

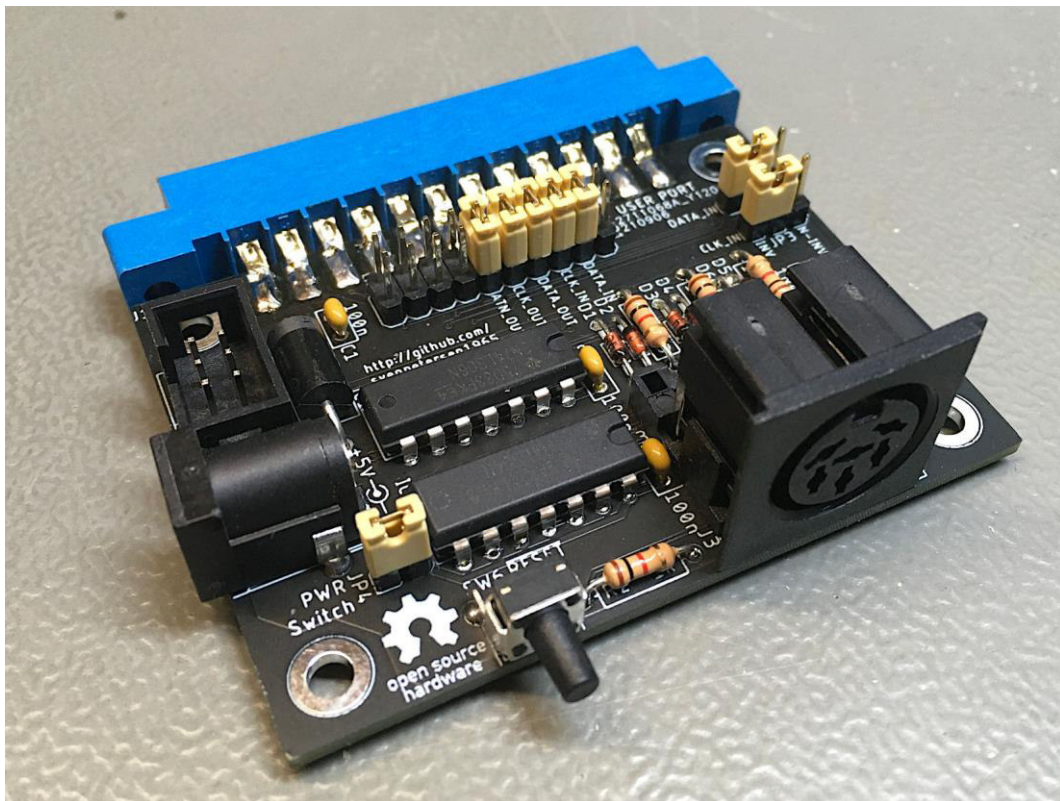
# Project Documentation

## Commodore PET/CBM 1541 Adapter

Project number: 186

Revision: 0

Date: 23.10.2021



# Commodore PET/CBM 1541 Adapter Rev. 0

## Module Description

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### Introduction

This is a reconstruction of an unknown hardware, which fits to the software from an EPROM, that was discovered in a CBM8032. It is an adapter for a 1541 Floppy Disk Drive, which connects to the User Port of CBM computers like the 8032.

The IEC port only allows to connect a floppy disk drive with device number 8 (which does not interfere with a device number 8 on the IEEE-488 bus!). The instructions for accessing the 1541 are not standard instructions (but very similar). Thus, the 1541 cannot replace an IEEE-488 floppy disk drive, when it comes to accessing files (SEQ or SER) or saving a machine language/assembler program from a monitor like the TIM.

It is good for saving and loading programs on/from the 1541, showing the directory (non-destructive) or displaying the disk status.

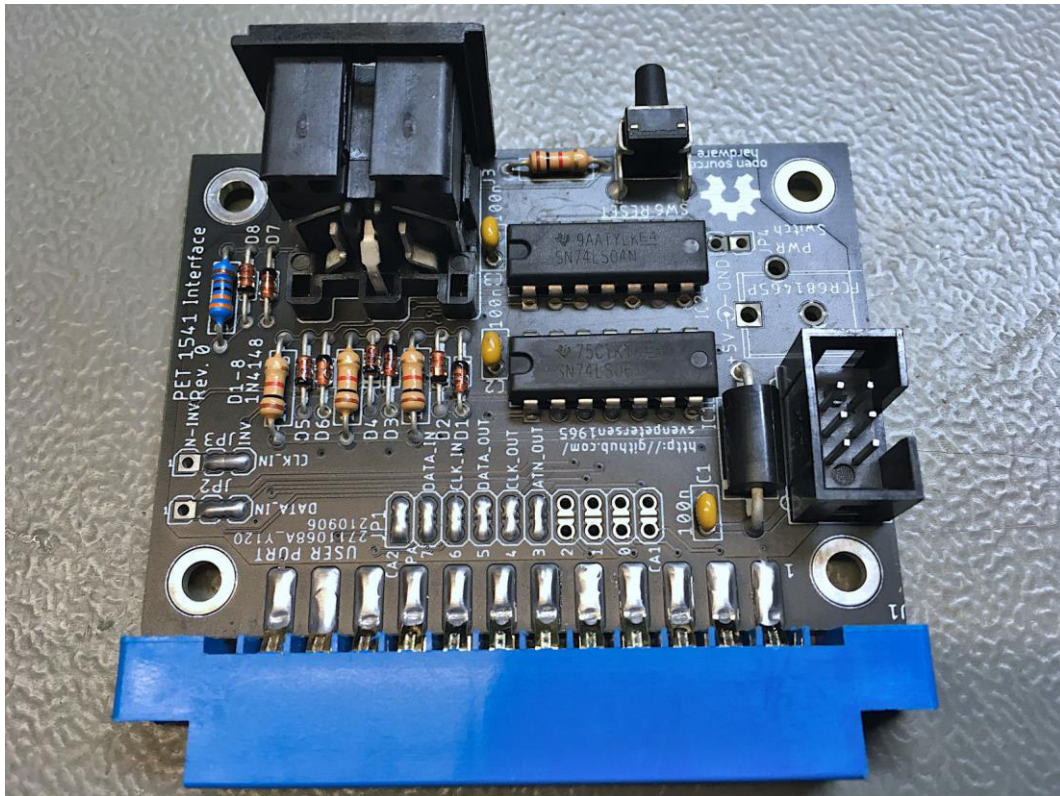


Figure 1: Standard assembly of the PET/CBM 1541 Adapter with the minimal required components

## Requirements

Since the User Port of the CBM and PETs does not provide a 5V supply voltage, it can be tapped at a cassette port dongle. It is recommended to use the C64 diagnostic harness cassette dongle for this purpose (it can be found here: <https://github.com/svenpetersen1965/C64-Diagnostic-Rev.-586220-Harness>). Further, the 6 pin ribbon cable of the previously mentioned project is required.



