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VERITUS
CHAUFFE-EAU À THERMOPOMPE À AIR

Service Manual
Models: 60 - 350*
Series: 100

⚠ WARNING If the information in this manual is not followed exactly, electrical shock or excessive pressure may result causing property damage, personal injury, or loss of life.

-- Installation and service must be performed by a qualified installer or service agency.

LOW LEAD CONTENT

DESIGNED ★ ENGINEERED ★ ASSEMBLED USA

c UL US

*Models 200 through 350 are composed of combinations of models 60 and 140 which are the certified units.

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual and the Veritus Water Heater Service Manual, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Contents

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠WARNING

Installer - Read all instructions, including this manual and the Veritus Water Heater Installation and Operation Manual, before installing. Perform steps in the order given.

User - This manual is for use only by a qualified heating installer/service technician. Refer to the Veritus Installation and Operation Manual for your reference.

Have this water heater serviced/inspected by a qualified service technician at least annually.

Failure to comply with the above could result in severe personal injury, death, or substantial property damage.

NOTICE

When calling or writing about the water heater – Please have the water heater model and serial number from the water heater rating plate.

When servicing the water heater –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow the water heater to cool before performing maintenance.

Water heater operation –

- Do not block flow of ventilation air to or from the water heater.
- Should overheating occur disconnect electrical supply to unit.
- Do not use the water heater if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

What is in this manual?

Service

The Veritus water heater display
- Display panel readout, buttons

Control module inputs
- Control module inputs and options

Control module outputs
- Control module outputs and options

General
- How the water heater operates
- How the control module operates
- Access modes - user and installer
- Sequence of operation - water heating

Control panel menu access
- Accessing programming mode and locating menus

Control panel parameter access
- Accessing and changing parameters from the display panel

Quick start information -- parameter table
- An index of available adjustments and readouts, where to access them, and where to find detailed information

Veritus water heater option
- General
- DHW Settings
- High Limits
- Backup Heat
- DHW Recirc Settings
- Boost Settings
- Control Modes
- BMS
- Unoccupied
- Service Mode
- Service Notification
- System Firmware
- Data Logging

Maintenance
- Service and maintenance schedules
- Address reported problems
- Inspect water heater area
- Inspect water heater interior
- Check inlet and outlet air ducting
- Check water system
- Check expansion tank
- Check relief valve at unit
- Check unit wiring
- Check refrigeration piping
- Check all water heater wiring
- Check control settings
- Perform startup and checks
- Check refrigerant change
- General maintenance
- Review with owner
- Cleaning the water heater heat exchangers
- Oiled bearing circulators
- Clean condensate trap

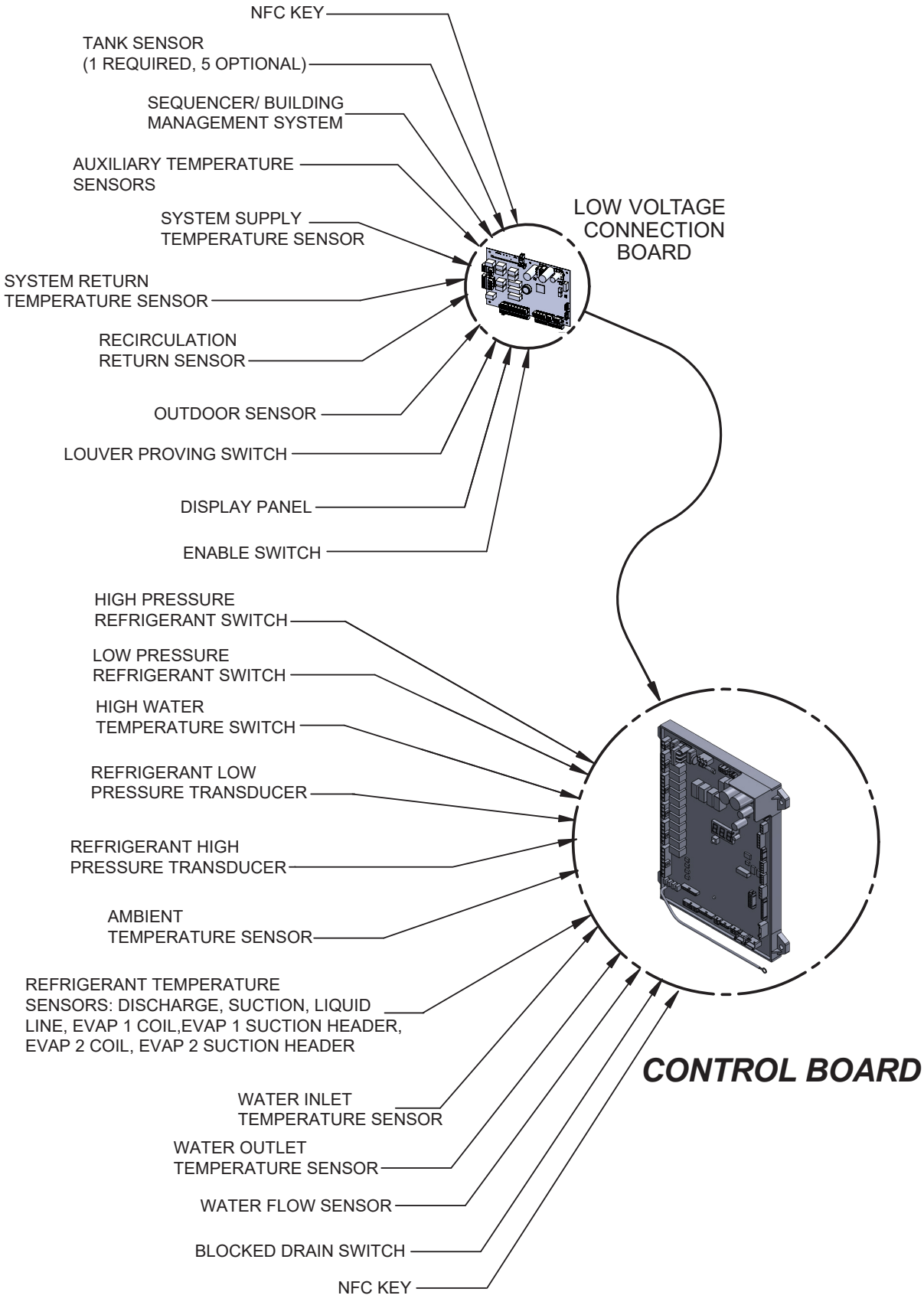
Troubleshooting
- Troubleshooting table - No display
- Checking temperature sensors
- Sensor tables
- Troubleshooting table - fault messages displayed on the water heater interface

1 Service

Veritus Water Heater Display - Home Screen

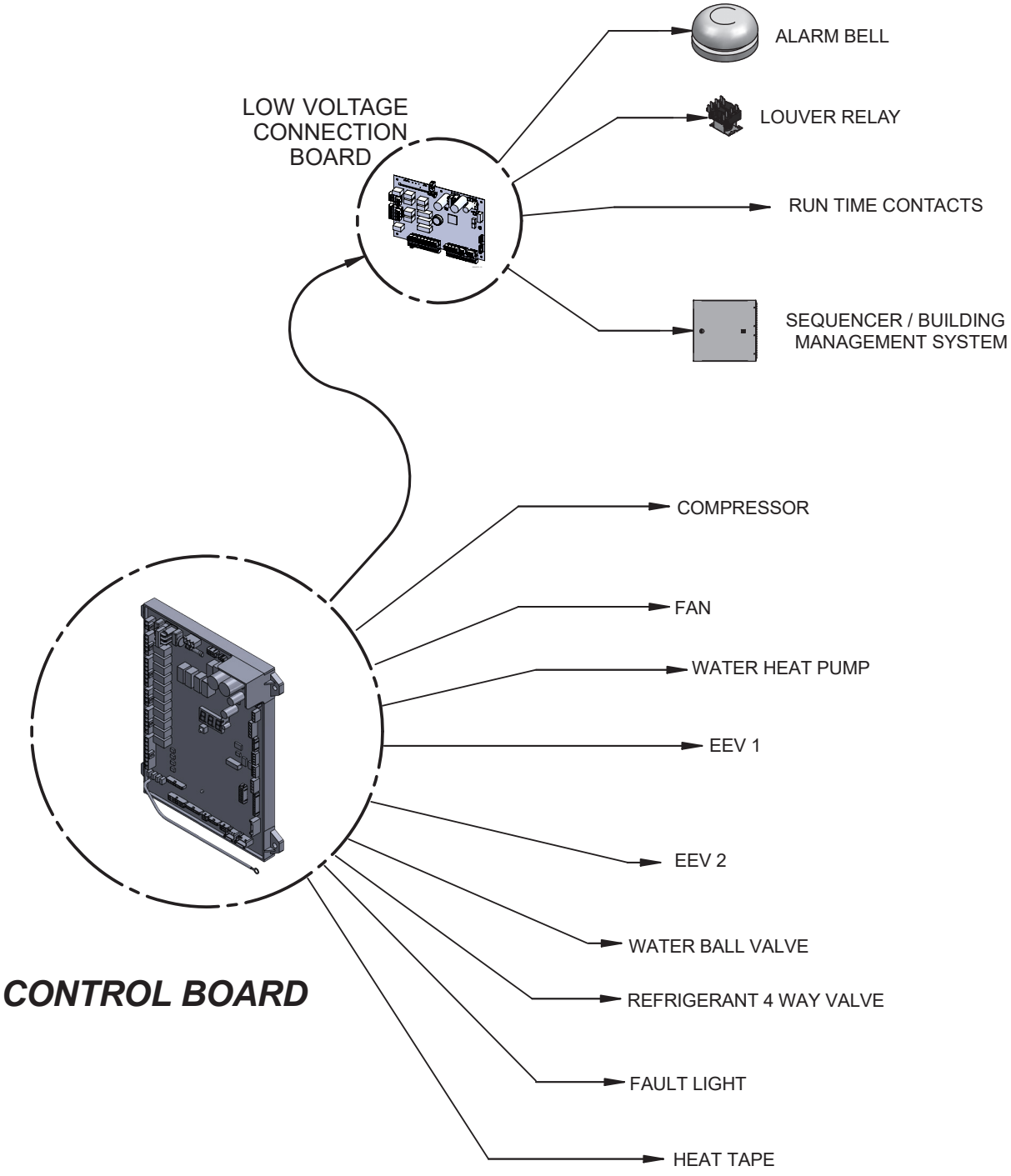
1 Service

Control Inputs



1 Service *(continued)*

Control Outputs



1 Service

General Operation

How the water heater operates

The Veritus water heater uses a scroll compressor to compress low pressure vapor refrigerant to a high pressure vapor state. The high pressure vapor is passed through a brazed plate heat exchanger along with cold water that passes through the heat exchanger in channels flowing in the opposite direction. The heat from the refrigerant is used to heat up the water and refrigerant returns to a liquid state. The amount of the liquid refrigerant flow is metered by electronic expansion valves (EEVs) as it enters 2 evaporators where air forced through the evaporators heats the refrigerant enough to change it back into a vapor. The vapor refrigerant returns to the compressor where the cycle starts over.

Sequence of operation

Table 1-1 shows control module normal sequences of operation for water heating operation.

Access modes

User

The USER can set the tank set point, view system information and parameters, and set up WiFi.

Installer

Most parameters are available only to the INSTALLER, accessible only by entering the installer password (5309) when selecting the Setup Section.

NOTE: The password will timeout after an hour from entry.

Table 1-1 Sequence of operation

1.	Upon a call for heat, the control will turn on the fan, open the water valve, and turn on the pump.
2.	The control confirms the fan comes up to the desired speed.
3.	The control initiates the compressor.
4.	When the call for heat is satisfied, the control will turn off the compressor.
5.	After a brief period of time the pump and fan will turn off.
6.	Once the DHW call for heat is satisfied, the control will turn off the compressor. Any pumps that are running will begin their respective pump delay cycles.
7.	At the end of the pump cycle, the louver relay contacts will de-energize.
8.	At the end of the pump delay cycle(s), the pump(s) will be turned off.

