NITE® PHOENIX
A Division of Bergstrom Inc.

Technical Information and Diagnostic Guide for

SECOND GENERATION

Use this guide with unit serial number prefix beginning with *BWF using Terra Power separator.*

This guide will assist you in becoming more familiar with the working components of the Phoenix No Idle System and the proper steps and procedures to completely diagnose the Phoenix Second Generation unit.

Rev 2 ©7/24/2013

!! Attention !!

Before proceeding with any diagnostics please call the Nite line for authorization. Opening the Unit without authorization could void your warranty!
Nite Line: 866-204-8570

Technicians are responsible for verifying all truck batteries and auxiliary system batteries are in good condition and are properly charged.

Do not proceed with any diagnostics without checking batteries and connections!

Battery Manufacturers and Websites for Additional Information

- Exide Technologies / www.exide.com
- East Penn Manufacturing (DEKA) / www.eastpenn-deka.com
- Interstate Batteries / www.interstatebatteries.com
- Odyssey Batteries / www.odysseybattery.com
- Trojan / www.trojanbattery.com

Heater Manufacturers and Websites for Additional Information

- Espar / www.espar.com

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A: Fuses

F1 Fuse 10 Amp (Mini)

This fuse provides short circuit protection for the System control.
Location: On the control center.

F2 Fuse 10 Amp (Mini)

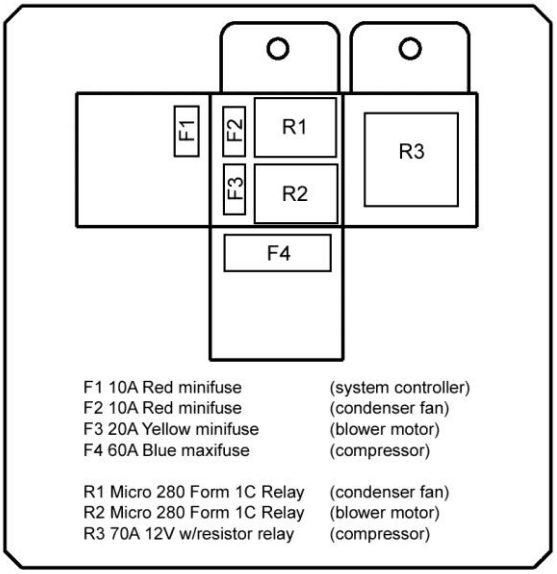
This fuse provides short circuit protection for the condenser fan.
Location: On the control center

F3 Fuse 20 Amp (Mini)

This fuse provides short circuit protection for the evaporator blower.
Location: On the control center

F4 Fuse 60 Amp (Maxi)

This fuse provides short circuit protection for the compressor.
Location: On the control center



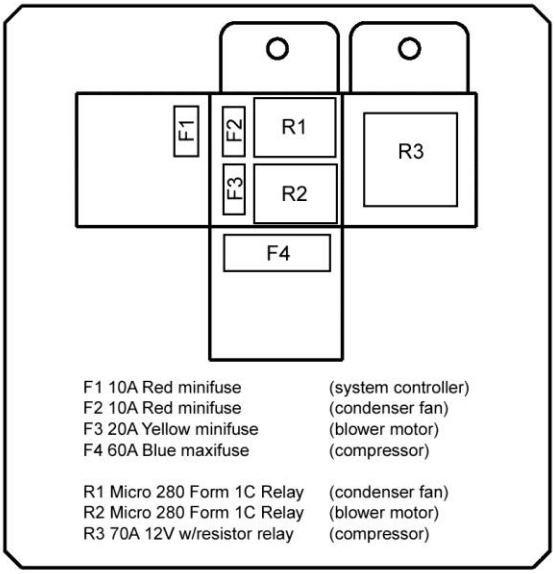
B: **Relays:**

Location: On the control center

R1. This relay controls the voltage to the condenser fan.

R2. This relay controls the voltage to the linear power module and evaporator blower.

R3. This relay controls the voltage to the compressor.



C: **Fan and Temperature Control Display LED Display**

Allows for temperature and Blower speed adjustment of the Phoenix unit when operating in Auto, cool or heat mode.

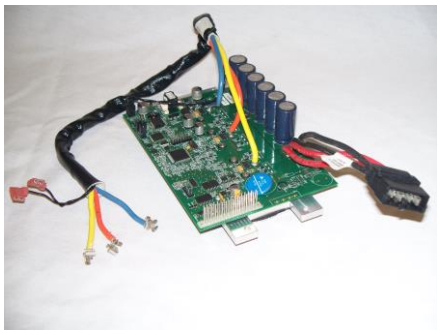
A/C Unit - stops when unit is shut off or batteries are depleted.

Auxiliary heater will shut down when batteries are depleted but will continue to run through the cool down cycle.

Also displays hours of service, battery health and service items.

D: **System and Compressor Controller:**

This device controls the unit and the output voltage to the variable speed compressor. It is located under the large access cover.



E: **Linear Power Module:**

This module controls the amount of voltage delivered to the evaporator blower creating variable blower speeds. It is located in the return air in front of the evaporator coil.

F: **Discharge Temperature Sensor - Freeze Switch:**

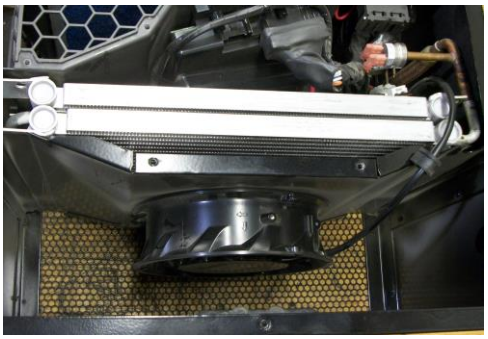
This sensor monitors the evaporator outlet temperature as it enters the vehicle duct system.

G: **Evaporator Blower:**

This blower pulls air through the evaporator coil and blows conditioned air into the interior of the sleeper.

H: **Condenser Fan:**

This blower draws air from under the truck and pushes it through the condenser coil to cool the refrigerant flowing through the system. The hot air is exhausted out underneath the truck.



I: **Battery Management System (PN 1000278739): Use this BMS with separator solenoid PN 1000282660 only.**

This device monitors the auxiliary batteries for state of charge, communicates with the Phoenix system and controls the battery separator solenoid. LED light on this device indicates power to the device and does not provide diagnostics. Power inputs to this device are fuse protected.

If one of the BMS fuses blows, the solenoid will disengage.

