Frequency Shifter

Thanks for picking up the Frequency Shifter – a powerful & experimental all-analogue processor. There have only ever been a handful of such designs commercially produced, perhaps because many of the circuit parts require very precise component values and calibration, but also as these are processors which are very much for experimenting and sonic design due to the often unharmonic or otherworldly signals they can produce!

Please consult the Block Diagram overleaf which highlights the signal flow. The design is made up of two main circuit blocks along with supporting/surrounding circuitry:

- The main audio route consists of a special phase shifting network (Dome Filter), followed by two Balanced/Ring Modulators and precision Sum/Difference stages. The Dome Filter generates two copies of the input that are 90 degrees out of phase with one another – these are then by multiplied by the Sin/Cos waves from the Quad Sine section and then by adding and subtracting these we get our Up/Down Frequency Shifts – yes, it is a bit magical!

- The Quadrature Sine is a precision Voltage Controlled Oscillator covering audio and sub-audio ranges and producing a pair of pure waveforms that are 90 degrees out of phase with one another.
  - Audio rate covers c.15Hz to over 20kHz while Sub-audio goes from super slow 0.2Hz up to 20Hz (particularly good for phasing effects). The main Rate control covers 10 octaves while the Fine control is 1 octave.
    Note – when first switching on, the oscillations in Sub mode need to first build up to full amplitude – turn the Rate control up full for a few seconds until the LEDs are pulsing brightly, then turn down to the desired rate.
  - There is a 1V/Oct banana input for accurate pitch tracking from an external source – see website notes for connection approaches. The Ext(ernal) modulation input can be set to either Linear (AC-coupled) or Exponential (1V/Oct) with switchable polarity.
  - The Int(ernal) modulation takes the Sine wave and feeds it back for Exponential modulation – this drastically alters the waveforms & decreases the pitch.
  - The Sin/Cos are indicated by bipolar LEDs and output on 4mm bananas (+/-5V)

- The two inputs are each on electronically balanced 1/4” sockets – unbalanced cables can be used without issue. The main Input has variable Gain up to +20dB while the Feedback input is unity gain – both preamps feature soft-clipping to keep signals to the ideal internal +/-5V amplitudes. Turn up the input gain until your loudest signal just starts to clip, then dial back a notch – or you can overdrive the Input Gain for nice saturation. Typically for Line signals I turn the Input Gain to around 12 o'clock, while for Modular it might be around 9 o'clock.

  Feedback is a key part for rich audio results – there is internal limiting so it doesn't run into crazy levels. It can be switched to either Internal, where the Down or Up shift output is fed-back, or External, which allows you to plug an extra processor in the feedback chain – for example, take one of the Down/Up outputs and process it through a Delay before passing it back to the Feedback input.

  All outputs are on impedance balanced 1/4” socket. The Down and Up outputs are fed direct from the sum/diff stages at full amplitude, while the Mix output combines the shifted outputs with the Dry signal. With these output options you can easily set up different mixer channel returns with stereo panning potential (and feedback chaos routing!).

Interfacing with Bananas:
For further details see my website page in the Technical Info section.
I can supply Interface Cables from minijack to banana.
The first connection is made with the twin cable – the black cable is connected to the 0V socket on the rear of the case/frame, while the white cable carries the signal. Once this initial 0V connection has been established, further connections to the same piece of equipment can simply be made with single signal cables. If you want to bring in another piece of equipment you should use a second twin cable.

