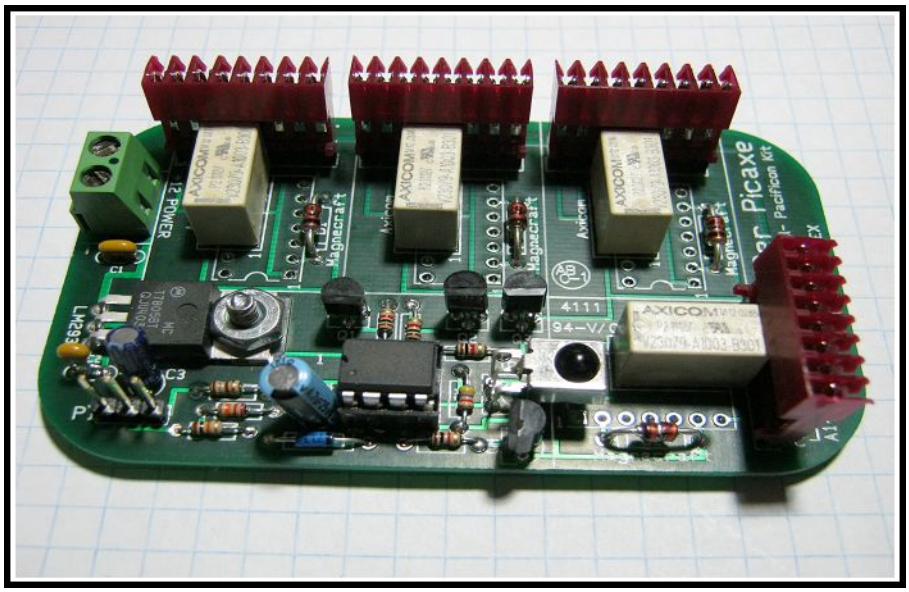
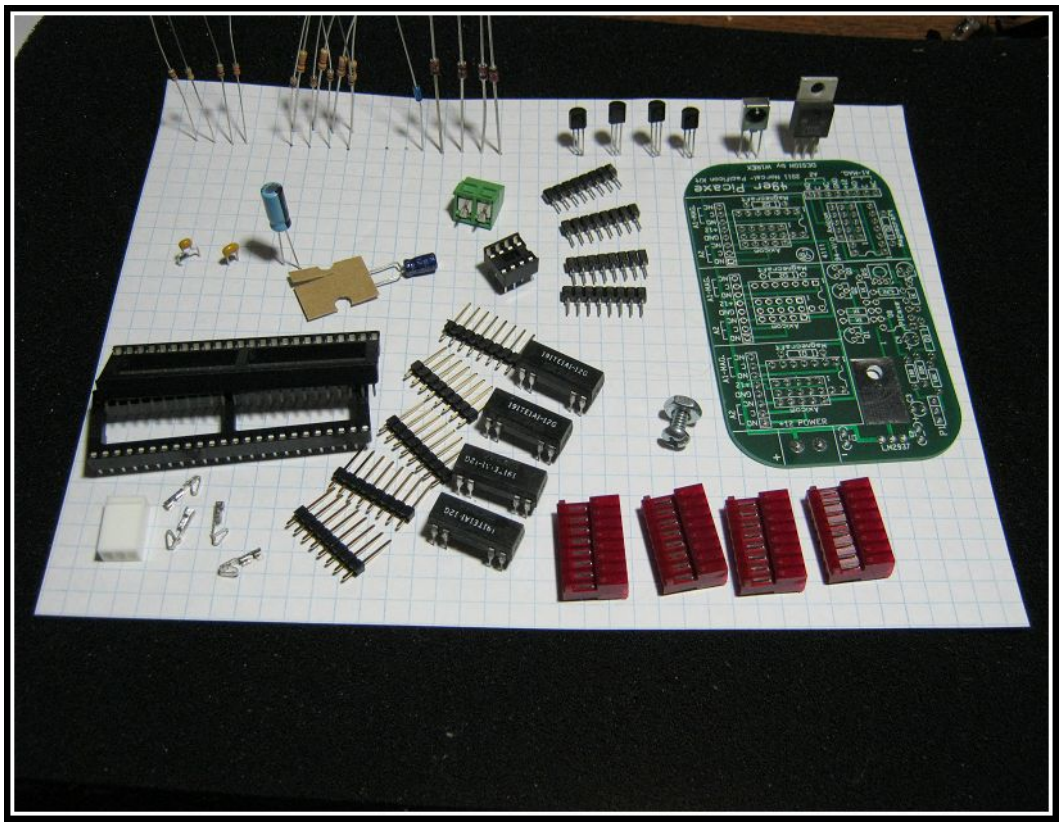
49er Picaxe
Pacificon 2011
Norcal Buildathon Project