Figure 2: PET/CBM 1541 adapter with cassette port dongle (and an SD2PET) with a CBM8032

Also, the VC-1541-DOS/80 EPROM is required to be installed in the EPROM socket UD11.



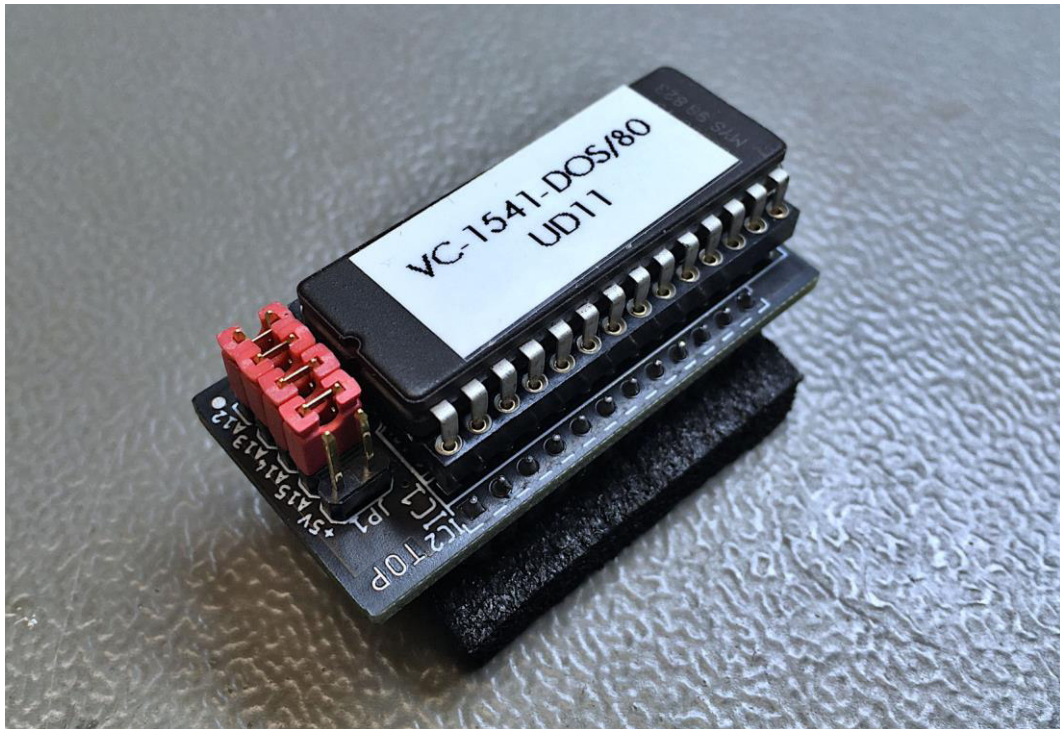


Figure 3: The Driver Software EPROM.

Originally, the driver software was burned in a TMS2532 4kB EPROM, which directly fits in the socket UD11 on the CBM mainboard. Since those are hard to get and not programmable with many EPROMmers, like the TL866, very likely, an adapter is required like shown in Figure 3.

## Instruction Set

The instruction set was derived from analyzing the binary of the driver software. The software is started with

```
SYS40960
```

The software will answer

```
vc-1541-dos/80
```

```
ready.
```

The instructions follow these rules:

- each instruction starts with '!'
- there are a couple of floppy disk related instructions, that have an alternative representation in the EPROM
- a !q will deactivate/quite the software
- a !@ will display the status of the 1541
- a !@"command" will send a command to the 1541
- No device number (, 8) is required for any of the instructions
- The instructions are mostly standard BASIC4 instructions and can be short-cut as usually

Instruction	Format	Note
load	!load"programe"	loads a program from 1541
save	!save"programe"	saves a program to 1541
verify	!verify"programe"	verifies a program
catalog	!catalog	displays the driectory of the floppy disk in the 1541
open	!open#SA,"file name"	it requires a # and after that it is a secondary address*
print#	!print#,"text"	prints a texts, also a secondary address after #*
get#	*	*
close	!close#SA	closes a file, also a secondary address after #*
input#	!input#SA...*	*
cmd	!cmd...*	*

The items marked with \* require some further investigation. See the test documentation.

The commands, which are usually sent to the 1541 via secondary address 15, can be sent with the !@ command.

Command	Function
!@"s:file name"	Scratch the file <file name>
!@"n0:disk name,xx,yy"	Format disk
!@"i"	Initialize disk
!@"v"	Validate disk
!@"	Displays the disk status
[...]	[...]

