

StampBug2

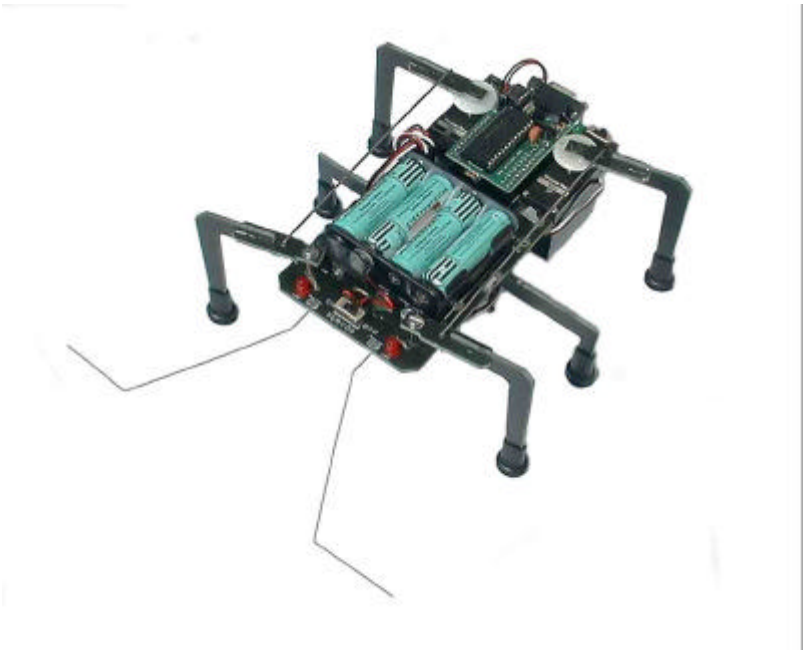


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Revision 1.0 May 2002

Parts List:

<u>Item</u>	<u>Description</u>	<u>Qty Reqd</u>
1	Circuit Board	1
2	Parallax CD-Rom	1
3	Diskette	1
4	150mm x47th dia wire	2
5	150mm x20th dia wire	2
6	AA Battery Holder	1
7	Feet (6mm grommets)	6
8	100x2.5 Tie Wrap	6
9	200x2.5 Tie Wrap	1
10	M3x20 screw	2
11	M3 Nyloc nut	2
12	10mm spacer	2
13	M3 Washer	6
14	Velcro Loops	4
15	Velcro Hooks	4
16	School Stamp2 (1-114)	1
17	Supertec servo (1-930)	3
18	Serial Programming Cable	1
19	#2 x3/8" self tapping screw	1
20	50x25mm adhesive foam	1

Requires 4xAA Nicad or NimH and 1x 9V PP3 type battery (not supplied)

General

Thank you for buying Stampbug2- we hope you enjoy building him!

Stampbug2 is a Stamp2 version of the original Stampbug. Stampbug2 allows programming using the latest Parallax editor software from within a full Windows environment such as '95,'98, 2000 and NT.

The use of the Stamp2 also increases the amount of programming space available for your application and provides 8 spare I/O pins for other add-ons. We have also included our small servo co-processor which will free your programme from constantly having to service the 3 servo motors whilst moving around.

Stampbug2 walks using the alternating triangle method- at any time he has the front and back legs of one side on the ground along with the center leg on the opposite side. The alternating triangle method is the simplest system that allows Stampbug2 to walk forwards and backwards in a straight line and allows left or right turning.

Stampbug2 is supplied with a standard bug2.bs2 programme which includes routines to make the bug move forwards, backwards and to turn left or right. These routines may be embedded in your own programme.

In the supplied form, Stampbug2 proceeds in the forwards direction until one or other of his feelers detects an obstacle, whereupon Stampbug2 backs up and then turns either left or right depending on which feeler was touched before proceeding on its way forwards again.