J: **Battery Separator Solenoid (PN 1000282660): Use this separator with BMS PN 1000278739 only.**

This device connects the truck batteries to the Phoenix batteries. When the starting batteries are at or above 13.2 volts, the battery management device will engage the solenoid to allow the alternator to charge the auxiliary batteries. When the voltage drops to or below 12.5 volts the battery management system will disengage the solenoid to prevent the truck starting batteries from being discharged below the engine start level.

INTERNAL COMPONENTS

K: **High Pressure Switch:**

This normally closed brazed pressure switch will open and prevent the operation of the compressor due to high internal pressure. It is NOT serviceable.

L: **Compressor:**

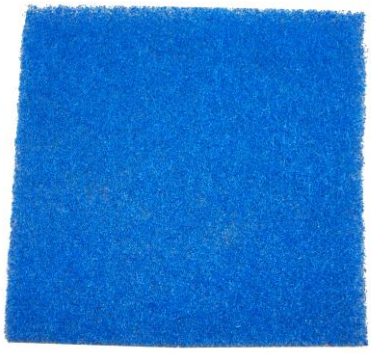
This unit is part of the hermetically sealed refrigeration system. It is NOT serviceable.

M: **Thermal Limit Switch on Compressor:**

This is a normally closed (auto reset) switch to protect the compressor from high temperature.

N: **Evaporator inlet filter:**

This filter protects the evaporator coil from dust and debris. It is washable and should be serviced every other month by washing dust and debris off with warm water. In environments with pets or dusty environments the filter may need more frequent washing. Failure to do so will affect the performance of the unit and could lead to drain tube clogging.



When necessary, Check Filter indicator will notify you that the Phoenix filter must be cleaned or changed. To reset Check Filter: at screen 1 press and hold enter button for 3 seconds.

A/C System Diagnostic Table

Check service screens before troubleshooting, see operating instructions.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION / SEE APPENDIX
Unit Will Not Run or Turn On **Display comes on for 5 seconds, shows service screen for 3 seconds and then powers off (see #9)**	1. Loose connection 2. No power is available at the unit. 3. Blown fuse or fuses 4. Check Voltage path to unit and control 5. Defective Control panel. 6. A/C system controller defective. 7. Broken wire or defective wire harness 8. Check for Fault code 9. Can Buss connection.	1. Confirm all connections are tight, including ground lugs, and terminals crimped on wires and battery cables. 2. Check **All** batteries for Voltage. Check battery management system and separator solenoid. Unit has a low voltage disconnect of 11.2 volts. 3. Check all fuses. See wiring diagrams pages 24/25. 4. Check for 12 volt through the 100 amp main fuse and F1 10 amp control fuse to controller pin C1. Also see appendix H. 5. Check control. See appendix B. 6. Test System Controller. See Appendix H. 7. Inspect wiring harness and all ground wires. 8. View faults on the controller. See pages 27-29 for instructions 9. Check can bus harness, resisters and connections. Reset controller. See appendix M and wiring diagrams pgs 24/25.
Auxiliary batteries will not recharge	1. Check battery Management System 2. Check Battery Separator	1. Check battery management device, harness and separator. See appendix L 2. Same as 4.
Unit Runs - But Does Not Blow Cold Air	1. Airflow blockage. 2. Compressor Fuse or Relay. 3. System and Compressor controller connections/ defective compressor. 4. Condenser fan and high pressure switch 5. Evaporator discharge temp sensor/Freeze switch defective 6. Compressor thermal switch 7. Evaporator blower/ Linear Power Module 8. Loss of charge (refrigerant system not serviceable).	1. Clear any blockage from recirculation grill or louvers. Also check condenser inlet and outlet for restriction (outside truck). 2. Check F4 compressor fuse and R3 compressor relay. See appendix C & E. 3. Confirm all wire harness plugs are connected. Test system and compressor controller. See appendix H. 4. Check high pressure switch and condenser fan. See appendix D & I. 5. Check sensor. See appendix F. 6. Check normally closed thermal switch. See appendix G. 7. Check Evaporator blower and linear power module. See appendix J. 8. If all tests check OK, a loss of refrigerant charge may have occurred. Call the Nite line at 1-866-204-8570

A/C System Diagnostic Table

Check service screens before troubleshooting, see operating instructions.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION / SEE APPENDIX
Unit Cycles On And Off and doesn't cool	1. Poor electrical connection. 2. Condenser fan inoperative. 3. Air flow blockage causing high pressure or freeze condition.	1. Check all electrical connections. 2. Check condenser fan. See appendix I. 3. Check for restricted airflow outside truck at condenser inlet and outlet and at louvers and recirculation grill. Check pressure switch, thermal limit and/or discharge temperature sensor. See appendix D, F, & G.
Unit Blows Cold Air, But Low Airflow	1. Check all duct work connections. 2. Air flow restricted 3. Evaporator Blower motor inoperative.	1. Make sure all ducts are connected, sealed and secure. 2. Check for airflow at louvers and recirculation grill. 3. Check evaporator blower motor and linear power module. See appendix J.
Unit Runs Correctly, But Less Than Expected Run Time	1. Ground terminal(s). 2. Batteries weak or not charged correctly. 3. High amperage draw 4. Check battery Management System 5. Check Battery Separator	1. Inspect and tighten ALL connections. 2. Check batteries for condition and state of charge. Check service screens in Phoenix control. See appendix A. 3. Check amp draw in Phoenix control service screen or use DC ammeter to check amps when running. Excessive amperage could signal compressor or internal component issue. **Amperage ranges 40 to 75 depending on settings and conditions**. 4. Check battery management device, harness and separator. 5. Same as 4.
Unit is Noisy or Vibrates	1. Evaporator Blower motor. 2. Condenser fan motor. 3. Compressor mounting. 4. Compressor internal.	1. Check evaporator blower. See appendix J. 2. Check condenser fan. See appendix I. 3. Check rubber compressor mounts. See appendix K. 4. If rubber compressor mounts check out acceptable, and compressor vibrates excessively, call Nite 1-866-204-8570.