## Dimensions

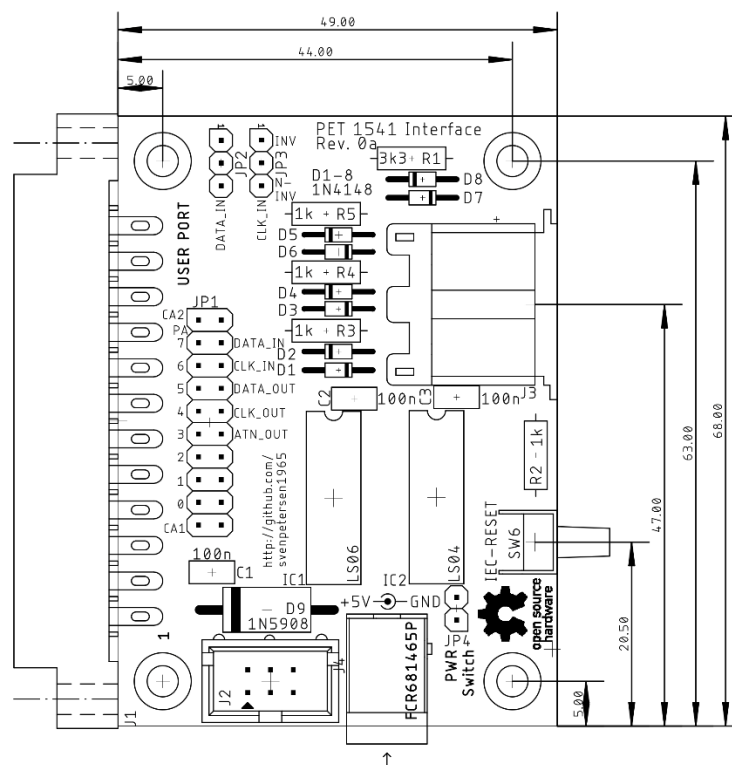


Figure 4: PCB Dimensions

## RESET Switch – SW6

The RESET Switch is a bus reset for the 1541 only. It does not reset the computer. It is a standard 90° TACT-switch.

## Connectors

### Cassette Port Dongle

J2 – 2x3 pin header for a ribbon cable connected to the cassette port PCB (project number 114).

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

n.c.: not connected

### +5VDC Power

J4 - 5,5mm/2,5mm barrel connector

Pin	Signal
Center	+5VDC
Shaft	GND

This connector is optional and not required, if it is intended to power the interface from the cassette port dongle. To make use of it, JP4 has to be closed, which can be achieved with a jumper, a solder bridge or a (power) switch.

### IEC-Bus (1541)

J3 – Lumberg 010599 06, 6p DIN receptacles

Pin	Signal
1	n.c.
2	GND
3	ATN
4	CLK
5	DATA
6	/RESET

/RESET is a drive reset, not a PET reset.

## Jumpers

The jumpers show the experimental character of the prototype design. They can be fix settings and don't need to be changed at any time. Thus, it is recommended to close them with a solder bridge as shown in Figure 1.

### JP1 - User Port Connections

Signal	Pin	Pin	Signal	Setting
CA2	1	2	n.c.	Don't care
PA7	3	4	DATA_IN*	close
PA6	5	6	CLK_IN*	close
PA5	7	8	DATA_OUT*	close
PA4	9	10	CLK_OUT*	close
PA3	11	12	ATN_OUT*	close
PA2	13	14	n.c.	Don't care
PA1	15	16	n.c.	Don't care
PA0	17	18	n.c.	Don't care
CA1	19	20	n.c.	Don't care

### JP2, JP3 – Input Inversion

Jumper	Pin 1	Pin 2	Pin 3	Setting
JP2	/DATA_IN	DATA_IN*	DATA_IN	Non-inverting (2-3)
JP3	/CLK_IN	CLK_IN*	CLK_IN	Non-inverting (2-3)

