

*Operating & Service Instructions...*

# HP7R

## Microprocessor Controller



***Dealer & Service Version***  
***Not for Distribution to Owners***

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## Getting Started

# HEATING- QUICK START & STOP

Note to Dealer/Installer: This, and the “Owner Level Programming” sections were originally written for use by the home owner/operator. As such, much of the language will be owner-directed.

The intent of this section is to provide rapid access to very basic operational information. Individuals who will be routinely using, installing, maintaining, and servicing the heat pump, are strongly encouraged to read this entire manual.

Herein, the terms: *Heat Pump*, *Heater*, and *Unit* are used synonymously. **The instructions contained within this section are intended for local control of a heat pump, independent of an external controller.** See pages-13 & 16 if the heater is, or will be controlled by an external controller.

### 1. Verify Electrical Power is Present at Heater:

- A. Ensure that the unit has electrical power connected; the heater controller display should be illuminated.
- B. If the display is blank, be certain the electrical breaker, and heater disconnect, are switched to “ON.”
- C. For now, leave the water circulation pump OFF.

### 2. Set the Heater Controls (Refer to Control Panel Layout, Pg-6):

OWNER- If heater is connected to a Call-Flex controller, also see “Selecting Call-Flex Pump Options,” located later in this manual.

INSTALLER- Is heater connected to an external controller? If so, see external controller information located on pages-13 & 16 of this manual.

- A. The user/owner settings can be made without water flowing. Once the heater has electrical power connected, with water *not* flowing, the display should read FLO.
- B. Press the MODE button until the HEAT (HEA) indication displays. This action will enable the remaining programming keys.
- C. Using the POOL / SPA selector key, select the POOL mode. An illuminated POOL indicator light, located on the left side of the display, will confirm the POOL control has been selected. If heating *only* a spa, using the DOWN arrow key, lower the POOL temperature until OFF is displayed; then proceed to Step-“E.”
- D. Use the UP / DOWN arrow keys to set the desired water temperature for the POOL water.
- E. If the heat pump will be used to heat a spa, use the POOL/SPA selector key to select SPA, then use the UP / DOWN arrow keys to set the desired water temperature for the SPA. An illuminated SPA indicator light, located on the left side of the display, will confirm the SPA control has been selected. If heating *only* a POOL, using the DOWN arrow key, lower the SPA temperature until OFF is displayed.
- F. The heat pump controls are now set to maintain the desired water temperature for the POOL and/or SPA.

(Quick-Start & Stop Continued Next Page)



## **HEATING-QUICK START & STOP** (continued):

### **3. To Begin Heating:**

- A. Verify MODE is set to: HEAT (HEA); then, depending on which body of water is to be heated, use the POOL / SPA selector key to select POOL or SPA.
- B. Position external water valves appropriately to flow water to & from the body of water and through the heater.
- C. Start the water pump; the fan will start, and within 4-minutes (depending on the status of the controller's internal time delay) the unit will begin heating. The selected body of water will be brought to temperature and maintained per the setting determined previously in: "Set the Heater Controls."
- D. In operation, whenever the actual (displayed) water temperature falls below the desired set point, after an initial time delay of 4-minutes, the unit will begin heating.

NOTE: THE HEATER CONTROLLER INCORPORATES AN ANTI-SHORT CYCLE TIME DELAY. SHOULD OPERATION BE INTERRUPTED, RESTART WILL BE DELAYED BY APPROXIMATELY 4-MINUTES.

### **4. Program Filter Pump Run Time:**

Most pool/spa systems utilize a timer or multifunction controller to manage filter pump run times. If your system incorporates such a device, follow the instructions below:

- A. It will be necessary to allow the filter pump to run continuously until the water has reached the desired temperature. If a timer controls the pool filter pump, it will be necessary to override the timer to allow 24-hr. operation.
- B. Once the desired temperature has been obtained (1-4 days), reset the pump control device. Colder months require longer running times—generally eight to twelve hours/day.
- C. A heat pump can only operate when the filter pump is running. Therefore, it may be necessary—during cooler weather—to extend the water pump's hours of daily operation. The increased run time is necessary in order to keep up with increased, weather-related heat losses.

### **5. Continuous Usage and Water Around Heater:**

Condensation... After the heat pump has been operating for some time, water may be observed surrounding the heater. The moisture seen is condensation produced as a normal by-product of transferring heat from the air into the pool or spa water. Quantities of 6-8 gallons of water produced per hour are common if the air humidity is high. Conversely, a low humidity condition may result in no condensation being produced. (If water around unit seems excessive, to troubleshoot, see the "water coming from unit" troubleshooting section of the full heat pump manual.)

### **6. To Stop the Heat Pump:**

- A. Select: OFF via the MODE selector. This method of shut down preserves the controller settings;
- B. An interruption of water flow—such as when a pump timer is in control—will also halt heat pump operation.