1 Service

Parameter table

Table 1-2 *This table lists SMART TOUCH control module parameters and where to access them*

Menu	Description	User Access		Installer Access	
		Display	Modify	Display	Modify
General	Temperature Units (ºC/ºF)	Yes	Yes	Yes	Yes
	Time and DAte	Yes	Yes	Yes	Yes
	Connect to Wi-fi	Yes	Yes	Yes	Yes
	Screen Settings	Yes	Yes	Yes	Yes
	Software Version (Update)	Yes	Yes	Yes	Yes
	Reboot Terminal	Yes	Yes	Yes	Yes
DHW Settings	Tank Set Point	Yes	Yes	Yes	Yes
	Controlling Tank Sensor	Yes	No	Yes	Yes
	Tank Set Point Differential	Yes	No	Yes	Yes
	Tank Minimum Set Point	No	No	Yes	Yes
	Tank Maximum Set Point	No	No	Yes	Yes
Back Up Heat	Backup Heat ON	No	No	Yes	Yes
	Min Voltage	No	No	Yes	Yes
	Max Voltage	No	No	Yes	Yes
	Setpoint Shift	No	No	Yes	Yes
	Min Setpoint	No	No	Yes	Yes
	Max Setpoint	No	No	Yes	Yes
Boost Settings	Boost Temp Increment	No	No	Yes	Yes
	Boost Time	No	No	Yes	Yes
	Max Boost Temp	No	No	Yes	Yes
Control Modes	BMS (Active/Inactive)	Yes	Yes	Yes	Yes
	Modbus TCP	No	No	Yes	Yes
	Modbus TCP Port	No	No	Yes	Yes
	Out of Order Timer	No	No	Yes	Yes

1 Service *(continued)*

Parameter table

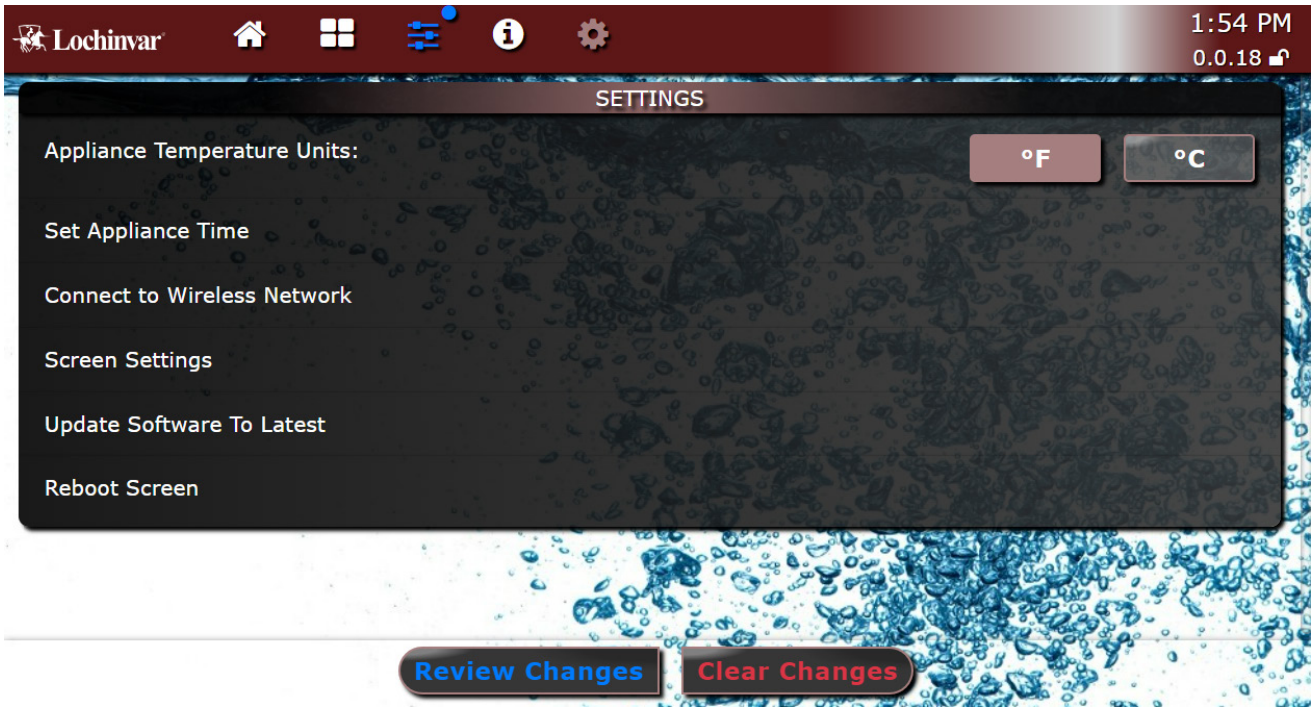
Table 1-2 *(continued) This table lists SMART TOUCH control module parameters and where to access them*

Menu	Description	User Access		Installer Access	
		Display	Modify	Display	Modify
BMS	BMS Setpoint Mode	No	No	Yes	Yes
	BMS Enable Mode	No	No	Yes	Yes
	Volts at Min	No	No	Yes	Yes
	Volts at Max	No	No	Yes	Yes
	Min Setpoint	No	No	Yes	Yes
	Max Setpoint	No	No	Yes	Yes
	Min Volts to ON	No	No	Yes	Yes
	Volts to OFF	No	No	Yes	Yes
Unoccupied	Vacation	No	No	Yes	Yes
	Night Setback	No	No	Yes	Yes
Service Mode	ON/OFF	No	No	Yes	Yes
Service Notification	Service Notification Months	No	No	Yes	Yes
	Service Notification Running Hours	No	No	Yes	Yes
	Service Notification Cycles	No	No	Yes	Yes
	Reset Service Notification	No	No	Yes	Yes
	Service Name and Phone Number	No	No	Yes	Yes
System Firmware	Firmware Version	No	No	Yes	No

1 Service

Initial Setup Screen

Figure 1-1 Settings Screen



Initial Setup

Temperature units (°C / °F)

The control can be configured to display temperature in either °C or °F.

Set Clock and Date

The SMART TOUCH control has a built-in clock that it uses for logging events. This clock must be set when the appliance is installed and anytime the appliance has been powered off for more than four (4) hours. Use the following procedure to set the clock.

1. Press the SETTINGS button (gear icon) at the top center of the screen.
2. Press the SET APPLIANCE TIME button, then press SET MANUAL TIME.
3. Deselect automatic date and time at the top section of the menu.
4. Proceed to set the date and time.
5. Press the triangle navigation button on the bottom of the screen to exit this menu.

Connect to Wi-Fi

The user has to ability to choose and connect to a wireless network.

Screen Settings

The brightness of the screen can be adjusted up and down to preference of the user.

Software Updates

When connected to Wi-Fi, the system can be updated to the latest software version through the SETTINGS button.

Reboot Screen

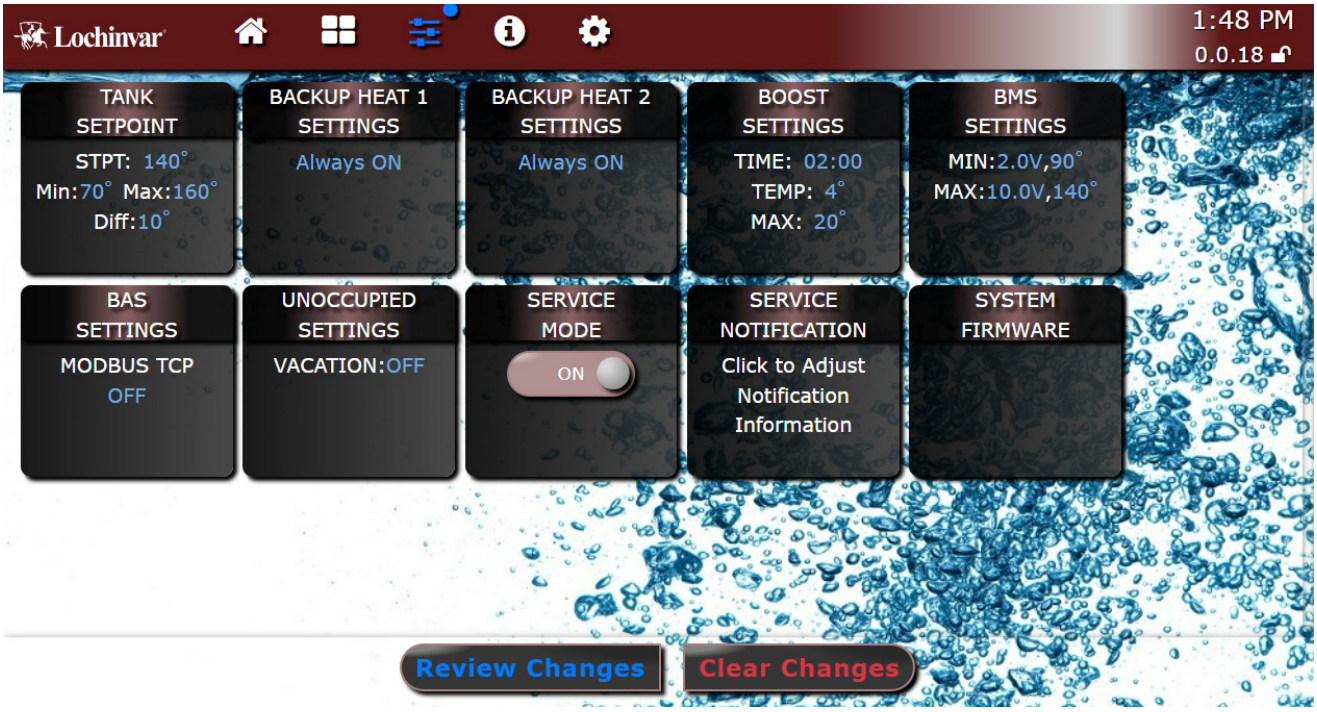
The ability to reboot the screen is under the SETTINGS button.

1 Service *(continued)*

Viewable and changeable control parameters

Set Point Screens

Figure 1-2 *Setup Screen*



CAUTION Before changing parameters, note the settings so that the unit can be returned to its original operating parameters.

Set Point Screens

Figure 1-3 *Tank Setpoints HW Screen*

1 Service

Tank Setpoint

At least one tank sensor must be installed and will be used to trigger heat pump operation. With the tank sensor installed, the SMART TOUCH control automatically detects the presence of this sensor. The controls will start a heating operation when the stratification boundary between hot and cold water in the tank reaches the sensor location. After the demand has been off for at least 5 minutes, if the tank temperature remains below tank setpoint - tank setpoint differential for a period of 5 minutes, the heating operation will be started regardless if the stratification boundary has reached the tank sensor yet. Heating operation will end based on the ability of the heat pump units to provide water near to heat pump setpoint (including any boost). When a heat pump unit has an inlet water temperature less than 15°F (-10°C) below heat pump setpoint and the heat pump outlet temperature is at least 15°F (-10°C) above heat pump setpoint, a heat pump will be shut off. Once all heat pumps have been shut off, the demand will be ended.

The parameter can be changed by the installer by accessing the Tank Setpoint parameter and ranges from 70°F to 180°F (21°C to 82°C). The temperature of this parameter ranges from the tank minimum setpoint to tank maximum setpoint. The default value is 125°F (52°C).

Controlling Tank Sensor

The controlling tank sensor should be below the hot water inlet to the tank. The sensor numbers correspond to the specific inputs of the system control board, with sensor 1 being the lowest and sensor 6 being the highest in the tank. The tank sensor controlling performance should be the connection number selected.

Tank Minimum Setpoint

This setting controls the minimum tank setpoint for the tank temperature. The installer can adjust this by accessing the Tank *Minimum Setpoint parameter*. The minimum setting is 70°F (21°C) and the maximum setting is the maximum tank setpoint (*Tank Maximum Setpoint parameter*). The default value is 120°F (49°C).

Tank Maximum Setpoint

This setting controls the maximum tank setpoint for the tank temperature. The installer can adjust this by accessing the *Tank Maximum Setpoint parameter*. The minimum setting is the minimum tank setpoint (*Tank Minimum Setpoint parameter*), and the maximum setting is 167°F (75°C). The default value is 160°F (71°C).

Tank Differential

The tank temperature must drop this amount below the tank setpoint and clear standby heat loss criteria before the water heater turns back on. The water heater will also turn on if the tank temperature sensor reaches 100°F (38°C) before meeting standby heat loss criteria. The installer can adjust the Tank Setpoint Differential parameter. If Tank Setpoint Differential is set too low, rapid short cycling of the units can occur as a result of the demand starting with tank temperature too close to setpoint. It is highly recommended to avoid a setting lower than 5°F. The minimum setting is 0°F (0°C), and the maximum is 18°F (10°C). The default setting is 10°F (5.5°C) parameter.

Internal Regulating Control

There is only one limit control, the Water Temperature Limit Switch. This device will auto-reset for safety control. However, the controls will trigger a manual reset lockout if this switch fails.

1 Service *(continued)*

Figure 1-4 *Backup Heat Screen*

Backup Heat 1 & 2

Backup Heat ON/OFF

There are different settings for running backup heat under different conditions (Figure 1-4).

