OSP Hardware - PCD Setup (Windows)

Created: May 20th, 2021

Last Updated: May 22nd , 2021

For macOS/Linux installation, see the PDF document

"documentation_pcdSetup_Windows.pdf" or the public [Google doc](#).

Table of Contents

Disclaimer - Device Overheating Issue

While the device is plugged in with a USB cable(s) and operating at the same time, the device will eventually overheat, which can reduce its audio quality and performance. The OSP team is working to resolve this.

For the time being, it is recommended to set up a SSH connection so that you don't have to use a cable to connect the Processing and Communication Device (PCD) to your computer.

1 - Purpose of Document

To install new software on OSP's Processing and Communication Device (PCD), the main OSP hardware device. The instructions in this guide may also refer to the PCD as "the device".

For more information not covered in this guide, please visit this [directory "OSP Hardware Documentation" via OSP's GitHub page](#).

V8 Version of the Processing and Communication Device (PCD)

uart   adb
port   port

*note that the battery level button doesn't do anything at this time

UART ADB

LEFT   ePhys   RIGHT

port for left   port for   port for right
BTE-RICs   ePhys   BTE-RICs

battery level button

0/I

on/off switch   mute button

V9 Version *of the Processing and Communication Device (PCD)*

adb port

port for left
BTE-RICs

port for right
BTE-RICs

port for
ePhys

P-3-07

battery level button

mute button

on/off switch
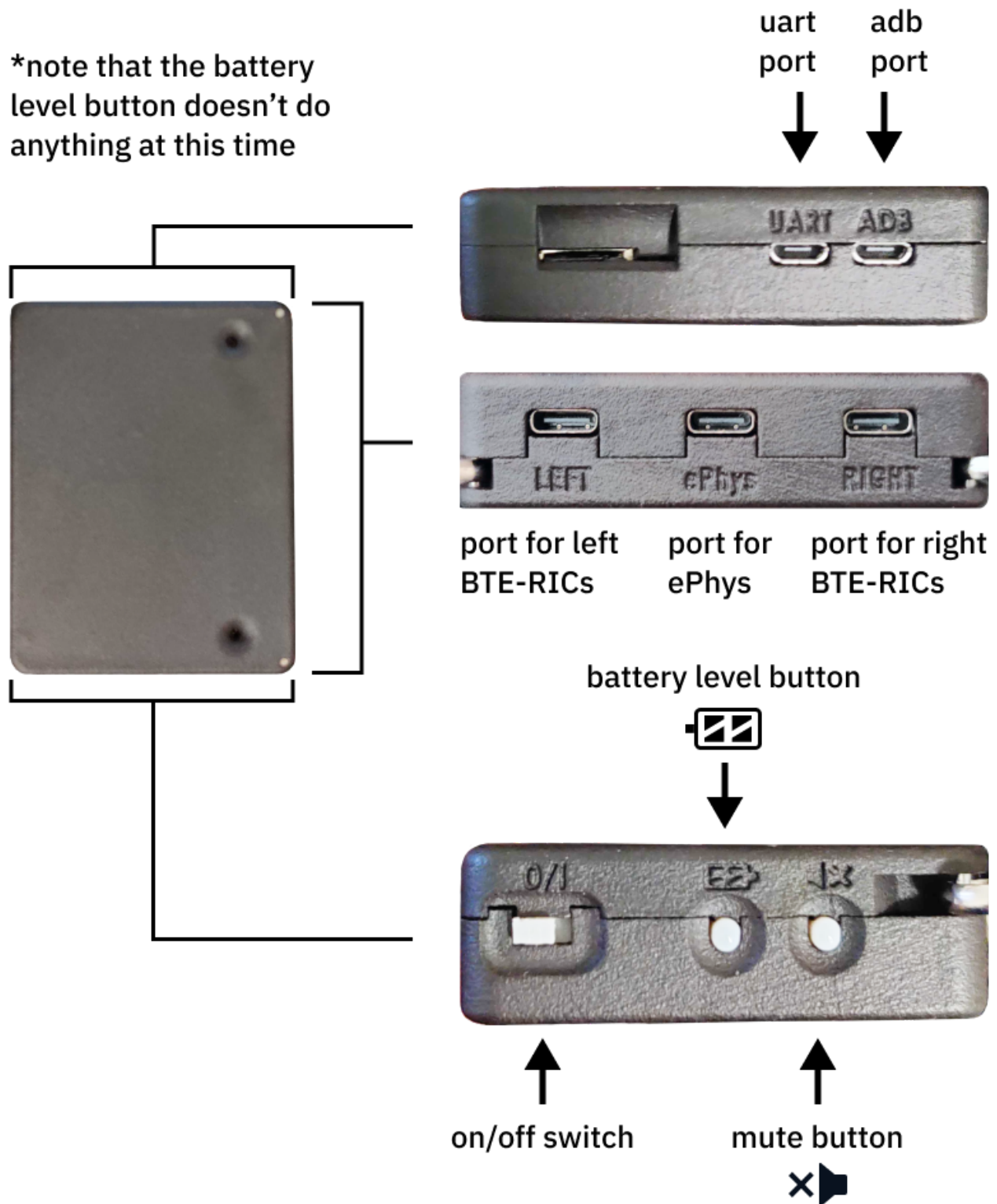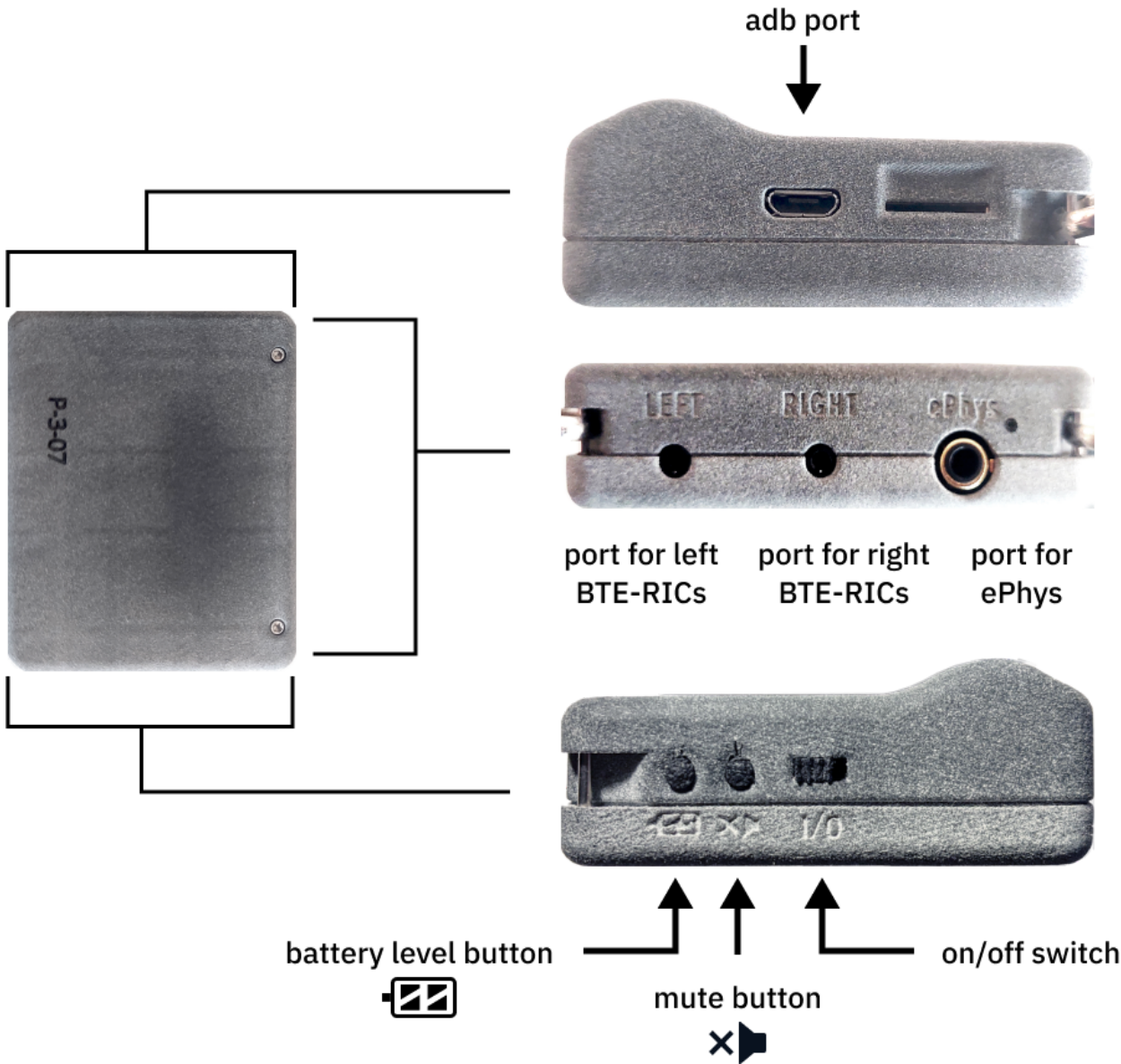
2 - Requirements

- The device (PCD), either the V8 or V9 version.
  - *V8 version* - Has two micro-usb ports labelled "UART" and "ADB".
  - *V9 version* - Has a single micro-usb port.

