AquaCal®

Installation Manual

WATER SOURCE
SWIMMING POOL AND SPA HEAT PUMPS

SUNPOWER

Important

Read this document before operating / installing this product

For additional product manuals and operation / installation procedures, please visit www.AquaCal.com

MODEL / SERIAL NUMBER

LTP0116 REV 3.2- (project rel 7.02)

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Contacting AquaCal AutoPilot, Inc.

For further assistance, please contact the distributor or installer of this product.

If unavailable, please contact AquaCal® for a partner in your area. To better assist you, please have the heat pump model and serial number available.

- See "*Identifying Model Specifications*" on page 74.

Product Information:	
Website	www.AquaCal.com
Phone	(1) 727-823-5642
Hours	8-5 pm, Eastern M-F

Service Information:	
Website	www.AquaCal.com/request-heat-pump-service/

SAFETY INSTRUCTIONS

- For personal safety, and to avoid damage to equipment, follow all safety instructions displayed on the equipment and within this manual. Repair and service of heat pump must be performed by an authorized service center.
- Warranties may be voided if the equipment has been improperly installed, maintained or serviced.
- If service is deemed necessary, please contact AquaCal. See "*Contacting AquaCal AutoPilot, Inc.*" above.

SAFETY SIGNALS

Throughout this document, safety signals have been placed where particular attention is required.

DANGER — Failure to heed the following will result in injury or death.

WARNING — Failure to heed the following may result in injury or death.

NOTICE — Failure to heed the following may result in damage to equipment.

When installing and using your heat pump basic safety precautions must always be followed, including the following:

DANGER — Failure to heed the following will result in injury or death.

- The heat pump utilizes high voltage. Use caution when servicing.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- Installation and repairs must be performed by a qualified technician.
- The heat pump contains refrigerant under pressure. Repairs to the refrigerant circuit must not be attempted by untrained and/or unqualified individuals. Service must be performed only by qualified HVAC technicians. Recover refrigerant before opening the system.
- Improper water chemistry can present a serious health hazard. To avoid possible hazards, maintain pool/spa water per standards as detailed in the product's operation manual.
- Prolonged immersion in water warmer than normal body temperature may cause a condition known as Hyperthermia. The symptoms of Hyperthermia include unawareness of impending hazard, failure to perceive heat, failure to recognize the need to exit the spa, and unconsciousness. The use of alcohol, drugs, or medication can greatly increase the risk of fatal Hyperthermia. People having an adverse medical history, or pregnant women should consult a physician before using a hot tub or spa. Children and the elderly should be supervised by a responsible adult.
- Prolonged immersion in water colder than normal body temperature may cause a condition known as Hypothermia. The symptoms of Hypothermia include shivering (although as hypothermia worsens, shivering stops), clumsiness or lack of coordination, slurred speech or mumbling, confusion and poor decision-making, drowsiness or low energy, lack of concern about personal welfare, progressive loss of consciousness, weak pulse and slow or shallow breathing. Persons having an adverse medical history, or pregnant women, should consult a physician before immersing in a cold body of water. Children and the elderly should be supervised by a responsible adult.

NOTICE Failure to heed the following may result in damage to equipment.

- Maintain proper water chemistry to avoid damage to the pump, filter, pool shell, etc.
- Water flow exceeding the maximum flow rate requires a bypass. Damage due to excessive water flow will void the warranty.

SAVE THESE INSTRUCTIONS

1 - Installation

WARNING Failure to heed the following may result in injury or death.

- Installation of this equipment by anyone other than a qualified installer can result in a safety hazard.
- The information contained throughout the "Installation" section is intended for use by qualified installation technicians familiar with the swimming Pool/Spa safety standards.

NOTICE Failure to heed the following may result in damage to equipment.

- Failure to protect equipment against corrosive conditions will adversely affect the life of the equipment and will void equipment warranty.

IN THIS SECTION:

1.1 Positioning Equipment

Controlling Irrigation and Rainwater Runoff

- Irrigation water may damage heat pump components. Direct irrigation water away from the heat pump.
- The heat pump will withstand normal rainfall. Do not allow a roof slope to direct rainwater onto the heat pump. Have a gutter installed on the roof edge to direct this water away from the heat pump. Or install the heat pump in another location.

Mounting Pad Requirements

- The heat pump's base must be installed on a flat and level surface that completely supports the entire base.
- Build the heat pump pad out of concrete or other code-approved material.
- Confirm the pad can support the weight of the heat pump. See "*Weights*" on page 75.
- Elevate the pad enough to allow for drainage.
- Make sure the pad is flat and level.
- Have the pad support the entire heat pump base in all directions.
- Do not install the heat pump on soil or grass.
- Do not allow the heat pump base to touch the building's foundation.
- Do not place the heat pump directly on a concrete floor. This can cause noise to be transmitted to an occupied space. If necessary install vibration dampers between the heat pump base and floor.
- Equipment pad must meet all requirements of authorities having code-related jurisdiction.

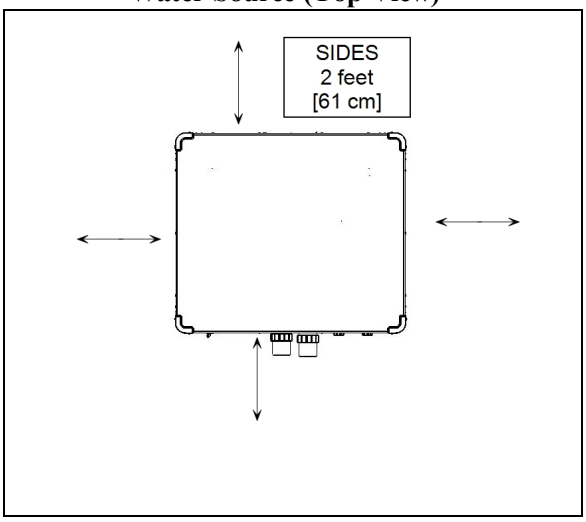
Anchoring to Pad

- Follow all applicable local, state, and national requirements regarding wind load anchoring.
- The shipping brackets used to secure the heat pump to the pallet are approved mounting (hurricane) brackets. They should be used to anchor the heat pump to the pad.
- If needed, contact AquaCal® to obtain anchoring kit information. Please have the heat pump model number and serial number when requesting support. See "*Identifying Model Specifications*" on page 74.

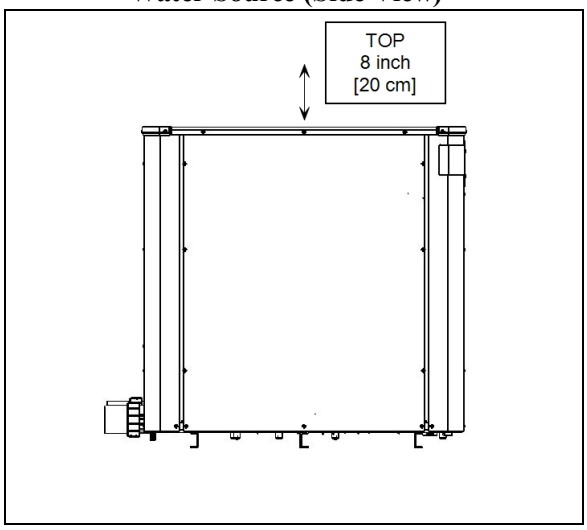
1.2 Clearances

- Locate the heat pump at least 24 inches (61 cm) away from the wall. And provide a minimum 24 inches (61 cm) between heat pumps. This will allow for rear plumbing access and electrical connections.
- Do not stack heat pumps on top of each other. Use approved racks when stacking equipment.
- Only rack equipment two units high.
- Equipment rack must meet all requirements of authorities having code-related jurisdiction.
- Avoid storing chemical containers near the heat pump. The chemicals can cause equipment damage.
- Avoid placing objects near or on top of the heat pump. This includes shrubbery and lawn furniture. These objects will hinder maintenance access.

Water Source (Top View)

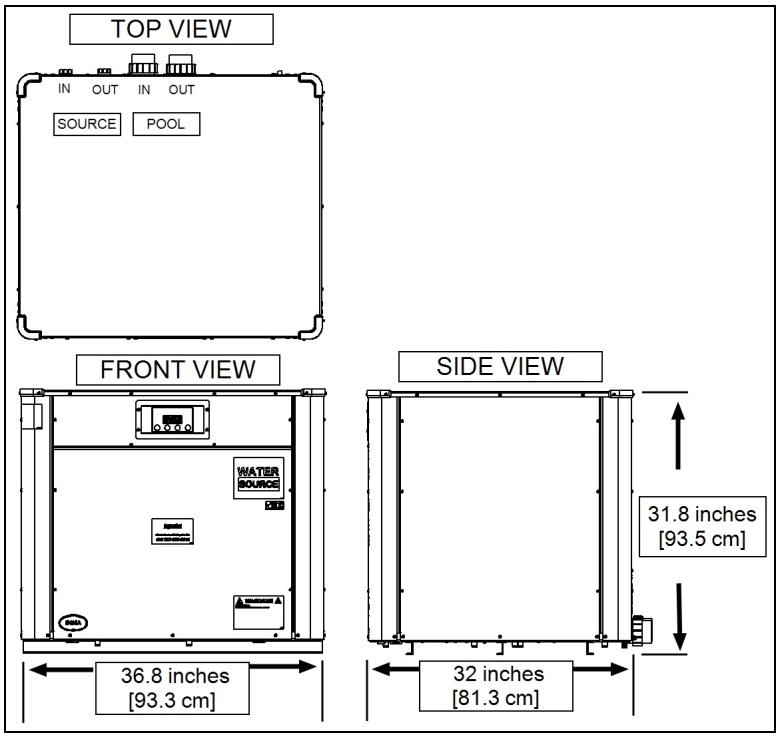


Water Source (Side View)

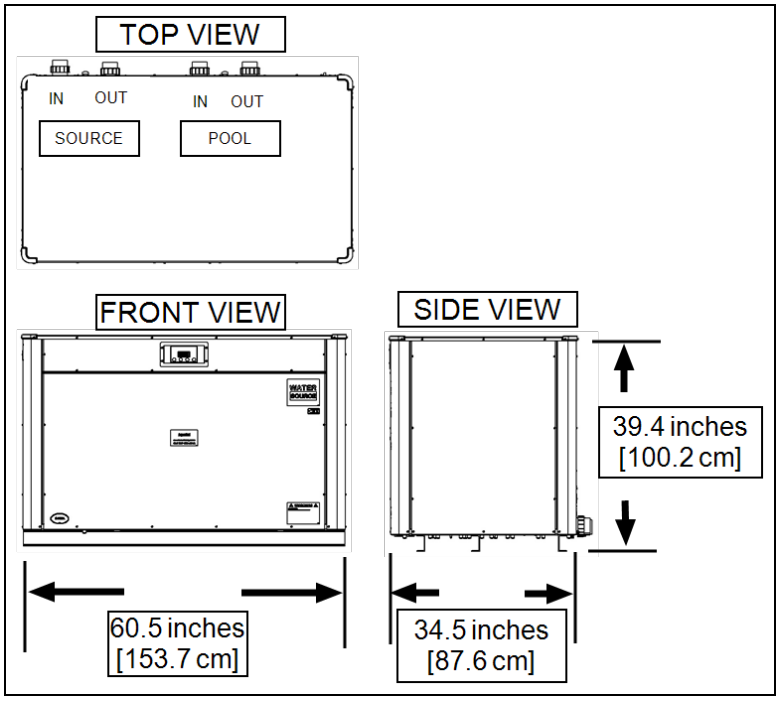


1.3 Dimensions

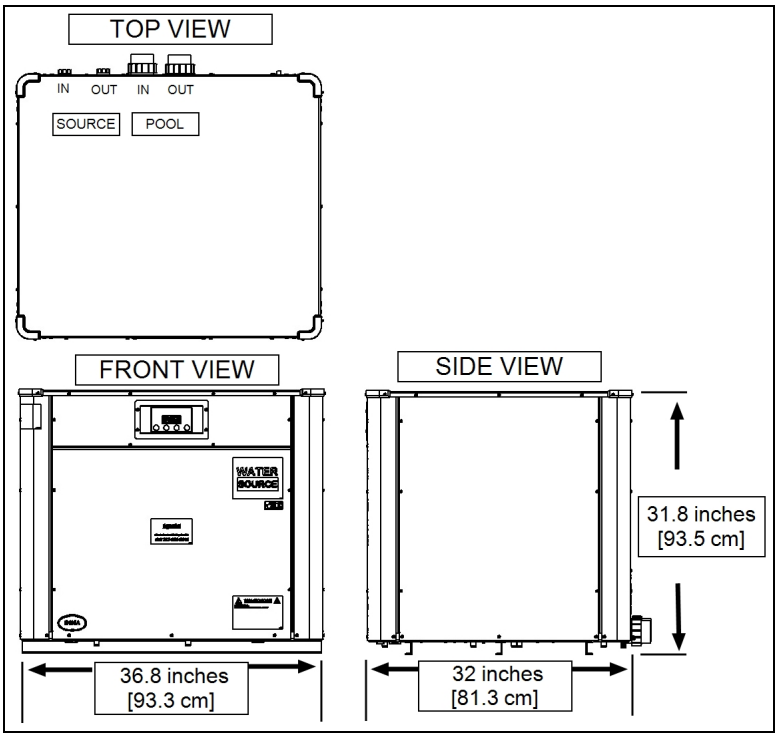
(Water Source WS03, WS05)



(Water Source WS10)



(SunPower SP05)



1.4 Plumbing

1.4.a Plumbing Requirements

NOTICE Failure to heed the following may result in damage to equipment.

- Do not use glue on the threaded portion of the equipment's unions. A glued-in-place union will prevent the equipment from being properly winterized.
- The heat pump must receive water flow within the specified minimum ranges under worst-case conditions such as a fouled water filter.
- Failure to provide clean filtered water to the heat pump can void the product warranty.
- Water flow exceeding maximum flow rates will negatively affect the total pool filtration performance and may damage the heat pump. This will not be covered under the equipment warranty. See "*Water Flow Rates*" on page 14.
- Using open saltwater applications as the heat pumps source water is not recommended.
  - Saltwater can promote the growth of crustaceans, which can clog a heat pump's heat exchanger. These types of applications are highly problematic and require additional maintenance.
  - If a saltwater source is unavoidable, install an external plate heat exchanger to protect the heat pump from fouling. Please note – Saltwater wells do not require an external plate heat exchanger.
- A safety-enhancing "Over Temperature Alarm" kit is strongly recommended for all spa applications. See "*Over Temperature Alarm Kit*" on page 77.

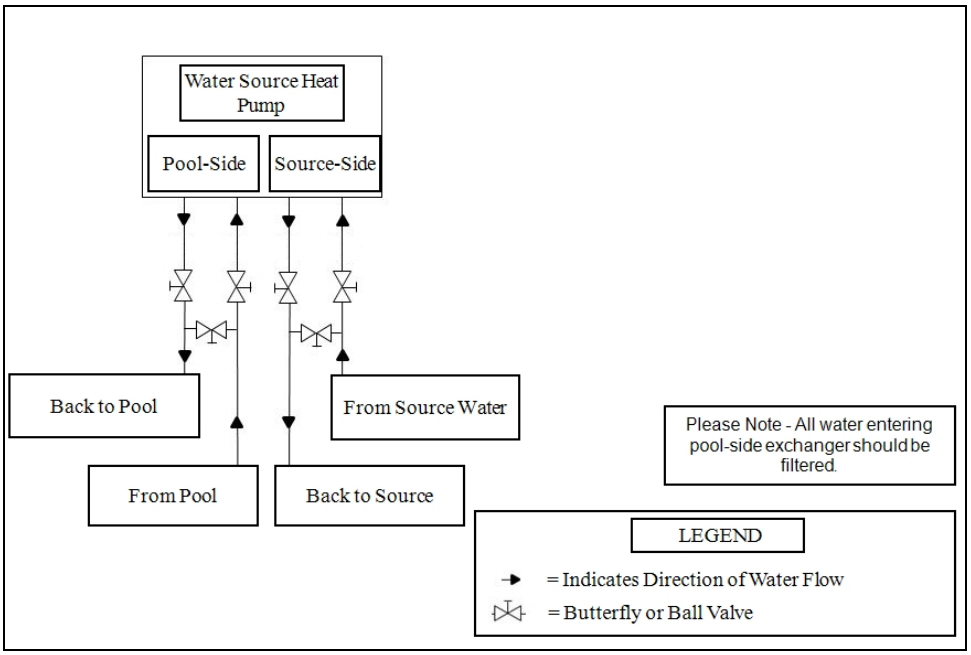
1.4.b Plumbing Diagrams (Water Source)

Plumbing diagrams are provided in this section as a planning guide to the sequence of equipment, valves, and fittings.

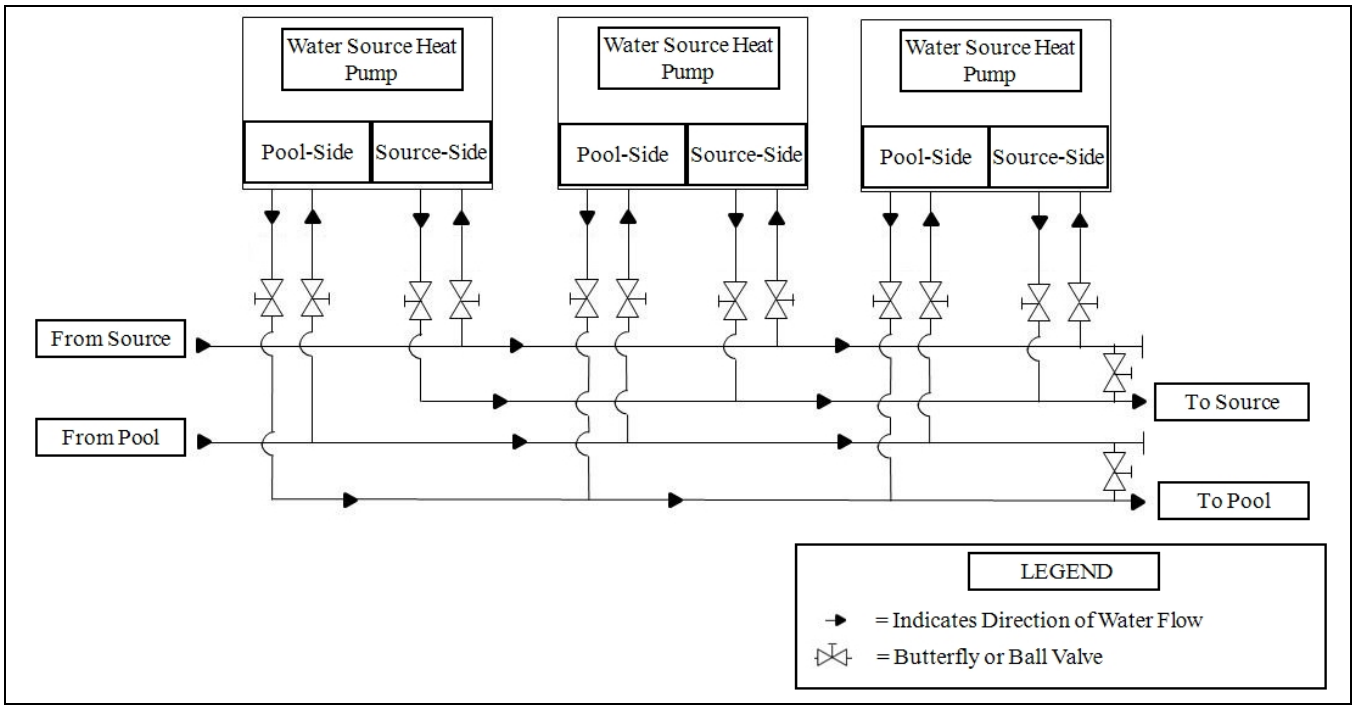
- The basic plumbing configurations for typical installations are shown.
- If the installation does not closely follow any of the supplied plumbing diagrams, AquaCal® Technical Support is available for installation advice and guidance.
- Confirm water provided to the heat pump is clean and filtered.

> It's important to use contractors familiar with geothermal applications when installing a Water Source heat pump.

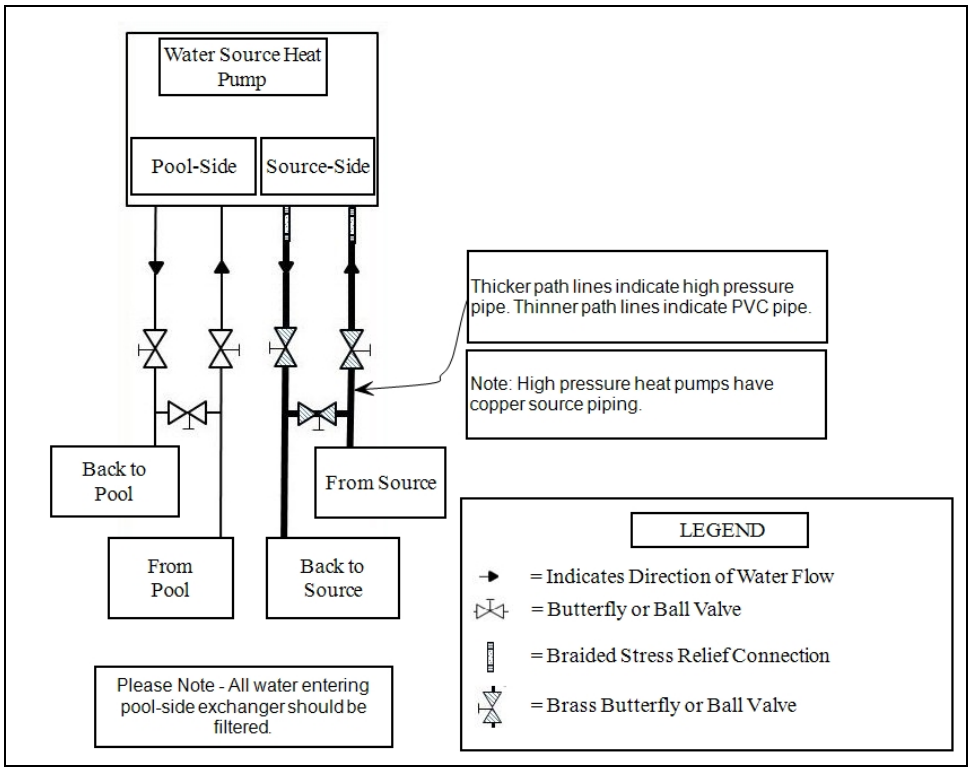
Single Water Source Heat Pump Configuration (Standard Pressures)



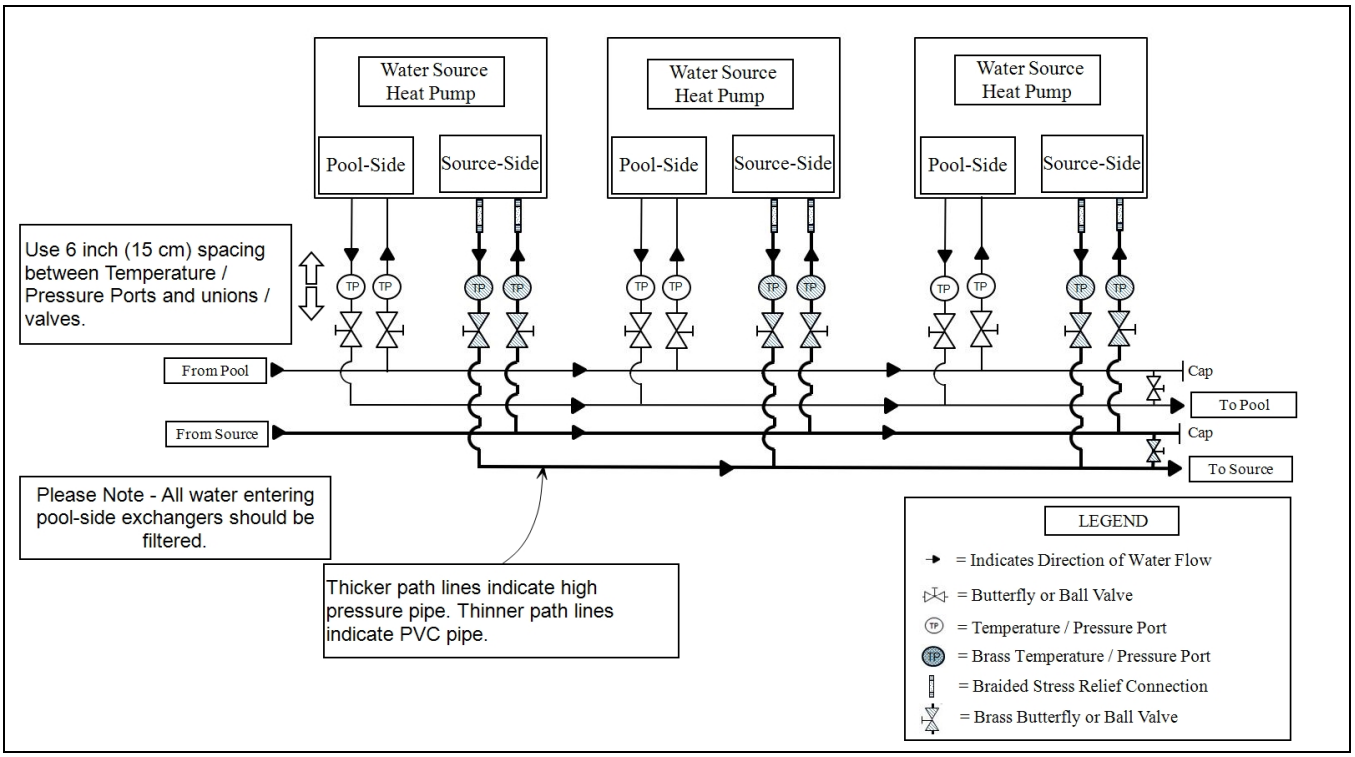
Multiple Water Source Heat Pump Configuration (Standard Pressures)



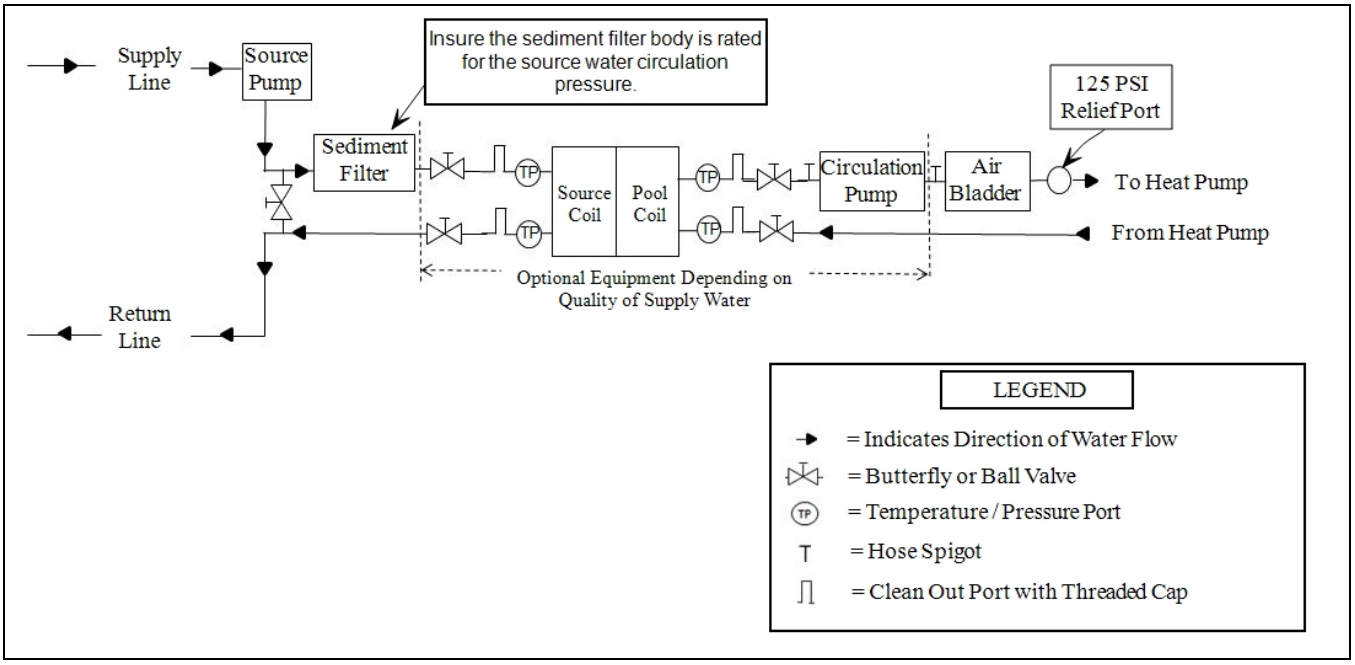
Single Water Source Heat Pump Configuration (High-Pressure)



Multiple Water Source Heat Pump Configuration (High-Pressure)



Water Source Heat Pump with Support Equipment



1.4.c Plumbing Diagrams (SunPower)

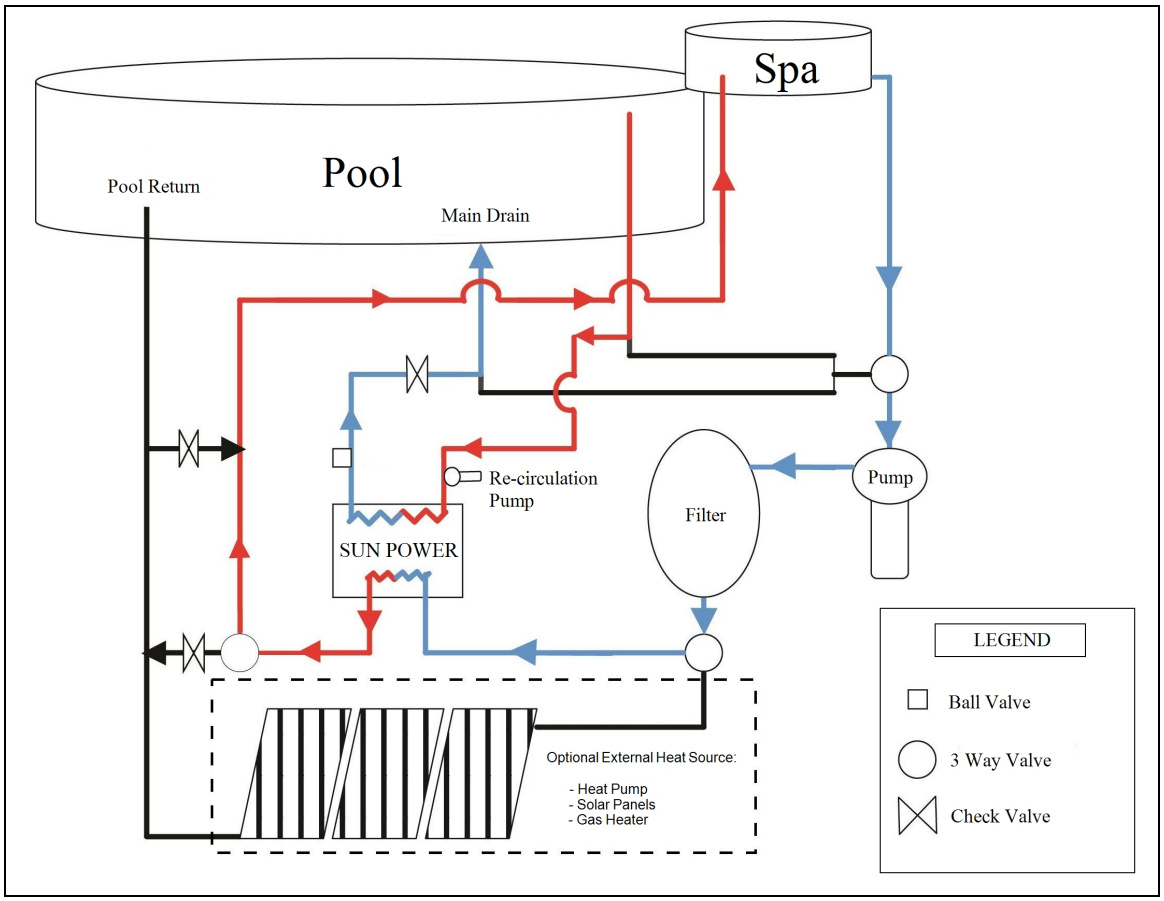
Plumbing diagrams are provided in this section as a planning guide to the sequence of equipment, valves, and fittings.

- The basic plumbing configurations for typical installations are shown.
- If the installation does not closely follow any of the supplied plumbing diagrams, AquaCal® Technical Support is available for installation advice and guidance.
- Confirm water provided to the heat pump is clean and filtered.

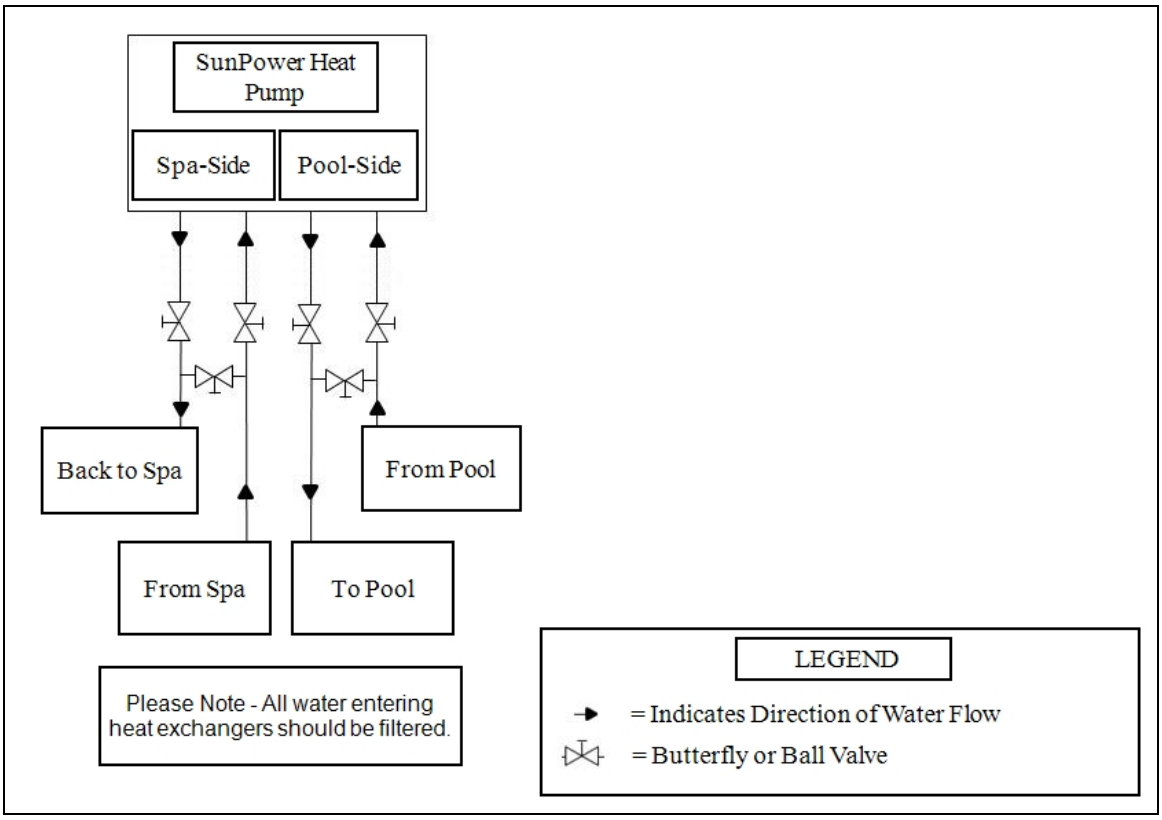
Typical SunPower Installation

Dedicated Spa Heater using Pool as the Heat Source.

