

Project Documentation

Commodore VIC-20 A/V-Adapter

Project number: 185

Revision: 2

Date: 10.11.2022



-Commodore VIC-20 A/V-Adapter Rev. 2

Module Description

Introduction

The VIC-20 A/V-Adapter serves as a breakout module for the 5-pin A/V jack, which allows using off the shelf cables of desired length and quality for connecting the VIC-20 to video/audio equipment.

The adapter is passive, it does not improve the video quality, but it helps to prevent video degradation. The S-Video jack works with VIC-20s, that are modified only. (S-Video mod like here: http://sleepingelephant.com/denial/wiki/index.php?title=S-Video_output or here: http://tech.guitarsite.de/vicky20_smod.html). The adapter **does not generate S-Video!**

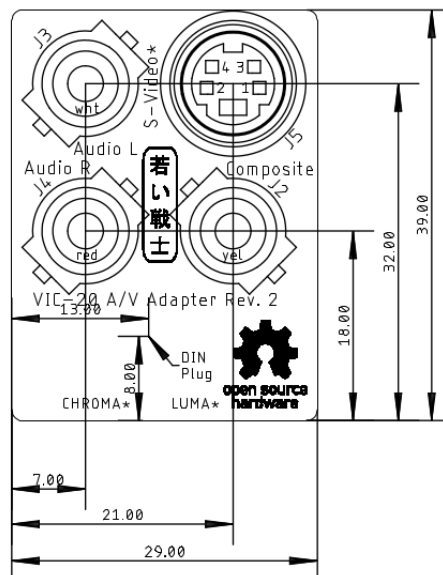


Figure 1: Dimensions of the PCB

The two audio jacks (Audio L and Audio R) are connected to the same signal, the (mono) Audio Out of the VIC-20.

A 3D printable case can be found in the project folder as well as a label for this case. The case for Rev. 0 and Rev. 1 is different from the case for Rev. 2.



Figure 2: 3D printed case and assembled PCB

Connectors

A/V-Plug – J1

The A/V-Plug for the VIC-20 is the inner part of a Lumberg SV 50 DIN-Plug (180°).

Pin	Signal
1	n.c.
2	GND
3	Audio Out (mono)
4	Composite Video/LUMA*
5	CHROMA*

* After S-Video mod.

RCA-Jacks – J2, J3, J4

Connector	Signal
J2	Composite Video
J3	Audio Out L (mono!)
J4	Audio Out R (mono!)

The DIN-Plug

The DIN-Plug is an **essential part** of this development. It is the inner part of a Lumberg SV 50 connector, which is not cheap, but it is definitely worth the money, since the flange is taking the forces introduced by the weight of the adapter and the cables. This way, the set-up is not hanging from the contacts, which might even damage those. Do not use a cheap connector without a flange, here.

Assembly

First, the DIN connector has to be soldered. The pins should be aligned flush to the top side of the PCB. This can be accomplished by putting the PCB top down on a heat resistant, flat surface. Then solder one pin from the top (the solder pads are shaped in a way, that allows doing so), check, if it is really flush and the connector is perpendicular to the board, then solder the remaining pins.

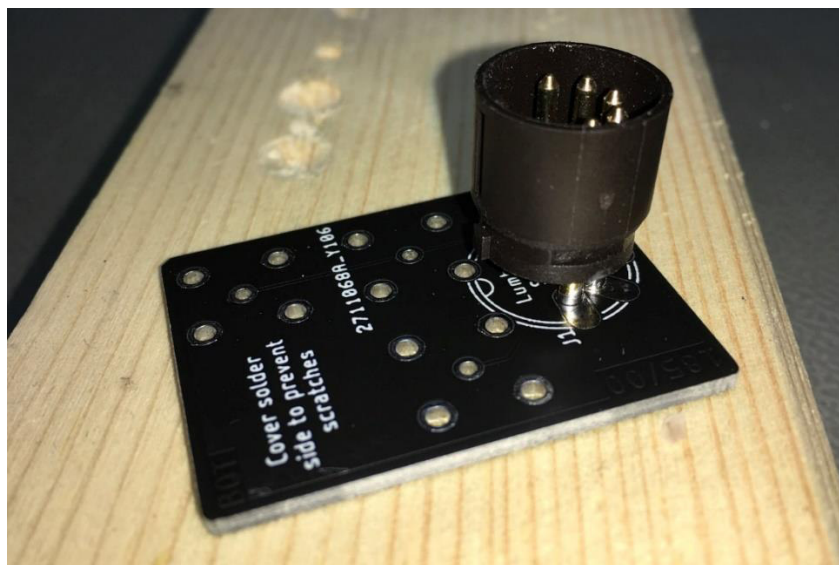


Figure 3: Aligning the DIN-Connector (PCB Rev. 0)

Now, place and solder the mini-DIN and finally the RCA jacks. They should be well aligned, too. The ground pins might require more energy to be soldered, so the use of a thick solder tip is recommended and may be even a higher temperature (450°C). After soldering, the pins should be trimmed (shorter than 1.5mm), so they fit into the 3D-Printed case. If you do not use a case, cover the pins with something like duct tape or small drops of hot glue to prevent scratching the case of your VIC-20.

