VTS MkII Vintage Tube Saturation - Step-by-Step Assembly Guide

Congratulations and thank you for purchasing the VTS MkII Vintage Tube Saturation Kit, based on a vacuum-tube circuitry, popular in the 60s.

This kit does not require any specialized or expensive tools or techniques. You simply need to follow the instructions. However, we would like to provide some useful tips:

Attention to Detail

The most important skill when assembling this kit is meticulousness. A single misplaced component, an incorrectly oriented part, or a faulty solder joint can prevent your kit from functioning properly. The key to success is simple: follow the assembly guide closely and double-check your work.

Good Soldering Practices

Your kit's reliability depends on the quality of your solder joints. Good soldering technique is essential, but it is a skill you can quickly learn. If you have no prior soldering experience, start by practicing on a piece of Veroboard with a handful of resistors. After an hour or two of practice, you should be ready to assemble your kit.

Basic Electrical Knowledge

It's helpful to understand basic electrical and electronic concepts. Do you know what voltage, resistance, and current are? Can you use a digital multimeter? If the answer is "no," consider asking a knowledgeable friend for assistance.

PLEASE READ THIS ASSEMBLY GUIDE IN ITS ENTIRETY BEFORE STARTING THE ASSEMBLY PROCESS.

Using Vacuum Tube

The VTS MkII is designed to integrate a triode vacuum tube, chosen specifically for its ability to provide a smooth signal saturation that results in a pleasant listening experience. Our goal is to achieve a rich, harmonically complex signal that remains controllable, allowing for deliberate saturation when desired, without losing clarity or precision. This result is embodied in the VTS, which we've named 'Vintage' for the retro-inspired tonal qualities it delivers, capturing the essence of classic, timeless sound. The heater voltage may take up to a minute to rise and stabilize, as the circuitry provides a "soft start." This specific configuration is designed to extend the life of the tube.

Basic Tools Required

Below is a list of essential tools for assembling your audio kit. Though the list is thorough, don't worry - everything is straightforward!

1. **Soldering Iron:** A good quality, temperature-controlled soldering iron is essential. It will allow you to create clean, precise solder joints. Do not use a hot-air soldering gun.
2. **Solder:** Use high-quality, lead-free solder. We recommend rosin-core solder for optimal flow.

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3. **Wire Cutters:** Sharp wire cutters will be needed for trimming component leads after soldering.
4. **Needle Nose Pliers:** These pliers are useful for bending component leads and positioning parts accurately on the board.
5. **Desoldering Pump or Desoldering Braid:** In case you need to correct mistakes or remove excess solder, a desoldering pump or braid is essential.
6. **Soldering Iron Tip Cleaner or Sponge:** Regularly clean your soldering iron tip by wiping it with a damp sponge or using a brass tip-cleaning pad.
7. **Tweezers:** Precision tweezers are invaluable for handling small components and placing them accurately on the board.
8. **Magnifying Glass or Magnifier Lamp (Optional but Recommended):** A magnifying tool is highly recommended, especially for inspecting small components and verifying connections.
9. **Anti-static Wrist Strap (Optional but Recommended):** Electrostatic discharge (ESD) can damage sensitive components. An anti-static wrist strap protects your kit from accidental static buildup.
10. **Workbench Mat (Optional):** An anti-static mat will help protect both your kit and your workspace.
11. **Multimeter:** A digital multimeter is essential for checking voltages, testing continuity, and troubleshooting assembly issues. The only piece of test equipment you need at this stage is a multimeter. Ensure it can read RMS AC voltage.
12. **Screwdrivers - Hex key: A** small Hexagonal key as well as a flathead and medium cross-point screwdriver are most commonly needed.
13. **Desoldering Tool (Optional):** Helpful for removing solder joints if necessary. The tool sucks the molten solder into the pump, clearing the joint.

By having these tools, you'll be fully equipped to assemble your kit with precision and ease.

Basic Techniques for Assembling the Kit

All the parts listed in the BOM are included in the kit. Insert components in order of size, starting with the smallest first. It can be difficult to place small components if larger ones are already in place.

Ensure components like resistors are flush against the board to avoid gaps. This helps with neatness and offers protection for the components.

Be systematic when inserting components to maintain a neat and organized board. A tidy board is more likely to function correctly the first time. Solder joints should be shiny; if they are dull, you may have created a "dry joint" that requires reworking.

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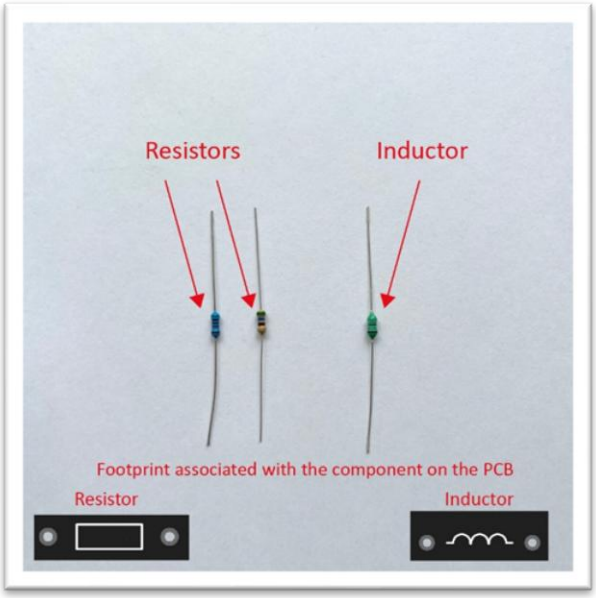
Check that all components are correctly oriented and placed in the right positions on the board. Remember that components such as electrolitic capacitors, LEDs, diodes, and transistors are polarity-sensitive, so double-check their orientation to avoid damage or malfunction.

