Transforming the Control of Hot Tubs

Revolution

Intellectual Property Advisement

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End User Warning

This Installation Manual is provided solely to aid qualified spa service technicians in installing spas with control systems manufactured by Balboa Water Group. Balboa controls have absolutely no end user serviceable parts. Balboa Water Group does not authorize attempts by the spa owner/user to repair or service any Balboa products. Non-qualified users should never open or remove covers, as this will expose dangerous voltage points and other dangerous risks. Please contact your dealer or authorized repair center for service.
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Warnings: Danger! Risk of Electric Shock!

- All electrical work must be performed by a qualified electrician and must conform to all national, state, and local codes.
- Before making any electrical connections, make certain that the Main Power breaker from the house breaker box has been turned off.
- Do not attempt service of this control system. Contact your dealer or service organization for assistance.
- Do not permit any electric appliance, such as a light, telephone, radio, or television within 5’ (1.5m) of a pool or spa.
- Follow all owner’s manual power connection instructions.
- Installation must be performed by a licensed electrician and all grounding connections must be properly installed.
- No user serviceable parts.
- Water temperature in excess of 38°C may be injurious to your health.
- Disconnect the electrical power before servicing.
- Keep access door closed.
CAUTION
• Test the ground fault circuit interrupter before each use of the spa.
• Read the instruction manual.
• Adequate drainage must be provided if the equipment is to be installed in a pit.
• To ensure continued protection against shock hazard, use only identical replacement parts when servicing.
• Install a VG Compliant suction guard that is suitably rated to match the maximum flow rate marked.

WARNING:
Water temperature in excess of 38°C may be injurious to your health.
Disconnect the electrical power before servicing.
Keep access door closed.

ATTENTION
• Toujours verifier l’efficacite du disjoncteur differentiel avant d’utiliser le bain.
• Lire la notice technique.
• Lorsque l’appareillage est instalé dans une fosse, on doit assurer un drainage adequat.
• Afin d’assurer une protection permanente contre le danger de shock electrique, lors de l’entretien employer seulement des pieces de rechange identiques.
• Les prises d’aspiration doivent etre equipees de grilles convenant au debit maximal indique.

AVERTISSEMENT:
Des temperatures de l’eau superieures a 38°C peuvent presenter un danger pour la sante.
Deconnecter du circuit d’alimentation electrique avant l’entretien.
Garder la porte fermer.
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GFCI

It is required by code to install a Ground Fault Circuit Interrupter (GFCI) in the supply power for a spa. This device will trip the breaker if there is an unsafe electrical condition caused by a malfunctioning component or even the slightest short to ground.

Note: Connect the control system only to a circuit protected by a Class A GFCI mounted at least 5’ (1.52M) from the inside walls of the spa/hot tub and in line of sight from the equipment compartment.

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Revolution Overview
Overview

REVOLUTION – Transforming the Control of Hot Tubs

Balboa’s Revolution hot tub control is setting a new industry standard for unmatched system reliability, manufacturing flexibility and end user friendliness.

INCOMPARABLE SYSTEM RELIABILITY

Utilizing advanced technology and high temperature corrosion proof mission critical materials from the automotive and other industries, the Revolution hot tub control systems all but eliminate leaks due to corrosion or harsh chemicals. Together with a newly designed, energy efficient heating coil that reduces element failures due to rattling, Balboa is providing peace of mind for the end-user.

TIGHT SPOTS ARE A THING OF THE PAST

The Revolution sports a compact low profile package offering flexibility with mounting to give you the most in tub design and manufacturing line flexibility. A single model can be configured on the line to support various system configurations without adding additional skus – the Revolution expands the world for you.

POWERFUL, YET SIMPLE USERFACE

The sleek new topside panel includes a large easy to read back-lit LCD with simple to follow end user menus. With new press and hold button technology, setting temperature and other common tasks have been simplified. User navigation is intuitive and easier than ever, reducing customer service help calls.
**revolution features**

**End User Friendliness**
- Press and hold buttons provide scrolling capabilities for temperature, time, etc.
- Tactile button feel: instant, positive feedback when button is pressed.
- Bigger LCD display: 1” x 2” display (easy to read).
- Display with backlight: easier to see in low light and at night.

**User Settable Selections**
- Day of week/time of day.
- User preferences.
- More flexibility.
- Temperature settings 50-104 – two temperature ranges.
- Lower range allows for energy savings when spa is idle.

**Inventory Innovations**
- 50/60 Hz systems available for domestic or export markets.
- Less inventory needs fewer skus.
- Single skus: multiple configurations are picked via menus on the manufacturing line.
- Reduced inventory need fewer skus.

**System Innovations**
- Design flexibility: the ease with which the system can be modified for use in applications or environments other than those for which it was originally designed.
- Bi-directional flow pressure or vacuum applications.
- Compact footprint: 1/2 cubic foot of space in tight equipment compartments needed.
- Time outs settable: energy efficient savings based on manufacturers preferences, manages energy usage more efficiently – GREEN.

**Heater Innovations**
- M7 patented technology that increases reliability.
- Corrosion resistant heater elements materials: no brazing, no dissimilar metals, no welds.
- Thermoplastic heater enclosure: high tech, high temp materials proven use in automotive & mission critical applications minimizes harmful effects of harsh chemicals on heater enclosure.
- Titanium element option: standard unit ships with Incoloy heater replaces Incoloy heater element with titanium, longer life element.
- Coiled heater, lower watt density: relaxed bends, more heating area reduces hot spots.
- Flow through heater design: maximizes water flow, minimal loss due to element bi-directional flow for more flexibility in tub design and plumbing configurations.

