cyber rain

APPLICATION NOTE 2012

Using Flow Sensors with Cyber-Rain Controllers

2/23/2012

Abstract: Best practices for choosing, installing, and wiring a flow sensor for a site operated by a Cyber-Rain XCI controller. Additional consideration is given to sharing flow sensors between multiple controllers.

Choosing a Flow Sensor

Cyber-Rain XCI Pro controllers support Badger/Data Industrial (DI), Creative Sensor Technologies (CST), ARAD/Netafim and other popular flow sensors. Supported flow sensors generally fall into two categories, DI/CST impeller type flow sensors and "meter type" flow sensors.
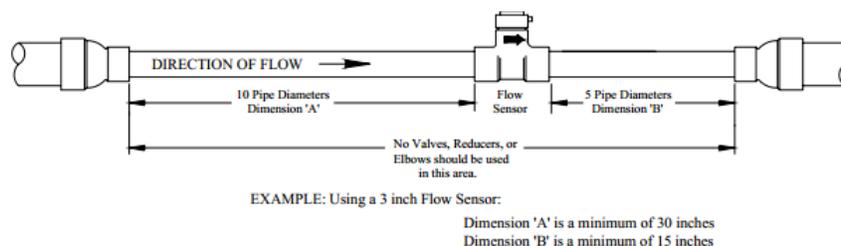
DI/CST flow sensors provide the controller a pulse rate from which the flow rate through the sensors can be determined through a function when both the "k value" and "offset" calibration parameters are given. These sensors are usually more precise, especially at low flow rates. CST offers a lower cost alternative to DI sensors.

"Meter type" flow sensors include sensors made by ARAD/Netafim, Bermad and other popular flow sensors that have a magnetic reed (dry contact) interface. These flow sensors have a meter that spins with a rotation velocity proportional to the flow rate through the sensor. The meter will have a magnet placed on it that closes a switch, and the rate at which this switch is closed determines the flow rate. The fact that these sensors have a built in meter make them attractive to some users, but they are less accurate than the DI/CST alternative and the meters come preset to a certain "gallons per pulse" value that may reduce their precision and stability at low or high flow rates.

Every flow sensor reads flow within well defined limits. Make sure the flow sensor that is selected can measure the flow range between the irrigation system's minimum and maximum flow rates. This may require the flow sensor to be one or even two sizes smaller than the main pipeline size.

Determining Proper Location of Flow Sensor

The following drawing shows a typical installation of a flow sensor:

DIRECTION OF FLOW →

10 Pipe Diameters
Dimension 'A'

Flow
Sensor

5 Pipe Diameters
Dimension 'B'

No Valves, Reducers, or
Elbows should be used
in this area.

EXAMPLE: Using a 3 inch Flow Sensor:

Dimension 'A' is a minimum of 30 inches
Dimension 'B' is a minimum of 15 inches

Each Cyber-Rain XCI Pro Controller should have one flow sensor connected to it that is not shared with any other controllers (see Sharing Flow Sensors section). The flow sensor should be placed at a location on the pipe with at least 10 diameters of straight pipe upstream and 5 diameters downstream of the sensor location. A pipe 3" in diameter will

require 30" upstream and 15" downstream to ensure accuracy. The sensor should be housed in an adequately sized valve/meter box for easy installation and service.

When choosing the point in the irrigation system where the sensor is to be placed, make sure the sensor will not experience any flow that is unrelated to the irrigation zones that the controller manages. If the flow sensor is installed in a section of pipe that supplies water to unrelated systems, the controller will not be able to interpret the cause of the water flow and report over-flow alerts.

Wiring Guidelines

The most important wiring consideration that must be made before beginning the installation of a flow sensor is to choose the correct signal cable. Use "shielded and armored buried signal cable" (sometimes referred to as irrigation communication cable). Simple valve cable will not work properly as the physical characteristics of this wire makes it unsuitable for communication.

Here are a few examples of acceptable flow sensor wire:

- Paige spec P7171D-A-Rev 7 Underground Communication Cable, shielded and armored, 18AWG
- Weathermatic SLC100 100 ft. Shielded Communication Cable
- Imperial Technical Services Flow Sensor Wire, Shielded, FSW16

Once proper wire has been chosen, use the following guidelines to wire the controller to the flow sensor.

Wiring Tips:

- Make sure that both flow sensor wires are securely inserted into the flow sensor wiring harness and each screw is tightened until it clamps down tightly on the wires.

- The (+) *positive* wire should be connected to the right side opening in the flow sensor harness and the (-) *negative* wire (or ground) to the left side opening (make sure the screw terminals are facing up). Normally, the *red* wire goes to (+) *positive* terminal and the *black* wire to the (-) *negative* terminal.

