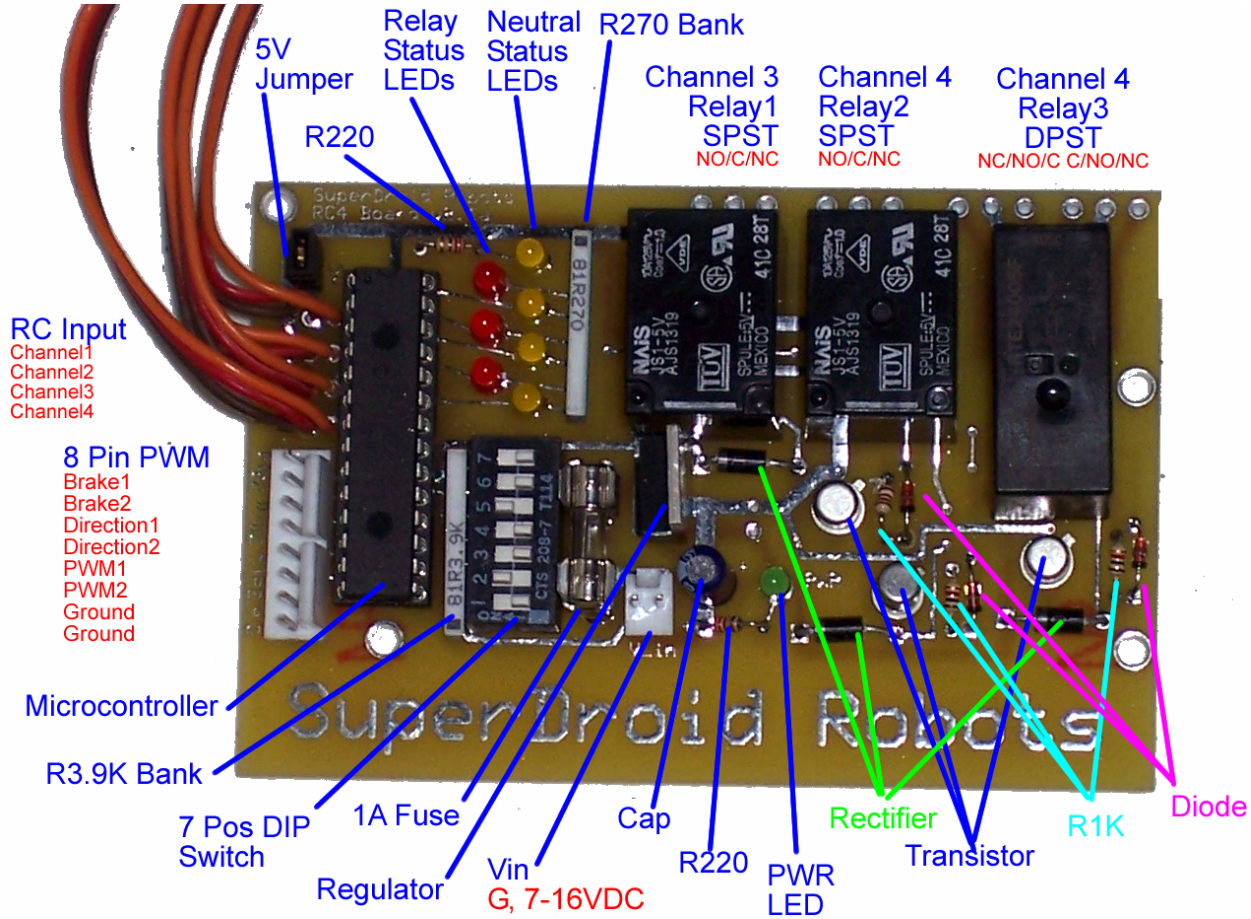
SUPERDROID ROBOTS™

Autonomous Robot Sales and Development

SuperDroid Robots Inc.



RC Interface Controller Board Assembly and Operation

Revision Date: January 17, 2006

RC Interface Controller Board

Accurate content is of the utmost importance to the authors of this document. If you find an error or see an item that needs more clarification report it to info@superdroidrobots.com

Assembly:

Recommended Tools

- 25 watt soldering iron with a sharp tip
- Solder
- Solder remover (optional, this should not be needed except to correct mistakes)
- Wire cutters/strippers
- Screw Driver
- Small needle nose pliers
- Multi-meter (recommended for any troubleshooting)
- Safety glasses
- Method of holding board and electronics (optional)

Assembly Sequence

Assembly order is not terribly important. The following steps assume basic soldering skills. SuperDroid Robots has a page on its web site addressing soldering WWW.SuperDroidRobots.com\soldering.htm\).

