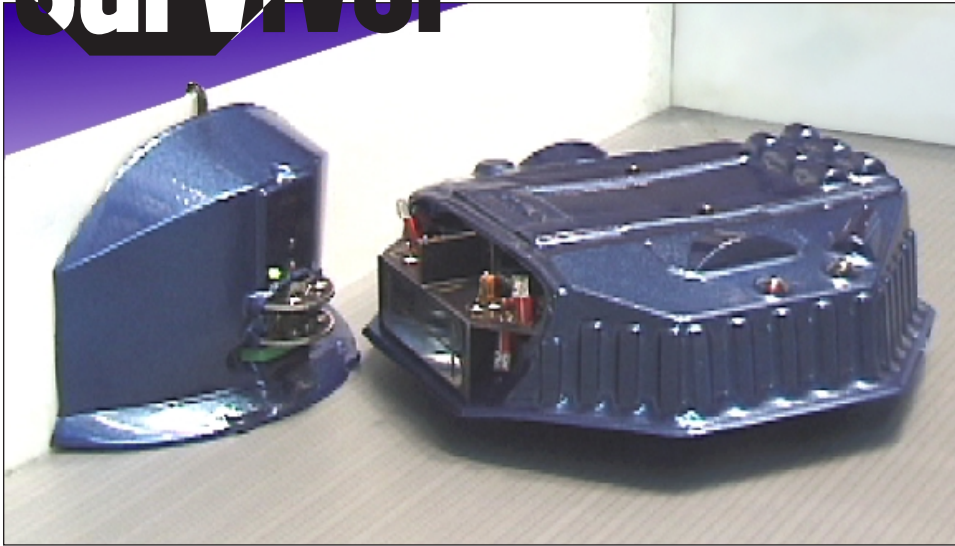


OctoBot Survivor™

Assembly & Operating Instructions V1.23 For kits produced after Feb 1, 2004



Section 1 - Introduction

It seems so simple. All living creatures share a basic fact of life known as the need to feed. If you don't eat, you don't live. But with most robots, when the batteries go dead, so do they.

Enter the OctoBot Survivor robot. When its on-board NiMH batteries get low, it doesn't just sit there - it gets active and looks for electric food! Dual IR detector "eyes" search for and track the bright infrared beacon on the OctoBot's charging station. It tracks in on it until it makes contact, then it "feeds" until fully recharged.

But that's not all! Between charges, the Survivor exhibits a range of active and interesting behaviors; wall following using dual IR proximity circuits, light seeking and light avoidance via dual photo sensors, and watching its surroundings and responding to sudden changes. Then, when the feeling strikes, its off to the charging station.

The OctoBot Survivor comes complete with octagonal main circuit board, all parts, dual drive motor and gear box, rear ball caster, high traction rubber tires, vacuum

formed body shell, charging station with IR beacon, AC adapter, NiMH batteries and complete instructions. Nearly 18 cm (7 in) in diameter and 6 cm (2.25 in) high.

Designed for the intermediate and advanced robot builder, assembly requires soldering and simple hand tools. The preprogrammed PIC brain performs all operations, and there's a socket for the Stamp 2 of your choice (sold separately) so you can expand its brain power and write your own programs. There's even a centrally mounted Parallax AppMod port and a lower sensor port so you can add your own circuitry, sensors and more.

Bring your own robot creation to life and explore the challenges of "Always On" robotics with the new OctoBot Survivor.

Section 2 - Circuit Board Assembly

a) You should prior experience soldering electronics. If you do not, please enlist the help of an experienced builder before beginning.

b) Do it step by step. Double check each of the parts and double check the positions before soldering. This will save you a lot of time and trouble later.

c) Note special instructions through out that identify the many parts that must be installed with a specific orientation on the board.

d) Pay special attention to the color codes on resistors as many are very similar. Severe damage to the circuitry can occur if wrong resistor values are used.

e) Take breaks to breathe and stretch. Have fun!

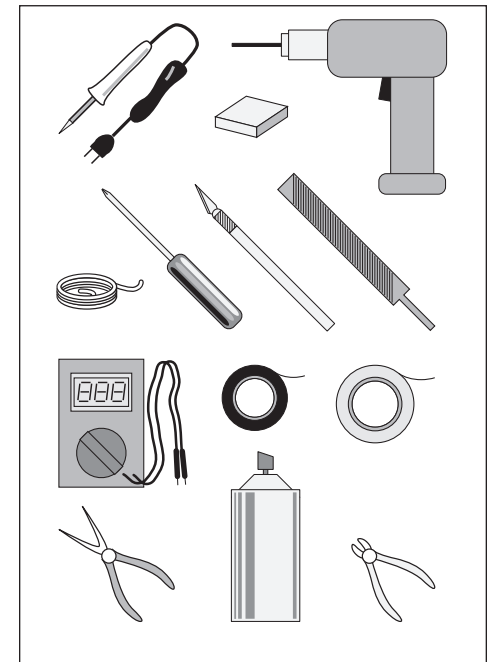
□ 2.01 - Tools for Assembly

In addition to the parts included with this kit, you will need the following:

- 1) Soldering iron for electronics, fine tip
- 2) Moist sponge to keep the soldering iron tip clean
- 3) Drill and bits
- 4) Solder for electronics
- 5) Phillips or "+" screwdriver
- 6) Hobby knife
- 7) Metal file or sanding block
- 8) Volt meter
- 9) Electrical tape
- 10) Masking tape
- 11) Needle nose pliers
- 12) Epoxy spray paint in your choice of color(s)
- 13) Side cutters

Also, the OctoBot will need a safe enclosure to live in, which can be built from corrugated cardboard, foam core or other available materials. See details in Section 3.

Later, if you choose to add a Stamp 2 processor and perform your own programming you will also require a Stamp 2, PC with Stamp software, and serial cable for the OctoBot. See details in Section 4.



OctoBot Survivor designed by Roger G. Gilbertson, Zach Radding and Ed Severinghaus.

BASIC Stamp is a trademark of Parallax Inc., OctoBot, OctoBot Survivor and OctoPad are trademarks of Mondo-tronics, Inc.

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Comments? Errors? Improvements? Compliments?
Help us make this product better with your feedback. We want to hear from you!

Email us at: support@RobotStore.com

Thanks!

Go outside and play. ©MMIII/MMIV Mondo-tronics Inc. V1.23 0212.01 / 0402.05 #1-348

2.02 - Check it All Out

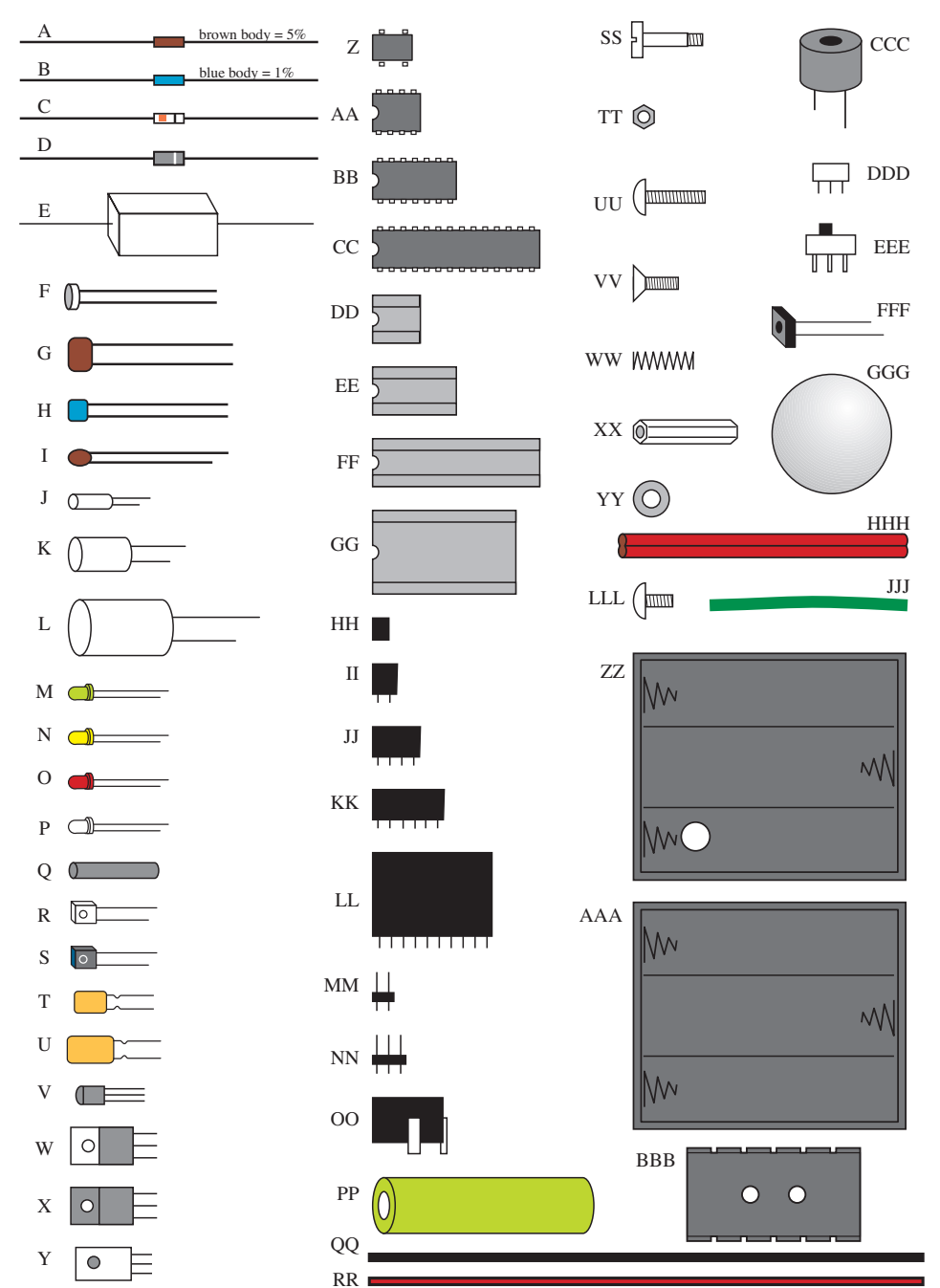
Before starting assembly, check over all the parts to identify and become familiar with them and verify that you

have them all. If something is missing, please double check through the parts, then send us an email and we'll get it to

you. Next, thoroughly review these instructions to become familiar with all the steps ahead.

Quan	Bag 1 - Chunky Parts	Figure
1	Ball, 1" diameter	GGG
1	Battery Holder, AA x 3, DRILLED	ZZ
1	Battery Holder, AA x 3	AAA
1	Capacitor 2200 μ F, 16V electrolytic	L
1	Heat sink, dual TO-220	BBB
1	Resistor 51 Ω 5W 5%	E
1	Socket 24-pin wide DIP	GG
2	Switch, pushbutton, momentary, N.O.	FFF
2	Wire, Hook Up, Black, 8"	QQ
1	Wire, Hook Up, Red, 8"	RR
1	Coffee Stirrer, for stand-offs	HHH
1	Twist-tie	JJJ
1	Shrink tubing, 1/8", 0.75" long	Q
Quan	Bag 2 - Antistatic Parts	Figure
1	Buzzer	CCC
1	IC DS2436 Battery Monitor	V
2	IC IR Receiver 56.8 KHz	Y
1	IC MN1381 Low Voltage Detect & Reset	V
1	Regulator 78L05 5V 100mA	V
1	Regulator LM2940 5V 1A	W
1	Resonator 4MHz with caps	DDD
1	Switch, SPDT, miniature slide	EEE
1	Transistor 2SA2057 PNP power	X
Quan	Bag 3 - Headers	Figure
2	Header, Female, 1 x 2, 0.100"	II
1	Header, Female, 1 x 4, 0.100"	JJ
1	Header, Female, 1 x 6, 0.100"	KK
1	Header, Female, 2 x 10, 0.100" 0.74" high	LL
1	Shorting Block (Jumper) 0.1"	HH
2	Header, Male 0.100" 1 x 2	MM
1	Header, Male 0.100" 1 x 3	NN
1	Jack 2.5mm Power, PCB mount	OO
Quan	Bag 4 - Hardware	Figure
2	Bolt, shoulder, 4-40	SS
6	Nut, Hex 4-40	TT
4	Screw 4-40 1/2" pan head phillips	UU
2	Screw 4-40 3/8" flat head phillips	VV
2	Screw 4-40 1/4" pan head phillips	LLL
2	Spacer, hex 0.75", F/F, 4-40 threaded	XX
2	Spring, #4 x 1/2" compression	WW
4	Washer #4, flat	YY
Quan	Bag 5 - Other Discrete Parts	Figure
2	Photocell, 4.2mm	F
2	LED IR Emitter, rectangular (clear body)	R
2	IR Detector, rectangular (dark body)	S
2	LED T-1 green	M
2	LED T-1 infrared (clear)	P
1	LED T-1 red	O
1	LED T-1 yellow	N
1	Polyswitch RUE090 (marked "U090")	T
1	Polyswitch RUE185 (marked "U185")	U

(Bag 5 continued)		Figure
8	Transistor PN2222A NPN	V
4	Transistor PN2907A PNP	V
Quan	Bag 6 - Batteries	Figure
6	Battery, NiMH, AA Bulk	PP
Quan	Bag 7 - Resistors & Diodes	Figure
3	Signal Diode, 1N4148	C
1	Diode Schottky 20V 1A	D
1	Resistor 27 Ω 1/4w 5% (red vio blk gld)	A
2	Resistor 47 Ω 1/4w 5% (yel vio blk gld)	A
1	Resistor 68 Ω 1/4w 5% (blu gry blk gld)	A
2	Resistor 100 Ω 1/4w 5% (brn blk brn gld)	A
5	Resistor 220 Ω 1/4w 5% (red red brn gld)	A
4	Resistor 360 Ω 1/4w 5% (org blu brn gld)	A
2	Resistor 1.8K Ω 1/4w 5% (brn gry red gld)	A
2	Resistor 5.1K Ω 1/4w 5% (grn brn red gld)	A
1	Resistor 6.8K Ω 1/4w 5% (blu gry red gld)	A
5	Resistor 10K Ω 1/4w 5% (brn blk org gld)	A
1	Res 11.8K Ω 1/4w 1% (brn brn gry org brn)	B
2	Resistor 22K Ω 1/4w 5% (red red org gld)	A
2	Resistor 47K Ω 1/4w 5% (yel vio org gld)	A
3	Resistor 100K Ω 1/4w 5% (brn blk yel gld)	A
1	Resistor 1.2 Ω 1/2W 5% (brn red gld gld)	big A
Quan	Bag 8 - Capacitors	Figure
1	Capacitor 0.001 μ F (marked "102")	G
3	Capacitor 0.01 μ F (marked "103")	G
10	Capacitor 0.1 μ F (marked "104")	H
2	Capacitor 0.47 μ F tantalum (marked "V47")	I
2	Capacitor 1.0 μ F tantalum (marked "1C")	I
2	Capacitor 3.3 μ F electrolytic	J
1	Capacitor 10 μ F electrolytic	J
2	Capacitor 330 μ F electrolytic	K
Quan	Tube 1 - ICs with Legs	Figure
1	IC 556 Dual Timer, 14-pin DIP	BB
2	IC LM567 Tone Decoder 8-pin DIP	AA
1	IC PIC16F876, "OctoBot", 28-pin narrow	CC
2	Bridge Rectifier, 1A	Z
Quan	Tube 2 - Sockets	Figure
2	Socket 8-pin DIP	DD
1	Socket 14-pin DIP	EE
1	Socket 28-pin narrow DIP	FF
Quan	Other Items	Figure
1	Adapter, 110V AC to 9V AC, 1 Amp	-
1	Twin Motor Gearbox Kit	-
1	Sport Tire Set (pair)	-
1	PCB Set, OctoBot Survivor (see next page)	-
1	Vacuum formed Body Shell Set	-
1	Registration Card (send it in!)	-
1	Instructions, OctoBot Survivor (these!)	-



2.03 - Separate the Circuit Boards

Using a side cutter, carefully clip apart the printed circuit board panel into the eleven separate boards.

