Actimetre System

APPENDICES

Actiserver Setup

Pre-requisites
    A computer with both Ethernet and WiFi interfaces
    Linux (Ubuntu or Debian) installed and an administrator account set up with sudo permissions
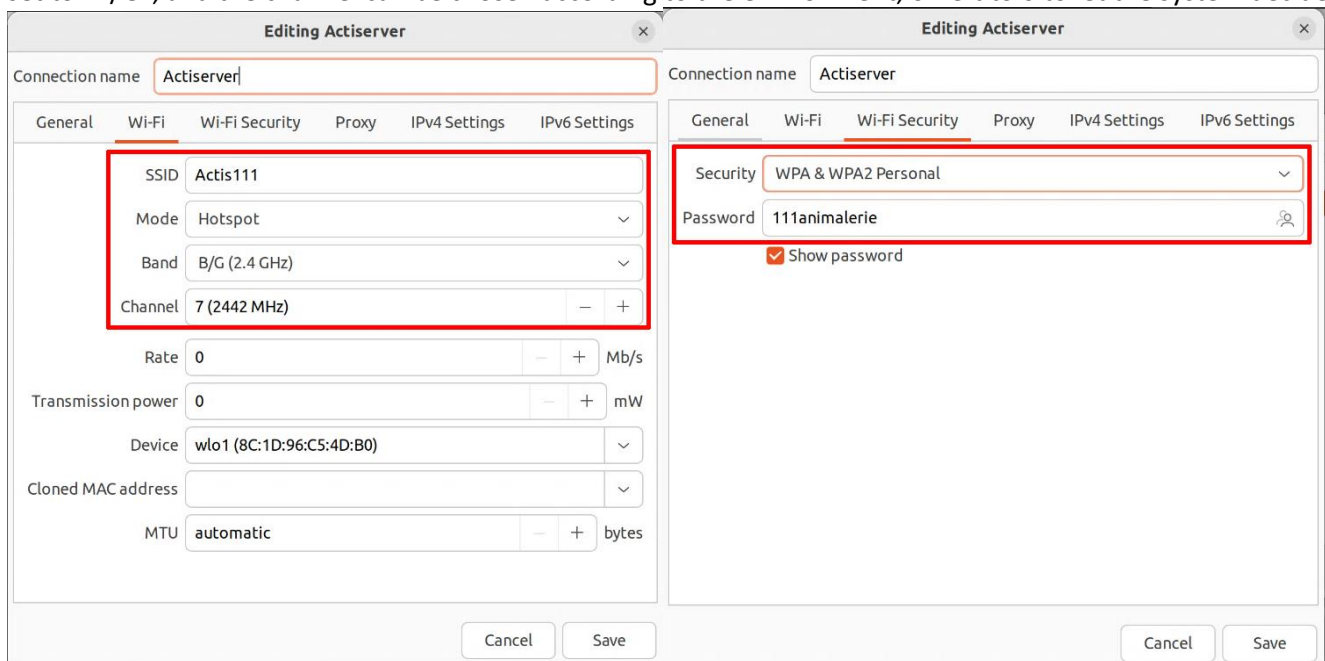
Software installation. Run the following commands:

```
sudo apt update
sudo apt -y upgrade
sudo apt -y install ntp ntpstat net-tools iw inxi git openjdk-17-jre apache2
sudo mkdir -p /media/actimetre
```

Choose a number between 100 and 899 for this Actiserver (we will call it **NNN**). Please ensure no two Actiservers have the same number.

For Ubuntu Desktop
    Using the Advanced Network Configuration program (found in the "Utilities" folder), set up the WiFi AP with SSID in the form of "`ActisNNN`" and password "`NNNanimalerie`" where NNN is the same. The "Band" must be set to "B/G", and the channel can be chosen according to the environment, or left to 0 to let the system decide.