- Micro-usb cable(s) that **can exchange data**.
  - 2 cables for the V8 version, 1 cable for the V9 version.
  - Use cables that can exchange data and verify that they can, even if they have the trident logo. Do not use any cables that only charge the device (aka "charge-only").
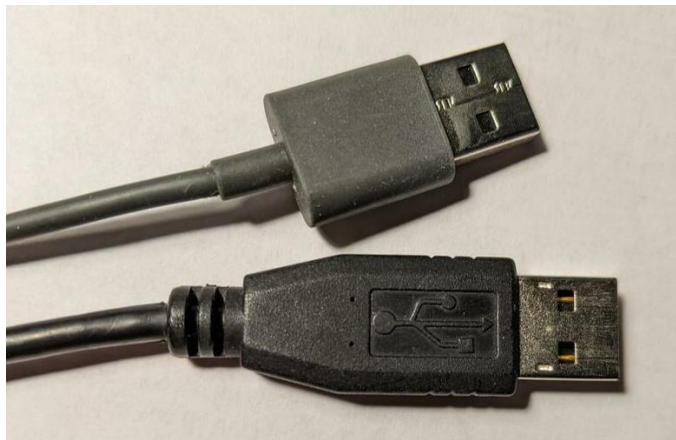
The top cable is a "charge-only" usb cable, do not use these. Bottom cable is a usb cable with the trident logo, which typically signifies that you can exchange data.

- Knowledge of using a Windows computer to navigate and use Windows' Settings, File Explorer, Device Manager, Microsoft Powershell.

- Knowledge of using a terminal, such as Microsoft Powershell. Terminal commands are covered in this guide.

It is recommended to download and install software that can open and extract .zip files, such as 7-zip.

3 - Installation Steps for Hardware

3.1 - Download, Save, and Open the PCD .zip File

Go to this link to the public ["Releases" folder in Google Drive](#) and download a .zip file named "pcd-windows-[date].zip" of the most recent version.
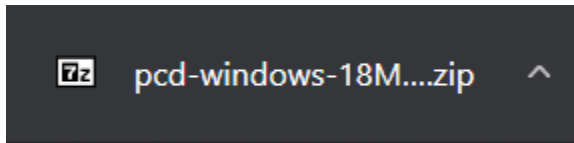
It is recommended to save the .zip file somewhere convenient on your computer, such as your "Downloads" or "Desktop" directory.

3.2 - Extract the .zip File

Go to File Explorer, open the .zip file with a program such as [7-zip](#), and extract the contents of the zip file.
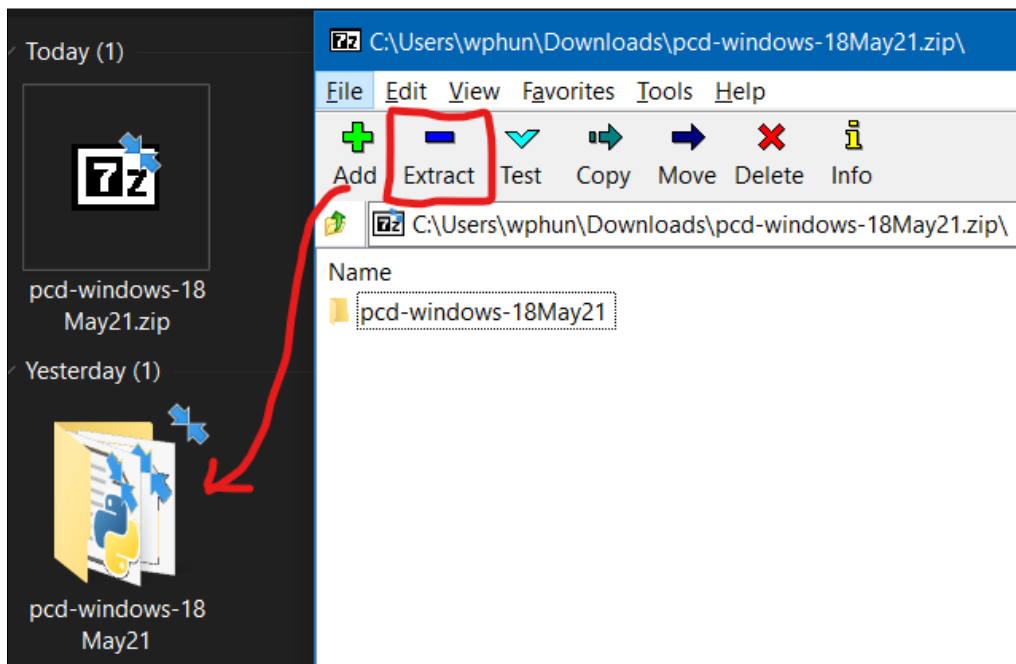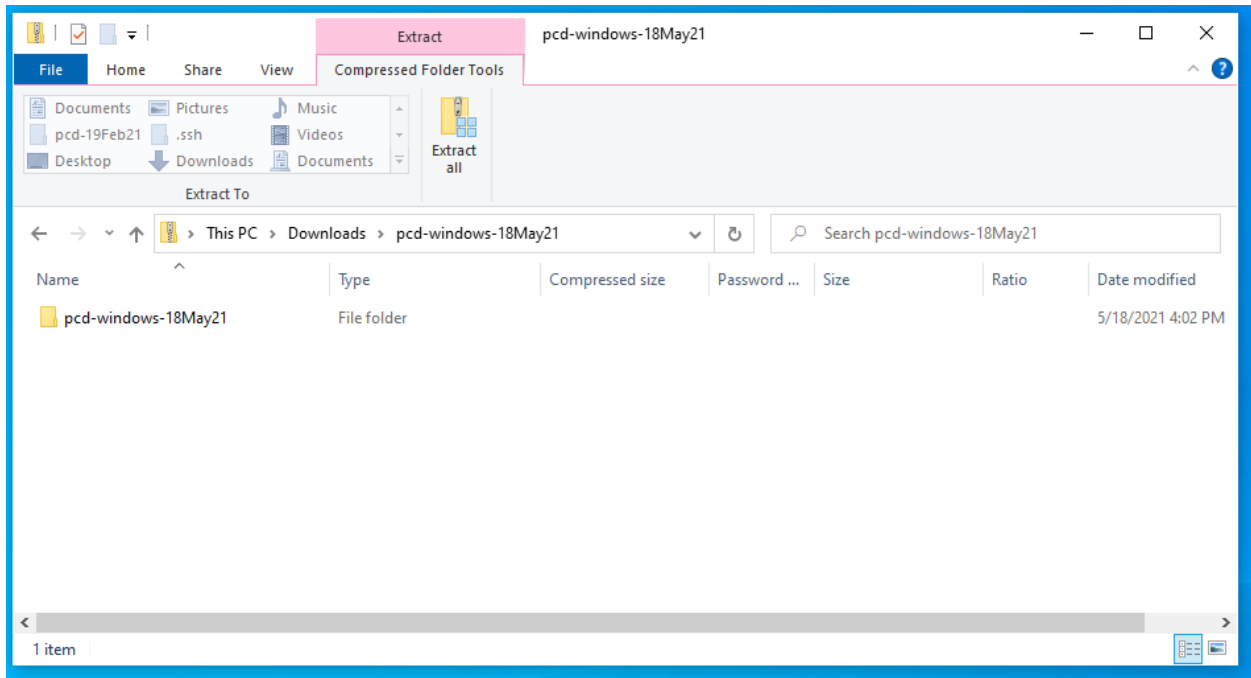
In [step 3.7](#), you will need to use the terminal to navigate inside the "pcd-windows-[date]" folder that gets produced from the extracted .zip file.

For example, if you have extracted a .zip file named "pcd-18May21", you will see a folder named "pcd-18May21".

If you're not sure how to find File Explorer:

1. Go to your Windows taskbar and make sure that you have the Search box shown (appearing as a rectangle with a magnifying glass).
2. Type in "File Explorer".