**Manufactured under one or more of these patents: U.S. Patents: 5,332,944, 5,361,215, 5,550,753, 5,559,720, 5,883,459, 6,253,227, 6,282,370, 6,590,188, 6,976,052, 6,965,815, 7,033,343, 7,417,834 B2. Canadian Patent: 2,342,614. Australian Patent: 2,373,248. Other patents both foreign and domestic applied for and pending. All software copyright Balboa Water Group.**
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Transforming the Control of Hot Tubs

Revolution Specifications

System Model
Revolution 60 Hz, (BP1500)

Part Number
55697 with a 4kW 800 Incoloy Element
55700 with a 4kW 800 Titanium Element

Topside Panels
TP 600
AX10: One button
AX20: Two button
AX40: Three button

Couplings (nuts and seals included)
Part No. 55911  2” Tailpieces (2-Speed Pump 1)
Part No. 55914  1.5” Tailpieces (2-Speed Pump 1)
Part No. 55912  1” Tailpiece Inserts (Circ)
Part No. 55913  One Direct Circ Pump Coupling, and one 1” Tailpiece Insert
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Revolution Components

1. Electric Housing Cover
2. Bi-directional Flow Heater
3. Heater Housing
4. Electronic Enclosure
5. Nut and Tailpiece
6. Support Legs
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System Dimensions

FRONT VIEW with tail pieces

SIDE VIEW (RIGHT SIDE)

FRONT VIEW w/o tail pieces

BOTTOM VIEW

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When Mounting the System

The design and technology behind the Revolution allows it to be used in most any application, and can be mounted on the suction side or discharge side of the pump.

💡 TIP

To improve reliability, take steps to minimize vibration from the pump(s) that could be transmitted to the Revolution.

- Use rubber isolation pads under the pumps and flexible PVC between the filtration pump and the heater to help minimize vibration.
- Mount the system with the heater horizontal and as low as possible in the equipment compartment.
- To avoid any potential for water to drip directly on the system, do not mount the system directly under the control panel mounting location. Allow a drip-loop in the control panel wiring to keep any water that may travel down the wire from wicking onto the system box.
- Do not mount upside down.

Firmly attach mounting holes on each side of the system box with the screws and washers provided.
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Top-Side Panel Installation

TIP

Choosing a Location for the Topside Panel

- Select a location that is easily accessible. The user should be able to reach the panel without stretching or getting into an awkward position.
- The mounting location should allow the user to see all of the visual indicators and display features of the topside panel without strain.
- Before drilling the cutout of the panel, test to see that the orientation of the topside panel is correct. Also, be sure that the cable reaches the control system without stretching or being forced against any sharp corners.
- Hold the topside panel at the desired mounting location and route the connecting cable toward the control system to determine that the cable is long enough to allow it to be connected inside of the unit.
- The mounting area must be above the maximum water level of the spa and in an area with good drainage to prevent the accumulation of any water. The topside panel should not be submerged.
- If the topside panel must be mounted underneath a spa cover, select a mounting location that will prevent the cover from resting directly upon the panel, but will allow the cover to seal when closed.
Topside Panel Installation (cont.)

The topside panel is specifically designed to withstand the harsh spa environment and is intended to be mounted in a location on, or close to the spa, in order to provide the spa user with the greatest convenience when controlling the spa equipment.

1. Cut a mounting hole as shown. (A more detailed view is shown on the following page.)
2. Fit the topside panel into the hole to make sure the hole is the proper size before proceeding.
3. Remove all dust and particles from the mounting surface around the hole. A clean smooth surface that is dry and oil free is required for the adhesive on the back of the panel to attain a good bond.
4. Remove the paper backing from the adhesive on the rear of the panel. All of the adhesive should be exposed.
5. Route the connecting cable through the opening and place the topside panel into the opening. Align the panel and press firmly onto the mounting surface. Route the cable to the control system.
6. Remove the top cover to the control system, and remove the cable retaining clamp.
7. Plug the cable connector into the connector labeled J33. Replace the connector clamp and secure the screw.
Drill a .5” hole on the kerf of the center hole. This will clear chips from the hole saw and speed the drilling of the first (center) hole.

Center to Center  1.7”

Center to Center  1.7”

2.5” Hole Saw for each overlapping hole.

3.5”

Pilot hole locations for optional fasteners

7.125”

Note:
To print actual size, set Page Scaling to NONE in the Acrobat print dialog.

To download a PDF of this template, please visit our web site:
http://service.balboa-instruments.com/appnotes/ > Topside Panels > VL600S. Click on the “Download the Cutout Template here” link.
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Topside Panel Cable Installation

1. Plug the panel connector into J33.
2. Route the panel connecting cable under the cable clamp.

   **TIP** Allow for a drip-loop in the panel cable before it enters the enclosure.

3. Verify settings on the logic board.
4. At this time, while the lid is off, check to see if any system configuration changes must be made. (See Advanced System Setup.)

   **TIP** The only configurations requiring a change would be:
   - Adding or removing a blower, or
   - Changing the operation voltage.
Terminal Block Connections

Tools Needed: Phillips and flat screwdrivers, wire strippers.

1. Remove the four screws holding the system lid.
2. Attach the conduit or wire connector to the system box.
3. Strip away 1" of insulation of each wire.
4. Pull the cable through the access hole.
5. Push the wires into the proper terminals as indicated on the terminal block sticker.
6. Connect the ground wire to the Bond Lug ground bar through the hole in the system box and tighten the screw.
7. Tighten the screws on the terminal block; torque between 21 and 23 in lbs.

**TIP**

When installing and routing wires to the terminal block, providing service loops to incoming wiring is highly recommended. Service loops provide an extra length of wire in the event of future serviceability.

You are now ready to fill and power up the spa.
Before Power-up: Filling the Spa
Revolution

Preparation Before Power-up
Preparing the spa refers to:
- Filling the spa
- Priming the spa

Filling the spa
Fill the spa to its correct operating level. Follow manufacturer’s instructions.

💡 TIP
Be sure to open all valves in the plumbing system before filling to allow as much air as possible to escape from the plumbing and the control system during the filling process.
Power-up Screen

Each time the system powers up, a series of numbers is displayed as the system runs a self diagnostic check. This is normal, and lasts for about 10 seconds. When LINK appears, press any button to link the panel with the system.
Revolution

Priming the Spa: Priming Mode

- Press the JETS button once to start Pump 1 in low speed
- Press again to switch to high speed
- Press the AUX button to turn on Pump 2, if available. Be sure to energize the 2nd pump.
- The pumps will now be running at high speed to assist priming.