Compatibility

The adapter also fits the C64 (in case S-Video is not required), especially the first C64 model with the 5-pin A/V-jack (this does not have the S-Video outputs). The same is for the C16. The VIC-20 A/V-Adapter does not work for the C128, since it blocks the serial bus. The adapter was also successfully tested with an Atari 800XL (composite).

Annotation

The said S-Video mod exposes the CHROMA pin of the VIC chip almost directly to the connector. This might get critical, if the VIC-20 or any of the video devices is switched on/connected to a PSU. I would definitely recommend a careful way of connecting the cables and devices.

Revision History

Rev. 0

- Fully functional prototype

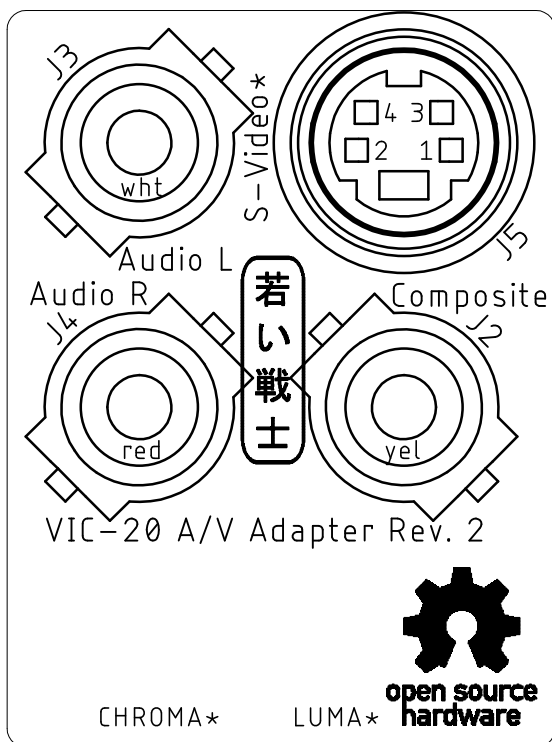
Rev. 0 → Rev. 1

- S-Video jack for modified VIC-20 added.

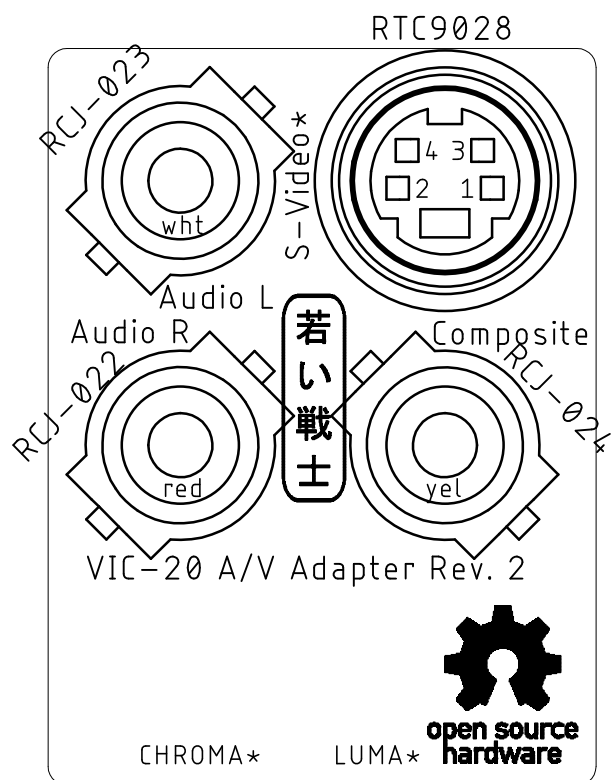
Rev. 1 → Rev. 2

- Replaced the obsolescent Lumberg BTOR1 RCA-jacks with CUI Inc. RCJ-02x type. There are alternative Keystone parts, that fit the same footprint (see BOM v2).
- A new 3D-printed case is required (bottom shell)