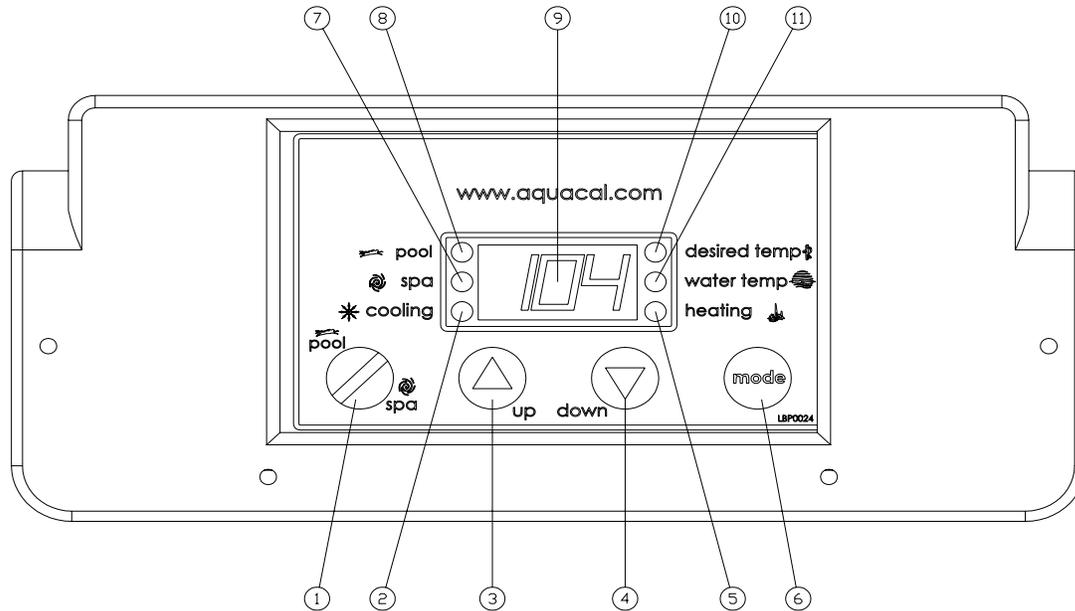
*(End... Quick-Start & Stop)*



# HEATER CONTROLS

## Control Panel Layout

(APPEARANCE VARIES BY MODEL)



## Control Buttons, Indicator Lights, & Display

(AS INDICATED BY CIRCLED NUMBERS)

- 1) **POOL / SPA SELECTOR** – Selects either pool or spa thermostat.
- 2) **COOLING INDICATOR LIGHT** – Indicates unit is cooling. (Note: this light nonfunctional with heat-only models.)
- 3) **UP ARROW** – Increases temperature setting. (Maximum setting is 104 °F)
- 4) **DOWN ARROW** – Decreases temperature setting. (Minimum setting is 45 °F)
- 5) **HEATING INDICATOR LIGHT** – Indicates unit is heating.
- 6) **MODE SELECTOR** – Used to select between the Heating, Cooling, Auto-Changeover, and Off for Heat & Cool models. Used to select between Heating and Off for heat-only models.
- 7) **SPA INDICATOR LIGHT** – Indicates heater is referencing spa thermostat.
- 8) **POOL INDICATOR LIGHT** – Indicates heater is referencing pool thermostat.
- 9) **LED DISPLAY** – Displays water temperature when no keys are being pressed. Displays desired temperature when UP ARROW or DOWN ARROW is pressed. Also displays operational, programming, and fault codes as applicable.
- 10) **DESIRED TEMPERATURE LIGHT** – Indicates temperature set point is being displayed. Indicates temperature set point is being changed due to the UP ARROW or DOWN ARROW being pressed.
- 11) **WATER TEMPERATURE LIGHT** – Indicates current water temperature is being displayed.



# HEATER CONTROLS...continued

## Operational & Programming Codes

THE FOLLOWING CODES WILL BE DISPLAYED AS PART  
OF THE NORMAL OPERATION OF THE HEATER:

- FLO.....** No Water Flow Detected. This code appears whenever the circulating pump is off, or when the heater is not receiving correct water flow.
- OFF.....** System is Off. This code appears whenever heater has been turned off via the mode selector button, or when the temperature set point has been lowered below 45 °F.
- CFI.....** Celsius/Fahrenheit Selection. This is a programming entry point to select in which format the water temperature will be displayed.
- ULC.....** User Lock Code. This is a programming entry point; when activated, steps to the next menu level: ELC.
- ELC.....** Enter Lock Code. This a programming entry point; permits end user to select a secret code, thereby limiting access to the owner settings.
- CFO.....** Call Flex Options. This is a programming entry point; when used in conjunction with an AquaCal Call/Flex add on kit, permits the use of CALL or FLEX options.
- FS.....** Heater in Defrost Mode (Applicable to Heat-Only Units, only). This code appears as a normal display during periods of lower air temperatures. Sequence follows:  
Heat-Only Defrost Sequence: Fan continues to run and compressor is off. Compressor will restart when air coil temperature rises to approximately 38°F.
- LOC.....** This is a Service Entry Point (not intended for use by the owner). The[LOC] code permits service personal to enter a factory code for access to adjustable calibration and site-dependant setup parameters. Service adjustments are available to authorized installation and service personnel, only.

### CAUTION !

Failure to heed the following may result in equipment damage and voiding of manufacturer's warranty.

Heat pumps contain no owner-serviceable components. Owner-initiated adjustments, beyond the controller "LOC" code, must not be attempted. If adjustments are deemed necessary, the owner should contact installing dealer or AquaCal Customer Support at (800) 786-7751.



# HEATER CONTROLS...continued

## Start Up & Setting Operating Controls

### Owner-Level Programming Instructions (Complete)

Covered within this section are features and settings typically accessed first by the installer, and then remaining accessible by the end user (the owner). These features reside at the Level-1 access point within the microprocessor. Note: if preferred, all programming may be performed without water flow, waiting to start the water pump as the last step in the set up and run process.

#### 1. Applying Power to The Controller:

- A. When power is first applied, the controller performs a lamp test and the display will read [888]. Following [888] the software version will display briefly.
- B. The control will then display the actual water temperature, provided the circulating pump is operating, and adequate water is flowing through the heater.
- C. If the pool-circulating pump is off, the control will display: [FLO]. This code message indicates no (or insufficient) water is being circulated through the heat pump.

#### 2. MODE Controls Explained, and Starting the Heat Pump:

- A. Once electrical power is supplied to the heat pump, sufficient water is circulating, and the heater controller has successfully completed its self-test, the heater is ready to operate.
- B. The heat pump is shipped with the controller [MODE] function set to "OFF". There are two ways to switch the heat pump OFF: First Method- One of the functions of the [MODE] button is "OFF". Second Method- The thermostat set point can be lowered to a position below the minimum temperature setting (45°F); this action will cause the display to read "OFF". To switch the unit ON, first use the mode button to select the HEAT mode—for Heat Only models—or, if the heat pump is a Heat and Cool model, use the mode button to select one of the following modes: HEAT, COOL, or ACH (Auto-Changer Over). In the [OFF] mode, the actual water temperature will be displayed as long as the circulating pump is operational and correct water flow is present. In the event water is not circulating through the heat pump (or flow is insufficient), the controller will display the [FLO] (No Water Flow) code message.
- C. Using the UP ARROW key, increase the desired temperature until it exceeds the value of the actual temperature displayed. (Note: See # "8," later in this section, if "000" is displayed upon pressing either the up or down arrow keys.) Once the desired temperature has been entered, the display will read the actual temperature and the heat pump will start to operate. Both the compressor and the fan must be operating before the "Heating" LED will illuminate. (Note: When MODE function is OFF, the current water temperature will be displayed; no functions, values, or programming will be available for adjustment.)

