Irrigation Technician II - Control

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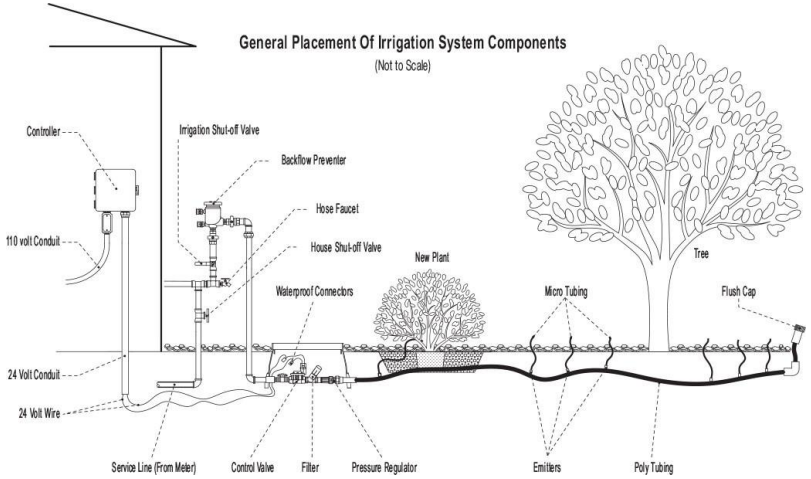
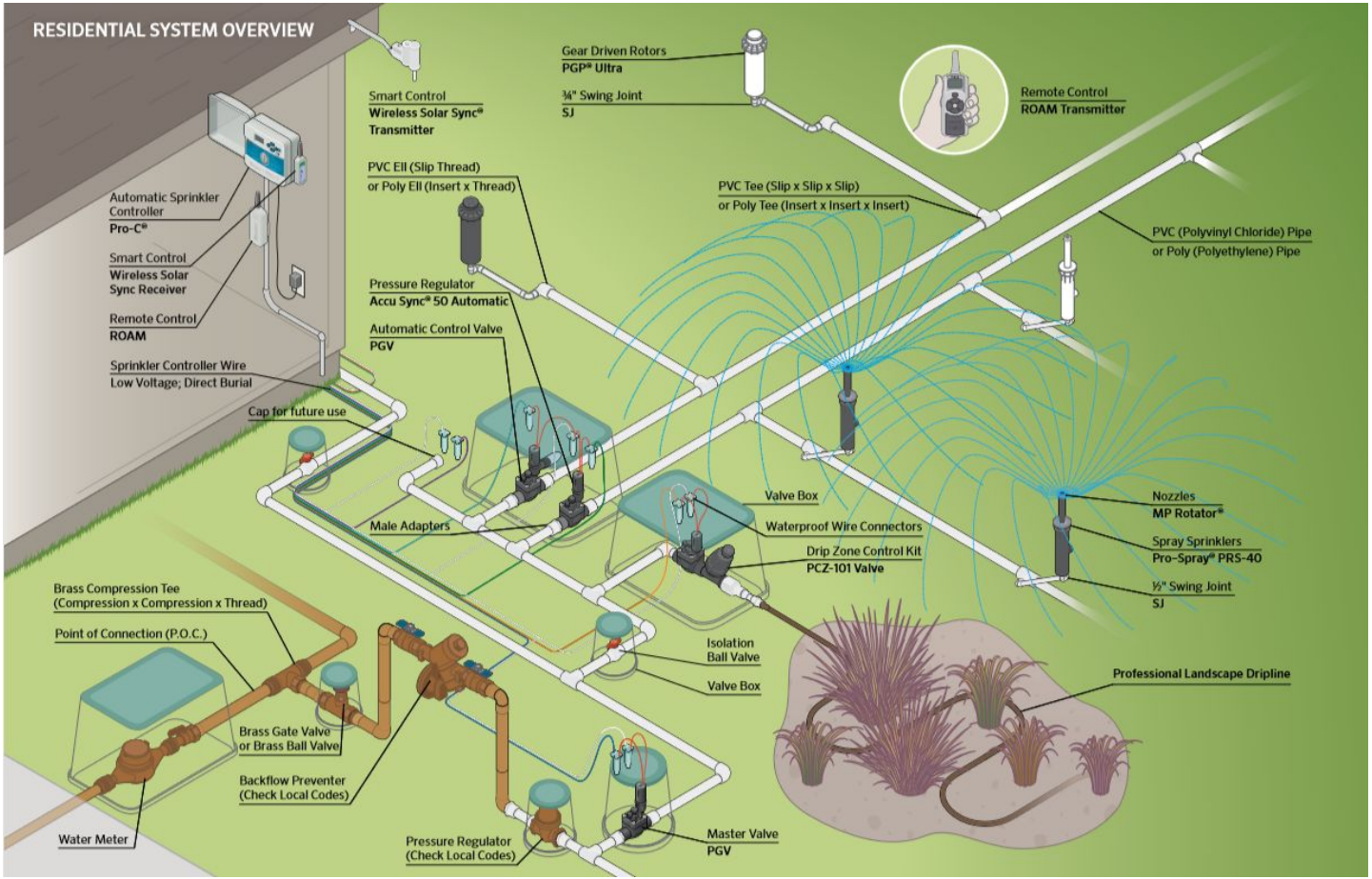
Learning objectives:

- Understand the hydraulic control of irrigation systems.
- Understand the electrical control of irrigation systems.

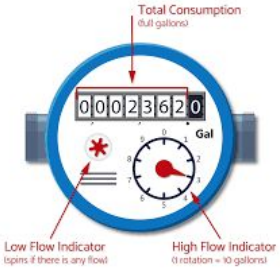



RESIDENTIAL SYSTEM OVERVIEW
Smart Control
Wireless Solar Sync® Transmitter
Gear Driven Rotors
PGP® Ultra
¼" Swing Joint
SJ
Remote Control
ROAM Transmitter
Automatic Sprinkler Controller
Pro-C®
Smart Control
Wireless Solar Sync Receiver
Remote Control
ROAM
Sprinkler Controller Wire
Low Voltage; Direct Burial
PVC Ell (Slip Thread)
or Poly Ell (Insert x Thread)
PVC Tee (Slip x Slip x Slip)
or Poly Tee (Insert x Insert x Insert)
PVC (Polyvinyl Chloride) Pipe
or Poly (Polyethylene) Pipe
Pressure Regulator
Accu Sync® 50 Automatic
Automatic Control Valve
PGV
Cap for future use
Valve Box
Waterproof Wire Connectors
Male Adapters
Drip Zone Control Kit
PCZ-101 Valve
Nozzles
MP Rotator®
Spray Sprinklers
Pro-Spray® PRS-40
½" Swing Joint
SJ
Brass Compression Tee
(Compression x Compression x Thread)
Point of Connection (P.O.C.)
Isolation
Ball Valve
Valve Box
Professional Landscape Dripline
Brass Gate Valve
or Brass Ball Valve
Backflow Preventer
(Check Local Codes)
Water Meter
Pressure Regulator
(Check Local Codes)
Master Valve
PGV

Hydraulic Control

1. Water Meter
2. Backflow Preventer
3. Flow Sensor
4. Irrigation Control Valve

Water Meter



What's the purpose of a water meter?

Water meters work similarly to a car odometer, recording the **total amount of water** that has passed through the meter. The volume of water is typically measured in gallons or cubic feet.

1. Track water usage: Used to track water daily, weekly, monthly, etc..
2. Billing: Used to determine the cost of water for the end user based on total volume of water used in a given period (billing tiers effect total cost).

Other useful tips:

- Check for leaks: Reading a water meter can help identify leaks - Spinning Meter.
- Verify bill accuracy: A water meter can be used to verify that the water meter reading on a bill is accurate.
- Monthly meter readings on smart controller sites to track and graph usage.

Water Meter vs Flow Sensor

The main difference between a water meter and a flow sensor is that a water meter measures the **volume** of water used, while a flow sensor measures the **rate** of fluid flow:

Water meter: Measures the total amount of water that has passed through a pipe over a period of time. Water meters are used for billing and conservation efforts.

- ★ Measured in gallons or cubic feet

Flow sensor: Flow sensors are used to monitor flow rates in real time and detect changes or irregularities. Flow sensors can be used in irrigation systems to measure water use separately, and to detect high or low flow rates.

- ★ Measured in gallons per minute - GPM

Backflow Preventers

What's the purpose of a Backflow Preventer?

The purpose of a backflow preventer is to **prevent contaminated water from flowing backward** into the main water supply, which can contaminate drinking water. Backflow preventers are installed on water pipes to allow water to flow in one direction only.

Backpressure = customer pressure overcomes the water district water pressure

- ★ Water forces itself back into the main supply.

Backsiphonage = street mainline goes negative

- ★ Water is siphoned back into the main supply (break in the water main).

Installation and maintenance:

- Typically installed as close as possible to the POC.
- Required to be Inspected/ tested annually.

