

Dirty Electronics: BEAM Fist

John Richards 2011

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The BEAM Fist is a hand-held touch instrument with copper etched artwork commissioned by the BEAM Festival, Brunel University, UK, 2011. The artwork combines rays of light with the letters of BEAM tattooed on to the fingers of a clenched fist. Touch the rays (beams) to play the instrument. The circular shape of the instrument is designed to fit in the hand and challenge the performer's relationship with the object in terms of orientation and playability. The BEAM Fist's circuit uses a dual low voltage power amplifier integrated circuit (IC) configured in feedback loops. From amplification comes oscillation, noise and distortion!

Exploring feedback loops and configurations has been central to my practice for many years, in particular in the group kREEPA and then latterly in the design of Dirty Electronics instruments. I have always been interested in some of the early works of David Tudor and Pauline Oliveros where the use of feedback was focal in the compositional process. In Dirty Electronics, these interests are manifested and epitomized in the ICA Solder a Score that is an out-and-out feedback instrument based around a dual operational amplifier.

The visual dimension plays a big part in the overall design of Dirty Electronics instruments. It is not just about the sound, but in this case, the exploration between graphical artwork and functioning circuit board. In fact, the starting point for the BEAM Fist was the graphical image and the copper etching. I was drawn to the image of the clenched fist, a symbol that has often been used for resistance and unity and has had many graphical adaptations. The dimension of the BEAM Fist was inspired by a circular beer mat: a particular shape and size that felt good in the hand.

The electronics were designed and built around the graphical image of the clenched fist and sun rays. Consequently, this radically influenced the scope of the circuit due to the available space on the board. To save space, I explored audio amp integrated circuits (ICs) that could be powered by a 3 volt coin cell battery. I looked at two options: the NJM2073D and TDA2822M. These are pin-to-pin, like-for-like dual low voltage power amplifiers capable of running on a power supply as low as 1.8 volts. The NJM2073D was chosen for economic reasons. The final design forsakes any complexity, and is an extremely minimal circuit based around two feedback loops. These loops are completed by touching pairs of electrodes on the circuit board (touch points derived from the sun ray image). The touch electrodes work in the same manner to other Dirty Electronics instruments where the conductivity of the human body and skin resistance are exploited.

Resistor capacitor (RC) filters are also used in the circuit. The two loops, labelled Oscil. 1 and Oscil. 2, are filtered differently to produce distinctive timbres (Oscil. 1 sounding bassier). Filtering is also employed to reduce noise and hum from the electrodes.

Playing the instrument

(see Appendix 1: Board Layout)

A & B (Oscil. 1); E & F (filt./feedb. Oscil. 1)

C & D (Oscil. 2); G & H (filt./feedb. Oscil. 2)

National Semiconductor. *LM386 Low Voltage Audio Power Amplifier* (data sheet), 1994

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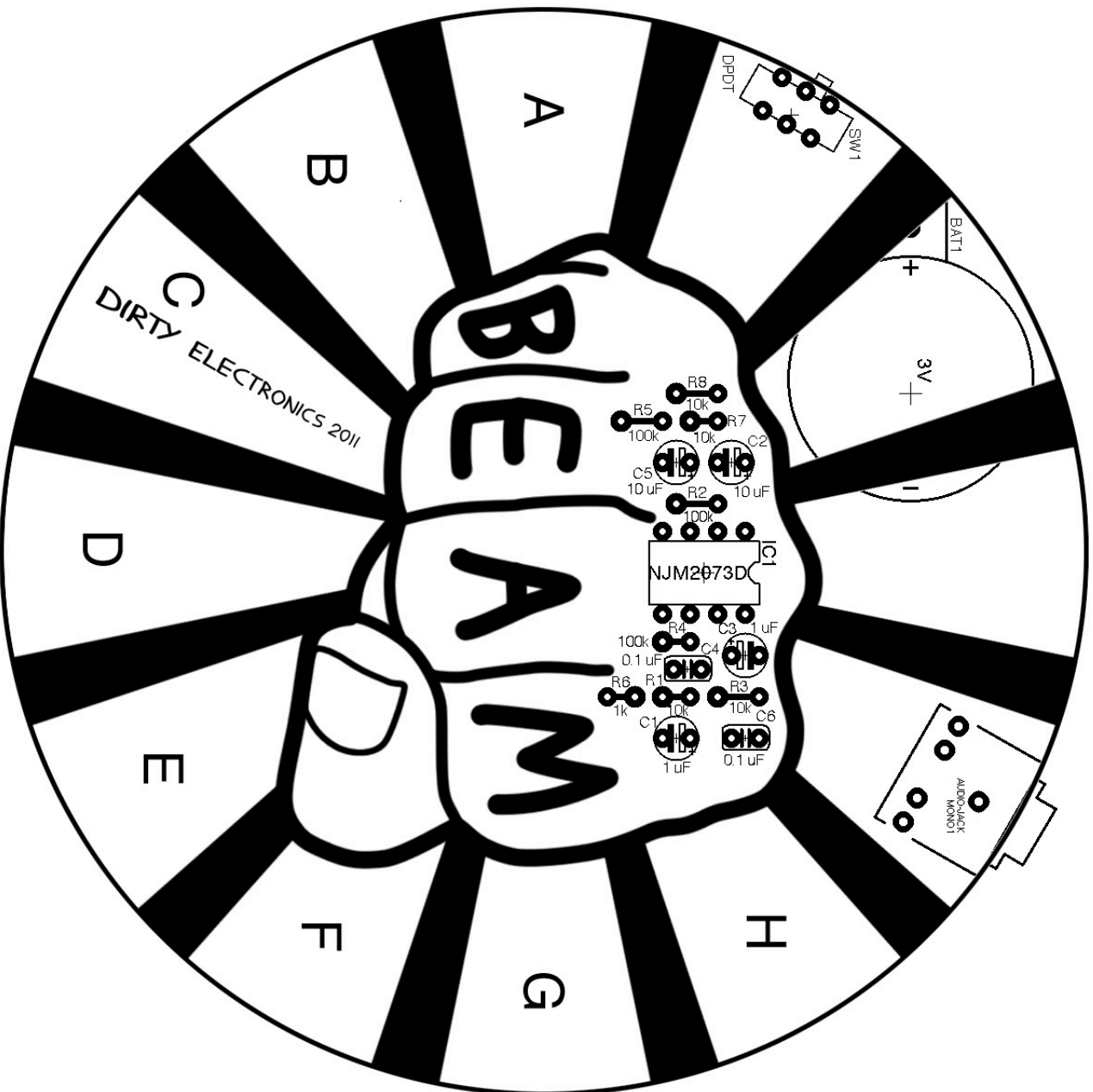
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Partlist

| | |
|------------|--------------------------|
| C1 | 1 uF |
| C2 | 10 uF |
| C3 | 1 uF |
| C4 | 0.1 uF |
| C5 | 10 uF |
| C6 | 0.1 uF |
| IC1 | NJM2073D |
| DIL | DIL SOCKET (8 PIN) |
| AUDIO JACK | jack socket (3.5 mm) |
| R1 | 10k (br/blk/blk/red/br) |
| R2 | 100k (br/blk/blk/org/br) |
| R3 | 10k |
| R4 | 100k |
| R5 | 100k |
| R6 | 1k (br/blk/blk/br/br) |
| R7 | 10K |
| R8 | 10k |
| BAT1 | 3V CR2032 |
| BAT HOLDER | CR2032 battery |
| FEET | rubber feet x3 |
| SW1 | DPDT |

Appendix 1: Board Layout



Appendix 2: Schematic

BEAM FST - JR_11