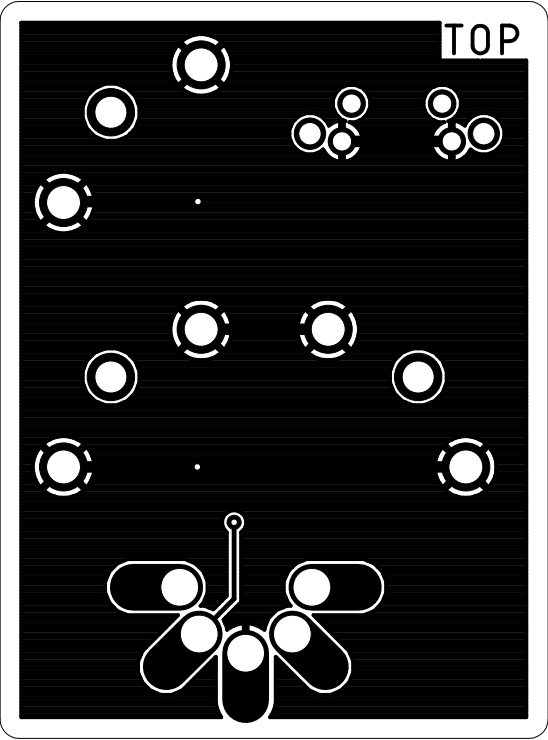
Sven Petersen 2022	Doc.-No.: 185-2-01-02	
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VIC-20_AV-Adaptor		
28.08.2022 18:31		Rev.: 2
placement component side		



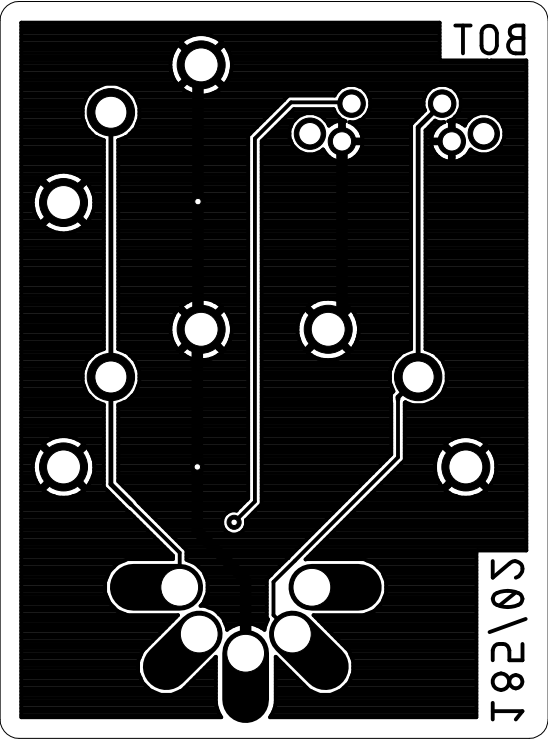
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placement component side		



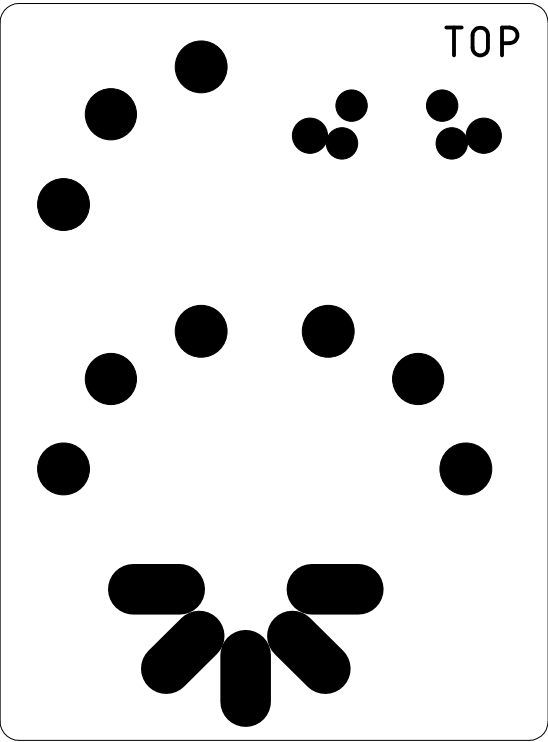
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VIC-20_AV-Adaptor		
28.08.2022 18:31		Rev.: 2
top		



