SHARI PiHat NeoPi5 Allstar Node Construction Manual

SHARI (**S**A818 **H**am **A**llstar **R**adio **I**nterface) PiHat NeoPi5 Allstar Node is a kit construction project that implements a Raspberry Pi5 hosted Allstar node using a NiceRF SA818S embedded UHF (420 – 450 MHz) or a VHF (144-148 MHz) radio module. The radio module and interface circuits are located on a custom Raspberry Pi Hat board. A complete Allstar node can be implemented with a SHARI PiHat kit, a Raspberry Pi 5 (with power supply and microSD card) and an Allstar image.

Figure 1 - SHARI PiHat NeoPi5

Figure 2 – SHARI PiHat internal view

A SHARI PiHat Allstar Node kit consists of the SHARI PiHat Mod1 PCB with antenna and a case.

The SHARI PiHat PCB Mod1 is implemented with surface mount parts and through-hole connectors. The board is supplied with all the small surface mount parts installed. The kit builder installs two through-hole connectors, an SMA RF connector and the SA818 radio module.

The kit builder also solders two wires to test points on the Pi5 to obtain the USB connection required for the SHARI PiHat board.

The kit contains an Argon Neo Pi5 case. It functions as a thermal heatsink for the CPU and other parts on the Pi5. An internal fan which is speed controlled by the Pi5 is used to provide additional cooling when needed.

Figure 3 – Argon40 Neo Pi5 case

The kit builder drills 4 holes in the case cover. A 3D printed hole location template is supplied with the kit to aid in proper hole location. SHARI is supported via the SHARI group at www.groups.io/g/shari

Disclaimer:

By building this kit you agree that you are responsible for installing, configuring, testing and verifying that the device performs properly in your environment. The developers cannot be held liable for any direct, indirect, consequential or incidental damage to other pieces of software, equipment, goods or persons arising from the use of this device.

Since you are assembling a kit for use in the amateur radio service, you are responsible for proper operation of the assembled unit per FCC part 97 requirements including RF power output, proper modulation, output frequency and harmonic/spurious output levels.

By constructing this kit you accept the above terms.

Release Notes:

RELEASE	DATE	CHANGES
1.00	2025-06-19	Initial release

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SHARI PiHat Allstar Node Overview

Key Features

- Uses CMedia CM108B USB Audio IC.
- Uses a NiceRF SA818S UHF (420-450 MHZ) or VHF (144-148MHz) embedded radio module with custom firmware (www.nicerf.com)
- Node uses LTCC lowpass output filter to meet FCC Part 97 ham radio requirements
- 200 to 500 milliwatts RF output power
- Raspberry Pi5, power supply and microSD card provided by kit builder.
- Argon Neo rugged RFI-resistant metal enclosure with Pi5 speed controlled internal fan also acts as heat sink for the Pi5.
- RX/TX serial connection from the Pi5 UART to the SA-818 radio module to program the RF module parameters including RF and CTCSS/CDCSS frequencies.
- Internal cooling fan air ducted through heatsink fins.
- 3D printed hole location tool to aid in modifying the case

Setting Expectations

- **Degree of soldering difficulty –Medium**
    - Assembly of the SHARI PiHat kit requires standard through-hole soldering of two through hole leaded connectors. The embedded radio module is surface mounted using castellated holes soldered to very large solder pads on the PCB. The SMA RF connector is also soldered to large pads on the PCB. **The builder also is required to solder two small wires to USB test point pads on the Raspberry Pi5.**

- **Degree of mechanical difficulty - Medium**
    - The kit builder has to drill 4 holes in the Argon Neo Pi5 case cover. A 3D printed hole location tool is included with the kit to aid in this process.

