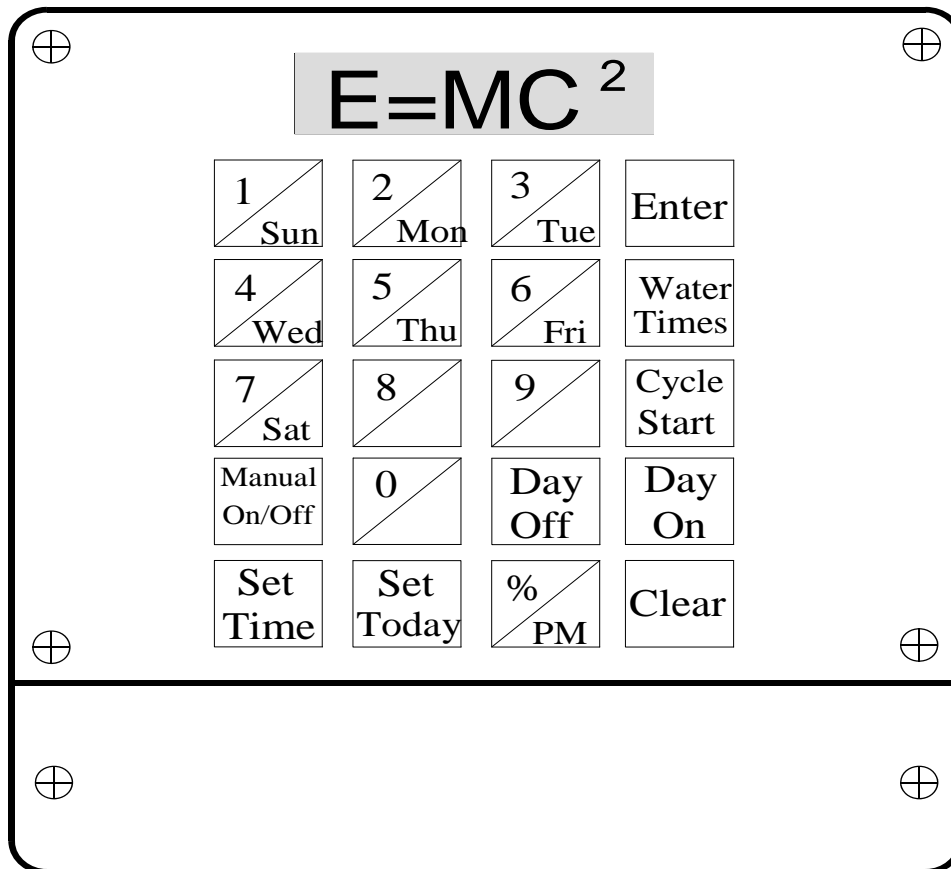


# Understanding and Programming Irrigation Controllers



Prepared by:  
Jeff Lee; Water Conservation Specialist  
Town of Gilbert  
&  
Donna DiFrancesco; Water Conservation Specialist  
City of Mesa

## Understanding and Programming Irrigation Controllers

Water is Arizona's most precious natural resource. Through wise water use and efficient landscaping, we can preserve and protect this resource and, at the same time, have beautiful and enjoyable yards. More than half of the water provided by valley cities is used outside to water lawns and landscape plants. Well planned and maintained irrigation systems can save water and money.

**Xeriscape** creates a beautiful, common sense landscape that reduces water use and is easier to maintain. Whether old or new, your landscape can be more water efficient simply by using the water wise principles of Xeriscape.

### Xeriscape includes the following principles:



- Good Planning and Design
- Use of Appropriate Turf Areas
- **Efficient Irrigation**
- Use of Mulches Around Plants
- Soil Improvements
- Plant Low Water Using plants, and
- **Appropriate Maintenance**

You can conserve water in your landscape by using these principles. But just because you have planted low water using plants in your yard doesn't mean that you'll automatically save water. Water savings come from people managing their irrigation efficiently.

