

## Setup ADS-B receiver for Airscouter (Airscout)

*A manual written with the instructions received from Thomas, OV3T.*

### What you need:

- raspberry pi 3B or better
- power supply for the raspberry (5V 2,5A)
- DVB-T USB stick
- 1090MHz antenna (preferably with LNA and filter)
- micro SD card (>8GB)
- network connection to your LAN

For setup, you connect a monitor with HDMI to the pi, and also a mouse and keyboard.

At this stage, connect all items, except the power supply.

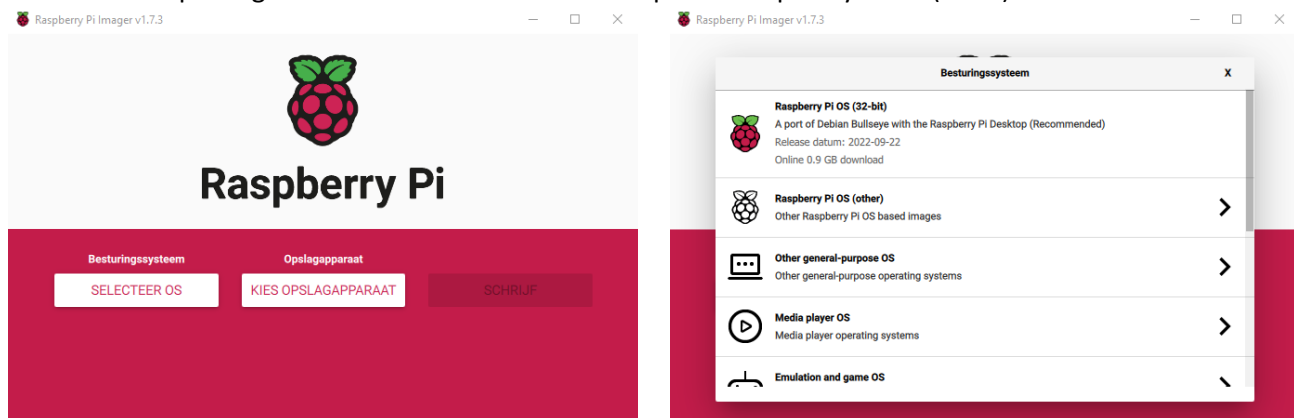
### Install the raspberry pi Operating System:

First, you download the raspberry pi imager software here: <https://www.raspberrypi.com/software/>

It is a small program that allows you to select an operating system for the pi, and flash it onto the SD card.

Connect the micro SD card to your computer (use a suitable adaptor) so you can access it.

Now start the pi imager software and select the first option "Raspberry PI OS (32bit):"

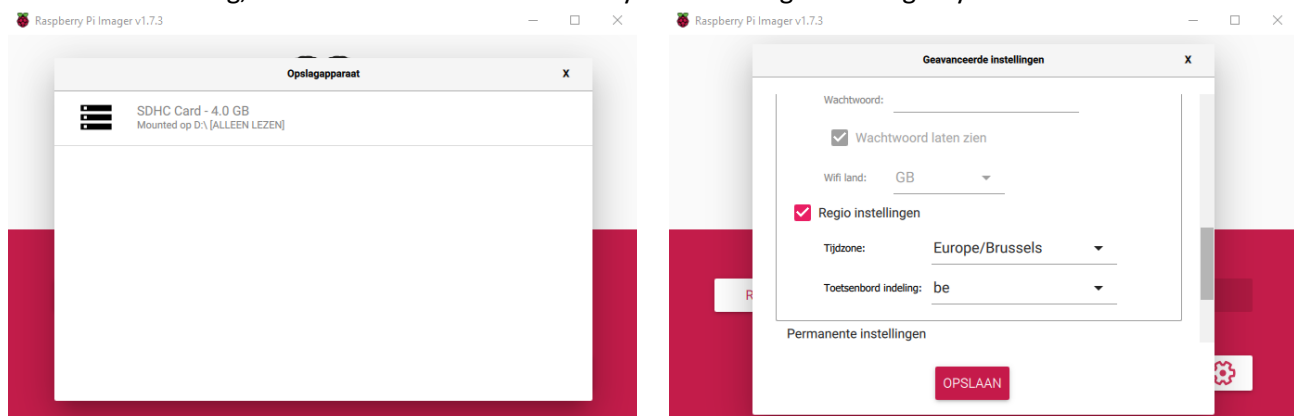


Then, in the center menu, choose the micro SD card (at least 8GB!) you just connected to your computer.

