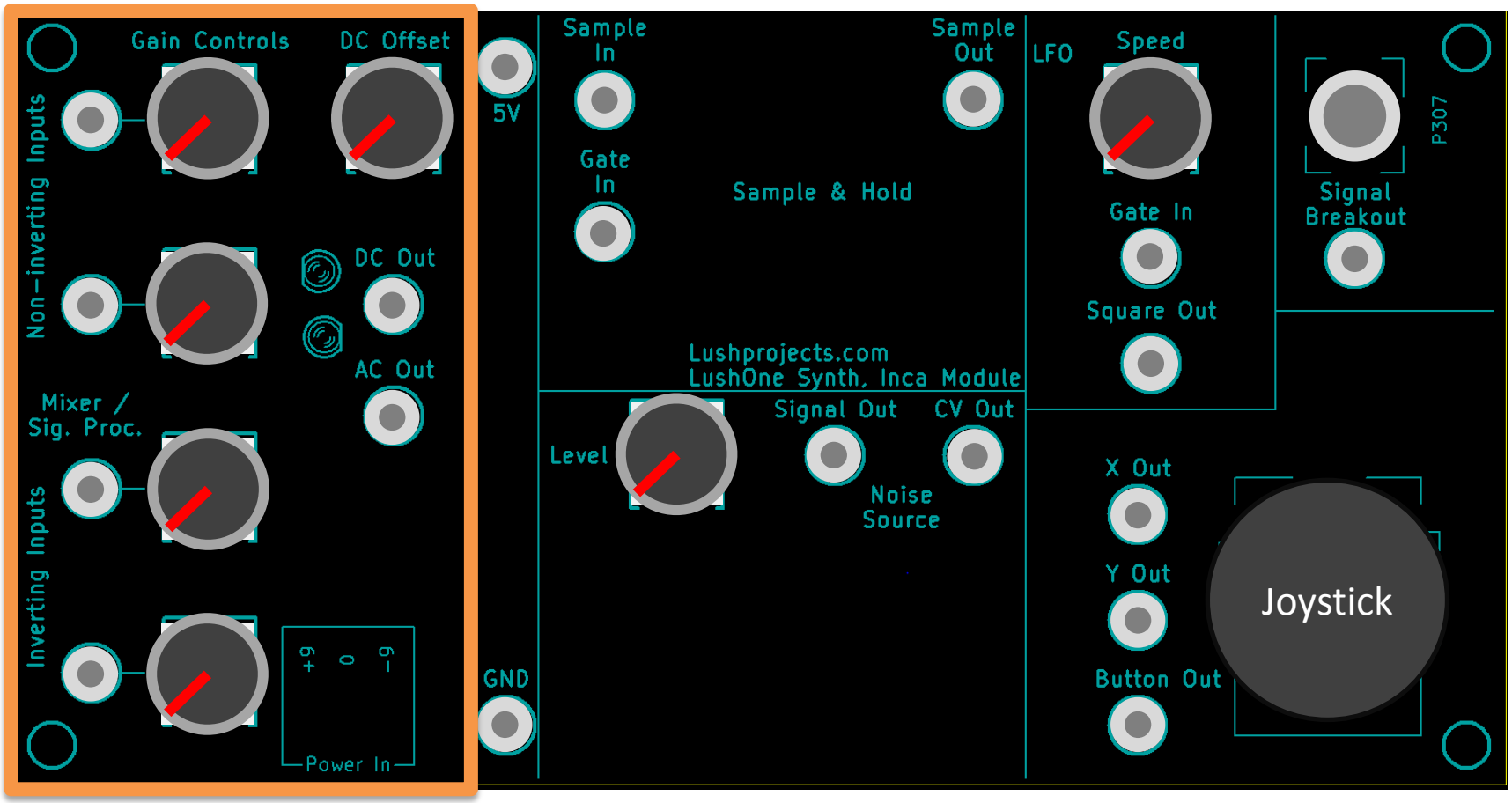
LushOne Inca Synth Module
302 – Mixer functions

