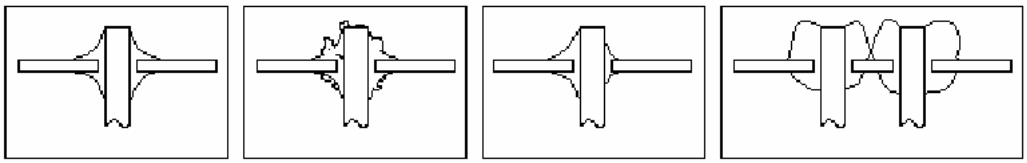
Tek-Bot Remote Control Transmitter Board Construction

Purpose

This tutorial illustrates the procedure for construction of the Transmitter board for the Tek-bot.

A Guide to Soldering

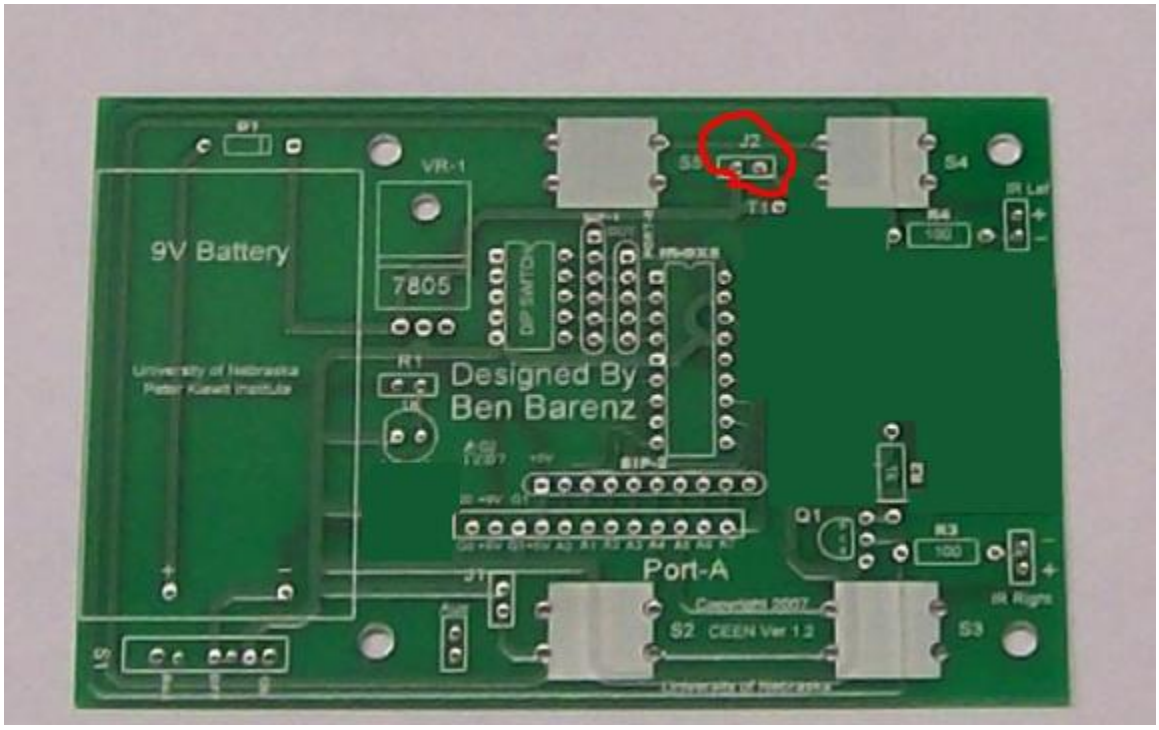
Many of you have soldered once or twice before but most likely very few of you have ever been instructed how to recognize 'good' soldering from 'bad' soldering. There are a few basic concepts involved in soldering that we will detail here, the first being that solder itself melts with heat. Well duh. Part of this simple concept though is the key to making a 'good' solder joint. A good solder joint will conduct electricity well and prevent the component from falling out. Since solder melts with heat we need to be sure that we give enough heat to the solder to get it to melt uniformly, not in clumps. A solder joint that was made without enough heat is called a 'cold joint' (See the figure below). Another problem can be if there is too much or too little solder used for the joint. If too little solder is used the joint will not be strong enough and will likely break. If too much is used there is a risk of a 'solder bridge' being formed (See figures below). An ideal joint should appear 'shiny' even after it cools and should look like the solder is stretched from the pad to the wire.

