Rudy's Retro Intelligence

Commodore Super PET - SP9000

2 Board Version Diagnostics Manual

Version 4.0

Created by Rudy's Retro Intel on December 2024
Updated in August 2025

The purpose of this manual is to help identifying issues and the repair of a Commodore Super PET (SP9000) computer. Excluded from this manual is the repair of the 8032 motherboard which is used in the Super PET.

This manual will only cover the **Super PET with the "2 Board Version"** The other version **"3 Board Version"** is not covered in this manual. Check my GitHub page for updates on 3 board version. The 8032 motherboard repair is covered.

The Super PET board I used to create this manual is the:

SUPER PET COMBO BD. ASSY NO. 9000007 1482
FAB NO. 9000008 REV. B
ARTWORK NO. 9000017 REV. B

This manual cam be used for REV A., B. and D boards.

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 Super PET boards for comparisons which allowed me to take measurement and fix my Super PET 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 Super PET 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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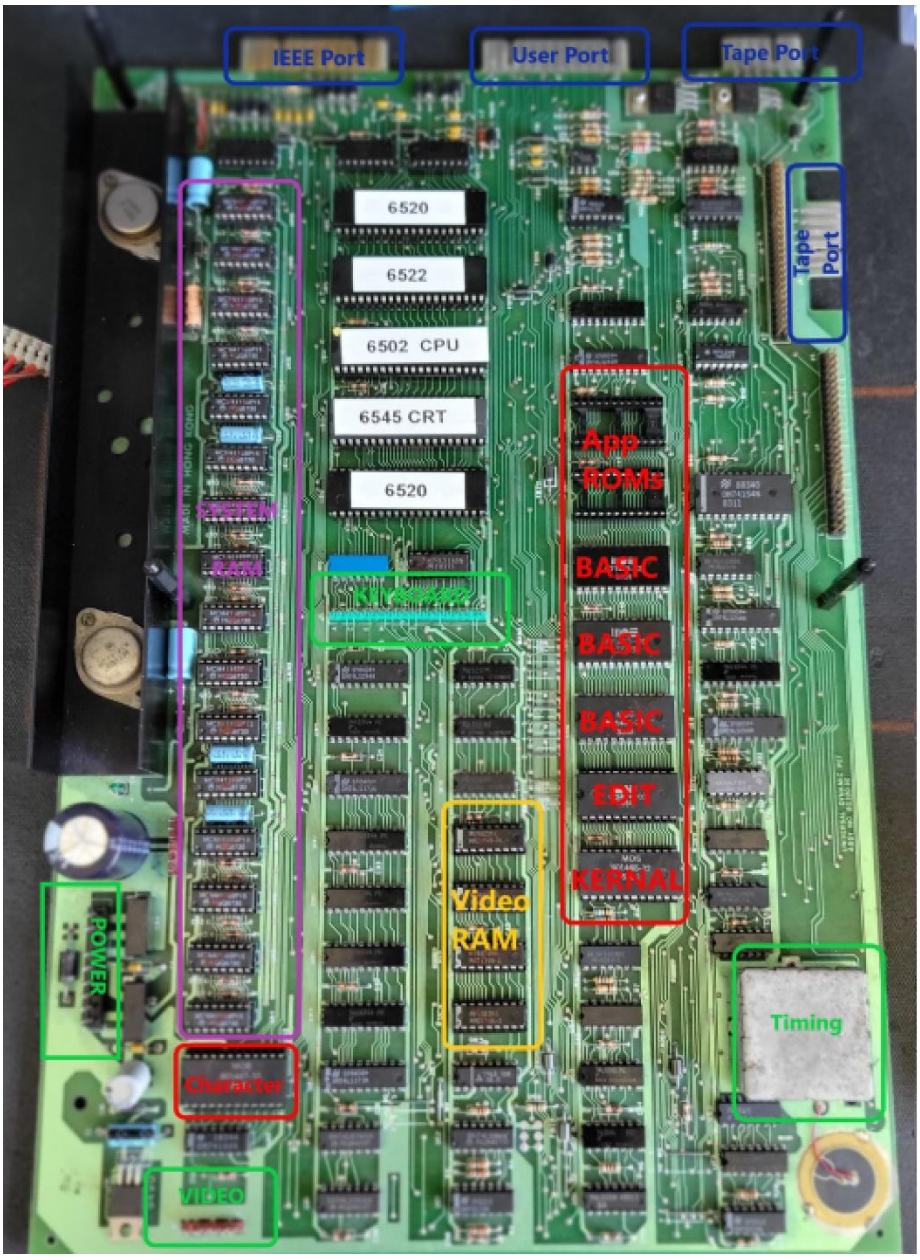
Super PET Motherboard Modifications (8032)

The Super PET 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

EDIT ROM replacement adapters can be use if computer is an 8032. This option will not work if on a Super PET 9000 computer. Since the Super PET daughter board needs to disable (send "No Rom" signal) to take all the ROM chips off the bus regardless of the address bus, the ROM replace adapter do not appear to work properly

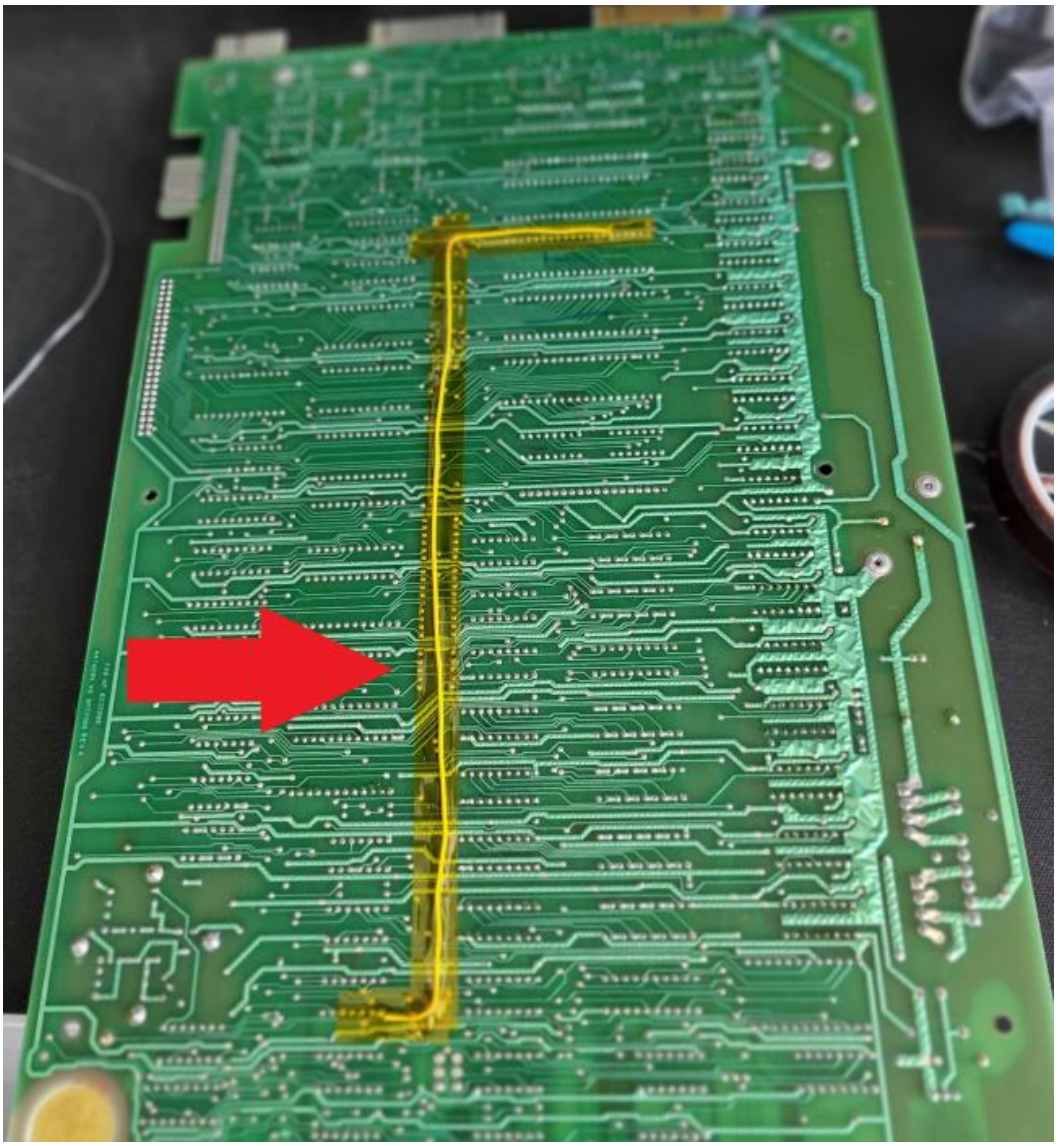
In order to get the PET 8032 (8032) to work as a Super PET, there are 2 modifications needed so that it will work with the Super PET daughter board.