> ***PLEASE NOTE -***
> *The SunPower is designed to provide heating for a spa. Not a pool.*



SunPower Heat Pump Configuration



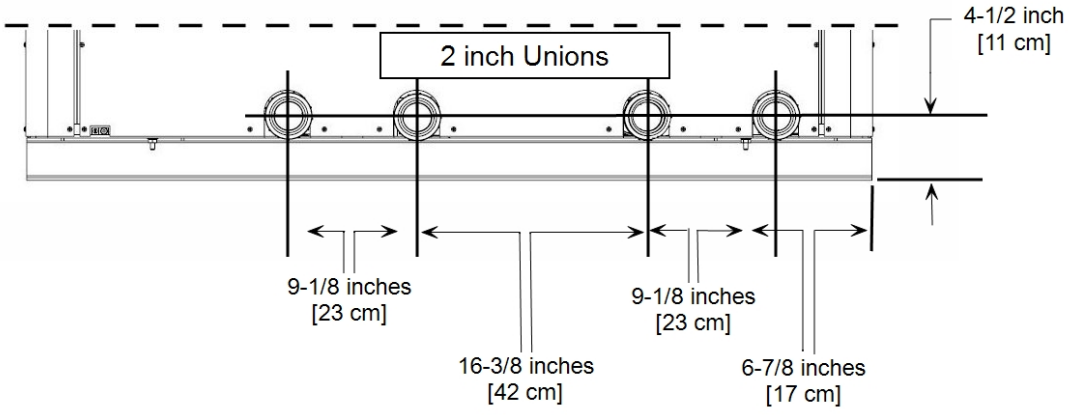
1.4.d Water Connections to Heat Pump

- Heat Pump union sizes are specified on diagrams.
- Connections to site plumbing are made via PVC solvent cement to the female slip socket of the plumbing unions.
- High-pressure units use joint compound on threaded copper connections.
- Plumbing unions are available from AquaCal®.

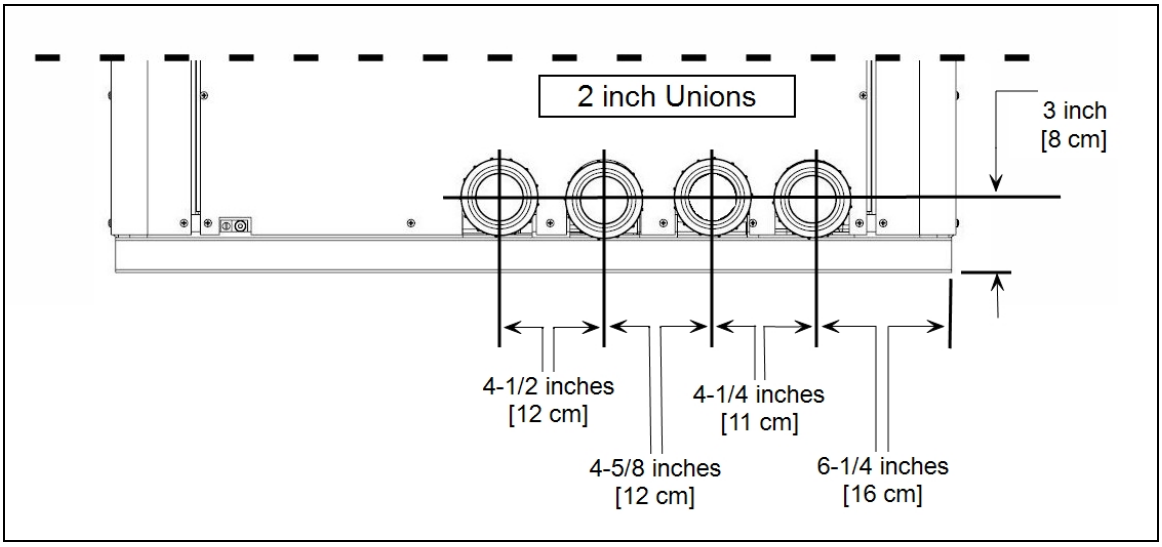
NOTICE Failure to heed the following may result in damage to equipment.

- Do not use glue on the threaded portion of the equipment's unions. A glued-in-place union will prevent the equipment from being properly winterized.

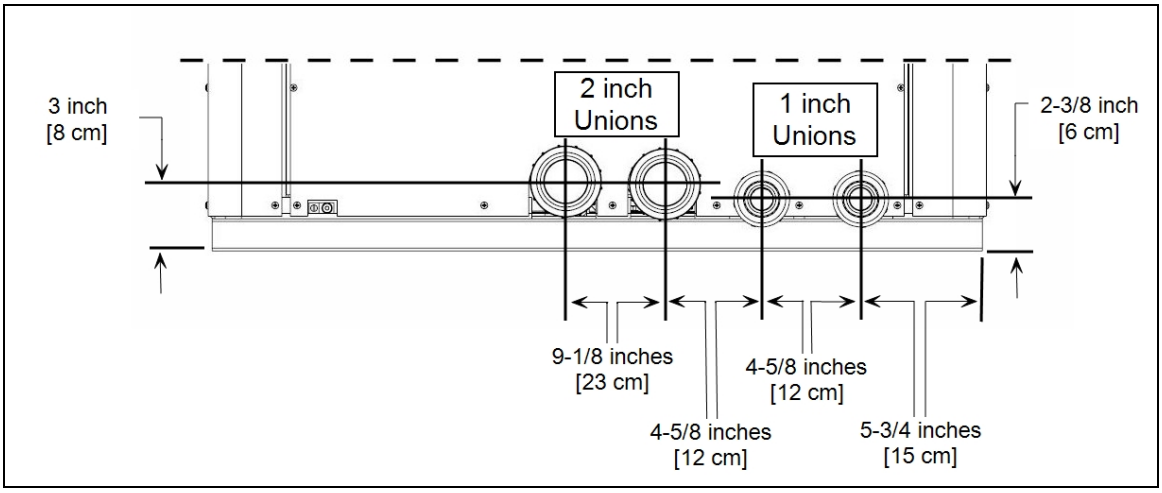
Water Source WS10 (Titanium or Cupronickel Exchanger)



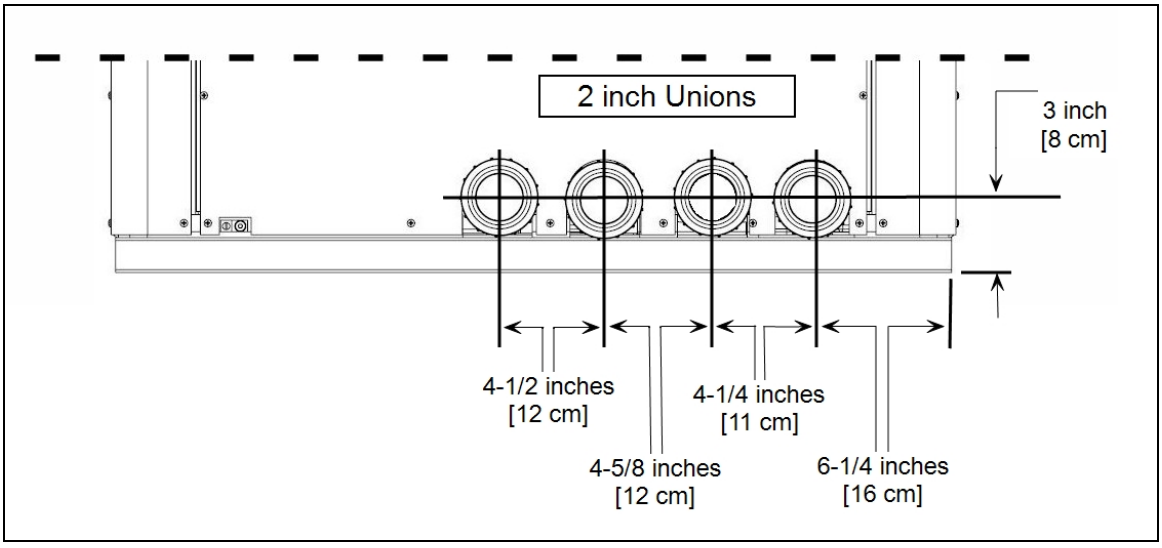
Water Source WS03 and WS05 (Titanium Exchanger Only)



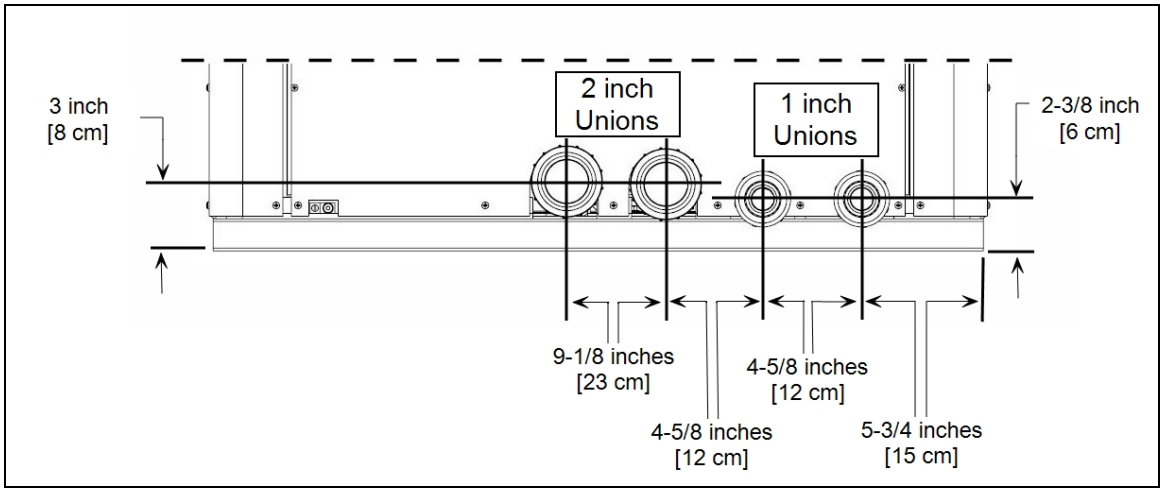
Water Source WS03 and WS05 (Titanium / Cupronickel Exchanger Combination)



SunPower SP05 (Titanium Exchanger Only)



SunPower SP05 (Titanium / Cupronickel Exchanger Combination)

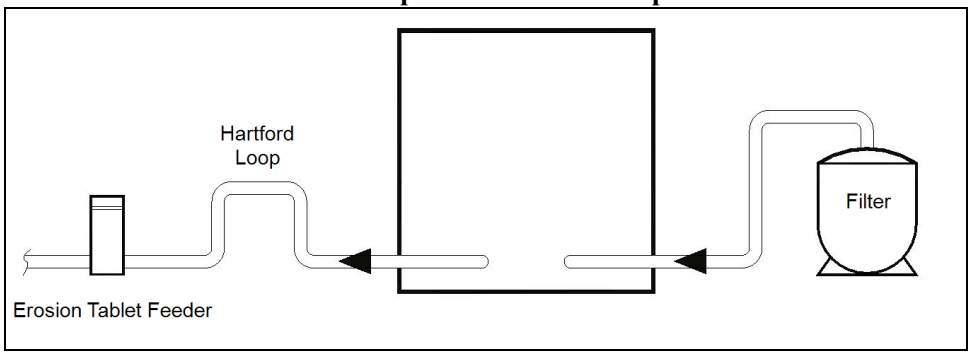


1.4.e In-Line Chlorine Feeders

Place in-line chlorinators downstream from the heat pump and as low in elevation as possible.

- If an erosion type feeder is used, it is recommended that a Hartford Loop be installed to protect internal heat pump components.
- A Hartford Loop is not necessary with a Salt Chlorine Generator.

Heat Pump with Hartford Loop



1.4.f Water Flow Rates

Maintain water flow rates as indicated. Please note, these specifications relate to the heat pump only. Code-specified whole system turnover rates must be satisfied.

NOTICE Failure to heed the following may result in damage to equipment.

- Water flow exceeding maximum flow rates will negatively affect the total pool filtration performance and may damage the heat pump. This will not be covered under the equipment warranty.

Water Source

MODEL	SOURCE	HEAT EXCHANGER TYPE	FLOW RATES	
			MINIMUM	MAXIMUM
WS03	Source-Side	Titanium ThermoLink®	20 GPM (75.7 L/min)	70 GPM (265 L/min)
		Cupronickel	10 GPM (37.9 L/min)	14 GPM (53 L/min)
	Pool / Spa	Titanium ThermoLink®	30 GPM (113.6 L/min)	70 GPM (265 L/min)

MODEL	SOURCE	HEAT EXCHANGER TYPE	FLOW RATES	
			MINIMUM	MAXIMUM
WS05	Source-Side	Titanium ThermoLink®	20 GPM (75.7 L/min)	70 GPM (265 L/min)
		Cupronickel	10 GPM (37.9 L/min)	18 GPM (68 L/min)
	Pool / Spa	Titanium ThermoLink®	30 GPM (113.6 L/min)	70 GPM (265 L/min)
WS10	Source-Side	Titanium ThermoLink®	30 GPM (113.6 L/min)	70 GPM (265 L/min)
		Cupronickel	30 GPM (113.6 L/min)	54 GPM (204.4 L/min)
	Pool / Spa	Titanium ThermoLink®	30 GPM (113.6 L/min)	70 GPM (265 L/min)

SunPower

MODEL	SOURCE	HEAT EXCHANGER TYPE	FLOW RATES	
			MINIMUM	MAXIMUM
SP05	Source-Side	Titanium ThermoLink®	20 GPM (91 L/min)	70 GPM (265 L/min)
	Spa Side	Titanium ThermoLink®	30 GPM (113.6 L/min)	70 GPM (265 L/min)

PLEASE NOTE -

If minimum flow rates are not met, heat pump performance is reduced and performance will suffer. Internal safety devices may deactivate the heat pump with the following errors:

- **HIGH PRESSURE FAULT**
- **HP5 SYSTEM LOCKOUT**
- **LOW PRESSURE FAULT**
- **LP5 SYSTEM LOCKOUT**

- Operate water filtration devices per manufacturer's specifications. Dirty filters can cause a reduction of water flow to the heat pump. An increase of 7-10 psi (48 to 69 kPa) higher than the clean filter pressure typically reduces flow rates. This requires the filter to be cleaned or back-washed.
- Keep baskets free of debris. A large quantity of debris in the pump and skimmer baskets can reduce water flow.
- Check for improper valve settings. A partially closed valve after the filter, or a full-open bypass around the heat pump, will cause insufficient water flow through the heat pump.
- The maximum static pressure (or operating pressure) is 50 psi (345 kPa) unless a special "high-pressure" unit has been ordered. These specifications relate to the heat pump only.
- Code-specified whole system turnover rates must be satisfied.

1.4.g Adjusting Water Flow Using ΔT (Delta-T)

The Delta-T is the temperature difference between the water temperatures entering and leaving the heat pump. The equipment can be fine-tuned for maximum performance by balancing water flow rates to maintain an ideal ΔT.

The adjustment procedure must be completed with the unit in heating mode.

PLEASE NOTE -

- See "*Temperature Port Kit (# STK0096)*" on page 78.

1. Adjust the thermostat to its lowest setting with the unit in heating mode.
2. Deactivate the water filtration pump.
3. Confirm that the filters leading to the heat pump are clean.
4. Adjust the valves controlling water headed towards the heat pump to the half-open position.
5. Adjust the valves controlling water leading away from the heat pump to a fully open position.
6. Activate the pool water filtration pump.
7. Slowly raise the thermostat temperature until the heat pump activates.
   - The source-water filtration pump will cycle on first.
   - After a three-minute delay, the heat pump's compressor will start.
8. With the heat pump running, confirm the source-side water filtration pump is operating properly with adequate flow and no short cycling.
9. Wait for water temperatures to stabilize (approximately 5 minutes).
10. Open the temperatures differences screen in the Geothermal Menus. See "*Geothermal Menus*" on the facing page.
12. Adjust valves in the following order using the temperature chart provided.
    a. Adjust the source-side valve on the heat pump outlet until the correct temperature differential is achieved.
    b. Adjust the pool-side valve that controls water exiting the heat pump until the correct temperature differential is achieved.
    c. Wait for water temperatures to stabilize. Then check the source-side temperature again. Re-adjust the valve as needed.

13. Mark valves at these positions for future reference.

HEAT EXCHANGER TYPE	MODEL	SOURCE-SIDE	POOL-SIDE
Titanium pool-side and source-side exchangers	WS03	1° to 5° F (.5° C to 2.8° C)	2° to 4° F (1.1° C to 2.2° C)
	WS05	2° to 8° F (1.1° C to 4.4° C)	3° to 6° F (1.7° C to 3.3° C)
	WS10	5° to 12° F (2.8° C to 6.7° C)	6° to 14° F (3.3° C to 7.8° C)

HEAT EXCHANGER TYPE	MODEL	SOURCE-SIDE	POOL-SIDE
Titanium pool-side exchanger and cupronickel source-side exchanger	WS03	6° to 8° F (3.3° C to 4.4° C)	1° to 3° F (.5° C to 1.7° C)
	WS05	7° to 13° F (3.9° C to 7.2° C)	2° to 6° F (1.1° C to 3.3° C)
	WS10	6° to 11° F (3.3° C to 6.1° C)	6° to 14° F (3.3° C to 7.8° C)

Table 1 - Temperature Chart (Water Source)

HEAT EXCHANGER TYPE	MODEL	SOURCE-SIDE	SPA-SIDE
Titanium ThermoLink®	SP05	2° to 8° F (1.1° C to 4.4° C)	3° to 6° F (1.7° C to 3.3° C)

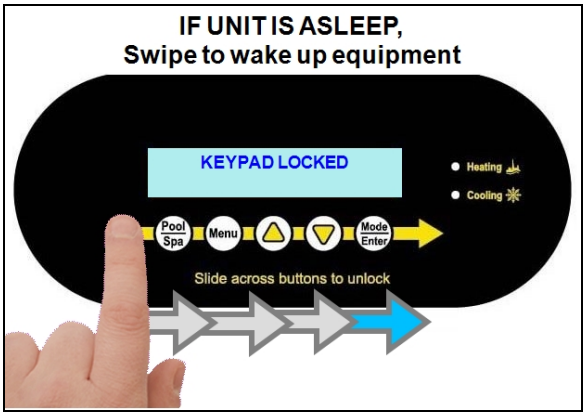
Table 2 - Temperature Chart (Sun Power)

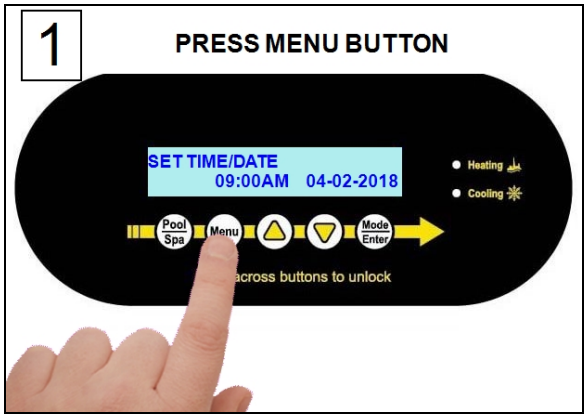
PLEASE NOTE -

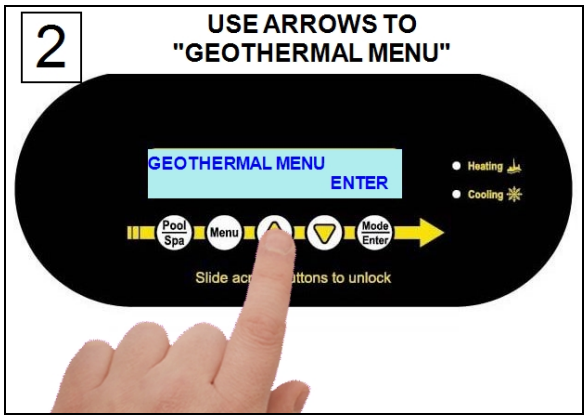
- Temperature differences are based on pool and source water temperatures of 69° to 75° F. (20.5° to 23.8° C)
- For water temperatures outside this range, contact AquaCal®. See "*Contacting AquaCal AutoPilot, Inc.*" on page 1.

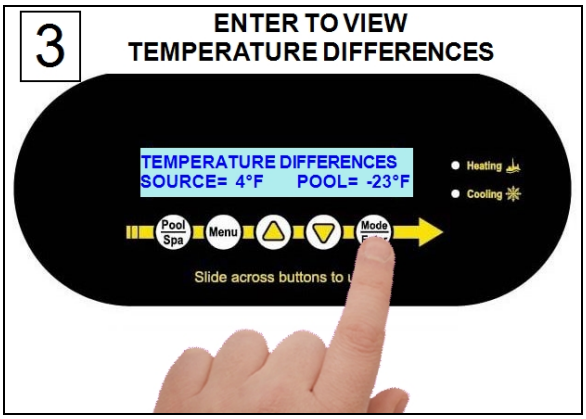
1.4.h Geothermal Menus

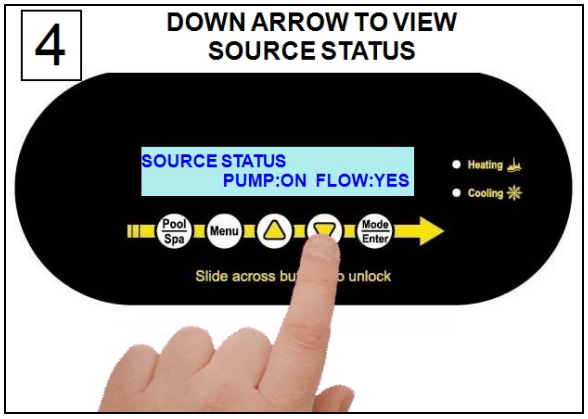
These menus are used when adjusting Water Flow Using ΔT (Delta-T). (See *Adjusting Water Flow Using ΔT (Delta-T)* on the previous page for more information.)

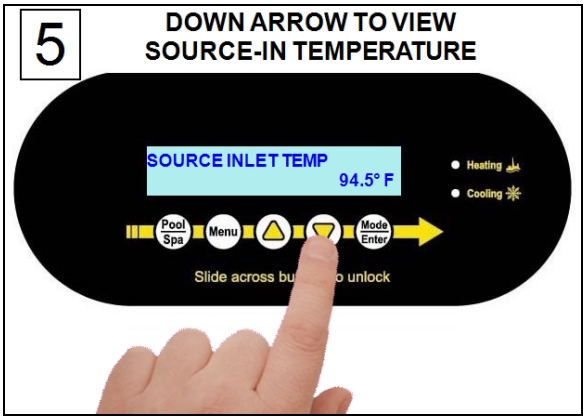


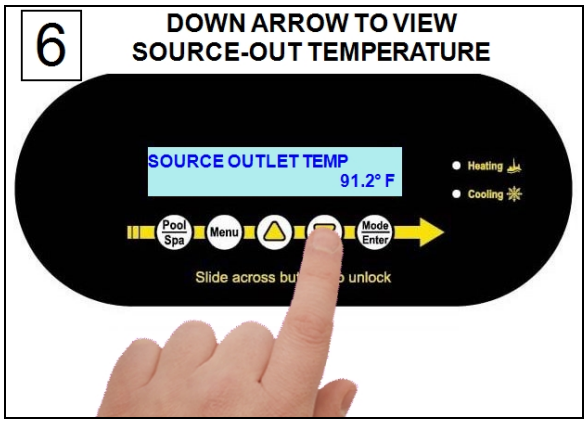


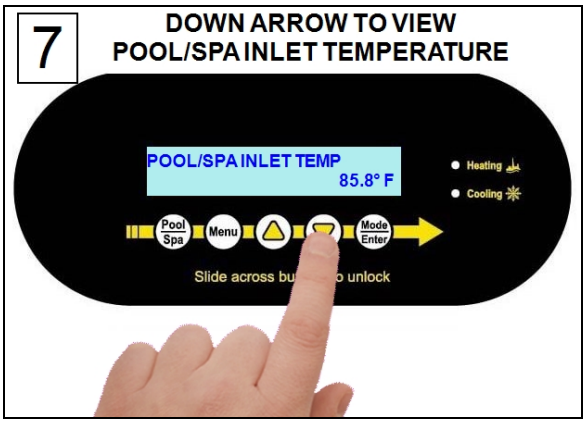

2
USE ARROWS TO
"GEOTHERMAL MENU"
GEOTHERMAL MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode Enter

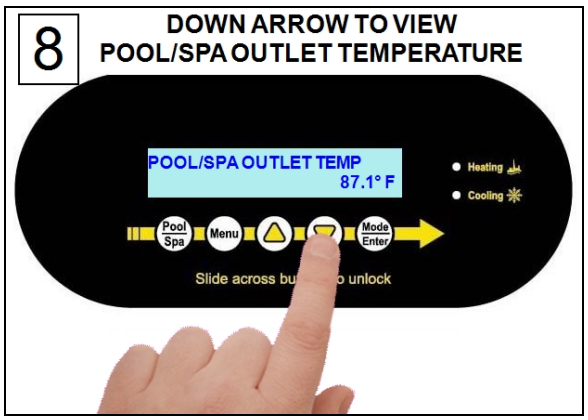

3
ENTER TO VIEW
TEMPERATURE DIFFERENCES
TEMPERATURE DIFFERENCES
SOURCE= 4°F POOL= -23°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

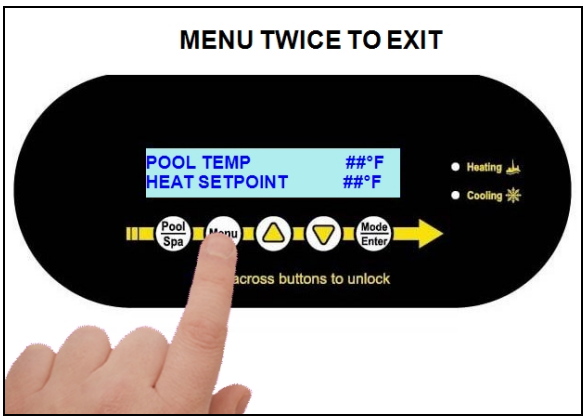

4
DOWN ARROW TO VIEW
SOURCE STATUS
SOURCE STATUS
PUMP:ON FLOW:YES
Heating
Cooling
Pool Spa
Menu
Mode Enter


5
DOWN ARROW TO VIEW
SOURCE-IN TEMPERATURE
SOURCE INLET TEMP
94.5° F
Heating
Cooling
Pool Spa
Menu
Mode Enter


6
DOWN ARROW TO VIEW
SOURCE-OUT TEMPERATURE
SOURCE OUTLET TEMP
91.2° F
Heating
Cooling
Pool Spa
Menu
Mode Enter


7
DOWN ARROW TO VIEW
POOL/SPA INLET TEMPERATURE
POOL/SPA INLET TEMP
85.8° F
Heating
Cooling
Pool Spa
Menu
Mode Enter


8
DOWN ARROW TO VIEW
POOL/SPA OUTLET TEMPERATURE
POOL/SPA OUTLET TEMP
87.1° F
Heating
Cooling
Pool Spa
Menu
Mode Enter


MENU TWICE TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

1.4.i Maintaining Ability to Winterize

Do not glue the threaded portion of the unions. The unions are used to decouple the heat pump from the plumbing system during hard freeze conditions.

NOTICE Failure to heed the following may result in damage to equipment.

- Do not use glue on the threaded portion of the equipment's unions. A glued-in-place union will prevent the heat pump from being properly winterized.

1.5 Electrical

1.5.a Electrical Requirements

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- The information contained in this section is intended for use by qualified electricians familiar with electrical service-industry safety standards and methods.
- Locate the equipment disconnect as near to the heat pump as possible. Always satisfy applicable codes and standards.
- Never mount power-disconnects directly to the heat pump.
- In sizing power wiring, be especially aware of up-sizing requirements necessary due to wiring distances. Always satisfy applicable codes and standards.
- AquaCal® heat pumps are designed to use copper conductors, only. Do not use aluminum wire.
- If multiple heat pumps are on-site, confirm that the multiple heat pump configuration has been utilized. See "*Connecting Multiple Heat Pumps (Master / Slaved)*" on page 41. This will prevent multiple heat pumps attempting to start at the same time, causing an excessive power drop at start-up.

Electrical Standards

Standards	Title
NFPA 70, Nat'l Elec. Code 2017	The electrical installation must conform to the current version of the National Electric Code (NEC), and all applicable local and state codes
IEC 60335-1	Household and similar electrical appliances - Safety - General Requirements
IEC 60335-2	Household and similar electrical appliances - Safety – Particular requirements for electrical heat pumps, air-conditioners, and dehumidifiers
UL 1995 & CSA C22.2 No. 236-15	Standard for Safety - Heating and cooling equipment

Table 3 - Standards

Grounding and Bonding

Follow local code requirements for proper grounding and bonding of heat pump equipment.

- A bonding lug has been provided on the lower left hand corner of the plumbing access panel.

Surge Suppression

The use of approved commercial surge protectors is strongly recommended.

Sizing the Electrical Service

Refer to equipment data plate for specific information required to size electrical service and over-current protection of the heat pump. Sizing is based on data plate information, wire size, wiring devices, and over-current protection per applicable local codes and standards. See "*Identifying Model Specifications*" on page 74.

Minimum and Maximum Operating Voltage

The heat pump must operate within specified voltages.

NOTICE Failure to heed the following may result in damage to equipment.

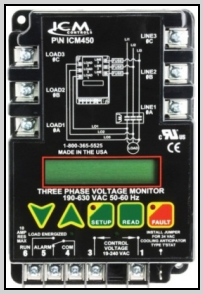
- Operating equipment under higher or lower voltage conditions may result in damage to your compressor, motors or other electrical components. This damage will not be covered by the product warranty.

1. Measure site voltage. The site voltage **MUST** be measured under “FULL LOAD” conditions. Activate all equipment using the same electrical panel as the heat pump.
2. If measured site voltage is outside listed ranges, immediately deactivate equipment until site conditions have been corrected. If unsure of heat pump equipment rating, please see "*Identifying Model Specifications*" on page 74.

Equipment Rating	Minimum Site Voltage	Maximum Site Voltage
A Voltage (208 to 230 Volts) Single Phase 60 hertz	200 Volts	253 Volts
B Voltage (208 to 230 Volts) Three Phase 60 hertz	200 Volts	253 Volts
D Voltage (380 to 420 Volts) Three Phase 50 hertz	361 Volts	441 Volts
G Voltage (460 Volts) Three Phase 60 hertz	437 Volts	483 Volts
H Voltage (200 to 240 Volts) Single Phase 50 hertz	180 Volts	264 Volts

PLEASE NOTE

ICM Digital Three-Phase Monitor



Standard Three-Phase Monitor

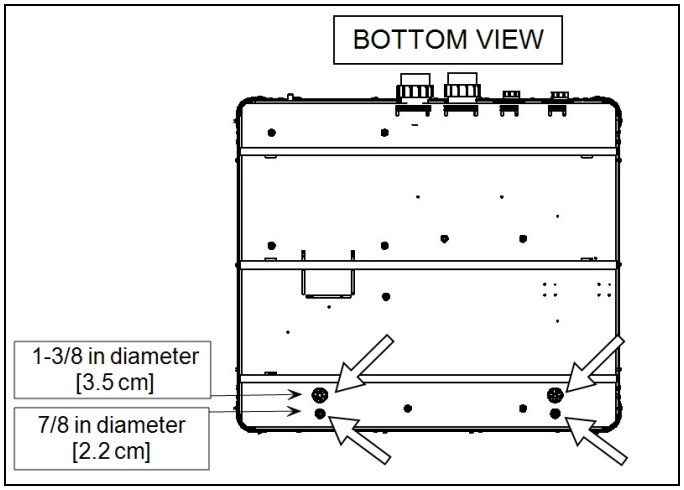
The WS10 Water Source heat pump comes with an ICM phase-rotation monitor. All other three-phase models use the standard phase-rotation monitor. These monitors are located inside the electrical panel.

The device protects the heat pump by preventing operation during abnormal voltage conditions.

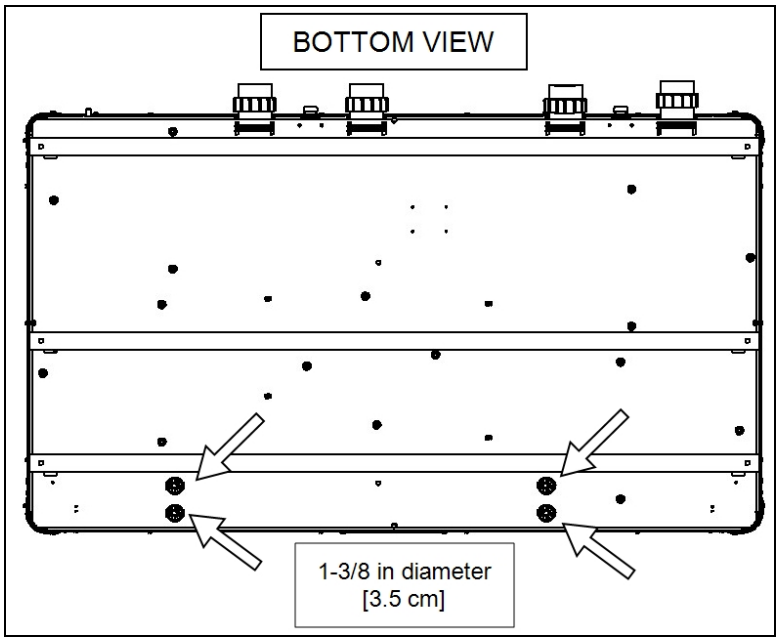
- If the unit fails to operate, a qualified technician should check the phase rotation monitor for faults preventing operation. Complete instructions for the ICM phase monitor are in the appendix. See "*ICM Digital 3-Phase Monitor*" on page 78.

