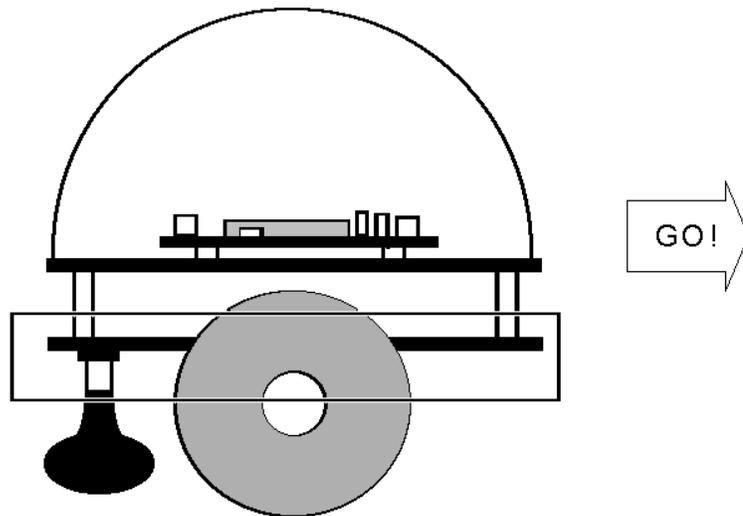


B-BOT Frame

BASIC - ROBOT - FRAME



by
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Version 1.2

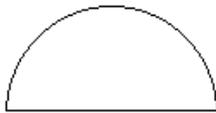
Introduction:

This kit is designed to spark your *intuitive engineering skills*. It comes with assembly instructions, diagrams, parts list, and all the custom parts needed to build the kit. This kit requires you to think, and be creative. You should have some basic construction skills. Please read the manual thoroughly before beginning. Take your time and have fun.

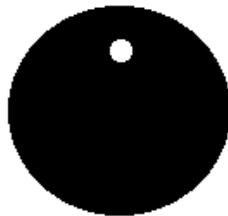
This kit includes four major components: The base lower platform, the base upper platform, the bumper guard, and the cover dome. The basic design of the B-BOT frame includes, the lower platform (with wheel slots) holding two drive servos, the drive skid, and the bumper skirt and bumper switches. The lower platform can also hold the battery pack and power switch. The upper platform holds the CPU and cover dome. This design is very flexible because you can add multiple platform levels.

Construction notes: First, acrylic can be brittle to drill, and can crack. I like to start a drill hole with a soldering iron, then drill with a small bit and work my way up to the right size. Second, assemble the B-BOT with good 3M double sided sticky foam tape (I love this stuff). This tape is very strong and allows assembly to go quickly and easily. For example, the bumper switches can be taped to the lower platform.

Supplied Parts List:

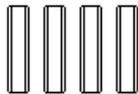


1 - Clear Head Dome



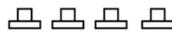
1 - Bottom Platform

1 - Top Platform



1 - Bumper Skirt

4 - Frame Posts



4 - Angle Brackets

4 - Shoulder Washers



1 - Skid with Washer and Spacer

2 - Rubber Bands

What You Need:

Shop around for the best price and location. Mail order is great, but you may also find what you need locally. Note that there are literally hundreds of microcontroller boards on the market in all sizes and price ranges. The microcontroller boards listed here are not the only ones that will work with the B-BOT frame, but they are inexpensive and easy to use.

Tools:

Double sided foam tape (3M brand is good), soldering iron, scissors, screw drivers. You may need a 4-40 tap if you need to make your own mounting holes. You may also need a ruler, pliers, wire cutters, and what ever else you think of.

Servos:

Futaba FP-S148 [\$20] - Tower Hobbies, Tammies Hobbies
Royal Titan Standards [\$13] - Tower Hobbies, Tammies Hobbies

Wheels:

Foam #WR25-5725 [\$5] - Dave Brown, Tammies Hobbies, Tower Hobbies
Steam Line Wheels [\$8] - NW Distributing, Tammies Hobbies

Controllers:

BOTBoard [\$6] - Marvin Green - Bare PC board you assemble.
BASIC STAMP [\$40] - Parallax - Small PIC board runs BASIC
Mini Board [\$100] - MIT - Runs programs in Assembly.
MaxFourth [\$80] - NMI - Powerful board that runs FORTH.

