Before we start, we just wanted to thank you for choosing the TH3D EZABL™ Pro kit. We've been working on perfecting the easiest, well documented, and supported ABL kit on the market. The EZABL™ Pro kit is the result of over 2 years of research and testing done by TH3D and feedback given to us from our customers.

We pride ourselves by using the highest quality parts in the kits and doing extremely thorough testing on every kit before packaging. Unlike other companies that use off the shelf hardware and/or low-quality parts on their boards we only use the best and work directly with our suppliers to bring you the best performing and reliable kits that we can.

We would not be where we are without YOU and your feedback. If you see something that needs changing/updating or you just want to suggest a new feature, we would love to hear from you. We can be easily reached by visiting ContactUs.TH3DStudio.com.

If something is not up to our rigorous QC standards, please let us know so we can correct it.

TH3D gives back to the community through many ways and you supporting us allows us to put out information for everyone as well as making donations every month to multiple open source projects (like the Marlin project that our firmware is built on and OctoPrint).

Thank you again for choosing TH3D and Happy Printing!

Sincerely,

~Tim Hoogland

TH3D EZABL™ Pro Installation Guide

V2.3 – 2/15/2021

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Re-distribution is NOT permitted and must be downloaded from our website
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Getting Started

Welcome to the EZABL™ Pro kit installation guide!

This will walk through the steps to install the EZABL™ Pro sensor on the printer. Be sure to follow all the steps and if you have issues or a question do not hesitate to reach out to us by visiting http://ContactUs.TH3DStudio.com.

There are optional accessories for the EZABL™ Pro Kit like AC power adapter or USB power adapter that are not pictured below. If you ordered these options, they will be in the EZABL™ Pro kit package when you receive it.

We are always making things better so the case or sensor may look slightly different than the below pictures.

Preparation

Before you begin you should have the following:

- **TH3D EZABL™ Pro Kit**
    - 1x EZABL™ Pro Control Box
    - Power Wire
    - 1X EZABL™ Pro **or** EZABL™ Pro Mini Sensor (depends on your selection)
        - EZABL™ Pro Mini Sensors will have 2x Adapter Rings included
    - 10X Zip Ties for Securing the Sensor Wiring
    - 1X Micro Screwdriver for Adjusting the Sensor and Screw Terminals
- **Printed Parts to Mount the Sensor to your printer**
    - We include a multitude of mounts in our Unified Firmware package in the "EZABL STL Files folder". You can also use any custom ones if you know the sensor offset values (this is noted in the firmware).
    - We offer printed parts if you do not want to print your own. If you want one please contact us with the STL files for a quote.
    - Small ones like the can be purchased on the EZABL Product page or separately on our site in the Printed Parts section.
- **Latest copy of the Unified or Marlin firmware for your printer**
    - **We have firmware for over 20 different machines on our website for customers – Check your order email for download info or download from Firmware.TH3DStudio.com.**
    - If you have a custom printer see the notes on the firmware section for the Marlin setup guide.
- **USB Cable to connect your printer to your PC to update the firmware**
    - Your board MUST have the bootloader already flashed on it to perform this update. Check our video guide page at Bootloader.TH3DStudio.com to flash the bootloader.

If you are missing anything from the TH3D EZABL™ Pro kit please visit ContactUs.TH3DStudio.com.

Email support is included in the kit for setup, install, and firmware questions.

Phone/Remote Support is available at an additional charge.

Pre-Installation Checks

Before installing the kit, there are a few things we recommend checking to make sure the printer is in optimal condition before installing the EZABL™ Pro kit.

1. Make sure your bed is level if you are using springs still, use Loctite or superglue to lock the nuts in place on the screws to prevent shifting.
    a. You can replace springs with aluminum spacers from a hardware store. We also sell solid mount kits that integrate bed wiring strain relief and optional camera mounts for select models on our website.
    b. Check all the wheels and eccentric nuts if your machine uses these.
2. Run through the Z axis checks that are outlined in our knowledge base.
3. Make sure the power cord your printer uses has a grounding plug. If you are using an adapter and/or extension cord make sure they are also grounded. If it is not grounded there can be electrical interference that can cause the sensor to not work
    a. If you are using a separate power adapter, make sure the power adapter/usb power source is on the same power strip as the printer.
4. Depending on what mount you are using, printer model, etc you may need additional screws. Most mounts use M3 screws so it would be recommended to pick up an M3 screw assortment from TH3D, Amazon, or your local hardware store.
5. Some printers require a bootloader to load the firmware. You will need an Arduino Uno with some jumper wires. We sell a bootloader kit in the TH3D Shop that comes with the Uno and ALL the cables needed.
    a. **Any of the models with the 1284p chips require a bootloader.**
    b. **The Anets, CR-10, Ender 2, Ender 3, Ender 5, and Wanhao i3 all use the same process for the bootloader.**
    c. **There is a video guide and information for flashing your bootloader at Bootloader.TH3DStudio.com and you will need an Arduino Uno to flash the bootloader using our guide.**

Troubleshooting Information

If you should have issues with your EZABL™ kit first visit our knowledge base on our website. This is where we document all known issues with the machines these kits are used on. If you cannot find a solution to your issue you can visit ContactUs.TH3DStudio.com.