1.5.b Incoming Power Access Holes

Water Source WS03, WS05
SunPower SP050



Water Source WS10

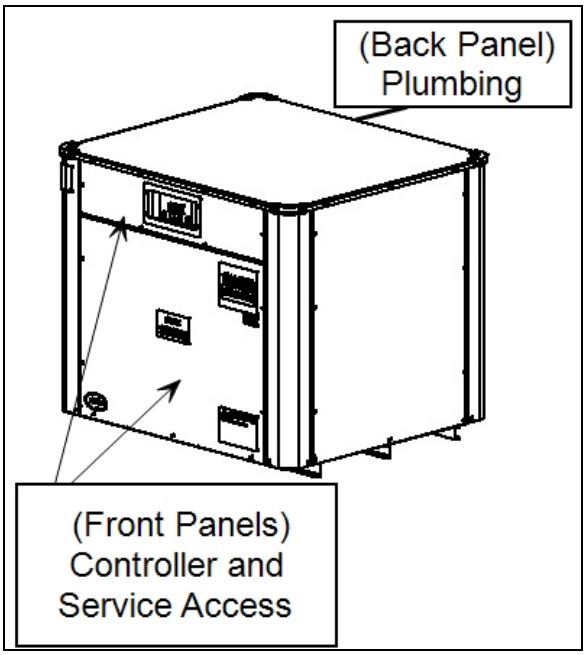


1.5.c Access Panels

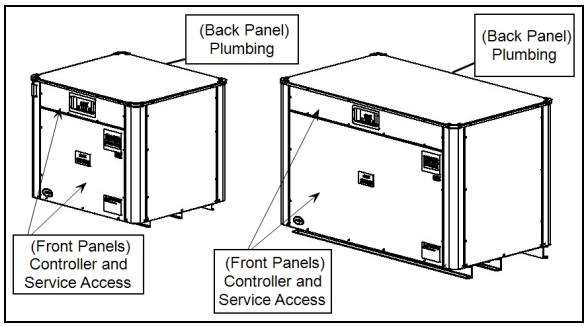
DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

(SunPower)



(Water Source)



1.5.d Verifying Transformer Setting

Transformer voltage must be confirmed and set correctly depending on the measured voltage found on the site. Incorrect settings may cause heat pump damage. The following procedure will allow the installer to set the heat pump's transformer for the appropriate site voltage.

DANGER Failure to heed the following will result in injury or death.

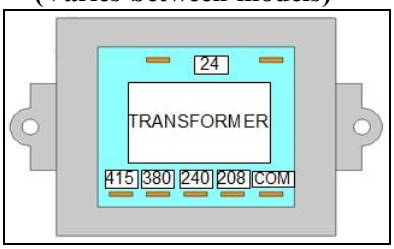
- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- The information contained in this section is intended for use by qualified technicians, familiar with electrical service-industry safety standards and methods.

1. Turn heat pump on by adjusting the thermostat to call for heating or cooling. If more than one heat pump is on-site, turn them all on. Allow time for all heat pump compressors to activate.
2. Measure the running site voltage.
3. Confirm transformer tap is set for the measured site voltage. If more than one voltage tap is shown, select the voltage nearest to the running site voltage.

Example of heat pump transformer (Varies between models)



PLEASE NOTE -

- If more than one voltage is shown on the equipment's data plate, the factory default setting is usually the higher voltage on the transformer.
- As an example, a "208/230" voltage will be set to "240" from the factory.

1.5.e Three-Phase Adjustment

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- The information contained in this section is intended for use by qualified technicians, familiar with electrical service-industry safety standards and methods.

NOTICE Failure to heed the following may result in damage to equipment.

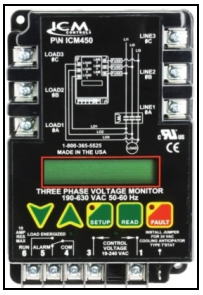
- Setting a voltage other than what is listed on the heat pump's data plate can damage equipment and is not covered under warranty.

If a three-phase unit fails to operate at start-up, the orientation of the line voltage "field" wiring may need to be adjusted.

- Three-phase models are equipped with a Three-Phase Monitor or the ICM Digital Three-Phase Monitor.
- Units equipped with the ICM Digital Three-Phase Monitor will display a "Back Phase Rev" fault code on the phase monitor display.
- There is no display on the standard three-phase monitor.
- The phase monitor is located inside the electrical panel.

Standard Three-Phase Monitor

ICM Digital Three-Phase Monitor



1. Deactivate power to the unit. **Confirm that power is off to all three legs using an electrical test meter set for the correct voltage.**
2. Switch position of the incoming power wires at each leg as follows, re-connect power and attempt to restart the unit. If the unit fails to start, disconnect power. Verify off and proceed to the next leg.
   - Switch incoming power wires at L1 and L2 on the line side to the contactor.
   - Switch incoming power wires at L1 and L3 on the line side to the contactor.
   - Switch incoming power wires at L2 and L3 on the line side to the contactor.
3. When heat pump starts, disconnect power and verify off. Then confirm all line voltage connections are securely tightened. Reconnect power.
   - If the heat pump does not start, contact AquaCal® for further assistance. See "*Contacting AquaCal AutoPilot, Inc.*" on page 1.

1.5.f Schematic Location

Schematics are located on the inside of the electrical panel.

Some schematics have been provided in the appendix of this manual. See "*Schematics*" on page 80.

1.6 External Equipment

1.6.a Connecting a Call Flex

To support a direct connection to a call flex accessory, AquaCal® heat pumps are equipped with optional terminal blocks on the microprocessor. The microprocessor is located on the low-voltage side of the electrical enclosure.

> The call flex accessory can override a circulation pump to provide water flow to the heat pump when the set temperature is not met. For ordering information on the accessory, see "*Call Flex Accessory (# 0030-LEDS)*" on page 76.

Connecting a Call Flex

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

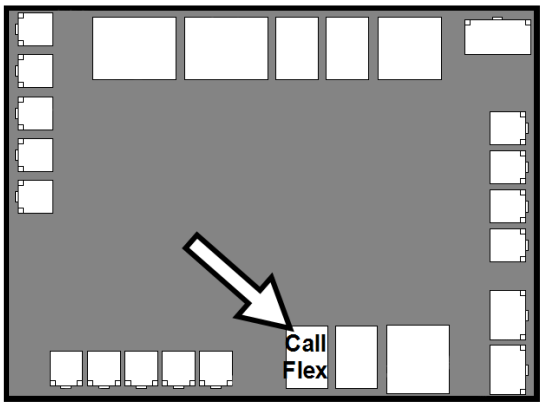
- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

NOTICE Failure to heed the following may result in damage to equipment.

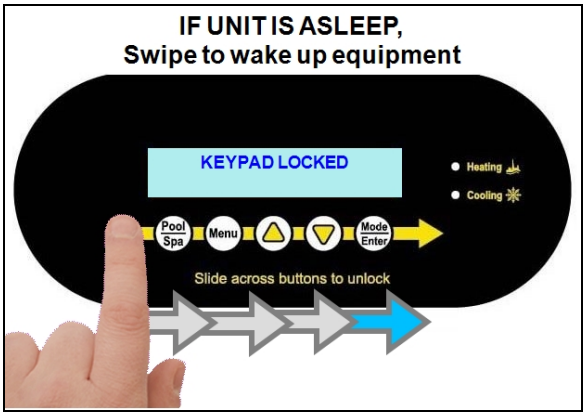
- The wire size connecting the controller must be 22-gauge (minimum), 2-conductor, low-voltage wire.

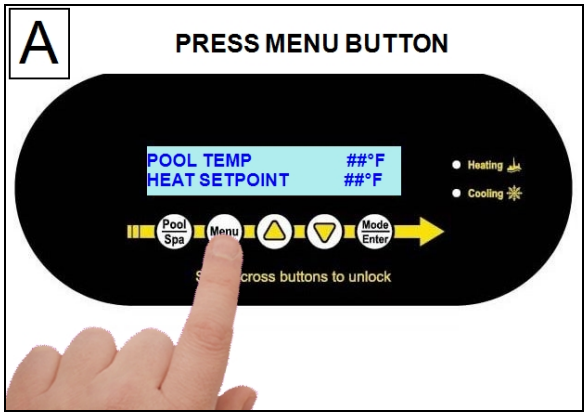
1. Deactivate power to heat pump.
2. Remove heat pump electrical access panel.
3. Route 22-gauge (minimum), 2-conductor, low-voltage wires to the low voltage side of the electrical enclosure. Follow all National Electric Codes (NEC) unless State or Local guidelines supersede.
4. Connect the controller wires to the port labeled "Call Flex" on the microprocessor as indicated.
5. Reattach heat pump access panel.
6. Apply power to heat pump.
7. Configure the heat pump to indicate an installed Call Flex. See "*Configure Call Flex*" on the facing page.

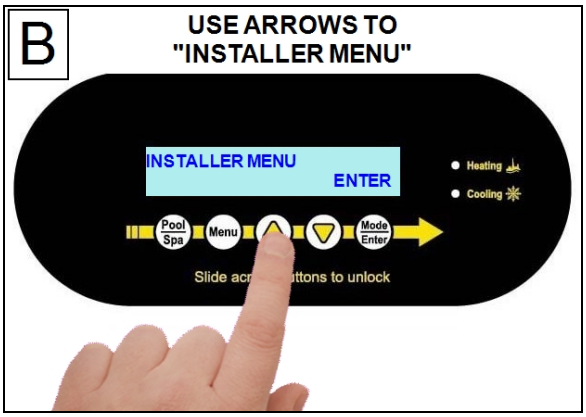
Connection Points to the Microprocessor

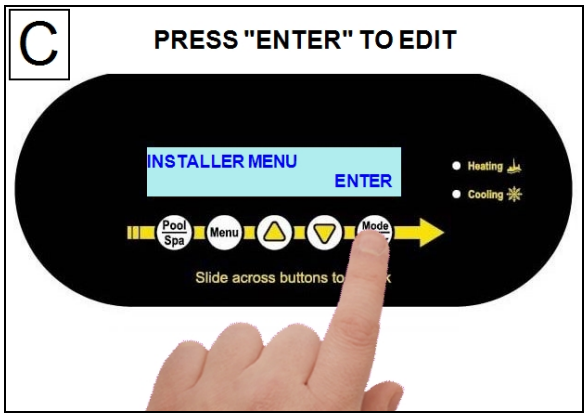


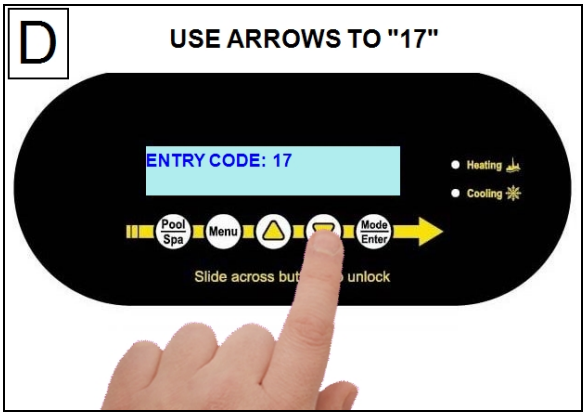
Enter "Installer Menus", then proceed

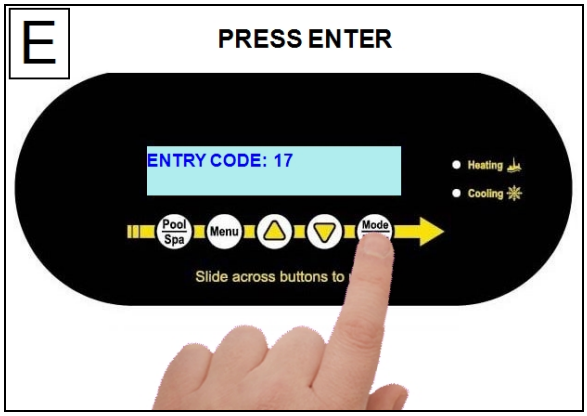


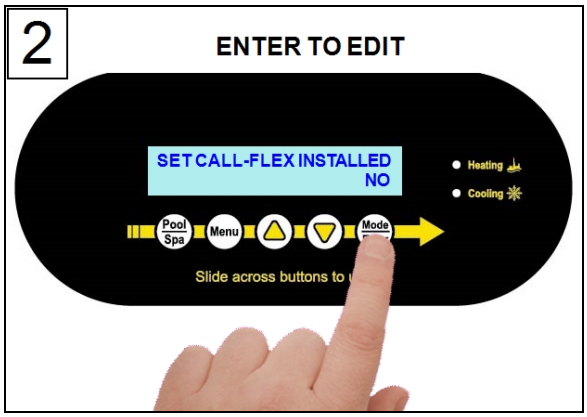


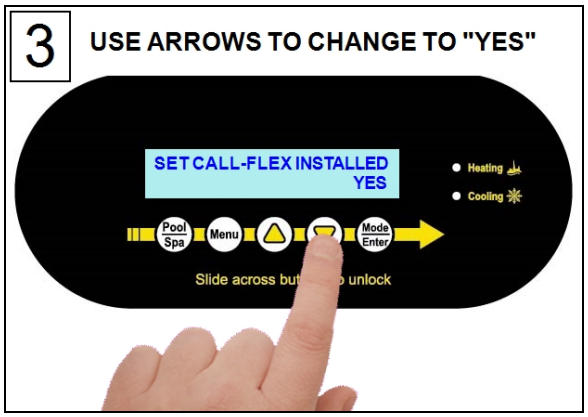


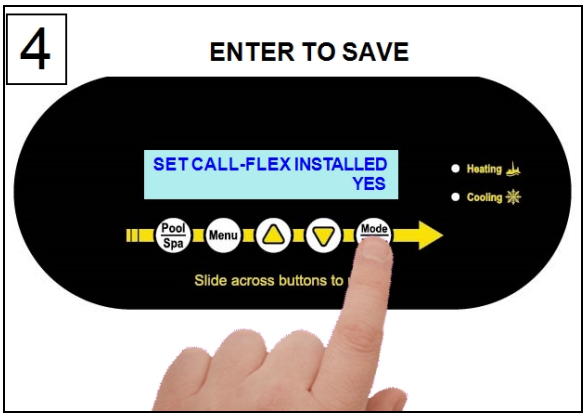


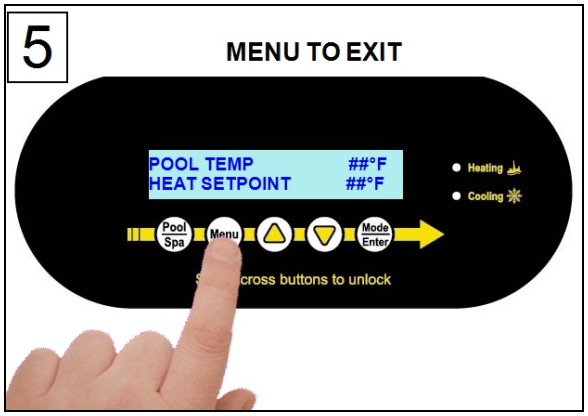







3
USE ARROWS TO CHANGE TO "YES"
SET CALL-FLEX INSTALLED
YES
Heating
Cooling
Pool Spa
Menu
Mode Enter


4
ENTER TO SAVE
SET CALL-FLEX INSTALLED
YES
Heating
Cooling
Pool Spa
Menu
Mode


5
MENU TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

1.6.b Connecting a Source Water Relay Switch

A direct connection to a source water relay switch has been provided on the terminal microprocessor. A source water switch will automatically activate or deactivate a geothermal source pump.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

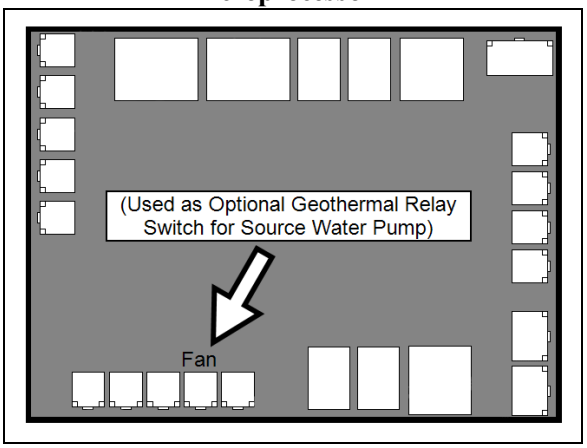
- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

NOTICE Failure to heed the following may result in damage to equipment.

- The wire size connecting the relay switch must be a minimum 22-gauge, 2-conductor, low-voltage wire.
- Use Fan (**dry contact)** connection on the microprocessor.

1. Deactivate power to heat pump.
2. Remove heat pump electrical access panel.
3. Route wires from the relay switch to the low voltage side of the electrical enclosure. Follow all National Electric Codes (NEC) unless State or Local guidelines supersede.
4. Connect the wires to the "Fan" jumper as indicated. Polarity is not important. Please note - While this connection point is labeled "Fan", it can be used as an optional connection point for controlling a geothermal relay switch.
5. Reattach heat pump access panel.
6. Apply power to heat pump.

Dry Contact Connection Points to the Microprocessor



1.6.c Connecting External Controllers to Heat Pump

To support a direct connection to an external controller, AquaCal® heat pumps are equipped with optional removable terminal blocks on the microprocessor. The microprocessor is located on the low-voltage side of the electrical enclosure.

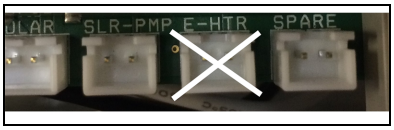
DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

NOTICE Failure to heed the following may result in damage to equipment.



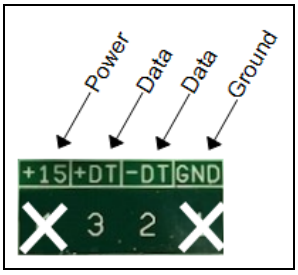
- **Do not use an electric heater connection on external controllers for heat pump wiring.** This can cause damage to external controllers, heat pumps, and pad equipment. This damage is NOT covered by warranty.
- The wire size connecting the external controller to the heat pump must be 22-gauge, 2-conductor, low-voltage wire.
- Use the two middle data lines on the external controller's standard communication port (RS-485). Do not use the outside power or ground connection on the port.

c.1 Connecting Smart Bus Controllers

Wire Connections

1. Deactivate power to heat pump and external controller.
2. Remove electrical access panels on the heat pump and external controller.
3. Route 22-gauge, 2-conductor, low-voltage wires from the external controller communication port (com port) to the low voltage side of the heat pump's electrical enclosure. Do not use the power or ground wire.

External Controller Communication Port



4. Connect control wires to the heat pump's "Port B" of the microprocessor as indicated. See Figure 1 and Figure 2.
   - It is OK to double up wires at the external controller connection if necessary.
   - If, for example, the external controller is using the data port for an indoor controller, add wires to the existing configuration. *Connectors can be removed from terminals for ease in connecting wires. See Figure 3*

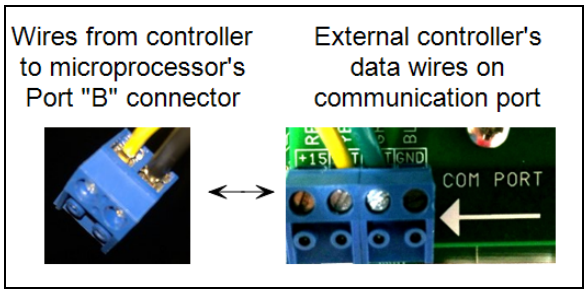


Figure 1

Typically a smart bus controller will have four wires on its smart bus for a heat pump. The power and ground (usually the 1st and 4th wire) are not used.

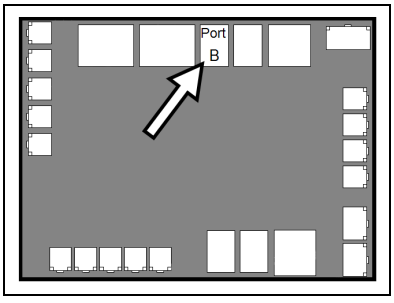


Figure 2

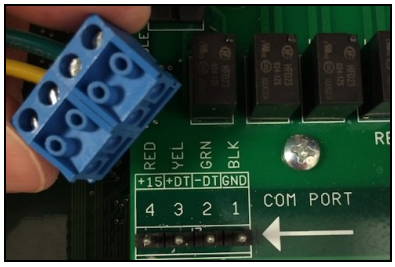


Figure 3

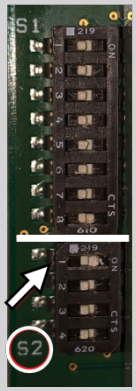
5. If dip-switch settings are required, configure them on the external controller now.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power to the external controller while setting dip-switches

Example - Jandy AquaLink® :
This external controller has dip switches. Confirm they are properly positioned to operate a heat pump.

- Set dip-switch "S2" #1 to "ON". The solar option is to be used for the heat pump.
- Check Jandy documentation for any further dip switch settings.



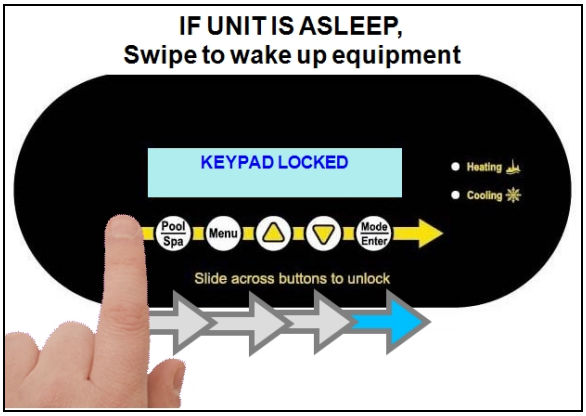
6. If additional sensors are required on the external controller, install them on the external controller now.

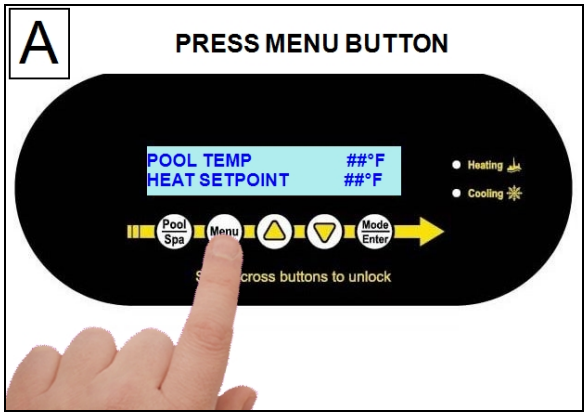
Example - Pentair EasyTouch® and Pentair IntelliTouch® :
Some controllers require an additional sensor be connected to the external controller's power supply circuit board at the solar connection point. The sensor is not used but will show an error if not connected.

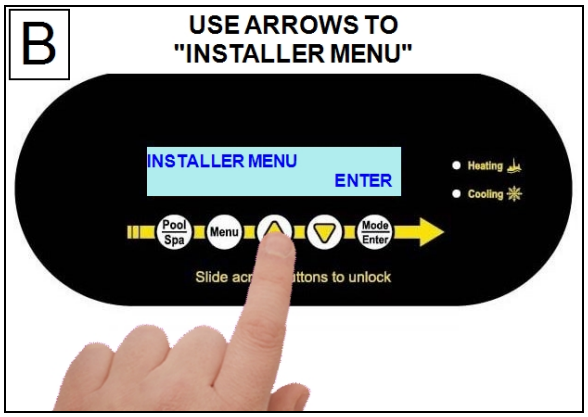
7. Reinstall electrical access panels on both the heat pump and external controller.
8. Reactivate power to heat pump and external controller.
9. Configure the heat pump to accept external controller signal. See "*Configure for Smart Bus Controller*" below.

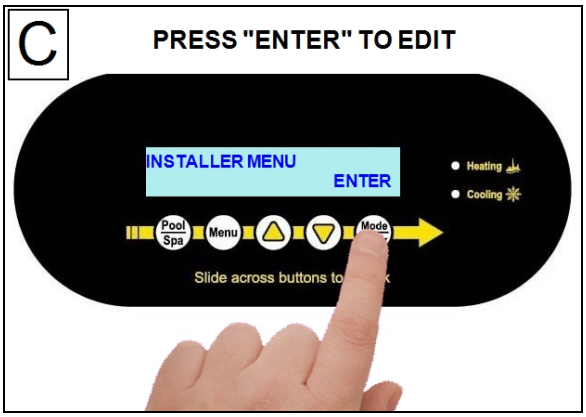
Configure for Smart Bus Controller

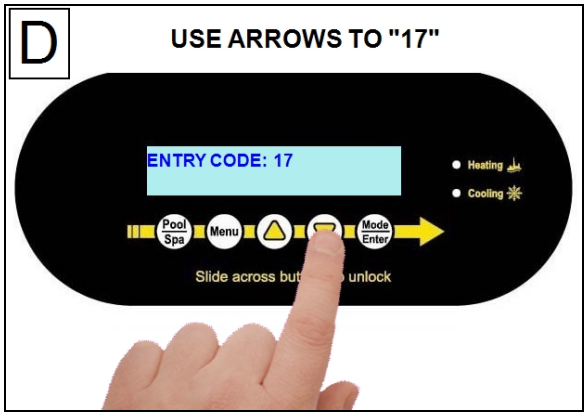
Enter "Installer Menus", then proceed

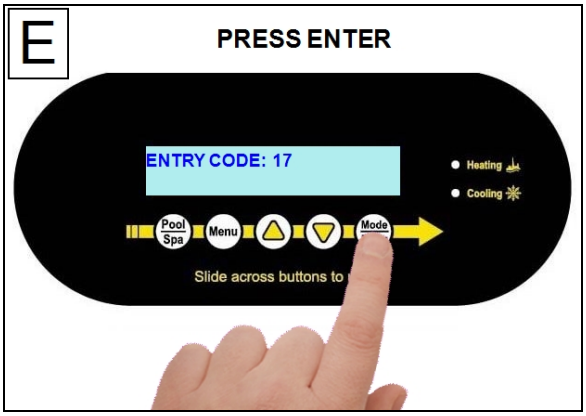


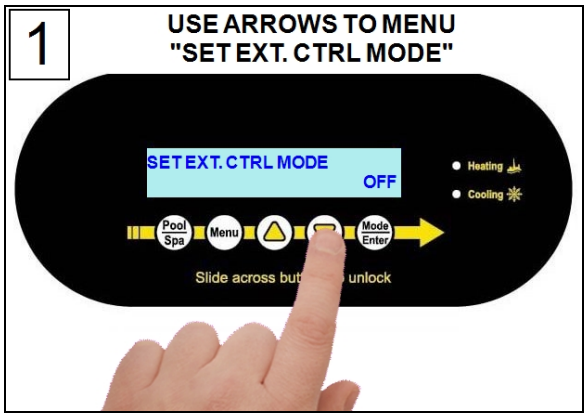


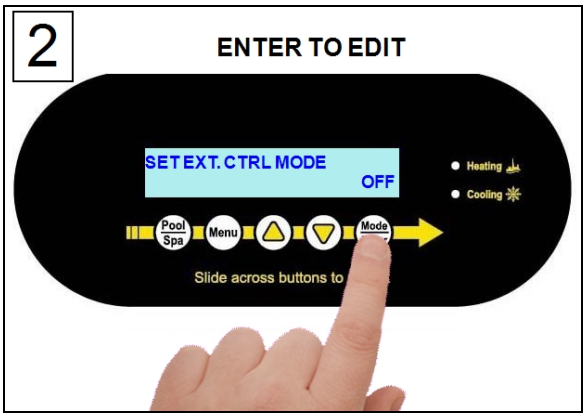

B
USE ARROWS TO
"INSTALLER MENU"
INSTALLER MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode Enter

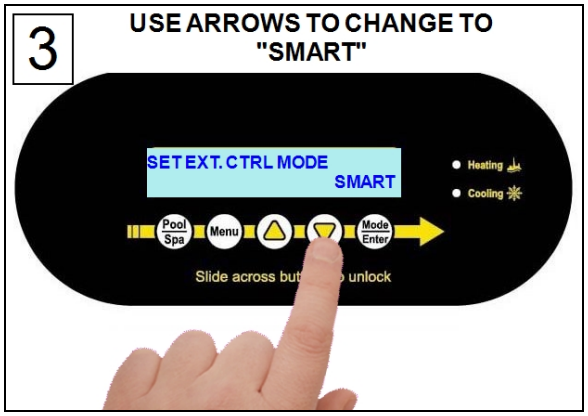

C
PRESS "ENTER" TO EDIT
INSTALLER MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode

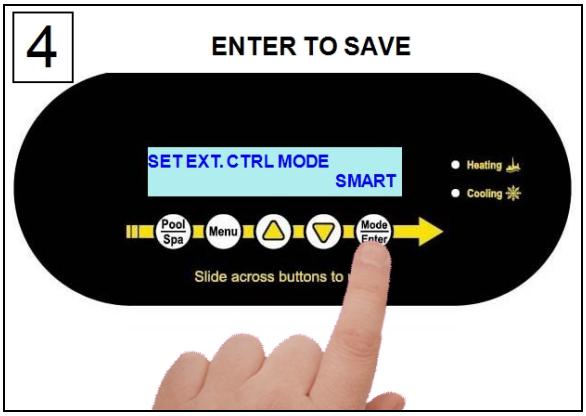

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

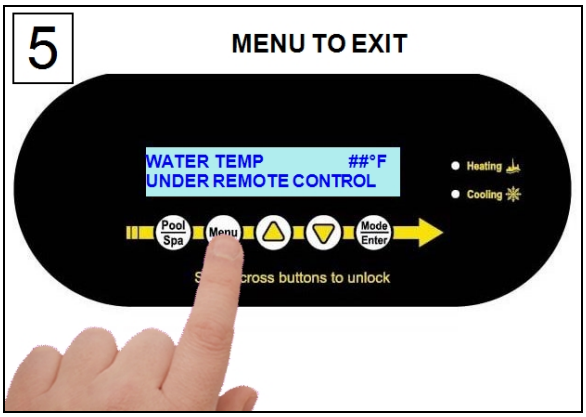

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode


1
USE ARROWS TO MENU
"SET EXT. CTRL MODE"
SET EXT. CTRL MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
SET EXT. CTRL MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode


3
USE ARROWS TO CHANGE TO
"SMART"
SET EXT. CTRL MODE
SMART
Heating
Cooling
Pool Spa
Menu
Mode Enter


4
ENTER TO SAVE
SET EXT. CTRL MODE
SMART
Heating
Cooling
Pool Spa
Menu
Mode



10. If after 45 seconds, the heat pump displays a "**SMART COMM FAULT**":
    A. **Confirm dip switches -** If external controller uses dip switches, confirm switches are in the correct position. Otherwise, proceed to confirm wiring.
        a. Deactivate power to the external controller.
        b. Remove access panel on external controller.
        c. Check the external controller manual for proper dip switch positioning and confirm dip switches.
        d. Reinstall electrical access panel.
        e. Reactivate power to the controller.
        f. If the fault persists, proceed to confirm wiring.
    B. **Confirm wiring -** Confirm wires are oriented properly on the heat pump's "Port B" of the microprocessor.
        a. Deactivate power to heat pump and external controller.
        b. Remove the access panel on the heat pump.
        c. Reverse wires on "Port B".
        d. Reinstall electrical access panel.
        7. Reactivate power to the controller.
        8. Reactivate power to the heat pump.
    C. If fault continues to occur, check with the manufacturer of the external controller for additional advice on using a heat pump with the controller.
11. After establishing a connection from the external controller to the heat pump, further programming will be required at the external controller.
    - See external controller manuals or contact installer or manufacturer of that product.

c.2 Connecting Two-wire Controllers (with internal thermostat)

PLEASE NOTE
2-Wire controllers are not designed to control chiller operation.
For full functionality, the Heat and Cool, and Cool Only heat pumps must use an external controller that has a SMART bus connection. Check with the external controller manufacturer for more information.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

1. Deactivate power to heat pump.
2. Remove heat pump electrical access panel.
3. Route 22-gauge (minimum), 2-conductor, low-voltage wires from the controller to the low voltage side of the heat pump's electrical enclosure. Follow all National Electric Codes (NEC) unless State or Local guidelines supersede.
4. Connect the controller wires to the microprocessor port labeled "Ext Controller" with the terminals labeled "Y" and "Z" as follows. See Figure 4.
   - Connect one wire to “Y”.
   - Connect other wire to “Z”.
   - The polarity of the wire is not important.
5. Reattach heat pump access panel.
6. Apply power to heat pump.
7. Configure the heat pump to accept a 2-wire external controllers signal as shown. See "*Configure 2-wire controller*" below.

