Rudy's Retro Intelligence

Commodore Super PET - SP9000

3 Board Version Diagnostics Manual

Version 1.6 Created in September 2024

Created by Rudy's Retro Intel

The purpose of this manual is to help identifying issues and the repair of a Commodore SuperPET (SP9000) computer that has 2 boards along with the 8032 motherboard (3 boards in total). Excluded from this manual is the repair of the 8032 motherboard which is used in the SuperPET. A separate document may be made available soon.

This manual will only cover the **SuperPET with the "3 daughter board version"** The 2 board versions with is not covered in this manual, however you can find that manual on my GitHub here:
https://github.com/RudyRetroIntel/Vintage-Computer-Diagnostics

The SuperPET boards I used to create this manual is the:

SUPER PET BD.BMB 810219 @1981
FAB NO. NA
ARTWORK NO. NA

For the latest version of this document and other diagnostic manuals, use the links below.
https://github.com/RudyRetroIntel/Vintage-Computer-Diagnostics

You can find my videos here.
https://www.youtube.com/@RudysRetroIntel

Contributors

Chuck Hutchins - Technical help with his many years of experience on the Commodore computers. Have a look at his collection and knowledge on his YouTube channel: https://www.youtube.com/@HutchCA

David Bradley - Provided several SuperPET boards for comparisons which allowed me to take measurement and fix my SuperPET board and several of his boards. See his many Commodore related videos here:
https://www.youtube.com/@DRBradleyPhotography

"Sharing knowledge, we can ensure that the Commodore SuperPET computers can be repaired and enjoyed now and into the future. Rudy's Retro Intel"

***** This document is based on the work I have performed on my Commodore SuperPET (SP9000) computer and is provided "as is". I\we do not take any responsibility for errors and\or damages that may occur when repairing your Commodore SuperPET (SP9000) computer. This is information is provided freely to all SuperPET computer owners. Please ensure you know how to perform electronics\electrical work. If not, please contact someone who has these skills before starting. *****

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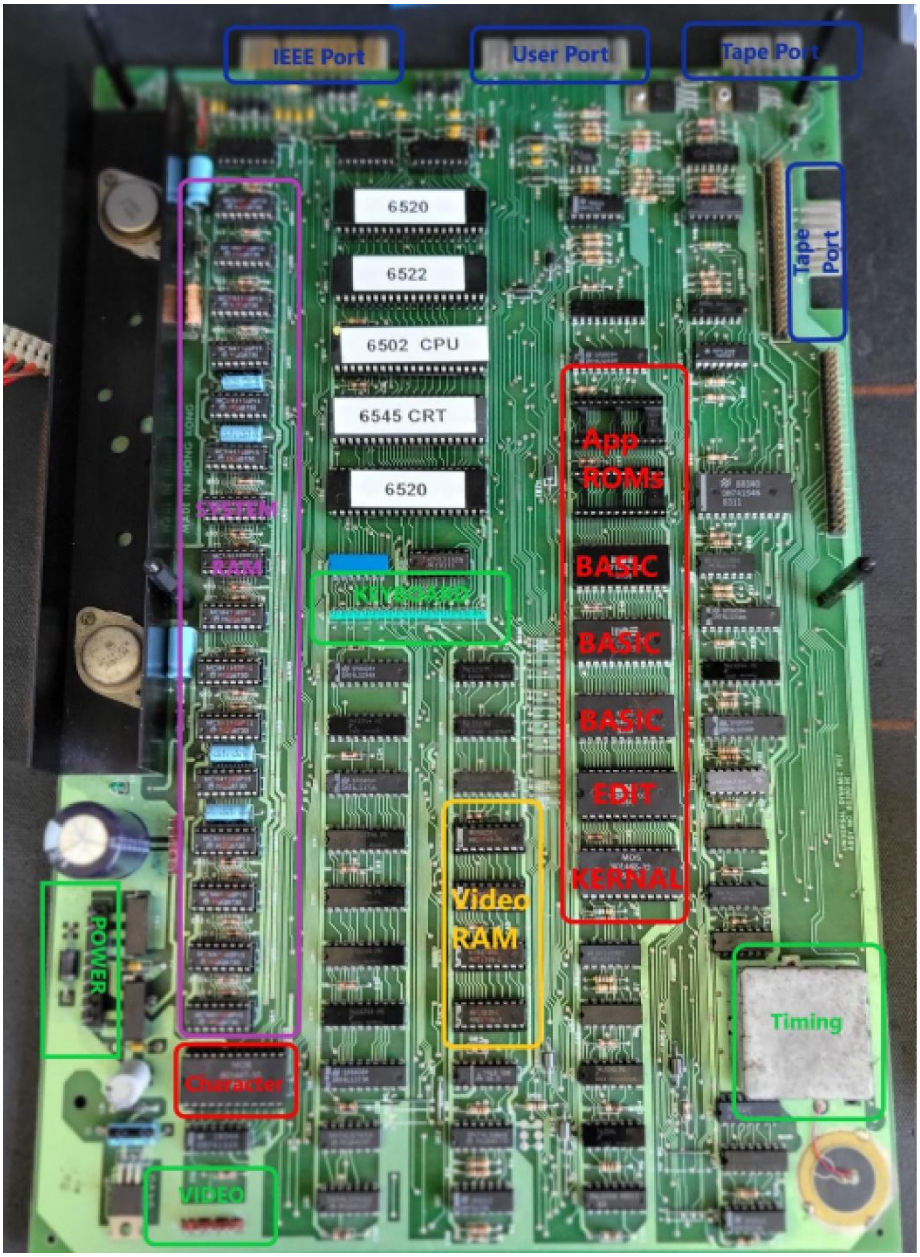
SuperPET Motherboard Modifications (8032)

The SuperPET computer was built on a Commodore PET 8032 computer which helped to reduce cost of designing a completely new computer system.

8032 Motherboard with identifications



Commodore PET 8032

Original
901465-19: BASIC ROM
901465-20: BASIC ROM
901465-21: BASIC ROM
901465-22: KERNAL ROM
Character ROM: 901447-10

BASIC ROM Bug Fix
901465-23: BASIC ROM
901465-20: BASIC ROM
901465-21: BASIC ROM
901465-22: KERNAL ROM
Character ROM: 901447-10