Mounting the sensor

Once you have the new mounts you will need to install them on your hotend and then mount the sensor to the new printed mount. **When you mount the sensor, it should be about 2mm ABOVE the tip of the nozzle for both sensor sizes.** This does not have to be exact just higher than the nozzle but not too high. Most of the flat wrenches included with the printers are about 2mm in height and can be used to set the sensor height.

If you are using the EZABL™ Mini size sensor and using the standard 18mm sensor mount use the included adapter rings to center the EZABL™ Mini in the 18mm mounting hole. The smaller side should be inside the ring of the 18mm hole to center the probe.
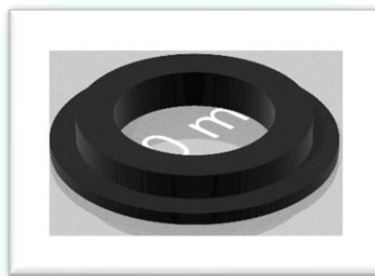
Once mounted make sure the nuts are tight and you check them from time to time. If the nuts loosen the sensor will not work reliably. You can use Loctite (blue preferred) to keep them in place if this happens to your setup frequently.
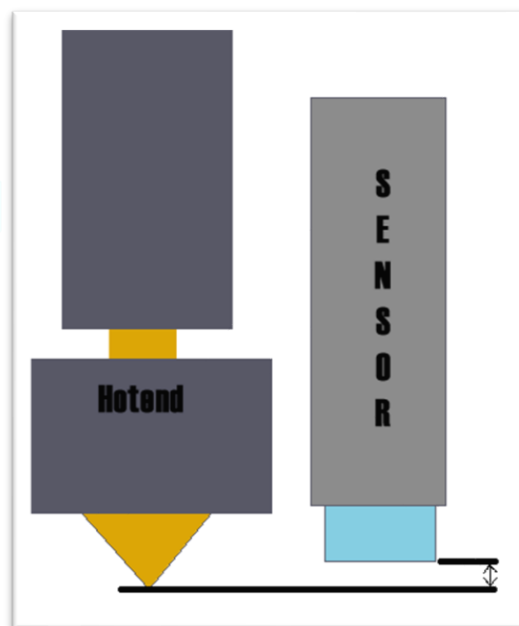

2MM higher than nozzle.

Powering the EZABL™ Pro Control Board

Connect power to the EZABL™ Pro Module is easy and flexible.

You can power the kit with the included power wire to your printer power supply **OR** if you ordered the AC adapter/USB adapter you can power it externally.

Do not press the self test button with a sensor connected to the EZABL control board. **It is only for use when directed to be used by our support team. This emulates the sensor trigger signal when pressed.**
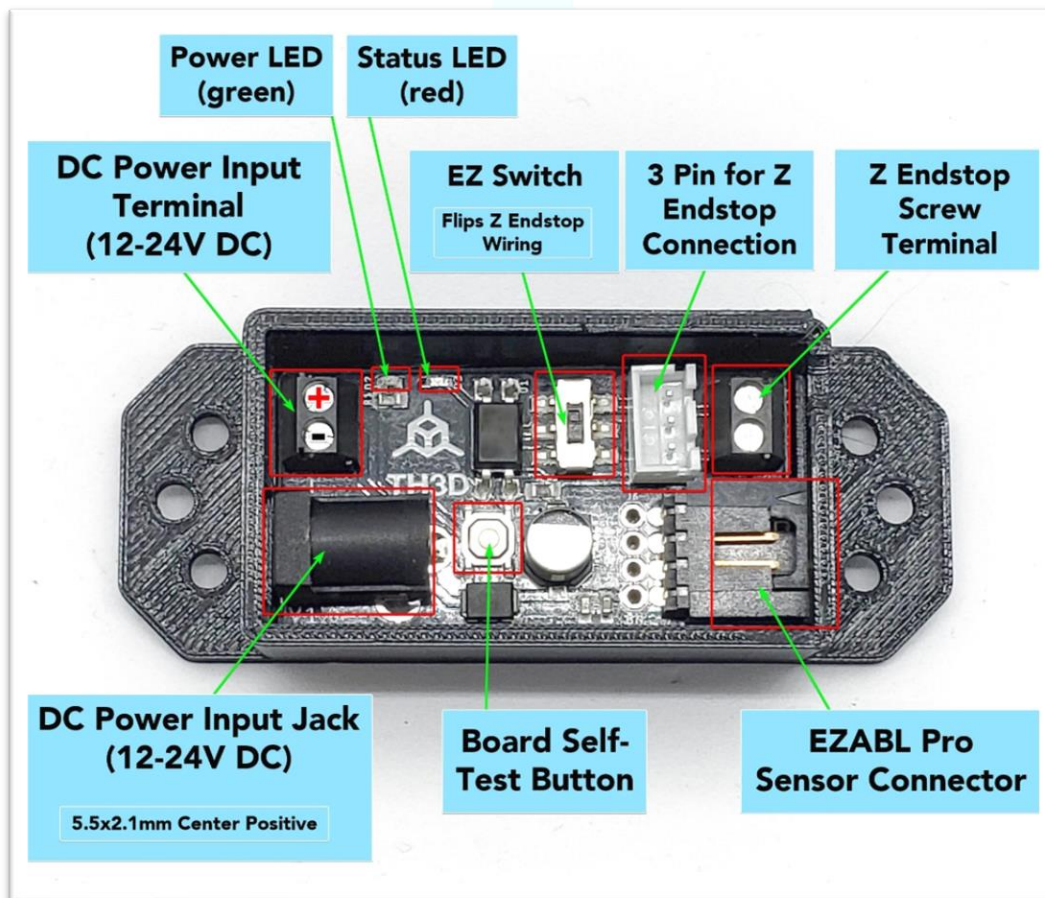
EZABL™ Pro Control Board Connections/Features

Separate Power Adapter

If you are using our AC adapter or USB adapter connect the DC plug to the DC Power Input Jack on the EZABL™ Pro Control Board.

