solstice®
HEAT PUMPS

ILHP2-1023

MODEL ILAHP INVERTER EXTREME LOW AMBIENT AIR-TO-WATER HEAT PUMP INSTALLATION AND OPERATION MANUAL

Warranty

Click or Scan for Warranty Registration

SPACE PAK®

IN UNITED STATES: 260 NORTH ELM ST. WESTFIELD, MA 01085 800-465-8558
IN CANADA: 7555 TRANMERE DRIVE, MISSISSAUGA, ONTARIO, L5S 1L4 (905) 670-5888

SECTION 1: INTRODUCTION

Read Before Proceeding

Hazard Definitions

The following terms are used throughout this manual to bring attention to the presence of potential hazards or to important information concerning the product.

⚠ DANGER Indicates an imminently hazardous situation, which if not avoided, WILL result in death, serious injury or substantial property damage.

⚠ WARNING Indicates an imminently hazardous situation, which if not avoided, COULD result in death, serious injury or substantial property damage.

⚠ CAUTION Indicates an imminently hazardous situation, which if not avoided, MAY result in minor injury or property damage.

NOTICE Used to notify of special instructions on installation, operation or maintenance, which are important to equipment, but not related to personal injury hazards.

Failure to comply with these recommendations will void the warranty.

⚠ CAUTION **ALL** air-to-water heat pump installations require some level of Propylene Glycol or Ethylene Glycol freeze protection in the hydronic circuit.

Refer to the graphic in Section 3 for the recommended concentration in your region. However, in all cases it is the responsibility of the contractor to ensure that sufficient freeze protection has been installed to prevent freezing under all conditions. Heat exchanger rupture or other component failure due to freezing is not covered under the manufacturer's warranty.

Benefits and Features

Inverter Compressor

ILAHP Inverter Extreme Heat Pump uses Inverter technology to precisely match the heating or cooling load.

Advanced Controls
Unit function is managed by a parametric microprocessor allowing on site adjustment to match specific operating requirements.

Easy Installation
The monobloc configuration keeps all refrigerant outdoors with no refrigeration connection or handling done on site. Only the water/antifreeze mixture is plumbed indoors.

Quiet Operation
The insulated housing, advanced fan profile, and variable speed fan and compressor all combine to achieve a low noise level of 47dBA to 57dBA @ 3 meters.

Efficient Energy Transfer
ILAHP Inverter Extreme heat pump is equipped with high efficiency, large surface area energy exchangers for both the air to refrigerant heat transfer and the refrigerant to water energy transfer.

Low Ambient Temperature Cooling Operation
ILAHP Inverter Extreme heat pump is capable of operating in cooling mode in ambient temperatures as low as 5°F.

Enhanced Vapor Injection
Compressor and refrigeration system are optimized for efficient and powerful heating performance in ambient temperatures as low as -22°F (-30°C).

Outdoor Coils
Outdoor coils have been tested in accordance with GB/T 2432.17 salt spray test.

Specification

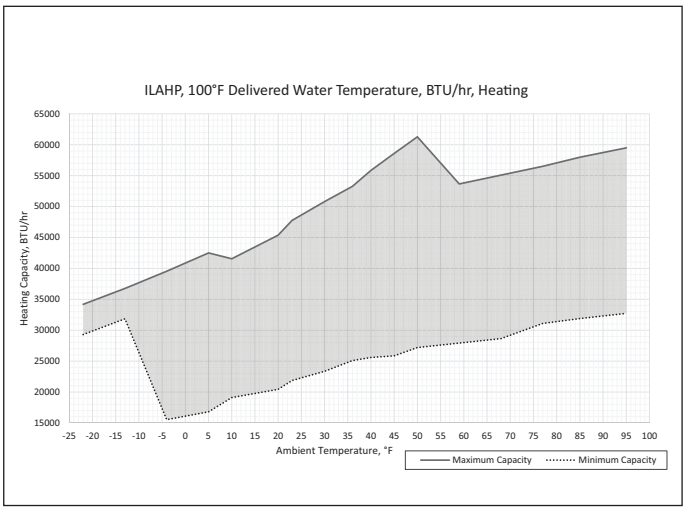
		Units	ILAHP
Cooling	Capacity Range	BTU/hr (kW)	24,226-63,466 (7-19)
	Efficiency Range	EER	7.26-10.41
	Efficiency	IPLV	18.4
	Delivered Water Temp Range	°F (°C)	42-77 (6-25)
	Ambient Temp Range	°F (°C)	5-109 (-15-43)
Heating	Capacity Range	BTU/hr (kW)	15,354-63,807 (5-19)
	Efficiency Range	COP	1.64-5.41
	Delivered Water Temp Range	°F (°C)	59-130 (15-55)
	Ambient Temp Range	°F (°C)	-22 - 109 (-30-43)
CEC Data	Cooling Capacity*	BTU/hr (kW)	45,424 (13)
	Cooling Efficiency*	EER	8.59
	Heating Capacity**	BTU/hr (kW)	53,214 (16)
	Heating Efficiency**	COP	2.78
	Heating Capacity***	BTU/hr (kW)	36,903 (11)
	Heating Efficiency***	COP	1.82
Electrical	Power	V/Ph/Hz	230/1/60
	Fan Motor	A	.8 (2)
	Compressor Motor	A	30
	MCA	A	45
	MOPD	A	50
	SCCR	kA	10
Refrigerant	Type		R410a
	Factory Charge	lbs. (kg)	6.2 (2.8)
Fan	Quantity		2
	Power Input	W	75
	Type		EC
	Max Speed	RPM	750
Sound @ 3 ft/1 m	Range	dBA	47-57
Hydronic	Rated Flow	GPM	12
	Max Water Temp	°F (°C)	130 (55)
	Piping Connections	inch (cm)	1-1/4 NPT (3.2)
	Rated Pressure Drop @ Rated Flow	PSI (ft W.C.)	12.8 (29.5)
Compressor	Type		Rotary Inveter, EVI
	Speed Range	Hz	30-90
	Brand		Toshiba
	Quantity		1
Dimensions	Net Dimensions (W x D x H)	inch (cm)	39 x 16 x 52 (99 x 41 x 132)
	Shipping Dimensions (W x D x H)	inch (cm)	42 x 17 x 53 (107 x 43 x 135)
	Net Weight	lbs. (kg)	349 (158)
	Shipping Weight	lbs. (kg)	388 (176)

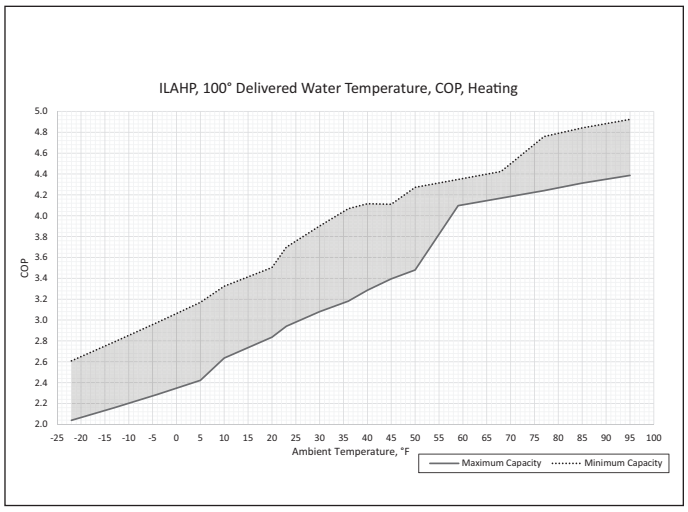
CEC is California Energy Commission. Data is tested in accordance with AHRI 550/590
*= 44°F LWT 54°F EWT @10 GPM & 95°F DB Ambient
**= 120°F LWT 107°F EWT @10 GPM & 47°F DB Ambient
***= 120°F LWT 110°F EWT @10 GPM & 17°F DB Ambient

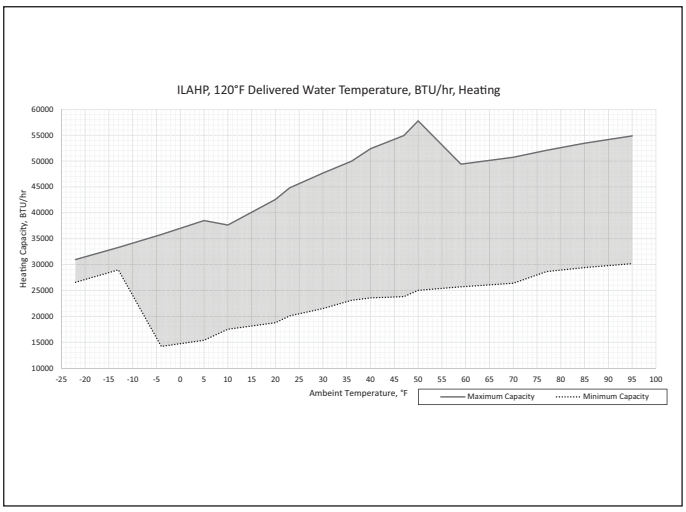
ILAHP Air-to-Water Heat Pumps modulate capacity based upon outlet water temperature. Temperatures shown above are delivered water temperature. Refer to the following performance charts to see the expected.

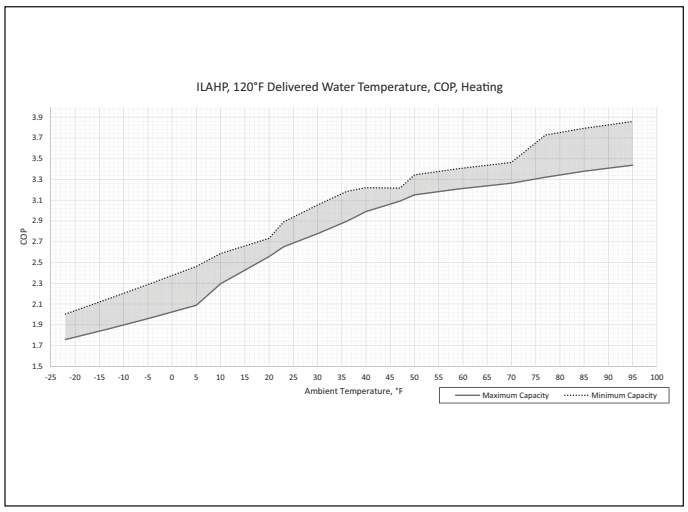
ILAHP Heating Performance

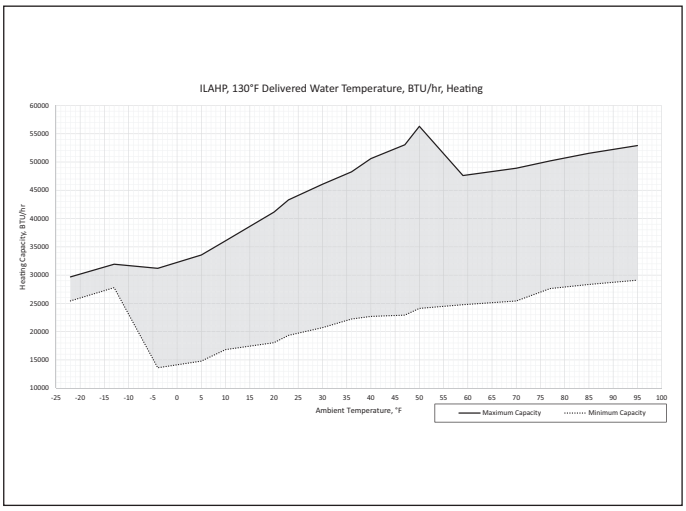
(all data based on pure water and rated flow)

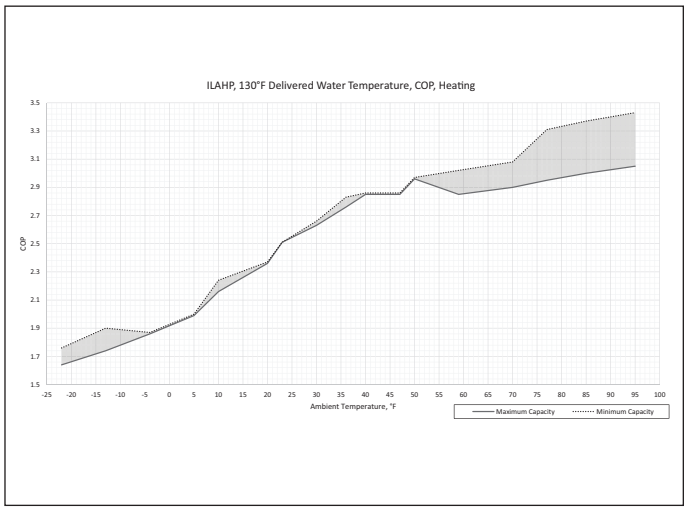




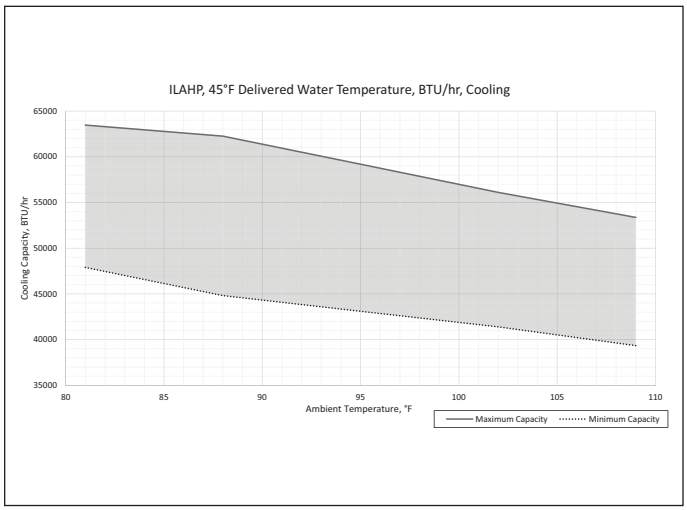


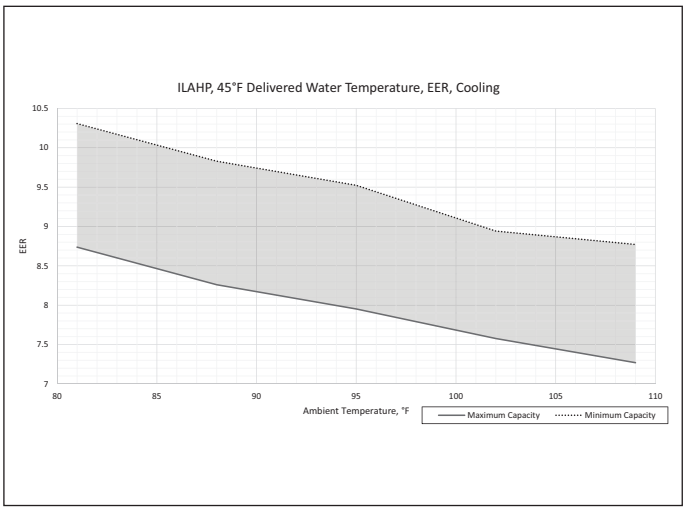


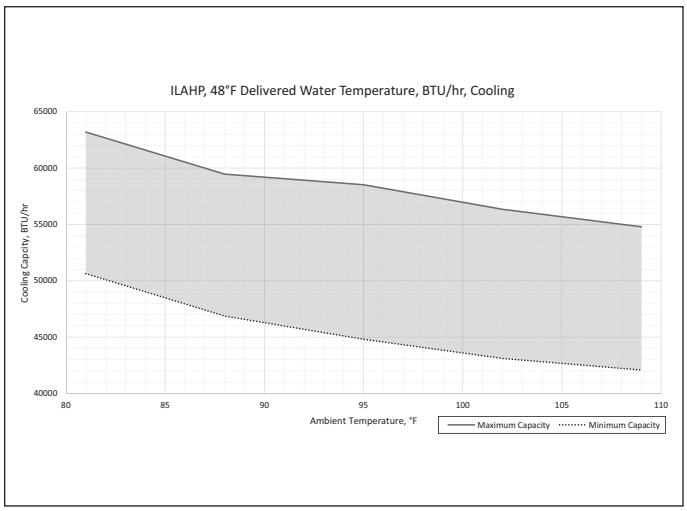


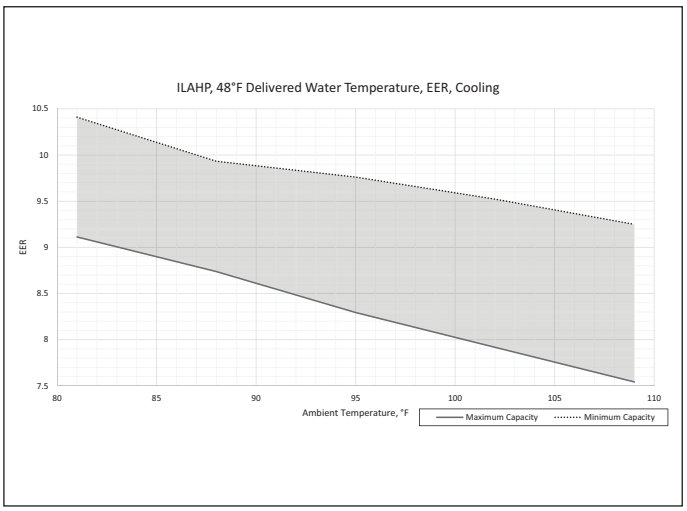


ILAHP Cooling Performance
(all data based on pure water and rated flow)



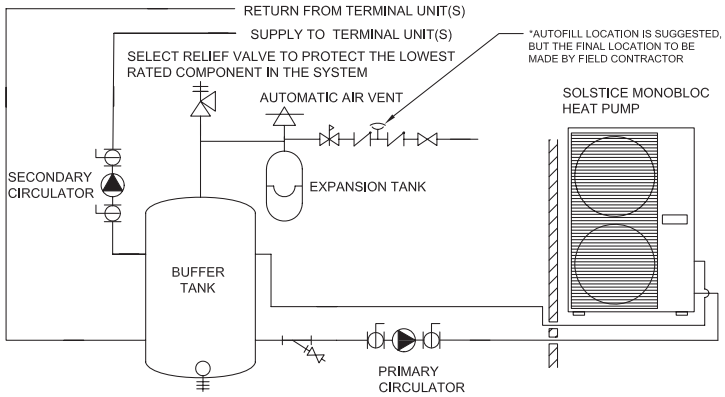




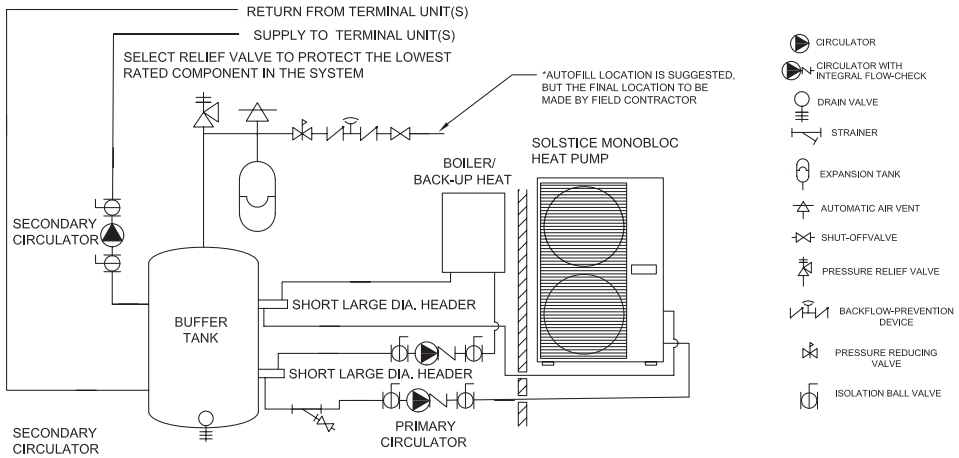


Typical System Diagram

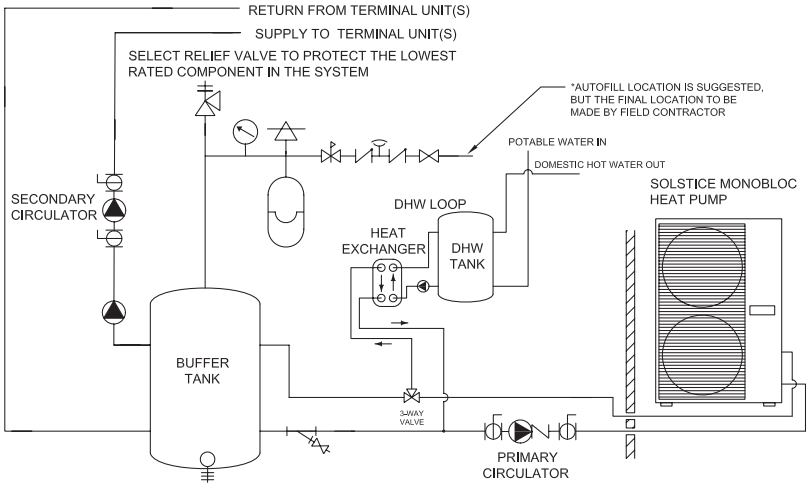
Basic Heat Pump Installation



Heat Pump Installation with Auxiliary Back-Up Heat



Heat Pump Installation with Domestic Hot Water Offset



***Autofill system is suggested but not required by SpacePak. If such installation is desired or required by local code, the Autofill MUST draw from a reservoir of pre-mixed glycol/water solution. Filling directly from a well or municipal water source may introduce contaminants and will dilute the glycol solution in the event of a system leak.**
This may impact warranty coverage.

SECTION 2: INSTALLATION

Choose the Correct Heat Pump

Perform appropriate load calculation to determine required heating or cooling load for the project. Refer to specifications in this manual to determine proper size heat pump.

Installation Location

- ILAHP heat pump must be installed outdoors, in a location capable of supporting the full weight, plus any potential snow load. The outdoor unit must be secured to the support with sufficient hardware to withstand any potential wind or seismic conditions without shifting or tipping. Additionally, the outdoor unit should be installed with enough clearance to allow for condensate roll-off during the defrost cycle. This will prevent freezing under the unit during defrost.
- The heat pump should be located away from sources of heat or moisture such as combustion vents, dryer vents, building exhausts, etc.
- Because the ILAHP uses ambient air as a heat source or sink, the performance is affected by the altitude of the installation. Refer to the table below for the approximate multiplier to apply to the capacity and efficiency due to the altitude.

Elevation above Sea Level		Effect on Cooling		Effect on Heating	
Feet	Meters	Capacity	EER or COP	Capacity	EER or COP
0	0	1.00	1.00	1.00	1.00
500	152	1.00	0.99	0.99	1.00
1000	305	0.99	0.98	0.98	0.99
2000	610	0.98	0.95	0.96	0.98
3000	914	0.97	0.93	0.94	0.97
4000	1219	0.96	0.90	0.91	0.96
5000	1524	0.95	0.88	0.89	0.95
6000	1829	0.95	0.86	0.87	0.95
7000	2134	0.94	0.84	0.86	0.94
8000	2438	0.93	0.82	0.84	0.93
9000	2743	0.92	0.80	0.82	0.92
10000	3048	0.91	0.78	0.80	0.91
11000	3353	0.90	0.76	0.78	0.90
12000	3658	0.89	0.74	0.77	0.89
13000	3962	0.89	0.72	0.75	0.89
14000	4267	0.88	0.70	0.73	0.88

- Proper clearances shown on following pages must be respected.

Water Loop Connection

Please read below for water piping instructions:

- The piping must be clean and free from dirt. Prior to insulating the pipe, it is suggested that a leak test be performed to ensure no water leaks are present.
- The system must be supplied with a pump sized to provide the minimum flow rate specified in the Glycol/Water System Design section of this manual. Pump selection must consider the pressure loss through the plumbing system and its components, plus the pressure loss through the Heat Pump's internal heat exchanger. The pump must be rated for the full range of heated or chilled water temperatures, as well as any anti-freeze or corrosion inhibitor additives.
- The piping system should have a wye strainer installed, on the inlet side, that is sized properly for the anticipated flow rate and pressure drop for the application. This will help protect internal components of the heat pump against sediments, contaminants and fouling that could damage the unit
- Do Not use the heat pump for DIRECT heating of potable water. The heat exchanger and internal components are not suitable for this application.
- Do not use the heat pump to DIRECTLY heat or chill pool water, open process water, untreated well or municipal water, or any working fluid other than aqueous Ethylene Glycol or Propylene Glycol solution circulating in a sealed, pressurized, and oxygen free system.

⚠WARNING Never expose the ILAHP Hydronic circuit to pressures in excess of 30 PSI. Loss of coolant, property damage, or equipment damage may result.

- The total system must be protected with a Pressure Relief Valve or valves sized to protect the system component with the lowest pressure rating. In no instance shall this exceed 30PSI.

⚠CAUTION It is the responsibility of the installing contractor to ensure that sufficient Propylene Glycol concentration is maintained in the hydronic circuit to provide freeze protection in all foreseeable conditions. Failure to do so voids the warranty and damage caused by freezing is not covered.

Electrical Connections

ILAHP Heat Pump must be connected to an individual 230V (220V-240V) circuit, sized and protected according to the Minimum Circuit Ampacity and Max Overload Protection ratings specified on the rating label affixed to the exterior of the unit.

The power connection must include a Protective Earth Ground and a properly sized Neutral as two separate conductors in accordance with National Electric Code and all local codes.

When using the ILAHP as a single standalone heat pump called on by external inputs, (Thermostat, SSIC, Zoning controller etc.) the voltage free wiring should be connected according to the Field Wiring Diagram, to the terminals listed below.

Control Input connections

Important: All of the inputs are for voltage free relay contacts. No voltage should ever be introduced to these inputs. Doing so will immediately destroy the control and such damage will not be covered under warranty.

Remote On/Off is a master unit enable. This must be closed for all unit operation. This connection is located at the power input panel at the front of the unit.

Heat/Cool On/Off is the input for space conditioning. This must be closed for operation in either Heating or Cooling mode. This connection at the power input panel at the front of the unit.

Remote Heat/Cool is the space conditioning mode selection. Open results in Cooling operation, Closed results in Heating operation. This connection is located at the power input panel at the front of the unit.

DHW On/Off enables the Domestic Hot Water mode. When the contacts are closed, the ILAHP Control monitors the (potable) Domestic Water temperature and automatically changes over to maintain the DHW temperature according to the parameters selected. This connection is located in the electrical compartment under the top cover.

TT input is from a 10kW thermistor sensor monitoring the DHW Tank Temperature. This connection is located in the electrical compartment under the top cover.

Control Output Connections

Circulation Pump provides line to neutral power (110-120VAC) or Line to Line (220-240V) of up to five amps to operate the primary circulator between the heat pump and the buffer tank. This is switched by the ILAHP control according to the selected parameters. This connection is located at the power input side access panel.

The electrical loads given in the Specification Table, allow for a pump load of no more than 5 amps and 110 VAC (2.5 amps at 230 VAC). If the pump load exceeds this, provide a separate power source to the pump. DO NOT feed power to the pump from the SpacePak air handler panel.

If the circuit is turned on remotely, it must still have the ability to operate for the unit's freeze protection or the warranty will be void.

⚠CAUTION If the circulator is controlled by an external source, it must still respond to a call from the heat pump, in order to allow to operate for the unit's freeze protection. Disabling this will void the unit warranty.

110V/60 Hz 3 Way Valve provides line to neutral power (110-120VAC) of up to five amps to operate a Three way Valve. This is energized when the ILAHP control changes over to DHW operation. This connection is located in the electrical compartment under the top cover.

110V/60 Hz Hot Water Pump provides line to neutral power (110-120VAC) of up to five amps to operate the circulator on the Secondary (Potable) side of the DHW heat exchanger. This is energized when the DHW operation is active. This connection is located in the electrical compartment under the top cover.

AUX Output provides two staged relay contacts capable of switching 24 to 240VAC at a low current to operate a contactor which engages electric, or any supplemental heat source, according the selected parameters. This connection is located at the power input side access panel. The staging logic is controlled by Parameters H18 and R35.

AUX Heat Outputs AUX HEAT 1 & 2 are 230V signal outputs intended to actuate a contactor or relay. They do not supply current to power any heating device. Any attempt to connect a heating element directly to these points will immediately render the heat pump inoperative and may cause permanent damage to the primary control board.

Alarm Output This sends a 230V signal to the ALARM OUT terminals when any fault or condition causes the heat pump to shut down, or prevents it from starting. This can be connected to a visual or audible device to alert a custodian that the heat pump requires immediate attention.

Communication Connections RS485 connections are provided for two-way serial communication via Modbus protocol to external Building Management and Monitoring equipment.