- Ensure that the proper **shielded and armored buried signal cable** wire is being used. The flow sensor wires should be properly insulated and shielded as to reduce the risk of electrical interference. 18 AWG multi-strand tin coated copper conductor with 0.002345" aluminum/mylar helically applied tape shielding and high density polyethylene insulation is suggested. The jacket should be suitable for direct burial.

- Running the flow sensor signal wires in the same wire harness as the valve wires increases the likelihood of electrical noise and is strongly discouraged**.**

- Make sure that the controller is grounded properly. The LEFT PIN of the flow sensor can be tied to ground to ensure this.

- Make sure the flow sensor harness is fully inserted into the connector located on the bottom of your controller labeled "FLOW", and that it is properly aligned.

- Make a water tight splice. Use a two part epoxy type or a silicone grease filled splice waterproofing kit. Be sure to cover the ends of the cable jacket.

cyber rain

- Make sure the epoxy is hardened before inverting the splice or dropping it in standing water.

Flow Sensor Grounding Guidelines

Make sure you are using shielded burial signal cable. Traditional irrigation wires will NOT work

The Cyber-Rain controller should be tied to earth ground to reduce likelihood of noise. The left pin of the flow sensor is connected to the controller's ground internally, so if the controller has been properly tied to earth ground during installation it may not need any external grounding. It is possible that the controller was left "floating" after installation if the controller's chassis was never connected to earth ground. In this case, the left pin of the flow sensor should be connected to earth ground to ensure the sensor's stability. The shielding that surrounds the flow sensor cabling wires can also be connected to ground to reduce the chance of noise. Please contact a licensed electrician is you are not familiar with grounding considerations. Be advised that incorrectly wiring your controller could cause injury to yourself, equipment, house, etc.

**Installing and Using a Flow Sensor (Pro Model Only)**

To properly implement flow sensing on your Cyber-Rain controller, you must complete the following steps:

Note: If you have a "Meter Type" flow sensor, a minimum of two pulses is required to establish flow rate. If a zone has emitters with very low precipitation rates, the "Fill Time" may be longer and there may be a delay in reporting flow to the PC.

1. **Mount:** Follow the instructions given in the flow sensor's manual to install the flow sensor at the desired location. Each flow sensor comes with its own instructions for where the sensor should be installed and aligned. Follow the manufacturer's instructions.

1. **Wire:** The flow sensor wires should be properly shielded as to reduce the risk of electrical interference. Use only shielded and armored buried signal cable, with stranded copper conductor twisted pair 18 AWG wire. Make sure the grounding guidelines (given before) have been observed. Avoid running the signal wires in the same wire harness as the valve wires increases the likelihood of signal noise.

2. **Connect:** There will be two wire leads that extend from the signal cable. Make sure that these leads are long enough to reach the controller. Insert each wire into the flow sensor harness *(included)* and tighten each screw until it clamps down tightly on the wires. Connect the (+) *positive* wire to the right side opening in the flow sensor harness and the (-) *negative* wire to the left side opening (make sure the screw terminals are facing up). Typically the *red* wire goes to (+) *positive* terminal and the *black* wire to the (-) *negative* terminal.

3. **Insert:** Insert the flow sensor harness into the connector located on the bottom of your controller labeled "FLOW", making sure that it is properly aligned. **Note this is the 2-wire harness on the RIGHT.**

4. **Setup Parameters:** Refer to the manual to enable the flow sensor through the Cyber-Rain software. You will have to also choose what type of flow sensor is installed, DI or meter type.

   a. Meter Type: Select this option if you have a "Meter Type" flow sensor (e.g., ARAD/Netafim, Bermad). The "gallons per pulse" parameter allows you to calibrate the software to your specific flow sensor. This value is typically found marked on the flow sensor itself. Enter this value in the appropriate field on the System Details tab.