Types of Backflow Preventers

1. Pressure Vacuum Breaker (PVB)
   - ❖ A common, residential backflow preventer that protects against backsiphonage only.
   - ❖ Must be installed 12” higher than the final outlet.
   - ❖ Can be used in health hazard conditions.

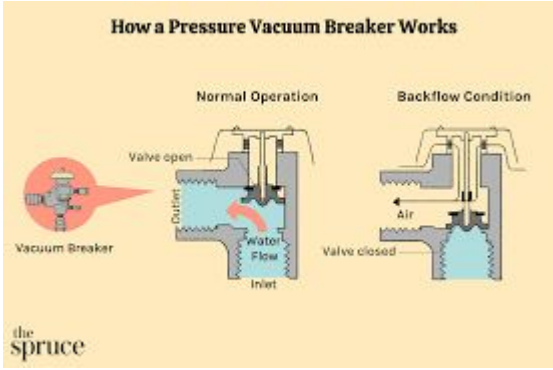
2. Double Check Valve (DC)
   - ❖ A backflow preventer with two check valves, two shutoff valves, and test cocks. If one check is stuck open, the other check will protect the water supply.
   - ❖ Only used to protect against non-health hazard conditions.
   - ❖ Commonly used in fire protection systems.

3. Reduced Pressure Principle Assembly (RP)
   - ❖ Maximum protection against backsiphonage and backpressure - most commonly used in commercial irrigation systems.
   - ❖ Used in health hazard conditions (irrigation systems).

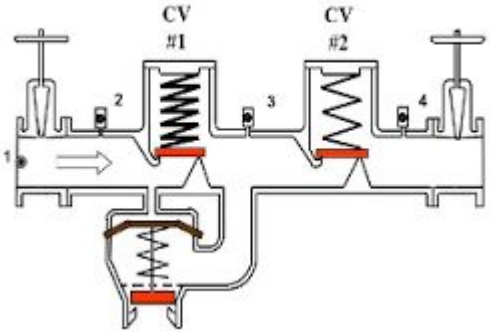
4. Atmospheric Vacuum Breaker (AVB)
   - ❖ Protects against backsiphonage only.
   - ❖ Requires one unit downstream of control valve - cannot be installed under constant pressure.
   - ❖ Must be installed 6” higher than final outlet.
   - ❖ Can be used in health hazard conditions.

PVB vs RPZ

PVB: A pressure vacuum breaker consists of a check valve, and an **air inlet that is vented to the atmosphere (open-air)**. The check valve is designed to allow water through and keep the air inlet closed during normal conditions. When the air pressure is greater than the water pressure, the vented chamber opens and breaks the suction effect of the low pressure, thereby preventing the backflow of water.



RPZ: provides the best level of protection because of its **relief valve, which will open up and dump the water** as a last resort to prevent contamination.The RPZ operates on the hydraulic principle that water will not flow from a zone of lower pressure to a zone of higher pressure. Its by a differential-pressure valve in which the relief valve is held closed when the pressure in between two main check valves is lower than the pressure on supply-side by a prescribed amount. When the pressure falls on the supply side below the required value, the relief valve opens and the intermediate zone discharges to the surrounding atmosphere.

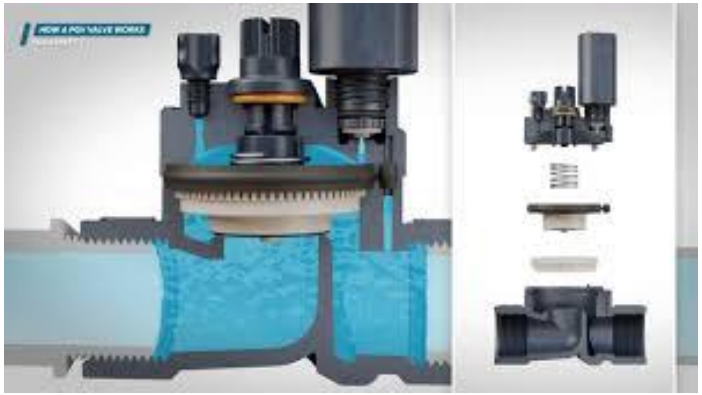


Irrigation Control Valve

If the controller is the brains of your system the valves are the heart. They control the flow of water through the lines. When a control valve is running you **can usually hear a clicking/buzzing sound when operating properly**.