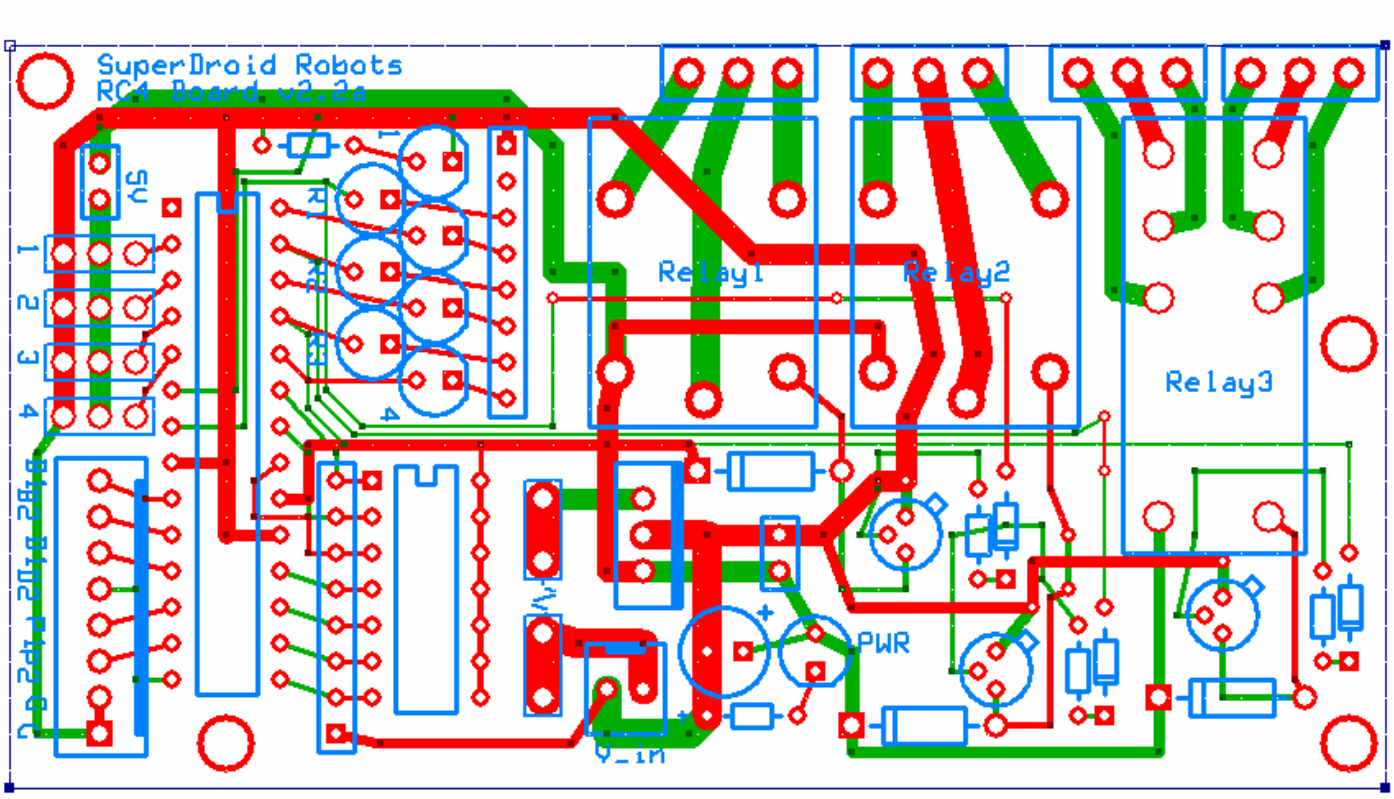
Tips:

- Where ever possible solder joints are kept as far from traces as possible or on the top side of the board. However, great care needs to be made to ensure excess solder is not applied and shorts the junction to an adjacent trace. Before powering the board a close inspection needs to be made to ensure no shorts are present.
- We do not recommend using resin core solder, the residual resin sometimes causes stray voltages and erratic behavior.
- The other common mistake is creating "dry sockets". Dry sockets will look like the solder joint is fine, but upon closer examination the solder is only joined to the board or pin. These connections will yield spurious behavior that is very difficult to troubleshoot. It is important that both the board junction and the pin are heated sufficiently to allow the solder to flow and bond the two components.
- The figure on the front page shows where all the components are located on the circuit board. The assembly sequence will require referral back this image for positioning of the electronic components. There is also a layout of the board at the end of this section.
- All the components should be placed on the top of the board (the labeled side) and soldered from the backside.

1. Insert the resistor arrays. Note the location of the black dot on the resistor bank in the figure. If you insert it backwards the board will not work and will likely be damaged. The 270 ohm resistor bank goes close the LEDSs, the 3.9K ohm resistors go close to the switch bank,
2. Insert the switch bank as shown in the figure.
3. Insert the IC socket. Pin one goes in the square pan hole. The notch should be up as in the figure.
4. Insert the 220 Ohm resistors as shown in the figure. Orientation is not important. Use the color bands to identify the resistors resistance. These resistors are resistors for the power LED and LED1.
5. Insert the 1k Ohm resistors as shown in the figure. Orientation is not important. Use the color bands to identify the resistors resistance. These resistors are resistors for relay circuits.

Resistor Color Code							
Color	**1st Band**	**2nd Band**	**3rd Band**	**Multiplier**	**Tolerance**	**Reliability**	**Temperature Coefficient**
Black	0	0	0	10^0	-	-	-
Brown	1	1	1	10^1	±1%	1%	100ppm
Red	2	2	2	10^2	±2%	0.1%	50ppm
Orange	3	3	3	10^3	±3%	0.01%	15ppm
Yellow	4	4	4	10^4	±4%	0.001%	25ppm
Green	5	5	5	10^5	±0.5%	-	-
Blue	6	6	6	10^6	±0.25%	-	-
Violet	7	7	7	10^7	±0.1%	-	-
Gray	8	8	8	10^8 or 10^{-2}	-	-	-
White	9	9	9	10^9 or 10^{-1}	-	-	-
Gold	-	-	-	10^{-1}	±5%	-	-
Silver	-	-	-	10^{-2}	±10%	-	-
None	-	-	-	-	±20%	-	-

6. Insert the rectifiers. The side with the line should go in the square pad hole as shown in the figure
7. Insert the diodes. The side with the line should go in the square pad hole as shown in the figure.
8. Insert the transistors. There is a small notch on the transistor and a line on the board to show the orientation. Do not flush mount the transistors. Leave it a little above the board so the traces don't short to the housing.
9. Insert the round cylinder shaped capacitor near the regulator. The polarity is important. The positive (longest) leg goes in hole closest to the "+" sign.
10. Insert the LEDs. Orientation is important. The short leg goes in the square pad hole.
11. Insert the regulator. Orientation is very important. Refer to the figure.
12. Insert the fuse clips as shown. There are tabs on the outside face of the clips, make sure they face outwards so the fuse can be inserted.
13. Insert the 8-pin PWM header as shown in the figure.
14. Insert the 2-pin power header as shown in the figure.
15. Insert the 2-pin 5V jumper header as shown in the figure.
16. Insert the relays as shown in the figure.
17. Insert the servo extension wires. The signal wire is closes to the IC chip.
18. Insert the fuse.
19. Power test make sure power LED comes on, then turn off. To supply power refer to the operation section.
20. Insert the PIC in the correct orientation (match the notch on the chip) to the notch on the IC socket.
21. Power test make sure power LED comes on, then turn off. The 4 status LEDs should oscillate then turn off.

