



Assembly Instructions

Assembly of the AStarBox is simple and should take less than 10 minutes. Once unpacked from the box, there should be three items – the box, containing the power board, a pack of screws, bolts and pillars and a finder foot attachment.

Please Note: To control the AStarBox power sockets, you must download and install the [AStarBox control software](#) once the AStarbox is assembled, even if you are using the Indi or TheSky plugins.



Figure 1. AStarBox contents when unpacked.

The bag should contain four long pillars with nuts, four short pillars, four small black screws, and two longer M4 screws– see Figure 2:



Figure 2. Contents of pack – 4 long pillars with nuts, four short pillars, four small black screws and two longer M4 screws.

The two M4 screws are for attaching the finder foot – put those to one side for now.

Tools: Assembly does not require many tools – a small screwdriver, some small pliers and if you are using adding a battery for a real time clock, something to keep this in place. Here we use stick on velcro, but the official Pi battery comes with a sticky pad.



Figure 3. Tools required to assemble an AStarBox.

You will also need a Raspberry Pi 5 and optionally the official active cooler and the Real Time Clock (RTC) backup battery.

Tips on choice of Raspberry Pi 5 and accessories:

- 4GB of ram is enough for deep sky imaging, though the incremental cost of having 8GB is small (about £20).
- The RTC backup battery will ensure the correct time is set if your AStarBox is not always going to be connected to the internet. This is highly recommended.
- A cooler is not generally needed – the Pi 5 runs cool and most imaging is in the winter. It may be helpful if e.g. solar imaging or you are lucky enough to image from warmer climates. In that case, use the official Pi 5 active cooler.
- Use a high speed micro SD card. The Pi 5 can read data at 90MB/S and write at 60MB/S. San Disk Extreme Pro cards benchmark well. Have a capacity of at least 64GB, more if you intend to take many short exposure images and have a large camera.
- You can install an NVME disk in an AStarBox. You will need the [Waveshare PCIe to M.2 Board\(E\)](#), as well as an NVME disk that can run at low power. We have tested the Waveshare board with the [Sabrent Rocket 2230 NVMe 4.0 1TB](#), but other NVME boards will likely work provided their power requirements are less than 5W, the maximum that can be provided through a PCIe connection.
- If you use the Waveshare board, there is no need to buy a fan since one is included on the board.

Assembly

Step 1: Use the screwdriver to undo the two screws on the top of the case. It may help to put the case on its side and keep a finger on the nut on the bottom of the screw.



Figure 4. Step 1 – undo the two screws on the top of the case.

Put the screws and nuts aside. You may find that the nuts remain in the insert in the case – that is fine, no need to remove them, though do watch out in case they drop out later.

Step 2: Lift off the top of the case and remove it. It works well to lift where the two holes are – the case is kept in position by a small hook on the other side.



Figure 5. Remove the top of the case by lifting as shown.

Step 3: Remove the power board from the case. With the top removed, you can do this simply by lifting from the case – there are no further screws or bolts holding it in position.

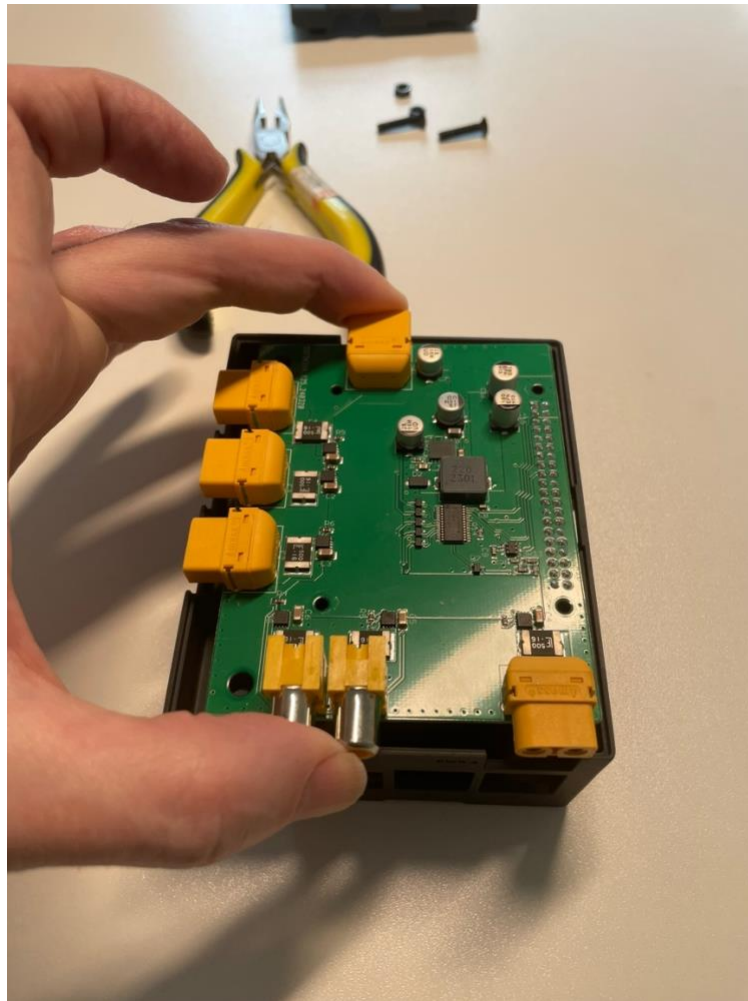


Figure 6. Remove the board by lifting from the case as shown.

