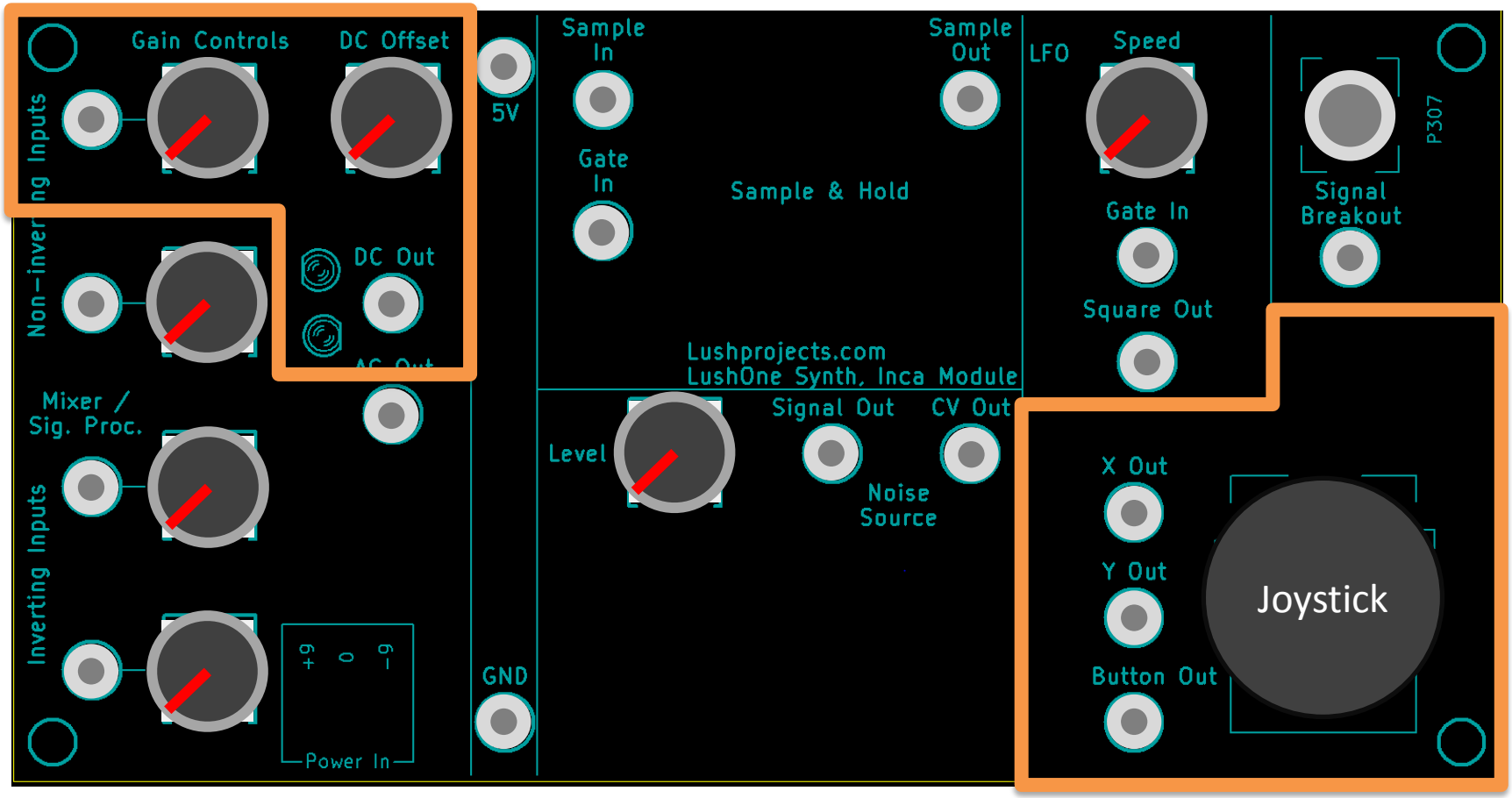
LushOne Inca Synth Module
Introduction, Joystick, Signal Processing