10/23/2011 ver 1.0

by W1REX / QRPme
www.QRPme.com



The 49er Picaxe board was designed by W1REX as one of the 2 Picaxe project boards for the Norcal QRP Club Buildathon at Pacificon 2011. The Picaxe micro-controller has built in commands that respond to and also generate SONY infrared control signals for TVs etc. The 49er Picaxe kit is designed to make use of that and enable the builder to control 4 relays using a standard SONY compatible TV remote. You can also use generic TV controllers that are programmed for SONY TVs. The 49er Picaxe fits into the ubiquitous shirt pocket sized Altoids tin.

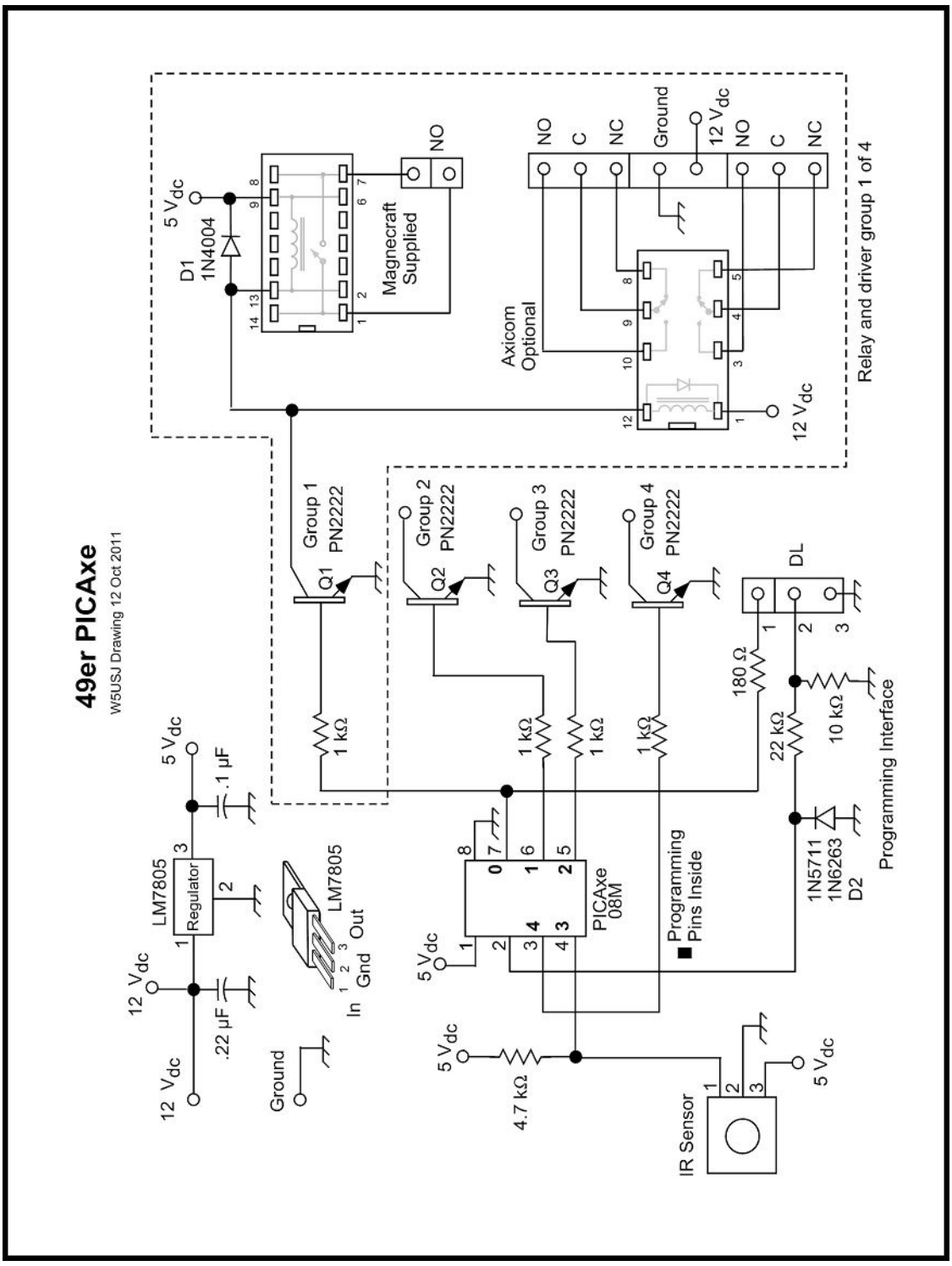


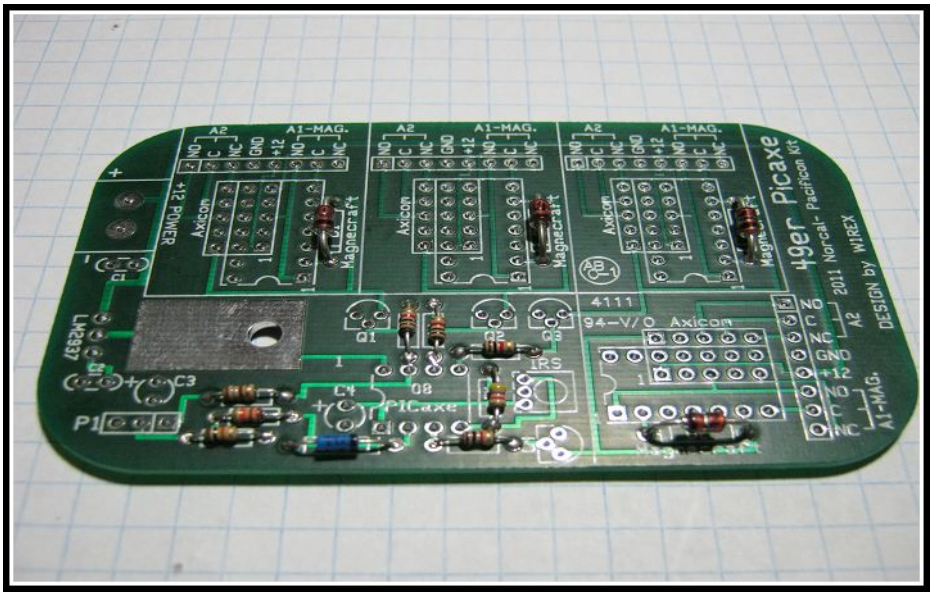
Organize the parts, compare them to the Bill of Materials (BOM) and check for shortages (or extras). If you take a little time to sort through the parts in the beginning, your build will be much smoother!

