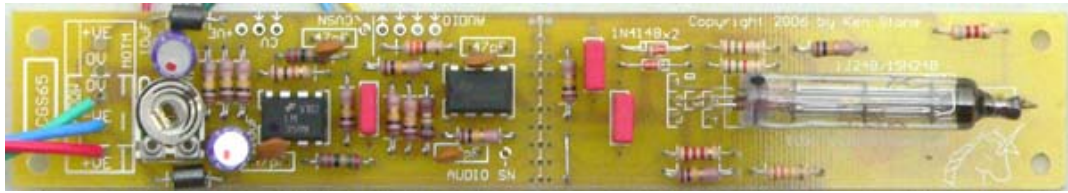


Tube VCA / Timbral Gate

for music synthesizers.

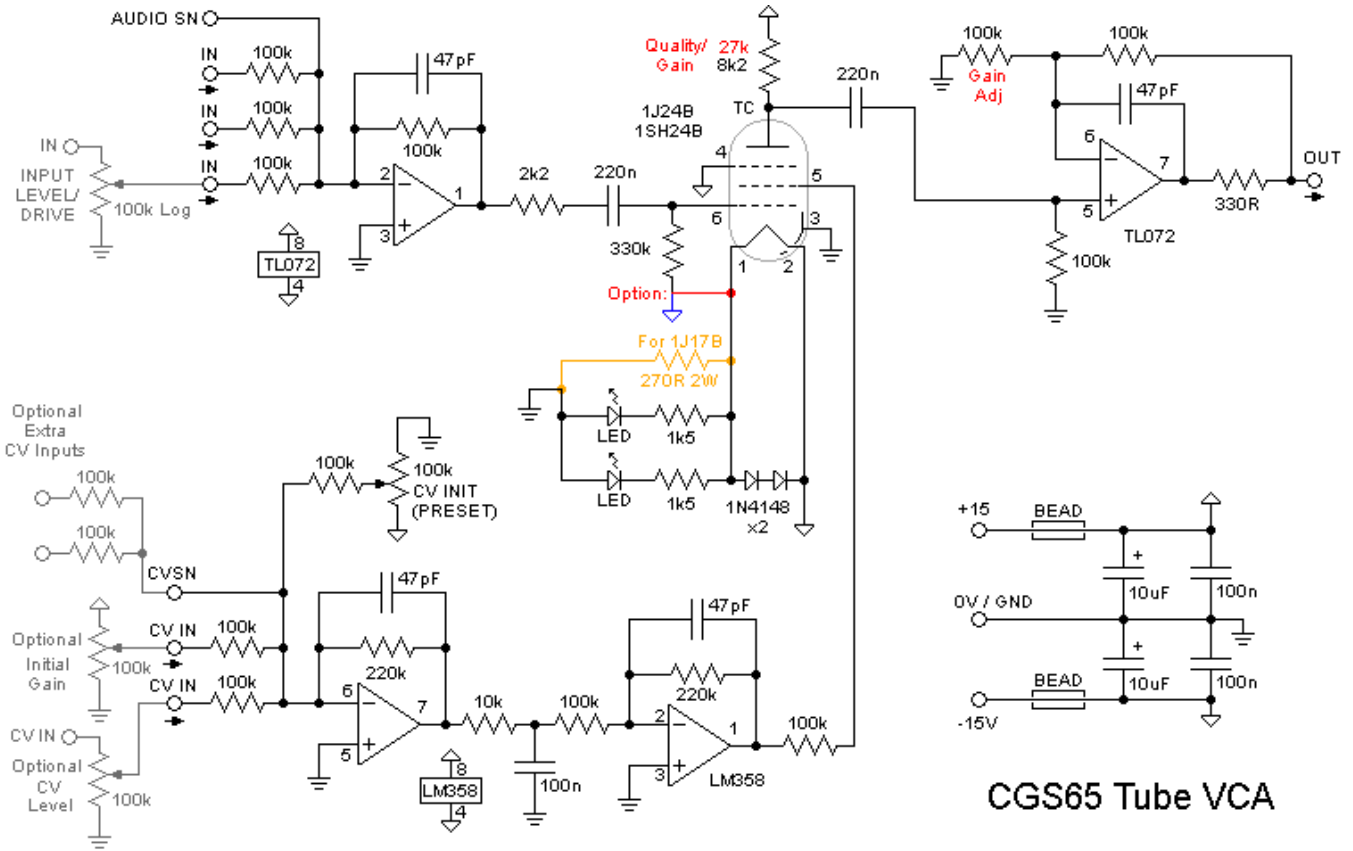


This is a tube based Voltage Controlled Amplifier / timbral gate. While this module basically operates as a VCA, it does add a degree of distortion to the signal. How much distortion depends on how hard it is driven. Add feedback and it begins to oscillate, synchronizing to the incoming signal to some extent. All this while running on a standard synthesizer power supply, with no extra heater supply required.

Sorry, the Wayback Machine does not have this video (S6_AF28BrQM) archived/indexed.

A demonstration of feedback oscillation and synchronizing on the Panther Euro version of this module.

A little on how it works.



