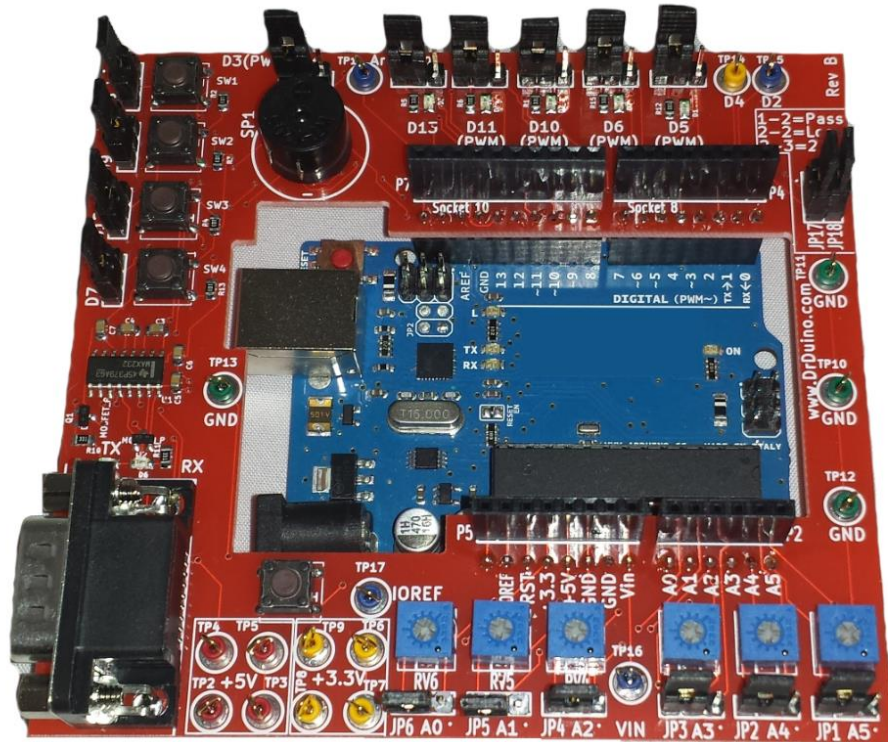


Dr. Duino™ Debugging and Arduino Learning Shield



Thank you for purchasing the Dr.Duino™ kit, the world's first Arduino hardware debugger and learning shield.

This kit assumes that you have soldering knowledge and some level of familiarity with the Arduino environment.

Before we get started here is what you will need:

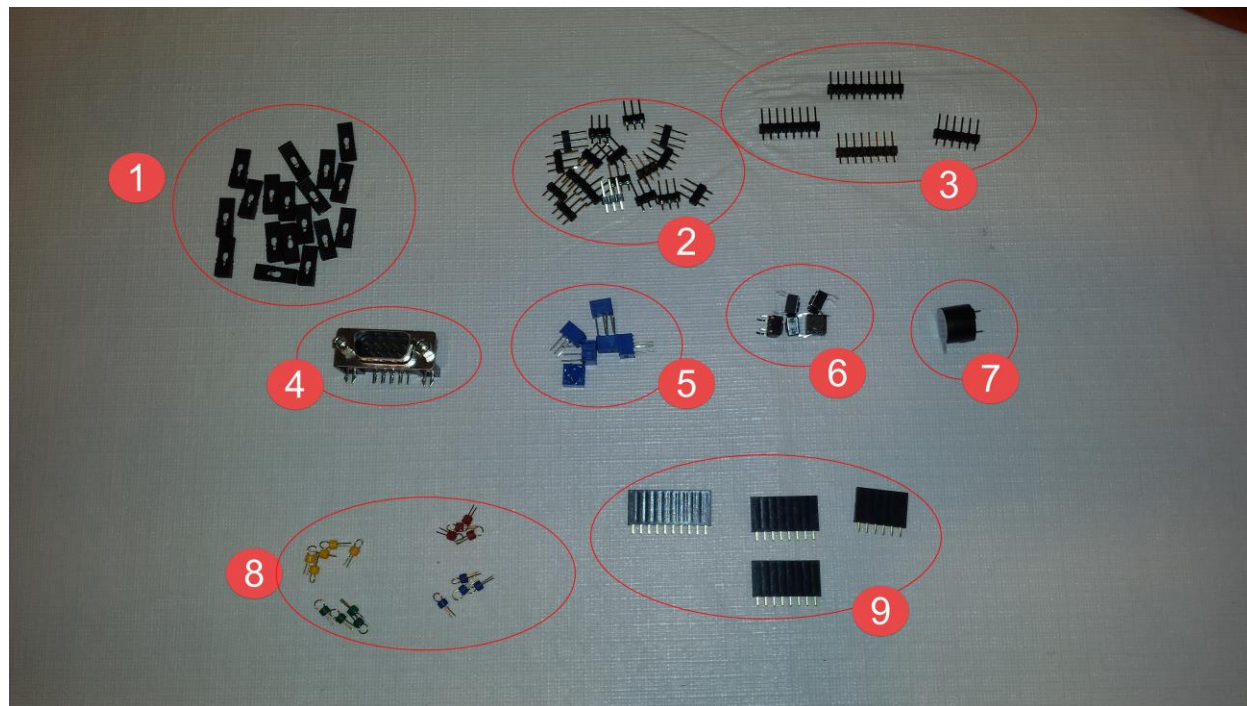
Tools Required:

- Safety glasses
- Soldering Iron
- Solder
- Pliers
- Cutters
- Small Philips screwdriver.

Wear safety glasses from this step forward.

Assembly Instructions (Time required approximately 30-40 minutes)

1. Start by separating all the parts out as outlined below for easy identification of all items.

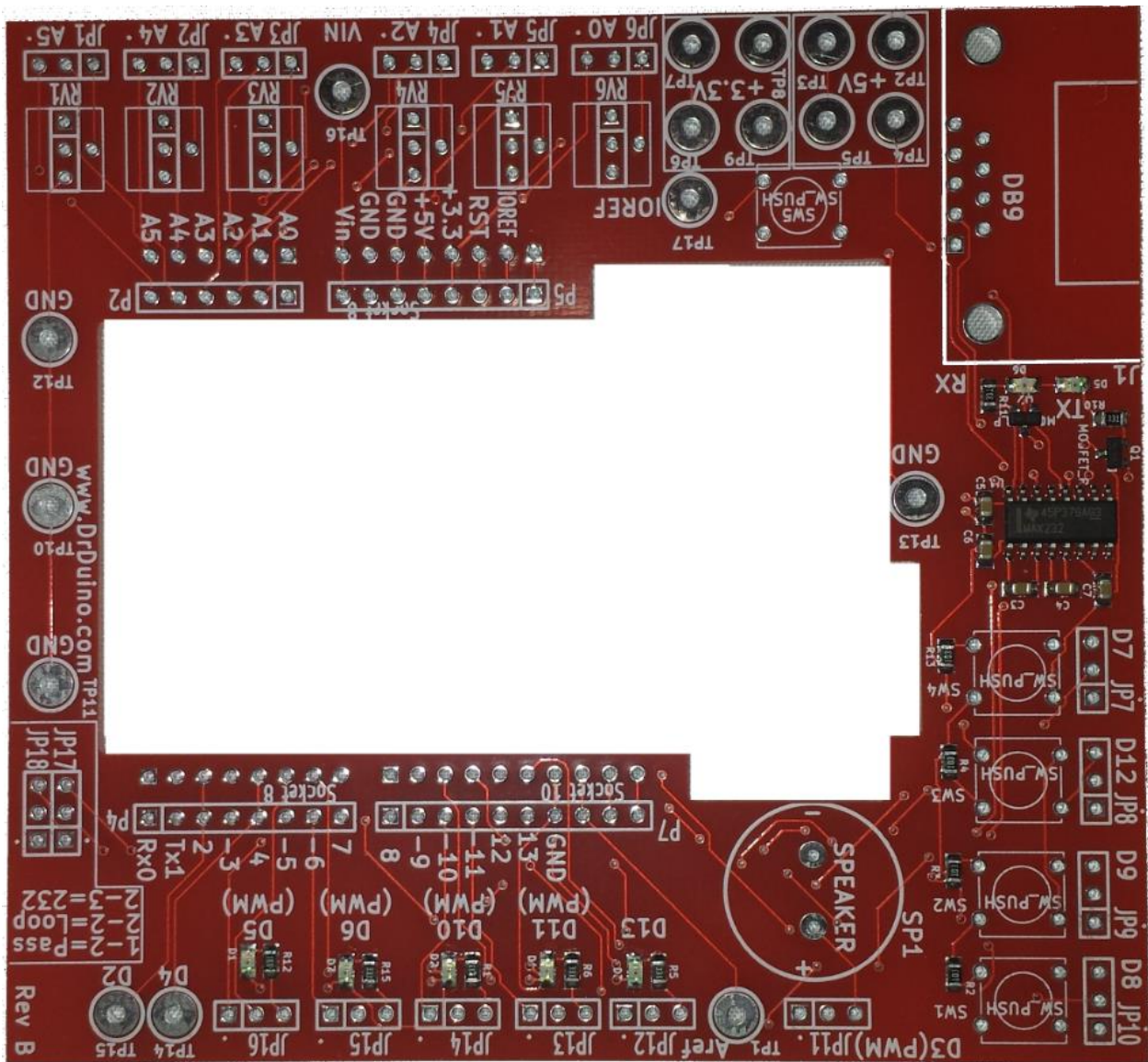


Number	Description	QTY
1	Shunts	18
2	3 Pin Headers	18
3	8 Pin Header	2
3	10 Pin Header	1
3	4 Pin Header	1
4	RS-232 Connector	1
5	Potentiometer	6
6	Switches	5
7	Piezo Buzzer	1
8	Yellow Test Point	4*
8	Red Test Point	4*
8	Blue Test Point	4*
8	Green Test Point	4

*Note- You may have 1 extra test point.

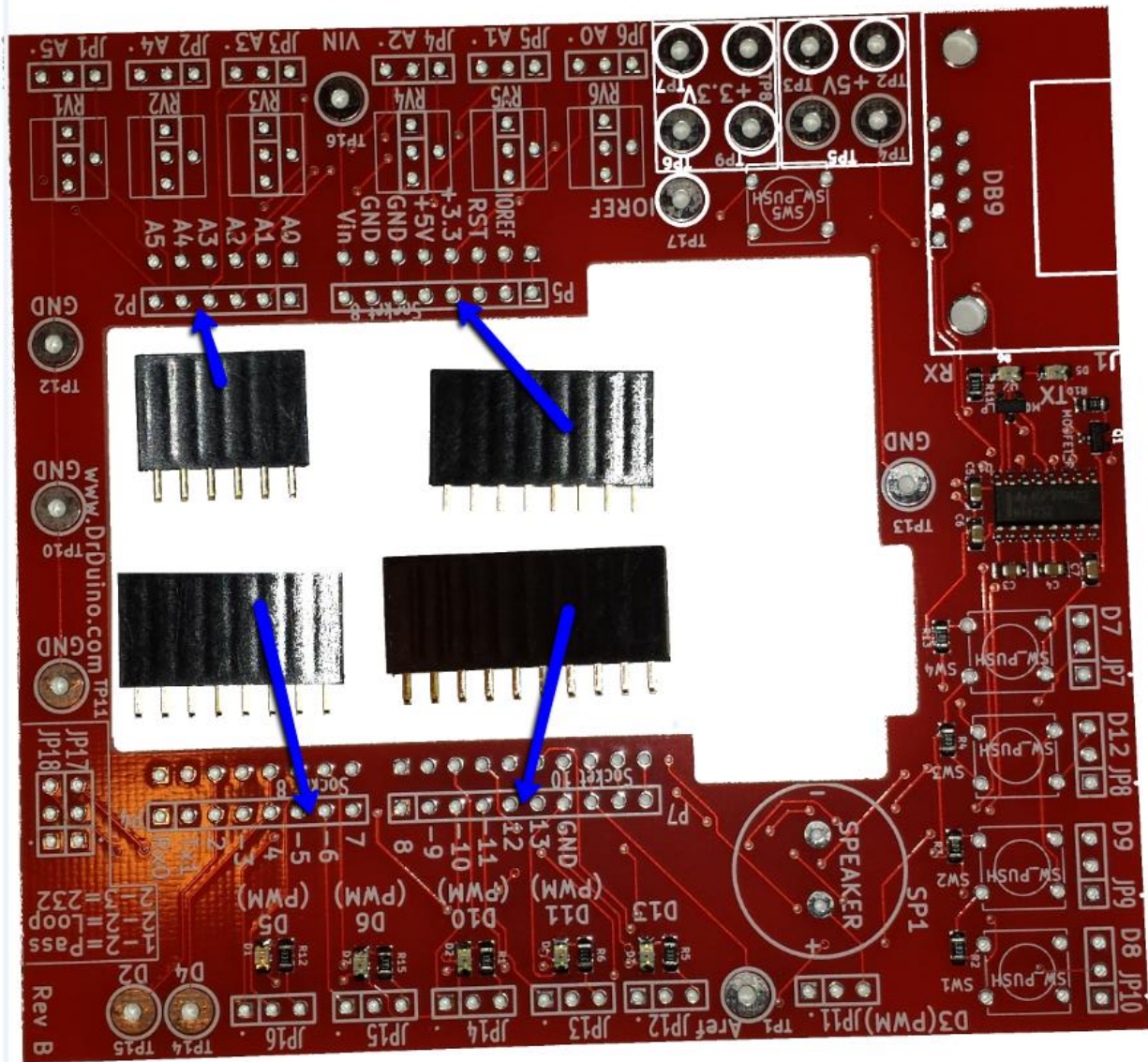
2. DR. Duino Board

Remove the Dr. Duino board from the anti-static bag. Familiarize yourself with the layout of the board. The picture below is the top of the board. Use appropriate electrostatic procedures when handling board.