Always OFF – Backup heat is always OFF.

Always ON– Backup heat is always ON.

Always ON Occupied – Backup heat is always on when the building is occupied. Backup heat will be off during vacation mode or during Night Setback periods.

Always ON Enabled – Backup heat is on when the Enable contact is closed on the SMART TOUCH control (any time the SMART TOUCH control is allowed to heat, the backup heat is on).

Added Heat Load - When there is a demand and there are no available heat pumps, backup heat is triggered to come on. When a heat pump becomes available, backup heat turns off to allow heat pump to run.

No Heat Pump Available - In this backup heat mode, the conditions are out of range of the heat pump operating range or any other condition preventing the heat pump from running, so the backup heat in always on when there is a demand.

Backup Heat Min Voltage

The Volts at Minimum parameter should be set to the minimum voltage signal sent to the SMART TOUCH control. The range of this parameter is 0 to 10V. The default setting is 2V.

Backup Heat Max Voltage

The Volts at Maximum parameter should be set to the maximum voltage signal sent to the SMART TOUCH control. The range of this parameter is 0.9 to 10V. The default setting is 10V.

Backup Heat Setpoint Shift

Allows backup heat setpoint to be higher or lower than the normal tank setpoint. This can be a difference of -30.6°F (-17°C) to +30.6°F (+17°C).

Backup Heat Min Setpoint

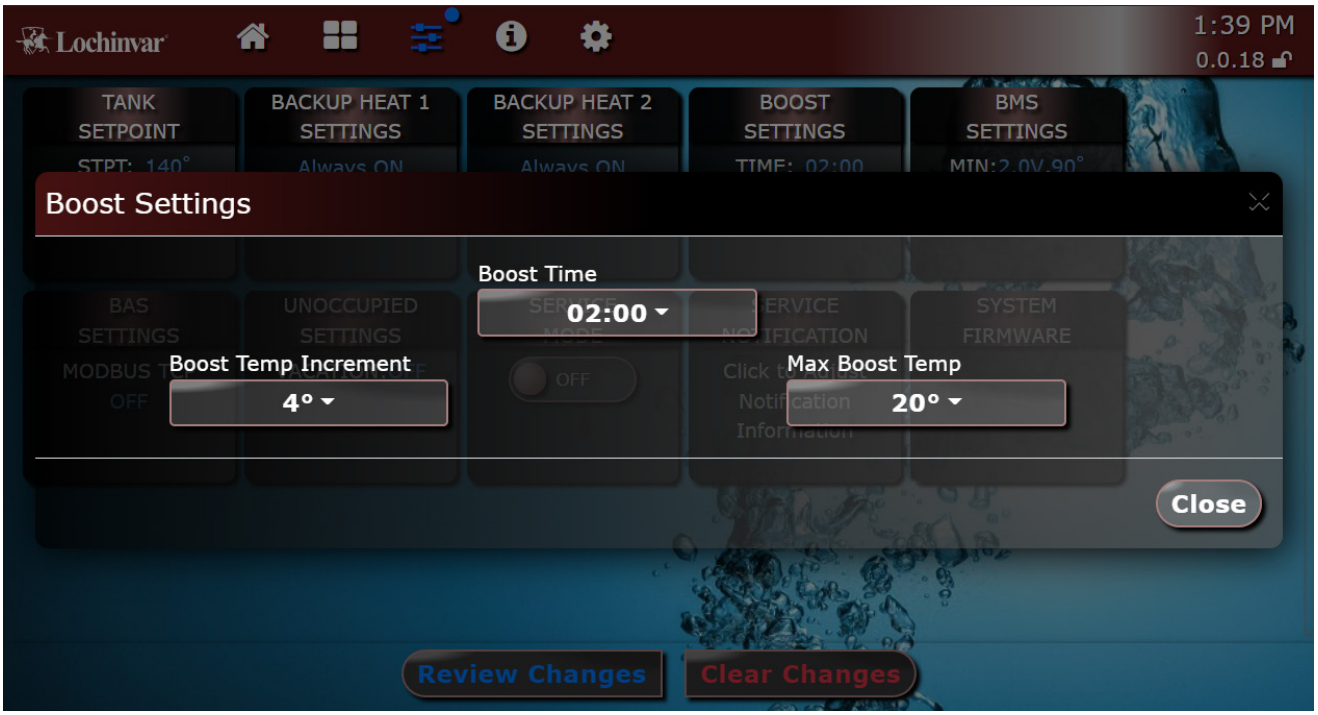
This setting controls minimum setpoint for the backup heater temperature. The installer can adjust this by accessing the *Min Setpoint* parameter. The Setpoint can range from 70°F (21°C) to 180°F (82°C). The default value is 60° (16°C).

Backup Heat Max Setpoint

This setting controls the maximum setpoint for the heater temperature. The installer can adjust this by accessing the *Max Setpoint* parameter. The Setpoint can range from 70°F (21°C) to 180°F (82°C). The default value is 140°F (60°C).

1 Service

Figure 1-5 *Boost Settings Screen*



Boost Settings

To help the tank recharge faster, the system control board (SCB) can boost the units' setpoint if a system supply sensor is connected. If the system supply temperature has not reached setpoint by a certain time, the SCB will increase the unit setpoint by the *Boost Increment* until the tank or system supply sensor reaches setpoint or the unit setpoint has reached the maximum temperature that it can be boosted. This can be disabled by setting *Max Boost Temp* to 0°F (0°C). Disabling the *Boost Increment* will result in no boosting over setpoint.

Boost Time

When there is a demand for heat, a countdown starts to reach setpoint. If in that amount of time, the *Boost Time* has elapsed and setpoint has not been reached, the unit setpoint temperature will be boosted by a set amount. This time can be 0 to 10 minutes.

Boost Temp Increments

The unit setpoint can be boosted in *Boost Temp Increments* or small steps until the tank setpoint has been met. When the Boost feature is needed the boost will increase by this value. If the tank setup is not reached within the *Boost Time*, the temperature will raise by the *Boost Temp Increment* that has been set. This will continue until the temperatures have been met or the max boost temperature has been reached. The *Boost Temp Increments* can be set between 0°F (0°C) and 36°F (20°C).

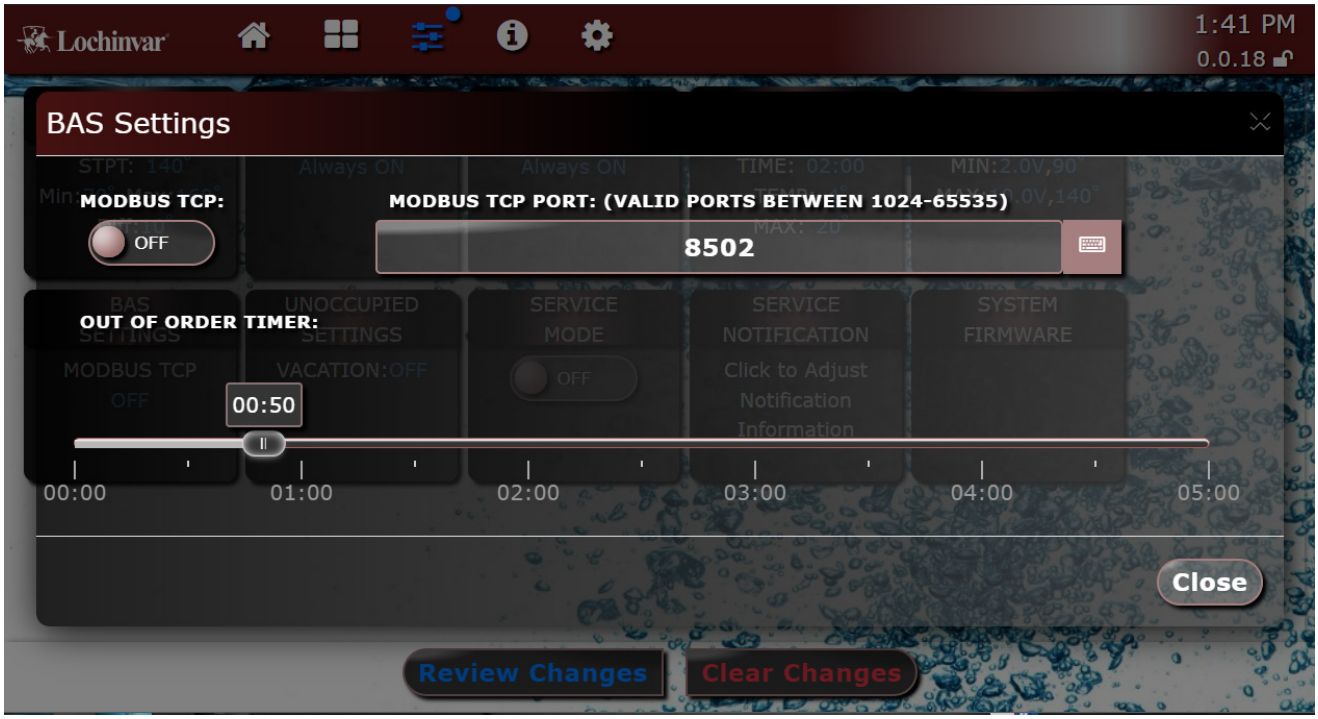
Note: These ranges are the limits of the SCB, not the display.

Max Boost Temp

The *Max Boost Temp* is the largest amount that the unit setpoint temperature can be set above normal unit setpoint. This can be set between 0°F (0°C) and 36°F (20°C).

1 Service *(continued)*

Figure 1-6 *BAS Settings Screen*



Control Modes

BAS

A building automation system (BAS) allows an operator to access, control, and monitor all connected building systems from a single interface.

ModBus TCP

ModBus TCP has a choice of ON or OFF. If ON is selected, the water heater can be monitored and/or controlled through ModBus

The default value is OFF.

ModBus TCP Port

The number for the ModBus TCP Port is required if ModBus is turned on. The value entered will be the connection number the heat pump system. Use the keyboard to enter a number between 1024 and 65535.

Out of Order Timer

The system will check to see if the *Out of Order Timer* has expired to choose to follow BAS or SCB commands. If the *Out of Order Timer* has expired the system will default to the SCB for direction. This timer can range from 0 to 5 minutes.

1 Service

Figure 1-7 BMS Settings Screen

BMS

BMS Setpoint Mode

BMS can be set to *Enabled* or *Disabled* communication. When *Enabled* the 0 - 10V signal controls the tank setpoint. The default setting is *Disabled*.

Volts at Minimum

When programmed for BMS control through the 0 - 10V BMS input, the *Volts at Minimum* parameter will determine the voltage that represents the minimum setpoint. Any voltage less than this value will not change the setpoint used. The range of this parameter is 0.0 to 10V. The default setting is 2.0V.

Volts at Maximum

When programmed for BMS control through the 0 - 10V BMS input or through ModBus, the *Volts at Maximum* parameter determines the voltage that represents the maximum setpoint. Any voltage above this value will not change the setpoint used. The range of this parameter is 0.2 to 10V. The default setting is 10.0V.

