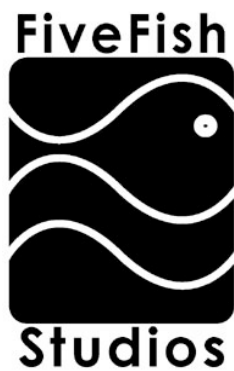


SC-1mk3 Mic Preamp Kit

Professional Mic Preamplifier
with Input Transformer Option



Simplicity Counts, Detail Matters.

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SC-1 Mic Preamp Solid State Mic Preamplifier with Input Transformers

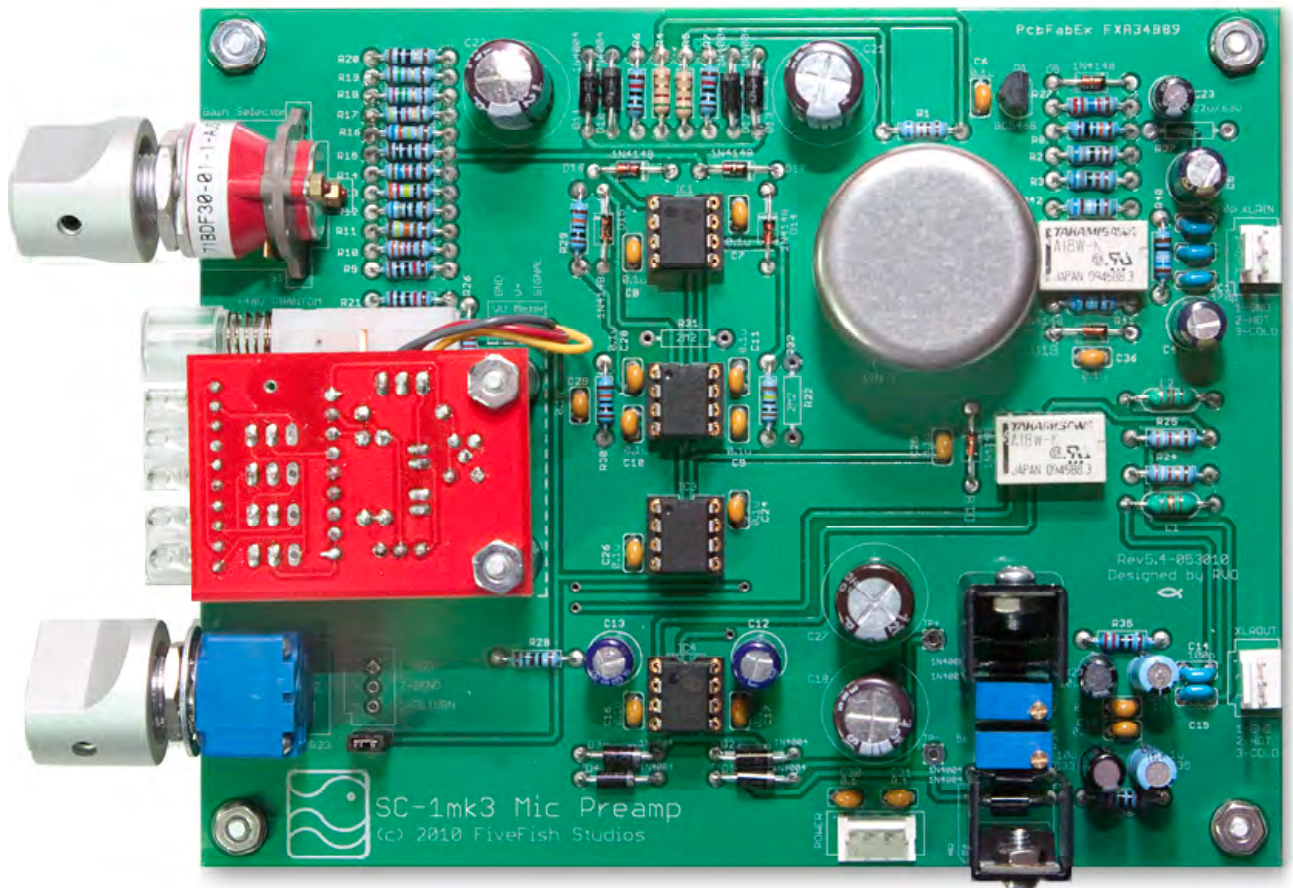
Congratulations and thank you for your purchase of the SC-1mk3 Mic Preamp Kit. This is the 3rd generation design of our popular SC-1 Mic Preamp Kit.

Hundreds of hours have been spent in the design, testing, manufacturing and packaging of this kit to deliver to you a great preamp, with the same features and performance found on high-end boutique preamps. All at a very affordable price!

There are no special, expensive tools or techniques required to assemble this kit. All you need is the ability to follow instructions, use common sense, and the confidence in knowing that YOU can do this.

PLEASE READ THIS DOCUMENT COMPLETELY BEFORE YOU ASSEMBLE YOUR PREAMP KIT.

I know people sometimes don't want to read manuals. But unlike software, there is NO EASY UNDO for this project. **READ THIS ASSEMBLY GUIDE COMPLETELY FIRST.** Take your time, and ask questions if you are unsure of something. You can email me at diy@fivefishstudios.com. Work methodically and carefully. I promise you, you'll be rewarded with a great preamp when you're finished. And you'll have pride and joy when you tell others that "Yes, I built this!"



Features, Advantages and Benefits of the SC-1mk3 Mic Preamp

Legend:

- None - this feature was introduced in the original SC-1 preamp
- Mk2 - this feature was introduced in the SC-1 mk2 version
- Mk3 - this feature was introduced in the SC-1 mk3 version

- Low-Noise, High-Quality Mic Preamp
- All solid-state design, using chipsets from THAT Corp and Burr-Brown
- Soft-start, slow ramp-on +48V phantom power
- Mk2: Option to use input transformer for added sound "flavor"
- Mk2: Gain range from +12 to +72dB, in 6dB increments from +12dB to +42dB; 4dB increments from 46dB to 72dB.
- Mk2: Onboard Power Supply Regulation, adjustable +/- voltage rails
- Mk2: Reduced clicking and popping when changing gains
- Mk3: Further reduced clicking and popping when changing gains
- Mk3: Robust 48Volt short circuit protection (from accidental phantom power shorts)
- Mk3: LED-lighted push buttons for phantom power, -20dB pad and polarity reverse
- Mk3: VU Meter, 5-LED bargraph
- Mk3: Relay controlled Pads
- Mk3: Relay controlled Polarity Reverse
- Mk3: Bigger PCB area, more room to work with
- Mk3: Hole locations compatible with our X-12 Mic Preamp. Now you can have (1) X-12 Mic Preamp and (1) SC-1mk3 Mic Preamp in the same 1u Rack Case
- Electronically balanced input and output stages (option to use input transformer for transformer balancing)
- 12-position Grayhill gain selector switch
- Input RFI protection
- Input clamping protection
- Output surge protection circuit
- Output RFI protection
- High quality Bourns, sealed, conductive plastic potentiometer for volume control
- Gold-plated, machined, low-profile IC sockets
- Use of high quality 1% Metal Film resistors, and high-quality ceramic and electrolytic capacitors
- Solder pads for optional INSERT jacks
- On-board jumper terminals
- Easy to assemble, easy to troubleshoot design
- Each component carefully labeled, protected and packed in separate zip bags
- Thick PCB board with 2oz. copper
- Very affordable!!! No, this is not "cheap junk" but a high quality product that is reasonably affordable! (i.e. because there are no middlemen, and we don't do expensive glossy magazine advertising!)

Basic Tools Required

A few basic tools are required to build this kit.

1. Soldering iron – adjustable temperature recommended, but not necessary. Your soldering iron must have a sharp conical tip. I do not recommend a “flat-head, screwdriver-type” soldering iron. DO NOT USE A SOLDERING GUN. They are usually rated at 100Watts and are overkill for this project.



2. Mini Pliers Cutter – to cut component leads, wires, strip insulation off wires (if you don't have a wire-stripper tool).
3. Mini Long Nose Pliers – to bend component leads, use as a heatsink, hold components, tighten bolts.



4. Manual Solder sucker pump or desoldering gun– sucks up solder when you made a mistake soldering components on the PCB. Pictured below is a Hakko model.



SC-1mk3 Microphone Preamp Kit

5. Multitester – A simple meter/tester to measure resistance, and voltages. A digital read-out is a big help.



6. Soldering Lead – 60/40 lead or lead-free solder.



7. Magnifying glass – to see what you're doing! Especially when soldering IC pins and the Grayhill selector switch.



8. Clean and well-lighted work area – Lots of good lighting, clean work area. You want to be able to leave your work-in-progress without packing everything away.

Extra Tools (Nice to have, but not required)

1. Vacuum desoldering pump – if you make a mistake, you need to pull out the component from the PCB
2. Component lead bender – bend component leads like resistors uniformly and evenly
3. PanaVise – to hold PCB while you're working on it
4. Tweezers – to pick tiny things
5. Masking tape – to hold components on the PCB while working
6. Wire-stripper – for cutting wires and stripping its insulation

SC-1 Parts Identification and Assembly Notes

For the newbies, this is not meant to be a full tutorial of electronics. But I want you to be able to identify components, recognize them and know what their basic functionality is.

Resistors

All resistors used in the SC-1 Kit are 1/4watt, 1% tolerance, Metal-Film type resistors. These are high quality resistors, way much better than carbon composition type resistors (which usually have 10-20% tolerance).

Resistors provide resistance, and are measured in OHMS, the unit of resistance.

1,000 OHMS = 1 KOhms (pronounced KiloOhms, where kilo = 1,000)

If you see a resistor value marked "1K", it means 1 KiloOhm. Sometimes, you would see values written as 6K8, or 3K3.

6K8 is also the same as writing 6.8 Kohm. The decimal point position is implied by the "K" letter.

3K3 is also the same as 3.3 KOhm, or 3,300 Ohms.

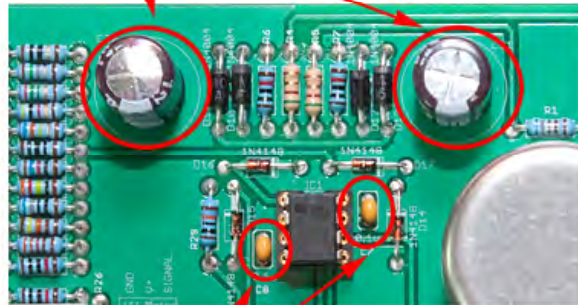
I don't need to teach you how to read resistor color codes since all the SC-1 parts are already labeled for you. But if you're curious on what those bands of wonderful technicolors mean, you can go here.

http://www.samengstrom.com/nxl/10116/5_band_resistor_color_code_page.en.html

Capacitors

There are many types of capacitors used in the SC-1 Mic Preamp project. Some are big, some small, some are polarized, some are non-polarized. We'll discuss the different types here.

Electrolytic Capacitors



Ceramic Capacitors

Ceramic Capacitors

Ceramic capacitors look like the picture on the right. On the SC-1 kit, these are colored "yellow" and "blue" and are very small in size. Ceramic capacitors are non-polarized, and does not matter what orientation they go in. They can go in either way.

They are rated in microfarads (abbreviated as "uf"). They also have a voltage rating (abbreviated as "V").

Capacitor parts are therefore rated with their capacitance (in microfarads, uf) and voltage... specified like this: 0.1uf 100V



SC-1mk3 Microphone Preamp Kit

Capacitance values may be expressed in microfarads (uf), nanofarad (nf) or picofarads (pf). The conversion between these units are shown on the table above.

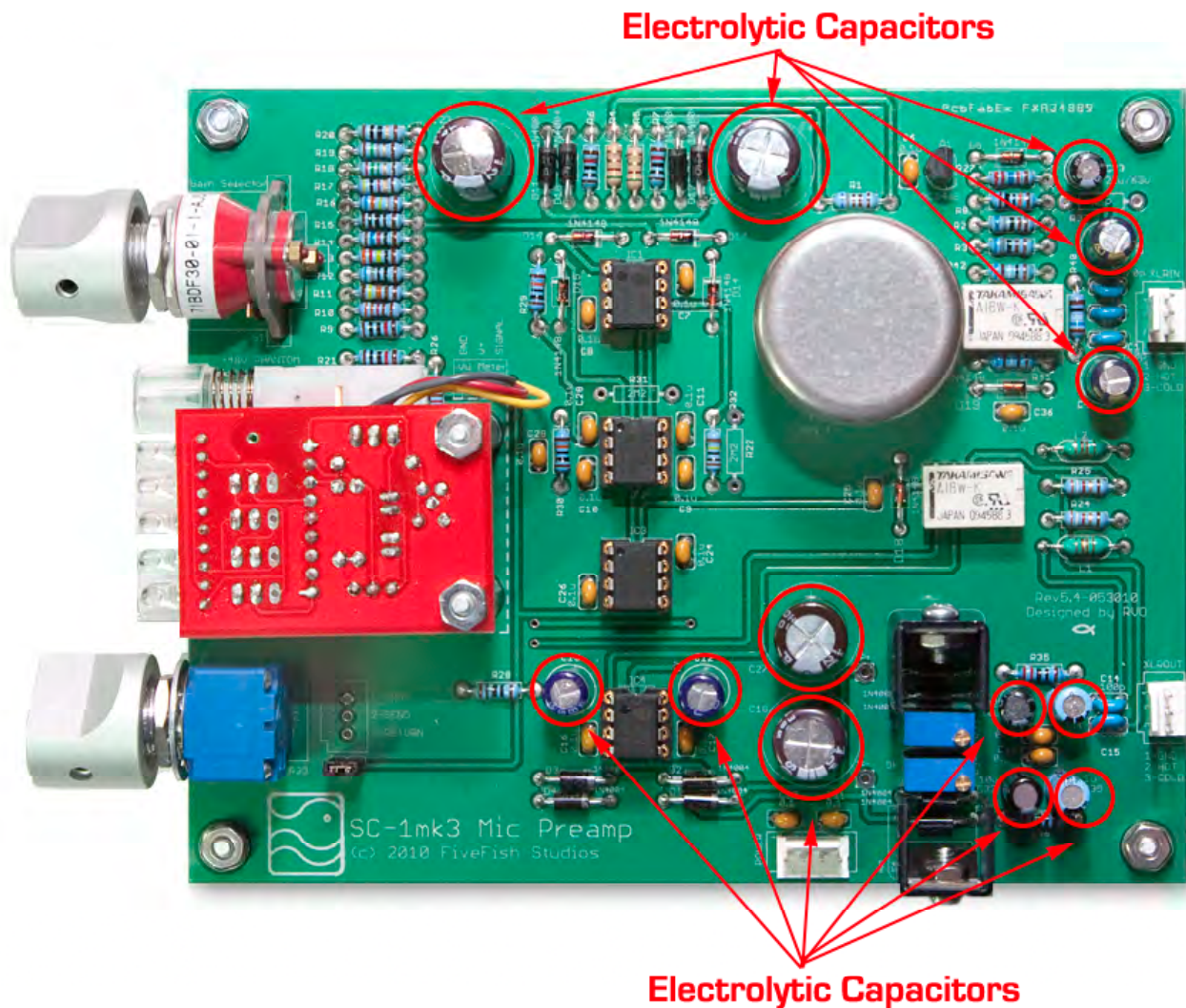
Electrolytic Capacitors

Electrolytic capacitors are cylindrical in construction. Unlike ceramic capacitors, electrolytic capacitors USUALLY/MOSTLY have polarity. One side is marked with the (-) sign, also called the Cathode, or negative side. The unmarked side is the (+) or Anode.

Just like ceramic capacitors, they are also measured in microfarads (uf). have a maximum voltage rating.

WARNING: It is VERY IMPORTANT not to insert Electrolytic capacitors backwards, or in the wrong polarity orientation. Doing so may/will cause the capacitor to explode. Yes, you read that right... EXPLODE. Do not let the small size of an electrolytic capacitor fool you. Even a tiny electrolytic capacitor can explode with a lot of energy.

Microfarads (µF)	Nanofarads (nF)	Picofarads (pF)
0.000001	0.001	1
0.00001	0.01	10
0.0001	0.1	100
0.001	1	1000
0.01	10	10000
0.1	100	100000
1	1000	1000000
10	10000	10000000
100	100000	100000000

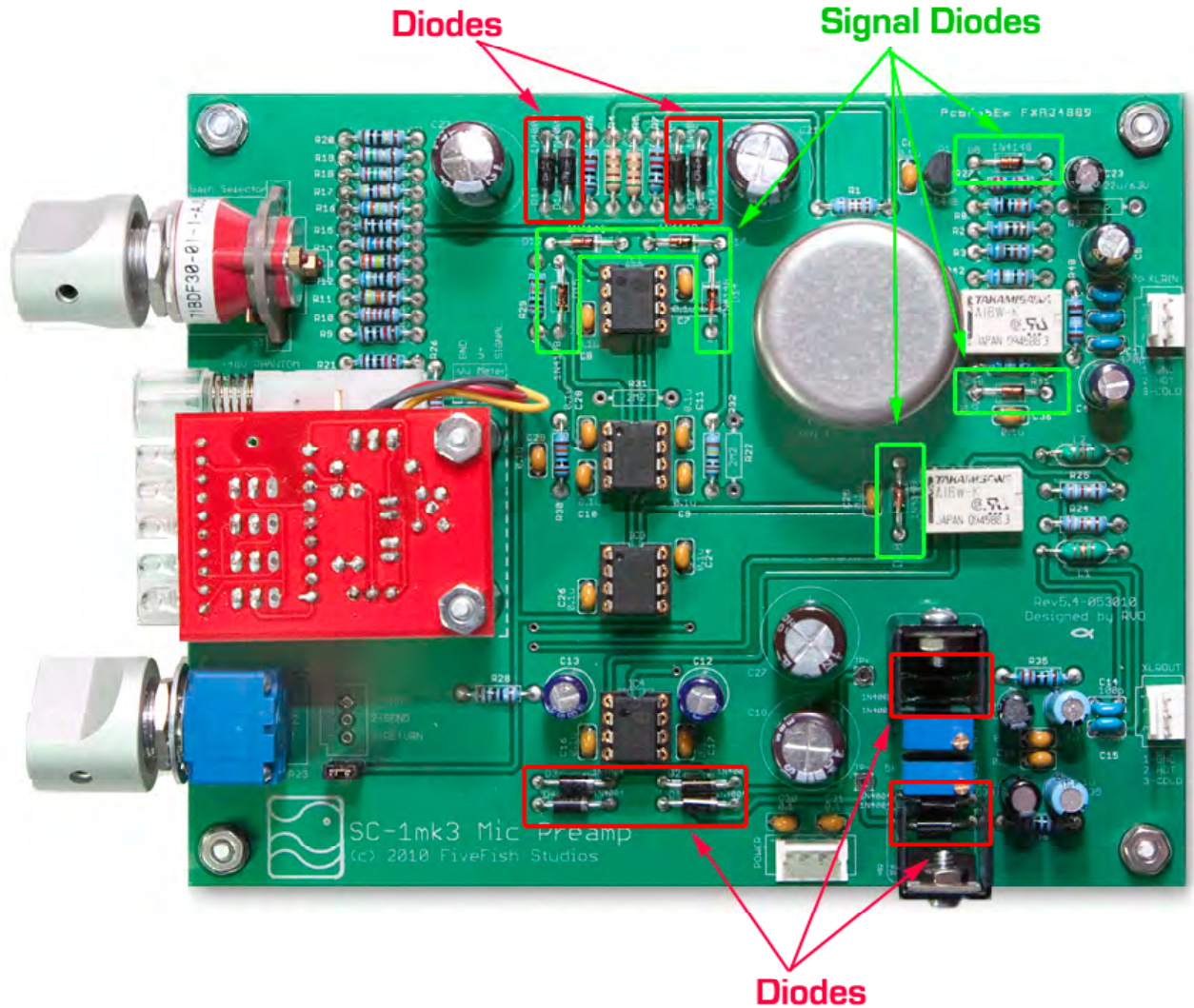


SC-1mk3 Microphone Preamp Kit

Diodes

The SC-1 preamp kit uses 2 different kinds of diodes.

1. The first type of diode we're using is the SIGNAL DIODE. They have glass body, and used around the relays and the soft-start phantom power.
2. The second type of diode we use is the General Purpose, Rectifier Diode. They are black, with a white/silver band. They're used for the local on-board voltage regulator as protection diodes.



