## The Fort Processor by Isn'tses - build guide and instructions

Further info on this circuit and its development can be found at http://isntses.co.uk/blog

These instructions and components are only for the black version of the Fort Processor circuit board: if you have a different colour PCB see our site for another build document.

### **Building Instructions**

Before starting we suggest you watch the build video on our youtube channel: "Fort Processor by Isn'tses - build instructions" at <u>https://youtu.be/pKruaRn7-Uc</u>

At each step double-check the components are in the right place before you solder them, or better still get someone else to do so. It's best to solder in order of height; the resistors first, then the IC sockets, then other components as listed, so that it's easier to keep everything level agaist the PCB while soldering.

#### Step 1: Resistors

Before soldering check each resistor colour code is the correct value.

| Label on PCB:        | Value:      | Qty | Notes:   |
|----------------------|-------------|-----|--|
| /4, R2, R3, R14, R15 | 10k         | 5   |  |
| FUZZ, /2, R1         | 1k          | 3   |  |
| R4,R5                | 3m3         | 2   |  |
| R10,R11              | 47k         | 2   |  |
| R7                   | 10M         | 1   |  |
| R8                   | 20M LDR     | 1   | Light dependent resistor                               |
| R9,R6, <b>C8</b>     | 100k        | 3   | NOTE: C8 is now a resistor, not a capacitor as marked. |
| R12                  | 470k        | 1   |  |
| (R13)                | wire jumper |     | NOTE: bypassed with wire - use a cut-off resistor leg  |

### Step 2: Sockets

Solder the IC sockets (check the number of legs and that they are all correctly in the holes) and the audio and power jacks.

| Label on PCB:         | Value                                    | Qty | Notes  |
|-----------------------|--|-----|--|
| INPUTJACK, OUTPUTJACK |  | 2   | 3.5mm switched stereo jacks                                |
| DC POWER JACK         | DC Power Socket 3.5mm<br>Centre-Negative | 1   | (or a 9v battery clip: red wire to +9v, black wire to GND) |
| 4066, 4093            | DIP-14 sockets - 14 legs                 | 2   | Make sure notches on sockets match those drawn on PCB      |
| 4049, 4040            | DIP-16 sockets - 16 legs                 | 2   | ű  |

#### **Step 3: Capacitors**

The electrolytic caps are polarised: the negative side (shorter leg, stripe on the side of the component) in marked with a white semicircle on the PCB. Ceramic/film caps aren't polarised.

| Label on PCB:                 | Value              | Qty | Notes   |
|-------------------------------|--------------------|-----|---|
| C1, C2, C3, C5, C9, C10, C11, |                    |     |   |
| C12, C14, C15, C18, C19, C20  | 100nF (AKA 0.1uF)  | 13  | Ceramic capacitors, marked '104'                  |
| C13                           | 10nF (AKA 0.01uF)  | 1   | Ceramic capacitor, marked '103'                   |
| C17                           | 220nF (AKA 0.22uF) | 1   | Ceramic/film capacitor, marked '224' or 'u22J63'  |
| C6, C7, C16                   | 1uF                | 3   | Electrolytic caps. (C6 controls LDR range )       |
| C4                            | 10uF               | 1   | Electrolytic cap. (controls chopper speed range.) |
| C22                           | 100uF              | 1   | Electrolytic capacitor.                           |
| (C8)                          | -                  | 0   | (changed to a 100k resistor, as listed above.)    |

#### **Step 4: Potentiometers**

| Label on PCB:    | Value:             | Qty | Notes: |
|------------------|--------------------|-----|--------|
| RV1              | 100k trimmer pot   | 1   |        |
| POT1,POT2, POT3, | 100k potentiometer | 3   |        |

## Step 5: CMOS chips

Carefully insert the ICs in the correct number sockets, making sure they are the right way round with the notches at the same end as is drawn on the PCB, and that all the legs are straight and in the correct holes.

| Label on PCB: | Value  | Qty | Notes                    |
|---------------|--|-----|--------------------------|
| U4 - 4049     | CD4049UBE, Hex, CMOS Inverter                  | 1   | Amplification/distortion |
| U3 - 4066     | CD4066BE, Analogue Switch Quad SPST            | 1   | Chopper/signal switcher  |
| U2 - 4093     | CD4093 CMOS Quad 2-Input NAND Schmitt Triggers | 1   | Oscillators              |
| U1 - 4040     | CD4040BE 12-stage Binary Counter               | 1   | Octave divider           |

