

Ladder Control

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Revision History:

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The Project

Model Railroad Control Systems designed an Arduino-based board to control relays. This device, the [Arduino Relay Breakout For Arduino Nano](https://github.com/joneschmidt/EffectController), was originally used for controlling special effects such as lighting effects for a model railroad. The sketch for this purpose may be found at <https://github.com/joneschmidt/EffectController>.

This board can be used to control turnouts. This document describes an Arduino sketch for that use, "Ladder Control." This and associated documents may be found at <https://github.com/joneschmidt/LadderControl>.

Arduino Sketch: LadderControl

The software controls a ladder of turnouts based on the activation of a pushbutton indicating the desired destination. Each destination requires an activating button, and a path to get to that destination. The user defines the tracks and associated buttons, and each turnout in the ladder.

- Turnouts may be stall (continuous power) or momentary.
- Momentary turnouts require an additional relay to turn on and turn off the power to the switch machine.
- Stall turnouts optionally may have an optional relay to turn on and turn off the power to the switch machine.

Not yet implemented:

- I2C connection to additional sensors/controls.
- Alternate paths.

The Design

The user defines their ladder by specifying destination tracks and turnouts into tables. The sketch will walk the tables and initially turn off power to any power relays it finds. It then goes into a loop waiting for a button to be pushed.

When a button is pushed the sketch walks the tables again and builds the path of turnouts it needs to throw to get to that path. It will confirm that the path is unoccupied before proceeding and then throws those turnouts from the selected track (bottom) up. It will only change turnouts in the selected path. It will then loop waiting for a different button to be activated to select a track.

Software: Definitions

```
// USER: number of turnouts in ladder
#define NUMTURNOUTS 5
// USER: number of destination tracks
#define NUMTRACKS 6
```

```
Turnout definitions:
// field definitions for the turnout table
TurnName - text name of the turnout
TurnType - "STALL" or "MOMNTRY"
```

TurnPort - the control port for the relay to set direction
 TurnPowrPort - the control port for the power relay: required for
 MOMNTRY machines, optional for STALL machines
 TurnOccPort - turnout occupied sensor: optional; path will not change
 if the path is occupied
 TurnWeight - not yet implemented (NYI) - for alternate path selection
 TurnUpName - upstream turnout name
 TurnUpLeg - upstream turnout leg, normal or diverge
 TurnUpName2 - 2nd upstream turnout for alternate path selection (NYI)
 TurnUpLeg2 - 2nd upstream turnout leg for alternate path selection
 (NYI)

Destination Track definitions:

// field definitions for the tracks table
 ButtonPort - the port for the button selecting the destination track
 TurnName - name of the first upstream turnout
 TurnLeg - upstream turnout leg

Examples:

```

// Example - 1-way ladder
//
//      |   T1
//      / \
//  /-----\
//      0       1 Tracks
//
// USER: number of turnouts in ladder
#define NUMTURNOUTS 1
// USER: number of destination tracks
#define NUMTRACKS 2
//
// define the ladder
TurnoutDef Turnouts [NUMTURNOUTS] = {
// TurnName TurnType TurnPort TurnPowrPort TurnOccPort TurnWeight
TurnUpName TurnUpLeg TurnUpName2 TurnUpLeg2
  "T1", STALL, 2, 4, 0, 0,
  "", 0, "", 0, // top of ladder
}; // Turnouts
// define the destination tracks, buttons, next higher turnout and
// direction
DestnDef Destins [NUMTRACKS] = {
// ButtonPort TurnName TurnLeg
// track 0
  A0, "T1", TNORM,
// track 1
  A1, "T1", TDVRG
}; // Destins

// Example - 6-way ladder

```



```

#define INVERTBUTTONS true
// Relays: if true, HIGH is off
#define INVERTRELAYS true
// milliseconds between each throw of machines in the ladder
#define THROWINTVMS 2000
// Turnout motor type
// stall motor
#define STALL 1 // don't change
#define STALLMS 3000 // duration of power on for STALL
// momentary
#define MOMNTRY 2 // don't change
#define MOMNTRYMS 200 // duration of power on for MOMNTRY
// Turnout Leg Direction
#define TNORM 1 // LOW signal
#define TDVRG 2 // HIGH
// time button live before action
#define DEBOUNCEINRMS 5 // check debounce loop
#define DEBOUNCEMS 20 // must be continuously active debounce
#define FLASHMS 100 // StatusLED flash rate

*** end ***

```