#### 3. Turning The Heat Pump Off:

- A. Method 1: using the [MODE] key, press the key until the display reads "OFF" The heater will shut off and remain off until the [MODE] key is used the select an operational mode. **This is the preferred method for shutting off the heat pump.**
- B. Method 2: using the DOWN key, press the key 2 until the desired water temperature reaches 45°F (minimum setting); then, press the DOWN key one more time, causing the display to read "OFF". This method is typically used in conjunction with 2-wire external controllers; these controllers are equipped with their own thermostats.

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# HEATER CONTROLS...continued

## Start Up & Setting Operating Controls

### Owner-Level Programming Instructions... continued:

#### 4. Selecting Pool/Spa Thermostat Settings:

- A. Press the [POOL/SPA] key to toggle between the pool and the spa temperature set points.
- B. The pool/spa LED indicator lights, located to the left of the temperature display, will confirm the selected set point.

#### 5. Changing The Pool Temperature Set Point:

- A. Using the [POOL/SPA] key, select the POOL temperature set point. The pool set point indicator light will confirm the selection.
- B. The pool temperature set point is adjustable from a minimum of 45°F to a maximum of 104°F. Pressing the [UP ARROW] key will raise the set point 1-degree for every push of the button. Pressing the [DOWN ARROW] key will lower the set point 1-degree for every push of the button.

#### 6. Changing The Spa Temperature Set Point:

- A. Using the [POOL/SPA] key, select the SPA temperature set point. The spa set point indicator light will confirm the selection.
- B. The spa temperature set point is adjustable from a minimum of 45°F to a maximum of 104°F. Pressing the [UP ARROW] key will raise the set point 1-degree for every push of the button. Pressing the [DOWN ARROW] key will lower the set point 1-degree for every push of the button.

#### 7. Selecting Between °F and °C:

- A. Simultaneously press and hold both the [UP ARROW] and [DOWN ARROW] keys until [CF1] (Celsius / Fahrenheit) code appears.
- B. With the [CF1] code displayed, pressing the [UP ARROW] or [DOWN ARROW] keys will change the selection code to either "0" or "1". Select "1" for Fahrenheit temperature display, or "0" for Celsius temperature display. Once the desired temperature display mode has been selected, not pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the {POOL/SPA} key will also save the selection and step to the next menu parameter: [ULC] (User Lock Code).

#### 8. User Lock Code Option [ULC]:

##### This Option Explained:

Heat pumps are shipped from the factory with the [ULC] option disabled. Enabling the [ULC] function permits the heat pump owner to restrict access to the unit's controls. With the [ULC] function enabled, unless the correct ULC code number is entered, changes to Level-1 programming are not possible. (I.e.: Altering temperature set points, Pool/Spa selection, C/F display changes, etc., will not be possible). The [ULC] option can be thought of as an electronic lockable cover for the controls.

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# HEATER CONTROLS...continued

## Start Up & Setting Operating Controls

### Owner-Level Programming Instructions... continued:

#### 8. User Lock Code Option [ULC]...continued:

##### A. Selecting ULC Option:

- 1) Press either the UP or DOWN ARROW keys; if "LOC" is momentarily displayed followed by "0", the ULC feature is enabled. If "0" displays proceed to "6)" of this section; otherwise, see number "2," below.
- 2) Simultaneously press and hold both the [UP ARROW] and [DOWN ARROW] keys until [CF1] (Celsius / Fahrenheit) code appears.
- 3) Press the [POOL/SPA] key once to display [ULC].
- 4) With [ULC] displayed, pressing either the Up or Down Arrow key will display either "1" or "0". Selecting "0" will allow the keypad to remain unlocked. Selecting "1" will enable the User Lock Code option. Then to enter a lock code number, press the [POOL/SPA] key once to display [ELC] (Enter Lock Code).
- 5) With [ELC] displayed, use the Up or Down arrow keys to select a lock code. The code can be any number from "00" to "99". The factory set lock code is "0". Not pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the [POOL/SPA] key will also save the selection, and will step the controller to the next menu parameter: [CFO] (Call Flex Options).
- 6) Once the ULC option has been enabled, pressing any key will momentarily display "LOC" followed by "0" (prompting the entry of the correct lock code number). To gain access to the controller:
  - a. Using the [UP ARROW] key, scroll to the correct lock code number, then;
  - b. Press the [POOL/SPA] key... Current water temperature will be displayed... Control setting can now be viewed or changed as desired.
  - c. After a period of approximately four (4) minutes, during which time no buttons have been pressed, the controller will automatically return to the locked mode. Provided ULC selection is set to "1," the controller will always fail-safe in the locked mode.
  - d. Without knowledge of the correct lock code, and with the ULC enabled, control adjustments will not be possible. **Be certain to record the lock code in a safe place.** The lock code may be changed any number of times by following the instructions detailed in this section.

##### B. De-Activating the User Lock Code [ULC] function:

- 1) Following the instructions detailed previously at: "8, 6)", press any key and enter the user lock code number; then press the [POOL/SPA] key.
- 2) Immediately following the entry of the user lock code, simultaneously press and hold the [UP ARROW] and [DOWN ARROW] keys until the code [CF1] appears on the display.
- 3) Then, use the [POOL/SPA] key to scroll to the [ULC] message; press the [DOWN ARROW] key to change the display to "0". This will disable the User lock function.

