# GS1-A & GS1-A$^2$ Build Guide

## BA662 Inspired VCA

*V1.1.2 July 2022*

The GS1-A and its smaller brother the GS1-A2 are based off the design of Roland's System 100M series of modular synth modules. The heart of these modules is the BA662 differential op-amp that Roland used in just about everything in the late 70's and into the 80's.

The BA662 is no longer available, but Open Music Labs created a clone (clown) design that is pin compatible for the original. It uses 9x tiny dual transistors and a couple of resistors and is perfect as a replacement for the original. The BA6110 IC is still available if you look hard enough, and while not being pin compatible is more or less identical to the BA662 for use in these modules. For this reason, the GS1-A provides footprints for both IC to be used, while the GS1-A2 (smaller) provides a footprint for just the BA6110. The partial kit comes with a BA6110. The builder is welcome to source a BA662 or OML clone from places like re303shop.com or SynthCube.


The signal flow of the GS1-A takes several input audio signals (up to three on the 8hp and just two on the 6hp version) and allows you to mix these via the gain controls next to each input jack (red box A)

The VCA can be run in either linear mode, or exponential mode by means of the toggle switch.

Next to this is an "initial GAIN" control (green C). This sets the gain of the incoming audio sources allowing you effectively open the VCA without the need for a modulation source (blue B). You can use this to bleed some of the audio signal into the output as well as using the modulation inputs.

Speaking of modulation sources, the module again provides either three or two CV modulation inputs to trigger/open the VCA itself. (blue B) Normally a gate or envelope would be applied, but of course with a modular synth any suitable CV input can be used. Each input has its own CV attenuation control. Remember that the initial GAIN has a general influence over these as well.

The rear of the module has 3 trimmers that can be used to adjust the overall drive of the VCA (adjust so at peaks the red LED is just showing, or overdrive if thats what you are after!) and the other two set the level of the linear and exponential modes accordingly. Calibration details are provided towards the end of this guide.

Finally, three (or two) outputs are provided (yellow D). Those common to both versions of the model are the L (low) and H (High) outputs. Essentially these can be thought of as line level (L) and euro level (H) – so you can use this VCA as an output module to get a euro signal down to line level for use outside of your Euro setup. The 8hp version also includes an M (Middle) output just in case you want a slightly less hot signal.

Contact info geosync.synth@gmail.com 

## !!! Important Notes !!!

During the time Roland were making late 70's and early 80's analog synths, it seems they basically used whatever they had in stock for the 3 pin transistors. By default, in the System 100 timeframe, the 2SA1015GR and 2SA1815GR seem to have been the PNP and NPN of choice, but any ECB pinout PNP, NPN will work just fine. For example 733/945 or 608/536 or even 115/603 etc These aren't particularly important to the sound, I've experimented with all of these and NOS/new parts, including cheapo Aliexpress variants of the 945P (marked P331) and all of them work.

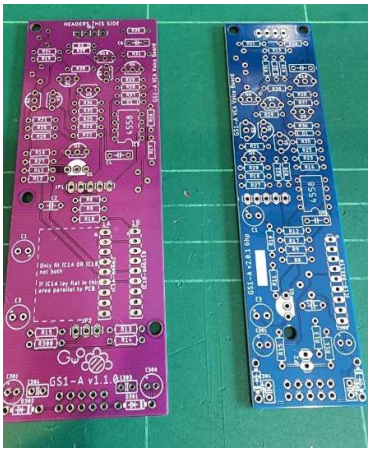
**DON'T POPULATE BOTH THE BA662 AND BA6110,** the pcbs may have footprints for both, just select one and use that. For the BA662 I suggest using a SIP pin strip style socket.

Note on electrolytics. I've tried to make it possible to use normal 11mm capacitors, so you will often see a marking on the silkscreen showing where you can lay the capacitor on its side. The solid white line designates the side where the -ve stripe should end up. You can of course use <11mm high caps and stand them up, but if you are like me I have loads of 11mm normally. These modules use some non-polarised electrolytics (often called NP or BP) so the +/- markings are not necessary.

