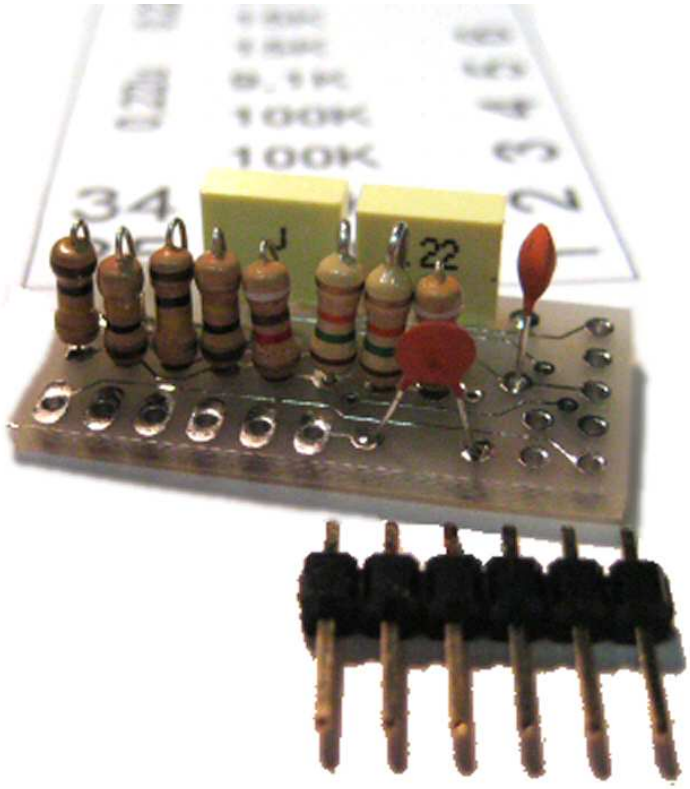
Stereo audio enhancement for the ZX Spectrum 128K / +2 / +2A / +2B / +3



by Ben Versteeg
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Overview

This stereo audio enhancement gives your ZX Spectrum 128K:

1. Crips and clear stereo sound from the AY-3-8912 sound generator
2. ‘Beeper’ sound on both left and right output channels
3. Load and save sounds on both channels
   and…
4. Finally you will hear all sound at the same volume level !

Compatibility

The stereo enhancement is compatible with all 128K ZX Spectrum models:
128K+ (heatsink model), +2 (grey), +2A, +2B, +3 and clones with AY-3-8912 soundchip.

Assembling complexity

The stereo sound enhancement is prepared as much as possible, but It’s still not easy to assemble!

I encountered these problems which can be dealt with:

a. Finding a good place for the audio output and the optional switch
b. Finding audio connectors which fit in the (thick) plastic of the ZX Spectrum’s
c. It’s impossible to solder wires to the matrix array (ULA) in the +2A / +2B
d. The AY-3-8912 output channels are short circuited on the +2A / +2B
e. Fitting the board into any ZX Spectrum because of it’s height
f. Soldering the pinhead header

Statement

The sold kits are assembled carefully, but there may always be a bad solder connection or shortcircuit.
Please check the board yourself again before assembling!

I’m not responsible for any defects or damage caused by building the stereo enhancement into your ZX Spectrum!

It takes some skill to solder the board onto the AY-3-8912 and the wires to the ULA or array.

Assembling the board is at your own risk!

ABC / ACB channel mixing

Channel mixing means how the three output channels (A, B and C) of the AY-3-8912 chip are mixed to the two stereo output channels (left and right).

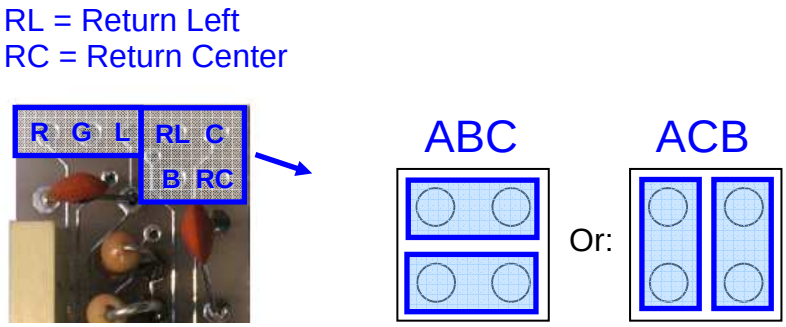
There are two common mixing standards:
ABC: A is mixed to right, B to left and right, and C to left (western-European).
ACB: A is mixed to right, C to left and right, and B to left (eastern-European).

