Alan's Electronic Projects

Button Code Kit

Single Button Code Entry System

Assembly Instructions and User Guide

Rev 1.0
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www.alan-parekh.com

Revision History

Date	Revision	Author(s)	Description
Dec 15, 2009	*1.0*	*Alan Parekh*	*Document creation.*

1. Introduction

Thank you for purchasing a Button Code project kit. This document will walk you through the assembly and usage of the kit. If you have any questions please don't hesitate to send us an email at support@alan-parekh.com.

Hi resolution pictures of the images in this guide along with an assembly video can be found at http://alan-parekh.com/kits/button-code-kit.

1.1 Concept of Operation

The Button Code project is microcontroller based, what this means is there is a small self contained computer that controls the unit. The Button Code controller has a user programmed code in memory and waits for the same code to be entered in using the button input. The user enters a 4 digit code by tapping the single button, feedback is provided by a single LED which can be mounted in or near the input button. When the correct code has been entered a built-in relay activates. The relay operation style is also user programmable. This relay can be connected to anything from a garage door to a lighting circuit. The button and indication LED are connected to a convenient 2 wire system for easy wiring.

1.2 Device Features

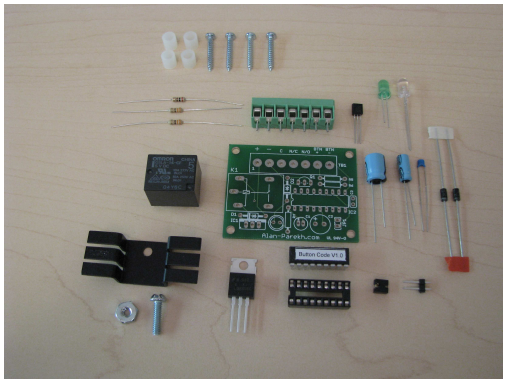
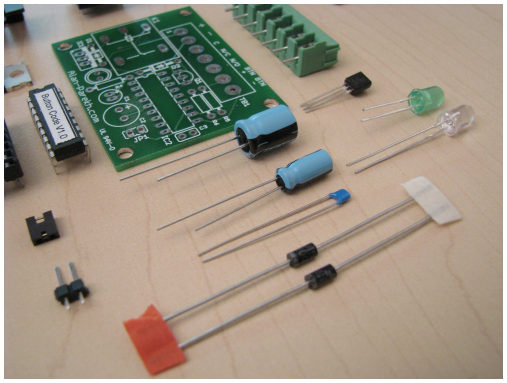
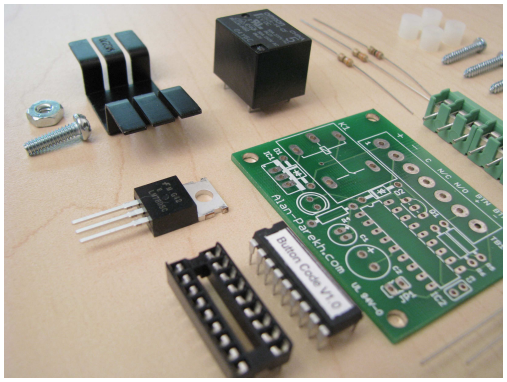
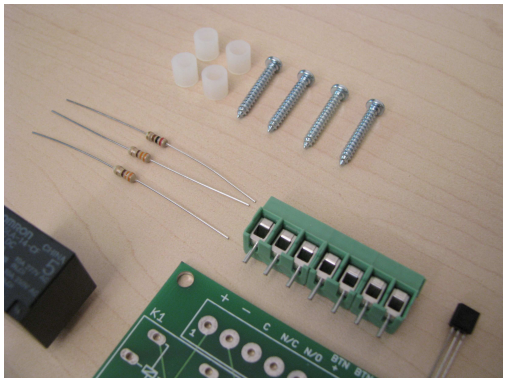
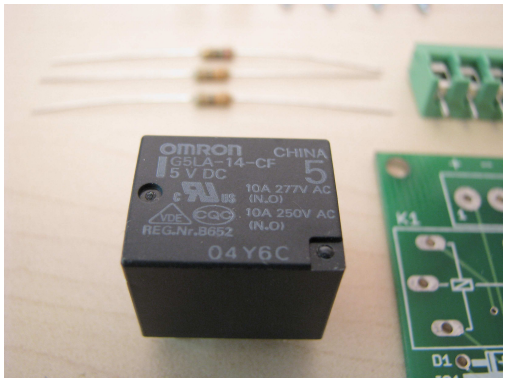
- Unique single button secure code entry.
- Vandalism of the button will be inexpensive compared to replacing a conventional keypad entry system.
- Flexibility due to the form-c dry relay contact that is used.
- Quick and simple method of changing the built in security code and activation style.
- Low cost security option.
- Small and compact.

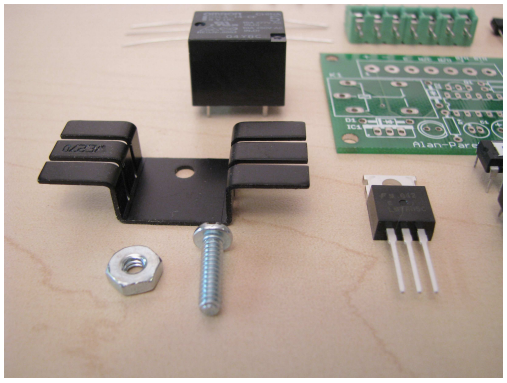
2. Kit Assembly

Many of the components in this kit are sensitive to static discharge. Before you begin it is important that you remove any static electricity from your body by grounding yourself. This is simply done by touching any grounded metal that is by the area you are going to be assembling the board in. A bare metal computer power supply is an example of something that might be close at hand and provides a good ground point. You must ground yourself again if you walk away and return to the location where you are assembling your control board. An antistatic wrist strap is a good investment if building many kits such as this one is in your future.