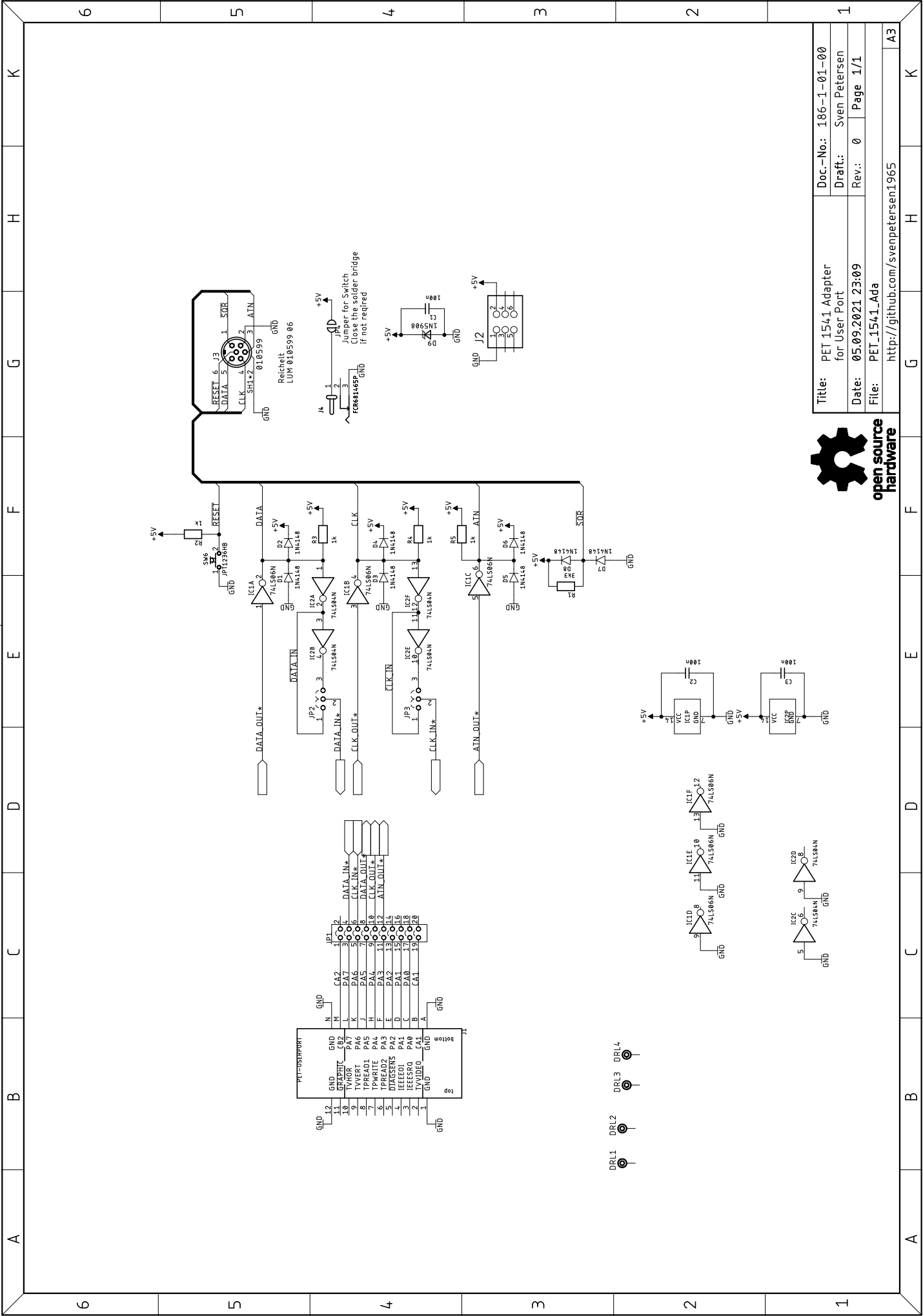
### JP4 – Power Switch

This Jumper can be used to connect a power switch or it can be closed. The +5V from the barrel connector are connected to the interface's supply voltage with the jumper. The +5V from the cassette port dongle are always connected and do not require to be switched. JP4 is only required in conjunction with J3 (See chapter +5VDC Power).

