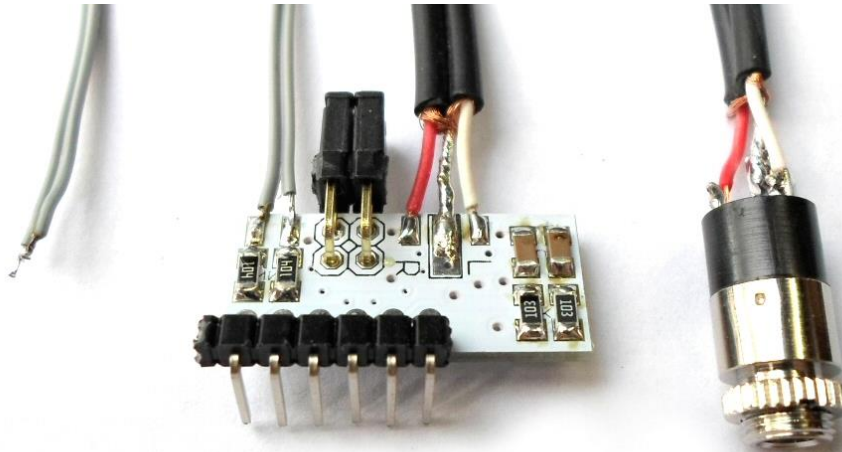




# Stereo audio enhancement for the ZX Spectrum 128K / +2 / +2A / +2B / +3



## 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
4. And finally you will hear all sound at equal volume levels!

The stereo enhancement is compatible with all 128K ZX Spectrum models:

128K+ (toastrack model), +2 (grey), +2A, +2B, +3 and clones with AY-3-8912 sound chip.

## Assembling complexity

You will need some soldering skills to assemble the kit.

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

**Assembling the board is at your own risk!**

The sold kits are pre-assembled carefully, but there may always be a bad solder connection or short-circuit; please check the board yourself again before assembling!

## ABC / ACB channel mixing

Channel mixing means how the three AY-3-8912 output channels (A, B and C) are mixed to the two stereo output channels (left and right). This means that if you want to hear a song as it was arranged, you should select the correct channel mixing.

There are two common mixing standards:

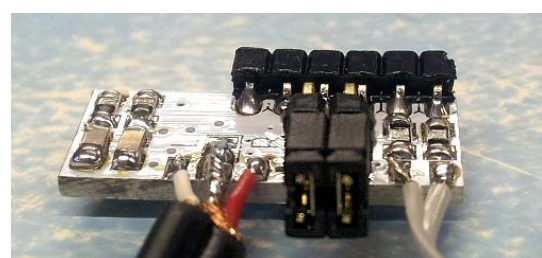
ABC: A is mixed to right, B to left and right, and C to left (common in west-Europe).

ACB: A is mixed to right, C to left and right, and B to left (common in east-Europe).

There are two jumpers to select ABC or ACB mixing:



ABC channel mixing (west-Europe)



ACB channel mixing (east-Europe)

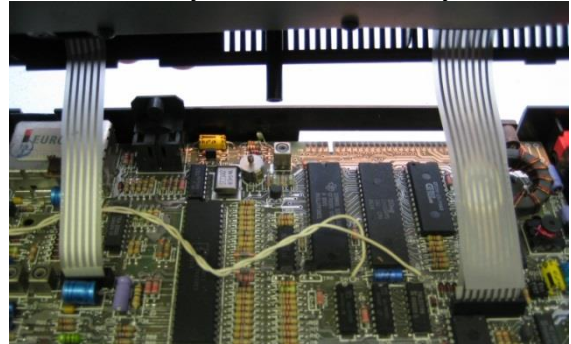
# Assembling instructions

The photos in these instructions are from various ZX Spectrum models.