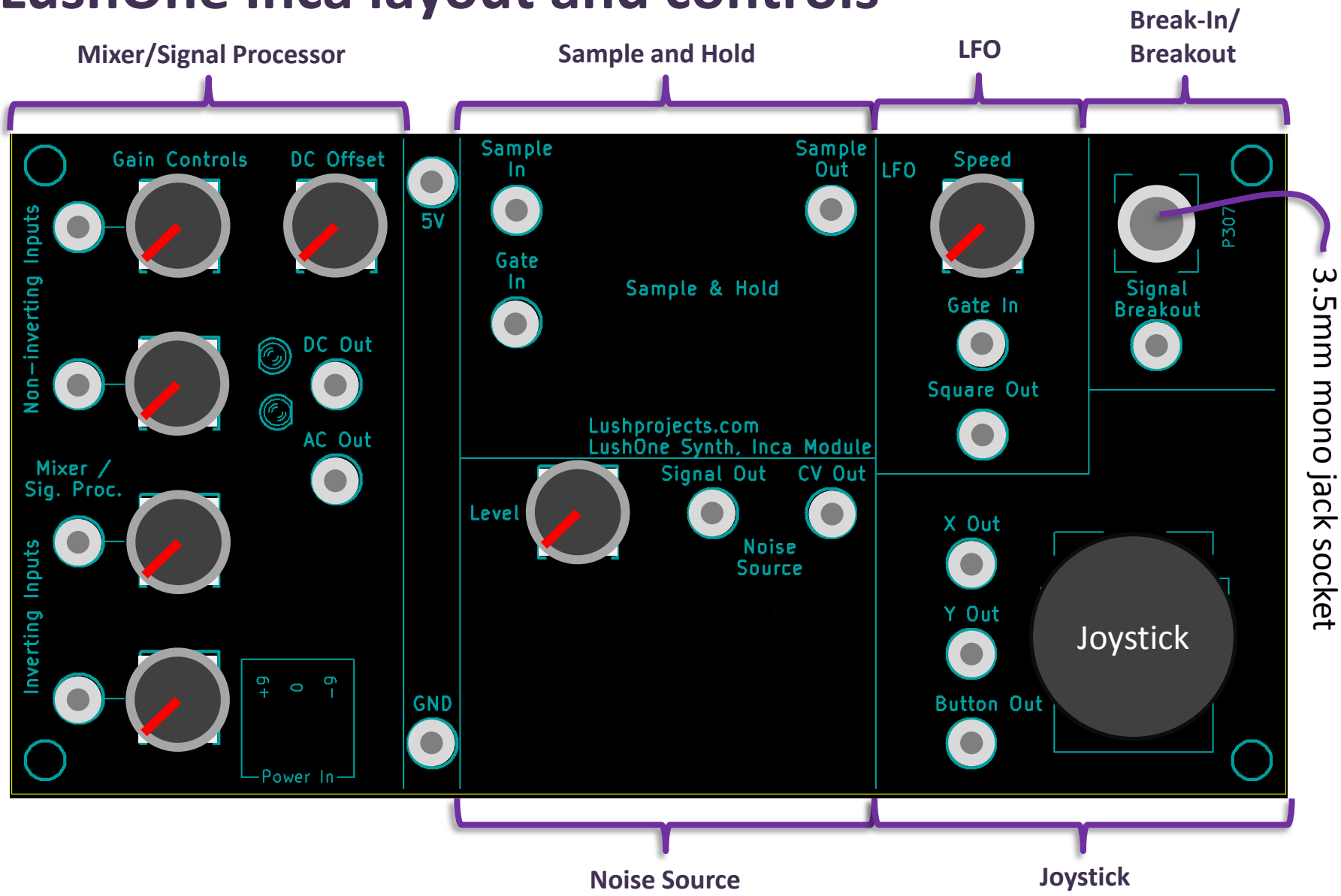


Inca - Introduction

- Additional module to the LushOne base
  - Joystick controller
  - New ways to combine signals
  - Percussive and random effects
  - Scores of new patches when used as a second or third module in a LushOne system

- Signal mixer and voltage processor
  - Mix or modify signals by summing, scaling and offsetting
- Noise source
  - Random voltage source and percussive sound
- Sample and Hold
  - Capture and hold voltage levels from clock
- Low Frequency Oscillator (LFO)
- Analogue thumbstick with switch
- 3.5mm mono Break-in/Breakout

