screens in the vent terminal and combustion air terminal (when used).
3. Keep the appliance area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
4. If the appliance is not going to be used for extended periods in locations where freezing normally occurs, it should be isolated from the system and completely drained of all water. All systems connected to it should also be drained or protected from freezing.
5. Low water cutoffs, if installed, should be checked every 6 months. Float type low water

- cutoff should be flushed periodically.
6. Inspect flue passages, and clean with brushes/vacuums, if necessary. Sooting in flue passages indicates improper combustion. Determine the cause and correct.
 7. Inspect the vent system and air intake system, and ensure that all joints are sealed properly. If joints need to be resealed, completely remove existing sealing material, and clean with alcohol. Apply new sealing material, and re-assemble.

7.2 Appliance Maintenance and Component Description

Only genuine Pentair Water Commercial Pool and Spa replacement parts should be used.

Caution

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

See Figures 7 through 11 for location of gas train and control components.

The gas and electric controls on the appliance are engineered for long life and dependable operation, but the safety of the equipment depends on their proper functioning. It is strongly recommended that a qualified service technician inspect the basic items listed below every year.

- a. Ignition controls
- b. Ignitors
- c. Water temperature control
- d. Automatic gas valve
- e. Pressure switches
- f. Blowers

7.2.1 Burners

Close main manual gas valve before proceeding. Checking the burners for debris - Remove the ignitor inspection panel(s) and ignitor(s) and inspect the burners through the ignitor hole(s) using a flashlight to illuminate. If there is any indication of debris on the burners that are visible, all the burners will need to be inspected more thoroughly. Remove the screws from around the front of the air box (large panel from which the ignitor inspection panel(s) were removed), and remove the large panel. Remove the gas manifold assemblies and the burner panels. Inspect the burners. Clean burners, if necessary, by blowing compressed air from the outside of the burners into the center of the burner. A dirty burner may be an indication of improper combustion or dirty combustion air. Determine the cause, and correct. Replace the burners in the reverse order.

7.2.2 Filter

The filter used in the PowerMax is washable with

an 83% arrestance. Since the filter is washable, it will only need replacement in very rare cases. If filter replacement is needed, it should only be replaced with a factory part. Inspect the air filter. If there is debris on the air filter, remove it from the filter box, and wash it with mild soap and water. Ensure that the filter is completely dry before re-installing, in reverse order.

7.2.3 Gas Valves

The gas valves are designed to operate with supply pressures of 4-13 inches w.c. (1.0 to 3.2 kPa).

To remove a valve, shut off 120-volt power and the manual gas shutoff valve. Remove the top front panel from the unit. Disconnect the wires to the valve. Disengage the unions before and after the valve, and remove the valve. Pull the pipe nipples from the inlet and outlet of the valve, and clean the threads on the pipe nipples for re-use. Apply pipe dope to the pipe nipples (threaded joints should be coated with piping compound resistant to action of liquefied petroleum gas), and re-install in reverse order. Turn on manual gas shutoff valve and 120 volt power and check appliance operation and tightness of gas valve connections.

7.2.4 Pool Loop High Limit Control

The high limit switch is an automatic reset switch with an adjustable set point, up to 135°F (57°C). To replace the switch, shut off the 120-volt power to the appliance. Remove the cover from the switch to access the mounting screws. Remove the screws, and pull the switch off the control panel. Remove the capillary and bulb from the thermal well located in the pool loop adjacent to the heater outlet. Replace in reverse order.

7.2.5 Automatic Reset High Limit Control

An automatic reset high limit is used to limit heater water from exceeding 200°F. The high limit switch has an adjustable set point, up to 190°F (88°C). To replace the switch, shut off the 120-volt power to the appliance. Remove the cover from the switch to access the mounting screws. Remove the screws, and pull the switch off the control panel. Remove the capillary and bulb from the thermal well located in the header. Replace in reverse order.

7.2.6 Temperature Control

The temperature control is a single stage control. To replace the control, shut off the 120-volt power to the appliance. Unplug all of the electrical connectors, remove the retainer clip and the control. Replace in reverse order.

7.2.7 Ignition Controls


The ignition controls ensure the proved interrupted-type ignition system. They control the hot surface ignitor(s) and prove that the flame signal is

appropriate for powering the gas valves. It also controls the blower's pre-purge and post-purge. PowerMax models 500, 750 and 1000 have one ignition control. Models 1250, 1500, 1750 and 2000 have two ignition controls. On these models, one ignition control provides for part-load start-up and the second control brings the heater to full rate, after the first control has started the part-load burners.

To replace a control, shut off the 120-volt power to the appliance. Remove the cover from the control panel. Remove the electrical connectors from the ignition control. Take out the controller's mounting screws, and pull the controller out. Replace in reverse order.