Required Materials

- **SHARI PiHat Kit**

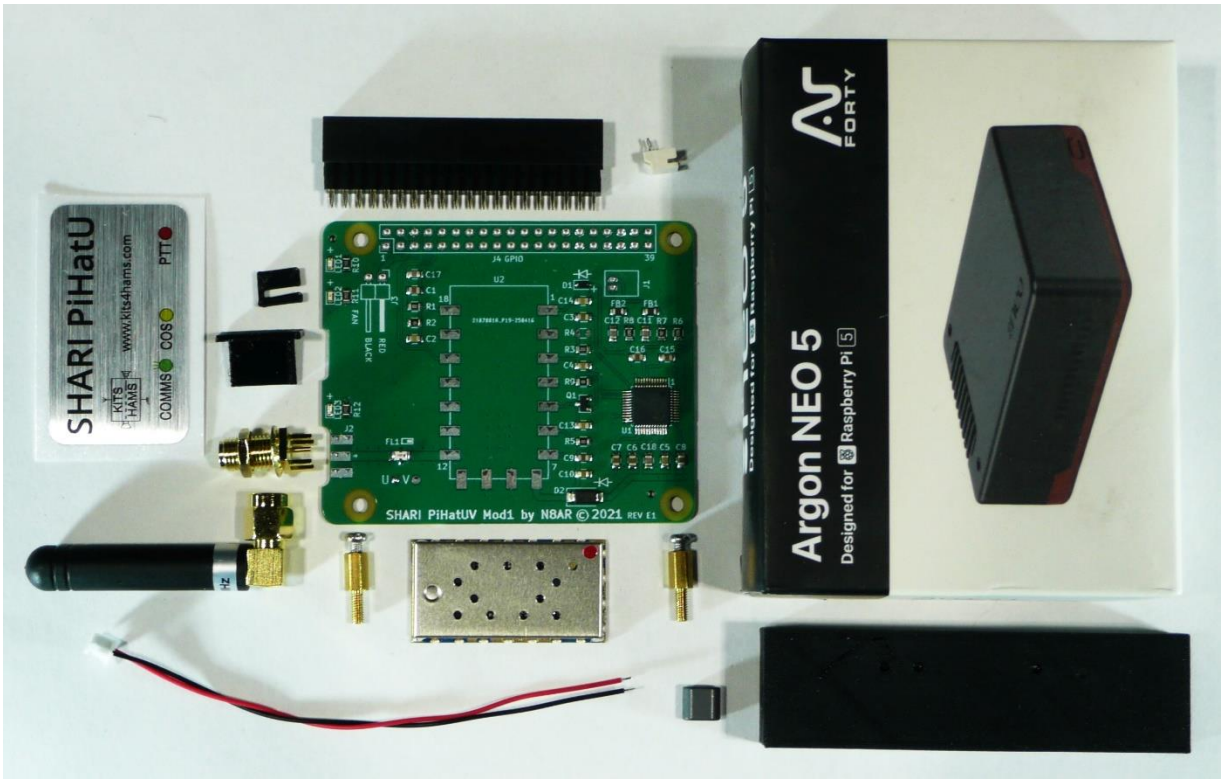


Figure 4 – SHARI PiHatU Kit Parts (Clamp-on Ferrite Core not shown)

- Kit Builder Supplied Parts
  - Raspberry Pi5 (1,2 or 4 GB ram)
  - Raspberry Pi5 Power Supply
  - MicroSD card (16 or 32 GB recommended)

- Tools
  - Low wattage (50 watt) temperature controlled soldering station with small tip and solder.
  - Phillips screwdriver (#1)
  - Small side cutters
  - Automatic center punch (recommended but alternatives work)
  - Drill set with 1/16” and 9/32” drills
  - Drill motor or drill press
  - Small hot glue gun (recommended but alternatives work)

Step 1. Drilling the Required Holes in the Argon Neo Pi5 Case

In this step you will drill the required holes in the end of the Argon Neo Pi5 case top cover. The holes are:

- Three 1/16” LED viewing holes
- One 9/32” SMA connector clearance hole

The location of all the holes should be carefully marked. An automatic spring-loaded center punch is ideal for this task. Marking with a scribe and center-punching the marks also works.

Locate the 3D printed hole location tool provided with the kit	
Install the hole location tool onto the end of the Argon Neo case top cover. Check that the tool is fully seated and contacts applicable surfaces of the cover. .	

Use a center punch to mark the location of the four holes in the top cover. A spring loaded center punch with a small tip is ideal. If your center punch has a larger tip, consider drilling out the holes in the hole location tool to the diameter of the tip of your center punch. You could also use a small sharp scribe to mark the hole locations and then use your center punch.	
Drill three 1/16” holes to the left and one 9/32” hole to the right as shown in the picture. The three holes to the left are LED viewing holes. The hole to the right is a clearance hole for the SMA antenna connector. Use care to ensure that the holes are centered on the original marked locations. A step drill with two flutes works great to drill the 9/32” hole. It is recommended that a small drill be used to start each hole and then the hole be expanded to the required size using drills of increasing diameter to ensure that the finished holes remain centered on the marked location.	

Step 2. SARI PiHat PCB Assembly

In this step, you will complete the PC board assembly by soldering the SA818 Radio Module; the 40 pin GPIO connector; the 2 pin JST connector J1 for the USB signal; and the SMA antenna connector to the PCB. (Note: For additional $5, Kits 4 Hams will install the SA818 for you).

KESTER No-Clean Solder
Sn63Pb37 1.1% 245 0.031"
PN: 24-6337-8800

The kit includes 12" of solder with "no clean" flux in a labeled plastic bag. Please use it for this project. Also, please read the addendum at this time.

First, you will solder the SA818 radio module to the PC board in the U2 position. You will solder 18 castellated holes on the module edges to the pads on the PCB. If you have never soldered castellated holes before, please go to

https://learn.sparkfun.com/tutorials/how-to-solder-castellated-mounting-holes/all

