Astro Pi Kit - Getting Started Guide

The following instructions will hopefully provide you with all the information you will need in order to get you up and running with your new Astro Pi kit.

Throughout this document you will find a number of links, which will also provide you with useful information to help you on your journey.

Kit Contents

In your Astro Pi kit you should find the following items:-

- A Raspberry Pi 2 - model B. In the box containing the Raspberry Pi, you will also find a SD card adaptor with a micro SD card inserted into it. This micro SD card contains the NOOBS operating system that is required to run your Raspberry Pi.
- A Raspberry Pi Sense Hat
- A small bag containing 8 screws and 4 hexagonal standoffs
- A Raspberry Pi Case
- An Ethernet cable
- An HDMI cable
- A USB mouse
- A USB keyboard
- A power supply

What else you will need

In order to build up your Astro Pi kit, you will also need the following additional items:-

- A small flat-head screwdriver
- An anti-static wrist strap connected to earth (not essential, but recommended)

Build Instructions

It is recommended that, while handling the Astro Pi and the Raspberry Pi, you wear an anti-static wrist strap connected to earth. Whilst this is not essential, it is a good idea, as it helps to protect the sensitive electronic components on the boards from possible damage due to electrostatic charge.

1. Take the Sense Hat out of its box and anti-static bag.
2. Grab the separate small bag containing the 8 screws and 4 standoffs, and remove them from the bag. You will only require 4 of these screws.
3. Insert a screw into each of the 4 holes at each corner of the Sense Hat, and screw them into the 4 standoffs. The standoffs should protrude from the underside of the Sense Hat board. Make sure you do not over tighten the screws.
4. Remove the Raspberry Pi from its box and anti-static bag. For now, put the SD Card/Adaptor to one side for later.
5. Align the 40 pin header on the Raspberry Pi with the 40 pin socket on the underside of the Sense Hat (make sure the rows and columns are correctly aligned), and gently push the Sense Hat onto the Raspberry Pi. The Sense Hat should sit on the Raspberry Pi such that the standoffs are in contact with the Raspberry Pi. Do not screw the Sense Hat onto the

Raspberry Pi, as the screw heads will prevent the Pi from sitting correctly in the Raspberry Pi case; however, if you do not wish to use the case, you can screw the Sense Hat onto the Raspberry Pi board using the remaining 4 screws.

6. Remove the Raspberry Pi case from its wrapping, and take the case apart. The case is made up of 5 parts:-
   - Pink base
   - 2 white sides
   - Pink top with rectangular window for viewing the Sense Hat LED matrix
   - White cover

7. Inside the case you should also find 4 soft plastic adhesive pads for sticking onto the base of the Raspberry Pi case. Carefully stick one of these pads in each of the 4 circles at the corners of the underside of the base.

8. Carefully place the Raspberry Pi into the base of the Raspberry Pi case by first sliding the SD card end of the Raspberry Pi (the end opposite the 4 USB ports and the Ethernet port) under the small ridge above the SD card access port of the Pi case. If you find that you have trouble sliding the Pi under the ridge, it is possible that the clear plastic insert in the 2 small LED viewing holes is not correctly inserted, so it may be necessary to push this insert fully into place before inserting your Raspberry Pi into the case. Having slid the Pi into place under this ridge, you should then gently push the other end of the Raspberry Pi (the end with the 4 USB ports and Ethernet port) down fully into the case. The Pi should snap into place inside the case. You will find that the Sense Hat will lift slightly away from the Raspberry Pi board, due to the 2 pins on the inside of the Pi case at the USB port end. This is not a problem, as the standoffs will sit on these pins.

9. Push the pink top of the Raspberry Pi case (the piece with the large rectangular window in it) onto the base of the case. The top should clip into place by means of the 2 clips at the SD card end of the Pi and the 2 clips (1 on each side of the case) indicated by the arrows on the pink case top. You will find that the top does not quite sit correctly; again due to the pins on the inside of the Pi case pushing the Sense Hat slightly away from the Pi board. If you prefer a slightly neater finish, you can snip off the 2 pins at the USB/ethernet port end of the case using a pair of side cutters.

10. Clip the 2 white sides of the Pi case into place on the base. One side has holes for each of the power, HDMI and A/V ports of the Pi, so it is easy to identify which side fits where.

11. Because you'll want to be able to view the 8x8 LED matrix on the top of the Sense Hat, and possibly also access the joy-stick, put the white cover of the Pi case to one side.

