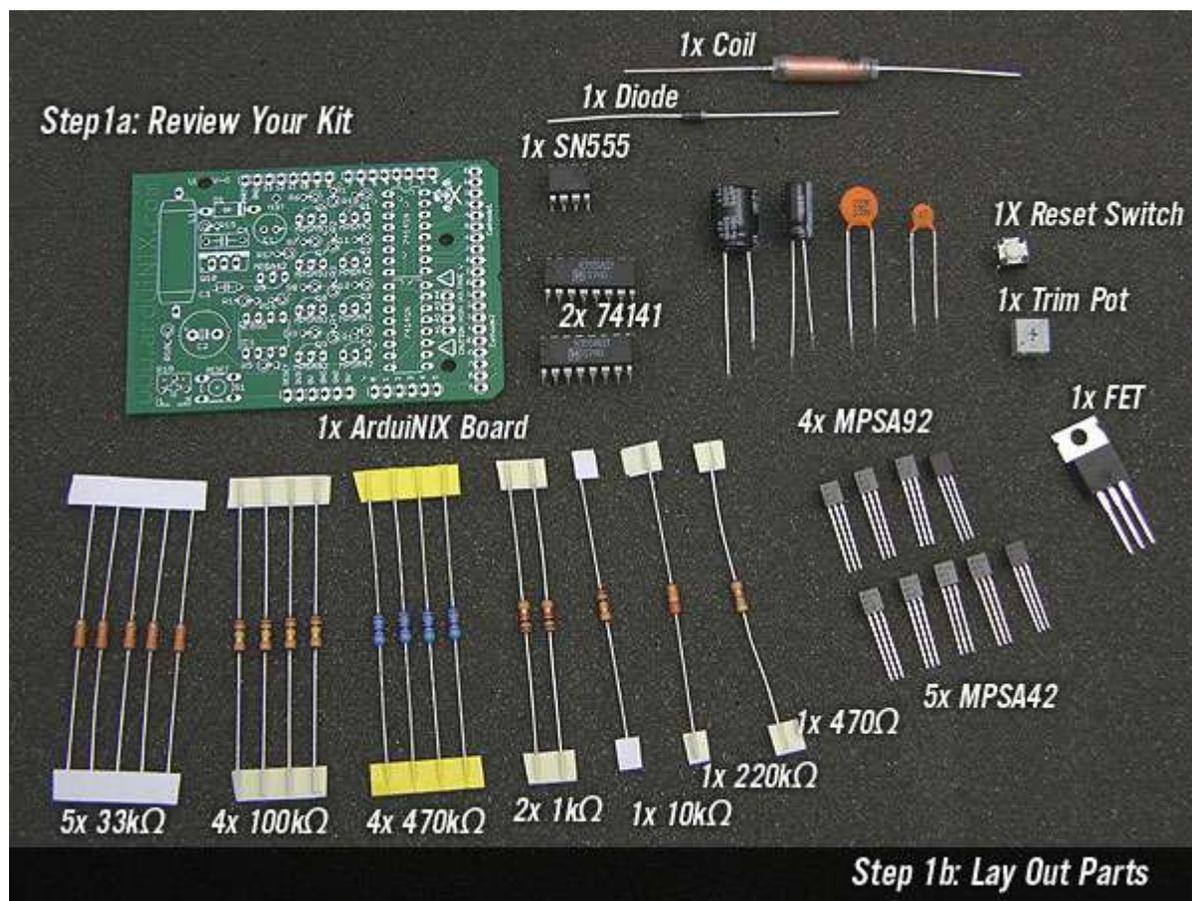


**ArduiNIX Printer Friendly Assembly Instructions – Version 1.0 – August 4, 2009**

**Step 1 Review Your Kit!**



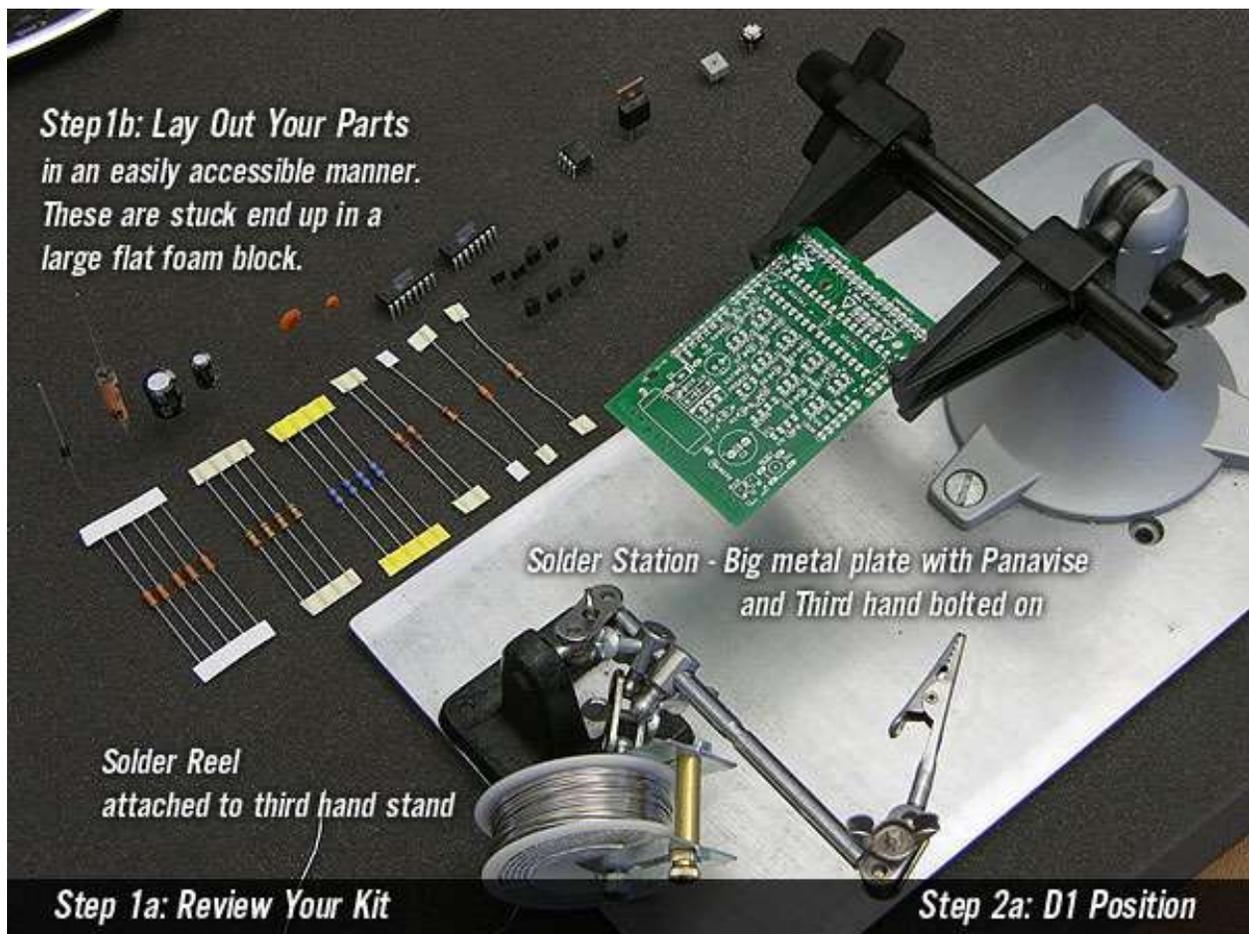
Welcome to the assembly portion of the site. Here we will take you step by step through the build process of your ArduiNIX kit. First, make sure you have your parts all accounted for!

Included in your kit should be the following parts. This is the most current, up to date parts list for the ArduiNIX.

Step	Part Name	Mouser #	Location	Qty
	ANX_Board			1
<u>2</u>	Damper Diode 1.0 Amp 400V BYT01-400	511-BYT01-400	D1	1
<u>3</u>	100uH 1 Amp RFI Suppression Coil	434-11-101M	L1	1
<u>4</u>	25 Volt 470 uF Capacitor	647-UVZ1E471MPD	C2	1
<u>5</u>	350 Volt 1 uF Capacitor	647-UVR2V010MED	C1	1
<u>6, 7</u>	500V 47pF SL Capacitor	140-500S5-470K-RC	C3, C4	2
<u>8</u>	IRF730 400V 5.5 Amp SingleGate MOSFET	844-IRF730APBF	Q10	1
<u>9</u>	1/4" Squ 1K 10% Single Turn Trimmer	858-25PR1KLF	R19	1
<u>10</u>	6X6 FLAT 4.3mm BTN Tactile Switch	653-B3F-1000	S1	1
<u>11</u>	General Purp Single NE555N Timer IC	511-NE555N	IC1	1

<u>13</u>	1/4watt 33Kohms 5% Metal Film Resistors	71-CCF07-J-33K	R1-R5	5
<u>14</u>	1/4watt 100Kohms 5% Metal Film Resistors	71-CCF07-J-100K	R6-R9	4
<u>15</u>	1/4W 470K ohm 1% Metal Film Resistors	660-MF1/4DCT52R4703F	R10-R13	4
<u>16</u>	1/4watt 1Kohms 5% Metal Film Resistors	71-CCF07-J-1K	R14, R15	2
<u>17</u>	1/4watt 10Kohms 5% Metal Film Resistors	71-CCF07-J-10K	R16	1
<u>18</u>	1/4watt 220Kohms 5% Metal Film Resistor	71-CCF07-J-220K	R17	1
<u>19</u>	1/4watt 470ohms 5% Metal Film Resistor	71-CCF07-J-470	R18	1
<u>20</u>	PNP MPSA92 Small Signal Transistor	512-MPSA92	Q6-Q9	4
<u>21</u>	NPN MPSA42 Small Signal Transistor	512-MPSA42	Q1-Q5	5
<u>22</u>	Nixie Driver IC - SN74141 *OR* Equivalent		IC2, IC3	2
	40P .100" Pin Strip Headers	517-6111TG	Pinrails	1

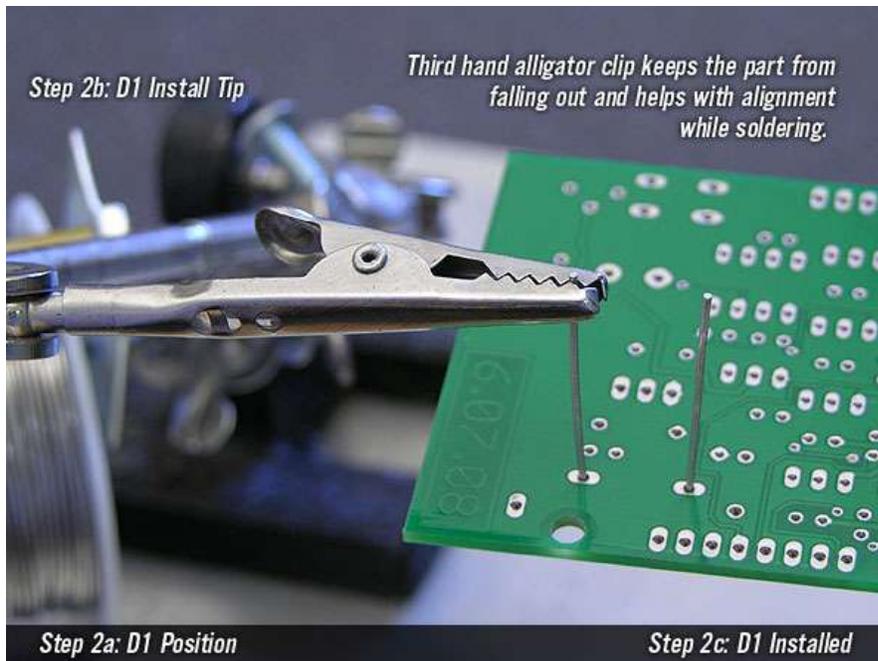
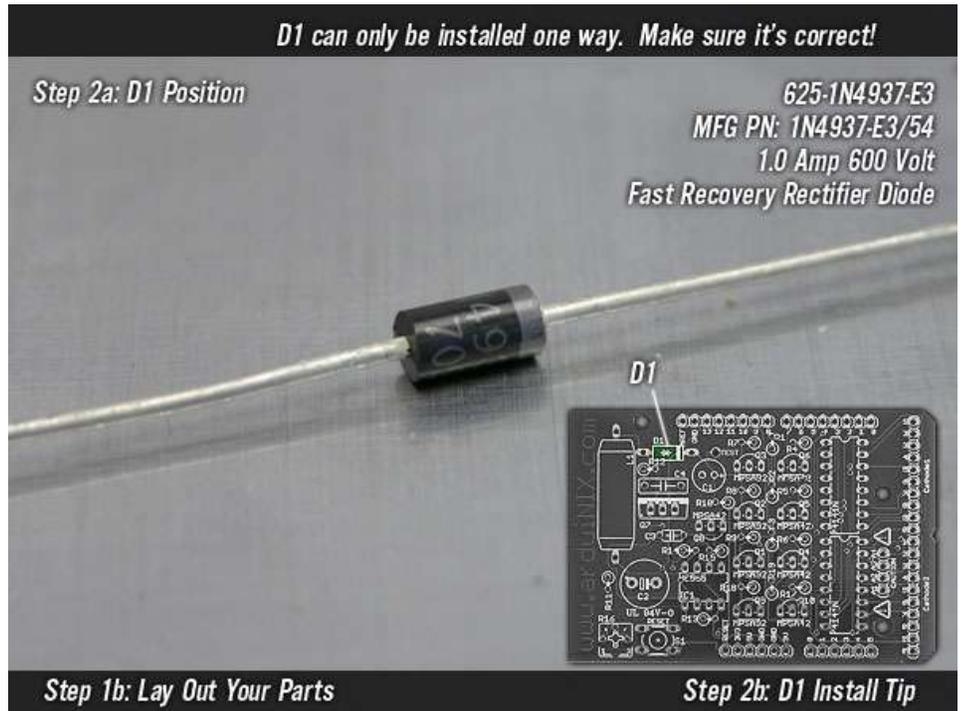
### Step 1B: Lay Out Your Parts



Lets lay out your parts in an easily accessible and organized manner. We don't supply the solder station, but it would be very handy if you had something similar to assemble your kit with.

### **Step 2A: D1 Position**

D1 is the Fast Recovery Rectifier Diode. Make sure it goes in correctly, it may only be installed one direction. The band on one end shows you which side is the positive side.



### **Step 2b: D1 Install Tip**

Use something handy to pull the diode up to the board, so your hands are free to solder the leads in.