3.3 - Install the FTDI USB Drivers

- In File Explorer, click on the extracted folder, go to a folder named "win", and click on a file named "CDM21228_Setup.exe" to open it.
- You should see a window called "User Account Control" that asks you "Do you want to allow this app to make changes to your PC?". Click "Yes" to continue and start the FTDI CDM installer instructions window.
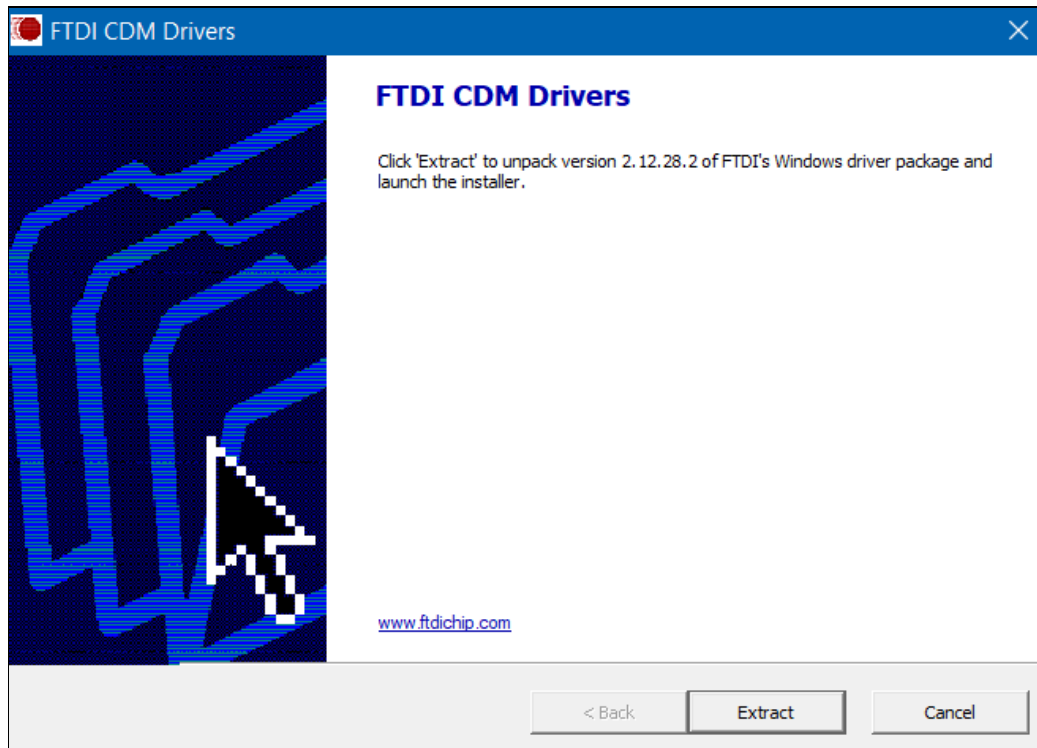
- Follow the instructions from the Device Driver Installation Wizard. Accept their license agreement to complete the installation.
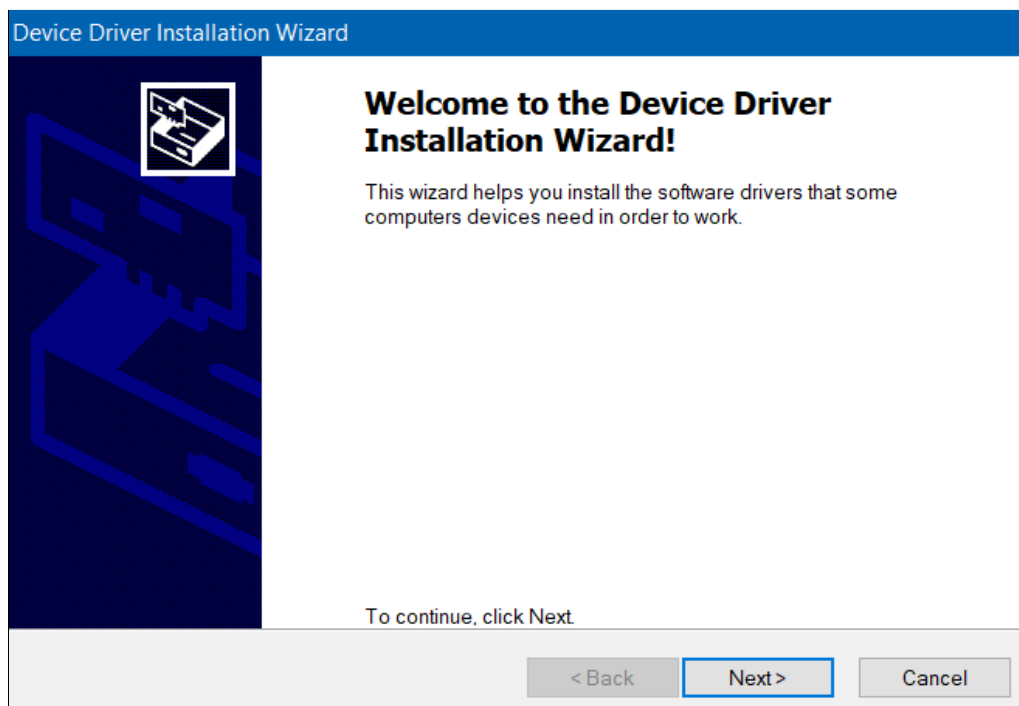
Device Driver Installation Wizard

License Agreement

To continue, accept the following license agreement. To read the entire agreement, use the scroll bar or press the Page Down key.

> IMPORTANT NOTICE: PLEASE READ CAREFULLY BEFORE INSTALLING THE RELEVANT SOFTWARE:
> This licence agreement (Licence) is a legal agreement between you (Licensee or you) and Future Technology Devices International Limited of 2 Seaward Place, Centurion Business Park, Glasgow G41 1HH, Scotland (UK Company Number SC136640) (Licensor or we) for use of driver software provided by the Licensor(Software).
>
> BY INSTALLING OR USING THIS SOFTWARE YOU AGREE TO THE

◉ I accept this agreement   Save As   Print
○ I don't accept this agreement

< Back   Next >   Cancel

Device Driver Installation Wizard

Completing the Device Driver Installation Wizard

The drivers were successfully installed on this computer.

You can now connect your device to this computer. If your device came with instructions, please read them first.

Driver Name	Status
✔ FTDI CDM Driver ...	Ready to use
✔ FTDI CDM Driver ...	Ready to use

< Back   Finish   Cancel

3.4 - Open Device Manager

In your Windows taskbar, use the Search box to find Device Manager and open it.
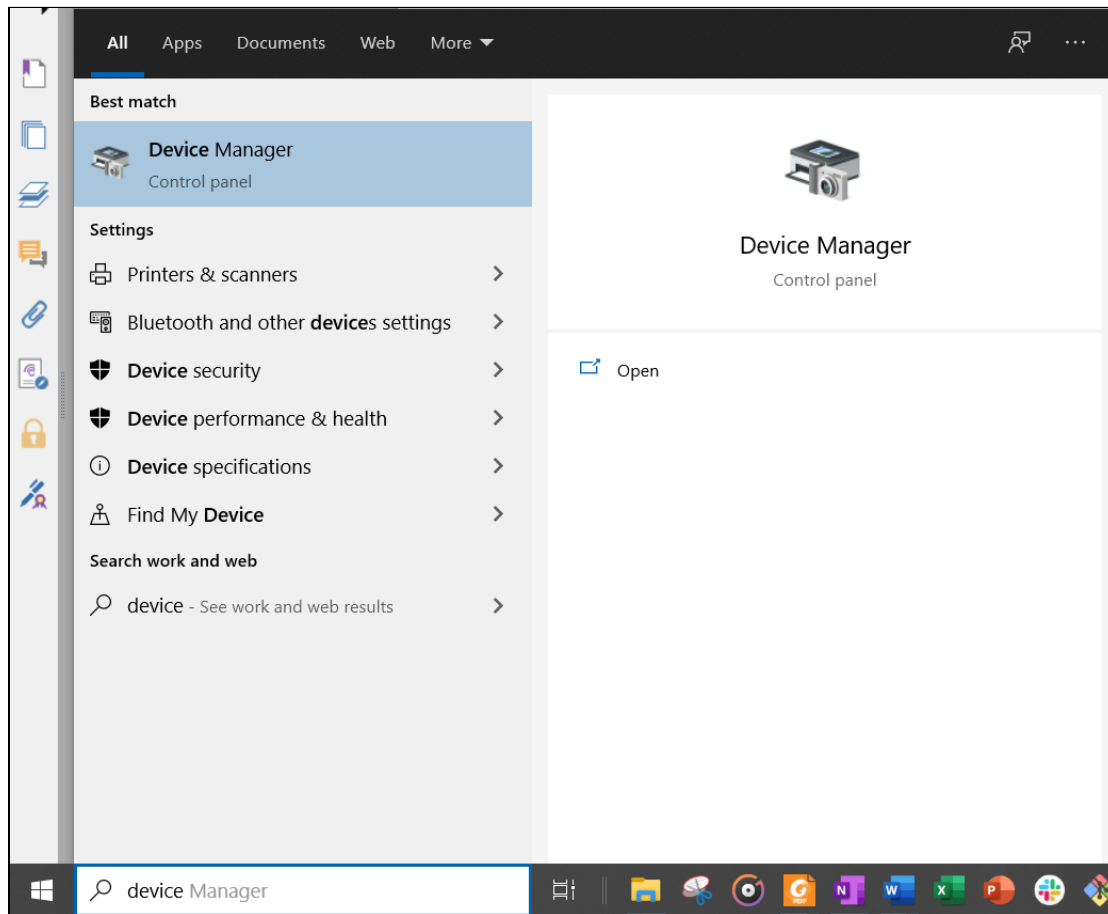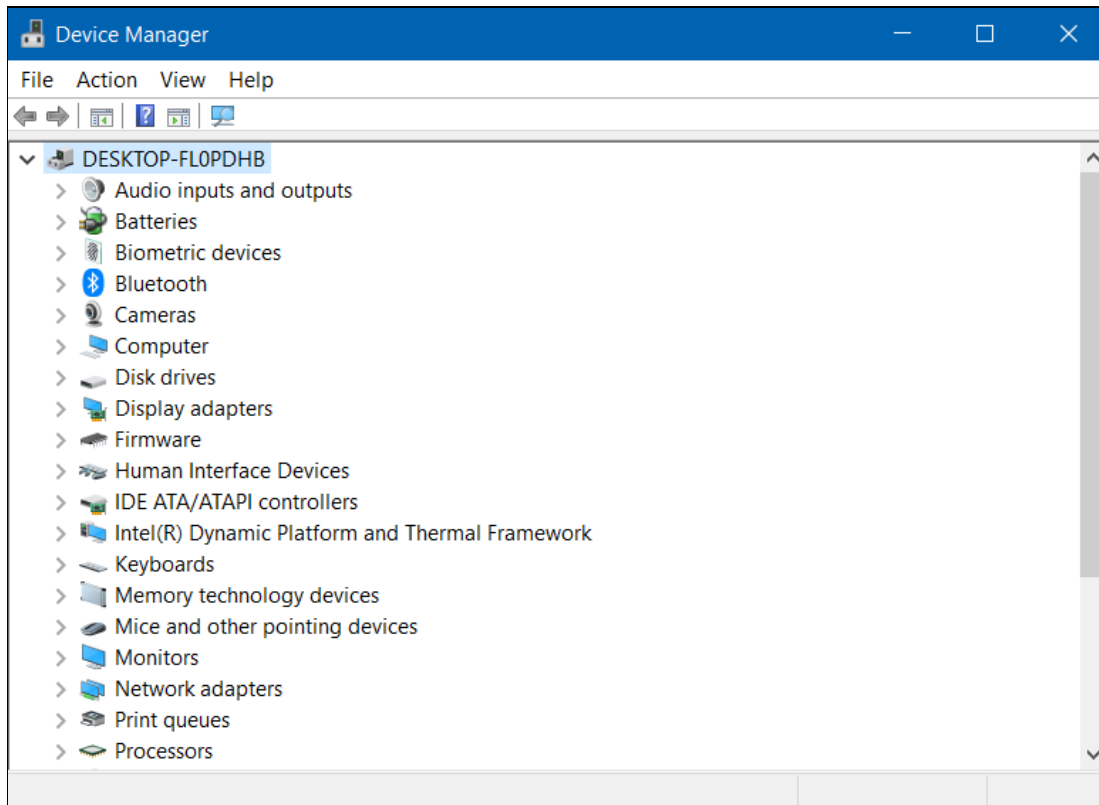
3.5 - Connect the Device to Your Computer Using Micro-USB Cables