NOTE: File or sand off all extending tabs to give each board smooth, continuous edges. Neatness counts!

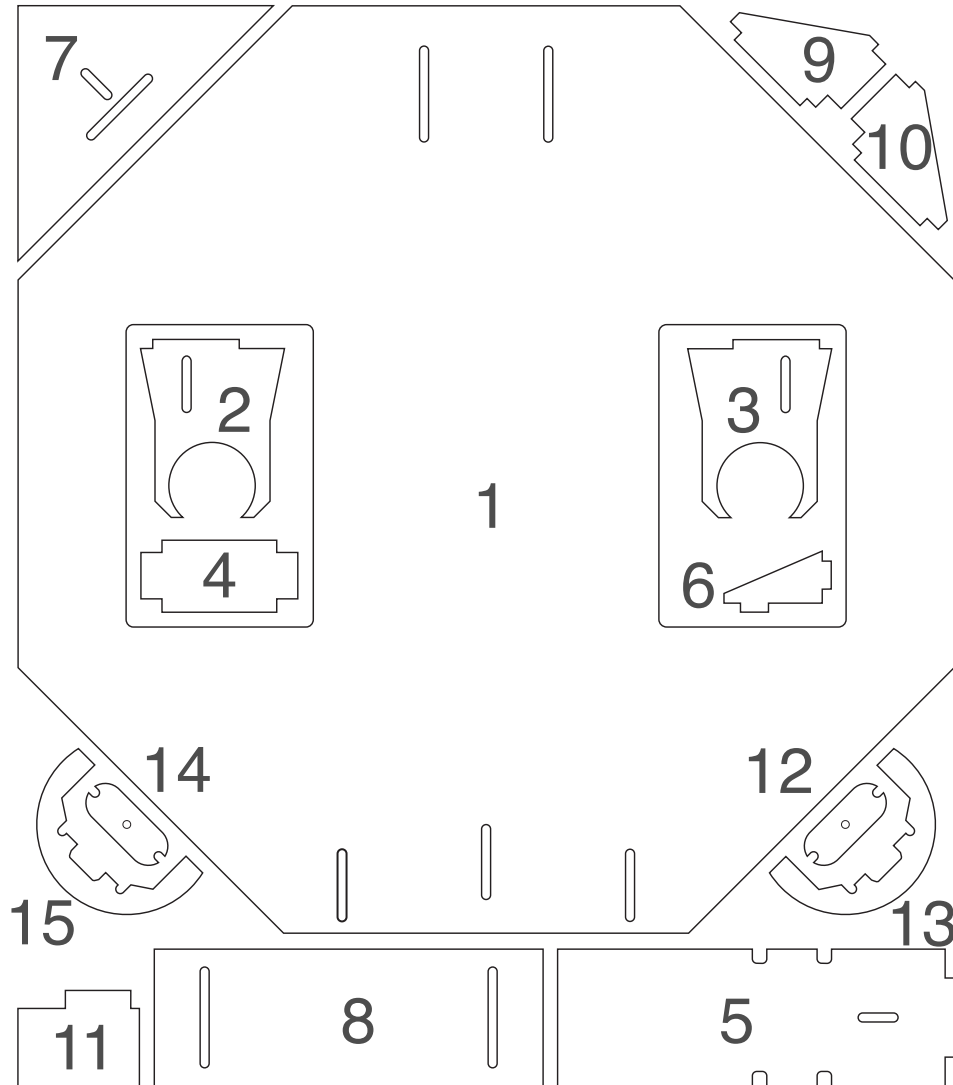
Set the boards aside for use as needed.

FIFTEEN SUB PRINTED CIRCUIT BOARDS

Board # Description

- 1 PCB, Main OctoBot Board
- 2 PCB, Right Ball Support "AC"

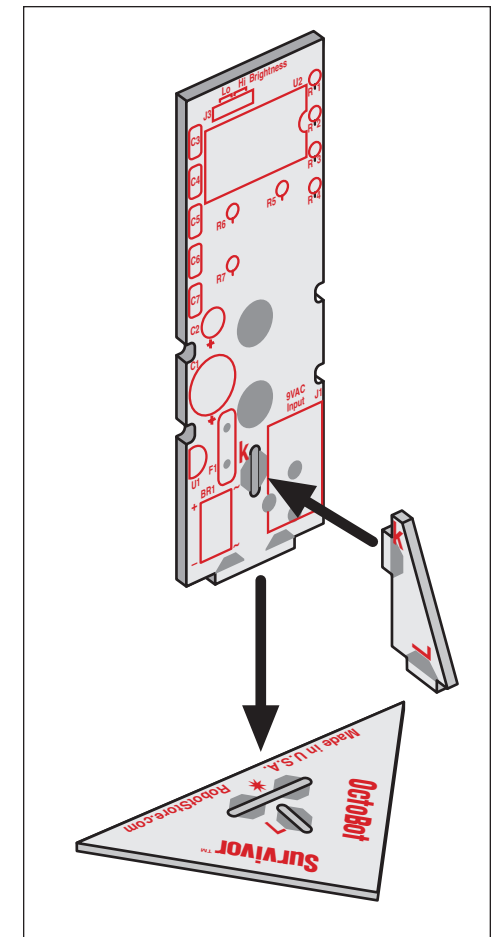
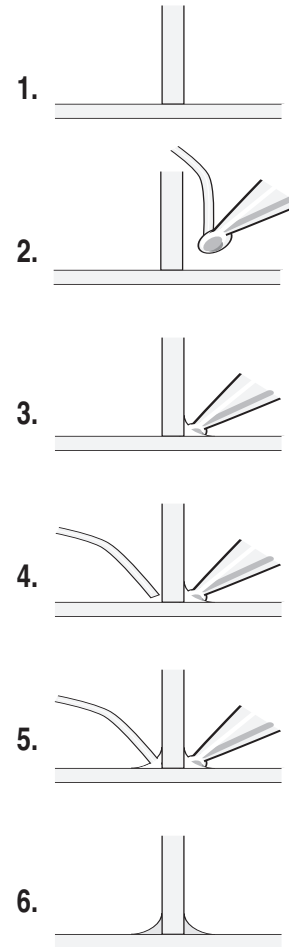
- 3 PCB, Left Ball Support "BD"
- 4 PCB, Ball Stabilizer, "AB"
- 5 PCB, Charger Beacon Board "k*"
- 6 PCB, Charger Support "kL"
- 7 PCB, Charger Bottom Plate "L*"
- 8 PCB, Contact Plate "GH"
- 9 PCB, Left Contact Plate Support "EG"
- 10 PCB, Right Contact Plate Support "FH"
- 11 PCB, IR Detector Divider
- 12 PCB, Support for Contact Arc
- 13 PCB, Contact Arc
- 14 PCB, Support for Contact Arc
- 15 PCB, Contact Arc



2.04 - OctoPad™ Soldering

Soldering OctoPads™

- 1) Position the parts and hold them securely, either with clamps, a "third hand" tool, or masking tape.
- 2) Pre-tin the tip of the soldering iron with a large amount of solder.
- 3) Press the soldering iron tip against the junction of the joint, making solid contact with the OctoPad portion of both boards.
- 4) Feed additional solder into the joint from the other side of the joint from the soldering iron, until it fills in and forms a smooth joint.
- 5) Remove soldering iron and let cool.
- 6) Inspect the joint. If not clean & smooth, redo it.



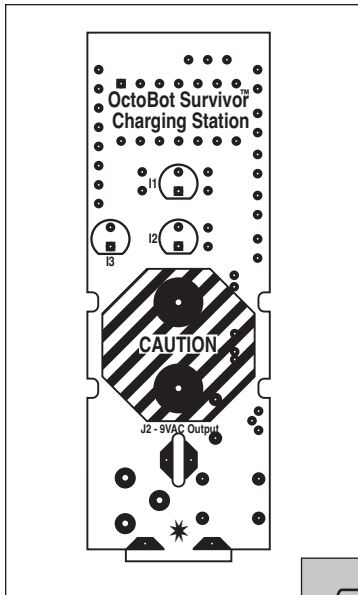
2.05 - Base and Support

Identify and position the three beacon sub boards (numbers 5, 6 and 7 on page 3) as shown above.

Carefully orient them as shown, and use small pieces of masking tape to help hold them together in position.

Solder the OctoPads together following the steps in section 2.04 below.

BASE AND SUPPORT	
Location	Description
<input type="checkbox"/> -	PCB, Charger Beacon Board "k*"
<input type="checkbox"/> -	PCB, Charger Support "kL"
<input type="checkbox"/> -	PCB, Charger Bottom Plate "L*"



2.06 - Charger Beacon Front Side

Use the Charger Beacon board. Note orientations of all the LEDs. Trim off excess leads.

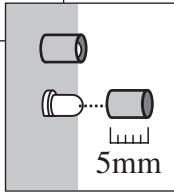
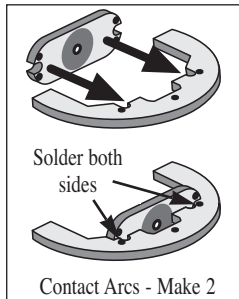
Cut two 5 mm long pieces of 1/8" diameter shrink tube and slip it over the IR emitters, I1 and I2. Heat them to shrink in place. These regulate the direction of the IR and reduces their spread.

FRONT OF BOARD

Location	Description
□ I1	LED, IR , OED-EL-8L, T-1
□ I2	LED, IR , OED-EL-8L, T-1
□ I3	LED, Green, T-1
□ -	Shrink tubing, 1/8", 0.75" long

2.061 - Charger Contact Arcs

Assemble two Charger Contact Arcs, subboards 12 & 13 and 14 & 15, soldering the OctoPads as described on page 3, making sure they fit tight and square to each other.



2.07 - Charger Beacon Back Side

Install parts in order listed. Note orientations of capacitors C1 and C2, Regulator U1, Socket U2, Bridge Rectifier BR1, and IC U2. After soldering, trim away excess leads.

Insert shoulder bolts from back of board charger board through holes at J2, add #4 washer and spring from front side. Insert a 4-40 nut into the space on each Contact Arc and mount to the shoulder bolt. Each contact should move freely, but not touch the other board.

Cut the black hook up wire in half, and strip the insulation about 3 mm (1/8") from all ends and pre-tin with solder. Solder the 1st wire to the very back top corner of the TOP contact arc. Solder the other end to the Front of the beacon board, at the TOP “~” contact on Rectifier BR1.

Solder the 2nd half wire to the bottom back corner of the BOTTOM contact arc, and the other end to the Front of the beacon board, at the BOTTOM “~” contact on BR1.

BACK OF BOARD

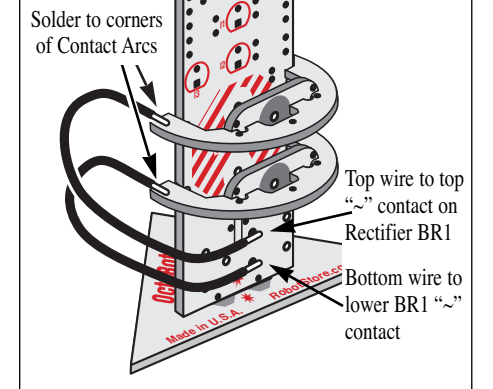
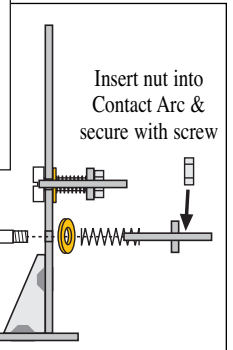
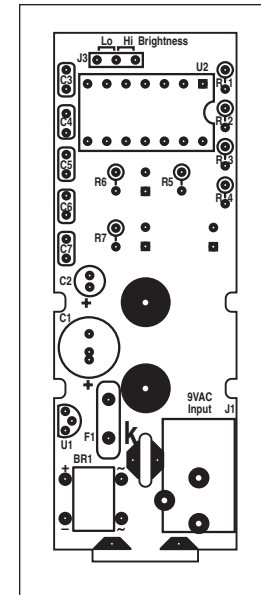
Location	Description
□ -	PCB, Charger Beacon Board “k*”
□ R1	Resistor, 5.1K Ω 1/4W 5% (grn, brn, red, gld)
□ R2	Resistor, 47K Ω 1/4W 5% (yel, vio, org, gld)
□ R3	Resistor, 1.8K Ω 1/4W 5% (brn, gry, red, gld)
□ R4	Resistor, 11.8K 1/4W 1% (brn, brn, gry, org, brn)
□ R5	Resistor, 360 Ω 1/4W 5% (org, blu, brn, gld)
□ R6	Resistor, 27 Ω 1/4W 5% (red, vio, blk, gld)
□ R7	Resistor, 68 Ω 1/4W 5% (blu, gry, blk, gld)
□ C1	Capacitor, 330 μ F, 16V
□ C2	Capacitor, 10 μ F, 6V
□ C3	Capacitor, 0.01 μ F “103”
□ C4	Capacitor, 0.1 μ F “104”
□ C5	Capacitor, 0.01 μ F “103”
□ C6	Capacitor, 0.001 μ F “102”
□ C7	Capacitor, 0.01 μ F “103”
□ BR1	Bridge rectifier, 1 A
□ U2	Socket, 14 pin DIP
□ U1	Regulator, 78L05, 5V, 100 mA
□ J1	Adapter input jack
□ J3	Header, male, 1 x 3
□ F1	Polyswitch, RUE090, 0.9 Amp “U090”