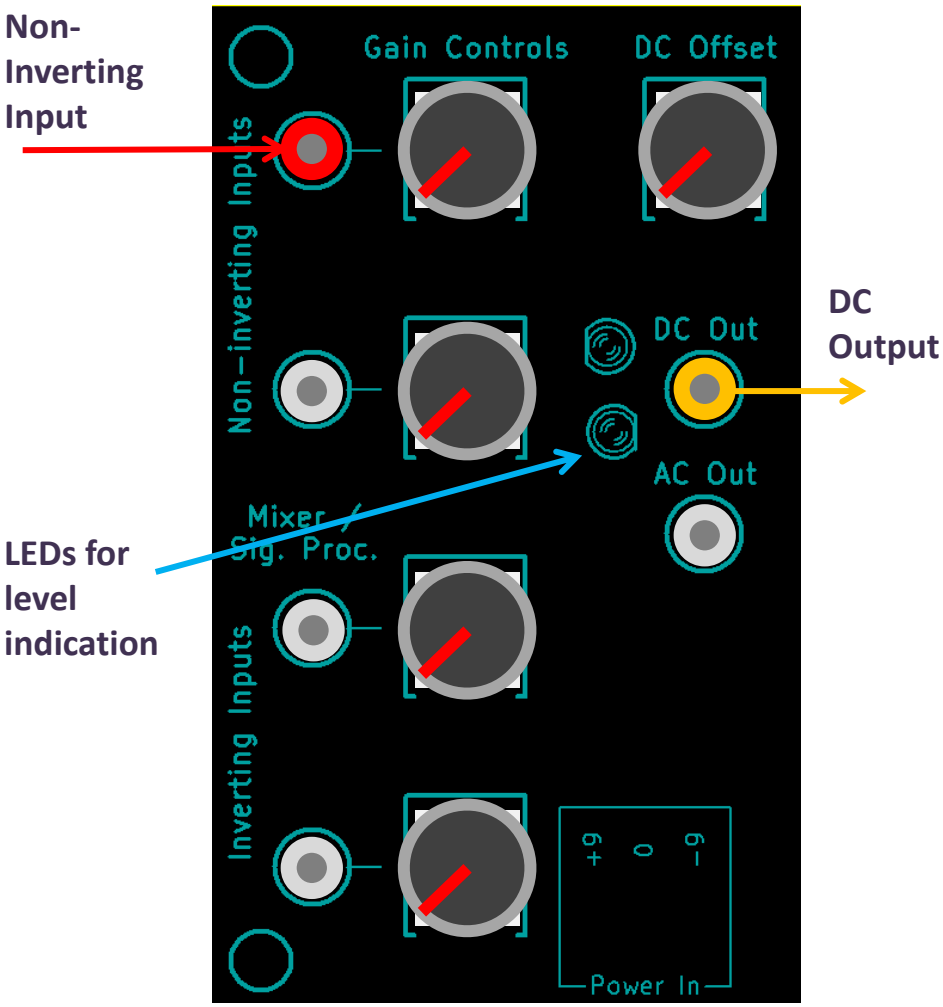


Inca – 302 Mixer functions

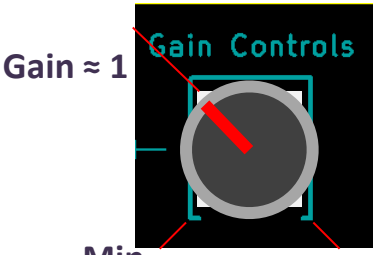
- The mixer takes up the left hand side of the Inca
- Two non inverting inputs
- Two inverting inputs

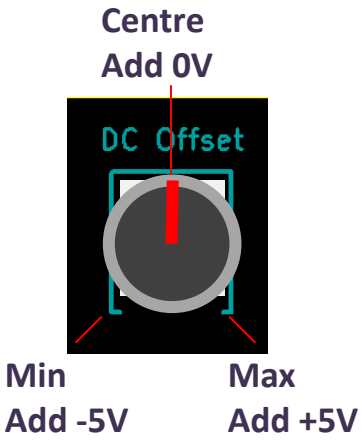
- Main functions:
  - Use one input and operate as a signal processor (See module 301)
  - Use two inputs and:
    - Mix audio signals
    - Combine control voltages

Recap (from 301)

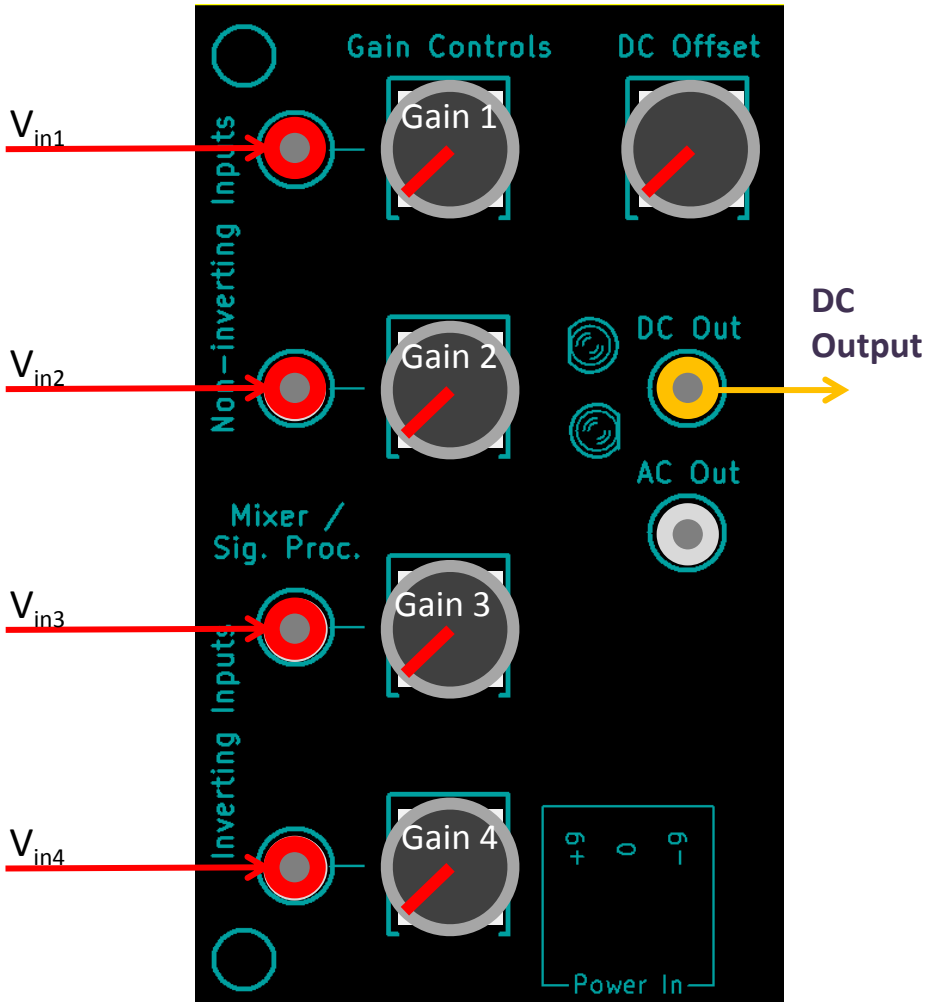


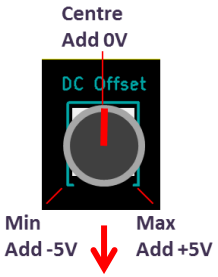
$V_{DC\ Out} = (Gain \times V_{In}) + DC\ Offset$