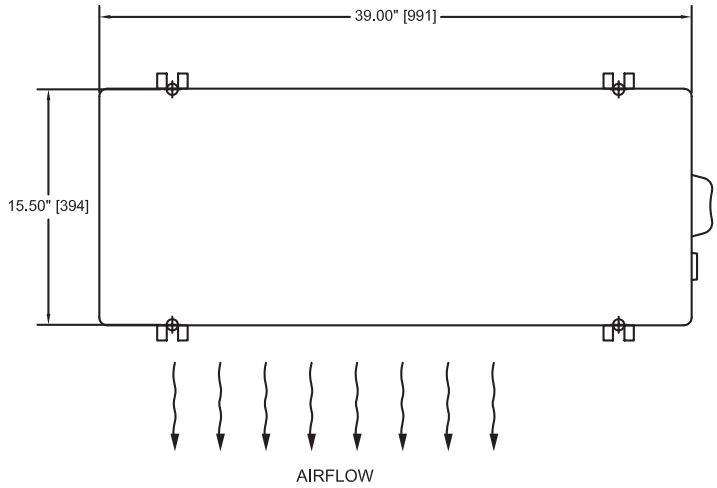
DI07 to GND on the ILAHP control board must be connected to a Normally Closed over temp safety switch located at the supplemental heat source. The switch must open if the safe maximum temperature is exceeded, and this will immediately open the AUX Output contacts. This feature must be employed when any supplemental heat source is used. This connection is located in the electrical compartment under the top cover.

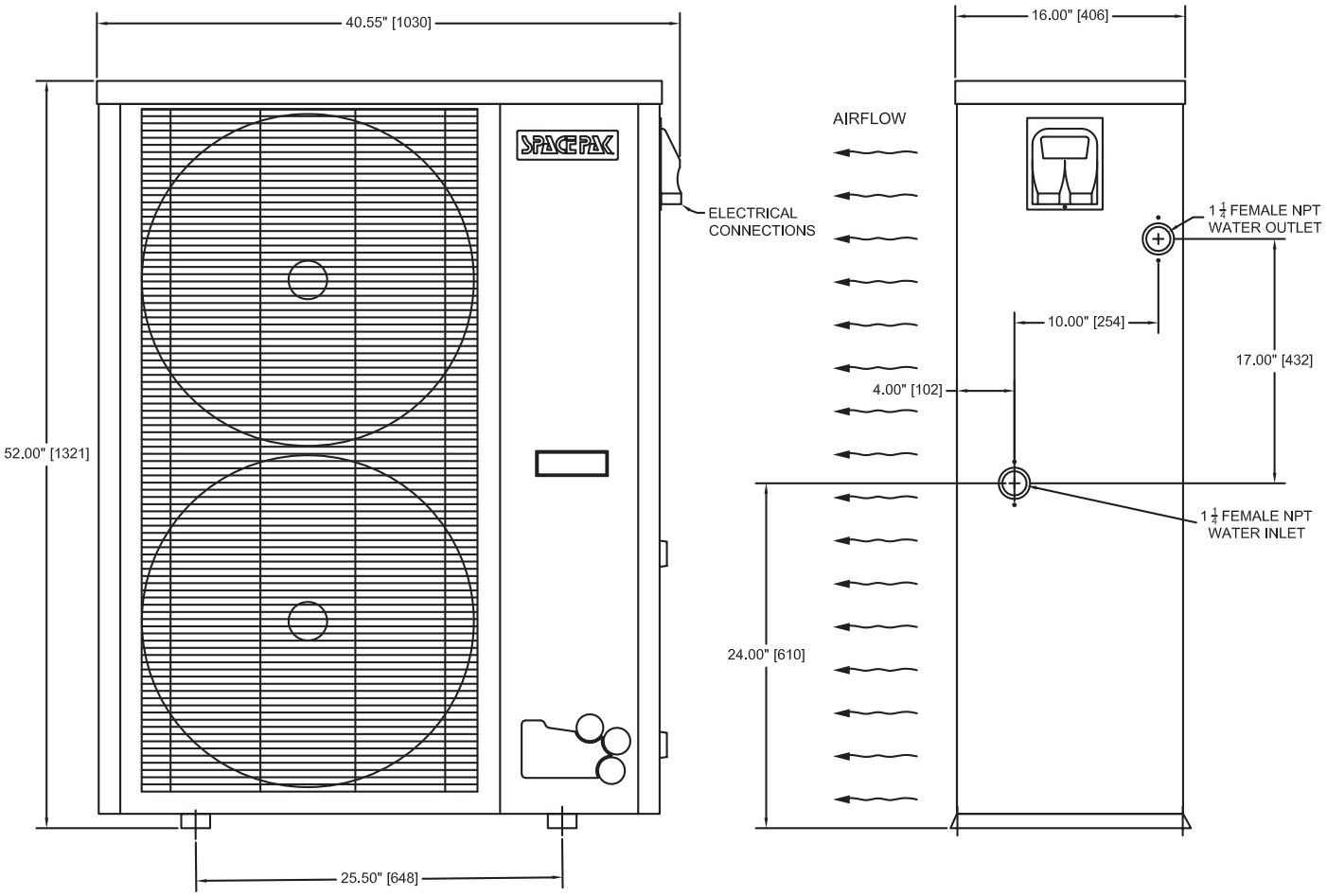
The **Remote Display** output is a pigtail with a five-conductor female plug located inside the top compartment. The Display has a short connector that can be plugged directly into this pigtail for commissioning, and a 20m (66') connection cable is provided to mount the display permanently in a suitable interior mechanical space. This cable can be extended up to 600' by using 24 AWG shielded five-conductor cable and splicing it into the connection cable.

Dimensions

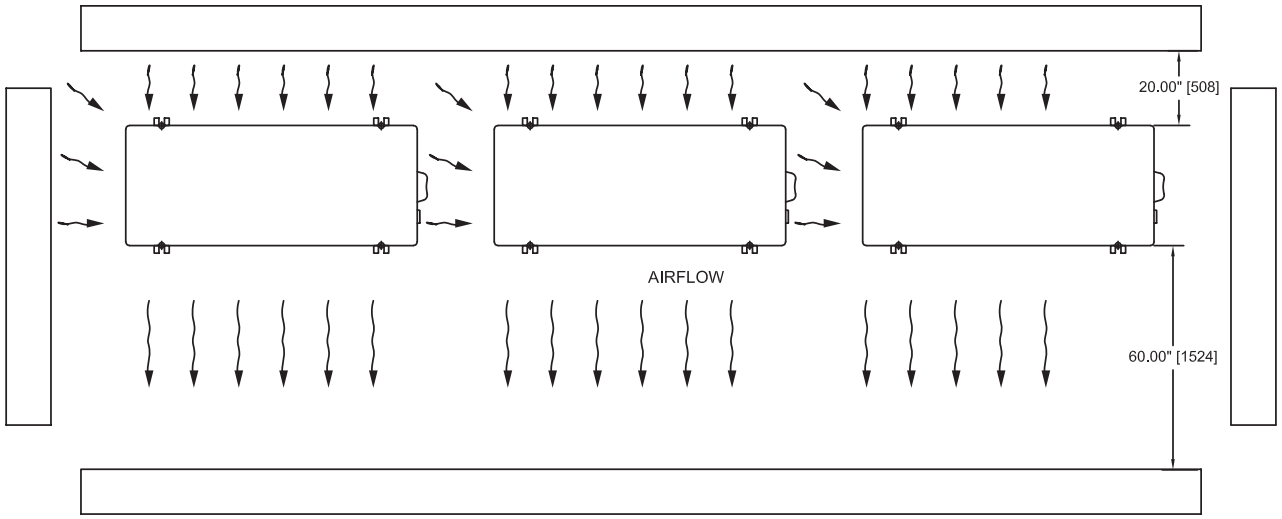
Unit Dimensions (inch (mm))

ILAHP

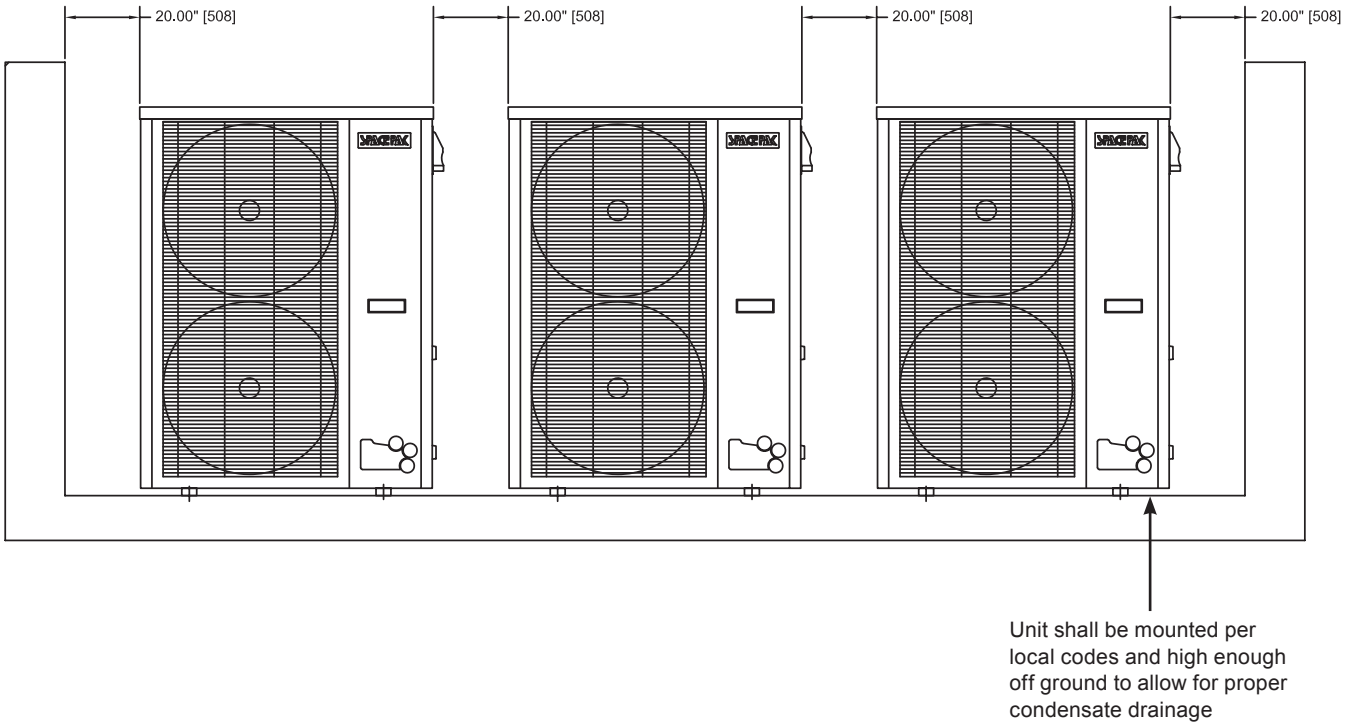




Required Clearances



CLEARANCES SHOWN ARE ASSUMING NO WALL EXTENDS MORE THAN 6" ABOVE THE TOP OF THE HEAT PUMPS, THERE IS NO OVERHEAD ROOF, AND THERE ARE NOT MORE THAN TWO BARRIER WALLS ADJACENT TO THE UNITS



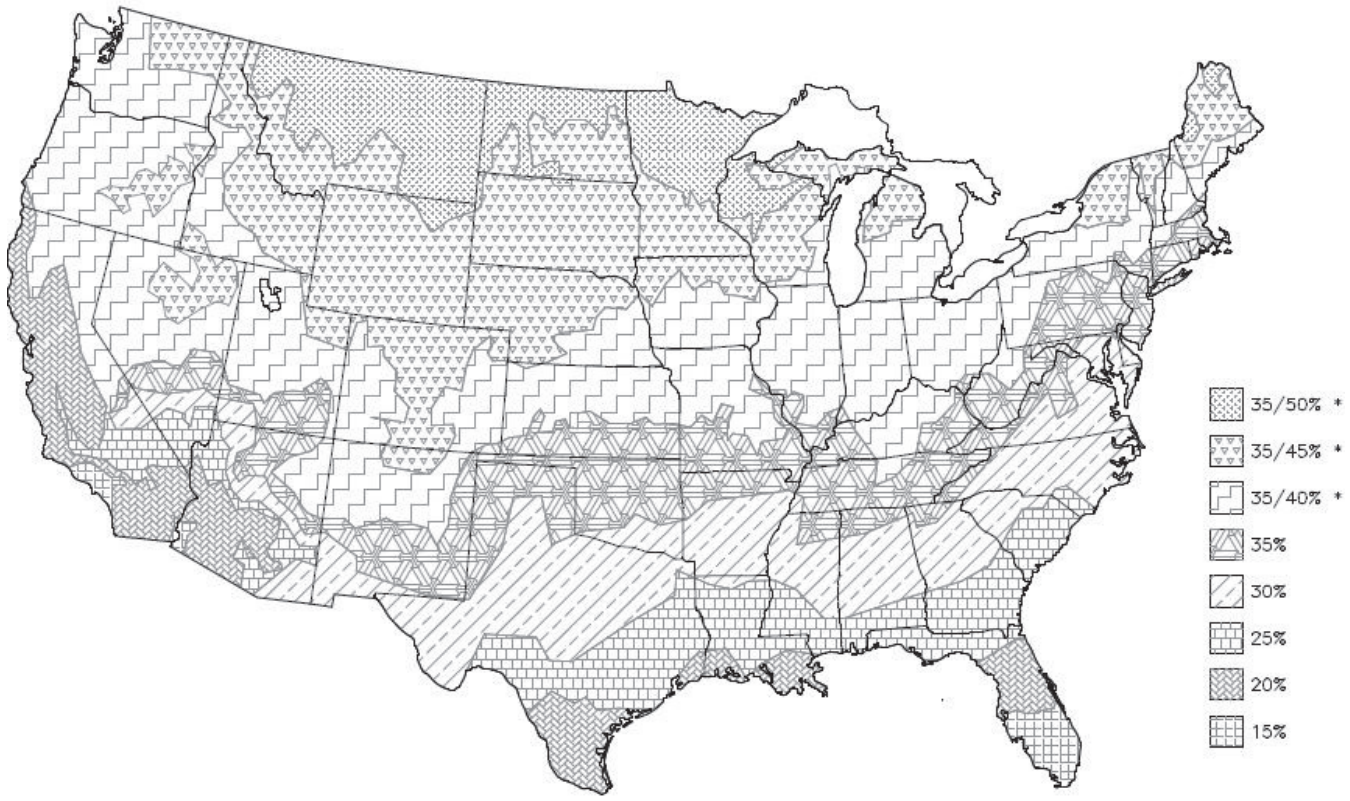
SECTION 3: GLYCOL/WATER SYSTEM

Table 1 ILAHP Glycol Concentrations (10% Minimum, 50% Maximum)

Ethylene Glycol %	10	20	30	40	50
Min. Ambient Temp for Operation	23°F/-5°C	14°F/-10°C	2°F/-17°C	-13°F/-25°C	-36°F/-38°C
SpacePak Capacity Multiplier	0.98	0.96	0.93	0.91	0.89
Pressure Drop Multiplier (Cooling)	1.06	1.12	1.16	1.25	1.36
Pressure Drop Multiplier (Heating)	1.06	1.12	1.16	1.22	1.28
Minimum Expansion Volume / System Volume					
Heating and Cooling (Gallons)	1 gallon expansion per 15 gallons system volume				
Heating only, HP only (Gallons)	1 gallon expansion per 20 gallons system volume				
Heating Only, with Boiler (Gallons)	1 gallon expansion per 15 gallons system volume				
Propylene Glycol %	10	20	30	40	50
Min. Ambient Temp for Operation	26°F/-3°C	18°F/-8°C	8°F/-13°C	-7°F/-22°C	-29°F/-34°C
SpacePak Capacity Multiplier	0.99	0.98	0.96	0.93	0.88
Pressure Drop Multiplier (Cooling)	1.10	1.20	1.34	1.5	1.65
Pressure Drop Multiplier (Heating)	1.10	1.20	1.34	1.46	1.5
Minimum Expansion Volume / System Volume					
Heating and Cooling	1 gallon expansion per 15 gallons system volume				
Heating only, HP only	1 gallon expansion per 20 gallons system volume				
Heating only, with Boiler	1 gallon expansion per 15 gallons system volume				

Non use of propylene glycol will void warranty.

This information is provided as a general guideline only, and is not intended to cover all possible conditions. It is ultimately the responsibility of the installer to ensure that proper freeze protection is provided.



*** A 35% concentration will prevent solid freezing, and protect from bursting, in all conditions. However, this solution will become a thick sludge at extremely low temperatures, possibly resulting in pump overloading, pump damage, or high pressures. Therefore this concentration should only be used in systems that will remain inactive during the winter. Use the higher value shown for systems that must start and run at the coldest temperatures.**

Glycol/Water System Design

The ILAHP has a recommended flow that should be maintained during all operation. The value is 12 Gallons per Minute, and should be considered a minimum. At this flow, the pressure drop through the heat pump is 12.8 PSI, or 29.5 ft WC, or 88 kPa. These head loss values are based upon pure water, see Table 1 for multipliers to correct for various concentrations of anti-freeze solution. Head Loss values shown are for the heat pump only, the selected circulator must be capable of overcoming the entire system head loss.

Note: these are the recommended flow values. Should the flow drop significantly below this value, the heat pump will shut down. This is not an indication of a fault in the heat pump, but rather points to insufficient pump or plumbing capacity, or air trapped within the system.

Glycol/Water Mixture

⚠CAUTION Automotive glycol is not suitable for use in the ILAHP system. Over time it may leave deposits which will degrade the performance and damage pumps or other devices in the system. Use only ethylene glycol or propylene glycol mixtures specifically labeled for boiler or HVAC use.

Obtain all components specified in the Typical System Diagram. Make sure all components and piping comply with applicable local codes.

DO NOT use galvanized pipe anywhere in the system. Galvanizing will react with the glycol and can cause glycol degradation and sludge in the system.

- Confirm charge of expansion tank is 12-15 PSIG (with no water or pressure in the system).
- Install the system piping. DO NOT connect the heat pump unit to the system piping until the system has been cleaned as required below.

The ILAHP must NOT be connected to the system during this process.

1. Connect a hose from a fresh water supply to the system fill hose bib. Note the drain port can be used for this purpose. The hose bib purge/drain valve should be located low in the system and close to the ILAHP return connection.
2. Open the high point purge valve, (not shown in illustration, as it may be inside the air handler) while slowly filling the system. Close the valve when air is removed from the system and water begins to flow out of the valve.
3. Fill the system with fresh water and run water until the system has been thoroughly flushed clean.

Automatic Fill – When an automatic fill system is installed, the cooling fluid (Glycol/water) must be inspected at least every 3 months, or whenever a leak is detected to ensure the proper glycol concentration is maintained.

System Volume and Expansion Volume

To ensure smooth temperature control and minimize cycling of refrigeration system, all installations must have total circulating volumes equal to or greater than 7.5 gallons per nominal ton of the unit performance at minimum capacity (The greater of either heating or cooling produced). In other words, in the case of a five ton heat pump with 3 to 1 turndown (0.33x rated capacity) the minimum total system volume is 5x0.33x7.5=12.5 gal. Multiple heat pump installations that are operating in a staged configuration follow the same rule, so that only a single heat pump tonnage needs to be considered. Additionally, the system requires an expansion volume (air) to compensate for the change in volume of the glycol mixture as it heats and cools, see Table 1 for expansion volume. A typical multiple heat pump installation may actually have a volume far greater than the minimum required, and it is this entire volume that must be considered when sizing the expansion tank. Note that the nominal expansion tank volume is not the same as the expansion volume. If the actual air volume is not published, consider it to be no more than half the nominal volume. As an example, a five ton nominal heat pump operating down to 33% capacity, used for both heating and cooling, requires a minimum of 12.5 gallons of circulated system volume. A 13 gallon buffer tank is selected for best operation. When the system installation is complete, the total volume including the heat pump, buffer tank, and all plumbing is 18 gallons. (Note: the expansion tank, no matter how large, is not considered circulated volume). According to the chart above, the minimum acceptance volume of the expansion tank must be at least 18/15, or 1.2 gallons. If the acceptance volume is not specified, assume it is no greater than 50% of the total tank volume. Therefore in the case of this example, the system would require a minimum tank size of 2.4 gallons. As it is unlikely to find this specific size. Always be sure to round up, so a tank of 3 gallons total volume, or larger, would be appropriate.

Air Separator

Locate at least one high efficiency air separator as shown in the piping to remove any air from the system.

Pressure Test The System

1. Add water to the system as needed to raise the pressure to 25 PSIG (verify that all system components are suitable for this pressure). Verify that the pressure remains constant for at least one hour. Locate and correct any leaks.
2. After successfully testing, drain the system and remove the fresh water hose.

Insulate The Piping

For systems used in cooling applications, the plumbing should be insulated using a vapor barrier to prevent sweating of the pipes and possible damage of the insulation or structure due to water accumulation.

SECTION 4: WIRING

ILAHP Control Wiring Connection

The SpacePak ILAHP requires a dry contact (relay) signal to enable and select between heating and cooling modes. They will not operate on the 24V signals from typical thermostats or air handlers. Connecting 24V to either of these points will result in significant component damage and void factory warranty.

- Connect multiple zone system to heat pump using SpacePak SSIC Control Module and instructions included with it. Refer to manual supplied with SSIC Control Module for connection and operational details.
- See wiring diagram for heat pump electrical diagram.

Terminal Block Screwdriver

Prior to connecting wiring to unit, please ensure to use a properly sized tool to insert wires into terminal blocks. See below figure for dimensions. Failure to do so can result in damage to the terminal blocks or wires. Note: Dimensional drawing is in mm.

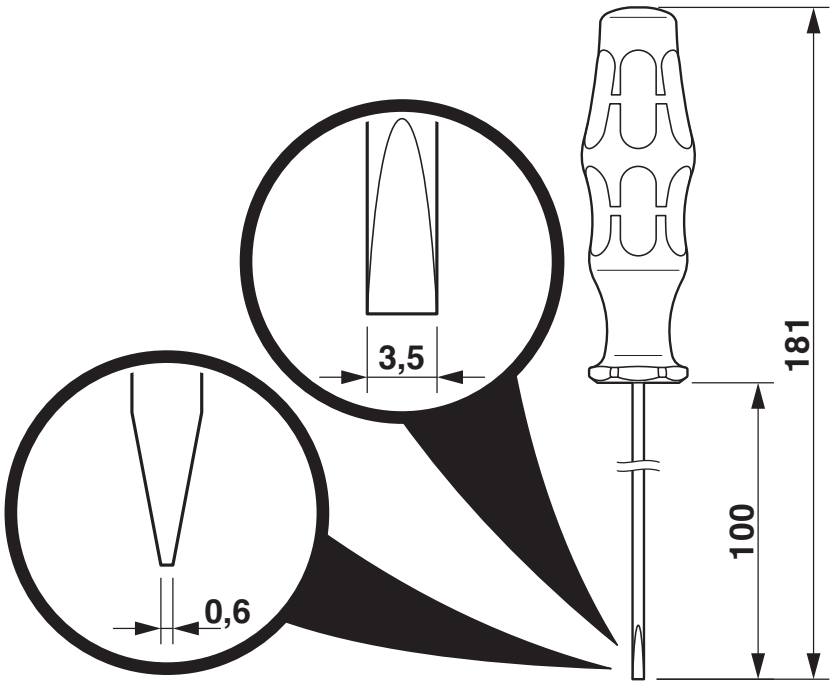
Note: As with all electronic devices, it is important to separate low voltage communication wiring from line voltage power wiring to avoid interference.

When alternating current flows through a conductor, it can induce voltage in another conductor that is placed nearby. This is the same principal that a transformer operates upon.

When 230VAC, 120VAC, or sometimes even 24VAC wires are run near any wires connected to the Remote On/Off, Remote Heat/Cool, Heat/Cool On/Off or ModBUS wiring, it can create interference that may cause erratic operation, or prevent normal operation of the heat pump.

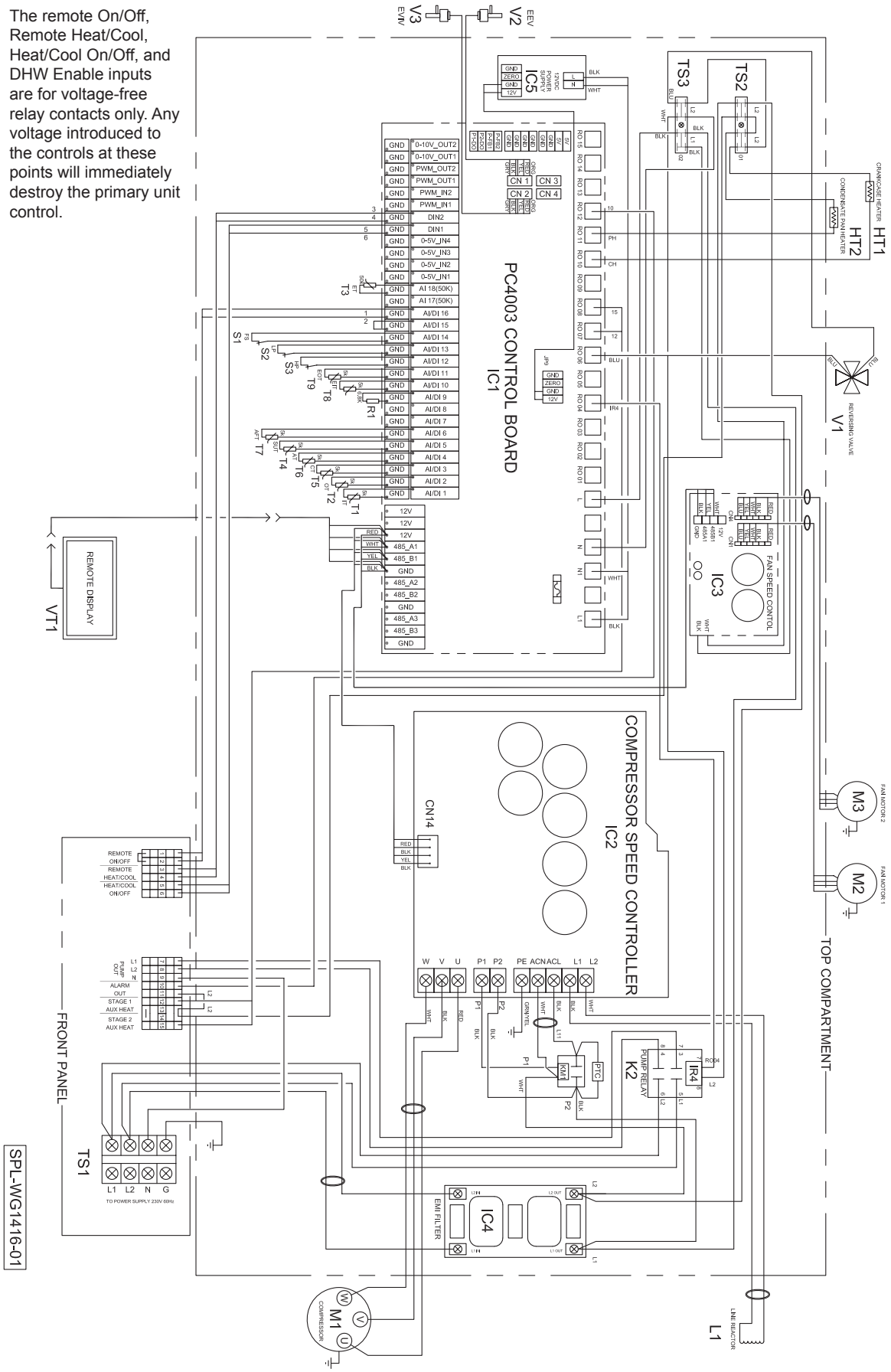
Alternating current and communication wiring should always be separated by a minimum of 6" throughout the length of the wires.

If it is unavoidable to run these wires with the proper separation, the use of shielded multi-conductor cabling for communication may provide sufficient protection to avoid interference. However this should be kept to a minimum length, and the system observed to verify normal operation.



Wiring Diagrams and Definitions: Internal Wiring

⚠ CAUTION The remote On/Off, Remote Heat/Cool, Heat/Cool On/Off, and DHW Enable inputs are for voltage-free relay contacts only. Any voltage introduced to the controls at these points will immediately destroy the primary unit control.

