Troubleshooting Guide for

Glacier Bay

Micro HPS

Document : 011-9001

Revision History	
March 12, 2011	Initial Release

Pacific Sea Breeze Marine, LLC
Santa Cruz, CA

Table of Contents

1.0 Introduction

This trouble shooting guide is intended to aid a technician or technically oriented system owner in isolating and correcting system operation issues. The guide can not address every issue that can occur but will attempt to at least narrow down where the trouble resides.

2.0 Subsystems

This section discusses each of the major subsystems of the Micro HPS. There are three main subsystems – the Condensing Unit, the Temperature Controllers, the Holding Plates, and the Raw Water Pump.

2.1 Condensing Unit

This section provides and introduction to the condensing unit. It is essential to understand the operation of the condensing unit in order to successfully troubleshoot the Micro HPS.

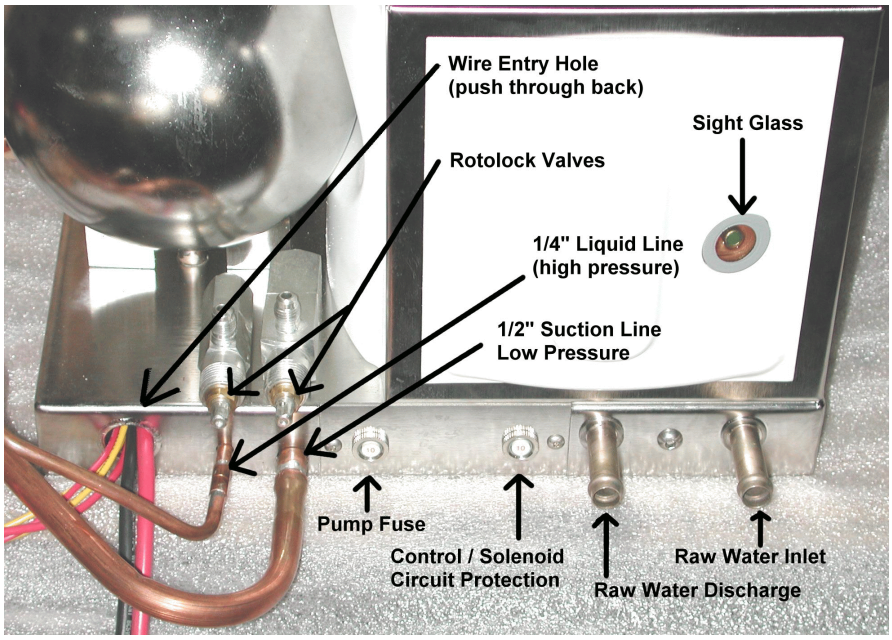

Fig 1. Front of the Condensing Unit

The condensing unit contains the compressor and condenser along with the compressor controller and other electrical controls. The primary electrical

connections are made in the condensing unit on the main terminal strip located behind a cover on the back side of the condensing unit. A drawing of the condensing unit with the back cover removed to expose the main terminal strip is shown below.

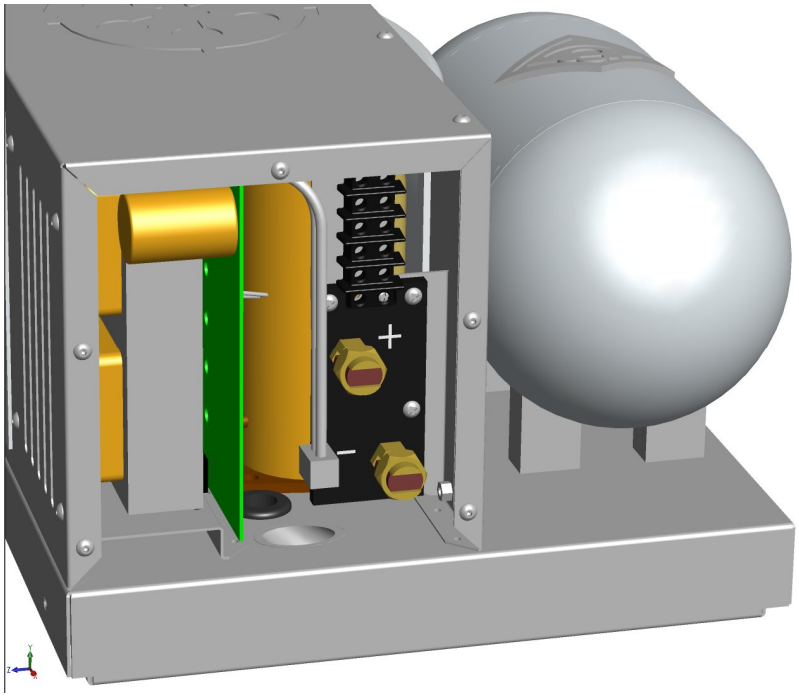

Fig 2. Back of the Condensing Unit with Cover Removed

The section discussing temperature controller wiring has a more detailed photo.

