VU-1 VU Meter Kit

Volume Unit Meter

Simplicity Counts, Detail Matters.

Last Revision: January 25, 2008

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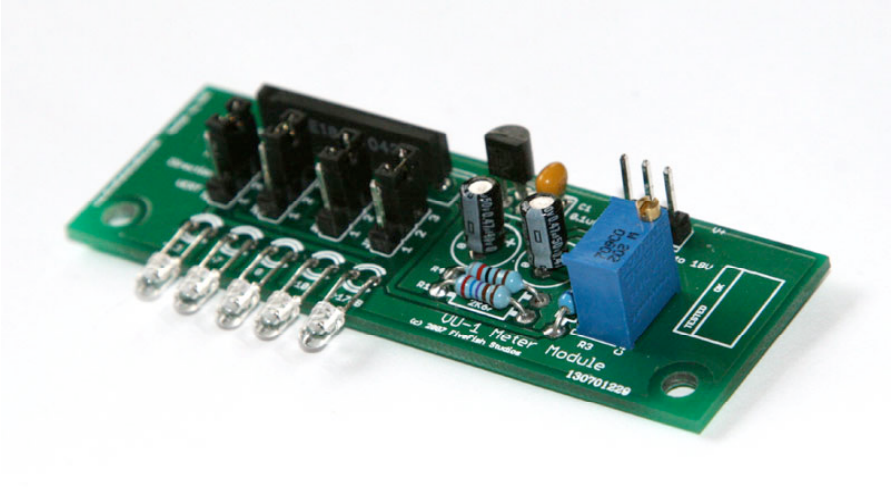
Congratulations and thank you for your purchase of the VU-1 VU Meter Kit.

Countless hours has been spent in the design, manufacturing and packaging of this kit to deliver to you a Volume Unit Meter (VU Meter) Kit 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 VU METER KIT.**

I know people sometimes don't want to read manuals. But unlike software, there is NO UNDO for this project. **READ THIS DOCUMENT COMPLETELY FIRST.** Take your time, and ask questions if you are unsure of something. Work methodically and carefully. I promise you, you'll be rewarded with a great working VU Meter 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 VU-1 VU Meter Kit

- Built-in rectifying amplifiers allow VU Meter operation by AC or DC input
- Wide display range covering -13dB to +17dB, allowing display of signals with wide dynamic range
- Regulated LED Drive current, independent of voltage supply
- High efficiency, crystal clear Red LED indicators for VU Meter display
- Wide DC power supply voltage range… 5V to +24VDC
- Built-in voltage regulator for supply, limited to maximum of +18VDC
- Use of high quality 1% Metal Film resistors, and high-quality ceramic and electrolytic capacitors
- Easy to assemble, easy to troubleshoot design
- Each component carefully labeled, protected and packed in separate zip bags
- Low Parts Count, Very affordable!!!
- Displays -13dB, -7dB, 0dB, +10dB, +17dB

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 – sucks up solder when you made a mistake soldering components on the PCB. Primitive operation, but it works… kind of.

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)

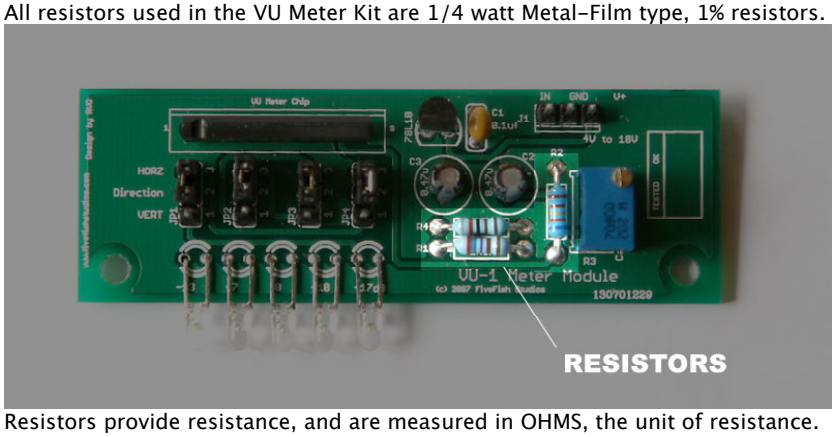
1. Desoldering pump – if you make a mistake, you need to pull out the component from the PCB
2. Component lead bender – bend component leads like resistors uniformly and evenly
3. PanaVise – to hold PCB while you're working on it
4. Tweezers – to pick tiny things
5. Masking tape – to hold components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