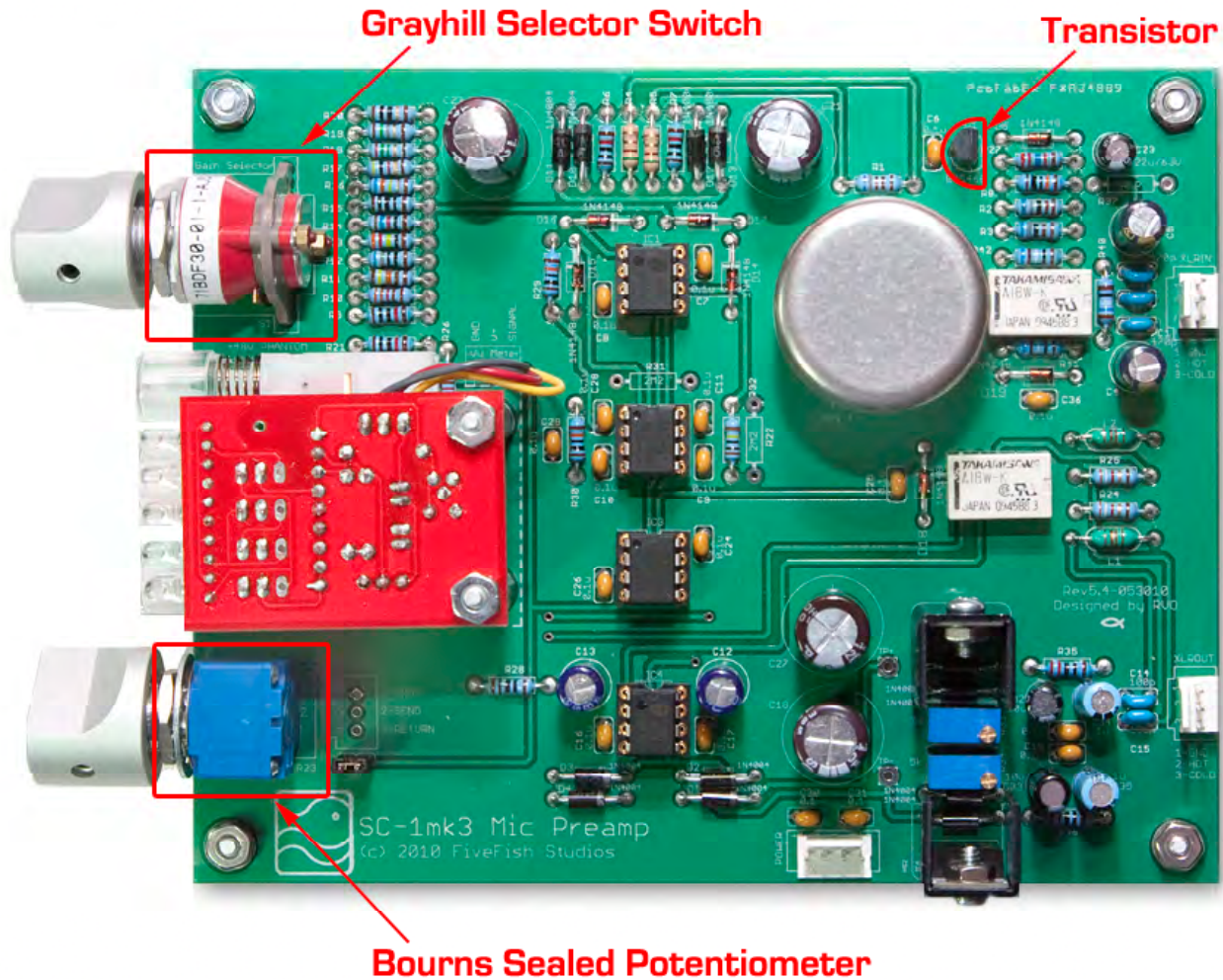
NOTE: Diodes have polarities just like electrolytic capacitors. One side is denoted as the ANODE (or positive side) and the other side is the CATHODE (or negative side). If you soldered these diodes in the wrong position, your phantom power or preamp may not work. Follow the band markings on the PCB silkscreen layout.

SC-1mk3 Microphone Preamp Kit

Transistor

Transistors are 3-terminal active semiconductor components, usually used in preamplifiers or amplifier circuits. But we're using the transistor as a switching device for our slow-start/ramp-up 48V phantom power. The transistor has (3) legs – Collector, Base and Emitter. Looking from the top, the transistor has a half-circle shape, like a half-moon.

Take note when inserting transistors that you do not insert them backwards. Otherwise, 48V phantom power will not work, and possibly even ruin the transistor. The flat side should be facing to the right.



Grayhill Selector Switch

The SC-1 uses a sealed, high-performance, high-quality, 12-position, Grayhill selector switch. It's the RED Selector switch below.

Most expensive “boutique preamp” manufacturers also use Grayhill selector switches for their products. They are durable, reliable, have a nice solid feel to it, and provide good resistance to RF Interference. This switch will be the most commonly used/abused mechanical device on the SC-1 preamp. I want this part to withstand being turned and turned and turned and is just one of the expensive parts in this kit.

Bourns Sealed Potentiometer

This is another expensive item in this kit because it is another mechanical component and I want this part to withstand the use and abuse of being rotated constantly. I want it to provide a smooth feel, and not wear out easily, and become “scratchy” like a cheap, carbon potentiometer. I want it to have a longer life than plain “guitar potentiometers.” This is also sealed from the elements so dirt, grime, oil, and impurities will not contaminate the resistive element and produce a “scratchy” volume control.

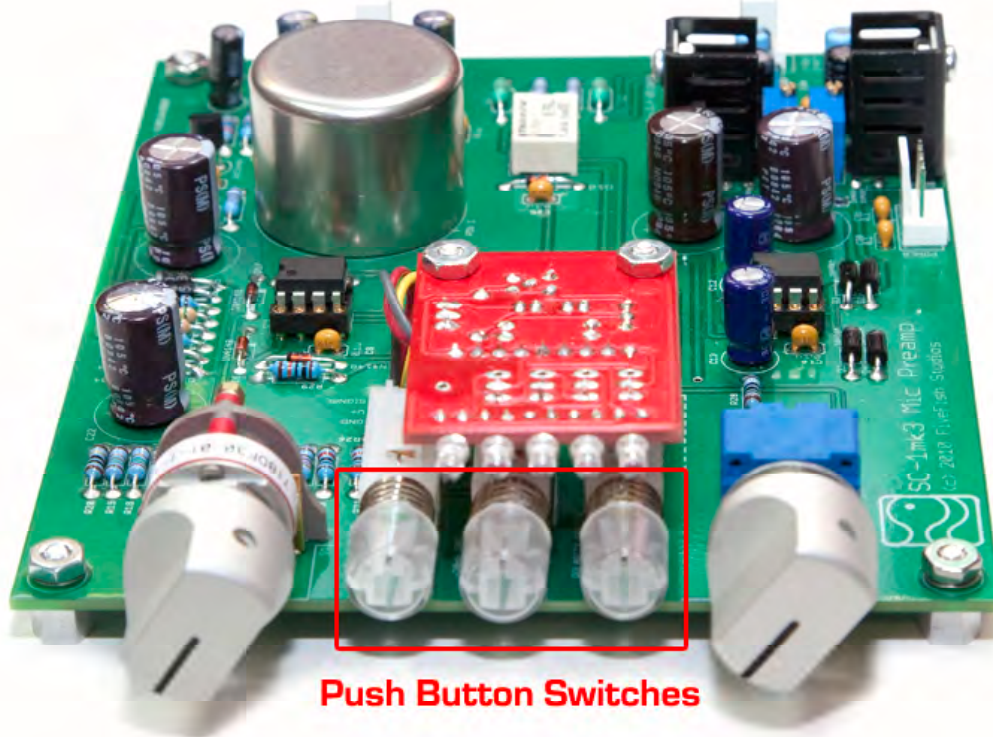
SC-1mk3 Microphone Preamp Kit

The resistive element inside is made of conductive plastic. Unlike carbon potentiometers, these pots will last a very long time even after repeated rotations.

LED-Illuminated Push Button Switch

The SC-1 also use a high quality, PCB mounted LED-Illuminated Push Button switch. From left to right, the functions are 48V Phantom Power (Green LED), -20dB Pad (Blue LED), and Polarity Reverse (Yellow LED). Each push-button switch has it's own color.

If you re-arrange the colors/switches, make sure to also re-arrange the LED current-limiting resistors (located immediately behind each switch).



SC-1mk3 Microphone Preamp Kit

Integrated Circuit (IC) Chips

IC1

IC1 is a THAT1510 Preamp IC. It has low noise characteristics, and an even lower noise at low gains, wider bandwidth, higher slew rate, lower distortion, and lower supply current.

You can substitute a THAT1512 chip for IC1, bringing down the gain selection from +6dB to +66dB. The 1512 chip was also tested and found to work the SC-1mk2 preamp. It is also pin-compatible for use with SSM2019/SSM2017/INA217/INA163

IC2

IC2 is a Burr-Brown OPA2134 chip. This is another ultra-low distortion, low noise chip designed for audio applications. This FET-input chip has high output drive capability, excellent DC performance and wide output swing, capable to within +/- 1V of the power supply voltage, which allows increased headroom. IC2 is used as a DC Servo in the SC-1mk2 Mic Preamp Design.

IC3

IC3 is also an OPA2134 chip. This chip is used as a buffer before the TRIM potentiometer and after the potentiometer. This also serves as a buffer for the SEND/RETURN inserts.

IC4

IC4 is a THAT1646 Balanced Line Driver output. Using OutSmarts technology, this chip is stable driving long cables and capacitive loads and is also capable of high output (18Vrms into 600 ohms according to manufacturer). Just like the Mic preamp chip, and the DC servo chip, this chip has low noise, low distortion, high slew rate and wide output swing.

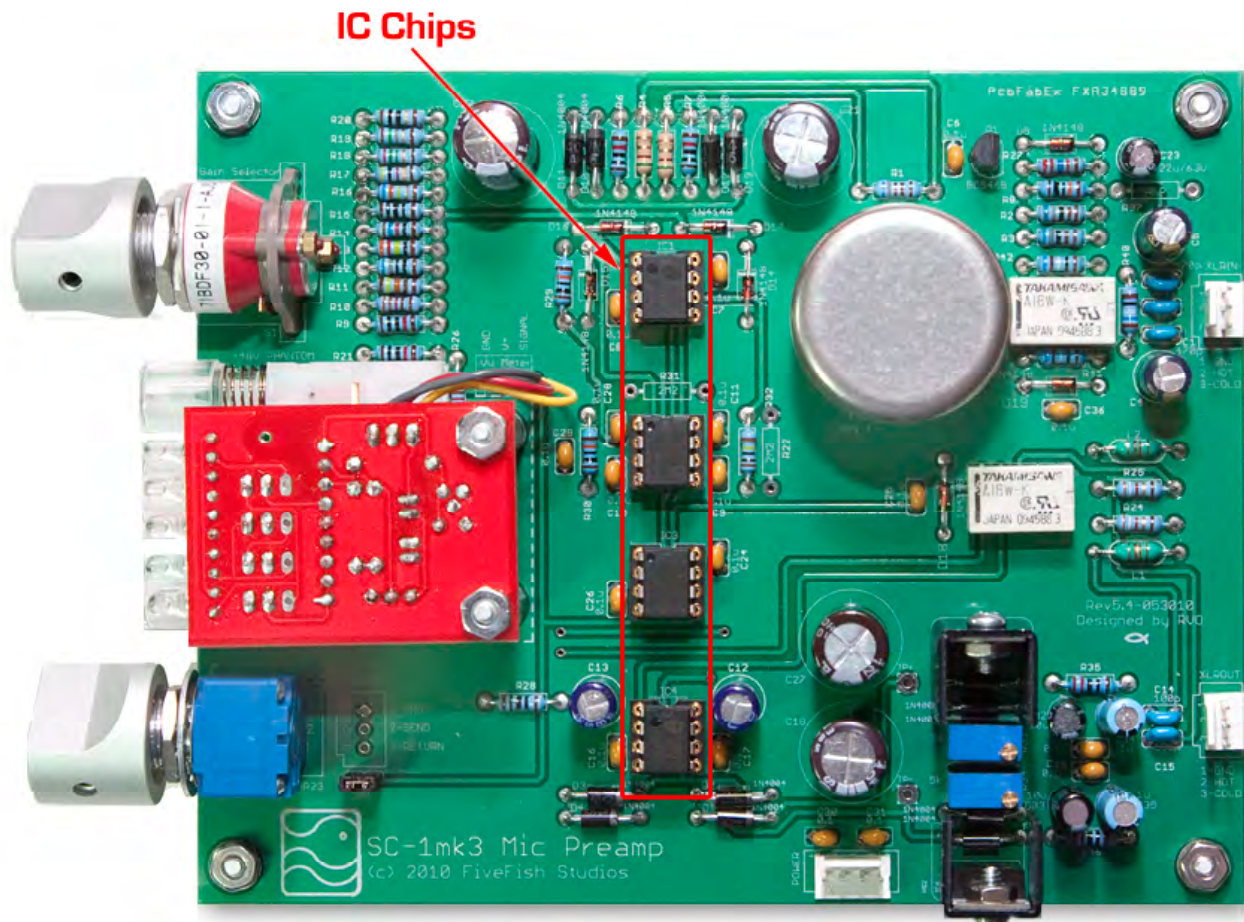
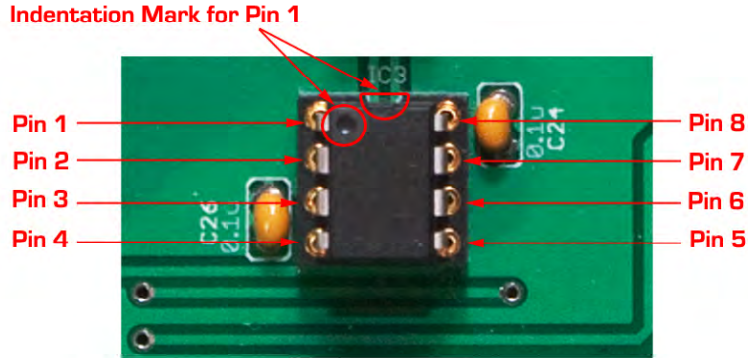


Photo above shows the locations (from Top to Bottom) of IC1, IC2, IC3 and IC4.

SC-1mk3 Microphone Preamp Kit

Note the proper orientation of the chips. See photo below. There is also a notch on one side of the IC body. All notches should be positioned on TOP when inserting the IC chips in their sockets.

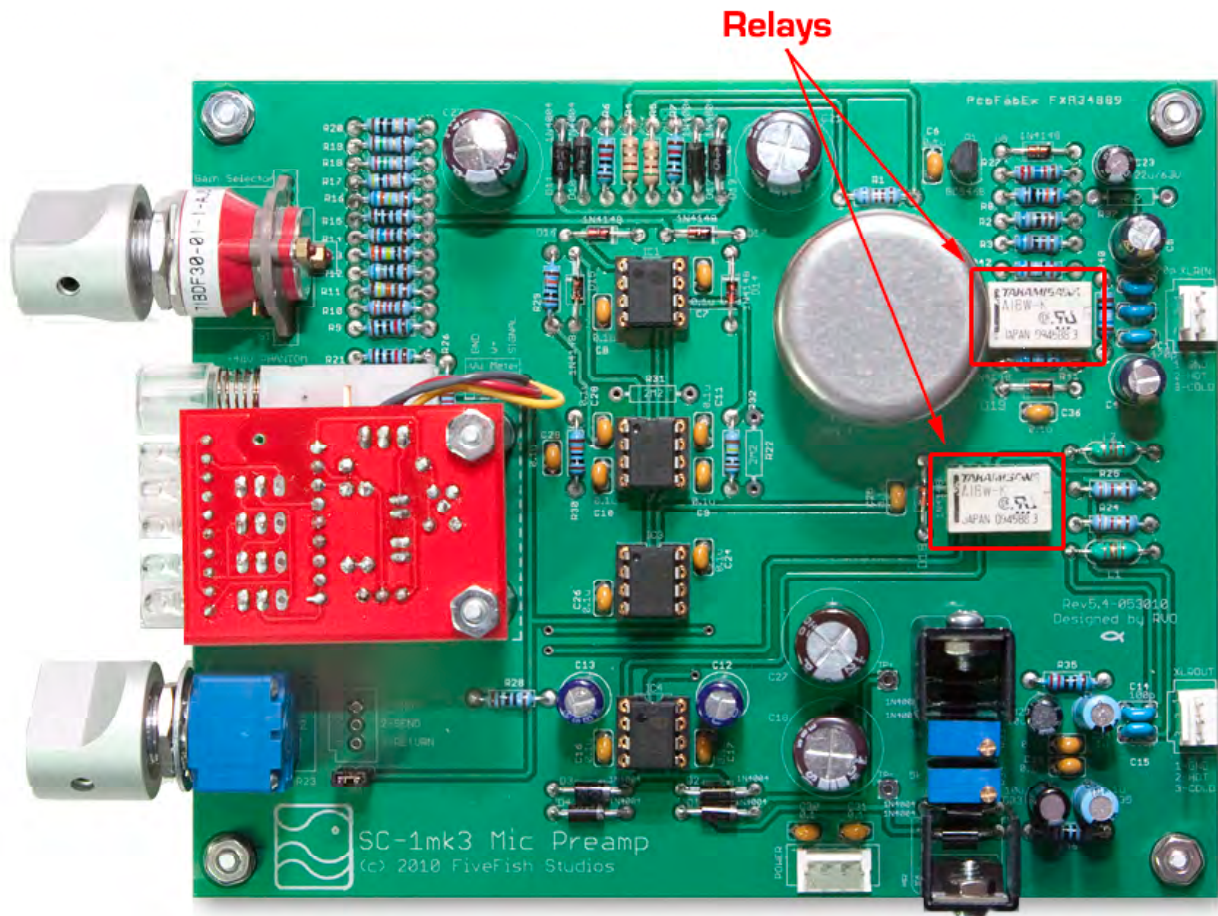


SC-1mk3 Microphone Preamp Kit

SIGNAL RELAYS

We're using two Fujitsu sealed, small signal relays to perform -20dB padding and polarity reverse switching on the preamp. This avoids running the signal wires to the front of the board towards the control switches. Instead, we keep the signal path short and sweet, and only run the relay control lines to the switches located on the front panel.

Take note of the proper orientation of the Relay. The "black line" on the relay part should align with the "silkscreen legend" on the PCB, i.e. left side. See photo below for proper orientation of the Relay.



VU METER BOARD

The SC-1 preamp kit includes a 5-LED VU Meter kit for some basic metering. This is also useful for gauging the strength of the signal and if there is any signal present during troubleshooting.

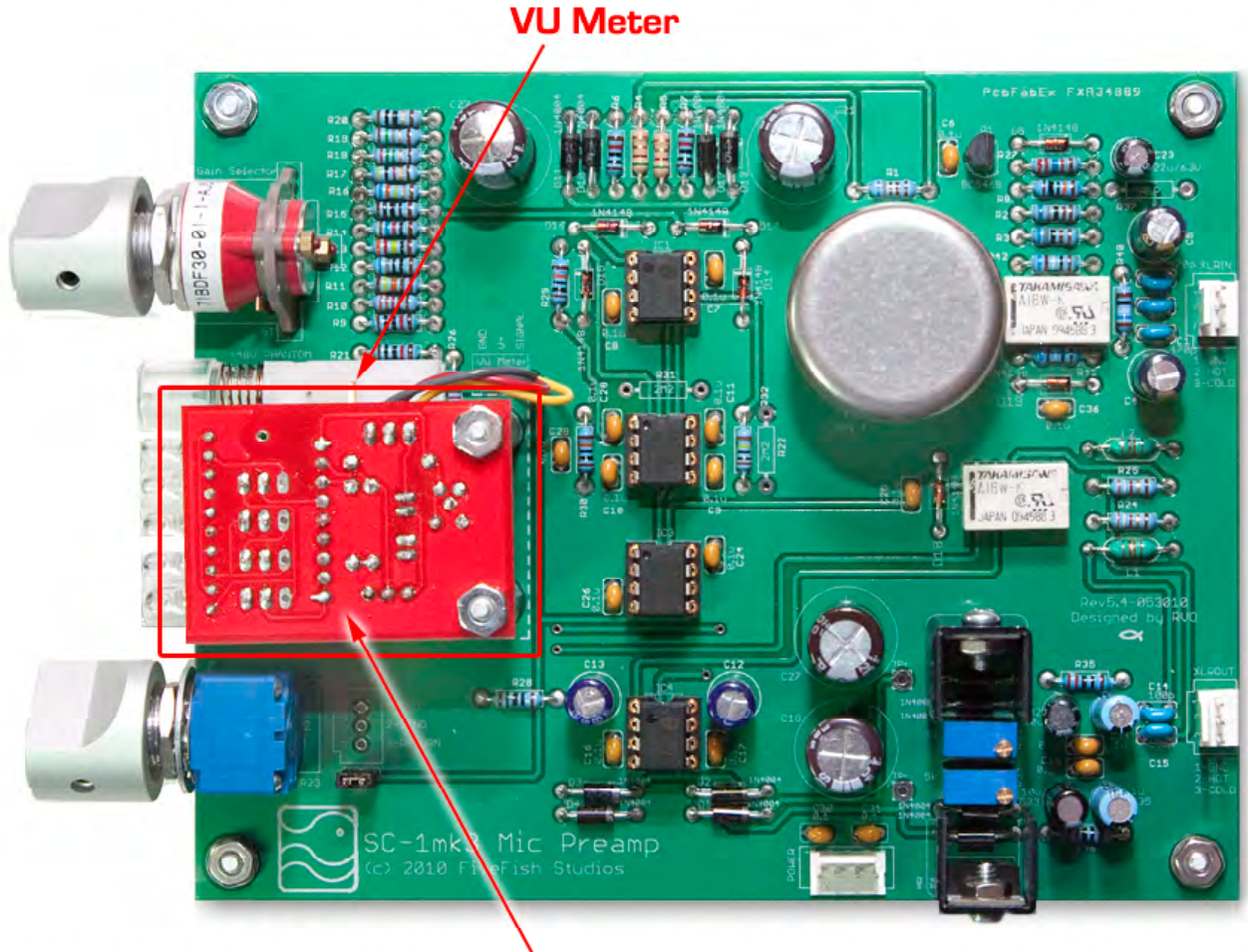
Please note that the accuracy of this VU meter is not 100%, and therefore, rely on your A/D Converter meters or DAW VU meters for the exact dB value of your signal.

