

Isn'tses - The Fort Processor

Instructions and construction details



The Fort Processor is a touch and light controlled synthesiser and audio effect circuit designed by Isn'tses for Fort Process festival 2018. The event is held at Newhaven Fort on the Sussex coast, and Isn'tses have based the design and artwork of the instrument on the layout of the site, with inspiration from the surrounding landscape and ocean.

The circuit consists of:

- A section which distorts and octave-divides incoming audio (eg from a radio, walkman, mp3, synth etc)
- Squarewave oscillators controlled by touching the metallic drawings across the centre of the circuitboard with fingers, and also by a light sensor (best played using flashing/colour-changing lights or moving shadows)
- A chopper/ring-modulator which rhythmically slices between the distorted input signal and the oscillators,
- A 'Twin-T' section; a classic kick drum circuit mutated into a mysterious bass oscillator/drum/drone/filter which is influenced by the audio input.

If no audio input is connected, the circuit instead uses feedback and acts as a self-contained synth.

The Fort Processor is, like Fort Process itself, a space for experimentation and exploration. Certain parts of the circuit can be altered by the builder. If you wish to heavily modify/circuitbend it we recommend using sockets or pins in order to try out different connections or component values, most notably across the two rows of holes which mix the different octaves from the 4040 chip. We would love to hear about any modifications or discoveries you make.

Please note that the audio jacks are wired in a slightly unorthodox manner which means that you must use a stereo cable, or a stereo to dual-mono one. A 3.5mm mono jack (ie eurorack patch cable) will not work in either the input or the output of the Fort Processor.

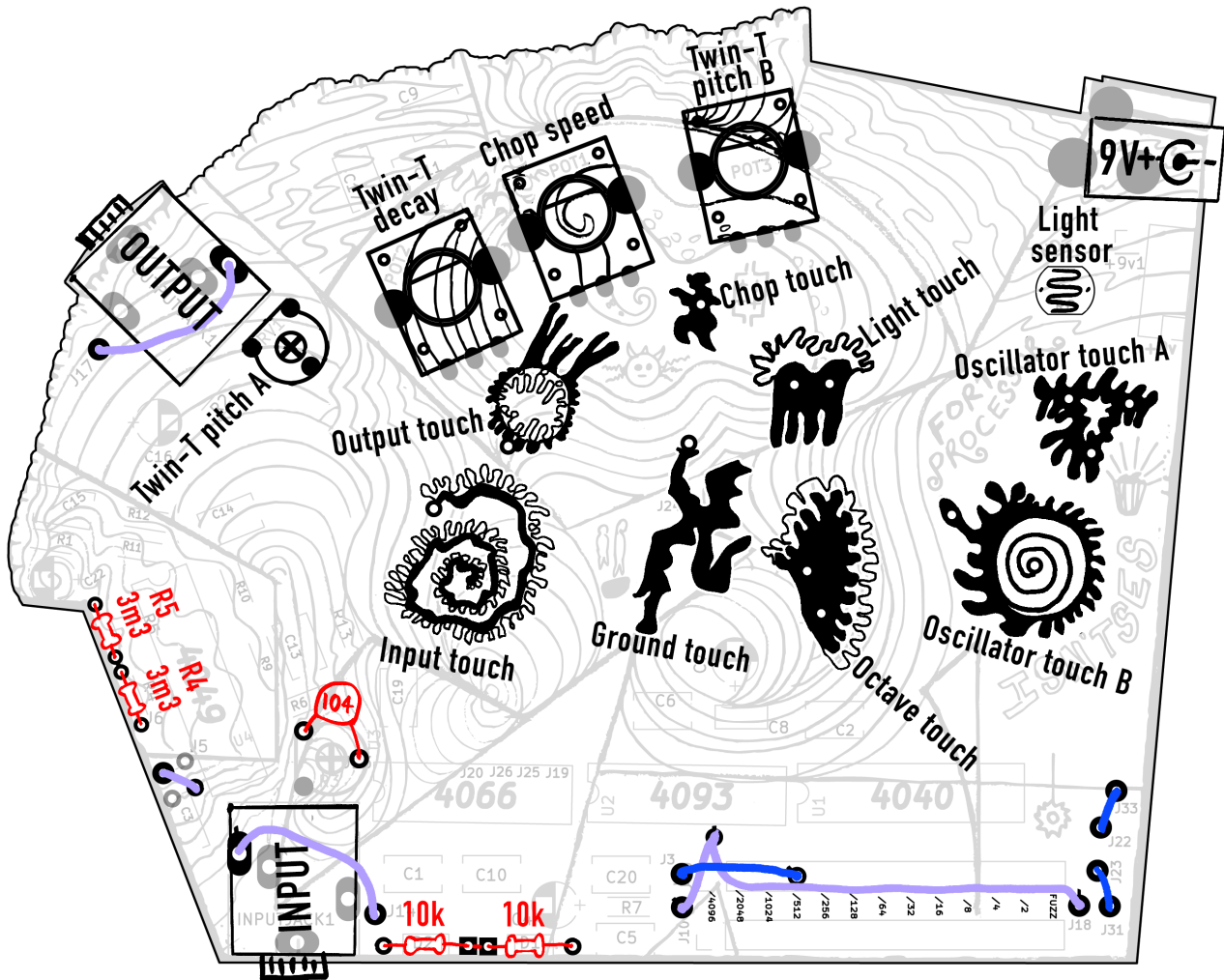
When building the circuit please pay special attention to the notes on the bill of materials and the diagram below. The circuit has evolved so some components are different to those marked on the PCB, and there are some crucial connections which must be made using small wire jumpers - the cut-off legs of soldered resistors work well for these.