Plug in (do not solder):

- U2 IC, 556 dual timer, 14 pin dip
- J3 Shorting Block, 2 pin, 0.100

CHARGER CONTACT ARCS

Quantity	Description
□ 2	PCB, Support for Contact Arc “12” & “14”
□ 2	PCB, Contact Arc “13” & “15”
□ 2	Bolt, shoulder, 4-40 (two places)
□ 2	Washer #4, flat (two places)
□ 2	Spring, #4, 1/2" long (two places)
□ 2	Nut, Hex 4-40 (two places)
□ 1	Hook up wire, black (cut it in half)



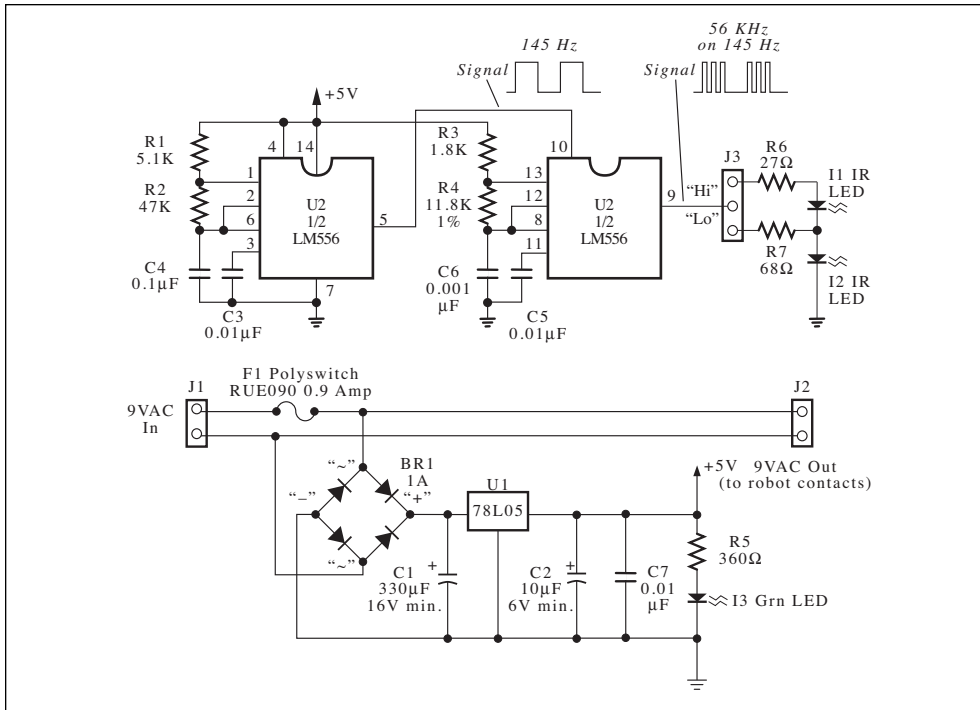
2.08 - Test It Out

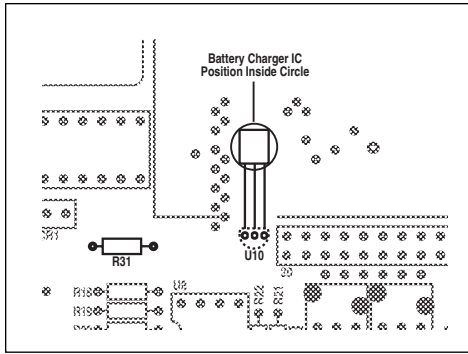
Plug in AC adapter into J1 and 110 VAC wall outlet. and observe the green LED light up.

Measure voltage at contacts J2 of 9 to 12 VAC.

Test Lo and Hi brightness settings and use a video camera to watch the flickering IR LEDs, I1 and I2.

Holes on base can be used for mounting to bottom of robot enclosure.





LOWER CENTER OF BOARD

Location	Description
□ -	PCB, Main OctoBot Board
□ U10	IC, DS2436 Battery Monitor, TO-92
□ R31	Resistor, 5.1K Ω 1/4W 5% (grn, brn, red, gld)

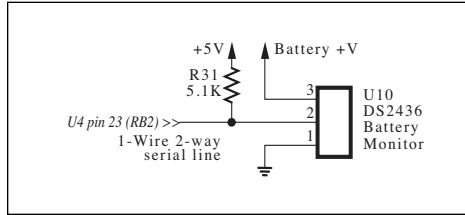
2.09 - Battery Monitor IC

Start with sub PCB 1, the Main OctoBot board.

Install the U10 Battery Monitor IC paying special attention that its flat side lays against the board, and to bend its leads so that it rests inside the circle on the board.

When installed, the hole in the battery holder BP1 will fit over U10, and permit the battery to make physical contact with U10, so that it can monitor the battery's temperature during the charging cycle.

After soldering, trim off and excess leads.



2.11 - Battery Holders & Batteries

Note that BP1 has a hold drilled through it, which fits over Battery Monitor IC (U10) and permits the battery to make physical contact with the plastic body of U10.

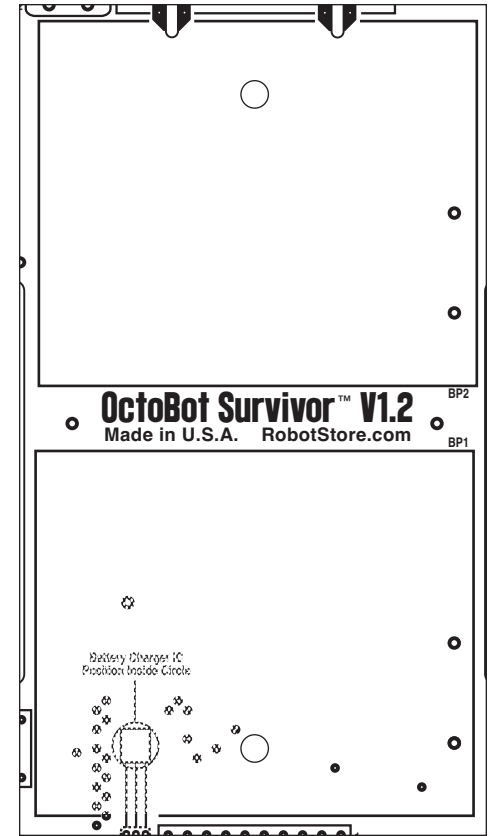
Insert a flat head screw through battery holder BP1, and the circuit board, then secure with a nut.

Repeat for BP2 (each battery holder is held by only one screw.)

Solder the electrical leads from the back of the board.

Trim off excess leads.

Install the six AA NiMH batteries, carefully noting the directions of cells. Use the continuity checker on a volt meter to make sure each cell contacts the next.



OctoBot Survivor™ V1.2
Made in U.S.A. RobotStore.com

CENTER OF BOARD

Location	Description
□ BP1	Battery holder, 3 x AA, drilled
□ BP2	Battery holder, 3 x AA
□ BP1	Screw, #4, 3/8", flat head, phillips
□ BP2	Screw, #4, 3/8", flat head, phillips
□ BP1	Nut, #4, hex
□ BP2	Nut, #4, hex
□ BP1, 2	Batteries, NiMH AA (6 places)

2.10 - Mount the Rear Ball

Insert the tabs on the Ball Stabilizer board into the slot marked "A" on Right Ball Support board, and into slot "B" on Left Ball Support board. Hold them in place and insert tabs on Left and Right Ball Support Boards through slots on bottom side of Main OctoBot board.

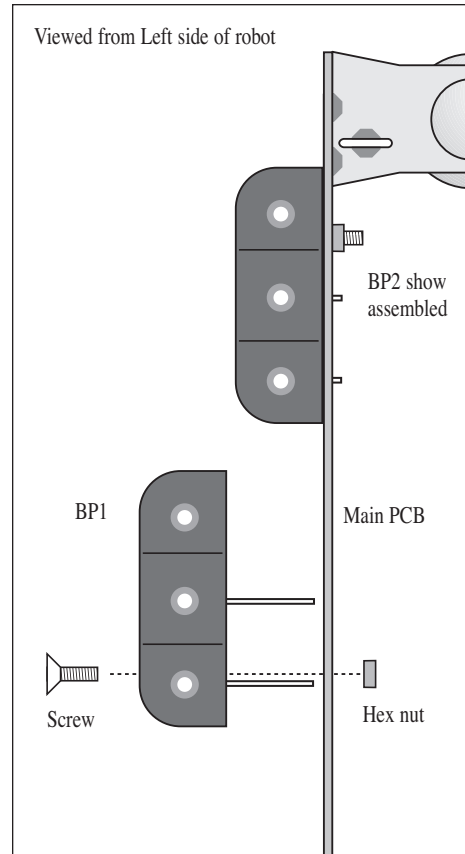
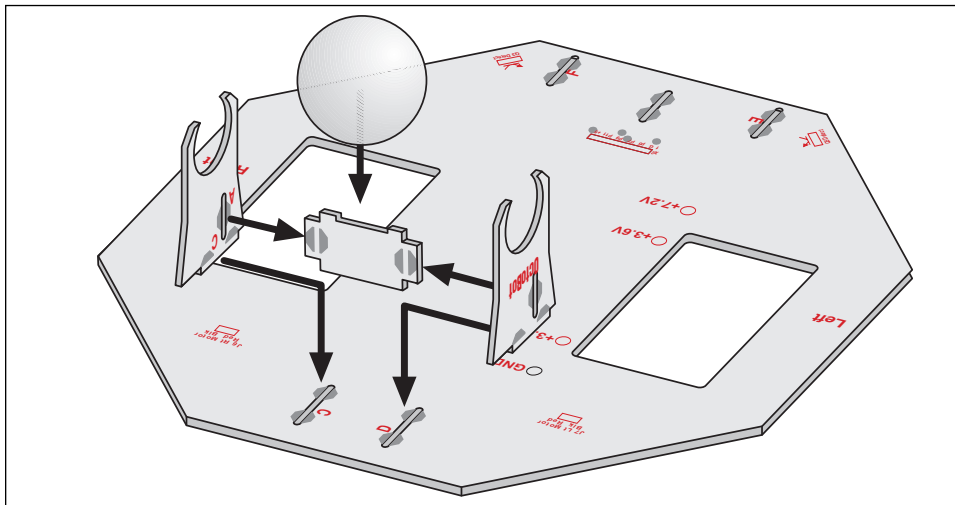
Hold together with small pieces of masking tape, and solder the OctoPads (as described on page 3), making sure that all boards are tight and perpendicular to each other.

Snap fit the 1" plastic ball between the Supports.

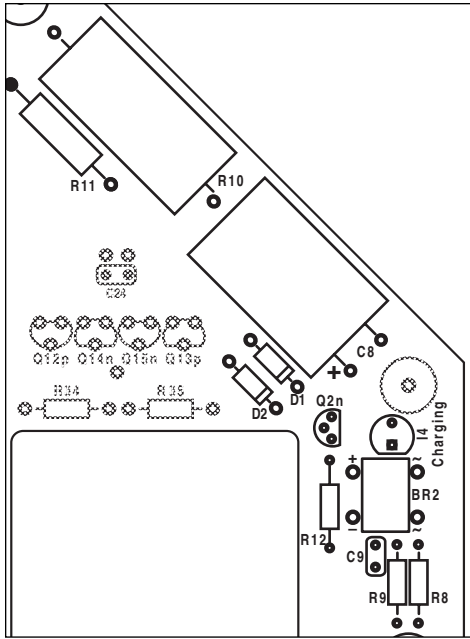
NOTE: Be sure the ball spins easily but does not fall out. If needed, heat the solder on the Stabilizer's OctoPads and reposition as needed.

BOTTOM REAR OF BOARD

Location	Description
□ AC	PCB, Right Ball Support "AC"
□ BD	PCB, Left Ball Support "BD"
□ AB	PCB, Ball Stabilizer, "AB"
□ -	Ball, 1" plastic



DANGER: Use only Nickel Metal Hydride batteries in this device. Use of other batteries may cause risk of damage.



2.13 - Battery Charger Circuit

On the main octagonal OctoBot PCB, install in order listed. With a hobby knife, carefully cut off an 8 mm long segment from the “coffee stirrer”, and use it as a standoff to support the yellow LED, I4, above the circuit board.

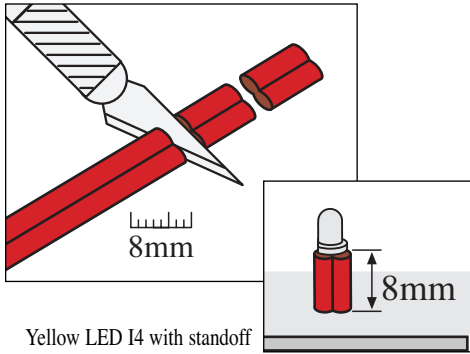
Note orientations of diodes D1 and D2, yellow LED I4, transistor Q2, capacitor C8 and bridge rectifier BR2.

NOTE: If the large electrolytic capacitor C8 is longer than the rectangle on the silk screen, carefully bend the leads back and under so that it fits in the given space and lays flat against the PCB. Note the polarity as indicated by the “+” on the PCB, and the “-” on the capacitor.

Trim off excess leads.

UPPER RIGHT OF MAIN BOARD

- | Location | Description |
|----------|-----------------------------------------------------------------------------------|
| □ R8 | Resistor, 47K Ω 1/4W 5% (yel, vio, org, gld) |
| □ R9 | Resistor, 100K Ω 1/4W 5% (brn, blk, yel, gld) |
| □ R11 | Resistor, 1.2 Ω 1/2W 5% (brn red gld gld, with larger diameter and length) |
| □ R12 | Resistor, 360 Ω 1/4W 5% (org, blu, brn, gld) |
| □ C9 | Capacitor, 0.1 μ F “104” |
| □ D1 | Diode, 1N4148 |
| □ D2 | Diode, 1N4148 |
| □ Q2 | Transistor PN2222A NPN |
| □ BR2 | Bridge rectifier, 1 A |
| □ R10 | Resistor, 51 Ω 5W 5% |
| □ C8 | Capacitor, 2200 μ F, 16V |
| □ I4 | Standoff, 8 mm (cut from coffee stirrer) |
| □ I4 | LED, Yellow, T-1 |



2.14 - Charger Circuit Part 2

Continue with main octagonal OctoBot PCB.

