Variable V-Star Installation Manual

Models: VVV / VVH
Geothermal Heat Pump

- R-410A Refrigerant
- 2.5, 4.0, 6.0 Ton Variable Speed

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Explanation of Terms / Acronyms used in Manual

AWG = American Wire Gauge
DHW = Domestic Hot Water
AHW = Auxiliary Hot Water (Infloor, Pool, etc.)
CFM = Cubic Feet per Minute
UV = Ultra Violet
Vac = Volts Alternating Current
Vdc = Volts Direct Current
BAS = Building Automation System
VA = Volt Amps
GPM = Gallons per minute
PVC = Polyvinyl Chloride
CPVC = Chlorinated Polyvinyl Chloride
Relay reference to C = common terminal
Relay reference to NO = Normally open terminal
Relay reference to NC = Normally closed terminal
E-Heat = Emergency heat / strip heat only, compressor locked off.
Aux heat = Auxiliary heat / strip heat running with compressor.

Hydro-Temp™ Corporation has compiled this manual with care; however *Hydro-Temp™* does not warrant that the information in this manual is free of errors. *Hydro-Temp™* reserves the right to change any portion of this manual without notice. The appearance of any technical data or editorial material in this manual does not constitute endorsement, warranty, or guarantee by *Hydro-Temp™* of any product, service, process, procedure, design, or the like. The user assumes the entire risk of the use of any information in this manual.

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Do not install, operate, or maintain this equipment before carefully reading this instruction manual. Additional copies of this manual are available from the installing dealer or from *Hydro-Temp™* Corporation.
Save these and any other operating instructions for yourself and any future owners of this equipment.
A trained Hydro-Temp installer must perform all installation practices.
A licensed refrigeration technician must perform all refrigeration repairs / modifications. Hydro-Temp must approve all service repairs if system is covered under manufacturer warranty.

Installation Manual Print Date: June 16, 2016

MODEL NOMENCLATURE

V	X	X	1	XXXX	X	X	X	1	X	X	XXX

SERIES:
C = COMMERSIAL
R = RESIDENTIAL
V = V-STAR

COMPRESSOR SPEEDS:
A = SINGLE SPEED
B = TWO SPEED
C = THREE SPEED
D = FOUR SPEED
E = FIVE SPEED
F = SIX SPEED
G = SEVEN SPEED
H = EIGHT SPEED
M = MULTI-SPEED
V = VARIABLE
X = NON-APPLICABLE

CONFIGURATION:
C = CORNER CONSOLE
H = HORIZONTAL
L = LONG CONSOLE
N = NARROW CONSOLE
O = COMPACT HORIZONTAL
P = COMPACT VERTICAL
R = ROOF TOP
S= SPLIT
V= VERTICAL
W = WATER TO WATER
F = COUNTER FLOW

REFRIGERANT:
1 = R410A
2 = R22
3 = R134A
4 = R407C
X = IF NON-APPLICABLE

UNIT BTU OUTPUT:
BTU X 1000

AIR FLOW DIRECTION:
X= Unknown at the time of submittal
A = UPFLOW-RIGHT RETURN
B = UPFLOW-LEFT RETURN
C = UPFLOW-BACK RETURN
D = UPFLOW-TOP RETURN
E = UPFLOW FRONT (CORNER CONSOLE ONLY)
F = HORIZONTAL FLOW-RIGHT RETURN
G = HORIZONTAL FLOW-LEFT RETURN
H = HORIZONTAL FLOW-BACK RETURN
I = HORIZONTAL FLOW/ FRONT
J = COUNTER FLOW-RIGHT RETURN
K = COUNTER FLOW-LEFT RETURN
L = COUNTER FLOW-COUNTER RETURN
M = COUNTER FLOW-BACK RETURN
N = END RETURN & SUPPLY – LEFT RETURN, RIGHT SUPPLY
O = END RETURN & SUPPLY – RIGHT RETURN, LEFT SUPPLY

STRIP HEAT:
XXX = NO STRIP HEAT
005 = 5KW
010 = 10KW
015 = 15KW
020 = 20KW
OR TOTAL KW

WATER SOURCE:
W = OPEN LOOP/WELL WATER
C = CLOSED LOOP
T = COOLING TOWER
X = IF NON-APPLICABLE

Microprocessor:
X = TERMINAL STRIP
1 = GEORGIA CONTROL/HYDRO-TEMP
2 = AUTOMATED LOGIC/583
3 = AUTOMATED LOGIC/6126
4 = END USER DDC

VOLTAGE/PHASE:
1 = 208/230Vac-1 PHASE
2 = 115Vac-1PHASE
3 = 208/230Vac-3 PHASE
4 = 460Vac-3 PHASE
5 = 575Vac-3 PHASE
6 = 265/277Vac-1 PHASE
7 = 380Vac- 3 PHASE

HOT WATER OPTIONS:
X = NO HOT WATER
B = DESUPERHEATER AND INFLOOR*
C = DESUPERHEATER AND POOL HEATING*
D = DESUPERHEATER
E = HYDROZONE AND DESUPERHEATER*
F = HYDROZONE AND INFLOOR*
G = HYDROZONE AND POOL HEATING*
H = HYDROZONE
I = INFLOOR
J = INFLOOR AND POOL HEATING*
O = DHW PRIORITY AND HYDROZONE*
P = DHW PRIORITY
Q = DHW PRIORITY AND INFLOOR*
R = DHW PRIORITY AND POOLING HEATING*
S = POOL HEATING
(SELECT ONLY ONE)

*THIS OPTION IS NOT AVAILABLE IN CONSOLE OR COMPACT MODELS

WATER PLUMBING LOCATION:
R = WATER THROUGH RIGHT SIDE
L = WATER THROUGH LEFT SIDE
B = WATER THROUGH BACK
C = WATER THROUGH BOTTOM
T = WATER THROUGH TOP
F = WATER THROUGH THE FRONT
X = NO WATER/UNKNOWN PLUMBING LOCATION

1.0 Transportation & Storage

Move and store units in an upright position. Do not stack units. Inspect shipment for shipping damage and check packing slip for accuracy. Any equipment or cartons in question should be removed from the packing and physically inspected. If any damage is detected, the carrier should make a note on the delivery slip acknowledging the damage. In some cases smaller items like thermostat or temperature sensors will be packed and shipped inside the system.

During freezing conditions special consideration should be made to prevent unit damage. **If a unit is taken to the job site or put in storage, anti-freeze will need to be pumped into the water coils to prevent freezing.** Failure to do this will void warranty.

2.0 Electrical Hazard Warnings

THE FOLLOWING IS A GENERAL WARNING STATEMENT WHICH SHOULD BE READ AND UNDERSTOOD BEFORE INSTALLING AND OR OPERATING YOUR NEW HYDRO-TEMP UNIT

ELECTRIC SHOCK CAN KILL!!

- Always protect yourself and others. Always turn off system power before removing panels. Some units may have more than one or two power supplies.
- Keep all covers and panels in place at all times. When removed for install or service purposes never leave the cover off when left un-attended.
- Do not stick hands into return or any other opening.
- All repairs, electrical or mechanical, should be attempted only by trained Hydro-Temp technicians. In the event of a unit problem, do not reset the equipment before correcting the problem. Equipment failure due to resetting without first correcting the problem will not be covered by the warranty.
- The presence of water around the base of the unit constitutes an electrical hazard. Turn off the power to the unit as soon as water leakage is discovered and call a service technician immediately.
- STRIP HEAT WARNING: On systems with auxiliary/emergency heat strips, be aware that the heat strip contactor may be wired on a separate circuit. Therefore an additional breaker must be shut off before removing panels and servicing unit.
- All breakers/fuses supplying power to this equipment should be clearly labeled at time of installation.
- All wiring and plumbing should be done in strict accordance with local and national codes and ordinances.

2.1 Electrical Connections

Power to the Hydro-Temp System and back-up electric heater may be two or sometimes three circuits (Some large dual compressor systems will require a circuit per compressor). A standard system requiring one circuit for compressor and one circuit for strip heat can be wired with 2 breakers in the main breaker panel or one circuit feeding a sub breaker panel near the system. All circuits must have its own power disconnect near the system. The electrical installation must be performed by a licensed electrician, except for the low voltage wiring (Class 2) (i.e. T-Stat) which can be done by the heat pump contractor. **Note:** In most areas high voltage can be taken from disconnect to the unit by the mechanical contractor if allowed by local codes. All wiring and plumbing should be done in strict accordance with local and national codes and ordinances.

3.0 Hydro-Temp System Installation

Locate the unit in a conditioned, indoor area that allows for easy servicing. Make sure that the air filter access and unit access panels are easily accessible. Provide sufficient room to make all ground loop, well water, DHW, condensate, electrical, and if applicable refrigeration connections.
If the unit is placed in a closet, make provision for adequate return air flow to the unit.

Some installations may require a condensate pump to take the condensate to a suitable drain location. Do not locate the unit in an area that is subject to freezing. The minimum recommended room temperature for equipment location is 60°F. Provide a heated, insulated enclosure for the unit where necessary.

4.0 Ductwork Considerations

Important Note: If ductwork is installed in an attic area, it needs to be built "low profile" and laid directly on the ceiling joist. After being installed and insulated with R6 insulation, it must be covered with six to eight inches of cellulose. If the attic ductwork is not covered with cellulose it can lose a significant amount of its heating and cooling capacity!!

Inadequate ductwork will cause poor system performance and customer dissatisfaction. In the USA, ductwork sizing methods should follow ACCA "Manual D".

Install ductwork within the conditioned space of the building to minimize duct heat loss or gain, wherever possible. To minimize air velocity noise transferring to the air supply grills, flex duct should be installed from the supply grill back six feet.

Vstar systems will ramp the compressor as needed to maintain heating or cooling set point. The CFM delivered by the system will initially ramp up equal to 400 CFM / ton in heat or 375 CFM / ton in cooling. After the Vstar system has run for a few minutes the blower will adjust slightly in an attempt to maintain discharge air temp set point. Default discharge air set points are 55ºF in cooling and 100ºF heat.

Ductwork should be designed to handle CFM delivery for the system while running in High Speed. Supply duct should be based on .08 inches of pressure drop per 100 feet. Return duct should be based on .05 inches of pressure drop per 100 feet.

Note: Always check register CFM requirements against register manufacturer's data for register performance. It is extremely important to ensure that duct system return air is NOT undersized. Undersized return air can cause poor system performance and in some cases can cause the blower to "pulse". Further, it is also important to provide adequate sized supply air plenums. Make all turns as smooth as possible avoiding any restrictions.
For residential design the target static pressure should not be greater than 0.3".

Caution: Observe the location where your ductwork is being attached to the unit. Ensure that drilling and screws do not damage the air coil.

4.1 Hydro-Temp System Noise and Vibration Isolation

A quality installation should be one where noise is not a complaint. A number of inexpensive features can be added to reduce noise and also aid in installation and maintenance. Flexible hose kits to the hot water loop will make for easy connection to the heat pump and the hot water tank and also reduce any noise being transmitted from the heat pump to the indoor plumbing. Next the heat pump and all associated water pumps should be installed on a shock-absorbing pad to isolate the heat pump from a hard surface floor. This pad will help stop the possibility of the cabinet being rusted out by trapped moisture under the unit. Flexible duct connections help to stop noise from the heat pump being transmitted through the metal ductwork. This collar also makes the connection of the heat pump to the ductwork a much simpler task. It is not recommended to hang the Hydro-Temp unit from the floor joist, but if this becomes necessary, adequate isolation MUST be provided to reduce unit noise and vibration from being transmitted to the rest of the building.

4.2 Air Filtering

To maintain good indoor air quality in a tight building, the air distribution system should have a high-efficiency air filter. To ensure proper unit operation, be sure to inform the building owner of the importance of proper maintenance and the maintenance schedule for the filter installed. Most air filters require monthly attention. On the first of every month the "CK Filter" button will appear on the main screen of the Protostar thermostat as a reminder to clean or replace the air filter. Press this button for instructions on how to reset the filter indicator after the filter has be cleaned or replaced. This feature can be turned off in the customer settings.

4.3 Construction / Remodeling

The Hydro-Temp system should never be run during any kind of construction or remodeling that would allow drywall, hard wood, or any kind of dust to be pulled in the system. Even with extra filtering dust particles can accumulate in the duct system causing unwanted dust

for years to come. It can also cause air coil clogging, condensate drain clogging, blower dust accumulation and many other problems to the system. Running the system during construction / remodeling will void the system warranty.

5.0 DHW & AHW Heating

There are two methods used by Hydro-Temp to heat domestic hot water. They are a standard desuperheater and on- demand priority hot water generation system. The standard desuperheater utilizes a small desuperheater coil as shown on the left of the picture, in-line with the hot gas circuit to heat water any time the system is on heating or cooling the space. The on-demand priority method utilizes a much larger coil and a sensor mounted on the DHW tank to monitor the tank temperature. The on-demand priority method will heat water any time the system is heating or cooling the space, as well as starting the system as needed to heat the DHW tank. When running to heat the DHW tank alone, the blower will not run.
The AHW option is similar to the DHW on-demand priority hot water generation system. It too will have a sensor mounted on the buffer tank, infloor lines, or pool lines. Just like the DHW on demand option the AHW will have adjustable set points to start and stop the AHW heating operation. In some cases one wire to the AHW sensor can be broke with a set of dry contacts provided by infloor or pool control systems for third party control. Since the AHW system is deactivated when the sensor temperature can't be read this provides an external method of controlling the AHW with other systems.

5.1 DHW Tank Preparation

If a hot water heating option is to be installed, electric domestic hot water (DHW) tanks are regularly used, although other fuel types are sometimes acceptable.

1. Turn off the power supply or the fuel supply to the DHW tank.
2. Close the cold water supply valve to the DHW tank.
3. Attach water hose to the tank drain connection and empty the tank to a drain or outside.
4. Open the pressure relief valve or faucet nearby to break the vacuum inside the water system to speed up the draining process.
5. After the tank has been drained disconnect the hose and remove the DHW tank drain fitting.

5.2 Desuperheater Option Installation (Only copper tubing should be utilized)

Install the desuperheater circuit similar as shown in Fig. 5.2. Include isolation valves and two boiler drain valves for tank draining and DHW system purging. Valves allow for pump service without draining the DHW tank. A horizontal swing check valve must be used to prevent over heating of the tank. Use 1/2" copper tubing if up to 30' tank distance. Over 30' adapt up to 3/4" copper pipe for lower DHW pressure drop.
Remove existing drain port from the hot water tank and insert a standard dielectric fitting (thread the male end of the fitting into the water heater drain port using a P. T. F. E. based thread sealer) and continue with installation as shown. Insulate all desuperheater circuit piping with pipe insulation.

5.2.1 Dual tank Preheat method Hot water loop hookup.

Figure 5.2 shows the dual tank preheat method. The preheat tank (Tank 1) is not powered and is heated to 116 ºF solely by the Hydro-Temp unit. The second tank (Tank 2) is powered but receives "heated" water from the preheat tank. The second tank will only turn on occasionally to replace its heat loss.

5.3 On-Demand Priority Hot Water Generation Option Installation
(Only copper tubing should be utilized)

Install the priority hot water circuit similar to the desuperheater circuit. Size the copper according to the fittings on the Hydro-Temp unit. Install all insulation, ball, and check valves as discussed with the desuperheater system. The horizontal swing check valve is critical on all priority systems to prevent over heating of the DHW tank. **Never use plastic fittings (CPVC or Pex) when connecting between the tank and the Hydro-Temp system. Only copper or brass should ever be used. Failure to do so could result in damage to system and home!**

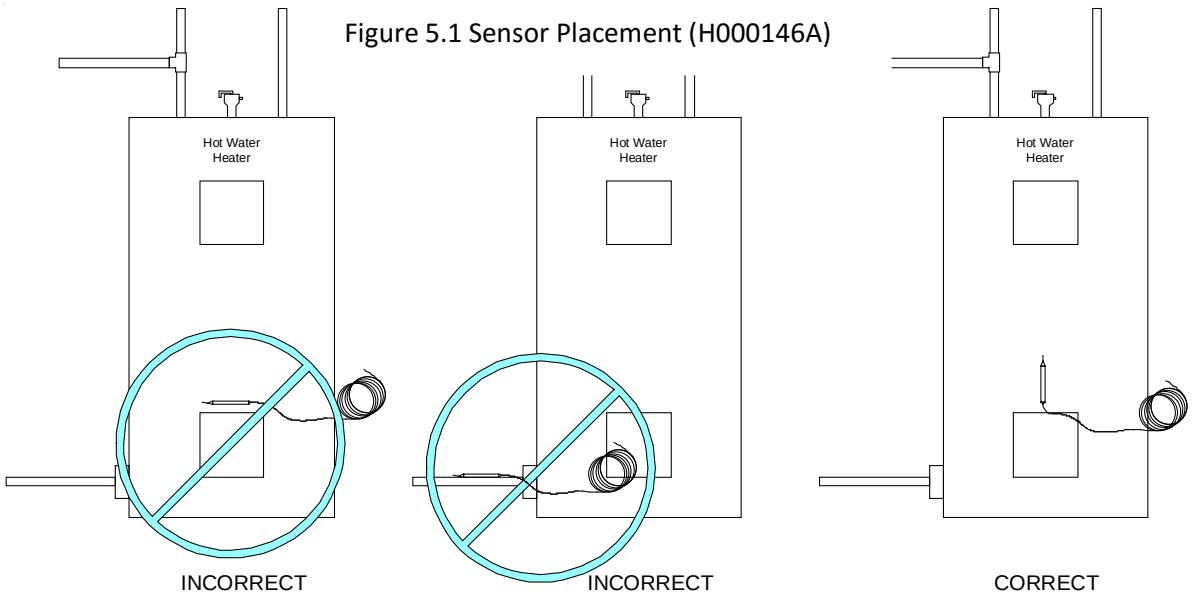
5.4 Priority Hot Water DHW & AHW Sensors

Systems with the DHW on-demand priority hot water generation or AHW will include a few extra sensors. Most are internal to the system and require no field installation. The domestic hot water tank sensor must be mounted directly on the hot water tank. This sensor will allow the Hydro-Temp unit to turn on and off as needed to heat the hot water. The sensor should be installed vertically above or beside the bottom element between the steel tank and the insulation as shown in the illustration below. Vertical mounting provides proper surface contact between the sensor and the round tank. The sensor must be tight against the tank and well insulated. Proper installation of the sensor is critical. If the sensor were to come loose, the system could easily overheat the tank, damaging the tank and/or the Hydro-Temp system. After installation make appropriate wiring connections to the Hydro-Temp system. Wire the two legs of the sensor to the terminal strip labeled "DHW Temp". The DHW & AHW tank sensor will be shipped with one of the two wires connected to the terminal strip inside the electrical box of the Hydro-Temp system. The other wire is intentionally left loose so the system will recognize no sensor is connected.

5.5 DHW & AHW Pump

On DHW or AHW on-demand priority hot water generation systems 6 tons and below, a 3 speed 230 volt stainless steel Pump comes standard with every DHW, AHW and Infloor option to be field installed next to the unit. This pump must be able to pump 2.5 – 3 G.P.M. per ton through the unit and all associated piping. This pump will be powered directly off the terminal block labeled "**DHW Pump 230 Vac" or** "**AHW Pump 230 Vac"** located in the unit's electrical panel.