49er PICAXE Bill of Materials

- printed circuit board
- 8 pin DIP socket
- Magnecraft W107 DIP relay (qty 4)
- PICAXE 08M microprocessor
- LM7805 voltage regulator
- EL-IRM-8601S Infrared demodulator
- PN2222 TO92 transistor (qty 4)
- 1N4005 diode (qty 4)
- 1N6263 OR 1N5711 diode
- 180 ohm resistor (1/8 watt)
- 1K ohm resistor (qty 4) (1/8 watt)
- 4.7K ohm resistor (1/8 watt)
- 10K ohm resistor (1/8 watt)
- 22K ohm resistor (1/8 watt)
- .22uf cap
- .1uf cap
- 1uf electrolytic cap
- 4.7uf electrolytic cap
- 48 pin DIP IC socket (qty 2)
- 14pin DIP IC socket (qty 4)
- 1X8X.1" SIP Swiss sockets (qty 4)
- 1x8x.1" SIP Molex male header (qty 5)
- 1x8x.1" IDC connector (qty 4)
- 1x3x.1" SIP Molex female connector shell
- Molex socket terminal (qty 4)
- 6-32 x .375 bolt
- 6-32 nut
- 2 pin screw terminal block

Now you might want to familiarize yourself with the schematic of the 49er Picaxe board....