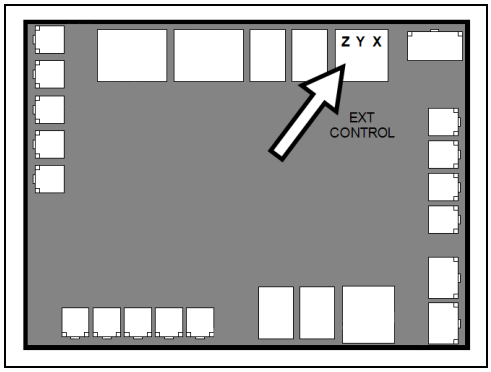
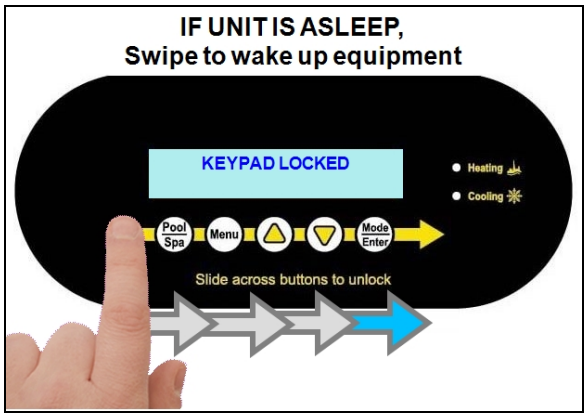
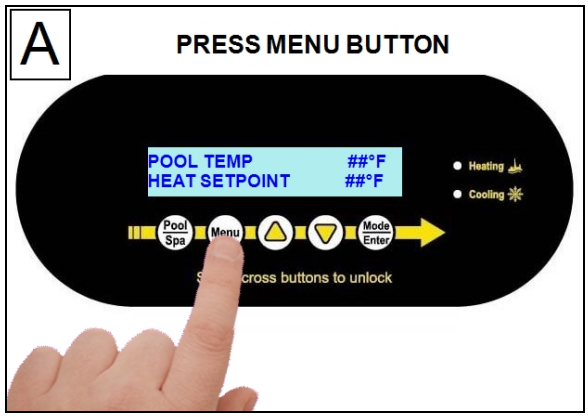


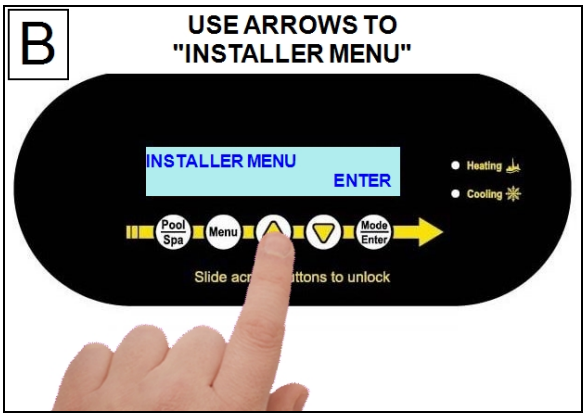
Figure 4

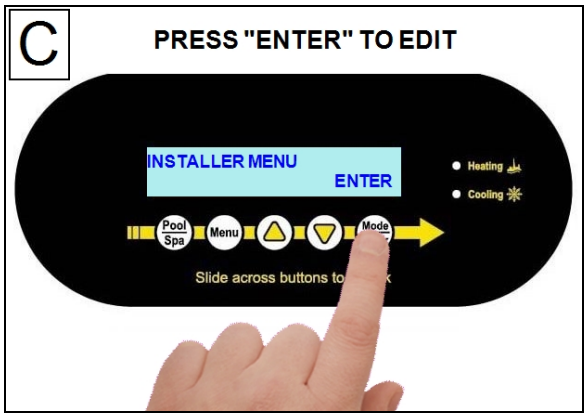
Configure 2-wire controller

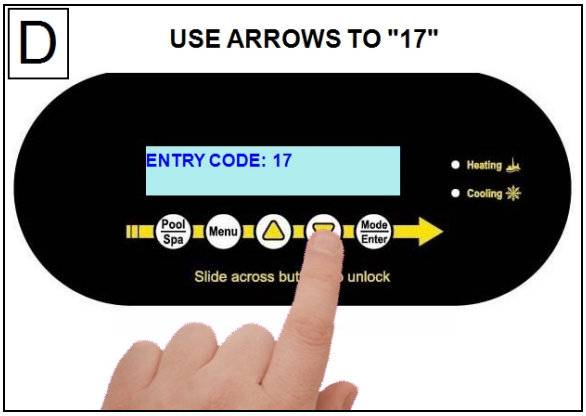
Enter "Installer Menus", then proceed

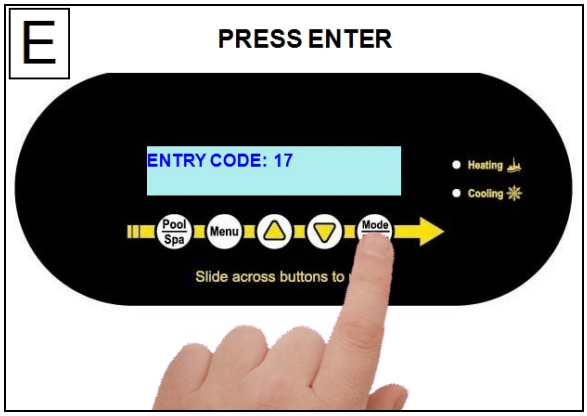


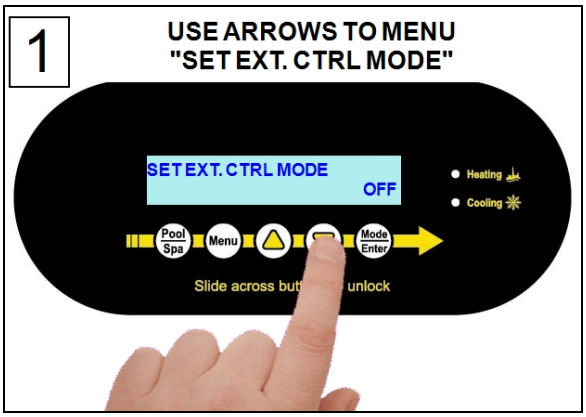


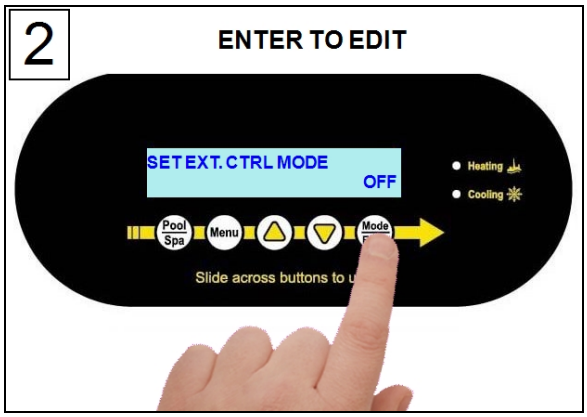

B
USE ARROWS TO
"INSTALLER MENU"
INSTALLER MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode Enter

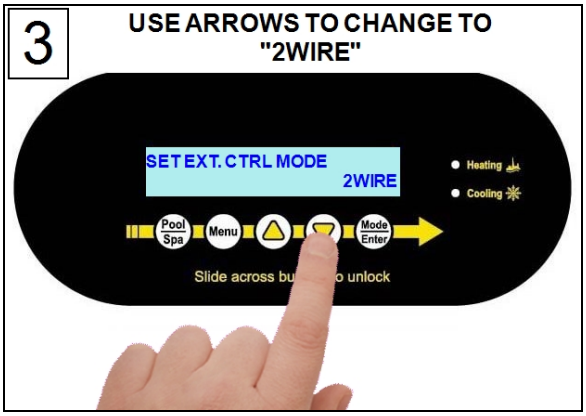

C
PRESS "ENTER" TO EDIT
INSTALLER MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode

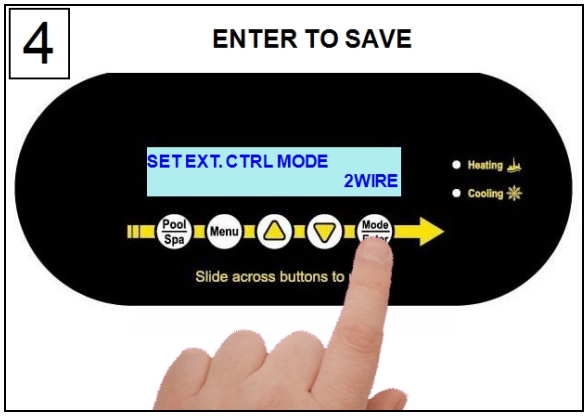

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

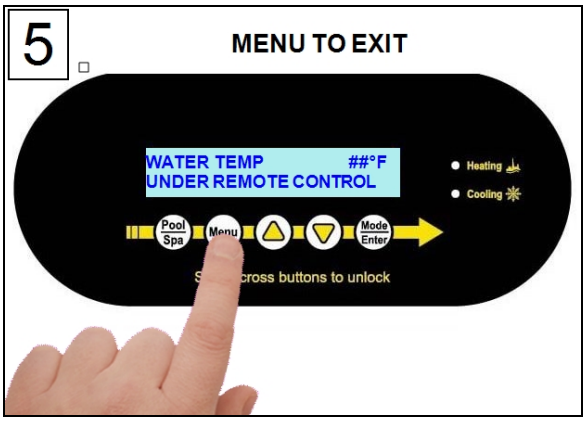

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode


1
USE ARROWS TO MENU
"SET EXT. CTRL MODE"
SET EXT. CTRL MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
SET EXT. CTRL MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode


3
USE ARROWS TO CHANGE TO
"2WIRE"
SET EXT. CTRL MODE
2WIRE
Heating
Cooling
Pool Spa
Menu
Mode Enter


4
ENTER TO SAVE
SET EXT. CTRL MODE
2WIRE
Heating
Cooling
Pool Spa
Menu
Mode



1.6.d Connecting Gas Backup Heater to Heat Pump

To support a direct connection to a gas backup heater, AquaCal® heat pumps are equipped with optional terminal blocks on the microprocessor. The microprocessor is located on the low-voltage side of the electrical enclosure.

PLEASE NOTE -
If the heat pump is connected and using an external controller with a SMART bus connection, the gas backup option is not available. The gas backup should be connected directly to the external controller.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

NOTICE Failure to heed the following may result in damage to equipment.

- The wire size connecting the gas heater to the heat pump must be 22-gauge (minimum), 2-conductor, low-voltage wire.
- Use direct connection (**dry contact)** provided on the microprocessor for the gas heater.
- Failure to follow the manufacturer's installation requirements for a fireman (cool down) switch may result in damage to the gas heater.

Connections

1. Deactivate power to heat pump and gas heater.
2. Remove heat pump and gas heater's electrical access panels. Follow all National Electric Codes (NEC) unless State or Local guidelines supersede.
3. Route 22-gauge (minimum), 2-conductor, low-voltage wires from the gas heater to the low voltage side of the heat pump's electrical enclosure. Depending on the gas heater's circuit boards, use the following connection points from the gas heater.
   - Use the "Com" and "Pool" connection points from the gas heater. See Figure 5.
   - Or replace the jumper wire from the Fireman's Switch on the gas heater with two wires leading to the heat pump. See Figure 6.

Gas Heater's Pool and Common Connection

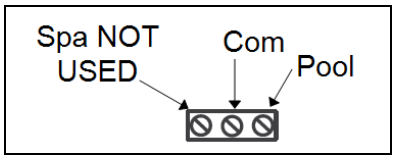


Figure 5

Gas Heater's Fireman Switch

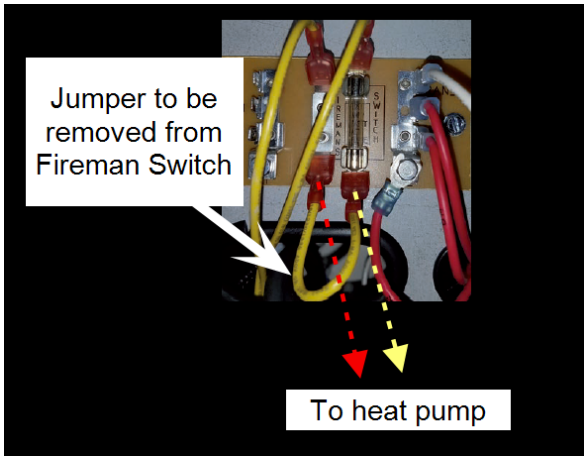


Figure 6

If the Gas Heater requires a fireman (cool down) switch, it is the installer's responsibility to ensure this requirement is met.

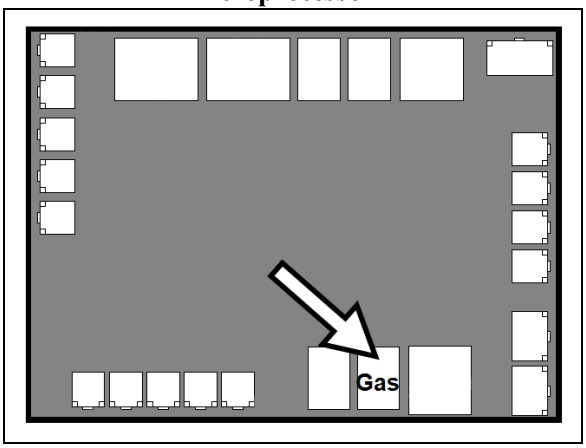
Failure to follow the manufacturer's installation requirements may result in damage to the gas heater.

PLEASE NOTE

Do not use a smart connection data comm port from the gas heater.

4. Connect the controller wires to the port labeled "Gas" on the microprocessor as indicated.
5. Reattach heat pump and gas heater access panels.
6. Apply power to heat pump and gas heater.
7. Configure gas heater to accept a two-wire remote control signal. See gas heater's manual for specifics on this procedure.
8. Configure gas backup mode on heat pump. See "*Configuring Gas Backup*" on the next page.

Dry Contact Connection Points to the Microprocessor



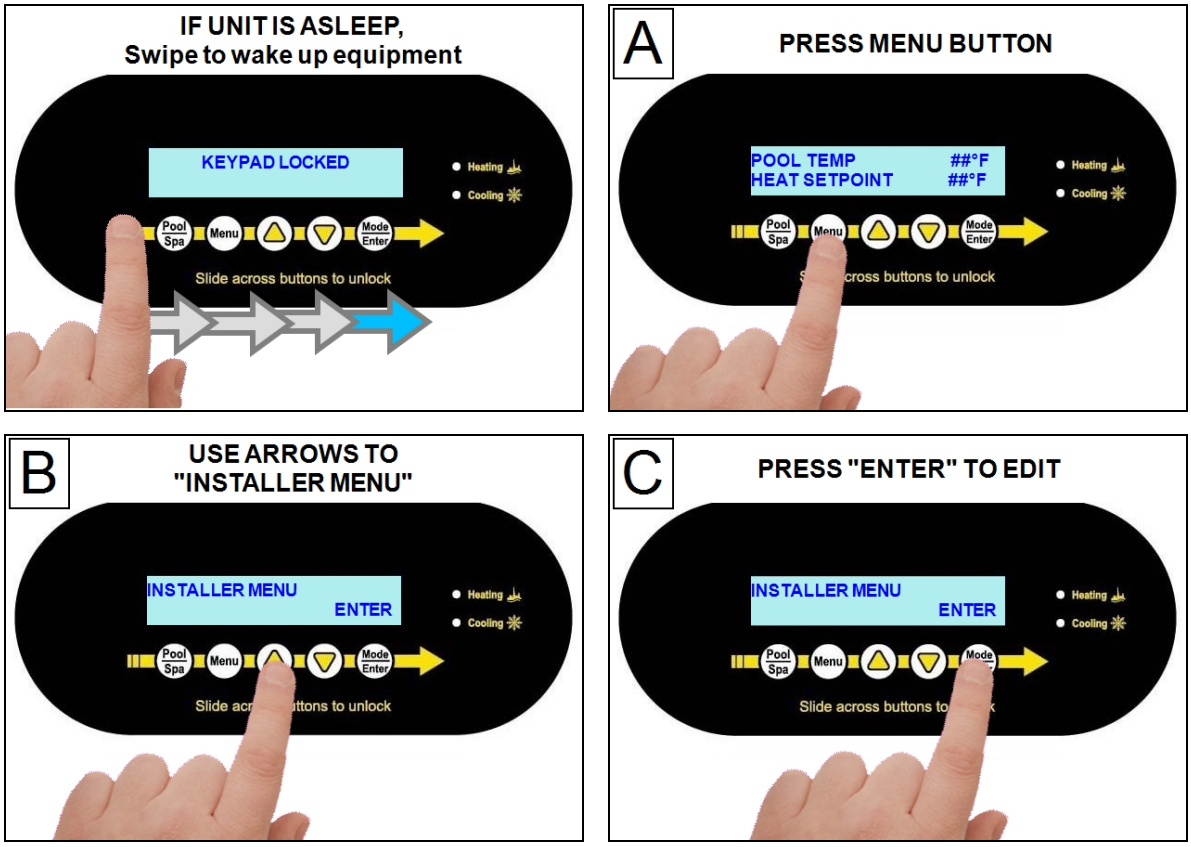
Configuring Gas Backup

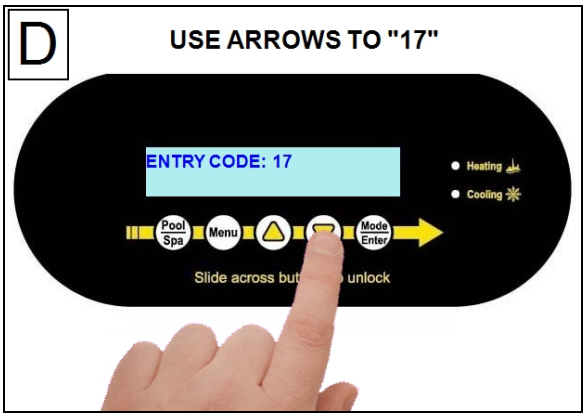
There are two different ways the gas backup heater can be configured.

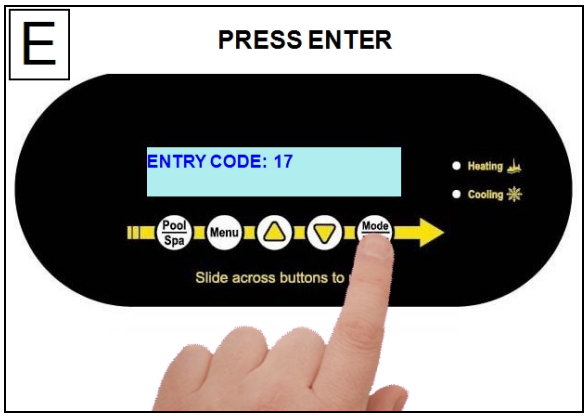
- **24-hour mode** - commonly used for commercial applications
  - The circulation pump operates continuously.
  - The gas heater will activate if the water temperature falls two degrees below the set temperature. When the set temperature is reached, the gas heater will be deactivated. See "*Configure for 24-Hour Mode*" below.
  - The Heat Pump will continue to maintain the set temperature.
- **Scheduled mode** - commonly used for residential applications
  - The circulation pump operates on the circulation pumps regular on-off schedule.
  - The gas heater will activate as needed to ensure that the desired temperature will be reached within the circulation pumps schedule. The gas heater will deactivate when the water is warm enough to allow the heat pump to finish within schedule. The heat pump will then continue to heat the water till the set temperature is reached. See "*Configure for Scheduled Mode*" on page 40.

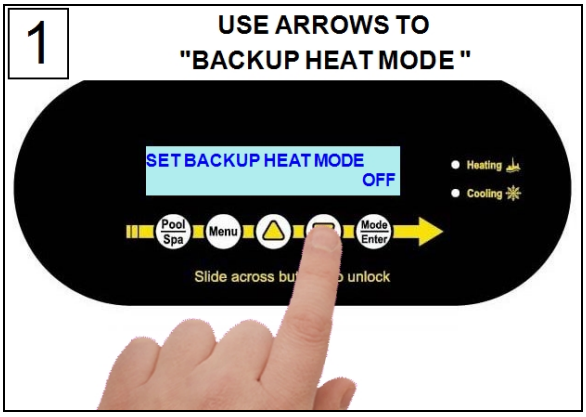
Configure for 24-Hour Mode

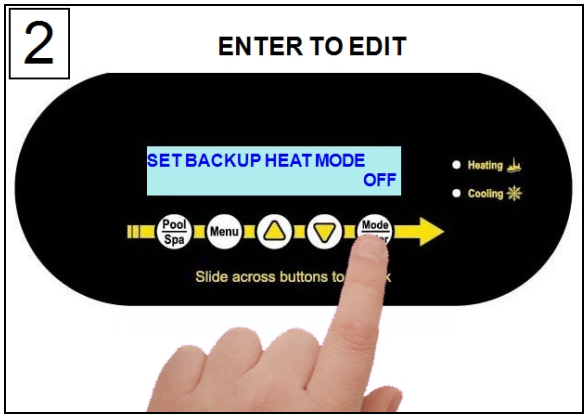
Enter "Installer Menus", then proceed

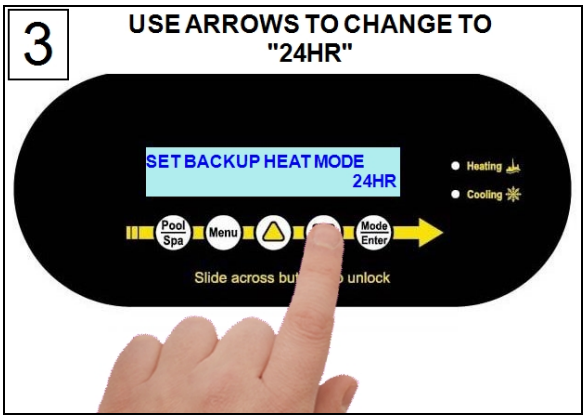


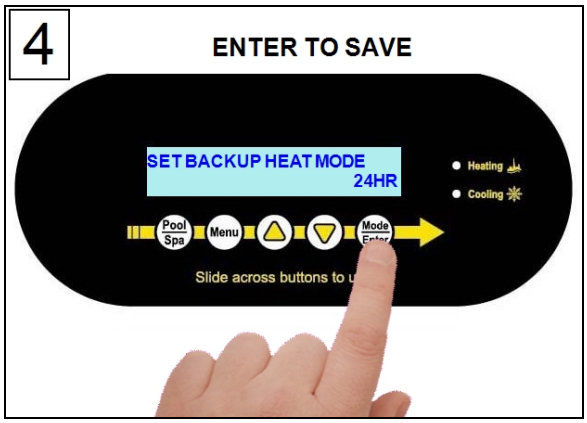

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

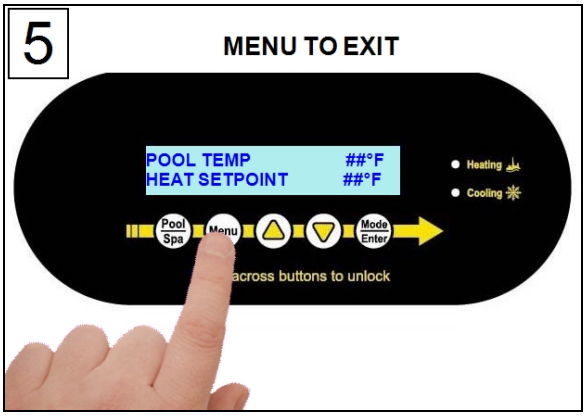

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode


1
USE ARROWS TO
"BACKUP HEAT MODE "
SET BACKUP HEAT MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
SET BACKUP HEAT MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode

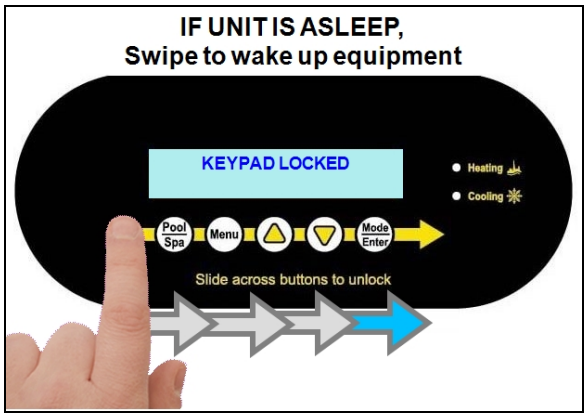

3
USE ARROWS TO CHANGE TO
"24HR"
SET BACKUP HEAT MODE
24HR
Heating
Cooling
Pool Spa
Menu
Mode Enter

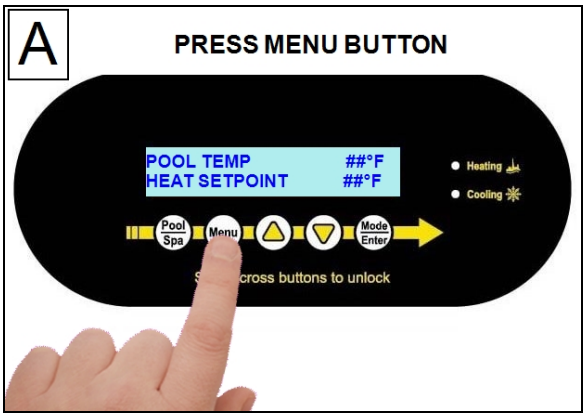

4
ENTER TO SAVE
SET BACKUP HEAT MODE
24HR
Heating
Cooling
Pool Spa
Menu
Mode

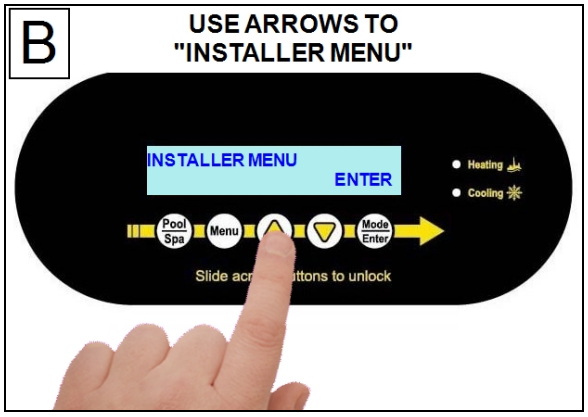

5
MENU TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

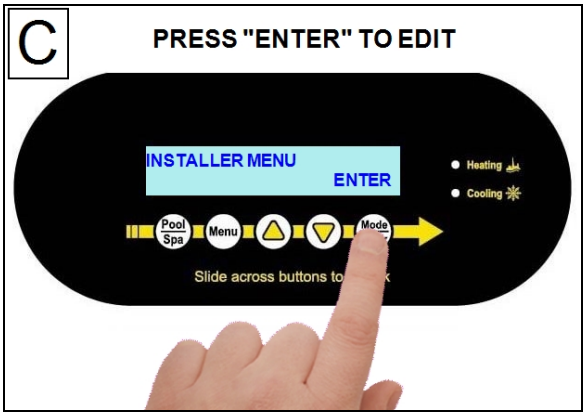
Configure for Scheduled Mode

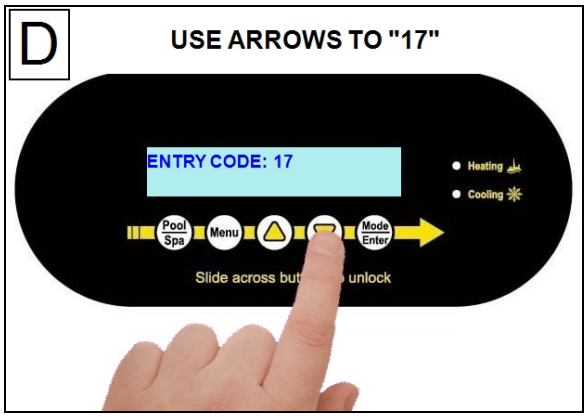
Enter "Installer Menus", then proceed

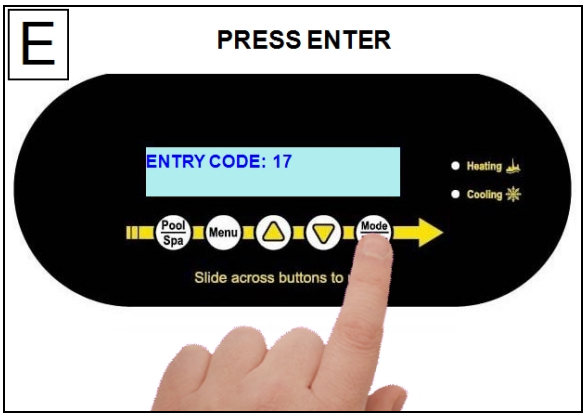


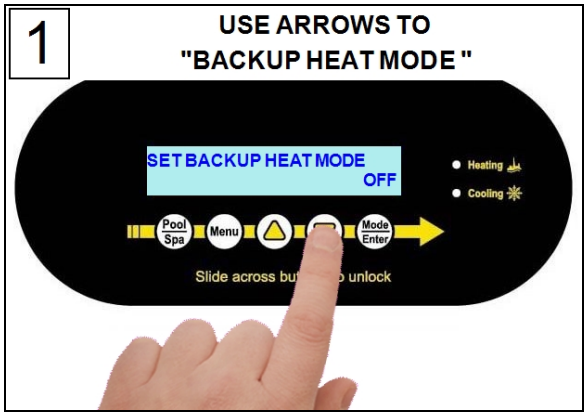


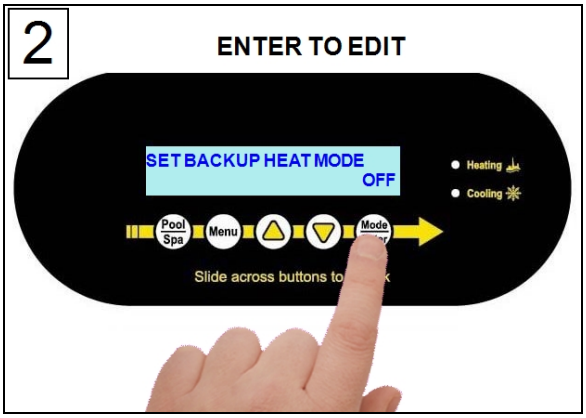


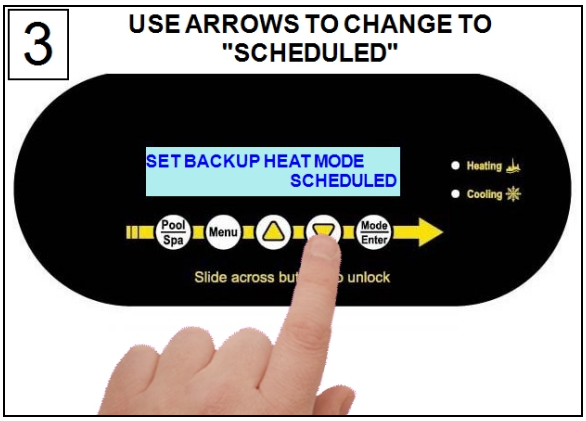


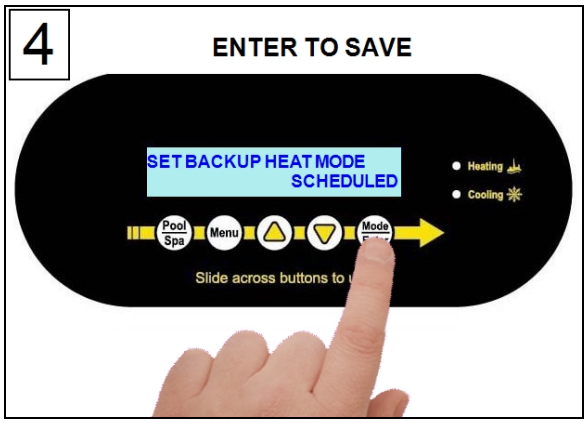


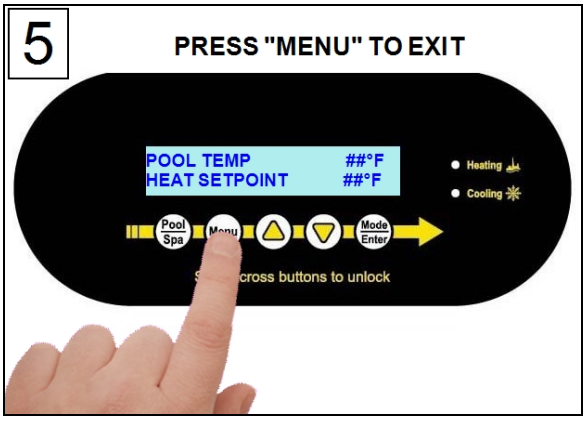












1.6.e Connecting Multiple Heat Pumps (Master / Slaved)

Up to 16 heat pumps can be connected and controlled from a primary heat pump.

There are two reasons for using a multiple heat pump configuration:

1. Controlling multiple heat pumps from one location; the master heat pump.
2. Preventing heat pumps from starting up at the same time and causing an excessive power draw on the electric circuit.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

NOTICE Failure to heed the following may result in damage to equipment.

- The wire size connecting the heat pumps must be 22-gauge, 2-conductor, low-voltage wire. Be sure that the size of the wire will allow at least two wires per connection point.
- Do not attempt to connect heat pump equipment in multiple configurations with previous HP7 and HP7R versions of the microprocessor. See Figure 7. No onboard port is provided for heat pumps with these microprocessor versions. An Automatic Sequencing Controller (ASC) accessory is required for those types of heat pumps.

DO NOT CONNECT HP7 or HP7R boards

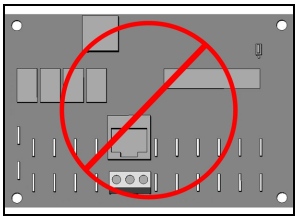


Figure 7

Connecting Multiple Heat Pumps

1. Choose one unit to be the lead (or master) unit. This is typically a unit that can be accessed easily when temperature adjustments are needed.
   - Note - The Lead unit can be connected to an external controller via the "smart bus" connection point if desired.
2. Deactivate power to heat pumps.
3. Remove electrical access panels.
4. Route 22-gauge, 2-conductor, low-voltage wires to the low voltage sides of the electrical enclosures. Follow all National Electric Codes (NEC) and/or State and Local guidelines.
5. Connect the first slaved heat pump's wires to the unit selected as the master heat pump's.
6. Use "Port C" on the microprocessors as indicated. Connecting the "Y" to the "Y" and the "B" to the "B" on each heat pump's port "C" connection point. The "G" and "R' connection points are not used. See Figure 8.

Dry Contact Connection Points to the Microprocessor

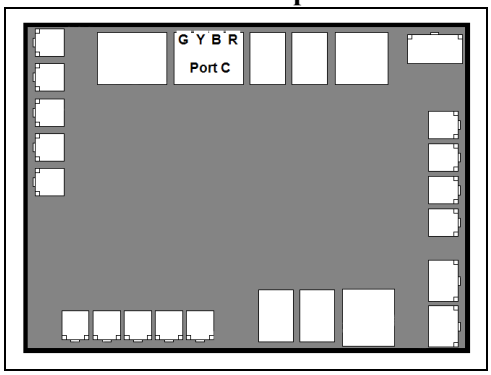


Figure 8

7. Connect any additional heat pumps as indicated, doubling up the wires as shown. See Figure 9. Confirm the same color wires connect to the same wires on each heat pump ("Y" to "Y" and "B" to "B"). Up to 16 heat pumps can be controlled by one heat pump.
8. Label the heat pumps appropriately as a master unit and slaved units (Master, Slaved 01, Slaved 02, etc.) to simplify configuration and future operation.
9. Reattach access panels.
10. Apply power to master heat pump. Confirm the mode is set to "**SYSTEM OFF**".
11. Apply power to the next heat pump and confirm the mode is set to "**SYSTEM OFF**". Do this for each heat pump.
12. Program heat pumps with assigned addresses. See "*Configuring Multiple Heat Pumps*" on the facing page.

Multiple Heat Pump Connection Points to "Port C"

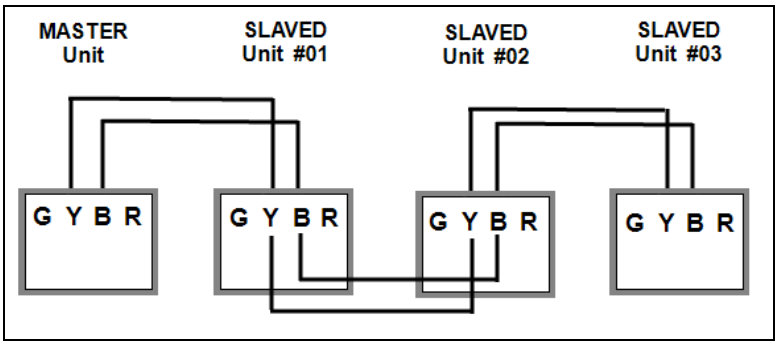
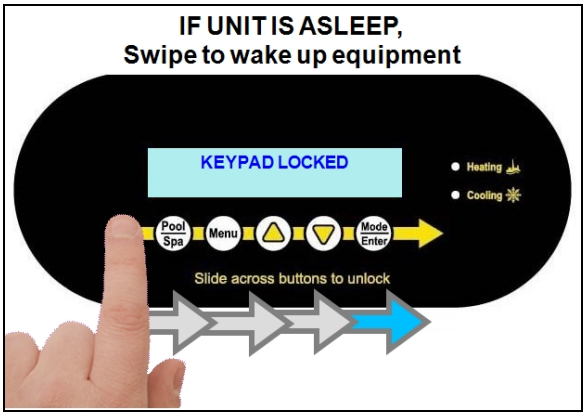


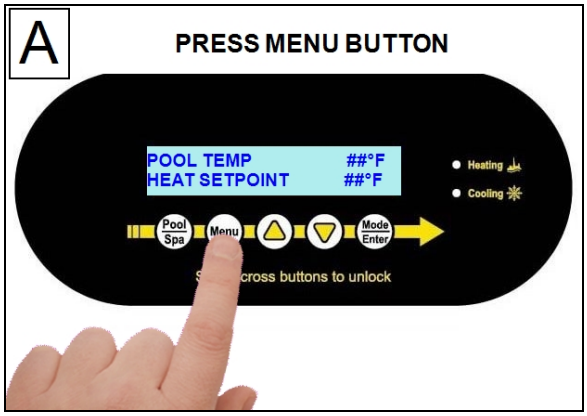
Figure 9

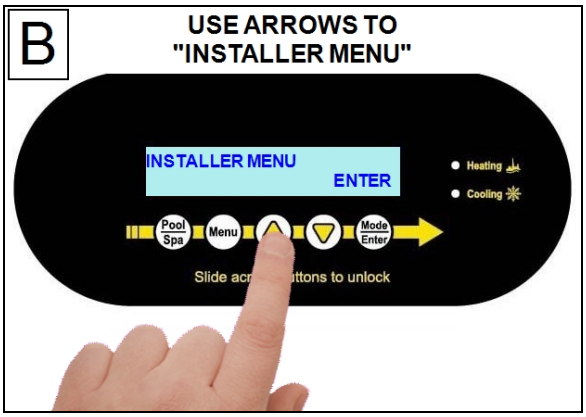
Master (Primary) Heat Pump

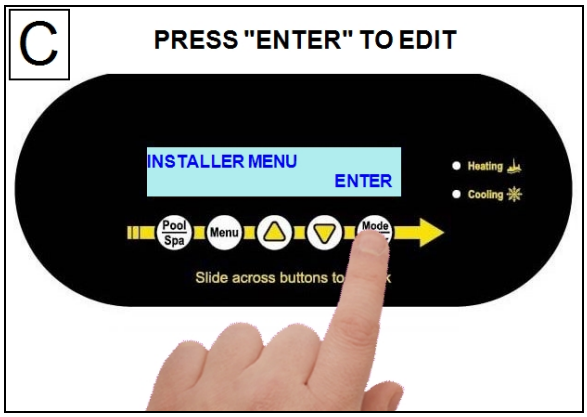
Confirm the first connected heat pump is designated as the master (primary) unit.