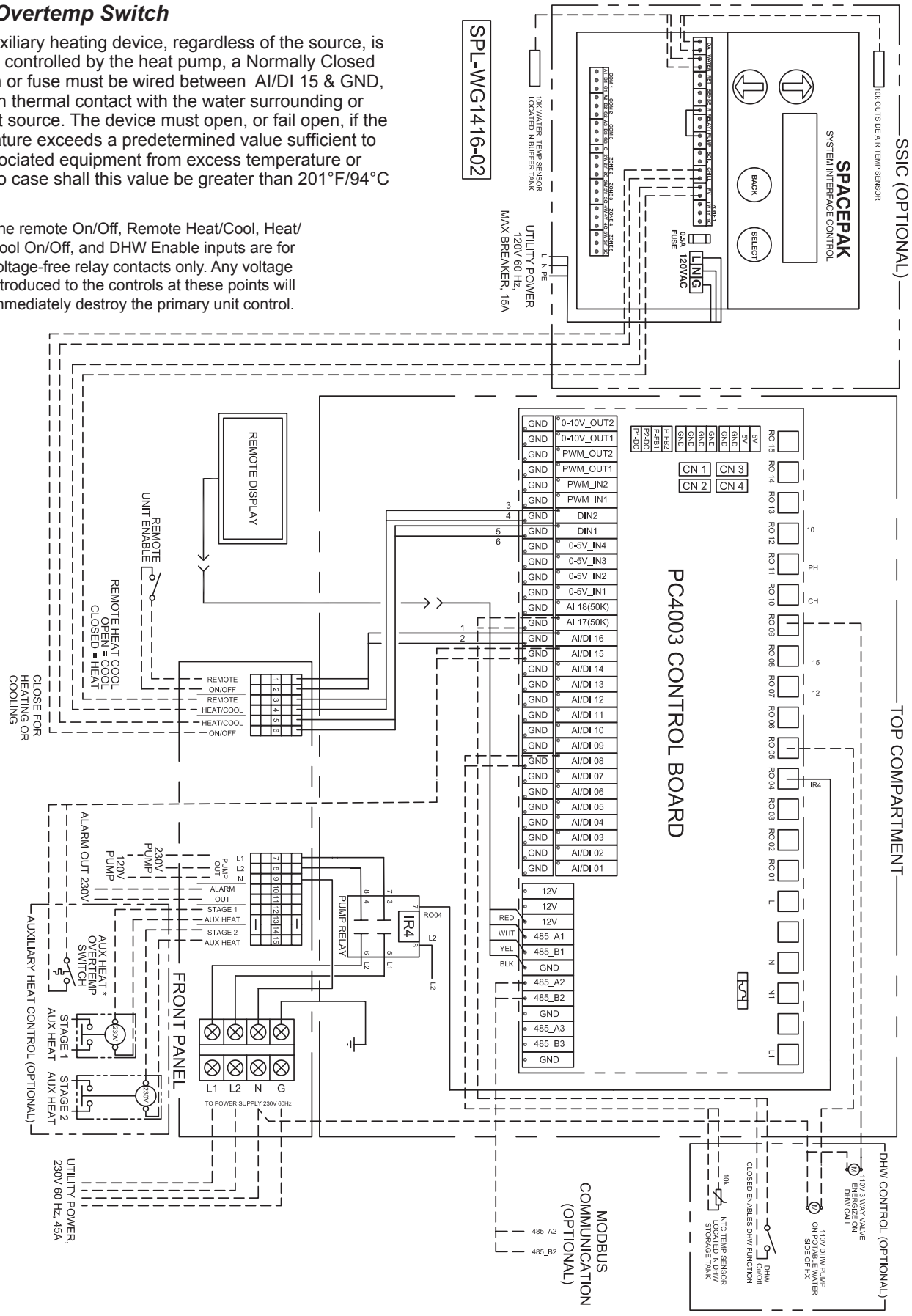


Wiring Diagrams and Definitions: Field Connections

AUX Heat Overtemp Switch

*When any auxiliary heating device, regardless of the source, is employed and controlled by the heat pump, a Normally Closed thermal switch or fuse must be wired between AI/DI 15 & GND, and installed in thermal contact with the water surrounding or within the heat source. The device must open, or fail open, if the water temperature exceeds a predetermined value sufficient to protect all associated equipment from excess temperature or pressure. In no case shall this value be greater than 201°F/94°C

⚠ CAUTION The remote On/Off, Remote Heat/Cool, Heat/Cool On/Off, and DHW Enable inputs are for voltage-free relay contacts only. Any voltage introduced to the controls at these points will immediately destroy the primary unit control.



SECTION 5: REMOTE TOUCHSCREEN DISPLAY

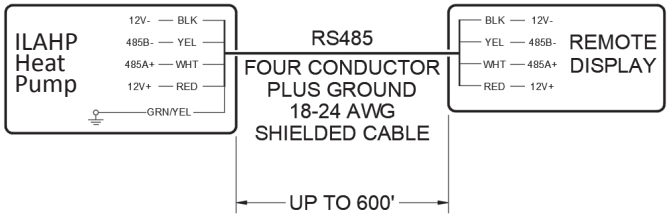
Overview of the Remote Touchscreen Display

The remote touchscreen display is the Operation and Service interface to the ILAHP control.

The full-color screen displays current water inlet and outlet temperatures, outdoor ambient temperature, and DHW tank temperature (if this feature is enabled).

It also allows the user to query the operating status of multiple system characteristics, as well as providing the ability to view and adjust operating parameters through various menu screens.

Remote Display Connection Diagram



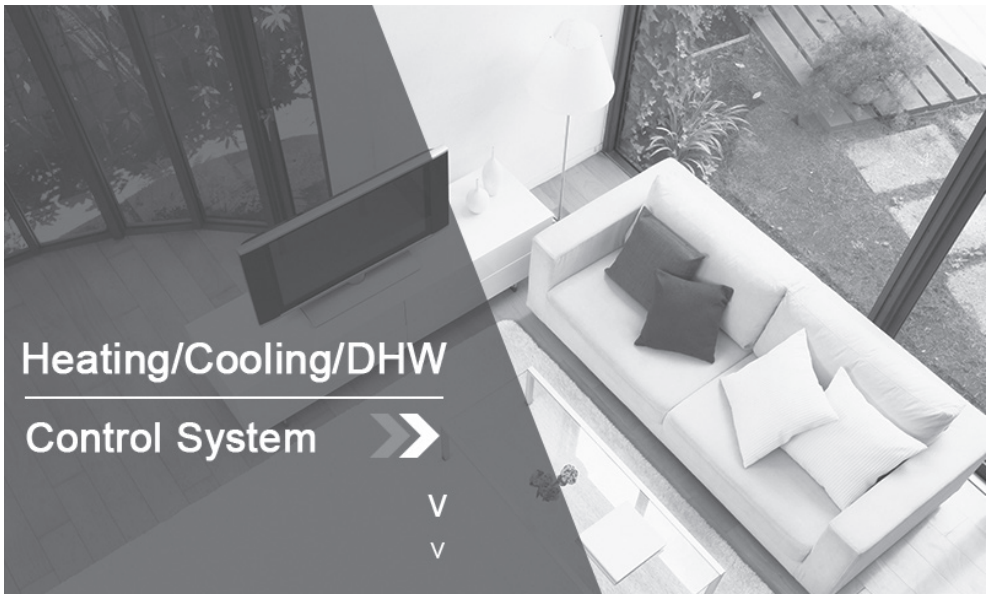
Function of the Ports

Port No.	Name	Terminals No.	Function
CN2	Signal port	485A/485B	Communicate with PC8002
	Power input	+12V/GND	Power supply of wire controller, 12V DC

Display Windows and Functions

If the display screen is not touched in 30s the screen will dim. The screen will go to sleep after 2 minutes of no operation. Touching the screen will "wake" up the controller again. If the units selected is deg F, the date and time will be displayed as MM/DD/YY, Hr/Min/Wk. If the units selected is deg C, the display date and time will be displayed as DD/MM/YYY and Hr/Min/Wk.

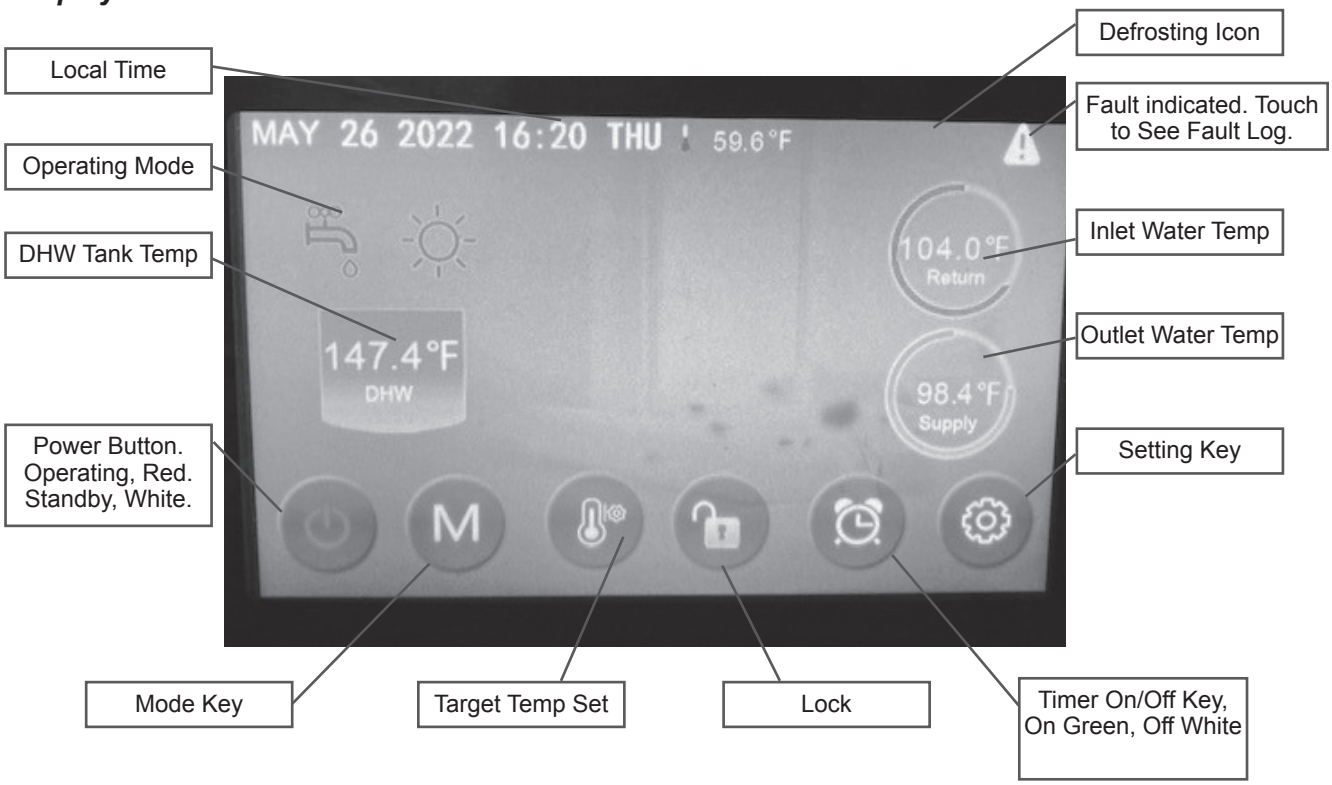
Power on Display Window



The display will show controller and display versions after several seconds at start up. The top number, after the upper-case V, is the Control Software version, the bottom number, after the lower-case v, is the Display Software version. These will be displayed for about four seconds, then show the Home Screen.

If communication fails, the version numbers won't be displayed and the Home Screen will appear after 15s. In this case, the home screen will show all zeros, or inaccurate default values.

Main Display Window



Contents and Buttons on Main Display Window

On the startup interface, contents and buttons on main display are illustrated above.

On/Off Key

The “on/off” key or power button allows a use to turn the unit on or off regardless of the status of the unit. This will shut down the entire unit, but the unit will still have power going to it. The main display will then turn grey.

Return Key

In each sub-menu (not the main interface) the user can use the “return key” to return to the previous screen. This is located in the upper left-hand corner of each menu and submenu.

Mode Key

By pressing the “Mode” key the user can now choose which mode they would like the heat pump to run in. Once the mode has been selected, the screen will automatically return to the main screen and the appropriate mode symbol will be displayed on the main screen. Heating = sun, cooling = snowflake etc…

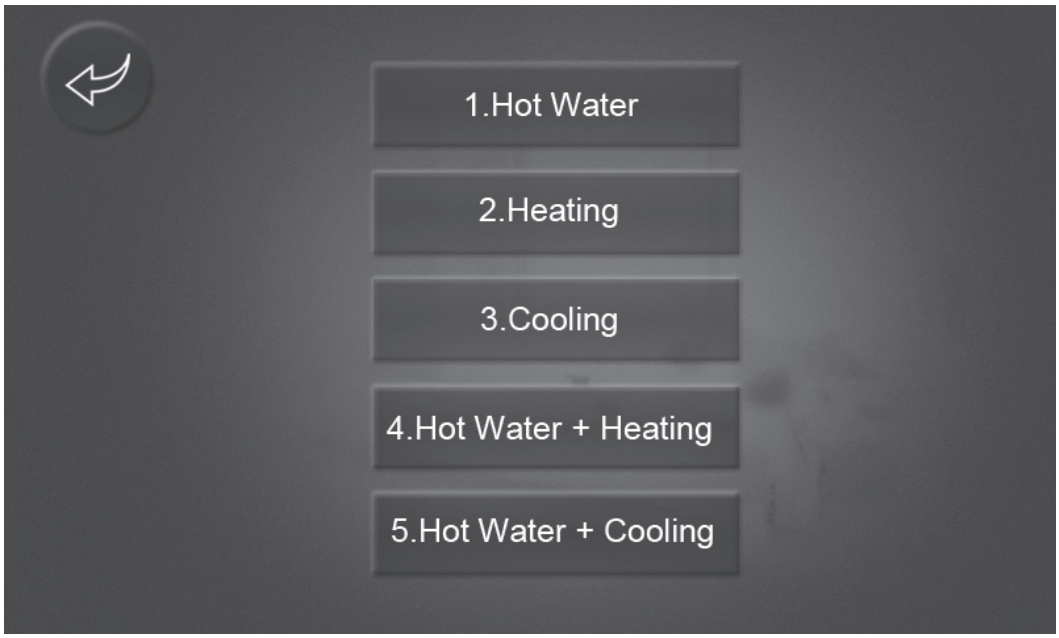
Target Temp Set Key

This key is used to set the target set point the heat pump will work to achieve.

Animation on Main Display Window

1. When the unit is in defrosting mode, the defrosting icon will show until the defrosting is completed.
2. When the unit is shutdown, the main display will turn grey.
3. When the unit is shutdown, if the timing switch function is activated, the color of the button for ‘timer on/off key’ will be green, if not, the button will be white.

Mode Selection and Target Temperature Setting



Mode Selection

On main display window, press ‘M’ button, it will show five modes. After having chosen one mode, It will return to main display automatically.

1. When choosing Hot Water mode, the display will show 'hot water' 
2. When choosing Heating mode, the display will show ‘heating’ 
3. When choosing Cooling mode, the display will show ‘cooling’ 
4. When choosing Hot Water + Heating mode, the display will show 'hot water' and 'heating'. 
5. When choosing Hot Water + Cooling mode, the display will show 'hot water' and 'cooling'. 

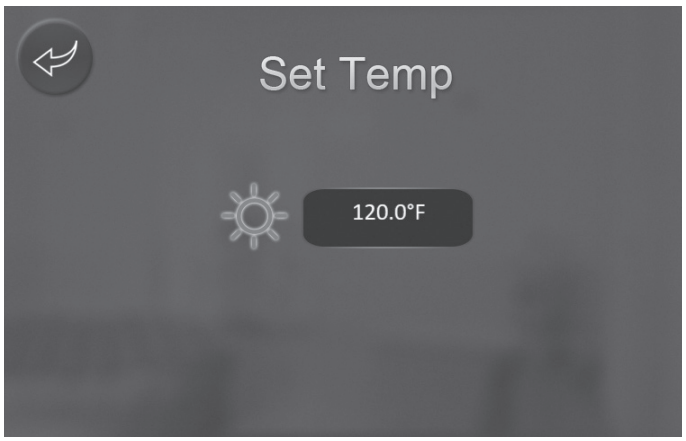
Other Selections

Mode Selection Under Member Mode

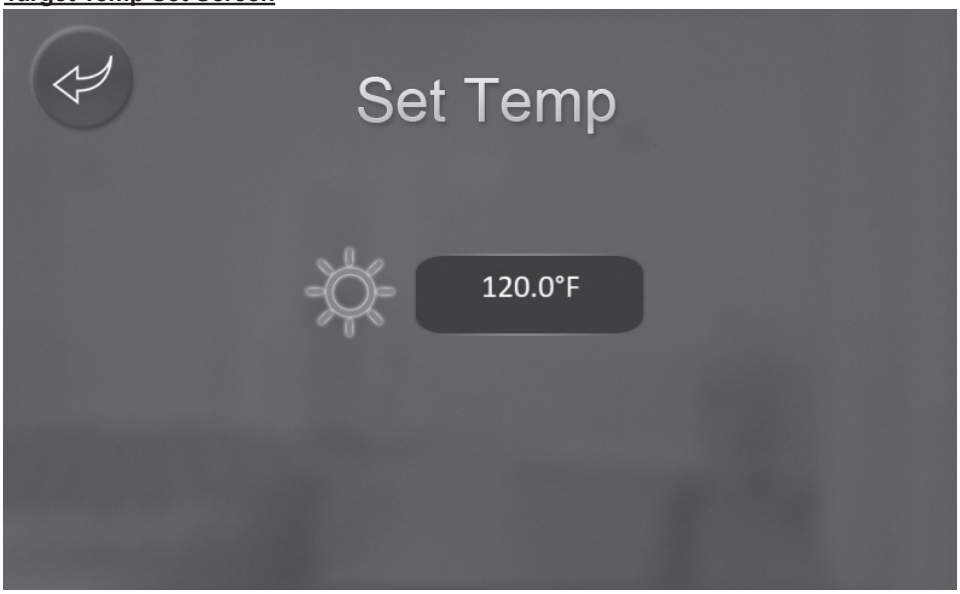
When choosing member mode H07=1, the color of the buttons on the display will turn grey and are not clickable.

Target Temperature Setting Under Current Mode

The different modes have different target temperature settings interface. For example, when choosing Cooling mode, The target temperature setting interface will show cooling set point.



Target Temp Set Screen



This can be adjusted by pressing the temp (on the screen) which opens a new screen and then entering in a numeric value within specified parameters in the control (see parameter chart for min and max settings). Once a target is set, the user will need to press “enter” to save the set point. This should return the user to the target set screen where they will see the new setpoint has been saved. Press the return key to return to the main interface.

Lock Key

The lock key button will allow a user to lock the screen and prevent un-wanted or accidental touches on the screen.

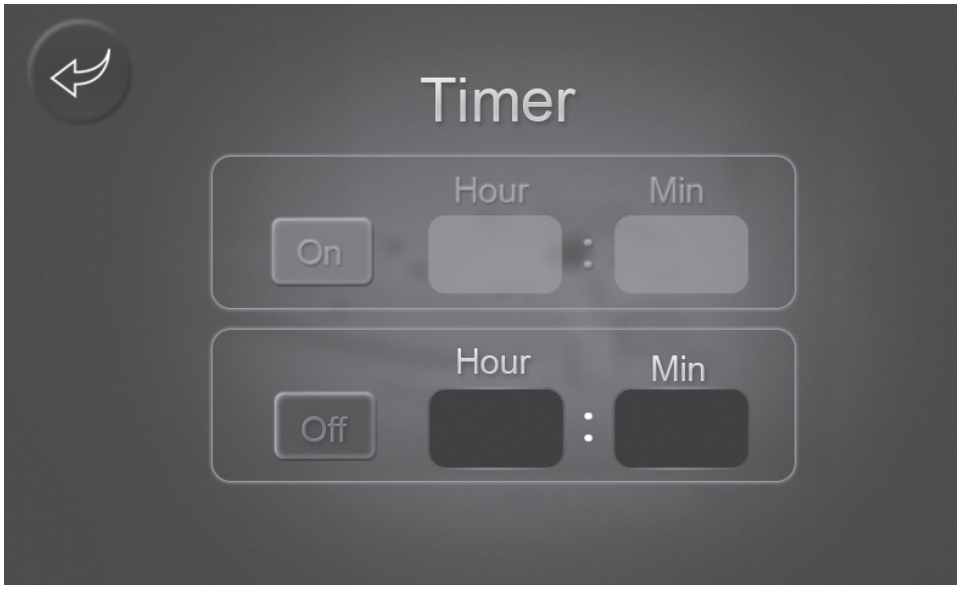
Lock Key Passcode Screen

To unlock, simply press the lock key again and enter the code “22” when prompted. Press enter and the screen will be unlocked again.

Timer Key

The timer key allows the user to set a schedule to not allow the unit to operate through timers regardless of set points.

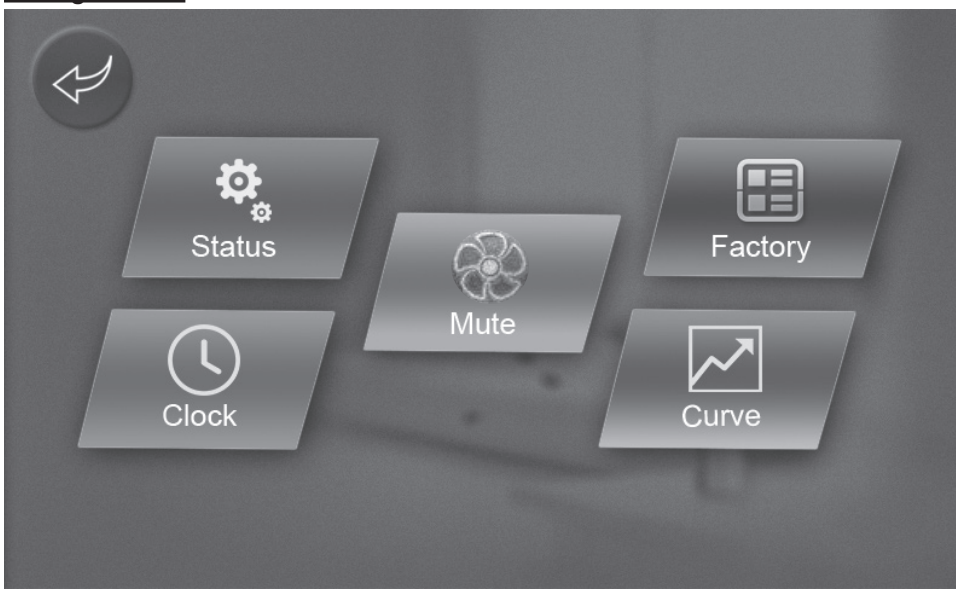
Timer Key Screen



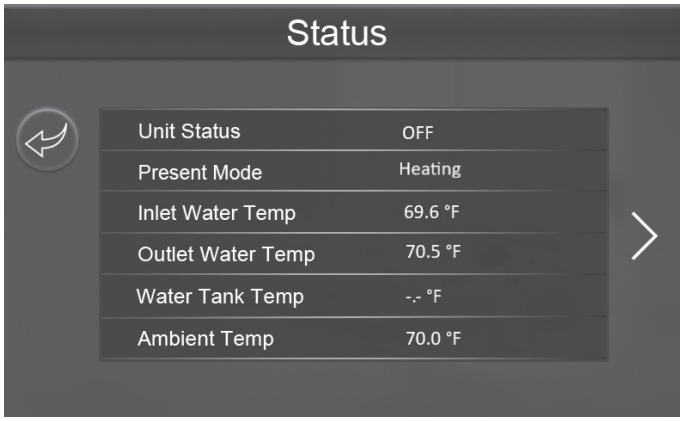
The user can use the day schedule on the bottom row to select the day they want to set the unit to be off. Once the day is selected, the user will need to select the appropriate times (AM or PM) that the unit will not need to be run. For example: If a user does not want the unit to run on Monday from 11 AM – 2PM. Select “Mon” at the bottom (red arrow should be under the day). Select “AM” and press the clock on the 11-12 block and the 1-2 block. This should highlight the blocks in green. Once the schedule has been set, the user will need to ensure the “on/off” toggle is set to “on” by pressing it if it set to “off”. Once confirmed, press the “return” key which will bring you back to the main interface. During normal operation, the unit will run normally. During the scheduled “off” time the main interface will now be grey and the “timer key” will be illuminated in green.

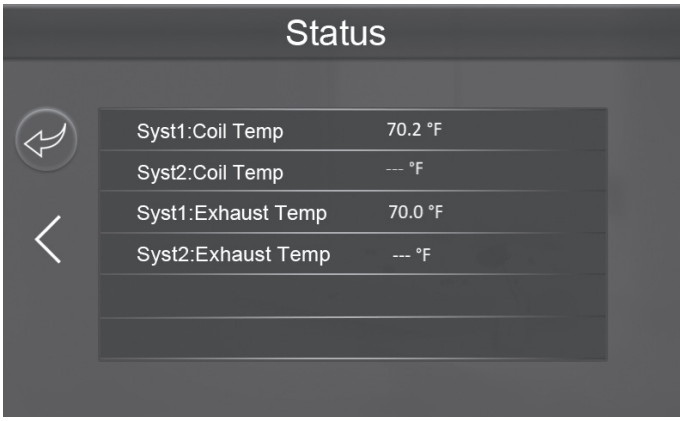
Settings Key

Settings Screen



Settings > Status



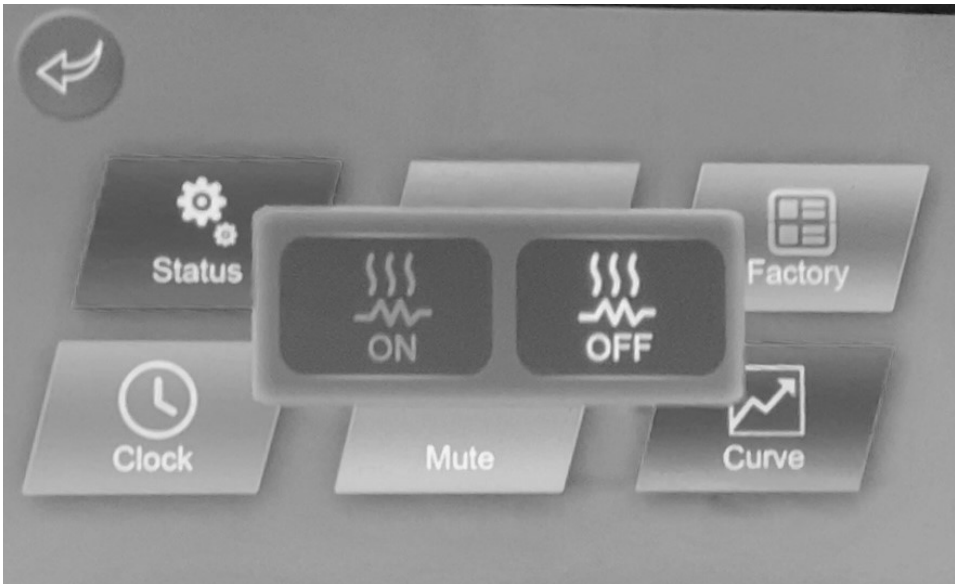


Under the status menu, the user can view the following status' of the unit during real time operation

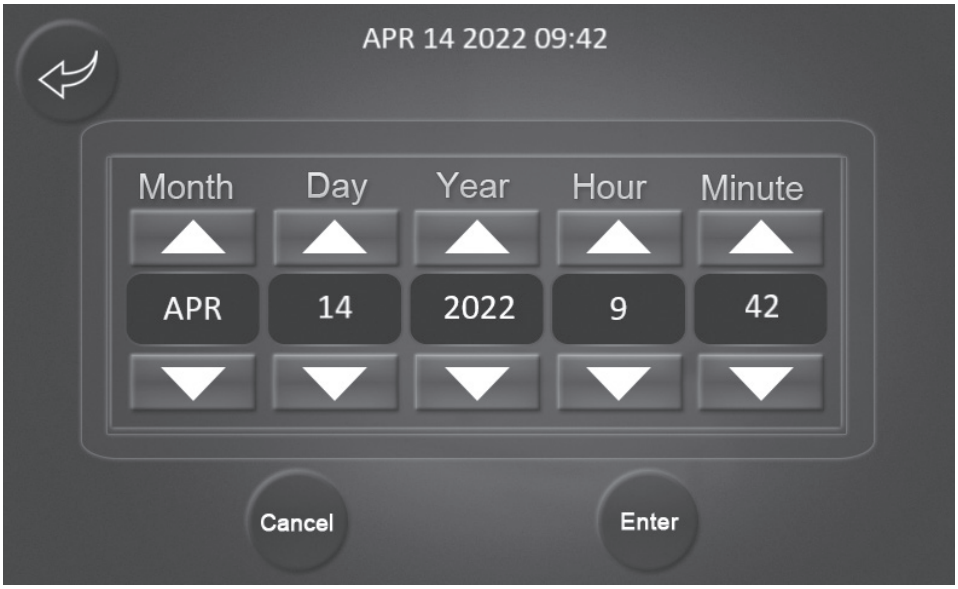
1. Unit Status (on/off). Whether the unit is operating or not
2. Present Mode: Displays the mode that the unit is running in (heating, cooling etc..)
3. Inlet Water Temp: Displays the current inlet water temperature being measured
4. Outlet Water Temp: Displays the current outlet water temperature being measured
5. Tank Water Temp: Displays the domestic hot water tank temperature, if used. If installed (see wiring diagram: field connections for wiring locations of tank water temperature). If not installed or not reading the display will show "- - -"
6. Ambient Temp: Will display the current ambient temperature being measured
7. Coil Temp: Will display the current coil temperature being measure on the surface of the finned coil.
8. Exhaust temp: Will display the current discharge refrigerant temperature.

