

**SPA BUILDERS'**

**LX-10**

**STANDARD**

**TROUBLESHOOTING APPROACH**

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# CONTROL PANEL FUNCTIONS

## DEFAULT DISPLAY

The default display is the actual water temperature. While the actual water temperature is being displayed, pressing **WARMER** or **COOLER** once, displays the set temperature, pressing it again within three seconds will cause the desired temperature to increase or decrease by one degree. Three seconds after the desired temperature is set, the display defaults to the actual water temperature. This temperature set point can be adjusted from 65°F to 104°F. In conjunction with setting the temperature, these two buttons are used in changing the filter cycles (see "Changing the Filter Cycles" section.)

**JETS:** First press - low speed pump  
Second press - high speed pump  
Third press - pump off  
(Jets time out - 20 minutes, unless filter cycle is on)

**LIGHT:** First press - spa light on  
Second press - spa light off  
(light time out - 1 hour)

## ECONOMY AND STANDARD MODES

Economy and Standard modes are mutually exclusive, one or the other will always be active.

**ECONOMY MODE:** the heater turns on automatically only during filter cycles.

**STANDARD MODE:** Spa maintains the water temperature at the set temperature. Low speed pump and heater come on automatically as needed to keep water temperature within three degrees of the set temperature. When the set temperature is reached, the heater will turn off followed by the low speed pump turning off thirty seconds later. The filter cycles will proceed as programmed with the heater being activated automatically.

LX-05 / LX-10 / LX-15 REV 8.01 / 1.31 / 5.31 PCB JUMPER SETTINGS

### LX-05 JP 1 JUMPER BLOCK

1-2 CENTI GRADE ON / FAHRENHEIT OFF  
3-4 PRESSURE SWITCH ON / WATER LEVEL SENSOR OFF  
5-6 1 SPEED PUMP ON / 2 SPEED PUMP OFF

### LX-10 JP 1 JUMPER BLOCK

1-2 110V 15A LOGIC ON / 220V 40A LOGIC OFF  
3-4 CENTI GRADE ON / FAHRENHEIT OFF

### LX-15 JP 1 JUMPER BLOCK

1-2 110V 20A LOGIC ON / 220V 50A LOGIC OFF  
3-4 TWO PUMPS ON / ONE PUMP OFF  
5-6 TWO SPEED BOOSTER ON / ONE SPEED OFF  
USED IN CONJUNCTION W JUMPER 3-4  
7-8 CENTI GRADE ON / FAHRENHEIT OFF

ON = JUMPER NEEDS TO BE THERE

**OFF = NO JUMPER REQUI RED**

# CHANGING THE FILTER CYCLES

The LX-10 comes with six pre-programmed filtration cycles and two **lockout** modes. Of the six filter cycles, three cycles are in the standard mode and three cycles are in the economy mode. The initial filter cycle will start two minutes after power up.

To change the filter cycles, press and hold “WARMER” and “COOLER” buttons for 3 seconds. This will get you into the filter cycle programming mode. Use the “WARMER” and “COOLER” buttons to scroll from F1 to L2. This numeric value coincides with a specific filter cycle that is to be used for filtration.

## FILTER CYCLES

### STANDARD MODE

- F1** 2 hours of filtration every 12 hours
- F2** 2 hours of filtration every 8 hours
- F3** 2 hours of filtration every 6 hours

### ECONOMY MODE

- F4** 2 hours of filtration every 12 hours
- F5** 2 hours of filtration every 8 hours
- F6** 2 hours of filtration every 6 hours

- L1** SYSTEM LOCKOUT -special feature used when cleaning or changing the filter cartridge or any type of non-electrical servicing that requires the spa's pump/s and air blower operation to be suspended while the work is completed. The temperature readout flashes in this function.  
NOTE: If the control is heating when the system is put into the lockout mode, the heater will immediately turn off and the pump will cycle water for thirty seconds, then turn off. This will assist in cooling the heater element.
- L2** PANEL LOCKOUT – special feature to prevent unauthorized use of your spa. The LX-10 incorporates a unique panel locking system which disables the controls on the panel. The temperature readout flashes in this function.  
NOTE: In this mode the system will operate as in the filter cycle **F1**.

