Installing your B9 LED Brain Assembly.
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Notice Regarding this Upgrade

Warning!

Although this upgrade has been tested and the

techniques used will not directly cause harm to your

B9 Robot. If you do something wrong,

you can very seriously damage the electronics!

So, Read the instructions

To perform this upgrade you should:

- Have a working understanding of electronics.
- Be familiar with safe handling procedures for electronic components.
- Have basic soldering and electronic assembly skills.
- Be able to follow directions.

Anytime you start messing around with something (particularly something electronic) you accept a certain amount of risk that you may break something. This kit carries with it no guaranty of compatibility to your robots internal custom electronic designs. If you carefully follow these instructions, you'll do fine and everything will work. If this looks like it's above your confidence level please recruit someone locally to install the kit for you!

Please read these instructions completely through before starting.

Introduction

Normally 6 to 12 vdc bulbs have been used in the robots brain assembly. This has been working fine, but there are a few issues with doing that. Heat being the biggest, as some of us have plastic brains they are subject to melting if the lamps generate too much heat. To make matters worse, the clear bubble just traps the heat in. Also, when a bulb burns out, it is quite difficult to disassemble the head to gain access to the brain for repair. This LED board set is made up of 3 PCBs with 32 high intensity LEDs. These lamp types generate very little heat, and do no burn out anywhere near as fast as a typical lamp would. Plus they draw less current, and that means longer battery life.

Inventory

You should have the following in your kit:

- Brain lamp boards with LEDs
- 8 splice connectors.
- 2 Harness Adapters.
- 10 Diodes (1N4001), 3 for top lamps, 7 for fingers (optional)
- Instructions

If any of these items are missing, please email me ASAP so we can get you up and going.

Necessary Parts and Tools

You will need the following parts for this modification:

- Electric Tape or (3) feet of 1/8" Heat shrink tubing.

Tools you will need for this modification:

- Soldering iron and solder.

Installing the Brain lamps

Step One: Wire path.

In order to install the wiring you will need approx a ¼ hole thru the brain and threw the brain cup so the wires can pass down the lifter area. This assembly will greatly differ between hobbyists, so you'll have to examine your assembly to determine the best route.

Key things to be aware of are:

Wires too tight.

Wires rubbing on other assemblies.

Step Two: Mounting the PCBs.

There is really very little room in the brain for any type of brackets to hold the boards. The best and probably the easiest mounting method that I have been able to come up with is a few strips of double sided foam tape available from any hardware store. I recommend the 1/8 thick tape.

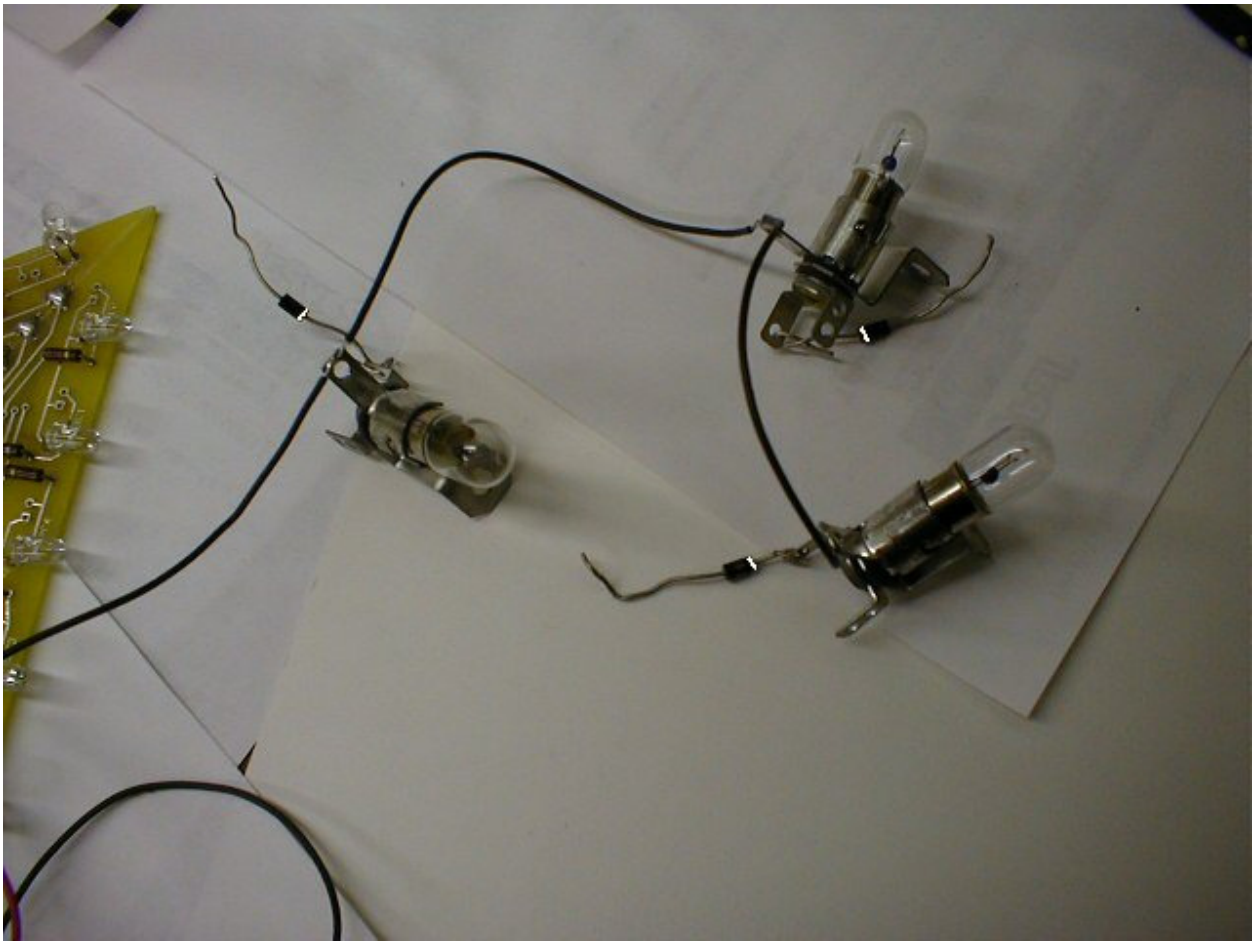
Carefully place the PCB into the brain. The front side has the two smaller boards wired to the large triangle with only one LED on it. These board's are for the eye's and should be placed near them. Attach with small squares of foam tape as well. If you wish you can adjust the height of the boards by doubling up on the foam tape.