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CGS65 Tube VCA

0-5V Control Voltage

There are several distinct sections to this circuit. First to consider is the heater supply. The tube chosen is the Russian sub-miniature 1J24B (1SH24B, 1K245). It operates on low voltage, and uses a mere 13ma at 1.2 volts for its heater. In other words, the heater uses less power than the average LED. Power for the heater is derived from the negative rail, by passing the current through first the heater, then some current limiting resistors with LEDs in series with them. Two resistors have been used to keep the dissipation within the resistors to appropriate levels. The LEDs are also using a little of the waste power. More info on this is given alongside a photo below. The two 1N4148 are merely an insurance policy. They are to prevent the heater seeing any more than around 1.5 volts if an incorrect resistor is installed, or a similar mishap occurs.

The top left of the schematic is a very standard summing amplifier/mixer with unity gain. It's output is AC coupled to the grid of the tube.

The bottom left of the schematic is a very standard summing amplifier/mixer with a gain of around 2. It's output is fed through a "de-thump" lag circuit and into a second stage, also with a gain of around 2. This part of the circuit is the CV mixer. It converts the expected 0 to 5 volt CV signal into something appropriate for driving the second grid of the tube by both amplifying it and adding an offset voltage.

The core of the circuit is of course the tube itself. It can be viewed as running on a 30 volt single rail supply, as its cathode is referenced to the negative 15 volt rail instead of 0 volts. It is a mixture of a triode wired pentode and a multiplier, though sans the usual automatic cathode bias, due to the use of a directly heated cathode.

The final section of the circuit is simply a load-independent, non-inverting buffer/gain stage.

Construction

Modifications

Read [Tube vca modifications and results](#) on electro-music.com forum for more ideas.

On the first (yellow) run of PCBs, the grid bias resistor (330k) goes to the negative rail. In this position, it causes some distortion of the signal. This can be a good thing. I prefer the resistor in this position when using the unit as a timbral gate. This is shown in BLUE on the schematic. An alternative is to bias the grid to around 1.2V with respect to the negative rail - in other words, to the other end of the heater/cathode. This is shown in RED on the schematic. Doing so will reduce the distortion at low input levels. Do not put in both red and blue options at the same time or you will short out the heater. It may be appropriate to connect pin 4 of the tube to pin 1 of the tube instead of pin 2 as well, if making this modification.

It is possible to increase the value of the plate resistor. I would not go above 27k, as strange (not good) things start happening. Increasing the value of this resistor will increase the over all gain, and may reduce the distortion at low signal levels. If you get too much gain doing this, overall gain can be reduced by increasing or even removing the 100k resistor marked "Gain" in RED on the schematic. Removing it convert the output gain stage to a 1:1 buffer. Reducing the value of the 100k between pin5 and 0 volts may also help reduce gain. Alternately if you wish to increase the gain of the output buffer, reduce the value of the 100k resistor marked "Gain" in RED on the schematic. 10k would give a gain of 10.

Positive feedback adds some versatility to this unit. It isn't really a modification. Just make sure you have two audio inputs with level pots, one for the incoming signal, and the other for direct connection to the output. Having two output jacks would of course make wiring this up easy. Alternatively you could normalize the output to one of the input jacks.

Rev 1.1 PCB

Install the 330k in the position marked "330k" AND the jumper in the position marked with a dashed line*,

OR

Install the 330k in the position with no value specified AND the jumper in the position marked with a solid line*.

* note that the above two connections were incorrectly displayed on this page until updated on 15 Nov 2008. No real harm will come if the incorrect wiring was followed.

Pins 1 and 2 of the tube can be swapped by installing them in the two holes next to the ones marked 1 and 2 (saves getting the wires crossed).

Notes:

- Tubes can usually be acquired from ebay, or one of several European tube sellers. Members of the CGS yahoo group may choose to band together to buy tubes rather than pushing up each other's bids on ebay. <http://www.engineersatwork.nl> appear to stock them, though I have not tried their service. www.military-tubes.com/ also have them listed.
DO NOT ask me to supply the tubes. I have as much trouble as you will to get them, if not more, being in Australia.
- **PCB info:** 1" x 6" with four 3mm mounting holes 0.15" in from the edges.
- The board is designed so it may be cut in half and jumpered with a 0.1" header or wire links, so it can be fit behind smaller panels.
- Please [email me](#) if you find any errors.
- Purists and tube experts - if you don't like what I've done, instead of complaining, how about you share some of your secrets. The amount of info on these so called "common as dirt" tubes is dismal, and that which can be found is usually in Russian.
- [Bill and Will's version](#).

Parts list

This is a guide only. Parts needed will vary with individual constructor's needs.

If anyone is interested in buying these boards, please check the [PCBs for Sale](#) page to see if I have any in stock.

Can't find the parts? See the [parts FAQ](#) to see if I've already answered the question. Also see the [CGS Synth discussion group](#).

Part	Quantity
Capacitors	
47pF	4
100n	3
220n	2
10uF 25V	2
Resistors	
330R	1

1k5	2
2k2	1
8k2	1
10k	1
100k	12
220k	2
330k	1
100k trimmer	1
Semi's	
1N4148	2
3mm LED	2
LM358	1
TL072	1
Misc.	
1J24B/1SH24B	1
Ferrite Bead (or 10R resistor)	2
0.156 4 pin connector	1
CGS65 PCB	1

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