❗ IMPORTANT

A pump should not be allowed to run without priming for more than 2 minutes. Under NO circumstances should a pump be allowed to run without priming beyond the end of the 4-5 minute priming mode. Doing so may cause damage to the pump and cause the system to energize the heater and go into an overheat condition.
RUN PMPS PURG AIR ----

When this menu appears, the system is asking what you would like to do. You have 3 options:

- If the spa does not need to be primed, priming mode can be exited by pressing any TEMP button.
- Do nothing. (Purbing mode terminates within 4 - 5 minutes.)
- Run Priming Mode

**NOTE:** Normally, priming mode can be bypassed. Priming mode is necessary only if the spa is refilled and if there's the possibility of air being in the system.
Priming the Spa: If the Pumps have not Primed

TIP

- If the pumps have not primed after 2 minutes, and water is not flowing from the jets in the spa, do not allow the pumps to continue to run. Turn off the pumps and repeat the process.
- Turning the power off and back on again will initiate a new pump priming session. Sometimes momentarily turning the pump off and on will help it to prime.
- Do not do this more than 5 times. If the pump(s) will not prime, shut off the power to the spa and call for service.
Exiting Priming Mode

Once the system has exited Priming Mode, the topside panel momentarily displays the set temperature; however, not immediately. The system requires approximately 1 minute of water flowing through the heater to determine the water temperature and display it.

The following pages show panel operations assuming no priming is needed.

Once the system has exited Priming Mode, the topside panel momentarily displays the set temperature.

The system then requires approximately 1 minute of water flowing through the heater to determine the water temperature and display it.
Initial Software Configuration
**Transformation of the Control of Hot Tubs**

**Revolution**

**Setting the Time**
Set the time before operating the system. Filtration times and other features are determined by the panel clock being set.

SET TIME appears on the screen if clock is not set.

**To Set the Time**

Press TEMP repeatedly until TIME appears.

The temperature flashes.

Display: SET TIME appears if clock is not set.
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Setting the Time (cont.)

TIME and a clock is displayed.

- Press TEMP

- When the screen flashes hours, press TEMP to the change the hours up or down.

  NOTE: If the clock is in a 12 hour clock mode, AM/PM switches automatically as the time advances or recedes.

- Press LIGHT to change the display to minutes.
Setting the Time (cont.)

- When the screen flashes minutes, press TEMP to change the minutes up or down.

- Press LIGHT to exit.
- The display will return to the main screen in approx. 10 sec.

If a 24 hour display is preferred, see Setting the 24 Hour Clock.
Diagnostic Messages
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Messages
Messages are part of the diagnostic function of the Revolution and require action.
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General Messages

---°F ---°C
After the pump has been running for 1 minute, the temperature will be displayed.

42°F TOO COLD
A potential freeze condition has been detected, or the Aux Freeze Switch has closed, and all pumps and blower are activated. All pumps and blower are ON for at least 4 minutes after the potential freeze condition has ended, or when the aux freeze switch opens.
In some cases, pumps may turn on and off and the heater may operate during Freeze Protection.
This is an operational message, not an error indication.

NO COMM
The control panel is not receiving communication from the System. Call for Service.

Water Temperature is Unknown
Too Cold - Freeze Protection
No Communications
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General Messages (cont.)

**BETA VERSION ----**

The Control System is operating with test software. Call for Service.

**102°F**

The Control System is in Test Mode. Call for Service.

**Flow Related Checks**

Check for low water level, suction flow restrictions, closed valves, trapped air, too many closed jets and pump prime.

On some systems even when spa is shut down, some equipment may occasionally turn on to continue monitoring temperature or if freeze protection is needed.
Heater Related Messages

**HTR FLOW LOSS ----**
There may not be enough water flow through the heater to carry the heat away from the heating element. Heater start up will begin again after about 1 min. See “Flow Related Checks” below.

**HTR FLOW FAIL ----**
There is not enough water flow through the heater to carry the heat away from the heating element and the heater has been disabled. See “Flow Related Checks” below. After the problem has been resolved, you must press any button to reset and begin heater start up.

**HTR MAY BE DRY ---- WAIT ----**
Possible dry heater, or not enough water in the heater to start it. The spa is shut down for 15 min. Press any button to reset the heater start-up. See “Flow Related Checks” below.

**HTR DRY ----**
There is not enough water in the heater to start it. The spa is shut down. After the problem has been resolved, you must press any button to reset and restart heater start up. See “Flow Related Checks” below.

* This message can be reset from the topside panel with any button press.
Heater Related Messages (cont.)

**WATR TOO HOT ---- (OHS)**

One of the water temp sensors has detected spa water temp 110°F (43.3°C) and spa functions are disabled. System will auto reset when the spa water temp is below 108°F (42.2°C). Check for extended pump operation or high ambient temp.

**HTR TOO HOT ---- (OHH)**

One of the water temp sensors has detected 118°F (47.8°C) in the heater and the spa is shut down. You must press any button to reset when water is below 108°F (42.2°C). See “Flow Related Checks” below.

**PRES BTTN TO RSET**

Some errors may require power to be removed and restored.
A reset message may appear with other messages.

* This message can be reset from the topside panel with any button press.
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Sensor-Related Messages

**102°F SNSR BAL-ANCE**

The temperature sensors MAY be out of sync by 2°F or 3°F. *Call for Service.*

**SNSR SYNC ---- CALL FOR SRVC ----**

The temperature sensors ARE out of sync. The Sensor Balance is Poor. Fault has been established for at least 1 hour. *Call for Service.*

**SNSR A ---- CALL FOR SRVC ----**

**SNSR B ---- CALL FOR SRVC ----**

A temperature sensor or sensor circuit has failed. Call for Service.

* This message can be reset from the topside panel with any button press.
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System-Related Messages

MEM FAIL ----
Memory Failure - Checksum Error*

MEM RSET ----
Memory Failure - Persistent Memory Error*

CNFG FAIL ----
Configuration Error – Spa will not Start Up

* This message can be reset from the topside panel with any button press.
STUK PUMP ----
A Pump Appears to have been Stuck ON when spa was last powered UP

HOT FALT ---- CALL FOR SRVC ----
A Pump Appears to have been Stuck ON when spa was last powered UP

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System-Related Messages (cont.)

