Project Documentation

PET Joystick Adapter

Project number: 220

Revision: 0

Date: 04.01.2025

Commodore PET Joystick Adapter Rev. 0

Module Description

1 Introduction

This is an adapter for connecting the widespread Commodore C64 or Atari Joysticks to the user port of the PET series computers.

There is no real standard for doing so, thus the most common pin assignments at the user port had to be determined. The main source was the website zimmers.net. The document https://www.zimmers.net/anonftp/pub/cbm/documents/projects/interfaces/pet_joystick.txt shows a pin assignment, that was used for most joystick games, that could be found on the website (https://www.zimmers.net/anonftp/pub/cbm/pet/games/english/joy/index.html). This pin assignment is also found at the original "Coyote Electronics" joystick adapter" and it is the one that is used for the „PET" joystick emulation in the VICE PET emulator.

There is a further pin assignment for „left/right/fire" games, that can also be found on the said website, which is not identical to the first pin assignment. The up/down directions are not defined for most of those games, except "leap frog fix.prg". The found pin configuration was confirmed by „Stupid PET tricks" adapter. There it is called "Space Invader +", thus the name.

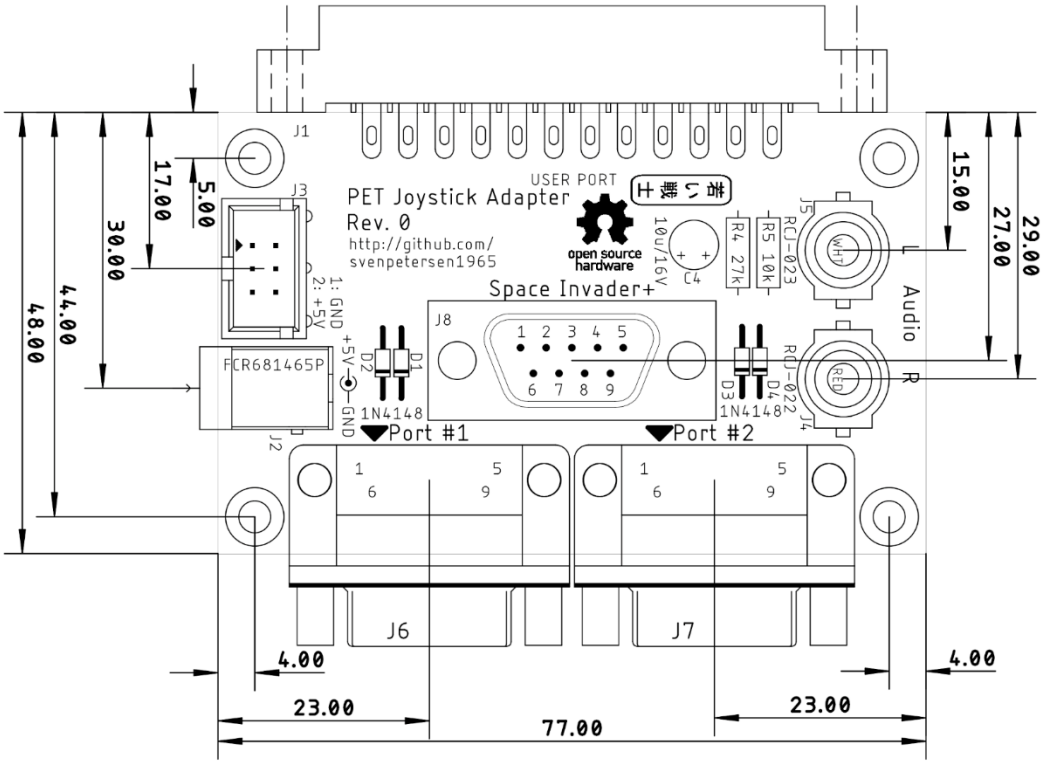


Figure 1: Dimensions of the PCB

2 Pin Assignments

2.1 Coyote Electronics

Port	D-Sub Pin	Direction	User Port	Pin
1	1	Up	PA0	C
	2	Down	PA1	D
	3	Left	PA2	E
	4	Right	PA3	F
	6	Fire	PA0 & PA1 (Diodes)	C & D
	7	+5V	Not available	-
	8	GND	GND	1, 12, A, N
2	1	Up	PA4	
	2	Down	PA5	J
	3	Left	PA6	K
	4	Right	PA7	L
	6	Fire	PA4 & PA5 (Diodes)	H & J
	7	+5V	Not available	-
	8	GND	GND	1, 12, A, N

2.2 Space Invader +

D-Sub Pin	Direction	User Port	Pin
1	Up	PA2	E
2	Down	PA3	F
3	Left	PA0	C
4	Right	PA1	D
6	Fire	PA4 & PA5 (Diodes)	H & J
7	+5V	Not available	-
8	GND	GND	1, 12, A, N

3 Further Features

3.1 Power Supply

The +5V supply voltage is **usually not required**, it only serves for powering auto-fire circuits. There are two ways of powering the adapter:

- From the cassette port with the Diagnostic cassette port dongle (https://github.com/svenpetersen1965/C64-Diagnostic-Rev.-586220-Harness/tree/master/Diag586220_Harness/Diag586220_Cassette_Port)
- Via the barrel connector (5.5mm/2.5mm).

3.2 Cassette Port Connector

Pin	Signal	Signal	Pin
1	GND	+5V	2
3	n.c.	n.c.	4
5	n.c.	n.c.	6

3.3 Barrel Connector

5.5mm/2.5mm

D-Sub Pin	Direction
Center	+5V
Ring	GND

3.4 Audio Output

The wide spread PET audio output from port pin CB2 is divided with a 27kΩ/10kΩ voltage divider. The ratio is about 1:4, the output voltage is approximately 1.25Vpp (0.615V_{RMS} ⇒-4dBU). In case a level of -10dBU is desired, R4 (27kΩ) can be replaced with a 62kΩ resistor. A capacitor provides DC decoupling. Both, the left and the right output channel are tied together, so stereo speakers can both be driven.