Enjoy!

# Lower – Voice Board

| GS1-A | GS1-A$^2$ |
|---|---|



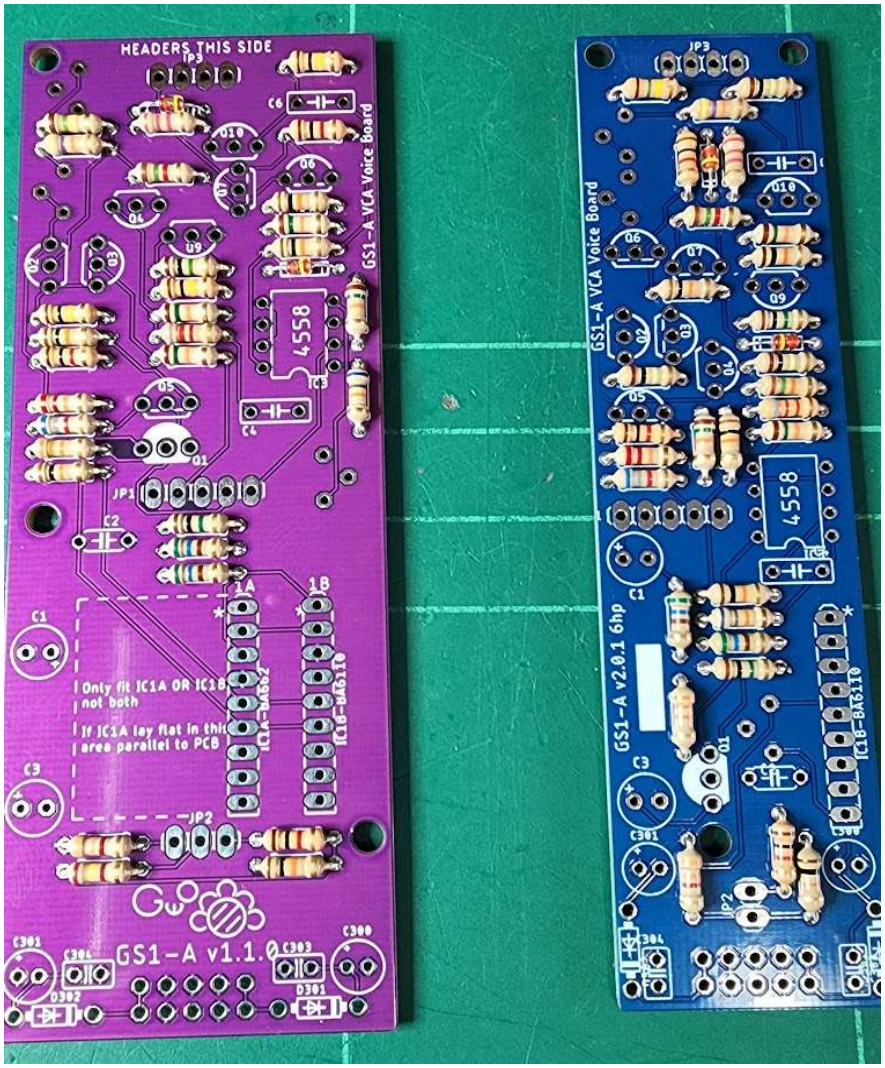
Start with the board marked as the voice board.

1. Solder the two 1SS133M diodes.
2. Solder all the resistors.

   Parts on the upper board are marked in blue text in the bom.

   For now, just look for and solder all the resistors that are shown with black text.