7.2.8 Ignitors

The ignitors used are 120v "Hot Surface" type. They are energized whenever there is a call for heat and switched off when ignition is established and the flame has been sensed. PowerMax models 500, 750 and 1000 have one ignitor. Models 1250, 1500, 1750 and 2000 have two ignitors. To replace the ignitor, shut off the 120-volt power to the appliance, remove the ignitor access panel, disconnect the Molex connector, remove the two mounting screws on the ignitor flange, and pull the ignitor out. Install in reverse order, always using a new ignitor gasket with the replacement ignitor.

 **Caution**
Ignitor gets hot.

7.2.9 Ignition Sensors

The ignition sensors ensure that the main flame is ignited, so that raw gas is not allowed to fill the combustion chamber. The ignitors are the ignition sensors on PowerMax appliances. There are no separate ignition sensors.

7.2.10 Transformer

The heater's transformer is not capable of supplying control voltage for external devices. Should a transformer need replacing, shut off the 120-volt power. Unplug the transformer wires, remove the mounting screws and remove the transformer. Replace transformer in the reverse order.

7.2.11 Blowers

The combustion air blowers bring the combustion air for the Pennant from the upper chamber to the lower chamber. Mixing of the gas and air occurs in the burners. If a blower change is required, turn off the 120-volt power and gas supply to the unit. Remove the front panel. Disconnect the blower's wire harness. Remove the screws at the blower flange, and pull the blower out. Replace blower in reverse order, ensuring that all joints are made correctly. After replacement, ensure that the unit

operates properly, by following the set-up procedure in this manual. Use caution in handling the blower, ensuring you do not put pressure on the blower wheel.

7.2.12 Flow Switch

The PowerMax uses a paddle-type flow switch to ensure that the unit has water flow before ignition is allowed.

7.2.13 Heat Exchanger Coil

Caution

Black carbon soot buildup on a dirty heat exchanger can be ignited by a random spark or flame. To prevent this from happening, dampen the soot deposits with a wet brush or fine water spray before servicing the heat exchanger.

The PowerMax has a pre-mixed burner system. These systems provide the burners with sufficient air for complete combustion, and black carbon sooting is seldom experienced. If sooting is suspected, view ports for inspection of the heat exchanger are provided on both sides of the heater. They are located below the headers, and are accessed by opening the small round cover that is attached by one screw. In the unlikely event that there is a buildup of black carbon soot or other debris on the heat exchanger, clean per the following:

1. Disconnect the electrical supply to the unit.
2. Turn off the gas supply by closing the manual gas valve on the heater.
3. Disconnect and remove the wires, conduit and sensors from all components that are attached to the inlet/outlet header.
4. Isolate the heat exchanger from the water supply.
5. Disconnect the header flanges from the inlet and outlet.
6. Allow the heat exchanger to drain. Remove the front cover(s). Remove the venting and remove the top, by removing the screws that attach the top to the side panels. Remove the side panels. Remove the front lower panels sealing the combustion area. To remove the gas train, disconnect the unions located above the intermediate pan and the field installed union located outside the cabinet, and pull up, bringing the union end connectors through the grommets in the intermediate pan. To remove the intermediate pan, remove the slide out control assembly and blower(s) to reveal the screws. Remove the screws holding the intermediate pan, and lift up to remove it. The heat exchanger has integral metal sections attached, which connect to the frame of the boiler. Locate and remove the screws along the front, rear and bottom of the

- integral metal sections, and remove the heat exchanger and metal sections by lifting up. On the larger appliances, a center heat exchanger support must be unbolted before it can be removed.
7. Remove the heat exchanger from the unit.
NOTE: The heat exchangers are heavy and will require two people to remove to avoid personal injury.
 8. Clean the heat exchanger: A light accumulation of soot or corrosion on the outside of the heat exchanger can be easily removed. Use a wire brush to remove loose soot and scale from the heat exchanger. Do not use water or compressed air for cleaning.
 9. NOTE: While the heat exchanger is out of the unit, inspect the firewall refractory insulation. Replace if necessary.
 10. Inspect the inside of the copper tubes for scale buildup. Scale can build up on the inner surface of the heat exchanger tubes, which can restrict water flow. If the tubes show signs of scaling, clean the internal surface. A tube cleaning kit part number R0010000 is available.
 11. Reassemble in the reverse order, and check appliance operation after start-up.

NOTE: The Warranty does not cover damage caused by lack of required maintenance, lack of water flow, or improper operating practices.

SECTION 8. Trouble Shooting

8.1 Resolving Lockouts

There are many causes of lockouts. The three most common causes are: (1) inadequate gas supply, (2) poor combustion, (3) ignitor failure.