Figure 5.1 Sensor Placement (H000146A)



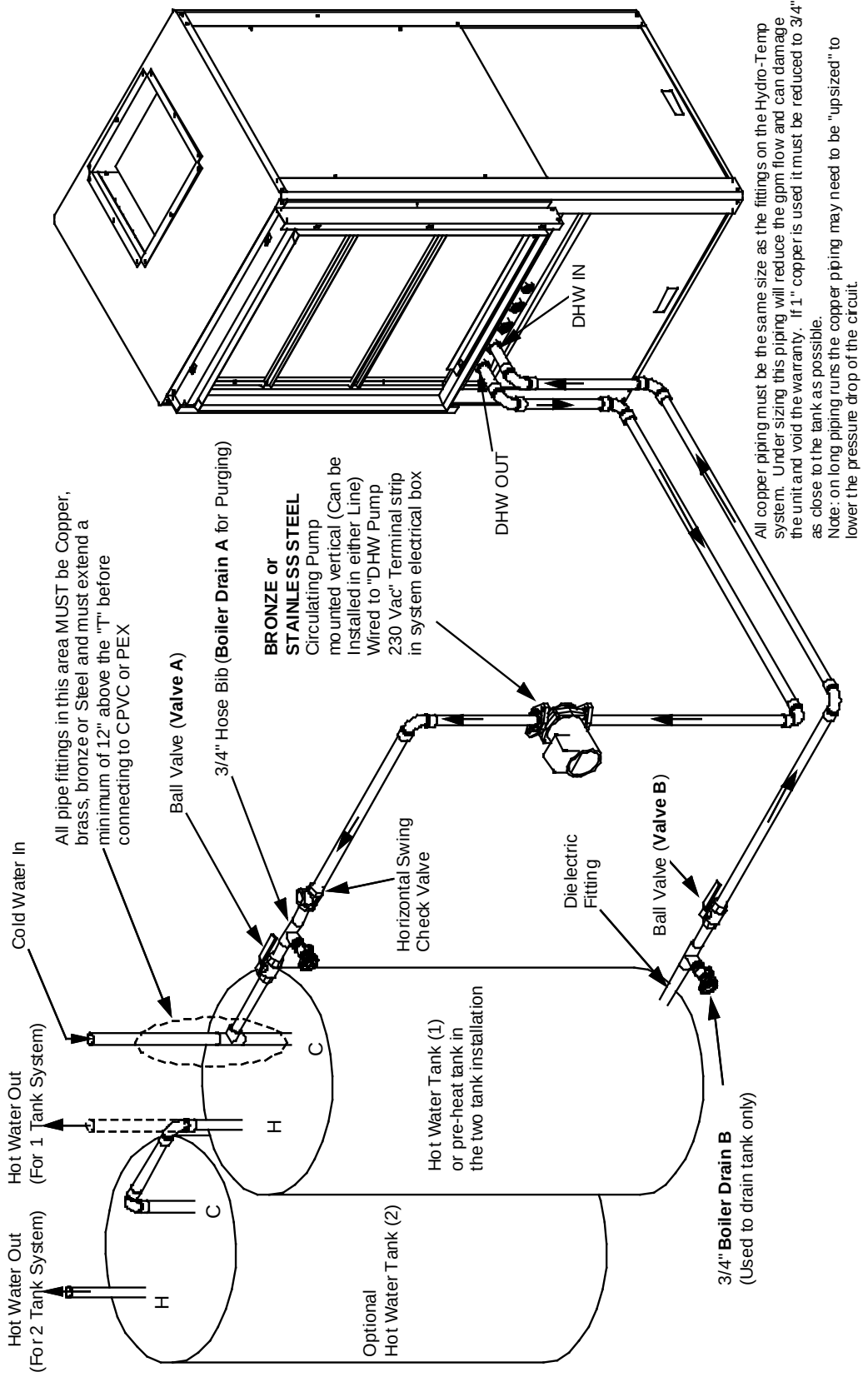


Figure 5.2 Hot Water Tank **Only copper tubing should be utilized** (H005672B)

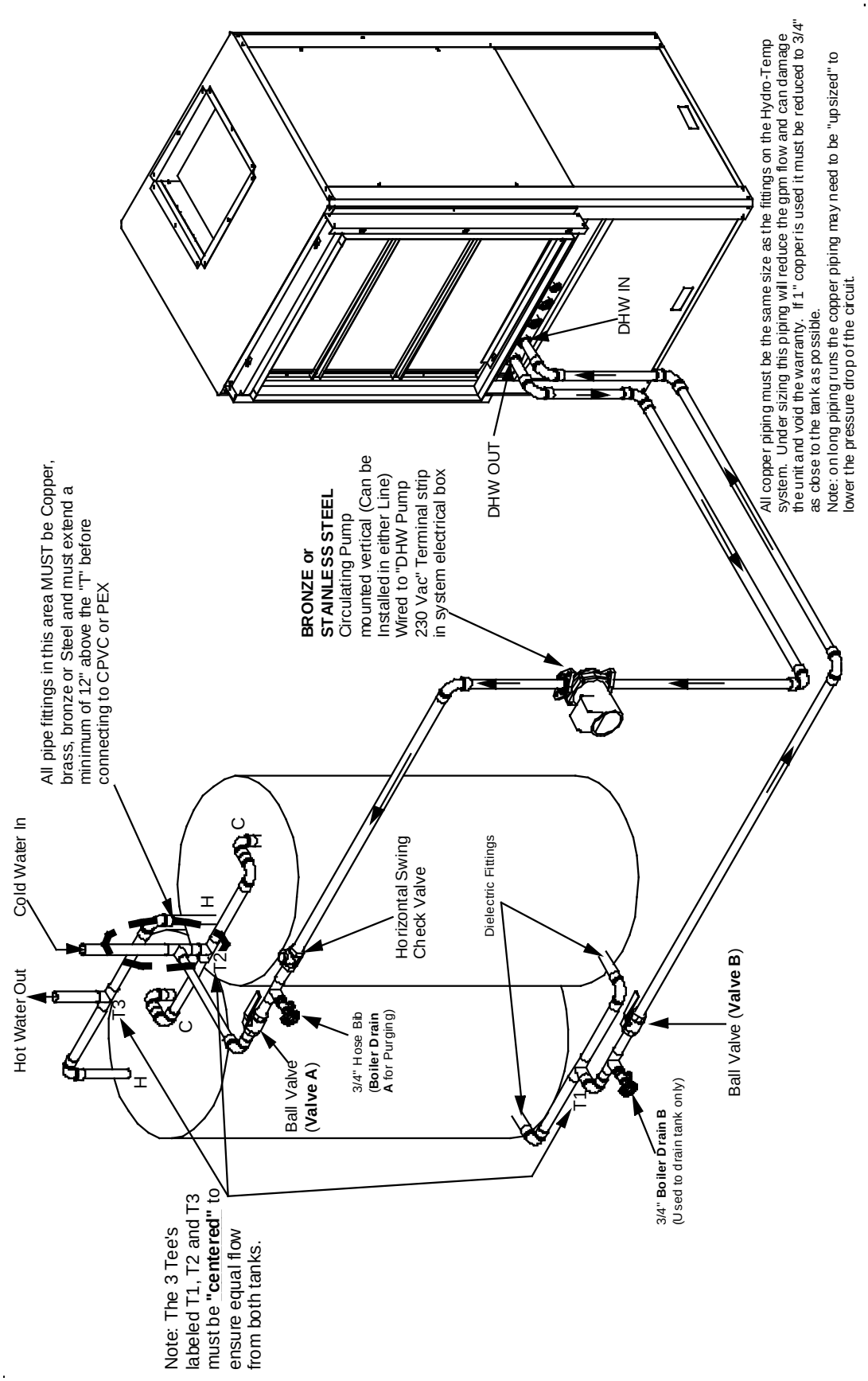


Figure 5.3 Dual Tank Hot Water **Only copper tubing should be utilized** (H005673B)

UPPER DHW Plumbing Fittings (connecting into cold water line on the top of the tank)

*Important: 1.) All fittings on the cold water line where the plumbing (below) connects to the tanks cold water line must be either copper, brass, bronze, or steel from 12" above the "T" to the tank.

2.) No other water lines can be connected between the "T" and the tank.

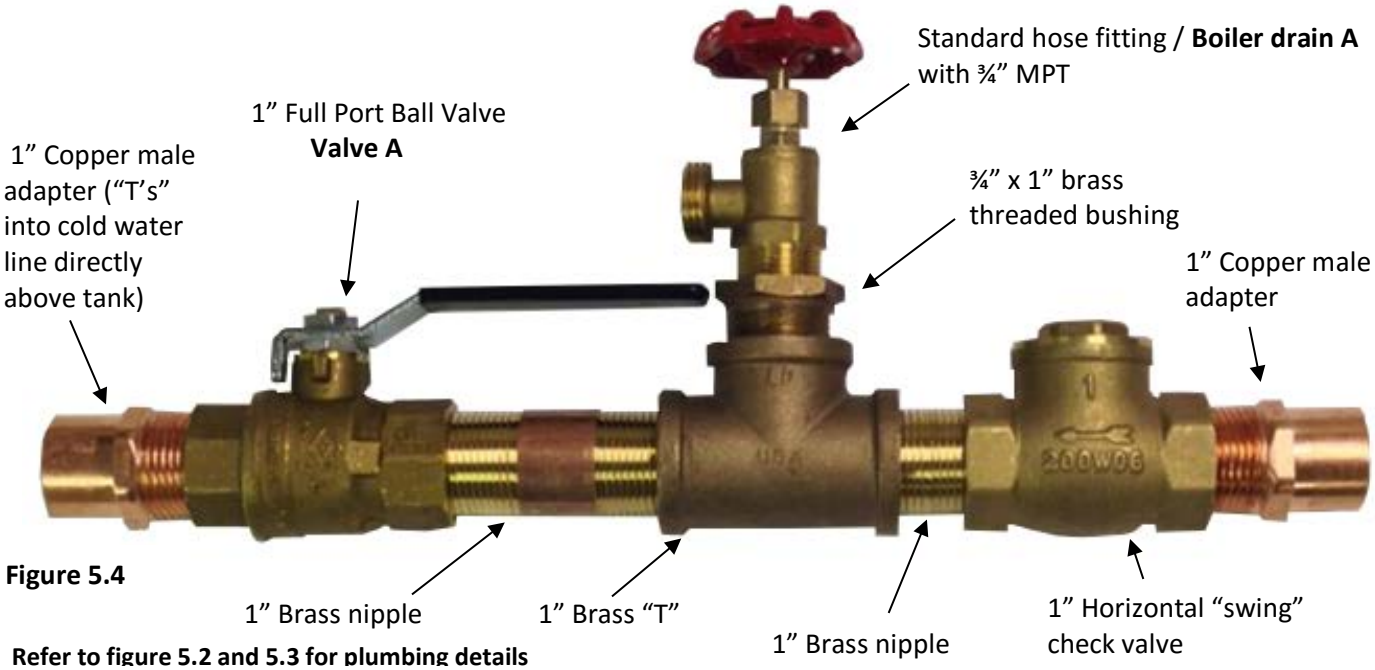


Figure 5.4

Refer to figure 5.2 and 5.3 for plumbing details

LOWER DHW Plumbing Fittings (connecting into bottom of the tank)

*Important: Most water heaters have ¾" fittings. It is important to increase pipe sizing to 1" (3-6 Ton Priority water heating units) in as short a distance as possible in order to assure proper water flow.

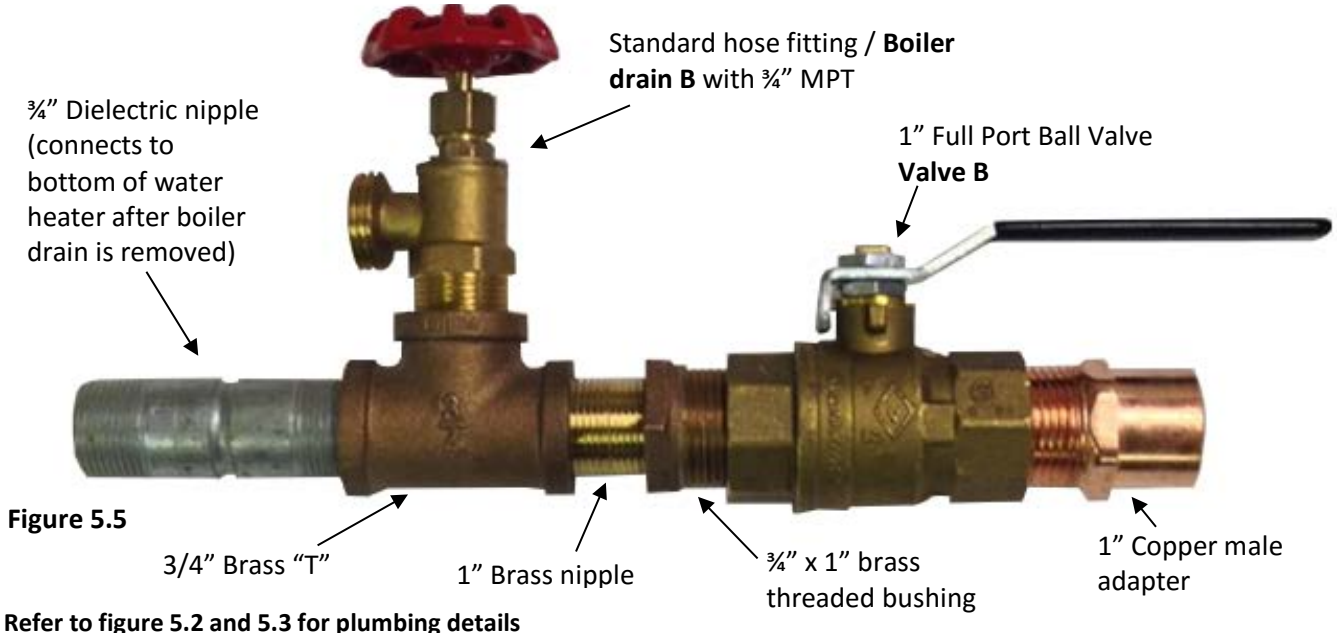


Figure 5.5

Refer to figure 5.2 and 5.3 for plumbing details

5.6 Purging the air from the DHW and AHW System

All the air must be purged from the DHW and AHW lines before the system can be run to make hot water. Improper purging will result in air in the pump causing the pump to cavitate and damage the pump. Systems are shipped from the factory with biodegradable RV antifreeze pumped into the DHW and AHW coils. If proper purging methods are followed this anti-freeze will easily be purged from the system.

5.6.1 Filling the Hot Water Tank

Close boiler drain valves and the isolation valves to the Hydro-Temp system. Open the cold water supply feeding the DHW tank. Open a hot water tap in the building and allow air to bleed out of tank. Alternatively you can depress lever on the tank relief valve to remove air trapped in the tank. Once the building plumbing is purged it is important to purge the air that is remaining in the Hydro-Temp system and plumbing between the hot water tank and the Hydro-Temp system. *Purging the building plumbing even with the isolation valves open to the Hydro-Temp system will not purge the air from the Hydro-Temp system.*

5.6.2 Purging the Hydro-Temp Hot Water Loop

Attach a hose to the boiler drain A (refer to figure 5.2) and run the hose to a floor drain or outside. Close the isolation valve B at the bottom of the DHW tank. Open the isolation valve A at the cold-water inlet on the DHW tank and allow the water to flow out the hose. Allow the water to run for a few minutes while checking for air leaving the drain hose. Once all of the air has been purged, close isolation valve A and open the isolation valve B. Allow the water to flow through the system and out the hose. Run for approximately 5 to 10 minutes while checking for air leaving the drain hose. To insure no air is trapped anywhere, open both valve A and valve B to allow flow both ways. Allow water to run for approximately one minute. Once purging is complete, close the boiler drain valve, remove the hose and ensure that both isolation valves “A & B” are open. Wiring to the DHW pump is normally left unwired in the Hydro-Temp’s electrical box and tagged with the proper reconnection location. This wire should only be hooked up after the system is properly purged to prevent pump damage.

5.7 Setting Hot Water Temperature

Refer to the hot water section of the Protostar user manual. Here you will find how to set the set points for DHW (Domestic hot water) heating and AHW (Auxiliary hot water) heating. Note: Auxiliary hot water heating normally refers to “infloor” or “Pool” heating.

5.8 Plumbing to a Marathon Hot Water Tank.

When plumbing the Hydro-Temp hot water heating system to a Marathon hot water tank you need to keep a couple of things in mind. All fittings must be mechanical fittings at the tank; due to the tank being plastic you cannot solder or braze close to the tank. The direction of flow in and out of the tank and plumbing is the same as with a steel tank. **Never use plastic fittings (CPVC or Pex) when connecting between the tank and the Hydro-Temp system.**

Take note of sensor location. Please refer to section 5.6 for best sensor installation practice.

In some cases an adjustment to the desired temperature must be adjusted due to the high R value of the plastic tank, as mentioned in section 5.6

6.0 The Ground Loop System

IMPORTANT! Do **NOT** use PVC or CPVC piping on any connections to your Hydro-Temp unit. The only exception where PVC or CPVC piping may be used is on the condensate lines.

6.1 Closed Loop Systems Plumbing

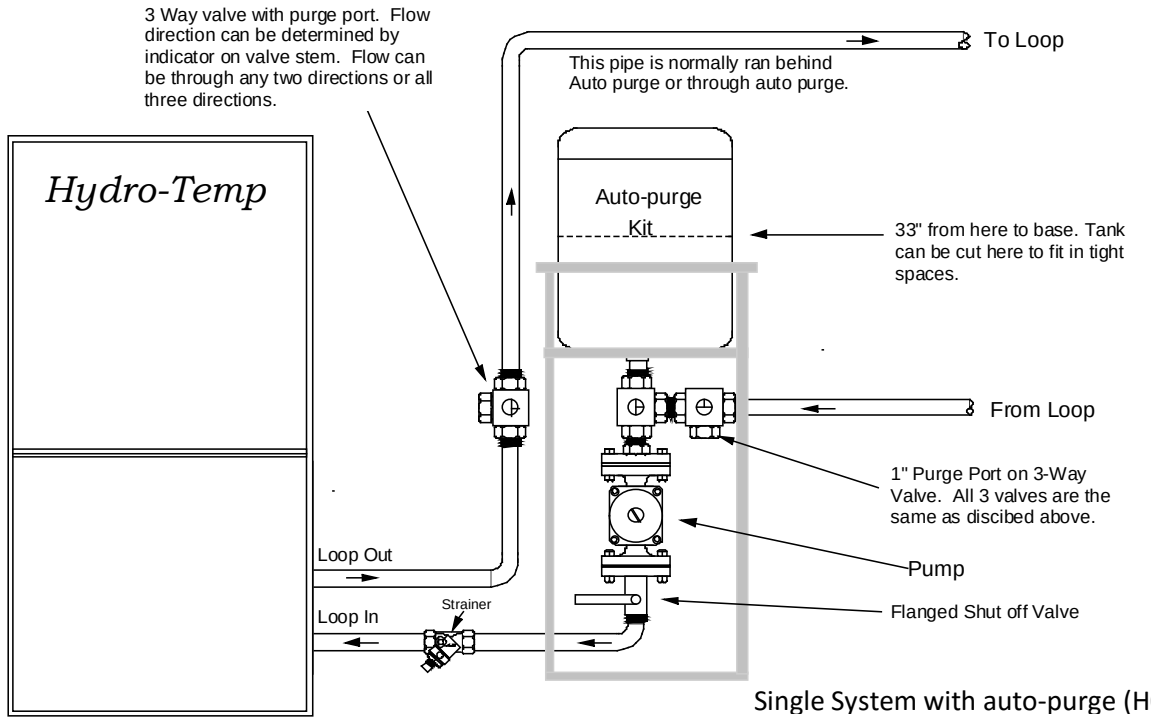
Closed loop systems will require a minimum of 3 G.P.M. per ton if the ground loop is designed to maintain a loop temperature above 32ºF and below 90ºF. If design temperatures are outside of these temperatures more flow will be needed.

On residential systems typically a pump is required for each unit. The loop pump requirement will depend upon the loop design for a given application. The ground loop piping system must provide suitable access for purging the outside loop and require isolation valves for purging the inside plumbing including the system. To properly purge a closed loop system, a **minimum** velocity of 2 feet per second in every branch of the ground loop must be achieved. The purge ports will also be used for anti-freeze charging.

IMPORTANT NOTICE: UNITS THAT UTILIZE GROUND LOOPS MUST MAINTAIN A MINIMUM OF 20% METHANOL OR 25% PROPYLENE GLYCOL AS ANTIFREEZE SOLUTION IN THE UNIT AND GROUND LOOP AT ALL TIMES. FAILURE TO DO SO WILL FREEZE THE SYSTEM AND CAUSE SEVERE DAMAGE TO THE UNIT. DAMAGE TO THE UNIT CAUSED BY THE FAILURE TO MAINTAIN PROPER ANTIFREEZE LEVELS IS NOT COVERED UNDER THE WARRANTY.