### Step 2C: D1 Installed

This is how D1 should look once it's installed correctly.



### Step 2a: L1 Coil

This little fellow is going to be helping us pick the correct parts to place on each step. Here he is holding up the 100uH Coil.



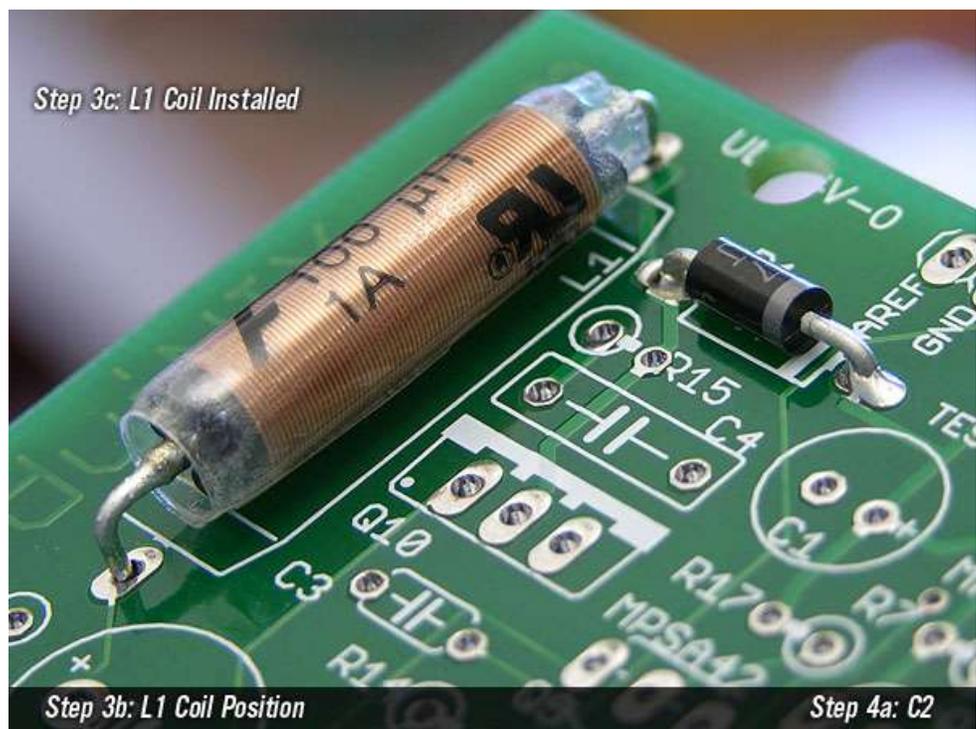
**Step 3b: L1 Coil Position**

The coil is one of the main components that allows us to take 9 volts up to 180. It can be installed either direction, so don't worry about polarity.



**Step 3c: L1 Coil Installed**

How nice, the diode and coil are going to be best friends.





**Step 4a: C2 Capacitor**

Thanks robot buddy. That's the large Capacitor we need next. C2 is a polarized 25Volt 470 uF Capacitor. The stripe on the side with the "-" signs in a row show you the negative side. This one has to be installed the proper way!

**Step 4b: C2 Position**

Make sure the negative side of C2 is not inserted into the positive hole on the board.

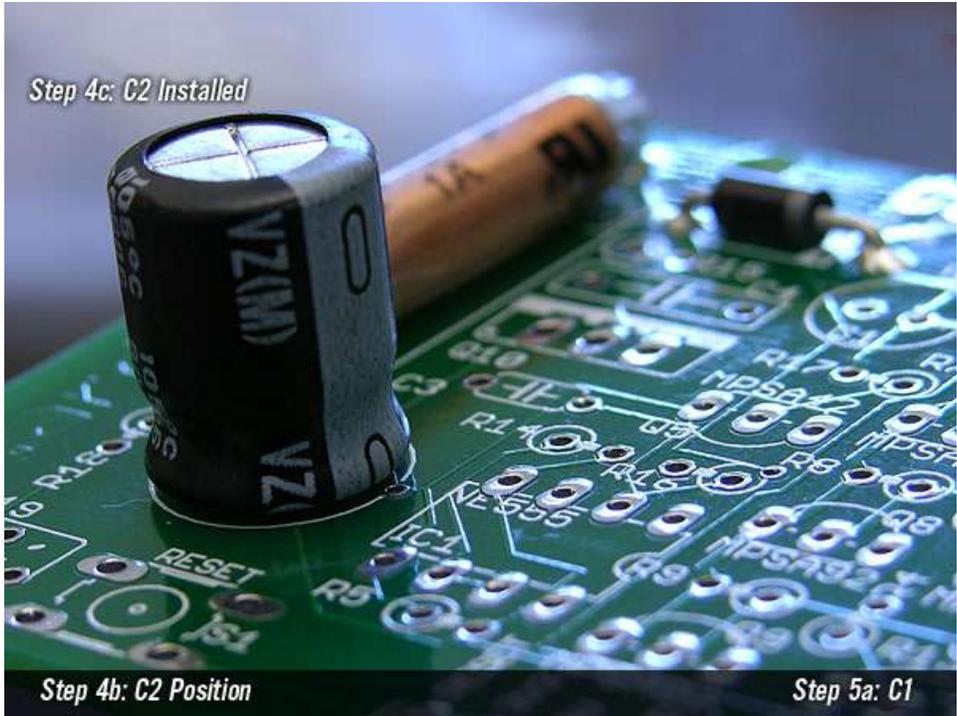
*C2 can only be installed one way, make sure it's placed correctly!*

**Step 4b: C2 Position**

647-UVZ1E471MPD  
25V 470µF 10x12.5mm  
Radial Electrolytic Capacitor

*C2 has a polarity, a positive and negative side. The negative side is marked on these caps near the short lead. The positive lead is the longer lead. Make absolutely sure these caps are installed in the proper orientation. On C2, the positive connection is on the left, marked with a + symbol.*

**Step 4a: C2** **Step 4c: C2 Installed**



**Step 4c: C2 Installed**

It should look like this when it's installed correctly.

**Step 5a: C1 Capacitor**

Yessir, C1 is the smaller of the two polarized capacitors. C1 is a 350 Volt 1  $\mu$ F Cap.



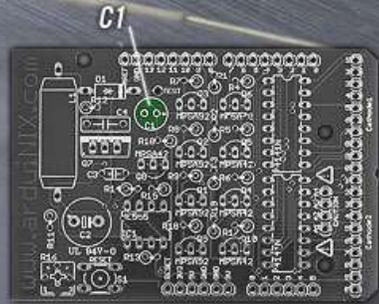
**C1 can only be installed one way, make sure it's placed correctly!**

**Step 5b: C1 Position**

**647-UVR2V010MED  
350V 1 $\mu$ F 6.3x11mm  
Radial Electrolytic Capacitor**

*C1 also has a polarity, a positive and negative side. The negative side is marked on these caps near the short lead. The positive lead is the longer lead. Make absolutely sure these caps are installed in the proper orientation. On the board, at position C2, the positive connection is on the left, marked with a + symbol.*

**Step 5a: C1**



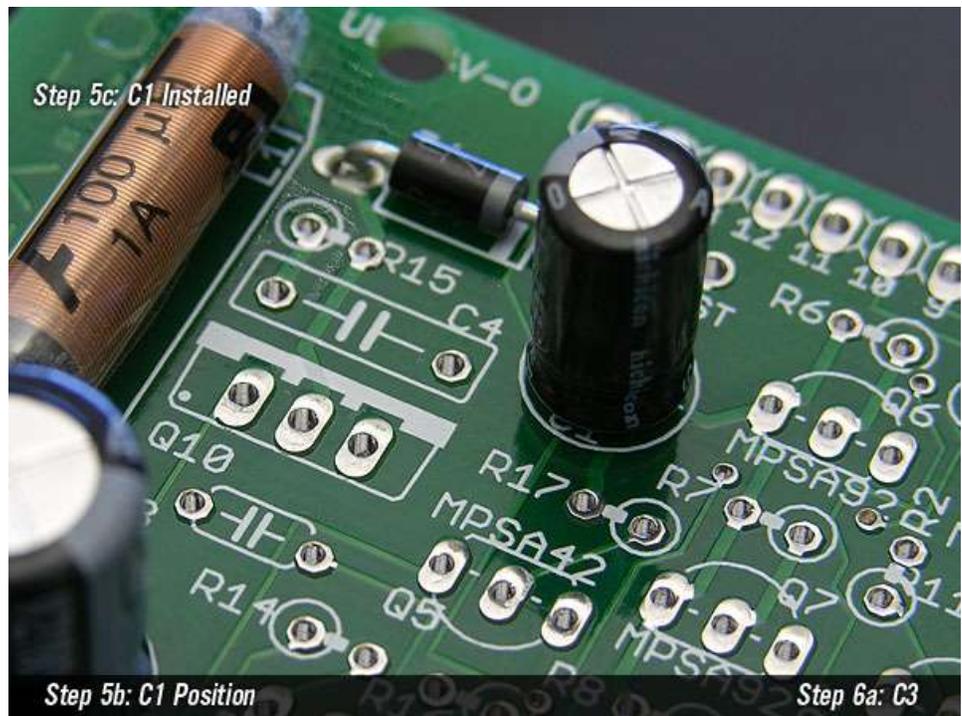
**Step 5c: C1 Installed**

**Step 5b: C1 Position**

Like C2, C1 must be oriented the correct way on the board

**Step 5c: C1 Installed**

Like C2, C1 must be oriented the correct way on the board.



**Step 5c: C1 Installed**

**Step 5b: C1 Position**

**Step 6a: C3**

### Step 6a: C3 Capacitor

Now we move on to C3. C3 is a component which varies from kit to kit. This capacitor controls the voltage range on your unit. The cap we supply may vary from the photo above.



*C3 determines unit power range. It can be installed either direction.*

**Step 6b: C3 Position**  
*Important Note! The size of C3 is what determines the overall power output of the unit. The smaller the cap, the higher the output voltage range. If you want to drive VFD tubes or displays of lower voltages than nixies, use a larger cap. If your unit needs more power, find a smaller cap.*

500V 2200pF Y5P  
Ceramic Disc Capacitor  
-OR-  
50V 0.01uF  
Poly Film Capacitor

*Your capacitor may vary depending on your kit, power requirements, etc.*

C3

Step 6a: C3

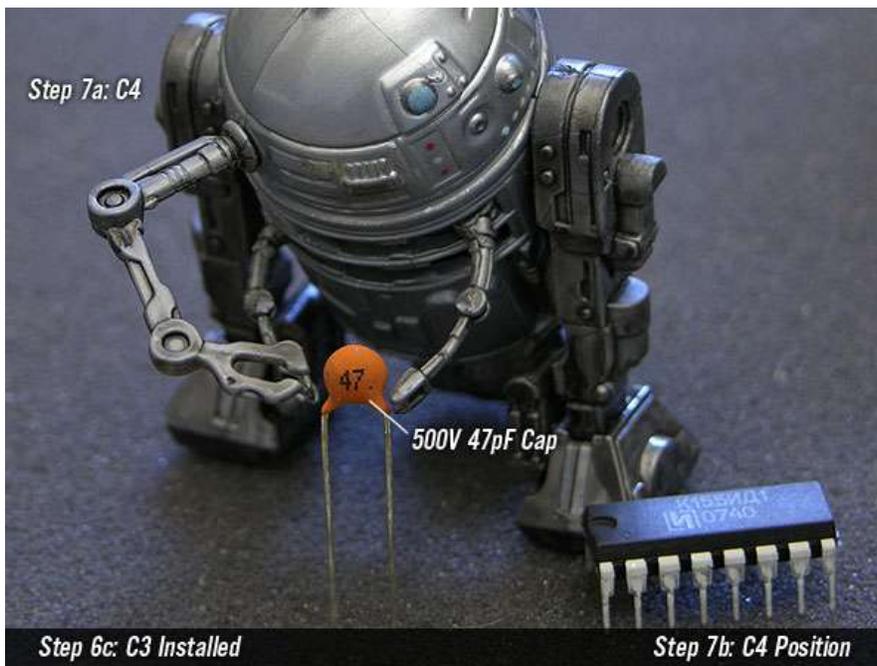
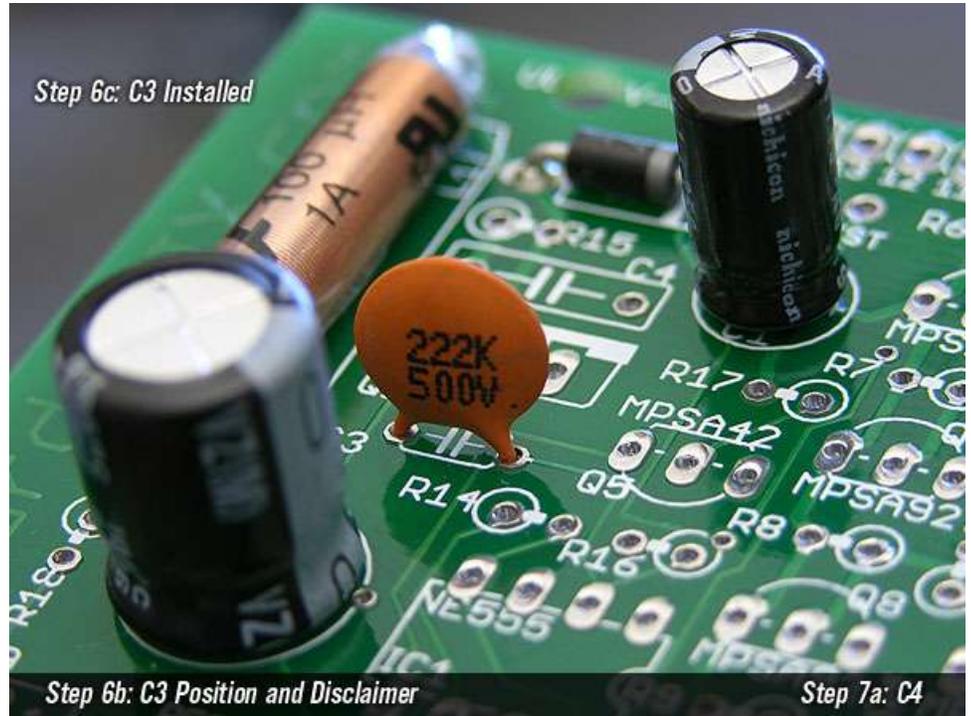
Step 6c: C3 Installed

### Step 6b: C3 Position & Disclaimer

Again, C3 is a component which varies from kit to kit. This capacitor controls the voltage range on your unit. The cap we supply may vary from the photo above. As we make slight modifications and improvements to the kit, this component stands to vary the most, so don't worry if your cap doesn't look exactly like this.