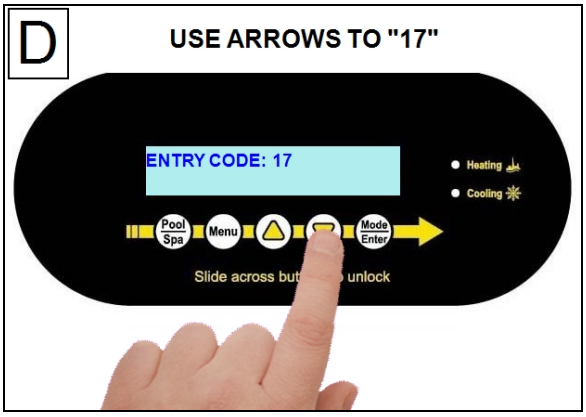
Enter "Installer Menus", then proceed

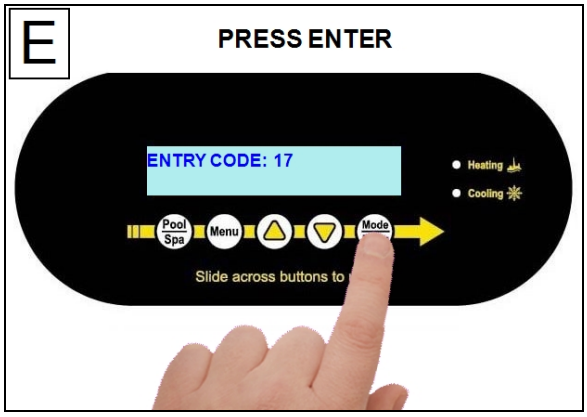


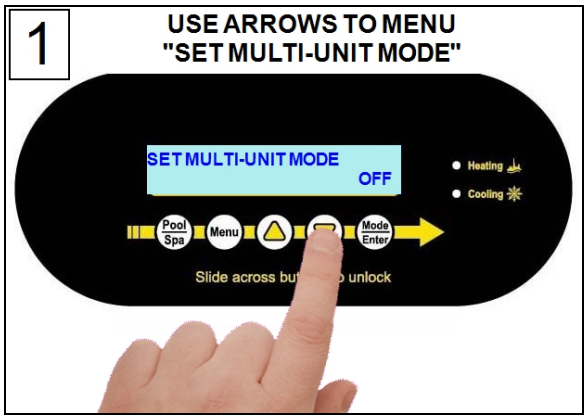


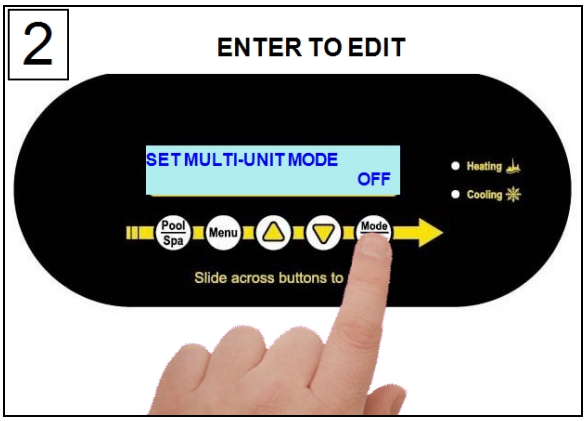


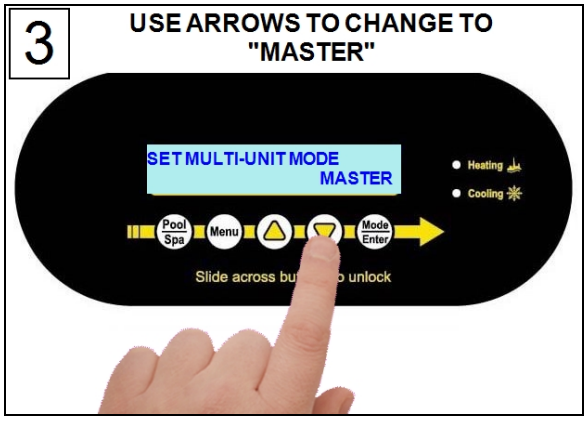


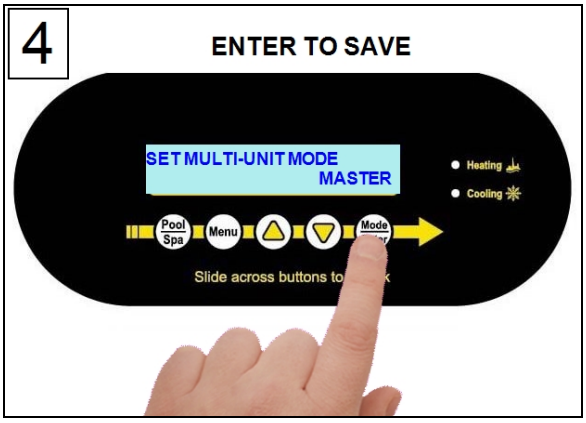


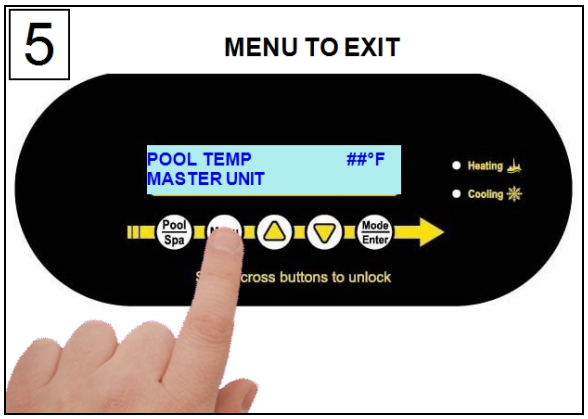



1
USE ARROWS TO MENU
"SET MULTI-UNIT MODE"
SET MULTI-UNIT MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
SET MULTI-UNIT MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode


3
USE ARROWS TO CHANGE TO
"MASTER"
SET MULTI-UNIT MODE
MASTER
Heating
Cooling
Pool Spa
Menu
Mode Enter

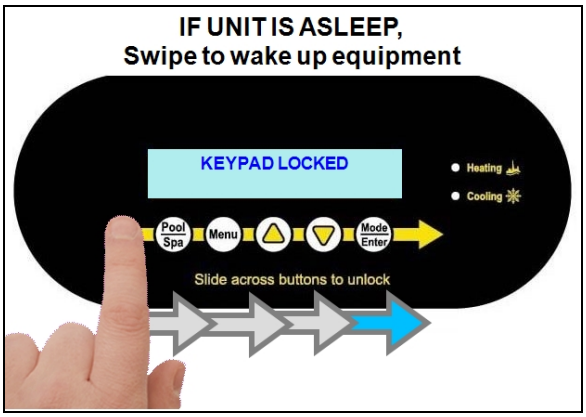

4
ENTER TO SAVE
SET MULTI-UNIT MODE
MASTER
Heating
Cooling
Pool Spa
Menu
Mode

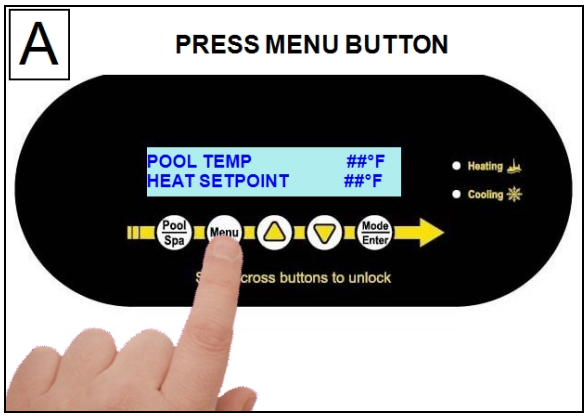

5
MENU TO EXIT
POOL TEMP
MASTER UNIT
##°F
Heating
Cooling
Pool Spa
Mode Enter

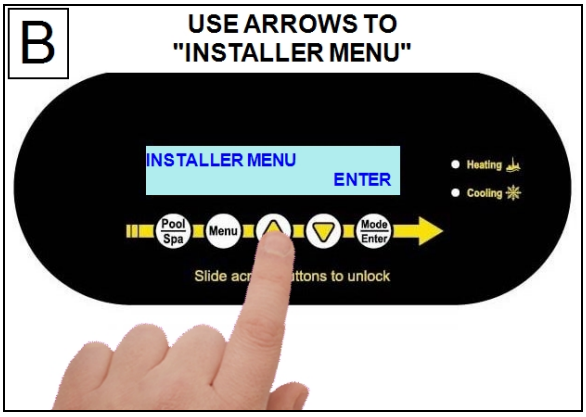
Slaved (Secondary) Heat Pumps

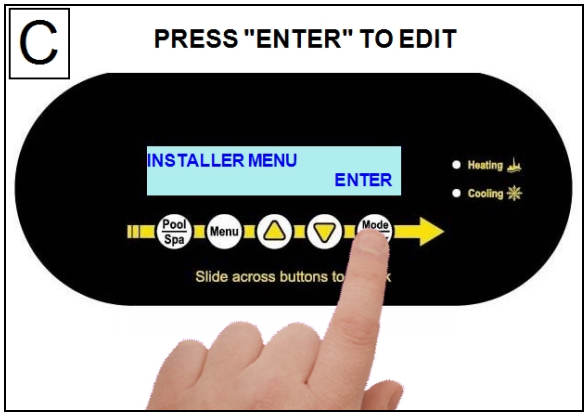
Go to the next connected heat pump and configure it as a slaved unit with a heat pump address of "01". Each additionally connected heat pump will require a unique heat pump address ("02", "03", etc.)

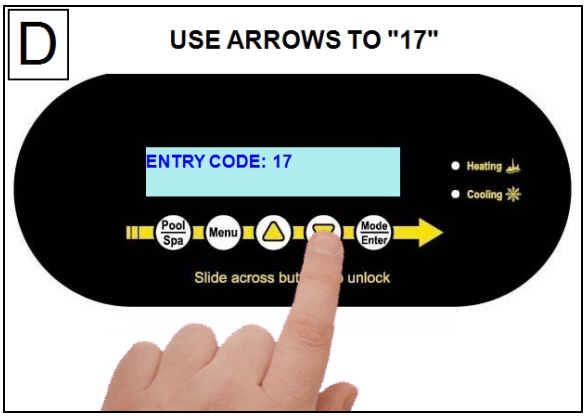
Enter "Installer Menus", then proceed

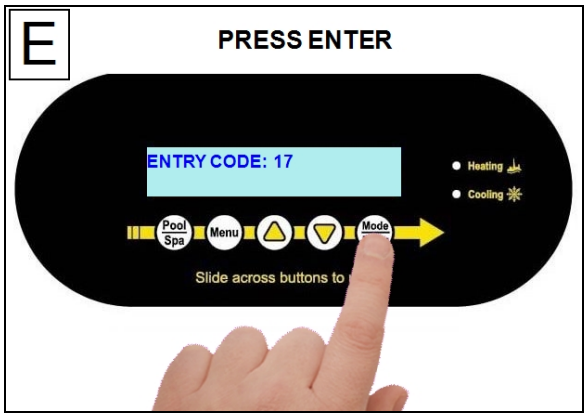


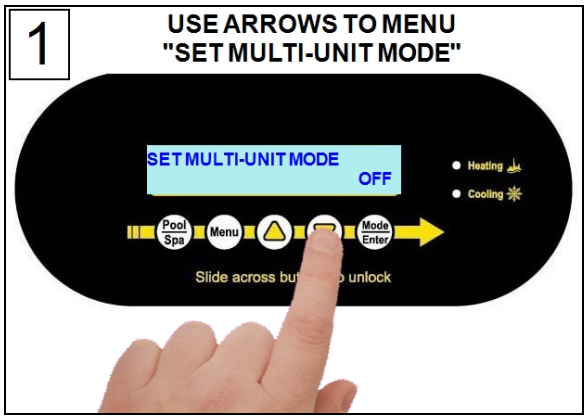


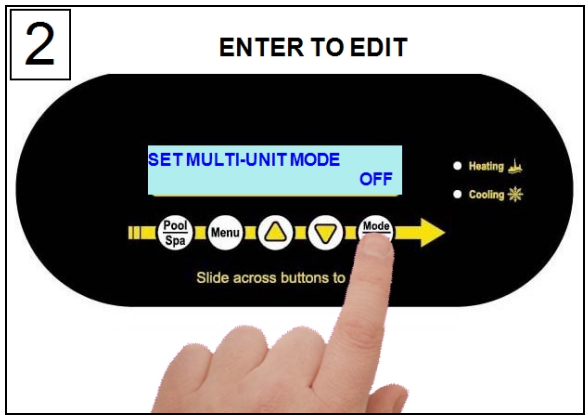


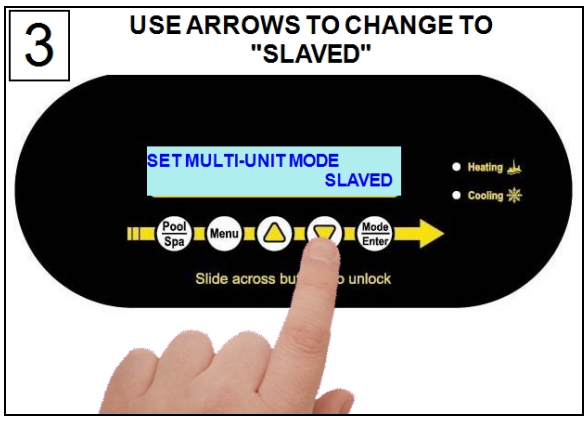


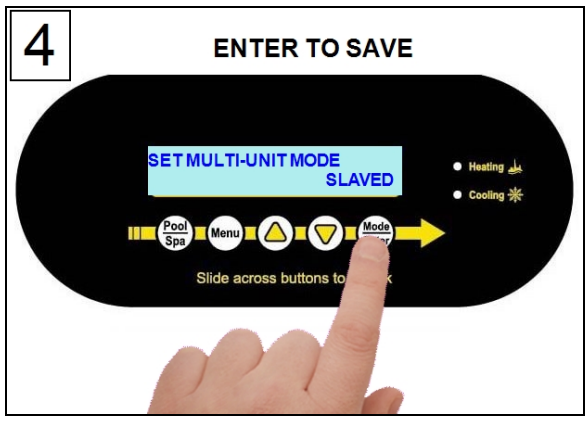


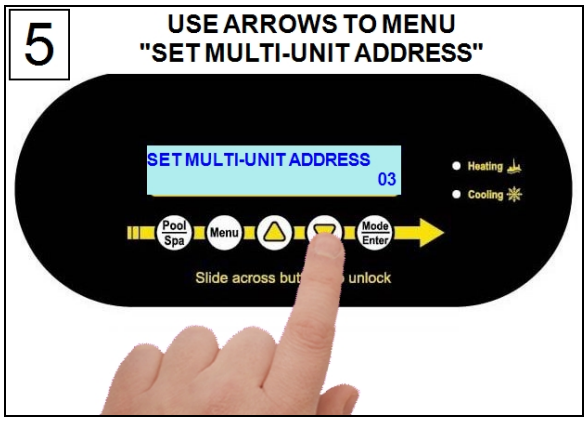


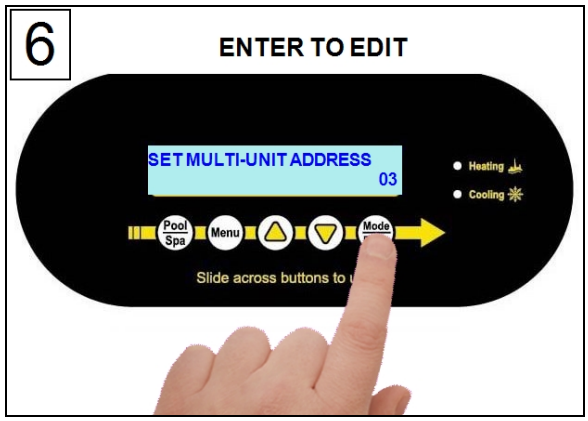

1
USE ARROWS TO MENU
"SET MULTI-UNIT MODE"
SET MULTI-UNIT MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter

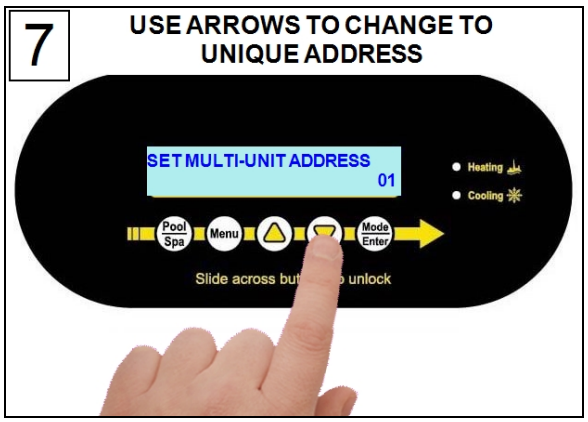

2
ENTER TO EDIT
SET MULTI-UNIT MODE
OFF
Heating
Cooling
Pool Spa
Menu
Mode

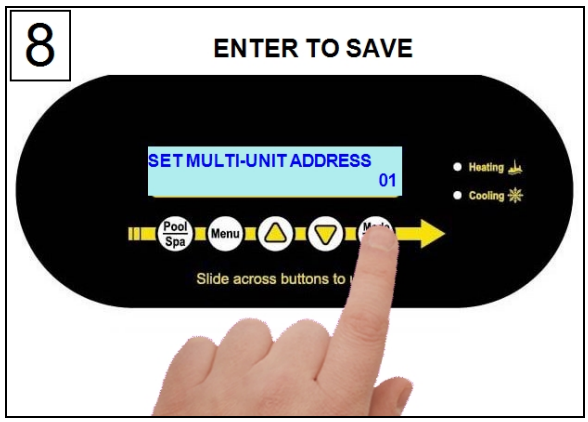

3
USE ARROWS TO CHANGE TO
"SLAVED"
SET MULTI-UNIT MODE
SLAVED
Heating
Cooling
Pool Spa
Menu
Mode Enter

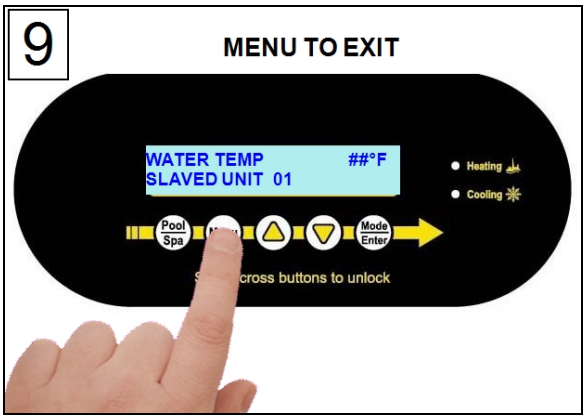

4
ENTER TO SAVE
SET MULTI-UNIT MODE
SLAVED
Heating
Cooling
Pool Spa
Menu
Mode


5
USE ARROWS TO MENU
"SET MULTI-UNIT ADDRESS"
SET MULTI-UNIT ADDRESS
03
Heating
Cooling
Pool Spa
Menu
Mode Enter


6
ENTER TO EDIT
SET MULTI-UNIT ADDRESS
03
Heating
Cooling
Pool Spa
Menu
Mode


7
USE ARROWS TO CHANGE TO
UNIQUE ADDRESS
SET MULTI-UNIT ADDRESS
01
Heating
Cooling
Pool Spa
Menu
Mode Enter


8
ENTER TO SAVE
SET MULTI-UNIT ADDRESS
01
Heating
Cooling
Pool Spa
Menu



1.6.f Connecting a Pool/Spa Switching Relay

A direct connection to an external flow relay switch has been provided on the terminal microprocessor.

A pool/spa relay switch will automatically change between the pool and spa thermostat depending on the position of the plumbing valves.

- When water flows to the pool, the pool thermostat will be used.
- When water flows to the spa, the spa thermostat will be used.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- This section is only for qualified installers who are familiar with the swimming pool and spa safety standards.
- The installer must be familiar with service industry techniques.

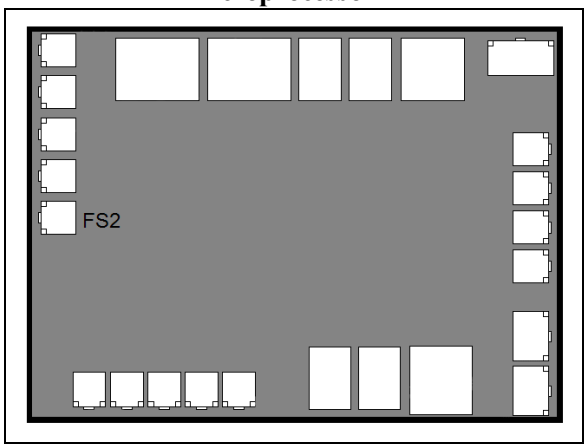
NOTICE Failure to heed the following may result in damage to equipment.

- The wire size connecting the relay switch must be a minimum 22-gauge, 2-conductor, low-voltage wire.
- Use FS2 (**dry contact)** connection on the microprocessor.

Connecting Switch

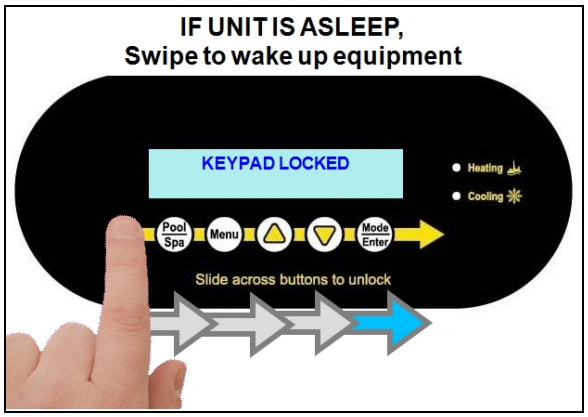
1. Deactivate power to heat pump.
2. Plumb the switch as indicated in accessories installation instructions.
3. Remove heat pump electrical access panel.
4. Using two of the three wires from the installed switch, route wires to the low voltage side of the electrical enclosure. The third wire is not used. Follow all National Electric Codes (NEC) unless State or Local guidelines supersede.
5. Connect the wires to the jumper provided. Polarity is not important.
6. Reattach heat pump access panel.
7. Apply power to heat pump.
8. Configure the heat pump to accept the pool/spa relay switch. See "*Configuring Switch*" below.

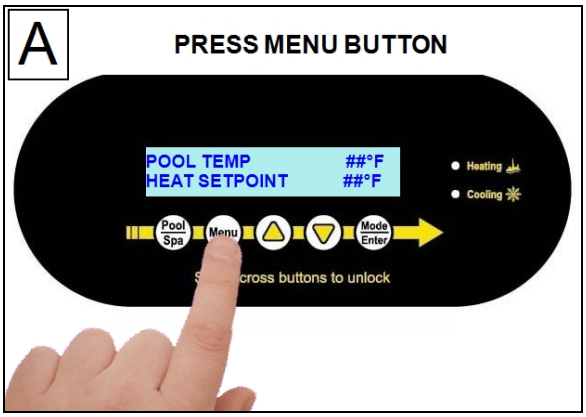
Dry Contact Connection Points to the Microprocessor

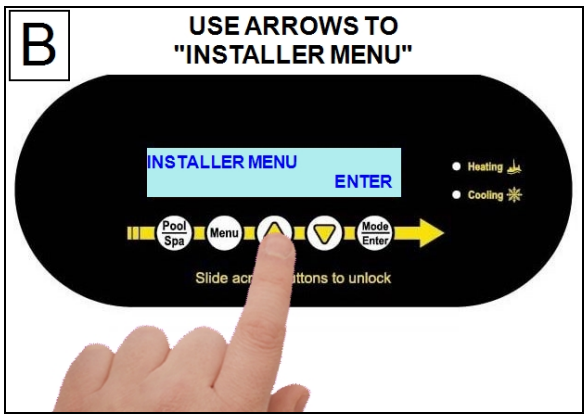


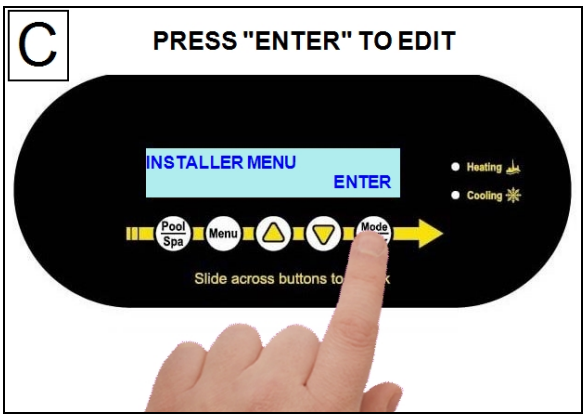
Configuring Switch

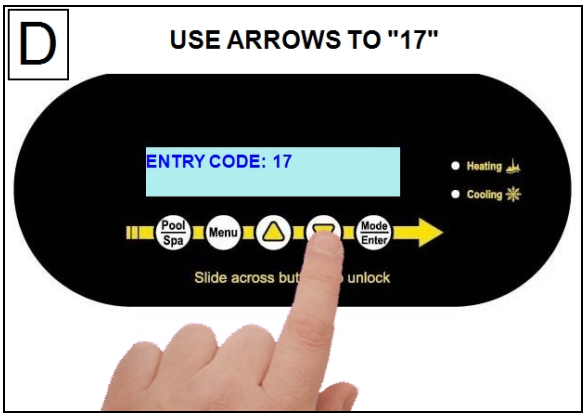
Enter "Installer Menus", then proceed

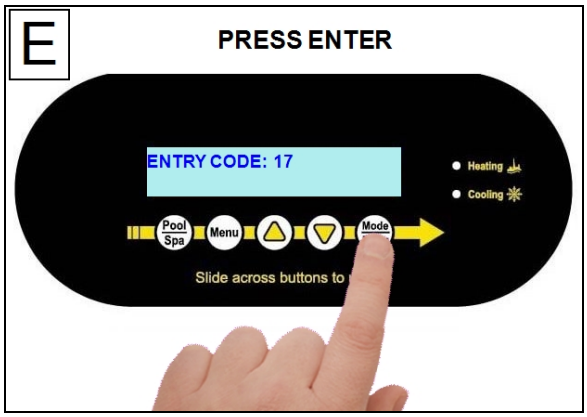


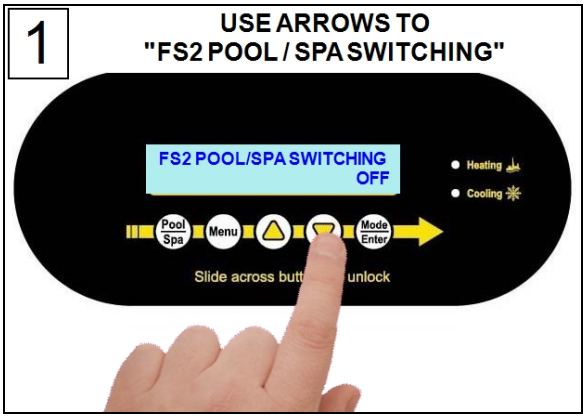


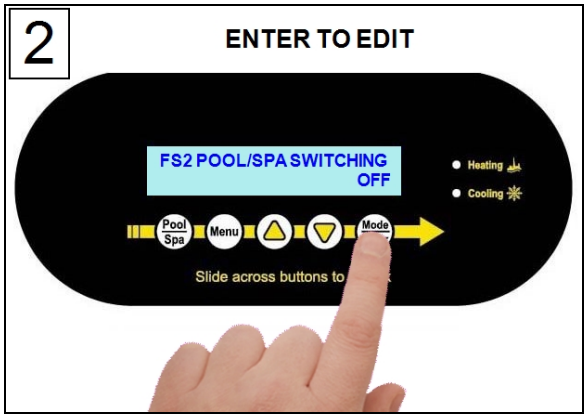


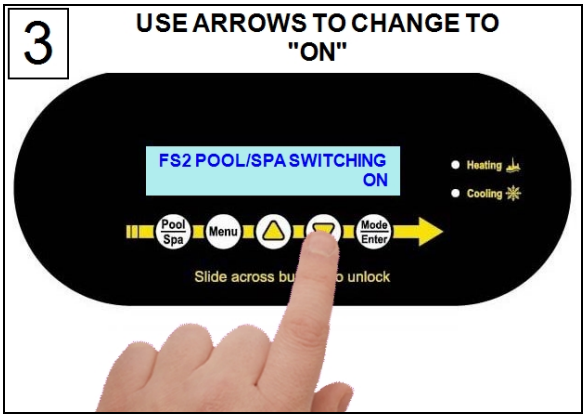


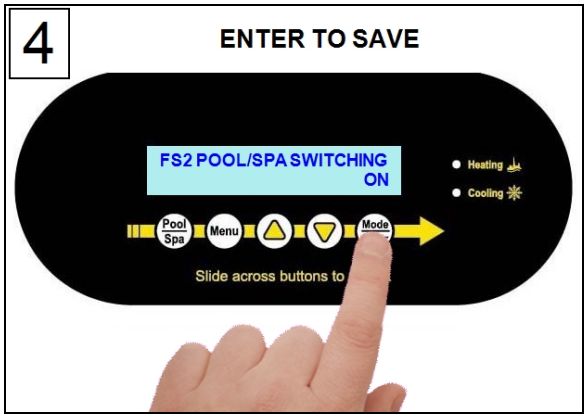

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

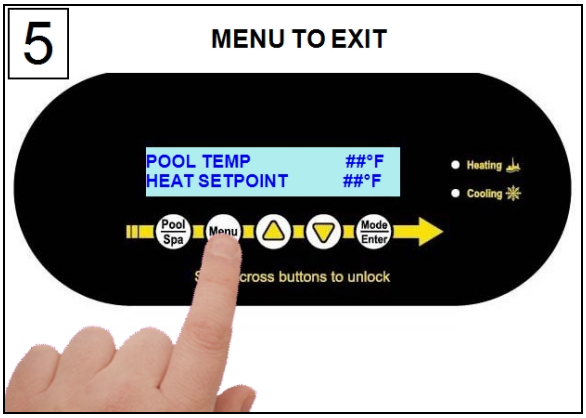

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode


1
USE ARROWS TO
"FS2 POOL / SPA SWITCHING"
FS2 POOL/SPA SWITCHING
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
FS2 POOL/SPA SWITCHING
OFF
Heating
Cooling
Pool Spa
Menu
Mode


3
USE ARROWS TO CHANGE TO
"ON"
FS2 POOL/SPA SWITCHING
ON
Heating
Cooling
Pool Spa
Menu
Mode Enter

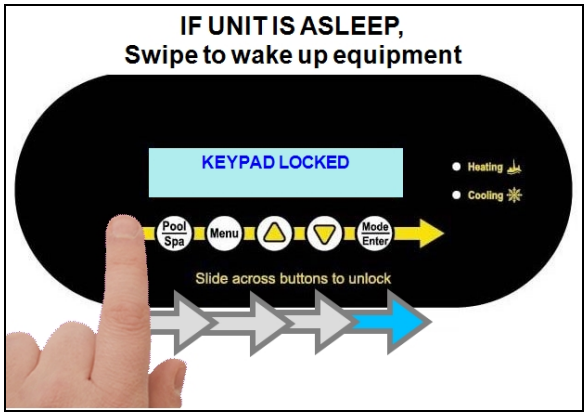

4
ENTER TO SAVE
FS2 POOL/SPA SWITCHING
ON
Heating
Cooling
Pool Spa
Menu
Mode

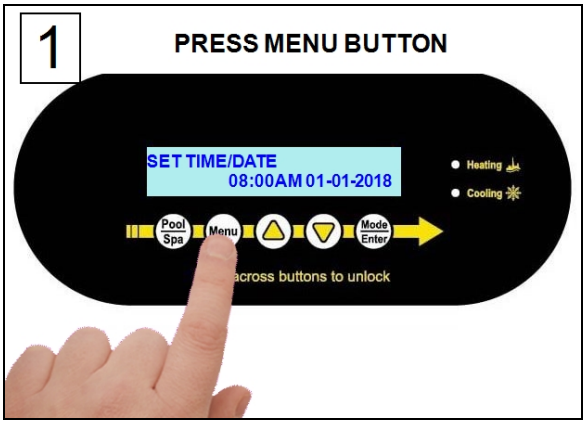

5
MENU TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

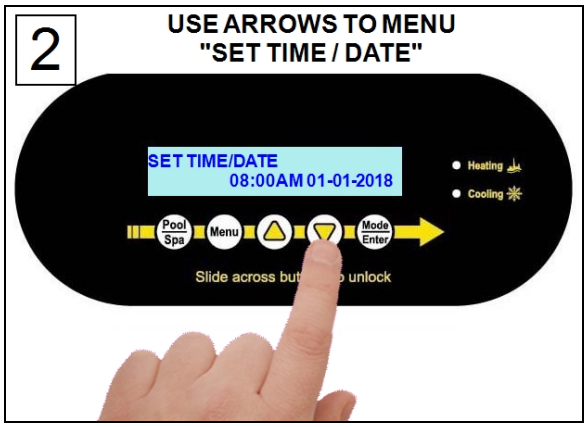
1.7 Program Heat Pump for the Customer

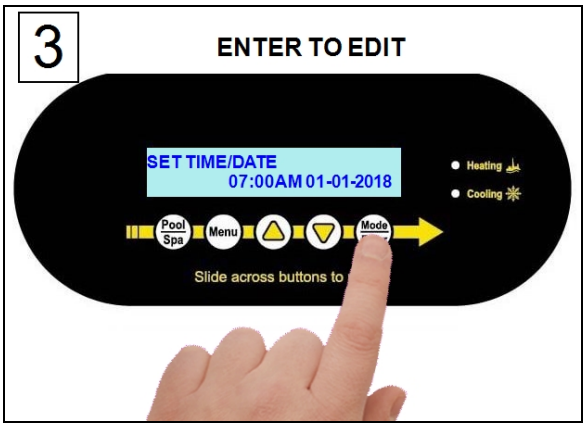
1.7.a Setting Date and Time

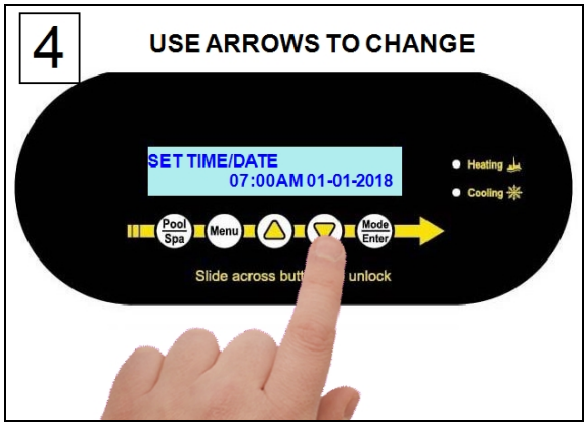
Set the heat pump's time and date using the following steps.