Next Steps

You've now completed the build of your hardware, so the next step is to get your hardware up and running and ready to run some of the fantastic projects that are available for the Astro Pi. There are loads of excellent resources available on the internet that will tell you everything you could possibly need to know to get your Raspberry Pi and Sense Hat up and running. The quick start guide at the Raspberry Pi foundation's web site is a good starting point.

https://www.raspberrypi.org/help/quick-start-guide/

If you follow the instructions at this link, you may be a little unsure about what kind of SD card we have provided you with in your Astro Pi kit. The micro SD card provided with the Astro Pi kit is pre-

installed with NOOBS, and is set up to boot automatically into the Raspbian operating system. This means that when you insert the micro SD card and switch on the power supply to your Raspberry Pi, the Sense Hat should briefly display a rainbow image on its 8x8 LED matrix. You will notice on your monitor that the Pi runs through its boot sequence, and will eventually display a desktop which will allow you to start working on your projects.

Checking It Works

Once you've got your desktop display, you might want to check that your setup is working. As previously mentioned, when your Raspberry Pi is powered up, you should have seen a rainbow image displayed for a short time on the Sense Hat's 8x8 LED matrix. This will confirm that the Sense Hat hardware is setup correctly. The following steps will allow you to check that your software is working correctly also.

1. The first step is to navigate to your program start menu to start a program; in this case, the Python programming shell. To do this, click on the 'Menu' button in the top left hand corner of the screen, select 'Programming' from the dropdown that appears, and then 'Python 2 (IDLE)'. This will cause a new window to appear, with the title 'Python 2.7.9 Shell'. The Python Shell window will have some text at the top, under which you will see '>>>'. This is the Python Shell prompt; which basically means, it is expecting you to tell it to do something.

2. The first thing we will tell Python to do is to import part of a software library that it will require in order to display something on the Sense Hat. This library is called 'sense_hat', and this library is already installed for you on your SD card as part of the Raspbian operating system distribution that you are running. In order to import from this software library, type the following at the '>>>' prompt (note, that this must be typed exactly as shown, as Python is very particular when it comes to use of upper and lowercase characters). If you get an error displayed in the Python shell window, check that you have typed the command correctly:-

   ```
   from sense_hat import SenseHat
   ```

3. Having imported the required part of the sense_hat library, you can now type in some Python commands to get your Sense Hat to actually do something. To get the Sense Hat to display something on its LED matrix, type in the following Python commands (one at a time) at the '>>>' prompt:-

   ```
   sense = SenseHat()

   sense.show_message('Hello World')
   ```

   The first of these commands creates something called an 'object' with the name 'sense'. This object can then be used as a link to the Sense Hat in order to control it. The second command uses the newly created 'sense' object to get it to execute the command 'show_message('Hello World')', which should cause a message to scroll across the 8x8 LED matrix. Again, if you get an error in your Python shell window, or you do not see the message on the LED matrix, check that you have typed the commands correctly.

If the above instructions work ok, then you have confirmed that you have the software required to use your Sense Hat. If you got errors in your Python shell window, and have checked that you typed

the commands correctly, then it is possible that the required software is not installed or your SD card. If this is the case, either of the following links will give you the necessary information to update your software environment for your Sense Hat:-

https://www.raspberrypi.org/documentation/hardware/sense-hat/

https://www.raspberrypi.org/learning/astro-pi-guide/software.md

A Few More Simple Projects

Once you've verified that your hardware and software are running fine, it's time to move on to something a little more advanced (though still fairly simple). There are a number of good Python code examples available at the following link:-