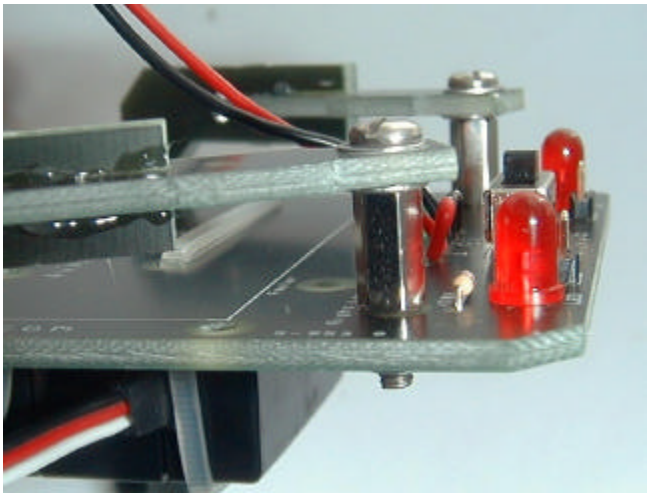
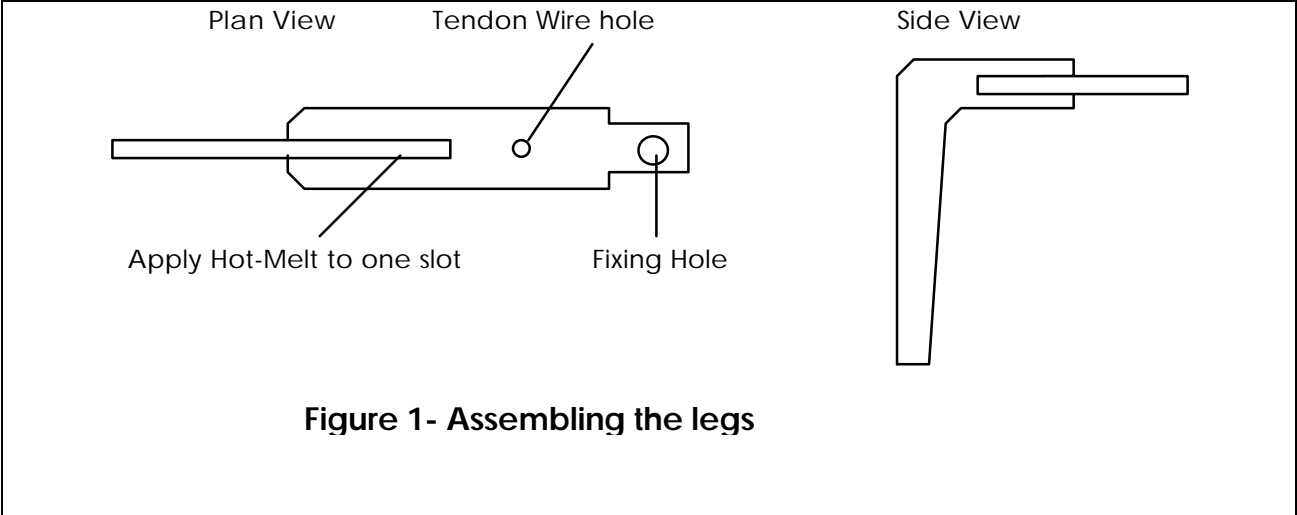
When you wish to experiment by changing the supplied programme- please see the section on programming.

We recommend you proceed with construction in the order presented in this booklet. However, if you get stuck please call or e-mail us and we will be happy to help.

Leg Assembly

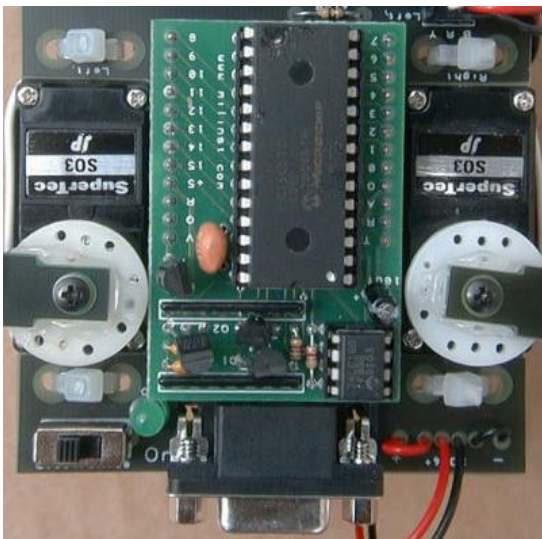
Begin by checking the parts against the supplied list.
Carefully cut the PCB parts from the main board- we used a section of hack-saw blade. File away any "pips" left from the retaining tabs.

The front and rear legs are assembled from two pieces of board as shown in figure 1. Assemble the 4 legs by spreading either "hot-melt" glue or epoxy into one of the leg slots and then firmly pushing the two leg section together. Leave to set.