## Step 6: check the circuit is working

Before plugging in for the first time, connect the audio output to an amp or mixer - set to a cautiously low volume - so you can immediately tell if it's working and quickly the unplug the power if there is no sound or any other problem. If it isn't working properly, check all solder joints and that all components are in the right place with polarised ones the correct way around. Make sure the power and audio connections are as follows:

#### Power:

The Fort Processor is powered by a standard Boss-style guitar pedal power supply, ie 3.5mm <u>centre</u> <u>negative</u> 9v DC. You can also use a 9v battery adaptor but again, ensure this is wired centre negative. Take great care never to use any other kind of power supply! There is no protection against reverse polarity, so if you accidentally plug in a centre-positive or an AC/AC power supply you will damage the circuit and will have to replace the chips!

To avoid short-circuits, we recommend sticking small rubber feet on the underside of the board, purchasing our laser-cut perspex base kit from <u>isntses.etsy.com</u>, making your own DIY wood or plastic base, or simply placing it on a soft and non-conductive surface when you play (eg fabric, plastic, rubber or wood.) DO NOT place it on a metal surface while plugged in, or it will be damaged.

### Audio connections:

Before plugging in for the first time, connect the audio output to an amp or mixer - set to a cautiously low volume - so you can immediately tell if it's working and quickly the unplug the power if there is no sound or any other problem. If it isn't working properly, check all solder joints and that all components are in the right place with polarised ones the correct way around.

The Fort Processor audio input is mono. If your cable is stereo then only the left (tip) signal will be used. The output signal is mono but split to left and right via resistors, so either TRS/stereo/aux cables or mono minijack cables (eg eurorack patch leads) should both work. We usually use a stereo minijack to dual-mono 1/4" cable for the output.

See our blog for modification ideas and alternative power options:

http://isntses.co.uk/blog



## Fort Processor by Isn'tses

The Fort Processor is an experimental synthesiser and audio effect circuit originally designed by Isn'tses for Fort Process sound art festival 2018. This event takes place in the tunnels and bunkers of Newhaven Fort on the Sussex coast, and the electronics and artwork of the instrument are based on the layout of the site, with inspiration from the surrounding landscape and ocean.

The synth is controlled by light, touch-contact and 4 knobs. Audio is created and manipulated by several elements which have been combined using a circuit-bent approach:

A section which distorts incoming audio (eg from a radio, walkman, phone, tablet, mp3, synth etc.) using extremely high gain then divides it to add two noisy sub-octaves. When no input jack is connected, the circuit instead feeds back and self-oscillates.
Squarewave oscillators controlled by a light sensor and further modulated by touching the metallic drawings across the circuitboard with your fingers (touch two or more at once.)
A variable-speed chopper which slices between the distorted input signal and the oscillators to create cut-up, tremolo or ring-modulation effects.

• A mysterious bass oscillator/filter/beat/drone generator, mutated from the classic 'Twin-T' analog kick drum circuit, which is triggered and influenced by the audio input.



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# Isn'tses "Fort Processor" - extra instruction notes isntses.co.uk

1. The 'twin-t' bass part of the circuit is controlled by esoteric interactions between the small trimmer knob (left) and the left and right of the 3 larger knobs, and by design it isn't always audible. It's more about finding a sweet spot and tuning the sound. The knob positions marked by white lines below are a good starting point. Try adjusting yours to match this and you should hear some bass pulse/tone in addition to the light-sensor tone. The knob marked 'A' below controls the envelope of the bass and also works as an on/off control - if you turn it clockwise the bass sounds will disappear.



2. The touchpads' effect can be subtle, some don't do much, and also they only do anything at all if you touch two or more at once - touching just one has no effect! As with most body-contact circuits they work better with sligtly damp fingers, and you need to keep your fingers down on the board rather than quickly tapping. The easiest to test are the two touchpads below the light sensor, on the right of the the Fort Processor logo. If you touch both of these at once you should definitely hear the light sensor tone change/modulate. To get the maximum effect you can touch the pads together with each end of a short patch cable rather than your fingers, tho if you try this then be VERY careful not to let it touch any of the components, only the touchpads!

3. The audio input at the bottom of the board can sound quite different depending on the volume of the input signal; control this using the volume control of your player/instrument/phone etc. A good way to test it is with a youtube or podcast of people talking with no background music, that way you can easily hear what effect it's having and set the levels to get the kind of distortion you want.