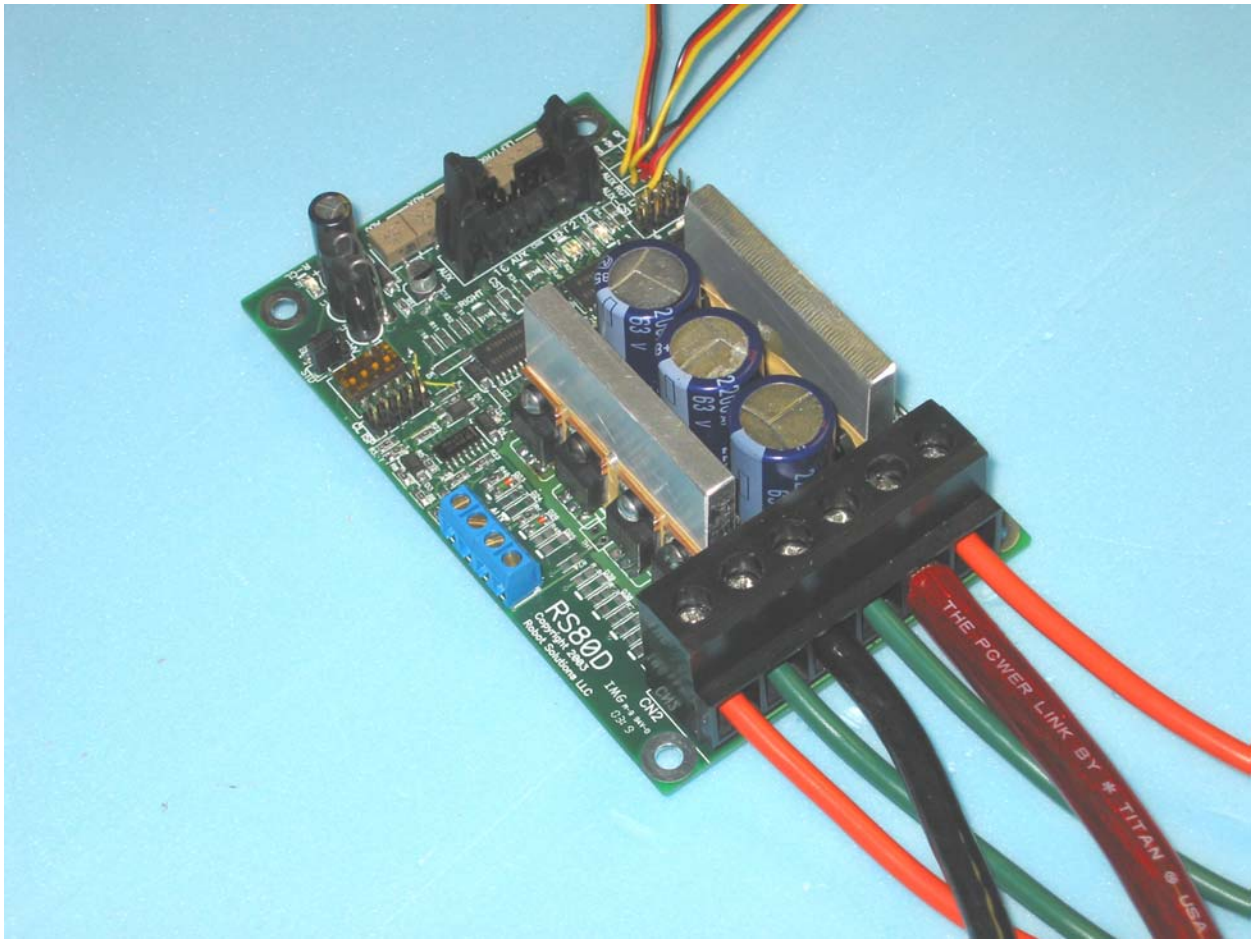
RS80D Brushed Motor Controller



Robot-Solutions, LLC

Specifications

- Board size: 5.18” x 3.2” x 1.62”
- Enclosure size: 6.18” x 3.75” x 2.20”
- Weight with enclosure: 1.0 lb.
- Four channel R/C style signaling.
- Dual main channels 80 Amps each
- 4-42v battery operation*
- Large power connector accepts up to 4awg wires
- Accepts pulse widths from .85 to 2.15 ms (IFI compatible)
- Two calibrations options
- Multi-mode Auxiliary channel:
    - Normal PWM
    - Spin Control mode
    - Fwd-off-Rev relay.
- Auxiliary channel interfaces to standard OSMC or MC1 motor controllers
- Thermal power monitoring and limiting
- User adjusted current limiting
- Robust signal processing for smooth, reliable fail-safe operation
- Six user programmable inputs via screwdriver adjustments
- Four R/C inputs for left/right channel mixing for single stick operation:
    - R/C left (throttle)
    - R/C right (steering)
    - R/C aux (PWM, spin, or relay control)
    - R/C flip (corrects drive when robot is inverted)
- Selectable channel mixing for single stick or tank style operation
- Adjustable brake and acceleration on the main drive and auxiliary weapon channels
- Adjustable exponential curve on the main drive channel only
