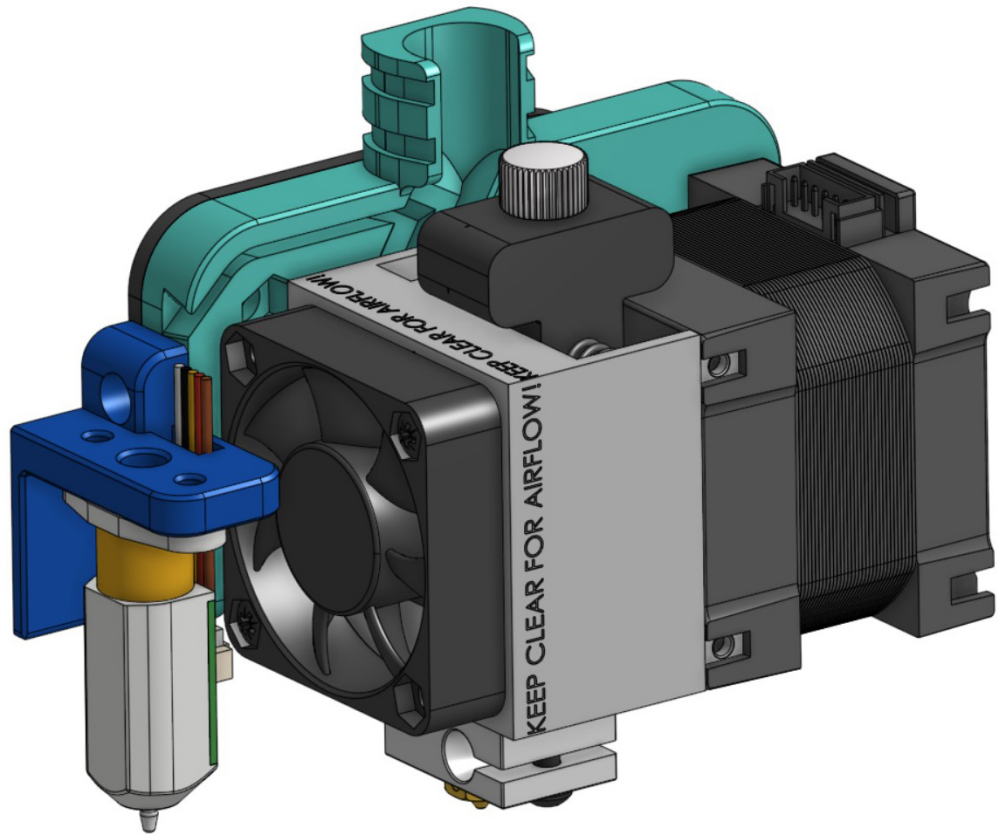


### E3D Hemera Mounting Plate for CR-10 and Ender 3



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# 1 Hardware Assembly

## 1.1 Pre-Build Notes

This project came about because I tried to use the mounting plate from E3D's CR-10 Upgrade guide (Version 1) [1], but their design has a critical flaw: The mounting plate is extremely compliant due to how far the Hemera ends up hanging over the side of the CR-10's original X-carriage. This ends up producing horrible prints because the height of the nozzle is extremely inconsistent (squishing layers randomly all the time), and any acceleration causes vibrations in the nozzle.

I then searched for more mounting options. First I looked at Version 2 of E3D's upgrade guide for the CR-10 and Ender 3 [2], but this very sparse mount still looks too compliant. I also found several designs online while scouring Thingiverse and PrisaPrinters, but nothing really seemed refined enough. The closest thing to what I was looking for was [this plate by Aaen on PrusaPrinters](#) [3], where the Hemera is mounted firmly to the plate with most of the weight supported by the steel X-carriage. However, the attachment points to the X-carriage are very thin in this design (1 mm), and I am a fan of modality, so I'd prefer to make the BLTouch mount as a separate part. Thus, the Teebert Industries Hemera Mount was born!

