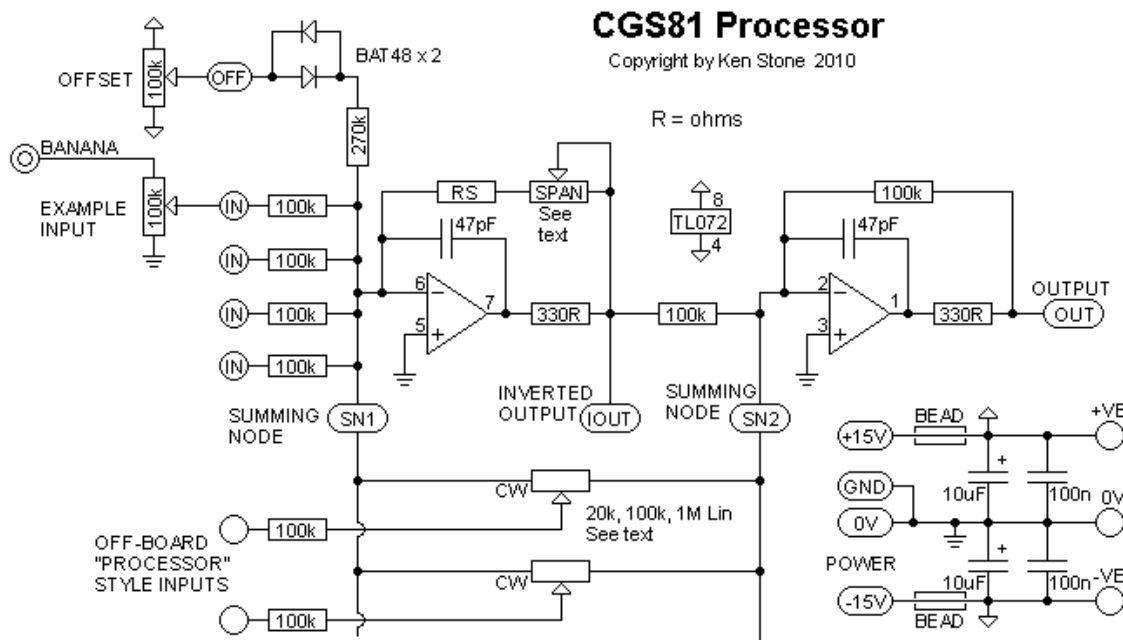# Voltage Processor

for music synthesizers.

This module is a variation on the standard two-inverting-stage op-amp DC Mixer. It has provision for an offset pot, four DC mixer inputs, processor style inputs, with both inverting and non-invering outputs, though the inverting output cannot be used with the processor function.

It will work on either +/- 12 volts or +/-15 volts without modification.

A little on how it works:

The schematic for one half of the dual voltage processor. Both sections are identical.

The circuit is a standard two-inverting-stage op-amp DC Mixer. The processor works by feeding the signal to the two summing nodes, both of which are at 0V (virtual grounds). With a processor input pot in the center of it's travel, the signal is fed equally to both inverting stages. The output of the first stage, being an inversion of the input signal, cancels out the signal being fed directly into the second stage. By adjusting the pot to either side, either the inverting or the non-inverting is increased with respect to the other, the difference being buffered by the second stage and fed to the output.

Construction
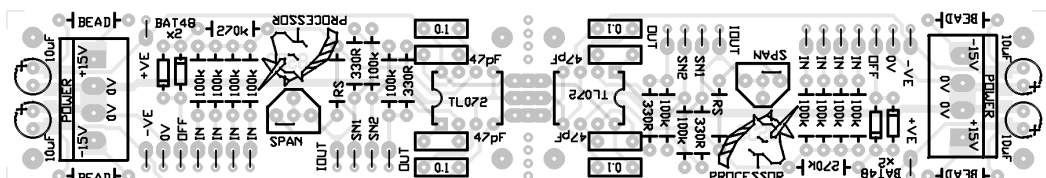
The component overlay for the VER1.0 PCB. Click here for an enlarged, printable version. Print at 300dpi. The board is designed so that it can be cut down the middle and separated into two identical units.

Before you start assembly, check the board for etching faults. Look for any shorts between tracks, or open circuits due to over etching. Take this opportunity to sand the edges of the board if needed, removing any splinters or rough edges.

When you are happy with the printed circuit board, construction can proceed as normal, starting with the resistors first, followed by the IC sockets if used, then moving onto the taller components.

Take particular care with the orientation of the polarized components, such as electrolytics, diodes, transistors and ICs.

When inserting the ICs in their sockets, take care not to accidentally bend any of the pins under the chip. Also, make sure the notch on the chip is aligned with the notch marked on the PCB overlay.

If you are not going to separate the board into two units, you do not need to install the beads and power connector at one end of the PCB. The 10uF electrolytics can be installed, as they will help with power rail decoupling.

There is provision on the rear of the board to install 10n to 100n, 1206 or 805 SMT capacitors across the power rails near the 10uF Electrolytic capacitors. These are optional.