Miscellaneous:

Battery holder, power switch, bumper switches, wire, connectors, and an assortment of small nut, bolts and screws. Contact Digi-Key for an excellent catalog of electronic components.

Resources:

Dave Brown Products	1 513-738-1576	4560 Layhigh Rd., Hamilton Ohio 45013
Digi-Key	1 800-344-4539	701 Brooks Ave. S., Thief River Falls NM 56701
Marvin Green	1 503-666-5907	821 SW 14th, Troutdale OR 97060
New Micros Inc.	1 214-339-2204	1601 Chalk Hill Rd., Dallas Texas 75212
NW Distributing	1 206-687-9452	21527 NE 227th Ave. Battleground Wa 98604
Parallax Inc.	1 916-624-8333	3805 Atherton Road #102, Rocklin CA 95765
Tammies Hobbies	1 800-521-5614	12024 SW Canyon Rd. Beaverton OR 97005
Tower Hobbies	1 800-637-4989	PO Box 9078, Champaign, Illinois 61826-9078

Building the Frame:

These diagrams should give a fairly good idea of how the B-BOT frame goes together. The frame is very flexible, and can be easily changed and modified to meet your projects needs. These instructions cover the B-BOT, and not specifically B-BOT jr. The B-BOT jr. is a tougher kit to build because you only have one platform surface on which to build.

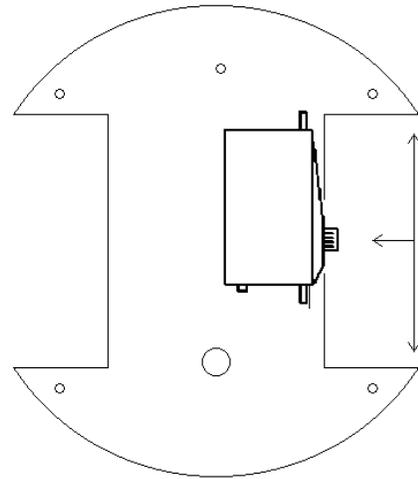
Visualize where you want to locate electronic components before you assemble the frame. For instance you may want to mount the battery pack onto the top of the lower platform before you mount the top platform. Think about where you want to put the power switch, bumper switches, and microcontroller. You may need to drill mounting holes, or do other types of modifications..

Step #1: Modifying the Servos.

The B-BOT frame uses two *modified* radio control servos to control steering. A standard or mini sized servo can be used. Most servos are basically the same internally and can be easily modified.

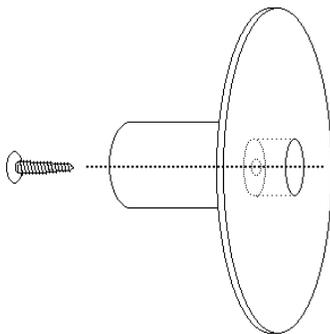
***Please refer to the page on servo modification.*

There are several different types of servo connector standards. The two most common are Futaba and Airtronics. Choose a microcontroller that can produce a pulse width modulation signal, and can be wired to connect to a servo. The BOTBoard is designed to control servos with Airtronic connectors.



Step #2: The Lower Base.

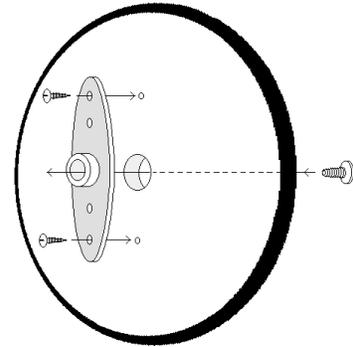
The lower base has cut-out notches for the wheels. You will need to find the center of the inside edge of the cut-out notch. Put a small mark in the center. This will help when mounting the servos. Next use foam tape to mount the servos into position. Keep the face of the servo flush with the edge of the wheel notch, and align the servo shaft with the mark at the center.



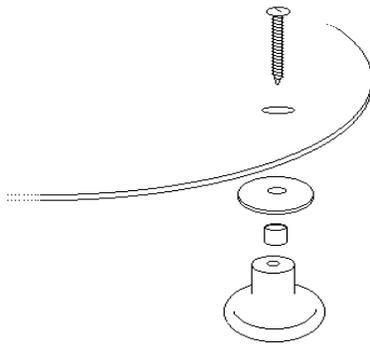
Step #3: The Wheels.