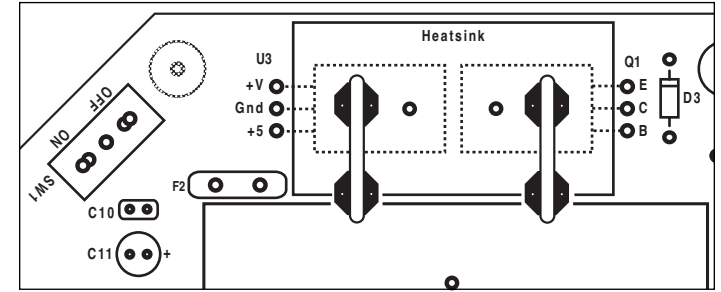
Install parts in the order listed.

Note orientations of electrolytic capacitor C11, and diode D3.

Trim off excess leads.

UPPER LEFT AND CENTER MAIN BOARD

- | Location | Description |
|----------|------------------------------------|
| □ C10 | Capacitor, 0.1 μ F “104” |
| □ C11 | Capacitor, 330 μ F, 6V |
| □ D3 | Diode, 1N5817, Schottky |
| □ F2 | Polyswitch, RUE185, 1.8 Amp “U185” |
| □ SW1 | Switch, SPDT |



2.15 - Heat Sink

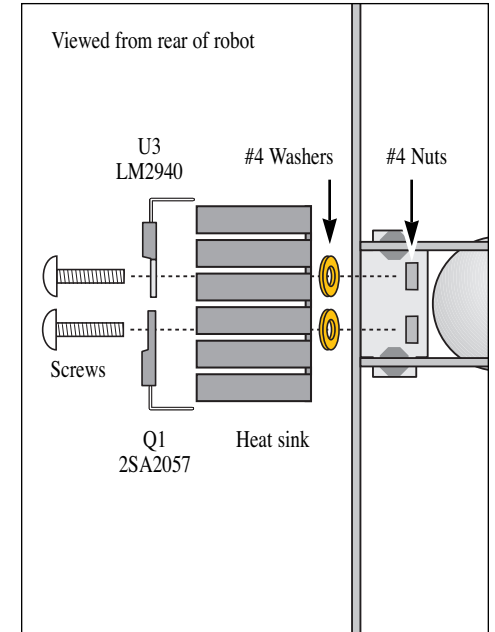
Carefully bend leads of Power Transistor Q1 and Power Regulator U3 so that the large hole on the heat sink tab lines up with the corresponding hole on the PC board.

Install screws from above, passing through component tab, heat sink and PCB, then secure from bottom side with nut. See drawing.

Be sure to put each part in their correct location.

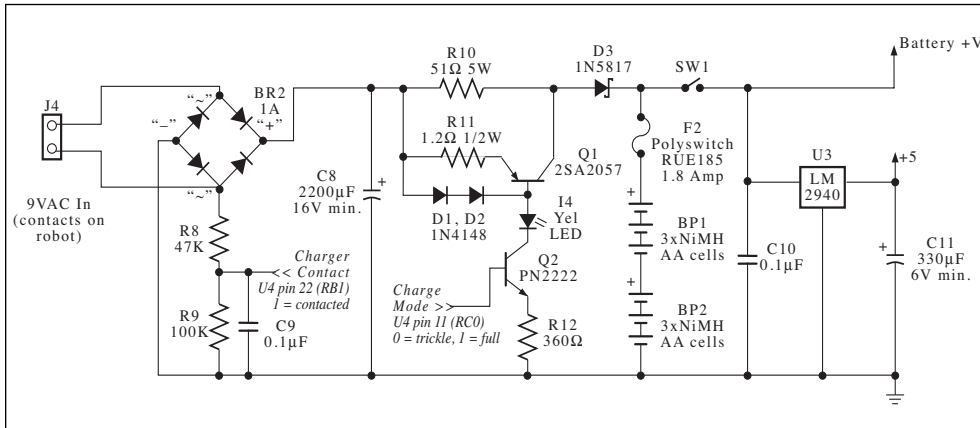
Solder in place.

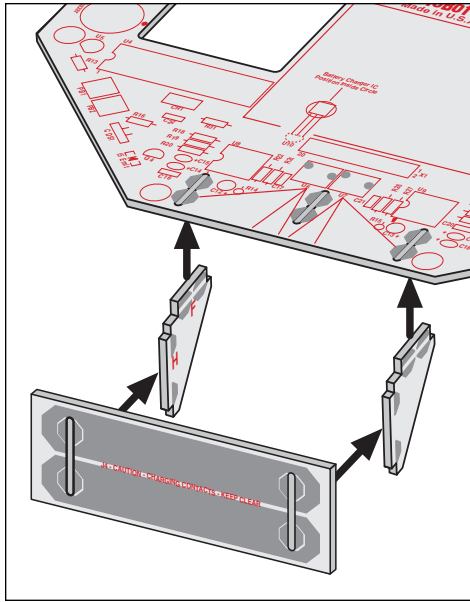
Trim off excess leads.



REAR CENTER MAIN BOARD

- | Location | Description |
|----------|------------------------------------------------|
| □ Q1/U3 | Heat sink, dual |
| □ Q1 | Power Transistor, 2SA2057, PNP, TO-220 |
| □ U3 | Power Regulator, LM2940, 5V, 1A, TO-220 |
| □ Q1/U3 | Screw, #4, 1/2", pan head, phillips (2 places) |
| □ Q1/U3 | Washer #4, brass (2 places) |
| □ Q1/U3 | Nut, #4, hex (2 places) |





FRONT EDGE OF BOARD

Location	Description
□ -	PCB, Contact Plate
□ -	PCB, Left Contact Plate Support "EG"
□ -	PCB, Right Contact Plate Support "FH"
□ BP1,2	Battery, AA, NiMH (6 places)

2.16 - Charger Contact Plate

Insert the tabs on the Left Contact Plate Support board into slot marked "G" on the Contact Plate, and the Right Contact Plate Support into slot "H" on the Contact Plate.

Insert the tabs on the Contact Plates into slots marked "E" and "F" on the Main board. Hold in place with short pieces of masking tape.

Solder all OctoPads (as described on page 3) to secure boards in position.

NOTE: Be sure all boards sit tight and square to each other. If not, reheal solder and reposition.

2.17 - Test It Out

Plug the AC adapter into wall outlet and into Charger Board at J1.

Press Contact Plate (J4) to both of the curved Contact Arcs on the Charger (J2). Hold it in place with masking tape or a large rubber band.

Turn switch SW1 to "On" and with a volt meter, measure the AC voltage across the bridge rectifier BR2 at the input pins labeled "~". It should read about 9 to 12 VAC.

Measure the DC voltage at the battery pack connection points on the bottom side labeled "GND" and "+7.2". It should measure about 7 to 10 volts DC.

Measure the output of U3, the LM2904 regulator at "Gnd" and "+5". It should read from 4.9 to 5.1 volts DC.

NOTE: Part 14, the yellow LED, does not yet light. That happens only after the installation of U4 later on.

2.18 - First Charge

Set up the Charger and Main board up so they remain in contact with batteries charging. If needed, use screws or tape to hold the Charger board to a table, and raise the Main board up on blocks so it makes contact at the right height.

Start a timer, and let the robot sit and charge for at least 4 hours, and no more than 8 hours.

NOTE: Be sure to disconnect after time has elapsed so as to not overcharge batteries.

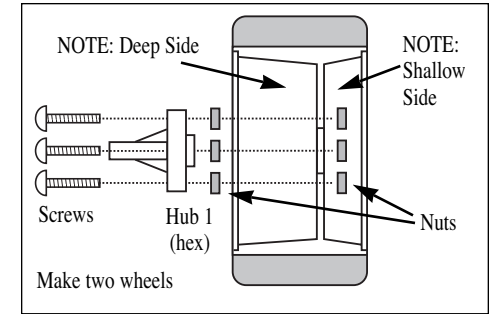
Once the robot is operational, it will be able to monitor its battery power, and perform its own recharging cycle.

2.19 - Wheel Assembly

Assemble the two Sport Tires according to the kit's directions. NOTE in step 1 use "Wheel Hub 1" for hexagonal shafts, and in step 2 use "narrow tread" configuration.

When completed, set them aside for later, keep the remaining spare parts elsewhere and do not mix them with other parts in this kit as they are metric.

Location	Description
□ 1	Sport Tire set



2.20 - Gear Box Assembly

Assembly the Twin Motor Gear box according to its directions, using the lower, stronger 203:1 gear ratio (noted as "Low speed Type C" in the instructions).

Set aside the remaining spare parts and do not mix them with other parts in this kit as they are metric.

Location	Description
□ 1	Twin Motor Gear box

2.21 - Motor Wiring

To the two motors on the Twin Motor Gear Box, attach wires and two pin male connectors, as follows:

Cut the red and the black wire in half, then strip and tin the ends with solder.

On the plastic end of the motor, locate the two electrical connection tabs, and identify the tab labeled with the small "Y" mark molded in the plastic.

Solder one end of the red wire to the "Y" motor tab as shown below.

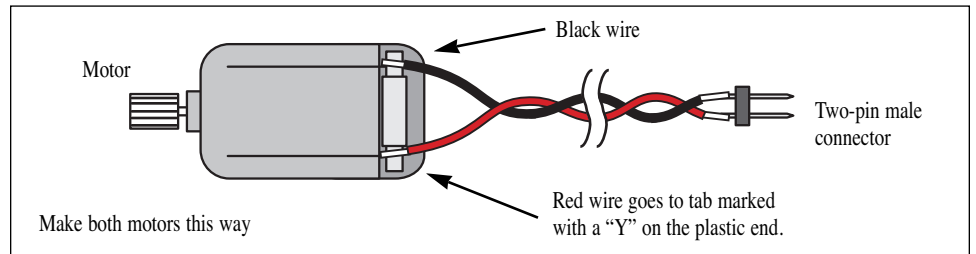
Solder one end of the black wire to the other tab.

Twist the wires together neatly.

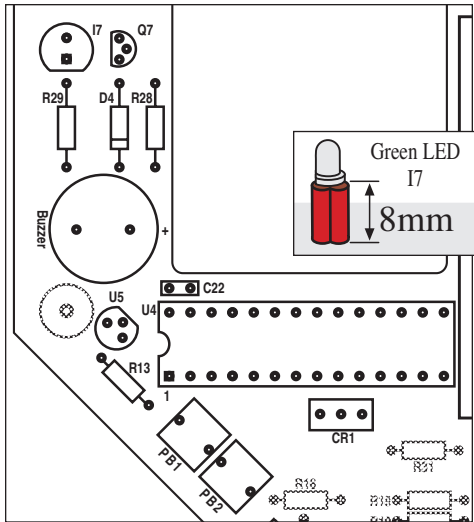
Solder the other ends of the red and black wires to the short ends of a 2-pin male header.

Repeat for the other motor, again noting that the red wire goes to the "Y" tab.

Slide both motors into place in the gear box, making sure the capacitors clear the housing. When completed, set the Gear Box aside for later.



Location	Description
□ -	Hook up wire, black (cut it in half)
□ -	Hook up wire, red (cut it in half)
□ -	Twin Motor Gear Box (from the step above)
□ -	Header, male, 1 x 2, 0.100"
□ -	Header, male, 1 x 2, 0.100"



2.22 - Brain, Buzzer & More

Install parts on the Main board in the order listed. Cut off an 8 mm long segment from the “coffee stirrer”, and use it as a standoff to support the green LED, I7, above the circuit board as shown. (See Section 2.13 for details.)

Note orientations of the socket U4, diode D4, transistor Q7, green LED I7, Buzzer and IC U4.

After soldering, trim away excess leads.

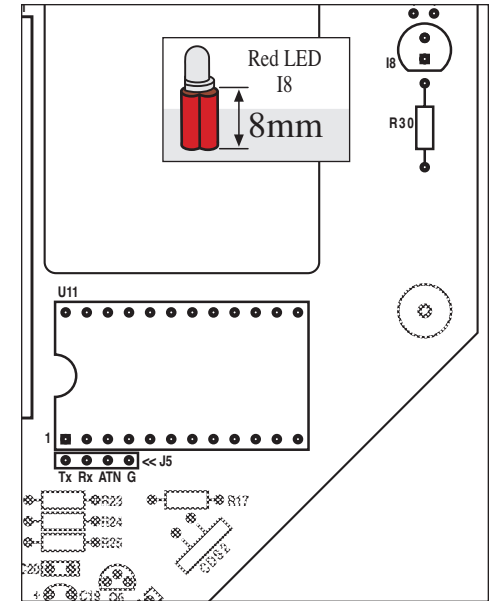
As the buzzer is very loud, you may wish to leave the sticker covering the sound opening in place.

2.23 - Stamp 2 Socket & more

Install parts on the Main board in order listed Cut off an 8 mm long segment from the “coffee stirrer”, and use it as a standoff to support the red LED, I8, above the circuit board as shown. (See Section 2.13 for details.)

Note orientations of the socket U11, and LED I8.

For more information on programming and customizing your OctoBot using a Stamp 2 processor, see product #3-905 “OctoBot Stamp 2 Set”.