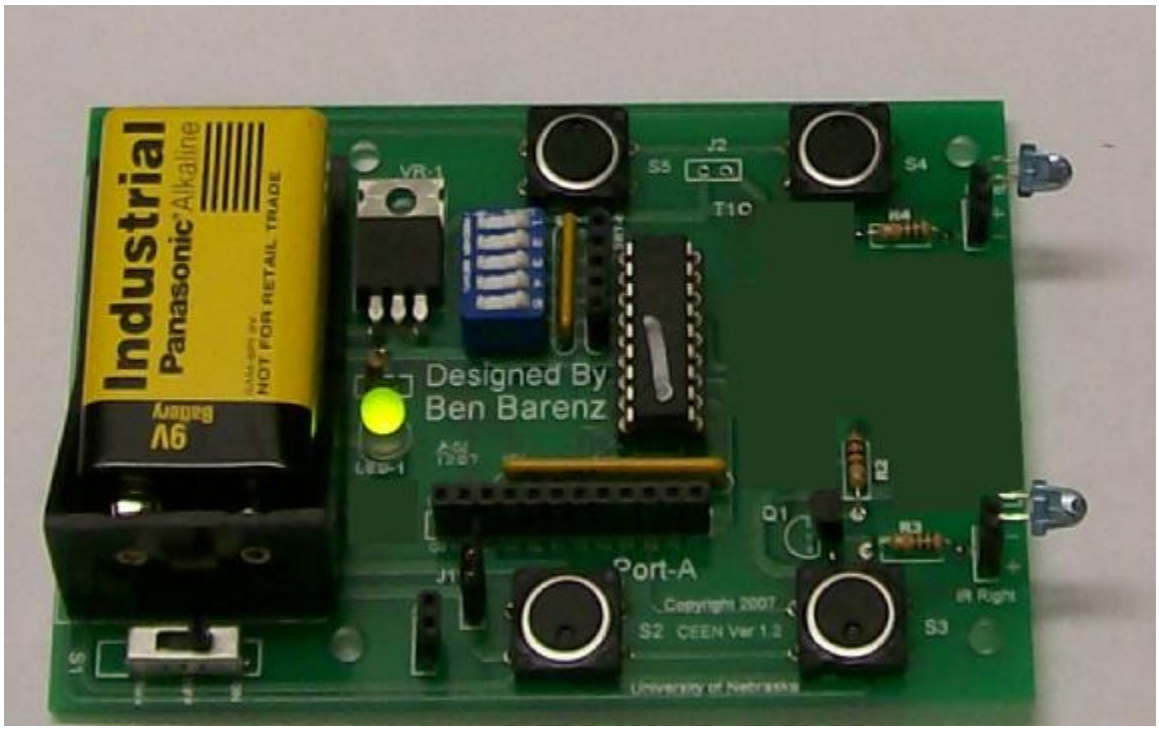


Pre-Project

Look over the blank and completed circuit board (**Fig 1**) and the photo of the parts laid out (**Fig 2)** and the parts list to become familiar with the placement of all the components. Note that the foot print circled in red in **Fig. 1** will NOT be connected. They are not intended for this activity. **Fig. 2** shows all the components laid out. Print off this page and lay your components over the pictures. This will ensure that you have all your components and that you have used them all when you are done. ***It is very important that you follow the order of assembly in this tutorial due to higher profile components making it very difficult to access lower profile components.***