After you selected the connected micro SD card, you can see in the right bottom side of the program a

symbol for extra settings (the little "gear" symbol). Click it, and scroll down to the region settings.

Activate the setting, and fill in the time zone and keyboard setting according to your location. Then click "save"



Ok, ready to go now, so click "Write".

This may take a while, the OS is now installed and verified onto the micro SD card.

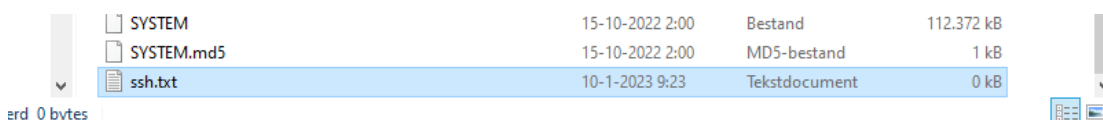
After completion, the program says: you can now eject the SD card. Do so, and close the imager program.

Before you do anything else, now connect the micro SD card back to your computer.

If you see the computer asking to format the SD card, say no!

look to the files on the micro SD card, and make an extra .txt file onto it. Name it **ssh.txt**:

There has to be nothing in the text file, just leave it blank!



Your micro SD card is now ready to plug it into the raspberry pi.

### Setup the raspberry pi

put the micro SD card into the raspberry pi. Connect all cables to the raspberry pi, make sure that your HDMI monitor is ON so the raspberry pi can see it at startup, and as last step, connect the power supply.

The raspberry pi will boot now, and it will ask you to create a user name and password.

use these settings => user name: **pi** password: **raspberrypi**

The raspberry pi might respond to you that the chosen user name is not safe, and you should change it, but ignore that message now, click OK and continue.

You can connect the raspberry pi wireless, it will show the networks it receives and you can select the network to connect to. You can skip this part, and connect the raspberry pi with a cable to your (DHCP) network.

The raspberry pi asks you if you would like to check for updates, go ahead and let the raspberry pi install them.

After the updates were downloaded and installed (this might have taken a while), you finally see the desktop environment, and your raspberry pi is now ready to install the necessary programs for the ADS-B receiver.

You can choose now to continue on the desktop of you raspberry pi, or remotely on your own computer.

You need a terminal window to complete the rest of the installation.

On the raspberry pi you can find it at the top. Click on it, and the terminal window will appear:



If you want to connect remotely to your raspberry pi with your computer, you can do so:

start cmd in Windows. You will get a dos-alike window. Now type in: **ssh pi@raspberrypi**

you will be asked is this connection is secure (this will happen only once), confirm by typing in: **yes**

now you will be asked for the password. Type in: **raspberrypi** (note: you cannot see the password you type here!)

if everything went well, you will get a similar window:

```
pi@raspberrypi: ~
login as: pi
pi@192.168.1.13's password:
Linux raspberrypi 3.2.27+ #250 PREEMPT Thu Oct 18 19:03:02 BST 2012 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Dec 17 10:59:46 2012 from 192.168.1.6
pi@raspberrypi ~ $
```

Either way you went, via the raspberry pi desktop terminal, or via the remote ssh terminal on your computer, the next steps work on both.

## **Install dump1090-fa** (<https://github.com/wiedehopf/adsb-scripts/wiki/Automatic-installation-for-dump1090-fa>)

type (or copy/paste) the following command in the terminal:

```
sudo bash -c "$(curl -L -o - https://github.com/wiedehopf/adsb-scripts/raw/master/install-dump1090-fa.sh)"
```

After the installation, type: **sudo reboot** and wait for the raspberry pi to reboot.

## **Install ModeSMixer2** (<https://github.com/abcd567a/mm2>)

type (or copy/paste) the following command in the terminal:

```
sudo bash -c "$(wget -O - https://raw.githubusercontent.com/abcd567a/mm2/master/install-mm2.sh)"
```

After the installation, type: **sudo reboot** and wait for the raspberry pi to reboot.

Both necessary programs are now installed. We only need to set them up properly now.

