

2004

M-7 Technical Service Manual

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End User Warning

This Technical Service Manual is provided solely to aid qualified spa service technicians in troubleshooting and repairing spas with control systems manufactured by Balboa Instruments, Inc. Balboa controls have absolutely no end user serviceable parts. Balboa Instruments 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.



Balboa Control Service Checklist

Preface

This manual is provided to aid the qualified service technician in troubleshooting and correcting problems found in spas with M-7 Technology and control systems manufactured by Balboa Instruments, Inc.

Tools Required

- Ammeter (50A)
- Digital Multi-meter
- Balboa Logic Jumper on a Stick
- Balboa Six-in-one Screwdriver, Includes:
Two Phillips Head and Two Flathead Screwdrivers Along with a 1/4" and 5/16" Nut Driver
- 5/16" Socket
- 1/4" Open End Wrench
- Small Wire Cutters
- Pliers & Needlenose Pliers
- Quick Check™ Test Kit
- Precision Thermometer - Digital Fever Type
- Padlock (to lock electrical disconnect during service)
- Plumber's Sealant



Quick Check™ Test Kit



Digital Fever Thermometer



Balboa Logic Jumper on a Stick

System Components Required

- Fuses (30 and 20A time delay plus 20, 10 and 3A)
- System Transformers (120 V and 240 V plus a 120 V Duplex)
- System Sensors
- System Panel(s)
- System Circuit Board

⚠ Important

Due to the danger of severe electrical shock, locate all power disconnects before servicing a spa. Precautions must be taken whenever working with breaker boxes, G.E.C.I.'s, or service disconnects.

Always refer to the wiring diagram which is included with each system on the inside of the system box cover. Use this diagram for voltage measurement points, and for proper reconnection of wires.

⚠ Important

Be sure to bring the correct circuit board, topside control panel, components, and tools.

⚠ Safety Tips

- Keep children and pets away.
- Be aware of your surroundings. Standing in water while repairing a spa puts you at serious risk.
- Avoid working in cramped or crowded conditions.

DANGER: SHOCK HAZARD.

DO NOT PROCEED IF UNQUALIFIED IN WORKING WITH HIGH VOLTAGE.



System Description

Highly advanced microprocessor technology has been combined with solid-state electronic switches to produce the world's finest, high quality state-of-the-art digital control systems. Balboa control systems are technologically sophisticated, yet easy to understand, use, and troubleshoot.

Topside Control Panel

The control panel activates functions at the touch of a button. Each function will echo from the circuit board to the LCD in a corresponding manner. The panel will also display diagnostic messages which enable the service technician to easily troubleshoot the system.

Circuit Board

A typical circuit board has the following output capabilities:

- 240 VAC System
- Two-speed pump
240 VAC, 60 Hz, 2 HP
- Single-speed pump
240 VAC, 60 Hz, 2 HP
- Blower
240 VAC, 60 Hz, 2 HP
- Heater
240 VAC, 60 Hz, 5.5 kW
- Light
12 V, 12 W, 60 Hz, 1A or
120 V, 100 W

In addition to these outputs, the board receives input from the two temperature sensors located within the heater housing.



Important

Do not remove and replace the circuit board unless you have tested all other components and proven that the circuit board is actually causing the problem.

M-7 Sensors

The two sensors located within the heater housing compare the inlet water temperature with the outlet water temperature (regardless of water flow direction) to determine the presence of water, low flow, temperature limits, and operating temperatures. The system will automatically select the sensor that is exposed to the lowest temperature as the spa water temp controlling sensor.

The sensors in combination with specific software allow the spa to be controlled without the use of external pressure switches, flow switches, or temperature sensors.



Wiring Checks

Safety is key when servicing any spa or spa control panel. Remember, safety comes first for you and your customer. Please take all necessary precautions before attempting any repairs. Wiring checks are the first step to ensure safety and proper function before beginning service on a unit.

Wiring Check Precautions

- When working in a system box always be aware that it may contain high voltage.
- Always keep your fingers and hand tools away from any wiring or circuit board when the power is on. Touching anything in these areas can result in serious injury.
- All service calls, no matter how minor, should include a complete wiring check, beginning with the house breaker.
- Keep in mind, Balboa equipped spas only run on single phase electrical service. Three phase power will not supply proper voltage to the system. Three phase power may overheat the pumps and cause the G.F.C.I. to trip.

Check for Loose Connections or Damaged Wires:

- Make sure the power is off before you touch any wiring.
- Once the power is off, carefully examine all wires for cuts or defects.

System Box Wire Gauge Check

When inspecting the wiring for any control system, note that connections for the incoming wires are clearly labeled at the main terminal block.

- 30A service – minimum ten gauge copper wire.
- 40A service – minimum eight gauge copper wire.
- 50A service – minimum six gauge copper wire.

These wires must connect the house breaker box, through the local disconnect, to the main terminal block. The wiring diagram inside the system box shows the main terminal block as TB1.

Important

Using non-copper wire can be dangerous, and also can be the cause of a spa's malfunction. If non-copper wire is used at any point, we do not recommend servicing the spa until an electrician replaces it with the proper gauge copper wire.

Important

This service must be single phase. Any abnormal voltage reading requires an electrician. Do not attempt to fix these types of problems yourself. High voltage can seriously injure or kill.

