

Anvilus RC Relay SSR Motor Controller

Board h_061003, Manual 061021

OVERVIEW

skid steering for two DC motors from a single joystick

RC throttle and steering servo signals are mixed for right and left motors

four on-board SPDT automotive relays with 12V, 30A capacity per motor

relays shut down if RC signals are lost to prevent run-away

optional - proportional speed control using off-board solid-state relays (SSRs)

single button calibration

reads RC signals to find high/low signal values and reduce trim offset

defaults to factory calibration if depressed on power up

QUICK START

- 1) READ AND LEARN power on/off sequences listed below
- 2) Mount printed circuit board and print a copy of Figure 1
- 3) Motor battery connections (BAT+, RB-, LB-) on large left barrier strip
- 4) PWM connections (LPWM, RPWM, GND) on lower left terminal block (optional)
- 5) Motor connections (RFOR, RREV, LFOR, LREV) on large left barrier strip
- 6) Coil power connections (COIL, GND) on upper left terminal block
- 7) Servo cable connections (S,T) to RC receiver
- 8) Follow power on sequence
- 9) Have fun

CONNECTIONS

The top surface of the printed circuit board (PCB) is shown in Figure 1. The PCB is 3.5 by 4.0 inches with 0.15 inch DIA mounting holes on 2.88 by 3.38 inch centers.

Use yellow 10 AWG ring connectors for #6 or #8 studs on the large left barrier strip for motor and battery connections. All battery connections should include appropriate kill switches and fuses. Many users install a 60A fuse in-line with the battery, or 30A fuses in-line with motors.

www.radioshack.com 60A fuse (#270-1126) \$4.29, in-line fuse holder (#270-1126) \$11.49

www.robotmarketplace.com 100A Hella key switch \$17, 75A push-pull switch \$6

The terminal block for coil power near the upper left corner of the PCB accepts up to 12 AWG wire stripped 0.2 inches from the tip. Stranded wire should be tinned for use in terminal blocks. Because coil power only draws up to 300 mA, lighter wire may be used.

The terminal block for pulse-width modulation (PWM) signals near the lower left corner of the PCB also accepts up to 12 AWG wire stripped 0.2 inches from the tip. Stranded wire should be

OPTION 1 - FORWARD/OFF/REVERSE CONTROL

To use forward/off/reverse control, a jumper wire must be installed between the two solder pads labeled JMPR near the right edge of the PCB as shown in Figure 1. This jumper wire is installed at the factory. Forward/off/reverse provides 33% dead band in the center of joystick travel. Motors will rotate at full speed forward, full speed reverse or full stop as shown in Appendix A.

Motor battery connections RB- and LB- on the left terminal block must be connected together and to the motor battery negative terminal as shown in Figure 2. Motor battery connections BAT+ are connected on the board and one of them must be connected to the battery motor positive terminal.

Two SPDT relays per motor create a dead short across the motor when OFF and provide inductive braking. Relays shut down for 20 msec delay when motors reverse to allow for relay make/break times and to prevent large voltage surges when motor currents suddenly switch direction. Relay contacts are rated for 12V, 30A.