But first, you need to know your exact location, that is, the exact location where the ADS-B receiver will be.

Easy solution is to look in google maps. Zoom in on your location as far as necessary, and then click with the right mouse button on the exact location where the receiver antenna will be installed.

you see something like this :



You need the top coordinates. In this example, the coordinates are: 50.95030 and 4.83420  
**use your own coordinates to continue the setup !!**

now, back to the settings of our 2 programs. First, let's set up the dump1090 file.

In the terminal window, type the following command: **sudo nano /etc/default/dump1090-fa**

```
GNU nano 3.2 /etc/default/dump1090-fa Modified
# dump1090-fa configuration
# This is sourced by /usr/share/dump1090-fa/start-dump1090-fa as a
# shellscript fragment.

# If you are using a PiAware sdcard image, this config file is regenerated
# on boot based on the contents of piaware-config.txt; any changes made to this
# file will be lost.

# dump1090-fa won't automatically start unless ENABLED=yes
ENABLED=yes

RECEIVER_OPTIONS="--net-only --net-bi-port 6000"
DECODER_OPTIONS="--modeac"
NET_OPTIONS="--net --net-heartbeat 60 "
JSON_OPTIONS="--json-location-accuracy 1"

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line
```

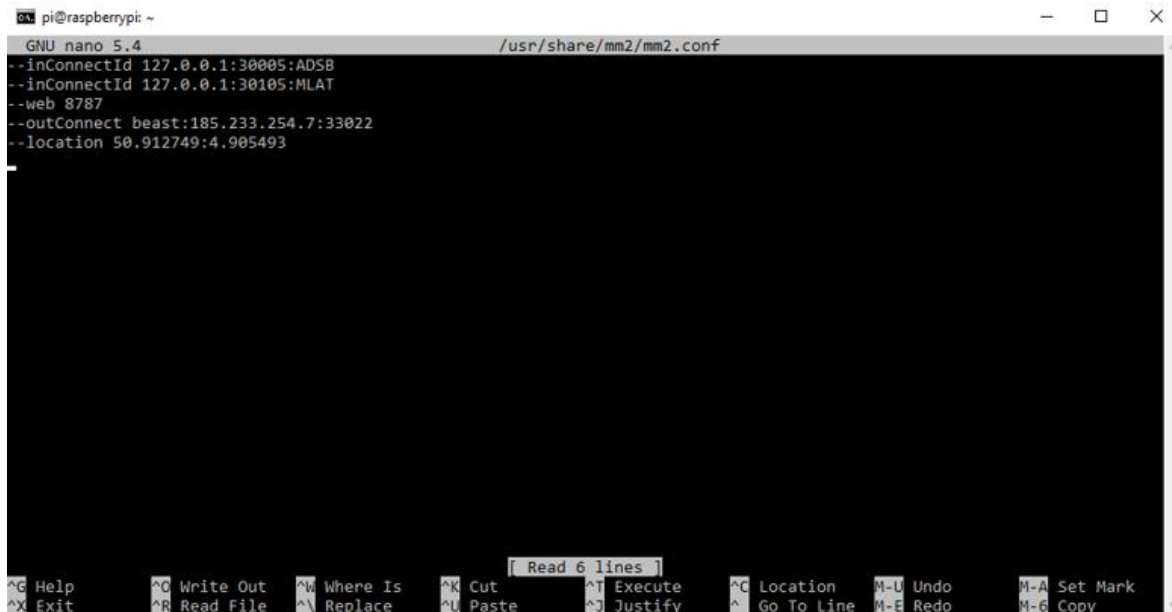
You now can make adjustments in the file. Scroll down with the “arrow down” key on your keyboard until you find LONGITUDE and LATITUDE. fill in your coordinates behind the words, leave no gaps, and remember to use a dot instead of a comma for number separation.

After this is done, press <Ctrl> and “o” on your keyboard. You will be asked to save the file, just press enter. When saved, press <Ctrl> and “x” on your keyboard, you will now leave the file and return to the terminal.

Now setup the ModeSMixer2 program.

In the terminal window, type the following command: **sudo nano /usr/share/mm2/mm2.conf**

You will get into the mm2 config file. Add the following lines so you end up with this:



```
--inConnectId 127.0.0.1:30005:ADSB
--inConnectId 127.0.0.1:30105:MLAT
--web 8787
--outConnect beast:185.233.254.7:33022
--location 50.95030: 4.83420
```

Notice! Also here, behind the “—location” you fill in your own coordinates !!