NOTE: If you are not using foam tape, take care when mounting these boards. Especially if you have a metal brain. There are wiring traces on the bottom of the boards and if you lay this directly on a metal brain you may short out some traces. The foam tape will insulate the boards from the metal and position the LED height wise so they are 'middle' height of the brain.

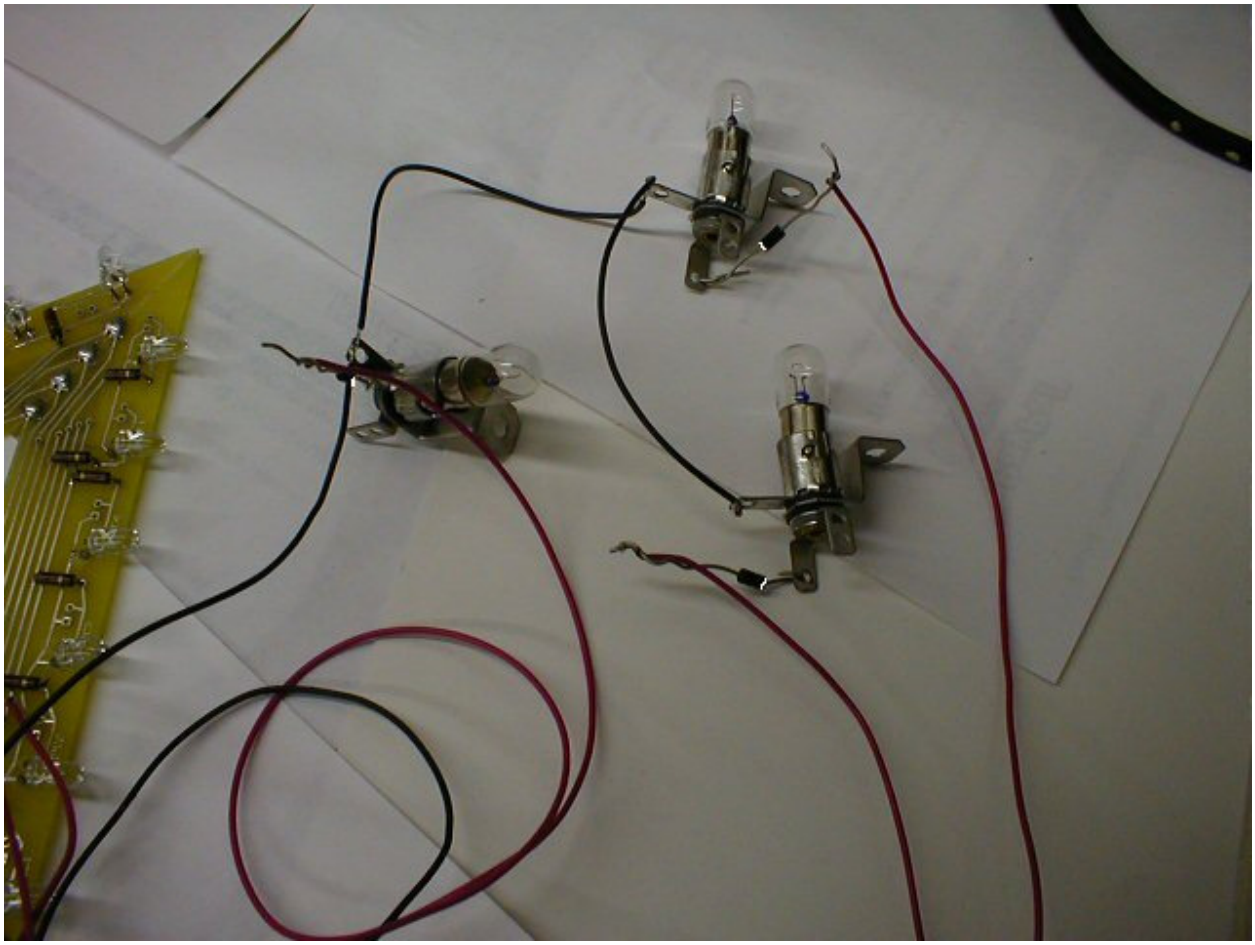
Step Three: Three Top lamps (Optional).