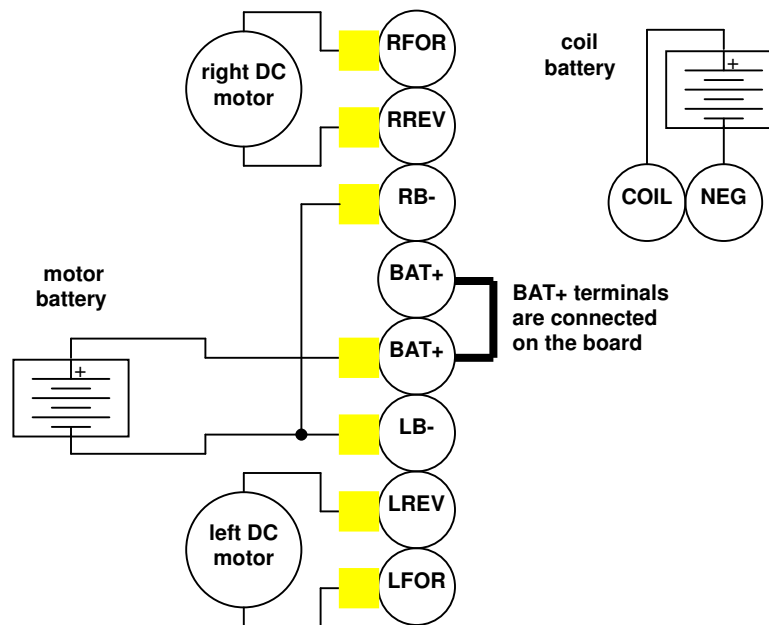


Figure 2 - Forward/off/reverse connections

OPTION 2 - PROPORTIONAL SPEED CONTROL

To use proportional control, the jumper wire labeled JMPR near the right edge of the PCB in Figure 1 must be removed. Proportional control provides 7% dead band in the center of joystick travel. Wider dead band can be requested by special order from the factory. Motors will rotate with proportional speed as shown in Appendix B.

Two off-board SSRs must be connected for proportional speed control as shown in Figure 3.

Users must provide SSRs with suitable current and voltage capacity. As an example, Crydom D1D40 SSRs can handle 100 VDC, 40A and typically sell for \$25 surplus.

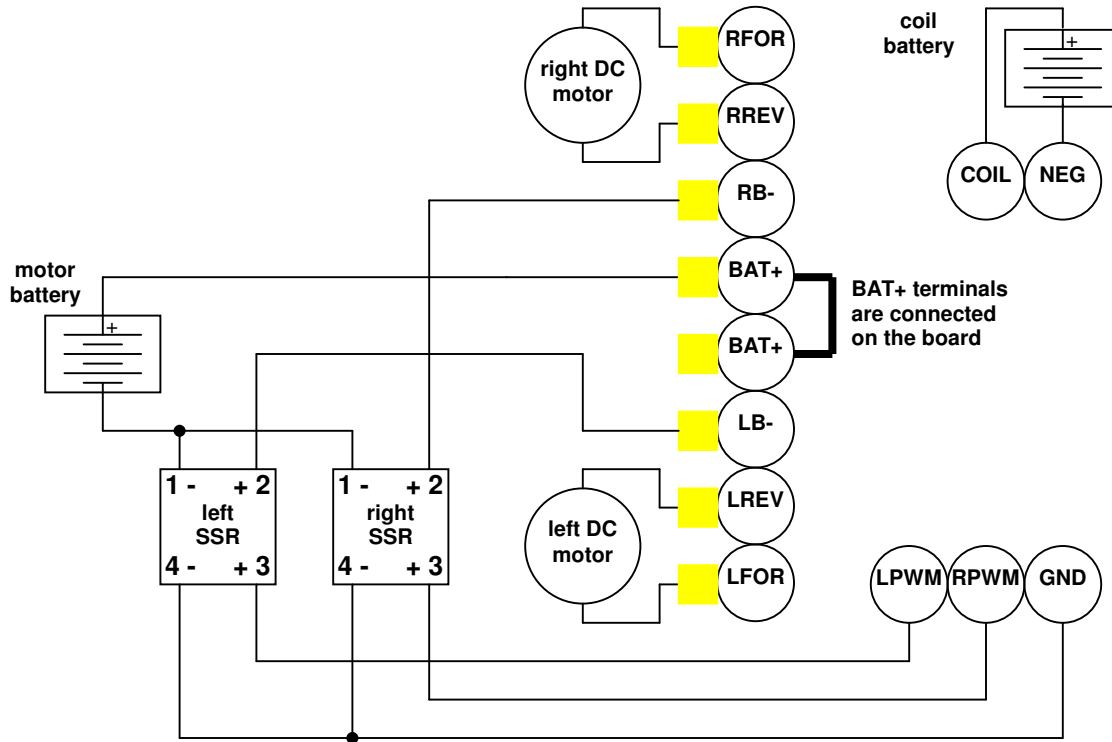


Figure 3 - Proportional speed connections
(Terminal numbers on SSRs conform to Crydom D1D40 SSRs.)

POWER

YOU MUST USE THE FOLLOWING SEQUENCES for activating and deactivating power to prevent potential problems caused by spurious RC signals when transmitters and receivers are turned on and off. This is standard practice for all RC systems.

POWER ON SEQUENCE

- 1) RC transmitter ON
- 2) RC receiver ON
- 3) Coil power ON
- 4) Motor battery power ON

POWER OFF SEQUENCE

- 1) Motor battery power OFF
- 2) Coil power OFF
- 3) RC receiver OFF
- 4) RC transmitter OFF

Motor battery power may be 3V to 24V with 30A maximum current.

Coil battery power must be 12V with 300 mA maximum current.

