The video-signals on 128K ZX Spectrum models

This document describes some fairly easy video-enhancements that should result in perfectly clear and crisp pictures from your ZX Spectrum!

(Document version: v0.1, november 2009)

Contents

1. Creating composite video-out on a +2A / +2B / +3

These ZX Spectrum models are missing a composite video-out signal that was available on the 128K heatsink model and the grey +2.
That signal was on pin 1 of the video-connector on the back.

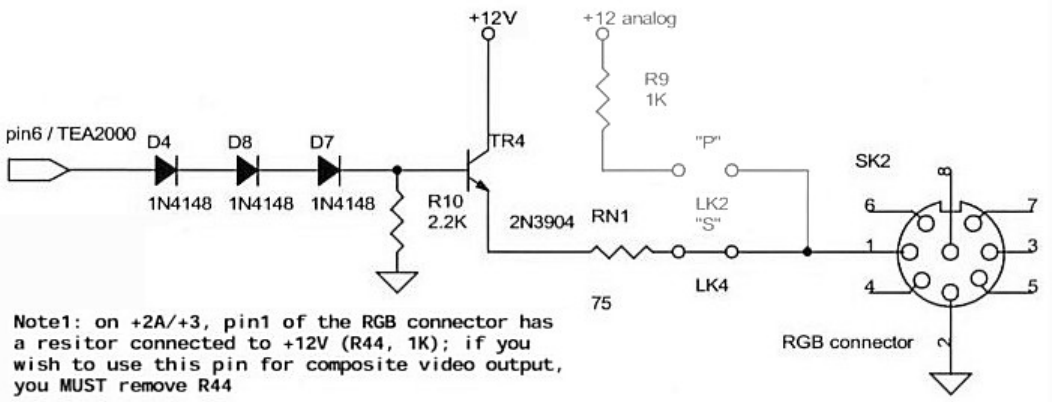
*Instead of the composite video signal there **they have a dangerous 12V on pin 1**!*
So if you use a cable that works on a 128K heatsink model or grey +2, you could seriously damage your TV, monitor or lcd display!

There are two solutions to create a nice video-out on these models.
One uses a TEA2014, a video selector that also boosts and creates the correct signal, or simply using a transistor and some discrete components.

1a. Using a 2N3904 and some resistors

I really prefer this solution because these components are simple to get, very cheap and it's not much work.

Here's the schematic:



The grey part is unimportent.
The +12V needed to feed the 2N3904's collector, is on pin (todo).
Do not forget to detach the 12V: you can do this by removing resistor (todo – is different for +2A / +2B / +3).

As described in the paragraph about the misplaced design with the 2N3904, it's very important that you ***use the correct datasheet of the 2N3904****!*

Here are three *correct* pin descriptions of the 2N3904:

1

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

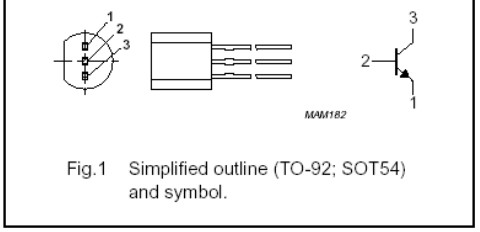
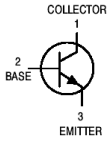
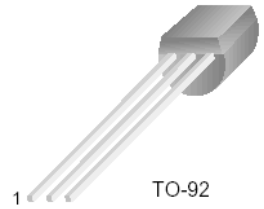


Fig.1 Simplified outline (TO-92; SOT54) and symbol.