STUK PUMP ----
Water may be overheated. POWER DOWN THE SPA. DO NOT ENTER THE WATER. Contact your dealer or service organization.

HOT FALT ---- CALL FOR SRVC ----
A Pump appears to have been Stuck ON when spa was last powered UP

POWER DOWN THE SPA. DO NOT ENTER THE WATER. Contact your dealer or service organization.

This fault can be reset by powering up in Test Mode.

WARNING:

HOT FALT indicates a serious condition and should not be treated lightly. The spa probably had a pump stuck in the ON position and could not be turned off, thereby overheating the water. The system tripped the GFCI to avoid additional heating.

NOTE: The GFCI Trip Feature must be enabled for this safety feature to function. The system should be monitored carefully and the main circuit board may need to be replaced.
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The Utilities Menu

Utilities provides general support of the Revolution. Utilities provides access to viewing information on hardware, panel, and software revisions. It also permits viewing of reminder and personal settings.

Main Menu > Utilities > Information >

- SSID: Software Self Identification (or, System Panel ID)
- MODL: Model
- SETP: Setup
- SIG: Signature
- 120V: 120V or 240V configuration
- H0: Heater type
- SW16: DIP switch settings
- PANL: Panel version
- A/B: Display, alternates A and B sensor readings
- FAULT LOG: Displays fault log
- DEMO: Demo, only if enabled

“At a Glance” of the Utilities Menu Tree
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Entering the Utilities Menu

Press TEMP for a flashing display.

Press LIGHT repeatedly until UTIL appears.

The temperature flashes.
Entering the Utilities Menu (cont.)

Press LIGHT.

Press LIGHT to set “A/B” On.

Please TEMP to toggle A/B sensor readings. When set to ON, Panel will display alternate readings from Sensor A and Sensor B on Main Screen.

Or, press LIGHT to continue to the Fault Log.
Enter the Utilities Menu (cont.)

Displays Fault Log.

Waiting 10 seconds allows the screen to return to normal operation.
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Entering the Sub-utils Menu

Press TEMP for a flashing display.
Revolution

Transforming the Control of Hot Tubs

Entering the Sub-utilities Menu (cont.)

Press TEMP.

SSID is displayed.

After SSID is displayed, a string of numbers appear. There is a two second delay on each number.

Press LIGHT to view MODL.
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Entering the Sub-utilities Menu (cont.)

After MODL is displayed, the string of numbers is displayed. (There is a two second delay on each number.)

Press LIGHT to view SETP.

Set-up displays the hardware set-up: S01, S 02, S 03, etc. (There is a two second delay on each number.)
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Entering the Sub-utilities Menu (cont.)

Press LIGHT to view SIG.

Revolution’s current SIG (Signature) appears. (There is a two second delay on each number.)

Press LIGHT to view current VAC input power sensed by the Revolution.
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Entering the Sub-utilities Menu (cont.)

Current VAC input power shown. Press LIGHT to continue to display Heater Type.

Current Heater Type shown. Press LIGHT to continue to display DIP Switch Settings.

Current DIP Switch settings.

In this case:
- 0 = DIP Switch 1 – Test Mode Off (0) or On (1)
- 3 = DIP Switch 2+3+4 = the number of HS pumps with heat
- 1 = N/A or Special Amperage Rule 1 or 2
- 0 = Store Settings (0) or Memory Reset (1)
Transforming the Control of Hot Tubs

Revolution

Entering the Sub-utilities Menu (cont.)

Press LIGHT to continue to display Panel Version.

Pressing LIGHT again will take you back to INFO.

To EXIT to the Main Screen, wait 10 seconds to allow the screen to return to normal operation.
Fault Log

The Fault Log stores up to 24 events in memory and they can be reviewed under the Fault Log Menu. Each event captures a Fault Message Code, how many days have passed since the fault, Time of the fault, Set Temperature during the fault, and Sensor A and B temperatures during the fault. The Fault Log is also available from the Test Menu (in Test Mode).
Fault Log (cont.)

Press TEMP for a flashing display.

The temperature flashes.

Press LIGHT repeatedly until UTIL appears
Fault Log (cont.)

Press LIGHT repeatedly until FALT appears.

Pressing TEMP displays up to 24 messages. Fewer messages may be displayed.

FALT LOG appears across the display.

Each press of the LIGHT button displays the next numbered fault log event.
Pressing TEMP at any fault event reveals a Message Code (next page).
Fault Log (cont.)

Pressing TEMP at any fault event reveals a Message Code

- Continuing to press TEMP reveals additional information for that specified numbered fault event.
- Waiting 30 seconds inside the fault log menu allows the screen to return to normal operation.

Fault Log Message Codes

- MXXX: Fault Message Code
- DZZZ: How many days have passed since the fault
- Time of the fault
- Set Temperature during the fault
- Sensor A Temperature during the fault
- Sensor B Temperature during the fault
Advanced System Configuration & Setup
Transforming the Control of Hot Tubs

Revolution

System Configuration

Flexibility in the Revolution allows the manufacturer or installer to choose from eight (8) preconfigured system options. Changing the configurations is made via the topside panel and in some options with a simple jumper wire change on the system board.

A basic configuration is shipped from the factory and any optional setups are documented here.

TIP

- The default factory setting is Setup 1: 2 Speed, Pump 1; 1 Speed, Pump 2.
- Most configurations only require a software change via the topside panel.
- Wiring changes are only needed for adding/removing a blower or changing an operating voltage.
Transforming the Control of Hot Tubs

Revolution

To Configure the Revolution

1. Decide on a configuration. (Consider what devices will be connected; see chart below.)
2. Make any changes on the power board, if needed.
3. If changing voltage, make a DIP switch change on the logic board.
4. Install incoming voltage supply wires.
5. If needed, configure the software through the panel.

