

WHISTLE ROCK AUDIO  
ML12 PSU KIT/PCB



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## **DISCLAIMER**

I am not liable for any damage, harm or loss of any kind resulting from the assembly and/or use of this kit. This kit contains small parts that may be easily swallowed by a child. Keep all components of the kit AWAY from children and animals. Finally, always take necessary precautions when handling potentially dangerous tools such as cutters, scissors, soldering iron, etc.

# INTRODUCTION

Thank you for purchasing the ML12 PSU Kit/PCB. This power supply is designed for the Whistle Rock Audio ML12 microphone preamplifier, however, it is very well suited for many other kind of projects. Whether your project requires a single positive rail or bipolar rails, this flexible PSU design will allow you to choose the configuration that fits best. It provides four separate regulated voltage rails: A single negative rail, two positive rails and a +48V phantom power voltage rail. The third voltage rail can be used to activate relays or power up LEDs. It can also be used to power up the CMOS/TTL logic circuits in your project. The last two pages of this document contain the schematic and silkscreen layout that can be printed out as a reference when assembling the PSU. Have fun!

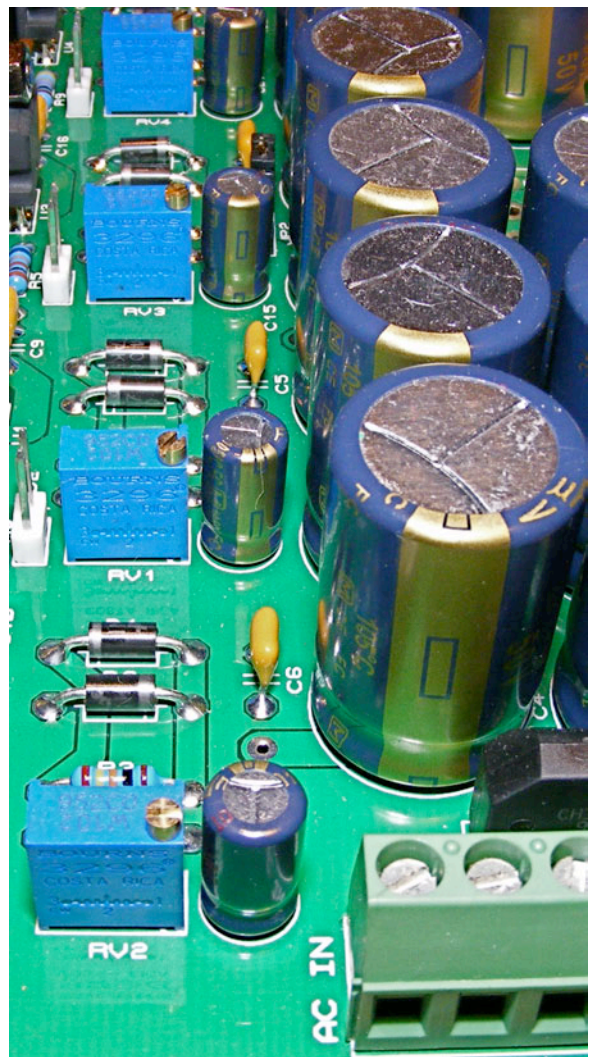
Sincerely,

Michael Lebon

Contact: [mike@whistlerockaudio.com](mailto:mike@whistlerockaudio.com)

## ML12 PSU features:

- ➔ Linear power supply, 317/337 based.
- ➔ Four regulated output voltages.
- ➔ Star grounding point available.
- ➔ Third rail regulator can be fed from the second rail output or from bridge rectifier.
- ➔ All voltages are fine trimmed via multi-turn Bourns potentiometers.
- ➔ Ample decoupling capacitors per rail.
- ➔ Wide range of compatible power transformers.
- ➔ All connections are done via screw terminal block.
- ➔ Optional Molex 0.1" header power output port.
- ➔ Indicator LEDs connect directly to the PSU board.
- ➔ High quality parts throughout.
- ➔ PCB is professionally manufactured with UL and RoHS certified process.
- ➔ All components are Lead Free/RoHS compliant.



