

# myRIO Robot Mechanical Build Information

Document Version 0.9b

Last updated March 18 2017 by Michael Margolis

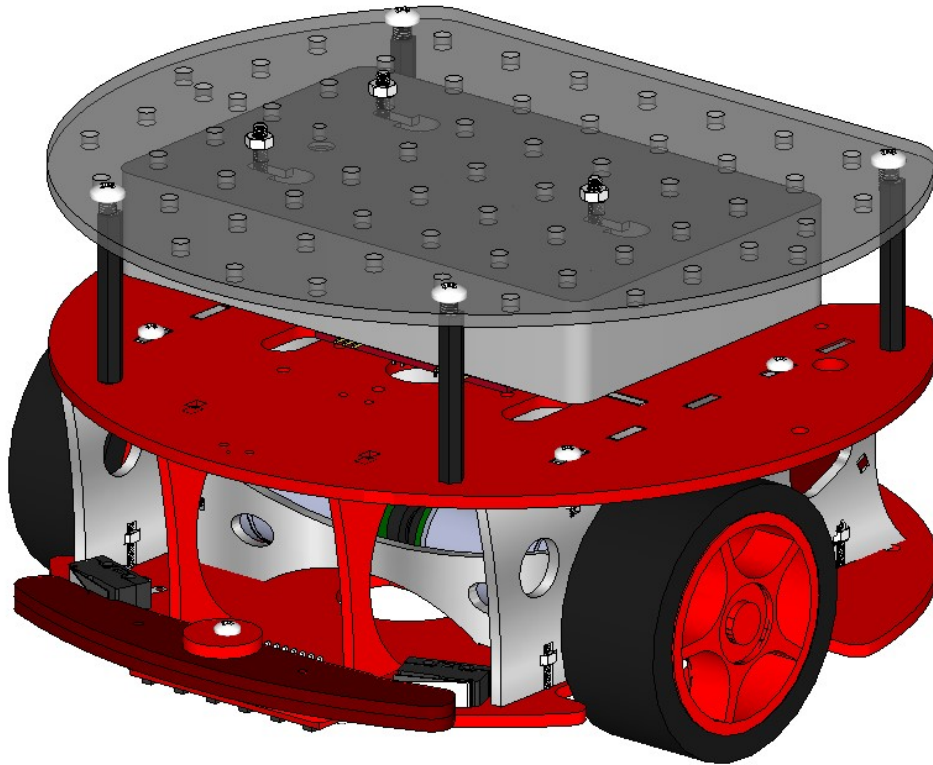


Figure 1: Front View of Robot

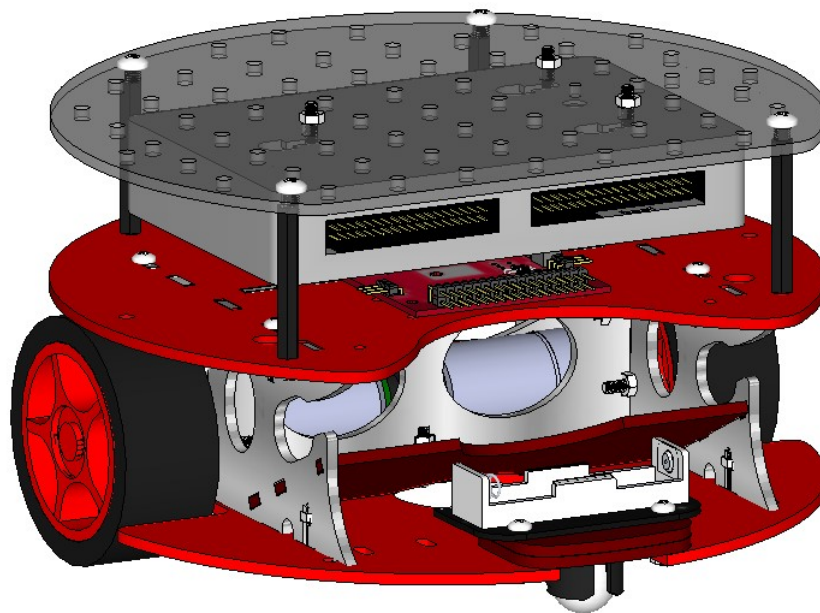
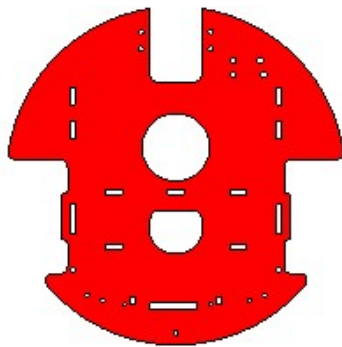
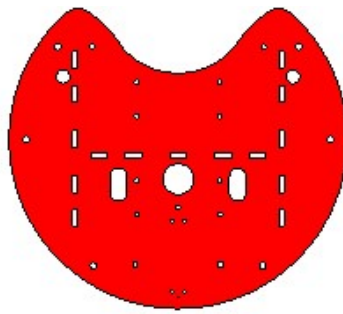


Figure 2: Rear View

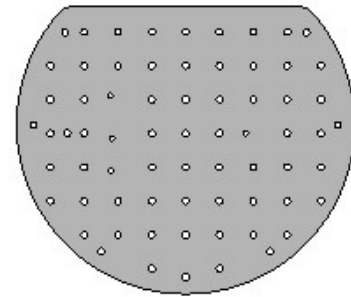
Robot Components (circuit board and wiring not shown, see Electronic Assembly Section for details)



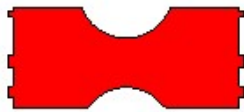
Bottom Plate



Middle Plate



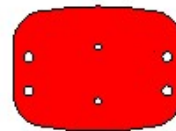
Top Plate



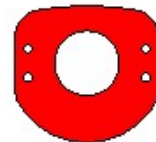
5V Battery Platform



Bumper x2



Caster Mount Top



Caster Spacer



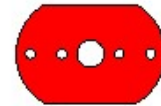
IR Sensors Spacer x2



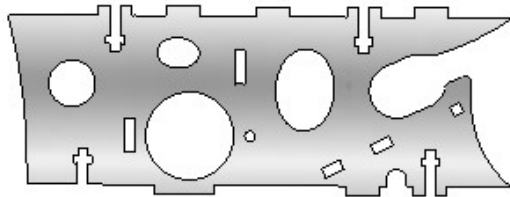
Strut x2



Bumper Cap



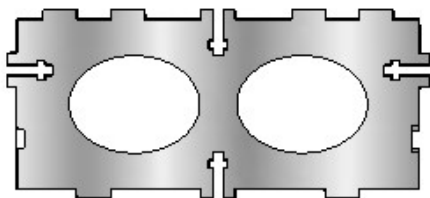
Motor Mount x2



Center Frame Side x2



AA Battery Holder



Rear Cross Piece



Front Cross Piece



Motor x2



Wheel Hub x2



Wheel x2





Caster



IR Sensor Board

Figures are not to scale

Hardware:

Quantity	Description	
4	M3 x 5 socket button screw	
16	M3 X 12 pan head machine screw	
24	M3 nut	
1	M3 X 20 socket button screw	
1	Plastic washer	
1	M3 X 6 spacer	
1	M3 locknut	
1	Nylon dome nut	
8	M2.5 x 12 pan head machine screw	
12	M2.5 nut	
2	M2 X 12 pan head machine screw	
2	M2 nut	
2	M3 X 16 pan head machine screw	
12	M4 X 8 pan head machine screw	
4	M4 x 40 hex spacer	

Build notes:

- **Read through all steps before beginning assembly**
- Double check hardware before each assembly step and make sure that the length of the screw matches the instructions.
- Look at the prototype if you are not sure how things go together
- **Don't overtighten the screws**
- Machine screws are pan head where not specified.
- Use thread lock only after initial assembly

Attach motors to mount using two M3x5 socket screws. Don't over-tighten these (hint – hold the shorter end of the hex key using only two fingers when tightening). **Caution – you must use the M3x5 hardware specified, longer screws will damage the gearbox!**