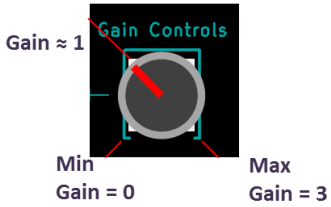


Mixer configuration





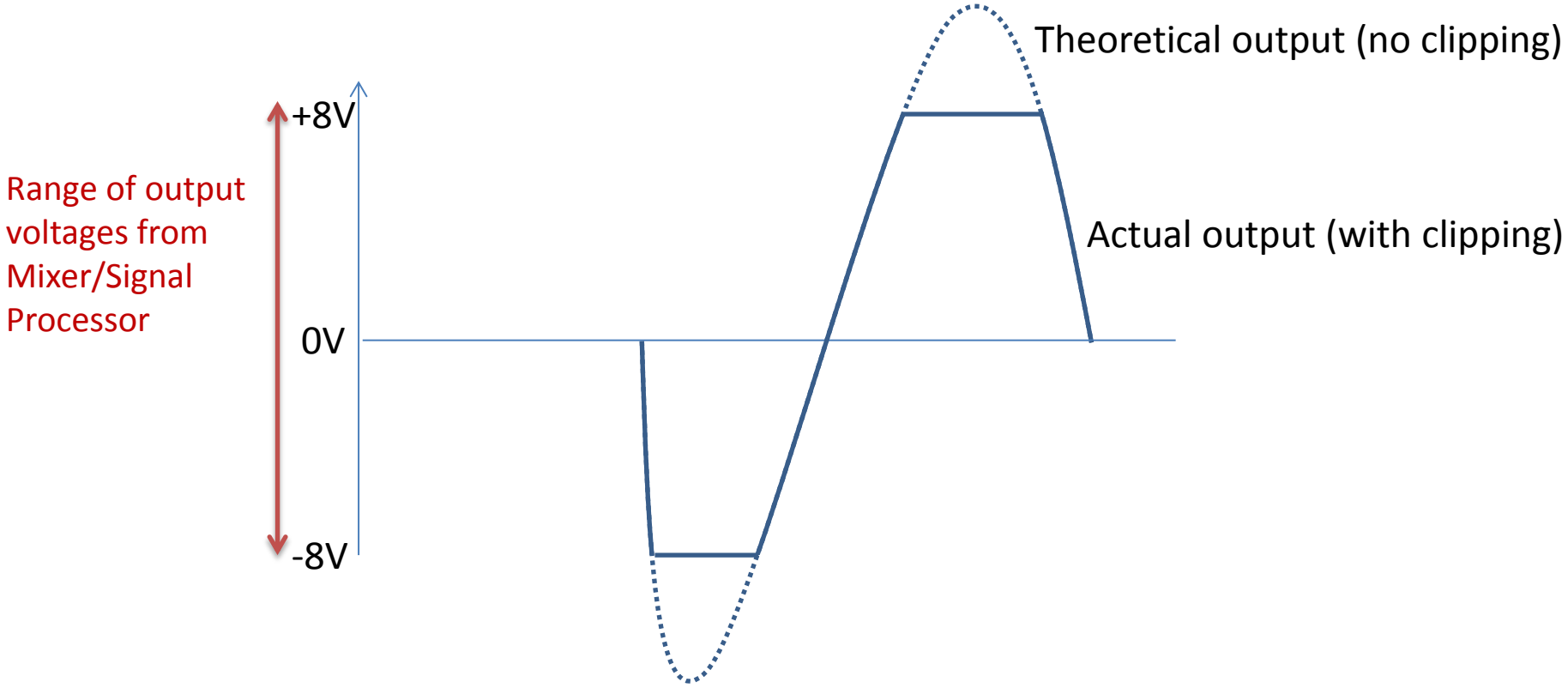
$$V_{DC\ Out} = \text{DC Offset} + (\text{Gain 1} \times V_{in1}) + (\text{Gain 2} \times V_{in2}) - (\text{Gain 3} \times V_{in3}) - (\text{Gain 4} \times V_{in4})$$



Disconnected inputs are treated as $V_{in} = 0$
ie do not effect the output

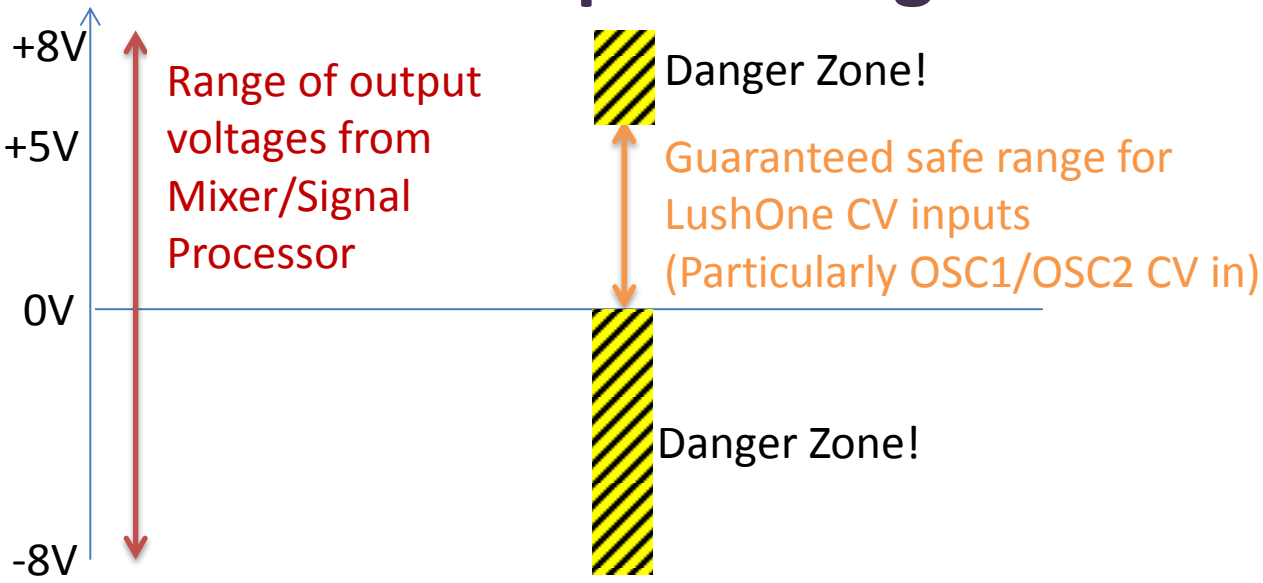
Remember: LEDs will indicate level of output (see module 301)

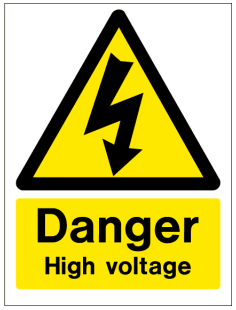
Mixer/Signal Processor Clipping



- The DC output is clipped to between about -8V and +8V
  - Particularly relevant for mixers where combining many inputs can generate big theoretical outputs
- For audio signals clipping will sound like distortion
  - May be desirable for some users!
- To prevent clipping reduce the gain on the inputs

