Sep 28, 2017 Severity: Information Eugeny Brychkov, RU

GR8NET mono to stereo modification

Special thanks to Alex Mena.

Background: GR8NET adapters prior serial number 6C are having monaural output onto the MSX PC internal mixer; starting serial number 6C GR8NETs are having 3.5 mm jack stereo output, which having very similar internals.

Issues:

1. Is it possible to attach line-out connector to the GR8NET to get sound directly from GR8NET not involving MSX PC audio mixer?
2. Is it possible to modify monaural GR8NET circuitry to have stereo output?

Warning: Modifications explained below should be performed by trained and experienced people only, and are performed on the owner's own risk.

You **must not connect earphones or headphones**, or any other low impedance equipment to the output of the circuits explained below; output must be connected to high-impedance equipment like audio amplifier.

When connecting amplifier to GR8NET, you must ensure that there's common signal ground between the MSX PC and amplifier – either by having another prior ground connection using signal wires (e.g. another Music Module connected), or through the power distribution grounding system. Please note that most MSX PCs are having 2-wire plugs, and do not feature power distribution grounding, while amplifier's grounding scheme may be different.

These differences may cause significant potential differences between grounds of devices being connected, and cause damage to these devices. *It is strongly recommended to disconnect MSX PC from the mains when connecting GR8NET to other, not yet connected devices.*