Hardware: 4 off M3x5 socket button screws

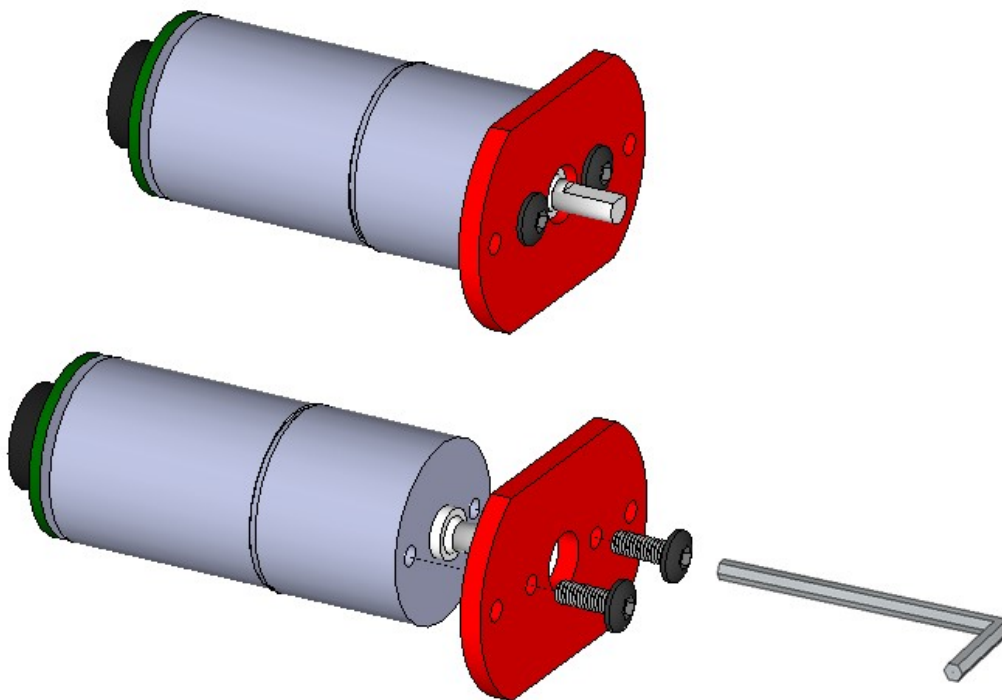


Figure 1: Motor Mount

Assemble the center frame using the two aluminium side pieces, two cross pieces and one acrylic battery platform.

Hardware:

2 off M3x12 pan head machine screws

4 off M3 nuts

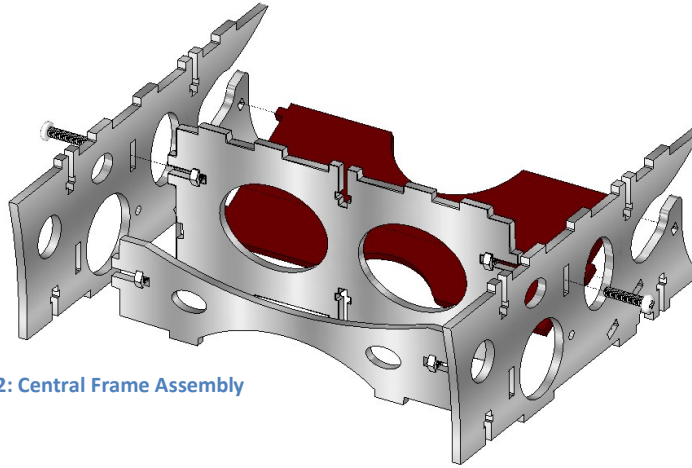


Figure 2: Central Frame Assembly

Four M3 nuts must be inserted into the slots on the cross pieces. The nuts are a tight fit and will only go into the slots when oriented as shown in Figure 3a. You may need to use a little force if the slot is cut slightly narrow.

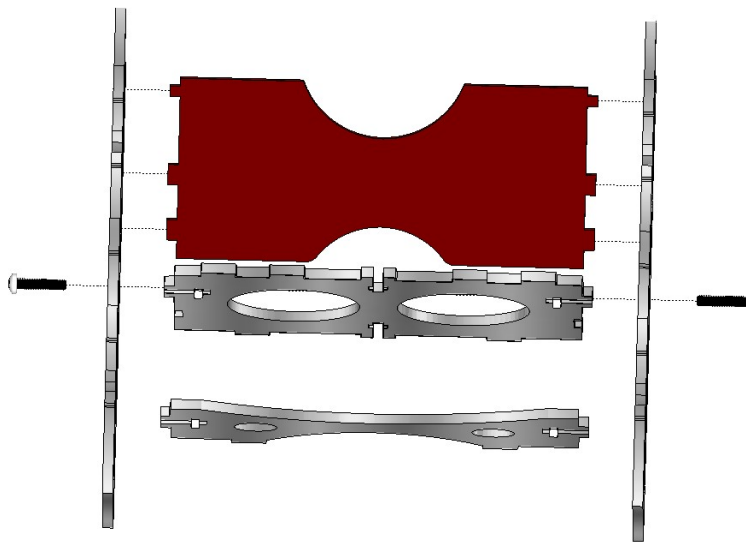


Figure 3: Central Frame from above

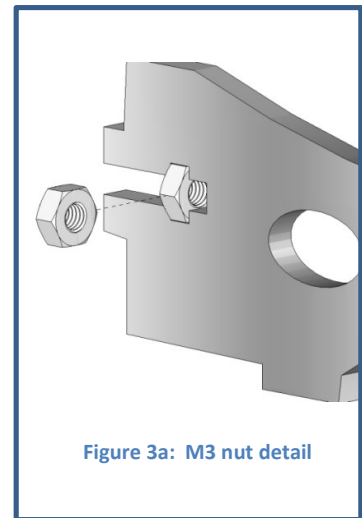


Figure 3a: M3 nut detail

The screws holding the smaller cross piece will be added in the next step but it will be easier to insert the nuts now before the motors are attached. Tip: if the nuts do not stay in place you can hold them with a small piece of masking tape.

Attach the motor assembly to the center frame using M3x12 machine screws. The screw holding the front (smaller) cross piece uses the nuts added in the previous step.

Hardware:

4 off M3x12 pan head machine screws

2 off M3 nuts

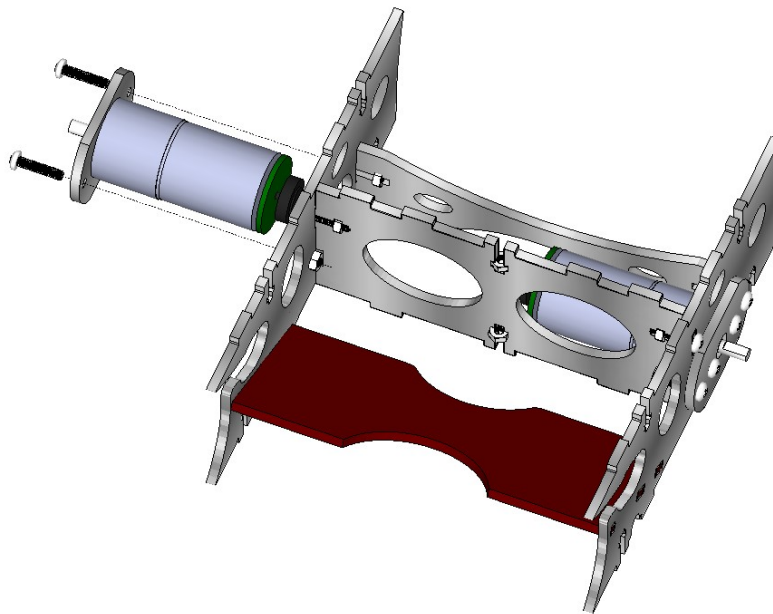
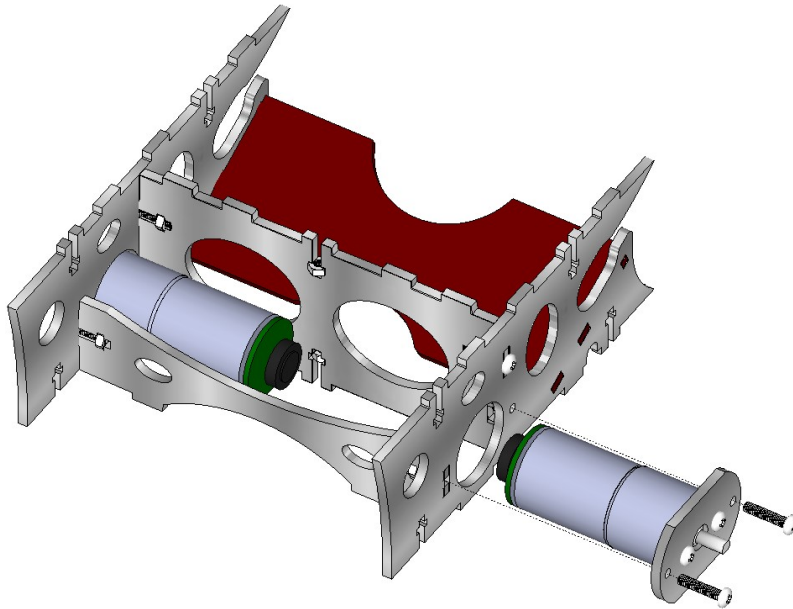