4 Gallery

4.1 PCB

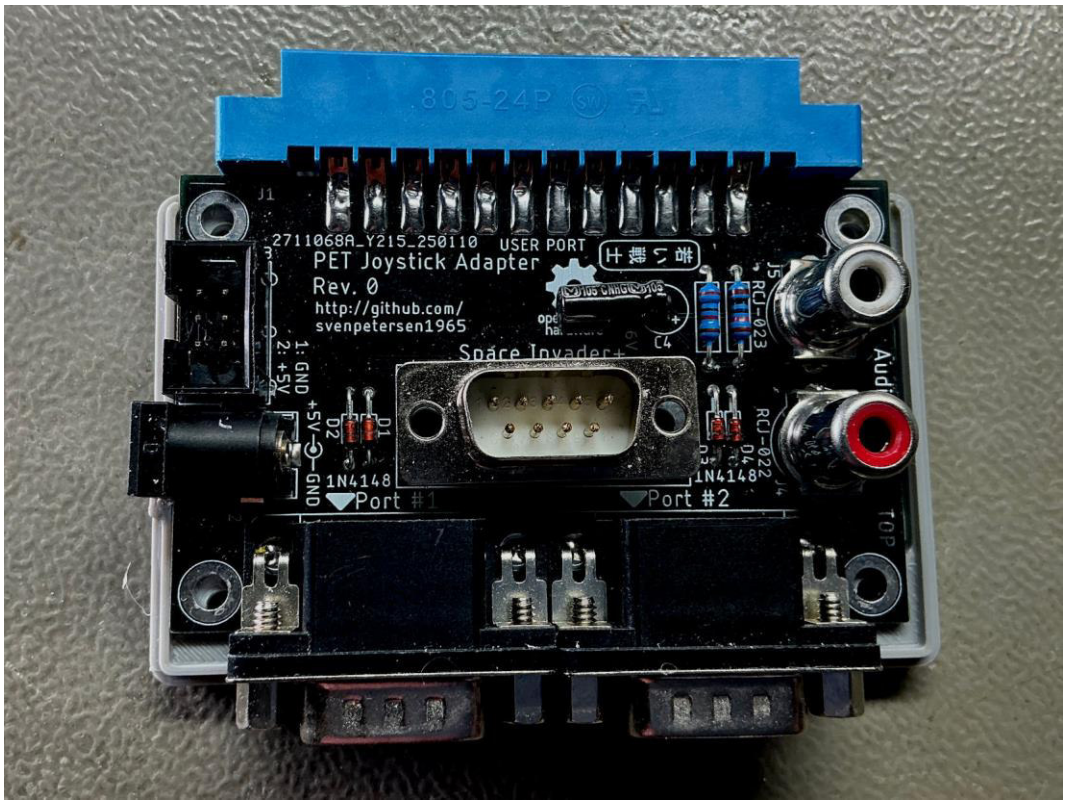


Figure 2: Top side of the PCB

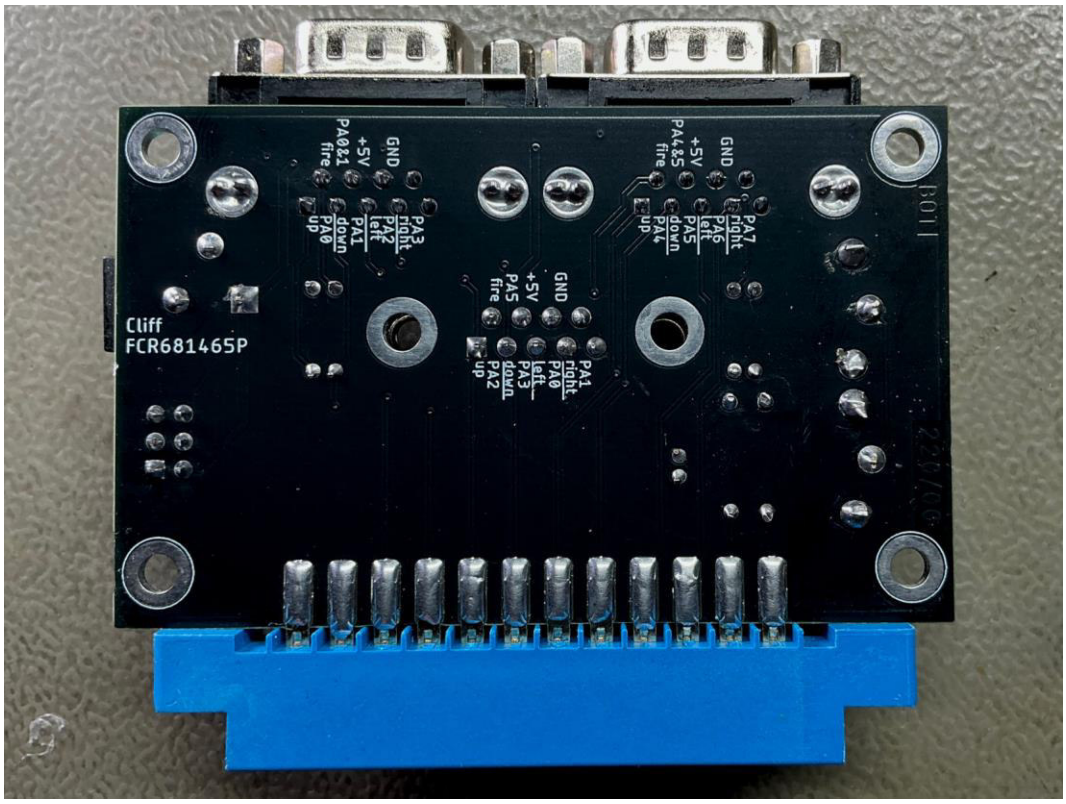


Figure 3: Bottom side of the PCB

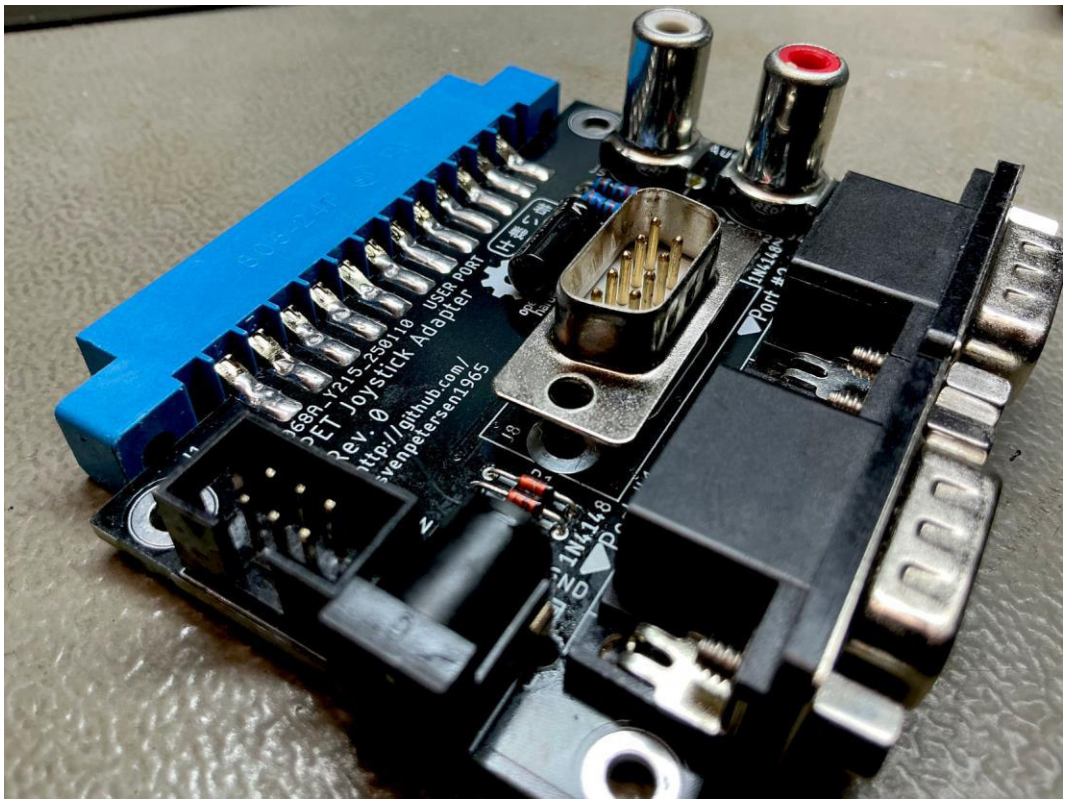


Figure 4: Soldering of the user port connector