Depending on which version of the device you have, do one of the following:

- **If you have the V8 version with two micro-usb ports**, attach one micro-usb cable to the "ADB" port. Attach the other cable to your computer or the USB hub.

- **If you have the V9 version with one micro-usb port**, attach one

  micro-usb cable and connect the cable to your computer via the USB

  hub.

Reminder to only use cables that can transfer data. The micro-usb ports
are used for charging, flashing, and connecting as a serial port.

3.6 - Turn on the Device in Boot Mode

To flash the device, the device must first be turned on and set to Boot
mode. Do one of the following for your device version (also see image
below).

- *V8 Version* - While pressing and holding down the *battery button*,
  flick the on/off switch **towards the battery button**.
- *V9 Version* - While pressing and holding down the *mute button*, flick
  the on/off switch **towards the mute button**.

  If you have received one of the pre-production V9 units with the
  mislabelled on/off switch, you may need to flick the on/off switch
  away from the mute button. **For these units, the device will turn on
  when the switch is towards the "0"**.
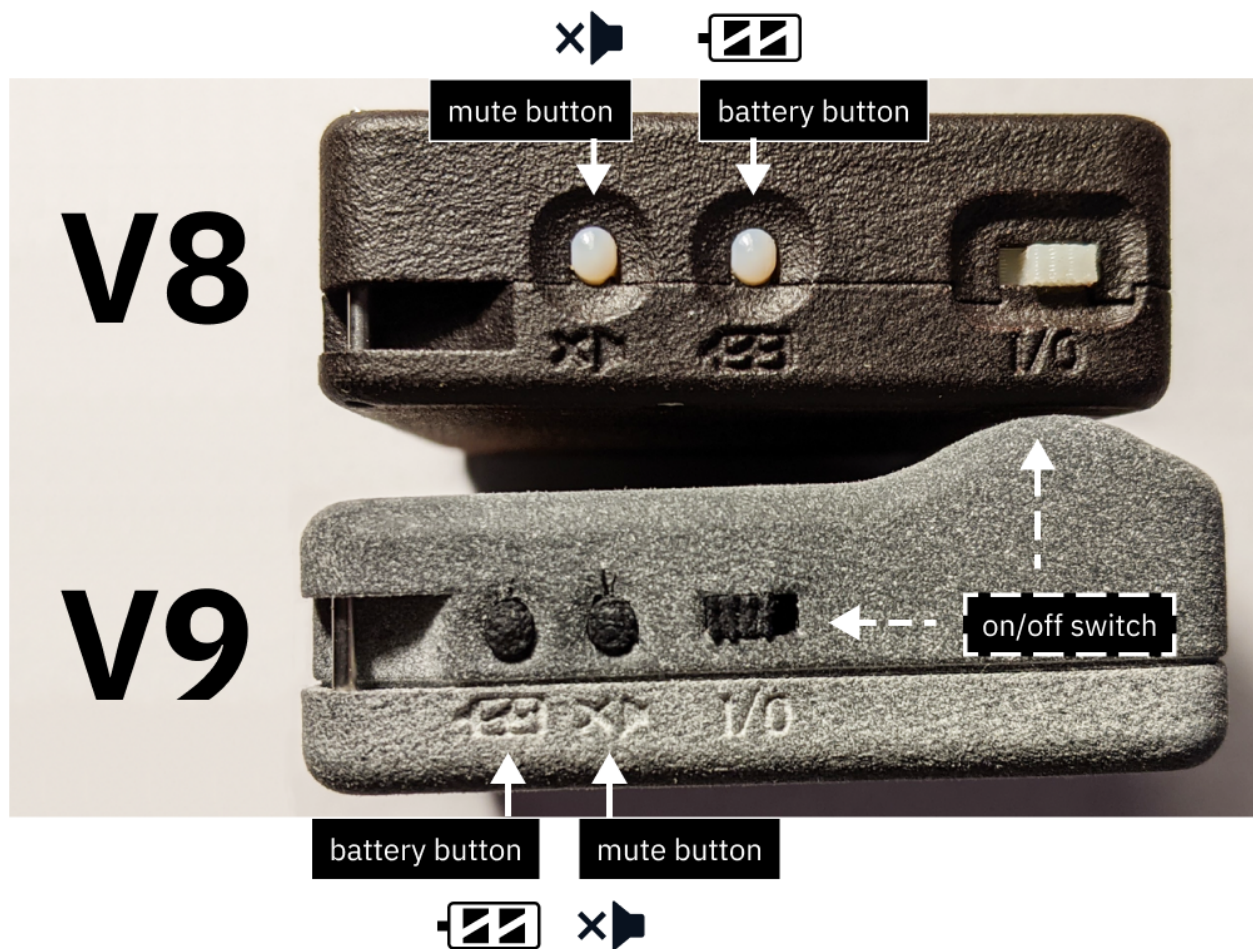
(top area) V8 device. The battery button is closer to the on/off switch.
(bottom area) V9 device. The mute button is closer to the on/off switch.

3.6 - Update Drivers in Device Manager

1. In device manager, find the following:

- *"FT4222H Mode 3 Device"* and *"USB Serial Converter"*: both are under "Universal Serial Bus Controllers".
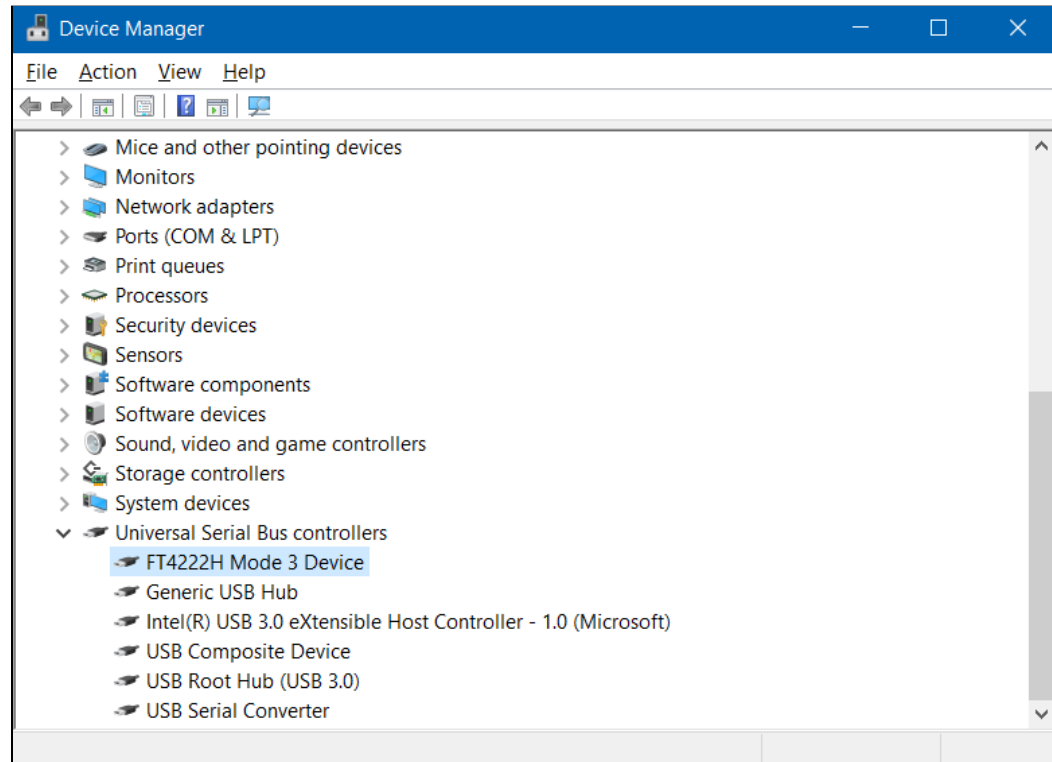
- ○ Click on "USB Serial Converter" and a window should appear describing the Converter's properties. Go to "Advanced" and verify that "Load VCP" is checkmarked

