



ESoCoP

European SOciety for COmputer Preservation

Restoration of Commodore SuperPET

written by Sergio Gervasini and Stefania Calcagno for ESOCOP
The European Society for Computer Preservation
<http://www.esocop.org>

Restoration of Commodore SuperPET

© 2023 by the European Society for Computer Preservation <http://www.esocop.org>

Table of Contents

License.....	3
Copyright (c) 2023 Esocop – The European Society for Computer Preservation.....	3
References.....	3
Introduction.....	4
Our machine.....	5
Initial Check.....	7
Fixing.....	8
6502 main board (ASSY 8032090).....	8
Fixing ROM.....	9
Fixing RAM.....	13
Waterloo board (with 6809 CPU).....	15
CPU check.....	15
ROM check and fix.....	16
RAM check.....	19
Fixing the Chassis.....	19
Final testing.....	20

License

Copyright (c) 2023 Esocop – The European Society for Computer Preservation.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, no Back-Cover Texts and with these Front-Cover Texts:

Restoration of Commodore SuperPET
written by Sergio Gervasini and Stefania Calcagno for ESOCOP – The European Society for Computer Preservation
<http://www.esocop.org>

A copy of the license is available on Esocop's site and can be obtained here:

<http://www.esocop.org/gnu/gnu-1.3-license.txt>

References

PET index – SuperPET by André Fachat:

<http://www.6502.org/users/andre/petindex/superpet.html>

Bo Zimmerman page about SuperPET:

<https://zimmers.net/cbmpics/csp9000.html>

Schematics of SuperPET:

<http://www.zimmers.net/anonftp/pub/cbm/schematics/computers/pet/>

xAD / nIGHTFALL page about repair of the SuperPET (italian):

<https://www.nightfallcrew.com/30/01/2018/commodore-mmf-9000-superpet-9000-repair-testing/?lang=it>

PETTESTE2K – by David E. Roberts – test aid for PET computers

<https://www.esocop.org/docs/PETTESTE2K.zip>

(see also: <https://drive.google.com/drive/folders/1fyLbr1kcG98a2FDOMo1H5pj9lIdJpHcx>)

Introduction

The Commodore SuperPET (or in Europe MMF – MicroMainFrame) 9000 was designed at the University of Waterloo in Canada for teaching programming.

In addition to the basic CBM 8032 hardware, the 9000 added a couple of board (or a single board in the most recent versions) with a Motorola 6809, 64k of RAM and all the logic to switch between the boards.

A lot of interesting and useful programming language were available for the 6809, such as: ANSI Minimal BASIC-compatible, APL, COBOL, FORTRAN, Pascal and a 6809 assembler, all provided on floppy disks.



Our machine

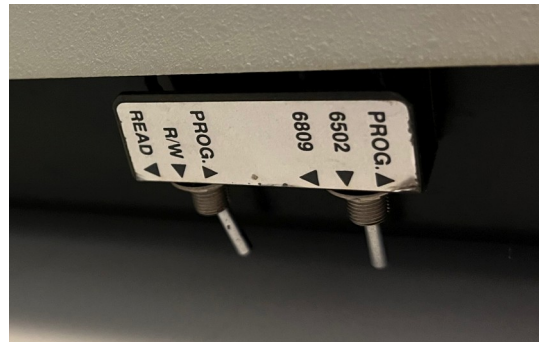
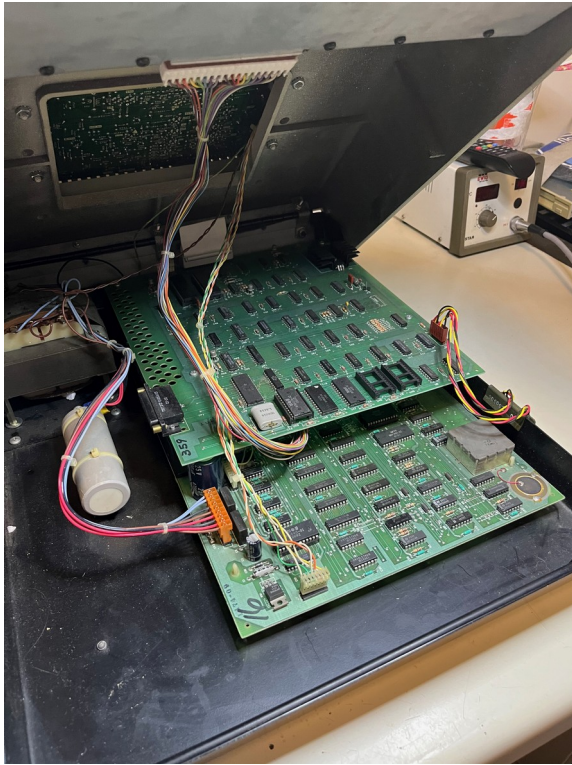


EsoCoP found this machine in Canada few years ago, but the restoration work was postponed for a long time, until the 2023 when we started the work.