The edge connector should be soldered flat on the solder side (Figure 3) and with bent pins on the top side (Figure 4).

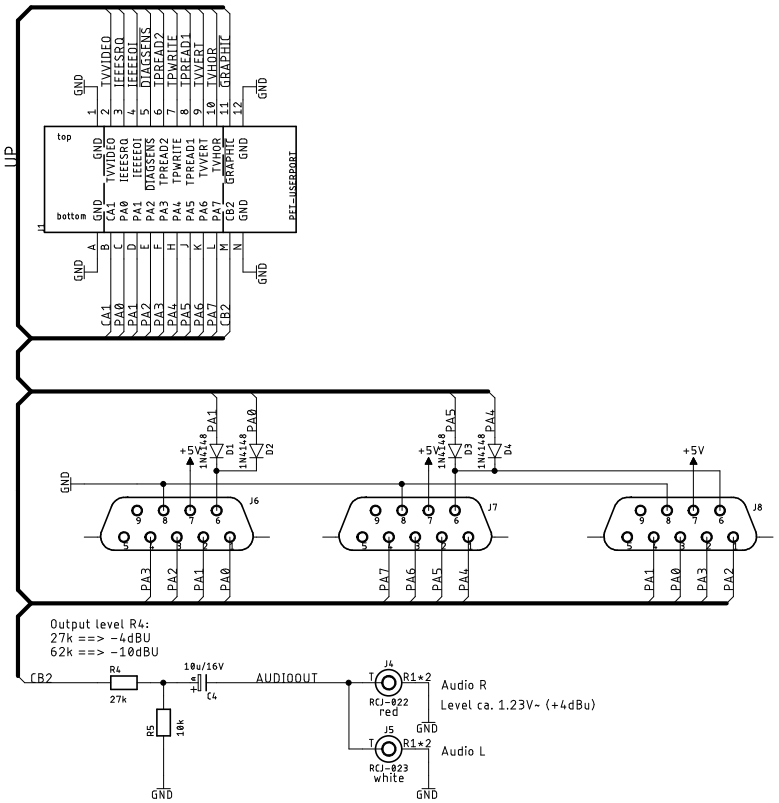
4.2 Full assembly

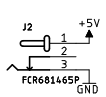
Figure 5: Joystick Adapter with 3D printed case and label

