ASSEMBLING

the

ECEbot

Printed Circuit Board: Part Two

Due Date

The Part Two assembly steps must be completed prior to: _____

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October 2008

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20081015RCM

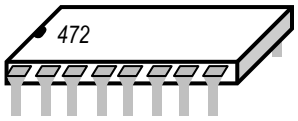
2. Resistor Packs, Transistors, Switches, and Headers

2.1. Soldering Step 5: Resistor Packs and Transistors

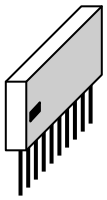
2.1.1. Components list

The components you will use for this step are listed below. The **bold** code refers to the component's name on the PCB silk screen. Find each of the components from your parts kit:

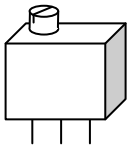
- One 4.7 kΩ dual in-line (DIP) resistor pack (black), **R1**



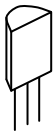
- One 10 kΩ single in-line (SIP) resistor pack (red or yellow), **R2**



- One 50 kΩ potentiometer, **R11**

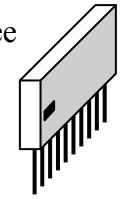


- Four 2N3906 PNP bipolar transistors, **Q1, Q2, Q3, Q4**

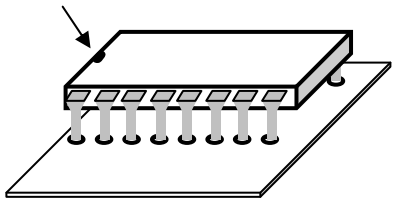


2.1.2. Placing the SIP and DIP resistor packs

Locate position **R2**, the ten-pin in-line resistor pack in the left center of the board (see the location circled in Figure 2-1). It is important to solder the resistor pack so the pin with the black square above it is in the first (leftmost) hole of the group.



→ Hold the pack in place on the front side while you solder each pin on the back side.



R1 is also a resistor pack, but it has eight separate 4.7 kΩ resistors inside a dual in-line package (DIP). *For this particular device* it does not matter which direction you put it in, but for the sake of consistency it is suggested that you insert the package so that the printed label has the same orientation as the PCB silk screen lettering and the notched end on the package is to the left.

→ Place the pins through the front side holes and solder each pin on the back side.

