Manitoba Robot Game's
Mini Sumo Tethered Robot
Instruction Set

We at the Manitoba Robot Games, want you to have a successful and fun time building and competing with your Mini Sumo Robot. If you have any comments please direct them to Ian at rcdesign@mts.net

Follow these steps to construct your first competitive robot.

Step 1
READ all the instructions carefully before opening any packages!

Step 2
There are many ways to build your robot. Study the options and make a decision. You can always rebuild it later in a different configuration. Winning robots are always the result of testing, modifications, rebuilds, improvements, sweat and some luck.

Step 3.
Collect all the tools you will need, and especially a tray so that small parts have less chance of rolling onto the floor and falling into oblivion.

Tools
You will need:...
Hobby Knife., Small Side Cutters, Jr Hacksaw or 8" Side Cutters, Fine metal file, #1 Phillips Screwdriver, Small Needle nose Pliers, a 100 mm Measure, Soldering Pencil and Solder, Small Vise or Table Clamp, Paint, Decals or Pictures to customize your robot.
Also useful:..., Electrical Tape, Crazyglue or 5 min Epoxy.

The safest knives are sharp ones. Hobby knives can be sharpened on a small piece of waterproof sand paper about 320 or 400 grit (that is the black sandpaper with the green backing).

Options
The Tamiya gearbox that is included in your kit can be assembled in one of three ways as shown on the gearbox carton. The front of the box shows an A type and the back of the box shows types A, B and C
A & B are variations on the same 58:1 gear ratio. This gives a higher speed but lower torque robot. A and B are the same ratio but have axle at different the heights. Probably A is the better choice as it keeps the gearbox as low as possible to the ground.
The C type functions better in the reverse direction to the A and B types but has a 203:1 gear ratio which means a lower speed but higher torque. Head to head the stronger of the two. The C type also has the axle positioned about 12 mm closer to the middle of the gearbox. You will need to modify the plastic body to mount the gearbox closer to the first bend. But wait until your gearbox is complete and the wheels are on before marking or drilling the holes.
You have been given a preformed PETG plastic body with your kit. You don't have to use this, you may choose to modify it or make a body from some other material. Remember that the Maximum size for your robot is 10 cm x 10 cm and the maximum weight is 500 grams.
One of the rules says that, to qualify to enter, the robot must be able to move a block that weighs 500 grams, so you might consider ways to increase traction between the robot and the playing surface.

In short, your options include;
Gear ratio (A or C), Position of axle (A or B), Shape of Body, Weight of finished robot, Traction provided by the tires, and how your robot is decorated, but be sure to display clearly your robot's name or ID.

Assembling the Gear Box

When assembling the gear box follow the instructions that are included in the box of parts, with ***one exception***...

To ensure that the finished robot will fit within the 10 cm by 10 cm size constraints for Mini Sumo competition you must carefully measure and cut 6 mm from the ends of the two hex shafts. This is best done with a Jr hacksaw or 8" side cutters. Don't use smaller side cutters as they will be damaged by the steel hex shaft. Smooth the cut end with a file or on a sharpening stone.

Step 4

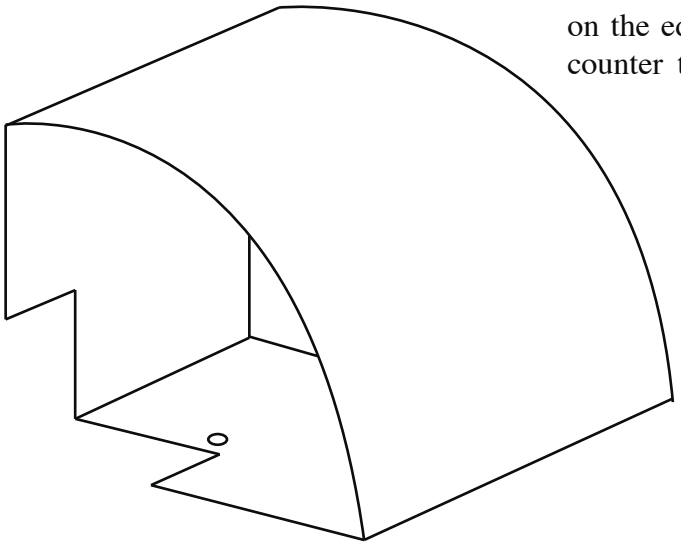
Open the box of parts for the gearbox and try to identify the parts. Don't open the bags until you are ready to use the contents.

Step 5

Pick out the two hex shafts that will be used to support the wheels and cut off 6 mm from the length of each using a Jr Hacksaw or 8" side Cutters. File the cut ends smooth. Follow the instructions for either the A, B or C type that came with the gearbox.

Step 6

If you chose to build the A or B type then the plastic can be used as is. Follow the instructions for Altering the Body A/B.



The Plastic Body

There is room for a great deal of flexibility in the design of your robot body.

However for the first time builder we suggest you follow these instructions first, then make your own special improvements later.

The Body is formed from PETG. PET is the same material that is used for making soft drink bottles but this sheet has been glycolized which gives it some extra impact properties. PETG is an impact resistant clear plastic sheet that can be bent with or without heat, drilled, cut with shears or scored (in straight lines) then snapped with your fingers. It can be glued using two part (5 min) Epoxy or Cyanoacrylate (crazyglue). Lap joints are the strongest and the only joints that work with crazyglue.

