Universal Power Supply

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The European Society for Computer Preservation
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Introduction

Almost all of our beloved vintage home computers have a weak point: the power supply.

Power supplies of the era, also perfectly manufactured ones, have the same age of the computer to which they are connected and a little problem in voltages, which is possible due to the age, may damage the computer itself.

For these reasons, we started to think about a power supply which shall manage any vintage computer, but built with modern components and adequately protected from overvoltages and short circuits.

Thinking about ...

We made a deep analysis about the needs of several machines, the most populars such as Commodore, Sinclair, Atari and others, and we figured out that the voltages needed overall where not so different: +5v +12 +9v (unregulated) -12v and 9vAC.

For any of the voltages we verified the maximum amount of power consumption and we sized the project consequently, with a bit of margin.

This is only a subset of the table with declared consumption for each of the listed machines:

	VIC1001 / VIC20	MAX / C64	C128	C16	Floppy 1541	Amiga 500	Amiga 600	Amiga 1200	Atari XL/XE	Sinclair ZX 80/81 Spectrum	Sinclair ZX Spectrum +2A/+2B/+3
+12V					0.5A	1A	0.5A	0.5A			0.7A
+5V		2A	3A		1A	4.5A	3A	3A	2A		2A
-12V						0.5A	0.5A	0.5A			0.05A
-5V	not used										
9V unreg.	2.5A			1A						2A	
9V ~		1.1A	1.1A								

We also thought about a situation with several machines connected at the same time, anyhow connected and ready to use without the need to connect or disconnect cables.

Finally, here it is the "ultimate" power supply idea, able to connect up to 4 different computers fully controllable one by one. Obviously we have to multiply by four all the available power, focusing on a reliable switching system.

Choice of components

After a careful study, we acquired the necessary components to build the power supply, always focusing on the needful voltages, current and reliability.

The "shopping list" has become more and more complicated, this is the final list:

- Dual power supply: +5v e +12v 300w (+5v 25A, +12v 15A)
- Power supply (-)12v 2A
- 4 step down modules -> 9v 3A
- Toroidal transformer 9+9v
- Enclosure
- 4 GX16 connectors – 7 pin (panel socket and flying plug)
- 4 switches with integrated led
- 4 four ways relays
- 4 1000 ohm resistences
- Filtered panel socket
- Power switch with integrated light