# BILL OF MATERIAL



Reference	Description	Retailer	Retailer. Part #	Qty.
C1 to C4, C11 to C13, C17, C24, C25	1000uF, 50V Alum Electrolytic Cap	Digikey	<a href="#">P10333-ND</a>	10
C5, C6, C9, C10, C14, C16, C20, C22	100nF, 100V Ceramic Cap	Digikey	<a href="#">478-3185-ND</a>	8
C7, C8, C15, C21	10uF, 100V Alum Electrolytic Cap	Digikey	<a href="#">P10769-ND</a>	4
C18, C19, C23	150uF, 100V Alum Electrolytic Cap	Digikey	<a href="#">P10777-ND</a>	3
D1 to D8	1A 1000V General Purpose Diode	Digikey	<a href="#">1N4007FSCT-ND</a>	8
BR1, BR2	2A 200V Bridge Rectifier	Digikey	<a href="#">2KBP02M-E4/51GI-ND</a>	2
AC_IN CONN	4 Position Terminal Block	Digikey	<a href="#">277-1265-ND</a>	1
POWER_OUT CONN	5 Position Terminal Block	Digikey	<a href="#">WM7856-ND</a>	1
LED1, LED2	Green LED 2mm 2.2V Flat Top	Digikey	<a href="#">P613-ND</a>	2
LED3	Amber LED 2mm 2.2V Flat Top	Digikey	<a href="#">P614-ND</a>	1
LED4	Red LED 2mm 2.2V Flat Top	Digikey	<a href="#">P612-ND</a>	1
RV1 to RV4	1K Trim Pot	Digikey	<a href="#">3296W-102LF-ND</a>	4
U1, U3, U4	LM317 Adjustable Positive Regulator	Digikey	<a href="#">497-1575-5-ND</a>	3
U2	LM337 Adjustable Negative Regulator	Mouser	<a href="#">595-LM337KCSE3</a>	1
R1, R3, R7, R10	240 Ohms - 1% Metal Film Resistors	Mouser	<a href="#">271-240-RC</a>	4
<b>R2, R4</b> , R12	2.4K - 1% Metal Film Resistors	Mouser	<a href="#">271-2.4K-RC</a>	3
<b>R5, R6</b>	680 Ohms - 1% Metal Film Resistors	Mouser	<a href="#">271-680-RC</a>	2
<b>R8</b>	1.5K - 1% Metal Film Resistor	Mouser	<a href="#">271-1.5K-RC</a>	1
<b>R9</b>	487 Ohms - 1% Metal Film Resistor	Mouser	<a href="#">271-487-RC</a>	1
R11	8.6K - 1% Metal Film Resistor	Mouser	<a href="#">271-8.66K-RC</a>	1

The above values for R2, R4, R5, R6, R8 and R9 are assuming the following output voltages: -16V, +16V, +12V and +48V.

# ALTERNATE RESISTOR VALUES

		<b>First Rail Output Voltage</b>									
		<b>-5V</b>	<b>-12V</b>	<b>-15V</b>	<b>-16V</b>	<b>-18V</b>	<b>-20V</b>	<b>-22V</b>	<b>-24V</b>	<b>-28V</b>	<b>-30V</b>
<b>R4</b>		240	1.5K	2K	2.4K	2.7K	3.3K	3.3K	3.9K	4.7K	4.99K
<b>R6</b>		140	487	649	680	787	887	1K	1.1K	1.3K	1.4K

		<b>Second Rail Output Voltage</b>									
		<b>5V</b>	<b>12V</b>	<b>15V</b>	<b>16V</b>	<b>18V</b>	<b>20V</b>	<b>22V</b>	<b>24V</b>	<b>28V</b>	<b>30V</b>
<b>R2</b>		240	1.5K	2K	2.4K	2.7K	3.3K	3.3K	3.9K	4.7K	4.99K
<b>R5</b>		140	487	649	680	787	887	1K	1.1K	1.3K	1.4K

		<b>Third Rail Output Voltage</b>									
		<b>5V</b>	<b>12V</b>	<b>15V</b>	<b>16V</b>	<b>18V</b>	<b>20V</b>	<b>22V</b>	<b>24V</b>	<b>28V</b>	<b>30V</b>
<b>R8</b>		240	1.5K	2K	2.4K	2.7K	3.3K	3.3K	3.9K	4.7K	4.99K
<b>R9</b>		140	487	649	680	787	887	1K	1.1K	1.3K	1.4K

		<b>Fourth Rail Output Voltage</b>								
<p>The fourth rail is designed to provide a +48V phantom power voltage. There are no alternate resistor values available for that rail.</p>										

# ASSEMBLY GUIDE

The following information applies to the kit but may also help those with bare PCBs.

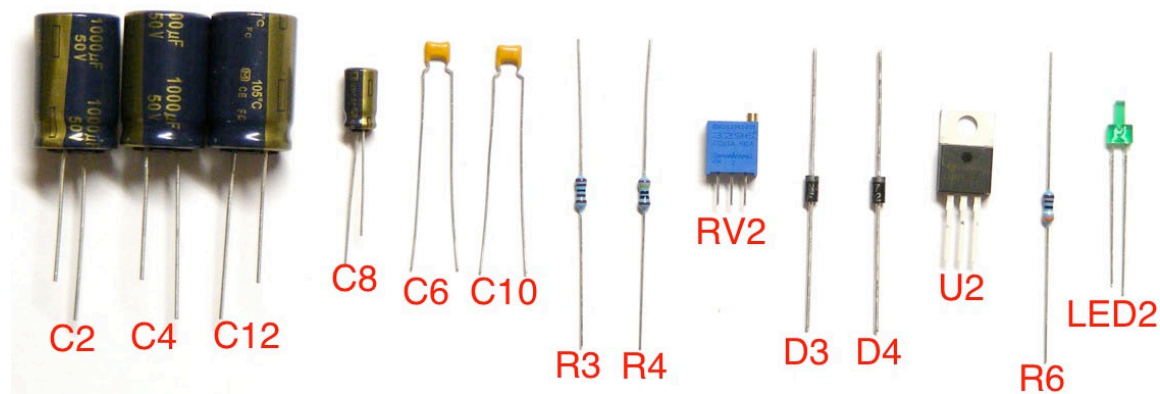
Before starting assembly, identify every component in the kit. Compare the content of the kit with the BOM provided previously. If you can't make out the resistor values from the colour rings, use a multimeter to confirm their values.