Figure 4: Motor Attachment to Frame

Attach two bumpers to the lower plate using a 20mm M3 button head screw. The washer and spacer are used to enable the bumpers to be held firmly but slide easily. Variations in acrylic thickness may require a second washer or no washer at all. The lock nut is metal with a nylon insert that resists turning; you will need to hold this nut with pliers when tightening the screw with a hex key. The plastic dome nut is then screwed onto the bottom to act as a skid to prevent the robot tipping forward and damaging the IR sensors.

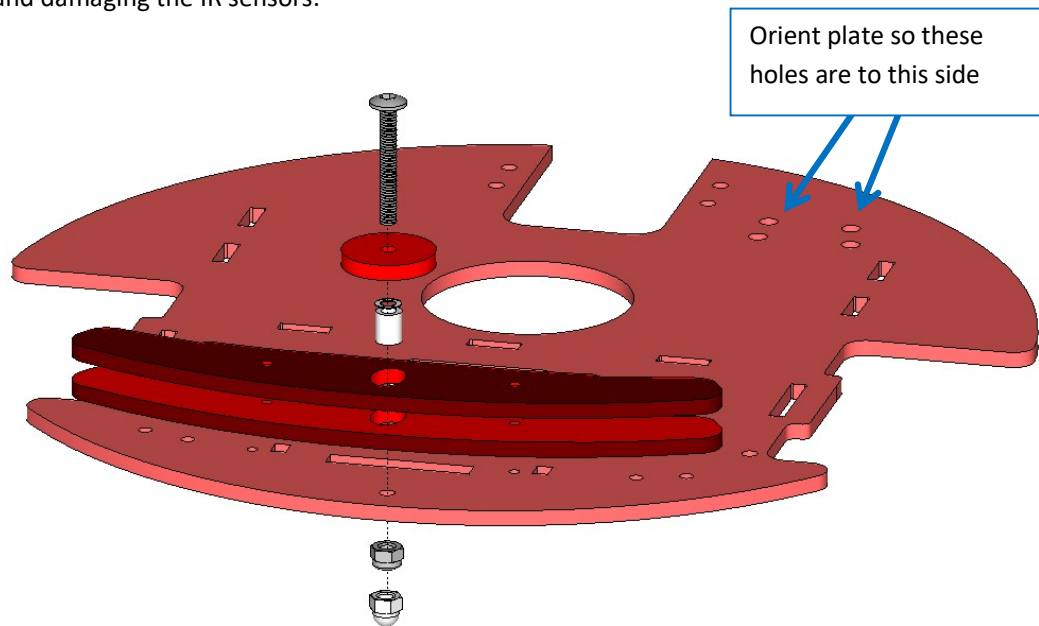


Figure 5: Bumper Assembly

Hardware:

- 1 off M3x20 socket button screw
- 1 off M3 plastic washer
- 1 off M3 6mm spacer
- 1 off M3 lock nut
- 1 off M3 plastic dome nut

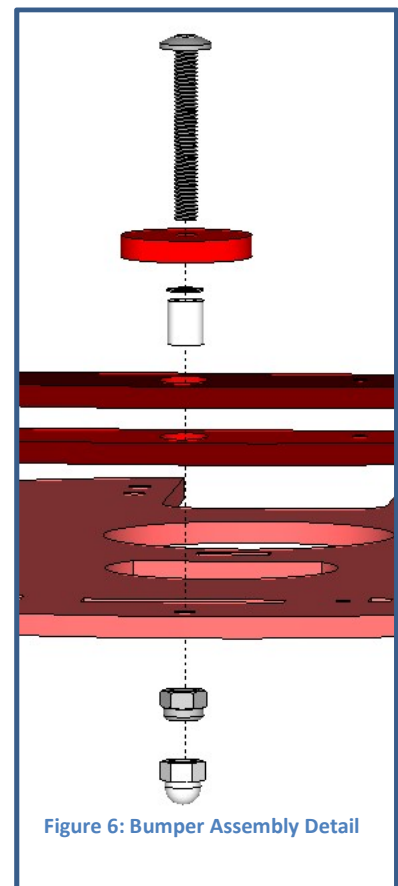


Figure 6: Bumper Assembly Detail



Attach the bump switches using M2.5x12 machine screws. Note the orientation of the switch levers (the hinges on both switches are towards the outside of the plate) and take care not to pull the ribbon cable apart.

Hardware:

4 off M2.5x12 pan head screws

4 off M2.5 nuts

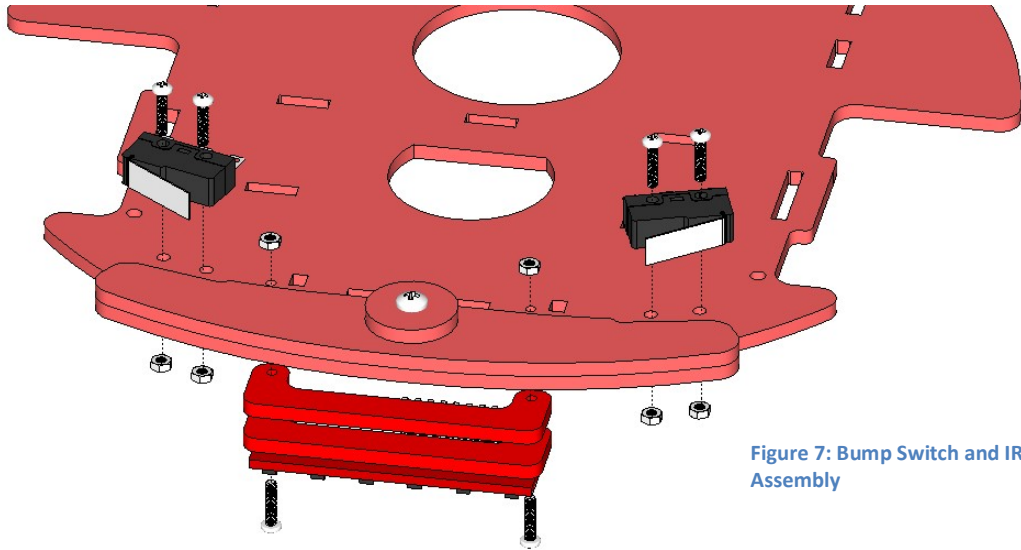


Figure 7: Bump Switch and IR Sensor Assembly

Two acrylic spacers are used to position the IR sensor board under the robot. Use M2x12 pan head screws and M2 nuts to secure the IR sensor board and spacers to bottom plate.