Step 4: The next step is to add the large pillars to the board. These go through the smaller holes in the board, highlighted in red below:

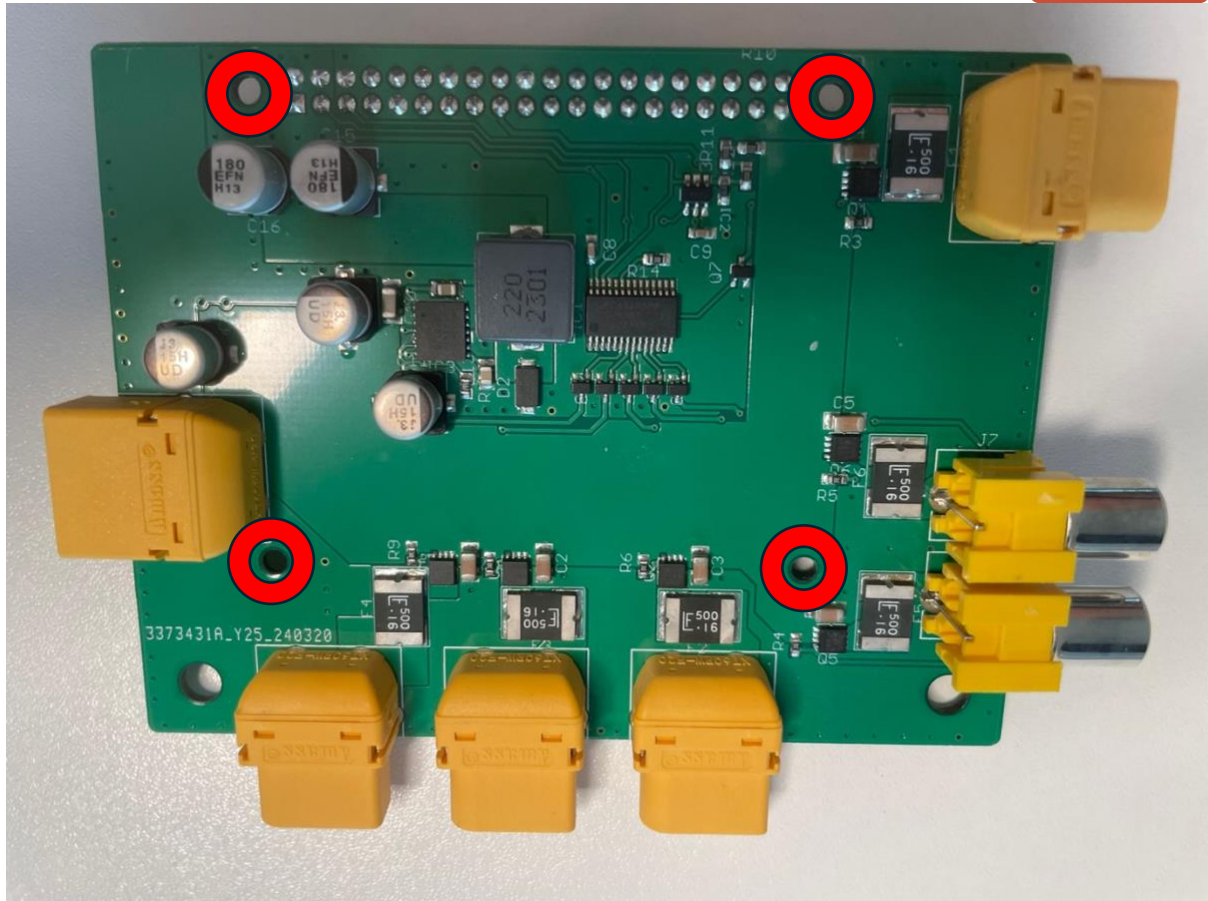


Figure 7. Location of four small holes where the large pillars will be inserted.