*(ULC Continued on Next Page)*



# HEATER CONTROLS...continued

## Start Up & Setting Operating Controls

### Owner-Level Programming Instructions... continued:

#### C. User Lock Code is Activated, but Pass Number is Not Known (“Back Door Entry”):

Note: Should the ULC option be enabled, and a lock code number other than the factory default (0) be installed but is unknown, the following procedure may be followed to regain controller programming access:

- 1) Simultaneously press and hold the [POOL/SPA] and [UP ARROW] keys until the display shows “888”. This operation will reset the controller to the factory default settings.
- 2) When reset to the factory default settings the user lock code [ULC] is deactivated and the user lock code number [ELC] is reset to “0.”
- 3) In addition, all other settings are returned to the factory defaults. If an external controller is in use, see External Controller programming on page-16 of this manual, or contact AquaCal Technical Support Group (800-786-7751); ask for assistance with re-configuring the controller for use with an external controller.

#### 9. **Selecting Call-Flex Pump Options [CFO]:**

##### General Information:

The Call-Flex option automatically adjusts the run time of the water circulator pump, and heater, based upon changing weather conditions. Without Call-Flex, as weather conditions grow progressively cooler during winter months, or when unusually cold weather occurs, the run duration of the circulator pump may require manual adjustments to permit the heater to maintain or reattain desired water temperature (the water pump must be running in order for the heater to operate). Likewise, without Call-Flex, one must remember to reset the pump run controls following the cold weather event. The Call-Flex option greatly reduces the need for seasonal, manually-made, pump run time adjustments. Call-Flex is a dealer-installed option that does not come with every heater; if unsure, check with the installing dealer to determine if a call-flex kit was part of the original installation. If Call-Flex was not part of the installation, and you would like to have Call-Flex added, your dealer can do so...contact the installing dealer.

If the installation is equipped with the Call-Flex option, the following steps are used to control the Call-Flex features:

- A. Simultaneously press and hold the [UP ARROW] and [DOWN ARROW] keys until the display shows “CF1”. Press the [POOL/SPA] key three times to scroll the display to [CFO].
- B. With the [CFO] (Call-Flex Options) code displayed, use the Up or Down keys to select “0” to disable the Call Flex Options, “1” to enable the Call Option, or “2” to enable the Flex Option. Not pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the [POOL/SPA] key will also save the selection, and will step the controller to the next menu parameter: [LOC] (Service Lock Code).
- C. For further information, please refer to Call-Flex installation instructions, shipped with the Call-Flex kit. For additional copies of these instructions, contact the AquaCal Customer Support (800-786-7751).

*(End... Owner-Level Programming Instructions)*



# Controls Configuration & Adjustments

## Level-2 (Dealer-Service) Microprocessor Programming

(Includes Configuration for External Controllers)

Level-2 programming involves configuring the controller for specific site characteristics. To explain, this programming is where the controller is set to operate with, or without, an external controller; where sensor calibrations are performed; and where changes to other factory default parameters are made.

Before transferring use of the heater to the owner, the installer must insure the controller programming is compatible with any site-installed external controllers, and that the heater starts and operates per the manufacturer's specifications.

Generally speaking, the installer's main focus within Level-2 programming will be in configuring for external controller compatibility. And, **unless instructed to do otherwise by the AquaCal Technical Support Group, the installer should not adjust sensor calibration or dead-band values.**

### CAUTION !

Failure to heed the following may result in equipment damage and voiding of manufacturer's warranty.

Heat pumps contain no owner-serviceable components. Owner-initiated adjustments, beyond the controller "LOC" code, must not be attempted. If adjustments are deemed necessary, the owner should contact installing dealer or AquaCal Customer Support at (800) 786-7751.

#### 1. Entering Service Menu:

- A. To enter the service menu, Simultaneously press and hold both the [UP ARROW] and [DOWN ARROW] keys until [CF1] (Celsius / Fahrenheit) code appears. (Note: if "000" displays, the User Lock Code is enabled, and the ULC pass code must be entered before proceeding. See Owner-Level Operating Instructions, page-9: "User Lock Code Option [ULC]." If the owner's ULC pass code is unknown, the factory default code "0" may be used to access controller programming.) Press the [POOL/SPA] key four times to display [LOC], which is the entrance point for the Service Menu.
- B. The [LOC] code function allows service personnel to use an access code to enter the service menu. This section of the programming is intended for authorized factory service personnel, only.
- C. Using the [UP] and [DOWN] arrow keys, scroll the displayed number to "50." ("50" is the default service entry pass code.)
- D. Once the correct service code is displayed, pressing the [POOL/SPA] key—once again—will allow access to the service menu.
- E. The first service parameter displayed will be [dEL] (4 -minute time delay on make).

**NOTE:** Pressing the [POOL/SPA] key will save the displayed value in any menu parameter, and will advance to the next service menu juncture.

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# Controls Configuration & Adjustments...

## Level-2 Microprocessor Programming... continued:

### 2. Time Delay [dEL]:

- A. With the [dEL] (4 minute time delay) code message displayed use the [UP] or [DOWN] arrow key to select either “1” to allow the time delay to remain active or “0” to deactivate the time delay. Not pressing any buttons for 15 seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the {POOL/SPA} key will also save the selection and step to the next menu parameter: [JAO] (External Controller Interface).
- B. **CAUTION!!!:** The time delay should only be deactivated for service convenience and must be reactivated prior to placing the heat pump back in service. Failure to reset the time delay feature could result in permanent damage to the heat pump compressor.

### 3. Configuring for External Controllers [JAO] or [FS2]:

NOTE: FOR WIRING TO AN EXTERNAL CONTROLLER, REFERENCE DOCUMENT LTP0050 SHIPPED WITH HEATER.