(if not, click on the check box to do so).
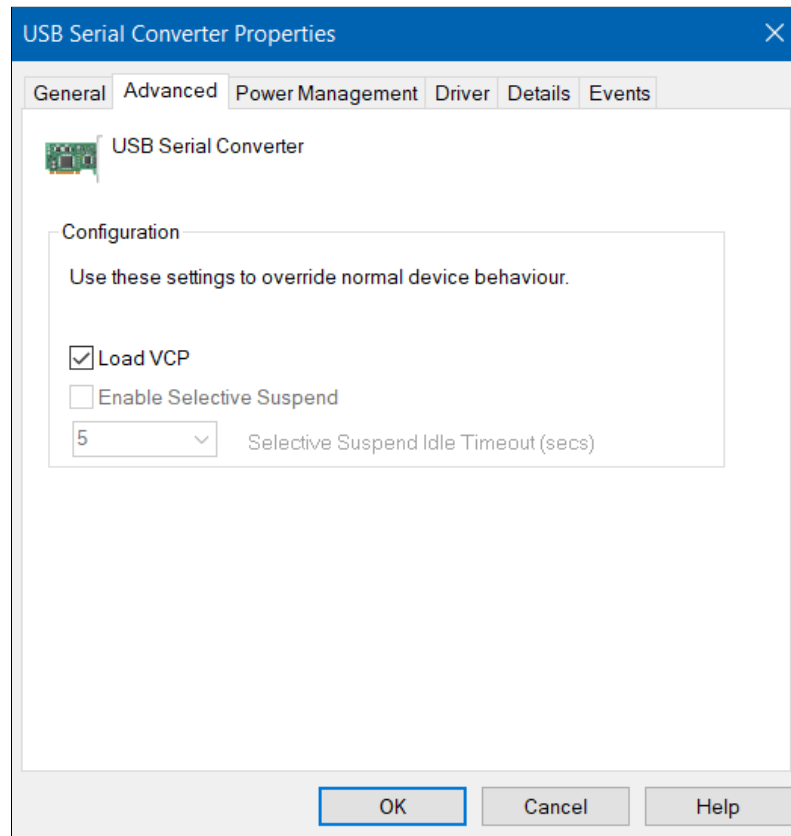
○ *"Android"*: This should appear under "Other devices".
You may need to restart your PCD in boot mode a few
times to see this.
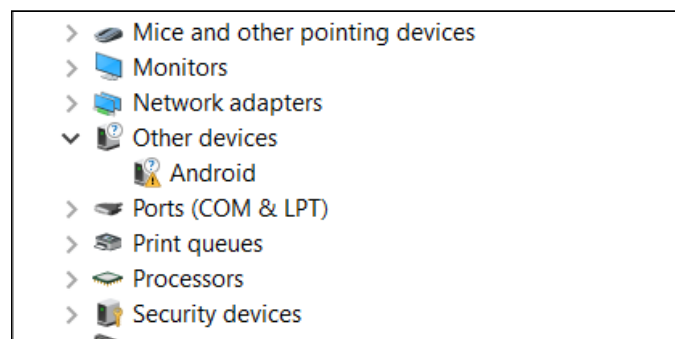
2. Click on "Android", and you'll see a window that describes its properties, then select "Update Driver...".
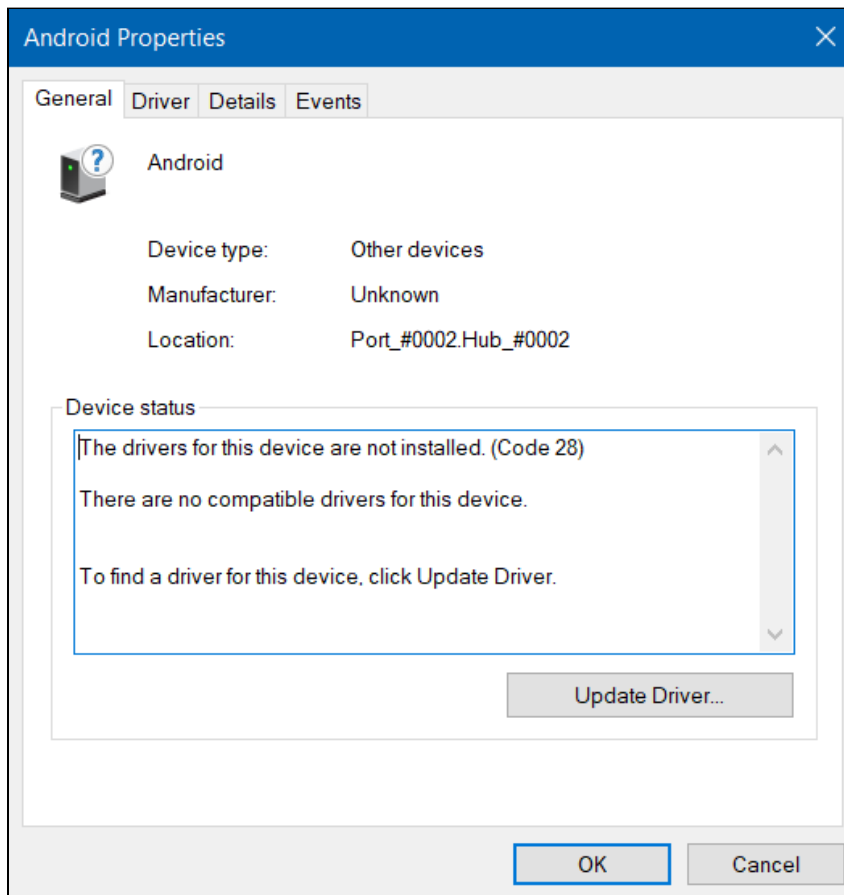
3. Select "Search automatically for drivers".
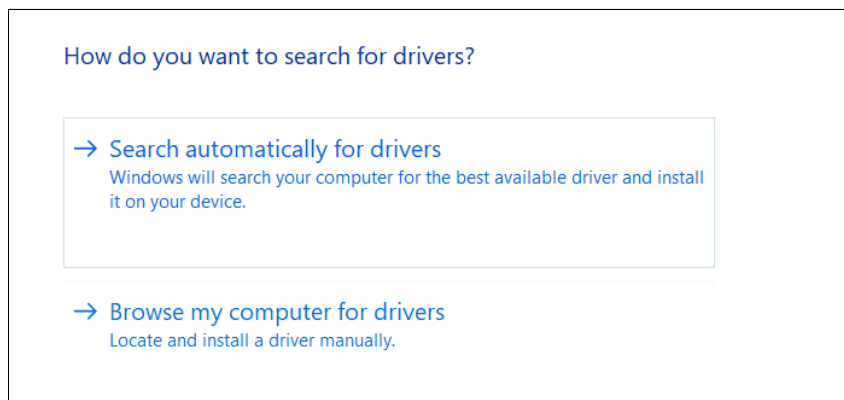
4. Select "Search for updated drivers on Windows Update".
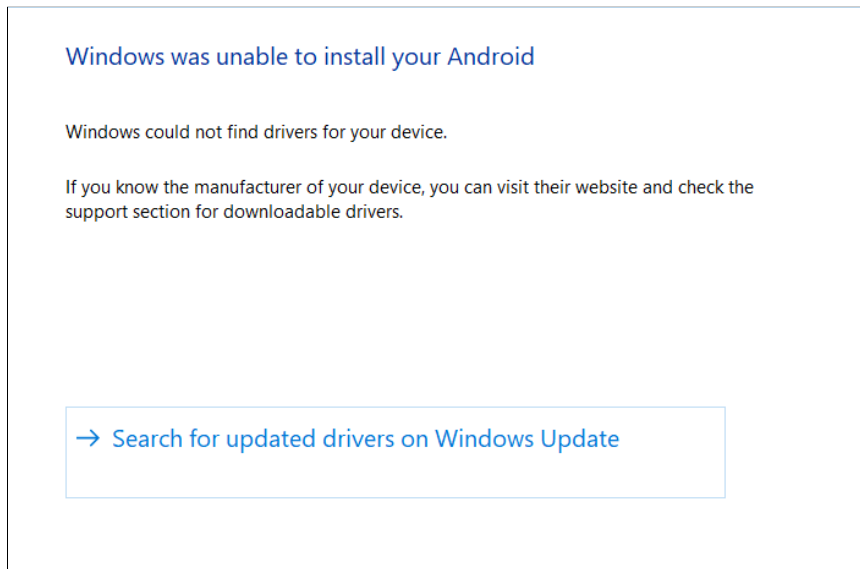
5. You'll see the Windows Settings window appear, showing "Windows Update". Select "View optional updates".
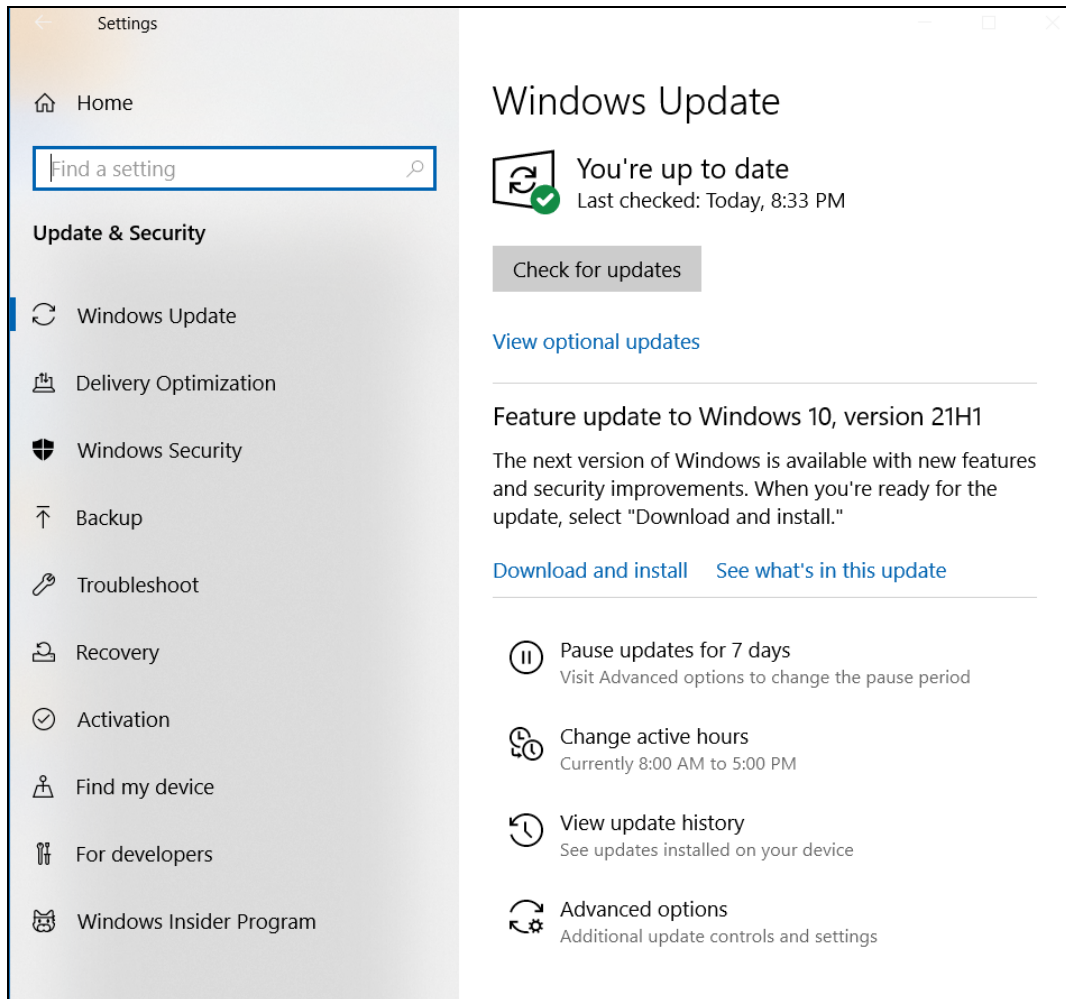
6. Go to "Driver Updates" and find "Google Inc - Other hardware - Android Bootloader Interface".