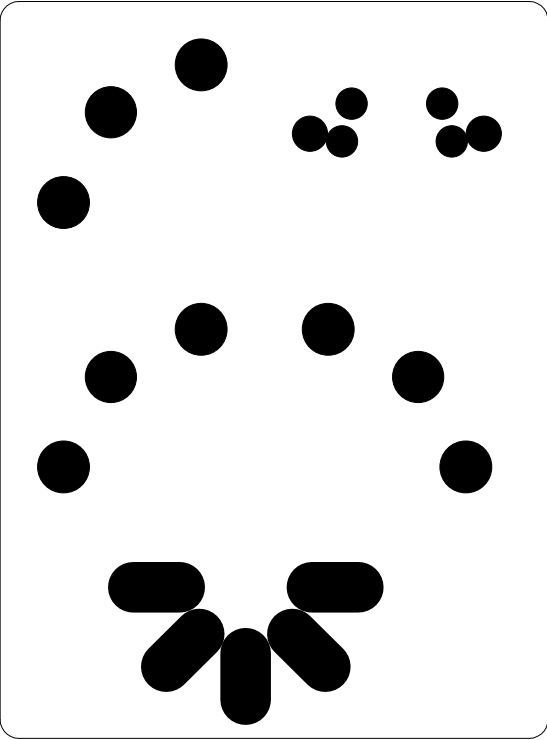
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VIC-20_AV-Adaptor		
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bottom		



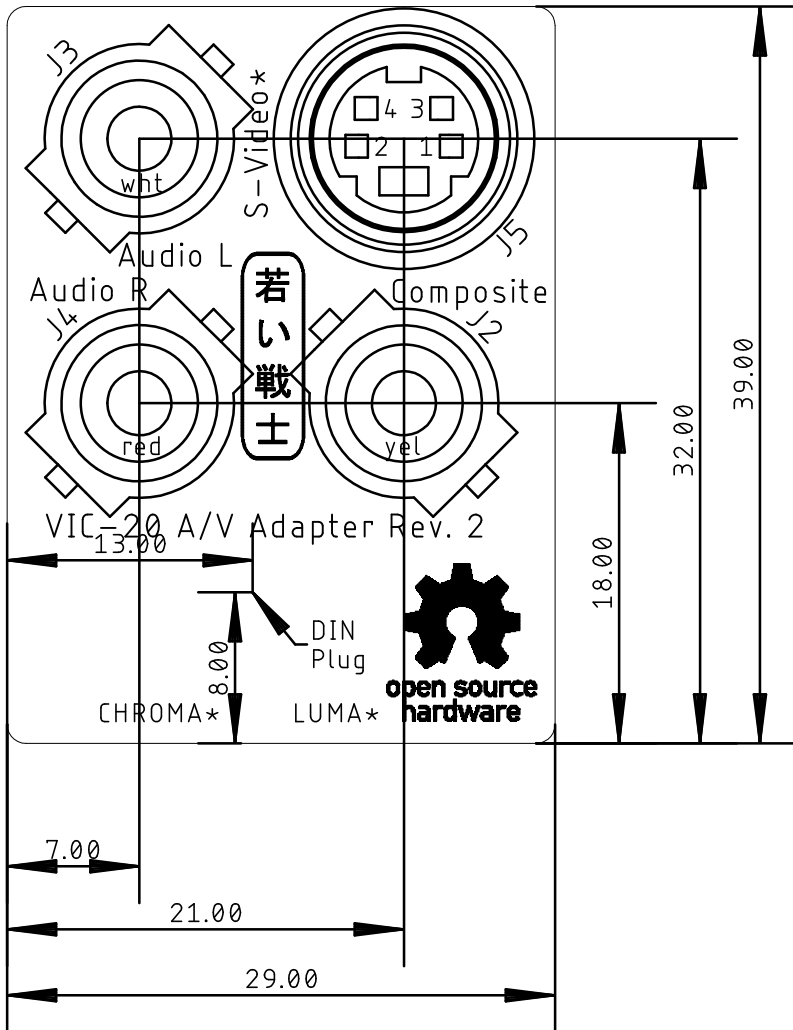
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VIC-20_AV-Adaptor		
28.08.2022 18:31		Rev.: 2
stopmask component side		



Sven Petersen 2022	Doc.-No.: 185-2-01-02	
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VIC-20_AV-Adaptor		
28.08.2022 18:31		Rev.: 2
stopmask solder side		



Sven Petersen 2022	Doc.-No.: 185-2-01-02	
	Cu: 35µm	Cu-Layers: 2
VIC-20_AV-Adaptor		
28.08.2022 18:31		Rev.: 2
placement component side		measures



Commodore VIC-20 A/V-Adapter Rev. 2

Test

Test Setup

The tests were executed with a VIC-20 A/V-Adapter Rev. 1 and Rev. 2. These computers were used for testing:

1. A VickyTwenty (clone of the VIC-20CR) in a plexilaser.de case
2. A two-prong VIC-20 (ASSY No. 324003)
3. A VIC-20CR (ASSY No. ASSY250403)
4. C64 ASSY No. 250469

The VickyTwenty has the S-Video modification (sleepingelephant.com or tech.guitarsite.de, respectively).

The retroTINK 2x (used with the HDMI capture device), the Framemeister (used with the TV) and a Samsung smart TV served as video equipment. A 1.5m RCA A/V cable connected the computer to the video equipment.