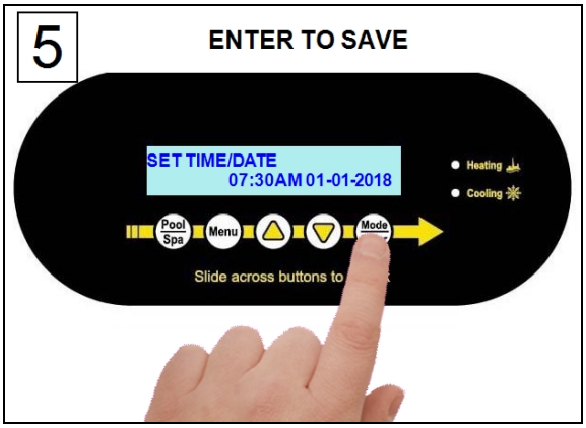


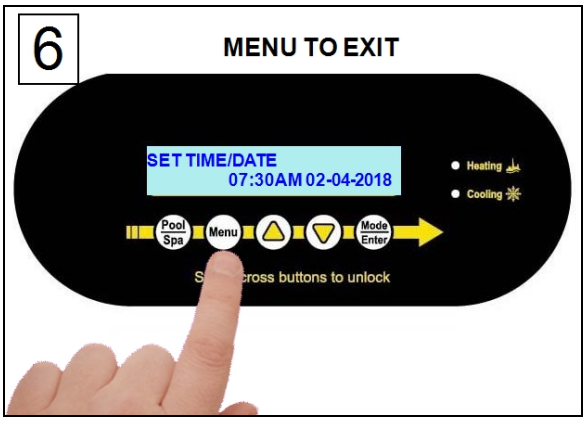












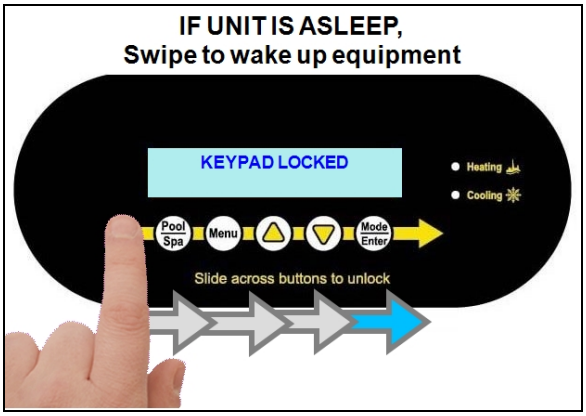
1.7.b Setting Time and Date Format

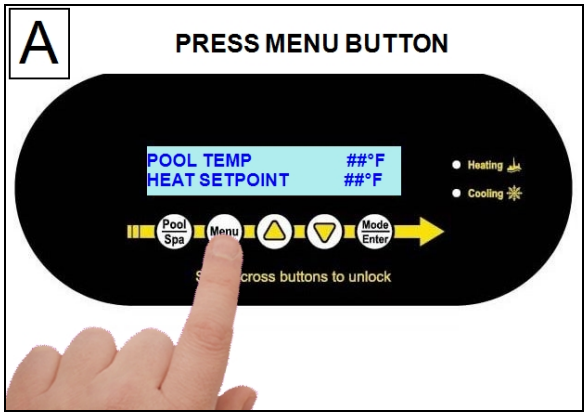
The heat pump's time and date format can be customized.

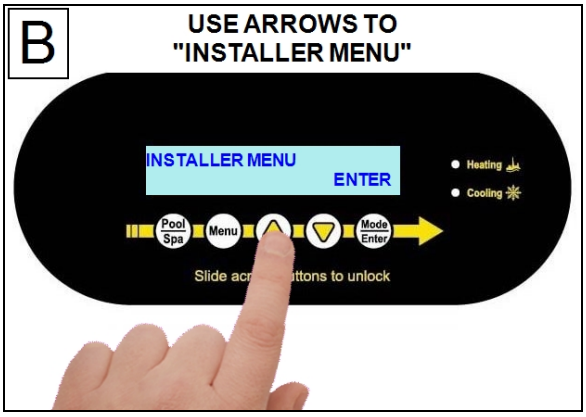
Customize Time

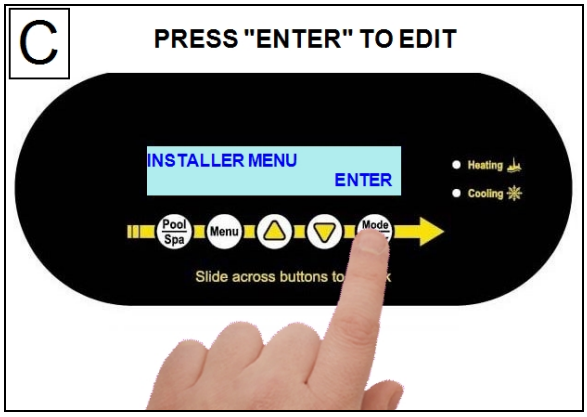
The time can be displayed in 24-hour *military* time (the default display is 12 hour).

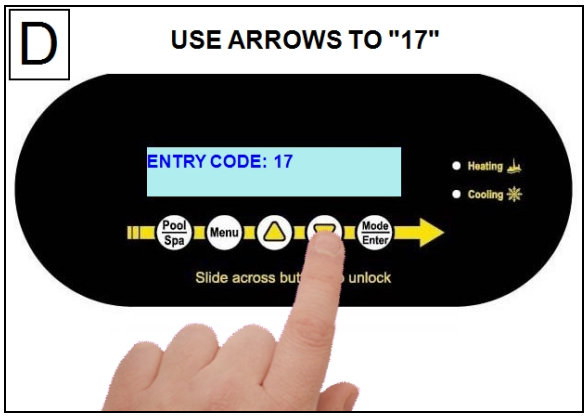
Enter "Installer Menus", then proceed

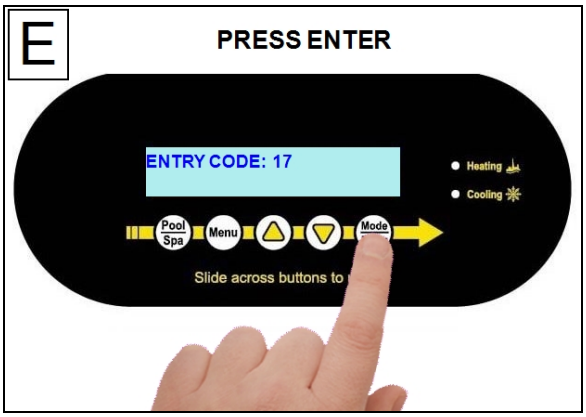


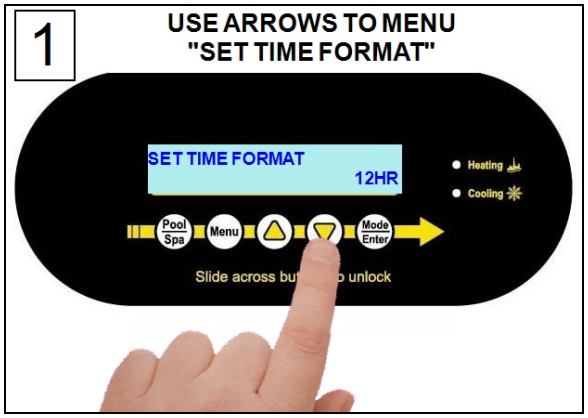


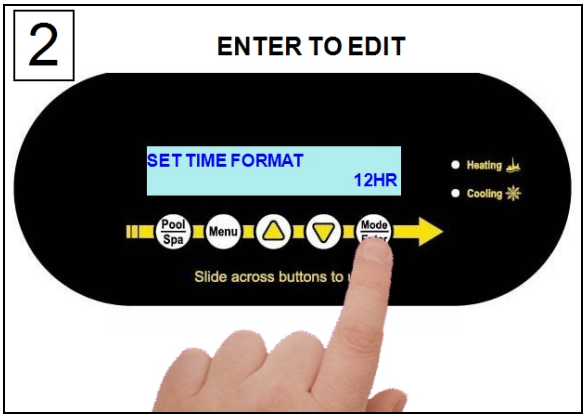


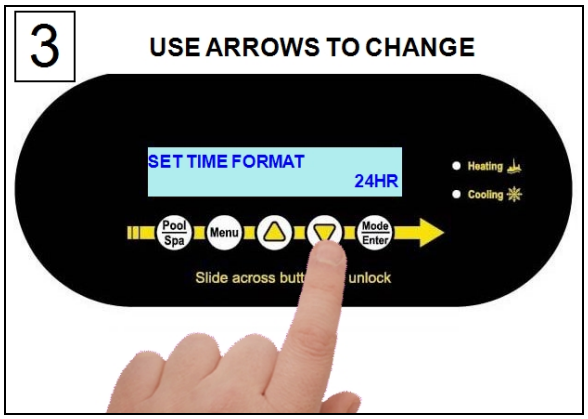


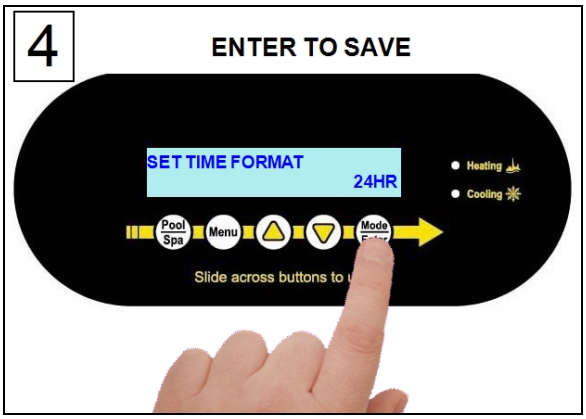

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

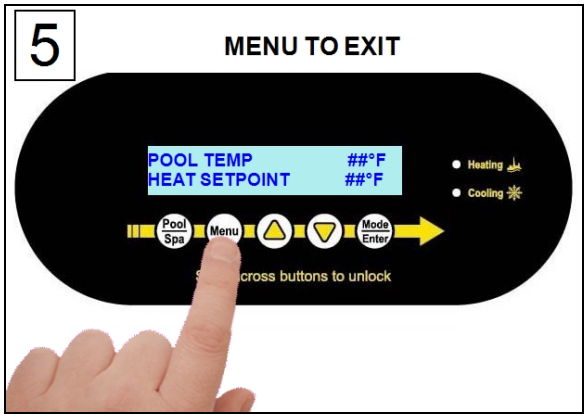

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode

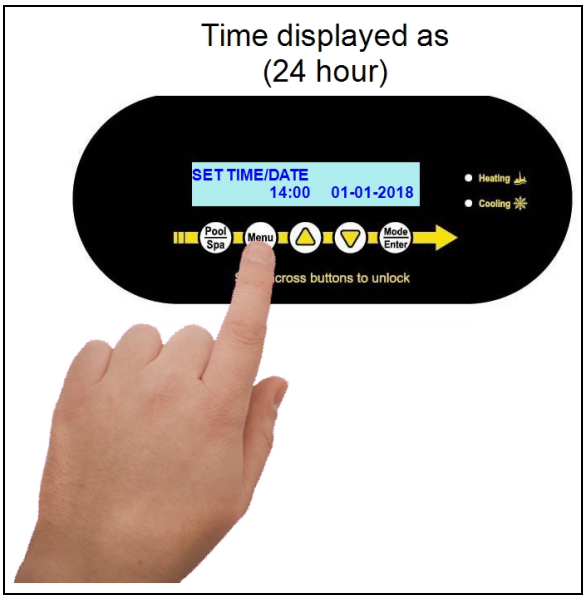

1
USE ARROWS TO MENU
"SET TIME FORMAT"
SET TIME FORMAT
12HR
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
SET TIME FORMAT
12HR
Heating
Cooling
Pool Spa
Menu


3
USE ARROWS TO CHANGE
SET TIME FORMAT
24HR
Heating
Cooling
Pool Spa
Menu
Mode Enter


4
ENTER TO SAVE
SET TIME FORMAT
24HR
Heating
Cooling
Pool Spa
Menu

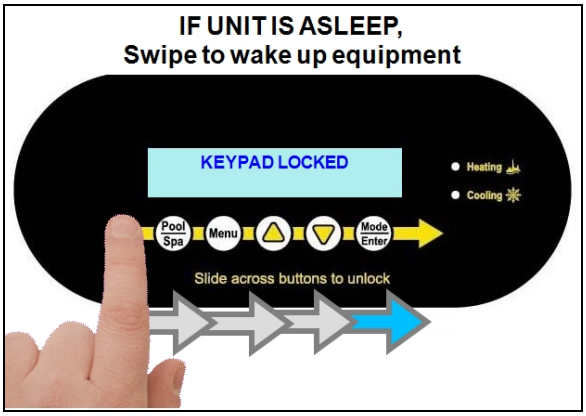

5
MENU TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

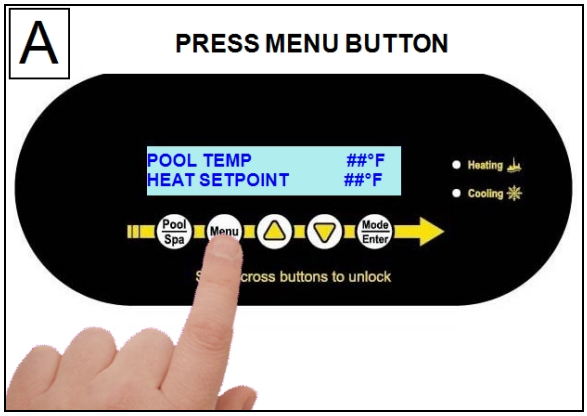


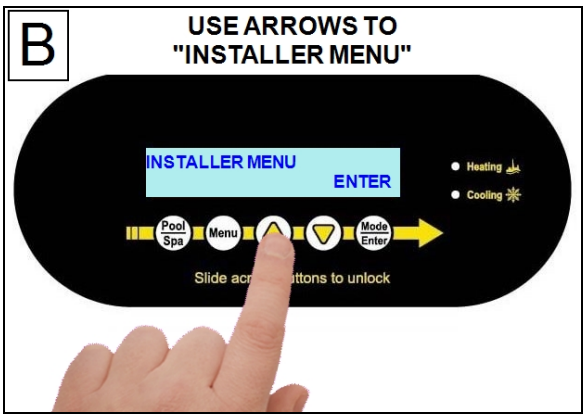
Customize Date

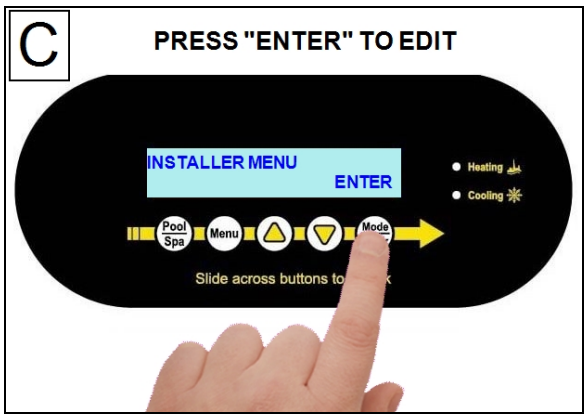
The date can be displayed as Day-Month-Year (the default is Month-Day-Year).

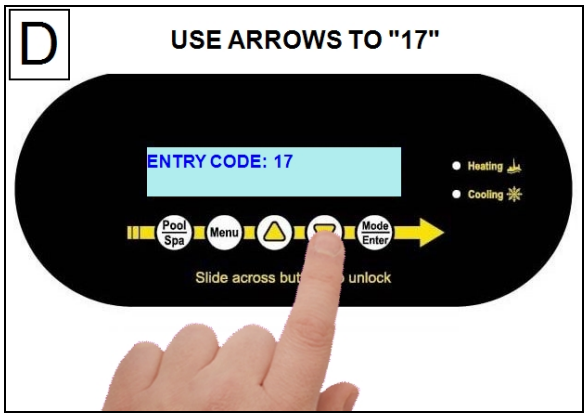
Enter "Installer Menus", then proceed

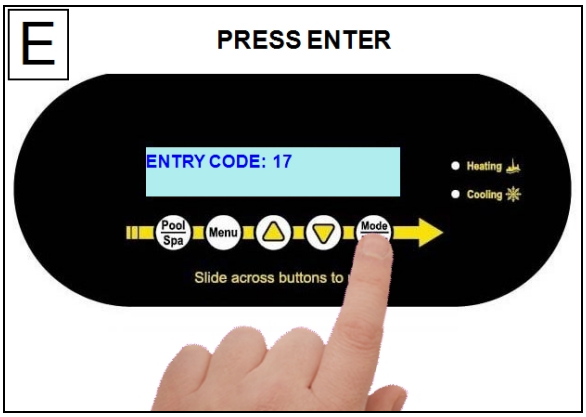


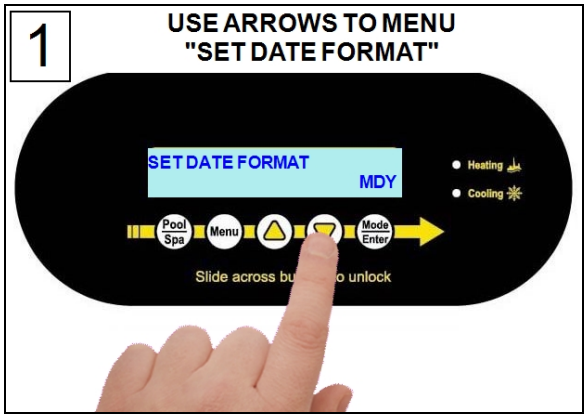


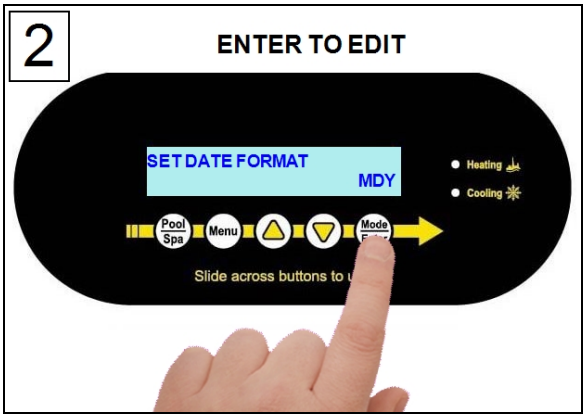


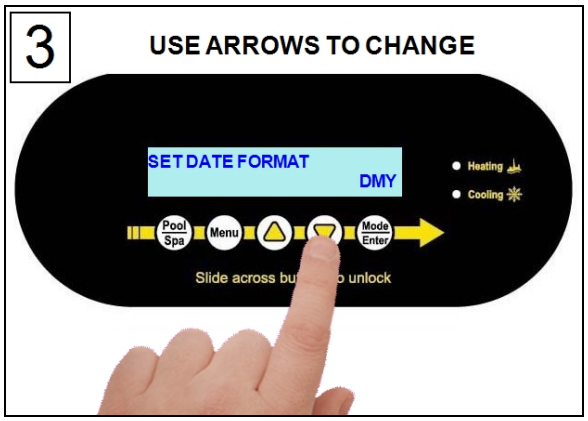


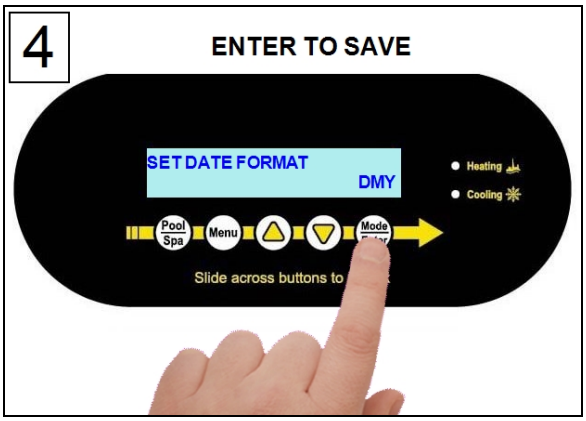

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

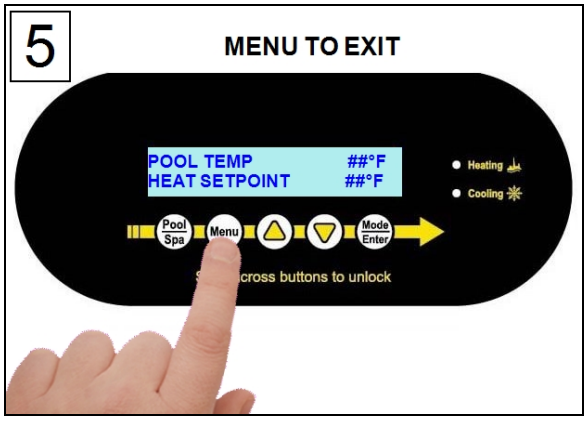

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode

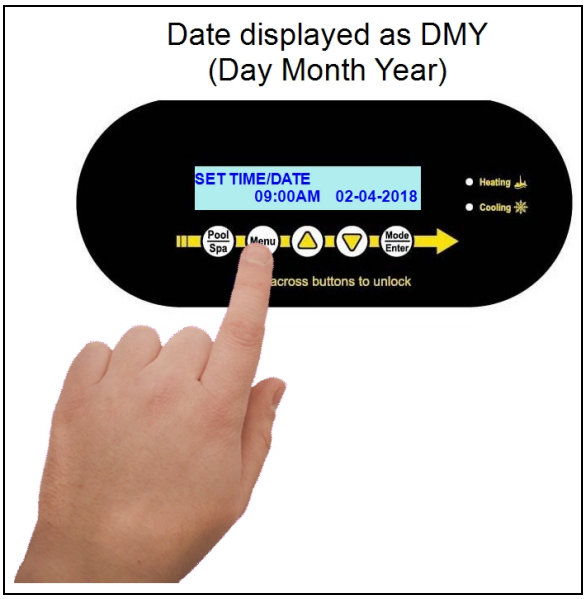

1
USE ARROWS TO MENU
"SET DATE FORMAT"
SET DATE FORMAT
MDY
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
ENTER TO EDIT
SET DATE FORMAT
MDY
Heating
Cooling
Pool Spa
Menu


3
USE ARROWS TO CHANGE
SET DATE FORMAT
DMY
Heating
Cooling
Pool Spa
Menu
Mode Enter


4
ENTER TO SAVE
SET DATE FORMAT
DMY
Heating
Cooling
Pool Spa
Menu

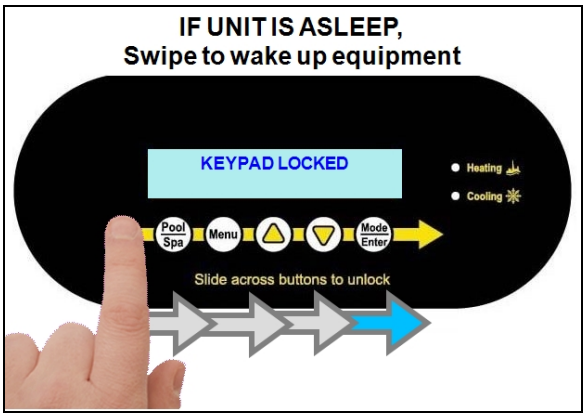

5
MENU TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

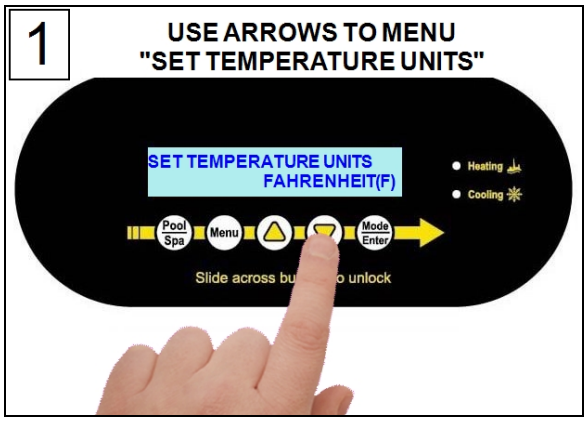


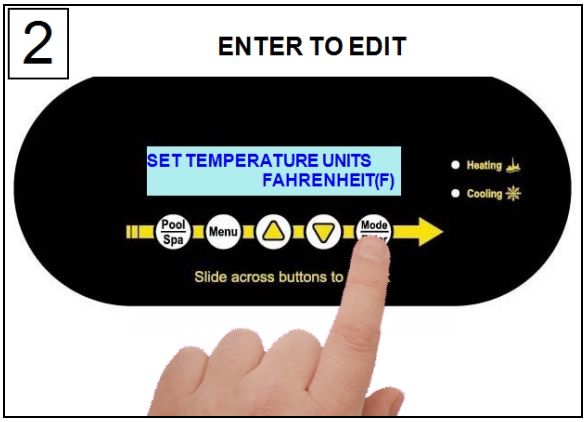
1.7.c Selecting Celsius or Fahrenheit

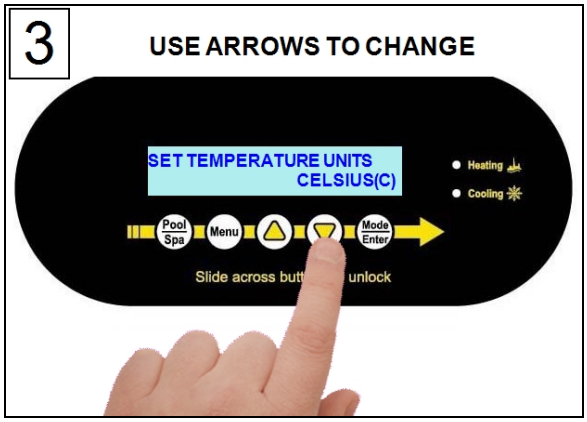
Set the water temperature to show in either Fahrenheit (default) or Celsius.

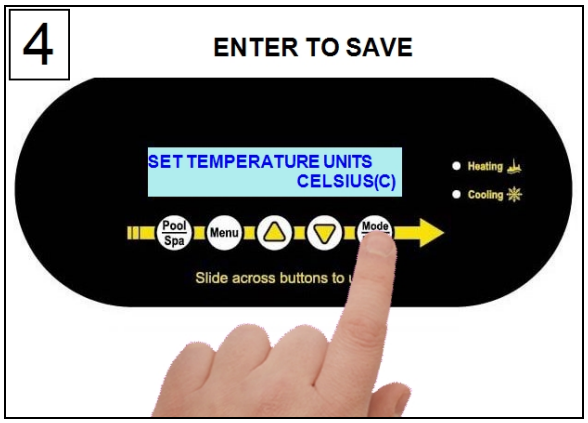
Enter "Installer Menus", then proceed

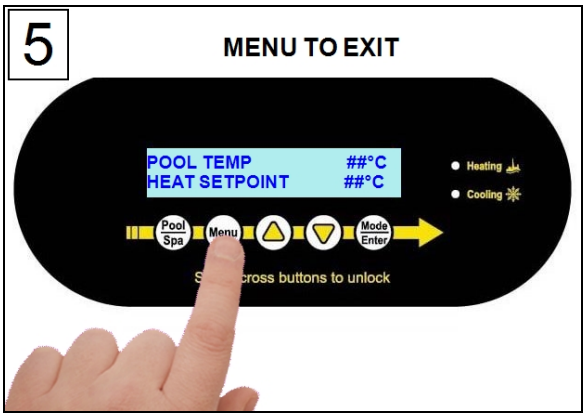












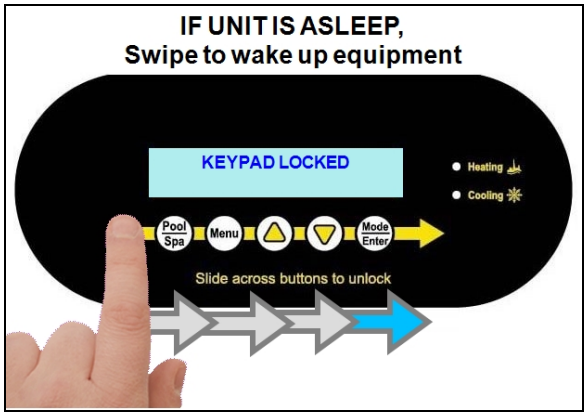
1.7.d Setting Entry Code Option

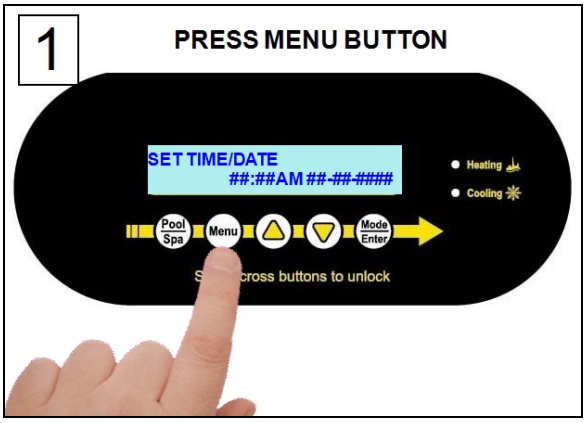
The entry code feature can prevent unauthorized temperature adjustments. This feature initiates after the heat pump goes into the sleep mode for the first time.

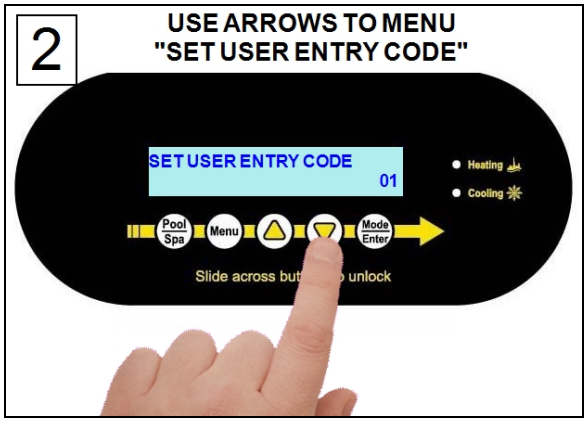
NOTICE

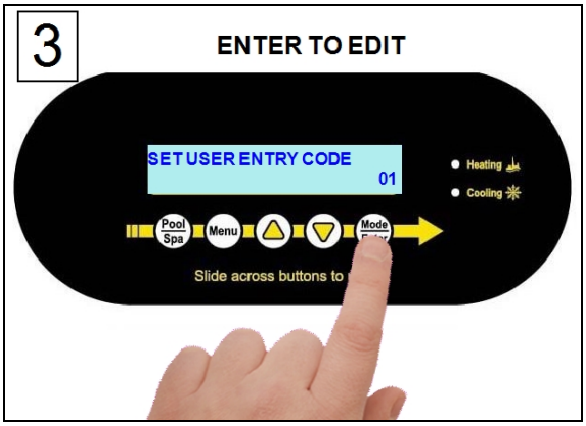
Failure to heed the following may result in damage to equipment.

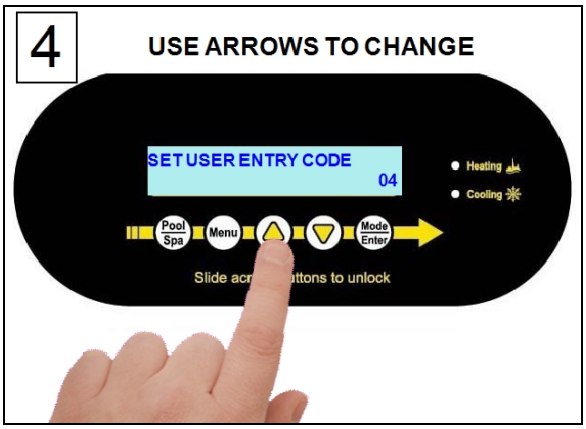
- **Before enabling the entry code feature, be sure to record the code.** If lost, the heat pump will require a program reset to regain access. This reset may require additional configuration by the installer.