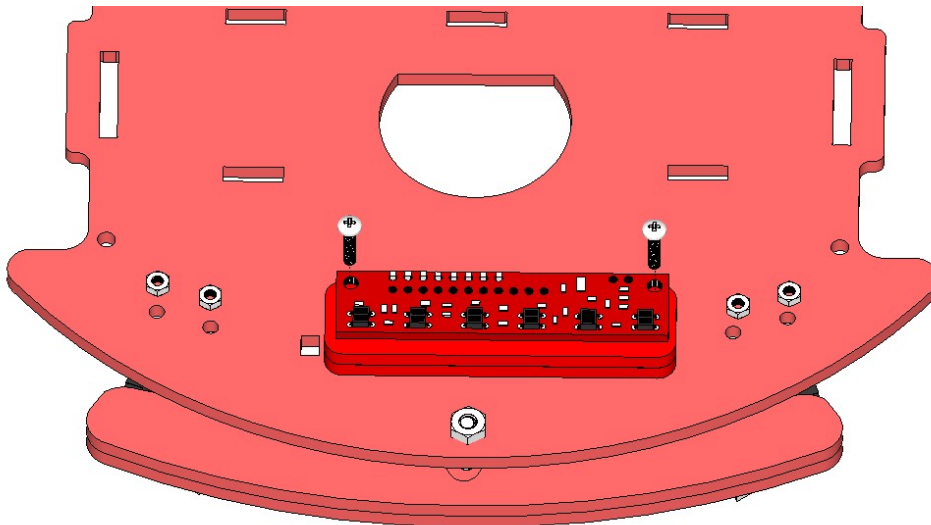


Figure 8: IR Sensor Detail (view from below)

Hardware:

4 off M2x12 pan head screws

4 off M2 nuts



Attach the bottom plate to the central frame using four M3x12 machine screws and nuts.

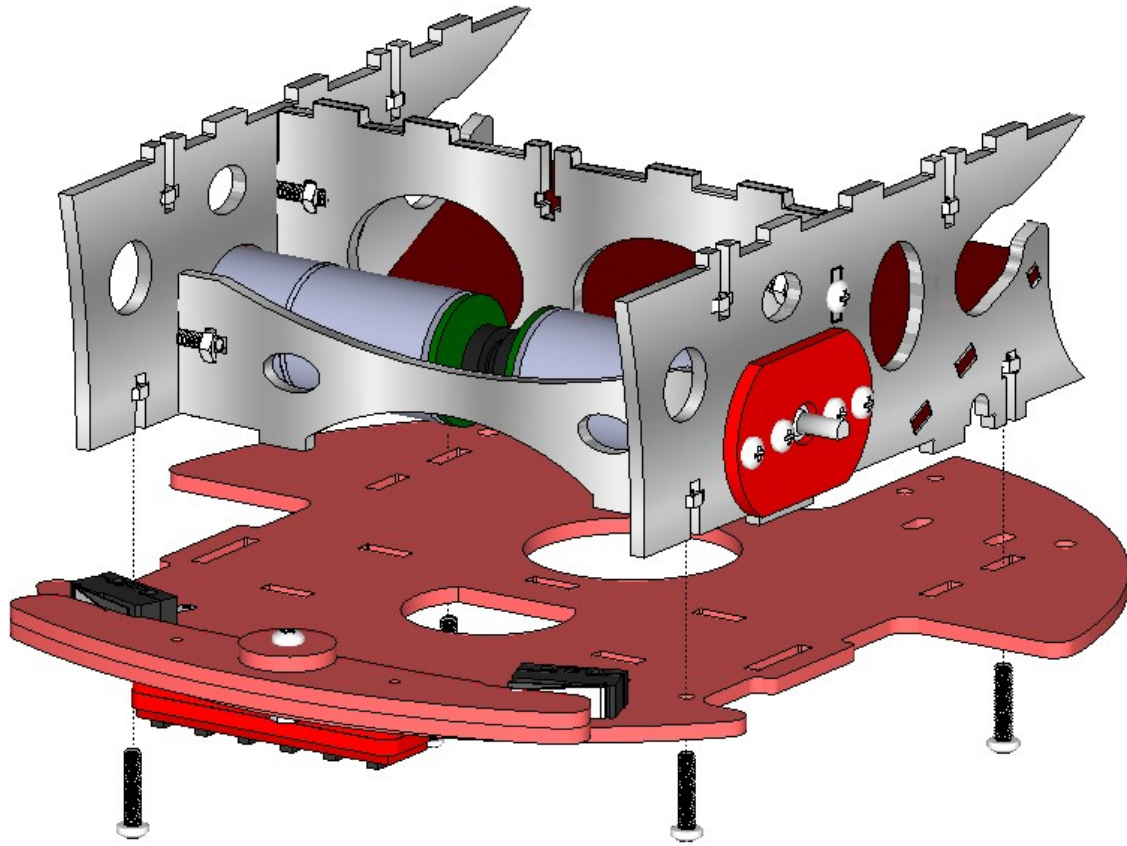


Figure 9: Attaching Bottom Plate to Frame

Hardware:

4 off M3x12 pan head screws

4 off M3 nuts

Assemble the caster mount. Remove the steel ball from the ABS caster housing and use the two small self-tapping screws supplied with the caster to secure the caster housing to the mount. Then push the ball back into the caster housing.

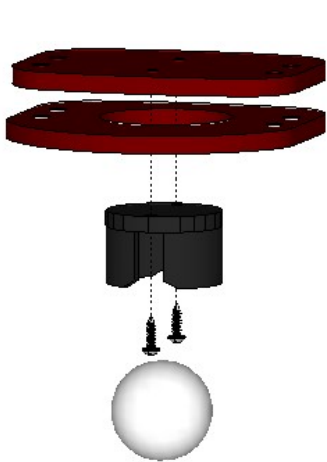


Figure 10: Assembling the Caster

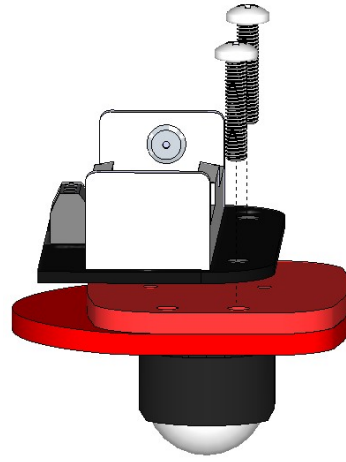


Figure 11a: Note orientation of the acrylic pieces and the battery assembly

Hardware:

2 self-tapping screws supplied with caster

Attach the battery holder and caster assembly using M3x16 machine screws. The rear edges of the castor acrylic spacer and top should be flush with the curve of the bottom plate.

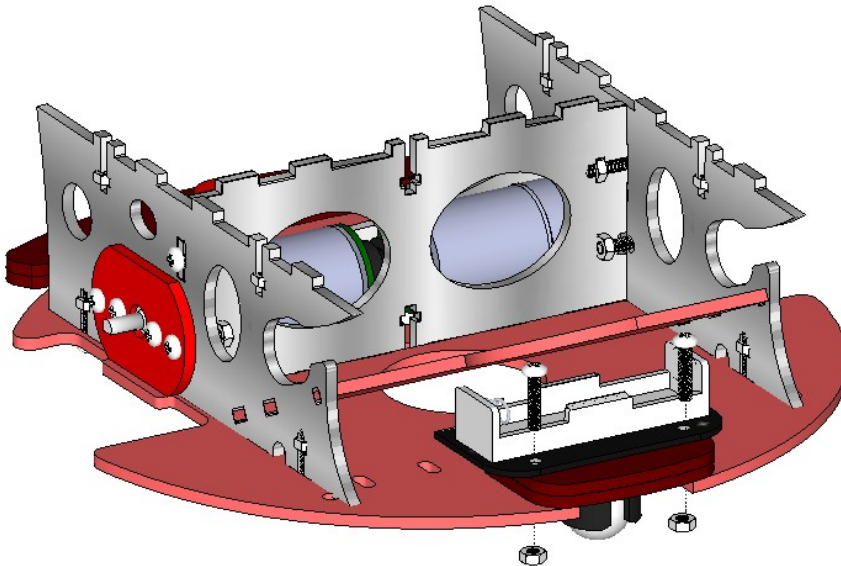


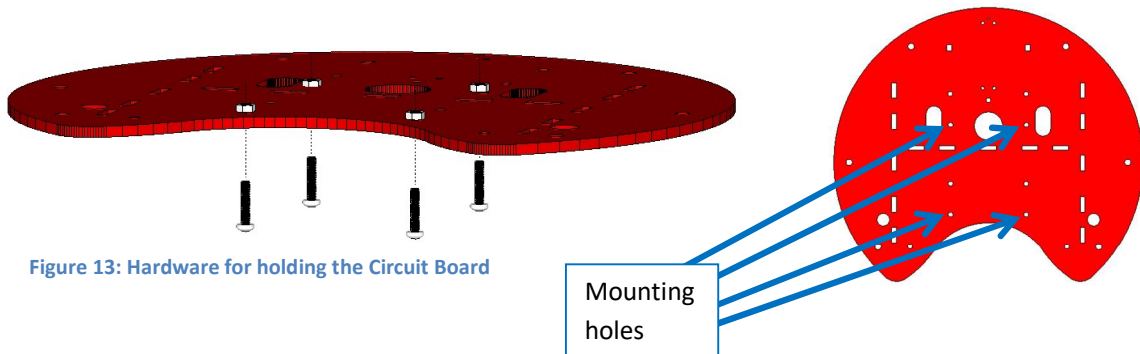
Figure 12: Caster and Battery Holder Assembly

Hardware:

2 M3x16 pan head screws

2 M3 nuts

M2.5x12 Machine screws inserted from underneath the middle plate and held in place with M2.5 nuts will be used to hold the circuit board.