N.B.: If you have ordered a custom kit, make sure that you can clearly identify R2, R4, R5, R6, R8 and R9. The "Alternate Resistor Values" table (on page 5) lists all possible combinations of resistors that you may have received.

Each rail will have certain components associated with it. The following is a list of the components needed to run each rail\*. The pictures below are for visual reference only.

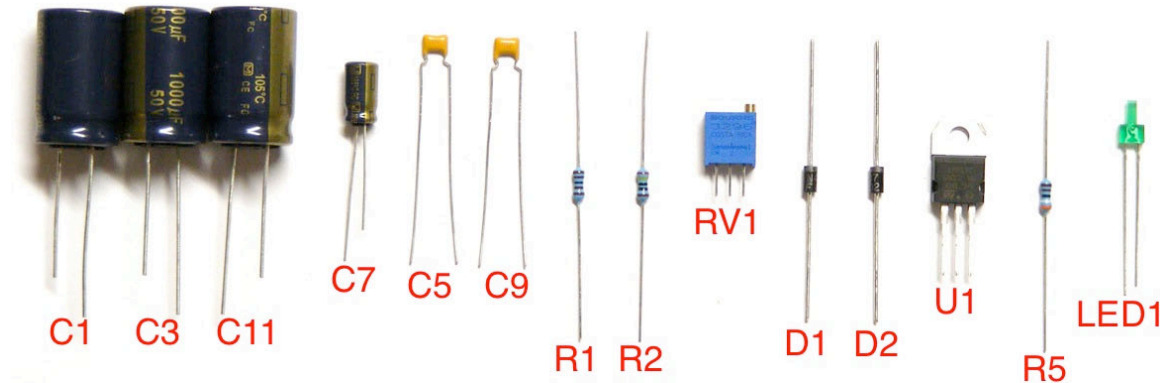
**FIRST RAIL:** C2, C4, C12, C8, C6, C10, R3, R4, RV2, D3, D4 and U2.

**OPTIONAL LED:** R6, LED2.



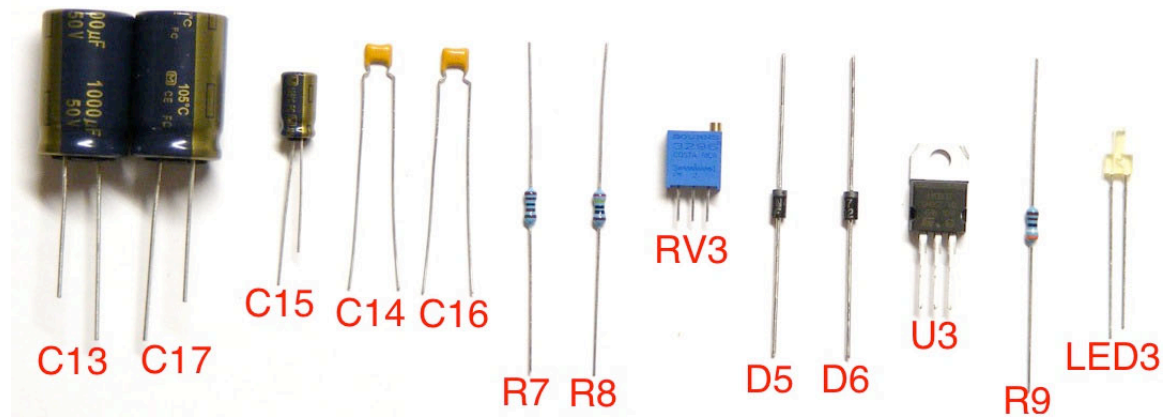
**SECOND RAIL:** C1, C3, C5, C7, C9, C11, R1, R2, RV1, D1, D2 and U1.

**OPTIONAL LED:** R5, LED1.

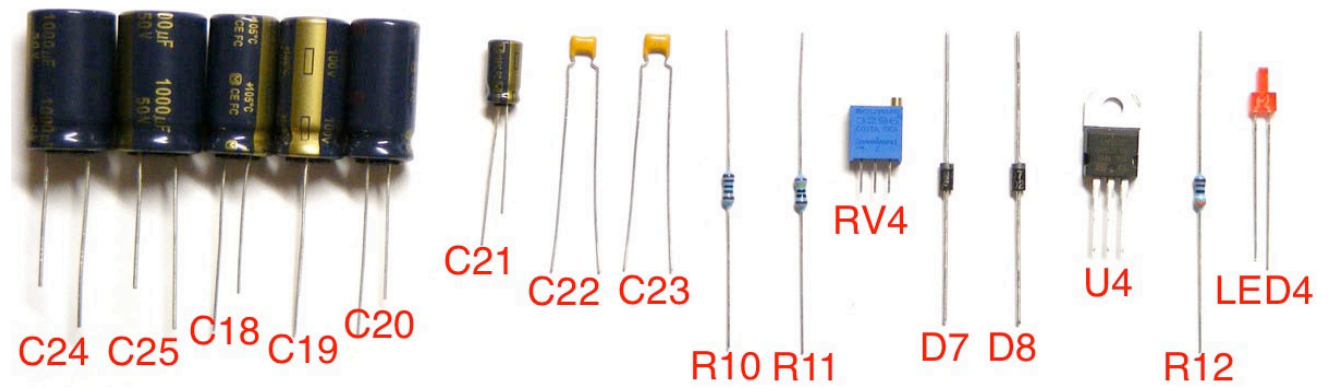


\*Thanks to Mark Plancke (Biasrocks) for the suggestion.

