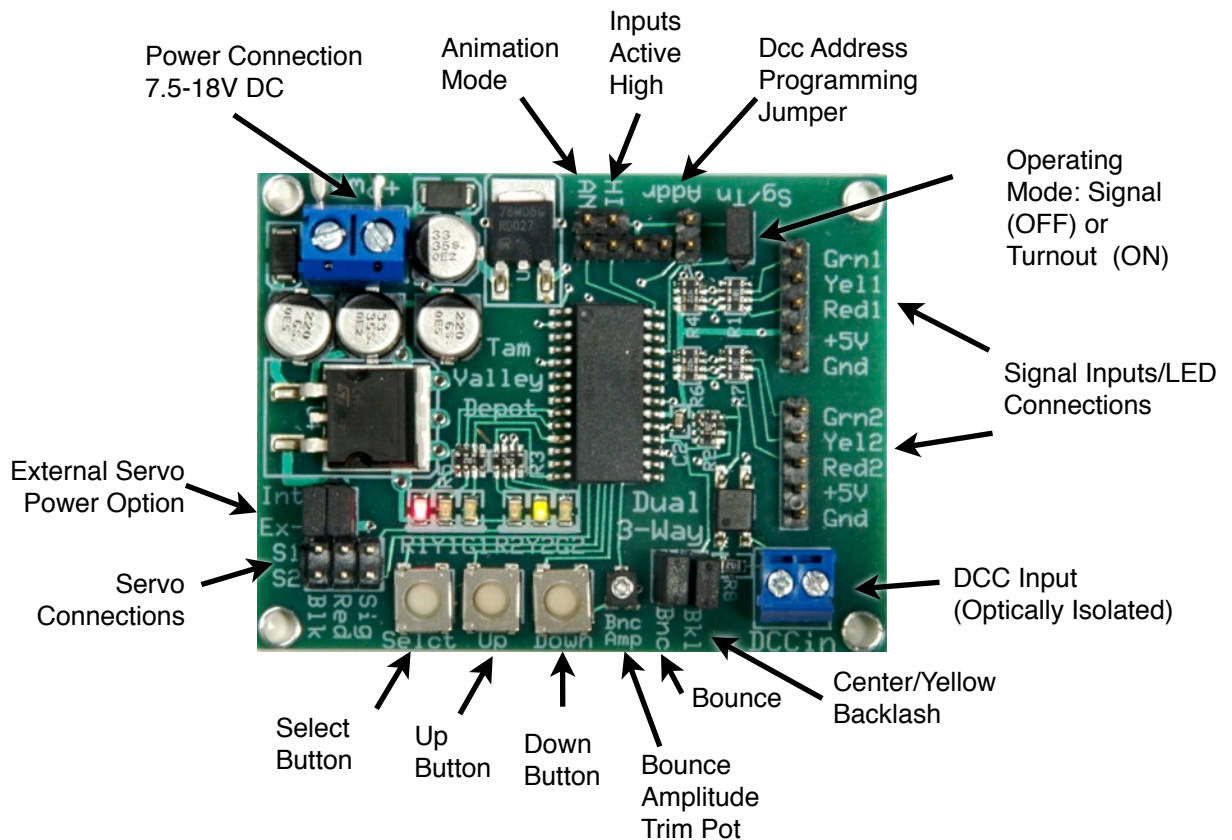


Overview

The Dual 3-way Servo Decoder will control 2 semaphore arms with either DCC command control or manually by pressing a button. It can also be used for 3-way stub turnouts. It uses R/C airplane servos which are ready available and inexpensive. The controller can also be used to drive LEDs or lamps for signals or control panels. There are several useful options including bounce, which simulates the bouncing of a heavy semaphore blade, and an animation option that simulates block control.