Settings > Electric Heating

All ILAHP units have a feature that allows the unit to turn on a dry contract “AUX” relay (see wiring section) for an external electric heater. The heater can be controlled by selecting and adjusting the appropriate parameters (see parameter chart) to provide supplemental heat when desired. To turn the feature on, press the electric heating key and choose “on”. To turn off, choose “off”. Once selected, the screen will automatically return to the “settings” screen.

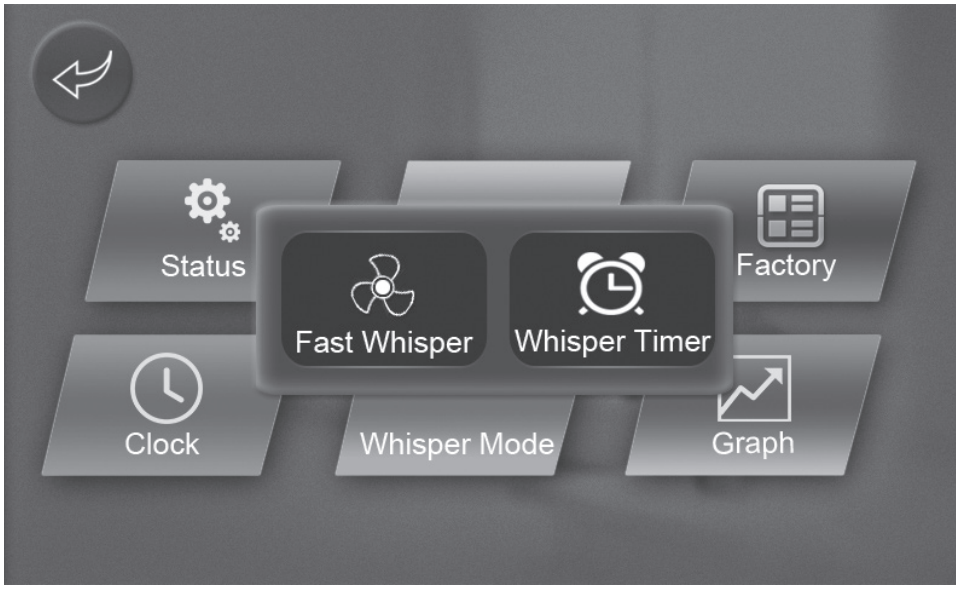


Settings > Clock



By pressing the clock menu, the user can set the correct time and date by using the up and down arrows keys. To save the user must press the enter key.

Settings > Whisper Mode



The purpose of the Whisper Key is to silence the fans and unit for a quieter operation. When pressing the Whisper key, the user has two options. “Fast Whisper” or “Whisper Timer”. In "Whisper Mode" both the compressor and the fans will be limited.

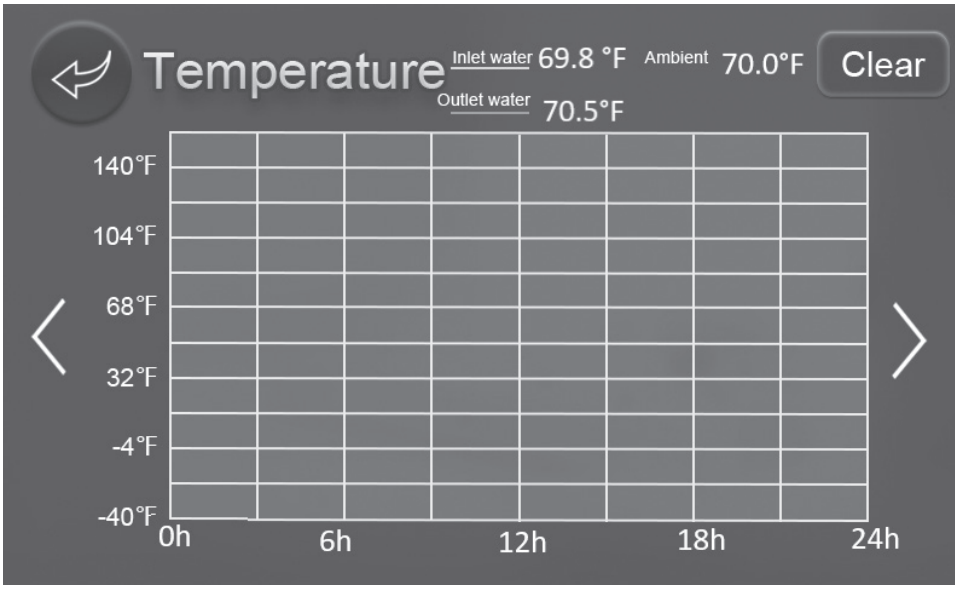
Fast Whisper- To enable the "Fast Whisper" function, press the "Fast Whisper" button, this will slow the fans down to provide a quieter operation. However, the fast whisper will also decrease capacity. Use only when quiet operation is required. To turn off, press "Fast Whisper" again.

"Fast Whisper" may also be referred to as "Fast Mute" however the functionality will be the same.

Settings > Whisper Mode > Whisper Timer

Allows the user to schedule times to quiet the unit. This will slow the fans down to provide a quieter operation during the scheduled times. However, the Whisper timer will also decrease capacity. Use only when quiet operation is required

Settings > Curve



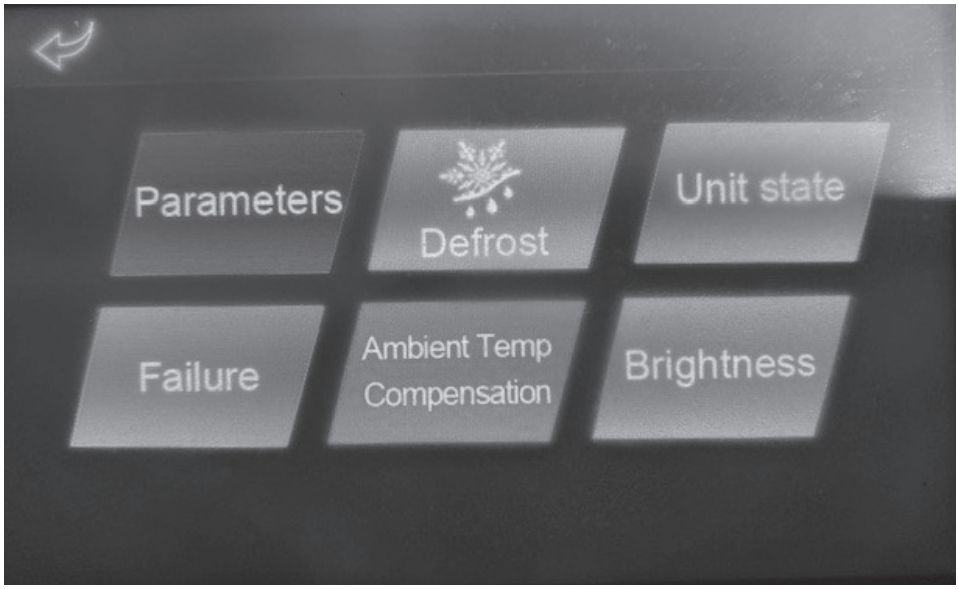
The curve key allows a user to visually see (in real time and historical) the operational curves of the inlet water, outlet water and ambient on graph of temperature versus time period.

Settings > Factory

The factory key allows the user to enter in a password that will provide certain information based on the password entered. Please see below charts for each menu based on password selection.

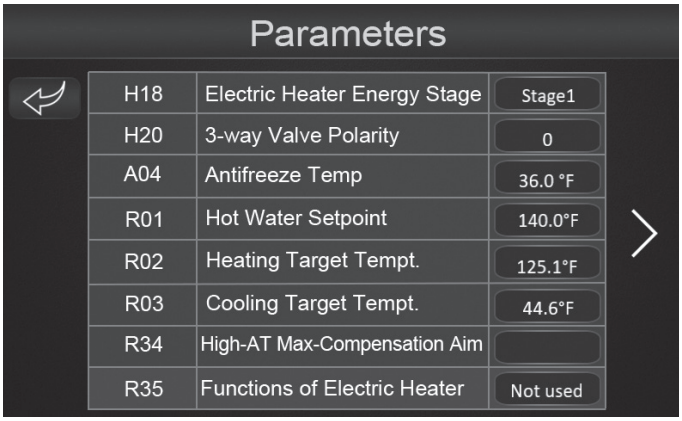
Settings > Factory > Passcode ‘’22”

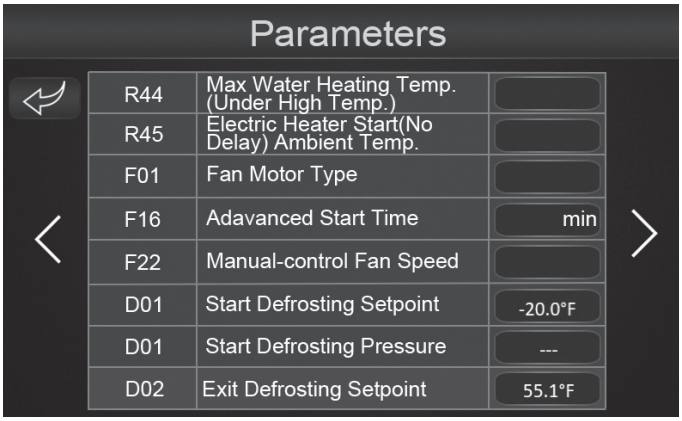
Password = “22” the following menus appear:

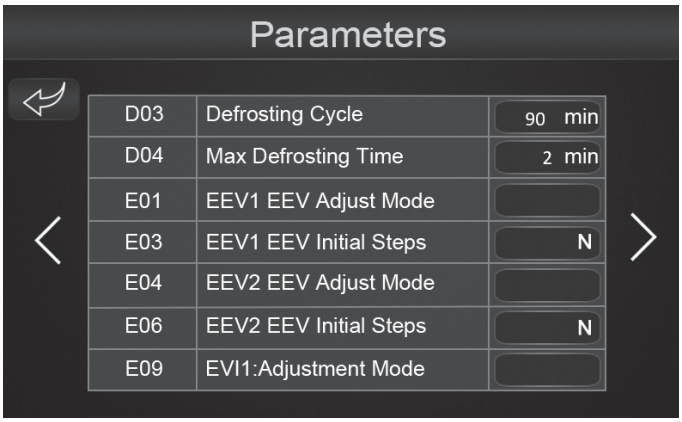


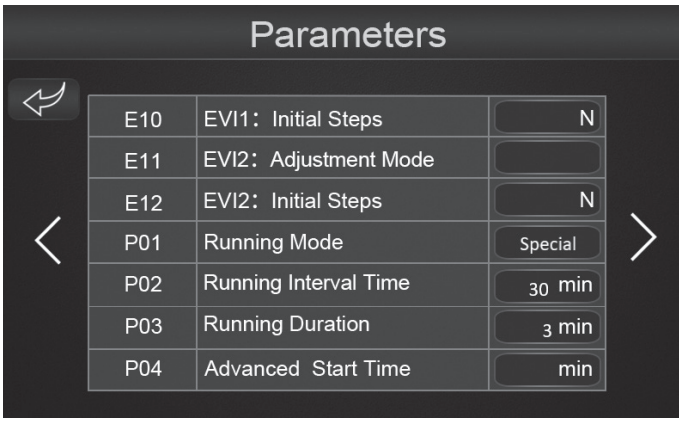
Settings > Factory > Passcode ‘’22” > Parameters

Parameters Submenu



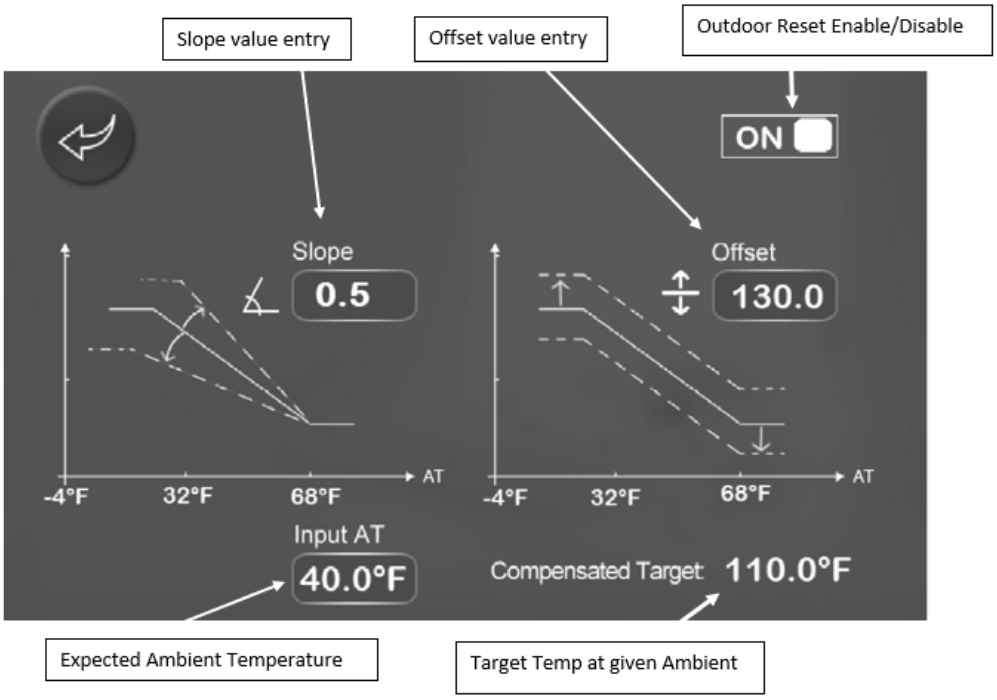






Press this key to access certain parameters only meant to be changed by a user. Use the parameter chart from this manual to determine what parameters are accessible with the proper password.

Temperature Compensation/Outdoor Reset Screen



The Outdoor Reset feature allows the Heat Pump to target specific Heating Temperatures according to the outdoor ambient temperature.

The Outdoor Reset curve is determined by three values;

1. The Maximum supply temperature, Parameter R42
2. The Offset, which is the Theoretical Target Temperature at 0°F Ambient
3. The Slope, which is the change in Water Temp, with respect to the change in Ambient Temp. This is expressed as the Water Temp change divided by the Ambient Temp. both expressed in degrees F.

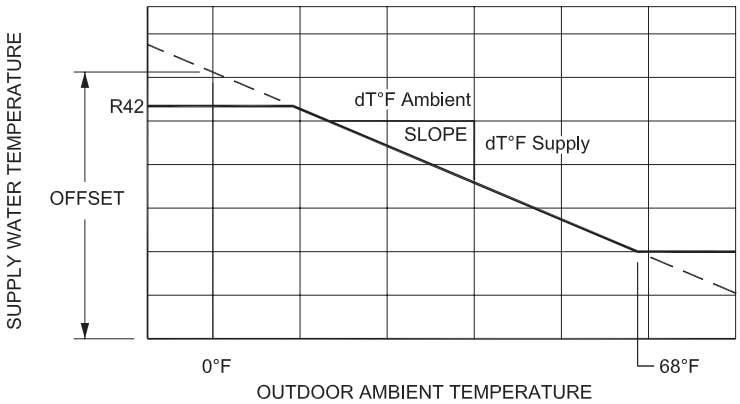
The value of R42 is accessed through the Parameter Menu, the Offset and Slope are entered directly in the Temperature Compensation Screen.

A window at the bottom of the screen allows the user to enter an arbitrary Ambient Temp. and seeing the predicted Target Temp. This is for information only and does not change the settings.

Where the Slope and Offset values would result in Supply temperature greater than the value of R42, the actual supply temperature is limited to not exceed R42. At Ambient temperatures greater than 68°F, the Supply temperature is maintained the same as at 68°F.

Note: when Outdoor Reset is on, the Heating Temperature Setpoint, R02, has no effect on unit operation. The temperature is controlled solely by the three values above.

ILAHP OUTDOOR RESET OPERATION, HEATING



Settings > Factory > Passcode ‘’22” > Unit State

Unit State Submenu

Load Status | Switch Status | Temp Status

O01	System1:Compressor	OFF
O02	System2:Compressor	---
O03	Fan Motor:High Speed	---
O03	Fan Motor1	---
O04	Fan Motor:Low Speed	---
O04	Fan Motor2	---
O05	Main Circulation Pump	OFF

Load Status | Switch Status | Temp Status

O06	Domestic Hot Water Pump Output	OFF
O07	Four-way-valve 1	OFF
O08	Stage 1	OFF
O09	Stage 2	OFF
O10	Hot Water Three-way-valve	OFF
O11	Alarm	OFF
O12	Crankcase Heater	OFF

Load Status | Switch Status | Temp Status

S01	Syst1:High Pressure	Closed
S02	Syst1:Low Pressure	Closed
S03	Flow Switch	Open
S04	Electric Heater Overload	Closed
S05	Remote Switch	Closed
S06	Air Conditioning Mode Switch	Closed
S07	Hot Water Switch	Closed

Load Status | Switch Status | Temp Status

S08	Syst2:High Pressure	---
S09	Syst2:Low Pressure	---
S10	Air Conditioning Switch	Closed

Load Status | Switch Status | Temp Status

T01	Inlet Water Temp	68.4 °F
T02	Outlet Water Temp	69.1 °F
T03	Syst1:Coil Temp1	68.9 °F
T04	Ambient Temp	69.3 °F
T05	Syst1:Suction Temp	67.3 °F
T06	Syst1:Antifreeze Temp1	68.9 °F
T07	Syst1:Antifreeze Temp2	32.0 °F

Load Status | Switch Status | Temp Status

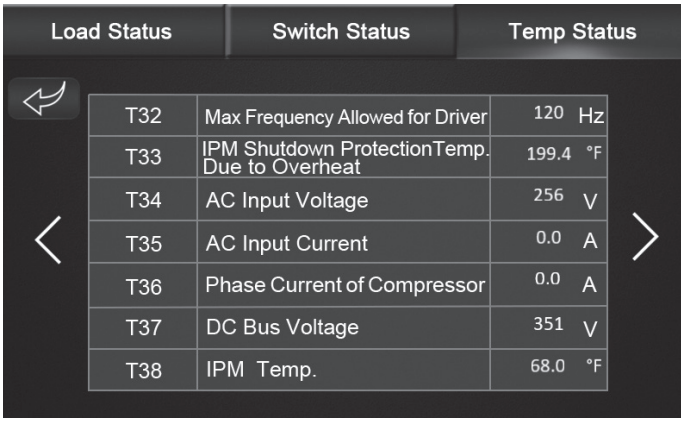
T08	Water Tank Temp	55.8 °F
T09	Room Temp	--- °F
T10	Syst1:Inlet Temp(EVI)	69.5 °F
T11	Syst1:Outlet Temp(EVI)	69.5 °F
T12	Syst1:Exhaust Temp	68.0 °F
T13	Syst1:Compressor Current	0.0 A
T15	Syst1:Pressure	---

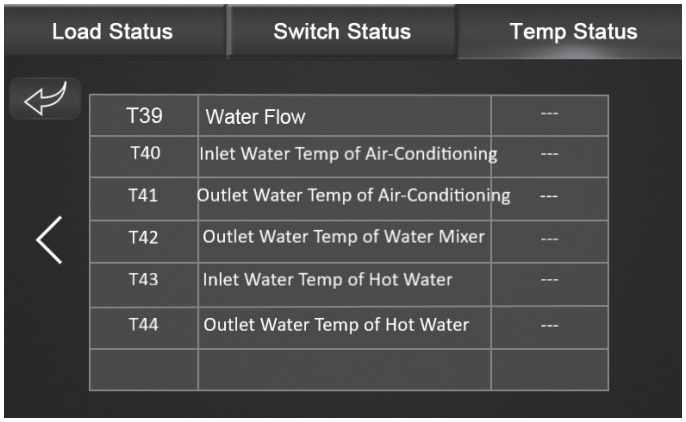
Load Status | Switch Status | Temp Status

T18	Syst2:Coil Temp	---
T19	Syst2:Suction Temp	---
T20	Syst2:Antifreeze Temp1	---
T21	Syst2:Antifreeze Temp2	---
T22	Syst2:Inlet Temp(EVI)	---
T23	Syst2:Outlet Temp(EVI)	---
T24	Syst2:Exhaust Temp	---

Load Status | Switch Status | Temp Status

T25	Syst2:Compressor Current	---
T26	Syst2:Pressure	---
T27	Speed of Fan Motor1	0 r
T28	Speed of Fan Motor2	--- r
T29	Target Speed of Fan Motor	0 r
T30	Compressor Frequency	0 Hz
T31	Operation Frequency of Compressor	0 Hz



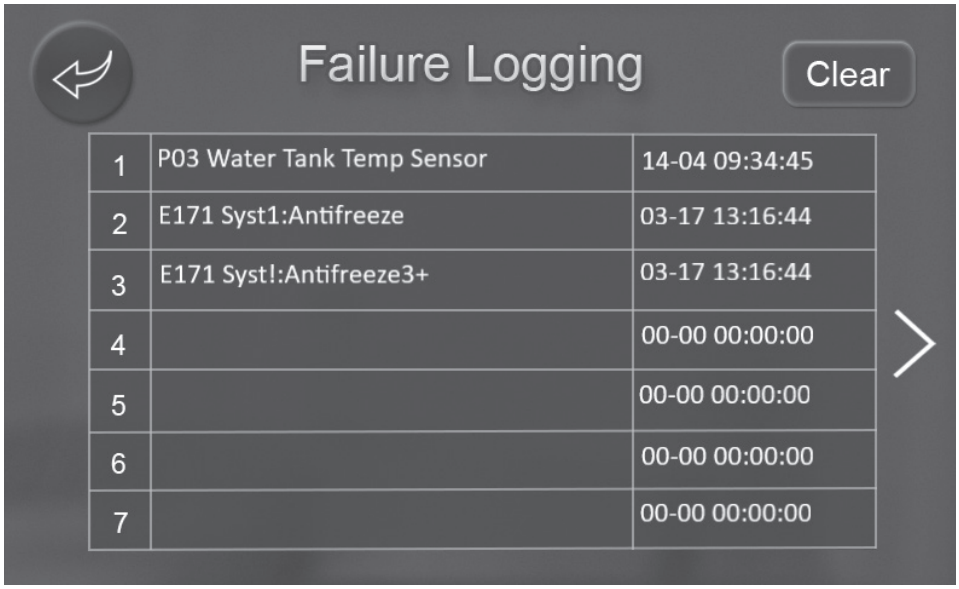


Allows the user to see the current state of certain items. By selecting the appropriate top menu, the user can see how the unit is currently operating. See below chart for each item a user can monitor.

Unit State Menu				
Top Menu	**Number**	**Name**	**Possible Options**	**Description**
Load Status	O01	System1:Compressor	On/Off	If ON, compressor is in use. If OFF, compressor is not in use.
	O02	System2:Compressor	N/A	Not used on this unit.
	O03	Fan Motor: High Speed	N/A	Not used on this unit.
	O03	Fan Motor1	N/A	Not used on this unit.
	O04	Fan Motor:Low Speed	N/A	Not used on this unit.
	O04	Fan Motor2	N/A	Not used on this unit.
	O05	Main Circulation Pump	On/Off	If ON, the main circulation pump is in use. If OFF, the main circulation pump is not in use.
	O06	Domestic Hot Water Pump Output	On/Off	If ON, the DHW pump is in use. If OFF, the DHW pump is not in use.
	O07	Four-Way-Valve 1	On/Off	If ON, the four-way-valve is active. If OFF, the four-way-valve is not active
	O08	Stage 1	On/Off	If ON, Stage 1 is On. If OFF, stage 1 is off
	O09	Stage 2	On/Off	If ON, Stage 2 is ON. If OFF, stage 2 is off
	O10	Hot Water Three-Way-Valve	On/Off	If ON, Hot water three way valve is ON. If OFF, hot water three way valve is off
	O11	Alarm	On/Off	If ON, the alarm is activated. If OFF, the alarm is not activated.
	O12	Crankcase Heater	On/Off	If ON, the Crankcase heater is in use. If OFF, the Crankcase heater is not in use.
Switch Status	S01	Syst1:High Pressure	Open/Closed	High Pressure protection switch. Closed indicates normal operation. Open indicates the switch is tripped on High Pressure, 638 PSIG, 4.4 MPa.
	S02	Syst1: Low Pressure	Open/Closed	Low Pressure protection switch. Closed indicates normal operation. Open indicates the switch is tripped on Low Suction Pressure, 2.1 PSIG, 0.15 MPa
	S03	Flow Switch	Open/Closed	Water flow switch. Closes when minimum flow is achieved, Approximately 12 GPM.
	S04	Electric Heater Overload	Open/Closed	Closed indicates normal operation. Open indicates the switch is tripped.
	S05	Remote Switch	Open/Closed	Closed indicates normal operation. Open indicates the switch is tripped.
	S06	Air Conditioning Mode Switch	Open/Closed	Closed indicates normal operation. Open indicates the switch is tripped.
	S07	Hot Water Switch	Open/Closed	Closed indicates normal operation. Open indicates the switch is tripped.
	S08	Syst2: High Pressure	N/A	Not used on this unit.
	S09	Syst2: Low Pressure	N/A	Not used on this unit.
	S10	Air Conditioning Switch	Open/Closed	Closed indicates normal operation. Open indicates the switch is tripped.
Temp Status	T01	Inlet Water Temp	°F / °C	Current return water temperature in °F or °C.
	T02	Outlet Water Temp	°F / °C	Current supply water temperature in °F or °C.
	T03	Syst1: Coil Temp1	°F / °C	Current coil temperature in °F or C.
	T04	Ambient Temp	°F / °C	Current ambient temperature in °F or °C.
	T05	Syst1: Suction Temp	°F / °C	Compressor Suction Temperature in °F or °C.
	T06	Syst1:Antifreeze Temp1	°F / °C	Current antifreeze temperature1 in °F or °C.
	T07	Syst1:Antifreeze Temp2	°F / °C	Current antifreeze temperature2 in °F or °C.
	T08	Water Tank Temp	°F / °C	Current water tank temperature in °F or °C.
	T09	Room Temp	N/A	Not used on this unit.
	T10	Syst1: Inlet Temp (EVI)	°F / °C	Current inlet temperature (EVI) in °F or °C.
	T11	Syst1: Outlet Temp (EVI)	°F / °C	Current outlet temperature (EVI) in °F or °C.
	T12	Syst1: Exhaust Temp	°F / °C	Current exhaust temperature in °F or °C.
	T13	Syst1: Compressor Current	A	Current compressor current in Amps.
	T15	Syst1: Pressure	N/A	Not used on this unit.
	T18	Syst2: Coil Temp	N/A	Not used on this unit.
	T19	Syst2: Suction Temp	N/A	Not used on this unit.
	T20	Syst2: Antifreeze Temp1	N/A	Not used on this unit.
	T21	Syst2: Antifreeze Temp2	N/A	Not used on this unit.
	T22	Syst2: Inlet Temp (EVI)	N/A	Not used on this unit.
	T23	Syst2: Outlet Temp (EVI)	N/A	Not used on this unit.
	T24	Syst2: Exhaust Temp	N/A	Not used on this unit.
	T25	Syst2: Compressure Current	N/A	Not used on this unit.
	T26	Syst2: Pressure	N/A	Not used on this unit.
	T27	Speed of Fan Motor1	RPM	Current fan motor speed in RPM.
	T28	Speed of Fan Motor2	N/A	Not used on this unit.
	T29	Target Speed of Fan Motor	RPM	Current target speed of fan motor in RPM.
	T30	Compressor Frequency	HZ	Current compressor frequency in Hz.
	T31	Operation Frequency of Compressor	HZ	Current operation frequency of compressor in Hz.
	T32	Max Frequency Allowed for Driver	HZ	Current max frequency allowed for driver in Hz.
	T33	IPM Shutdown Protection Temp. Due to Overheat	°F / °C	IPM shutdown protection temperature in °F or °C.
	T34	AC Input Voltage	AC	Current AC input voltage.
	T35	AC Input Current	AC	Current AC input current in Amps.
	T36	Phase Current of Compressor	A	Current phase current of compressor in Amps.
	T37	DC Bus Voltage	DC	Current DC bus voltage.
	T38	IPM Temp.	°F / °C	IPM temperature in °F or °C.
	T39	Water Flow	N/A	Not used on this unit.
	T40	Inlet Water Temp of Air-Conditioning	N/A	Not used on this unit.
	T41	Outlet Water Temp of Air-Conditioning	N/A	Not used on this unit.
	T42	Outlet Water Temp of Water Mixer	N/A	Not used on this unit.
	T43	Inlet Water Temp of Hot Water	N/A	Not used on this unit.
	T44	Outlet Water Temp of Hot Water	N/A	Not used on this unit.