ESPAR Heating System Diagnostic Table

Check service screens before troubleshooting, see operating instructions.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION / SEE APPENDIX
Heater is connected to the Phoenix unit and will not operate	1. Loose connection 2. No power is available at the unit. 3. Blown fuse or fuses 4. Check Voltage path to unit and control 5. Defective Phoenix Control. 6. System controller defective. 7. Broken wire or defective wire harness 8. Check for Fault code	1. Confirm all connections are tight, including ground lugs, and terminals crimped on wires and battery cables. 2. Check **Aux.** batteries for Voltage. Check for heater enable signal from Phoenix unit. Heater unit has a low voltage disconnect of 10.6 volts. See Appendix N. 3. Check 20 amp main fuse and 5 amp control fuse. See Espar manual. 4. Check harness. 5. Check control. See Appendix N and Espar manual. 6. Test System Controller. See Espar manual. 7. Inspect wiring harness and all ground wires. 8. View faults in the heater controller with Espar's Edith pc diagnostics or hand held diagnostics tool. See Espars guide.
Heater is not connected to the Phoenix unit and will not operate	1. Loose connection 2. No power is available at the unit. 3. Blown fuse or fuses 4. Check Voltage path to unit and control 5. Defective Heater Control. 6. System controller defective. 7. Broken wire or defective wire harness 8. Check for Fault code	1. See Espar Manual.
Heater blows cold air but no heat	1. Fuel 2. Fuel pump 3. Connections 4. Glow pin / screen 5. Sensors	1. See Espar Manual.

Monthly running and periodic maintenance are required for proper heater operation and performance.

Appendix

A. Battery Condition and Performance:

Battery Voltage is critical for system operation. Special attention should be given to both sets of batteries.

Attention: Poor quality batteries or a weak alternator will have a negative impact on unit run time. Always maintain the best possible batteries and charging system.

Load test and maintain batteries as required by the manufacturer.

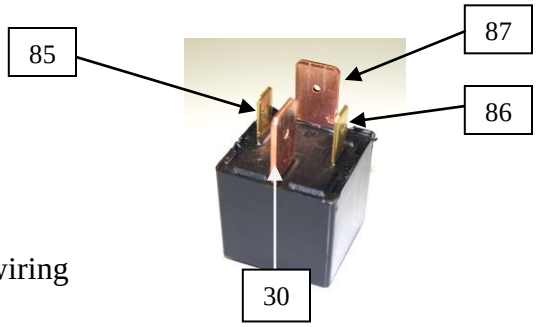
Battery symbol in diagnostics screen indicates battery health. This is created after many cycles. If batteries have been disconnected recently this symbol will reset. Several cycles will be needed to get accurate battery health.

An alternator providing 30 amps over OE spec is required for recharging

B. Fan and Temperature Control Display:

With the control off - check for 12 VOLT at and from F1 10 amp fuse to the connector on rear of control, terminal 1. Terminal 7 is negative. Check for 12 volts at control terminal 6 (wake up) coming from the main/ compressor controller terminal D6. Pushing the control (on) will switch this input from the main controller to ground at the control panel. This signals the main control to start the system. When control is on the wake up signal should be less than 1 volt.

C. Relay Testing:



With relay unplugged, confirm there is 12 VOLT on the sockets where 85 and 30 relay terminals are connected

If you do not have 12 VOLT here check fuses, wiring and battery connections.

Now, with relay unplugged, check across terminals 85 and 86 of the relay, using an OHM meter. You should have approx. 80 to 100 ohms. This is measuring the resistance through the relay coil. If you do not, replace relay.

Overview

When you turn the **NITE Phoenix** unit on, if all safety switches are ok, such as the high pressure switch, temperature sensor / freeze switch and the compressor thermal limit switch, the Main / Compressor controller will connect the compressor relay, condenser fan relay and the evaporator blower relay terminals 86 to ground at their respective terminals D10, D11 and D12 at the controller. This will close the contacts 30 and 87 of all 3 relays and allow power to each component.

You should now have 12 VOLT passing through the relays on spade terminals 87. This provides power to fuses F2, F3 and F4, continuing to the Linear Power Module, evaporator blower, condenser fan and the compressor controlling section of the Compressor Controller Assembly.

With relay plugged in: TURN THE UNIT ON. If you do not have 12 VOLT on terminal 87, check across terminals 85 (+) an 86 (-). You should have 12 VOLT. If you do not, you may have a defective harness or system controller. If you have 12 VOLT here and do not have 12 VOLT on terminal 87 your relay is defective. The internal coil of the relay is energized but the contacts are not closing. Replace the relay.

If you have 12 VOLT on terminal 87 and the compressor, condenser fan or evaporator blower does not run you could have a defective component such as evaporator blower, condenser fan or compressor controller.
See testing Evaporator blower Appendix J, Condenser fan Appendix I, Main/Compressor Controller, Appendix H.

D. Pressure Switch Testing:

You must remove top covers to access the switch.

The brazed switch (see photo page 9) is not removable. This switch is **normally closed.** When the unit is off for a few minutes, unplug the System Controller and check between pins D2 and D5, you should always have continuity. If you do not, you may have a broken wire, bad connection, high pressure situation or defective switch. If the pressure, harness and connections are ok, the Phoenix unit will have to be replaced. Call the Nite line at 1-866-204-8570

E. Check continuity across fuse body (fuse does not look blown)

Remove fuse from fuse holder. Using a meter, check for continuity across the fuse. You can check for voltage at and through the fuse using a dc volt meter, with the fuse installed.

F. Discharge Temperature Sensor/Freeze Switch Testing:

Location: Between evaporator coil and intake side of blower.
The freeze switch is a temperature sensor. To verify the condition you will need a Volt/OHM meter.

If a freeze condition occurs, the unit will stop the compressor. If the freeze condition leaves, the compressor will restart and the unit will continue to run.

Check resistance (ohms) value at the system controller with the 32 pin connector disconnected. You should read a resistance across terminals D3 (pos) and D5 (neg) within the range listed on the table page 20. If you cannot read the resistance, check at the sensor connection. If you read the resistance here, and it's within the range allowed, you have a defective harness.
If you cannot read the resistance or it is not within the given range, your sensor is defective.

G. Compressor Thermal Limit Switch: You must remove the top cover and the plastic shield on top of the compressor, to access the switch.

This device is a normally closed switch. If the compressor gets too hot, the thermal limit switch will open and the compressor will stop. Checking with a meter you should always have continuity between the two terminals when it is cool.

H. Main Controller/Compressor Controller: You must remove the cover.

Do not attempt to test the controller or compressor until you have completely eliminated all other possibilities.

Overview

When you turn the **NITE Phoenix** unit on, if all safeties are ok, such as the high pressure switch, temperature sensor / freeze switch and the compressor thermal limit switch, the Main / Compressor controller will connect the compressor relay, condenser fan relay and the evaporator blower relay terminals 86 to ground at their respective terminals D10, D11 and D12 at the controller. This will close the contacts 30 and 87 of all 3 relays and allow power to each component. The compressor and evaporator blower will begin to operate at a speed determined by the manual control panel. The condenser fan will run at normal operational speed.