1. Inadequate gas supply: Before proceeding, ensure that the gas supply has not been shutoff or the LP tank (LP boilers) is not empty. Then, restart the boiler and observe the operational cycle. After a 15-second fan pre-purge, the ignitor will heat up for 20 seconds, and then the unit will light. If it does not, check the gas supply pressure to the appliance, after resetting the appliance and attempting another start-up. The gas pressure to the appliance must be above 5" W.C. (1.2kPa) throughout the entire start-up cycle. If it is not, correct the supply problem (check gas valves or supply piping). If the supply pressure is adequate, consult the factory for assistance.
2. Poor Combustion: Poor combustion should be suspected if there is a strong flue gas odor. The odor may result from an improper gas/air ratio (high or low O₂ or CO₂). PowerMax appliances

operate best with 45% excess air (8% CO₂ on natural gas, 9.2% CO₂ on LP). Check the CO₂ of the appliance and adjust if necessary.

3. Ignitor failure: If the boiler goes through a normal start cycle but combustion does not occur, and the gas pressure is at least 5" w.c., ignitor failure may be the cause. Check the ignitor by unplugging it, allowing it to cool to room temperature, and measuring the ignitor resistance. It should be 50-80 ohms. If the resistance is not 50-80 ohms, replace the ignitor. If the resistance is correct, reset the boiler and check for 120 VAC at the ignitor plug during the start cycle. If there is no voltage, replace the faulty ignitor wire harness or the ignition control.

8.2 Delayed Ignition - Possible Causes

A defective burner can cause a delayed ignition. If the gas supply pressure is proper and the gas valves are functioning properly, then burners should be inspected. There should be no distortion or perforations in the burners outside of the active burner port area. Replace if indicated.

8.3 Short Cycling

Because of the large mass of pool systems, short cycling should not exist. If it does, it will be caused by insufficient flow in the pool loop. Check that there is no blockage in the pool loop such as a plugged or partially plugged pool filter.

8.4 High Gas Consumption

Appliances operating with an improper air/fuel ratio are very inefficient and consequently, have very high gas consumption. Because efficiency is high when the CO₂ is high (or O₂ is low), appliances operating with low CO₂ or high O₂ (especially LP appliances) consume more gas. Adjust the CO₂ or O₂ for optimum efficiency. If no combustion analyzing equipment (CO₂ or O₂) is available then a proper adjustment of the air/fuel ratio (CO₂ or O₂) cannot be accomplished. However, by briefly sniffing the flue gases it is possible to determine if the CO₂ or O₂ is within the proper range. No significant flue gas odor should be detected when combustion is proper. A strong piercing smell indicates poor combustion and generally a lean mixture - low CO₂ or high O₂. The CO₂ should be 8% (natural gas, 9.2% LP) at high fire. To check the CO₂, first verify that the supply gas pressure is within 5" to 13" w.c. (1.2 to 3.2 kPa) With the PowerMax running with both stages firing, set the air box pressure to 1.5" w.c. (0.37 kPa) (as a starting point), by adjusting the air shutter(s) at the bottom of the fan(s). Check the CO₂, and adjust the air shutters if further adjustment to the CO₂ is needed. Models 1250, 1500, 1750 and 2000 have two blowers and two air chambers (boxes). The pressure of each air box must be equal when the final adjustment is made.

8.5 Troubleshooting the Pool Heater Temperature Control

With a Voltmeter, test for 24 VAC between terminals 1 & 2 on the 10 pin connector. Check that the sensor temperature is lower than the setpoint temperature by at least the differential setting. If this is true, check that there is 24 VAC at the yellow wire on the 4 pin connector. If there is not 24 VAC, check that the high limit is not open. If there is 24 VAC at the yellow wire on the 4 pin connector and not at the light blue wire on that connector, replace the control.

8.6 Troubleshooting PowerMax Controls

The PowerMax series consists of three models with one ignition module (500, 750 & 1000) and four models with two ignition modules (1250, 1500, 1750 and 2000).

A diagnostic panel, that includes test points, as well as diagnostic lights, is provided in the control module. It is located on the right side of the module, behind the display. To access, remove the retaining screws from the display cover panel and remove it. Grasp the control module at its base and pull it outward. Ladder diagrams are shown in Figures 12 and 13.

Figure 12 shows the diagram for the 500, 750 & 1000. These have one blower and one ignition