This onboard VU meter is meant for a rough estimate of the signal strength, and as a visual reminder there is signal coming out of the preamp, not a dB accurate VU meter.

Some aluminum hex spacers, nut and bolts are included in the kit. Attach the VU Meters to the main preamp board using the aluminum spacers, and nut and bolts.

Note how the VU meter is installed. The component side of the VU meter is facing upside down, and the copper portion is facing upwards.

SC-1mk3 Microphone Preamp Kit



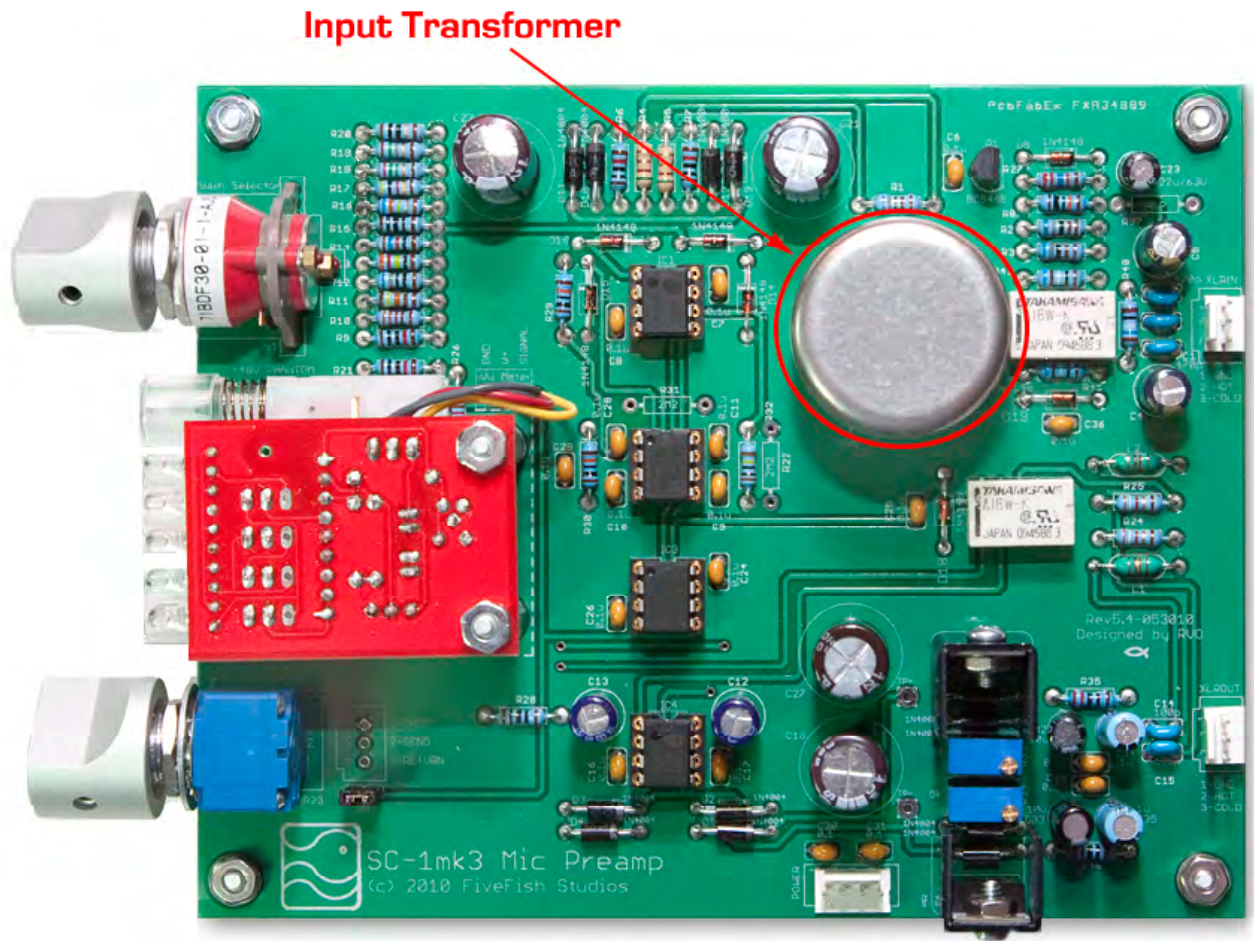
VU Meter

Note: VU Meter board is installed upside down.

SC-1mk3 Microphone Preamp Kit

AUDIO INPUT TRANSFORMER

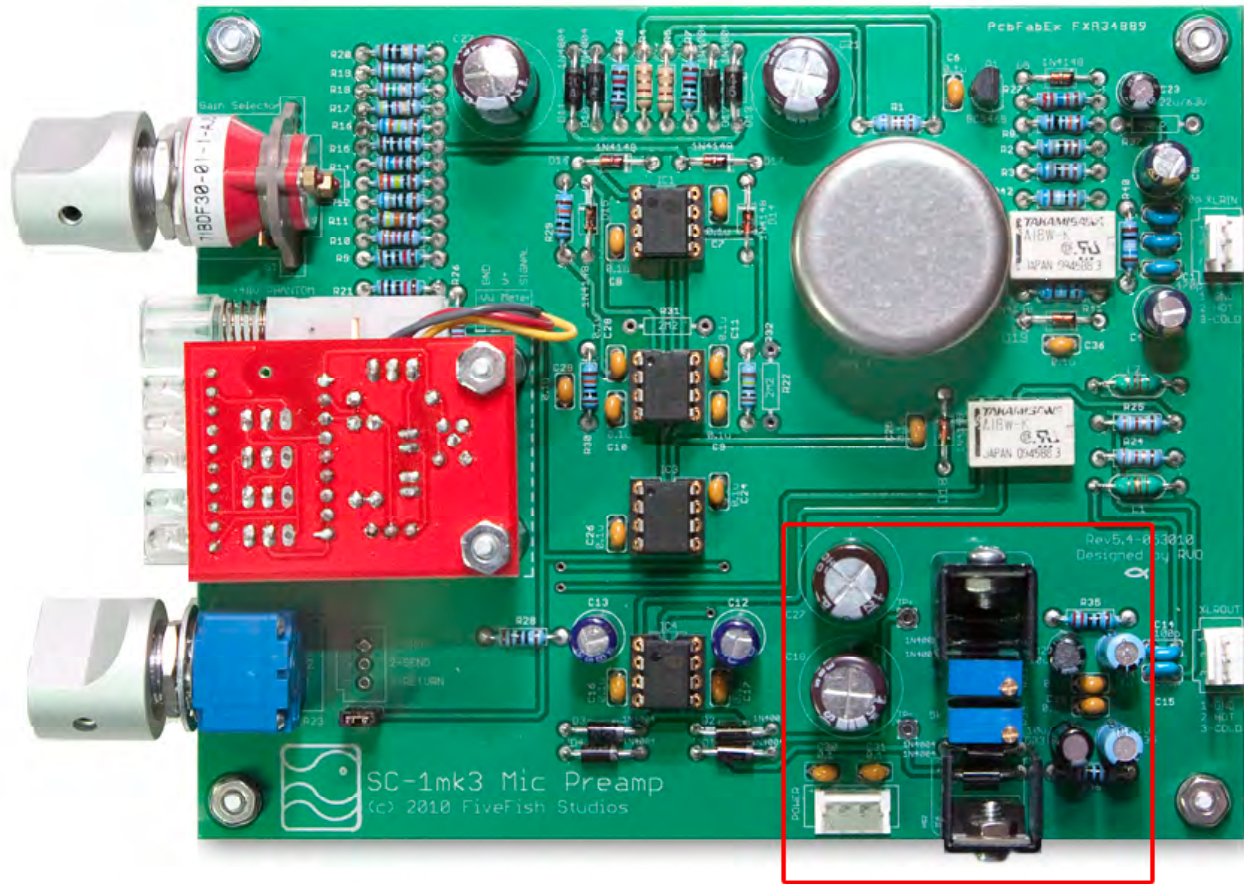
The Audio Input Transformer we're using provides impedance matching, galvanic isolation, and "flavor enhancement" to our signal. It's a High-Nickel Input Transformer with Mu-Metal shielding. Made in the USA by Cinemag, Inc.



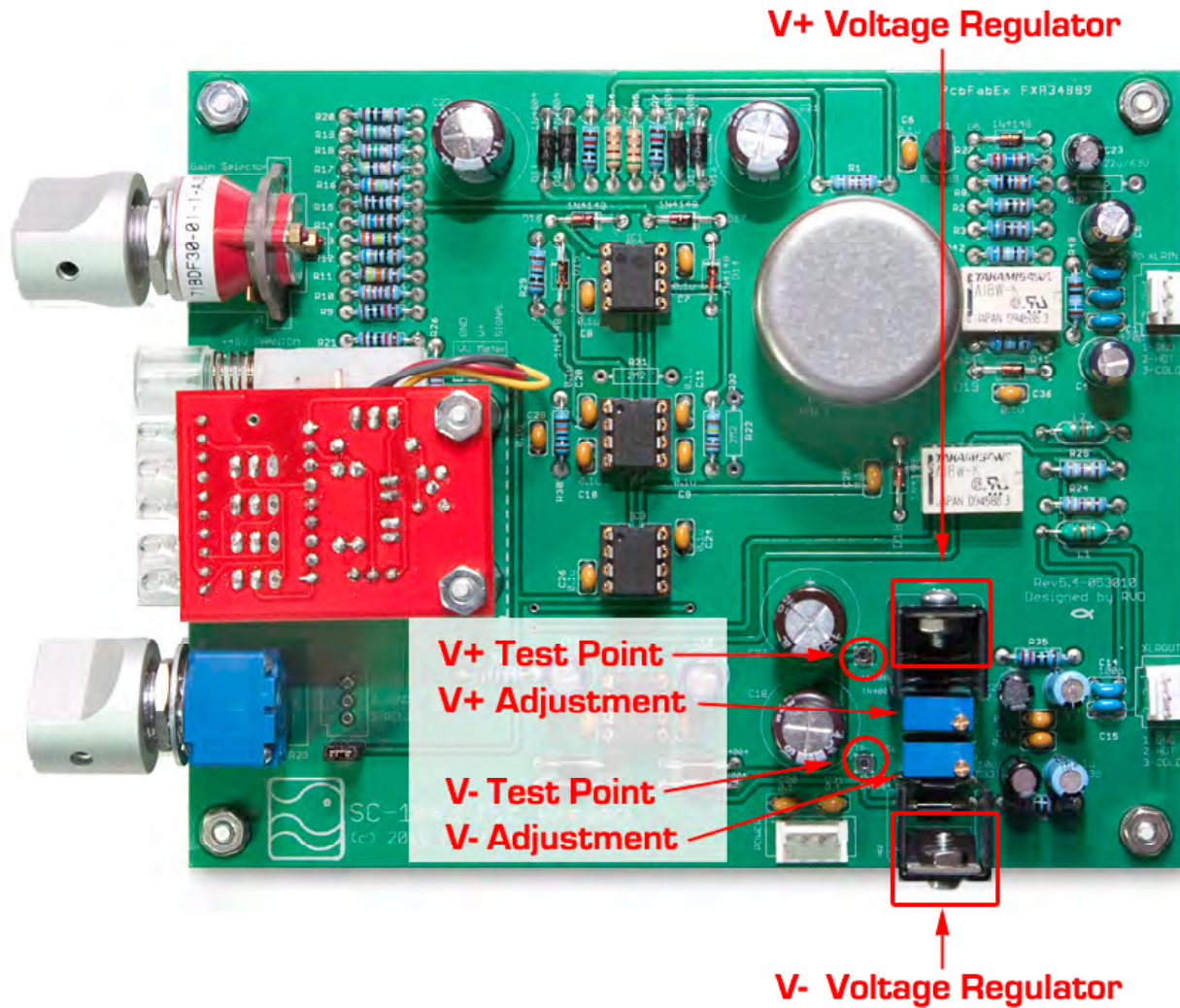
SC-1mk3 Microphone Preamp Kit

VOLTAGE REGULATOR SECTION

There is an onboard, local voltage regulator section for the V+ and V- supply lines. Two voltage regulators provide both positive and negative voltage regulation. Even then, I still recommend using a regulated power supply to feed voltages to the SC-1 Mic Preamp.... Something like my PSU-2448mk2 Power Supply Kit. (shameless plug!)



Voltage Regulator Section



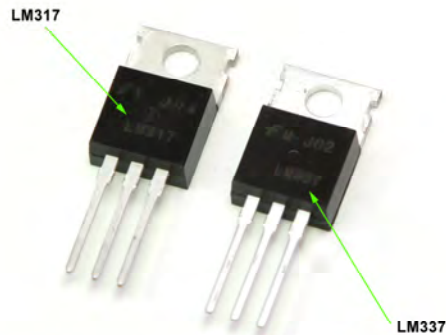
POSITIVE VOLTAGE V+ ADJUSTMENT

The top trimmer is used for adjusting the V+ voltage. Turn the screw to adjust the voltage up or down. We want a reading of +18Volts on the V+ test point. (See photo above.)

NEGATIVE VOLTAGE V- ADJUSTMENT

The bottom trimmer is used for adjusting the V- voltage. Turn the screw to adjust the voltage up or down. We want a reading of -18Volts on the V- test point. (See photo above.)

IMPORTANT: The (2) regulators included in the zip bag are DIFFERENT. One is an LM317 (Positive) and the other is an LM337 (Negative) regulator. DO NOT INTERCHANGE THE TWO REGULATORS!



SC-1 Parts Kit

I've taken the time to individually package and label every component used in the kit. Just read the part # printed on the zip bag.

Some bags will contain 2, 3 or 5 different components. Other bags will contain just one part#. I want you to be able to build this kit, without sorting through hundreds of parts and not knowing what to do. This will save you a lot of time, and headaches!

Some of you may not even have a multimeter (buy one, okay?) so I'm assuming even if you don't have one, or don't know how to use one, you'd still be able to figure out which is the 680-ohm resistor from the 6K8 resistor. It's all labeled! See sample photo below.



Assembly and Soldering Tips

Use a clean soldering iron tip. Heat the component lead and PCB pad, then apply the solder to the component lead while heating both with your iron. Do not apply the solder only to the iron.

Do not remove all the parts from the zip bags until you are ready to solder them. I've taken the time to sort them out; do not make a big unsorted pile out of them.

The holes on the PCB are plated through. This is also a double-sided PCB. Solder needs to make good contact inside the holes and on both sides of the PCB. Check that some solder flowed on the other side of the PCB, or that the holes are completely filled.

Be careful that you do not solder resistors in the wrong locations. For example: The resistors near the Grayhill switch are the gain staging resistors. It is important not to swap the locations of any of these resistors. Otherwise, your gain steps will be out of order depending on which resistors you swapped locations with each other... For Example: 6dB, 12dB, **24dB**, **18dB**, 30dB The resistors for the 18dB and 24dB were swapped with each other in this example.

Note the orientation of diodes, and electrolytic capacitors. There is only one correct way to mount them. Do NOT mount electrolytic capacitors backwards.

When soldering multiple-pin devices (like IC sockets, jumper pins, Grayhill switches, DPDT Switches, Pots) solder one leg/pin first. Then check if the device is still flushed to the board, straight and not crooked. If crooked, re-heat the leg and straighten with your fingers while the solder is still soft/melted. (DO NOT STRAIGHTEN THE PINS AFTER THE SOLDER BECOMES HARD. You'd risk ruining the PCB or breaking the part.)

I sometimes use masking tape to hold the component in place on the board, while I solder the leads on the other side. This is very useful when soldering resistors, inductors, jumper connectors, IC sockets, small parts, etc...

SC-1mk3 Microphone Preamp Kit

Use a magnifying glass when soldering. This prevents you from using too much solder and let's you see what you're doing. Also, the Grayhill switch has very fine pin spacing. You need good eyesight to solder all pins properly without shorting them together.

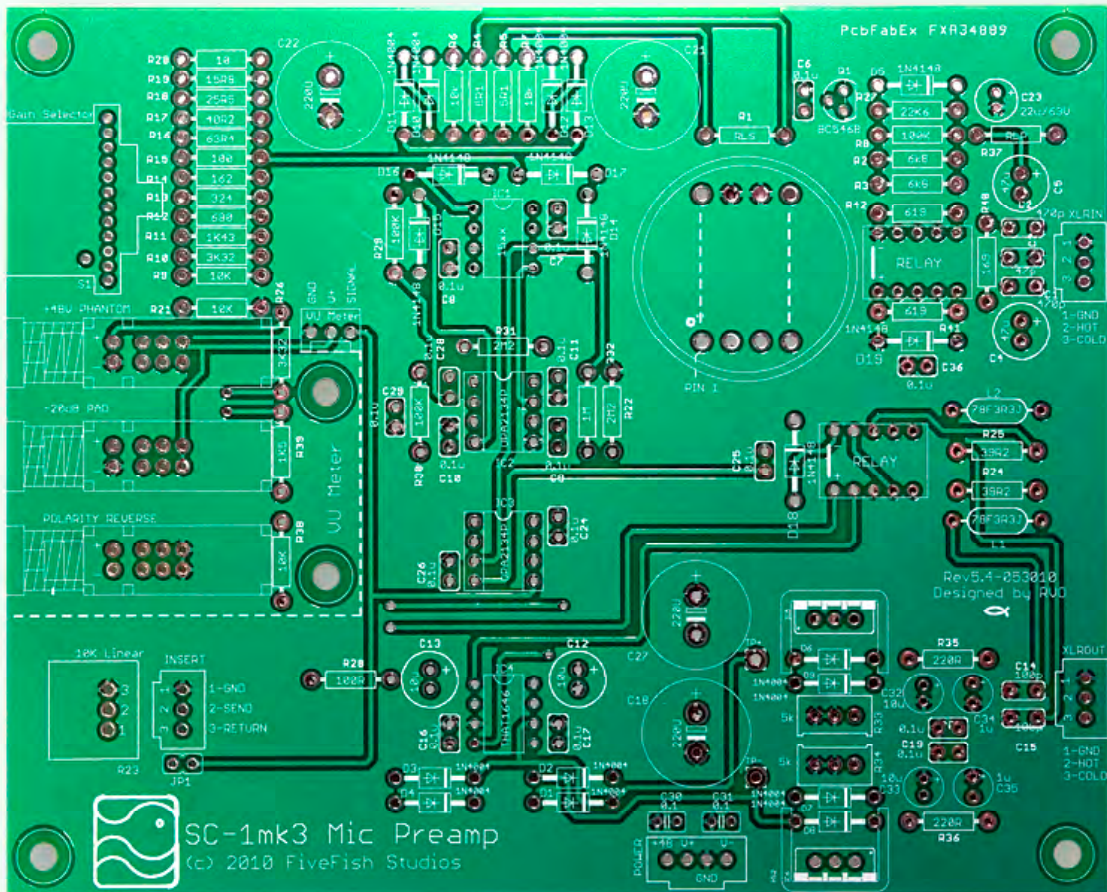
SC-1 Assembly Guide

The general guideline in electronics assembly is solder the smallest/shortest component first (resistors, diodes, inductors), and solder the bigger/taller components last (ceramic capacitors, electrolytic capacitors, switches, etc).

The last step is inserting the IC chips, wiring and voltage adjustments and testing.

So are you ready?

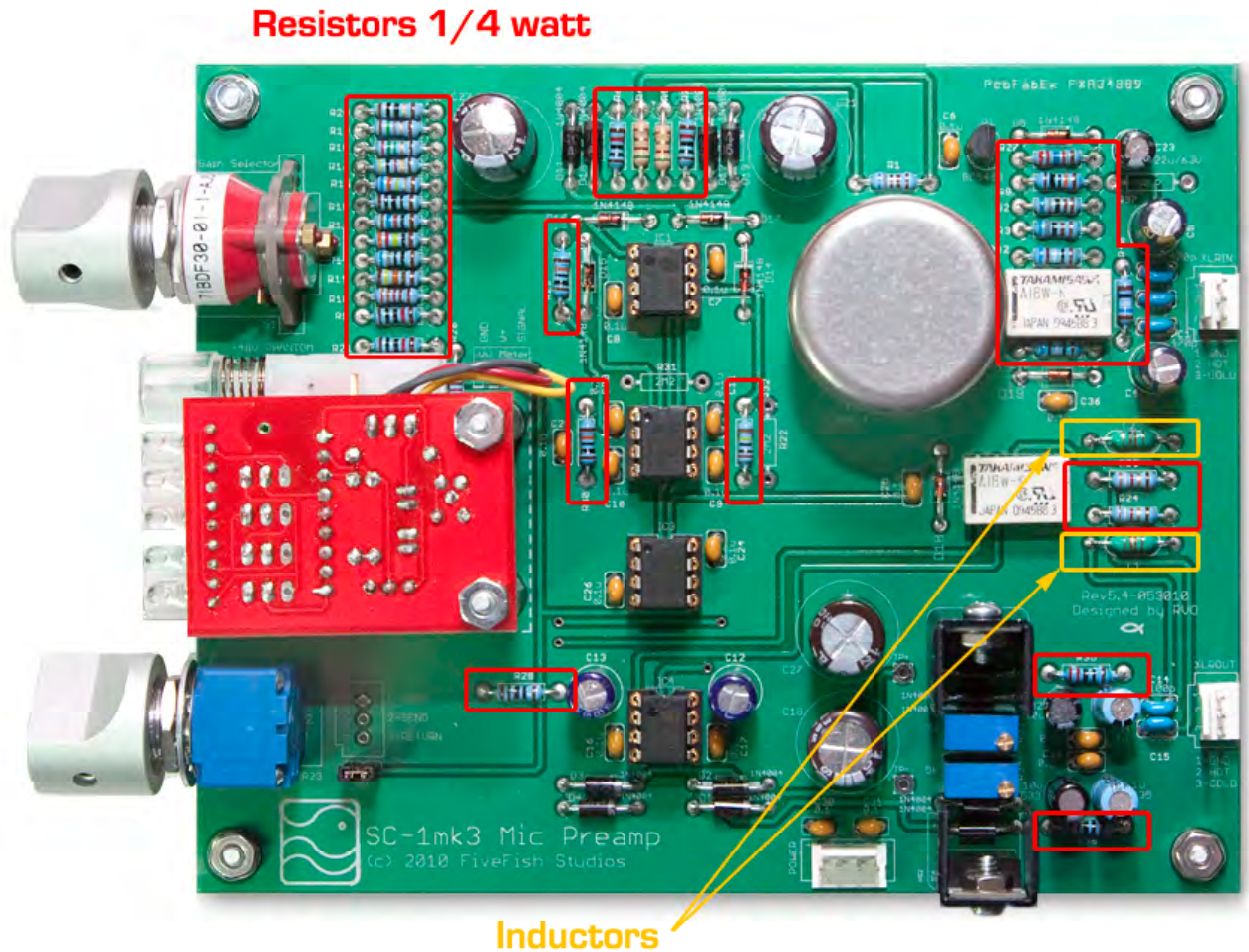
We'll be making this plain piece of fiberglass and copper board into something more useful... like a mic preamp!



