# Centauri Carbon
# ALESI MOD 48V VERSION

## ⚠ DISCLAIMER: I am not responsible if you damage your printer, cause a fire, or suffer personal injury. Proceed at your own risk.

**Now lets begin**

**Preparation & Required Prints**

Before beginning the hardware teardown, you must print the necessary mounting hardware.

**EBB36 Housing**: Required to mount the EBB36 to the top:
https://www.printables.com/model/1531302-ebb36-on-topside-for-centauri-carbon

**Stepper Driver Cooling**: Recommended for driver longevity. I use a 120mm bottom fan, but this duct is an alternative should work:
https://www.printables.com/model/676974-btt-stepper-cooler

**Firmware Pre-Requisites**

⚠ **IMPORTANT:** You must flash the **EBB36** for Klipper and CAN bus *before* final assembly.

1. Follow my separate guide to flash the EBB36.
2. **Note**: The **Octopus Pro H723** will be flashed at the very end to ensure you can retrieve the CAN bus IDs during the final setup.

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**Initial Disassembly**

**Zip-Lock Bags & Labels**: ⚠ **Do not skip this.** Keeping track of screws is critical for a successful reassembly.

**Steps:**

1. Remove all filament.
2. 🛑 **UNPLUG THE PRINTER.**
3. Remove top glass, door glass, and the rear/bottom covers.

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## Motor Upgrade (48V)

Replacing stock motors with **48V LDO-42STH48-2804AH** steppers.

**Motor Removal**: Refer to the Elegoo Wiki Guide for stock motor removal steps.
https://wiki.elegoo.com/Centauri-carbon/how-to-replace-the-motor-of-the-print-head

**Required Hardware**: **2x GT2 Pulleys (20 Teeth, 5mm Bore)**. Use **10mm belt width** pulleys for the best fitment on the 6mm belt.

**Installation**: Swap in the 48V LDO motors and route the wiring down to the electronics bay.

**Board Removal**: Disconnect all wires from the **Original Red Motherboard** and remove the board. It is no longer needed.

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## Strain Gauge Modification

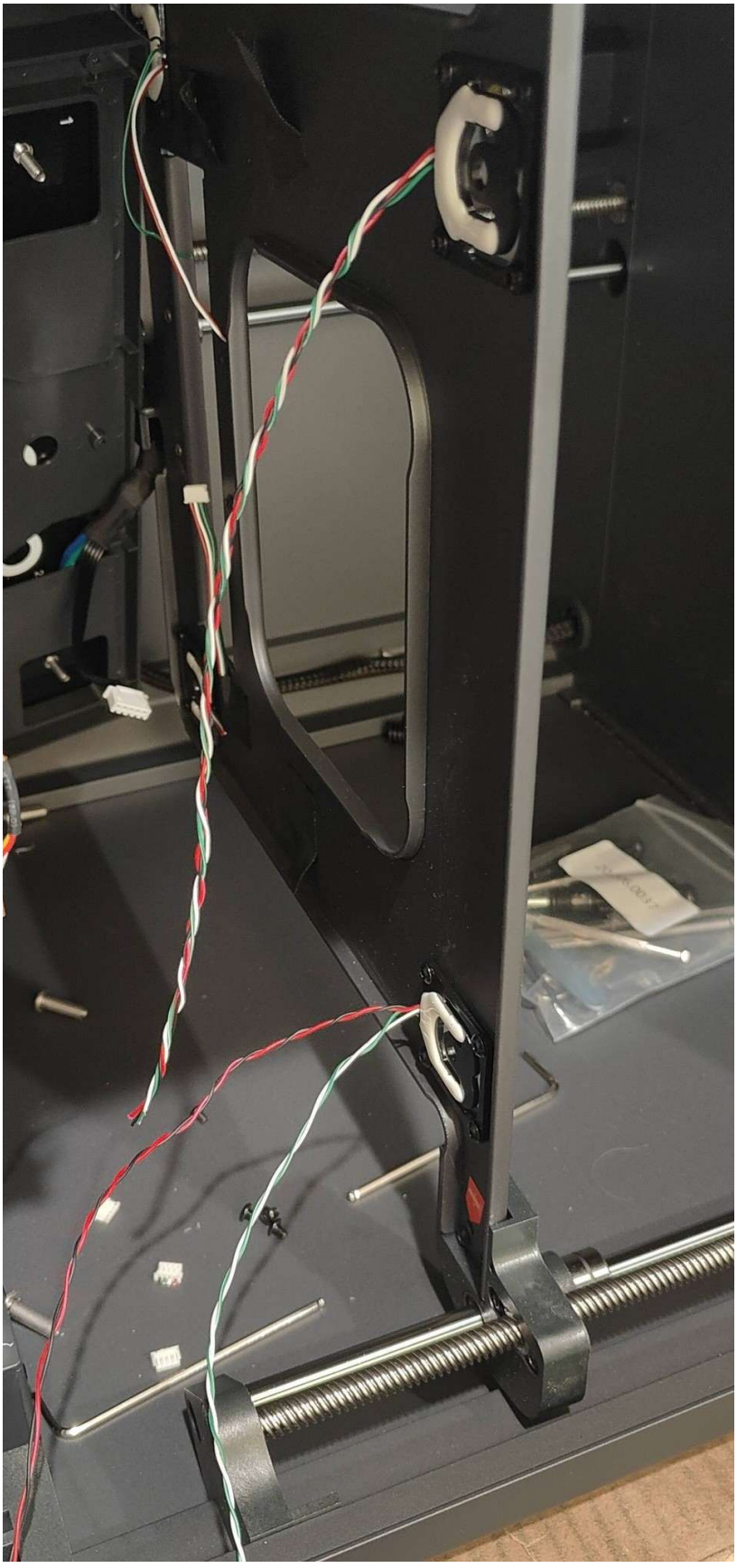
**Bed Removal**: Remove the build plate and the 4 screws securing the heated bed to the frame. Set the bed aside.

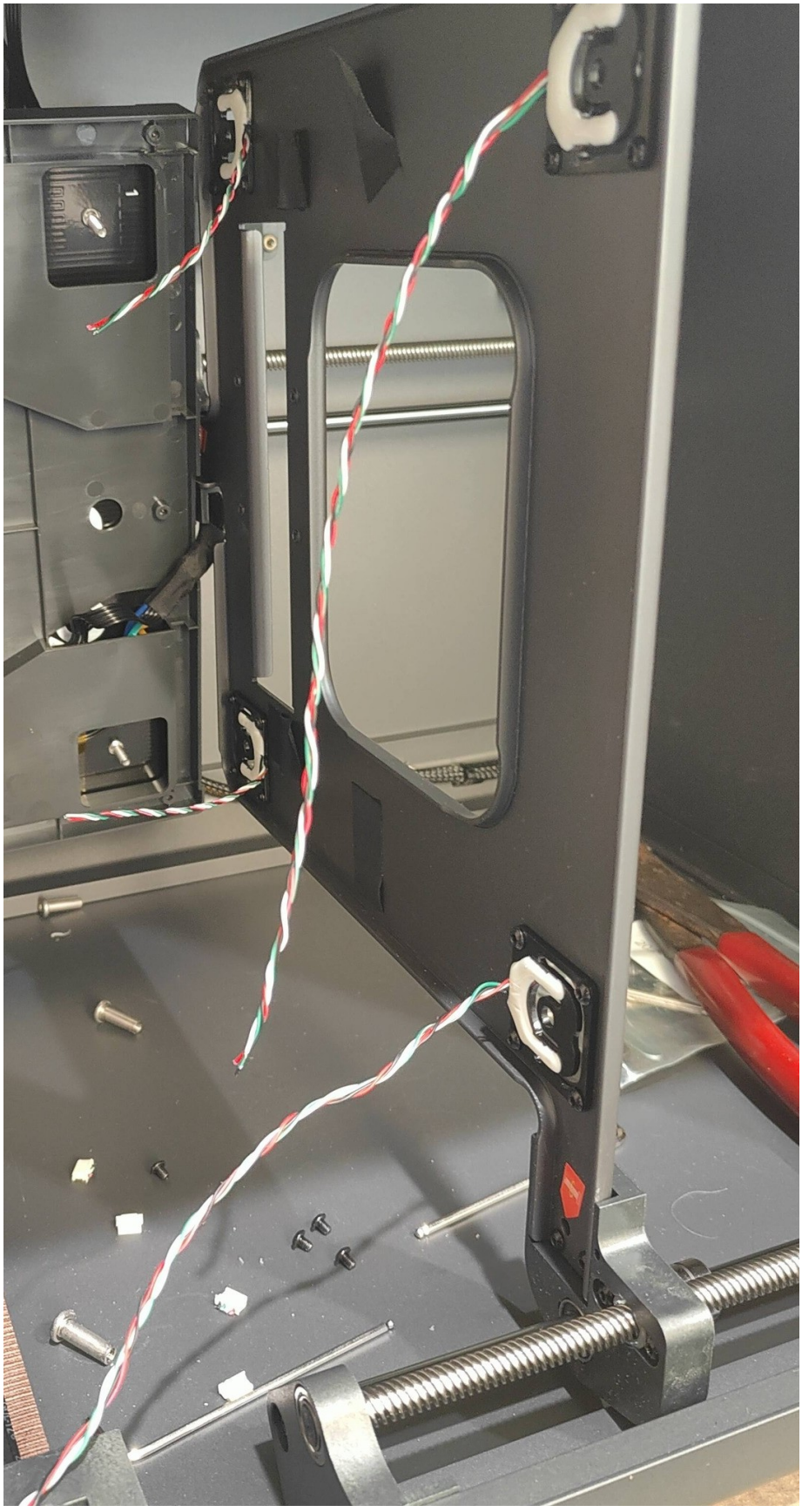
**Controller Board Removal**: Unplug the four strain gauge sensors from the small central red board and remove the board.