- 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

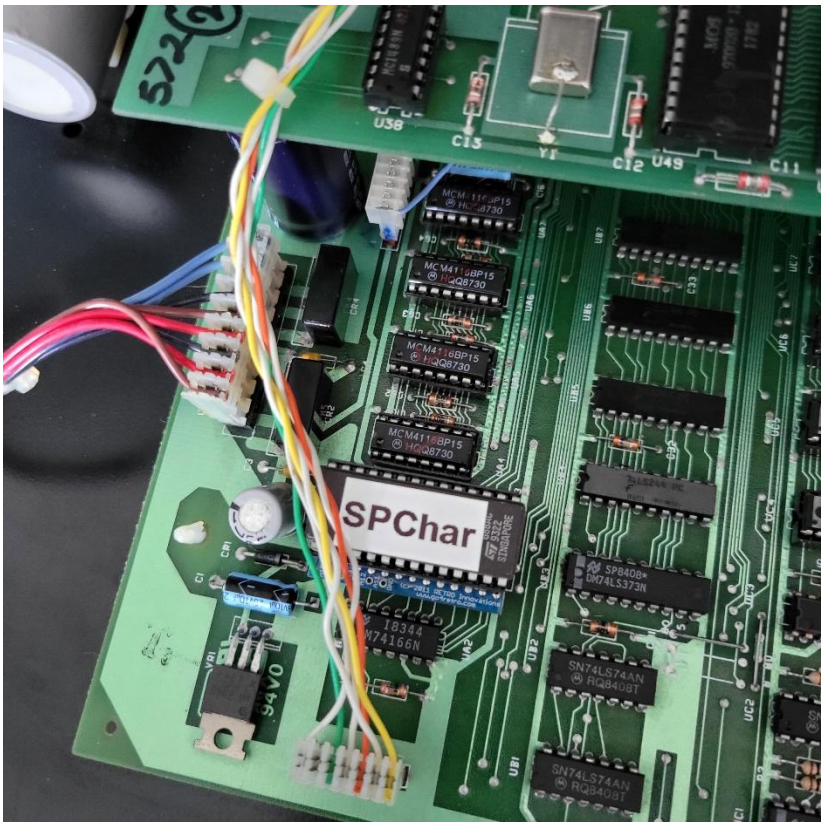


Character ROM modification

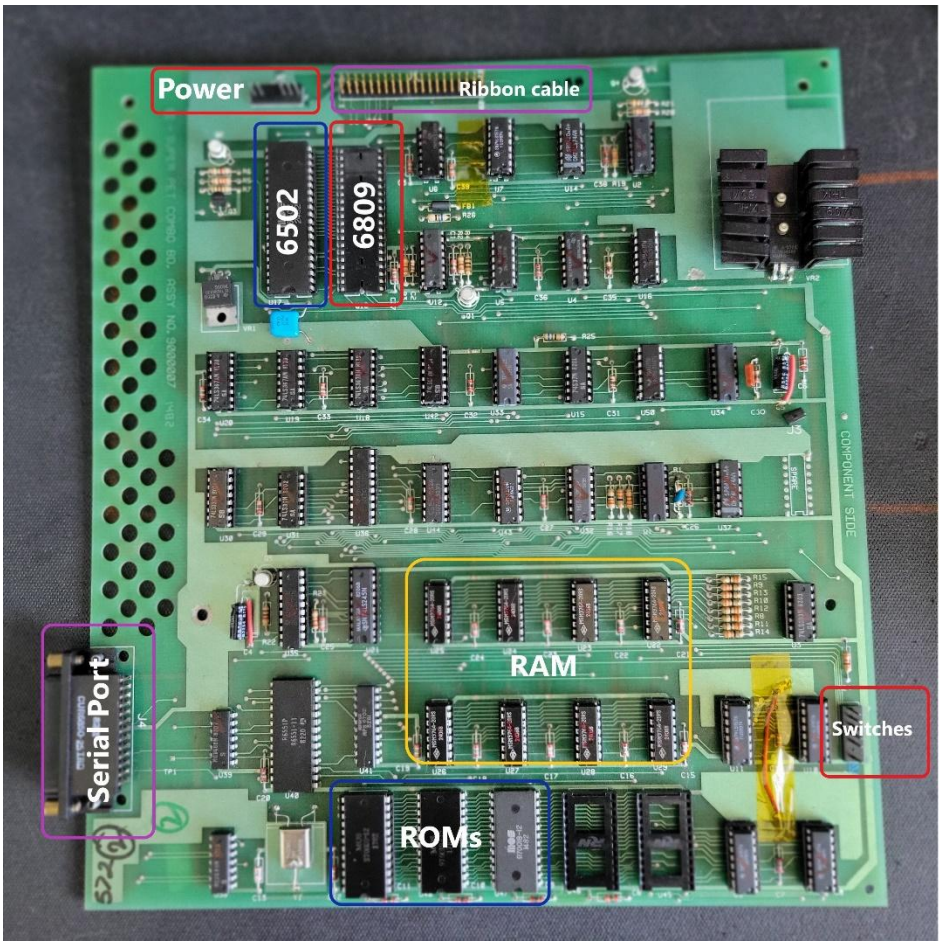
The character ROM is the 901340-01 which is different from the original character ROM found on the 8032 motherboards.

Super PET 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 Super PET 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 Super PET board (2 board version)



Commodore Super PET Board

6502 CPU: At U17
6809 CPU: At U13

RAM: At U22 - U29 - 3764. The 4164 can be used

970018-12: At U47 "Waterloo A000-BFFF" ROM
970019-12: At U48 System's operating\firmware
970020-12: At U49 System's operating\firmware

The "Waterloo A000-BFFF" ROM is part of the system's firmware and contains essential software for the operation of the Super PET. If this ROM is missing or faulty, the system may not function correctly.

Power: At J5 - Get power from main 8032 board

Ribbon Cable: At J1 - Replaces CPU (6502) on the main 8032 motherboard

Switches: At J2 - To switch between 6502,6809, and other modes

Serial Port: At J4 - Standard RS232 connection is used.

NOTE: 8032 motherboard must be completely working \tested or the Super PET board will not work.

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

The Commodore Super PET is comprised of the following:

- Commodore 8032 motherboard with modifications.
- Daughter board with connects to the 8032 via a ribbon cable and a power cable.

There are 2 versions of the Super PET daughter boards:

- Older version is made up of 3 boards. One for the memory, one is for the CPUs and the large motherboard which is the 8032 board.
- Newer version is made up of 2 boards. One houses the CPUs, memory and additional support logic. The other is the 8032 board.

Before starting, check the following:

- Check to ensure the ribbon cable is connect into the 6502 socket on the 8032 motherboard and to the Super PET daughter board.
- Check to ensure the power cable is connected from the 8032 motherboard and to the Super PET daughter board.

Super PET Parts

Location	Part Number	Description
U22-U29	4164 (8)	64K x 1 dynamic RAM
U17	6502	CPU
U40	6551	ACIA
U41	901889-01	6702 encoder
U13	6809E	CPU
U47	970018-12	2764 EPROM Waterloo A000-BFFF
U48	970019-12	2764 EPROM Waterloo C000-DFFF
U49	970020-12	2764 EPROM Waterloo E000-FFFF

970018-12: At U47 "Waterloo A000-BFFF" ROM
970019-12: At U48 System's operating software or firmware
970020-12: At U49 System's operating software or firmware

- RAM: U22 - U29 are 3764 RAM ICs, however the 4164 RAM ICs can be used

- The "Waterloo A000-BFFF" ROM is part of the system's firmware and contains essential software for the operation of the Super PET. If this ROM is missing or faulty, the system may not function correctly.

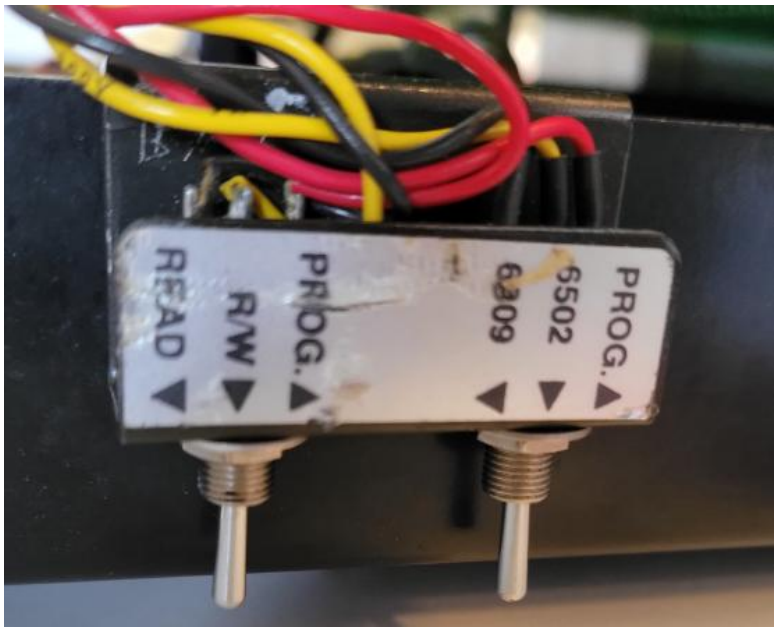
- Power: At J5 - Gets power from main 8032 board (specialized cable from J10 to J11 on 8032)

- Ribbon Cable: At J1 - Replaces CPU (6502) on the 8032 motherboards. The 6502 is placed onto the daughter board.

- Switches: At J2 - To switch between 6502,6809, and other modes which are Read, Read\Write and Program.

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 Super PET user manual for details on how\when to use these switches. The only switches used to repair a Super PET is 1) leaving the memory switch to **R\W** and 2) switching between 6502 (8032 PET) and the 6809 (Super PET) modes.



Super PET Power cable and Switch Connections

Super PET Power Cable

This is the connections needed in order to bring power to the upper board from the 8032 board.

Super PET Connector is J5 and the 8032 board has **J10** and **J11**

J5 Pin 1 → **J10** Pin 7
J5 Pin 2 → Not connected
J5 Pin 3 → Not connected
J5 Pin 4 → Not connected
J5 Pin 5 → **J11** Pin 1
J5 Pin 6 → Not connected
J5 Pin 7 → **J10** Pin 1

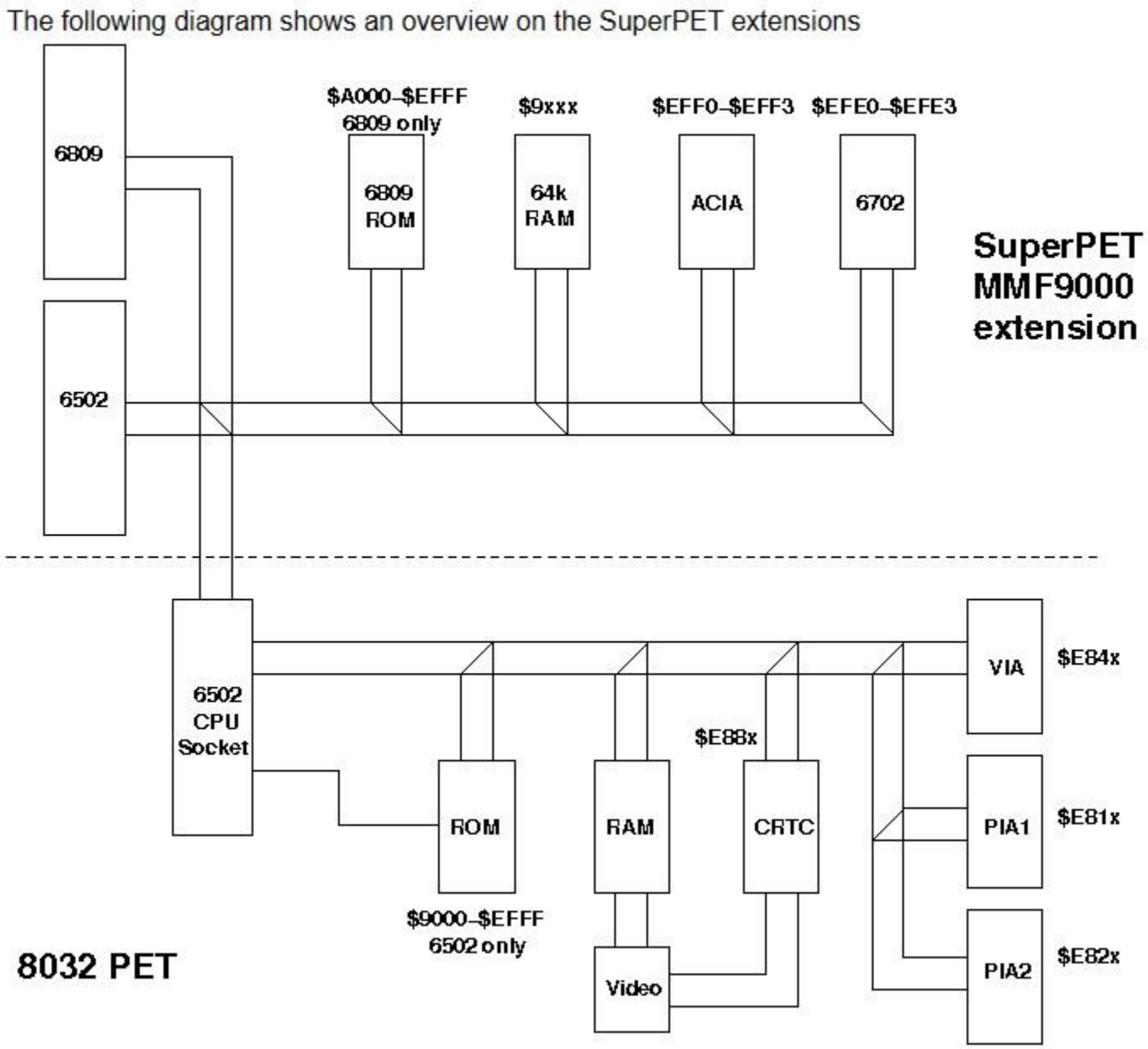
Super PET Switches

The Super PET need to have the set of switches connected so that you select either CPUs and other settings. There are 2 switches. One closest the front, nearest you, is Switch 1 and the send, furthest from you is Switch 2. See diagram on page 8.