# NOTHING WORKS

Something to remember: When a system fails, there is probably one, and only one problem. When nothing works, verify power to the spa by observing the control panel. The control panel display will always be displaying something as long as there is power to the spa. The display panel can display one problem condition which will de-activate the spa ("---".)

### STANDARD TROUBLESHOOTING APPROACH

1. Check for proper voltage to the spa (ref #A, 220Vac.)
2. Is the display showing "---" error?
3. Check all fuses for continuity (out of circuit.)
4. Check the voltage at the secondary side of the transformer (J4, Yellow-yellow) (ref #C)(12.4Vac.) If there is no voltage and the fuses are good, replace the transformer.
5. Replace control panel.
6. Replace circuit board.

# USING THE CONTROL PANEL FOR TROUBLESHOOTING

The spa's control system constantly monitors the temperature sensors for proper operation. The LX-10 system is a self-diagnostic control system. The system will automatically display a numeric symbol of FL1 to --- if a problem is detected

**SN1 Non-functional high temperature sensor**

Ensure the sensor plug is making contact. Check resistance value of the sensor. This must be repaired or replaced by the dealer or qualified service technician.

**SN2 Non-functional temperature sensor**

Ensure the sensor plug is making contact. Check resistance value of the sensor. This must be repaired or replaced by the dealer or qualified service technician.

**FL1 Water flow problem**

Ensure the pump is on. Pressure switch is not closed when the pump is activated. Heater is deactivated. Proper flow of water is inhibited or pressure switch has malfunctioned. Check for proper water level, pump is primed and/or clogged filter. Pressure switch may need to be adjusted. Contact dealer or qualified service technician.

**FL2 Pressure switch problem**

Ensure the pump is off. Pressure switch is closed, while pump is deactivated. Pressure switch may need to be adjusted. Contact dealer or qualified service technician.

**COL Cool condition**

If the water temperature drops 20°F (11°C) below the set temperature, the low speed pump and the heater will activate to bring the temperature within 15°F (8°C) of the set temperature. No corrective action is required.

Note: Cool condition can only exist in the economy mode.

**ICE Freeze condition**

A potential freeze condition has been detected (55°F)(12.8°C.) No action is required. The low speed of the pump will be activated along with the heater. The spa will automatically heat, until the spa is out of danger (65°F.)

**OH High temperature condition**

Spa water temperature is above acceptable limits, do not enter spa water. Water temperature has reached 110°F (43.3°C.) The low speed pump is activated to assist in lowering the water temperature.

**--- Watchdog**

Water temperature has reached 118°F (48°C). The entire system is disabled. Contact dealer or qualified service technician.

## **PRELIMINARY SET-UP AND OBSERVATIONS**

### **"FIRST STEPS"**

1. Look at the control panel's LCD for any flashing messages: SN1, SN2, FL1, FL2, COL, ICE, OH or ---
2. Put the control in the Standard mode. Set the temperature (3°F) higher than the present water temperature to force a call for heat signal. If spa goes into standard mode and the temperature was able to be set higher, go to 4.
3. If control panel does not seem to work and voltage to the spa is o.k., turn the spa off and connect a spare panel. If the spare panel works, replace the defective panel. If the spare panel does not work, replace the circuit board.
4. If no messages flash, go to step 5. If a message flashes, turn off the spa at the house breaker and install a replacement sensor set. Turn on the spa. Return to the standard mode, set the temperature higher than the present water temperature to force a call for heat signal and manually bypass the pressure switch connection. If no messages flash at this time, whichever icon that has turned off insinuates which component is faulty.
5. If no messages flash, it appears that the panel and the circuit board can communicate, at least on some level. Gather voltage and temperature data and thoroughly check each of the spa's function for proper operation:
  - a. Be sure spa is out of the filter cycle by manually turning it off, using the "JETS" button.
  - b. Put spa in the standard mode (Filter cycle F1) and set the temperature (3°F) higher than the present water temperature to force a call for heat signal.
  - c. Observe: Pump turns on at low speed, ozone turns on (if applicable) and the HEATER ON icon comes on ten seconds following the pump.
  - d. If control panel does not seem to work and voltage to the spa is o.k., turn power off to the spa, and connect a spare panel. If the spare panel works, replace the defective panel. If the spare panel does not work, replace the circuit board.
  - e. Check all other spa functions from the panel.