2.1 Unpack the Parts

Before we begin putting everything together make sure that your kit came with everything needed. Below are some pictures of all the items that should be in the kit. Please note that some items might be in antistatic or crush protective casings.



2.2 Control Board Assembly

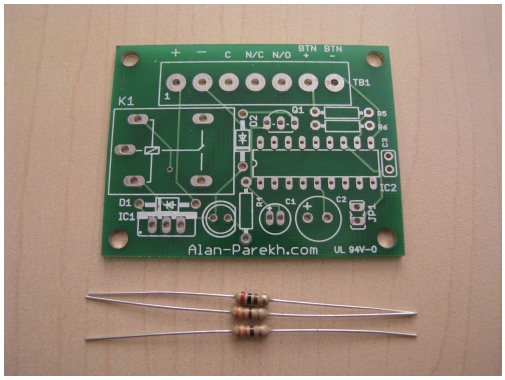
To assemble the Button Code control board you will need a soldering iron, solder, wire cutters, pliers and a small flat blade screw driver.

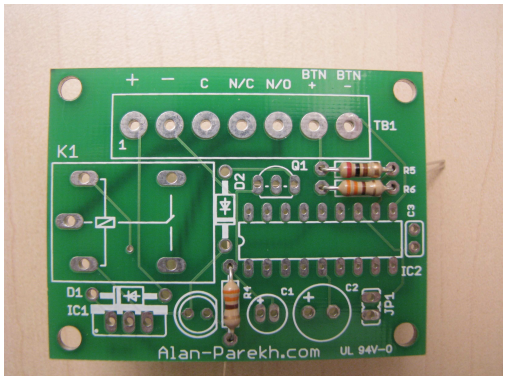
Many of the components look similar but if installed in incorrect location can cause damage to the control board. It is very important to ensure that the components are installed in the correct position. We are going to start by installing the shortest components and progress to the larger ones. When the instructions say to "install" this means to place the leads through the required holes allowing the component to sit close to the board, soldering the component in place and trimming the leads. If you have never soldered before it is recommended that some online tutorials are reviewed prior to put this kit together.

1. **Install all resistors.** Resistors positions are marked with an "R" followed by a number. Resistors are non-polarized, this means that they can be install in either direction. It is very important that the correct value of resistors be used in the correct location!

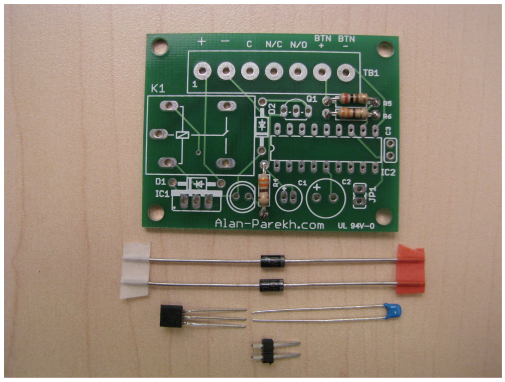
   There are two types of resistors used on the control board, 200 ohms and 330 ohms. The value of the resistor is represented by colored bands on the resistor.
   200 ohms is RED, BLACK, BROWN, GOLD.
   330 ohms is ORANGE, ORANGE, BROWN, GOLD.

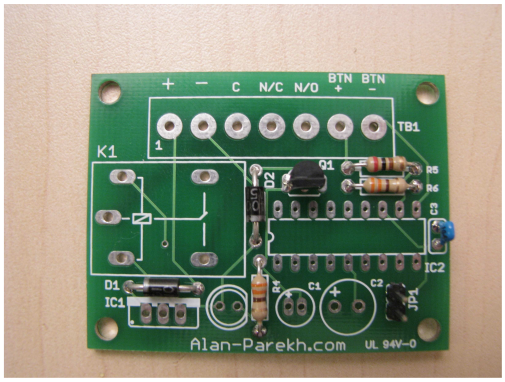
   R4: 330 ohms
   R5: 200 ohms
   R6: 330 ohms



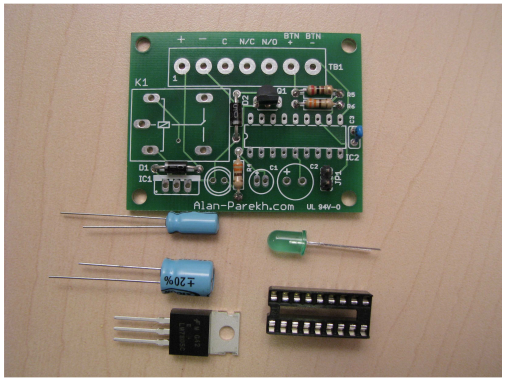


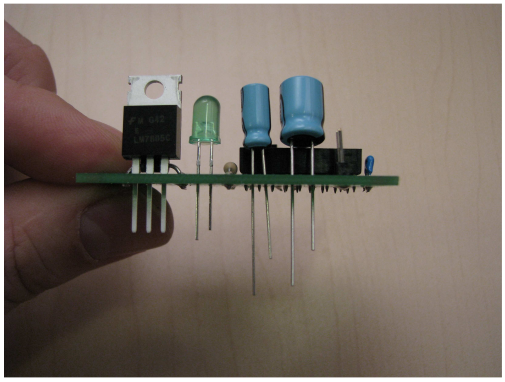
2. **Install the diodes, transistor, small capacitor and pin header.**
   - There are two diodes to install and they are polarity sensitive. These components are listed as D1 and D2 on the board. The white bar on one end of the diode represents negative, this marking is also on the board for easy reference.
   - The transistor is the three leg component, this device is also polarity sensitive. Install the transistor in the location designated Q1, install round part of the device following the guidelines shown on the board.
   - The small blue capacitor is not polarity sensitive and gets placed in location C3.
   - The pin header gets soldered into JP1.