Super PET connector is J2

J2 Pin 1 → PROG (switch 1, memory settings). This setting allows the application to control memory as READ ONLY or is READ\WRITE.
J2 Pin 2 → Not connected.
J2 Pin 3 → R\W (switch 1, Read and Write memory settings).
J2 Pin 4 → READ (switch 1, Read memory setting).
J2 Pin 5 → Select 6809 (switch 2, Processor mode). This is the Super PET mode.
J2 Pin 6 → Select 6504 (switch 2, Processor mode). This native 8032 mode.
J2 Pin 7 → PROG (switch 2, CPU settings). This setting allows the application to determine which processor is to be used, 6502 or 6809.

Basic Operation of the Super PET



*This diagram is credited to Andre Fachat

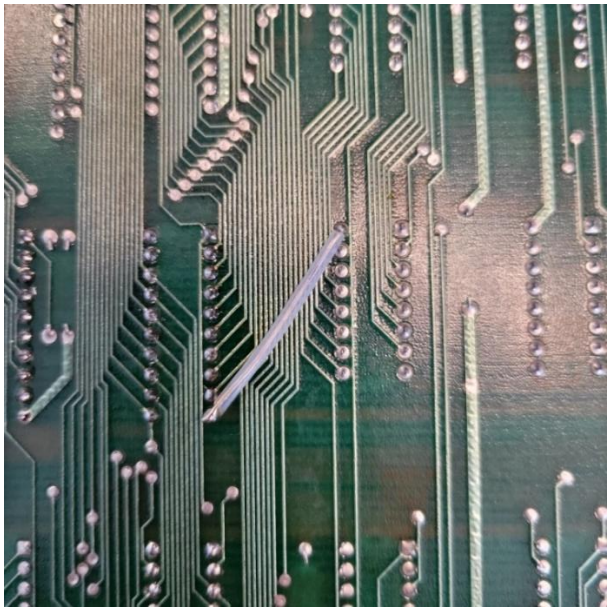
Jumper Wires on Super PET board

There are 2 jumper wires on the bottom side of the Super PET board, and 1 on the top side. Ensure they are there and connected properly. **Note**: on the REV D. board, there are **no** jumper wires. The rest of the board is the same as REV A. and REV B.

Bottom Side Jumper Wires

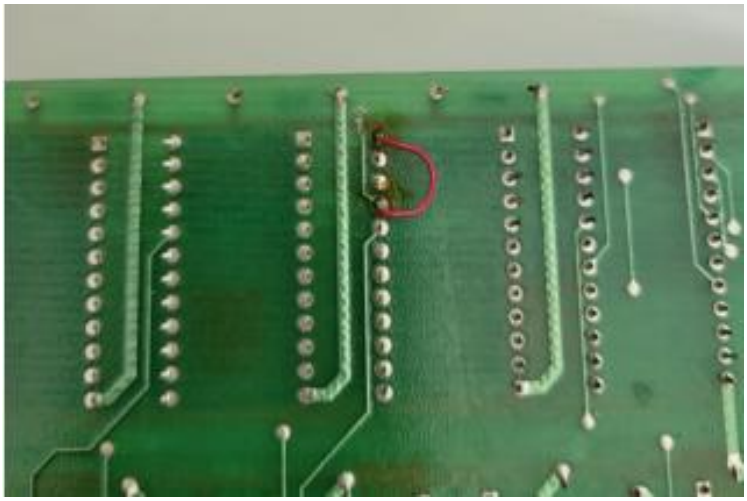
Verify\Install a wire from **U21** pin 10 -74LS245 connected to **U25** pin 16 – 4164 RAM.

This jumper wire **is not required on the REV A board **ARTWORK NO. 9000017 REV. A***

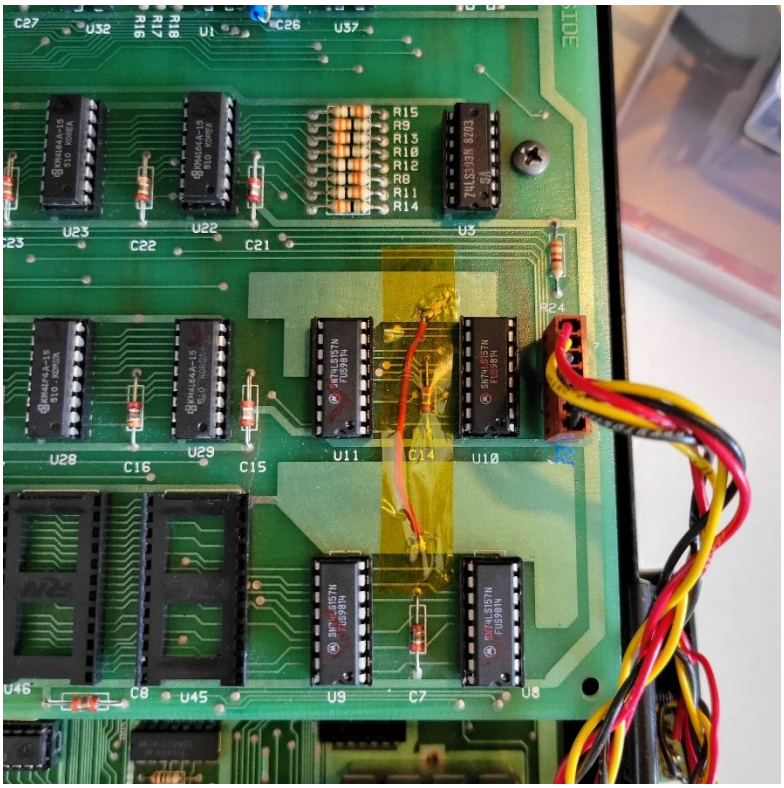


Verify\Install a wire from **U46** – Blank ROM socket Pin 24 to 21.

This jumper wire **is required on the REV A board **ARTWORK NO. 9000017 REV. A***



Top Side Jumper Wire



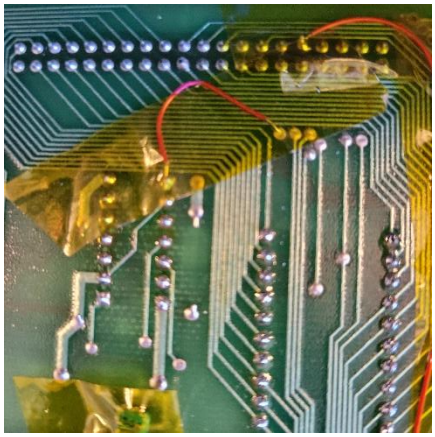
Verify\Install a wire from the 2 locations as per above picture as there are no markings on the daughter board as to where exactly to install this jumper wire.

This jumper wire **is not required on the REV A board **ARTWORK NO. 9000017 REV. A***

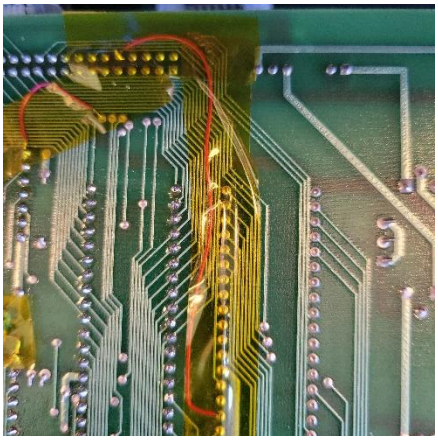
Additional Jumper Wires Required on ARTWORK NO. 9000017 REV. A

These are the jumper wires required on the REV. A board and not on the REV B. board. Please know which version you are working. See bottom of the Super PET board for REV versions.

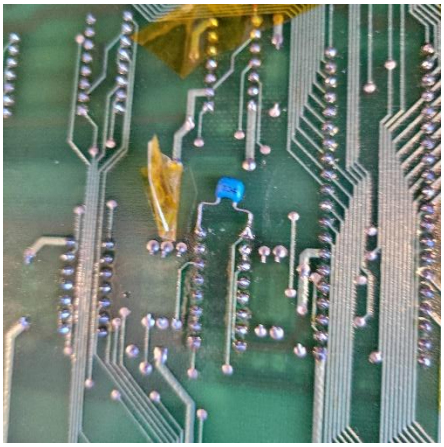
Jumper Wire (short wire) from **U6** Pin 8 connected to CPU ribbon cable connector header Pin6



Jumper Wire (longer wire) from **U17** (6502 CPU) Pin 36 connected to Pin36 on the CPU ribbon cable connector

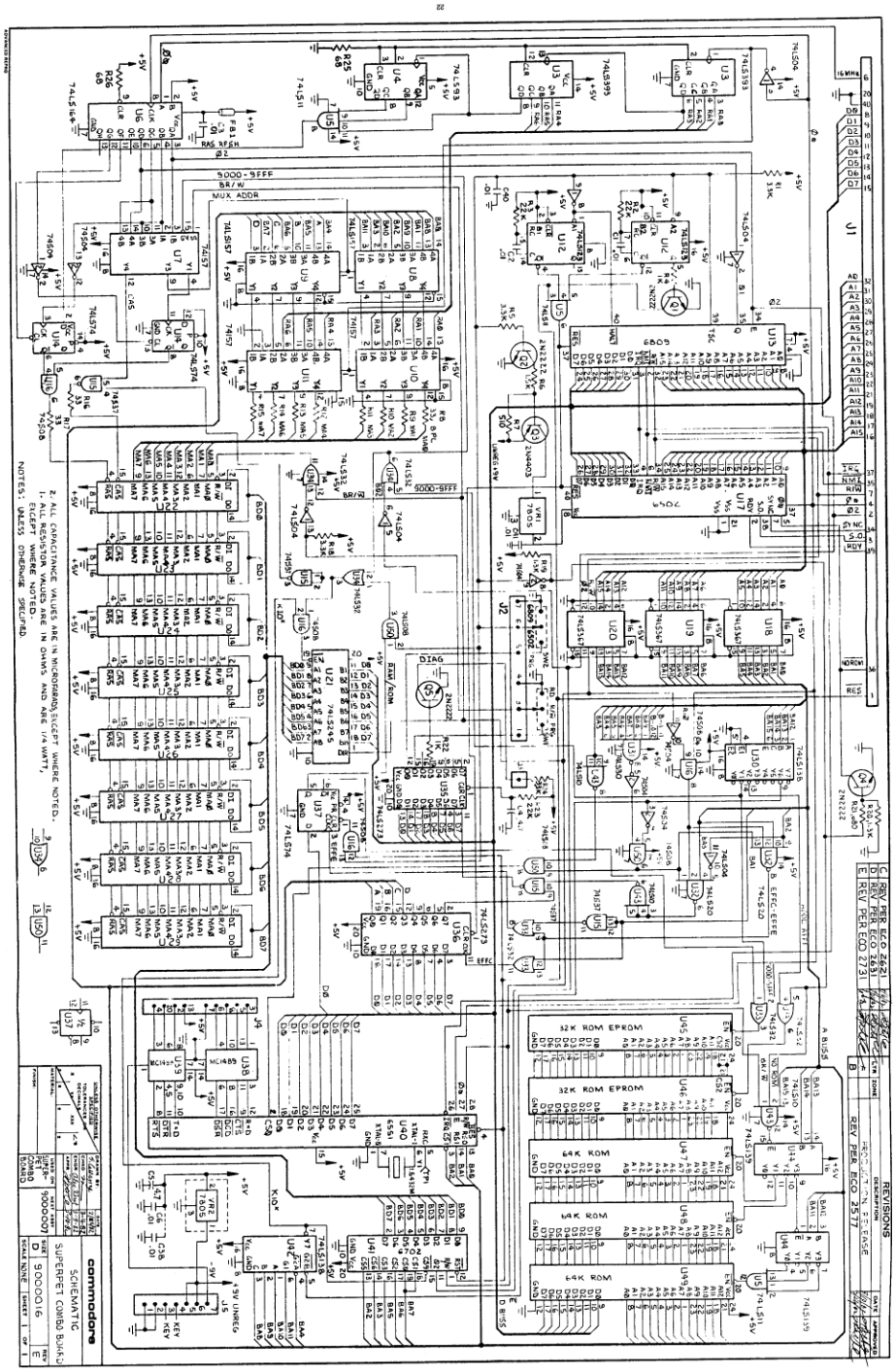


Capacitor (0.1uF) from **U12** Pin 8 connected to **U12** Pin9 (same IC).