## 1.2 Off-The-Shelf Hardware

This mount is designed to re-use most of the hardware from a standard CR-10 or Ender 3 X-carriage. However, there are a few fasteners you'll need to scrounge up:

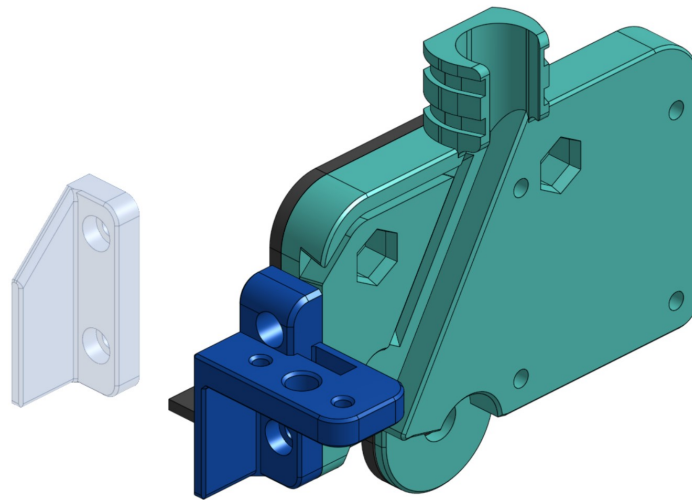
- 5x **M3 x 8mm screws** (4 of these come with the Hemera)
- 4x **M3 square nuts** (2 of these come with the Hemera)
- 2x **M3 x 6mm screws** (for the BLTouch mount)
- A Few **M3 washers**
- 1x **M5 washer**
- 40mm length of cable wrap.
- 2x Zip ties

Additionally, if you choose to use the fan duct provided by E3D for the part cooling fan, you will also need a 5015 Blower fan that runs at the correct voltage for you system (12 V or 24 V), two M3 x 10mm Screws, and one M3x 20mm screw.

## 1.3 Printed Parts

The first step is to print the three parts of this mounting plate (as shown in Fig. 1.1):

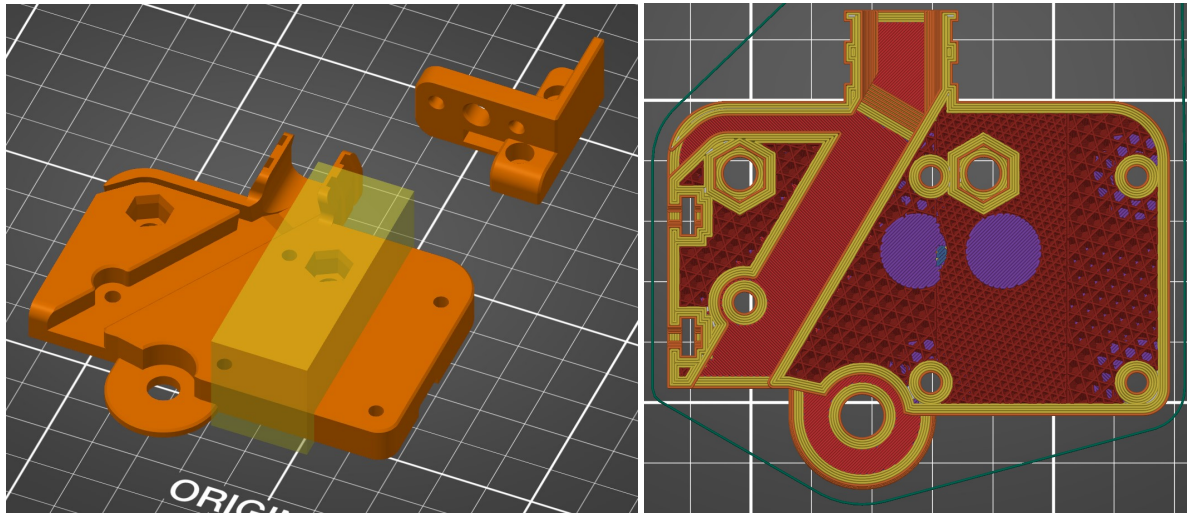
1. Main mounting plate
2. BLTouch mount OR simple x-axis extension
3. Your choice of part cooling fan duct. Many options exist for cooling ducts, but I prefer the "Ender\_3\_V2\_Duct" provided by E3D in a [only partially relevant tutorial](#) [2]



**Figure 1.1:** This build requires two printed parts: the main plate (right), and either the BLTouch mount or x-axis extension (left).