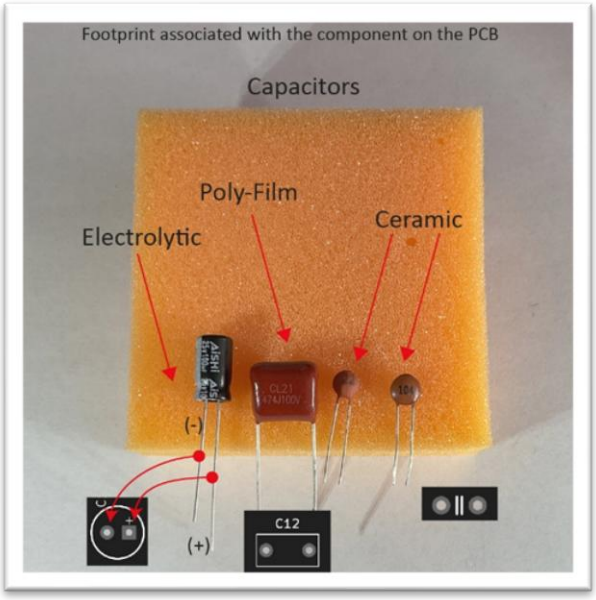
We strongly recommend using a multimeter to verify component values, as this is the best way to avoid mistakes.

Below are some pictures that will visually explain how to properly choose the component and how to orient it on the PCB. For each component shown, the associated PCB footprint can be found.



Resistor & Inductor: The shape of the inductor is similar to that of the resistor, but it is slightly fatter" than the resistor. The kit includes resistors with both large and small bodies.

Electrolytic Capacitorss are typically cylindrical in shape. They often have polarity, with one side marked with a (-) sign (the cathode or negative side), and the unmarked side being the (+) or anode.
It's crucial not to insert electrolytic capacitors backward, as doing so can cause them to explode. Even small electrolytic capacitors can be quite dangerous when installed incorrectly.



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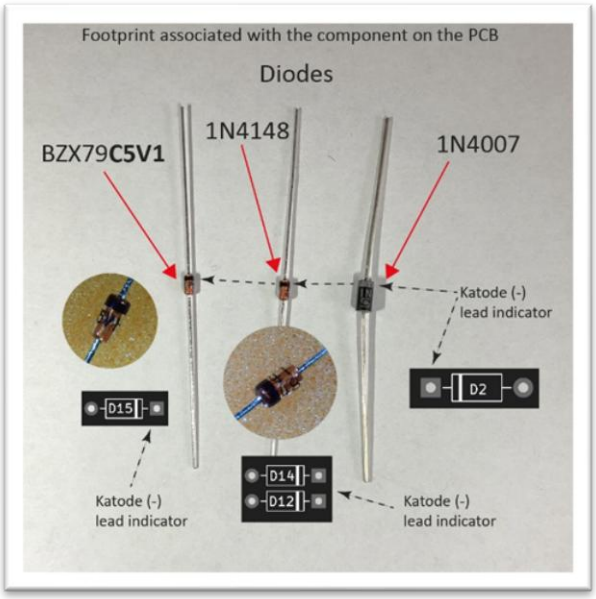

Diodes are semiconductor devices. The VTS MkII kit uses two types of diodes:
Signal Diodes: These have glass bodies, and Rectifier Diodes: These are black with a white or silver band.
Diodes also have polaritie. Incorrect diode placement can prevent relays from working. Always follow the band markings on the PCB layout.

Voltage Regulator

The voltage regulator is an active component that provides a regulated voltage at its output, according to the specific needs of the project design. Although the component comes in various packages, we want you to focus on the one that resembles a transistor: it has three pins and a black, semi-circular plastic body. To avoid any confusion between the voltage regulator and a transistor, we recommend checking the code visible on the flat surface of the component. Refer to the component list to correctly identify each component and determine where it should be soldered.

