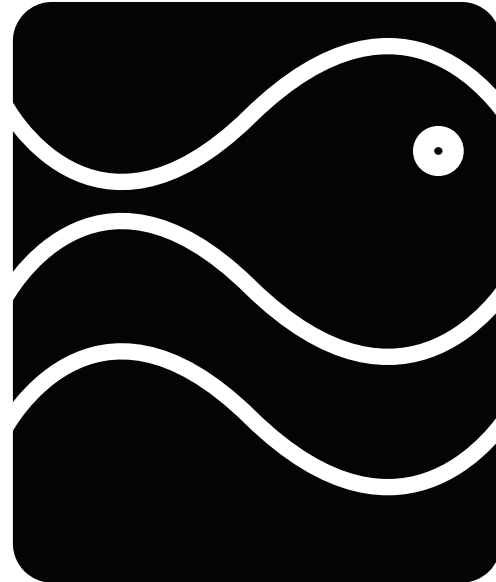


**FiveFish**



**Studios**

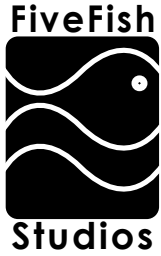
**NK-72DI Mic Preamp + DI Kit  
Assembly Guide**



Assembly Guide Revision 1.1 - 20160530

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## FiveFish Audio

[www.fivefishaudio.com](http://www.fivefishaudio.com)

Dear Customer,

Thank you for purchasing our NK-72DI Mic Preamp + DI Kit.

Great care has been taken to make this assembly guide complete and as accurate as possible. Our goal is to make your assembly work easy and trouble-free, and deliver to you a working, reliable, and high-performance mic preamplifier.

This assembly guide is a work in progress and we're continually working to improve it. As always, we welcome the input of the DIY community if you have any comments, suggestions, or additional information that you think will be helpful for inclusion in this assembly guide.

If you have any questions that are not covered by this assembly guide, please feel free to contact us at [www.fivefishaudio.com](http://www.fivefishaudio.com), or via our facebook page.

Sincerely,

FiveFish Team

# SAFETY CONSIDERATIONS

## GENERAL

This assembly guide must be reviewed for familiarization with safety markings and instructions before assembly of the Mic Preamp kit.

## BEFORE APPLYING POWER

Verify that all components and parts are inserted in the right location and correct orientation. Visually inspect that there are no cold solder joints, or short-circuits.

### **WARNING**

The WARNING sign denotes a hazard. Pay attention to the procedure, instructions, or the like, which if not correctly performed could result in damage to your equipment, electronic component or personal injury.

### **WARNING**

*Any interruption or disconnection, or lack of connection of the protective earth terminal/safety ground may cause a potential electric shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection).*

*This mic preamp module is designed to be plug-in into an API 500 series rack or compatible unit. DC Power is supplied by the 500 series rack to this module.*

*It is strongly suggested that you use a lab power supply the **first-time** you power your mic preamp project. If you made any mistake during assembly of this kit (for example: components inserted in wrong location, wrong orientation, short-circuit in your soldering job, etc.) you will not be subjecting the built-in power supply of your rack to the problem, and avoid damaging your power supply.*

*If you don't have a lab power supply and instead will be using your rack to power directly this project the first time, I recommend using an extender card with built-in fuses to protect your rack power supply from accidental shorts or over-current. (The in-line fuses will blow if there is overcurrent or short-circuit condition, thus protecting the rack power supply).*



# GENERAL INFORMATION

## 1. DESCRIPTION

The NK-72DI is a high-performance, low-noise Mic Preamp and Direct Inject (DI) combo unit for use with API 500 Series lunchboxes or racks. It is a transformer-based preamp design, using Carnhill/UK Input and Output Transformers to deliver a rich, big sound.

The NK-72DI design utilizes a Discrete OpAmp for signal amplification and direct drive of the output transformer. The amount of voltage gain or amplification is set by a simple resistor, which can either be a single-turn potentiometer or a 12-step selector switch with the necessary resistor ladder values. The stock NK-72DI Mic Preamp Kit is supplied with the single-turn potentiometer but can be upgraded to use a 12-step selector switch. There is also built-in RFI input and output protection, to protect the preamp from radio frequency interference.

The 48Volt section utilizes a soft-start design, such that 48Volts is applied gradually to your expensive microphones. This “soft-start” approach also prevents the typical sudden “popping” noise when phantom power is turned ON.

The NK-72DI uses switched relays with separate push-button controls for 48V Phantom Power, -20dB Pad, Polarity Reverse, and Mic/DI Input selection. The kit builder can also wire optional 3mm LED indicators for each switch to indicate when the function is enabled.

The NK-72DI also features a built-in DI input for use with high-impedance instruments like electric guitars, bass guitars, etc. A push-button switch is used to select either Mic-level or DI-input to the unit. A 1/4” TRS jack is provided on the front panel for instrument input.

The NK-72DI Mic Preamp Kit can be upgraded with a 5-LED VU Meter board and Stepped-Gain Selector Switch. These extra options are not necessary for the preamp’s operation, but is provided as a “nice-to-have” upgrade step. The Stepped-Gain Selector Switch and 5-LED VU Meter kit are a separate purchase and not part of the basic NK-72DI kit package.

The NK-72DI requires a dual power supply, and +48Volts (power supplied by a 500 series rack). When using our DOA-12 Discrete OpAmp, and racked separately, it can be powered up to (+/-22 Volts) for more headroom before clipping.

## 2. TOOLS & EQUIPMENT REQUIRED

A few basic tools and equipment are required to assemble this kit. These basic tools are not supplied with the kit.

- 2.1. Soldering Iron and Lead - We recommend a temperature-controlled soldering iron. **DO NOT USE A BIG 100 WATT SOLDERING GUN.** A small to medium-sized soldering tip is required to solder the small parts. You may use Lead-free or 60/40 lead-based solder.
- 2.2 Cutter - You will need a cutter to cut component leads and wires.
- 2.3. Solder Sucker Pump - If you made a mistake and need to desolder a component, you'll need one.
- 2.4. Multitester - Used for measuring resistance, continuity, and voltages.
- 2.5. Magnifier & Lamp - I recommend a clean and well-lighted space for your assembly area.
- 2.6. Other Tools (not required, but nice to have) - Component lead bender, vise, tweezers, wire stripper.

### 3. ASSEMBLY GUIDE

BEFORE YOU BEGIN: Pick a clean work area where you can leave your work-in-progress unattended if you need to.

Keep individual components in their labeled zip bag until you're ready to solder them. Kit components have been sorted and labeled for your convenience. The labeled components lessens chances of insertion errors, inserting the wrong component into the wrong location. Keeping the components in their zip bags also reduces chance of small parts getting lost or misplaced.

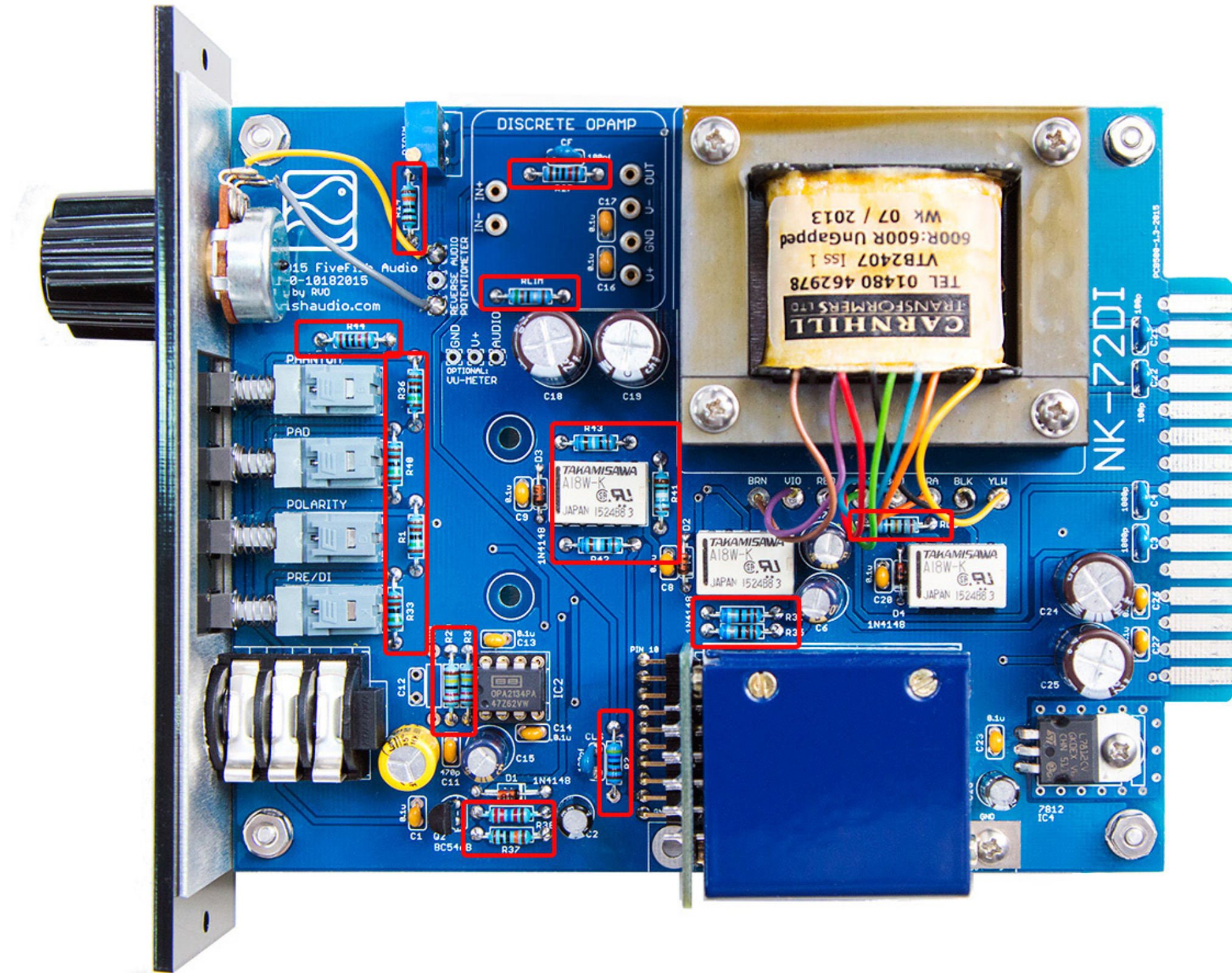
The best practice is to solder the smallest and/or shortest components first. Then solder the taller and larger components next. Big bulkier components like switches, jacks, big capacitors and transformers are best soldered last.

**Please review Section 4.0 for any ERRATA and last minute changes before starting assembly.**





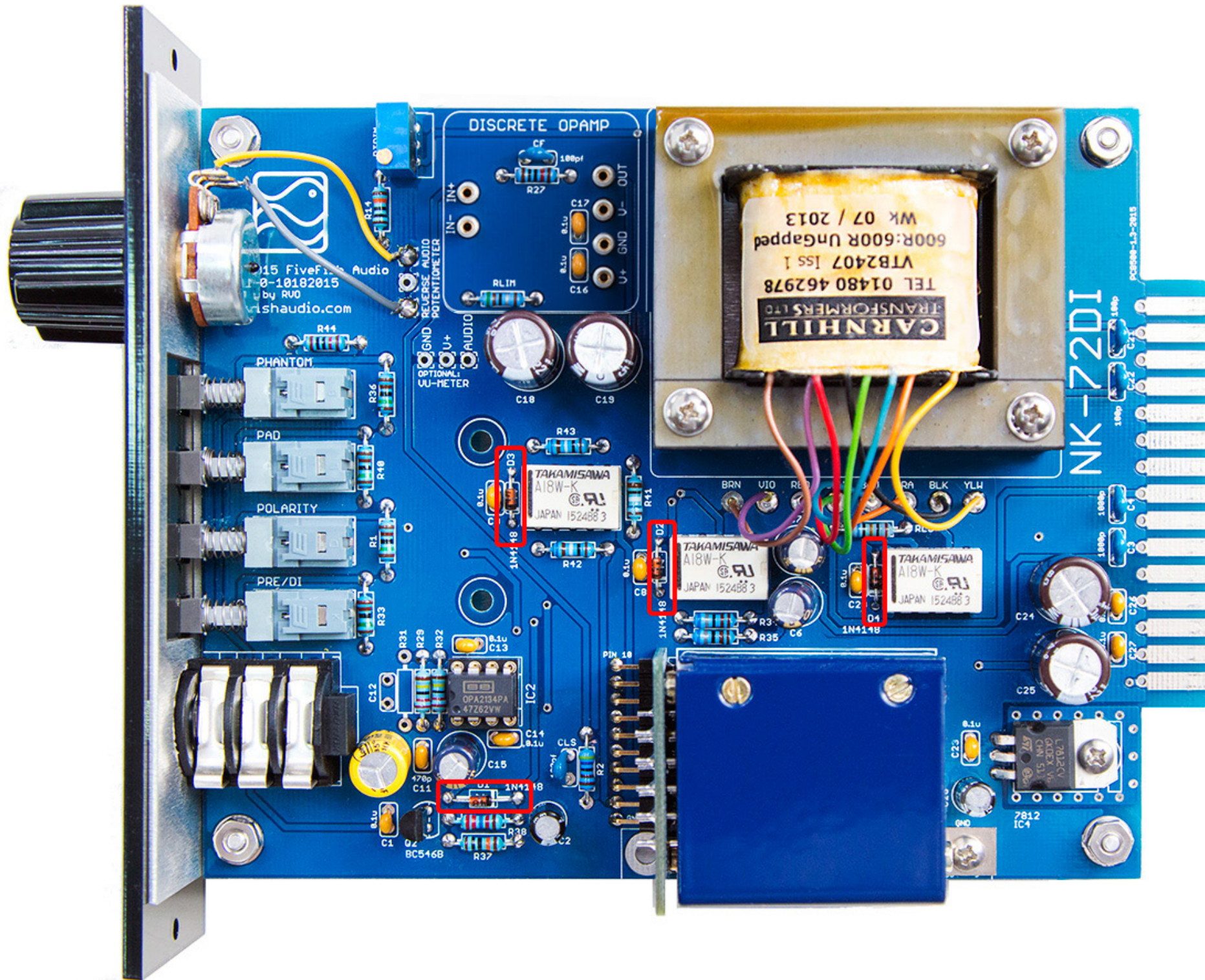
### 3.1 Solder all 1/4 watt Resistors.





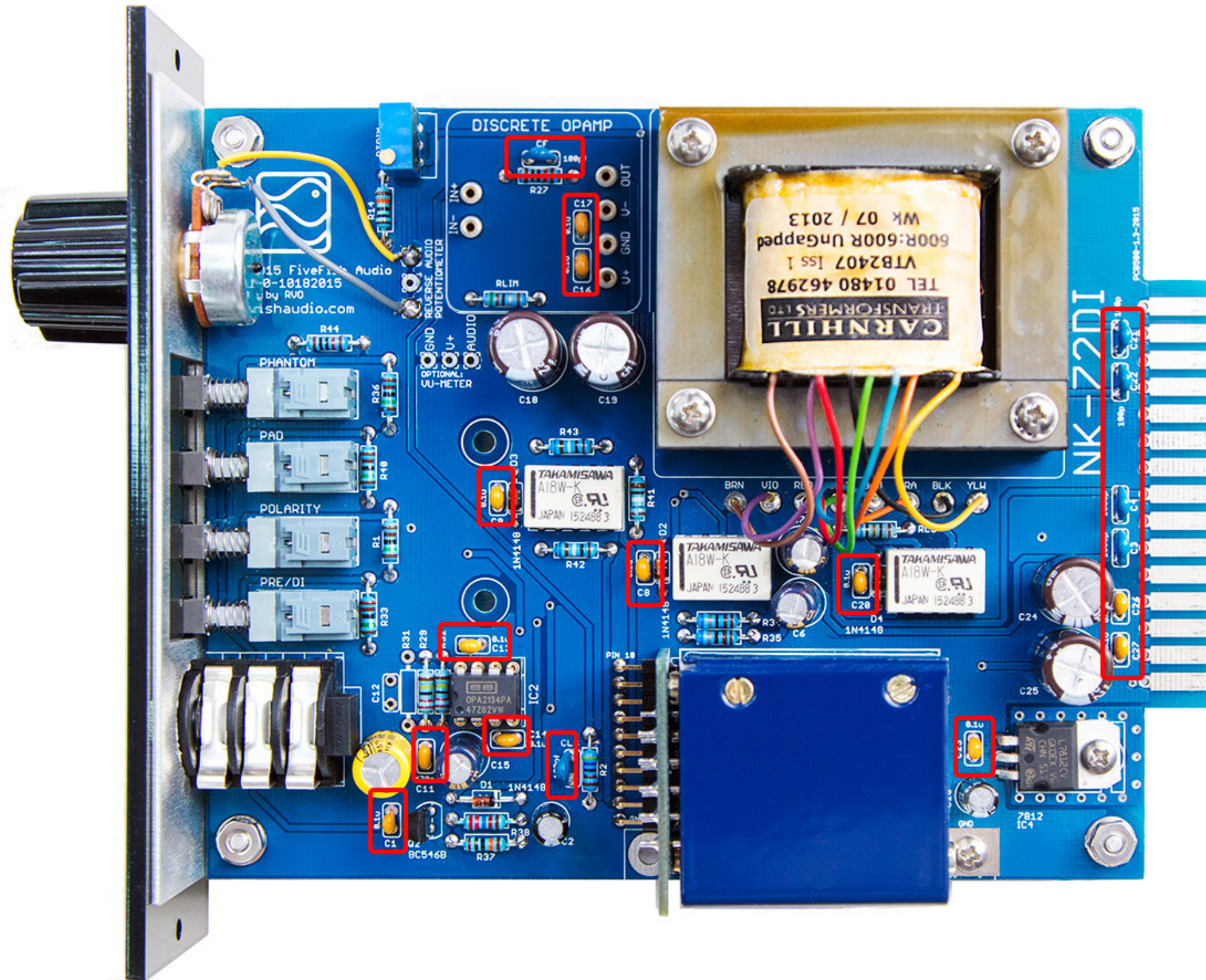
### 3.2 Solder all Diodes.