Directly Wiring Power

If you are wiring to your printer power supply, make sure that you match the positive and negative connections on the power supply and EZABL™ Pro Control Board DC Power Input Terminal. DO NOT connect to the AC lines.

The supplied wire has a red wire and a black wire contained inside the outer sheathing. Strip this back at both ends and then strip the black and red wires at each end as well.

Positive is labeled with + on our board and usually is V+ on your power supply. Use the red wire for this connection.

Negative is labeled with – on our board and usually is V- on your power supply. Use the black wire for this connection.

Use the included screwdriver to secure the wires in the terminal, do NOT over tighten.

If in doubt sent a picture of the wiring to our support BEFORE you power the machine on and we will verify proper connection

Connect your Z endstop to the EZABL™ Pro Control Board

The EZABL™ Pro Control board replaces your Z endstop switch. It accepts 2 types of Z endstop connections, 2/3 Pin JST XH and stripped wires.

Printers with a 2 or 3 Pin JST XH Plug (Creality, Geeetech, Alfawise):

If you have a printer that uses a 2 or 3 pin JST XH plug then you can use the 3 pin header on the EZABL™ Pro Control Board.

If you have a 2 pin JST XH you will want to connect to pins 1 and 2.

Printers with soldered Z endstop wires:

If you have a printer with wires that are soldered to the Z endstop switch or one without a JST plug, you will cut the wires and insert them into the black screw terminal on the right. Wire placement does not matter. Use the included screwdriver to secure the wires in the terminal, do NOT over tighten.
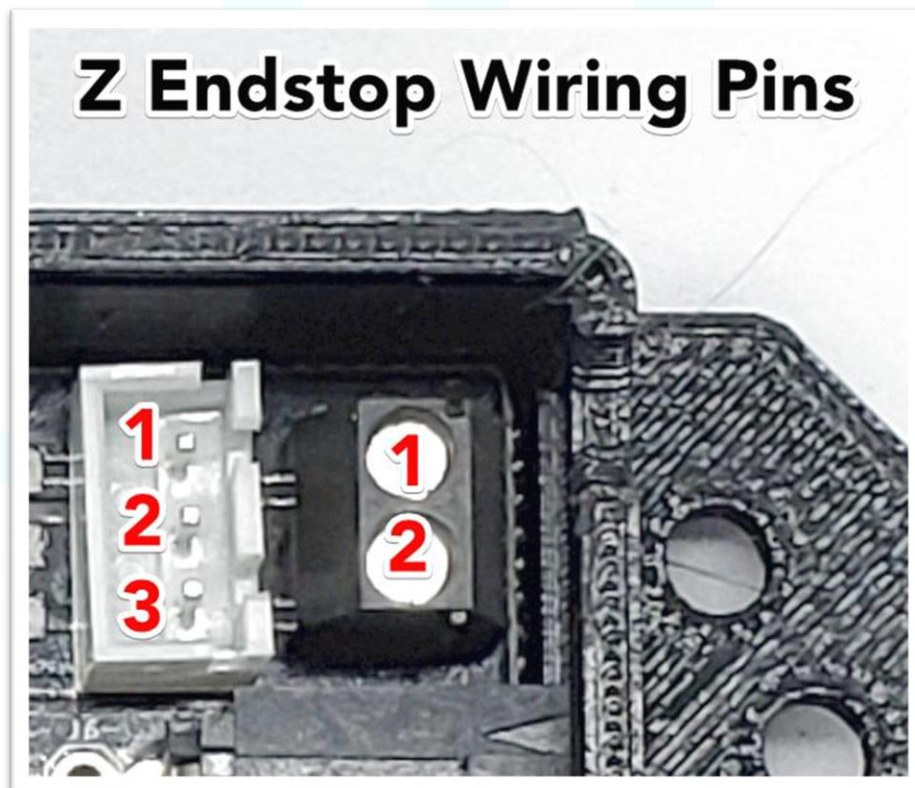

If you printer has 3 wires going to the Z endstop connection, please contact our support BEFORE connecting. You can contact us through ContactUs.TH3DStudio.com.
For the Geeetech machines with a 3 pin endstop see our Knowledge Base for wiring the Z.

Verify Power and Test the EZABL™ Pro Sensor Detection

When you power on your printer the Power LED on the EZABL™ Pro Control Board will light up green. If the power LED is not lighting check that you have the polarity correct if directly wired or if you are using a separate power adapter that it is plugged into a power source that is on.