This guide has been written to help you understand the value and capabilities of your irrigation controller. Managing your water schedules will help you save water and money, as well as to keep your landscape healthy and beautiful

### What is an irrigation controller?

An irrigation controller is a device that uses programmed information to turn the irrigation on and sometimes more importantly to turn it off. Irrigation controllers may also be referred to as clocks or timers. There are many different models available with a variety of features to help manage the water more effectively. With the advancements made in the electronics industry over the years, these are now available to the homeowner at affordable prices.

### What does a controller do for you?

- It will turn the irrigation on and off at the scheduled intervals.
- It can be set to water early in the morning when it's best.
- It will water the yard when you are away from home.

### What won't a controller do for you?

- It won't adjust itself for the different seasons.
- It won't shut itself off when it rains.
- It won't react to leaks or other problems in the system.

### What type of controller do I need?

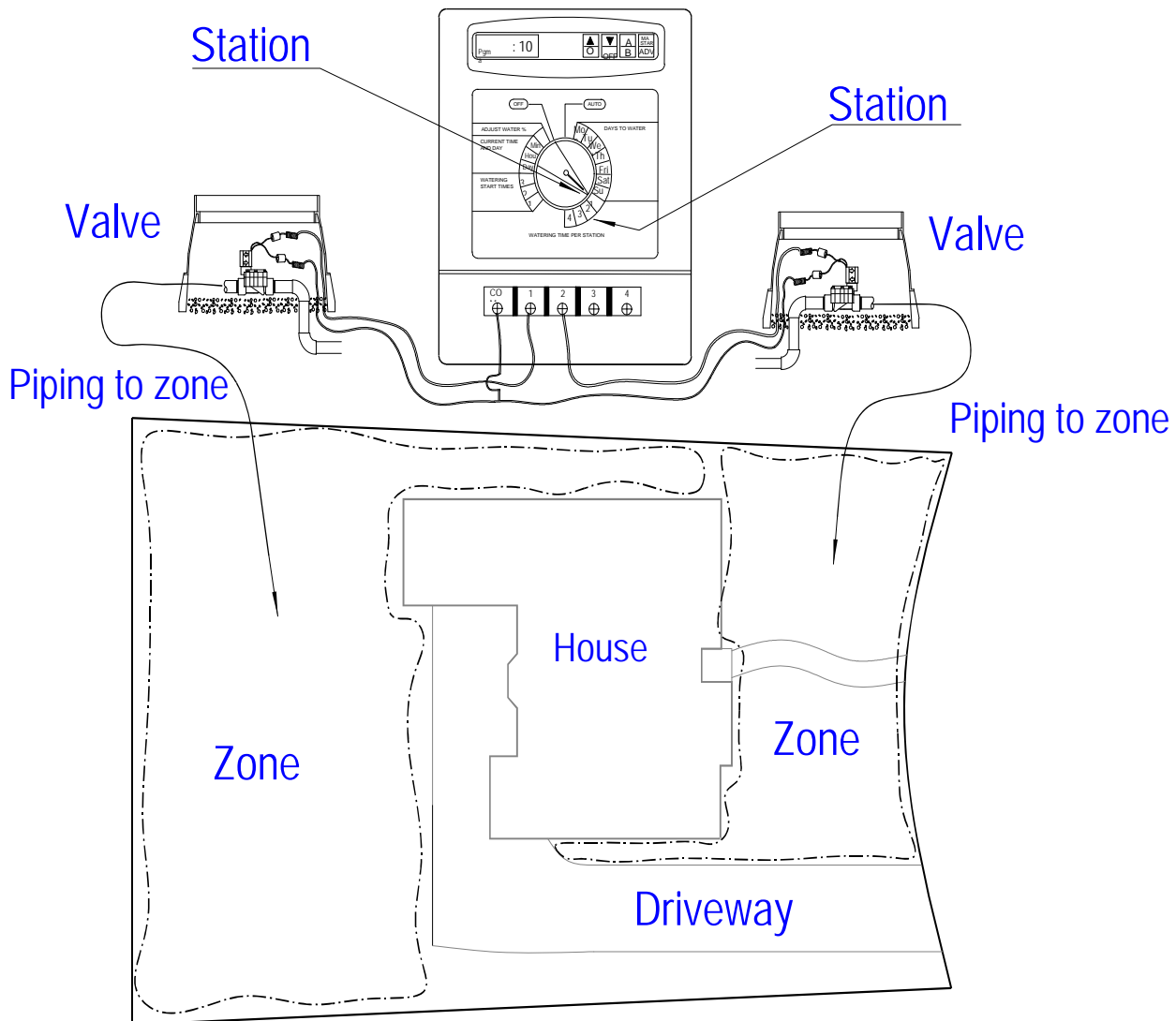
This depends on the landscape that you have. The choices are determined by the following basic controller functions:

- How many stations you need to water.
- How long you need the stations to water.
- How many programs you need.
- How many start times you need.
- How long of a schedule interval you need.

## What do station, valve, and zone mean?

- A station is how the controller keeps the information separate for the different watering areas.
- A valve is the device that takes the signal from the controller to allow the water to flow to the different areas.
- A zone is the areas of the yard or groups of plants with similar water needs in the yard that are watered by a valve.

Figure 1: All of these terms are closely related. It just depends on what part of the system you're talking about. The controller holds the information, and defines the watering areas as **stations**. This information includes when they are supposed to run and for how long. At the programmed time the controller sends a signal through wires to open the **valve** that corresponds to that station. When the valve opens, it lets water flow through the pipes to irrigate the **zone** that it controls.



The above illustration is just an example to show how zones relate to the physical area of the yard. A more desirable approach to zoning would be to have one zone for trees and another for shrubs and groundcovers. In that case the zones would actually be overlapping in the yard.

## Selecting a Controller

When selecting a controller these definitions will help you understand the different functions in order to choose one that will best fit your needs.

### Station capacity:

A station is how the controller identifies a valve and keeps the information of when and for how long to run. The station capacity of a controller is just how many stations it can handle. With new systems, it is generally preferable to buy a controller that will handle more stations than you need. There are some new models on the market that are modular. You buy a base controller that may handle 4 stations now but can be expanded to accommodate more stations with snap in modules. It's a kind of pay as you go concept.

### Station duration:

This refers to the maximum amount of time that you can set for a station. Here in the desert southwest where drip irrigation is more widely used you need to have a controller that can accommodate the long run times. With the low output of these systems it's not unthinkable to have situations where you want to run the station for 2 hours or even more.

### Programs available:

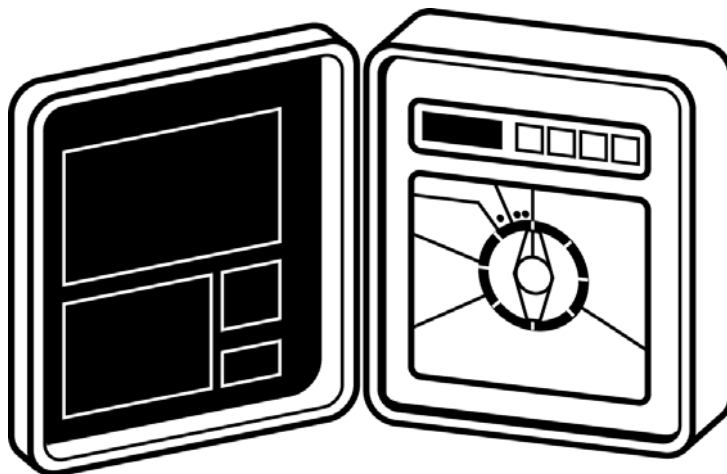
A program is the information that you enter to turn the irrigation on and off for the days and times you select. Multiple programs on a controller let you run different stations on different schedules. It's like having several controllers in one box. If you have shrubs that need to be watered every seven to ten days and trees on another station that need watering every ten to fourteen days, you'll need a controller with two programs. If you also have a lawn that needs to be watered every three days, you'll need another program and so on.