3. Socket Installation

Start by stuffing sockets P5, P2, P7 & P4 as shown below. Place sockets exactly where pointed to within the white rectangle. Note*- Alignment of sockets is key to operation see pictures on next page before soldering.



Note*- Alignment of sockets is key to operation. Pay special attention to their alignment. Figure 1 below shows incorrect alignment while figure 2 shows correct alignment.

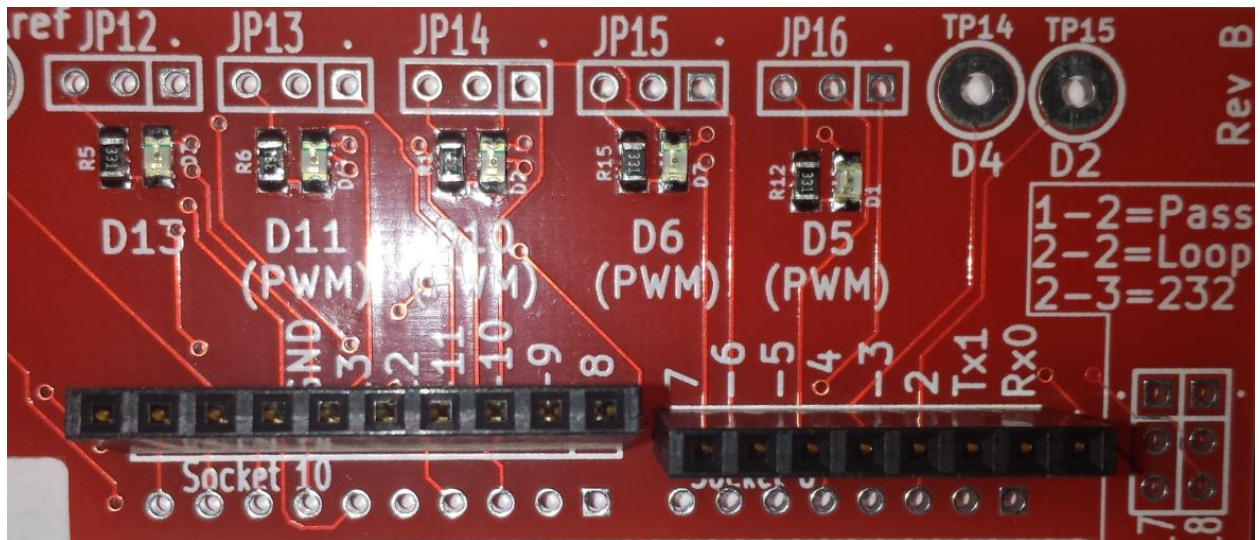


Figure 1-Incorrect alignment of Socket

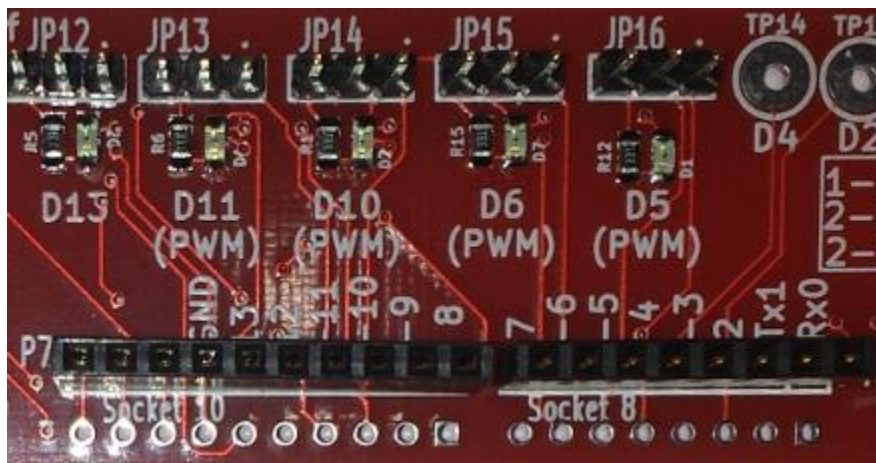
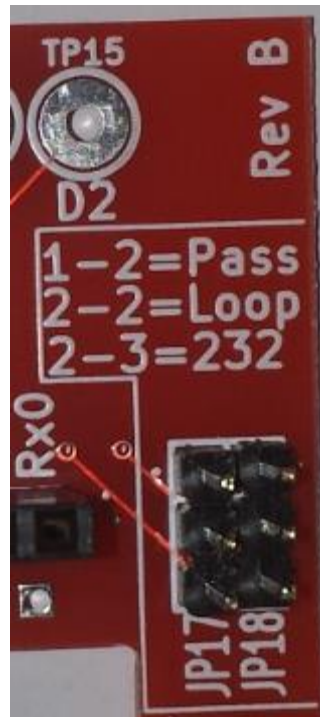


Figure 2-Correct alignment of sockets

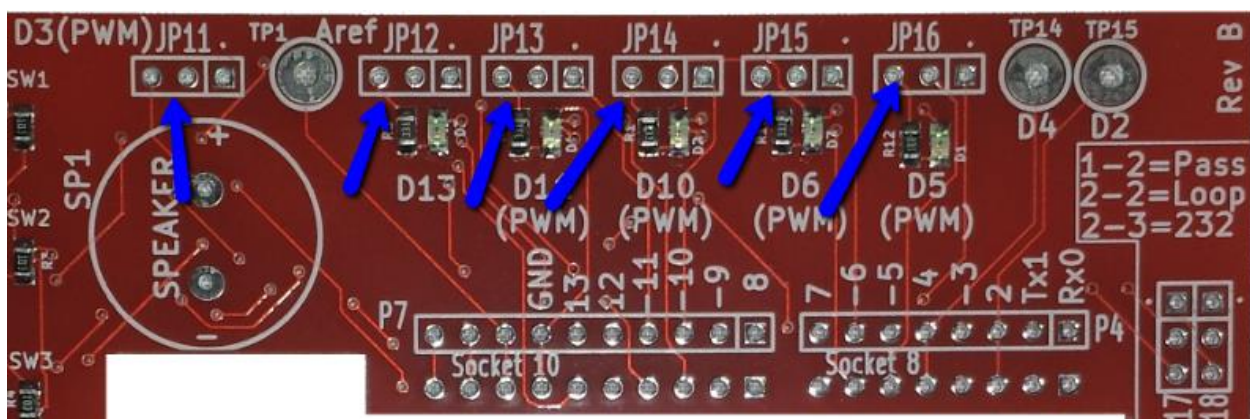
4. Rs-232 Headers

Next populate the 3 pin headers in JP17/18. Again pay special attention to alignment. They must sit flush and even next to one another or the jumpers will not sit correctly.