6545 used in 12"inch screen PETs for H-Sync and V-Sync

6522 VIA (Versatile Interface Adapter)

6520 PIA (Peripheral Interface Adapter)

Video RAM
4 x 2114 RAM ICs

Main System RAM
16 x 4116 RAM ICs

CPU: 6502 (1 Mhz)

https://www.youtube.com/@RudysRetroIntel

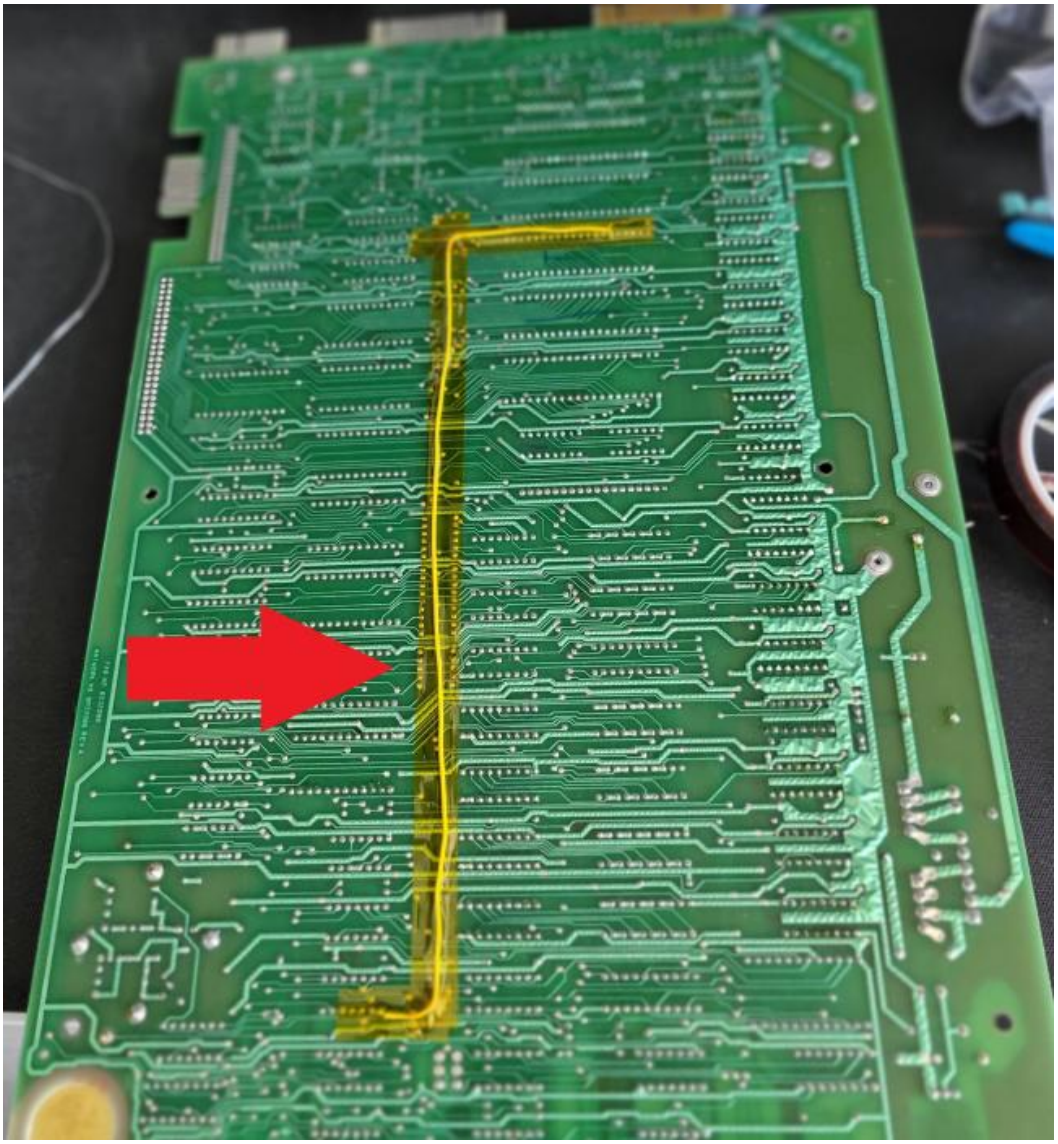
In order to get the PET 8032 (8032) to work as a SuperPET, there are 2 modifications needed so that it will work with the SuperPET daughter board.

- Motherboard jumper wire installation
- Upgrade the Character ROM

Motherboard jumper wire installation

A jumper wire is needed to pass through a clock signal from the 8032 to the daughter board

Verify\Install a wire from **UD3** pin 1 - 74LS393 connected to **U17** pin 35 – 6502 CPU

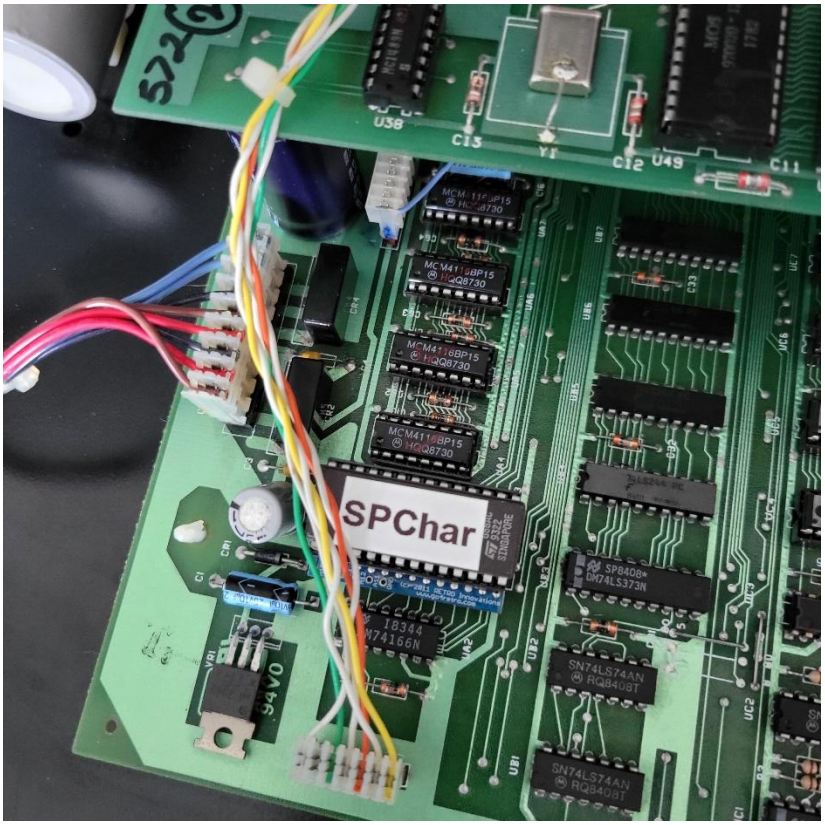


Character ROM modification

The character ROM is the 901340-01 which is different from the original character ROM found on the 8032 motherboards.

SuperPET character ROM, is made of 2 halves. The first have the original 8032-character ROM and the second half of this ROM contains a true ASCII character set and an APL character set. Without this modified character ROM, the SuperPET board will not work.