The 270k resistors control the limit of the offset pot, and can be reduced or increased to suit individual taste. The BAT48 diodes provide a dead zone in the center of the offset pot's rotation, to allow for easier zeroing.

When built as a mixer, overall gain, with an input pot fully clockwise, can be changed by varying the value of the resistor "RS" and its associated trimmer "SPAN". A higher value will give more gain. For unity gain at either end of the pot's travel, the total of RS and SPAN will be 100k. A 91k resistor "RS" and a 20k single turn trimmer would be acceptable for adjusting unity gain. A 100k resistor "RS" and a 100k single turn trimmer would give a gain roughly tunable between unity and 2 times. A 47k resistor "RS" and a 100k 25 turn trimmer would give a gain roughly tunable between 0.5 and 1.5 times, but with fine enough resolution to accurately set unity gain.

OR you could just use 100k for RS and place a link between the two pads of the SPAN trimmer linked with a line. That will give you unity gain without the hastle of trimming. If you are building this as a processor, you need to do this, as the trimmer only controls gain in the first stage, and as such is of little use.

The number of 100k resistors used depends on the number of inputs that are to be used. You will need one per input. There is provision on the PCB for 4 resistors per mixer. Additional resistors can be connected to the point marked "SN1". If you are using the board to make processors, the input resistors can be omitted from the PCB. A 100k resistor will be needed between each input jack and the wiper of its corresponding pot.

The value of the pot used in the processor will affect the response of the pot. The pot itself MUST be linear. For example, a 50k will be slightly anti-log.

- 10k - Anti-log response - Greater sensitivity near center of rotation. Finer control towards ends of travel.
- 100k - Linear response.
- 1M - Log response - Finer control near center of rotation. Greater sensitivity towards ends of travel.
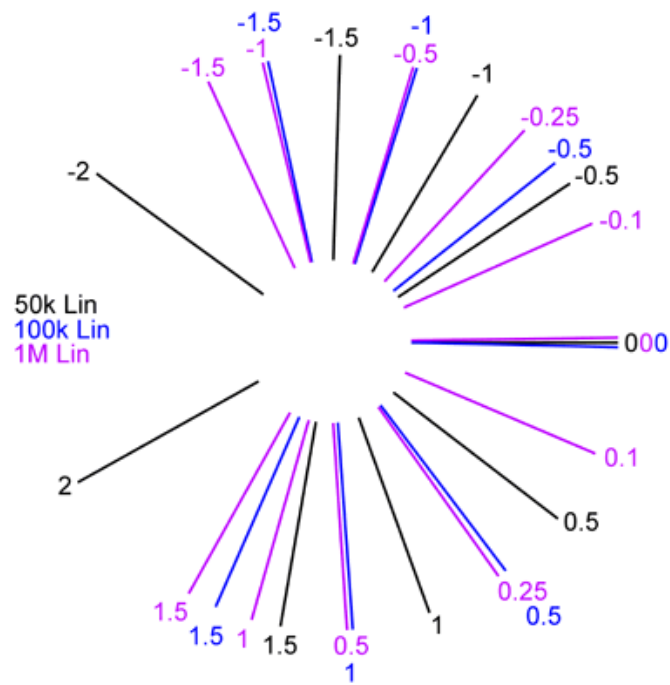
Processor responses depending on pot value.
All other components remain unchanged.

Pad identification

+VE	+VE to offset pots CW end
-VE	-VE to offset pots CCW end
0V	0V connection for jacks, and mixing pots
IN	Input for if the board is being used as a DC Mixer
SN1	to CW side of processor pots
SN2	to CCW side of processor pots
OFF	DC offset pot wiper connection
IOUT	Inverting output for if the board is being used as a DC Mixer
OUT	Output.

Example wiring for the Voltage Processor.

Set Up

For both mixer and processor functions, setup is the same procedure.

- Turn one input pot fully clockwise.
- Feed a voltage into the associated input.
- Adjust the SPAN trimmer until the normal output is the same voltage as the input if unity gain is required, or to the appropriate voltage if a different gain is desired. E.g. 1 volt in, 2 volts out for 2x gain.

Notes:

- 330R refers to 330 ohms. 100n = 0.1 uF.
- The module will work on +/-12 volts.
- **PCB info:** 6" x 1" with 3mm mounting holes 0.15" in from the edges.
- Please email me if you find any errors.

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 (0.1) decoupling caps	4
100n 1206 SMT (optional)	4
10uF 25V	4
Resistors	
330R (330 Ohms)	4
47k 1% (RS -see text)	2
100k 1%	12 see text
270k 1%	2
22k/100k/1M lin pot	see text
100k lin pot	see text
100k 25 turn trimmer	1
Semi's	
TL072	2

BAT48 schottky	4
Misc.	
Jacks	as needed
Ferrite Bead	2 (4)
0.156 4 pin connector	1 (2)
CGS81 VER1.0 PCB	1

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