VU-1 VU Meter Parts Identification and Assembly Notes

For the newbies, this is not meant to be a full tutorial about 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 VU Meter Kit are 1/4 watt Metal-Film type, 1% resistors.



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 two kinds of capacitors used in the VU Meter Kit project. We'll discuss the different types here.

Ceramic Capacitors

Ceramic capacitors look like the picture on the left. On the VU Meter kit, these are colored "yellow" and are very small in size. Ceramic capacitors are non-polarized, and therefore it does not matter what orientation they go in.

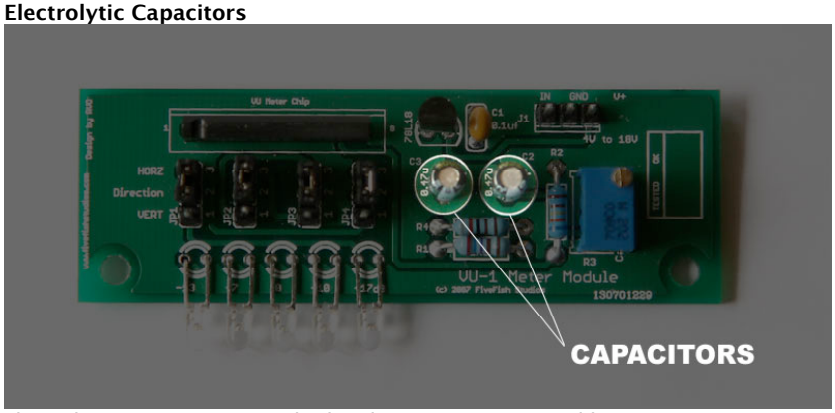
They are rated in microfarads (abbreviated as "uf"). They also have a voltage rating (abbreviated as "V"). In a design, the voltage rating must not be exceeded. Otherwise, you'll ruin the capacitor. Either short it out, or blow it open.

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

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

Microfarads (mF)	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

Electrolytic Capacitors



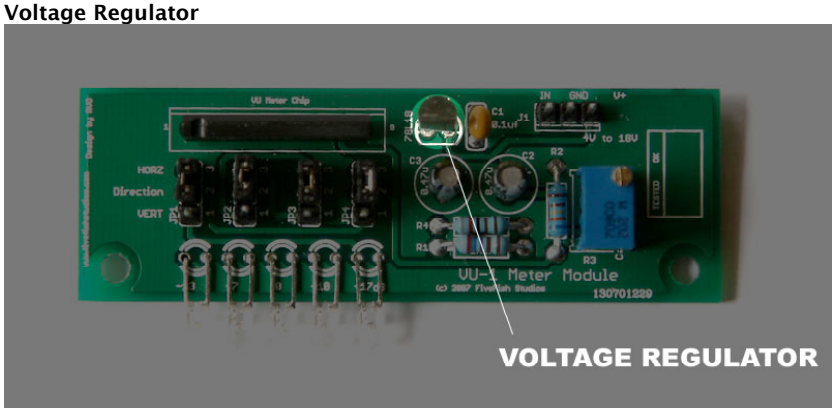
Electrolytic capacitors are cylindrical in construction. Unlike ceramic capacitors, electrolytic capacitors USUALLY/MOSTLY have polarity. One side is marked with the (-) sign, also called the cathode, or negative side.