Initial start up, the system defaults to Auto Mode, Blower speed 1 and 60°F set point. After the settings are changed for the first time, they will always default to the last setting.

Use the following steps to check the controller

a. With the control switch off - check for 12 VOLT from F1 10 amp fuse to the back of the control.

b. Now check for 12 volts at switch terminal 6 (wake up) coming from the main/ compressor controller terminal D6. Turning the unit on will switch this 12 volt input from the main controller to ground at the control panel. This signals the main control to start the system.

c. With a correct 12 volt signals to and from the control, now check for (ground) signals to relays on D10, 11 and 12. All relays should be closed and all terminals # 87 should have 12 volts. If you lose any signals from the controller it must be replaced.

d. With relays closed, the main controller will now signal each component to start. The evaporator blower receives its power from the linear power module. Safety controls must be in a normal state for the above signal to operate the unit.

e. If all signals are correct and the safety controls thermal limit on compressor, high pressure switch and temp sensor /freeze switch are ok, the control is calling for cold and the sleeper temperature is above 60 degrees, you should have voltage out on the three wires connected to the compressor terminals: A – Blue, B – Orange and C – Yellow. (ABC – BOY), and the compressor should run.

f. If the compressor does not operate, disconnect the three wires from the compressor. You will have to remove plastic cap from the top of compressor.

Using a volt meter check each wire, positive on (blue, orange or yellow) negative to battery ground. If you do not have a 6 volt pulse voltage out on each wire, replace the controller. Pulse voltage means the controller will cycle to each colored wire. You should see the voltage appear and disappear continuously.

If you do have a 6 volt pulse voltage out and the compressor does not run you have a defective compressor. Call the **NITE LINE** 1-866-204-8570

I. Condenser Fan Motor Testing:

First do a visual inspection of all fan parts.

Note: This fan cycles on and off with the compressor! Before testing fan, start the unit, make sure the control is set for full cold and the temperature in the truck will allow the control to attempt to start the compressor and fan.

Turn the unit on**,** you should have 12 volts across terminals 1 and 2 at the condenser fan connector. If you do not have 12 volt at the fan, check fuse F2 And relay R1. If all voltages are correct, and the fan does not run, it is defective, and needs to be replaced

Using a DC ammeter you can check the amperage draw of the blower. Normal amps approx. 4.5

Caution: If attempting to connect blower to an outside power source, internal electronic components are sensitive to arcing or reverse polarity! Damage will occur!!

J. Evaporator Blower Motor and Linear Power Module Testing:

First do a visual inspection of all blower parts. The evaporator blower speed is controlled by the **LPM**, Linear Power Module, item H page 7.

Turn the unit on, you should have 12 volt at the **LPM** pins 6 (pos) and pin 5 (neg), if you do not, check fuse F3 and relay R2. If you have 12 VOLT main power, check for the speed signal voltage on the **LPM** at pin 3 coming from the system controller pin C13. You should have approx. 5.6V for speed 1, approx. 4.9V for speed 2 and approx. 3.1V for speed 3. If all of these voltages are correct, check the output voltage from the **LPM** pins 1 and 2 going to the blower. You should have approx 6.6V out for speed 1, approx. 8.1V out for speed 2 and approx. 10V out for speed 3 to the blower.

If fan does not run, it is defective, and needs to be replaced.

Using a DC ammeter you can check the amperage draw of the blower. Normal amps will range from 4 to 10 amps.

Caution: If attempting to connect blower to an outside power source, internal electronic components are sensitive to arcing or reverse polarity! Damage will occur!!

K. Compressor Rubber Mounts:

Visual inspection of the compressor rubber mounts may be necessary if excessive vibration is present. Check for loose mounting nuts. If mounting nuts and captive studs are ok, vibration could be from the internal part of the compressor.

L. Testing the Battery Management System (BMS)

Overview

The BMS monitors the auxiliary batteries for state of charge, communicates with the Phoenix system and controls the battery separator solenoid. LED light on the BMS indicates power to the device and does not provide diagnostics. Power inputs to the BMS are fuse protected.

When the truck starting battery voltage is above 13.2 volts for at least 15 seconds, the BMS will send an **engage** signal to the separator. The separator will close and allow charging of the aux batteries. When the truck starting battery voltage falls below 12.5 volts for 15 seconds, the BMS will **disengage** the separator. The separator will open and stop the charge of the aux batteries, and prevent the truck starting batteries from being discharged.

Testing

Before testing the BMS or separator, unplug the BMS for at least 1 minute to reset the system then reconnect and attempt to operate the system. If the system does not operate continue with the following tests.

BMS tab with hole must be connected to the negative battery terminal on the aux batteries. First, check the aux battery voltage. Voltage must be above 6 volts for the device to work. Batteries should be tested and fully charged before they are installed in the truck for best results. If not, it can take a considerable amount of time for the battery state of health indicator to be correct.

Check the LED light on the BMS, it should be flashing indicating the device has power.
If the aux battery voltage is ok, and the LED is not flashing, check the connection and 5 amp fuse in the aux battery sense wire near the BMS.

With aux voltage ok and LED flashing, check for 12 volts from the truck starting batteries. This voltage passes through a 5 amp fuse in the start battery box and connects at pin 8 (pos) and 1 (neg) in the 8 pin connector on the BMS. This voltage, from the truck batteries, is displayed on the LED controller (service) screen. It also powers the output for the engage signal to the separator. If you do not have 12 volts across pins 8 (pos) and 1 (neg), check the 5 amp fuse and the wiring harness.

With aux voltage ok, LED flashing and 12 volts across pins 8 and 1, start the truck or connect the start batteries to a battery charger and bring the voltage above 13.2 for at least 15 seconds. You should hear a click when the solenoid pulls in. This would indicate that the BMS has sent the engage signal from pin 5 (orange

wire) of the BMS to pin 2 on the Terra Power separator, pin 1 is ground on both devices. This is a 12 volt signal. When the separator closes, you should see an increase in voltage on the aux side of the separator and at the aux batteries. The voltage across both sides of the solenoid will slowly become the same value, which indicates that the tractor batteries and auxiliary batteries are tied together in parallel. If the separator did not close by the BMS, check the separator. (See below) If the separator checks ok, recheck the BMS. If the separator closed and does not allow charge to the aux batteries, the internal contacts of the switch could be defective. Replace the separator.