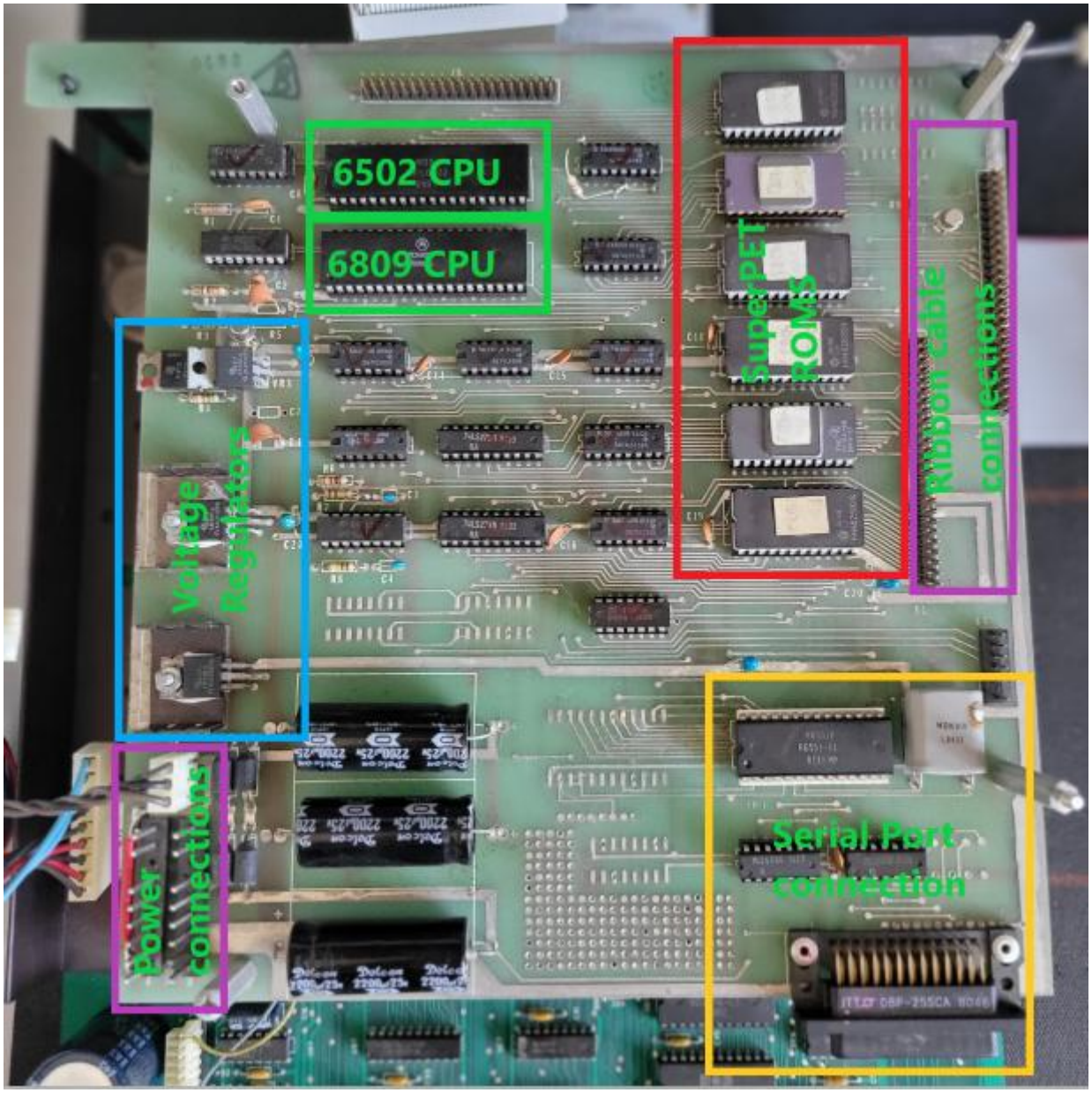
You can find the ROM image file here:
https://www.zimmers.net/anonftp/pub/cbm/firmware/computers/pet/SuperPET/index.html



The Commodore SuperPET is comprised of the following:

- Commodore 8032 motherboard with modifications.
- 2 Daughter board (lower and upper boards) which connects to the 8032 via a ribbon cable and a power cable.

Super PET Lower Board – top view

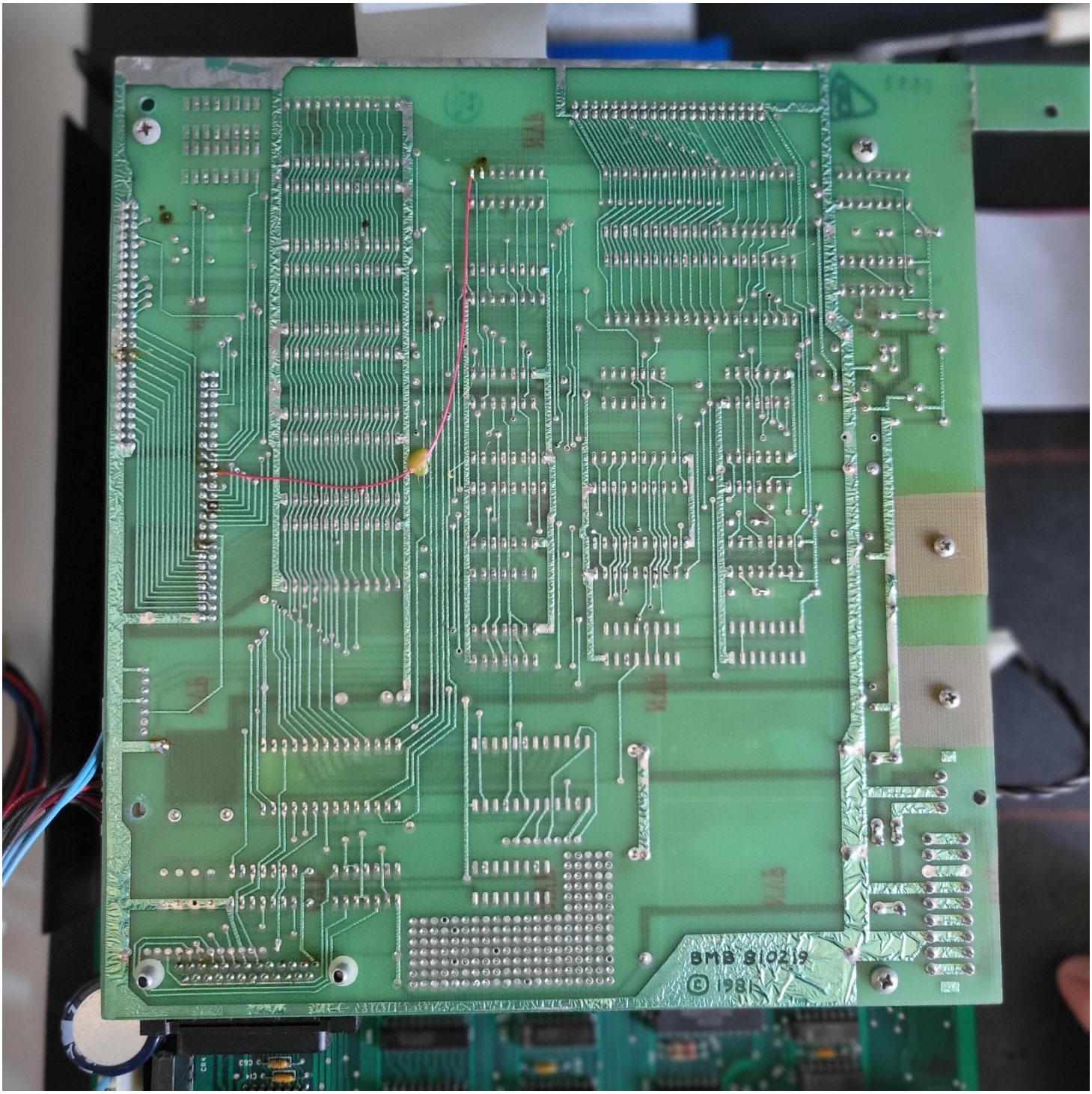


- Check to ensure the ribbon cable is connect into the 6502 socket on the 8032 motherboard and to the SuperPET daughter board.
- Check to ensure the ribbon cable for the extended memory is connect to lower SuperPET board and the 8032.
- Check to ensure the power cable is connected from the 8032 motherboard and to the SuperPET daughter board.