Configuration Table

<table>
<thead>
<tr>
<th>Setup No.</th>
<th>Pump 1 (P1)</th>
<th>Pump 2 (P2)</th>
<th>Blower</th>
<th>Circ Pump</th>
<th>Ozone</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 SPD</td>
<td>1 SPD</td>
<td>NA</td>
<td>NA</td>
<td>240V</td>
<td>240V 60Hz</td>
</tr>
<tr>
<td>2</td>
<td>1 SPD</td>
<td>1 SPD</td>
<td>NA</td>
<td>YES</td>
<td>240V</td>
<td>240V 60Hz</td>
</tr>
<tr>
<td>3</td>
<td>2 SPD</td>
<td>NA</td>
<td>YES</td>
<td>NA</td>
<td>240V</td>
<td>240V 60Hz</td>
</tr>
<tr>
<td>4</td>
<td>1 SPD</td>
<td>NA</td>
<td>YES</td>
<td>YES</td>
<td>240V</td>
<td>240V 60Hz</td>
</tr>
<tr>
<td>5</td>
<td>2 SPD</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>240V</td>
<td>240V 60Hz</td>
</tr>
<tr>
<td>6</td>
<td>1 SPD</td>
<td>NA</td>
<td>NA</td>
<td>YES</td>
<td>240V</td>
<td>240V 60Hz</td>
</tr>
<tr>
<td>7</td>
<td>2 SPD</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>120V</td>
<td>120V 60Hz</td>
</tr>
<tr>
<td>8</td>
<td>1 SPD</td>
<td>NA</td>
<td>NA</td>
<td>YES</td>
<td>120V</td>
<td>120V 60Hz</td>
</tr>
</tbody>
</table>
Transforming the Control of Hot Tubs

Revolution

Configuration Setup 1, 2, 5 & 6

240 Volt Configuration without Blower

Power Board:
Wiring changes: Not required
Voltage: 240V, 60Hz
Heater: 4.0 kW @ 240 VAC

Logic Board:
S1 DIP switch No. 2: ON
LED Spa Light (J15): 12 VAC .25 A

Power Board Setup Chart

<table>
<thead>
<tr>
<th>Setup No.</th>
<th>Pump 1 (P1)</th>
<th>Pump 2 (P2)</th>
<th>Blower</th>
<th>Circ Pump</th>
<th>Ozone</th>
<th>Jumper 15 Connects To</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>J8</td>
<td>J14</td>
<td>J14</td>
<td>J21</td>
<td>J22</td>
<td>J12</td>
</tr>
<tr>
<td>1</td>
<td>2 SPD</td>
<td>1 SPD</td>
<td>NA</td>
<td>NA</td>
<td>240V</td>
<td>J12</td>
</tr>
<tr>
<td>2</td>
<td>1 SPD</td>
<td>1 SPD</td>
<td>NA</td>
<td>YES</td>
<td>240V</td>
<td>J12</td>
</tr>
<tr>
<td>5</td>
<td>2 SPD</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>240V</td>
<td>J12</td>
</tr>
<tr>
<td>6</td>
<td>1 SPD</td>
<td>NA</td>
<td>NA</td>
<td>YES</td>
<td>240V</td>
<td>J12</td>
</tr>
</tbody>
</table>

Default Setup 1 includes:
Setup 1, 2, 5 & 6
Factory default settings.
As shipped; no wiring changes needed.

*SWITCH #6 SHOULD BE SET TO OFF UPON FINAL INSTALLATION.

*SWITCH #6 SHOULD BE SET TO OFF UPON FINAL INSTALLATION.

S1 SWITCH #
OFF POSITION
ON POSITION

*SWITCH #6 SHOULD BE SET TO OFF UPON FINAL INSTALLATION.

S1 SWITCH #
OFF POSITION
ON POSITION

S1 SWITCH #
OFF POSITION
ON POSITION

Sensor A
Sensor B

4.0 kW
Setup 3 & 4
Move jumper wire connector J12 to J13.

Configuration Setup 3 & 4
240 Volt Configuration with Blower

**NOTE:** The top logic board must be removed to gain access to the connections on the power board.

*If the board configuration is changed, the software setup must be changed. This is accomplished in the SETP menu under UTIL.*

**Power Board:**
- Wiring changes: Move J12 to J13
- Voltage: 240V, 60Hz
- Heater: 4.0 kW @ 240 VAC

**Logic Board:**
- S1 DIP switch No. 2: ON
- LED Spa Light (J15): 12 VAC .25 A

**Power Board Setup Chart**

<table>
<thead>
<tr>
<th>Setup No.</th>
<th>Pump 1 (P1)</th>
<th>Pump 2 (P2)</th>
<th>Blower</th>
<th>Circ Pump</th>
<th>Ozone</th>
<th>Jumper 15 Connects To</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>J8</td>
<td>J14</td>
<td>YES</td>
<td>NA</td>
<td>240V</td>
<td>J13</td>
</tr>
<tr>
<td>4</td>
<td>J14</td>
<td>J14</td>
<td>YES</td>
<td>YES</td>
<td>240V</td>
<td>J13</td>
</tr>
</tbody>
</table>
Transforming the Control of Hot Tubs

Revolution

Configuration Setup 7 & 8

120 Volt Configuration

NOTE: The top logic board must be removed to gain access to the connections on the power board.

All services will run at 120V when the jumper J29 - J33 is installed.

Power Board:

Voltage: 124V, 60Hz
Heater: 1.0 KW @ 120 VAC

Logic Board:

S1 DIP switch No. 2: OFF
LED Spa Light (J15): 12 VAC .25 A

<table>
<thead>
<tr>
<th>Setup No.</th>
<th>Pump 1 (P1) Connects To</th>
<th>Circ Pump Connects To</th>
<th>Ozone Connects To</th>
<th>S1 Switch Connects To</th>
<th>Jumper 15 Connects To</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>J8</td>
<td>J21</td>
<td>120V</td>
<td>OFF</td>
<td>J12</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
<td>YES</td>
<td>120V</td>
<td>OFF</td>
<td>J12</td>
</tr>
</tbody>
</table>

Add Jumper J29 - J33 to change system to 120V.