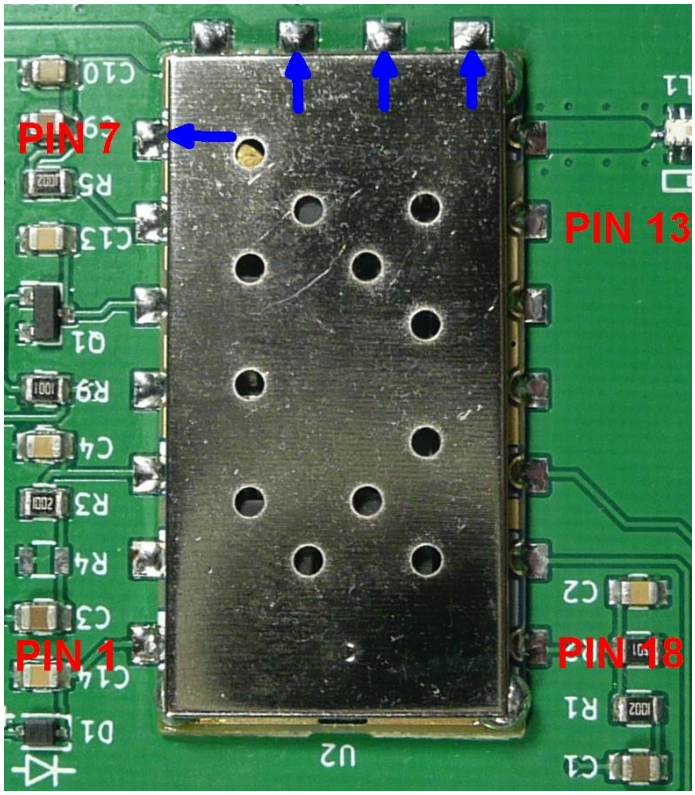
for an excellent tutorial on how to solder castellated mounting holes as used on the SA-818 radio module you are about to install.

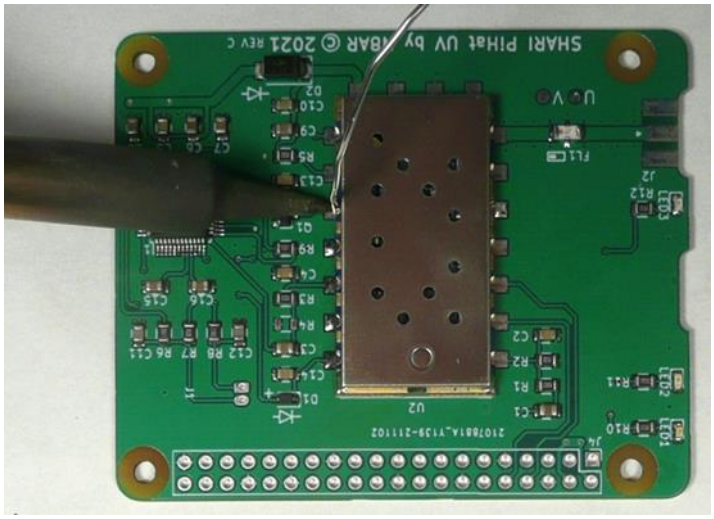
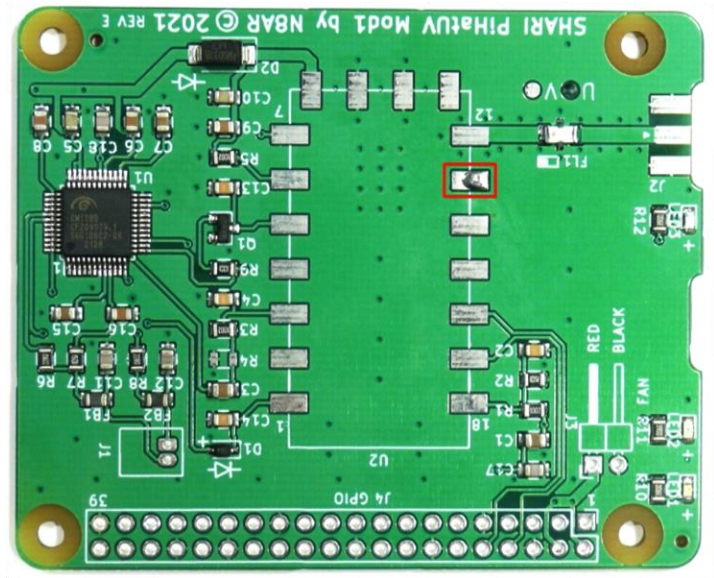
Here are some things to be aware of before you begin soldering.

- The SA818 radio module pin numbering is shown in the photo. The pin numbers increase clockwise from Pin 1. Note that Pins 7, 9, 10 and 11 (blue arrows) are connected to ground of the PC board and to the shield of the module.

- Pins 8, 9, and 10 require more time to heat as you are soldering to pads connected to a large trace (pin 8) or the board ground plane (pins 9 and 10). Make sure that the solder contacts the wall of the castellated hole on all your solder joints. In the picture to the right, note how the solder flows up the wall of the castellated hole on the two outside solder joints but fails to attach to the wall in the two in the middle.

- The module shield is notched above each castellated hole except pins 9, 10 and 11 to minimize the possibility of a solder short to the shield from the castellated hole. Ensure that your soldering does not create a short of any castellated hole to the shield with the exception of pins 7, 9 10 and 11. Check with an ohmmeter if in doubt.