This is one of the most recent machines, with a single add-on board.

In the next pages we'll show the status of the machine when we received it. In general the conditions were not too bad, excluding a notable chassis repair.

Restoration of Commodore SuperPET

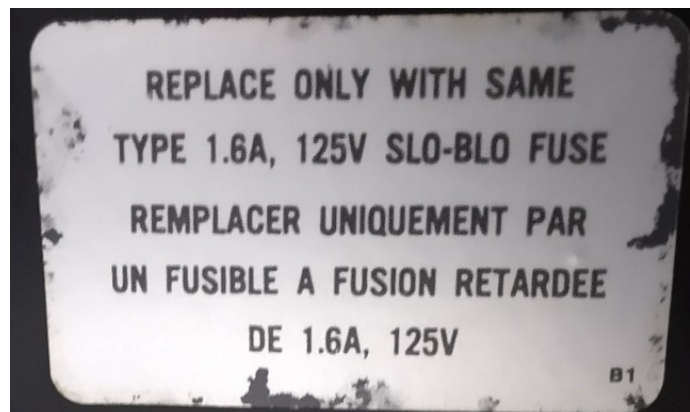


Restoration of Commodore SuperPET

Initial Check

The 115v power supply needs a transformer to work on European 230v network. We used a portable transformer.

The fuse blew a few times, then we decided to use a slo-blo fuse, however as suggested on the SuperPET backlabel .



We verified the power supply and the tensions were correct, but the machine did not give any sign of life both in 6502 and 6809 modes.

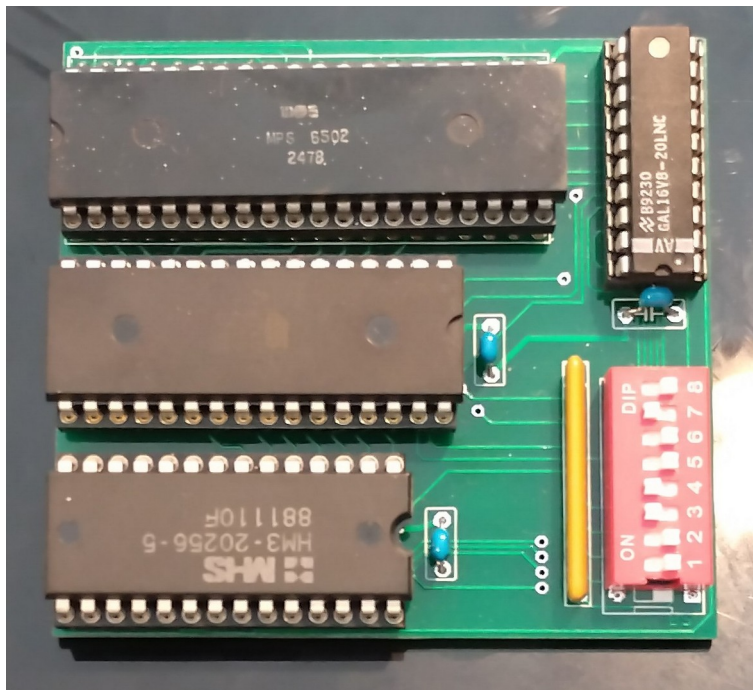
First of all we removed completely the 6809 waterloo board and started to resolve problems on the motherboard, labelled "Universal Dynamic PET – ASSY NO 8032090" which is the PET 8032 standard board.

Fixing

6502 main board (ASSY 8032090)



We did use a diagnostic kit to identify problems in a fast and efficient way. This diaboard must be placed in the 6502 CPU socket and with this kit it is possible to switch on and off Rom and Rams from the mainboard (using the built in versions at their place) and to verify that all the rest is working properly or not too.