Editing Actiserver		Editing Actiserver	
Connection name Actiserver		**Connection name** Actiserver	
General Wi-Fi Wi-Fi Security Proxy IPv4 Settings IPv6 Settings		General Wi-Fi Wi-Fi Security Proxy IPv4 Settings IPv6 Settings	
SSID	Actis111	Security	WPA & WPA2 Personal
Mode	Hotspot	Password	111animalerie
Band	B/G (2.4 GHz)	☑ Show password	
Channel	7 (2442 MHz)		
Rate	0 Mb/s		
Transmission power	0 mW		
Device	wlo1 (8C:1D:96:C5:4D:B0)		
Cloned MAC address			
MTU	automatic bytes		
	Cancel Save		Cancel Save

For Debian (including Raspbian)
    Install additional software

```
sudo apt install hostapd dnsmasq dhcpcd5
```

    Find the name of the WiFi device: run the following command

```
ifconfig
```

    and note down the name of the WiFi device (wlo1 in the example below)

```
enp89s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.200  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::b9ee:2b0c:38a5:efb0  prefixlen 64  scopeid 0x20<link>
        ether 1c:69:7a:af:d2:2a  txqueuelen 1000  (Ethernet)
        RX packets 272033  bytes 346345738 (330.3 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 139924  bytes 17397499 (16.5 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device memory 0x6a200000-6a2fffff

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 24485  bytes 3043795 (2.9 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 24485  bytes 3043795 (2.9 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlo1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.200.1  netmask 255.255.255.0  broadcast 192.168.200.255
        ether 8c:1d:96:c5:4d:b0  txqueuelen 1000  (Ethernet)
        RX packets 816272  bytes 88336954 (84.2 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 817235  bytes 59169904 (56.4 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

WiFi AP setting
  Run the following:

```
sudo systemctl unmask hostapd
sudo systemctl enable hostapd
```

In the file `/etc/hostapd/hostapd.conf` (create it if it doesn't exist), add the following, where **NNN** is a number between 002 and 250. The leading zeros are important, so there are exactly 3 digits. The name `wlo1` comes from the information gathered before.

```
country_code=FR
interface=wlo1
ssid=ActisNNN
hw_mode=g
channel=7
macaddr_acl=0
auth_algs=1
ignore_broadcast_ssid=0
wpa=2
wpa_passphrase=NNNanimalerie
wpa_key_mgmt=WPA-PSK
wpa_pairwise=TKIP
rsn_pairwise=CCMP
```

Note: it is recommended that each Actiserver use a different `channel` number (7 in the example above).

In the file `/etc/dhcpcd.conf`, add the following:

```
interface wlo1
    static ip_address=192.168.4.1/24
    nohook wpa_supplicant
```

In `/etc/dnsmasq.conf`, add the following at the end of the file:

```
interface=wlo1
dhcp-range=192.168.4.2,192.168.4.250,255.255.255.0,24h
domain=wlan
address=/gw.wlan/192.168.4.1
```

Run the following to finalize the configuration and reboot:

```
sudo rfkill unblock wlan
sudo reboot
```

For other Linux systems

The procedure described above for Debian should work on most systems. If the system has Network Manager enabled, try the following command, then reboot.

```
sudo nmcli d wifi hotspot ifname wlo1 ssid ActisNNN password NNNanimalerie
sudo reboot -f now
```

Set up Apache Web server

Open the file `/etc/apache2/sites-available/000-default.conf` and find the line

```
    DocumentRoot /var/www
```

Change it to

```
    DocumentRoot /media/actimetre/
```

In /etc/apache2/apache2.conf, find the line

```
    <Directory /var/www/>
```

Replace it with

```
    <Directory /media/actimetre/>
```

Restart Apache:

```
    sudo systemctl restart apache2
```

Install Actiserver software

In a new directory:

```
git clone https://github.com/jay1han/V2-Actiserver-executables.git
```

This creates a directory named `V2-Actiserver-executables`. Run:

```
cd V2-Actiserver-executables
sudo ./install.sh
```

Configure

Edit the file `/etc/actimetre/actiserver.conf` as needed:

```
REPO_ROOT        = /media/actimetre    the mount point of the file server
LOCAL_REPO       = true                set to true if NOT using fatdata, i.e. using local storage
MAX_REPO_SIZE    = 1_000_000_000       maximum size of a data file before a new one is created
MAX_REPO_TIME    = 24                  maximum age (in hours) of a data file
```

Note: please do not add any lines or comments. The parser if very simple and will be confused.

Run the Actiserver

The following command will install the program in the system and make it run automatically:

```
sudo ./run.sh
```

Actiserver is now running

To stop it, run the following command. But it will restart when the computer is rebooted.