### Start times:

This is simply what time of day you want the irrigation to start. With drip type irrigation systems only one start is typically used. If you have a lawn that's on a slope and it needs fifteen minutes of irrigation but the water runs off in five minutes, you need to run the station for five minutes with three different starts allowing enough time in between to let the water soak in. These extra start times are also utilized when overseeding with rye grass for a winter lawn. When you put the seed down, you want to keep it evenly moist throughout the day. You accomplish this by watering with short run times with multiple starts.

### Schedule length:

This defines the maximum number of days that you can skip between irrigation. If you have a drip system, it's best to have a controller with a schedule length of at least 14 days. For example you may have a tree zone that you only want to water once every 14 days. If you need to water a lawn 2 to 3 times per week, a controller with a 7 day schedule can easily handle this.



# What are the differences between the styles of controllers?

There are three different basic styles of controllers; Electro-mechanical, Digital, and Hybrid. Each has advantages and drawbacks.

## Electro-mechanical:

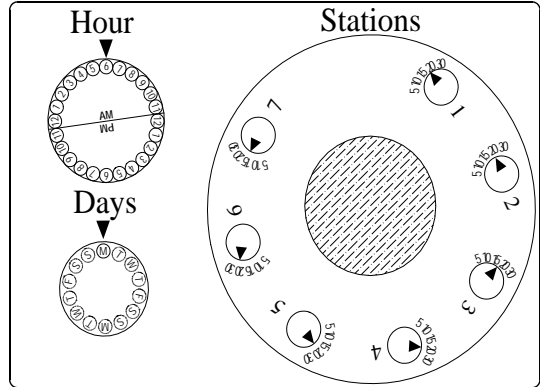
This type consists of several dials for the various programming functions. On these dials are either knobs to turn to the desired settings or pins to push or screw in.

### Advantages

Easy to program.  
Tolerant to power surges.  
Never loses its program.

### Disadvantages

Not very accurate.  
Not very flexible.  
More expensive.



## Digital:

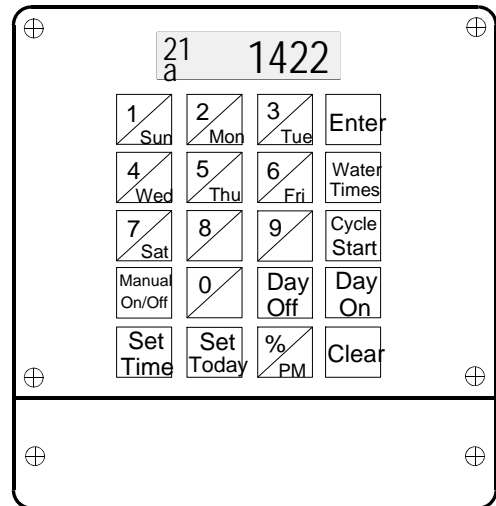
This type consists of a keypad and a display. You follow a step by step process where first you call up a function with a certain key. Next you type in the desired setting. Then you enter it to the program.

### Advantages

Very accurate.  
Very flexible.  
Can handle many stations.

### Disadvantages

Harder to program  
Less tolerant to power surges



## Hybrid:

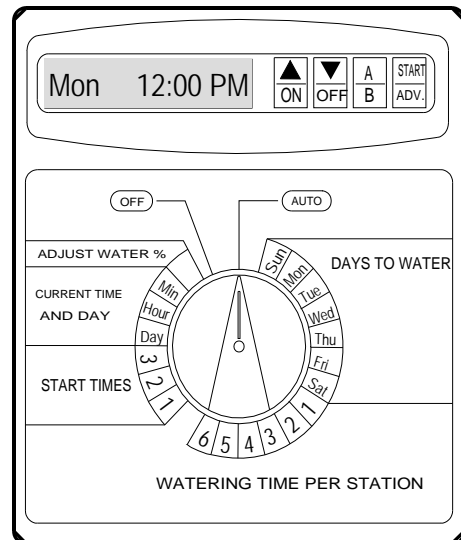
This style combines the ease of programming of the electro-mechanical style with the accuracy and flexibility of the digital style. On these you have a dial to point to the different functions and buttons for adjusting up or down and on or off.

### Advantages

Easy to program.  
Very accurate.  
Very flexible.