Reminder – output voltages

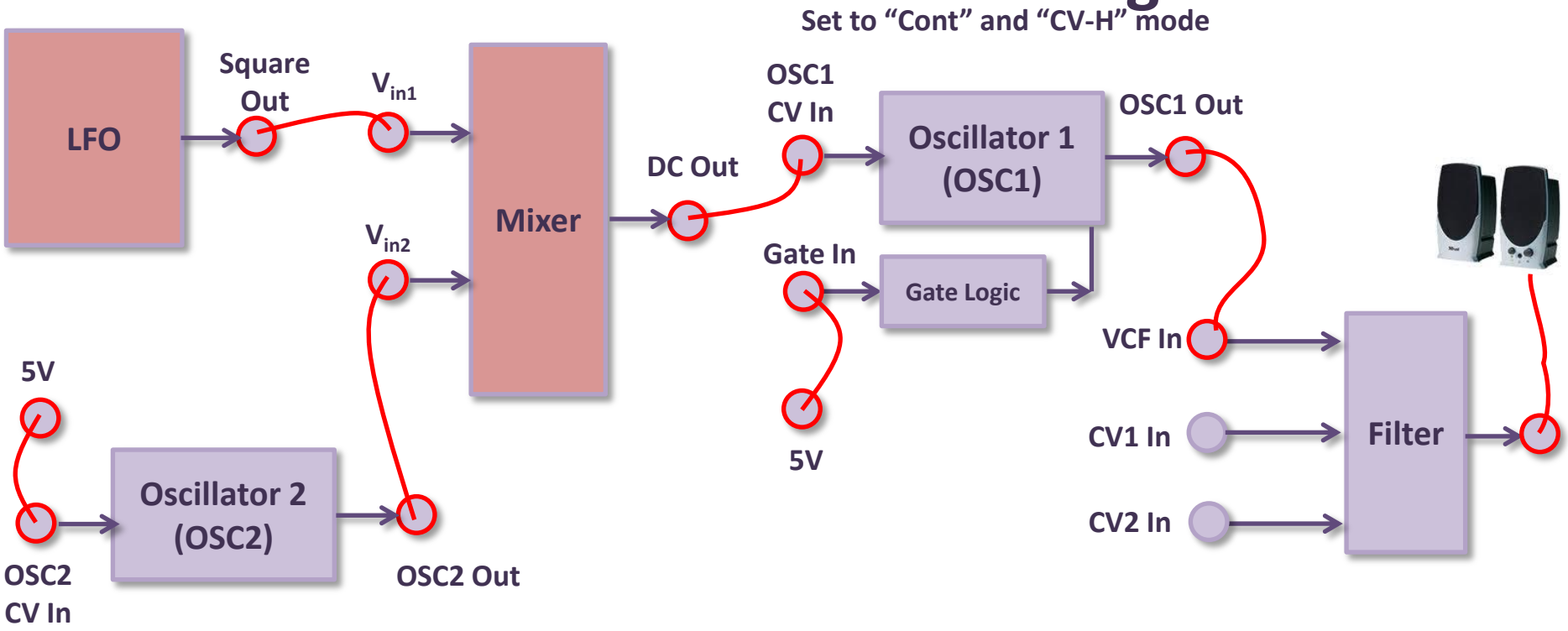




Take care not to overload CV inputs!

- Output of Mixer/Signal Processor is clipped to about 1V above/below the power supply voltage
- Still, output can easily exceed the guaranteed safe input range for CVs
  - OSC1/OSC2 CV inputs are particularly sensitive because the feed the AVR Microcontroller
- For safe operation:
  1. Connect input(s) to mixer but start with DC Out disconnected
  2. Start with very low gain
  3. Adjust the DC Offset to put the voltage in the safe range (use a meter or LEDs to assess)
  4. Make connection from DC Out to the CV in
  5. Increase the gain in small steps until you are happy. After each step adjust the DC Offset as necessary
     - Keep a short eye on the LEDs – in particular watch for the negative LED lighting up!
- Some inputs (eg CV in to the filter) are not too sensitive about the voltage in and can be more freely used.