LushOne Inca layout and controls

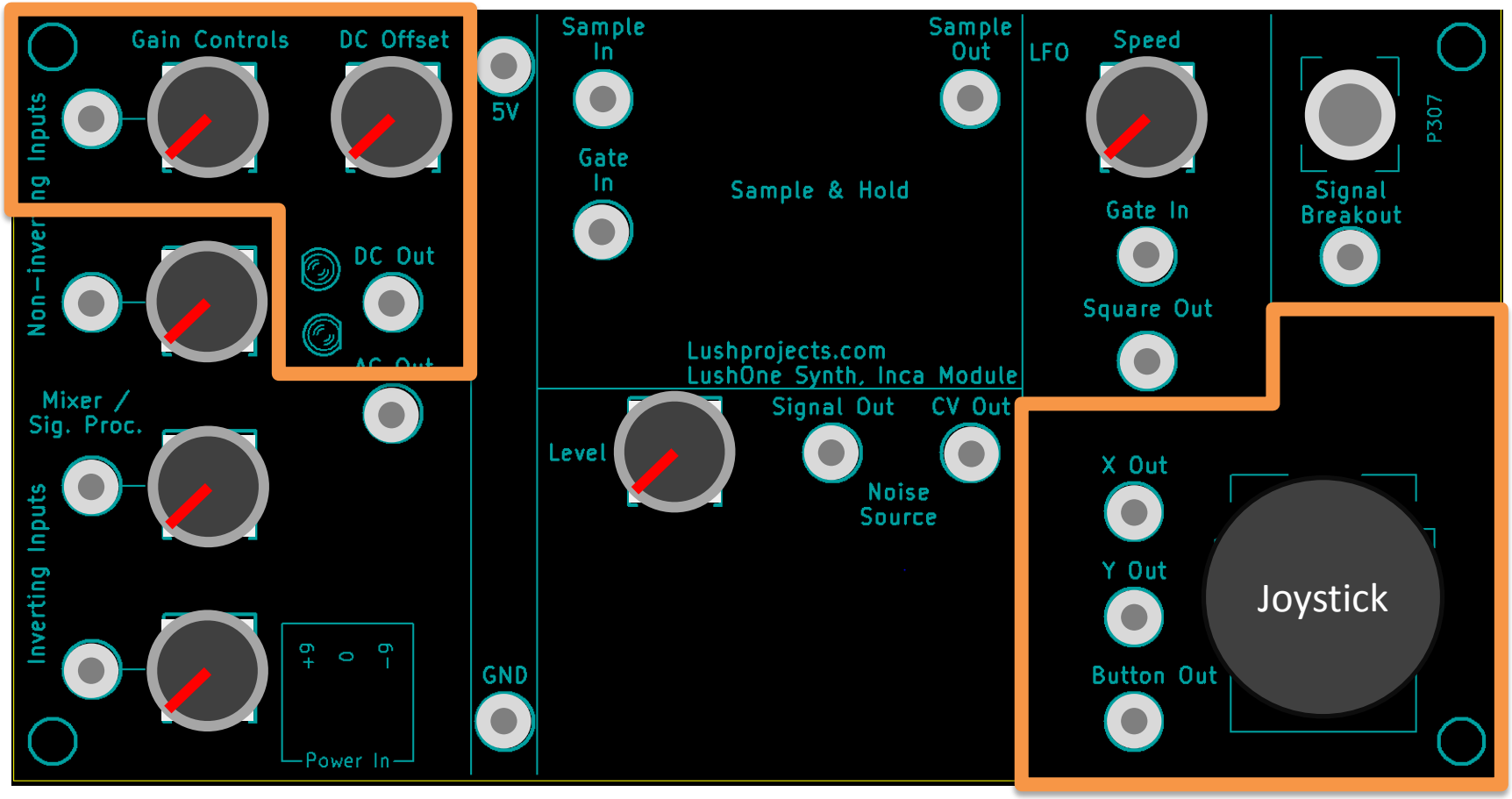


= 2mm banana plug patch connector

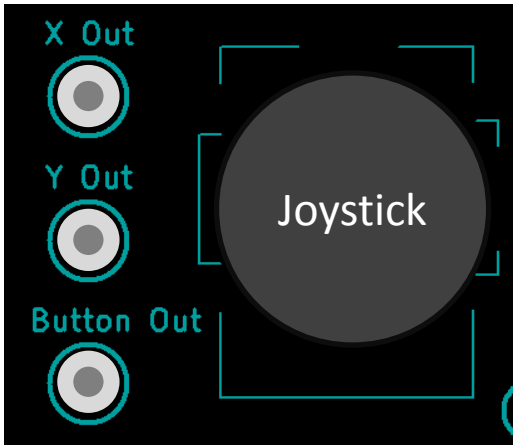
Lushprojects.com

In this teaching module

- Using the joystick
- Using one input of the mixer as a signal processor to manipulate a control voltage (CV)