## **NO HEAT OR NOT ENOUGH HEAT**

Go through "First Steps". Any heat problems should show up in a thorough check out of the spa functions. The most common are described below.

### **PUMP TURNING & PANEL INDICATES HEAT, BUT THERE IS NO HEAT**

1. If you have not, go through "**First Steps.**"
2. Be sure the spa is in the Standard Mode and the temperature is set high enough to make a heat call.
3. Check for voltage at heater relay load terminals (k7-com terminal to k6-com terminal) (ref #D, 220Vac.) If no voltage, replace the circuit board.
4. Check for voltage at Hi-limit snap switch(k7-com terminal to load terminal at hi-limit snap switch) (ref #E, 220Vac.) If no voltage, replace the Hi-limit snap switch.
5. Check for voltage at heater (ref #F, 220Vac.) If no voltage, replace heater wires.
6. Check for current through heater using a clamp-on ammeter. If no current, replace heater element.

### **PUMP TURNING, NO HEATER INDICATOR**

1. If you have not, go through "**First Steps.**"
2. Be sure the spa is in the standard mode, and the temperature is set high enough to make a heat call.
3. No HEATER ON icon indicated, turn power to spa off. Check all connections to the circuit board. Turn the power on.
4. Connections o.k. but there is still a problem, replace the circuit board.

## **PUMP NOT TURNING AND NO HEAT INDICATIONS**

1. If you have not, go through "**First Steps.**"
2. Check voltage to the spa.
3. Be sure the spa is in the standard mode and the temperature is set high enough to make a heat call.
4. Check for supply voltage between white and black wires at the pump receptacle.
5. If no voltage, plug in spare panel. If the spare panel works replace the panel.  
If it does not work, replace the circuit board.

## **INTERMITTENT HEATING**

As with all intermittent problems, routine measurements and icon indicators are not trustworthy. The following procedure will eliminate the most probable causes. It is important to explain to the customer how difficult intermittent problems are to locate. You will be doing a series of things to eliminate the problem. Ask the customer to be patient and please cooperate by calling you back and informing you of the status of the spa until the problem is eliminated. It might be a good idea to review this Standard Troubleshooting Approach(STA) with the customer. It will help him or her to understand why it might take several call-backs to complete the repair.

Suspects: circuit board, temperature sensor, control panel, wiring connections, and partial water flow obstructions.

### **STANDARD TROUBLESHOOTING APPROACH**

1. Check crimped connections to heater element. If burned, replace wires. Be sure connections are good at the circuit board.
2. Check "heater load" (k7-com terminal to k6-com terminal) (ref #D, 220Vac.) terminals at the circuit board. If possible, clean and renew the connections. If relay is physically burned at the terminals, replace the circuit board.
3. Check the pressure switch for proper and consistent mechanical operation. Cycle the low speed pump on and off six times. Did the -03 icon ever activate?

NOTE:: Cycling the pump on and off in too short of a time will cause the motor to overheat tripping the thermal overload.

The overload will eventually reset but it takes awhile. Best way to prevent thermal overload is to let the pump run for a few minutes every four or five on/off cycles. A running motor cools down quickly because of air flow.

4. Check for a partial water flow obstruction by unscrewing the pressure switch. Cycle the low speed pump on momentarily and observe the water flow out the heater manifold. It should be a straight, steady stream. If it is not, clear the obstruction. If water flow is o.k. but the pressure switch action was not o.k. (in step 3,) replace the pressure switch.
5. If all of the above items check out, ask the customer if error message FL1 was ever posted. If posted, replace the temperature sensor.
6. Tell the customer what you have done.
7. If the customer calls back, replace the circuit board.
8. If the customer calls back, replace the control panel.
9. If the customer calls back with the same problem call Spa Builder's technical support department.



