PCB Components and Assembly

Power Board

- Teensy microcontroller: The Teensy 3.2 microcontroller is shown in Figure 1. It runs on a 32-bit ARM microcontroller and has a pinout given here. An SD card sits on top of the Teensy and collects data. You will solder the machine sockets that will hold the Teensy on the powerboard.

Figure 1. Teensy Microcontroller

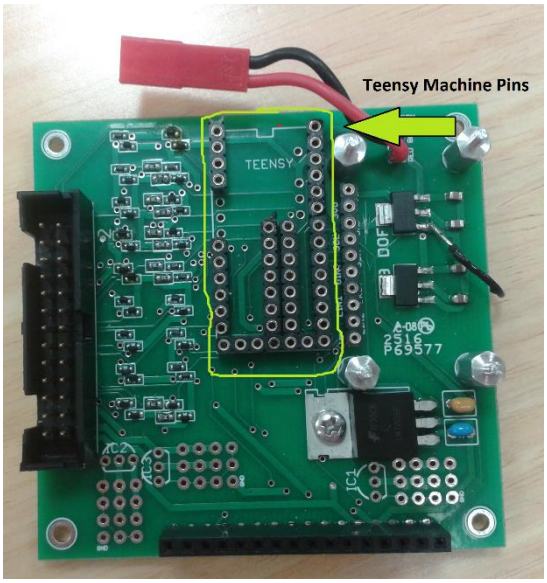
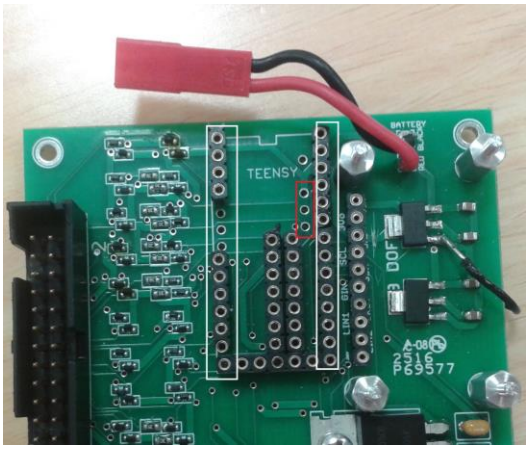


Figure 2. Teensy Machine Pins

1.) There are 2 types of 801 machine sockets, one higher than the other.
2.) The higher machine sockets go on the two long parallel sides, 14 pins on each side. They are boxed in white.
3.) The shorter machine sockets go on the bottom end (5 pins), the center two columns (14 pins total), and the odd three-pin column (boxed in red).

Ignore the fact that some of the holes are not soldered. The picture is not up-to-date.



- Lipo Battery: A 7.4V 1300mAh Li-Po battery will power your Teensy. Li-Po batteries are extremely dangerous and must be handled with care. Absolutely avoid shorting your battery. Doing so will generate a lot of heat that can melt anything connected to the battery. Solder the JST connector for the battery on your board.

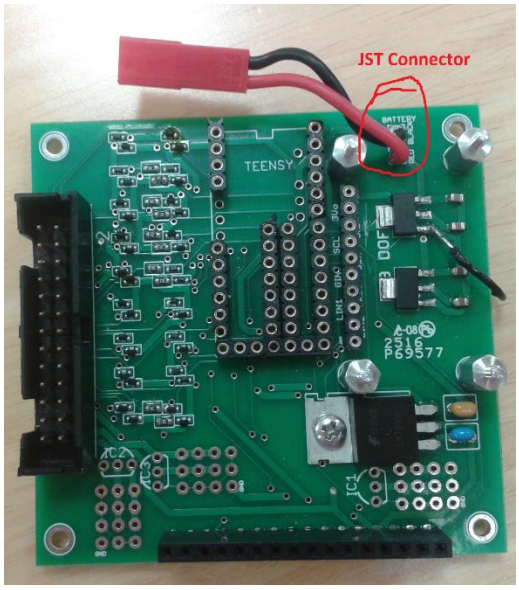


Figure 3. Battery JST Connector

- Adafruit IMU: The IMU (Figure 4) contains an accelerometer, gyroscope, and magnetic compass, each in three axes, so it has 9 degrees of freedom (DOF) in total. You will use the IMU to gather positional information to navigate the robot in future labs. Solder 301 machine sockets and screw four standoffs for the IMU.