Functional Test

The A/V adapter was connected to the computers and the video was displayed properly, the audio could be heard.

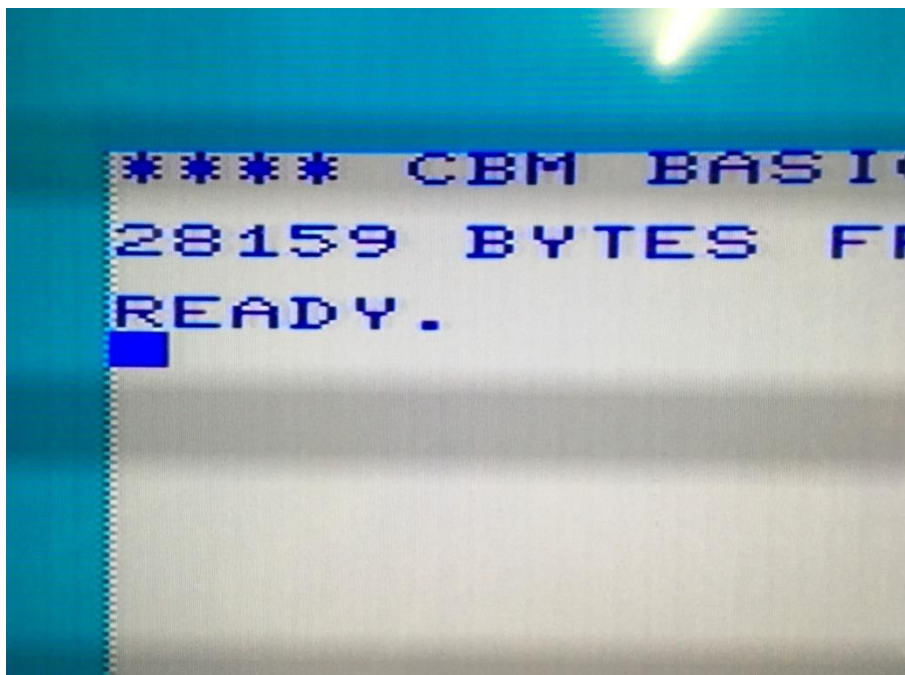


Figure 1: Boot screen of the VIC-20 CR (Hyper Expander RAM expansion installed)

The video quality was as good as it can get with the unmodified VIC-20. The video quality of ASSY No. 324003 is best, next is the Vicky Twenty.

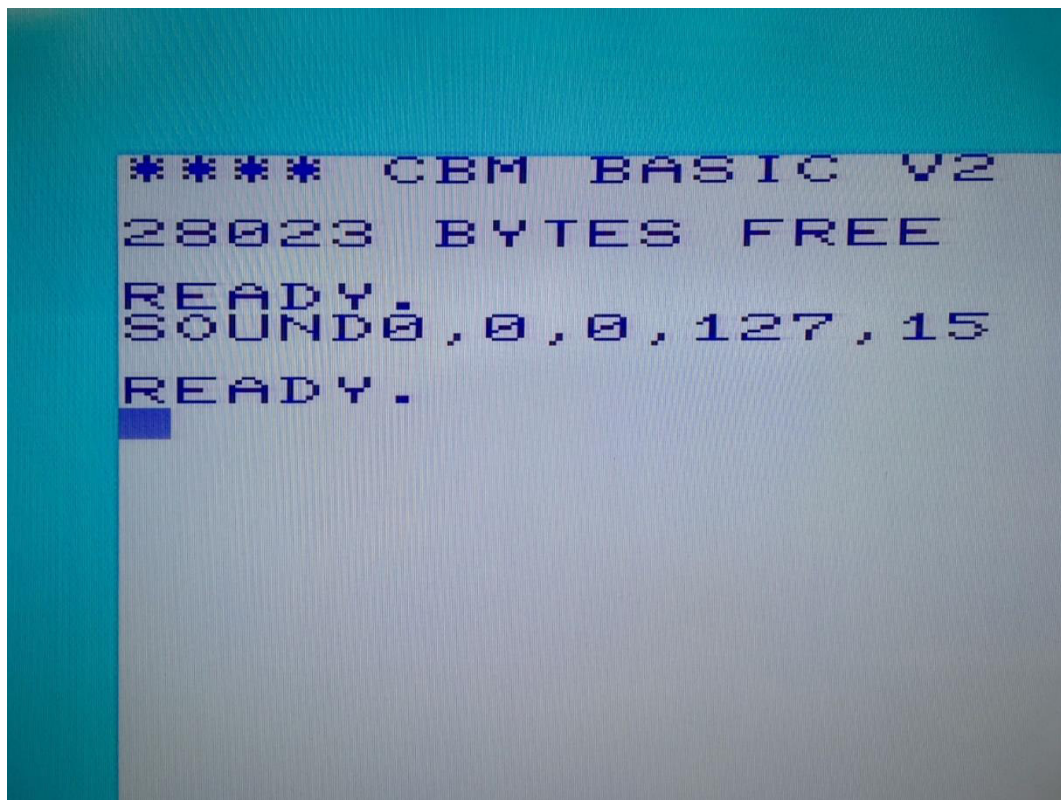


Figure 2: Photo of the BASIC start up screen of the VickyTwenty with the S-Video mod