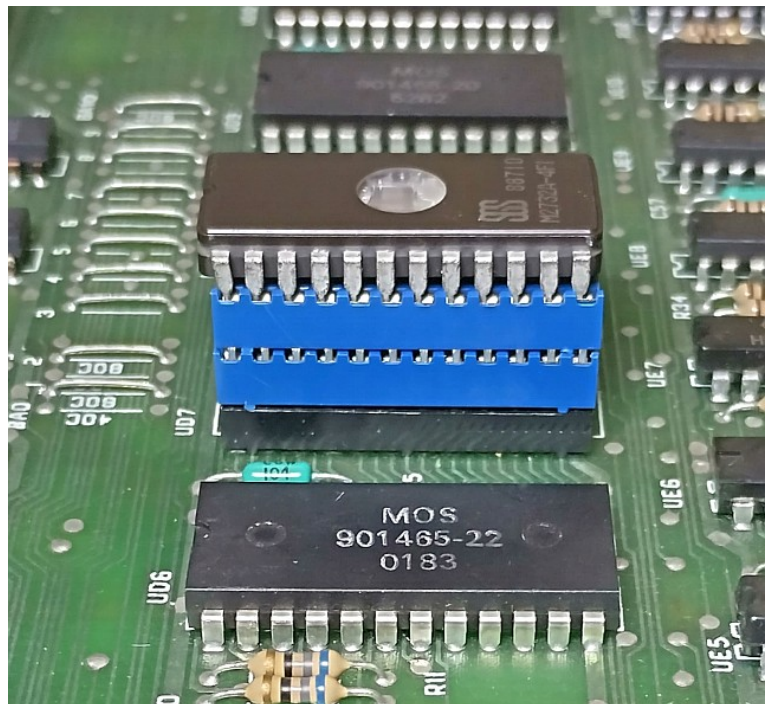
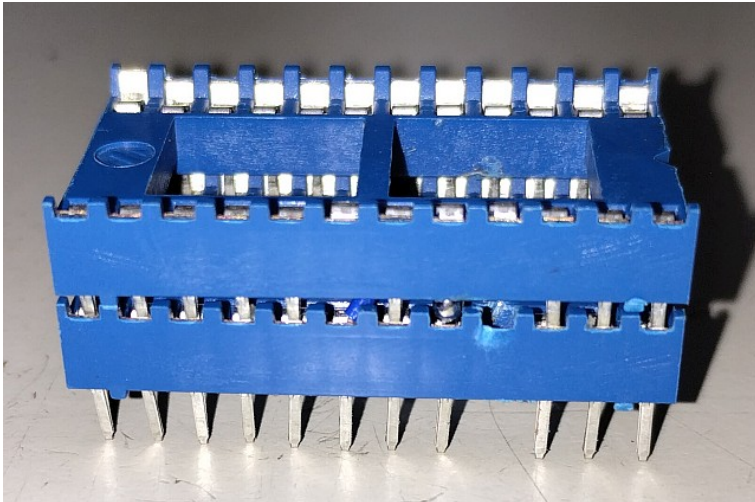


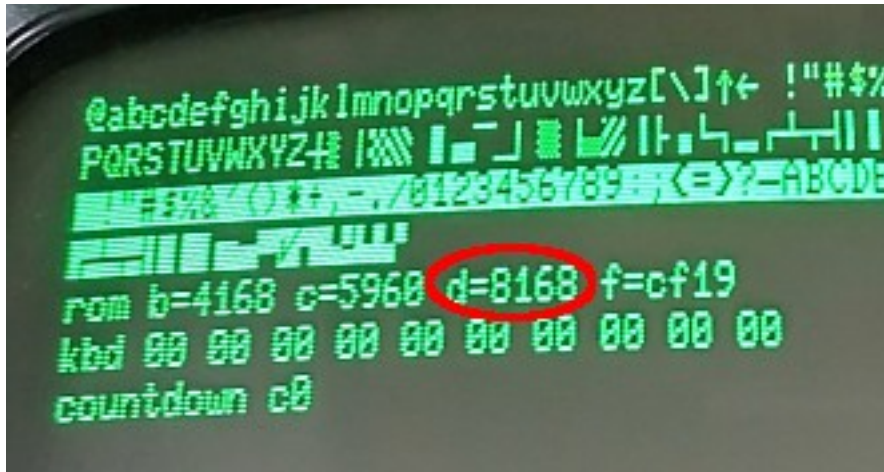
Switching off the ROM we finally got the basic prompt, even if with a smaller amount of available RAM.

We have surely a problem on the ROM, and on the RAM too.

