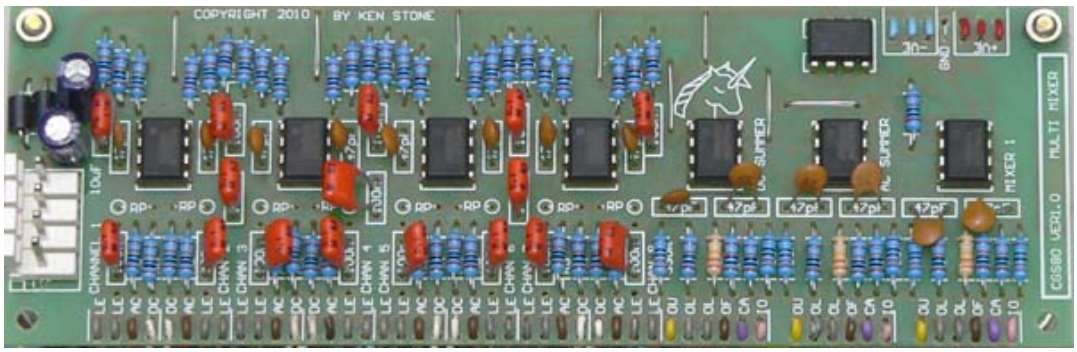


Multi-Mixer

for music synthesizers.

This module is a multi-purpose mixer that can be used for both synth-level audio and control voltages. There are eight input channels, each which has AC coupled and DC coupled inputs and a level control. The AC inputs are primarily for audio use, but can be used to remove any DC offset from a control voltage. Only the fast moving portions of the control voltage will be passed.

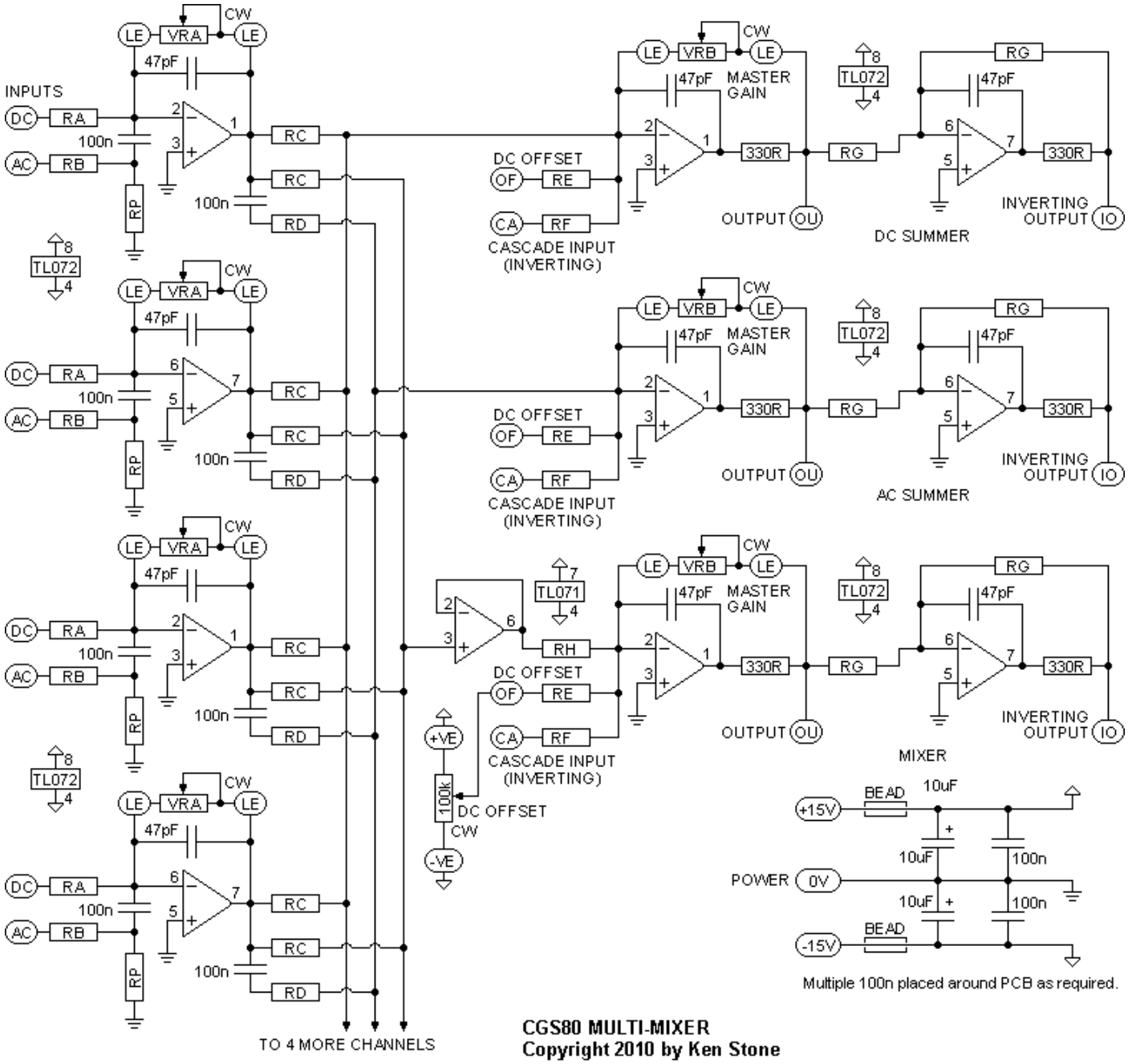
The eight inputs are then mixed into three different types of output stage.