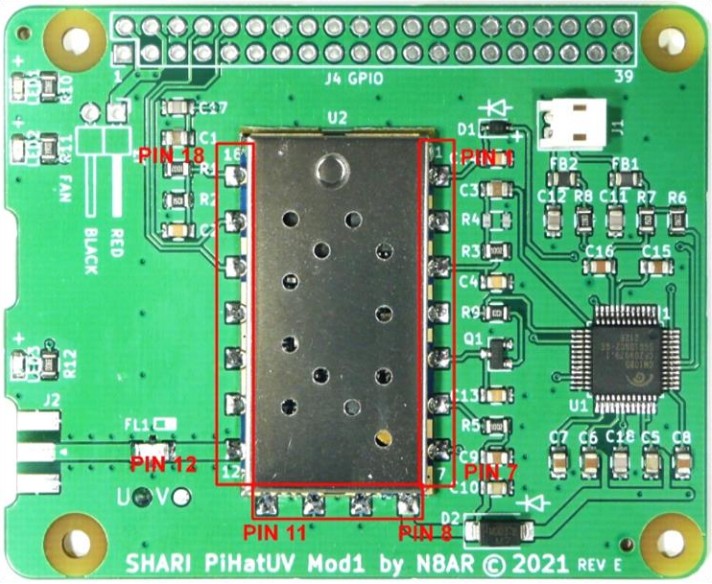
Soldering Hint for castellated holes Clean your soldering iron tip. Hold the solder vertically with the end against the pad on the PC board and the solder touching the wall of the castellated hole. Then, with the soldering iron tip touching the pad and at about a 30 degree angle to the PC board, push the tip into the solder. As soon as the solder melts pull it away and continue to push the molten solder towards the wall of the castellated hole. As soon as the solder flows up the side of the castellated hole, remove the soldering iron tip.	
Flow a small amount of solder onto pad 13 outlined in red on the SHARI PiHat PCB.	

Use the following procedure to solder the module. **Be sure to orient the module so the castellated holes on the module align with all the PC pads on the board.**

Place the U2 radio module on the board with pin13 next to pad13. Reheat the solder on pad 13 from the previous step and slide the module onto the pad in the correct position. Check alignment of the module to all pads. Reheat the solder and reposition the module as necessary and let the solder cool to hold the module in the correct position.

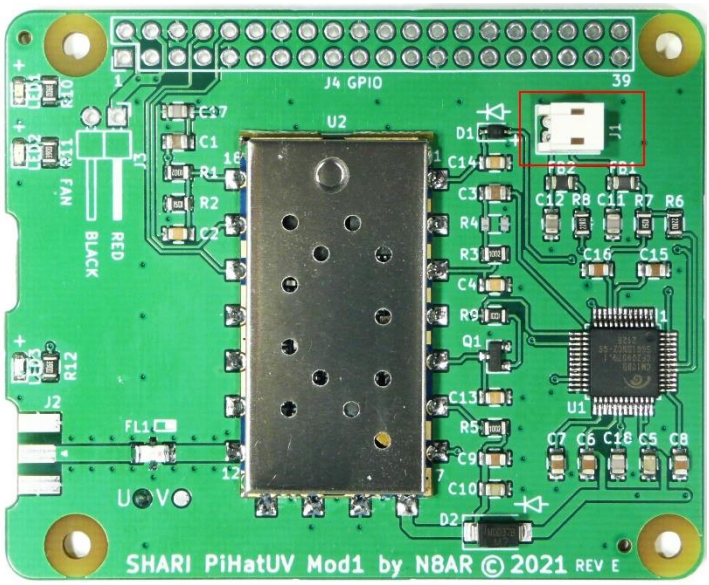
IMPORTANT - Make sure the module is oriented properly on the PCB and **flush** with the surface of the PC board.

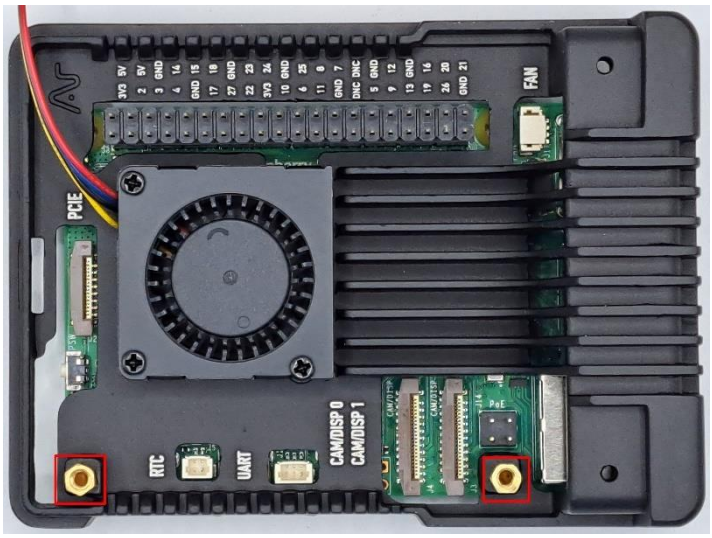
1) Solder pin 1 through pin 7
2) Solder pin 18 through pin 12
3) Solder pin 8 through pin 11

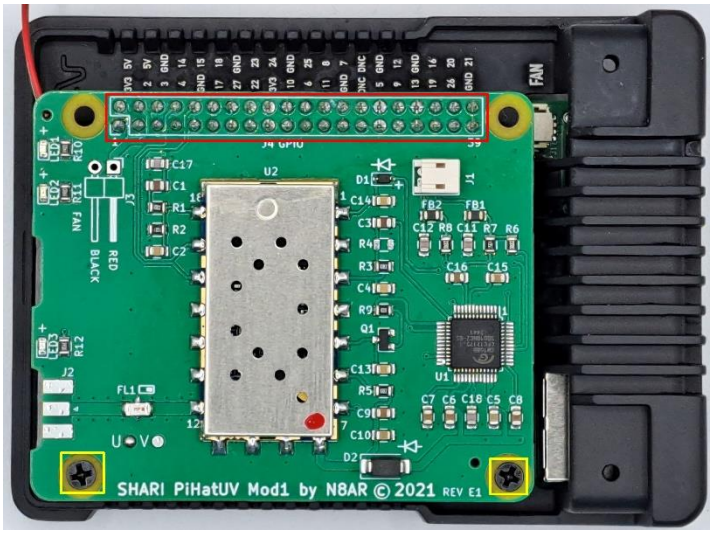


Insert the right angle JST connector into the J1 position on the board in the orientation shown in the picture and solder its 2 leads.