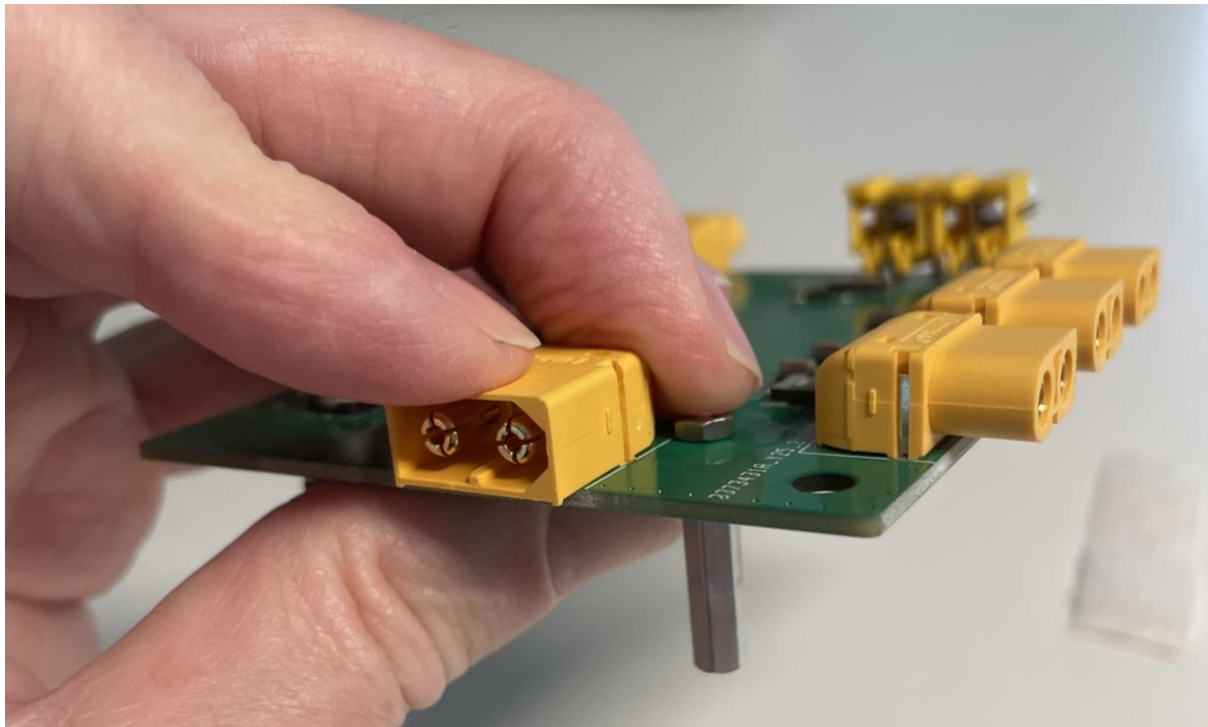


Figure 8. Place a nut on the top of one of the small holes on the board. Insert the screw end of the long pillar through the hole and tighten. You may require small pliers to sufficiently tighten the nuts on the holes closest to the GPIO extension – the long 40 pin connector on the bottom of the power board.

Step 5 (optional): If desired, fit an active cooler and Real Time Clock (RTC) backup battery to your raspberry Pi 5. Both are cheap. Since astronomy tends to be undertaken at night, you may not require the cooler, but the RTC battery will make your life much easier if you are imaging away from an internet connection since the time will still be accurate. Refer to the [official Raspberry Pi](https://www.raspberrypi.com) site for information on these optional accessories.

There is room to attach the RTC battery to the power board. Our advice is to attach it at the location shown below – this prevents it from being crushed by the fan or heated by the heat sink from the active cooler:

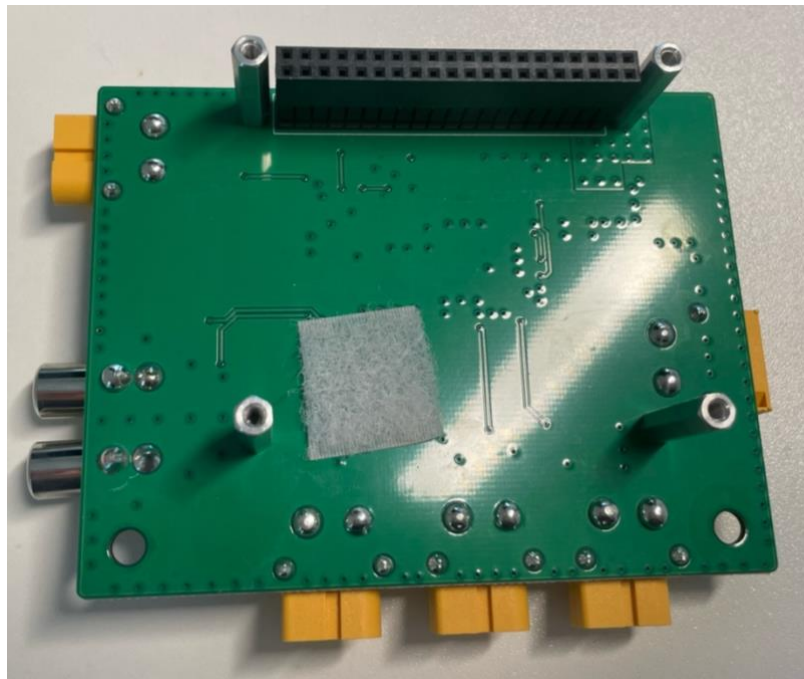


Figure 9. Attach the RTC backup battery where the Velcro is shown here – this prevents the battery from being crushed by fan or heated by the heat sink.