SC-1mk3 Microphone Preamp Kit

For your convenience, you can follow this checklist during assembly.

STEP 1. Solder all 1/4-watt resistors and the (2) inductors to the PCB. The orientation does not matter.



ASSEMBLY TIPS:

OPTION 1: You can insert each resistor into the board, then bend the legs outward so it doesn't fall off the board (when you turn the board upside down). After all resistors have been inserted, turn the board over and start soldering the leads. Cut the leads when you're done soldering.

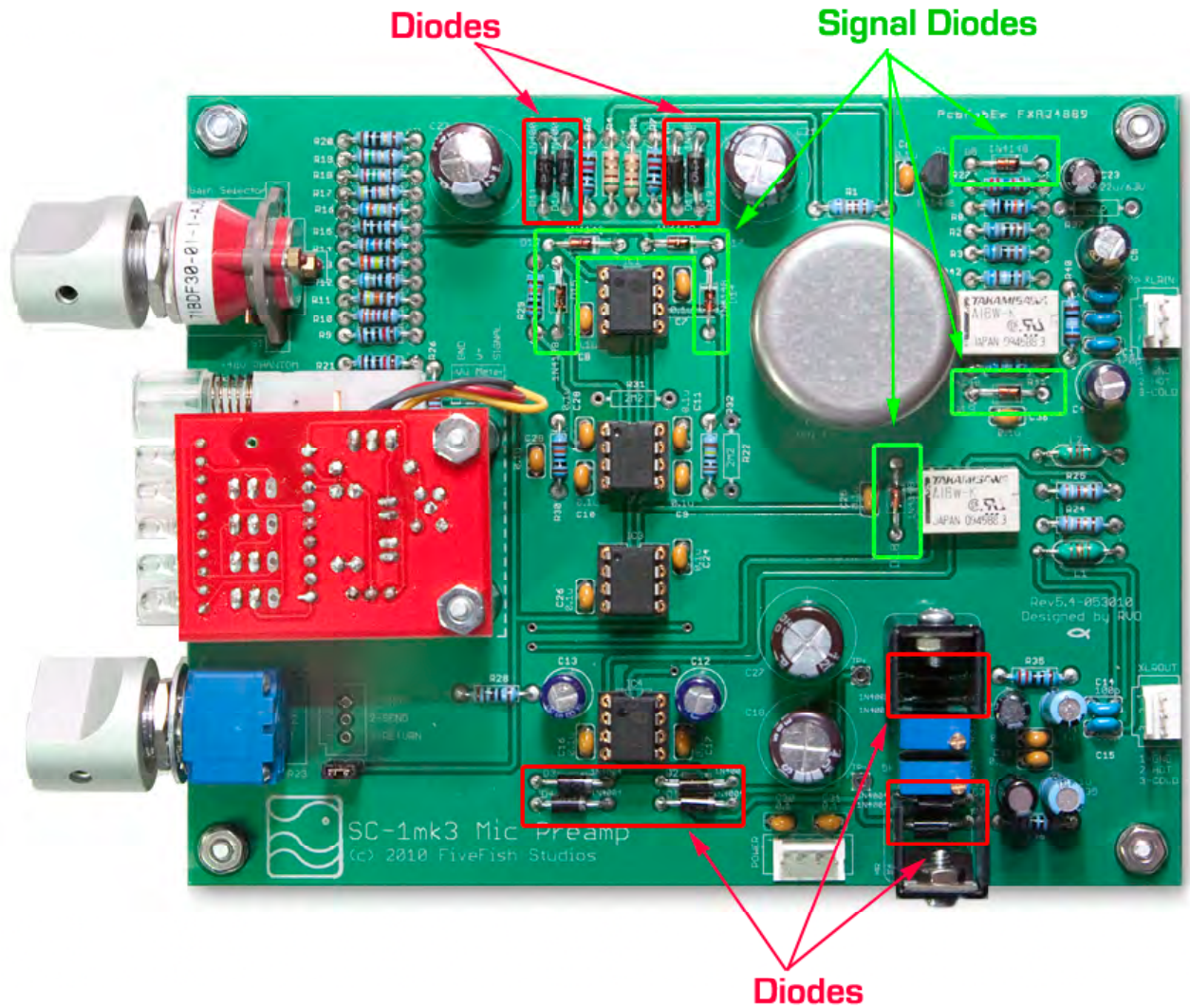
OPTION 2: Some people solder the component leads on the top side first, then they turn the board over, cut the leads, then solder the bottom side. You just have to be more careful if you'll be doing this method. You are more likely to burn some component bodies if your hot soldering iron touched any of the resistor bodies.

How do factories do it? They insert all resistors into the board (either using a pick-and-place machine, or manual labor). They keep the leads straight down (and don't bend them outwards). Then they feed the board to a machine that cut the leads at just the right length. Then the board passes slowly over molten solder, in a wave soldering machine.

SC-1mk3 Microphone Preamp Kit

STEP 2. Solder all signal diodes and general purpose diodes to the PCB.

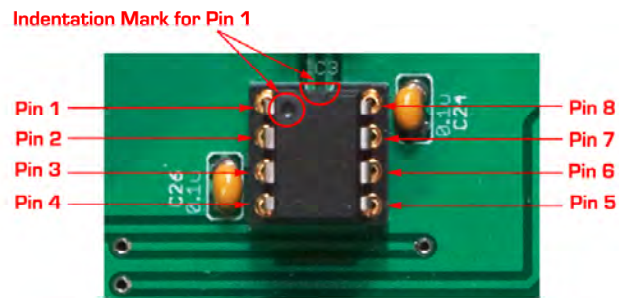
Note the orientation of the diodes. Don't forget to solder the signal diodes located near each relay (white box component shown below).



ASSEMBLY TIP: Follow the orientation of the diode as printed on the PCB silkscreen legend. The “white bands” or “black bands” of the diodes are either pointing UP or facing to the RIGHT.

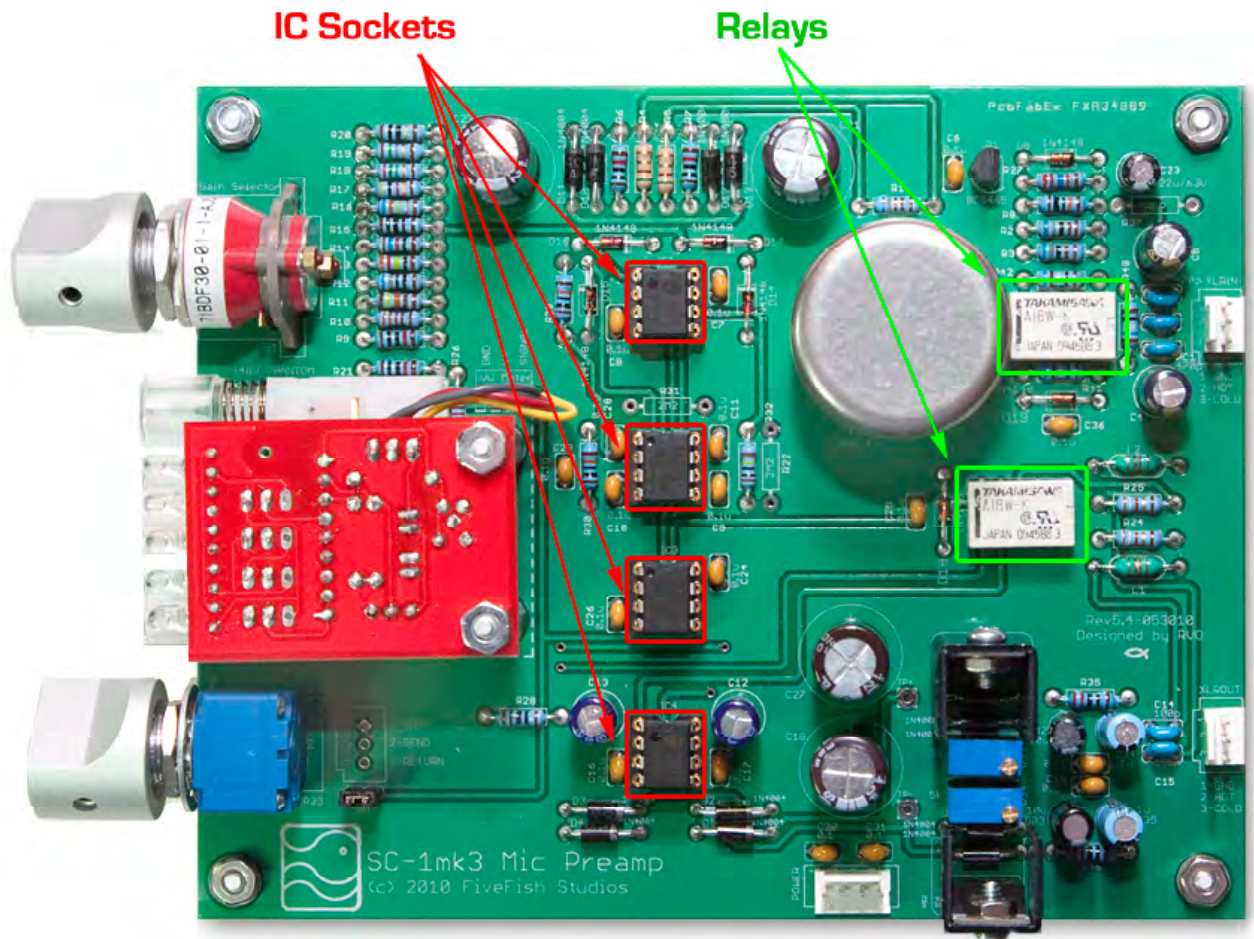
SC-1mk3 Microphone Preamp Kit

STEP 3: Solder all IC sockets and Relays to the PCB. Make sure to mount all IC sockets in the correct orientation - notch on top. (This will serve as a reminder later on how the IC chips should be inserted.)



ASSEMBLY TIP: Use masking tape to hold the IC sockets in place while soldering. Solder the opposite ends of the IC sockets first, before soldering the rest of the pins.

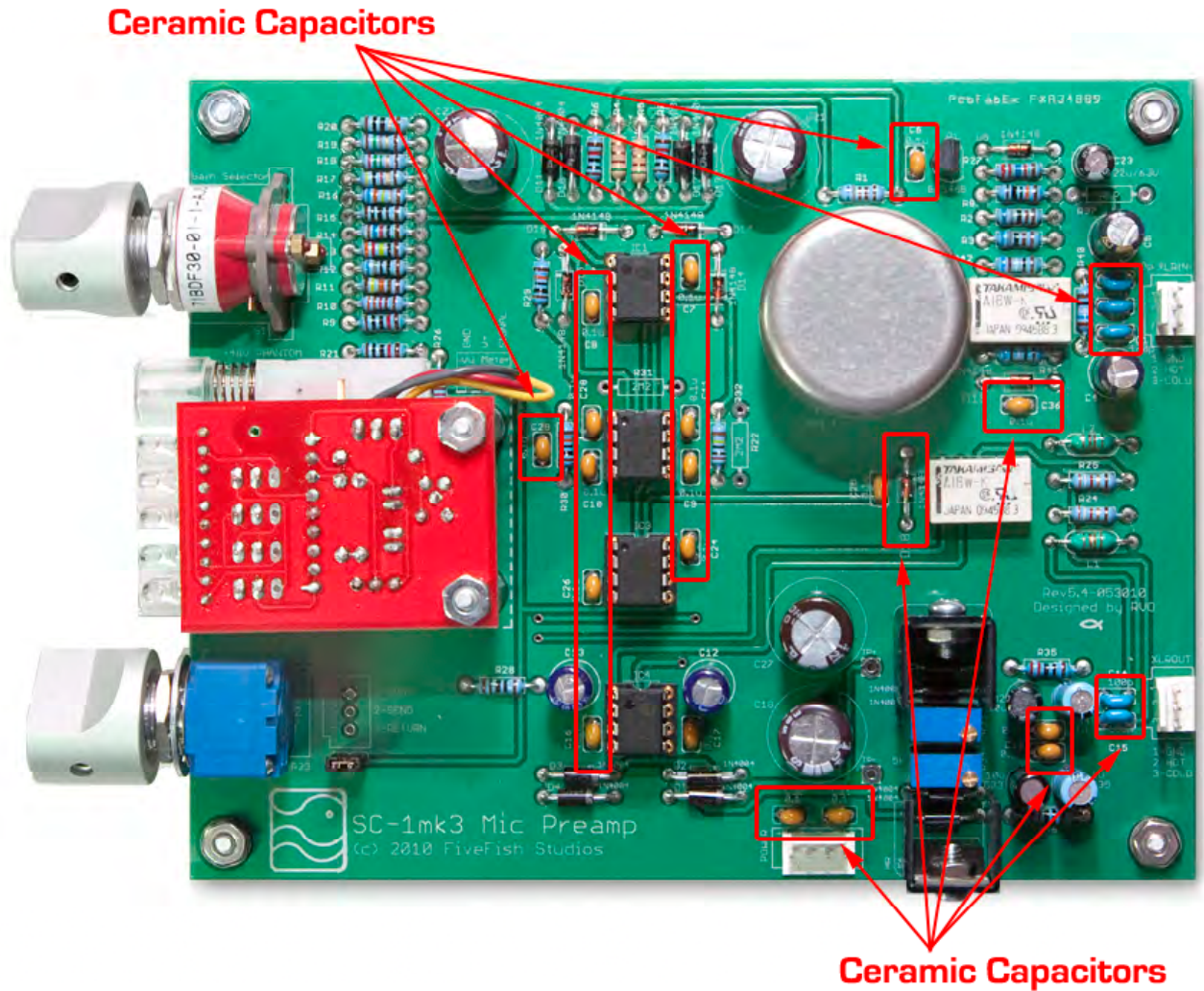
DO NOT INSERT YET THE (4) IC CHIPS INTO THEIR IC SOCKETS. We'll do this later after we've verified voltages and perform some preliminary adjustments.



Also make sure the Relay is oriented in the correct direction. Orient the "line marking" of the relays with the printed silkscreen on the board.

SC-1mk3 Microphone Preamp Kit

STEP 4: Solder all ceramic capacitors to the PCB. These are the yellow and blue capacitors. The orientation does not matter.



ASSEMBLY TIP: Push the blue capacitors down until they “snap” to the PCB.

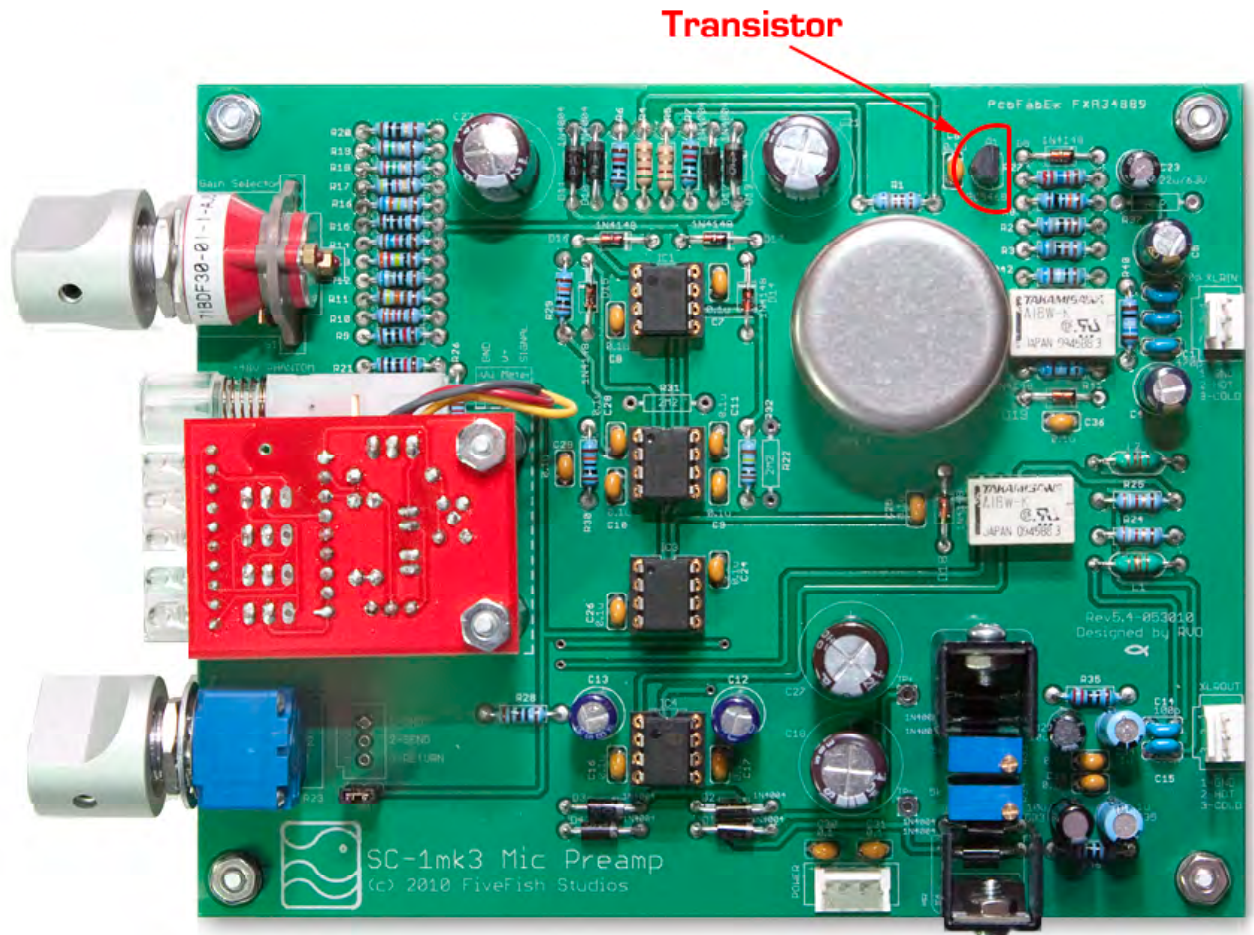
Try to mount all ceramic capacitors as close as possible to the PCB.

SC-1mk3 Microphone Preamp Kit

STEP 5: Solder the Transistor.

Note orientation of transistor. The flat side should be facing to the right.

