Rudy's Retro Intelligence

Commodore PET 8032 and 4032 Diagnostics Manual

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Created by Rudy's Retro Intel

The purpose of this manual is to help identifying issues and the repair of a Commodore PET 8032\4032. Excluded from

The PET 8032 boards I used to create this manual is the:

Universal Dynamic PET
Assy Number 8032090

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 PET boards for comparisons which allowed me to take measurement. See his many Commodore related videos here: https://www.youtube.com/@DRBradleyPhotography

"Sharing knowledge, we can ensure that the Commodore PET 8032 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 PET 8032 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 8032 and\or 4032 computer. This is information is provided freely to all Commodore PET 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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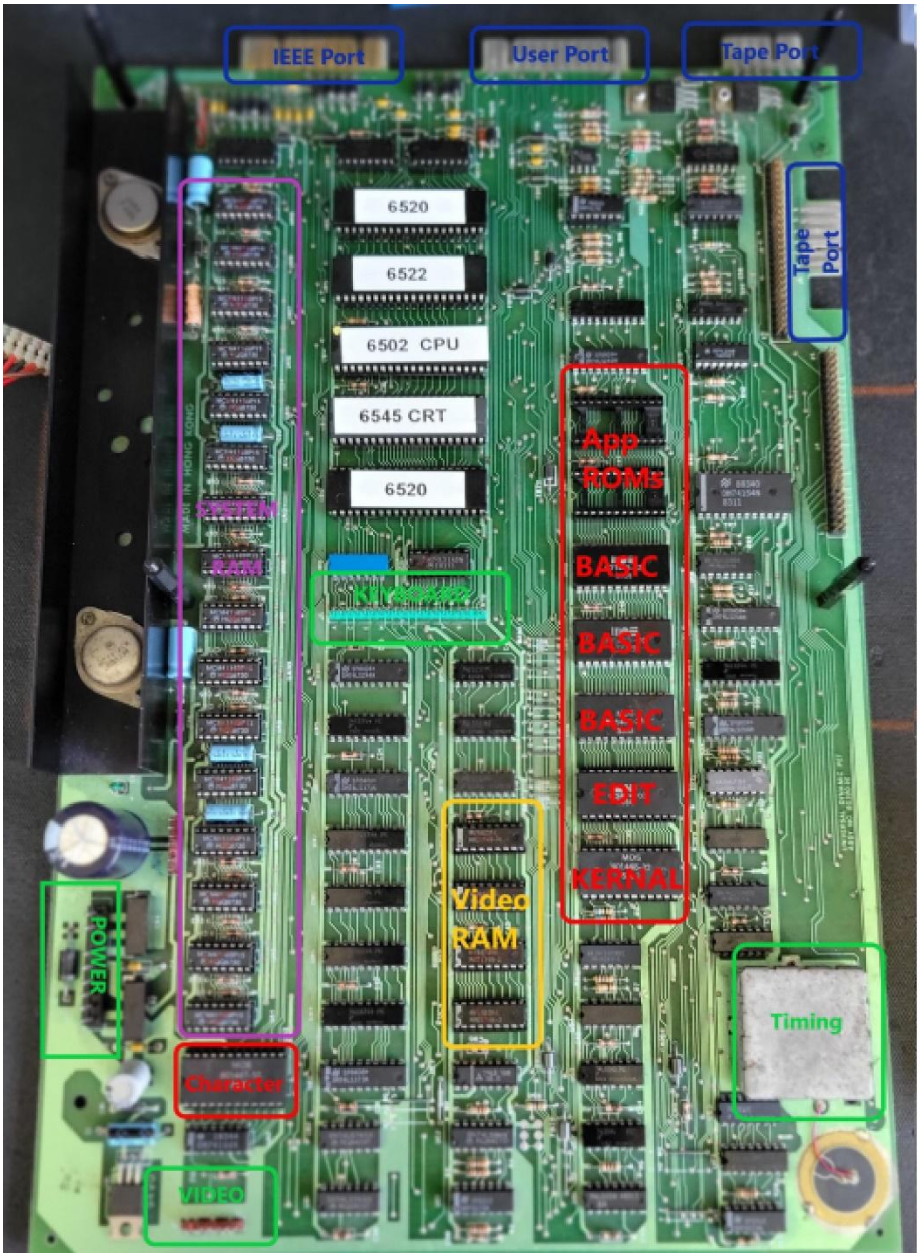
Motherboard Identification

Below is a picture of the 8032's motherboard. The 4032's motherboard is identical with some changes.



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

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

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 SuperPET, 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.

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.