### Disadvantages

Less tolerant to power surges



## How do I create an irrigation program?

There are 5 pieces of information to a complete program that all controllers need in order to function. The way that you enter the information will vary depending on the model controller you have but the components themselves are universal. If one of the pieces is missing, there will never be a time when all conditions are met in order to start running the irrigation.



### What day is it today?

This is fairly self-explanatory for most cases, but some controllers use a numerical assignment for the current day. In these cases it's common to use 1 as Sunday, 2 as Monday and so on. It's completely arbitrary and you can use 1 for Wednesday if you like, just remember that you set it that way when you are assigning days to run.



### What time is it now?

This is just like setting your alarm clock although the method may be different. Just be careful that you get the A.M. or P.M. correct. The clock only knows what time it is by what you tell it. If you get this reversed, a 5:30 A.M. start time could surprise your 5:30 P.M. barbecue.



### What days do you want the irrigation to run?

This is the first condition the controller looks for before initiating an irrigation cycle. It's asking "is today a watering day or not?" The above instructions are what are known as global, where this is a program specific entry. You can have program 1 water on Mondays, Wednesdays, and Fridays and program 2 water on Tuesdays, Thursdays, and Saturdays. On some controllers, you can have program one set to water on specific days of the week so you don't water the lawn on the morning you mow, and program two set for a cyclical schedule such as every third day.



### What time of day do you want the irrigation to start?

This is the second condition the controller verifies before starting irrigation. It's asking, "if today is a water day, when should I start?" On almost all controllers, one start time will run all of the stations assigned to that program in sequence. Think of it as a cycle start not a station start. The manufacturers make them this way so you don't have to do the math for how long each station will run and set the start times accordingly.

For example, you have a four station timer with all the stations set to run for ten minutes and you set the start time for 6:00 A.M. At 6:00 A.M. the controller would start with station #1 and run for ten minutes. At 6:10 A.M. it would automatically shut off station #1 and start station #2. At 6:20 A.M. it would move to station #3 and so on. If you tried to enter the #2 start time as 6:10 A.M., the controller would see this as an entirely new cycle to run starting with station #1 and running through all the other stations again as well. Some of the newer controllers can have as many as 6 or 8 start times so this error can cause a very soggy lawn and high water bills. Not to mention the frustration of thinking the controller is defective because it never seems to shut off.



### How long do you want the stations to run?

Now that the controller knows that it's a water day, and it knows when it's supposed to start, it needs to know what stations it should run and for how long. This information is program specific, and is how the controller allows you to set the different stations to the different programs for the schedules desired.

For example, if you only want to run stations 1 and 2 on program 1, enter run times for only those two stations and make sure that all others are set to zero. If you want to run stations 3 and 4 on program 2, again enter run times for only those stations in that program. If you enter time for a station in both programs, the controller will run that station according to both schedules.

## Example of a split schedule in a dual program controller:

<u>Program 1</u>	<u>Program 2</u>
<b>Days on:</b> Monday, Wednesday, Friday	<b>Days on:</b> Tuesday, Saturday
<b>Start time:</b> 5:00 A.M.	<b>Start time:</b> 6:00 A.M.
<b>Station</b>	<b>Station</b>
<b>Run times:</b> 1: 20 minutes	<b>Run times:</b> 1: 0 minutes
2: 20 minutes	2: 0 minutes
3: 0 minutes	3: 2 hours
4: 0 minutes	4: 3 hours

In the example above, at 5 A.M. on Mondays, Wednesday, and Fridays only stations one and two would run for twenty minutes each consecutively. Then on Tuesdays and Saturdays starting at 6 A.M. station 3 would run for two hours and then station 4 would run for three hours. If the twenty-minute run times for stations 1 and 2 were accidentally entered into program 2 as well as in program 1, they would run the desired schedule of Monday, Wednesday, and Friday starting at 5 A.M. and on the Tuesday and Saturday schedule starting at 6 A.M.

## What are some of the optional features I've heard about and what do they do?

There are many new features available on controllers today that can help in managing the water and making the programming easier. Just remember that the more bells and whistles the controller has, the greater the cost.