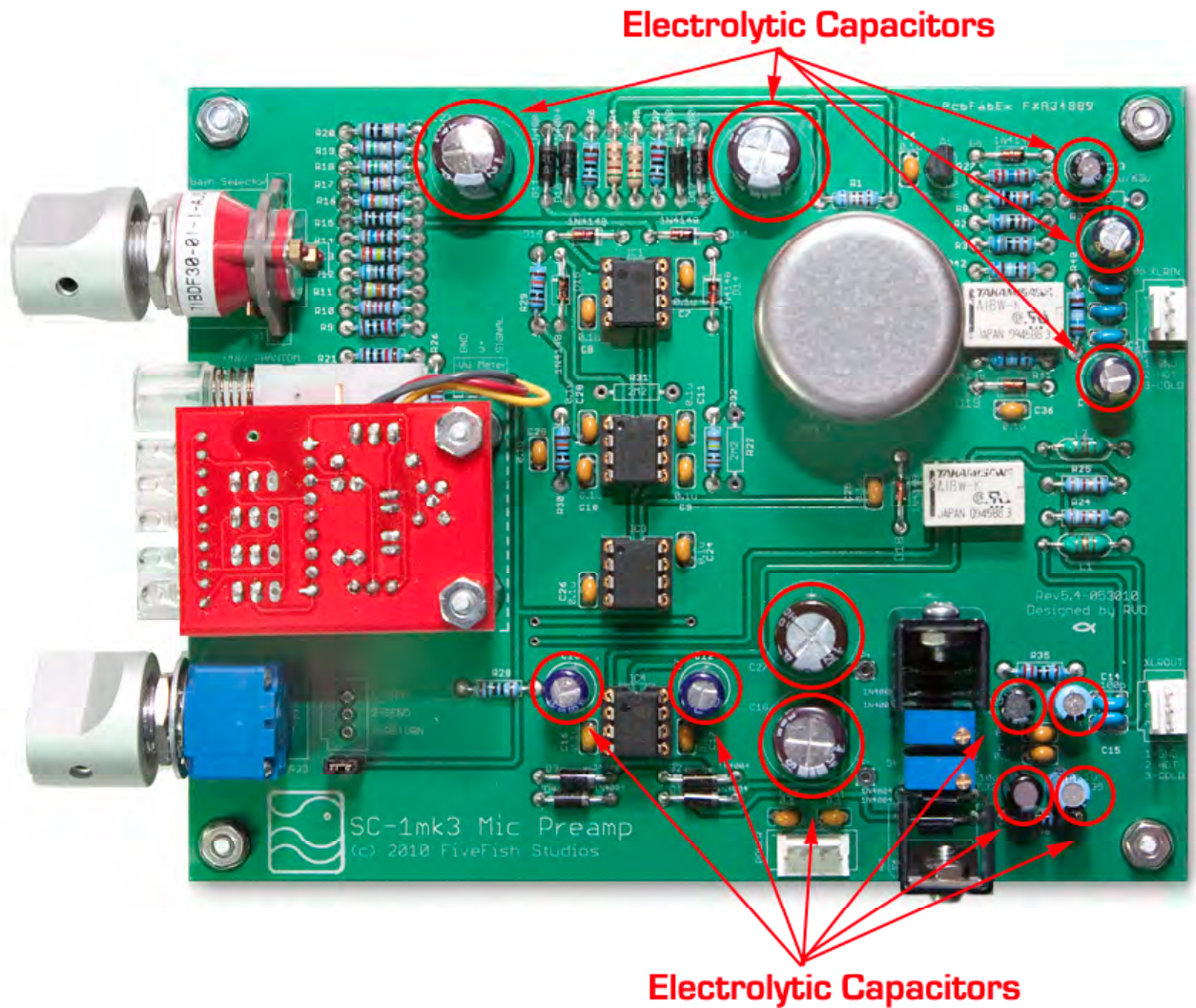
You'll need to bend the middle leg backwards to go through the hole.



ASSEMBLY TIP: Be quick soldering the transistor. Too much heat may damage the transistor.

SC-1mk3 Microphone Preamp Kit

STEP 6: Solder all electrolytic capacitors. Note that Electrolytic Capacitors are polarized components with a positive (+) and negative (-) terminal.

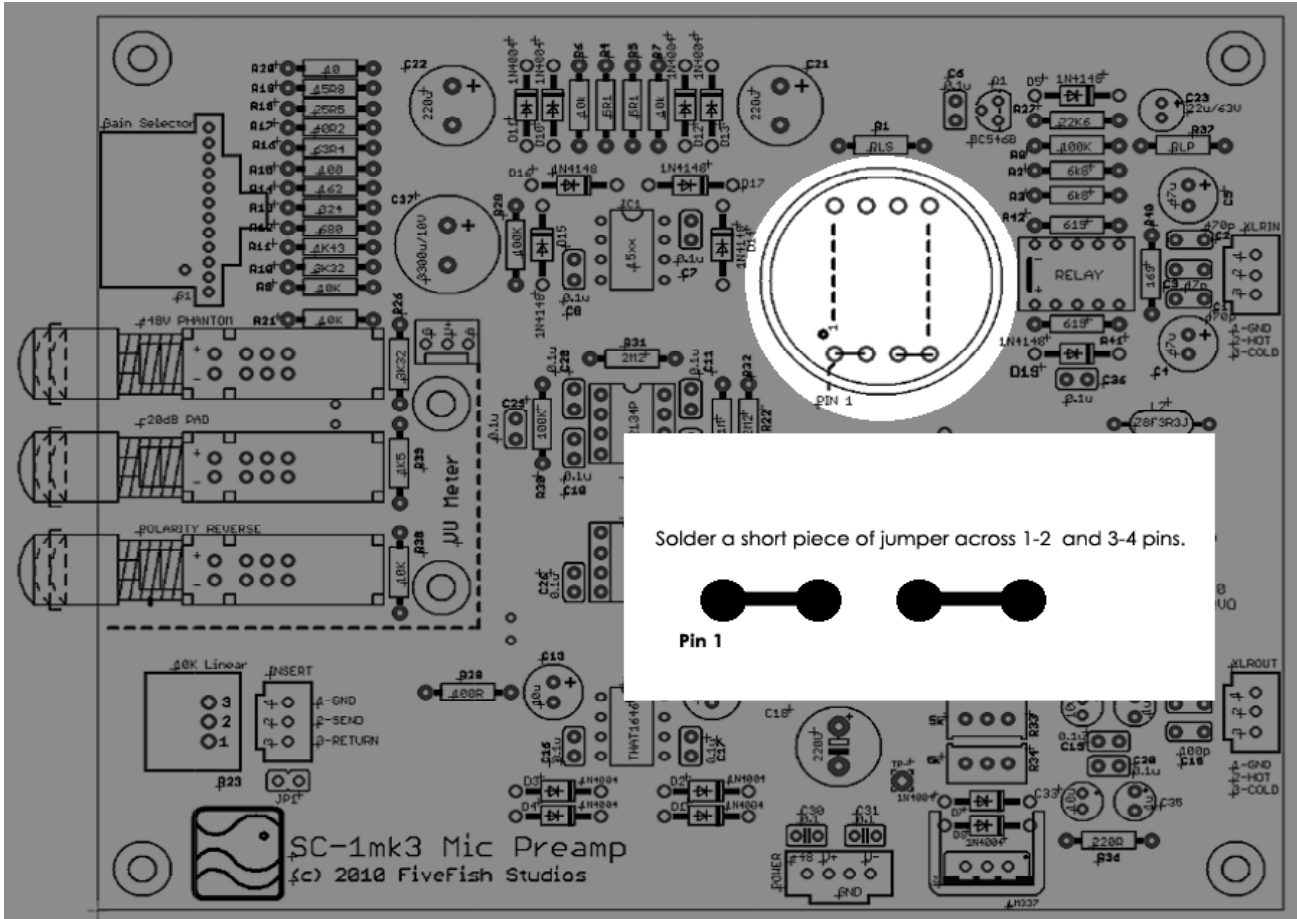


ASSEMBLY TIP: Note the orientation of the (-) and (+) legs. All (-) Negative legs of the capacitors are pointing downwards. Follow the silkscreen legend on the PCB. The silkscreen marks where the positive (+) terminal should go (i.e. the unmarked lead).

SC-1mk3 Mic Preamp ERRATA

Solder a jumper across C37, 3300u/10V capacitor location.

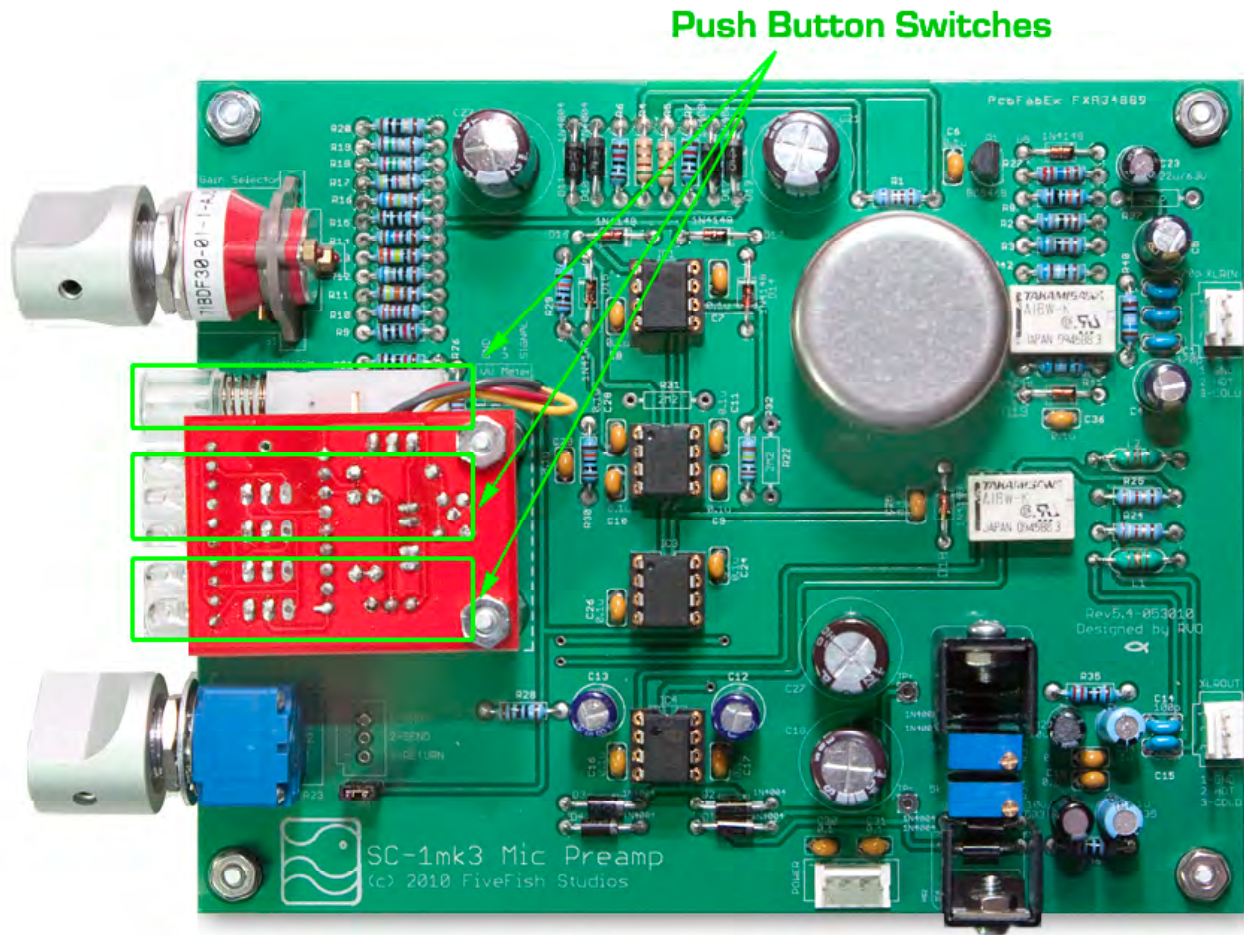
If you're installing an Input Transformer with your SC-1mk3 Mic Preamp, please short the pins 1-2 and 3-4 shown below using a small jumper wire (soldered at bottom of PCB).



SC-1mk3 Microphone Preamp Kit

STEP 7: Solder the headers. After soldering the headers, insert the shorting jumper.

STEP 8: Solder the (3) Push button switches. This switch have 8 legs. They are designed to “snap-in” to the holes in the PCB. Push firmly down until you hear it snap-in.



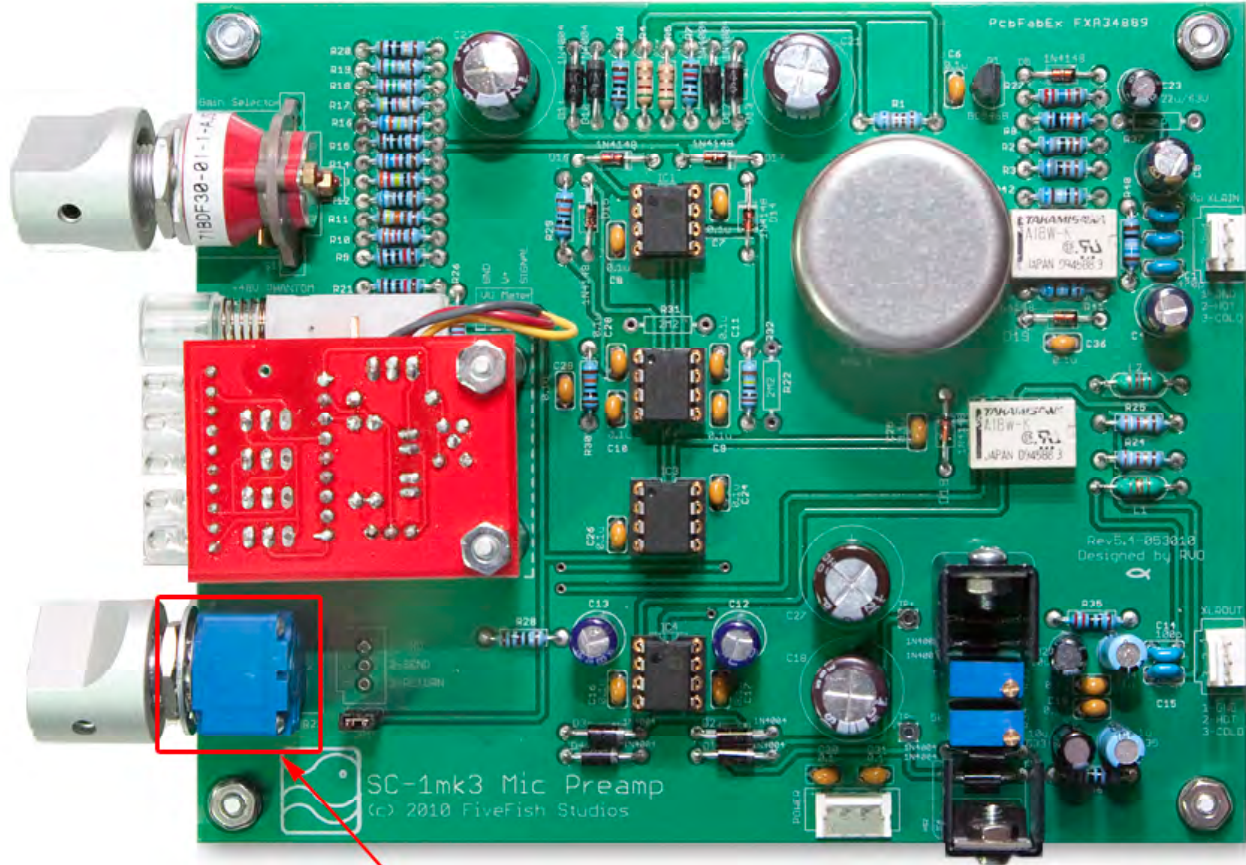
ASSEMBLY TIP: Make sure all (8) legs of the switch are aligned with the (8) holes on the PCB. Gently rock the switch back and forth while gently pushing down the switch body.

Install the switch plastic caps before you mount the switch to the PCB. It's just easier if you do it beforehand.



SC-1mk3 Microphone Preamp Kit

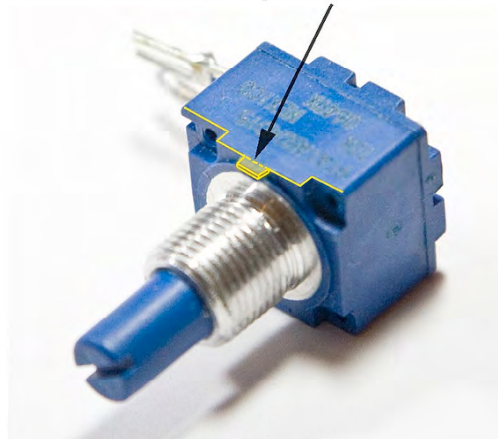
STEP 9: Solder the Bourns potentiometer. Solder the middle leg first, check alignment, and then solder the 2 outer legs.



“Jason” Bourns Potentiometer

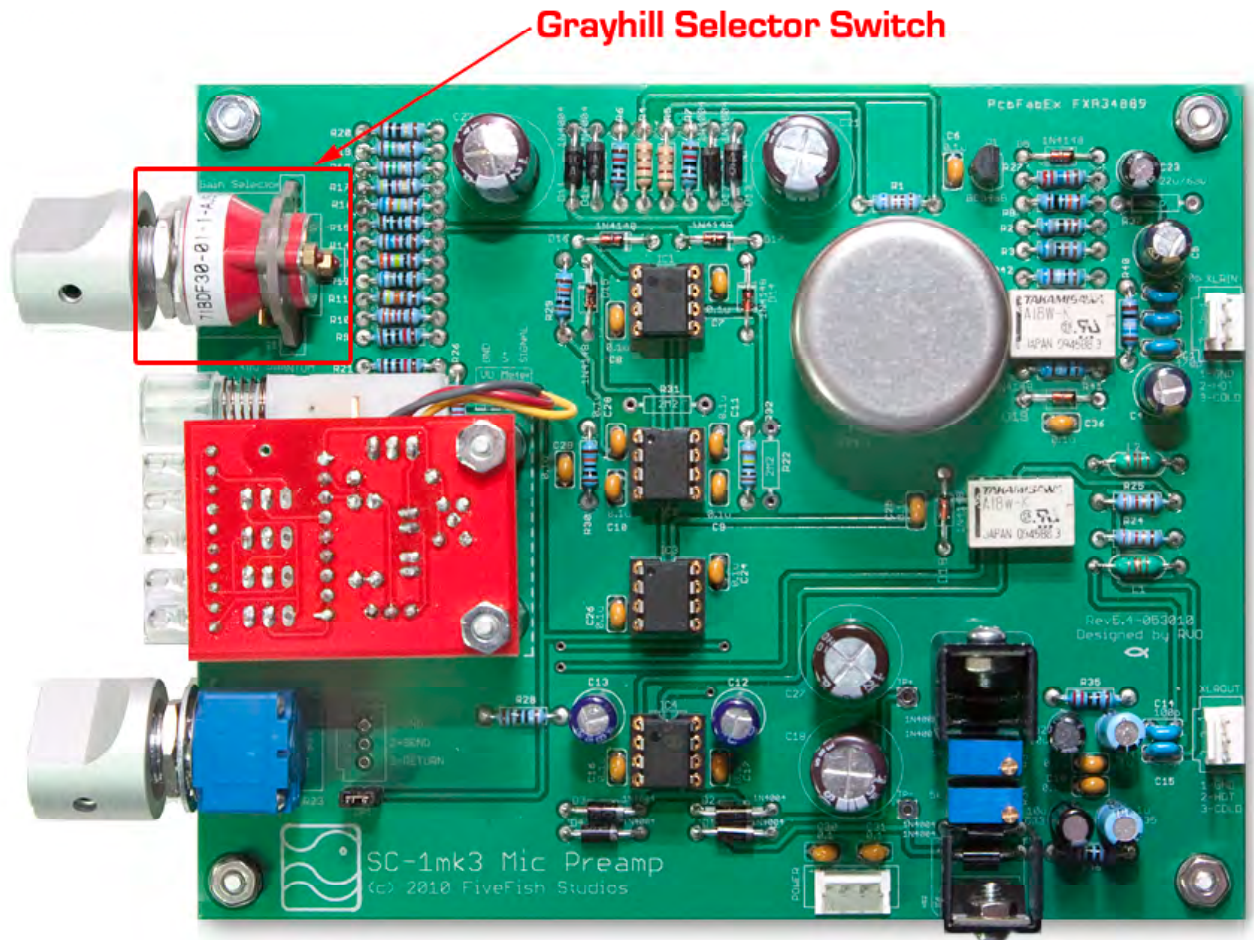
IMPORTANT: Make sure you cut/snip the tab located on side of the blue potentiometer. You can use a cutter for this. Cutting this tab will make the potentiometer align straight and perpendicular to the Front Panel as you tighten the potentiometer’s nut.

Cut this tab on the potentiometer

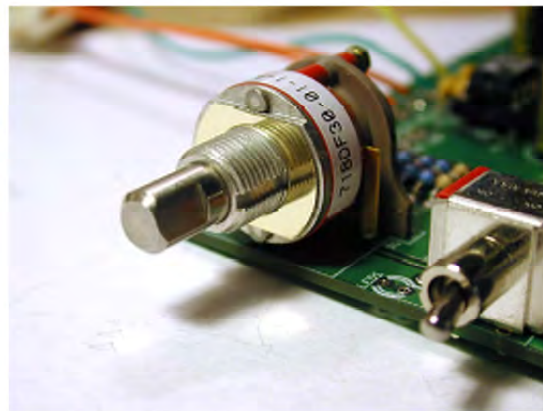


SC-1mk3 Microphone Preamp Kit

STEP 10: Solder the Grayhill selector switch. You may need a magnifying glass to make this work easy and accurate. The pins are very close together and you don't want to short these pins... otherwise, your gain dB steps will be all wrong.