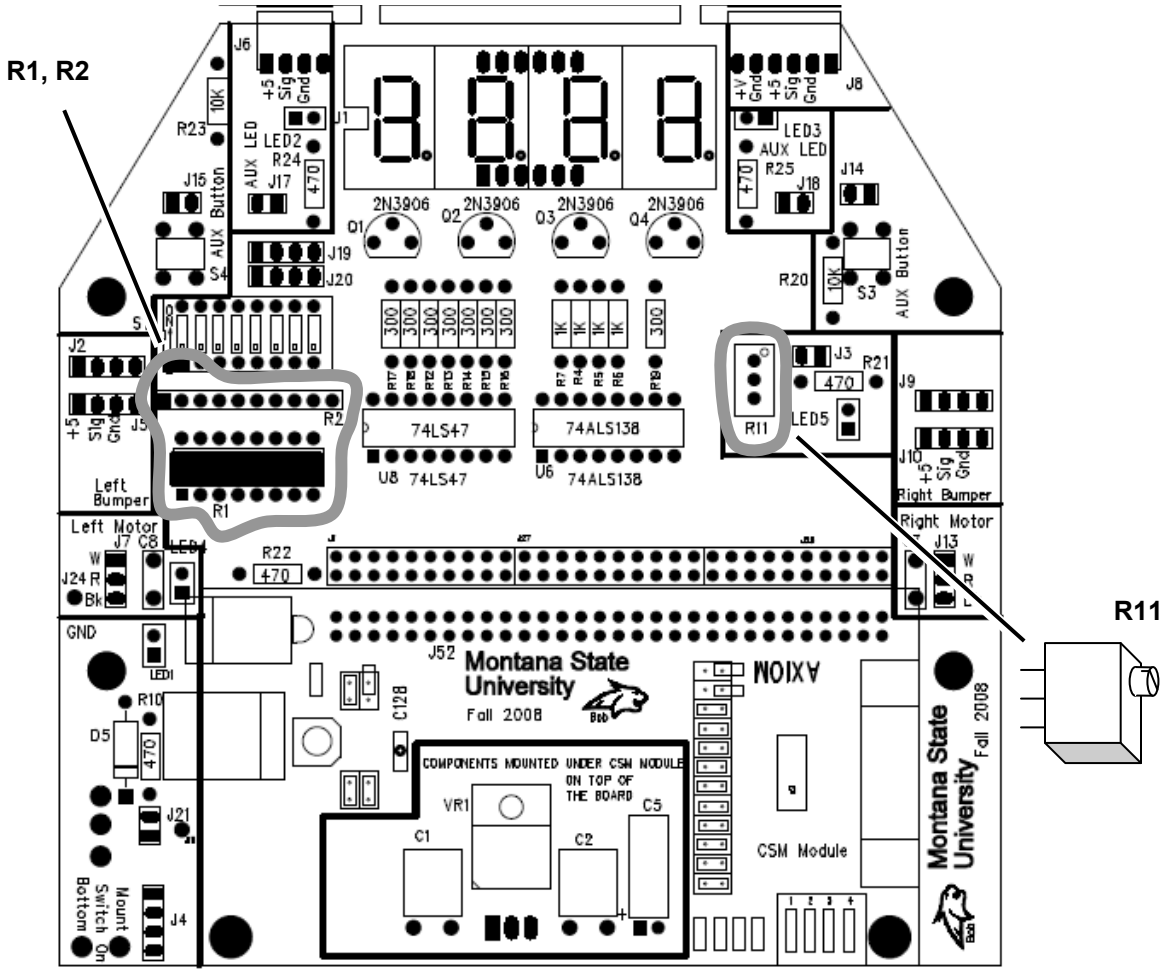


Figure 2-1: PCB layout: Front

2.1.3. Installing the potentiometer

The potentiometer is installed at position **R11** in the right center of the board. Orient the "pot" so that the adjustment screw is at the top (toward the center of the board), as indicated on the silk screen.

→ Place the pot's three leads through the holes and solder the potentiometer in place.

2.1.4. Transistors

The next components to install are the four transistors. Find the small half cylinder-shaped objects with three leads. These are the 2N3906 PNP bipolar transistors. Locate the **Q1-Q4** holes in the upper center of the PCB. Orient the transistors so the shape is aligned with the silk screen emblem (curved side to the top).

Hints: Gently bend the middle pin out so it will fit as the transistor is inserted, but do not press it down so hard that the middle pin is in danger of snapping. The black transistor body should not be forced down into contact with the board: leave a little space so the leads do not kink.

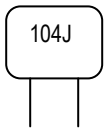
→ Solder the four transistors in place, then snip off the excess wire. Take your time: make sure the solder only contacts the leg of the transistor and the pad, not the adjacent board surfaces and components.

2.2. Soldering Step 6: Pushbuttons and Capacitors

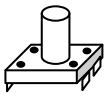
2.2.1. Components list

The components you will use for this step are listed below. The **bold** code refers to the component's name on the PCB silk screen. Find each of the components from your parts kit:

- Two 0.1 μF (104) capacitor (non-polarized plastic film), **C7** and **C8**.



- Two small pushbutton switches, momentary contact, **S3** and **S4**.

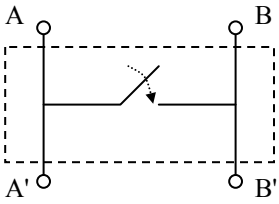


2.2.2. Pushbutton circuits

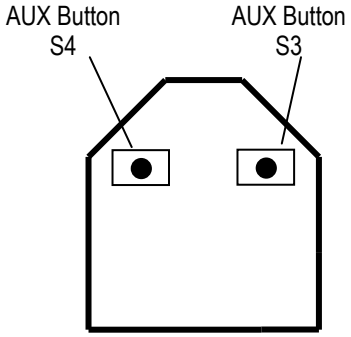
The PCB has two small momentary pushbutton AUX switches (**S3** and **S4**).

Challenge: *With the help of your lab partner use the DMM (digital multi-meter) to test the connectivity of the pins on the momentary buttons provided in the kit. When the button is not depressed, which of the four pins are connected to each other? Now push and hold the button while you repeat the measurement: which pins are connected now?*

The answer to the challenge can be determined by looking at the internal circuit schematic diagram for the switch (see below). Note that both pins on the left side are connected to each other all the time, both pins on the right side are connected to each other all the time, and all the pins are connected together when the button is pressed. It is very important that the buttons be soldered onto the board with the correct orientation.



Locate the two AUX button locations on the PCB. The pin spacing is slightly wider in one direction than in the other, so make sure you have the switch in the proper orientation as you insert the pins.



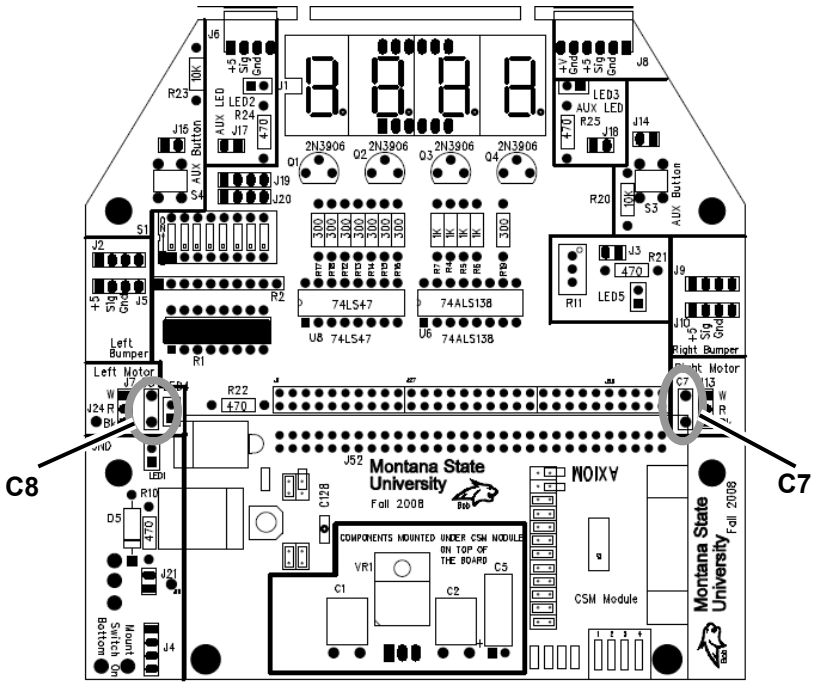
→ Solder the pins of each switch on the back side of the PCB.