G.F.C.I. Wiring Check

If a Ground Fault Circuit Interrupter has recently been installed, a majority of tripping problems can be attributed to incorrect wiring of the G.F.C.I. A clear understanding of the correct configuration is essential. **Please refer to the figure on page 10 as needed.**

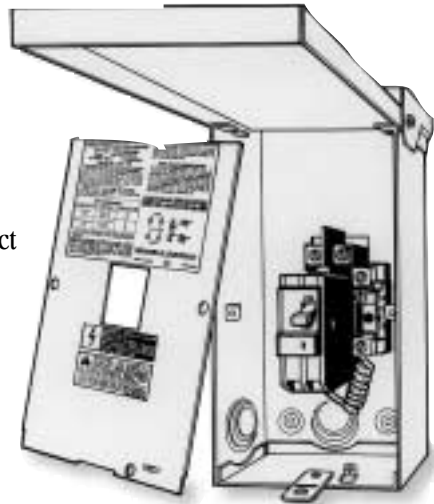


Wiring Check for G.F.C.I./Service Disconnect



Important

The National Electrical Code states that a service disconnect breaker box (a G.F.C.I. can be used for this purpose) must be located at least five feet away from the spa and should be conveniently located near the equipment bay. If it is not in plain sight, keep the disconnect padlocked when in the off position.



- From the neutral bar, locate the white load neutral, and the green ground wire.
- Be sure there are no other appliances on the spa circuit. If there are, service must be re-wired to supply the spa only.
- Make sure all four wires exit the house breaker box via conduit, routed to the G.F.C.I. breaker box. The black should be connected to the G.F.C.I. line-in 1. The red should be connected to the line-in 2. The white load neutral connects to the neutral bar. The green ground wire should be attached securely to the ground lug inside the G.F.C.I. box.

Precautions

Effective January 1994, G.F.C.I.'s are required for spa installations. Prior to that, G.F.C.I.'s had been recommended for spa installations, but were not mandatory.

If the spa you are servicing was not installed with a G.F.C.I., strongly urge your customer to improve safety and comply with current standards by installing one.

Note: A suitable G.F.C.I. may be acquired through your local distributor or Balboa Direct.



Important!

Remember, high voltage is still accessible in the house breaker box even though you have turned off the spa breaker.

G.F.C.I. Line-in Wiring Check

- Locate the proper circuit breaker and turn it off.
- Remove the cover from the house breaker box. Check the main service amperage rating to the breaker box.

Note: Typically, a house circuit will require at least a 100 Amp service when a spa is installed.

- From the circuit breaker, locate the red load wire and the black load wire.

G.F.C.I. Line-out Wiring Check for 240 V Dedicated System (3 wire system including ground wire)

The black wire should connect to load out 1, the red wire from load out 2, and the green ground wire should be attached securely to the ground lug inside the G.F.C.I. box. All wires will exit the box via conduit routed to the spa control system. The white pigtail should be connected to the G.F.C.I. neutral bar. All wires will exit the box via conduit routed to the spa control system. If the system does not operate a 120 V component (ozone, music equipment, etc.) then the white load neutral wire is not required.

G.F.C.I. Line-out Wiring Check for 120/240 V Convertible System (3/4 wire system including ground wire)

If the spa is equipped with a 120/240 V control system, an additional white load neutral wire must connect to the load neutral out. This wire runs with the others to the system box. Proper placement of this neutral wire is essential. If miswired, the G.F.C.I. will trip when a 120 V device is activated.

Once you have found all wiring correctly installed, begin to check for proper voltage.



Voltage Checks - Breaker Box/G.F.C.I.

When checking for proper voltage, please keep in mind that the acceptable voltage range is $\pm 10\%$ of the recommended voltage. Acceptable voltage when 120 V is specified as the desired voltage, is between 108 and 132 V. Acceptable voltage when 240 V is specified as the desired voltage, is between 216 and 264 V.

Important!

This service must be single phase. Any abnormal voltage reading requires an electrician. Do not attempt to fix problems yourself. High voltage can seriously injure or kill.

Breaker Box Voltage Check

- Set your multi-meter or voltmeter for AC Volts.
- Make sure the G.F.C.I. is off.
- Carefully turn on the spa circuit breaker.
- At the house breaker box, probe the spa circuit breaker between the black and red wires. Your meter should read 240 V.
- Probe the black wire and the green ground wire. You should see 120 V.
- Probe between the red wire and the green ground wire. You should also see 120 V.
- The voltage between the white load neutral and the green ground wire should be approximately 0 V.

G.F.C.I. Line-In Voltage Check

240 V Dedicated System:

- Be sure the spa circuit breaker (located in the house breaker box) is on.
- Make sure the G.F.C.I. is off.
- Probe the black and red wires. The meter should read 240 V.
- Probe the black wire and the green ground wire. The meter should read 120 V.
- Probe the red wire and the green ground wire. This should also read 120 V.
- Turn on the G.F.C.I. breaker before continuing to the system box.

Note: A white load neutral wire is not used in a 240 V dedicated system.

120/240 V Convertible System:

- Be sure the spa circuit breaker (located in the house breaker box) is on.
- Make sure the G.F.C.I. is off.
- Probe the black and red wires. The voltage should be 240 V.
- Probe the black wire and the white load neutral wire. The voltage should read 120 V.
- Probe the red wire and the white load neutral wire. The voltage should read 120 V.
- The voltage between the white load neutral and the G.F.C.I. box ground lug should read approximately 0 V.
- Turn on the G.F.C.I. breaker before continuing to the system box.