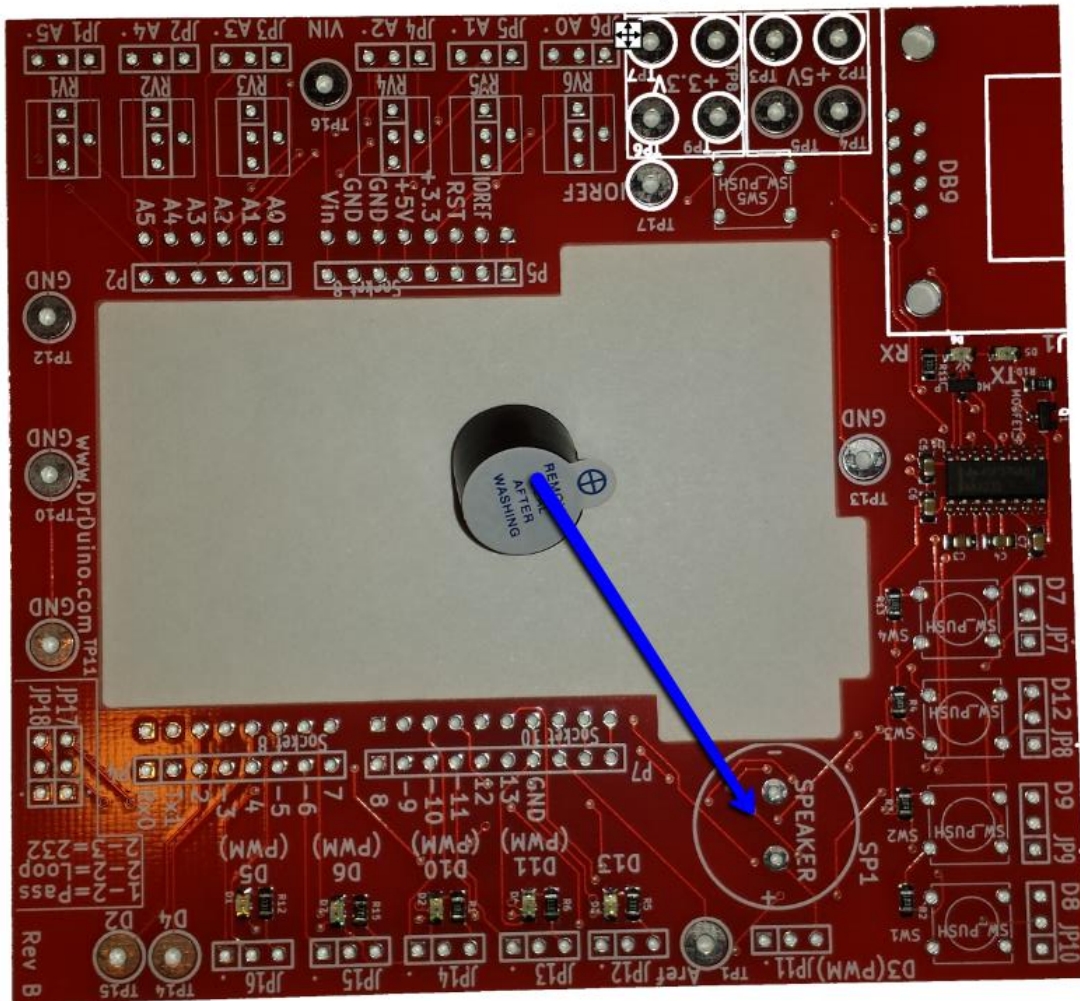
5. LED & Piezo Jumpers

Next populate the 3 pin headers above the LED's and piezo buzzer. JP 11- JP16



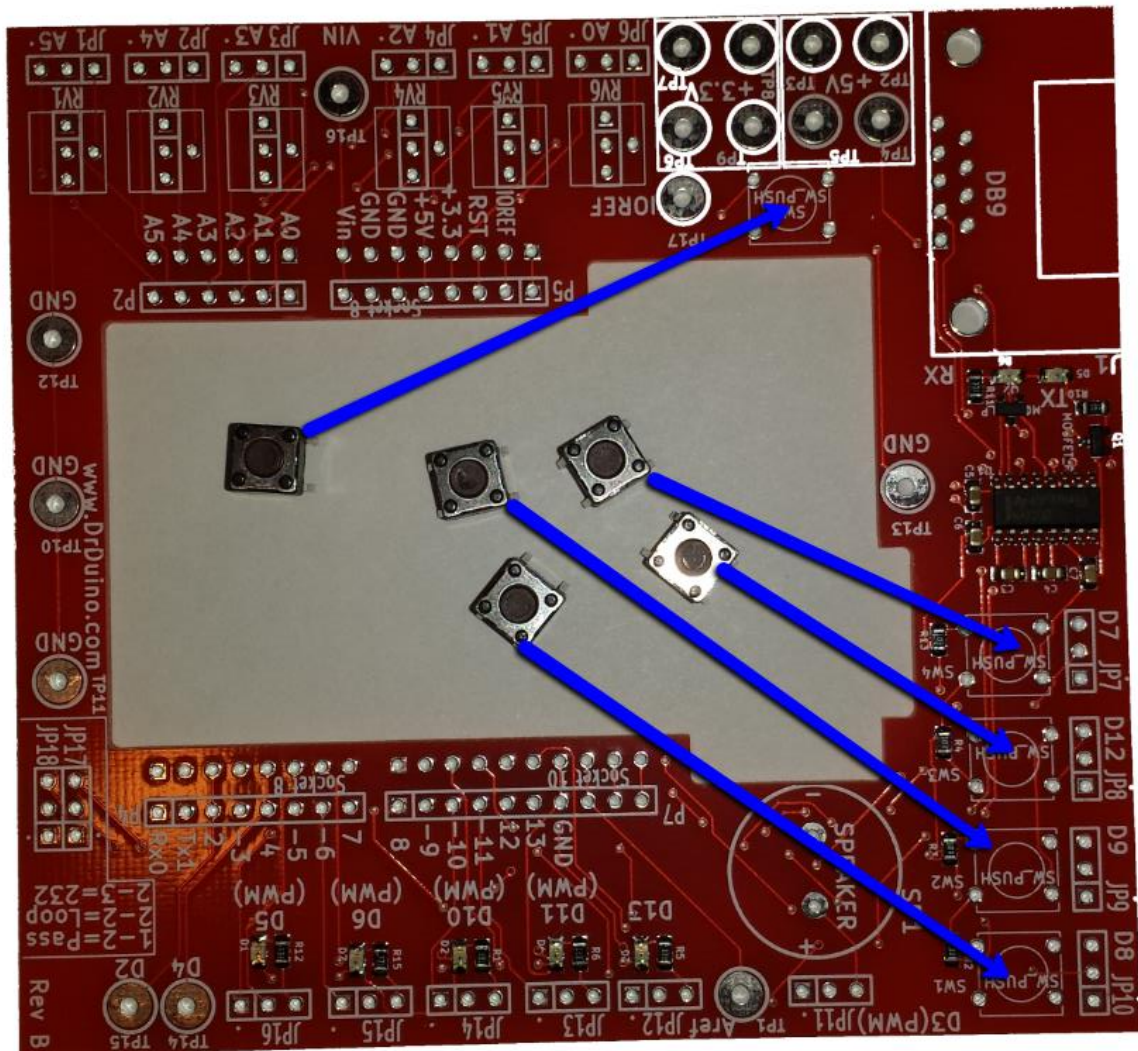
6. Piezo Buzzer

Populate the buzzer, paying special attention to polarity(+ -). Match the + to the + symbol of the buzzer.



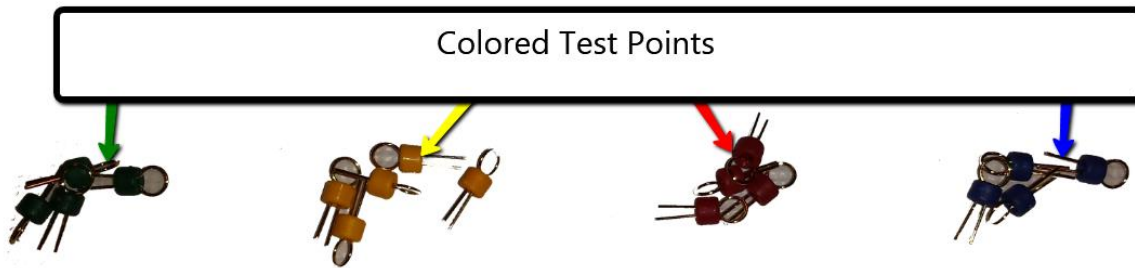
7. Switches

Populate the five push buttons. Note- switches will only fit one way, orientation doesn't matter.

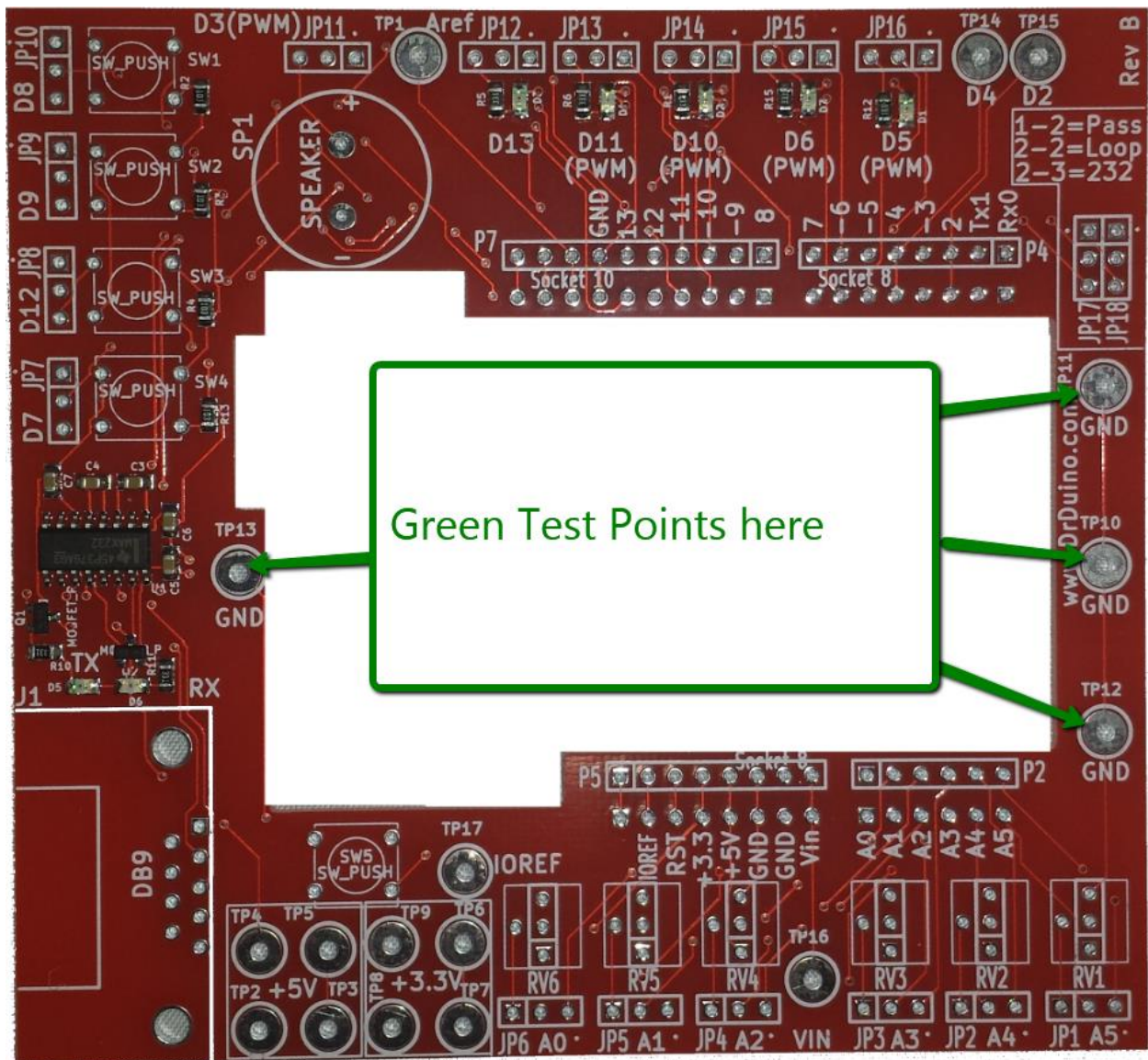


8. Test Points

The next few pictures depict the color coded test points and their location.