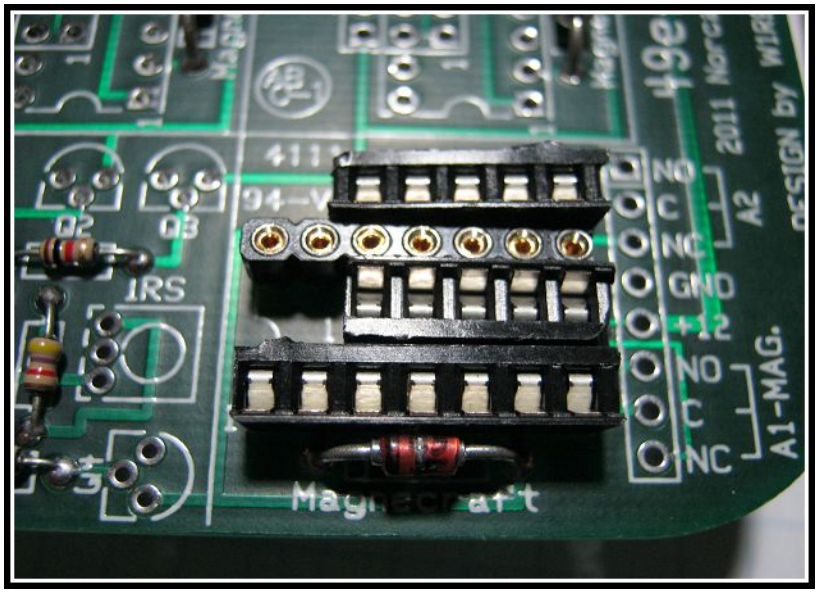
No Sweat! The little stuff…

I usually start kits by installing all the stuff that is low to the board which allows the board to sit stable on the table while I melt solder with the Weller. So start off with the 1/8 watt resistors and diodes. All the resistor values are marked on the silk screen.

Install:

- 180 ohm in the downloading circuit
- 1K ohm (x4) to the transistors
- 10K ohm in the downloading circuit
- 22K ohm in the downloading circuit
- 4.7k at the IR sensor

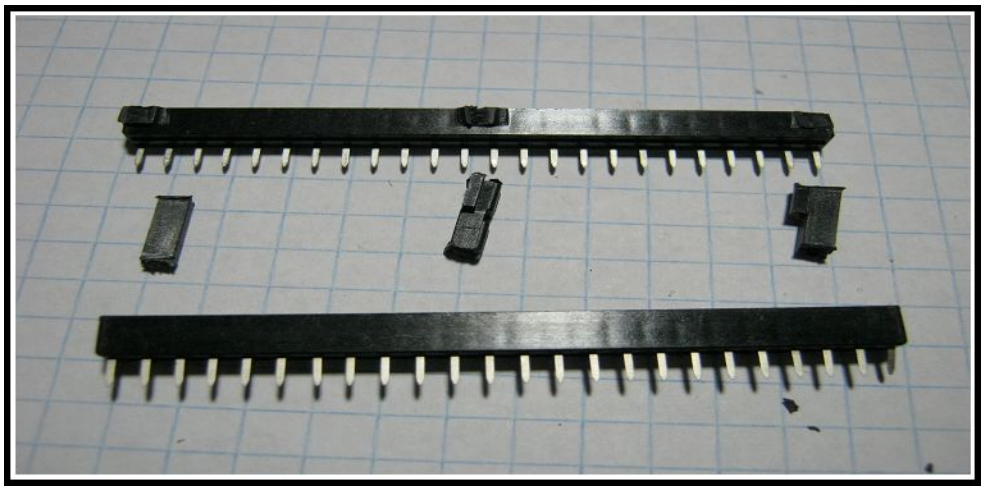
- 1N6263 or 1N5711 in the downloading circuit
- 1N400x (x4) in the relay areas



Decisions, decisions, decisions!