SuperPET ROM Memory Locations

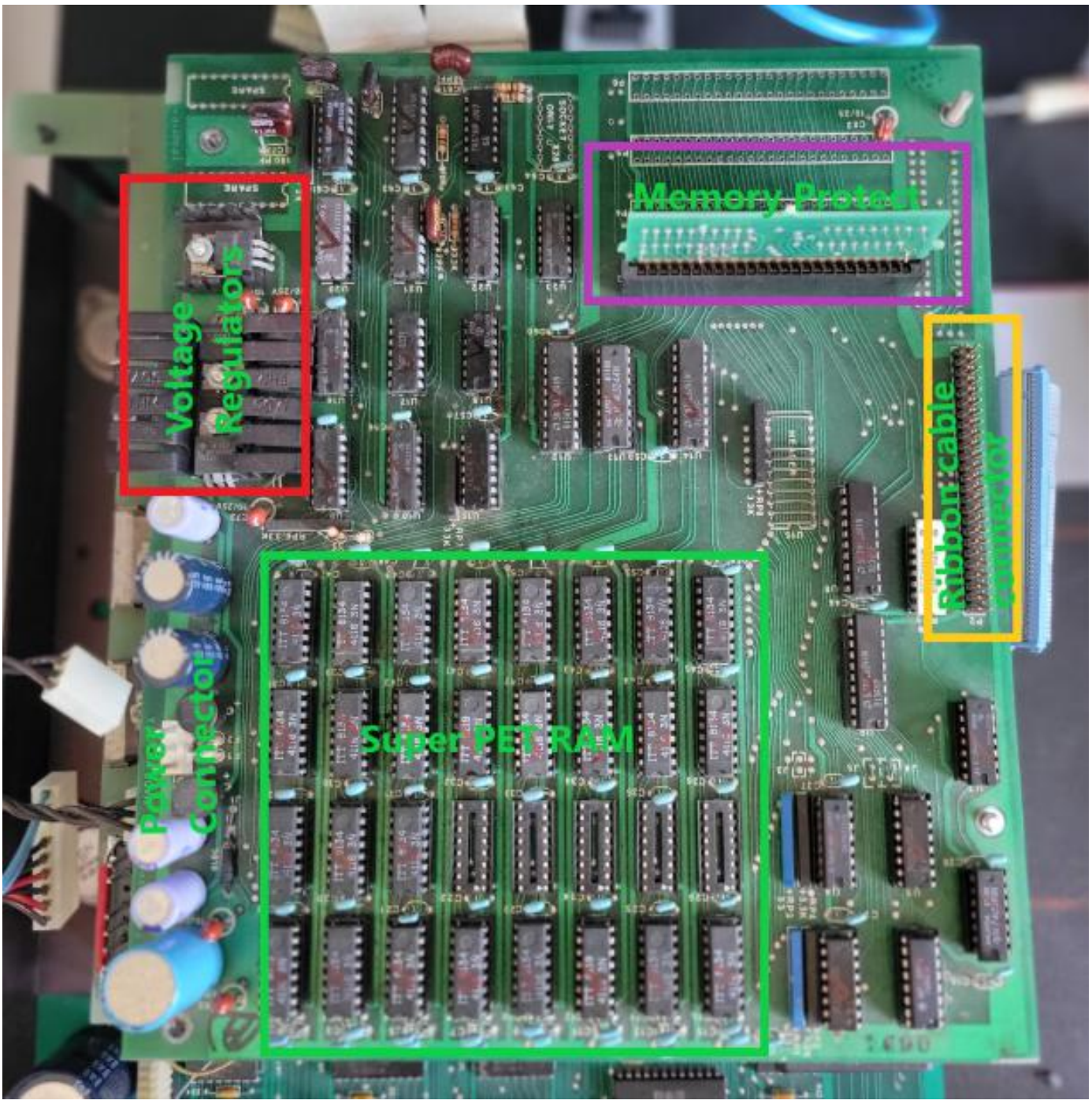
The EPROMs used are 2532 EPROM and has a storage capacity of 4KB

Super PET Lower Board – bottom view

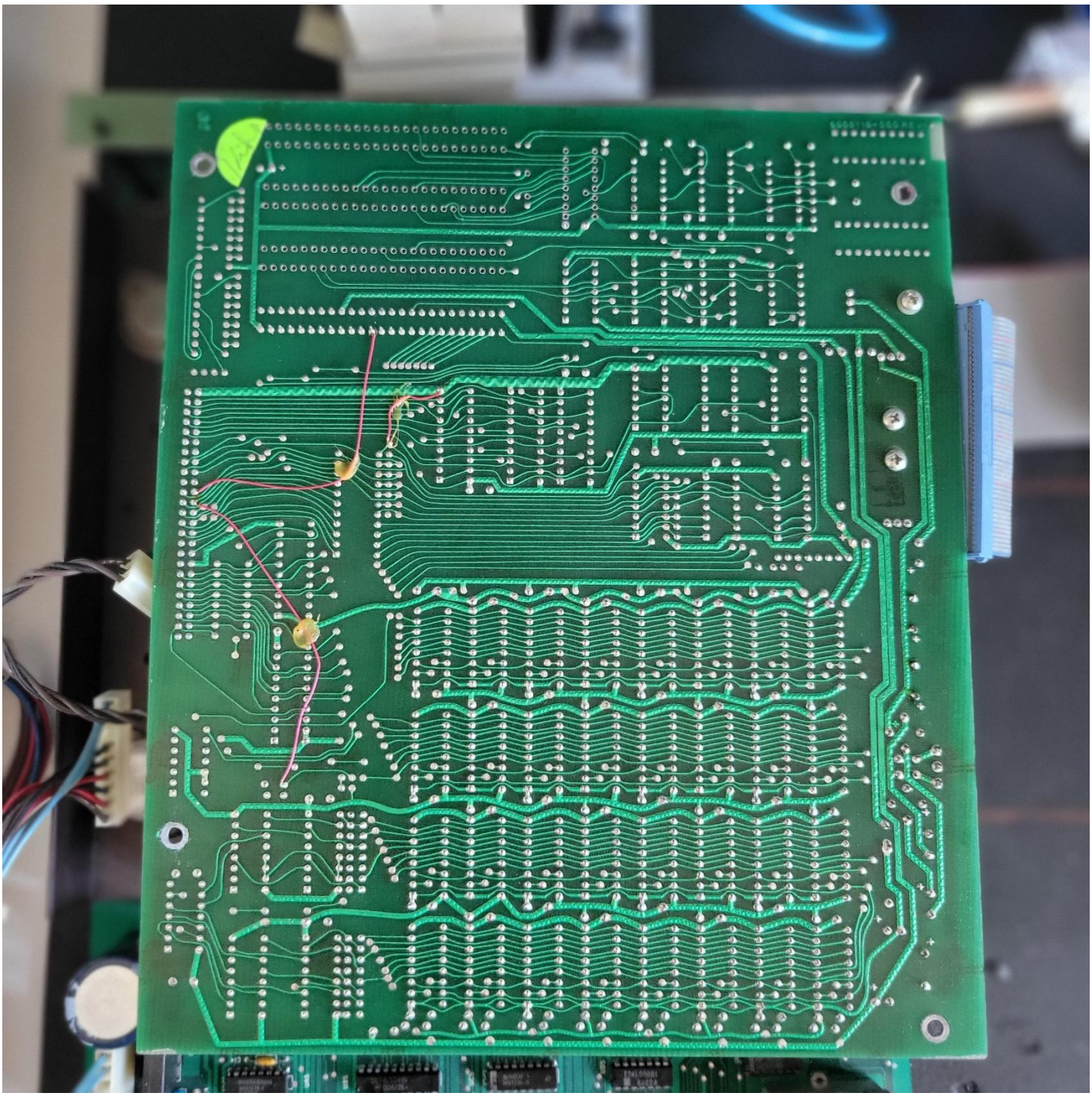


Verify that these jumper wires are in place.