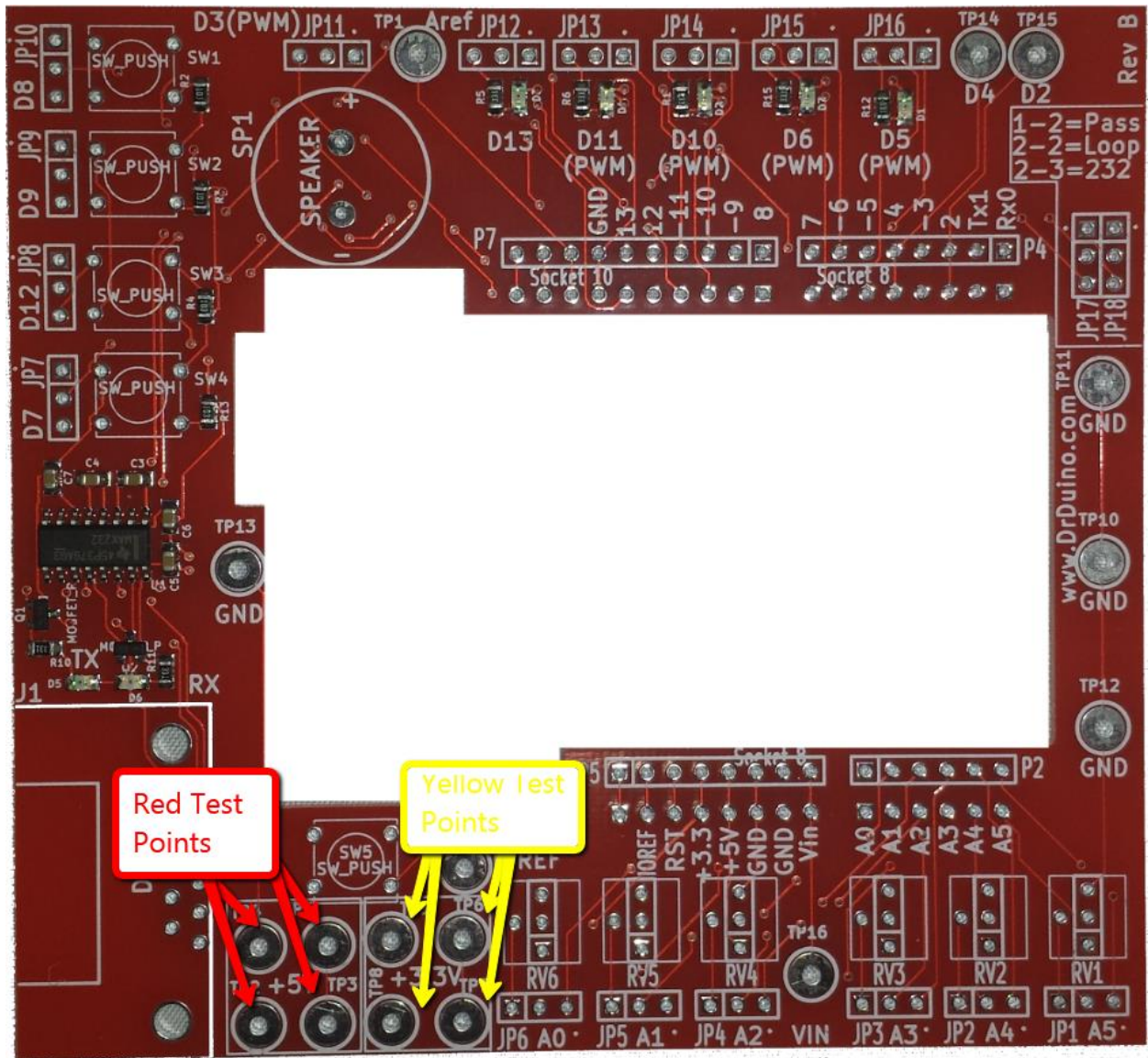


TP10 through TP13= GREEN Test Ponits

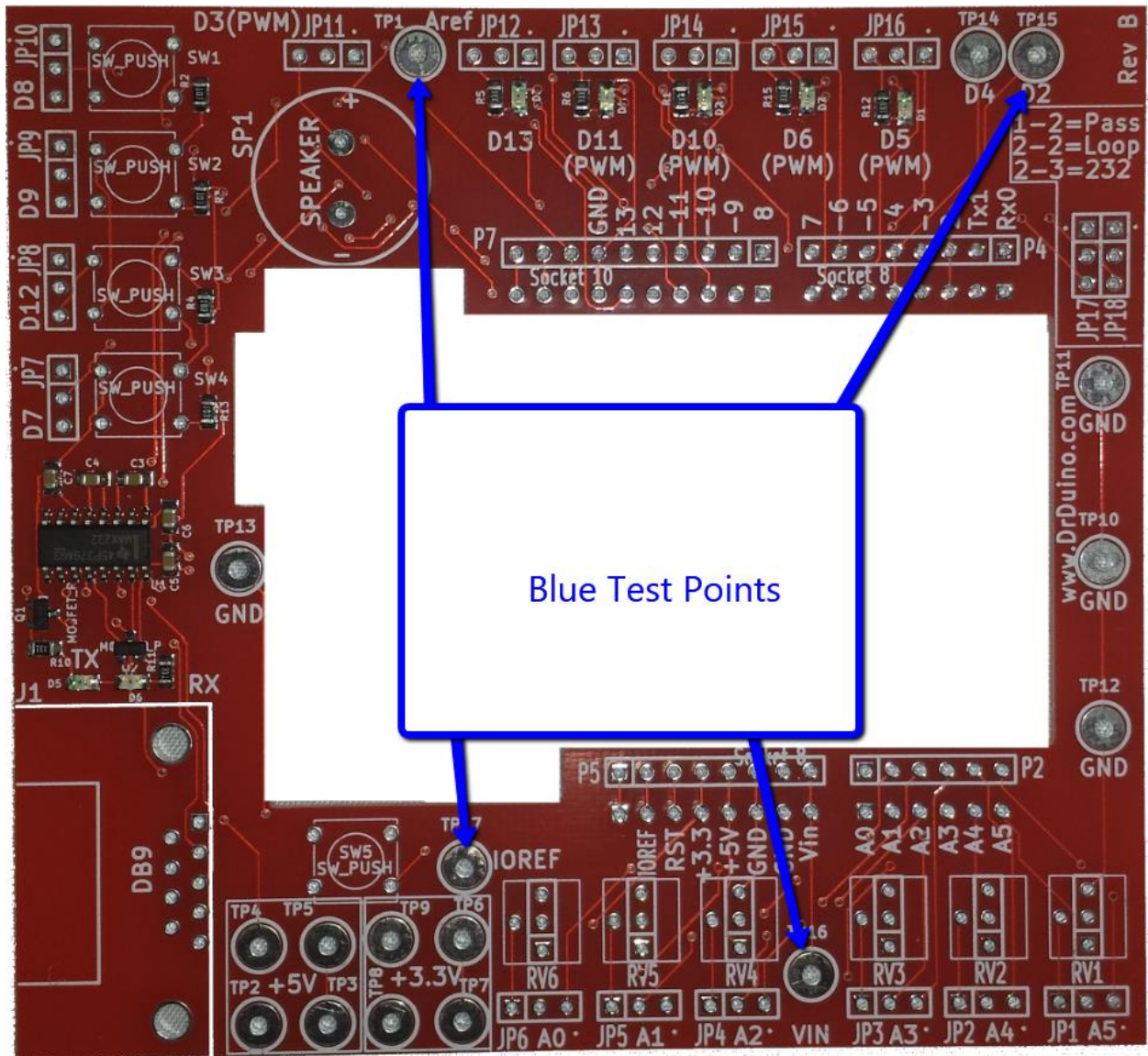


TP2-TP5 = RED Test points

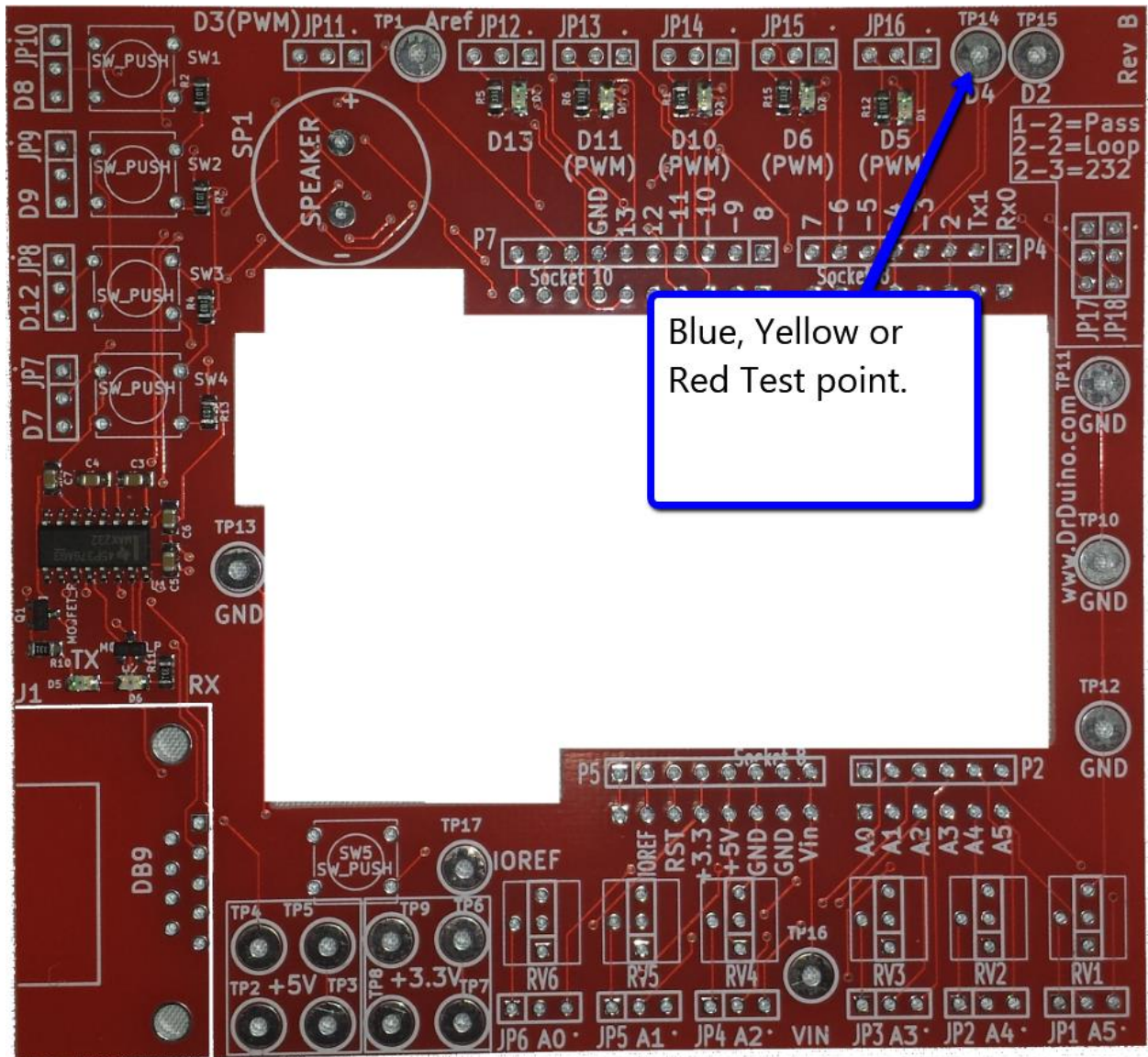
TP6-TP9 = YELLOW Test Points



TP1,TP15,TP16, TP17 = BLUE Test points



TP14 = BLUE, YELLOW or RED Test Point (Depending on what is in kit).



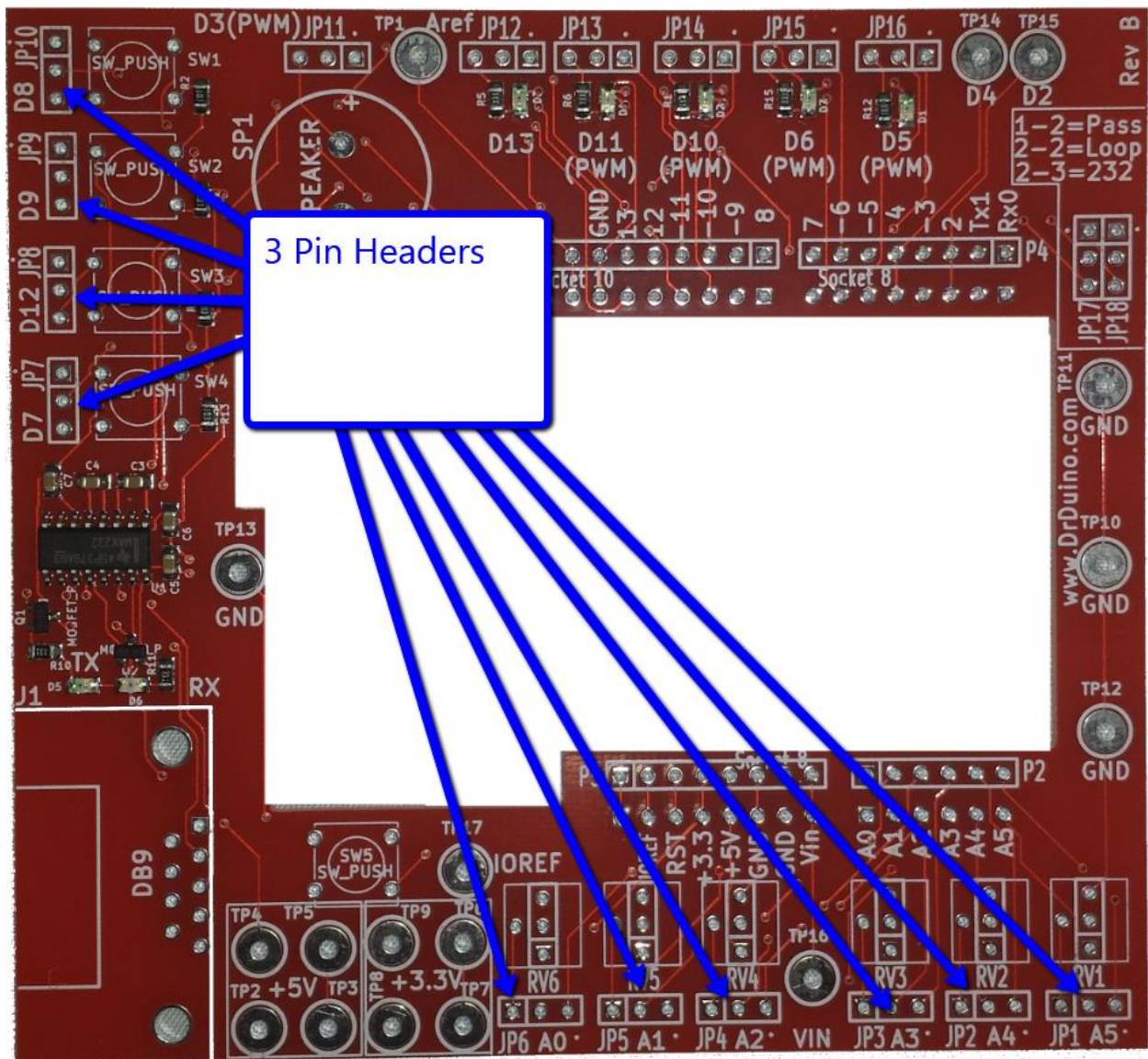
9. Potentiometers

Next populate all six potentiometers in the following location. Note you might notice that there are 4 wholes under the potentiometer. However the potentiometer will only fit one way.



