Irrigation Troubleshooting

TABLE OF CONTENTS

LANDSCAPE WATERING SYSTEMS LIMITED

Bratch Lane Ÿ Dinton Ÿ Salisbury Ÿ Wiltshire Ÿ SP3 5EB Ÿ Telephone: 0845 230 9697 Ÿ Fax: 0845 230 9698
enquiries@lws.uk.com Ÿ **www.lws.uk.com**

Registered in England No. 3480689

INTRODUCTION

The following pages are a compilation of class information from the Rain Bird ASC seminar "Troubleshooting an Irrigation System." Its purpose is to serve as a reference manual for troubleshooting problems. We hope that you keep this manual and refer to it when needed.

Remember, you don't have to know the answer, you just need to know where to look for the answer. Additional information has been added by the LWS team.

1. SPRAY HEADS

Spray heads are relatively simple to troubleshoot, below are the most common problems found with spray heads.

Misting

This is a result of excessive water pressure. Reducing the pressure may be done in one of two ways.

1. Using the flow control on the remote control valve, or
2. Installing a pressure regulator before or on the valve

Inaccurate pattern

This is usually caused by some type of blockage, either in the nozzle itself or in the screen. Only water, air or a soft bristled object should be used to clean the nozzle and water to clean the screen.

Leaking around the stem (also known as "blow by")

This is usually caused by debris between the wiper seal and stem. A quick way to solve this problem is to step down lightly on the stem while the sprinkler is in operation. This causes water to flush quickly between the stem and cap, taking the debris with it. If this doesn't work, the cap is probably damaged and needs to be replaced.

Sprinkler not popping up or down correctly

This can be caused by debris between the wiper seal and stem. Other causes can be lack of flow or pressure caused by incorrect nozzle selection (nozzle choice too large hence insufficient flow) or a leak.

Problems may be experienced when using 1812SAM or 1806SAM and connecting to side inlet, therefore only connect to bottom inlet when using sprays fitted with SAMS.

2. CLOSE CASE ROTORS

The 3504 & 5004 series are Rain Bird's short to mid range gear drive rotors. They are designed to operate in the 2-4 BAR range and cover a radius of 4.6 to 15.2 metres.

Installing and Removing Nozzles

1. Insert tool into pull-up slot, turn 90 degrees, and lift up stem
2. Insert the desired nozzle into the nozzle socket, and turn the radius adjustment screw clockwise to secure the nozzle in place.
3. Insert the selected nozzle's identification plug into the opening on the top of the rotor (5000 only)
4. To remove the nozzle, back out the radius adjustment screw, place the blade of the screwdriver under the nozzle removal tab and press the handle down.

LANDSCAPE WATERING SYSTEMS LIMITED

Bratch Lane Ÿ Dinton Ÿ Salisbury Ÿ Wiltshire Ÿ SP3 5EB Ÿ Telephone: 0845 230 9697 Ÿ Fax: 0845 230 9698
enquiries@lws.uk.com Ÿ **www.lws.uk.com**

Arc adjustment and to align fixed LEFT edge:

1. Pull up turret and turn to the left trip point (counter clockwise). **CAUTION:** If the rotor does not turn easily to the left, first turn it right (clockwise) to the right trip point.
2. Rotate entire case to the desired fixed left position, OR unscrew cap and pull out assembly, rotate internals to re-align left trip point to the desired point and re-install.

To increase or decrease the arc:

1. While holding the nozzle turret at the fixed LEFT stop, insert tool or screwdriver into the adjustment socket.

2a. Turn the screwdriver clockwise (+) to INCREASE arc.

2b. Turn the screwdriver counter clockwise (-) to DECREASE arc.

3. Each full clockwise turn of the screwdriver will add or remove 90 degrees of arc.
4. When the maximum arc of 360 degrees or minimum arc of 40 degrees has been set you will hear a ratcheting noise. Do not adjust the rotor beyond the maximum or minimum arc.

Radius Adjustment (Radius can be reduced up to 25%)

1. Insert screwdriver into the radius adjustment socket (stainless steel screw)
2. Turn the screwdriver clockwise to reduce radius, and counter clockwise to increase radius.