Figure 3: Donkey Kong on the VickyTwenty/S-Video mod



Figure 4: PENULTIMATE+ Cartridge on VickyTwenty / S-Video mod



Figure 5: PENULTIMATE+ Cartridge (composite video) on a VIC-20CR

The improvement due to the S-Video mod is obvious when comparing Figure 4 and Figure 5.

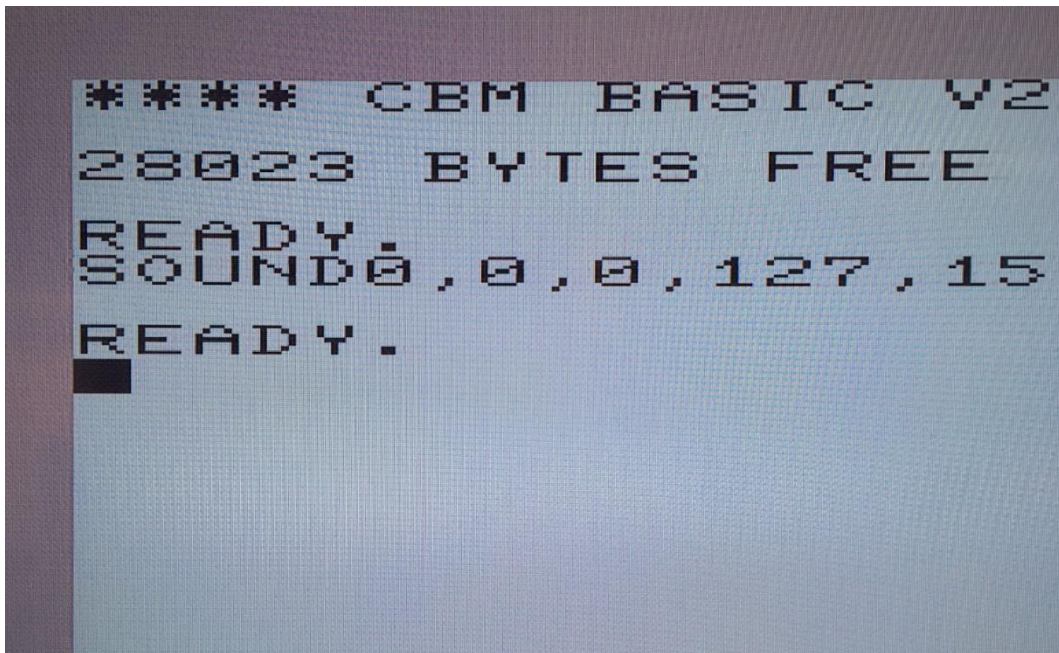


Figure 6: Composite output of the S-Video modded VickyTwenty (photo)

As expected, the composite output of the VickyTwenty with S-Video mod produces a black&white picture only, since the composite output is now luminance.