First we need to add a diode to each of the three lamps on the top. These diodes are included with the kit and you should notice a banded stripe on one end of the diode. This end goes toward the lamp when you solder it on. It does not matter which lug you solder it on to, just that the banded end goes pointed TOWARD the lamp. One diode per lamp.

Next with the of short piece of Black wire go from lamp to lamp with this wire. This is the common wire for the three top lamps. It should be going to the side of the bulb that does NOT have the diode attached. Then connect the Black wire from the PCB to the lamps Black, so in the end you have a black wire going from the pcb to lamp1,lamp2,lamp3.



There are three more red wires that we need to connect before we can say we are done with the brain. Connect one of these wires to each bulb on the DIODE side and then shrink wrap the solder joint. The order you connect them is not important, just one wire per bulb diode and you will be fine.



Note: The bulbs need to be 6VDC. The controller supply voltage can be between 12 and 18 volts DC, it will reduce this voltage for the lamps.

These lamps are utilized by the special effects modes, such as the chase mode.

If you do not want to wire these lamps, you can simply cut off the leads that would route to them. You will then need to feed your own power to them.

Step Four: Route Wires to Controller (The big hook up)

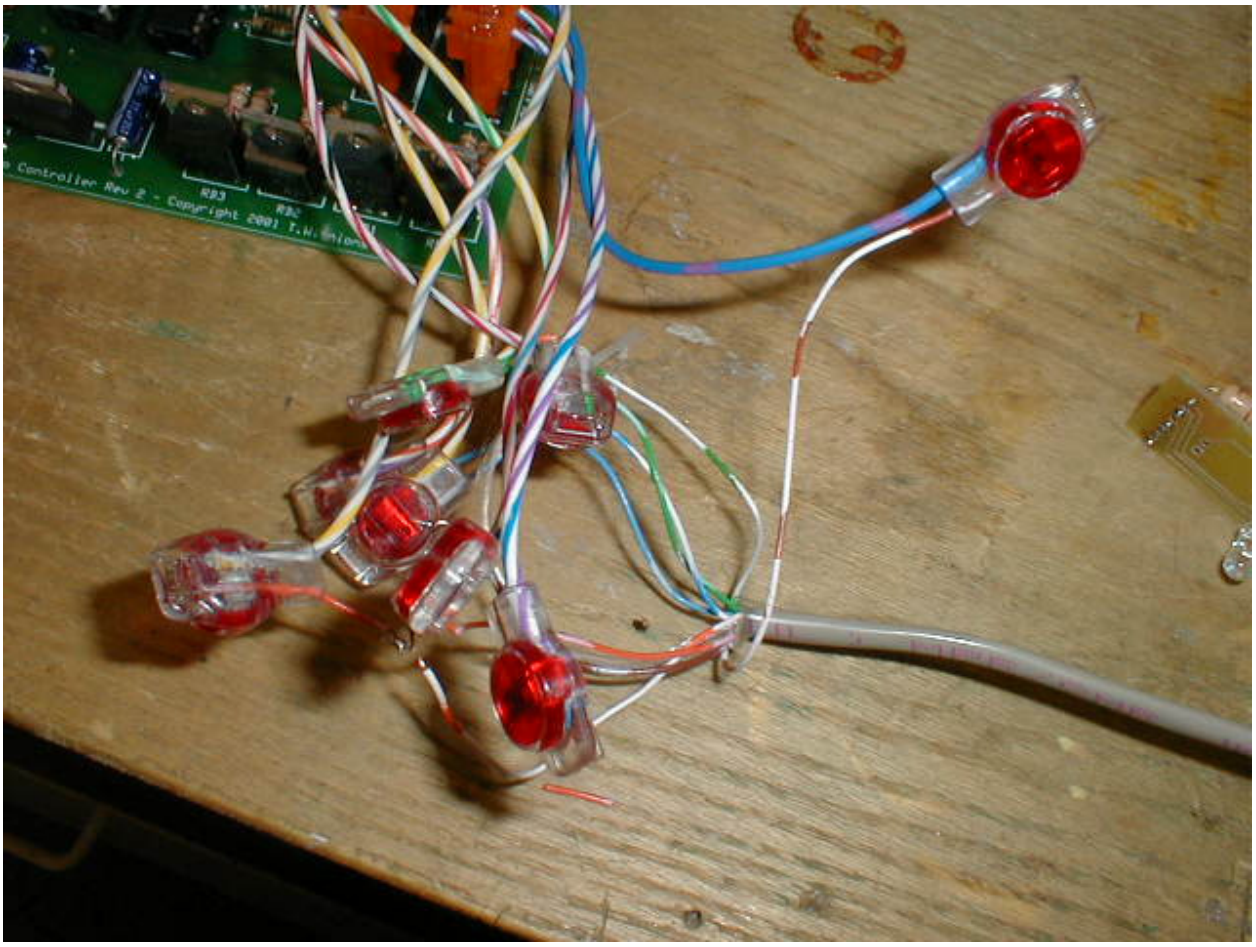
Now that you've got the top lamps connected, we will begin to connect the PCBs to the controller. Because of the difference in wire size it will be necessary to map the wire colors from the harness to ones that are in the Molex connector. If you are using one controller for both the brain and the chest, you will need to splice the brain lamp harness into the chest harness. Provided is 8 Scotchlok splicing connectors. Each splice connector can hold a max of 3 wires. Simply cut the wires going to the chest and insert them both in the Scotchlok, then insert the matching wire from the harness for that color pair into the same Scotchlok. With a pair of pliers squeeze the round red button of the lok firmly until you hear a click. Your wires should all be spliced.