   Click on the box next to "Google Inc...Bootloader Interface" to select it, then select the "Download and install" button.
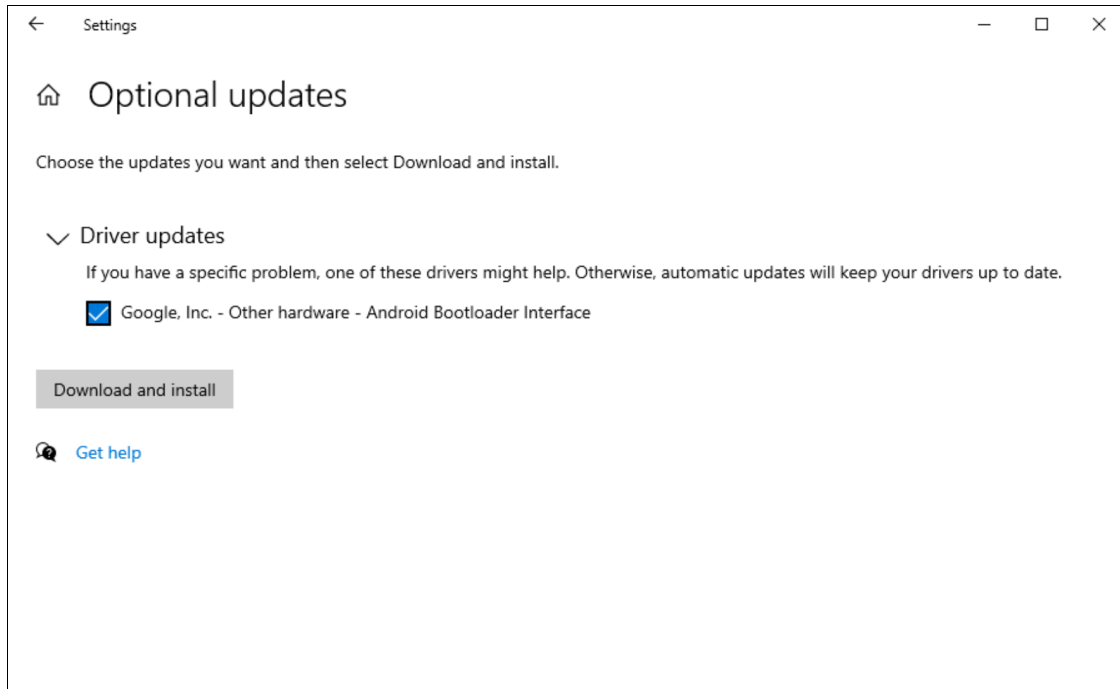
In the previous screen, you'll see it start downloading.
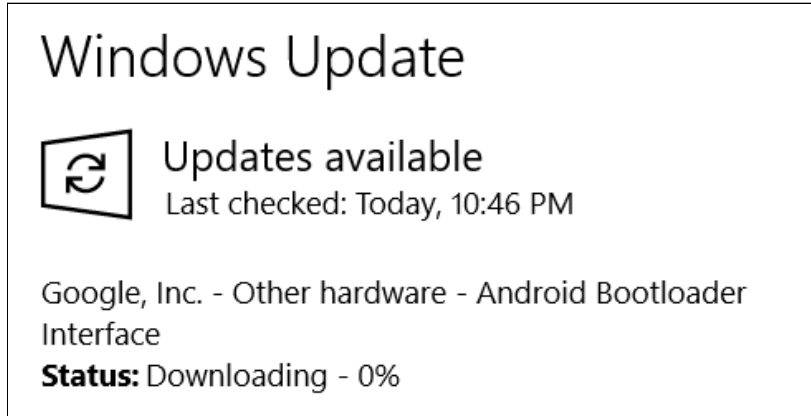
Troubleshooting: If "Google Inc...Bootloader Interface" doesn't immediately show up, go back to "Windows Updates", click on the "Check for updates" button, wait a few seconds, then repeat the

following: "View optional updates" > "Driver Updates".

7. Go back to Device Manager and find the "Android Bootloader

Interface" under "Kedacom USB Device".
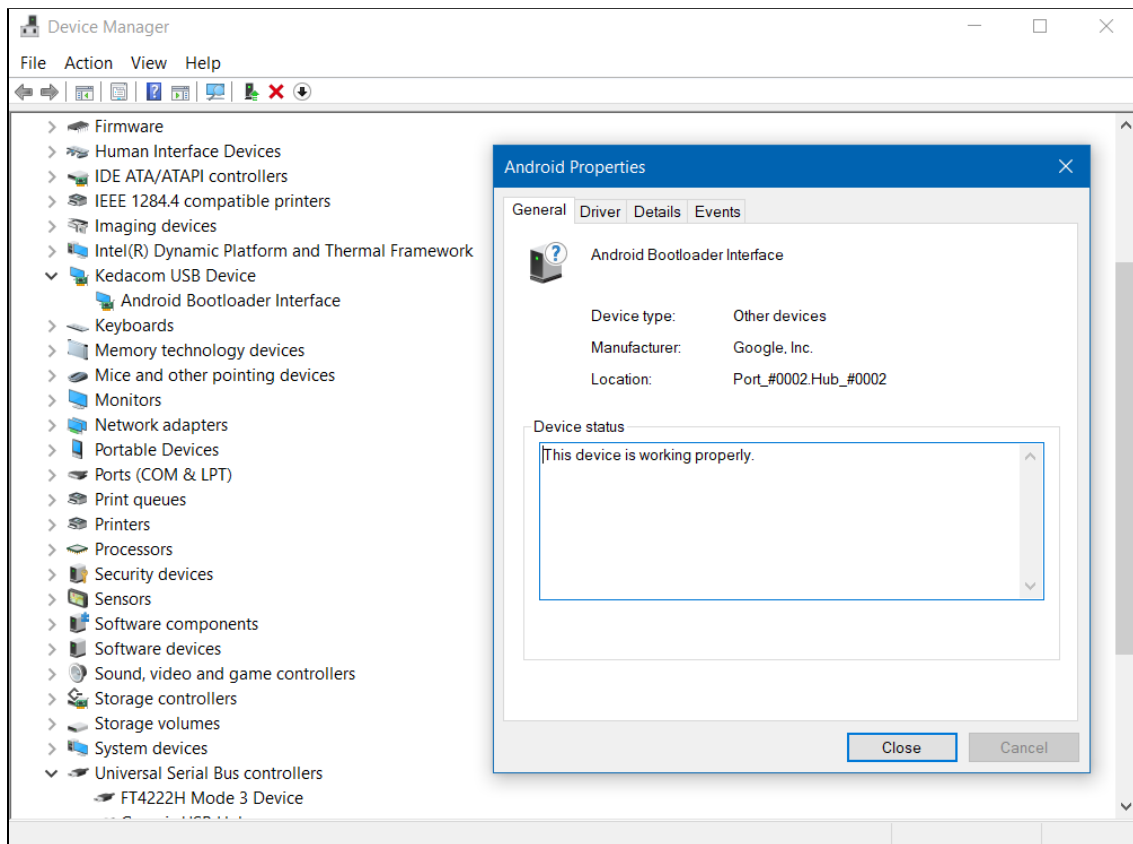
At this point, you are now ready to connect to the PCD.