### Step 6c: C3 Installed

Again, C3 is a component which varies from kit to kit. This capacitor controls the voltage range on your unit. The cap we supply may vary from the photo above. As we make slight modifications and improvements to the kit, this component stands to vary the most, so don't worry if your cap doesn't look exactly like this.



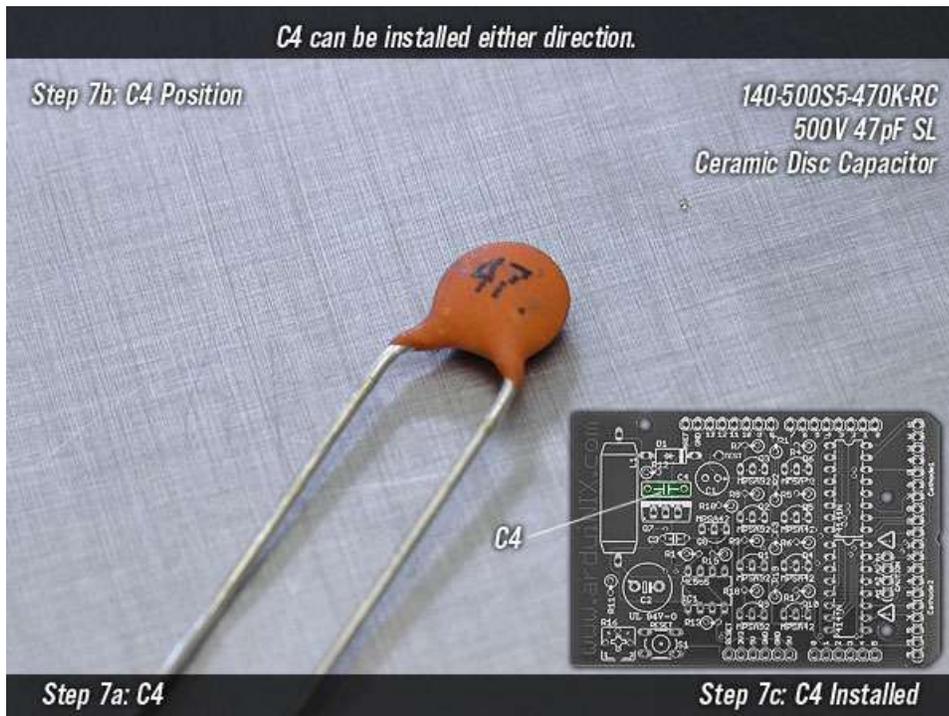
### Step 7a: C4 Capacitor

Now we have C4. This cap works with C3 to control the voltage range. In most current versions of our kit, C4 and C3 are identical 500volt 47pF capacitors.

*C4 can be installed either direction.*

*Step 7b: C4 Position*

*140-500S5-470K-RC  
500V 47pF SL  
Ceramic Disc Capacitor*



*Step 7a: C4*

*Step 7c: C4 Installed*

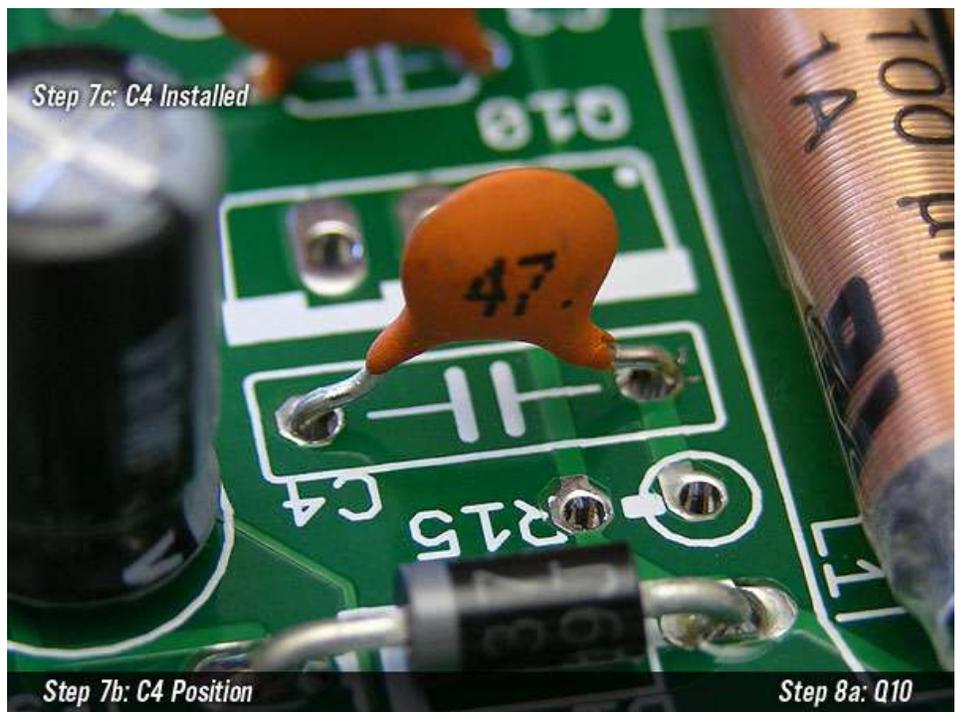
**Step 7b: C4 Position**

C4 may be installed either direction, and again, In current versions of our kit, C4 and C3 are identical 500volt 47pF capacitors.

**Step 7c: C4 Installed**

C4 may be installed either direction, and again, In current versions of our kit, C4 and C3 are identical 500volt 47pF capacitors.

*Step 7c: C4 Installed*

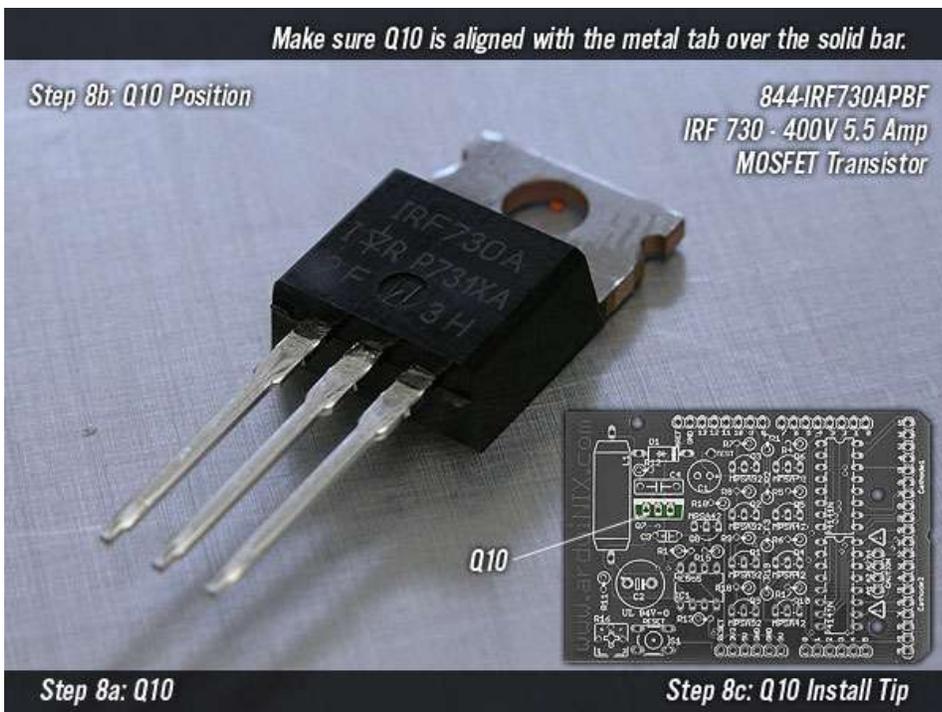


*Step 7b: C4 Position*

*Step 8a: Q10*

**Step 8a: Q10 MOSFET**

Hey fellow, you're a swell guy for showing the folks the IRF 730 MOSFET Transistor!

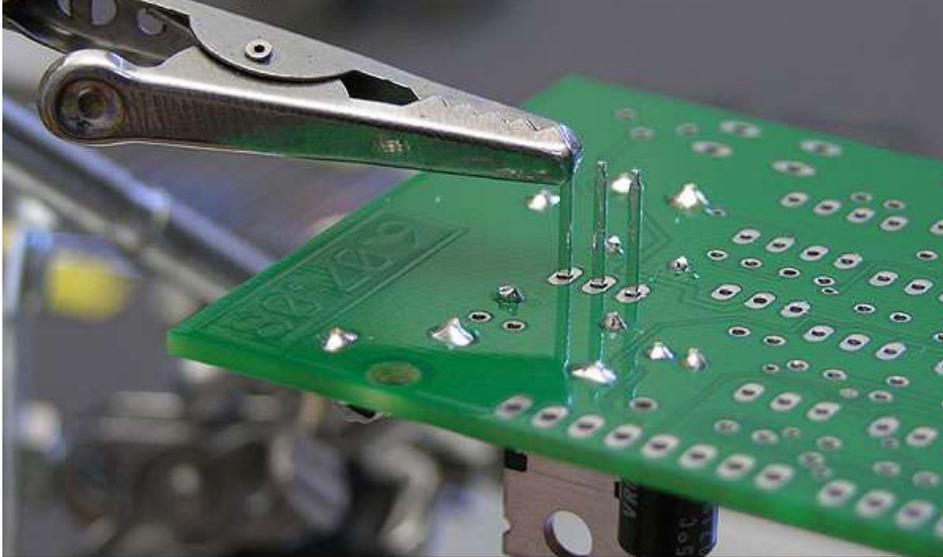


**Step 8b: Q10 Position**

This power transistor must be installed correctly, with the metal tab aligned over the solid white stripe at position Q10 on the board.

Helping metal hand keeps the part from falling out while soldering.

Step 8c: Q10 Install Tip



Step 8b: Q10 Position

Step 8d: Q10 Installed

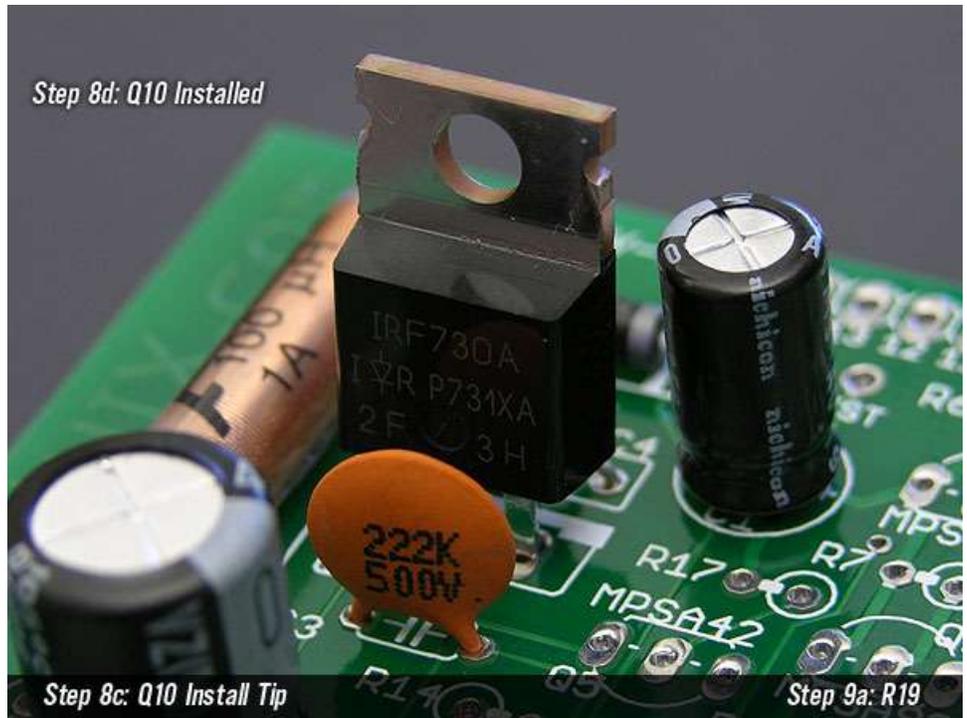
### Step 8c: Q10 Install Tip

Using a third hand to tug slightly up on the leads while soldering makes for a great installation.

### Step 8d: Q10 Installed

Q10 MOSFET Transistor installed

Step 8d: Q10 Installed



Step 8c: Q10 Install Tip

Step 9a: R19



Step 9a: R19

1K Trimmer

Step 8d: Q10 Installed

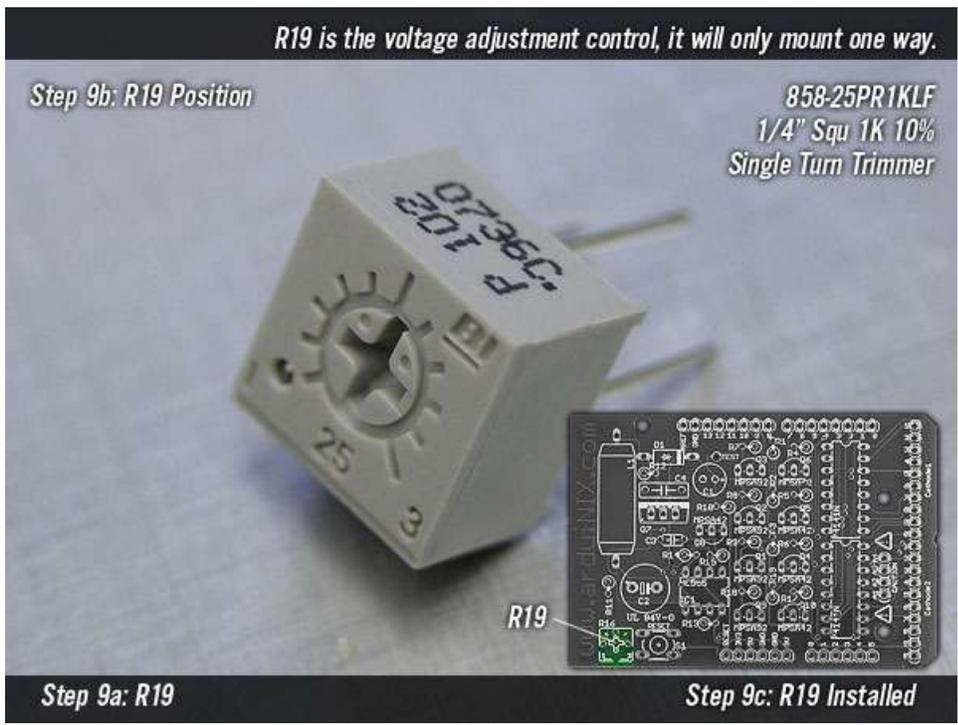
Step 9b: R19 Position

**Step 9a: R19 Trimmer**

This little fellow lives at R19, he is the 1K Trim pot, which will allow us to tune our output anode voltage to the desired range for the Nixie tubes or VFD tubes we want to use.