```
sudo systemctl stop actiserver
```

To disable it, so it doesn't start automatically after a reboot:

```
sudo systemctl disable actiserver
```

Actimetre Dashboard

The Actimetre Dashboard is available at `https://www.actimetre.fr`

The graph chart shows the status of the Actimetre over the past 7 days (if available), in the form of its sampling frequency, from 10 to 100Hz, over time. The date/time above shows the starting point of the graph. When the Actimetre is turned off, the graph drops at "0" and is shown in red color. The green bar shows the length of the latest uninterrupted operation of the Actimetre. The "scissors" button lets you cut the graph down to the latest green bar, i.e. forget previous runs.

"Signal" shows the WiFi signal strength as seen from the Actimetre. "Rating" is the percentage of missed sampling cycles during the latest up period. This is an indicator of the connectivity between the Actimetre and the Actiserver it's connected to.

You can click on the Project title to enter the project management screen. From there, you can reassign an Actimetre to a different project, and in general view the Project status.

In the Actiservers list, if that server uses local storage (see settings for Actiserver), you can click on the Data size information to retrieve the full list of files, and directly download them from the Actiserver. This will only work if the Actiserver has a valid, reachable IP address assigned to it.

Note that there is NO ACCESS CONTROL, so anyone can change any information. Please be careful.