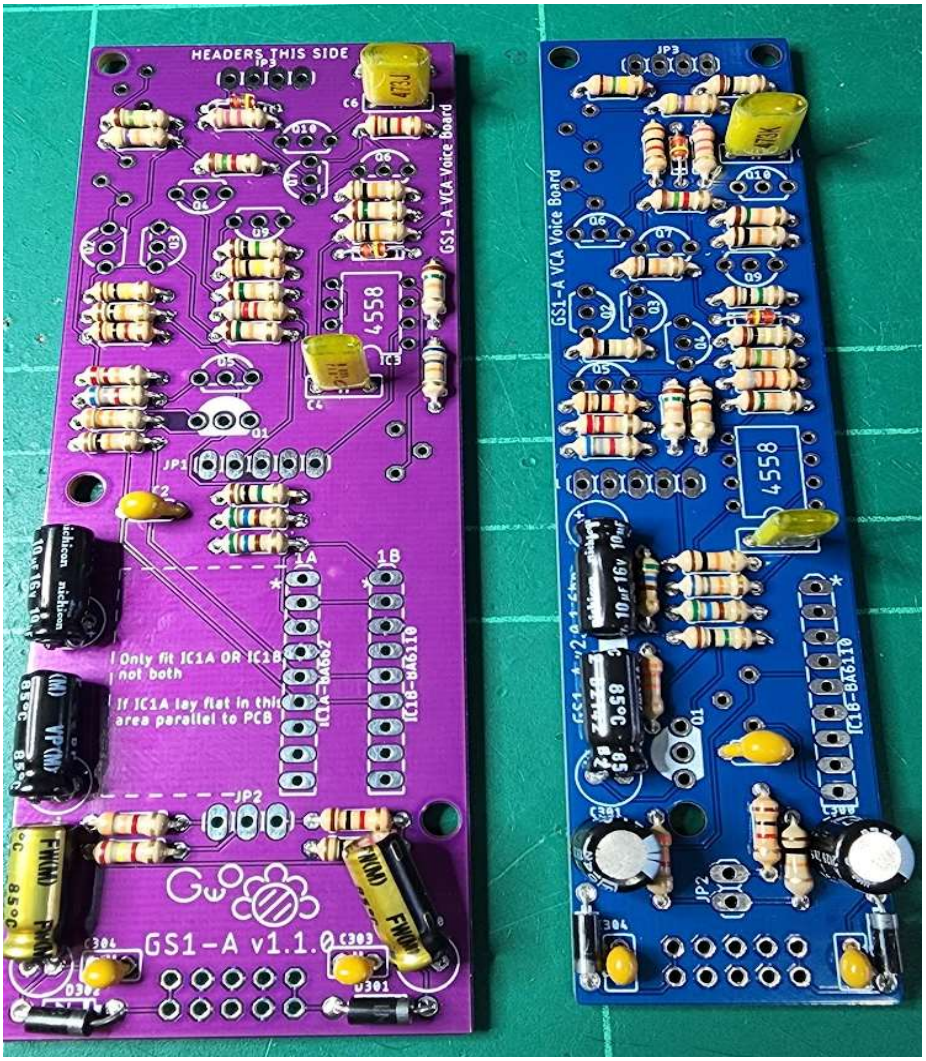
   The board should look something like this; some pictures are of prototype boards and may differ slightly. Also note that both the 8hp and 6hp modules are shown in the pictures.



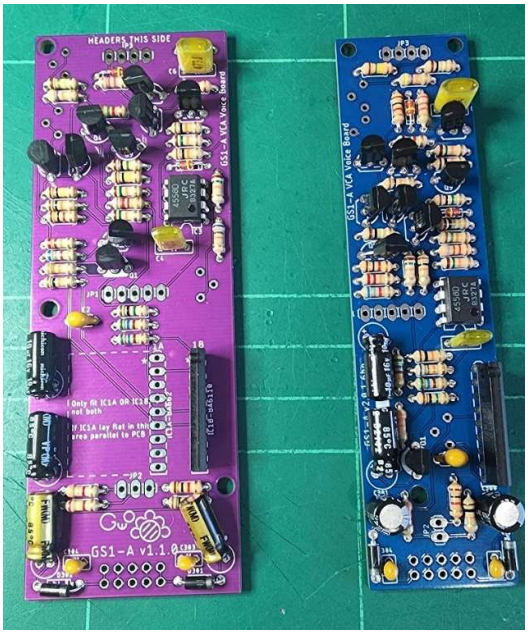
3. Solder the two 1N5817 diodes.
4. I like to add the IC sockets next, so if you are using them, place the single 8 pin DIP socket and 9pin SIP (if using BA662).
5. Next comes the capacitors, again my routine is usually;

    a. MLCC small ceramics
    b. Polyester/polypropylene yellow/greenies and the poly box ones
    c. Finally, the electrolytics.