A Y-Strainer must be installed on the "Loop In" line as shown in the drawings below. Failure to do so could cause severe damage to the unit and void unit warranty.

It is recommended to always mount the ground loop pump **vertically** so air will not be trapped in the pump if not properly purged. A dry or air locked pump will quickly burn out.
The recommended auto purge kit (shown below) is designed with the pump mounted vertically and tees strategically placed to purge air from the system and into the auto purge tank automatically while running (this should be used to remove small amounts of air left after purging the system with the purge pump, or a system pump replacement). The auto purge kit is **not** used in place of purging the system but is left on the system to purge the loop continuously. Systems with the auto purge kit are not pressurized.

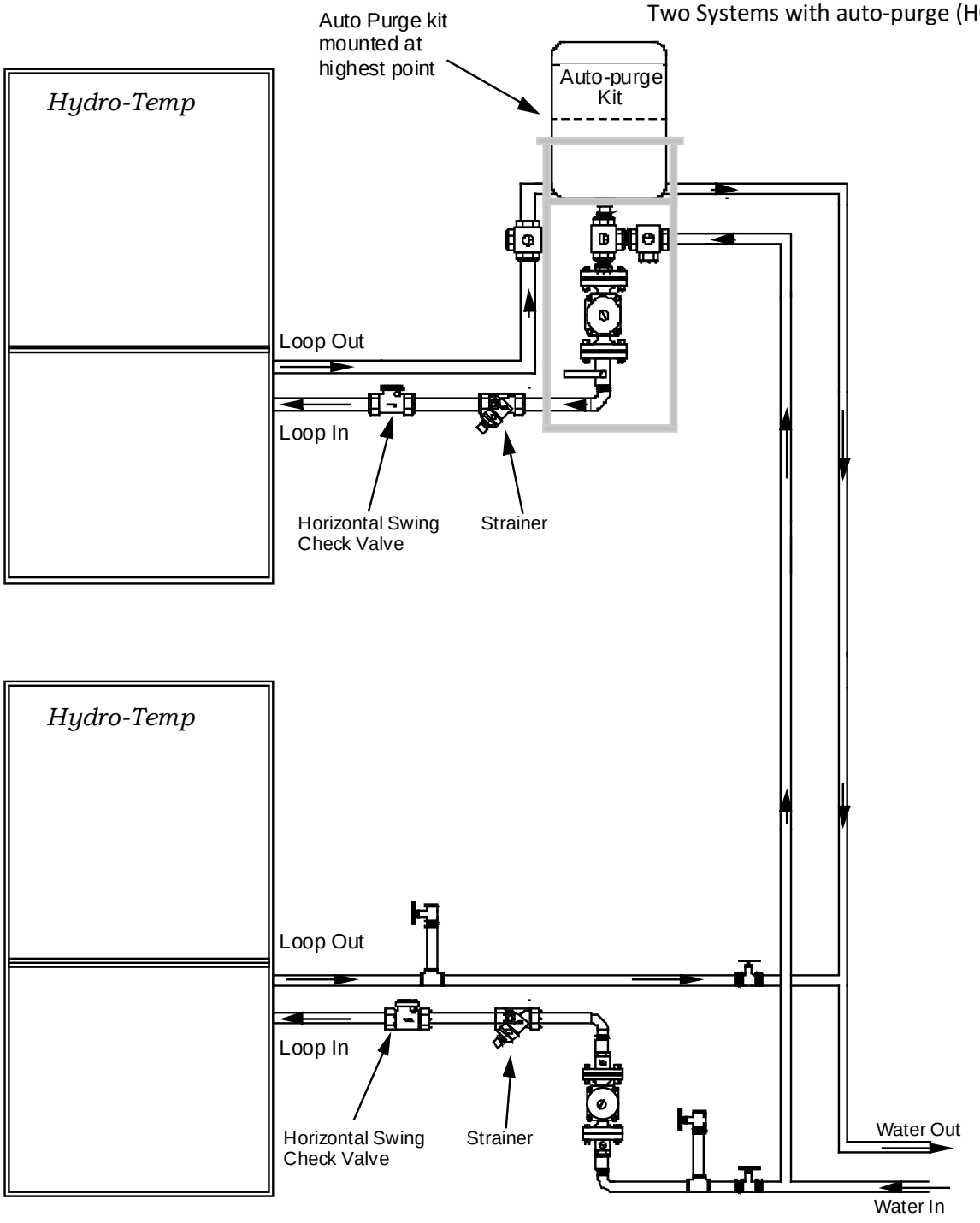


Single System with auto-purge (H000047A)

6.2 Closed Loop with two or more Systems

When two or more units are connected to one loop, **ONLY ONE** auto purge kit is used. It is best if installed on the highest unit at the highest point but does not have to be higher than the loop field. Check valves and a Y-strainer must be installed on each unit to prevent backward water flow when the unit is off. The auto purge keeps proper pressure on the suction side of the pump to prevent air locking or cavitation from occurring. The tank must be kept ½ to ¾ full at all times. As shown in the drawing below, the other unit(s) simply need to have a pump for each unit.

Two Systems with auto-purge (H0001776)



6.3 Purging the Closed Loop

Purging of the ground loop and system should only be done after it has passed the air pressure check and all leaks have been repaired. Purging should be done by installing dealer or sub-contractor.

1) Connect purging unit to purge ports.
2) Close both isolation valves to the unit, close the isolation valve to the optional auto purge tank, open both isolation valves to the loop and open both purging ports connected to the purging unit. Be aware most pump flange kits have built in isolation valves. In some cases as shown in most of our drawings a three way valve will be used where flow can be straight through only, straight through and through tee, or completely off.
3) Fill the purging unit water reservoir so that the water level is above the return line. (If possible your anti-freeze should be added here as required. When purging in methanol it should be diluted to 50% methanol and 50% water for safety until the required amount has been added
4) Start the purge pump. Make sure the water is always above the supply water line. This will prevent any splashing and prevent extra air from entering the loop. Use a strainer to try and catch any debris returning to the purging unit. Turn the purge pump off and on as needed while refilling the reservoir. Once a solid flow is established it is EXTREMELY important to maintain a minimum flow velocity in any section of pipe of 2 ft/second. It may be necessary on very large residential loops to close off some sections of the loop field to maintain this velocity. Most very large residential or commercial loop fields are purged one section at a time.
5) Purge the loop for about 10 minutes after all micro air bubbles are gone. Micro air bubbles will often appear milky and restrict the view to the bottom of the purge reservoir. Close the inlet valve of the purging unit with the pump running for about 5 seconds. This will "dead head" the system. In other words the internal pressure of the loop will be increased. Important: Watch for any significant drop in the water level of the reservoir, if the water level in the purger drops more than one or two inches, this will indicate the presence of air in the loop. If there is a large water level drop continue purging in the same direction. "Dead heading" the system will provide bursts of high pressure through the system. This will help dislodge any difficult air pockets. "Dead heading" can be done at any time and can speed up the whole purging procedure.
6) Keep purging until no more air is seen coming out of the loop into the Purging unit reservoir. "Dead head" the system again and watch for any significant drop in the purger's water level. If after “dead heading” multiple times the water level still drops more than an inch then you may need to reverse the purger lines to purge through the loop in reverse repeating steps 4 – 6. Be aware of any check valves that may be between the purge ports and the ground loop.
7) Once the outdoor loop is purged and free of debris, the indoor loop can be purged. The first step is to perform a cleansing purge of the indoor piping. This is done by bypassing the equipment by either using a bypass valve at the unit or having the supply and return hose kits connected together. The important thing is not to allow any debris to enter the unit. Once the cleansing purge has been completed, attach the hose kits to the units and purge the units. All of the indoor purging will follow the same procedure as described for the outdoor loop.
8) If no auto purge is used the system will have to be pressurized. Most purging units will generate enough pressure by “Dead heading” the system with both the unit and the ground loop isolation valves open.
9) If an auto purge is used you can now disconnect the purging unit. Use the left over water from the purging unit reservoir to fill the auto purge tank. Open the isolation valve on the Auto purge tank.

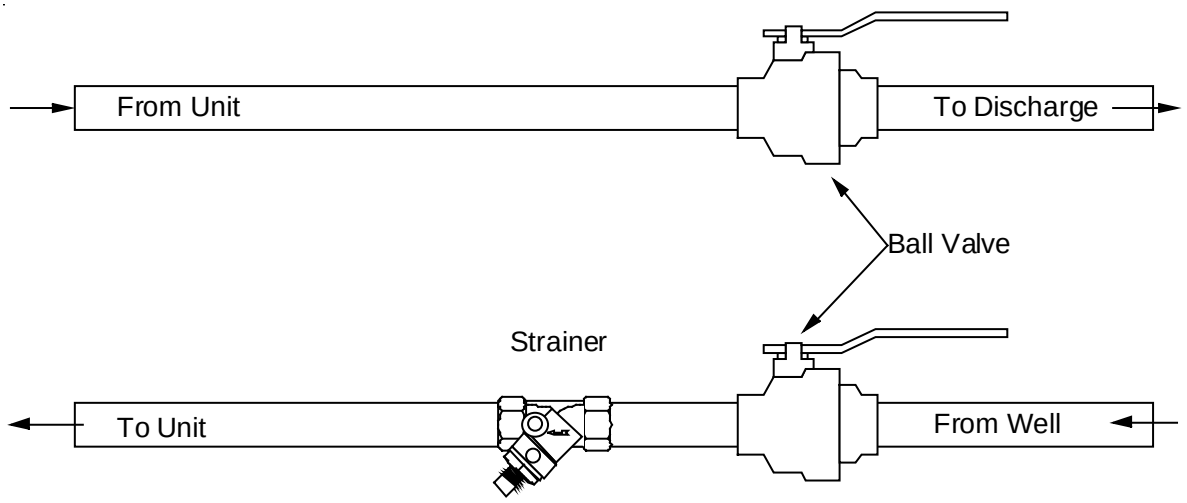


Figure 7.1 Typical Open loop plumbing Components (H00046B)

7.0 Open Loop Systems

A well of sufficient capacity and good water quality are the only acceptable water sources for Open loop Systems.

Caution: To prevent unreliable operation and component damage, do not pump pond or lake water directly through the units.

7.1 Open Loop System Plumbing

Assemble well water components in the same order as shown in fig. 7.1. A 18 to 20 mesh strainer is recommended. Use a water strainer to keep debris out of water regulating valves and heat exchanger. Ensure strainer is situated to provide easy access and maintenance. Provide isolation valves and instruct end user on how to isolate the system and clean strainer. Some wells have excess debris which can restrict the unit's strainer in a short period of time. If this is the case replace the existing strainer with a larger capacity 18-20 mesh strainer. A strainer with more surface area will have to be cleaned less often.
Ensure the water flows through the unit and out the discharge with no leaks.
Discharge water should run outside with no restrictions, to a discharge well, creek, pond or where ever water is needed. Never connect the discharge water line directly to a sprinkler as this will restrict the water flow and lower the unit's efficiently, and possible cause damage to the unit. ***Check local state and county codes for proper discharge of water.*** Discharge tubing must be prepared in a manner that will not freeze.

Normally 1 to 2.5 US G.P.M. per heating or cooling ton (in high speed) is required for open loop systems. Water flow is regulated with pressure regulated water control valves. On all well water systems a Belimo motorized water valve is also provided to turn off the water flow when the unit shuts down. In installations where the groundwater temperature is expected to fall below 50°F during any part of the heating season, perform a calculation to anticipate higher flow rate requirements. A higher water flow rate results in a lower temperature drop through the liquid to refrigerant heat exchanger. This prevents the Freeze stat from activating unnecessarily. The Freeze stat helps protect the liquid to refrigerant heat exchanger from freezing internally. Freeze protection is accomplished by measuring the refrigerant temperature exiting the water coil in the heating mode. If this temperature drops below the freeze set point the system will activate the freeze / defrost routine then lock out until manually reset.

7.2 Open Loop System Pressure Regulating Valves

Open Loop system will come standard with pressure regulating water valves to be field installed. These valves (one for heat and one for cooling) will come plumbed together and will need to be field installed into the loop inlet water line between the system and the water strainer. Refrigerant access fittings will be

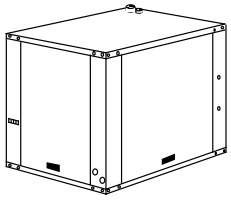
provided next to the loop in and loop out lines for the refrigerant connection. Fittings and lines are labeled accordingly. Water flow settings are factory set.

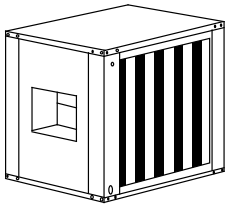
8.0 Condensate Considerations

Make provision for a condensate drain connection. Some installations require a condensate pump to take the condensate to a suitable drain. All Hydro-Temp systems have a negative pressure on the condensate drain so a P-trap is required on all systems. A vent is only necessary if possible double p-trap conditions apply. Double p-trap is commonly caused by un-level drain piping that allows standing water to create a second p-trap condition. If the system has two or more p-traps an "air lock" will occur and the system will not drain. The vent should only be installed downstream of the p-trap at the unit. Never install a vent between the unit and the p-trap as this will negate the purpose of the p-trap. It's common practice to install extra tees near the Hydro-Temp system to allow access for pouring drain cleaner down the condensate drain, insure all extra openings are capped off or are plugged.

Never run the condensate drain in to the same line as the discharge water of a well water system. If the discharge were to become clogged the back pressure would backup through the condensate and cause severe water damage.

8.5 Split System installation





8.5.1 Split System Pipe Sizing

The installing technician must use acceptable refrigeration trade piping practices such as correct pipe sizing, liquid / oil trapping and line set gradients for reliable operation. Blower sections can be located up to 100 equivalent feet away from the compressor section with a maximum of 30' of rise.

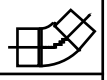
Nominal Pipe Size (ins)	90° Std	90° Long	90° Street	45° Std.	45° Street
					
3/8"	1.4'	0.9'	2.3'	0.7'	1.1'
1/2"	1.6'	1.0'	2.5'	0.8'	1.3'
5/8"	1.8'	1.0'	2.9'	0.9'	1.5'
3/4"	2.0'	1.4'	3.2'	0.9'	1.6'
7/8"	2.3'	1.6'	3.7'	1.1'	1.9'
1"	2.6'	1.7'	4.1'	1.3'	2.1'
1-1/8"	3.0'	2.0'	4.9'	1.5'	2.6'
1-1/4"	3.3'	2.3'	5.6'	1.7'	3.0'
1-3/8"	3.7'	2.5'	6.0'	1.9'	3.2'

Table 8.5.2 Equivalent Lengths of Pipe Fittings

Determine the pipe sizes required for split system line sets from the unit by using the following "Equivalent Footage" calculation.

Total length of line set = Pipe Length (ft.)
+ Equivalent Length of Fittings (ft.)

For example -
Length of Liquid (7/8" Material) = 50.0'
Fittings are 4 long elbows, (4 x 1.6' each)

Equivalent Length of fittings, from Table 8.5.2 = 1.6'
each x4 fittings = 6.4' Equivalent Length
Total Equivalent Length =50.0' pipe plus 6.4' in fittings
so Total Equivalent Length equals 56.4'

8.5.2 Split System Line Sizes

Tonnage	20 -100 Equivalent Ft.	
	Hot Gas	Liquid
1 – 2 Ton	5/8"	1/2"
2 ½ - 6 Ton	7/8"	5/8"

Table 8.5.1 Split System Pipe Sizes

Line sizes can be selected from Table 8.5.1 after performing the "Equivalent Footage" Calculation.

8.5.3 Split System Electrical connections.

Split System High voltage connections: The high voltage required for the blower section is 230 volt AC. This is normally powered from the compressor section but can be supplied from any 230 volt supply. A terminal block is located in the blower section and the compressor section labeled P1, P2, and P3 (P3 = ground). Wire P1 from the compressor section to P1 in the blower section, wire P2 from the compressor section to P2 in the blower section and so on.
Split System Low voltage connections: A low voltage terminal strip is located in the blower section and in the compressor section labeled S1, S2, S3 and so on. Depending on system model these terminals control the blower speed, optional strip heat and optional temperature sensors. Just like the high voltage block these two terminal strips must be wired together by wiring S1 in the compressor section to S1 in the blower section, S2 in the compressor section to S2 in the blower section and so on.

9.0 Low & High voltage Connections

Always use caution when working with or around electrical wiring or connections!
When running high and low voltage wire into electrical box always leave enough slack to swing out or remove the electrical box. The electrical box can be swung out by removing one screw from the bottom of the box. Then if desired the **box can be lifted out** for easy servicing behind box. This only works if slack is left in the field wiring.
The controller is mounted on a **Swing out panel** that hinges out to provide access behind the panel. Some terminal strips or electrical components are normally located behind the controller swing out panel.

9.1 Main system Power

Size all wire in accordance to local electrical code. Main power will land on the top of the large distribution block in the electrical box labeled **L1** & **L2**. An additional L3 terminal will be provided for 3 phase equipment. A green ground lug will also be provided for the ground wire.

9.2 Pump outputs

A terminal strip will be provide for each pump output that applies. Each will be labeled as needed. Examples are:

- DHW Pump 230Vac
- AHW Pump 230Vac
- Loop Pump 230Vac

9.3 Master Switch

On systems with controllers an exterior **master switch** is located on the front right corner of the unit. The purpose of the switch is to disable the unit from running without turning off the power.
Caution **MUST** be taken when opening the unit for service work as the master switch does not disconnect power. The unit is still powered with the master switch off. This switch is useful when needing to shut down the system for filter replacement or system operation is not needed but thermostats are to remain powered. Cycling the master switch will also reset any system lockouts.

If needed, other items such as a condensate drain pan float or building automation on/off switch could be wired in series with the master switch for system control. The master switch is normally closed from input to ground, it opens to shut down the system.

9.4 Temp Sensor

A terminal strip will be provided for all field mounted temperature sensors. Example of labeling would be:

- DHW Temp
- AHW Temp

9.5 Belimo motorized valve (Open loop or well water)

As mentioned in section 7.2 pressure regulated water valves are used to regulate the water flow, a belimo on/off valve is used on all well water systems to start and stop the water flow. The water valves and belimo may be shipped with the unit and require field installation and wiring. If field wiring is required a terminal strip labeled Belimo valve will be provided. This is a 3 wire connection including common, power open and power close.

9.6 Occupied / Un-occupied

A terminal strip for building automation systems (BAS) is provided to force the system into occupied mode or un-occupied mode (Home or away). The terminal strip will be labeled "Occupancy Sensor". This terminal strip leaves the factory jumped which forces the system to be occupied all the time. When the jumper is removed or broken by the BAS the system will go un-occupied unless schedules are set up in the Protostar touch screen. For more information about schedules in the Protostar see section 10 in this manual.

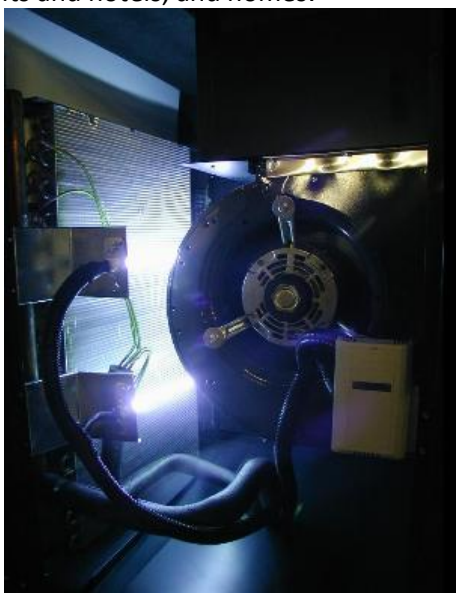
9.7 Optional Ultra Violet Sanitizer.

A Hydro-Temp Option for a Healthier Environment

The Purifying Power of Sunlight

For more than 50 years, scientists have known that one of the most effective sterilizers of airborne contaminants is natural sunlight. Not the light we see when we look out the window, but the invisible ultraviolet rays. The most powerful part of the UV wave is called the "C" band, and that's what the ultraviolet air purifying system uses to destroy and reduce micro-organisms in the air.