Super PET Single Board Version Schematic

This is a sample of the full schematics which can be found here:
https://www.zimmers.net/anonfp/pub/cbm/firmware/computers/pet/SuperPET/index.html or here
https://github.com/RudyRetroIntel/Vintage-Computer-Diagnostics



Super PET 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 Super PET 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 power cable is connected from the 8032 motherboard and to the Super PET daughter board. Ensure power is coming into the daughter board.
4. Check voltages at voltage regulators at **VR1** and **VR2**.

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

Most Common Defective ICs

After repairing many "2 board" Super PETs daughter boards, I have found the following IC should be checked first as they tend to become defective most often.

U19 – 74LS367

U47 – ROM *970018-12: At U47 "Waterloo A000-BFFF" ROM*

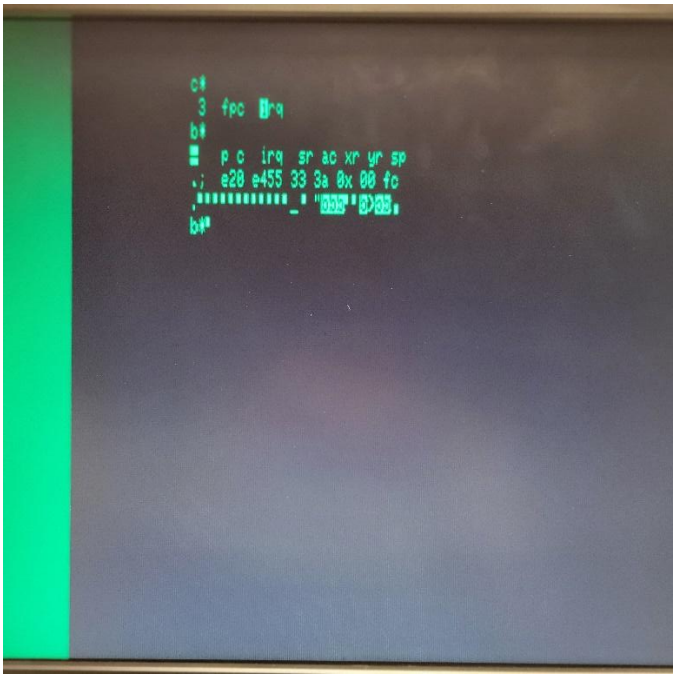
U49 – ROM *970020-12: At U49 System's operating software or firmware*

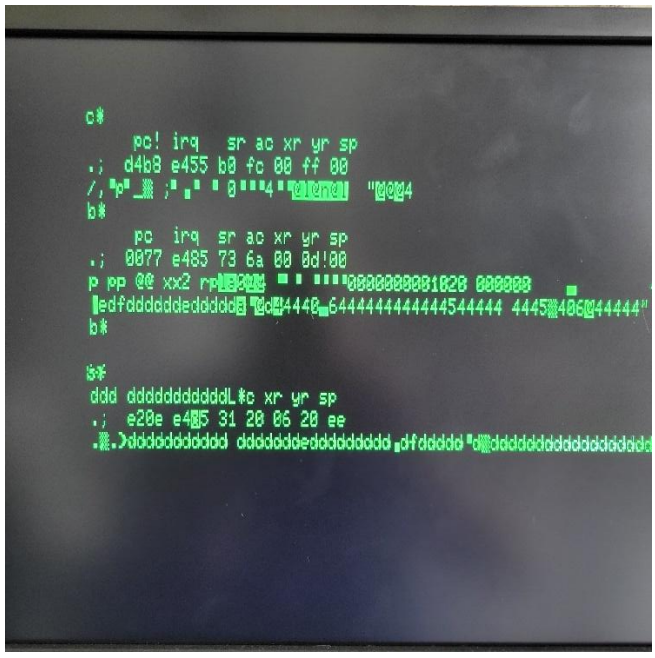
U17 – 6502 CPU

U13 – 6809 CPU

Continue with the rest of this manual if the above ICs check out as good. I recommend placing heat sinks on all the ROMs ICs at they get hot when running in 6809 mode. This is why they tend to go bad.

Symptoms: With side switches set to either 6502(8032) or 6809(Super PET) the following errors are show:





Diagnoses: The jumper wire on the back side of the 8032 is missing, disconnected or not connected to the correct pins. Review and correct. See page 4.

Check the 6502 CPU at **U17**.

Check the 2 set of switches are in working order. Clean or replace as needed. Ensure switches are connected the Super PET daughter board.

Check Ferrite Bead at **FB1** (rev. B board) or **FB1** and **FB2** (rev. A board). Replace if detective.

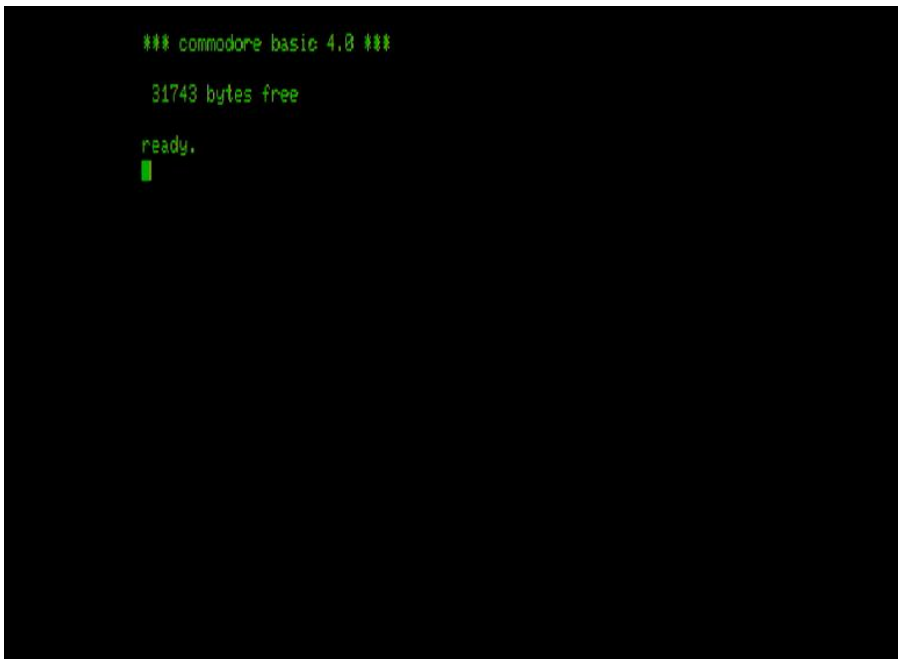
Symptoms: Super PET is working with switch to 6502 (8032) mode, however when switching to 6809 (Super PET) you see the following:

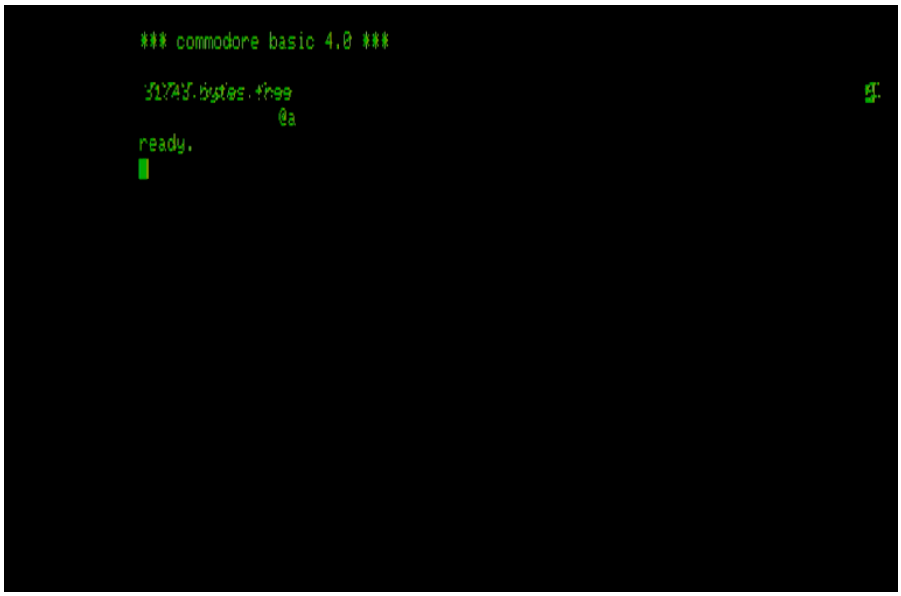
Diagnoses: The character ROM on the 8032 motherboard is missing the second half of the data. Replace the character ROM with the 901340-01. Burn the ROM onto an EPROM and with an adapter you can replace the ROM.

If the character ROM is correct, then issue is with the ROM itself. Burn a new EPROM and replace. *Regardless of which daughter board you are using this modification needs to be done.*

See **Character ROM modification** section in this manual for more information. This is located on *page 5*.

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





Diagnoses: Check\replace **U47**, **U48** and\or **U49**. Check each ROM and replace. If ROM(s) are good, check their support logic ICs:

U5 – 74LS11

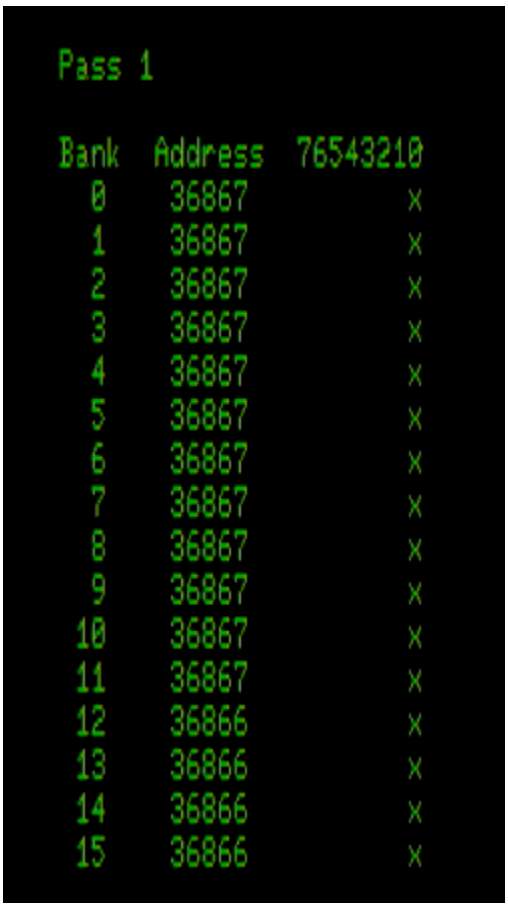
U44 – 74LS139

U43 – 74LS10

U33 – 74LS32

Also check\replace 6809 CPU in **U13**

Symptoms: When running the Super PET memory test software, you see “X” s on the screen.