It is important that this plate comes out very rigid since the Hemera is mounted such that it overhangs the edge of CR-10's X-carriage a bit. To ensure sufficient bending stiffness, the main plate should be printed at 40-50% infill with 1.5-2mm thick walls (4-5 walls if using a 0.4mm nozzle). Optionally, we can do some trickery in PrusaSlicer, as shown in Fig. 1.2 to ensure even greater rigidity by setting the infill of the plate higher for the section that could bend over the edge of the X-carriage.

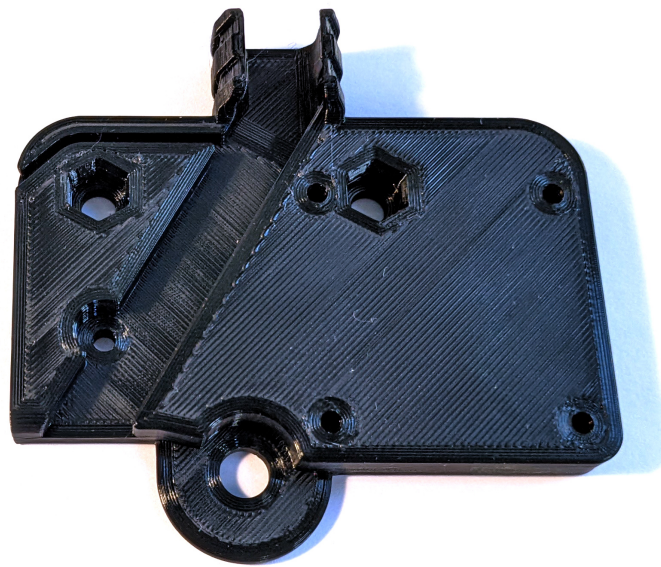




(a) Plater view with small modifier rectangle

(b) Resulting infill is 50% for the body, and 99% in the modified section.

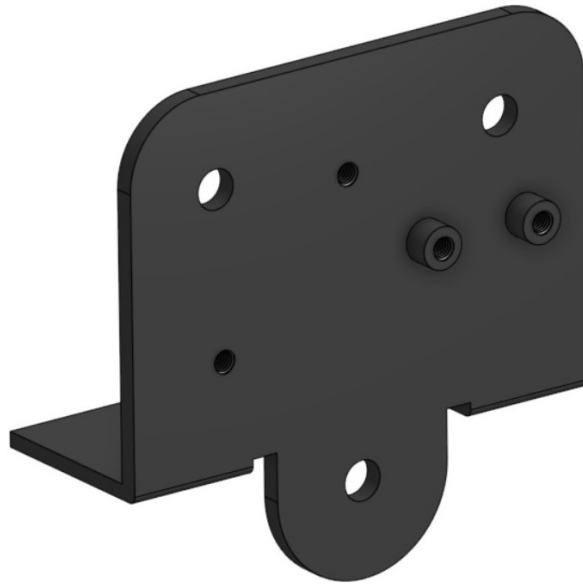
**Figure 1.2:** Use a modifier in PrusaSlicer to increase the infill percentage.



**Figure 1.3:** The main plate printed

## 1.4 X-Carriage Disassembly

We begin by disassembling the x-carriage, following the instructions on the official [upgrade guide for the CR-10/Ender 3](#) from E3D [4]. Once you have taken the rollers off (step 11 in the guide), jump back here.



**Figure 1.4:** Disassemble the entire X-carriage per the instructions, and you'll be left with just the steel plate (attached to the belt)

## 1.5 Mounting Plate Assembly

### Step 1

Partially build the Hemera, stopping before you attach the fan.

1. Follow the official [Hemera Assembly Guide](#) from E3D [5] to build Hemera from the kit, but stop after installing the heater block into the main extruder assembly (step 6). **Do not install the fan yet.**
2. When building the Hemera, make sure the heat block/heater wires are oriented away from the body of the extruder (as pictured in the assembly guide).

### Step 2

Start by pressing in the M5 Locknuts from the X-Carriage into the mounting plate. Don't worry if the fit is a bit too tight: You can always tighten an M5 bolt into the nuts from the other side to pull them into the hole.



**Figure 1.5:** Press the M5 locknuts into the holes in the main mounting plate

### Step 3

Next, we need to prep some screws:

1. Put in one M3 x 8mm screw into the hole in the cable channel (see Fig. 1.6), since this will be difficult to access later. To make sure it stays while we are working on other steps, temporarily secure the screw from the back with a nut.
2. Looking at the back of the mount, press in two M3 Square nuts into the two slots on the right side of mount (where the BLTouch attaches). Temporarily secure them with two M3 x 6mm screws.