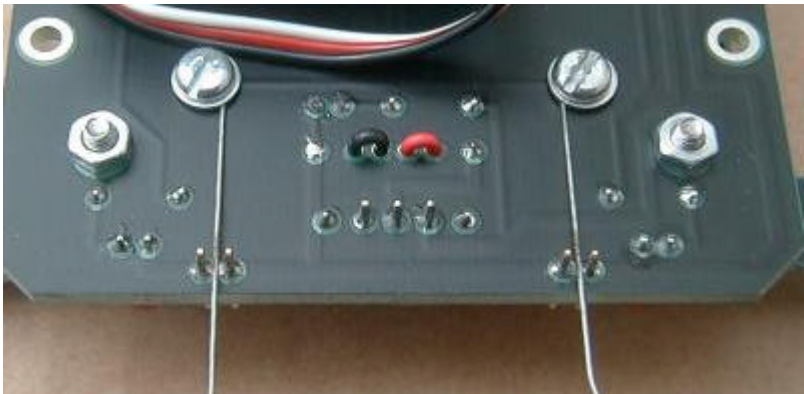
Electronics

The electronics board is supplied fully built and tested.
Simply fit the School Stamp2 Module into the twin rows of sockets above the servo co-processor. Check the module is aligned as shown below.



Feelers

Take one of the two thinner 150mm long feeler wires. Put a small radius in one end and loop this round the 3mm dia screw as shown below. Ensure the feeler wire is mid-way between the switch contact posts and not touching either of them otherwise the Stampbug2 will interpret this as though it has touched something. Bend the remainder of the wire as shown in figure 2
Repeat for the second feeler wire.