**Step 9b: R19 Position**

R19 will only insert into the board one way, the three pins on the back will align with the three holes in the board.



R19 is the voltage adjustment control, it will only mount one way.

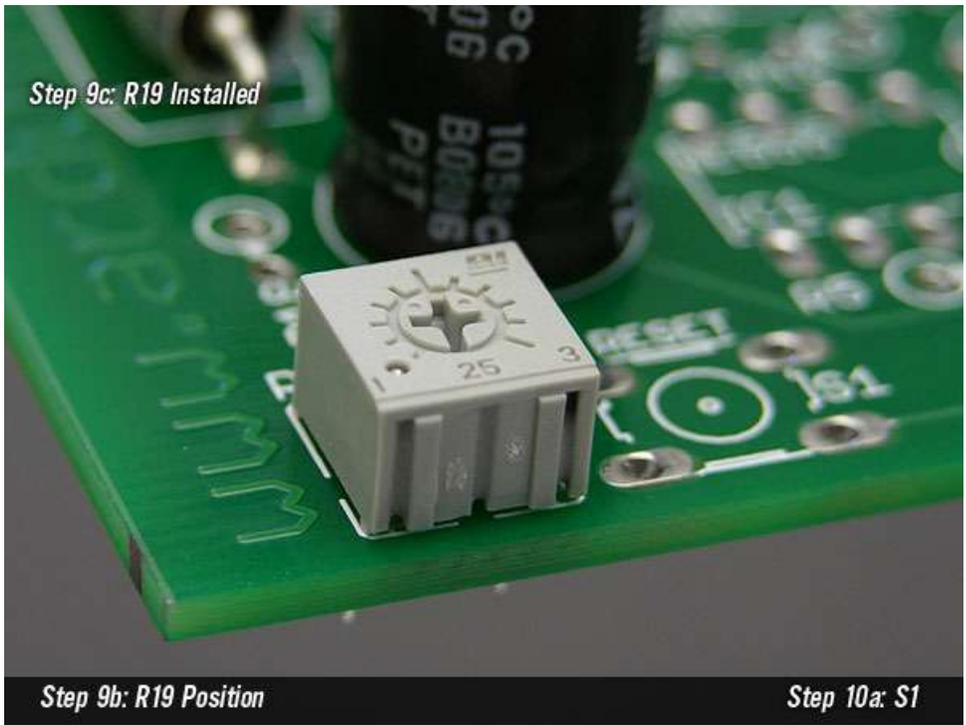
Step 9b: R19 Position

858-25PR1KLF  
1/4" Squ 1K 10%  
Single Turn Trimmer

R19

Step 9a: R19

Step 9c: R19 Installed



**Step 9c: R19 Installed**

R19 will be soldered in here, at the edge of the board near the tall capacitors

**Step 10a: S1 Tactile Switch**

This little tactile switch tells the Arduino to reset the entire unit.



Step 9c: R19 Installed

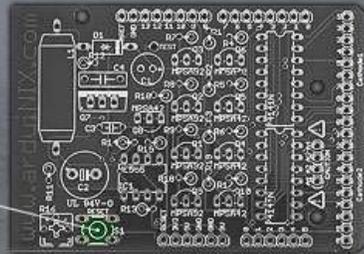
Step 10b: S1 Position

*S1 resets the arduino, in case you ever need a hard reset.*

*Step 10b: S1 Position*

*653-B3F-1000  
6x6 FLAT 4.3mm BTN  
Mechanical Tactile Switch*

*Step 10b: S1 Position*

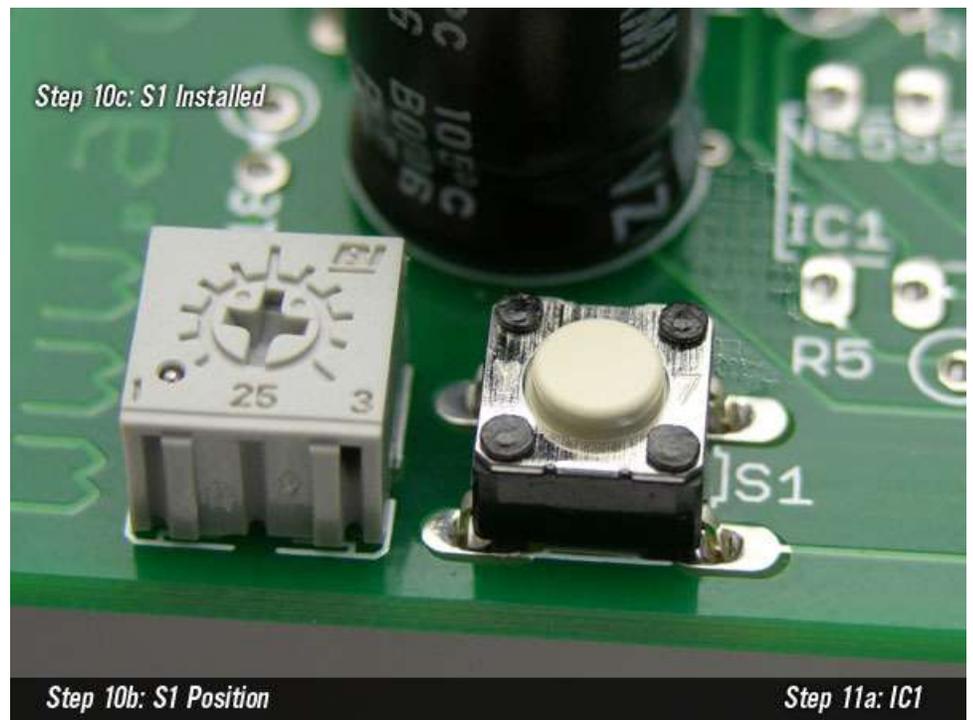


*Step 10a: S1*

*Step 10c: S1 Installed*

*Step 10c: S1 Installed*

Howdy, S1. Welcome to the board.



*Step 10b: S1 Position*

*Step 11a: IC1*

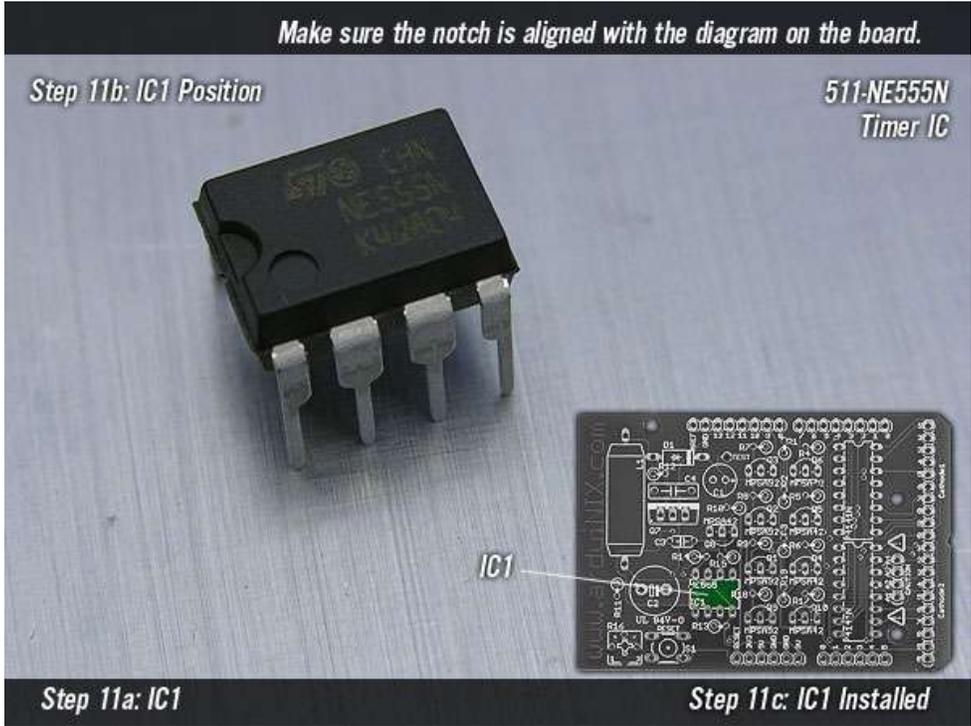


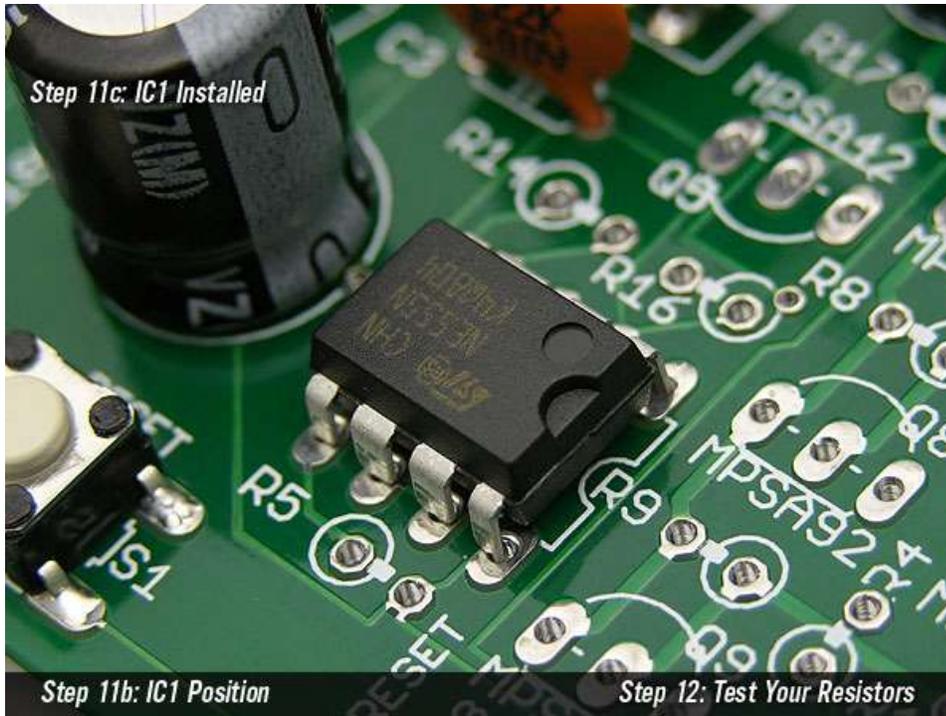
**Step 11a: IC1 Timer**

Robo buddy here is showing you the NE555N Timer IC. It is the ticker that controls oscillation to the power end of the ArduiNIX.

**Step 11b: IC1 Position**

The timer IC, like all other ICs must be aligned properly! Take note of the notch on the IC and align it with the notch on the diagram on the board.



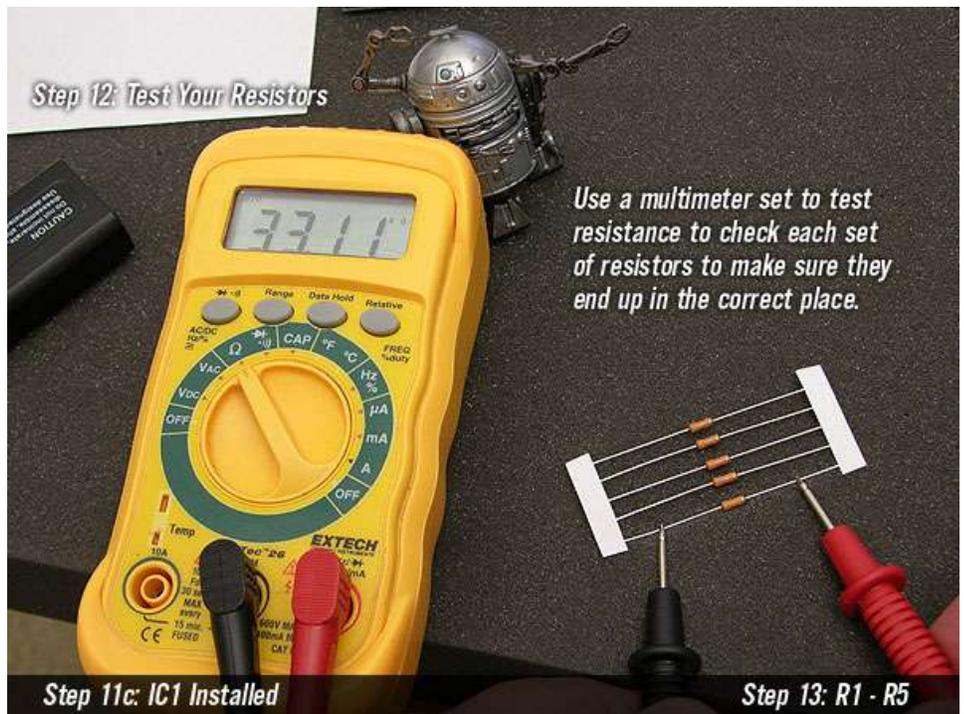


**Step 11c: IC1 Installed**

Make very sure that the timer IC is oriented properly. The image on the board shows which way to point the cutout, or dish that is on one end of all timer ICs.

**Step 12: Test Your Resistors**

PROTIP: Use your multimeter to test your resistors to make sure they are installed in the right spots.



Use a multimeter set to test resistance to check each set of resistors to make sure they end up in the correct place.