Super PET Upper Board – top view

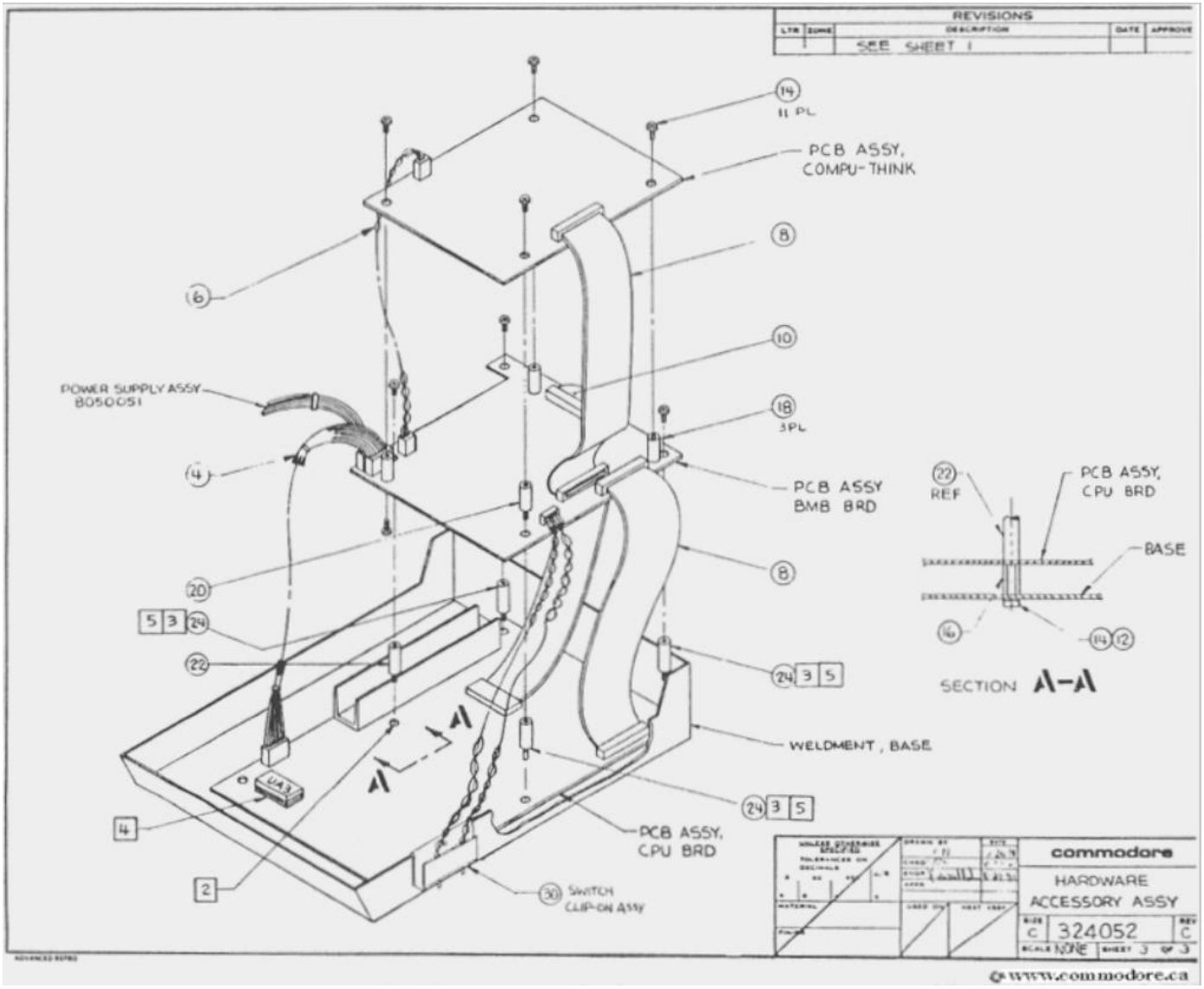


Super PET Upper Board – bottom view



Verify that these jumper wires are in place.