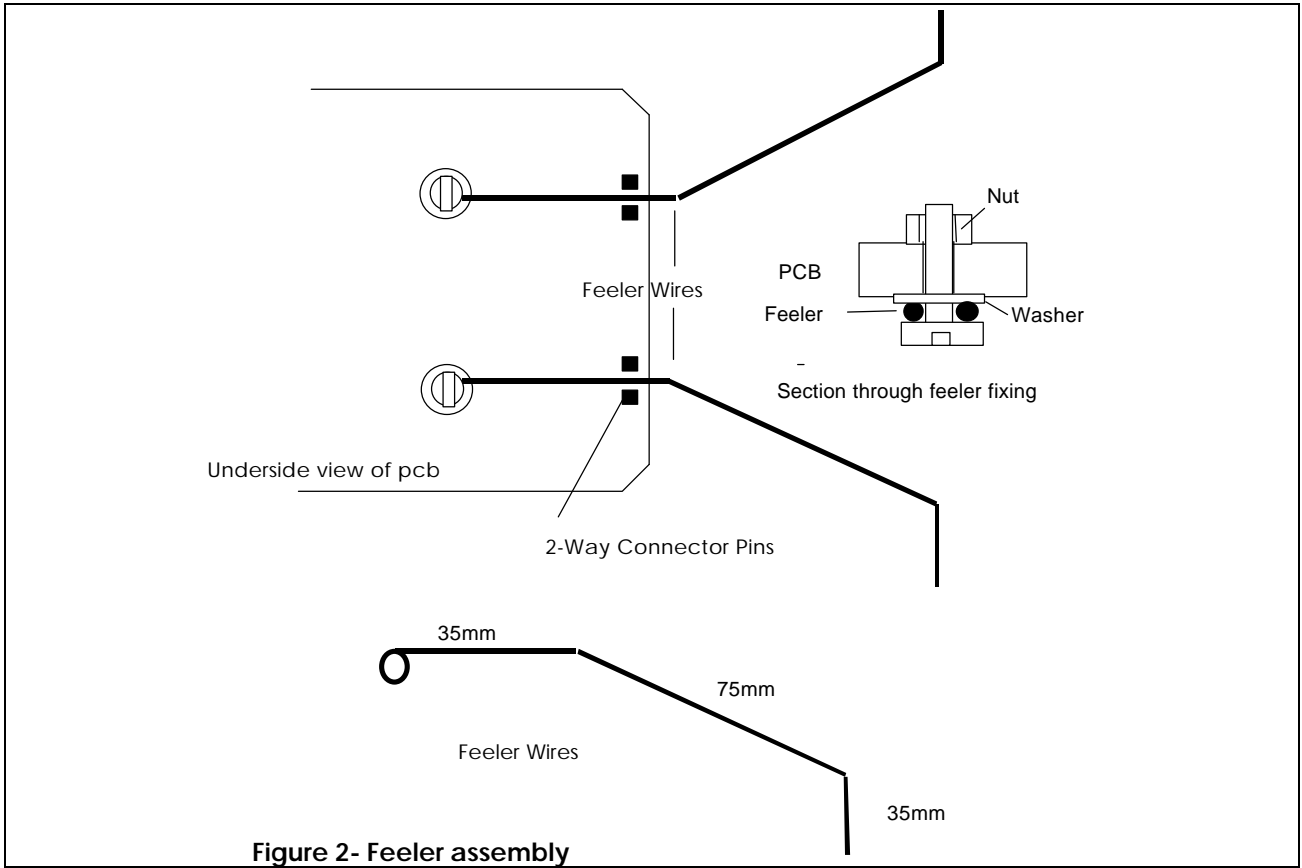


Figure 2- Feeler assembly

Servo Mounting

If not already fitted, select and loosely fit a small white circular actuator horn to the Left and Right leg servos.
Select the 2-arm horn, trim off one of the arms as shown below and fit the center leg assembly using a #2x3/8 self tapping screw. Loosely fit this to the Center leg servo.



Trimmed horn for the center leg

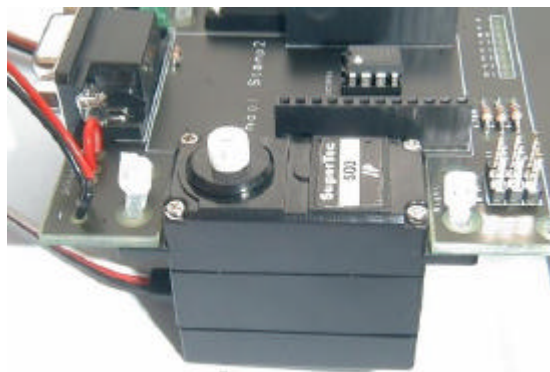


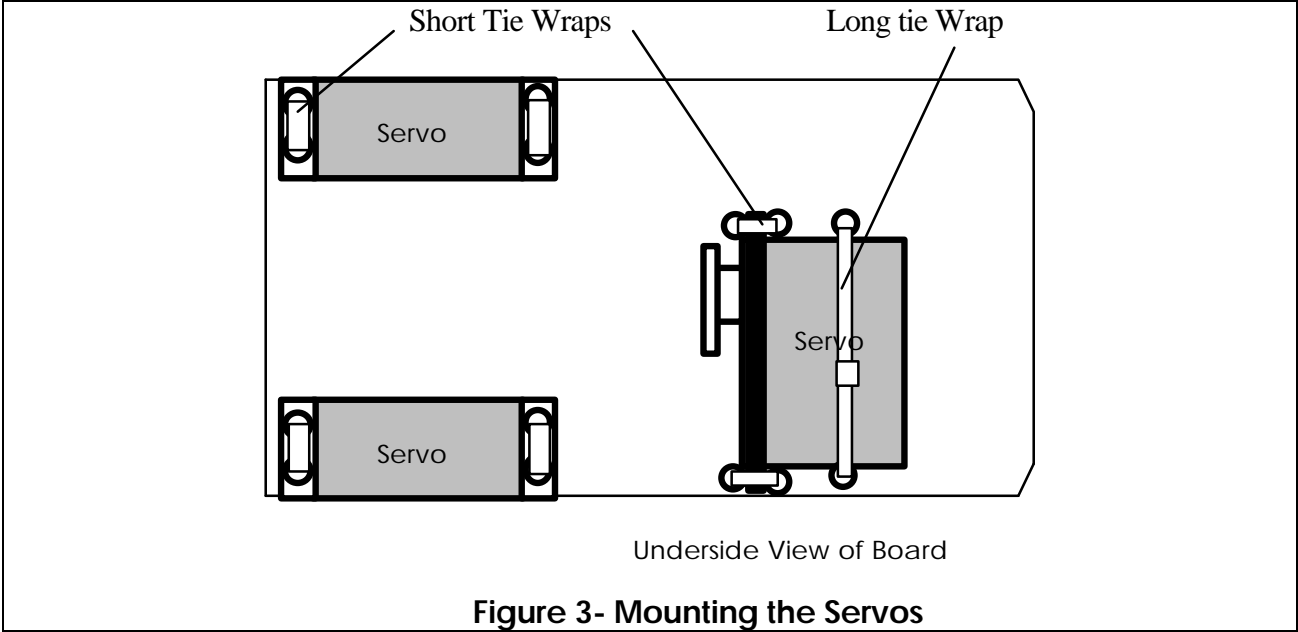
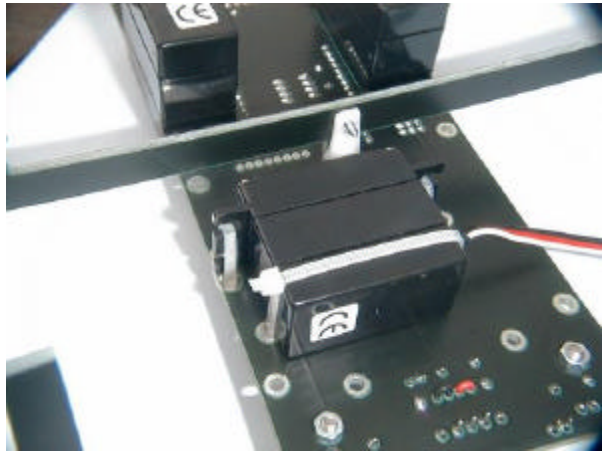
Leg assembly fitted to the horn and loosely fitted to the servo