Fixing ROM

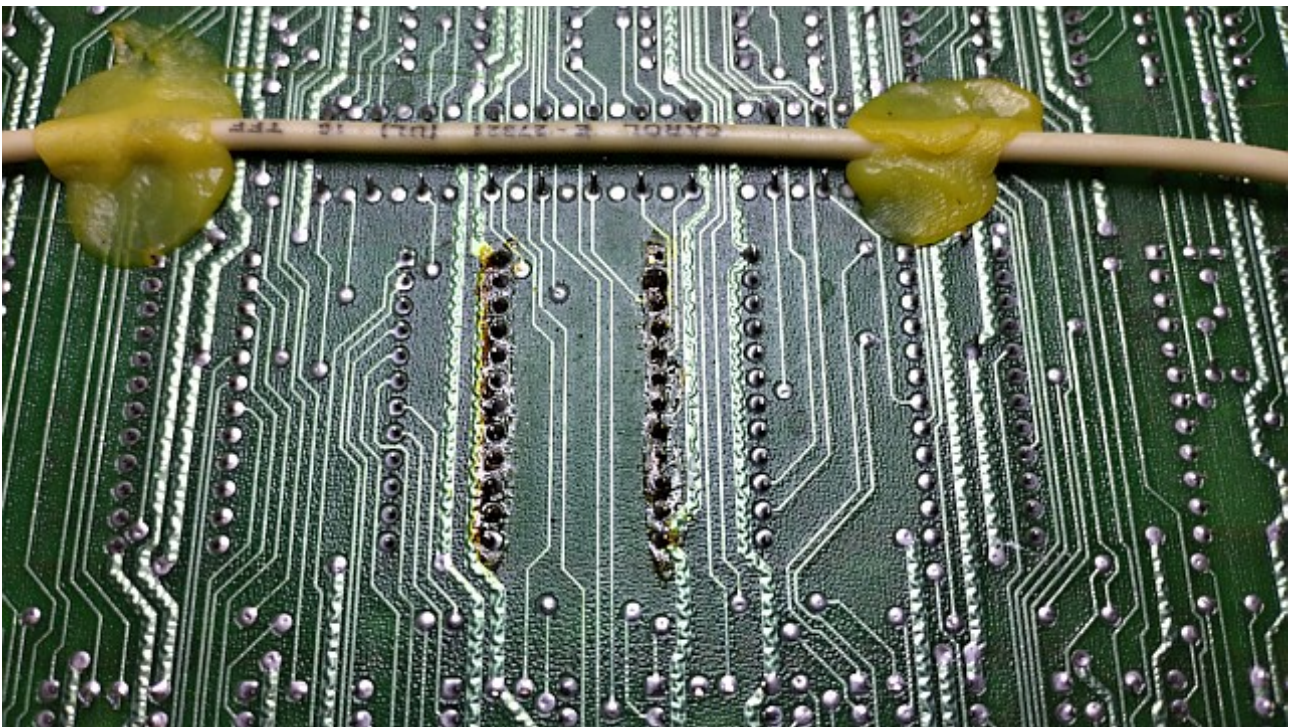
To acknowledge which was the faulty ROM we used a tool created by David E. Roberts (see references) and we built an adaptor in order to use a standard 2732 Eprom at its place.





The Rom checksum at address \$D000 should have been \$A425 while we got \$8168, this way we identified the faulty ROM.

While disassembling the motherboard to place a socket on it, we noted that someone already did some work on that ROM, clearly without success.



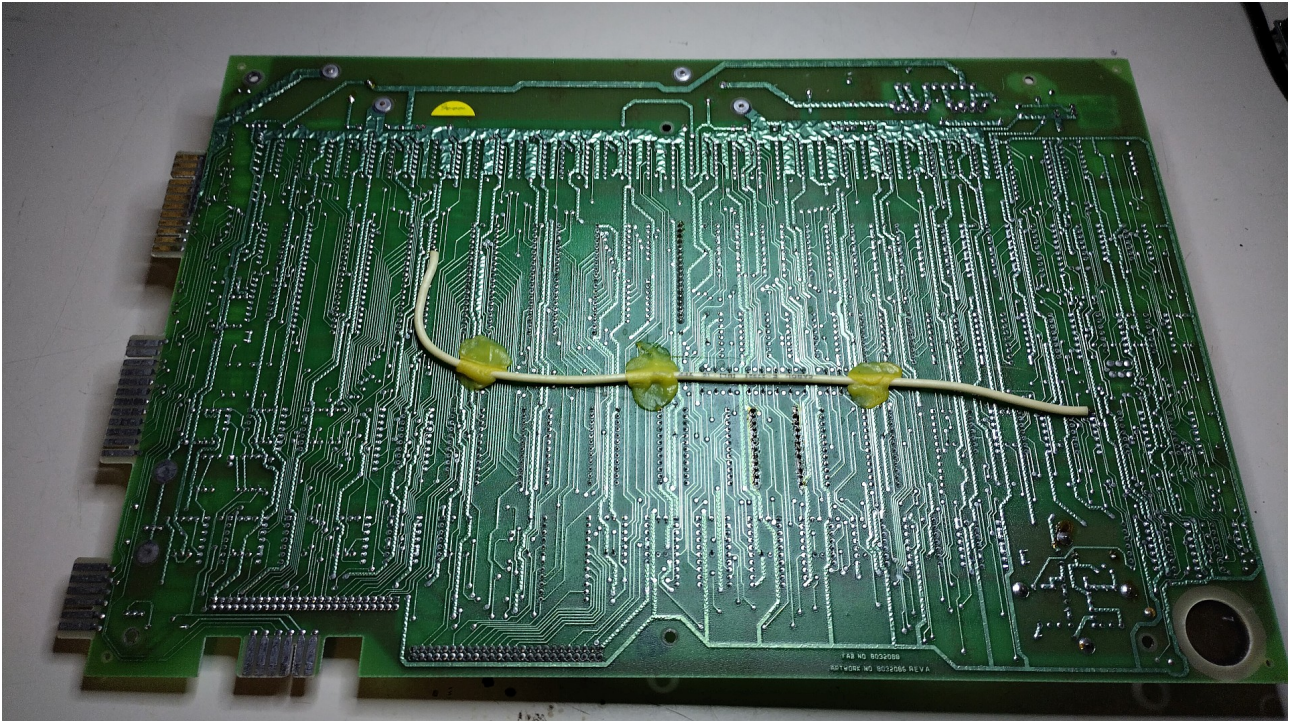
Once installed the socket we had to create a new adaptor in order to use a 2732 Eeprom instead of the 2332 Rom.