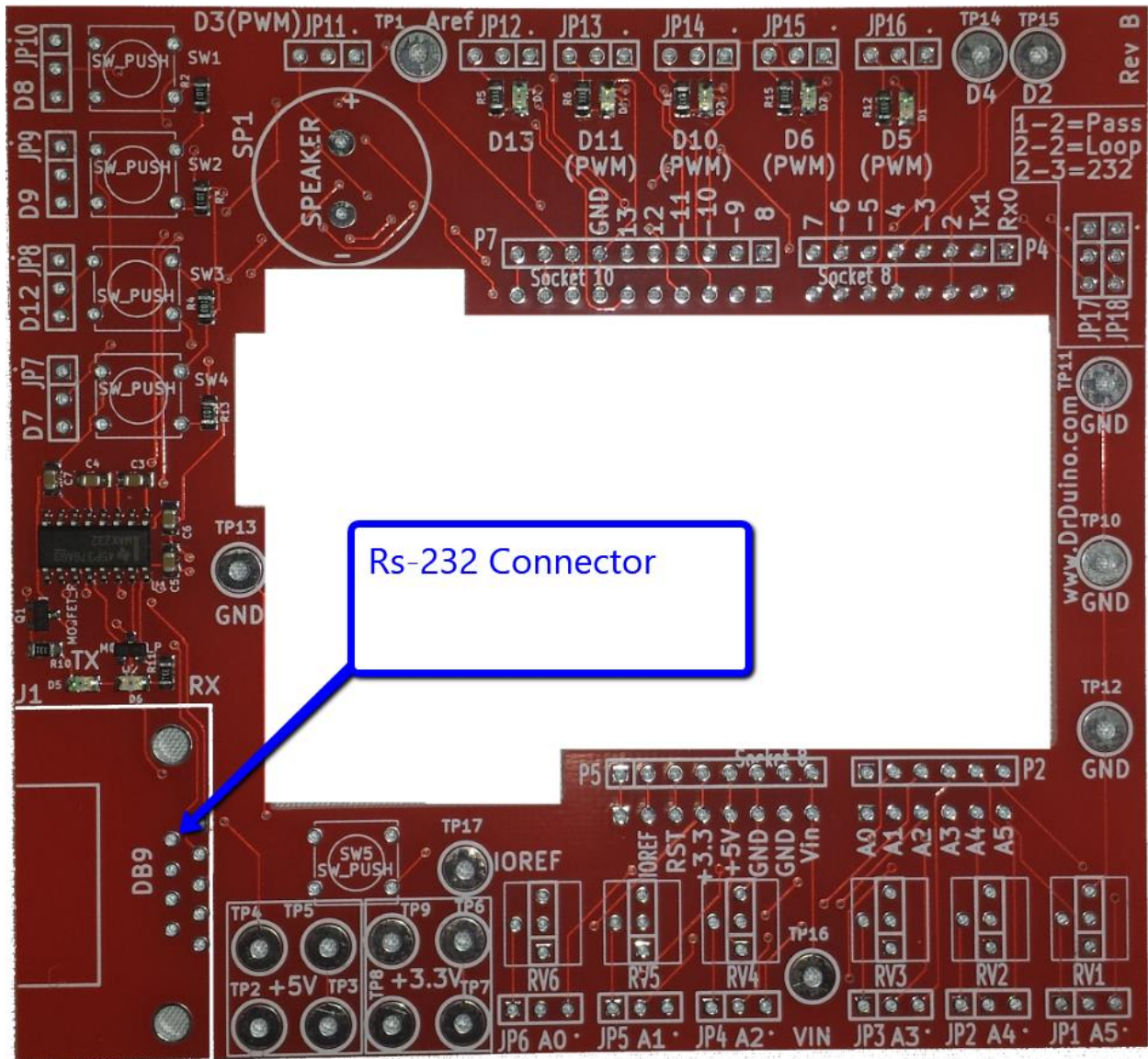
10. Three pin headers

Populate the remaining three pin headers.



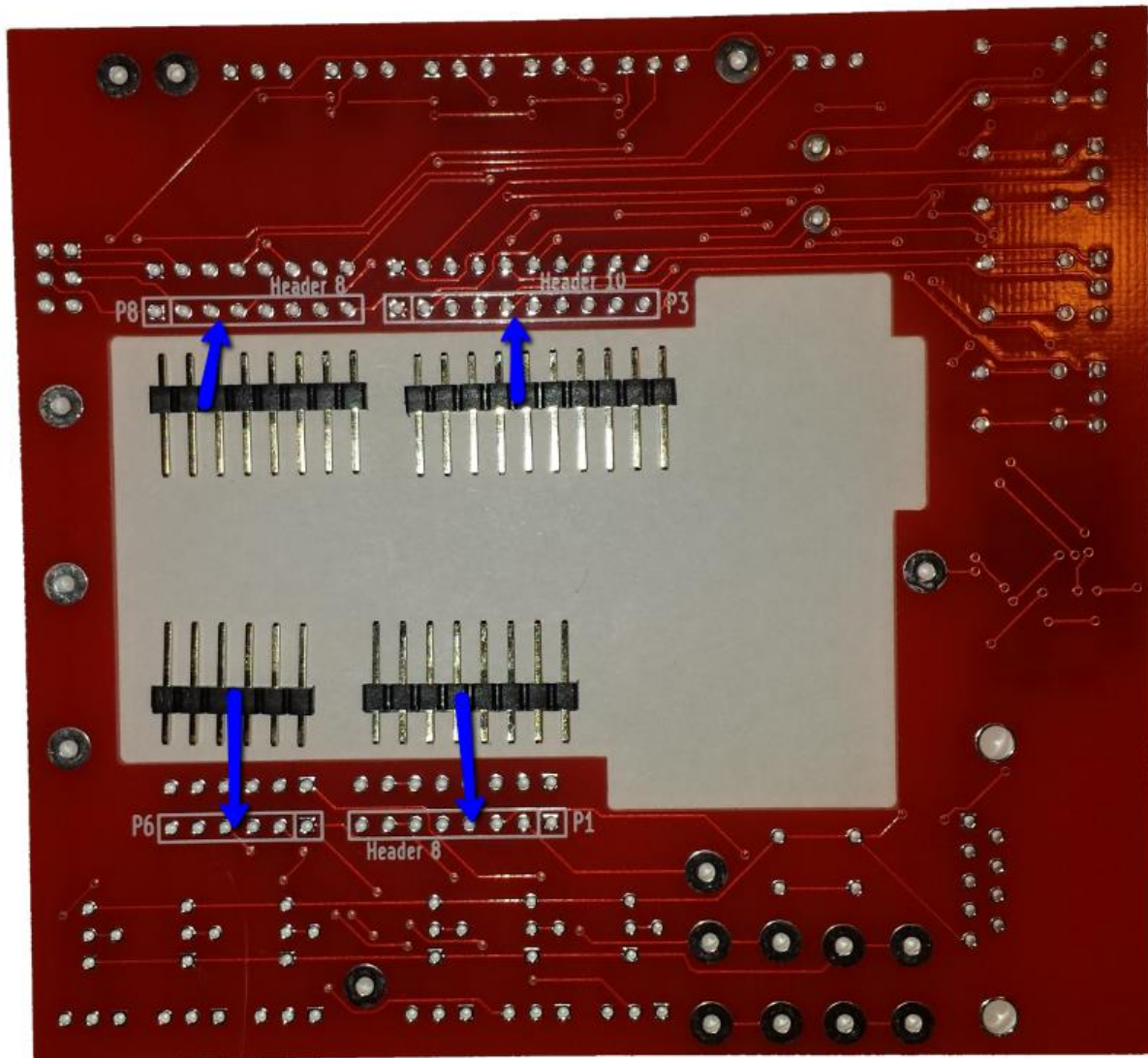
11. Rs-232 Connector

Populate the RS-232 connector. Use care when inserting this connector, take your time when aligning all pins to prevent any unwanted bending.



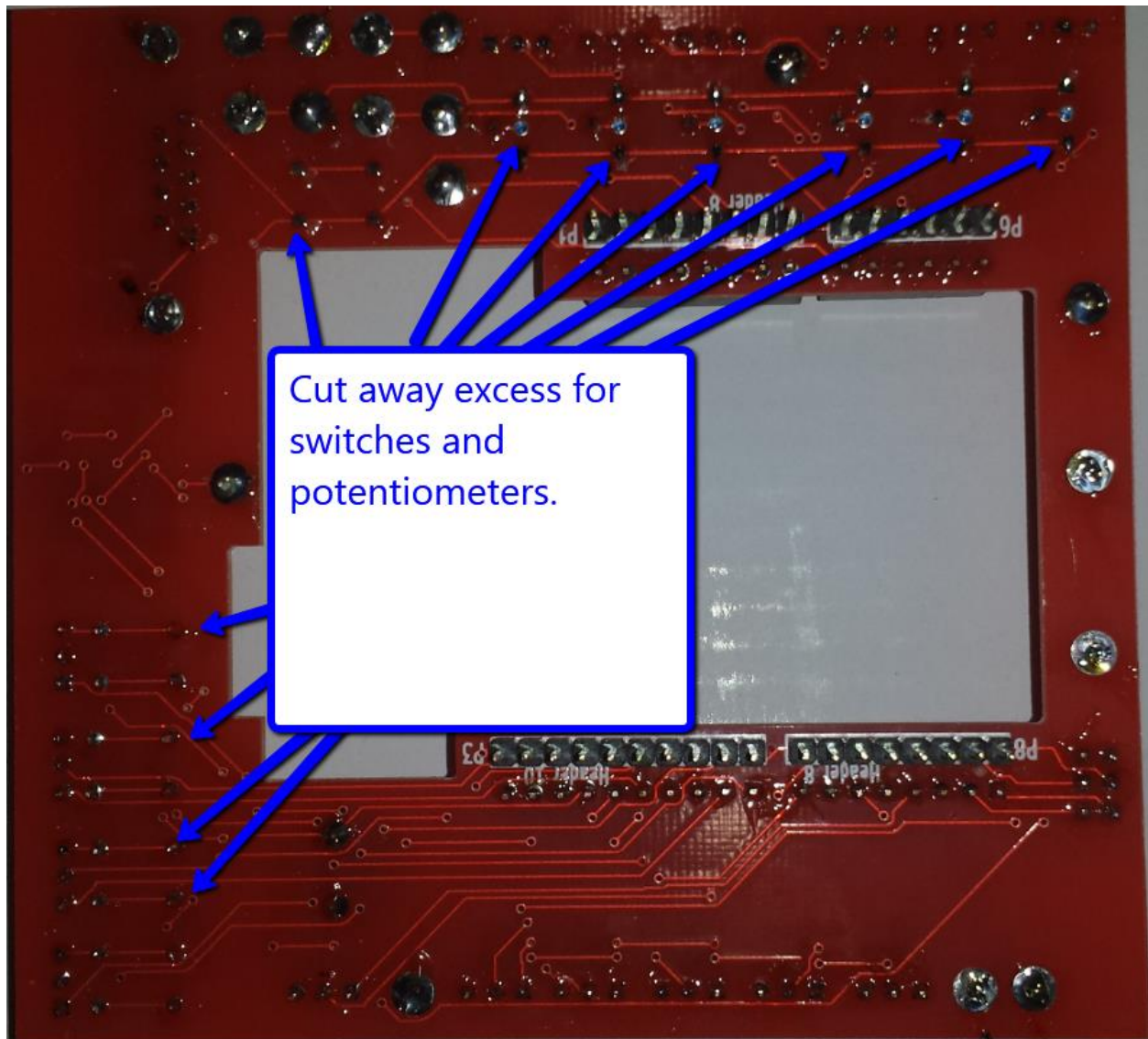
12. Arduino matting headers

Flip the board over and populate the remaining headers again paying special attention to alignment. Note*- Place headers in exactly the location shown within the white rectangle on board.



13. Excess pins

Cut away excess pins protruding through back side of board.



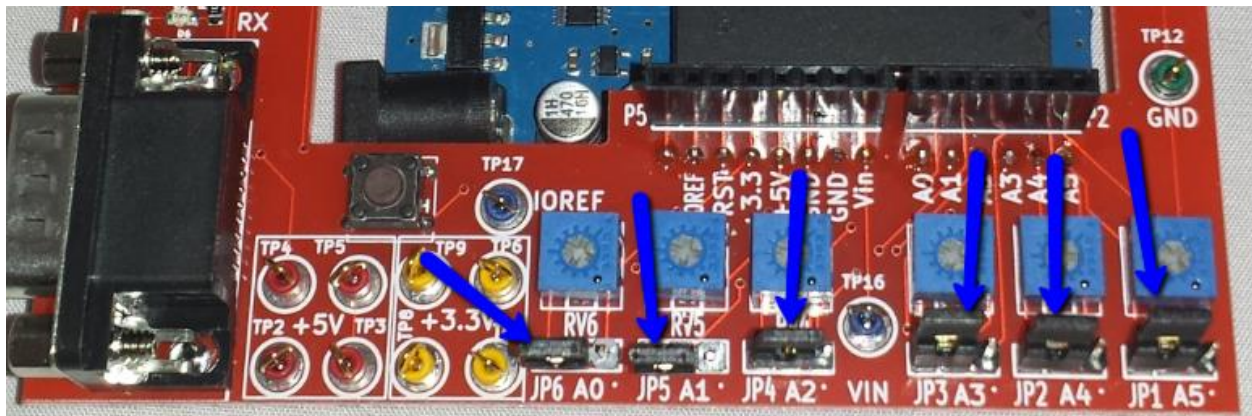
WARNING!!!! Cutting of leads presents a flying debris hazard take extreme caution when performing this step. Safety glasses should be worn, clipping component leads should be performed facing away from yourself and/or others.