Now plug the EZABL™ Pro Sensor plug into the EZABL™ Pro Sensor Connector on the control board.
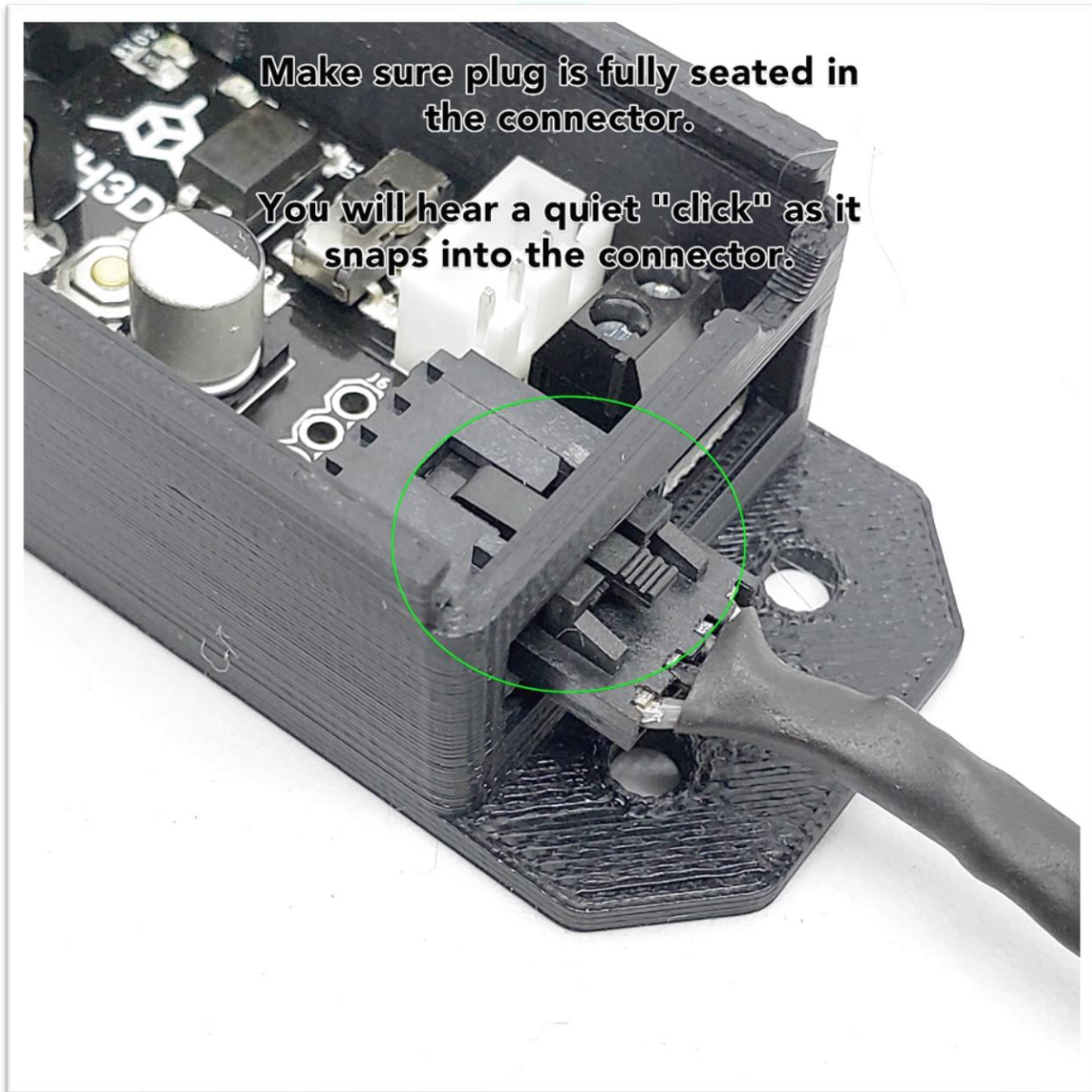
To verify that the sensor is working touch the tip sensor with your finger. The Red LED light on the Sensor AND the Status LED on the EZABL™ Pro Control Board should light up. Depending on your sensor it may or may not also have a green power LED that will be lit (this will shut off when triggered).

If they do not light up place your finger on the tip of the sensor while adjusting the gold screw clockwise on the side of the sensor until it lights up when you touch it.

Firmware Setup – <mark>CLOSE ALL SLICERS BEFORE FLASHING</mark>

We support many different printer models and all are listed on the Unified Firmware page.

- Download the latest Unified Firmware Package for your machine from **Firmware.TH3DStudio.com** and extract all the files to a folder on your computer.
    - Check Unified 2 section for your machine/board support and if it is not supported in Unified 2 yet then go with the Unified 1 firmware.
- Follow the directions at the top of the Configuration.h and on the firmware download page for your machine.
    - Be sure to follow each step and make sure you enable a probe mount for the mount you are using on your machine.
- Set the EZABL_PROBE_EDGE setting to 45-50mm for larger printer beds (300mm+ size beds) and 15-20mm for smaller printer beds.
    - Adjust the probe edge so that it is not probing over any bed clips or screws. This will skew the reading.
- We recommend using an EZABL_POINTS setting of 3 (this is the default) to start with and most people use this value on beds up to 300x300. Larger beds should use 5.