Assembly of the 3 SuperPET boards

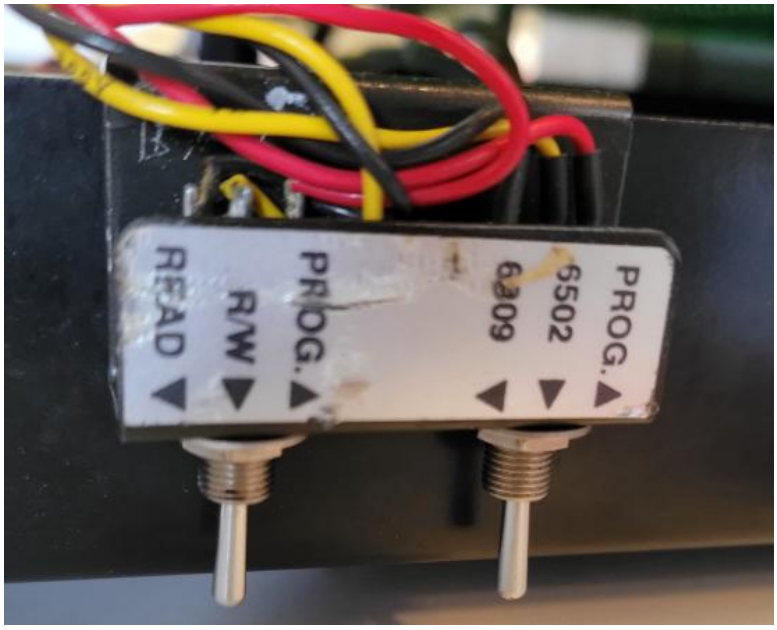


SuperPET Parts

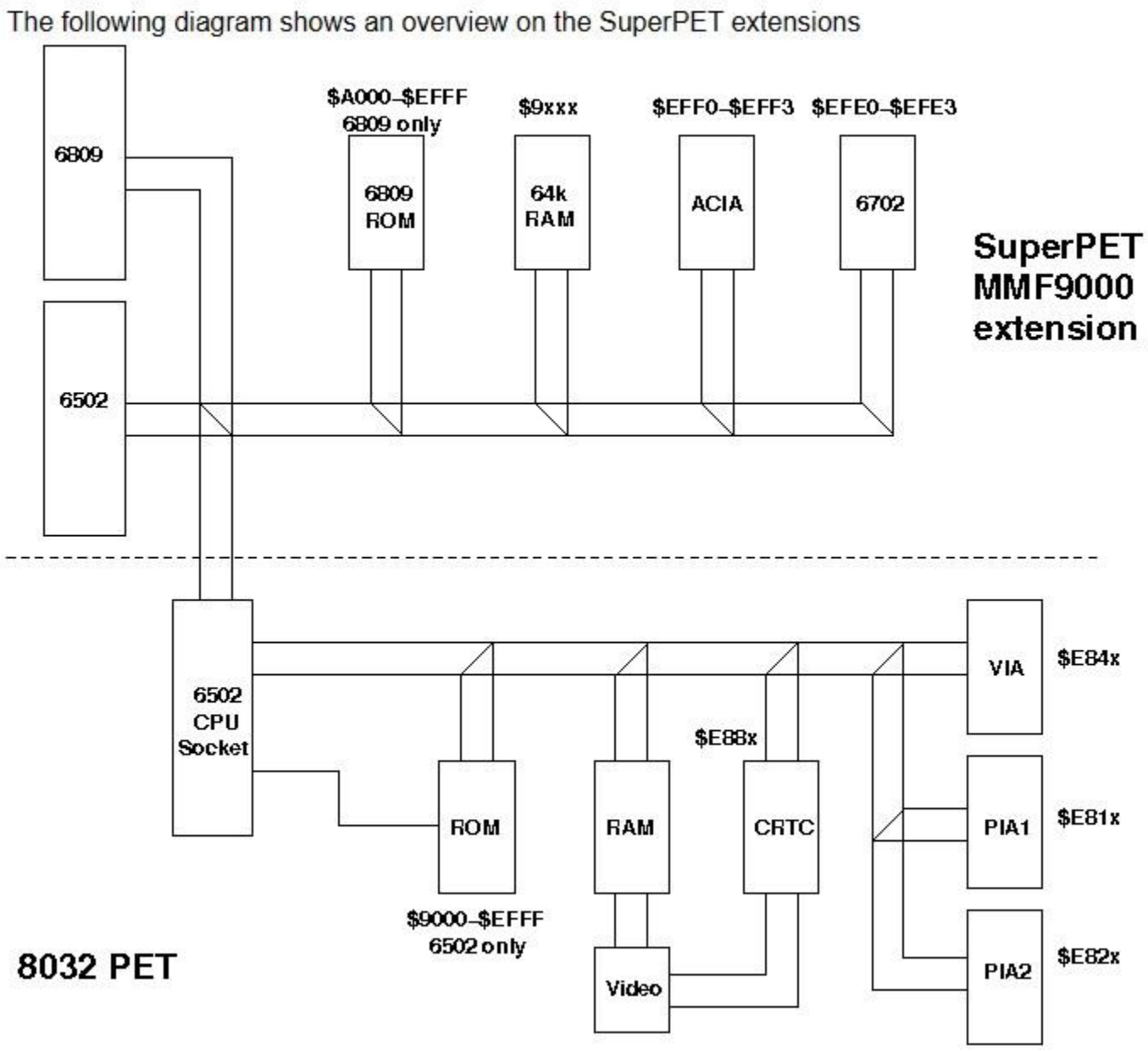
- RAM: 4116. Can be replaced with **4164 RAM ICs** as a substitute, with a few modifications.
    1. Bend pin 1 and pin 8 upwards so they no longer go into the socket's connectors.
    2. Connect pin 8 and pin 9 with a short piece of wire.
- EPROMS: HN462532G (2532 EPROM) with 4KB of capacity
- Voltage regulator replacements
    - **TIP 30 8129** can be replaced with **TIP42A**
    - **LM340-5** can be replaced with **LM340T-5 or 7805**
    - **7812C** can be replaced with **LM340-12 or 7812**

Switch Setting and Usage

For general purposes, leave the 2nd switch to **R\W** (Read and Write). The usage of these switches will not be covered in this manual. You can find the programming language manuals or SuperPET user manual for details on how\when to use these switches. The only switches used to repair a SuperPET is 1) leaving the memory switch to **R\W** and 2) switching between 6502 (8032 PET) and the 6809 (SuperPET) modes.



Basic Operation of the SuperPET



*Original diagram was found randomly on the internet. If you know who created this diagram, please let me know so that I can credit them in this document.

SuperPET Schematic

Full schematics which can be found here:
https://www.zimmers.net/anonftp/pub/cbm/firmware/computers/pet/SuperPET/index.html

SuperPET Symptoms and Diagnostics

In the following sections, symptoms are presented and diagnoses. Please note that there *could be several faulty\failed ICs*.

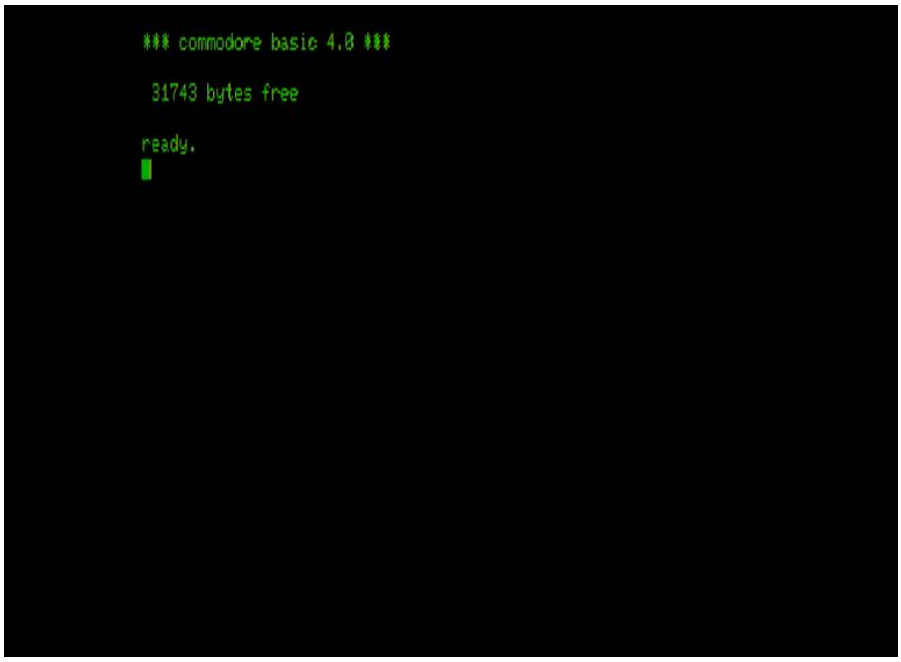
1. Ensure you remove all ICs in sockets and clean the sockets with an electronic cleaner before starting.
2. Check to ensure the ribbon cable is connect into the 6502 socket on the 8032 motherboard and to the SuperPET daughter board. Verify that the ribbon cable is good. With multimeter, check both ends of the ribbon cable for breaks and\or shorts.
3. Check to ensure the ribbon cable is connect from the lower SuperPET board to the upper board. Verify that the ribbon cable is good. With multimeter, check both ends of the ribbon cable for breaks and\or shorts.
4. Check to ensure the connector with 3 wires is connected from the lower board to the upper board. This is for power. Verify that the ribbon cable is good. With multimeter, check both ends of the ribbon cable for breaks and\or shorts.
5. Check to ensure the power cable is connected from the 8032 motherboard and to the SuperPET lower board. Ensure power is coming into the daughter board.
6. Check to ensure the power cable is connected from the 8032 motherboard and to the SuperPET lower board. Ensure power is coming into the daughter board.
7. Check voltages on all 7 voltage regulators.