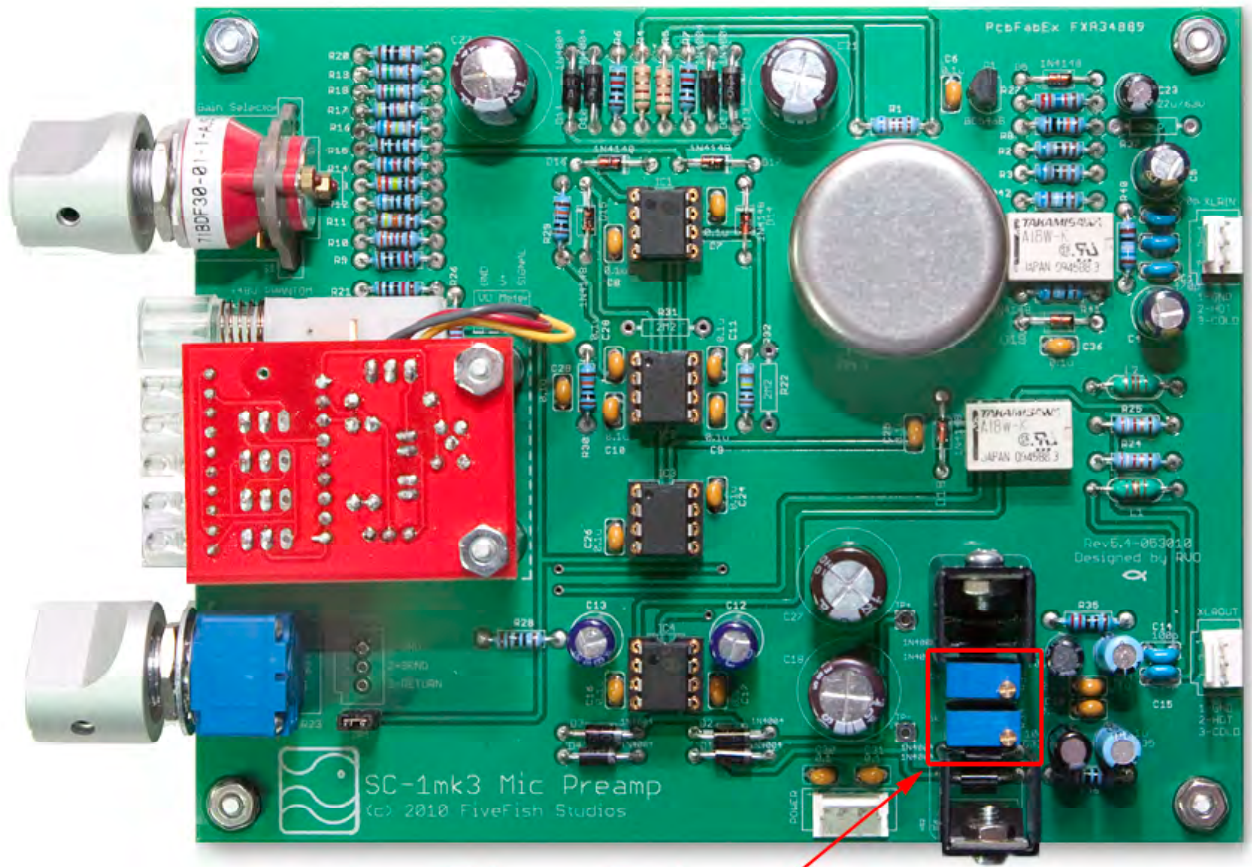
The Grayhill switch comes with a metal stop pin rod, and a sticker. Use tweezers to insert this pin at the 12:00 position hole as shown in the photo below. Use the head of a flat-screwdriver on it's side to press the pin inside the hole until it is flush. Then put the sticker over it. If you lost the included stop pins, don't worry. Just use some cut leads from a resistor.



2. Make sure the switch is mounted flushed and flat to the board. Make sure it's also parallel to the board. Solder one pin first, check alignment before soldering the rest of the pins. (DO NOT STRAIGHTEN THE COMPONENT AFTER THE SOLDER BECOMES HARD. You'd risk ruining the PCB or breaking the part.)

SC-1mk3 Microphone Preamp Kit

STEP 11: Solder the two (2) adjustable trimmer resistors.

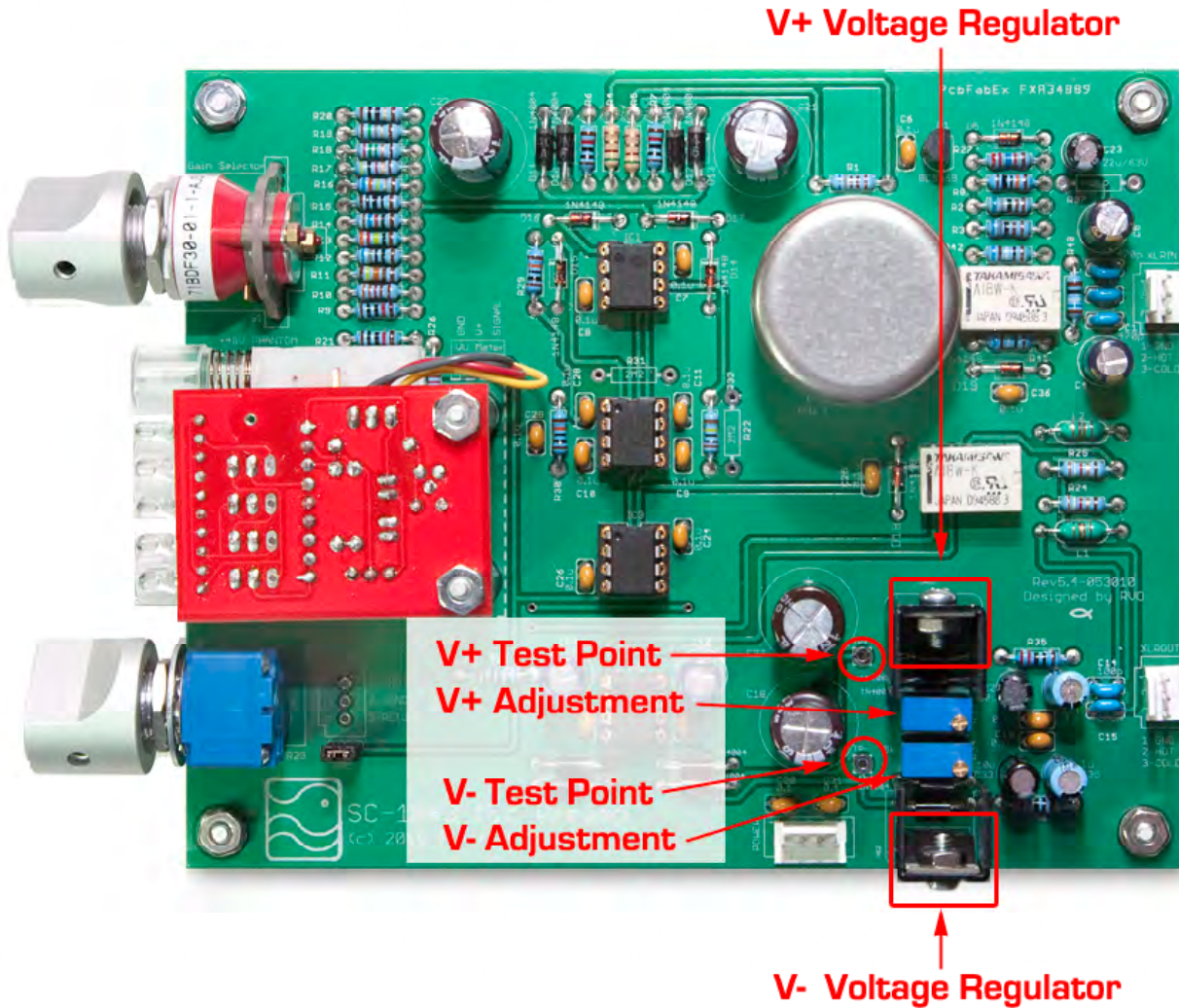


Trimmer Resistors

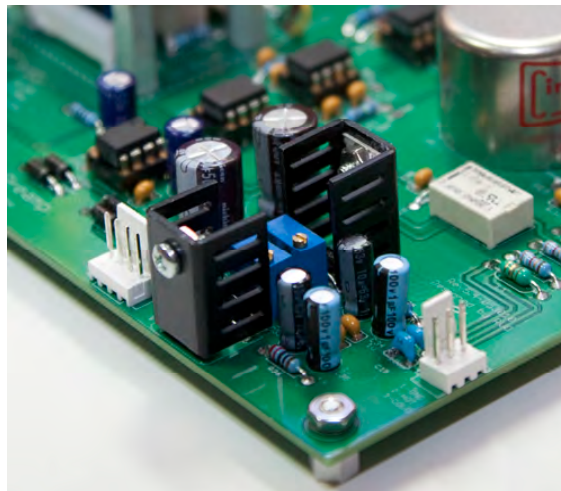
SC-1mk3 Microphone Preamp Kit

STEP 12: Solder the two (2) TO-220 regulators.

IMPORTANT: One of the regulator is an LM317 (V+ Positive) and the other regulator is an LM337 (V- Negative). DO NOT INTERCHANGE THE TWO. Follow the locations on the PCB on where you should solder the (V+) LM317 and (V-) LM337.



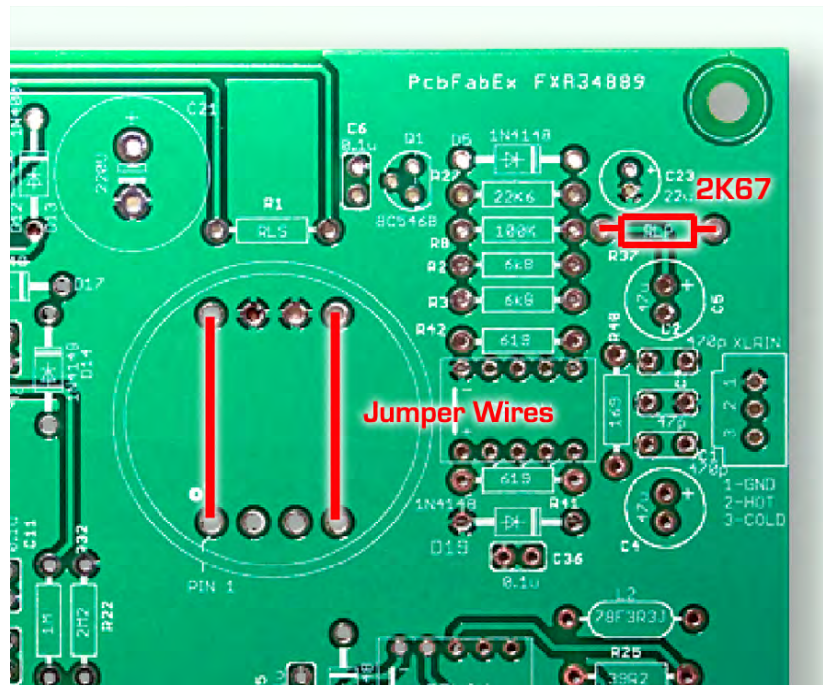
Assembly Tip: You may want to install the heatsinks to the regulators first before soldering the regulator to make the job easier.



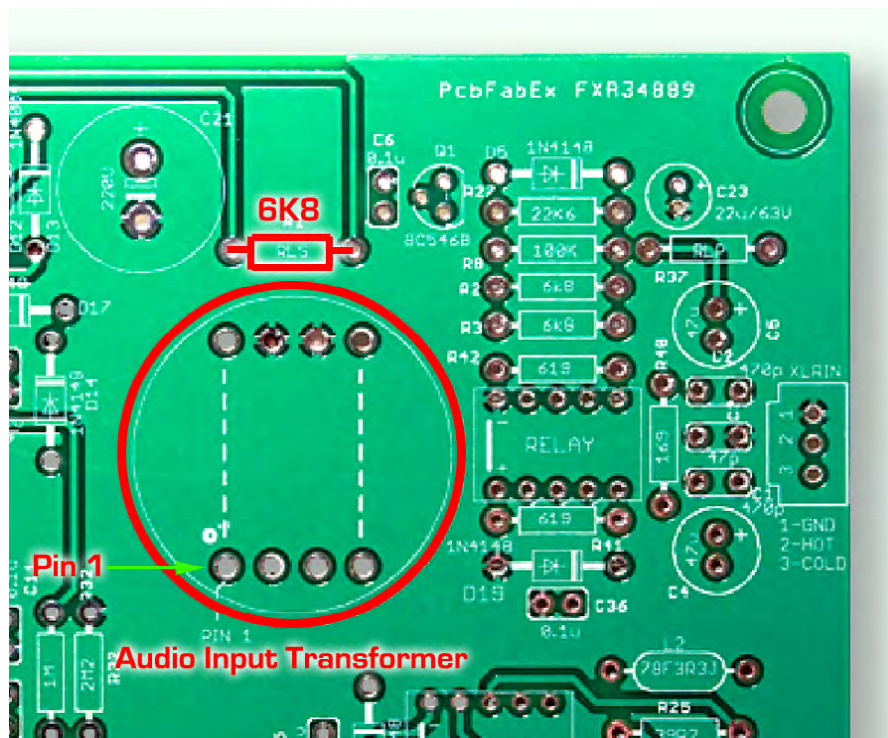
SC-1mk3 Microphone Preamp Kit

STEP 13: The Input Transformer is OPTIONAL. It is not required for normal operation. But it gives additional “sound flavor” to the preamp. If you prefer a clean/neutral/clear/fast sounding preamp, you can omit the use of the Input Transformer.

NO TRANSFORMER: If you are NOT using an Input Transformer, solder a 2K67 resistor in the RLS location. Also, make sure to jumper the terminals as shown in this photo.



WITH TRANSFORMER: If you are USING an Input Transformer, solder a 6K8 resistor in the RLS location. Make sure to orient the transformer so the Pin 1 (dot) marking on the transformer aligns with the Pin 1 silkscreen on the PCB.



SC-1mk3 Microphone Preamp Kit

Photo of SC-1mk3 Preamp with optional Input Transformer installed. Note orientation of Transformer.



ASSEMBLY TIP: Do NOT use too much solder when soldering the audio transformer pins. Use just enough.

If you use too much solder, it's possible the solder will flow through the holes, overspill out on top and create a bridge short circuit between the metal can of the transformer and the PCB solder pads. If you accidentally created a short, you'll notice the sound is faint (or no sound at all) during testing of your preamp.

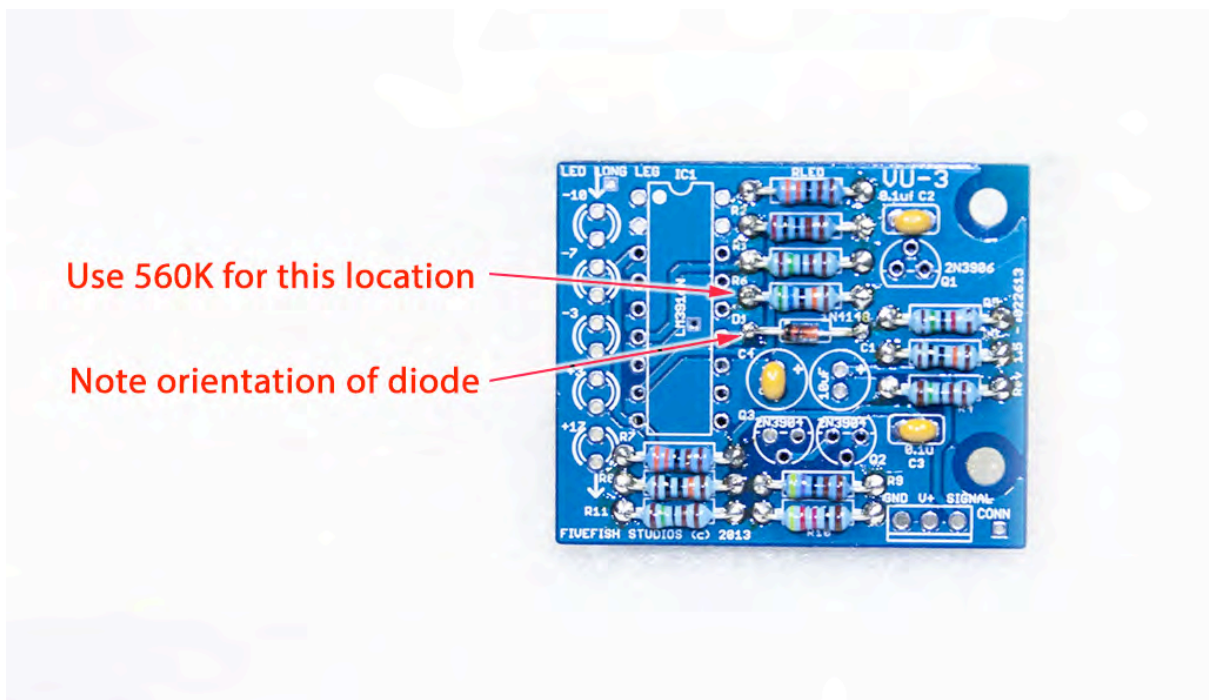
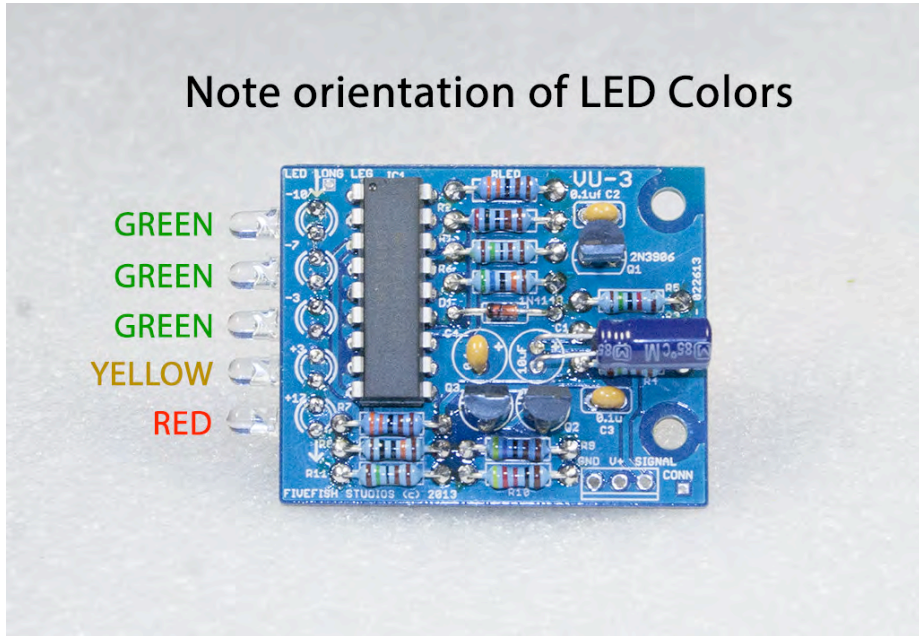
You may want to insert a piece of paper (folded to create a 2 or 3 layer) between the transformer and PCB when soldering the transformer. This will give the transformer a few millimeter height clearance above the PCB. This also lessens the possibility of the solder pads and metal can creating a short circuit.

IMPORTANT: If you have the BLUE VU Meter Board, as shown below.... please follow this guide! VU Meter board is installed right side up, components facing up.

STEP 14: Build the VU Meter Module. Follow the silkscreen layout on the VU meter PCB and insert the components into its right location. Start with the resistors and diodes, followed by the LEDs, ceramic capacitor, electrolytic capacitors, then the IC socket.

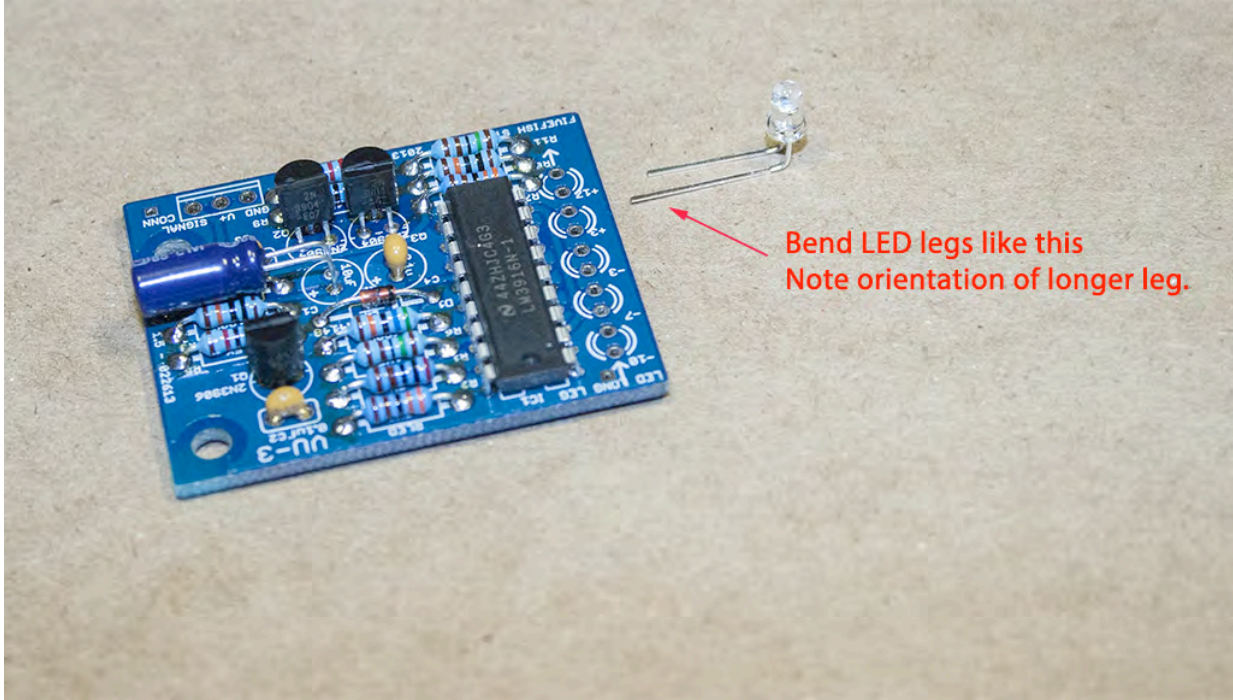
Arrange LED colors as shown on photo below.

IMPORTANT! If you are using the FiveFish Studios Rack (or Budget Front Panel), install the LEDs from the underside of the PCB. -- See photo below.