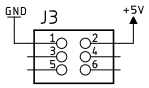
5 Revision History

Rev. 0

- Working prototype





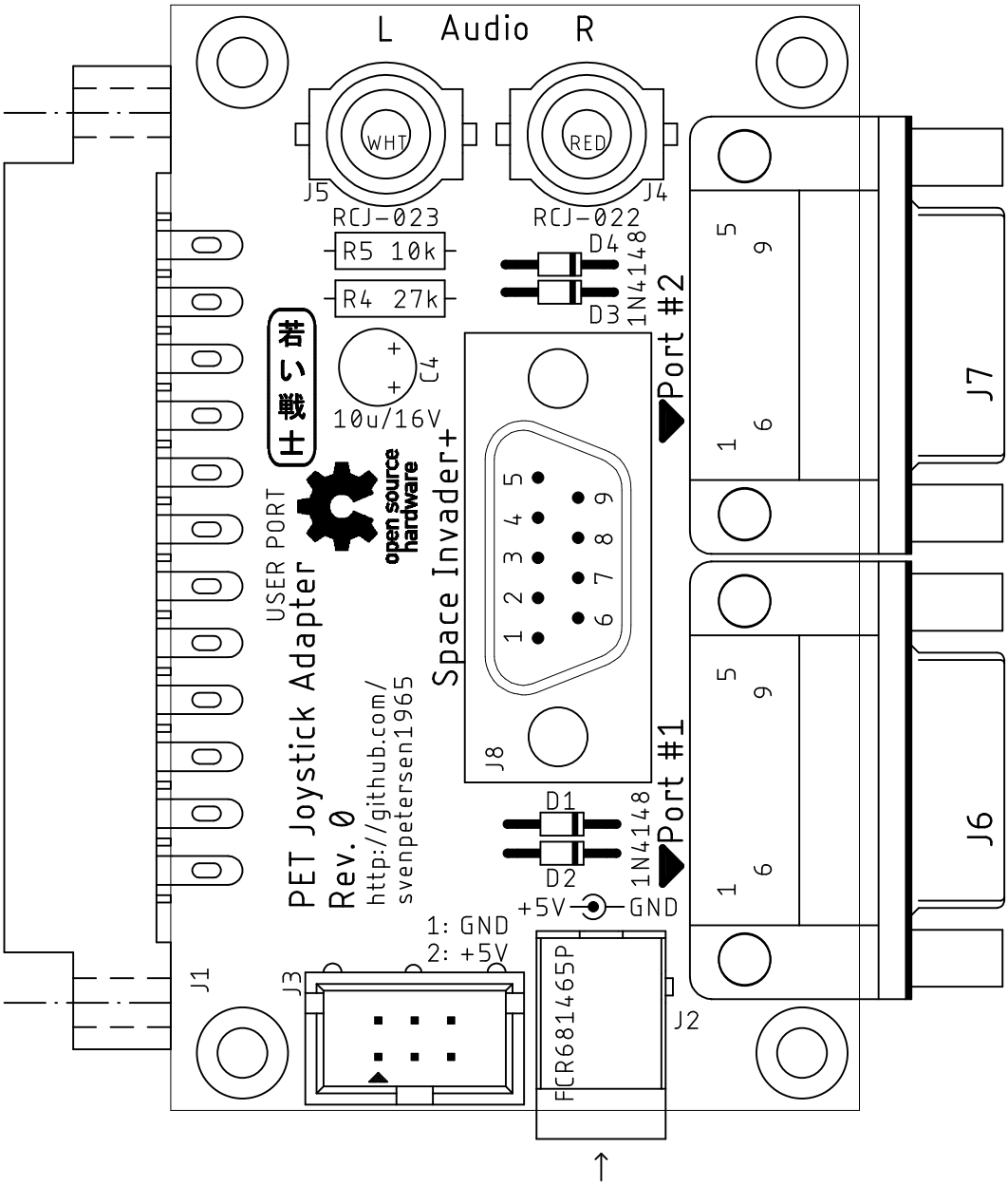


Control Port	Port 1	Port 2	Space Invaders+
1: up	PA0	PA4	PA2
2: down	PA1	PA5	PA3
3: left	PA2	PA6	PA0
4: right	PA3	PA7	PA1
6: fire	PA0&1	PA4&5	PA4&5
7: +5V			
8:GND			

open source hardware

Title:	Commodore PET/CBM Joystick Adapter	Doc.-No.:	220-1-01-00
		Draft.:	Sven Petersen
Date:	16.01.2026 11:44	Rev.: 0	Page 1/1
File:	PET_Joystick_Adapter		
	http://github.com/svenpetersen1965		A3

Sven Petersen 2025	Doc.-No.: 220-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
placement component side		



Sven Petersen 2025	Doc.-No.: 220-2-01-00	
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PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
placement solder side		