## Revision History

### Rev. 0

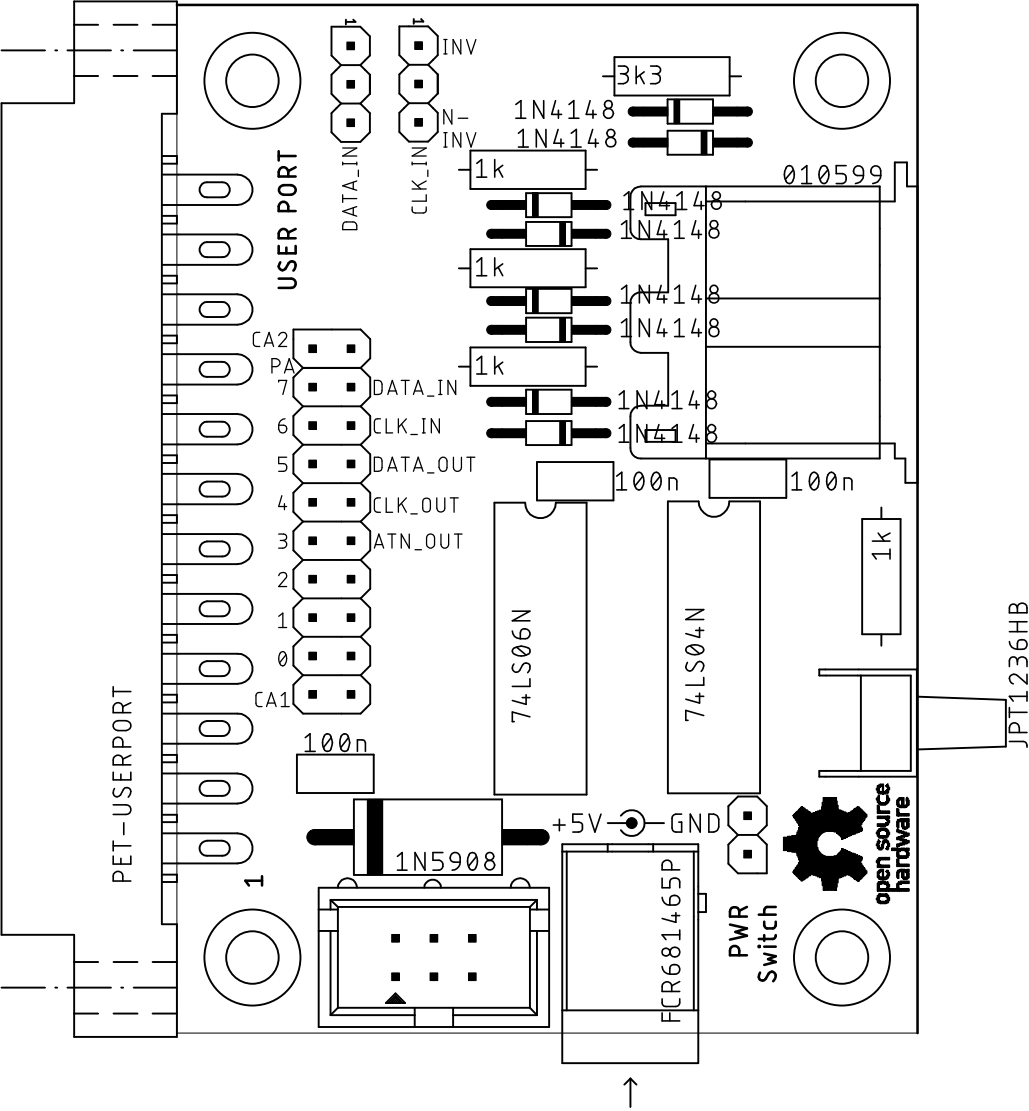
- Fully functional prototype



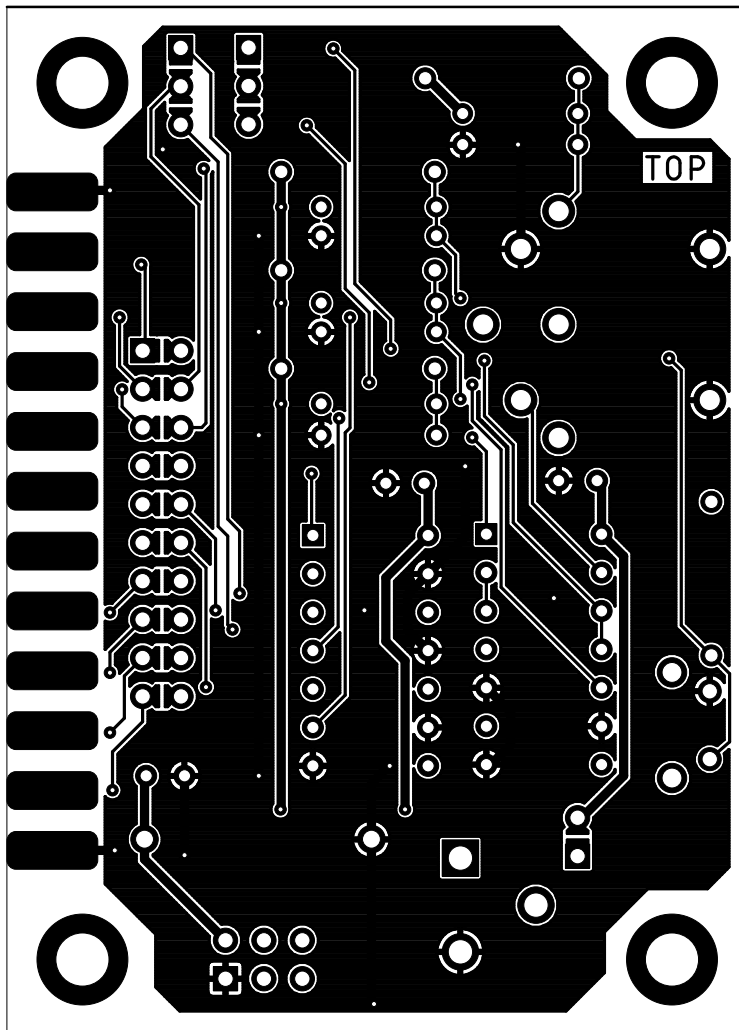




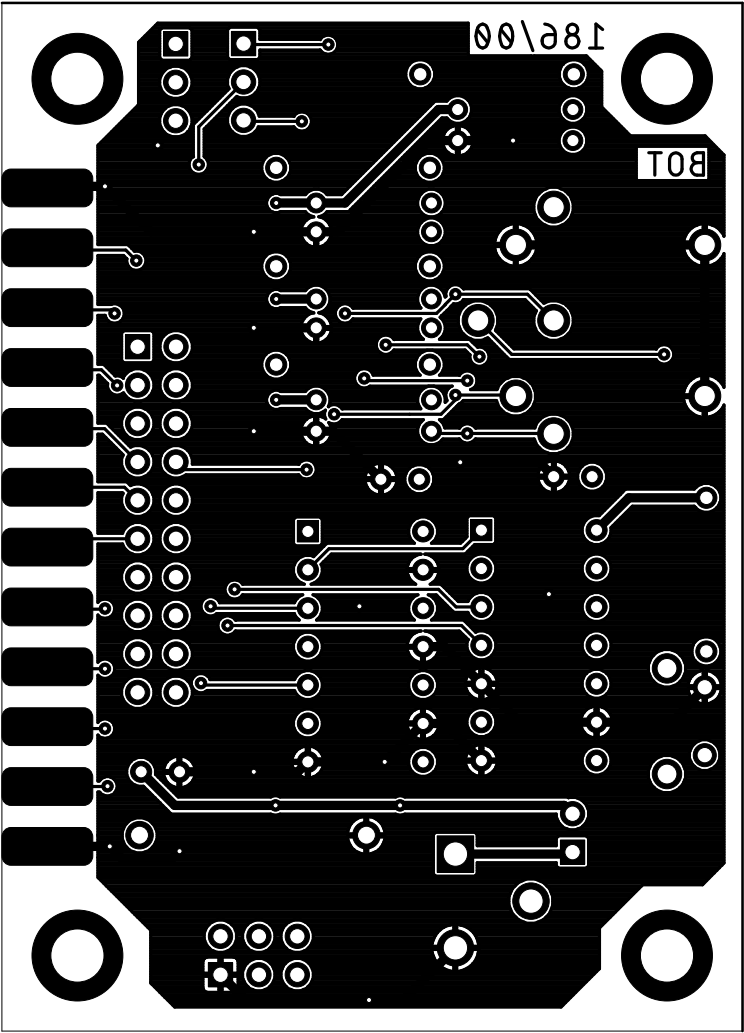
Sven Petersen 2021	Doc.-No.: 186-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_1541_Ada		
12.10.2021 18:10		Rev.: 0
placement component side		



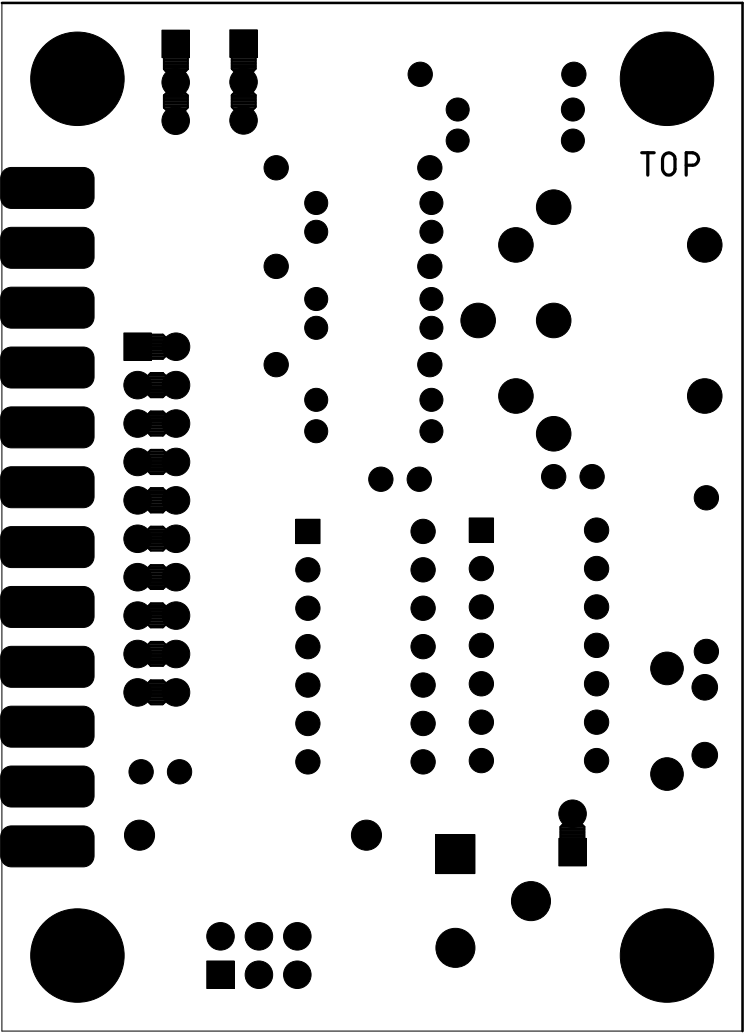
Sven Petersen 2021	Doc.-No.: 186-2-01-00	
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PET_1541_Ada		
06.09.2021 12:17		Rev.: 0
top		



