

Installing your B9 Light Controller
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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

Before you begin to install the controller, you **MUST** have all the lamps mounted in your robot. So if you have not mounted you're lamp sockets, put this manual away and get cutting. I'm not going to get into how to drill your torso and mount your lamps, there are tons of different ways to do that, and the B9 Builders club can help you with suggestions. But you will need to have them mounted.

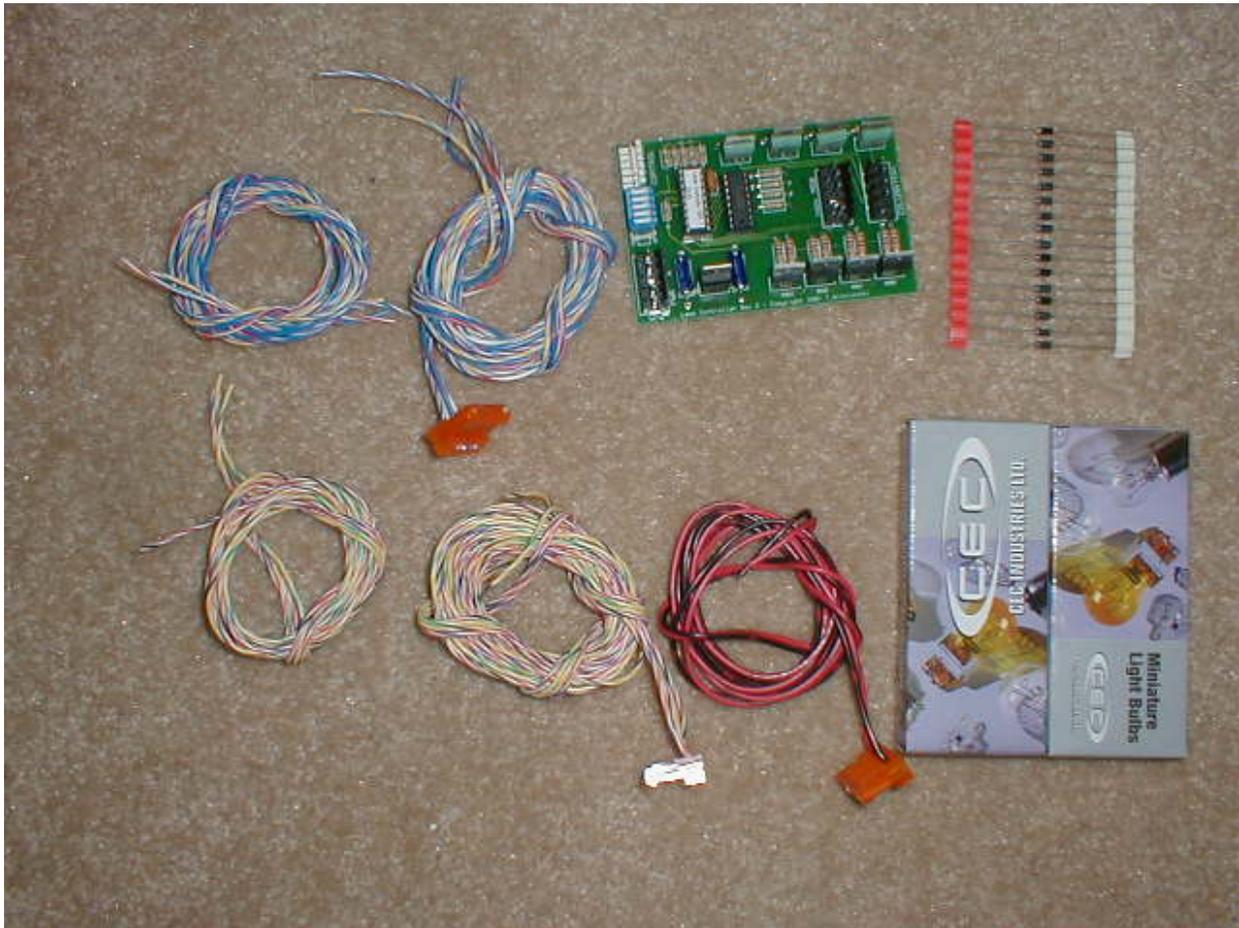
Finally before we get started, grab your favorite beverage, maybe something to snack on, and find a quiet place to read this manual so you fully understand what to do before you start tinkering around with your precious Labor of Love, your B9!