Minimum Setpoint

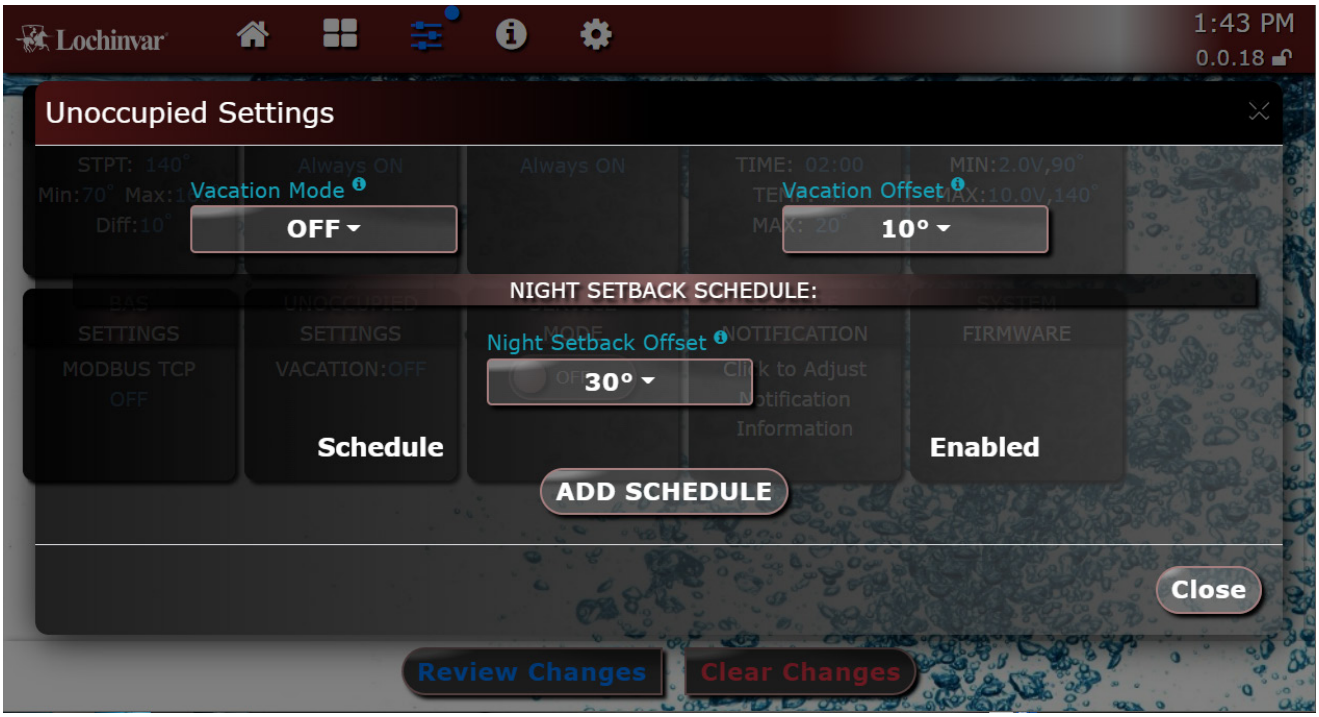
When BMS is enabled, this setting determines the setpoint when the 0-10V BMS input is equal to or less than the Volts at Minimum parameter value. The installer can adjust this by accessing the *Minimum Setpoint* parameter. Setpoint can range from 70°F (21°C) to 167°F (75°C). The default setting is 70°F.

Maximum Setpoint

When BMS is enabled, this setting controls the setpoint when the 0-10V BMS input is equal to or more than the BMS volts at maximum parameter. The installer can adjust this by accessing the *Maximum Setpoint* parameter. Setpoint can range from 70°F (21°C) to 167°F (75°C). The default setting is 167°F (75°C).

1 Service *(continued)*

Figure 1-8 *Unoccupied Settings Screen*



UNOCCUPIED

Vacation Mode

Vacation mode can either be turned On or Off. When in the On position, the setpoint for normal operation will be adjusted down by the amount indicated by the Vacation Offset parameter. The mode will persist until the button is returned to the Off position.

Vacation Offset

This is the amount specified to reduce the tank setpoint when vacation mode is active. The setting allowed is 0-90°F (0-50°C).

Note: Vacation mode does not time out. Vacation mode should not reduce the setpoint below the minimum allowed tank setpoint.

Night Setback

Domestic Hot Water (DHW) Night Setback On and Off Times:

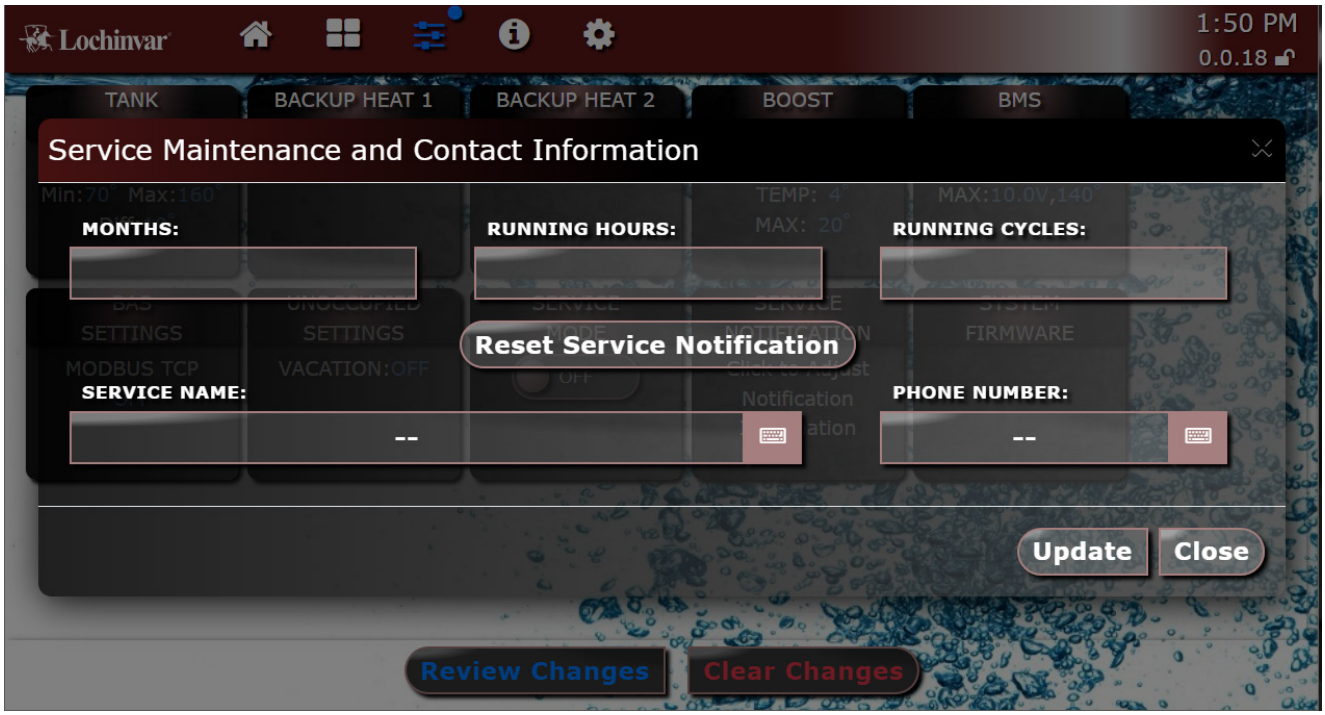
This is the time in which the Night Setback Offset becomes active. There are 7 start times and 7 stop times each for the DHW night setback feature. The DHW Night Setback On Times may be set to any time within a 7-day week. These settings are referred to as triggers. Multiple start or stop triggers may be set within a single day, if desired. When a start trigger and a stop trigger are set to the same time, the stop trigger has priority. The installer may adjust the DHW start triggers in the DHW Night Setback On Times parameter. This screen shows the start trigger number, the day of the week, and the time of day.

Domestic Hot Water (DHW) Night Setback Off Times:

The stop triggers for the DHW night setback feature can be adjusted by accessing DHW Night Setback Off Times parameter.

1 Service

Figure 1-9 *Service Maintenance Screen*



Service Notification

Service Notification in Months

When the water heater control determines that a scheduled service is due based on months of installation, the water heater display will alternate the standard water heater display text on the home screen with the message SERVICE DUE every 5 seconds. This parameter is adjustable by the installer by accessing the Service Notification in Months parameter. The time range for this parameter is 0 months to 100 months. The default time is 12 months.

This feature has been disabled by the manufacturer. To enable this feature, change the Months parameter to the desired time range.

System Firmware

This box shows information about the system firmware version. There is also an option to reset heat pump addressing.

Data Logging

Reset Log Hours

The reset log errors function clears the last 10 errors log.

2 Maintenance

General Operation

Table 2-1 *Service and Maintenance Schedules*

Service Technician (See the following pages for instructions)	
ANNUAL START-UP	**General:** • Address reported problems • Inspect water heater area • Inspect interior, clean and vacuum if necessary. • Check for leaks (water, air) • Check water heater relief valve • Check system water pressure/ system piping/expansion tank • Check control settings • Check wiring and connections • Clean and inspect evaporators • Check internal insulation • Clean condenser (brazed plate hex) • Check air flow • Check refrigerant charge by viewing temperatures, pressures, and superheat on the Smart Touch control • Check Delta T (Temperature Rise)

Owner Maintenance	
Daily	• Check water heater area
Monthly	• Check air piping • Check air and vent termination screens • Check relief valve • Check drain system • Check automatic air vents • Check Delta T (Temperature Rise) • Remove debris from Y-strainer per manufacturer's instructions • Check building recirculation filter (if filter required) • Check for and clean any debris or obstruction from bird screens (if equipped)
Every 6 months	• Check water heater piping (refrigerant and water) for leaks • Check and clean drain pan • Operate relief valve • Check water chemistry • Inspect fan blades

2 Maintenance

⚠ WARNING Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the water heater. Failure to perform the service and maintenance could result in damage to the water heater or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING The water heater should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the water heater designated in Table 2-1 and explained on the following pages must be performed to assure maximum water heater efficiency and reliability. Failure to service and maintain the water heater and system could result in equipment failure.

⚠ WARNING Electrical shock hazard – Turn off power to the water heater before any service operation on the water heater except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

⚠ WARNING Should the unit have to be serviced with live electricity, only trained and qualified technicians should carry out the service. Failure to follow all the safety warnings may result in serious injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect water heater area

1. Verify that water heater area is free of any corrosive materials.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 of the Veritus Water Heater Installation and Operation Manual. If any of these are present in the water heater intake air vicinity, they must be removed. If they cannot be removed, replace the air and vent lines per this manual and the Veritus Water Heater Installation and Operation Manual.

Inspect water heater interior

1. Remove the front access cover and inspect the interior of the water heater.
2. Inspect for oil on the components and base which could indicate a refrigerant leak.
3. Vacuum any sediment from inside the water heater and components. Remove any obstructions.

Check all piping for leaks

⚠ WARNING Eliminate all system or water heater leaks. Leaking water may cause severe property damage.

1. Inspect the condensate drain line, condensate PVC fittings, and condensate trap.
2. Look for signs of leaking lines and correct any problems found.

Air Ducting

1. Visually inspect the entire air venting system for blockage, deterioration, or leakage. Repair any joints that show signs of leakage. Verify that the air inlet and outlet duct is connected and properly sealed.
2. Verify that water heater air discharge and air intake are clean and free of obstructions.
3. Verify that bird screens are clean and free of debris or obstruction.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the water heater heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

Check Expansion Tank

Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed or diaphragm or bladder type. See Section 4 - System Piping of the Veritus Installation and Operation Manual for suggested best location of expansion tanks and air eliminators.

2 Maintenance *(continued)*

Check Relief Valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Caution should be taken to ensure that (1) no one is in front of or around the outlet of the temperature pressure relief valve discharge line, and (2) the water manually discharged will not cause any bodily injury or property damage because the water may be extremely hot.

⚠ WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the water heater relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge, and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise, severe personal injury may result. If no water flows, valve is inoperative. Shut down the water heater until a new relief valve has been installed.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, immediately close the cold-water inlet to the heat pump, follow the draining instructions in the storage tank manual, and replace the relief valve with a new one. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or under sizing.

Read Section 4 - System Piping before proceeding further. If you do not understand these instructions or have any questions regarding the temperature-pressure relief valve, call the toll-free number 1-800-722-2101 for technical assistance.

Check all water heater wiring

1. Inspect all water heater wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the SMART TOUCH control module display to Parameter Mode and check all settings. See Section 1 of the Veritus Service Manual. Adjust settings if necessary. See Section 1 of the Veritus Service Manual for adjustment procedures.

2. Check settings of external limit controls (if any) and adjust if necessary.

Perform startup and checks

1. Start water heater and perform checks and tests specified in Section 9 - Start-up.

2. Verify cold fill pressure is correct and that operating pressure does not go too high.

Review with owner

1. Emphasize the need to perform the maintenance schedule specified in this manual.

2. Remind the owner of the need to call a licensed contractor should the water heater or system exhibit any unusual behavior.

3. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up.

Evaporator Cleaning and Inspection

CAUTION Read all the warnings provided for the cleaning products used for refrigeration coil cleaning. Follow all instructions for personal protection and safe application of the products. Before cleaning the evaporator, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

Inspect the evaporator coil for dirt buildup or fin crush on at least once per year. If there are signs of fin fold over, use a fin comb to straighten the fins. Should the coils need cleaning, follow the steps listed below:

2 Maintenance

⚠ WARNING Read all the warnings on the bottle of the cleaning products used for evaporator cleaning. Follow all instructions for personal protection and safe application of the products. Before cleaning the drain pan or evaporators, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

⚠ WARNING Direct stream of water should be avoided, to prevent damage to evaporators. Instead, use a fanned-out method.

1. Disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.
2. Wear the prescribed personal protective equipment prescribed from the cleaning product instructions.
3. Install a block-off sheet to prevent splash over into the dry sections of the HPWH.
4. Most of the time cleaning solutions are not needed but if used, follow the recommendations and guidelines provided by the cleaning solution manufacturer.
5. Start by spraying from the inside out in the opposite direction of air movement. Keep the nozzle perpendicular to the coil at least 6 inches from the coil face. If the water pressure is questionable, observe the impact of cleaning on a small section of the coil before implementing universally.
6. Thoroughly rinse the cleaned coil with cool, clean water.
7. Straighten out any fins displaced during the cleaning using a fin comb.
8. Confirm the drain pan line is not clogged.
9. Replace all panels on the unit and wipe down any standing cleaning solution of water on or around the unit.

Cleaning Internal Pipe Insulation

Inspect the internal pipe insulation on a yearly basis for any microbial growth. The insulation never has to be cleaned unless microbial growth is detected. If microbial growth is detected, follow the removal steps below:

1. Disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.
2. Wear the personal protective equipment prescribed from the cleaning product instructions.
3. Remove as much dirt and organic material from the insulation using a vacuum device with a HEPA filter (99.97%) efficient at 0.3 micron particles). Be careful not to tear the insulation during the cleaning procedure.
4. Apply the microbial cleaning agent as prescribed by the application and usage instructions.
5. Allow the unit to dry thoroughly.
6. If necessary, apply an anti-microbial agent on the insulation per the instructions provided on the product label. Discard collected microbial contaminants as required by local or state codes.

Drain Pan

⚠ WARNING Read all the warnings on the bottle of the cleaning products used for drain pan cleaning. Follow all instructions for personal protection and safe application of the products. Before cleaning the drain pan, disconnect all power to the unit and follow the prescribed lock-out/tag-out procedure.

The condensate pan and drain line must be checked for cleanliness, growth, and blockage at least every six months. To clean the drain pan, start by disconnecting the power to the unit. Find a cleaner that is safe to use on ABS plastics. Wear the appropriate personal protective equipment prescribed by the cleaning product instructions. Apply the cleaning solution, allow it to sit for prescribed amount of time, then rinse. Remove any particles that could potentially block the drain line.

Braze Plate Cleaning Instructions

In some applications the heat exchanger may be subjected to severe fluid conditions, including high temperature hard water conditions, causing accelerated scaling and corrosion rates, and will diminish performance.

***Table 2-2** Scaling Performance*

Ambient (°F)	AHP060 performance (btu/hr) (approx.)	AHP140 performance (btu/hr) (approx.)
23	33000	65000
30	35000	70000
40	40000	80000
60	52000	100000
80	66000	134000
95	65000	130000
120	84000	135000

If the performance numbers are 12000 btu/hr less than what is indicated on Table 2-2 at a given ambient, this might indicate scaling on the heat exchangers.

It is important to establish regular cleaning schedules. A 5% solution of Phosphoric Acid or Oxalic Acid may be considered. Other types of solutions can be obtained from your local wholesaler. Make sure cleaning solution is applicable for stainless steel and copper and all directions are followed.

Do not heat solution. Be sure to flush the heat exchanger with fresh water after cleaning using flush valves provided with manifolds. See Figure 2-1.

2 Maintenance *(continued)*

Figure 2-1 *Braze plate*

Inspecting Fan Assembly

Before performing any maintenance on the fan assembly, disconnect all power to the unit and follow the prescribed lockout/ tag-out procedure.

⚠ WARNING Allow time for fan capacitor dissipation which takes several minutes. Failure to assure safe electrical working conditions, including proper consideration for capacitors, could result in electrical shock, causing severe personal injury or death.

During inspection, visually check the blades for wear or damage and replace as necessary. Inspect to confirm the center hub bolt holding blades is in place and tighten to 10 FT-LBS. Clean the blades periodically as material buildup on the blades can cause an imbalance that may lead to bearing failure. Every six months visually inspect the fan motor. Clean off any dust, grease or oily buildup and vacuum out any cavities in the motor. Motors are permanently lubricated from the factory. It is not necessary to lubricate the motor upon start-up or lubricate as part of maintenance.

Check Air Flow

Correct any problems with air flow before checking the refrigerant pressures. (Use Table 3-2 for checking the rpms at different ambient conditions).

Checking Refrigerant Charge

Servicing of the refrigeration circuit must only be performed by agencies or individuals possessing Type II or Universal certification as defined in Section 608 of the Clean Air Act. See Qualifications on page 6 of the Veritus Installation and Operation Manual.

This HPWH unit is factory charged with 513A refrigerant. See the rating label on the HPWH unit and Table 2-4 for refrigerant charge by weight. It should not be necessary to add or remove refrigerant during installation or start up. Refrigerant lost during frequent refrigerant pressure testing can cause low refrigerant conditions. **IT IS RECOMMENDED THAT PRESSURES, TEMPERATURES, AND SUPERHEAT VALUES BE TAKEN FROM THE SMART CONTROL.** Air and water flow should always be checked first to eliminate other potential problems before checking the refrigerant charge. **USING GAUGES SHOULD BE A LAST RESORT WHEN TROUBLESHOOTING REFRIGERATION ISSUES.**

Superheat

1. Use the display screen to record the ambient temperature and measured superheat.
2. Use Table 2-3 to verify that superheat is in range for the temperature.
3. **ALWAYS REFER TO SMART TOUCH TO MONITOR PRESSURES, TEMPERATURES, AND SUPERHEAT TO PREVENT USING GAUGES.**

Table 2-3 *Superheat for Ambient Temperatures*

Model 60K		Model 140K	
Temperature Ambient (°F)	Superheat (°F)	Temperature Ambient (°F)	Superheat (°F)
23 - 40	15 - 22	23 - 40	15 - 22
40 - 80	22 - 24	40 - 80	22 - 24
80 - 95	24 - 27	80 - 95	24 - 30
95 - 120	27 - 30	95 - 120	30 - 35

Check Water Temperature

Always check water temperature rise through the HPWH unit's internal heat exchanger before checking the refrigerant charge. If the measured temperature rise is more than expected, check for restrictions in the inlet and outlet water piping connected between the HPWH unit and the storage tank.

Table 2-4 *Refrigerant Charge by Weight*

Model	Factory Charge R513A
AHP060	11.5 lbs
AHP140	15 lbs

Check Refrigeration Piping

Refrigeration piping should be inspected to verify whether all the factory provided refrigerant-pipe insulations are intact. Ensure there is no oil residue in the refrigeration piping which can sometimes be the result of a refrigerant leak (see the section "Checking Refrigerant Charge" in Maintenance section of the Veritus Installation and Operation Manual).

2 Maintenance

Table 2-5 *Saturated Temperature Chart*

R513A SATURATED TEMPERATURE CHART		
Saturated Temperature °F	**Saturated Temperature °C**	**Saturated Pressure PSI**
0	-18	9.1
5	-15	11.9
10	-12	15.0
15	-9	18.3
20	-7	21.9
25	-4	25.9
30	-1	30.1
35	2	34.6
40	4	39.6
45	7	44.8
50	10	50.5
55	13	56.5
60	16	63.0
65	18	69.9
70	21	77.3
75	24	85.1
80	27	93.4
85	29	102.0
90	32	112.0
95	35	121.0
100	38	132.0
105	41	143.0
110	43	155.0
115	46	167.0
120	49	180.0
125	52	193.0
130	54	207.0
135	57	222.0
140	60	238.0
145	63	254.0
150	66	271.8
155	68	289.9
160	71	308.9

3 Troubleshooting

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

⚠ WARNING Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to the water heater before servicing. Failure to comply could result in severe personal injury, death, or substantial property damage.

Before Troubleshooting

Have the following items:

- Voltmeter that can check 480 VAC,120 VAC, 24 VAC, and 12 VDC.
- Continuity checker
- Contact thermometer

Check the following:

- Check for 480 VAC (minimum 451.2 VAC to maximum 508.5 VAC) to water heater.
- Make sure thermostat is calling for heat and contacts are closed. Check for 24 VAC on each side of the enable contacts and to ground.
- Make sure all external limit controls are installed and operating on each side of the enable contacts to ground.
- All wire harness connectors going to the control board are securely plugged in at the control board. and system control module.
- Communication cables are securely connected. These cables run from J11 on the system control board to J27 on the 1st heat pump control board. Subsequent cables will run from J7 on the heat pump control board to J27 on the next heat pump.
- Check fuses are not blown. Fuses are in three different locations on the heat pump.
    - Main power fuses are location in the rear high voltage panel (Figure 3-1).
    - Crankcase heater fuses are located in the bottom portion of the main control panel accessible from the front of the unit (Figure 3-2).
    - Fuses are in the harness wires connecting the 480/120 transformer to the main panel box.

Figure 3-1 *High Voltage Panel*

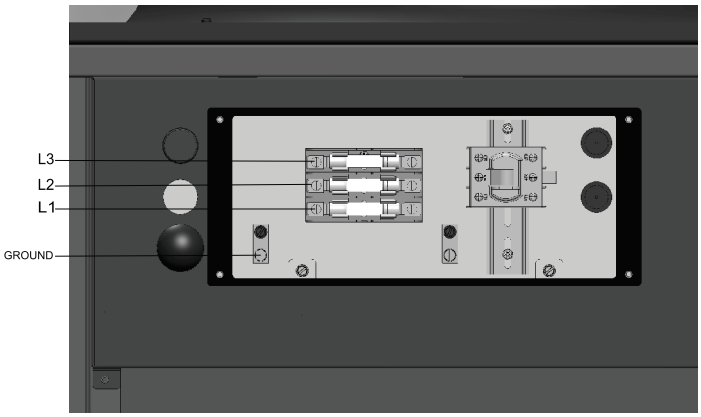
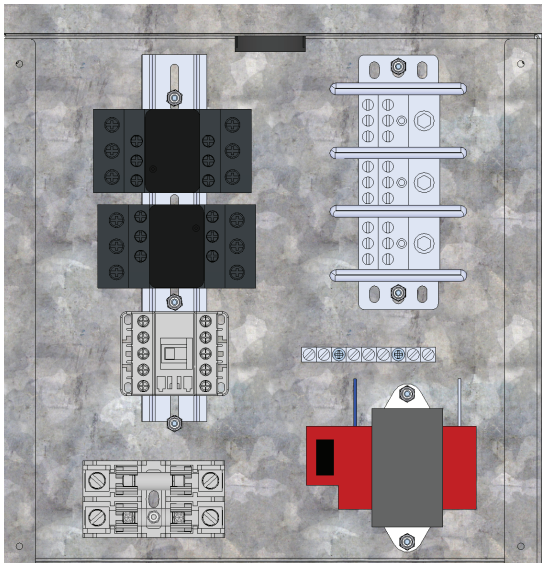


Figure 3-2 *Crankcase Heater Fuses*



3 Troubleshooting

Table 3-1 *Troubleshooting Chart*

Problem	Possible Causes	Corrections
Heat Pump is too noisy	• Sheet Metal fasteners are loose. • Operating vibration is transferring to floor or building structure.	• Tighten Fasteners • Place vibration dampers underneath unit
Water on floor around the heat pump and or water tank	• Tubing, valves, or fittings are leaking. • Heat Pump is not leveled causing drain pan overflow • Condensate trap not installed properly • Drain pan overflowing • Condensation forming on the bottom of unit (humid environments)	• Repair leaks as necessary • Shim unit to level, See installation section • Condensate trap depth must maintain a water column during operation • Use pipe snake or compressed air to remove obstruction • Cover bottom of unit with foam insulation
Heat Pump is not running - Electrical issues - Out of Phase	• Circuit does not have adequate ampacity • Short circuit or loose connection in field wiring • Short circuit or loose connection in the cabinet • Thermostat failure • Compressor burn-out	• Refer to nameplate for unit requirements • Check field wiring diagram, Tighten all connections • Check for loose wiring and tighten • Replace thermostat • Replace Compressor
Heat Pump is not running - High Pressure Fault	• Tank Setpoint or Max Boost is too high • Air temperature over 120° F • Low water flow causes: a. External Pump or water valve is not operating b. Piping between the heat pump and storage tank exceeds 500 equivalent feet c. Heat exchanger has scale buildup d. Shut off valves are partially closed • Faulty high pressure switch	• Reduce Tank Setpoint and/or Max Boost • If air temperature exceeds 120°F, heat pump will remain off until back in operating range • Low water flow corrections a) Replace unit pump b) Reduce piping or add booster pump c) Clean heat exchanger with a mild acid wash d) Open all shut off valves • Replace high pressure switch
Heat Pump is not running - Low Pressure Fault	• Room temperature below 23° F • Fan not operating at nameplate CFM • Flow though the evaporator is restricted or blocked. • Unit does not have adequate clearances obstructing air flow • Loss of Refrigerant • Faulty low pressure switch • Filer dryer restriction • EEV locked in closed position	• If air temperature warms up above 23°F and does not exceed 120°F, heat pump will remain off until back in operating range • Correct air-flow issue • Relocate unit to allow for even air flow • Find source of leak, repair, and recharge • Replace low pressure switch • Replace dryer filter • Clean or replace EEV