For the Right and Left leg servos, use a small file or craft knife to carefully remove the small bracing gussets on the upper surface of the servo mounting flange so that the servo flange will sit flat against the underside of the pcb.



Fit the 3 servos in the positions shown using the 6 short and single long tie wraps. The mounting flanges of the "Right" and "Left" servos should be on the underside of the pcb with the output "horn" end towards the rear of the Bug.

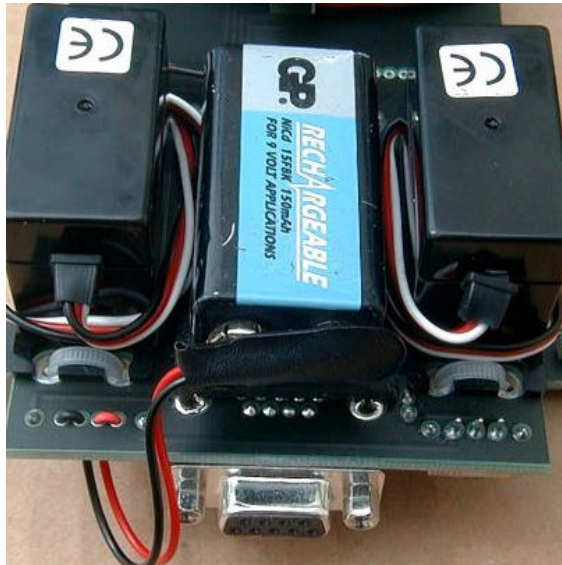




Battery Holders

Fit the 4xAA battery holder to the top of the circuit board in the position shown using two sets of Velcro hooks and loops. Insert the 4xAA Nicad (or NimH) batteries, ensure the servo switch is set to OFF and connect the battery connector.

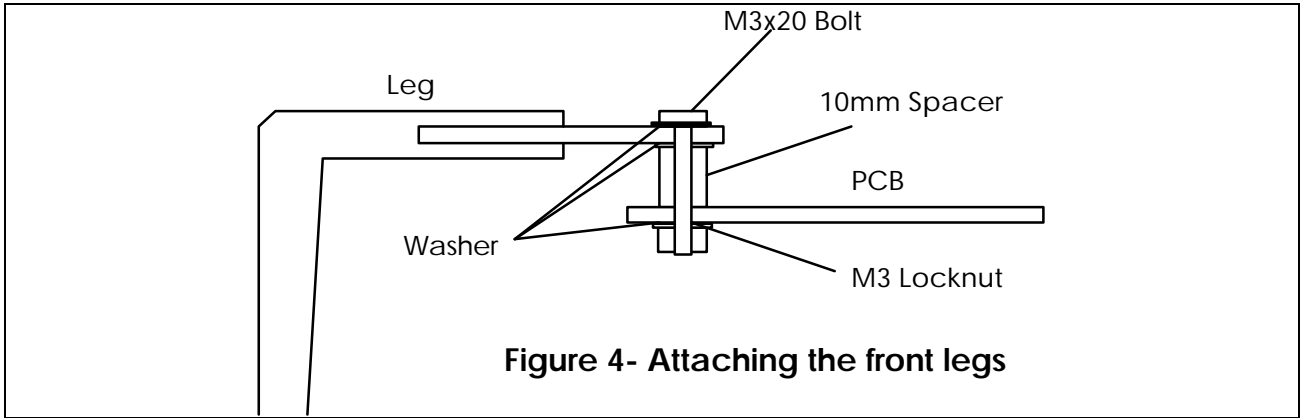
Fit the 50x25mm foam strip to the underside of the circuit board between the left and right leg servos. Fix the PP3 battery in place on the foam strip using the remaining two sets of Velcro hooks and loops. Ensure the Electronics switch is set to OFF and connect the battery connector.