### Back-up battery:

This is usually a 9-volt battery plugged into the controller that will hold the program information in the event of a power outage. These batteries don't have enough power to run the irrigation system, but will keep the information in memory for when the power returns. This can be a real plant saver. Some models use the rechargeable type of battery and others use the standard alkaline type. Read your controller's manual to determine what type you need and the recommended replacement interval.

### Default program:

Many of the digital and hybrid style controllers have this feature. This is a pre-set program that is programmed onto the chip at the factory. In most cases it consists of a ten minute run time for all stations once every day. This ensures that if there is a prolonged power outage and the back up battery goes dead, at least some irrigation will occur until the problem is noticed and the controller re-programmed. At this point it's time to replace the battery as well. This is usually noticed when the irrigation seems to be going off at the wrong time, or if your plants show signs of stress.

### Water budgeting:

Many controllers offer a feature that will allow you to change all the station run times by a percentage with one adjustment. This makes seasonal adjustments much easier, particularly with more complex systems with many stations. Some models will adjust all programmed run times on all programs and some will allow you to set the budget for each program on the controller. This way you can have one program set to run at 150% of the programmed run time and another program at 120%. This is possibly the most under-utilized feature on irrigation controllers by landscape contractors and homeowners alike. You do however want to be careful with this feature on drip systems. For the cooler seasons, you want to still keep the longer run time of at least 2 hours but water less often. You wouldn't want to "budget" a drip station down to 25% of a 2-hour run time.

## **Rain sensors and shut-off devices:**

These are devices sold separately from the controller that react to rainfall and prevent irrigation from occurring. Some are simple catch-pan devices that, when filled to a certain level, open a switch to stop the signal from the controller before it gets to the valves. The idea is that it will take a few days for the water in the pan to evaporate below the set level before allowing the irrigation to continue.

Most sensors are typically connected to the wiring between the controller and the valves as a type of interrupter. The controller continues to function as normal running its program. It will even show on the display that it's running but the signal from the controller is stopped before it gets to the valves. Some of the newer controllers allow these devices to be connected directly.

Both ways work equally well, but it's a lot easier to bypass the connection at the controller if you need to diagnose a problem. Some controllers will have a bypass switch on the faceplate to ignore the signal from the sensor. Some models will display an alert signal if the sensor is interrupting a normal irrigation cycle.

## **Test cycle:**

Some models will allow you to run through a short test cycle of 2 minutes without affecting the programmed station run time. On most residential scale landscapes this gives plenty of time to follow the stations around as they turn on and inspect them to make sure they are functioning properly. Some models will also do a self-diagnostic during this process and alert you to any electrical problems. With the lower flow of drip zones this 2 minute cycle may be enough to verify that it turns on and off but is probably not be long enough to discover some of the more subtle problems that can occur.



## **Why is my controller acting so crazy?**

When things start going wrong with an irrigation system, the controller is usually the first thing people blame. Over the years, irrigation controllers have become much more dependable. This isn't saying that the controller isn't the problem, it's just that the real problem is often elsewhere. There are some simple steps to narrow down the source of the problem depending on the symptom.

## **The irrigation keeps starting over again after it's finished:**

This is almost always caused by extra start times being accidentally entered. Check the programming to be sure that it contains only the start time you want. Delete any unwanted start times. Duplicating information in more than one program can also cause this. Remember that a dual program controller is like two controllers in one box. If you have the same information in two programs for the same stations, you have told it to run them twice. This can be an easy mistake to make by not noticing which program is showing in the display when entering information.

## **The irrigation seems to run at strange times:**

Again double check to make sure that only the start times you want have been entered. Remember to check in all of the programs that your controller has available. Also double check that the start times are correct as to A.M. and P.M. If this seems to be OK then check to make sure the controller is displaying the proper current time and day. If this is incorrect re-set it and check on it the next day. One of the most common reasons your irrigation will run at strange times is if you've lost your programs and the controller has reverted to the factory default. Occasionally the timing portion of the digital processor will malfunction and cause the controller to either run too fast or too slow. If this is the case, contact the manufacturer to locate a service center.