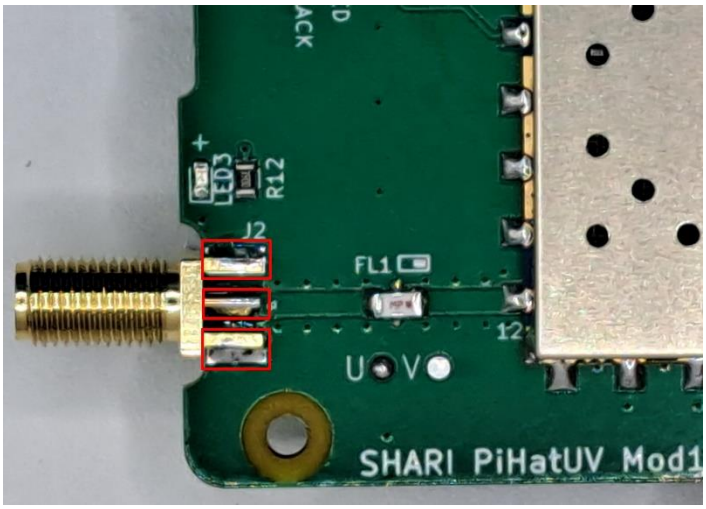
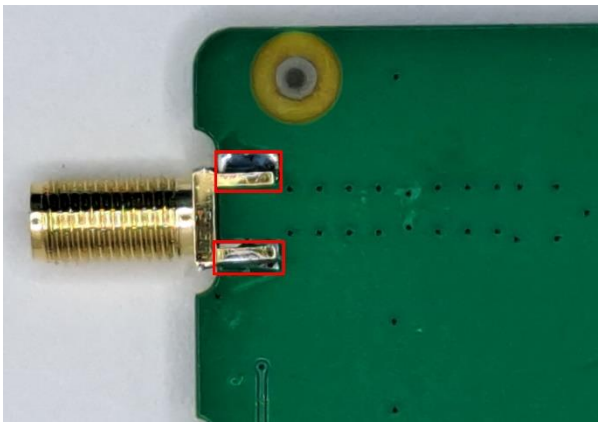
Do not install this connector in the J3 (FAN) location.



Temporarily install your Raspberry Pi5 into the Neo Pi5 case. **Do not use the four thermal transfer pads at this time**. Insert the Pi5, place the bottom cover over it and use four screws to secure the cover. Hint: Installing the bottom cover protects the Pi5 board from physical damage while you preform the next seven steps of this procedure.	
Install the two brass standoffs outlined in red in photo. **Hint:** If you have difficulty screwing the standoffs in, screw one of the black flathead screws into the hole until it bottoms and then remove it. As the screw bottoms in the hole, it pushes back the threads at the top of the hole allowing the brass standoff to more easily engage the threads in the hole.	

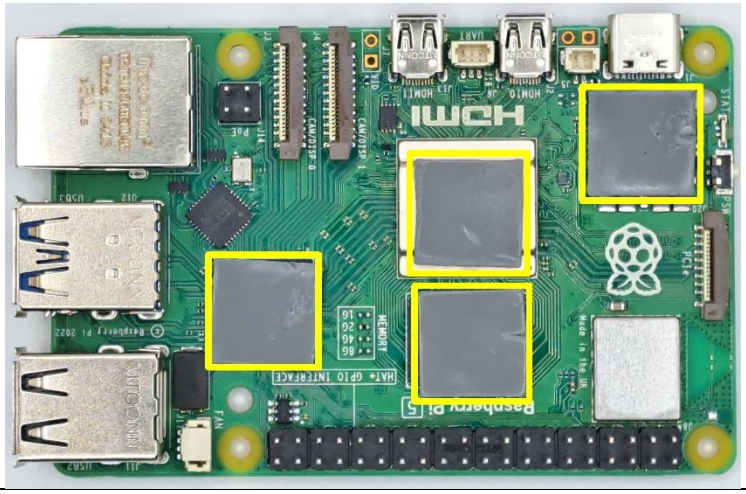
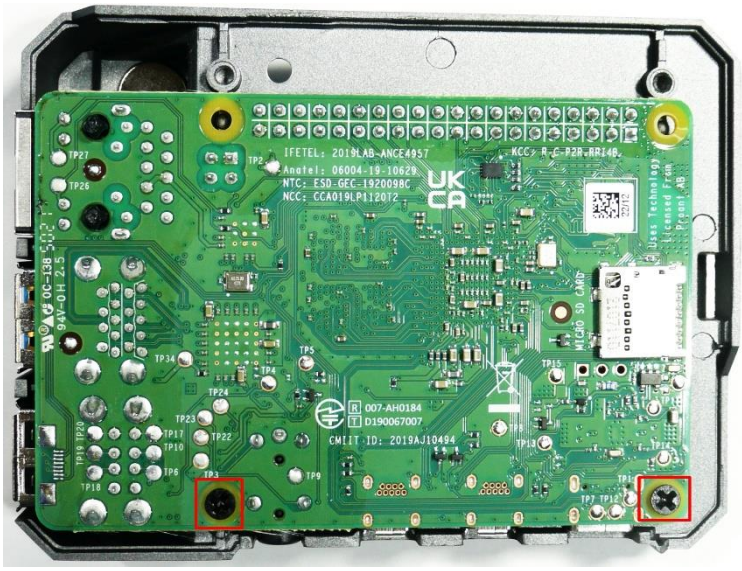
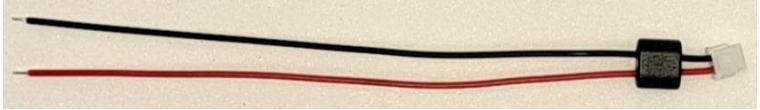
Press the 40 pin female GPIO connector onto the male header pins of the Pi5. Make sure it is fully seated on the GPIO male header installed in the Pi5. **Hint:** If you have difficulty seating the connector proceed to the next step where you can press on the PC board in the area at each end of the connector.	
Place the PiHat PCB over the female GPIO pins. Fasten the board in place using two mounting screws (outlined in yellow). Ensure the PC board is fully seated on the GPIO connector and solder the 40 pins of the GPIO connector (outlined in red). **Hint:** If the PC board does not seat on the connector, loosen the two mounting screws slightly.	