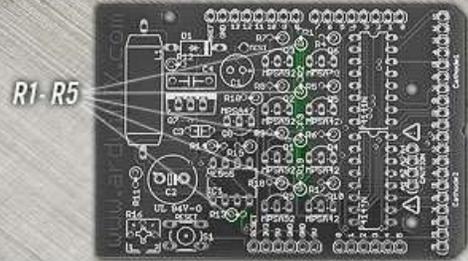
Step 11c: IC1 Installed

Step 13: R1 - R5

*It helps to bend your resistors like so, they fit vertically on board.*

*Step 13: R1, R2, R3, R4, R5 Position*

*71-CCF07-J-33K  
1/4 Watt 33kΩ Resistors*



*Step 12: Test Your Resistors*

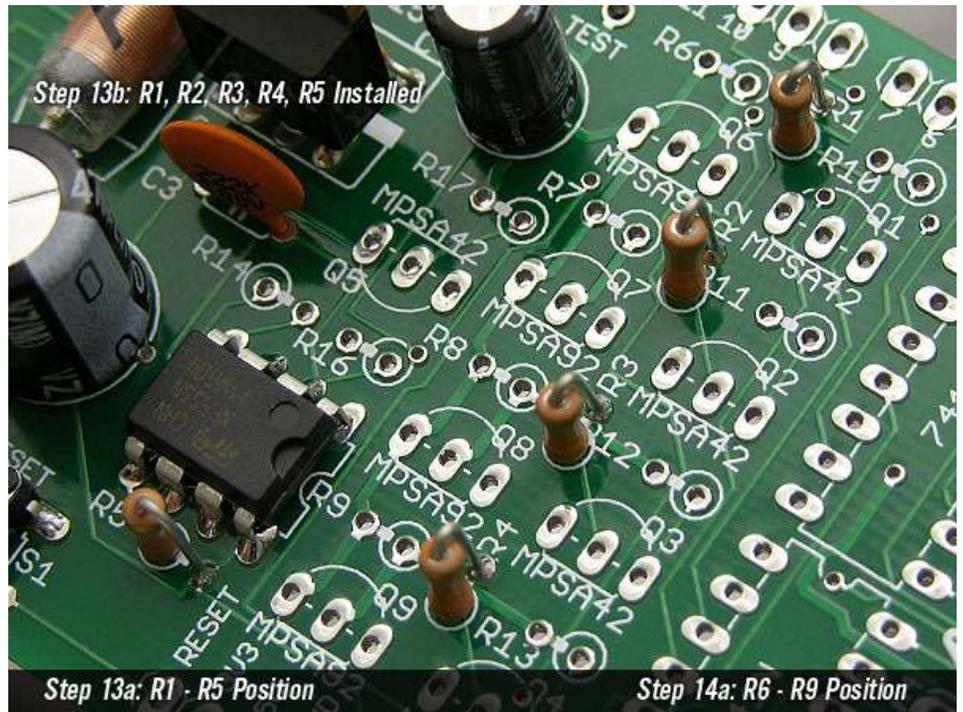
*Step 13b: R1 - R5 Installed*

**Step 13: R1 - R5**

Carefully bend the leads on the resistors like this, so they fit on the board vertically.

**Step 13b: R1 - R5 Installed**

R1 - R4 are in a row, R5 is over by the Timer IC.



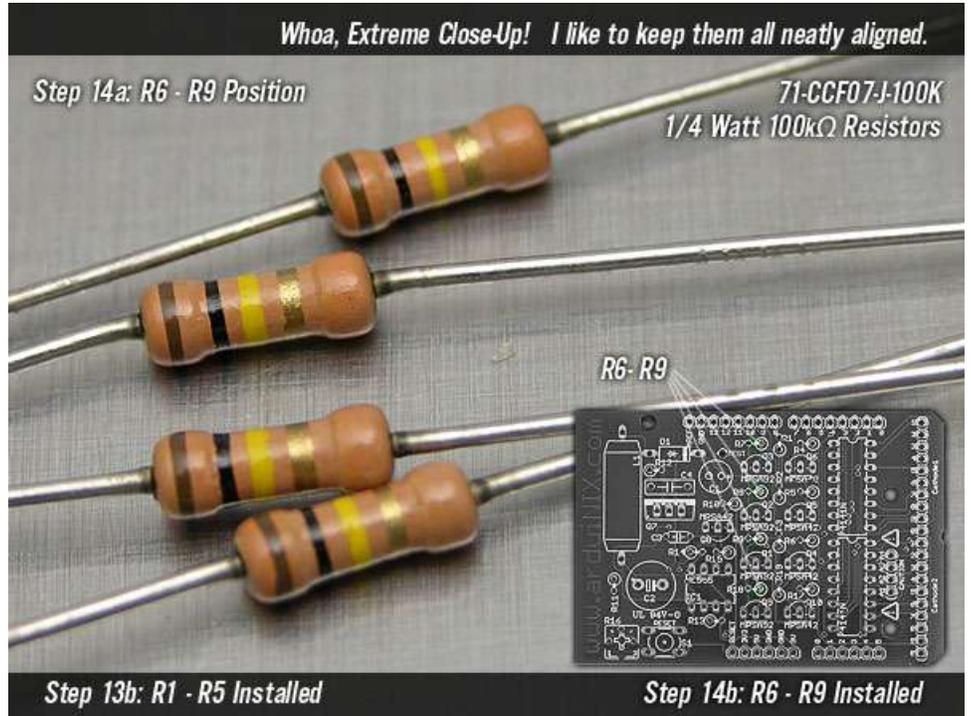
*Step 13b: R1, R2, R3, R4, R5 Installed*

*Step 13a: R1 - R5 Position*

*Step 14a: R6 - R9 Position*

**Step 14a: R6 - R9 Position**

R6 - R9 are in a row similar to R1 - R4.

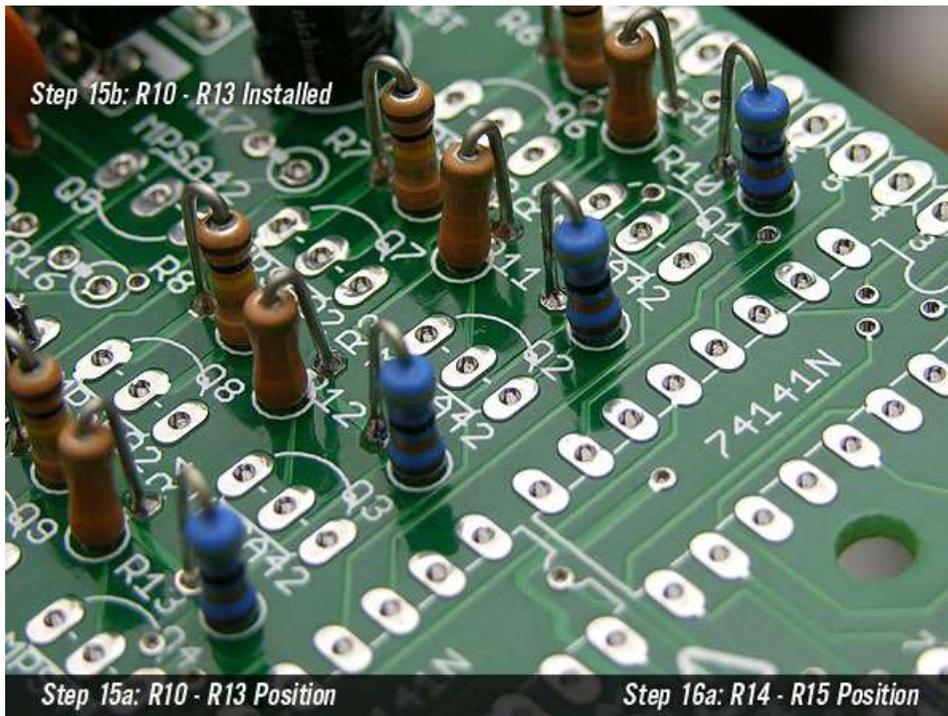
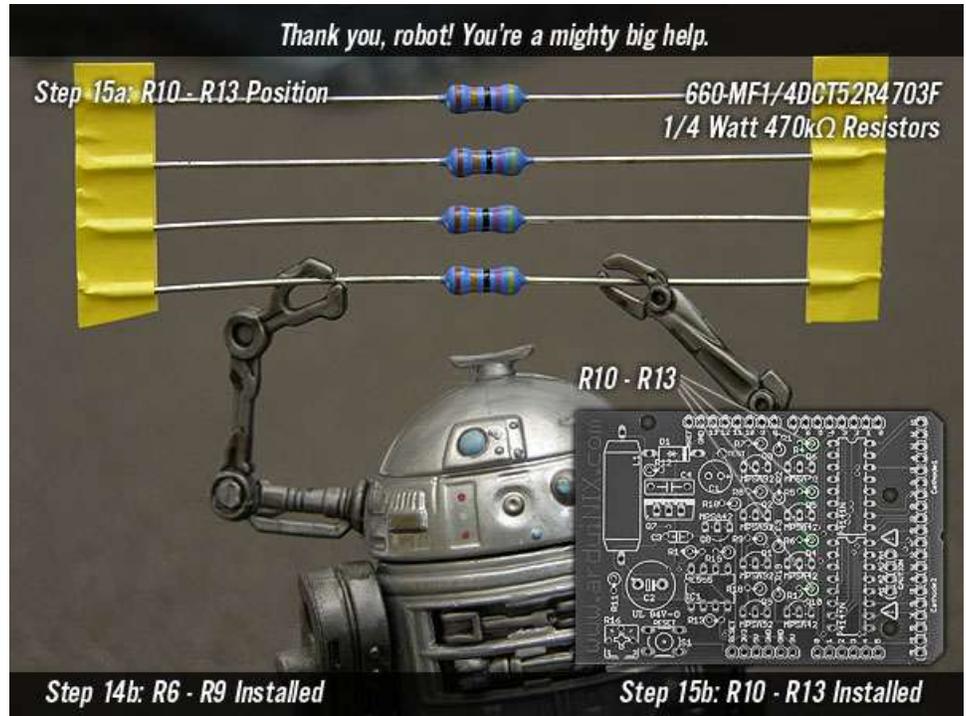


**Step 14b: R6 - R9 Installed**

R6 - R9 are in a row similar to R1 - R4.

**Step 15a: R10 - R13  
Position**

Pump that iron, robot!  
These are the 1/4 watt  
470K resistors.

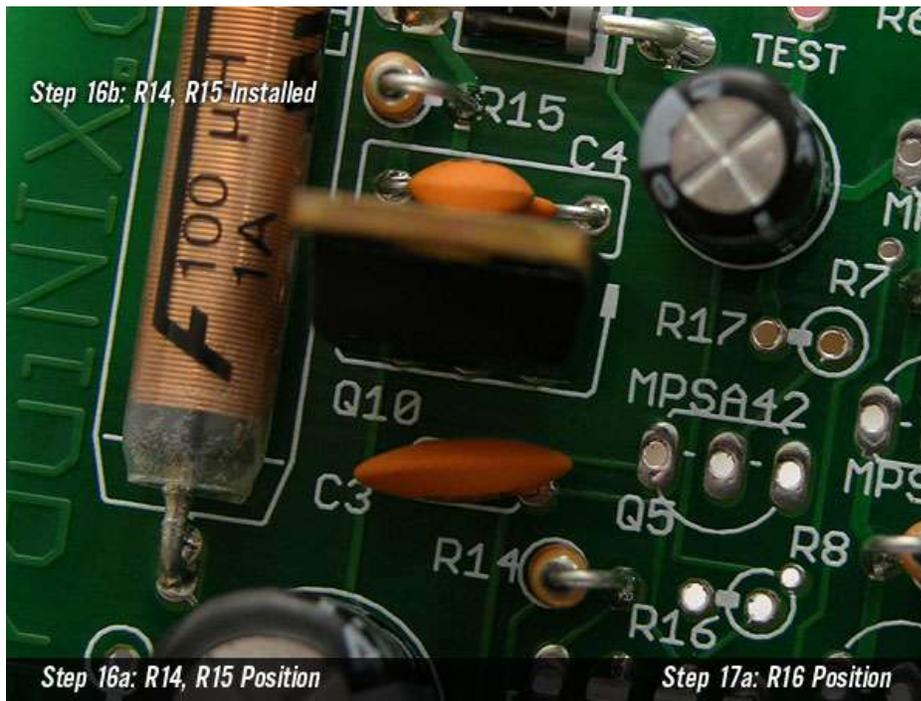


**Step 15b: R10 - R13  
Installed**

All resistors are  
vertically installed,  
making sure that  
markings are aligned  
for identification later if  
need be.

**Step 16a: R14 - R15  
Position**

All resistors are vertically installed, making sure that markings are aligned for identification later if need be.

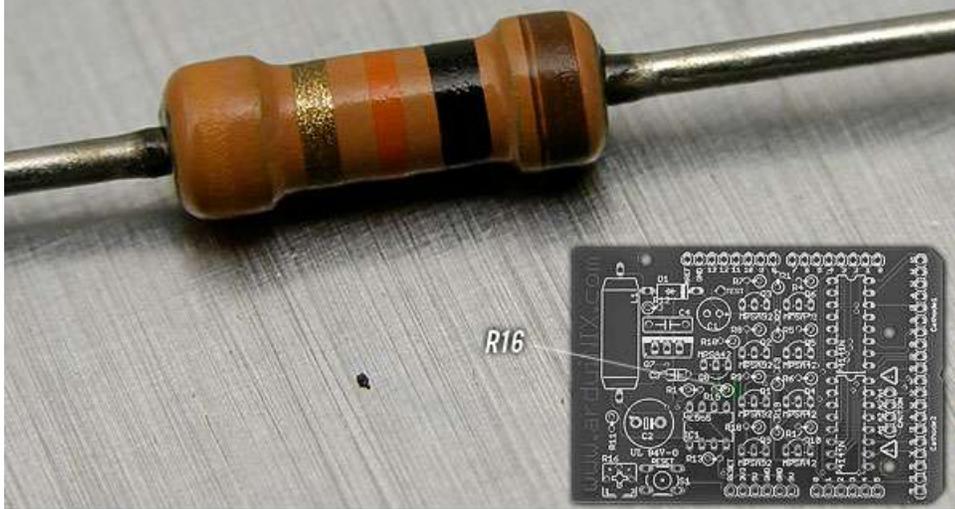


**Step 16b: R14, R15  
Installed**

*The wonderful telephone system*

*Step 17a: R16 Position*

*71-CCF07-J-10K  
1/4 Watt 10kΩ Resistors*



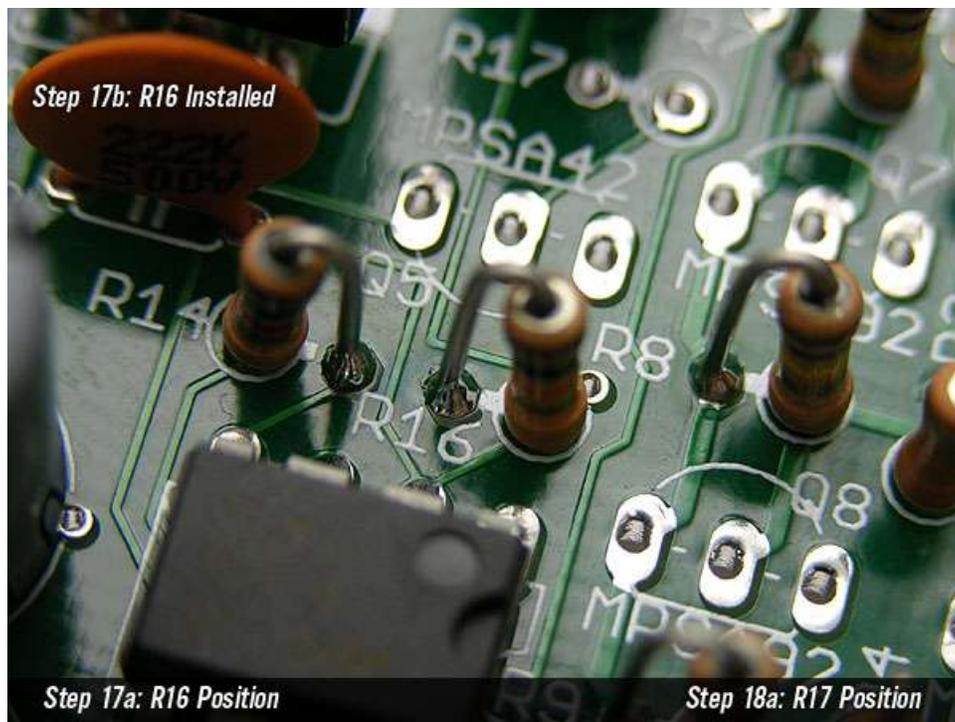
*Step 16b: R14 - R15 Installed*

*Step 17b: R16 Installed*

**Step 17a: R16 Position**

All resistors are vertically installed, making sure that markings are aligned for identification later if need be.