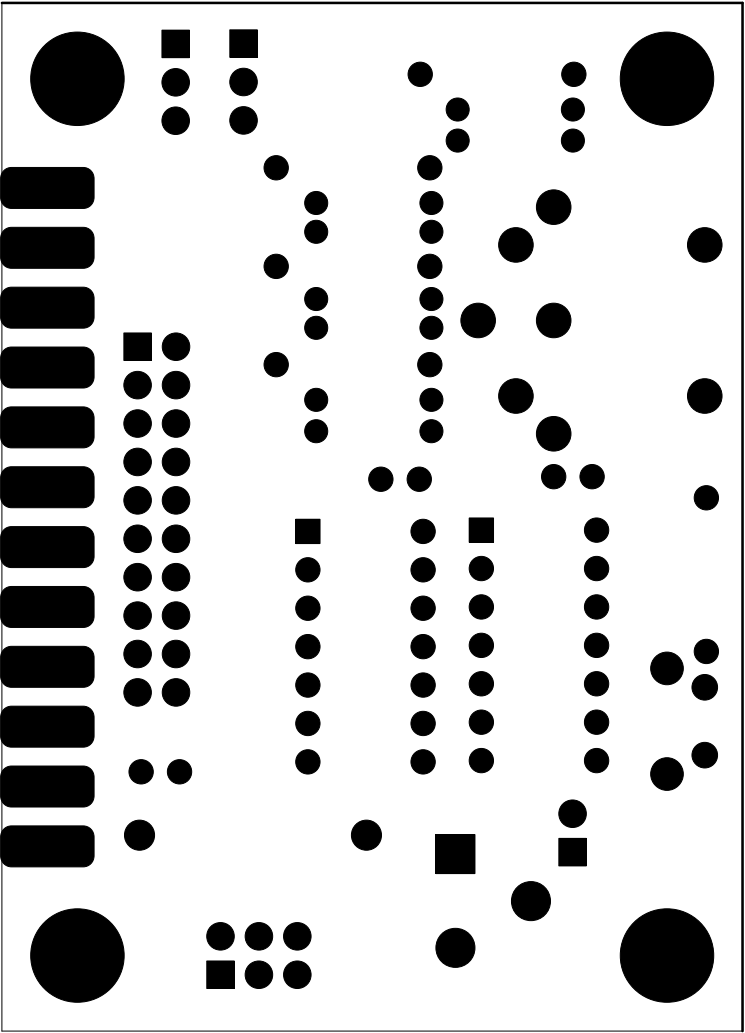
Sven Petersen 2021	Doc.-No.: 186-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_1541_Ada		
06.09.2021 12:17		Rev.: 0
bottom		



Sven Petersen 2021	Doc.-No.: 186-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_1541_Ada		
06.09.2021 12:17		Rev.: 0
stopmask component side		

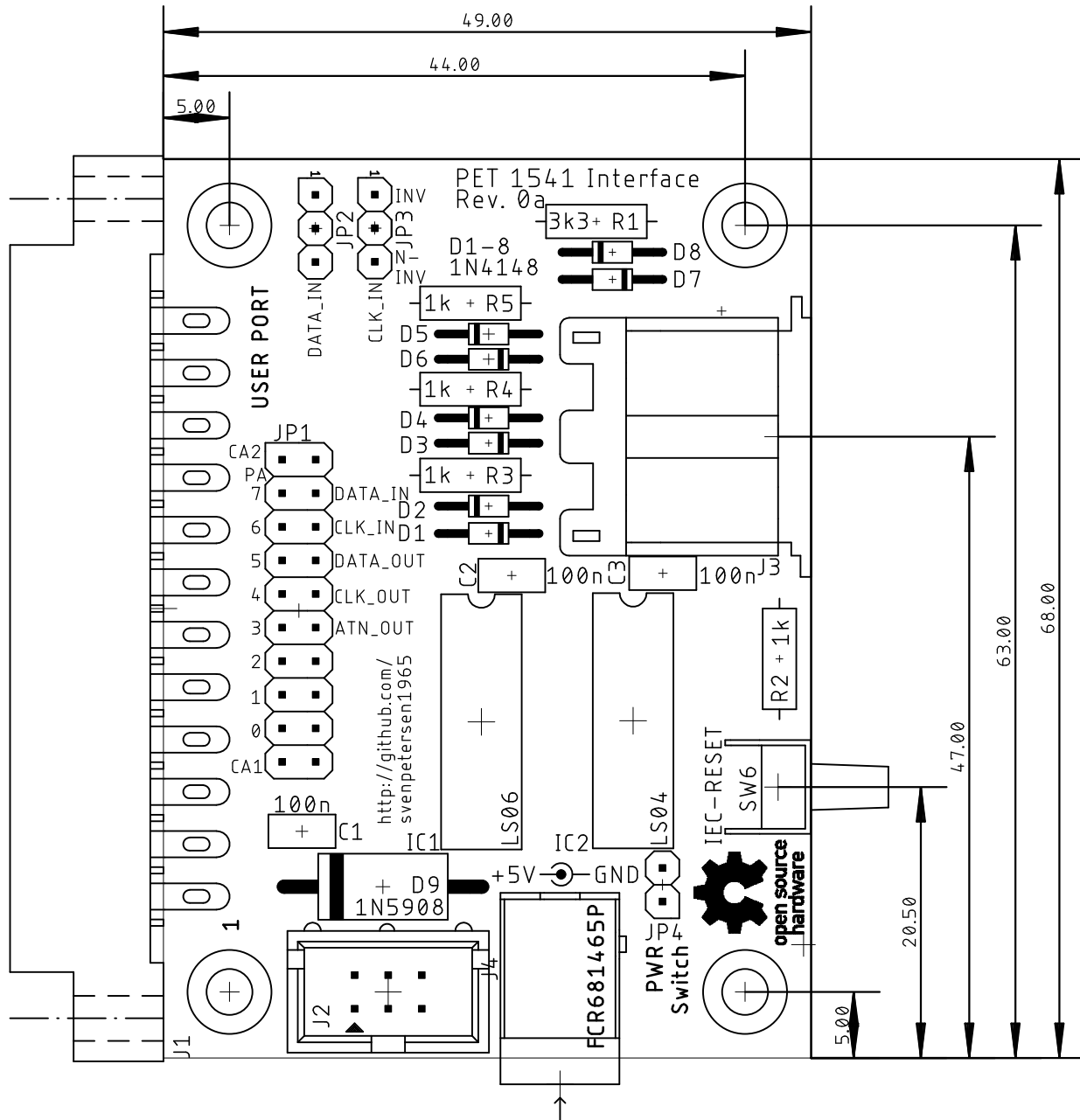


Sven Petersen 2021	Doc.-No.: 186-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_1541_Ada		
06.09.2021 12:17		Rev.: 0
stopmask solder side		