The hardware should be tightened so the screws protrude above the middle plate. The circuit board will be placed onto these bolts and fastened with M2.5 nuts. This method of assembly is used so the circuit board can be easily removed when the robot is fully assembled and the bottom of this plate is not easily accessible.

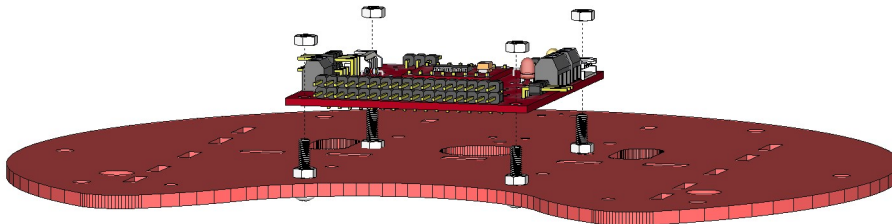


Figure 14: Mounting the Circuit Board, this step may be performed after the robot assembly is completed

Hardware:

4 M2.5x12 pan head machine screws

8 M2.5 nuts

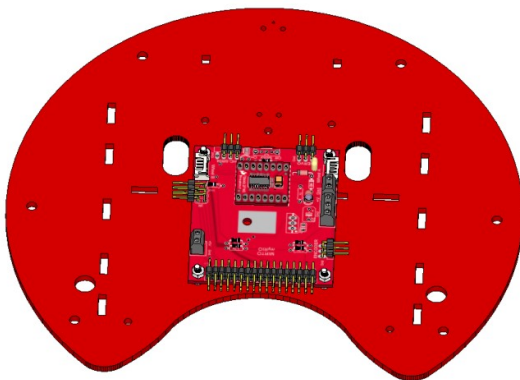


Figure 15: View showing location of Circuit Board

Attach the middle plate to the central frame using four M3x12 machine screws. **Note that the two support struts must be fitted during this step.** The square tabs at the ends of the struts fit into slots on the upper and lower plates.

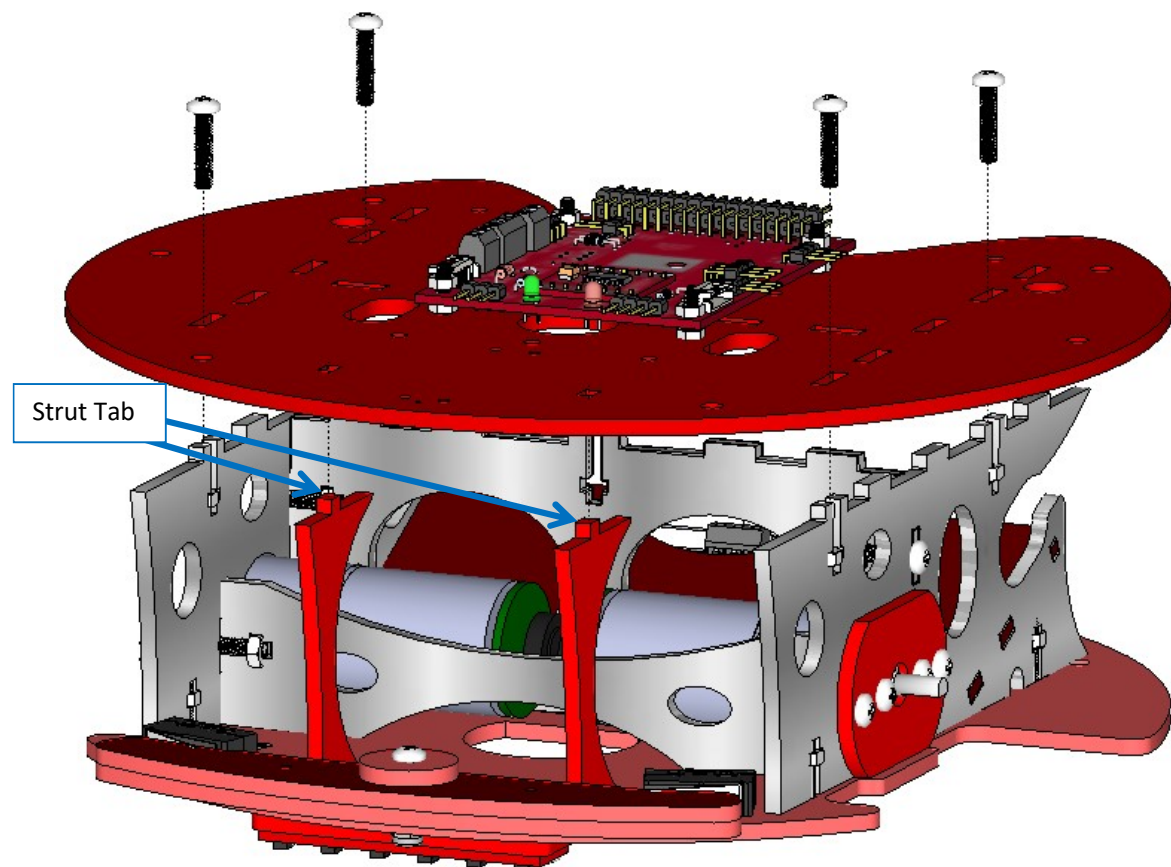


Figure 16: Attaching the Middle Plate and Support Struts

Hardware:

4 off M3x12 pan head screws

4 off M3 nuts

Attach the 12mm hex wheel hub adapters to the motor shafts using a hex key on the grub screws. You may need to loosen the grub screws to fit onto the shaft. One grub screw should be aligned with the flat on the shaft. **It is important that the hub is not rubbing against the motor mounting screws; the gap can be paper thin.**

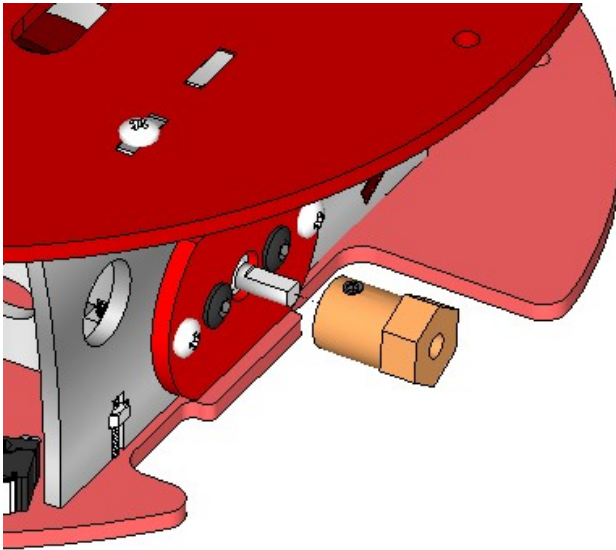


Figure 18: Attach Brass Hub to Motor Shaft

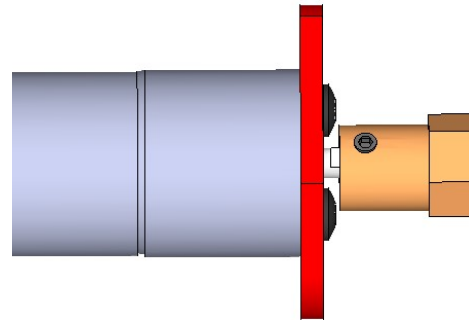


Figure 17: Detail showing Hub Mounted on motor

Push wheels onto the hubs and secure with M4 pan head screws.