## NO JETS

This is a condition of zero water pressure. The first step in diagnosing the problem is to determine if the pump is turning or not. Once this determination is made, follow the appropriate portion of the Standard Trouble Approach.

### STANDARD TROUBLESHOOTING APPROACH

(Pump **is not** running)

1. Try to turn on the jets from the control panel. If the jets icon comes on, the panel is good (go to step 4.) If the icon does not come on (go to step 2.)
2. If the indicator does not come on, observe the pump relay on the circuit board. If it clicks when you try to activate the JETS button from the panel, the display or icon on the panel is bad. Replace panel. (NOTE: The panel icon may have been bad for a long time, but the customer may not have noticed. Replacing the control panel, may not fix your problem.)  
If the relay does not click, go to step 3.
3. If the relay does not click when you try to activate the jets from the panel, the panel or the circuit board is bad. To determine whether the panel or the circuit board is bad, plug in a spare control panel. If the pump operates, the panel is bad. If the pump does not operate, the circuit board is bad. Replace whichever is bad. This should fix the "No Jets" problem.
4. You should be entering this step from step 1. The control panel is o.k., you have tried to turn on the jets, and the icon is active. Measure the voltage at the pump receptacle (White-black for low speed, white-red for high speed.) If there is no voltage, replace the circuit board. If voltage is o.k., replace the pump.

### STANDARD TROUBLESHOOTING APPROACH

(Pump **is** running)

Check for a flow problem.

1. Make sure valves are open.
2. Check for a clogged filter.
3. Check for obstructions in the plumbing line.

## PUMP RUNS AND QUILTS DURING JET OPERATION

This is usually a problem of the pump overheating. The pump motor incorporates a thermal overload which trips when the motor gets too hot. There is no reset for the thermal overload. When the motor cools, the thermal overload resets automatically. In some cases, a faulty circuit board can also cause this problem. NOTE: pump has a 20 minute time out.

### STANDARD TROUBLESHOOTING APPROACH

(Circuit board check)

1. Run the pump at low speed by pressing the JETS button and listen to the motor. If it hums when it goes into high speed, it is possible that the low speed relay is arced closed. Check voltage at the pump receptacle (ensure power is only going to the low speed circuit by checking voltage at the pump receptacle from black wire to white wire for low speed, then check voltage between red wire to white wire for high speed.) If voltage to both circuits simultaneously, replace the circuit board.
2. If the motor makes a "laboring" sound and never quite goes into high speed, check the voltage at the pump receptacle from red wire to white wire. If the voltage is too low, or the points are bad, correct the problem.
3. If the jets and pump operate normally, then quit after running for a while, check the voltage to the pump at the pump receptacle, **after the pump quits**. If there is no voltage replace the circuit board.
4. If the voltage to the pump, **after the pump quits**, is o.k., the problem is most likely to be a thermal overload.

(Troubleshooting a thermal overload)

1. Be sure voltage to the spa is correct. Too much of a voltage drop causes the motor to pull too much current and it overheats. This voltage situation must be corrected.
2. If the voltage and the current are o.k., examine the environment in which the spa is installed. Hot weather and lack of breeze can cause heat to build up in the equipment bay and become added to the normal heat produced by the pump. This can raise the temperature high enough to cause the thermal overload to trip. There are two possible solutions to thermal overload problems which are **not** due to low line voltage. One is to change the filter cycle period so that it does not coincide with the hottest time of the day. The other is to ventilate the equipment bay.
3. If there seems to be no overheating problem, yet the motor keeps cutting out, the thermal overload in the motor may be bad. In this case, the motor should be replaced.