Both options can be added later if required – simply reverse the steps 6 to 10 below to remove the assembly from the case and separate the power board and the raspberry Pi. The cooler and/or the RTC battery can be added and AStarBox reassembled.

It is also possible to install an M.2 NVME board in place of the active cooler. Use the [Waveshare PCIe to M.2 Board\(E\)](https://www.waveshare.com/) as discussed above. If you are using this board and the RTC backup battery, then connect the battery first – it's hard to access the pins once the M.2 board is installed.

The Waveshare board with its various components is shown next to the Pi5 in Figure 10. The first step is to add the thermal paste onto the three main Raspberry Pi chips – Figure 11.

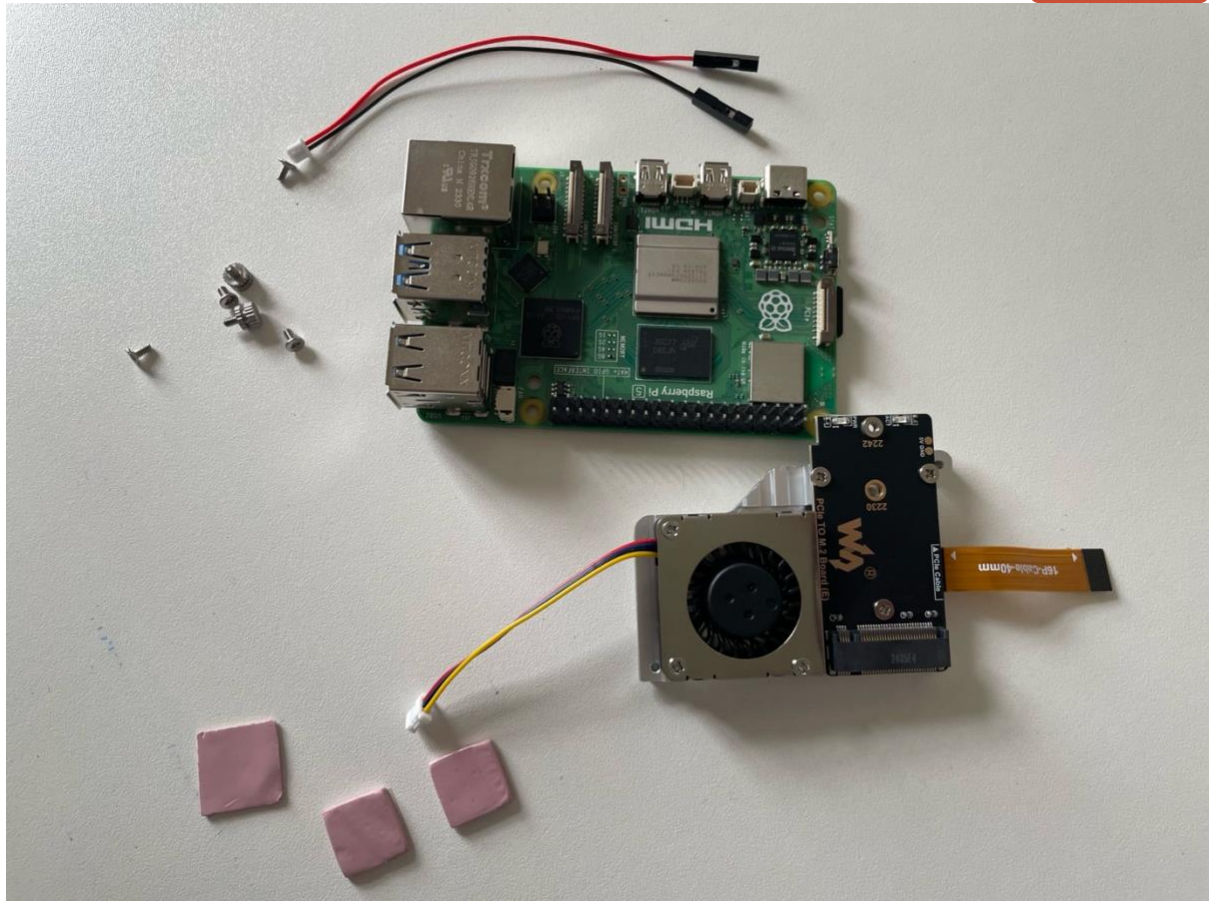


Figure 10. Waveshare board plus screws and wires. The 5V connector (at the top) cannot be used with the AStarBox so low power NVME cards must be selected.