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 my Super PET diagnostic manual 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

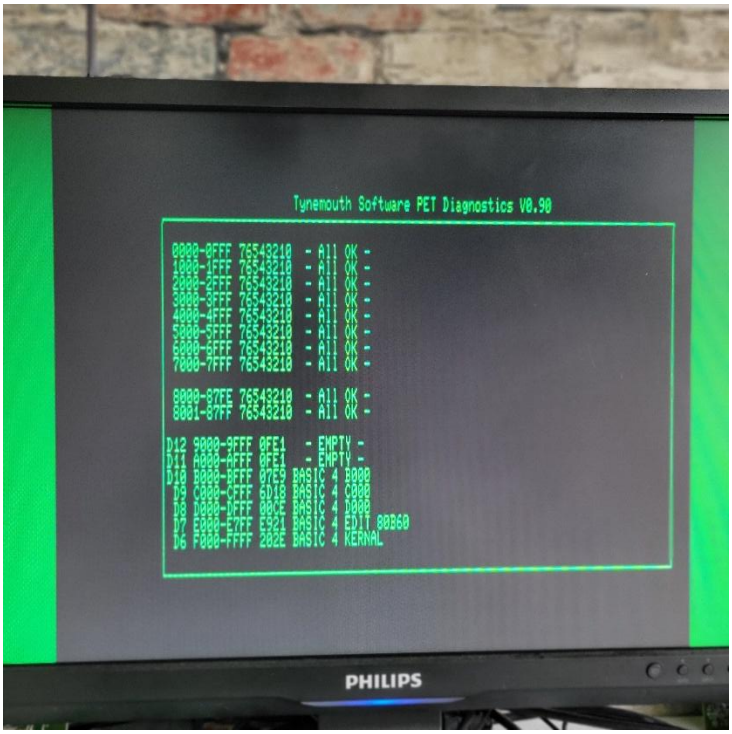
ready.

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.**

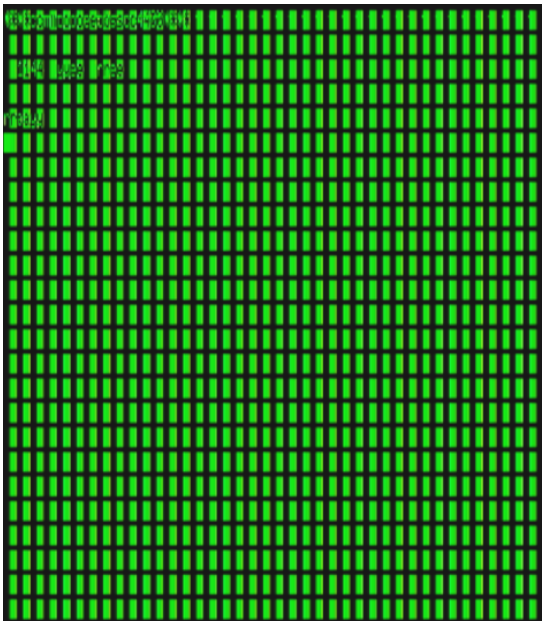
Symptoms: Screen show a complete green background. No chirp from speaker

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

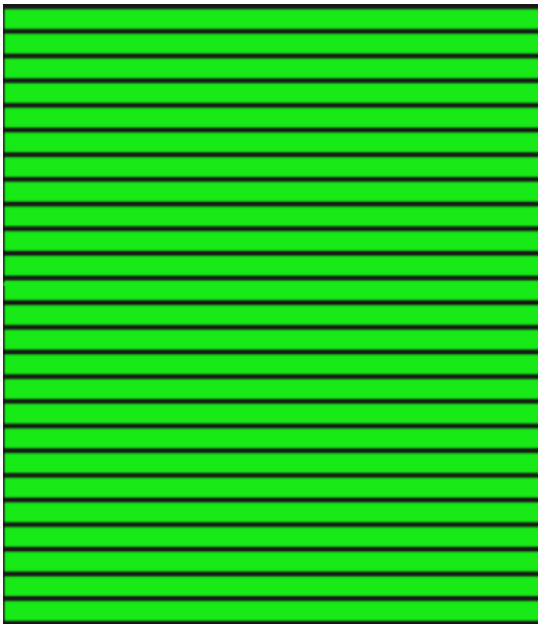
NOTE: Due to the many ICs that could be defective, it is recommended that you use an oscilloscope and schematics for troubleshooting. Using an oscilloscope\schematic to troubleshoot is not covered in this manual.

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.