- Calibration mode for compatibility with all R/C systems including IFI
- Indicator LED’s show direction, power, over-temperature, and board status
- Tether connector (requires special adapter – not yet available) for operation while transmitter is impounded (or the battery is dead)

*** If the main battery voltage is over 36V, jumper J7 must be moved to the HV position and a logic battery supply must be connected to the HV SUPPLY connector. The HV supply can range from 4V to 36V.**

Note the GND terminal on the logic supply and the GND terminal on the main power connector are tied together. If tapping off of the center of a multiple series battery for the logic supply, do not provide a second ground to the logic connector.

User Adjustable Inputs

There are six user adjustable inputs on the RS80D controller. Two apply only to the Auxiliary channel. The other four apply only to the main drive (left and right channels).

Acceleration (Accel)

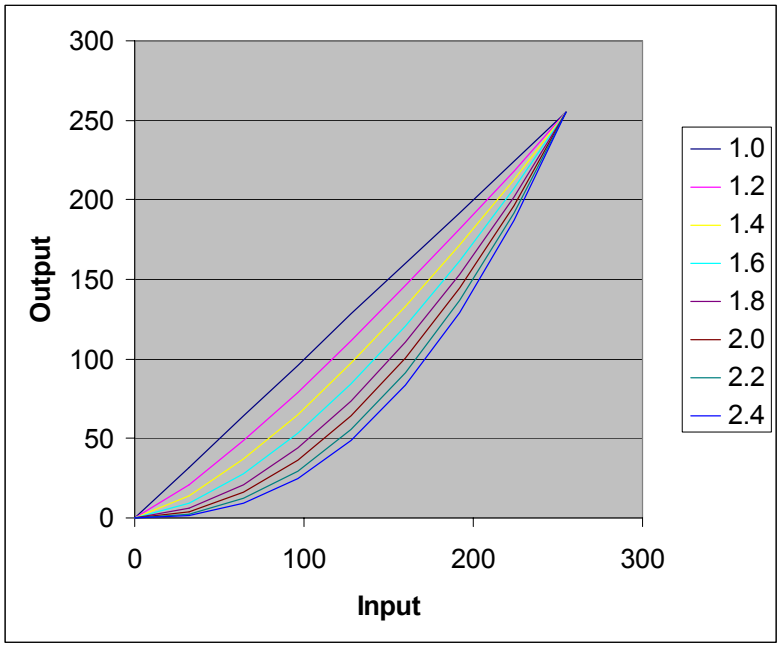
Sets the power rate of change value. The maximum is roughly the amount of time, in seconds, it takes to go from –100% to 100% power output. Note: the Auxiliary and Left/Right channels have differing maximum amounts.