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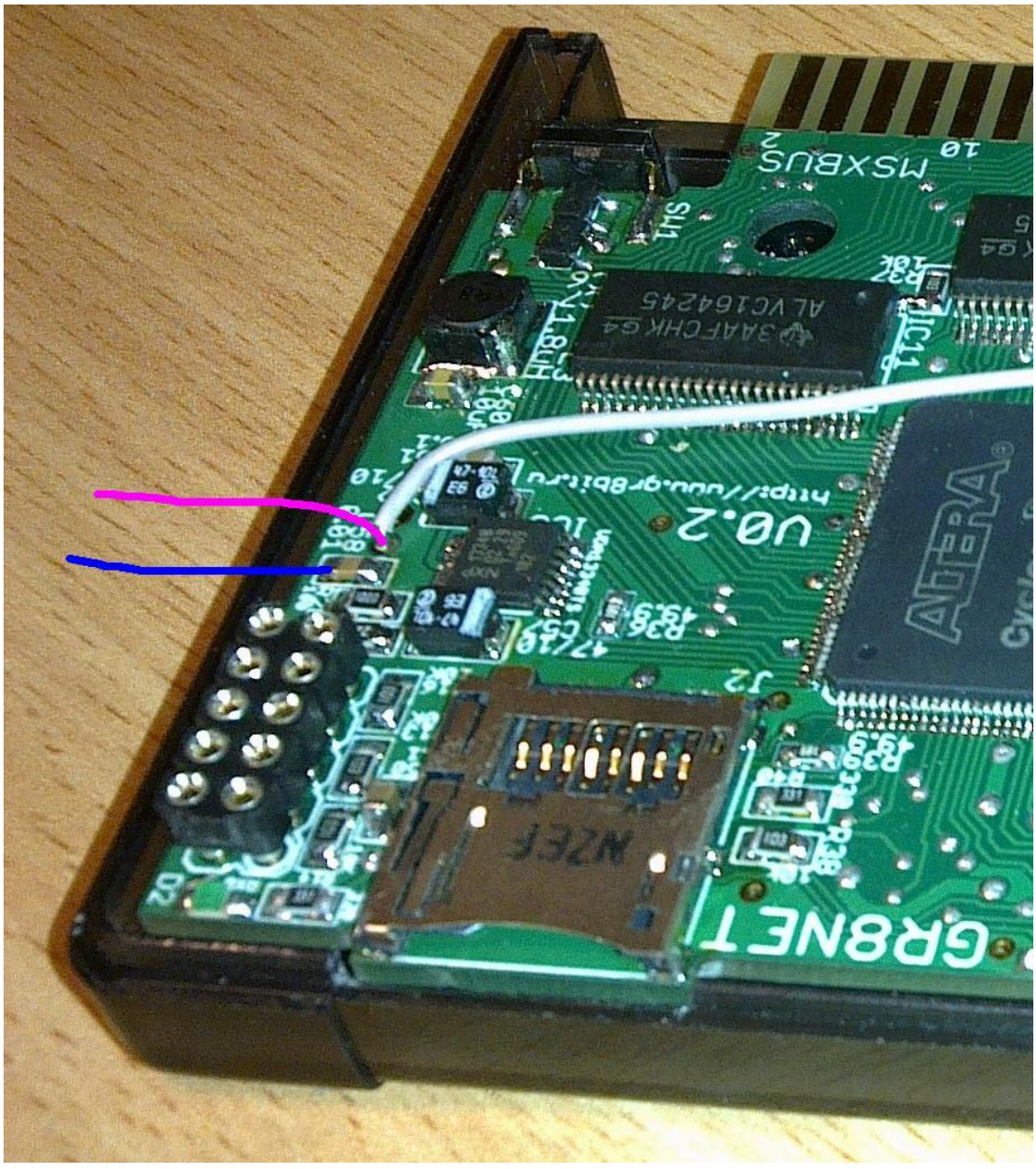
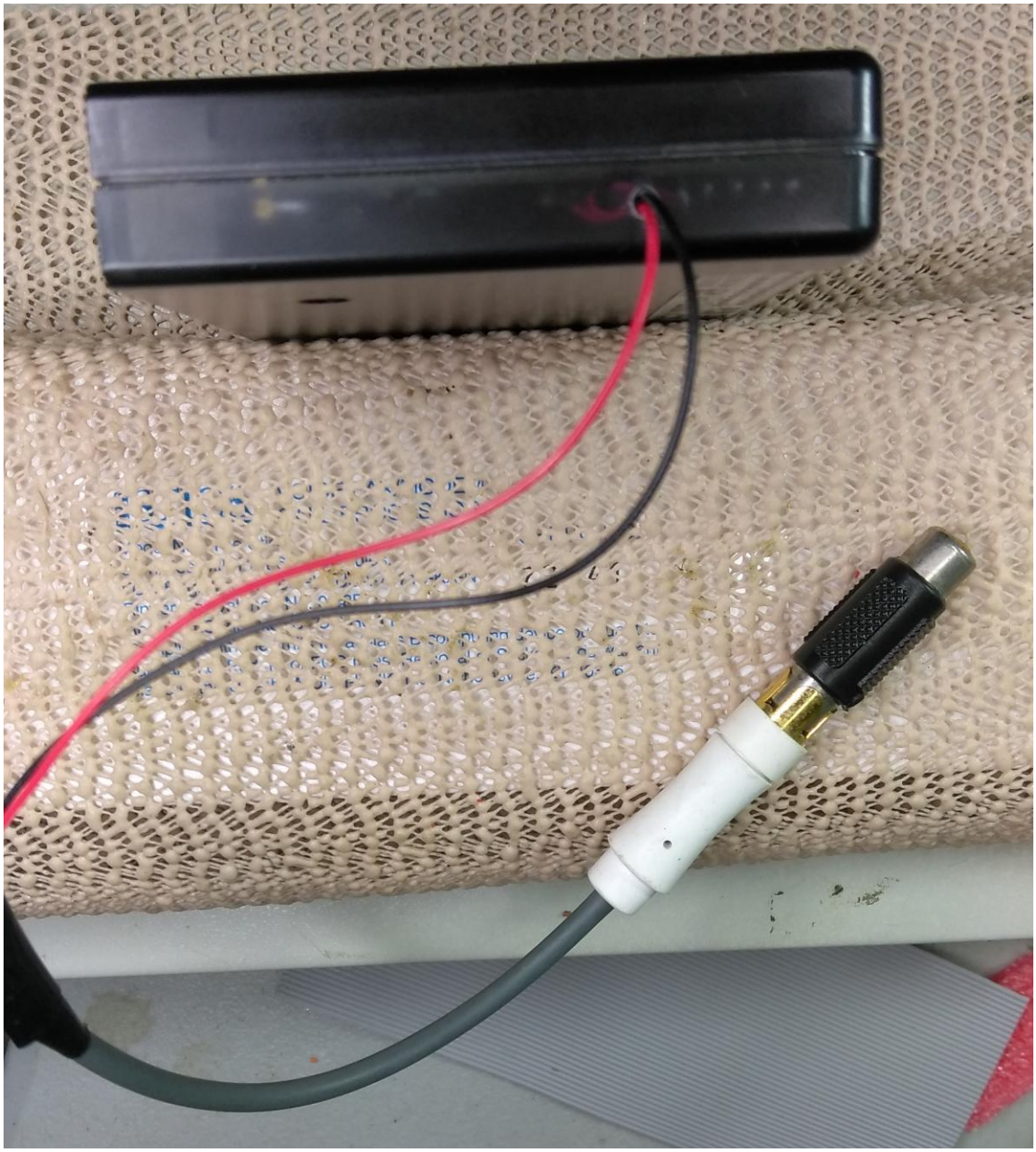
Modification 1: adding external monaural line-out connector.
Difficulty level: easy-moderate.

This modification involves soldering two wires to the already existing circuitry of the GR8NET, with audio connector at its end. Picture below shows the locations of solder points: pink wire is signal wire, to be soldered to the pad GR8NET air-wire is soldered into (the best is to solder at another side of the board), and blue wire is ground wire. Please do not confuse these wires – at another end pins wire does not the tip of the connector, and blue goes to sleeve. If confused, signal wire will be shorted to ground which potentially can lead to GR8NET DAC chip overcurrent.