FIG 1


9V Battery
7805
VR-1
J2
S5
S4
T1C
IR Left
R4
100
DIP SWITCH
University of Nebraska
Peter Kiewit Institute
R1
Designed By
Ben Barenz
Q1
R3
100
Port-A
J1
Copyright 2007
S2 CEEN Ver 1.2
S3
IR Right
S1
University of Nebraska


Industrial
Panasonic Alkaline
NOT FOR RETAIL TRADE
9V
Battery
VR-1
J2
S5
S4
T1C
R4
Designed By
Ben Barenz
LED-1
R2
Q1
R3
Port-A
J1
Copyright 2007
S2 CEEN Ver 1.2
S3
IR Right
S1
University of Nebraska

IR-DX8 Encoder

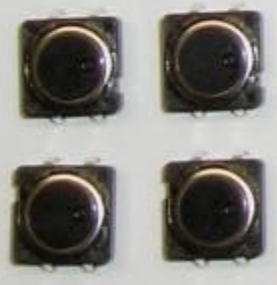
IR-DX8 Socket

5P-DIP Switch

6-Pin SIP 1k

5V Regulator

SPST Button Switches



9V Battery

9V Battery Holder

SP3T Power Switch On,Off,Aux

Indicator LED

1KΩ LED Resistor

NPN Transistor

1kΩ Q1 Base Resistor

10 Pin 1kΩ SIP

Reverse Protection Diode

Infrared Emitter LED

100Ω IR LED Resistor

2 Pin Jumper

Female Header Stock

Male Header Stock

FIG 2

Parts List

Look over this parts list and the photo and make sure you have all your components. If you have a missing or damaged component alert one of the lab technicians before proceeding.

Transmitter Board Parts list			
Part	Description	Circuit ID	Quantity
Encoder	DIP-18 Encoder	IR-DX8	1
18-Pin IC Socket for IC-1	DIP18 Encoder Socket	IR-DX8	1
5P-DIP Switch	DIP-10 Blue Switch	Dip Switch	1
6-Pin SIP 1k	6 pin SIP Resistor	SIP-1	1
5V Regulator	Large 3 Pin IC	VR-1	1
SPST Button Switches	Black Buttons	S2-S5	4
9V Battery	9V battery	9V	1
9V Battery Holder	Black Plastic Holder	9V Battery	1
SP3T Power Switch On,Off,Aux	Small Silver Slide Switch	S1	1
Indicator LED	Translucent lens	LED-1	1
1KΩ LED Resistor	brown,black,red	R1	1
C5019 NPN Transistor	Small 3 pin IC	Q1	1
1kΩ Q1 Base Resistor	brown,black,red	R2	1
10 Pin 1kΩ SIP	10 pin SIP Resistor	SIP-2	1
Reverse Protection Diode 1N4001	Black with Grey stripe	D1	1
Infrared Emitter LED	Blue/Clear LED	HL,HR	2
100Ω IR LED Resistor	brown,black,brown	R3,R4	2
2 Pin Jumper	small 2pin black	J1	1
2 Pin Female Header cut from stock	Aux, HL,HR	Aux,HL,HR	3
5 Pin Female Header cut from stock	PORT-B	Port-B	1
12 Pin Female Header cut from stock	PORT-A Power	Port-A	1
2 Pin Male Header cut from stock	Button Enable Jumper	J1	1
		Total Parts	30