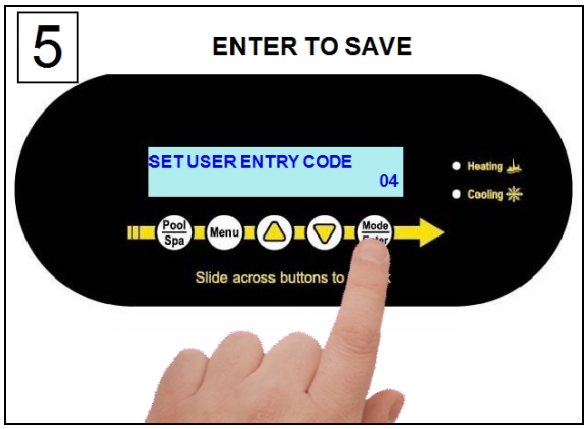


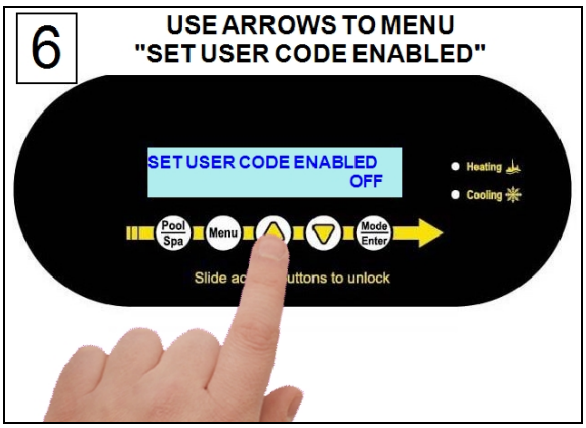


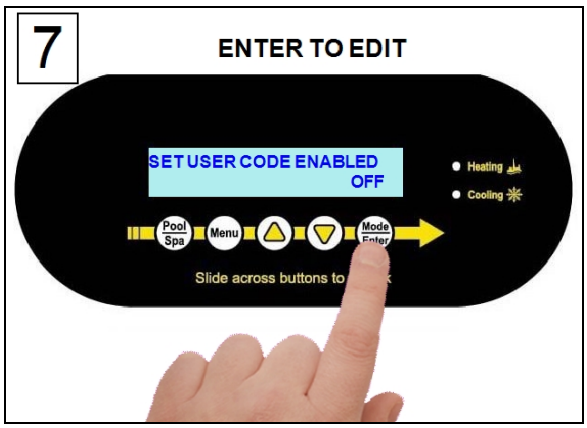


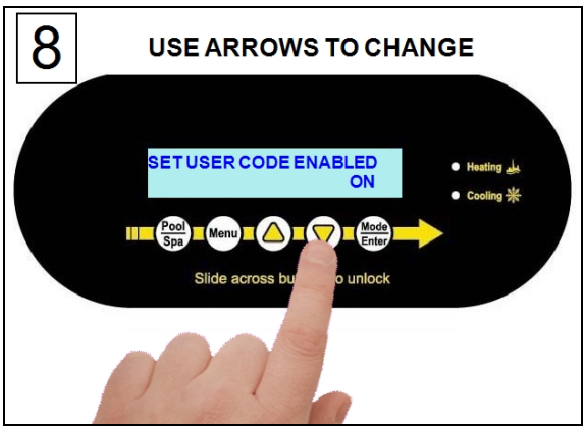


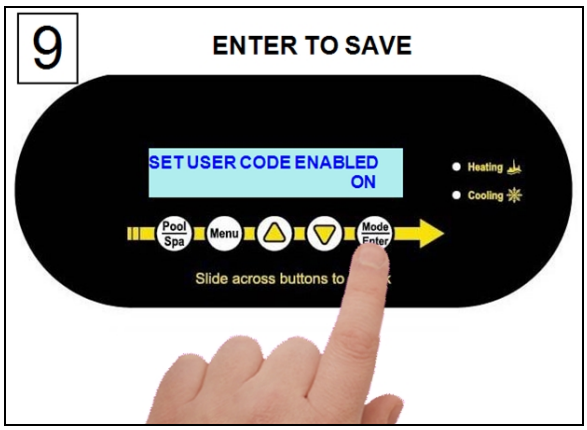

4
USE ARROWS TO CHANGE
SET USER ENTRY CODE
04
Heating
Cooling
Pool Spa
Menu
Mode Enter

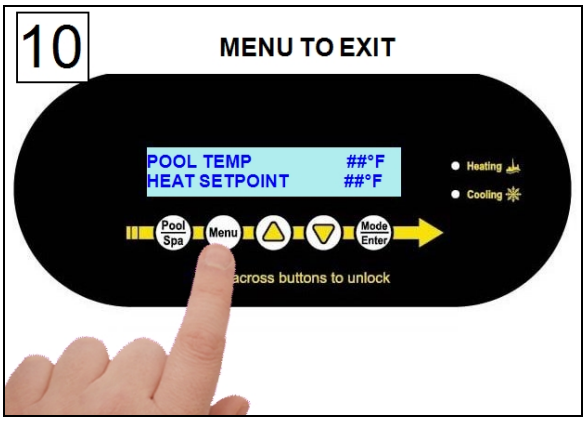

5
ENTER TO SAVE
SET USER ENTRY CODE
04
Heating
Cooling
Pool Spa
Menu
Mode Enter


6
USE ARROWS TO MENU
"SET USER CODE ENABLED"
SET USER CODE ENABLED
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter


7
ENTER TO EDIT
SET USER CODE ENABLED
OFF
Heating
Cooling
Pool Spa
Menu
Mode Enter

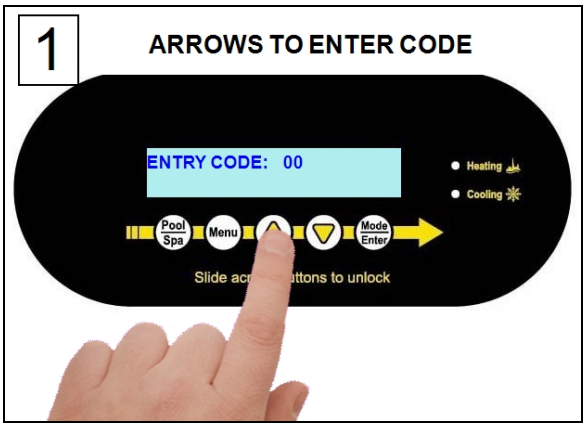

8
USE ARROWS TO CHANGE
SET USER CODE ENABLED
ON
Heating
Cooling
Pool Spa
Menu
Mode Enter

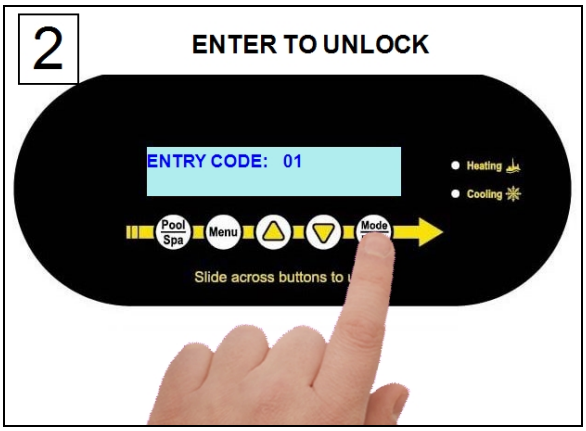

9
ENTER TO SAVE
SET USER CODE ENABLED
ON
Heating
Cooling
Pool Spa
Menu
Mode Enter


10
MENU TO EXIT
POOL TEMP ##°F
HEAT SETPOINT ##°F
Heating
Cooling
Pool Spa
Menu
Mode Enter

1.7.e Using Entry Code to Access Heat Pump

If a user entry code has been enabled in the user menu, an entry code will be required to access heat pump options.





PLEASE NOTE -

- If the entry code has been misplaced, the heat pump will need to be reset to factory defaults.
- After three minutes of inactivity, the heat pump's sleep mode will activate.

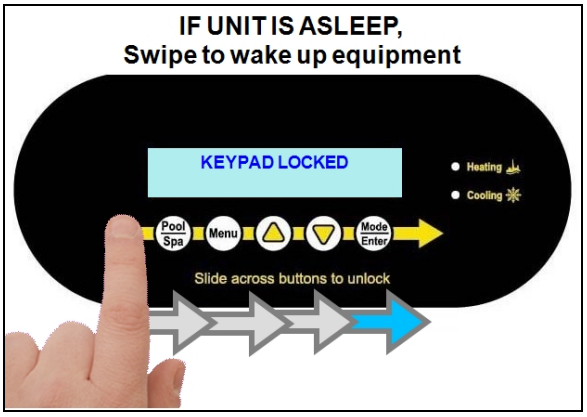
1.7.f Resetting Factory Defaults

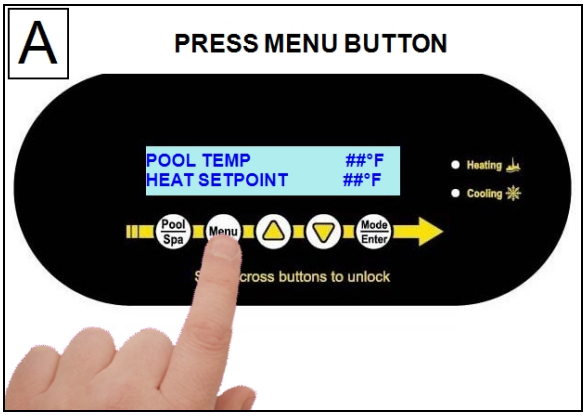
If needed, the installer can reset programming to the heat pump's factory default settings. See "*Factory Defaults*" on page 73.

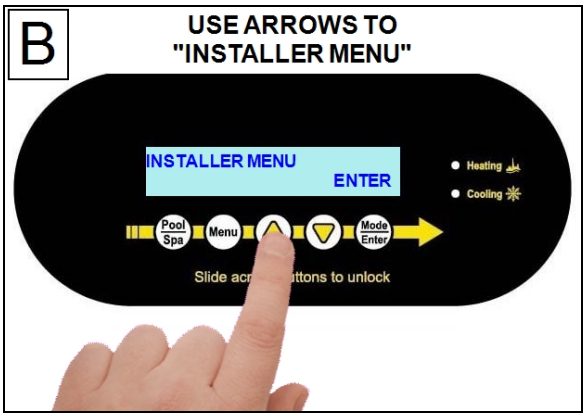
PLEASE NOTE:

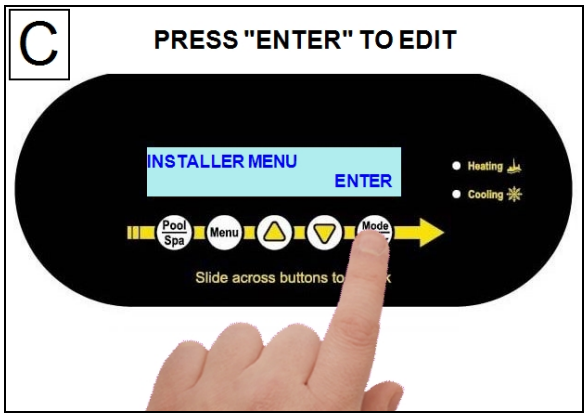
This will reset any external device configurations.

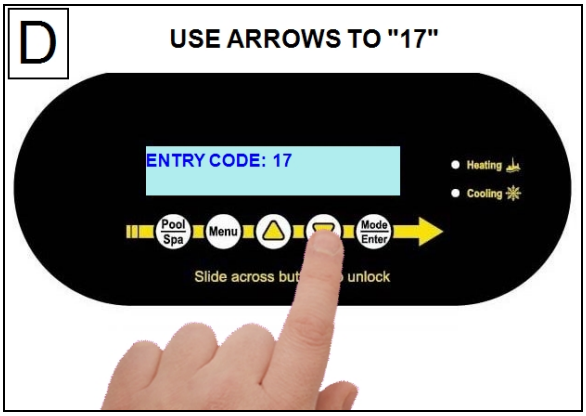
Enter "Installer Menus", then proceed

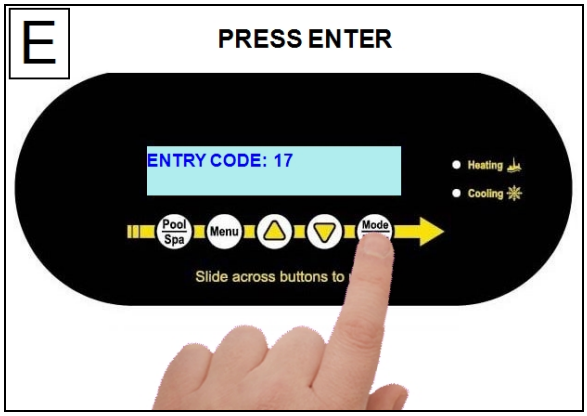


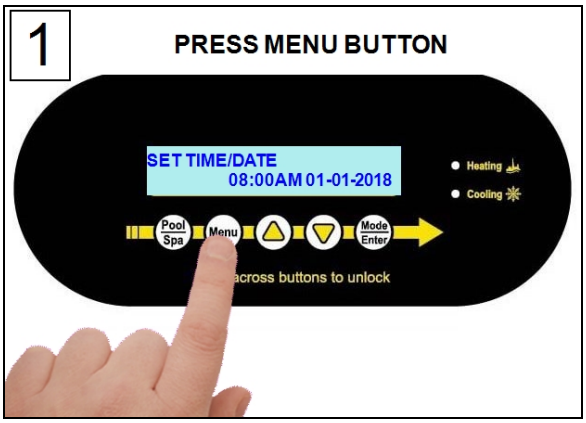


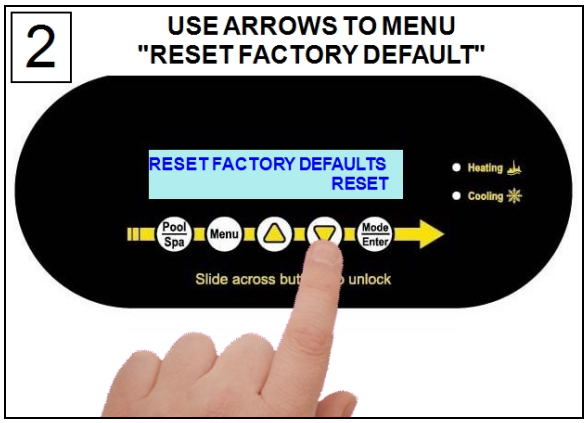

B
USE ARROWS TO
"INSTALLER MENU"
INSTALLER MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode Enter

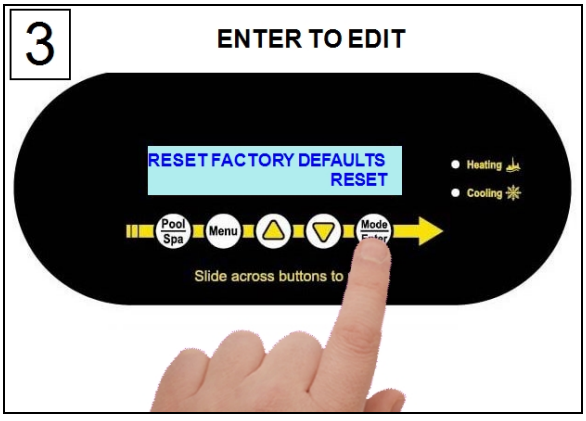

C
PRESS "ENTER" TO EDIT
INSTALLER MENU
ENTER
Heating
Cooling
Pool Spa
Menu
Mode

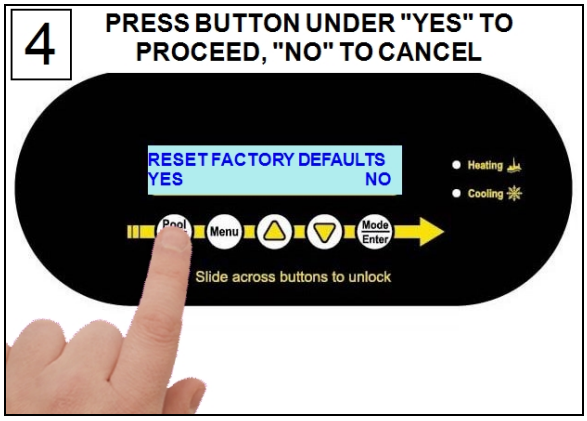

D
USE ARROWS TO "17"
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode Enter

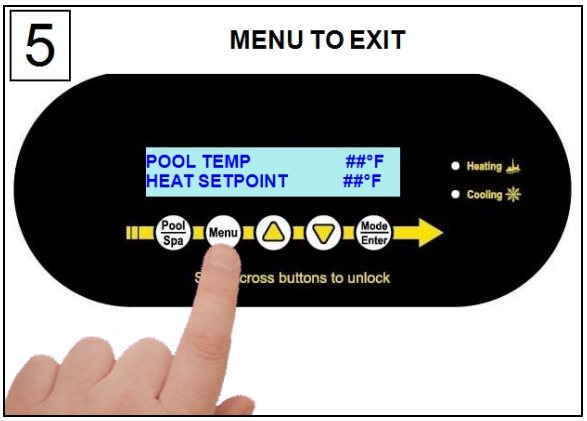

E
PRESS ENTER
ENTRY CODE: 17
Heating
Cooling
Pool Spa
Menu
Mode


1
PRESS MENU BUTTON
SET TIME/DATE
08:00AM 01-01-2018
Heating
Cooling
Pool Spa
Menu
Mode Enter


2
USE ARROWS TO MENU
"RESET FACTORY DEFAULT"
RESET FACTORY DEFAULTS
RESET
Heating
Cooling
Pool Spa
Menu
Mode Enter


3
ENTER TO EDIT
RESET FACTORY DEFAULTS
RESET
Heating
Cooling
Pool Spa
Menu


4
PRESS BUTTON UNDER "YES" TO
PROCEED, "NO" TO CANCEL
RESET FACTORY DEFAULTS
YES
NO
Heating
Cooling
Menu
Mode Enter
Slide across buttons to unlock



1.8 Cleaning Equipment After Installation

Installer - If you need to clean the equipment after installation, please use the following guidelines.

WARNING Failure to heed the following may result in injury or death.

- Possible electric shock hazard - Deactivate power to all electrical devices on the pad when washing heat pump. Do not restore electrical power until equipment is completely dry.

NOTICE Failure to heed the following may result in damage to equipment.

- Do not use a pressure cleaner to wash the heat pump. Damage to heat pump components may result. If using a hose-end spray nozzle adjust the spray pattern to low strength only.
- Do not spray water directly into the interior of the heat pump; damage to components may result.
- Do not use chemicals on the display panel.

Cleaning

1. Wash cabinet using a low-pressure water hose.
2. While the heat pump is still wet, use an approved cleaning agent to clean the exterior of the heat pump. **Do not use chemicals on the display panel.**
3. Use a detergent-dampened cloth to wipe the heat pump's exterior cabinet.
4. Flush all exterior with fresh water using a low-pressure water hose.
5. Dry the cabinet's exterior using a soft cloth.

APPROVED CLEANING AGENTS•
Fantastic®
Formula 409®
Cascade®
All Power Plain Detergent (3% Solution)

Table 4 - Cleaning Agents

• The trademarks used in approved cleaning agents are the property of their owners and are not related to AquaCal®.

Polishing

1. Polish the heat pump's cabinet panels using an approved polishing agent and following the manufacturer's instructions. **Do not use chemicals on the display panel.**
2. Rinse the heat pump panels with fresh water, wipe, and buff panels using a dry soft cloth.
3. Allow heat pump interior and surrounding equipment to "air-dry" for several hours prior to restoring electrical power.

APPROVED POLISHING AGENTS•
Simoniz® Wax
Glo-Coat®
Armor All® Protectant

Table 5 - Polishing Agents

• The trademarks used in approved polishing agents are the property of their owners and are not related to AquaCal®.

2 - Troubleshooting

IN THIS SECTION:

Fault Codes

Issues and resolutions

2.1 Fault Codes

A fault code indicates a specific issue or condition that will require action before the equipment can resume operating.

Please perform the following troubleshooting.
If the issue reoccurs, please contact AquaCal. See "*Contacting AquaCal AutoPilot, Inc.*" on page 1.

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- Repairs must not be attempted by untrained or unqualified individuals.
- The heat pump contains refrigerant under high pressure. Repairs to the refrigerant circuit must not be attempted by untrained or unqualified individuals. Service must be performed only by qualified HVAC technicians. Recover refrigerant before opening the system.

NOTICE Failure to heed the following may result in damage to equipment.

- Service by unauthorized personnel will void the heat pump warranty.

AIR TEMP SENSOR OPEN or AIR TEMP SENSOR SHORT

ISSUE

Open or shorted air sensor.

RESOLUTION

A qualified technician should replace the air sensor.

CLOCK LOW BATTERY

ISSUE

The real-time clock controller indicates a low battery condition.

- The time will reset to factory default.
- If connected, a gas backup heater may start and stop at an incorrect time when set to use a "SCHEDULED" mode.

RESOLUTION

A qualified technician should replace the battery. The date and time will need to be reset on the heat pump after replacement.

ERROR AT MASTER UNIT

ISSUE

The heat pump is slaved to a master heat pump that is displaying a fault code.

RESOLUTION

The error at the master heat pump must be corrected before the slaved unit will resume operation.

HIGH PRESSURE FAULT

ISSUE

The refrigerant system's high-pressure switch is showing as open.

RESOLUTION

Heat Only Units

Place heat pump in heating mode and perform the following troubleshooting.

Determine if an insufficient amount of water is being supplied to the equipment.

1. Confirm the filter pump is on.
2. If a multiple-speed filter pump is being used, run filter pump at a higher speed. Do not exceed the maximum flow rate for the model.
3. Confirm water is not being diverted away from the heat pump.
   - See "*Water Flow Rates*" on page 14.
   - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.

Heat and Cool Units (Reversing)

Place heat pump in heating mode and perform the following troubleshooting.

Determine if an insufficient amount of water is being supplied to the equipment.

1. Confirm the filter pump is on.
2. If a multiple-speed filter pump is being used, run filter pump at a higher speed. Do not exceed the maximum flow rate for the model.
3. Confirm water is not being diverted away from the heat pump.
   - See "*Water Flow Rates*" on page 14.
   - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.

HIGH WATER TEMPERATURE

ISSUE

Incoming water temperature has exceeded 110° F (43° C) and the unit has been deactivated. The heat pump will not operate until the incoming water temperature drops to 100° F (38° C) or lower.

RESOLUTION

1. Determine if a gas heater is sending water directly to the heat pump. This situation would need to be corrected before continuing.
2. If a solar heater is sending water directly to the heat pump, the water can initially be hotter than 110° F (43° C). After the water from the solar panel normalizes, the fault will no longer display and the heat pump will resume as needed.
3. If the **HIGH WATER TEMPERATURE** fault continues to display, the water temperature sensor may require replacement.

HP5 SYSTEM LOCKOUT

ISSUE

The heat pump has locked due to five high-pressure faults during one call for heating or cooling.

RESOLUTION

1. Deactivate then reactivate power to the heat pump to clear error.
2. Troubleshoot the high-pressure issue causing the error.
   - See "*HIGH PRESSURE FAULT*" above.

LOW PRESSURE FAULT

ISSUE

The refrigerant system's low-pressure switch is showing as open.

RESOLUTION

If the heat pump is a reversing unit, place it in heating mode and perform the following troubleshooting.

Determine if an insufficient amount of water is being supplied to the equipment.

1. Confirm the filter pump is on.
2. If a multiple-speed filter pump is being used, run filter pump at a higher speed. Do not exceed the maximum flow rate for the model.
3. Confirm water is not being diverted away from the heat pump.
   - See "*Water Flow Rates*" on page 14.
   - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.

LP5 SYSTEM LOCKOUT

ISSUE

The heat pump has locked due to five low-pressure faults during one call for heating or cooling.

RESOLUTION

1. Deactivate then reactivate power to the heat pump to clear error.
2. Troubleshoot the low-pressure issue causing the error.
   - See "*LOW PRESSURE FAULT*" above.

MULTI-UNIT COMM FAULT

ISSUE

Slaved heat pump is not receiving a signal from the master heat pump.

RESOLUTION

1. Confirm the master heat pump is operating correctly. If, for example, no power is supplied to the master heat pump, an error will appear on the slaved heat pumps.
2. Confirm the heat pump is properly connected and configured to a master unit.
   - See "*Connecting Multiple Heat Pumps (Master / Slaved)*" on page 41.

NO LOCAL EXPANSION

ISSUE

The Heat Pump expected an attached local expansion module to be active.

RESOLUTION

A qualified technician should confirm the correct model number has been entered into the heat pump.

The installer should confirm that an expansion module is properly installed in the unit.

OTA SYSTEM LOCKOUT

ISSUE

A malfunction has occurred that could allow the water temperature to surpass a safe level. An installed "Over Temperature Alarm" kit has disabled the system.

- See "*Over Temperature Alarm Kit*" on page 77 for more information.

RESOLUTION

Call for service.

SMART COMM FAULT

ISSUE

Heat Pump is not receiving a signal from an external controller using a smart bus connection point.

RESOLUTION

1. Confirm a smart bus external controller is being used.
   - If not, set external controller mode to "none" instead of "SMART".
     - See "*Configure for Smart Bus Controller*" on page 31.
2. Confirm connection points from the external controller to the heat pump are correctly configured.
   - See "*Connecting Smart Bus Controllers*" on page 30.
3. If using a smart bus external controller, confirm the controller is correctly set to send signals to the heat pump. See manuals or guides provided with the external controller.

SOURCE FLOW FAULT

ISSUE

If source water flow goes on and off 5 or more times during one call for heating or cooling, the Heat Pump will deactivate.

RESOLUTION

Confirm source water pump is operating correctly.

SOURCE-IN SENSOR SHORT or SOURCE-IN SENSOR OPEN

ISSUE

Shorted or open water sensor.

RESOLUTION

A qualified technician should replace the water sensor.

SOURCE-OUT SENSOR SHORT or SOURCE-OUT SENSOR OPEN

ISSUE

Shorted or open water sensor.

RESOLUTION

A qualified technician should replace the water sensor.

SOURCE HIGH WATER TEMP

ISSUE

Incoming source water temperature has exceeded 108° F (42° C). The unit has been deactivated.

RESOLUTION

The heat pump will not operate until the incoming source water temperature drops to 100° F (38° C) or lower.

SOURCE LOW WATER TEMP

ISSUE

Incoming source water temperature has fallen below 38° F (3° C). The unit has been deactivated.

RESOLUTION

The heat pump will not operate until the incoming source water temperature rises to 42° F (5.5° C) or higher.

WATER TEMP SENSOR SHORT or WATER TEMP SENSOR OPEN

ISSUE

Shorted or open water sensor.

RESOLUTION

A qualified technician should replace the water sensor.

2.2 Issues and Resolutions

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.
- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

WARNING Failure to heed the following may result in injury or death.

- Repairs must not be attempted by untrained or unqualified individuals.
- The heat pump contains refrigerant under pressure. Repairs to the refrigerant circuit must not be attempted by untrained or unqualified individuals. Service must be performed only by qualified HVAC technicians. Recover refrigerant before opening the system.

NOTICE Failure to heed the following may result in damage to equipment.

- Service by unauthorized personnel will void the factory warranty.

Please perform the following troubleshooting.
For further assistance, please contact AquaCal. See "*Contacting AquaCal AutoPilot, Inc.*" on page 1.

A Front Panel Warning Indicator is Red (Select Units)

ISSUE

The Heat Pump is experiencing an incoming power fluctuation.

RESOLUTION

An electrician should check for improper electrical site conditions.

Blank Display

ISSUE

The Heat Pump may have an incoming power problem.

RESOLUTION

Confirm electrical power is being supplied to the heat pump from electrical disconnect(s).

If the heat pump is a 3-phase unit, a qualified technician should check for low voltage or phase loss.

1. If equipped with an ICM three-phase monitor, a qualified technician should check the display screen located inside the unit's electrical panel.
   - See "*ICM Digital 3-Phase Monitor*" on page 78.
2. If the issue is still occurring, contact the heat pump installer or manufacturer.

Can't set temperature above 96° F (35.6° C)

ISSUE

The maximum allowed set temperature for a Water Source unit is 96° F (35.6° C).

RESOLUTION

Install an over temperature safety device. This will allow a maximum set temperature of 104° F (40° C). See "Over Temperature Alarm Kit".

Display Panel Not Responding

ISSUE

The heat pump's display panel will not respond to user input.

RESOLUTION

1. If heat pump display shows "**UNDER REMOTE CONTROL**", use the external control device to control the heat pump.
2. If needed, check with the external controller manufacturer for further assistance using that device.

Displays "NO SYSTEM FIRMWARE"

ISSUE

The heat pump has encountered a software error.

RESOLUTION

Call for service.

Displays "NO POOL/SPA WATER FLOW"

ISSUE

Low or no pool/spa water detected. This is normal when the circulation pump is deactivated.

RESOLUTION

1. Confirm the filter pump is on.
2. If a multiple-speed filter pump is being used, run at a higher speed to determine if the error persists. Do not exceed the maximum flow rate for your model.
3. Confirm water is not being diverted away from the heat pump.
    - See "*Water Flow Rates*" on page 14.
    - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.

Displays "NO SOURCE WATER FLOW"

ISSUE

Low or no source water detected.

RESOLUTION

1. Confirm the source water pump is on.
2. If a multiple-speed source water pump is being used, run at a higher speed to determine if the error persists. Do not the exceed maximum flow rate for your model.
3. Confirm water is not being diverted away from the heat pump.
    - See "*Water Flow Rates*" on page 14.
    - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.

Displays "SET TO SWITCH REMOTELY"

ISSUE

If when pressing the "Pool / Spa" button the display flashes the message "**SET TO SWITCH REMOTELY**", the heat pump is using a remote relay switch or a 3-wire controller.

RESOLUTION

- The Pool and Spa thermostat automatically switch when using these modes.
- Operation manually will not be available when using these external devices. No action is required.

Displays "SET UNIT MODEL NUMBER"

ISSUE

The heat pump has encountered a software error.

RESOLUTION

- The model number and serial number will need to be re-entered into the system. The system will then operate as normal.
- If the issue reoccurs, please contact AquaCal® Technical Support.

Heat Pump Not Running

ISSUE

The heat pump will not run.

RESOLUTION

1. Confirm equipment is receiving power. Is the heat pump display illuminated?
   - If not, confirm the main breaker (located at the power supply panel) and the disconnect switch (located near the heat pump) are both turned on.
   - If the display still does not illuminate, it is recommended that the heat pump installer or electrician confirm the heat pump is receiving power.
2. Confirm correct mode is selected.
3. Confirm thermostat is set correctly.
   - When heating the water is desired, the thermostat should be set above the current water temperature.
   - When cooling the water is desired, the thermostat should be set below the current water temperature.
4. If an error code is displayed, diagnose and correct the cause of the code.
   - See "*Fault Codes*" on page 63.
5. If the heat pump is using an external controller, the heat pump may not be set correctly to accept the controller's signal.

Heat Pump's Tripping Breaker

ISSUE

The heat pump breaker(s) keeps tripping.

RESOLUTION

1. If AquaCal® heat pumps have been connected using a multiple heat pump configuration, the configuration may be incorrect. Please confirm settings or contact installer of equipment.
   - See "*Connecting Multiple Heat Pumps (Master / Slaved)*" on page 41.
2. Have an electrician confirm breakers are correct type, in good condition, and properly sized for the heat pump.

Heat Pump Won't Shut Off

ISSUE

The heat pump will not deactivate.

RESOLUTION

> ***PLEASE NOTE***
> *When the heat pump is set to off, the display will show the current water temperature or no water flow indicator.*

1. Confirm the correct mode has been set on the heat pump.
2. Confirm the heat pump has reached the desired temperature set on the thermostat. The heat pump will continue to run until the set temperature is reached.
3. If the heat pump is using an external controller, it may not be set correctly. See the external controller's manual.

Heat Pump Is Running, Not Heating

ISSUE

The heat pump is running. But the water is not heating.

RESOLUTION

1. If the heat pump is using an external controller, confirm it is set correctly.
   - Contact the installer of the device or the device's manufacturer for further assistance.
2. Confirm heat pump mode is set to heat.
3. Confirm thermostat is set to the desired water temperature.
4. Confirm valves are positioned to heat the correct body of water (either the pool or the spa). If heating a spa that overflows into a pool, confirm the spa is isolated when being heated (not flowing into the pool).
5. Confirm heat pump is transferring heat into the water.
   - Measure the pool-side and source-side discharge water coming out of the heat pump.
   - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.
6. If an error code is displayed, diagnose and correct cause of code.
   - See "*Fault Codes*" on page 63.
7. Confirm that the filter pump has a sufficient run-time. The heat pump will not run (or heat the water) without water flow.
   - See "*Heating Recommendations*" on page 76.
8. If heating a spa, deactivate air blower or venturi (if equipped) to allow for quicker heating times. For pools, deactivate water features, such as slides, waterfalls, or fountains to allow water to retain heat. Use of a liquid pool blanket product, such as an Aqua Blanket™, can also compensate for excessive heat loss.
   - See "*Liquid Blankets*" on page 77.

Heat Pump Is Running, Not Cooling

ISSUE

The heat pump is running. But the water is not cooling.

RESOLUTION

1. If the heat pump is using an external controller, confirm the heat pump is programmed properly to allow for cooling.
2. Confirm the heat pump mode is set to cool.
3. Confirm the thermostat is set below the current water temperature.
4. Confirm valves are positioned to cool the correct body of water (either the pool or the spa). If cooling a spa that overflows into a pool, confirm the spa is isolated when being cooled (not flowing into the pool).
5. If an error code is displayed, determine and correct the condition causing the code.
   - See "*Fault Codes*" on page 63.
6. Confirm heat pump is transferring heat out of the water.
   - Measure the temperature of source-side and pool-side discharge water coming out of the heat pump.
   - See "*Adjusting Water Flow Using ΔT (Delta-T)*" on page 16.
7. Confirm that the filter pump has a sufficient run-time. The heat pump will not run (or cool the water) without water flow.
   - See "*Cooling Recommendations*" on page 76.

"Pool / Spa" Button Will Not Work

ISSUE

The "Pool / Spa" button is disabled if the following devices have been configured on the heat pump.

RESOLUTION

- A 2-wire external controller.
- A 3-wire external controller.
- An external flow switch.

3 - Appendix

IN THIS SECTION:

3.1 Factory Defaults

Certain programming options have been preset at the factory. These options can be overwritten for site-specific conditions.

NOTICE Failure to heed the following may result in damage to equipment.

- Unauthorized adjustments in Service Menus (**not shown**) may void the heat pump's warranty.