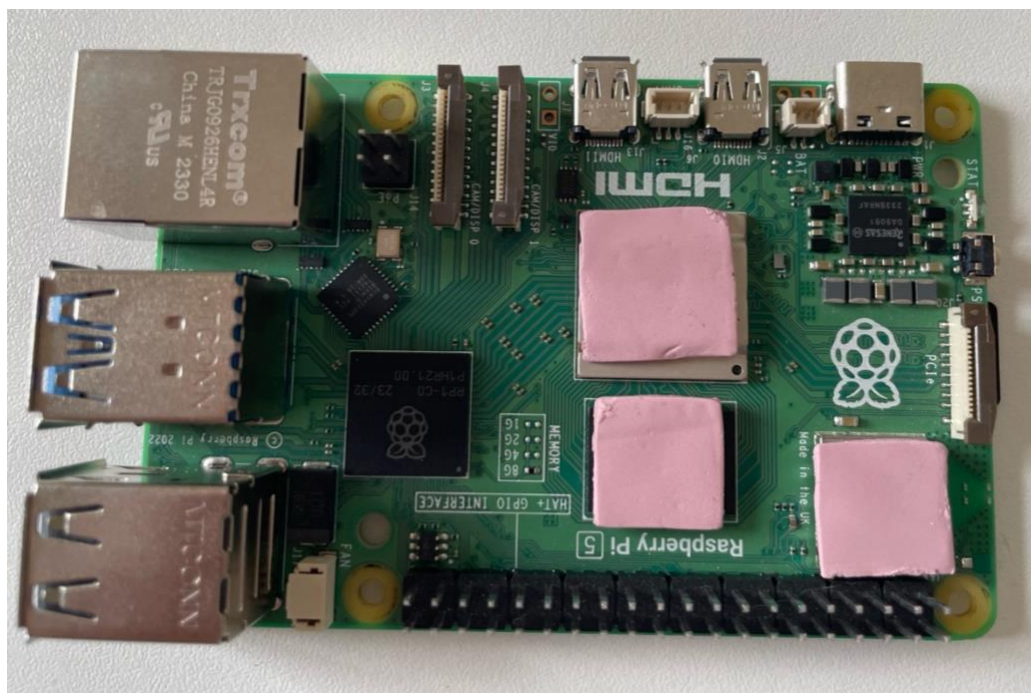


Figure 11. The first step is to add the thermal paste to the three chips shown on the Raspberry Pi 5.

If you are using an RTC battery, connect it now. Once done, lift the gate on the PCIE connector (Figure 12) and connect the PCIE cable to the Waveshare board (Figure 13).



Figure 12. Lift the gate on the PCIe connector – this allows you to connect the Waveshare board.



Figure 13. Insert the PCIe ribbon from the Waveshare board into the PCIe connector on the Raspberry Pi and close the PCIe gate to hold it into position.

Now place the Waveshare board on top of the Pi, aligning the aluminium feet with the fan mounting holes on the Raspberry Pi. Turn over the board and use the screws to hold this in place – see Figure 14.

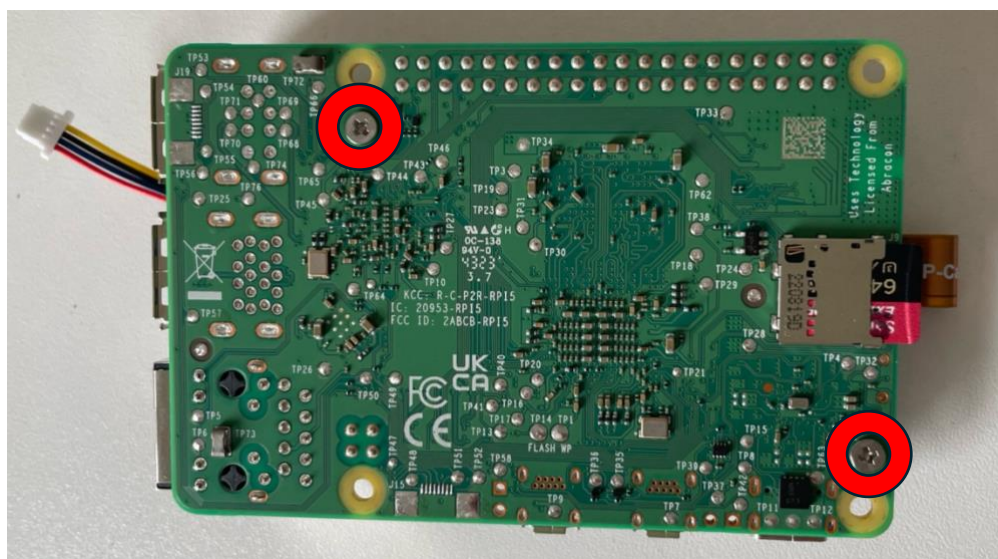


Figure 14. Use two screws from the Waveshare set to hold the board in place (red circles).