THIRD RAIL: JP2, C13, C14, C15, C16, C17, R7, R8, RV3, D5, D6 and U3.  
OPTIONAL LED: R9, LED3.



FOURTH RAIL: C24, C25, C18, C19, C20, C21, C22, C23, R10, R11, RV4, D7, D8 and U4.  
OPTIONAL LED: R12, LED4.



### **STUFFING ORDER:**

a) - **Resistors:** Remember to check your resistor values before soldering them to the board. Use a multimeter if needed.



b) - **Diodes:** Diodes are polarized components, which require a bit more attention when inserting them on the PCB. The cathode is clearly marked on the diode's body with a grey ring. It MUST match the marking on the PCB silkscreen.

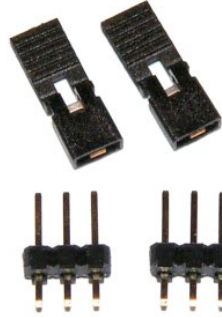


c) - **Ceramic Capacitors (100nF):** These ceramic capacitors are part of the decoupling circuits and eight are required if building a full kit.

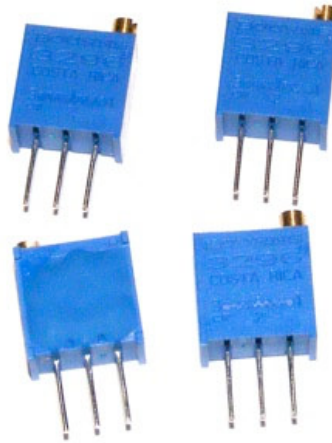




d) - **Jumpers**: Two 3-pin headers and jumpers are included with a full 4-rail kit. They are to be used for JP1 and JP2. Custom kits may only have one or none depending on your rail requirements. Refer to the setup section on page 13 to understand what those jumpers do and how to configure them.



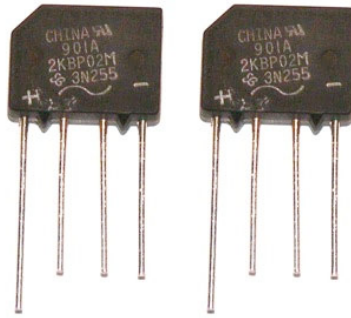
e) - **Trim resistors**: The trim resistors allow you to fine adjust the voltage outputs. There are four of them in a full 4-rail kit: RV1, RV2, RV3 and RV4. Place them as indicated by the PCB silkscreen.



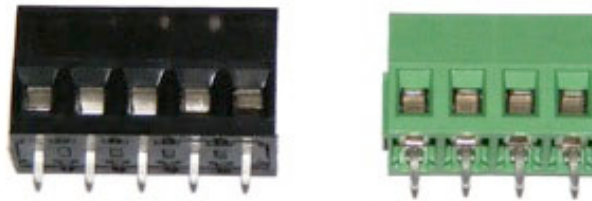
f) - **Small Electrolytic Capacitors (10uF)**: These reside right beside the trim resistors. Notice that they are polarized components. The band along the capacitor's body indicates the negative side. The positive side is marked on the PCB silkscreen. You **MUST** place these in the right direction. There are four of them in a full 4-rail kit: C7, C8, C15 and C21.



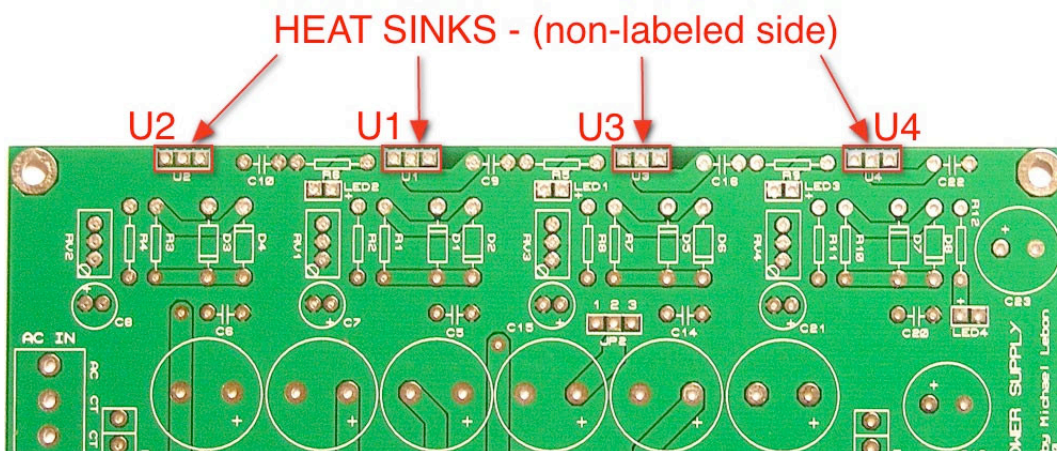
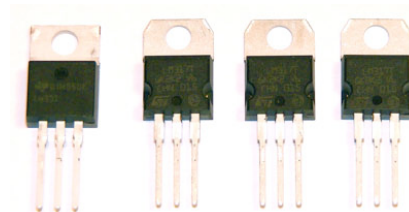
g) - **Bridge Rectifiers:** These are polarized and must be placed correctly on the PCB according to the silkscreen marking. The positive side is marked on the component and must match the rectangular marking on the PCB. If you have a custom kit that does not include the +48V rail, you will only find a single bridge rectifier to be used for BR1.