Also note, all date/times are in UTC. This is to avoid dealing with DST.

Please keep in mind that Acticentral does NOT manage the repository. It is the user's responsibility to copy, process, and clean the repository of data. The files are all clearly labelled with "ActimXXXX", but please be careful when managing the repository, to avoid erasing or misplacing important data.
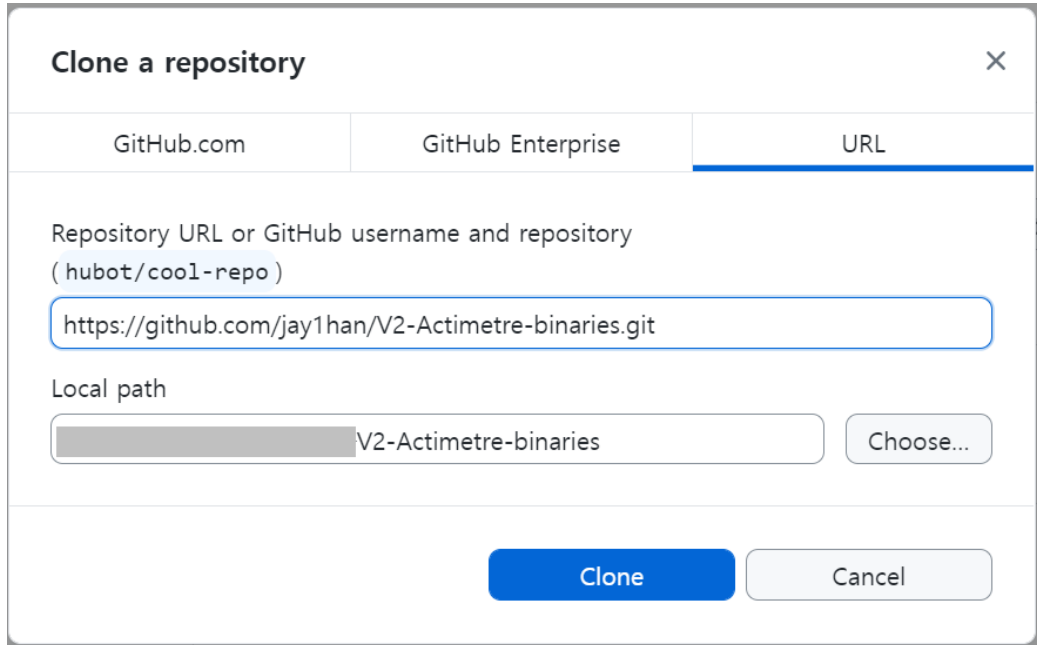
Set up the Actimetre

To use the lastest version of the Actimetre firmware

    Install Github desktop from `https://desktop.github.com/`

    File > Clone Repository > URL tab

    In the URL enter: `https://github.com/jay1han/V2-Actimetre-binaries.git`

    Choose a convenient folder to put it. Please remember where, we'll need it later.

Download and install the firmware download tool for the ESP32 chips direcly from Espressif at `https://www.espressif.com/en/support/download/other-tools` (look for the "Flash Download Tools")


Run the Flash Download Tool. Select ESP32-S2 as the chip type and USB as the mode.
For the ESP32-S3 board, select ESP32-S3 in "ChipType".
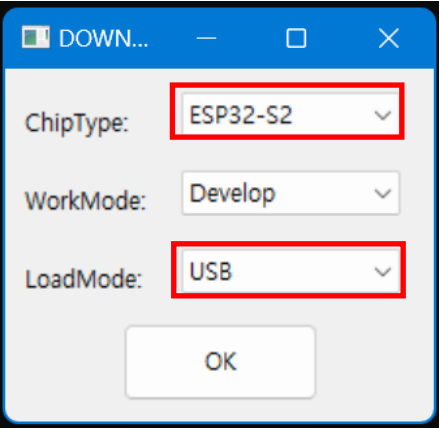
Enter the fields as shown, replacing the file path with the correct directory you've cloned the Git into. Enter the right addresses on the right-hand side and check the checkboxes on the left-hand side. Make sure the COM number corresponds to the S2 mini board, anc check the BAUD rate is set at 921600.
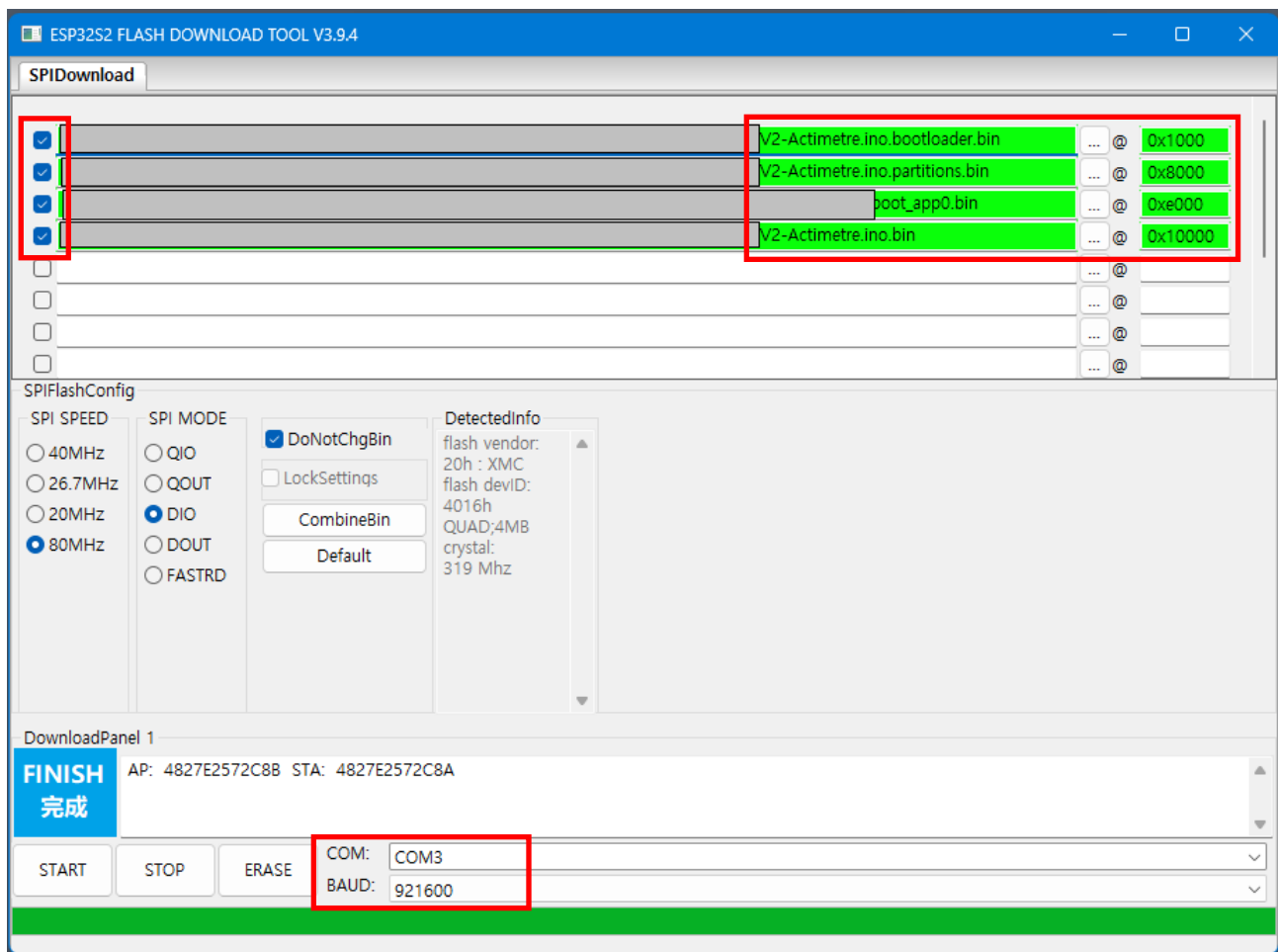
For the S3, the addresses are slightly different (bootloader goes at 0x0000).