User Menus		
MENUS	**DEFAULT**	**OPTIONS**
SET GAS BOOST	OFF	OFF ON
SET TIME / DATE	USER TO SET	
SET BACKUP HEAT MODE	OFF	OFF SCHEDULED 24HR
SET ENTRY CODE ENABLED	OFF	OFF ON
SET USER ENTRY CODE	01	
SET CALL-FLEX MODE	OFF	OFF CALL FLEX

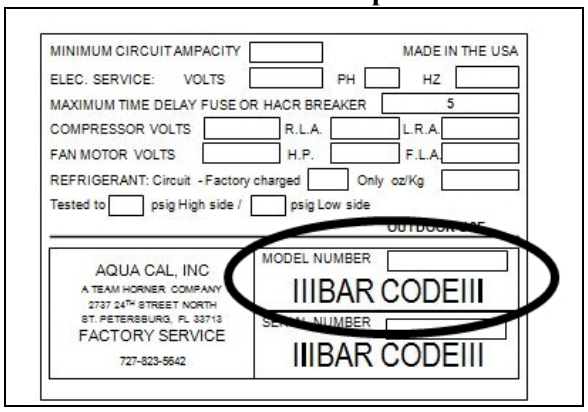
Installer Menus		
MENUS	**DEFAULT**	**OPTIONS**
SET MULTI-UNIT MODE	OFF	OFF MASTER SLAVED
SET EXT. CTRL MODE	OFF	OFF SMART 2WIRE 3WIRE

Installer Menus		
MENUS	**DEFAULT**	**OPTIONS**
SET TIME FORMAT	12 Hour	12 Hour 24 Hour
SET DATE FORMAT	MDY	MDY DMY
SET TEMPERATURE UNITS	Fahrenheit	Fahrenheit Celsius
SET BACKUP HEAT MODE	OFF	OFF SCHEDULED 24HR
SET ENTRY CODE ENABLED	OFF	OFF ON
SET USER ENTRY CODE	01	
SET CALL-FLEX INSTALLED	NO	YES NO
SET CALL-FLEX MODE	OFF	OFF CALL FLEX

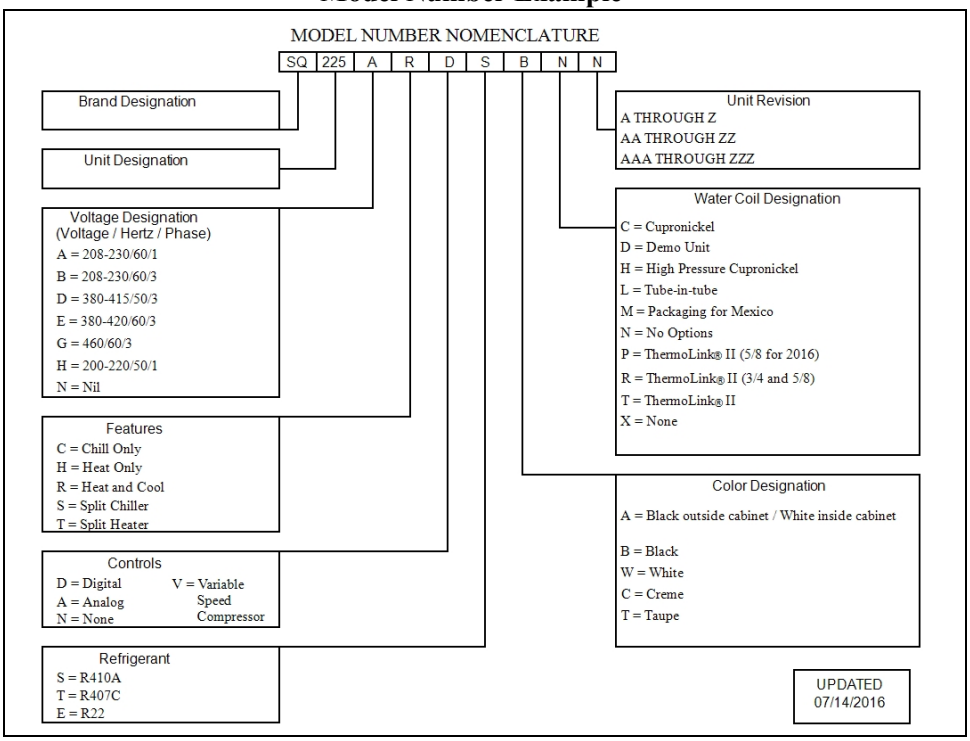
3.2 Identifying Model Specifications

1. Find Data Plate - The data plate is usually posted on the side of the equipment or the inside of the heat pump's access plate.
2. Find the model number on the data plate. The first letters and numbers indicate the model type.
3. The complete model number identifies the equipment's specifications.

Data Plate Example



Model Number Example



3.3 Weights

NOTE:
Specifications subject to change.

Model Type	Model Number	Install Weight
Water Source	WS03 (source side Titanium)	290 Pounds (131.5 kg)
Water Source	WS03 (source side Cupronickel)	300 Pounds (136.1 kg)
Water Source	WS05 (source side Titanium)	300 Pounds (136.1 kg)
Water Source	WS05 (source side Cupronickel)	320 Pounds (145 kg)
Water Source	WS10 (source side Titanium)	745 Pounds (338 kg)
Water Source	WS10 (source side Cupronickel)	840 Pounds (381 kg)
SunPower	SP05 (source side Titanium)	340 Pounds (154 kg)
SunPower	SP05 (source side Cupronickel)	350 Pounds (158.8 kg)

3.4 Heating Recommendations

The following recommendations will reduce the amount of time required to heat a pool. **If unsure of equipment heating capability, review equipment data plate.** See "*Identifying Model Specifications*" on page 74.

1. Confirm heat pump mode has been set to heating mode.
2. Set the desired temperature (set-point) for the water.
3. Temporarily set the filter pump for continuous operation.
    - This will allow the Heat Pump the time required to heat the water at start-up.
    - After the water has reached the desired temperature, reset the filter pump to normal operating time-frames.
4. Use a pool cover or blanket to reduce heating time.

3.5 Cooling Recommendations

The following recommendations will reduce the amount of time required to cool a pool or cold plunge application. **If unsure of equipment cooling capability, review equipment data plate.** See "*Identifying Model Specifications*" on page 74.

1. Confirm heat pump mode has been set to cooling mode.
2. Set thermostat to desired water temperature.
3. Temporarily set the filter pump for continuous operation.
    - This will allow the Heat Pump the time required to cool the water at start-up.
    - After the water has reached the desired temperature, reset the filter pump to normal operating time-frames.

3.6 Available Accessories

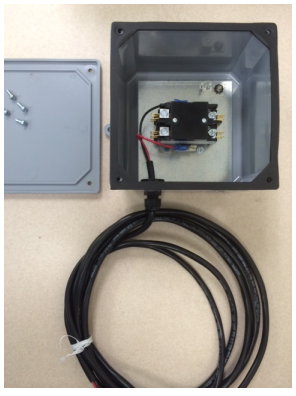
Accessories may be purchased through an authorized dealer of AquaCal® products.

Bypass Valve Kit (# STK0135)

- When high flow rates are outside recommended specifications, please use this kit or an alternative bypass valve system.
- This kit can be used to control excessive water flow through the heat pump. It provides automatic flow adjustments for most applications.

Call Flex Accessory (# 0030-LEDS)

- This accessory will override a circulation pump to provide water to the heat pump when the set temperature is not met.



Grid Flow Switch (# 0040S)

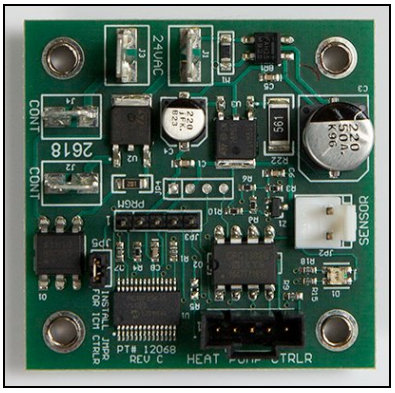
- Used for automatic pool/spa thermostat switching.
- This kit is not to be used on applications exceeding 50 PSI (345 kPa).

Liquid Blankets

- An invisible liquid heat barrier designed to retain heat and extend the swimming season.
- AquaCal® recommends Lo-Chlor® Aqua Blanket™.

Over Temperature Alarm Kit

- This kit is an additional safety device. It disables the heat pump if any malfunction occurs that allows the water temperature to surpass a safe level.
- This kit comes standard for SunPower equipment.
- In the case of a Water Source unit, if the kit isn't present, the maximum allowed set temperature is 96° F (35.6° C). If this kit is installed, the maximum allowed set temperature is 104° F (40° C).
- This kit is strongly recommended for all spa applications.
  - Single Phase Heat Pump - (# STK0221)
  - Three Phase Heat Pump - (# STK0222)

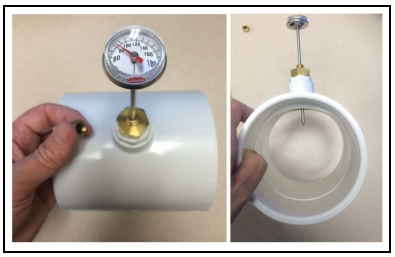


Plumbing Unions

- 1 Inch Unions - (# PLP0059)
- 2 Inch Unions - (# PLS2627)

Temperature Port Kit (# STK0096)

- This kit can be used to adjust water flow using Delta-T.
- The kit comes with a port, installation components, and a temperature probe.



3.7 ICM Digital 3-Phase Monitor

DANGER Failure to heed the following will result in injury or death.

- Deactivate power while routing wiring to control board.

- Follow all National Electric Codes (NEC) and/or State and Local guidelines.

ICM450

Programmable Three Phase Voltage Monitor with 25-Fault Memory

Protects motors from premature failure and burnouts

Parameters

Phase Unbalance Protection

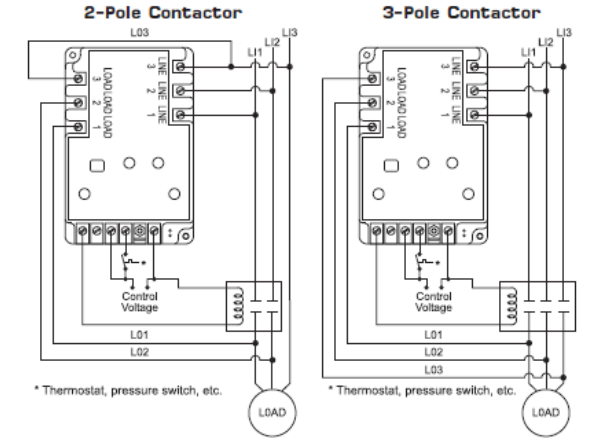
Factory set at 5% for unbalance, 9% for under voltage, and 14% for over voltage.

- **Phase Loss Condition:** Equals 25% of nominal for any given phase; system will shut down and a fault will be recorded should this occur

Delay on Break Timer
- **Control Voltage:** 18-240 VAC
- **Time Delay:** 0 to 10 minutes adjustable

Fault Interrogation Delay
- **Time Delay:** 0 to 15 seconds adjustable
- Provides a delay between fault detection and system shutdown - helps to eliminate nuisance trips or unnecessary shutdowns

ICM450 Wiring Diagrams



Button Functions

Press arrows to scroll through and select user parameter settings in Setup mode. HOLD down for fast edit.

Press to enter Setup mode and select user parameters.

Hold for voltage display a→b, b→c, a→c (simultaneously).

Press to read faults. Hold for 5 seconds to clear faults and reset memory.

Parameters

Parameter	Description	Range	Default	Recommended
Line Voltage	Average phase to phase line voltage	190-600	208	Nameplate Voltage
Delay On Break	Amount of time between the load de-energizing and re-energizing	0-10 minutes	.1 minute	4 minutes**
Fault Interrogation	Amount of time before the load de-energizes due to a non-critical fault*	0-15 seconds	15 seconds	7-8 seconds**
% Over/Under Voltage	Maximum/minimum phase to phase average voltage, respectively	2-25%	20%	12-15%**
% Phase Unbalance	Amount of allowable voltage unbalance	2-20%	20%	4-5%**
Reset Mode	AUTO or number of times the load can be re-energized after a load side fault before a manual reset is necessary **Note:** *When monitoring line side only, the reset mode will always be AUTO*	AUTO, 0-10	AUTO	AUTO
Control Mode	With control mode set to OFF, the load will energize if no 3- phase fault conditions exist; with control mode ON, the load will energize if no fault conditions exist and control voltage is present at terminals 1 and 3 of the **ICM450**	ON or OFF	ON	Based on wiring

* Non-critical faults are faults such as High/Low Voltage and Phase Unbalance. Critical faults, such as Phase Loss and Phase Reversal, have a fault interrogation and typical response time of under 4 seconds and it is not user adjustable.

** For best recommendations, consult manufacturer of equipment.

Under no circumstances should this monitor be adjusted to allow operation when voltage is below 200 volts

Fault Conditions

Press and release fault button to scroll through all saved faults.

Note: *For initial setup, press and hold FAULT for 5 seconds to remove any previously stored faults.*

Fault	Problem	Corrective Action
Back Phase Loss	Not all three of the phases on the load side are present	1. Re-energize the contactor. 2. If the fault reappears after the load energizes: a. Turn all power OFF b. Check all load side connections c. Check the contacts of the contactor for debris or excess carbon.
Back Phase Rev	Loads 1, 2, or 3 are not in sequence (not 120° phase shifted)	1. Turn OFF all power. 2. Swap any 2 phases on the load side of the **ICM450** only (example: swap load 1 and load 2) * 3. Re-apply power.
Back Phase Unbalance	A voltage unbalance between the three load phases exceeds the unbalance setpoint	1. Press the **READ** button to observe the present load voltages. Check system for unbalance cause. 2. Increase the fault interrogation time if necessary. 3. Increase the percent unbalance setting if necessary.
Front Over Voltage	Average phase-phase voltage exceeds the maximum percentage	1. Check system for over-voltage cause. 2. Increase the percent over-voltage setting if necessary. 3. Increase the fault interrogation time if necessary.
Front Phase Loss	Not all three of the phases on the line side are present	1. Press and hold the **READ** button on the phase monitor or use an AC voltmeter to carefully measure all three phase-phase line voltages (***example:*** Line 1 → Line 2, Line 2 → Line 3, Line 3 → Line 1). 2. Repair the missing phase.
Front Phase Reversal	Lines 1, 2, or 3 are not in sequence (not 120° phase shifted)	1. Turn OFF all power. 2. Swap any 2 phases on the line side of the **ICM450** (example: swap Line 1 and Line 2)* 3. Re-apply power.
Front Phase Unbalance	A voltage unbalance between the three line phases exceeds the unbalance setpoint	1. Press the **READ** button to observe the present load voltages. Check system for unbalance cause. 2. Increase the fault interrogation time if necessary. 3. Increase the percent unbalance setting if necessary.
Front Under Voltage	Average phase-phase voltage is below the minimum percentage	1. Check system for under-voltage cause. 2. Increase the percent under-voltage setting if necessary. 3. Increase the fault interrogation time if necessary.

* **Only** swap phases during initial setup, **not** after the **ICM450** has been in operation without errors.

Troubleshooting

Problem	LCD Readout	LED Status	Corrective Action
Load will not energize	Phase Avgerage	All LEDs Off	Confirm that the control input (terminals 1 & 3) is properly connected and configured
Load will not energize	Phase Avgerage	Load LED Off, Fault LED blinking	Press **FAULT** once to observe the current fault; correct the condition of the first fault that appears (see Fault Conditions above, for a list of corrective actions)
Fault LED blinks repeatedly while load is energized	Phase Avgerage	Fault LED Blinking, Load LED On	Indicates there are faults saved in the memory, press **FAULT** rapidly to scroll through saved faults; to clear the faults, press and hold **FAULT** for more than 5 seconds
Load will not de-energize when control voltage is OFF	Phase Avgerage	Load LED On, Control LED Off	The control mode setting is OFF; press **SETUP** to get to the control mode. Press ^ to set the control mode ON
Setup LED is on while load is being energized	Anything Other Than Phase Avgerage	Setup LED On, Load LED On	To exit the setup mode, press either **READ** or **FAULT**
Load will not energize	Reset	Fault LED Blinking	Unit in lockout; maximum number of retries in manual reset mode has been reached; to reset unit, press **FAULT** and hold for more than 5 seconds
Load turns ON and OFF repeatedly	Readout is Irrelevant	Fault LED Blinking	Fix load side fault; press **FAULT** to observe condition; the delay on break period may be too short; press **SETUP** to enter the delay on break mode; press ^ to lengthen the delay

3.8 Schematics

Some schematics have been provided in the appendix of this manual.

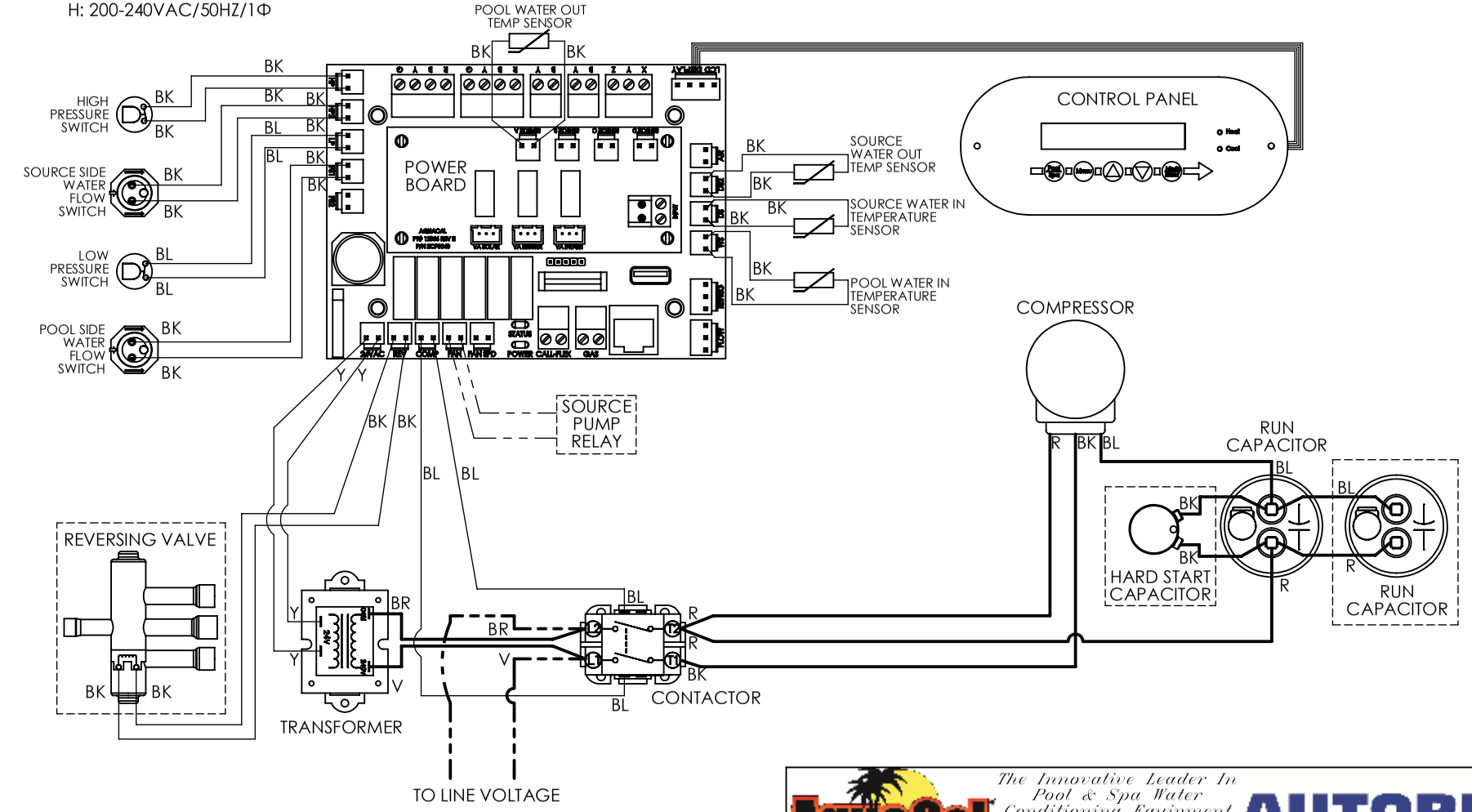
PLEASE NOTE:

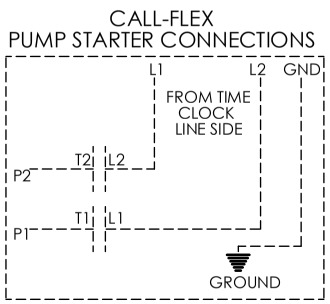
- Specifications are subject to change without notice.
- Schematics are available by calling AquaCal® Customer Support. See "*Contacting AquaCal AutoPilot, Inc.*" on page 1.
  - Please have the complete model and serial number available.
  - See "*Identifying Model Specifications*" on page 74.

Schematic Document Numbers Chart		
Phase	**Equipment Model Numbers**	**Schematic #**
Single	WS03, WS05	LTM0943
Three	WS03, WS05	LTM0946
Three	WS10	LTM0951
Single	SP05	LTM0943
Three	SP05	LTM0946

NOTES UNLESS OTHERWISE SPECIFIED:
1. USE COPPER CONDUCTORS ONLY.
2. TO BE WIRED IN ACCORDANCE WITH NAT'L ELEC (NEC) & LOCAL CODES.
3. CONNECT TRANSFORMER TO CORRECT VOLTAGE.
4. LINE VOLTAGE CODES:
   A: 208-230VAC/60HZ/1Φ
   H: 200-240VAC/50HZ/1Φ

REVISION TABLE			
REV.	PCA NUMBER/DESCRIPTION	CHANGED BY	DATE
REL-B	ADDED SOURCE PUMP RELAY (OPTIONAL) & FLOW SWITCHES; RELOCATED POOL OUT AND SOURCE IN TEMP SENSORS	RENEEC	6/6/2019





24VAC
OPTIONAL
LINE VOLTAGE
FIELD WIRED 24 VAC
FIELD WIRED LINE VOLTAGE

COLOR CODE
BK: BLACK
BL: BLUE
BR: BROWN
R: RED
V: VIOLET
Y: YELLOW

CAD GENERATED DRAWING, DO NOT MANUALLY CHANGE

AquaCal — The Innovative Leader In Pool & Spa Water Conditioning Equipment
2737 24th St. No.
St. Petersburg, FL 33713

AUTOPILOT SALT CHLORINE GENERATORS

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE INCHES [MILLIMETERS]

TOLERANCES:
DECIMALS: TBD
ANGLES: TBD

MATERIAL

FINISH

DO NOT SCALE DRAWING

DESCRIPTION
DIAGRAM,WIRING,1-PH,WATERSOURCE

MODELED BY: RBC	DRAWN BY: RBC	PROJECT ENG: RBC	CHK'D BY: RBC
DATE: 9/10/2018	DATE: 12/11/2018		

DWG. NO. LTM0943

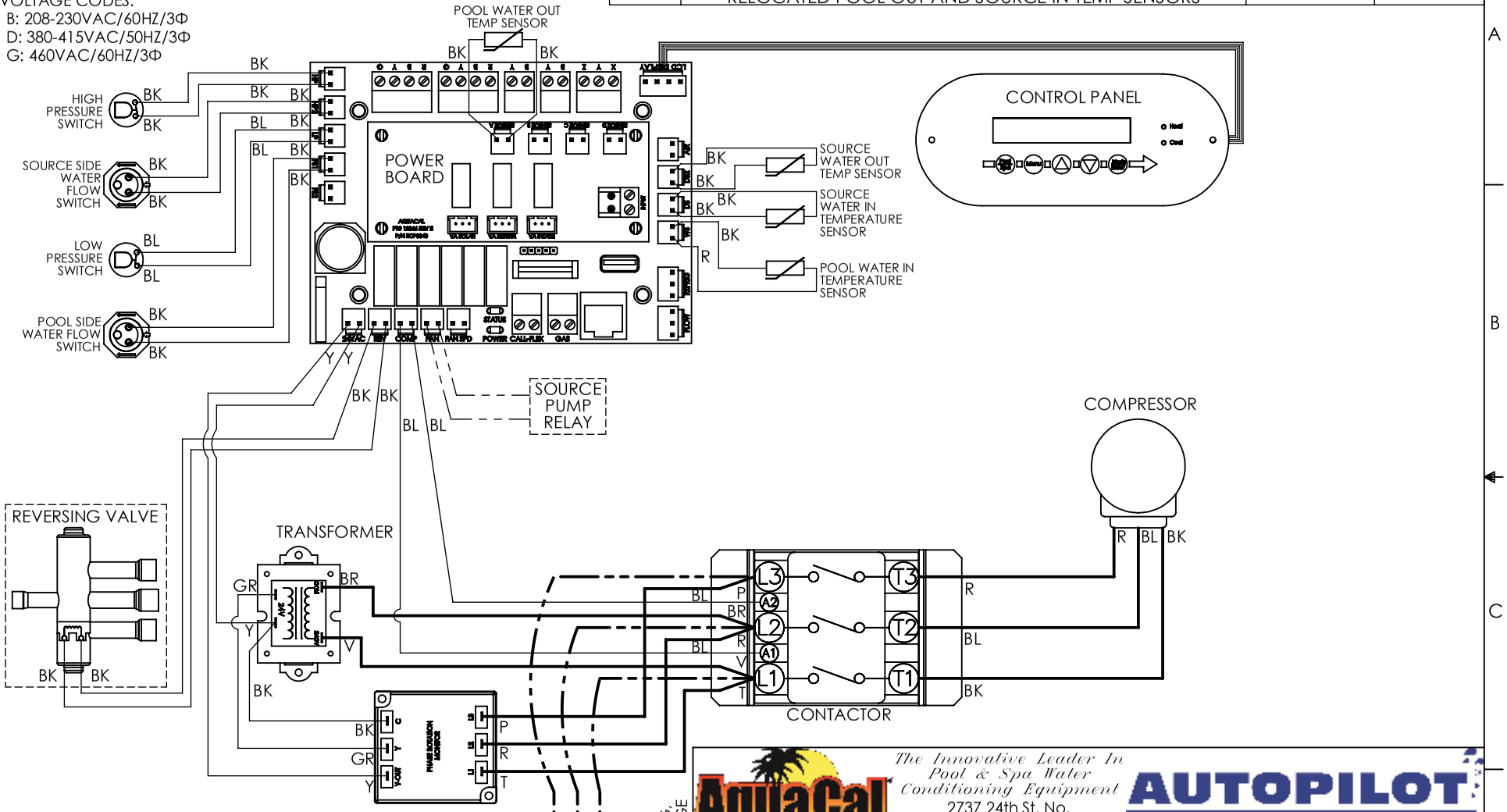
SCALE	DWG SIZE	REVISION
1:4	A	REL-F

CAD FILE: LTM0941 — SHEET 1 OF 1

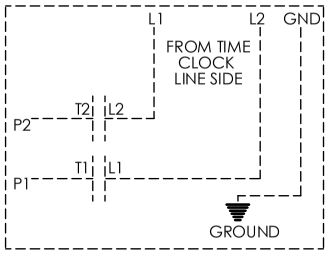
Last Revision: 01/04/18

NOTES UNLESS OTHERWISE SPECIFIED:
1. USE COPPER CONDUCTORS ONLY.
2. TO BE WIRED IN ACCORDANCE WITH NAT'L ELEC (NEC) & LOCAL CODES.
3. CONNECT TRANSFORMER TO CORRECT VOLTAGE.
4. CUT RED WIRE ON PHASE ROTATION MONITOR FOR D-VOLT
5. LINE VOLTAGE CODES:
   B: 208-230VAC/60HZ/3Φ
   D: 380-415VAC/50HZ/3Φ
   G: 460VAC/60HZ/3Φ

REVISION TABLE			
REV.	PCA NUMBER/DESCRIPTION	CHANGED BY	DATE
REL-B	ADDED SOURCE PUMP RELAY (OPTIONAL) & FLOW SWITCHES; RELOCATED POOL OUT AND SOURCE IN TEMP SENSORS	RENEEC	6/6/2019



CALL-FLEX
PUMP STARTER CONNECTIONS



COLOR CODE
BK: BLACK
BL: BLUE
BR: BROWN
GR: GRAY
R: RED
V: VIOLET
Y: YELLOW
W: WHITE

24VAC
OPTIONAL
LINE VOLTAGE
FIELD WIRED 24 VAC
FIELD WIRED LINE VOLTAGE

CAD GENERATED DRAWING, DO NOT MANUALLY CHANGE

AquaCal — The Innovative Leader In Pool & Spa Water Conditioning Equipment
2737 24th St. No.
St. Petersburg, FL 33713
AUTOPILOT SALT CHLORINE GENERATORS

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE INCHES [MILLIMETERS]
TOLERANCES: DECIMALS TBD ANGLES TBD
MATERIAL
FINISH
DO NOT SCALE DRAWING

DESCRIPTION
DIAGRAM,WIRING,3-PH,WATERSOURCE

MODELED BY: RBC	DRAWN BY: RBC	PROJECT ENG: RBC	CHK'D BY: RBC
DATE: 9/10/2018	DATE: 12/12/2018		

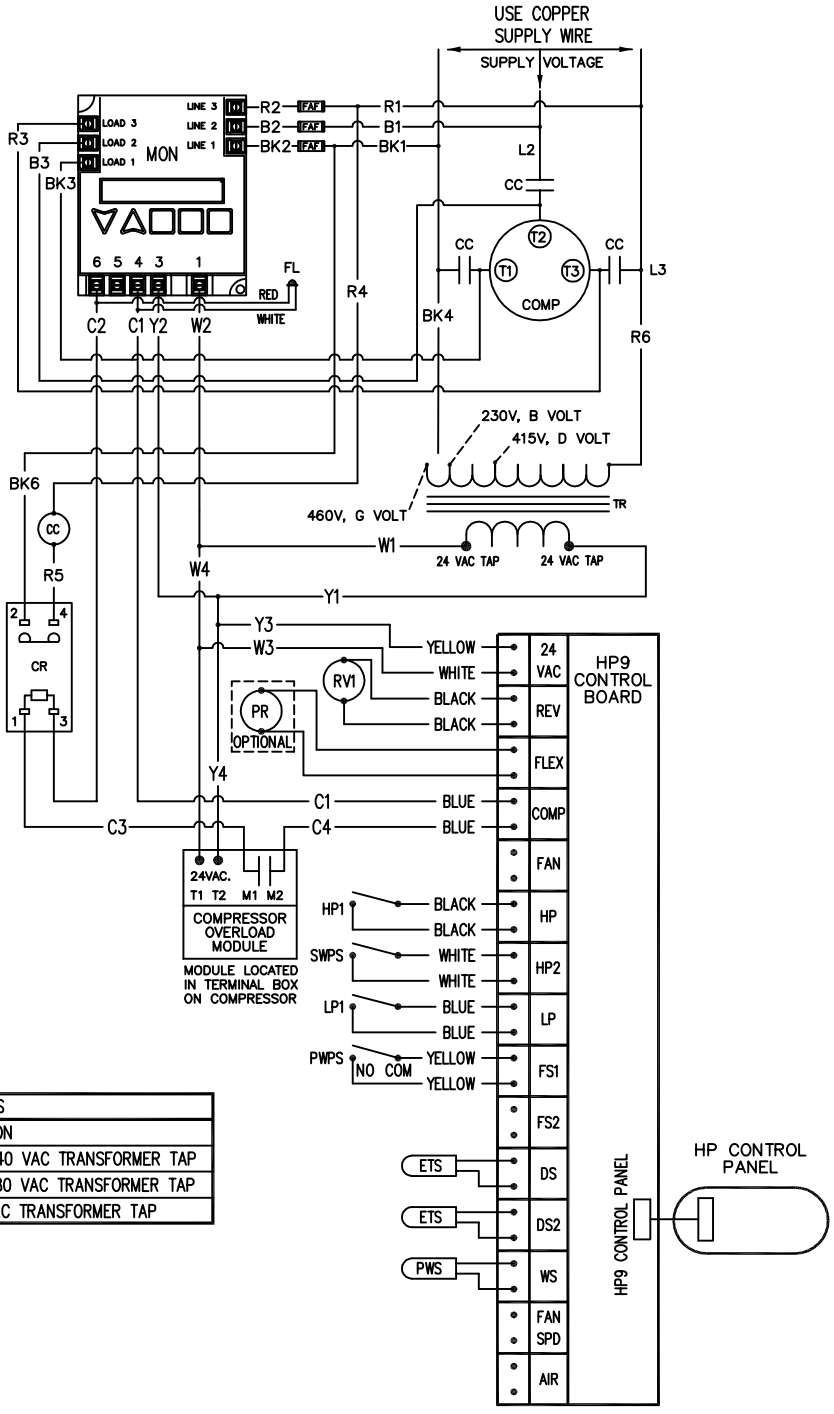
DWG. NO. LTM0946
SCALE 1:4 | DWG SIZE A | REVISION REL-F
CAD FILE: LTM0944 | SHEET 1 OF 1
Last Revision: 01/04/18

NOTES UNLESS OTHERWISE SPECIFIED
1. USE COPPER CONDUCTORS ONLY.
2. TO BE WIRED IN ACCORDANCE WITH NATIONAL ELECTRIC (NEC) & LOCAL CODES.
3. EXTERNAL CONTROLLER HOOK UP:

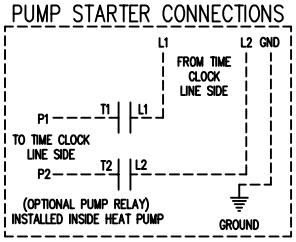
A. TWO–WIRE CONTROLLERS (JANDY RS 4,6,8, COMPOOL LX 3800)
 a. WIRES CONNECT TO Y & Z ON THE MICROPROCESSOR.
 b. WITH HEATER DISPLAYING WATER TEMPERATURE, PRESS THE UP & DOWN ARROW AT THE SAME TIME UNTIL CF1 APPEARS
 c. PUSH THE POOL/SPA KEY UNTIL LOC APPEARS PUSH THE UP ARROW UNTIL 50 APPEARS.
 d. PUSH THE POOL SPA KEY UNTIL JAO DISPLAYS; PUSH UP ARROW UNTIL 2 DISPLAYS.
 e. WHEN WATER TEMPERATURE DISPLAYS, TURN BOTH THERMOSTATS TO THE OFF POSITION

B. THREE–WIRE CONTROLLERS (JANDY AQUASWITCH, COMPOOL) (USE ONLY COMMON AND THE SPA TERMINALS IN THE CONTROLLER)
 a. WIRES CONNECT TO FS2 ON THE MICROPROCESSOR.
 b. WHEN THE HEATER DISPLAYS WATER TEMPERATURE, HOLD THE UP & DOWN ARROW AT THE SAME TIME UNTIL CF1 APPEARS
 c. PUSH THE POOL/SPA KEY UNTIL LOC APPEARS; PUSH THE UP ARROW UNTIL 50 DISPLAYS.
 d. PUSH THE POOL/SPA KEY UNTIL FS2 DISPLAYS; PUSH THE UP ARROW UNTIL 1 APPEARS.
 e. WHEN THE WATER TEMP DISPLAYS, SET BOTH THE THERMOSTATS.

REVISIONS			
REV.	DESCRIPTION	CHG	DATE
REL–A	INITIAL RELEASE	RBC	01/24/19



CALL–FLEX PUMP STARTER CONNECTIONS



VOLTAGE CODES	
CODE	DESCRIPTION
B	200–230 VAC, 60 Hz, 3Ø–USE 240 VAC TRANSFORMER TAP
D	380–415 VAC, 50 HZ, 3Ø–USE 380 VAC TRANSFORMER TAP
G	460 VAC, 60 Hz, 3Ø–USE 480 VAC TRANSFORMER TAP

LEGEND	
———	FACTORY WIRING
- - - - - -	FIELD WIRING
AIR	AMBIENT AIR SENSOR
CC	COMPRESSOR CONTACTOR
COMP	COMPRESSOR MOTOR
ETS	EVAP TEMP SENSOR
FL	FAULT LIGHT
HP	HIGH REF. PRESSURE SWITCH
LP	LOW REF. PRESSURE SWITCH
MON	DIGITAL VOLTAGE MONITOR
PR	PUMP RELAY
PWPS	POOL WATER PRESS. SWITCH
PWS	POOL WATER TEMP SENSOR
RV	REVERSING VALVE
SWPS	SOURCE WATER PRESS. SWITCH
TR	TRANSFORMER

WIRE COLORS	
B	BLUE
BK	BLACK
C	BLUE/WHITE TRACER
R	RED
W	WHITE
Y	YELLOW

CAD GENERATED DRAWING, DO NOT MANUALLY CHANGE

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ARE:

DECIMALS tbd ANGLES tbd

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

DESCRIPTION

DIAGRAM, WIRING, DIG MON, WS, HP9

MODELED BY: — DRAWN BY: RBC PROJECT ENG: RBC CHK'D BY: —

DATE: — DATE: 01/23/19

DWG. NO. LTM0951

SCALE 1:1 | DWG SIZE A | REVISION REL–A

CAD FILE: N/A | SHEET 1 OF 1

Last Revision: 12/13/18