**Noise Cancellation (Twisted Pair Method)**:

- Cut the plug ends off the strain gauges.
- **Pair 1**: Twist **White** and **Green** wires together.
- **Pair 2**: Twist **Red** and **Black** wires together.
- **Final Step**: Twist both pairs together. This prevents electrical interference from the system from ruining your bed leveling accuracy.

I show it in the pictures below





## Strain Gauge Parallel Wiring & Signal Extension

To connect the four bed sensors to a single input, we must wire them in parallel.

**Step A: Parallel Solder Points**

1. Gather the four sets of wires from the strain gauges.
2. If the wires do not reach a central point, use small extensions, ensuring you keep the **White/Green** and **Red/Black** pairs twisted together to maintain noise cancellation.
3. **Solder the wires together by color:**
    - Solder all **GREEN** wires together.
    - Solder all **WHITE** wires together.
    - Solder all **RED** wires together.
    - Solder all **BLACK** wires together.

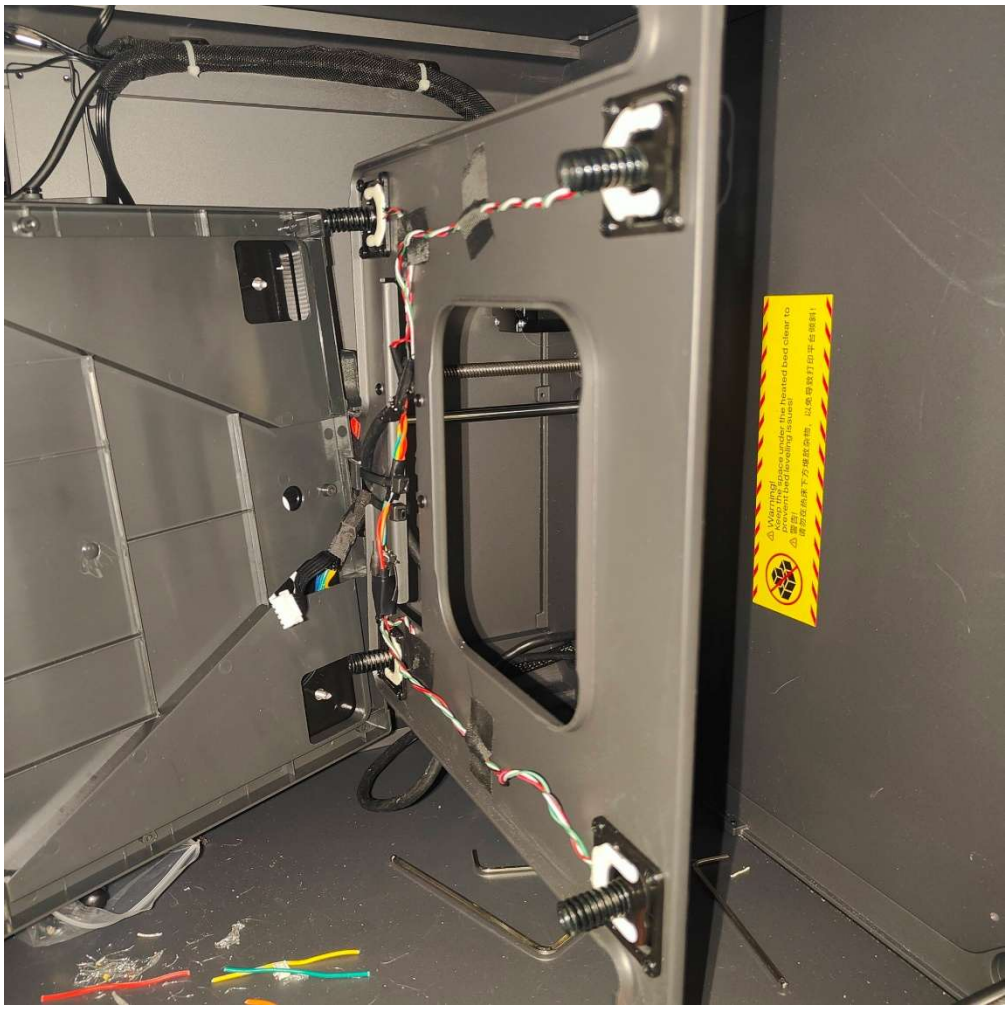
**Step B: CAT6A Signal Cable Attachment**

⚠ **IMPORTANT:** CAT6A cable uses twisted pairs internally. You **must** match your signal pairs to the physical pairs inside the CAT6A cable to prevent EMI (electromagnetic interference).

1. Select **two pairs** from your CAT6A cable (e.g., the Blue/Blue-White pair and the Orange/Orange-White pair).
2. **Solder the CAT6A pairs as follows:**
    - **Pair 1:** Solder to the **Green** and **White** junction.
    - **Pair 2:** Solder to the **Red** and **Black** junction.
3. **DOCUMENT YOUR COLORS:** On a piece of paper, write down exactly which CAT6A colors correspond to Green, White, Red, and Black. You will need this reference when connecting to the **ADS1220** later.

**Step C: Insulation & Cable Management**

1. **Insulate:** Use electrical tape, heat shrink, or liquid electrical tape on every solder joint to prevent shorts.
2. **Trim:** Cut any unused CAT6A wires and the internal shielding flush with the cable jacket.
3. **Route:** Secure the connection with zip ties and route the CAT6A cable down to the electronics bay at the bottom of the printer.
4. **Reassemble:** Reinstall the heated bed onto the frame chassis.



**ADS1220 Load Cell Controller Wiring (SPI3)**

This step is critical for getting your bed leveling sensors working with the new motherboard. We will be using the **SPI3 pins** on the Octopus Pro.

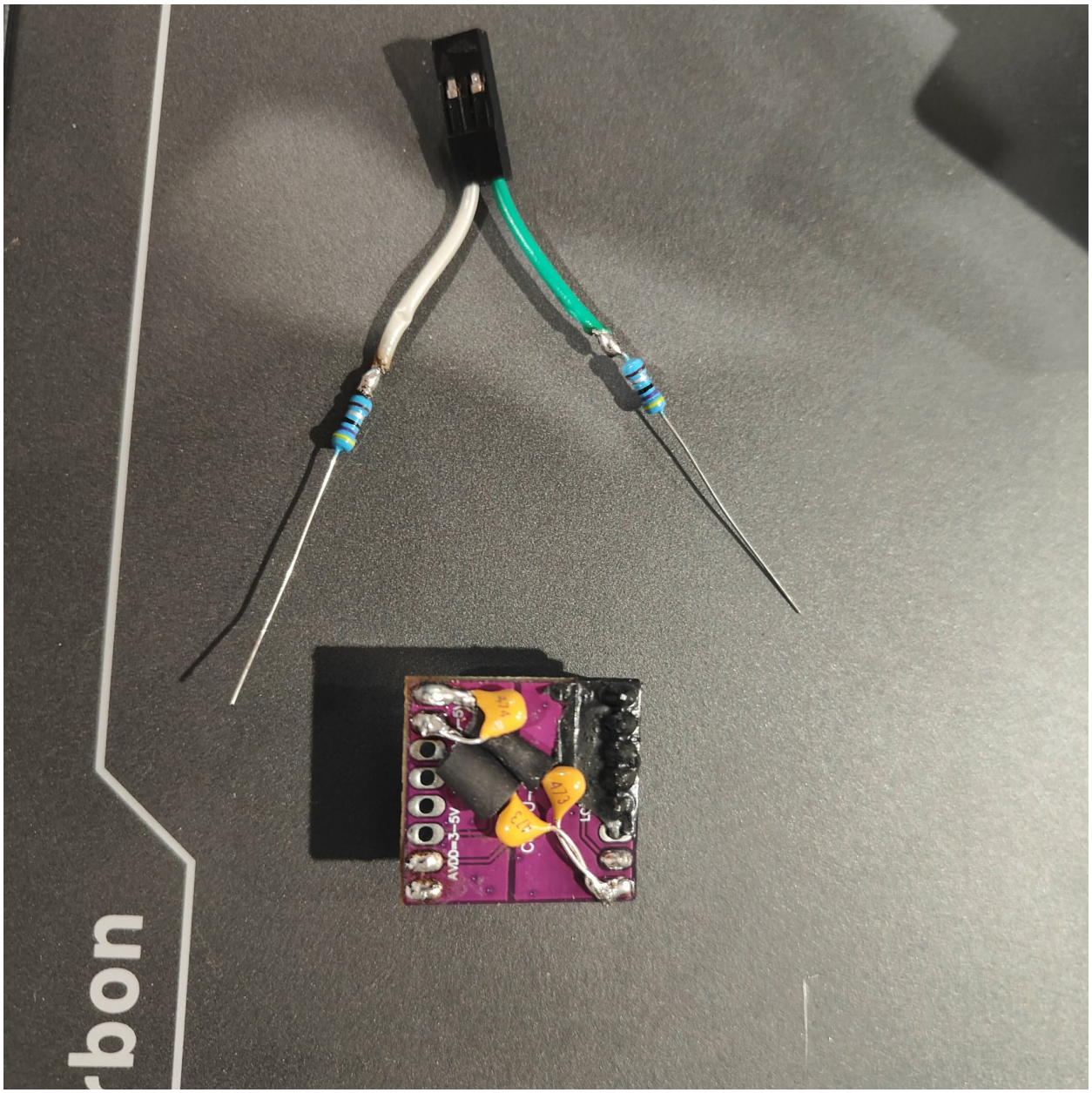
**⚠ Precision Soldering Required**

Follow these connections exactly. The resistors and capacitors are essential for filtering out noise from the system.

