

BUILD AN 8-14 ZONE IRRIGATION CONTROLLER USING THE LynX-PORT

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 Application Note 003
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INTRODUCTION

The LynX-PORT is one of the most versatile X-10 peripherals available today. Due to the flexibility of the board, it can be used to control remote low-voltage valves like those used in irrigation systems. In this application note we will examine what it takes to create an irrigation controller using a single LynX-PORT, which will provide 1-14 zones of valve controls as well as manual controls and over-rides.

DESCRIPTION OF APPLICATION

Irrigation systems are typically divided up into zones to maintain enough water pressure to run the sprinkler heads. This usually requires either a valve manifold (a localized group of valves off a single feed) or distributing valves around the system. In either case, the system needs to perform certain tasks to ensure the proper operation of sprinklers and adequate coverage of the landscaping. Let's examine the LynX-PORT and see how this might be accomplished.

The LynX-PORT model 201 has 8 programmable relays, 8 programmable inputs, and 4 programmable analog channels. The LynX-PORT itself has no knowledge of time or schedules, but it has the ability to lock out or restrict certain functions if programmed correctly. In the irrigation case, only a single valve is allowed on at a time to insure proper water pressure. Irrigation systems are designed using the water pressure available at the valves, and only a limited number of sprinkler heads can be attached to each zone. To insure that no more than one valve is allowed on at a time, we will use the EXCLUSIVE feature of the LynX-PORT relays.

Another useful feature of the LynX-PORT is its 3 relay

buses. These will allow you to connect the 24VAC power required for the valves to the commons of the relays without adding wires. You can also connect +5V or +12V to a bus (as shown in figures 1, 4 and 5) for driving indicators external to the LynX-PORT. This can be useful for remote push-button switches with built-in indicators. The shunts that short a bus to a relay common are rated at 1 amp and will work fine for irrigation valves.

BASIC WIRING

Figure 1 shows the basic wiring diagram for creating a 1 to 8 zone irrigation system. For more than 8 zones we need to break the valves into 2 groups – group A and B. We will use relay 8 as a group selector which will limit the total number of valves to 14 (two groups of 7 each). Figure 4 shows the wiring diagram for that scenario. Which method you use depends on how many valves you need to control. You can also separate other functions other than valves, which we will discuss later.

The relays need to be programmed correctly to insure that no more than one relay is on at a time. Figure 2 shows the programming for relay 1. In this example, the LynX-PORT is on house code J, so the code for the relay is J1. As you can see, every choice is checked in the RELAY CONFIGURATION dialog box. Let's explain what is going on. You always want the relay to respond to X-10 messages, so that is enabled. You also want to limit the time the relay is engaged to prevent run-away watering (which could be a very bad thing if you or your client go away for vacation). You want to prevent more than one relay from being engaged at a time, so the EXCLUSIVE function is enabled. We have all the relays join group zero (0). If a relay in this group is turned on by any

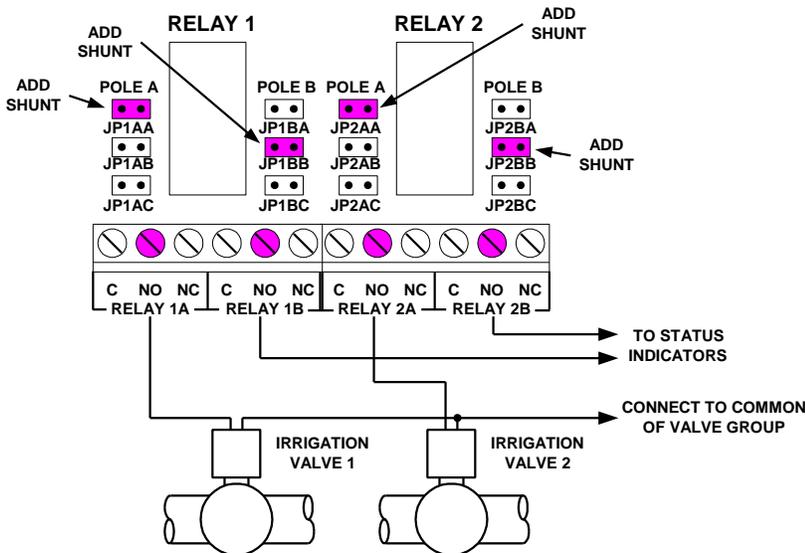
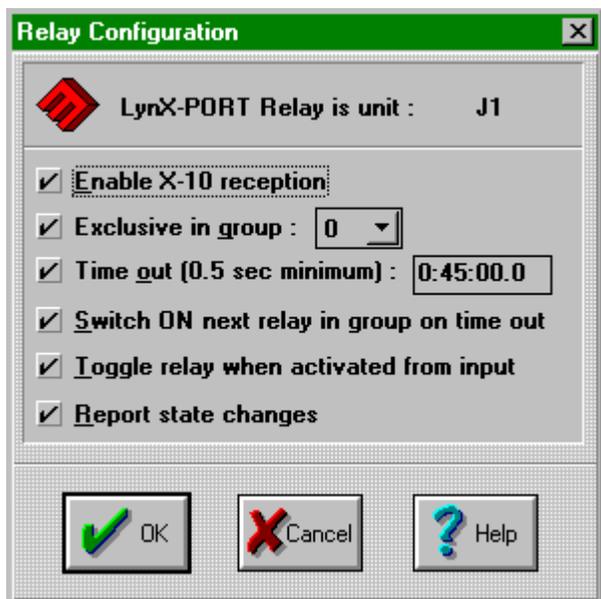