If the separator closes and allows charge to the aux batteries, that part of the BMS is working. Now shut off the truck engine or battery charger and put a load on the tractor batteries. Examples of a load include the headlights and radio. Allow the voltage of the truck batteries to drop below 12.5 volts for 15 seconds. You should hear a click when the solenoid disengages. This would indicate that the BMS has disengaged the signal from pin 5 of the BMS to pin 2 on the separator. The voltage of the tractor batteries and the auxiliary batteries should now start to be different. Turn off the headlights or other loads that were placed on the batteries. When the separator opens, it prevents the starting batteries from being drained. If the separator clicks and does not disengage the internal contacts, the contacts could be welded together. Replace the separator.

Separator Switch Testing:

Disconnect the Deutsch connecter of the Terra Power separator. Connecting 12 volts to terminals 2 (Pos) and 1 (Neg) will engage the separator and close the contacts connecting the start and aux batteries. Disconnecting the 12 volts to terminals 2 (Pos) and 1 (Neg) will disengage the separator and open the contacts connecting the start and aux batteries.

If the separator switch tests ok, reconnect the separator wires, unplug the PMS for at least 15 seconds, reconnect BMS and repeat BMS test. If the BMS will not operate the separator, replace the BMS.

M. Can Bus

NOTE: Before checking Can Bus, if control lights for a few seconds and goes out, disconnect the controller harness at the unit. Reconnect to reset. If unit does not run, continue with Can Bus tests.

POWER TO BOTH DEVICES (PHOENIX AND BATTERY MANAGEMENT SYSTEM) MUST BE DISCONNECTED TO PERFORM THESE TESTS

The communication from the BMS to the Phoenix unit travels through the controller harness and the BMS harness. These harnesses have a twisted pair of wires, yellow (Can H) and green (Can L). These harnesses should be loomed and routed away from any components in the truck that could cause interference, such as florescent lights, etc.

First, determine what part of the can is affected. If you lose the Can Bus to the BMS, the Phoenix unit will operate normally. You will not see volts and amps displayed on the service screens and the battery symbol will indicate full as a default.

If the digital controller does not communicate to the Phoenix unit, the unit will not operate. If the unit is operating and loses communication for more than 5 seconds it will shut down.

Units built before 9-1-2013 that include the Y connector and resistor follow steps 1-3

1. Check the Can Bus Harness. Disconnect the harness on the BMS and the controller harness connected to the back of the digital controller. With the 120 OHM resister and resister Y connector installed in the harness near the BMS, check across the yellow (Can H) and green (Can L) wires. Both ends of the harness should measure 120 OHM's. This indicates the circuit is ok.
2. Now, leave the controller harness disconnected and reconnect the BMS harness. Check across the yellow (Can H) and green (Can L) wires at the controller. You should read 60 OHM's. If you do not read 60 OHM's, you have a defective BMS.
3. Reconnect the controller harness. Disconnect the BMS harness. Check across the yellow (Can H) and green (Can L) wires at the BMS. You should read 60 OHM's. If you do not read 60 OHM's you have a defective controller.

Units built after 9-1-2013 follow these instructions

Units built after 9-1-2013 have the 120 ohm resistor internal in the controller and Battery Management System

Remove controller and disconnect the harness. Check across pins 4 & 5 on the controller. You should have 120 ohms.

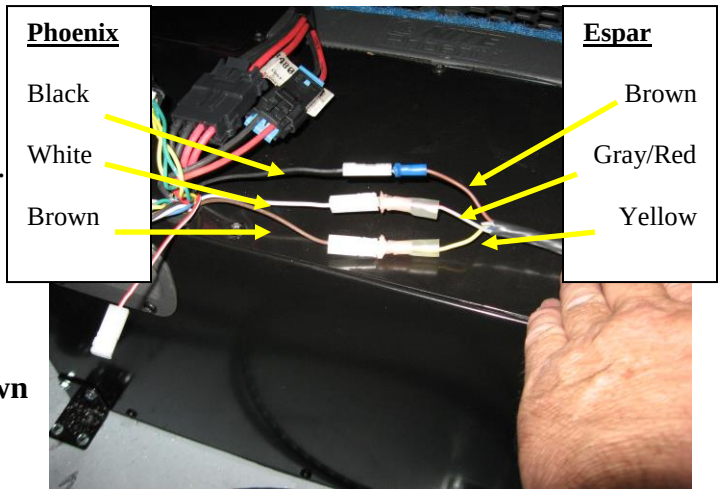
Back probe the harness. You should have 120 ohms with harness connected to the unit and BMS, if not check at BMS.

Disconnect harness at BMS. Check pins 6 & 7. You should have 120 ohms. With harness still connected to the controller and unit, back probe harness. You should have 120 ohms. With all harnesses connected you should have 60 ohms.

N. Testing the Espar Heater *connected* to the Phoenix Digital Controller

See the Espar heater or Phoenix install manual for installation procedures and main power harness and fuel pump connections.

The heater control harness is connected to 3 wires coming from the Phoenix unit.



Phoenix Heat enable 12 volt (Brown)
Connects to heater control wire - Yellow

Phoenix Ground - (Black)
Connects to heater control wire - Brown

Phoenix Temperature Level (White)
Connects to heater Gray with red stripe

Selecting HEAT mode will turn the ENABLE signal on. The heat level will be controlled through the Phoenix (white) wire coming from the unit. This is a variable resistance signal from the Phoenix digital controller. Resistance ranges from approx. 1.8k ohms for low heat and 2.2k ohms for high heat.

First, set the Phoenix digital controller to HEAT mode, set the temperature to full heat 85 degrees. When testing the heater, the ambient temperature in the sleeper must be below 85 degrees.
Check for the heat enable signal between the Phoenix brown and black wires. You should have 12 volts. If the digital controller shows the temperature set point and heat mode and you do not have 12 volts, check the Phoenix internal system controller output from pin C15. If you have 12 volts on pin C15 but not outside the unit, you have a bad connection or the harness is defective. If you do not have 12 volts on pin C15, you have a defective system controller.

With 12 volts on the heat enable, check the heat level signal on the Phoenix (white) wire using the Phoenix black as ground. This variable resistance signal will range from approx. 1.8k ohms to 2.2k ohms. If this resistance is within range, the heater should operate. If it does not operate, the problem is internal in the heater. See Espar guide for heater diagnostics.