2.2.3. Capacitors

Now install the two 0.1µF plastic film capacitors, C7 and C8.

C7 is located in the Right Motor area and **C8** is located in the Left Motor area. The capacitors are non polarized so they can go into the board in either orientation. It is a good idea to place the capacitor so its label will be visible once the motor connector is installed in the adjacent position.

→ Solder the leads of each capacitor on the back side of the PCB, then *gently* clip the excess wire.



2.3. Soldering Step 7: Main Headers

The other items to be installed this week are headers, and there are quite a few of them!

Header size	*Qty*	*Locations*
2-pin	5	J3, J14, J15, J17, J18
3-pin	2	J7, J13
4-pin	2	J19, J20 (optional)
30-pin	2	J1+J27+J28

→ The locations to install are circled in the PCB layout shown in Figure 2-2. Insert all the specified headers and solder them in place. Try to make sure the pins end up perpendicular to the board. *Note* that several header positions can be left empty: J2, J5, J9, and J10 are optional.

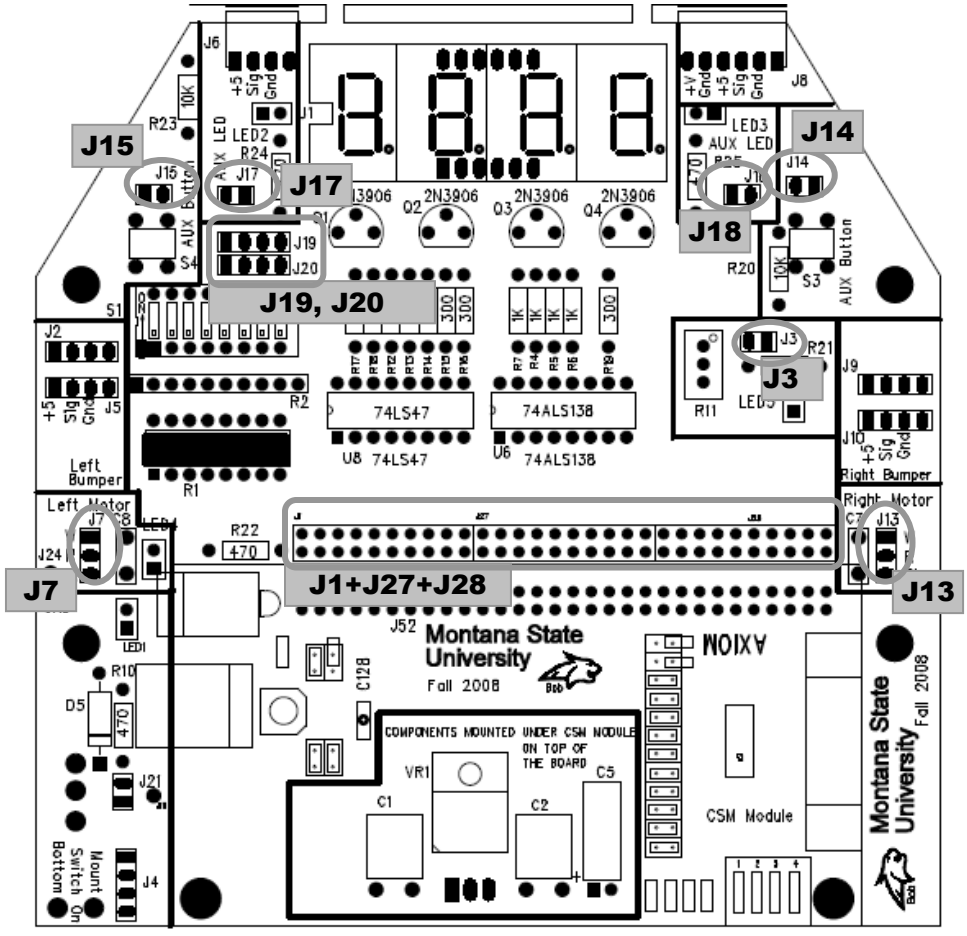


Figure 2-2: Locations to install the indicated headers.

This concludes soldering Part Two.
This coming week you will complete the PCB assembly with the Part Three steps.