1. DC Summer. This is the standard type of DC "mixer" used with synthesizers. The voltages on all inputs are added together, the sum being present at the output. An inverted output is also provided (mirrored around 0V). Optional DC offset and cascade inputs can be fitted. The problem with this sort of mixer is that the output can easilly be pushed beyond the usual voltage range of a synthesizer. E.G. 8 x 5V = 40V. Of course the output will clip long before this, and in extreme cases, may lock up until power is removed. The Master Gain for the output stage can be used to scale the sum to a useful level.

2. AC Summer. This is an AC coupled summer. All DC offsets will be removed from the mix. The output will be the sum of the AC portions of the signal. An inverted output is also provided (mirrored around 0V). Optional DC offset and cascade inputs can be fitted. This output is primarily for audio use, but may give interesting modulation possibilities. Its functionality overlaps that of the AC coupled inputs. A Master Gain is provided for convenience, but will not have the same inpact as with the DC summer.

3. DC Mixer..... well, read a bit more about this below.

A little on how it works:



The schematic of the Multi-Mixer.

The Multi-Mixer is basically an array of inverting summers. Inputs are buffered (and inverted) by the op-amp on each input stage. The outputs of these buffers are fed to three mixing buses. The AC summer and DC summer busses are then fed to their summer stages, where they are also re-inverted. The inverted output is provided by an extra inverting buffer.

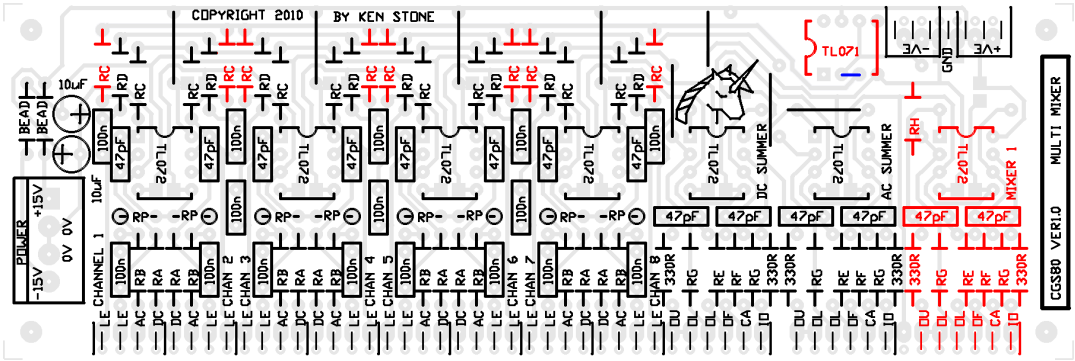
The resistive mixer bus is buffered by a voltage follower before being fed to a two op-amp output stage identical to the others. It is this voltage follower that prevents the output stage from summing the voltages on this bus.