2.1.1 Safety Controls

The condensing unit has several safety controls built in. They are the high pressure cutout, the low pressure cut out, a 10A circuit breaker for the solenoid and controllers and a 10A circuit breaker for the water pump.

The high pressure cutout, the low pressure cut out, and the 10A circuit breaker for the solenoid and controllers are wired in series so that any one of these safety controls being tripped will prevent the temperature controllers from requesting cooling and therefore prevent the system from operating. The 10A circuit breaker for the “Pump Fuse” is dedicated to the water pump. If it is tripped, other functions of the system will appear normal but the water pump will never start.

More information about the interaction of these controls is presented in the Trouble Isolation section of this troubleshooting guide.

2.1.2 Basic Theory of Operation

1. A motor drives a compressor to compress refrigerant vapor and sends the resulting hot, dense gas through the high side rotolock valve to a cupronickel seawater condenser.

2. The condenser contains tubing which is surrounded by the refrigerant gas. Seawater is pumped through this tubing. The seawater is cooler than the refrigerant gas. This allows heat to flow from the refrigerant to the seawater and the warmed seawater is returned overboard. The refrigerant gas condenses to liquid as it transfers its heat to the seawater.

3. The liquid refrigerant flows into the receiver and through copper tubing to the capillary tube or expansion valve at the beginning of the evaporator. (A holding plate is a type of evaporator.) This completes the high pressure portion of the system.

4. The pressure drops at the exit from the capillary tube or expansion valve and the liquid refrigerant boils inside the evaporator, changing to gas and absorbing heat from the air or eutectic solution surrounding the evaporator.

In the case of a holding plate evaporator, the eutectic solution surrounding the coils freezes.

In the case of an air conditioner, moisture in the air condenses and falls to the bottom of the condensate tray and out through the drain outlet. The cool, dry air is directed by a fan into the cabin.

5. The cold, low pressure refrigerant gas returns to the reciever and then to the compressor through the low side valve and the cycle begins again as long as the compressor is running.

2.2 Temperature Controllers

The temperature controllers are used as thermostats and system controllers. They sense the temperature of the box and control the operation of the condensing unit and the solenoid valves.

The temperature controllers are panel mounted with a zone enable switch. A picture of the front of the controller is shown below. Whether the controller is used for a freezer or refrigerator, the same controller type is used. For freezer or refrigerator there is no difference other than the temperature settings at which the controller requests cooling (flashing dot on display) or stops requesting cooling.

Fig 3. Digital Thermostat / Temperature Controller / ECM

There are two types of controllers that can be used with the system. The primary difference is whether the controller can accept an external signal indicating that the batteries are being charged due to the engine running. This signal is then used to top off the holding plates while extra energy is available, which would extend the operation time on battery power once the engine is shut off. This type of controller is referred to as an ECM and can easily be identified from the back side of the controller. This holding plate top-off feature is not addressed in this trouble shooting guide at this time. A photo of the two types of controllers is shown below. Notice that the ECM has an additional terminal strip in the upper half of the back of the controller with three screw terminals.