Patch to demo mixer for control voltages

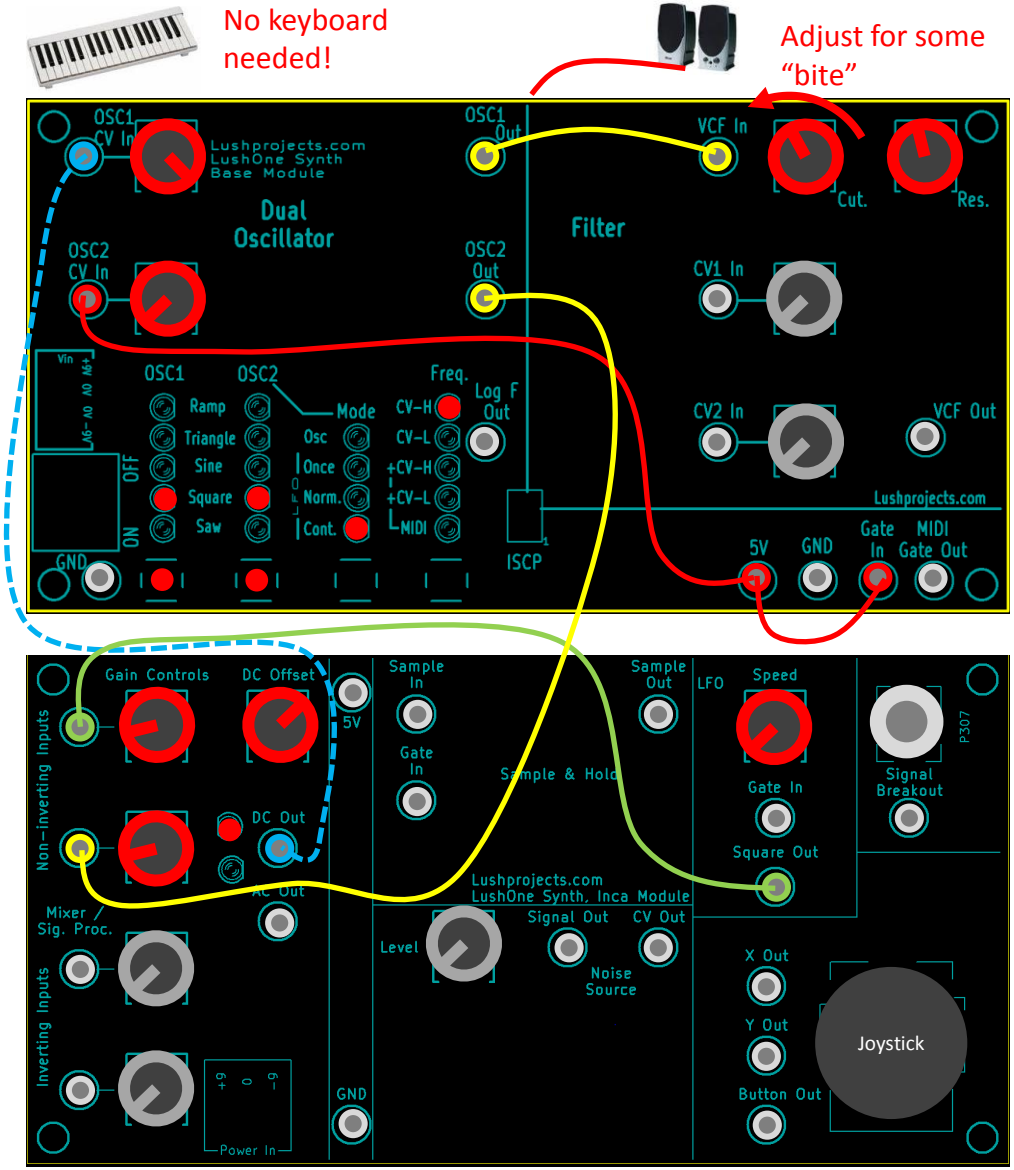


LushOne Base Module

Inca Module

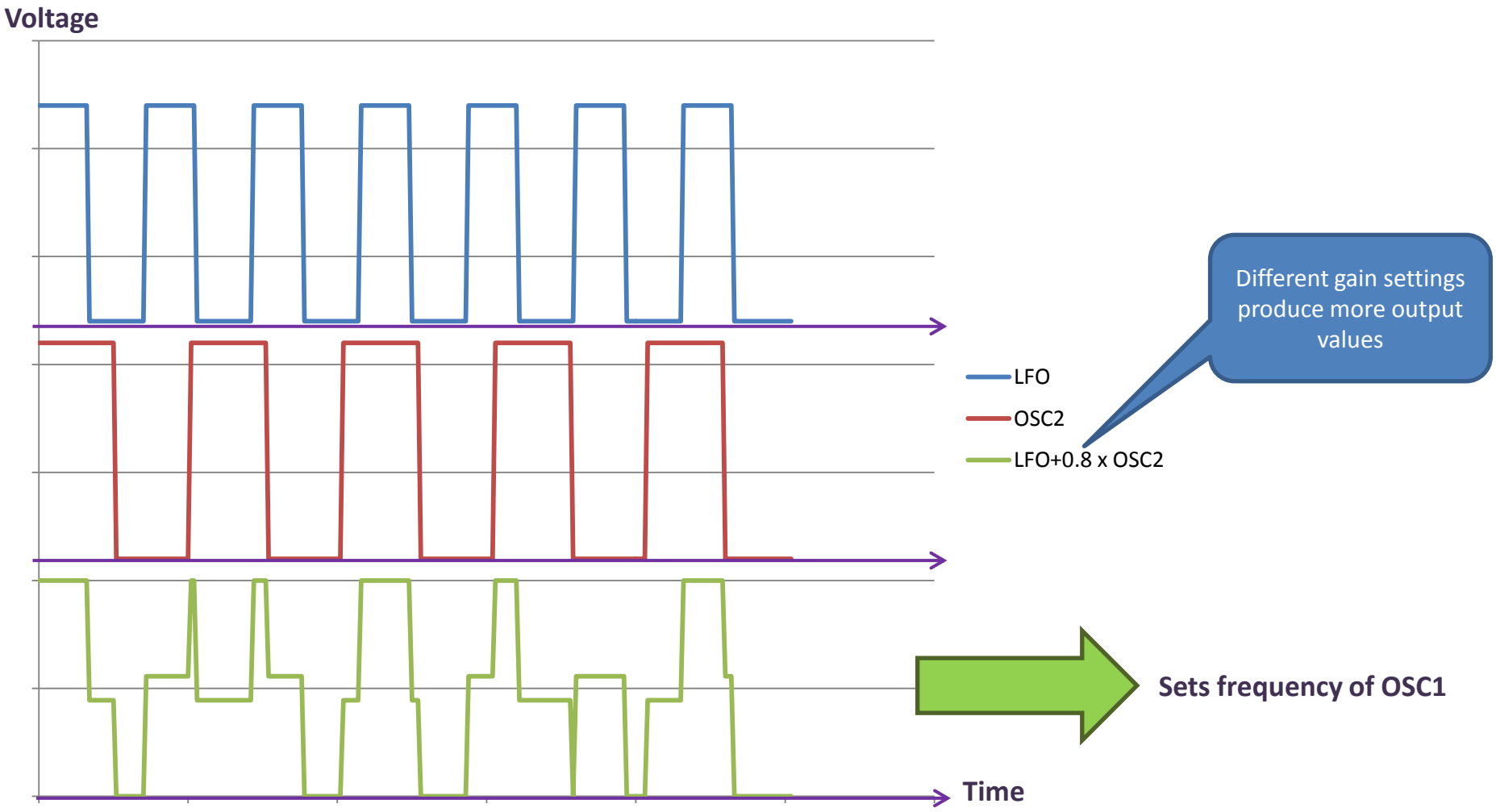
- Adding outputs of two LFOs to produce combined CV to control frequency of OSC1
- Check control settings are not overloading OSC1 CV In before making that patch