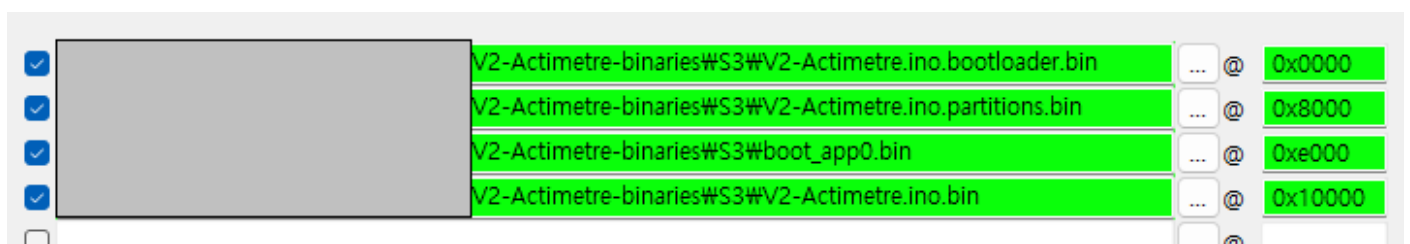
Place the board in download mode: while the board is powered, press Reset and keep it pressed, then press Boot (marked "0"), then release Reset and release Boot. Click Start and wait.

When the display turns blue "FINISH", it's done.

Build an Actimetre

The Actimetre is based on the [ESP32 S2 Mini](#) board designed by Wemos.cc. The card has been cloned by many manufacturers with reasonable quality. It can be found for less than 3€ from Aliexpress when bought by lots of 10 units.

Another non-commodity component is the 0.96 inch 128*64 OLED screen with a SSD1306 controller on I2C interface. It can be found from many places from Aliexpress, for about 2€ apiece when bought by lots of 6 units. Be sure to use the newer, more compact version with yellow and blue lines.

The sensor chip is a MPU-6050 from Invensense. The reference board is GY-521 and they are available for about 2€ in lots of 10 units.

Other material needed: JST XH (2.54mm) 4-pin connectors, 4-core cable (26 AWG), wrapping cable (30 AWG), soldering iron, wrapping tool, some dexterity and a lot of patience.
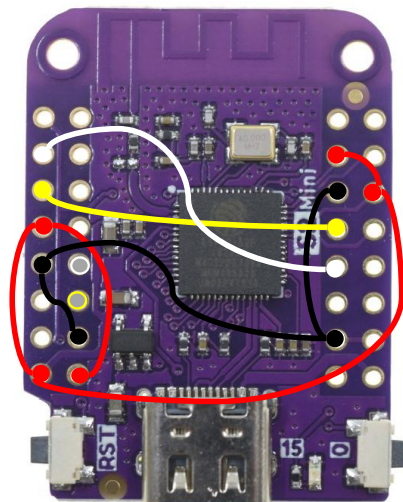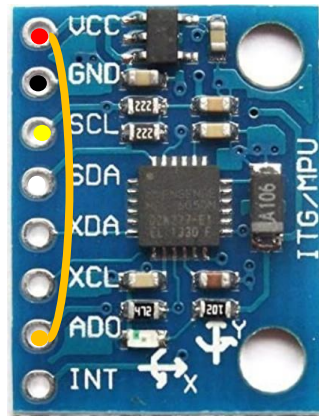
Actimetre (S2)

In the pictures we will designate the "up" side to be the side with the USB connector. The "down" side is the other side
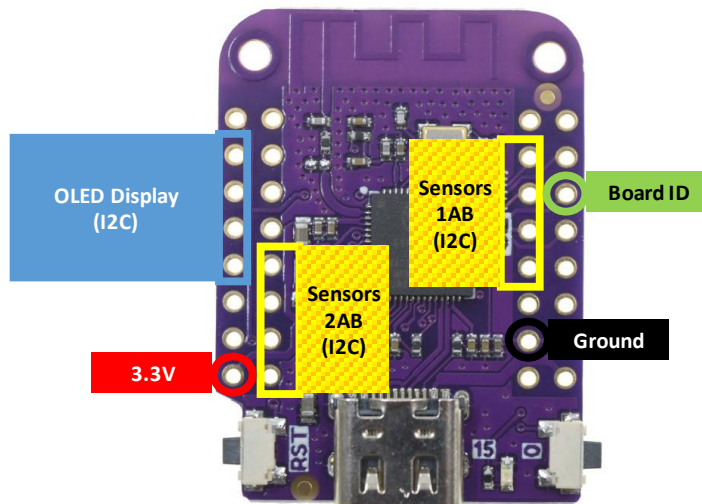
The connectors for the sensors are on the down side, while the display is on the up side.
The display is sharing the I2C with Sensor pair "1".