h) - **Screw Terminals:** There are two screw-terminals to be placed. One has four positions for the power transformer connections and the other has five positions for the voltage outputs.



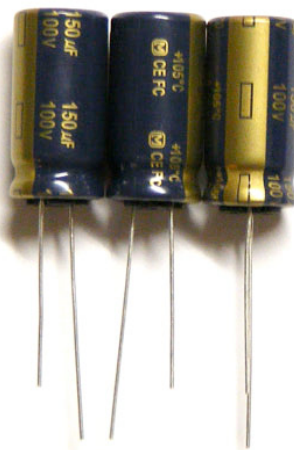
e) - **Voltage Regulators:** The voltage regulators are placed along the edge of the PCB for easy heat sink mounting.



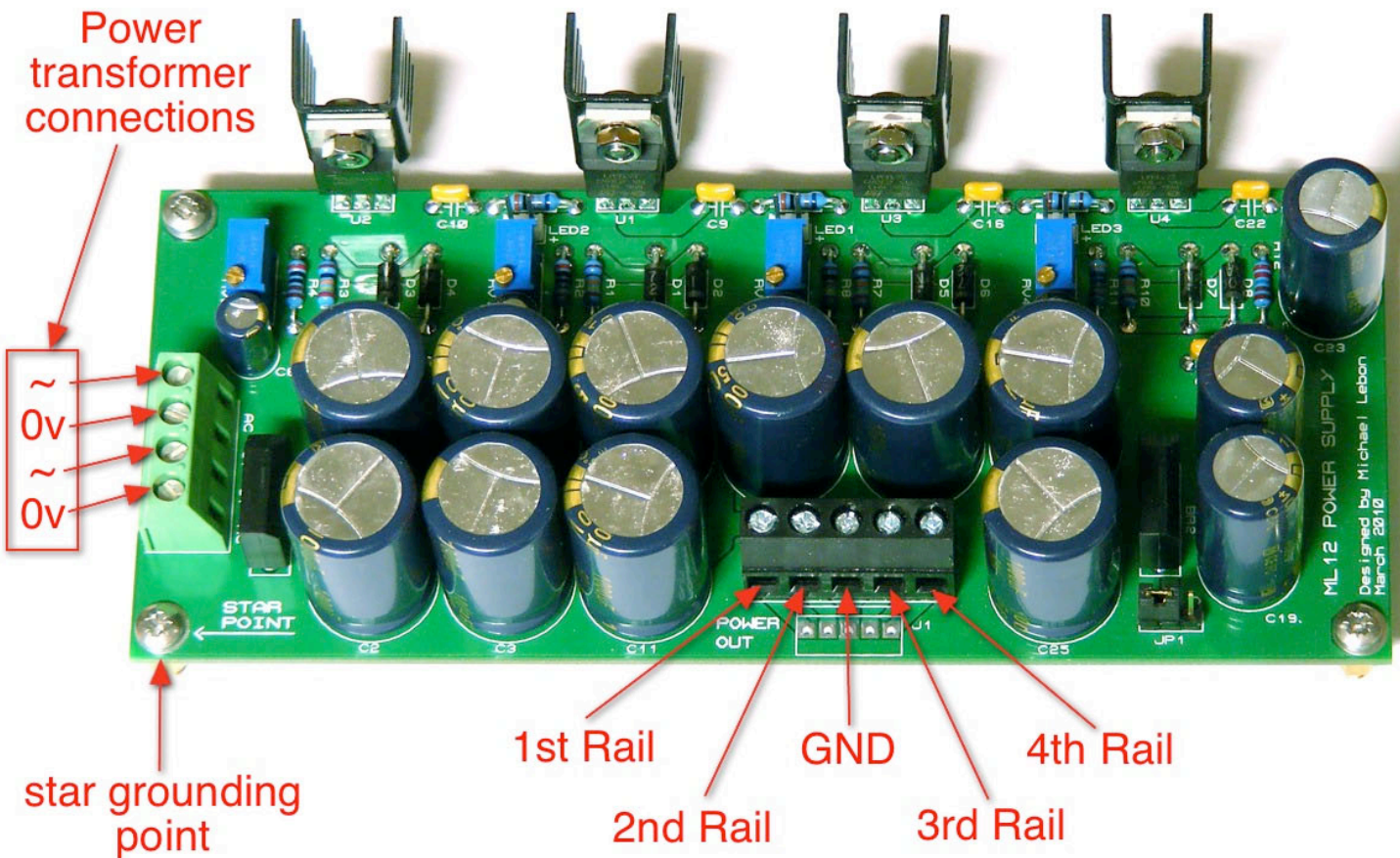
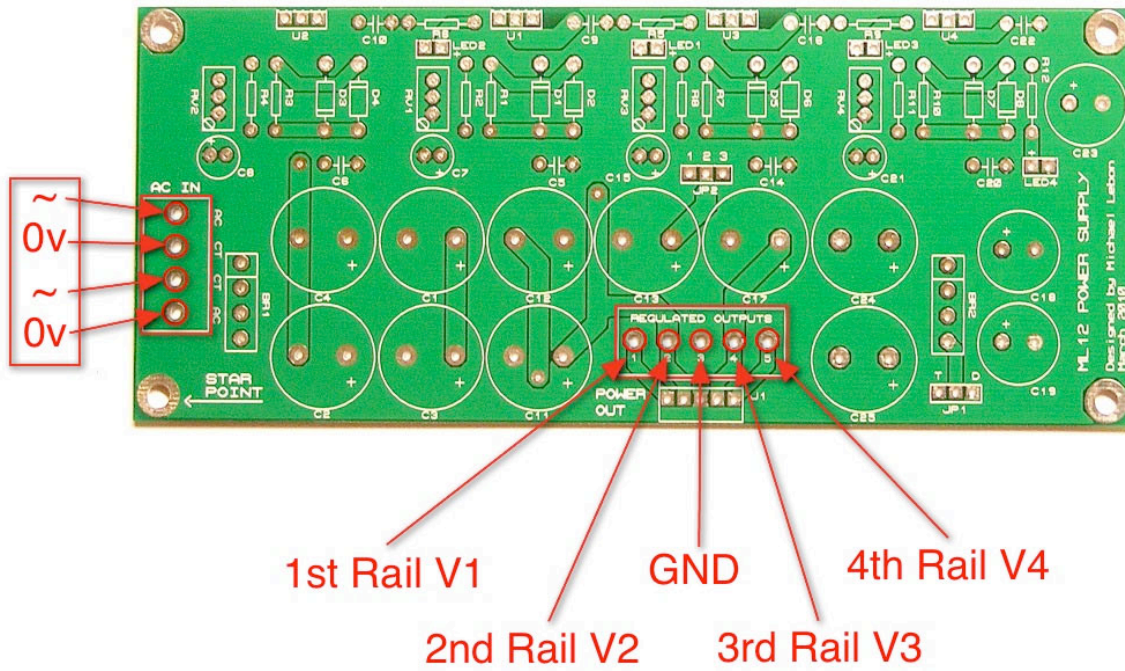
f) - **Large Electrolytic Capacitors (1000uF)**: Watch the polarity! The negative side is marked with a gold stripe along the component's body. There are ten of them in a full 4-rail PSU.