- **AN0 (Signal Input):** Take the **WHITE WIRE** from the load cell, solder a **4.7kΩ resistor** in-line, and connect the other end to the **AN0** pin.
- **AN1 (Signal Input):** Take the **GREEN WIRE** from the load cell, solder a **4.7kΩ resistor** in-line, and connect the other end to the **AN1** pin.
- **Power (5V/AVDD):** The **RED WIRE** from the load cell "Tees" into both the **AVDD** pin on the ADS1220 and the **5V pin** on the SPI3 header.
- **DRDY (Data Ready):** Solder a **100Ω resistor** in-line with the data line and connect it to the **DRDY** pin.

**Capacitor Placement (Filtering):**

1. **Between AN1 and AN0:** Solder a **0.47µF (474)** capacitor directly between the AN1 and AN0 pins
2. **AN1 to Ground:** Solder a **0.047µF (473)** capacitor from the **AN1** pin to the **DGND** (Ground) pin.
3. **AN0 to Ground:** Solder a **0.047µF (473)** capacitor from the **AN0** pin to the **DGND** (Ground) pin.
4. **Power Filter:** Solder a **0.1µF (104)** capacitor directly between the **DVDD (3.3V)** pin and the **DGND** pin.




**This picture above is missing the 0.1µF (104)** capacitor directly between the **DVDD (3.3V)** pin and the **DGND** pin. Because I added it later and forgot to take a new picture

**Wiring ADS1220 to Octopus Pro Wiring (SPI3 & PB6)**

To connect the ADS1220 board to the **Octopus Pro H723**, we will use the **SPI3 header** for data and the **BLTouch (PB6)** pin for the Data Ready signal. Using **20AWG Dupont jumpers** is highly recommended for a secure connection.

**⚠ Wiring Map**

Follow this table to connect your Dupont jumpers from the ADS1220 board to the octopus pro motherboard:

| ADS1220 Pin | Octopus Pro Header / Pin | Klipper Pin Name |
|---|---|---|
| **DVDD** | **SPI3: 3.3V** | -- |
| **DGND** | **SPI3: GND** | -- |
| **CS** | **SPI3: PA15** | PA15 |
| **SCLK** | **SPI3: PB3** | PB3 |
| **DIN (MOSI)** | **SPI3: PB5** | PB5 |
| **DOUT (MISO)** | **SPI3: PB4** | PB4 |
| **DRDY** | **BLTouch: PB6 (Signal Pin)** | PB6 |

**🛑 Important Installation Notes:**

1. **DRDY Connection**: Connect your **100Ω resistor** (soldered in-line) to the **PB6** pin on the Octopus Pro's BLTouch header.
2. **Verify Voltages**: Ensure you are using the **3.3V** pin on the SPI3 header for **DVDD**.
3. **Secure the wires**: I recommend using a zip tie to ensure the Dupont jumpers do not vibrate out of the pins over time.

**Shielding & Grounding (Noise Management)**

To prevent electromagnetic interference (EMI) from the 48V motors from affecting your sensors, you must ground your cable shields correctly.

**🛑 The "One-Side Only" Rule**

For both the **CAT6A (Strain Gauges)** and the **EBB36 CAN bus** cables, the shield/drain wire must only be grounded at **one end only** (the Octopus Pro side). This prevents "ground loops" that can cause ghost signals.

1. **CAT6A Shielding**:
   - On the bed/sensor side, cut the shield/foil flush and do not connect it to anything.
   - On the printer bottom side, connect the CAT6A shield wire to a **GND pin** on the **SPI3 header or any open GND pin on the octopus pro**.
2. **EBB36 Shielding**:
   - On the toolhead side, leave the shield disconnected.
   - On the motherboard side, connect the shield to an available **GND pin** on the **SPI3 header or any open GND pin on the octopus pro**.

- **Why SPI3?**: The Octopus Pro SPI3 header has multiple ground pins. Using these for your shields keeps the "noise" away from the main power ground and helps keep your strain gauge readings stable.

## Octopus Pro H723 Installation

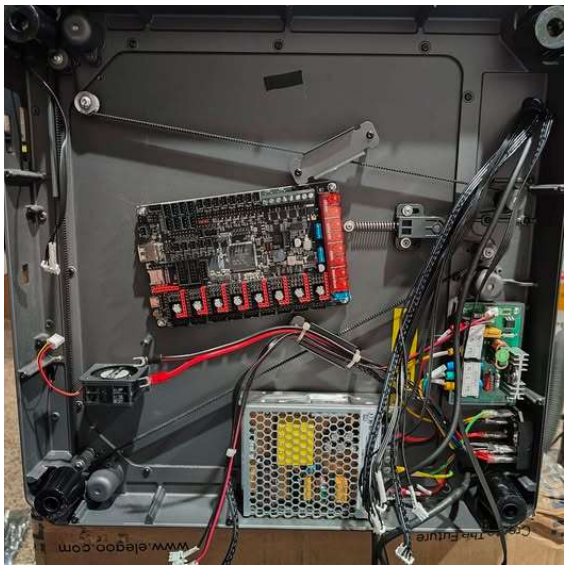
We will now mount the main control board in the bottom compartment of the printer.

**⚠ WARNING: Prevent Short Circuits**

The back of the Octopus Pro board has many exposed circuit traces. You **must** ensure the board is spaced away from the metal chassis to prevent catastrophic short circuits.

**Installation Steps:**

1. **Placement:** Position the Octopus Pro H723 in the center of the bottom case. Ensure you leave enough clearance on the front side of the board for the **USB cable**, making sure it does not rub against the front belt path.
2. **Mark Holes:** Mark the four mounting holes required for the board's standoffs.
3. **Drill Holes:** Drill the four mounting holes in the chassis panel.
4. **Mounting Hardware:**
   - Use **3mm bolts**.
   - Use **3 or 4 nuts** stacked as spacers between the board and the metal case to provide adequate clearance.
5. **Secure the Board:** Bolt the Octopus Pro securely to the chassis using the spacers you created



## Octopus Pro Jumper & Driver Configuration

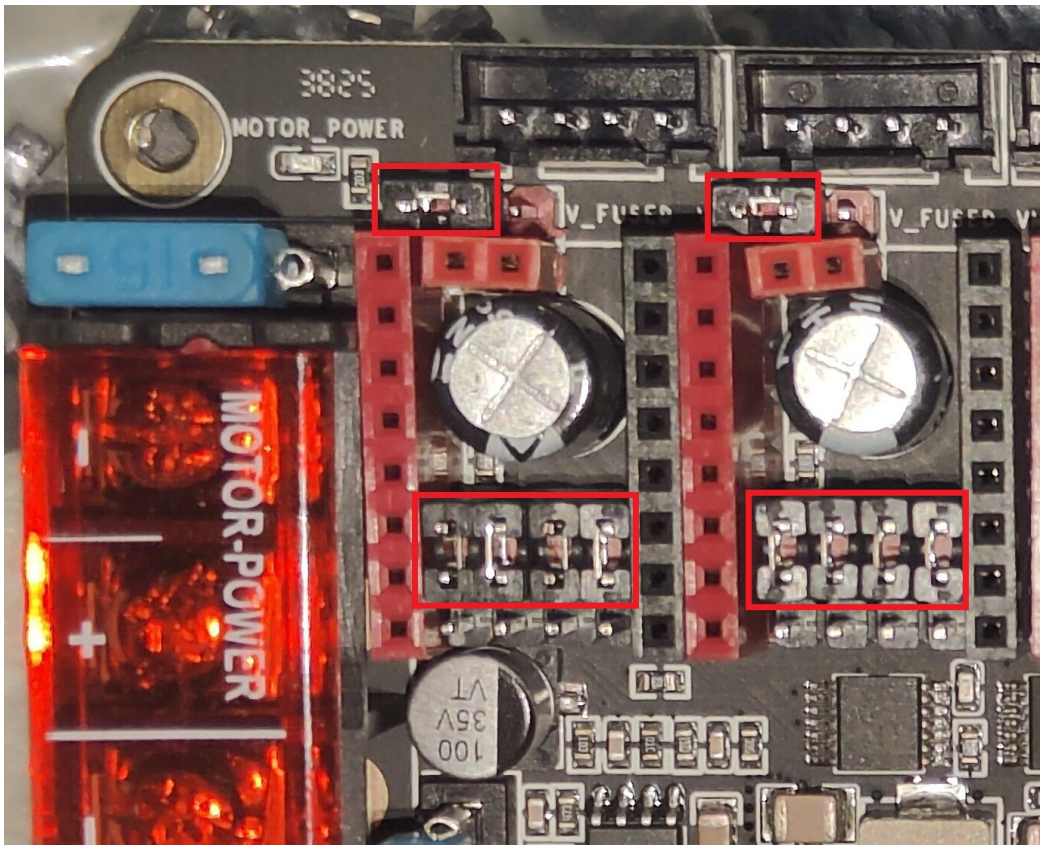
This mod uses a dual-voltage setup. **Slot 0 and 1** will run at **48V**, while **Slots 2 through 7** will run at the standard **24V**.