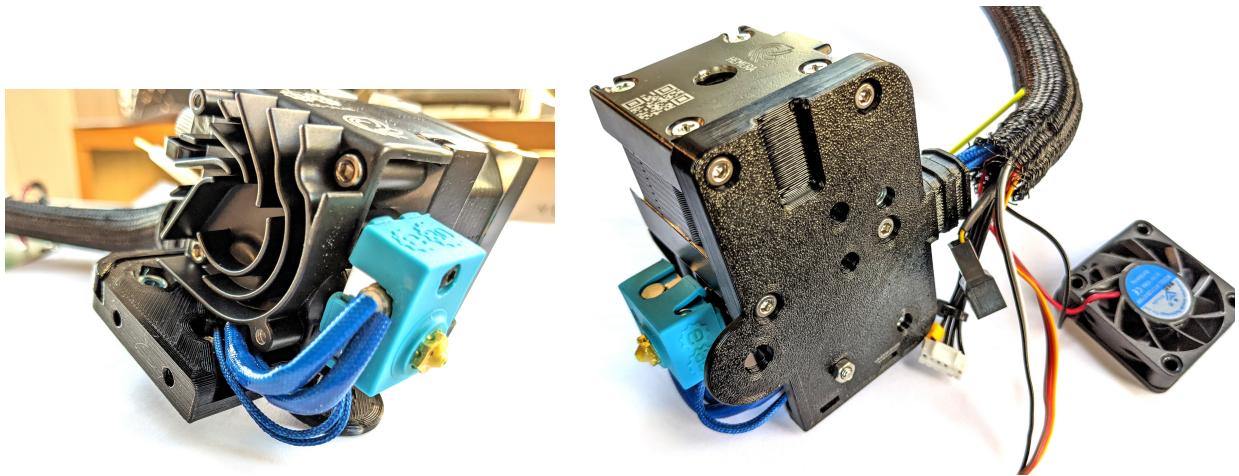


**Figure 1.6:** Place an M3 x 8mm screw into the hole in the cable channel, and secure it with a nut from the back

## Step 4

Now we will attach the Hemera to the mounting bracket:

1. Attach the thermister extension wire to the thermister
2. Use pliers to make a bend in the heater wires close to the heater (1.5 cm) so that they will more easily fit into the cable channel in the mounting plate.
3. With the mounting plate face up, route the thermister wire and heater wires into the mounting channel and place the Hemera roughly in place on the plate, as shown in Fig. 1.7. *This step is challenging, so take your time and make sure no wires are accidentally pinched.*
4. While holding everything together, flip the whole assembly over and install two M3 x 8mm screws to attach the Hemera to the plate using the two holes close to the center of the plate.
5. Now place the two square nuts into the slots on the outside end of the Hemera motor and use the other two M3 x 8mm screws to fix the Hemera in place.
6. Tighten everything down reasonably tight.



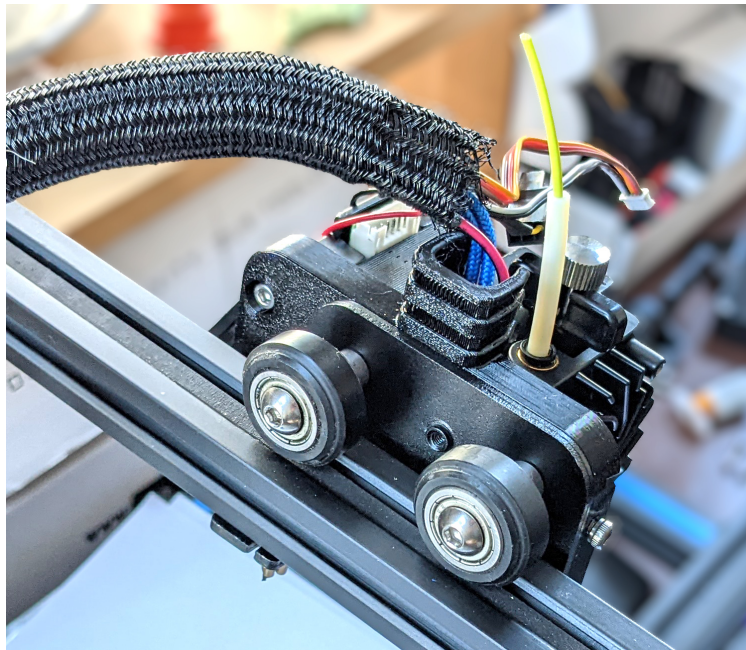
**Figure 1.7:** Route the thermister and heater cables into the cable channel in the mounting plate, then flip over and screw in the Hemera



