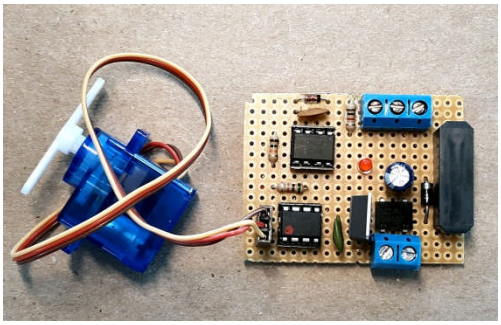
DCC SERVO TURNOUT CONTROL

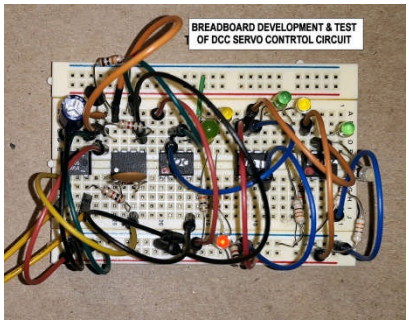
By F. Miller, MMR



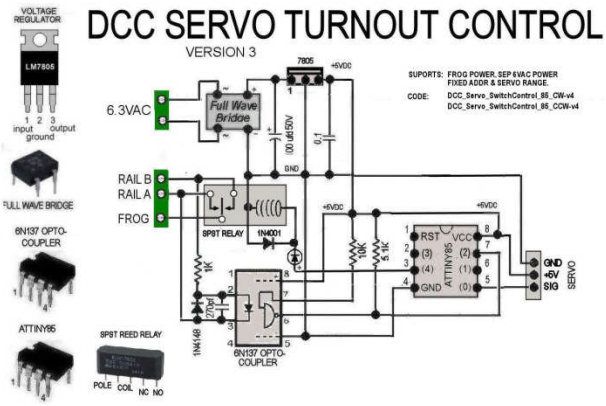
Operation of model railroad turnouts is accomplished by either manual or electro-mechanical means. In years past, model railroaders used solenoid-type switch machines. However these proved to be loud (snap) and subject to wear. To this day, some HO and N Scale turnouts come equipped with self-contained solenoids to actuate the switch points. Many modelers have more recently switched to slow-motion switch machines. Tortoise is perhaps one of the most popular.

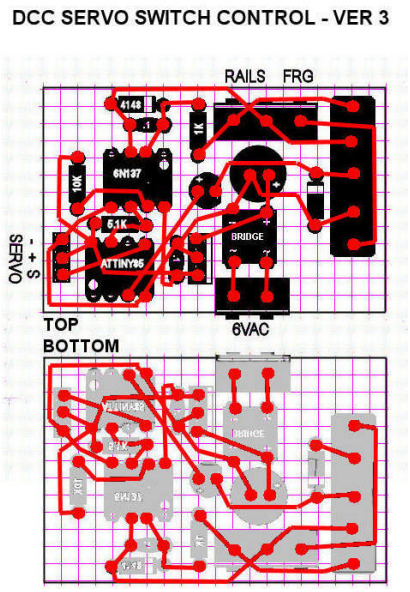
Electrical operation of both types of switch machines is possible with manual push-buttons or toggles. DCC users have an additional option using 'accessory' or 'stationary' decoders, where a DCC Switch Command provides a pulse for the solenoids, or applicable DC voltage for the slow-motion motors. Those DCC switch commands are issued from DCC throttles or other electronic means like JMRI, and serviced by accessory/stationary decoders.

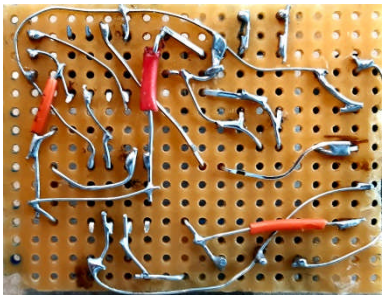
The growing interest in micro-controllers (e.g. Arduino) in model railroad applications, offers still another, even less expensive way to control turnouts from DCC switch commands. I have developed a micro-controller circuit to operate small servo motors, initiated by DCC switch commands. The inexpensive servos I use are typical of the model airplane or robotics hobbies. Servo motors provide rotational motion, generally up to 180 degrees. My electronic circuit makes use of a small, 8 pin micro-controller called an ATTINY85 which runs the controlling software. The price of each device works out to be $6-8, depending upon options and parts sourcing. I feel this is a great price for both control AND motor compared to the popular slow-motion machines plus their controlling means.



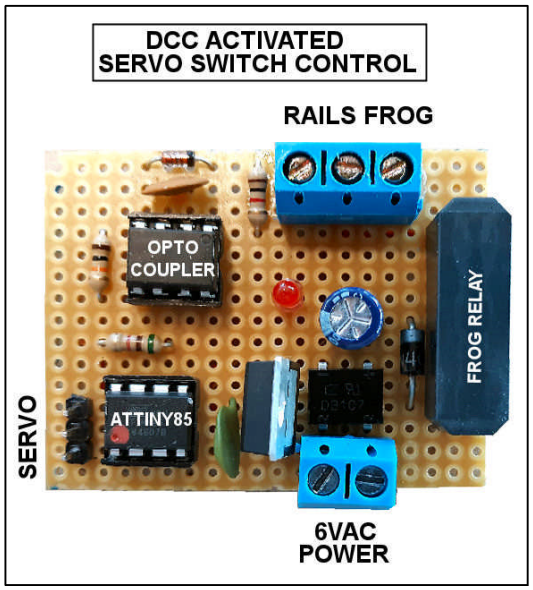
My controlling Arduino program (sketch) was developed on an Arduino UNO with a Breadboard Shield. When the circuit and program worked satisfactorily I moved the code over to a smaller micro-controller, in this case an ATTINY85. I then rechecked the operation with the ATTINY85 (instead of the Arduino UNO) on a breadboard. When that is operating correctly I graphically lay out the components on a perf board template and "wire" the components graphically in a top view. The drawing is then flipped to represent the bottom of the circuit.