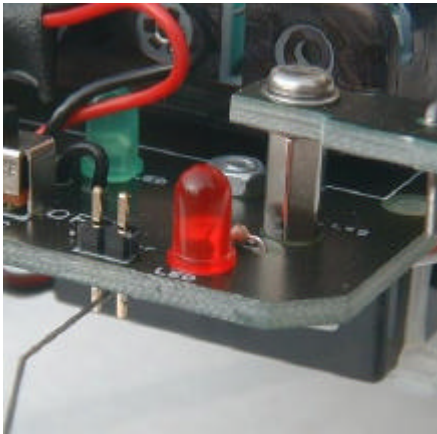
9v Battery position

Fitting the Legs

Fit the front legs as shown below.

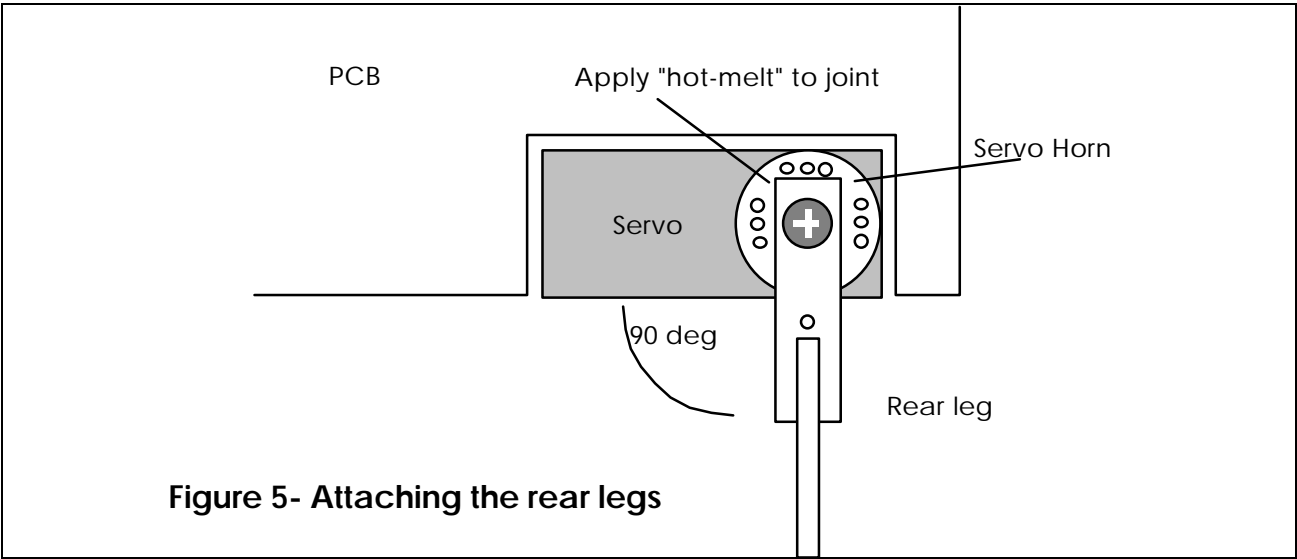


Adjust the 10mm spacer on the screw so that the leg is free to rotate with the spacer locked against the pcb.



Connect the 3 servos to their respective connection points on the circuit board making sure the wire colours correspond to those shown on the board.

Switch on the power to the servos and then to the electronics whilst holding the left feeler against one of the feeler connecting pins. The servos should move to their central position and stay there. The programme is generating a calibration pulse stream that moves and holds the servos in their mid position. Fix the Right and Left Rear legs to the servo horns using the servo horn screw and a small amount of hot melt glue. The legs should be sticking out exactly at right angles to the edge of the board (Figure 5).