Note: DC Mixer. The idea was to provide a different mix to the DC summer, but if my brain is finally working correctly, the output of this will merely be the sum of the inputs divided by the number of inputs (8) - which is no different from the DC summer with its output turned down to one-eighth. So with that taken into account, it is rather pointless. It can however serve as a separate "partial mix" channel, or a second output buffer if a person wants to divide this into two smaller mixers. Leave out the TL071, link pin 3 to pin 2, and put a link in place of resistor RH.

If you don't reqire this channel, simply leave out all associated parts. These are the resistors marked RC that are connected to the mixer bus, and the buffer amplifier marked "mixer 1" on the PCB.

If you do want to add an odd mix, just to fill the panel holes, connect the output of the DC Summer (OU) via a 200k to inverting input of the mixer buffer TL072 (Pin 2) and install every second mixer bus resistor marked RC. These will inputs will now subtract from the output total instead of adding to it.

Construction



The component overlay for the VER1.0 PCB. Click here for an enlarged, printable version. Print at 300dpi. Parts marked in RED are associated with the DC Mixer circuit. The blue line shows where to place a link instead of the TL072.

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 planning to use this for audio mixing, the DC offset pots should be omitted.

If you are planning to drive the mixer to saturation, it may be wise to substitute op-amps that do not suffer from phase-inversion when their common mode range is exceeded.

Resistor identification

Most resistors are shown on the board as identifiers. The values given here are recommended values. Resistors sharing the same functions in each channel share the same identifier, making it easy to substitute different values if required. In the default configuration, most of these resistors are 100k.

Designator	Function	Recommended Value
RA	DC input resistor	100k
RB	AC input resistor	100k
RC	DC summer and DC mixer output stage gains	100k
RD	AC summer output stage gain	100k
RE	Output stage DC offsets	330k
RF	Cascade input gains	100k
RG	Inverting output stage input and feedback resistors	100k
RP	AC input pulldown	1M (optional)
VRA	Input level pot	100k
VRB	Output stage level pot	100k