**IMPORTANT:** Diodes must be installed in the correct orientation. Observe location of the “white band” on the board silkscreen, and orient Diodes to follow the same direction.



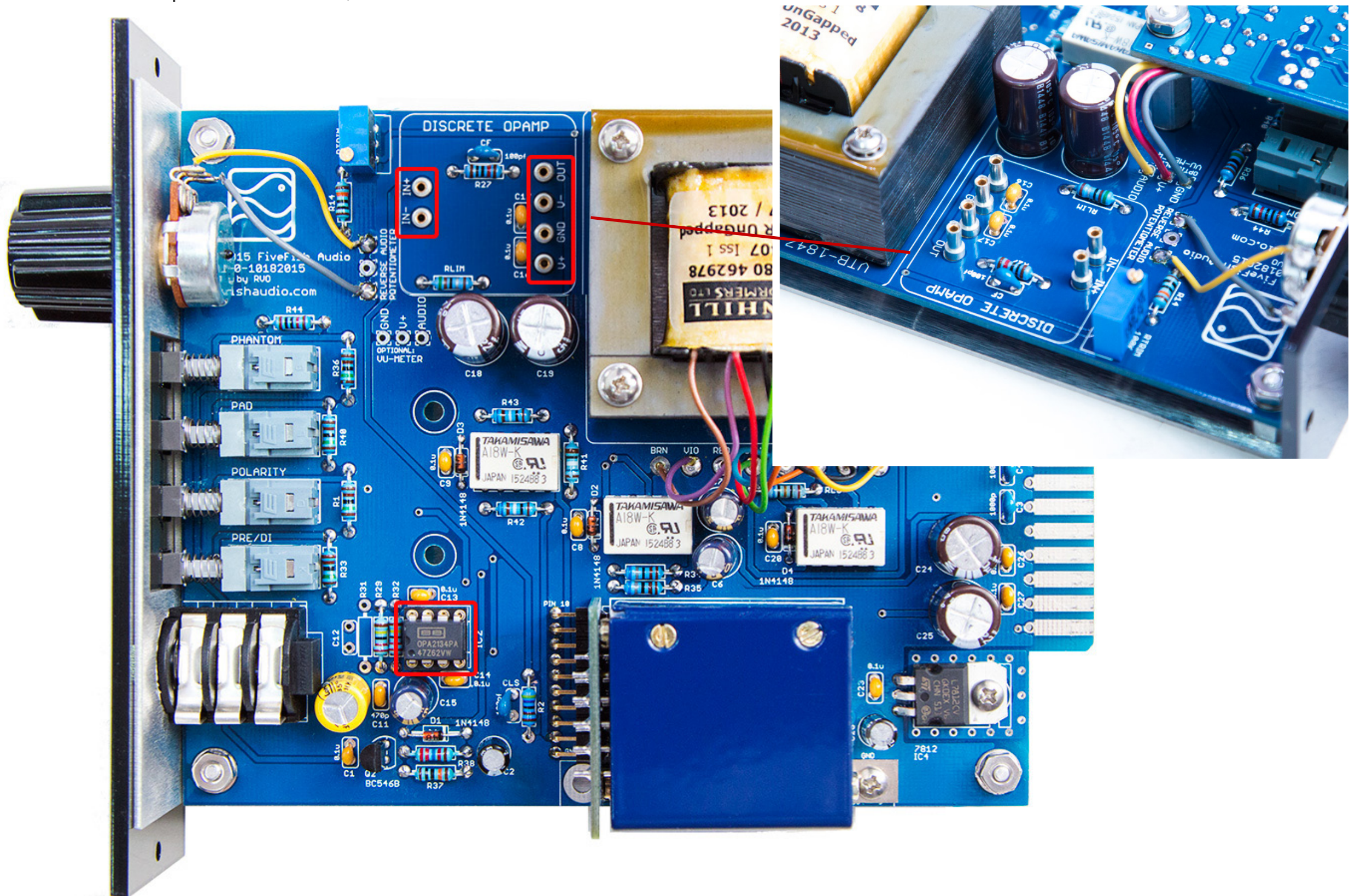


### 3.3 Solder all Ceramic capacitors.



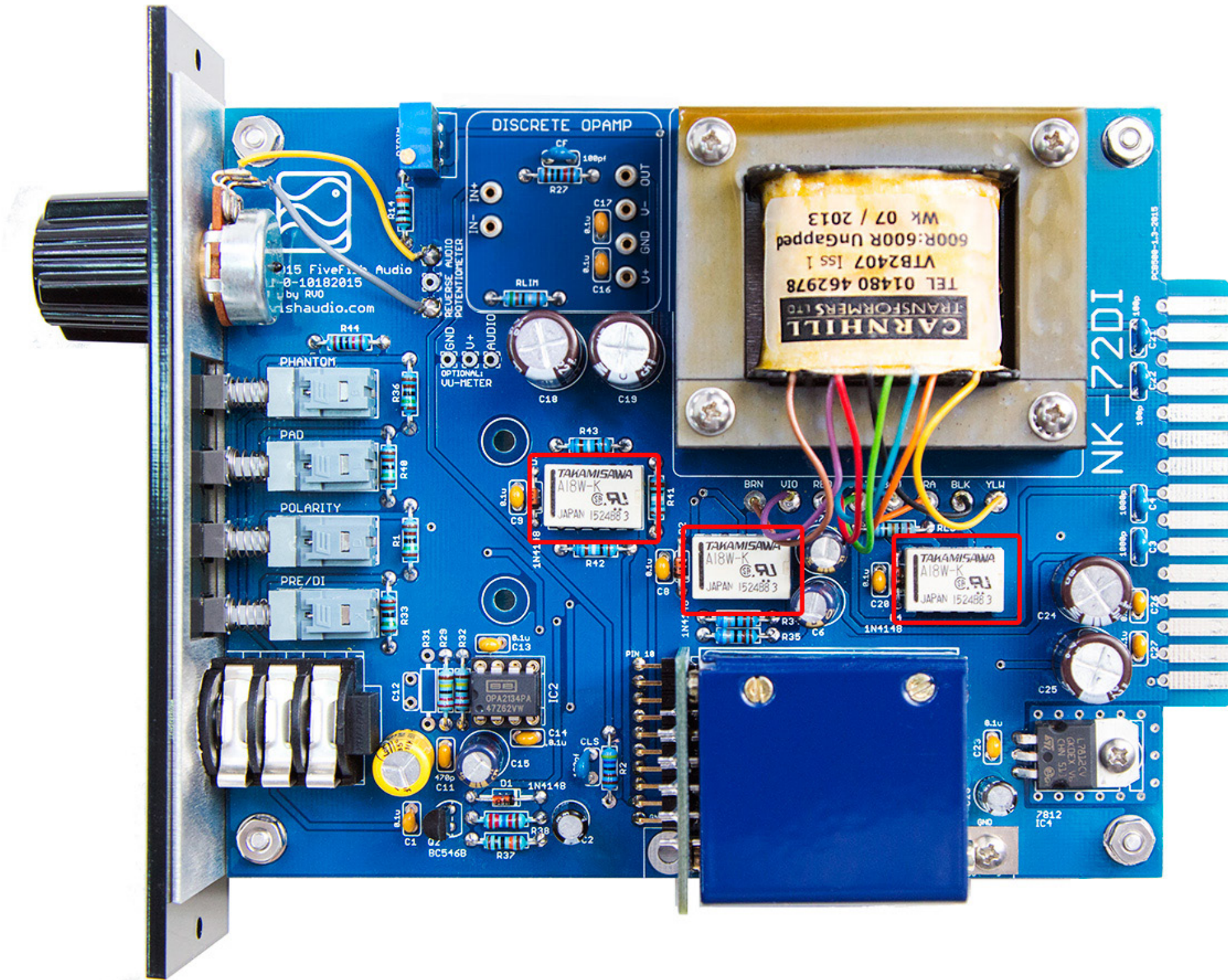


3.4 Solder the (6) Mill-Max Sockets. Try to keep each socket as vertical as possible.  
Solder the 8-pin IC socket too, located on lower left corner.

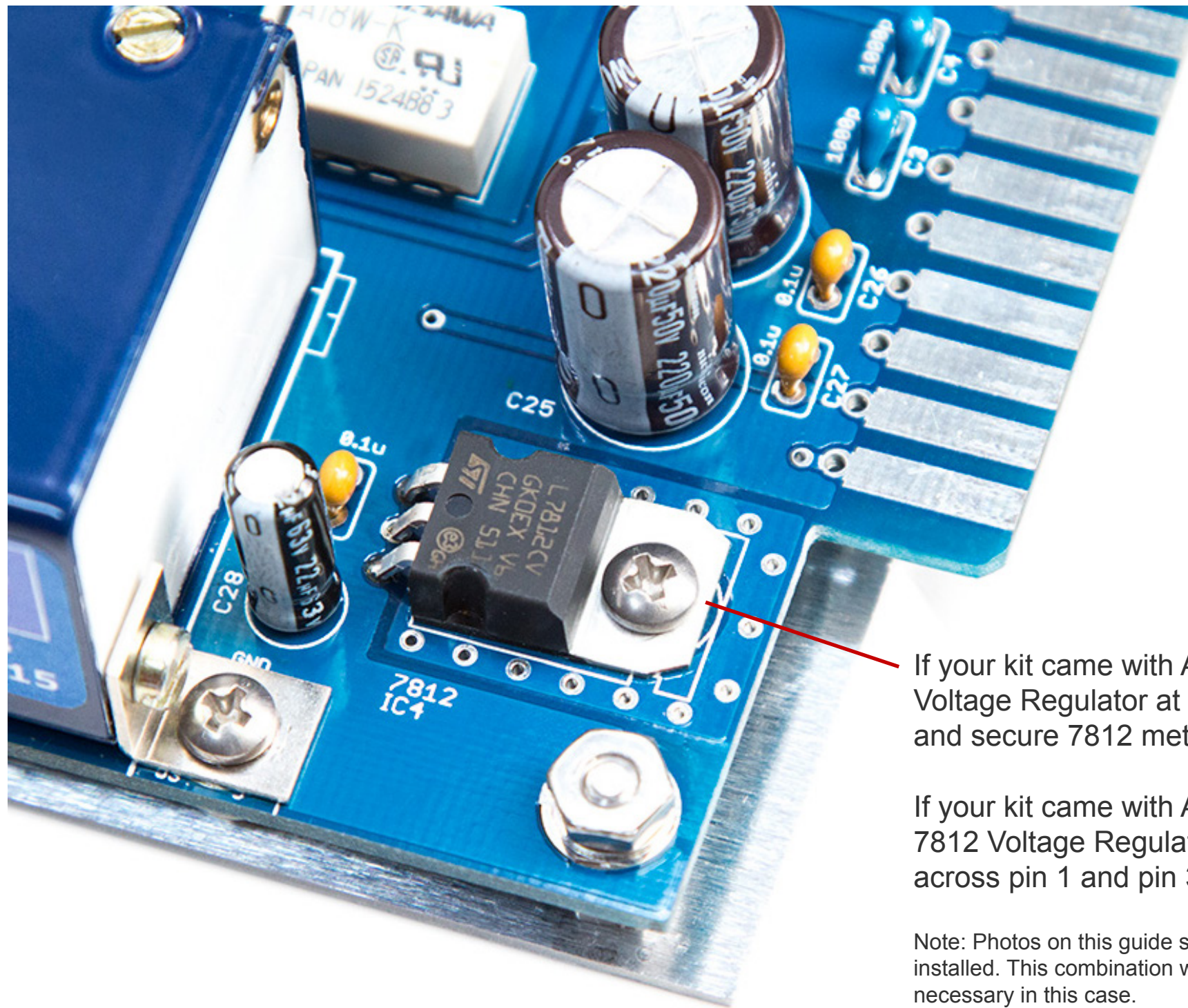




3.5 Solder the (3) PDIP Relays. Take note of the Relay part number that came with your kit and follow the next step.  
**IMPORTANT:** Insert Relays in proper orientation. Match the “white band” on PCB silkscreen with the Relay’s line markings.







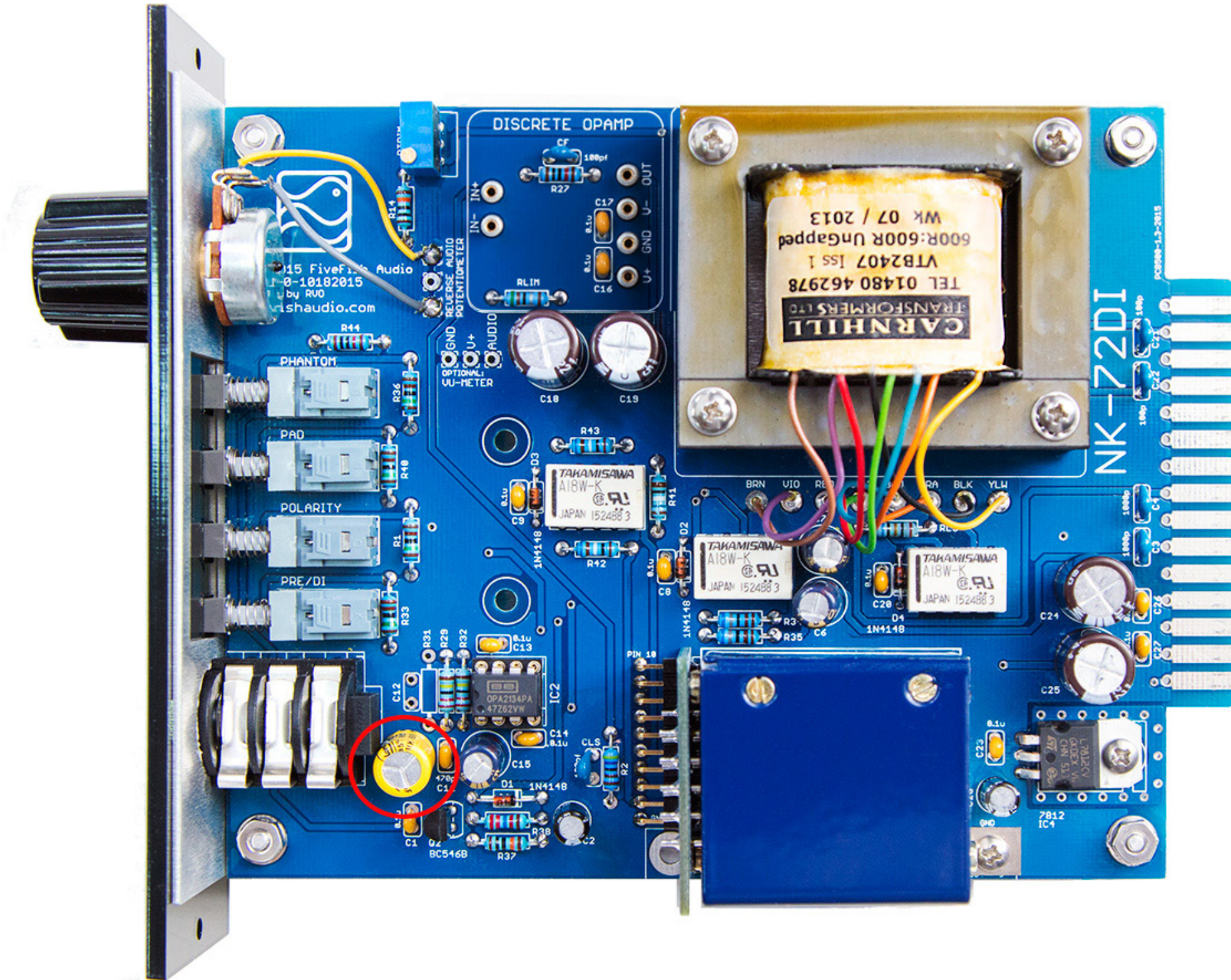
If your kit came with A12W-K Relays, solder the 7812 Voltage Regulator at IC4 location. Bend the legs as shown and secure 7812 metal tab with machine screw and nut.

If your kit came with A18W-K Relays, Do NOT install the 7812 Voltage Regulator. Instead, solder a JUMPER wire across pin 1 and pin 3 of IC4 location.

Note: Photos on this guide show A18W-K relays with a 7812 Regulator also installed. This combination will also work, but the 7812 Regulator is not really necessary in this case.