Figure 4. Adafruit 9-DOF IMU

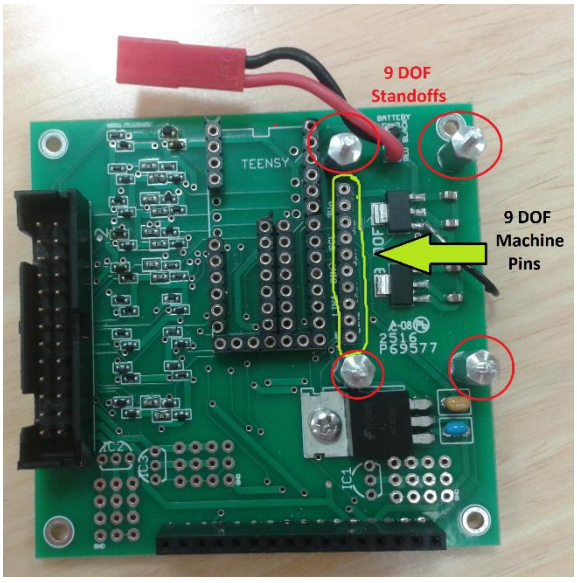


Figure 5. 9-DOF Assembly

- Protection Diodes: Part of your board is dedicated to protection diodes. The diodes protect sudden large voltages from killing the Teensy. They are arranged as shown in Figure 3. These diodes have been soldered for you.

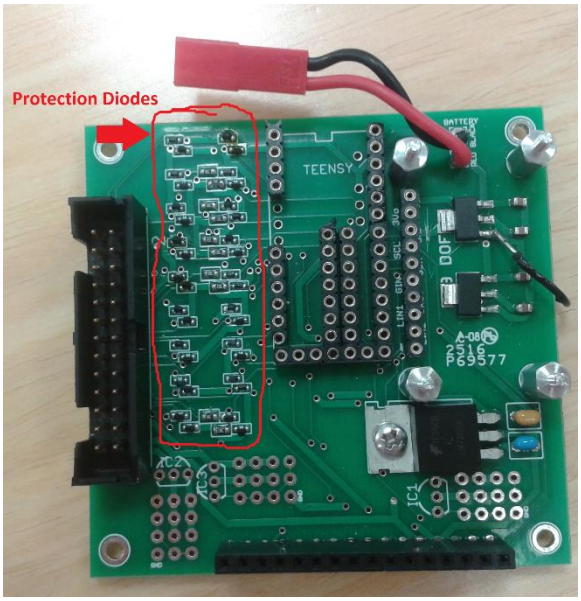


Figure 6. Protection Diodes

- Voltage Regulators: The Teensy and Adafruit 9-DOF IMU run on 5V. A 5V surface-mount (SMT) voltage regulator powers both of them (see Figure 7). Both bypass capacitors for the 5V SMT regulators are 10uF.