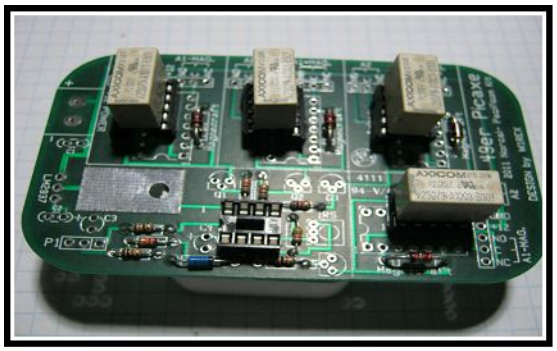
The basic 49er kit is supplied with 4 SPST reed switches, which are rated for about 10VA. If you have more serious ambitions for controlling the world, then you might want to consider bigger relays. Personally, I like to use tiny Axicom DPDT relays in a lot of my projects because they are small yet have 5 amp contact ratings. I laid out the 49er Picaxe board to accommodate both relays. If you examine the pcb traces in the relay areas you can see that the footprints of both relays are intertwined in order to save space and get 4 sets of EITHER relay on the board. If you opt for the Axicom relays right from the start, then you really don't have to plan for any upgrades, so you can go right to installing the Axicoms on the board. If you plan to ONLY use the reed relays that were included with the kit, then you can install those without trying to plan for a relay upgrade path. However, if you want to start off with the relays provided and plan for possibly upgrading to the Axicoms in the future, then you have a little more work to do on the kit than the others. You will have to make sockets for the Magecraft/Sigma type reed relays AND the Axicom relays so you can yank the reed relays and replace them with the Axicoms at a later date.
So the previous picture is the socket setup for one of the relay sections on the 49er pcb.

A 48-pin DIP socket can be cut up with sharp dykes and will yield one 7-pin segment and two 5-pin segments per side. You need to use a 7-pin Swiss pin strip between the two 5-pin segments because the spacing is too tight for another strip of cut-up IC socket.

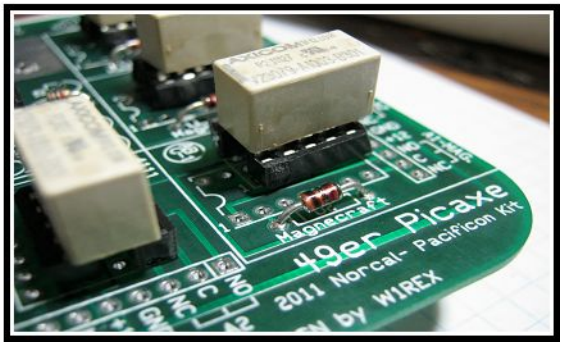


To cut the strips, cut a section from the DIP socket piece 1 pin BIGGER than what you relay want. Cut to the excess side of the extra pin. The extra pin will either fall out or will be exposed after the cut. You can then nibble at the plastic until you have cleaned up the plastic so that the extra hole is no longer there. Now you have a socket strip for a set of relay pins. From each side of a 48-pin DIP IC socket, you should be able to fashion one 7-pin and two 5-pin segments with some spare socket left over. Try making a 5 -pin segment first. You will be able to see how the cutting and nibbling works and still have enough socket left to make the actual segment that you need. The easiest way to mount them is to insert the 7-pin IC socket segment and a 7-pin Swiss pin strip into the appropriate pads and then insert a relay into them. Now you can hold onto the relay while you turn over the board and solder the pins. You can't do that for the Axicom relays unless you have them, but you can simply stash the extra parts away in a safe place for when you do get a set of Axicom relays and install them then. OR, you can insert the two 5-pin strips into the Axicom pad locations and solder them in. If you are careful, the pads will be aligned when you go to install the Axicoms. Also note that if you look at a set of DIP IC pads from the end, you will see that the plastic is not symmetrical around the pins so you should dry-fit all the pieces before soldering them to check for proper clearances.