Almost any type of wheel will work with the B-BOT frame as long as you can attach it to the servo. The two types of wheels covered in the instructions are the Dave Brown thick foam wheels and the thin Stream Line wheels. The thick foam wheels work well on carpet, and the Stream Line wheels work well on hard surfaces. Each wheel has a different way of mounting to the servo shaft.

Adapting the foam wheels is easy. The wheel hub pulls apart to make three separate pieces, two hubs and one foam tire. Work with hub that has the outside sleeve. If you drill a 15/64" hole approximately 3/16" deep into the axial hole of the wheel, you can push the servo shaft into the new hole. Use the servo shaft screw to tighten the wheel and shaft together. Now you can reassemble the wheel.



If you use the Stream Line wheel, you can use one of the control horns that came with the servo. Mount the control horn as shown in the diagram. You may need to drill small holes into the wheel, then use mounting screws. The servo shaft screw can then mount the control horn to the servo shaft.



Step #4: The Skid.

The next step is to mount the skid. The skid acts as a third 'wheel' to balance the robot. The skid is a simple plastic knob with a spacer and washer to hold it to the correct height. You can mount the battery pack (flat, 4 AA) above the skid to help stabilize the robot. You may also want to experiment with a second skid at the other end of the robot. This will help make the robot more stable..

Step #5: Frame Posts.

The frame posts can now be mounted to the lower platform. They secure the top and bottom platforms as well as hold the shoulder washers for the bumper skirt and the angle brackets for the head dome. View the assembly diagram to help you to assemble the frame posts.

Step #6: The Upper Platform.

Mount the upper platform to the frame posts. All holes should align correctly. If you want to mount the head dome, the small angle brackets can be mounted on top of the upper platform. The dome will have screws that fit into the threads of the angle brackets..

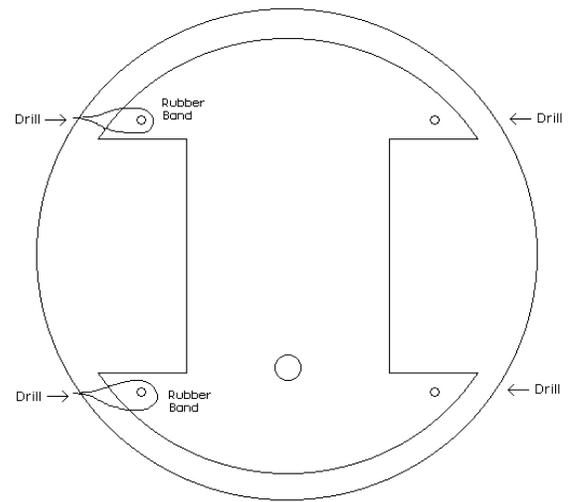
Step #7: The Head Dome.

The dome has a small tab that can be removed with an exacto knife. Simply score and break off the tab. Four holes need to be drilled into the dome for the mounting screws to attach to the angle brackets. Set the dome on the top platform outside of the angle brackets. Mark on the head dome where the drill holes should line up with the brackets. Now you can drill holes where the marks line up.