Diagnoses: There is a memory test software that can test all the RAM in the Super PET daughter board called “spetmemtest.prg”.

In the above screenshot, the “X” indicates memory issue at **U22** which is shown in column “0”

The column with “76543210” indicates the location of the bad RAM IC. Here is the list for all the other RAM failures:

An X in column 0 = Bad RAM in **U22**

An X in column 1 = Bad RAM in **U25**

An X in column 2 = Bad RAM in **U24**

An X in column 3 = Bad RAM in **U25**

An X in column 4 = Bad RAM in **U26**

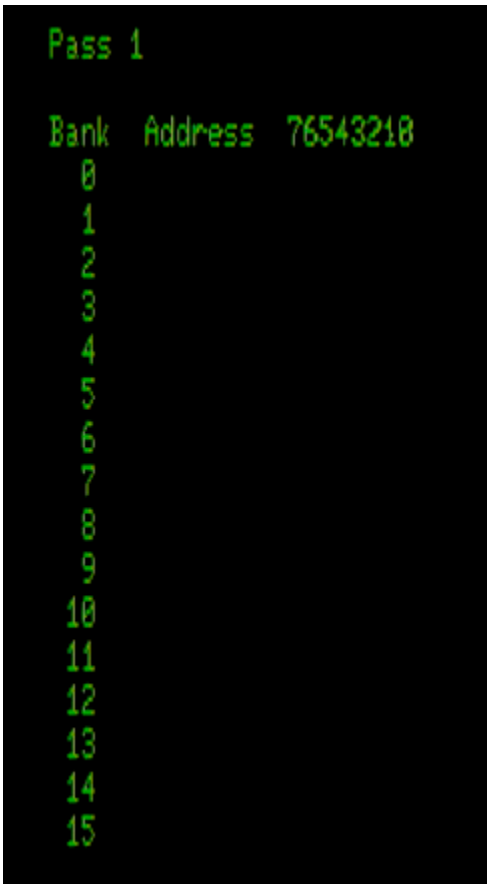
An X in column 5 = Bad RAM in **U27**

An X in column 6 = Bad RAM in **U28**

An X in column 7 = Bad RAM in **U29**

Multiple “X” s means there are several bad RAM ICs. Replace bad RAM with 4164 as they can be used. Ensure that the replacement RAM ICs are the same speed or faster.

When running the Super PET memory test and all RAM ICs are good, you should see no “X” s.



Symptoms: Memory related issues. Memory not working properly, memory has strange behavior, however RAM ICs test good on external RAM tester.

Diagnoses: Check support logic ICs:

- **U3** – 74LS393
- **U4** – 74LS393
- **U7** - 74157
- **U8** – 74LS157
- **U9** – 74LS157
- **U10** – 74LS157
- **U11** – 74LS157
- **U14** – 74LS 74
- **U15** – 74S37
- **U16** – 74S08
- **U21** – 74LS245
- **U41** – 6702

****NOTE:** The 6702 at **U41** is a very RARE IC!! There are no replacements for it and Commodore has never release the logic that is within the MPS 6702 IC.

The 6702 is required for the original versions of the Super PET software but the programs have been cracked so they don't require the 6702. You can find them here: http://mikenaberezny.com/hardware/superpet/waterloo-languages/

Symptoms: No programming language loads. 6502 and 6809 appears to be working and language file is on the diskette (or SD card). System tries to load the program but is never successful. 6809 mode appears suck and 6502 mode is working.

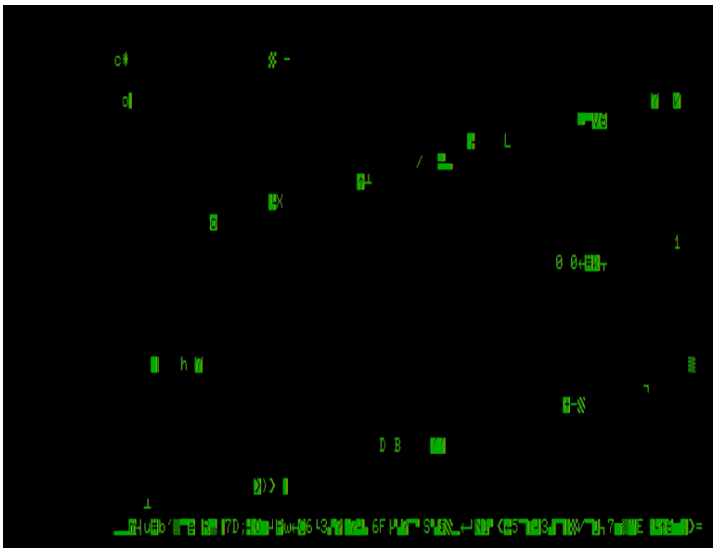
Here is an example trying to load FORTRAN language.

Diagnoses: Check\replace **U41** – 6702. This IC is required to load any development language. When testing, the language software does take a while to load.

****NOTE:** The 6702 at U41 is a very RARE IC!! There are no replacements for it and Commodore has never release the logic that is within the MPS 6702 IC.

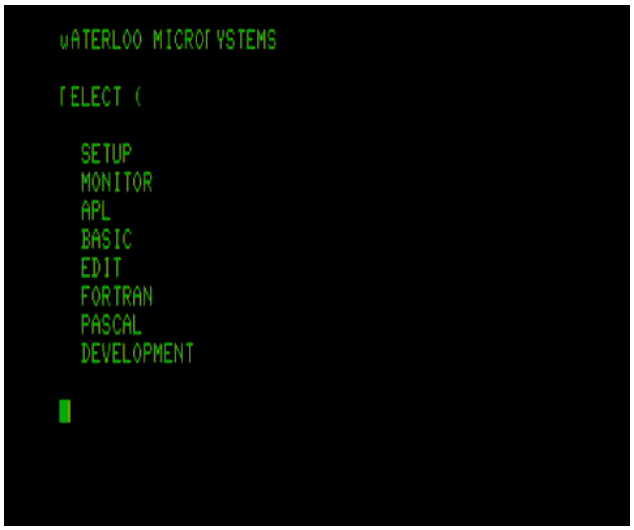
The 6702 is required for the original versions of the Super PET software but the programs have been cracked so they don't require the 6702. You can find them here: http://mikenaberezny.com/hardware/superpet/waterloo-languages/

Symptoms: Turning on the Super PET with switch in 6502 <u>or</u> 6809 position, you see garbage on the screen, like the following:



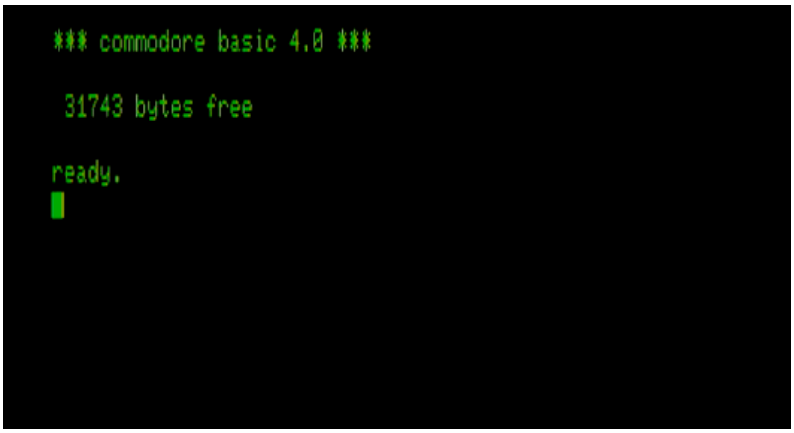
Diagnoses: Check\replace **U6** – 74LS164 and\or check\replace **U40** – 6551-11

Symptoms: System will not boot up into 6502, no video however when switching to 6809 mode you the menu or something like the following:



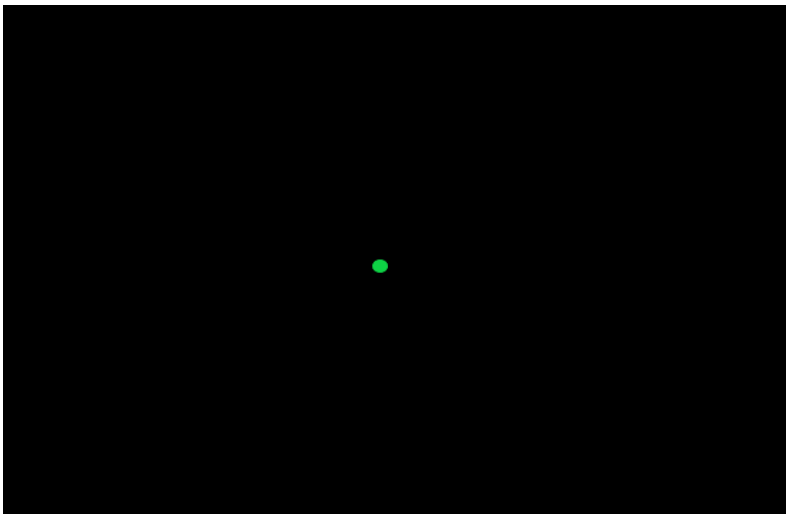
Diagnoses: Check\replace **U2** – 74LS04 and\or **U5** – 74LS11

Symptoms: Super PET boots up but hangs and no keyboard input. Both 6809 and 6502 show the following screen.



Diagnoses: Check\replace **U12** – 74LS123, **U20** – 74LS367, **U18** – 74LS367 and\or check\replace **U40** – 6551-11

Symptoms: Super PET show a green dot in the middle of the screen. No chirps and no power up.



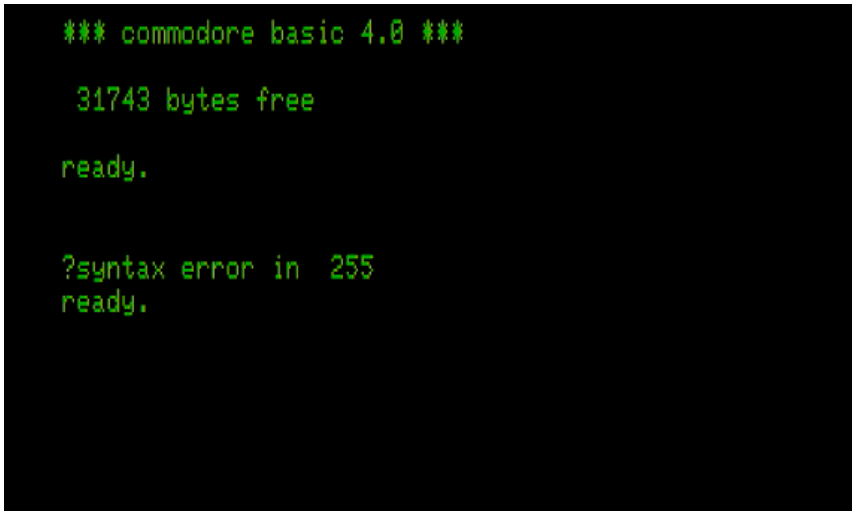
Diagnoses: *Turn off the Super PET immediately!!* This can cause damage to the monitor.