3 Troubleshooting *(continued)*

Table 3-1 *Troubleshooting Chart (continued)*

Problem	Possible Causes	Corrections
Water is not reaching desired temperature	• Tank Setpoint is too low • Heat pump/storage tank undersized for application • Heat pump is not properly connected to storage tank • Unit cooling coil is over cooling the space • Heat pump, water pump or water valve is not functioning correctly.	• Increase Tank Setpoint • Increase size of storage tank or install gas or electric heater to make up for shortfall • Refer to field piping diagrams for recommended piping • If the room air temperature is too cool: a) Use back up water heating b) Duct cool air to another space c) Duct warmer air from another space to the installed room
Evaporator coil is icing	• Insufficient air flow through the unit • Low air temperature • Partial refrigerant loss • Defective EEV valve • Clogged filter dryer	• Refer to “Heat pump not running - low pressure fault” section for correction suggestions • If room air temperature is too cool a) Use back up water heating b) Duct cool air to another space c) Duct warmer air from another space to installed room • Find source of leak • Replace EEV valve • Replace filter drier
4-way valve not functioning properly	• Faulty coil • 4-way valve stuck in one position	• During normal operation, make sure the suction and discharge pressures are normal. Lower than normal suction pressure and higher than normal discharge pressure at a given ambient might indicate a faulty valve. See Figures 3-3 and 3-4. • A “touch test” could be performed by the service personnel on the common suction lines on the 4-way valve to see if there is a difference in temperature between the two. It is advisable to use a temperature clamp instead because of the high temperatures in the 4-way valve discharge lines in the proximity. If there is a difference of more than 5°F between common suction lines or common discharge lines, it might be an indication of a faulty 4-way valve and needs to be replaced. • To make sure the coil is good, check for continuity of the coil using an ohm meter. If the reading is ‘OL’ then most likely the coil needs to be replaced. • A rare earth magnet can be used to indicate the movement of the sleeve inside the 4-way valve when the coil is energized. If the magnet does not move while energizing the 4-way valve, it indicates a stuck 4-way valve which needs to be replaced.

3 Troubleshooting

Table 3-1 *Troubleshooting Chart (continued)*

Problem	Possible Causes	Corrections

Pressure Transducer not functioning properly	• Faulty pressure transducer
	• Loose wire connections to HPC
	• Loose mechanical connection to Schrader Valve
		• Disconnect Wires and Tighten Pressure Transducer onto Schrader Valve.
		• Verify the wire connections to the HPC are intact and the discharge pressure transducer connects to a four pin molex connector. The suction pressure transducer connects to a three pin molex connector.
		To verify the proper working of pressure transducer:
		  • Measure the pressure (P) at the transducer with the help of a calibrated or reliable gauge.
		  • Determine the Pmax and Pmin values for the transducer's pressure range. (The high and low pressure transducers will be having different ranges).
		  • Use the below formula to determine calculated output voltage (Vo), or see Tables 3-8 and 3-9 .
		  • Measure the voltage between the transducer output and common (-) pins.
		  • Compare the calculated output voltage and measured output voltage. If the measured voltage differs greatly from the calculated output voltage, replace the transducer.

No pump operation	• Incorrect pump power and/or control wiring • Faulty pump • Internal fault on control board • Faulty pump relay • Blown fuse	• Check control wiring. Control wiring for pump connects black to PWM output, blue to PWM reference, and brown to PWM input. • Replace pump • Replace Heat Pump Control board • Replace relay • Replace fuse
Compressor not functioning properly	• Faulty compressor/compressor not running • Low suction pressure • Abnormal noise during compressor start • Faulty Compressor Contactor and/or wiring • Fast Safety Chain interruptions • Reverse Phase • Missing Phase • Service Valves not functioning correctly	• Replace compressor • Motor winding continuity and short to ground check to be made to determine if the inherent overload motor protector has opened. Check display screen to make sure there are no high discharge temperature alarms. Allow time to cool down if there is an alarm. • Make sure system has enough charge and see if there is any blockage in the system • Compressor wired out of phase could create an abnormal noise during startup. Check if the compressor legs are wired right.

3 Troubleshooting *(continued)*

Table 3-1 *Troubleshooting Chart (continued)*

Problem	Possible Causes	Corrections
No Display	• No 120 VAC supplied to display panel • No 24 VAC supplied to Control boards • No voltage through switch	• Check external line switch, fuse, or breaker • Check Line and Neutral connections inside display panel • Check wiring harness connections from the transformer to the System Control board and Display control board • Check ON/OFF position of the switch inside the display panel
No compressor operation	• Tank temperature set point satisfied • Remote enable not satisfied • Unit locked out on fault • Internal Regulating Control not satisfied • Louver Proving Open on SCB • High Ambient Shutdown • Low Ambient Shutdown	• Review tank temperature setting and selected controlling sensor if applicable • Check connections on the System Control board. Enable contacts J2-1 & J2-2 must be closed to enable heat demand. This can be done with a jumper wire or thermostat • Consult display or Heat Pump Control board LED display for specific fault. Refer to fault descriptions in this manual for corrective actions
Unit outlet water temperature does not reach unit setpoint (set by SCB)	• Water heater controlled by BMS • Temperature sensor reading incorrect • Water flow is not controlled	• Check BMS parameter settings • See Sensor Troubleshooting section and tables • Check inlet water motorized ball valve is powered • Check the unit pump power and control connections in the rear junction box.
Unit outlet water temperature is too high	• No water flow • Incorrect piping • Excessive flow restriction in unit piping causing lower than expected flows	• Verify proper operation of the pump and water valve • Verify the system is full of water and all air has been properly purged • Verify the water heater is properly piped into the system. Refer to the System Piping section of the Installation and Operation manual
Anti-cycling	• Unit is in anti-cycle	• The unit is off in anti-cycle to protect the compressor from starting too frequently. Wait until the anti-cycle timer is complete, a minimum of three minutes.
Fan Speed low or high	• Actual fan RPM is 30% lower or higher than what is being called for	• Vent/air intake lengths exceed the maximum allowed lengths. Refer to the General Venting section of the Installation and Operation Manual • Check for obstruction or blockage in the vent/air intake or discharge ducts • Check wiring connection at the fan and Heat Pump Control board

3 Troubleshooting

Table 3-1 Troubleshooting Chart (continued)

Problem	Possible Causes	Corrections
System controller not recognizing module(s)	• Unexpected addresses in history	• From the setup screen select "System Firmware." In the system firmware window select "Reset Heat Pump Addressing." This may need to be performed multiple times.

*Reset the heat pump by holding the red reset button on the control panel for 5 seconds, pressing "reset heat pump lockout" from the details screen, or by removing then restoring power to the unit at the breaker or manual switch. If the heat pump faults again, additional troubleshooting is necessary to find the cause.

DO NOT CONTINUE TO RESET THE HEAT PUMP, AS CONTINUED SHORT-CYCLING MAY STRESS OR DAMAGE INTERNAL COMPONENTS

Troubleshooting Modes

Service Mode

To aid in troubleshooting, the water heater may be placed into service mode to simulate a call for heating and command the heat pump to run. It is important to note that all faults will still occur normally in Service Mode. Once placed in Service Mode, the water heater will run at the user setpoint until canceled or a 40 minute timeout has been reached.

Manual Defrost

A manual defrost can be performed at any time by entering this mode. Once selected, a complete defrost cycle will be performed. All faults will still occur normally in this mode.

Mode Selection

Troubleshooting modes may be activated in two ways. The first is at the water heater by using the red push button on the side of the main control panel. Hold the button for 5 seconds to access the menu on the control board LED display, viewed through the window on the control panel. There are three options that will flash on the display. These are cancel (CAn), defrost (dEF), and service (Srv). Cycle through these flashing options by a single button press. Navigate to the desired flashing option and press and hold the button for 5 seconds to activate that mode. Once in service mode, press and hold the button for 5 seconds again to navigate to CAn, press and hold for 5 seconds to cancel service mode. Note that defrost cannot be canceled; it will run a complete defrost cycle.

The other way to access troubleshooting modes is through the HMI display. Navigate to the settings screen and enter service code "5309". Select Service Mode on. Navigate to the heat pump details screen and four options will be available as button selections: Start, Prime, Flow, and Defrost. Start will begin service mode as described previously. Prime will manually open the heat pump water valve to aid with system priming. Flow will run the heat pump water pump at max flow to aid in troubleshooting piping and flow issues. Defrost will initiate a full defrost cycle.

Table 3-2 Fan Speed Look-up Table

Model 60K		Model 140K	
Temperature Ambient (°F)	Fan speed (rpm)	Temperature Ambient (°F)	Fan speed (rpm)
23 - 30	1200 - 1100	23 - 30	1600 - 1500
30 - 40	1100 - 1000	30 - 40	1500 - 1400
40 - 50	1000 - 900	40 - 50	1400 - 1300
50 - 60	900 - 800	50 - 60	1300 - 1200
60 - 70	800 - 700	60 - 70	1200 - 1100
70 - 80	700 - 600	70 - 80	1100 - 1000
80 - 95	600 - 400	80 - 95	1000 - 800
95 - 120	400	95 - 120	800 - 400

Sight Glass

The sight glass could be used to detect low charge in the system as well as moisture. When there are bubbles in the sight glass during normal system operation it indicates low refrigerant charge in the system. It could also indicate a potential blockage in the system. There is also a moisture indicator in the sight glass which changes color from green to yellow based on the moisture content PPM in the system. Green color means that the system has no/minimal moisture whereas yellow indicates the presence of moisture in the system. The color yellow also indicates that the filter drier should be replaced as it has reached its capacity.

3 Troubleshooting *(continued)*

Checking Temperature Sensors

The water heater temperature sensors are all resistance type devices. The following tables show the correct values for the sensors at various temperatures. Use an ohmmeter to read the resistance of the sensor at a known temperature. If the resistance of the sensor does not closely match its corresponding table, replace the sensor.

It is important to note that the outlet water sensor has two temperature sensing devices in one housing. These devices are designated as Water Outlet Sensor A and Water Outlet Sensor B. Please reference the wiring diagram in the Veritus Water Heater Installation and Operation Manual for correct terminal location.

Figure 3-3 *Reversing Valve - Normal Operation*

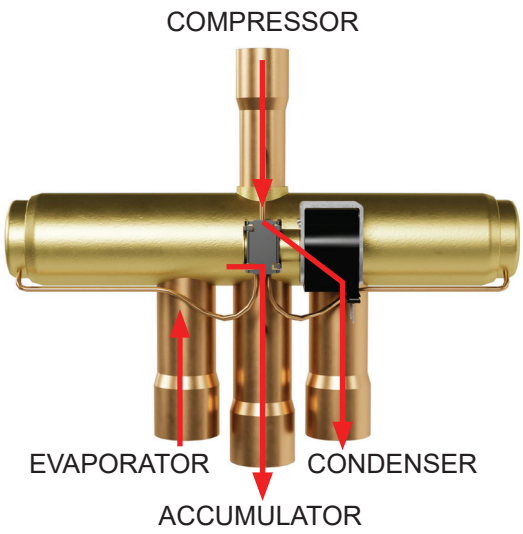


Figure 3-4 *Reversing Valve - Defrost*

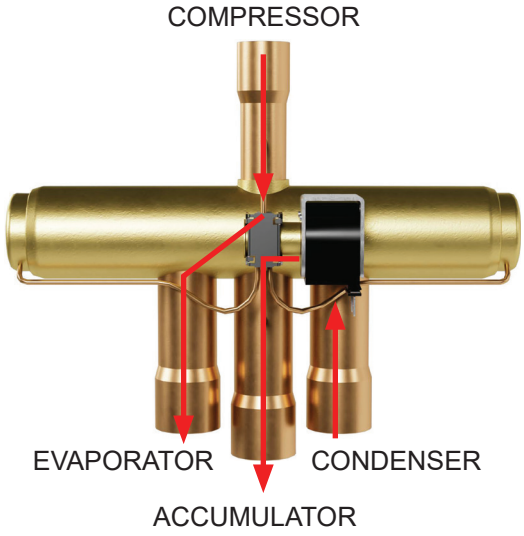


Table 3-3 *Outlet Water - Sensor A (100170543)*

Temperature		Resistance
°F	°C	Ω
32	0	30902
50	10	19553
68	20	12690
77	25	10291
86	30	8406
104	40	5715
122	50	3958
140	60	2786
158	70	2004
176	80	1464
194	90	1084
212	100	816