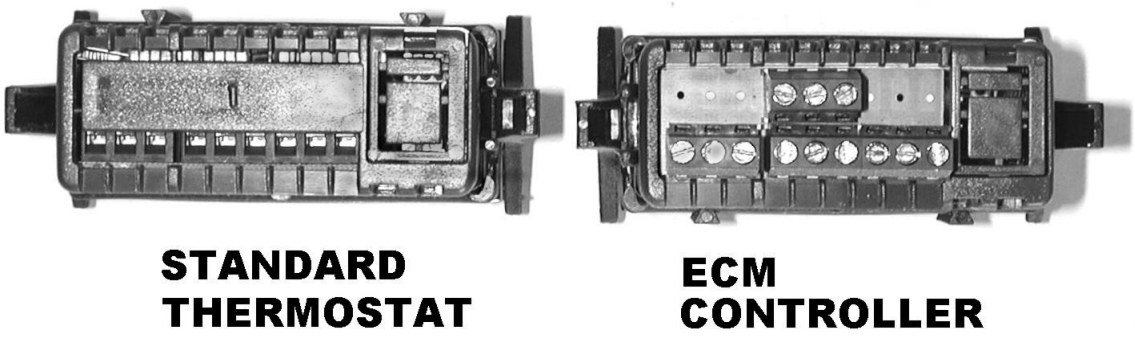

Fig 4. Back view of Temperature Controller / ECM

2.3 Holding Plates

Information for the holding plates will be added to a later version of this troubleshooting guide.

2.4 Raw Water Pump

Information for the raw water pump will be added to a later version of this troubleshooting guide.

3.0 Trouble Isolation

This section presents information to assist in determining which of the subsystems is not functioning properly. Use the following table to determine which section to consult.

Symptom	Section to Start
Water pump and compressor start but shutoff soon after	Micro HPS Compressor Shutting Off
After the compressor begins to run, it stops and the temperature controllers go dark	Temperature Controllers Go Dark
Temperature Controllers seem to be functioning and request cooling (blinking dot on display) but compressor and water pump never start	Temperature Controller vs. Condensing Unit

3.1 Micro HPS Compressor Shutting Off

1. If you have a gauge set hooked up – what are the high and low pressure readings?
    a. HP trips at 400 and turns system on at 300.
    b. LP trips at 5 and turns on at 20. The purpose in a **low-pressure cut-out** is to prevent compressor damage due to lack of cooling (hermetic compressors) or lack of lubrication. The Masterflux hermetic compressor we use relies on circulating gas and oil for cooing and lubrication.
2. It may also be **low voltage**. Check the battery voltage. For 12 volt units, the system will cut out at 11.5 volts. Also, if the voltage drops too low, the solenoid coils will not energize to open the valve and let refrigerant flow to the proper zone.

3.2 Temperature Controllers Go Dark

This symptom can be caused by the high pressure switch or low pressure switch cutout. These pressure switches are there to protect you and the system. Never override the pressure switches as this can cause damage to the system including rupturing a refrigerant line, which can result in serious injury.

The symptom can also be caused by tripping the 10A circuit breaker labeled "Control Fuse" located on the front of the Micro HPS condensing unit. Whether caused by a pressure switch or by the breaker, the voltage at the "Controls" terminal (terminal 6) will be 0 volts.

If the problem is pressure related, the pressure will bleed off over time and the symptom will clear until the system starts again. If the circuit breaker is tripping, the controllers will stay dark and the voltage at the "Controls" terminal (terminal 6) will remain 0 volts until the "Control Fuse" circuit breaker is pressed. See the photo below for the location of the "Controls" terminal.

If it is determined that this symptom is being caused by the pressure switches tripping, see the following steps:

1. Make sure there is no clog in the seawater intake line.
2. Proper heat exchange - Be sure that the pump is getting primed. Wait a few minutes for the "request for cooling" from the controls (the blinking dot).
3. If systems is OVERCHARGED, then high pressure cutout could trip. Some techs like to continue adding refrigerant until the site glass clears. They should do this instead: recover all refrigerant, evacuate and either weigh exactly 3.5 lbs and add, or wait until plate is cold before adding refrigerant and watching the site glass clear.
    a. System is low on refrigerant: when site glass does not clear after a few minutes and the holding plates are not as cold as they used to be. To winterize, the refrigerant can be pumped down into the receiver and close off the rotalocks.

3.3 Temperature Controller vs. Condensing Unit

This section discusses the wiring interconnecting the controller and the condensing unit. A step by step set of measurements is provided to try and isolate where the problem is when the temperature controllers seem to be functioning normally but the compressor and the water pump never start.

If the refrigeration system has multiple zones, the temperature controllers are interconnected in a way that only allows one zone to be active at any time.