The Air Purifying System is a safe, silent, and proven way to make your conditioned space a healthier place to live. The Air Purifying System has been proven effective in hospitals, schools, daycare centers, restaurants and hotels, and homes.



Installed directly inside your Hydro-Temp System, the Air Purifying System silently and effectively reduces airborne contaminates such as:

Molds

Dust Mites

Yeasts

Bacteria

Viruses associated with Allergies and Sick Building Syndrome

FACTS YOU SHOULD KNOW

The air circulating through the Hydro-Temp system in your home or office can be some of the poorest quality anywhere. Molds, bacteria, yeasts, dust mites, viruses—all could be present in every breath you take. You fill your lungs up to 20,000 times each day. Over time, these contaminants become concentrated causing allergies, inflammation of the mucous membrane, upper respiratory problems, asthmatic conditions, headaches and even flu-like symptoms.

Indoor air can contain up to 100 times more airborne contaminants than outside air.

Indoor air quality problems, often referred to as Sick Building Syndrome, cost North Americans over $100 billion each year in health care, absenteeism, lost production and lost revenue.

65 to 75 percent of infections and allergy sources are passed from person to person through the air.

Airborne contaminants cause diseases such as influenza, hepatitis, tuberculosis and pneumonia.

HOW DOES THE SYSTEM WORK?

The Ultraviolet Air Purifying System uses the energy from a specially designed, high-intensity UV-C bulb to kill micro-organisms that cycle through your heating and cooling system. Mounted inside the unit, the Ultraviolet Air Purifying System sterilizes contaminants as they pass by the UV bulb.

The process requires very little maintenance and costs just pennies a day to operate. The Ultraviolet Air Purifying System could be one of the best health and comfort investments you will ever make.

The ultraviolet bulb needs to be replaced every 18 months.

A factory mounted UV on/off switch is located on the front of the system for servicing the blower section.

Caution: Exposure to UV light when in operation with the blower section cover removed can cause Sever burn / eye damage. Always remove power when servicing UV light.

The Ultraviolet system can be factory installed into all Hydro-Temp systems or retro-fitted into any Hydro-Temp system. The UV bulb ships

The UV light mounting bracket and plug will be located in the blower chamber. The UV blub will ship uninstalled, in a box in the blower chamber in order to prevent breakage.

9.8 Optional Zone Damper Output

If the system was designed to control multiple zones, each zone will have a 3 position terminal strip for a damper connection. Each terminal strip will be labeled with the zone number and in smaller letters C, NO and NC.
C = 24Vac common
NO = 24Vac when damper is to open
NC = 24Vac when damper is to close

A maximum of 4 zones can be controlled. The number of dampers that can be used is limited by the power consumption of each damper.
Total damper power consumption from all 4 zones cannot exceed 40 VA. If power consumption is not equally spread between all 4 zones keep in mind no one zone can handle more than 16 VA.
For example the recommended damper motor the Belimo LMB24-3-T, is rated for 2.0 VA. Using this damper we could have 5 dampers on each zone output. For example if there were only 3 zones one could have two zones with 6 dampers and one zone with 8 dampers, but one could never have a zone with more than 8 dampers. Check the output of your dampers if not using the recommended Belimo damper, most other brands will pull much more wattage then the Belimo motors.

9.9 Thermostat Wiring

All thermostats for the advanced controller utilize communicating thermostats. Communication wire is required. Communication wire requirements are:

- Wire Gauge 18 AWG
- Wire Type stranded copper
- Wire insulation 0.009" low smoke PVC
- UL temp rating -40 to 75 deg C
- Jacket 0.0140" low smoke PVC
- 0.255" nominal O.D.
- Shielding foil, with drain wire. Drain wire should be connected to ground lug in system.
- Capacitance 47 pF/ft nominal
- Resistance 6.9 ohms / 1000 feet
- Maximum length 500 feet.

Note: For a priority system, **NEVER** install the T-Stat directly over the return air grill. Installing the T-Stat in this position can cause erratic system operation. This is due to the warm air at times rising out of the return when the unit is heating water.

9.9.1 Protostar Touch Screen Thermostat Wiring

The Protostar Touch Screen Thermostat is the standard thermostat used for zone one or the primary thermostat in a non-zoned system. No addressing to the Protostar is required because it's always considered zone 1.
The Protostar thermostat wires to a 4 position terminal in the electrical box labeled "Touchscreen". This terminal strip has a second label identical to the labeling on the Protostar thermostat. Connection is simply connecting D on the terminal strip to D on the Protostar, C to C, B to B and A to A.
It's important to note the Protostar thermostat is powered by 24 vac, always wire to the correct terminal strip provided and labeled in the electrical box.

9.9.2 ZS Thermostat Wiring

The ZS thermostats are used for zones two - four. The ZS thermostats are to be wired in series (daisy chain) with each other and require the address for each zone to be set on the thermostat. The address number is always the same as the zone number. For example zone 2 will be addressed 2, zone 3 will be addressed 3 and zone 4 will be address 4. There are 4 Address dipswitches on the back of the ZS thermostat. Dipswitch one has a value of 1, dipswitch 2 has a value of 2, dipswitch 3 has a value of 4 and dipswitch 4 has a value of 8. Turn on the dipswitches as needed to add up to the value of the zone you're installing the ZS into. Refer to Fig. 9.9.2 for zone thermostat dipswitch settings.

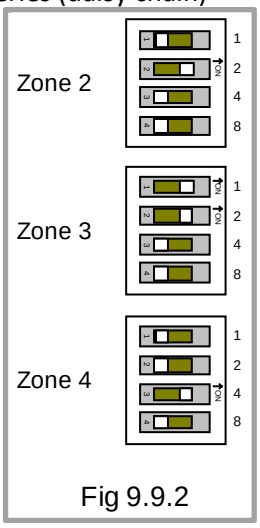


Fig 9.9.2

A 4 position terminal strip labeled "ZS Stat" is provided in the electrical box to wire the zone 2 ZS thermostat to. This terminal strip has a second label indicating wire termination labeled the same as the wire termination on the ZS t-stat. Simply connect "+12V" from the ZS stat to "+12V" on the terminal strip, "RNET-" from the ZS stat to "RNET-" on the terminal strip, "RNET+" from the ZS stat to "RNET+" on the terminal strip and "GND" from the ZS stat to "GND" on the terminal strip. Next the zone 3 ZS thermostat will wire to the zone 2 ZS thermostat. Then the zone 4 ZS thermostat will wire to the zone 3 ZS thermostat. This will complete the daisy chain connection as shown in fig 9.9.2.1.

It's important to note the ZS thermostat is powered by 12 vdc, always wire to the correct terminal strip provided and labeled in the electrical box.

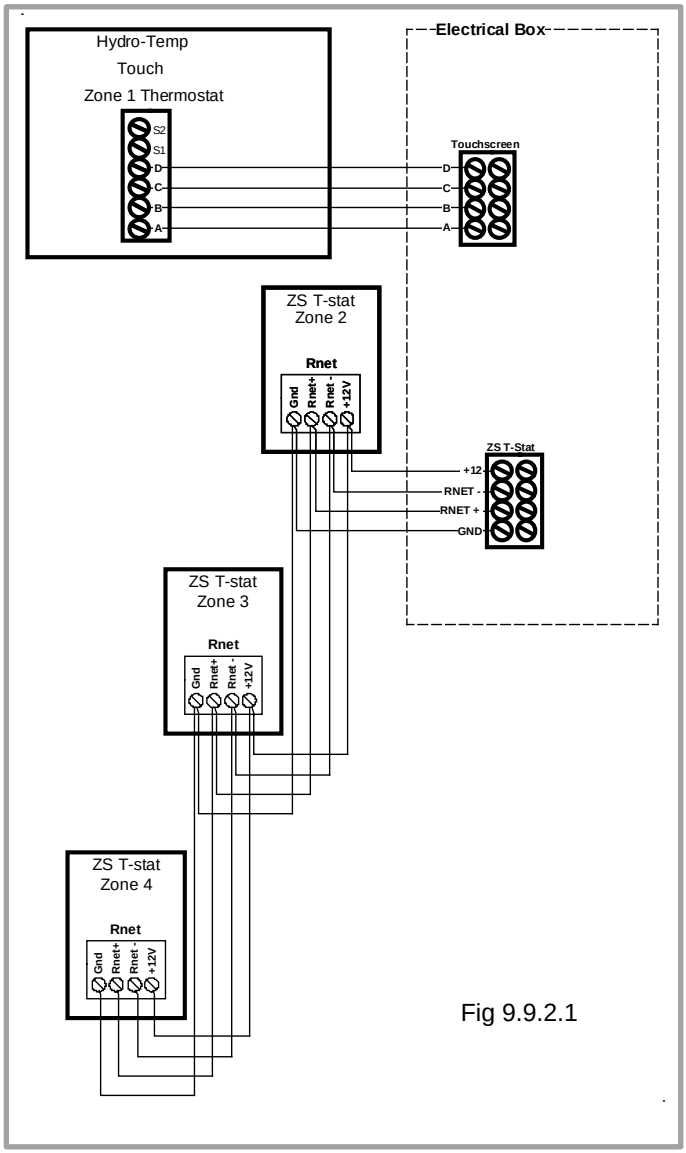


Fig 9.9.2.1

10.0 Protostar Thermostat Customer Navigation Instructions

The Protostar touch screen is the standard thermostat used for Zone one or the primary thermostat in a no zone system for all V-Star systems with the advanced controller. All of Hydro-Temp's system functions and settings are accessible through the Protostar advanced control. System status, set points, installer settings, factory settings, alarms, and logs are all accessible through the Protostar thermostat. Installer settings and factory settings are separately password protected to prevent inadvertent changes.

Screen Navigation

At the top left hand corner of every page you will find these two buttons. The only exception is the home screen which does not have the “Home” button

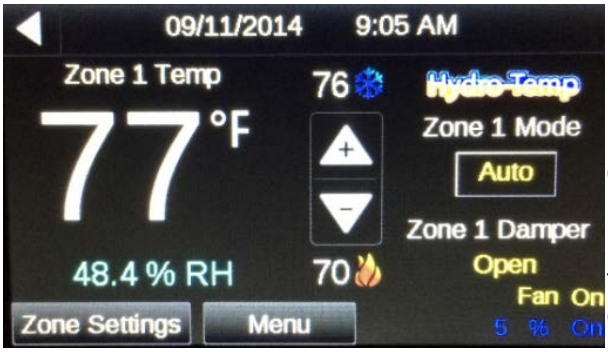
The “Home” Button will return you to the Home screen.

The left arrow or “Previous” button will return you to your previous screen

The bottom row will show navigation buttons including a **fault and Check Filter button** that will only be shown if the system is in a fault / check filter condition. (Neither Fault nor check filter button shown below)

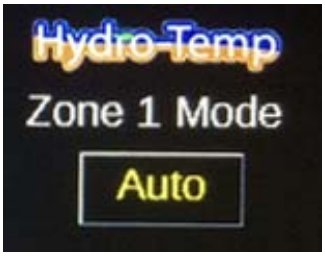
The Hydro-Temp unit has built in diagnostic features to inform the end user when an issue occurs. If a fault occurs, simply press the fault button and the fault screen will indicate which fault has occurred. In some cases repeated faults will lock out the unit's compressor in order to protect the unit. All faults should be addressed by contacting your installing dealer so the system fault can be addressed by correcting the indicated issue.

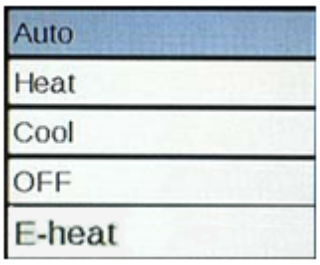
Home Screen



From the home screen you will see current room temp, current humidity, up and down arrows to adjust heating and cooling set points, Mode switch to set zone from off, heat, cool, emergency heat or auto. If multiple zones then the damper position will be displayed. At the bottom right the percentage of the compressor running and on/off state will be displayed. It will be displayed in blue if on in cooling and orange if on in heating. Just above that will be the fan status on/off. If the optional strip heaters are energized SH will appear just above the Fan status in red. The CK Filter button will show on the first of every month to serve as a reminder to clean or replace the air filter. Press the button for instructions on how to reset the filter indicator.

Adjusting Zone / System Mode





To select the Zone mode press the button as shown. A pop-up window will be displayed to either choose between Auto, Heat, Cool, off, or E-heat.

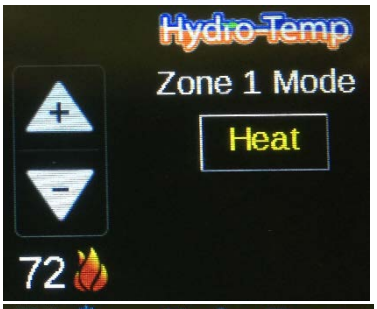
Auto Mode: This mode will allow the unit to automatically switch between heating and cooling.
Heat Mode: When this mode is selected the unit will only run when heating is required.
Cool Mode: When this mode is selected the unit will only run when cooling is required.
Off Mode: This mode will prevent the unit from running in either the heating or cooling modes.
E-heat: This mode will cycle the optional strip heaters as needed to provide heat. The compressor will be locked off. Used for emergency heat only

As a suggestion when using the Auto mode, keep the set-point between heating and cooling no closer than 4 degrees (i.e. 72 degrees heating and 76 degrees cooling). This will prevent undesirable switching between heating and cooling modes during days when both heating and cooling could occur. For best operation it is recommended to dedicate the units operation to heating or cooling as required.

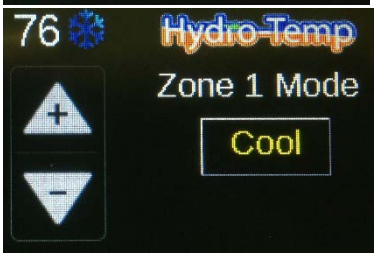
In the auto mode both the heating and cooling set-points will be displayed above and below the plus and minus (up and down) arrows.

 Icon for Cooling

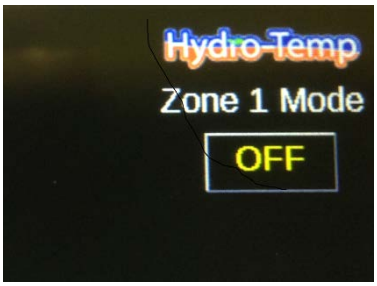
 Icon for Heating



In the heat mode only the heating set-point will be displayed below the plus and minus (up and down) arrows.

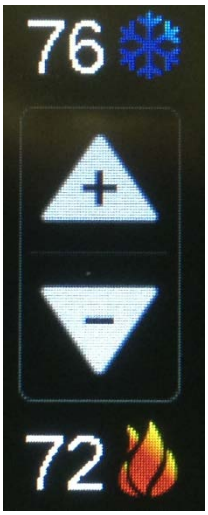


In the cool mode only the cooling set-points will be displayed above the plus and minus (up and down) arrows.



In the off mode neither the heating or cooling set-points or plus and minus arrows are displayed.

Plus and Minus Arrows (Set-point Adjustment)



Original

Adjusted

The temperature for the space can be manually adjusted by pressing the plus and minus arrows. In this example the original set-points were 76 and 72. The minus button was depressed 3 times (0.5 degrees/ push) and both the heating and cooling set-points were lowered by 1.5 degrees. Conversely if the plus arrow was pushed the temperature would increase. In this example the mode was “Auto”. If the mode was set for either heating or cooling only the heating or cooling temperature would be affected.

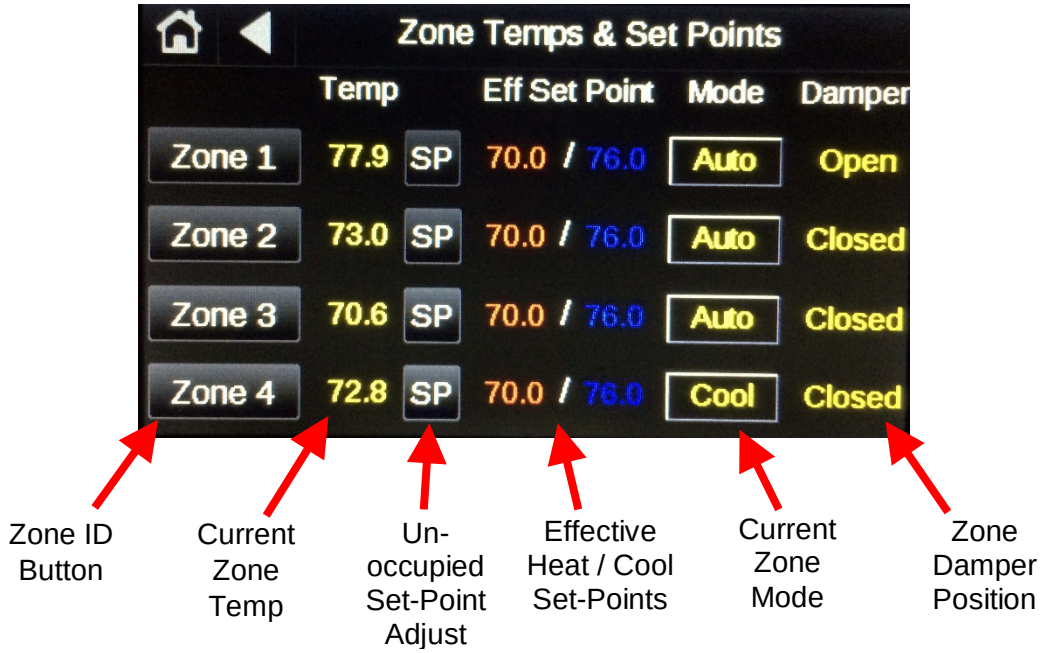
*After any adjustment wait a few seconds before navigating away for this screen to allow adjustment to take effect.

*If pressing the plus or minus buttons have no effect on the set points verify the system is in occupied mode. No adjustment will be allowed in un-occupied mode.

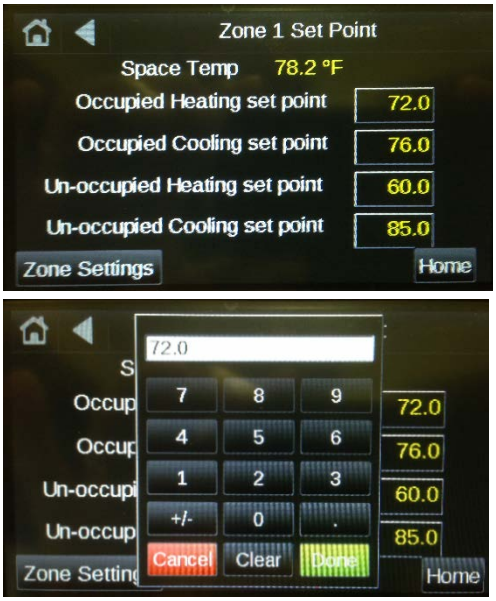
Zone Settings

If your equipment has been setup for multiple zones (maximum of 4 zones) **all** of the zones can be monitored and adjusted from the Protostar touch thermostat or from the zone thermostat installed in each zone's area. If a zone's set point is changed on the zone thermostat it will automatically update on the Protostar and vice versa.
In order to access the other zones, depress the "Zone Settings" button on the home screen. This will navigate you to the "Zone Temps & Set Points" screen.

This screen displays the number of zones connected to the controller. In this example the controller has 4 zones connected. If only 2 zones were connected the areas on the screen in this example occupied by Zone 3 and 4 would be completely blank.



By depressing the "Zone ID" Button you will see a screen similar to the main home screen. The big difference is the zone is identified and any changes you make effect that zone only, in this example Zone 4. All adjustments described for the main zone can be made to each connected zone. For example you can adjust the heating and cooling set points and zone mode for zone 4 from the Protostar thermostat!!



The "Un-occupied Set-Point Adjust" Button allows for the adjustment of the base un-occupied temperature set-points. Press each temperature box and a numerical keypad will pop up to adjust each of the set-points. This temperature set point will be the base set point and any adjustments made from the zone home screen ("plus" or "minus" arrows) will be added / subtracted from this value. **These set points will rarely need adjusting. Any room temperature adjustments needed should always be done from the zone's HOME SCREEN.** The factory default settings for the occupied set points are 70 for heating and 76 for cooling.