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

WARNING: It is VERY IMPORTANT not to insert them backwards, or in the wrong polarity orientation. Doing so may cause the capacitor to explode. Do not the let the small size fool you. Even a small capacitor can explode with a lot of force.

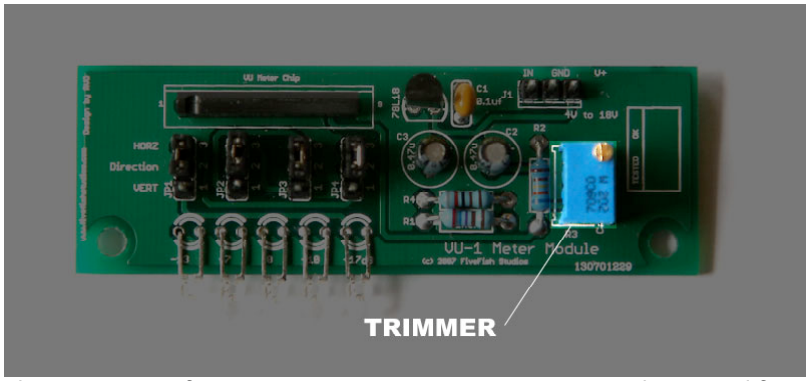
All of the electrolytic capacitors used in the VU Meter Kit have polarity.

Voltage Regulator



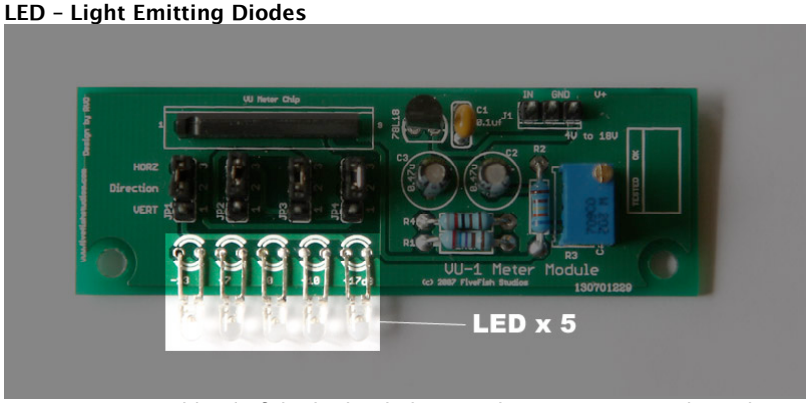
The VU Meter Kit uses an on-board voltage regulator, limiting the supplied DC voltage to the VU Meter chip to +18V. This means, you can connect this VU Meter Kit to power supply greater than +18V, for example: +24V or higher. I would suggest though that keep the input voltage to the VU Meter Kit under +25V.

Trimmer



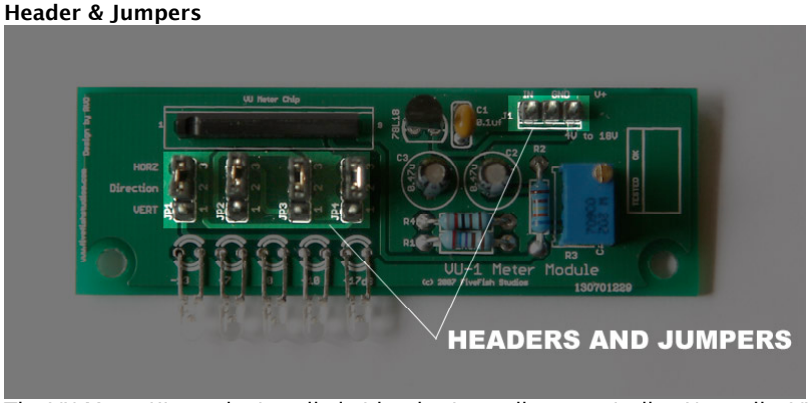
The VU Meter Kit features a 25-turn trimmer potentiometer. This is used for calibrating your VU Meter. (More on this later.)