Note: When inserting the wires, make sure that you push them in as far as you can. If you need more Scotchloks (great for the robot!) they are available from Home Depot hardware in the phone wiring section.

Here is the wiring Map:

Harness Wires	Molex/Controller Wire	Connection
White/Blue	Blue Purple Purple	Column 4
Blue/White or BLUE	Blue Red Red	Column 3
White/Green	Blue Purple	Column 2
Green/White or GREEN	Yellow Gray Gray	Column 1

Harness Wires	Molex/Controller Wire	Connection
White/Orange	Black Black	Row 4
Orange/White or ORANGE	Green Yellow Yellow	Row 3
White/Brown	Brown Yellow Yellow	Row 2
Brown/White or BROWN	Orange Orange Purple	Row 1



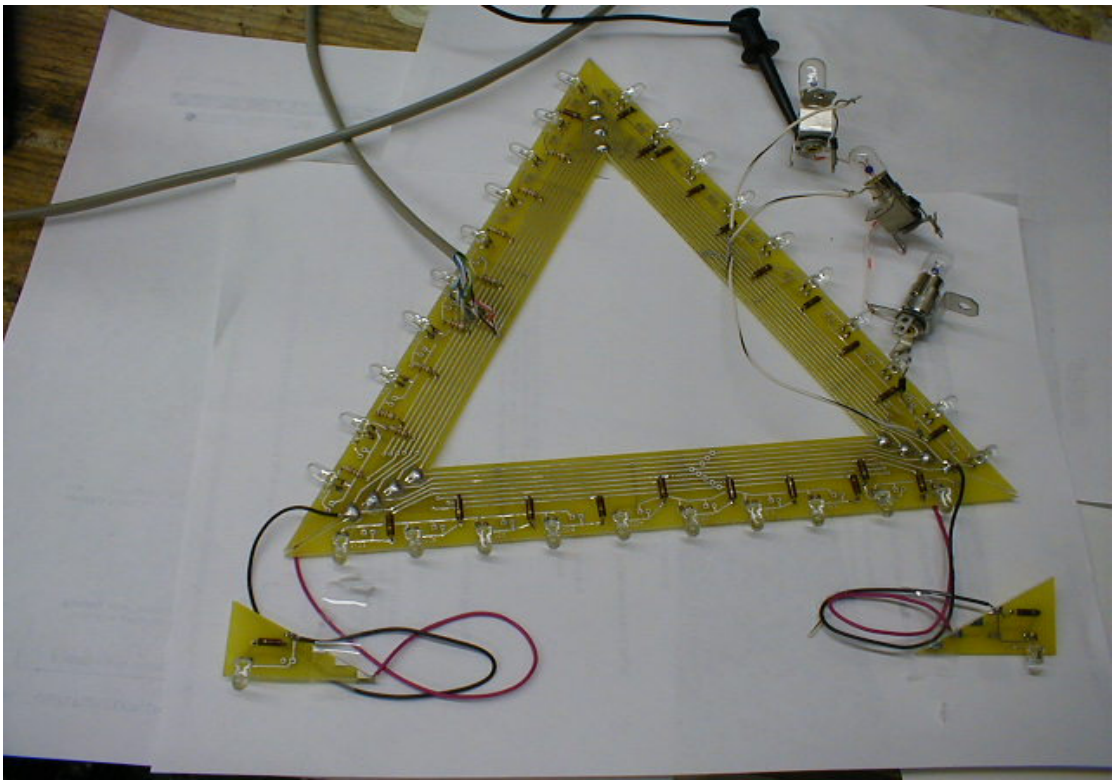
Power for this setup is +12vdc. The Red and Black is your power feed to the controller, Red is +, black is -.