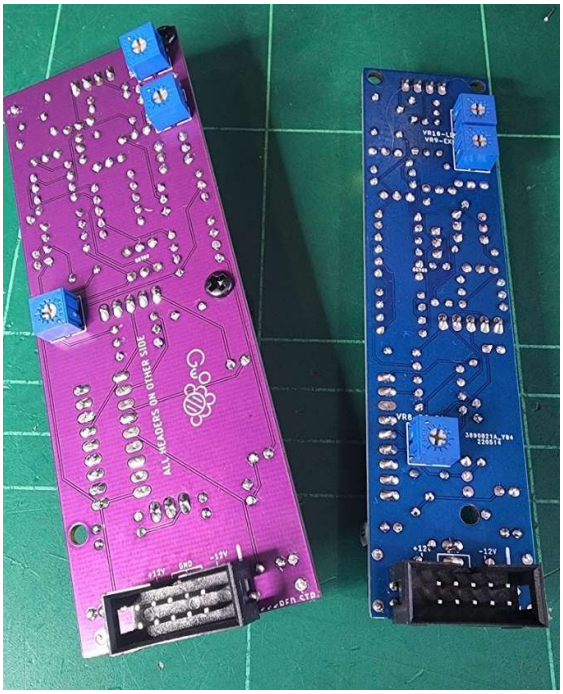
    Due to the stacking of the boards you cannot stand up the electrolytics if the are standard 11mm. If you have low profile electrolytics, all good, but otherwise insert the caps and bend them over to sit parallel to the as shown. Make sure they won't foul on the standoff holes. **The GS1-A2 needs low profile 47uF caps!**



6. Now we can add the transistors.
7. Add the ICs into the sockets (or solder them). If using a BA662, bend it flat parallel to the board in the area shown, make sure it doesn't short on anything.