Inventory

You should have the following in your kit:

- Power Harness
- Column Harness
- Column Hookup wire
- Row Harness
- Row Hookup wire
- 2 packages of #47 bulbs
- 16 Diodes
- 1 Lamp Controller PCB Assembled
- 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.

Light Bulb Change

Step One: Remove the Old bulbs and wiring (Upgrades only, Fresh Installs skip to Step One B)

If this is an upgrade to your existing lighting system, you will need to remove all the flasher bulbs that were in the 12 chest lights, the two large lens lights and the programming bay lights. I recommend that you replace them with #47 bulbs. They are cheap, readily available, and draw less current than the flashers. This will result in a longer battery life for you robot if you're intending on making it mobile.

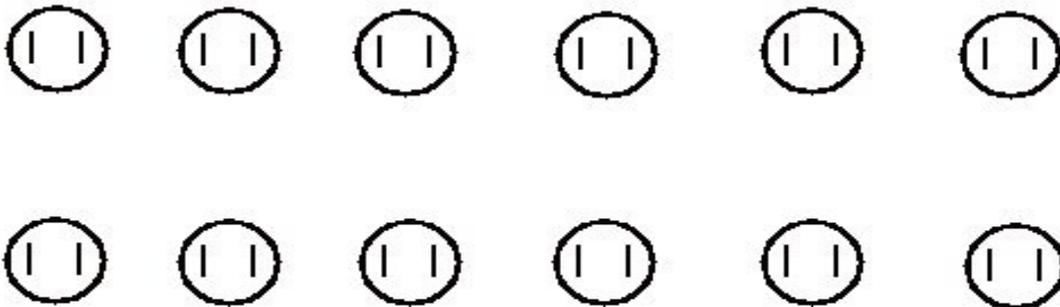
Sad to say, most of the lamp wiring that you have done to make the flasher bulbs work in your robot will not work with this controller. While there is probably a few runs that you may be able to salvage, I highly recommend just removing all the wiring and starting fresh. I'm supplying you with some wire so that you can follow the colors with the manual. Also, make sure you align your sockets as shown in the picture below; it will save you a bunch of time if everything matches the instructions.

Step One-B: Remove the Flasher bulbs and wiring (Fresh Installs only)

This is a simple one; install all the #47 bulbs (Provided) into the sockets. Naturally mount the sockets in your torso.

Step One-C: Align the sockets

Note: For clarity and to insure that you don't make a wiring error. Align all the **sockets in the torso** so that they are positioned the same. I recommend that you align them so all the lamp lugs are in a horizontal row. **All wiring is shown from INSIDE the torso. This is what the 12 small chest lights inside would look like properly aligned from inside.**



Lamp Matrix

All modern display signs, pinball machines and dot matrix displays function on a matrix. This method of wiring reduces the number of wires to control the lamps. As an example, in order to control the 12 small chest lights you would need 12 wires plus a ground to control them separately. But if you hook them up in a matrix, you can control up to 16 lamps. This includes the two large chest lights and the programming bay lamp with just 8 main control wires.

A lamp matrix uses a computer processor to 'pulse' the lamps very quickly, one at a time. To the naked eye it appears that many lamps are lit. But in reality only one bulb is lit. With the lamp controller, in order to keep the programming simple; I turn pulse each 'Row' of lamps very fast with the programming in the microprocessor.

By applying power to the columns and grounding a row, I can turn the lamp on and off at various speeds. As a result, I can even control the brightness.

This is the lamp-wiring matrix that we will be using, don't worry, it will make sense later.