Motor battery connections are isolated from coil battery connections on the PCB to allow using separate batteries if desired.

CALIBRATION

The button switch labeled CAL_SW and a red CAL LED near the lower edge of the PCB are provided to calibrate the RC relay SSR motor controller if desired.

Users should only complete step 2) in the power on sequence for calibration. The green RC LED must be illuminated before calibrating. All outputs shut down during calibration.

When the calibration button is pressed, the red calibration LED will illuminate and the PCB will read both servo signals to find their minimum and maximum values. You should hold the calibration button down and toggle the joystick on your RC transmitter over its full range of travel in both directions. Failure to fully toggle the joystick may result in erratic operation later.

Factory default calibration values may be restored by pressing and holding the calibration button before and during step 2) of the power on sequence. The red calibration LED will blink to indicate that factory default calibration values have been reset. Release the calibration button to complete this procedure. Factory default calibration values are 1 msec minimum and 2 msec maximum RC pulses for both channels.

NO WARRANTIES

Do not use this product in a health care or personal safety application. This product is provided without any express or implied warranty. Anvilus cannot be held responsible if your motor controller does not work for any reason. Anvilus cannot be held responsible if your motor controller damages any other devices. Anvilus cannot be held responsible for electrical or electromagnetic interference resulting from use of your motor controller. Anvilus cannot be held responsible for any personal injury, property damage or loss of profit resulting from use of your motor controller. Anvilus does not warrant the accuracy or completeness of any documentation. Anvilus may change documentation or the products described therein, at any time without notice. Anvilus makes no commitment to update documentation.

APPENDIX A - Forward/off/reverse joystick mixing

	LEFT	STEERING	RIGHT	
MOTOR DIRECTION	FORWARD	↑ ↑	↑ ○	↑ = FORWARD
	THROTTLE	↓ ↑	○ ○	○ = OFF
	REVERSE	↓ ○	↓ ↓	↓ = REVERSE
	RELAYS			LF LR RF RR
				0 = off
				1 = on

	LEFT	STEERING	RIGHT
FORWARD	○ ↑ L R LF LR RF RR 0 0 1 0	↑ ↑ L R LF LR RF RR 1 0 1 0	↑ ○ L R LF LR RF RR 1 0 0 0
THROTTLE	↓ ↑ L R LF LR RF RR 0 1 1 0	○ ○ L R LF LR RF RR 0 0 0 0	↑ ↓ L R LF LR RF RR 1 0 0 1
REVERSE	↓ ○ L R LF LR RF RR 0 1 0 0	↓ ↓ L R LF LR RF RR 0 1 0 1	○ ↓ L R LF LR RF RR 0 0 0 1

APPENDIX B - Proportional speed joystick mixing

LEFT MOTOR SPEED
-7 = full reverse, 0 = stop, +7 = full forward

	LEFT				STEERING				RIGHT								
MOTOR DIRECTION	FORWARD	0	1	2	3	4	5	6	7	7	7	7	7	7	7	7	7
	THROTTLE	-1	0	1	2	3	4	5	6	6	6	6	6	6	6	6	7
	REVERSE	-2	-1	0	1	2	3	4	5	5	5	5	5	5	5	6	7
		-3	-2	-1	0	1	2	3	4	4	4	4	4	4	5	6	7
		-4	-3	-2	-1	0	1	3	3	3	3	3	4	5	6	7	
		-5	-4	-3	-2	-1	0	1	2	2	2	3	4	5	6	7	
		-6	-5	-4	-3	-3	-1	0	1	1	2	3	4	5	6	7	
		-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	
		-7	-6	-5	-4	-3	-2	-1	-1	0	1	3	3	4	5	6	
		-7	-6	-5	-4	-3	-2	-2	-2	-1	0	1	2	3	4	5	
	-7	-6	-5	-4	-3	-3	-3	-3	-3	-1	0	1	2	3	4		
	-7	-6	-5	-4	-4	-4	-4	-4	-3	-2	-1	0	1	2	3		
	-7	-6	-5	-5	-5	-5	-5	-5	-4	-3	-2	-1	0	1	2		
	-7	-6	-6	-6	-6	-6	-6	-6	-5	-4	-3	-2	-1	0	1		
	-7	-7	-7	-7	-7	-7	-7	-7	-6	-5	-4	-3	-2	-1	0		

RIGHT MOTOR SPEED TABLE IS SYMMETRIC