- A. Configuring for External Controllers Using [JAO] Selection:
  - 1) Follow the steps **1, A** through **1, D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [JAO].
  - 2) With the [JAO] (External Controller Interface) code message displayed, use the [UP] or [DOWN] arrow keys to select either “0” to disable the External Controller Interface, “2” to connect a thermostat type controller (2-wire connection). Apply [FS2] configuration to connect a thermostat selector type controller (3-wire connection); see “3. B,” below. Do NOT use [JAO] “3.”
- B. Configuring Remote Flow Switch / Automatic Thermostat Switching Using [FS2] Selection:
  - 1) Follow the steps **1, A** through **1, D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [FS2].
  - 2) With the [FS2] (Remote Flow Switch / Automatic Thermostat Switching) code message displayed, use the [UP] or [DOWN] arrows to select either “0” to disable Remote Flow Switch / Automatic Thermostat Switching, “1” to enable Remote Flow Switch / Automatic Thermostat Switching.

NOTE: ALL FLOW SWITCH KITS PRODUCED BY AQUACAL ARE SHIPPED WITH FULL INSTALLATION AND PROGRAMMING INSTRUCTIONS. PLEASE CONTACT AQUACAL CUSTOMER SUPPORT (800-786-7751) IF ADDITIONAL COPIES OF THESE INSTRUCTIONS ARE NEEDED.

### 4. Water Sensor Calibration [tSC]:

If it is believed the displayed pool or spa water temperature does not match the actual temperature, follow the steps below to verify and adjust the controller as necessary. Be certain to use an accurate thermometer:

- A. With the circulating pump in operation, and water moving through the heater, use a reliable thermometer to measure the temperature of the pool or spa water. Be sure to measure the water temperature away from returns. The object is to accurately determine the temperature of the water entering the heater.
- B. Once you have measured the water temperature, compare the result to the heater’s displayed water temperature. If the water temperatures are the same or within 1°F, no calibration is necessary. If the temperatures differ by 2 to 3°F, calibration is necessary. Perform calibration procedure as follows:

*(Continued on Next Page)*



# Controls Configuration & Adjustments...

## Level-2 Microprocessor Programming... continued:

### 4. Water Sensor Calibration... continued:

- C. Follow the steps **1, A** through **1, D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [tSC] (Water Temperature Calibration). Using either the [UP] or [DOWN] arrow keys, calibrate the water temperature sensor by increasing or decreasing the numeric value displayed to match the measured water temperature. The controller can be adjusted to +10°F to -10°F from the nominal displayed temperature. However, offset calibrations greater than 3°F should be avoided... Such large offsets generally indicate problems with the method of water temperature measurement, a water sensor not properly inserted into the well, or other equipment issues. Do NOT attempt to mask such issues through offset calibration.
- D. Once the corrected temperature is displayed, Not pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the {POOL/SPA} key will also save the selection and step to the next menu parameter: [dSC] (Defrost Sensor Calibration).

### 5. Defrost Sensor Calibration [dSC] (Checking-Adjusting):

In the event it is suspected the defrost Sensor requires calibration, the following steps must be followed closely to ensure correct defrost operation:

- A. Turn the heater OFF at the main circuit panel.
- B. Remove the heater front panel to gain access to the defrost sensor location. The defrost sensor will be found strapped to the suction line in combination with the TXV bulb, or strapped and separately insulated nearby the TXV bulb. Note: if unsure of sensor location, follow-to-termination-the pair of wires leading from the "FS" terminals on the controller PC board.
- C. Position a clamp-on, thermocouple-type temperature sensor onto the suction line; position the clamp immediately adjacent to the defrost sensor. Connect the clamp-on thermocouple to a multimeter designed to accept the input of the clamp-on device.
- D. Restart the heater, allowing the compressor to operate for at least 10-minutes; the suction line temperature should have stabilized at this point. Make note of the suction line temperature as measured by the clamp-on thermocouple probe/multimeter.
- E. Follow steps **1, A** through **1, D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [dSC] (Defrost Sensor Calibration). With [dSC] displayed, pressing either the [UP] or [DOWN] arrow key, once, will display the current temperature value of the defrost sensor.
- F. Compare the controller's displayed defrost sensor temperature against the reading obtained by the clamp-on device. If the temperatures are the same, or within 1°F, calibration is NOT necessary. If the temperatures differ by 2 to 3°F, calibration is necessary. The controller can be adjusted to +10°F to -10°F from the nominal displayed temperature. However, offset calibrations greater than 3°F should be avoided. Such large offsets generally indicate problems with the method of suction line temperature measurement, a defrost sensor not properly attached to the suction line, or other equipment issues. Do NOT attempt to mask such issues through offset calibration.

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## Controls Configuration & Adjustments...

### Level-2 Microprocessor Programming... continued:

#### 5. Defrost Sensor Calibration... continued:

- G. Once the correct temperature value has been selected, *not* pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the [POOL/SPA] key will also save the selection and step to the next menu parameter: [dBS] (Dead Band for Spa).

#### 6. Spa Dead Band Differential [dBS]:

In the heating mode, the dead band differential determines the number of degrees the water temperature must *fall* below the set point before the thermostat closes. In the cooling mode, the dead band differential determines the number of degrees the water temperature must *rise* above the set point before the thermostat closes. When in the auto-changeover mode, the dead band differential operates in the same manner as described above for the heating and the cooling modes. However, in all modes, the thermostat will open when the set point is reached independent of the direction the water temperature is changing. The factory spa dead band differential is set to 1°F. It is strongly recommended the factory default of 1°F remain; however, if for some reason the dead band requires adjustment, follow the steps outlined below:

- A. Follow the steps **1, A** through **1, D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [dBS] (Spa Dead Band Differential).
- B. With the service menu parameter [dBS] displayed, pressing either the [UP] or [DOWN] arrow keys, once, will display the current setting. Using the [UP] or [DOWN] arrows keys will increase or decrease the value respectively. The differential is adjustable in 1° increments from 1 to 5-degrees.
- C. Once the desired dead band value has been selected, *not* pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the [POOL/SPA] key will also save the selection and step to the next menu parameter: [dBP] (Dead Band Pool).