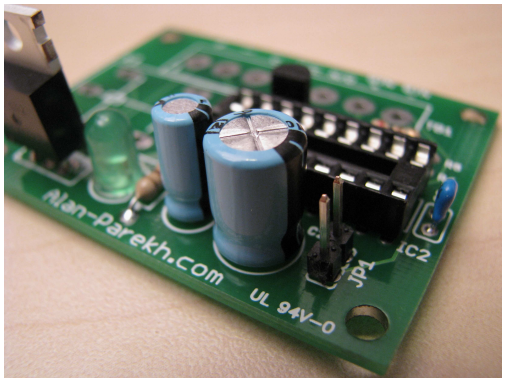


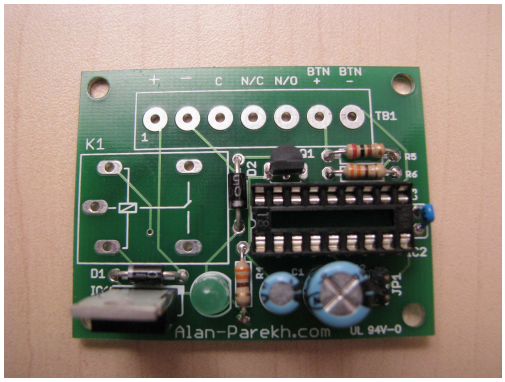


3. **Install radial capacitors, green LED, chip socket and voltage regulator.**
   - There are two different sized radial capacitors, the one that is marked as 10 volt 47uF gets installed into location C1, the one that is marked as 35 volt 100uF gets installed into location C2. These are polarity sensitive, negative is indicated by a black stripe, the terminal opposite the black stripe is positive. The positive terminal is marked on the board. Please note that the positive lead is also indicated by a longer lead.
   - The green LED gets installed next, it is also polarity sensitive, there is a flat spot on the LED and a short lead that indicates the negative lead, this is shown on the board as a flat spot also. There is no designation for the LED on the board but you can locate it directly between components IC1 and R2.
   - Do not install the microcontroller at this time! The socket goes in the location marked as IC2, this is actually referring to the microcontroller chip but the location is the same since the microcontroller plugs into this socket. To orientate the socket properly, align the notch of the socket with the notch indication on the board.
   - The voltage regulator is the 3 leg device, this device also needs to be orientated correctly. The rear metal tab is indicated on the board as a thick white line.

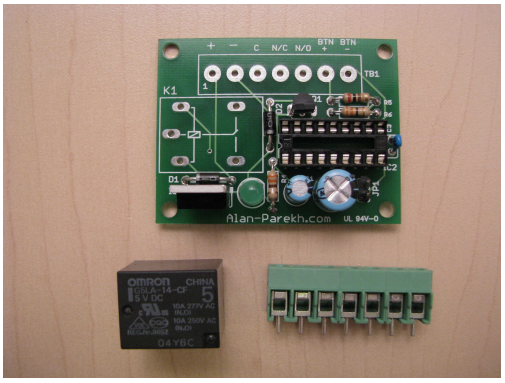


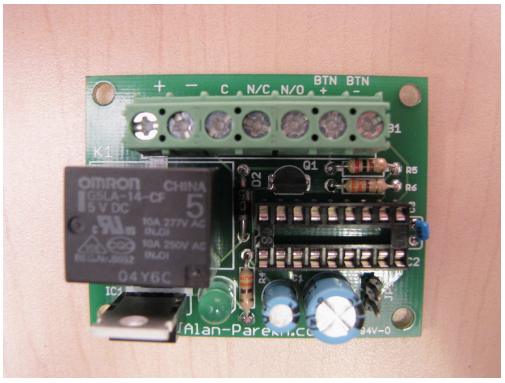




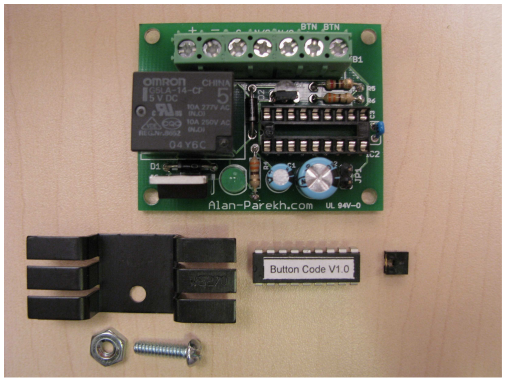


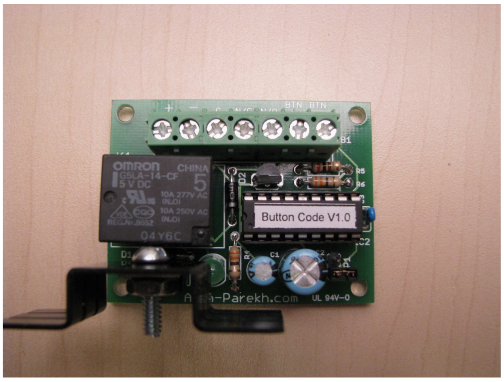
4. **Install the relay and terminal block.**
   - The relay gets installed in the location designated as K1. The device pinout prevents it from being inserted wrong.
   - The terminal block should be installed in the location listed as TB1. Make sure it is installed so that the terminal openings are facing the correct way.