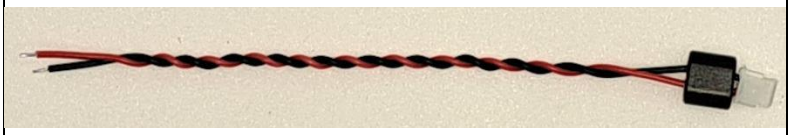
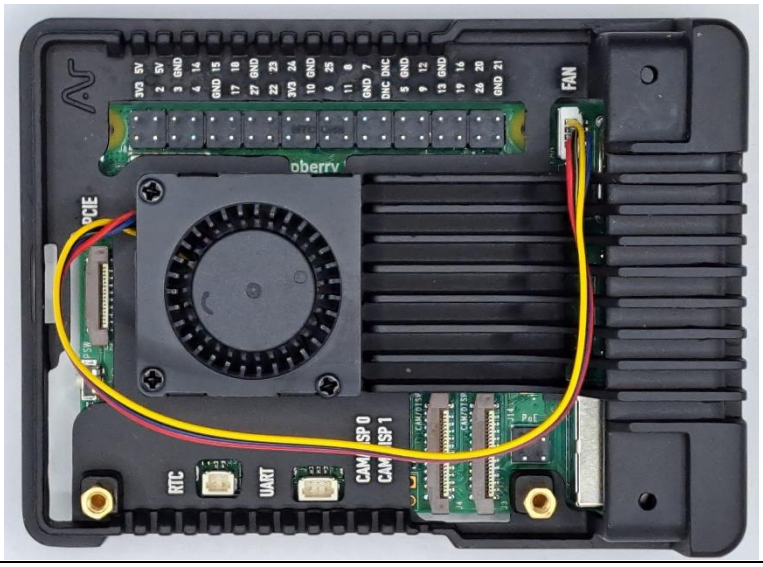
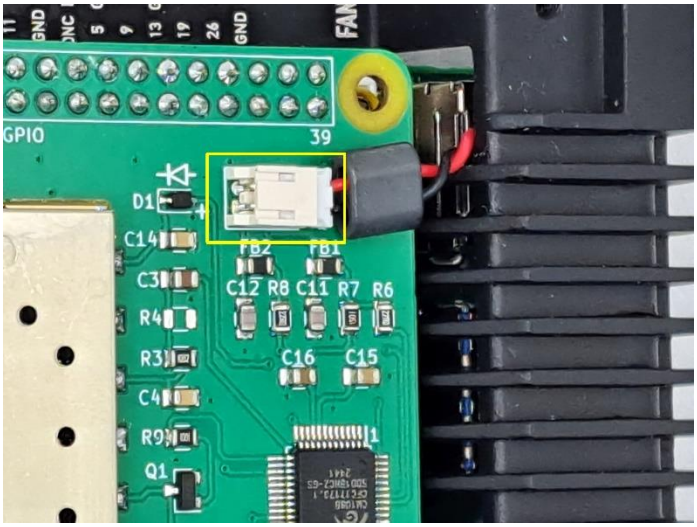
Place the SMA antenna J2 in position (yellow box) on the pads on the PiHat PCB. Align it so that it is perpendicular to the edge of the PCB and the axis of the center conductor is parallel to the plane of the PCB. **Lightly** solder a ground pin of the connector to the pad on the PCB to hold it in place so you can check its alignment.	
Attempt to slide the Argon Neo case top cover into place and verify that the SMA connector fits through the hole in the cover. Re-melt the solder connection of the SMA center pin and reposition the SMA connector to center it in the hole if required. Use care to avoid damaging the solder pad on the PCB. The connector does not have to be perfectly centered as the nut and brass star lock washer installed later will cover the hole. **Hint:** Vertical alignment can be adjusted by slightly tilting the SMA connector so it's not parallel to the board or the board can be slightly raised by backing out the two brass standoffs a small amount.	