When done, press press <Ctrl> and “o” on your keyboard. You will be asked to save the file, just press enter. When saved, press <Ctrl> and “x” on your keyboard, you will now leave the file and return to the terminal.

All is setup now, just reboot one last time by entering **sudo reboot** and wait for the raspberry pi to reboot.

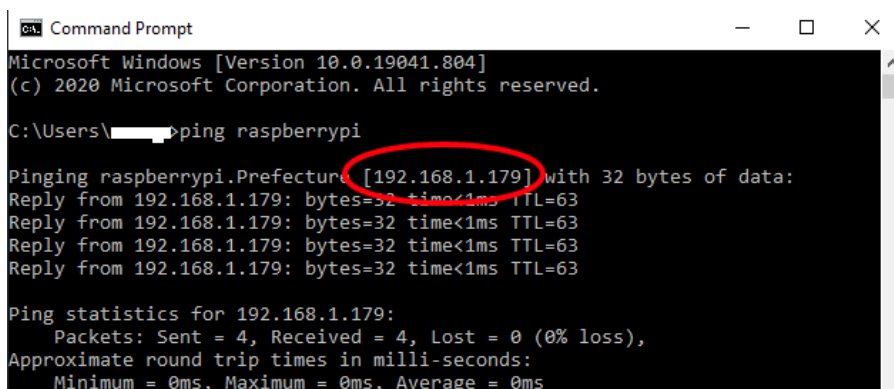
Once the raspberry pi is rebooted, find the ip address that is given to your raspberry pi.

on the raspberry pi itself, you can type in the terminal window: **hostname -I** (the capital letter i)

You will be prompted with the IP address of your raspberry pi.

On your computer, you can type in the cmd window: **ping raspberrypi**

you will get this return: (the raspberry pi’s IP adress is circled in red, this is an example, yours will be different!)



```
Microsoft Windows [Version 10.0.19041.804]
(c) 2020 Microsoft Corporation. All rights reserved.

C:\Users\>ping raspberrypi

Pinging raspberrypi.Prefecture [192.168.1.179] with 32 bytes of data:
Reply from 192.168.1.179: bytes=32 time<1ms TTL=63
Reply from 192.168.1.179: bytes=32 time<1ms TTL=63
Reply from 192.168.1.179: bytes=32 time<1ms TTL=63
Reply from 192.168.1.179: bytes=32 time<1ms TTL=63

Ping statistics for 192.168.1.179:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Now, open a browser window, and type in the ip address of your raspberry pi, followed by **:8787**  
from the above example, I would type in: **http://192.168.1.179:8787** Your ip address will be different!

If all is correct, you now see the MM2 (ModeSMixer2) interface on your screen.

Here you can access a lot of data about the aircrafts that you currently are receiving, just browse through the menu's. (charts, flights, map, misc)

If you click on **"MISC"** and then choose **"LOG"** you can see the logfile of the program.

Here, you ideally see something like this, without errors:

```
2023-01-09 22:13:08.272 INFO Magnetic declination calculated
2023-01-09 22:13:08.286 INFO outConnect(beast:185.233.254.7:33022) connecting 185.233.254.7:33022
2023-01-09 22:13:08.286 INFO inConnectId(127.0.0.1:30105:MLAT) connecting 127.0.0.1:30105
2023-01-09 22:13:08.286 INFO inConnectId(127.0.0.1:30005:ADS-B) connecting 127.0.0.1:30005
2023-01-09 22:13:08.287 INFO inConnectId(127.0.0.1:30105:MLAT) connected
2023-01-09 22:13:08.287 INFO inConnectId(127.0.0.1:30005:ADS-B) connected
2023-01-09 22:13:08.325 INFO outConnect(beast:185.233.254.7:33022) connected
2023-01-09 22:13:09.432 INFO inConnectId(127.0.0.1:30005:ADS-B) BEAST data stream detected
2023-01-09 22:13:21.993 INFO Coverage area was determined
2023-01-09 22:13:21.993 INFO Magnetic declination calculated
```

If there would be any errors, like so:

```
2023-01-09 21:29:35.303 ERROR inConnectId(127.0.0.1:30105:MLAT) connect host 127.0.0.1:30105 error Connection refused
```

Some settings could be wrong. In the above particularly case, the "inConnectId 127.0.0.1:30105:MLAT" parameter that I gave into the mm2.conf file, was different in the "dump1090-fa" configuration file.

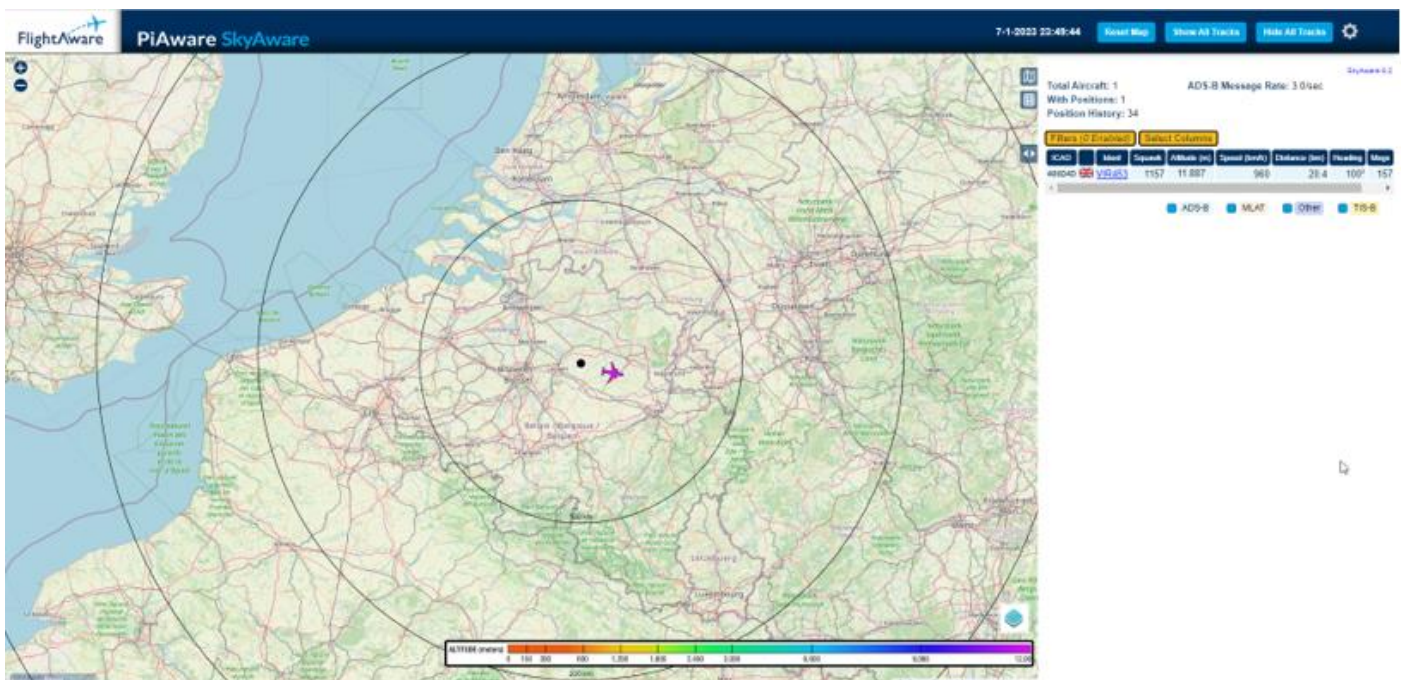
I had to go back and adjust the correct port. (mine was 30104 instead of the 30105 in the above example.)

After adjusting the mm2.conf file, reboot the raspberry pi again, and check the above logfile again.

If after startup, you have only "INFO" messages instead of "ERROR" messages, your receiver is up and running.

You can access the "dump1090" page in your browser by typing in the raspberry pi's IP address, followed by **:8080**

You will get this page where you can see the center dot, representing the coordinates you entered in the dump1090 configuration file, and the airplanes you are currently receiving in real-time:



You can keep the raspberry pi now running without keyboard, mouse and monitor. Only the DVB-T stick, network cable (if not in wireless mode) and power supply needs to stay connected. On power loss, the raspberry pi should reboot itself and start the necessary programs by itself.