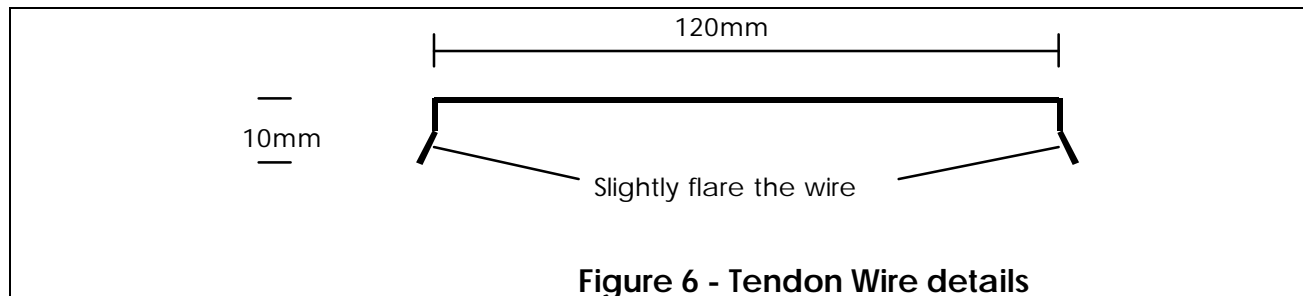


Fit the middle leg structure to the middle servo, the central bar should be parallel to the underside of the pcb.

Switch the electronics off and then on (now without the left hand side feeler touching the pin). The Right and Left servos should now swing an equal amount forwards and backwards. The center legs should lift the body an equal amount on either side. Switch the electronics servos OFF.

Bend the two thicker gauge wires into the shape shown in Figure 6 and fit between the front and rear legs using the pre-drilled holes.

Slip a rubber grommet over the ends of each of the legs to act as feet.



Switch On

Switch Stampbug2 on. The servos should immediately start to move as Stampbug2 tries to walk. If this is not the case switch OFF and check that the feelers are not touching the connector pins.

Once the servos appear to be working satisfactorily, check that the LEDs are flashing.

Check the action of the feelers by touching the ends- if working correctly, pressing a feeler should cause a change in the Stampbug2's walking rhythm and also affect his LED "eyes". If the eyes are a) flashing on and off in unison or b) not flashing at all then this indicates one or other of the feelers is continuously touching one of the feeler contact pins- check and correct before proceeding further.

Programming

The supplied School Stamp2 module has been pre-loaded with the bug2.bs2 programme. Programming is only required if you wish to modify the pre-loaded programme.

Install the Parallax BASIC Stamp2 editor software from the supplied CD-ROM. The CD-ROM also includes a .pdf version of the full BASIC Stamp manual and many application notes demonstrating BASIC Stamp programming.

Connect the supplied programming cable to the rear D-9 socket and to the comms port on your PC.

Ensure the servo switch is set to OFF and the Electronics switch set to ON- this way the StampBug2 may be programmed but doesn't try to walk of the bench at the same time!

Load the Bug2.bs2 programme into the editor screen from the supplied diskette. Run the programme. The programme should download to the bug.

Programme Notes and Final Set-Up

Hopefully, you will find the Bug2.BS2 programme pretty self explanatory (we have tried to include sufficient comments to make it so) but here are a few additional notes:

The listing first details the syntax and connection details for the servo co-processor. By all means take a look at these but if you use the supplied movement routines then you won't have to worry too much about the co-processor syntax.

Under the "Servo connections" section there are 3 constants that may be used to fine tune the servo mid points- while setting up the servo you may have not been able to get the legs into the exact center position due to the orientation of the splines on the servo output shafts. You may fine-tune the center position by adjusting these values.

The Main programme is only 5 lines long- the Bug continues to walk forwards until one of its feelers detects an object in its path.

At this stage the Bug selects one of 3 actions- to back-up, turn left or turn right. For each of these actions you may select the required speed and number of steps to be included in the action.

Each of these actions calls one or more of the main walking subroutines.

The walking subroutines detail how each step should be made and handle all communications with the servo co-processor. For the forwards, backwards, turn-left and turn-right actions you need to supply the speed for the action, the gait (the stride of the right and left legs) and the amount of lift on the center legs. For most circumstances, you can use the default gait and lift and just change the speed of operation.

The walking subroutines regularly call the "finished" routine. Once a command is sent to the co-processor, the "finished " routine checks with the co-processor to see if the action has been completed. This avoids having to include lots of pause statements in your programme.

The programme leaves lots of spare programme space in the Stamp2 for further routines that you may wish to generate yourself. There are also 8 unused i/o pins available for your own applications so you may wish to add ultrasonic object detection or other additional sensors.

Four fixing holes have been provided to allow a daughter board to be fixed above the 4xAA Nicad power pack. Two of these holes are connected to the +9V and 0V electronics power lines.

Batteries

Finally- a word on batteries. We very, very strongly recommend:

**USE ONLY NICADS or NiMH for the servo power pack- other batteries
DO NOT have the required current performance for driving Servos**

Problems

Stampbug2 walks backwards

Check you have the Right and Left servos the correct way round.