Voltage Checks - System Box

G.F.C.I. Load Out Voltage Check

240 V Dedicated System:

- Be sure the house breaker is on.
- Be sure the G.F.C.I. breaker is on.
- Probe the black and red wires at the G.F.C.I. load out 1 and 2. The voltage should be 240 V.
- Probe the black wire and the G.F.C.I. neutral bar. The meter should read 120 V.
- Probe the red wire and the G.F.C.I. neutral bar. The voltage should read 120 V.
- Probe the black load out wire and the box chassis ground lug. The voltage should read 120 V.
- Probe the red load out wire and the ground lug. The voltage should be 120 V.
- Recheck voltage under peak load conditions.*

120/240 V Convertible System:

- Be sure the G.F.C.I. breaker is on.
- Probe the black and red wires at G.F.C.I. load out 1 and 2. The voltage should be 240 V.
- Probe the black wire and the white load neutral wire. The meter should read 120 V.
- Probe the red wire and the white load neutral wire for 120 V.
- Probe the red load out wire and the box chassis ground lug. Your meter should read 120 V.
- Probe the black load out wire and the ground lug. The voltage should read 120 V.
- Recheck voltage under peak load conditions.*

Important!

If the voltage is not within the acceptable range, call an electrician or the local electric company to diagnose the problem.

System Box Check (at TB1)

240 V Dedicated System Check:

- Be sure the G.F.C.I. breaker is on.
- Probe the black and red wires. Look for 240 V.
- Probe the black wire and the green ground wire for 120 V.
- Probe the red wire and the green ground wire – also 120 V.
- Recheck voltage under peak load conditions.*

120/240 V Convertible System Check:

- Be sure the G.F.C.I. breaker is on.
- Begin the voltage check at TB1. Probe the black and red wires. Your meter should read 240 V.
- Probe the black and white wires. Look for 120 V.
- Probe the black wire and the green ground wire – also 120 V.
- Probe the red wire and the green ground wire – again 120 V.
- Probe the red wire and the white load neutral wire. This should read 120 V.
- Probe the white neutral wire and the green ground wire. This will show approximately 0 V.
- Recheck voltage under peak load conditions.*

*Peak Load Check

It is important to check the voltage again under **peak load conditions**. To reach peak load, turn on the blower, heater, light, and all pumps.

Peak Load Check for 240 V System:

- Check the voltage between the black and red wires. The acceptable voltage range is between 216 and 264 V.
- Probe the black wire and the white neutral wire. This voltage must be between 108 and 132 V.

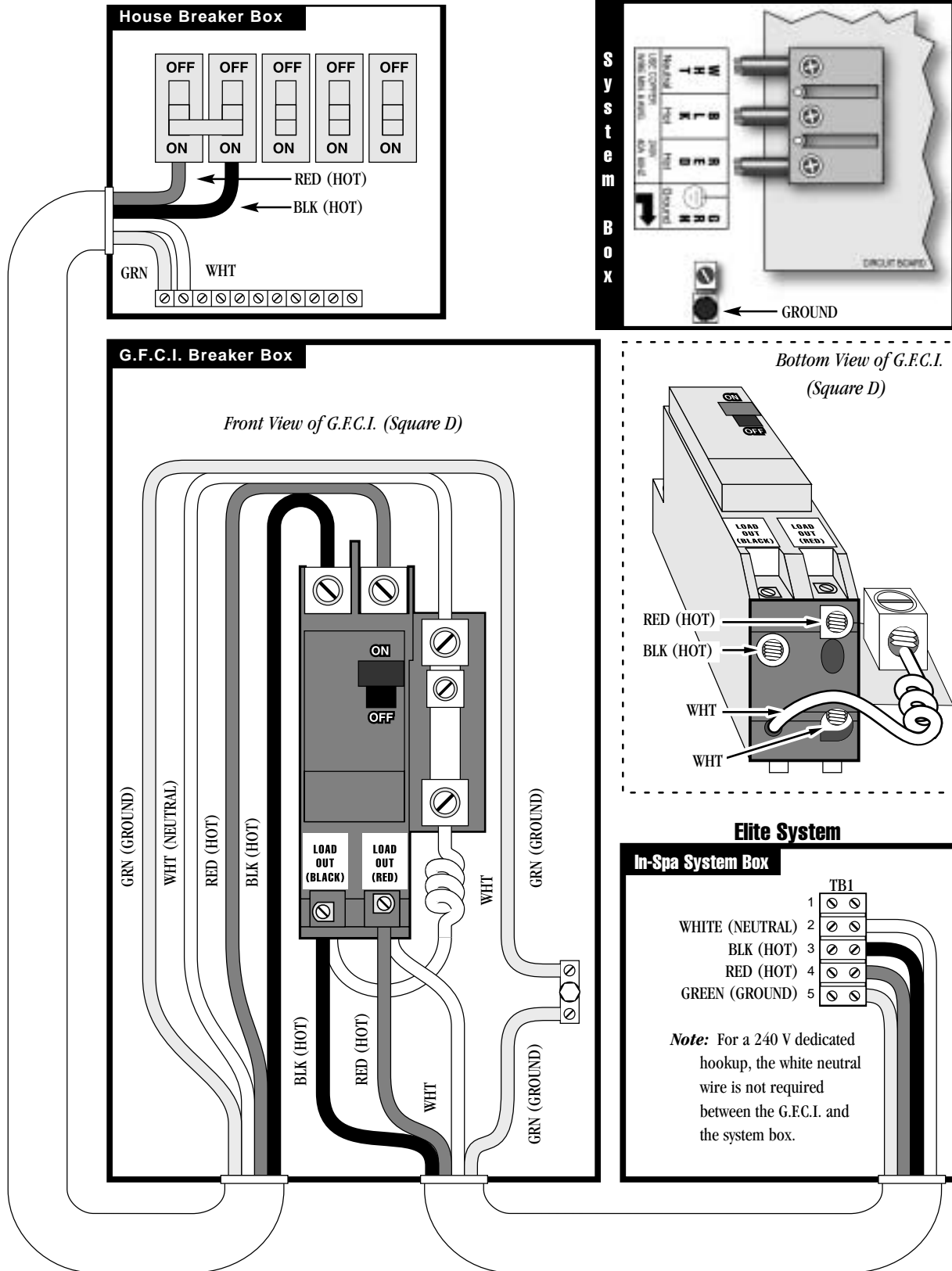
Peak Load Check for 120/240 V Convertible System:

- Check the voltage between the black and red wires. Acceptable range is between 216 and 264 V.
- Probe the black wire and the white load neutral wire. The voltage must be between 108 and 132 V.
- Probe the red wire and the white load neutral wire. The voltage must be between 108 and 132 V.



Wiring Schematic

SUV, Value M-7, 2000LE M-7, Prestige Systems



Basic Control System Troubleshooting

Low Voltage

At Balboa, it's been our experience that the majority of the problems associated with electronic control systems are due to low voltage.

Brown outs

“Brown outs” can have an effect on the spa's operation in a variety of ways. The control panel may go blank, have scrambled messages on the LCD, or only a few features will function.

- If the system is getting the proper voltage at TB1, but still does not operate, then test for a blown power input fuse. If the system you are troubleshooting is a Prestige, 2000LE M-7, Value M-7, or SUV System, the power input fuses snap directly to the circuit board.

Checking the System Power Input Fuse

Warning

These procedures are performed while the system is powered up and running under peak loads. **Be careful.**

SUV, Value M-7, 2000LE M-7, and Prestige Systems

If your system uses 120V peripheral devices:

- Measure between the white TB1 terminal and F5 power input fuse on the side farthest away from the circuit board edge (opposite the F5 silkscreen). You should see 120 volts.
- If the system is equipped with the additional F6 power input fuse, measure F6 in the same manner. You should also see 120 volts.

If your system uses 240V peripheral devices:

- Measure between the red TB1 terminal and F5 power input fuse on the side farthest away from the circuit board edge (opposite the F5 silkscreen). You should see 240 volts.
- If the system is equipped with the additional F6 power input fuse, measure F6 in the same manner. You should also see 240 volts.
- If you determine that there is no voltage at one or both locations, then the system power input fuse(s) need to be

replaced. Both F5 and F6 use a 25A time delay fuse. Only use a fuse of the same type and amp rating when you replace any of these fuses.

Elite System

- Measure fingers 5 and 6 of the circuit board. You should see either 120V or 240V, depending upon the system configuration.
- If you determine that there is no voltage at fingers 5 and 6, then the system power input fuse needs to be replaced. This fuse is located in the large fuse block inside the system box. This configuration utilizes a 30A time delay fuse.

Note For All Systems: In each situation, the most likely reason for the system power input fuse to blow is a pump problem. However, on occasion, a blower problem may also cause this fuse to blow if a 10A blower fuse is not built in.

Once the power input fuse has been changed:

- Probe the red wire and the white neutral wire. Again, voltage must be between 108 and 132 V.
- Check the voltage between the black and red wires again. Acceptable voltage range is between 216 and 264 V.

These readings should be taken under peak load conditions.

Important

If the voltage is not in the acceptable range, call an electrician or the local electric company to diagnose the problem.



Troubleshooting (cont.)

To Determine the Cause of a Blown Power

Input Fuse:

Perform the following **sequence of tests**:

Test the System:

- Turn the power off.
- Be sure to replace the system power input fuse with the same type.
- Unplug the blower and all pumps.
- Restore the power and verify system operation.
- If the fuse blows, then re-check the internal system wires and connector for burns, cracks or cuts in insulation.
- If the fuse does not blow, turn the power off and plug in the pump.

Note: Be sure to test each device individually.

Test the Pump:

- Restore the power and activate the pump.
- If the fuse blows, there is a pump problem.
- If the fuse does not blow, turn off the power.

Test the Blower:

- Plug in the blower.
- Power up the system and activate the blower.
- If the fuse blows, then there is a blower problem.
- If the fuse does not blow, the combined pump and blower amperage may be excessive. To verify this, first check with your spa manufacturer for amperage draw limits on each device.
- Since the blower should now be running, you can check the amperage draw with an ammeter by measuring around the black blower wire and compare with manufacturer's specifications.

Test the Amperage Draw:

- Turn off the power, disconnect the blower, make sure the pump is plugged in, and restore power.
- Start the pump and switch to high speed (if available), this should draw the most current.
- Make sure all jets and valves are open.
- Check the amperage at the red pump wire. Compare your reading with manufacturer specifications. (If the other plug-in devices exist, they should be tested in the same way.)
- If the amperage draw for each device is within manufacturer's specifications, the problem could be a nuisance spike in the pump, or water in the blower.



Note: These slow-blow fuses are not always discolored when blown. **Always test continuity of a fuse with an ohmmeter.**

Note: Miswiring of the spa is the most common reason for this fuse to blow. However, a lightning strike in the area is a possible, though less likely, cause of the failure.



Troubleshooting (cont.)

Test the Circuit Board Protection Fuse: SUV, Value M-7, 2000LE M-7, and Prestige Systems

If your system has a white neutral line coming in from either your service disconnect or GFCI installed into TB1:

- Probe from the white TB1 terminal and one side of the circuit board protection fuse. The voltage should read 120 volts.
- Probe from the white TB1 terminal and the other side of the circuit board protection fuse. The voltage should read 120 volts.