- Install the 8-pin socket for the micro
- Cut & install the socket pieces for the 4 relays



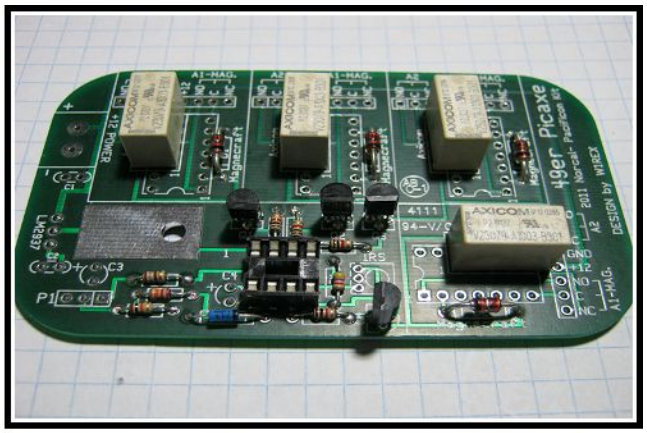
Look closely in the picture, pin 1 of the Axicom relays is the bottom left as you read the markings. Pin 1 is also marked on the board. If you have the Axicom relays, you only need to cut & install the IC socket strips for those. There relay is no sense in adding hardware for a future downgrade of the relays, so you can skip everything dealing with the 14-pin reed relays.



In my case, I'm quite comfortable in not having any sockets for the relays at all. I simply soldered the Axicom relays in without sockets. I have no trouble un-soldering them in case a relay ever burns up and I need to replace it. You may want to do the same and not use sockets for the relays at all. Easier to build, but of course, troubleshooting and replacing relays that are NOT in sockets is more difficult. AND there is a reliability issue... Sockets add another mechanical connection to the circuit that could possibly inject a problem down the road...

So the real question HAMlet was asking was: “To socket or not to socket? That is the relay question!”

Sorry! I couldn't help myself....

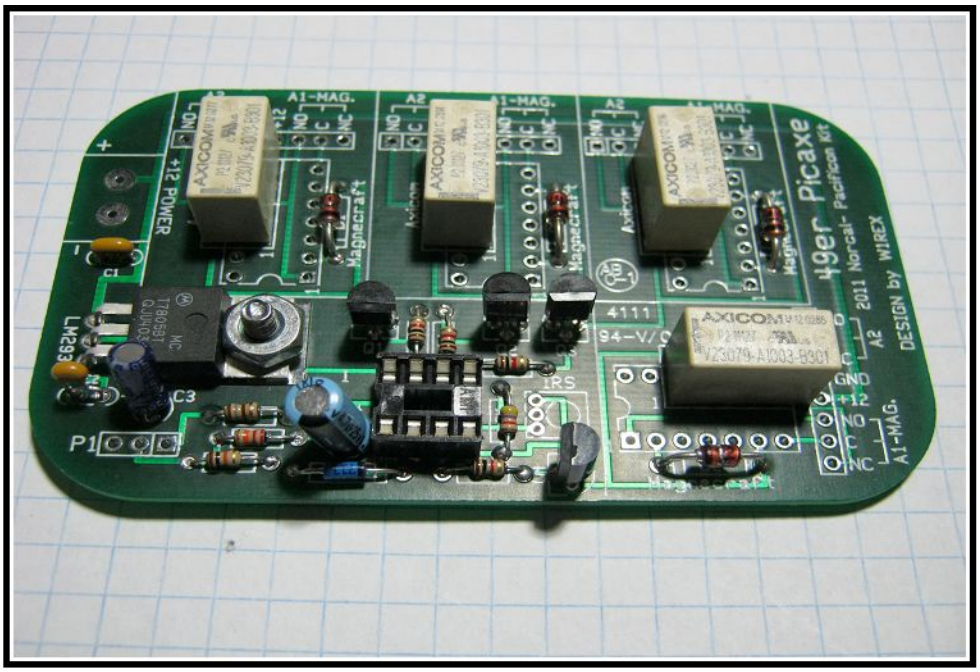


The above picture shows my build with Axicom relays and NO sockets.

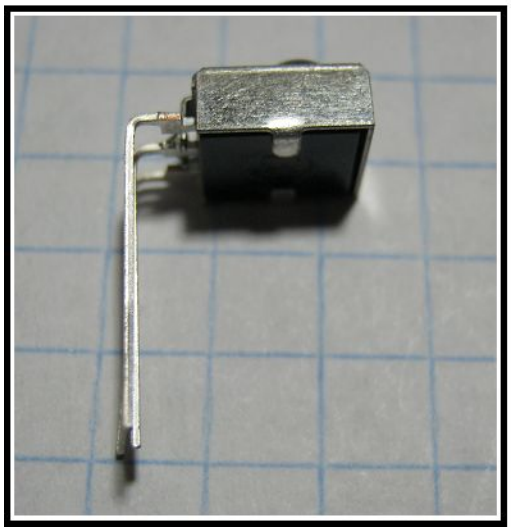
You might need to re-bend the capacitor leads in order to install them easily in their proper locations as a couple of caps could be .2” lead spacing for .1” spaced pads.