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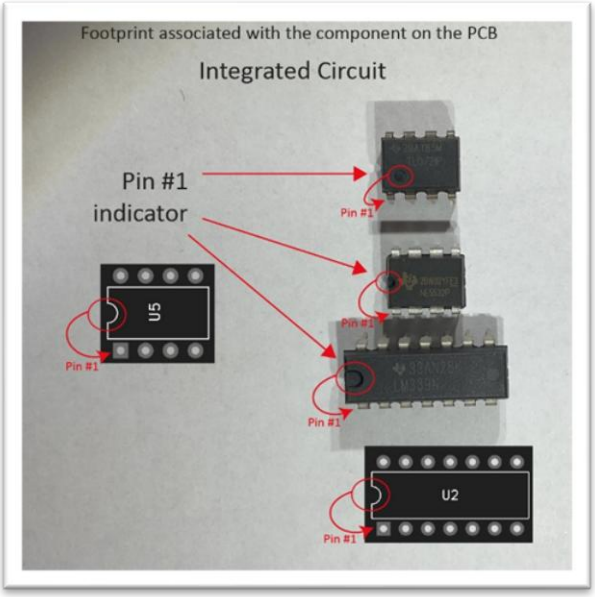
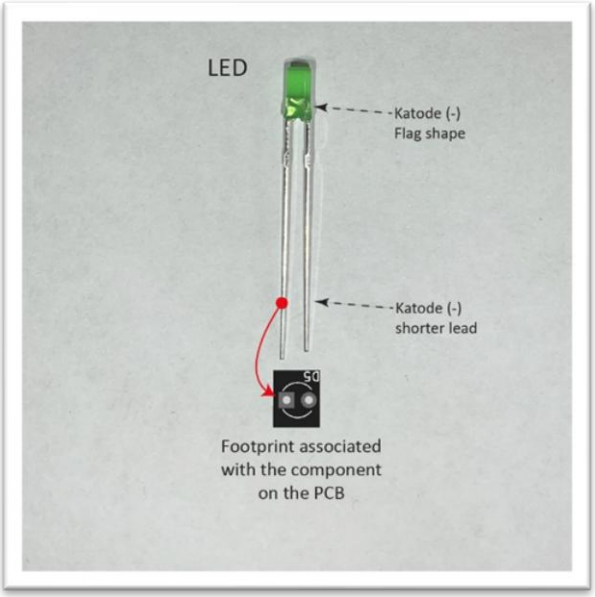
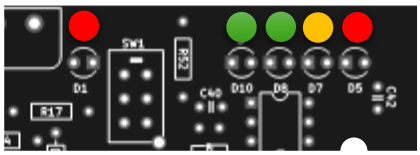
Integrated Circuit: The reference notch on some integrated circuits is quite clear in showing how to orient them on the PCB. Special mention should be made for ICs that do not have any reference notch. Pin #1 is marked with a small drilled or silkscreened dot on the corner.

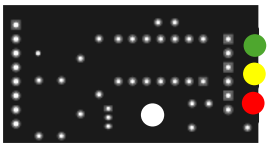




LED: LEDs will not light up if installed incorrectly. For this reason, it is essential to orient them correctly as shown in the diagram.
In the rare case that the leads are of equal length, the cathode can be identified by the flag-like shape inside the plastic body.
On the PCB, the square pad should always be aligned with the longer pin.
Each LED has its own reference in both the BOM and on the PCB. However, please refer to the diagram below for additional assurance in placing the correct color in the right position.

LED color placement on the VTS mainboard and meter PCB





Other components: All components have a clear reference on the PCB that corresponds to the kit's BOM. Components that do not have any orientation or placement ambiguities on the PCB have been omitted from the list of explanatory pictures.

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Assembly and Soldering Tips

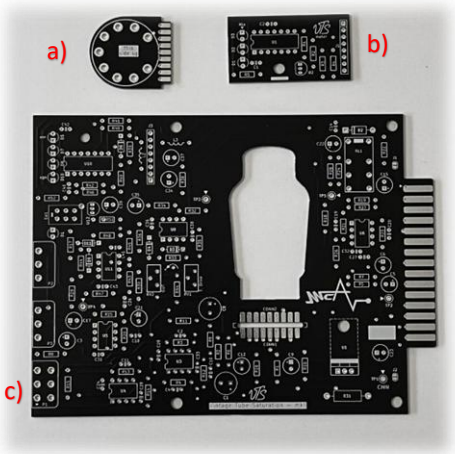
Use a clean soldering iron tip. Heat both the component lead and PCB pad, then apply solder to the component lead while heating both parts. Avoid applying solder only to the iron.

Ensure that solder flows properly through the PCB holes and onto both sides of the board. Check that solder has flowed through and filled the holes.

Pay attention to the orientation of diodes and electrolytic capacitors. There is only one correct way to mount them - incorrect orientation can damage the components.

For multiple-pin devices (like ICs, switches, and relays), solder one pin first, check the alignment, and reheat if necessary to straighten the part.

The VTS mkII PCBs



The kit consists of three distinct PCBs. In clockwise order, starting from the top left:

a) Valve support PCB (designed to mount the valve in a vertical position).

b) 'Tube Load' meter PCB.

c) Main PCB."

VTS MkII Assembly Guide Checklist (all PCBs)

Follow the same steps for both main and meter PCBs:

1. Solder all resistors and inductors.
2. Solder all diodes, noting their orientation. *(pict. 1a,b)*
3. Solder ceramic capacitors.
4. Solder all IC chips, ensuring proper pin alignment. *(pict. 2a,b)*

   We have deliberately omitted the IC sockets from the kit, encouraging users to solder the integrated circuits directly to the PCB. This does not require any greater precision in soldering than would be needed for installing the sockets. The advantage of eliminating intermediary components between the contacts is that they can be subject to deterioration (such as oxidation or mechanical performance degradation), which can negatively impact the circuit's characteristics and potentially compromise the overall functionality of the device.

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5. Solder the voltage regulator U12, ensuring proper orientation. *(pict. 3)*
6. Solder electrolytic capacitors, paying attention to polarity. *(pict. 4)*
7. Solder the trimmers and the pin headers. *(pict. 5)*
8. Solder all relays.
9. Solder the push-button switch.
10. Solder the potentiometers, trimming any excess legs afterward. *(pict. 6)*
11. Solder the LEDs, paying attention to polarity. *(Please follow the steps outlined in the 'LED installation guide – Main PCB').*
12. Solder the Tube socket onto the tube holder PCB and then solder its connector to the main PCB. *(pict. 7a,b,c)*
13. Solder the voltage regulator (U1), then attach the heat sink (use thermal paste for improved performance). *(pict. 8a,f)*
14. Solder the components onto the Meter PCB, following the instructions provided earlier in this guide to ensure proper component orientation
15. Solder the LEDs, paying attention to polarity. *(Please follow the steps outlined in the 'LED installation guide - Meter PCB').*
16. Connect the meter PCB to the main PCB, using the standoff, washers and screws. *(pict. 9)*
17. Complete the assembly of the VTS MkII by installing the metal parts.