Check\replace

- **U19** – 74LS367
- **U42** – 74LS138
- **U34** – 74LS32

Recommend to replace all 3 of the above ICs with new ones due to their importance and how they may damage the monitor. These are common ICs and very inexpensive.

Symptoms: Super PET continuously reboots and chirp is heard over and over again in 6502 mode. When booting directly to 6809 mode, you get a screen full of characters. Or 6502 boot fine and when you switch to 6809 and back to 6502, you see the following:



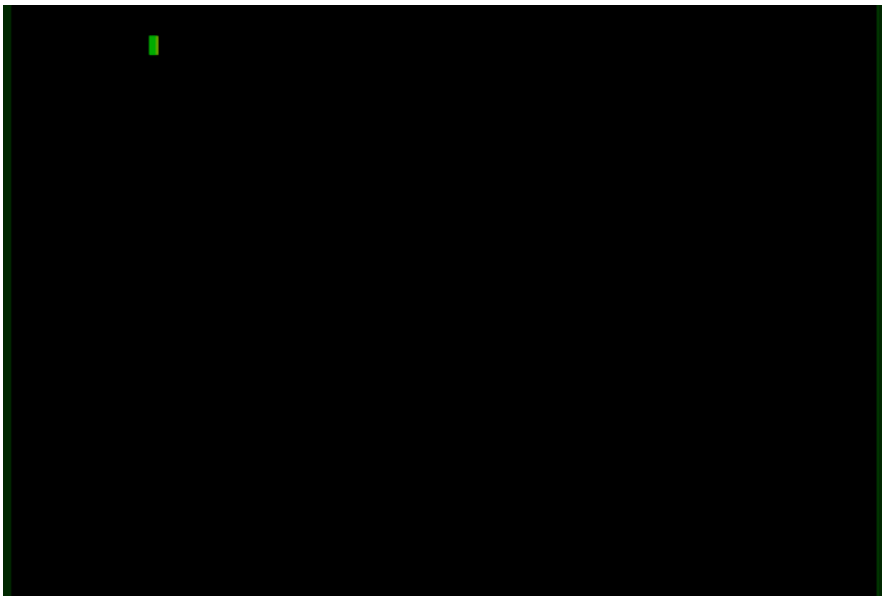
Diagnoses: Check\replace **U1** – 74LS04

Symptoms: Super PET only shows a complete green screen on boot up. This is true for 6502 or 6809 modes.

Diagnoses: Check\replace **U19** – 74LS367

Symptoms: Booting in 6502 mode, you get no beep and no prompt, just green screen,

and when switching to 6809 mode you get this, garbage **or** 6809 menu.



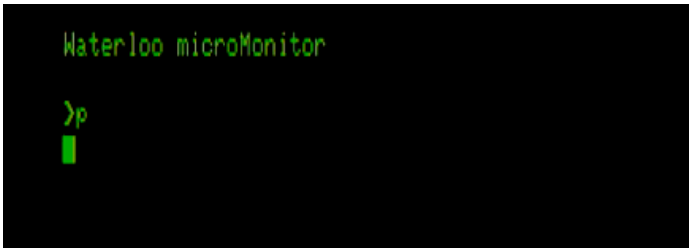
Diagnoses: Check\replace **U17** – 6502. If 6502 mode is working but switching to 6809 mode and you seeing the above or garbage then the issue could be the **U13** - 6809.

Testing Super PET Serial Port with a Real Modem

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

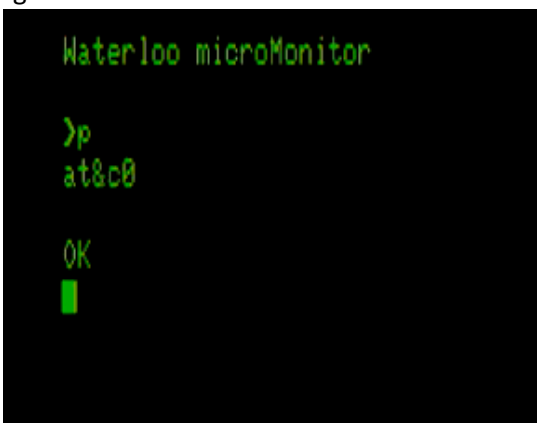
2. Start up the Monitor, by pressing **m** <return>

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



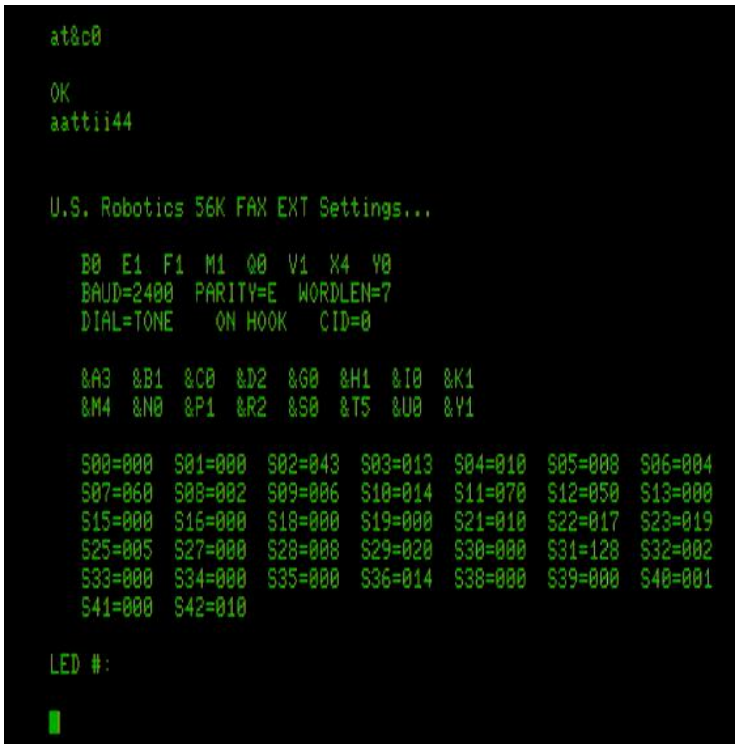
4. Hooked up a real modem or other physical modem with serial cable to the RS232 connector on the Super PET daughter board. Power on the modem.

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:
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

The COM Master Terminal program is a program that allows for communications via the serial port. 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.

Command Keywords

ANL = Turn the auto new-line feature on or off.
BR = Set the serial port baud rate.
CP = Specify a command file name.
CS = Choose between an ASCII or APL character set.
DI = Produces a disk directory listing.
DUP = Set the duplex mode.
DWL = Set the data word length.
E = Choose between dumb or ADM-3A screen emulation.
Fx = (where x = 0-9) Specify the character string to represent the indicated function number.
NSB = Set the number of stop bits.
PAR = Set the transmission parity type.
REOR = Specify the End-Of-Record mark used by the remote system.
RP = specify the file name to be transmitted.
RPP = Specify a protocol for how the Read Pile data is to be transmitted out the serial line.
RFPD = Specify a data byte whose meaning depends on the current Read File Protocol (RFP) value.
SH = Specify the amount of software handshaking.
TIME = Set the system time clock and/or toggle the 25th screen line display on or off.
WP = Specify the file name to receive data.

How to Enter COMMAND in CONTROL Mode

Commands entered in Control Mode take on the general format of **(KEYWORD) or (KEYWORD) =(data)**. Input of any command must be precise (i.e., with no preceding or imbedded blanks allowed). Typing errors can be corrected by using the DEL key to erase the most recently typed character.

A summary list of all possible keywords is listed and with an explanation for each. Notice that the correct keyword for any item can be determined by picking out those letters which are capitalized on the left side of the 'equals' sign on the Control-Mode screen.

ANL This controls what happens when the cursor is positioned in column 80 and a non-control character is received:

on: The cursor will advance to column 1 of the next screen line after printing the received character. If the cursor is on the 24th screen row, screen lines 1-24 will first be scrolled up one line.

off: The cursor will remain in its column 80 position after printing the received character.

BR Set the serial port baud rate: Any of the baud rates listed may be selected. The 'extclk' selection stands for 'external clock' and would only be useful if some appropriate hardware modifications have been made to provide an external clock signal to the SY6551 ACIA IC (the Super PET's serial interface chip).

CP Specify a command file name: This is the name of a disk file from which COM-MASTER will read records and interpret each as Control Mode commands. This file must be created outside of COM-MASTER using any available editor (such as the Waterloo EDIT program).

CS Choose between the ASCII or APL character sets: this only applies to On-Line Mode; Control Mode will always appear using ASCII characters. See Appendix C for illustrations of the character codes that are generated for each character set's keyboard.

DI Causes the Control Mode screen to be cleared and a two-column directory listing of disk drive 0 to appear; if there are more directory entries than will fit on the screen, the word 'PARTIAL' is displayed at the bottom of the second column and a RETURN must be entered before the listing will continue. When the listing is complete, the number of free blocks are listed, the word 'COMPLETE* is displayed, and the next RETURN causes the Control Mode screen to reappear. To obtain a listing for a unit other than drive 0, the command must be entered as 'DI DISK/x' where x is the desired unit.

DDP Set the duplex mode:

full: The only data displayed on the screen is that which is received as input on the serial port. (This mode should be used where the remote system echoes each character as it is received.)

half: All data entered on the keyboard (or transmitted from a Read File) will be displayed on the Super PET screen as soon as it is transmitted out the serial port.

DHL Set the data word length: Most remote systems require 7-bit data words, although some may permit 8. 5 and 6 are provided only because they are supported by the SY6551 ACIA. Note that changing this parameter to 5 may affect the current Parity and Number of Stop Bits values as a 5-bit, no-parity combination implies a 1.5 stop bit value.

E Select the protocol of terminal emulation to be performed.
dumb: Employs a minimal number of control codes. See
adm3a: Emulates the Lear-Siegler ADM-3A protocol.

Px (where x * 0-9) Specify the character string to represent the indicated Function number. Once specified, the entire string can be invoked in On-Line Mode with a single shifted keystroke (as though it was being typed out on the keyboard) by simply entering the corresponding shifted numeric on the Super PET's numeric keypad. A Function can be disabled (i.e., the string value removed), by entering 'Fx=' (i.e., with no data between the 'equals' sign and the RETURN) when in Command Mode.

NSB Set the number of stop bits: typically, 1 or 2, depending on what is expected by the remote device; 1.5 is a pseudo case used only with a 5-bit data word length and no parity.

PAR Set the serial parity option: (a vertical redundancy check).

none: parity disabled; no parity bit generated, no parity bit received.
odd: odd parity both receiver and transmitter.
even: even parity, both receiver and transmitter.
mark: mark parity bit transmitted, parity check disabled.
space: space parity bit transmitted, parity check disabled; used only with a 5-bit data word length and no parity.