Troubleshooting

Sprinkler not popping up or down correctly

This can be caused by debris between the wiper seal and stem. Other causes can be lack of flow or pressure caused by incorrect nozzle selection (nozzle choice too large hence insufficient flow) or a leak in the system.

Sprinkler not rotating

Remove internals from sprinkler body and check that debris has not entered the base of the sprinkler. Reset the fixed left edge and reset the arc adjustment.

Sprinkler not registering arc adjustment

Reset fixed left edge and ensure when using screwdriver in adjustment socket that you are holding the nozzle turret at the fixed left edge position. The unit will not retain the adjustment made if the turret is allowed to move or in any other position. When undertaking the adjustment, the motion of the screwdriver should feel smooth.

Excessive water and puddling around sprinklers at low points

If SAM valves are fitted (these prevent low head drainage of up to 2.1m elevation) check that debris is not preventing the stem from retracting fully to close the SAM. Also check for general leakage or if an automatic drain valve is fitted to the base of the sprinkler that it has not failed. If the system is supplied via a water storage tank and booster pump check that water is not siphoning from the tank to the lowest point. This is more common on non pressurized systems. On pressurized system a very small amount of seepage through a solenoid valve can cause a similar problem.

3. REMOTE CONTROL SOLENOID VALVES

The valves covered in this section will be electrically operated remote control valves. All remote control valves can be separated into two different types. The difference between the two is how the water enters the upper chamber. The upper chamber is the area between the cover and the top side of the diaphragm. Once the water has entered the upper chamber there are only two paths for it to escape: the manual bleed or the solenoid exhaust port.

Forward Flow

The water enters the upper chamber through a port in the centre of the diaphragm. This port will normally be filtered, be sure that the filter is kept clean.

Reverse Flow

The water can enter the upper chamber in several ways. Through an external tube that runs from the pressure side to the upper chamber, through holes in the outer edge of the diaphragm, or through ports machined in the valve body.

Operation

A common misconception is that a valve stays closed because of a higher pressure above the diaphragm (the upper chamber). If there is, for example, 100 psi of static water pressure in the mainline, how can there be more than 100 psi above the diaphragm? Without a pump installed at each valve, this situation would be impossible. The valve will stay closed because the surface area above the diaphragm is roughly 2 1/2 times larger than the pressurized surface area below the diaphragm. This difference causes a greater *force* above the diaphragm than there is below the diaphragm. *Force equals Pressure times Area* (Force = P x A). Water enters the valve on the pressure side (usually the side opposite the solenoid). The water will then enter and fill the upper chamber through the path detailed in the preceding section. When operating properly, this water is trapped in the upper chamber. The valve will only open once the force above the diaphragm has been relieved. This can happen in either of two ways, the solenoid has been energized by the controller, or the manual bleed has been activated.

Common Problems

Before assuming that there is a valve problem, check the obvious. Is the water or pump turned on, is the controller plugged in and programmed correctly, are there any isolation valves that might be turned off? Verify valve operation by using the manual bleed. This might indicate a controller or wiring problem if the valve works properly when using the manual bleed.

Valve will not close

There are two things that will cause this. The first cause is a physical obstruction (rocks or other debris) preventing the diaphragm from seating. When removing a physical obstruction, be sure to thoroughly inspect the diaphragm assembly and valve seat area for damage. The second reason is insufficient force being developed above the diaphragm. Insufficient force above the diaphragm can be caused by several things.

1. The plunger is missing or stuck in the up position. Remove and inspect the solenoid.
2. Diaphragm filter plugged. This will prevent water from entering the upper chamber.
3. Flow control turned up too high. The diaphragm can stick in the up position under low flow/low pressure conditions.
4. Constant voltage from the controller, the solenoid will usually be warm to the touch and a slight vibration can be felt if this is happening.
5. Leak between the bonnet and body, water will be visibly leaking where the body and bonnet are connected. This will again prevent sufficient force from developing in the upper chamber.
6. Open manual bleed, this is normally very obvious due to the amount of water present. An internal manual bleed system can be unknowingly activated if the valve is unfamiliar to the customer.
7. A large hole in the diaphragm. (forward flow valve only). Sufficient force will not build up in the upper chamber. Remove the diaphragm assembly and inspect it very carefully, replace it if there are any bubbles or other signs of wear.
8. The valve is installed backwards. The valve is now an expensive coupling. The arrows on the valve body indicate the direction of water flow through the valve.