*Step 17b: R16 Installed*



*Step 17a: R16 Position*

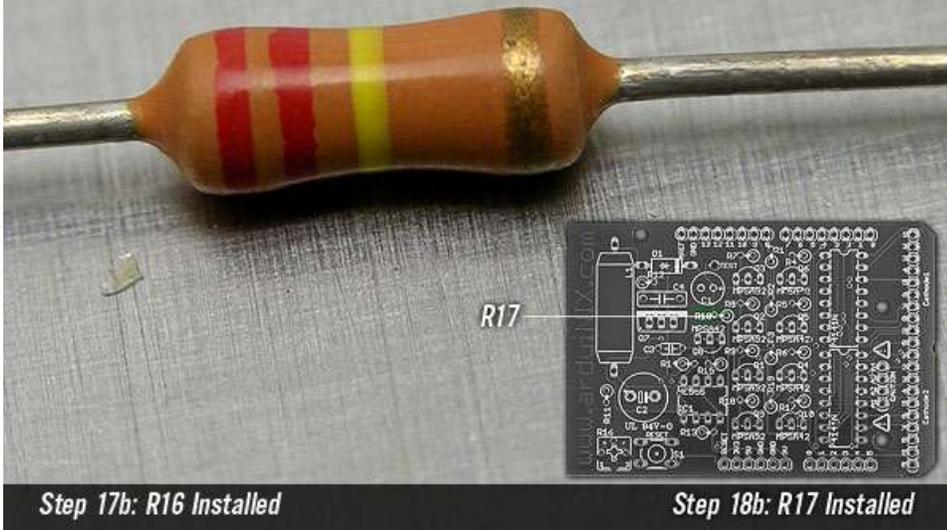
*Step 18a: R17 Position*

*And mani interesting furry animals*

*Step 18a: R17 Position*

*71-CCF07-J-220K  
1/4 Watt 220kΩ Resistors*

*Step 18a: R17 Position*



*Step 17b: R16 Installed*

*Step 18b: R17 Installed*

*Step 18b: R17 Installed*

*Step 18b: R17 Installed*



*Step 18a: R17 Position*

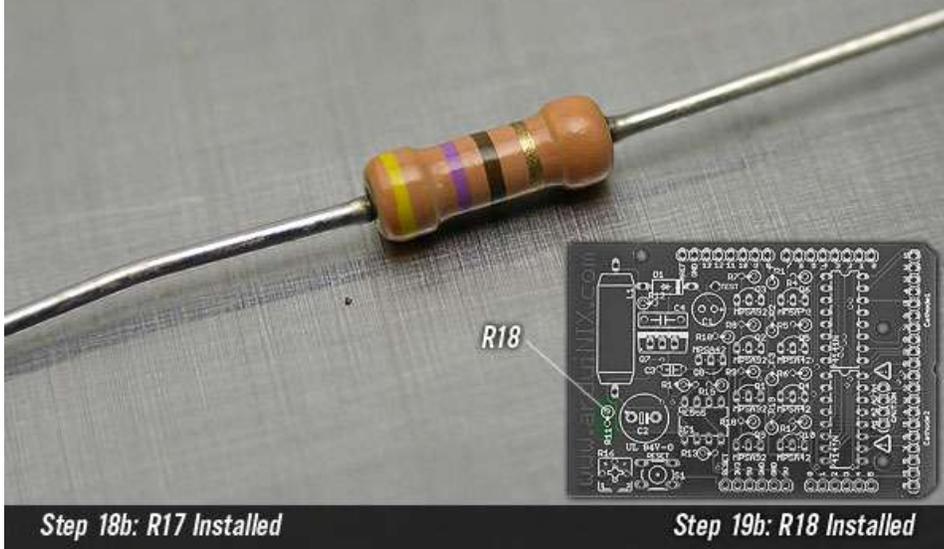
*Step 19a: R18 Position*

*We apologise for the fault in the subtitles.*

*Step 19a: R18 Position*

*71-CCF07-J-470  
1/4 Watt 470Ω Resistors*

*Step 19a: R18 Position*



*Step 18b: R17 Installed*

*Step 19b: R18 Installed*

*Step 19b: R18 Installed*

*Those responsible have been sacked.*

*Step 19b: R18 Installed*



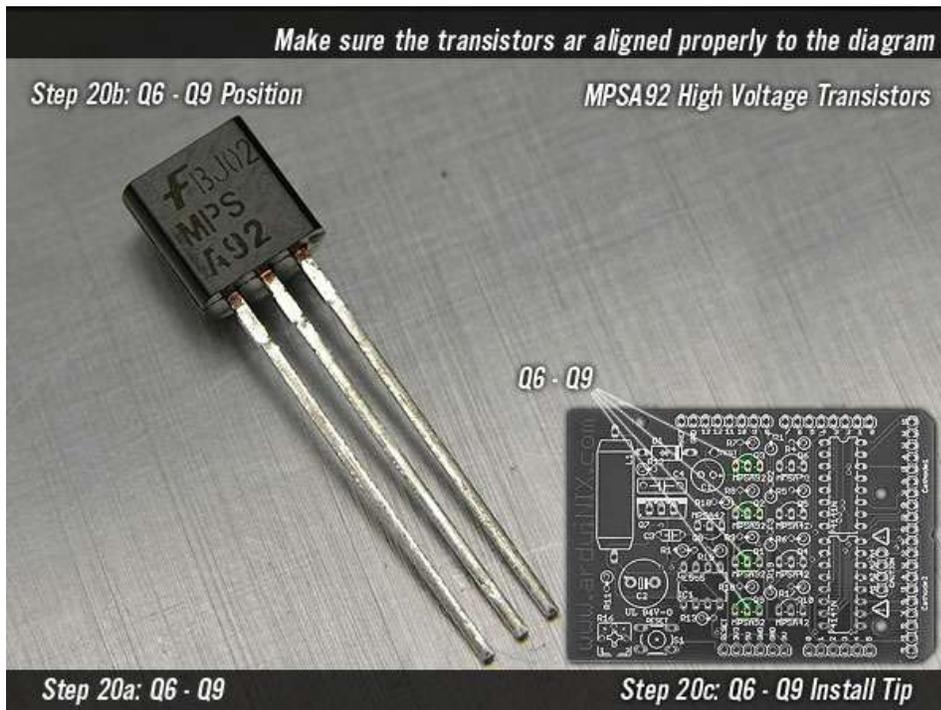
*Step 19a: R18 Position*

*Step 20a: Q6 - Q9; MPSA92*

**Step 20a: Q6 - Q9;  
MPSA92**

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Woohoo! now for something completely different. MPSA92 Hi voltage transistors!



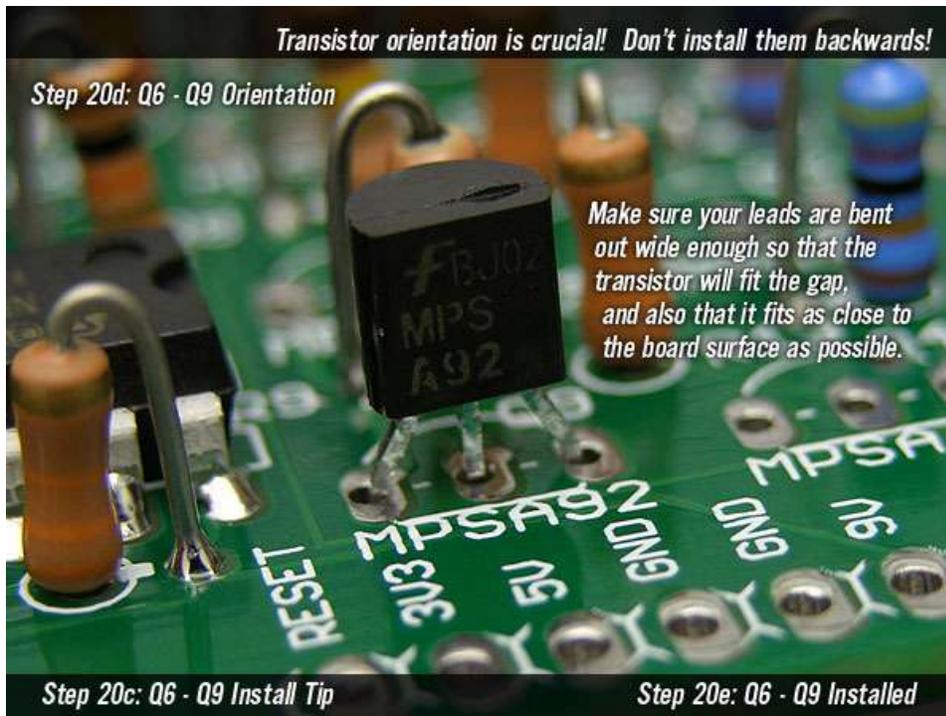
**Step 20b: Q6 - Q9  
Positions**

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Watch the orientation on these, make sure they match the diagram.

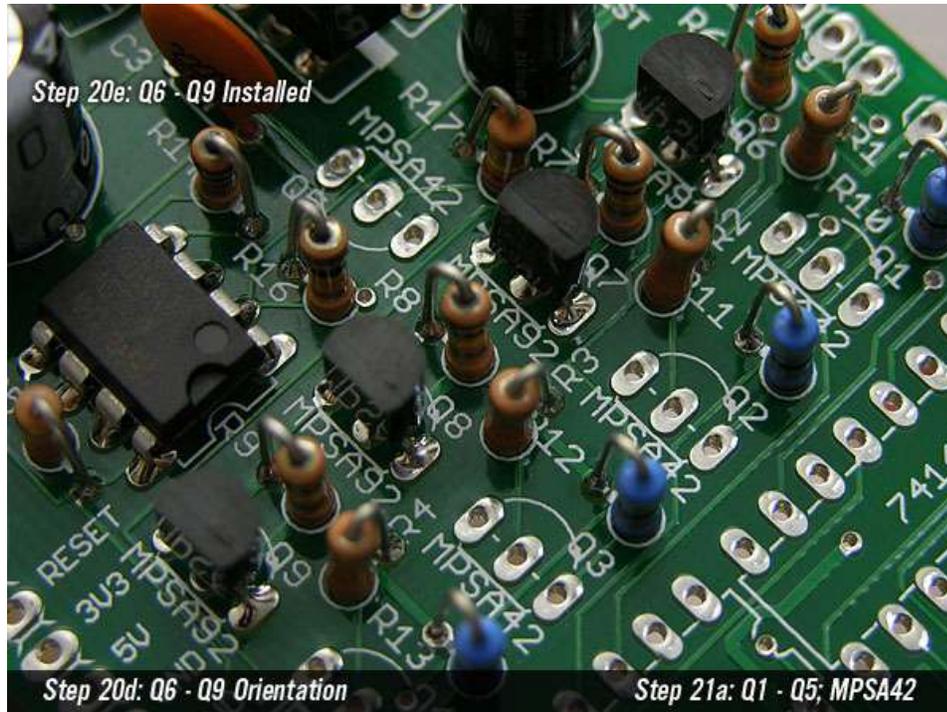


**Step 20c: Q6 - Q9 Install Tip**



**Step 20d: Q6 - Q9 Orientation**

Bend leads like this, so they fit the holes in the board.



*Step 20e: Q6 - Q9 Installed*

**Step 20e: Q6 - Q9 Installed**

---

Installed in proper location and orientation, should look like this.

*Step 20d: Q6 - Q9 Orientation*

*Step 21a: Q1 - Q5; MPSA42*

**Step 21a: Q1 - Q5; MPSA42**

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Make sure you read the labels correctly on all transistors, don't mix them up!