If you have a printer that needs a bootloader this must be flashed before you can load any firmware on the machine. Most printers with a 1284p CPU will need their bootloader flashed. You can follow our bootloader flashing guide by visiting Bootloader.TH3DStudio.com

The EZABL™ Probe mount STL files are included in the Unified Firmware package for every model and probe mount variation that we support.

Be sure to reset your printer EEPROM by either going to Control>Reset EEPROM or you can reset it via Gcode by sending a M502 followed by a M500. This will wipe the EEPROM and put the firmware defaults in. Failure to do this step will result in erratic printer behavior.

Adding the EZABL™ Pro Kit to a Custom Printer

Setup the firmware as if you did not have a probe and follow our Marlin setup guide here: https://support.th3dstudio.com/hc/product-information/ezabl/ezabl-firmware-setup-for-vanilla-marlin/

Custom Probe Mount Setup

If you have a probe mount you will need to measure the distance on X and Y that the center tip of the probe is from the tip of the nozzle. Those will then be entered into the custom probe section in the firmware. This is in the "Custom Probe Mount Settings" section and there is a visual layout in the firmware showing an example.

Sensor/Endstop Test

The next step you want to do is to check if the endstop is properly being recognized by your board.

Make sure you have your Z endstop wire connected to our EZABL™ Pro Control Board.

<mark>DO NOT HOME YOUR Z OR "HOME ALL" UNTIL YOU VERIFY THAT THE FIRMWARE IS SEEING THE SENSOR CORRECTLY AND YOU HAVE CALIBRATED THE SENSOR.
YOU CAN DAMAGE YOUR HOTEND AND/OR PRINTER.</mark>

Start by moving the Z up until the light on the sensor and the Status LED on the EZABL™ Pro Control Board turn off.

Next, connect to your printer over your preferred slicer (or Octoprint) and issue an M119 and see if the Z_min is showing TRIGGERED or open.

If it shows open place your finger or an object under the sensor so the light comes ON and then issue M119 again. If it shows TRIGGERED then proceed to setting your sensor sensitivity.

If your slicer (namely Cura) does NOT support sending terminal commands then use the Gcode sender program in the "Extra Programs" folder of the Unified Firmware Package.


If it does not, then move the "EZ Switch" on the EZABL™ Pro Control Board and re-run the M119 test. If it is in the up position, then move it down. If it is in the down position, then move it up.

Mounting the EZABL™ Pro Sensor to your printer

Now that we have the wiring completed and verified that your printer is seeing the sensor correctly it is time to mount the sensor on your machine. In the Unified Firmware package that we downloaded earlier there is a folder called "EZABL STL Files", all mounts are in here.

Install the sensor mount for your machine and place the sensor in the mount where it is higher than the nozzle, we will adjust this in the next step. Use the sensor nuts to secure the sensor in the hotend mount. Use the included zip ties to secure the sensor wire to your hotend wires.

When you route the wire for your sensor so NOT create a pinch point with a zip tie where the wire will be bending back and forth while the print head is moving. This will internally break the wires on the cable and the sensor will no longer work. Leave some slack do NOT make a "loop" with the wire. Install the sensor wire exactly as seen in the picture below, notice the curve of the wire to the sensor top. This is what you want to see when you secure the wire. See appendix for example of what NOT to do when installing the sensor wire.
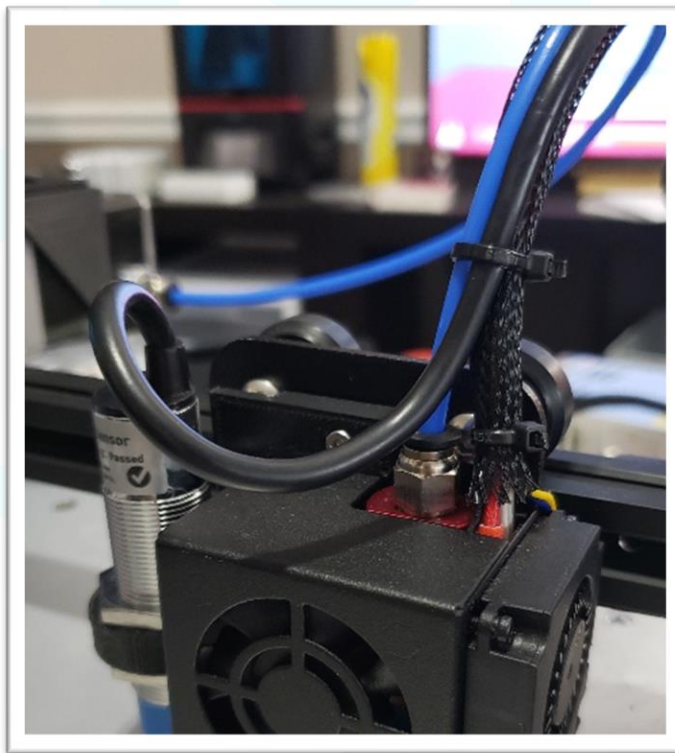
Zip Tie/Wire Strain Notes

Do NOT overtighten the zip ties as you can damage your printer wiring and/or the EZABL™ Pro sensor wire. Damaged wires due to excessive zip tie force and/or improper strain relief are not covered under warranty. See above picture for proper cable routing.

## Calibrating the EZABL™ Pro Sensor for your printer

The next step is setting the sensor sensitivity. If you have a heated bed do this with your bed heated to your normal print temperature. This is to account for the bed changing shape during the heating cycle.

Status LED Information

- **Both sensor sizes have a RED LED that lights when the sensor is triggered.**
- **18mm Size –** Has **2 LEDs**, a **GREEN LED** that lights to indicate power and shuts off when the **RED LED** lights (triggered).
- **12mm (Mini) Size - ONLY** has the **RED LED** (triggered) and no green power led.

If you print at different temperatures depending on the material, you are printing then select one in the middle of the highest and lowest print temps you use. Lower the Z until your NOZZLE is on the bed, if you have filament on the nozzle heat it before lowering and clean it off.

Manually move the Z with the printer LCD or your Computer/Pi until the nozzle is on the bed, then move the Z up **2mm for EZABL™ Pro** and **1mm for EZABL™ Pro Mini**.
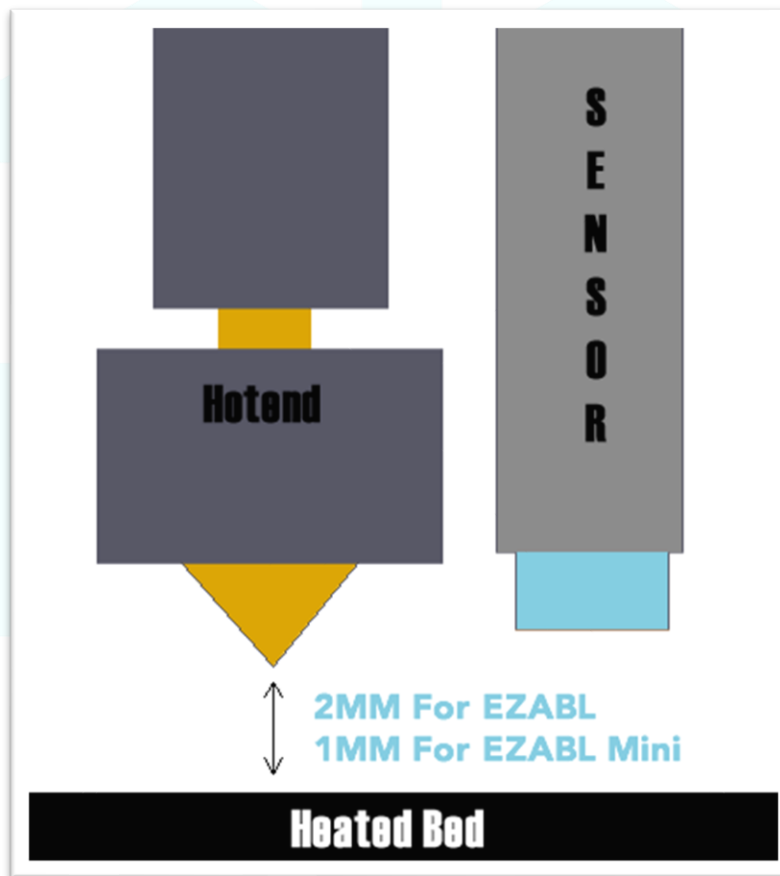
If you have an AC bed turn the heat off during this step. If you have a direct drive printer disable steppers as well to make sure E is off. This mitigates any potential EMI from the bed/e motor.

The adjustment screw is on the SIDE of the sensor and gold/brass colored. Some mounts may cover it up. If this is the case hold the sensor in position while calibrating it and then secure the sensor with the included nuts after calibrating.

Sensor calibration/adjustment screw
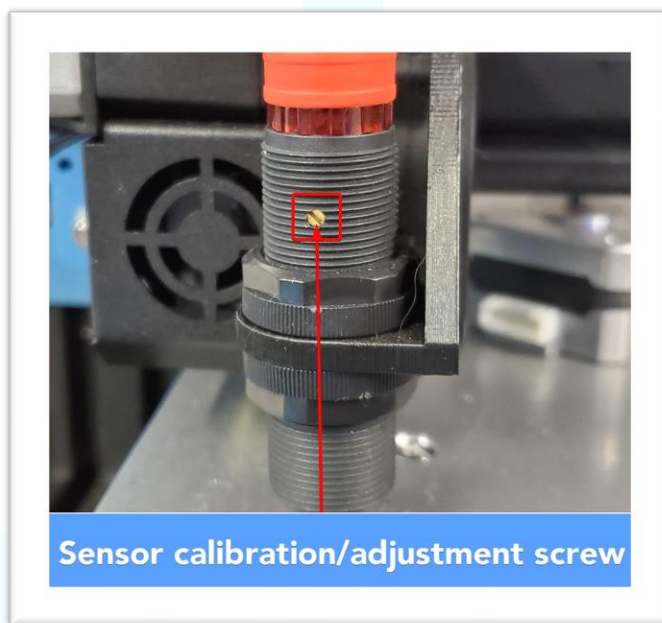
If the sensor RED LED is already on, turn the screw counterclockwise until the RED LED turns off. Now turn the screw clockwise slowly until the sensor RED LED turns on. Make sure the RED LED stays on when you remove your screwdriver AND move your hand away from the sensor. If it shuts off or flickers when you do this turn it just a hair clockwise and move the screwdriver and your hand out of the way again.

RED LED Turning off? - Repeat the clockwise adjustment until the RED LED stays on when you remove your screwdriver and hand from the sensor. If you are having issues getting the RED LED to stay on check the grounding on your machine, visit our Knowledge Base on grounding checks and how to perform them.

Do NOT change the sensitivity if you are getting different heights between prints due to temperature changes. This should be handled by the Z Offset/BabyStepping the Z height. Under normal conditions at most you should only have to occasionally Babystep small amounts. If you are getting more than that please contact our support to go through more advanced troubleshooting steps.
Large babystep changes are usually related to a physical machine issue if M48 is returning a consistent reading under 0.01mm.

Setting your Z Offset

I HIGHLY recommend you watch the video as it is much easier to see what to do. Here is a video on how to set the Z Offset: https://www.youtube.com/watch?v=IP-UHn7_yqs

Now that we have the sensor installed and calibrated you need to set your Z Offset. This is the distance the printer needs to move the head down to place it on the bed after the sensor triggers.

1. Get the bed to your normal print temp and do a G28/Auto Home to home the sensor. Your **EZABL™ Pro sensor** should be in the middle of the bed. Let it sit there for 1 minute after the bed has reached its target print temperature.
2. After homing the Z will show 5mm on the LCD (Z5). This is NOT included in the ZOffset. Move Z down 5mm before proceeding, the LCD will show Z0.
3. Grab a sheet of standard paper and then move the nozzle down by 0.1mm until it just grabs the paper. Once you do that you can look at your printer LCD and note the number that the Z shows. This will be a negative number. This is your Z Offset.
4. Enter that number in the ZOffset section using your printer LCD, look for a menu that says Probe Z offset in the title (this may vary as the firmware is updated rapidly). This is located under Menu>Control>Motion.
5. Store your Z Offset by going to Menu>Control>Store Settings.
6. Now do another G28/Auto Home command. The Z should show 5mm still but if you notice it will be 5mm as the offset is considered when homing Z.
7. Move the nozzle down 5mm and it should be grabbing the paper. If it is too high or too low you can further fine tune your Z Offset by increasing or decreasing that number. We recommend using the babystepping Z feature to fine-tune on your first print.

When printing if you are getting it starting too high or too low press the printer menu button 2 times while printing and it will bring up the "Probe Z Offset" menu. You can then turn the knob counterclockwise to move the nozzle closer to the bed in real time or clockwise to move it further away.

It is NORMAL to have to babystep a little especially when changing bed temps. If the resulting 1st layer is level after adjusting the 1st layer height then the probe is working correctly.

If you notice that you ALWAYS have to babystep a certain amount every print then add that to the Z offset. Lets say you have to babystep -0.2mm and your offset is -2.0. You can change your offset to -2.2mm and store it.

Updating your Slicer

Update your 1st Layer settings - To get the best 1st layer and adhesion we recommend the following settings:

- 150% 1st layer width
- 0.3mm 1st layer height
- Print SLOW 25-30% speed or 20mm/s
- Use a skirt set 2-3mm from the part with 2-3 outlines. Use this to adjust/check the leveling result.
  - Use the Babystepping feature mentioned on the previous page to live adjust your Z height.
- **DO NOT TURN ON ANY SETTINGS IN YOUR SLICER TO MAKE THE HOME POSITION THE CENTER OF THE BED. Your X0 Y0 position is still the same as it was before the upgrade, which is the front-left corner of the bed.**

Update your starting Gcode

- Open the "EZABL Starting Gcode V2.txt" file located in the Installation Guides folder.
- Copy the entire file contents and paste it into the starting code/scripts section of your slicer replacing the existing code

The new gcode will have a 10 second wait for heaters to recover after probing. If 10 seconds is not enough to let your heaters recover change the S10 in the starting code above to however many seconds you want to wait for the heaters to recover.

Get into the habit of leaving your sensor homed BEFORE you start a print this will ensure that the bed is in the same state as when the sensor was calibrated.

Your bed will warp/flex during each heating cycle and this minimizes getting an inaccurate mesh when the sensor takes its readings.

You can now run your first print!

Slice up your favorite test file (ours is the 3D Benchy) and print!

Make sure to check the skirt and use the Babystepping feature to fine-tune your first layer. If you made any adjustments be sure to store them using Control>Store Settings.

Installation Finished!

Congratulations! You have installed your EZABL™ Pro sensor kit!
Enjoy the benefits of having Automatic Bed Leveling on your printer!

Things to note

- Make sure you are only using Gcode that was sliced after you installed the kit so that the starting code is present. If it is not then the system will not work correctly
- Join our communities! Check them out at Community.TH3DStudio.com
- Make sure your machine is mechanically sound in terms of your belts, leadscrews, wheels (if any), and hotend mount
  - If you have a Creality Ender 3/3X/Pro look up "The Edge of Tech" as they have some great assembly/troubleshooting guides for the Ender 3
- Be sure to check the sensor nuts from time to time to make sure they are not "walking" loose. If they are you can secure them with some Loctite Blue thread locker to make sure they are staying put.
- Most issues that come up are machine related and not issues with the kits themselves. Be sure to rule our machine issues and check our Knowledge Base before contacting support.
- **If you should have issues with your EZABL™ kit first visit our knowledge base at Support.TH3DStudio.com. This is where we document all know issues with the machines these kits are used on. If you cannot find a solution to your issue you can reach technical support at ContactUs.TH3DStudio.com**

OctoPrint/EZPi Notes and Tips

For those of you using OctoPrint/EZPi I highly recommend installing/using the Marlin EEPROM plugin (our version).