g) - **Large Electrolytic Capacitors (150uF)**: Watch the polarity of these as well. The stripe indicates the negative side.



# CONNECTIONS



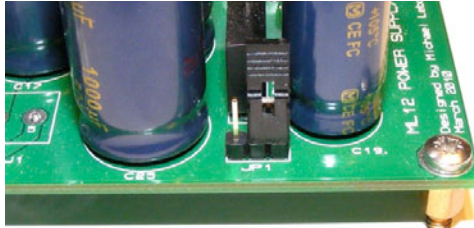
# SETUP GUIDE

This section will go over the proper setup of the PSU.

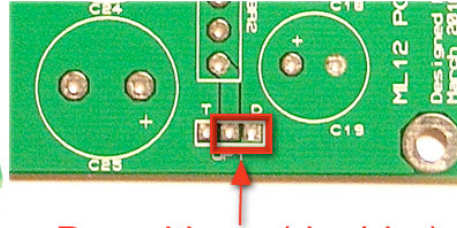
## **STEP 1: Jumper settings.**

JP1 is used only if a +48V rail is needed. It has two possible positions: D (doubler) or T (tripler).

- JP1 must be set to the D position when the power transformer used is rated for 2x20 VAC or more.

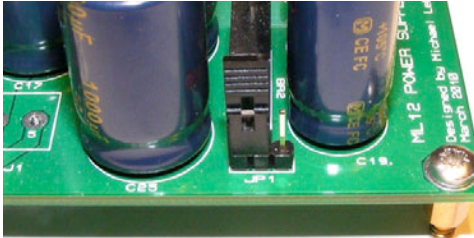


JP1 shown in D position

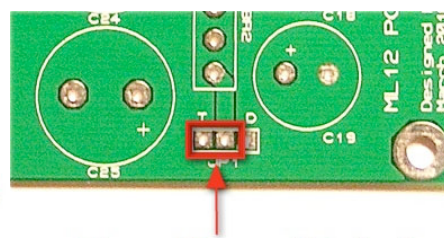


D position - (doubler)

- JP1 must be set to the T position when the power transformer used is rated for 2x18 VAC or less.