An irrigation control valve regulates the flow of water in an irrigation system and can be used to:

- ➔ Water only part of the landscape at a time - zoning.
  - ◆ Plants vs lawn
- ➔ Regulate water flow to areas within the landscape with different water requirements - hydrozoning.
  - ◆ Trees, shrubs, turf, palms, annuals, etc.
- ➔ Control water pressure
  - ◆ Adjust flow control to regulate flow through the valve



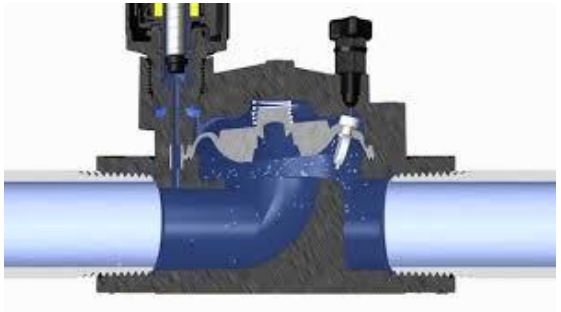
Irrigation Control Valve - How it works

Irrigation valves work by using a solenoid to control the flow of water through the valve:

1. Water pressure
   - When the system is turned on, water pressure builds in the center of the valve around the diaphragm.
   - The pressure differential inside the valve keeps the valve/diaphragm closed.

2. Solenoid activated
   - When the controller sends an electrical signal to the solenoid, it becomes an electromagnet and pulls the plunger up.
   - This opens the passage for water to flow from the solenoid and bonnet chamber into the valve outlet.
   - This allows the pressure differential inside the valve to lift the diaphragm and allow water to flow out.

3. Solenoid deactivated
   - When the electricity to the solenoid stops, the plunger drops down, closing the passage and controlling the water flow to build pressure and close the valve.



Electrical Control

1. Irrigation Controller
2. Irrigation Wiring
3. Irrigation Control Valve
4. Troubleshooting

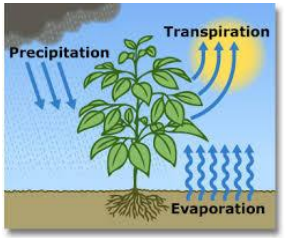
Irrigation Controller

What's the purpose of an irrigation controller?

An irrigation controller's purpose is to automatically turn on and off an irrigation system, such as lawn sprinklers or drip irrigation systems, based on a programmed schedule.

- Create a customized watering schedule: Use local weather and landscape information to match watering schedules to weather conditions and plant needs
- Reduce water waste: Weather-based irrigation controllers (WBICs) use local weather data and landscape conditions to determine when and how much to water
- Support multiple zones: Regulate watering for each zone in a lawn's irrigation system
- Support sensors: Enhance controllers with sensors like rain, flow, or freeze sensors to optimize water use
- Be controlled remotely: Smart controllers can be managed from a remote location through Wi-Fi, cellular signals, and radio.

Smart Irrigation: ET (evapotranspiration)



Evapotranspiration, or ET, is the process of water evaporating from land and water surfaces, and transpiring from plants, and re-entering the atmosphere. It's affected by many factors, including:

- Temperature: Higher temperatures increase the rate of evapotranspiration, especially during the growing season.
- Wind: Increased air movement around plants increases the rate of transpiration.
- Humidity: Lower relative humidity means drier air and higher evaporation rates.
- Soil moisture: Significant evaporation only occurs when the top layer of soil or plant canopy is wet.
- Soil type: The composition and structure of soil determines its ability to retain water.
- Solar radiation: The amount of solar radiation affects the rate of evapotranspiration.
- Atmospheric vapor pressure: Atmospheric vapor pressure affects the rate of evapotranspiration.
- Plant cover: As the growing season progresses, canopy cover increases, which gradually decreases evaporation from the wet soil surface.
- Biological processes: Biological processes like leaf emergence, leaf development, and stomatal conductance affect evapotranspiration.

Irrigation Wiring

Irrigation controller wiring works by sending electrical signals from the controller to the valves in the sprinkler system to open and close:

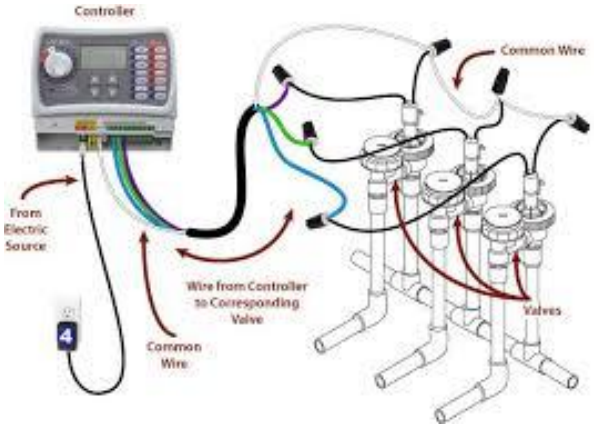
Controller: Stores information on when and how long to water, cycle and soak, and field wire conditions.