There are 9 lines to connect, preferably by wrapping. The connectors must be soldered because the legs don't have enough length for wrapping. The screen will be soldered last and will cover all the wires.

The AD0 line must be connected to VCC for the "B" sensor. One "A" sensor and one "B" sensor can be connected at the same time to one I2C connector.

The display on the Actimetre is organized as below

v200>0004 123	Software version > Actimetre ID – Server ID
1AB2AB S2x@100	Sensors – Board type @ Frequency(Hz)
5h45 3.4	Time since boot – Average performance (lower is better)
M0 E0 Q0%	Missed cycles – I2C read errors – Queue occupation%

Cabling information for S2x board

```
        o EN   1 x                     x 40    39 x
   :sda: (i)3   2 x            :vcc:{d}38    37 x
OLED:scl: (j)5   4 x        Sens:gnd:{w}36    35(bd)
Disp:vcc:(ac)7   6 x          #0:scl:{j}34<   33 x
   :gnd:(vz)9   8 o :sda:      :sda:{i}21<   18 x
        x 11  10 o :scl:Sens         x 17    16 x
        x 12  13{v}:gnd:#1      (wz)GN1 GN2 x
     (ab)3V3 14{c}:vcc:         X 15 VBUS X
```

Cabling information for S3i board. The I2C0 connector's position is different.

```
        X EN   1 x                     x 33    43 x
        x 2    3 x                     x 37    44 x
        x 3    5 x                     x 38    36 x
   :sda: (i)12   6 x                   x 34    35 x
 I2C:scl: (j)13   7 o :sda:   Port:sda:{i}21<   18 x
Disp:vcc:(ac)11   8 o :scl:     #0:scl:{j}17<   16 x
   :gnd:(yz)10   9{y}:gnd:Port    :gnd:{z}GN1 GN2 x
     (ab)3V3 14{c}:vcc:#1     :vcc:{b}15 VBUS X
```