Elite System

- For a class 2 transformer circuit, UL requirements specify that a fuse must be permanently installed to protect the circuit board.
- If you have determined that the system is getting proper voltage through the power input fuse, then you must check to see if the circuit board protection fuse has blown.
- First, turn off the power. Next, unplug the transformer from the circuit board, then turn the power back on and probe from the red TB1 terminal to one side of the fuse.
- The voltage should read 120 V or 240 V depending on the system.
- Probe from finger 5 to the other side of the circuit board protection fuse. The voltage should read 120 V or 240 V depending on the system.
- If either side has 0 volts, then the fuse is blown. If so, turn off the power and replace the circuit board. (See page 26.)

Note: Another, less likely reason for the circuit board protection fuse to blow is that a 240 V transformer was replaced with a 120 V transformer by mistake.

- Make sure that the transformer is properly rated for the system. The voltage reading between fingers 5 and 6 on the circuit board will determine the proper transformer input voltage for Deluxe and Standard models.
- For a 120 V system, the transformer should have **two blue connectors**.
- A 240 V transformer should have **one blue connector**.
- If you determine that the circuit board protection fuse is not blown, this means that the transformer is receiving voltage.

Transformer Installation Requirement

*(Applies to **Elite and Prestige only**; other systems have the transformer as a permanent part of the circuit board.)*

Some symptoms of low voltage may be caused by the transformer.

When working on a 120 V Elite or Prestige system, double check to make sure the transformer has **two blue connectors**.

A 240 V transformer with **one blue connector** may be installed by mistake in a 120 V system causing low voltage.

Confirm Transformer Connections:

Intermittent problems may occur when transformer connections are loose. Make sure your fingers are away from exposed high voltage connections. Wiggle the transformer wires near the connector on the circuit board. This will determine if there is a loose transformer connection or bad pin on the circuit board.

- If the system intermittently turns on and off, turn the power off.
- Plug in the test transformer, restore the power, and wiggle the transformer wires again.
- If there is no intermittent failure, no further analysis is required.
- Turn off the power and replace the transformer.
- After installing your test transformer, intermittent symptoms may still occur during the test. If so, replace the circuit board (see page 26) and install the original transformer.



Important

Be sure to turn the power off before replacing any component, especially a circuit board.



Power-Up, Pump Priming and Software ID

Before applying voltage to the System, it is very important that you understand the sequence of events that occur when power is applied so that the pumps can be primed efficiently and faults created by no water flow can be prevented.

Please review the following procedures and power-up events before applying voltage to the System:

1. Check the voltage at the main power panel to be sure that you have the correct voltage for the System being used. Also, be sure that the voltage is within + or - 10% of the mean voltage. For 120V it should be between 108V and 132V. For 240V it should be between 216V and 264V.
2. Test and reset the GFCI. If it does not operate properly, do not apply voltage to the System until the problem has been corrected.
3. Fill the spa to its correct operating level. 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 heater during the filling process.
4. Vent air from the pump(s). Do this by loosening the union nuts on the discharge of all pumps. Allow a small amount of water and air to escape from the pump(s) and related plumbing. Retighten the union nuts.
5. Turn the power on at the main power panel. Depending on which top-side panel the System is configured for, the displays will go through specific sequences. During these sequences, you will need to prime the pump(s) as described in the following:

The following will occur:

- Display will show a series of numbers immediately following Power-Up. On M-7 software created or updated since May 2001, this will be a series of four numbers. **The first three numbers in combination are called the Software ID.** The three numbers in order are the Software Manufacturer ID, the Software Product Type ID, and the Software Version ID. Following the Software ID will be either 12 or 24, indicating the heater wattage the software is configured for. There are differences in freeze protection between units that display a Software Version ID of 00 (or that don't display a Software ID at all), versus units that display a Software Version ID of 01 or greater.

- Display will show "Pr" (or "Priming Mode" on Prestige Systems), indicating that the System is in a pump priming mode. During this mode the heater is disabled to allow the priming process to be completed without the possibility of energizing the heater under low flow or no flow conditions. Nothing comes on automatically, but the pump(s) can be energized by pushing all Jet buttons. This mode will automatically last for about 4 minutes or you can manually exit the priming mode after the pump(s) have primed. (Manually exiting the priming mode is described later in this text). Regardless of whether the priming mode is automatically terminated or you manually exit the priming mode, the system will automatically return to the normal heating and filtering mode at the end of the priming mode.
- **Pump Priming.** As soon as "Pr" is indicated on the top-side panel, push all Jet buttons to start the pumps. On models with a combined Jet button, push it until all pumps are on high speed. All pumps need to be running in the high speed mode to facilitate priming. 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 the power off at the main power panel and repeat the process of venting the air from the pump(s). (See step 4 on this page). After venting air from the pump(s) a second time, turn the power back on at the main power panel. This will initiate a new pump priming mode. Sometimes momentarily turning the pump off and on will help it to prime. Do not do this more than 5 times.

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 minute priming mode. Doing so may cause damage to the pump and cause the system to go into an overheat condition.

- After pump priming, push all Jet buttons to turn off the pump(s).
- Next, manually exit the priming mode by pushing either the "Warm" or "Cool" button (the "Temp" button on smaller panels). Note that if you do not manually exit the priming mode as described above, the priming mode will be automatically terminated after 4 minutes. Be sure that the pump(s) have been primed by this time.



Power-Up, Pump Priming and Software ID (cont.)