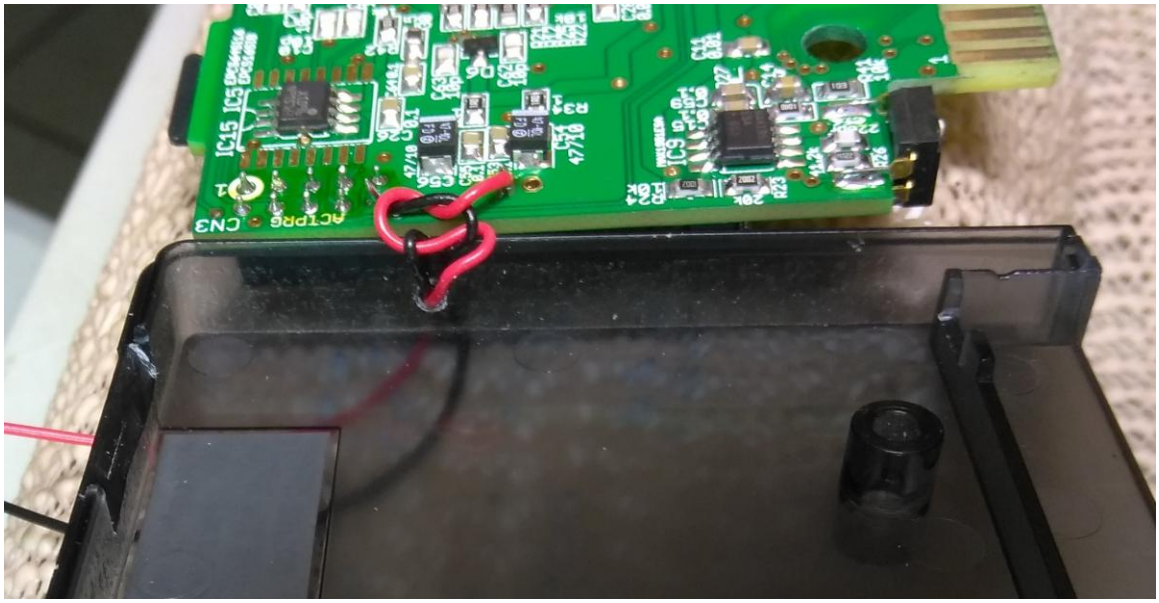


You can use 3.5 mm stereo connector at another end of the wires, and in this case just connect pink wire to both left (tip) and right (ring) terminals of the connector for hearing audio signal in both channels.

The images below are provided by Alex Mena having performed this modification to his GR8NET adapter.



Alex has drilled a hole in the cartridge casing from its right side near wire solder point.



Note that Alex decided to solder ground wire to another pad – to the FPGA programming connector pin 10, which is also at the ground potential.

GR8NET
V0.3
MSXBUS

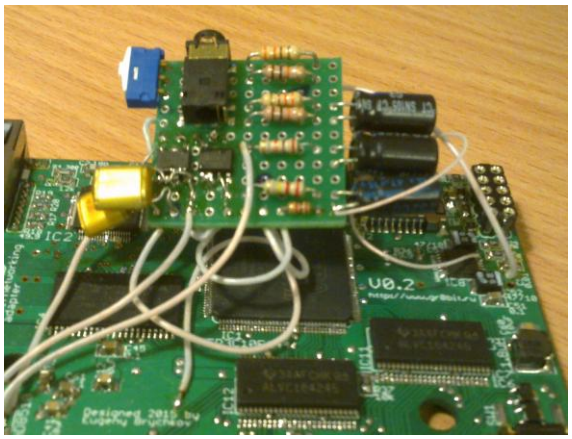
Modification 2: adding second channel and stereo jack.
Difficulty level: hard-very hard.

Hardness of the task is related to two issues:

- You will have to connect to the pin 14 of the DAC, which has 0.65 mm pin pitch. You will not be able to do it with regular wire; you will require very thin single-core wire or well twisted and tinned multi-core wire; you will require very good soldering equipment, magnifier and certain level of soldering proficiency and firm hands;
- Whole modification, will require small board to mount additional components to, and it is a good question where to place these components within GR8NET cartridge space, or how to connect them externally.