Valve seeping

This is usually indicated by a puddle at the lowest sprinkler head. Using an automotive stethoscope may aid in determining which valve is leaking in a manifold. There are two main causes for this to happen.

1. Solenoid or solenoid seat is damaged. Water will constantly leak past the plunger. Replace the solenoid plunger or the seat if possible.

2. Valve seat is damaged. Check the valve seat and the diaphragm seating area for pitting and small debris. Replace the diaphragm if damaged. It may be necessary to replace the valve body if the seat area is damaged.

Valve will not open

There are again two main causes of this problem.

1. The first cause is an adjustment problem, the flow control stem is tightened all the way down.

2. The second is that the force is not being released from the upper chamber. There are several reasons for this to happen:

    a) Solenoid burned out. A resistance test will verify if the coil is bad or not. Refer to the volt ohm-meter section to learn how to perform this test. Replace if necessary.

    b) A torn diaphragm. (Reverse flow valve only). The hole in the diaphragm will allow more water into the upper chamber than can be bled off through the solenoid port. Inspect the diaphragm, and replace it if necessary.

    c) Plugged ports. The port below the solenoid and/or the port leading to the solenoid chamber is plugged. This would again prevent the water in the upper chamber from being relieved. Clean the ports with a paper clip, *never drill out the ports*.

    d) Solenoid not receiving voltage. The controller is not sending the necessary voltage, there are wiring problems, or the wire connections are faulty. Refer to the volt ohm-meter section to learn how to inspect the field wiring.

4. CONTROLLERS

This section will describe some troubleshooting procedures that will determine if the controller is indeed the bad component in the irrigation system. The controller is usually the first component blamed for an irrigation system failure. Typically, once the controller has been removed and taken to a repair facility, a conservative estimate is that 25% are returned without a defect being found in the controller. Before removing the controller it is recommended that the following be checked:

Programming

A program consists of three steps:

1. Start time - The time of day that the irrigation should begin.
2. Run time - The irrigation duration for each station.
3. Days on - The day that the irrigation will operate.

If any of these steps are missing, the controller will not activate the valves.

Auto/Off switch

This switch must be in the AUTOMATIC or ON position in order for the controller to operate.

Sensors

If the controller is equipped with a rain sensor or moisture sensor, the program will not run if they have been activated.

Troubleshooting

Hybrid /Solid State Controllers

Hybrid and solid state controllers are designed to provide the programming versatility that is needed to better protect our water resources. The technology that is necessary to accomplish this makes repairs by untrained persons nearly impossible. The following items should be checked before assuming that the controller is the problem.

Visible damage

Inspect the controller for any visible signs of damage. Check the keyboard for collapsed buttons: run your finger lightly over each of the buttons (a slight "hill" should be felt at each location). If a "valley" is felt then the keyboard must be replaced. This is not a warranty item. Inspect the printed circuit board for burned components; this is normally caused by lightning or other power surges.

Power surges are also not covered by Rain Bird warranty.

Primary power

Verify that the primary power is within acceptable limits. Contact an electrician if incorrect.

Transformer

Verify that the transformer output voltage is between 24 and 28 VAC. If the output voltage is zero and the primary power is correct, then replace the transformer.

Circuit breaker or Fuse

Check the condition of the circuit breaker or fuse. If it has blown, the most likely reason is a field wiring short. When this happens, it only interrupts the 24 volt section of the transformer. The 12 volt section will remain active; therefore, the display will show that the station is on. Press the appropriate button(s) on the keypad to turn the active station(s) off. Reset the circuit breaker or replace the fuse with the value specified by the manufacturer. Manually advance the controller to station #1 and allow it to run for one minute. If station #1 operates correctly then advance to station #2 and repeat this procedure until the fuse blows. This will determine the problem station. Once the defective station has been located, disconnect the wire that operates that valve.

Continue the above procedure to test the rest of the stations as there could be more than one problem. Once this has been completed the controller will operate all of the stations that are still connected. The faulty field wiring will have to be repaired before it can be reconnected to the controller.