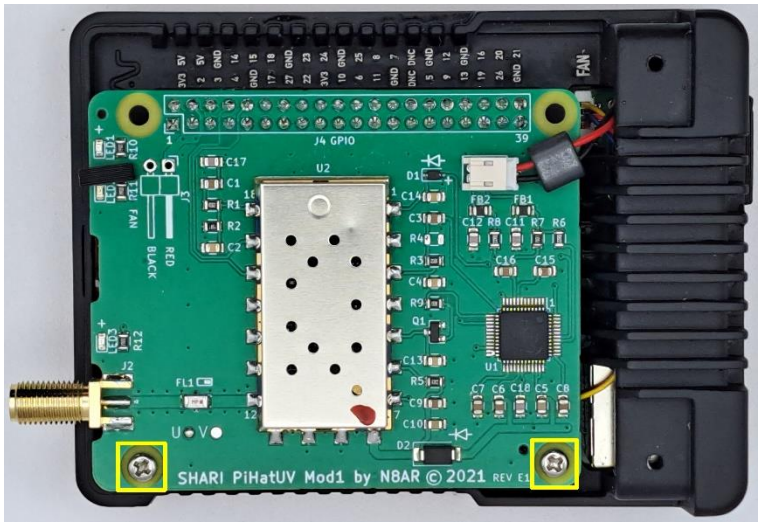
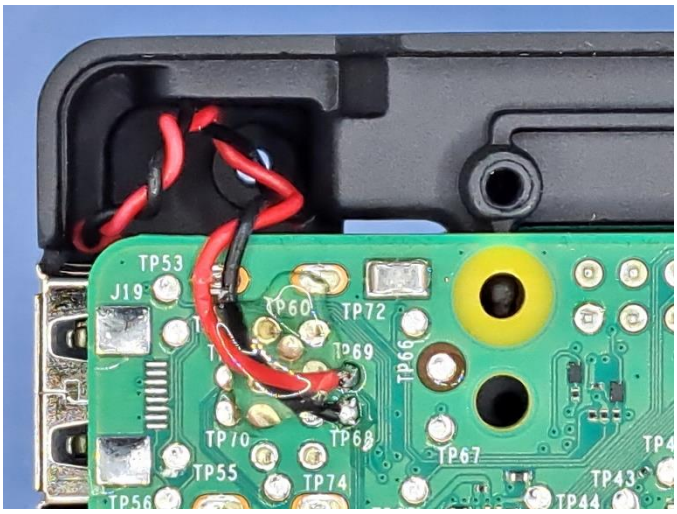
When you are satisfied with the SMA connector alignment, solder the center pin and other ground pin to the PCB pads. **Hint:** Don't forget to solder the center pin	
Remove the 2 screws holding the PiHat PCB in place and unplug the PCB at the GPIO connector. Solder the 2 SMA connector ground pins on the bottom side of the PCB. This completes the construction of the PiHat PCB. Set it aside for final assembly.	
Remove the four screws holding the bottom cover and Pi5 in place and remove the Pi5.	

Step 3. SHARI PiHat Allstar Node Final Assembly

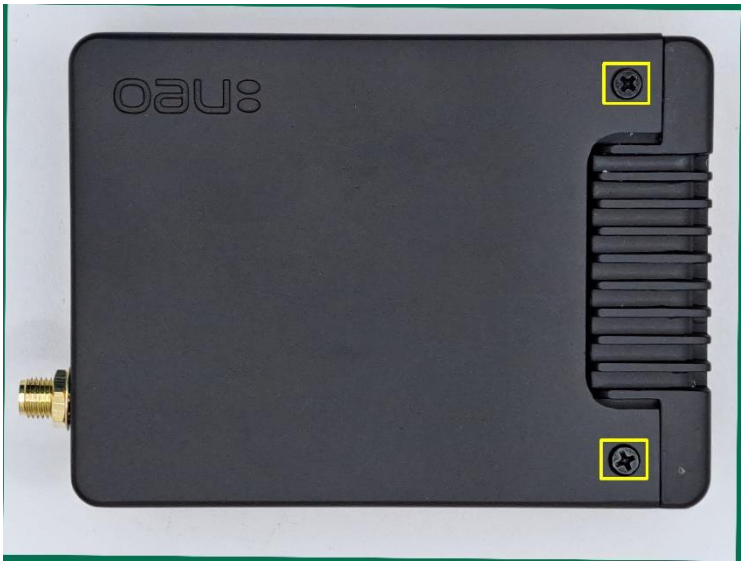
In this section, you will perform final assembly of your SHARI PiHat NeoPi5 Allstar node. Begin by removing the case bottom cover by removing four screws and removing the Pi5 board.