*Step 21a: Q1 - Q5; MPSA42*

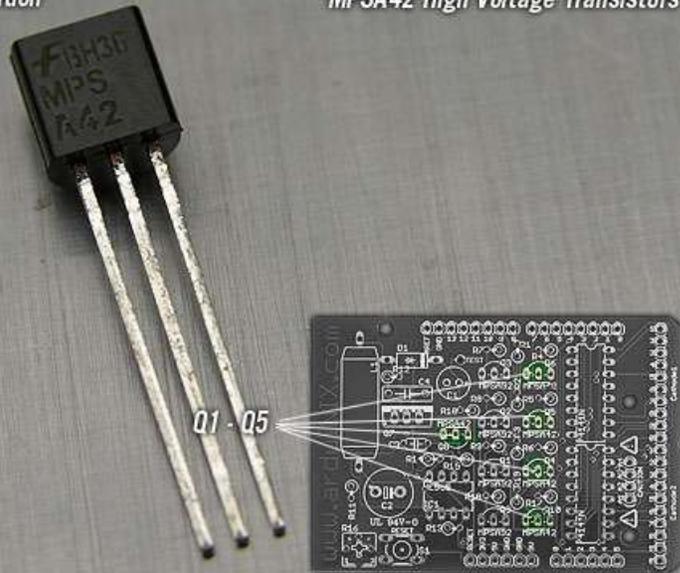
*Step 20e: Q6 - Q9 Installed*

*Step 21b: Q1 - Q5 Position*

*Bend the leads of the MPSA42s like you did the MPSA92s.*

*Step 21b: Q1 - Q5 Position*

*MPSA42 High Voltage Transistors*



*Step 21a: Q1 - Q5; MPSA42*

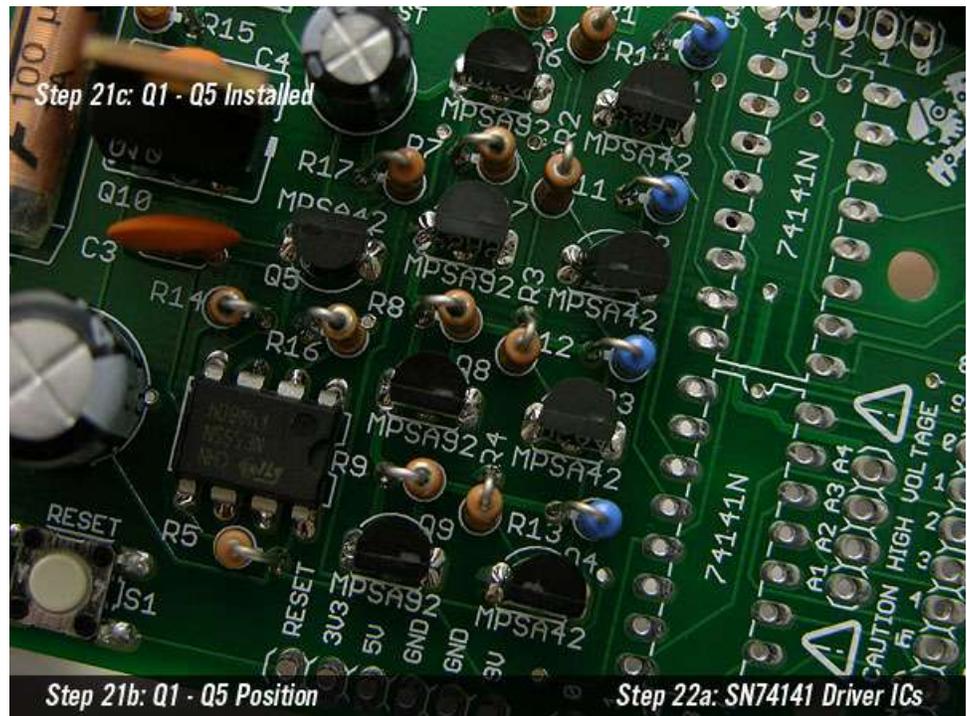
*Step 21c: Q6 - Q9 Installed*

**Step 21b: Q1 - Q5 Position**

Also bend the leads on these transistors so they fit their holes on the board.

**Step 21c: Q1 - Q5 Installed**

Also bend the leads on these transistors so they fit their holes on the board.



*Step 21b: Q1 - Q5 Position*

*Step 22a: SN74141 Driver ICs*



**Step 22a: Nixie Driver ICs**

Your kit will come supplied with Texas Instruments 74141 Driver chips or the Russian K155NA1 equivalent..

**Step 22b: Driver IC Positions**

We highly recommend socketing your driver chips, as they are the most delicate part of the ArduiNIX. These are no longer made, and are only available on eBay if you short one or burn one out. TAKE CARE with these.

*Make sure the driver ICs notches line up with the diagram.*

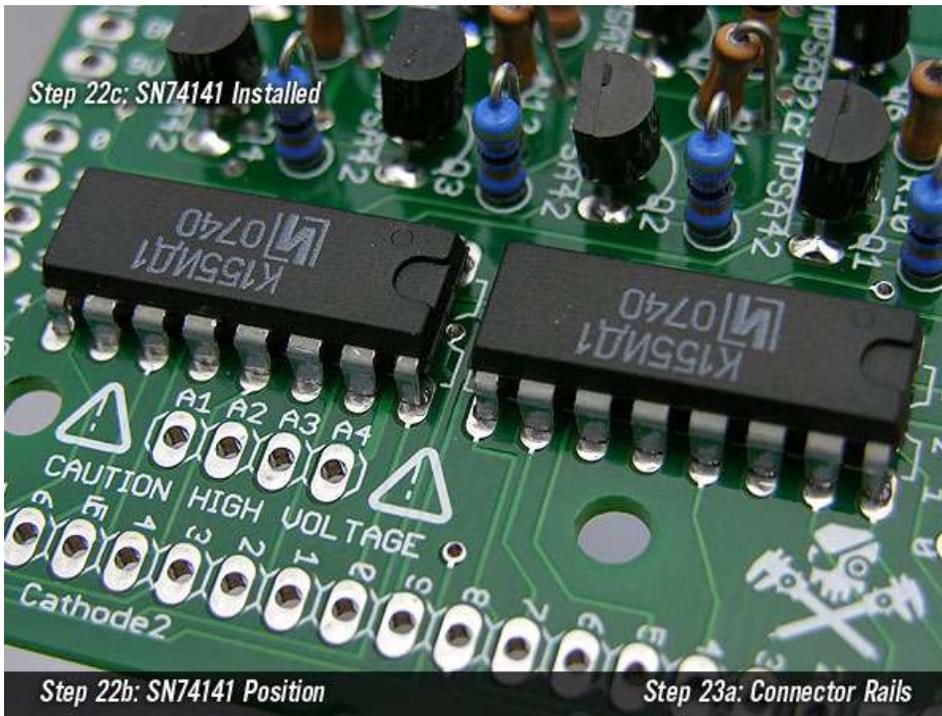
*Step 22b: SN74141 Position*

*Take care soldering in your driver ICs. They can be damaged by excessive heat on the leads. You may want to use 16 pin sockets to install your driver ICs. This will allow for easier and safer installation and replacement should the need ever arise.*

*SN74141 (or russian equivalent) Nixie Driver IC*

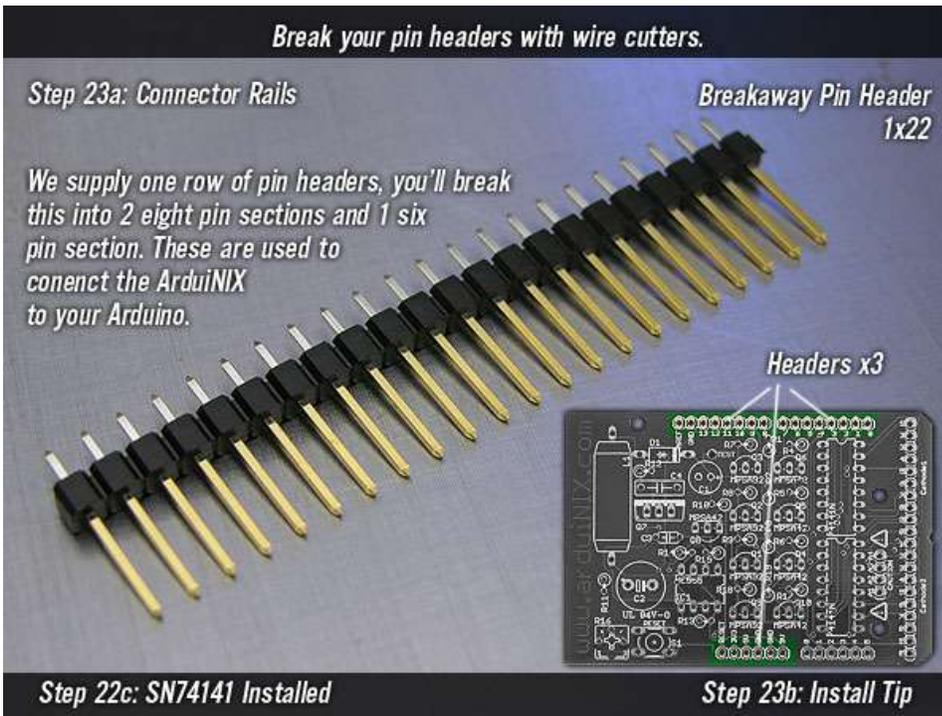
*Step 22a: SN74141 Driver ICs*

*Step 22c: SN74141 Installed*



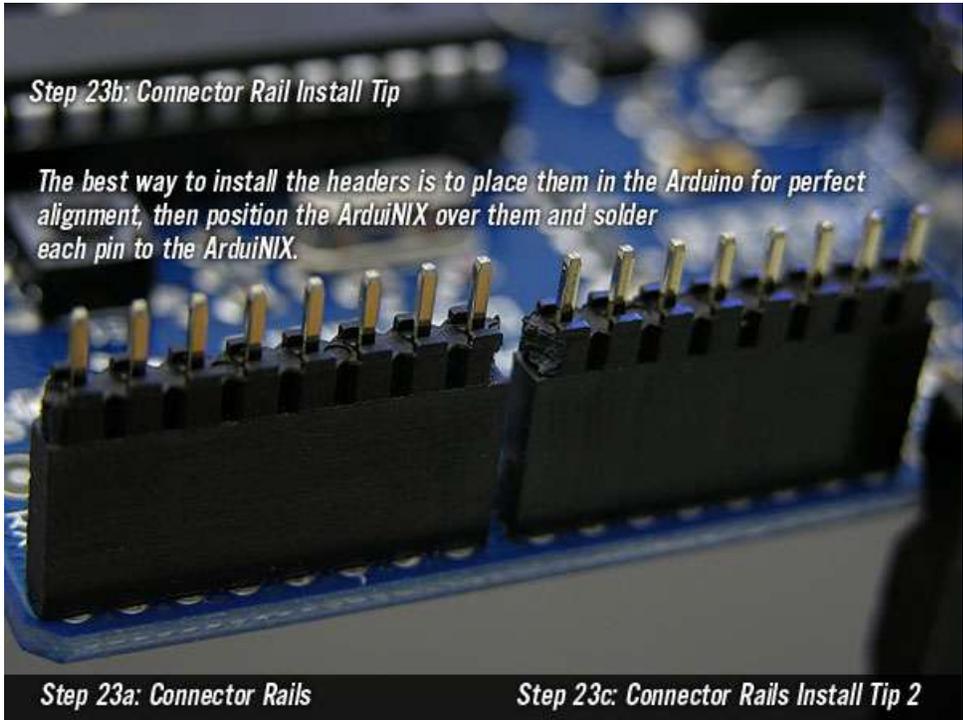
**Step 22c: Driver ICs Installed**

Make sure the notches on the chip line up with the notches on the diagram. Again, we highly recommend socketing your driver chips, we don't include sockets in the kits to keep the costs down.



**Step 23a: Connector Rails**

The Pin headers we supply will be used to connect the ArduiNIX Shield to the top of the Arduino Board..

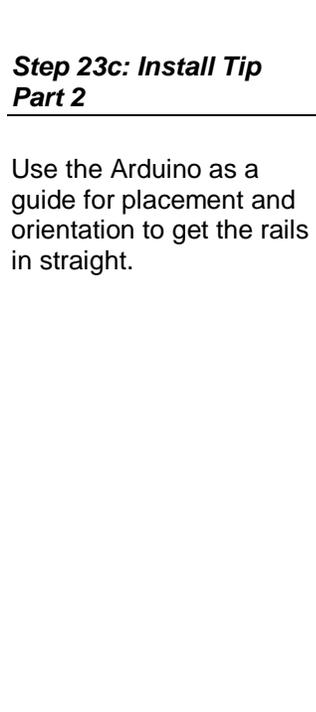


*Step 23b: Connector Rail Install Tip*

*The best way to install the headers is to place them in the Arduino for perfect alignment, then position the ArduiNIX over them and solder each pin to the ArduiNIX.*

**Step 23b: Install Tip**

Use the Arduino as a guide for placement and orientation to get the rails in straight.



**Step 23c: Install Tip Part 2**

Use the Arduino as a guide for placement and orientation to get the rails in straight.

*Step 23c: Connector Rail Install Tip 2*

*Once you've soldered each header pin, your ArduiNIX will be perfectly aligned to the Arduino..*

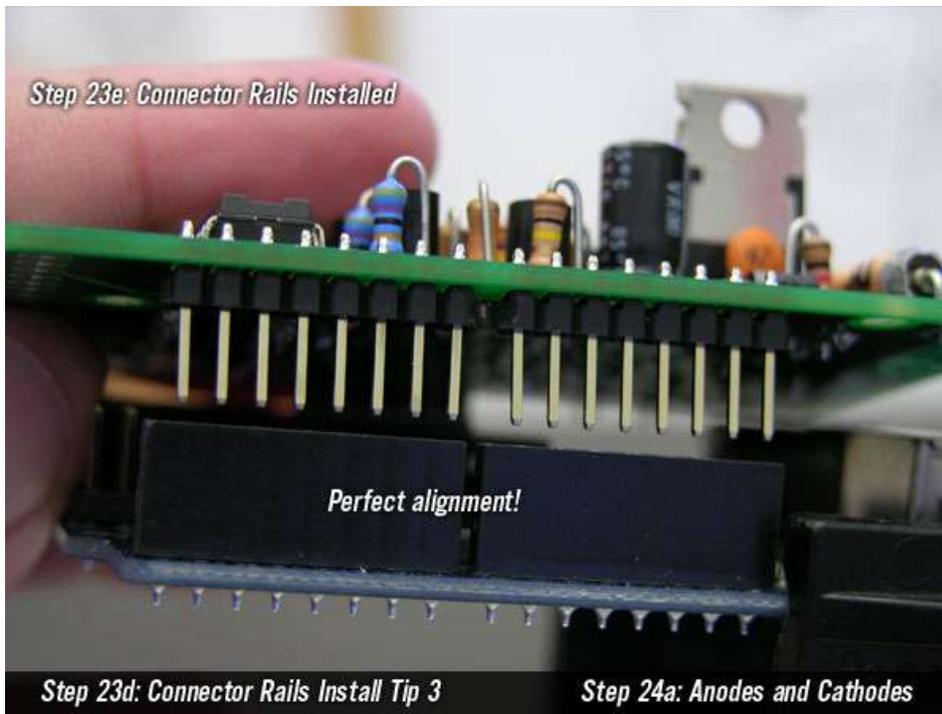
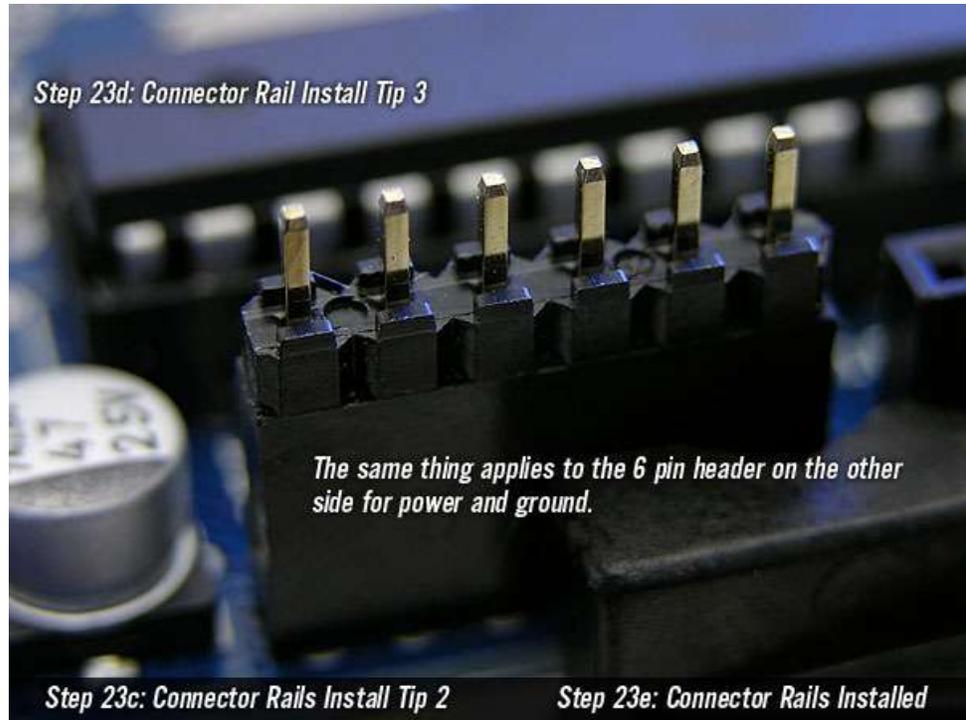
*Step 23b: Connector Rails Install Tip 1*