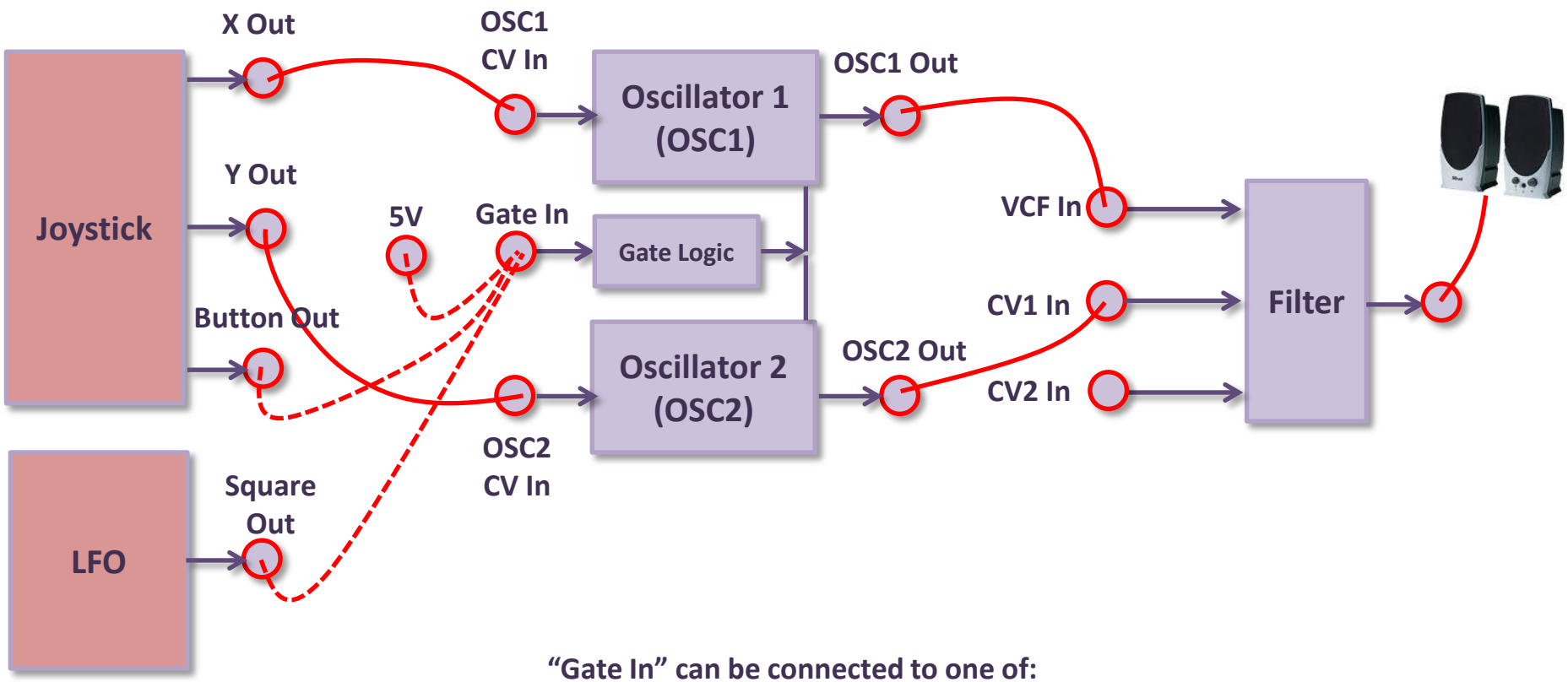
Joystick



- Fun way to “perform” by manipulating two control voltages
- *X Out* and *Y Out* go from 0V to +5V based on the joystick position
- *Button Out* goes from 0V (joystick not pressed) to +5V (joystick pressed)
- Connect through the Mixer/Signal Processor to change range of polarity of outputs
- The joystick makes me smile

Joystick patch

Set to “Norm” and “CV-H” mode



“Gate In” can be connected to one of:
1) 5V for continuous operation
2) Button Out for control by Joystick
3) LFO Square Out for regular beats