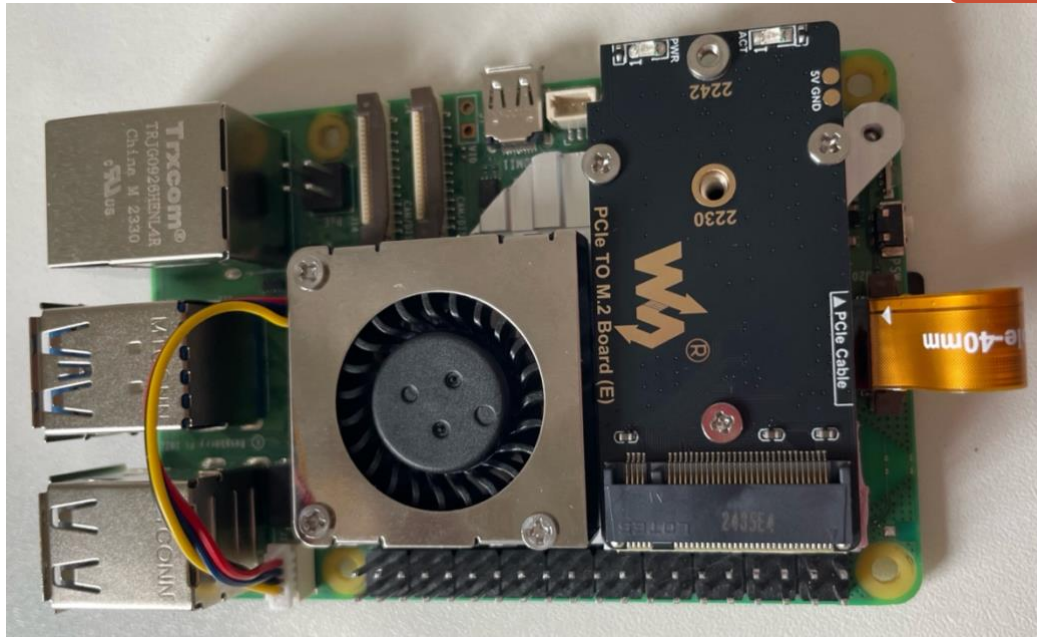


Figure 15. Connect the fan cable to the header on the Raspberry Pi board.

Once held in place, connect the fan cable from the Waveshare board to the fan header on the Raspberry Pi (Figure 15). Finally, secure your NVME card in place on the board using another of the screws from the Waveshare components (Figure 16).

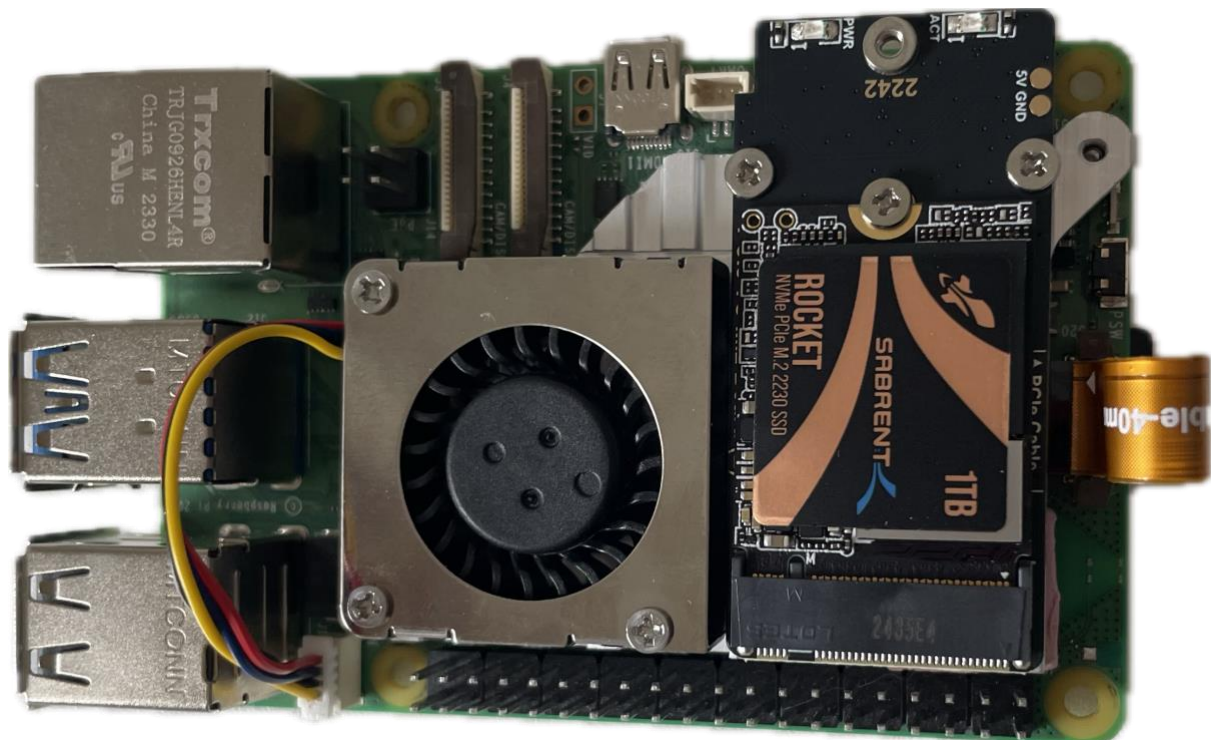


Figure 16. Final step. Connect your NVME card to the Waveshare M.2 card and secure in place with a screw.