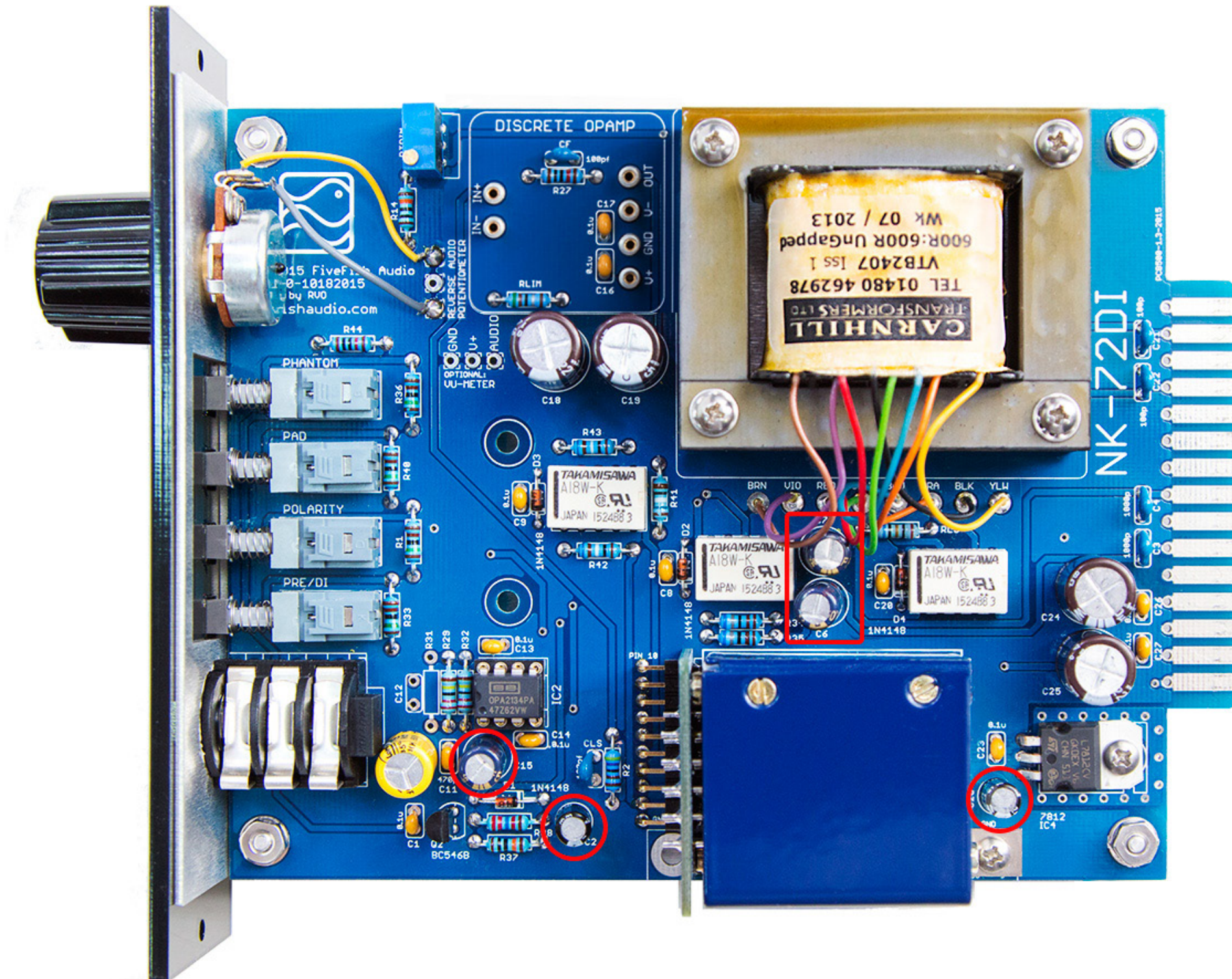


3.6 Solder the Bi-polar capacitor. This capacitor has no polarity and can be inserted either way.





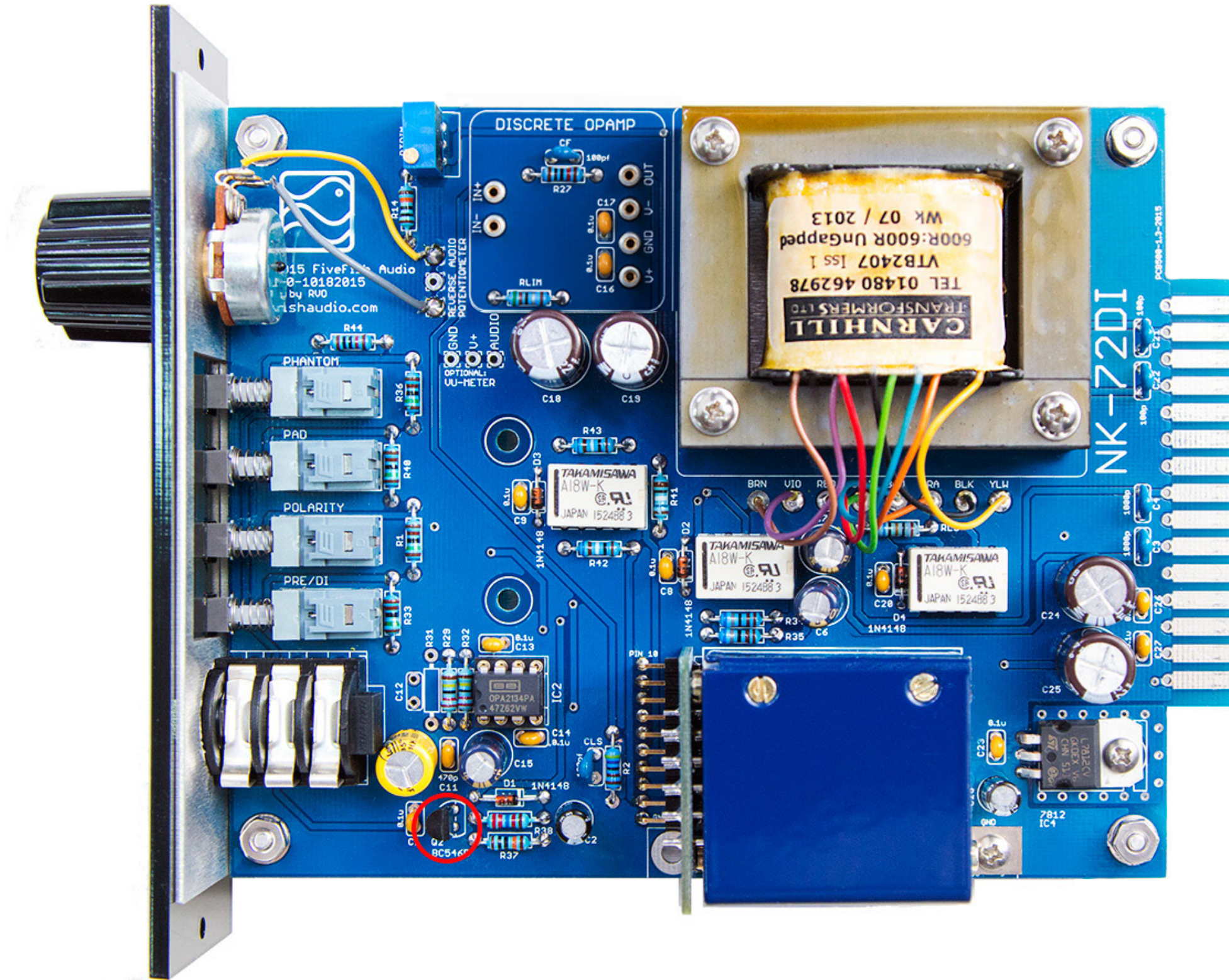
3.7 Solder all small Electrolytic Capacitors. These capacitors have polarity markings, one lead is (+) and the other lead is (-). **IMPORTANT:** Observe the proper polarity when inserting these capacitors. Match polarity with PCB silkscreen markings. All negative (-) leads of electrolytic capacitors are orientated facing downwards.





### 3.8 Solder Q1 Transistor.

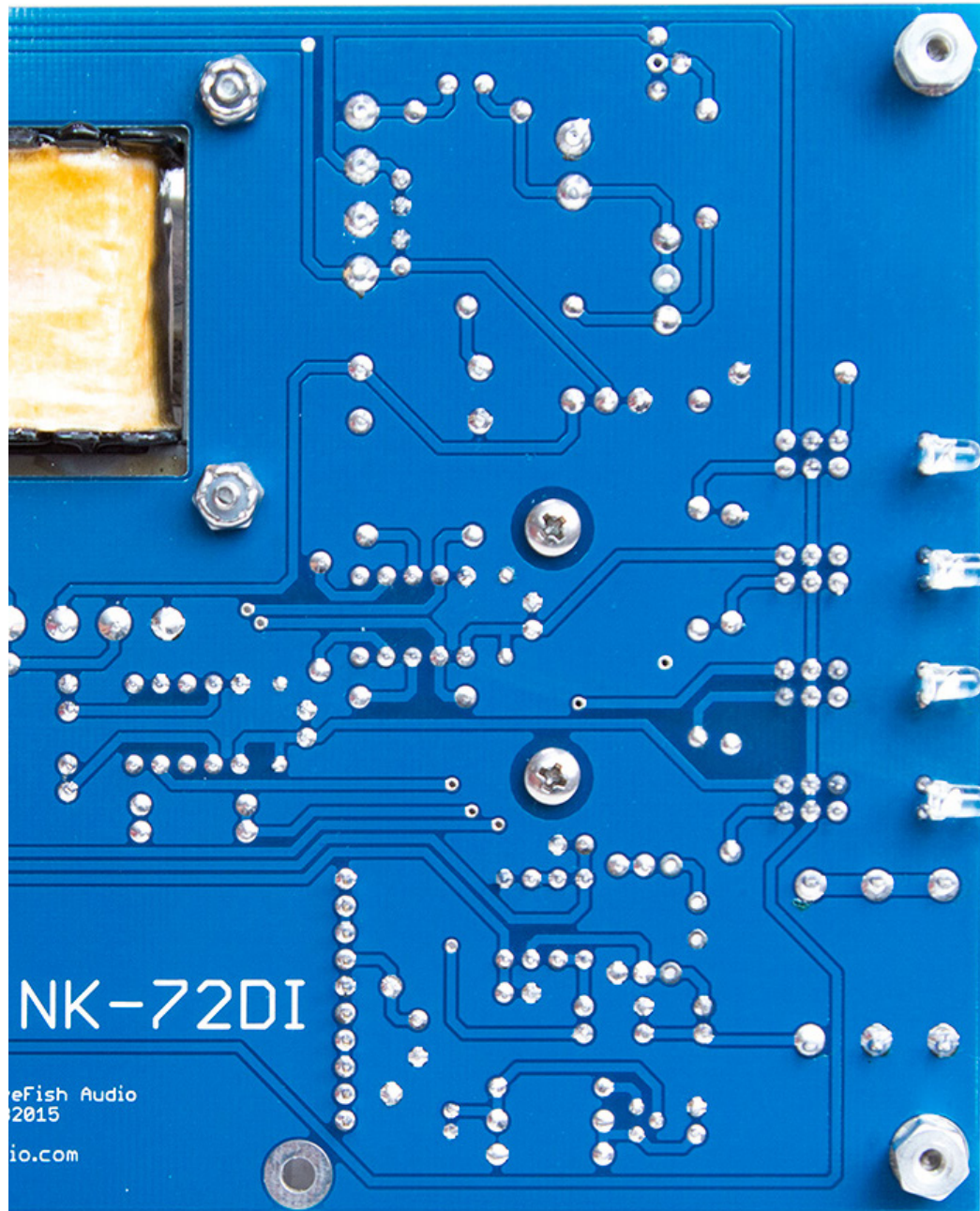
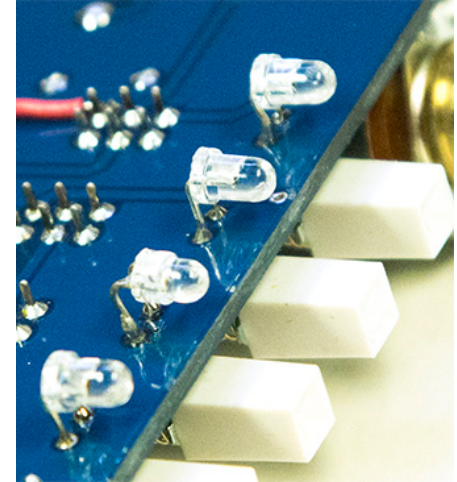
**IMPORTANT:** Observe proper orientation and the direction transistor is facing. Follow the PCB silkscreen markings.





3.9 Solder all 3mm LED indicator lamps from bottom of board. These LED lamps are optional and not required. You can arrange the LED colors any way you want. But for consistency, use the same color arrangement on all mic preamp kits you'll build.

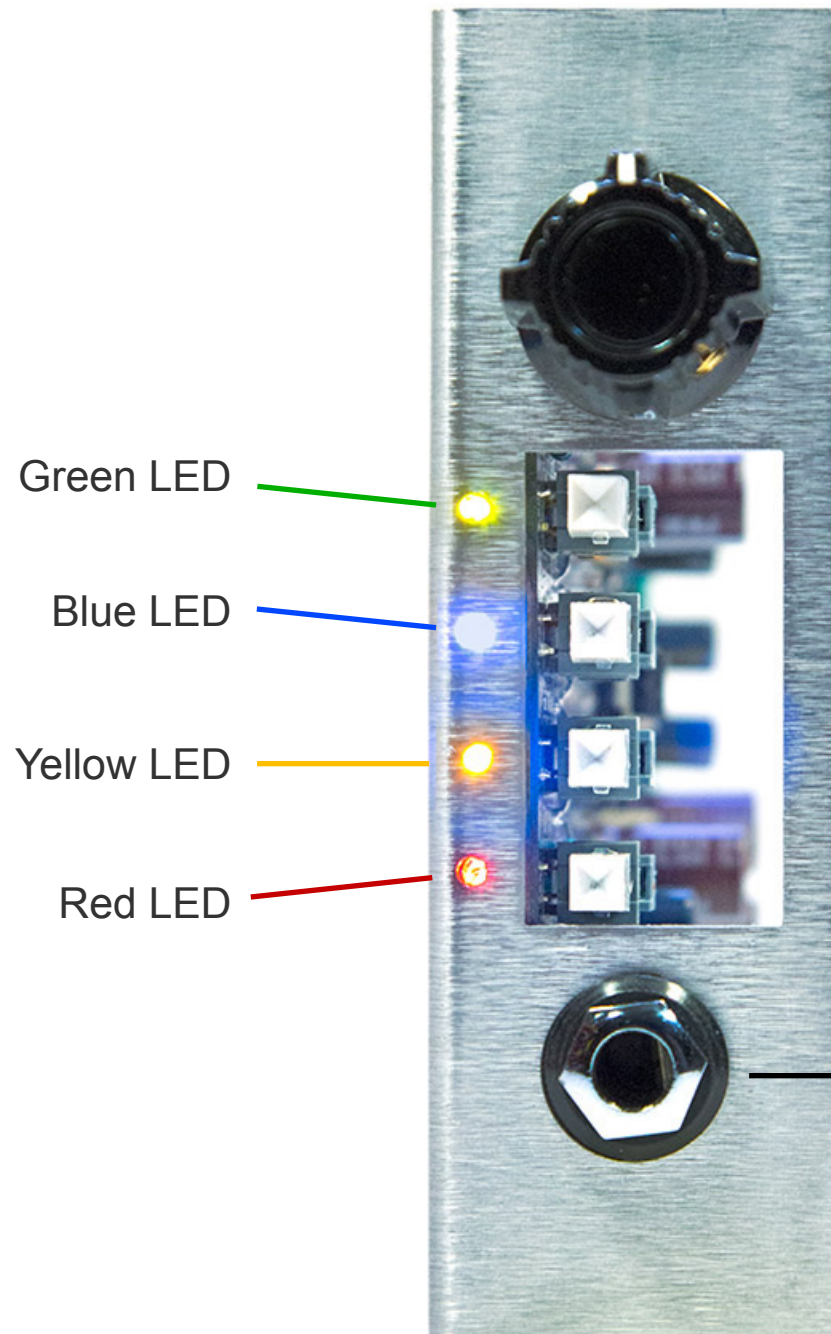
**NOTE:** LEDs are installed from the bottom. Bend LED legs as shown on photos.



A typical color arrangement may be  
**GREEN** - for phantom power switch,  
**BLUE** - for 20dB Pad,  
**YELLOW** - for polarity reverse,  
**RED** - for Mic/Instrument selector switch.

**IMPORTANT:** The LONG LEG of the LED must be oriented at the TOP position as shown for the NK-72DI Mic Preamp Kit.

3.10 OPTIONAL: Drill (4) holes on the aluminum sled if you want to use the LED indicator lamps. Position the LEDs so they are aligned with the drilled holes on your aluminum sled. You can use anywhere from a 1/16" hole up to 1/8" hole size. The larger the drill size you use, the less critical the alignment of the LED to the hole.