Table 3-4 *Outlet Water - Sensor B (100170543)*

Temperature		Resistance
°F	°C	Ω
32	0	66050
50	10	19553
68	20	25030
77	25	20000
86	30	16090
104	40	10610
122	50	7166
140	60	4943
158	70	3478
176	80	3492
194	90	1816
212	100	1344

3 Troubleshooting

Table 3-5 *Intlet Water - Sensor (100170559)*

Temperature		Resistance
°F	°C	Ω
32	0	30902
50	10	19553
68	20	12690
77	25	10291
86	30	8406
104	40	5715
122	50	3958
140	60	2786
158	70	2004
176	80	1464
194	90	1084
212	100	816

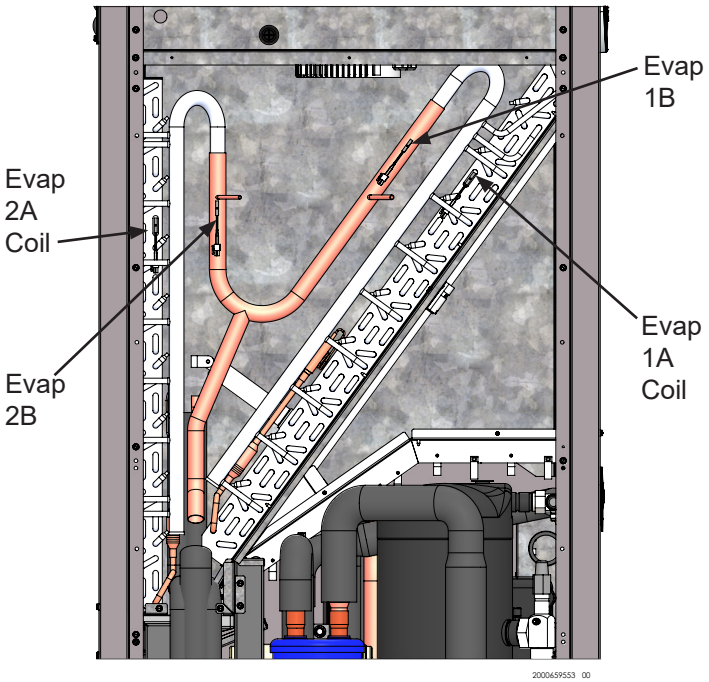
Table 3-6 *Ambient Sensor (100170604)*

Temperature		Resistance
°F	°C	Ω
32	0	32650
50	10	19900
68	20	12490
77	25	10000
86	30	8057
104	40	5327
122	50	3603
140	60	2488
158	70	1752
176	80	1258
194	90	918
212	100	680

Table 3-7 *Refrigerant Sensors - Discharge, Suction, Evap1A, Evap1B, Evap2A, Evap2B (100369844)*

Temperature		Resistance
°F	°C	Ω
32	0	32554
50	10	19867
68	20	12486
77	25	10000
86	30	8060
104	40	5332
122	50	3607
140	60	2491
158	70	1753
176	80	1256
194	90	915
212	100	677

Figure 3-5 *Refrigerant Evaporator and Temperature Sensors*



3 Troubleshooting *(continued)*

Table 3-8 *Tank, System Supply, Return, Recirc, Sensors (100170544)*

Temperature		Resistance
°F	°C	Ω
32	0	30902
50	10	19553
68	20	12690
77	25	10291
86	30	8406
104	40	5715
122	50	3958
140	60	2786
158	70	2004
176	80	1464
194	90	1084
212	100	816

Table 3-9 *Sensor Wire and Corresponding Color*

Sensor Wire	Color
Water Outlet	Blue
Water Inlet	Green
Ambient	Black & Red twisted pair
Refrigerant Discharge	Red
Refrigerant Suction	Orange
Evap 1A	Yellow
Evap 1B	Gray
Evap 1A	Black
Evap 1B	Pink

3 Troubleshooting *(continued)*

Table 3-10 *High Pressure Transducer - Voltage and Pressure*

High Pressure Transducer	
Voltage Output (VDC)	**Pressure (PSI)**
0	0
0.5	25
1.0	50
1.5	75
2.0	100
2.5	125
3.0	150
3.5	175
4.0	200
4.5	225
5.0	250
5.5	275
6.0	300
6.5	325
7.0	350
7.5	375
8.0	400
8.5	425
9.0	450
9.5	475
10.0	500

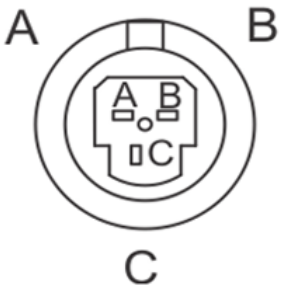
Table 3-11 *Low Pressure Transducer - Voltage and Pressure*

Low Pressure Transducer	
Voltage Output (VDC)	**Pressure (PSI)**
0.0	0
1.0	10
2.0	20
3.0	30
4.0	40
5.0	50
6.0	60
7.0	70
8.0	80
9.0	90
10.0	100

Table 3-12 *Pressure Transducer Corresponding Color*

Transducer	Low Pressure	High Pressure
Pin A: (-) Common	Yellow	Yellow
Pin B: (+) Supply	Purple	Purple
Pin C: Output	Orange	Red

Figure 3-6 *Pressure Transducer: Voltage Between Output and Common*



Pin A: (-) Common
Pin B: (+) Supply
Pin C: Output

3 Troubleshooting

Compressor CoreSense Module

The Copeland compressor is installed with a CoreSense module that is used to switch the compressor on and off, protect the compressor from fault conditions, and alert the user. The CoreSense is installed inside the junction box of the AHP140 compressor and external to the AHP060 compressor. Both models also include a compressor current transducer and the AHP140 includes a discharge temperature sensor connected to the CoreSense. See below for default DIP switch settings on the CoreSense module. The CoreSense faults will be relayed and shown on the unit display and through flash codes on the module itself. See below for flash error codes. A full description of these codes can be found in the Error Code Chart of this manual.

The Heat Pump Controller will control the compressor through the M1 and M2 relay contacts on the CoreSense.

Label all wires prior to disconnection when servicing controls.

Figure 3-7 *Coresense Diagnostics Module*

Table 3-13 *CoreSense LED Codes*

LED	Solid	Flashing
Green	Normal operation	Normal operation with Alert
Yellow	Demand, No current	System Trip (Auto Reset)
Red	-	Lock Out (Manual Reset)
Blue	Digital operation	-

LED	Flashes	Code Description
Yellow, Red	1	High discharge temperature
Yellow	2	Excessive system limit trips
Green	3	Excessive demand cycling
Yellow, Red	4	Locked rotor
Green	5	Demand present, no current detected over 4 hr period
Yellow, Red	6	Phase loss detected
Red	7	Reverse phase detected
Green	8	Welded contractor
Yellow	9	Low module voltage
Green	10	Module communication error
Green	11	Discharge temperature sensor error (AHP060 will show this in normal operation)
Green	12	Current transducer error

3 Troubleshooting *(continued)*

Table 3-14 *Rocker DIP Switch default settings*

ON						
Switch	EXV Injection	Digital Control	Failsafe	Stop Bits	Reset to Default	Lockout Enable
OFF	■	■	■	■	■	■

Table 3-15 *Communication DIP Switch default settings*

ON	■				
Switch	1. Node Address	2. Node Address	3. Node Address	4. Node Address	5. Node Address
OFF		■	■	■	■
ON					
Switch	6. Baud Rate	7. Parity	8. Control Mode	9. Not Used	10. Termination
OFF	■	■	■	■	■

LED

The Veritus water heater control will monitor and lockout the unit for any abnormal condition detected. As a visual aid, there is a status light at the rear panel of each unit. While running, the light is solid, when off the light will be off, and when in fault the light will flash on/off. Units in fault will be shown in red on the main screen of the display. Click the unit in fault and navigate to the Fault History to view the list of current faults. After faults have been corrected the unit can be reset from the Details screen. Alternatively, faults can be viewed as a 3 number code found on the main control board LED display. Remove the lower front panel of the unit and look through the viewing window on the control panel to see the fault code. Faults can also be reset by holding the red reset button on the control panel for 5 seconds. Refer to Table 3-14 for a full list of fault codes and corrective actions.

3 Troubleshooting

Table 3-16 *Error Code Chart*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
3	All Tank Sensors Faulty (System)	Auto Reset Lockout	All tank sensors that are used are disconnected or shorted	• See Sensor Troubleshooting section and tables
10	Heat Pump Control Board Frequency Fault	Warning	Control board power frequency is < 47 Hz or > 68 Hz	• Check incoming power
10	System Control Board Frequency Fault (System)	Auto Reset Lockout	Input power frequency < 54Hz or >66Hz	• Check incoming power
11	Control Board Memory Error	Manual Reset Lockout	Able to communicate but unable to write to internal EEPROM memory.	• Replace Heat Pump Control
20	Control Communication Error	Warning	Heat Pump Control has lost RS485 communication	• Check wire harness connections to J27 (Cascade in) and J7 (Cascade out) • May be necessary to press “Reset Heat Pump Addressing” button on the HMI
20	System Control Communication Error	Warning	System Control has lost RS485 communication	• Check wire harness connections to J11 • May be necessary to press “Reset Heat Pump Addressing” button on the HMI
25	System Return Temperature Error (System)	Warning	The optional System Return Temperature Sensor is disconnected	• See Sensor Troubleshooting section and tables
25	System Return Temperature Error (System)	Warning	The optional System Return Temperature Sensor is shorted	• See Sensor Troubleshooting section and tables
25	Evaporator 1 Coil Temp Sensor	Warning	Oblique evaporator coil temperature sensor disconnected	• See Sensor Troubleshooting section and tables
25	Evaporator 1 Coil Temp Sensor	Warning	Oblique evaporator coil temperature sensor shorted	• See Sensor Troubleshooting section and tables
26	Suction Temperature Sensor	Warning	Refrigerant suction temperature sensor disconnected	• See Sensor Troubleshooting section and tables
26	Suction Temperature Sensor	Warning	Refrigerant suction temperature sensor shorted	• See Sensor Troubleshooting section and tables

3 Troubleshooting *(continued)*

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
27	Discharge Temperature Sensor	Warning	Refrigerant discharge temperature sensor disconnected	•See Sensor Troubleshooting section and tables
27	Discharge Temperature Sensor	Warning	Refrigerant discharge temperature sensor shorted	•See Sensor Troubleshooting section and tables
28	Ambient Temperature Sensor	Auto Reset Lockout	Ambient temperature sensor disconnected	•See Sensor Troubleshooting section and tables
28	Ambient Temperature Sensor	Auto Reset Lockout	Ambient temperature sensor shorted	•See Sensor Troubleshooting section and tables
29	System Supply Temperature Error (System)	Warning	The optional System Supply Temperature Sensor is disconnected	•See Sensor Troubleshooting section and tables
29	System Supply Temperature Error (System)	Warning	The optional System Supply Temperature Sensor is shorted	•See Sensor Troubleshooting section and tables
29	Outlet 01 Water Sensor Error	Manual Reset Lockout	The outlet water sensor is disconnected	•See Sensor Troubleshooting section and tables
29	Outlet 01 Water Sensor Error	Manual Reset Lockout	The outlet water sensor is shorted	•See Sensor Troubleshooting section and tables
30	System Recirc Temperature Error (System)	Warning	The optional System Recirc Temperature Sensor is disconnected	•See Sensor Troubleshooting section and tables
30	System Recirc Temperature Sensor Shorted	Warning	The optional System Recirc Temperature Sensor is shorted	•See Sensor Troubleshooting section and tables
39	System CPU Voltage out of Tolerance (System)	Auto Reset Lockout	3.3V Supply Voltage is out of range by +/-5%	•Replace System Control
50	Inlet Water Sensor	Auto Reset Lockout	Inlet water sensor disconnected and heat pump has attempted to run	•See Sensor Troubleshooting section and tables
50	Inlet Water Sensor	Auto Reset Lockout	Inlet water sensor shorted and heat pump has attempted to run	•See Sensor Troubleshooting section and tables
51	Outlet 02 Water Sensor Error	Manual Reset Lockout	The outlet water sensor is disconnected	•See Sensor Troubleshooting section and tables
51	Outlet 02 Water Sensor Error	Manual Reset Lockout	The outlet water sensor is shorted	•See Sensor Troubleshooting section and tables