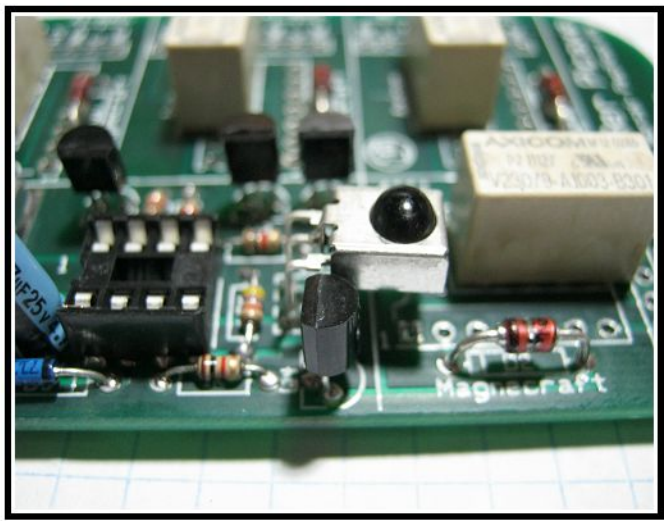
Install:

- .22uf at C1
- .1uf at C2
- 1uf aluminum at C3
- 4.7uf aluminum at the 'other' C1 (Oopsy Daisies!)
- PN2222 transistors at Q1 – Q4
- LM7805 voltage regulator (or optional LM2937) at LM2937

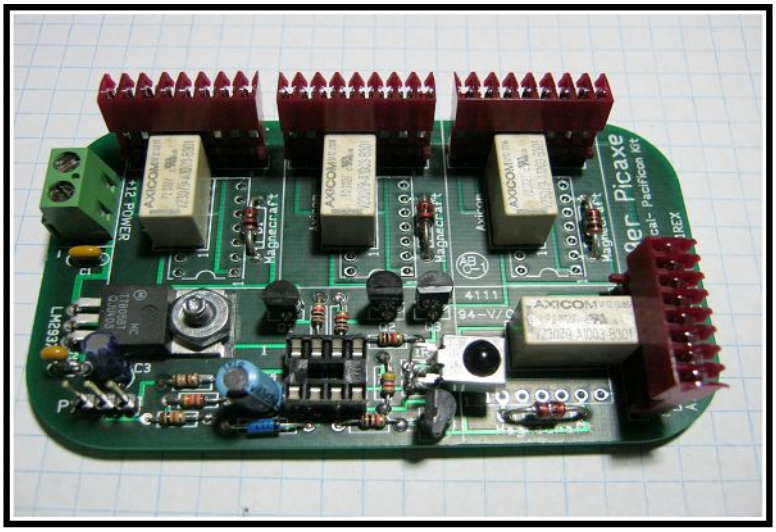


Your board should look something similar to the board in the above picture (depending on your particular relay situation).