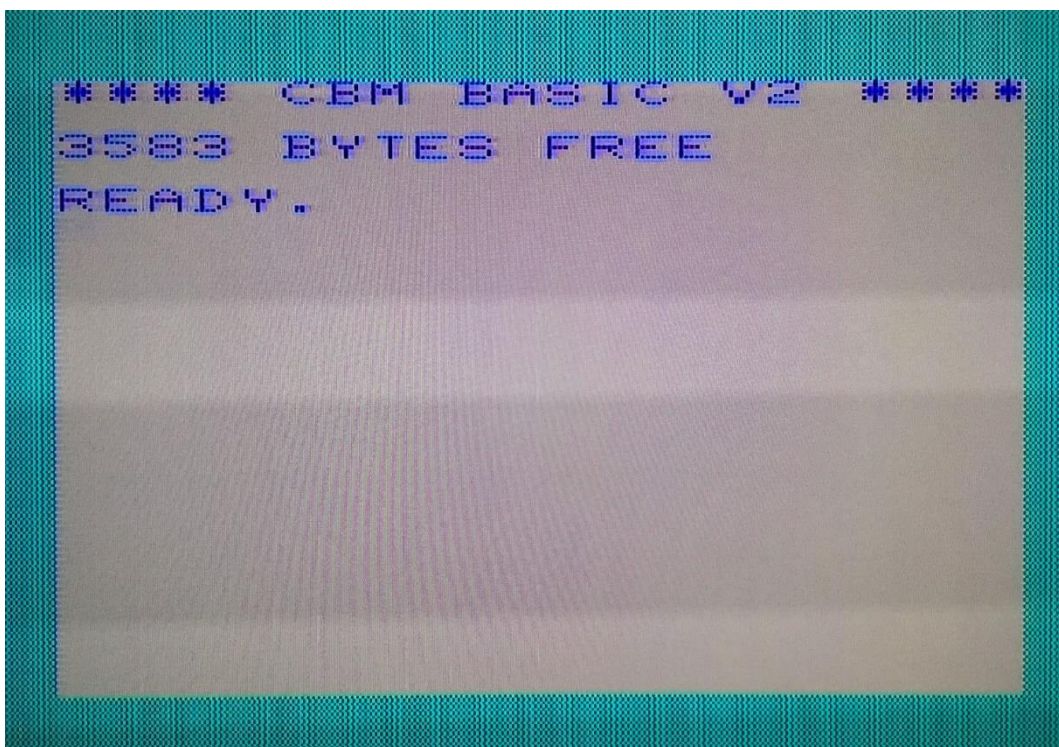


Figure 7: S-Video output of a VIC-20CR *without* the S-Video mod on a Framemeister

As expected, the video quality is low from the s-video jack on an unmodified VIC-20CR. Here, pin 4 and pin 5 of the A/V jack are both composite (instead of luma/chroma for S-Video).

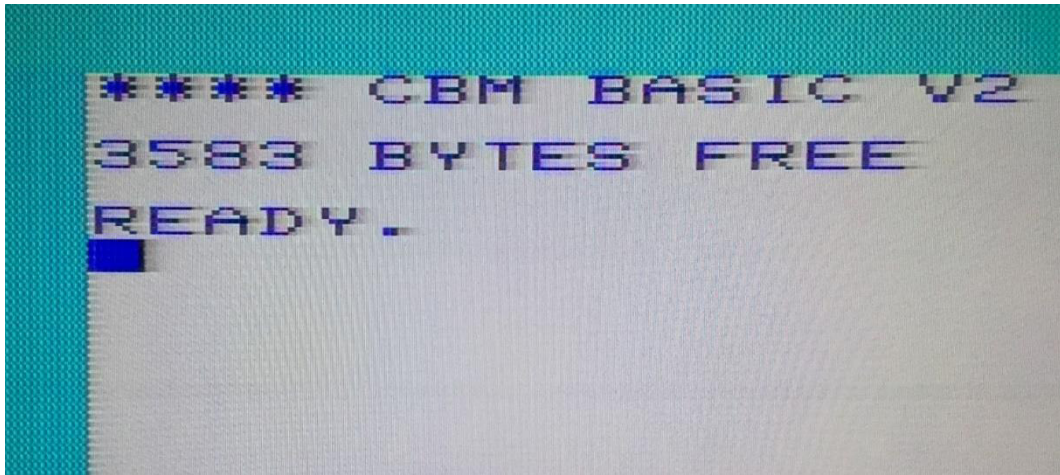


Figure 8: S-Video output of the unmodified VIC-20 (2 prong)

As expected, the output is degraded. The 2-prong VIC-20 has a different video circuitry as the VIC-20CR. Pin 4 and pin 5 are not tied together, but pin 4 is a composite signal (Pin 5) after an L/C-low pass filter. Thus, the different output "quality" of incorrectly connected VIC-20s.

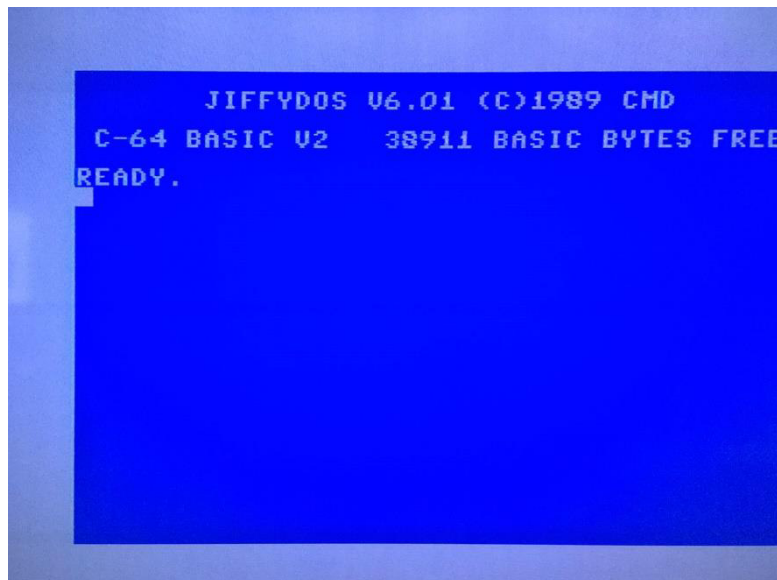


Figure 9: Photo of the C64 boot screen (composite Video)