Settings > Factory > Passcode ‘’22” > Failure

Failure Log Submenu



Press this key to find the log of the most recent faults the unit has encountered. The fault, the time of the fault and the date of the fault will all be recorded and displayed. The log is capable of holding the most recent 35 faults. The fault log can be cleared by pressing the “Clear” button in the upper right hand corner and then entering in the correct password. The password changes everyday with the day of the month (see instructions how to set up time and date). Example: if the date is 1/5/21 the password will be “5”. Press Yes to continue/verify to clear the log.

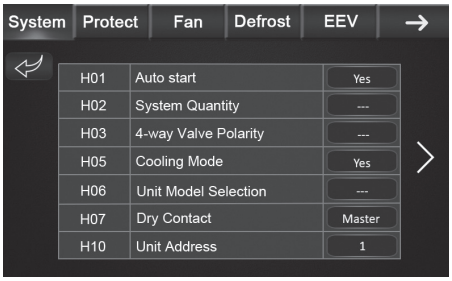
Settings > Factory > Passcode ‘’22” > Brightness

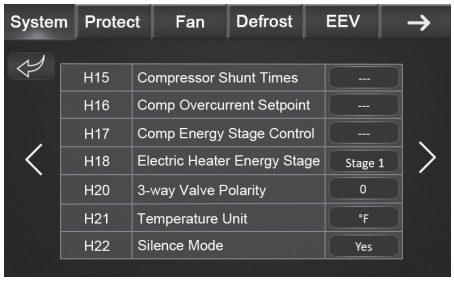
Brightness Submenu

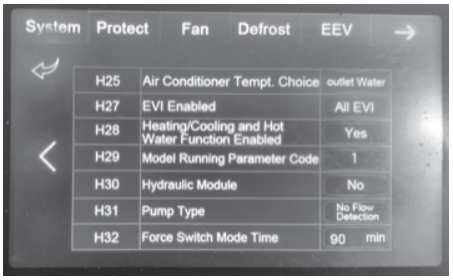
The brightness key allows the user to adjust the screen brightness. Press the brightness bar to the right to make the display brighter and the left on the brightness bar to make the display less bright.

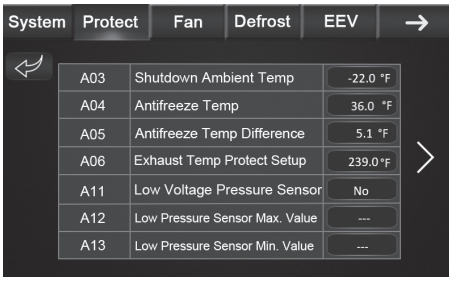
Settings > Factory > Passcode ‘’66”

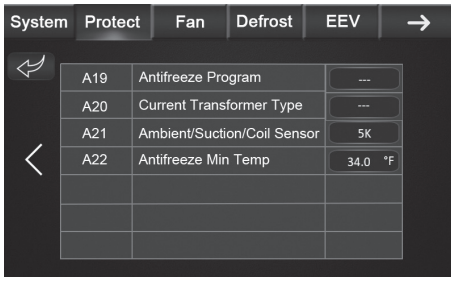
Password = “66” the following menus appear: Use the Parameter table in this manual to define and determine which parameter are accessible through the "66" pass code.

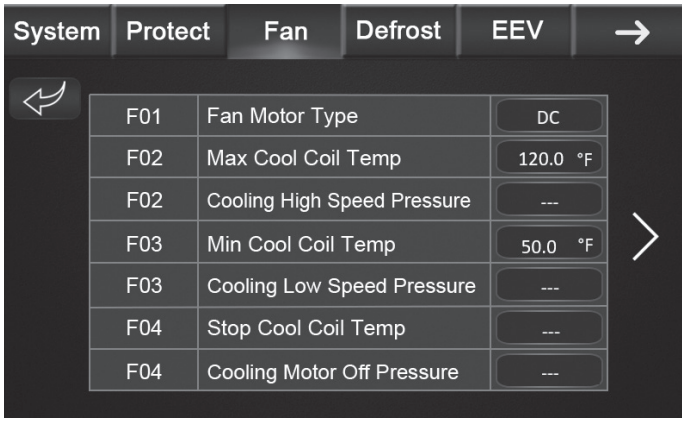


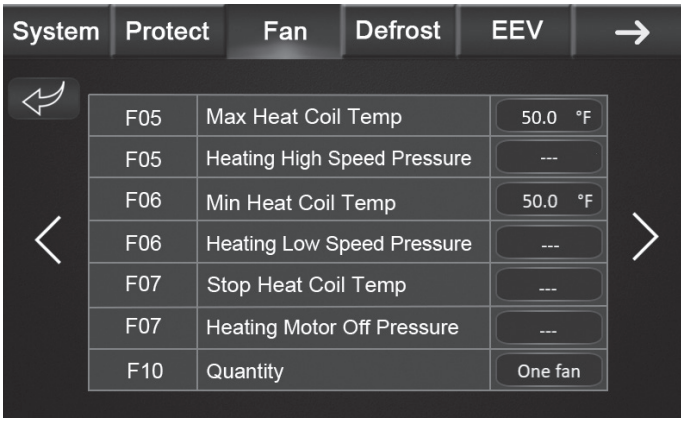


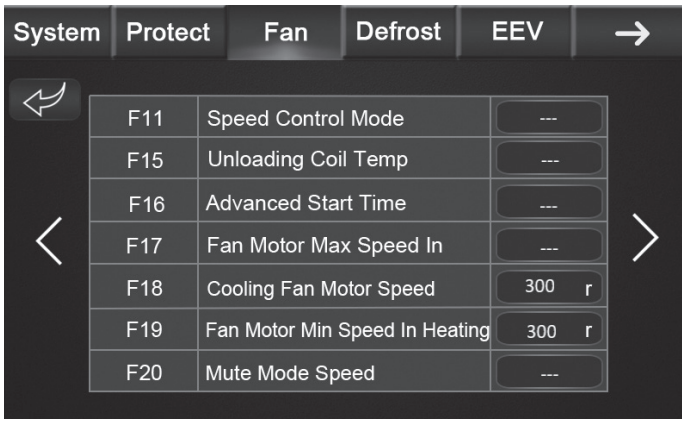


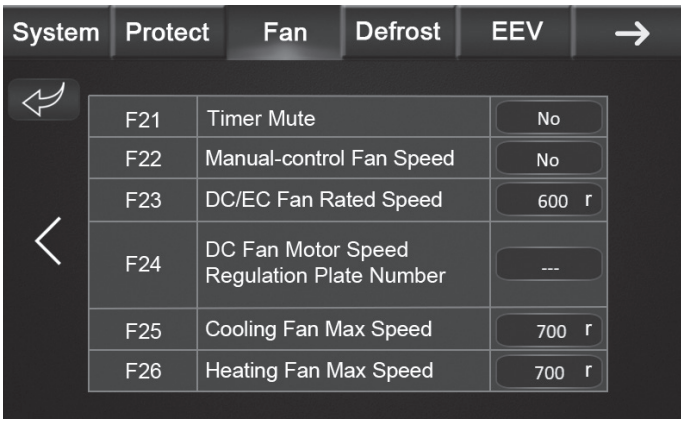


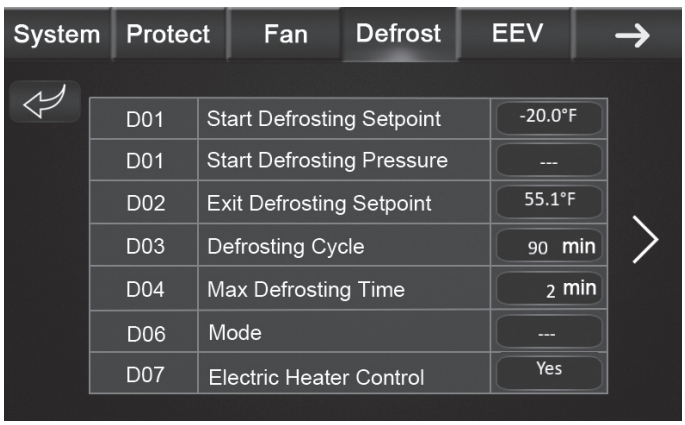


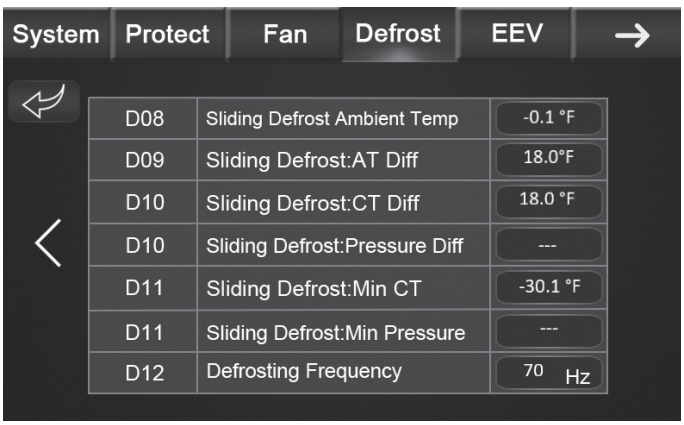

System Protect Fan Defrost EEV
F01 Fan Motor Type DC
F02 Max Cool Coil Temp 120.0 °F
F02 Cooling High Speed Pressure ---
F03 Min Cool Coil Temp 50.0 °F
F03 Cooling Low Speed Pressure ---
F04 Stop Cool Coil Temp ---
F04 Cooling Motor Off Pressure ---

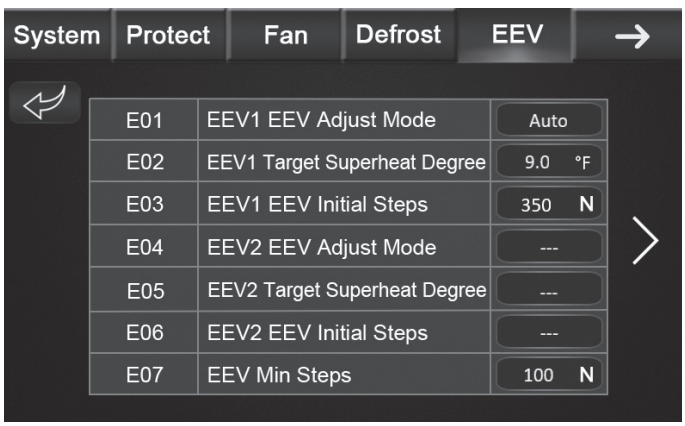

System Protect Fan Defrost EEV
F05 Max Heat Coil Temp 50.0 °F
F05 Heating High Speed Pressure ---
F06 Min Heat Coil Temp 50.0 °F
F06 Heating Low Speed Pressure ---
F07 Stop Heat Coil Temp ---
F07 Heating Motor Off Pressure ---
F10 Quantity One fan

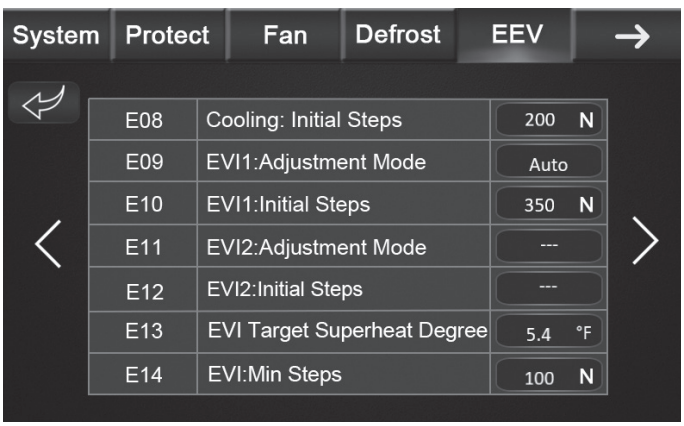

System Protect Fan Defrost EEV
F11 Speed Control Mode ---
F15 Unloading Coil Temp ---
F16 Advanced Start Time ---
F17 Fan Motor Max Speed In ---
F18 Cooling Fan Motor Speed 300 r
F19 Fan Motor Min Speed In Heating 300 r
F20 Mute Mode Speed ---

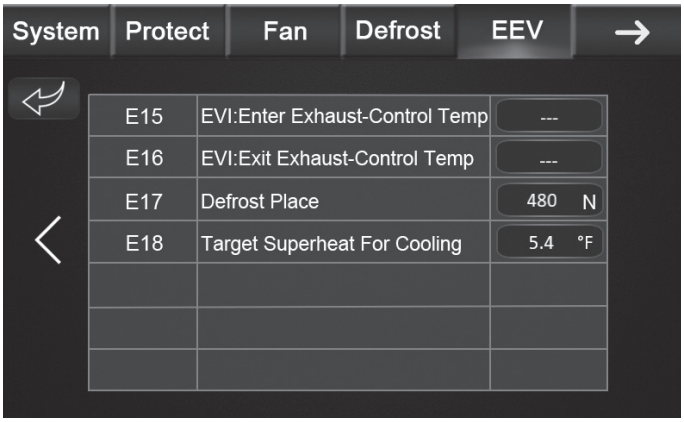

System Protect Fan Defrost EEV
F21 Timer Mute No
F22 Manual-control Fan Speed No
F23 DC/EC Fan Rated Speed 600 r
F24 DC Fan Motor Speed Regulation Plate Number ---
F25 Cooling Fan Max Speed 700 r
F26 Heating Fan Max Speed 700 r

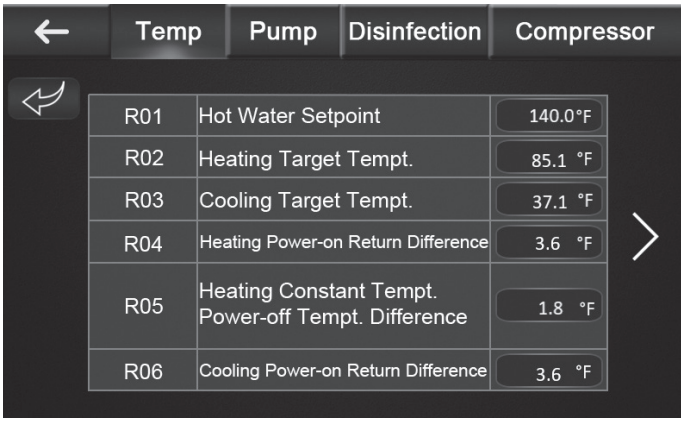

System Protect Fan Defrost EEV
D01 Start Defrosting Setpoint -20.0°F
D01 Start Defrosting Pressure ---
D02 Exit Defrosting Setpoint 55.1°F
D03 Defrosting Cycle 90 min
D04 Max Defrosting Time 2 min
D06 Mode ---
D07 Electric Heater Control Yes

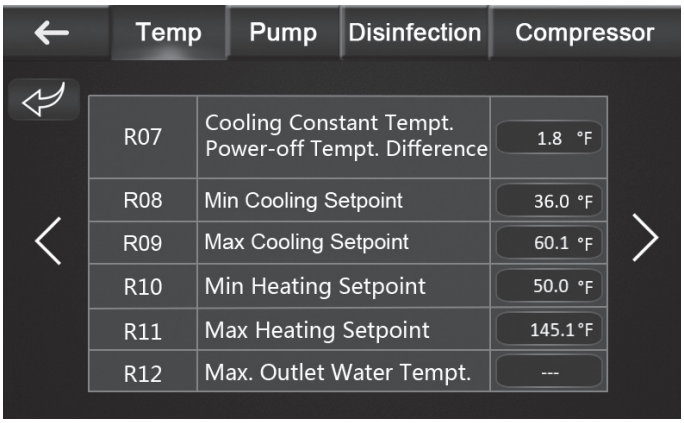

System Protect Fan Defrost EEV
D08 Sliding Defrost Ambient Temp -0.1 °F
D09 Sliding Defrost:AT Diff 18.0°F
D10 Sliding Defrost:CT Diff 18.0 °F
D10 Sliding Defrost:Pressure Diff ---
D11 Sliding Defrost:Min CT -30.1 °F
D11 Sliding Defrost:Min Pressure ---
D12 Defrosting Frequency 70 Hz

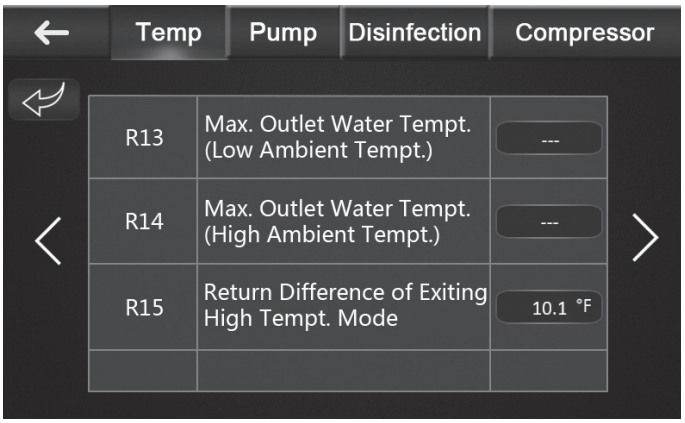

System Protect Fan Defrost EEV
E01 EEV1 EEV Adjust Mode Auto
E02 EEV1 Target Superheat Degree 9.0 °F
E03 EEV1 EEV Initial Steps 350 N
E04 EEV2 EEV Adjust Mode ---
E05 EEV2 Target Superheat Degree ---
E06 EEV2 EEV Initial Steps ---
E07 EEV Min Steps 100 N

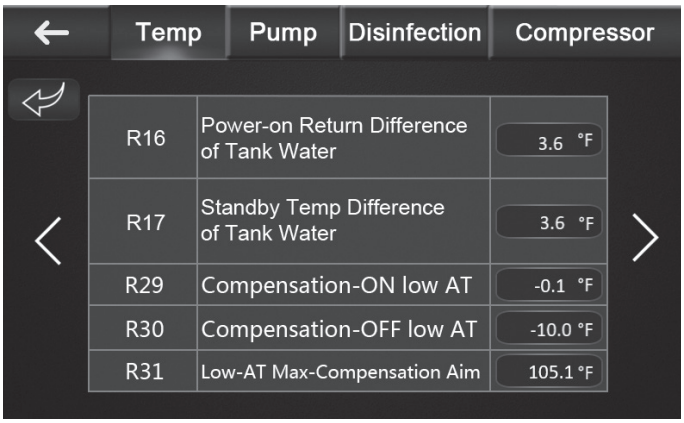

System Protect Fan Defrost EEV
E08 Cooling: Initial Steps 200 N
E09 EVI1:Adjustment Mode Auto
E10 EVI1:Initial Steps 350 N
E11 EVI2:Adjustment Mode ---
E12 EVI2:Initial Steps ---
E13 EVI Target Superheat Degree 5.4 °F
E14 EVI:Min Steps 100 N

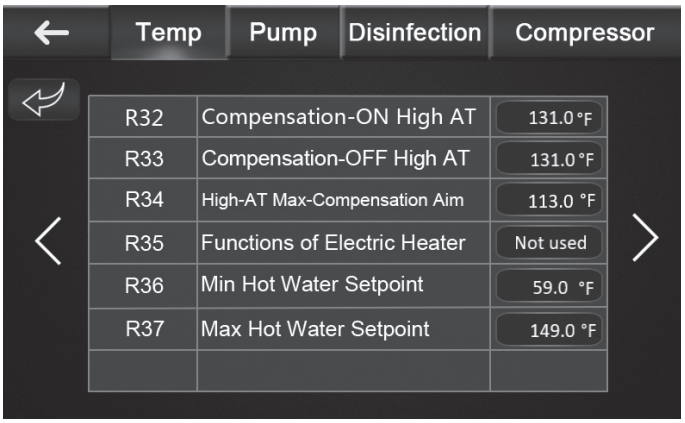

System
Protect
Fan
Defrost
EEV
E15 EVI:Enter Exhaust-Control Temp ---
E16 EVI:Exit Exhaust-Control Temp ---
E17 Defrost Place 480 N
E18 Target Superheat For Cooling 5.4 °F

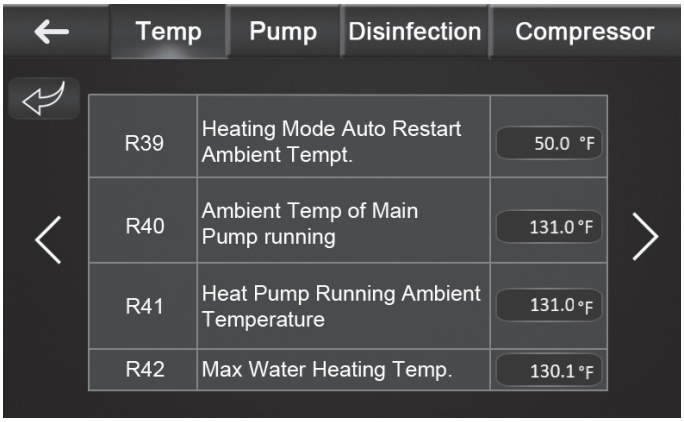

Temp
Pump
Disinfection
Compressor
R01 Hot Water Setpoint 140.0°F
R02 Heating Target Tempt. 85.1 °F
R03 Cooling Target Tempt. 37.1 °F
R04 Heating Power-on Return Difference 3.6 °F
R05 Heating Constant Tempt. Power-off Tempt. Difference 1.8 °F
R06 Cooling Power-on Return Difference 3.6 °F

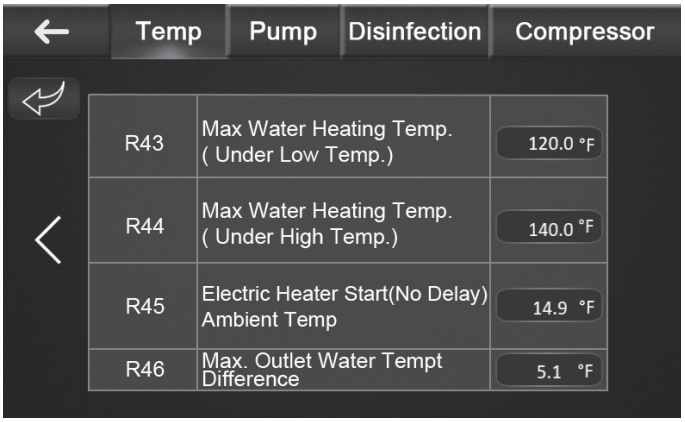

Temp
Pump
Disinfection
Compressor
R07 Cooling Constant Tempt. Power-off Tempt. Difference 1.8 °F
R08 Min Cooling Setpoint 36.0 °F
R09 Max Cooling Setpoint 60.1 °F
R10 Min Heating Setpoint 50.0 °F
R11 Max Heating Setpoint 145.1°F
R12 Max. Outlet Water Tempt. ---

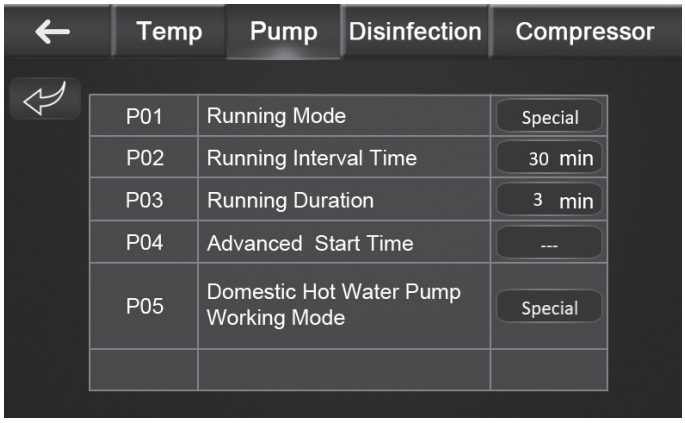

Temp
Pump
Disinfection
Compressor
R13 Max. Outlet Water Tempt. (Low Ambient Tempt.) ---
R14 Max. Outlet Water Tempt. (High Ambient Tempt.) ---
R15 Return Difference of Exiting High Tempt. Mode 10.1 °F

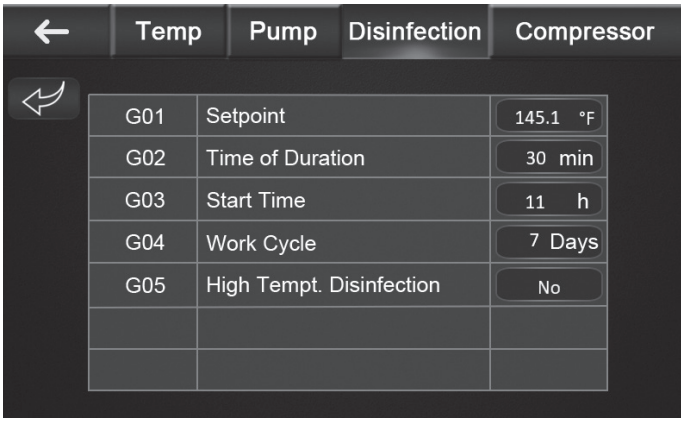

Temp
Pump
Disinfection
Compressor
R16 Power-on Return Difference of Tank Water 3.6 °F
R17 Standby Temp Difference of Tank Water 3.6 °F
R29 Compensation-ON low AT -0.1 °F
R30 Compensation-OFF low AT -10.0 °F
R31 Low-AT Max-Compensation Aim 105.1 °F

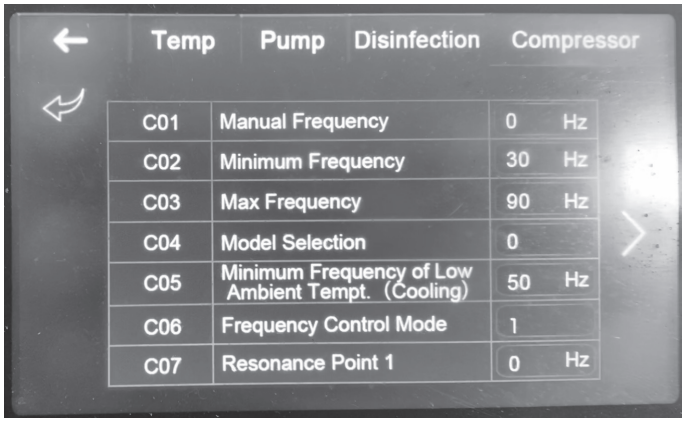

Temp
Pump
Disinfection
Compressor
R32 Compensation-ON High AT 131.0 °F
R33 Compensation-OFF High AT 131.0 °F
R34 High-AT Max-Compensation Aim 113.0 °F
R35 Functions of Electric Heater Not used
R36 Min Hot Water Setpoint 59.0 °F
R37 Max Hot Water Setpoint 149.0 °F

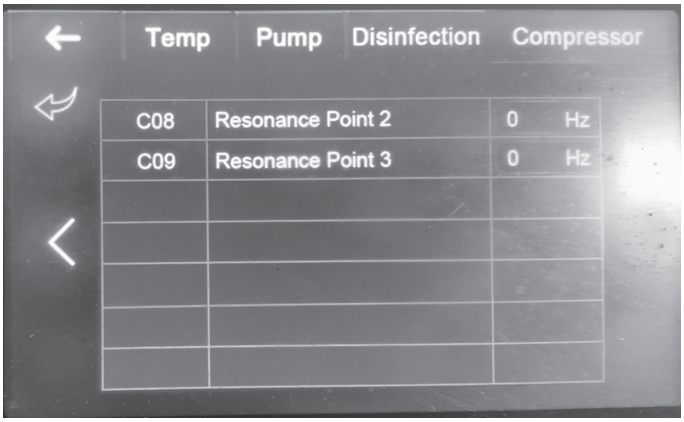

Temp
Pump
Disinfection
Compressor
R39 Heating Mode Auto Restart Ambient Tempt. 50.0 °F
R40 Ambient Temp of Main Pump running 131.0 °F
R41 Heat Pump Running Ambient Temperature 131.0 °F
R42 Max Water Heating Temp. 130.1 °F