REOR Specify the type of End-Of-Record mark used by the remote system.

cr: ASCII carriage-return only; this is the type used by
most Commodore disk drives; when this option is selected, files which are being uploaded or downloaded are transmitted character by character with no special handling.

crlf: ASCII carriage-return, line-feed sequence; there are many remote system types which use this two-byte sequence
as its end-of-record marker; When COM-MASTER is downloading files with this parameter set to this value, all ASCII line-feed characters which follow ASCII carriage-returns will be filtered out of the character stream before it is written to any currently enabled Write File. Conversely, when uploading files, an ASCII line-feed will be inserted after each ASCII carriage-return in the data stream before it is transmitted to the remote system.

lfs: ASCII line-feed only; there are some remote system types which will use this type; When downloading from such systems, this value will cause all incoming ASCII line-feeds to be replaced by ASCII carriage-returns before they are written to any currently enabled Write File. Likewise, when uploading, this value will cause all out go in g ASCII carriage-returns to be replaced by ASCII line-feeds.

RF Set the Read File: This is the name of a disk to be transmitted out (uploaded) through the serial port when CONTROL-CRSR/UP is typed in On-Line Mode. (Notice that C R S R / U P is a shifted character, so this is accomplished by holding down both CONTROL and SHIFT when depressing CRSR/UP.) Transmission may be stopped at any instant by again entering CONTROL-CRSR/UP. This may be any legal Waterloo file name. (See the Waterloo Super PET System Overview Manual for details.) The file is actually opened for READ access when this command is entered in Control Mode, so the diskette containing the file must be loaded in the appropriate drive when the command is entered.

RFP Specify the Read File Protocol: Useful if the remote system does not have software handshaking (XON/XOFF) implemented and/or is not interrupt driven for character input.

none: the Read File is transmitted with no pause or wait after any character.

pause: after each ASCII carriage-return character read from the Read File is transmitted, COM-MASTER will pause
the number of seconds specified by the current Read File Protocol Data value before continuing to transmit. This pause may be as long as 25.5 seconds When selecting this option, the RFPD value will default to 1.0 second. If some duration other than 1.0 second is desired, the RFPD command must be subsequently used to set in the desired
duration value.

wait: after each ASCII carriage-return character read from the Read File is transmitted, COM-MASTER will suspend
transmitting the Read File until a particular 8-bit character as determined by the Read File Protocol Data value is received at which time transmission of the Read File will continue. When this option is selected, the RFPD will default to 10, which is the ASCII decimal equivalent for a line-feed (i.e., transmission will resume when a line-feed is received from the remote device). If some 8-bit character other than an ASCII line-feed is desired.

RFPD Specify data relative to the type of Read File Protocol specified with RFP. Read the description for RFP above for details on what is controlled by this parameter. H Specify the amount of software handshaking: determines when XON/XOFF handshaking is to be observed.

none: no handshaking on either input or output.

input: handshaking will be implemented on input only; i.e., if incoming data fills the input buffer to 90% full, a XOFF character will be sent to the remote device which should interpret the XOFF as a command to quit sending data; when the input buffer has emptied to less than 10% full, a XON character will be sent to the remote
device which should interpret the XON as a command to resume sending data. output: handshaking will be implemented on output only; i.e., any incoming XOFF character will cause COM-MASTER to stop sending data until a subsequent XON character is received; both: both input and output handshaking, as described above, will be implemented simultaneously.

TIME Set the system time clock or toggle the 25th screen line time display on or off: When entered without appending an 'equals' sign and data, COM-MASTER will turn on the 25th screen line if it is currently off, or turn it off if it is currently on. To set the clock, append an 'equals' sign and a data string in either of the formats (hour): (minute)X or (hour): (minute) t (second)X (where X is either A for AM or P for PM). Examples of valid inputs are 'TIME=1:30P' and 'TIME=11:20:30A'.

WF Set the Write File: This is the name of a file which is to receive (download) a copy of any data which comes in the serial port. Transmission actually begins when CONTROL-CRSR/DOWN is typed in On-Line Mode and may be stopped at any time by entering a subsequent CONTROL-CRSR/DOWN. The file name may be any legal Waterloo file name string. (See the Waterloo Super PET System Overview Manual for details.) This includes file name strings such as 'printer' or 'ieee5' which might be used to cause incoming serial data to be copied to a Commodore printer or any other device which can be attached to the Super PET's IEEE-488 bus. The file device is actually opened for WRITE access when this command is entered in Control Mode, so the file device must be powered up and monitoring the IEEE-488 bus when the command is entered.

Other Serial Software for Windows Computers

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.

Repairing the 8032 Motherboard

This section of the manual will go over the motherboard repair. In order for the Super PET to work, this is the first part to repair.

8032 and 4032 Differences

The 8032 and 4032 are very similar, except for the following:

1. **Video RAM**: 8032 has 4 video RAM ICs. 4032 only has 2 video RAM ICs.
2. **ROMS**: EDIT ROM is different between the two as the EDIT ROM for the 8032 produces 80 columns of text and the EDIT ROM 4032 produces 40 columns of text.
3. **Jumper Wires**. There are jumper wires\connection that are different, depending 40 or 80 column text.
4. **Keyboard**: The 4032 uses a graphical keyboard while the 8032 will use the business keyboard. You cannot interchange them.
5. **4032**: This PET computer is not compatible with the Super PET, unless it is the 12" inch version and has the modifications made to become an 8032 computer. That being said, you can use this section to repair a 4032.

Commadore PET Schematic and Other Files

Full schematics, ROMs images, support programs, etc. can be found here:
https://www.zimmers.net/anonftp/pub/cbm/firmware/computers/pet/index.html

Symptoms and Diagnostics Basics

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

1. Ensure you remove all ICs in sockets and clean the sockets with an electronic cleaner before starting.
2. Press all socketed ICs down to ensure full contact with the socket.
3. Check to ensure the power cable is connected from the 8032 motherboard.
4. Check voltages on all voltage regulators.
5. Check for proper clock signal.
6. Check for RESET signal on the CPU.

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

8032 Motherboard from Super PET Computer

Since the 8032 motherboard is also used in the Super PET 9000 computer, this document can be used however the following should be noted:

1. Special **CHARACTER ROM** and **jumper wire** needed. Check Super PET diagnostic section, above for this information
2. **EDIT ROM** replacement adapters can be use. This option will work on a Super PET 9000 computer. The SuperPET daughter board needs to disable (send "No Rom" signal) to take all the ROM chips (on the motherboard) off the bus regardless of the address bus, the ROM replace adapter can work properly.

Correct Boot Screen

The prompt should be:

***** commodore basic 4.0**

31743 bytes free

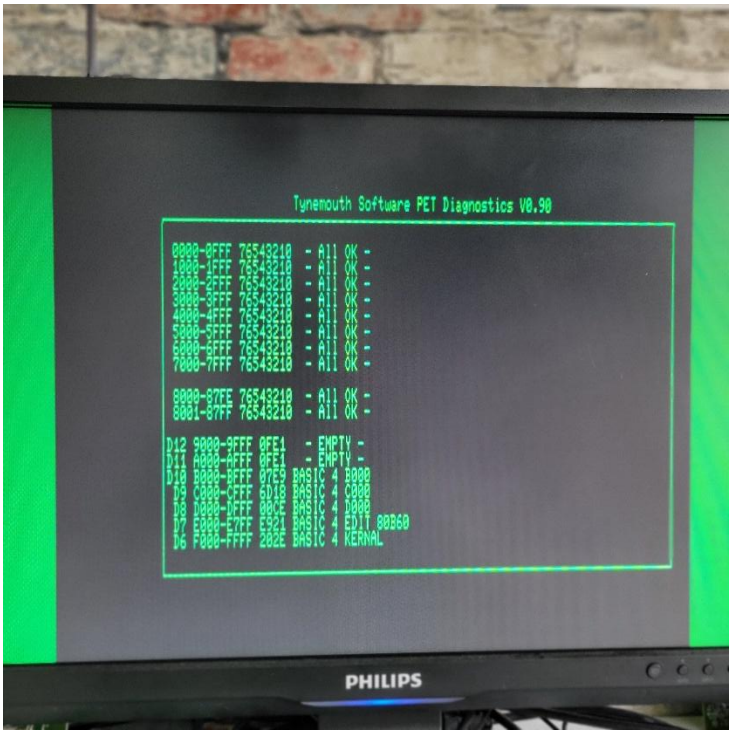
ready.

NOTE: the green block on the screen should be blanking(flashing) on and off.

Booting to this screen does not mean that the 8032 motherboard is fully working. Further testing is required.

Using a Diagnostic Tool

This diagnostic tool is an excellent way to help determine issues. You can purchase on here: https://www.tindie.com/products/tynemouth/pet-diagnostics/ just remove the CPU-6502 IC at **UB14** and place this board into the CPU socket. After setting the switches correctly, the boot will start the diagnostics.



This diagnostic tool will require that the 6545 CRT, video RAM and video support IC are working.

Note: All RAM should show " **– All OK –**" and each ROM detected. The two ROM sockets (D12 and D11) are empty and will display " **– EMPTY –**"

This diagnostic board will help determine if memory and ROMs are working correctly.

Order of ROM detection is as follows:

D12 9000-9FFF – Empty socket and used for application(s)

D11 B000-BFFF – Empty socket and used for application(s)

D10 D000-DFFF – BASIC 4 ROM – 901465-23 (this version has the fix for BASIC)

D9 C000-CFFF – BASIC 4 ROM – 901465-20

D8 D000-DFFF – BASIC 4 ROM – 901465-21

D7 E000-E7FF – BASIC 4 EDIT ROM

D6 F000-FFFF - BASIC 4 KERNAL ROM

Commodore PET 8032\4032 Symptoms and Diagnostics

This section will go over the symptoms and diagnostics information without the use of a diagnostics board as mentioned above. Diagnostics with the board (above) is shown in later sections.

Recommendation: If defect ROMs and RAM ICs are found, replace defects ROMs before replacing system RAM. Defective ROMs can impact system memory.

Not Booting

Symptoms: Blank screen on boot up. No chirp from speaker.

Diagnoses: Check\replace

1. Ensure there is power to the motherboard. Check for +5VDC and no shorts to ground.
2. Verify that 6502 CPU is working **UB14** and that the RESET signal is present on **Pin 40**. Verify that the clock signal is present on **Pin 3.**
3. If no REST signal present, check 555 Timer - **UD16**.
4. If no clock signal present, check 7400 – **UF1.**
5. Ensure that there is a video signal on **Pins 38 and 39** on the 6545 CRT chip - **UB13.**
6. Verify that the video RAM at **UC4, UC5, UC6, UC7** are working. Video RAM issues is usually the main reason for no video.
7. 74LS383 – **UD3**
8. BASIC ROM - **UD8**
9. 74LS04 -**UE4**
10. 74LS244 – **UE10**

NOTE: Due to the many ICs that could be defective, it is recommended that you use an oscilloscope and schematics for troubleshooting. Using an oscilloscope\schematic to troubleshoot is not covered in this manual.