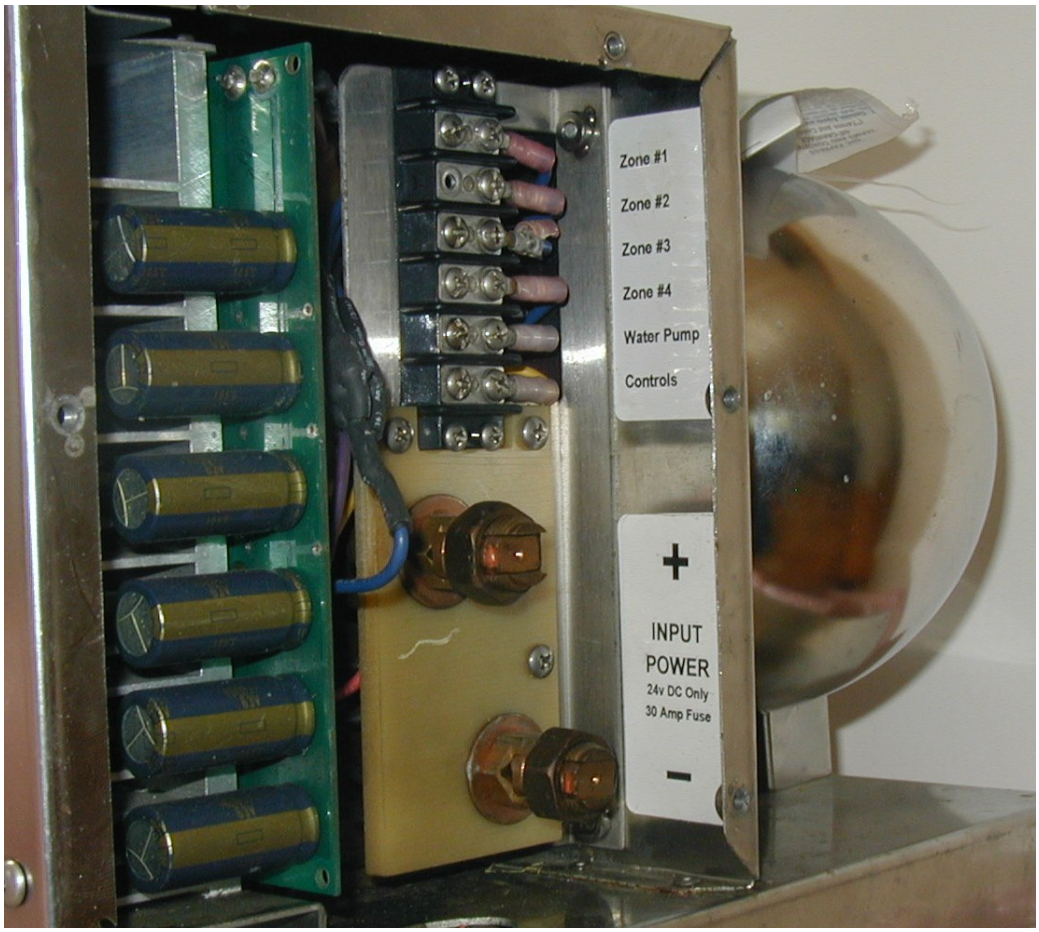

Fig 5. Terminal Strip located inside the back of the Condensing Unit

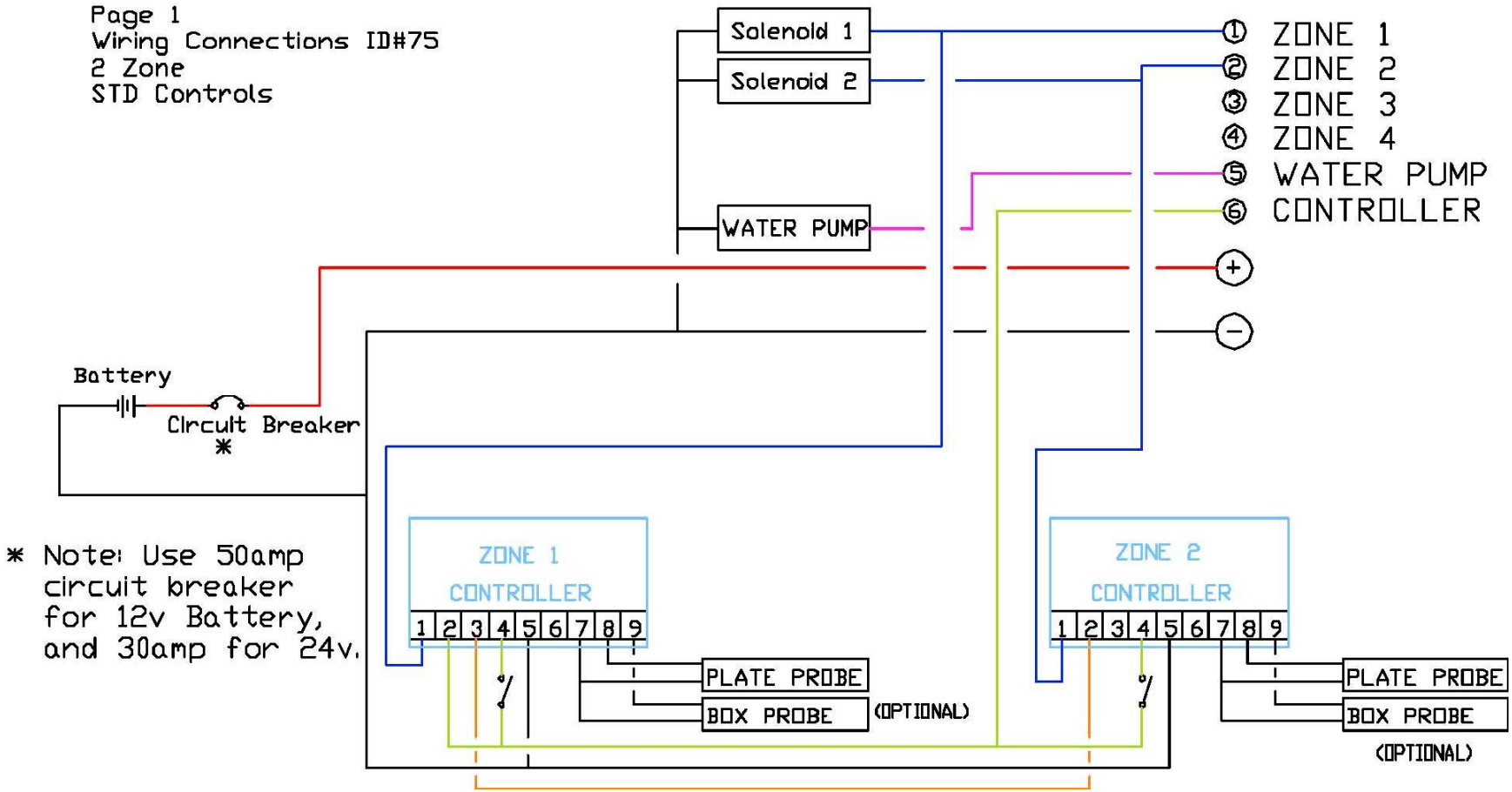

Fig 6. Wring Diagram – Condensing Unit to Temperature Controllers and Solenoids

(Backside of Standard Temperature Controllers)

Temperature Controller terminal strip connections:

1. Normally Open Output Contact
2. Common for Output Contacts
3. Normally Closed Output Contact
4. +12volt Power Input
5. Ground (or Return for 12volt Power)
6. Not Used
7. Probe Common
8. Probe 1
9. Probe 2

3.3.1 Step by Step - Temperature Controller and Condensing Unit Interaction

Refer to the Terminal Strip Photo and Wiring Diagram above while executing the following steps:

1. Do the Temperature Controllers have power (Digital Display has displays showing)? If yes go to step 4, otherwise go to step 2.

2. Since there are no digits displaying on Temperature Controllers, check for 12volts between screw terminal 4 and screw terminal 5 of Temperature Controller (screw terminal 4 must be +12volts and screw terminal 5 must be ground). If 12 volts is present but no digits or other indicators are displayed, the Temperature Controller may be bad. Replace Temperature Controller and go to step 1. If 12 volts is not found between screw terminal 4 and screw terminal 5 of Temperature Controller, go to step 3.