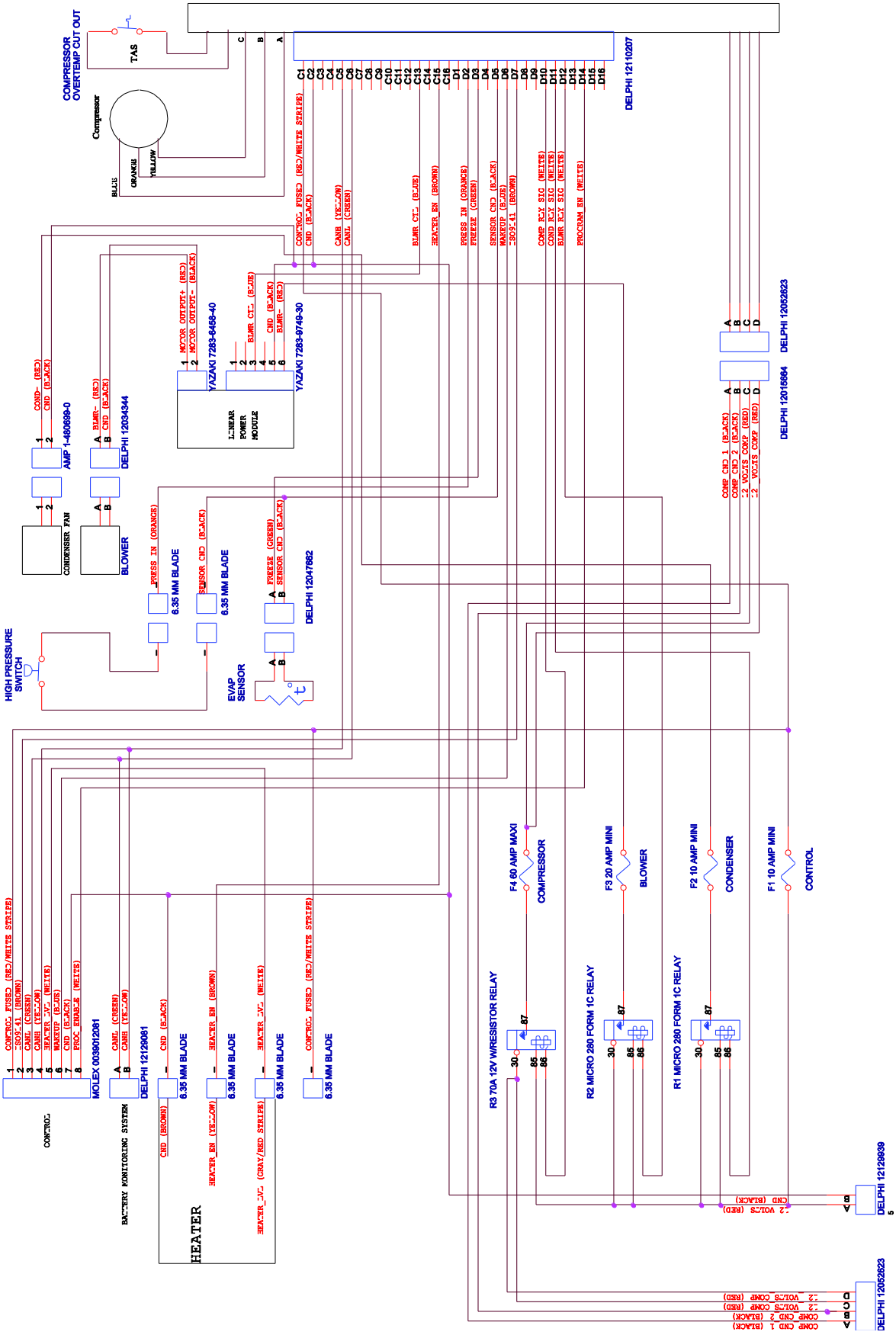
If the resistance level is not present or correct, check across pins 5 and 7 on the back of the digital controller. If you have the correct resistance here but not outside the Phoenix unit, you have a bad connection or a defective harness. If you do not have the correct resistance here, your digital controller is defective.