Mixer CV Patch



- Patch the system and adjust the settings as shown
  - Initially, use low-ish gain on mixer inputs
- Check output of mixer is OK to connect to OSC1 CV In (0V to 5V) before making dotted blue connection
  - Only upper LED on mixer should light – indicating positive output
- Try changing speeds of oscillators
  - If oscillators have close, but not identical, periods then chaotic patterns will emerge

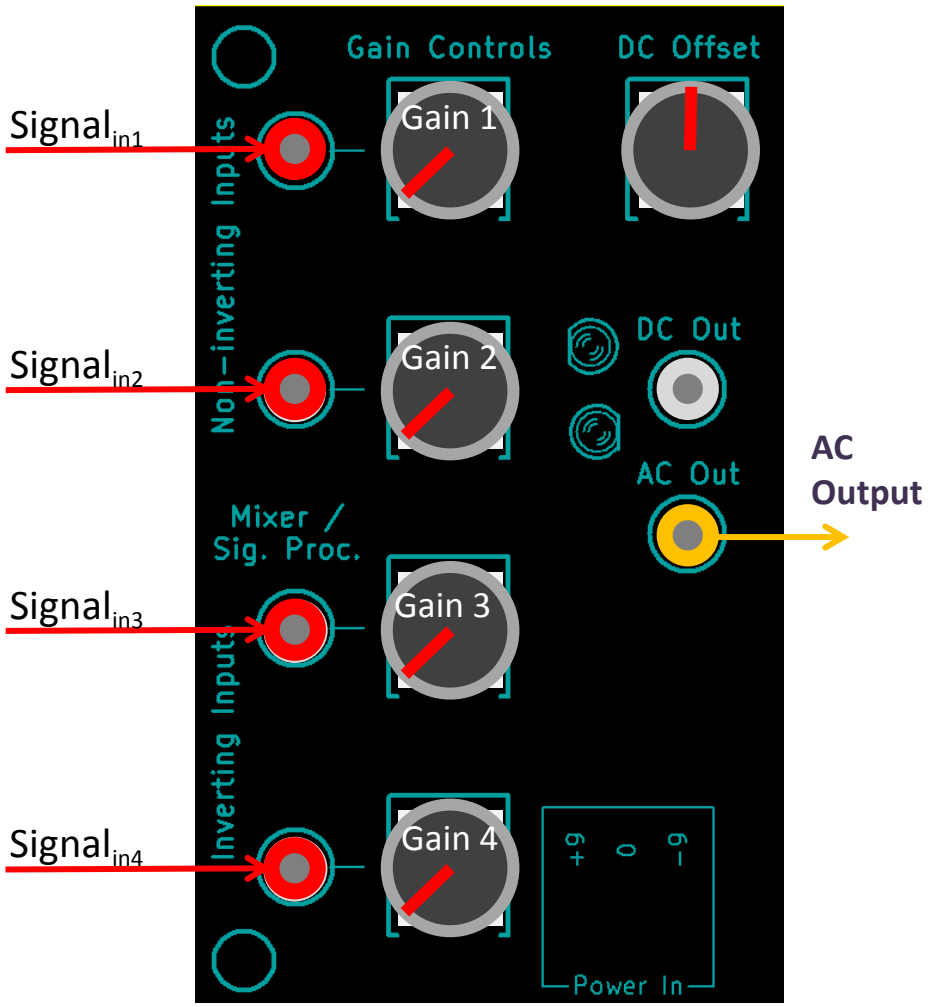
Mixer CV Patch – What is happening



Other thoughts on CV mixing

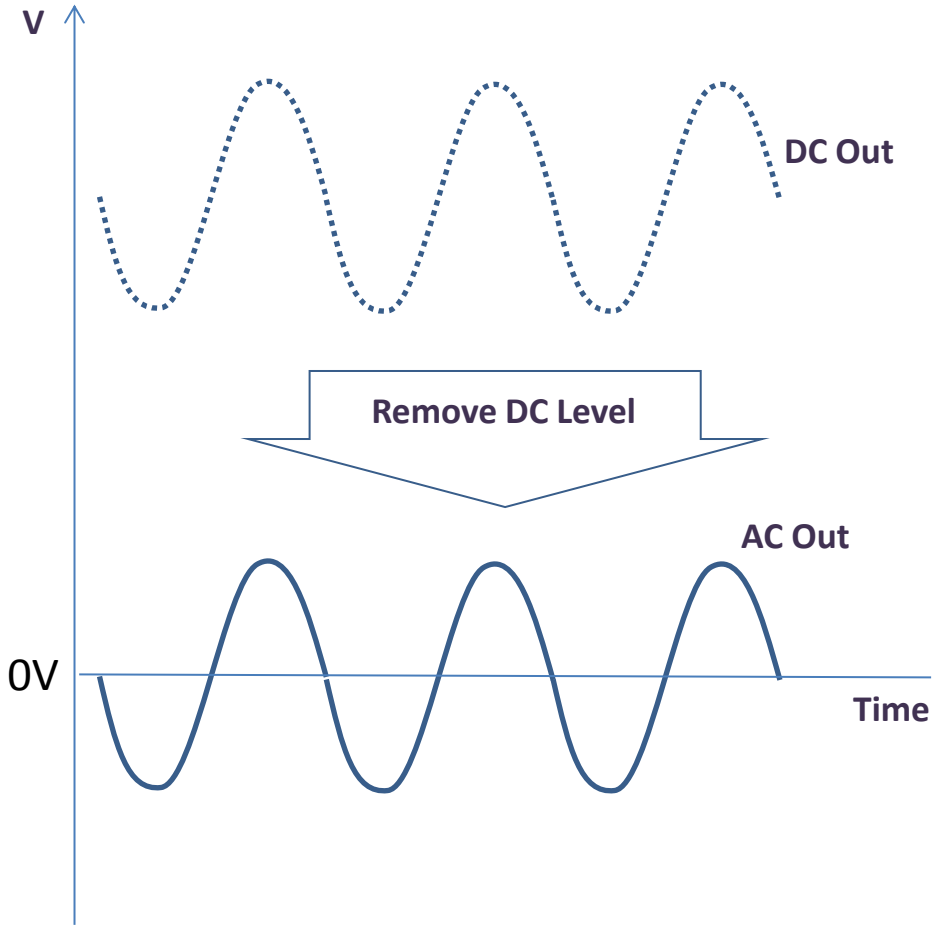
- With the Contour module mix ADSR out and an LFO out in to the VCA to create vibrato effects
- Add noise (from the Inca Noise Source) to CVs to create random or percussive effects