Wiring changes:
Add Jumper J29 - J33 to change system to 120V.
Revolution

Software Setup

**Note:** Software Setup is changed through the panel, and is only necessary if the wiring configuration is changed from factory default (Setup 1). If the factory default had not been changed, this section can be skipped.

! **The No. 1 DIP switch on the logic board must be set to S-1 (ON).**

1. Remove Lid.

2. Place DIP switch No. 1 on the logic board to the ON position.
   (Note: The power does not have to be off for this change.)
Transforming the Control of Hot Tubs

Revolution

Software Setup (cont.)

3. If the power is off, turn it on.

4. Once LINK appears, press the TEMP button repeatedly until a temperature reading appears and is flashing
Revolution

Software Setup (cont.)

5. Press Light once. TEST will appear.

6. Press TEMP repeatedly until your choice of S 01 - S 08 appears.

The temperature flashes.

Press repeatedly until a setup choice appears (S 01 - S 08)
Transforming the Control of Hot Tubs

Revolution

Software Setup (cont.)

7. Stop at your chosen setup. Press LIGHT to enter your choice into the configuration system. Press LIGHT again to exit the menu.

Press LIGHT twice.

8. Place DIP switch No. 1 to the OFF position.

9. Software configuration is complete. Replace Lid.
Revolution
Transforming the Control of Hot Tubs

Spa Information

Manufactured under one or more of these patents. U.S. Patents: 5332944, 5361215, 5550753, 5559720, 5,883,459, 6253227, 6282370, 6976052, 7030343, 7,417, 854 b2, Canadian Patent: 2342614, Australian patent: 2373248 other patents both foreign and domestic applied for and pending. All material copyright of Balboa Water Group.
## Revolution

### Transforming the Control of Hot Tubs

### Specifications & Certifications

Environmental, Mechanical, Enclosure, Certifications, Electrical, Patents & Copyrights.

### Environmental

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-20°C (-4°F) to 60°C (140°F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-25°C (-13°F) to 85°C (185°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>Humidity: up to 85% RH, non condensing</td>
</tr>
</tbody>
</table>

### Mechanical

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (without cable)</td>
<td>7.83 lbs. (3.552 kg)</td>
</tr>
<tr>
<td>Dimensions (without tail pieces)</td>
<td>8.5&quot;H x 15.0&quot;W x 5.8&quot;D</td>
</tr>
<tr>
<td>Dimensions (mounting holes)</td>
<td>11.45&quot; x 5.30&quot;</td>
</tr>
</tbody>
</table>

### Enclosure

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPx5</td>
<td>Thermoplastic Heater</td>
</tr>
</tbody>
</table>

### Certifications

<table>
<thead>
<tr>
<th>UL Standard/Files</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 1563 5th Edition/E90059</td>
<td></td>
</tr>
<tr>
<td>UL 1795 3rd Edition/E188744</td>
<td></td>
</tr>
</tbody>
</table>

### Electrical

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump 1</td>
<td>1 or 2 Speed - 240V/12A or 120V/12A</td>
</tr>
<tr>
<td>Pump 2</td>
<td>1 Speed - 240V/12A or 120V/12A</td>
</tr>
<tr>
<td>Circ Pump and Ozone (combined total)</td>
<td>240V/5.5A or 120V/5.5A</td>
</tr>
<tr>
<td>Blower</td>
<td>240V/8A</td>
</tr>
<tr>
<td>LED Lights (No Incandescent lights)</td>
<td>12 VAC/.25A</td>
</tr>
<tr>
<td>Option Output</td>
<td>4 Amp Max.</td>
</tr>
</tbody>
</table>

### Heater Flow

<table>
<thead>
<tr>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 GPM minimum.</td>
</tr>
</tbody>
</table>

### Patents & Copyrights

Manufactured under one or more of these patents. U.S. Patents: 5332944, 5361215, 5550753, 5559720, 5,883,459, 6253227, 6282370, 6590188, 6976052, 6965815, 7030343, 7,417,834 b2, Canadian Patent: 2342614, Australian patent: 2373248 other patents both foreign and domestic applied for and pending.

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Transforming the Control of Hot Tubs

Revolution

Auxiliary Panels

<table>
<thead>
<tr>
<th>FEATURE:</th>
<th>DEFAULT</th>
<th>OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aux Button A1</td>
<td>Jets 1</td>
<td>See Aux Button Note</td>
</tr>
<tr>
<td>Aux Button A2</td>
<td>Jets 2</td>
<td>See Aux Button Note</td>
</tr>
<tr>
<td>Aux Button A3</td>
<td>Unused</td>
<td>See Aux Button Note</td>
</tr>
<tr>
<td>Aux Button A4</td>
<td>Light</td>
<td>See Aux Button Note</td>
</tr>
</tbody>
</table>

TIP

Aux Buttons can be set with the following functions based on Manufacturer Specification: (These functions can vary by Setup Number as well).


AX10 A1 | NO O/L | 52803
AX10 A2 | AUX O/L | 55919 (SHOWN)
AX10 A3 | NO O/L | 52805
AX10 A4 | NO O/L | 52806

AX20 A1 A2 | NO O/L | 52800
AX20 A1 A3 | AUX O/L | 52801
AX20 A1 A4 | NO O/L | 52802

AX40 | NO O/L | 52799
2” TAILPIECE KIT, PART No. 55911
Standard 2” sockets to glue up to 2” PVC pipe.

1.5” TAILPIECE KIT, PART No. 55914
1.5” sockets to glue up to 1.5” PVC pipe with the I.D. Be sure to orient the fittings so that the insert is at the 12:00 position to prevent trapped air.

1” CIRC PUMP INSERT KIT, PART No. 55912
1” barb fittings for use with 1” tubing. Be sure to orient the fittings so that the insert is at the 12:00 position to prevent trapped air.

1” CIRC PUMP INSERT KIT, PART No. 55913
One fitting for direct coupling to the threaded suction of an appropriately-sized circ pump. A 1” barb fitting for use with 1” tubing is used on the other end of the heater. Be sure to orient the fittings so that the insert is at the 12:00 position to prevent trapped air.
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Recommended Installation Accessories

- Rated SUCTION FITTINGS
- PUMP 1 SHUT-OFF VALVES
- PUMP 2 SHUT-OFF VALVES
- AIR BLOWER CHECK VALVE
- GROUND FAULT CIRCUIT BREAKER (GFCI)
Transforming the Control of Hot Tubs

Revolution

Optional System Components

- 2ND PUMP
- AIR BLOWER
- OZONE GENERATOR
- LED SPA LIGHT
Glossary

Circ Pump (or circulation pump)
Low horse power pump designated especially for maintenance of filtration and heating. It often runs all day.

Clean-up (or purge) Cycle
An action designed to circulate water to maintain sanitary conditions. Pumps or blowers purge standing water to prevent the water from becoming stagnant.

Filtration Cycle
Period of time designated to filter the system. Oftentimes there are two filter cycles, 12 hours apart, and designated as F1 and F2.

Freeze Protection
A safety feature detecting water or air temperature approaching freezing. Once a set low temperature is reached, an action is often initiated automatically. Oftentimes pumps will start to keep water circulating in all plumbing and the heater may operate.
Glossary (cont.)

**GFCI**
A device intended to protect people in the event of an electrical malfunction. Spa owners should know how to test the GFCI as routine maintenance.

**Link**
Refers to “linking” the TP600 panel with the BP1500 system so that they communicate with each other. Linking is necessary only when a new panel or auxiliary panels are installed. Linking can be done at any time the system is functioning.

**Preferences**
Programmed events according to personal preferences.

**SSID**
Software Self Identification (or, System Panel ID)
Glossary (cont.)

Priming Mode

Act of water flow through the plumbing to purge air from the spa system.

Normally, priming mode can be bypassed. The priming mode is necessary only if the spa is refilled and if there’s the possibility of air being in the system.

What Priming Mode does:

Each time the spa is powered up, it will enter Priming Mode. The purpose of Priming Mode is to allow the user to run each pump and manually verify that the pumps are primed (air is purged) and water is flowing. This typically requires observing the output of each pump separately, and is generally not possible in normal operation. Priming Mode lasts 4 minutes, but you can exit it earlier by pressing any Temp button. The heater is not allowed to run during Priming Mode. **NOTE:** If your spa has a Circ Pump, it will turn on with Jets 1 in Priming Mode. The Circ Pump will run by itself when Priming Mode is exited.

Programming

Setting an order and time for planned events, such as filter times, clean-up cycle, etc.
Transforming the Control of Hot Tubs

Revolution

Supporting Documents

- BWG TP600 Control Panel Document No. 40940.
- A Cutout Template for the BWG TP600 Control Panel.

Supporting Documents for Download

- Also, visit our technical site for Application Notes: http://service.balboa-instruments.com/appnotes/

  **Topics include:**
  - Auxiliary Jet Pumps Installation
  - Basic Configurations & System Mounting
  - Circ Pump Plumbing: Vacuum Heater, Vacuum Filter, Pressure Heater, Freeze Sensor Installation
  - NON-Circ, 2-Speed Pump 1
  - Ozone Installation
  - pH and ORP Installation
Transforming the Control of Hot Tubs

Revolution

Codes and Compliance

- All of the electrical wiring methods and materials used to complete the electrical installation of the Revolution control system must be in accordance with the National Electrical Code or the Canadian Electric Code, as well as any local electrical codes in effect at the time of installation.
- The selection of electrical materials required to accomplish this installation and the installation of the control system must be made by, or be under the direct supervision of, a qualified electrician.
- The Revolution is classified as a “continuous duty appliance” and is intended primarily for installation at a single family dwelling. The installation recommendations and instructions contained in this manual are directed solely toward these issues.

WARNING!

If there is any doubt whether the system that you are installing into does not have these features, contact a licensed, qualified electrician. **Do not attempt to modify the wiring yourself.**
Revolution

Electrical Protection

1. Local Disconnect
   A local disconnect (sometimes referred to as an “electrical disconnect”) is installed apart from the main service panel. The local disconnect must be installed where readily accessible and within sight of the spa, but at least 5’ (1.5 meters) from the inside wall of the spa.

2. GFCI
   It is required by code to install a Ground Fault Circuit Interrupter (GFCI) in the supply power for a spa.

   **NOTE:** A GFCI power cord is included with a 120VAC spa. This can be used for a cord-connected 120V setup only, and only in place of a stand-alone GFCI.

Safety and Electrical Systems

- Use minimum 6AWG copper conductors only.
- Torque field connections between 21 and 23 in-lbs.
- Connect only to a circuit protected by a Class A Ground Fault Circuit Interrupter (GFCI) CSA enclosure: Type 2.
- The Revolution is classified as a “continuous duty appliance” and is intended primarily for installation at a single family dwelling. The installation recommendations and instructions contained in this manual are directed solely toward these issues.

**WARNING!**

If there is any doubt whether the system that you are installing into does not have these features, contact a licensed, qualified electrician. **Do not attempt to modify the wiring yourself.**
Transforming the Control of Hot Tubs

Revolution

Voltage Checks

Set voltmeter to AC Volts. Voltages should check out as follows:

- Line 1 Black to Line 2 Red – 240VAC: (Range of acceptability: 216VAC – 246VAC)
- Either Line to Neutral – 120VAC (Range of acceptability: 108VAC – 132VAC)
- Either Line to Ground – 120VAC (Range of acceptability: 108VAC – 132VAC)
- Neutral to Ground – 0 Volts

These readings should be consistent at all points in all electrical enclosures and breaker boxes. If the readings are not in the acceptable ranges, do not power up the system.
Installation and Setup/Appendix
Transforming the Control of Hot Tubs

Revolution

General Spa Design Guidelines

System Orientations Supported

The Revolution supports two basic system configurations. When installing the Revolution, keep in mind the following characteristics that each system has. It will help in determining where to place and how to configure the Revolution. Follow these guidelines.

Two Circulation Systems

- **Non-circ System**: A non-circ system uses a 2-speed pump to heat and filter the spa.
- **Circ System**: A circ system uses a dedicated 1-speed pump to heat and filter the spa. The circ pump motor must not exceed 2 amps.