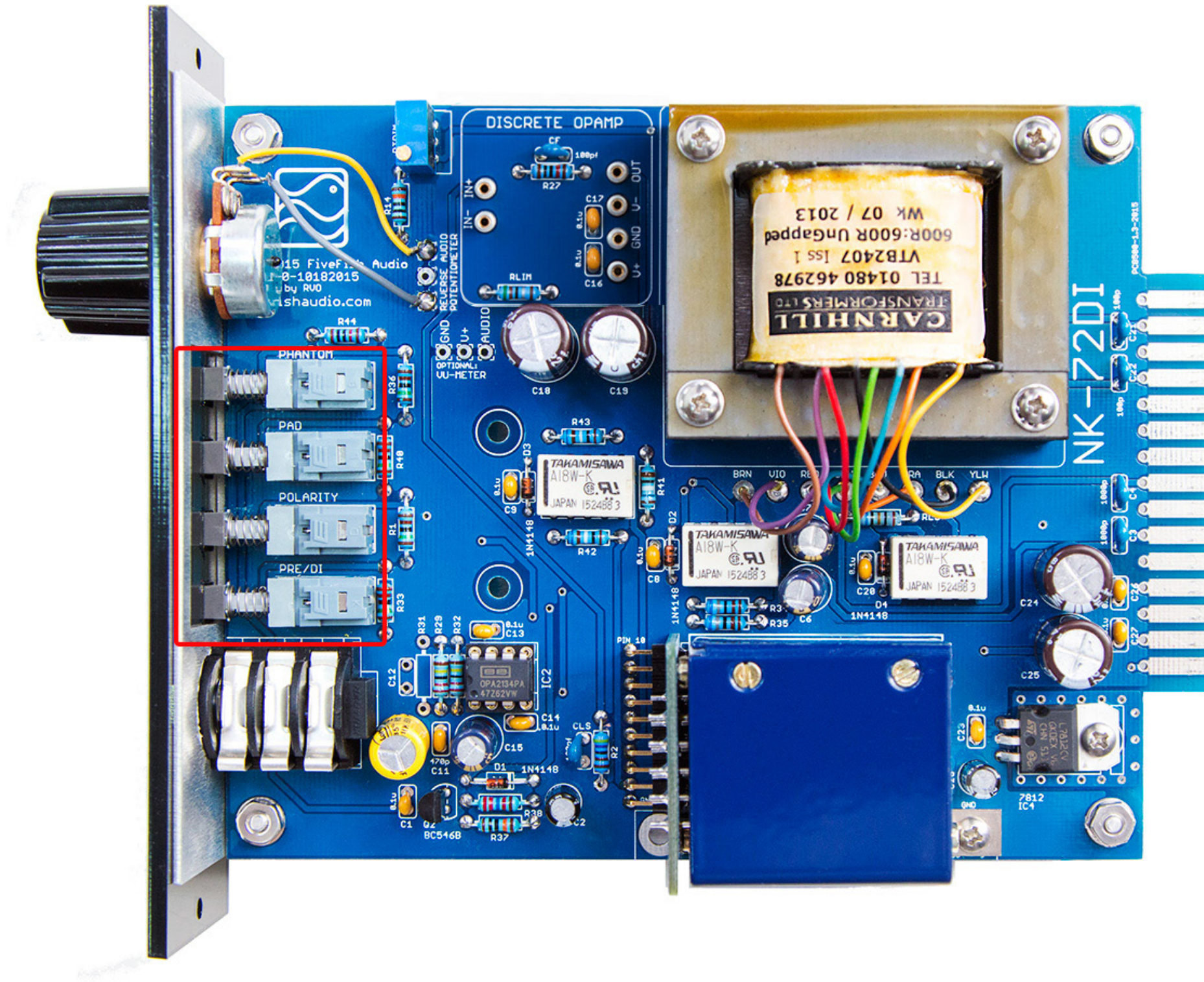
Smaller sized holes look better as LEDs are not too overpowering bright when lit up. However, exact alignment is more critical.

NOTE: The LEDs are mounted at the bottom of the PCB.

You may need to enlarge the hole on the aluminum sled for the 1/4" TRS jack.



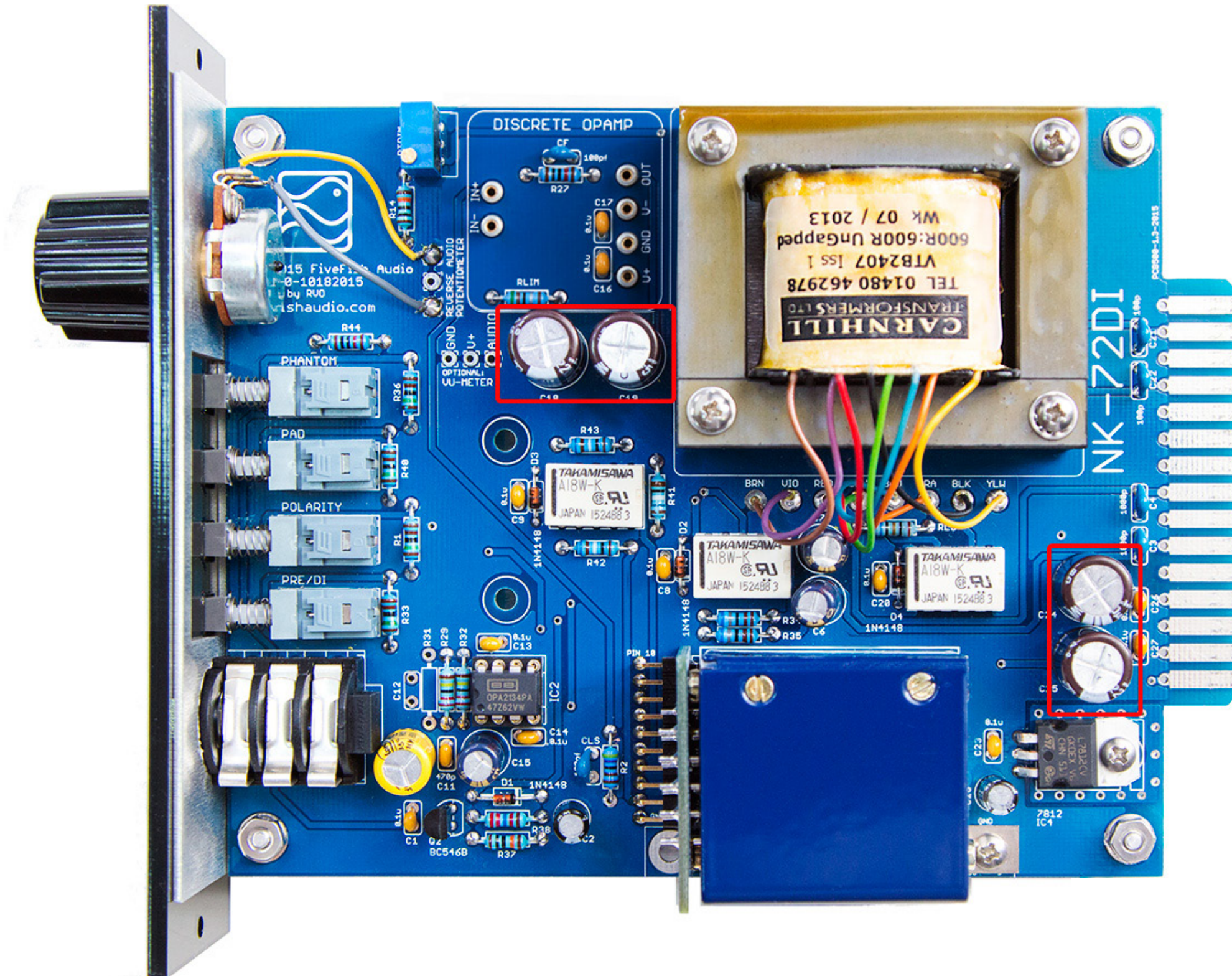
- 3.11 Solder the (4) Push-Button switches. Make sure they're mounted horizontally level and not crooked or mis-aligned.  
TIP: You can use masking tape to hold the switch securely in it's place while you solder them. Solder one leg/terminal of the switch first and re-check if the switch is still horizontally level. If everything looks good, solder the rest of the switch terminals.





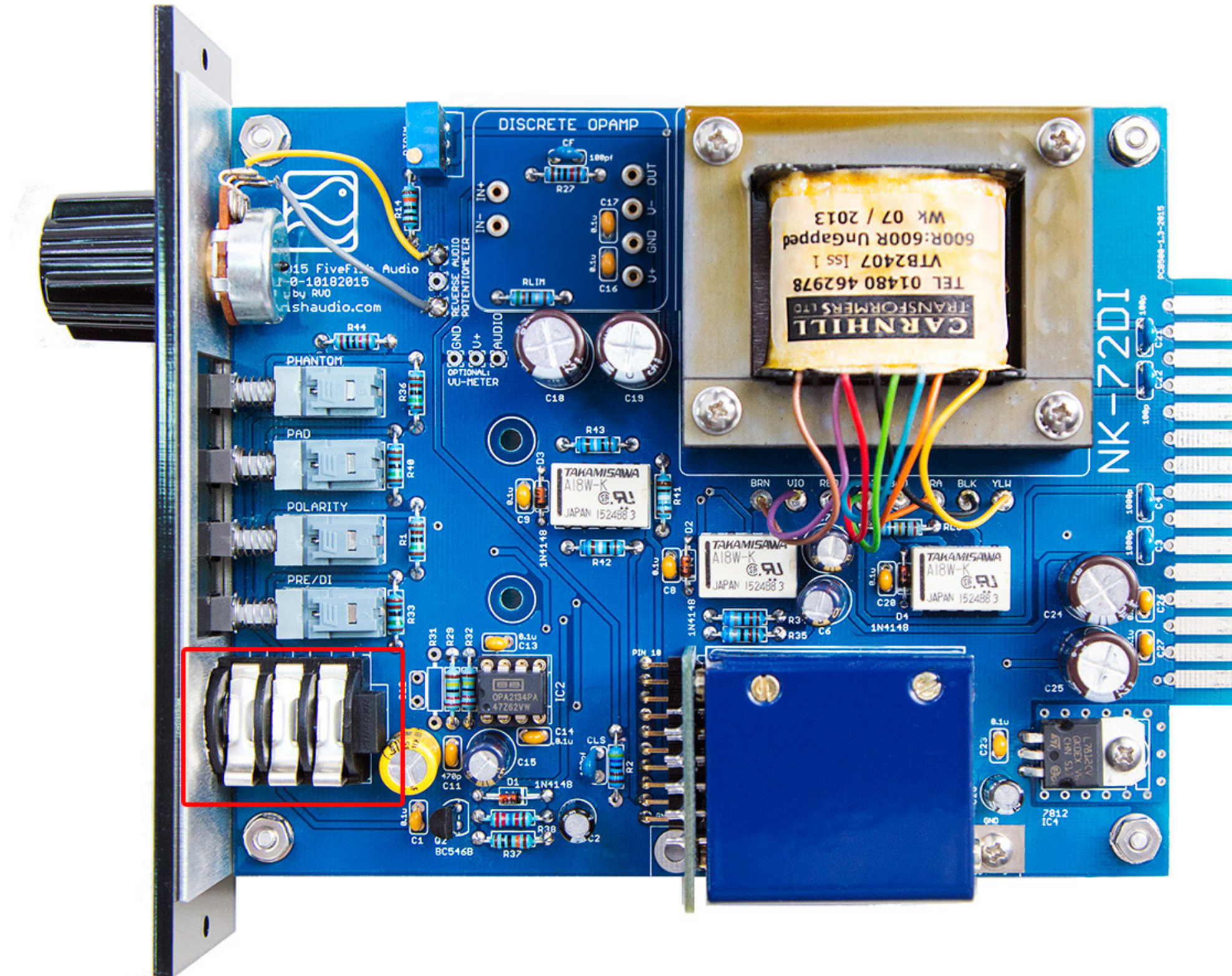
3.12 Solder all medium-sized 220uf electrolytic capacitors.

**IMPORTANT:** Observe proper polarity and orientation of (+) and (-) leads.





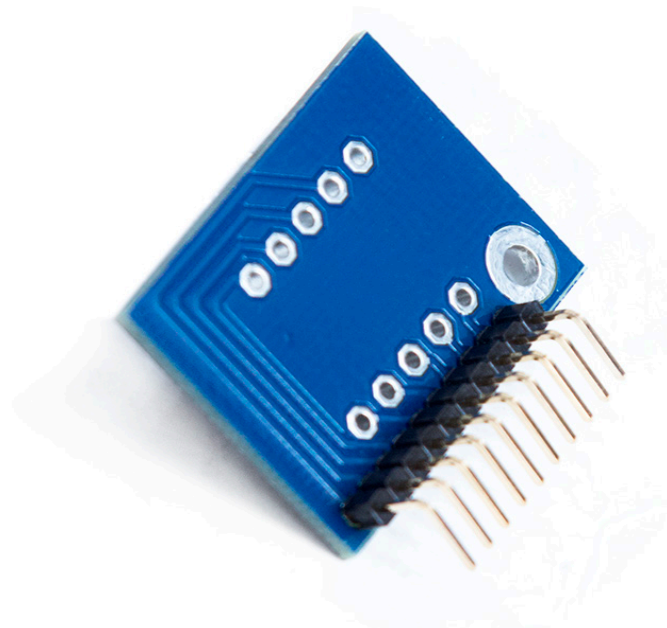
3.13 Solder the 1/4" TRS Instrument Jack. Make sure to mount TRS jack level and flat as possible with the PCB. You may need to push the TRS jack down to be flat as possible, then solder the legs.



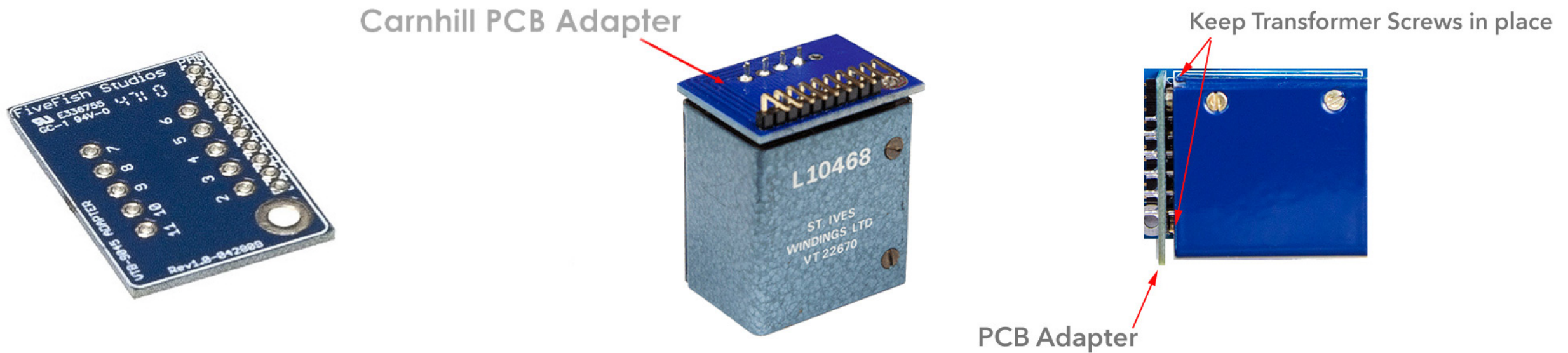


3.14 The Input Transformer needs to be installed horizontally so it will fit within the width requirement of the 500 series. We'll be using a PCB Adapter with right-angle headers to secure the Input Transformer to the main board, and make electrical connection.

3.14.1 Solder the Right-Angle headers to the PCB Adapter, with the Right-Angle headers mounted at the Bottom Side.

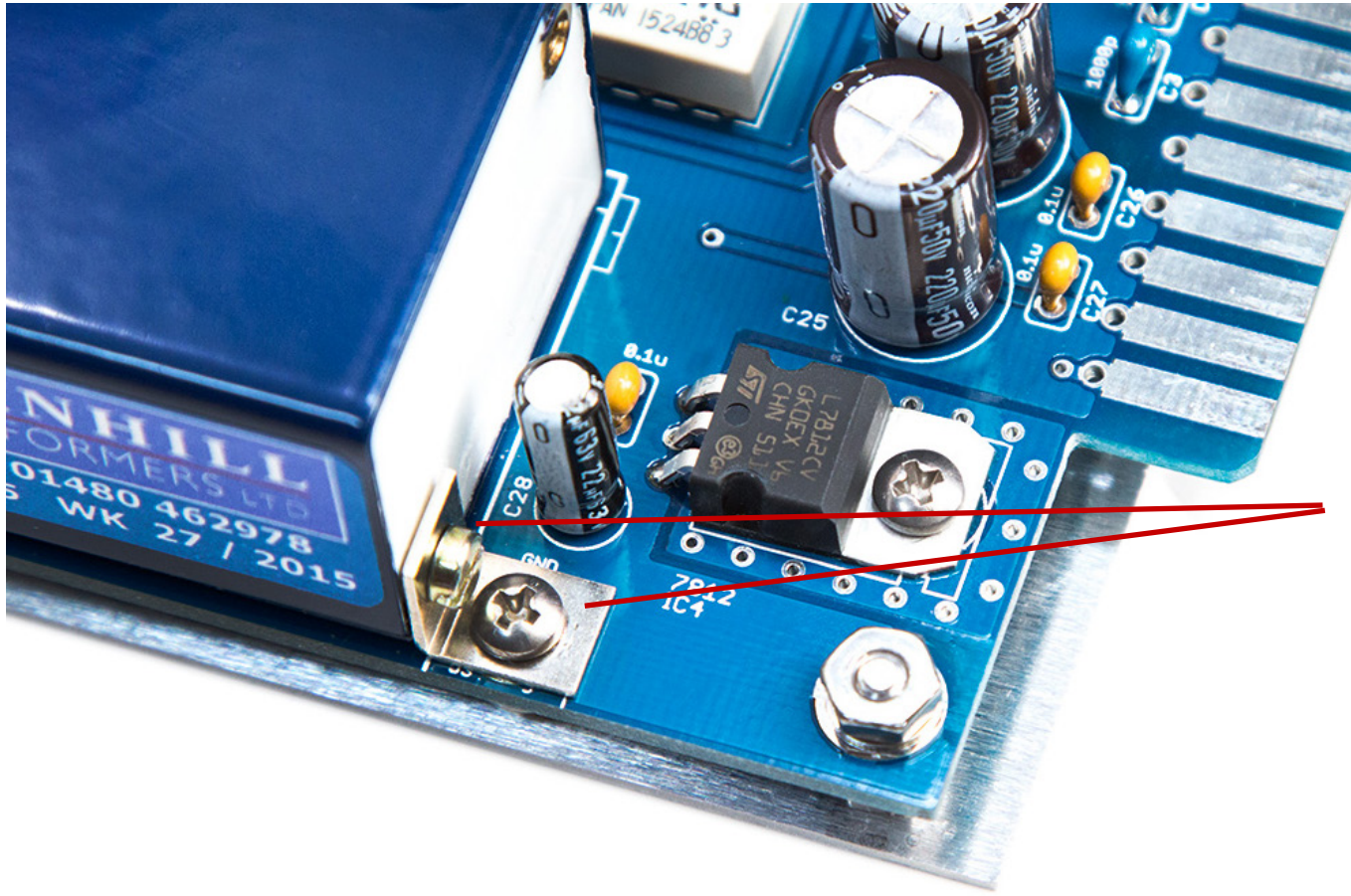


3.14.2 The PCB Adapter has silkscreen on the Top side with the Pad Pins numbered. Align these numbered Pads with the corresponding Transformer Pins. Solder Transformer pins to PCB.