Brake

Sets the amount of braking when the output drive level is zero. Full counter-clockwise sets 0% braking (coasting) and full clockwise sets 100% braking.

Curve

The CURVE control on the main drive modifies the R/C input signal with an exponential curve. The exponent value can be modified from 1 (no curve) to 2.4, which is a fairly steep curve. Below is a table graphing the various curves available. Note, even a modest curve of 1.4 gives a soft, wide dead band.



Current Limiting

The CL adjust potentiometer varies the maximum current output of the main channels. Fully clockwise is maximum current. This is the most efficient position for the controller and should be set in this position whenever possible.

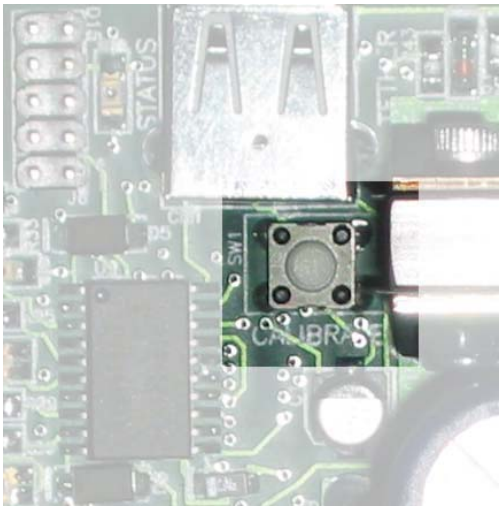
Thermal Limiting

To protect the controller while still delivering the most power possible, the RS80D is designed to start cutting back the power output as the controller becomes hotter. The controller will disable the motors when the controller reaches 160^{o} C. The temperature LED will reflect this as follows:

- Normal operation, the LED will be off
- As the temperature rises, the LED will flash increasingly faster until the controller reaches 160^{o} C at which point the LED will be on continuously.

Calibration

R/C signal status and Calibration controls are above the LEFT/RIGHT controls as illustrated.



The status light winks once per good R/C signal, per one-second cycle. If one wink, only one good signal has been detected. If two winks, then two good signals have been detected and so forth.

Calibrating to your radio

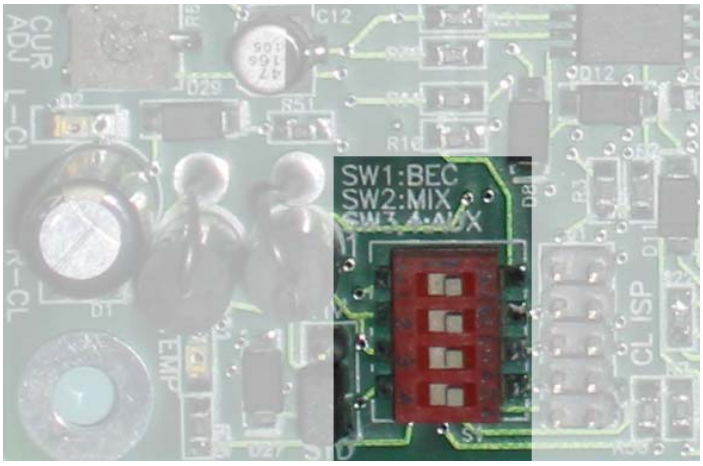
1. Connect your radio (or computer), disconnect the outputs (if practical) and apply power to the unit.
2. Restore the trim values to their center point and verify the STATUS LED winks once for each channel that has an R/C signal connected
3. Press and hold the CALIBRATE button for two to three seconds, until the STATUS LED blinks a steady 2 Hz.
4. Move all controls from one extreme to another. This sets the range of the calibration.
5. Press and hold the CALBRATE button again. The STATUS LED should resume winking, once for each channel of R/C signals.
6. If appropriate, adjust your trim settings to zero each channel and illuminate the COAST LED. The COAST LED will only light if the brake setting is ***NOT*** set at 100%.
7. If the center setting of the transmitter was off a large amount, it might be necessary to repeat the calibration procedure a second time.