#### 7. Pool Dead Band Differential [dBP]:

In the heating mode, the dead band differential determines the number of degrees the water temperature must *fall* below the set point before the thermostat closes. In the cooling mode, the dead band differential determines the number of degrees the water temperature must *rise* above the set point before the thermostat closes. When in the auto-changeover mode, the dead band differential operates in the same manner as described above for the heating and the cooling modes. However, in all modes, the thermostat will open when the set point is reached independent of the direction the water temperature is changing. The factory pool dead band differential is set to 1°F. It is strongly recommended the factory default of 1°F remain; however, if for some reason the dead band requires adjustment, follow the steps outlined below:

- A. Follow the steps **1, A** through **1, D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [dBP] (Pool Dead Band Differential).
- B. With the service menu parameter [dBP] displayed, pressing either the [UP] or [DOWN] arrow keys, once, will display the current setting. Using the [UP] or [DOWN] arrows keys will increase or decrease the value respectively. The differential is adjustable in 1° increments from 1 to 5-degrees.

(Continued on Next Page)



# Controls Configuration & Adjustments...

## Level-2 Microprocessor Programming... continued:

### 7. Pool Dead Band Differential... continued:

- C. Once the desired dead band value has been selected, not pressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the {POOL/SPA} key will also save the selection and step to the next menu parameter: [LOC] (LOCK CODE).

### 8. Changing the Service Lock Code and “Back Door” Entry:

#### A. Changing the Code...

The factory default Service Lock Code is “50”. Service personnel are strongly advised to retain the factory default setting. However, should unauthorized access to Level-2 (Service) menu be suspected, it may be necessary to select a code other than “50”. To change the Service Lock Code:

- 1) Follow the steps **1 A** through **1 D** to enter the service menu. Once [dEL] is displayed, press the [POOL/SPA] key until the display shows [LOC] (LOCK CODE).
- 2) Press the [UP] arrow key to display the current service lock code value. With the current value displayed the [UP] arrow key will increase the value while the [DOWN] arrow key will decrease the value. When the desired value is displayed not pressing depressing any buttons for 15-seconds will allow the controller to save the selection and return to the normal operating mode. Pressing the {POOL/SPA} key will also save the selection and step to the next menu parameter. **It is recommended, however, unless attempting to prevent tampering, that the factory setting of: “50” remain in use.**

#### B. Back-door Access (For use when correct Service Lock Code is unknown):

- 1) Simultaneously press and hold the [POOL/SPA] and [UP ARROW] keys until the display shows “888”. This operation will reset the controller to the factory default settings.
- 2) The factory reset will change the service lock code back to the factory setting “50”. In addition, **all other settings (including external controller configuration) are returned to the factory defaults.** See section in this manual entitled: “Factory Default Settings” for a complete list of factory default parameters.

*(End... Level-2 Microprocessor Programming)*

## Connecting External Controllers

- See document entitled: “Connecting External Controllers to AquaCal Heat Pumps”; this document is shipped with every AquaCal heater. For extra copies, contact AquaCal Customer Support (800-786-7751); request literature piece: “LTP0050.”
- For Call-Flex option, reference instructions received with the Call-Flex kit.
- Please contact the AquaCal Technical Support Group (800-786-7751) concerning the application of any external controller, Call-Flex, sequencing control, etc.



# Controls Configuration & Adjustments...

## Microprocessor Level-2 Set Up & Calibration Codes Service Adjustable Parameters

Code	Description	Factory Setting	Range
[LOC]	Service Lock Code	50	00-99
[dEL]	4-minute Delay on Make	1	0 / 1
[JAO]	External Controller Interface	0	0 / 2 / 3
[FS2]	Flow Switch/Auto T-Stat Switching	0	0 / 1
[tSC]	Water Sensor Calibration	Factory Calibrated	+10° to -10° of display
[dSC]	Defrost Sensor Calibration	Factory Calibrated	+10° to -10° of display
[dBS]	Spa Dead Band Differential	1°	1° to 5°
[dBP]	Pool Dead Band Differential	1°	1° to 5°

## Microprocessor Factory Default Settings

### Level -1 and Level-2 Default Settings

Menu	Code	Description	Default Value	Range
Level-1	[CF1]	Celsius/Fahrenheit	1	0 / 1
Level-1	[ULC]	User Lock Code	0	0 / 1
Level-1	[ELC]	Enter Lock Code	0	00-99
Level-1	[CFO]	Call / Flex	0	0 / 1 / 2
Level-1	[LOC]	Service Lock Code	50	00-99
Mode	Key Pad	Operating Mode	OFF	For Heat Only: OFF/HEAT For Heat & Cool: OFF, HEA, COO, ACH
Thermostat	Key Pad	Thermostat Settings Pool & Spa	OFF	45°F – 104°F
Level-2	[dEL]	Anti-Short Cycle, 4-minute Delay on Make	1	0 / 1
Level-2	[JAO]	External Controller Interface	0	0 / 2 / 3
Level-2	[FS2]	Flow Switch / Automatic Thermostat Switching	0	0 / 1
Level-2	[tSC]	Water Sensor Calibration	Factory Calibrated	+10° to -10° of displayed value
Level-2	[dSC]	Defrost Sensor Calibration	Factory Calibrated	+10° to -10° of displayed value
Level-2	[dBS]	Spa Dead Band Differential	1°	1° to 5°
Level-2	[dBP]	Pool Dead Band Differential	1°	1° to 5°



# Controls Configuration & Adjustments...

## Troubleshooting Using Displayed Codes

### Interpreting Error Codes

The HP7R heat pump microprocessor controller is designed to be self-diagnostic through the display of various fault codes.

Owners & Operators: If you believe you are experiencing a problem with the heater, and feel a need to call the factory for assistance, it will be beneficial to let the factory Service Representative know which code is being displayed. Having this information at hand will permit the Service Representative to work through—with you—any site related issues causing or contributing to the problem. Then, if after working through site-related issues the heater is still not functioning correctly, the Service Representative will offer to set up a service visit. As necessary, please Contact AquaCal Customer Support Group (800-786-7751).

Dealers and Service Centers: For troubleshooting use, listed below are all possible fault messages output by the microprocessor, what the codes mean, and possible causes with solutions for the indicated problem. Please contact AquaCal Technical Support Group, as necessary (800-786-7751).