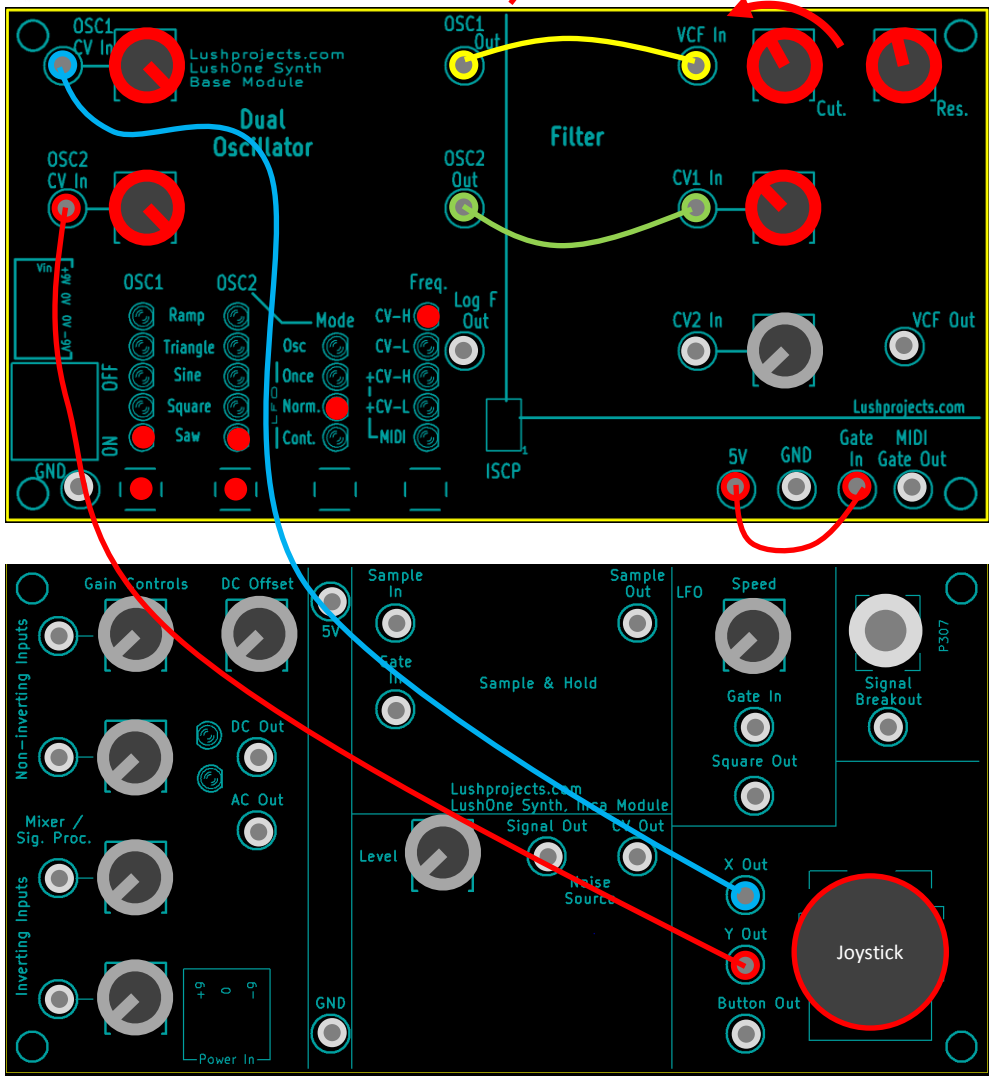
LushOne Base Module

Inca Module

Joystick Patch

No keyboard needed!

Adjust for some "bite"



Twiddle joystick

- Patch the system and adjust the settings as shown
- Twiddle joystick to get wide range of weird sounds
- Try different wave shapes
- Try connecting the "Gate In" to other sources:
  - "Button Out" on the joystick – press joystick for sound
  - "Square Out" on Inca LFO for repeating bursts

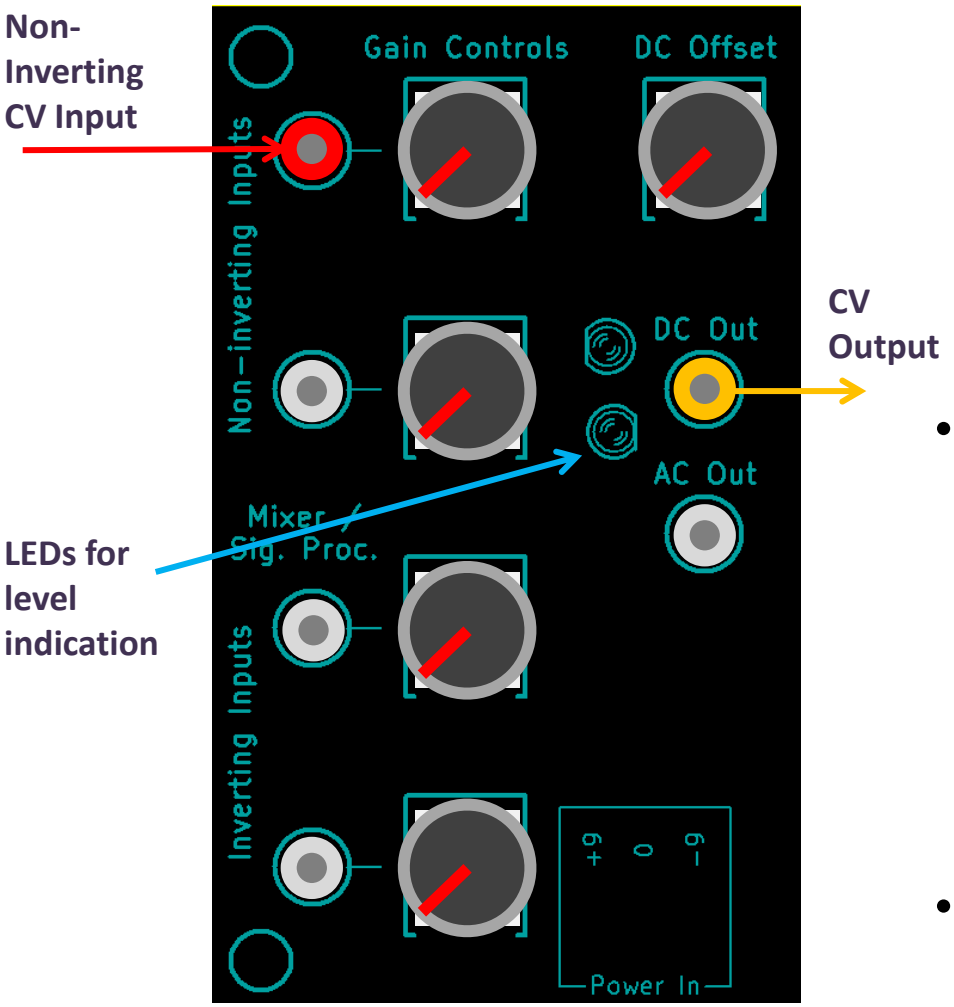
CV processing with the mixer/signal processor