5. **Install the heatsink, microcontroller and programming jumper.**
   - The heatsink gets bolted onto the tab of the voltage regulator.
   - The microcontroller is very sensitive to static electricity. Ground yourself again before removing it from its antistatic package. Do not handle the chip excessively; simply insert it into the socket that was installed in step 3. When aligning the chip, place the notch of the chip in the same orientation as the notch on the socket.
   - The programming jumper can be placed on one of the JP1 pins.





3. Powering the Button Code Control Unit

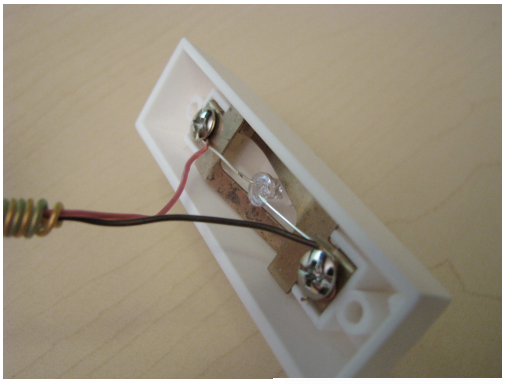
The Button Code control module uses an on-board regulator so the power requirements are not very strict. Any power supply that is between 9 and 12 volts DC with at least 150mA (0.15A) current capability will work just fine.

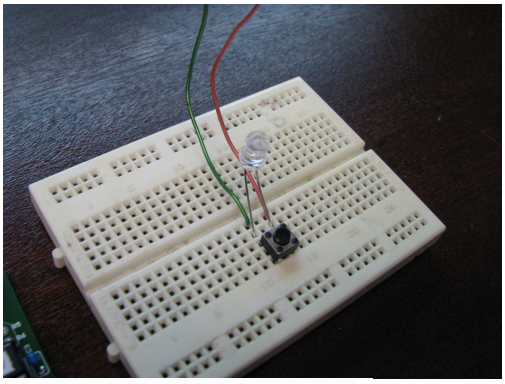
The first 2 terminals are where system power gets hooked up. Positive is terminal 1 and negative is terminal 2. When the unit is powered the green on-board LED will light.

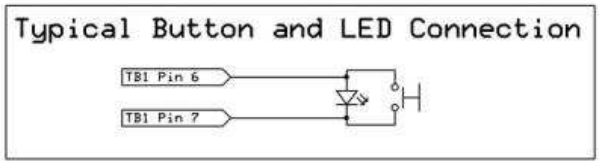
4. Wiring up a Button and LED

The Button Code system needs an input device wired into it. Terminal 6 and 7 are labeled BTN + and BTN -. This is where the button and indication LED will be connected. Any normally open switch can be used. The enclosed LED can be installed inside the switch if there is room or in another location that is convenient. The LED needs to have its cathode (negative side) connected to the BTN – terminal. The cathode of the LED is indicated by a flat spot and a short lead. Below is an example of how an LED can be placed inside a typical door bell, the actual plastic button is translucent so the LED flash can be seen through the plastic when it is in operation.

One thing to note about many inexpensive switches is that the construction can be quite poor, have a look at the doorbell below. The actual switch is made from two bent pieces of metal that are spring loaded and rub together when depressed. Pressing this button on the top or bottom end produces a much cleaner switch closure than a press in the center of the button. A button that snaps on and snaps off is the best type of switch since they activate and deactivate much more cleanly. There is a switch debounce time built into the button code controller however very noisy switches could cause unpredictable operation.







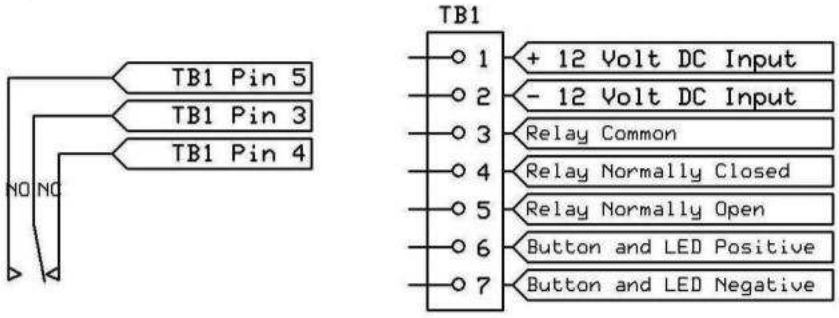
5. Using the Button Code Control Unit Relay Output

The Button Code relay output is known as a form C dry contact output. This means that there is a N/C (normally closed) and N/O (normally open) set of contacts that are not electrically connected to anything on the Button Code circuit board.

Terminal 3 is labeled as C, this stands for common. As you can see in the diagram below the common pin is normally in contact with terminal 4 and switches to terminal 5 when the relay is activated.

What this means is that you can interface this unit to anything that needs a contact closure when the system is activated or a contact open when it is activated. For example the button that is pressed to open your garage door is most likely a N/O contact, if you connected a wire from terminal 3 (common) and terminal 5 (normally open) across your garage door button the Button Code system would “press” the button when activated.

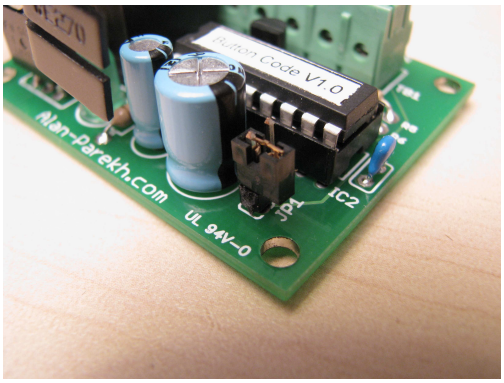
The relay output is designed to handle low voltage loads of up to 2.5 Amps, anything greater than this can be handled by using a larger external relay.



6. Change Operating Mode

There is a program jumper that can be placed on two pins labeled as JP1 that is used to change the running mode. When the jumper is out the mode is the normal running mode, when the jumper is in the system is in program mode.

Please note that the state of the jumper is only checked when power is applied. This means that if the system is in program mode and the jumper is removed, the mode will not change until power is removed and re-applied.



7. Programming a Button Code Control Unit

To put the system in program mode as noted in section 6, place the jumper on JP1 so that the pins are being shorted out with the jumper, then remove power and re-apply power. The system will now be in programming mode.

There are three program menu options, to change between the menu options press and hold the button for at least 3 seconds. When the button is released you will be in the next menu option. The LED will flash to let you know what menu option you are in. For example Flash, Flash, pause, Flash, Flash, pause… means that the system is in menu 2.

Program Mode Menu Options

1) Code Change: Used to change the 4 digit system code. Tap in the new code that is desired just as you would when in normal running mode. The system will give you a fast flash confirmation when the new code has been saved. Note, see section 8 for the method of entering the new code since it is the same visual process as tapping in a code to operate the unit.

2) Activation Time Change: Used to change the activation time desired. Tap the button once for each second desired. For example if you would like a 10 second activation time just tap the button 10 times. The system will give you a fast flash confirmation when the new activation time has been saved.

3) Operation Mode Change: Used to change the operation style.

- The first mode is a timed mode, in this mode the relay is activated when the correct code is entered and de-activates after the activation time is up.
- The second mode is a toggle mode, in this mode the relay state is changed whenever a correct code has been entered. For example if the relay is de-activated it will activate when a correct code is entered and if the relay is activated when a correct code is entered is will de-activate.

To change the mode, press the button once for the first mode and twice for the second mode.

8. Operating a Button Code Control Unit

To put the system in normal run mode as noted in section 6, the jumper can be on one pin of JP1 but must not be shorting out the programming pins, then remove power and re-apply power. The system will now be in normal run mode.

In normal running mode the system is waiting for a code to be entered and reacts as programmed when the correct code is entered. To enter a code tap the button once for each number in code digit, wait for a confirmation flash, then proceed with the next digit in the 4 digit sequence.

For example if the code to be entered is 1, 2, 3, 4 you would do the following.

- Press the button 1 time
- Wait for a confirmation flash from the LED
- Press the button 2 times
- Wait for a confirmation flash from the LED
- Press the button 3 times
- Wait for a confirmation flash from the LED
- Press the button 4 times

After the 4 digit code has been entered the system will operate as programmed. If the code is wrong a slow flash will be displayed on the LED.