2



3

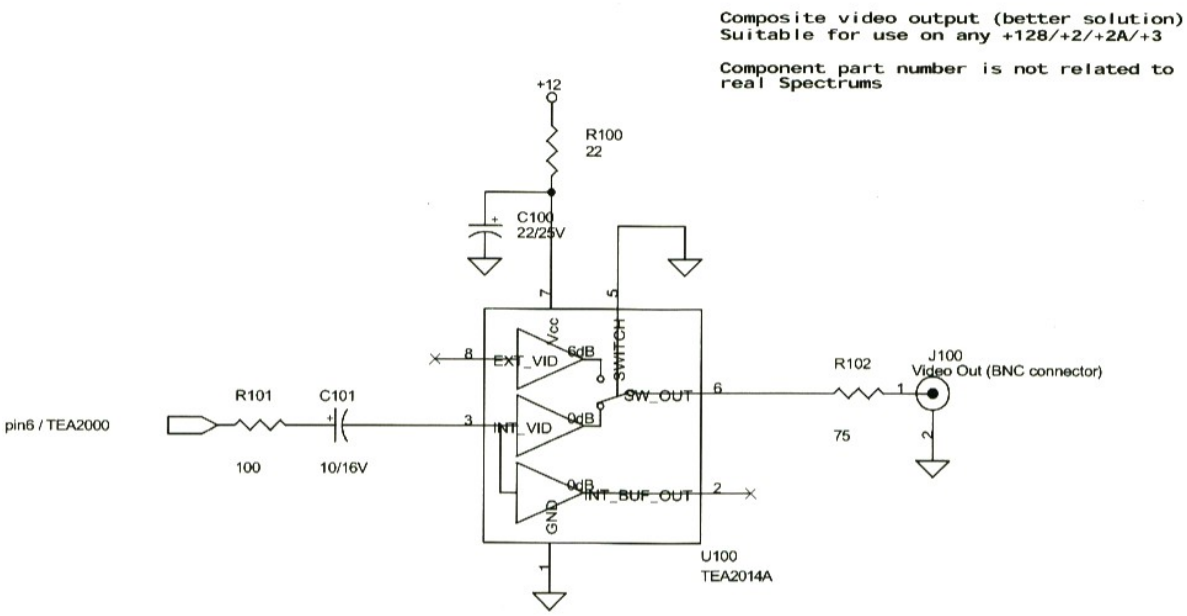


1. Collector 2. Base 3. Emitter

1b. Using a TEA2014

The TEA2014 could create a slightly better picture than the solution with the transistor, but in practice there is no difference noticeble.

But, if you want to try, here's the schematic:



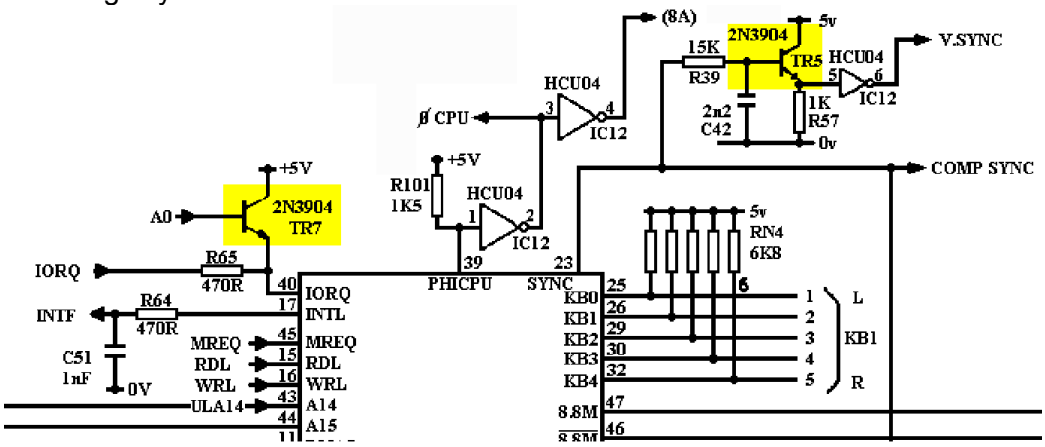
2. Design fault on +2

There is a major design-fault on the Spectrum +2 (grey model): all 2N3904 transistors (3 pieces) are mounted incorrectly.
(todo: could also be wrong for +2A / +2B / +3)

It's not clear why this mistake is made, maybe earlier designs used another transistor that have another pin-order than the 2N3904, and the 2N3904 was chosen later in the process.

Or maybe they used a wrong datasheet: I found some wrong datasheets of the 2N3904 on the web.

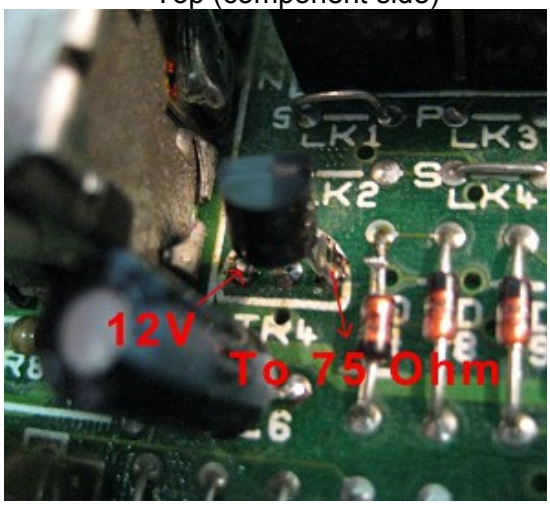
Anyway, whatever the reason is, it causes a bad (not to say unusable) videosignal and it's a wonder the ULA works as it should: not only this transistor is used to create the correct composite video signal, but the other 2N3904's in the grey ZX Spectrum +2 are also mounted wrongfully:



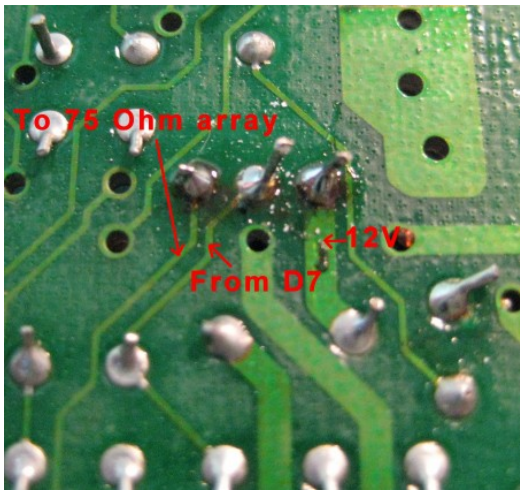
But anything that works, should be left intact, so never mind the other transistors.
I will only focus on the one that creates the composite video signal.