14. Jumpers

All three pin headers along the outside of the board have a dot on the silk screen denoting how to pass the signal up to the shield above or out through the Dr.Duino™ shield itself.

- 14.1. Placing the jumper between the middle pin and the dot, passes the signal up to the shield above.
- 14.2. Placing the jumper between the middle pin and where there is no dot, passes the signal from the Arduino Uno board to the Dr.Duino™ Shield.

In the next few steps, we will begin testing the Dr.Duino™ shield for proper operation. In order to do so, place all remaining jumpers on to the 3 pin headers all around the board in the pass out mode (middle pin to where there is no dot as shown below). **EXCEPT FOR JP17/18 RS-232 HEADERS.**

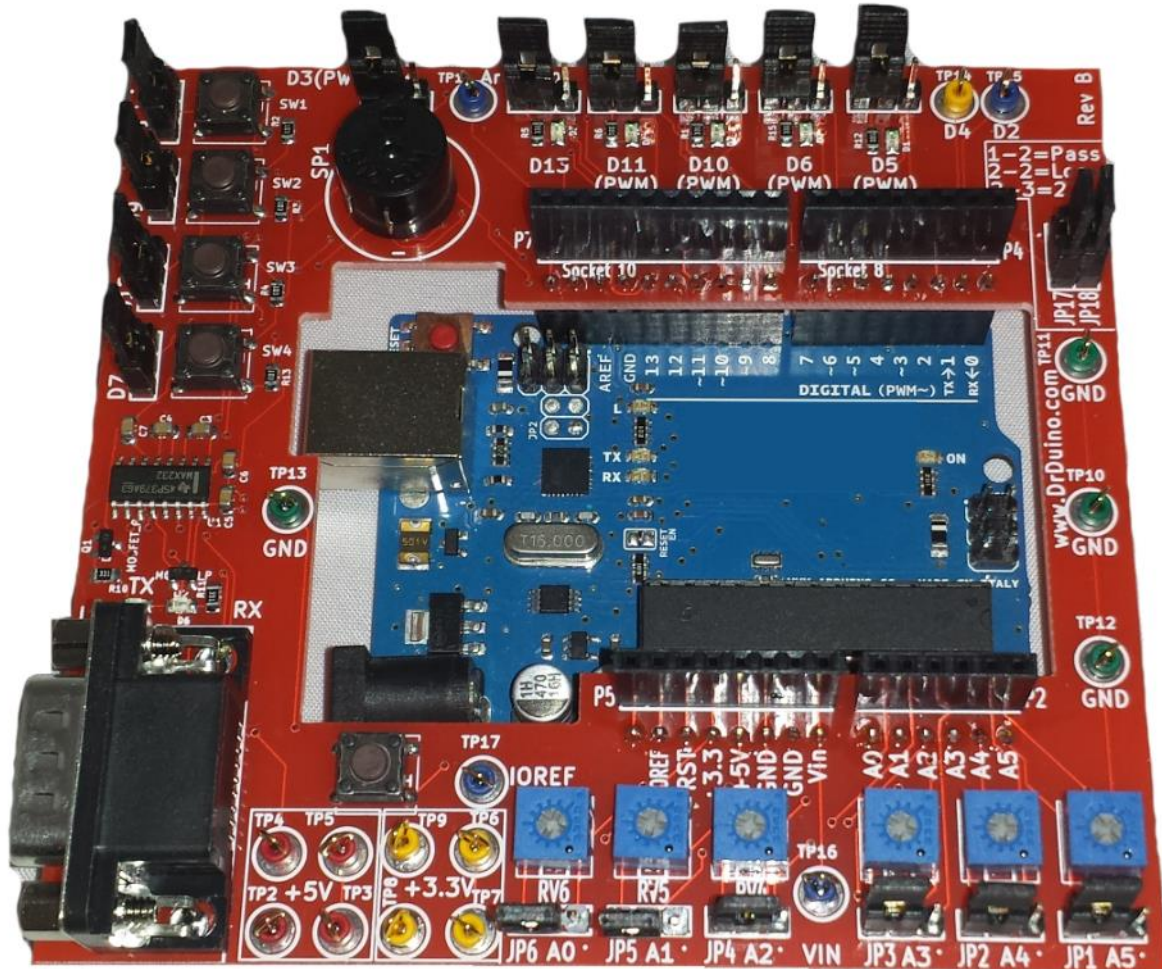


15. Testing Instructions

Below is what your Dr.Duino™ board will look like once complete.

15.1. Mechanical Fit Test

Begin by placing an unpowered Arduino Uno board into the Dr.Duino™ Board as depicted below.



If the Arduino board doesn't not mate easily, then there is an alignment issue do not proceed until this is corrected!

15.2. Testing the fully assembled Shield

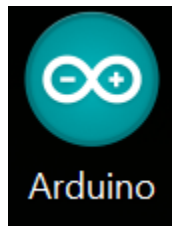
In this next section we will test the shield to insure proper operation. In order to do so you will need to do the following:

15.2.1. Go to www.DrDuino.com and visit the download section.

If you don't have the Arduino IDE you can download it from the Arduino website. www.Arduino.cc

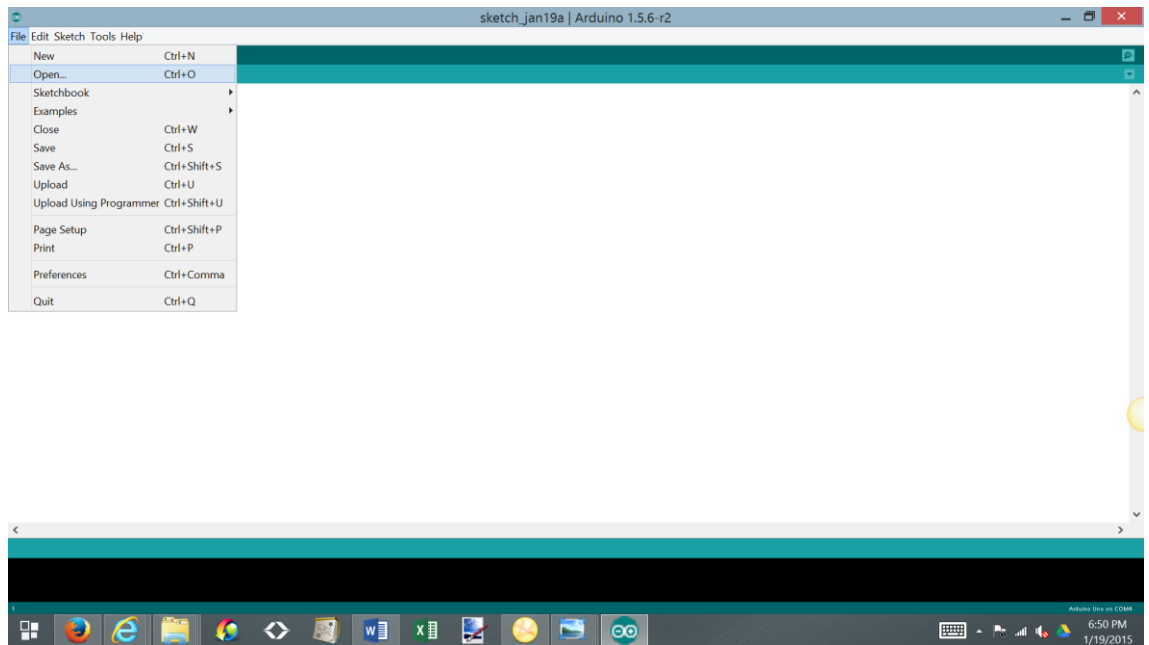
- Download the DrDuino.zip file which contains the following:
 - DrDuino.ino (Arduino sketch)
 - Pitches.h (header file for buzzer music)
 - Dr.Duino™ manual
- Unpack all files to your PC.

15.2.2. Open the Arduino Environment by clicking on the Arduino shortcut.



○

15.2.3. Click File Open within the Arduino Environment.



15.2.4. Navigate to where you downloaded the DrDuino.ino file and click open.

15.2.5. Note*- If this is the first time you are using the Arduino environment make sure you have selected the port and board from the Tools menu.

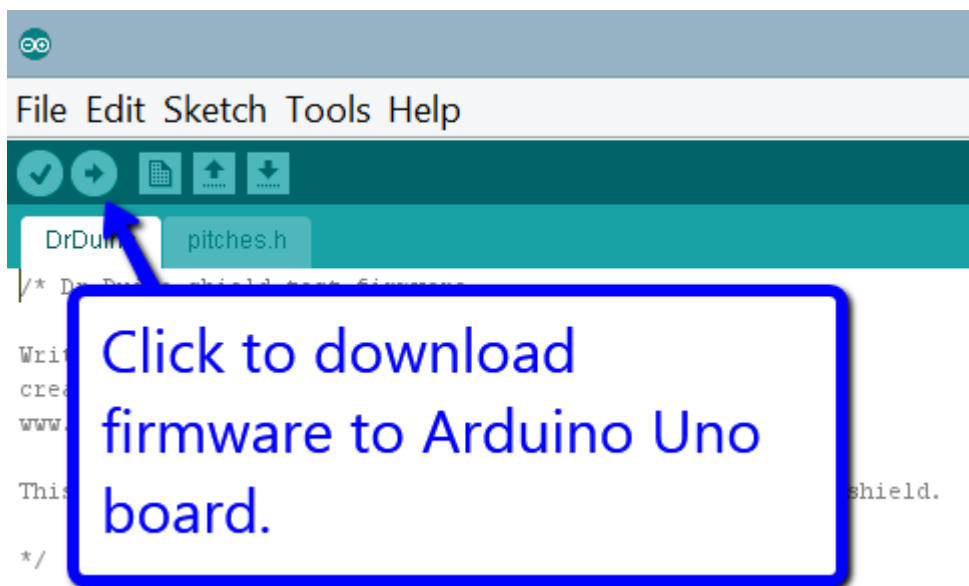
- The port is the com port which windows associates with the Arduino driver.
- The Board should be set to Arduino UNO.
- If either of these steps is missed, the code will not download the Arduino board.

15.2.6. Make sure the Dr.Duino™ shield is correctly inserted into the Arduino Uno Shield.

15.2.7. Connect the Arduino Uno to the PC via USB cable.

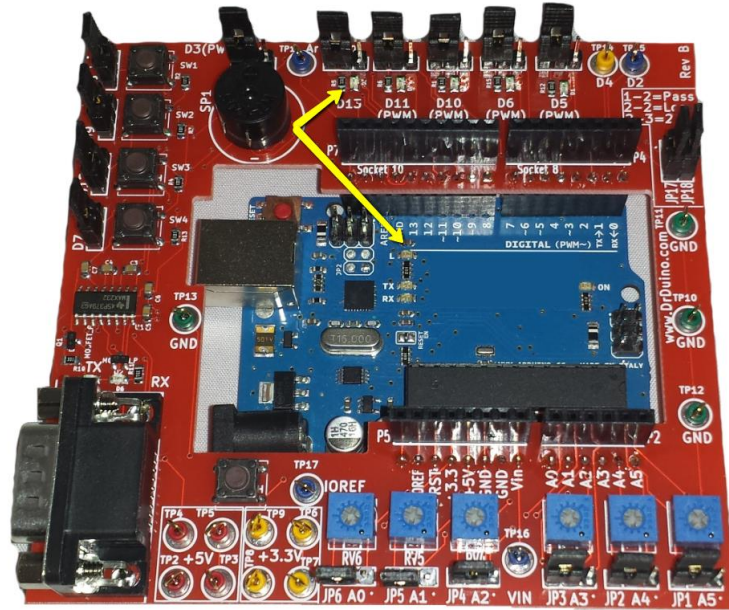
15.2.8. Note*- be sure that JP17/18 are not installed as this will prevent the code from downloading to the Arduino Uno board.