The steps above are basic troubleshooting and will not be covered in this manual.

Symptoms: 6502 boots up, switching to 6809 mode produces a blank screen

Diagnoses: Check\replace A000 ROM at **U17**

Symptoms: 6502 works but when switching to 6809 you get the same screen or garbage. Keyboard not responding.



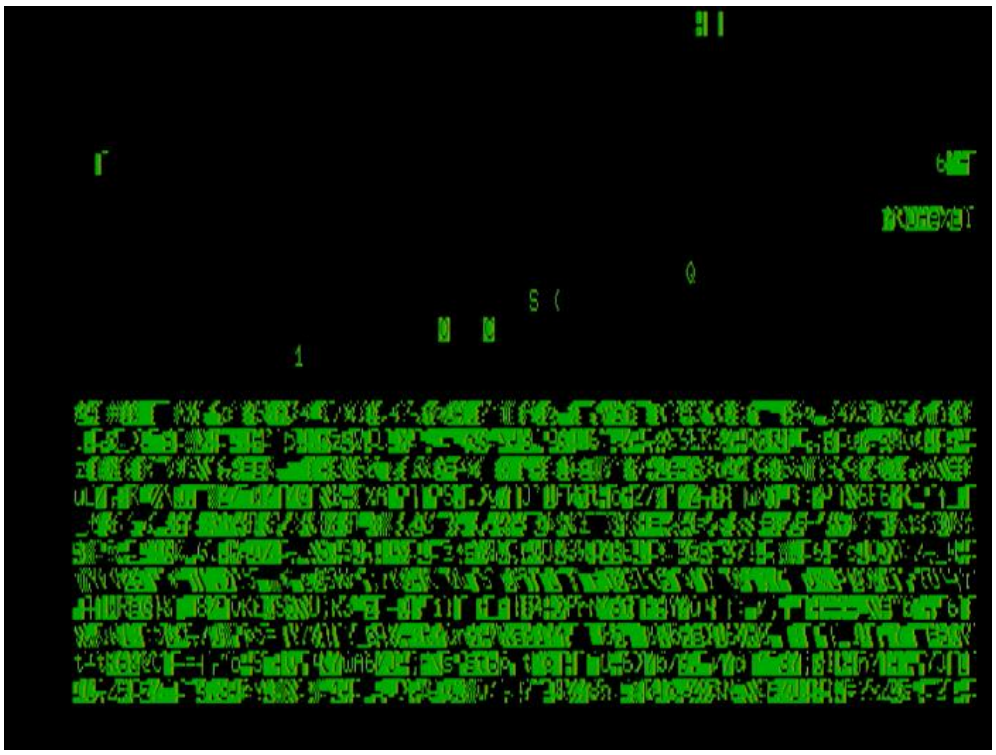
Diagnoses: Check\replace B000 ROM at **U18**, C000 ROM at **U19**, D000 at **U20**, E000 at **U21**,

74LS123 at **U2,** 6809 CPU at **U4**, 74LS00 at **U8** and check the ribbon cable at **J2**

Symptoms: 6502 works but when switching to 6809 you get a black screen.

Diagnoses: Check\replace F000 at **U22**

Symptoms: In both 6502 and 6809 modes, screen is full of garbage characters and screen is flashing

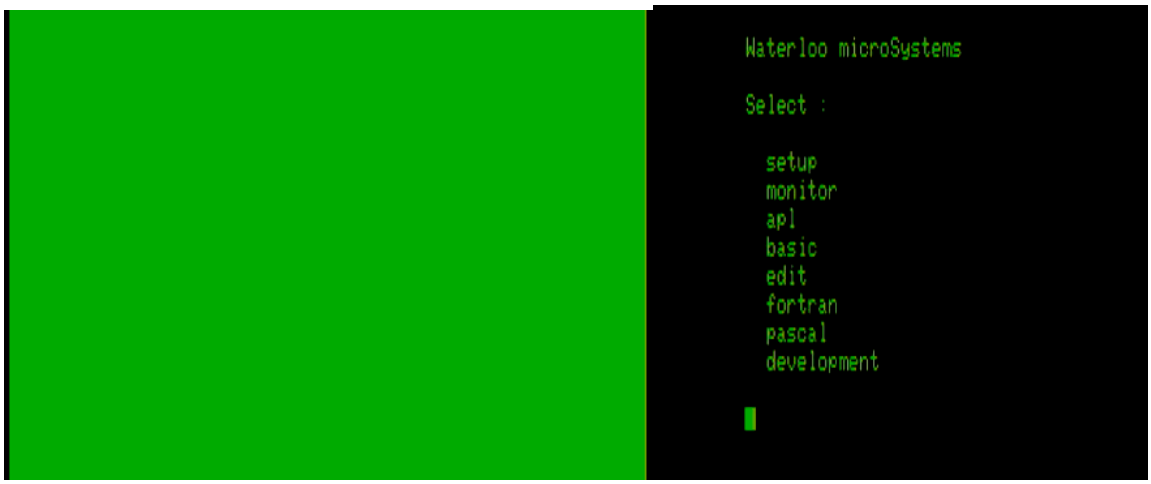


Diagnoses: Check\replace CD4049 at **U1**

Symptoms: Green screen is produced on boot up in both modes

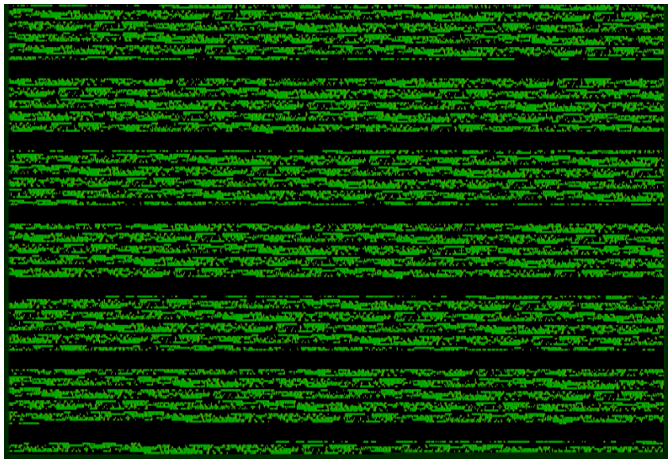
Diagnoses: Check\replace 74LS138 at **U12**, 74LS08 at **U6**

Symptoms: Green screen when booting into 6502 mode but get the menu in 6809 mode.



Diagnoses: Check\replace 6502 CPU at **U3**

Symptoms: 6502 mode produces vertical static lines, 6809 produces block cursor.



Diagnoses: Check\replace74LS04 at **U13**

Symptoms: Initial boot into either mode works but when switching between them the computer freezes

- No image shown for this error

Diagnoses: Check\replace 74LS123 at **U7**

Super PET Serial Port Testing

This section will cover different ways you can test the serial port to ensure it is working.