A. First, screw the standoffs to the base metal plate. Remember to place two washers between the plate and each standoff. *(pict. 10)*
B. Next, align the main PCB with the metal plate and secure it by tightening the four nuts.
C. Now, attach the front panel to the metal plate tightening the nuts on the opposite side.
D. Ensure that all screws are firmly in place and tighten the nuts securely. *(pict. 11)*
E. Place a washer then nut over each potentiometer and slowly tighten each nut using a nut driver. Turn the potentiometer shafts fully clockwise. Put the knob on and align the pointer with the rightmost notch on the front panel. Repeat for the other two potentiometers. Do not overtighten.
F. Install the knobs and tighten the screw using an hexagonal key.
G. Install the vacuum tube into the socket.

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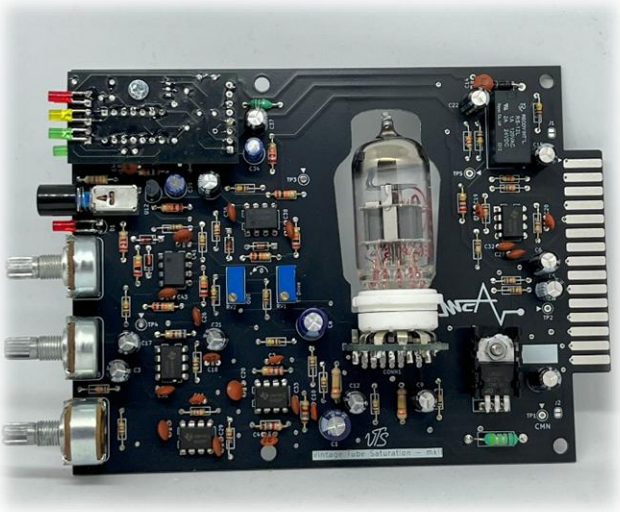

the VTS mkII electronics fully assembled

Ground Path

The ground path is essential in audio equipment. A ground loop is a common source of background noise and can significantly degrade the quality of the signal.

The market for 500-series lunchboxes is vast, and each lunchbox accommodates different modules from various manufacturers. With this level of variety, it's easy to run into a ground loop issue. To address this, we designed our boards to be flexible.

On the VTS MkII, there are two jumpers, J1 and J2, that allow for customization.

To adjust them, simply bridge the two pads on J1 using a soldering iron and solder, and do the same for J2.

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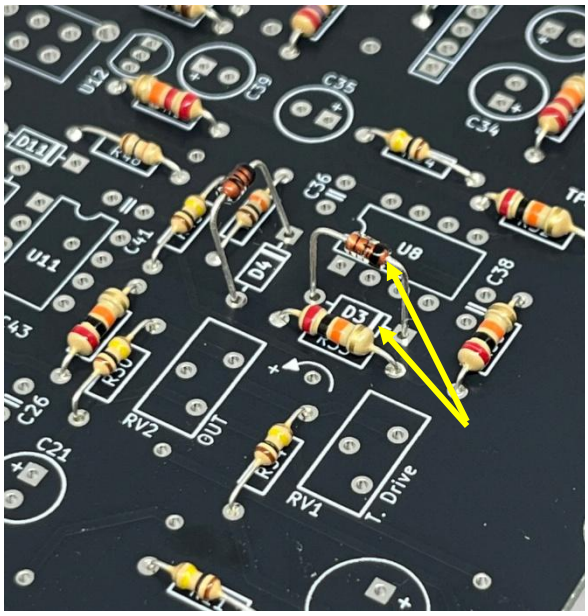
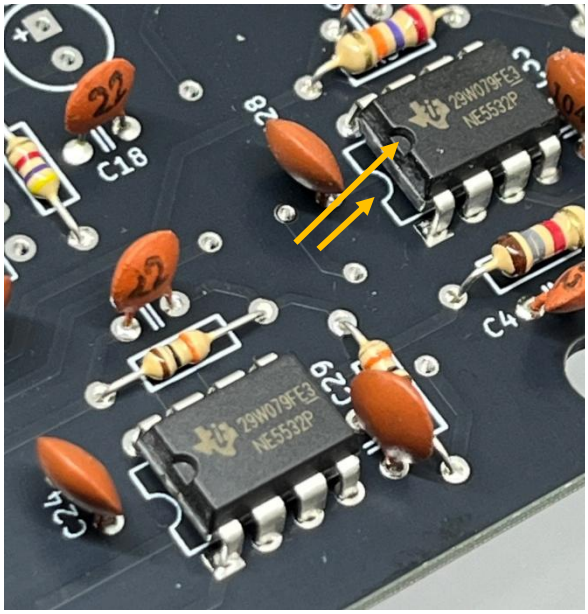
Stepwise Assembly: A Photo Guide