4032 – Only has 2 video RAM chip **UC4 and UC5.**

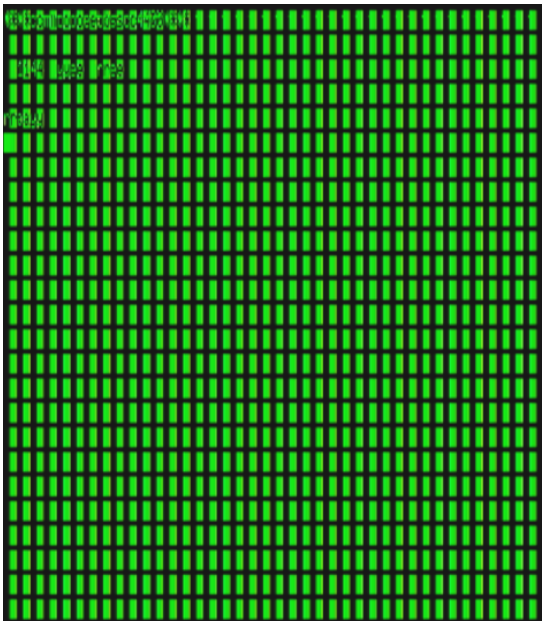
Symptoms: Screen show a complete green background. No chirp from speaker

Diagnoses: Check\replace

1. Follow step in previous section
2. Verify that the following ICs are working:
1. 7417 - **UD15**
2. 74LS164 – **UE3**
3. EDIT ROM – **UD7**
4. KERNAL ROM – **UD6**
5. 74LS04 – **UC2 and UD2**
6. 74LS02 – **UD1**
7. 74LS10 – **UD4**
8. 74LS00 – **UD5**
9. 74LS244 – **UD13 and UD14**
10. 74LS74 - **UE1**
11. 74LS157 - **UE2**
12. 74LS164 - **UE3**
13. 74LS00 – **UE5**
14. 74LS244 – **UE9**
15. 74LS00 – **UE11**
16. 74154 Decoder - **UE12**
17. 74LS10 – **UE13**
18. 7425 – **UE14**
19. 74LS04 – **UE15**
20. Lower RAM range 0000-3FFF (4116) -UA5, UA7, UA9, UA11, UA13, UA15, UA17, UA19

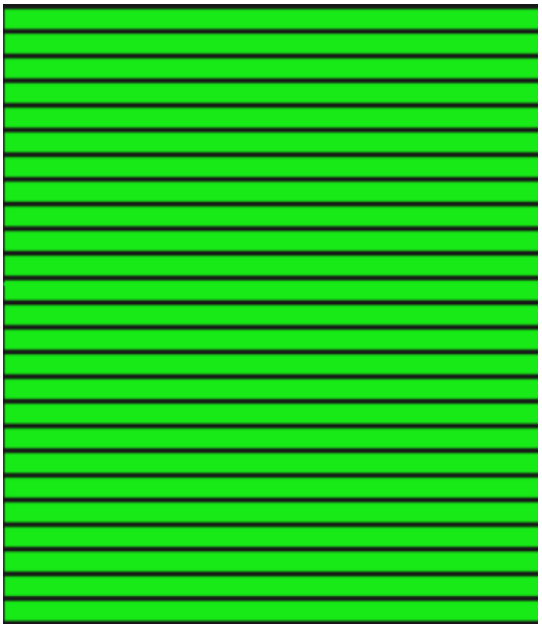
NOTE: Due to the many ICs that could be defective, it is recommended that you use an oscilloscope and schematics for troubleshooting. Using an oscilloscope\schematic to troubleshoot is not covered in this manual.

Symptoms: Boot with chirp but screen not correct.



Diagnoses: Check\replace Video RAM 2114 – **UC5 and\or UC7.** Also, 74LS373 – **UB3 and\or UB8**

Symptoms: Boot with chirp but screen not correct.

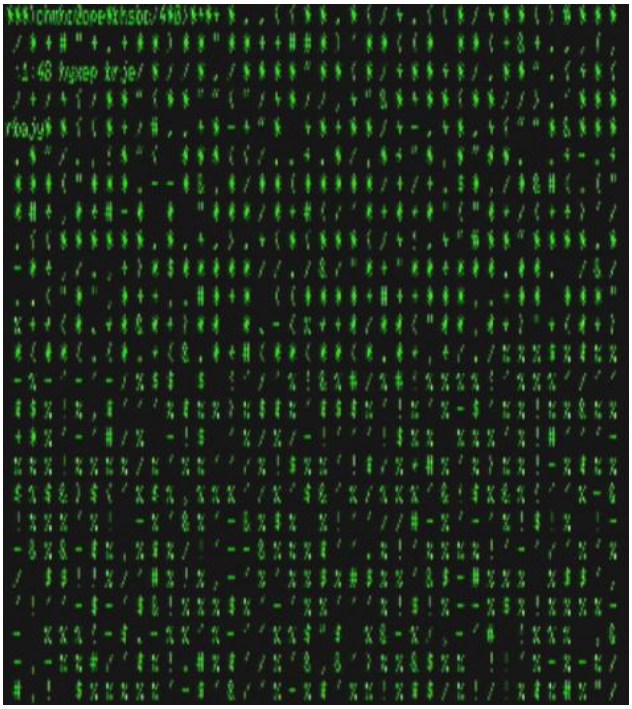


Diagnoses: Check\replace Character ROM – **UA3 and\or** 74LS166 **– UA2**

Symptoms: Boot with chirp but screen not correct.

Diagnoses: Check\replace 74LS244 – **UB5 and\or UB9**

Symptoms: Boot with chirp but screen not correct.



Diagnoses: Check\replace 74LS244 – **UB6 and\or UB7**

Symptoms: Boot with chirp but screen not correct.

Diagnoses: Check\replace 74LS 244 – **UB9 and\or** 74LS10 **– UE7**

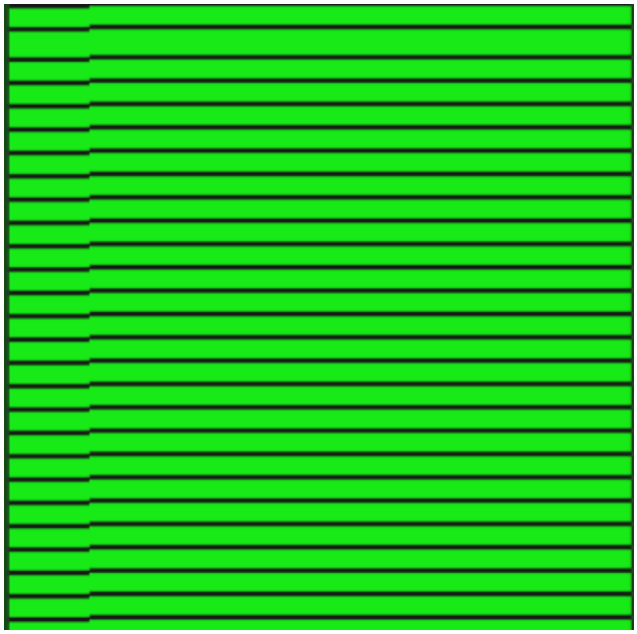
Symptoms: Boot with chirp but screen not correct.

Diagnoses: Check\replace 74LS74 **– UB2**

Symptoms: Boot with chirp but screen not correct. Characters off screen and roll over to next line.

Diagnoses: Check\replace 74LS74 **– UB1**

Symptoms: Boot with chirp but screen not correct. Note how part of the green bar is shifted down.

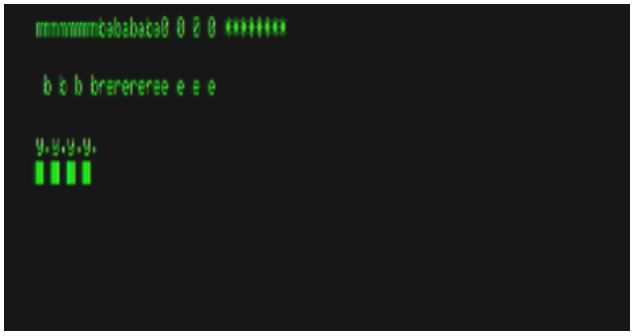


Diagnoses: Check\replace 74LS74 – **UC1**

Symptoms: Boot with chirp but screen not correct. Note some characters are flickering.

Diagnoses: Check\replace 74LS138 – **UC3**

Symptoms: Boot with chirp but screen not correct.



Diagnoses: Check\replace 74LS157 – **UC8**

Symptoms: Boot with chirp but screen not correct.

Diagnoses: Check\replace 74LS157 -**UC9**

Symptoms: Boot with chirp but screen not correct.

Diagnoses: Check\replace 74LS157 – **UC10**

Symptoms: Boot with chirp but screen not correct.

Diagnoses: Check\replace BASIC ROM – **UD10**

Main RAM Related Issues

Below is a diagram showing the memory locations and corresponding RAM ICs. The locations shown are ONLY for PET computers that have the CRTC IC – 6545. Here is the upper memory in a chart

Bit	IC	Address Range
0	UA18	24576–32767 (D0 line)
1	UA16	24576–32767 (D1 line)
2	UA14	24576–32767 (D2 line)
3	UA12	24576–32767 (D3 line)
4	UA10	24576–32767 (D4 line)
5	UA8	24576–32767 (D5 line)
6	UA6	24576–32767 (D6 line)
7	UA4	24576–32767 (D7 line)

PET 4016,4032,8032 (12 inch – WITH CRTC)

Address Range	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
0000-3FFF	UA5	UA7	UA9	UA11	UA13	UA15	UA17	UA19
4000-7FFF	UA4	UA6	UA8	UA10	UA12	UA14	UA14	UA18

Symptoms: Total memory shown: 15359 bytes free

Diagnoses: Check\replace Upper RAM range **4000-7FFF**. See image above for IC locations.

Symptoms: Green screen on boot up

Diagnoses: Check\replace Lower RAM range **0000-3FFF**. See image above for IC locations.

For lower RAM issues, you will need to use an oscilloscope and\or a diagnostic board to troubleshoot.

For upper RAM issues, you can use an oscilloscope, a diagnostic board to troubleshoot and\or memory test program that could be loaded from floppy drive, tape or SD card reader.

Booting Correctly, Peripherals\Ports Not Working Properly

Symptoms: Not able to read from attach drive or SD card unit attached to IEEE port

Diagnoses: Check\replace

- Clean the edge connector, on both sides, for the IEEE port.
- MC3446 – **UA20, UB17 and\or UC12.**
- 6520 – **UB16 and** 7417 – **UD15**.

Symptoms: DIRECTORY or CATALOG works, however when loading a program, the SEARCH is looking the wrong program.

Diagnoses: Check\replace System RAM related issues. RAM is partially working correctly however may pass memory tests. Use PETTEST program or other RAM test program to determine which ICs are bad. You can also, with another working PET, rename the diagnostic software to "t.prg" and try loading it.

Symptoms: Not able to load programs from TAPE drive
Diagnoses: Check\replace

- Clean the edge connector, both sides, for the TAPE port.
- 6522 – **UB15,** 74LS00 **– UD5**
- 6520 – **UB12.**
- Q2T2222 – **UE16**.
- Verify that the tape itself is in good condition and that READ head is clean. You can use a cotton swab and some 99% rubbing alcohol to clean it.

Symptoms: Booting and working ok, however no chirp\sound
Diagnoses: Check\replace

- 6522 – **UB15,** 74LS00 **– UD5**
- 6520 – **UB12**

Symptoms: User port not working
Diagnoses: Check\replace 6522 – **UB15**

Symptoms: Keyboard not responding. Cannot type on keyboard
Diagnoses: Check\replace

- 6520 – **UB12**
- 74LS145 **- UC11**

Rudy's Retro Intelligence

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