- The current patch gives the joystick control over the full range of both oscillators
- What if you wanted to reduce the range of OSC1 so you got finer control?

- Using the Mixer/Signal Processor as a signal processor you can manipulate control voltages to:
  - Control the gain
  - Add or subtract a voltage offset
  - Invert the polarity of a signal

Or any combination!

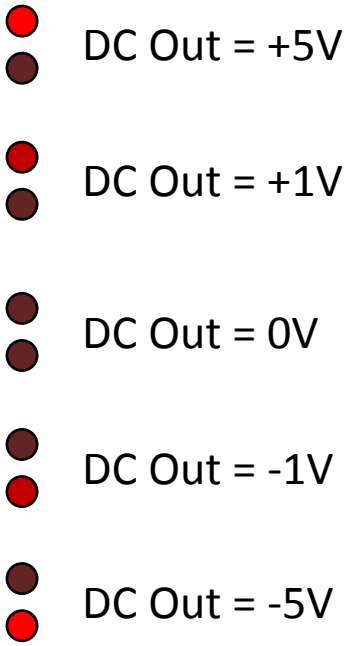
CV Processing Configuration



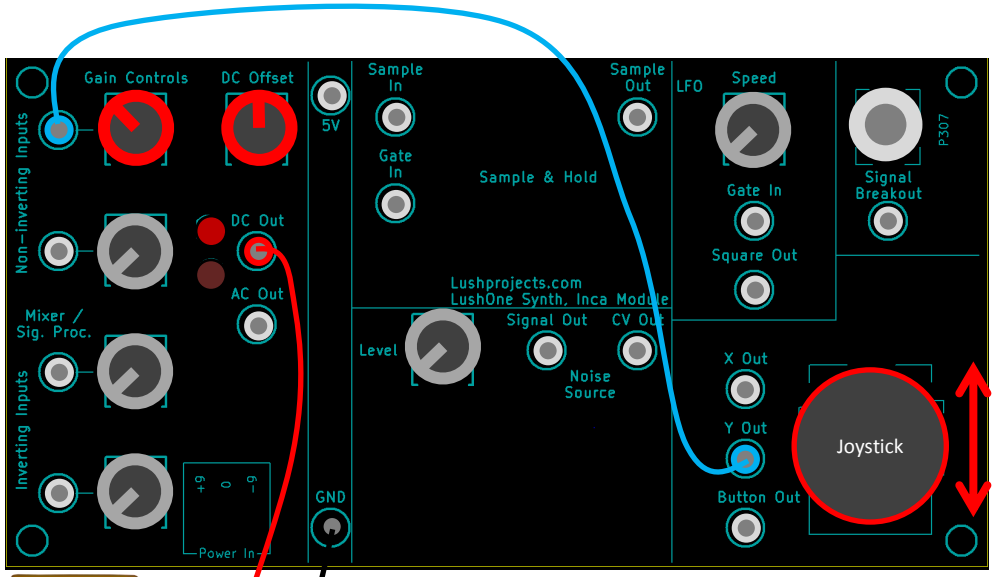
- To manipulate a CV connect it to one input
  - Use a non-inverting or inverting input
    - An inverting input will create an output voltage that reduces as the input voltage increases
  - Any of the non-inverting or inverting inputs can be used
- Typically you want a control voltage output to use the DC (Direct Current) output
  - DC out preserves the absolute level of the signal and allows you to add offsets
  - Allows control voltages between 0V and 5V
  - AC output will go negative
- Use the two LEDs to monitor the output voltage (see next slide)