LOWER RIGHT OF BOARD

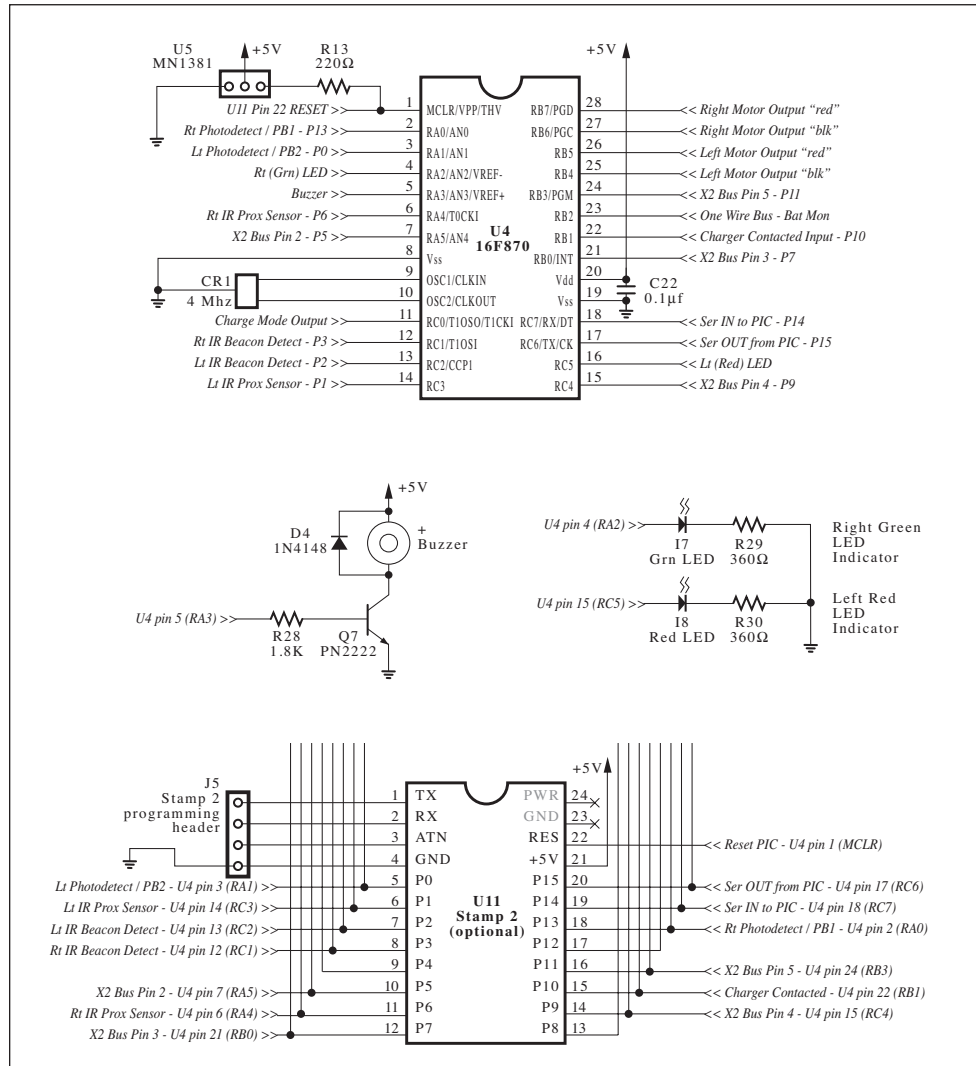
Location	Description
R30	Resistor, 360 Ω 1/4W 5% (org, blu, brn, gld)
U11	Socket, 24 pin wide DIP
J5	Header, female, 1 x 4, Stamp programming
I8	Standoff, 8 mm (cut from coffee stirrer)
I8	LED, Red, T-1

LOWER LEFT OF BOARD

Location	Description
R13	Resistor, 220 Ω 1/4W 5% (red, red, brn, gld)
R28	Resistor, 1.8K Ω 1/4W 5% (brn, gry, red, gld)
R29	Resistor, 360 Ω 1/4W 5% (org, blu, brn, gld)
D4	Diode, 1N4148
C22	Capacitor, 0.1 μF “104”
U4	Socket, 28 pin narrow DIP
U5	IC, MN1381, Low Voltage Detect & Reset
Q7	Transistor PN2222A NPN
I7	Standoff, 8 mm (see Section 2.13)
I7	LED, Green, T-1
PB1	Pushbutton, momentary, PC mount
PB2	Pushbutton, momentary, PC mount
CR1	Resonator 4MHz with caps
Buzzer	Buzzer, GB-12TP01

Plug in (do not solder):

- U4 PIC, 16F870, 28 pin narrow, “OctoBot”



2.24 - Test Buzzer & LEDs

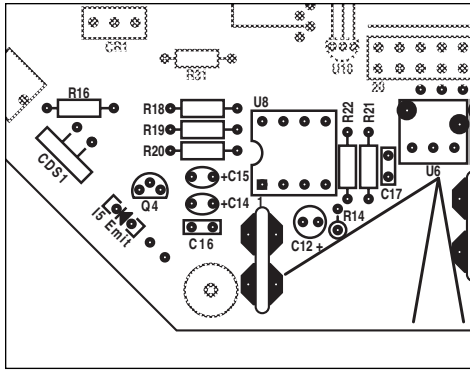
To test out the basic systems installed so far, hold down button PB1 down and turn on power switch SW1.

The following should occur:

- The red LED should flash briefly.
- After a few seconds, the Buzzer should sound briefly.
- The red LED should light for about 3 seconds
- The green LED should light for about 3 seconds

Turn the power switch SW1 off. There are additional operations in this sequence, and they will be demonstrated in later steps.

If it does not work as described, stop and check for errors, solder problems, etc.



2.25 - Right Sensors

Install parts on the Main board in order listed. Pay extra attention to resistors, as the colors are similar, but the values are very different.

Note orientations of capacitors C12, C14 & C15, socket U8, transistor Q4, infrared LED I5 (on top of board), infrared detector Q3 (on bottom of board), photocell CDS1, and tone decoder IC U8 when plugging into socket.

Note: On the photocell CDS1, LED I5 and IR detector Q3, be sure to include an 8 mm long segment from the "coffee stirrer" and mount them as shown below.

LOWER LEFT OF BOARD

Location	Description
□ R14	Resistor, 47 Ω 1/4W 5% (yel, vio, blk, gld)
□ R16	Resistor, 100K Ω 1/4W 5% (brn, blk, yel, gld)
□ R18	Resistor, 22K Ω 1/4W 5% (red, red, org, gld)
□ R19	Resistor, 10K Ω 1/4W 5% (brn, blk, org, gld)
□ R20	Resistor, 100 Ω 1/4W 5% (brn, blk, brn, gld)
□ R21	Resistor, 6.8K Ω 1/4W 5% (blu, gry, red, gld)
□ R22	Resistor, 10K Ω 1/4W 5% (brn, blk, org, gld)
□ C12	Capacitor, 3.3 μF, electrolytic
□ C14	Capacitor, 1μF, tantalum "1C"
□ C15	Capacitor, 0.47 μF, tantalum "V47"
□ C16	Capacitor, 0.1 μF, ceramic "104"
□ C17	Capacitor, 0.1 μF, ceramic "104"
□ U6	IR Detector, 56.8 KHz, GPIUD287YK
□ U8	Socket, 8 pin DIP
□ Q4	Transistor PN2222A NPN
□ I5	Standoff, 8 mm (cut from coffee stirrer)
□ I5	LED IR Emitter, rectangular (clear body)
□ CDS1	Standoff, 8 mm (cut from coffee stirrer)
□ CDS1	Photocell, 4.2mm

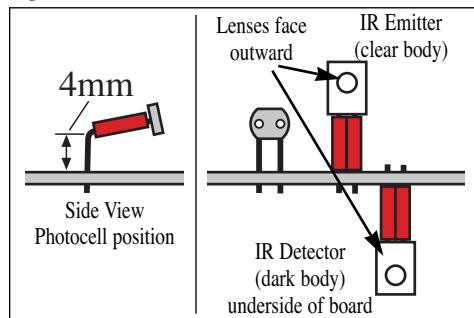
Press into socket:

- U8 IC, LM567, tone generator

Mount on bottom side of board:

- Q3 Standoff, 8 mm (cut from coffee stirrer)
- Q3 IR Detector, rectangular (dark body)

Right Side IR Emitter, IR Detector and Photocell



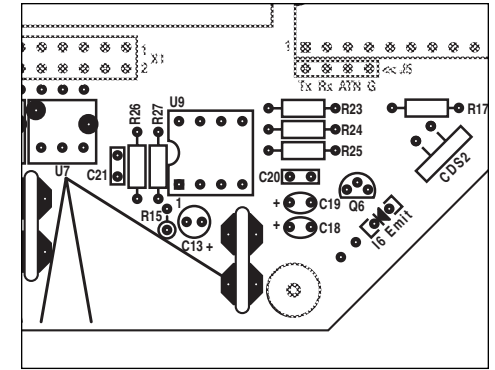
2.26 - Left Sensors

Install parts on the Main board in order listed

Note orientations of capacitors C13, C18 & C19, socket U9, transistor Q6, infrared LED I6, infrared detector Q4 (on bottom of board), photocell CDS2, and tone decoder IC U9 when plugging into socket.

Note: On photocell CDS2, IR LED I6 and IR detector Q4, be sure to include an 8 mm long segment from the "coffee stirrer" and mount them as shown below. (Basically mirror image of drawing at lower left.)

After soldering, trim away excess leads.



LOWER RIGHT OF BOARD

Location	Description
□ R15	Resistor, 47 Ω 1/4W 5% (yel, vio, blk, gld)
□ R17	Resistor, 100K Ω 1/4W 5% (brn, blk, yel, gld)
□ R23	Resistor, 22K Ω 1/4W 5% (red, red, org, gld)
□ R24	Resistor, 10K Ω 1/4W 5% (brn, blk, org, gld)
□ R25	Resistor, 100 Ω 1/4W 5% (brn, blk, brn, gld)
□ R26	Resistor, 10K Ω 1/4W 5% (brn, blk, org, gld)
□ R27	Resistor, 10K Ω 1/4W 5% (brn, blk, org, gld)
□ C13	Capacitor, 3.3 μF, electrolytic
□ C18	Capacitor, 1μF, tantalum "1C"
□ C19	Capacitor, 0.47 μF, tantalum "V47"
□ C20	Capacitor, 0.1 μF, ceramic "104"
□ C21	Capacitor, 0.1 μF, ceramic "104"
□ U7	IR Detector, 56.8 KHz, GPIUD287YK
□ U9	Socket, 8 pin DIP
□ Q6	Transistor PN2222A NPN
□ I6	Standoff, 8 mm (cut from coffee stirrer)
□ I6	LED IR Emitter, rectangular (clear body)
□ CDS2	Standoff, 8 mm (cut from coffee stirrer)
□ CDS2	Photocell, 4.2mm

Press into socket:

- U9 IC, LM567, tone generator

Mount on bottom side of board:

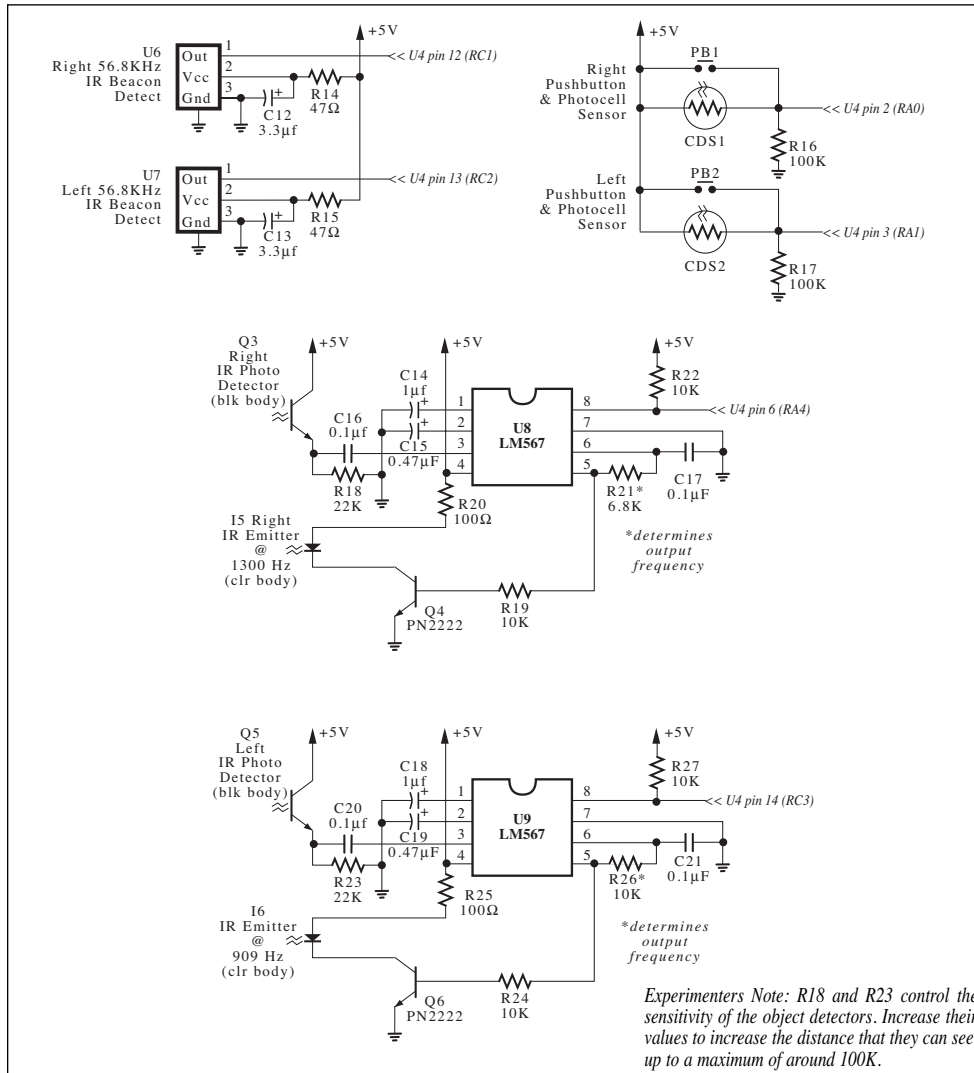
- Q5 Standoff, 8 mm (cut from coffee stirrer)
- Q5 IR Detector, rectangular (dark body)

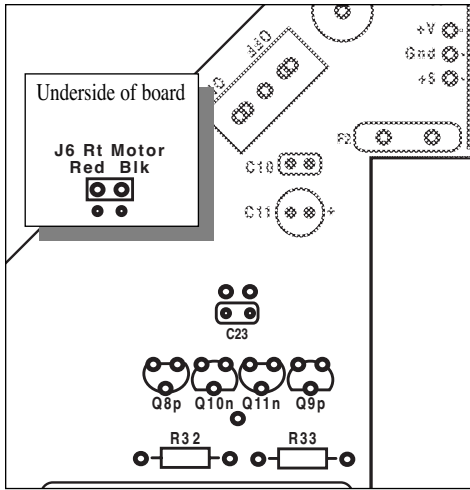
2.27 - Test IR Proximity Sensors

To test the sensors, this time hold button PB2 and turn on power switch SW1.

After a few seconds, the Buzzer will sound, and the IR Proximity sensors will cause their corresponding LEDs (red on left, green on right) to blink when seeing an object from 1 to 10 centimeters away, depending on lighting.

Wave your hands around in front of the sensors to test them out. They have a longer range in dimmer light. (Use a video camera to see the emitters shining in infrared.)