It is highly recommended to keep the cooling set-point **4 - 6** degrees warmer than the heating set-point.

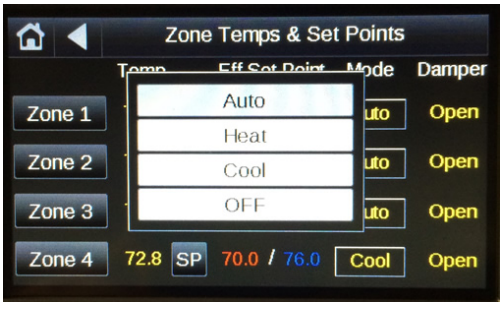
Note the microprocessor will not allow the difference between the heating and cooling set-points to be any closer than **two** degrees.

Effective Set-point

The effective set-point shown on this screen is the calculated temperature the unit is trying to achieve. The effective set-point for each zone is calculated individually. The zone effective set point is the base set-point entered using the "SP" button on the [zone temps and set points] screen and any plus or minus adjustments that have been made using the **"plus"** and **"minus"** arrows on the home screen. The effective set-point shown on this screen will reflect any **smart set point adjustment** delays.

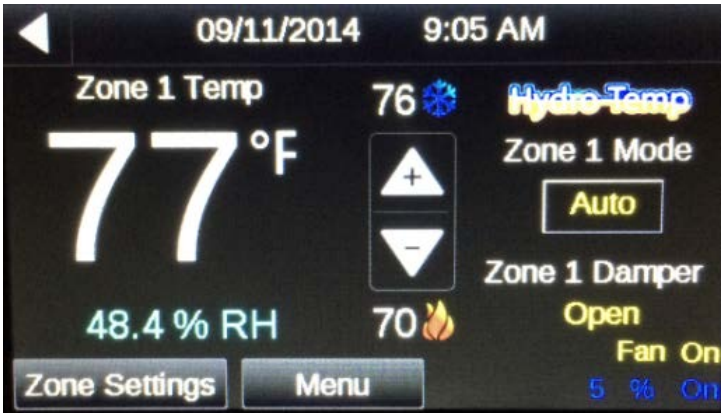
Smart Set Point Adjustment

Should a set point adjustment be made, some instances will occur where the effective set point will change at a rate of only five degree per hour (adjustable in the dealer settings screen). This is critical to keep the compressor from ramping up unnecessarily to high speed when someone adjusts the thermostat set point or the unit comes out of setback. For example, if the zone temperature is 75 degrees and the zone cooling set point is lowered from 76 degrees to 70 degrees, the effective set point will drop quickly to the zone temperature (in this example 75 degrees) then slowly continue to drop after that at a rate of 5 degrees per hour. This programming will initiate a response from the equipment when adjustment is made but prevents the V-Star compressor from ramping up into a higher speed (capacity) then necessary. The lower the compressor speed the unit is running at, the higher the unit's efficiency.



The Current Mode can also be adjusted in the same manner as it could be adjusted from the home screen.

Each zone can be set separately for desired mode or set to off if no heating or cooling is needed.

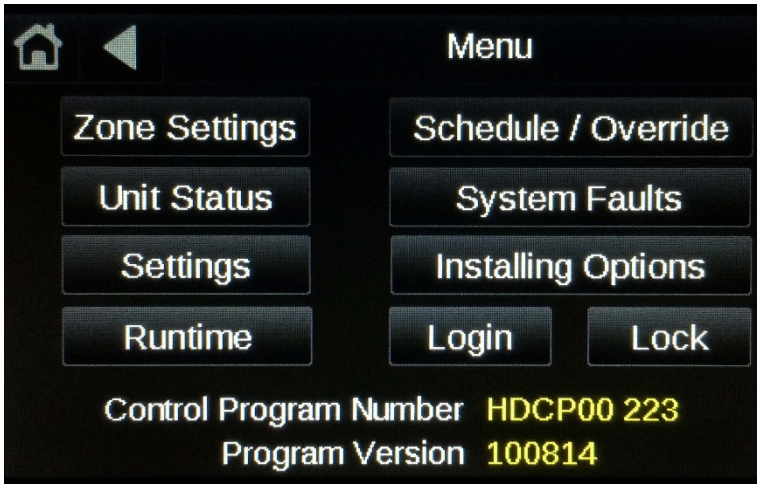


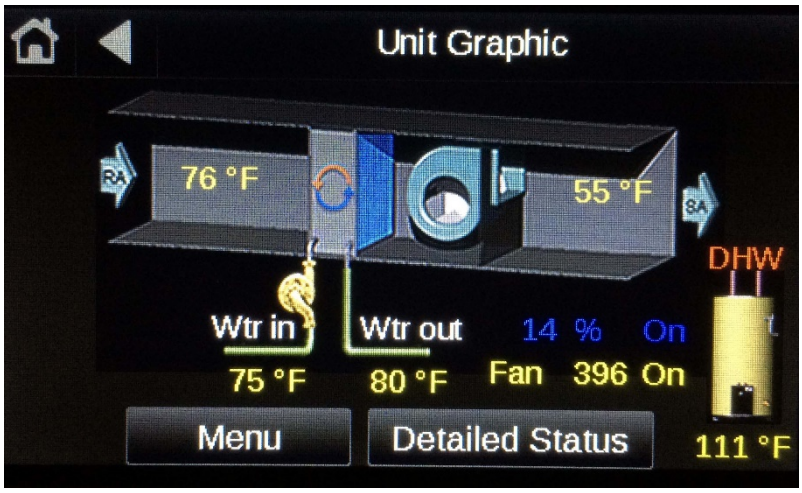
Menu Button

Other settings can be accessed by pressing the Menu button on the bottom of the home screen.

Menu Screen

The Menu screen provides navigation to many other screens and provides program version information.





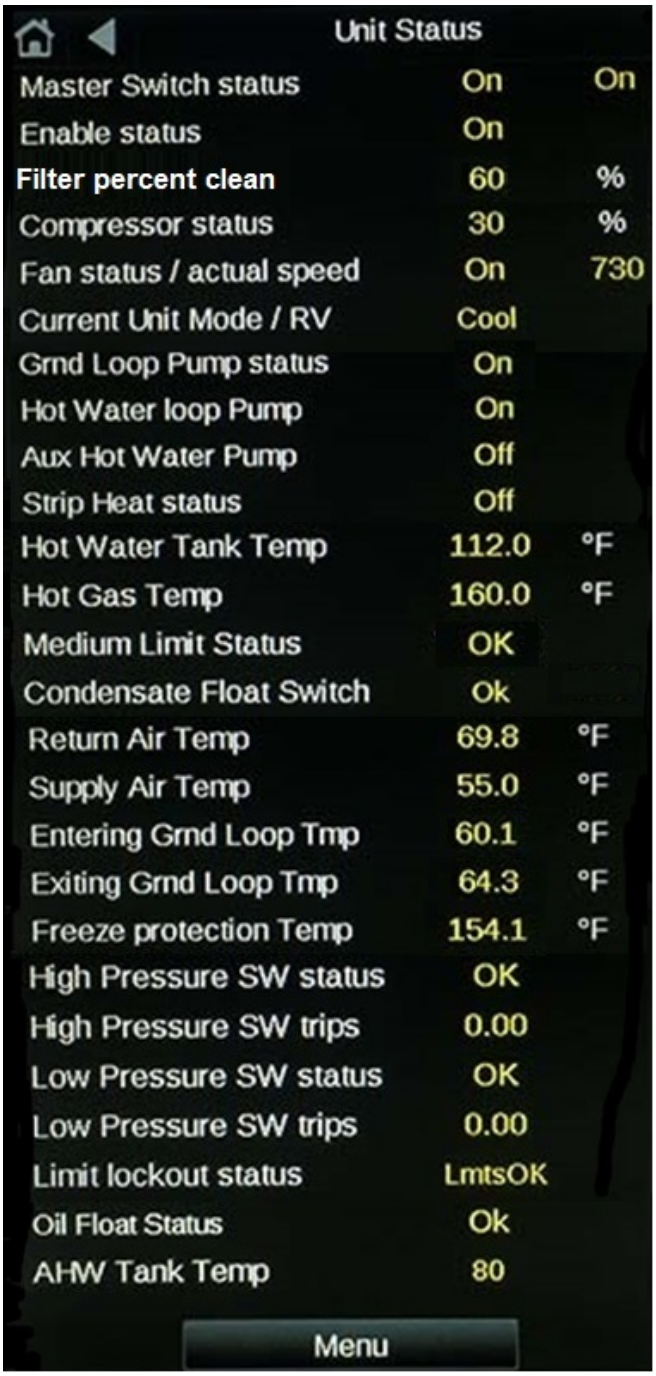
Unit Status / Graphic Screen

This screen shows a real time status of the entering and exiting air temps and water temps. Just like the home screen, the compressor speeds and blower speeds are also displayed.

If the system is equipped with Priority DHW the tank temperature will also be displayed.

The detailed status button can be pressed to display more detail in a text layout.

Detailed Status Screen



The Detailed status screen is available from the Unit Status / Graphic Screen. This screen shows all temperature sensors, system safeties, and the status of outputs. Most are for diagnostics only.

Most of these are shown on the graphic. Some that are not:

Master Switch status – Status of the toggle switch on system and status of the Net master setting in the customer setting screen. "Off" will shut down the system.

Enable Status – Status of several system safeties, shows "off" if a problem exist or if the system is in a power up delay.

Filter percent clean – this indicates the percentage of filter life remaining

Hot Gas Temperature – Temperature of the refrigerant hot gas line. This is used to determine if desuperheating of the DHW is ok.

Medium Limit Status – This is an auto reset high pressure switch that trips before the normal high pressure switch. This is used to stage down the equipment in the hot water heating mode if the high pressure starts getting too high. It will also restart the ground loop pump if tripped while running in cooling with a hot water call.

Condensate Float Switch – Used to tell if the system condensate pan is getting full of water.

Freeze protection temperature – This is the temperature of the refrigerant exiting the water coil in heating mode. This is used for freeze protection in the heating mode.

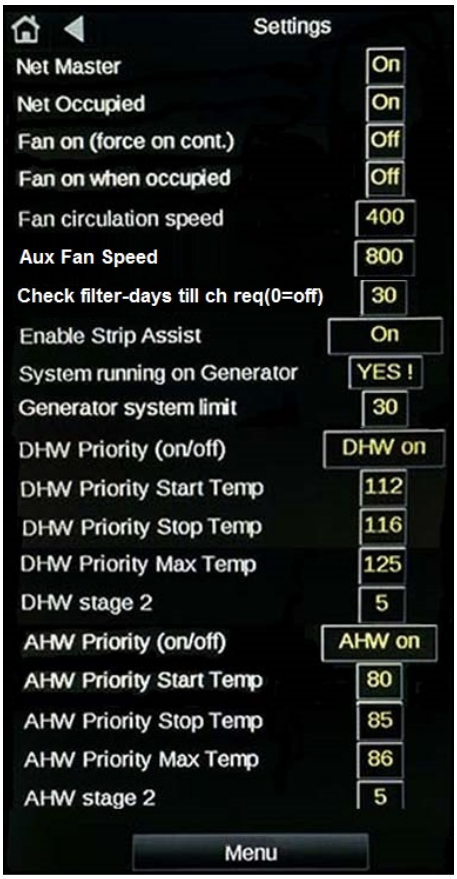
High and Low pressure switch status – This will show real time the status of these refrigerant pressure switches.

High and Low pressure switch trips – This will show the number of trips in the last 24 hours.

Limit Lockout Status – If a low or high pressure switch trips 3 times in 24 hours the system will lock out for safety.

Oil Float Status – This displays the status of the compressor oil float.

Customer Setting Screen



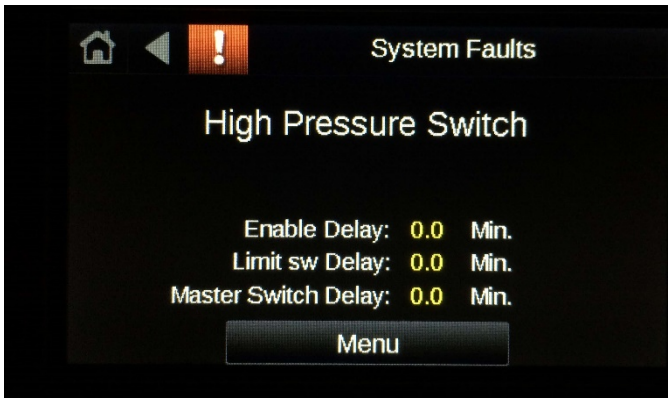
The customer setting screen provides the following settings:
Net Master: Must be "on" for the system to run. This provides the customer a "software method" of shutting down the system.
Net Occupied: Forces the system to be occupied all the time. If this is "ON" the system will remain at occupied set points all the time.
Fan Circulation selection and **Fan Circulation Speed** setting: These settings are used for fan circulation mode to set the CFM requested.
Aux Fan Speed: This setting is the CFM the fan will run with optional Aux input. Must be turned on in the installer settings by installing contractor.
Check Filter - days till ch req: This setting sets the frequency in days that the "CK Filter" indicator will show on the home screen. 30 days is the default. Set this to 0 to disable the check filter indicator.
Enable Strip Assist: With this setting turned "on", the strip heaters will run to supplement the system in the heating mode as needed. If this setting is turned to "Eheat only" the strip heater will only run if a system fault is detected during a heating call or if the unit is set to the emergency heat mode (E.Heat).
System running on Generator: When this setting is set to "Yes", another set point will appear labeled "Generator system limit". The default setting for limiting the system is "30%". This means that when this setting is set to "YES", the system will be limited to 30%. It is important to note this setting needs to be manually selected when the system is being powered from a generator. If this setting is selected as "Yes", the system will never exceed the limit set point and the strip heat will be disabled. If the generator being used is large enough to handle the system at 100% the "Generator system limit" can be increased accordingly.

DHW Priority (on/off): This setting turns on / off the domestic hot water option. When turned off other settings pertaining to the DHW will disappear. When turned back on navigation away from this screen then back will force the settings back on the screen.
DHW Settings if DHW Priority is set to on:
DHW Priority Start Temp—This is the temp the system will turn on and start making hot water
DHW Priority Stop Temp—This is the temp the system will heat up to and turn off.
DHW Priority Max Temp—This temp setting is the max the system will heat the water when desuperheating and providing free hot water. Desuperheating takes place when the system is heating hot water while heating or cooling the space.
DHW stage 2 temp—This setting stages the system up to maximum compressor speed if the hot water tank temperature drops this much below the DHW start temp. For example in the screen shot above if the tank temp drops below 112 the system will start in Priority hot water generation mode with the compressor in stage 1 (factory preset speed). If the tank temperature continues to drop below 107 (priority start temp – DHW stage 2 temp) the system will ramp the compressor up to stage 2 (factory preset speed).
DHW water sampling – This setting when turned on will occasionally start the DHW pump to circulate water to sample the temperature if the tank temperature sensor is placed on the DHW water in line. Another setting will allow one to set the frequency (in seconds) the pump will run and the time (in seconds) the pump will run before a temperature sample will be read from the sensor. The sensor will only be read during that time. After the temperature is read the pump will turn off if no hot water is needed. Use this setting with caution. It's always best to leave this setting off and mount the tank temperature sensor on the tank.

If an optional **AHW (Auxiliary Hot Water)** source is needed additional AHW settings will appear below the DHW settings. These will include AHW Priority on/off, AHW Priority start, AHW Priority stop, and AHW Priority Max temp.

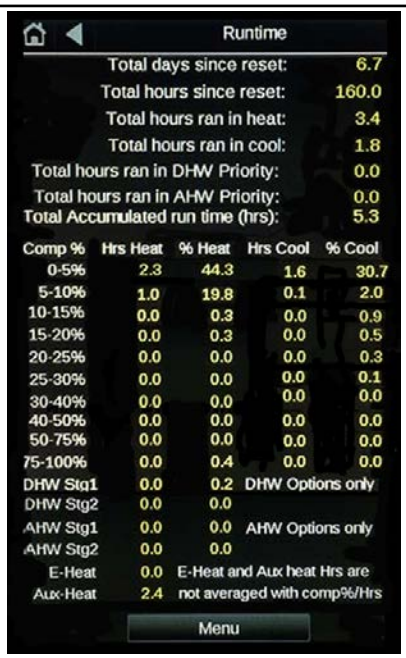
Other Items on the Menu Page

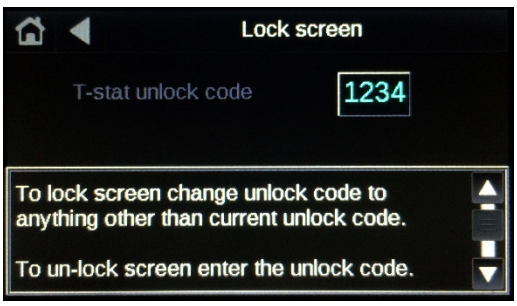
A few other buttons are available to the end user / homeowner. System Faults, Runtime, and Lock. The Installing Options page is password protected and is only used during the initial equipment installation and commissioning.



The **Fault screen** will display the current system status in plain text and the status of any time delays that are active. If no faults are detected the screen will simply read "No Faults". Other possible faults may be Low or High pressure switch, Freeze fault, Sensor Failure, Master off, Temp diff fault, Low or high limit lock out, or V-star drive Fault.
The Timers will normally read 0.0 minutes unless a delay is active. If the air filter indicator is active red text labeled "Clean or replace filter" and a reset button will appear.

The **Runtime Screen** shows the accumulated system run time. This is divided up into total hours run in **heat,** total hours run in cool, total hours run in **DHW**, total hours run in **AHW**, total hours run in **E-heat**, and **total accumulated** run time.
In the **Runtime Screen** we divide this up even more to show the compressor runtime in increments of percentage the compressor has run in heat and cool.
With this you can determine how hard your system is having to work to keep you comfortable.
Hydro-Temps ultimate goal is to have the unit operate for long periods of time at the lowest compressor percentage possible to provide the exact amount of heating / cooling needed for the home or building. This will allow the unit to create a more comfortable environment while operating at the highest possible efficiency.

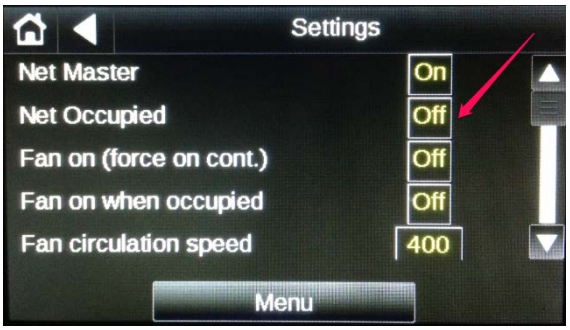




The **thermostat lock screen** will display the code needed to unlock the screen. If the code is anything other than 1234 (adjustable in factory settings) the screen will lock and go to the home screen. No adjustments will be allowed. Only the unlock button will show on the home screen. To unlock press the unlock button and enter the unlock code (1234). A help screen is provide at the bottom to explain how the lock screen works.

Occupied/Unoccupied (Occupied or Setback)

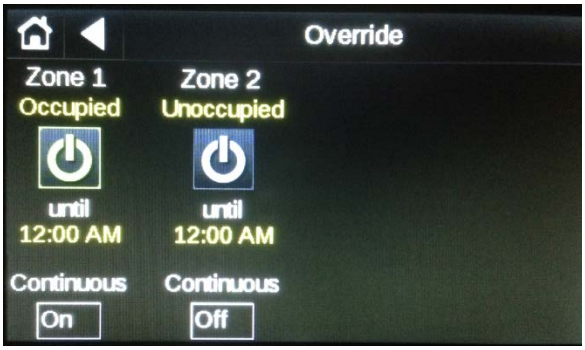
The best mode of operation for VStar units is normally when maintaining a constant space temperature 24/7. The unit will run only enough to keep the space at the predetermined occupied set-point temperature. A consistent set-point will enable the unit to run in its lowest (most efficient) speed and at the same time maintain a constant temperature and a low summertime humidity level.
This means the unit will run to satisfy only the “occupied” temperature settings.
Should it be necessary to have the ability to schedule occupied and unoccupied times navigate to the “Menu” screen, then select the “Settings” button. In the Settings screen toggle the “Net Occupied” to off.