15.2.9. Download the DrDuino sketch to the Arduino Uno board by clicking on this button.



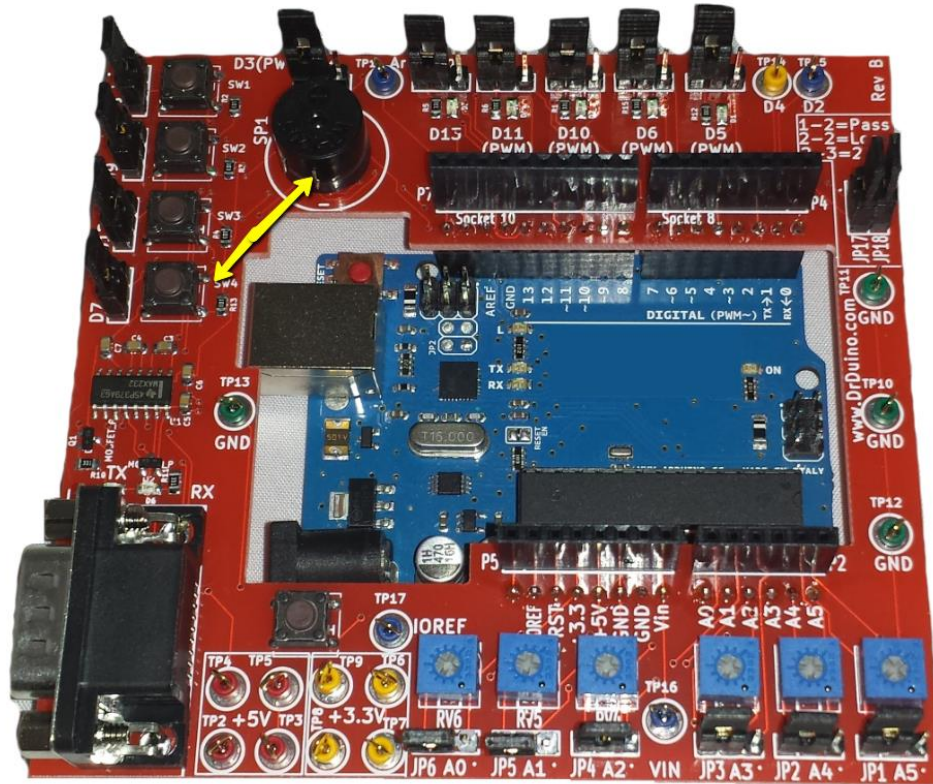
15.3. LED Testing

After downloading the firmware, D13 will be blinking at the same rate as the LED on the Arduino Uno Board.



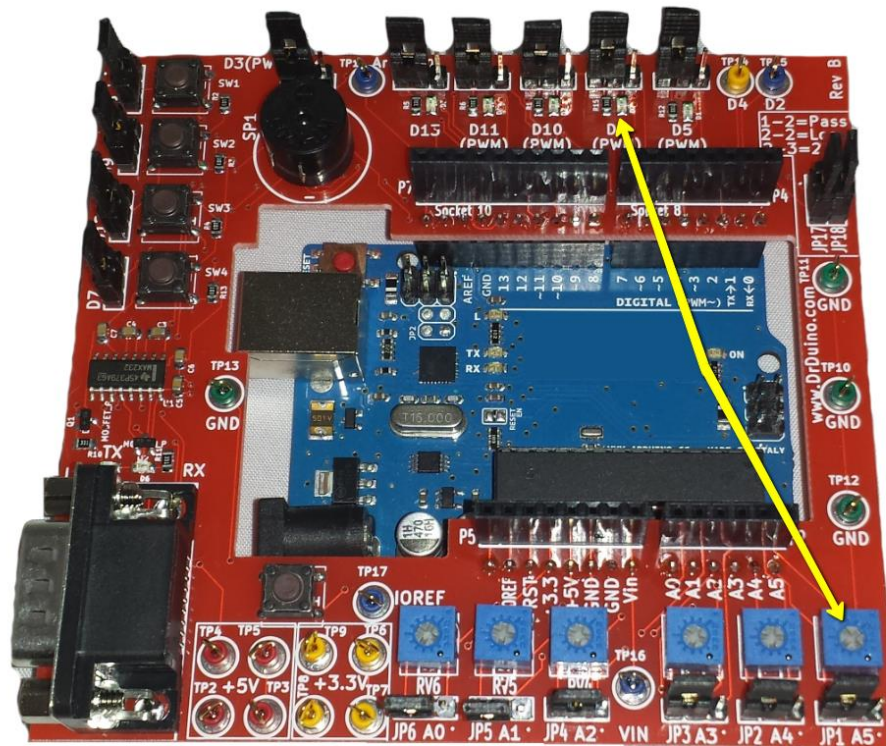
15.3.3. SW4 and Piezo Buzzer

Pushing SW4 will activate the piezo buzzer and sing a little song.



15.3.4. D6 and Potentiometer RV1

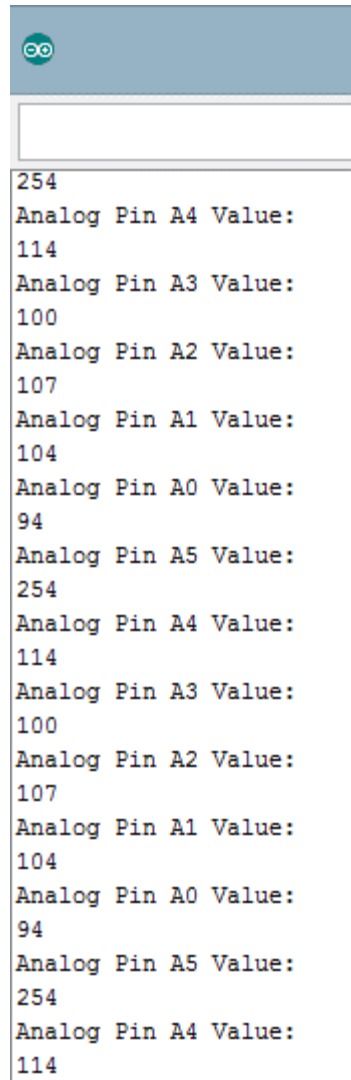
Use a small Philips head screwdriver to slowly turn potentiometer RV1 back and forth. You will see that LED D6 will dim and turn on depending on which way you turn the potentiometer.



15.3.5. Potentiometers & Switch 2

With the Arduino still connected to the USB port, click on tools/Serial Monitor within the Arduino IDE.

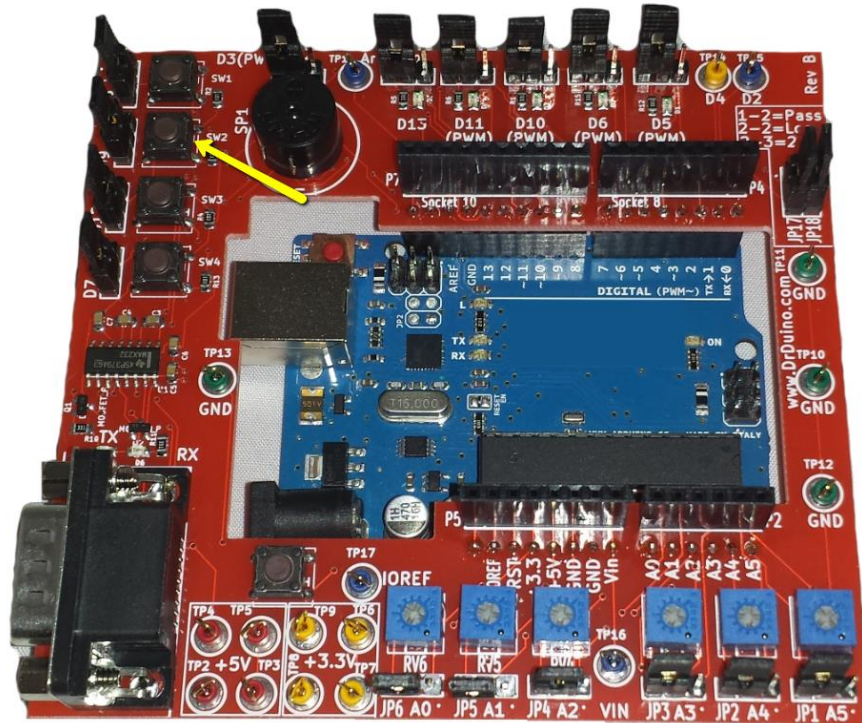
You will see the following data scrolling continuously from each potentiometer.



```
254
Analog Pin A4 Value:
114
Analog Pin A3 Value:
100
Analog Pin A2 Value:
107
Analog Pin A1 Value:
104
Analog Pin A0 Value:
94
Analog Pin A5 Value:
254
Analog Pin A4 Value:
114
Analog Pin A3 Value:
100
Analog Pin A2 Value:
107
Analog Pin A1 Value:
104
Analog Pin A0 Value:
94
Analog Pin A5 Value:
254
Analog Pin A4 Value:
114
```

One potentiometer at a time, begin to slowly turn each one with the screwdriver. You will notice the values of each potentiometer change. Repeat this for all potentiometers on the board.

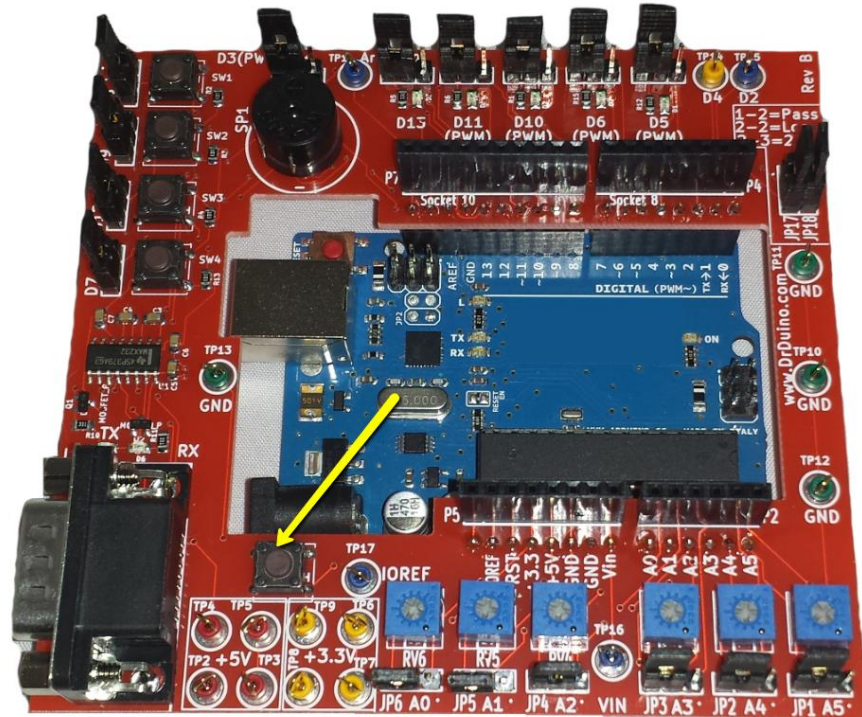
After all potentiometers have been tested press and hold switch SW2. You will see the following message in the serial monitor.



```
104
Analog Pin A0 Value:
94
-----Switch 2 Pressed-----
Analog Pin A5 Value:
254
Analog Pin A4 Value:
114
Analog Pin A3 Value:
100
```

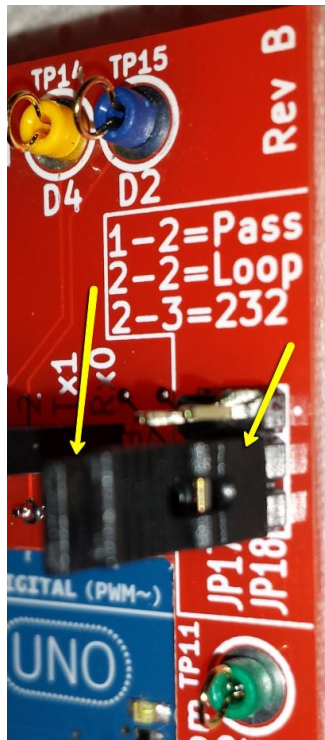
15.3.6. Reset Switch

Pressing the reset switch will reset the entire Arduino Uno and will not get covered by the shield above!