Temp
Pump
Disinfection
Compressor
R43 Max Water Heating Temp. (Under Low Temp.) 120.0 °F
R44 Max Water Heating Temp. (Under High Temp.) 140.0 °F
R45 Electric Heater Start(No Delay) Ambient Temp 14.9 °F
R46 Max. Outlet Water Tempt Difference 5.1 °F


Temp
Pump
Disinfection
Compressor
P01 Running Mode Special
P02 Running Interval Time 30 min
P03 Running Duration 3 min
P04 Advanced Start Time ---
P05 Domestic Hot Water Pump Working Mode Special


Temp
Pump
Disinfection
Compressor
G01 Setpoint 145.1 °F
G02 Time of Duration 30 min
G03 Start Time 11 h
G04 Work Cycle 7 Days
G05 High Tempt. Disinfection No


Temp
Pump
Disinfection
Compressor
C01 Manual Frequency 0 Hz
C02 Minimum Frequency 30 Hz
C03 Max Frequency 90 Hz
C04 Model Selection 0
C05 Minimum Frequency of Low Ambient Tempt. (Cooling) 50 Hz
C06 Frequency Control Mode 1
C07 Resonance Point 1 0 Hz


Temp
Pump
Disinfection
Compressor
C08 Resonance Point 2 0 Hz
C09 Resonance Point 3 0 Hz

SECTION 6: PARAMETERS

Top Menu	Number	Name	Range	Factory Default	Description
System	H01	Auto Start	Yes/No	Yes	The control will retain the last operating mode when powered down and restarted
	H02	System Quantity	N/A	N/A	Not used on this unit.
	H03	4-Way Valve Polarity	N/A	N/A	Not used on this unit.
	H05	Cooling Mode	Yes/No	Yes	If H05 = No, unit will only operate in heating. If H05=Yes, unit can operate in both heating and cooling.
	H06	Unit Model Selection	N/A	N/A	Not used on this unit.
	H07	Dry Contact	Master/Member	Master	When H07 = Master, unit is controlled by remote display, when H07 = Member, unit is controlled by field wired inputs
	H10	Unit Address	1-32	1	When multiple units are operating from a Modbus signal, H10 is set to the unique address of the individual unit.
	H15	Compressor Shunt Times	N/A	N/A	Not used on this unit.
	H16	Comp Overcurrent Setpoint	N/A	N/A	Not used on this unit.
	H17	Comp Energy Stage Control	N/A	N/A	Not used on this unit.
	H18	Electric Heater Energy Stage	Stage 1/Stage2/ Stage3	Stage1	H18 = 1single stage of electric heat engages after 30 minutes. H18 = 2, stage 1 runs for 30 minutes, then disengages and Stage 2 engages.H18 = 3, Stage 1 runs for 30 mintues, then disengaged and Stage 2 engages and runs for 30 minutes, then Stage 1 and Stage 2 run together
	H20	3-Way Valve Polarity	Hot Water ON/Hot Water OFF	Hot Water ON	When H20 = Hot Water ON, DHW circuit energizes on a DHW call. When H20 = Hot Water OFF, circuit de-energizes on a DHW call.
	H21	Temperature Unit	°C/°F	°F	H21=0, Degrees Celsius; H21=1, Degrees Farenheit
	H22	Silence Mode	Yes/No	No	H22 = No, whisper mode disabled, H22 = Yes, whisper mode enabled
	H25	Air Conditioner Temp Choice	Outlet Water/ Room	Outlet Water	H25 = Outlet Water Temperature, heating operation modulates on Leaving Water Temperature. H25 = 1 is not supported.
	H27	EVI Enabled	No EVI/EVI for Cooling/EVI for Heating/All EVI	All EVI	H27 = 0 EVI is not active. H27 = 1 EVI is active in cooling only. H27 = 2 EVI is active in heating only. H27 = 3 EVI is active in both heating and cooling
	H28	Heating/Cooling and Hot Water Function Enabled	Yes/No	No	H28 = No, DHW is not enabled. H28 = Yes, DHW function is enabled
	H29	Model Running Parameter Code	0-20	0	H29 = 0 for all modes of operation. All other values are for factory testing only
	H30	Hydraulic Module	Yes/No	No	Feature is not used in the ILAHP
	H31	Pump Type	No Flow Detected/ Grundfos25-75/ Grundfos25-105/ Grundfos25-125	No Flow Detected	H31 = No Flow Detected. No integral water pump is offered. No other options are applicable on this unit.
	H32	Force Switch Mode Time	1-300	60	This is the maximum continuous time DHW will operate if there is a heating call. After H32 time expires, unit will change over and satisfy the heating call.
Protect	A03	Shutdown Ambient Temp	-40-50°F	-22	The ILAHP will not start or operate when the ambient temperature is below A03.
	A04	Antifreeze Temp	N/A	36	Freeze protection will energize the circulator when the ambient temperature is below 35.6°F and the Inlet Water Temp is below A04. The ILAHP will start in Heating mode when the ambient temperature is below 32°F and the inlet water temperature is below A04.
	A05	Antifreeze Temp Difference	1.8-90°F	5	Freeze protection will shut off when the inlet water temperature rises above A04+A05.
	A06	Exhaust Temp Protect Setup	140-266°F	239	Comressor will shut off if the discharge temperature reaches A06. It will restart when the temperature falls to A06 - 54°F
	A11	Low Voltage Pressure Sensor	Yes/No	N/A	N/A
	A12	Low pressure Sensor Max. Value	N/A	N/A	Not used on this unit.
	A13	Low Pressure Sensor Min. Value	N/A	N/A	Not used on this unit.
	A19	Antifreeze Program	N/A	N/A	Not used on this unit.
	A20	Current Transformer Type	N/A	N/A	Not used on this unit.
	A21	Ambient/Suction/Coil Sensor	5K/2K	5K	5k NTC Thermistor, 2k NTC Thermistor
	A22	Antifreeze Min Temp	-5-140°F	34	The minimum allowable value of A04 is defined as A22

Top Menu	Number	Name	Range	Factory Default	Description
Fan	F01	Fan Motor Type	High/Double/DC	DC	F01=DC fan
	F02	Max Cool Coil Temp	5-140°F	95	The fan will run at the maximum speed according to F25 when the Coil temperature is above F02 in Cooling
	F02	Cooling High Speed Pressure	N/A	N/A	Not used on this unit.
	F03	Min Cool Coil Temp	5-140°F	50	The fan will run at the minimum speed according to F18 when the Coil temperature is below F03 in Cooling
	F03	Cooling Low Speed Pressure	N/A	N/A	Not used on this unit.
	F04	Stop Cool Coil Temp	N/A	N/A	Not used on this unit.
	F04	Cooling Motor Off Pressure	N/A	N/A	Not used on this unit.
	F05	Max Heat Coil Temp	5-140°F	32	The fan will run at the maximum speed according to F26 when the Coil temperature is below F05 in Heating
	F05	Heating High Speed Pressure	N/A	N/A	Not used on this unit.
	F06	Min Heat Coil Temp	5-140°F	50	The fan will run at the minimum speed according to F19 when the Coil temperature is above F06 in Heating
	F06	Heating Low Speed Pressure	N/A	N/A	Not used on this unit.
	F07	Stop Heat Coil Temp	N/A	N/A	Not used on this unit.
	F07	Heating Motor Off Pressure	N/A	N/A	Not used on this unit.
	F10	Quantity	One Fan(0) /Two Fans (1)	Two Fans	F10 = 0 then 1 fan is present, F10 = 1 then 2 fans are present
	F11	Speed Control Mode	N/A	N/A	Not used on this unit.
	F15	Unloading Coil Temp	N/A	N/A	Not used on this unit.
	F16	Advanced Start Time	N/A	N/A	Not used on this unit.
	F17	Fan Motor Max Speed In	N/A	N/A	Not used on this unit.
	F18	Cooling Fan Motor Speed	10-1300	450	F18 is the minimum RPM of the fan in Cooling according to coil temp F03
	F19	Fan Motor Min Speed in Heating	10-1300	350	F19 is the minimum RPM of the fan in Heating according to coil temp F04
	F20	Mute Mode Speed	N/A	N/A	Not used on this unit.
	F21	Timer Mute	Yes/No	No	F21 = No, timer mode is disabled, F21 = Yes, timer mode is enabled
	F22	Manual-control Fan Speed	Yes/No	No	F22 = No, manual fan speed cannot be enabled, F22 = Yes, manual fan speed can be enabled
	F23	DC/EC Fan Rated Speed	10-1300	600	F23 = the manual fan speed if F21 = 1 Yes
	F24	DC Fan Motor Speed Regulation Plate Number	N/A	N/A	Not used on this unit.
	F25	Cooling Fan Max Speed	10-1300	700	F25 is the maximum RPM of the fan in Cooling according to coil temp F02
	F26	Heating Fan Max Speed	10-1300	700	F26 is the maximum RPM of the fan in Heating according to coil temp F05
Defrost	D01	Start Defrosting Setpoint	-22-41°F	20	Defrost will start if coil temp is below D01 and compressor has been running longer than D03 minutes
	D01	Start Defrosting Pressure	N/A	N/A	Not used on this unit.
	D02	Exit Defrosting Setpoint	32-86°F	50	Defrost will end when the coil temp rises above D02
	D03	Defrosting Cycle	30-90	45	Minimum Start to Start time between two consecutive defrost cycles
	D04	Max Defrosting Time	1-12	8	Maximum allowable duration of one defrost cycle
	D06	Mode	N/A	N/A	Not used on this unit.
	D07	Electric Heater Control	Yes/No	Yes	Energizes Electric heat during Defrost operation
	D08	Sliding Defrost Ambient Temp	-40-122°F	36	ODR Defrost is enabled below this ambient temp
	D09	Sliding Defrost: AT Diff	1.8-90°F	18	ODR Defrost ranges between D08 and D08-D09 ambient
	D10	Sliding Defrost: CT Diff	1.8-90°F	18	ODR Defrost ranges between D01 and D01-D10 Coil Temp
	D10	Sliding Defrost: Pressure Diff	N/A	N/A	Not used on this unit.
	D11	Sliding Defrost: Min CT	-40-122°F	-10	Minimum Coil temp of ODR Defrost range
	D11	Sliding Defrost: Min Pressure	N/A	N/A	Not used on this unit.
	D12	Defrosting Frequency	30-90	70	Fixed compressor speed during defrost operation

Top Menu	Number	Name	Range	Factory Default	Description
EEV	E01	EEV1 EEV Adjust Mode	Manual/Auto	Auto	E01 = Auto EEV is automatically controlled
	E02	EEV1 Target Superheat Degree	-36-36	5.4	Target suction superheat of EEV in Heating mode
	E03	EEV1 EEV Initial Steps	0-500	0	Initial EEV opening at startup in Heating
	E04	EEV2 EEV Adjust Mode	N/A	N/A	Not used on this unit.
	E05	EEV2 Target Superheat Degree	N/A	N/A	Not used on this unit.
	E06	EEV2 EEV Initial Steps	N/A	N/A	Not used on this unit.
	E07	EEV Min Steps	0-500	100	Minimum opening of EEV during modulation
	E08	Cooling: initial Steps	0-500	350	Initial EEV opening at startup in Heating
	E09	EVI1: Adjustment Mode	Manual/Auto	Auto	E09 = Auto EVI EEV is automatically controlled
	E10	EVI1: Initial Steps	0-500	250	Initial EVI EEV opening at startup
	E11	EVI2: Adjustment Mode	N/A	N/A	Not used on this unit.
	E12	EVI2: Initial Steps	N/A	N/A	Not used on this unit.
	E13	EVI Target Superheat Degree	-36-36°F	5.4	Target EVI superheat
	E14	EVI: Min Steps	0-500	60	Minimum opening of EVI EEV during modulation
	E15	EVI: Enter Exhaust-Control Temp	N/A	N/A	Not used on this unit.
	E16	EVI: Exit Exhaust-Control Temp	N/A	N/A	Not used on this unit.
	E17	Defrost Place	10-500	480	Main EEV opening during Defrost operation
	E18	Target Superheat For Cooling	-19-18°F	3.6	Target suction superheat of EEV in Cooling mode
Temp	R01	Hot Water Setpoint	N/A	130	Target temperature of sensor inside potable domestic hot water tank
	R02	Heating Target Setpoint	N/A	120	Target temperature of the outlet water supplying the Heating loop
	R03	Cooling Target Setpoint	N/A	42	Target temperature of the outlet water supplying the Cooling loop
	R04	Heating Power-on Return Difference	0-18°F	3.6	Heating operation will on a new call when the Outlet water is R02 - R04
	R05	Heating Constant Temp Power-off Temp Difference	0-18°F	3.6	Heating operation will stop when the Outlet water rises to R02 + R05. Then set value of T = Inlet temp at that instant. When Heating call is maintained, operation will resume when Outlet temp falls to T - R04
	R06	Cooling Power-on Return Difference	0-18°F	3.6	Cooling operation will start on a new call when the Outlet water is above R03 + R06
	R07	Cooling Constant Temp Power-off Temp Difference	0-18°F	3.6	Cooling operation will stop when the Outlet water falls to R03 - R06. Then set value of T = Inlet temp at that instant. When Cooling call is maintained, operation will resume when Outlet temp rises to T + R06
	R08	Min Cooling Setpoint	-22 to 180	36	Minimum allowable Cooling setpoint
	R09	Max Cooling Setpoint	-22 to 180	60	Maximum allowable Cooling setpoint
	R10	Min Heating Setpoint	-22-145°F	80	Minimum allowable Heating setpoint
	R11	Max Heating Setpoint	65-210°F	140	Maximum allowable Heating setpoint
	R12	Max Outlet Water Temp	N/A	N/A	Not used on this unit.
	R13	Max Outlet Water Temp (Low Ambient Temp)	N/A	N/A	Not used on this unit.
	R14	Max Outlet Water Temp (High Ambient Temp)	N/A	N/A	Not used on this unit.
	R15	Return Difference of Exiting High Temp Mode	0-27°F	3.6	Differential to reset Outlet water High Temp protection. Unit restarts at Max Outlet T - R15
	R16	Power-on Return Difference of Tank Water	0-18°F	3.6	DHW function will start when the DHW Tank temperature is below R01 - R16
	R17	Standby Temp Difference of Tank Water	0-18°F	3.6	DHW function will stop when the DHW Tank temperature reaches R01 + R17
	R29	Compensation-ON low AT	-10-39°F	0	Heating Outlet temp roll back begins as ambient falls to R29
	R30	Compensation-OFF low AT	-10-39°F	-10	Heating & DHW Outlet temp roll back ends as ambient falls to R30
	R31	Low-AT Max-Compensation AIM	68-185°F	105	Heating & DHW Temperature of Outlet Water when Ambient is below R30
	R32	Compensation-ON High AT	50-131°F	115	DHW Temp roll back starts as Ambient rises above R32
	R33	Compensation-OFF High AT	131-140°F	120	DHW Temp roll back ends as Ambient reaches R33
	R34	High-AT Max-Compensation Aim	68-185°F	110	Target Temperature of DHW when Ambient is above R33
	R35	Functions of Electric Heater	Not used/Water Line/Water Tank	Not Used	R35 = Not Used no electric heater present. R35 =Water Line, Heater active in Heating Mode, R35 = Water Tank, Heater active in DHW Mode
	R36	Min Hot Water Setpoint	32-149°F	100	Minimum Allowable setpoint for DHW Tank
	R37	Max Hot Water Setpoint	32-149°F	136	Maximum Allowable setpoint for DHW Tank
	R39	Heating Mode Auto Restart Ambient Temp	41-68°F	50	Room temp control Setpoint when H25 = 1
	R40	Ambient Temp of Main Pump Running	14-140°F	140	When the Ambient temp is below R40, the pump will operate according to P01 value. Above R40 the pump will operate as if P01=1
	R41	Heat Pump Running Ambient Temperature	14-140°F	140	When the Ambient temp is below R41, the pump will operate according to P05 value. Above R41 the pump will operate as if P05=1
	R42	Max Water Heating Temp	68-185°F	130	Max Outlet water temp during Heating operation.
	R43	Max Water Heating Temp (Under Low Temp)	68-185°F	110	Temperature of Outlet Water when Ambient is below R30
	R44	Max Water Heating Temp (Under High Temp)	68-185°F	110	Temperature of Outlet Water when Ambient is above 68°
	R45	Electric Heater Start (No Delay) Ambient Temp	-58-68°F	15	Electric heat engages without delay when Ambient Temp is below R45
	R46	Max Outlet Water Temp Difference	0-45	3.6	Unit shuts down on High Outlet Temp if outlet water temperature is above R11 + R46

Top Menu	Number	Name	Range	Factory Default	Description
Pump	P01	Running Mode	Ordinary/Special/ Interval	Special	P01 = Ordinary, Pump runs whenever Remote On/Off is closed. P01 = Special, Pump runs when when Remote On/Off and Heat/ Cool On/Off is closed. P01 = Interval, Pump runs on intervals according to P02 and P03
	P02	Running Interval Time	1-120	30	Interval between Main Circulator runs when P02 = 2
	P03	Running Duration	1-30	3	Run time of Main Circulator when P01 = 2
	P04	Advanced Start Time	N/A	N/A	Not used on this unit.
	P05	Domestic Hot Water Pump Working Mode	Ordinary/Special/ Interval	Special	P05 = Ordinary, DHW Pump runs whenever DHW On/Off is closed. P05 = Special, Pump runs when whenDHW On/Off is closed and TT is below DHW setpoint - R32. P05 = Interval, Pump runs on intervals according to P02 and P03
Disinfection	G01	Setpoint	140-158°F	145	Target temperature or Sterilize cycle
	G02	Time of Duration	0-60	30	Duration of Sterilize Cycle
	G03	Start Time	0-23	23	Time of day (24h) to start Sterilize cycle. 23 = 11:00 PM
	G04	Work Cycle	1-30	7	Number of days between Sterilize cycles
	G05	High Temp Disinfection	Yes/No	No	G05 =No, Sterilize Cycle is Dormant G05 =Yes, Sterilize Cycle is active
Compressor	C01	Manual Frequency	0-120	0	This fixes the compressor at a fixed speed, in Hz. If C01 = 0, compressor speed will modulate
	C02	Minimum Frequency	20-60	30	The minimum speed, in Hz, that the compressor will modulate to in response to the load
	C03	Max Frequency	30-120	90	The maximum speed, in Hz, that the compressor will modulate to in response to the load
	C04	Model Selection	0-99	0	C04 = 0 for all ILAHP. Do not Change
	C05	Minimum Frequency of Low Ambient Temp (Cooling)	0-60	50	The minimum speed, in Hz, that the compressor will modulate to in response to the load when the Ambient temperature is below 23°F
	C06	Frequency Control Mode	1-120	1	C06 = 1 for all ILAHP. Do not change
	C07	Resonance Point 1	N/A	N/A	Not used on this unit.
	C08	Resonance Point 2	N/A	N/A	Not used on this unit.
	C09	Resonance Point 3	N/A	N/A	Not used on this unit.

To ensure reliable cold weather operation, the ILAHP48 employs electric heaters in the lower pan, to prevent condensate from freezing and accumulating at the bottom of the outside coil, and a compressor crankcase heater, to prevent refrigerant from dissolving into, and diluting, the compressor oil.

The control board provides line voltage outputs and logic to operate these heaters.

The heaters are powered directly by Relay Outputs. RO10 to the pan heater turns on as the temp falls to 4°C (39°F) and turns off as the temp rises to 6°C (43°F)

When the compressor is off, RO11 turns on the crankcase heater whenever the ambient temp falls to 8°C (46°F) and turns off when the temp rises to 10°C (50°F) The CC heater is off any time the compressor is running. These actuation points are not adjustable.

Meaning of Each Parameter

Parameter A (Protection Parameter)

Anti-Freeze Protection

Detect Malfunction

Cooling mode: After the compressor starts, it will detect water outlet temperature (T02). If T02≤A01 or the suction pressure is lower than A02 for 10s, the unit will enter anti-freezing protection.

Note: The unit only starts to detect suction pressure after the compressor has run for 5 minutes.

Heating / Hot water mode: After the compressor starts, it will detect water outlet temperature (T02).

If T02≤T01-2 and T02≤A01 at the same time, the unit will enter anti-freezing protection.

Malfunction Performance

The unit will stop running and the 4-way valve won't change its place. The pump will keep running.

Recovery

1. When the unit detects its water outlet temperature T02≥ parameter A01+A03 or the suction pressure≥parameter A02, the unit will restart to run automatically.
2. If the protection happens over 3 times within 30min, the unit must be restarted manually.

A04——Shutdown Ambient Temp

When the ambient temperature (T07) is lower than A04, the unit will not run but there is a primary winter protection function still in place. (Electric heating is not affected. The pump must remain on while electric heating is in use.). When the Ambient Temp>parameter A04+2°C, the unit will restart to run.

A05——Discharge Temp Protect Setup

The unit will stop running and enter high exhaust temp protection five minutes after the compressor starts if the exhaust temperature is higher than A05.

When the unit detects its exhaust temperature T03<parameter A05-25°C, the unit will restart automatically.

A06——Spray Valve Open Temp

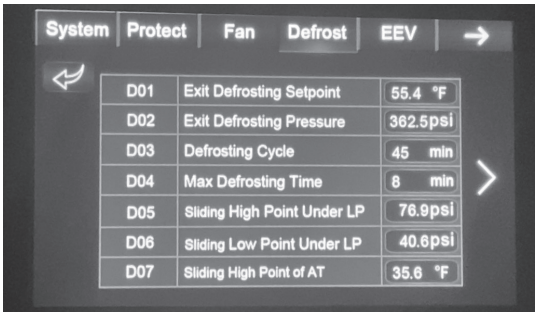
In cooling mode, when the ambient temperature (T07) reaches the value A06, the unit will open spray valve to cool the condenser. If the T07≤A06-2°C, the spray valve will shutdown.

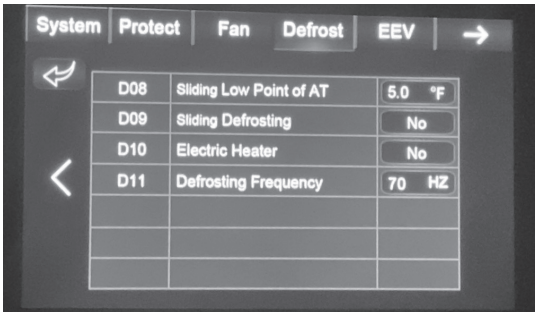
Parameter D (Defrost Parameter)

1. Requirements to enter defrost
   ① The defrost timer will start when the suction pressure is less than D05 for longer than a minute after the compressor starts.
   ② If there is a suction pressure sensor failure, the unit will start timing defrost, and the defrost cycle is D03, defrost time is D04.
2. Requirements to stop defrosting
   ① The unit will stop defrosting when T09≥D02, and T06≥D01.
   ② If the defrosting time reaches the maximum D04, the heat pump stops defrosting. D01——Exit Defrosting Setpoint.
3. Defrosting action
   ① The following operations shall be conducted if it complies with beginning defrost requirements:
      a. The compressor starts to lower the frequency at the target frequency of 30Hz.The timer starts.
      b. When the elapsed time is 55S, the fan stops working and the four-way valve turns its direction.
      c. Wait 5s, and then start to increase the frequency until you reach the target frequency of D11 (max value).
   ② The following operations shall be conducted if it complies with stop defrost requirements:
      a. The compressor starts to lower the frequency at the target frequency of 30Hz. (The timer starts).
      b. When the elapsed time is 55S, the fan stops working and the four way valve turns its direction.
      c. Wait 5s, and then start to increase the frequency;
      d. Increase the frequency to the start frequency setting and maintain it for 3 minutes before automatically determining the inlet temperature.

Abnormal end of defrosting

① If the system turns off while defrosting, the defrosting cycle will continue until it is completed.
② When the HP switch is disconnected in the course of defrosting, the heat pump will stop defrosting.
③ When the water flow switch is disconnected in the course of defrosting, the heat pump will stop for protection.
④ When the LP switch is disconnected in the course of defrosting, the heat pump shield this fault and keep defrosting.
⑤ When the exhaust temperature is overheated in the course of defrosting, the heat pump will stop for protection.
⑥ When anti-freezing protection in the course of defrosting, the heat pump will stop for protection.





Parameter F (Fan Parameter)

Normally, in heating mode or cooling mode, fan will start 10s ahead of compressor and stay on 30s after it has shut off.

1. Fast mute function

   When the fast mute function is turned on, the fan will run according to parameter F13 if necessary. The mute function will run for 8 hours. If the timer mute function is active and a user activates the "fast mute" then timer mute function will be canceled. Unit will run in "fast mute".

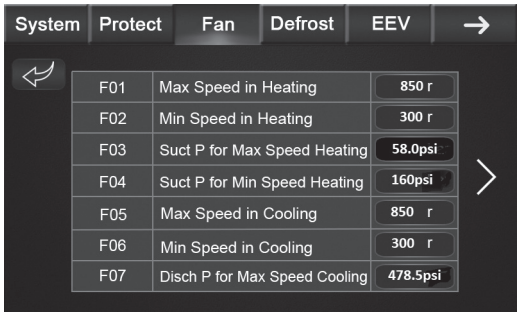
2. When F10=1, enable the timing mute function.

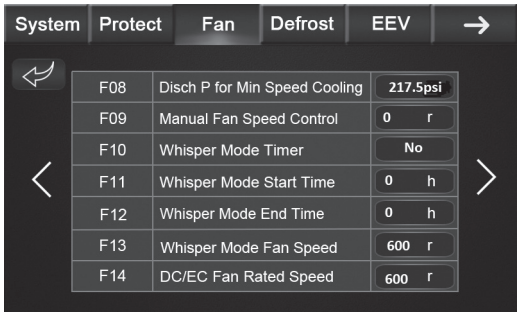
   During the time of F11-F12 (including F11, excluding F12), the fan will run according to parameter F13 if it must be used. If the fan needs to be turned on at other times, the speed will be controlled according to the suction pressure and exhaust pressure.

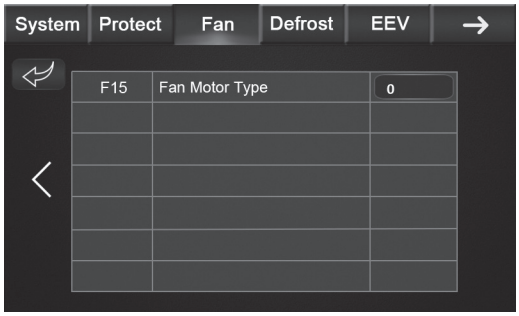
3. During the mute function cycle if a high or low pressure protection occurs, the unit will react as follows:

   ① Automatic exit from fast mute function;

   ② The unit will not return to the timer mute settings unless the power has been cycled.

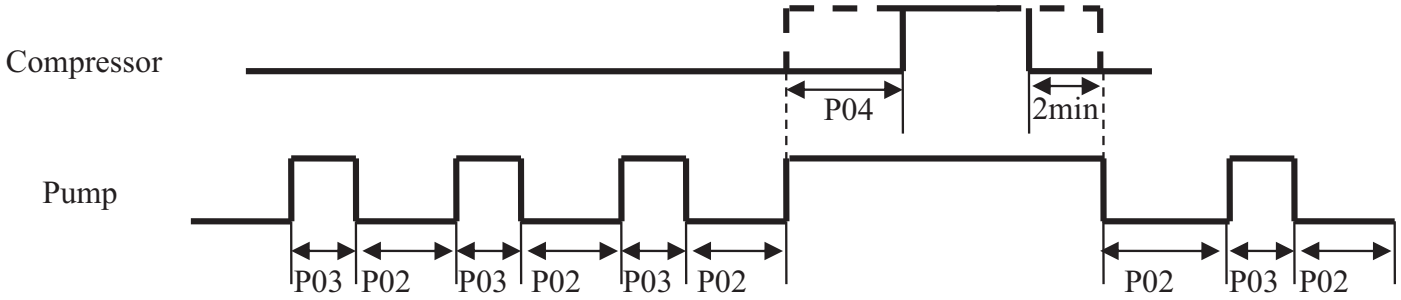






Parameter P (Pump Parameter)

In normal modes of cooling, heating and electrical heating, the water pump will be started at least P04 time earlier and shut down 2 minutes later than the compressor. The water pump must be on for the entire duration of defrosting. The controller starts to inspect water flow switch after P04-10s. If the water flow switch is inspected as ON for 10s successively, the compressor can be started.