*Step 23d: Connector Rails Install Tip 3*

**Step 23d: Install  
Tip Part 3**

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Use the Arduino as a guide for placement and orientation to get the rails in straight.



**Step 23e: Connector  
Rails Installed**

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The ArduiNIX board has a spot for connector rails between the 9V connector and the Cathode2 Connector on the bottom of the board. These may be left unconnected if you prefer to run a cable to the Arduino connections under these terminals to use those pins as inputs for setting the clock, advancing the numbers, etc.

### Step 24a: Anodes and Cathodes

The ArduiNIX has two sets of 10 cathodes, and one set of four Anodes. The Anodes supply approx. 180 volts (depending on configuration) to the Anode pins of your Nixie or other neon displays. The Cathodes allow your display to ground back to the unit, lighting the correct element.

If you are going to use a ribbon cable to attach your tubes to your ArduiNIX, you may want to use angled headers to relieve strain on the wires. The ArduiNIX supports 4 Anodes and 20 Cathodes, you may drive a Nixie or neon display of up to 80 separate elements. Example- 8 ten element Nixie tubes, or 80 one element Nixie tubes. The configuration is up to you!

Step 23e: Connector Rails Installed

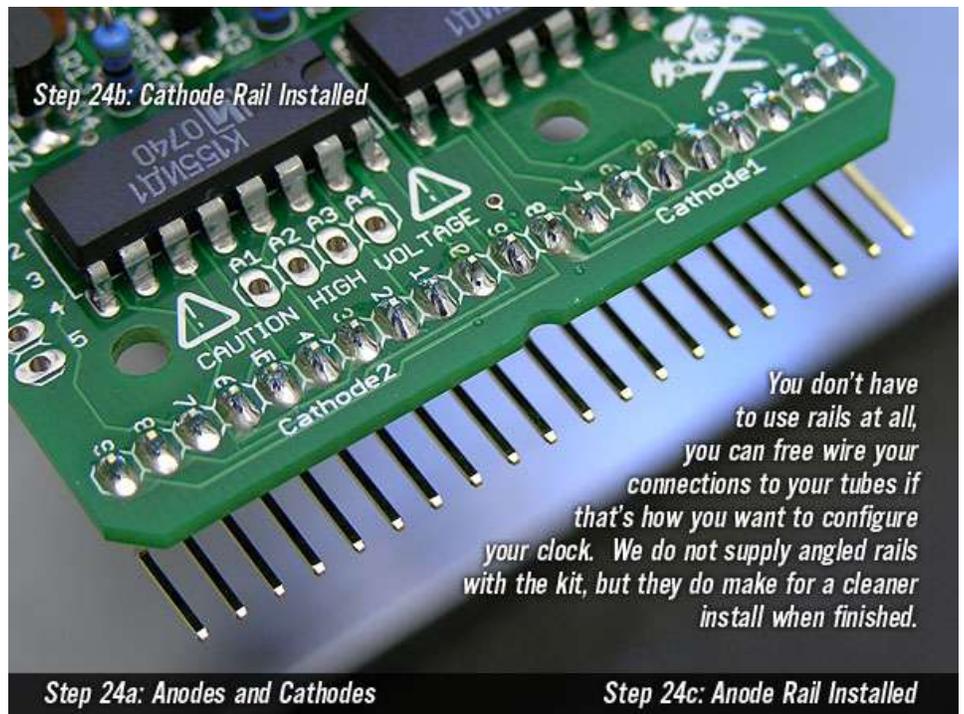
Step 24b: Cathode Rail Installed

### Step 24a: Anodes and Cathodes

The ArduiNIX kit does not include connector rails for the Cathodes. The way you connect your ArduiNIX Shield to your tubes is up to you. We prefer IDE Ribbon cable and angled pin rails, you may prefer hardwiring.

### Step 24b: Cathode Rail Installed

The ArduiNIX connects to your nixie tubes through these terminals. The cathodes connect to the numeral plates 0 through 9, and the anode terminals connect to the anode pin of your nixie tube. ALWAYS use a resistor between the anode terminal and the anode pin of your nixie tube. This is required. The value of the resistor varies depending on your tubes, but 10K works well to start with.



You don't have to use rails at all, you can free wire your connections to your tubes if that's how you want to configure your clock. We do not supply angled rails with the kit, but they do make for a cleaner install when finished.

### ***Step 24c: Anode Rail Installed***

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The anode rail is the high voltage output for the ArduiNIX shield. It supplies driving voltage to the anode pins of your tubes. Make sure to use a resistor between the anode terminals and the tubes of your choice. Each anode terminal is designed to handle up to two anode connections, meaning the four anode terminals will support up to eight nixie tubes total.

### ***Step 25a: Check Your Work***

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Assemble the ArduiNIX Shield to the Arduino board, and check your work, solder welds, alignment and orientation of components. Now doublecheck. It's important to have everything in the proper place and orientation for the first bootup so you don't fry out any components. We claim NO RESPONSIBILITY if your board starts sizzling due to bad assembly.

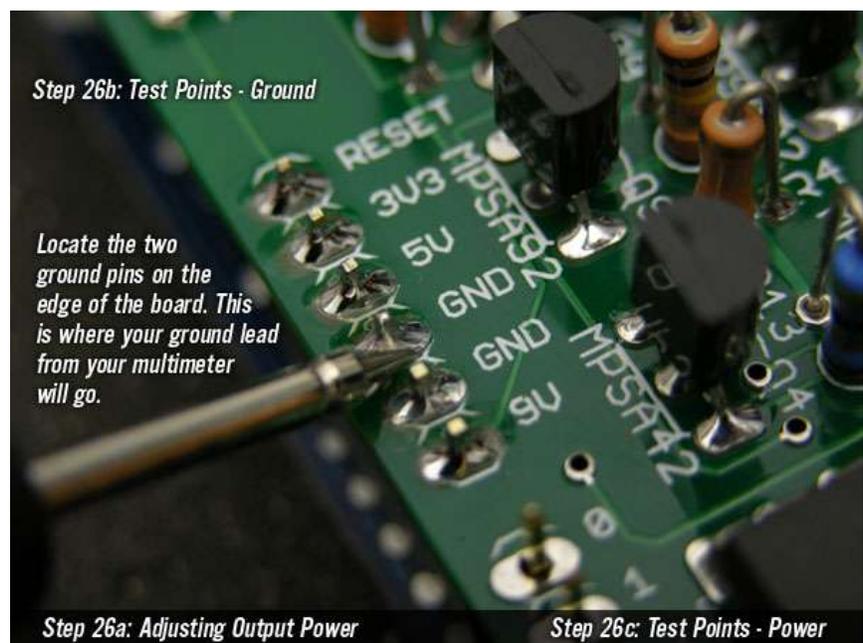
## Step 26a: Adjusting Output Power



Use a 9Volt DC wallwart power supply with the ArduiNIX (Not included) Once plugged in, certain portions of the ArduiNIX will become charged with high voltage. Do not touch the anode pins, or test points, or any exposed solder points while the unit is charged.

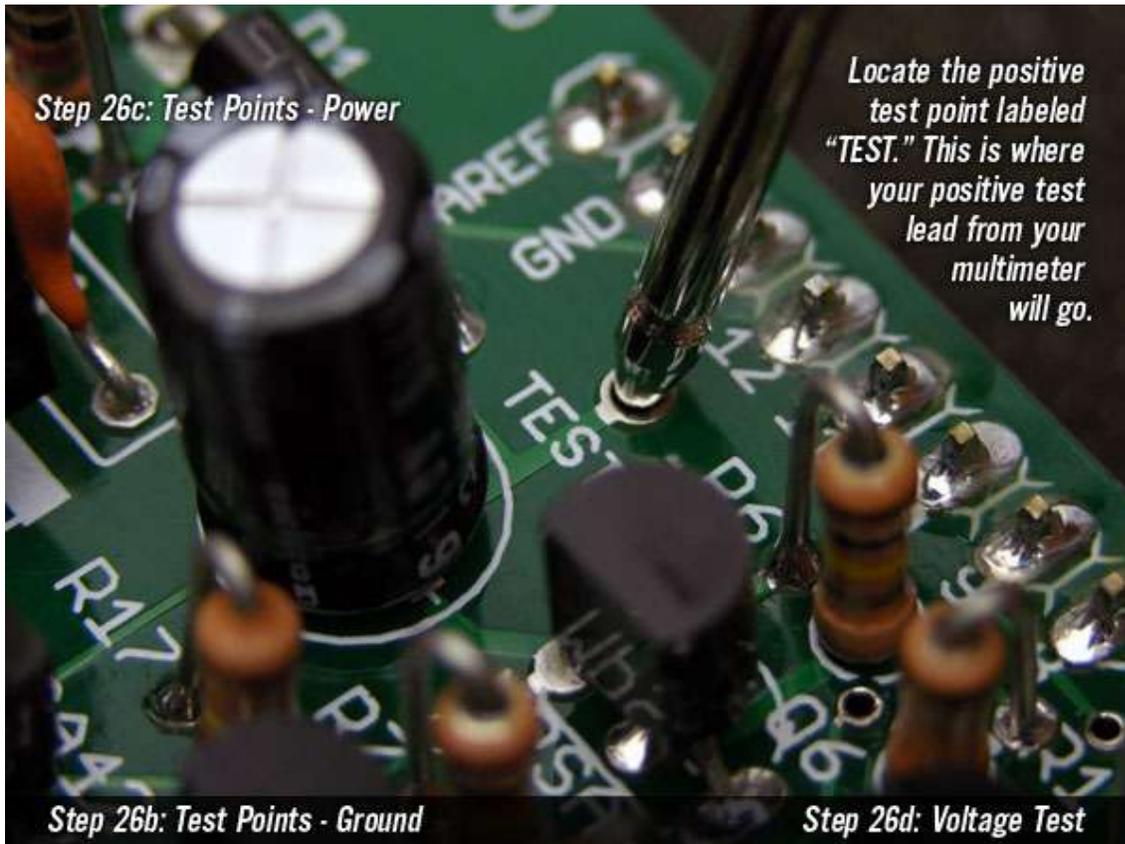
### Step 26b: Test Points - Ground

Use a 9Volt DC wallwart power supply with the ArduiNIX (Not included) Once plugged in, certain portions of the ArduiNIX will become charged with high voltage. Do not touch the anode pins, or test points, or any exposed solder points while the unit is charged.



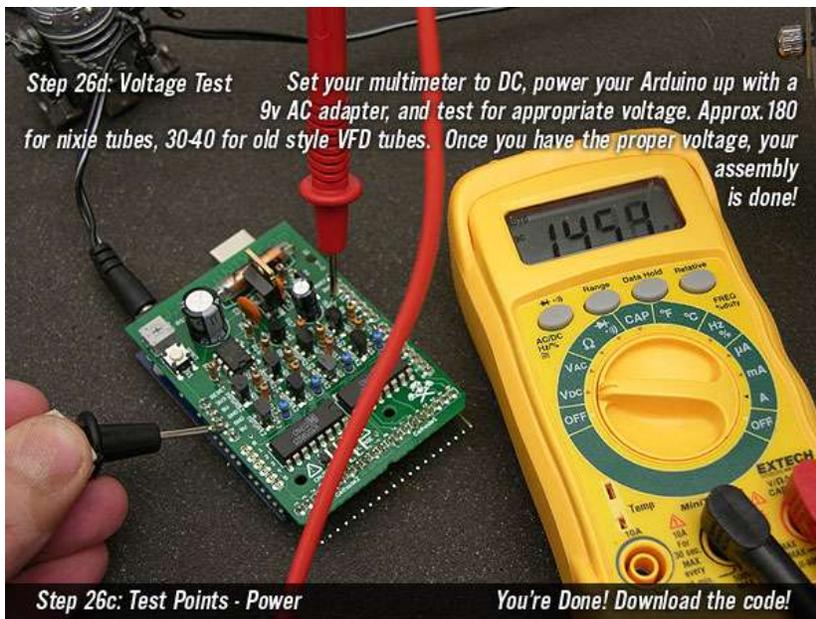
**Step 26c: Test Points - Power**

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**Step 26d: Voltage Test**

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Use a 9Volt DC wallwart power supply with the ArduiNIX (Not included) Once plugged in, certain portions of the ArduiNIX will become charged with high voltage. Do not touch the anode pins, or test points, or any exposed solder points while the unit is charged.

To drive VFD Tubes in the 30 to 40 voltage range, the timing capacitors in steps 6 and 7 must be changed to higher value capacitors.