Being Equipped to Effectively Locate Wires and Valves

**Tips and Tools for Tracking Field Wiring and Tackling Electrical Challenges**

With the right tools and a little experience, troubleshooting electrical problems in today’s automatic irrigation systems does not have to be a frustrating or even time-consuming challenge. Successful troubleshooting begins by knowing what tools are available and how to most effectively use them to locate components and potential problems.

Zeroing in on potential electrical problems still begins with a volt-ohm meter, but an effective wire and valve locator is an essential tool for tracing field wires, locating valves and finding possible breaks in wires.

**Begin with the Basics**

When the irrigation system is not getting a signal to the valve, troubleshooters quickly suspect an electrical problem. But before you invest time tracking down wires and breaks, check the obvious solutions.

- Is the water on?
- Have you checked the entire system with the volt-ohm meter? (Refer to previous Technical Newsletter issues online at [http://www.rainbird.com/rbturf/resources/asc/ascnewsletter.htm](http://www.rainbird.com/rbturf/resources/asc/ascnewsletter.htm) for further tips.)

It’s time to use a locator to trace the wire path, if you:

- strongly suspect a wiring problem such as a broken wire
- have no idea where the valve is located
- need to locate the wire path in order to dig

**What Is a Locator?**

A wire and valve locator is a troubleshooting, maintenance tool designed to locate wire paths, wire depth, wire breaks, solenoids, and nicks in the wires of electronically controlled sprinkler irrigation systems.

Progressive Electronics’ 521 Wire and Valve Locator is one of the industry’s standards. The 521 is used here as an example, although general principles can apply no matter what locator you are using.

**Model 521 Wire Valve Locator:**

1. Adjustable transmit power allows the operator to select the best signal for maximum performance.
2. Receiver provides both audible and visual indications of signal strength to clearly identify wire and breaks.
3. The unit is battery-powered and self-contained with headphones, receiver, antenna, and ground stake.
4. Red lead attaches to the wire to be located while black lead attaches to the ground.

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Setting Up the Wire Locator

Begin by testing the battery

1. Turn the selector switch to the battery test position. The meter should read between 8-10.

2. To ensure the best signal, connect the red and black leads together and turn the unit on. Turn the selector to position #5. The meter needle should rise to at least 10. If it does not, change batteries and re-test.

NOTE: Do not connect transmitter to any active A.C. circuits.

Establishing a Good Ground – Indoors or Out

The 521 Wire Locator requires an absolutely good ground to work. With the transmitter off, connect the red lead to the wire to be located. Connect the black lead to a good earth ground with the stake. (see figure 1)

If the clock is indoors, the stake MUST be grounded at a point where the wires exit the building. This often requires running wire to the outside. DO NOT use a common inside electrical “building” ground or water pipe.

Setting the Transmitter for Maximum Efficiency

Once a ground is established, turn the transmitter on and turn the selector knob clockwise to #1. The meter will drop to almost zero. With each turn of the knob to increase output, the needle will rise. Stop when the meter reads between 4 and 8. Transmitter is now set for maximum efficiency.

Note: If the meter cannot reach 4, the path to the earth’s ground along the wire route is not good enough for the 521 to locate the wire.

When you point the receiver antenna or probe at the transmitter with the unit on, you should see movement on the receiver meter and should hear a pulsing tone through the headset.

NOTE: A very high-pitched tone indicates the headset is too close to the receiver antenna or the receiver battery is low.

Isolate the Field Wire Whenever Possible

If you know where the valve is located, disconnect the common wire before hooking the red locator lead to the field wire. This isolates the single field wire you need to track. If you cannot disconnect the common, nothing will prevent the signal from moving through the field wire and sending a signal throughout the common circuit and entire system.

How to Effectively Use the Locator

Following and Marking the Wire Path

Once you have properly connected the locator and turned it on, point the receiver antenna at the ground and walk, swinging the antenna slowly from right to left. As the unit moves from side to side, you will hear a tone signal that will increase and decrease in intensity.