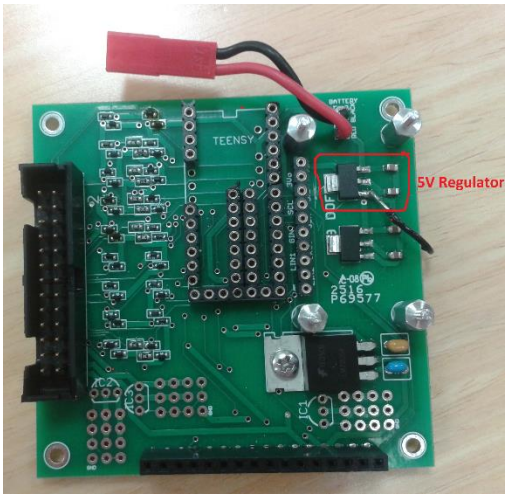


Figure 7. 5V SMT Regulator and Bypass Capacitors

Some of your sensors might run on 5V. The board has a separate 5V line, powered by a through-hole (TH) regulator (see Figure 8), for those sensors. The 5V power for the Teensy and sensors are separated to protect the expensive Teensy from any power surges that your sensors might cause. The values of the bypass capacitors for the TH regulator are shown in Figure 8. Be sure to solder the back of the regulator. This solder plane will serve as a heatsink. Screw the top of the regulator to the board.

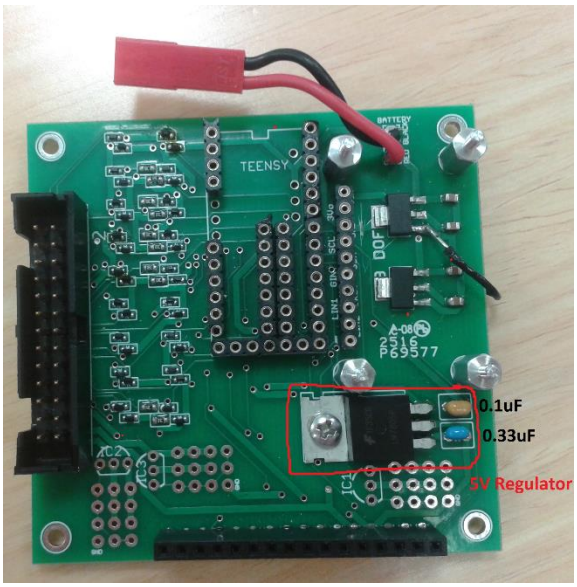


Figure 8. 5V Through-Hole Capacitor

There is a 3.3V SMT regulator for the protection diodes. Both bypass capacitors are 1.0uF.

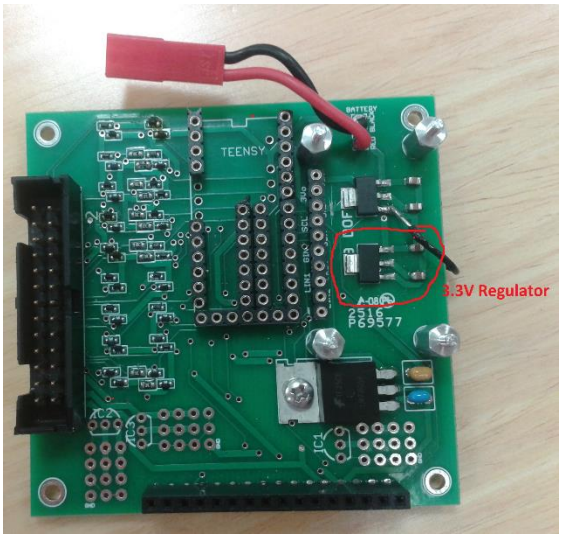


Figure 9. 3.3 SMT Regulator

Finally, there are footprints for three additional through-hole voltage regulators of your choosing. You will add these to your board in the final lab.

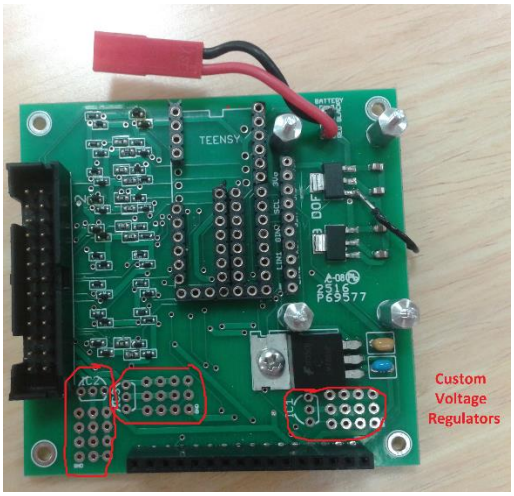


Figure 10. Additional Voltage Regulators

- Breakout Header Pins: A 16x1 female header connects power, motors, and temperature and pressure sensors from the Teensy to the E79 board.(*) A ribbon cable header connects the Teensy to the sensors on your protoboard. Solder these two headers.