Column \ Row	1 Yellow/Gray	2 Blue/Purple	3 Red/Blue	4 Purple/Blue
1 Orange/Purple	Chest Light 1	Chest Light 2	Chest Light 3	Chest Light 4
2 Brown/Yellow	Chest Light 5	Chest Light 6	Chest Light 7	Chest Light 8
3 Yellow/Green	Chest Light 9	Chest Light 10	Chest Light 11	Chest Light 12
4 Black/Black	Large Chest Red	Large Chest Green	Programming Bay 1	Spare

Step Two: Wiring the lamp matrix.

The magic behind a lighting matrix is a diode. This little device acts to isolate the lamps in the matrix so the processor can control them. We must solder one diode to EACH lamp.

Solder the BANDED side of a diode to the LEFT side of each lamp socket as looking from the inside of the torso. Solder it as show, keeping the diode about $\frac{1}{4}$ away from the lamp socket.

Connect the diode as shown, and then solder it.



Trim the Diode so that it looks like this. You can use heat shrink tubing when you attach the wire to insulate the connection.



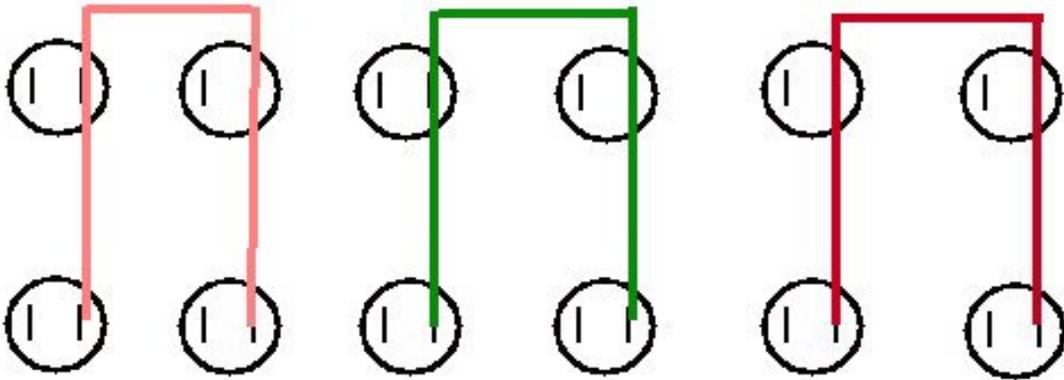
Step Three: Wire the ROW Commons

Using the chart below and the wire supplied. Wire your lamps as shown then join that loop to the matching color from the controller harness. Shown from the inside of torso.

Orange=Green/Yellow

Green= Yellow/Purple

Red=Orange/Purple



Step Four: Wire the Column Commons.

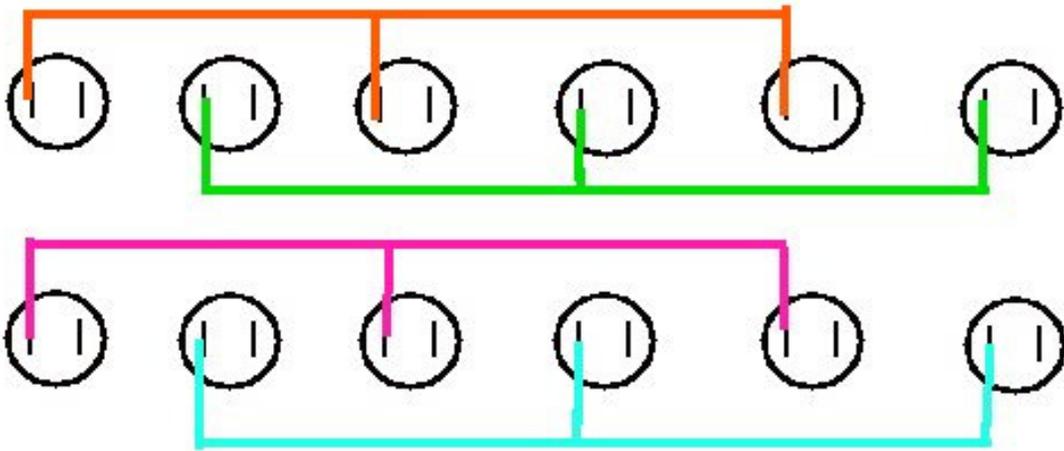
Do the same again, except this time, you will be CONNECTING TO THE DIODES that you previously installed. Again, tape or heat shrink your solder joints on the diodes. Be careful that you do not break a diode off. Shown from inside of torso.

