NOISE-X

Noise-X has the following features:

- 4 DCOs (digitally-controlled oscillators) + mixer
- pitch and amplitude LFOs
- waveforms - sine, square, triangle, rising sawtooth, falling sawtooth, pulse, noise
- frequency modulation and ring modulation
- delay line with feedback
- flanger
- user patch (non-volatile)

Construction

First fit and solder the resistors (R1 to R12) and trim their legs. Identify the resistors by the coloured stripes on the body.

Next fit the chip sockets (IC1 and IC2) matching the notch in the socket against the notch in the symbol on the board. Care should be taken when soldering these components to avoid solder bridges between the pins. It is not recommended that the chips are soldered directly to the board.

Fit and solder the capacitors, paying attention to the polarity of the electrolytics (C1, C2, C3 and C6) (negative is marked by a stripe on the side of the body). The tantalum capacitor (C8) should be fitted such that the shorter leg is by the minus sign. The ceramic capacitors (C4, C7 and C9) and the polyester capacitor (C5) can be fitted either way around.

Bend the legs of the regulator (REG) at right angles and solder it such that the metal heatsink is flat on the board and the side with the writing is facing upwards. Solder the LEDs (LED1 to LED4) matching the shorter leg (also flat on the rim) to the hole with the line.

Solder the pushbuttons (S1 to S6).

Solder the presets (VR1 to VR4) and sliders (VR5 and VR6). Push the spindles into the presets and the knobs onto the sliders.

Solder the transistors (TR1 to TR5) matching the shape to the symbol on the board.

Solder the jack socket (AUDIO), first cutting off the five small plastic lugs on the underside so it fits flush on the board.

Solder the power socket (POWER). Optionally also fit the PP3 battery snap (BATTERY). Support holes are drilled on the board for the battery snap leads. Feed the leads up through the support holes from the track side of the board and then down the solder holes. Red is positive and black is negative.

Don't fit the chips into their sockets until you have thoroughly checked your construction. Check that all the components have been inserted correctly and that there are no dry joints and no solder bridges between pins. Then match the small notch in each chip to the notch in its socket.

Attach rubber feet to the underside of the board (the left of R3, the right of R6, the outer ends of VR5 and VR6, under the website address).

Either connect a mains power supply (5-9V regulated dc, 300mA, centre +) to the power socket, or 4 AA cells to the battery snap. Note that if using a mains power supply then a transformer-based supply is preferable, from a noise point of view, to a switched-mode power supply.

The software includes a power-on self-test. The LEDs should flash twice if the board is functioning correctly.

Connect headphones or powered speakers (with a 3.5mm jack plug) to the audio output socket.

Move the two sliders up and down and you should hear a tone.

How to Use

The fundamental sound generators in *Noise-X* are digitally-controlled oscillators (DCOs). Four are available and their pitch (frequency), amplitude (volume) and waveform can be individually controlled. The frequency range of the oscillators is from ~30Hz to ~8kHz (8 octaves). The four oscillators are mixed together to produce the audio output.

The available waveforms are the standard set available in many analogue synthesisers - namely sine, square, triangle, rising sawtooth, falling sawtooth, pulse, and white noise. The pulse width of the pulse waveform is continuously variable.

The pitch and amplitude of each DCO can be modulated (varied) by a pair of low-frequency oscillators (LFOs). Pitch modulation is known as vibrato and amplitude modulation is known as tremolo. The same set of DCO waveforms is available for the LFOs and the frequency and amplitude of each LFO can be independently varied.

The pushbuttons (S1 to S6) are used to select one of 12 modes. Pressing and releasing S1 selects mode #0, pressing and holding S1 selects mode #1, pressing and releasing S2 selects mode #2, pressing and holding S2 selects mode #3, and so on. Refer to the table below to see the effect of the sliders and presets in each mode. The pattern of running lights changes with the mode.

The presets and sliders remember their previous positions when the mode is changed and subsequent movements are relative to the previous position. To obtain the full range of values from a preset or slider it may be necessary to move it first to the two extremities of its travel.

A ring modulator is available which produces bell-like sounds rich in inharmonic partials. Pairs of oscillators can be ring modulated (their waveforms are multiplied together).

Pairs of oscillators can also be frequency modulated (the first oscillator in each pair modulates the second). This is similar in function to the pitch LFOs but the frequency of modulation is not limited to a low rate.

A flanger is available which acts as a dynamic filter removing a set of regularly-spaced frequencies from the sound spectrum (i.e. a comb filter). The position of the filter notches is under the control of a separate LFO, and the range, waveform and speed of frequency sweep are all controllable. (The flanger is implemented as a variable-length delay line and its parameters affect the instantaneous length of the delay line.)

A longer delay line is also available for reverb effects. Feedback can be applied to the delay line to produce complex non-linear effects. Reverb, particularly with feedback, is very effective at generating sci-fi type sound effects.