**🛑 CRITICAL: Driver Compatibility**

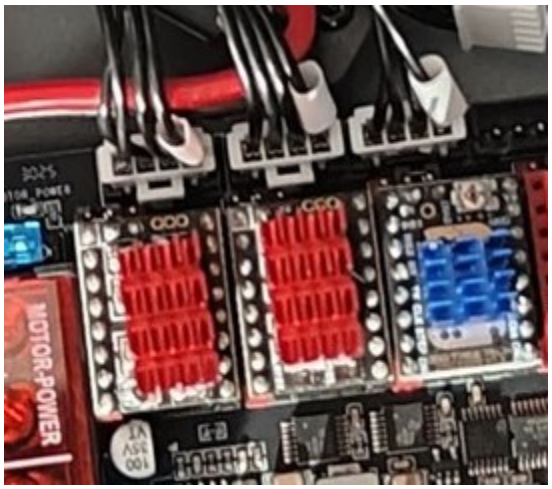
- **Slots 0 & 1 (X/Y Axes):** Use **ONLY TMC5160 PRO** drivers. These are the only drivers rated for 56V.
    - ⚠ **WARNING:** Do **NOT** use standard **TMC5160**, **TMC5160T**, or **TMC2209** drivers here. These drivers are not rated for 48V and will fail/burn if installed in these slots.
- **Slots 2–7 (Z/Other):** Use **TMC2209** drivers. These will run at the standard printer voltage.

**Jumper Settings for Slots 0 & 1 (48V SPI)**

1. **Voltage Selection (Motor Power):** Set the power jumpers for Slot 0 and Slot 1 to the **VM** position. This allows them to draw from the dedicated 48V input.
2. **Communication Mode:** Install the jumpers for **SPI Mode** on these two slots only.

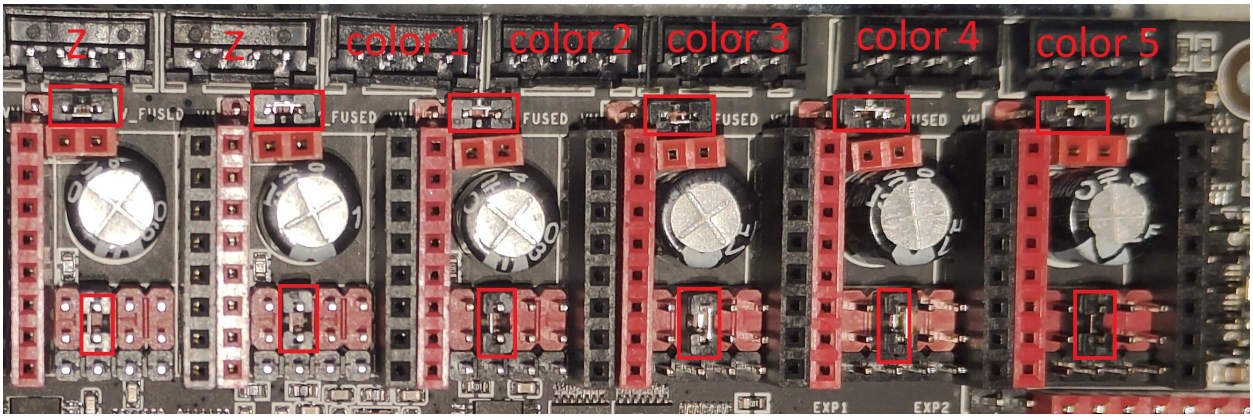


Then install the TCM5160 Pro drivers in slot 0 and slot 1




**Jumper Settings for Slots 2–7 (24V UART)**

1. **Voltage Selection:** Set these jumpers to the **V-FUSED** position (this draws the standard 24V from the main board power).
2. **Communication Mode:** Install the jumpers for **UART Mode**.
    - **Note:** For **TMC2209** UART, you only need to install **one pin/jumper** per slot as per the BigTreeTech Octopus Pro Documentation.
3. **Safety Check:** Double-check that NO **TMC2209** is sitting in a slot set to "VM" (48V).




**Stepper Motor & Driver Installation**
Now that the jumpers are set, we will install the remaining drivers and connect the stepper motor wiring.
**Step A: Install TMC2209 Drivers**

- Install **TMC2209** drivers into **Slots 2 through 7**.
- **Slot 2** is dedicated to the **Z-axis**.
- **Slots 3–7** are dedicated to the **AMS (Automatic Material System)** feeders.

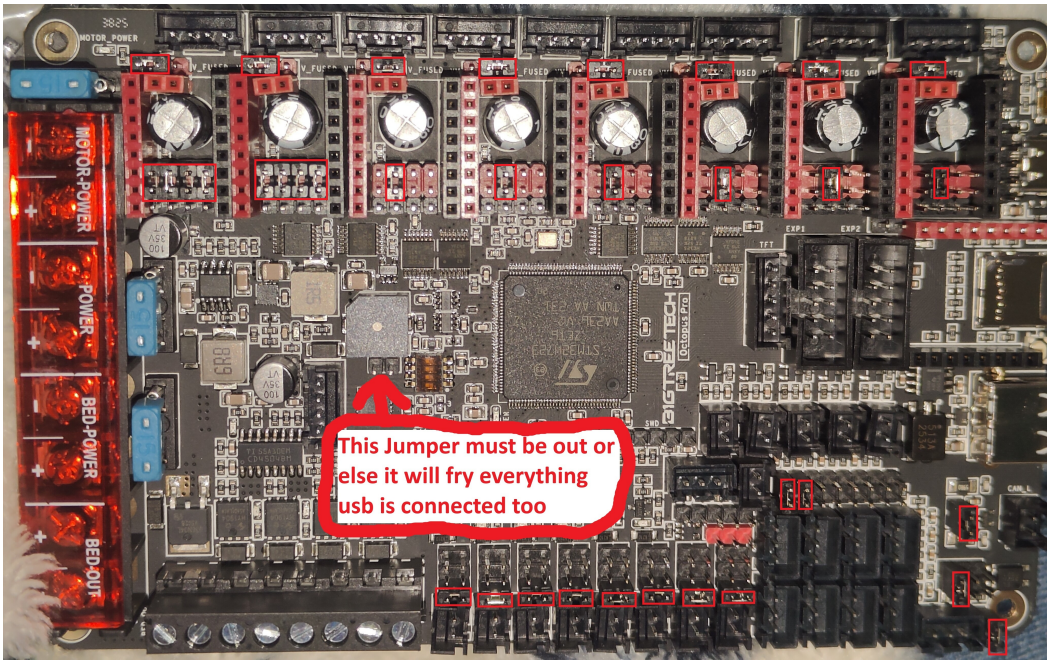
**Step B: Wiring Map**

Plug your stepper motor cables into the following ports. Ensure the connectors are seated firmly.

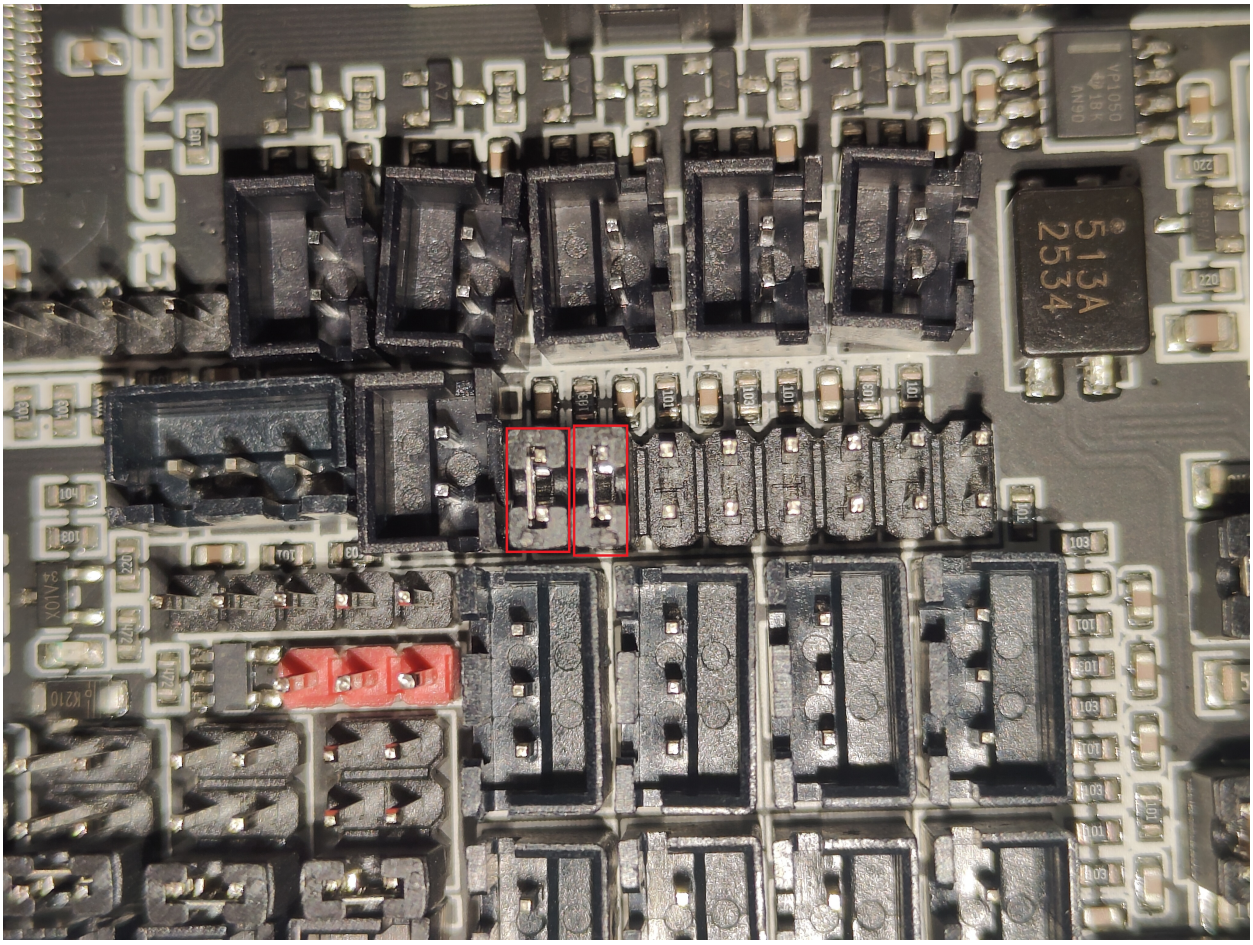
| Slot Number | Driver Type | Component |
|---|---|---|
| **Slot 0** | **TMC5160 PRO** | **X-Axis Motor** |
| **Slot 1** | **TMC5160 PRO** | **Y-Axis Motor** |
| **Slot 2** | **TMC2209** | **Z-Axis Motor** (Dual ports available) |
| **Slot 3** | **TMC2209** | **AMS Color 1** |
| **Slot 4** | **TMC2209** | **AMS Color 2** |
| **Slot 5** | **TMC2209** | **AMS Color 3** |
| **Slot 6** | **TMC2209** | **AMS Color 4** |
| **Slot 7** | **TMC2209** | **AMS Color 5** |

**⚠ Note on Z-Axis Wiring:**
The Centauri Carbon uses a **single Z motor**. Although **Slot 2** on the Octopus Pro has two physical ports, you only need to plug your motor into the first port. **Skip the second port** as it will remain empty.

Now lets make sure you have all these Jumpers in place and **remove the USB jumper or else it will fry everything connected to USB when powered on**




You should have a jumper in everywhere I have a Red Square in the picture above



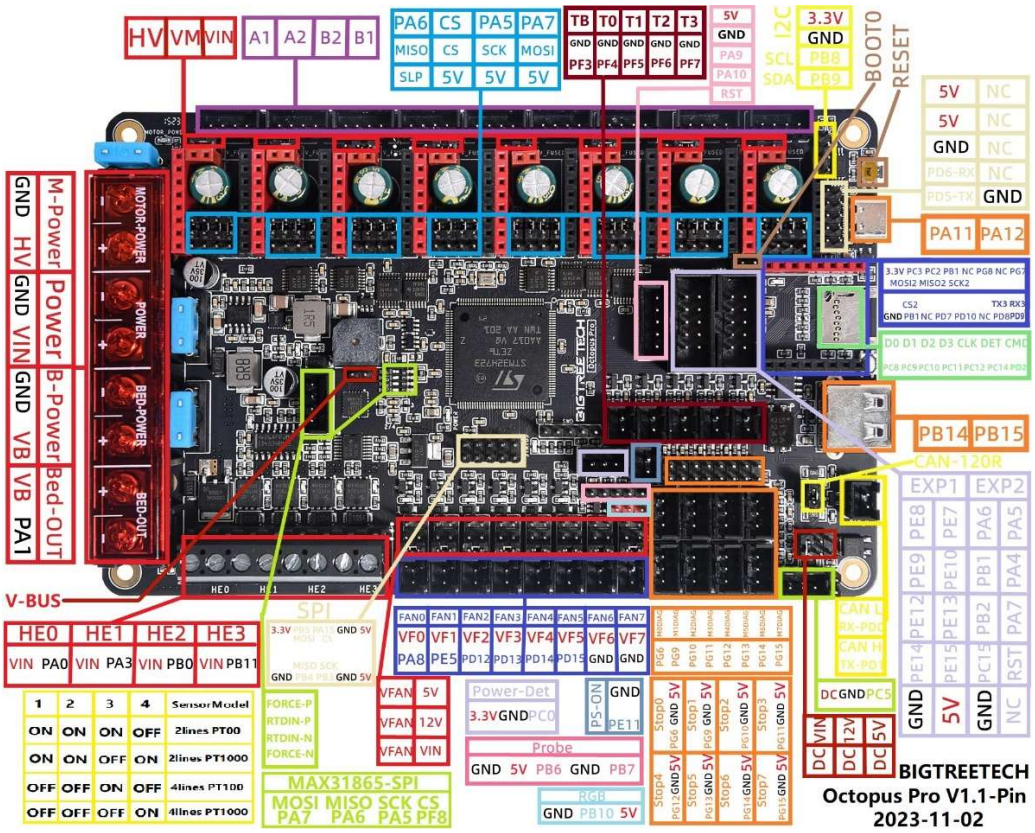
**Sensorless Homing Setup (X & Y Axes)**

To take full advantage of the **TMC5160 PRO** drivers, we will be using sensorless homing. This allows the printer to detect when the toolhead has reached the end of its travel by sensing the "stall" in the motor.

**Jumper Configuration**

For sensorless homing to work, the "Diag" (Diagnostic) signal from the driver must be physically connected to the MCU.

1. **Diag Jumpers**: Refer to the picture above. You must install exactly **two jumpers** on the Diag pins:
    - One for **Slot 0** (X-axis).
    - One for **Slot 1** (Y-axis).
2. ⚠ **WARNING**: **Do not** install Diag jumpers for any of the other slots (2–7). Those slots are for your Z-axis and AMS, which use standard homing or physical sensors.




## Fans, LEDs, and Temperature Sensors

Most of the cooling and lighting on the Centauri Carbon is "plug and play," but you must pay close attention to the **Bed Heater (HBED)** wiring and the specific port assignments.

### Lighting & Cooling Ports

Connect your fans and LEDs to the following ports on the Octopus Pro:

| Component | Octopus Pro Port | Notes |
|---|---|---|
| **Exhaust Fan** | **FAN0** | Software controlled. |
| **Fan 1** | **FAN1** | Software controlled. |
| **LED Strips** | **FAN2** | Controlled via the Fan 2 slider/config. |
| **Stepper Cooler** | **FAN7** | Always ON at 100% (Hard-wired power). |

### Temperature Sensors (Thermistors)

| Component | Octopus Pro Port | Notes |
|---|---|---|
| **Bed Temp (BedT)** | **TB** | Standard bed thermistor port. |
| **Box Temp (BoxT)** | **T0** | Chamber/Box temperature sensor. |

### 🛑 CRITICAL: Bed Heater (HBED) Modification

1. **Depin**: You must depin the HBED wires from their original connector.
2. **Swap**: Swap the wire positions (reverse the polarity).
3. **Connection**: Plug the modified wires into **FAN3**.
4. **Warning**: Failure to swap these wires before plugging into the Fan 3 port may cause a short or prevent the heater from functioning.

## Power Supply Wiring (24V & 48V Dual Setup)

This mod uses two power supplies: the stock **24V** unit for the mainboard/fans/Leds/AMS/EBB36 and a new **48V** unit specifically for the X and Y high-speed motors.

**🛑 DANGER: HIGH VOLTAGE**

- **SHOCK HAZARD:** You are working with **120V Mains AC**. Ensure the printer is **unplugged** from the wall.
- **FIRE HAZARD:** Double-check every polarity (+ and -). 48V will destroy your hardware instantly if reversed.

### Step A: Main Board Power (24V)

1. Connect the **Positive (+)** and **Negative (-)** wires from the **24V power supply** to the **Power** terminals on the **Octopus Pro**.
2. Ensure these are tight and no stray strands are touching other pins.

### Step B: Mounting & AC Wiring (48V)

1. **Mounting**: Mount the **48V power supply** securely to the back of the printer.
2. **Cable Entry**: Drill or cut a hole for the wires to enter the chassis and route them down to the motherboard compartment.
3. **AC Mains (120V)**: You must "share" the main power coming into the printer.
    - Connect the **Line (L)**, **Neutral (N)**, and **Earth Ground (E)** terminals of the 48V power supply to the **exact same AC terminals** where the 24V power supply gets its power.
    - ⚠ **WARNING**: Ensure you are connecting to the **AC Input** side of the 24V supply, **NOT** the 24V DC output terminals.

### Step C: Motor Power (48V)

1. Run the **Positive (+)** and **Negative (-)** wires from the **48V power supply** output.
2. Connect them to the **Motor Power (Motor In)** terminals on the **Octopus Pro**.
3. **Verification**: Because we set the **X and Y jumpers to "VM"** earlier, these specific drivers will now pull from this 48V source, while the rest of the board remains on 24V.

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**Power Wiring Map**

| Source | Target Terminal | Function |
|---|---|---|
| **Mains (Wall)** | **24V & 48V (L, N, E)** | Input Power (Parallel) |
| **24V Output** | **Octopus Pro Main Power** | Logic, Fans, & 24V Motors |
| **48V Output** | **Octopus Pro Motor Power** | X/Y Axis High-Speed Motors |

## EBB36 CAN Bus Wiring & Termination

This section covers the data connection between your toolhead and the **Octopus Pro**. High-speed CAN bus communication is sensitive to interference, so follow the shielding and termination steps exactly.

**Step A: Wiring the Data & Power**

Use a high-quality cable with **4 wires (20 AWG)**. I highly recommend **soldering all connections** for maximum reliability.

1. **CAN Data Lines**:
    - Connect **CAN High** from the EBB36 to **CAN High** on the Octopus Pro.
    - Connect **CAN Low** from the EBB36 to **CAN Low** on the Octopus Pro.
    - Use a connecter XH-2
2. **Power (24V)**:
    - **RED Wire**: Connect to **24V Positive (+)** on the 24V power supply.
    - **BLACK Wire**: Connect to **Negative (-)** on the 24V power supply.

**Step B: Shielding & Grounding (One-Side Only)**

To keep motor noise out of your data lines, you must ground the cable shield correctly:

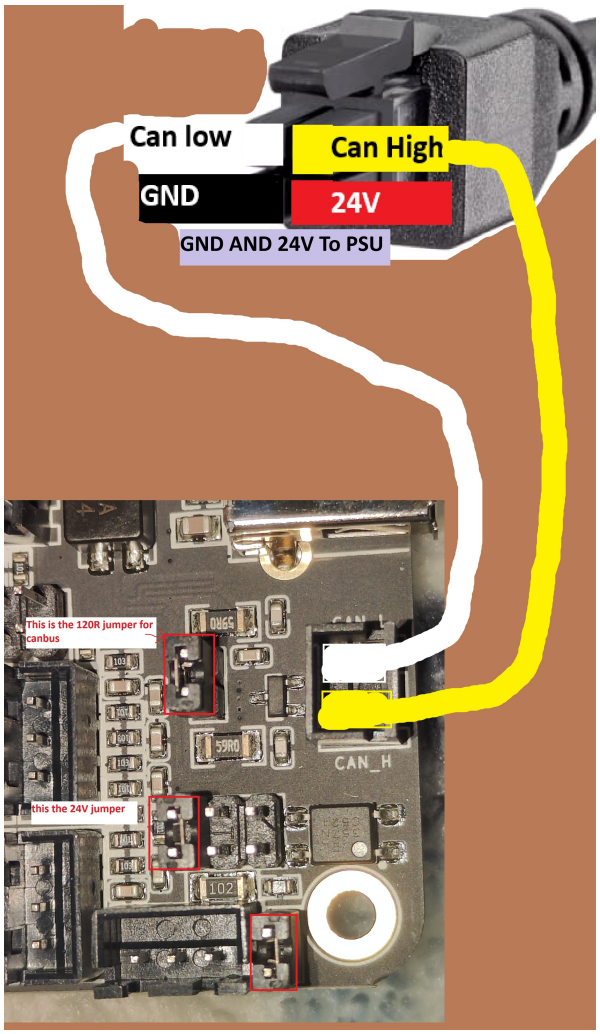
- **Toolhead Side**: Cut the shield/drain wire flush with the cable jacket. **Do not connect it to the EBB36.**
- **Octopus Pro Side**: Connect the shield wire to one of the available **GND pins** on the **SPI3 header**.
- **Why?** Grounding only one side prevents ground loops while still draining interference away from the data wires.

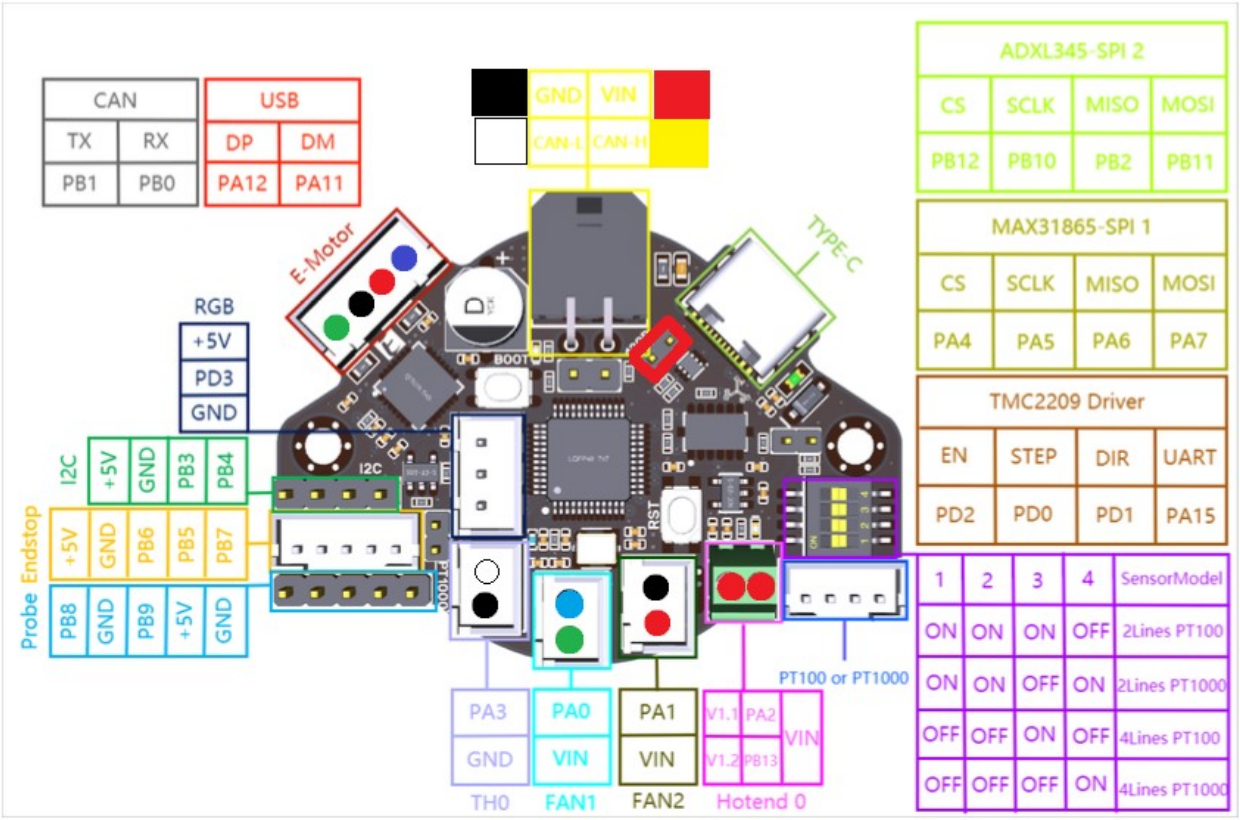
**Step C: 🛑 CRITICAL: 120R Termination Jumpers**
The CAN bus signal must be "terminated" at the start and end of the line. Without these jumpers, Klipper will not be able to communicate with the toolhead.

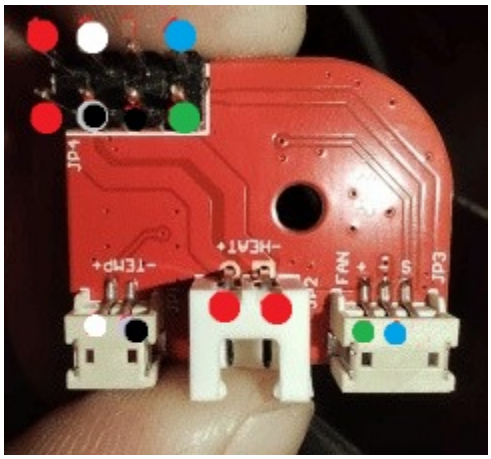
1. **EBB36 Jumper**: Locate the two pins labeled **120R** on the EBB36 board and install the jumper.
2. **Octopus Pro Jumper**: Locate the **120R** termination pins (near the CAN header) on the Octopus Pro and install the jumper.
3. **Visual Check**: Refer to the images below to ensure jumpers are on the correct pins.

Below I show all the connection on the EBB36 and 120R Jumper

Bottom is Octopus pro to ebb36






**EBB36 Toolhead Board Wiring**

Refer to my color-coded reference photos while wiring your toolhead. I have marked the polarity for critical components and highlighted the specific jumper locations.

**Component Wiring & Polarity**

I used **20AWG Dupont** wires cut to length and soldered to **XH-2Y** connectors for a secure fit on EBB36 ports.

- **Heater (Red/Red)**: Polarity does **NOT** matter here. These are "plug and play"—simply insert the wires into the screw terminals and tighten them down securely. Ensure no stray wire strands are sticking out.
- **TH0 (Thermistor)**: Polarity is critical; refer to the color-coded reference in the photo.

- **FAN1 (Heatsink Fan)**: ⚠ Ensure the positive and negative wires match the board pins exactly.
- **FAN2 (Parts Cooling)**: ⚠ Ensure the positive and negative wires match the board pins.
    - 🛑 **FAN MOD**: You must swap the stock 4-wire parts cooling fan for a **2-wire fan**. 4-wire fans do not work reliably with the EBB36 control circuit.
- **Toolhead Stepper**: The wires on the toolhead motor are extremely thin. I cut out a connector to create a **breakout board** since the original wires are so fragile and difficult to manage.

**Signal & Terminations**

- **120R Jumper**: Look for the **Red Box** in the photo. You **must** have this jumper installed for the CAN bus to function.

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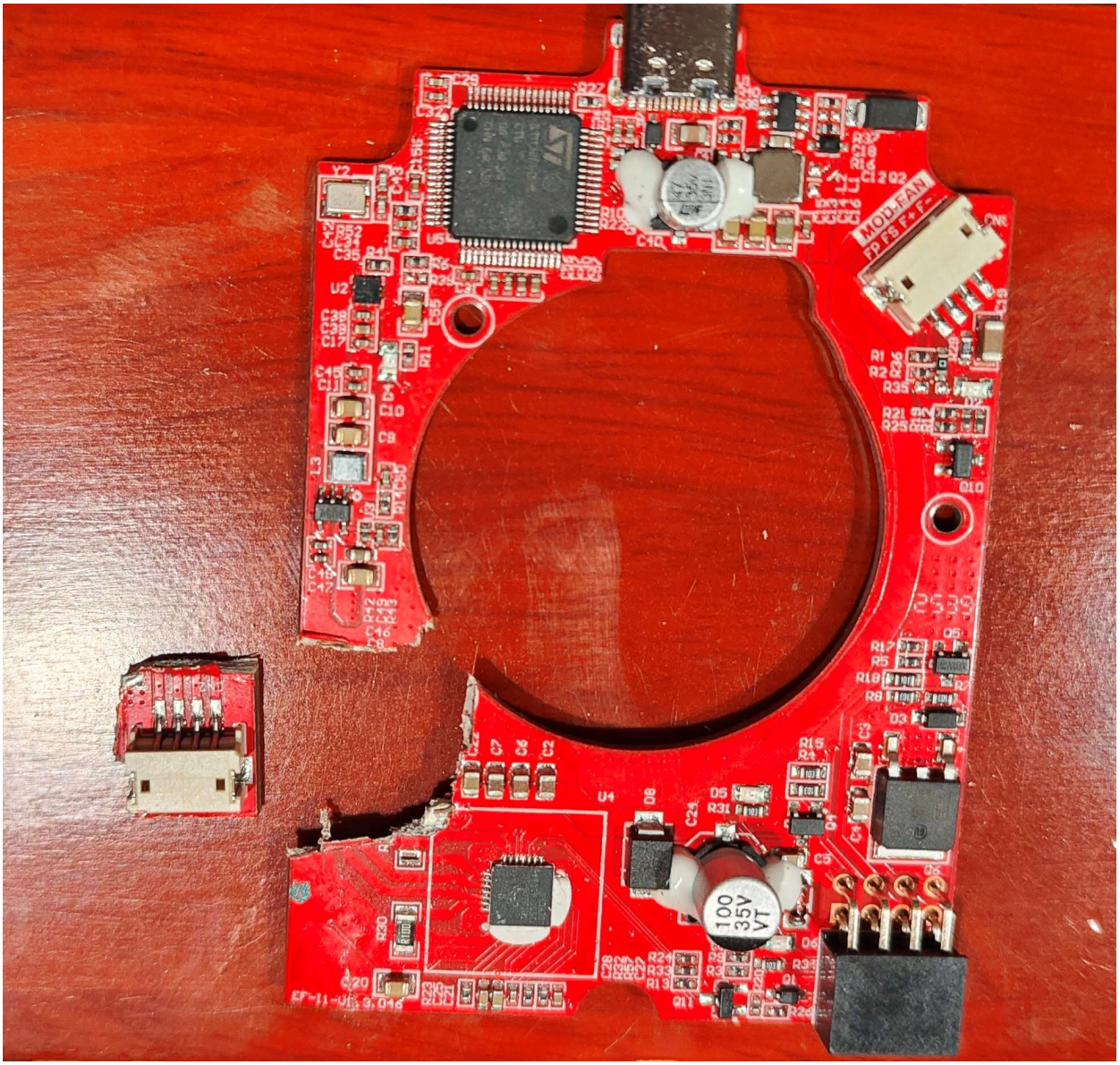
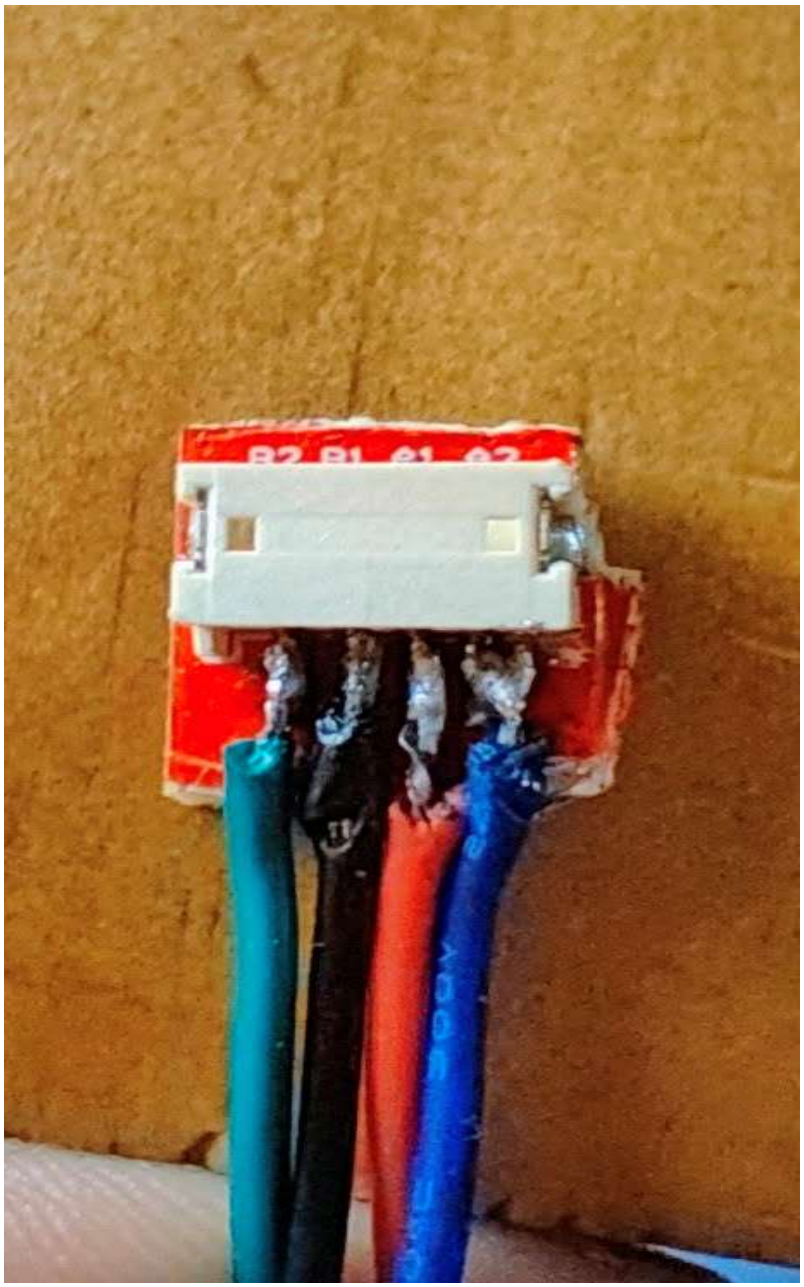
**EBB36 Component Map**

| Port | Component | Instruction |
|---|---|---|
| **Heater** | Hotend Heater | Insert into terminals and tighten down. |
| **TH0** | Thermistor | Verify polarity via color-coded photo. |
| **FAN1** | Heatsink Fan | Standard 2-wire connection. |
| **FAN2** | Parts Cooling Fan | **Requires swap to 2-wire fan.** |
| **Stepper** | Extruder Motor | Use a breakout board for thin wires. |


MOD-FAN
100
35V
VT



## Z Optical Sensor Modification & Connection

Because the pinout of the stock Z optical sensor differs from the Octopus Pro, you must "depin" the connector and swap the wiring order.

**Connector Modification:**

1. **Depin the Connector**: Use a small needle or precision tool to gently lift the plastic tabs on the sensor's connector and remove the **two outer wires**.
2. **Swap Positions**: Swap the positions of these two outer wires and click them back into the connector housing.
3. **Connection Point**: Plug the modified connector into the **Probe Jack** located at the corner of the board (near the CAN bus connector).

**Jumper Configuration (CRITICAL):**

you must set the board to provide the correct voltage to this port:

- **Voltage Jumper**: Ensure the voltage selection jumper for the Probe port is set to **24V**.
- **Signal Jumper**: Ensure the jumper directly next to the port is **installed** (as shown in the reference picture below).

**CAUTION: Verification is Key**

Connecting the Z optical sensor without swapping the outer wires, or with the wrong voltage jumper, can result in hardware failure.

- **Lost track of the wires?** If you lose track of which wire is which during the swap, **remove the optical sensor** from the printer and look at the PCB. The board is labeled for **Signal** and **Positive (+)**.
- **Verify with a Multimeter**: Use a multimeter to trace the wires from the sensor PCB back to the connector to ensure you have the correct orientation before plugging it into the Octopus Pro.

**Filament Runout & Buffer Wiring (XH-3Y Connection Guide)**

To connect these sensors, you will use **3-pin XH-3Y connectors**. Even though we are only using specific pins, the 3-pin housing ensures a secure fit in the Octopus Pro endstop ports.

**Step A: Filament Runout Sensor (Endstop 2 / PG10)**

- **Connection**: Plug your standard Filament Runout Sensor into **Endstop Port 2** using its standard connector.
- **Klipper Pin**: **PG10**.

**Step B: Buffer Low Limit "Bridge" (Endstop 4 / PG12)**

This switch acts as a bridge between the Runout sensor and the PG12 input.

1. **From PG10**: Take one wire from your Buffer Low Limit switch and **tap it directly into the PG10 signal wire** (Endstop 2). Wire the switch as Normally Open
2. **To PG12**: Take the second wire from the switch and crimp it into a **3-pin XH-3Y connector** so it aligns with the **PG12 signal pin** on **Endstop Port 4**.
3. **Result**: The signal flows from PG10 -> Switch -> PG12.

**Step C: Buffer High Limit (Endstop 5 / PG13)**

This is a standard 2-wire connection using a 3-pin housing.

1. **Wiring**: Crimp your two wires from the High Limit switch into a **3-pin XH-3Y connector**. Wire the switch as Normally Open
2. **Pins Used**: You must align the wires so they connect only to the **Ground** pin and the **PG13 signal pin** on **Endstop Port 5**.
3. **Note**: Leave the 5V/VCC pin on the connector empty.

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**Connector Pinout Reference**

| Component | Port | Klipper Pin | Wiring Logic |
|---|---|---|---|
| **Filament Runout** | **Endstop 2** | **PG10** | Standard 3-pin XH-3Y |
| **Buffer Low Limit** | **Endstop 4** | **PG12** | **Wire 1**: Taps into PG10. **Wire 2**: To PG12 Signal Pin. |
| **Buffer High Limit** | **Endstop 5** | **PG13** | **Wire 1**: To Ground. **Wire 2**: To PG13 Signal Pin. |

## Camera Wiring (USB Conversion)

The Centauri Carbon uses a high-quality internal camera, but it uses a **JST-XHB-4P** connector instead of a standard USB plug. To use this with your Raspberry Pi, you must convert the camera cable to a standard USB-A connector.

**⚠ CRITICAL: Identifying All-Black Wires**

On many Centauri Carbon units, **all four camera wires are black.** You cannot rely on wire color to identify 5V or Ground.

1. **Check the Factory Board**: Before cutting anything, look at the original Elegoo motherboard where the camera was plugged in. The pins are marked: **5V, DM, DP, and GND**.
2. **Mark Your Wires**: Use a piece of tape or a marker to label each black wire according to the motherboard pins **before** you remove the connector.
3. **Multimeter Check**: If you lose track, use a multimeter to check for continuity between the camera's PCB components and the wires to confirm Ground and 5V.
4. **Camera Pinout (JST-XHB-4P)**

Map your labeled wires to a standard USB-A cable according to this pinout:

| Pin Nr | Board Marking | Function | Standard USB Color |
|---|---|---|---|
| **1** | **GND** | Ground | **Black** |
| **2** | **DP** | USB Data Plus (+) | **Green** |
| **3** | **DM** | USB Data Minus (-) | **White** |
| **4** | **5V** | +5V Power | **Red** |

**Installation Steps:**

1. **Solder Connections**: Solder the labeled black camera wires to the matching wires on your USB cable.
2. **Insulate Individual Wires**: Use small heat shrink on each of the four solder joints. **Do not let them touch.**
3. **Final Wrap**: Use a larger piece of heat shrink over the entire connection to prevent the wires from pulling out.
4. **Connect**: Plug the USB connector into a **USB 2.0 port** on your Raspberry Pi 5.

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🛑 **WARNING**: Reversing the **5V** and **GND** wires will instantly kill the camera. Triple-check your labels against the factory board markings before plugging in the USB.

## Software Setup & Custom Drivers

Now that the hardware is finished, we move to the software side. You must flash the mainboard and install the custom load cell drivers and command extensions.

**Step A: Flash the Octopus Pro Firmware**

🛑 **STOP:** Before the Raspberry Pi can talk to the printer, the **Octopus Pro** needs Klipper firmware installed.

- **Action**: Follow my dedicated guide
- **Note**: Complete the flash and ensure the board is visible via USB\CAN before proceeding.

**Step B: Essential Software & Extensions**

Log into your Raspberry Pi via **SSH**. You need to install the core software and the **G-Code Shell Command** extension to allow Klipper to run advanced scripts.

1. **KIAUH Installations**: Use KIAUH to install **KlipperScreen**, **Obico (Local)**, and **Happy Hare**.
2. **G-Code Shell Command**: You **must** install the G-Code Shell Command extension (available in the "Advanced" menu of KIAUH). This is required for the custom macros to run correctly.
3. **Variables**: Ensure you have a `variables.cfg` file in your configuration directory to store persistent data for the AMS and Load Cell.

**Step C: Installing Custom Load Cell Drivers**

⚠ **CRITICAL:** For the **ADS1220** strain gauges to work, you must replace the stock Klipper files with my modified versions. If you use the stock files, your bed leveling will fail.

**1. Delete the Stock Klipper Files**

First, you need to remove the original files from the Pi. Open your **SSH terminal** (like PuTTY) and copy/paste this command:

```
rm ~/klipper/klippy/extras/load_cell.py
~/klipper/klippy/extras/load_cell_probe.py
~/klipper/klippy/extras/sos_filter.py
```

**2. Upload the Modified Files (Using SCP)**

Now, you will upload the new files from your computer. Open a **Command Prompt** (Windows) or **Terminal** (Mac/Linux) on the computer where you downloaded my files. Navigate to that folder and run this command:

```
scp load_cell.py load_cell_probe.py sos_filter.py
pi@centauri.local:~/klipper/klippy/extras/
```

*(Note: Replace **pi** with your username and **centauri.local** with your Pi's IP address if needed.)*

**3. The "Dirty" Warning**

⚠ Once the files are uploaded, the **Klipper Update Manager** in Mainsail/Fluidd will show a status of **"Dirty"** or **"Modified."**

- **THIS IS NORMAL.** It means Klipper has detected my custom high-performance code.
- 🛑 **DO NOT CLICK "RECOVER" OR "HARD RESET."** If you do, Klipper will delete my files and replace them with the broken stock versions, and your load cells will stop working.

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**Step D: Final Config & CAN Bus UUIDs**
Now that the software and drivers are installed, you need to link Klipper to your specific hardware using their unique "fingerprints" (UUIDs).

1. **Open Mainsail**: In your web browser, go to your Pi's address and navigate to the **Machine** (or Configuration) tab.
2. **Upload Configuration**: Upload the **printer.cfg backup** and the **MMU/Happy Hare config** settings I provided.
3. **Find Your Unique IDs**: You must do this via the **SSH terminal** (PuTTY) to ensure the boards are seen by the system. Run the following command:`python3 ~/klipper/scripts/canbus_query.py can0`
4. **Identify the Boards**: The command will return two different UUIDs:
    - One is for your **Octopus Pro**.
    - One is for your **EBB36**.
5. **Update printer.cfg**:
    - Open your `printer.cfg` in the Mainsail editor.
    - Find the `[mcu]` section and paste the Octopus UUID into the `canbus_uuid:` field.
    - Find the `[mcu ebb36]` section and paste the EBB36 UUID into the `canbus_uuid:` field.
6. **Save & Restart**: Click **Save & Restart** in the top right corner.

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**✅ Hardware & Software Complete**
Congratulations! You have successfully completed the **Centauri Carbon ALESI MOD (48V Version)**.