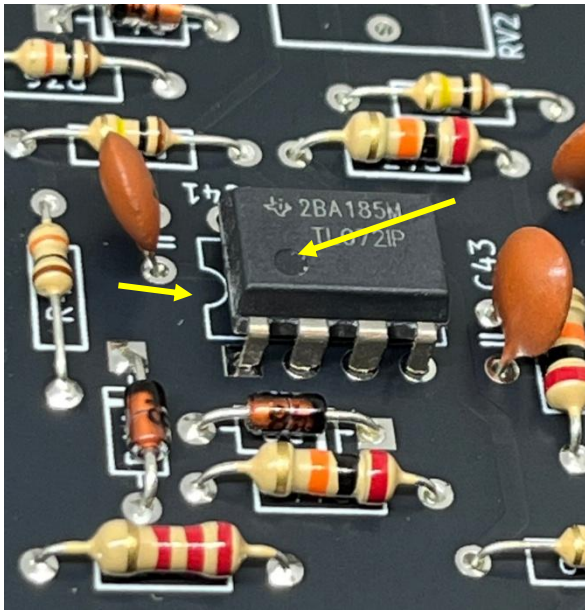


(pict. 1a)

(pict. 1b)



(pict. 2a)



(pict. 2b)

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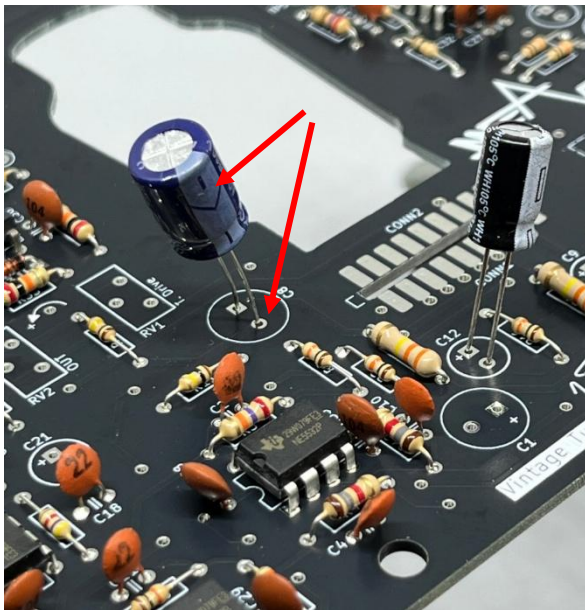
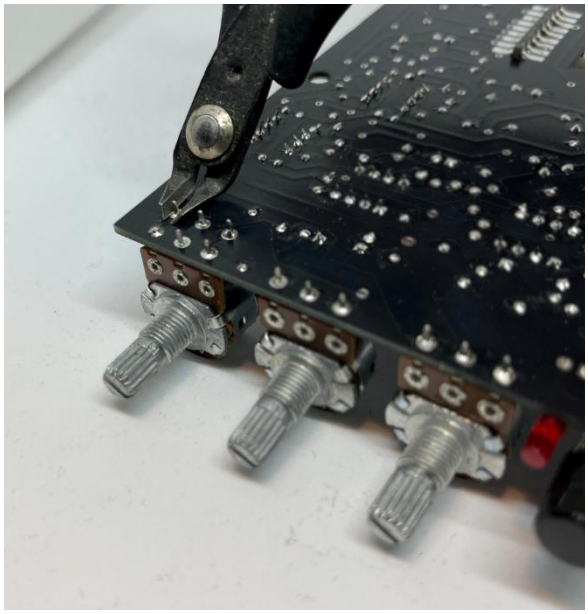
(pict. 3)



(pict. 4)

(pict. 5)



(pict. 6)

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(pict. 7a)

(pict. 7b)

(pict. 7c)

Make sure to solder the two PCBs together properly. Be sure to solder also on the opposite side of the one shown in the image. Avoid excess solder, as adjacent contacts MUST not touch each other.

It is mandatory to solder the two PCBs from the soldering side. However, soldering the two PCBs from the component (CONN1 & CONN2 label) side as well ensures greater stability for the valve holder PCB.

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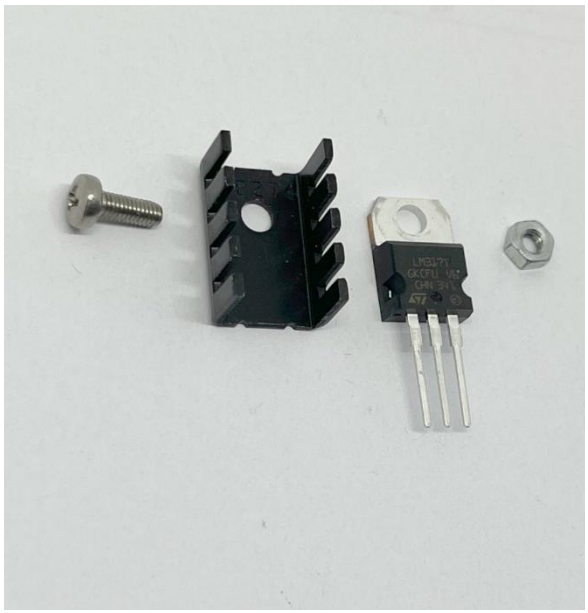
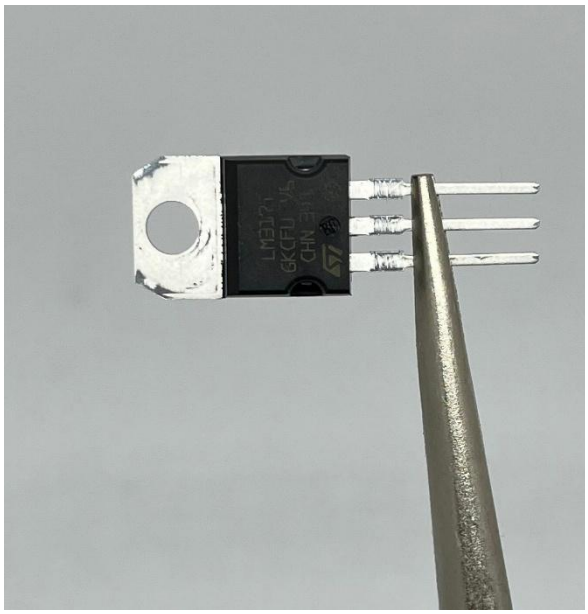
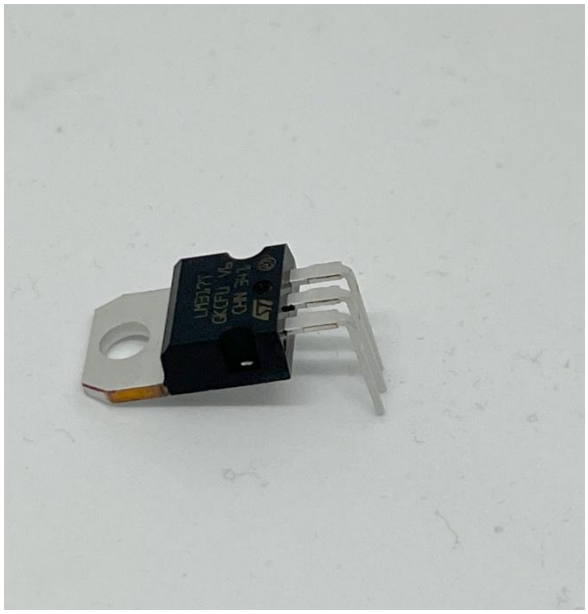