9. Mount a Button Code Control Unit

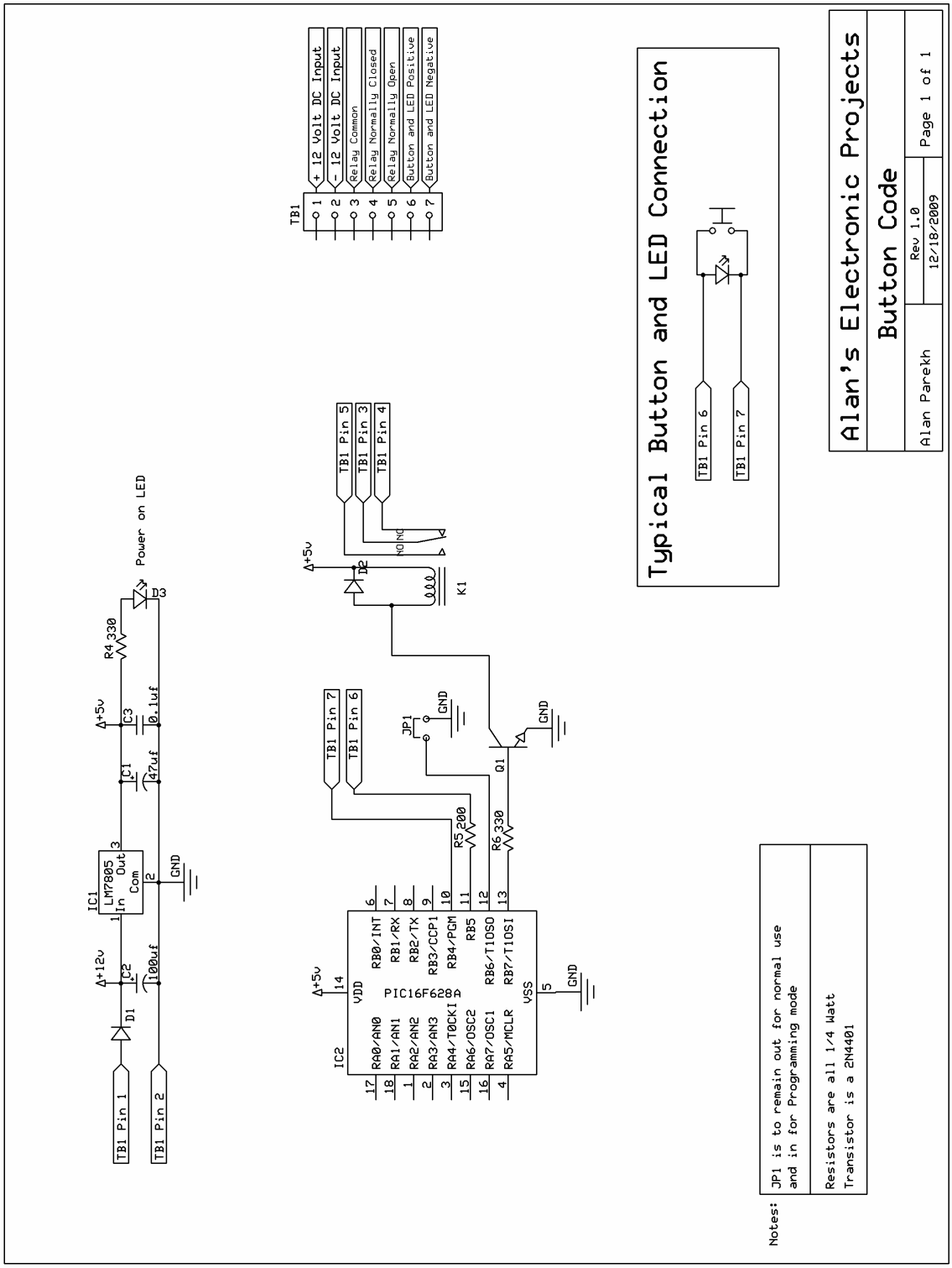
The control module should be mounted in a dry location that is secure since access to the control unit is all that is needed to change the system code. The kit comes with 4 plastic stand-offs and 4 screws which need to be used when mounting, this ensures that exposed traces on the rear of the circuit board do not short out to anything metal. A plywood covered wall or the inside of a metal cabinet make for ideal mounting locations.

10. Maintenance

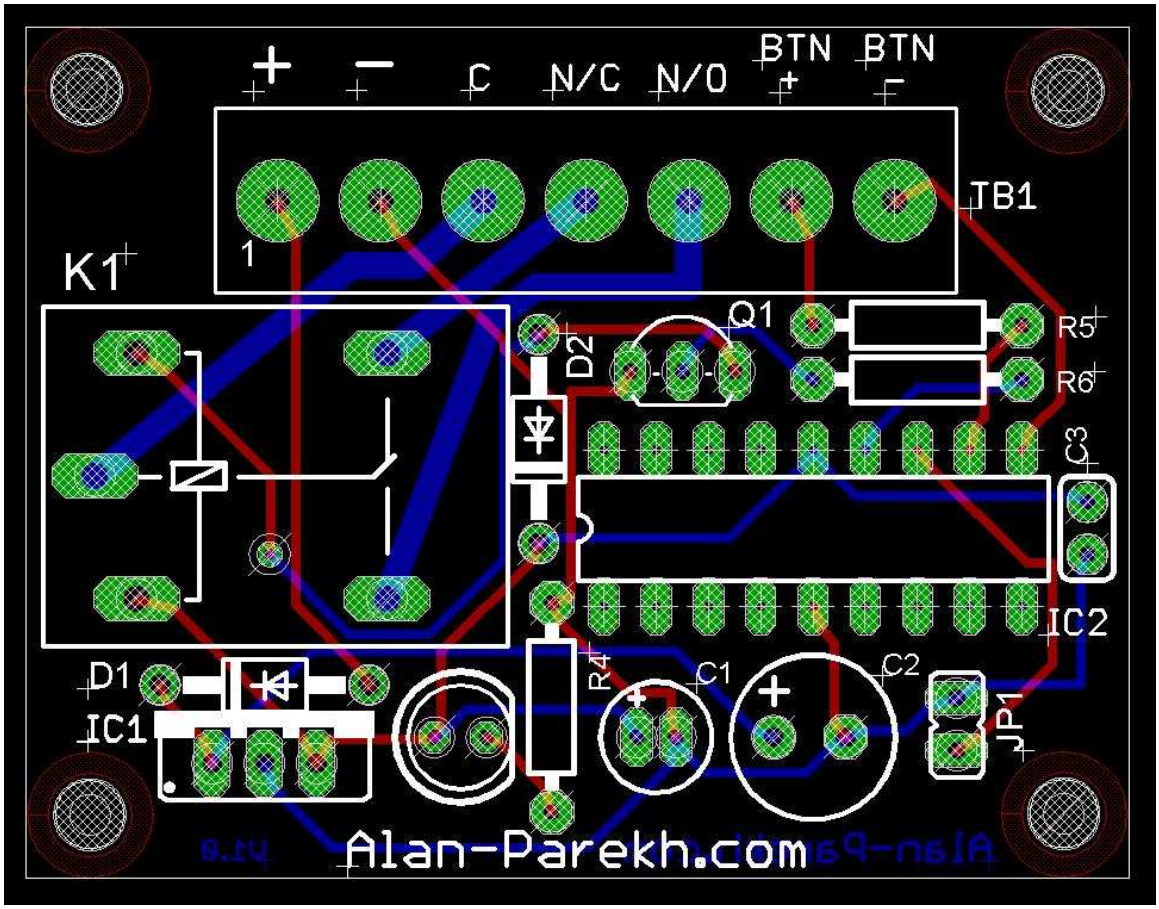
Any dust accumulation on the Button Code Control Unit circuit board should be blown off. Canned compressed air works well for this purpose and is available at any computer store. We recommend powering down the controller during cleaning.