There are various type of adaptors ready to use on the market, but all have a defect that usually does not give any problem, but on a SuperPET it become critical: the NOROM signal, which permit to disable all the roms on the motherboard, it is not connected, and it prevents the Waterloo board operation.

That's why we added an NPN transistor with NOT function to invert the signal and send it to the \overline{CE} of the 2732.

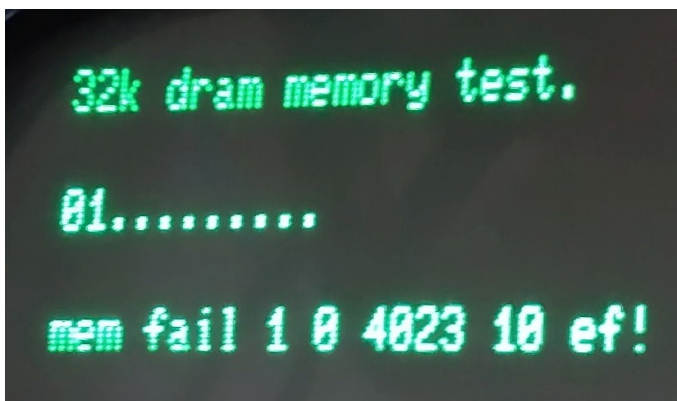
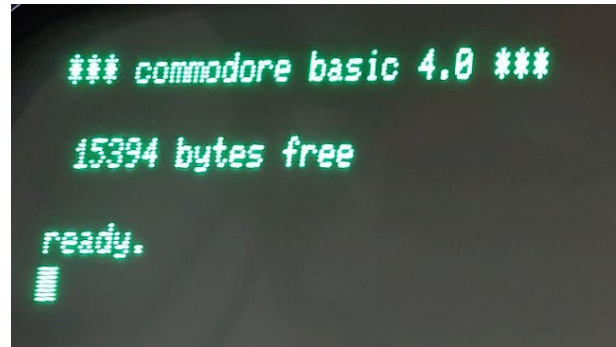


Note: on the mainboard it is present a cable which connects the 6502 CPU pin number 35 to the pin 1 of the UD3 chip (74LS393). It's not totally clear why it is connected that way, in doubt we left it there.



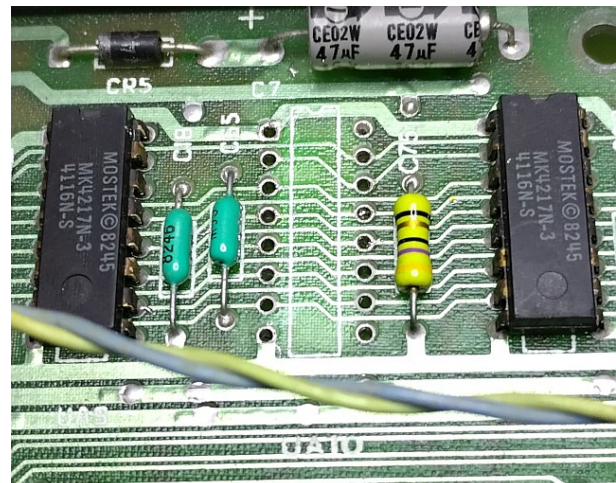
Fixing RAM

As we already told, the RAM amount available at bootstrap is lower than it'd be (32k). We need to find the broken chip.



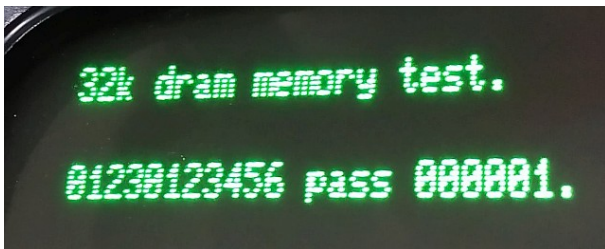
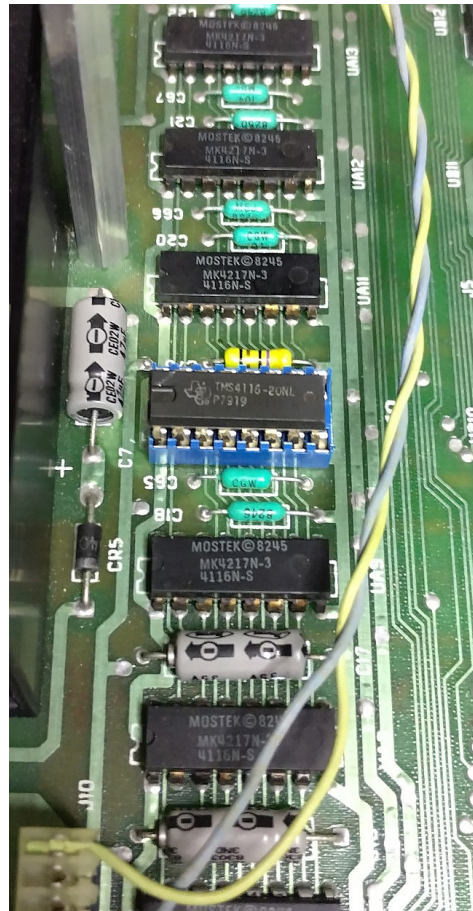
We used the same diagnostic kit we used for the ROM to identify the faulty ram. As soon as we started to test rams we immediately found the guilty. It was UA10.