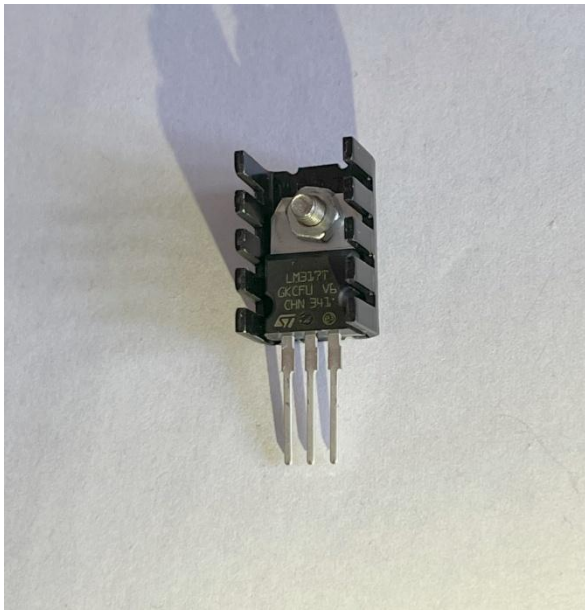
(pict. 8a)



(pict. 8b)



(pict. 8c)



(pict. 8d)

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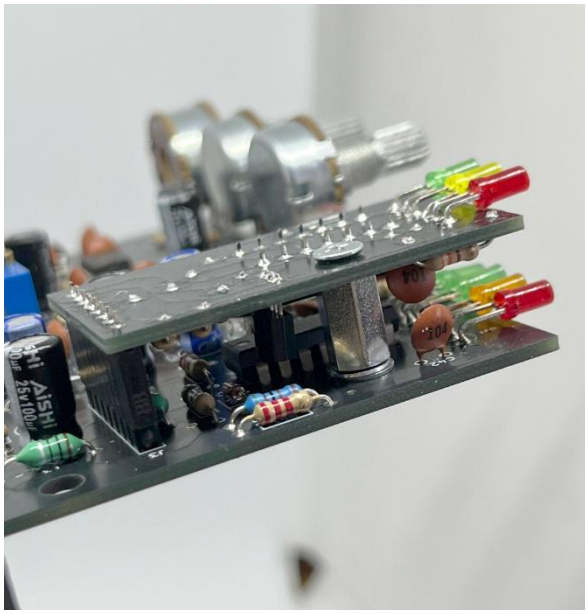
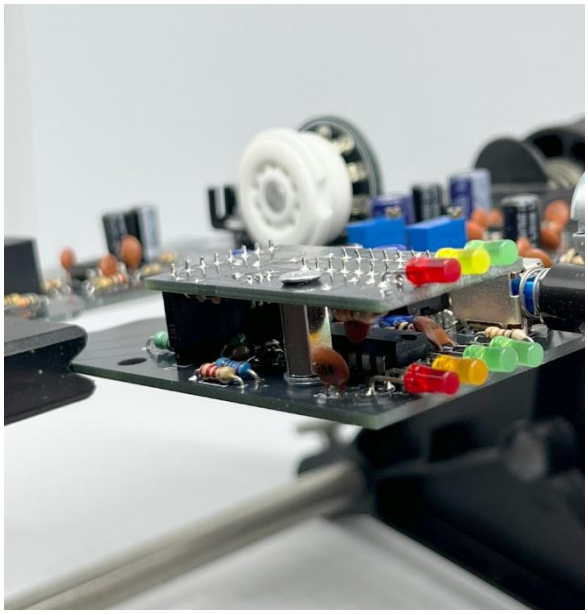
(pict. 8e)

(pict. 8f)



(pict. 9a)



(pict. 9b)

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(pict. 10)

(pict. 11)

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Output LED Meter Calibration Guide