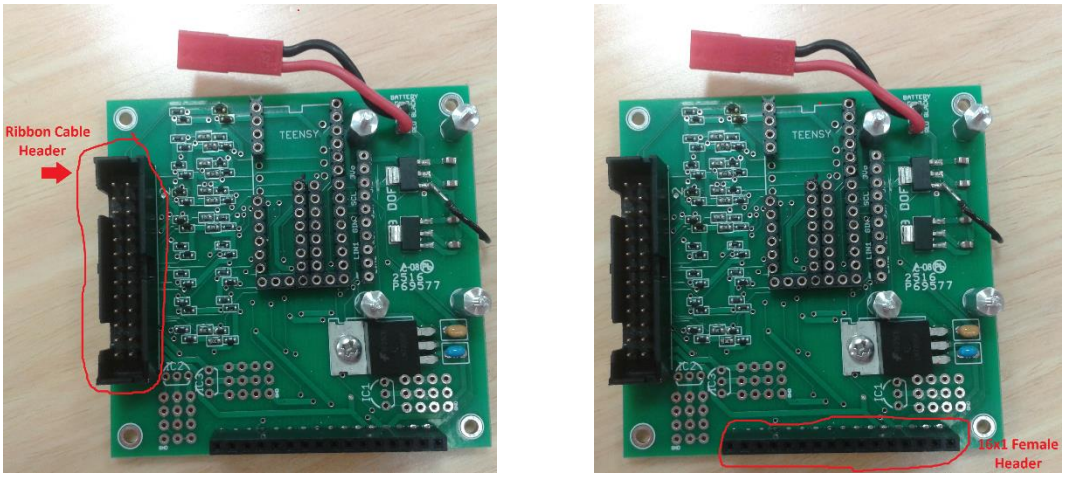


Figure 11. Header Connections to Protoboard and E79 Board

(*) Revision (1/12): The 16x1 header has been replaced with four 2x2 headers.

Protoboard

The protoboard has the power rails, buses, and ribbon cable connection ports shown in Figure 12. It also have a ribbon cable header to receive the Teensy breakout and a SPST switch that resets your Teensy when pressed, shown in Figure 13. You will not be working with the protoboard in this lab, but do solder the ribbon cable header and switch.