We unsoldered the guilty chip.....

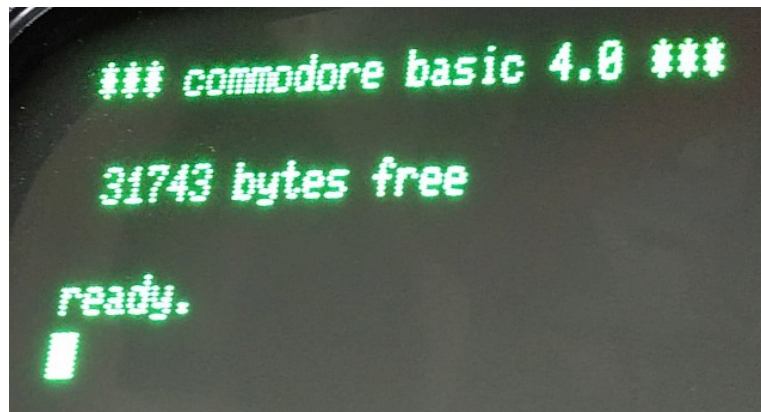


...and we put a socket and a "new" chip.

As soon as we changed the faulty ram (even if we used a really different ram, both as manufacturer and by age), the computer started to work perfectly.



Finally bootstrap shows the correct value and the 8032 is definitely working fine.



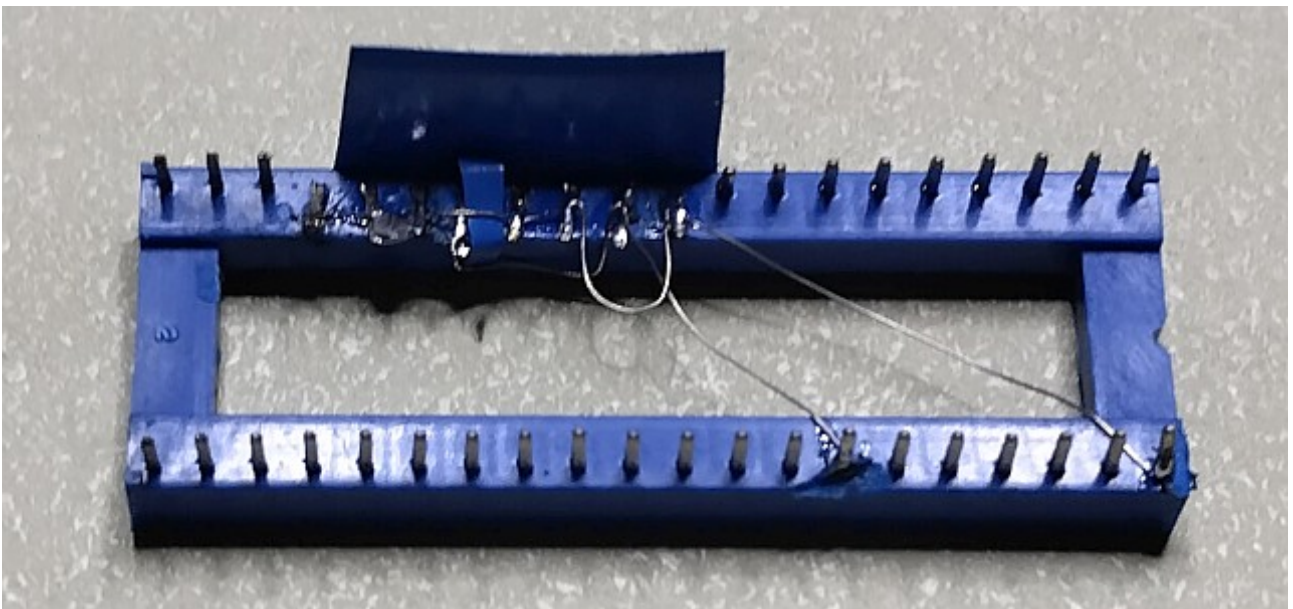
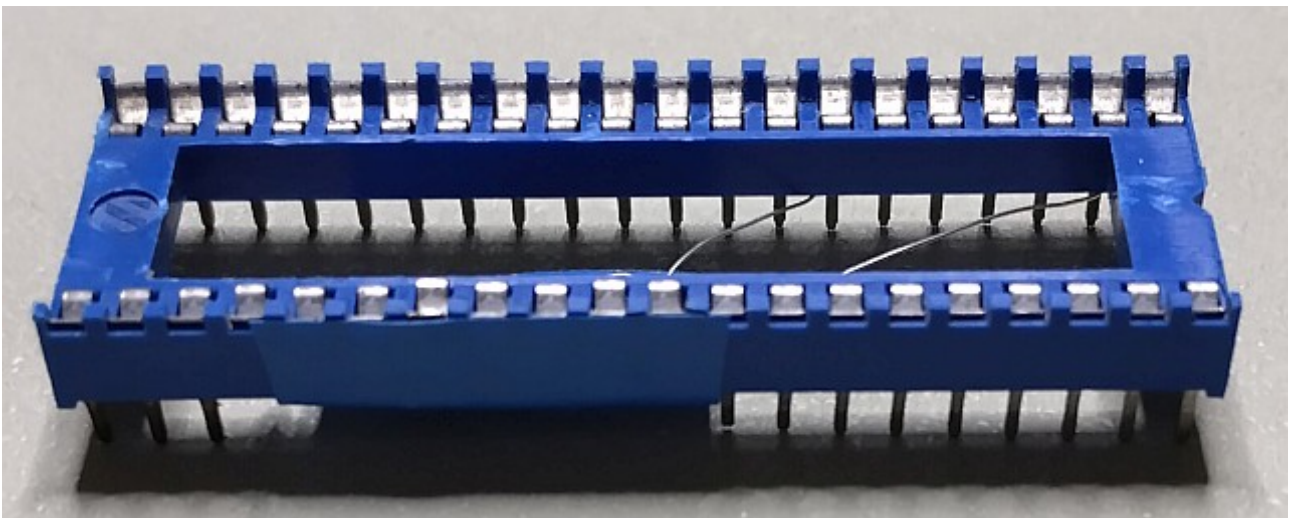
Restoration of Commodore SuperPET