Installation

Mount the decoder with a couple of wood screws through the mounting holes, or use double sided tape. In some cases you may just want to leave the decoder floating and tack down the wires around the decoder to keep it in place. *Make sure to keep the decoder away from conductive surfaces such as metal that could short the board. Also you can kill the board if let a hot DCC wire touch the wrong part of the board.*

Make certain the voltage regulators are free to ventilate the excess heat. If the regulators get too hot they will shut down. No need for fans or anything like that, just make sure there is some ventilation.

Connect the power terminals to a power supply of 7.5-18V DC of at least 0.5 A or larger. Note the plus and minus signs on the inputs. If you connect the supply backwards, blocking diodes will prevent harm to the board, but the board will not work until you reverse the power inputs. Budget about 150 mA (0.15 A) for each servo plus its LEDs. When the servos are driving between positions they draw a short burst of around 0.3 A so some excess capacity is needed on the supply.

Servos

Plug the servos in to the bank of servo connection pins as shown. Servos have three wires, the power leads are black and red and the third, the signal lead is white, brown, yellow or orange depending upon the brand. Plug the servos in so that the black wire is aligned with the Blk label on the board. If you do it incorrectly, it won't hurt anything, but the servo won't move.



Bounce

The semaphore blades can be made to bounce at the end of each movement to simulate the weight of a prototype servo blade. To turn this feature on put the **Bnc** jumper across its two pins. The amplitude of the bounce can then be adjusted with the **Bnc Amp** trim pot. Use a small Philips head screwdriver to rotate the trim pot. Clockwise increases the bounce. Use the Up (servo1) or Down (servo2) button to change the servo position to see the effect of the change in amplitude.

Anti-Backlash

When driving a 3-way stub the center position can be hard to reproduce depending upon whether the servo is driven to the center from the left or the right due to mechanical tolerances. To take care of this, put the **Bkl** jumper on. This will cause the servo to always finish the move from the same direction.

Signal Animation

If you watch a signal when a train passes it you will see that it first turns red and then after the train has gone by it goes to yellow and then after another pause the signal goes to green when the train has completely cleared out of the block. You can simulate this operation using a train detector connected to the red input and putting on the AN jumper. After the red is triggered and the train has cleared the detector, a timer will countdown for 20 seconds and change the board to yellow and after another 20 seconds the board will turn yellow.

Servo Extensions

If the wire is too short to reach the decoder after installation, servo extenders in various lengths are available from Tam Valley Depot or at your local R/C hobby shop. Alternatively you can splice in extra lengths of wire. The servos draw little current so that any wire 26 gauge and above will work well. How many extensions can you add? In a test I was able to add 15 feet of 26 gauge extensions and the servos still worked well - at 20 feet the servos stopped working. A heavier gauge wire would allow longer extensions, although I haven't made any tests.

Connecting servos to a semaphore

These photographs show a Tomar semaphore being controlled by a servo mounted under the subroadbed. Only a small movement is needed by the servo to control the blade.

1. Remove the servo horn from the servo by loosening the screw. Mount the servo so that it is below the semaphore as shown. You can use double-sided sticky tape to place the servo initially and then use L-brackets (available from Tam Valley Depot) to hold the servo permanently. Hot glue or wood blocks will also work well.
2. Power up the servo by connecting it to the board and put it in the yellow, center position with the Up (servo 1) or Down (servo 2) button.



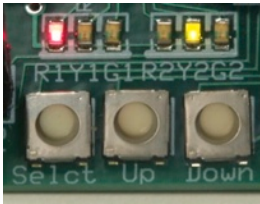
Detail of how the wire is connected to the servo. Drill a small hole just larger than the wire in the servo horn. The holes in the servo horn as they come are too large and will have too much slop. The hole should be close to the center as shown - this will make the adjustment less sensitive.

3. Center the semaphore blade approximately halfway between the endpoints and bend the actuating wire forward 90 degrees at the level of the servo axle.

4. Slide the servo horn over the wire and put it on the servo axle. Replace the screw holding the servo horn. Bend the actuating wire down 90 degrees and trim off the excess. Leave an inch or so in case you need to readjust things later.