Additive synthesis means that the frequencies of DCOs #1, #2 and #3 are locked to respectively 2, 3 and 4 times the frequency of DCO #0 (the fundamental).

Fuzz can be used to distort the output of the mixer by clipping the waveform to a limit.

The current settings can be stored in non-volatile memory and restored later.

A small number of demo sounds are pre-programmed.

A master volume control is provided. *Noise-X* can output an audio signal on its jack socket which has a maximum peak-to-peak of about 2 volts. This is more than capable of producing a loud sound in a pair of 32-ohm impedance headphones.

Pushbutton(s)	
S1	select mode 0/1
S2	select mode 2/3
S3	select mode 4/5
S4	select mode 6/7
S5	select mode 8/9
S6	select mode 10/11
S1 + S6	restart
S3 + S4	toggle gain x 2
S1 + S2	save settings to memory
S5 + S6	restore settings from memory
S1 + S3	demo #1
S4 + S6	demo #2
S2 + S5	demo #3

Mode	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
VR1	DCO #0 waveform	DCO #0 amplitude LFO pulse width	DCO #1 waveform	DCO #1 amplitude LFO pulse width	DCO #2 waveform	DCO #2 amplitude LFO pulse width	DCO #3 waveform	DCO #3 amplitude LFO pulse width	off/ring modulation/ frequency modulation on DCOs #0 and #1		master volume	
VR2	DCO #0 pitch LFO waveform	DCO #0 amplitude LFO waveform	DCO #1 pitch LFO waveform	DCO #1 amplitude LFO waveform	DCO #2 pitch LFO waveform	DCO #2 amplitude LFO waveform	DCO #3 pitch LFO waveform	DCO #3 amplitude LFO waveform	reverb feedback		fuzz (hard clipping)	
VR3	DCO #0 pitch LFO frequency	DCO #0 amplitude LFO frequency	DCO #1 pitch LFO frequency	DCO #1 amplitude LFO frequency	DCO #2 pitch LFO frequency	DCO #2 amplitude LFO frequency	DCO #3 pitch LFO frequency	DCO #3 amplitude LFO frequency	off/ring modulation/ frequency modulation on DCOs #2 and #3		additive synthesis	
VR4	DCO #0 pitch LFO amplitude	DCO #0 amplitude LFO amplitude	DCO #1 pitch LFO amplitude	DCO #1 amplitude LFO amplitude	DCO #2 pitch LFO amplitude	DCO #2 amplitude LFO amplitude	DCO #3 pitch LFO amplitude	DCO #3 amplitude LFO amplitude				flanger pulse width
VR5 (left slider)	DCO #0 pitch	DCO #0 pulse width	DCO #2 pitch	DCO #1 pulse width	DCO #2 pitch	DCO #2 pulse width	DCO #3 pitch	DCO #3 pulse width	reverb period		flanger frequency	flanger waveform
VR6 (right slider)	DCO #0 amplitude	DCO #0 pitch LFO pulse width	DCO #1 amplitude	DCO #1 pitch LFO pulse width	DCO #2 amplitude	DCO #2 pitch LFO pulse width	DCO #3 amplitude	DCO #3 pitch LFO pulse width	reverb level		flanger amplitude	flanger base

Component List

Resistors

R1	4R7 (yellow, purple, gold, gold)
R2	100R (brown, black, brown, gold)
R3, R4, R5, R6	1k (brown, black, red, gold)
R7, R8, R12	10k (brown, black, orange, gold)
R9	470R (yellow, purple, brown, gold)
R10	220R (red, red, brown, gold)
R11	10R (brown, black, black, gold)
VR1, VR2, VR3, VR4	47k preset + spindle
VR5, VR6	100k slider + knob

Capacitors

C1	100uF electrolytic (blue or black)
C2	10uF electrolytic (blue or black)
C3, C6	220uF electrolytic (blue or black)
C4, C7, C9	100nF ceramic (brown, marked '104')
C5	100nF polyester (yellow or blue, square)
C8	10uF tantalum (yellow/brown, beaded)

Semiconductors

TR1, TR2, TR3, TR4	BC547B transistor (black)
TR5	ZTX689B transistor (black, thin)
REG	LD1117V33 LDO 3.3V 0.8A regulator (black/silver)
LED1, LED2, LED3, LED4	5mm blue
IC1	MCP4921 12-bit DAC + 8-pin socket
IC2	dsPIC33FJ128GP802 microcontroller (B11X) + 28-pin socket

Miscellaneous

S1 - S6	miniature tactile pushbutton
AUDIO	3.5mm jack socket
BATTERY	PP3 moulded battery snap + 4 x AA battery box
POWER	2.1mm dc power socket

PCB
Self-adhesive rubber feet x 5