Waterloo board (with 6809 CPU)

There aren't available any diagnostic tools for the waterloo board, so we had to measure everything with oscilloscope.

CPU check

To check the 6809 CPU we built an adaptor which simulates NOP instruction to the CPU, in this way we could see address forwarding on the relative lines. The CPU was correctly working.



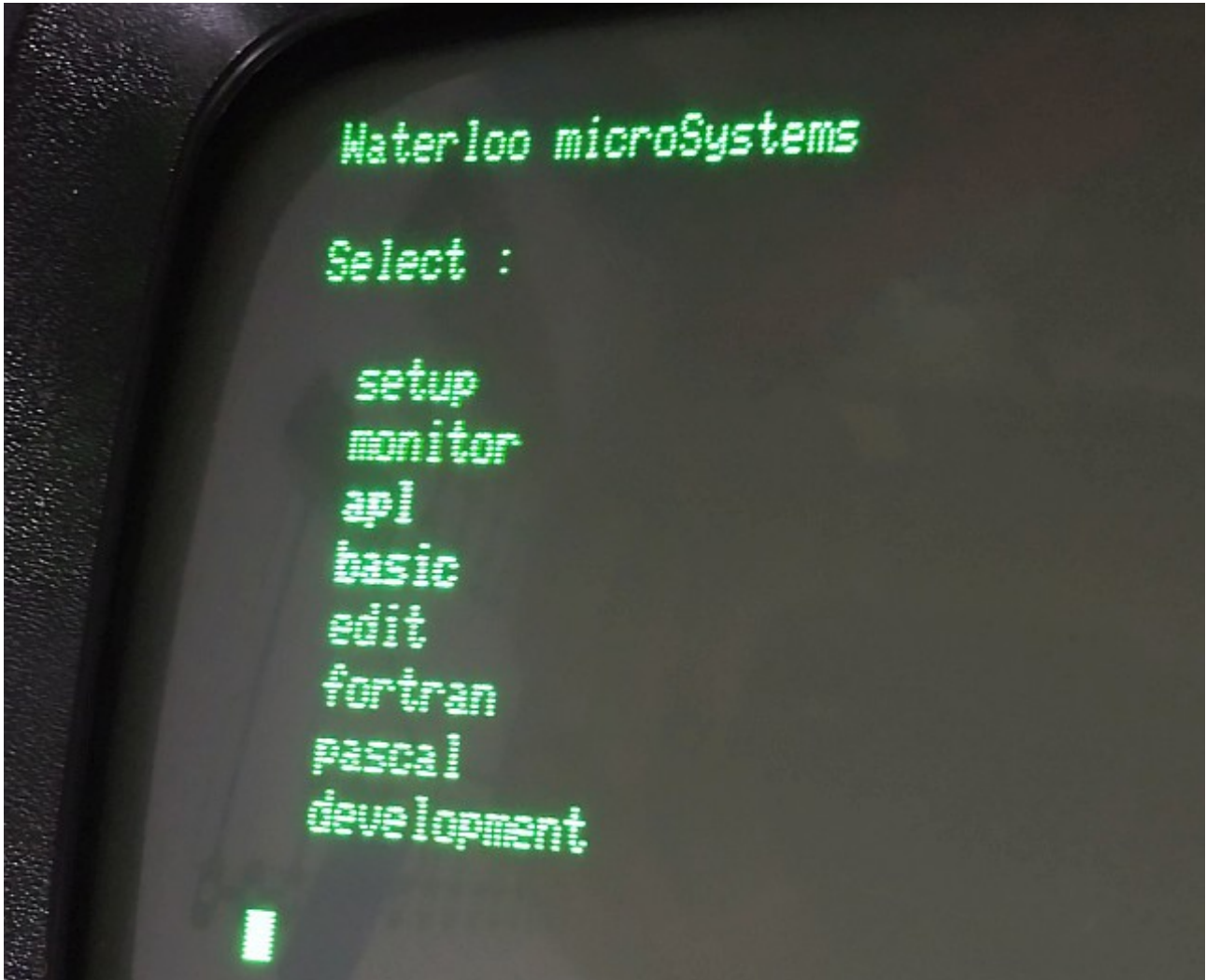
ROM check and fix

As there is no diagnostic available and since there's one rom socket-mounted only, we replaced it to verify if it was the guilty.

We needed to create another new adaptor in order to install a 2764 standard Eprom replacing the 2364 ROM.



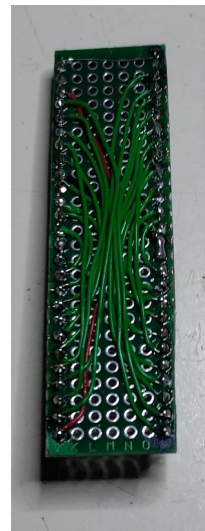
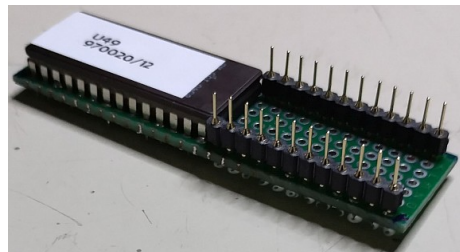
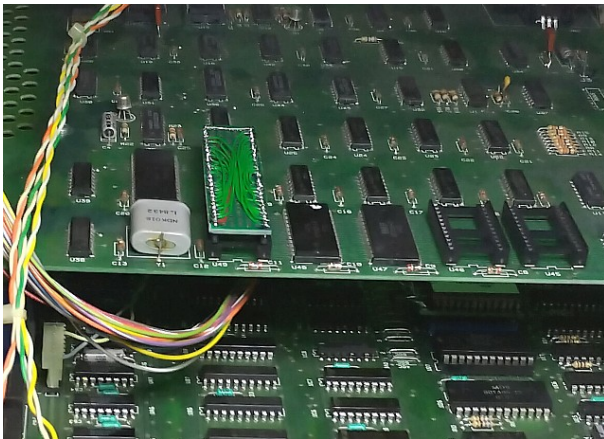
Well, actually it was really the rom damaged, and we finally have seen the correct Waterloo prompt:



Sadly when we tried to close the case we noticed that the Eprom and its adaptor shared the same place of the keyboard connector..... it was not going to close.



We created a new adaptor, without the eprom socket, and we solved the problem both in height and size.



Restoration of Commodore SuperPET

RAM check

Since as we already said there's no diagnostic available for the Waterloo we used the built-in monitor program

With this software we have been able to fill the memory with the Fill command (f 9000-9fff aa), changing from time to time the bytes we wrote in memory and we noticed with the Dump command (d 9000-) that all the locations were correctly written.

With the Bank Switch command (b 0 , b 1 ...) we moved through memory banks (there are 16 4kilobytes banks for a grandtotal of 64 Kilobytes).

Everything went fine and we declared the RAM working.

Fixing the Chassis

Our unit had a notable chassis repair, in fact it was broken and the repair was very visible.

Since it is very complex to fix this chassis in a perfect way we preferred to use another SuperPET 9000 chassis we had in our warehouse, sadly without the 6809 board.

We are actually looking for a 6809 board to insert into this old chassis, we already restored the 8032 board and it is perfectly working.

We will restore the chassis together with the "new" Waterloo board, if we'll ever succeed in finding one.



Final testing

At the moment we are writing this document we simply tested the ROM resident softwares, in the next days we will verify all the external software provided in Floppy disks.





Restoration of Commodore SuperPET



Restoration of Commodore SuperPET