1. Open your ZX Spectrum:



2. Carefully disconnect the keyboard:

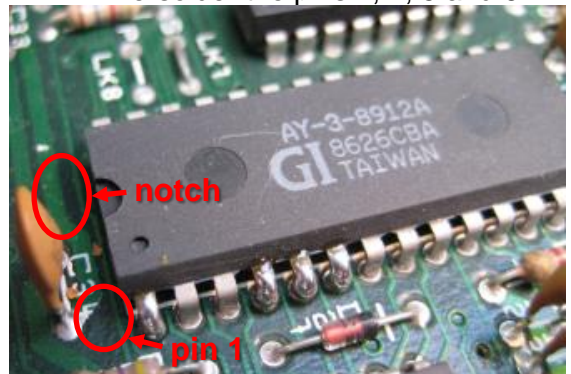


+2/+2A/+2B: disconnect taperecorder cable

3. Locate the AY chip:



4. Pre-solder the pins 1, 4, 5 and 6:



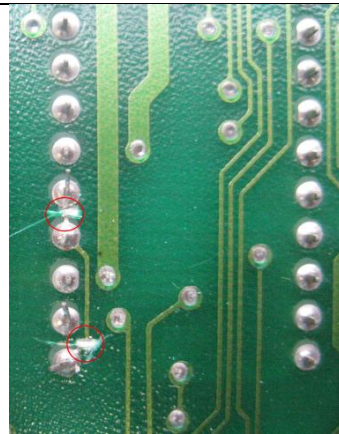
Pin 1 is first pin anti-clockwise from notch

5. +2A / +2B / +3 only:

Amstrad decided to shortcircuit the AY-3-8912 output channels on +2A, +2B and +3 for mono output.

We want to have the channels separated.

So, cut the copper lines at the bottom of the +2A / +2B / +3 board (at the AY-3-8912 location), at the locations shown on the picture on the right.



How to determine the difference between +2A and +2B?

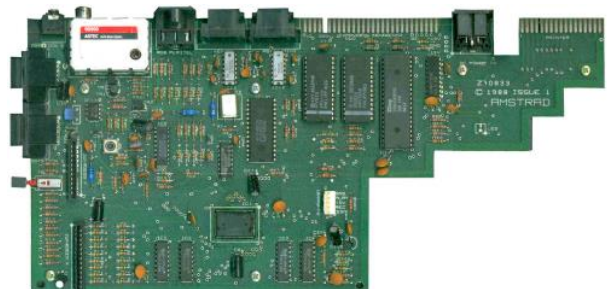
You may need this info in paragraphs 7 and 8.

Often +2B boards are assembled in a +2A case, so you need to know what board you are using.

+2A mainboard:

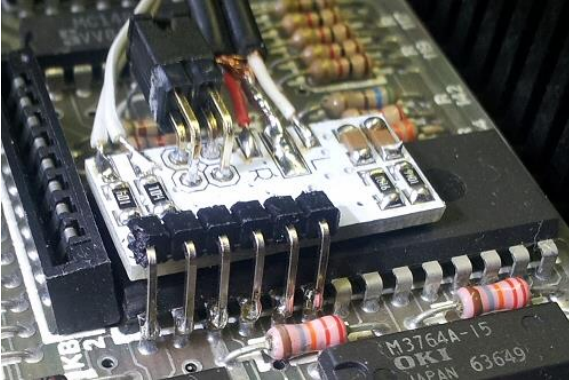


+2B mainboard:





6. Solder the board to the AY chip:



Make sure there is no short-circuit with other pins of the AY chip or the board wires

7. +2A / +2B / +3 only:

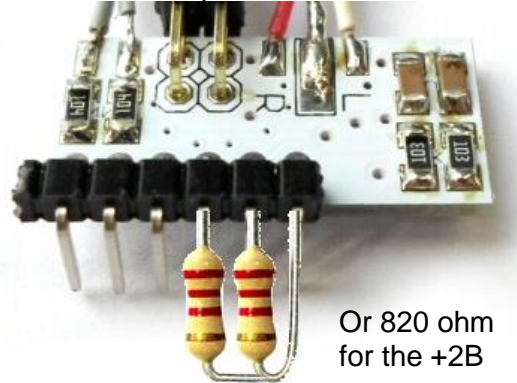
Two extra resistors are needed.

For +2B use 820 Ohm:

For +2A and +3 use 2,2K Ohm:



Solder these on the 6-pin header as shown here:



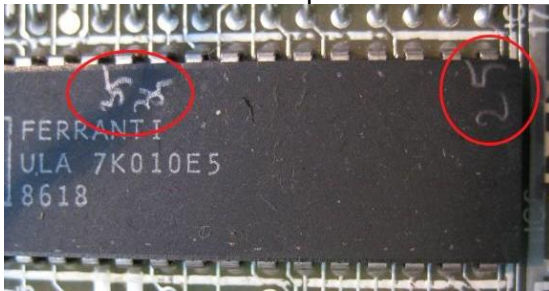
Or 820 ohm for the +2B

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

128K toaster model or grey +2

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

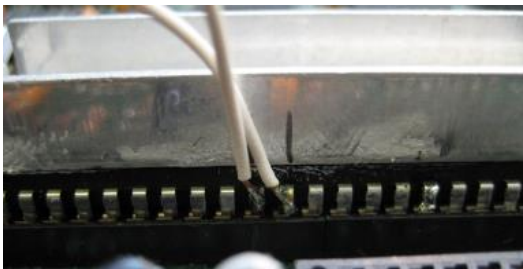
First locate / mark pin 34 and 35:



..or with the heatsink:

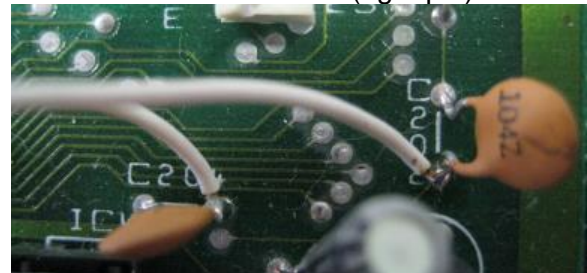


Then solder the wires:



+2B mainboard

solder one wire on C202 (lower pin) and one on C204 (right pin):

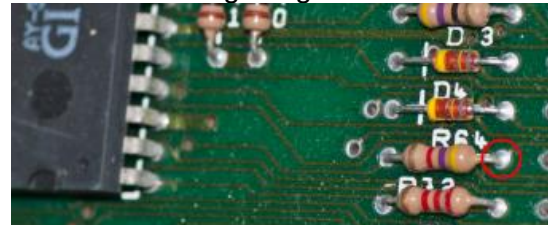


+2A / +3 mainboard

left leg of R63:



and right leg of R64:



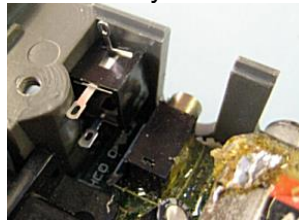
9. Fitting the stereo audio socket:
  - a. Find a good location
  - b. Drill a 5 mm hole
  - c. Insert the socket
  - d. Fit the ring

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

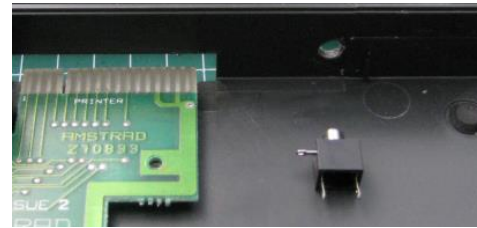
Toastrack:



Grey +2:



+2A / +2B:



### 10. Finally:

- a. Connect all cables of your ZX Spectrum
- b. Test the output (see test routine)
- c. Close your ZX Spectrum

## Testing

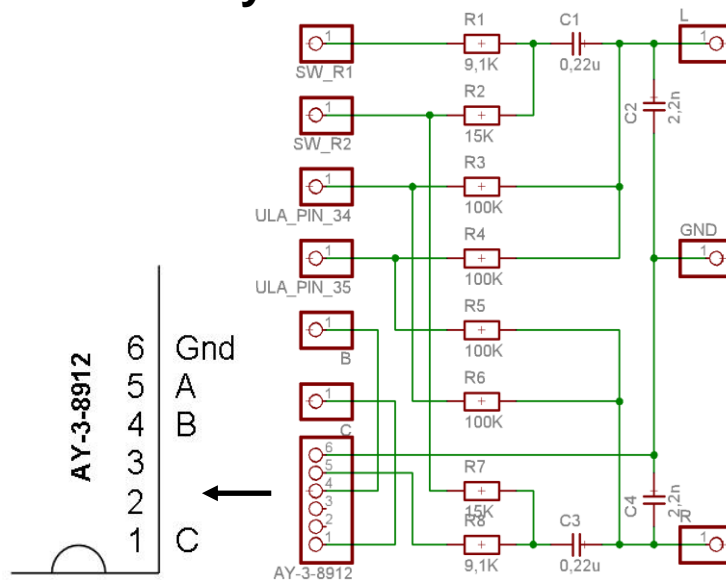
This BASIC code plays a note on channel A first, then B, then C, and performs a BEEP.

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 BEEP 1, 10
50 GOTO 10
  
```

## Board layout and schematic



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