**Also, keep in mind that:**

- The heater requires at least 20 Gallons per Minute (GPM) of flow for proper function.
- Some systems may require at least 25 GPM.
Spa Guidelines to Keep in Mind

Whether replacing an older control system, or if designing a new spa system, keep these guidelines in mind.

1. The suction system for the 2-speed pump or for the circ pump must be dedicated. There must not be any other pumps connected to this suction system.

2. The suction system for the 2-speed pump or for the circ pump must include the following:
   a. 2 suction fittings, or
   b. 1 suction fitting and a skimmer.

3. If the suction system for the 2-speed pump or for the circ pump includes a filter, it is desirable that the filter incorporate a by-pass around the filter cartridge that opens when the cartridge gets dirty. (Spring tension holding the by-pass valve closed must be overcome by the vacuum of the pump.) This by-pass should be capable of flowing a minimum of 20 GPM during the low speed operation of the 2-speed pump or during circ pump operation with the cartridge 100% blocked. The inclusion of a suction fitting appropriately plumbed into the suction circuit in conjunction with a vacuum filter may also meet this requirement.

4. The pressure system for the 2-speed pump or for the circ pump must be dedicated. There must not be any other pumps connected to this pressure system.
5. The pressure system for the 2-speed pump or for the circ pump must discharge water freely into the spa.

6. If the pressure system for the 2-speed pump includes a diverter valve, or a diverter jet, there must not be an “off” position that would stop water flow from the pump or any other position that would throttle or reduce water flow from the pump.

7. If the pressure system for the 2-speed pump includes flow adjustable jets that can be 100% closed, at least 2 non-adjustable jets must be included in each possible inlet circuit so that a minimum of 20 GPM can flow during low pump operation with all the jets closed. Any other means of by-passing flow around the closed jets is acceptable as long as the by-pass means is down stream from the heater and allows a minimum of 20 GPM to flow through the heater during low speed operation.

8. If the pressure system for the 2-speed pump includes flow adjustable jets that do not close 100%, at least 20 GPM must flow during low speed operation through each possible inlet circuit with all the jets closed.

9. If the pressure system for a 2-speed pump or for a circ pump includes a filter, the filter must be equipped with a by-pass around the cartridge that opens when the cartridge gets dirty. (Spring tension holding the by-pass valve closed must be overcome by the pressure of the pump.) This by-pass must be capable of flowing a minimum of 20 GPM during low pump operation with the cartridge 100% blocked.
10. If the pressure system for a 2-speed pump or for a circ pump includes branch circulation lines such as circuits intended to operate ozone injection systems, these branch circulation lines must be connected downstream from the heater.

11. Avoid inter-connection of the plumbing circuits for the 2-speed pump or for the circ pump with other pumps in the spa plumbing system for the purpose of freeze protection. The Revolution control system will provide freeze protection. There is also provision for remote sensing freeze protection if required.

12. Position inlets and jets in the spa so that they do not direct water flow towards suction fittings or skimmers. This will avoid a “thermal short circuit” and prevent excessive heater and pump cycling.

13. If service valves are a part of the circulation system for the 2-speed pump or for the circ pump, be sure to use valves that incorporate a means of “locking” in the open position.

14. If the 2-speed pump or the circ pump is replaced in the field by service personnel, the replacement used must equal or exceed the hydraulic specifications of the original pump.

15. To assure adequate performance, the spa plumbing must be 1 1/2” minimum. The use of 2” is highly recommended. Either schedule 40 or flexible PVC pipe is acceptable.

16. It is recommended that shut-off valves be installed in the suction and discharge lines.
Non-Circ Systems must use a 2-speed Pump 1 for filtration and heating.
Circ Pump Plumbing Schematics

Circ Systems use a dedicated low horsepower pump.

**Plumbing Schematic:**
Circulation Pump, Pressure Heater, Pressure Filter

**Plumbing Schematic:**
Circulation Pump, Vacuum Heater, Pressure Filter

**Plumbing Schematic:**
Circulation Pump, Vacuum Filter, Pressure Heater

**Plumbing Schematic:**
Circulation Pump, Vacuum Filter, Vacuum Heater
Transforming the Control of Hot Tubs

Revolution

Pressure and Suction Side Mounting

- The Revolution can be used in most any application. If installing in a newly built spa system, study the diagrams in order to plan the location of the Revolution. Also, keep in mind that:
- The heater requires at least 20 Gallons Per Minute (GPM) of flow for proper function.
- Some systems may require at least 25 GPM.
- **Pressure-Side System:**
  A pressure side heater system is a heater that is located on the discharge side of the pump.
- **Vacuum-Side System:**
  A vacuum side heater system is a heater that is located on the suction side of the pump.
Mounting

- Revolution technology allows mounting flexibility. The Revolution can be mounted on either the suction or pressure (discharge) side of the pump. However, it must be mounted on a flat surface parallel to the ground.
- To improve reliability, take steps to minimize vibration from the pump(s) that could be transmitted to the Revolution.
- Use rubber isolation pads under the pumps and flexible PVC between the filtration pump and the heater to help minimize vibration.
- Mount the system with the heater horizontal and as low as possible in the equipment compartment.
- To avoid any potential for water to drip directly on the system, do not mount the system directly under the control panel mounting location.
- Allow a drip-loop in the control panel wires to keep any water that may travel down the wire from wicking onto the system box.
- The Revolution can not be mounted upside down. The Revolution is not to be mounted sideways. The Revolution is only to be mounted upright on a flat horizontal surface.
Suction-Side System Mounting

- When mounting the system on the suction (vacuum) side of the pump, care must be taken to mount the system in such a way that it is aligned with the suction port on the pump wet-end. The suction-side mounting can generally be done much lower in the system, making it easier to keep proper water flow in the heater at all times. The system should be mounted with appropriate fasteners.

- **Note:** When employing suction-side mounting, the system may need to be placed on a spacer block so that it complies with UL height requirements for electrically live components, in the same manner as a pump motor.
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