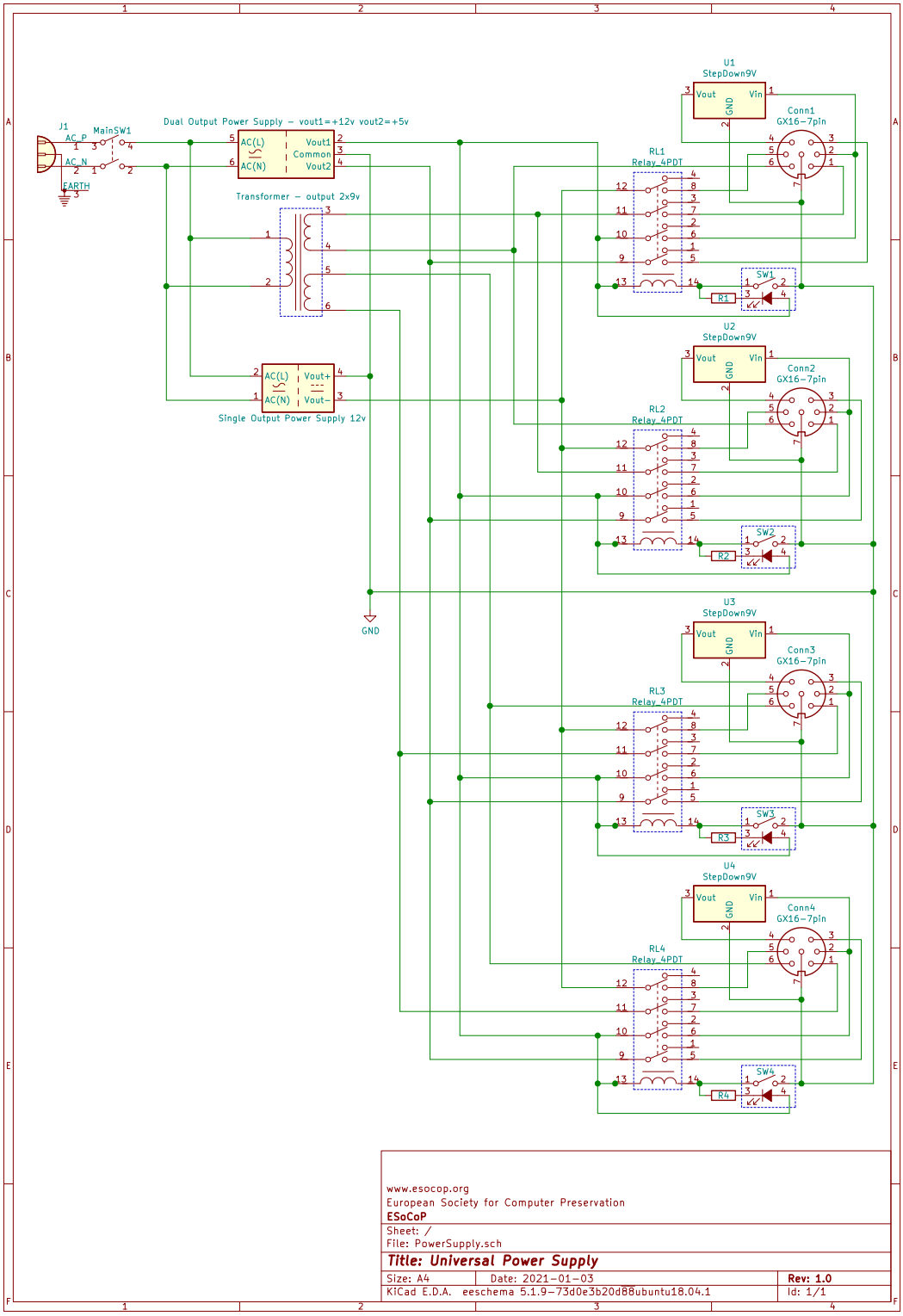
Notes about components choice:

- The metal enclosure should contain all the components with enough space to allow cooling through side openings in the cover
- The power of the dual supplier is surely exuberant, the machine with the most declared absorption is the Amiga 500 for which are (theoretically) needed 4.5A for +5v, 1A for +12v and 0.5A for -12v; that's why we decided to use a power supply capable to deliver at least four times the currents needed by this machine: at least 18A for +5v and 4A for +12v. We have lot of margin on the +5v, and on +12v the margin is even bigger, while on -12v we maybe are on the edge, but we are quite sure that the real absorption on this line is surely lower.
- Outputs switching has been done with 4 ways relays, easily available, controlled by a switch with integrated led to indicate power on. Relays switches the principal powers: +5v, +12v, -12v and one of the edge for the 9vAC (the other edge is directly connected to the connector).
- +9v generation is done with a step-down module powered by +12v coming directly from the relay, so it doesn't need switching (it's not needed a specific line on the relay) and this simplify the overall construction, beyond it takes advantage from +12v, which power is plenty available.
- We have chosen strong panel sockets, also known as "aviation socket", which support high currents and are very reliable, beyond they have a fixing ring that prevents accidental detachment.

As far as we did these assumptions the project cost is quickly grown up to 120 Euros for components only, but this expenses will surely compensate by years.

We are almost sure that necessary currents are lower, manufacturers usually declare overrated datas, but as we would like to have reserve power, the choice has been quite easy.