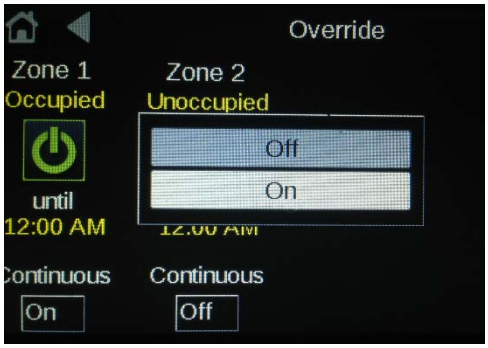


Setting Occupied/Unoccupied Times

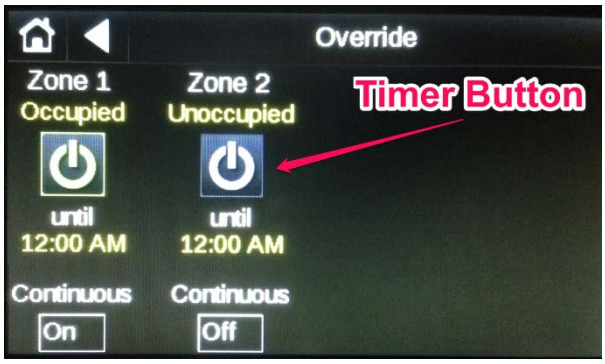
To set a schedule or override, navigate to the menu screen by pushing the “Menu” button on the home screen. Then on the Menu page select Schedule/Override

We will first discuss the override option. This is the easiest way to set the unit for an occupied mode. There are two options here. One is the continuous mode and the other is timed mode. If the “Continuous” button is selected, a pop-up will appear that provides the option for “on/off”. If “On” is selected the zone will be occupied 24/7 much like having the “Occupied Sensor” jumper in place in the electrical box.





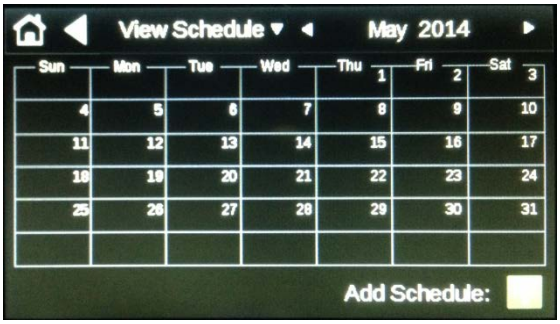
The other override mode is a timed override. This is useful if there happens to be a zone that has occasional occupancy. To enable this option press the “Timer Button” (as shown below). A pop-up will appear. Adjust the override on time by using the “Plus/Minus” buttons and then enter “Done”



Setting A Schedule

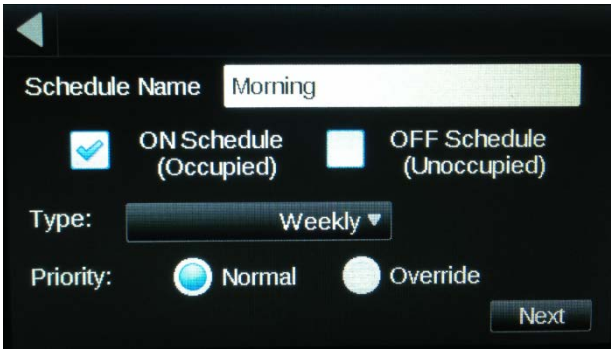
Next we will discuss setting of schedules. This mode will allow you to set specific periods of the day to be occupied. Each day can be set to have different schedules. To navigate to “Select a Schedule” Screen, press the”Schedule/Override” button on the Menu screen, “Schedules” on the Schedule/Override screen. Choose the zone for which you would like to set a schedule. Note; Object #1 is Zone #1, Object #2 is Zone #2 and so on.

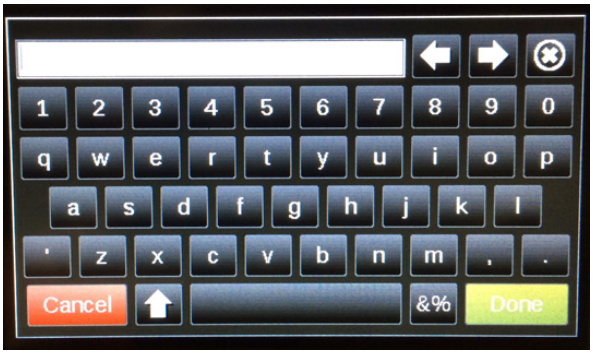
In this example we will set a schedule for Zone #1 (Object #1). Select Object #1 and a calendar page will be displayed showing all of the current schedules. Since this is the first time a schedule is being entered the calendar will be blank as shown.



Press the “Add Schedule” Button.

It is a good idea to provide a name for the schedule you are setting up. In this example the schedule was name “Morning”. This was accomplished by pressing on the name area, typing in the desired name and pressing “Done”.

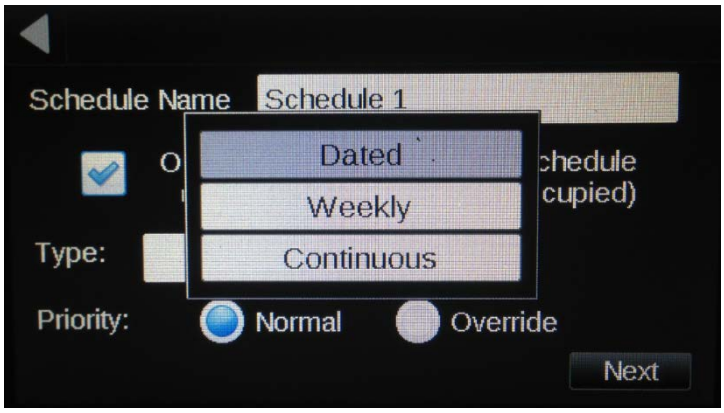


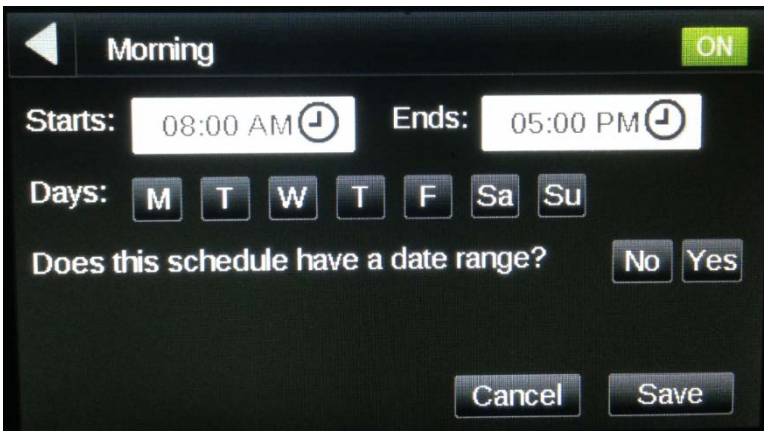


The next step is to choose an “On Schedule” or an “OFF Schedule”. Most of the time an On Schedule is chosen, however if the desired schedule was to place the unit into an unoccupied mode, overriding a previous schedule the “OFF Schedule” can be chosen.

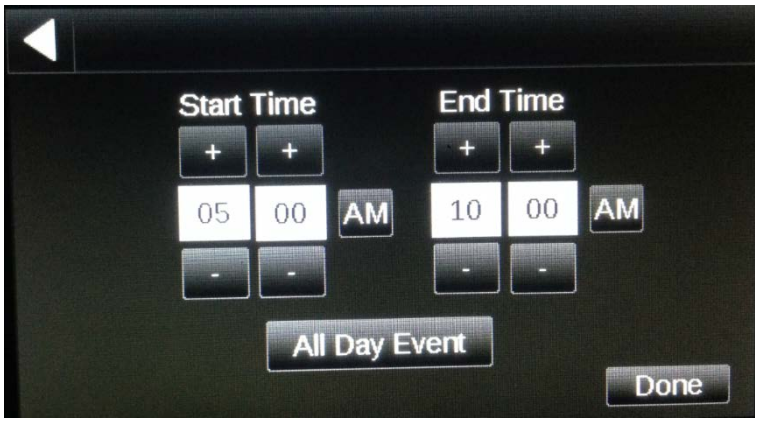
Continuing the scheduling process, the type of schedule needs to be chosen. The most common schedule would be a weekly schedule. The dated schedule would be used for specific dates. This is usually used once a general schedule has been set-up and an exception such as a holiday or a special event occurs. The continuous schedule is the least common schedule type. The continuous schedule puts the unit into a 24/7 occupied mode for a specified date range.

In this example the “Weekly” type will be discussed. To select the schedule type, depress the “Type” button and choose weekly. Then press “Next”.

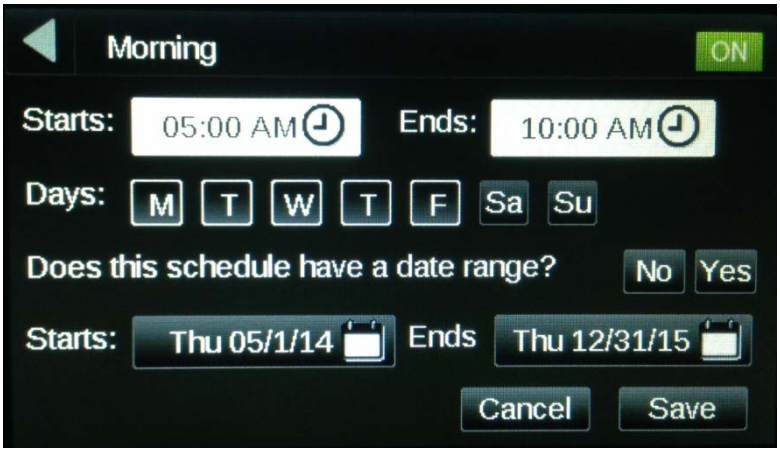




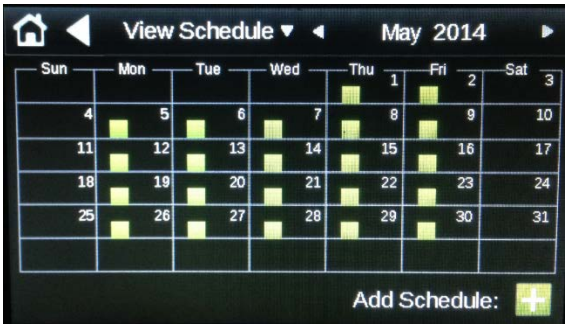
The next step is to select the time of day for the schedule. Press either the “Starts” or “Ends” button and the following screen will appear. For this example the Start time is 5:00 AM and the End time is 10:00 AM. This means the unit will react to occupied temperatures between 5:00 and 10:00 AM.



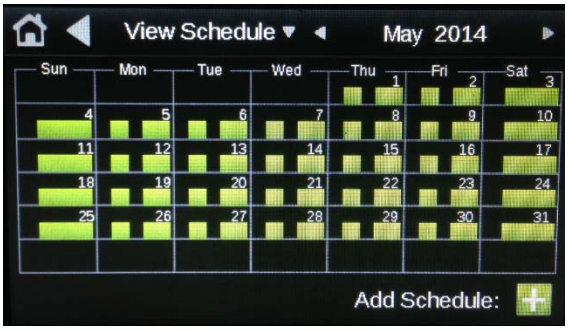
After the times have been set and “Done” has been entered, the days of the week for this schedule can be entered. In the example the weekdays have been chosen. If more than one event is required per day the question “Does this schedule have a date range?” must be answered “Yes”. If the answer is “No” only one schedule can be entered per day. For this example a long term date range was chosen to reduce the repeated programming time and allow for more than one schedule per day.



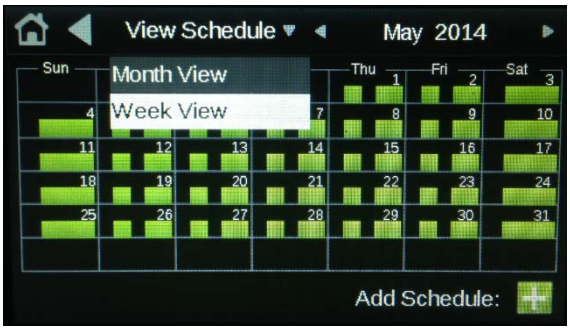
After the save button has been pressed the following calendar is displayed. For the purpose of this example an Evening weekday and a Weekend schedule has been entered by pressing the “Add Schedule” and following the exact steps used for the morning schedule.



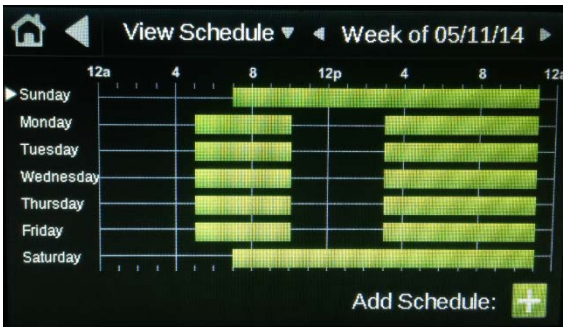
Calendar with Morning, Evening and Weekend schedules entered.

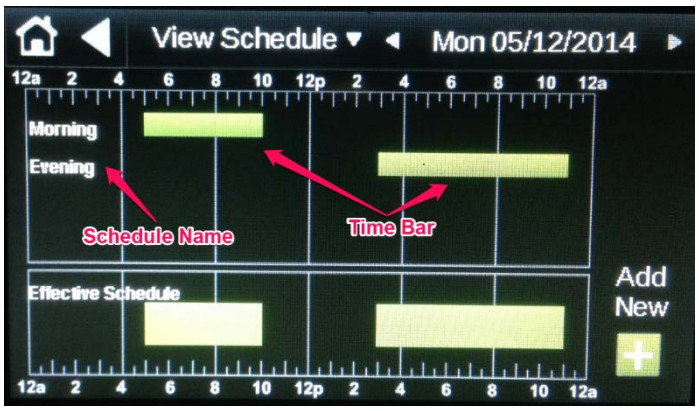


If it is necessary to edit the schedules it can be done from either the Calendar “Month View” or “Week View”. In the “Month View”, press the day of the month which contain the schedule you want to change.

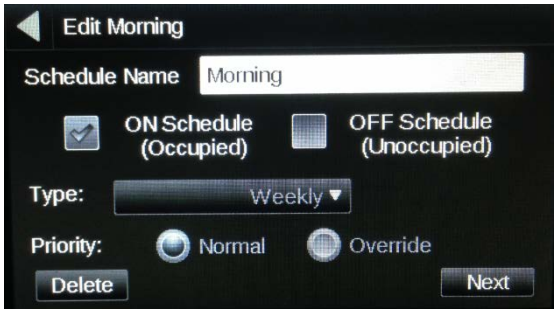


In the “Week View”, press the day of the week which contains the schedule you want to change.





For this example Monday was chosen to adjust the “Morning” schedule.



Select the “Schedule Name” or the “Time Bar” to be edited. In the example the “Morning” schedule was selected and the following screen is displayed. Editing of the schedule is now exactly the same as the initial programming of the schedule.

10.1 Zone Sensor / T-stat

The ZS thermostat is commonly used for zone two through four thermostats when there are multiple zones.

The home screen will display room temperature, zone mode icon and a fault bell if a system fault is detected.

The Zone Temp set point can be adjusted by pressing the ▲ up arrow key or ▼ the down arrow key. Each press will change the effective set point one half of a degree. The effective heating and cooling set points will also display as adjustment is being made. The screen will revert back to the home screen after 5 seconds. The illustration on the right shows the room temp is 78, effective cooling set point is 76 and the effective heating set point is 70.

The zone mode Icon will display as a snow flake when in cool mode and a flame when in heat mode. They will alternate when in auto mode. Changing modes will be discussed later from the Info Screen setup.

The system fault bell will only be displayed if the system has detected a system fault or the system is in a power up delay (power up delay is 5 minutes).

The info Screen allows for adjusting of base set points, zone mode, and displays system fault. Each display output has a reference number or text that shows in the bottom left corner. For example 601 refers to the zone mode and 1500 refers to the system faults status. The illustration below shows this zone's mode set to off. If you wanted to change the zone mode from off to auto (auto heat & cool) you would press the *i* button until the number 601 is displayed in the bottom left, the current mode will also be displayed. In this example the zone mode has been set to off. By pressing the up or down arrow one can scroll through the various modes and select the desired mode.

Information available to view or adjust from the information screen include:
601 refers to Zone Mode
Off – This zone will not run.
Cool – Zone will be allowed to run in cooling mode only as needed
Heat – Zone will be allowed to run in heating mode only as needed
Auto – Zone will be allowed to run in heating or cooling mode as needed, also referred to as auto changeover mode.
E-heat – When in E-heat the compressors will be locked off and optional strip heaters will be used for heating the zone as needed.
1500 refers to System Fault status. If the system is in a fault condition this information would be good to transfer to the service personal when they are called (Some examples are No Faults, Low Pressure trip, High Pressure trip, Sensor Failure, Freeze, Master switch off)
Occ cool set point refers to the occupied cooling set point.
Occ heat set point refers to the occupied heating set point.
Un-Occ cool set point refers to the un-occupied cooling set point.
Un-Occ heat set point refers to the un-occupied heating set point.
Others may be present depending on zone being accessed. Call installing dealer if adjustment is needed.

The Manual override button ⏻ can be used to override the system if the system is un-occupied.

The Green LED in the middle of the thermostat will come on when the system is occupied and will be off when un-occupied. Each ZS thermostat is addressed for the zone it's controlling, thermostats can't be freely moved from zone to zone unless address is changed. Contact the installing dealer before moving thermostats.

11.0 V-Star Installer Settings.

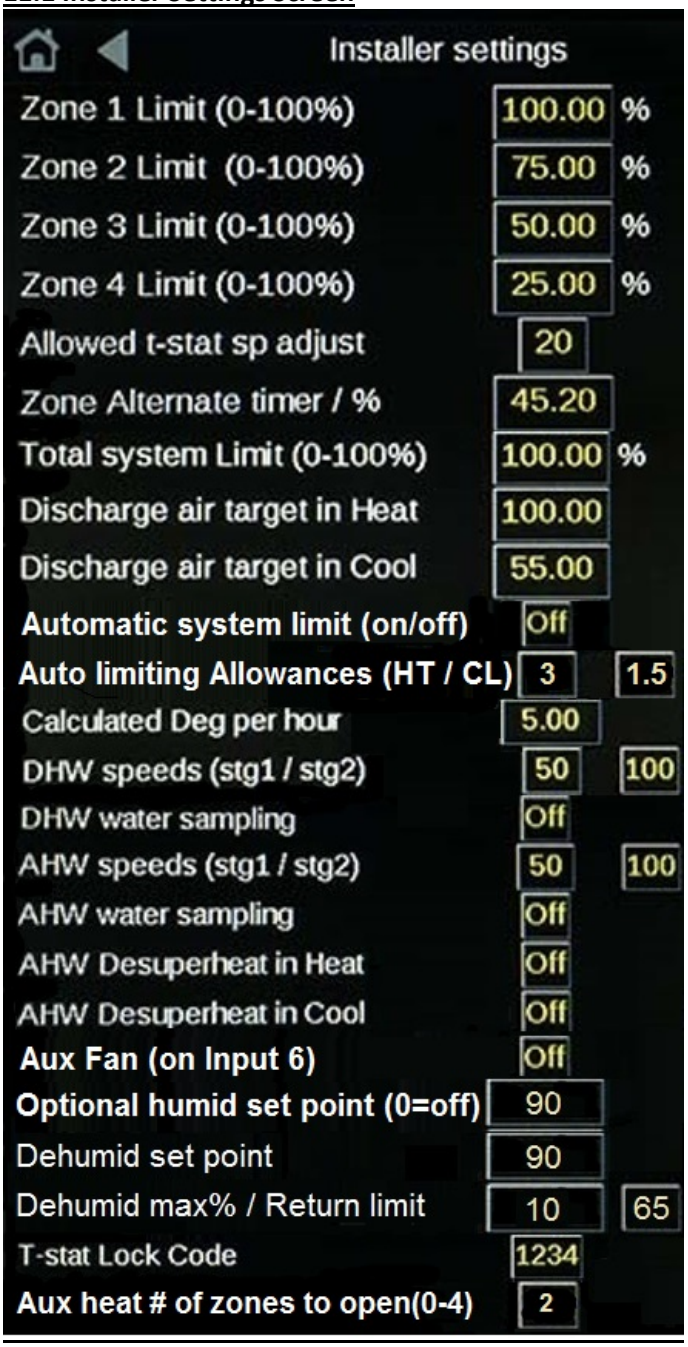
Installer settings that must be adjusted depending on the parameters of the job are all accessible through the Protostar thermostat. They are all password protected to insure the end user doesn't inadvertently change a setting.
Some settings may refer to the **compressor percentage**. See the chart in section 11.1.4 for a full scale listing of the compressor precentage. As you can see from the chart the compressor percentage is not the percentage of the systems total capacity but the percentage the compressor is being driven from minumum speed to maximum speed.