To form a sharp corner, place on the edge of a sturdy table or counter top and bend the sheet over the edge of the table. Once a bend has been established, a sharper angle can be had by folding it further in your hands. PETG can almost be folded back on its self before it starts to show significant weakening. To form a curved surface, form the sheet over a round object such as a broom handle or rolling pin or simply roll it between your hands.

Altering the Body, A/B

The body has been shipped with two bends leaving the center open for you to mount the gearbox inside and do the wiring easily, but before adding the gearbox, we suggest you put a curve in the long part of the body to form the top and front.

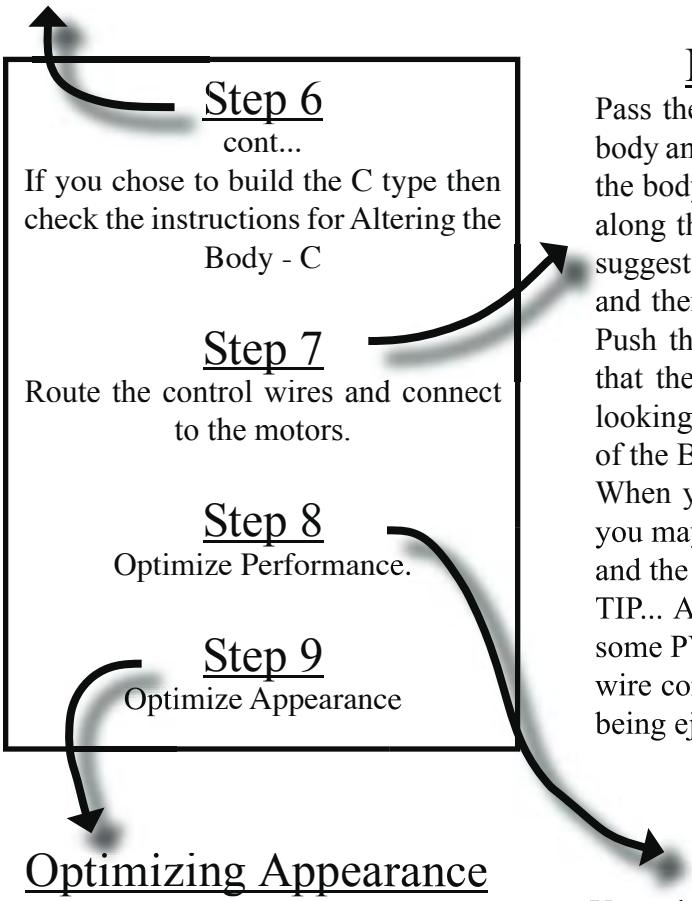
You can do this by rolling the long part between your hands in a smaller and smaller radius until the plastic starts to take the shape you want, alternatively, you can bend the top over the edge of a table to form the curve. For now simply tape the edge of the top to the front edge of the bottom.

Drill a small hole in the center of the top close to the back. This hole should be just large enough to pass the four control leads through. Approximately 3 mm dia.

Altering the Body - C

If you are using the C type gear configuration then the axle will end up being 12 mm further forward and the wheels will run more efficiently in the opposite direction to those of the A/B type. Therefore the simplest solution might be to flip the gearbox over so that the mounting ears are on the top and then mount the chassis above the gearbox. Be sure to build the gearbox and add the wheels before marking out the chassis for cutting. Form the rest of the body to your liking and drill a small hole on the top near the rear of the robot just large enough to pass the 4 control wires through.

Remember the 10 x 10 cm maximum dimensions and in fact it might be safer to aim for 9.8 x 9.8 cm so you can be sure it will fit in the sizing jig on competition day.



Making the Electrical Connections

Pass the wires through the hole you have made in the top of the body and tie a knot in them so that the wires cannot be pulled out of the body while leaving enough length so that they will pass safely along the body to the solder tabs on the ends of the motors. We suggest installing three "C" cell batteries into the controller body and then hold the Blue and Yellow wires to the right motor tabs. Push the right controller lever forward and look at the direction that the wheel rotates. It should be going forward or clockwise looking at the wheel hub. If that is not the case then swap position of the Blue and Yellow wires and try again.

When you are satisfied that you have the correct wiring pattern, you may solder these connections. Repeat this with the left motor and the Black and Red wires.

TIP... After soldering the wires to the motor and testing it, wrap some PVC electrical tape around both motors. This will ensure the wire connections are safe from damage and keep the motors from being ejected due to any gear backlash.

Optimizing Appearance

There is only one rule that applies here, which states that the name of the robot or suitable identity for the robot must be clearly visible so that spectators can identify the contestants. There are many options here. You could paint the body or glue on a print of your own design or some clip art, sponsor's decals, or simply have the robot's name emblazoned across the front. It is your choice. Have fun with this step but remember to keep the message appropriate, after all, your robot may be displayed in the news media.

Optimizing Performance

Your physics teacher will tell you that your robot is unlikely to go fast enough to consider the 'Coefficient of Drag' or a 'Reynolds number' but the 'Coefficient of Friction' is of utmost importance as this will determine how much of the developed power can be transmitted into motion. The constants are the Arborite playing field surface and the available power from the Tamiya Gearbox. The variables are the tire surface, the friction between wheel to axle and wheel to tire, and the downward force. To this end the maximum allowed weight of the robot excluding the controller is 500 grams.