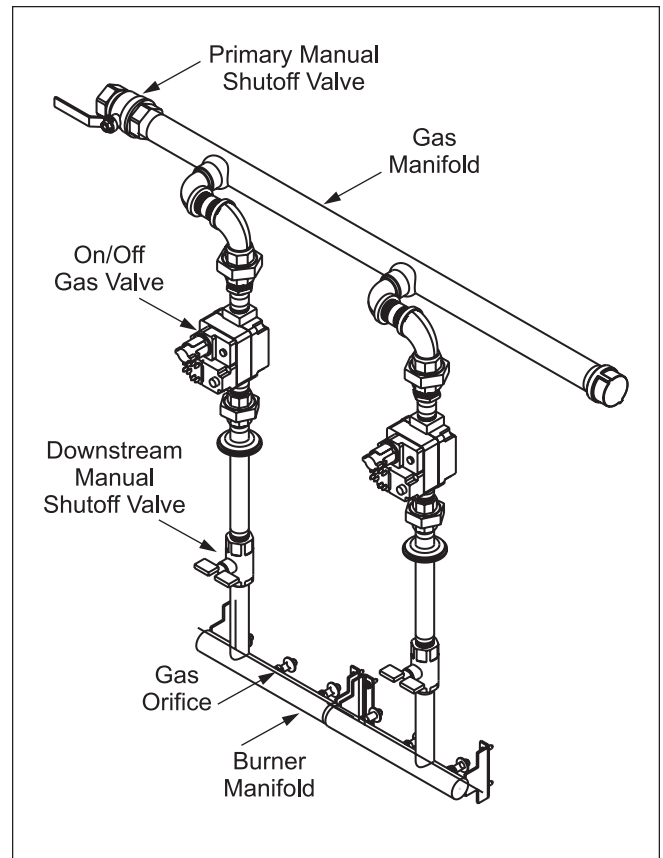


Figure 7. Typical Gas Train Configuration.

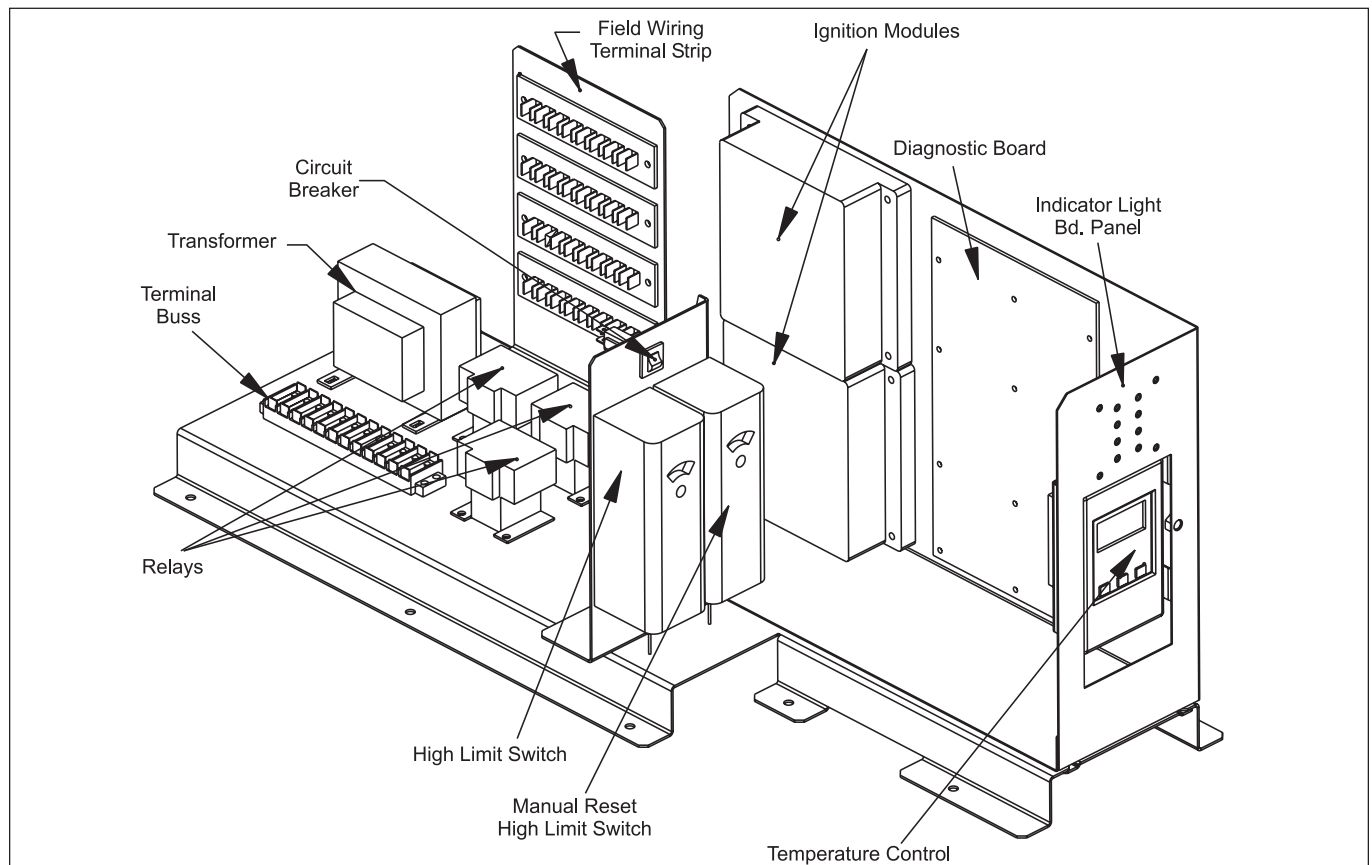


Figure 8. Typical Control Panel.

module. The blower is energized directly through the “inducer” terminals F1 and F2 of the (Fenwal) ignition module. The 24V power to the T’STAT terminal of the ignition module(s) are routed through the safety interlocks.