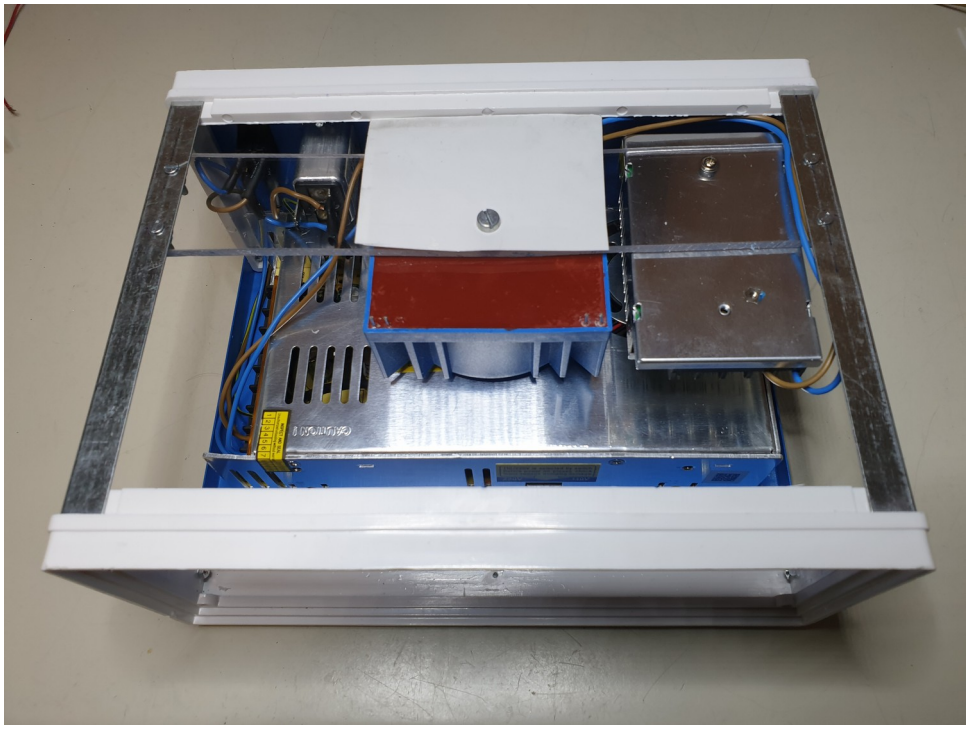
Schematic

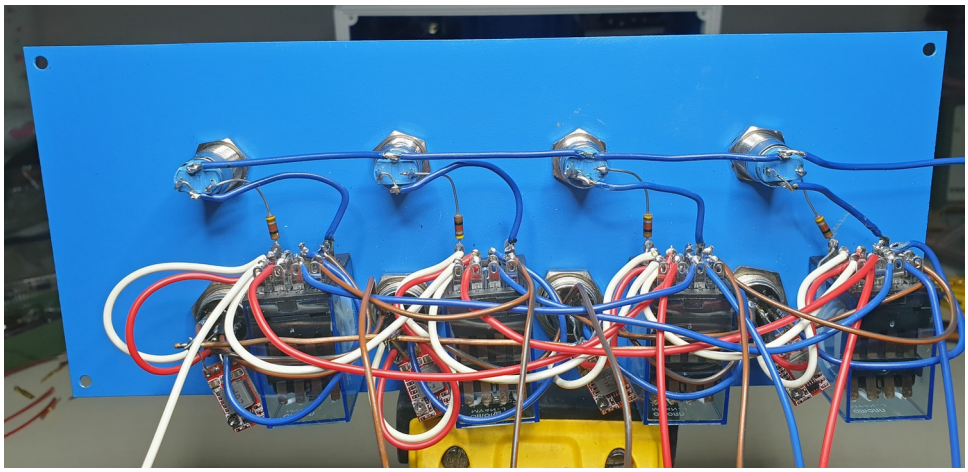


Reference	Value	description
Conn1	GX16-7pin	GX16 Contacts 7 Pin Aviation Connector
Conn2	GX16-7pin	
Conn3	GX16-7pin	
Conn4	GX16-7pin	
J1	Conn_WallSocket_Earth	
MainSW1	SW_DPST	
PS1	Dual Output Power Supply	300W A Dual output 5V 12V Switching power supply
PS2	Single Output Power Supply 12v	20W 12V 2A Ultra thin Single Output Switching power supply
R1	Resistor 1000Ohm	
R2	Resistor 1000Ohm	
R3	Resistor 1000Ohm	
R4	Resistor 1000Ohm	
RL1	Relay_4PDT	JQX-13F MY4NJ HH54PL Mutiple 5A Coil Power Relay 14Pins 4PDT
RL2	Relay_4PDT	
RL3	Relay_4PDT	
RL4	Relay_4PDT	
SW1	SW_SPST_LED	12mm 12V Push Button Switch LED Light Momentary Latching Waterproof
SW2	SW_SPST_LED	
SW3	SW_SPST_LED	
SW4	SW_SPST_LED	
T1	Transformer - output 2x9v	YHDC PCB toroidal transformer PTC50 50VA 115V*2/9V*2