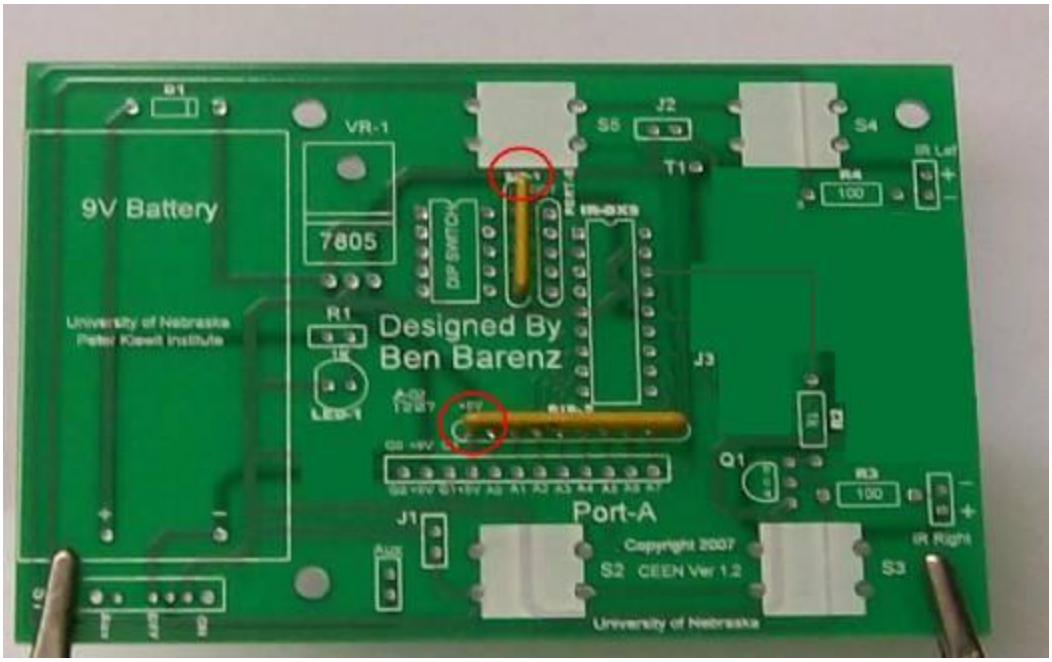
Tools:

- Soldering Iron
- Flux Core Solder
- Wire cutters
- Small Pliers (Optional)

Assembly

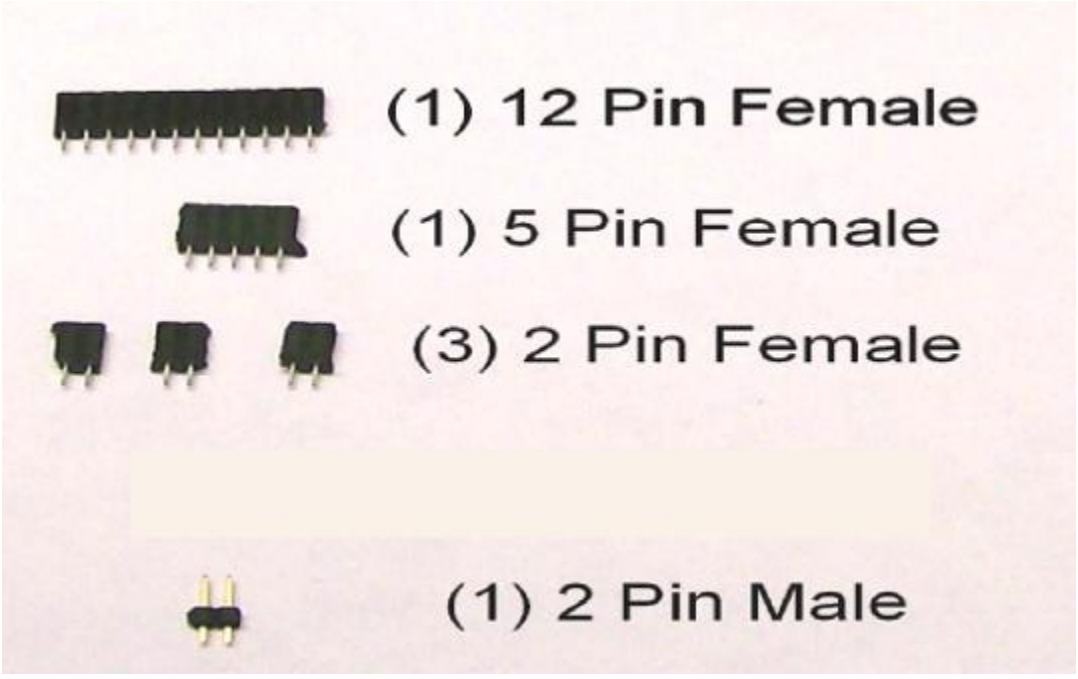
First, place the SIP resistors, SIP-1 (6 pin) and SIP-2 (10) pin. The SIP resistor must be placed with the DOT facing the outside of the board for SIP_1 and toward the battery for SIP_2 as in **Fig 3.** Next place the resistors and check them against **Fig 5.**