The ladder diagram for models 1250, 1500, 1750 and 2000 is shown in Figure 13. These models have two ignition modules, each with its own blower, and each controlling part of the input so that startup at reduced input is provided. The blowers are energized by the ignition modules indirectly via switching relays. When either ignition module receives a call for heat, it switches its blower to high speed and the blower of the idle ignition module to low speed.

The wiring schematic for the PowerMax 500 – 1000 is shown in Figure 14, and the schematic for the 1250 – 2000 models is shown in Figure 15. All 24V wiring is routed through the diagnostic PC board. Wiring harnesses connect between the diagnostic PC board and the control components, indicator board, or field wiring terminal strip. The diagnostic board contains LEDs that indicate open status of the safety interlocks, and quick-connect terminals that provide tests points for checking voltage/continuity at various points in the control circuit.

Certain control elements that may need to be rewired in the field are connected via the field wiring terminal strip rather than to the diagnostic PC board. These include the low-water cutoff (LWCO), external alarm, and water flow switch.

SECTION 9. Replacement Parts

Only genuine Pentair Water commercial Pool and Spa replacement parts should be used.

9.1 General Information

To order or purchase parts for the PowerMax, contact your nearest dealer or distributor. If they cannot supply you with what you need, contact Technical Support (see page 35).

9.2 Parts List

Item	Description	Model 500	Model 750	Model 1000	Model 1250	Model 1500	Model 1750	Model 2000
Sheet Metal Components								
See Figure 9								
1	Panel, Jacket, Side Left	5C3420	5C3420	5C3420	5C3420	5C3420	5C3420	5C3420
2	Panel, Jacket, Side Right	5C3520	5C3520	5C3520	5C3520	5C3520	5C3520	5C3520
3	Panel, Jacket, Front	5C3320	7C3320	10C3320	12C3320	15C3320	17C3320	20C3320
4	Panel, Jacket, Front, Left							
5	Panel, Jacket, Front, Right							
5A	Panel, Jacket, Rear	5C3220	7C3220	10C3220	12C3220	15C3220	17C3220	20C3220
6	Panel, Jacket, Rear, Filter Enclosure	5C3021	7C3021	10C3021	12C3021	15C3021	17C3021	20C3021
6	Panel, Jacket, Top							
6	Panel, Jacket, Top, Left							
7	Panel, Jacket, Top, Right							
8	Control Door, Access	5C3010	5C3010	5C3010	5C3010	5C3010	5C3010	5C3010
9	Plate, Gas Pipe Seal	5C3304 (2)	5C3304 (2)	10C3304 (2)	20C3304 (2)	20C3304 (2)	20C3304 (2)	20C3304 (2)
10	Plate, Cover, Wiring	5C3502	5C3502	5C3502	5C3502	5C3502	5C3502	5C3502
11	Plate, Vent	5C3004	5C3004	10C3004	20C3004	20C3004	20C3004	20C3004
12	Cover, Vent Plate							
13	Plate, Cover, Filter	5C3002	5C3002	5C3002	20C3002	20C3002	20C3002	20C3002
14	Collar, Vent	5C3100	7C3100	10C3100	15C3100	15C3100	15C3100	20C3100
15	Air Filter Assembly	R2014701	R2014701	R2014703	R2014704	R2014704	R2014704	R2014705