LED – Light Emitting Diodes



LEDs are a special kind of diode that lights up when current goes through it. We're using low-current, high efficiency LEDs for the VU Meter Kit. These are crystal clear when OFF, and bright RED when turned ON. Insert the LEDs with the longer legs on the left side, looking at the VU Meter PCB from the front.

Header & Jumpers



The VU Meter Kit can be installed either horizontally or vertically. Normally, VU Meter movement go from LEFT → RIGHT or BOTTOM → TOP direction.

That means, when the VU Meter Kit board is installed in a vertical configuration, you want your LED movement going from BOTTOM → TOP.

If the VU Meter Kit board is installed in a horizontal configuration, you want your LED movement going from LEFT → RIGHT.

Four (4) on-board jumpers are provided on the PCB to allow you to change the direction of LED movement display. Just move ALL jumpers either to the HORZ or VERT position (for Horizontal or Vertical position respectively).

IC Chip

The IC chip used in the VU Meter Kit is a 9-lead SIP (Single Inline Package). One side of the chip will have a V notch. This designates where pin #1 is located. Install the IC Chip with pin #1 (V notch) on the left side of the board (looking at the VU Meter PCB from the front view.)

Assembly and Soldering Tips

Use a clean soldering iron tip. Heat the component lead AND PCB pad at the same time, 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

Note the orientation of LEDs, IC chips, voltage regulator and electrolytic capacitors. There is only one correct way to mount them. Do NOT mount electrolytic capacitors backwards. Do not mount the IC chip and voltage regulator backwards too.

When soldering multiple-pin devices (like trimmers, headers, IC chips, voltage regulators) 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, and small parts, etc...

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 IC chip has very fine pin spacing. You need good eyesight to solder all pins properly without shorting them together.

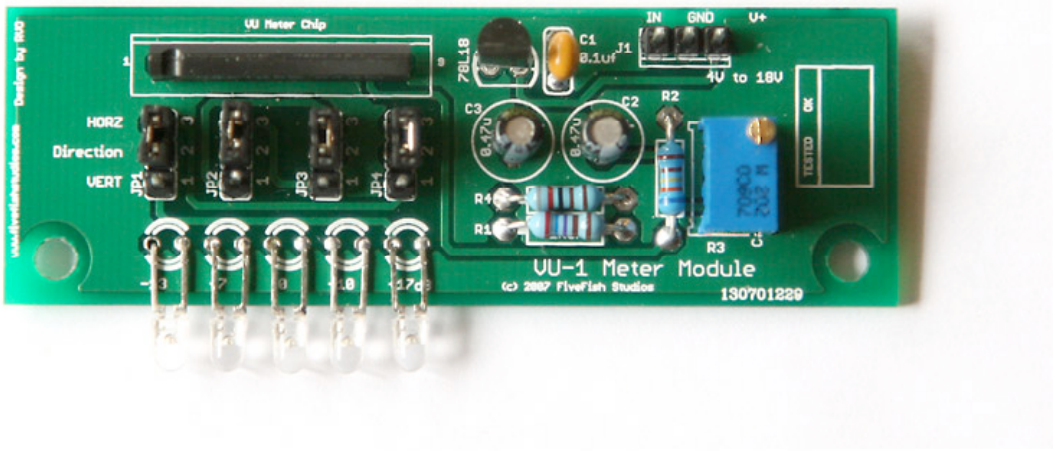
VU-1 Assembly Guide

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

IMPORTANT NOTE: Observe the orientation of the VU Meter Chip!!!

NOTE: The photos on this Assembly guide may not exactly match the PCB you received. But the instructions are still valid.