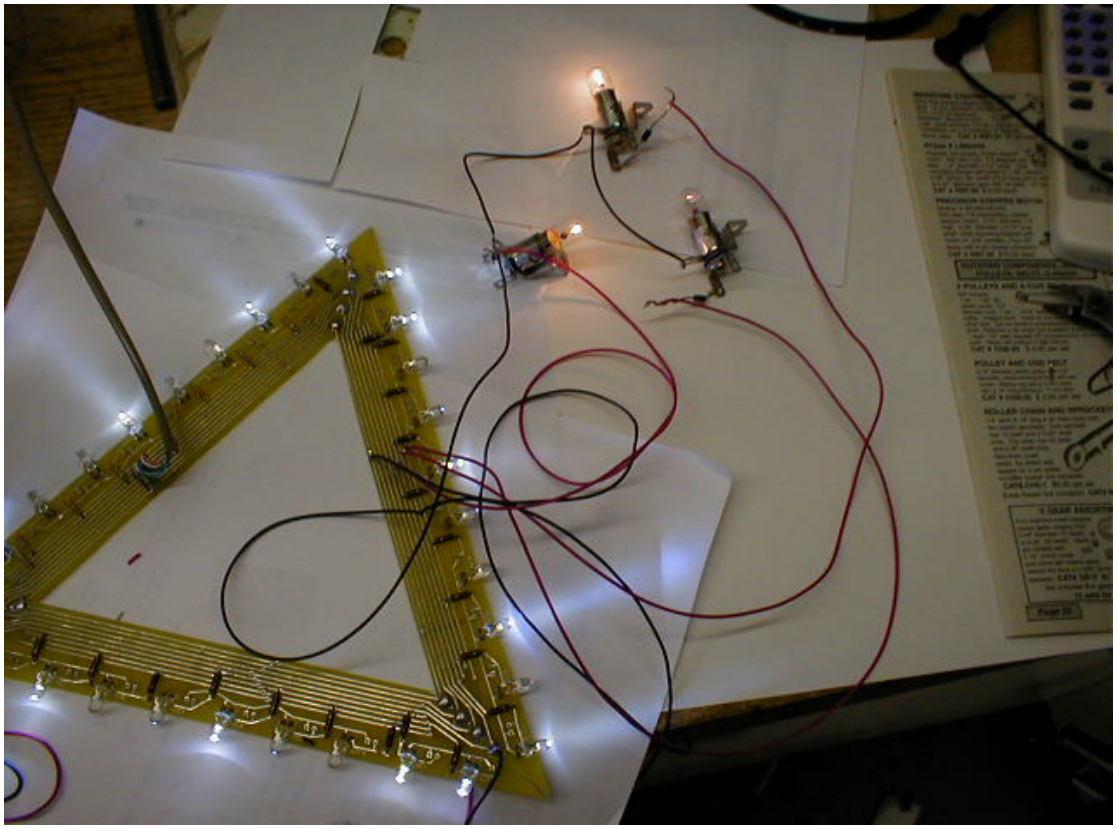
Step Eight: Check your work.

Now it may make perfect sense, but at this point you've done a lot of bending over into your torso to do this wiring, and you're probably pretty anxious to see what the heck this board does in person. But, from years of experience, I highly recommend putting this aside for a day, re-reading the instructions, and then with a fresh mind the next day. CHECK YOUR WORK!

You may be confident that you've wired it up correctly, but if you didn't your going to fry the microprocessor and you're going to have to send it back to me to get fixed. So, relax, take your time, and you'll have no problems.

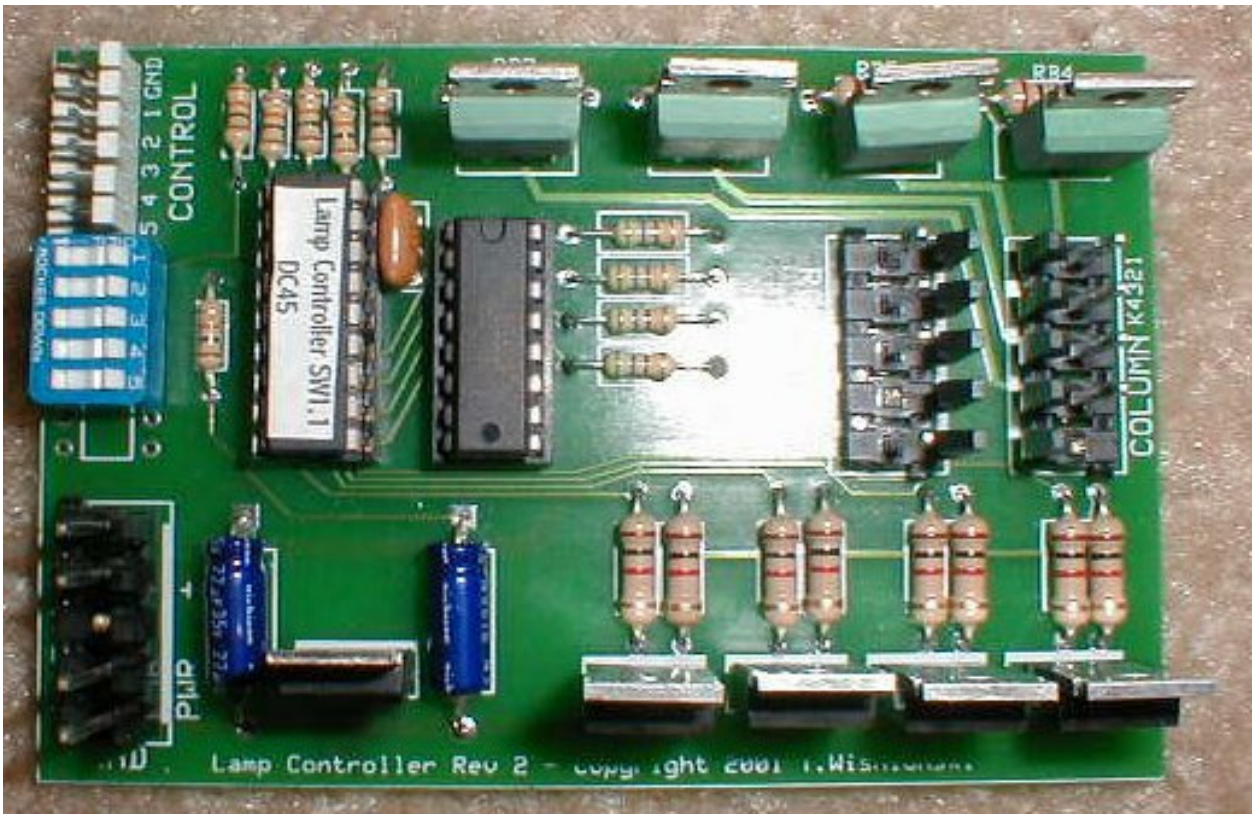
At this time**, DO NOT plug the harnesses into the controller**; just check your work.