U1	StepDown9V	Mini DC-DC Buck Step-down Converter Adjustable Power Module 3.3V 3V 5V 9V 12V 3A
U2	StepDown9V	
U3	StepDown9V	
U4	StepDown9V	

Assembly

Some images during the assembly.



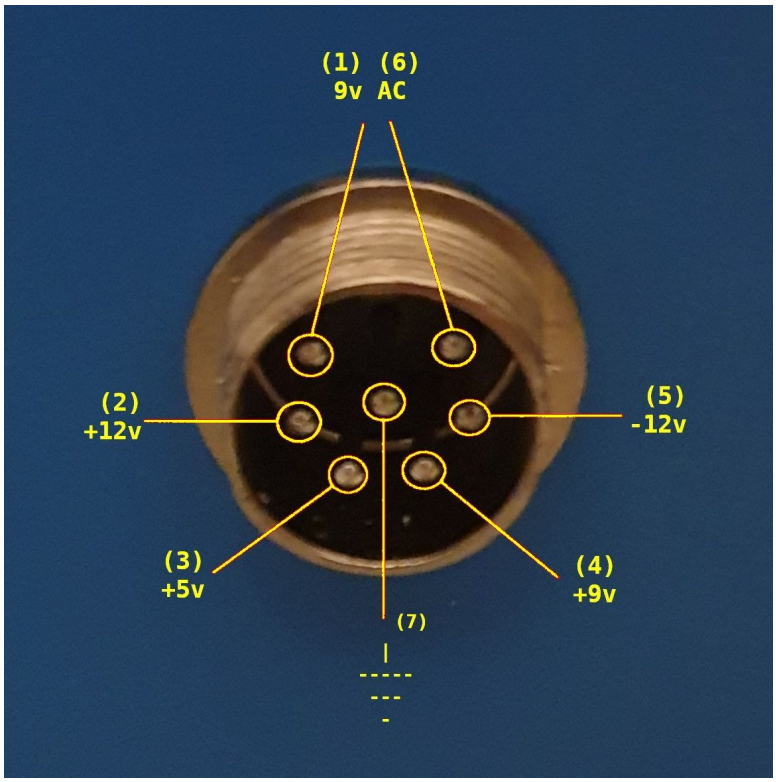


Notes about the cabling:

- Use different colours cable for each voltage, we used: red (+5v), blue (+12v), white (-12v), brown (9v AC)
- If it is possible, originate any of the +5v +12v and 9vAC directly from the power supply/transformer, in order to use thin section cables, easier to solder onto relays and connectors. In our case we used a mixed solution, parallelizing two outputs for each wire.
- Transformer has two independent 9v outputs, so we have been able to feed the 4 output separately two by two.
- -12v are the less critical part, they don't require particular attention in wire sizing, just remember that the ground must be placed on positive pole of the power supply and not on the negative.