Locate the 4 thermal interface pads packaged with your Neo Pi5 case. Working one at a time, r**emove the protective plastic film** from one side of each pad exposing a sticky surface. Place this pad with the sticky side on the components shown (yellow boxes). Remove the plastic film from the top of each pad.	
Install the Pi5 into the case and install two screws to temporarily hold it in place. Warning: Because we need access to pads on the Pi5 we are not installing the bottom cover to protect the Pi5 so use care in the next steps to not accidentally damage it or subject it to a static discharge.	
Slide the small ferrite with two holes over the red and black wires of the JST connector cable	

Twist the red and black wires as shown. Try to control your twist so the wires end up about the same length. This will occur if the wires are twisted equally versus wrapping one wire around the other.	
Route the fan cable as shown and plug it into the fan connector on the Pi5.	
Plug the JST cable into the receptacle on the PiHat board. Thread the JST cable through the open area in the case as shown and plug the PiHat board onto the PI4 board GPIO connector. **Support the Pi5 from the bottom as you plug in the PiHat board as it has no support from the bottom cover at this time**.	

Ensure that the fan cable is still routed correctly. Secure the PiHat board in place using two screws. **Bonus:** We have included two stainless screws in the kit which can be used instead of the black screws intended for this purpose provided with the Neo Pi5 case. Ours look nicer :>)	
Solder the red wire of the USB cable to TP69 of the Pi5. Solder the black wire to TP68. We have found the best way to do this is to first apply solder to the TP68 and TP69 pads to form a semicircle ball of solder on the pad. Then reheat the solder and push the wire down into the solder ball. Apply a small amount of hot glue as shown and then stuff the extra wire into the recess as shown.	

Remove the two screws used to temporarily hold the Pi5 board in place. Place the bottom cover in position over the Pi5 and use four black flat head Phillips screws to secure it. Apply the four black urethane feet that came with the Argon Neo Pi5 case to the four locations for them in the bottom cover	
Install the 3D printed light shield (yellow box) between the two SMD LEDs as shown by sliding the grove in the shield onto the PC board. The taller side of the shield should be up (i.e. facing you).	

Install the top cover. Use two black flat head Phillips screws (yellow boxes) to secure it	
Place the serrated SMA washer with the teeth towards the case cover on the SMA connector. Install the SMA nut and tighten lightly.	

Insert the 3D printed USB jack filler plug supplied with the kit into the top left USB jack. Orient it with the longer side up so it does not interfere with a device plugged into the USB jack below it. This is the USB port that is used internally by the SHARI PiHat (the wires you soldered to the Pi4 board) so it can not be used by another USB device.	
Apply the SHARI PiHat label to the top cover of the case. Attach the antenna to the SMA connector.	
Install the ferrite core supplied with the kit at the power supply end of the cable. Pass the wire through the center of the core 3 times This ferrite will ensure that you have no “hum” or “buzz” interference while using the node. Here is a link to a discussion on this topic. https://groups.io/g/SHARI/topic/hum_buzz_on_signal/73406860?	

Addendum – Note About Solder and Flux

The solder we provide with all SHARI kits has a “no clean” flux core to assist in soldering. So normally, no extra flux should be required to assemble the kit. However, soldering the four ground pins on the SMA connector can be difficult because the thermal mass off the connector is drawing the heat away from the solder joint. If you use flux, it is best to use “no clean” flux. Do not use type RA (Rosin Activated) or RMA (Rosin Mildly Activated) as these contain an acid which can be conductive and corrosive. Here is why.

When choosing between **RA flux** (Rosin Activated) and **no-clean flux** for electronic soldering, here’s what you need to know:

RA and MRA Flux (Rosin Activated)

- Pros:
    - Very aggressive and provides excellent cleaning action, especially on oxidized or dirty surfaces.
    - Good for difficult-to-solder joints or older components.
- Cons:
    - Leaves behind residue that is corrosive and conductive over time if not cleaned.
    - Must be thoroughly cleaned with isopropyl alcohol or specialized flux remover.
    - Not ideal for sensitive electronics or high-density PCBs where residue can cause shorts or leakage.

No-Clean Flux

- Pros:
    - Leaves minimal, non-corrosive, non-conductive residue that usually doesn’t require cleaning.
    - Ideal for modern electronics, rework, and surface-mount assembly.
    - Speeds up production or DIY work due to no post-cleaning.
- Cons:
    - Less aggressive than RA; may struggle with heavily oxidized surfaces.
    - May require higher soldering skill or very clean components/pads.

The use of RA or RMA flux when soldering the castellated connections on the SA818S module is especially problematic and has resulted in at least four SHARI models being returned to Kits 4 Hams for repair. The problem is that the flux flows underneath the SA818 module where it cannot be removed.

Pin 6 of the SA818 module is the "Power Down" pin. Pulling this pin low shuts off the SA818 internal 3.3 VDC regulator – thus shutting down the module. Normally, Pin 6 is pulled high to 5 VDC using a 10K resistor on the PC board. But if the RA or MRA flux is sufficiently conductive it acts as a voltage divider to ground with the 10K pullup to lower the voltage to pin 6. This results in a voltage that is less than required to tell the regulator it should be ON and greater than required to tell it to be OFF resulting in erratic operation. Since the conductivity of the flux increases as it warms up, the SHARI may work fine until the module warms up (i.e. transmits a lot) and then goes whacky.

Thus, the bottom line is if you use flux make sure it is "no clean". CHIPQUIK SMD291 flux is what we use at Kits 4 Hams if we have to rework a solder joint.

https://www.amazon.com/Chipquik-Quik-SMD291-Clean-Syringe/dp/B0CT5T6HWN