Step Nine: Final Hookup, Plugging in the harnesses.

Ok, your wiring checks out, lets get the harnesses plugged in.



Before you power the system up, make sure ALL switches are in the OFF position, and the robots main power is off.

Now plug in the Column and row connectors that you make up. Take care to insure that you align the connections correctly.

And finally the Power plug, that's the connector on the bottom left. Once more, carefully align it, and snap it down.

Step Ten: Mounting the Controller.

I'm going to leave that one up to you; everyone seems to have different designs for the inside. Just keep the controller from contacting anything metal. Anything touching the circuit board or the transistor tabs can damage the board. When I mount mine, I'm going to make some mini rails so the board can slide into. Keep your wiring neat; invest in some cable ties! And you can even tack the harness to the torso with a glob of silicon or the glue gun. There is also 4 screw holes to mount with, but do make sure that it does not short out on anything metal.

Step Eleven: The Show.

Then power it up. If all is correct you should have some cool flashing lights.

Settings.

There are tons of other ideas I'm sure. All you have to do is ground the correct pin. Here's the pin outs and switch equilivents:

Pin 5 = SW5 Power Down/Up effect (Flip it, and the lights slowly blink out, release it, and they slowly come back to normal cycle)

Pin 4 = SW4 Overall Speed of Lamp Cycles, Controls all the modes.

Pin 3 =SW3 Scanner (All 12 chest lamps, in 3 sets of 3 bulbs, circling with only 3 lit at one time, or if alternate is on SW1, 3 bulbs chase in 3 circles, lights stay lit) This one is kind of hard to describe, but great for 'Processing Soil Samples'.

Pin 2 = SW2 Chase Light Effect (1 BRIGHT bulb in a chase on the 12 chest lights.) "Robot Scanning/Processing".

Pin 1 = SW1 Alternate Scan Effect.

GND = Ground

Note: Power down effect requires release of Scanner or Chase effects.

Basically the switches are there for testing, and to configure things that you may not want to change, like the speed. If you like the fast over the slow effects, just leave it set to fast.

BRAIN MODE

If switches 1 **and** 3 are on upon **INITIAL** controller power up, the CPU will be put into Brain Display mode. What that will mean is two lamps, (what was the Red and Green large chest lights) will now be the robots eyes, and the rest will flash. You will have full control over speed and be able to change that dynamically so you can make the brain go faster when he's talking, etc. You will also be able to initiate a power down brain effect, with the power down switch.

In this mode, no other switches will have any other effect (Only speed and power down). Once in brain mode, the only way out is to reset the switches to normal configuration and power down.

Connecting the Fingers into the controllers Matrix (Optional).

Do this after you have wired and tested the brain light pcb's.

Note: Splicing connectors are not included for the fingers because depending on how you hook the fingers into the matrix you may need more connectors, and rather than raise the price of the kit I'll leave it up to you on how you make the splices. I recommend the ScotchLoks for this (Home Depot, 25 to a box). You can simply cut into the cable running up the neck at a convenient spot and splice into the lines there.

The lamp controller is quite capable of controlling the 7 finger lights on the robot. In fact, by letting the controller do the 'flashing' you can create some very interesting lighting effects. The first thing you must do is make a decision on what types of lighting you are going to use in your fingers. It is possible to use an LED inserted into a small clear globe to make it look like a bulb, or you can simply use a regular 6 volt lamp (non-flashing).

No matter what type of light you choose, you cannot have any common grounds to the lamps. Every lamp must have two connections to it, later on we will common some lamps together, but for now you must have two wires running up each finger.