- After you have manually exited the priming mode or the system has automatically exited the priming mode, the top-side panel will momentarily display the set temperature and then dashes.

Note that the display is not showing the temperature yet. This is because the system requires approximately 2 minutes of water flowing through the heater to determine the water temperature.

- After 2 minutes of water flowing through the heater the temperature will be displayed. Push the “Warm” or “Temp” button to adjust the temperature to the desired setting. If the water temperature in the spa is less than the set temperature, the heat indicator will turn on signifying that the heater has been energized.
- When the System is in the “Standard” operational mode it will automatically heat the spa and maintain it at the set temperature. All user buttons will be functional. If a higher temperature is desired, simply push the “Warm” or “Temp” button until the desired temperature is displayed. (The maximum temperature setting is 104°F). Other energy-saving operation modes are selectable by pushing “Mode” (or mode button sequence).

6. After the System has been powered-up and the pumps have been primed, make a final voltage check at the System terminal block.

- Voltage Check
 1. Activate the low speed of the pump.
 2. Adjust the temperature to turn on the heater.
 3. Activate any other equipment that does not turn the heater off.
 4. Activate the light.
 5. Check the voltage.

The voltage for 120V systems should be 108-132 between line and neutral..

The voltage for 240V systems should be 216-264 between either line and 108-132 between either line and neutral.

Note:

If the voltage is not within tolerance while the System is operating as described above, turn off the power at the main power panel and correct the problem before continuing to operate the System.



Test Mode Operation

Selecting Test Mode and Analysis Display Mode

- The software is in test mode when J43 is on 2 pins on the Elite, or when DIP switch 1 is ON on all models that have a DIP switch at the edge of the circuit board.
- Test mode may be entered and exited (by changing the jumper or switch setting) at any time (no need to cycle power).
- The software goes into analysis display mode when in test mode and the light is on (at any intensity, if light is dimmable).

Note that on models where the light button is combined with the pump button, it is not possible to go into analysis display mode without the pump running.

Differences in the display when in test mode (but not in analysis display mode)

- In standard mode (circ or non-circ), temperature shimmers when not current.
- In economy mode (circ or non-circ), temperature shimmers when not current, and is always displayed with "E" instead of "F" or "C".
- In sleep mode (circ or non-circ), temperature shimmers when not current, and is always displayed with "P" instead of "F" or "C".

Differences in the display when in analysis display mode:

- On the Elite: Whether in standard, economy, or sleep mode (and circ or non-circ), temperature display alternates between displaying "temp" connector sensor temperature with "t" instead of "F" or "C" and "high limit" connector sensor temperature with "H" instead of "F" or "C". (These sensors are not actually serving different "temp" versus "high limit" functions; the labeling on the circuit board simply predates M7 nomenclature.)
- On all other models: Whether in standard, economy, or sleep mode (and circ or non-circ), temperature display alternates between displaying "A" connector sensor temperature with "A" instead of "F" or "C" and "b" connector sensor temperature with "b" instead of "F" or "C".

- Pressing Mode toggles pump/blower/light timeouts off (displays "toOF" or "tF") and back on (displays "toOn" or "tn"). When timeouts are off, ozone disabling on function button presses is suppressed (but not retroactively to function buttons pressed before timeouts were turned off; it's thus suggested that timeouts be turned off as the first action after powering up the spa). This setting is not saved upon power down. NOTE: Even though the main purpose of turning timeouts off is to disable timeouts on manual pump/blower/light turn ons – on some models, **leaving timeouts off can make a pump run "forever" once it's turned on automatically in certain situations. For this reason, it's imperative that the spa never be left in test mode for the user. And if you're unsure as to whether you turned timeouts off or not in test mode, it's safest to exit test mode and then cycle power on the spa.**

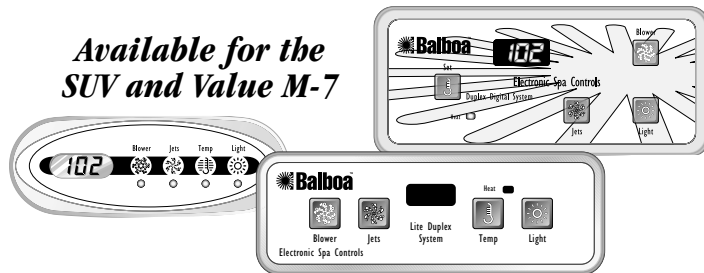
On panels which cannot display a letter such as F or C after the temperature:

In test mode, the character that would be shown to the right of the temperature (A, b, F, C, E, or P) is instead shown for a split second before the temperature it's for, with an equal sign (=) to the right of it. For example, instead of 105A alternating with 104b, you'll see A= followed quickly by 105 alternating with b= followed quickly by 104.

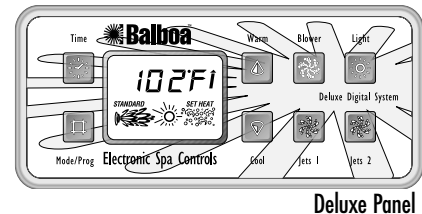


Topside Control Panels

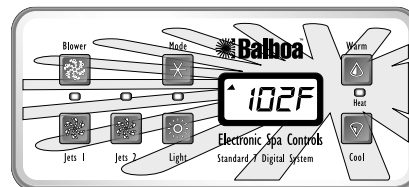
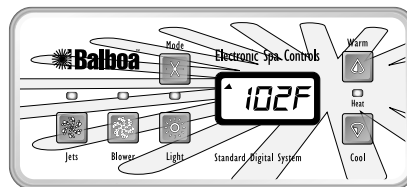
*Available for the
SUV and Value M-7*



Available for the Elite



Available for the Elite and 2000LE M-7



Preliminary Panel Check

- If the problem is not obvious, look on the topside control panel for diagnostic messages. If no messages are seen, run through all spa functions and note any inconsistent operation.
- If diagnostic messages appear on the topside control panel, see page 19 for troubleshooting tips.