To access the Installer Options from the menu screen press the installer options button. The password required window will pop up. Press OK and enter your dealer password.

This will take you to the Installer Options Screen.

Buttons in Red are factory settings and should not need adjustment during install of the system.

11.1 Installer Settings Screen



11.1.1 Zone Limiting: There are 4 settings for zone limiting, one for each zone. These four setting allow you to set the amount in percentage a zone will allow the compressor to run if it's the only zone calling. Zone limiting is used for limiting smaller zones. For example a smaller zone set to 50% calling for heat with

no other zone calling will never allow the system to run above 50% for that zone.
These limits will add together if two zones call for the same mode at the same time, so if another zone set at 25% initiates a heating call, the system would then be allowed to ramp up to 75%. *See the Total system limit section 11.1.4 for a chart to convert compressor percentage to tonnage.*
A zone set to 0.5% will never start the system if it's the only zone calling. It could however combine with another zone to start the system. For example two zones calling for .5% could start the compressor at 1%.

Default settings from the factory are:
Zone 1 – 100%
Zone 2 – 75%
Zone 3 – 50%
Zone 4 – 25%

11.1.2 Allowed T-stat SP Adjust
This setting limits the amount the ZS zone thermostats can be adjusted up or down. The default setting is 20 degrees.

11.1.3 Zone Alternate / Percentage

This installer setting typically needs no adjustment. This setting is used to handle a situation where one zone is calling for heat and one zone is calling for cool. This setting defines how long the system will run in each mode and the minimum speed the compressor will run when a coinciding heat and cool call occurs. The factory default for this setting is "45.20". The controller breaks this setting down as "time.percentage". Time between modes and minimum percentage to run compressor. For example using the factory default setting, if a heat call is being initiated by zone 1 and the compressor is running at 2%, then zone 2 makes a cooling call at 1% the zone alternate timer will start and the compressor will ramp up to 20 percent. Zone 1's damper will remain open and all other dampers will remain closed. The system will run like this for 45 minutes or until zone 1 is satisfied. Then the system will switch to cool, open zone 2's damper, close zone 1's damper and remain at 20% compressor speed. The system will remain in cool until zone 2 is satisfied or for a maximum of 45 minutes. Then it could potentially switch back to heat for zone 1 and start the process again. *Twenty percent in the example above is the factory default. If the calculated compressor speed required by the zone were to increase above 20% the system would have ran at the calculated speed when that zone was getting conditioned. This setting (Twenty percent) is the minimum.*
This routine provides heating and cooling to all zones as needed in a precise way. The compressor percentage is increased to try and satisfy the zone calling so it can switch to the next mode. The actual compressor percentage the compressor will run will never exceed the Zone limit set for that zone.

11.1.4 Total System limit
Total system limit restricts the maximum system output. This limit will take priority over the zone limiting and if set lower than DWH or AHW stages will affect the hot water output. The factory default setting is 100%. You can use the following chart to convert percentage to system tonnage.

Percentage	Comp HZ	2.5 Ton VStar Output Tonnage	4.0 Ton VStar Output Tonnage	6 Ton VStar Output Tonnage
1	40	.70	1.10	1.80
5	46	.77	1.22	1.98
10	52	.86	1.37	2.21
15	58	.95	1.52	2.44
20	64	1.05	1.68	2.66
25	70	1.14	1.83	2.89
30	76	1.23	1.98	3.12
35	82	1.32	2.13	3.35
40	88	1.41	2.28	3.57
45	94	1.50	2.43	3.80
50	100	1.59	2.58	4.03
55	106	1.68	2.74	4.25
60	112	1.77	2.89	4.48
65	118	1.86	3.04	4.71
70	124	1.95	3.19	4.94
75	130	2.05	3.34	5.16
80	136	2.14	3.49	5.39
85	142	2.23	3.65	5.62
90	148	2.32	3.80	5.85
95	154	2.41	3.95	6.07
100	160	2.5	4.10	6.30

11.1.5 Discharge air target temperature

Two settings make up the discharge air target temperature. Discharge air target temperature in heat and discharge air target temperature in cool. The

factory default settings are Heat 100ºF and cool 55ºF. These targets are achieved by regulating the blower. For example, a heating or cooling call will start the blower at a rate of 400 CFM per ton in heat or 375 CFM per ton in cool. After the system runs for a few minutes the blower will start to modulate as needed to achieve the discharge air temp. By factory default the blower can be sped up or slowed down 300 CFM to achieve this setting.

11.1.6 Automatic System Limit (on/off)

This setting will turn on a method of limiting the total system by monitoring the discharge air temperature, versus the discharge air target set points for heat and cool. If for example, the system is running in forced air heat and the discharge air temperature migrates above the "Discharge air target in heat" set point the system will slowly decrease the compressor capacity until discharge air falls back in range. The same effect will take place in the cooling mode.

11.1.7 Auto Limiting Allowances

These two set points should rarely need adjusting. They determine how many degrees past the discharge air target set points the discharge air temperature will be allowed to go before system limiting will start. For example, if the heating discharge air target set point is 100 degree and the heat auto limiting allowance is 3, system limiting will not start until the discharge air gets to 103 degree.

11.1.8 Calculated Degree per hour

This setting limits the rate the effective set points will change if a set point change is made from the thermostat. This is a critical setting to keep the compressor from ramping up unnecessarily to high speed when someone adjusts the thermostat set point or the unit comes out of setback. The default value of 5 will allow the effective set points to change 5 degrees per hour.

11.1.9 DHW Speeds

If the system is equipped with the optional Priority On-Demand hot water generation system these two settings set the two speeds the compressor will run to make hot water if there is no call for heating or cooling. The factory default setting of 50 and 100 mean that when the tank temperature drops below the Priority start temp the compressor will start at 50%. If the tank temperature continues to drop the compressor will ramp up to 100%. In a lot of cases these can be adjusted to 40 and 75 to be more efficient. This is useful for instances where the tank temperature has fallen and only needs to top off the temperature of the tank. The high speed is used when hot water is being consumed and a faster recovery rate is required.

11.1.10 DHW Water Temperature Sampling.

This setting when turned on will force another setting to appear in the installer setting screen labeled "Sample every _____ sec / run for ___ sec" This setting allows a DHW water temperature sampling to take place, for example every 15 minutes turn on the DHW pump for 2 minutes then if the DHW temp is below the set point turn on the system in Priority. This should only be used if mounting the DHW sensor on the DHW water line entering the system. It's always best **NOT** to use this function and mount the sensor directly on the DHW tank.

11.1.11 AHW Speeds

If the system is equipped with the optional AHW heating generation system these two settings set the two speeds at which the compressor will run to heat hot water. A DHW call will take priority over AHW. If there is an AHW and a forced air heating call the compressor will ramp up to the AHW stg 2 setting.

11.1.12 AHW Desuperheat in Heat & Desuperheat in Cool.

When "ON" these settings will allow the system to "Desuperheat" into the AHW when the system is running in heating or cooling. These settings are normally always off.

11.1.13 Aux Fan (On Input 6)

This setting switches input 6 from reading the seldom used occupied / un-occupied input to an input that is capable of starting the unit fan. This input is looking for a short to ground to start the unit fan for optional items such as; duct mounted humidifiers, outside wood furnaces, etc. The fan speed set point is set in the

customer setting area called “Aux Fan Speed”. If the fan is already on due to a heating or cooling call, the fan will run at the calculated speed needed for that call and only open the zone dampers for the zone or zones calling. If this input is activated when no zones are calling for heat or cool all zone dampers will be opened and the fan will start. One thing to keep in mind is if the system is running to make hot water for DHW or AHW the fan will not be allowed to run until the hot water call is satisfied. If an output is needed to prove the fan is on before starting the optional device, the “Optional humid set point” can be set to 1 to allow analog output 3 to output 10vdc when the fan is initiated by this call.

11.1.14 Optional humid Set Point (0=Off)

This Optional setting will allow the user to set the desired humidity level for the space. When the measured humidity drops below this set point it will force on the unit fan, open all zone dampers, and energize an output to turn on a field installed humidifier. The space humidity is read from the zone one Protostar t-stat or ZS pro with optional humidity sensor. Just like the Aux fan input this option can only turn on the system fan and external humidifier output if the system is not on for a DHW or AHW water heating call. When calling, this option starts the unit fan at the fan speed set on the customer settings screen “Aux Fan Speed” set point and energizes analog output 3 with 10vdc. A 10vdc solid state relay must be factory or field installed to turn on the humidifier. If this option is activated when the unit fan is already on due to a heating or cooling call the fan will run at the calculated speed needed for that call and only open the zone dampers for the zone or zones calling. The humid set point must always be 5% less than the dehumid set point. If not, the humid set point will be auto calculated to equal the dehumid set point minus five.

11.1.15 Dehumid Set Point

This Optional setting is used to control humidity in the space. When the humidity in the space (measured from the Protostar or ZS t-stat with the optional humidity sensor) rises above this set point the system will start in cooling to dehumidify. This setting is defaulted to 90% RH from the factory.

11.1.16 Dehumid max% / Return limit

If the humidity in the space rises above the dehumid set point this setting sets the maximum percentage the compressor will be allowed to ramp up to (factory default is 10%). If this is set too high it’s possible to over cool the space.
The return limit set point is a safety to help prevent over cooling. If the return temperature drops below the return limit set point the dehumidification mode will be deactivated.

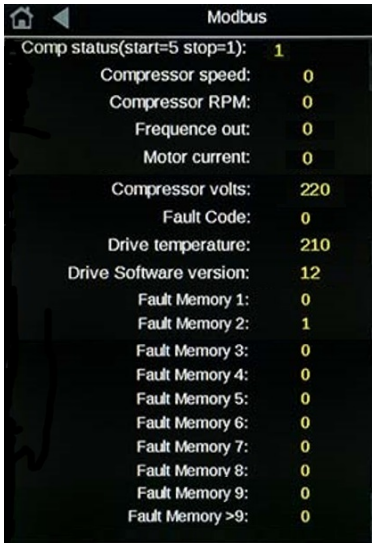
11.1.17 Thermostat Lock code

The Protostar touch thermostat can be locked so no adjustment can be made. This setting sets the unlock code needed to unlock the thermostat. This feature is explained in more detail in the previous section under the Protostar thermostat navigation instructions.

11.1.18 Aux heat # of zones to open

Any time an Aux heat call is initiated the system will calculate the blower speed by adding together the maximum air flow each zone calling for heat can handle by using the zone limit percentage. **The Aux heat # setting** allows for setting the number of zones to open if Auxiliary heat is needed from any zone. This may be needed to force open bigger zones if small zones call for aux heat. A setting of 0 will only open the damper of the zone calling for aux heat and all other zones that are satisfied will be closed. A setting of 1 will open the zone calling and open zone 1, whether it’s calling or not. A setting of 2 will open the zone calling, zone 1, and zone 2. A setting of 3 will open zones 1 through 3 and a setting of 4 will open all dampers if any zone calls for aux heat. The factory setting for this parameter is 2 in order to insure the strip heater gets plenty of air flow. This setting has no effect on the dampers during an E-heat call. When there is an E-heat call all dampers are opened and the blower runs a the maximum speed designed for the system.

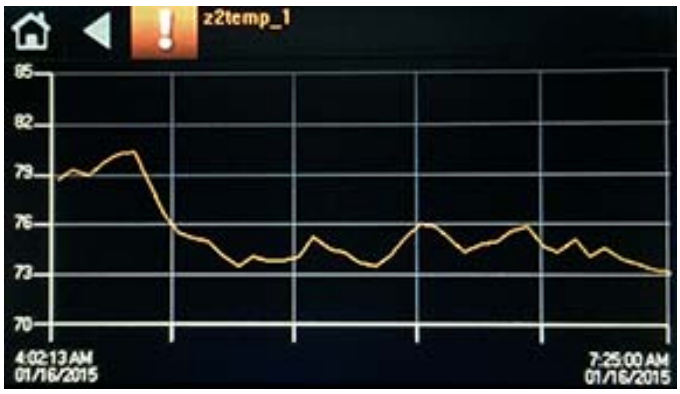
11.2.0 Modbus Screen



The Modbus Screen is a display only screen that shows detailed information pertaining to the V-Star compressor drive. This information is read via Modbus communications from the drive. Examples include: Compressor start / stop status, RPM, actual frequency out, motor current, fault codes, and drive software version. This is an important diagnostic when needed.

11.3.0 Trends

Trends of specific points are available. Trends will be listed in alphabetical order and can be shown for a selectable time frame. The trends are not available without the installer password due to the complexity of accessing and setting up the trends.
Shown here is a trend of the zone 2 temperature from 1/16/2015 @ 4:02 AM till 1/16/2015 @ 7:25 AM.

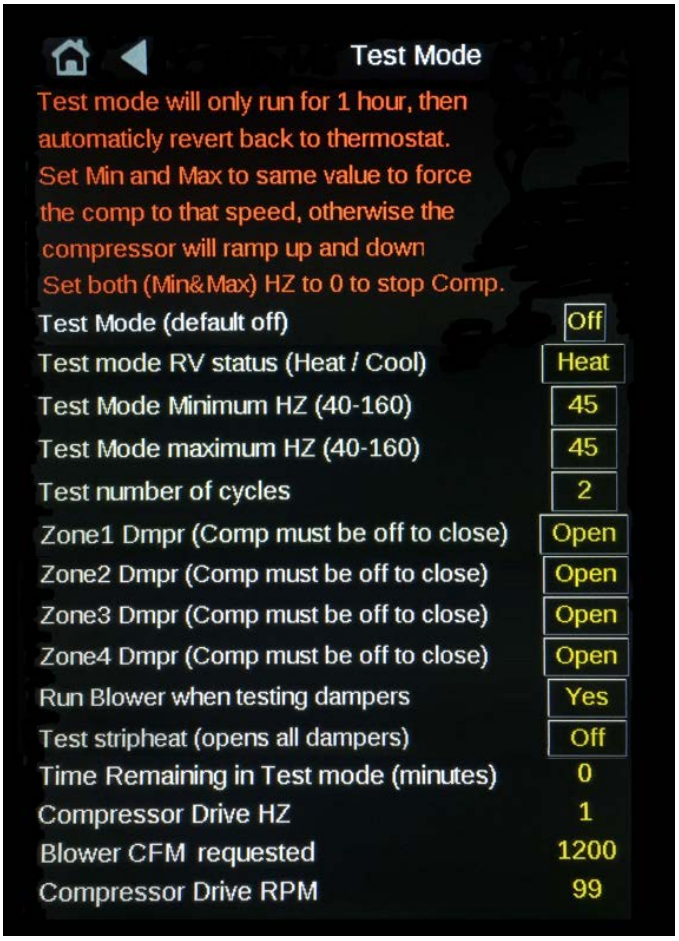


11.4.0 Alarms

All alarms are stored and viewable from the initial factory power up. These alarms include all system safeties and compressor drive failures. The alarms panel will even log each time the master switch is turned off. This diagnostic tool can prove to be in valuable when trying to diagnose an intermittent service issue.

11.5.0 Installer Test Mode

Test mode is available from the Installer Options Screen.
Test mode was designed to start the variable speed compressor at a minimum speed and slowly ramp up to maximum speed then back down to minimum speed. This is necessary when detecting any frequencies that require skipping due to high harmonic vibration. The "Skip Band" test is performed in the factory during test run. Hydro-Temp Installers will find using the test mode to test the system and dampers will speed up the install of the system by bypassing many time delays when in test mode.



Settings include:

Test Mode (on/off): When turned on the test mode is initiated. The system will run in test mode for 1 hour or until this setting is turned off. It's always best to turn off test mode instead of allowing it to time out.

**Note: when the test mode is initiated the ground loop pump will be turned on continuously.*

Test Mode RV status: The Hydro-Temp reversing valve is always de-energized for heat and energized for cooling. Setting this will set the system mode (Heat / Cool) when the compressor is running.

Test Mode Minimum HZ & Maximum HZ: These two set points allow the compressor to modulate between a minimum and maximum speed range.

The minimum HZ the compressor will run is 40 HZ. The maximum is 160HZ. (Refer to chart in section 11.1.4) If the minimum HZ is set to 40 and the maximum HZ is set to 160 the system will start at 40 HZ and slowly ramp up to 160 HZ. After dwelling at 160 for a few seconds the system will slowly begin to ramp back down to 40 HZ. The time to ramp up from 40 HZ to 160 HZ or down from 160 HZ to 40 HZ is 12 minutes.

****Note: The blower output will ramp as needed to match the compressor speed. Anytime the compressor is running in test mode all 4 damper outputs will be opened.***

If a fixed compressor speed is required set both minimum and maximum to the desired fixed speed. For example if the compressor is to run at 160HZ set both minimum and maximum at 160 and the compressor will run at that one fixed speed for the duration of the test mode.

If both Minimum and Maximum HZ are set to 0 the compressor will shut off and stay off. If the compressor is off the blower will shut off also.

Test number of cycles:

This setting sets the number of times the system will ramp up to maximum then back down to minimum. If both min & Max are set to the same setting the number of cycles is ignored.

Zone Damper Open / Closed:

The next 4 settings allows for testing dampers. The system dampers will disregard this setting if the compressor is running and open all dampers. If the compressor is off these four settings can be used to open or close each zone damper individually for testing dampers.

Run Blower when testing dampers:

This setting is used in conjunction with the zone Damper test. Turn this setting on if the blower is required to run during the damper test. If left off the blower will remain off during the damper test.

When the blower starts it will look at what zones are being told to open and three other parameters to calculate the blower speed to run. The calculation shown below will be done on all zones with dampers open and the maximum value will be used to run the fan. Blower speed = (System Fan maximum speed x Zone limit x .01). This should be the most each zone will ever see. In some cases a one minute delay will occur before the fan starts or changes speeds to allow dampers to open /close.

**Note: Zone limiting should be set before testing dampers. Testing each zone individually after the zone limiting is set is a good way of verifying each zone can handle the maximum CFM the system will deliver into that zone.*

Test Strip Heat:
This set point, when on, will open all dampers, start the blower at Fan maximum speed, and start the strip heat.

The rest of the parameters shown are for read only purposes. They include: Time remaining in test mode (in minutes), Compressor drive HZ, Blower CFM requested, and compressor drive RPM.

When in test mode - Pumps are turned on as follows:
Ground loop pump – Comes on as soon as test mode is initiated.
DHW pump – Comes on if in test mode and the DHW temp sensor is reading a temperature lower than the DHW Start set point.
AHW pump - Comes on if in test mode and the AHW temp sensor is reading a temperature lower than the AHW Start set point and the DHW pump is not running.
**Note: If both DHW and AHW sensors are below start set point the DHW must be satisfied or unwired to start the AHW pump.*

11.6.0 Faults / Lock outs

Some System faults such as the low refrigerant pressure switch or the high refrigerant pressure switch will be allowed to trip a few times (default = 3) within 24 hours. Then for system safety the compressor will lockout for 24 hours or until the condition causing the fault is repaired and reset. Once the condition causing the fault is repaired the lockout can be reset by cycling the master switch or cycling the system power. Never reset a lockout without repairing the issue that caused the fault.