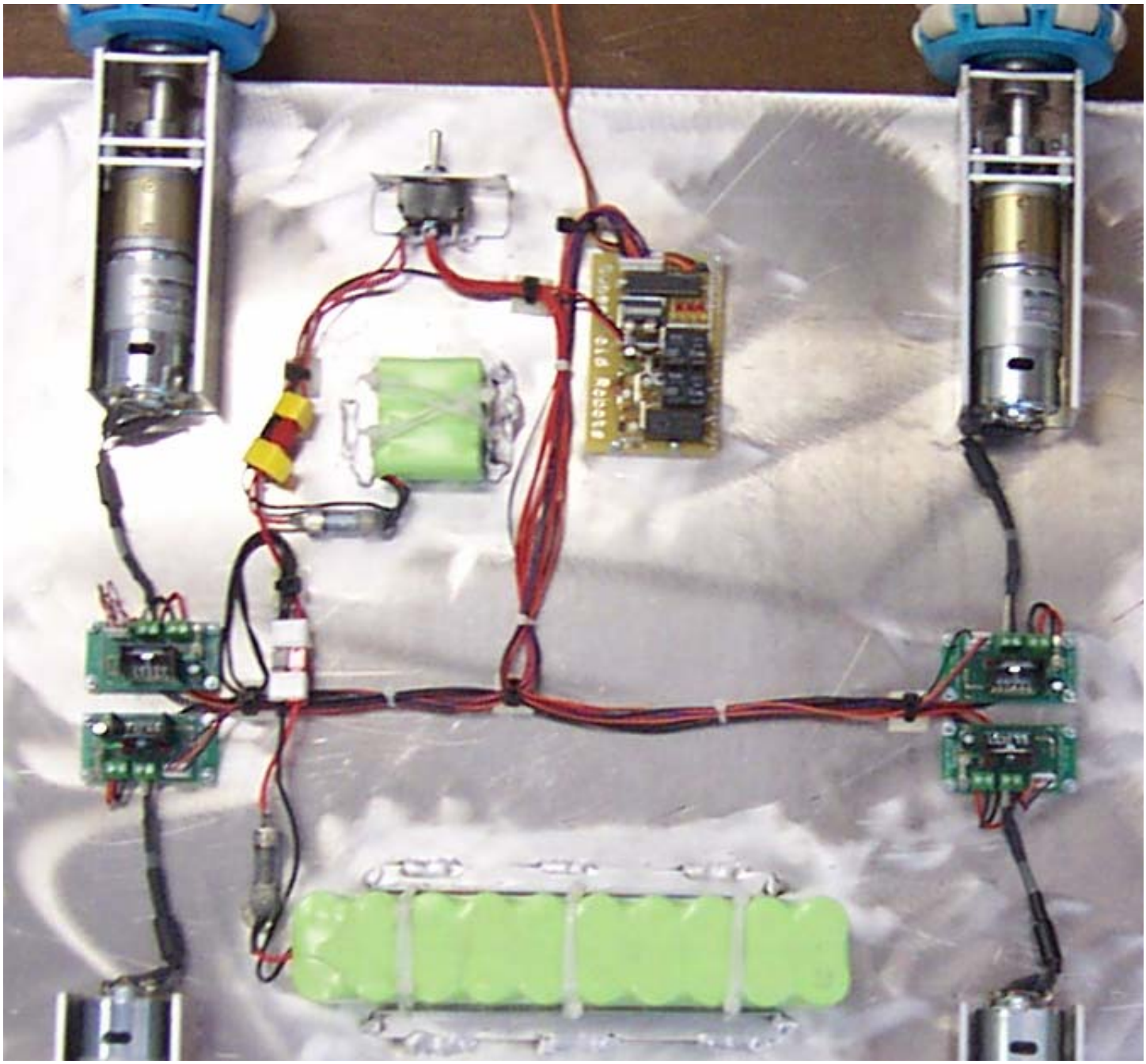


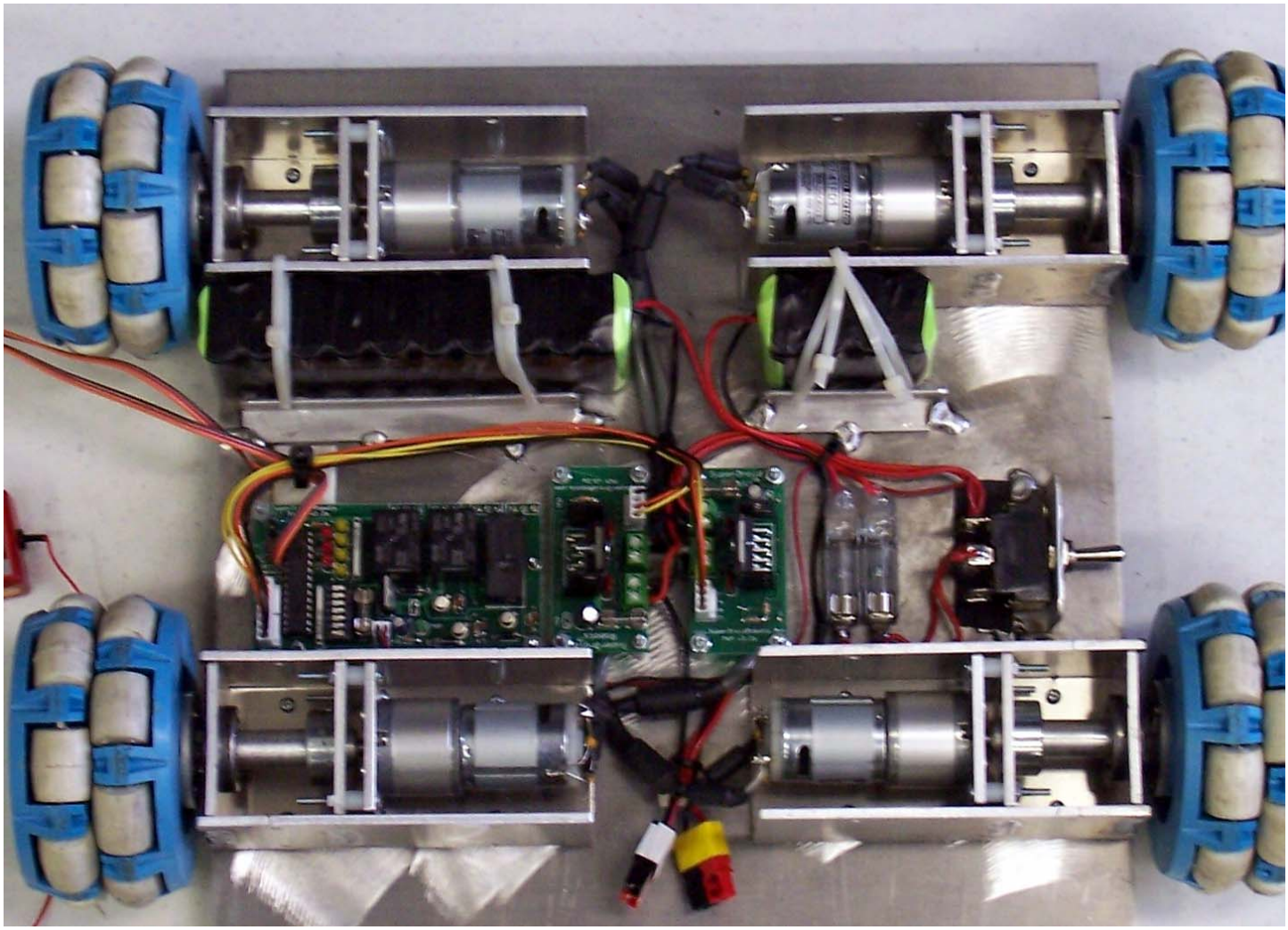
Connection to PWMs

This controller is intended to be attached to our PWM motor drivers (TE-058-000), but can be hooked up to any motor controller that has a PWM input and a direction and brake input. The Connection to the PWMs is best done using our PWM to RC interface board hook up kits (TE-060-000). With the larger IG42 motors we recommend our motor per PWM, for the smaller IG32 gear motors one PWM motor controller can be used to drive two motors.

The boards are labeled. B = brake, D = Direction, P = PWM, G = Ground. You do not need to hookup the brake, its up to you. The gear motors will generally stop right away with or without the brakes connected.

1. Attach B1, D1, P1, and G to the respective PWM controllers. If you are using two PWM controllers (recommended for the IG42 motors) just parallel the lines from the RC controller board (ie two lines on B1, D1, P1, and G) and go to each PWM.
2. Attach B2, D2, P2, and G to the respective PWM controllers. If you are using two PWM controllers (recommended for the IG42 motors) just parallel the lines from the RC controller board and go to each PWM.
3. Attach the motors and motor power supply to the PWMs. P1, is generally the right, and P2 is the left, but with channel reversing it does not make much difference. If it turns when it should go straight switch channels 1 and 2. See Operation section below. If you are putting two motors to the same PWM, make sure they are wired the same, if one turns the opposite of the other, change the leads of one of the motors.
4. See the figures below for two examples of wiring the controller.