Mixing audio signals



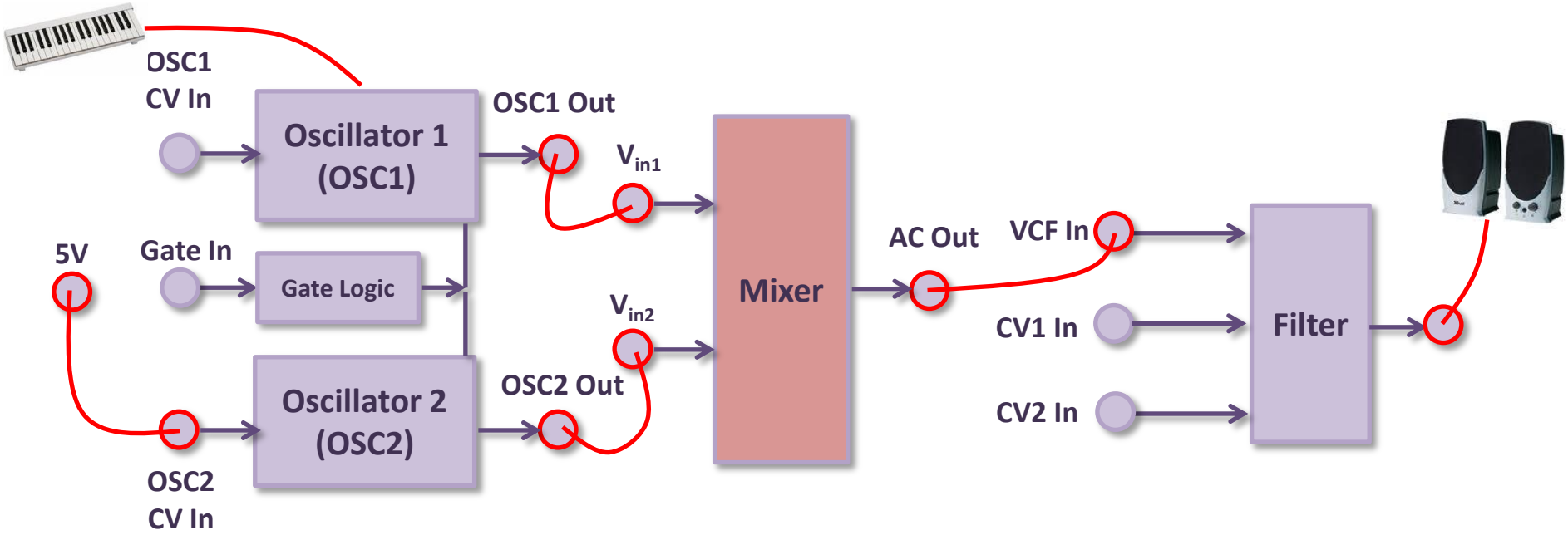
- The signal processor/mixer can mix audio signals like on a mixing desk
- Both non-inverting and inverting inputs can be used
  - The ear can't hear the difference between positive and negative versions of the same waveform
- Normally want to use the AC output for audio signals
- DC offset should be set to roughly central
  - AC Out doesn't really depend on the DC Offset, but need to avoid clipping (see later)

About AC output (also called “AC coupling”)



- AC Out is derived from the DC Out by removing any DC level using a capacitor
- AC out goes positive and negative about 0V
- Sudden changes in DC level (eg turning the Offset control) will take a moment to normalize again
- If the DC Out clips then so will the AC Out
  - Normally putting the DC Offset to the centre will minimize clipping
- The LEDs show the DC Out level (not the derived AC Out)
- LushOne CVs are expected to be positive – don’t use AC Out to connect to a CV input