11. Appendix

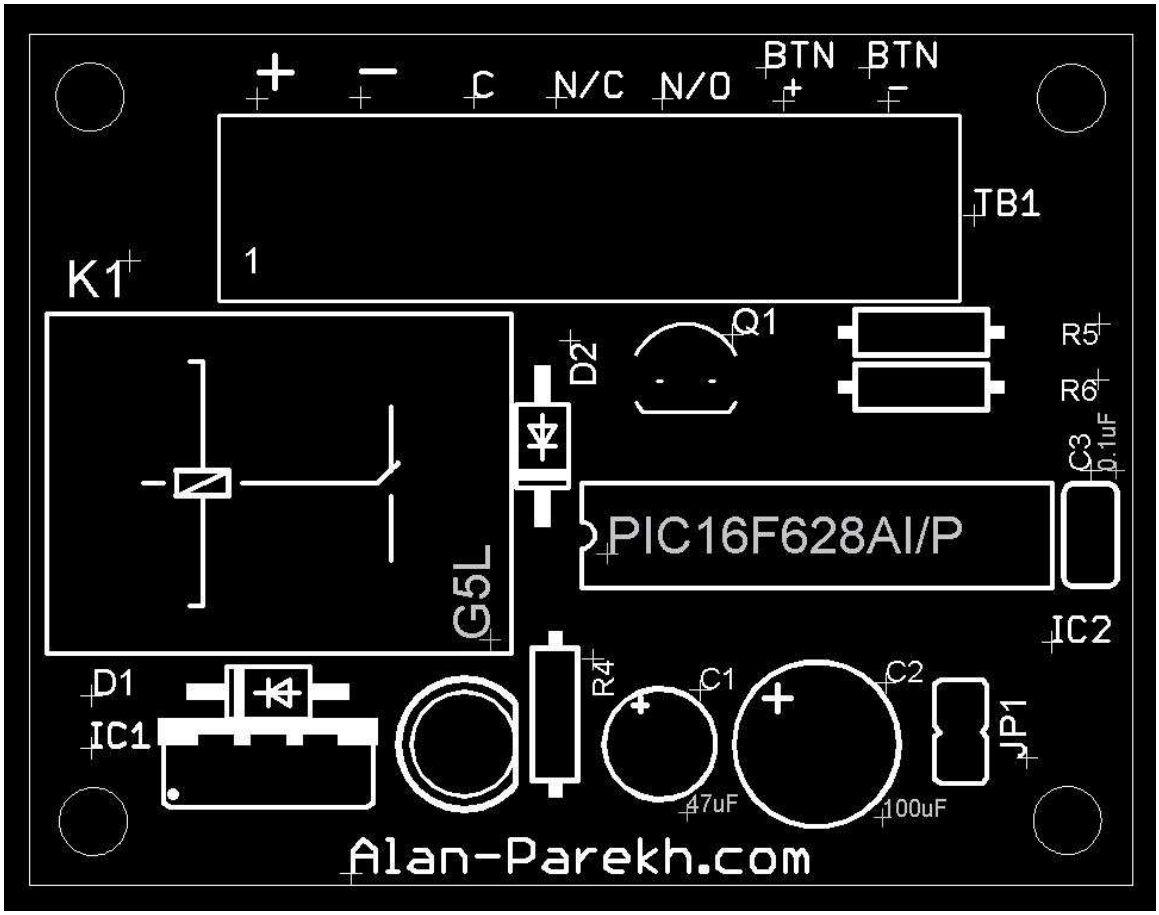
11.1 Button Code Control Board Schematic