Microprocessor Lockup Problems

The microprocessor is the "brains" of the controller. Occasionally, due to electrical problems, the microprocessor will freeze all of its functions. The symptoms of this are normally one or more of the following:

a) Display blank, (the display does not show any information)

b) Frozen display, (the display shows erratic information that cannot be cleared or changed from the keypad)

c) The controller will not perform any of its programmed functions.

If the following 6 steps are taken, the microprocessor will usually resume its normal functions. It will be necessary to completely power down the controller.

*** Note: This process will delete your existing program!*

1. Primary power
It is necessary to disconnect the controller from its primary electrical source either by unplugging it from the outlet or by turning off the appropriate circuit breaker in the electrical panel.

2. Battery backup
Remove the battery from the controller. The purpose of the battery is to maintain the information inside of the microprocessor in the event of a primary power failure. By removing the battery the microprocessor is allowed to reset itself to its normal condition.

3. Wait
Maintain this power down condition for 5 minutes to be certain the microprocessor will reset itself.

4. Primary power
Reconnect the primary power to the controller.

5. Function check
The display should now show 12:00 A.M. Set the time and day to the current setting. Using the manual controller function, turn on several stations and observe that they operate properly.

If the controller now operates properly re-enter your original program and continue on to the next step. If controller still will not perform correctly it will need to be repaired by a qualified repair facility.

6. Battery replacement
If the controller uses an alkaline battery, it is recommended that it be replaced with a new one at this time. (See section to determine if your model controller uses alkaline or NICAD batteries.) Reinstall the correct battery in the controller and perform a final resistance test to ensure proper operation. This procedure will normally resolve approximately 30% of the solid state "failures."

5. VOLT OHM-METER (VOM)

A volt ohm-meter is an inexpensive piece of test equipment that is capable of measuring AC volts, DC volts, and resistance. By learning how to use this equipment, it is possible to troubleshoot controllers, solenoids, field wiring, and to verify AC and DC voltage levels.

There are two styles of VOM's, analogue and digital. An analogue VOM is the style that has a needle that moves across a face (similar to a speedometer). The DMM (digital multi-meter) has a digital display. DMM's normally have additional features than are available with an analogue VOM, and therefore are more expensive. For this reason the following instructions are designed to work with an analogue style VOM.

Electrical terms

AC volts (VAC)
Alternating Current, this is household voltage. Most irrigation solenoids operate on AC voltage.

DC volts (VDC)
Direct Current, this would normally be from a battery. DC voltage is polarized, meaning that there is a positive (+) and a negative (-), sometimes referred to as ground. The VOM must be connected properly to prevent VOM damage, the RED lead is (+), and the BLACK lead is (-).

Resistance
A measurement of how difficult it is for the current to flow through the electrical system. This would be similar to being able to actively measure the friction loss when water flows through a piece of pipe.

Comparisons between water and electricity

Water term		*Electrical term*	
Pressure	(psi)	Voltage	(volts - V)
Friction Loss	(psi)	Resistance	(ohms - Ω)
Flow	(GPM)	Current	(amps - A)

For irrigation applications, a solenoid is considered to be good if its resistance is between 20 - 60 ohms.

Short
When the measured resistance is below 20 ohms for a single solenoid.

Open
If the resistance is above 60 ohms when measuring the field wiring.

Note:
When two valves are operated together on a single station, the resistance will be approximately 1/2 of a single solenoid.

Hook-up
Your VOM will have one jack labelled (-) COM, into which the Black lead will be inserted. Insert the Red lead into the jack marked (+) V - Ω - A. This same setup is used to measure AC volts, DC volts, and resistance.

Taking measurements

AC volts
Set the dial to the appropriate VAC scale. For example, if 117 volts is expected to be measured, the dial must be set to a scale above that. *WARNING* - if the dial is set to the 50 ACV range and 117 volts is measured, damage to the VOM is likely. *If the voltage is unknown, start with the dial on the highest available setting.*

DC volts
As above, the dial must be set to the appropriate scale. In addition be sure that the polarity is correct. DC voltage has a positive (+) and a negative (-) terminal. The red lead is (+), and the black is (-), connecting the leads in reverse can cause damage to the VOM. If, from the rest position, the needle moves to the left, the polarity is incorrect; reverse the leads on the circuit that is being tested and take the measurement again.