FIG 3



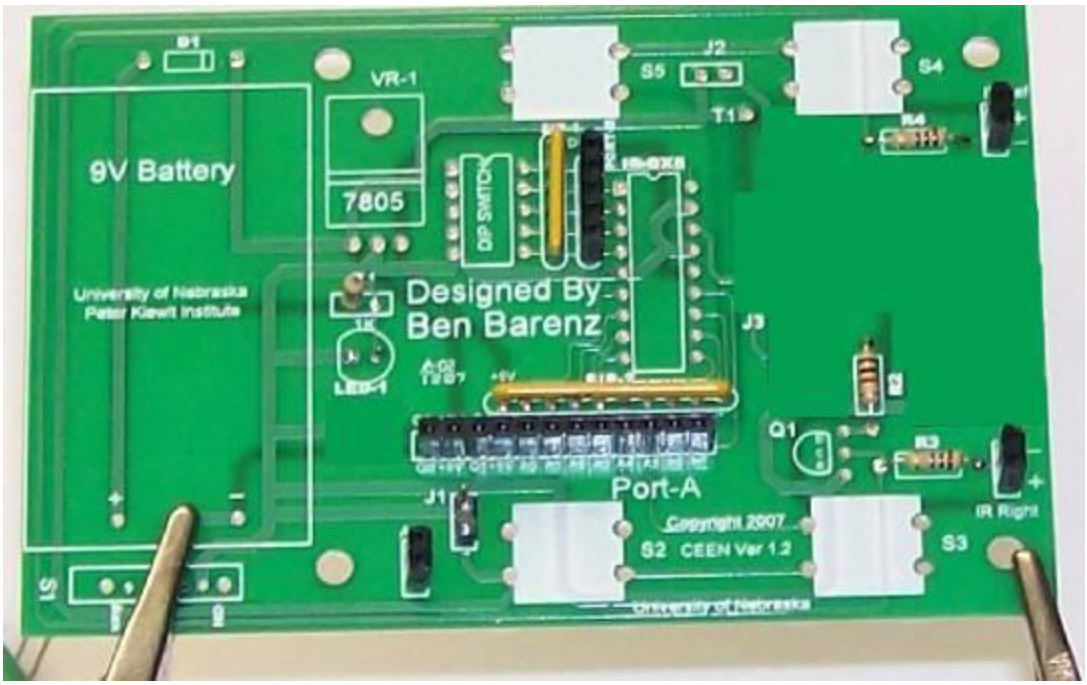
Cut out the header as shown in **Fig 4.**