Sven Petersen 2021	Doc.-No.: 186-2-01-00	
	Cu: 35µm	Cu-Layers: 2
PET_1541_Ada		
12.10.2021 18:10		Rev.: 0
placement component side		measures



# Commodore PET/CBM 1541 Adapter Rev. 0

## Prototype Testing

### Test Setup

- Prototype Rev. 0 installed in the User Port
- CBM8032
- 2532 EPROM "VC-1541-DOS/80" in UD11
- Cassette Dongle with ribbon cable for power supply
- 1541 and 1541-II disk drives with different floppy disks and serial cable
- SD2IEC with a suitable disk image on SD-card
- Pi1541 with a suitable disk image on SD-card
- 1581 with a suitable disk
- A C64 setup with disk drive to check the files written with

### Test Execution

With each drive, the same tests were executed:

1. Showing the disk status with !@
2. Formatting the disk with !@"N:CBM8032,00
3. Showing the directory with !catalog
4. Saving a program with !save"<prog name>"
5. Verifying the program with !verify"<prog name>"
6. Loading a program with !load"<prog name>"
7. Writing a SEQ file with the program "seqtest"
8. Reading the SEQ file

The sequence of the test steps are not necessarily the same. The program "seqtest" looks like this:

```
2 print"scratch file"
5 !@"s:test"
7 print"open test for writing"
10 !open#1,"test,s,w"
20 fori=1to100
30 !print#1,"This is a test"
40 next
50 !close#1
```

### General Results

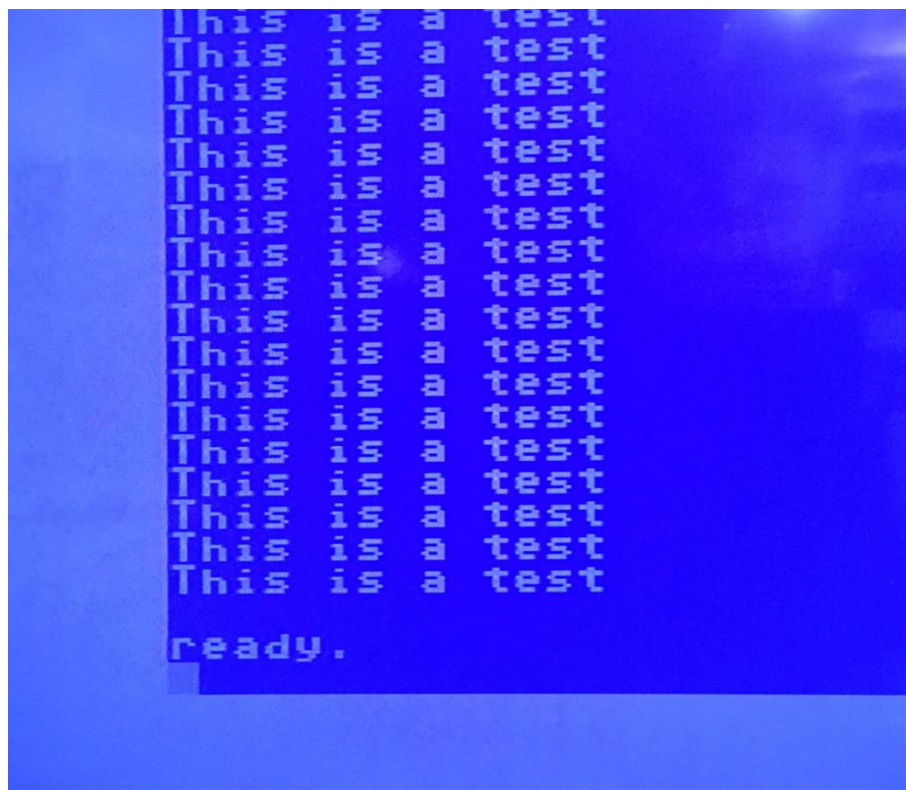
All tests were executed successfully except reading back the sequential file with the CBM8032 on any drive. It turned out, that the file number for !open, !input# etc. is rather a secondary address. An !open#15,"test,s,r" returned a "syntax error" in the status and SA 15 is for sending commands to the disk drive. An !input#2,a\$ always returned a "G" in a\$ (note: the software was found in an old EPROM and scope of the project is to reconstruct the hardware).

The SEQ file from the CBM8032 was the read with a program on the C64.

```
50 INPUT"FILE NAME";N$
70 OPEN2,8,2,N$+",S,R"
80 INPUT#2,A$
90 PRINTA$
```

```
100 IF ST<>0 THEN120
110 GOTO80
120 CLOSE2
```

The result looks ok.



*Figure 1: The SEQ file read with a C64*

Further, the SD2IEC was not capable of the !catalog command. A !load"\$" did work, though.

## Pictures of the tests



Figure 2: CBM8032 with a 1541 (SpeedDOS ROM)

```
*** commodore basic 4.0 ***  
  
31743 bytes free  
  
ready.  
sys40960  
vc-1541-dos/80  
  
ready.  
!@  
73,speeddos 2.7 1541,00,00  
  
ready.  
!catalog  
0 "dracopy" 2a 2a  
49 "dc" prg  
9 "fb" prg  
1 "hallo" prg  
596 blocks free.  
  
ready.  
█
```

Figure 3: Software start, status and directory (1541)





Figure 4: Setup with the 1541-II (SpeedDOS ROM)



Figure 5: Setup with the SD2IEC

```

*** commodore basic 4.0 ***

31743 bytes free

ready.
sys40960
vc-1541-dos/80

ready.
!@
73,sd2iec v1.0.0atentdead0-24,00,00

ready.