Mixer/Signal Processor – Signal level LEDs

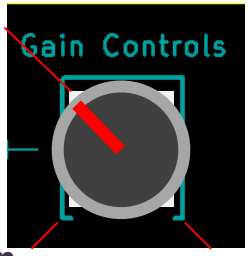
- LEDs light up when DC output voltage is positive (upper LED), or negative (lower LED)
- LED brightness goes from dim (near 0V) to bright (at ±5V)
- DC signals will cause steady lights
  Slow AC signals will cause flickering lights
  Fast AC signals will cause steady lights again (due to persistence of vision hiding the fast flicker)
- With practice you will learn to infer the signal behaviour from the pattern of the lights



Signal processor demo



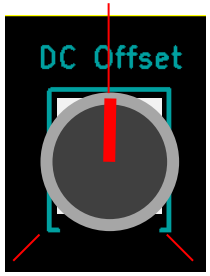
$V_{DC\ Out} = (Gain \times V_{In}) + Offset$



Gain ≈ 1

Min
Gain = 0

Max
Gain = 3



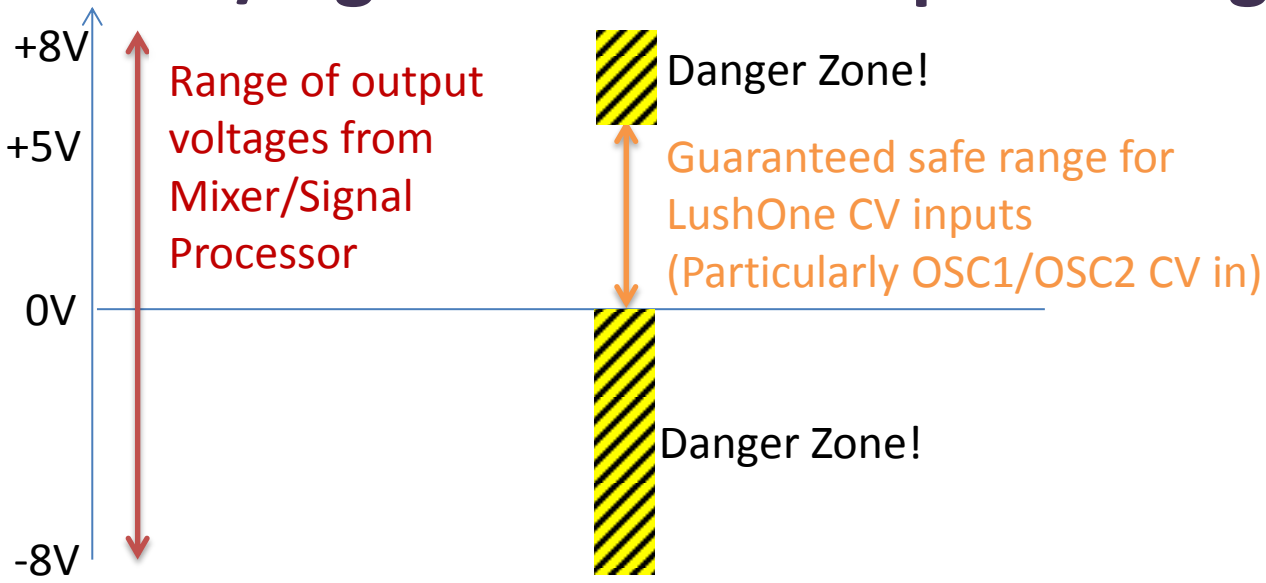
Centre
Add 0V

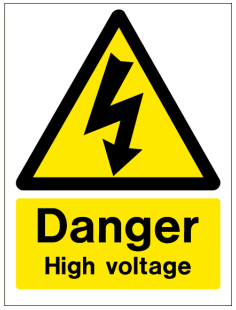
Min
Add -5V

Max
Add +5V

- Set up as shown
- If you have a volt meter you can connect to the "DC Out" to see the actual voltage
  - If you don't have a meter just use the LEDs
- Turn the gain to "min" and then adjust the offset
  - You should see the output vary from about -5V to +5V
  - Note that the input has no effect if the gain is at minimum (gain = 0)
- Set the DC offset to the centre (0V)
  - Adjust the gain while moving the joystick up and down to vary the input
  - Note that unity gain is approximately 1/3rd round the travel of the gain control
  - Maximum gain is about x 3
- Observe how the offset and gain controls can be used together to set the absolute voltage and the range of adjustment of the CV
  - For non-inverting inputs:
    Vout = (Gain x Vin) + Offset
  - For inverting inputs:
    Vout = - (Gain x Vin) + Offset