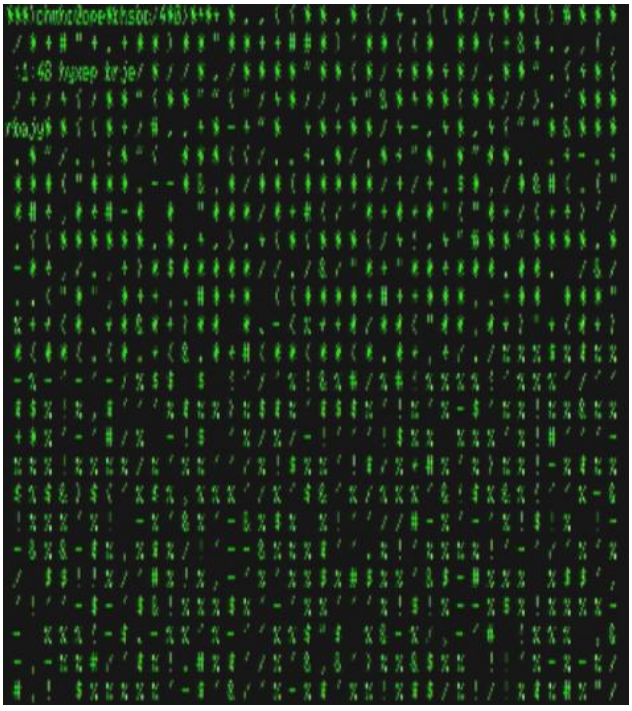


Diagnoses: Check\replace Character ROM – **UA3 and\or** 74LS166 **– UA2**

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**

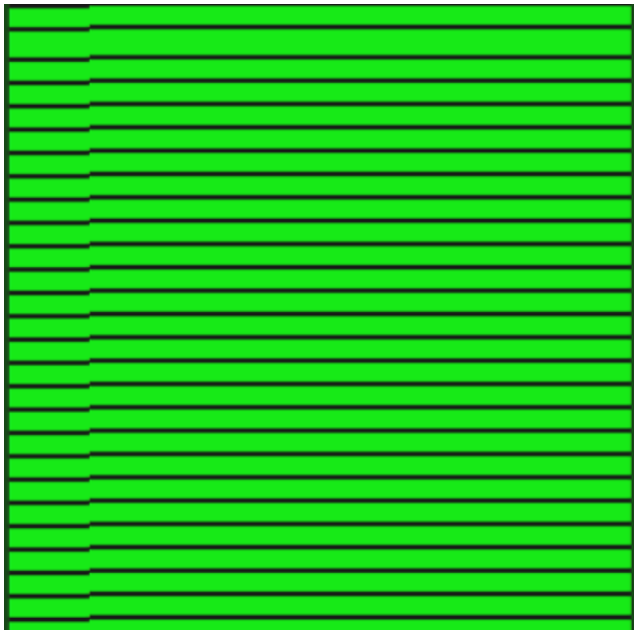
Symptoms: Boot with chirp but screen not correct.

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.

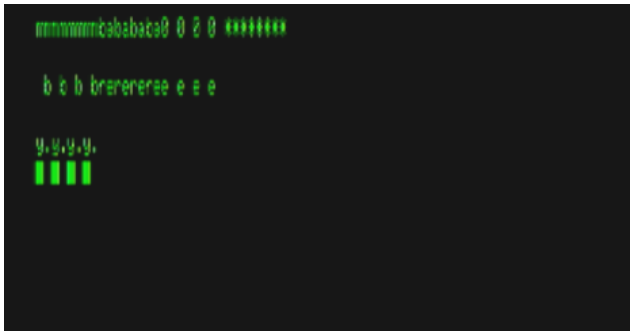


Diagnoses: Check\replace 74LS74 – **UC1**

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

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.

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.

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**.

Symptom: When you turn on the computer or reset the computer with the disk drive attached and turned on, the drive resets as it should, but when you issue a command, such as catalog or directory, the computer locks up. Turning the disk drive off will produce an error "device not present error". No disk activity can be initiated by the computer even though both units appear to be working.

Diagnoses: Ensure that the IEEE port (both sides), and the cable connections are clean. Use a pencil eraser and some sort of electronic cleanser like DE-OXIT and retest. Check 6520 - **UB16**

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**

Ensure that the keyboard is clean, check each key is moving properly, plunger and contacts on the board are also clean. If some keys are not working correctly, use rubbing alcohol to clean 1. The board that is used by the keyboard and 2. Clean each plunger until the coating is a matt colour. You do not need to use other products to get the keys to register. Rubbing alcohol and a cotton swab is all that is needed.