DISCHARGE SENSOR / FREEZE SWITCH TESTING CHART

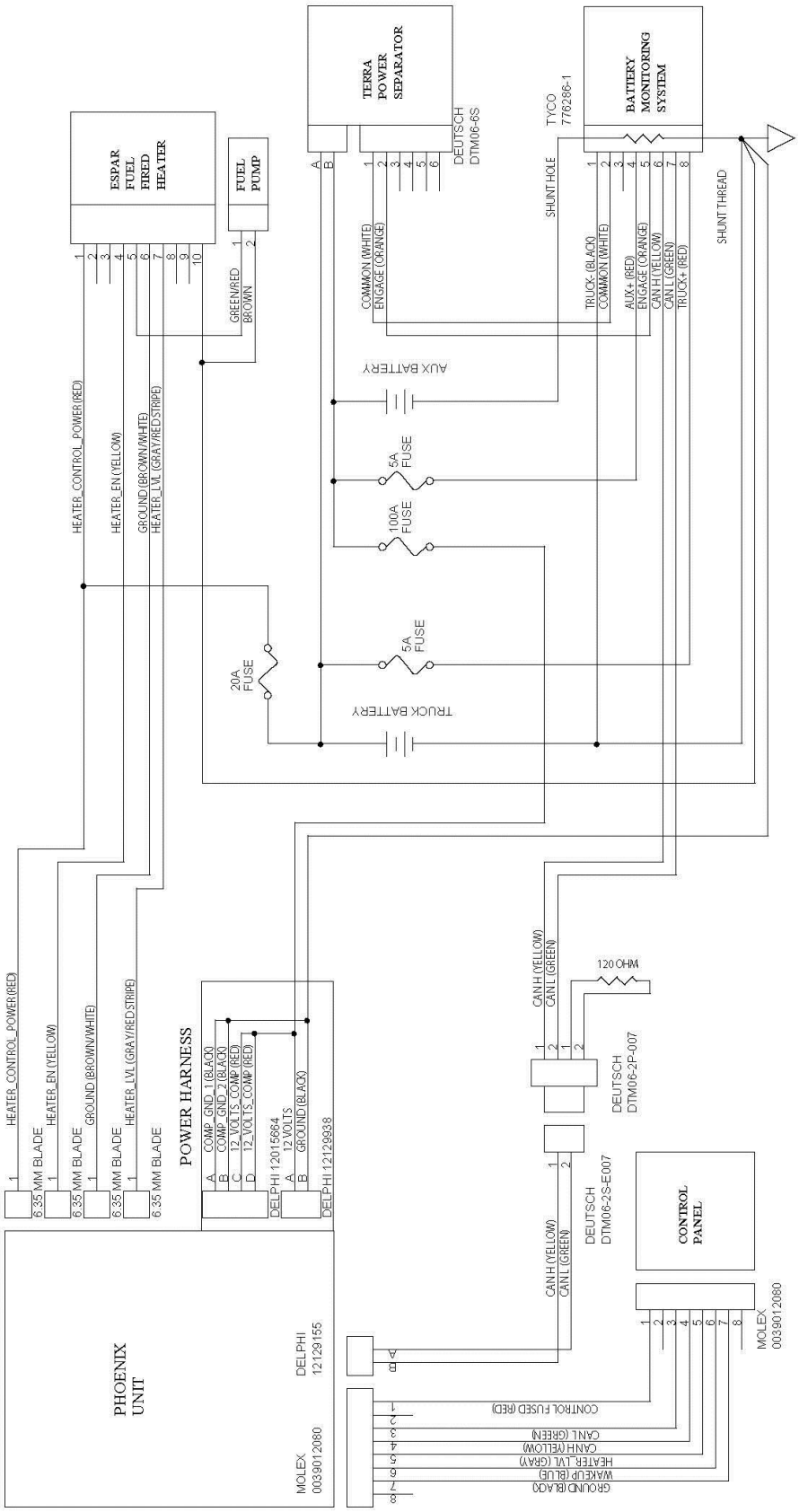
TEMP (°C)	R (min)	R (cent)	R (max)	R (min)	R (max)
-30	84.45	86.75	89.11	-2.7%	2.7%
-29	79.39	81.51	83.68	-2.6%	2.7%
-28	74.68	76.62	78.61	-2.5%	2.6%
-27	70.28	72.06	73.89	-2.5%	2.5%
-26	66.16	67.80	69.48	-2.4%	2.5%
-25	62.32	63.82	65.36	-2.4%	2.4%
-24	58.72	60.10	61.51	-2.3%	2.3%
-23	55.35	56.62	57.92	-2.2%	2.3%
-22	52.20	53.37	54.55	-2.2%	2.2%
-21	49.25	50.32	51.41	-2.1%	2.2%
-20	46.49	47.47	48.47	-2.1%	2.1%
-19	43.89	44.80	45.71	-2.0%	2.0%
-18	41.46	42.29	43.13	-2.0%	2.0%
-17	39.18	39.94	40.71	-1.9%	1.9%
-16	37.04	37.74	38.44	-1.8%	1.9%
-15	35.03	35.67	36.32	-1.8%	1.8%
-14	33.14	33.73	34.32	-1.7%	1.8%
-13	31.37	31.90	32.45	-1.7%	1.7%
-12	29.70	30.19	30.69	-1.6%	1.6%
-11	28.13	28.58	29.03	-1.6%	1.6%
-10	26.65	27.06	27.48	-1.5%	1.5%
-9	25.26	25.64	26.02	-1.5%	1.5%
-8	23.95	24.30	24.64	-1.4%	1.4%
-7	22.72	23.03	23.35	-1.4%	1.4%
-6	21.56	21.84	22.13	-1.3%	1.3%
-5	20.46	20.72	20.98	-1.3%	1.3%
-4	19.43	19.66	19.90	-1.2%	1.2%
-3	18.45	18.67	18.88	-1.2%	1.2%
-2	17.53	17.73	17.92	-1.1%	1.1%
-1	16.66	16.84	17.01	-1.1%	1.1%
0	15.84	16.00	16.16	-1.0%	1.0%
1	15.05	15.21	15.37	-1.1%	1.1%
2	14.30	14.46	14.62	-1.1%	1.1%
3	13.60	13.75	13.91	-1.1%	1.2%
4	12.93	13.09	13.24	-1.2%	1.2%
5	12.30	12.46	12.61	-1.2%	1.3%
6	11.70	11.86	12.01	-1.3%	1.3%
7	11.14	11.29	11.45	-1.3%	1.4%
8	10.61	10.76	10.91	-1.4%	1.4%
9	10.10	10.25	10.40	-1.4%	1.5%
10	9.626	9.771	9.918	-1.5%	1.5%
11	9.174	9.316	9.461	-1.5%	1.5%
12	8.745	8.885	9.027	-1.6%	1.6%
13	8.339	8.477	8.616	-1.6%	1.6%
14	7.954	8.089	8.226	-1.7%	1.7%
15	7.589	7.722	7.856	-1.7%	1.7%
16	7.243	7.373	7.504	-1.8%	1.8%
17	6.914	7.041	7.170	-1.8%	1.8%
18	6.602	6.727	6.853	-1.9%	1.9%
19	6.306	6.428	6.552	-1.9%	1.9%
20	6.025	6.144	6.265	-1.9%	2.0%
21	5.758	5.875	5.993	-2.0%	2.0%
22	5.504	5.618	5.734	-2.0%	2.1%
23	5.263	5.374	5.488	-2.1%	2.1%
24	5.034	5.142	5.253	-2.1%	2.2%
25	4.816	4.922	5.030	-2.2%	2.2%
26	4.608	4.712	4.818	-2.2%	2.2%
27	4.411	4.512	4.615	-2.2%	2.3%