3.7 - Connect to the PCD Using Windows Powershell

1. Go back to the Search box in the Windows taskbar, and start typing

"Microsoft Powershell" to open the program.
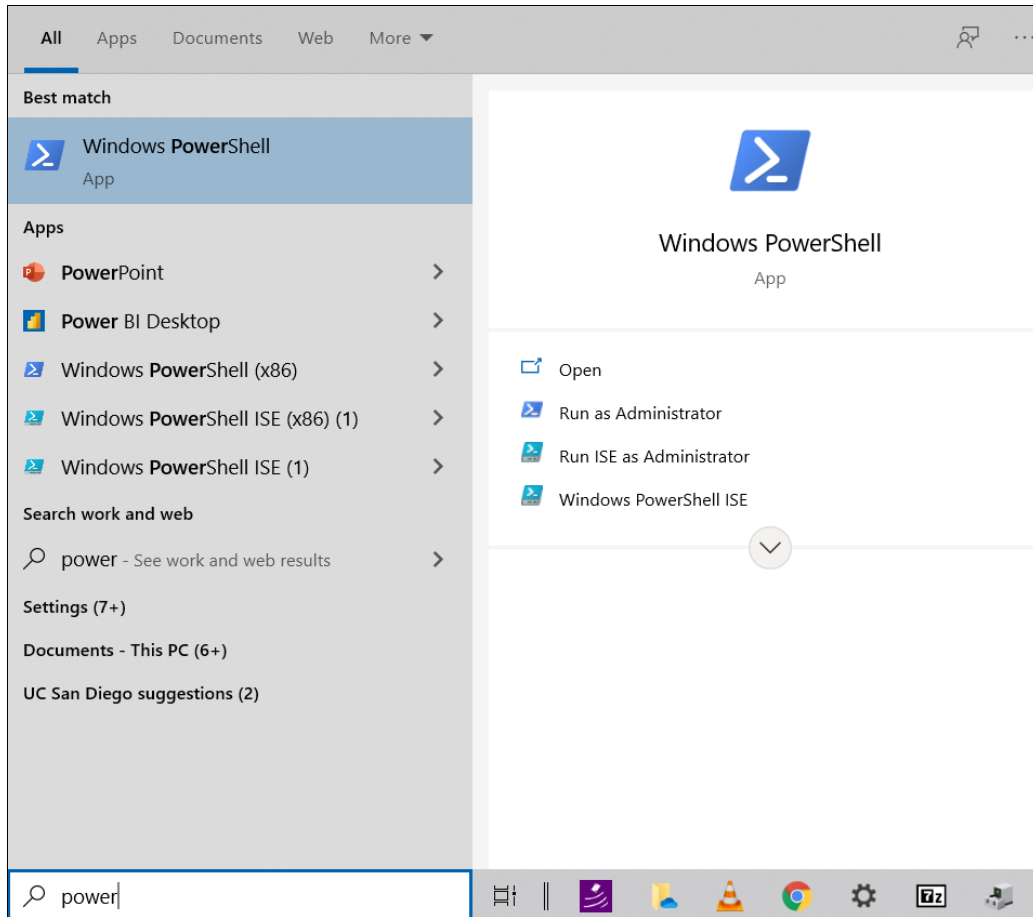
You will see a blue terminal window with a message similar to below.

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights
reserved.

PS C:\Users\[USERNAME]>
```

2. In Powershell, navigate to the "pcd-windows-[date]" folder that was produced from <u>step "3.2 - Extract the .zip File"</u>. You can do this by entering the command: **cd [PATH_TO_"pcd-windows-[date]"_FOLDER]**

For example, if you have extracted a .zip file named "pcd-windows-18May21", you will see a folder named "pcd-windows-18May21". If that folder was saved within "Downloads", you would enter: **cd Downloads/pcd-windows-18May21**

```
PS C:\Users\[USERNAME]> cd
.\Downloads\pcd-windows-18May21\
PS
C:\Users\[USERNAME]\Downloads\pcd-windows-18May21>
```

Finally, check that you see pcdtool.exe and relevant files by entering the command: **ls**

```
PS C:\Users\[USERNAME]\pcd-windows-18May21 > ls
Directory: C:\Users\[USERNAME]\pcd-windows-18May21
Mode LastWriteTime Length Name
---- ------------- ------ ----
d----- 5/18/2021 3:50 PM opt
d----- 5/18/2021 3:01 PM win
------ 5/18/2021 3:19 PM 1823 ospboard_id
-a---- 5/18/2021 4:08 PM 6922874 pcdtool.exe
-a---- 5/18/2021 4:08 PM 7007 pcdtool.py
------ 2/24/2021 3:19 PM 2107578 README.pdf
------ 5/18/2021 3:19 PM 2107578 WINDOWS.pdf
```

3.8 - Flash the Image to the Device

The "pcdtool" utility can flash the filesystem, boot the device, connect to it, and transfer files to and from it.

Enter the terminal command **.\pcdtool flash** to flash the device.

```
PS C:\Users\[USERNAME]\Downloads\pcd-windows-18May21>
.\pcdtool flash

FLASHING DEVICE.  Hold mute button and power on device

Flashing rootfs and rebooting

Sending 'boot' (16426 KB)
OKAY [  0.519s]
Writing 'boot'
OKAY [  0.352s]
Finished. Total time: 1.026s
```

If pcdtool does not work for you, you can also flash the device manually by issuing these three commands in order (copy and paste):

i.   **.\win\fastboot.exe flash:raw boot**
     .\opt\osp\var\build\boot -v9.img

ii. **.\win\fastboot.exe flash:raw boot**
     .\opt\osp\var\build\boot -v9.img

iii. **.\win\fastboot.exe reboot**

```
PS C:\Users\[USERNAME]\pcd -20Feb21 >
.\win\fastboot.exe flash:raw boot
.\opt\osp\var\build\boot -v9.img
Sending 'boot ' (16414 KB) OKAY [ 0.638s]
Writing 'boot ' OKAY [ 0.344s]
Finished. Total time: 1.011s
PS C:\Users\[USERNAME]\pcd -20Feb21 >
.\win\fastboot.exe flash:raw boot
.\opt\osp\var\build\boot -v9.img
Sending 'boot ' (16414 KB) OKAY [ 0.638s]
Writing 'boot ' OKAY [ 0.344s]
Finished. Total time: 1.011s
...
PS C:\Users\[USERNAME]\pcd -20Feb21 >
.\win\fastboot.exe reboot
Rebooting
```

After flashing the device, you should expect the following:

- You should see "ospboard" show up in the wifi SSID list on a laptop or cell phone.

- You should be able to connect to the device with a serial connection over the USB cable.

- You should be able to see lights flashing inside the case.

3.9 - Connecting to the Device Using the Serial Port

You can use a terminal program, such as **pcdtool**, to connect the PCD to a usb port (/dev/ttyUSB0 on Linux or /dev/cu.usbserial* for Mac). You may need to specify the device name and speed (baud rate) to use so that the terminal program can start the connection up. If you have multiple devices, you may see ttyUSB1, cu.usbserial1, etc. and they only appear when the PCD is attached and powered on.

If you're continuing to use **pcdtool** after flashing the device, you need to connect to the device by entering the terminal command:

./pcdtool.exe conn

```
PS C:\Users\[USERNAME]\Downloads\pcd-windows-18May21>
.\pcdtool.exe conn
Trying COM3: USB Serial Port (COM3) [USB
VID:PID=0403:6015 SER=DT04N584A]


Hit Ctrl-Z to exit


root@ospboard:~#
```

SSID is the wifi name when you typically view available wifi networks. If you don't see any terminal output, you may need to press the "Enter" key once or twice for terminal feedback (to confirm feedback, you'll see `root@ospboard:~>`).

If you are considering an alternative to `pcdtool`, **PuTTY** works well ([link to PuTTY download](#)) for any installation step that requires the serial port. In PuTTY, set the baud rate (speed) of 115200, which is required to communicate with the PCD.

3.10 - Hotspot and NetworkManager Modes

The device has two different modes, ["Hotspot mode"](#) and ["NetworkManager mode"](#).
You can check the device's current mode by entering the command:

`print_mode`

You can also have the option to set up SSH to connect to your PCD without needing a USB cable.

Hotspot Mode - Introduction

When the device is first flashed, the device is in hotspot mode by default.

- *Benefits* - This mode allows you to connect to the PCD using a browser-enabled phone or computer via wifi SSID. The PCD has a consistent IP address and is not dependent on any external wifi router.
- *Drawbacks* - The device has no internet connectivity and when you connect your phone or laptop to the PCD, it will lose internet too.

To set the PCD to hotspot mode, enter the command **set_mode hs** and let the device reboot itself.

Entering the **print_mode** command shows the following terminal output for hotspot mode.

```
root@ospboard:~> print_mode
Hotspot Mode
Connect to the device at SSID "ospboard" password
"hearingaid" then
open a browser and connect to
http://192.168.8.1:5000 and/or http://192.168.8.1
If you wish to put the board back into
NetworkManager mode then use following command:

set_mode nm
```

You can connect to the PCD using the PCD's native wifi hotspot by connecting to the wifi "ospboard", with the password "hearingaid".

Hotspot Mode - Using SSH to Connect to the Device

To use ssh to connect to the device, enter the command: **ssh -i ospboard_id root@192.168.8.1**

"ospboard_id" is a file containing an ssh key that is included in the zip file. To simplify ssh connections to the PCD, you should copy ospboard_id to "~/.ssh" and add an entry to your ".ssh/config" file such as:

```
Host osp_hs
HostName 192.168.8.1
User root
IdentityFile ~/.ssh/ospboard_id
```

Then, you can enter the command **ssh osp_hs** instead to connect to the device in Hotspot mode.

Hotspot Mode - Setting the HotSpot SSID

For 01Mar2021 and later PCD file releases, you can set the Hotspot SSID and passphrase.

Simply enter the command: **set_hs_name -n ospboard2 -p my_password**

Then, let the PCD reboot itself.