## Step 5

Now we can attach the mounting plate to the X-carriage:

1. Remove the temporary nut holding the channel screw in.
2. Press the mounting plate onto the X-carriage. The two holes in the back of the mount will press tightly onto the metal studs where the stock hotend originally went.
3. Screw the channel screw into the x-carriage.
4. Attach the two top rollers with the screw heads facing the back of the printer (screwing into the M5 locknuts).
5. Attach the bottom roller with the thick side of the eccentric nut facing up (minimum tension) and the bolt head facing the same direction as the top rollers.
6. On the front of the mounting plate, use an M5 washer between the plastic and the locknut to provide proper force distribution.
7. Tighten the eccentric nut to tighten the x-carriage down to the v-rail. Get it reasonably tight (but not too tight).

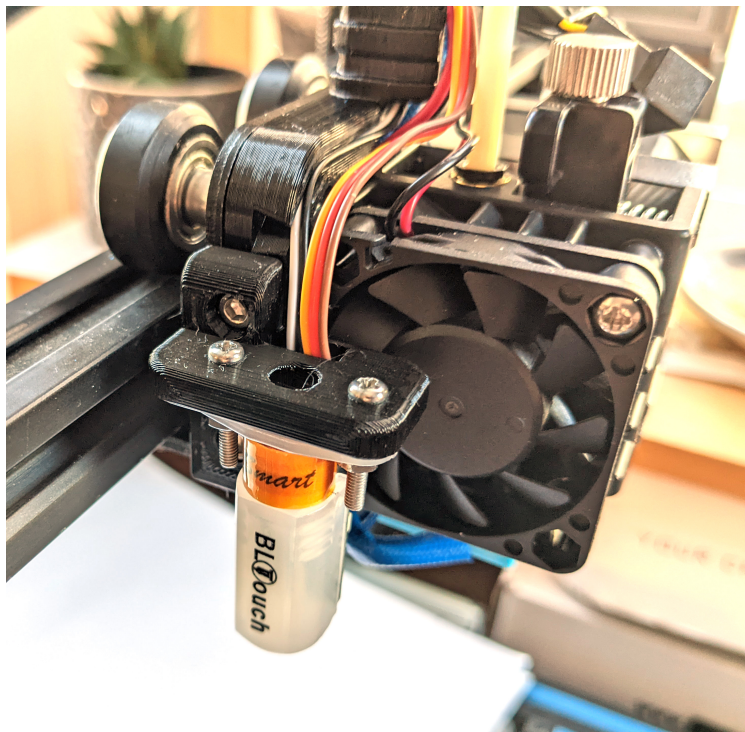


**Figure 1.8:** Press the mounting plate onto the X-carriage, and secure with the screw in the cable channel. Next, attach the wheels and tighten the carriage.

## Step 6

Finally, we can attach the fan and the BLTouch:

1. Screw in the Hemera's fan using the two included self-tapping screws.
2. Attach the BLTouch to the BL Touch mount using the included M2.5 screws and nuts. *Tip: try to get the BLTouch as far away from back of the mount as possible. This will help the connector slide through the hole in the mount easier.*
3. Route the BLTouch cable through the hole in the BLTouch mount and plug it in.
4. Attach the BLTouch mounting assembly to the main plate using the two M3 x 6mm that you used earlier (they should still be screwed in on the side of the mount).