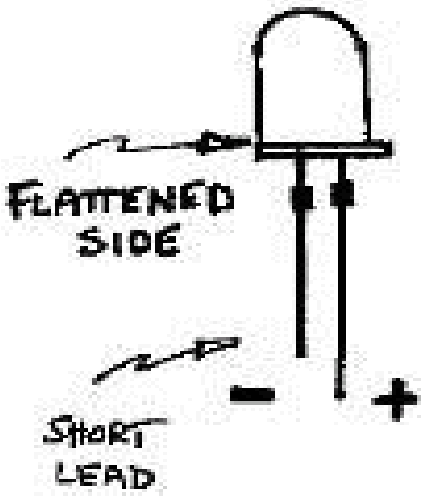
BULB LAMP Configuration

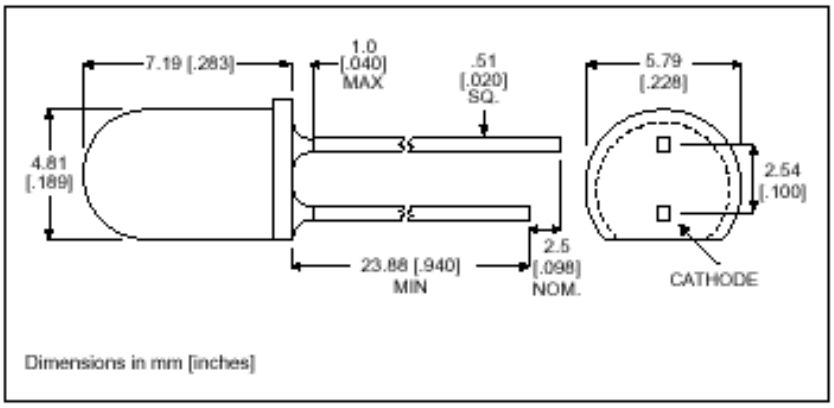
To configure your bulbs so the controller can run them, we need to add a diode to each lamp. These diodes can be purchased at Radio Shack; they are 1N4001 type diodes and are very common. If you cannot locate them locally contact me and I can set you up with some. You will need seven diodes, one for each finger. Each diode should be soldered to the wires running to the bulb, one diode per bulb. ON the diode you will see a banded end. This banded end MUST be pointed toward the bulb, if you put it in the other way the lamp will not light. It does not matter which of the two wires on the bulb you choose, only that you only put one diode per bulb.

LED LAMP Configuration

LEDs have a polarity, and are basically diodes that can emit light. So, if you're using LEDs you will NOT need any diodes, but polarity is important. The Long lead on the diode is POSITIVE, and the short lead is NEGATIVE. If for some reason both the leads are the same length you can still determine the LEDs polarity by looking at the LED. There is a small flange on the bottom and on this flange one side should have a flat spot. This flat spot is the Negative side. Now LEDs run at a lower voltage that the bulbs, so we will have to get some resistors to allow for this. A standard LED pulling 20 ma in this type of matrix circuit will need a 150 ohm resistor on each LED. These can be purchased at radio shack as well. If you cannot locate them locally contact me and I can set you up with some. Solder one resistor to the Positive side of each LED.

When installing Finger LED wires that run up the rods, make a note on the wires as to which wire of the pair is positive. A bit of masking tape will do.





The Connection

Ok, you've made your decision on what type of lighting you're using, and you have the wires run (diodes or resistors installed) and installed in each finger.

Now you need to connect it into the controllers systems. You have the harness running from the brain down the neck and have tested the brain lighting and it works fine. You're now ready to tie the fingers into the controller. But we have a few options here on how we are going to connect the fingers into the matrix. No matter what you do, you will get a good random flash sequence on the fingers, but if we take into consideration where we put the fingers in the matrix we can give the 'viewer' a completely different visual effect even though it's coming off the same controller.

For our discussion, let's number the fingers. Starting from the left, F1,F2,F3,F4,F5,F6,F7. That gives us Finger 4 (F4) as the dead center finger

Lets make it light the lamps in this sequence

F4,F3,F5,F2,F6,F1,F7 Then it would wait a bit and start over.

This is easy, the controller lights the lamps based upon a lighting matrix. Depending on how we connect the lamps into the matrix we can vary the effect. Scan mode lights Lamp1, then Lamp 2, then Lamp 3 and so on till Lamp 12. The Last row is 'off' in scan mode. SO we have 12 positions to connect the finger to, and depending on how we connect them we have different effects.

Column / Row	1 **Yellow/Gray**	2 **Blue/Purple**	3 **Red/Blue**	4 **Purple/Blue**
1 **Orange/Purple**	Finger 4 Lights 1st	Finger 3 Lights 2nd	Finger 5 Lights 3rd	Finger 2 Lights 4th
2 **Brown/Yellow**	Finger 6 Lights 5th	Finger 1 Lights 6th	Finger 7 Lights 7th	open Lights 8th
3 **Yellow/Green**	open Lights 9th	open Lights 10th	Open Lights 11th	open Lights 12th
4 **Black/black**	No Fingers	No Fingers	No Fingers	No Fingers

So what does this mean?

If you look at the controller, the two lamp connectors are marked Row and column. That's how they are connected up. The matrix above also shows the wire colors that you need to tap into. So, let's take the above matrix and put it to work.

Step one, Fingers 4,3,5,2 are all on the same ROW. Gather those four wires from the bulbs. Row wires DO NOT have the diode on them. Connect all 4 of these bulbs together and run one wire to the ROW 1 connection. Which is Orange/Purple on the chart.

Lets do the same for Row 2. Gather Fingers 6,1, and 7 and tie them together, and then run one wire to Row 2 connection which is Brown/Yellow. Again this would be the wires without the diodes, or if using LEDs the negative sides of the diodes.

Great, that's it for the Row Wiring, on to columns. From the matrix above we see that Finger 4 and 6 share the same column, so gather those two wires and connect them together. If you did the rows correctly, these two wires should

have diodes on them, or if using LEDs should be the positive sides of the two LEDs. Connect these two wires together and run a connection to Column 1 which is Yellow/Gray.