FIG 4



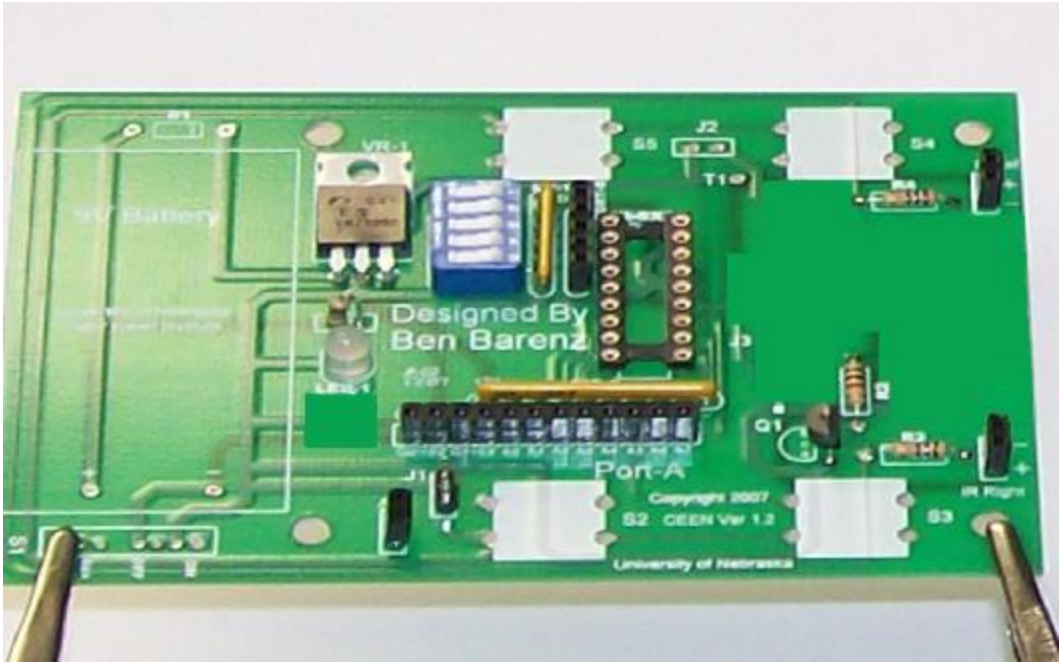
Solder the male and female headers. Make sure they are close to 90° to the board as shown in **Fig 5.**

FIG 5



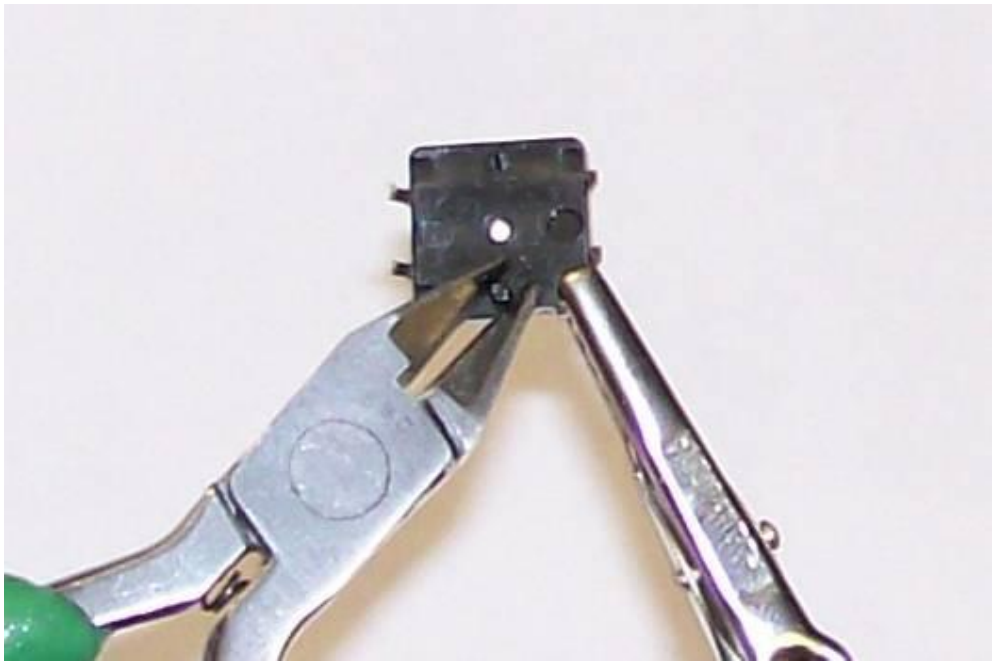
Next, place the DIP-18 Socket for the IR-DX8 followed by the DIP switch. Pay attention to the notch on the socket, and match it to the board. The numbers of the DIP switch should be closest to the SIP resistor. Continue by placing the LED-1, Q1, and the 5V regulator as in **Fig 6.** The LED has a flat spot (shorter lead is closest to it) that aligns with the board, this indicates polarity.