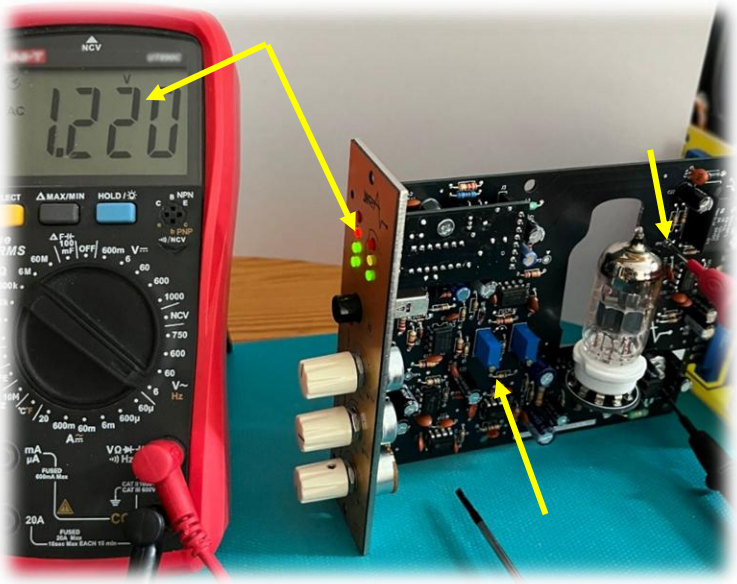
Before you switch the VTS on, prepare the voltmeter for a VAC (V~) voltage test.

Set the multimeter to VAC mode. Keep the COM probe connected to the Test Point marked 'CMN' from now on.

Follow the steps outlined below in the description and, when instructed, place the multimeter probes on the specified test points. Refer to the values you should see on the display.

- Turn on the VTS mkII and wait one minute before starting any test. The tube is equipped with a ‘soft start’ and will reach the correct temperature one minute after you turn on the VTS mkII.
- For a +4dBu operation, send a 1kHz sine wave to the VTS Input. Signal level around -6dBFS.
- Refer to the TP2 on the PCB. You should read 1.27V on the multimeter display.
- Start with all three controls set to MIN and OFF. Keep the ***Drive control*** set to MIN.
- Turn the ***Tube Load*** control clockwise to h12.
- Turn the ***Output*** control clockwise to h3.
- Refer to the TP5 on the PCB. Adjust the Output until you can read 1.22V on the multimeter display.
- You can set the multimeter aside for now. Move on to the trimmer adjustment. Adjust the trimmer resistor RV2 until the ***0dB*** LED barely lights up.

Note: The left-pointing arrow indicates that turning the trimmer screw counterclockwise will cause the meter’s LEDs to light up from "Sgn" to "+6"



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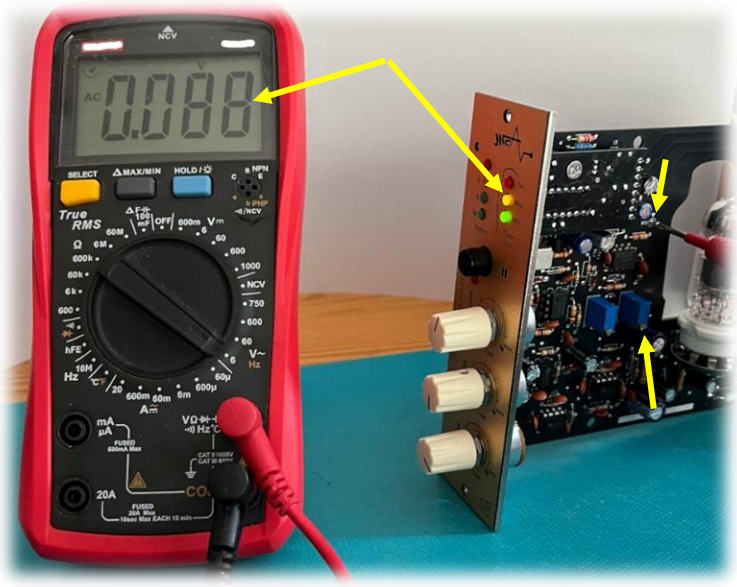
Tube Load LED Meter Calibration Guide

- Send a -6dBFS (around 1.27V), 1kHz sine wave to the VTS mkII Input.
- Rotate the ***Drive*** control fully right.
- Rotate the ***Output*** control to Min.
- Refer to the TP4 on the PCB. Rotate the ***Tube Load*** control until the multimeter reads 100mV.
- Refer to the TP3 on the PCB.
- Move on to the trimmer resistor RV1 until the multimeter reads 88mV. The ***Max*** LED should barely light up.

Note: The left-pointing arrow indicates that turning the trimmer screw counterclockwise will cause the meter's LEDs to light up from "Min" to "Ovr".



List of Test Points and Their Corresponding Functions

TP1 – CMN	Common, Signal Ground Connection
TP2	Input level
TP3	Tube Load meter level
TP4	Drive level
TP5	Output (+) level

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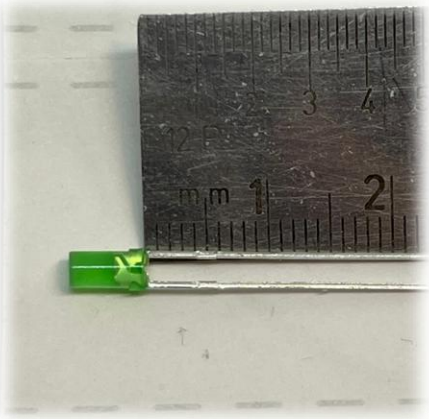
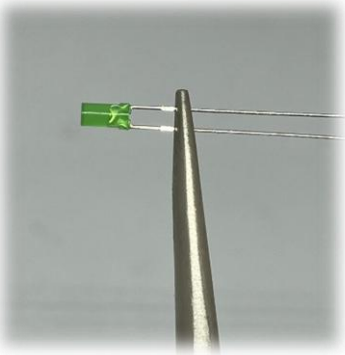
LED installation guide - Main PCB

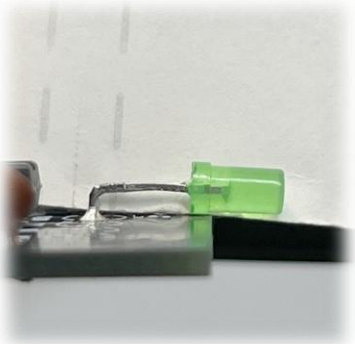
Orientation of the LED: Begin by orienting the LED according to the instructions provided in the previous diagram. Ensure the polarity is correct: the longer lead should be connected to the square pad, while the shorter lead should be placed in the round pad.



Measuring and Bending the Leads: Using a ruler and a pair of pliers, measure 5mm from the base of the LED.



Carefully grasp the leads of the LED with the pliers, and bend the LED at a 90-degree angle. This step helps ensure that the LED will sit properly on the PCB and makes the installation process easier.



Placing the LED onto the PCB: Insert the LED into the designated holes of the PCB, making sure the leads are positioned so they remain parallel to the surface of the board.

It is crucial to ensure that the LED is aligned properly during this step, as this alignment will impact the overall effectiveness and uniformity of the lighting. Take your time to check the positioning of all the LEDs before proceeding.

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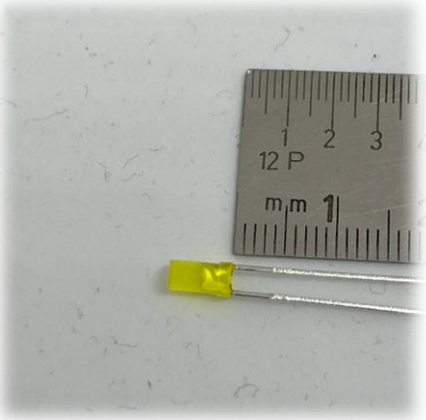
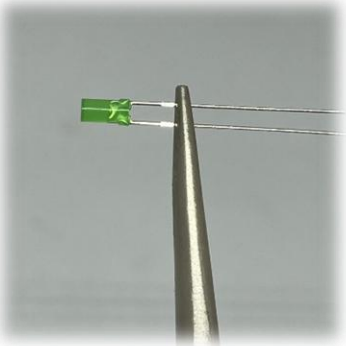
LED installation guide - Meter PCB

Orientation of the LED: Begin by orienting the LED according to the instructions provided in the previous diagram. Ensure the polarity is correct: the longer lead should be connected to the square pad, while the shorter lead should be placed in the round pad.

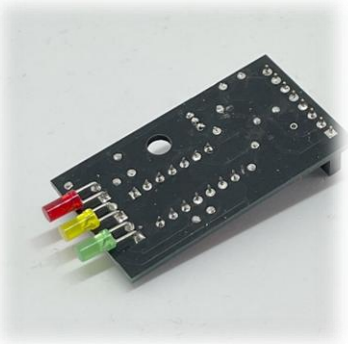
IMPORTANT: LEDs must be soldered on the opposite side (solder surface)



Measuring and Bending the Leads: Using a ruler and a pair of pliers, measure 4mm from the base of the LED.



Carefully grasp the leads of the LED with the pliers, and bend the LED at a 90-degree angle. This step helps ensure that the LED will sit properly on the PCB and makes the installation process easier.



Placing the LED onto the PCB: Insert the LED into the designated holes of the PCB (solder side), making sure the leads are positioned so they remain parallel to the surface of the board.

It is crucial to ensure that the LED is aligned properly during this step, as this alignment will impact the overall effectiveness and uniformity of the lighting. Take your time to check the positioning of all the LEDs before proceeding.

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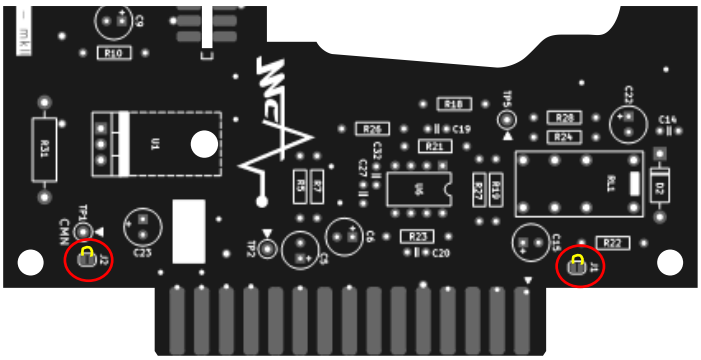
Final Check

The final step is the easiest test: listen for any noise. You should not hear the typical hum caused by ground loops, only the normal signal.

If you do hear a hum, you should try to eliminate it by removing the jumper from J2, then alternately from J1 if the noise is still present.

If the hum persists, remove the jumper from both of the jumpers to resolve the issue.



Always refer to the manual of your Lunchbox 500 for specific instructions regarding ground connections.

IMPORTANT NOTE:

Component Packaging: Please note that the packaging and the components in your kit may differ from the photos provided. Always refer to the component list and part numbers to confirm the correct items are being used.

MCAudioLab reserves the right to modify parts of the kit at its discretion without prior notice.

The images are for illustrative purposes only.

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