Arduometer

Electrical Test, Programming, Casework

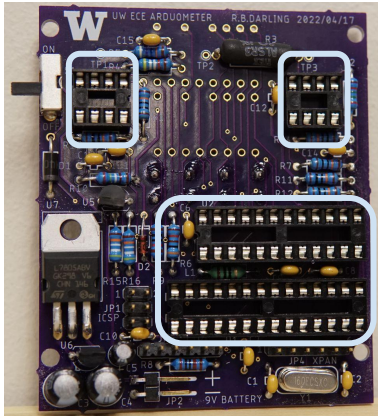
Electrical Test (Step 1/2)

Before slotting in your chips (U1 - U4), it is good practice to ensure they will not “fry”, which could most easily happen if a power pin is shorted.

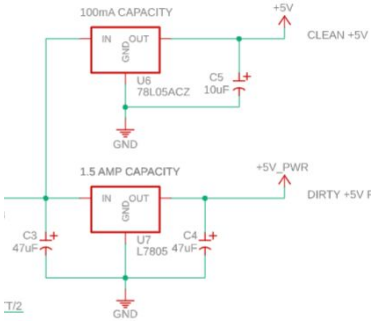
First, power up the board by connecting a 9V battery or 9V power supply:

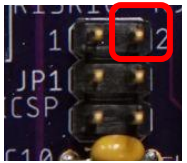
Then use a voltmeter to check the output of the two regulators is 5V:

1. **Output of U7: +5V_PWR** - less stable but high power for the display driver
2. **Output of U6: +5V** - clean and stable power for microcontroller and op amps. U6 can be hard to physically probe - there is another Clean +5V on pin 2 of JP1:



Leave chips unslotted for now!





+5V (easier to access than output of U6)

+5V_PWR

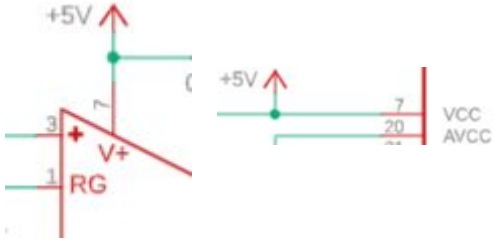
+5V

Electrical Test (Step 2/2)

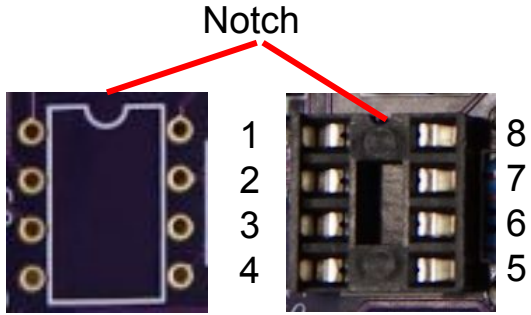
Disconnect power and perform a continuity check to ensure all chip sockets U1-U4 are getting power on the right pins, as well as no power on non-power pins. You can check which pins are power on the schematic. Summary below:

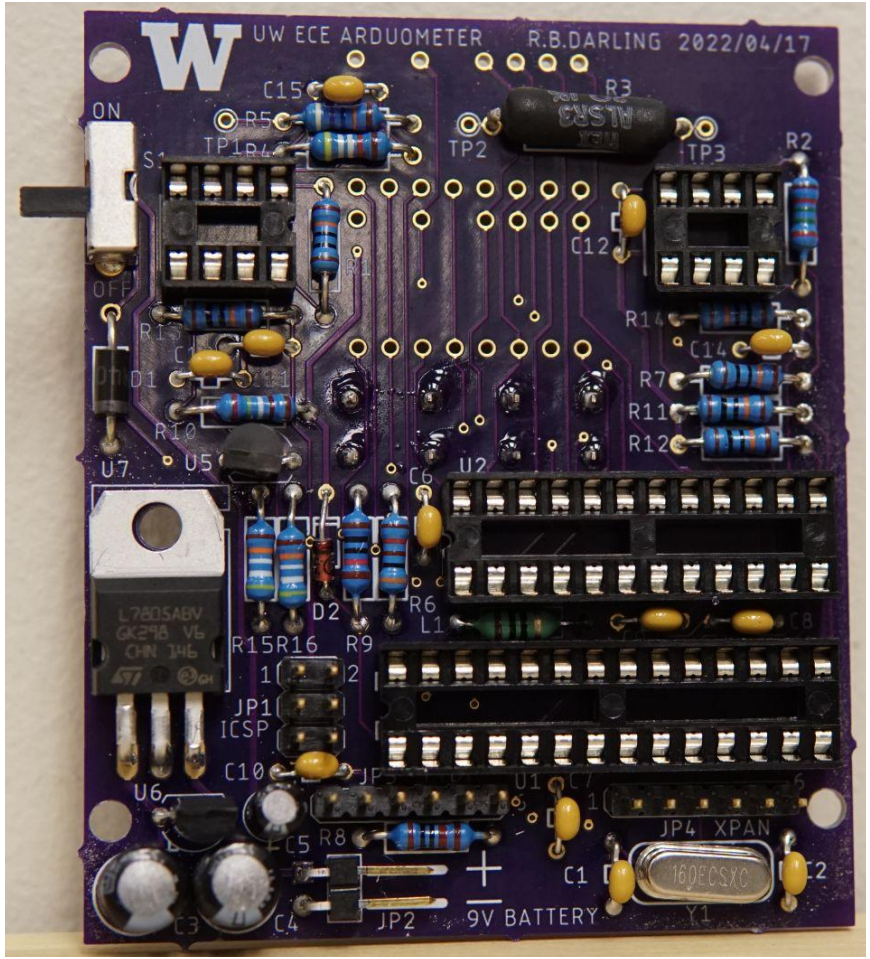
+5V_PWR should go to:
- U2: Pin 19

+5V should go to:
- U3, U4: Pin 7
- U1: Pins 7, 20



To count pins, find the notch printed **on the PCB** (it's OK if the sockets are soldered backwards) and count as follows in this orientation:





Programming (1/2) - Bootloader

If you have successfully completed the Electrical Test, you can slot in your chips (notch on chip should follow notch on PCB - it's OK if your sockets are backwards).

If you would like to try this yourself (happy to lend an Arduino if you don't have one):

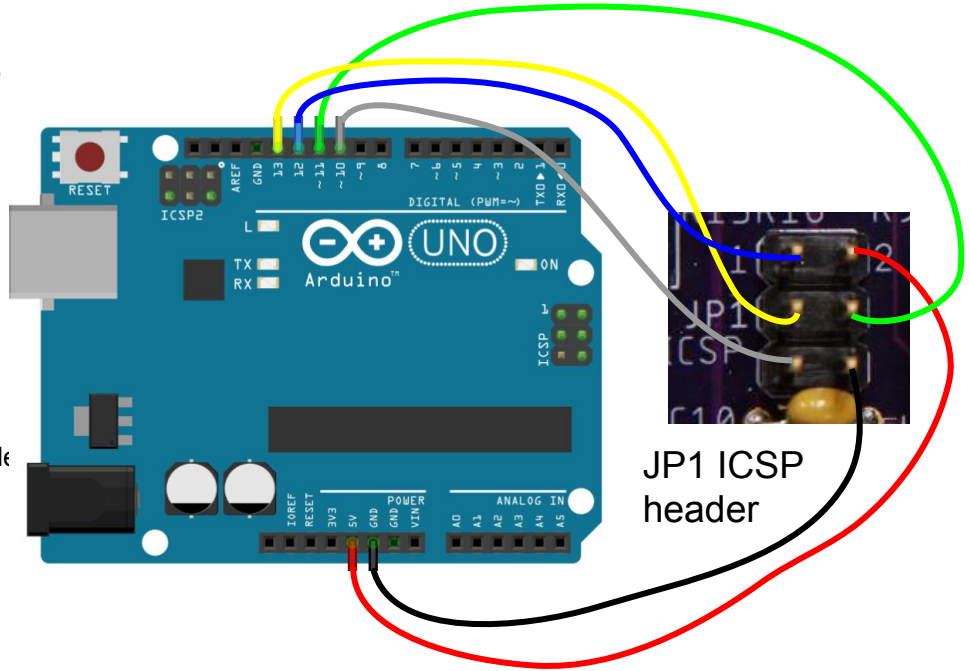
Step 1 - Copy the Arduino bootloader (one time only):

Hardware required:

- A standard Arduino Uno
- 6 x male-to-female jumper wires

Power to your board is not required for this step since the Arduino will provide power. Using a real Arduino Uno, connect the ISP (in-system programming) as in the diagram to the right. Then follow the "Easy way" instructions in this tutorial to burn the bootloader:
https://learn.sparkfun.com/tutorials/installing-an-arduino-bootloader/all

After burning the bootloader, you can disconnect the ISP wires and you shouldn't need to do it ever again! Your board will just show up as an Arduino Uno when you connect it to a PC.