TEMP (°C)	R (min)	R (cent)	R (max)	R (min)	R (max)
28	4.223	4.322	4.422	-2.3%	2.3%
29	4.044	4.140	4.239	-2.3%	2.4%
30	3.874	3.968	4.064	-2.4%	2.4%
31	3.711	3.803	3.897	-2.4%	2.5%
32	3.557	3.646	3.738	-2.5%	2.5%
33	3.410	3.497	3.586	-2.5%	2.5%
34	3.269	3.354	3.441	-2.5%	2.6%
35	3.135	3.218	3.303	-2.6%	2.6%
36	3.007	3.088	3.171	-2.6%	2.7%
37	2.886	2.964	3.045	-2.7%	2.7%
38	2.769	2.846	2.925	-2.7%	2.8%
39	2.658	2.733	2.810	-2.7%	2.8%
40	2.553	2.625	2.700	-2.8%	2.8%
41	2.451	2.522	2.595	-2.8%	2.9%
42	2.355	2.424	2.495	-2.9%	2.9%
43	2.262	2.330	2.399	-2.9%	3.0%
44	2.174	2.240	2.307	-2.9%	3.0%
45	2.090	2.154	2.219	-3.0%	3.0%
46	2.009	2.072	2.136	-3.0%	3.1%
47	1.932	1.993	2.055	-3.0%	3.1%
48	1.859	1.918	1.978	-3.1%	3.2%
49	1.788	1.846	1.905	-3.1%	3.2%
50	1.721	1.777	1.834	-3.2%	3.2%
51	1.656	1.711	1.767	-3.2%	3.3%
52	1.594	1.647	1.702	-3.2%	3.3%
53	1.535	1.587	1.640	-3.3%	3.4%
54	1.478	1.529	1.581	-3.3%	3.4%
55	1.424	1.473	1.524	-3.3%	3.4%
56	1.372	1.420	1.469	-3.4%	3.5%
57	1.322	1.369	1.417	-3.4%	3.5%
58	1.274	1.320	1.367	-3.4%	3.6%
59	1.228	1.273	1.318	-3.5%	3.6%
60	1.185	1.228	1.272	-3.5%	3.6%
61	1.142	1.184	1.228	-3.5%	3.7%
62	1.102	1.143	1.185	-3.6%	3.7%
63	1.063	1.103	1.144	-3.6%	3.7%
64	1.026	1.065	1.105	-3.6%	3.8%
65	0.9902	1.028	1.067	-3.7%	3.8%
66	0.9559	0.993	1.031	-3.7%	3.8%
67	0.9229	0.9589	0.9960	-3.7%	3.9%
68	0.8913	0.9263	0.9630	-3.8%	3.9%
69	0.8609	0.8950	0.9304	-3.8%	4.0%
70	0.8317	0.8649	0.8994	-3.8%	4.0%
71	0.8036	0.8360	0.8697	-3.9%	4.0%
72	0.7766	0.8082	0.8410	-3.9%	4.1%
73	0.7506	0.7815	0.8135	-3.9%	4.1%
74	0.7257	0.7558	0.7870	-4.0%	4.1%
75	0.7017	0.7310	0.7615	-4.0%	4.2%
76	0.6786	0.7072	0.7369	-4.0%	4.2%
77	0.6564	0.6843	0.7133	-4.1%	4.2%
78	0.6351	0.6622	0.6905	-4.1%	4.3%
79	0.6145	0.6410	0.6686	-4.1%	4.3%
80	0.5947	0.6206	0.6475	-4.2%	4.3%
81	0.5756	0.6009	0.6271	-4.2%	4.4%
82	0.5573	0.5819	0.6075	-4.2%	4.4%
83	0.5396	0.5636	0.5886	-4.3%	4.4%
84	0.5226	0.5460	0.5704	-4.3%	4.5%
85	0.5062	0.5290	0.5528	-4.3%	4.5%

Internal Wiring Diagram



External Wiring Diagram



Control module pinout with functional information

Pin	Circuit ID	Wire Color	Function	Typical Voltage	Other End of Circuit
C1	12V_CTL_FUSED	Red/White	12V power from F1 10 amp fuse	12-14V	Control fuse F1 and control pin 1
C2	GND	Black	Ground for controls	0V	Black harness connector / various internal grounds
C3					
C4					
C5	CANH	Yellow	J1939 Can bus HI	2.5V with "pulsing"	Yellow wire Pin 4 in connector on back of Control
C6	CANL	Green	J1939 Can bus LO	2.5V with "pulsing"	Green wire Pin 3 in connector on back of Control
C7					
C8					
C9					
C10					
C11					
C12					
C13	BLWR_CTL	Blue	PWM ground switched output to control blower speed	5.6V speed 1, 4.9V speed 2, 3.1V speed 3	Linear Power Module
C14					
C15	HTR_ENABLE	Brown	12V output to enable FOH operation	11-14V in heat mode Connects to Yellow at exit of unit	Connects to Yellow at exit of unit
C16					
D1					
D2	PRESS_SW	Orange	Pressure switch input	11-14V if open and unit on, <1V if switch closed or unit off	High pressure switch
D3	evap temp-freeze switch	Green	0-5V input from evaporator temperature sensor	5V with sensor open or unplugged, 1V-2.5V with sensor plugged in	Evaporator temperature sensor - inside unit
D4					
D5	SENSOR_GND	Black	Ground from control module for sensor, pressure switch	Ground	Temperature sensor, high pressure switch
D6	WAKEUP	Blue	Switch to Ground input from ACU - turns on Parked unit	11-14V with control off, <1V when unit on	Blue wire Pin 6 in connector on back of Control
D7	ISO 9141	Brown			Brown wire Pin 2 in connector on back of Control
D8					
D9					
D10	RELAY R3	White	Switch to Ground output to relay 3 - Compressor power from AUX Batteries	<0.5V if on, otherwise 11-14V	Relay in electrical center
D11	RELAY R1	White	Switch to Ground output to relay 1 - Condenser fan power from AUX Batteries	<0.5V if on, otherwise 11-14V	Relay in electrical center
D12	RELAY R2	White	Switch to Ground output to relay 2 - Evap blower power from AUX Batteries	<0.5V if on, otherwise 11-14V	Relay in electrical center
D13					
D14	PROG_ENABLE	White	Ground input to go into reprogramming mode	Not normally used	White wire Pin 8 in connector on back of Control
D15					
D16					

To start the system push ON/OFF button. Display will show current mode/ temperature setting / battery level.

Initial default setting is blower speed 1/ AUTO-MODE /60 °F

ON/OFF

Changing MODE – press ENTER, while mode is flashing use up or down arrows to select AUTO / COOL / HEAT. After 5 seconds selection will be set.

ENTER

Changing BLOWER SPEED – press ENTER until display shows FAN and SPEED. Press up or down arrows to select 1 – 2 – 3 speed. After 5 seconds selection will be set.

ENTER

Changing TEMPERATURE set point. Anytime the temperature set point is displayed on the screen, push the up or down arrows to change. Temperature range is from 60 °F (coolest) to 85 °F (warmest).

NOTE: Control will always default to the last setting when the unit is turned on.

ENTER

To view system runtime/hours – press ENTER until "Hrs" show on display. When hours are displayed, pressing ENTER for 7 seconds will reset the hours to zero.

ENTER

To change from °F to °C press ENTER until temperature symbol only shows – push the up or down arrow to change. After 5 seconds selection will be locked.

Anytime the control is idle for 5 seconds the screen will return to the temperature set point screen.

ENTER

To enter SERVICE MODE: Push both the ON/OFF and ENTER button simultaneously at any time.

Display will show service indicator and a code #1 to #3. Use up and down arrows to scroll through the Fault Codes.

1) Evap sensor open or shorted high
2) Evap sensor shorted low
3) High pressure switch open or shorted high

Press the ENTER button to proceed through the available service screens.

1) SV = Starting batteries Voltage
2) AV = Auxiliary batteries Voltage
3) AA = Unit Amperage draw

Pressing ENTER arrow after viewing service screen will return you to the fault code screen.

Pressing the ON/OFF button will return you to the Temperature Display screen.

When necessary, Check Filter light will notify you that the Phoenix filter must be cleaned or changed. To reset filter: at screen 1 press and hold enter button for 3 seconds.