11.6.1 System Faults

Some examples of **system faults** as they will be displayed on the Protostar are listed here. Most are self-explanatory.

These we will explain:

Sensor Failure: Either the supply air sensor or freeze sensor has failed or is missing.

Enable off: Enable looks at the master switch and the sensor fail check routine, if both are ok then a 3 minute delay will count down. After this delay the enable will go away. The enable will always be off during the power up routine for 3 minutes.

Temp Fault: The temp fault routine looks at the return air temperature and the supply air temperature to see if the system is working correctly. If the system has been running for 1 hour and the air differential is less than 8 degree the Temp Fault will be initiated.

Examples of System Faults

No Faults
Low Pressure Switch
High Pressure Switch
Freeze fault
Sensor Failure
Enable Off
Master Switch off
Temp Fault detected
Low Limit Lock out
High Limit Lock out
V-Star Drive Fault
Oil Float
Condensate Float SW

11.6.2 Compressor Drive Faults

Compressor drive faults will be displayed on the Protostar thermostat and indicated by a flashing light directly on the v-star drive. Some examples of **Drive Faults** as they will display on the Protostar are listed here. Some like fault 3 & fault 6 will never apply to the V-Star system so no description is provided.

The two most common are Manual HI limit trip and Comm loss.

A manual reset high refrigerant limit is wired directly to the V-star drive for safety, this is the only thing that will cause a Manual HI limit fault.

Examples of Drive Faults

No Drive faults
Drive not ready
Manual HI limit trip
Fault 3
Phase loose/thermal
Comm loss (wait)
Fault 6
Drive over Current
Motor Stall
Low load
Excessive drive temp
Under Voltage
Over voltage
Comp failed to start
Excess motor temp
Ground Fault
excess start/hr

Comm loss is normally a temporary fault caused by power flash or brownout. This fault normally goes away after power has been restored for a few minutes.

12.0 System Sequence of Operation for Fully Variable V-star with Protostar Thermostat

The I/O flex 6126 controller with the Protostar touch screen thermostat or the ZS pro thermostat will drive the v-star compressor fully variable from 40 HZ to 160 HZ. The compressor speed will be referred to as percentage in this sequence. This percentage is not the compressor total capacity percentage but the percentage the system is being driven between minimuim (40 HZ) to Maximum (160 HZ). For example 1% = 40 HZ, 50% = 100 HZ, and 100% = 160 HZ.

A communicating thermostat (Protostar touch or ZS pro) is required to constantly report the space temperature back to the controller for accurate variable speed control.

A priority DHW (Domestic Hot Water) or priority AHW (Auxiliary Hot Water) call is determined by placing a temperature sensor on the hot water tank. This temperature is read into the control board to determine DHW and AHW demand.

HEATING MODE

a. Protostar T-stat sensing space temp lower than heating set point.

i. Reversing valve de-energized.
ii. ECM Fan on at calculated speed equal to 400 CFM per calculated ton of V-star compressor. ECM fan will run for one minute at this speed then slowly modulate to maintain 100 degree discharge air temperature.
iii. Ground loop pump on.
iv. DHW pump on if hot gas temperature is hotter than DHW tank and DHW tank temp is lower than DHW priority max temp set point.
v. V-star compressor will ramp up as needed to keep space temp within a half of degree of heating set point.

b. Heating with Aux heat or Emergency Heat.

See section 11.1.12 for an explanation of the blower speed and damper operation when aux heat or e-heat are calling.

i. Aux heat – If any zone has reached its zone limit for 30 minutes or longer and that zone is 1.5 degree below set point then the auxiliary strip heat will be allowed to start and heat with the compressor.
ii. Aux heat with a fault – If the V-star compressor shuts down due to a limit trip or freeze condition the auxiliary heat will be allowed to come on immediately. The Auxiliary heat will cycle as needed via heating set point.
iii. E-heat mode – if the thermostat is set to E-heat. The compressor will be locked off and the strip heat will cycle on and off as needed to provide heat for the space. This should only be used during component failure scenario.

HEATING MODE WITH PRIORITY DHW CALL

a. In the event of a heating call and the DHW tank temperature drops below the Priority start temp set point, the system will modulate as normal for heating except the minimum the compressor will be allowed to run increases to 50%. The blower will maintain a calculated speed to achieve 100ºF discharge air temp. The blower speed will not exceed the Zone limit calculated speed per zone.

b. If the DHW tank temperature continues to drop 5 degree below the Priority start temp set point the system will ramp the compressor up to 100% in order to heat both the space and DHW tank quickly. The blower will maintain a calculated speed to achieve 100ºF discharge air temp. The blower speed will not exceed the Zone limit calculated speed per zone.

PRIORITY DOMESTIC HOT WATER (DWH) CALL ONLY

a. Hot water drops below field adjustable Priority Start temperature.

i. Reversing valve de-energized
ii. Blower off (Even if fan is set to run continuously)
iii. Loop pump on
iv. DHW pump on
v. V-star compressor ramps up to 50%.

b. If Hot water Continues to drop another 5ºF below Priority Start Temperature

(The 5º is field adjustable with in the Protostar)

i. Reversing valve de-energized
ii. Blower off (Even if fan is set to run continuously)
iii. Loop Pump on
iv. DHW pump on
v. V-star compressor ramps up to 100%.

c. When the DHW tank tamp reaches the Priority stop temperature the DHW priority will shut off.

PRIORITY AUXILIARY HOT WATER (AHW) OPTION.

If the system is equipped with the Auxiliary hot water (AHW) heating option this will function just like the DHW option and have the same set points available. The AHW option is normally used to provide heating for radiant heat or swimming pool applications. It's important to note if the DHW and AHW are both calling at the same time the AHW pump will be disabled until the DHW is satisfied then the DHW pump will be shut off and the AHW pump will start. Both water sources cannot be heated at the same time.

COOLING MODE ALONE

a. Protostar T-stat sensing space temp higher than cooling set point.

i. Reversing valve energized
ii. ECM Fan on at calculated speed equal to 375 CFM per calculated ton of V-star compressor. ECM fan will run for one minute at this speed then slowly modulate to maintain 55 degree discharge air temperature.
iii. Loop pump on unless DHW temperature is less then Priority Stop temp.
iv. DHW pump on if hot gas temperature is hotter than DHW tank.
v. V-star compressor will ramp up as needed to keep space temp within a half of a degree of cooling set point.

COOLING MODE WITH PRIORITY HOT WATER CALL

a. Cooling call from Protostar T-stat and DHW tank temp below Priority Start set point. *(default priority start set point = 112)*

i. Reversing valve energized

ii. ECM Fan on at calculated speed equal to 375 CFM per calculated ton of V-star compressor. ECM fan will run for one minute at this speed then slowly modulate to maintain 55 degree discharge air temperature.

iii. *Loop pump off until Priority DHW satisfied or med limit trip (Med limit is a safety to protect from low flow on hot water loop).*

iv. DHW pump on

v. V-star compressor will ramp up as needed to keep space temp within a half of degree of cooling set point. No additional compressor speed is added due to the ground loop pump being in the off position. All the heat extracted from the space is transferred into the hot water loop.

13.0 Recommended *Hydro-Temp™* Start-Up Procedure

13.1 Start-Up Check List.

Verify the following items **are addressed before** starting the unit:

- If closed loop system, loop is purged and auto purge is filled to 3" from top of tank and all valves are open. Ensure a minimum of 20% methanol or 25% Propylene glycol is purged into the loop and properly mixed. Ensure all piping is verified to provide designed flow rate and all valves are open.
- If open loop system, well has pressure (20PSI – 50 PSI) and all valves are open. Make sure water flow stops when system is off.
- All air is purged from hot water loop lines and all valves are open. A dry pump will quickly burn up. If Priority On Demand system insure DHW sensor is properly installed.
- Optional U.V. light installed. (UVC must be powered down if panel is removed to area where light is installed. Severe eye burn could occur)
- All supply and return grills are installed and unrestricted.
- All supply air dampers are installed and powered correctly. All dampers should power open if no zone is calling for heat or cool.
- Return duct and grills are installed and unrestricted with filter installed.
- All service panels to air chamber are secured to unit.
- Supply voltage is correct and matches nameplate.
- Fuses, breakers, and wire sizes are correct.
- Low voltage wiring complete including all thermostats and field safeties.
- Unit is level for proper condensate drainage and a condensate drain is open, correctly pitched, and p-trap is installed.
- Service / Access panels are in a place with proper clearance to allow service to front and sides.
- All Protostar installer settings are correctly configured.

13.2 Start Unit

- Turn on main power.
- Adjust thermostat up or down to bring system on or start the system in Test mode.
- Check to ensure blower is running. If 3 phase voltage ensure blower rotation is correct.
- Check to ensure compressor is running. 3 phase voltage ensure compressor rotation is correct.
- Check that auxiliary heat (if applicable) is pulling proper amperage.
- Check for water flow.
- Check hot water loop for water circulation.
- Reinstall all panels.
- Set thermostat to desired temperature.
- If well water system, water flow should be approximately 1 GPM to 2.5 GPM per ton.
- If closed loop system, check the temperature of the water in and out. This should not exceed a 10°F difference. If more than 10ºF then check pump and try to increase water flow.
- Reinstall all panels.

13.3 Charging a *Hydro-Temp™* System

To get optimal performance from your *Hydro-Temp™* system, proper charging is essential. Ensure that the refrigerant used is of the proper type. Consult the unit label or call the factory for assistance.

For proper charging consult the unit label and weight in the name plate rated amount of refrigerant.

14.0 Preventative Maintenance

YOUR *HYDRO-TEMP™* WATER SOURCE HEAT PUMP HAS BEEN BUILT TO BE VIRTUALLY MAINTENANCE FREE IF PROPERLY MAINTAINED. THERE ARE ONLY A FEW THINGS YOU NEED TO DO TO KEEP YOUR SYSTEM RUNNING AS EFFICIENTLY AS POSSIBLE.

IT'S STRONGLY RECCOMMENDED TO HAVE THE SYSTEM CHECKED ONCE A YEAR BY A TRAINED SERVICE PROFESSIONAL. MANY INSTALLING DEALERS OFFER PREVENTATIVE MAINTENANCE CHECKS.

WARNING! ⚠ BEFORE PERFORMING SERVICE OR MAINTENANCE ON SYSTEM, TURN OFF ALL BREAKERS INCLUDING MAIN POWER AND POWER TO OPTIONAL AUXILIARY HEATER. WAIT FIVE MINUTES BEFORE REMOVING ANY PANELS TO ALLOW POWER TO DISSIPATE FROM VARIABLE FREQUENCY DRIVES. ELECTRICAL SHOCK CAN CAUSE PERSONAL INJURY OR DEATH.

DO **NOT** OPEN PANELS/DOORS! DANGER OF ELECTRICAL SHOCK AND/OR PINCH HAZARD!

- Be aware of thermostat setting. In some cases, programmable thermostats will mistakenly be programmed to set the temperature back when not desired. Check the programming to insure the correct time of day and desired temperature is programmed or set the thermostat on hold. Which will stop the programming and allow a constant setting.
- **Keep a clean** air filter on your unit. Air filters need to be changed about once every 30 days. Always buy the best air filter available. Air filters can be purchased through *Hydro-Temp™* if necessary. *Hydro-Temp™* recommends a lifetime electrostatic air filter that can be taken out once a month and cleaned by back flushing / washing with

water. If filter is not changed / cleaned on a regular basis expensive air coil cleaning may be required during preventative maintenance checks.

- Give the unit an occasional visual check. Look for water around the base of the unit and listen for any unusual noises.
- Closed loop systems are a sealed system unless an auto purge tank is used. If totally sealed they require no physical maintenance short of visual inspection for leaks. If your system was installed with an auto purge tank / kit it is recommended to check the fluid level in the tank once a month when you replace the air filter. Ensure the fluid level in the tank is between ½ and ¾ of the way full. It should be rare to have to add fluid after the first year. If you are required to add fluid more than a few times after the first year contact the installing dealer to have the anti-freeze levels checked. Never fill more than ¾ of the way full to prevent over flow.

⚠ IMPORTANT NOTICE: UNITS THAT UTILIZE GROUND LOOPS MUST MAINTAIN A MINIMUM OF 20% METHANOL OR 25% PROPYLENE GLYCOL AS AN ANTIFREEZE SOLUTION IN THE UNIT AND GROUND LOOP AT ALL TIMES. FAILURE TO DO SO WILL ALLOW REFRIGERANT TEMPERATURES TO DROP, CAUSING INTERNAL FREEZING OF THE UNIT TO OCCUR, CAUSING SEVERE DAMAGE TO THE UNIT. **DAMAGE TO THE UNIT CAUSED BY FAILURE TO MAINTAIN PROPER ANTIFREEZE LEVELS IS NOT COVERED UNDER WARRANTY.**

- Open loop systems require well water to be pumped through the system. For this reason Hydro-Temp recommends the installing dealer to install isolation valves and a water strainer on the entering water line feeding water to the Hydro-Temp system. Be aware of the location of these components in the event the strainer needs to be cleaned more often than once a year during your preventive maintenance check. Be aware of all isolation valves so cleaning can be done with minimal water spillage. It's a good idea to be familiar with the location of the isolation valves in the event of a major water leak. All open loop systems have a discharge water line that discharges the water to a discharge well, creek, pond, etc. ***Check local state and county codes for proper discharge of water.*** Be aware of discharge location and check occasionally to insure proper drainage is occurring. During the winter, insure discharge is protected from freezing. Do not attach any kind of sprinkler to the end of the discharge water line as the increase in back pressure will result in decreased water flow and damage the Hydro-Temp system.
- Fan motors are permanently lubricated and do not need further lubrication. Motors and fan assemblies will be inspected on a yearly basis for wear during preventative maintenance checks.
- DHW plumbing consist of a closed recirculating loop which is purged free of air by the installing dealer. If any maintenance or hot water tank replacement is done, insure the DHW plumbing is properly purged of air. Consult with your installing dealer before draining the hot water tank for proper procedures.
- During your annual preventative maintenance check, inspect the drain pans for debris to avoid condensate tubing blockage. Tubing needs to be checked at both ends to ensure blockage doesn't clog up the pipe from the inside or outside of the house if exposed.
- If the system is equipped with a ultra-violet light, the bulb will need to be replaced every 18 months. Due to the hazard of UV exposure, the bulb should only be replaced by a trained professional.
- Most systems are now equipped with controllers that allow for a system lock out feature. If the system trips a protective limit switch 3 consecutive times the system will lockout. If the system locks out power will need to be cycled to reset the lockout. Before resetting the lockout you must always insure the problem causing the lockout has been repaired. If unsure consult your installing dealer before resetting the lockout.
- Be aware of all breaker locations. Some systems may have two breakers for the compressor section. If the system is equipped with auxiliary heat a separate breaker will be needed to supply power to auxiliary heat strips.

ADDITIONAL REMINDERS:

Chemicals, cleaners, inhibitors or other products that corrode or attack copper (such as Trisodium Phosphate) should never be placed into the water circulation loop(s) connected to the Hydro-Temp equipment or stored in the same room as the Hydro-Temp equipment. Failure to follow this requirement will void the equipment warranty.

Protect the *Hydro-Temp™* unit from freezing temperatures. If the system is in your attic or outside special precautions may need to be taken to ensure freeze protection.

The *Hydro-Temp™* unit should never be exposed to a dirty or dusty air environment. Dust, such as sawdust or sheet rock dust, can damage the electrical components, fan motor, and air coil on the unit. Simply place a cover (tarp, etc.) over the unit when construction or any other dust producing job is being done in the area of the *Hydro-Temp™* unit. Never run the system during construction. Not only will sheet rock dust plug up and cause damage to the air coil but it will also accumulate in the duct system and slowly be blown out over the years.

- If the unit is ever moved from its original location, never lay it on its side. Never jar or drop the unit during transport. This is a sealed refrigeration system; rough handling may cause the system to develop a leak. Once removed, protect the system from freezing. Anti-freeze may need to be flushed into the plumbing. When being reinstalled, anti-freeze levels will need to be checked.
- All plumbing from the Hydro-Temp system to the hot water tank may require a licensed plumber. If any repairs are ever needed, insure all plumbing is done / maintained with **copper tubing only**. Do not use PVC, CPVC, PEX or any other plastic pipe.
- Keep an accurate service record. Keep a copy of all service reports with this booklet.

15.0 Basic Trouble Shooting Chart For The Hydro-Temp System

SYMPTOM	*POSSIBLE CAUSE*	*CORRECTIVE ACTION*
Water around base of unit	*1. Water leak.* *2. Condensate from water coil or accumulator.* *3. Condensation pan not draining.* *4. Air coil freezing.*	*1. Find and repair leak.* *2. Insulate these items.* *3. Check for algae. Blow out restriction in condensate pipe.* *4. Check for dirty air filter or restriction in ductwork*
Noisy operation	*1. Normal after recharging unit.* *2. Defective fan motor.* *3. Defective compressor mounts.* *4. Defective compressor (internal damage).* *5. Refrigerant line vibrating.* *6. Loose blower wheel.* *7. Foreign material in blower housing.* *8. Duct work leaking or loose duct (causing a whistle noise)* *9. Excessive water pressure on well, (thumping noise).* *10. Duct work Vibrating*	*1. Initial operation after recharging may be noisy as refrigerant separates from oil.* *2. Repair or replace motor.* *3. Replace mounts.* *4. Replace compressor.* *5. Reposition and secure.* *6. Realign and tighten.* *7. Clean housing.* *8. Repair and secure duct work properly* *9. Install 25 lbs. Pressure reducer on well water supply line.* *10. Install flex connectors on supply and return duct.*
Low air flow	*1. System running in low speed.* *2. Leaks in duct work.* *3. Dampers and/or registers closed.* *4. Obstruction in system.* *5. Clogged filters.* *6. Dirty air coil.*	*1. No Action needed. This is normal operation.* *2. Repair duct work.* *3. Open dampers and/or registers.* *4. Remove obstruction.* *5. Clean or replace filters.* *6. Clean air coil.*

Fan runs continuously, compressor runs normal	1. Thermostat fan setting turned to "on" position.	1. Switch thermostat selector to off.

Unit inoperative	1. No power to unit. 2. Defective control wiring or thermostat. 3. Defective transformer.	1. Check unit electrical supply, fuses, breakers, etc. Restore power. 2. Repair wiring. Check thermostat wiring. Replace thermostat. 3. Reset or replace transformer.

Fan operates, but compressor inoperative	1. Thermostat not set properly. 2. Low or high pressure limit tripping and or locked out due to excess trips. 3. Internal protector activating, operating. 4. Faulty internal protector. 5. Freeze protector activating (well water systems only) 6. Defective Compressor Drive. 7. Defective compressor.	1. Read thermostat instructions. 2. Repair condition causing excessive pressures. 3. Repair condition causing extreme temperatures. 4. Replace compressor. 5. Check water flow / replace protector 6. Replace drive. 7. Replace compressor.

Reversing valve will not switch	1. No voltage to solenoid. 2. Bad solenoid coil. 3. Stuck valve.	1. Correct voltage problem. 2. Replace coil. 3. Tap valve with hammer until it switches or replace valve.

Operating pressures too high and/or high pressure limit tripping Check duct sizes.	1. Too little water flow (cool cycle). 2. Clogged air filter (heat cycle). 3. Air restriction (heat cycle). 4. Bad high pressure limit. 5. Unit overcharged.	1. Check loop pump and flow. 2. Clean or replace air filter. 3. Check duct work for collapsed duct line. 4. Replace limit. 5. Adjust charge.

Operating pressure too low and/or low pressure limit tripping	1. Refrigerant leak. 2. Too little water flow (heat cycle). 3. Air restriction (cool cycle). 4. Bad low pressure limit.	1. Find and repair leak. 2. Check loop pump and flow or water supply. 3. Check air filter, duct work, etc. 4. Replace limit.

Freeze switch activating (Reversing valve switches During heating mode) ** Well water systems only**	1. Too little water (heat cycle). 2. Freeze set too high. 3. Bad freeze sensor.	1. Follow procedure previously described. 2. Lower setting. Call factory. 3. Replace sensor.