FIG 6



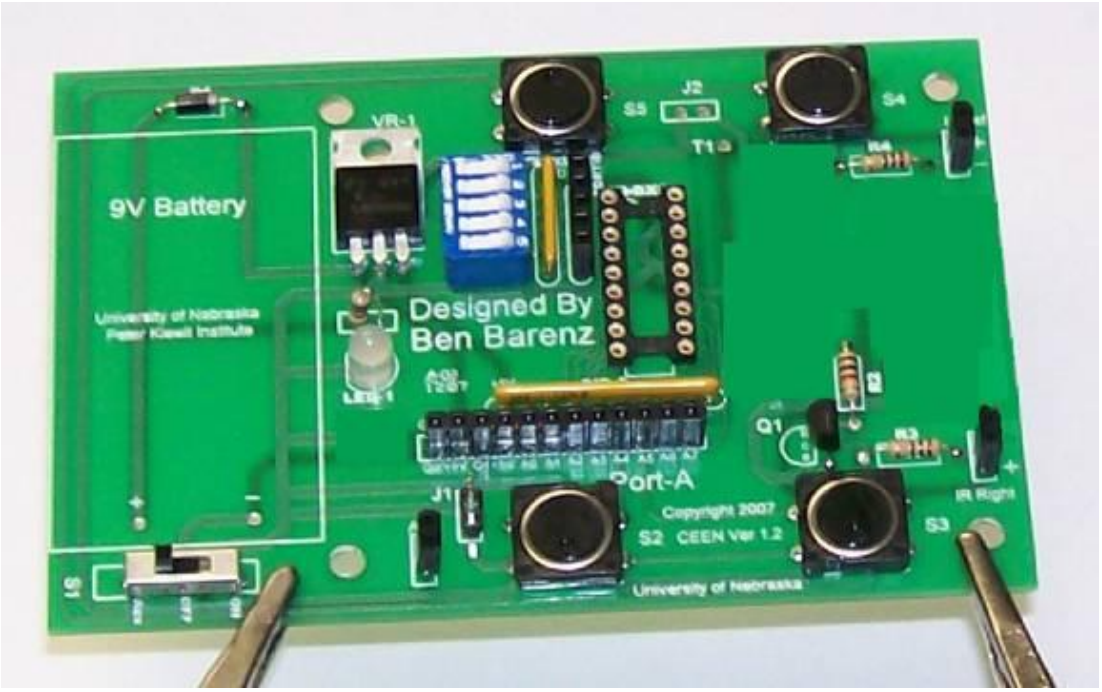
Next gather the (4) tactile switches and use your wire cutters to snip the small **PLASTIC** alignment pins off the bottom as shown in **Fig 7.**

FIG 7



Next mount the black tactile switches and solder them in (orientation does not matter). Mount the blocking diode D1, slide switch S1 as shown in **Fig 8.**

FIG 8



The last component to mount is the battery holder. It is necessary to hot glue the battery holder to the circuit board to ensure that it will not move. Test the alignment of the battery pins with the metal pads, then apply a dime sized amount of hot glue to the top of the battery silkscreen, away from the metal pads. Quickly mount the battery holder. When the glue cools, solder and clip the leads off the back. This completes the soldering.

Place your IR-DX8 chip into the socket. Bend the IR LEDs such that the shorter leads align with the minus (-) marks on the board, and the longer leads with the plus (+) marks. Install the IR LEDs, and place the 2 pin black jumper over the male headers of J1 as shown in **Fig 9.**

FIG 9

The board is now ready for testing. Refer to the functional overview on how to communicate with your receiver board.