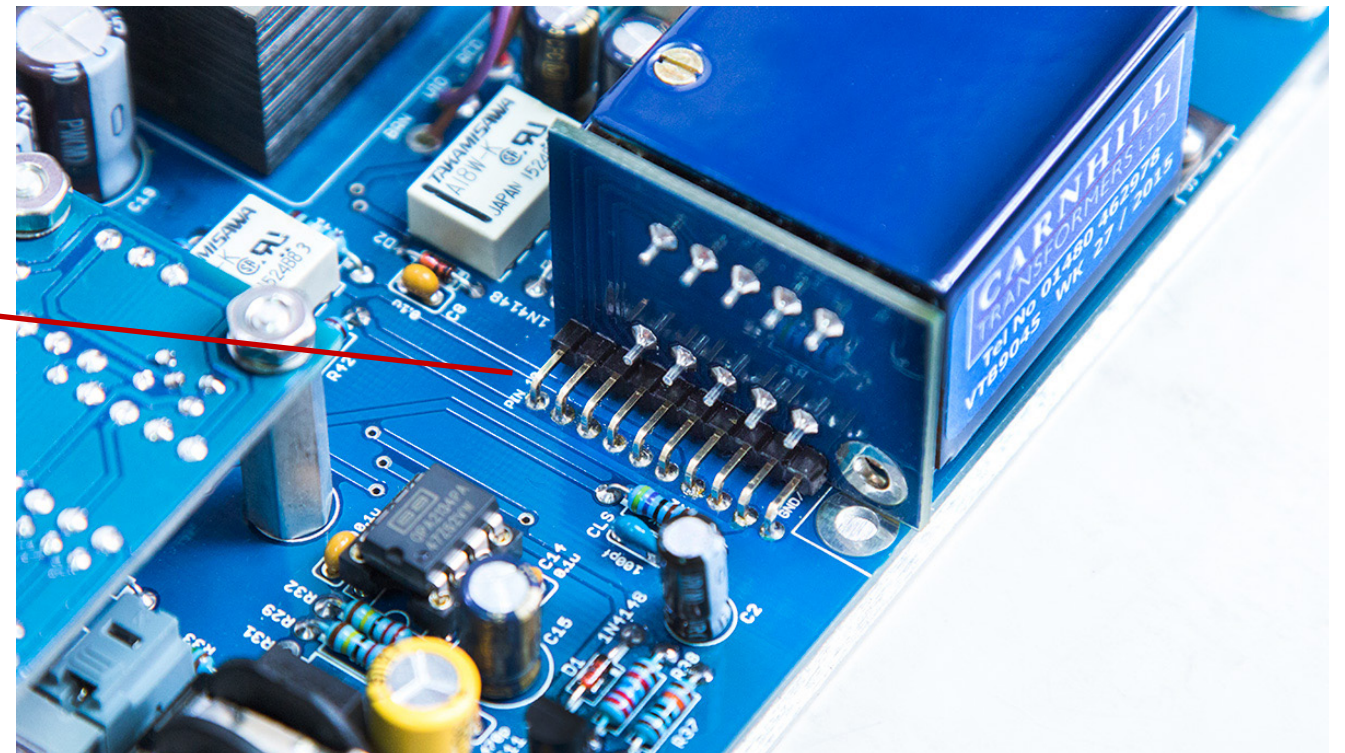
### 3.15 Mount the Input Transformer.



3.14.3 Remove the brass screws on top of the transformer and re-use it to attach the Stainless Steel Right-Angle Bracket. Secure the Right-Angle bracket to the PCB using the 1/4" machine screw and 4-40 nut. **DO NOT TIGHTEN THE SCREWS YET!**

3.14.4 Solder the headers to the main board. Make sure the PCB adapter board is flushed to the main board (and not tilted up or skewed.)

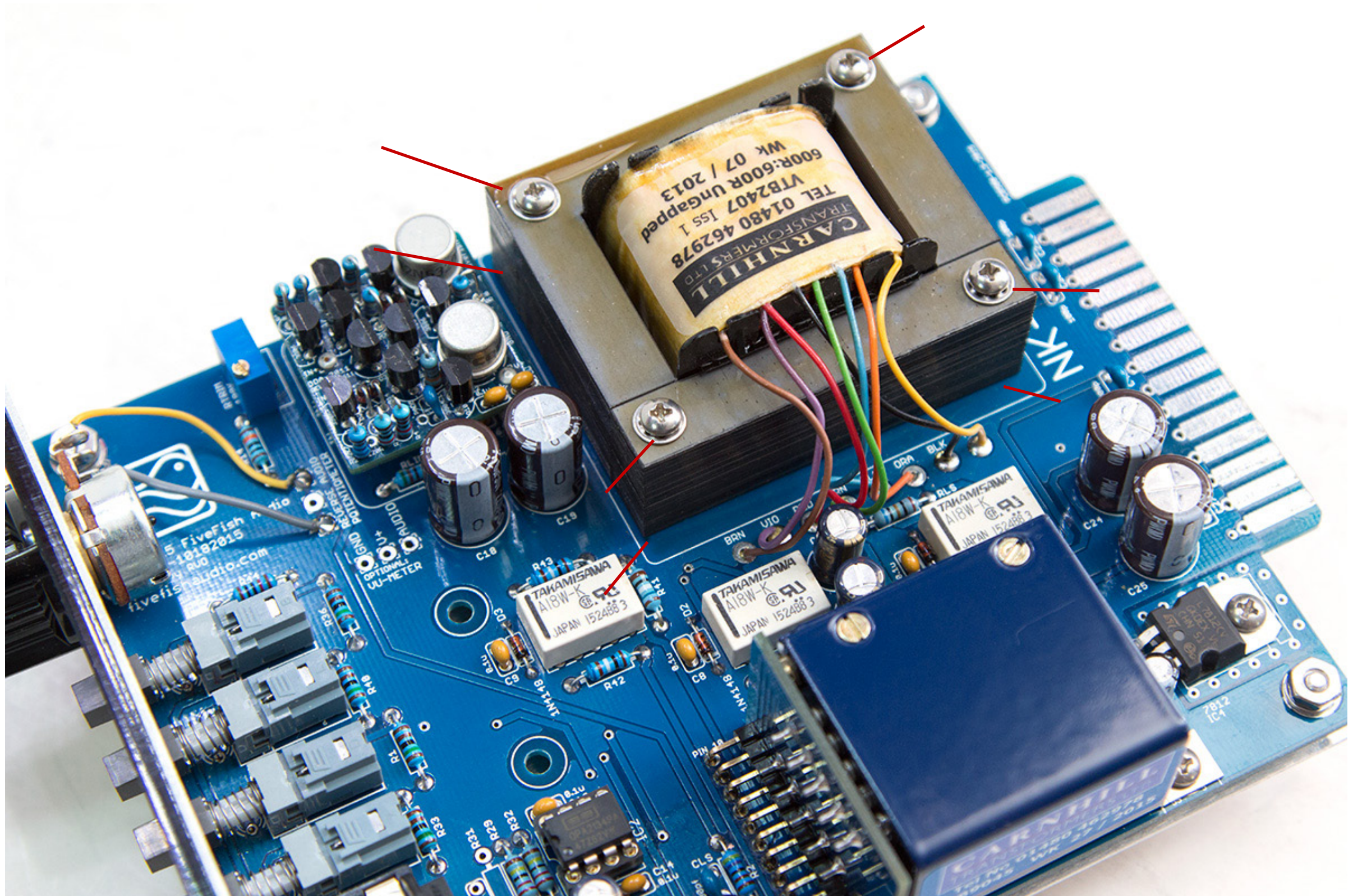
After successfully soldering the headers, you may now re-adjust the Right-Angle Bracket and tighten the screws.





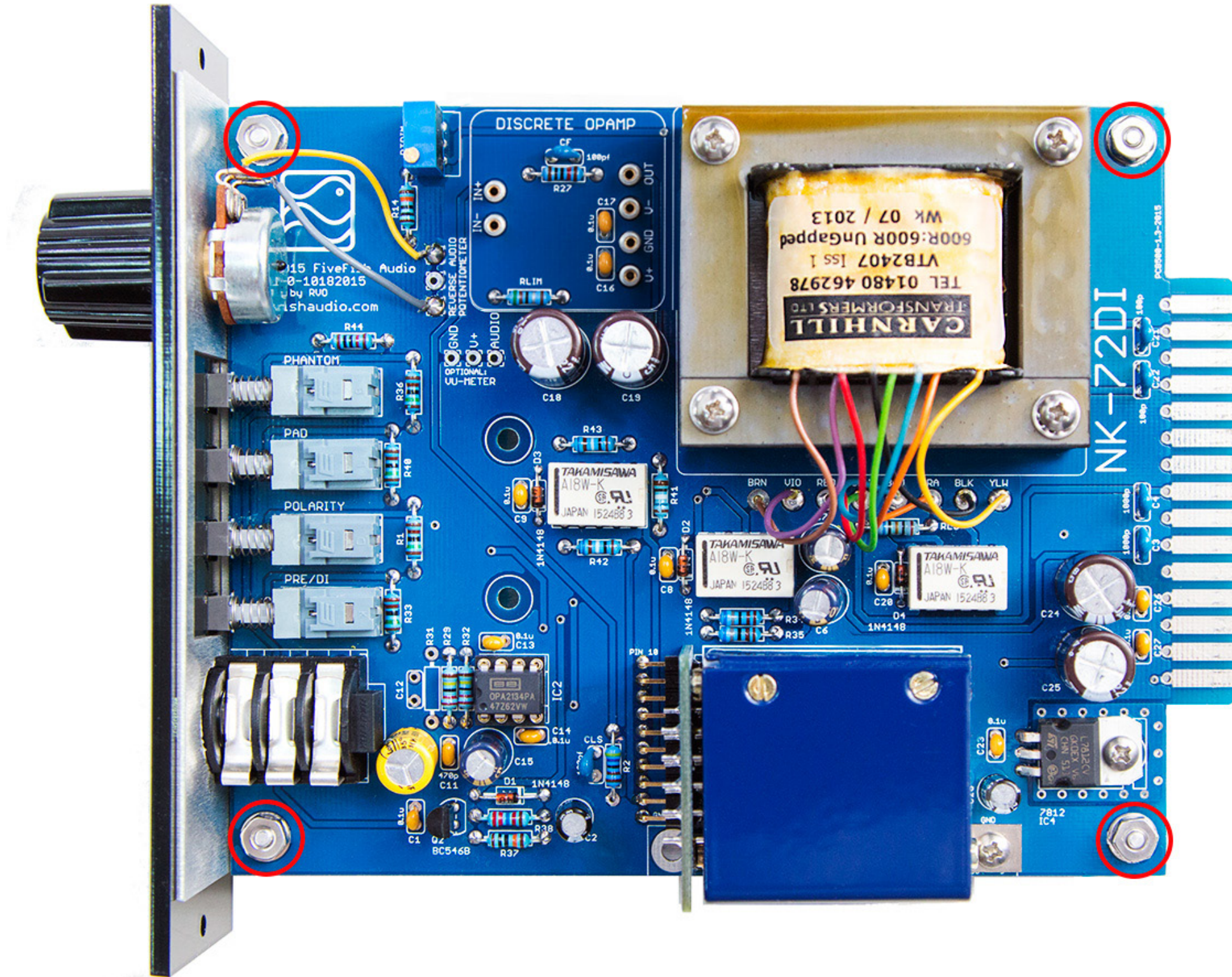
3.16 Mount the Output Transformer to the PCB. Use the (4) long machine screws with (4) lock washers on top of the transformer, and (4) lock washers between the transformer and PCB. Use the (4) lock nuts to secure the transformer to the PCB.

**IMPORTANT:** Solder the different colored transformer wires to their corresponding locations on the PCB.





3.17 Install mounting spacers to PCB using the Aluminum Male-Female Hex Spacers and 4-40 nuts. Then mount PCB to aluminum sled using the provided small screws.

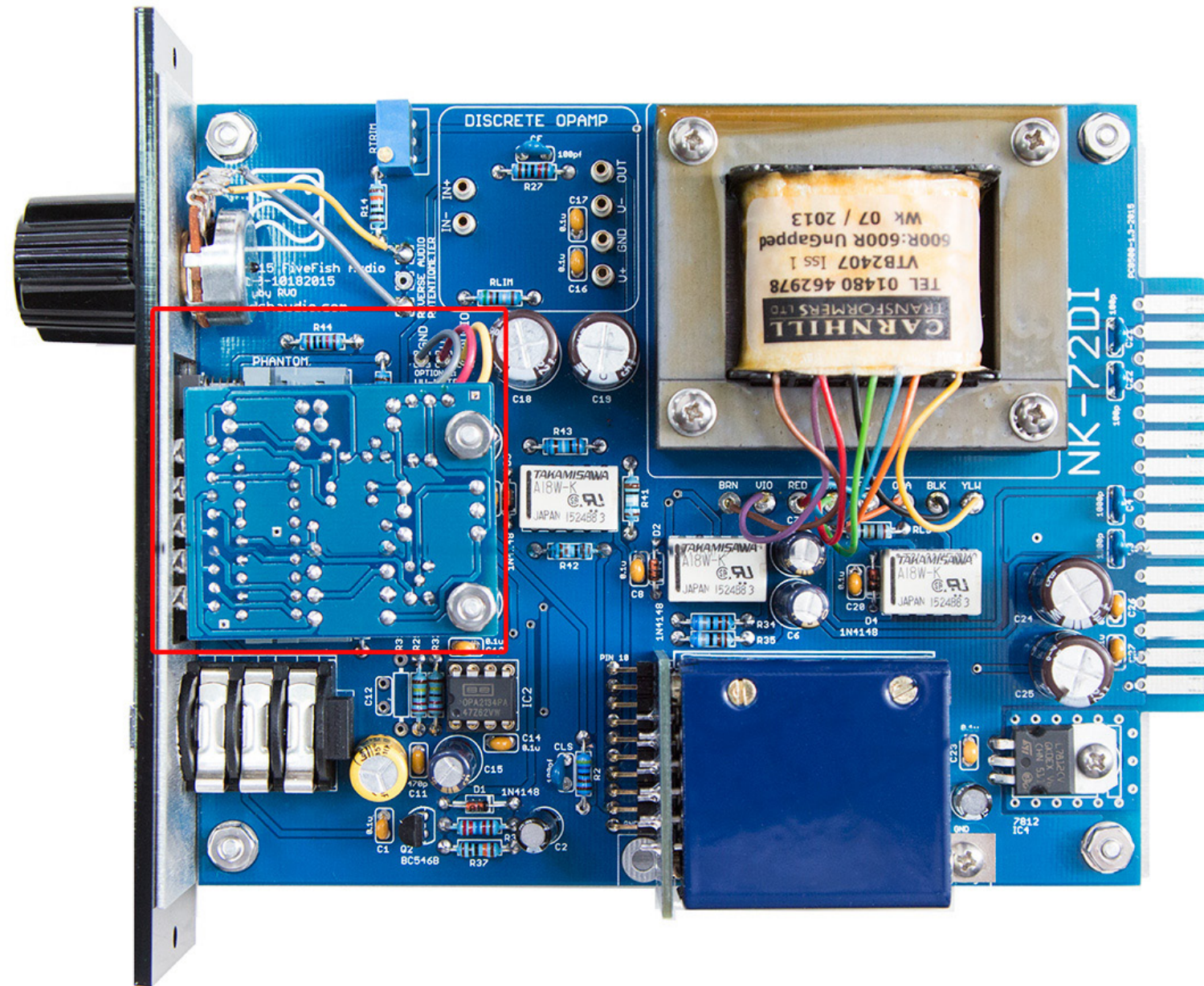




3.18 OPTIONAL: Assemble and mount the VU Meter kit. Solder the GND, V+ and Audio wires between VU Meter Board and SK-1DI Mic Preamp Board.