```
root@ospboard:~> set_hs_name -n ospboard2 -p
my_password
Done. Reboot for changes to take effect
root@ospboard:~> print_mode
Hotspot Mode
Connect to the device at ssid=ospboard2 with
wpa_passphrase=my_password
open a browser and connect to
http://192.168.8.1:5000 and/or http://192.168.8.1
If you wish to put the board back into
NetworkManager mode then use following
command:
set_mode nm
```

NetworkManager Mode - Introduction

NetworkManager mode allows you to connect to a local wifi SSID. Its address will be allocated by the wifi router.

- *Benefit* - Easy connectivity from your phone, laptop, or desktop computer.

- *Drawback* - Device must connect to a specific wifi network. If you want to talk to the device via SSH, you need a specific IP address reserved.

To set the device in NetworkManager mode, enter the command `set_mode nm` and let the device reboot itself.

Once the device has finished rebooting, entering the `print_mode` command shows the terminal output below with a list of SSIDs the device can see. (The list may not be complete, so you can always try other SSIDs.)

```
root@ospboard:~> print_mode
NetworkManager Mode
Connect to your wifi with one of the following:
> nmcli dev wifi con MYSSID password "MY PASSWORD"
or
> nmtui
IN-USE  SSID  MODE   CHAN  RATE        SIGNAL  BARS  SECURITY
        DNRC  Infra  1     130 Mbit/s  49        __  WPA2
        DNRC  Infra  6     130 Mbit/s  42        __  WPA2
        DNRC  Infra  6     130 Mbit/s  40        __  WPA2
If you wish to put the board back into hotspot mode
then use following command:
```

```
set_mode hs
```

NetworkManager Mode - Connect to Your Wifi

Connect to your wifi by entering the command: **dev wifi con MYSSID password "MY PASSWORD"**

```
root@ospboard:~> nmcli dev wifi con MYSSID password
"MY PASSWORD"
[  203.944162] wlan0: authenticate with
70:3a:cb:2a:06:d8
[  203.989349] wlan0: send auth to
70:3a:cb:2a:06:d8 (try 1/3)
[  204.000409] wlan0: send auth to
70:3a:cb:2a:06:d8 (try 2/3)
[  204.002978] wlan0: authenticated
[  204.006728] wlan0: associate with
70:3a:cb:2a:06:d8 (try 1/3)
[  204.023939] wlan0: RX AssocResp from
70:3a:cb:2a:06:d8 (capab=0x1431 status=0 aid=4)
[  204.057159] wlan0: associated
[  204.164330] IPv6: ADDRCONF(NETDEV_CHANGE):
wlan0: link becomes ready
```

```
Device 'wlan0' successfully activated with
'2ce4abfd-9c36-446c-9a25-6511d85c9dea'.
```

When entering the **print_mode** command, note the assigned IP address number to the right of "inet". This number will be different for your network.

```
root@ospboard:~> print_mode
NetworkManager Mode
        inet 192.168.86.33  netmask 255.255.255.0
broadcast 192.168.86.255
Connected
If you wish to put the board back into hotspot mode
then use following command:
set_mode hs
```

At this point, the device should be running on your local wifi and will continue to use this mode after it reboots.

You can now simultaneously hit the "ctrl" and "z" keys to exit from the terminal.

You can also disconnect the USB cable if you want.

You will periodically need to reconnect it to a charger to recharge the PCD's battery.

NetworkManager Mode - Using SSH to Connect to the Device

From another computer, you can connect the device by entering the command: **ssh -i ospboard_id root@192.168.86.33**
Replace "192.168.86.33" with your IP address number.

At this point, it is highly recommended that your wifi router reserves that IP address for your device so it doesn't change in the future.

To simplify ssh connections to the PCD, you should copy "ospboard_id" to ~/.ssh and add an entry to your ".ssh/config" file, like the following:

```
Host osp
    HostName  192.168.86.33
    User root
    IdentityFile ~/.ssh/ospboard_id
```

This way, you can simply enter the command **ssh osp** for future use instead of **ssh -i ospboard_id root@192.168.86.33**.

4 - Using Visual Studio Code

Visual Studio Code is an integrated development environment that, when used with the Remote SSH Extension, is a great way to do development on the device.

You will need to setup your "~/.ssh/config" file as described above.

5 - Monitoring and Controlling the OSP Processes

By default, the PCD boots up in Hotspot mode. You can connect to the PCD using the PCD's native wifi hotspot by attaching to SSID "ospboard", password "hearingaid".

Then, open a browser window/tab and enter http://192.168.8.1:5000 and http://192.168.8.1:8080 to launch OSP's software interface.

If you are using NetworkManager mode, you will need to use the IP address assigned by your wifi router.

OSP has three processes that are started automatically in "/etc/rc.local"

```
screen -L -Logfile /var/log/osp.log -dmS
osp_startup ionice -c 1 /opt/release/bin/osp -m
screen -L -Logfile /var/log/ews.log -dmS
ews_startup /opt/release/bin/start-ews
screen -L -Logfile /var/log/ews-php.log -dmS
php_startup /opt/release/bin/start-ews-php
```

You can cat or tail the log files. You can also kill any of the processes you don't need.

For osp, you can monitor CPU usage by entering the command: **ps_osp**.
osp runs realtime threads in CPUs 1-3.

```
root@ospboard:~> ps_osp
CPUID CLS PRI %CPU   LWP COMMAND
    0  TS  19  0.0   558 OSP
    1  FF 130 22.3   566 OSP: Chan 0
    2  FF 130 21.8   567 OSP: Chan 1
    3  FF  41 13.0   607 OSP: AudioCB
```

In the above example, the command `kill 558` will kill all the OSP threads. You can restart it later with the command `nohup ionice -c 1 /opt/release/bin/osp -m > /var/log/osp.log &`

If you wish to disable all the OSP processes, simply create a file named `/root/.no_osp_startup` and reboot. As long as that file exists, OSP will not be run on startup.

Use the command `touch /root/.no_osp_startup` to create the file.

Device Temperature

To check the CPU temperature, enter the command `temp`.

To monitor the temperature every 5 seconds, enter the command `temp -t 5`

6 - Charging the Device

Currently, the devices do not have a way to measure the battery level. They also have some charging quirks, which would be fixed in later hardware revisions.

If a device in Hotspot mode is not creating an "ospboard" SSID, the battery may be too low. If it is in NetworkManager mode and you cannot ping or ssh to it, the battery is likely discharged.

V9 Device Charging

V9 PCDs will charge at up to 600mA when powered on and when powered off, BUT only if the PCD is turned off while the USB port is connected.

If a device is not responding, attach a USB cable and plug the PCD into a computer or charger. Switch the power on. Normally the PCD will charge briefly then start working. If it does not start after 15 minutes, turn the PCD off then on again. It may take 6-8 hours to fully charge.

If you disconnect the USB cable or unplug the charger/laptop, keep the device power on. Once it is moved, wait 5 seconds then you can turn the power off and it will keep charging. If the device was off, you should turn it on, wait 30 seconds then turn it off.

Disclaimer - Device Overheating Issue

While the device is plugged in with a USB cable(s) and operating at the same time, the device will eventually overheat, which can reduce its audio quality and performance. The OSP team is working to resolve this.

For the time being, it is recommended to set up a SSH connection so that you don't have to use a cable to connect the Processing and Communication Device (PCD) to your computer.

V8 Device Charging

V8 devices charge whenever the USB port labelled "ADB" is connected.

System Check

To see a summary of the PCD's system status, enter the command:

```
system_check
```

7 - Next Steps

At this point, your PCD should be ready to go.

To take advantage of the PCD's software features over the browser, refer to the "OSP Software - User Guide".

8 - Resources

Below are hyperlinks to OSP-related resources:

- [OSP Website](#) - General information of OSP.
- [OSP Forum](#) - Community discussion of issues and suggestions for improving OSP.
- ["Releases" folder in Google Drive](#) - You will find downloadable .zip and installer files for OSP hardware and software setup.

There are separate hardware guides for doing the sanity checks on the software within the PCD. Below are more hyperlinks:

- [OSP Hardware Sanity Check Guide - Node.js Version of EWS](#) - Guide to testing that the Node.js version of the embedded web server (EWS) within the PCD works as intended.
- [OSP Hardware Sanity Check Guide - PHP/Laravel Version of EWS](#) - Guide to testing that the PHP/Laravel version of the embedded web server (EWS) within the PCD works as intended.

If you want to simply download OSP software without the device, you may refer to the [Software Getting Started Guide](#), which is a combined version of the following list of separate guides.

- Installation Requirements and Steps (included in the [Software Quick Start Guide](#))

- Software Troubleshooting Guide - Covers steps for possible issues during OSP software installation.
- Software Sanity Check - Audio Input and Output Sources - Guide to checking that your audio input and output sources are connected for OSP software usage.
- Software Sanity Check - Node.js Version of EWS - Guide to testing that the Node.js version of the embedded web server (EWS) works as intended.
- Software Sanity Check - PHP/Laravel Version of EWS - Guide to testing that the PHP/Laravel version of the embedded web server (EWS) works as intended.

9 - Acknowledgments and Bibliography

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