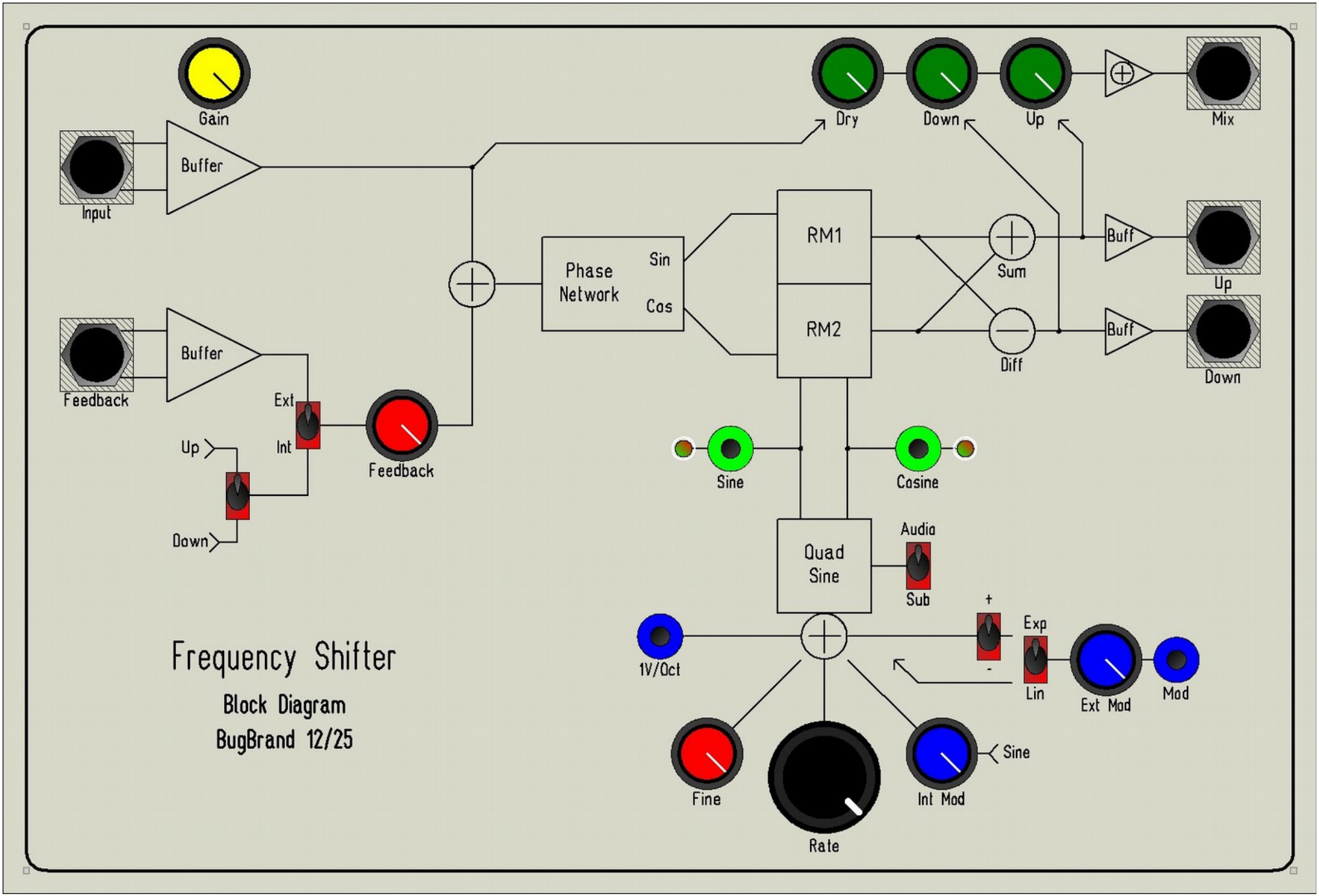
Calibration:
Be cautious before attempting calibration! It should not be required regularly. If in doubt, contact me first.
There are two sections to it:

- Audio path – there are four multiturn trimmers (A1/B1 & A2/B2) on the raised board, along with two jumpers marked J3/J4.
  First – with NO audio input, monitor either the Down or Up output – plug the cable then turn the volume up as loud as possible (note extreme caution!). Set oscillations to Audio rate and trim A1/A2 trimmers to minimise bleed of the oscillator – it should be nigh on silent, though there may be slight difference between Down/Up outputs. TURN DOWN volume before unplugging/proceeding.
  Second – with volume down, set jumpers onto their alternate pins (ie. Not corresponding to the white printed line). Feed a pure sinewave into the audio input with appropriate gain setting. Again monitor either the Down or Up output and carefully turn up again to full volume. Now adjust trimmers B1/B2 to minimise bleed – there will still be a little but by careful adjustment you will find the quietest setting. Again TURN DOWN before unplugging and replacing the jumpers to their original position.
- Quadrature Sine – there are three trimmers – Scale, HFT (Hi-FreqTrim) and Offset.
  Scale and HFT are used to ensure accurate 1V/Oct tracking.
  First set the main rate to around A1 (55Hz) and check with inputs of 1V and 2V – adjust Scale so that there is accurate tracking.
  Then applying a larger voltage (eg. 5V) check that the high-frequency tracking remains accurate – HFT can be tweaked but needs to be done in tandem with corresponding small adjustments to the scaling.
  Variation should be within 1cent from A1 to A7.
  Offset is then used to set the base rate to 20Hz when Rate is fully down and Fine is in a central position.

Technical Specifications:
Inputs – Mono Electronically-balanced 1/4″ Jack – impedance 20k Ohms
Outputs – Mono Impedance-balanced 1/4″ Jack – impedance 100 Ohms
CV inputs – 4mm Banana – impedance 100k Ohms
CV outputs – 4mm Banana – impedance 470 Ohms

Guarantee:
The Frequency Shifter comes with a 2 year 'reasonable' warranty. If any mechanical or electronic failure occurs within the period, I will repair the fault free of charge. This excludes failure from maltreatment or modification and any cosmetic degradation. Contact should first be made via email to discuss the problem. Shipping to return the device is paid by the user and I cover return shipping. Failures that are not covered by this guarantee may be fixed at standard rates.

Tom Bugs – BugBrand – Dec 2025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Frequency Shifter
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