3 Troubleshooting

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
83	Refrigerant Low Pressure Switch	Auto Reset Lockout	Refrigerant suction pressure falls below 5 psig during stabilized running (ignored during defrosting)	• Check for blockages in refrigerant piping including closed compressor service valve • Check for charge leak; check for a steady column of liquid in sight glass. • Check for frosting in the evaporator. Run a manual defrost cycle if needed.
85	Compressor Discharge High Temperature	Manual Reset Lockout	Compressor discharge temperature exceeds 250°F	• The compressor has reached a temperature where oil may begin to deteriorate. Monitor the compressor for unusual sound, vibration, or pressures. • Check for refrigerant blockages
87	Compressor CoreSense Comm Error	Warning	Heat Pump Control has lost RS485 communication with the compressor Core Sense module	• Check the harness connections from the compressor Core Sense module to J8 on the Heat Pump Control
88	Fan Communication Loss	Auto Reset Lockout	Fan has lost RS485 communication	• Check the control wiring harness and connections to the fan
89	Pressure Transducer Error	Warning	Potential issue with the suction or discharge pressure transducer detected	• Check the harness connections from the pressure sensors to J6 on the Heat Pump Control • Check each pressure transducer against a known pressure source. Replace if necessary.
90	Refrigerant High Pressure Switch	Manual Reset Lockout	Refrigerant discharge pressure exceeds 400 psig. Reset when discharge pressure falls below 280 psig.	• Verify if there is water flow through the unit • Verify if the fan is running during heat pump operation
91	Evap2 Coil Temp Sensor	Warning	Vertical evaporator coil temperature sensor disconnected	• See Sensor Troubleshooting section and tables
91	Evap2 Coil Temp Sensor	Warning	Vertical evaporator coil temperature sensor shorted	• See Sensor Troubleshooting section and tables
92	Evap1 Temp Sensor	Warning	Oblique evaporator suction header temperature sensor disconnected	• See Sensor Troubleshooting section and tables
92	Evap1 Temp Sensor	Warning	Oblique evaporator suction header temperature sensor shorted	• See Sensor Troubleshooting section and tables

3 Troubleshooting *(continued)*

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
93	Evap2 Temp Sensor	Warning	Vertical evaporator suction header temperature sensor disconnected	• See Sensor Troubleshooting section and tables
93	Evap2 Temp Sensor	Warning	Vertical evaporator suction header temperature sensor shorted	• See Sensor Troubleshooting section and tables
94	Liquid Line Temp Sensor	Warning	Refrigerant liquid line temperature sensor disconnected	• See Sensor Troubleshooting section and tables
94	Liquid Line Temp Sensor	Warning	Refrigerant liquid line temperature sensor shorted	• See Sensor Troubleshooting section and tables
95	High Water Temperature Auto Reset	Auto Reset Lockout	Outlet water temperature exceeds 185°F (85°C)	• Verify proper operation of the pump and water valve • Verify the system is full of water and all air has been properly purged from the system • Verify the water heater is properly piped into the system. Refer to the System Piping section of the Installation and Operation manual. • Check resistance of the outlet water sensor and compare to the table in this manual. Replace sensor if necessary.
95	High Water Temperature Manual Reset	Manual Reset Lockout	Outlet water temperature exceeds 200°F (93°C)	• Verify proper operation of the pump and water valve • Verify the system is full of water and all air has been properly purged from the system • Verify the water heater is properly piped into the system. Refer to the System Piping section of the Installation and Operation manual. • Check resistance of the outlet water sensor and compare to the table in this manual. Replace sensor if necessary.
96	Low Superheat	Warning	Superheat has dropped below 5°F	• Check for proper EEV control

3 Troubleshooting

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
98	Blocked Drain	Warning	The condensate drain pan switch has detected excessive condensate	• Check condensate tube from unit to the floor drain for proper installation • Inspect the drain pan and condensate tube for blockages • Check for loose wiring connection at the drain switch • Damaged drain switch. Replace switch.
98	Blocked Drain Shutdown	Auto Reset Lockout	The condensate drain pan switch has detected excessive condensate for an extended period	• Check condensate tube from unit to the floor drain for proper installation • Inspect the drain pan and condensate tube for blockages • Check for loose wiring connection at the drain switch • Damaged drain switch. Replace switch.
100	Selected Tank Sensor Error (System)	Warning	The sensor selected to control tank temperature is disconnected or shorted. The next sensor will be used in its place.	• See Sensor Troubleshooting section and tables
140	Compressor Reversed Phase	Manual Reset Lockout	The compressor is running in reverse	• Switch two of the 480 VAC main incoming power legs at the unit rear panel.
141	Compressor Phase Loss	Manual Reset Lockout	One or more legs of compressor power are missing or disconnected	• Check compressor power wiring
142	Compressor Discharge High Temperature	Auto Reset Lockout	Compressor discharge temperature exceeds 260°F (ZB95K5E compressor only with top cap sensor)	• The compressor has reached a temperature where oil may begin to deteriorate. Monitor the compressor for unusual sound, vibration, or pressures. • Check for refrigerant blockages
143	Compressor Locked Rotor	Auto reset Lockout (20 min)	Compressor draws current without rotating	• Check all legs of power for compressor • Verify compressor crankcase heater is on and has had adequate time to prevent excess liquid from gathering in the compressor • Compressor bearings are seized. Replace compressor.

3 Troubleshooting *(continued)*

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
144	Compressor Excess Trips	Auto Reset Lockout (5 min)	Four consecutive compressor faults	•-Check all legs of power for compressor •Verify compressor crankcase heater is on and has had adequate time to prevent excess liquid from gathering in the compressor •Compressor bearings are seized. Replace compressor.
145	Compressor Low Module Voltage	Auto Reset Lockout (5 min)	Low voltage to Core Sense module	•Check 120VAC wiring connections to L1 & L2 on the Core Sense
146	Compressor Welded Contactor	Manual Reset Lockout	No compressor demand but current detected	•Inspect both compressor contactors for damage. •Replace contactors if necessary
147	Compressor Module Communication Error	Warning	Communication error to the compressor Core Sense Module	•Inspect communication cable from Core Sense to Heat Pump Control J8
148	Compressor Current Transducer Error	Warning	Core Sense Module detected a current transducer error	•Check each leg of compressor power is routed through the current transducer inside the junction box •Check the connection of the current transducer to the Core Sense Module
149	Fan Hardware Failure	Manual Reset Lockout	Fan hardware detection exception	•Fan motor may need to be replaced
150	Fan Locked Rotor	Auto Reset Lockout (Manual reset after 9 tries)	Fan speed is less than 30 RPM while running	•Check all legs of power for fan motor •Check for blockages in fan blades •Fan motor bearings seized. Replace fan motor.
151	Fan Output Short Circuit	Auto Reset Lockout	Fan current exceeds 20A	•Check fan wiring connections
152	Fan Over Current	Auto Reset Lockout	Fan current exceeds motor rating	•Check fan wiring connections •Check fan for damage including seized bearings
153	Fan Output Phase Loss	Manual Reset Lockout	One or more legs of fan power output are missing or disconnected	•Check fan wiring connections
154	Fan Input Phase Loss	Manual Reset Lockout	One or more legs of fan power input are missing or disconnected	•Check fan wiring connections

3 Troubleshooting

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
155	Fan Over Voltage	Auto Reset Lockout	Voltage supplied to fan exceeds 523 VAC	• Check incoming 480VAC power to the unit
156	Fan Under Voltage	Auto Reset Lockout	Voltage supplied to fan is lower than 220 VAC	• Check incoming 480VAC power to the unit
157	Fan Over Temperature	Auto Reset Lockout	Fan motor temperature exceeds 239°F (115°C)	• Check fan wiring connections • Check fan for damage including seized bearings
159	NFC Key Wrong CRC	Warning - Manual Reset	Bad key product information	• Replace NFC key
159	NFC CRC Error (System)	Warning	Key redundancy check bad	• Replace system control key
160	Outlet water sensor differential	Manual Reset Lockout	The dual housed outlet water sensors have read different temperatures.	• See Sensor Troubleshooting section and tables
161	Compressor Discharge Extreme Temperature	Manual Reset Lockout	Compressor discharge temperature exceeds 275°F	• The compressor has reached a temperature where oil has failed and the compressor has overheated. Replace the compressor oil. Monitor the compressor running after oil replacement. If there is unusual sound or vibration, or if the compressor does not maintain pressure, replace the compressor.
162	Unknown Superheat	Manual Reset Lockout	Multiple sensors are missing or in error and can not provide a refrigerant superheat value.	• Check the suction pressure transducer and suction temperature sensor. Refer to these faults for corrective action.
163	High Water Temperature Switch	Manual Reset Lockout	Outlet water temperature exceeds 203°F (95°C)	• Verify proper operation of the pump and water valve • Verify the system is full of water and all air has been properly purged from the system • Verify the water heater is properly piped into the system. Refer to the System Piping section of the Installation and Operation manual. • Check resistance of the outlet water sensor and compare to the table in this manual. Replace sensor if necessary.

3 Troubleshooting *(continued)*

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
164	Discharge Pressure Sensor	Warning	Discharge Pressure Transducer is disconnected or shorted	•Check the harness connections from the pressure sensors to J6 on the Heat Pump Control •Check each pressure transducer against a known pressure source. Replace if necessary.
169	Suction Pressure Sensor	Warning	Suction Pressure Transducer is disconnected or shorted	•Check the harness connections from the pressure sensors to J6 on the Heat Pump Control •Check each pressure transducer against a known pressure source. Replace if necessary.
170	Louver Proving Switch Open	Auto Reset Lockout	The optional remote proving switch is not made	•If an external louver proving switch is used, check wiring connections to the System Control Board J22 •If no louver proving switch is used, check that there is a jumper wire in place at the System Control Board J22 connection
171	Bad CRC Repeat	Warning	Key redundancy check bad	•Replace NFC key
172	Wrong Suction and Discharge Temp	Manual Reset Lockout	Suction temperature is greater than discharge temperature while running	•Suction and discharge temperature sensors may be switched, check for correct connections. Verify each sensor is working properly.
173	Safety Contactor Unknown	Manual Reset Lockout	Compressor safety contactor no feedback while powered	•Check for correct wire connections to compressor safety contactor
174	Safety Contactor Stuck	Manual Reset Lockout	Compressor safety contactor feedback present while not powered	•Inspect compressor safety contactor and replace if stuck or welded closed
175	Compressor Contactor Unknown	Manual Reset Lockout	Compressor contactor no feedback while powered	•Check for correct wire connections to compressor contactor
176	Compressor Contactor Stuck	Manual Reset Lockout	Compressor contactor feedback present while not powered	•Inspect compressor contactor and replace if stuck or welded closed
177	State Duration Timeout	Auto Reset Lockout	Internal control sequence timeout	•Reset or power cycle heat pump as needed
178	Low Fan Speed Timeout	Auto Reset Lockout	Fan did not reach target speed	•Check fan power connections •Check for blockages in fan

3 Troubleshooting *(continued)*

Table 3-16 *Error Code Chart (continued)*

Code	Heat Pump Fault	Recoverability	Description	Corrective Action
179	Low Water Flow Timeout	Auto Reset Lockout	Water flow did not reach minimum flow	•Check pump power connections •Check for blockages in water lines such as closed valves
205	NFC Key Uninitialized	Manual Reset Lockout	Key does not initiate	•Replace NFC key
205	NFC Key Wrong Device	Manual Reset Lockout	Key ID does not match	•Heat pump and System NFC Keys may be swapped. Use the correct key for corresponding control
205	NFC Key Not Initialized (System)	Warning	System key did not initialize	•Cycle power to display panel •Replace system control key if necessary
205	NFC Key Wrong Device ID (System)	Warning	Key ID does not match	•Heat pump and System NFC Keys may be swapped. Use the correct key for corresponding control
222	NFC Key Missing (System)	Warning	NFC key missing in display panel	•Add correct key to system control board in the display panel
222	No Heat Pump EEPROM	Manual Reset Lockout	Missing heat pump control key	•Check wiring harness and connection for the key -Key and/ or Heat Pump Control may need to be replaced
227	NFC Key Old Version	Manual Reset Lockout	Key firmware is an old version	•Update firmware or replace key
227	NFC Key Firmware Not Supported (System)	Warning	Incorrect system key firmware	•Replace system control key

NOTES

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Revision Notes: *Revision A (PCP #3000058109/ CN #500044379) initial release.*

Revision B (PCP #3000059127/ CN #500045231) reflects update the Set Clock and Date section on page 11.

Revision C (PCP #3000060652 / CN #500046800) reflects updates correcting errors and updating Table 3-1.

Revision D (PCP #3000063502 / CN #500049263) reflects an addition to table 3-1.

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