

# Resonant Lopass Gate Build Document

## Revision 3.2

Friend and fellow builder,

Thank you for your purchase of this PCB that is a derivative of the famous Buchla 292c Lopass Gate. Don Buchla himself gave approval to this endeavor for us all to learn a bit more about analog synthesizer module design, and for this we owe him a debt of gratitude as a true scholar and gentleman. This is not the first, nor will it be the last Lopass Gate module to come out to the world. People have become transfixed on the magic of Vactrol's which are a combination of a resistor and LED in a light-tight package that seals out the light of the world yet somehow glows with an internal magic, that for the Synth\_DIY crowd becomes hard to ignore.

Many have contributed to this PCB project through the various designs and ideals made public through the wonders of the Internet. These people include Don Buchla, Peter Grenader, Chris MacDonald, Mark Verbos, Grant Richter and others. We would like to thank them for their valuable contributions to our Synth\_DIY community and for their brilliant modules which have helped to spawn a crowd of Vactrol addicts.

Building this PCB requires the same fundamental practices which we have generally put in practice with our other personal modules we have built. If this is your first module, or your 100'th I hope you find the documentation and support offered within to be satisfactory. However, if this "is" your first module I highly recommend you to find and frequent the dirty Internet watering holes for us synth junkies otherwise known as [www.electro-music.com](http://www.electro-music.com) and [www.muffwiggler.com](http://www.muffwiggler.com)

These forums offers a unique place to learn about, share, and sometimes advertise and sell simple PCB projects such as this one. Members range from the synth designer elite like Juergen Haible (Update: RIP, 2011) and Grant Richter to the layperson such as you and I. All kinds are welcomed and accepted in the name of growing our small community of synthesizer freaks. If you need help with this project, please post your requests there. If you make an outstanding version, please post your pictures there. The information located on [www.naturalrhythmmusic.com](http://www.naturalrhythmmusic.com) about this project will only serve as a resource for the documents and will not allow for posting and feedback like that which can be found at [www.electro-music.com](http://www.electro-music.com) and [www.muffwiggler.com](http://www.muffwiggler.com)

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### Building the PCB

In building this PCB, the first step is to download and refer to all of the documents. You will find PCB images, component overlays, parts lists, schematic, basic wiring diagram, Front Panel Express files, and even a Microsoft Excel file that will allow for easier USA ordering with Mouser.com. Once you have all the parts, start with the resistors and the diode. Then move to IC sockets. Next would be the capacitors. Following that would be the Vactrols, trimmer and potentiometers... all of the aforementioned being dependent 100% on your personal panel design. When you power it up, it should work right away. The trimmer can be adjusted to shift the range of the "Offset" frequency.

There are several modifications which have conveniently been built into the PCB for you as the consummate builder. Modifications are not necessary, and the modifications do move this design away from the classic Buchla 292c design that made the concept famous. But, we are an anxious bunch and modifications often "must" be done just to "see what happens." Recognizing this I have tried to enhance the circuit to the best of my non-designer abilities in ways that you will be able to appreciate. The following is a summary of the modifications presented:

**1. Resonance** – Adding resonance to the Lopass Gate (LPG) has been done before, so it was worth pursuing here. Not my idea, but one I included in the circuitry with having to make significant extra modifications in your builds. There are 3 sections for jumpers on the PCB. One is for the Resonance Mod.

To use the module without resonance, as in the original design, simply connect jumper JP1A to JP1B. [Jumpers JP1B and JP2B remain unconnected.](#)

If you'd like to include the resonance mod, and "Why not?", then you connect two jumpers. These would be:

JP1a connected to JP2a  
JP1B connected to JP2b

This will essentially route the audio output through the added resonance section. If you do not want the resonance modification you can leave P2 and R18 unconnected entirely.

**2. Audio Mixer Section** – The original lopass gate (LPG) had a single audio input. I have added a 3 input audio mixer to allow for multiple signals to be summed before feeding into the audio input of the LPG. These inputs can be wired up optionally, and potentiometers can be added if level control per input is desired. In this fashion, the LPG can be put into the very familiar Synthech MOTM 2 Unit panel layout. Some, such as I, prefer to have every possible feature on the front panel... so I'll be using all three inputs with three level pots. What you do is up to you!

The audio mixer can be left off by simply connecting the "IN" jumper to "DI" instead of "SM1". This connects the Direct Input wiring pad to the LPG input, completely bypassing the Audio Mixer Stage. If one really wanted, they could use the 3-input mixer and tap the output from the "SM1" pad for a simple mixer. The exact same concept here is duplicated for the CV section.

**3. CV Mixer Section** – This section is the same as the audio mixer section above. The inputs are summed and can have pots attached if you so desire. In both examples the schematic shows how to wire the pots up. There is one difference though. Thanks to a suggestion by an [electro-music.com](#) forum member I added an inverting output (R34). This allows for the summed CV's to be output as an inverted signal. This can be patched right in to one of the second CV inputs with a pot to vary the mixing of a positive and inverted CV signal for interesting results.

See the Audio Mixer section above, and the schematic, for notes on the jumpers used to route the CV Mixer or Direct Input pad to the CV section of the LPG circuit.

**4. Deep Switch (a.k.a. Offset Range)** – This switch is an extremely simple mod I discovered while circuit bending my prototype. It allows for an extra resistor to be connected between pins 6 and 7 of U1. The effect of this is that the offset frequency range

is dropped so that the low end of the Offset Pot without the Mod allows for continued downward sweeping to sub audio range when the switch is flipped. While this is completely unnecessary to make the LPG sound like a LPG, it does allow for more flexibility when using the LPG as a Voltage Controlled Filter.

**5. Mode Switch** – The Mode Switch can use either a 3-Pole Double-Throw toggle switch “OR” a 4 pole-3 Position rotary switch depending on what you feel is right in your build. Wiring diagrams for each are presented in the schematic for the project. Either way, you will have access to both the Amplifier, Frequency, and “Both” modes presented in the original Buchla design. It is possible to wire this up as “only a filter” or “only an amplifier” but that is completely up to you to pursue if you see fit to do so.

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**I offer my personal thanks to you for supporting this project!**

I have wanted Lopass Gate for my modular for a long time now. Working on this project has been an excellent learning experience for me, a challenging development, and a satisfying contribution back the Synth\_DIY community from which I have learned so much. My personal thanks goes out to all who helped to refine the final circuit diagram, particularly Mr. Schilling and ChrisSugar who stepped in to make sure that some quality issues were addressed before the final PCB revision. I look forward to hearing your builds on the Internet via audio samples or Youtube videos. I hope to see panel designs that take this project to the next level. Learn, share, and enjoy this project. Respectfully,

**Thomas White**  
LPG Project Coordinator

Thank you Don Buchla for being such an outstanding supporter of the DIY Community!

*This project is dedicated to Larry Hendry who inspired others by doing it himself - TW*