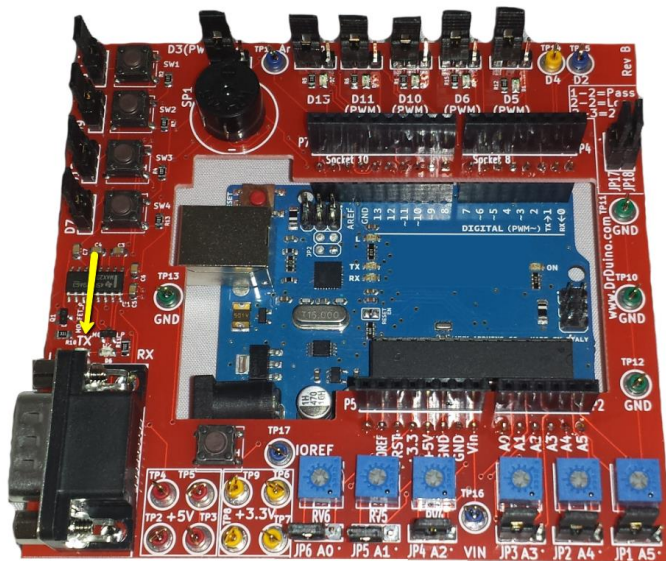


15.3.7. RS-232 Output mode

Place a jumper on JP17 and JP18 into position 2-3. See picture below.

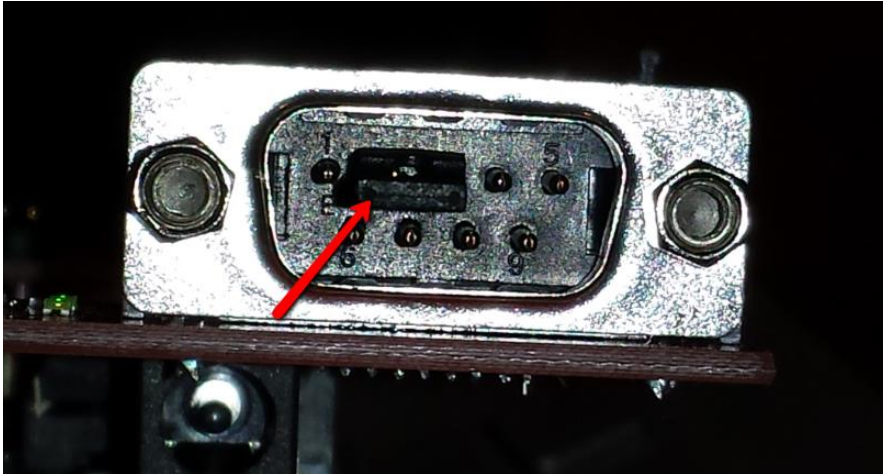


Once installed you will see the TX LED begin to blink.

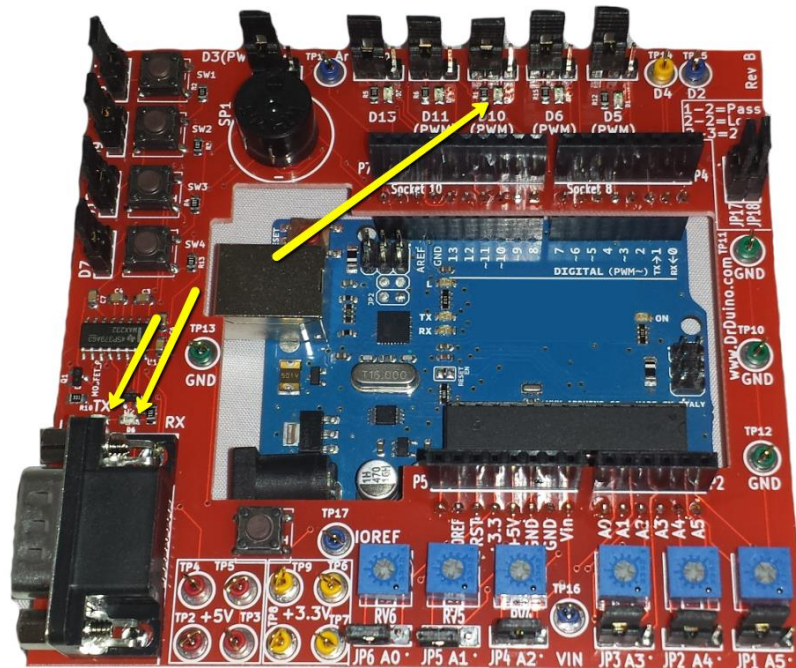


15.3.8. RS-232 Receive LED and LED D10.

Temporarily remove jumper JP4 (near the potentiometers). Place the jumper inside the RS-232 connector on pins 2 and 3.



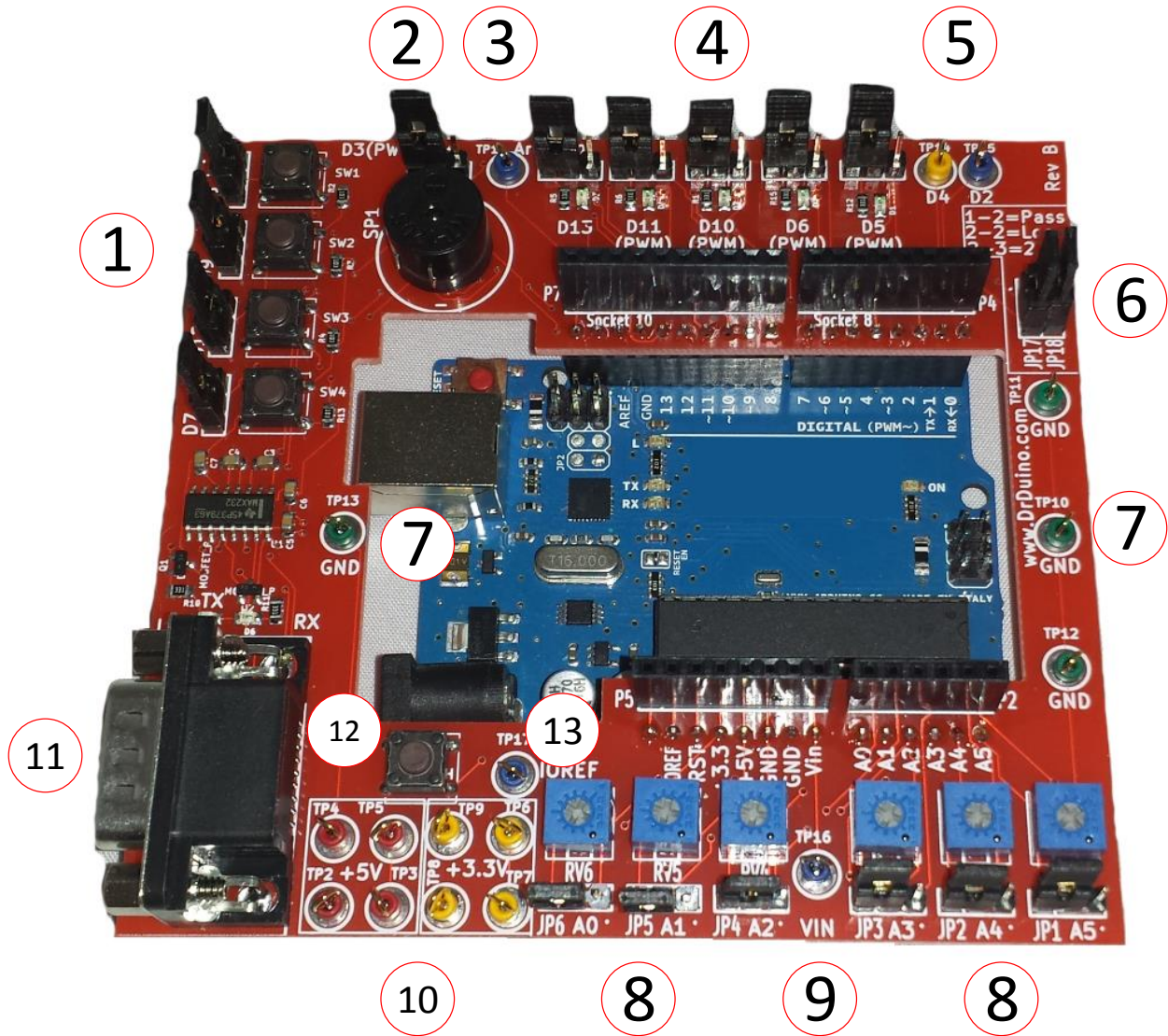
After the jumper is in place you will notice the TX and RX LED's near the RS-232 connector will turn on and LED D10 will turn off. This indicates that traffic is being sent out the RS-232 connector and looped back into the RS-232 connector thus illuminating the RX LED. LED D10 turning off indicates that the Arduino has received an actual command.



Remove the Jumper from the RS-232 connector and place back on to JP4. You will notice that LED D10 turns back on.

Congratulations, your Dr.Duino™ board is now fully functional and ready to debug your projects for years to come! For a complete listing of all features of the Dr.Duino™ board see the following section.

Features of the Dr.Duino™ shield



1. Switch inputs- Used to simulate switch inputs

Switch Designation	Pull Up/Down	Arduino Pin	Selectable Jumper
SW1	Up	D8	JP10
SW2	Down	D9	JP9
SW3	Down	D12	JP8
SW4	Up	D7	JP7

2. Piezo Buzzer- Used to provide audible signal from Arduino board.

3. Aref Test Point- Provides convenient access to inject reference voltage directly into Arduino board via test point.

4. Led outputs- Used to provide visual indicators

LED Designation	Arduino Pin	Selectable Jumper
D3	D13	JP12
D4	D11	JP13
D2	D10	JP14
D7	D6	JP15
D1	D5	JP16

5. Test Points- Convenient access to Arduino I/O D4/2 via TP14/15 respectively.

6. RS-232 Configuration Header Block

Header Number	Jumper Setting	Mode
JP17	1 to 2	Pass Through*
JP18	1 to 2	
JP17	2	Loop Back Mode**
JP18	2	
JP17	2 to 3	Output to Rs-232*** Connector
JP18	2 to 3	

* Passes the signal from the board below to the board above.

REMOVE JUMPERS JP17/18 WHEN REPROGRAMMING

ARDUINO!

**Forces the RX and TX lines to loop back on one another from the Arduino board back to the Arduino board.

***Sends RX/TX signals through the RS-232 connector.

7. Ground test points- Provides convenient access to the Arduino's ground.

8. Potentiometers- Used to inject Analog voltage into A/D of Arduino.

Potentiometer Designation	Arduino Pin	Selectable Jumper
RV6	A0	JP6
RV5	A1	JP5
RV4	A2	JP4
RV3	A3	JP3
RV2	A4	JP2
RV1	A5	JP1

9. Vin- Provides convenient access to the Vin of the Arduino board.

Remember to use acceptable input voltages to prevent damage to the Arduino board.

10. 5V & 3.3V- Provides convenient to the Arduino's +5V and +3.3V .

11. RS-232 connector- Provides access to a standard Male connector for communications to various serial peripherals.

12. External Reset Switch- Provides convenient access to a dedicated external reset switch for the Arduino.

13. IOREF- Provides convenient access to the IOREF of the Arduino via TP 17.

Disclaimer

The Dr.Duino™ board is not meant to be permanently embedded with your project. It should always be removed from the project after every use.

Dr.Duino™ is a product of Innovative Electronics Solutions LLC. By using this product the customer (where the customer is defined as the purchaser of the Dr.Duino™ shield) will hold harmless Innovative Electronic Solutions LLC and its affiliates from all actions relative to its Dr.Duino™ product as described in this document. Upon use of this product, Customer agrees to fully indemnify and hold Innovative Electronic Solutions LLC and any of its affiliates harmless to fullest extent of the law in the event that any property damage and or bodily injury or harm occurs as the result of the use of this product other than as a result of any active negligence on the part of Innovative Electronic Solutions LLC and its affiliates. Said agreement shall include the reimbursement of any expenses or costs incurred by Innovate Engineering Services LLC and its affiliates as a result of the defense of any action including, but not limited to any reasonable attorney fees and any judgments obtained as against Innovative Electronic Solutions LLC and its affiliates. Innovative Electronic Solutions LLC shall also be held harmless and indemnified to the fullest extent permitted by law by the Customer for any and all actions, claims or proceedings commenced against Innovative Electronic Solutions LLC and any party Innovative Electronic Solutions LLC may be required to defend pursuant to any agreement including but not limited to license agreements, trademark, patents etc or any other matters concerning the product or legal actions against the Customer.

The customer agrees to provide defense and indemnity including all legal costs and expenses etc for these possible actions as well. Any actions or claims brought against Innovative Electronic Solutions LLC and all expenses and fees including costs and expenses including attorney fees incurred by Innovative Electronic Solutions LLC will be reimbursed by Customer. In the event of a dispute with regard to the agreement between the parties concerning this letter of intent, New York law would control.