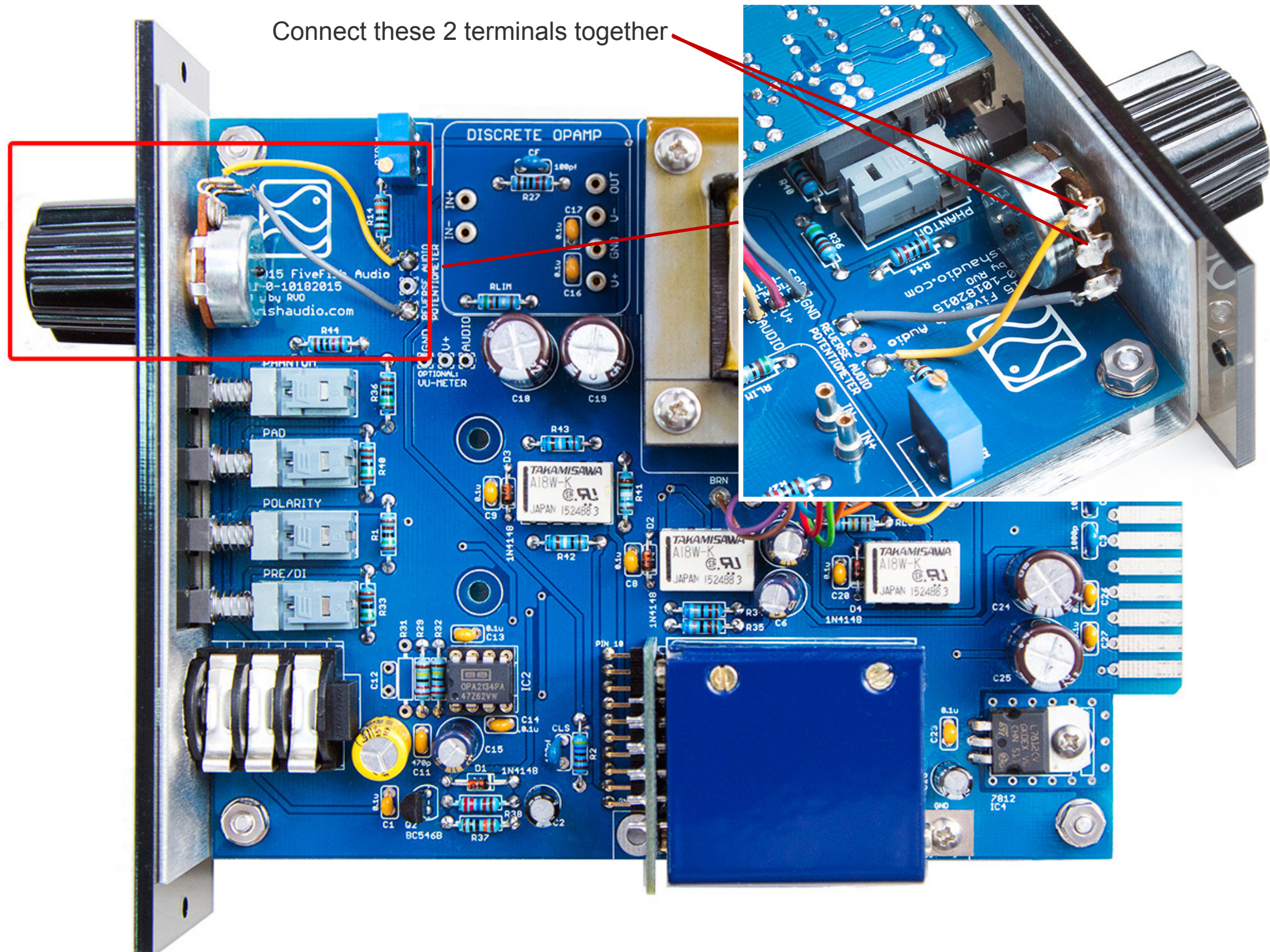
NOTICE: Currently, the VU Meter kit cannot be used with the Acrylic Front Panel (unless you drill (5) additional 1/8" holes for the LEDs). The Anodized Aluminum Front Panel upgrade will have the ready-made holes for the VU Meter LEDs.

If there is enough requests for VU Meters for use with the Acrylic Front Panel, we will create an alternate Acrylic Front Panel design with the VU Meter LED holes. So let us know what you think!





3.19 Solder the 10K Potentiometer as shown below. Use a couple short pieces of wire to connect potentiometer to the board.



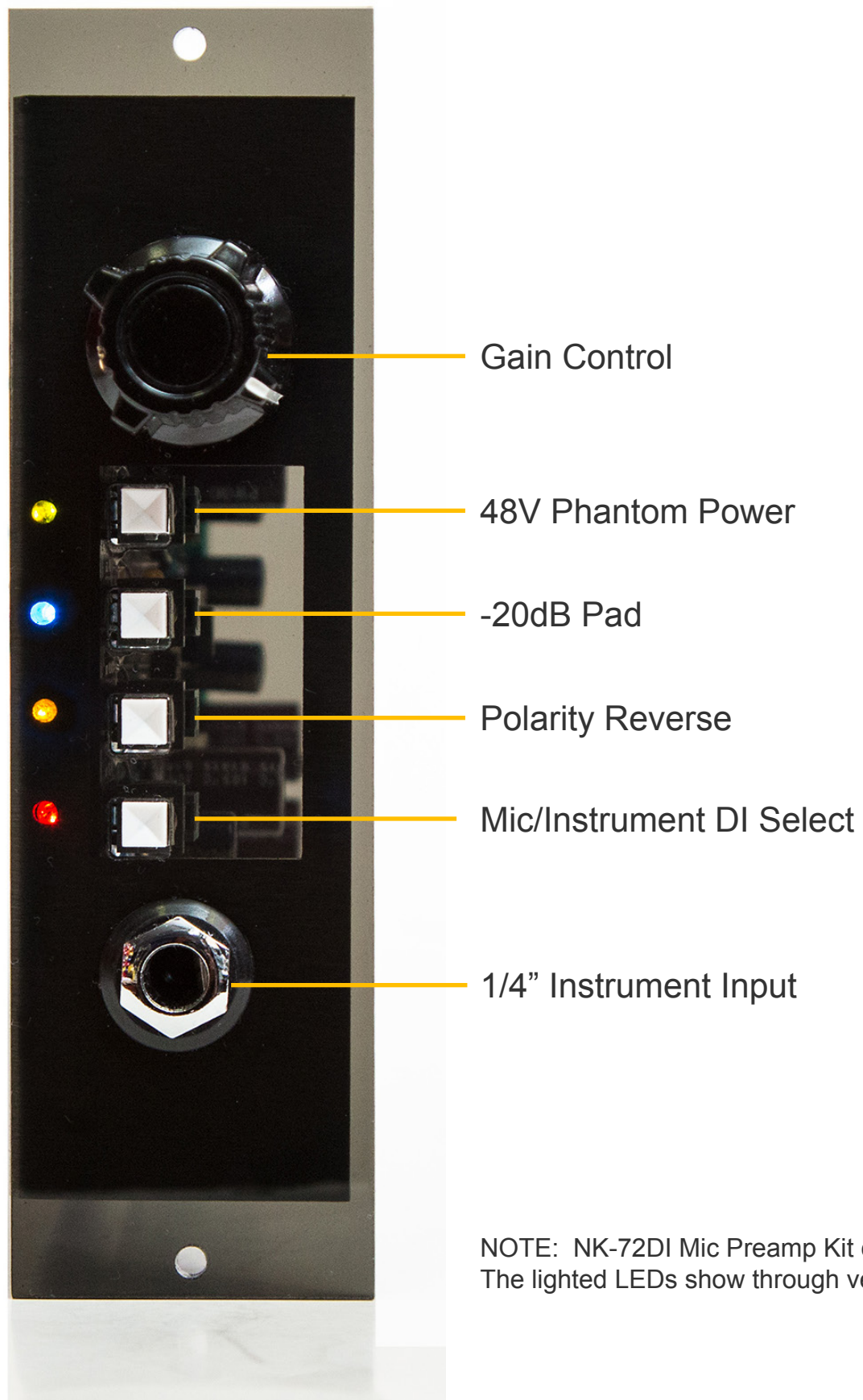


3.20 Attach the transparent acrylic front panel. Tighten nuts of potentiometer and 1/4" TRS jack. Then install knobs. **IMPORTANT:** Do not overtighten nuts to avoid damaging the Acrylic Front Panel.



NOTE: Anodized 0.125" thick aluminum CNC-engraved Front Panels are also available as an upgrade option. Contact FiveFish Audio for details.

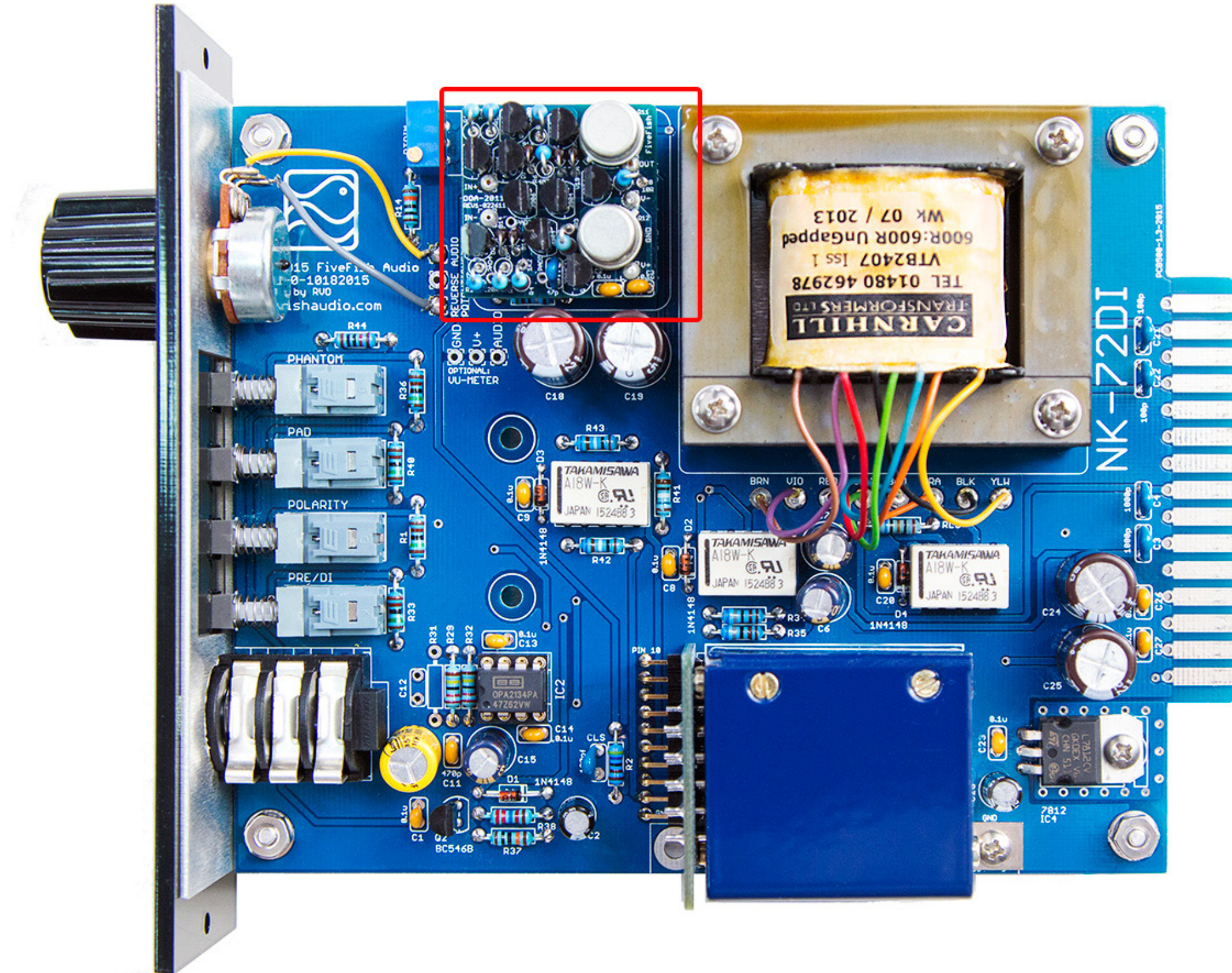




NOTE: NK-72DI Mic Preamp Kit comes with a 3mm Transparent Gray Acrylic front panel. The lighted LEDs show through very nicely through the tinted transparent front panel.



3.21 Finally, insert the Discrete OpAmp into the Mill-Max sockets.  
Note: Discrete OpAmp is a separate purchase.

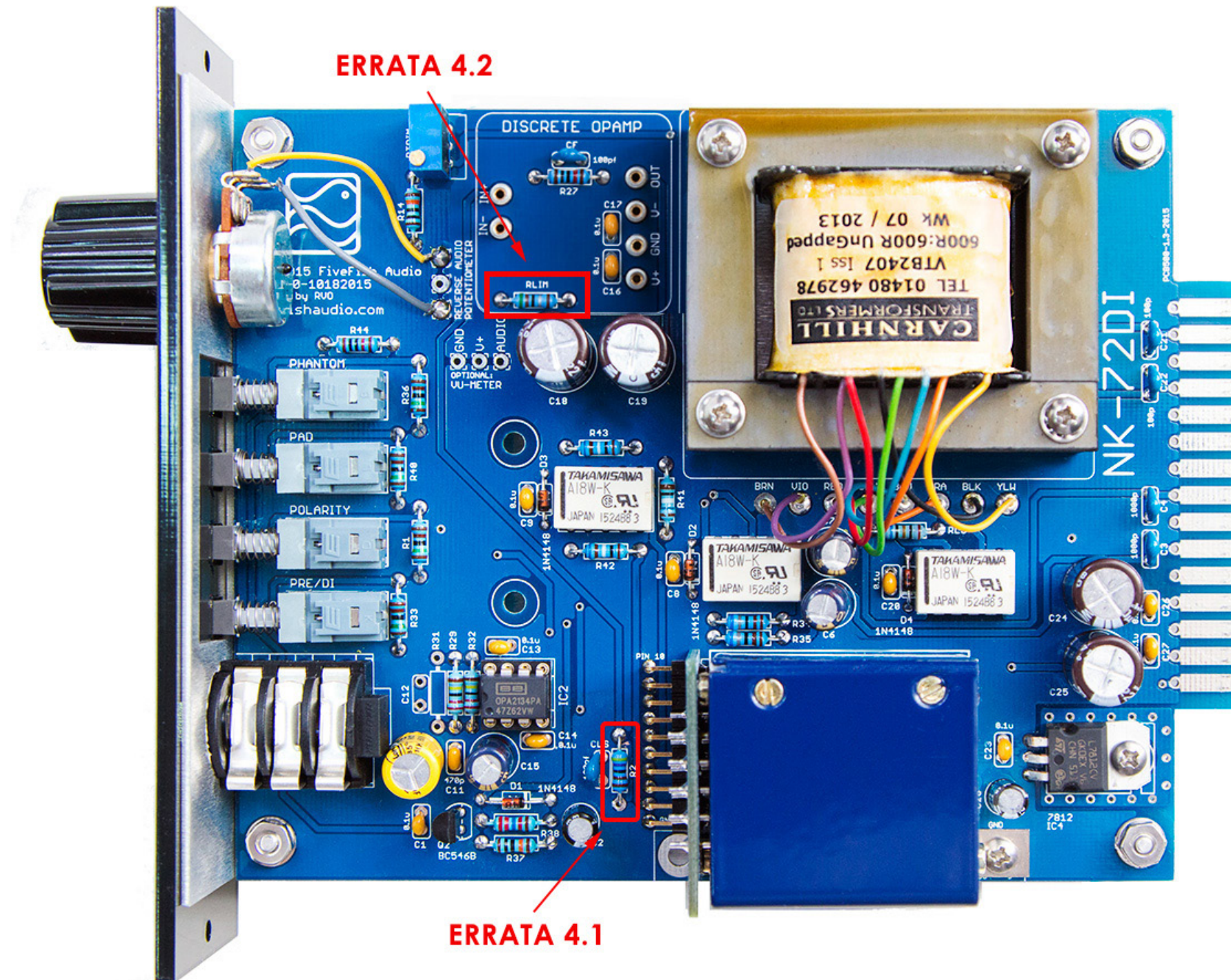




## 4. ERRATA / MANUAL CHANGE INFORMATION

4.1 Correction: R2 (located nearest the Input Transformer header pins) new value is 4K7 ohms.

4.2 Correction: RLIM (located inside Discrete OpAmp outline) new value is 25R5 ohms.



## 5. PRE-FLIGHT CHECK

Before applying power to the unit, please review your work one last time.

Go over Step 3, and in particular review the following specific items:

5.1 Perform a visual inspection. Check for any cold solder joints, or short circuit bridges.

5.2 Check if all diodes are installed in correct orientation.

5.3 Check if all polarized electrolytic capacitors are installed in correct orientation.

5.4 Check if all relays are installed in correct orientation.

5.5 Check if jumper to bypass IC4 is required (only required if using A18W-K Relays).

5.6 Check if Discrete OpAmp is installed and secure in it's socket.

5.7 Check if output transformer wiring is correct, Brown Wire goes to BRN pad, etc...



## 6. VOLTAGE OFFSET ADJUSTMENT

For best performance and maximum headroom, adjust DC voltage offset at output of Discrete OpAmp to Zero (0) Volts DC.

NOTE: Adjust RTRIM trimmer for closest to 0 Volts DC. Offsets of a few +/- millivolts are fine (less than 1mV is even better). Several hundred millivolts is not acceptable.

While nothing bad will happen if you skipped this voltage adjustment procedure, (we have capacitor C19 to block any DC voltage from reaching the output transformer), adjusting for minimum DC offset at this stage minimizes or removes any popping sound when changing the gain selector switch (i.e. if you used the optional Selector Switch upgrade). But removing any DC at this point will also help the potentiometer, and avoid any “pops” down the road when the potentiometer gets dirty or it’s tracks worn out.