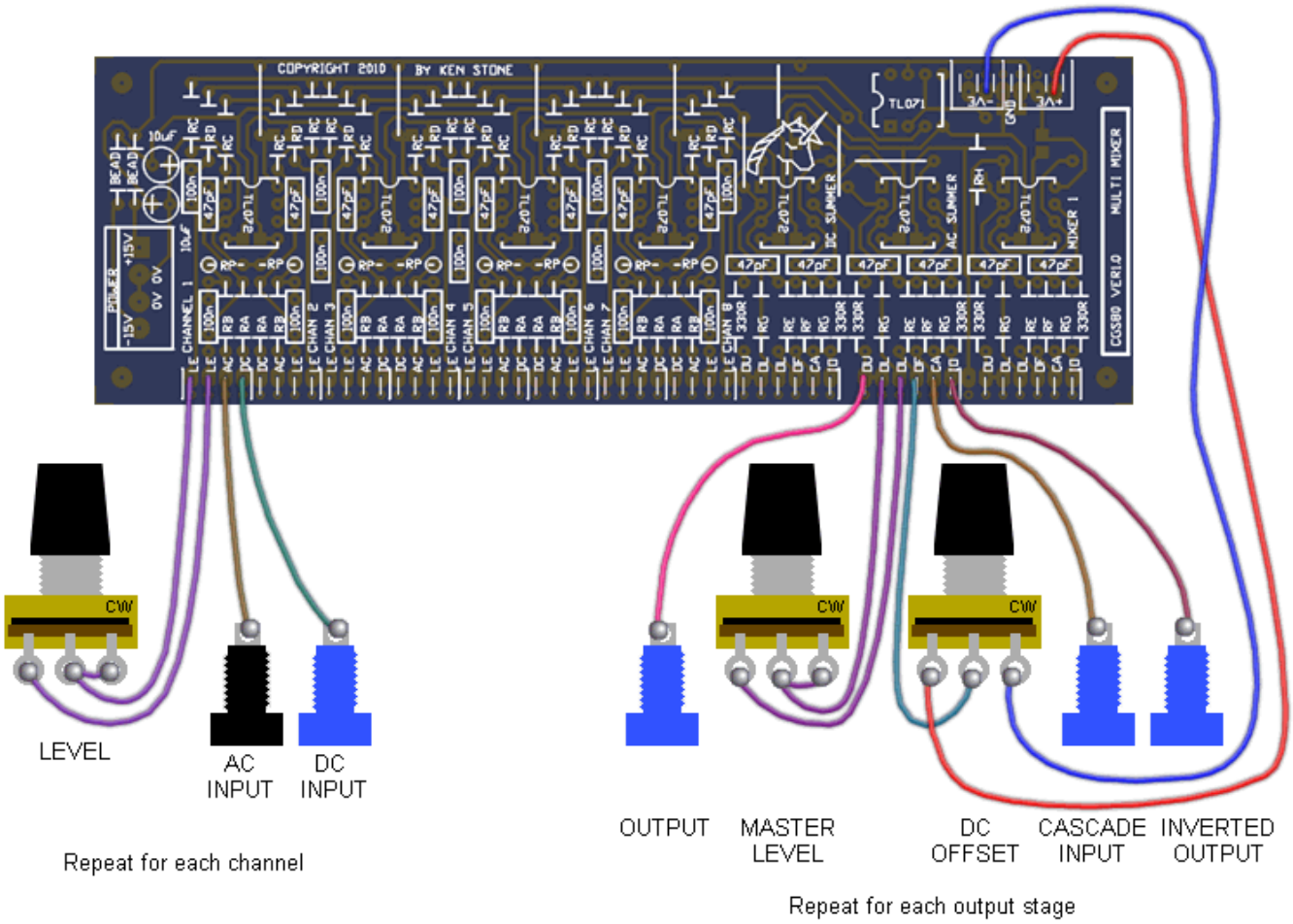
If you wish to achieve greater than unity gain, reduce the values of RC and RD.

Pad identification

Each channel has its connections grouped on the PCB. Each output stage has its connections grouped on the PCB. To distinguish between each group, look on the PCB for the corresponding label.

LE	Each pair goes to that channel's level pot. If no pot is required, a fixed resistor can be soldered between each pair of pads.

AC	AC coupled input for each channel
DC	DC coupled input for each channel
OU	Output
OL	Each pair goes to that output stage's level pot. If no pot is required, a fixed resistor can be soldered between each pair of pads.
OF	DC offset for that output. This can be omitted, connected to an input jack or to a pot. Note that it is inverting.
CA	Cascade input. DC Coupled expansion input. Note that it is inverting.
IO	Inverting Output
+VE	For connection to the DC offset pots if used (CCW end)
-VE	For connection to the DC offset pots if used (CW end)
0V	0V/GND connection for jacks.



Example wiring for the Multi-Mixer. As shown, the offset pots allow both positive and negative offsets, but with the disadvantage that zeroing the output can be difficult. Instead you may wish to limit the offset to between zero and positive. To do this, connect the CCW end of the pot to 0V instead of the positive rail.

Set Up

There should be no setup required. Depending on the quality and tolerance of the pots used, you may find that you do not have unity gain with a pot set to its maximum position. This can be corrected by tweaking the values of other resistors in the circuit. The easiest solution is to pre-test your pots and select suitable ones.

Notes:

- 330R refers to 330 ohms. 100n = 0.1 uF.
- The module will work on +/-12 volts.
- **PCB info:** 6" x 2" with 3mm mounting holes 0.15" in from the edges.
- Please email me if you find any errors.

Parts list

Part	Quantity

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.

Capacitors	
47pF	14
100n (MKT or sim)	16
10uF 25V	2 (4)
Resistors	
330R	6
100k 1% metal film	53
1M 1% metal film	8
100k lin pot	14
Semi's	
TL071 See text	0
TL072	7
Misc.	
Ferrite Bead (or 10R resistor)	2
0.156 4 pin connector	1
CGS80 PCB	1

Modular Synth Home

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