UPPER LEFT OF BOARD

- | Location | Description |
|----------|----------------------------------------------|
| □ R32 | Resistor, 220 Ω 1/4W 5% (red, red, brn, gld) |
| □ R33 | Resistor, 220 Ω 1/4W 5% (red, red, brn, gld) |
| □ Q8 | Transistor, PN2907A PNP |
| □ Q9 | Transistor, PN2907A PNP |
| □ Q10 | Transistor, PN2222A NPN |
| □ Q11 | Transistor, PN2222A NPN |
| □ C23 | Capacitor, 0.1 μF, ceramic "104" |

Mount on bottom side of board:

- J6 Header, female, 1 x 2, 0.100

2.28 - H-bridge Motor Drivers

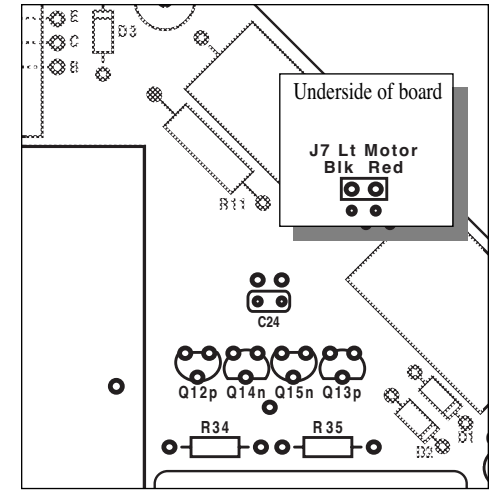
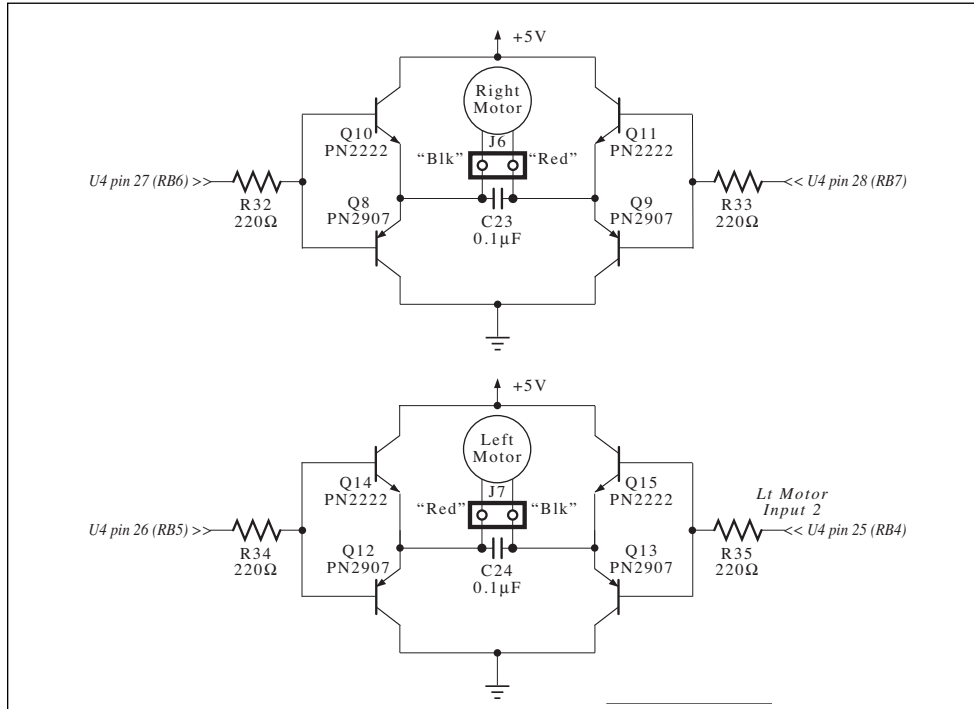
Install parts on the Main board in order listed

IMPORTANT NOTE: The motor drivers use *two* types of transistors: P-type (PN2907A) and N-type (PN2222A). Be sure to put the correct **type** in the right **location** and with

the right **orientation**, then check them all once again *before* soldering them in.

Note that the two 2-pin female headers, J6 and J7, mount on the bottom side of the board.

After soldering, trim away excess leads.

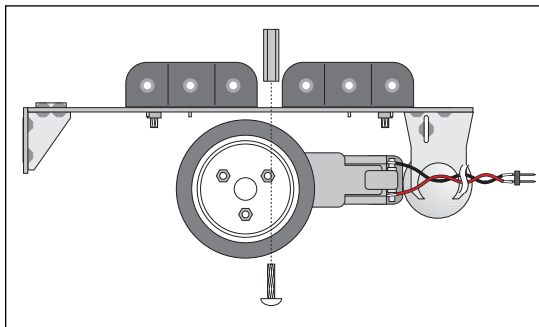


UPPER RIGHT OF BOARD

- | Location | Description |
|----------|----------------------------------------------|
| □ R34 | Resistor, 220 Ω 1/4W 5% (red, red, brn, gld) |
| □ R35 | Resistor, 220 Ω 1/4W 5% (red, red, brn, gld) |
| □ Q12 | Transistor, PN2907A PNP |
| □ Q13 | Transistor, PN2907A PNP |
| □ Q14 | Transistor, PN2222A NPN |
| □ Q15 | Transistor, PN2222A NPN |
| □ C24 | Capacitor, 0.1 μF, ceramic "104" |

Mount on bottom side of board:

- J7 Header, female, 1 x 2, 0.100



- | Location | Description |
|----------|---------------------------------------|
| □ - | Gear Box and Motor Assembly |
| □ - | Wheels (2 pieces) |
| □ - | Screw, #4, 1/2" pan head (2 pieces) |
| □ - | Standoff, Hex, #4 FF, 3/4" (2 pieces) |

2.29 - Mount Drive System

Insert motors into gear box.

Press the wheels (assembled earlier) on to shafts of the gear box and motors (also done earlier).

Mount the gear box to the main PCB, inserting screws from the bottom through tabs on gear box, through two #4 washers on each screw, insert through PCB holes, and secure with standoffs from the top of the board.

NOTE: If the wheels are too wide to fit the board cutouts, return to the wheel assembly step and change both wheels to the "narrow tread" configuration.

Plug motors into J6 and J7, noting orientations of red and black wires, as printed on the bottom of the board. Tuck the wires neatly along the gearbox.

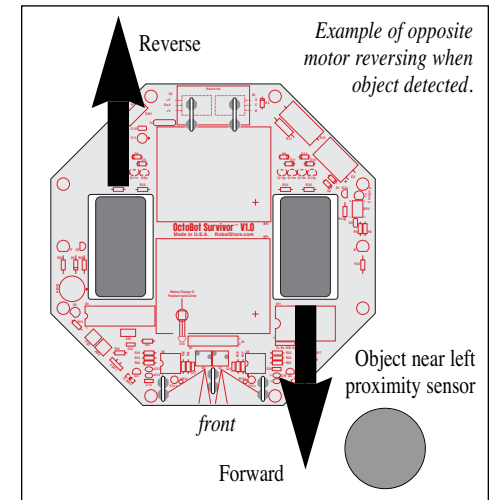
2.30 - Test Motors

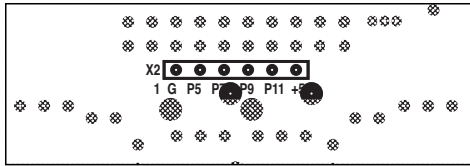
On your desk or work bench, raise the robot up a few centimeters (a block of wood, deck of cards, etc.) so that the wheels can spin without contacting the surface.

To test the motors, again hold down button PB1 down and turn on power switch SW1. The buzzer sounds, the red and green LEDs light, then the motors will move in a "forward" mode.

And, as each IR Proximity sensor detect something in front of it (like your hand), it will cause the *opposite* motor to go into reverse.

If it does not work as described, stop and check for motors being plugged in correctly (J6 and J7 on the bottom side), errors, solder problems, etc.





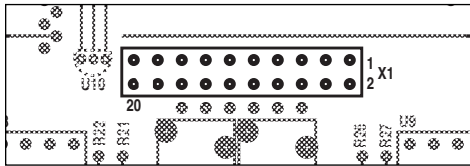
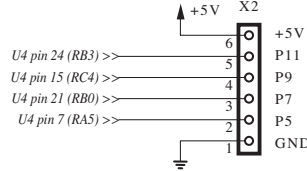
UNDERSIDE CENTER OF BOARD

Mount on bottom side of board:

- X2 Header, female, 1 x 6, 0.100"

2.31 - Bottom Expansion Port

On the bottom side of the board, install the six pin female header and solder from the the top side.



CENTER OF BOARD

Location Description

- X1 Header, female, 2 x 20, 0.100" spacing

2.32 - Top Expansion Port

On the top of the board, install the 20 pin female header and solder in place from the bottom. *NOTE: Press it in firmly so that it stands flat against and square to the board.*

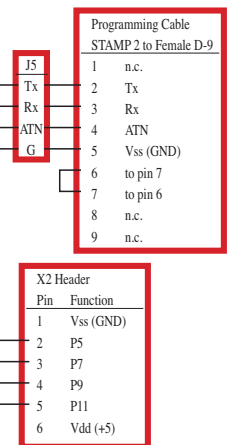
This port follows the standard from Parallax Inc (creators of the BASIC Stamp™) and permits the easy addition of "AppMod" compatible boards.

See our website for details, and available modules.

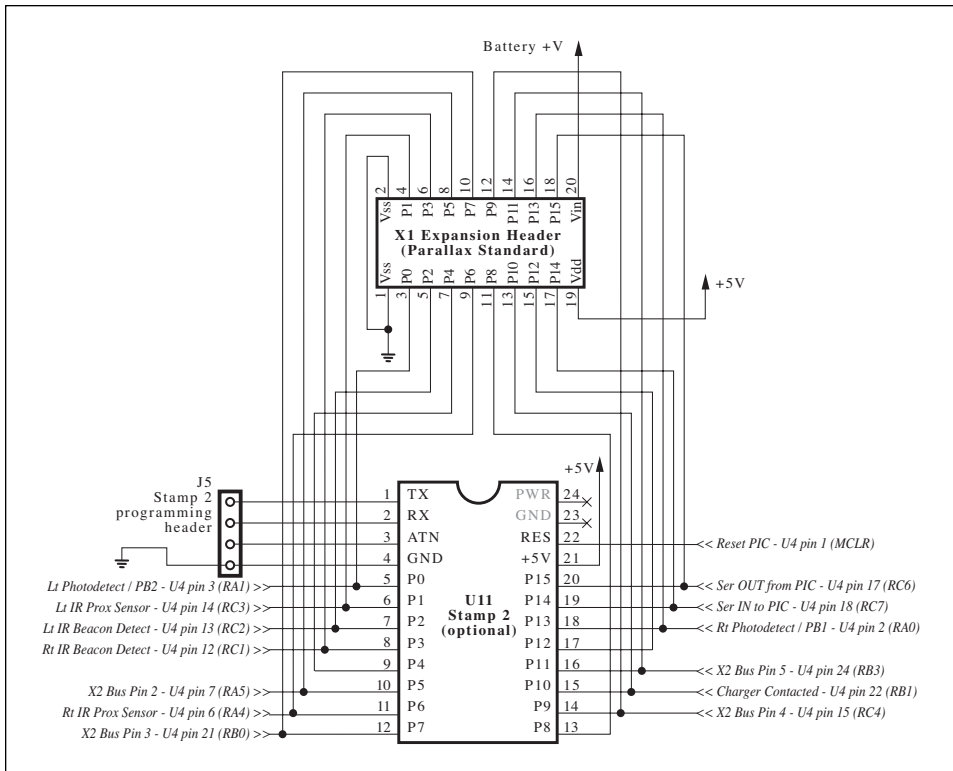
2.33 - Processor Connections

U4 - PIC16F876	Robot	Function
1	MCLR/VPP/THV	Reset
2	RA0/AN0	Rt Photodetector / PB1
3	RA1/AN1	Lt Photodetector / PB2
4	RA2/AN2/VREF-	Rt (Grn) LED
5	RA3/AN3/VREF+	Buzzer
6	RA4/T0CK1	Rt IR Prox Sensor
7	RA5/AN4	X2 Bus Pin 2 (P5)
8	Vss (GND)	
9	OSC1/CLKIN	
10	OSC2/CLKOUT	
11	RC0/T1OSO/T1CKI	Charge Mode Output
12	RC1/T1OSI	Rt IR Beacon Detect
13	RC2/CCP1	Lt IR Beacon Detect
14	RC3	Lt IR Prox Sensor
15	RC4	X2 Bus Pin 4 (P9)
16	RC5	Lt (Red) LED
17	RC6/TX/CK	Ser OUT from PIC
18	RC7/RX/DT	Ser IN to PIC
19	Vss (GND)	
20	Vdd (+5)	
21	RB0/INT	X2 Bus Pin 3 (P7)
22	RB1	Charger Contacted Input
23	RB2	One Wire Bus - Bat Mon
24	RB3/PGM	X2 Bus Pin 5 (P11)
25	RB4	Motor B1
26	RB5	Motor B2
27	RB6/PGC	Motor A2
28	RB7/PGD	Motor A1

X1 Header	Function
1	Vss (GND)
2	Vss (GND)
3	P0
4	P1
5	P2
6	P3
7	P4*
8	P5**
9	P6
10	P7**
11	P8*
12	P9**
13	P10
14	P11**
15	P12*
16	P13
17	P14
18	P15
19	Vdd (+5)
20	Vin (PWR)



Notes:
Ports marked with * and ** are available to Stamp 2 for use as Input or Output from X1 Header.
Ports marked with ** are available to Stamp 2 for use as Input or Output from X2 Header.

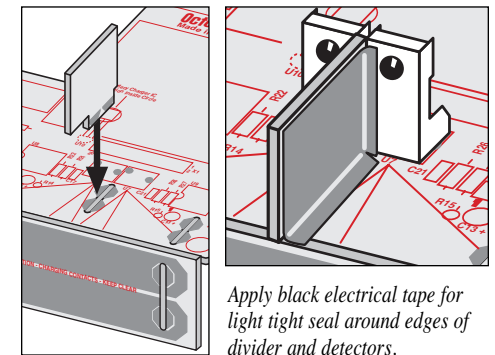


2.34 - Detector Divider Board

On the top side of the board, install the small divider board between the IR Beacon Detectors. Hold it in place with a piece of masking tape, then flip the board over and solder the OctoPads as described on page 3.

NOTE: Add a layer of black electrical tape to cover the seams along the divider, the main board and sensors to provide extra light blockage (IR can be very sneaky!)

- | Board # | Description |
|---------|--------------------------|
| 11 | PCB, IR Detector Divider |



Apply black electrical tape for light tight seal around edges of divider and detectors.

2.35 - Test Beacon Detectors

To test the beacon sensors (U6 and U7), hold down button PB2 down and turn on power switch SW1.

After a moment, the Buzzer will beep twice, and the IR Proximity sensors will cause their corresponding LEDs (red on left, green on right) to blink when seeing an object from 1 to 10 centimeters away, depending on the lighting conditions.

Also, the LEDs also indicate when U6 and U7 detect the IR signal from the charger beacon.

Plug the AC adapter into a wall outlet and into J1 on the charger. Set the robot about 50 cm (20 inches) away from the beacon, with the front pointed towards the charger. The red and green LEDs should both light steadily.