## **The irrigation runs longer than it's supposed to:**

Check the station run times and make sure that they are correct. If they are, check to see if your controller has a water budgeting feature as described in the options section on page six. If for example you have ensured that the run times are entered as ten minutes but they always run for twenty, the water budget may be set to 200%. This feature won't physically change the run time you have entered, but it will run the percentage of that time. Most controllers that have this feature will have an icon or symbol in the display to alert you when it is different than the normal 100%.



### **One station won't stop watering:**

For some reason this always seems to happen on the Friday afternoon of a holiday weekend. When you leave for work in the morning, the irrigation is running just like it's supposed to and all is well. Then when you come home in the evening it's still running and there's a river running down the street! In most of these cases the problem isn't with the controller but in the valve. Irrigation professionals refer to this as a "stuck-on" condition. Just to be sure check your controller. Most of the electronic styles whether they are digital or hybrids will show in the display if they are running any programs. Others may have an indicator light on the faceplate to show what station they are running. If the display is showing just the current time, the controller may be as unaware of the problem as you are.

The easiest way to tell if the controller is malfunctioning is to simply remove the power to it. This is accomplished by turning off the circuit breaker in your electrical box, or with some, you can simply unplug them from the wall outlet. If, when the controller goes dead, the irrigation doesn't stop, the problem is with the valve. At this point you need to shut off the water supply to the irrigation system and fix the valve.

### **One station won't water:**

Many times this problem isn't in the controller but in the valve or the wiring connecting the controller and valve. The first thing to do is verify whether the problem is electrical or hydraulic. The easiest way to do this is to try and open the valve that controls that station manually. Different valves will have different methods so consult the operating guide for your particular valves. If the valve doesn't open manually, then the problem is most likely in the valve itself and needs to be repaired. If it does open manually, then the problem is electrical.

Since the different controllers have different configurations for testing, it is best at this point to either call in a contractor or contact the technical services department of your controller's manufacturer. The output voltage is relatively low for irrigation controllers so you're not likely to hurt yourself, but improper testing procedures can damage your controller and/or your meter. This is a very important consideration if your controller is still under warranty.

### **None of the stations will water:**

There are several different scenarios that can cause this problem. The first thing to do is check the controller and make sure it is running. This means that it has power and is reading the proper display. Next make sure that you haven't accidentally set it to the rain-off function. Then you will want to double check your program and make sure it is correct. Many times a landscape has been toasted or flooded by a simple programming error. If you have a rain shut off device on your system, make sure the catch pan isn't full, or the device isn't malfunctioning.

After you have verified these things, try turning on a station manually at the valve. If the irrigation still doesn't come on, make sure that the water supply to the irrigation system hasn't been accidentally turned off. If the irrigation turns on by manually opening the valve, then the problem is probably electrical and you should contact the manufacturer of the controller for further troubleshooting or consider hiring a contractor to find the problem.

### **No matter where I turn the dial or what button I push the controller won't respond:**

With electronic type controllers, a power surge can cause them to freeze or lock-up. Don't panic most of the time there isn't permanent damage. All you have to do is remove the power to the controller for a short time to allow the microprocessor to "re-set" itself. If your controller has a back up battery feature, make sure you unplug this as well. You don't want the processor to hold any information that may be causing the problem. Usually one to two minutes is sufficient for this process. After that re-apply power to the controller and re-program as usual. If the symptoms don't go away after this procedure, contact the manufacturer to locate a service center to repair the controller.

### **What are the technical service phone numbers?**

These are usually printed on the manual that came with the controller. Of course many times the manual has seemed to disappear so below are some of the major manufacturers numbers. They can send you a manual if you need one, many times at no cost. When you call them, make sure that you have all the information handy such as model number and any symptoms.

**Rain Bird:** 800-724-6247

**Hunter:** 800-733-2823

**Nelson:** 800-622-8024

**Richdel:** 800-231-5117

**Hardie:** 800-333-8125

**Toro:** 800-367-8676