Instructions for installing software onto the NVME card are contained in the software installation guides. If you plan on using a USB to NVME adapter to install the software, do this before installing the NVME card.

Step 6: Connect the Raspberry Pi 5 and the power board. Align the GPIO header (the long row of 40 pins on the PI) with the GPIO extension socket on the power board (the 40 pin black socket shown at the top of Figure 9) and gently push the two together.

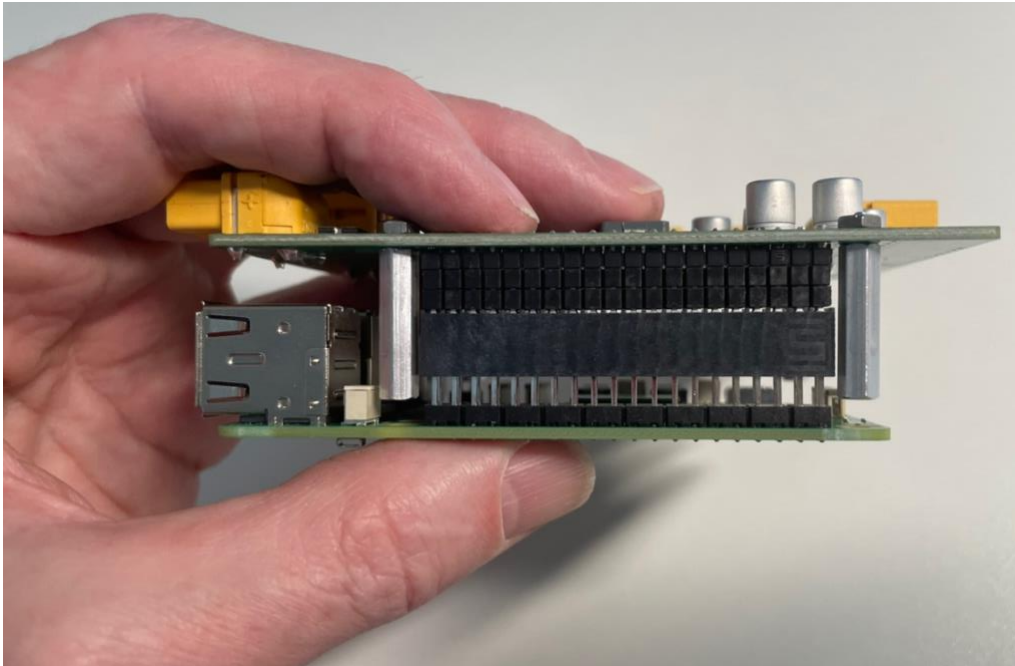


Figure 17. Align the 40 pin GPIO socket on the Raspberry Pi 5 with the black 40pin GPIO extension socket on the power board and gently push the two together.

Step 7: Use the small pillars to secure the two boards together. Push the screw end of a small pillar through the appropriate hole in the Pi 5 and screw into the corresponding large pillar on the power board. Do this for all four pillars.

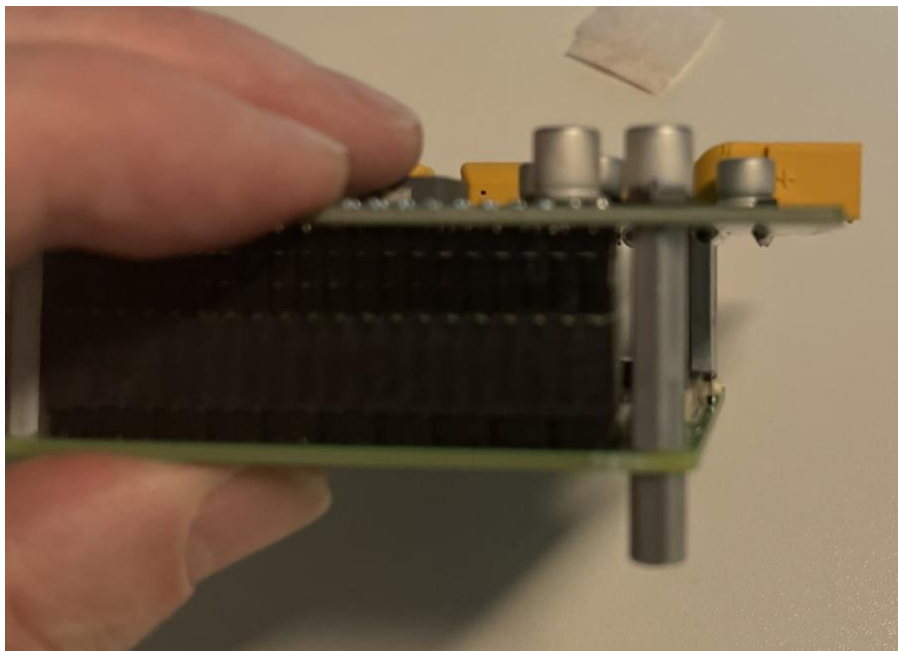


Figure 18. Push the screw end of a small pillar through the appropriate hole in the Pi 5 and screw into the corresponding large pillar on the power board. Do this for all four pillars.