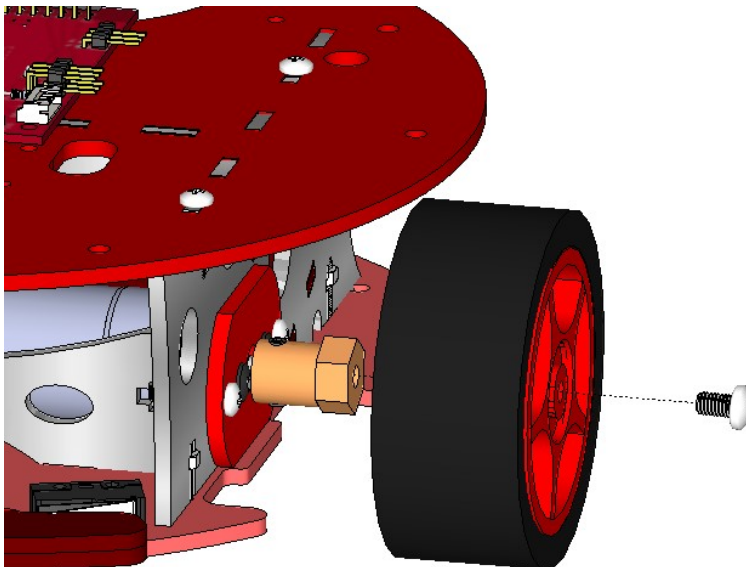


Figure 19: Attaching Wheel to Hub

Hardware:

2 off M4x8 pan head machine screws

Attach four M4 support pillars to the middle plate using M4 machine screws.

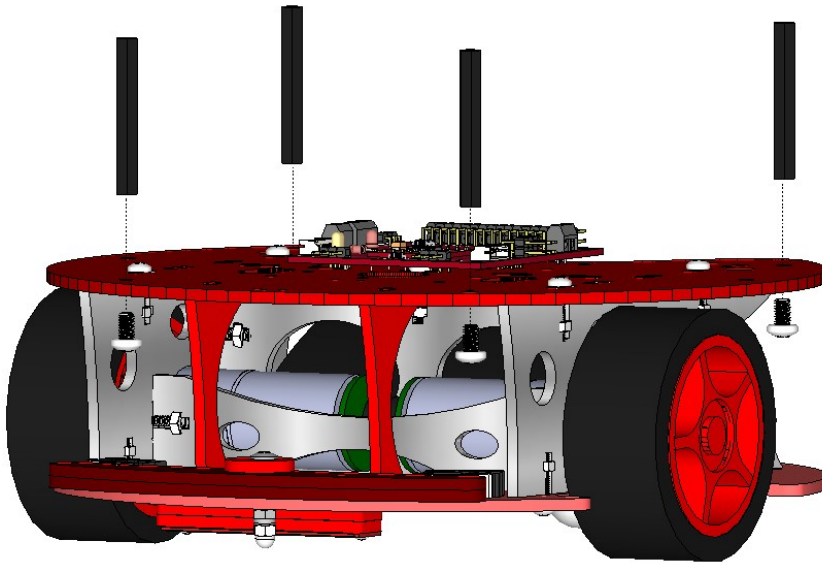


Figure 20: Attaching Support Pillars for Top Plate

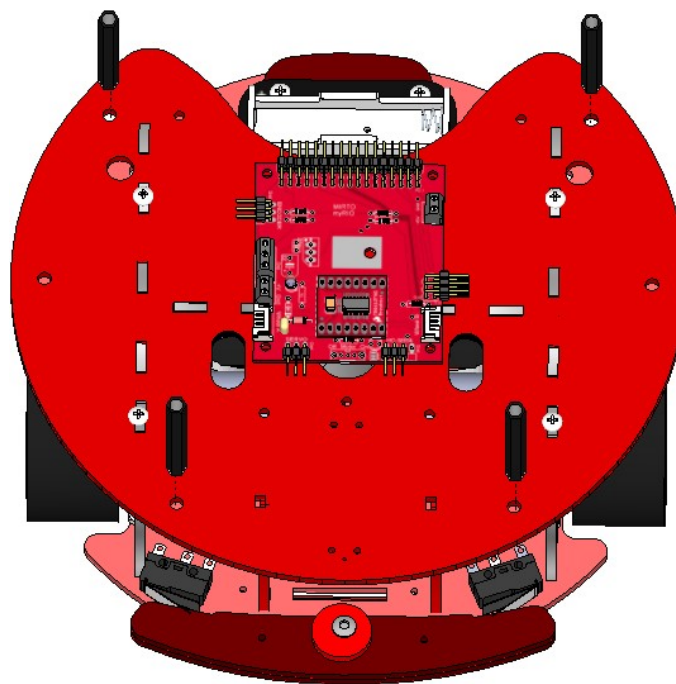


Figure 21: View Showing Pillar Location

Hardware:

4 off M4x40 hex standoff pillars

4 off M4x8 pan head machine screws



Carefully locate the three holes with the help of this figure. If you don't use the correct holes, the myRIO will not attach. Assemble the mounting studs that hold the myRIO board using M3x12 button head screws. These will slide into slots on myRIO (see the next step). The space between the head and nut should be 2.5mm (slightly less space is better than more). Tighten the nuts to prevent them coming loose.

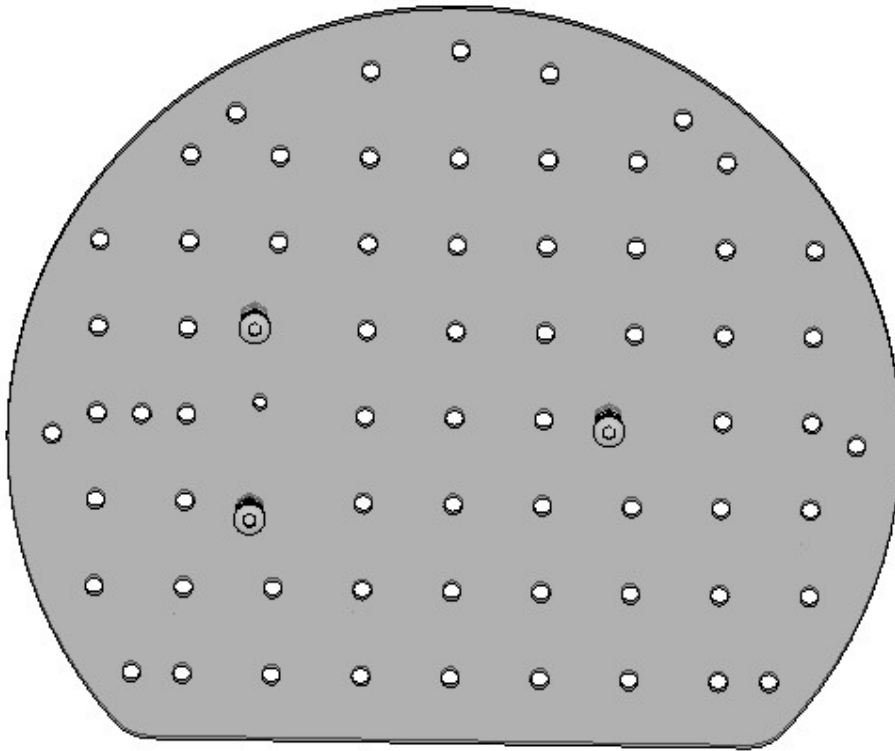


Figure 22: Location for myRIO mounting



Figure 23: Side View of Mounting Hardware

Hardware:  
3 off M3x12 socket button screw  
6 off M3 nut



Clip MyRio onto the upper plate.