Once you have determined that proper voltage is running through the circuit board and transformer, continue to the topside control panel. A panel that is not functioning properly may include the following symptoms: low voltage such as missing or scrambled segments, missing icons on the LCD, non-functional LED's, or nonfunctional buttons. If any of these symptoms are present, perform the following:

- Turn the power off and unplug the panel from the circuit board.
- Then, plug in your test panel and restore power. If everything functions normally, replace the topside panel.
- If you still see symptoms of low voltage, such as a sluggish, blank or partially blank panel, or if the display or the LED's do not function at all, turn the power off; reset the battery backup (if applicable); unplug the ozone generator (if equipped); then restore power to the system. If the problem persists, turn off the power and replace the circuit board.

Bulb Replacement

Another panel problem may be burned out backlighting bulbs. These bulbs can easily be replaced.

- With the power off, gently pry up the topside control panel with a screwdriver. Next, locate the gray bulb holes in the back of the panel. Use a screwdriver to twist the bulb approximately $\frac{1}{4}$ turn to remove and replace the bulb. (Needlenose pliers may also be useful.)

Remote Panel Troubleshooting

Remote panel applications need special consideration where the panels connect to the circuit board.

If You are Working on a Spa With a Remote Panel:

- Before replacing the circuit board or any panel, remove the gang connector from the system box and plug each panel into the circuit board directly and individually. Test all functions with each panel separately.

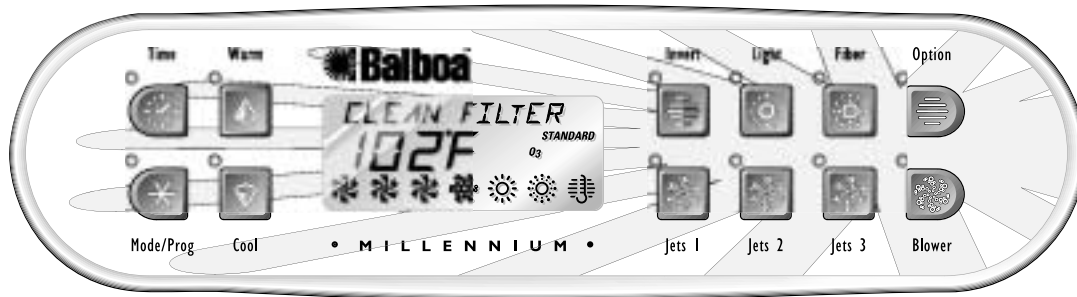
If a Remote Panel Doesn't Work:

- Remove the remote panel from its location.
- Be sure to secure the end of the panel cable.
- Plug the remote panel directly into the board. This removes the extension loom with its one-to-one connector from the circuit board and will help you determine whether you have one panel with a problem, a defective gang connector, a bad extension loom, a bad one-to-one connector, or a circuit board problem.



Topside Control Panels

Available for the Prestige



Preliminary Panel Check

- If the problem is not obvious, look on the topside control panel for diagnostic messages. If no messages are seen, run through all spa functions and note any inconsistent operation.
- If diagnostic messages appear on the topside control panel, see page 19 for troubleshooting tips.
- Most error messages are stored in the fault log. To view the fault log, the spa must be in test mode and the spa light must be turned on. (See page 22)

Once you have determined that proper voltage is running through the circuit board and transformer, continue to the topside control panel. A panel that is not functioning properly may include the following symptoms: low voltage such as missing or scrambled segments, missing icons on the LCD, non-functional LED's, or nonfunctional buttons. If any of these symptoms are present, perform the following:

- Turn the power off and unplug the panel from the circuit board.
- Then, plug in your test panel and restore power. If everything functions normally, replace the topside panel.
- Disconnect ozone generator (if applicable).
- If you still see symptoms of low voltage, such as a sluggish, blank or partially blank panel, or if the display or the LED's do not function at all, turn the power off; reset the battery backup (if applicable); unplug the ozone generator (if equipped); then restore power to the system. If the problem persists, turn off the power and replace the circuit board.
- Press "Warm" and "Cool" simultaneously to access the performance analysis mode. (See page 23)

Bulb Replacement

Another panel problem may be burned out back-lighting bulbs.

These bulbs can easily be replaced.

- With the power off, gently pry up the topside control panel with a screwdriver. Next, locate the gray bulb holes in the back of the panel. Use a screwdriver to twist the bulb approximately $\frac{1}{4}$ turn to remove and replace the bulb. (Needlenose pliers may also be useful.)

Remote Panel Troubleshooting

Remote panel applications need special consideration where the panels connect to the circuit board.

If You Are Working on a Spa With a Remote Panel:

- Before replacing the circuit board or any panel, plug each panel into the circuit board directly and individually. Test all functions with each panel separately.

If a Remote Panel Doesn't Work:

- Remove the remote panel from its location.
- Be sure to secure the end of the panel cable.
- Plug the remote panel directly into the board. This removes the extension loom with its one-to-one connector from the circuit board and will help you determine whether you have one panel with a problem, a defective gang connector, a bad extension loom, a bad one-to-one connector, or a circuit board problem.
- Gang connectors cannot be used on the first three jacks (i.e., on Millennium panel jacks).
- The first three jacks are functionally identical. Try the panel in another one of these jacks.
- The two aux panel jacks are functionally identical.
- If multiple panels work in one jack but not another jack (of the same set), the problem is most likely with the controller board.