This means that if you want to hear a song as it was arranged, you should use the correct channel mixing.

If you do not think it's that important (like me), you can fix the channel mixing to ABC or ACB by using jumpers directly on the stereo enhancement board.

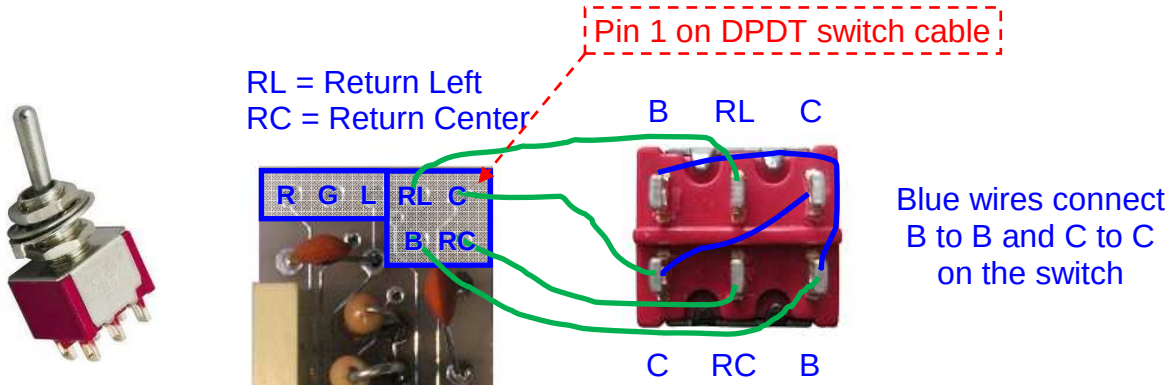
If you want to be able to choose between the two standards, you can use a switch.

Using jumpers



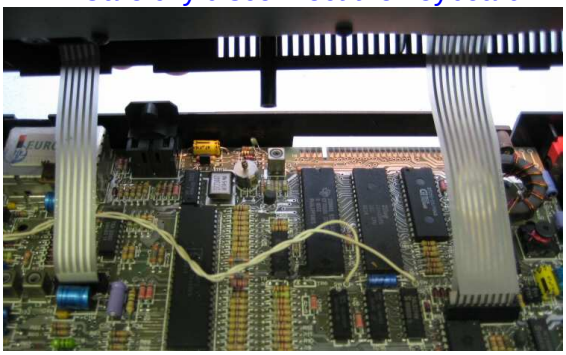
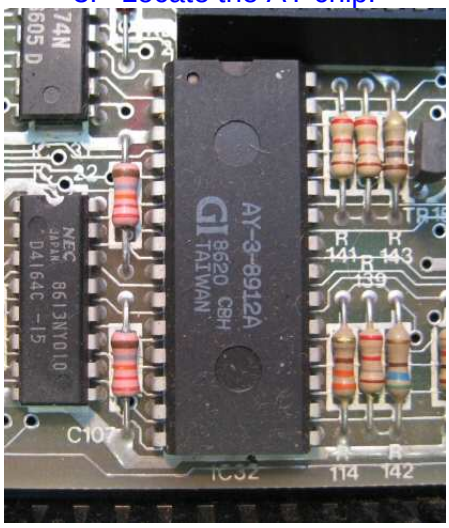
Using a DPDT switch

A DPDT (double pole, double throw) switch is wired as following:



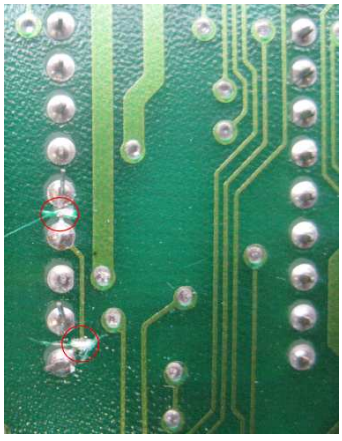
Assembling instructions

The pictures in these instructions are from different ZX Spectrum models.