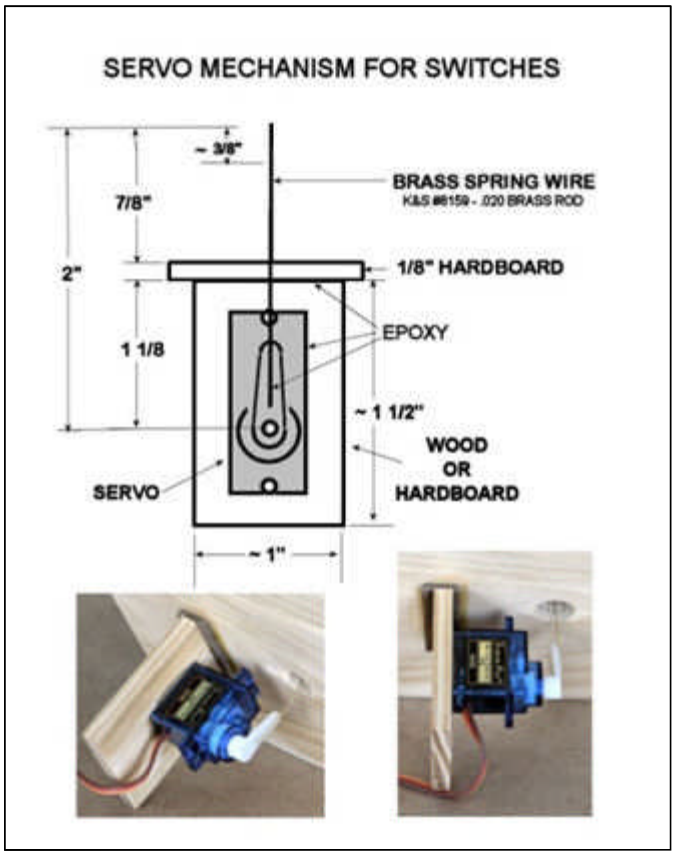




My circuit-software device has provision for powering turnout FROGs. The frog to stock rail connection is changed half-way through the servo arm motion. To prevent possible shorting, the points should be isolated from the-stock rails. (Good DCC turnout practice, anyway.) This version of the unit does not have external provision for setting the DCC Accessory address or the range of motion the servo will take. These are established in the program code, specific to a particular turnout. The last turnout position is saved in the ATTINY's EPROM memory so that on power-up, the turnout will be returned to its last position.



For convenience, I mount the Servo Motor on a block of wood, which in turn is mounted to the bottom of the layout with the spring wire running up to the switch throw rod.



I typically use 5-min Epoxy to fasten the Servo to the wood mount, then Walther's GOO glue to fasten the Servo to the bottom of the layout. (The GOO glue offers time to adjust the positioning while drying.)

The accompanying chart lists the components, identification and prices for the project. Most of the JAMECO prices shown are for single items when purchased in quantities of 10. The total price is about $8. I would be glad to share the ARDUINO software as well as more information on transferring the software to the ATTINY85 micro-controller. I can be contacted at my email address shown in the references.

DCC SERVO SWITCH MACHINE - VER 3					
QTY	PART	SOURCE	PART #	UNIT PRICE	
1	7805 5V 1 AMP REGULATOR	JAMECO	51262	$ 0.45	*
1	6N137 OPTO COUPLER	JAMECO	113911	$ 0.49	*
1	FULL WAVE BRIDGE	JAMECO	178001	$ 0.35	*
1	100 ufd 25V CAPACITOR	JAMECO	93761	$ 0.17	*
1	0.1 ufd CAPACITOR	JAMECO	15270	$ 0.15	*
1	1N4148 DIODE	JAMECO	36038	$ 0.06	*
1	270 PF DISC CAPACITOR	JAMECO	2301975	$ 0.16	*
1	10K RESISTOR	JAMECO	691104	$ 0.06	*
1	5.1K RESISTOR	JAMECO	691032	$ 0.06	*
1	1K RESISTOR	JAMECO	690865	$ 0.06	*
2	8 PIN IC SOCKET	JAMECO	112206	$ 0.16	*
1	ATTINY85 MICROCONTROLLER	JAMECO	2151312	$ 1.75	*
1	SG90 MICRO SERVO	BANGGOOD	1078614	$ 1.74	*
1	SPST RELAY	ALLTRONICS	RLY-496	$ 1.00	
1	2 PIN SCREW TERMINAL	JAMECO	152347	$ 0.59	
1	3 PIN SCREW TERMINAL	JAMECO	2094493	$ 0.69	
1	3 PIN MALE HEADER	JAMECO	109576	$ 0.10	*
	PERF BOARD	JAMECO	616690	~	**
	MISC HARDWARE/SOLDER/GLUE			~	
			~TOTAL	$ 8.04	
	* MIN ORDER QTY OF 10,	** 4.5" X 6.5" BOARD @ $4.19			

References:

- Arduino website (*for tutorials, etc.*): https://www.arduino.cc/
- Jameco website (*for parts*): https://www.jameco.com
- BangGood website (*for parts*): https://www.usa.banggood.com
- AllElectronics website (*for parts*): https://www.allelectronics.com
- Download NMRA DCC library: https://www.arduinolibraries.info/libraries/nmra-dcc
- Authors email *(for further information, files, etc.):* tractionfan@aol.com