Orange=Red/Blue

Green=Gray/Yellow

Blue=Solid Blue/Purple

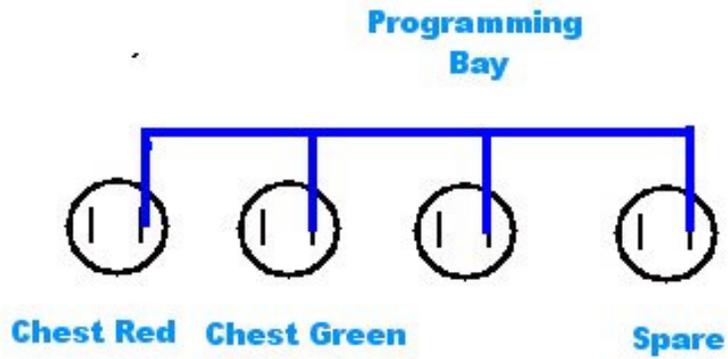
Red=Purple/Blue



Step Five: Wire the Large Chest Light and Programming Bay (Row)

Using the chart below and the wire supplied. Wire your lamps as shown then join that loop to the matching color from the controller harness. Shown from inside of torso.

Blue=Black/Black



Step Six: Wire the Large Chest Light and Programming Bay (Column)

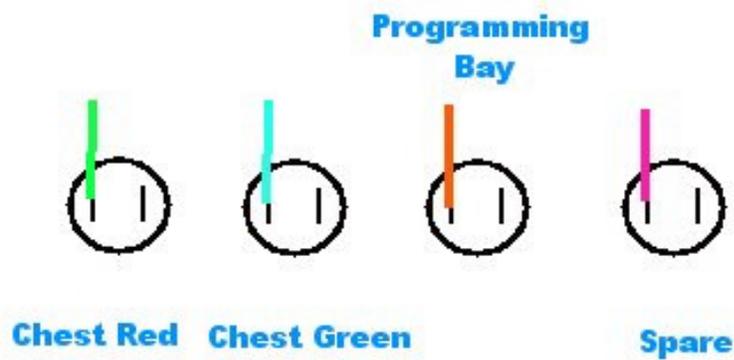
Do the same again, except this time; you will be CONNECTION TO THE DIODES that you previously installed. Again, tape or heat shrink your solder joints on the diodes. Be careful that you do not break a diode off. You can simply join these colors to the same colors of the 12 small chest lights. This will keep your wiring junctions in one place. Shown from inside of torso.

Orange=Red/Blue

Green=Gray/Yellow

Blue=Solid Blue/Purple

Red=Purple/Blue



Step Seven: You're in the home stretch now. Connecting the Power.

This is a simple one, the Solid Red/Black wire is your + and the Solid Black/Red is the -.

Your supply voltage can be between 12 and 18 volts DC. Do NOT POWER THE SYSTEM UP YET!

Step Eight: Check your work.