Sven Petersen 2025	Doc.-No.: 220-2-01-00	
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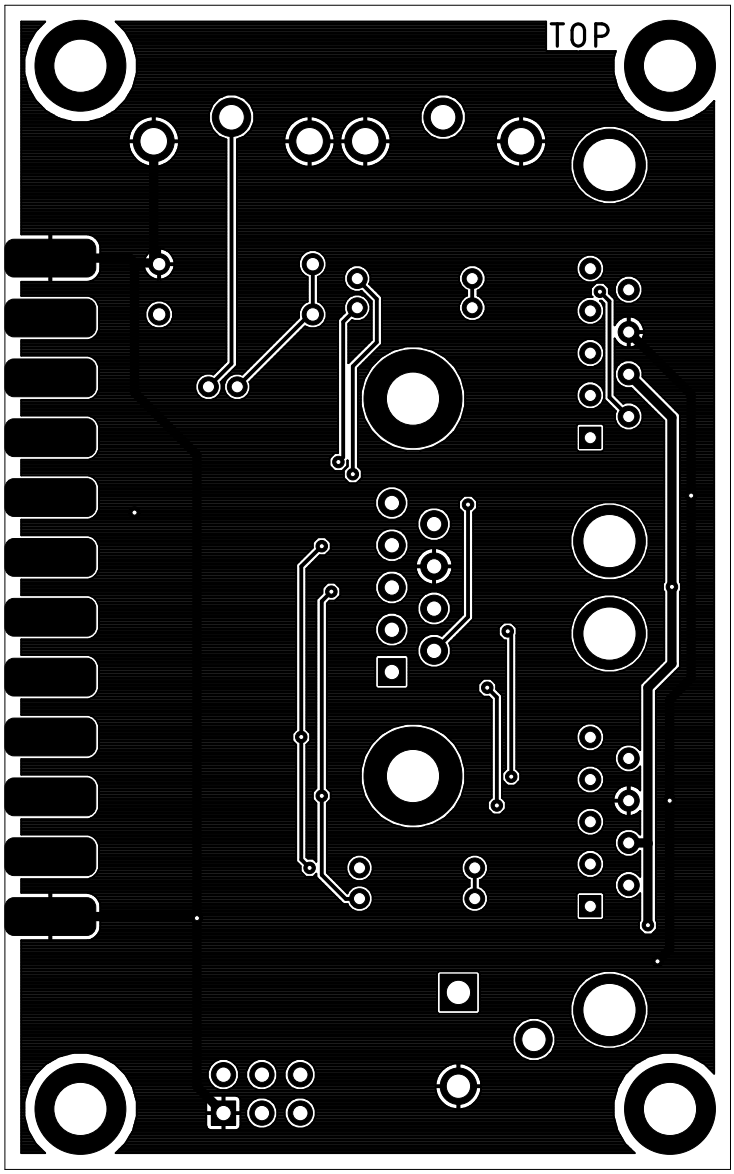
PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
top	[redacted]	



Sven Petersen 2025	Doc.-No.: 220-2-01-00	
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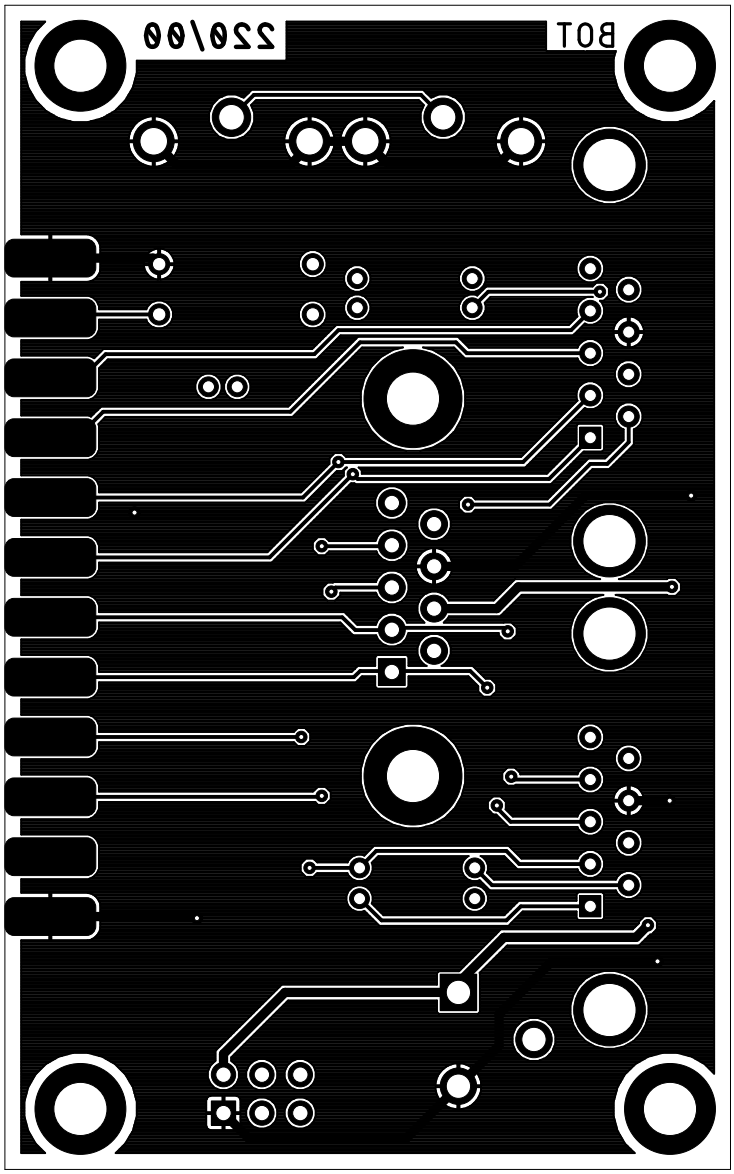
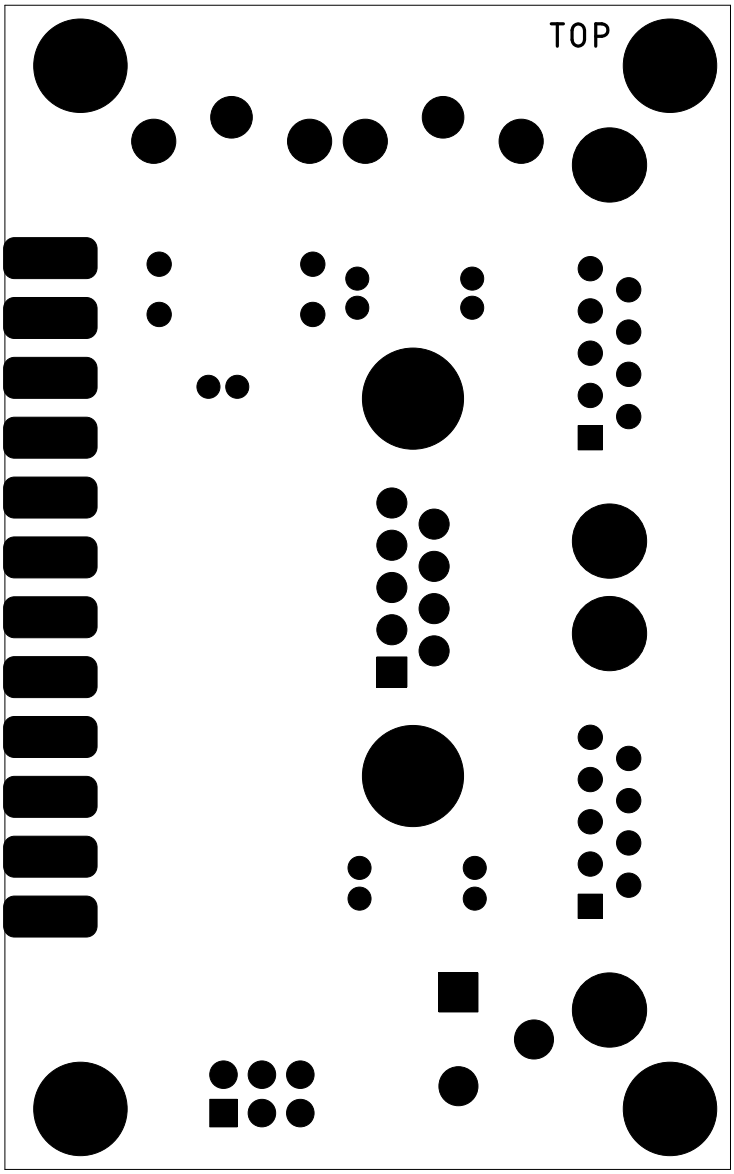
PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
bottom		