Programming (2/2)

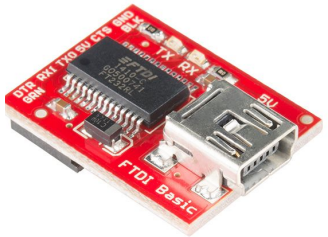
Step 2 - Program the board using the Arduino IDE

Hardware Required:

- USB-FTDI Bridge (https://www.sparkfun.com/products/9716) - this one is the easiest to use since it already has female headers but you can also use other USB-FTDI bridges but you may need different jumper wires
- USB-to-miniUSB cable

Software Required:

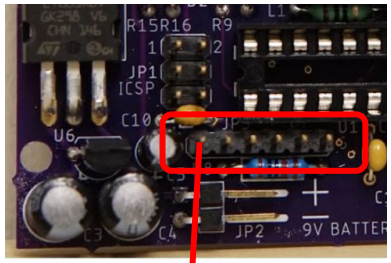
- Arduino IDE (free to use) https://www.arduino.cc/en/software



Connect the mini-USB side of the cable to the USB-FTDI bridge to create the **programming cable**.

Power your board on the 9V battery header. Using the programming cable on the **JP3 programming header** (if using the USB-FTDI bridge suggested above, it should only fit in one direction with GND on the left), program a sample program (see Canvas -> Week 10) as you usually would an Arduino program.

See Arduino resources for instructions on how to upload programs: https://support.arduino.cc/hc/en-us/articles/4733418441116-Upload-a-sketch-in-Arduino-IDE



JP3 Programming header

GND pin

Casework (1/2)

Step 1: Use the metal drill guides to mark the drill points on the **front half** (the piece **without** a battery holder) using a small sharp tool (like a nail or drill bit). Don't actually drill with the metal drill guides on, use them only for measurement/marking. Use a utility knife to heavily score the rectangular cutout.

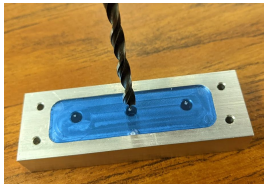
Step 2: Drill the holes.

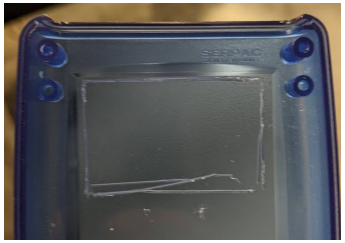
Step 3: For the rectangular cutout, first drill holes in the 4 corners, then dremel out the sides. File smooth.

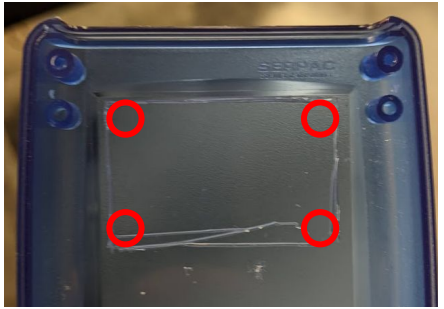
Step 4: Insert the binding posts into the small top piece. Use pliers or a wrench to tighten the nut.

Step 5: Use a nibbling tool to cut a notch for the on/off switch on the **back half** of the case:

Use drill guides to mark where to cut/drill







To cut rectangular hole, first drill 4 corner holes **inside** the rectangle. Then, dremel out the sides.

Casework (2/2)

Step 6: Use PCB screws (4 short silver ones) to screw the PCB on the front half.

Step 7: Solder the binding posts in your chosen orientation to TP1, TP2, and TP3 using a wire strand. Color choice is up to you:

- TP1 - Voltage
- TP2 - Common/ground
- TP3 - Current

Use a wire strand instead of soldering directly as this is much more mechanically stable; wind the wire a few times around the bottom of the post to more securely solder it. Use a piece of tape under the posts in case you are afraid of shorting something. Note TP2 and TP3 are connected to the nearby pads of the large resistor R3 anyway.

Step 8: Solder the battery connector wires to the case battery contacts **before** inserting the metal contacts into the case. Once they are soldered, insert them in the case.

Step 9: Try loading the multimeter program to your board and congrats on completely finishing the project :)