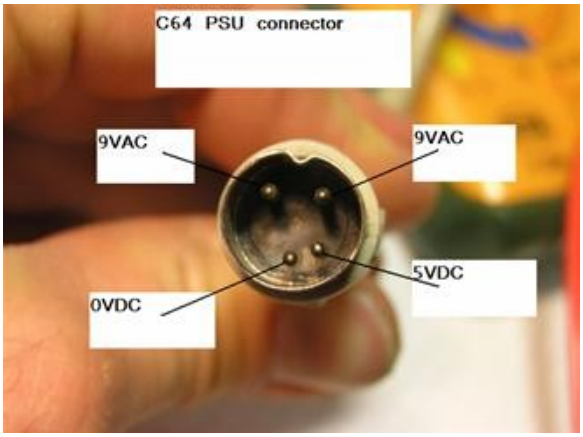
Connectors

Wiring of the output connector:

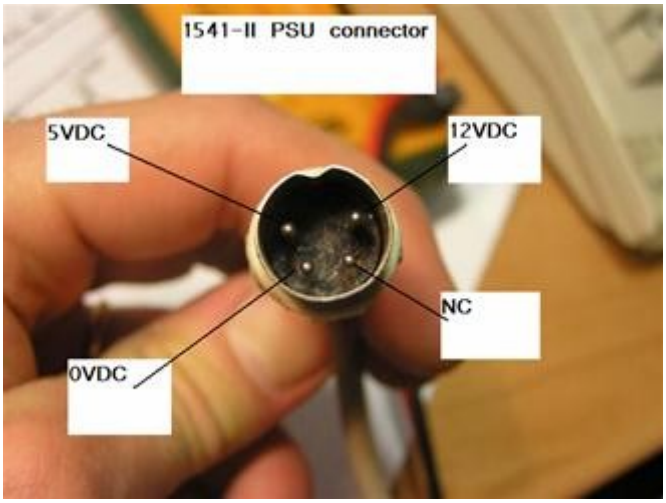


With knowledge about pin connection of every machine it is quite easy to create a suitable cable for each one. Here there are some references:

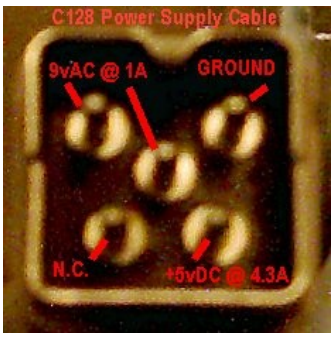
- **Commodore 64**



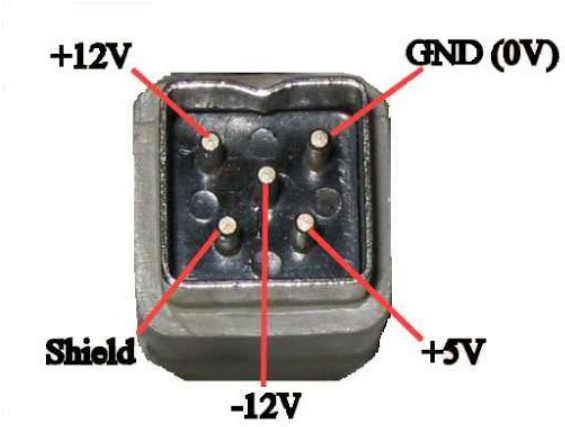
- **Commodore 1541-II / Amiga CD32 / Commodore 65**