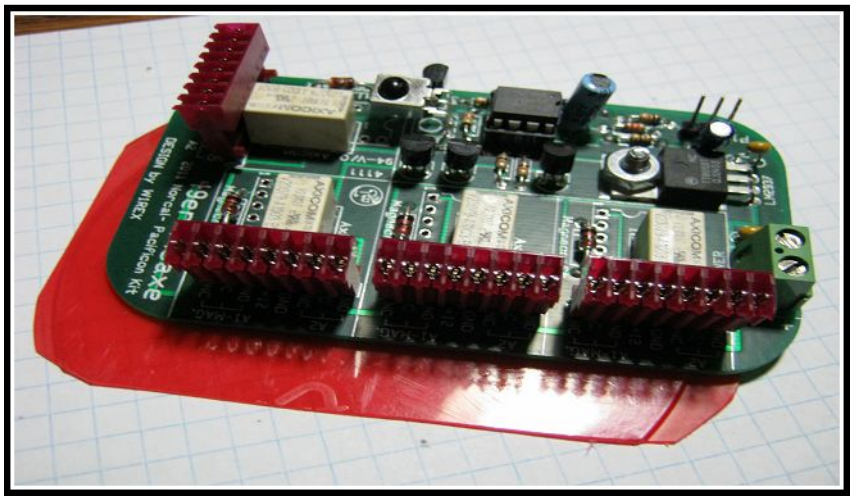




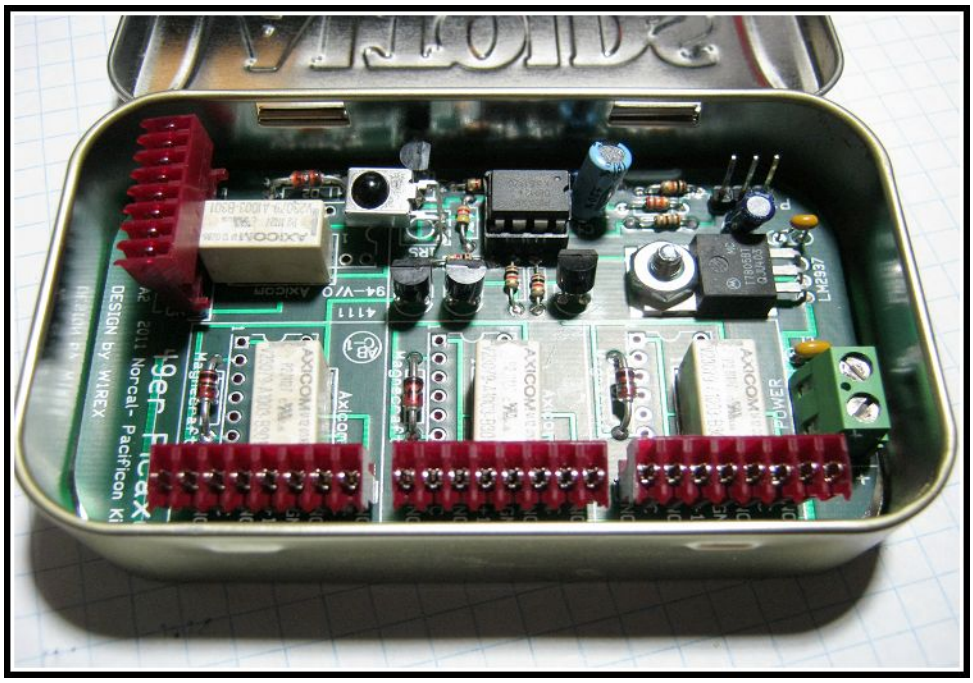
You need to pre-bend the IR demodulator like the example in the above left picture and install it on the board like the right hand picture. **Don't** install it seated all the way down onto the board....



The 2-pin screw terminal block and relay output connectors are the final parts to put on the board. Install it OPPOSITE from that shown in the picture above. Insert wires from the inside of the tin NOT from the tin wall! Place the IDC (insulation displacement connector) on the 8-pin male headers and place them all on the board. They will have to lean a little as the spacing is crowded. Putting a piece of flat material over the whole board, you can flip it over, lay it on the bench and then commence to solder all the connections.



Cut an insulator for the bottom of the board to prevent shorting stuff out in the tin. I used the plastic lid from a potato stick can, as I have bunches of those lying around. Trace out the board and cut.



The plastic insulator is placed in the can and the 49er Picaxe board is dropped in on top of it. Make sure the insulator board is of a thickness to keep those sharp cut off leads from penetrating through to the metal bottom of the tin!

FINI!

Now you need to go out and control something.

Note: The power for the board can come in EITHER from the 2-pin terminal block OR from the +12 & ground connections on any of the relay output connectors. The IR demodulator & Picaxe software will decode ALL the IR commands for SONY home electronics equipment. Refer to the Picaxe manuals (Manual #2: the Commands) for a complete description as to how the IR input commands work.

Also refer to the 49er Picaxe demonstration program on the QRPme website: www.QRPme.com