https://github.com/RPi-Distro/python-sense-hat

To download these examples, open up a Web browser ('Menu' > 'Internet' > 'Epiphany Web Browser') on your Raspberry Pi, and navigate to the above URL. You should see a screen similar to that shown below:-
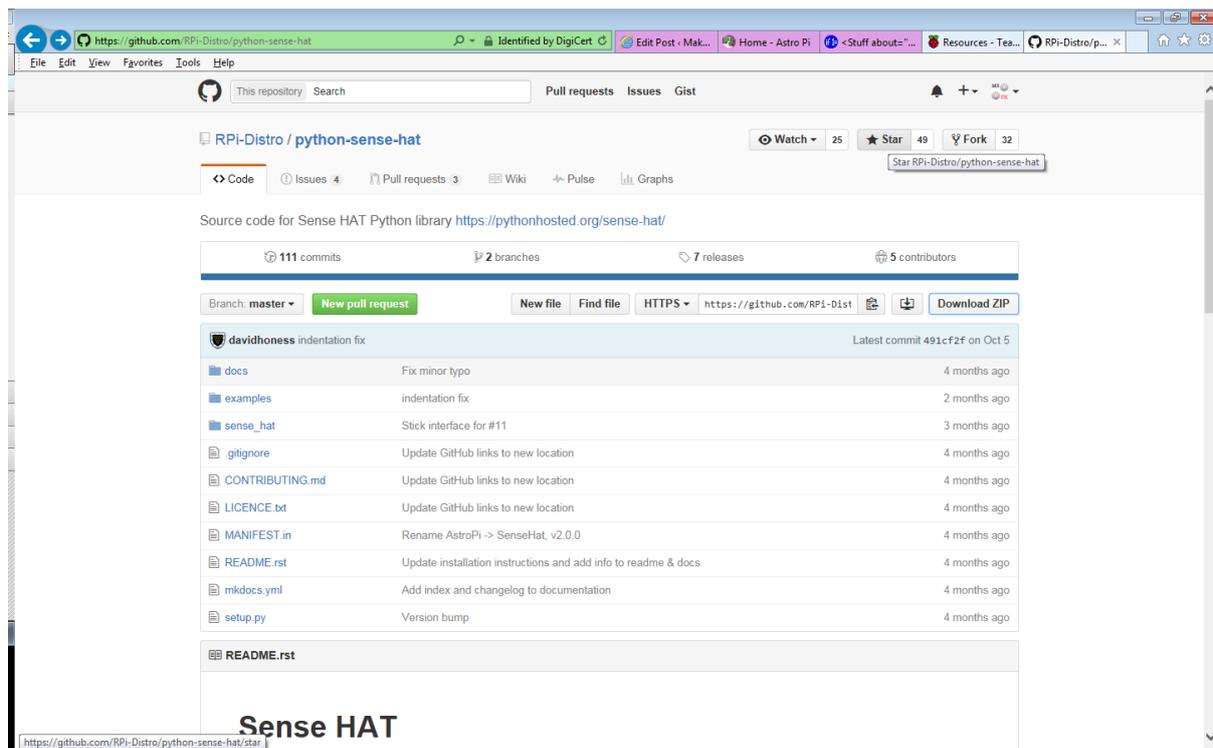
In this screen, click on the 'Download ZIP' button, and save the zip file into the Raspberry Pi's 'Downloads' folder. Having downloaded the zip file, you will then need to access it in order to extract the files. The easiest way to do this is to start the 'File Manager' program on your Raspberry Pi ('Menu' > 'Accessories' > 'File Manager'), and navigate to the 'Downloads' folder. Having located the zip file in the Downloads folder, right click on the file and select 'Extract To...'. We suggest that you extract the files to the '/home/pi' folder, which will create a new folder called 'python-sense-hat-master' under the '/home/pi' folder.

In order to run any of these example programs, you can navigate to the '/home/pi/python-sense-hat-master/examples' folder using 'File Manager', and right click on any of the files with the extension '.py' (Python program). Select the 'Open With...' option from the dropdown menu, and select 'Programming' > 'Python 2 (IDLE)'. This will open the program code file in a Python code window, and once this window has opened, selecting the program code window and pressing the F5 key on the keyboard will cause the program code to execute.

Another way to run these programs is from a Terminal window. To do this, open a new Terminal window ('Menu' > 'Accessories' > 'Terminal'), and start typing commands into the Terminal window. To run the example programs, you will first need to navigate to the 'examples' folder using the following command (remember that Linux is case sensitive, so you will need to enter the command exactly as shown):-

```
cd ~/python-sense-hat-master/examples
```

You will then be able to run any of these examples programs by typing in the appropriate command into the Terminal window; for example:-

```
python rainbow.py
```

What Next?

You've made an excellent start with your Astro Pi, so now it's time to move onto something a little more advanced. The following link will take you to a web page that contains links to the various programs that UK astronaut Time Peake will be using during his 6 month stay on the ISS:-

https://github.com/astro-pi

The following link is a really fun way to explore how to use some of the sensors and the LED matrix on the Sense Hat:-

https://www.raspberrypi.org/learning/astro-pi-guide/sensors/movement.md

For further information about Astro Pi, visit the Astro Pi web site at:-

https://astro-pi.org/

We've also put a few links to Astro Pi related stuff on our Makerspace blog at:-

http://www.makerspace-uk.co.uk/astro-pi/