# WARNING !

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

Heat pumps contain no owner or operator repairable components. Repairs must not be attempted by untrained and/or unqualified individuals. If service is deemed necessary, contact installing dealer or AquaCal Customer Support at (800) 786-7751.

Message	Error Description	Possible cause
[dPO]	Defrost Sensor Open	Cut or loose sensor wiring
[PO]	Water Temperature Sensor Open	Cut or loose sensor wiring
[dPC]	Defrost Sensor Shorted	Short circuit in defrost sensor wiring or defective sensor.
[PC]	Water Temperature Sensor Shorted	Short circuit in water temperature sensor or defective sensor.
[LP]	Refrigerant System Low Pressure Switch Open	System refrigerant charge low, defective low pressure switch, clogged evaporator coil, or defective wiring.
[HP]	Refrigerant System High Pressure Switch Open	Low water flow, defective high pressure switch, or defective wiring.
[HP5]	5 High Pressure Faults Within One Hour (Unit Locked)	See causes for [HP]
[LP5]	5 Low Pressure Faults Within One Hour (Unit Locked)	See causes for [LP]
[OTA]	Over Temperature Alarm< Temperature over 110°F (Unit Locked)	Defective compressor contactor, defective controller, or defective water temperature sensor
[FLO]	Low or No Water Flow Detected	Circulating pump off or filter dirty, isolation valves set improperly, defective or improperly set heater water pressure switch
[FS]	Heater in Defrost Mode (HEAT-ONLY UNITS)	Normal function in lower air temperatures. Fan continues to run and compressor is off. Compressor will restart when air-coil temperature reaches 38°F or above.
[CSE]	Control System Error	Controller may need to be reset. Disconnect then reconnect power to controller. If error continues replace control board, display board, or both.



# Controls Configuration & Adjustments...

## Microprocessor Mode Jumper Positioning

### Mode Jumper Explained

The HP7R microprocessor is designed to operate as a Heat-Only or a Heating & Cooling controller.

The selection between the two choices is made through the positioning of a mode jumper contained on the microprocessor board. The position of the jumper is set at the factory, and is dependant upon the design of the heater being controlled. Heaters designed to heat only, have the microprocessor mode jumper set in the heat-only mode; heaters capable of both heating and cooling (reversing), have their microprocessor mode jumper set to permit control of both heating and cooling.

**Important:** The position of the mode jumper must match the capabilities of the heat pump. Simply placing the mode jumper to the heating and cooling position, with a heater designed to heat only, will not make a heat-only heater heat & cool. In fact, a mis-positioned mode jumper will cause heater control difficulties.

### Verifying the Mode Jumper Position is Correct

1. Apply electrical power to the heater.
2. Review the available modes by repeatedly pressing the [MODE] key:
  - A. Heat-Only Models: the [MODE] key functions should appear as: [OFF] and [HEA].
  - B. Heat-Cool Models (Icebreakers): the [MODE] key functions should appear as: [OFF], [HEA], [COO], and [AHC].
3. If the modes do not display correctly for the heater being serviced, the mode selector jumper, located on the microprocessor PC board, is likely placed in the wrong position. To correct this condition, the jumper will need to be repositioned. See repositioning instructions, below.

### Repositioning the Mode Jumper

Use this procedure if [MODE] key functions indicate jumper positioning is incorrect. The mode jumper is located on the microprocessor controller board, within the heater's electrical enclosure.

## WARNING !

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

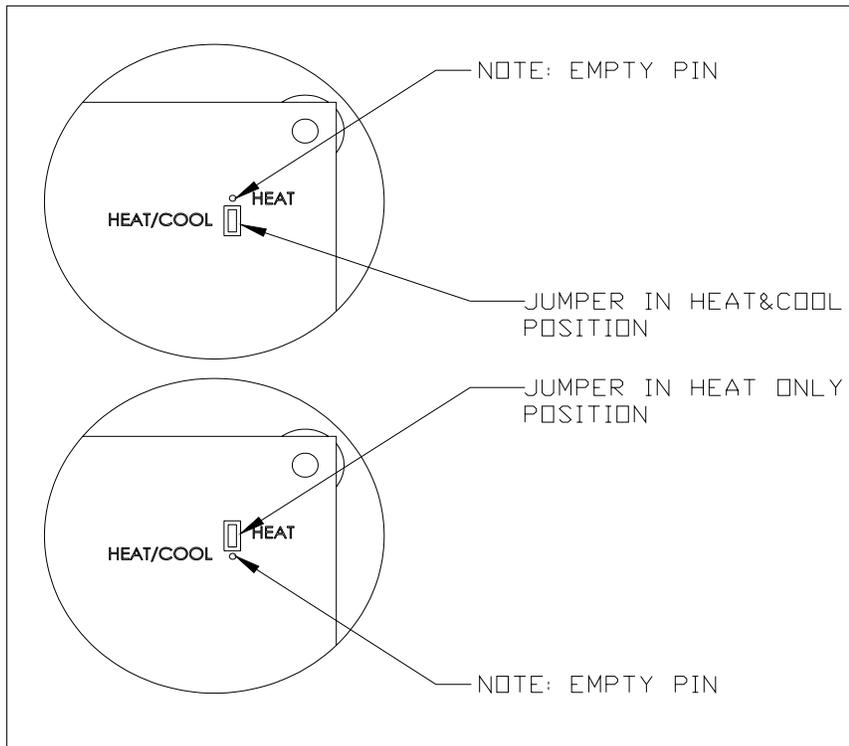
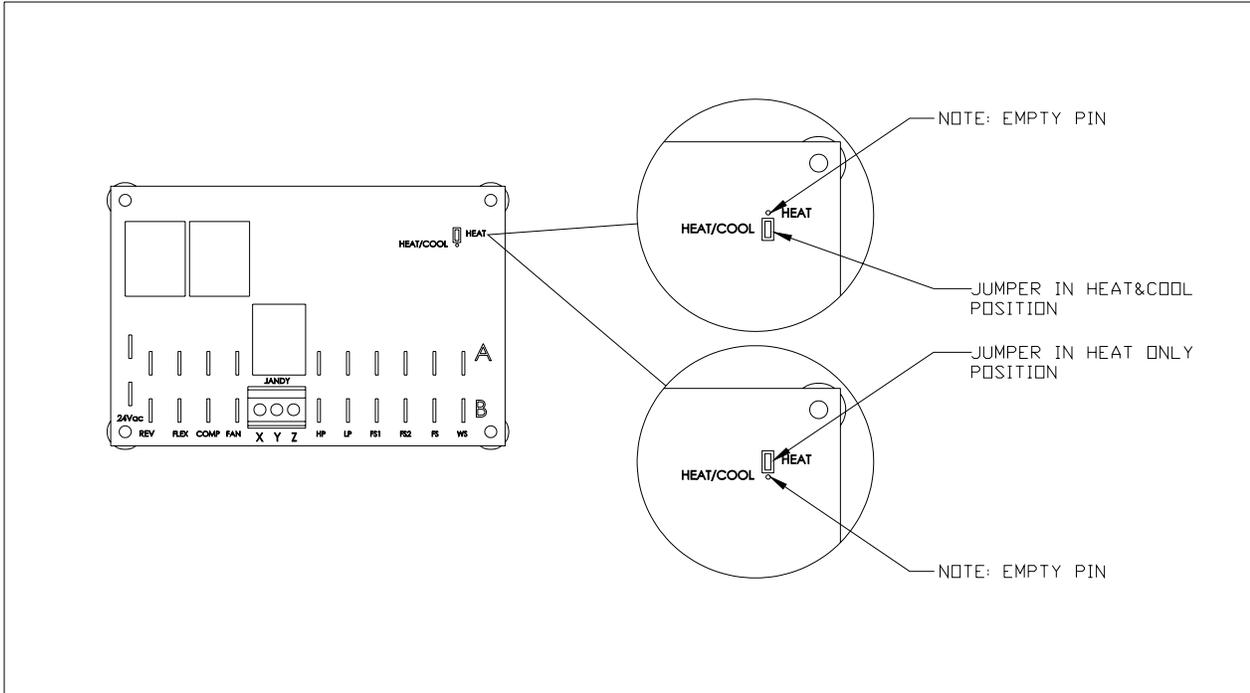
This is NOT an owner or operator procedure. Repairs must not be attempted by untrained and/or unqualified individuals. Risk of Electrical Shock... **Ensure all electrical power to the heater has been disconnected** prior to removing the heater front access panel. **Leave electrical power disconnected** throughout the following jumper repositioning procedure.