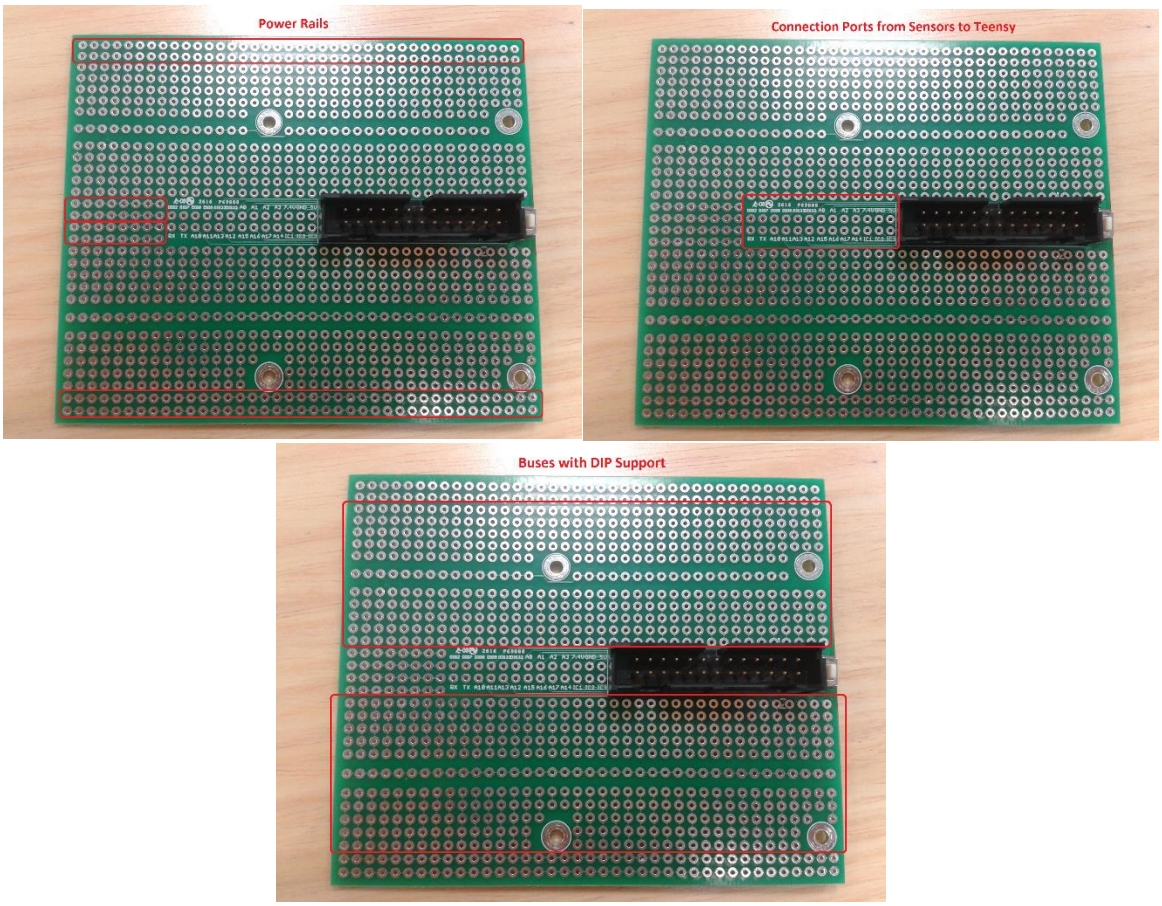


Figure 12. Protoboard Layout

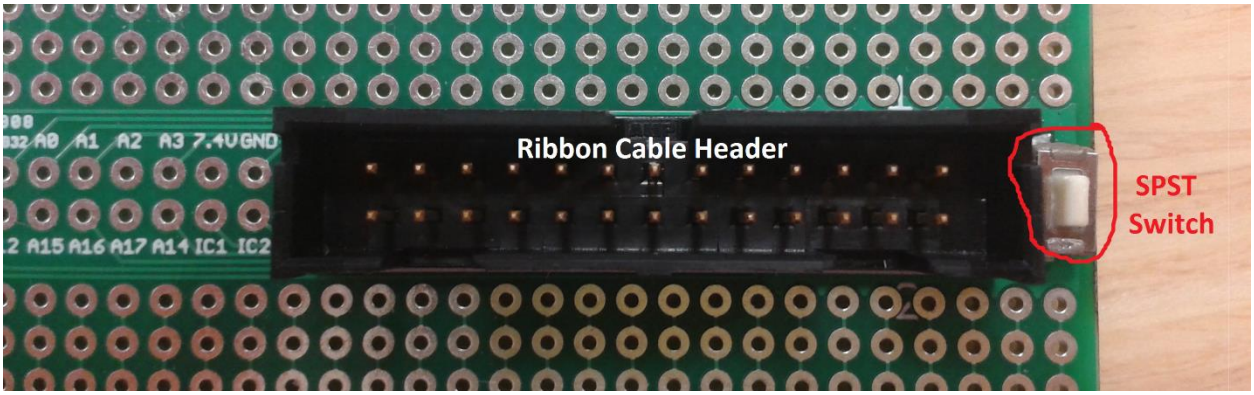


Figure 13. Ribbon Cable Header and SPST Switch