3. Check for 12 volts at “Controls” (terminal 6 of Condensing Unit Terminal Strip). If 12 volts is found, follow wiring back to Temperature controller to determine why 12volts is not present at Temperature Controller (could be bad Zone Enable switch). When 12volts is found at “Controls” (terminal 6 of Condensing Unit) and between screw terminal 4 and screw terminal 5 of Temperature Controller, go to step 1. If 12 volts is not found at “Controls” (terminal 6 of Condensing Unit), check the 12 volt supply to the condensing unit at the “Input Power” terminals (very large terminals inside Condensing Unit – see photo). If 12 volts is found at the “Input Power” terminals of the Condensing Unit but 12 volts is not found at “Controls” (terminal 6 of Condensing Unit), then the “Control Fuse” circuit breaker or one of the pressure switches is tripped or bad. See “Temperature Controllers Go Dark” section above. Once 12 volts is found at “Controls” (terminal 6 of Condensing Unit), if the system is not functioning go to step 1 and start over.

4. If the Temperature Controller is requesting cooling (blinking dot in display), go to step 5. Otherwise, change the setpoint or increase the temperature in the refrigerator/freezer box until Temperature Controller requests cooling (blinking dot in display) then go to step 5.

5. If compressor and water pump did not start but the Temperature controller is requesting cooling (blinking dot) verify that the temperature controller signal is reaching the Condensing Unit by going to step 6. If the compressor and/or water pump did start, but stop soon thereafter, then see “Micro HPS Compressor Stops” section above.

6. First make sure the dot is still blinking in the display and then check for 12volts at terminal 1 of the temperature controller (this is the output contact). If 12volts is not found at terminal 1 and the dot is still blinking check for 12 volts at terminal 2 (common for the output contacts) of the temperature controller. If 12volts is found at terminal 2 but not terminal 1, and the dot is still blinking, the temperature controller is bad or possibly incorrectly configured or programmed. Try resetting or replacing the temperature controller. Once the dot is blinking and 12volts is found at terminal 1 of the temperature controller (the output) go to step 8. If 12volts is not found at terminal 2 of the controller go to step 7.

7. Terminal 2 of the Temperature Controller is the “electrical common” for the outputs of the Temperature Controller. If the Temperature Controller is the first zone then there should be a direct connection to the “Controls” (terminal 6 of Condensing Unit – see wiring diagram). If the Temperature Controller you are using is not the first zone and 12 volts is not found at terminal 2, then this could be because of one of the lower numbered zone Temperature Controllers since they are chained together through the output contacts terminal 1, 2 and 3. For example, Zone 2 Temperature Controller terminal 2 (common for outputs) is connected to Zone 1 terminal 3 (Normally Closed output). Zone 1 must not be requesting cooling and 12 volts must be present at terminal 1 & 2 of the Zone 1 controller in order to have 12 volts at Zone 2 terminal 2. Using the first zone controller for troubleshooting a system level problem such as the compressor never runs is less complicated and should be the first step. If you are using Zone 1 and 12 volts is not found at terminal 2 of the controller, trace the wires back to the “Controls” (terminal 6 of Condensing Unit) which you already verified had 12 volts in step 3. Once 12 volts has been restored to terminal 2 of the Temperature Controller and the system is still not working, either start over at step 1 or go to step 6 if you are confident in all of the preceding steps.

8. Terminal 1 of the Temperature Controller is the output and is connected to solenoid valve for the Zone and to the Zone Input at the Condensing Unit (see wiring diagram and Condensing Unit Terminal Strip picture above). Since the Temperature Controller is requesting cooling (dot blinking) and 12 volts is found at terminal 1 of the Temperature Controller, the solenoid valve should be activated and 12 volts should be found at the Zone Input of the Condensing Unit. If 12 volts is not found at the Zone input of the Condensing unit, trace the wiring to find the

problem. Once 12 volts is found at the Zone input of the Condensing Unit and neither the compressor or the water pump are starting, then go to step 9.

9. With 12 volts at the Zone input of the Condensing Unit, the control Relay on the underside of the Condensing Unit should be activated (see photo of underside of Condensing Unit below). The control relay switches the power to the water pump and the Compressor Controller. If 12 volts is found at the Zone input of the Condensing Unit but the relay is not activated, check the wires for corrosion at terminal 8 & 9 (the relay coil) of the relay socket. Terminal 8 of the relay socket is ground and terminal 9 of the relay socket is the 12 volts from the output of the Temperature Controller. If these check out but the relay does not activate then replace the relay. If the relay activates but neither the water pump nor the compressor starts, check terminal 5 & 6 for 12 volts (common for relay outputs). If the relay is activated and 12 volts is found at terminal 5 & 6 but not at terminal 3 (water pump output) and terminal 4 (compressor output), then replace the relay. If the relay is activated and 12 volts is found at terminal 3 & 4 of the relay, go to step 10.