NOTE: Some flat screen computer displays can emit a signal similar enough to the beacon to trigger the sensors. (Guess how long it took us to figure that out!) Keep any screens out of the robot's line of sight.

Rotate the robot so that it sees and doesn't see the sensors, and watch how the LEDs change.

2.36 - Paint the Shells

The OctoBot body shell adds a layer of protection to the robot, as well as giving it a finished look. The outside of the tough transparent plastic shell arrives with a thin bluish sheet that protects the shell from scratches and over spray during painting.

The steps includes drill and cut the required slots and holes, wash and dry, paint the shell from the inside, then remove the protective layer and mount the shell on your robot. By painting the inside surface with a bit of care and attention to detail, you will create a finely finished body for your OctoBot and the charger beacon station.

Choose a color for your robot. Sparklie “metallic” paints look great. The durable plastic sheet requires an extra strong epoxy type paint. Don’t try using regular spray

BODY & BEACON SHELLS	
Location	Description
□ -	Vacuum formed Body Shell Set
□ -	Epoxy Spray Paint (color of your choice)

enamel, it will not hold well, and will easily scratch or even flake off.

1) With a Sharpie or similar permanent marker, mark the locations for cutting as shown below. Be sure to mark only the outside of the shell, so the marks are actually on the protective film which will be removed later.

2) With a sharp hobby knife, cut slowly and carefully along the lines. Use several shallow cuts rather than one complete cut. Next, drill the holes as indicated. Finally, deburr all holes and edges with the hobby knife and if needed, a bit of fine sandpaper.

2) Wash the interior of the shells with warm water and a bit of dish washing soap. Scrub the interior surfaces with a coarse cleaning pad (Scotch Brite or similar) to provide a better surface for the paint to adhere.

3) Dry the shells with a clean lint-free cloth and let air dry completely.

4) Mask the three LED “domes” from the inside of the shell using round circles of masking tape. Alternately, you

can apply a dab of rubber cement to the inside of each dome, and push it around so it just fills the dome. Let the rubber cement dry thoroughly. This masking lets the domes remain clear, and allows the LEDs to shine through.

5) Following the directions on the paint for preparation, temperature, ventilation, etc. To begin, spray the interior of the shells with one light coat - just a translucent misting. Let dry for 20 minutes.

6) Follow up with another light coat, and let it dry. Repeat four or five times.

Note that many light coats will serve much better than one heavy coat.

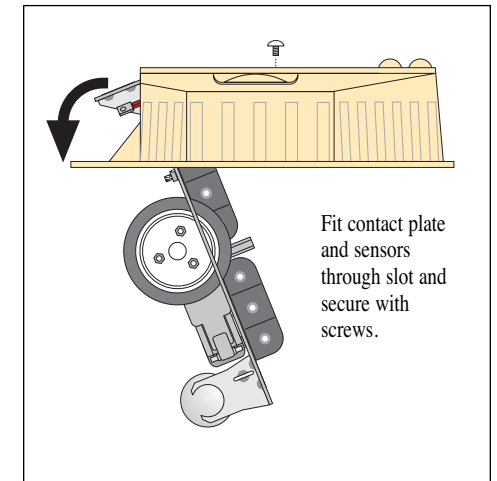
7) Pro Note: Finish off the interior painting with a final “backing layer” of a light color (flat white, or gray primer work well). This gives a extra sharp finish, especially on lighter colors like yellow, gold, and silver.

8) When the paint has dried thoroughly, remove the masking from the domes and the protective sheet from the outside of the shells.

2.37 - Mount the Shells

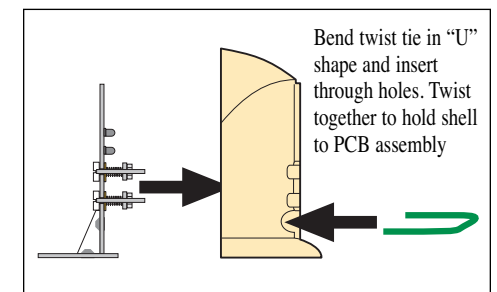
Mount the shells on to the robot and charger as shown.

Location	Description
□ -	Painted Body Shell
□ -	Painted Beacon Shell
□ -	Screw, #4, 1/4" pan head (2 pieces)
□ -	Twist tie



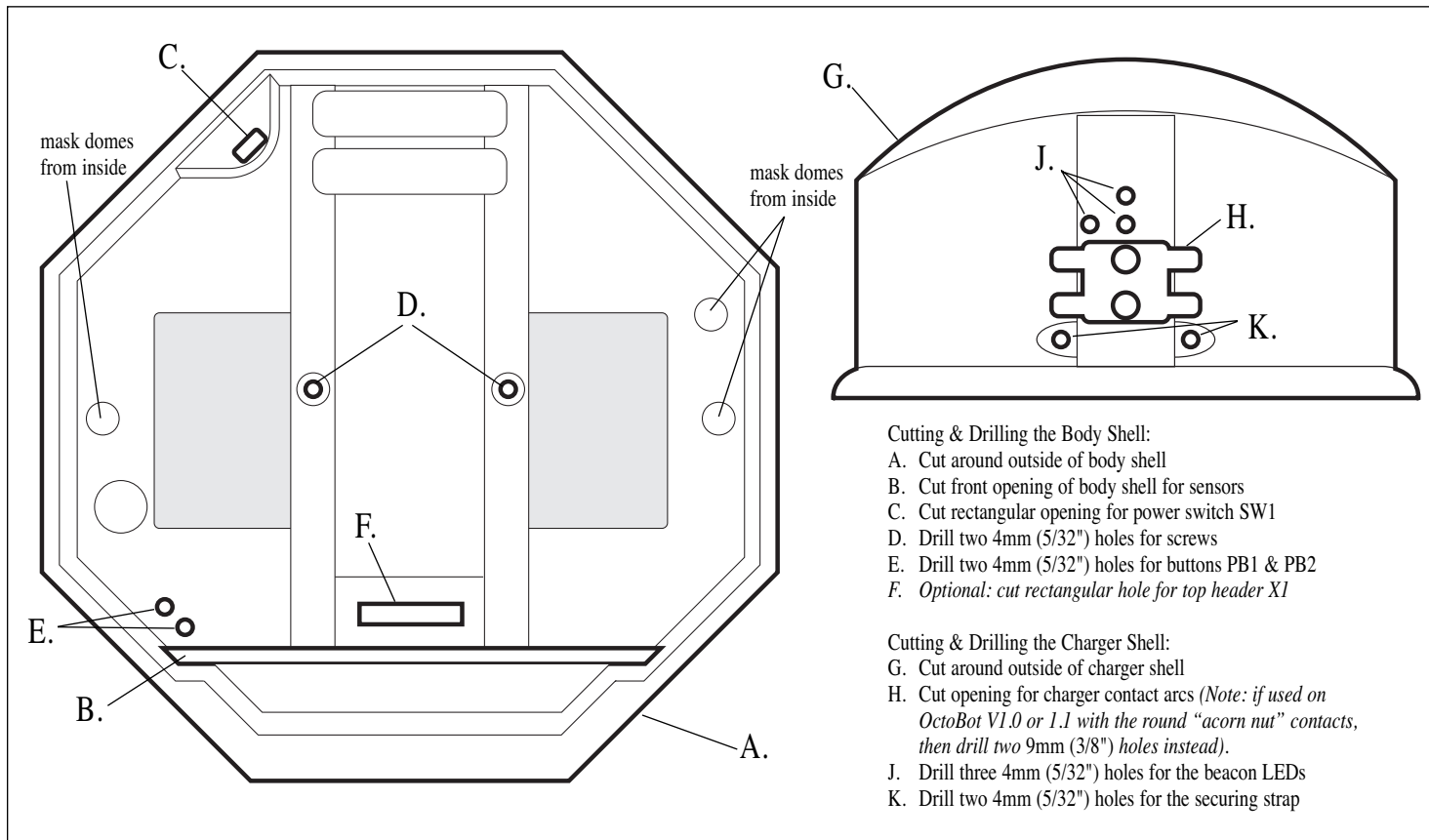
Hold the assembled OctoBot vertically, and slide its front charger contact plate carefully up through the bottom of the body shell and through the front opening. Make sure the IR detectors on the bottom clear the opening.

Secure with two screws through the top of the shell into the standoffs at the center of the robot.



Insert the charger beacon circuit assembly through the back of the shell with the contact arcs extending out the front. Pass the twist tie through the two holes (marked K on the drawing at the left) and twist it around the back of the circuit board, inside the shell, to hold it all together.

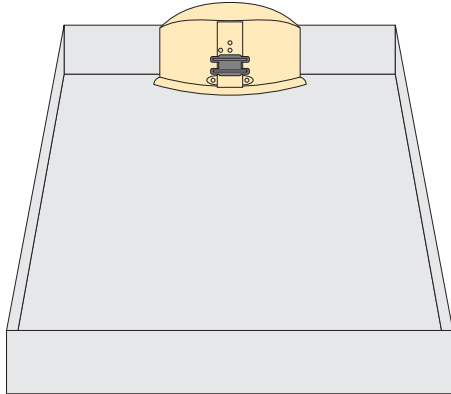
The contact arcs should move freely without touching or jamming on the shell body.



❑ 3.00 - Creating an Environment

As with any small creature, the OctoBot will need a safe enclosure to live in, to keep it from falls, getting stuck and other problems.

BOX: Build an enclosure from corrugated cardboard sheet, foam core or other materials that you may have on hand. Make it at least 1 meter square (3 feet), and have the walls at least 10 cm (4 inches) high.



A minimal enclosure. Pens can be larger and more complex to evoke more interesting and involved behaviors.

CHARGER: Tape or nail the charger beacon to the floor on one side, about 5 cm (2 inches) out from the wall. (This seems to work better than corner positions.) Be sure the area around the charger is flat and level, so that the contacts on the charger and robot will line up. Sloped or uneven floors can cause them to be out of alignment.

WALL: The walls need to be somewhat reflective of infrared light so the sensors can see them. Paper and cardboard materials tend to work well, but reflectivity can vary. Test various materials by placing the robot in PB2 mode and holding them up to the IR proximity sensors.

LIGHT: Place the enclosure where it won't be exposed to direct sunlight (which can overwhelm the sensors). Low or no light works fine. You can also create a dark area by putting a sheet of cardboard across one of the corners, as the robot's photosensors can tell the difference.

❑ 3.01 - Care & Feeding

NOTE: As soon as all circuitry performs as expected, cover the bottom side perimeter of the main circuit board with strips of black electrical tape to prevent electrical contact points from inadvertently touching the charger contacts (a rare but unfortunate failure mode).

Keep the pen clean (its easier than with small animals). Check the wheels and gears periodically for dust, hair and

other build up. Lubricate the gear train as needed, or when it sounds loud. Occasionally check the set screws that hold the drive gear to the hex shaft and keep it tight.

The batteries should last for many hundreds of charging cycles. However, they may eventually need replacing if they should fail to charge, or not hold their charge for very long. Be sure to use only the same type of NiMH cells.

Check the positions and angles of sensors to make sure they've not become bent or obstructed.

Periodically clean and curved Contact Arcs on the charger. Gently clean the robot's front charging contacts (J4), as they can develop oxide over time.

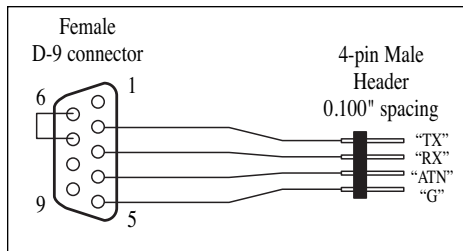
Periodically clean and inspect the robot for problems.

Experiment with objects in the robot's environment (obstacles, hiding places, etc.) When adding anything, be sure to observe the robot closely and watch for any unwanted interactions (getting stuck, caught in a loop, etc.) If it catches on the beacon, add paper "walls" on either side to help it better see and avoid the beacon.

Keep a log book of your observations, and see how to best keep the robot running for long periods of time.

❑ 4.00 - Stamp 2

Adding a BASIC Stamp 2 microprocessor to socket U11 permits the programming of additional routines and behaviors into the OctoBot. BASIC Stamps come with various processor speeds and on-board memory amounts, giving a wide range of power and expandability.



In addition to the Stamp, you will also require a PC with serial port, Stamp 2 software, and a special serial cable for connecting the PC serial port to connector J5 on the OctoBot (see drawing).

Stamp 2 program have access to many of the OctoBot sensors, and can instruct the OctoBot's PIC processor to perform a wide range of functions.

One example of Stamp 2 software for the OctoBot is on the following page. A PDF version of the program is available on our website. You can copy the program from it and avoid having to retype the entire text.

❑ 5.00 - OctoBot Modes

The push buttons PB1 and PB2 have various functions if held down when switch SW1 is first turned on. With the body shell in place, push the button using the hex key from the Twin Motor Gear Box, or a straightened paper clip.) Refer to the flow charts on page 14 for details on each of the following modes.

❑ 5.01 - PB1 - Demo Mode

Use this mode to demonstrate the OctoBot's basic functions for testing and presentations.

- Buzzer sounds briefly.
- Red LED lights for about 3 seconds
- Green LED lights for about 3 seconds
- Spins and searches for charger beacon for 20 seconds. If no beacon is found it will continue with the next step. If the beacon is found, it will move towards it until it makes contact, wait a second, then back away (unless it needs to charge, then it will stay a while).

It then begins a loop of these three behaviors, performing each for about 1 minute.

- 1 beep. Light seeking - spins to locate the brightest light and then moves towards it. If there is no obvious brightest source, it may just sit and wait for a change.
- 2 beeps. Wall follow - circles slowly seeking a wall, which it will follow on the left or right side (whichever is found first).

- 3 beeps. Wander - moves quickly, bouncing around the enclosure.

These three behaviors repeat continuously, being interrupted by recharging cycles as needed.

❑ 5.02 - PB2 - Test Mode

• **Blinking** - If an IR proximity detector (wall sensor) sees an object, the LED on the same side will blink on and off about once a second (ie red on the left, green on the right). Use this mode to measure the sensor's abilities under various lighting conditions.

• **Steady** - If the IR beacon detector sees the charging station IR beacon, the LED on the same side will stay on solid (red on the left, green on the right).

❑ 5.03 - PB1 & PB2 - Sound On/Off

Holding both PB1 and PB2 when turning SW1 on either enables or disables sound output. A sound swooping

from low to high pitch indicates that the sound is now set "on". A sound swooping from high to low indicates that sound is "off". The sound setting is stored in EEPROM and remains even with power off.

❑ 5.04 - Behaviors

When started up without either PB1 or PB2 pressed the OctoBot performs in a more unpredictable manner.