Testing Super PET Serial Port with a Real Modem

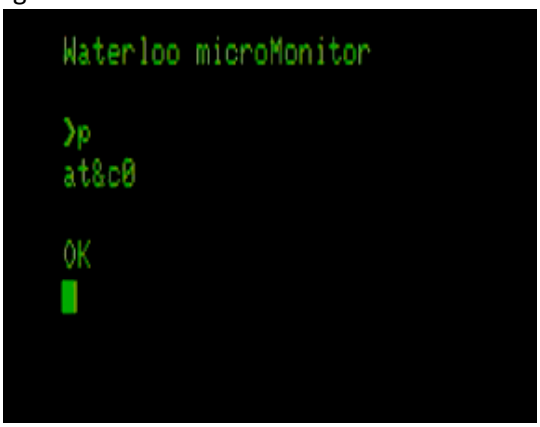
1. Switch to 6809 mode by selecting it with the toggle switches

2. Start up the Monitor, by pressing **m** <return>

3. Type: **p** <enter>

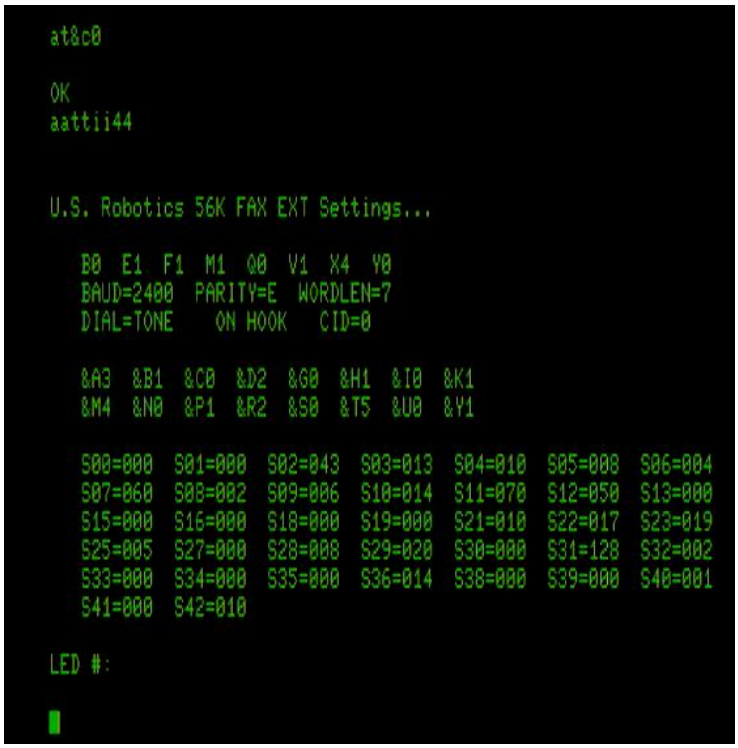
4. Hooked up a real modem or other physical modem with serial cable to the RS232 connector on the Super PET daughter board. Power on the modem.

5. Type: **at&c0** <return> **note last letter is a zero and not the letter O**. You will see "**OKAY** " from the modem, or whatever modem you are testing with.



6. Now you can type commands and they will be echo back.

7. Type: **ati4** <return> and should see modem related information. **Note as you type this command it will be echoed back, meaning you will see double entries**



8. To end this type: **atz** <return> which stopped the echo.

   If you are seeing your modem information, similar to what is show above then your serial port should be working. More testing with terminal related software is required.

9. Hit "**RunStop**" key and then type: **q** <return> which will exit back to the menu.

   This test shows that the modem is accepting requests and successfully showing the results of the request back to the Super PET.

Testing Super PET Serial Port with a Loopback Tester

Using a serial port loopback tester is another way to test, if you do not have a modem.

To create a correct DB25 pin loopback connector for a serial port, follow these steps:

1. **Get a Female DB25 Connector**: You'll need a female DB25 connector for this loopback plug.
2. **Wire the Pins**: To connect the pins.

DB25 Pin Loopback Configuration:

1. **Pin 2 (TxD)** connected to **Pin 3 (RxD)**: This allows the data sent from the port to be received back.
2. **Pin 4 (RTS)** connected to **Pin 5 (CTS)**: This sets up the Request to Send and Clear to Send lines for flow control.
3. **Pin 6 (DSR)** connected to **Pin 20 (DTR)**: This connects the Data Set Ready and Data Terminal Ready lines.
4. **Pin 8 (DCD)** connected to **Pin 20 (DTR)**: This connects the Data Carrier Detect to the Data Terminal Ready.

Function	Pin A	Pin B
TxD to RxD	2	3
RTS to CTS	4	5
DSR to DTR	6	20
DCD to DTR	8	20

Test the Connection: Plug the loopback connector into the serial port and use a terminal program to send and receive data to verify the port is working correctly. Basically, when you type the letter should be echoed back to you. If this happening, then the serial port is working.

You can also use the “Monitor” for testing. Follow steps 1 - 4 in this manual’s section called “**Testing Super PET Serial Port with a Real Modem”**. When typing, you will see double the letters\numbers. Shown as double character because the serial port loopback tester is sending the keystroke back to the screen. You should see the same letter or number you typed. If not, there are issues with the serial port.

Super PET Setup Program

From the main Super PET menu, select SETUP as this will allows you to make changes for the serial port for communications.

Baud

Possible baud rates are:

50 75 110 135 150 300 600

1200 1800 2400 3600 4800 7200 9600

Default value is ***2400***

Parity

Possible parity setting are:

EVEN ODD MARK SPACE

Default value is ***EVEN***

Stop bits

Possible stop bits are: 1 or 2

Default value is ***1***

Prompt

The values used are assigned in hexadecimal. Default value is **11**, which is known as ***XON***

Lineend

The values used are in hexadecimal. Default value is **0D** (zero not the letter "O"), which is known as the ***ASCII carriage-return*** character.

Response

The values used are in hexadecimal. Default value is **12**, which is known as ***XOFF***

Commodore Super PET COM MASTER Terminal Software

This is my setup for using the “com-master” terminal program.

Emulator = **adm3a**

Data Word Length = **8**

Duplex = **full**

Character Set = **ascii**

Parity = **even**

Baud Rate = **2400**

Number of Stop Bits = **1**

Auto New Line = **on**

Software Handshake = **both**

Read File Protocol = **none**

Read File Protocol Data = **0** (this is zero not the letter “0”)

Remote End of Record = **crlf**

Commands to enter each mode

To go into the terminal, once you have configured the setting, just hit RETURN with no other parameters.

To go back into the settings menu press SHIFT + (OFF\RVS) + ESC keys at the same time.

To go back to the 6809-menu press SHIFT + (OFF\RVS) + RUN STOP keys at the same time.

I have not been able to connect to PUTTY or TerraTerm, I can connect and can type from my PC and it shows up fine on the Super PET, however when typing on the Super PET, I get some letters but mostly garbage on the PC. I did connect the Super PET to my PC running Telix BBS software as a *VT100 terminal*, using a null modem cable, using default values for RS232 setting on the Super PET and these setting:

- Strip High Bit = ***ON***
- Auto wrap lines = ***ON***
- Destructive Back Space = ***ON***
- Auto line feed IN = ***ON***
- Auto line feed OUT = ***ON***
- Keep cursor in view = ***ON***
- ANSI blinking = ***ON***
- Backspace send = ***DELETE***
- Enquiring Response = ***OFF***
- XON/XOFF = ***ON***

With the above settings, typing on either the PC or on the Super PET produced the correct characters.

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