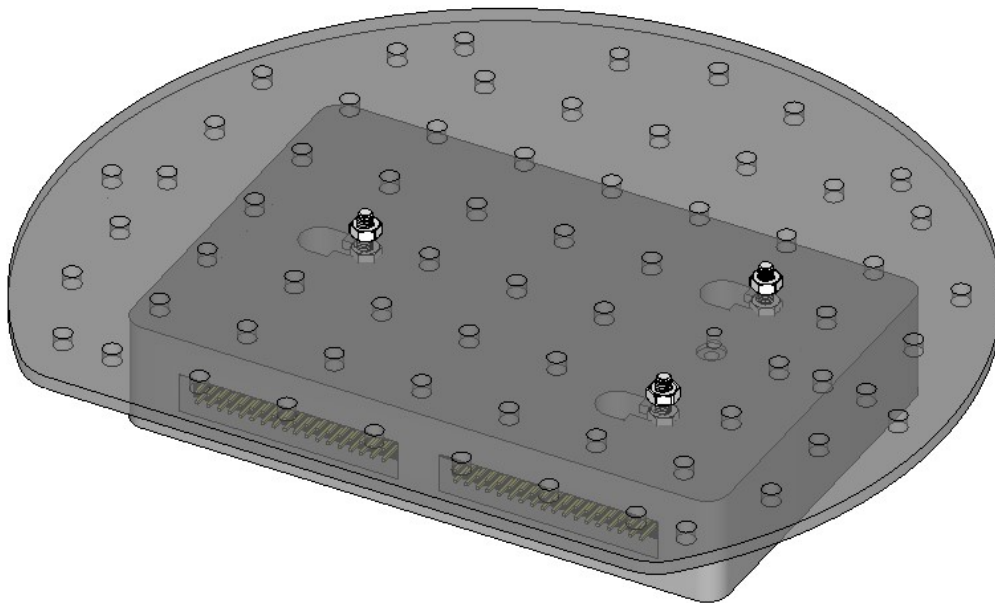


Figure 24: myRIO clipped to upper plate

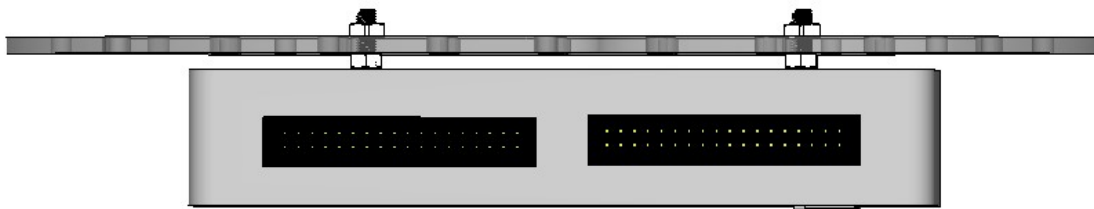


Figure 25: myRIO Side View

If the circuit board is already attached, this is a good time to wire everything together, see the next section for wiring details. The upper plate can then be attached to the standoffs with four M4x8 machine screws.

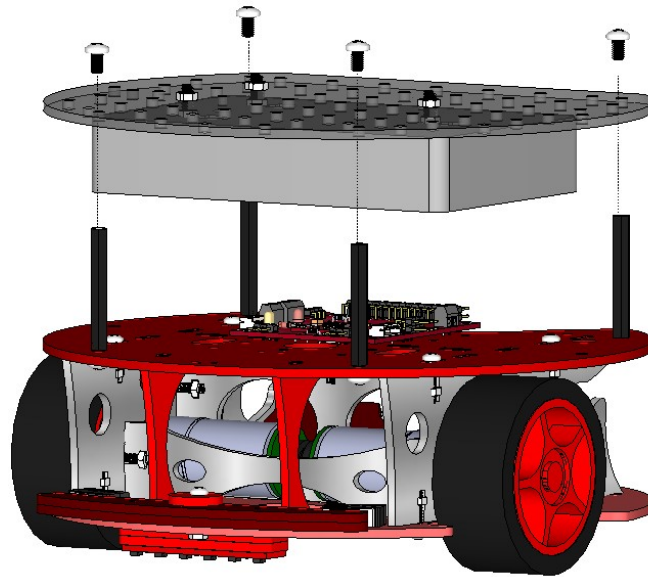


Figure 26: Upper Plate Attachment

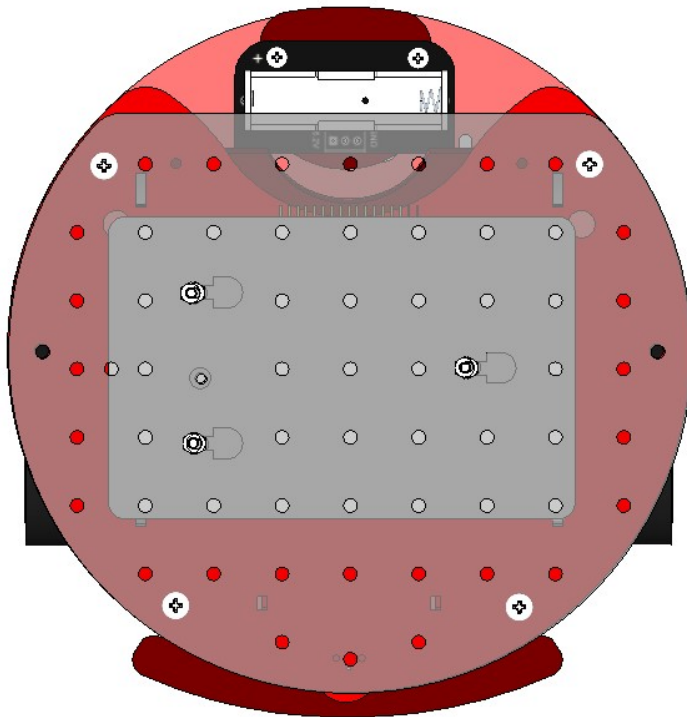


Figure 27: Location of Mounting Screws for Upper Plate

Hardware:  
4 off M4x8 pan head machine screw

## Electronic Assembly and Wiring Information

The IR Sensor Connector Board is made by soldering the eight pin header inserted from underneath, then solder the six pin header to the top. The IR sensors are connected to the main circuit board using a 6 conductor IDC cable.

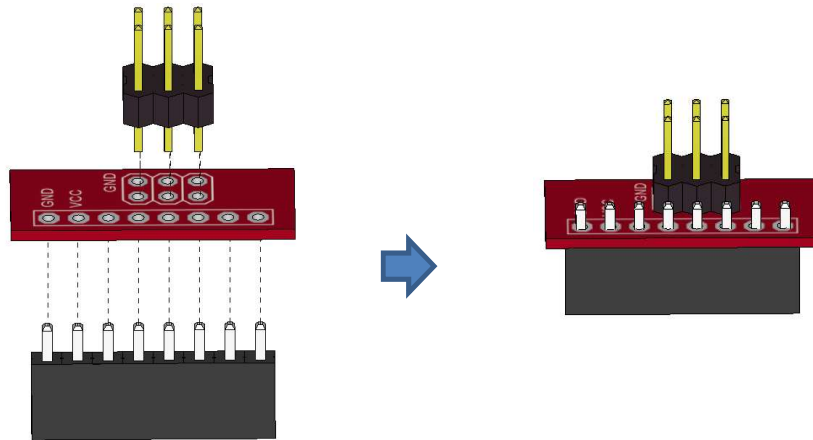


Figure 28: IR Sensor Connector Board

The bump switch assembly is made by soldering 20 cm of four conductor ribbon cable to the switches as shown. Strip 5mm of the other end of the cable and tin the ends so they can be easily attached to the terminal block on the circuit board.