- **Commodore 128**

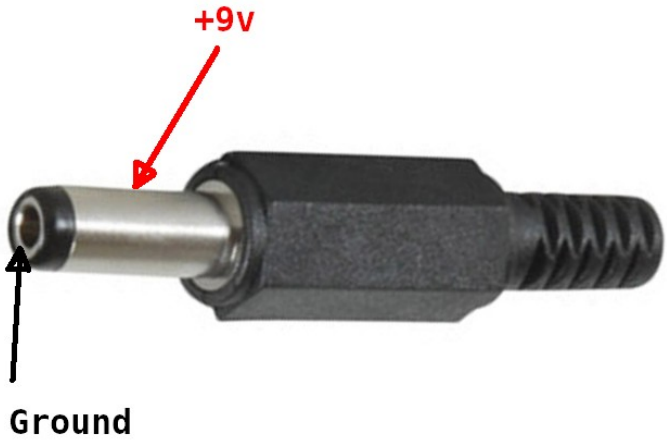


- **Amiga 500/600/1200**

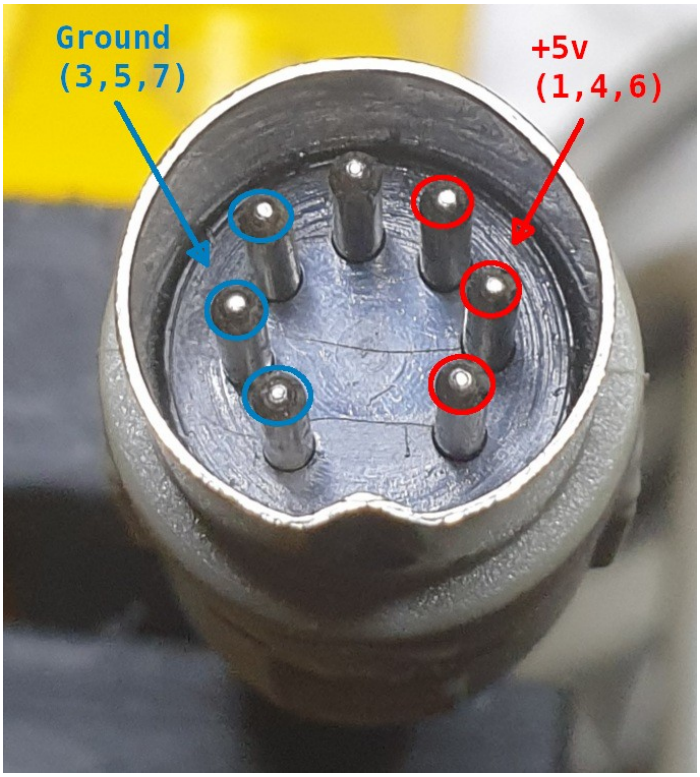


- **Sinclair ZX80/ZX81, Atari CX 2000/2600**

- **Sinclair Spectrum and Commodore 16**
  (not suitable for ZX Spectrum (black)+2a/b or +3)



- **Atari 600XL, 800XL, 130XE, 800XE, 65XE, XEGS**



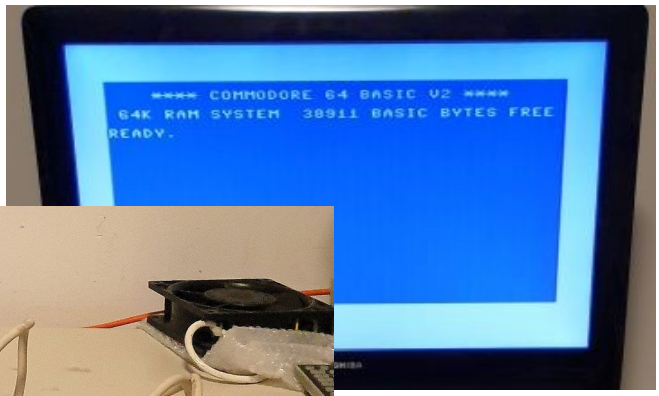
Example cable for Spectrum/C16 and Amiga

The idea is to use different color cable depending on the destination computer, but also put a sticker on the connector to better identify the cable.

Testing

The 2 prototypes, all output on on the upper one.

Testing on a C64



An Amiga 500 + A590 and a Sinclair Spectrum all running simultaneously