## **WEAK OR SURGING JETS**

Weak or surging jets are always caused by insufficient water supply to the pump. The water level may simply be too low (usually the reason), or there may be some obstruction in the water flow path before the pump or trapped in the impeller. A "weak" condition is caused by a lack of water flow into the pump which is not great enough to cause the pump to cavitate (run dry.) A "surging" condition is caused by a lack of water flow which is great enough to cause the pump to alternately pump itself dry, fill with water, pump itself dry, etc. The cycle repeats itself every two or three seconds and this phenomenon is audible.

### **STANDARD TROUBLESHOOTING APPROACH**

1. Check for proper water level. Adjust level.
2. Check for a clogged or dirty filter. Clean or replace filter.
3. Check for a filter installation problem below the water level. Correct the problem.
4. Check for a loose foreign object between the filter and the pump intake or trapped in the impeller. Remove such item.

## **PUMP HUMS AND WILL NOT START**

If the pump impeller is not seized, this is almost always a bad start capacitor or failing starter switch, which are inside the motor. (NOTE: The pump motors use their starter switch to start in low speed and use their start capacitors to start in high speed.)

### **STANDARD TROUBLESHOOTING APPROACH**

1. Press the JETS button. Check for voltage at pump receptacle between both the low and high speed. (White-black for low speed and white-red for high speed.) If there is no voltage, replace the circuit board. If the voltage is o.k., replace the pump.
2. If the voltage is present to both low and high simultaneous, replace the circuit board.
3. If the voltage is present only to low, when in low or present in high speed, when in high, repair or replace the pump.

## **HOUSE BREAKER TRIPS**

If the house breaker trips, check the spa current draw. If the current draw is within the range of the house breaker rating, the house breaker or wiring is defective and must be repaired or replaced. If the current draw from the spa is high, individual current checks to the spa devices must be made to determine which is pulling excessive current. Replace or repair the device which is drawing excessive current.

## TESTING THE PRESSURE SWITCH

When the "FL1" error message appears, it means the pressure switch failed to close its contacts when pump was turned on. A "FL2" error message appears when the pressure switch failed to open its contacts when pump was turned off. This could be caused by an obstruction in the water flow line as well as a faulty switch. The first thing to look for is an obvious obstruction, remembering, that while not likely, it is possible for a small object to work its way into the plumbing where it will not be obvious. After being certain that no obvious blockage exists, the pressure switch can be tested.

An installed pressure switch may be tested with an ohmmeter or continuity checker.

1. Disconnect the wiring at the switch and put an ohmmeter or continuity checker across the terminals on the pressure switch. With the pump off, the reading should be infinity ohms or no continuity.
2. Keeping an eye on the ohmmeter, press the "JETS" button. Very shortly after the pump comes on, the reading should read zero ohms or continuity. This proves the switch is working properly. (NOTE: since the switch is disconnected, the logic will think it has not closed the pressure switch, and will post the "FL1" error message and deactivate heater.)

## TESTING THE SENSORS

The sensors can be tested by taking the resistance reading. As the temperature of the water increases, the resistance value of the sensor decreases.

<u>DEGREES F</u>	<u>RESISTANCE</u>	<u>DEGREES F</u>	<u>RESISTANCE</u>
59.0	48840	60.8	46680
62.6	44610	64.4	42630
66.2	40770	68.0	39000
69.8	37290	71.6	35700
73.4	34170	75.2	32700
77.0	30000	78.8	28740
80.6	27540	82.4	26400
84.2	25311	86.0	24270
87.8	23280	89.6	22329
91.4	21429	93.2	20571
95.0	19740	96.8	18960
98.6	18210	100.4	17490
102.2	16800	104.0	16149
105.8	15519	107.6	14919
109.4	14349	111.2	13800

## TIPS FOR REPLACING CIRCUIT BOARDS

Connections to the circuit board are made with push-on type connectors. When removing and replacing these connectors, be sure they fit tightly and are all the way onto their terminals. You may find a small pair of needlenose pliers handy for straightening and tightening a removed connectors. Loose and improperly seated connectors will cause overheating at the terminal. Wiring and relays may be damaged if connectors are loose and will result in call backs and circuit board replacements.