JP1 shown in T position



T position - (tripler)

JP2 is used to set the unregulated voltage source of the third rail.

- JP2 should be set to 2-3 if the third rail is set to provide a voltage equal to or greater than the second rail.
- JP2 should be set to 1-2 if the third rail is set to provide a voltage lower than the second rail by more than 2V.

## **STEP 2: Double-checking.**

This is VERY important! Make sure that every solder joint is properly done and double (and triple) check the polarity of the diodes and electrolytic capacitors. The silkscreen layout on page 15 is provided in this document as a reference.

## **STEP 3: Smoke test!**

Once you are sure that all the components are properly placed, hook up the power transformer to the 'AC IN' screw terminal block as described in the previous page. Now is time for the first power up test: Plug it in and step back. If you see no smoke, sparks or exploding capacitor within the first couple of minutes of power up, you're good!

**STEP 4: Trimming voltages.**

If everything went fine, you can now put a multimeter to the output 'POWER OUT' terminal block to fine adjust the voltages. The first, second, third and fourth rails are adjusted by RV2, RV1, RV3 and RV4 respectively. After you have finished the adjustments, you can wire up the indication LEDs safely. The LEDs are polarized. The long lead is the positive side and must be wired to the PCB accordingly.

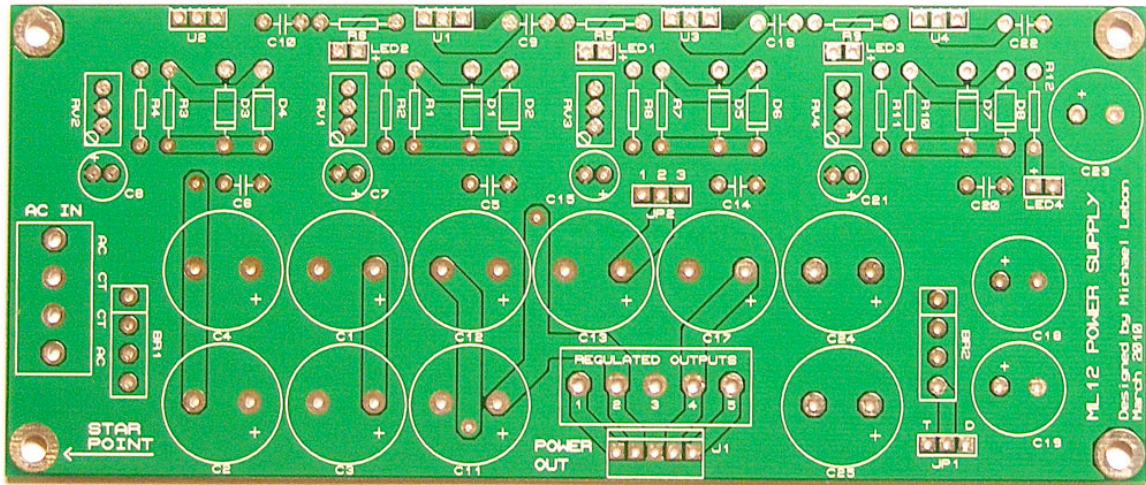
**STEP 5: Congratulations! You now have a working PSU!**

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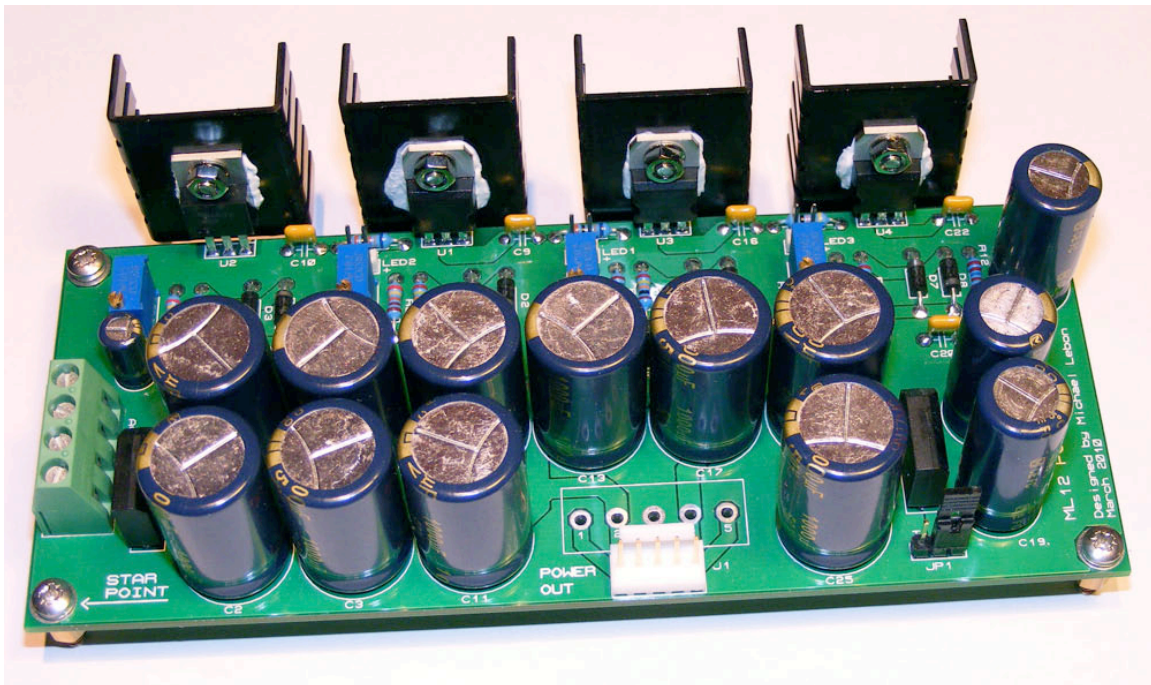
All the information within this document including the PCB layout of the ML12 PSU discussed herein is my intellectual property. No copying or distribution of this manual in part or in full is allowed without my prior consent. DO NOT use this product in any commercial application without contacting me first.