Now on to Column 2. From the matrix above we see that Finger 3 and 1 share the same column, so gather those two wires and connect them together. If you did the rows correctly, these two wires should have diodes on them, or if using LEDs should be the positive sides of the two LEDs. Connect these two wires together and run a connection to Column 2 which is Blue/Purple.

Column 3. From the matrix above we see that Finger 5 and 7 share the same column, so gather those two wires and connect them together. If you did the rows correctly, these two wires should have diodes on them, or if using LEDs should be the positive sides of the two LEDs. Connect these two wires together and run a connection to Column 3 which is Red/Blue.

Last one, Column 4. From the matrix above we see that Finger 2 is all alone. If you did the rows correctly, this wire should have a diode on it, or if using LEDs should be the positive side. Connect this wire Column 4 which is Purple/Blue.

Now you may be saying, what about those other row/columns that I say no finger on. Well you can use any open spot except for Row 4. That row is not used in 'effects/scan' modes, only in normal flash modes. Basically, anywhere that you see 'open' you can attach a bulb/led. The controller fires the bulbs off in 'lamp order' that I have labeled on the matrix in scan mode.

Here are some additional configurations

Another great effect would be F1,F3,F5,F7,F2,F4,F6 Then it would wait a bit and start over.

Column / Row	1 **Yellow/Gray** Green/White	2 **Blue/Purple** White/Green	3 **Red/Blue** Blue/White	4 **Purple/Blue** White/Blue
1 **Orange/Purple** Brown/White	Finger 1 Lights 1st	Finger 3 Lights 2nd	Finger 5 Lights 3rd	Finger 7 Lights 4th
2 **Brown/Yellow** White/Brown	Finger 2 Lights 5th	Finger 4 Lights 6th	Finger 6 Lights 7th	open Lights 8th
3 **Yellow/Green** Orange/White	open Lights 9th	open Lights 10th	open Lights 11th	open Lights 12th
4 **Black/black** White/Orange	No Fingers	No Fingers	No Fingers	No Fingers

Alternate 2

How about F2, wait, F3, wait, F4, wait, F5, wait, F6 wait and then F7+F1(same time), Then it would wait a bit and start over. (Yes, you can connect two bulbs/LEDs to the same point and they will light at the same time.

Column / Row	1 **Yellow/Gray** Green/White	2 **Blue/Purple** White/Green	3 **Red/Blue** Blue/White	4 **Purple/Blue** White/Blue
1 **Orange/Purple** Brown/White	Finger 2 Lights 1st	open Lights 2nd	Finger 3 Lights 3rd	open Lights 4th
2 **Brown/Yellow** White/Brown	Finger 4 Lights 5th	open Lights 6th	Finger 5 Lights 7th	open Lights 8th
3 **Yellow/Green** Orange/White	Finger 6 Lights 9th	open Lights 10th	Fingers 7+1 Lights 11th	open Lights 12th
4 **Black/black** White/Orange	No Fingers	No Fingers	No Fingers	No Fingers

Alternate 3

F1,F2,F3,F4,F5,F5,F7 Then it would wait a bit and start over.

Column / Row	1 **Yellow/Gray** Green/White	2 **Blue/Purple** White/Green	3 **Red/Blue** Blue/White	4 **Purple/Blue** White/Blue
1 **Orange/Purple** Brown/White	Finger 1 Lights 1st	Finger 2 Lights 2nd	Finger 3 Lights 3rd	Finger 4 Lights 4th
2 **Brown/Yellow** White/Brown	Finger 5 Lights 5th	Finger 6 Lights 6th	Finger 7 Lights 7th	open Lights 8th
3 **Yellow/Green** Orange/White	open Lights 9th	open Lights 10th	open Lights 11th	open Lights 12th
4 **Black/black** White/Orange	No Fingers	No Fingers	No Fingers	No Fingers

Blank Template

Here's a blank template to mess around with. Just write down in the squares what finger number you want there and when you're done, you will have your own effect. Any squares you omit will cause a 'wait' during the sequencing of the lamps in chase modes. These opens/waits will still flash regularly in normal mode. Wait/opens give the effect of a different speed/effect to the viewer.

Column / Row	1 **Yellow/Gray** Green/White	2 **Blue/Purple** White/Green	3 **Red/Blue** Blue/White	4 **Purple/Blue** White/Blue
1 **Orange/Purple** Brown/White	Lights 1st	Lights 2nd	Lights 3rd	Lights 4th
2 **Brown/Yellow** White/Brown	Lights 5th	Lights 6th	Lights 7th	Lights 8th
3 **Yellow/Green** Orange/White	Lights 9th	Lights 10th	Lights 11th	Lights 12th
4 **Black/black** White/Orange	No Fingers	No Fingers	No Fingers	No Fingers

One final note:

You may have noticed that the Row/Column squares have two designations for the wire colors. This was necessary because in order to find a wire thin enough to go threw the brain and still be able to flex I had to use a different type of wire. This wire had a different color coding than the wire I already had. So if you're tying in at the controller, you can use the colored headings, if you're splicing into the cable use the bold headings.