The ILAHP provides the ability to control the main and Domestic Hot Water circulators based upon the measured outdoor air temperature.

The value of parameter P01 controls the logic of the main circulator output when the outdoor temperature is below the value of parameter R40, the pump will operate according to the parameter P01. When the air temperature is above R40, the pump will revert to economy mode and always operate as if P01=1, where the pump shuts down two minutes after the compressor stops, and restarts only when the measured water temperature falls to the restart point.

The same logic applies to the DHW circulator function, according to the outdoor temperature and value of parameter R41.

If either or both of these functions is not desired, simply set the value of R40 or R41 to the maximum of 140°F. This will effectively shut off this feature.

Parameter R (Temperature Parameter)

When set to hot water mode and tank temperature<R01-R04, the unit will run in hot water mode until the target temperature of R01 is reached. When water tank temperature≥R01+R05, the unit will exit hot water mode. The unit uses the hot water side to defrost when in defrosting.

When set to heating mode and inlet water temperature<R02-R04, the unit will run in heating mode until the target temperature of R02 is reached. When inlet water temperature ≥R02+R05, the unit will trun off.

When set to heating mode and inlet water temperature >R03+R04, the unit will run in cooling mode until the target temperature of R03 is reached. When inlet water temperature ≤R03+R05, the unit will turn off.

Compressor Short Cycle Protection

In order to protect the compressor from short cycling and ensure proper oil circulation and return, the compressor will remain running at startup for a minimum of three minutes, and remain off for minimum of three minutes at shut-off, regardless of whether the temperature setpoint has been satisfied.

The compressor can be restarted after 3min when switch OFF. It is applicable to all conditions.

ModBus BMS Controls

Every ILAHP unit has the ability to communicate with Building Automation Systems (BMS) through ModBus. The “RS485” terminals on the main control board will be utilized for this feature. The table below lists all addresses available. It is important to note that some are read only while others can be changed and are writable functions.

Prior to connecting to BMS the following steps need to be taken

1. Ensure the transmission format is set in the BMS when trying to connect. This includes baud rate, start bit, byte width, parity, and stop bits. These can be found in the table below labeled “Transmission Format”
2. Connect the - wire (from the BMS) to the terminal labeled “RS485 -” in the ILAHP electrical cabinet and + wire (from the BMS) to the terminal labeled “RS485 +” in the ILAHP electrical cabinet. Locate a GND (if required) and wire from BMS to a ground terminal in the ILAHP electrical cabinet.
3. Ensure that the ILAHP unit is in the "Master" mode set at the local controller through parameter H07. (to access H07 press the setting key, factory passcode= 66, system tab, change parameter H07 accordingly)
4. Ensure parameter H10 is set to the address of the unit being controlled (if it's the first unit H10 = 1, 2nd unit H10 = 2 etc...). To access parameter H15 press the settings key, passcode= 66, system tab, change parameter H10 accordingly).
5. Place a jumper on the "Remote ON/OFF" terminals located at the main board connections.

Important Note: All temperatures values in the MODBUS registers are stored as tenths of a degree Celsius, regardless of whether the unit is set to display Fahrenheit or Celsius.

Therefore, a temperature value such as register 1158 = Heating Target Temperature may be stored as 500. Divide this value by 10 and you get 50.0°C. To determine the equivalent value in Fahrenheit, multiply this value by 9/5, to get 90, then add 32. The Fahrenheit temperature is 122°F.

If you wish to change the target temperature to 115°F, first subtract 32 to get 83, then multiply by 5/9. The Celsius temperature is 46.1°C, multiply this by 10 and enter the value 461.

When a value represents a difference between two temperatures, such as register 1160, Start temperature differential, the conversion from Celsius to Fahrenheit is simply, multiply by 9/5, and from Fahrenheit to Celsius is multiply by 5/9.

For example, if the default value is 36, divide this by 10 and it represents 3.6 deg Celsius difference, multiply by 9/5 to get 6.5 deg Fahrenheit difference. Conversely, if you want to set this value to 5 deg Fahrenheit differential, multiply by 5/9 to get 2.8 deg Celsius differential. Divide this by 10, and set the register value to 28.

Modbus RTU Protocol

1. Transmission Format

Baud Rate	9600bps
Start bit	1
Byte width	8
Parity	N
Stop bits	1
Unit address	H10

2. Packet Format

Address	Function	Data	CRC checksum
16bits	16bits 03:Function of reading multi registers 16:Function of presenting multi registers 06: Fuction of presenting single	N*16bits	16bits

3. Data types

Data Types	Description
TEMP	Important Note: All temperatures values in the MODBUS registers are stored as tenths of a degree Celsius, regardless of whether the unit is set to display Fahrenheit or Celsius. Therefore, a temperature value such as Heating Target Temperature may be stored as 500. Divide this value by 10 and you get 50.0°C. To determine the equivalent value in Fahrenheit, multiply this value by 9/5, to get 90, then add 32. The Fahrenheit temperature is 122°F. When a value represents a difference between two temperatures, such, Start temperature differential, the conversion from Celsius to Fahrenheit is simply, multiply by 9/5, and from Fahrenheit to Celsius is multiply by 5/9. For example, if the default value is 36, divide this by 10 and it represents 3.6 deg Celsius difference, multiply by 9/5 to get 6.5 deg Fahrenheit difference. Conversely, if you want to set this value to 5 deg Fahrenheit differential, multiply by 5/9 to get 2.8 deg Celsius differential. Divide this by 10, and set the register value to 28.
DIGI1	No symbol byte,unit :1,When show 123,the data transmission is 123;
DIGI2	No symbol byte,unit :10,When show 1230,the data transmission is 123;
DIGI3	No symbol byte,unit :100,When show 12300,the data transmission is 123;
DIGI4	No symbol byte,unit :5,When show 10,the data transmission is 2;
DIGI5	No symbol byte,unit :0.1,When show 12.3,the data transmission is 123;
DIGI6	No symbol byte,unit :0.001,When show 0.123,the data transmission is 123;
DIGI9	No symbol byte,unit :0.01,When show 0.12,the data transmission is 12;

4. Modbus Address

Address	Function	Number	Content	mode	Default	Description	Remark
1011	03/16		ON/OFF	read/write		0-OFF/1-ON	DIGI1
1012	03/16		Mode	read/write		H05=1:0-Hot water/1-Heating/2-Cooling/3-Hot water+heating/4-Hot water+Cooling H05=0:0-Hot water/1-Heating/3-Hot water+heating	DIGI1
1013	03/16		Reserved	read/write			
1014	03/16		Reserved	read/write			
1015	03/16		Reserved	read/write			
1016	03/16		Manual control	read/write		bit0:Manual defrost(0-off 1-on) bit1:Mute flag bit (0-off 1-on) bit2:A key manual heating (0-off 1-on)	DIGI1
1017	03/16		Reserved	read/write			
1018	03/16	H01	if with disable automatic restart (0-no/1-yes)	read/write	1	0-no/1-yes	DIGI1
1019	03/16		Reserved	read/write			
1020	03/16		Reserved	read/write			
1021	03/16	H05	Cooling Mode	read/write	1	0-No/1-Yes	DIGI1
1022	03/16		Reserved	read/write			
1023	03/16	H07	Controler choice	read/write	0	0-display control 1-remote control	DIGI1
1024	03/16	H10	Unit address	read/write	1	1~32	DIGI1
1025	03/16		Reserved	read/write			
1026	03/16		Reserved	read/write			
1027	03/16	H27	EVI enabled	read/write	3	0-no EVI 1-EVI on cooling 2-EVI on heating 3-EVI both heating and cooling	DIGI1
1028	03/16	H28	Hot water mode enable	read/write	1	0-no/1-yes	DIGI1
1029	03/16	H21	Temperature unit	read/write	0	0-°C/1-F	DIGI1
1030	03/16	H22	Silence mode	read/write	1	0-no/1-yes	DIGI1
1031	03/16		Reserved	read/write			

Address	Function	Number	Content	mode	Default	Description	Remark
1032	03/16	H18	Electric heater energy stage	read/write	3	1-Electric heater stage 1 2-Electric heater stage 2 3-Electric heater stage 3	DIGI1
1033	03/16	H20	3-way valve polarity	read/write	0	0-ON on hot water mode/1-OFF on hot water mode	DIGI1
1034	03/16	H29	Model running parameter code	read/write	0	0~20	DIGI1
1035	03/16	H25	Control temp chioce when heat/cool mode	read/write	0	0-outlet water temp./1-room temp.	DIGI1
1036	03/16	H30	Hydraulic module enable	read/write	0	0-no,1-yes	DIGI1
1037	03/16	A03	Heat pump shutdown ambient temp	read/write	-25°C	-40.0~10.0°C	TEMP1
1038	03/16	A04	Antifreeze setting temp	read/write	4°C	A22~10.0°C	TEMP1
1039	03/16	A05	Antifreeze setting temp difference	read/write	3°C	1.0~50.0°C	TEMP1
1040	03/16	A06	Exhaust temp protect setting	read/write	120°C	60.0~130.0°C	TEMP1
1041	03/16	H31	Water pump type	read/write	0	0-not water flow function 1- Grundfos 25-75 2- Grundfos 25-105 3- Grundfos 25-125	
1042	03/16	A11	low pressure sensor enable	read/write	0	0-no,1-yes	DIGI1
1043	03/16		Reserved	read/write			
1044	03/16		Reserved	read/write			
1045	03/16	H32	Force running time of DHW change to heating	read/write	120	1~180min	DIGI1
1046	03/16		Reserved	read/write			
1047	03/16		Reserved	read/write			
1048	03/16		Reserved	read/write			
1049	03/16		Reserved	read/write			
1050	03/16		Reserved	read/write			
1051	03/16		Reserved	read/write			
1052	03/16	A21	Ambient/Suction/Coil Sensor type	read/write	0	0-5K/1-2K	DIGI1
1053	03/16	A22	Antifreeze min temp setting	read/write	4°C	-20°C~10°C	TEMP1
1054	03/16		Reserved	read/write			
1055	03/16		Reserved	read/write			
1056	03/16		Reserved	read/write			
1057	03/16		Reserved	read/write			
1058	03/16		Reserved	read/write			
1059	03/16	F01	Fan motor type	read/write	3	1-Double speed motor/3-DC fan motor	DIGI1
1060	03/16	F02	Coil temp setting when fan high speed on cool mode	read/write	50°C	-15.0~60.0°C	TEMP1
1061	03/16		Reserved	read/write			
1062	03/16	F03	Coil temp setting when fan low speed on cool mode	read/write	10°C	-15.0~60.0°C	TEMP1
1063	03/16		Reserved	read/write			
1064	03/16		Reserved	read/write			
1065	03/16		Reserved	read/write			
1066	03/16	F05	Coil temp setting when fan high speed on heat mode	read/write	10°C	-15.0~60.0°C	TEMP1
1067	03/16		Reserved	read/write			
1068	03/16	F06	Coil temp setting when fan low speed on heat mode	read/write	20°C	-15.0~60.0°C	TEMP1
1069	03/16		Reserved	read/write			
1070	03/16		Reserved	read/write			
1071	03/16		Reserved	read/write			
1072	03/16		Reserved	read/write			
1073	03/16		Reserved	read/write			
1074	03/16	F10	Fan quantity	read/write	0	0-single/1-double	DIGI1
1075	03/16		Reserved	read/write			
1076	03/16		Reserved	read/write			
1077	03/16		Reserved	read/write			
1078	03/16		Reserved	read/write			
1079	03/16		Reserved	read/write			
1080	03/16		Reserved	read/write			
1081	03/16	F18	Fan motor min Speed in cooling	read/write	300r	300~1300	DIGI1
1082	03/16		Reserved	read/write			
1083	03/16	F19	Fan motor min Speed in Heating	read/write	300r	300~1300	DIGI1
1084	03/16		Reserved	read/write			
1085	03/16		Reserved	read/write			

Address	Function	Number	Content	mode	Default	Description	Remark
1086	03/16	F21	Timer mute	read/write	0	0-no/1-yes	DIGI1
1087	03/16	F22	Manual-control Fan Speed	read/write	0	0-no/1-yes	DIGI1
1088	03/16		Reserved	read/write			
1089	03/16	F23	DC fan rated speed	read/write	600r	300~1300	DIGI1
1090	03/16		REserved	read/write			
1101	03/16		Reserved	read/write			
1102	03/16		Reserved	read/write			
1103	03/16	F25	Cooling fan max speed	read/write	700r	300~1300	DIGI1
1104	03/16	F26	Heating fan max speed	read/write	700r	300~1300	DIGI1
1105	03/16		Reserved	read/write			
1106	03/16		Reserved	read/write			
1107	03/16		Reserved	read/write			
1108	03/16		Reserved	read/write			
1109	03/16		Reserved	read/write			
1110	03/16	D01	Start defrosting setpoint	read/write	-7°C	-30~5.0°C	TEMP1
1111	03/16		Reserved	read/write			
1112	03/16	D02	Exit defrosting setpoint	read/write	13°C	0.0~30.0°C	TEMP1
1113	03/16	D03	Defrosting cycle	read/write	45min	30~90Min	DIGI1
1114	03/16	D04	Max defrosting time	read/write	8min	1~12 Min	DIGI1
1115	03/16		Reserved	read/write			
1116	03/16	D07	Electric heater control	read/write	0	0-no/1-yes	DIGI1
1117	03/16	D08	Sliding defrost ambient temp	read/write	2°C	-30~10.0°C	TEMP1
1118	03/16	D09	Sliding defrost:ambient temp difference	read/write	14°C	1~50.0°C	TEMP1
1119	03/16	D10	Sliding defrost:coil temp difference	read/write	10°C	1~50.0°C	TEMP1
1120	03/16		Reserved	read/write			
1121	03/16	D11	Sliding defrost:min coil temp	read/write	-30°C	-30.0~50.0°C	TEMP1
1122	03/16		Reserved	read/write			
1123	03/16	D12	Defrosting compressor frequency	read/write	70	30~90Hz	DIGI1
1124	03/16		Reserved	read/write			
1125	03/16		Reserved	read/write			
1126	03/16		Reserved	read/write			
1127	03/16		Reserved	read/write			
1128	03/16		Reserved	read/write			
1129	03/16		Reserved	read/write			
1130	03/16		Reserved	read/write			
1131	03/16	E01	EEV1 EEV adjust mode	read/write	1	0-Manual/1-Auto	DIGI1
1132	03/16	E02	EEV1 target superheat	read/write	5	-20.0~20.0°C	TEMP1
1133	03/16	E03	EEV1 EEV initial steps	read/write	350	0~500N	DIGI1
1134	03/16		Reserved	read/write			
1135	03/16		Reserved	read/write			
1136	03/16		Reserved	read/write			
1137	03/16	E07	EEV min Steps	read/write	100	0~500N	DIGI1
1138	03/16	E08	Cooling initialSteps	read/write	200	0~500N	DIGI1
1139	03/16	E09	EVI1:adjustment mode	read/write	1	0-Manual/1-Auto	DIGI1
1140	03/16	E10	EVI1:initial steps	read/write	350	0~500N	DIGI1
1141	03/16		Reserved	read/write			
1142	03/16		Reserved	read/write			
1143	03/16	E13	EVI target superheat	read/write	3	-20.0~20.0°C	TEMP1
1144	03/16	E14	EVI:min steps	read/write	100	0~500N	DIGI1
1145	03/16		Reserved	read/write			
1146	03/16		Reserved	read/write			
1147	03/16	E17	Defrost steps	read/write	480	10~500N	DIGI1
1148	03/16	E18	Target superheat for cooling	read/write	3	-20.0~20.0°C	TEMP1
1149	03/16		Reserved	read/write			
1150	03/16		Reserved	read/write			
1151	03/16		Reserved	read/write			
1152	03/16	G01	Sterilize target temp	read/write	63	60~70°C	TEMP1
1153	03/16	G02	Sterilize maintain time	read/write	0	0~60min	DIGI1
1154	03/16	G03	Sterilize start time	read/write	1	0~23h	DIGI1
1155	03/16	G04	Sterilize cycle	read/write	30	1~30days	DIGI1
1156	03/16	G05	Sterilize function	read/write	1	0-no/1-yes	DIGI1
1157	03/16	R01	Hot water target temp	read/write	55	R36-R37	TEMP1

Address	Function	Number	Content	mode	Default	Description	Remark
1158	03/16	R02	Heating target temp	read/write	45	R10~R11	TEMP1
1159	03/16	R03	Cooling target temp	read/write	7	R08~R09	TEMP1
1160	03/16	R04	Heating restart difference	read/write	2	0~10°C	TEMP1
1161	03/16	R05	Heating constant temp downtime difference	read/write	1	0~10°C	TEMP1
1162	03/16	R08	Min cooling setpoint	read/write	8	-30.0~R09°C	TEMP1
1163	03/16	R09	Max cooling setpoint	read/write	28	R08~80.0°C	TEMP1
1164	03/16	R10	Min heating setpoint	read/write	15	-30.0~99.0°C	TEMP1
1165	03/16	R11	Max heating setpoint	read/write	50	-30.0~99.0°C	TEMP1
1166	03/16	R15	Exiting outlet water high temp difference	read/write	2	0~15°C	TEMP1
1167	03/16	R29	Heating compensation-on low ambient temp	read/write	-5	-35~4°C	TEMP1
1168	03/16	R30	Heating compensation-off low ambient temp	read/write	-23	-35~4°C	TEMP1
1169	03/16	R31	Low-AT max-compensation aim	read/write	40	20~60°C	TEMP1
1170	03/16	R32	Hot water compensation-on high ambient temp	read/write	55	10~60°C	TEMP1
1171	03/16	R33	Hot water compensation-off high ambient temp	read/write	55	10~60°C	TEMP1
1172	03/16	R34	Hot water compensation-on high ambient temp target temp	read/write	45	20~60°C	TEMP1
1173	03/16	R35	Electric heater functions	read/write	0	0-no use/1-water line electric heater /2-water tank electric heater	DIGI1
1174	03/16	R06	Cooling restart difference	read/write	2	0.0~10.0°C	TEMP1
1175	03/16	R07	Cooling constant temp downtime difference	read/write	1	0.0~10.0°C	TEMP1
1176	03/16	R36	Min hot water setpoint	read/write	15	0~75°C	TEMP1
1177	03/16	R37	Max hot water setpoint	read/write	58	0~75°C	TEMP1
1178	03/16		Reserved	read/write			
1179	03/16		Reserved	read/write			
1180	03/16		Reserved	read/write			
1191	03/16		Reserved	read/write			
1192	03/16	R39	Heating mode auto restart ambient temp	read/write	10	5~20°C	TEMP1
1193	03/16	R40	Ambient temp of water pump running	read/write	2	-10~20°C	TEMP1
1194	03/16	R41	Ambient temp of hot water pump running	read/write	2	-10~20°C	TEMP1
1195	03/16	R16	Hot water restart difference	read/write	5	0~10°C	TEMP1
1196	03/16	R17	Hot water constant temp downtime difference	read/write	2	0~10°C	TEMP1
1197	03/16	P01	Water pump running mode	read/write	2	0-Normal/1-Economic/2-Interval	DIGI1
1198	03/16	P02	Water pump running interval time	read/write	30	1~120min	DIGI1
1199	03/16	P03	Water pump running duration	read/write	3	1~30min	DIGI1
1200	03/16		Reserved	read/write			
1201	03/16	P05	Hot water pump working mode	read/write	2	0-Normal/1-Economic/2-Interval	DIGI1
1202	03/16	P06	Water pump manual function	read/write	0	0-no,1-yes	DIGI1
1203	03/16		Reserved	read/write			
1204	03/16		Reserved	read/write			
1205	03/16		Reserved	read/write			
1206	03/16		Timer function---start	read/write	0	0-NO/1-YES	DIGI1
1207	03/16		Timer function--hour start setting	read/write	0	0~23	DIGI1
1208	03/16		Timer function---closed	read/write	0	0-NO/1-YES	DIGI1
1209	03/16		Timer function--hour closed setting	read/write	0	0~23	DIGI1
1210	03/16		Timer function--minuter start setting	read/write	0	00~59	DIGI1
1211	03/16		Timer function--minuter closed setting	read/write	0	00~59	DIGI1
1218	03/16	C01	Compressor manual frequency	read/write	0	0~120Hz	DIGI1
1219	03/16	C02	Compressor minimum frequency	read/write	30	20~60Hz	DIGI1
1220	03/16	C03	Compressor maximum frequency	read/write	90	30~120Hz	DIGI1
1221	03/16	C04	Compressor model selection	read/write	0	0~99	DIGI1
1222	03/16	C05	Compressor minimum frequency of low ambient temp. (Cooling)	read/write	50	0~60Hz	DIGI1
1223	03/16	C06	Compressor frequency control mode	read/write	1	1-120	DIGI1
1224	03/16	C07	Frequency resonance point 1	read/write	0	0~120	DIGI1
1225	03/16	C08	Frequency resonance point 2	read/write	0	0~120	DIGI1
1226	03/16	C09	Frequency resonance point 3	read/write	0	0~120	DIGI1
1227	03/16		Reserved	read/write			

Address	Function	Number	Content	mode	Default	Description	Remark
1228	03/16	R42	Max water heating temp.	read/write	55	20~60°C	TEMP1
1229	03/16	R43	Max water heating temp.(Under Low Temp.)	read/write	50	20~60°C	TEMP1
1230	03/16	R44	Max Water heating temp.(Under High Temp.)	read/write	40	20~60°C	TEMP1
1231	03/16	R45	Electric heater start(No Delay) ambient temp)	read/write	-10	-50~20°C	TEMP1
1232	03/16	R46	the temp restart difference of the outlet water overheat protection	read/write	5	0~15	TEMP1
1233	03/16		Reserved	read/write			
1234	03/16		Weather compensation slope	read/write		0~3.5	DIGI5
1235	03/16		Weather compensation offset	read/write		0~85	TEMP1
1236	03/16		Weather compensation function enable during heating	read/write		0-no,1-yes	DIGI1
1237	03/16		Reserved	read/write			
1238	03/16		Reserved	read/write			
1239	03/16		Reserved	read/write			
1240	03/16		Reserved	read/write			
1241	03/16		Reserved	read/write			
1242	03/16		Reserved	read/write			
1243	03/16		Reserved	read/write			
1244	03/16		Timer mute function on enable	read/write		0-off/1-on	DIGI1
1245	03/16		Timer mute on hour	read/write		0-23h	DIGI1
1246	03/16		Timer mute on minute	read/write		0-59min	DIGI1
1247	03/16		Timer mute function off enable	read/write		0-off/1-on	DIGI1
1248	03/16		Timer mute off hour	read/write		0-23h	DIGI1
1249	03/16		Timer mute off minute	read/write		0-59min	DIGI1
1250	03/16		system time enable	read/write		system time enable	
1251	03/16		system current minute	read/write		system current minute	
1252	03/16		system current hour	read/write		system current hour	
1253	03/16		system current day	read/write		system current day	
1254	03/16		system current month	read/write		system current month	
1255	03/16		system current year	read/write		system current year	
1256	03/16		7*24 hours timer on/off Sunday	read/write		/	
1257	03/16		7*24 hours timer on/off Sunday	read/write		/	
1258	03/16		7*24 hours timer on/off Monday	read/write		/	
1259	03/16		7*24 hours timer on/off Monday	read/write		/	
1260	03/16		7*24 hours timer on/off Tuesday	read/write		/	
1261	03/16		7*24 hours timer on/off Tuesday	read/write		/	
1262	03/16		7*24 hours timer on/off Wednesday	read/write		/	
1263	03/16		7*24 hours timer on/off Wednesday	read/write		/	
1264	03/16		7*24 hours timer on/off Thursday	read/write		/	
1265	03/16		7*24 hours timer on/off Thursday	read/write		/	
1266	03/16		7*24 hours timer on/off Firday	read/write		/	
1267	03/16		7*24 hours timer on/off Firday	read/write		/	
1268	03/16		7*24 hours timer on/off Saturday	read/write		/	
1269	03/16		7*24 hours timer on/off Saturday	read/write		/	
1270	03/16		Reserved	read/write			
2011	16		Unit state	read		0-off/1-on	DIGI1
2012	16		Unit mode	read		0-cooling/1-heating/2-defrost/3-sterilize/4-hot water	DIGI1
2013	16		Temperature vlaue after limiting	read			TEMP1
2014	16		Temperature vlaue after weather compensation during heating	read			TEMP1
2015	16		Reserved	read			
2016	16		Reserved	read			
2017	16		Reserved	read			
2018	16	O124	DTU state	read		0-OFF/1-ON	DIGI1

Address	Function	Number	Content	mode	Default	Description	Remark
2019	16	O01~014	Load output	read		bit0:O01 compressor output (0-OFF/1-ON) bit1:Reserved bit2:O03 fan high speed output (0-OFF/1-ON) bit3:O04 fan low speed output (0-OFF/1-ON) bit4:O05 water pump output (0-OFF/1-ON) bit5:O06 hot water pump output (0-OFF/1-ON) bit6:O07 4 way valve 1 (0-OFF/1-ON) bit7:O08 Electric heater stage 1 (0-OFF/1-ON) bit8:O09 Electric heater stage 2 (0-OFF/1-ON) bit9:O10 3 way valve (0-OFF/1-ON) bit10:O11 alarm output (0-OFF/1-ON) bit11:O12 Crankcase Heater (0-OFF/1-ON) bit12:O13 Pan heater (0-OFF/1-ON) bit13:O21 heating water pump (0-OFF/1-ON) bit14:O22 Hydraulic module water loop electric heater (0-OFF/1-ON) bit15:O23 Hydraulic module DHW tank electric heater (0-OFF/1-ON)	DIGI1
2020	16	O15	EEV Steps	read		0~500N	DIGI1
2021	16	O16	Reserved	read		0~500N	DIGI1
2022	16	O17	EVI EEV Steps	read		0~500N	DIGI1
2023	16	O18	Reserved	read		0~500N	DIGI1
2024	16		Reserved	read			
2025	16		Reserved	read			
2026	16		Reserved	read			
2027	16		Reserved	read			
2028	16		Reserved	read			
2029	16		Reserved	read			
2030	16		Reserved	read			
2031	16		Reserved	read			
2032	16		Compressor accumulative running time	read			DIGI1
2033	16		Reserved	read			
2034	16	S01~S10	Switch state	read		bit0:S01 high pressure switch (0-on/1-off) bit1:S02 Low pressure switch (0-on/1-off) bit2:S03 water flow switch (0-on/1-off) bit3:S04 Electric heater overheat switch (0-on/1-off) bit4:S05 Remote ON/OFF (0-on/1-off) bit5:S06 Remote heating/cooling (0-on/1-off) bit6:S07 hot water switch (0-on/1-off) bit7:Reserved bit8:Reserved bit9: Heating/cooling ON/OFF (0-on/1-off) bit10:Reserved bit11:Reserved bit12:Reserved bit13:Reserved bit14:Reserved bit15:Reserved	DIGI1
2035	16	T40	Heating return water temp	read			
2036	16	T41	Heating outlet watre temp	read			
2037	16	T42	Mixing outlet water temp	read			
2038	16	T43	DHW return water temp	read			
2039	16	T44	DHW outlet water temp	read			
2040	16		Reserved	read			
2041	16		Reserved	read			
2042	16	T36	Compressor currents	read		real test value	DIGI5
2043	16	T37	DC line voltage	read		real test value	DIGI1
2044	16	T38	IPM temp	read		real test value	TEMP1
2045	16	T01	Inlet water temp	read		real test value	TEMP1
2046	16	T02	Outlet water temp	read		real test value	TEMP1
2047	16	T08	DHW tank water temp	read		real test value	TEMP1
2048	16	T04	Ambient temp	read		real test value	TEMP1
2049	16	T03	Coil temp	read		real test value	TEMP1
2050	16		Reserved	read			TEMP1
2051	16	T05	Suction temp	read		real test value	TEMP1
2052	16		Reserved	read			TEMP1
2053	16	T12	Discharge temp	read		real test value	TEMP1