FIGURE 1: Irrigation valve connection to relays 1 and 2 of the LynX-PORT. Add more valves as needed up to 8. For more than 8, group the valves into banks and switch between each bank with a relay. Note: you'll only be able to handle up to 14 valves since one relay is used to switch the banks. See text for more details.

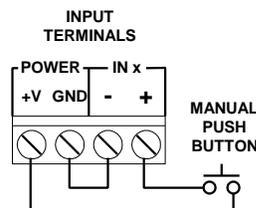
FIGURE 2 – Relay programming dialog box



means, the LynX-PORT will turn off all relays in group zero (0) first, before turning on the new relay. We also want the LynX-PORT to report any changes in the states of these relays to keep any X-10 control software synchronized. If a relay turns on or off, it will send an X-10 command on to the power line (as well as the RS-232 port). We also use the SWITCH ON NEXT RELAY IN GROUP ON TIME OUT option, which will automatically signal the next relay to turn on when the previous relay times out. This can be an optional function depending on your requirements. The relays run in numerical order with the lower number relays (like J1) tripping the higher number relays in the group. The relays do not need to be consecutive to work in this fashion. For instance, J1

can trip J3 if they are in the same group. For manual control we also enable the TOGGLE RELAY WHEN ACTIVATED FROM INPUT feature. This allows a user to manually turn on or off a valve by using a momentary push button connected to an input and slaved to a relay. It will require one push-button per zone. For the systems that use valve bank switching, one push-button will toggle the valve bank, and the others will toggle the valve state. The push-button connection to the LynX-PORT is shown in figure 3.

FIGURE 3 – Manual push-button connections



In the case where we use relay 8 to control two banks of valves, we program this relay differently. Here we only enable REPORT STATE CHANGES, and ENABLE X-10 RECEPTION. We don't make it exclusive in any group (we need it to be engaged at any time), and we don't allow it to time out. You could however set its timeout to a period longer than the sum of all the valve relays combined which would set the bank relay back to bank A as a default. Most zones will be programmed to time out after 1 hour. The longest period that can be programmed is around 9 hours.