Operation

This is our custom RC interface board. It was developed for our ATR robot kits. In order to control motors or any heavy load from a standard hobby remote controller you need to be able to take the signals (pulses) that are typically used to control servos and use them to control motors and other heavy loads. This RC board does just that! The RC board accepts 4 RC inputs (4 channels) and drives 2 PWM motor controllers and 3 relays (two 10A SPDT and one 8A DPDT relay).

The board has an onboard 5V regulator and fuse for power. There is a jumper that allows you to power the RC receiver via the board or isolate the receiver power from the RC interface board. If you are going to power the RC receiver and the RC board with separate supplies, the jumper should be removed.

The board has one power LED that is always on as long as the board has 5V. It also has 3 LEDs showing the status of the 3 relays. If the light is on, the LED is pulled in. Finally it has 4 LEDs showing the status of the 4 RC channels, when they are lit it has a RC signal and its centered ~1.5mS pulse.

The PWM output is an 8 pin header. The outputs are the PWM signal, brake (on/off), and direction for each channel and two ground pins. The PWM outputs a 2000hz signal equivalent to 0-5V. The board is intended to be used with our PWM motor controllers. Center stick will be 0 volts, then full stick in either direction will yield 5V and in one direction the direction output will turn on to change the direction of the motor. You can run the PWMs in parallel. For our large motors on our ATRs we run one PWM per motor (or 2 PWM motor controllers to each channel). The PWM motor controllers can be hooked up using our PWM to RC hookup kit. We have found that the combination of this controller with our PWM motor controllers dramatically increases the performance of the robot both in range and control. The controller has been programmed to filter and dismiss most erratic or lost readings. If it loses too much data it will shut the PWMs and relays down into a safe mode and wait until it gets several good readings in a row before starting back up. Depending on the transmitter and receiver, dozens of readings are taken a second.

The RC controller PWM output can be set on as two independent controls or the channels can be mixed. In independent mode, each PWM responds individually to the output of the RC receiver. So if you want to use only one PWM or have two independent PWMs you can use this mode. In mix mode it will take two channels (a fwd/rev stick movement and a left/right stick movement) and blend them together to control the two PWM controllers. Both channels have to be hooked up or neither PWM will work when set to this mode. Mix mode is intended for tank steering or skid steering. Pushing the stick proportionally forward will drive both PWMs proportionally forward, same for reverse. As the stick if moved forward or reverse, then moving the stick to the left or right will turn the robot left and right by backing-off the appropriate motor. The controller will also allow a hard turn. To perform a hard turn start with the stick(s) in center, then push left or right and the robot will pivot left or right by driving one motor forward and the other in reverse.

The relays can be used in many capacities. One of the SPST relays operates off of one of the channels as an on/off or off/on relay for driving things like lights. The other SPST relay works along with the DPDT relay off the other RC channel. Mode select DIP switches allow you to configure how you operate the relays. It can drive many different things and can also be set up to drive a motor forward/off/reverse. The table below shows how the switches can be used to set up relays. Please note Channel 3, and 4 only refer to the channel numbering on the RC interface board, you can plug them into any channel on your receiver to have them operate from the RC channel you desire. The controller reads the switch groups in order, it will process the 1st switch selected in the group.

	Off	On
Group 1 - PWM Channels - - RC Channel 1 & 2		
SW1	Independent PWM control	PWM Mixing
Group 2 - SPDT Relay1 - RC Channel 3		
SW2	OFF	Relay1-OFF-Relay1
SW3	OFF	Relay1-OFF-OFF
Group 3 - SPDT Relay2, DPT3 Relay3 - RC Channel 4		
SW4	OFF	Relay2&3-OFF-Relay2
SW5	OFF	Relay2-OFF-Relay3
SW6	OFF	Relay2&3-OFF-Relay2&3
SW7	OFF	Relay2&3-OFF-OFF
	The three positions for the relays are each side of center and center stick. Center stick will be off. The relays will turn on about 1/3 stick, but if the radio has ATV or EPA you can vary when the relay comes on. You can reverse the channels of your RC transmitter to get the opposite responses.	