SECTION 10. Wiring Diagrams

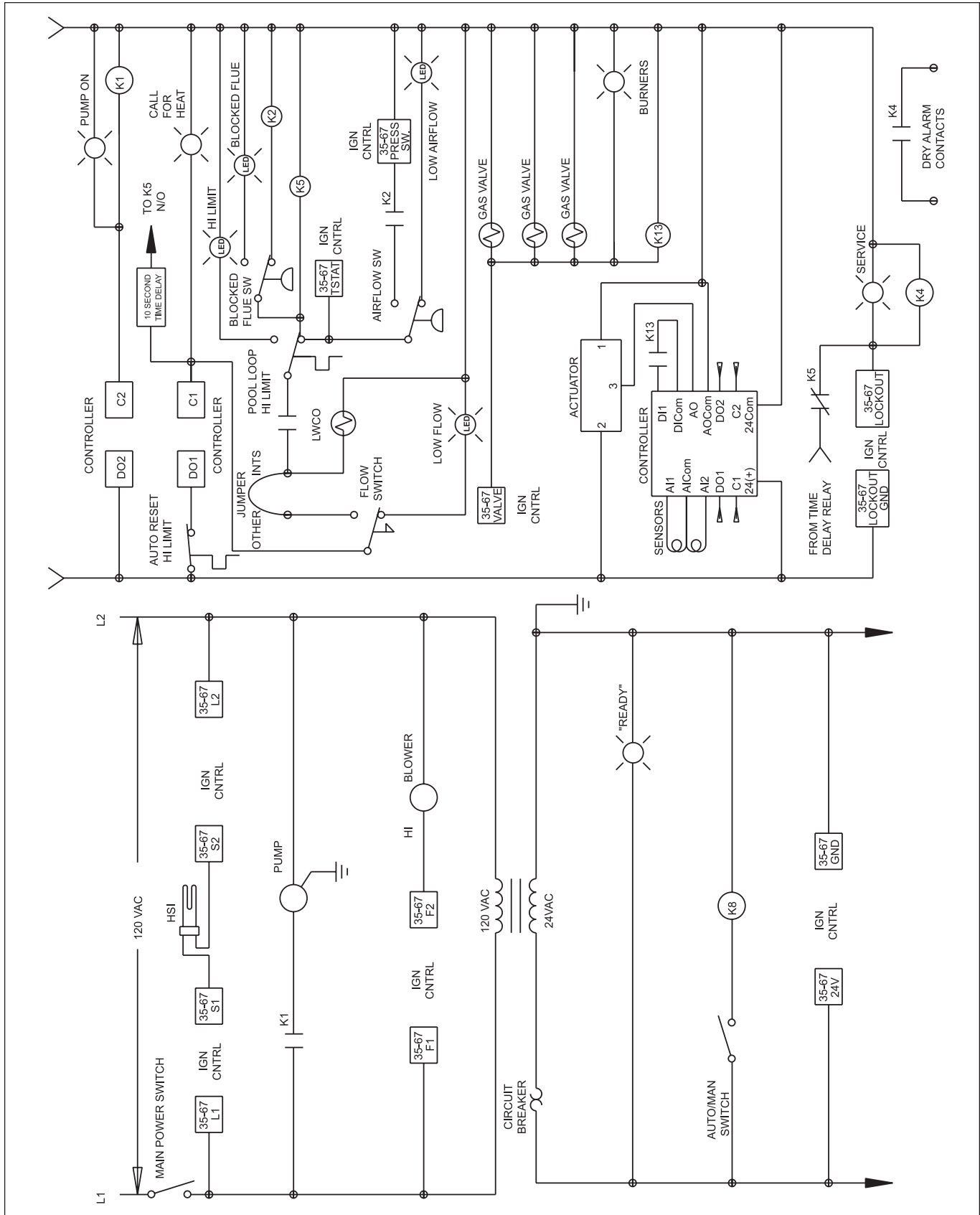


Figure 12. PowerMax 500 - 1000 Ladder Diagram.