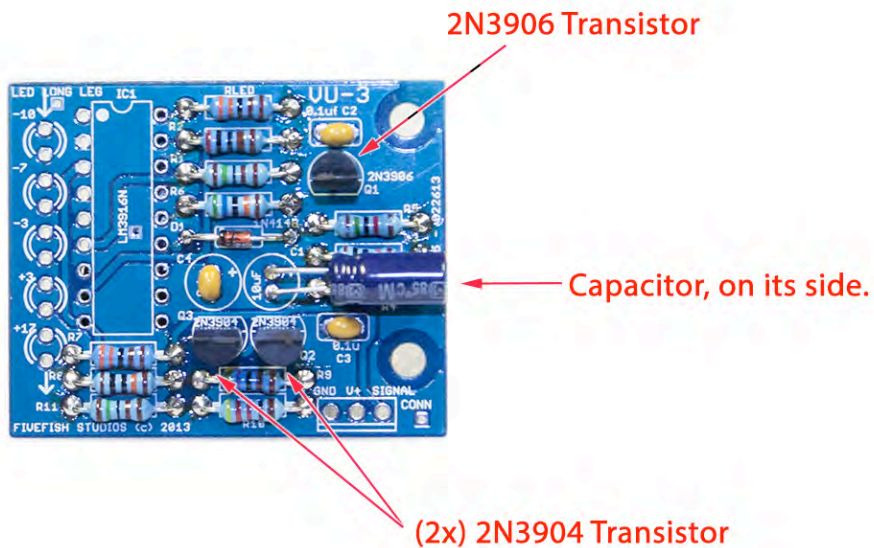


SC-1mk3 Microphone Preamp Kit

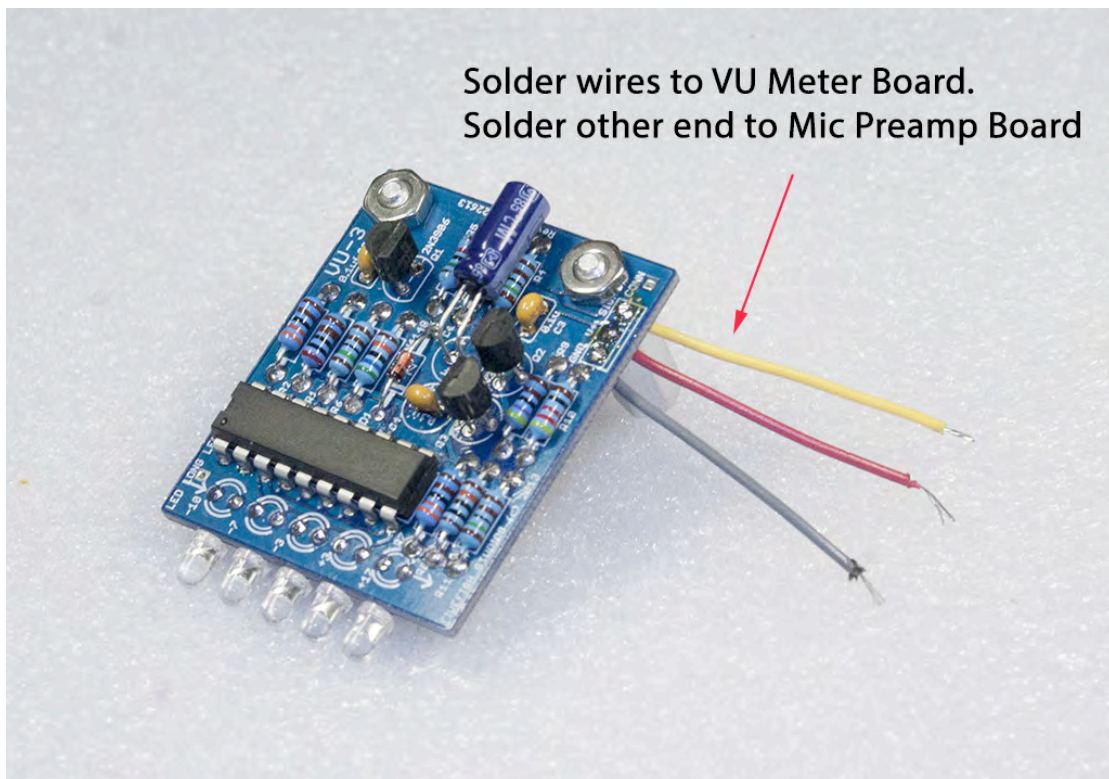
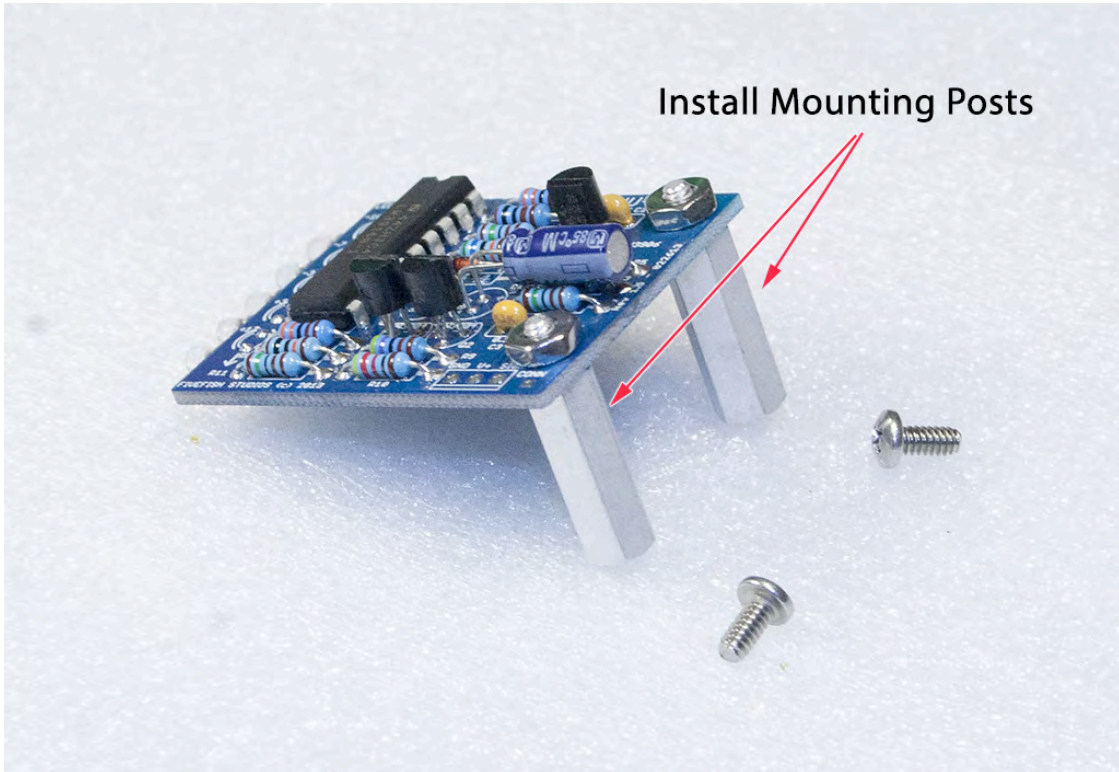
Bend LED legs as shown in the photo below. Note position of LONG leg. This will facilitate insertion of LED from the bottom side of the board.



NOTE: The 10uf capacitor should be installed laying on it's side (see photo), to prevent it from interfering with the switches on the preamp board.



NOTE: VU Meter board is installed right side up, components facing up.



VU Meter Troubleshooting Guide

Well, hopefully you won't need this part.

"Measure twice, cut once"... as they say. Take your time assembling the kit, don't be in a hurry, work carefully and methodically and you won't need this troubleshooting guide

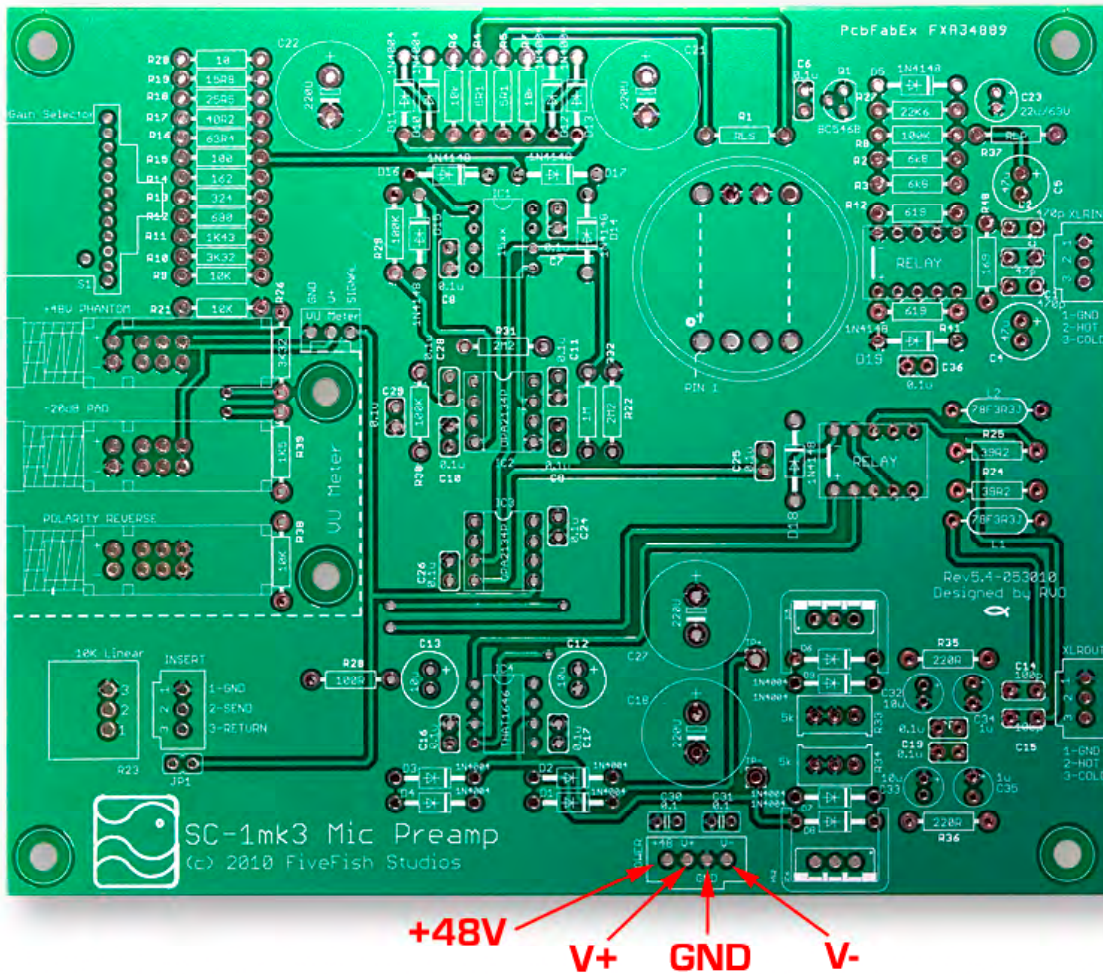
Problem: No lights, no LED movement. VU Meter does not work!

Check if there is power applied to the VU Meter Kit. Check the GND wire is connected.

Check that the LEDs were inserted in the correct orientation. Long leg soldered to the top hole (see photo above).

STEP 15: Solder wires to the +48V, V+, GND, and V- pads. Later on, you will connect these wires to your power supply (i.e. PSU-2448 if you also bought the FiveFish Studios PSU kit). You can use AWG#22 for hookup wires.

All pads are 0.1" pitch on center, so you can also use standard Molex 0.1" headers and connectors with the SC-1mk3 board. (Not included.)

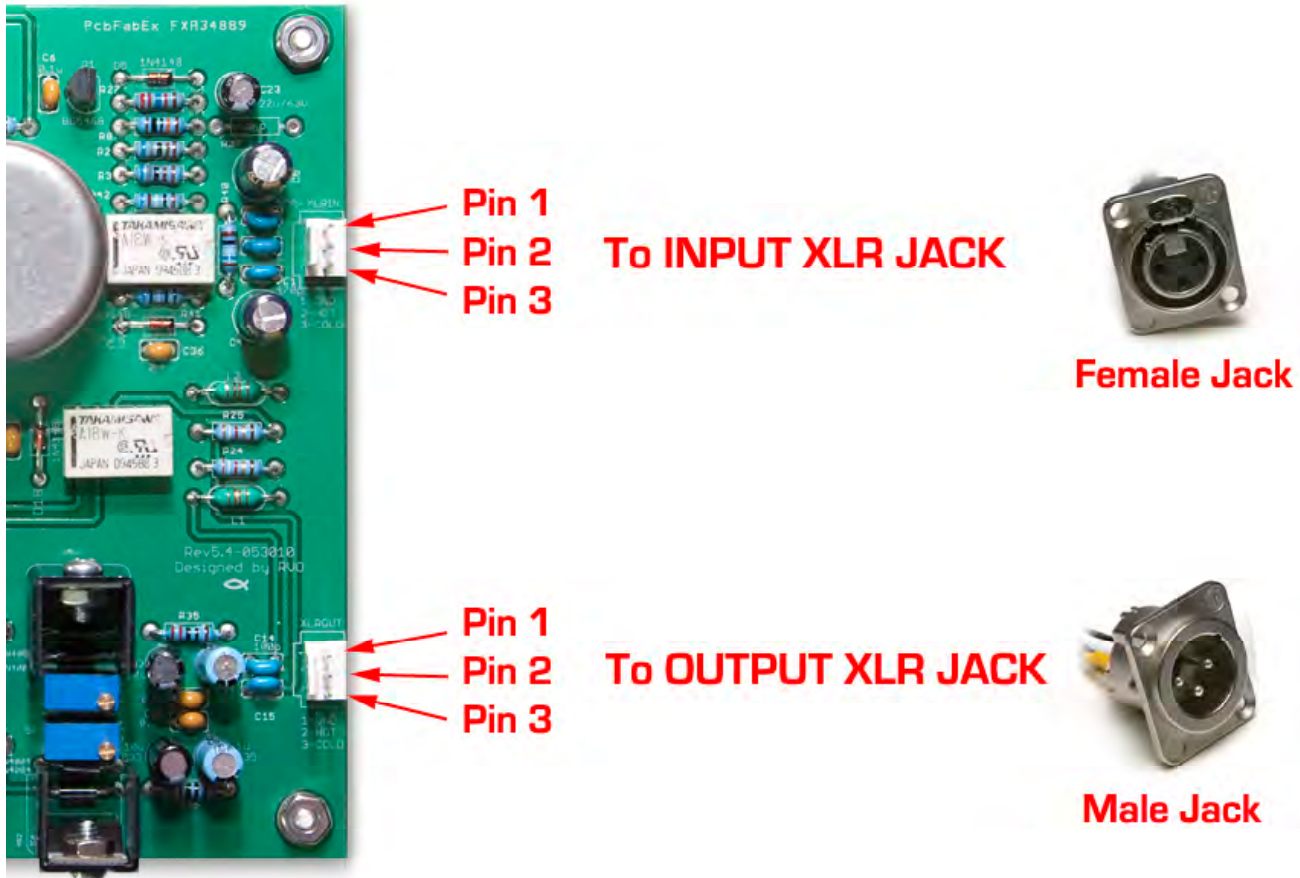


SC-1mk3 Microphone Preamp Kit

STEP 16: Solder wires from the PCB to your XLR jack. Solder pads 1, 2 and 3 to XLR Pins 1, 2 and 3 respectively. Do the same procedure for both the input XLR and output XLR jacks.

All pads are 0.1" pitch on center, so you can use standard Molex 0.1" headers and connectors with the SC-1mk3 board. (Molex headers not included.)

Also, note what the XLR Female and Male jacks look like. Female jacks are for "input" and Male jacks are for "output." - I know what you're thinking. Yes it works in the same fashion.



PAD 1 = XLR Pin 1 = GROUND

PAD 2 = XLR Pin 2 = HOT

PAD 3 = XLR Pin 3 = COLD

STEP 17: Insert the IC chips, IC1, IC2, IC3 and IC4.

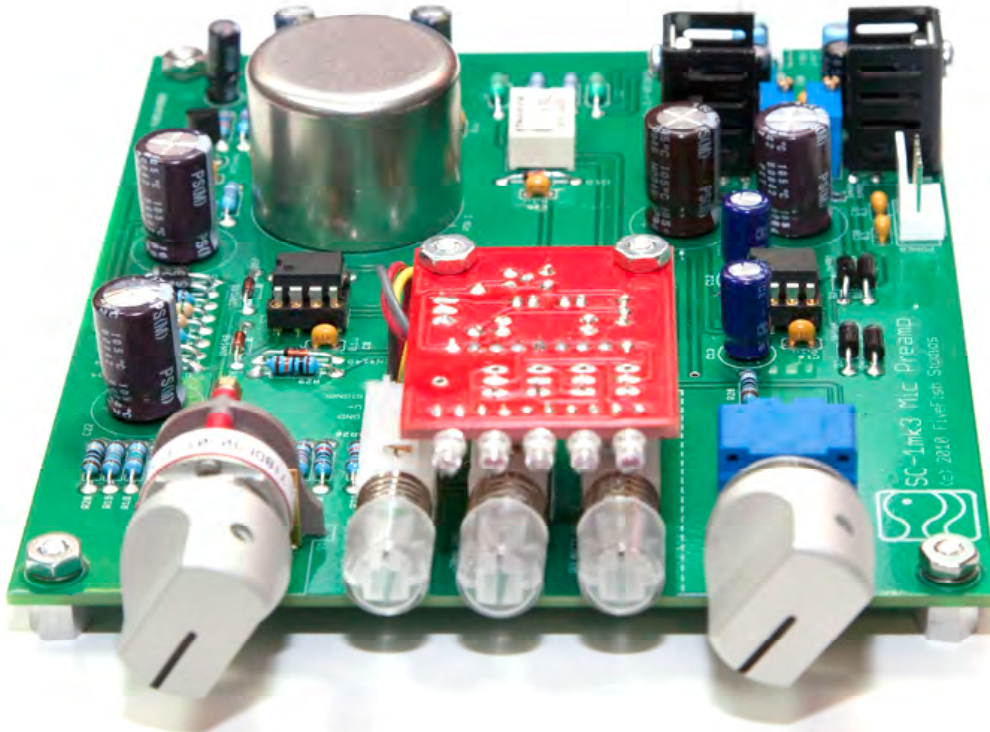
Be careful inserting the chips, and make sure all eight (8) pins go in properly into their respective socket holes. If you have an IC Lead Straightener tool, use it. It will make the job of inserting ICs easier.



ANTI-STATIC WARNING: Ground yourself before handling the chips. Touch a metal gear to discharge any static electricity on your body. Avoid touching the metal pins of the IC chip. If you have a wrist ground strap, use it. Or better yet, use a grounded wrist strap.

Failure to handle the chips properly without the proper anti-static precaution may damage the chips.

PRE-FLIGHT CHECK ADJUSTMENTS:



STEP 1. DO NOT APPLY POWER YET! KEEP POWER OFF.

STEP 2. Review your work. Finished reviewing it? Good.... Now REVIEW IT AGAIN! It's easier and less stressful to review your work now before any "smoke" comes out of it!

To be specific, make sure components are inserted in the right locations.

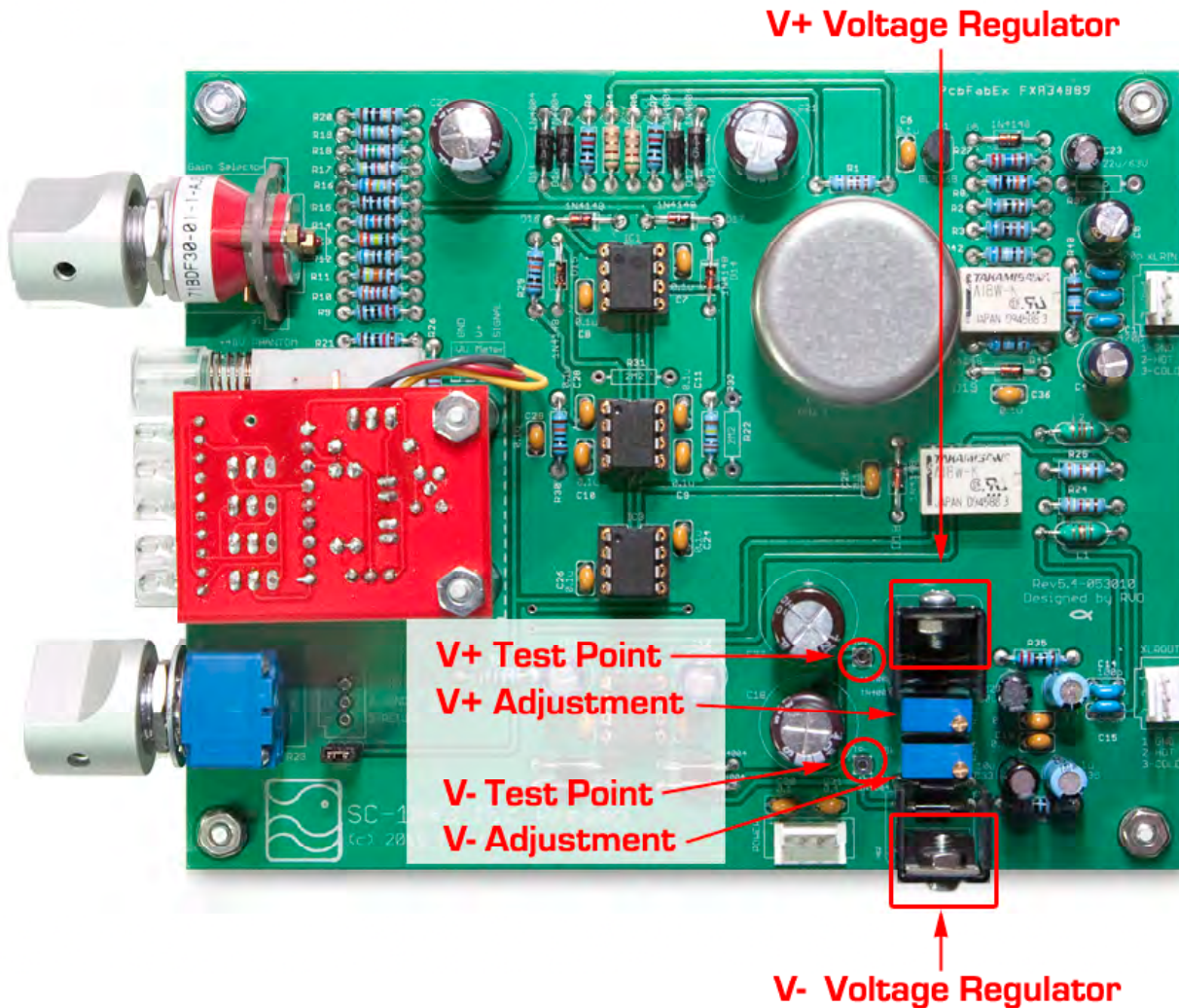
Make sure all the diodes are pointing in the right direction.