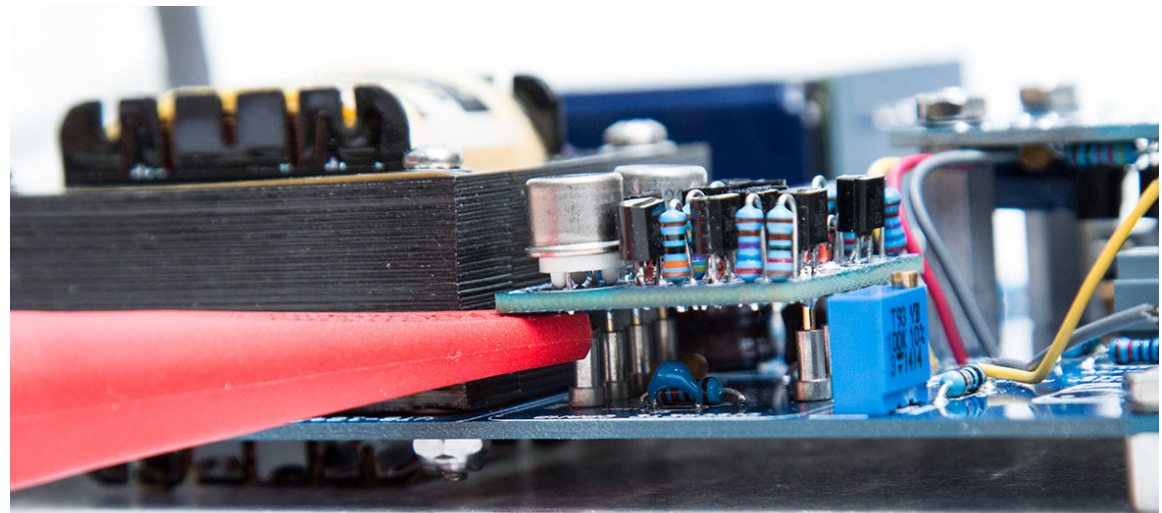
To perform this adjustment step, power must be applied to the module. See section 11 for pinouts on where to apply the V+ and V- voltages, and ground connection.

\*\* This step obviously needs a dual power supply. One can use a 500 rack or lunchbox to get power, but without a 3rd-party extender card, it may be difficult to apply power to the module.

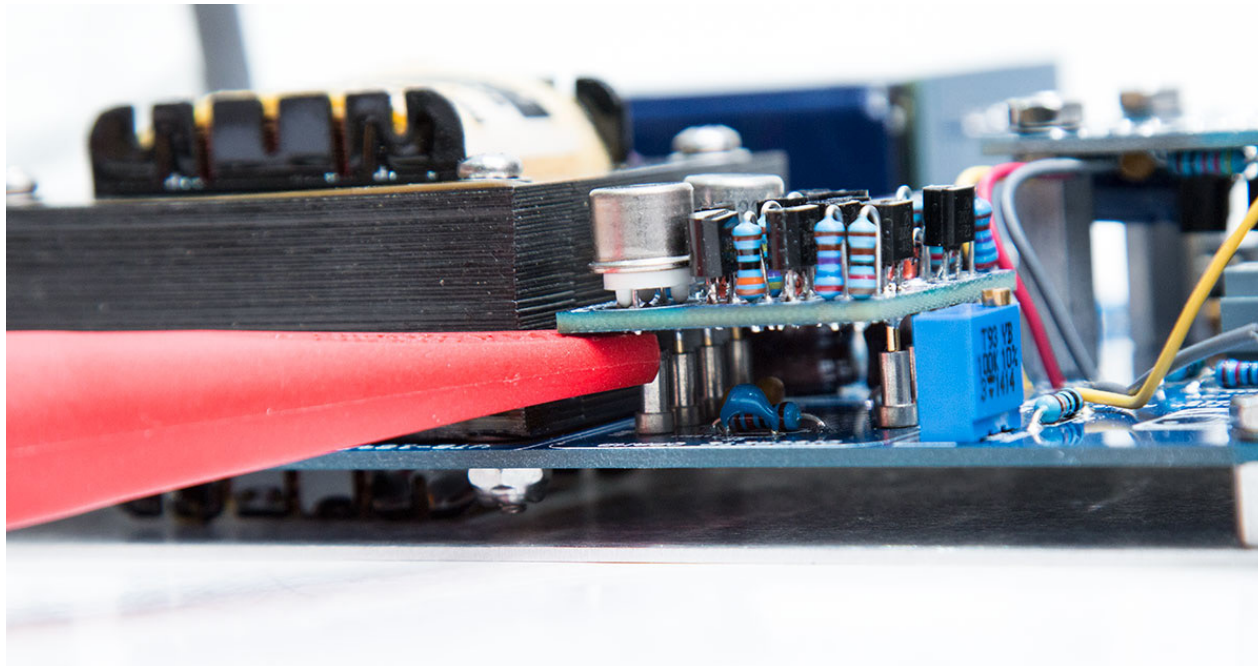
Connect the positive/red lead of your multimeter to the OpAmp OUT pin as shown in the picture on the right.

Connect the negative/black lead of your multimeter to Ground. (See section 11 for pinout/location.)

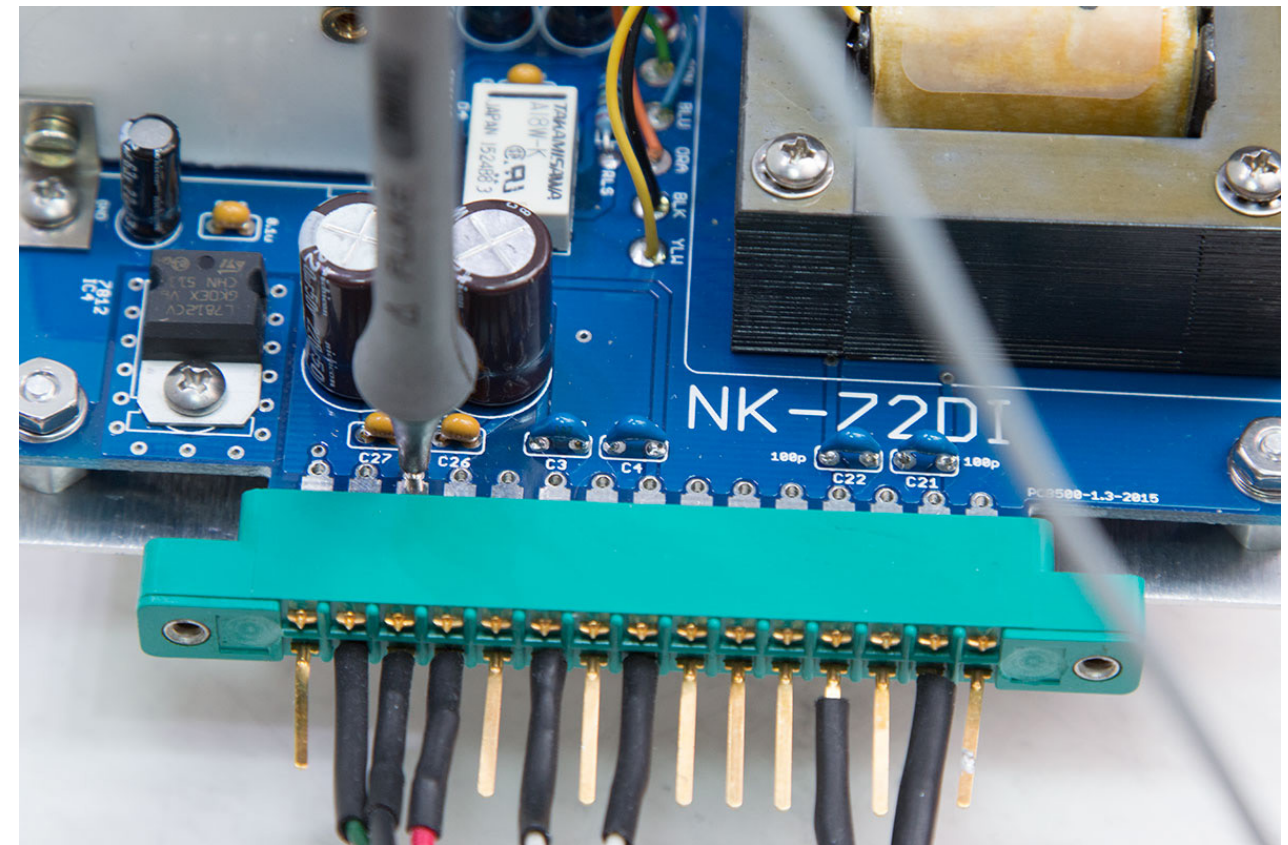
Adjust trimmer RTRIM (located just beside the OpAmp) and turn the screws until you can get as close to 0 Volts DC, as best as you can.







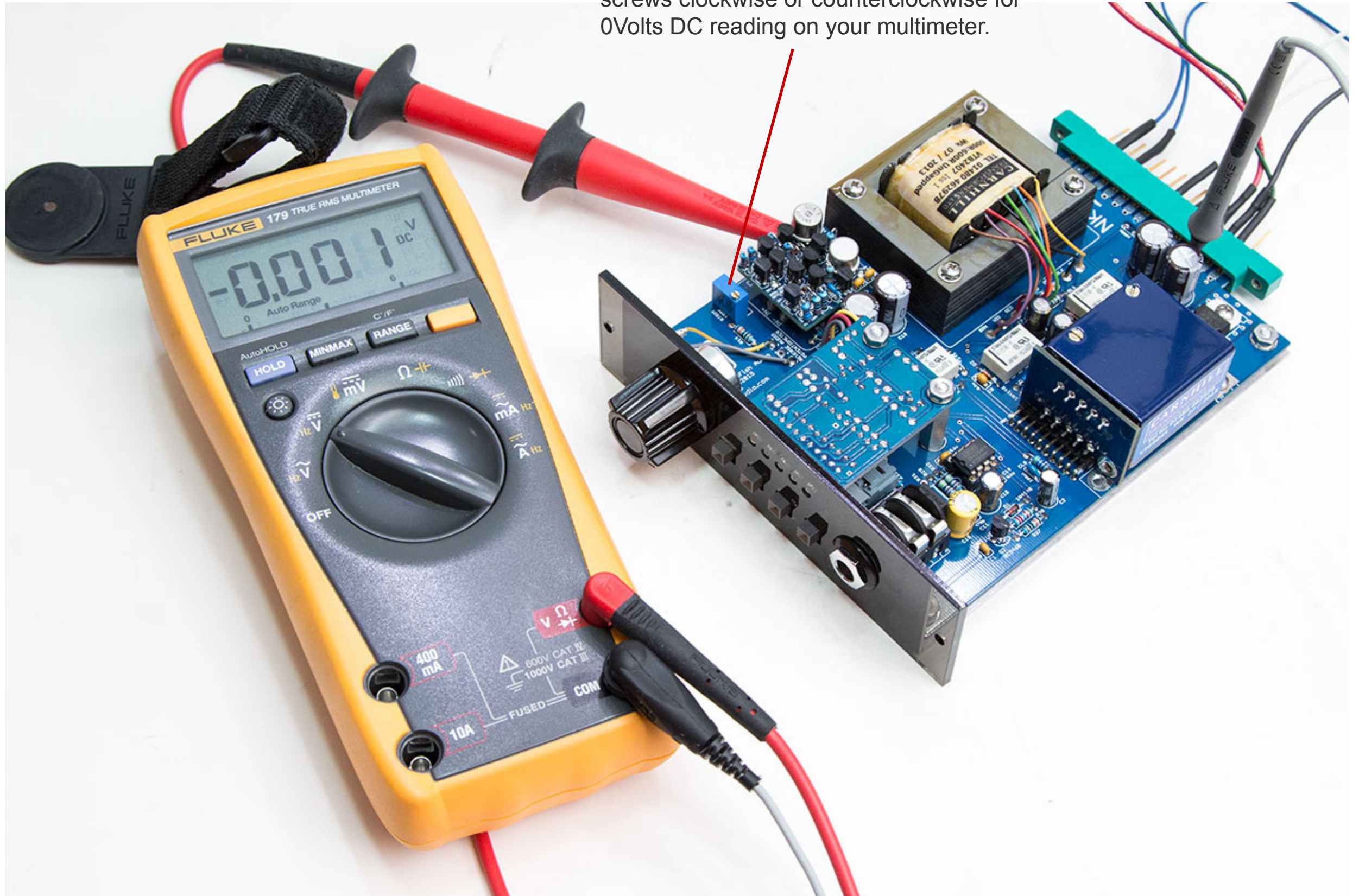
Connect Positive/Red lead of multimeter to OUT pin on OpAmp.



Connect Negative/Black lead of multimeter to GND of module.



Adjust trimmer RTRIM by turning the screws clockwise or counterclockwise for 0Volts DC reading on your multimeter.





# 7. PARTS LIST

PART REFERENCE	QTY	VALUE
<b>PCB</b>	1	NK-72DI 500-series PCB
<b>CAPACITORS</b>		
C1, C8, C9, C13, C14, C16, C17, C20, C23, C26, C27	11	0.1uf / 100V
C2, C28	2	22uf / 63V
C3, C4	2	1000pf 50V
C5, C12	0	NOT USED
C6, C7, C15	3	47uf / 50V
C10	1	10uf / 50V NON-POLAR
C11	1	470pf 50V
C18, C19, C24, C25	4	220uf / 50V
C21, C22, CF, CLS	4	100pf / 50V
<b>SEMICONDUCTORS</b>		
D1, D2, D3, D4	4	1N4148
LED1, LED2, LED3, LED4	4	GREEN, BLUE, YELLOW, RED
Q1	0	NOT USED
Q2	1	BC546B NPN transistor
IC1/DISCRETE OPAMP	0	DOA-17 DISCRETE OPAMP
IC1/DISCRETE OPAMP	0	DOA-12 DISCRETE OPAMP
IC1/DISCRETE OPAMP	0	HYBRID DOA
IC2	1	OPA2134P
IC3	0	NOT USED
IC4	1	7812



<b>All resistors 1/4 watt, metal film when available</b>		
RPOT	1	10K REV AUDIO POT
RLIM (SEE ERRATA)	1	25R5
RLS	1	600R
RTRIM	1	100K TRIMMER
R1, R33, R36, R40	4	1K5
R2 (SEE ERRATA)	1	4K7
R14, R37	2	100K
R27, R44	2	10K
R29, R32	2	2M2
R34, R35	2	6K8
R38	1	22K6
R41	1	169R
R42, R43	2	619R
R3, R4, R5, R6, R7, R8, R9, R10,	0	NOT USED
R11, R12, R13, R15, R16, R17, R18, R19, R20,	0	NOT USED
R21, R22, R23, R24, R25, R26, R28	0	NOT USED
R30, R31, R32, R39	0	NOT USED
<b>HARDWARE</b>		
MILL-MAX SOCKETS	6	MILL-MAX SOCKETS FOR DOA
TRS JACK	1	TRS JACK, PCB MOUNT
RLY1, RLY2, RLY3	3	RELAY
SW1, SW2, SW3, SW4	4	PB, DPDT, MTH-2-2U



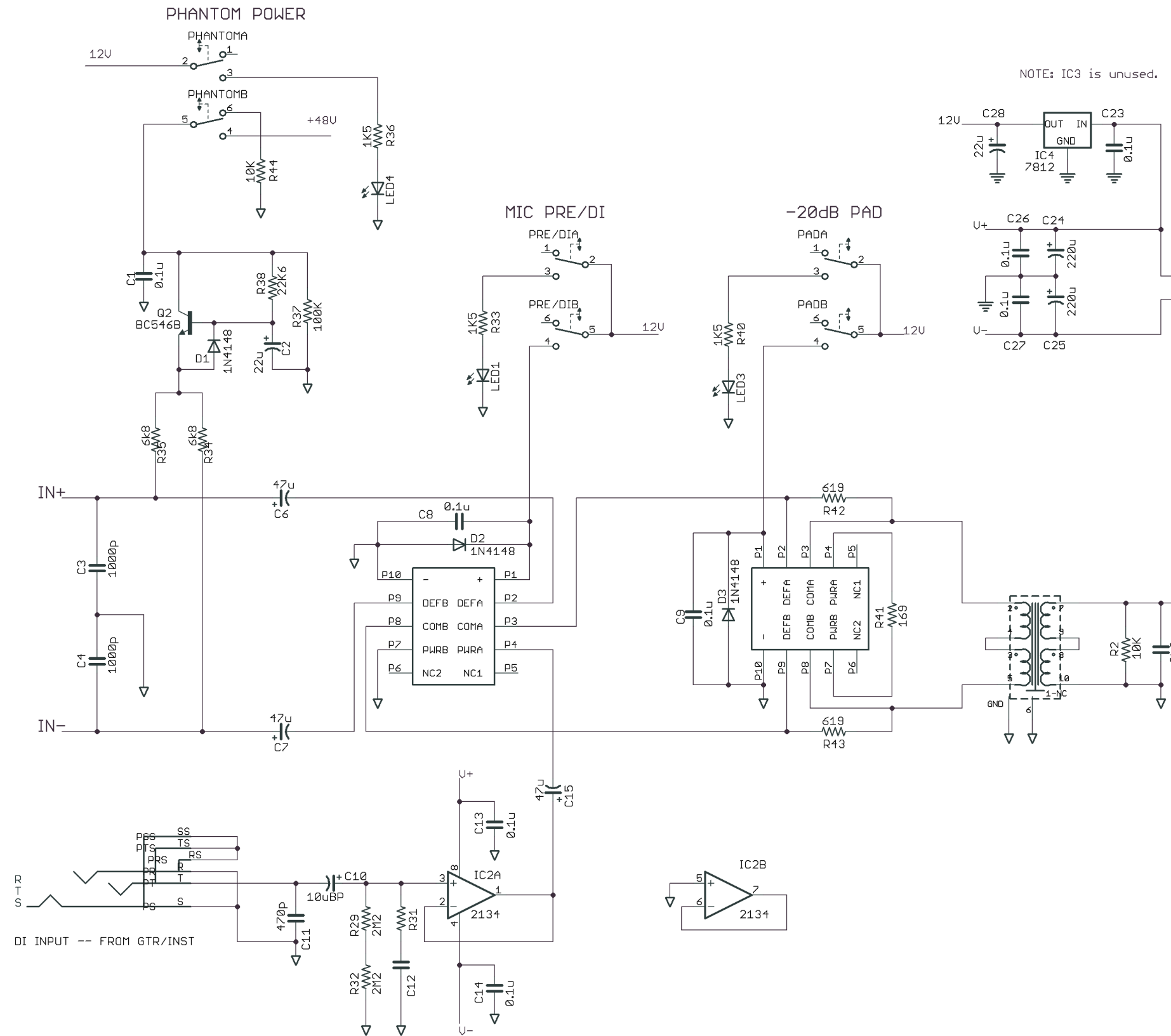
<b>HARDWARE</b>		
ALUMINUM SLED - MACHINED	1	ALUMINUM SLED
HEX SPACER FOR SLED	4	HEX .187X.250 ALUM M/F
4-40 NUT	4	FOR ALUMINUM SLED
LOCK WASHER	4	FOR ALUMINUM SLED
UNDERCUT MACHINE SCREW	4	FOR ALUMINUM SLED
4-40 x 1/4" MACHINE SCREW	1	FOR 7812 REGULATOR
LOCK WASHER	1	FOR 7812 REGULATOR
4-40 NUT	1	FOR 7812 REGULATOR
L-BRACKET	1	FOR INPUT TRAF0
LOCK NUT	1	FOR INPUT TRAF0
4-40 X 1/4" BOLT	1	FOR INPUT TRAF0
10P RIGHT-ANGLE HEADERS	1	FOR INPUT TRAF0
INPUT TRANSFORMER PCB ADAPTER BOARD	1	FOR INPUT TRAF0
LONG MACHINE BOLTS	4	FOR OUTPUT TRAF0
LOCK NUT	4	FOR OUTPUT TRAF0
LOCK WASHER	8	FOR OUTPUT TRAF0
<b>PANEL</b>		
BLACK KNOB	1	KNOB
FRONT PANEL, ACRYLIC	1	FRONT PANEL, LASER CUT
<b>TRANSFORMERS</b>		
INPUT TRANSFORMER	0	INPUT TRANSFORMER
OUTPUT TRANSFORMER	0	OUTPUT TRANSFORMER