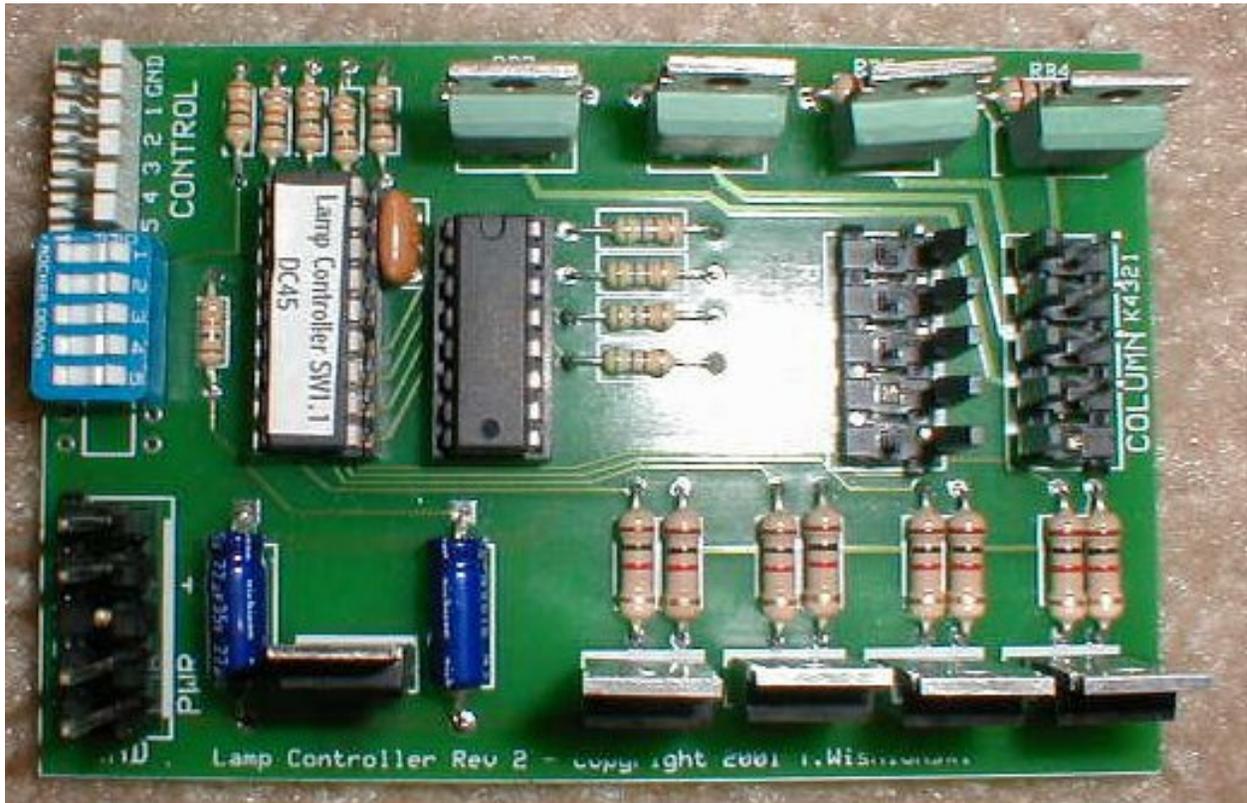
Now it may make perfect sense, but at this point you've done a lot of bending over into your torso to do this wiring, and you're probably pretty anxious to see what the heck this board does in person. But, from years of experience, I highly recommend putting this aside for a day, re-reading the instructions,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

The connectors are keyed so you should not be able to put the connectors in wrong. There are three main connectors you will be plugging in, PWR for power, Column for Column controls and Row for Row control. Note, each connector female end has one more hole than there are pins. This was a costing factor, seems the 5 pin connectors were double the cost of a six pin. The connectors have both the KEY and the extra pin blocked. The Extra hole will just hang off the end when plugged in.

Start with the column plug, it's the one with the solid Blue/Purple wire in the collection. Carefully align it, and snap it down.

Next, the Row plug, it's the one with the Red/Black striped wire in the collection. Again, carefully align it, and snap it down.

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

All systems go?

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.

Step Eleven: The Show.

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

What's Next?

The whole goal of this for me was to eventually control some of the robots system with a computer. The computer will communicate to several systems processors. This technique is used frequently in today's modern control systems with one central monitoring and control point rather than having one computer do everything. Anyway this is the first module I've designed, and if you remember there is a smaller connector on the light controller board marked control. This connector simply has the same function as the little switches. One pin is ground, and you simply ground the correct pin for that effect. By using these pins you can cause certain effects to happen under digital control (computer), remote control or physical inputs.

Some examples are:

- If we ever find the correct 'affordable' pushbuttons for the robot, pushing a button can cause different lighting effects!
- Since the power pack is held in with simple audio plugs, you could wire it so that when the power pack is pulled, the power down effect pin becomes grounded and caused the power down effect to be played. When the pack is returned, the system will automatically play the power up effect!

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 equivalents:

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.

New Feature 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.

That's it, enjoy you new light show.