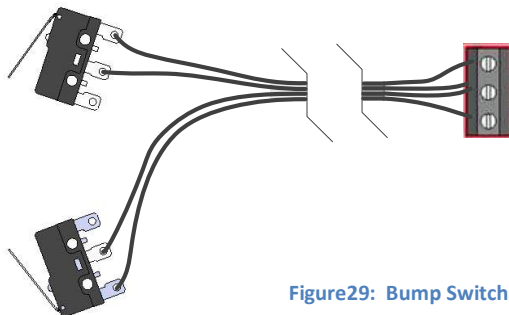
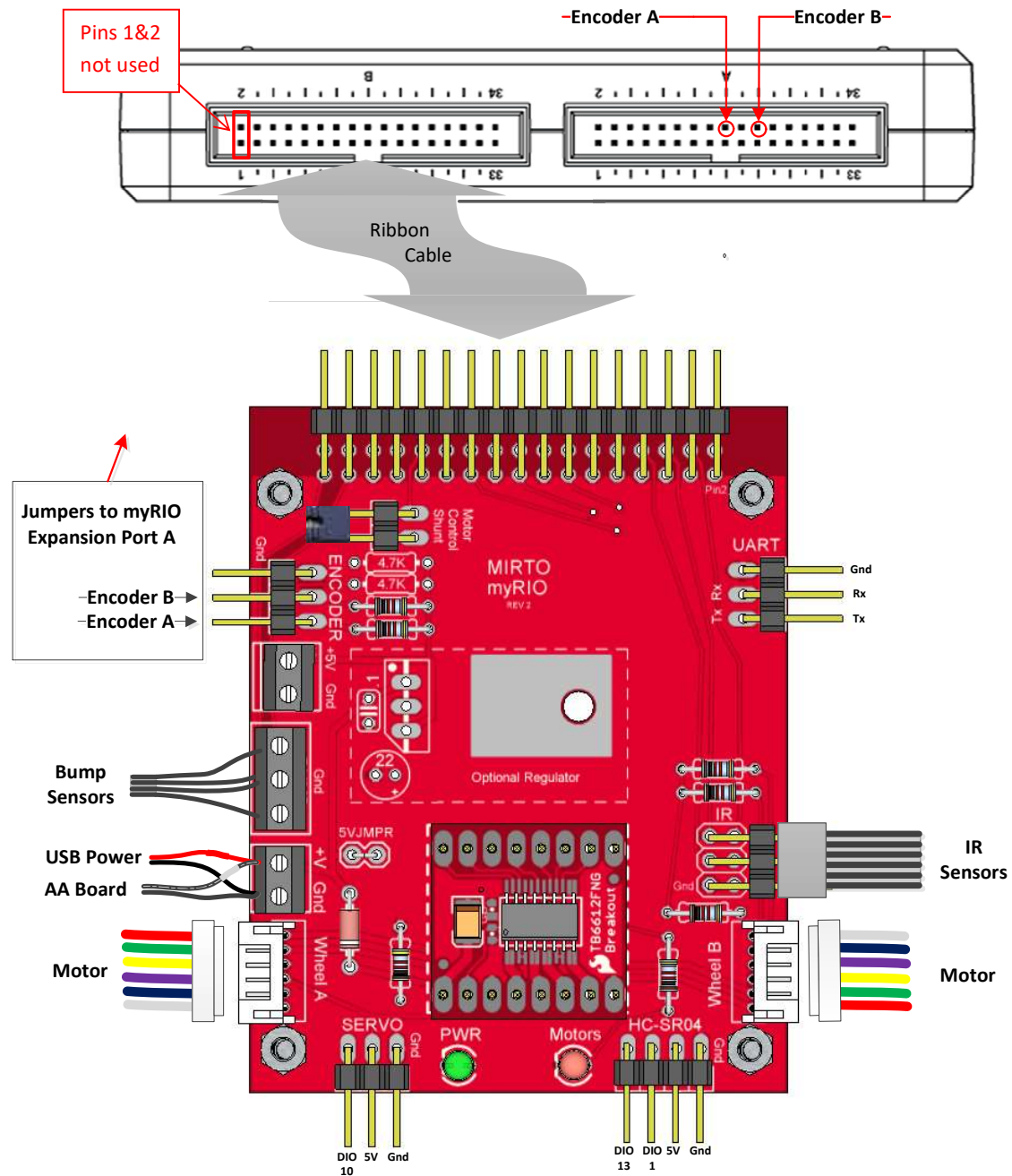


Figure29: Bump Switch Wiring

19



**Figure 30: Circuit Board Wiring (see next page for details on battery wiring)**



Circuit board Schematic

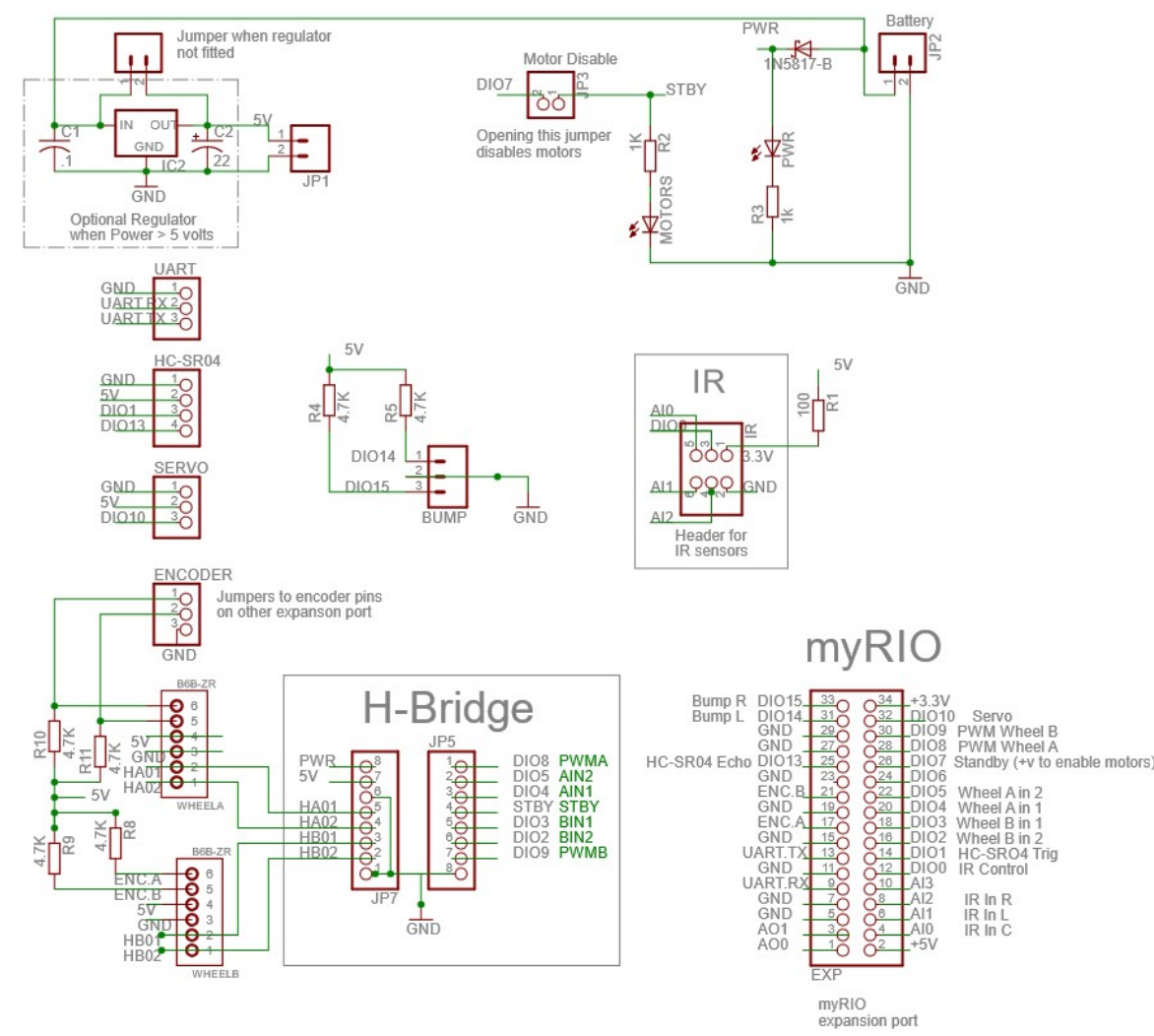


Figure 31: Schematic Diagram

## Motor Details

The specifications for the motors measured at 6 volts are as follows:

### NO LOAD:

Current: < 0.15 Amps Max

Speed:  $197 \pm 10\%$  rpm

### ON LOAD :

Torque: 0.7kg.cm

Current: < 0.54A Max

Speed:  $158 \pm 10\%$  rpm

### STALL:

Current: < 2.87 Amps

Torque 4kg.cm

Gearbox Ratio 1:34

Maximum Motor Drive Voltage: 8.4 Volts