Audio mixer patch



Set to “OSC” and “CV+L” mode

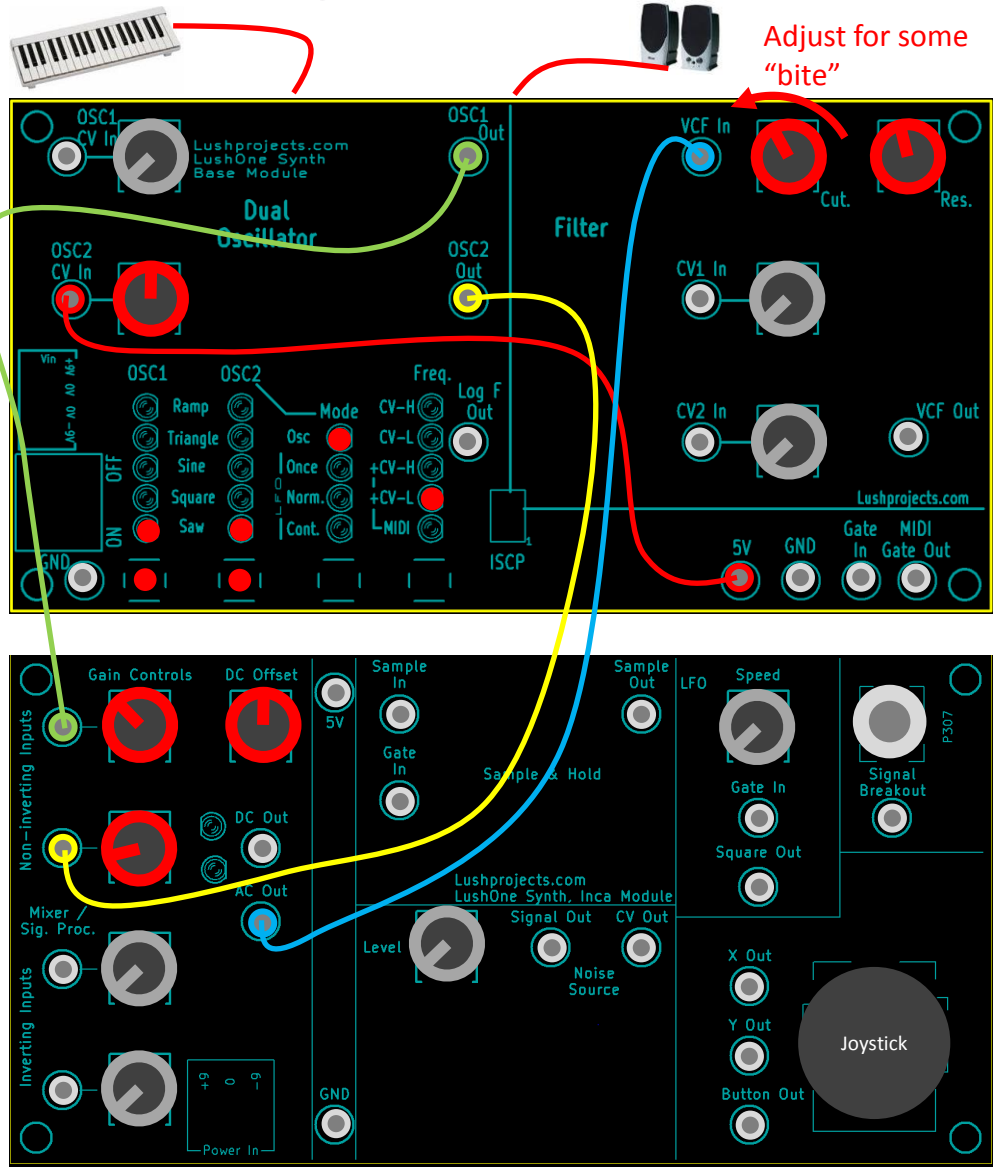
LushOne Base Module

Inca Module

Adjust the OSC2 CV Gain control to create different chords and effects when notes are played.

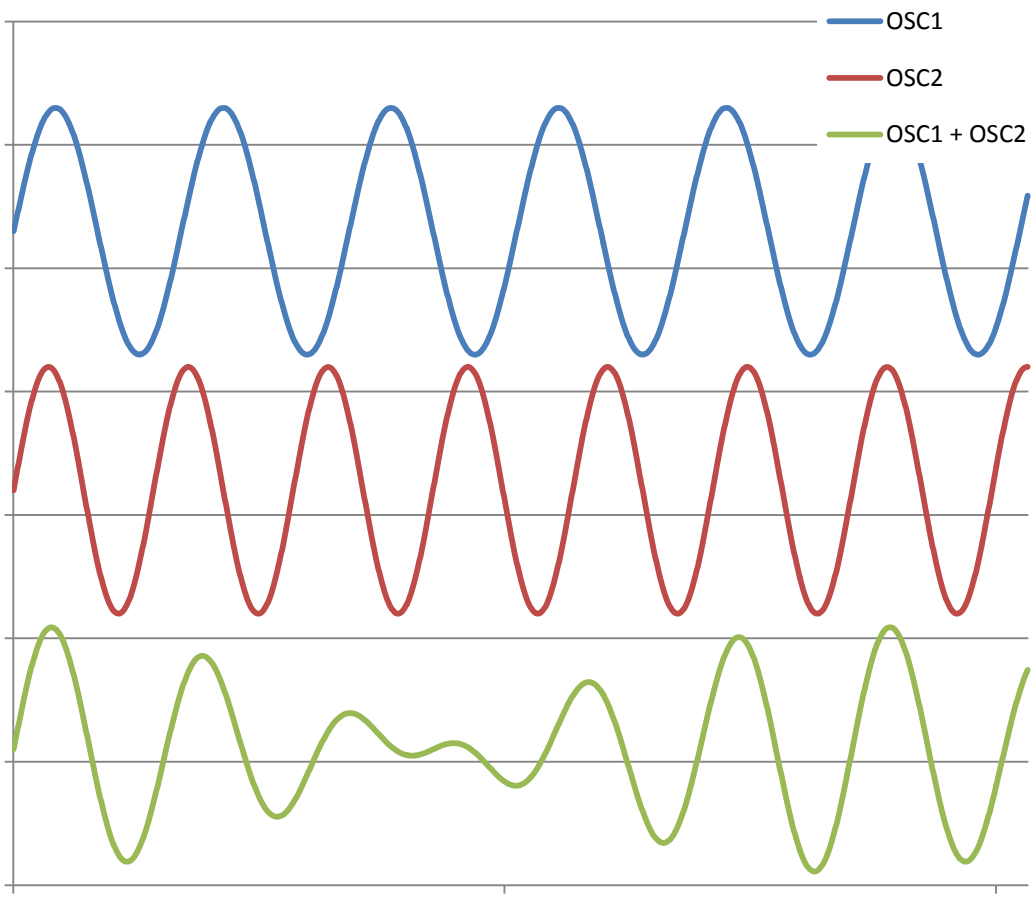
NOTE: Side effect here - we are taking the OSC2 output (at CV voltage levels) and converting it to signal levels.

Mixer signal patch



- Patch the system and adjust the settings as shown
  - Gain on Mixer input 1 wants to me set to about 1/3rd (ie gain =1). Gain on Mixer input 2 should be lower (about 1/6th perhaps)
  - Remember that OSC1 out is +/- 1V and OSC2 out is 0V to 5V.
- Hold a note and adjust the OSC2 CV gain around the centre to hear different chord/beat effects
- Change relative gains of the Mixer inputs to change depth of beats

Mixer signal patch – Example



- Patch sets OSC1 and OSC2 to almost the same frequency (OSC1 is controlled by MIDI note input)
- OSC2 delta frequency from OSC1 is controlled by OSC2 CV In gain
- Combined signal is a complex wave (in fact a type of chord) which has “beats” (silent periods) with frequency equal to the difference in the two input frequencies
- Depth of beats depends on relative amplitude of OSC1 and OSC2 signals in the mixer

Other thoughts on Signal mixing

- Add noise (from the Inca Noise Source) to signals to create random or percussive effects
- With suitable settings CVs can be input to the Signal Processor/Mixer and output as Signals

That's all folks

- The mixer creates more complicated waveforms of many components
  - For both CVs and signals
- Don't forget if you also have a contour you can invent patches involving all three modules

- Next time:
  - Noise source, sample and hold