10. If 12 volts is present at the terminal 3 of the relay but the pump does not run, verify that 12 volts is found at “Water Pump” terminal of the Condensing unit. If 12 volts is not found at the “Water Pump” terminal of the then “Pump Fuse” circuit breaker is tripped or bad. If 12 volts is found at the “Water Pump” (terminal 5 of the Condensing Unit) then tracing the wiring to verify that 12 volts is reaching the water pump and that the water pump is functional.

11. These trouble shooting instructions will be updated with corrections and additions and your comments are welcome. For additional assistance with trouble shooting the Micro HPS you may contact Pacific Sea Breeze at info@pacificseabreeze.com or at 831-600-7878.

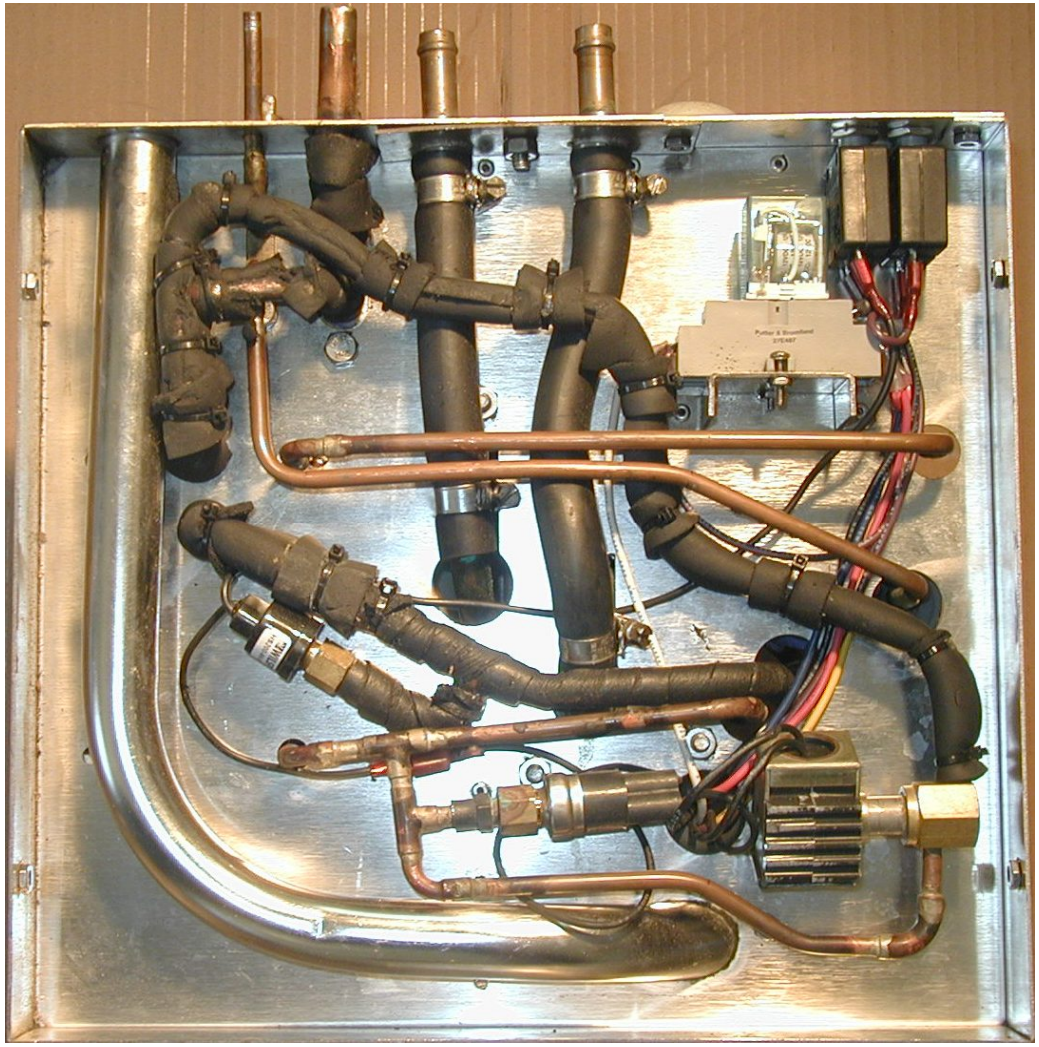

Fig 7. Underside of the Micro HPS showing Control Relay

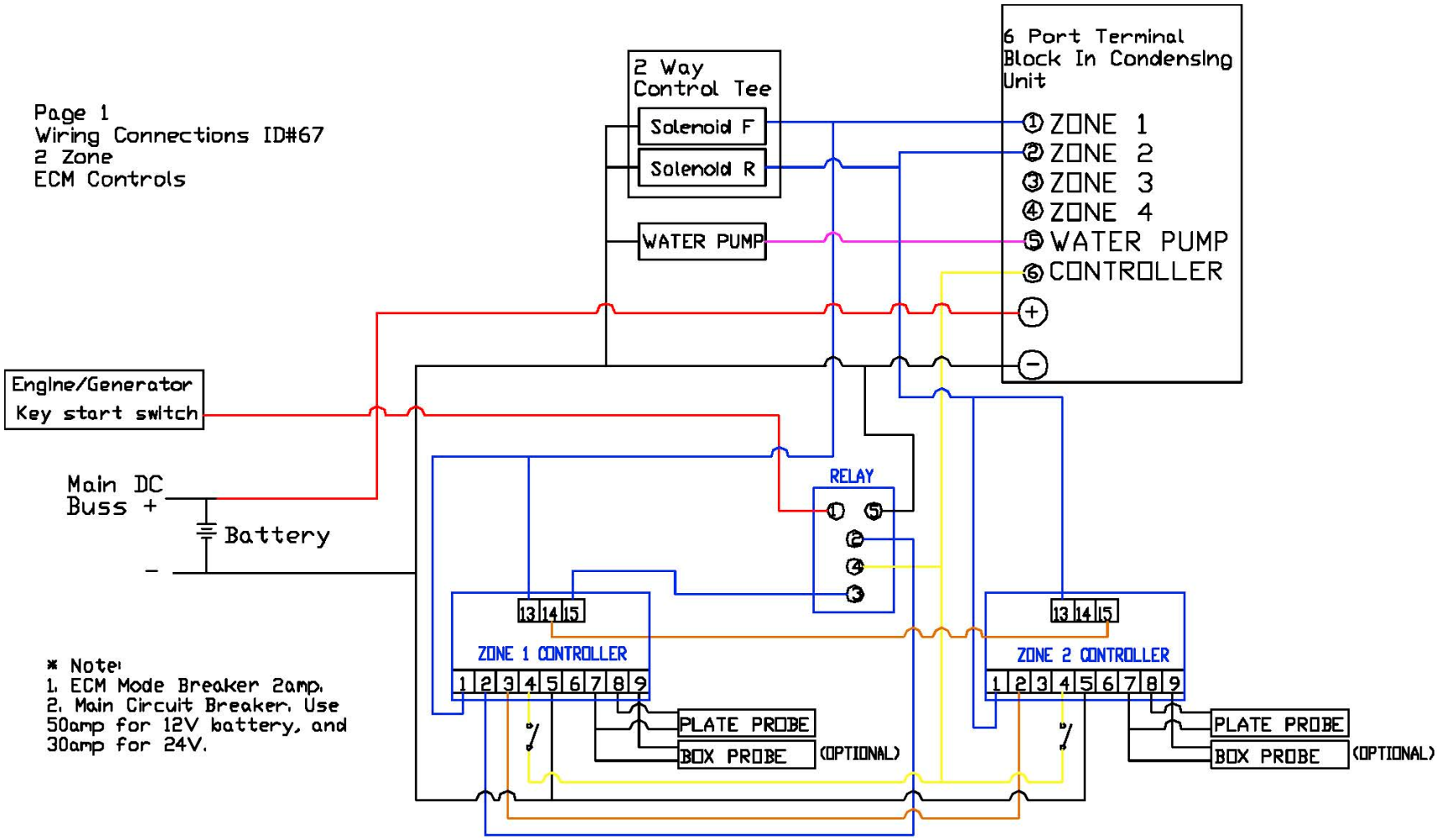

Fig 8. Wring Diagram – Condensing Unit to Temperature Controllers and Solenoids

(Backside of ECM Temperature Controllers)