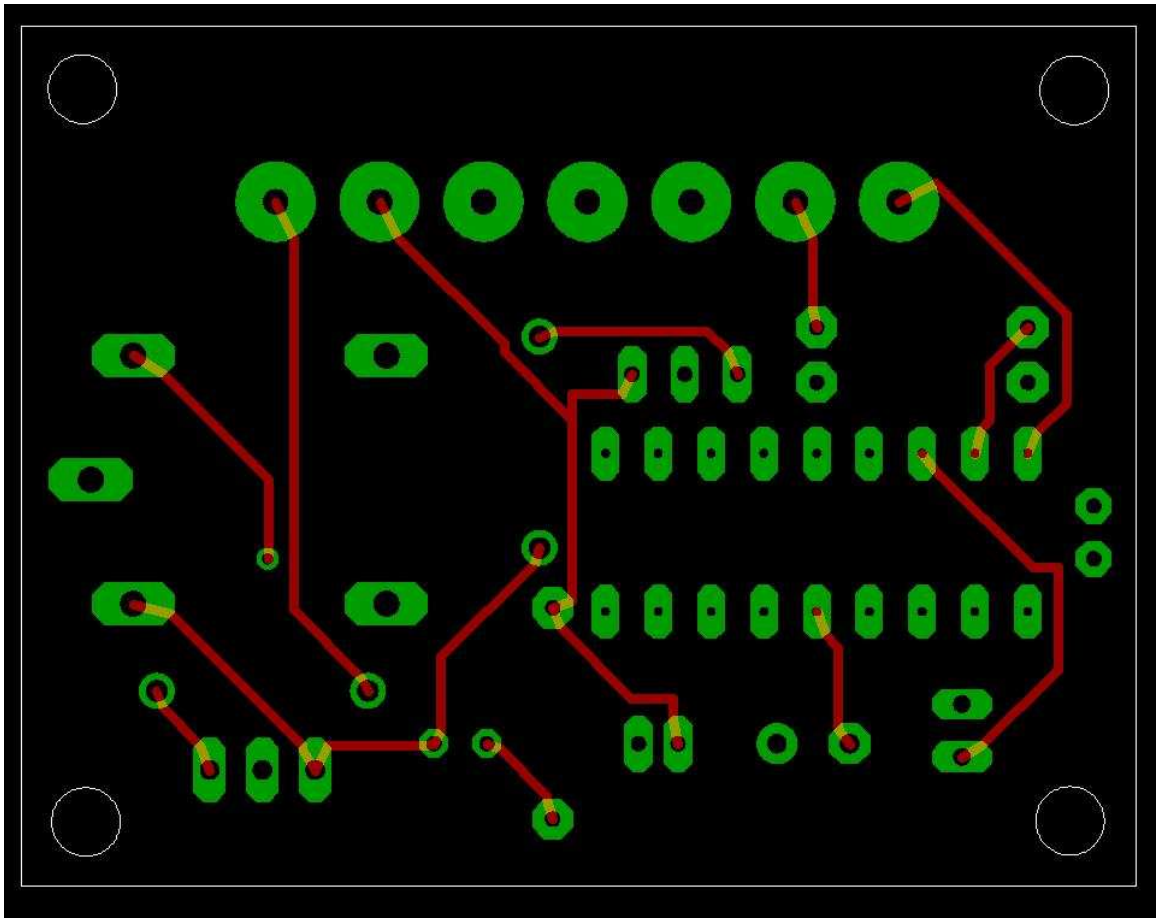
11.2 Circuit Board Diagram – All Layers



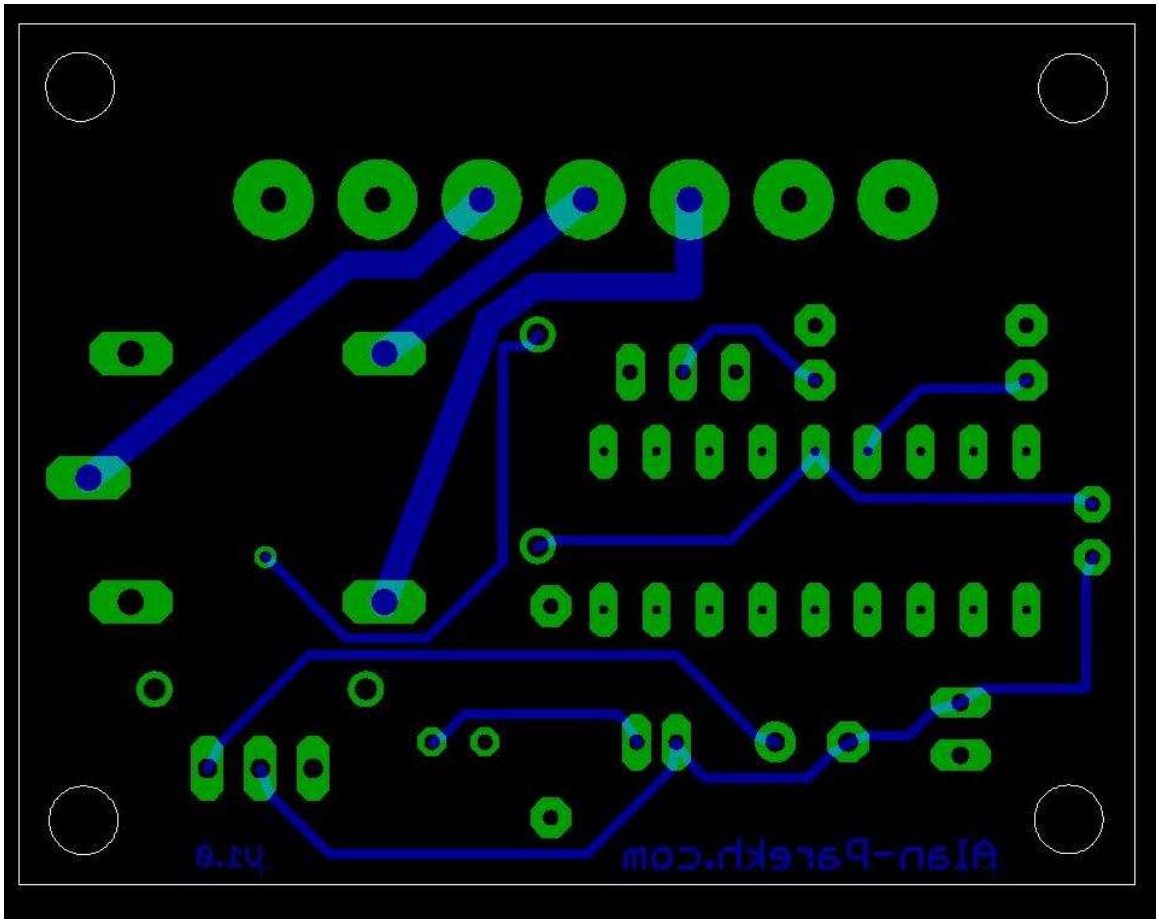
11.3 Circuit Board Layout Diagram



11.4 Circuit Board Top Copper Layer



11.5 Circuit Board Bottom Copper Layer



11.6 Circuit Board Assembled Photo