8. Add the Euro 10pin header and the 3pin trimmers **on the reverse side of the board.**

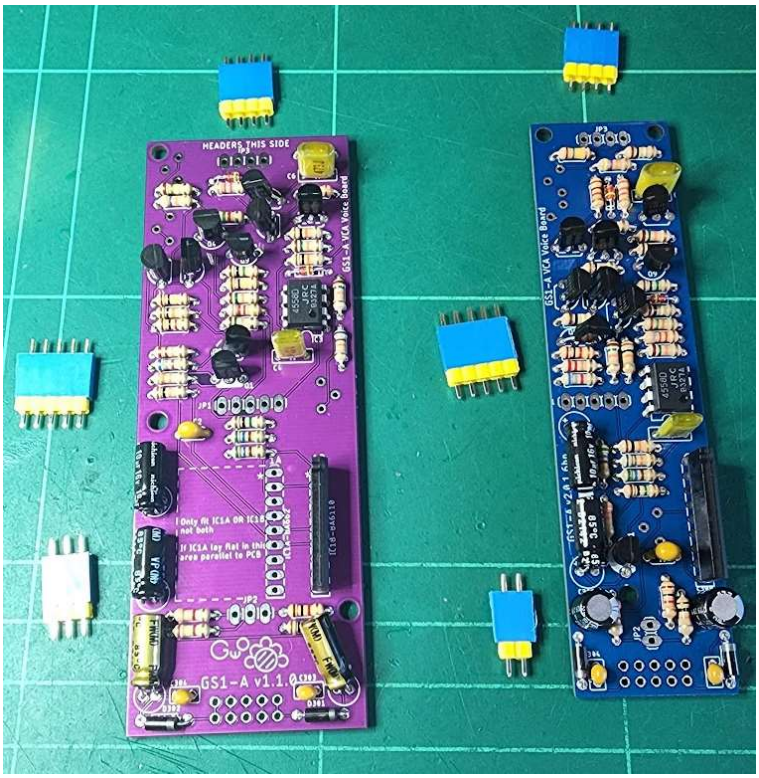


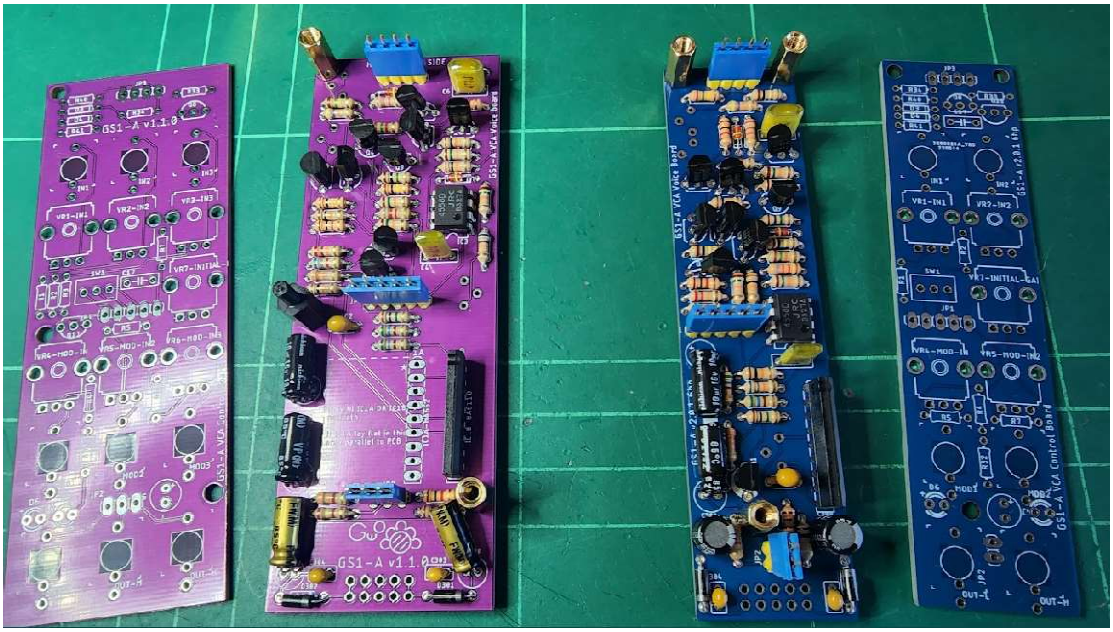
9. Finally, the headers to join the two boards.