Wires: Connect the controller to the valves, allowing the controller to remotely start and stop the sprinkler system.

Common wire: Typically a white wire that runs from the controller to each valve in the system. This wire serves as the return path for the current. If the common wire is cut, all of the valves after the cut will not turn on.

Hot wires: Run from each zone at the controller to each valve in the system. Each zone can be operated independently through the controller. A break in the hot wire will prevent only a single station from watering.

Waterproof connectors: Used for each connection to prevent water damage and corrosion to the wiring circuit.



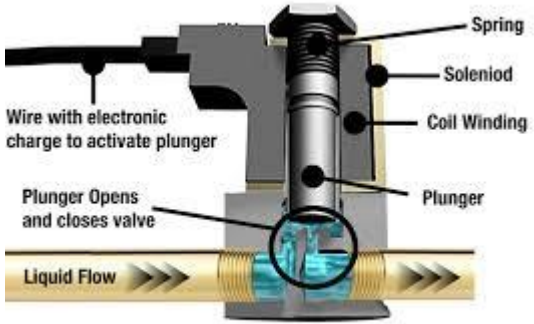
Remote Control Valve Wiring

A solenoid valve works electrically by using an electromagnetic coil to create a magnetic field that moves a plunger, which controls the flow of water through the valve:

1. Energize the coil: When an electrical current is applied to the solenoid's coil, it creates a magnetic field.
2. Move the plunger: The magnetic field attracts or repels the plunger, causing it to move linearly.
3. Control the valve: The plunger's movement changes the position of valve components, which controls the flow, direction, and pressure of the fluid.
4. De-energize the coil: When the current is removed, the spring returns the plunger to its original position.

Causes for a solenoid to not work:

- a break in the common or hot wire
- a short in the solenoid coil
- corroded wiring / water damage to the system



Parts of a Solenoid Valve

Electrical Troubleshooting Process

1. Confirm Water Supply - Check valve (backflow, mainline) manually to see if there is water.
    - Go to valve to check to see if flow control stem is opened, ball valve is open, and any isolation valves on the mainline are opened as well.
2. Return to clock – Check to see if clock has power or blown fuse.
    - Make sure panel is functioning properly. Power can be checked using voltmeter on incoming power. Incoming power should read 120-128VAC.
    - If no incoming power, check breaker and fuses.
3. At clock - Check programming and make sure runtimes, watering days, and start times are correct for the season (Winter, Spring, Summer, Fall).
4. At clock - use multimeter to see if there is voltage to the modules/station.
    - Use multimeter on Volts ~ AC. **You need to manually turn on a station from clock**, then check between common and hot wire of the station you manually turned on. Voltage should read between 21 and 27 ~ VAC.

Electrical Troubleshooting Process

5. At clock – check to see if there is a short, open current, or bad common using multimeter.
    - Use multimeter on Ohms Ω. First, disconnect common wire from clock! Hot wire can stay inside module if you're able to connect multimeter. If not remove both common and hot wire and check resistance (ohmsΩ) between common and hot wire. OhmΩ reading between hot and common should be between 20-60Ω ohms.

    - If the reading is less than 20 ohms Ω there is a short, most likely at valve in the solenoid.
        - Go to valve, cut out solenoid and check ohms. If shorted, replace solenoid.

    - If the reading is 70-500Ω, there is a partial open. This indicates a nicked wire, bad wire splice, or wires in water.
        - Check for new construction (new electrical, internet) removed trees, or any signs of digging between controller and valve. If there are signs, dig up area and check wiring.
        - Go to valve box and check wire connections. If bad, rusted, black, or not in wire proof connectors, resplice wiring and make the connections are waterproof.

Electrical Troubleshooting Process

- If the reading is higher than 500Ω or reads and infinite∞, this indicates an open current.
    - Check all wire connections, signs of new construction. The common wire connection could be bad in valve box that is not working, in the valve directly before it, or somewhere along that path in between.
    - Make sure all connections are good and waterproofed.
    - If broken connections are not found, a wire tracker and toner will most likely be necessary to find the break.

6. TEST VALVE - At clock, manually turn on valve and ensure the valve opens and closes properly from the clock. Make sure all repairs are made clean and neat. **Remember to turn the clock back to “RUN”.**