Address	Function	Number	Content	mode	Default	Description	Remark
2054	16		Reserved	read			TEMP1
2055	16	T06	Anti-freeze temp	read		real test value	TEMP1
2056	16		Reserved	read			TEMP1
2057	16	T35	AC input currents	read		real test value	DIGI5
2058	16	T09	Room temp	read		real test value	TEMP1
2059	16		Reserved	read			TEMP1
2060	16		Reserved	read			TEMP1
2061	16	T33	IPMoverheat syop running	read		real test value	TEMP1
2062	16	T34	Acinput voltage	read		real test value	DIGI1
2063	16	T10	EVI inlet temp	read		real test value	TEMP1
2064	16	T11	EVI outlet temp	read		real test value	TEMP1
2065	16		Reserved	read			TEMP1
2066	16		Reserved	read			TEMP1
2067	16		Reserved	read			DIGI5
2068	16		Reserved	read			DIGI5
2069	16	T15	low pressure value	read			DIGI5
2070	16		Reserved	read			DIGI5
2071	16	T30	Compressor frequency setting	read		real test value	DIGI1
2072	16	T31	Compressor running frequency setting	read		real test value	DIGI1
2073	16	T32	inverter board max frequency	read		real test value	DIGI1
2074	16	T27	DC fan 1 speed	read		real test value	DIGI1
2075	16	T28	DC fan 2 speed	read		real test value	DIGI1
2076	16	T29	DC fan target speed	read		real test value	DIGI1
2077	16	T39	Water flow	read			DIGI9
2078	16		Reserved	read			
2079	16		Reserved	read			
2080	16		Reserved	read			
2081	16		Failure 7	read		bit0: IPM overheat bit1: compressor start failure bit2: compressor over currents bit3: Input voltage phase loss bit4: IPM current sampling fault bit5: Overheat protection of drive board devices bit6: PFC failure bit7: DC busbar overvoltage bit8: DC bus undervoltage bit9: AC input voltage undervoltage bit10: AC input overcurrent shutdown bit11: Input voltage sampling fault bit12: DSP and PFC communication failure bit13: Drive plate temperature fault bit14: DSPand communication board communication failure bit15: mainboard communication failure	DIGI1
2082	16		Failure 8	read		bit0: IPM overheat stop bit1:Reserved bit2:Reserved Bit3: 15VDV undervoltage bit4:Reserved bit5:Reserved bit6:Reserved bit7:Reserved bit8:Reserved bit9:Reserved bit10:Reserved bit11:Reserved bit12:Reserved bit13:Reserved bit14:Reserved bit15:Reserved	DIGI1

Address	Function	Number	Content	mode	Default	Description	Remark
2083	16		Failure 9	read		bit0: Voltage electromechanical current down frequency alarm bit1: Compressor weak magnetic protection alarm bit2: Power unit overheating alarm bit3: Reserved bit4: AC input current down alarm bit5: EEPROM failure warning bit6: Reserved bit7: / bit8: Reserved bit9: Reserved bit10:Reserved bit11:Reserved bit12:Reserved bit13:Reserved bit14:Reserved bit15:Reserved	DIGI1
2084	16			read			DIGI1
2085	16		Failure 1	read		bit0:Reserved bit1:Reserved bit2:Heating return water temp sensor failure (0-no/1-yes) bit3:Heating outlet water temp sensor failure (0-no/1-yes) bit4:High pressure protection (0-no/1-yes) bit5:Reserved bit6:Low pressure protection (0-no/1-yes) bit7:Reserved bit8:water flow protection (0-no/1-yes) bit9:Electric heating overload protection (0-no/1-yes) bit10:Winter first class anti-freeze protection (0-no/1-yes) bit11:Winter secondary class anti-freeze protection (0-no/1-yes) bit12:anti-freeze protection (0-no/1-yes) bit13:Reserved bit14:Room temp (0-no/1-yes) bit15:Reserved	DIGI1
2086	16		Failure 2	read		bit0:Exhaust temperature overprotection (0-no/1-yes) bit1:Reserved bit2:Reserved bit3:Fan 1 overload speed limit (0-no/1-yes) bit4:Fan 2 overload speed limit (0-no/1-yes) bit5:Reserved bit6:Outlet water over heat (0-no/1-yes) bit7:Mixing outlet water temp sensor failure(0-no/1-yes) bit8:Hot water return temp sensor failure (0-no/1-yes) bit9:Hot water outlet water temp sensor failure(0-no/1-yes) bit10:Reserved bit11:Reserved bit12:Reserved bit13:Reserved bit14:Reserved bit15:Reserved	DIGI1

Address	Function	Number	Content	mode	Default	Description	Remark
2088	16		Failure 4	read		bit0:Discharge over heat protection 3 times (0-no/1-yes) bit1:Reserved bit2:Reserved bit3:Reserved bit4:Outlet water overtemp protection 3 times (0-no/1-yes) bit5:Reserved bit6:Reserved bit7:Reserved bit8:Reserved bit9:Reserved bit10:Reserved bit11:Reserved bit12:Reserved bit13:Reserved bit14:Reserved bit15:Reserved	DIGI1
2089	16		Failure 5	read		bit0:Inlet water temp failure (0-no/1-yes) bit1:Outlet water temp failure (0-no/1-yes) bit2:Coil temp failure (0-no/1-yes) bit3:Ambient temp failure (0-no/1-yes) bit4:Suction temp failure (0-no/1-yes) bit5:Anti-freeze temp sensor failure (0-no/1-yes) bit6:Reserved bit7:Reserved bit8:Reserved bit9:EVI inlet temp failure (0-no/1-yes) bit10:EVI outlet temp failure (0-no/1-yes) bit11:discharge temp failure (0-no/1-yes) bit12:Reserved bit13:Syetem 1 pressure sensor failure (0-no/1-yes) bit14:low ambient temp failure (0-no/1-yes) bit15:Reserved	DIGI1
2090	16		Failure 6	read		bit0:Reserved bit1:Reserved bit2:Reserved bit3:Reserved bit4:Reserved bit5:Reserved bit6:Reserved bit7:Reserved bit8:Hot water temp failure (0-no/1-yes) bit9:Reserved bit10:Reserved bit11:Fan 1 failure (0-no/1-yes) bit12:Fan 2 failure (0-no/1-yes) bit13:Communication failure(main board with fan motor module board) (0-no/1-yes) bit14:Reserved bit15:Communication failure(main board with fan motor 2 module board) (0-no/1-yes)	DIGI1
2101	16		Reserved	read			
2109	16		Reserved	read			
2110	16		Reserved	read			
2111	16		Reserved	read			
2112	16		Reserved	read			
2113	16		Reserved	read			
2114	16		Reserved	read			
2115-2180	16		Reserved	read			

SECTION 7: TROUBLESHOOTING

ILAHP Error Codes

Error Code	Description	Cause	Solution
P01	Inlet Water Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T1
P02	Outlet Water Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T2
P032	DHW Water Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor (optional component)
P04	Ambient Air Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T6
P153	OD Coil Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T5
P17	Suction Line Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T4
P181	Discharge Line Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 50k sensor T3
P182	Discharge Line Overtemp	Excessive discharge Temp, over A06	Excessive Suction Superheat or compressor fault Default value of A06 is 239°F
P001	EVI Inlet Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T8
P002	EVI Outlet Temp Sensor	Sensor failed open or shorted. Wiring fault	Correct wiring or replace 5k sensor T9
TP	Low Ambient Protection	Outdoor temperature is below A03 setpoint	Normal operation based upon parameter setting
E032	Flow Switch protection	Water flow is below acceptable level	Ensure pump and plumbing are cabable of achieveing required flowrate
E04	Aux heater overtemp	Safety switch has tripped or circuit failed open	Determine cause of overtermp, correct or repair circuit
E051	Compressor overload	Excessive current draw due to high discharge temperature or low input voltage	Ensure 220-240V to the unit under max load, sufficient water flow (if in heating) or outdoor air flow (if in cooling)
E08	Loss of communication with Remote Display	Remote display failure or wiring fault	Correct wiring or replace Remote Display VT1
E081	Loss of communication with Fan Speed Control	Fan Speed Control failure or wiring fault	Correct wiring or replace control board IC3
E11	High Discharge Pressure	High discharge pressure or switch or circuit failed open	If fault remains constant, correct wiring or replace switch S3
E12	Low Suction Pressure	Low discharge pressure or switch or circuit failed open	If fault remains constant, correct wiring or replace switch S2
E171	Freeze Protection	Water temperature below 63°F When Ambient T is below 36°F	Check water temperature. If it is over 63°F, check or replace 5k sensors T6 or T7
E19	Primary Freeze Protection	Inlet Water Temperature between 32° and 36°F and Ambient T is below 32°F	Check water temperature. If it is over 36°F, check or replace 5k sensors T6 or T7
F12	Loss of communication with Compressor speed control board	Loose or broken wiring/Failed compressor inveter board.	Correct wiring or replace compressor inverter board.
E29	Secondary Freeze Protection	Inlet Water Temperature below 32° and Ambient T is below 32°F	Check water temperature. If it is over 36°F, check or replace 5k sensors T6 or T7
F031	DC Fan motor #1 Failure	Wiring fault or fan motor #1 has failed	Check and repair wiring, replace fan motor.
F032	DC Fan motor #2 Failure	Wiring fault or fan motor #2 has failed	Check and repair wiring, replace fan motor.

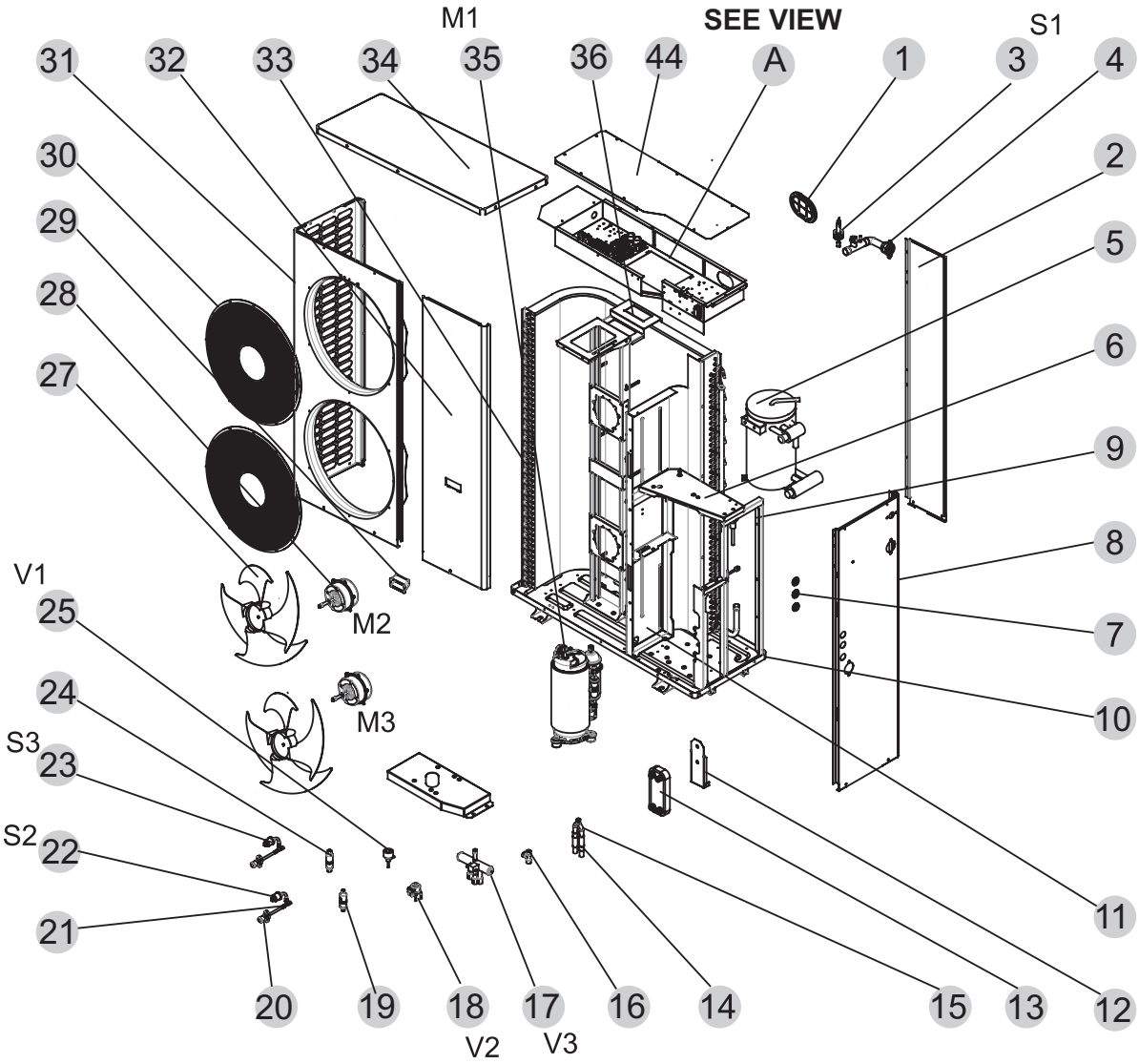
Maintenance for Air to Water Heat Pumps

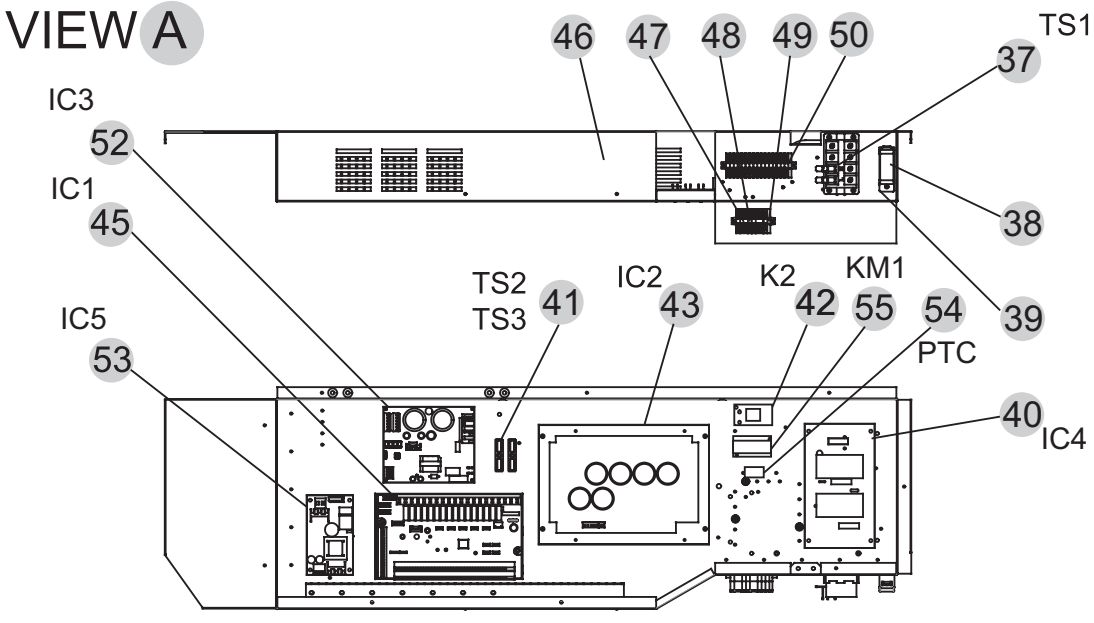
Like all mechanical equipment, air to water heat pumps require maintenance to maintain peak performance and reliability. Refer to the following table for maintenance and inspection schedules.

Time Period	Task	Description
Annually	Maintain Glycol %	Over time the % of glycol will degrade leaving the fluid in the system vulnerable to freezing and contaminants. Once a year the fluid should tested using approved test strips for glycol %. If glycol % is below the minimum required for your system design (see install manual for specific % required) the appropriate amount (based on volume) of proper glycol should be added to bring the system back to the minimum. If necessary, the system should be flushed completely, and fresh glycol/water mix should fill the system. If an autofill system is installed, it must be filled with the appropriate concentration.
Seasonally*	Clean coil	Once a season the exposed coil at the outdoor unit should be cleaned using appropriate and approved HVAC coil cleaning solvents ONLY. Use of non-approved solvents can severely damage the system and can impact warranty eligibility.
	Check for loose wires	Verify all wires are still intact and are not making loose connections. Repair as needed
	Clear condensate	Under the outdoor coil there are drain holes for condensate run off. Ensure the path is clear of obstructions that could cause a backup of condensate and potential freezing in freezing conditions.
As Needed	Clear debris	The heat pump should be clear of all debris around the unit to ensure proper air flow
	Rodent damage	Inspect all wiring cabinets, compressor cabinets and panels for any rodent damage. Repair/replace as needed and make provisions to keep rodents out of heat pump cabinets.

*Seasonally is defined at the end of the equipment's operating season. If the unit is used for cooling only, then inspections should be done prior to startup of next season. If unit is used for heating and cooling applications, then inspections/tasks should be completed during the in between time when unit is ready to change from cooling to heating and heating to cooling.

SECTION 8: REPLACEMENT PARTS





Replacement Parts

NO	Part Number	Description	Wiring Diagram Callout
1	45W05-WG1371-01	Oval Grommet	
2	45W41-WG1372-01	Rear Compressor Access Panel	
3	45W11-WG1211-01	Flow Switch	S1
4	45W40-WG1373-01	Water Outlet Manifold	
5	45W50-WG1374-01	Refrigerant to Water Heat Exchanger	
6	45W41-WG1375-01	Heat Exchanger Support	
7	45W05-WG1376-01	Wiring Access Split Bushing	
8	45W41-WG1377-01	Compressor End Panel	
9	45W41-WG1378-01	Heat Exchanger Support Bracket	
10	45W41-WG1379-01	Base	
11	45W41-WG1380-01	Vertical Separator Panel	
12	45W41-WG1381-01	EVI Heat Exchanger Support Bracket	
13	45W50-WG1382-01	EVI Heat Exchanger	
14	45W28-WG1383-01	Check Valve	
15	45W40-WG1384-01	U-Bend Tee	
16	45W40-WG1385-01	Tee	
17	45W28-WG1220-02	Reversing Valve	V3
18	45W28-WG1386-01	EVI EEV	V2
19	45W27-WG1387-01	Refrigerant Filter	
20	45W40-WG1388-01	Access Valve	
21	45W40-WG1389-01	Tee	
22	45W11-WG1347-01	Low Pressure Limit Switch	S2
23	45R2001-3605	High Pressure Limit Switch	S3
24	45W27-WG1214-01	Refrigerant Filter	
25	45W28-WG1390-01	Primary EEV	V1
27	45W34-WG1200-01	Fan Blade	
28	45W31-WG1391-01	Axial Fan Motor	M2, M3
29	45W19-WG1197-01	Access Panel Handle	
30	45W32-WG1392-01	Fan Guard	
31	45W41-WG1393-01	Fan Compartment Panel	
32	45W41-WG1394-01	Component Access Panel	
33	45W50-WG1395-01	Finned Tube Coil	
34	45W41-WG1396-01	Unit Cover Panel	
35	45W33-WG1397-01	EVI Compressor	M1
36	45W41-WG1398-01	Electrical Box Support Bracket	
37	45W09-WG1225-01	Four Pole Terminal	TS1
38	45W41-WG1399-01	Cable Clamp	
39	45W41-WG1400-01	Cable Clamp	
40	45W09-WG1401-01	EMI Filter	IC4
41	45W09-WG1402-01	Four Pole Terminal	TS2, TS3
42	45W09-WG1403-01	Pump Relay	K2
43	45W09-WG1404-01	Compressor Speed Inverter Board	IC2
44	45W41-WG1405-01	Electrical Compartment Cover	
45	45W09-WG1406-01	Control Board	IC1
46	45W41-WG1407-01	Electrical Components Cabinet	
47	45W09-WG1359-01	2 Pole Feed Through Terminal	
48	45W09-WG1408-01	2 Pole Feed Through Terminal	
49	45W09-WG1358-01	1 Pole Feed Through Terminal	
50	45W09-WG1409-01	Terminal End Cap	
51	45460-WG1410-01	Display	VT1
52	45W09-WG1542-01	Module, Fan Speed Control	IC3
53	W09-WG1545-01	12VDC POWER SUPPLY	IC5
54	45W09-WG1415-01	THERMISTOR, PTC, COMPRESSOR START	PTC
55	45W09-WG1544-01	CONTACTOR, COMPRESSOR START	KM1
N/A	45Y11-WG1417-01	Cable, Remote Display	
N/A	45R2000-3242	TEMPERATURE SENSOR, 5K NTC	T1, T2, T4, T5, T6, T7, T8, T9
N/A	45W09-WG1413-01	TEMPERATURE SENSOR, 50K NTC	T3
N/A	45W09-WG1543-01	TEMPERATURE SENSOR, DHW TANK, 10K NTC	

Limited Warranty Statement

SpacePak "Solstice Inverter"* Series Air-to-Water Heat Pumps

Subject to the terms and conditions of this Limited Warranty Statement (the "Limited Warranty"), SpacePak warrants to the original purchaser of the "Solstice Inverter" Series that:

1) The parts are warranted for a period of two (2) years to the original owner of the System (as such term is defined in part (4) below). If any parts should prove defective due to improper workmanship and/or material for a period of two (2) years from the date of installation, SpacePak will replace any defective part without charge for that part. Replacement parts are warranted for the remainder of the original 2-year warranty period. Parts used as replacement may be of like kind and quality and may be new or remanufactured. Defective parts must be available for SpacePak in exchange for the replacement parts and become the property of SpacePak.
2) The compressor is warranted for a period of five (5) years to the original owner of the System. If the compressor should prove defective due to improper workmanship and/or material for a period of five (5) years from the date of installation, SpacePak will replace the defective compressor without charge for the compressor. Replacement compressors are warranted for the remainder of the original 5-year warranty period. Compressors used for replacement may be of like kind and quality and may be new or remanufactured. Defective compressors must be made available to SpacePak in exchange for the replacement compressor and become the property of SpacePak.
3) **Notwithstanding the foregoing, if the System is installed in a residential single-family home by a SPACEPAK CERTIFIED CONTRACTOR the parts will be warranted for five (5) years and compressor will be warranted for a period of ten (10) years, to the original owner, so long as the original owner resides in the home.** Specifically, if any parts and/or the compressor should prove defective due to improper workmanship and/or material for the period listed above from the date of installation, SpacePak will replace any defective parts or compressor without charge for the part or compressor. The replacement parts and/or compressor are warranted for the remainder of the original warranty period. Parts and/or compressors used for replacement may be of like kind and quality and may be new or remanufactured. Defective parts and/or compressors must be made available to SpacePak in exchange for the replacement parts and become the property of SpacePak.
4) For purposes of this Solstice Inverter" Series Limited Warranty, as used herein, the term "System" shall mean the Solstice Inverter outdoor and indoor components connected via refrigerant piping and electrical wiring purchased on or after February 1, 2021, (i) sold from a licensed HVAC representative of SpacePak (and not an unauthorized third party) to the original owner, (ii) installed by such contractor in accordance to local and National regulations in the continental U.S., Alaska, Hawaii, and Canada; and (iii) registered on SpacePak's website located at www.SpacePak.com/warranty)

*For any Solstice equipment that is non-inverter, please refer to warranty located in the equipment original installation manual.

SpacePak Small Duct High Velocity Air Handlers and Hydronic Fan Coils

Subject to the terms and conditions of this Limited Warranty Statement (the "Limited Warranty"), SpacePak warrants to the original purchaser of the Small Duct High Velocity Air Handlers and hydronic fan coils that:

1) The parts are warranted for a period of one (1) year to the original owner of the System (as such term is defined in part (3) below). If any parts should prove defective due to improper workmanship and/or material for a period of one (1) year from the date of installation, SpacePak will replace any defective part without charge for that part. Replacement parts are warranted for the remainder of the original 1-year warranty period. Parts used as replacement may be of like kind and quality and may be new or remanufactured. Defective parts must be available for SpacePak in exchange for the replacement parts and become the property of SpacePak.
2) Notwithstanding the foregoing, if the System is installed in a residential single-family home by a SPACEPAK CERTIFIED CONTRACTOR the parts will be warranted for five (5) years, to the original owner, so long as the original owner resides in the home. Specifically, if any parts should prove defective due to improper workmanship and/or material for the period listed above from the date of installation, SpacePak will replace any defective parts or compressor without charge for the part or compressor. The replacement parts are warranted for the remainder of the original warranty period. Parts used for replacement may be of like kind and quality and may be new or remanufactured. Defective parts must be made available to SpacePak in exchange for the replacement parts and become the property of SpacePak.
3) For purposes of this Small Duct High Velocity Air Handlers and hydronic fan coils limited warranty, as used herein, the term "System" shall mean the "SpacePak Small Duct High Velocity Air Handlers, hydronic fan coils purchased on or after February 1, 2021, (i) sold from a licensed HVAC representative of SpacePak (and not an unauthorized third party) to the original owner, (ii) installed by such contractor in accordance to local and National regulations in the continental U.S., Alaska, Hawaii, and Canada; and (iii) registered on SpacePak's website located at www.SpacePak.com/warranty)

SpacePak Buffer Tanks

The “Manufacturer” warrants to the original owner at the original installation site that the Hydronic Buffer Tanks (the “Product”) will be free from defects in material or workmanship for a period not to exceed ten (10) years from the startup, provided the product is installed in accordance with the manufacturers installation instructions. If upon examination by the Manufacturer the Product is shown to have a defect in material or workmanship during the warranty period, the Manufacturer will repair or replace, at its option, that part of the Product which is shown to be defective.

The following items apply to each Limited Warranty offered by SpacePak.

4) **NO LABOR.** Each Limited Warranty offered by SpacePak does NOT include labor or any other costs incurred for service, maintenance, repair, removing, replacing, installing, complying with local building and electric codes, shipping or handling, or replacement of the System/Products, compressors or any other parts. For items that are designed to be maintained or replaced by the original owner, the original owner is solely responsible for all labor and other costs of maintaining, installing, replacing, disconnecting or dismantling the System/ Products and parts in connection with owner-required maintenance. Please consult the applicable technical documentation for regularly suggested maintenance procedures.
5) **PROPER INSTALLATION.** This Limited Warranty applies only to Systems/Products that are sold by SpacePak HVAC representatives, installed by contractors who are licensed for HVAC installation under applicable local and state law, and who install the Systems/Products in accordance with (i) all applicable building codes and permits: (ii) SpacePak’s installation and operation instructions: and (iii) good trade practices.
6) **BEFORE REQUESTING SERVICE,** please review the applicable technical documentation to insure proper installation and correct customer control adjustment for the System/Products. If the problem persists, please arrange for warranty service.
   a. **TO OBTAIN WARRANTY SERVICE:**
      i. Contact the licensed contractor who installed the System/Products or the nearest licensed contractor, dealer, or distributor (whose name and address may be obtained on our website at www.SpacePak.com of any defect within the applicable warranty time period.
      ii. Proof of the installation date by a licensed contractor is required when requesting warranty service. Present the sales receipt, building permit or other document which establishes proof and date of installation. In the absence of acceptable proof, this Limited Warranty shall be deemed to begin one hundred twenty (120) days after the date of manufacture stamped on the System/Products.
      iii. This Limited Warranty applies only to System/Products purchased on or after February 1, 2021 only while the System/Products remains at the site of the original installation, and only to locations within the continental United States, Alaska, Hawaii and Canada.
      iv. Shipment, to the Manufacturer, of that part of the Product thought to be defective. Goods can only be returned with prior written approval from the Manufacturer. All returns must be freight prepaid. Determination, in the reasonable opinion of the Manufacturer, that there exists a defect in material or workmanship.
   b. **THIS LIMITED WARRANTY DOES NOT COVER:** property damages, malfunction or failure of the System/ Products, or personal injury caused by or resulting from: (a) accident, abuse, negligence or misuse; (b) operating the System/Products in a corrosive or wet environment, including those containing chlorine, fluorine or any other hazardous or harmful chemicals or environmental factors, including sea- or salt-water; (c) installation, alteration, repair or service by anyone other than a licensed contractor or other than pursuant to the manufacturer’s instructions; (d) improper matching of System/Products components; (e) improper sizing of the System/Products; (f) improper or deferred maintenance contrary to the manufacturer’s instructions; (g) physical abuse to or misuse of the System/Products (including failure to perform any maintenance as described in the Operation manual, or any System/ Products damaged by excessive physical or electrical stress; (h) System/Productss that have had a serial number or any part thereof altered, defaced or removed; (i) System/Products used in any manner contrary to the Operation Manual; (j) freight damage; or (k) events of force majeure or damage caused by other external factors such as lightning, power surges, fluctuations in or interruptions of electrical power, rodents, vermin, insects, or other animal- or pest-related issues.
   c. **THIS LIMITED WARRANTY ALSO EXCLUDES:** (a) SERVICE CALLS WHERE NO DEFECT IN THE SYSTEM/ PRODUCTS COVERED UNDER THIS WARRANTY IS FOUND: (b) System/Products installation or set-ups; (c) Adjustments of user controls; (d) System/Products purchased or installed outside the continental United States, Alaska, Hawaii and Canada; or (e) System/Products purchased or installed prior to **February 1, 2021**. Consult the operating instructions for information regarding user controls.

SPACE PAK®

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