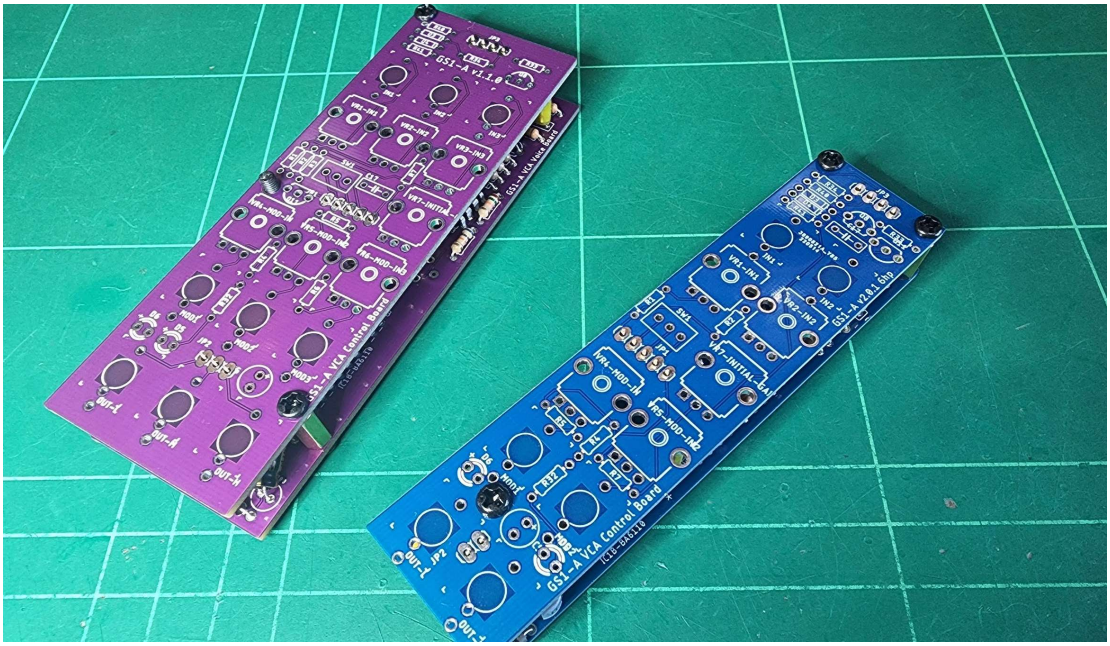
   Use your usual technique for this but I find the following makes it easy.

   a. Screw the 11mm standoffs to the voice board. The standoff should be on the same side as the components, so screw from the underside.
   b. Cut / prepare both the male and female connectors and join them together.
   c. Place all into the voice board sticking up the same way as the standoffs. **Don't solder yet.**
   d. Bring the control board to the stack and place it carefully so the standoffs line up with the holes and most importantly so that all the connector pins go through the corresponding holes in the control board.
   e. Screw the control board to the standoffs and you should now have a nice, neat sandwich and you can simple solder all the connector pins from the top and bottom.
   f. Unscrew one of the boards from the standoffs and carefully pull apart the connectors. Perfectly lined up every time!

      (NB: I usually leave the standoffs attached to the upper board, so unscrew the bottom board. This is because I am lazy and if they are already attached to the upper board, you can fit the panel later and not have to worry about access to the screw holes!)




GS1-A v1.1.0
GS1-A v1.1
GS1-A VCA Control Board


GS1-A v1.1.0
GS1-A VCA Control Board

# Upper - Control Board

Complete the same order of components on the control board:

Diodes, Resistors, Capacitors and Transistors. **The electrolytic needs to be a low profile.**

Insert **but do not solder yet** the 7 pots, single switch and the 9 jack sockets on the GS1-A or 5 pots, single switch and 6 jack sockets into the boards. Add the two LEDs and place the front panel over them so you can ensure they line up with the holes. Here, as I don't want to have to take all the nuts off again I make sure I have the standoffs attached to the upper control board, fit all the jack nuts, washers and nuts to the pots.

For the switch, the easiest is to leave one nut on the switch body, screwed all the way down. This sets the correct height. Then use the second nut to fix to the panel.

Once you are happy everything fits, is lined up solder them all from the underside. Check that none of the pots or jacks foul against the components on the lower board, you may need to trim the solder joints a little. Connect the two boards, check everything over and time to power on.

# Calibration

The calibration as with most VCA's can be down to taste.

The three trimmers on the rear set the DC balance (VR8) – the red LED shows clipping, so you want to adjust the DC balance so at peak levels the red LED just pings on and off.

The two other trimmers set the levels of the linear and exponential gain. These are in series, so the linear (VR10) does actually influence the exponential gain also.

Basically you want to adjust so that with the initial gain pot fully counter clockwise, and the modulation inputs all off, there is no blead of the audio signal to the output. Then as you increase the modulation pot(s) with say an envelope input, you hear the audio signal begin to come through with either linear curve or exponential curve depending on the switch position.

Once you have set those two, go back and check with the initial gain at full clockwise and a full clockwise modulation input that the DC balance is still just bouncing around the clip point. Here you can set this to taste, you may want a slightly overdriven sound for example, hence to taste!