Programming (Training) the Servo Positions and Speed

The system ships with the servos programmed for a small movement so that it will not move too far and break something before it is trained. To train the final positions, use the 3 buttons marked Select, Up and Down. Press and hold Select for about 1/2 second until the LEDs start flashing.



You can then program the servo Red position by pressing the Up/Down buttons. Press Select briefly again to move the next position and train it using Up/Down again. Each press of Select will move to the next servo position (The controller LEDs will indicate the current position) until you have cycled through all 3 and then it will let you set the servo speed. In this mode the Up and Down buttons change the servo speed. Each press alternates the servo direction so you can see the effect of the speed change. Once the speed is set pressing Select again will take you to the second servo.

When done, press and hold Select again to exit the training mode and save the positions.

DCC Address

To program the base DCC address, place the jumper across the two **Addr** pins and issue an accessory command. The decoder will store the address and flash the LED twice to indicate it has been successfully programmed. The decoder uses 4 consecutive addresses starting with 1-4, the next groups are 5-8, 9-12, 13-16 and so forth. See the table on the last page for a handy reference for those of us who are algebraically challenged. Be sure to remove the jumper when finished programming. It can be stored on a single pin.

Position	1	2
Red1	throw	close
Yellow1	throw	throw
Green1	close	throw
Dark1	close	close

DCC Operation

The decoder comes from the factory programmed for addresses 1-4. Each servo uses 2 consecutive addresses (see tables). To move a servo, issue a DCC accessory command by entering the address into the DCC system and then issue either a “t” or “c” command (for NCE these are called normal and reverse. On NCE systems the equivalent commands are The LED flashes once to indicate the decoder has accepted the DCC command. On Digitrax systems the accessory commands are accessed with the “Switch” button. On NCE systems use the Select Accy button. Consult your manual if you are unsure how to issue accessory commands on your system. The decoder responds to 4 consecutive DCC addresses - the first two move servo 1 and the second two move servo 2 (see the table).

Position	3	4
Red2	throw	close
Yellow2	throw	throw
Green2	close	throw
Dark2	close	close

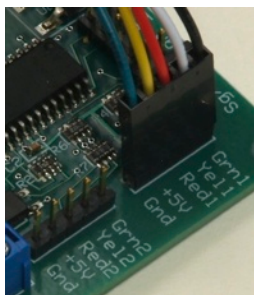
You can also change the servo positions manually with the buttons (when not in programming mode). Press the Up button to cycle the positions for servo1 and Down button for servo2. This is particularly useful for setting up and testing the servo positions.

Reset to Factory Defaults

To reset the memory to the factory defaults (Address 1-4 and the default servo positions), press the Up and Down buttons while turning on the power.

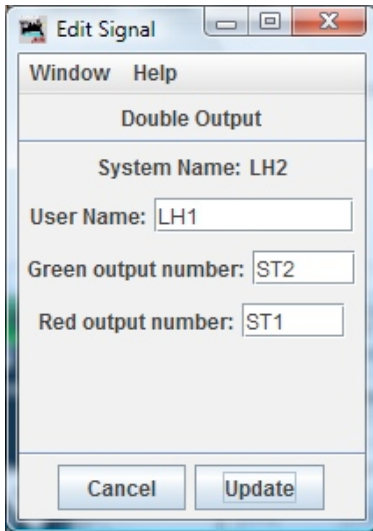
I/O Connector

There are two 5-pin I/O connectors - one for each servo. They can be used to provide inputs from signal systems or to provide manual control with pushbuttons. They can also be hooked up to provide external LED indications. Each connector has +5V and ground connections to enable wiring. The two jumpers **HI** and **Sig/Tn** control how the I/O connectors behave.