Mixer/Signal Process output voltages

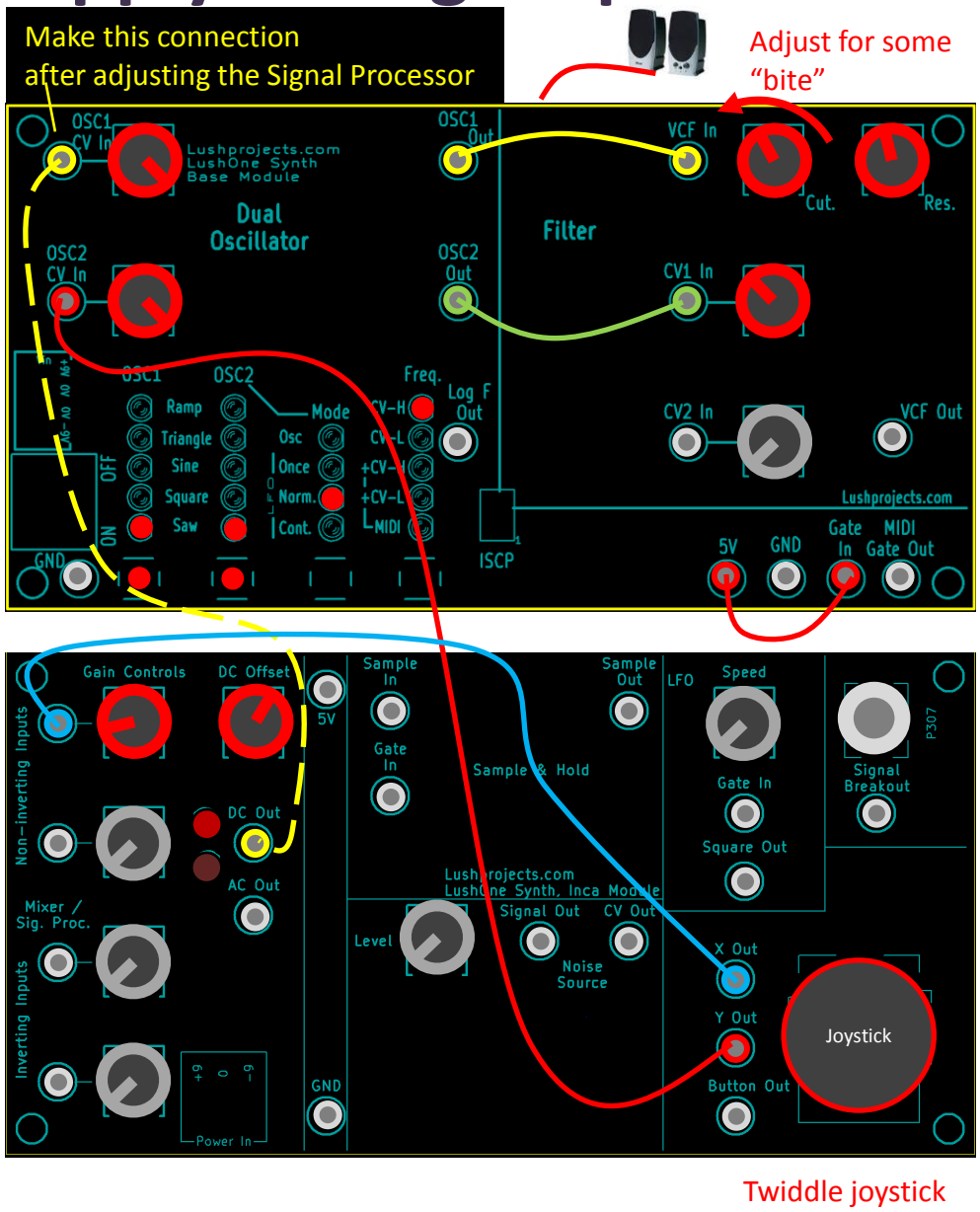




Take care not to overload CV inputs!

- 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.

Apply the signal processor to the Joystick patch



- Patch as shown, except for the yellow wire going to OSC1 CV In
- Set the DC Offset slightly above centre
- Set the Gain on the signal processor low
- Check that DC Out stays within range 0V to 5V as you move the joystick left and right
  - Bottom LED should not light
  - Adjust DC Offset or Gain if needed
- Add patch lead to OSC1 CV In
- Follow procedure on previous slide to progressively adjust the Signal Processor Controls to get a range of effects you like while keeping within the allowed voltages

That's all folks

- Have fun messing around with the joystick
- Use the signal processor to change responses to control voltages
- Don't forget if you also have a contour you can invent patches involving all three modules

- Next time:
  - Using the Mixer to combine signals
  - Interconnecting external signals