Sven Petersen 2025	Doc.-No.: 220-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
stopmask component side		



Sven Petersen 2025	Doc.-No.: 220-2-01-00	
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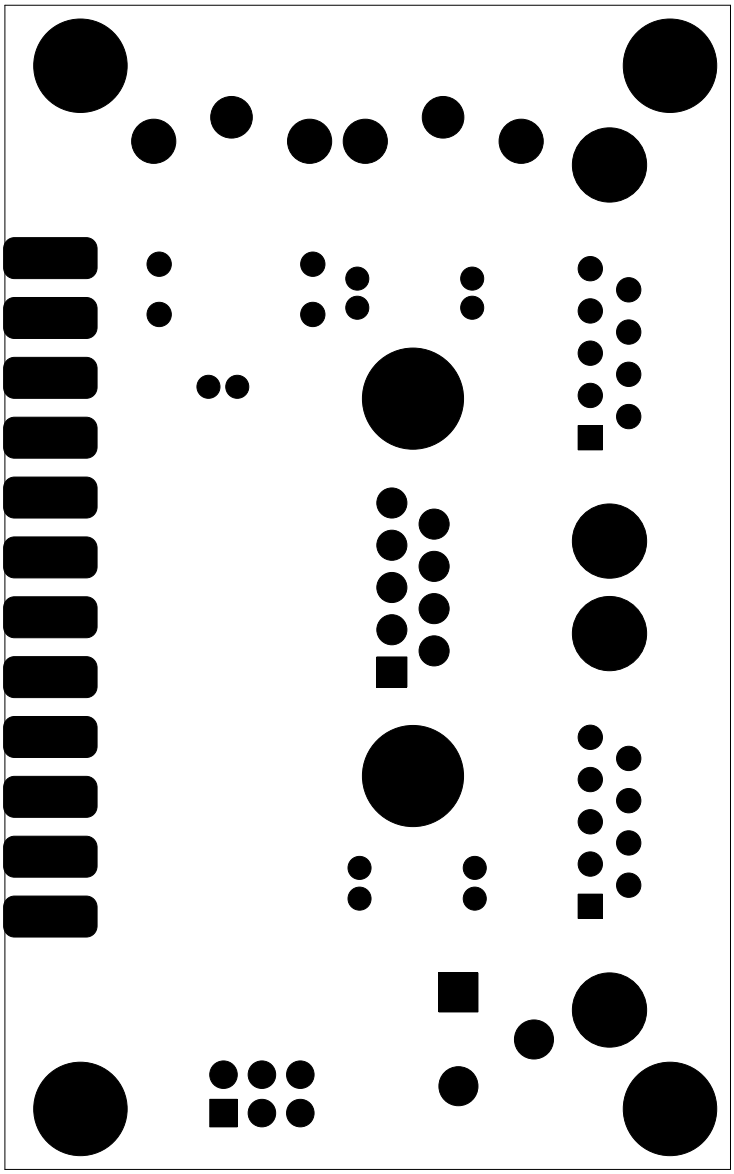
PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
stopmask solder side		