   b. Data Industrial Type: Select this option if you have a "Data Industrial" impeller type flow sensor. The "K Value" and "Offset" parameters should be provided with your meter and allow you to calibrate the software to your specific flow sensor. Enter these values in the appropriate fields on the System Details tab.
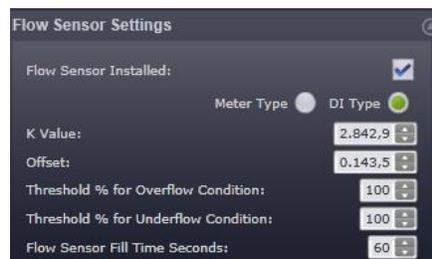
5. **Set Thresholds:** The "Thresholds" are used for setting the alert levels for too much or too little water flowing through the system. **If Cyber-Rain detects overflow, it will shut off your watering** and send you an email. If it detects underflow, it will send you an email but keep watering. Thresholds are set as a percentage difference from normal flow. For example, if the normal flow for a valve is 10 GPM and the overflow threshold is set to 20%, a flow rate of 12 GPM or greater will cause an overflow condition. Likewise, if the underflow threshold is set to 20%, a flow rate of 8 GPM or less will cause an underflow condition. The Cyber-Rain software ships with default threshold values of 20%, but these can be adjusted as needed.

6. **Set Fill Time:** Fill time is the amount of time that it takes the irrigation pipes to reach a steady state flow of water. Irrigation pipes tend to flow water more rapidly when first they are first opened as the pipes are pressurized. If the fill time is set too short, the controller will register an overflow event before the flow rate has had a chance to stabilize. To properly determine your fill time for each zone, manually run the zone while keeping note of the elapsed time. The amount of time that passes before the flow rate stabilizes is your fill time. Fill time is typically 30-90 seconds; Cyber-Rain defaults this time to be 30 seconds.

7. **Set Normal Flow:** Flow alerts do not occur for any zone until the "Normal Flow" has been set for each zone. Normal flow is the typical rate water flows through each valve when water is flowing at a steady state and everything is working correctly. The normal flow rate should be set for every zone. Refer to the manual for more information.

Once your flow sensor has been properly installed and setup on the Cyber-Rain software, you are ready to begin using it for monitoring your irrigation flow and receiving alerts for abnormal flow conditions. You can monitor the actual flow rate through a zone by watching the gauge on the Controller tab while that zone is running. The counter will keep track of gallons used and can be reset by pressing the reset button.

Sharing Flow Sensors

Sometimes it is desired to use a single flow sensor to read the flow of two or more controllers. This should generally be avoided if possible, and it is recommended that each controller have its own flow sensor. Although generally discouraged, it is possible to use a relay to share a single flow sensor between two controllers. If this is done, it is important to note that if both controllers are activated at the same time flow can be unpredictable and thus over-flow alerts may be thrown which can cause watering to abruptly stop.

A "double throw" relay must be used in this instance. An example is shown below:

Double throw relays have two coil terminals and three switch terminals. One terminal, in this case Terminal C, is shared with the other two terminals. Terminals B and C will be normally closed, and terminals A and C will be normally open. When the relay is energized, Terminals A and C will connect, and Terminals B and C will disconnect.

The coil/energizing terminals of the relay should be connected to the first controller's master valve and common ports. The left pin the first controller's flow port should be connected to the negative (or ground) wire of the flow sensor. The right pin of the controller's flow sensor port should be connected to Terminal A of the relay. The second controller's left pin of the flow sensor port should also be connected to the ground/negative wire of the flow sensor, but its right pin should now be connected to Terminal B. The shared terminal of the relay (in our example Terminal C) should go to the flow sensor's positive wire.

When the first controller is energized, the relay is energized, and the flow switch flips, causing the flow sensor to be connected to Terminal A, which is connected to the first controller. When the first controller is not in use, the flow sensor will be connected to the second controller, which will read any overflows that occur when neither controller is in use.

The following figure illustrates how to wire two controllers to one flow sensor using a single SPDT relay:
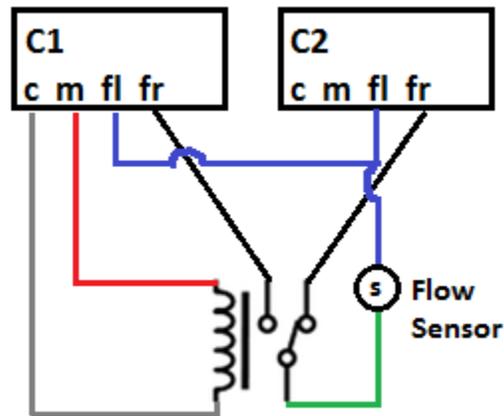
Figure 1: Two Controllers Sharing Single Flow Sensor

Cyber-Rain recommends the following relays, which are available from Allied Electronics:

- RJ2S-CL-A24 IDEC DPDT 24VAC Relay
- SJ2S-05B   Socket for IDEC Relay

In addition, Creative Sensor Technologies offer a relay known as an "Iso-Flow" that is used to isolate two controllers using a single flow sensor.

For more information about the "Iso-Flow", visit http://www.creativesensortechnology.com/