```

Figure 6: Software start and status (SD2IEC)

```

689 "Amiga Mania.d64" prg
1 "sexp-circles" prg
67 "easyprog.prg" prg
2 "blinkenlights" prg
0 "8050" dir
689 "md201704.d64" prg
23 "system'1.prg" prg
1 "@sexp-circles" prg
689 "VIC20doom.d64" prg
689 "VIC20RAMTest.d64" prg
18 "putest62.prg" prg
20 "putest'1.prg" prg
689 "sd2iec.d64" prg
689 "sd2iectest.d64" prg
51642 blocks free.
ready.
!@"cd:sd2iectest.d64

ready.

```

Figure 7: directory and change directory instruction (SD2IEC)



```

ready.
list

1 "sd2iec" 2a
664 blocks free.
ready.
!@"n:form8032

ready.
!@
00, ok,00,00

ready.
!10"$

searching for $
loading 00, ok,00,00

ready.
list

1 "form8032" 2a
664 blocks free.
ready.

```

Figure 8: Formatting a disk image (SD2IEC)



Figure 9: Setup with Pi1541



Figure 10: Setup with the 1581

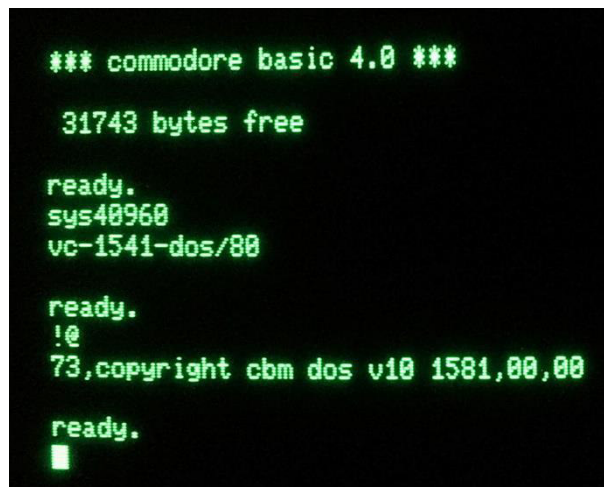


Figure 11: Software start and status (1581)

```
18  "backup128-1581"  prg
18  "backup 64-1581"  prg
37  "sector editor"   prg
21  "show bam"        prg
5   "change unit"     prg
11  "unscratch"       prg
10  "load address"    prg
19  "uni-copy"        prg
17  "filecopy"        prg
2   "filecopy.bin"    prg
10  "zapload 64"      prg
30  "compress 128"    prg
7   "auto-run 64"     prg
9   "auto-boot 128"   prg
5   "pic demo 128"    prg
21  "rel file example" prg
26  "burst exampl.bas" prg
5   "burst subs.bin"  prg
112 "burst subs.src"  seq
233 "burst subs.lst"  seq
17  "partition aid"   prg
2475 blocks free.

ready.
```

Figure 12: !catalog with the 1581



```

new

ready.
10 print"hello 1581
20 goto 10
!save"test hello
00, ok,00,00

ready.
!verify"test hello

searching for test hello
verifying 00, ok,00,00

ready.
new

ready.
!10"test hello

searching for test hello
loading 00, ok,00,00

ready.
█

```

Figure 13: Test of the 1581 (!save, !verify, !load)



Figure 14: Setup with the Oceanic OC-118N

```

ready.
sys40960
vc-1541-dos/80

ready.
!@
73,r-dos 40 tr. 1541,00,00

ready.
!catalog
0 "cbm3032" "00 2a"
1 "seqtest" prg
6 "test" seq
1 "readseq8032" prg
1 "hello" prg
1 "c64seq" prg
8 "tstseq" seq
1 "c64readseq" prg
2 "sisi" seq
1 "satest" prg
2 "cbmtestseq" prg
641 blocks free.

ready.

```

Figure 15: Status (OC-118N)

## Result

The hardware of the PET/CBM 1541 Adapter is fully functional. The software, that was found in the EPROM seems to work at least mostly. It is not sure, if the !input# and !get# instructions work properly, since the proper instruction syntax might not be figured out, yet.

# Commodore PET-1541 -Adapter Rev. 0

## Bill of Material Rev. 0.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment
1	1	186-2-01-00	2 Layer	PCB Rev. 0	2 layer, Cu 35 $\mu$ , HASL, 68.0mm x 49.0mm, 1.6mm FR4
	1	2x3 box connector	2X03WV	J2	e.g. Reichelt WSL 6G
	1	10599	10599	J3	Lumberg, e.g. Reichelt 010599 06, tme.eu: 0105-06
	3	100n/50V	C-2,5	C1, C2, C3	ceramic capacitor, pitch: 2.5mm
	8	1N4148		D1, D2, D3, D4, D5, D6, D7, D8	standard silicon diode
	1	1N5908	CB429	D9	TVS Diode (5V)
	4	1k	R-10	R2, R3, R4, R5	1/4W, 1%
	1	3k3	R-10	R1	1/4W, 1%
	1	74LS04N	DIL-14	IC2	TI or other
	1	74LS06N	DIL-14	IC1	TI or other
	2	COMBI-3P	COMBI-3P	JP2, JP3	Solder bridge, see Module description
	1	COMBI_2P	COMBI-2P	JP4	Solder bridge, see Module description
	1	COMBI_2X10	COMBI-10X2	JP1	Solder bridge, see Module description
	1	FCR681465P	FCR681465P	J4	optional: Cliff, Reichelt: CLIFF FCR681465P, tme.eu: FCR681465P
	1	JPT1236HB	JTP_1236HB	SW6	TACT switch, 90°, Nanae Electronics, e.g. Reichelt TASTER 3305B, tme.eu: TACTA-68N-F
	1	2x12, 3.96mm pitch	USERPORT	J1	edge connector, user port