Sven Petersen 2025	Doc.-No.: 220-2-01-00	
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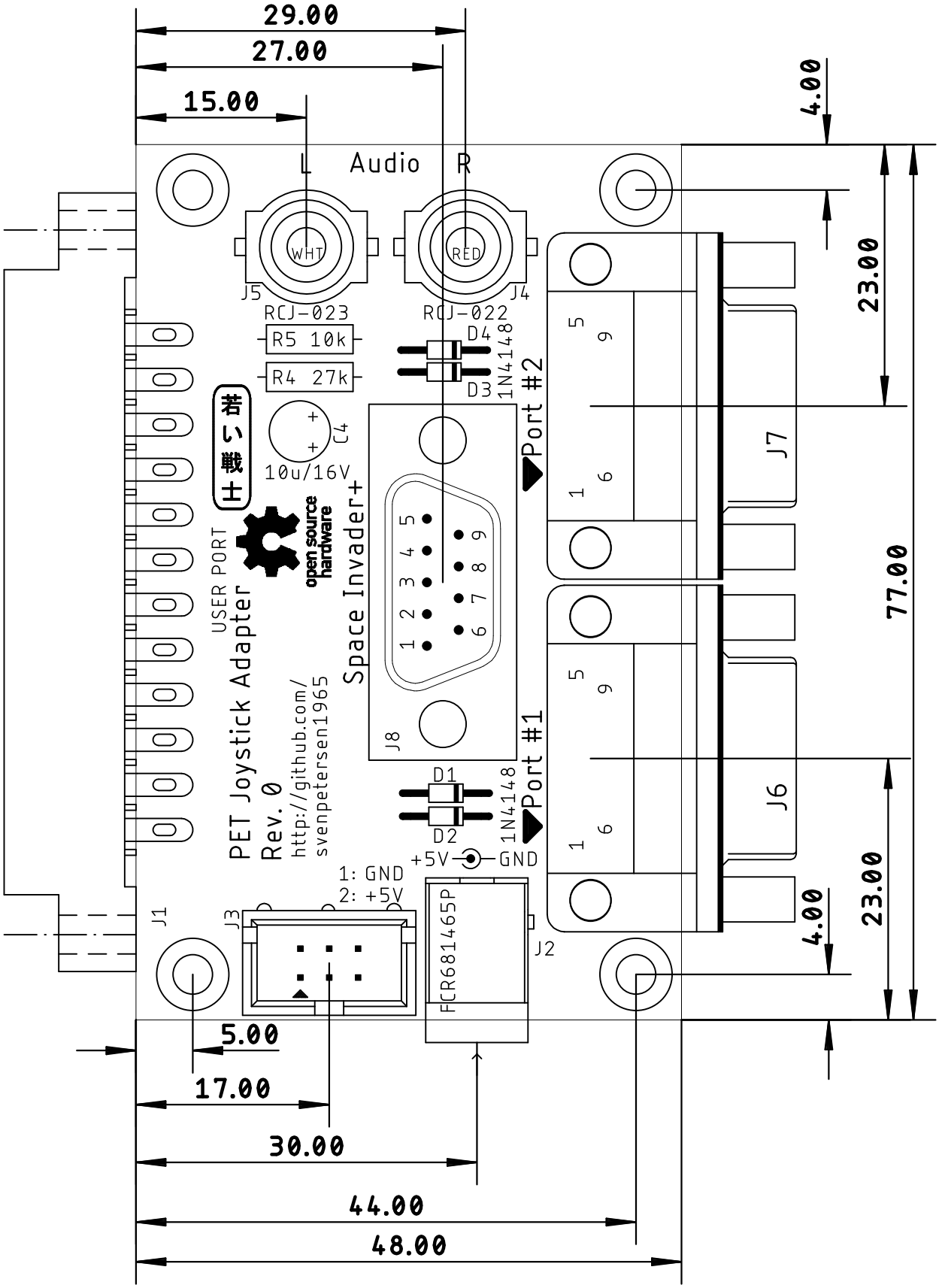
PET_Joystick_Adapter		
06.01.2026 17:33		Rev.: 0
placement component side measures		



Commodore PET Joystick Adapter Rev. 0

Testing

Test Setup

- *Commodore CBM3016 computer*
- *Three C64 Joysticks*
- *PET Joystick Adapter Rev. 0*
- *SD2PET future with software*
- *Cassette Port Dongle from the C64 diagnostic harness for supplying powering*
- *C64 Control Port Switch/Rapid Fire*
- *FNRSI*
- *PC speakers*

Test Execution

The Joysticks were connected to all joystick/DSub connectors on the joystick adapter. The user port bits were displayed with the test software uptest.prg.

Coyote Electronics:

Port	Direction	User Port	Result
1	Up	PA0	☑
	Down	PA1	☑
	Left	PA2	☑
	Right	PA3	☑
	Fire	PA0 & PA1	☑
2	Up	PA4	☑
	Down	PA5	☑
	Left	PA6	☑
	Right	PA7	☑
	Fire	PA4 & PA5	☑

Space Invader +:

Direction	User Port	Result
Up	PA2	☑
Down	PA3	☑
Left	PA0	☑
Right	PA1	☑
Fire	PA4 & PA5	☑

The displayed user port bits were compared to the Coyote Electronics and the Space Invaders+ configuration. All bits were as expected.