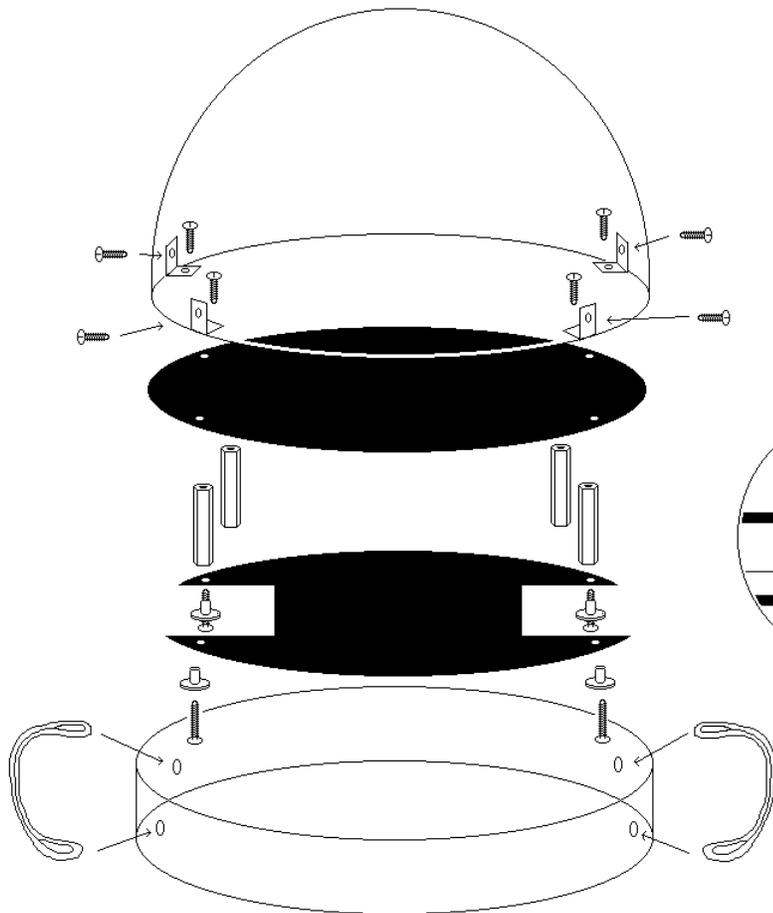
Step #8: Bumper Guards.

The bumper guard needs to have four holes drilled into it that line up with the shoulder washers. One rubber band is stretched through the two holes, and each end is wrapped around the shoulder washers. You can adjust the tension of the rubber bands to move the bumper skirt around a little.

This is the B-BOT basic frame. It is designed to be flexible and easy to build. It is now up to you to add the microcontroller, sensors, and bumper switches. Use your imagination, and have fun with it.



B-BOT Assembly Diagram:



* B-BOT jr. doesn't have the upper platform, or the frame posts. All components are mounted to the lower platform.

Modifying a Futaba FP-S148 Hobby Servo Motor for Use as a Robot Motor

In the following instructions, "front" means the part of the motor case that encloses the motor's output shaft (and has the Futaba label on it); "back" means the opposite side of the motor case.

You will need:

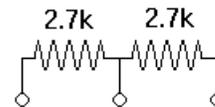
Jeweler's screwdrivers (Phillips), Small solder iron , Solder sucker, Needlenose pliers, Diagonal cutters, Exacto knife, Two 2.7K ohm, 1/4-watt resistors (you could probably use 2.2K ohm resistors Radio Shack 271-1325)

1. If your motor already has some form of mechanical coupler device screwed onto the end of the output shaft, remove it.
2. Remove the four screws from the back of the case.
3. Remove the front and back covers.
4. Remove nylon center (top) gear and nylon gears on output shaft and motor shaft.
5. Using an Exacto knife, carefully trim and remove the nylon spur on the surface of the large output gear. This spur normally limits the servo's movement to an arc of about 270 degrees. Make sure you remove the spur completely. You must not leave any chunks of nylon that might prevent the output gear from rotating freely.
6. Pry off the bronze sintered bushing from the plastic hub around the potentiometer (pot) shaft.
7. Remove the two small screws on either side of the motor shaft.
8. Firmly press on the pot's shaft to push it back through the servo's case. This should push the pot and the printed circuit board (PCB) out the back of the case.

WARNING: DO NOT pry on the PCB at all! DO NOT push on the motor's spindle!

9. Remove the pot from the PCB by carefully heating its connections, then removing the excess solder with a solder sucker. Work carefully and do not damage the PCB's traces.
10. Install two 2.7K resistors, wired in series, in place of the pot. The two resistors will appear to the servo's circuit as a 5K pot rotated to its center position. Refer to the following schematic:

The Os represent the solder pads that previously held the pot's leads. Make sure you install the junction of the two resistors in the center pad on the PCB. Trim the leads so the resistors will fit inside the case when you later reassemble the motor. Make sure you don't accidentally short any traces on the underside of the PCB when you solder the resistors in place.



11. Carefully reassemble the servo motor. Simply reverse the above steps for disassembling the motor.