Restoring Factory Default Calibration
The default calibration settings are suitable for most off the shelf R/C gear. The default settings are 1.150 ms to 1.850 ms, with 1.500 ms center. Performing the calibration procedure with no signal attached to the controller, or not varying the stick positions, restores default settings.

1. Apply power.
2. Press the CALIBRATE button, hold until the STATUS LED flashes steadily, about one to two seconds.
3. Press and hold the CALIBRATE button a second time until the flashing stops. The default values will be restored.

Mode Switch

Various Auxiliary modes and main channel mixing are selected with the MODE switch. Mode switches are active when in the on position.



Mode Switch location

Close up view

Mix selects normal (tank style) vs. mixed or single stick control on the Left and Right channels. NOTE: Left becomes “throttle” and Right becomes “Steering” when in mixed mode.

Mode	Mix
Normal (Tank)	Off
Mixed (Single stick)	On

Main Drive Mix Table

BEC (Battery Eliminator Circuit) optionally powers the R/C receiver from the board power. BEC should not be used when any other power supply is used for the receiver.

Mode	BEC
On	On
Off	Off

Mode Switch BEC table

Auxiliary Channel Modes

Mode	A1	A0
Normal PWM	On	On
Spin Control	On	Off
Relay	Off	Off

Auxiliary Modes Table

Normal PWM
This mode is straight R/C pulse to PWM with dead-band, variable brake and variable acceleration support. Note: Exponential curve does not apply to the Auxiliary channel.

Spin Controller
Auxiliary spin control, selected with Mode Switch A1 in the ON position, modifies the standard forward/reverse PWM mode for unidirectional operation and variable brake. Forward stick gives 0-100% forward powers while reverse stick gives 0-100% braking. Furthermore, with loss signal (broken cable, dead radio, dead transmitter) full braking is applied at once. Spin control uses the AUX ACCEL control input, but does not use the BRAKE input.

Relay controller
Auxiliary relay control, selected with Mode Switch A0 and A1 in the OFF position, drives the AUX controller as a bi-directional relay with Limit switch support. This can be used for non-servo lifter systems. The operation is as follows:

Stick neutral	Coast
Stick ½ forward	100% forward
Stick ½ reverse	100% reverse
Loss of signal	100% brake

Indicators and Outputs

Status LED

This LED winks once per valid channel per two-second period. With all four channels connected it appears like four rapid flashes and a long pause. When in calibration mode the LED flashes evenly without pause.

COAST LED (Aux, Left & Right)

Illuminated (Red) indicates the controller has disconnected the power driver from the load. The load is coasting. Dark indicates the power driver connected to the load. This LED varies from fully illuminated to fully dark depending upon the position of the input signal and the BRAKE user adjustment.

FWD/REV LED (Aux, Left, Right)

Green = Forward, Yellow = Reverse. Dark = zero drive. The RS80D modulates the Coast signal to implement variable brake. When the power driver has zero drive and zero COAST (i.e. both LED's are dark) maximum braking is applied to the load.

Tether Interface

The tether interface can be used to display diagnostic information about the signals that the controller sees and the resulting control outputs. In addition, the tether interface may be used to control all aspects of the controller via a serial stream of data.

The tether interface operates at 33.4kbaud 8N1 and supports the following commands:

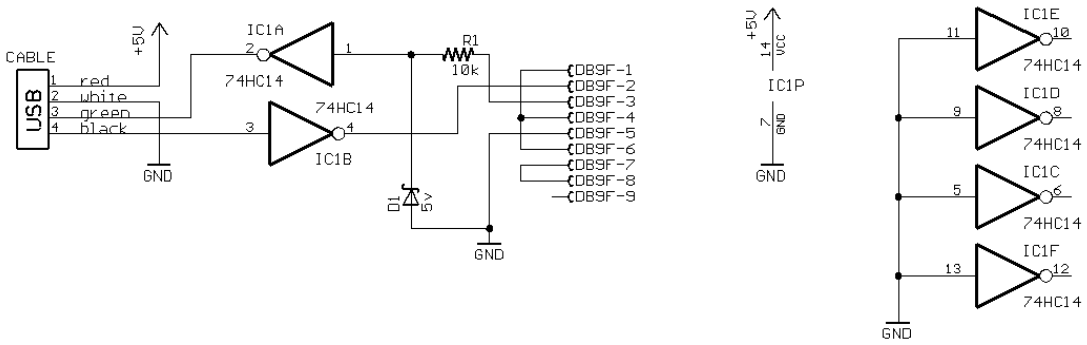
r{c}	Display Left, Right, Aux and Flip R/C input values in microseconds.
d{c}	Displays Left, Right and Aux drive values (-127 to 127)
a{c}	Displays the six analog channels (channel 1 = servo feedback)
c[lra] [1]{c}	Display input value and output drive for Left, Right or Aux channel.
i[lraf]xxxx[2]	Set an R/C pulse width override for the Left Right Aux or Flip channels. Override last ~15 seconds. Input values are in microseconds. Valid range is: 900-2100.
o{c}[3]	Display internal oscillator calibration byte value.
sxxx	Set internal oscillator calibration byte[4].

Notes:

1. {lraf} = select one of left, right or aux + flip on input override.
2. xxx = decimal number
3. {c} = Optional "continuous" output modifier.
4. Internal oscillator sets all timing including serial interface. If an inappropriate value is entered the communications will fail and further adjustments will not be possible until the calibration is reset.

Connecting the Tether interface

The tether interface is an USB type A connector. However, connecting this port to an USB port on your computer ***WILL NOT WORK AND MAY DAMAGE YOUR COMPUTER AND THE RS80D!*** A special adaptor is needed (not yet available). TTL to RS232 adaptors are available from a variety of sources on the web and would need to be modified for the USB connector. For those technically adept, a simple converter is illustrated below:



Calibrating the internal oscillator

The RS80D comes calibrated. However, over time and temperature the accuracy of the oscillator may change and the tether display of received R/C pulse widths will not be accurate. Calibrating the oscillator can restore accuracy. The procedure is as follows:

1. Calibration is against the LEFT channel ONLY. Provide a center stick signal of 1.500 ms on the LEFT channel.
2. Press and hold the CAL button
3. Turn the power on.
4. Wait a second or so and release the CAL button.

The board is now calibrated to read the center stick as a 1500 us pulse width. If the calibration change was large, it might be necessary to re-calibrate the stick travel for your radio.

Restoring the factory calibration

1. Remove all signals sources from the board
2. Press and hold the CAL button
3. Apply power to the board.
4. Release the CAL button. Factory calibration is restored.

Limitations and Warrantees

Robot-Solutions, LLC (robot-solutions.com) provides no warrantee of suitability or performance for any purpose for the RS80D. Use of the RS80D software and or hardware is with the understanding that any outcome whatsoever is at the users own risk. Robot-Solutions, LLC sole guarantee is that the software and hardware performs in compliance with this document at the time it was shipped.

Robotics, particularly combat robotics, can be very hazardous. You need to know what you are doing. In the event of defective products, Robot-Solutions, LLC will replace or repair products or refund money in exchange for the original product.

Support

On line support, latest software, news, and replacement parts are available through the Robot-Solutions web site at:

www.robot-solutions.com

For additional information or for parts not listed on the web site, send an e-mail to David@robot-solutions.com.

General Guidelines

- Caution does need to be taken with the use of the RS80D as with any other motor controller. In some cases where the motor controller fails, it can lock in the “ON” position with no ability to stop the motor that is being controlled. All users should utilize a safety disconnect to the main power to allow for the safe disconnect of the power.

- While it was designed to withstand significant abuse, normal static handling procedures should be observed.

- Robot-Solutions, LLC provided no warrantees of suitability or performance for any purposes for the RS80D. Use of the RS80D software or hardware is at the user’s own risk.

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