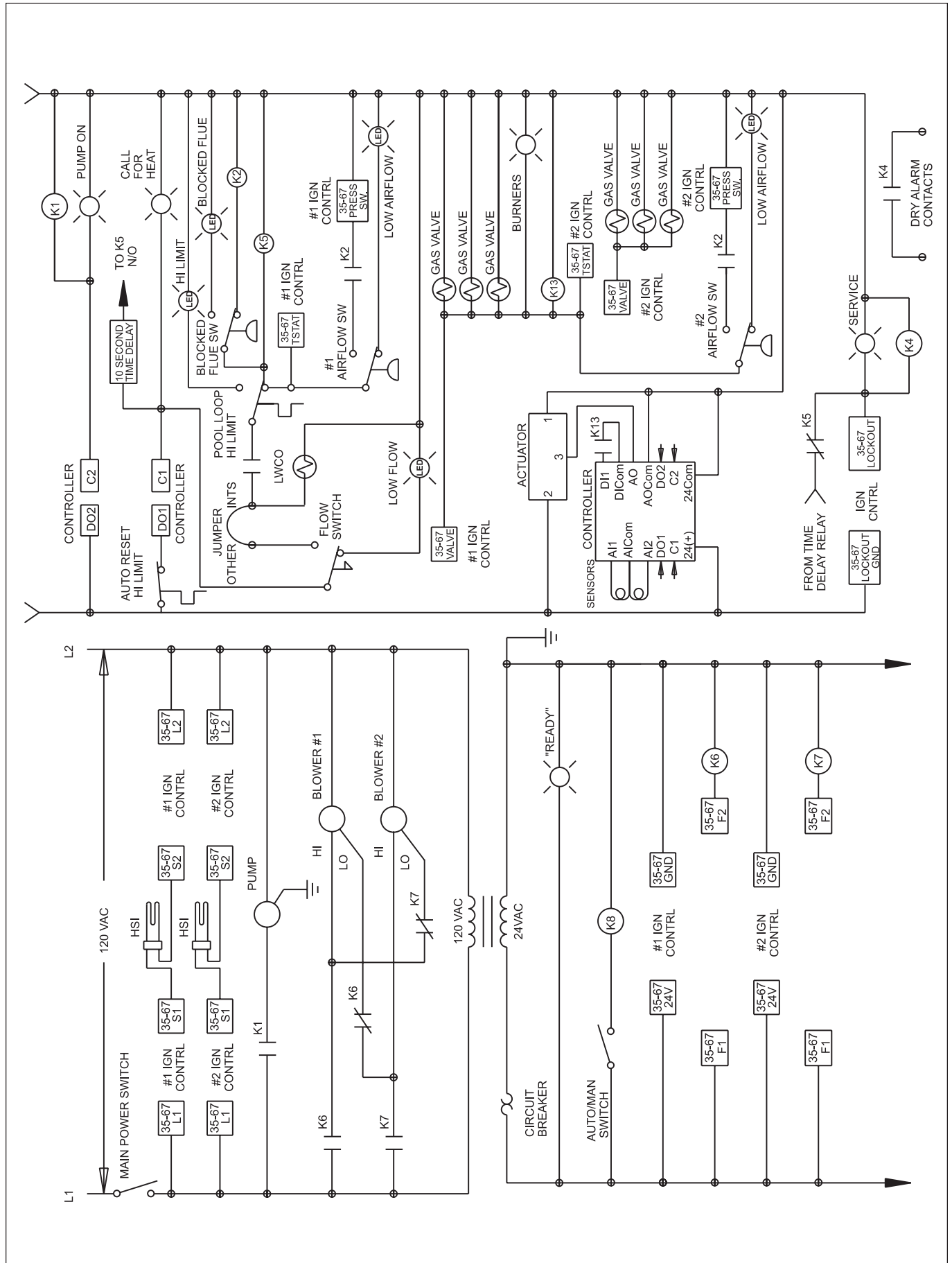


Figure 13. PowerMax 1250 - 2000 Ladder Diagram.

