√Note

Using Small Timers to Control Large Irrigation Valves

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Irrigation research sites are often located at remote locations where AC power is not available to operate irrigation timers and control valves. The expense of bringing AC power to these sites may be prohibitive. Battery-powered timers offer flexible programming options in these circumstances. Small electronic water timers such as the Nelson Rain Date (L.R. Nelson Corp., Peoria, Ill.) allow programming of up to three different watering cycles during each 24-hour period. The Nelson unit may be programmed to run from 1 minute up to 11 hours and 59 minutes. Watering cycles may be programmed to water any day or every day of the week as well as every other day or every third day.

Unfortunately, the orifice of small battery-powered timers may not allow sufficient water flow to service large research or commercial plots. The Nelson Rain Date will allow 38 to 79 L/min of water flow at 69 to 345 kPa water pressure, respectively. Above this flow rate, significant friction losses may result. Manufacturers specifications state the maximum flow is 113 L/min through a 19-mm Dorot (Netafim Irrigation Inc., Valley Stream, N.Y.) control valve, 189 L/min through a 25-mm valve, and 662 L/min through a 50-mm valve.

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We use Nelson Rain Date timers to activate larger irrigation valves equipped with Shastomits (Netafim Irrigation Inc.). A Shastomit is a three-way pressure-operated pilot valve that is actuated by an internal diaphragm and serves as a hydraulic relay. It transforms a valve's normally open function to a normally closed function. A magnetic, latching solenoid is normally used to apply pressurized water to the Shastomit-valve assembly. In our system, the latching solenoid, its power source, and control device were replaced with a Nelson Rain Date water timer (Fig. 1).

To adapt our timer, a 100- to 150-mm-long piece of 12.7-mm polyethylene tubing (PE) with a female hose fitting was fitted to the outlet of the timer. The open end of the PE tubing was closed off. A 450- to 600-mm length of 6- or 8-mm microtubing was used to connect the PE tubing and the Shastomit. This was accomplished by inserting one end of a 6-mm barbed connector fitting into one end of the microtubing and inserting the remaining end of the barbed fitting into the PE tubing. The remaining end of micro tubing was attached to the Shastomit with a fitting supplied with the Shastomit unit.

When the timer valve opened, pressure was applied to the Shastomit, opening the larger control valve. When the timer valve closed, the connecting tubing remained pressurized, and the control valve failed to operate properly without modification. To eliminate this problem, a drip-irrigation emitter with an output of 8 L/hour was fitted to the 12.7-mm PE tubing by inserting the barbed end of the emitter into a prepunched hole. When the timer valve closes, the irrigation emitter acts as a pressure-release valve to the Shastomit and the irrigation valve closes. There is a small discharge of water from the emitter when the timer valve is open, but enough pressure will be maintained at the Shastomit to allow the irrigation valve to remain open. This small continuous discharge may be a slight inconvenience with this technique. To avoid a malfunction, the water supply to the Shastomit must be relatively clean. Therefore, a 150-mesh screen filter was placed upstream of the water timer. Figure 2 illustrates the water flow paths through the system.

The previously described system was used on the Texas Agricultural Experiment Station at Stephenville to control irrigation to melon test plots in 1994, 1995, and 1996. System failures were few. Most failures were attributed to insects plugging the outlet of the pressure relief emitter. Other failures were in the electronic timer itself.