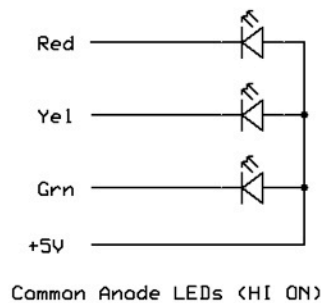
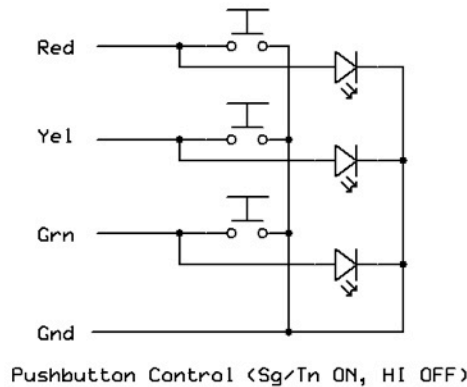
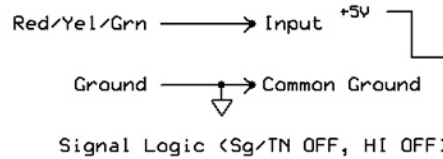
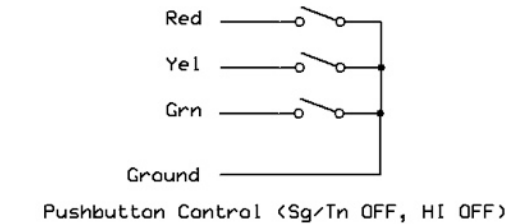


Sig/Tn - This controls Signal/Turnout mode. When the jumper is off the I/O connector is in input only mode and does not provide any drive current for external LEDs. This is the mode to use if you are connecting the system to an external signaling system. When the jumper is on the I/O connector provides current to the pins to drive an external LEDs or lamps. There is a resistor on the board to limit the output current to approximately 20 mA. Every 20 ms the pin is floated briefly and scanned to see if it is being driven high or low by an external source. This allows hooking up a NO pushbutton to ground to control the pin. Each pin has a pull-up resistor on it so that if the pushbutton is not pressed the pin will go high and if the pushbutton is closed the pin will be pulled low and the position activated. (This assumes the HI jumper is off).

HI - This pin changes the I/O pins from active low (jumper off) to active high (jumper on). When driving LEDs it changes the pin from common cathode/common ground (jumper off) to common anode/common +5V (jumper on). This lets you drive different types of signals when being used with LEDs. In signaling systems it lets you use different signaling logic. Most signal systems are active low, also known as open collector type logic. In this configuration if an input goes from high (+5V) to low (0V) the position is activated. Some signal systems are active high - that is a 0 to +5V transition is used to indicate the active position.



JMRI Setup (requires a computer connected to the layout and a basic knowledge of JMRI). To use your semaphores with JMRI signaling add to the Signal Head table as shown above. The type must be Double Output. Note the output numbers. The first letter is dependent on your layout connection - in this case it is S for SPROG, and T1 for turnout with DCC address 1. This will activate the first signal - use T3 (red) and T4 (green) for the second signal. See the DCC address group table for other addresses other than the default 1-4. *Note: We are NOT JMRI or signaling experts so we can only provide limited support for complex signal systems.*



DCC Address Groups
1, 2, 3, 4
5, 6, 7, 8
9, 10, 11, 12
13, 14, 15, 16
17, 18, 19, 20
21, 22, 23, 24
25, 26, 27, 28
29, 30, 31, 32
33, 34, 35, 36
37, 38, 39, 40
41, 42, 43, 44
45, 46, 47, 48
49, 50, 51, 52
53, 54, 55, 56
57, 58, 59, 60
61, 62, 63, 64
65, 66, 67, 68
59, 70, 71, 72
73, 74, 75, 76
77, 78, 79, 80
81, 82, 83, 84
85, 86, 87, 88
89, 90, 91, 92

More Information and Help

Please feel free to contact us at dmcree@tamvalleyrr.com.