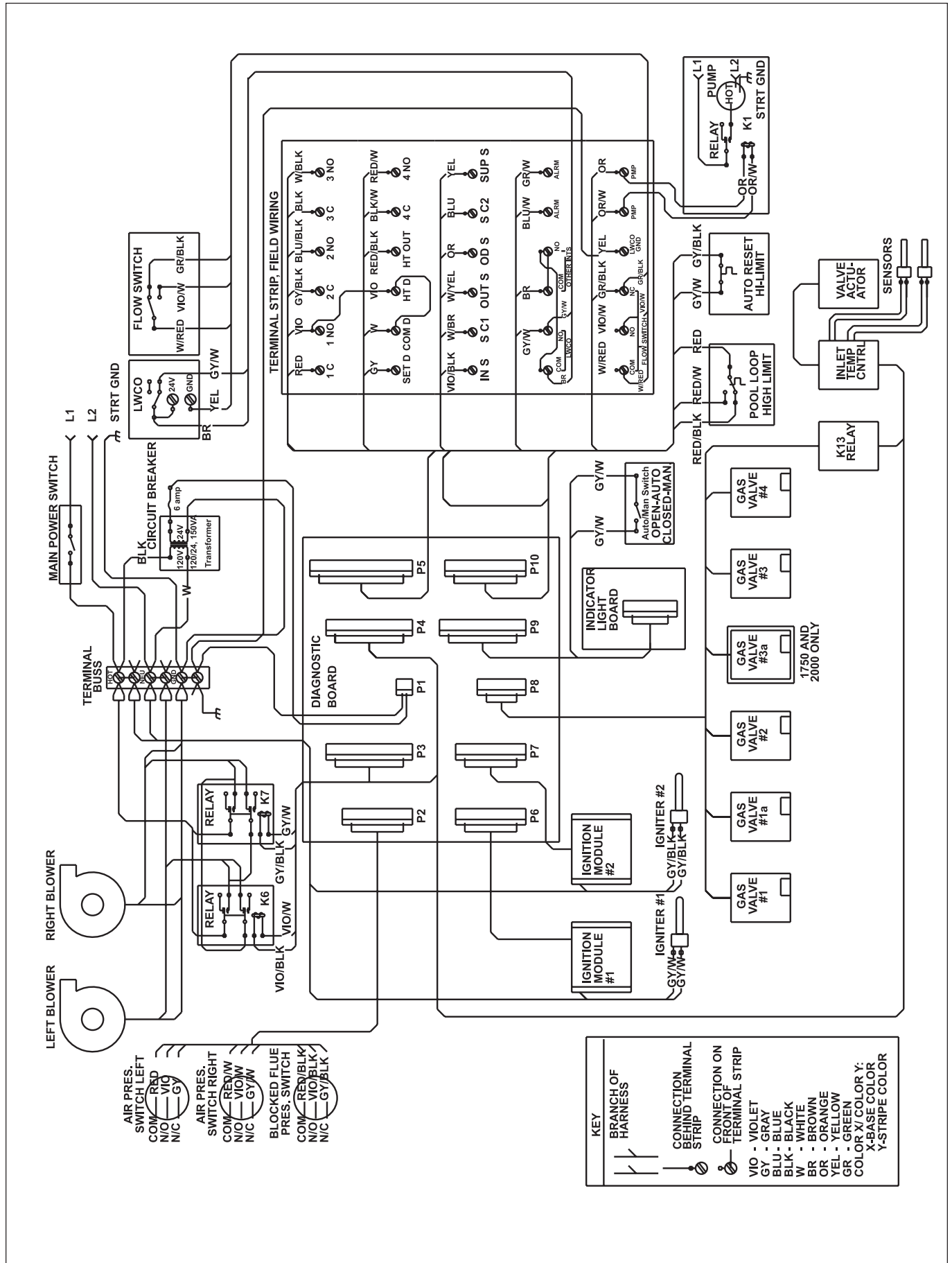


Figure 15. PowerMax 1250 - 2000 Wiring Schematic.

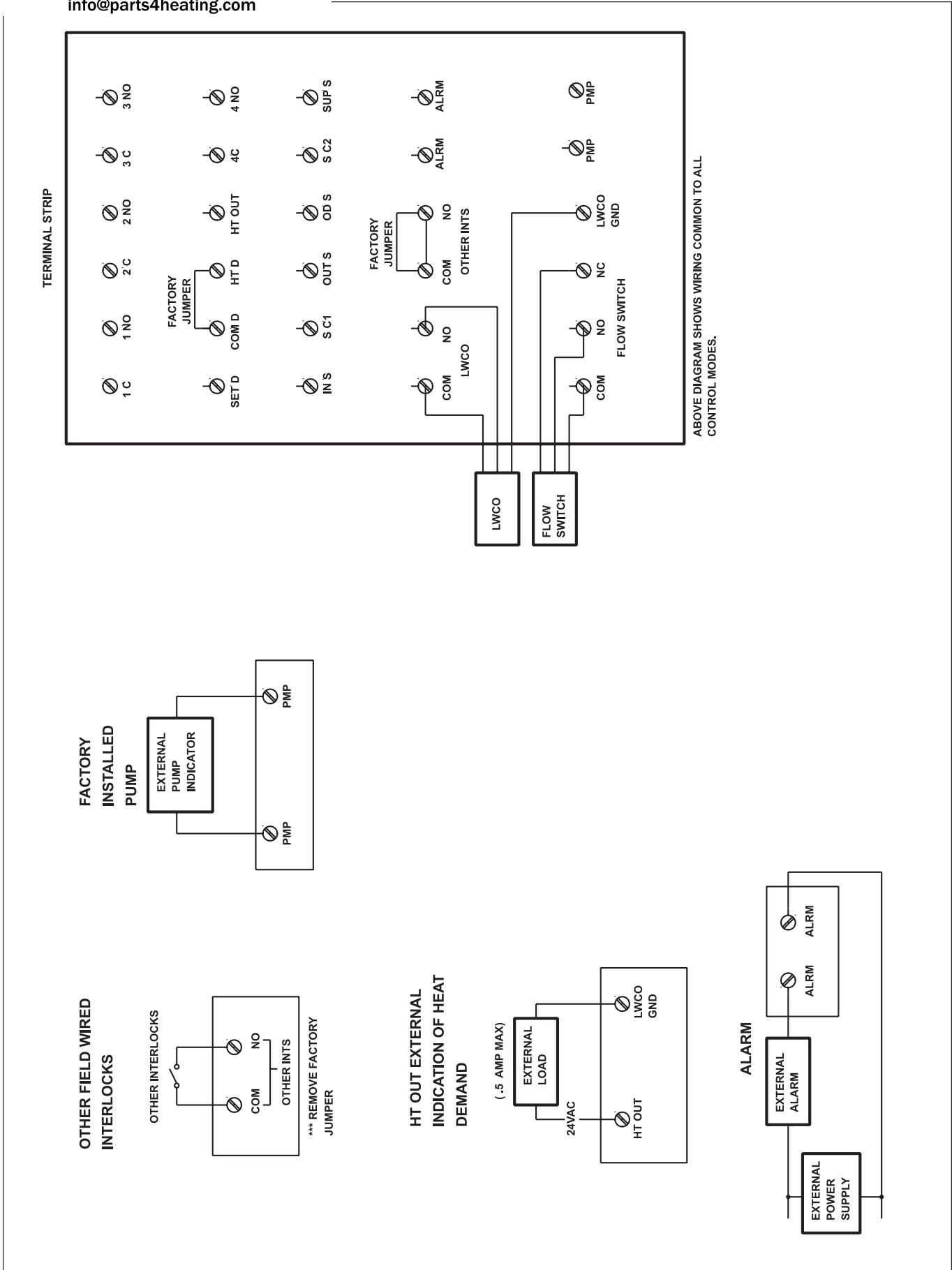


Figure 16. Field Wiring, PM 500-1000.