The audio outputs were inspected with an oscilloscope. For this purpose, an oscilloscope was connected via an adapter cable and the following basic instruction were executed to generate a waveform on the user port CB2:

```
POKE59467,16
POKE59466,51
POKE59464,128
```

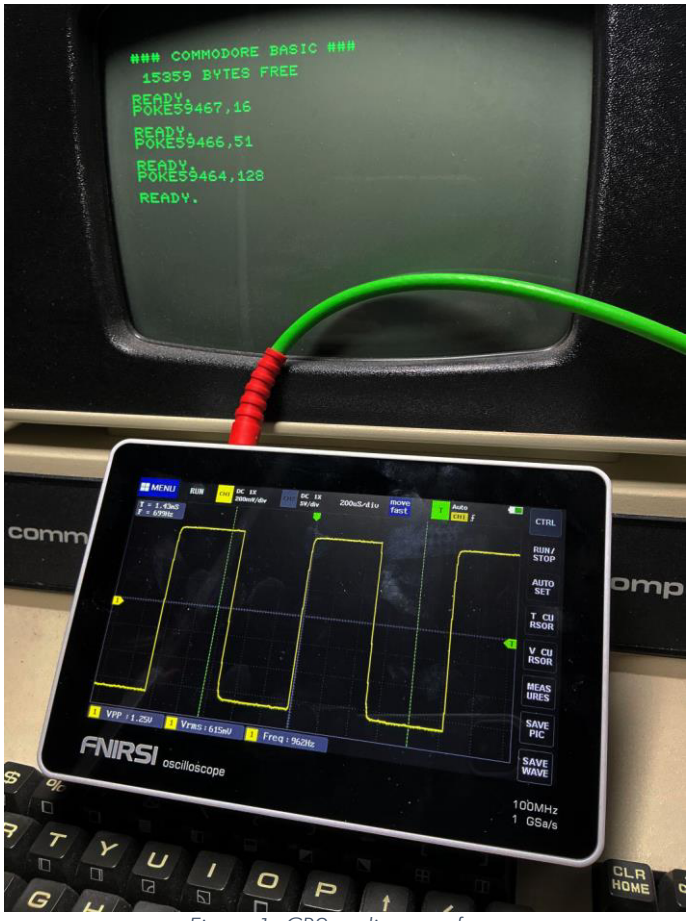


Figure 1: CB2 audio wave form

The audio output is as desired. The amplitude was 1.25V_{PP} and 615mV_{RMS}, which is -4.2dBV (within the headroom of a -10dBV consumer audio line out). This level is no problem with standard audio equipment. In case this is too hot for your desire, you can replace the 27kΩ resistor in R4 with a 62kΩ resistor to get closer to the -10dBU.

The +5V supply was tested with an auto-fire circuit, which was connected to Port #1 and Port #2. A power supply was connected to the barrel connector and the auto-fire was powered properly. The same was tested while powering the device via the 6p pin header from the cassette port.

Finally, the games from zimmers.net were tested with the joystick adapter.

Game	Pin Configuration	Note
afo.prg	Coyote Electronics, port #1	
arrow.prg	Coyote Electronics, port #1	
bomber.prg	Coyote Electronics, port #1	
break-out.prg	Coyote Electronics, port #1	

breakout.prg	Coyote Electronics, port #1	
brickwall.prg	Coyote Electronics, port #1	
cosmiads uni.prg	Space Invaders+:LEFT=PA0, RIGHT=PA1, FIRE=PA5.	POKE 2571,79 before RUN for joystick on user port.
galaxy invdr joy.prg	Space Invaders+ (left/right/fire)	
invaders.prg	Space Invaders+ LEFT=PA0, RIGHT=PA1, FIRE=PA5.	
joystick_test.prg	Coyote Electronics, port #1&2	
leap frog fix.prg	Space Invaders+ (4 dir)	
pong joysticks.prg	port #1 & #2 (left/right: moves down/up)	
print_racer.prg	Coyote Electronics, port #1	
shark.prg	Coyote Electronics, port #1	
space war.prg	?	No joystick function found
star spores.prg	Space Invaders+	
zap.prg	Coyote Electronics, port #1	

Except space war.prg, all games were playable with one of either joystick pin configurations. It is not clear, if this program requires a poke to activate the joystick (like cosmiads uni) or is it does not even support joysticks. There was no reaction on any of the three ports, which actually should have been the case, since every user port bit can be manipulated this way.

Conclusion

The PET Joystick Adapter Rev. 0 is functional with the programs on zimmers.net, that support joystick and it seems, that the two pin configurations are the most popular ones.

Commodore PET Joystick Adapter Rev. 0
Bill of Material Rev. 0.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment
1	1	220-2-01-00	2 Layer	PCB Rev. 0	2 layer, Cu 35µ, HASL, 48.0mm x 77.0mm, 1.6mm FR4
2	1	2x3 box header, 2.54mm	2X03WV	J3	e.g. Reichelt WSL 6G. **Option: Power from tape**
3	2	Dsub, 9p, male, horizontal	DS9M-H	J6, J7	e.g. Reichelt BKL 10120037
4	1	Dsub, 9p, male, vertical	DS09M-V	J8	e.g. Reichelt D-SUB ST 09P
5	1	10k	R-10	R5	1/4W, 1% or better
6	1	10u/16V	C5,0/2,0	C4	aluminum electrolytic, ∅5.0mm/pitch 2.0mm 105°C, l=11mm, e.G. Reichelt RD1C106M05011180
7	4	1N4148	D1, D2, D3, D4		standard silicon diode
8	1	27k	R-10	R4	1/4W, 1% or better. 27k for -4dBU or 62k for -10dBU audio level.
9	1	FCR681465P	FCR681465P	J2	Cliff. 2,5mm/5.5mm barrel connector. E.g. Reichelt CLIFF FCR681465P **Option: external Power**
10	1	Edge connector, 2x12, 3.96mm	USERPORT	J1	edge connector, C64 user port, Ali Express, "series 805" or other
11	1	RCJ-022	RCJ-02X	J4	CUI Inc., RCA jack, vertical, red. Mouser: 490-RCJ-022, Digikey: CP-1407-ND. Alternative part: Keystone 577
12	1	RCJ-023	RCJ-02X	J5	CUI Inc., RCA jack, vertical, white. Mouser: 490-RCJ-023, Digikey: CP-1408-ND. Alternative part: Keystone 584