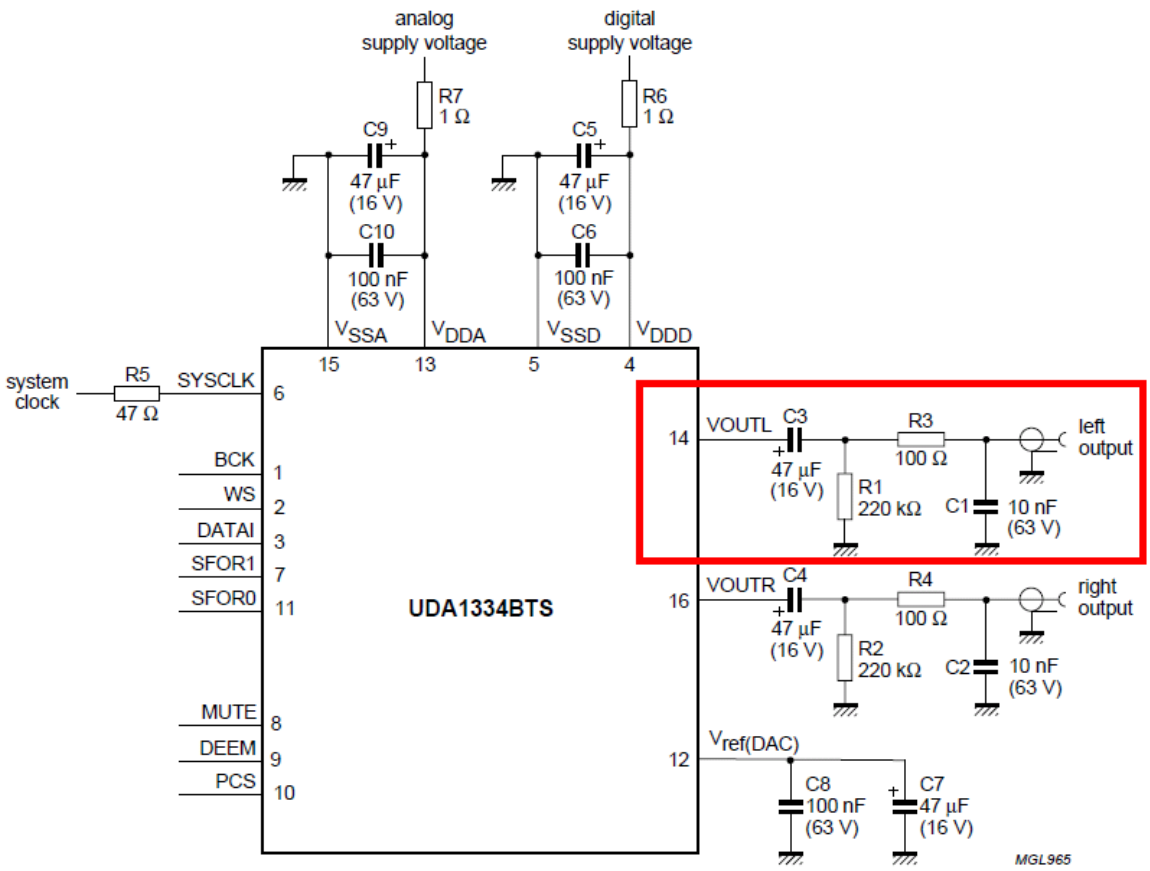
At the picture above you can see such a wire soldered; this wire is a copper multicore with core size of 0.05 mm^2 (diameter ~0.25 mm), with cores being well twisted and carefully tinned before mounting, mounted in vertical position, almost parallel to the pin's vertical wire to increase the surface of contact between wire and then pin (so that it would not easily tear off the pin).

It is extremely important to ensure there is, and will be no shortage between this pin 14 and 13 (analog supply voltage) or 15 (ground).



Here's the link to the DAC chip datasheet, UDA1334BTS. The additional circuit you must connect to soldered wire is in the red rectangle on the picture on next page.

There's electrolytic capacitor, two resistors and one ceramic capacitor involved; you can see my test board on the picture to the left. It involves 4 channels, two op-amp chips and connector, but you will need components only for one channel.



The additional board will have 47µF 16V electrolytic capacitor on it, with its positive pins connected to the thin wire soldered to the pin 14 of the DAC. You must ensure that there could be no physical tension leading to tearing off or constant bending (up to the point of copper cracking). Then there're two resistors, 220 kΩ and 100 Ω, you take ground from the capacitor or FPGA update connector (see modification 1). And finally there's 10 nF (0.01 µF) connected to the ground, and then output wire. Thus your board will be connected with four wires – input from pin 14, ground input, and two wires to the audio connector. Please do not confuse ground and audio output when connecting to audio connector.

And in overall there will be 4 (or 3) wires out of the GR8NET casing – two (or one) for ground, and two for left (additional board) and right (see modification 1) audio channels. Connect them to the respective terminals on the audio 3.5 mm jack: ground to the sleeve, "right" wire to the ring, and "left" wire to the tip.

Sources and information for further reading

- NXP Semiconductors (2000) *UDA1334BTS Low power audio DAC*, available online at https://www.nxp.com/docs/en/data-sheet/UDA1334BTS.pdf (accessed on 28-Sep-2017)