Resistance
Important, to prevent VOM damage the circuit power must be turned off. There are several scales on the VOM, usually Rx1, Rx10, Rx100 etc. When changing the dial settings, it is necessary to multiply the upper most scale by the dial setting. For example, if the needle is pointing to 15 on the ohms (Ω) scale, and the dial is set at Rx1, then there are 15 Ω of resistance (15 x 1 = 15). If the dial is set on Rx10 then there are 150 Ω of resistance (15 x 10 = 150). If the dial is set on Rx100, then there are 1500 Ω of resistance (15 x 100 =1500).

Whenever resistance is measured, the VOM must be calibrated. This is a very simple procedure. Set the VOM to the correct scale (usual Rx1). Touch the two probes together and use the ohms adjust

LANDSCAPE WATERING SYSTEMS LIMITED
Bratch Lane Ÿ Dinton Ÿ Salisbury Ÿ Wiltshire Ÿ SP3 5EB Ÿ Telephone: 0845 230 9697 Ÿ Fax: 0845 230 9698
enquiries@lws.uk.com Ÿ **www.lws.uk.com**
Registered in England No. 3480689

wheel to set the needle to zero. Keep in mind that zero ohms is on the right hand side of the scale (this would indicate a short) and the left side is infinite resistance (indicating an open). Start with the dial on the lowest setting (Rx1). If the reading shows infinite, change the dial to the next higher setting. Keep increasing the setting until an accurate reading is obtained. If the needle stays to the left side of the scale then the circuit is open.

Knowing how to operate a VOM will save considerable time when testing the wiring on a job site. It is possible to inspect the solenoid and field wiring condition from the controller. The procedure is as follows:

Resistance measurements

1. Disconnect the common wire from the controller.

2. Set the VOM to the Rx1 scale and zero the meter.

3. Connect one of the VOM leads to the common wire (not the controller common terminal).

4. Touch the second VOM lead to each of the station terminals and record the resistance readings. Compare your readings to the acceptable range of 20 - 60 ohms.

5. If the measurements are within the acceptable range then the electrical circuit for that station is good. This test only inspects the field wiring, it is possible for that station to not work properly because of controller and/or valve problems.

6. If the resistance range is below 20 ohms (a short), proceed to the valve and disconnect the solenoid from the field wires. Test the resistance of the solenoid only. If the measurement is still low, then the solenoid must be replaced. If the solenoid resistance is acceptable then the short is in the field wiring itself (2 solenoids connected to the station can also produce a low reading). Wire tracing equipment should be used to locate the problem.

7. If the resistance is above 60 ohms (an open), as above test the solenoid without the field wires connected. Replace the solenoid if the resistance is still above 60 ohms. More than likely the solenoid will test within proper limits. If this is the case, then cut out the wire connectors, twist the station and common wires together and re-test the resistance from the controller. The resistance should now read very low, possibly only 2 - 3 ohms. If the resistance is this low, then the problem was a faulty wire connector. Install new waterproof wire connectors on the existing solenoid and test the resistance again at the controller. If the resistance is still high when the common and station wires are twisted together, then there is an open somewhere between the valve and the controller. Wire tracing equipment should be used to locate the problem.

8. The final test will determine shorts directly into the earth. For this test, the scale on the VOM should be changed to Rx1K(1K = 1,000). Disconnect each of the station wires from the controller, in addition to the common still being removed. Connect one of the VOM leads to a piece of wire wrapped around a screwdriver. Insert the screwdriver into the ground. One at a time, touch the second lead to each of the station wires and the common. Each of these measurements should be above 700K (700,000) ohms. If the resistance is below 700K, it would indicate that a section of the wire has the insulation removed, and is making contact with the earth. Wire tracing equipment should be used to locate the problem.

LANDSCAPE WATERING SYSTEMS LIMITED

Bratch Lane Ÿ Dinton Ÿ Salisbury Ÿ Wiltshire Ÿ SP3 5EB Ÿ Telephone: 0845 230 9697 Ÿ Fax: 0845 230 9698
enquiries@lws.uk.com Ÿ **www.lws.uk.com**

Registered in England No. 3480689