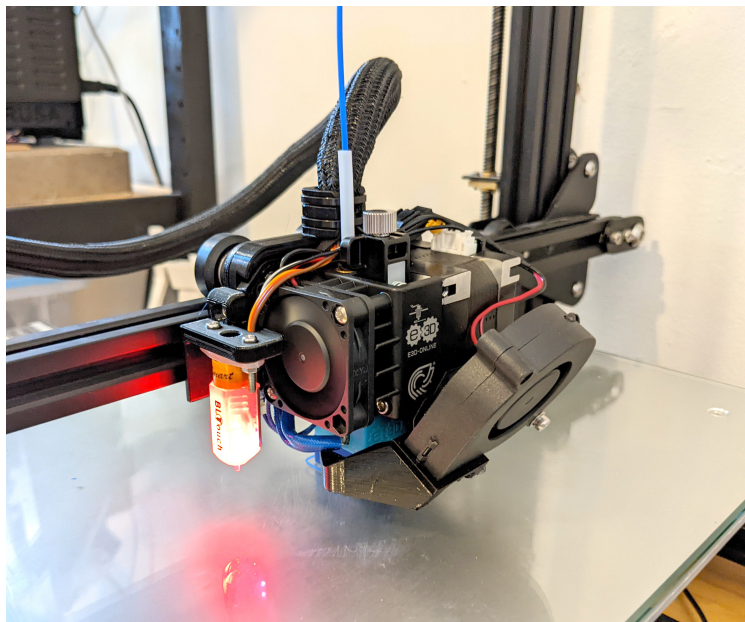
**Figure 1.9:** Attach the fan to the Hemera, then attach the BLTouch to the mounting bracket, then to the main plate.

## Step 7

The last step before cable management is to attach the part cooling fan to the front of the Hemera. If you used the design I linked to, then this is very straightforward (two M3 x 10mm Screws, and one M3x 20mm screw).

Now we need to deal with cable management:

1. Route all of your cables to the appropriate places. To make things easier, you may want to cut existing cables and splice the new ones in. *Note: I would try to avoid splicing the heater wires, but with the CR-10's large size, it may not be possible to run the Hemera heater wires all the way to the control board. Splice at your own risk.*
2. Route some cable wrap to the cable flange on the mounting plate, and shove all the wires inside.
3. Use two zip ties to secure the cable wrap to the mounting plate.
4. Congrats! You did it!

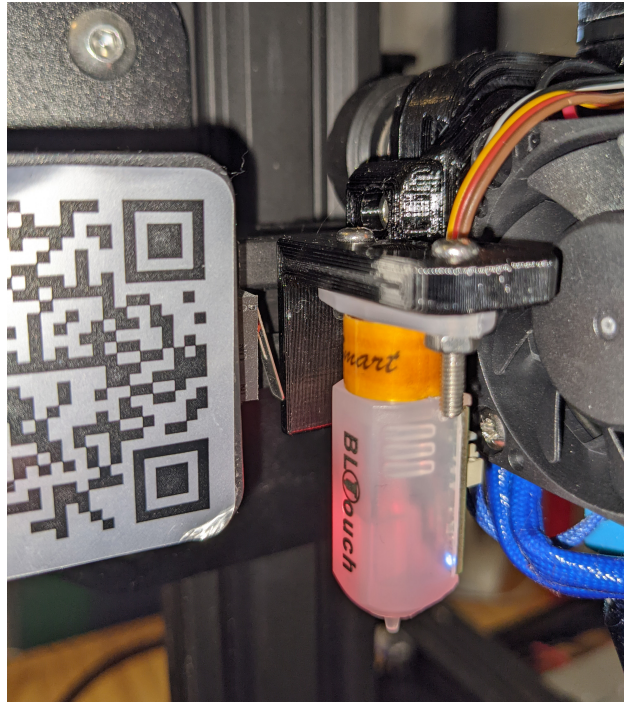


**Figure 1.10:** The final result of the Hemera upgrade.



**Note:**

*The BLTouch mount is designed extend out and press the X-axis limit switch. This is useful in firmware since it results in no x offset. If you are not using a BLTouch, then you can either leave of the mounting bracket, or add the x-carriage extension bracket as a drop-in replacement.*



**Figure 1.11:** The BLTouch sensor mount also acts as an extension of the x-axis carriage to press the limit switch. This prevents the sensor from hitting into the motor cover.