Panel Messages

Panel messages are a quick clue toward solving a variety of problems. Here are the most common messages and what they mean:

The Panel Displays:

HH, QHH, or HTR TEMP LMT

(At least one of the sensors has detected water temperatures of 118°F inside the heater.)

or

The Panel Displays:

QH, QHS, or SPA TEMP LMT

(One of the sensors has detected the temperature of the water coming into the heater to be 110°F, and so the water in the spa is likely to be that hot.)

These indicate that the spa has shut down due to an overheat situation:

Note: Overheating may occur if the low-speed pump is set to operate for extended periods of time, or if the incorrect pump is installed. In rare cases (usually warmer climates), the circulation pump may also cause overheating.

The following is a list of most probable causes of this message. Inspect these first:

- Check slice or ball valves. Make sure that they are open.
- Make sure the correct pump is installed.
- Clean the filter/skimmer if there is any blockage.
- Check heater element alignment.
- Check for debris on the heater element.
- In extremely hot weather, check for proper cabinet ventilation.
- Make sure the temperature sensor is fully inserted into the sensor fitting on the heater.
- Check for excessive filter duration.

Note: A common programming mistake is overlapping filter times that may cause the spa to filter continuously.

- Check the water level.
- Check the water temperature with an accurate temperature thermometer. Remove the spa cover

and allow the water to cool to below 108° F. Adding cool water may be necessary. Touch any button to reset the system. If the water is still hotter than the set temperature, press the blower button (if applicable) to cool the spa.

If the Problem Recurs, test the Sensor Set. (See page 21)

The Panel Displays:

SA, SNA, SNH, or

SENSOR A
SERVICE REQ

or

The Panel Displays:

Sb, Snb, Snt, or

SENSOR B
SERVICE REQ

This indicates that the spa has shut down due to an open or faulty sensor:

If the problem recurs, test the sensor set. (See page 21)

Note: In rare cases, rapid system overheat causes sensor error messages. Be sure to rule out possible situations like no flow or no water.

The Panel Displays:

Sn, Sns, or SENSOR SYNC

This indicates that the sensors are out of balance.

If alternating with temperature, it may just be a temporary condition. If flashing by itself, spa is shut down.

If the panel also displays “Service Reqd,” spa is shut down.

If the spa shuts down due to this error, one (or both) of the sensors are probably reading several degrees off. If the problem recurs, test the sensor set. (See page 21)

The Panel Displays:

Ed, ELd, or COLI WATER

This indicates that a sensor detects a possible freeze condition.



Panel Messages (cont.)

This message does not appear on M-7 software showing a Software Version ID of 01 or greater.

This is a normal spa function; no further action is necessary.

When either sensor reads below 40° F, the system provides freeze protection. It automatically activates the pump (and the heater if necessary) to circulate the water and warm the plumbing. The equipment stays on until the sensors detect that the spa temperature has risen to within 15°F of the set temperature. The other pumps and the blower will purge for 30 seconds to 2 minutes at the end of the freeze condition. If pump 1 was turned on due to this reason alone, this message will appear for up to two minutes right after very cold water is detected.

Note: Internal freeze protection only functions when there is proper power running to the spa, and the control system is operational. Using an optional freeze sensor may be necessary in extreme climates to prevent plumbing damage, but will only work properly if placed inside the spa skirt in the coldest area.

All spa models are different in shape and size and have different thermal characteristics; therefore, Balboa Instruments, Inc. cannot be held responsible for freeze damage to the spa's plumbing. Testing is the responsibility of the spa manufacturer and must be done to determine the best location for the freeze sensor.

The Panel Displays:

IC, ICE, or FREEZE COND

This indicates that the auxiliary sensor detects a possible freeze condition.

This is a normal spa function; no further action is necessary.

When the auxiliary sensor reads around 40°F (actual temperature dependent on specific auxiliary sensor used), the system provides freeze protection. It automatically activates all of the pumps and the blower to circulate water and warm the plumbing.

Note: This auxiliary freeze protection functions at all times, even when another fault condition has occurred and has otherwise shut the spa down.

This message can also indicate "simplified" sensor freeze protection in progress (on M-7 software showing a Software Version ID of 01 or greater), which behaves as follows:

Any time the lower of the two temperature sensors goes below 45°F, all pumps/blowers turn on. They continue to run for 4 minutes after the temperature reaches 45°F or above. As soon as the temperature falls below 45°F again, this process restarts. This "simplified" sensor freeze protection functions at all times, even when another fault condition (other than total sensor failure) has occurred and has otherwise shut the spa down.

The Panel Displays:

, or

This indicates that a substantial difference in temperature between sensors has been detected during heating.

This could indicate a flow problem. Check water level in spa. Refill, if necessary. If the water level is okay, make sure the pumps have been primed.

On the fifth occurrence of the above message the panel will display:

, or

This indicates a persistent flow problem

The heater is shut down while all other spa functions continue to run normally. Power on the spa must be cycled before the heater will function again.

The Panel Displays:

, or

This indicates that there is not enough water in the heater. Spa shuts down for 15 minutes.

This could indicate poor flow or air bubbles in the heater. *On the third consecutive occurrence of the above message (without a successful heating cycle in between) the panel will display:*

, or

Spa is shut down and will not reset in 15 minutes. Press any button to reset manually.