BUS CONNECTIONS

To use the circuits shown in figures 1 and 4, we must

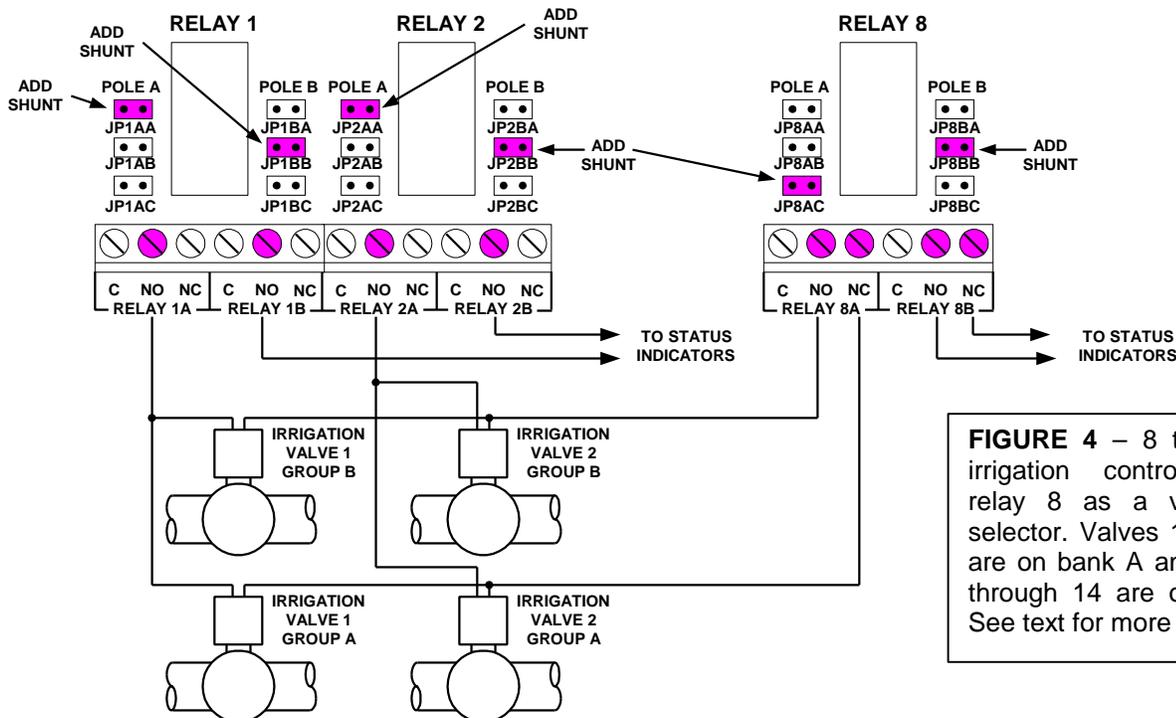
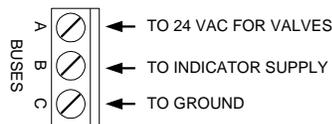


FIGURE 4 – 8 to 14 zone irrigation controller using relay 8 as a valve bank selector. Valves 1 through 7 are on bank A and valves 8 through 14 are on bank B. See text for more details.

connect valve power, indicator power, and ground to the 3 buses on the LynX-PORT. The shunt connections shown in both figure 1 and 4 place the valve power (24VAC) on bus A, the indicator power (whatever the indicators require, +5VDC for example) on bus B, and ground (or common) on bus C. If you are using indicators that require +5VDC, the LynX-PORT can provide it from the analog section terminals. This makes wiring this design a breeze. You use the normally open (NO) connections on pole 'A' for the relays. Their commons are connected to the 24VAC through the bus 'A' shunt next to the relay. The indicators hook up in a similar fashion and use the normally open (NO) contacts of pole 'B'. The current to run the indicators is provided by bus 'B' through the shunt on the 'B' side of the relay. Be careful not to place a shunt in the wrong place. Damage to power supplies or indicators may result. Always double-check the outputs before hooking up the valves and indicators.

You can optionally hook the normally closed (NC) connections of pole 'B' (the indicator side) of each valve relay to a ZONE OFF indicator if desired. This is sometimes handy since there will always be a state indication. If nothing is lit, a user will be alerted that power may have failed at the controller.

FIGURE 5 – Bus connections for power and ground



OTHER FUNCTIONS

Additional functions can be incorporated into the design such as a system override for rain detection. A simple method of override is to interrupt the power supplied to the irrigation valves. If you need computer control to override the system, another relay can be used to interrupt the power to the valves. This relay can also be slaved to a rain or wind sensor to terminate the cycle. The input should be slaved to the relay controlling the power to the valves. With this relay engaged, valve power will be interrupted no matter what commands are sent to the LynX-PORT, either manual or automatic.

Another function might be a pump control. One relay can be dedicated to running the pump controls (note: the LynX-PORT relays are only rated to 2 amps at 30VDC or 0.6 amp at 125VAC). The relay would tie into the main power controls for the pump and could be used to start and stop the pump under X-10 control (or via the RS-232 port as well).

The on-board Analog to Digital Converter (ADC) can also be used for additional features like soil moisture measurements. Using an in-ground analog moisture

sensor, the LynX-PORT analog inputs can be programmed to disable the system (via a relay – or computer control) whenever the soil moisture is above a certain level. Also, conversely the system could be activated or the controlling computer be alerted that the soil moisture has fallen below desired limits so irrigation can begin.

CONCLUSION

As seen in this application note, the LynX-PORT is a very flexible and useful device. Irrigation requires a special set of functions for valve exclusion, time outs, and manual overrides. The LynX-PORT works well in this environment, and should prove very useful and easy to use.