1. To access the jumper, disconnect electrical power and remove the heater front entry panel; then, remove the metal cover from heater electrical enclosure. For layout details of the PC control board, see figures on next page.
2. Locate the mode jumper in the upper right hand corner of the PC control board; per the figures on the following page, identify the correct location for the jumper. If the jumper is found to be incorrectly positioned, gently disengage the jumper by pulling it directly away from the control board.
3. Correctly reposition the jumper, leaving one pin uncovered. **Note:** The jumper should cover two (2) pins: one always being the middle pin, and the other the correct pin for the features of the heat pump.



# Controls Configuration & Adjustments...

## Microprocessor Mode Jumper Positioning... continued:





# Controls Configuration & Adjustments...

## Defrost Systems- Described

### DEFROST CYCLE (HEAT ONLY UNITS):

The microprocessor controller monitors the heater's air-coil temperature, minimizing air-coil freeze-up during cooler weather conditions. If the controller senses air-coil temperatures conducive to making ice, the heater's compressor operation is interrupted while the fan is allowed to continue in operation.

With the compressor off, the air-coil begins to warm to the surrounding air temperature. When air-coil temperatures rise above approximately 38°F, the compressor is restarted and heating resumes.

In the event air temperatures remain below approximately 38°F, the compressor will remain off until the air temperature rises above 38°F. The unit will not heat the water as long as the compressor remains off.

During defrost cycles, when the controller has stopped compressor operation, the display will read: [FS].

### DEFROST CYCLE (HEAT & COOL UNITS):

The microprocessor controller, in conjunction with the defrost sensor, constantly monitors the heater's evaporator (air-coil) temperature. Should the controller sense ice or frost has formed on the evaporator, sufficient in amount as to affect the heater's performance, an active defrost cycle (more below) is initiated. Before initiating a defrost command, the controller defrost logic looks at both the air-coil temperature, and the length of time the coil has remained at an ice-making temperature.

Active defrost involves using hot refrigerant gas, from the compressor, to rapidly remove ice or frost from the evaporator coil. In practice, during a hot gas defrost cycle, valving, internal within the refrigerant system, reverses the flow of the refrigerant; this reversal of flow temporarily makes the air-coil the condenser. During hot gas defrost, the air-coil warms very quickly, and accumulated ice and frost is rapidly melted. Under most conditions the evaporator will be completely cleared in under 5-minutes.

### HEAT & COOL DEFROST SEQUENCE DETAILS:

- When the controller senses air-coil temperatures conducive to making ice, the unit will enter a 50-minute defrost delay (counting) period.
- During the counting period, the fan and compressor will continue to operate, and the water will continue to be heated. During the counting period it is normal to see a moderate amount of frost and ice formation on the air coil.
- If, after the 50-minute counting period, the controller senses a need to defrost:
  1. The refrigerant circuit reversing valve will be activated, changing the flow of hot refrigerant gas from the pool water heat exchanger to the air-coil.
  2. Fan operation will be suspended, permitting maximum heating of the air-coil.
  3. The reverse cycle will continue until either:
    - A. The air-coil attains a predetermined temperature (indicative of total defrost), or;
    - B. Until 5-minutes have elapsed (regardless of total defrost having occurred).
- During hot gas defrost cycles, the compressor will not deactivate; rather, the compressor will continue operation throughout the sequence. Upon completion of the defrost cycle (as terminated per "A" or "B," above), the reversing valve will be deactivated, fan operation will recommence, and water heating will resume.



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