Check the feelers are not touching the contact pins- Stampbug2 interprets this as meaning that one of its feelers is being touched and makes him continuously back up.

Stampbug2 only walks for 5 minutes

Stampbug2 will only run successfully on good quality NiCad or NiMH batteries - **dry-cell batteries will not work.**

Stampbug2 walks forwards and suddenly starts to back-up

One of the feeler switches has been activated- check that the feeler wires are central between the switch posts otherwise vibration may cause the switch to momentarily close.

Stampbug2 tends to topple backwards

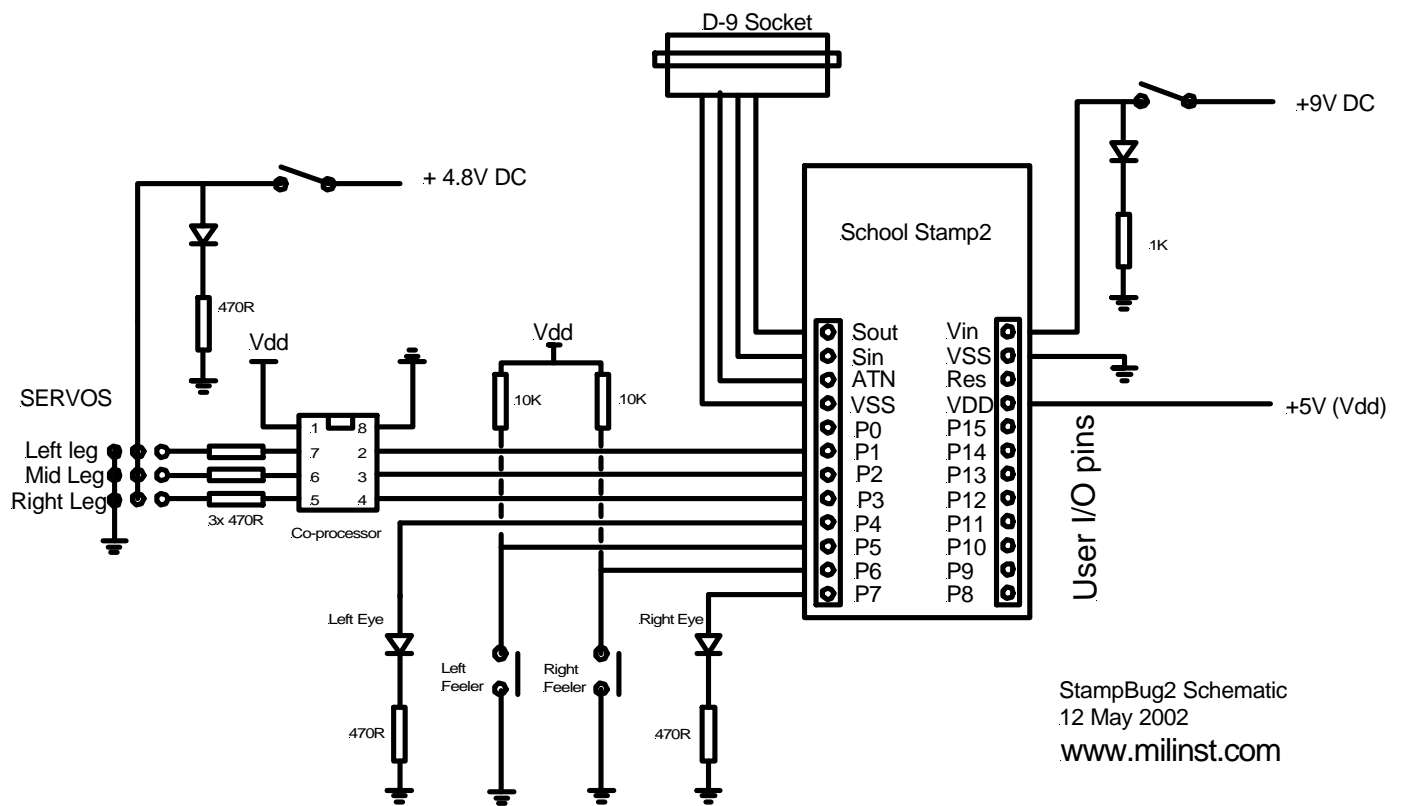
Stability problem caused by one of the following:

Battery pack not far enough forward,

Left and Right leg pairs moving further "forward" than "backwards" during their stroke- recalibrate either physically or change the software constants,

Left and Right leg stroke set too long,

Center leg lift set too high.



StampBug2 Schematic
 12 May 2002
www.milinst.com