Make sure all the electrolytic capacitors are inserted in the right direction.

Make sure there are no SHORTS or COLD SOLDER in your soldering job.

STEP 3. Since the SC-1mk3 Mic Preamp has on-board voltage regulators, you can feed it a supply voltage higher than +/-18Volts. The ideal thing to do is feed the preamp an input voltage somewhere in the +/-20 Volts to +/-24 Volts (regulated preferably... like from a PSU-2448 kit).

TURN ON POWER. (Remember, wear some safety goggles.) Stand back.... Wait a few seconds. Did it smoke? If yes, turn off power. If not, good!... Proceed cautiously to next step.



STEP 4. Next, we need to adjust the trimmers of the onboard voltage regulators. Basically, the external supply voltage you fed to the preamp will be regulated down to +/-18V.

There are two test points on the preamp board labeled (V+ TP) and (V- TP). Hook the negative probe of your voltmeter to Ground. Connect the positive probe of your voltmeter to the TP+ terminal, adjust the top trimmer (turn the screws) until you get a voltage reading of +18Volts.

Do the same for the TP- terminal. Connect the positive probe of your voltmeter to the TP- terminal, adjust the bottom trimmer until you get a voltage reading of -18Volts.

If you cannot adjust the voltages to +/-18Volts no matter how you turn the trimmers, something is wrong. POWER OFF and re-check your work. (Note: I'm assuming you're feeding the Mic Pre board with a voltage more than 18Volts coming from your power supply).

STEP 5. TURN POWER OFF. Make sure you TURN POWER OFF!! Insert the IC chips, IC1, IC2, IC3 and IC4. Make sure the orientation of the IC chips are correct. Make sure all the legs of the chips are inserted properly in their corresponding IC sockets.

STEP 6: TURN POWER ON AGAIN. See if any smoke comes out. Feel the IC chips and check if they're hot. They should not be. Touch the other components to see if they're hot. None should be hot. Maybe the voltage regulators can be a little warm, but nothing should be too hot to touch.

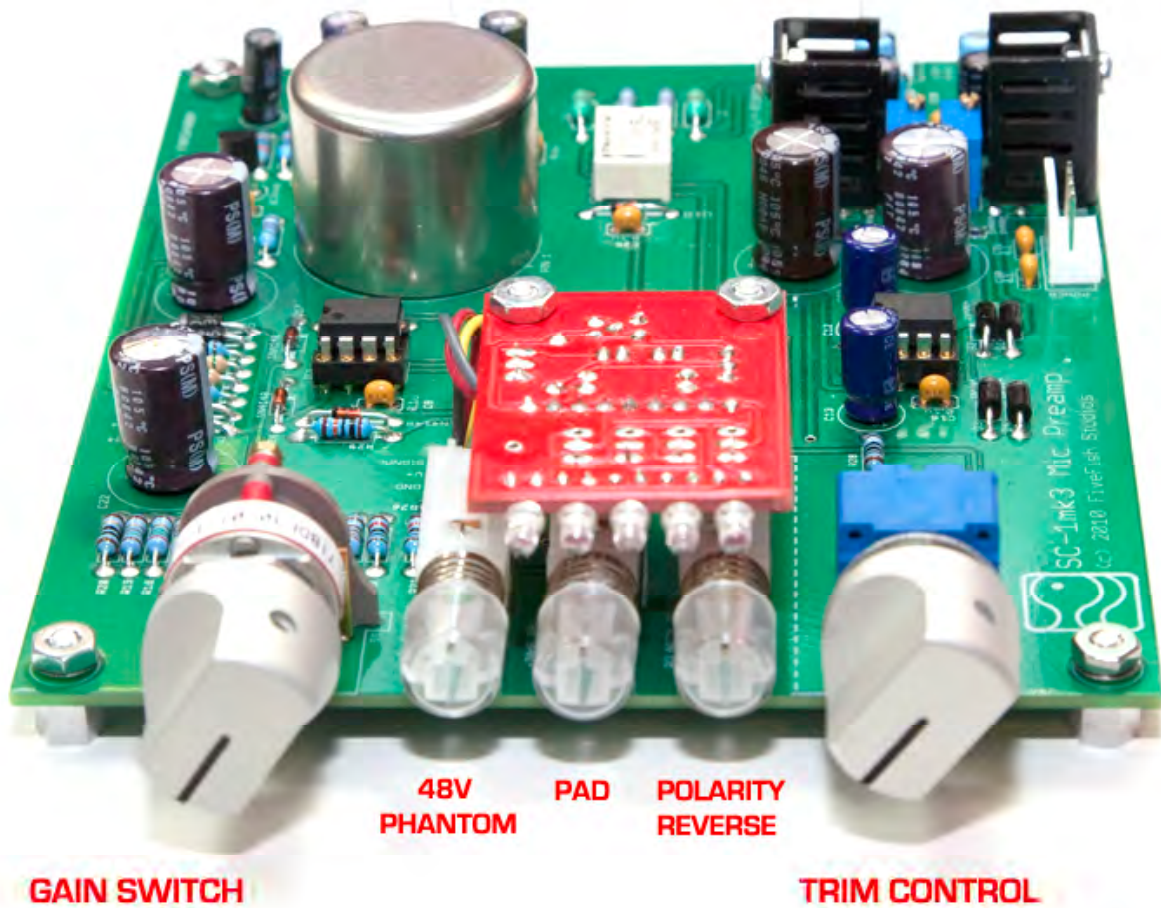
Re-check your voltages on TP+ and TP- to see if they're still +/-18Volts. Re-adjust if necessary.

STEP 7: PAT YOURSELF ON THE BACK. Congratulations on your build! Now, let's proceed to Audio Testing.

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SC-1mk3 Microphone Preamp Kit

STEP 8. Connect the preamp's XLR output to an active monitor or an amplifier and speaker. Connect a dynamic microphone to the preamp's XLR input.



STEP 9. Adjust gain and trim knobs and check for audio signal.

STEP 10. Remove the dynamic microphone and connect a condenser microphone.

STEP 11. Turn on the Phantom Power Switch. Check for audio. Upon turning on the phantom power switch, it may take a few seconds before your mic becomes "alive." This is due to the gentle 48V soft-start feature of the SC-1mk3 preamp. We slowly ramp up the voltage to avoid damaging your expensive microphones (and also avoid that loud popping sound!)

STEP 12. Check if the PAD switch works. Signal should be attenuated (i.e.reduced) when you turn on the PAD switch.

STEP 13. Check the POLARITY switch. You should hear one of the relays softly clicking.

SC-1 Troubleshooting Guide

Well, hopefully you won't need this chapter.

"Measure twice, cut once"... as they say. Take your time assembling the kit, don't be in a hurry, work carefully and methodically and you won't need this troubleshooting guide. I've built several prototype preamps in the course of testing and designing the SC-1 and each one of my prototype worked on the 1st try.

So I'll try to imagine where are the "critical" areas where somebody might make a mistake.

Problem: No sound. No thump, no noise, no nothing.

Check if there is power. Check all wires of the power supply. Check all IC chips are in the correct orientation. Check that volume pot is not at minimum setting. Check that you did not swap the positive and negative voltage regulators.

Problem: No phantom power. My condenser mic does not work.

Check if there is 48V power. Check that the transistor is mounted correctly. Did you turn on the phantom power switch?

Problem: Sound is very faint. And very noisy. Distorted sound.

The IC1 chip is probably damaged. Replace IC1 with another chip of the same part # and test again. Check that you're applying the proper voltages to the preamp.

Problem: My gain settings are out of order. It will get loud, very loud, then soft, then loud.

Check if there are shorts in the Grayhill selector pins. Check that the resistors nearest the Grayhill selector are the proper values and that you did not "swap" any 2 of them.

Problem: I turn on phantom power but I don't hear a thump and it takes a few seconds before I can hear sound.

This is normal. This is due to the soft-start phantom power. It takes anywhere from 15 seconds to 30 seconds to stabilize and reach full power. I'm not applying the full 48V at full blast to your expensive mics. Rather, I feed phantom power to the mic gradually and raise the voltage gradually. It also protects your speakers from the thumping sound, and your expensive mics.

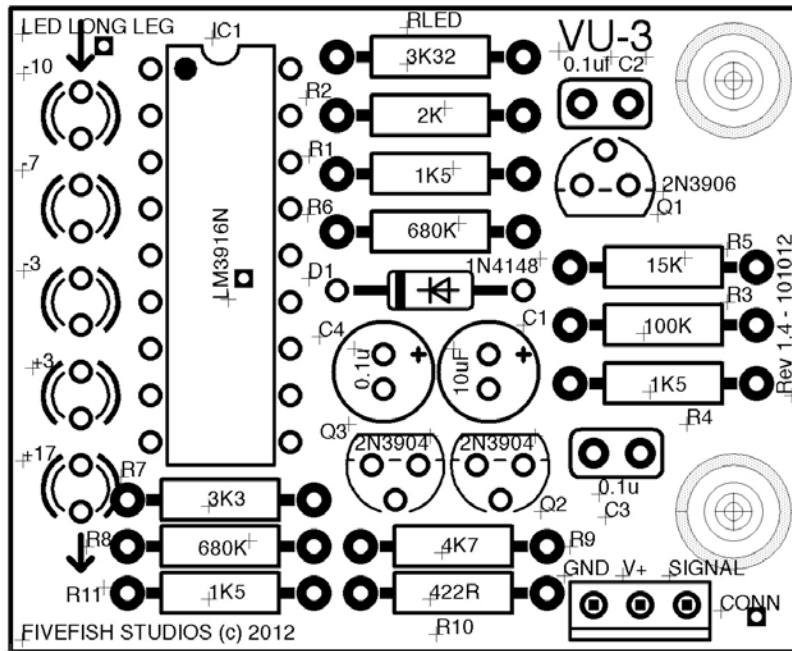
Problem: I don't have any mic connected, but I'm hearing hissing noise at +66dB gain.

First, let's talk in real numbers instead of decibels (dB). A gain of 66dB is 2000x amplification. And without any mic connected to the preamp, you're basically leaving the inputs unterminated. In normal use, the preamp should see a 150-ohm load at the inputs, and there will be less noise/hiss. At these high gain settings, and without any mic or load connected, what you're hearing is called "Johnson noise." You're basically hearing the random movement of electrons in the circuit. It's the law of physics. The hotter the temperature, the more the electrons are agitated, and the higher the hissing noise you'll hear. See this article in wikipedia. http://en.wikipedia.org/wiki/Thermal_noise. I've attempted to reduce this Johnson or thermal noise phenomena by using metal film instead of carbon resistors as much as possible. Another method of reducing this type of noise is cryonic freezing. Wear a warm jacket.

Problem: I want to record in stereo, but I only have (1) SC-1 preamp.

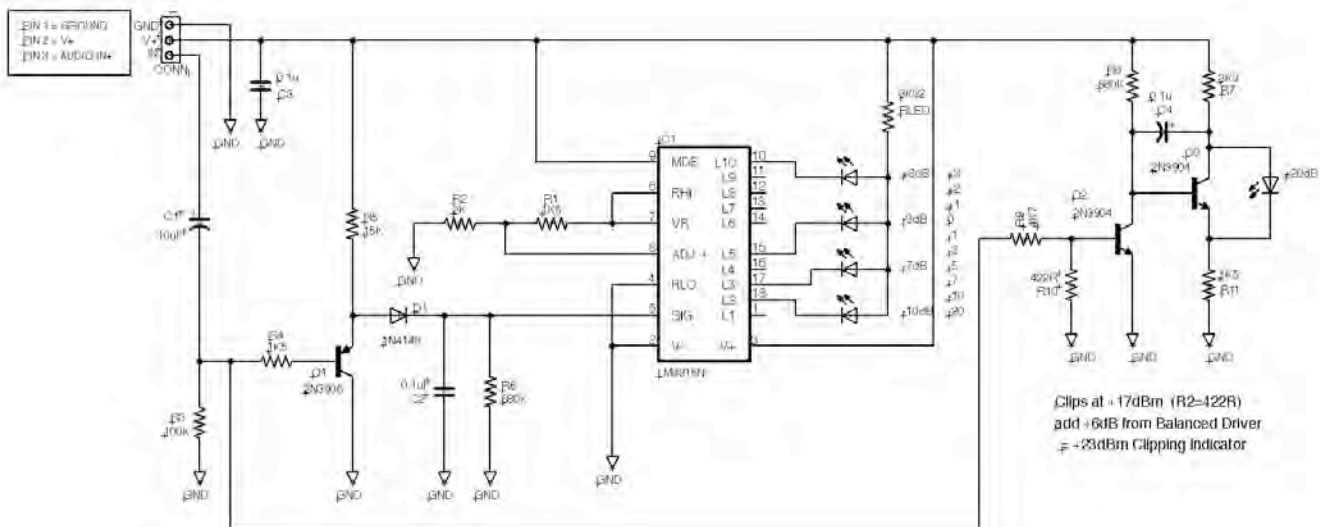
Buy another kit ☺

VU Meter Component Guide



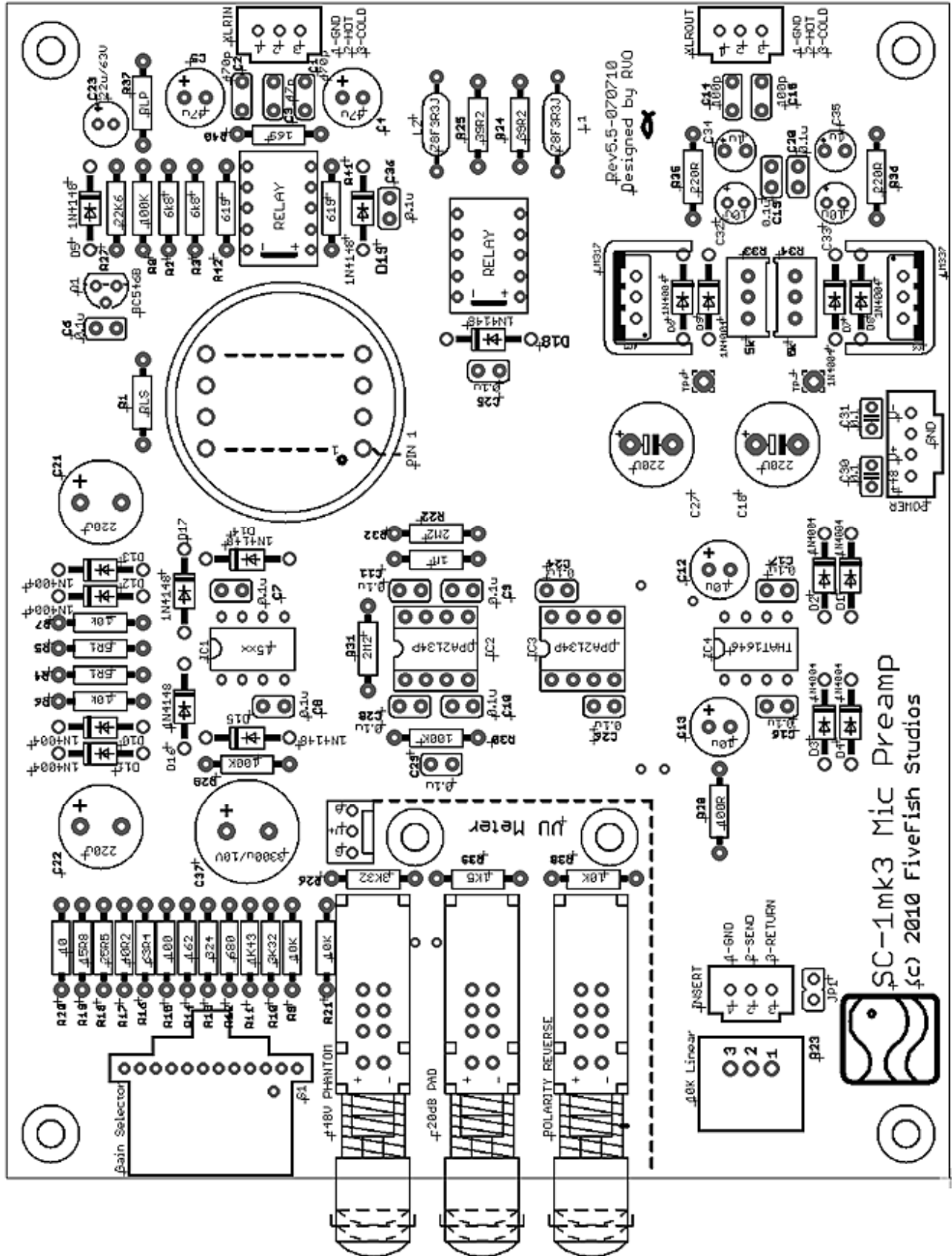
VU Meter Schematic

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 This document is solely provided to the kit builder of the VU Meter Kit.



Clips at +17dBm (R2=422R)
 add +6dB from Balanced Driver
 = +23dBm Clipping Indicator

SC-1 PCB Component Layout Guide



SC-1mk3 Mic Preamp
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SC-1mk3 Parts List**Rev5.4**

Part	Qty	Value
PCB	1	SC-1mk3 PCB
CAPACITORS		
C1,C2	2	470pf/50V
C3	1	47pf/50V
C4,C5	2	47uf / 50V
C6,C7,C8,C9,C10,C11,C16,C17, C19,C20,C24,C26,C28,C29,C30,C31,C36,C39	18	0.1uf / 100V
C12, C13	2	10uf / 50V NON-POLAR
C14, C15	2	100pf / 50V
C18,C27,C21,C22	4	220uf / 50V
C23	1	22uf / 63V
C32,C33	2	10uf/ 63V
C34,C35	2	1uf/ 100V
C37	1	3300uf / 10V
SEMICONDUCTORS		
D1,D2,D3,D4,D6,D7,D8,D9,D10,D11,D12,D13	12	1N4004
D5, D14,D15,D16, D17, D18, D19	7	1N4148
IC1	1	THAT 1510
IC2,IC3	2	OPA2134P
IC4	1	THAT 1646
IC5	1	LM317T
IC6	1	LM337T
L1, L2	2	78F3R3J-RC
Q1	1	BC546B NPN transistor
All resistors 1/4 watt, metal film when available		
RLP	1	2K67
RLS	1	6K8
R26	1	3K32 (GREEN PB)
R2,R3	2	6K8
R4, R5	2	5R1
R6,R7,R9, R21, R38	5	10K
R8,R29,R30	3	100K
R11	1	1K43
R12	1	680R
R13	1	324R
R14	1	162R
R15, R28	2	100R
R16	1	63R4
R17	1	40R2
R18	1	25R5
R19	1	15R8
R20	1	10R
R22	1	1M

SC-1mk3 Microphone Preamp Kit

R23	1	10K POT, LINEAR TAPER
R24,R25	2	39R2
R27	1	22K6
R31,R32 (not used)	0	2M2
R33,R34	2	5K TRIMMER
R35,R36	2	220R
R39	1	1K5 (BLUE PB)
R40	1	169R
R41,R42	2	619R
HARDWARE		
XLR IN	1	Neutrik XLR Female
XLR OUT	1	Neutrik XLR Male
IC Sockets	4	8-pin IC socket .300 GOLD
SW1	1	GRAYHILL 1-DECK, 12-POS SWITCH
SW2	1	PUSH BUTTON SWITCH LED GREEN
SW3	1	PUSH BUTTON SWITCH LED BLUE
SW4	1	PUSH BUTTON SWITCH LED YELLOW
JP1	1	Conn Header 2Pos 0.100 vert
SHORT1	1	Conn Jumper Shorting Tin
HS1,HS2	2	Heatsinks TO-220
Aluminum Knobs	2	Aluminum solid knobs
OPTIONAL INPUT TRANSFORMER		
T1	1	Input Transformer

VUMETER-3916 PARTS LIST

Part	Qty	Value
PCB	1	VU METER REV3
LED1, LED2, LED3	3	GREEN LED
LED4	1	YELLOW LED
LED5	1	RED LED
C2,C3	2	0.1uf / 100V CERAMIC
C1	1	10u 63V
C4	1	0.1uf / 100V CERAMIC
D1	1	1N4148
Q1	1	2N3906
Q2,Q3	2	2N3904
IC1	1	LM3916
R1,R4,R11	3	1K5
R2	1	2K
R3	1	100K
R5	1	15K
R6,R8	2	100K
RLED, R7	1	3K
R9	1	4K7
R10	1	270R
SOCKET	1	IC SOCKET