Using pseudo random numbers (seeded by the local light levels), and depending on it's battery charge level (low, medium or high) the OctoBot may choose to act in various ways.

❑ 5.05 - Happy Mood

In a "good mood" (high battery charge), the OctoBot is more likely to exhibit the following behaviors:

- Wander - move at fast speed around the enclosure.
- Figure 8's - dance in a sweeping pattern around one wheel and then the other.
- Find the brightest area - use the photosensors to go towards the brightest source (phototropism).
- Flash LEDs - sit quietly and blink.
- Make happy sounds - generally "upwards" in tone.

❑ 5.06 - Sad Mood

In a "bad mood" (medium battery charge), the OctoBot is more likely to exhibit the following behaviors:

- Finding the darkest area - use the photosensors to go away from the brightest source (photophobia).
- Slow Spinning - turning in circles (bored).
- Shaking - wiggling back and forth.
- Wall following - go somewhere else.
- Do nothing - sit with LEDs blinking.
- Make sad sounds - generally downward in tone.

In both happy and sad moods, changes in light level, and objects moving in front of the sensors will cause reactions, mainly backing away behaviors.

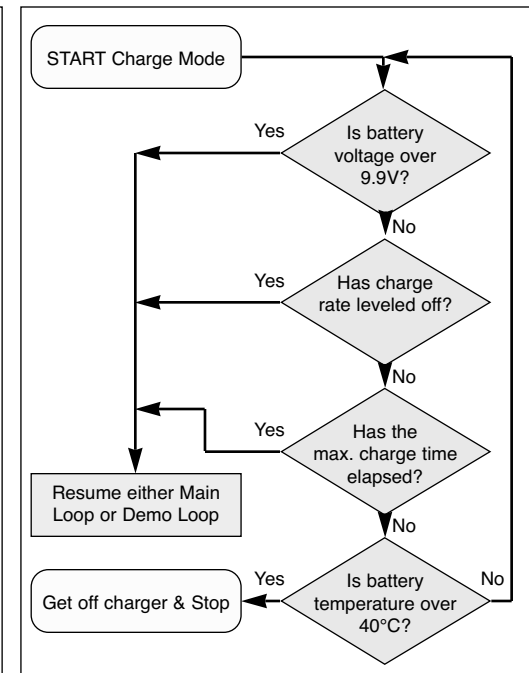
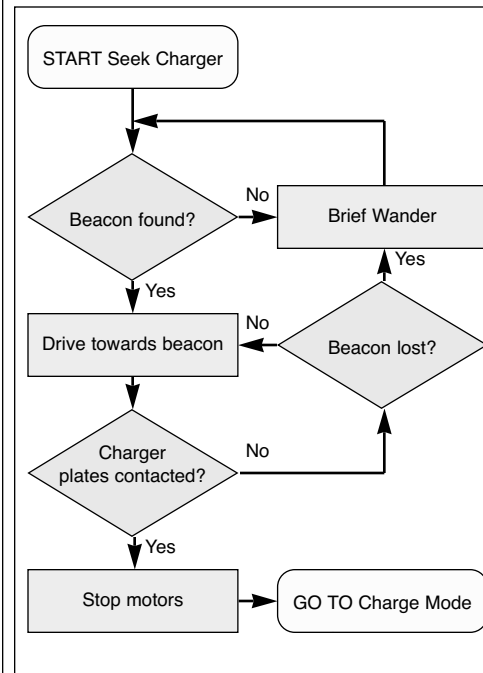
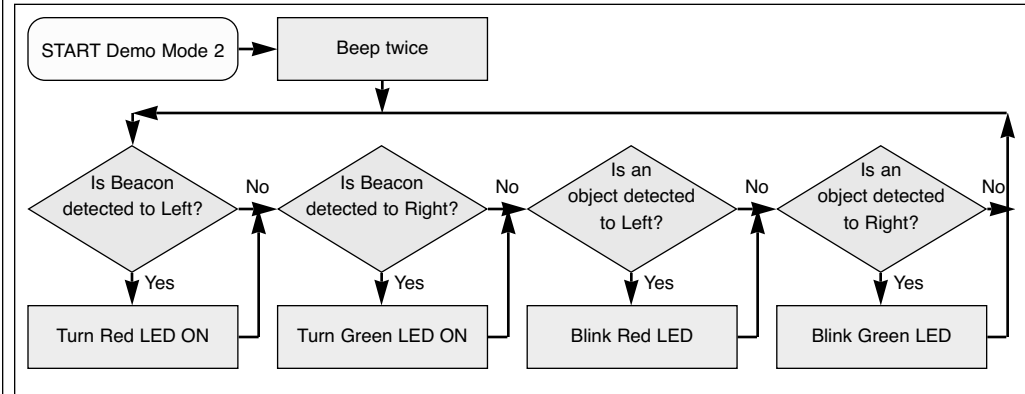
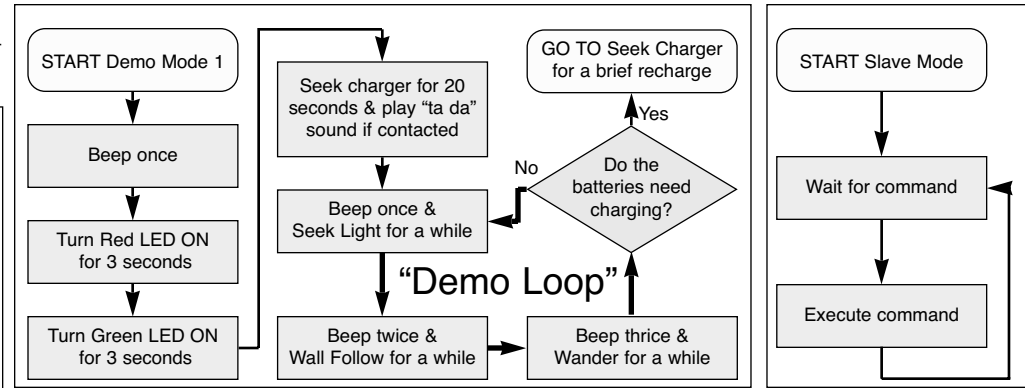
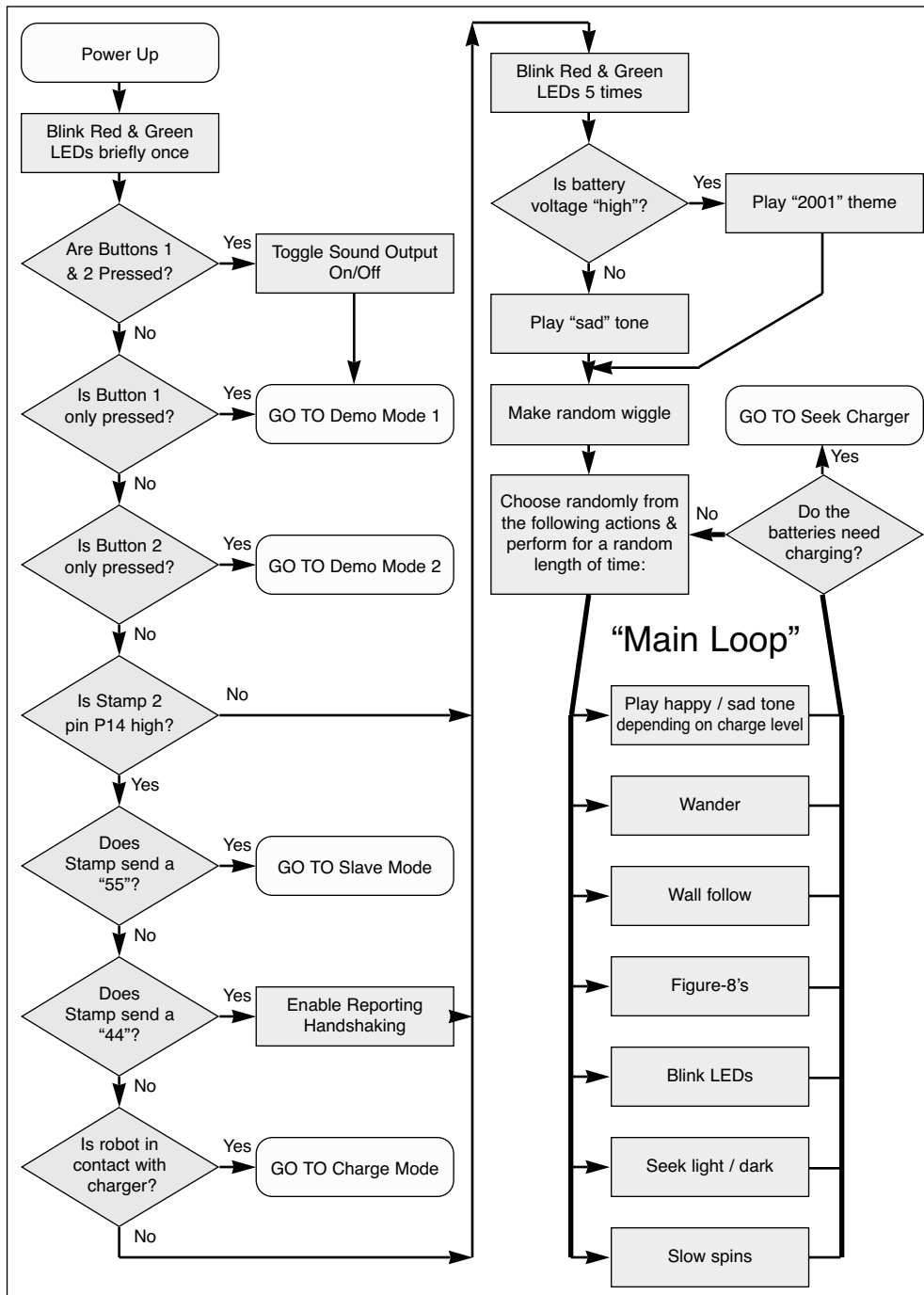
In the low battery charge condition, the OctoBot will seek out its charger and make contact. It will then sit for up to two and a half hours and recharge (with LEDs flashing about every 10 seconds or so), then resume its activities.

Go forth! Give your creature life!!!

8.00 - Firmware Flow Chart

These diagrams give a general overview of the various

operating modes and routines of the OctoBot. They are greatly simplified, but indicate the various actions and decisions made by the robot during operation.



```

*****
* OctoDem1.BS2
* Demonstration program for the OctoBot, using a BASIC Stamp 2 or
* 2E. Shows how to send commands to the OctoBot's PIC processor to have
* it perform various functions.
*
* Can be run on a desktop. Have OctoBot face charger beacon about 20 cm
* (8 inches) away. Connect programming cable, then power up in Demo 2
* mode, then download this program, leaving cable connected.
*
* It will blink the LEDs, report battery voltage and temperature,
* move back and forth, seek the charger and recharge (up to 2.5 hours),
* then back up, play tune and stop.
*****

i          var byte
length var word
note      var word
lowerbyte var byte
higherbyte var byte
result var word
dec result var word
voltage var word

*****
* Octobot 1.1 command set
*****
halt      con 0      'stops the robot's motors
forward   con 1      'start the robot moving forward
backward  con 2      'start the robot moving backward
left      con 3      'start the robot rotating left
right     con 4      'start the robot rotating right
lled_on   con 5      'left LED on
lled_off  con 6      'left LED off
rled_on   con 7      'right LED on
rled_off  con 8      'right LED off
sound     con 9      'Plays a tone
get_temp  con 10     'returns temperature around the batteries in Celsius
get_bat   con 11     'returns 100x battery voltage; i.e. 725 = 7.25 Volts
go_charge con 12     'finds charger, charges, returns a 255 when complete

*****
* Notes for music
*****
Fl        con 698    'F lower octave
C         con 1047
Cs        con 1108
D         con 1175
Ds        con 1244
E         con 1319
F         con 1397
Fs        con 1480
G         con 1568
Gs        con 1661
A         con 1760
As        con 1964
B         con 1975

*****
* program starts here
*****
high 14          'signal "not ready" to OctoBot PIC
pause 500        'give Octobot some time to power up
serout 14,84,[55] 'send "55" to indicate go into slave mode
high 14          'signal "not ready" to OctoBot PIC
pause 1000       'wait another second

*****
* flash the LED's
*****
debug "Blink LEDs", cr, cr
for i=1 to 10
  serout 14,84,[255,lled_on]      'Left LED on
  pause 100
  serout 14,84,[255,rled_on]      'Right LED on
  pause 100
  serout 14,84,[255,rled_off]     'Right LED off
  pause 100
  serout 14,84,[255,lled_off]     'Left LED off
  pause 100
next

*****
* Read the battery voltage
*****
serout 14,84,[255,get_bat]        'request voltage
serin 15,84,[lowerbyte,higherbyte]
voltage = (higherbyte * 256) + lowerbyte
dec result = voltage - ((voltage / 100) * 100) 'prepare 10ths of volts
result = (voltage / 100)           'prepare volts
debug "Battery voltage is ", dec result, ".", dec dec_result, " Volts", cr, cr

*****
* Read the battery temperature
*****
serout 14,84,[255,get_temp]        'request temperature
serin 15,84,[lowerbyte,higherbyte]
debug "Battery temperature is ", dec lowerbyte, "C", cr, cr

*****
* Move around
*****
debug "Move a bit", cr, cr
serout 14,84,[255,forward]         'drive forward
pause 1000                         'for one second
serout 14,84,[255,backward]        'drive backward
pause 1000                         'for one second
serout 14,84,[255,left]            'spin left
pause 1000                         'for one second
serout 14,84,[255,halt]            'stop
serout 14,84,[255,right]           'spin right
pause 1000                         'for one second
serout 14,84,[255,halt]            'stop

*****
* Go charge then report when done
*****
debug "Seek out charger", cr, cr    'go charge
serout 14,84,[255,go_charge]
pause 1000
serin 15,84,[wait(255),lowerbyte]  'wait for 255 then take next byte from PIC
pause 1000                         'for one second
debug "Charging done! - ", dec lowerbyte, cr, cr

*****
* Back away from charger
*****
serout 14,84,[255,backward]        'drive backward
pause 1000                         'for one second
serout 14,84,[255,halt]            'stop

*****
* Play a tune
*****
debug "Getting closer...", cr, cr
for i = 0 to 4
  lookup i, [G,A,F,Fl,C],note
  length=1000
  serout 14,84,[255,sound,length.lowbyte,length.highbyte,note.lowbyte,note.highbyte]
  pause 1050                        'this pause should be a little longer than the note length
next                                 'to give the PIC a chance to play the note

debug "Stamp program done.", cr
END

```

OctoBot Survivor Schematic V1.2

RG 0212.30 / 0312.03

All resistors are 1/4 watt, 5% unless otherwise noted.