When you go over the wire, you will hear nothing. This absence of tone is called a null and occurs only directly over the path of the wire. As you move through the wire, you will detect the locating signal on each side. (see figure 2)

Use marker flags to mark the wire path every 5-10 feet (1 ½ - 3 meters) from the controller to the valve or as far as you can go.

Listen, Look, Locate!

Remember, you are receiving two inputs – a visual on the receiver meter, and an audible signal through the headset. Use both for maximum efficiency. Learning to interpret and recognize a good, clean null is the key. The signal intensity will increase as you move off path. You may need to back up until you once again obtain a strong null (absence of sound) and point the antenna in a different direction.

TIP: Do not try to guess where the wire is headed. It may turn unexpectedly. Rely on and trust the equipment.

Detecting Breaks or Faults

While the 521 Wire Locator is not specifical-
ly designed to pinpoint faults in the field wire, with a little experience you can use it to approximate the location of breaks.

To find nicks or breaks, decrease the sensitivity of the receiver antenna while it is pointed at either side of the null. Adjust the sensor knob until the signal is 10 or below. You should notice a change in signal intensity.

If you suspect a break, follow the marked wire path. If you pass a break in the wire, the signal will remain fuzzy. Instead of a clear, crisp null, you will hear a weak, continuous or choppy signal.

**Locating the End of a Broken Wire or Open**

Follow the marked wire path until the null disappears and you note a hot spot (or intense signal). Beyond the hot spot, you will hear static, rather than a clean null. Back up until you once again detect the null. This is the approximate location of the broken wire. *(see figure 3)*

**Locating a Larger Nick or Ground Fault.**

Follow the null and strong signals along the sides of the wire path until the signal becomes very weak along the sides of the null. This weak signal indicates that the signal is bleeding into the ground at the nick and is trying to return back to the ground stake along the outside of the wire itself. *(see figure 4)*

To confirm, touch the receiver antenna to the ground close to where the last strong signal was detected at the side of the wire path. The tip should be approximately six inches (15 cm) on either side of null. Adjust the sensitivity until the meter reads just below 10. Keeping the antenna six inches from the null, move the receiver down the line, watching the meter closely. The majority of the signal stops at the nick. When you pass an “open” cut wire or nick, the meter will fall off rapidly.

**Determining Wire Depth**

To determine wire depth, mark the ground directly over the wire path. Turn the receiver at a 45 degree angle to the path (level the bubble on the face). Keeping the 45 degree angle, move the receiver away from the path until you detect the null and mark this spot. The distance between the two marks is the approximate depth of the wire.

**Locating Solenoids**

1. At the clock connect the red transmitter lead to the station wire that leads to the subject valve. Connect the black lead to an earth ground. Always disconnect the common from the clock. Turn the transmitter on and adjust the output to the highest level. Trace the wire by following the null. When you pass a solenoid valve, the signal becomes very strong. Mark this spot.

Check around this hot spot for a null leaving the area. If the null continues, follow it and mark any additional hot spots.

2. If only one hot spot is located, this is the valve.

3. If you find more than one hot spot, mark all and turn the transmitter off. Disconnect the common wire from the controller first. Move the black lead from the ground stake to the common wire. Turn the transmitter on and set the selector knob to the highest reading. Touch the receiver antenna to the ground in center of the first hot spot and adjust the sensitivity knob to mid-scale. Keep the sensitivity knob in the same place, and touch the center of the second hot spot. Compare all hot spots this way and

Figure 3

Figure 4

Figure 5

Figure 6

Figure 6 (above) shows an overview of typical wiring situations discussed.
determine which has the strongest signal. That is the valve. (see figure 5)

Next Steps
Now that you’ve found the wire path, valves, and may have located general areas for breaks or nicks, it’s time to use Progressive Electronics’ Pulser Model 2003 or similar equipment to pinpoint problems from clean wire breaks down to pinhole leaks. See Rain Bird’s Technical Newsletter Fall 2001 for details on effectively using the Pulser to identify areas for repair.

Walk through the troubleshooting process step-by-step in figure 7 to determine the source of the system’s electrical problems.

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Figure 7