## 2 Firmware Changes

We can start by following the [Marlin 2.0 Upgrade Guide](#) from E3D[6]. This walks us through changing the following firmware settings:

**Code 2.1:** Firmware settings in “*Configuration.h*” from E3D’s Upgrade Guide

```
// Define the temperature probe type
#define TEMP_SENSOR_0 5
...

// Define the new max temperature and min temperature
#define HEATER_0_MAXTEMP 300

#define HEATER_0_MINTEMP 5

// Set the default axis steps per Unit (steps/mm)
#define DEFAULT_AXIS_STEPS_PER_UNIT { 80, 80, 400, 397 } // Hemera's gear ratio --> 397 steps/mm
```

From here, we need to update the printer’s understanding of where the nozzle, bed leveling probe, and upper/lower motion bounds are.

**Code 2.2:** Additional setup in “*Configuration.h*” for this mount

```
// The size of the print bed
#define Y_BED_SIZE 300 // These do not change
#define Y_BED_SIZE 300 // These do not change
...

// Manually set the home position. Comment these out for automatic settings.
// #define MANUAL_X_HOME_POS 0 // The flange on the BLTouch mount places the nozzle at x=0
#define MANUAL_Y_HOME_POS -10 // Hemera's nozzle is 10mm further out than stock CR-10
...

// Travel limits (mm) after homing, corresponding to endstop positions.
#define X_MIN_POS -2 // The endstop switches can compress 2 mm beyond their actuation point
#define Y_MIN_POS MANUAL_Y_HOME_POS-2 // Match manual home position settings
// + account for endstop

#define X_MAX_POS 305 // We can overshoot the print area by 5 mm
#define Y_MAX_POS 305 // We can overshoot the print area by 5 mm
...

// Specify the bed probe position (BLTouch)
#define NOZZLE_TO_PROBE_OFFSET { -40, 8.5, 0 } // All units are mm
```

Finally, compile the firmware, upload it to your printer, and you should be good to go.

*Note: If you are not using a bed sensor and have chosen not to use the x-axis carriage extension, then you will need to make the following changes:*

**Code 2.3:** Additional setup in “*Configuration.h*” if not using BLTouch or X-Carriage Extension

```
// Manually set the home position. Comment these out for automatic settings.
#define MANUAL_X_HOME_POS -17 // Hemera's nozzle is 17mm further left on the carriage
#define MANUAL_Y_HOME_POS -10 // Hemera's nozzle is 10mm further out than stock CR-10
...

// Travel limits (mm) after homing, corresponding to endstop positions.
#define X_MIN_POS MANUAL_X_HOME_POS-2 // Match manual home position settings
                                     // + account for endstop
#define Y_MIN_POS MANUAL_Y_HOME_POS-2 // Match manual home position settings
                                     // + account for endstop
```

## References

- [1] Daniel Rock and E3D. *Hemera Creality CR10 Upgrade Guide (Edition 1)*. 2020. URL: <https://e3d-online.zendesk.com/hc/en-us/articles/360017637478-Hemera-Creality-CR10-Upgrade-Guide-Edition-1->.
- [2] Daniel Rock and E3D. *Hemera Ender-3 V2 (Ender 3, CR10, CR10 V2) Upgrade Guide (Edition 2)*. 2022. URL: <https://e3d-online.zendesk.com/hc/en-us/articles/360018062117-Hemera-Ender-3-V2-Ender-3-CR10-CR10-V2-Upgrade-Guide-Edition-2->.
- [3] Aaen. *Ender 3 - compact Hemera mount plate with BLTouch*. 2020. URL: <https://www.prusaprinters.org/prints/21817-ender-3-compact-hemera-mount-plate-with-bltouch>.
- [4] Daniel Rock and E3D. *Hemera CR10 Series & Ender 3 Series Upgrade Guide (Edition 2)*. 2021. URL: <https://e3d-online.zendesk.com/hc/en-us/articles/4404469429521-Hemera-CR10-Series-Ender-3-Series-Upgrade-Guide-Edition-2->.
- [5] Daniel Rock and E3D. *Hemera Direct V6 Assembly Guide (Edition 2)*. 2021. URL: <https://e3d-online.zendesk.com/hc/en-us/articles/360017204078-Hemera-Direct-V6-Assembly-Guide-Edition-2->.
- [6] Will Hardy and E3D. *Marlin 2.0 Hemera Guide*. 2021. URL: <https://e3d-online.zendesk.com/hc/en-us/articles/4406823770769-Marlin-2-0-Hemera-Guide>.