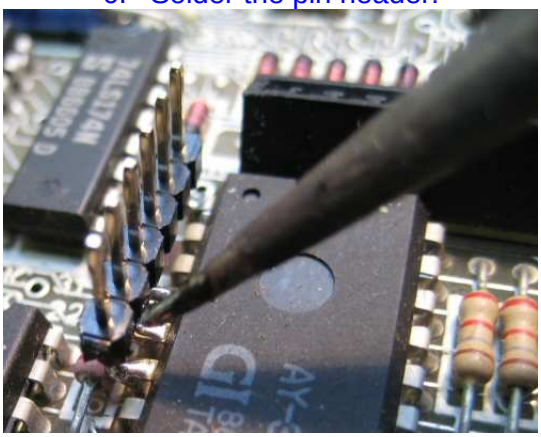
<table>
<tr>
<td>1. Unscrew your ZX Spectrum:
  </td>
<td>2. Carefully disconnect the keyboard:
 
Also disconnect the taperecorder cable on the +2 / +2A / +2B.</td>
</tr>
<tr>
<td>3. Locate the AY chip:
  </td>
<td>4. Pre-solder the pins 1, 4, 5 and 6:
 
Pin 1 is the first pin anti-clockwise from the notch.</td>
</tr>
<tr>
<td>5. +2A / +2B only:

Amstrad decided to shortcircuit the AY-3-8912 output channels on +2A and +2B models before sending them to the modulator and audio out, as the AY-3-8912 supports this.

Unfortunately we want to have the three channels seperated..

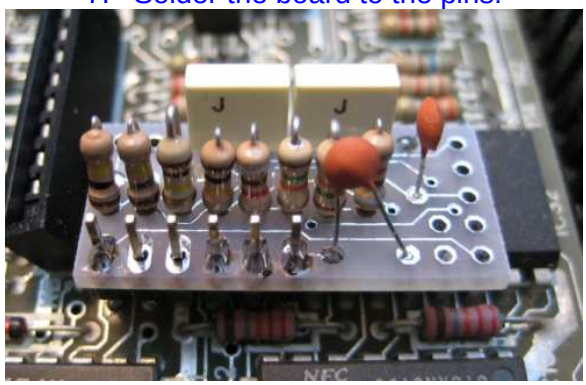
So, cut the cupper lines at the bottom of the +2A / +2B board (at tha AY-3-8912 location), at the locations shown on the picture on the right.</td>
<td>  </td>
</tr>
</table>

6. Solder the pin header:



Make sure the short side is down otherwise the stereo board might not fit!

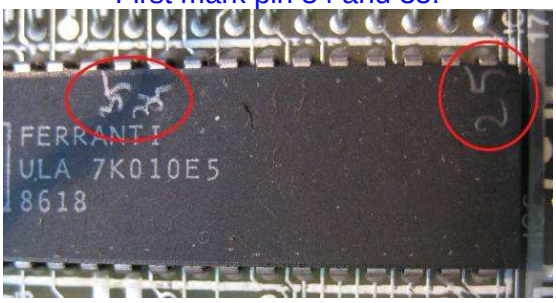
7. Solder the board to the pins:



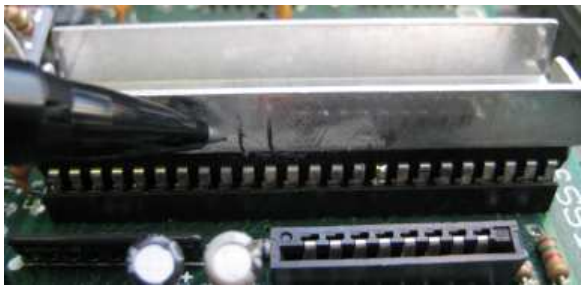
8. Solder the 2 wires to the ULA / matrix array:

128K heatsink model or grey +2:
solder 2 wires on ULA pins 34 & 35

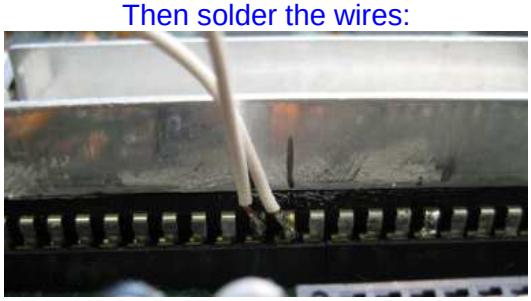
First mark pin 34 and 35:



..or with heatsink on ULA:

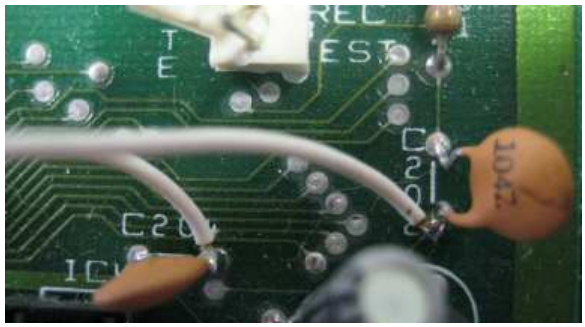


Then solder the wires:



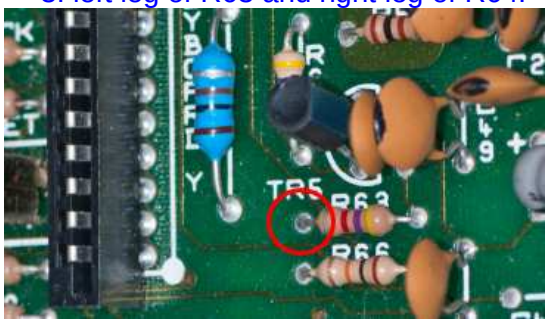
The ULA has 24 pins on each side.
The grey +2 model has a heatsink on ULA.
Swapping the 2 wires is no problem.

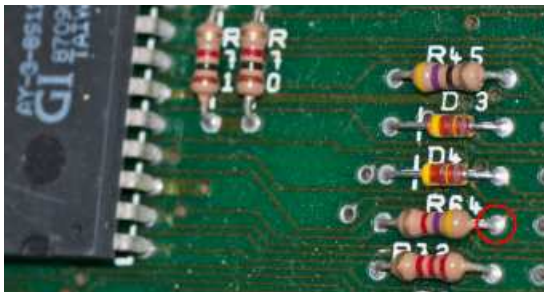
.. or +2A / +2B:
solder one wire on C202 (lower pin)
and one on C204 (right pin)



These lead to the correct pins on the matrix array (ULA).

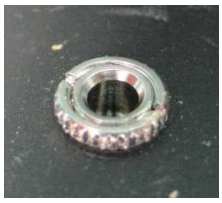
+3: left leg of R63 and right leg of R64:





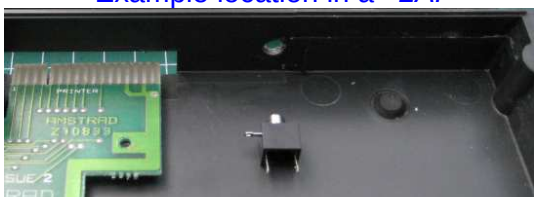
9. Fitting the stereo audio socket
   a. Find a good location
   b. Drill a 6 mm hole
   c. Insert the socket
   d. Fit the ring

Please take your time for finding a good location; it's easy to make a mistake here!

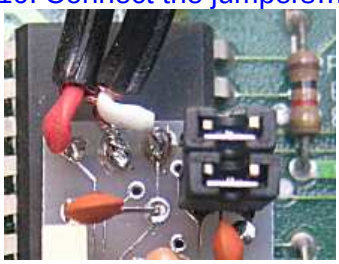


Example location in a grey +2:

Example location in a *+2A:*

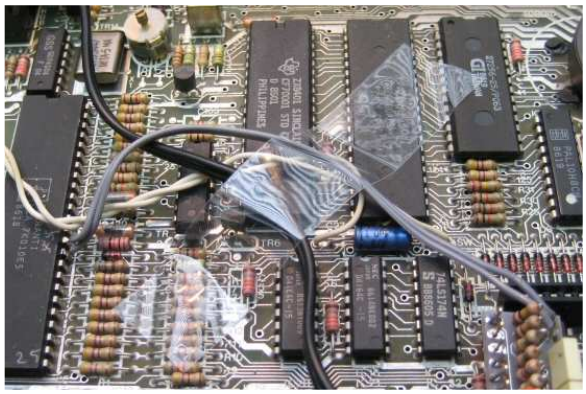


10. Connect the jumpers…



… or assemble the DPDT switch:

11. Fix the wires to the board:



12. Finally:

a. Connect all cables

b. Test the output (see test routine)

c. Close your ZX Spectrum

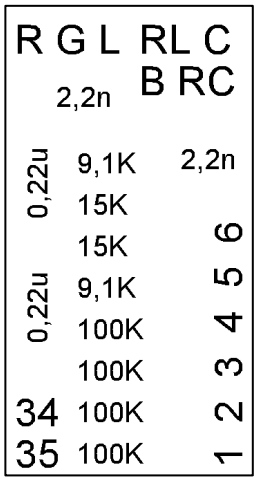
Testing

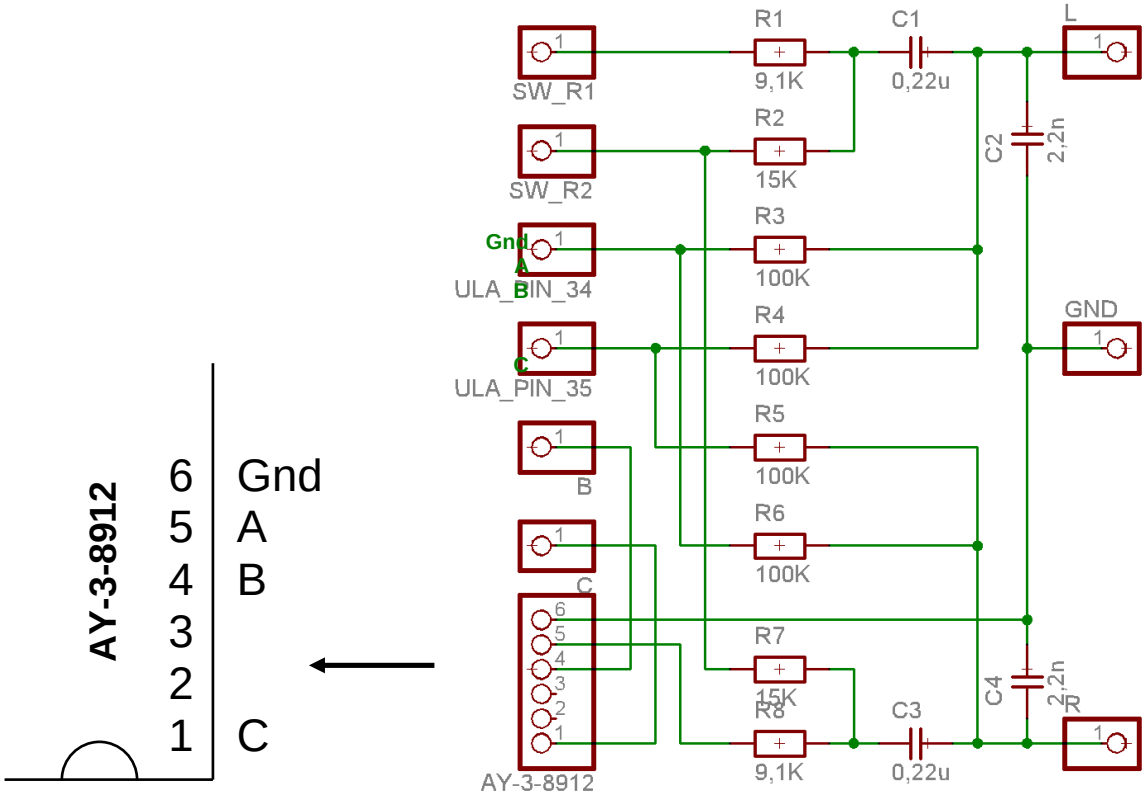
This BASIC code plays a note on channel A first, then B, then C.
Use it to test if all channels are mapped to the correct output (left, right or center).

```
10 PLAY "A"
20 PLAY "", "A"
30 PLAY "", "", "A"
40 GOTO 10
```

Don’t forget to do some beeping too!

Board layout and schematic





Wire lengths:

- from pcb to ULA: about 15 cm
- from pcb to audio output connector: about 25 cm
- from pcb to DPDT switch: about 25 cm

Package contents:

- Stereo audio board, assembled with soldered audio output cable and socket
- DPDT switch with cable and 4-pin header
- 2x jumpers
- 1x6 pin header

Manual by: Ben Versteeg
Document version: v1.3 / nov 2011

Visit **www.benophetinternet.nl/hobby** for more ZX Spectrum projects!