We recommend sticking small rubber feet on the underside of the board, or mounting it in on a base or in a box with bolts thru the provided holes, or placing it on a soft and non-conductive surface when you play.

Please contact us if you have any questions or need any advice about building the circuit.

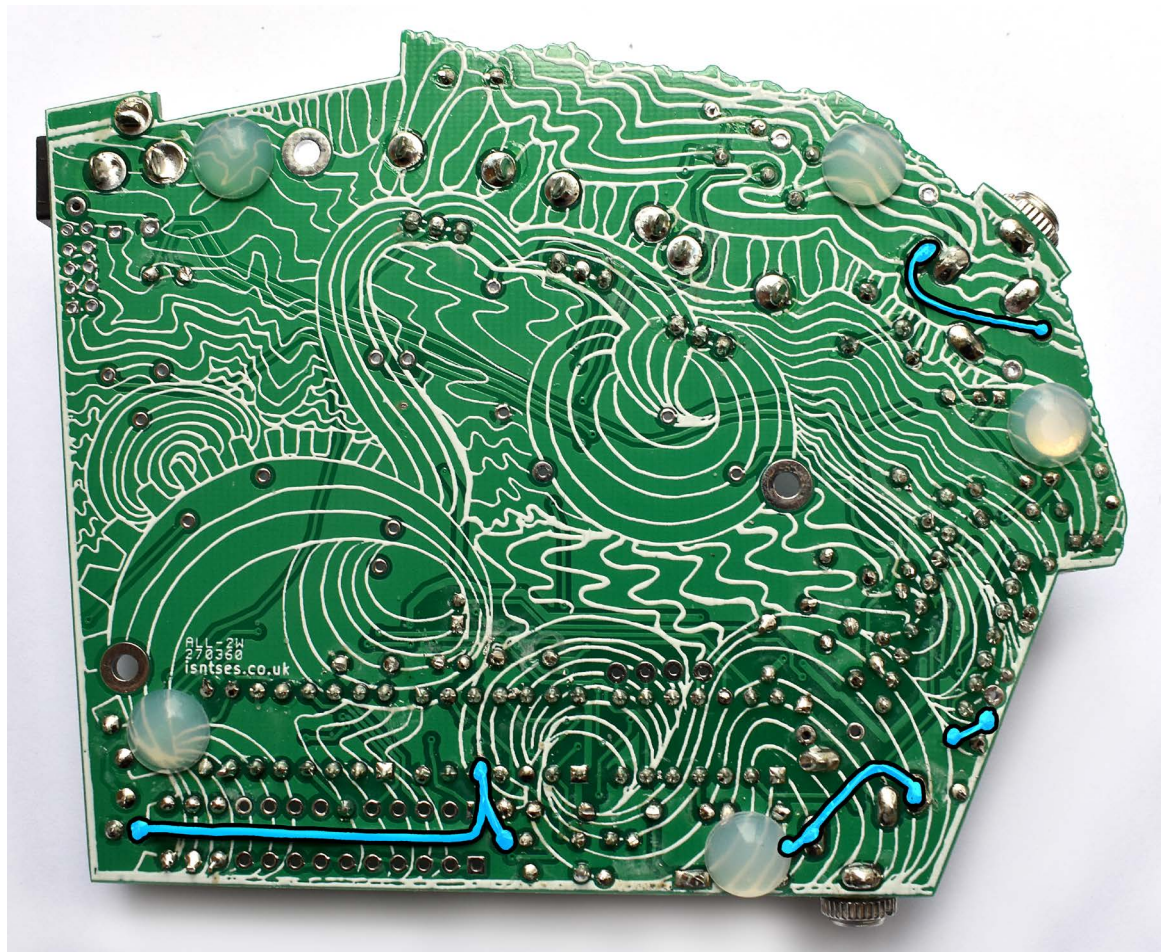
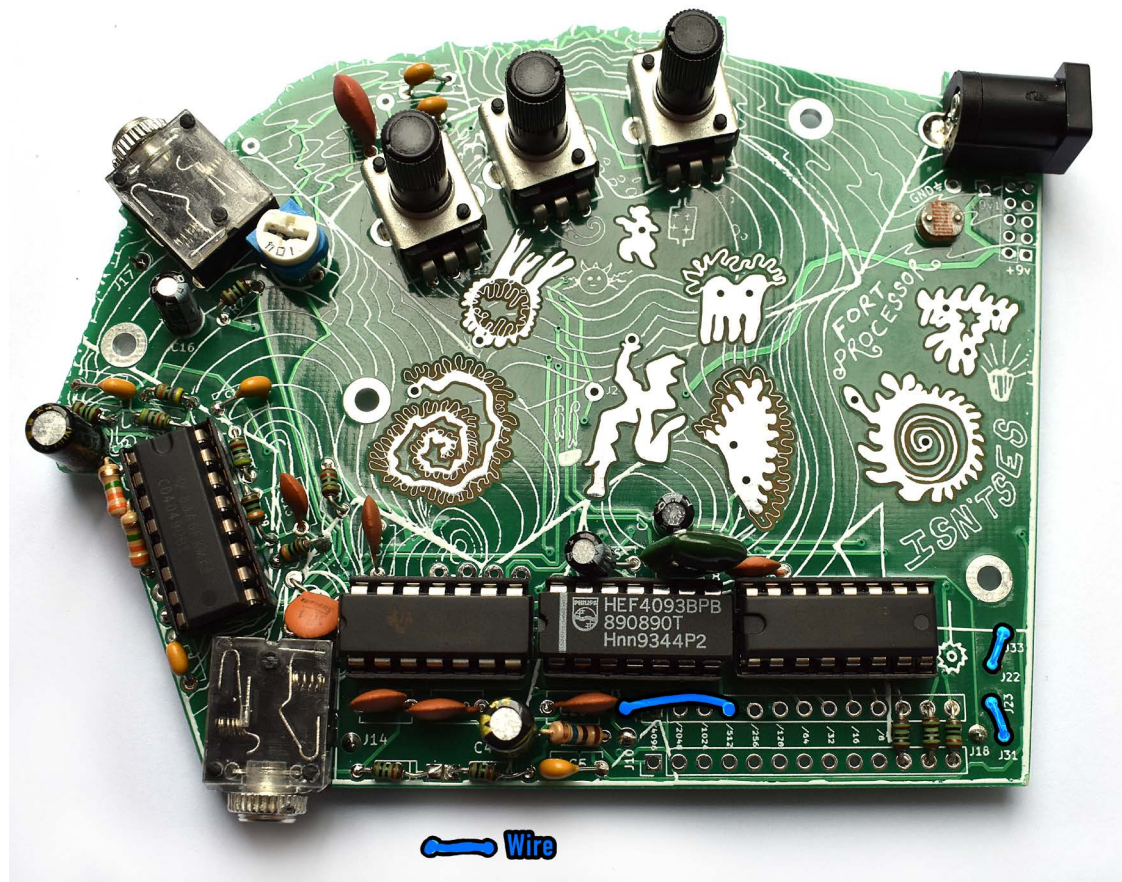
More info and background on the project can be found at <http://isntses.co.uk/blog>