The AStarBox electronic components are now fully assembled and ready to be placed in the case.

Step 8: Place the electronic assembly into the case. Replace the top on the case, remembering to slot the hook on the top of the case through the hole in the base of the case – see below.

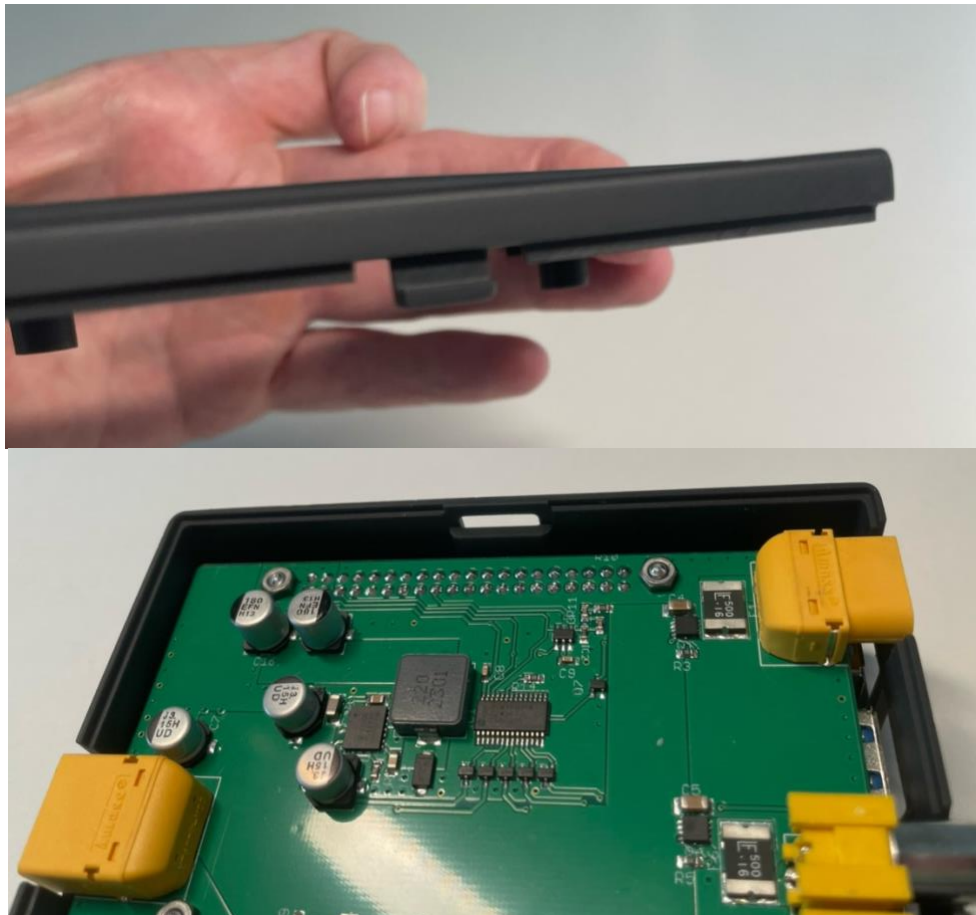


Figure 19. Put the electronic assembly into the case and place the top back on. Remember to slot the catch on the top of case through the hole in the base of the case.

Step 9: Reverse step 1. First put a nut into the recess on the bottom of the case, then tighten the screw. As with step 1, it may be easier to do this with the case on its side allowing you to use a finger to keep the nut in place.

Step 10: Turn the AStarBox over and use the four small screws to secure the electronic assembly to the bottom of the case.



Figure 20. Final step. Turn the AStarBox over and screw the four small black screws into the four recessed holes on the bottom of the case. This will secure the electronic assembly to the case.

Your AStarBox is now assembled and you can begin to install your desired software.

Adding the Finder Foot Attachment:

Place the two M4 screws into the bottom of the finder foot and align with the holes in the aluminium puck on the bottom of the AStarBox – see Figure 21. Choose the direction of the finder foot to best match your set up.



Figure 21. Installing the finder foot attachment. Place the two M4 screws into the bottom of the finder foot and align with the holes in the aluminium puck.

Use a 3mm Allen key to tighten the screws. The AStarBox can now be held in place in a finder shoe – see Figure 22.



Figure 22. AStarBox with finder foot attached to the aluminium puck on the base of the box.