Michael Lebon, May 2010.

# REFERENCE PICTURES

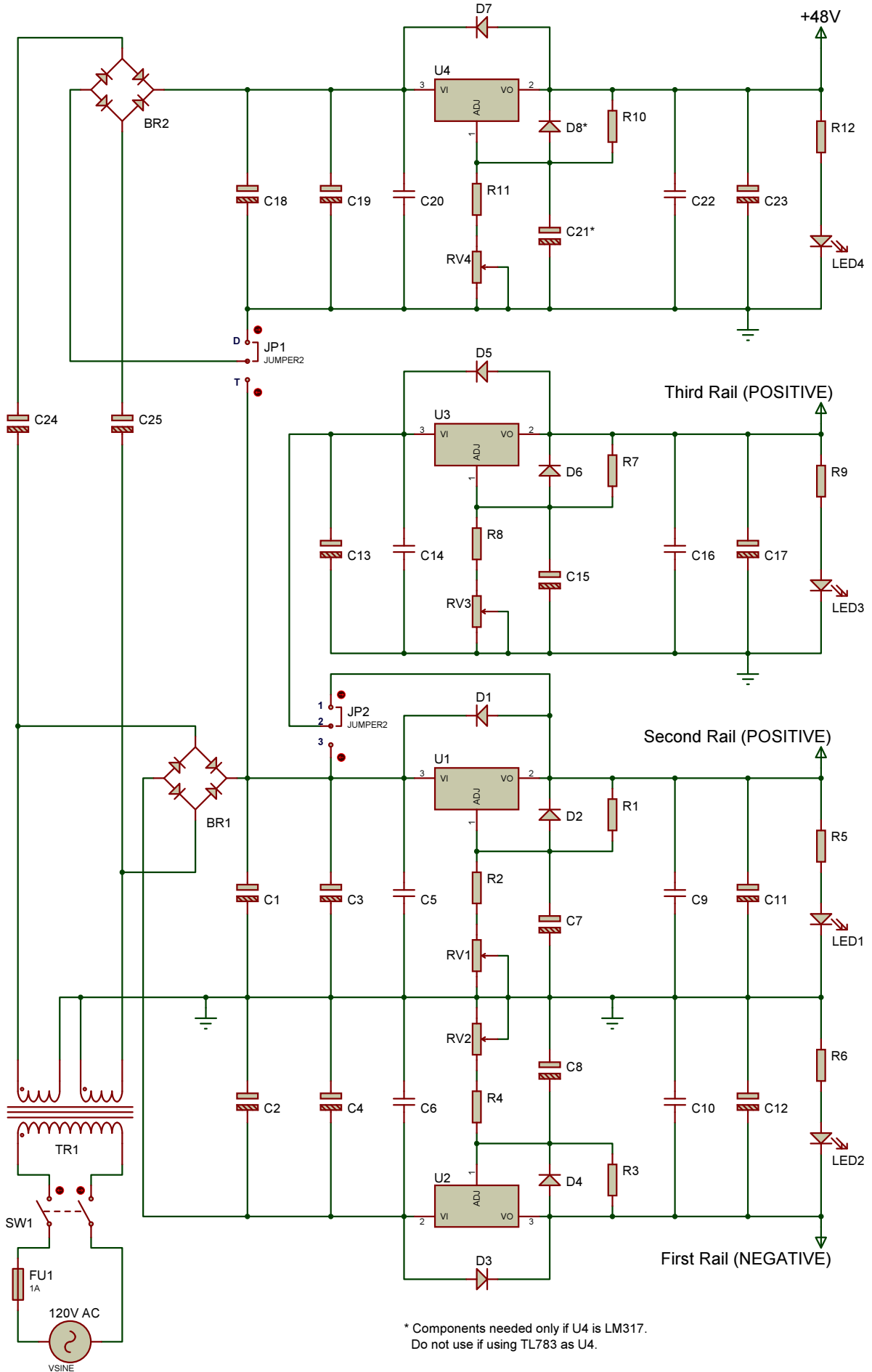


Bare PSU PCB component side.



PSU with heat sinks and optional 0.1" regulated output header.

# ML12 Power Supply Unit - Schematic



\* Components needed only if U4 is LM317.  
Do not use if using TL783 as U4.



ML12 PSU - TOP SILK (not to scale)