Controls and notable components



- components which have changed or are unclear on board - see notes for details.
- wire jumpers - on top of board. see notes for details.
- wire jumpers - underneath board. see notes for details.

Example of completed circuit
Jumper wires highlighted for clarity



Bill of Materials for the Fort Processor circuit, designed by Isn'tses			http://isntses.co.uk
Component number/name as marked on PCB:	Qty:	Value:	Notes:
Resistors + Pots:			We used metal film resistors but carbon would work fine. Ideally get small resistors, the holes are 5.08 mm apart. Larger ones will work but might have to stick up a bit
R1,R2	2	1k	
R4,R5	2	3m3	NOTE: Not clearly numbered! These two go on the edge of the board next to the 4049 IC. See diagram
R10,R11	2	47k	(These are the 2 resistors which mix the oscillator signal with the octave-distorted input signal)
R7	1	10M	
R8	1	LDR03	Light dependent resistor
R9,R6	2	100k	
R12	1	470k	
R13	1	2.2k	
			<i>You could use sockets for 'FUZZ' and all the octave divisions (labelled /1 thru /4096 on the board) to experiment with different resistors, diodes, pots, LDRs etc connected across the two rows of holes on either side of the numbers</i>
FUZZ	1	10k	10k resistor (for mixing the distorted input signal with the 4040 octave divisions)
/2	1	1k	1k resistor (for CD4040 octave mixing)
/4	1	1k	1k resistor (for CD4040 octave mixing)
D1, D2	2	10k	NOTE: these are actually 10k resistors, not diodes as marked on the board!
RV1	1	trimmer potentiometer	100k trimmer (or experiment other values for a different range.)
POT1,POT2, POT3,	3	100k potentiometer	Alps RK09K series vertical 9mm pcb-mount pot or similar. We used "Bourns PTV09A-4020U-B104, 6 mm Dia. Shaft, 100k" (or experiment other values for a different range.)
Capacitors			
R3	1	100nF ceramic cap	NOTE: R3 has been changed to a cap instead of trimmer pot! the cap goes in place of the 2 legs furthest from the input jack, see diagram
C1,C2,C3,C5,C6,C9,C10,C11,C12,C14,C15,C19,C20	13	100nF (AKA 0.1uF)	100nF Ceramic (Marked 104) or poly film capacitor
C4	1	4.7uF	Electrolytic capacitor
C7,C16	2	1uF	Electrolytic capacitor
C22	1	100uF	Electrolytic capacitor
C8	1	47nF	Ceramic (Marked 473) or poly film capacitor
C13	1	10nF (AKA 0.01uF)	10nF Ceramic capacitor (Marked 103)
C17	1	220nF (AKA 0.22uF)	220nF ceramic disc - Marked 224
IC chips			<i>Use sockets for all ICs. Listed below are the specific ICs we used, but other versions should work work so long as they still have "CD4xxx" in the names</i>
	2	DIP-14 sockets	chip holder, 14 pins
	2	DIP-16 sockets	chip holder, 16 pins
U1 - 4040	1	CD4040BE 12-stage Binary Counter	CD4040 - this octave-divides the distorted input signal. 16 legs.
U2 - 4093	1	CMOS Quad 2-Input NAND Schmitt Triggers	CD4093 - used as 3 oscillators, 1 inverter. 14 legs.
U3 - 4066	1	CD4066BE, Analogue Switch Quad SPST	4066 - Rapidly switches between the oscillators and distorted input for chopping/ring-mod fx. 14 legs
U4 - 4049	1	CD4049UBE, Hex, CMOS Inverter	4049 - Distorts the input, mixes signals, also used for the Twin-T drum/filter section. 14 legs
Connectors			
INPUTJACK1,OUTPUTJACK1	2	3.5mm switched stereo jack	NOTE: AUDIO WILL BE IN RIGHT CHANNEL ONLY unless bridged with wire jumpers as detailed below. The jack we used was "Decelect Forgos 3.5 mm PCB Mount Stereo Jack Mfr. Part No. IES101-4"
DC POWER JACK	1	DC Power Socket WR-DC Series, 3.5mm Right Angle (or a 9v battery clip: red wire to +9v, black wire to GND)	
Jumper wires			NOTE: A few wire jumpers are essential to connect points which were left optional on the PCB, or changed because the circuit mutated. See notes below and diagram.
Wire jumper J22-J33		wire (cut-off resistor leg)	on top of board (spare 4066 input A - must be wired to ground, unless used for modifications to the circuit)
Wire jumper J23-J31		wire (cut-off resistor leg)	on top of board (spare 4066 input B - must be wired to ground, unless used for modifications to the circuit)
Wire Jumper J18 to pin 5 of CD4093		shielded wire	underneath the board (J18 = the clock input for 4066 ringmod/chopper. Could be modulated by some other squarewave source for different effects.)
Wire Jumper J10 to pin 5 of CD4093		wire (cut-off resistor leg)	underneath the board
Wire jumper J5 to gnd		wire (cut-off resistor leg)	underneath the board - from J5, diagonally to pin 8 of 4049 (gnd) (Spare 4049 inverter input - must be wired to ground unless used for modifications to the circuit)
Wire jumper J3 to '/512' output of CD4040		shielded wire	on top of board from J3 to the hole to the left of '/512' - NOTE: you can experiment with connecting J3 to other octaves: Bigger numbers = slower. Around /512 it's rhythmical. Below /32 it acts more like a filter than a drum/oscillator
Wire jumper J14 to Left channel of Input jack		wire (cut-off resistor leg)	underneath the board - With this jumper, left and right inputs are summed to mono. Without, right channel only. NOTE: Mono 3.5mm cables will not work; you need stereo, or stereo to dual-mono
Wire jumper J17 to Left channel of Output jack		wire (cut-off resistor leg)	underneath the board - With this jumper, left and right outputs are summed to mono. Without, right channel only. NOTE: Mono 3.5mm cables will not work; you need stereo, or dual-mono to stereo

Info on the unused CMOS gates, these are usually safely connected to ground by 3 of the wire jumpers listed above. Ignore this diagram unless you are doing advanced modifications:

