

# ASSEMBLY GUIDE FOR THE NOVADUINO<sup>®</sup> DISPLAY KIT

KIT001

Nova Radio Labs LLC

Rev1p2

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### 1.0 Assembly Guide for the Novaduino® Display Kit

This Assembly Guide provides steps for assembling the Nova Radio Labs Novaduino® Display KIT001 and options. Please see the Novaduino® Display User Manual pdf document for electrical design details and software loading details.

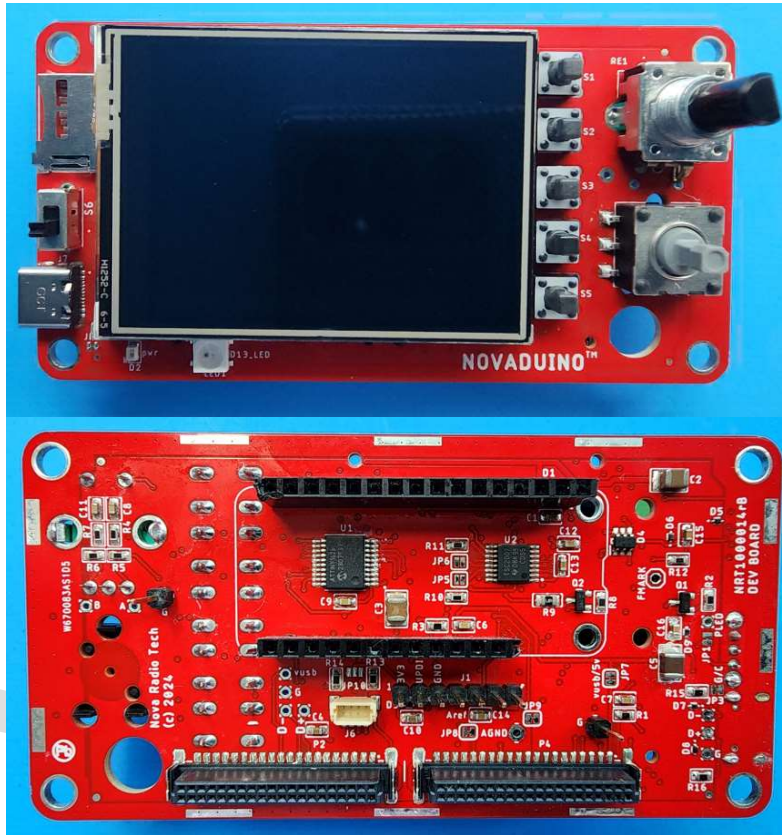


Figure 1. Novaduino® Display shown with all control options installed

## 2.0 KIT001 Contents

| Item No. | NRL Part Number | Product   |
|----------|-----------------|---|
| KIT001   |                 | <b>Novaduino® Display Kit</b>   |
|          | A01             | 1 - Novaduino(R) Display PCBA, NRT1000014   |
|          | A02             | 1 - Display Module, 4DLCD-24320240-rtp-ips  |
|          | A03             | 1 - LCD Spacer  |
|          | A04             | Headers for Feather Proc<br>1- 16 pin and 1 - 12 pin, female 2.54 mm pitch (short PTH pins)                 |
|          | A05             | 1 - On/Off Switch   |
|          | C20             | 2 - light pipes for Front Panel<br>3mm dia, 0.188" L  |
|          | C16             | 4 - #6-32 5/8-inch machine screws, Front Panel attach   |
|          | C18             | 4 - E-Z LOK, #6-32 thread   |
|          | --              | STL File Kit for Display: Faceplate, Vented Case, Front Bezel, Sensor Cover, NavButton                      |
|          |                 |   |
| option   | A09             | Optional - Rotary Encoder   |
| option   | A10c            | Optional - Rotary Encoder knob  |
| option   | A07             | Optional - Tact Buttons   |
| option   | A08             | Optional - key caps for Tact Buttons (White or Black)   |
| option   | D02 or D08      | Adafruit Feather M0 Express Or SparkFun Thing Plus SAMD51 Or try your own. Ours comes with Stacking Headers |
|          |                 |   |

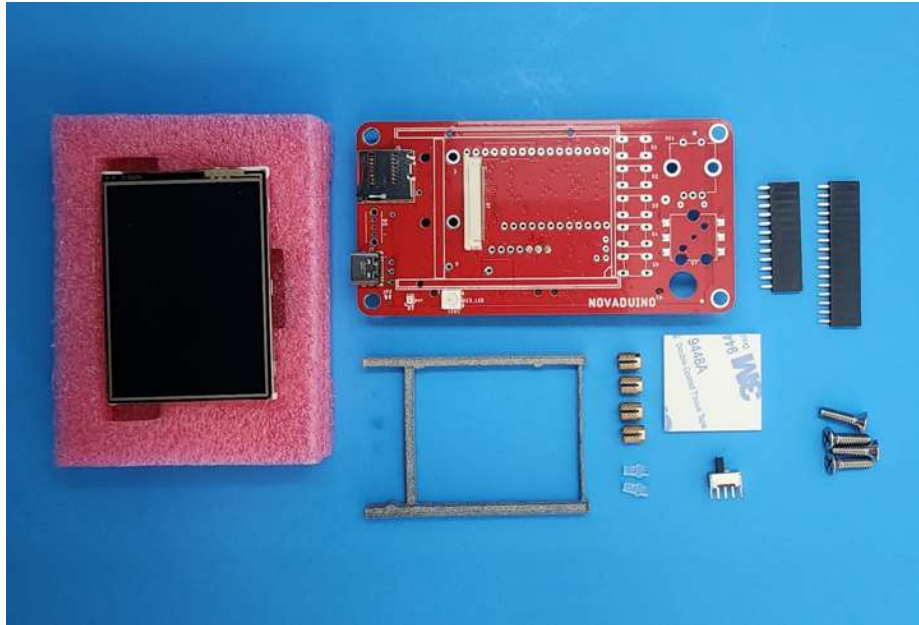


Figure 2. KIT001 contents



Figure 3. Optional controls and Feather Processors

## 2.0 General Instructions and Precautions

### 2.1 Tools and Materials Required:

- Soldering iron with small tip
- Solder
- wire cutters

- wire strippers
- Philips screwdriver
- Flat head screwdriver
- Breadboard
- small needle nose pliers and/or tweezers
- small hammer
- properly grounded ESD mat with wrist strap

We also recommend using an air filtration device such as the Hako FA-400 while soldering. A PCB vise may also be very helpful while soldering certain components.

## **2.2 Electrostatic Discharge:**

This kit includes Electrostatic Discharge (ESD) sensitive components. Please use a properly grounded ESD mat connected to an ESD wrist strap. Please wear the ESD wrist strap when handling or touching the components contained in this kit.

Electrostatic discharges can induce very high voltages into these sensitive components that can destroy them or cause latent or intermittent damage.

## **2.3 Soldering:**

Soldering of through-hole components to a printed circuit board is required for assembling this kit. Soldering of surface mount components is not required.

If you are not familiar with soldering electronics equipment, please watch and follow one of these fine tutorials before soldering this kit.

[Tools | Adafruit Guide To Excellent Soldering | Adafruit Learning System](#)

And/or:

[\(3129\) SparkFun How to Solder with David Stillman - YouTube](#)

Please be careful if you decide to clean any residual flux from the PCB once you are done soldering. We have found that cleaning flux from the PCB can possibly contaminate the tact switches and/or the rotary encoder or any other switches resulting in intermittent operation. If your switches are acting strange, you may need to clean them or replace them.

## **3.0 Discussion of Feather Processor Mounting Options**

You can attach the Feather processor to the Novaduino® Display board using several methods. The board comes without pre-soldered headers to provide you with greater design flexibility. Female Headers for method 1 are included in this Kit.

Methods to mount Feather Processor to the Novaduino® Display PCB:

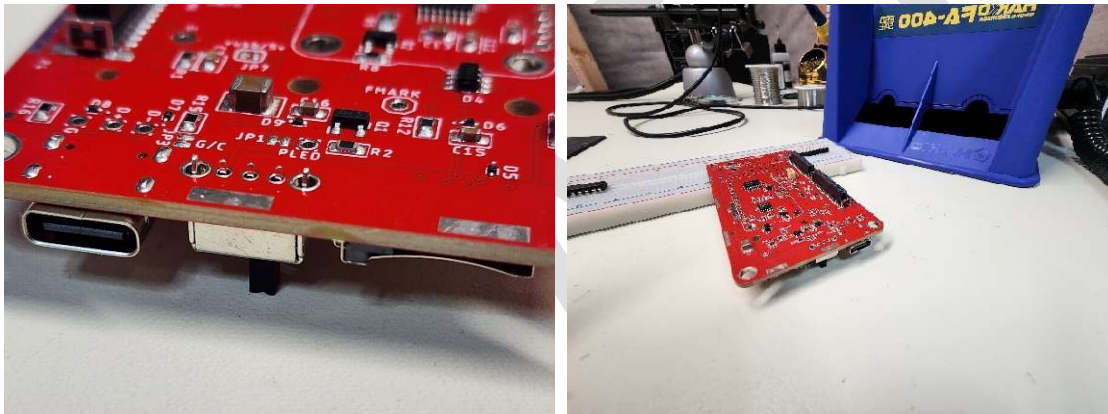
1. Solder female headers (16-pin and 12-pin) onto the Display board and stacking headers on the Feather Processor.
2. Solder the Feather Processor directly to the Display board with 16-pin and 12-pin male headers.
3. Use a female header on the Display board and male headers on the Feather Processor.
4. Mount any compatible processor to the Novaduino® Proto Expansion Card (see KIT002), which supports display and key interfaces over the backplane.
- 5.

For more details and images, refer to the Novaduino® Display User Manual pdf.

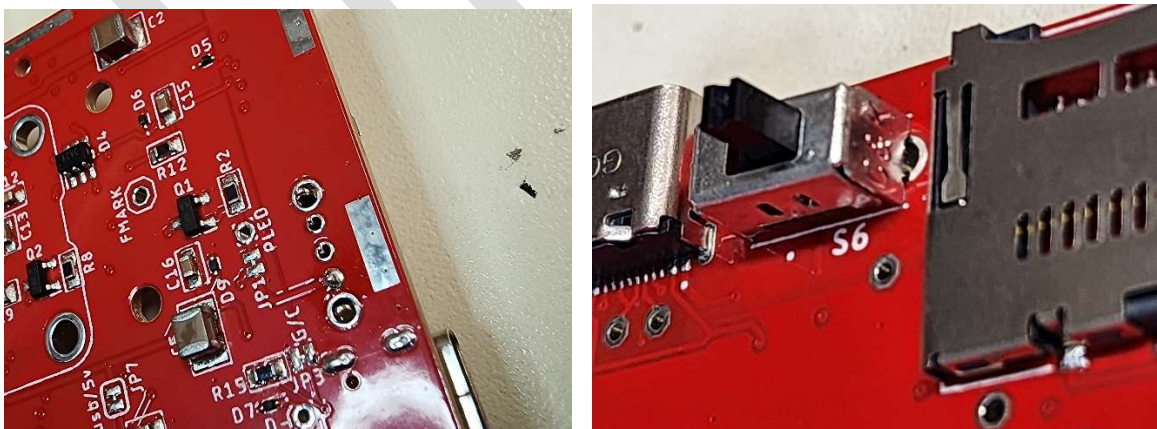
### 4.0 Assemble the Novaduino® Display PCBA

This section provides directions for Feather attachment method 1.

**Step 1.** Solder the on/off switch to the Novaduino® Display PCBA.

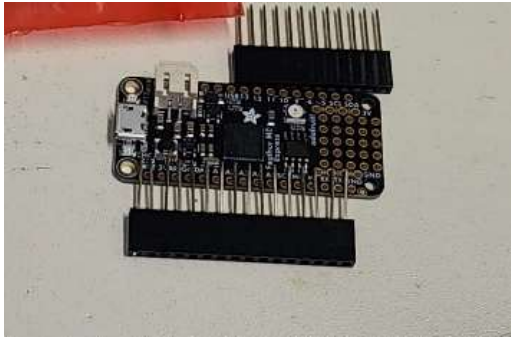


Hold the enable switch in place. We prop the opposite end of the PCBA up to about the same height of the on/off switch using a bread board, but you can use anything that is similar in height. Gravity holds the PCB and the switch in place.



Solder one pin of the on/off switch while assuring that the switch is flush with the PCB. Inspect the switch to make sure it is flush, if not, heat the solder up again while pushing the switch so that it is flush with the PCBA. Then solder all the other pins of the enable switch.

**Step 2.** Solder the 12 pin and 16 pin female stacking headers (with long pins) to the Processor module.

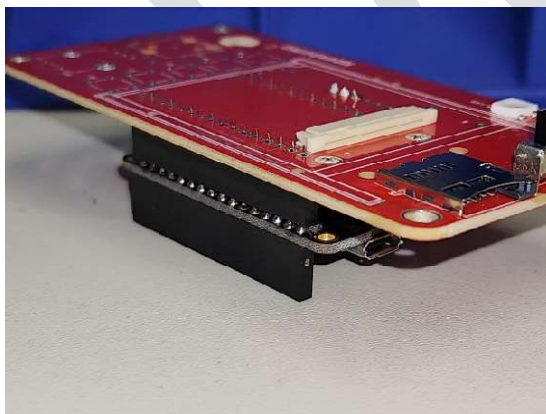


Insert the stacking header pins from the top side of the processor and solder on the bottom side.

**Step 3.** Solder the 12 pin and 16 pin female headers with short leads to the Novaduino® PCBA.



Use the processor to hold the 16 pin and 12 pin female headers with short pins in place.

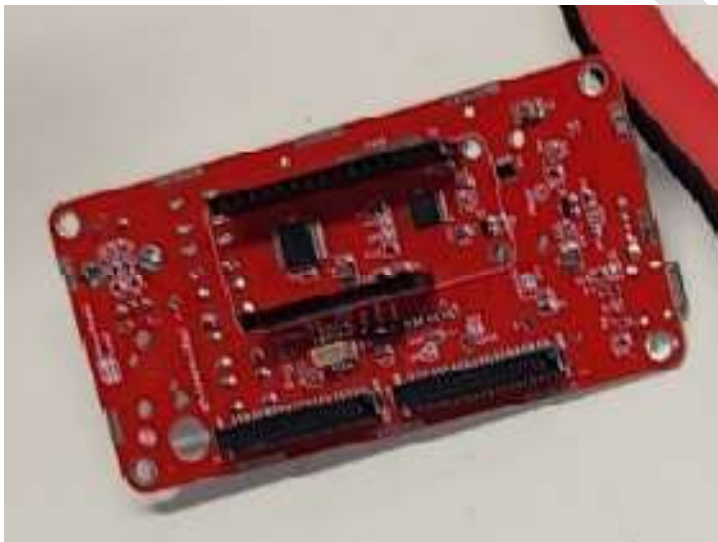


Place the Novaduino™ PCBA onto the processor header pins with the front side of the display PCB facing up.



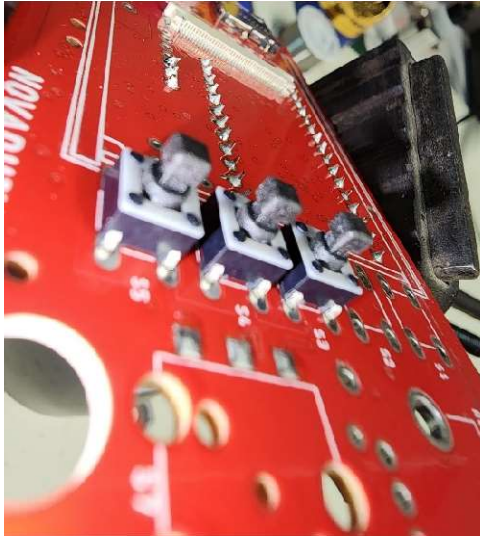
Solder one or two pins on each of the headers to hold them in place. Be especially careful to not melt the Flat-PC (FPC) connector while soldering near it.

Next, remove the processor from the headers that you are soldering to prevent it from overheating. Then solder all the other pins.

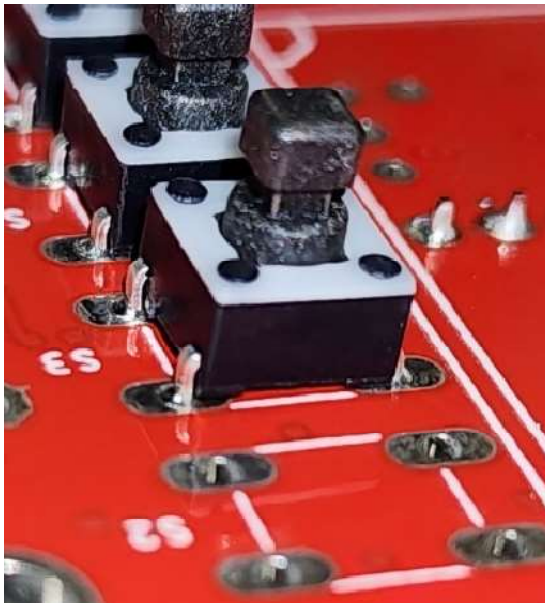


This picture shows the Feather headers mounted on the back side of the Novaduino® Display PCBA.

**Step 4.** Solder the optional Tact Switches to the Novaduino® Display PCBA.



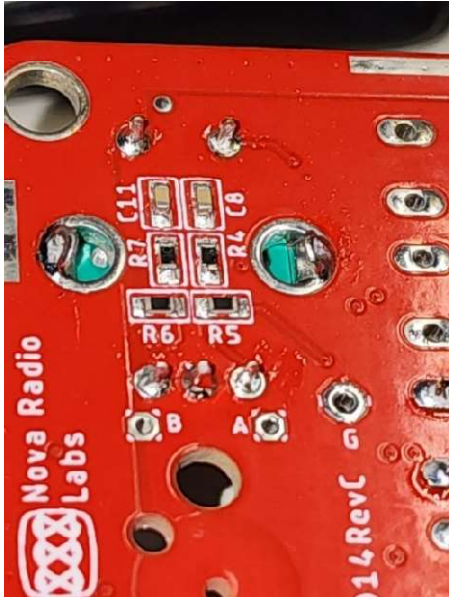
Insert the optional tactile switches into the front side of the Novaduino® Display PCBA, assure they are all the way against the PCB.



Before soldering the tactile switches, assure they are completely flush with the PCB. Double check before soldering because once soldered it is very difficult to fix the alignment. This picture shows a switch that was not flush with the PCB. We had to cut the switch out and install a new one to fix it.

Solder the switch leads on the back side only.

**Step 5.** Solder the Rotary Encoder to the Novaduino® Display PCBA.

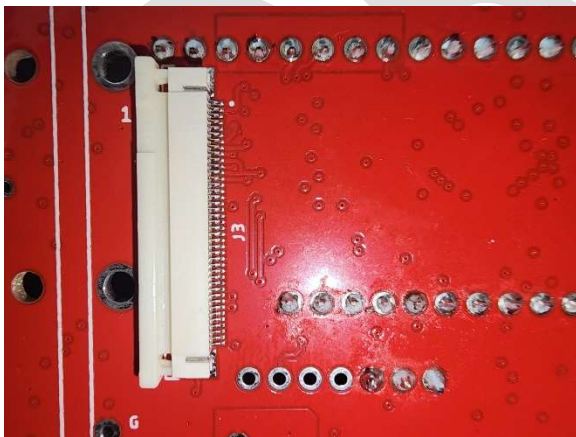


Insert the rotary encoder on the front side of the Novaduino® Display and solder on the back side.

## 5.0 Assemble the LCD and Novaduino® Display PCBA

Before attaching the LCD Display module, please note whether the it uses the ILI or ST driver chip. The one shown in these pictures uses the ILI driver chip.

### Step 6. Attach the Display Module



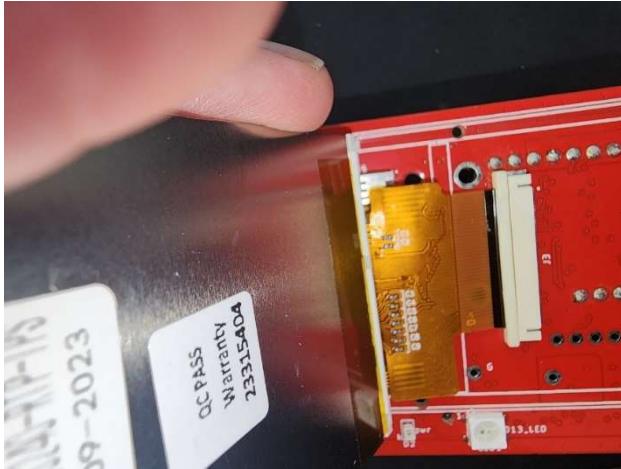
Gently open the Flat PC connector with a small flathead screwdriver. Use the screwdriver to alternately push at the top and the bottom of the connector.



Gently insert the display FPC ribbon into the open FPC connector. Make sure it is all the way in as pictured above.



Use a small flat head screwdriver to close the top part of the FPC connector, followed by the bottom part. It may be necessary to alternate between both sides several times to fully close the connector. Take care not to touch the FPC ribbon with the screwdriver.



This shows the Flat-PC cable correctly mounted in the FPC connector.



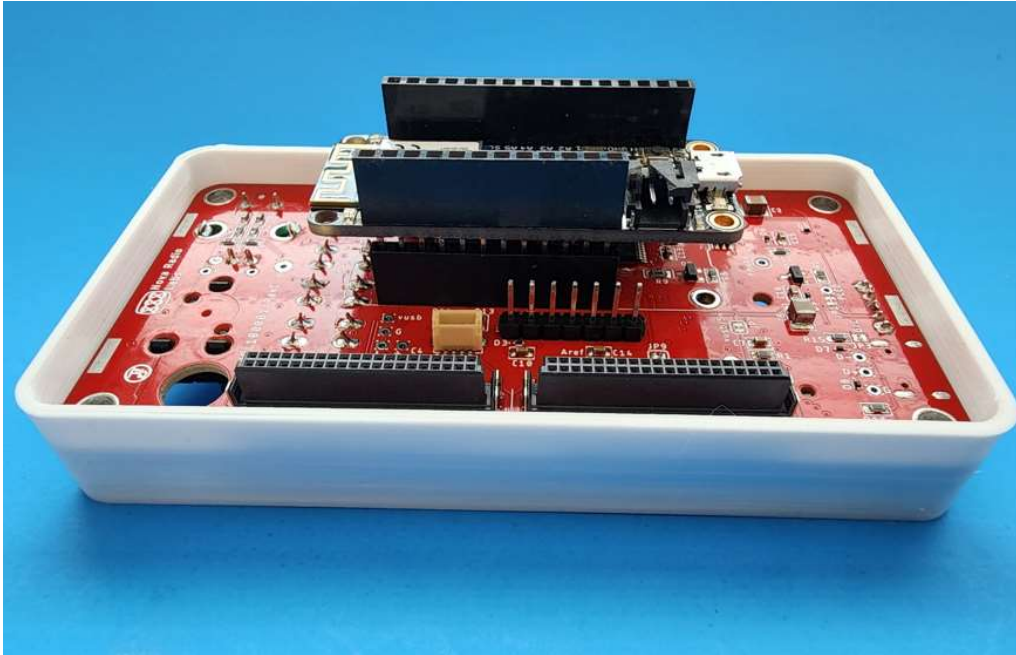
Next slide the LCD Spacer over the LCD as shown. Then snap it into the 3 small holes on the Novaduino® Display PCB.

Fold the Display down into the LCD holder.

If the Novaduino® Display will not be installed in a case with a faceplate, the LCD Module can be secured by cutting a small piece of the included double-sided adhesive foam and applying it to the bottom of the display module and the top of the vertical cross member on the LCD spacer near the tactile switches. Typically, this step is unnecessary when using a case, as the faceplate provides adequate support to hold the display module in place.

## Step 7. Attach the Processor Module.

Plug the Feather processor into the 12 and 16 pin headers on the Novaduino® Display as shown below.



This completes the hardware assembly. Before performing the final assembly with the case, load the software and assure that everything works.

## 6.0 Load the Software

### Step 8. Load some demo software

Please see the “Novaduino Display User Manual” pdf file for instructions on how to load software onto the Feather Processor that you have chosen.

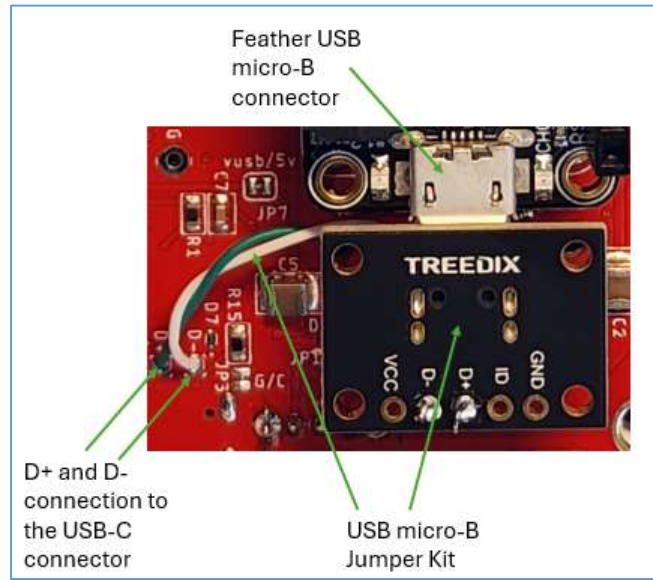
Please load either your own software or one of our demonstration programs onto your Feather Processor and test out the Display before doing the final assembly into a case.

Our demonstration software is located at [www.github.com/novaradiolabs/](http://www.github.com/novaradiolabs/)

## 7.0 Installing the Optional USB Data Jumper Cable Kit

The optional USB Data Jumper Cable allows you to program the Feather Processor via the USB-C connector on the side of the Novaduino® Display without disassembling the case. Or you may alternatively connect the Feather Processor USB micro-B connector to the Novaduino® Proto Expansion Card USB-B connector using a slightly longer twisted pair wire. If your Feather Processor uses USB-C instead of USB micro-B, we will offer a male USB-C Data Jumper Cable Kit soon.

Solder the twisted pair of wires to the USB micro-B male plug PCB first and then solder the other end of the twisted pair to the Novaduino® PCB as shown in the picture below. Be sure to observe and use the correct polarity. There is no need to connect Vcc (3.3 V) or ground as these are already connected through the Feather socket connections on the Novaduino® PCB. If you would like to substitute shielded twisted pair in place of the wires that we provide, be sure to connect the shield to only one side of the connection to prevent ground loops.



If you have the Novaduino® Proto Expansion Card, you may solder the twisted pair to it rather than to the Display PCBA.

### 8.0 Assemble the Case (3D Printed or Optional)

**Step 9.** 3D print or purchase an optional case, Front Bezel, Faceplate, etc...

|                      |     |                      |                        |
|----------------------|-----|----------------------|------------------------|
| 1. Faceplate         | PLA | 0.2 mm layer height  | No Support Needed      |
| 2. Front Bezel       | PLA | 0.2 mm layer height  | Some Support Suggested |
| 3. 40 mm Vented Case | PLA | 0.2 mm layer height  | No Support Needed      |
| 4. Sensor Enclosure  | PLA | 0.2 mm layer height  | Some Support Suggested |
| 5. NavButton         | PLA | 0.12 mm layer height | No Support Needed      |

3D-print the STL files provided with KIT001. We use PLA but you may print in other materials. If the size of mounting holes and other parts are too small or too large you may need to scale the STL model in your slicer software. We have printed each file many times with the layer heights listed above on our Bambu Lab P1S printer with good success. You may need to experiment a bit.

We provide both the STL and the F3D (Autodesk Fusion model) for the Faceplate so that you can customize it to your liking.

You may also purchase these 3D-printed items from our web store.

Please remember that the final assembled device with a case, although appearing professional, is not a certified product that can be re-sold as one. These 3D-print files are for your own limited use.

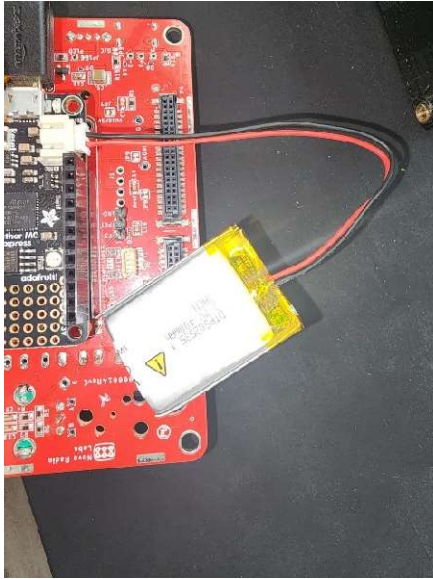
## 9.0 Final Assembly

**Step 10.** Insert the EZ-LOKs into the main case. If the holes in the case are too small, you can drill them out with a  $\frac{1}{8}$ " drill bit and the EZ-LOKs should fit fine.



Press the EZ-Lok-inserts into the main case and then tap until flush with the case using a small hammer. We also suggest putting a #6-32 screw into each EZ-LOK and screwing all the down until it is snug to set the EZ-LOK. You will then need to remove these screws before final assembly.

**Step 11.** Install the Lithium-Ion battery

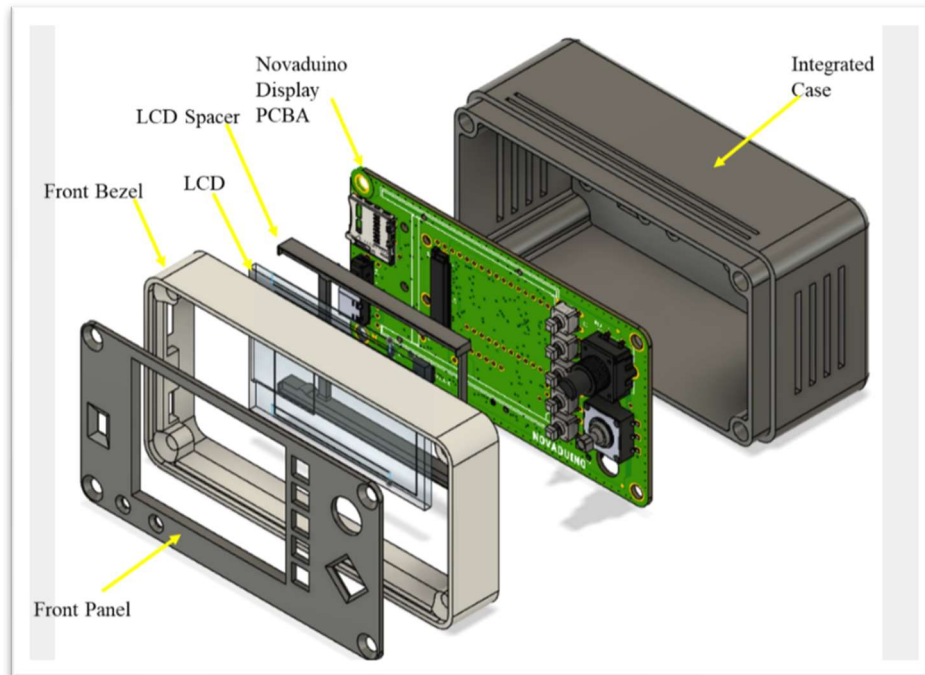


If you have obtained an optional 3.7 volt Lithium-Ion Polymer battery featuring a 2-pin 2.0 mm JST connector, it should be connected directly to the Feather processor. When sourcing batteries from suppliers other than Nova Radio Labs, Adafruit, or SparkFun, please verify that the battery's polarity corresponds with the diagram provided above. It is important to note that many similar batteries available through Amazon or other vendors may have incorrect polarity. Connecting a battery with reversed polarity to the Feather processor can result in overheating and permanent damage to the device.



Cut a small piece of double-sided foam pad, provided, and attach it to the battery. Be careful not to dent or ding the Lithium-Ion batteries, this may cause the battery to fail in a bad way.

Attach the battery to the bottom inside of the case, assure that it is secure in the case and that it does not interfere with any other components.



Optional 3D Printed Case

After the battery has been attached to the Feather processor and secured to the case, place the completed Novaduino® Display PCBA into the Front Bezel making sure that the holes for the USB-C connector and the microSD card socket line up properly.

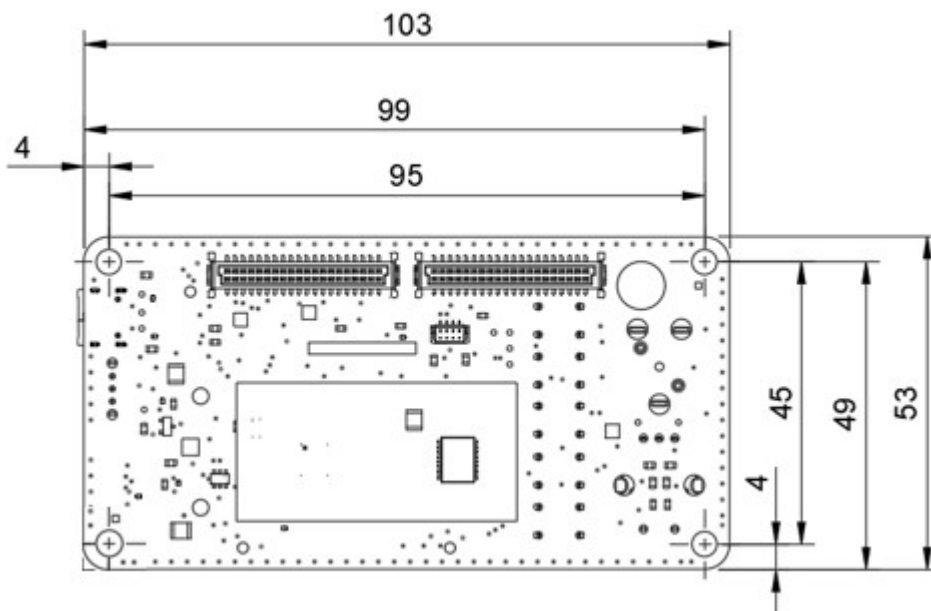
Attach the light pipes to the front panel. Depending on the accuracy of your 3D printer the light pipes may fit snugly into the two 3 mm holes. If the holes are too tight, you can drill them out with a 3 mm drill bit or 1/8-inch drill bit. If the light pipes are too loose to reliably stay secure, you may glue them in. We used super glue in the picture below.



Next, Remove the screen protector from the LCD and place the Faceplate onto the Front Bezel and over the buttons.

Next, Screw the assembly together with the 4 provided 5/8" #6-32 machine screws. Then attach all the key caps, the Nav-Button, and the Rotary Encoder knob that are applicable to the options that you have selected.

## 10.0 PCB Dimensions



Dimensions are in mm

## 11.0 Appendix

\*The 3D print files provided with KIT001 Novaduino® Display consist of STL files for the Front Bezel, 40 mm Vented Case, Sensor Enclosure, and NavButton. These files, along with additional ones, are typically available for a fee and are intended for personal use only.

The kit also contains both Faceplate STL and F3D files, allowing users to customize the faceplate with no restriction on usage.

Please remember that the final assembled device with a case, although appearing professional, is not a certified product that can be re-sold as one. These 3D-print files are for your own limited use.

\* These are Trademarks for Arduino, Adafruit Industries, Feather, SparkFun Electronics, Thing Plus, ARM Cortex, Hammond, 4D Systems , etc...

\*Novaduino® is a trademark of Nova Radio Labs LLC

\*Novaduino® technology is patent pending

\*The Novaduino® Display PCBA and Expansion Proto Card PCBA are Development Boards. They have been designed and built with lead-free components, materials, and PCB processes. They are not yet RoHS, UL, FCC, nor CE certified.

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