In this picture I already twisted the 2N3904 around, as it should have been mounted (the red text explain what signal on the board the pointed pin is on):

Top (component side)



Bottom



The picture of the bottom makes it clear: on the bottom side the right pin is the 12V, so on the top side that is the left pin.
But in the original design the left pin is the emitter of the 2N3904, and that is definately wrong.

3. Detaching audio from the video signal on ZX Spectrum 128 / +2 / +2A / +2B / +3

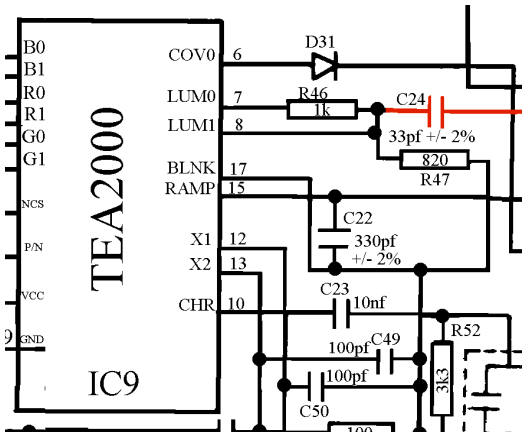
(Todo: have to translate the Dutch text)
(Todo: have to add schematics and description for the other models)

Source: http://user.tninet.se/~vjz762w/

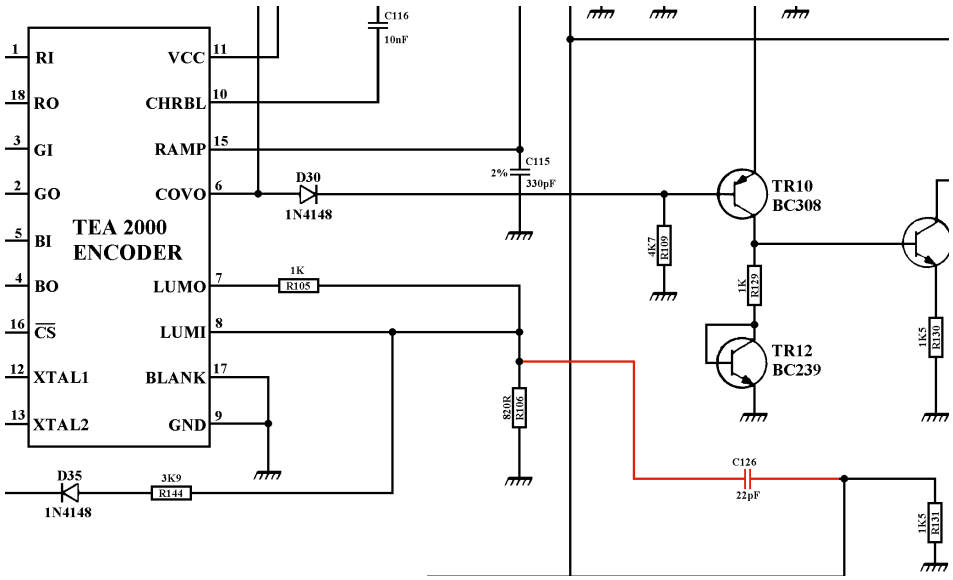
The audio from every 128K ZX Spectrum model is mixed together with videosignal, but this causes distorsion on the picture and it causes many monitors not to detect the color signal.

To fix this you need to remove the audio signal from the video signal by disconnecting it. The easiest way is to remove a capacitor (or disconnecting it by lifting one leg up).

+2A: C24



+2 heatsink: C126



Getting the audio back on the antenna signal
I have not tested these advices from the source above!

“The disadventage of this is that there will be no sound on the antenna plug.
If you still want this, you should desolder the pin of the capacitor that goes to the TAE2000 (pin 8) and solder that pin of the capacitor to the emitter of the transistor that is directly before the modulator. You will note that the picture is much better but sound on air plug is present.”

“If you should use the composite signal there is a further important improovement: you should solder a series of a inductance (32µH or 16 µH) and a capacitor (51pF or 100pF) from pin8 of TEA2000 (that former pin of the sound capacitor) to ground.
That series resonance circuit shorts signal components of the video signal that would interfer with the color carrier.
You will note that after soldering that resonance circuit undesired color effects at vertical lines (especially at letters) will disappear.”

Attachments:

128K schematic and board layout
(todo)

+2 (grey model) schematic and board layout
(todo)

+2A schematic and board layout
(todo)

+2B schematic and board layout
(todo)

+3 schematic and board layout
(todo)