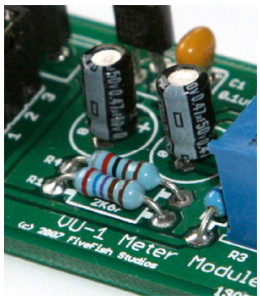
Follow this checklist during your construction.



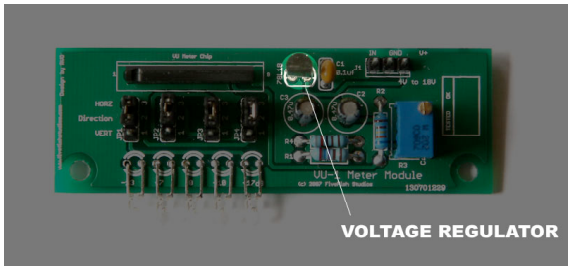
STEP 1. Solder all 1/4-watt resistors and inductors to the PCB. The orientation does not matter.

STEP 2. Solder the ceramic capacitor to the PCB. The orientation does not matter.

STEP 3. Solder the two electrolytic capacitors. Note orientation of (-) leg. The negative leads should be as shown in the photo below:



STEP 4: Solder the Voltage Regulator. Note the orientation of where the “flat side” is facing.



STEP 5: Solder the IC Chip. Note orientation of pin #1. The V-notch of the chip should be on the left side. Solder one pin first, check orientation and alignment, then solder the rest of the pins. If crooked, reheat the first leg and straighten the chip before soldering the rest of the pins.

STEP 6: Solder all 3-terminal headers. Solder one leg first, adjust and straighten if necessary before soldering the rest of the pins.

STEP 7: Solder the trimmer resistor. You may install the trimmer resistor on it’s side for a lower height profile. Solder one leg first, adjust and straighten if necessary before soldering the rest of the pins.

[see photo]

STEP 8: Solder the (5) LEDs to the board. Bend as shown in the photo below. The long leg of the LED goes to the left position. Try to make all the LEDs uniform in length.

STEP 9: Insert the Jumper pins to the headers.

And you’re done!

VU-1 Installation Guide

The VU meter only needs (3) wires to get it working. Look at header J1 (not JP1).

1. The first pin is labeled “IN”. This is connected to either pin2 or pin3 of the XLR output jack.

2. The second pin is labeled “GND”. Connect this to the GND of your Power Supply.

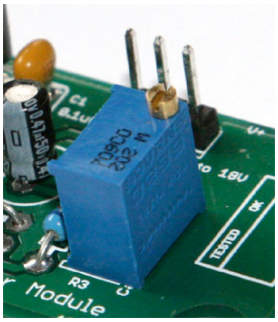
3. The third pin is labeled “V+”. Connect this to the Positive Terminal of your Power Supply. Voltage applied to this pin must be between +5VDC to +25VDC.

4. Adjust the jumper headers for the direction of LED movement (HORZ/VERT).

VU-1 Calibration Guide

1. Adjust trimmer resistor so that when you feed a 0dB signal to the VU Meter, the 3rd LED lamp lights up.

For +4dBu operation, connect a signal generator to the VU meter input, 1Khz, adjust output of Signal generator to 1.22Vrms, and adjust trimmer resistor until 3rd LED lights up.



VU-1 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. Supply voltage must be at least 5Volts DC. Check the GND wire is connected.

Also check that the "IN" pin on Jack J1 is connected to your XLR jack. You can connect it to either pin2 or pin3 of the XLR output jack.

Check that the LEDs were inserted in the correct orientation. Long leg soldered to the left side.

Check that you installed the jumper headers for JP1, JP2, JP3 and JP4. All jumpers must be either in the HORZ position, or VERT position. Do not mix and match.

Check that the trimmer resistor is adjusted.

Check that you have signal coming out of your preamp/XLR jack. Make sure it is strong enough to register on the VU Meter Kit.

VU-1 PCB Component Layout Guide