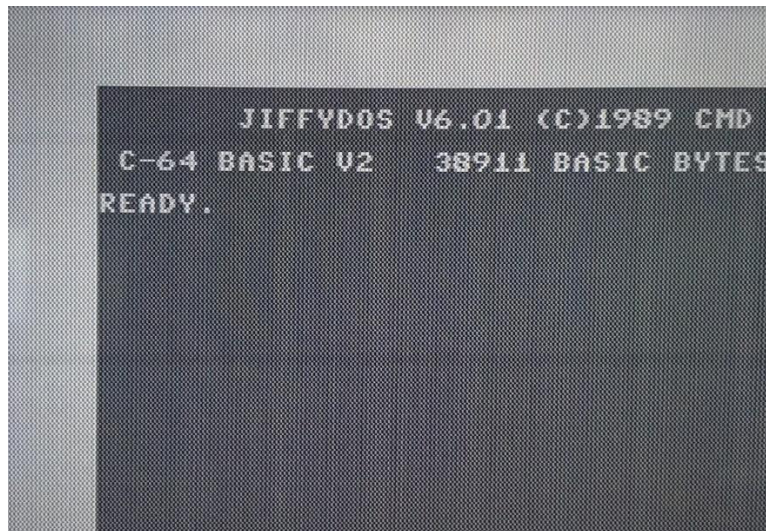


Figure 10: C64 S-Video output

As expected, the S-Video output of the C64 does not work properly. The display is black and white, since Pin 5 (which is chrominance on a modified VIC-20) is audio in on the C64. Neither the C64 nor the Framemeister were harmed during this experiment.

Mechanical Testing

The VIC-20 A/V adapter did not block any port of the said computers.



Figure 11: Testing the A/V adapter with a two-prong VIC-20

Again, the connection is stable and no ports are blocked with the ASSY No. 324003 two-prong VIC-20.



Figure 12: Fitting of the A/V-Adapter with a VIC-20CR

Conclusion

The VIC-20 A/V-Adapter works well with different equipment. The video quality depends very much on the used video equipment. The video adapter will not improve the picture of the computers, since it is passive only, but since it allows to use good, off the shelf cables, it is superior to most hand-made custom cables.

Connecting S-Video to not modified VIC-20s does not harm the video equipment or the computer, but the quality is degraded. The same applies to the C64, which has its dedicated S-Video pins, that are not connected to the S-Video jack of the VIC-20 A/V-Adapter. The composite out of the C64 is displayed properly through the VIC-20 A/V-Adapter.

The VIC-20 A/V-Adaptor Rev. 2 is fully functional.

VIC-20 A/V-Adaptor Rev. 2

Bill of Material Rev. 2.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment
1	1	185-2-01-02	2 Layer	PCB Rev. 2	2 layer, Cu 35μ, HASL, 39.0mm x 29.0mm, 1.6mm FR4
2	1	RCJ-022	RCJ-02X	J4	CUI Inc., RCA jack, vertical, red. Mouser: 490-RCJ-022, Digikikey: CP-1407-ND. Alternative part: Keystone 577
3	1	RCJ-023	RCJ-02X	J3	CUI Inc., RCA jack, vertical, white. Mouser: 490-RCJ-023, Digikikey: CP-1408-ND. Alternative part: Keystone 584
4	1	RCJ-024	RCJ-02X	J2	CUI Inc., RCA jack, vertical, yellow. Mouser: 490-RCJ-024, Digikikey: CP-1409-ND. Alternative part: Keystone 586
5	1	SV50	SV50_INNER	J1	Inner part of Lumberg SV 50 (SV 50-8), e.G. Reichelt: LUM SV 50, Newark: 82AH3339 , Farnell: 3549652, TME.eu: SV50, alliedelec.com: 70151556
6	1	solder bridge		JP1	structure on PCB, close for proper operation
7	1	RTC9028	MINIDIN4_V	J5	Mini-DIN, 4p, vertical. Not required for 5-pin and VIC-20. E.g. AliExpress:
8					RTConnector: RTC9028
9					ebay.de

Rev. 1.0 → Rev. 2.0

- Pos. 1 pcb revision
- Pos. 2 new RCA jack
- Pos. 3 new RCA jack
- Pos. 4 new RCA jack