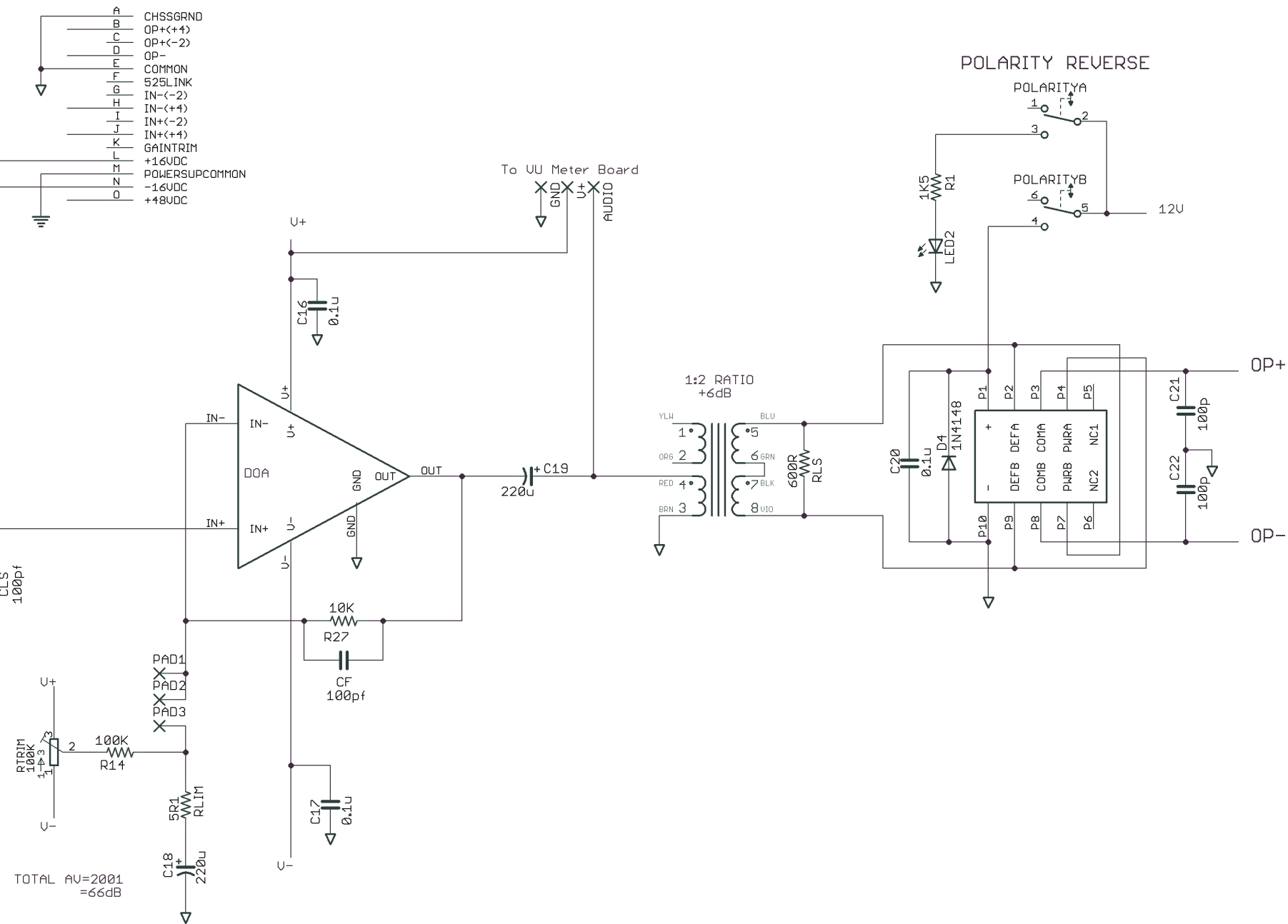
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# 8. SCHEMATIC DIAGRAM

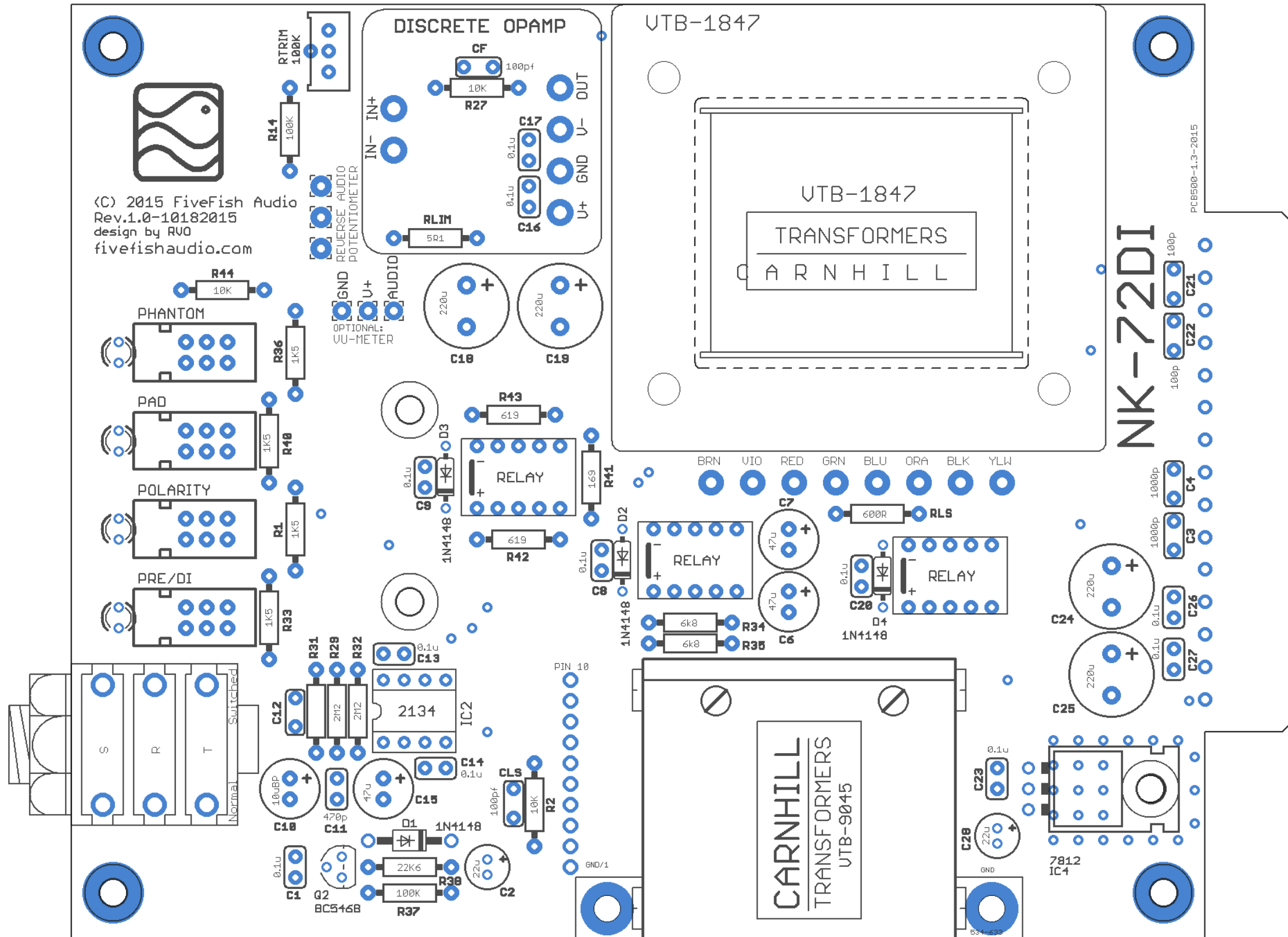








# 9. COMPONENT GUIDE - REV1.0 PCB





# 10. TROUBLESHOOTING GUIDE

Hey, we're all human and make mistakes. Hopefully the tips below will help you troubleshoot your Mic Preamp build.

**When I turn the gain knob clockwise, the sound decreases instead of increasing. At minimum gain setting, I have a very loud output signal. It's backwards!**

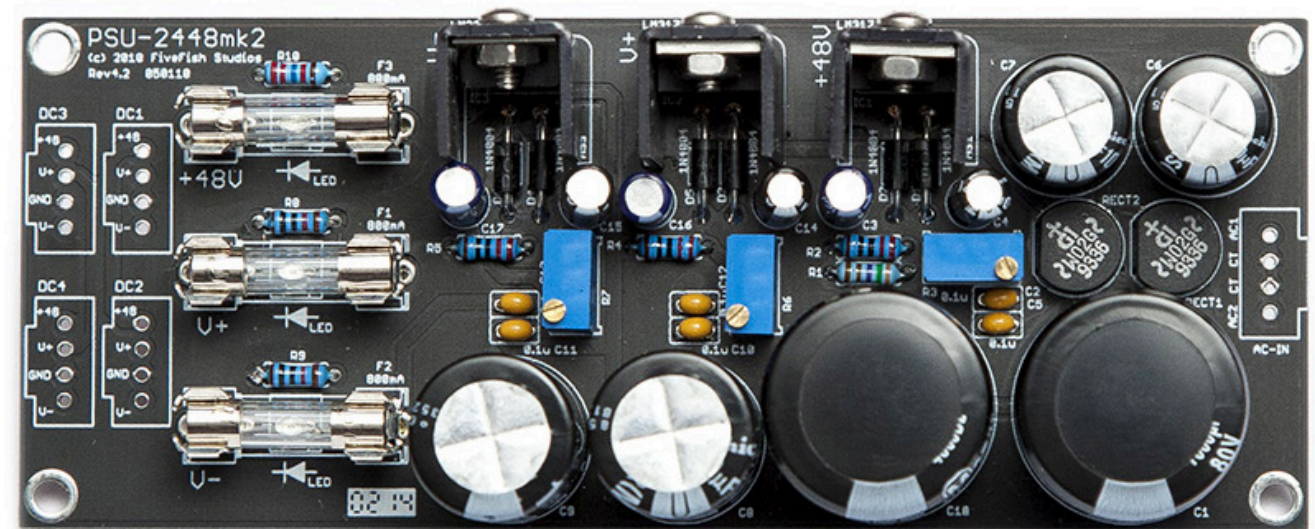
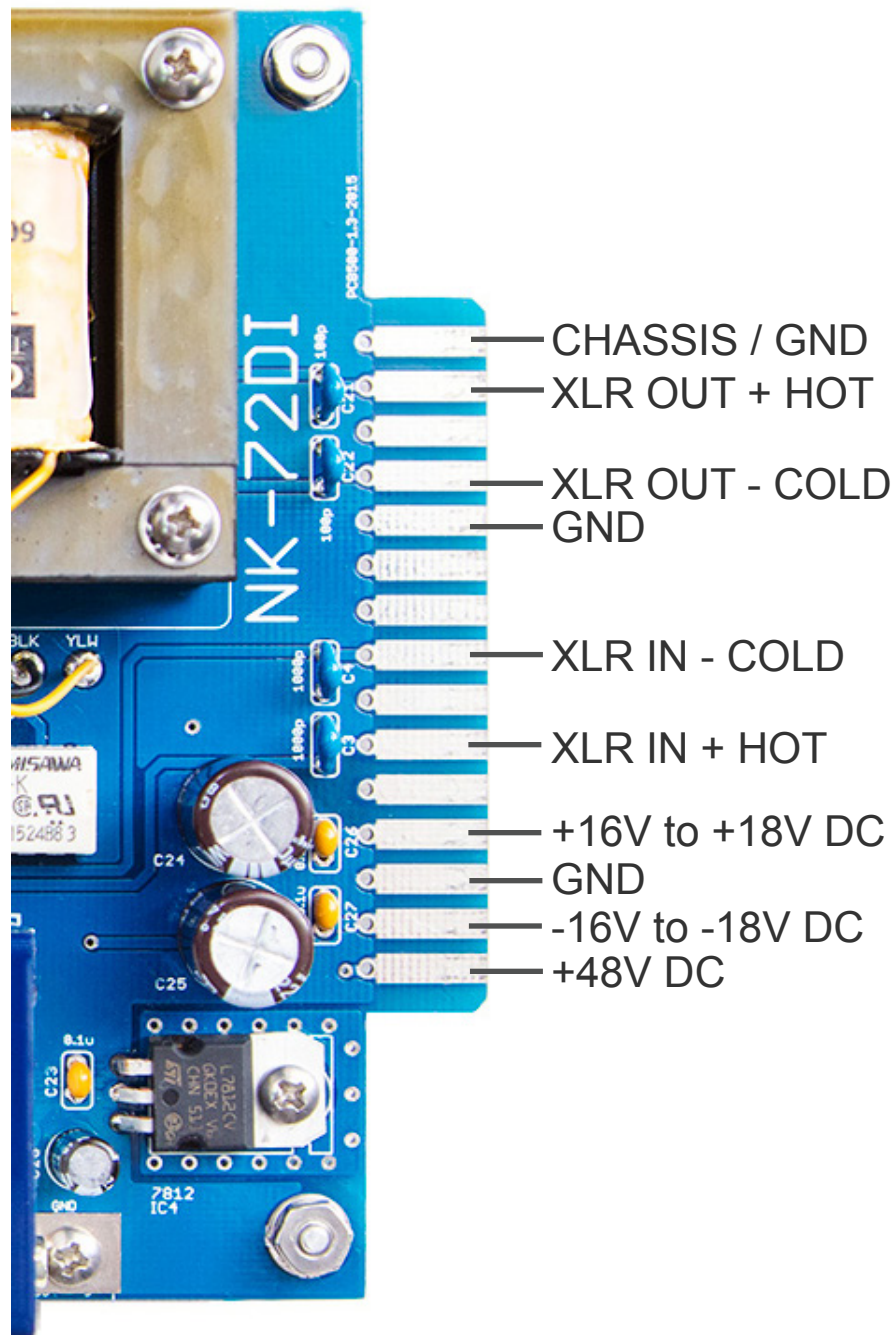
Please review Step 3.19 and look closely at how the wires are connected to the potentiometer. You need to swap the location of your 2 wires if your gain is backwards.

**I hear a popping sound when I switch from DI Instrument to Mic Input. I'm using a Condenser microphone with 48Volt phantom power switched ON.**

Turn OFF 48V Phantom Power switch and wait a few seconds before switching between DI Instrument and Mic Input or vice versa. Otherwise, you may get a popping sound if you switch between the (2) inputs, AND have 48V Phantom Power turned ON.

# 11. RACK MOUNTING THE NK-72DI MIC PREAMP MODULE

You may also mount the NK-72DI Mic Preamp inside a custom 1u 19" rack case. Just supply the NK-72DI module with the necessary +/- voltages, and connect to XLR male and female jacks. Use the wiring guide below. You can use a 15-pin EDAC connector, or solder the connection wires directly to the holes provided on rear of the board.



For rack mounting, we recommend a FiveFish PSU-2448 Power Supply Kit and Power Transformer to supply regulated +/- voltage and +48V phantom power to your NK-72DI module.