This allows you to set your offset from your web browser instead of the display. This is MUCH quicker and saves it to EEPROM automatically. This is the plugin we use on all our machines.

Plugin Details: https://plugins.octoprint.org/plugins/eeprom_marlin/

This plugin is pre-installed on our EZPi kits that we sell.

Sensor Connector Wiring

When disconnecting the EZABL Pro sensor wiring you must press the locking tab to release the plug from the EZABL Pro Board. With the locking tab pressed use your other fingers to grasp the sides of the plug and pull out. Do NOT use the wires to pull the plug out of the socket. Do NOT try to remove the plug from the socket without first pressing the locking tab down to release the tab. The picture below shows where the locking tab is. If wires are pulled out of the connector due to mis-use this is not covered under warranty and all connectors are checked before shipment to ensure they are fully crimped.
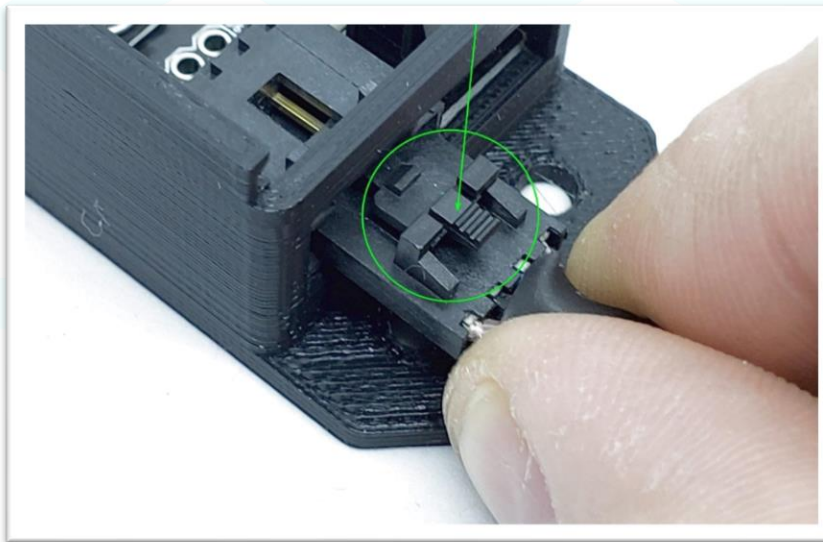
Legal

By purchasing and installing this kit you agree to the below terms and the terms of service on: https://www.TH3DStudio.com/terms/

There are many things you can do to your printer installing this upgrade kit or any other modification.

You are assuming all risk associated with this modification.

You understand that this and/or any modifications to your printer can and/or may void your manufacturer warranty (if any).

TH3D Studio LLC is not to be held liable for any damage to your printer, home, person, or anything else due to issues that may arise from improper installation or failure of this kit.

Firmware Setup and Support

Support for your printer using the Unified Firmware is included free with the purchase of the kit. TH3D supports covers features listed on the Unified Firmware page.

If you need more advanced configuration in a case where you have a custom machine or swapped a board on a standard machine this may or may not be included depending on how much time is required, this is handled on a case by case basis.

If you need help with a custom machine that runs Marlin please contact us here http://ContactUs.TH3DStudio.com

Warranty

This kit comes with a full 90 day warranty against any failed component of the kit (board, AC/USB adapter, sensor, enclosure). Warranty is longer if you purchased the Extended warranty plan when you purchased your EZABL™ Pro Kit

If you have a problem with the unit you can contact us through http://ContactUs.TH3DStudio.com

Trademark

EZABL™ is a registered trademark of TH3D Studio LLC.

Change Log

- V1 – EZABL™ Pro Installation Guide 1st Release
- V1.1 – Added section on how to remove the plug from the EZABL Pro board.
- V1.2 – Added more notes about mini sensor rings and picture of the ring.
- V1.3 – Updated information about printed sensor mounts. Added picture of adjustment/calibration screw on sensors. Added picture of PSU with V+ and V- called out for direct power connection.
- V1.4 – Added note about slicer setting NOT to be set to put home in the center of the bed since many people were doing this for some reason. Updated support info for new contact page.
- V1.5 – Improved firmware directions and added further clarification for custom probe mounts.
- V1.6 – Added more words to convey the proper way to mount the wire to the hotend. Added appendix to end of guide.
- V1.7 – Updated link to the offset settings video.
- V1.8 – Updated link for EEPROM plugin
- V1.9 – Updated Firmware download information. Added information about self-test button.
- V2.0 – Revised starting code directions
- V2.1 – Added details about the LED colors on the sensors.
- V2.2 – Update help center links to new URLs
- V2.3 – Fix spelling typos on some pages.

Appendix
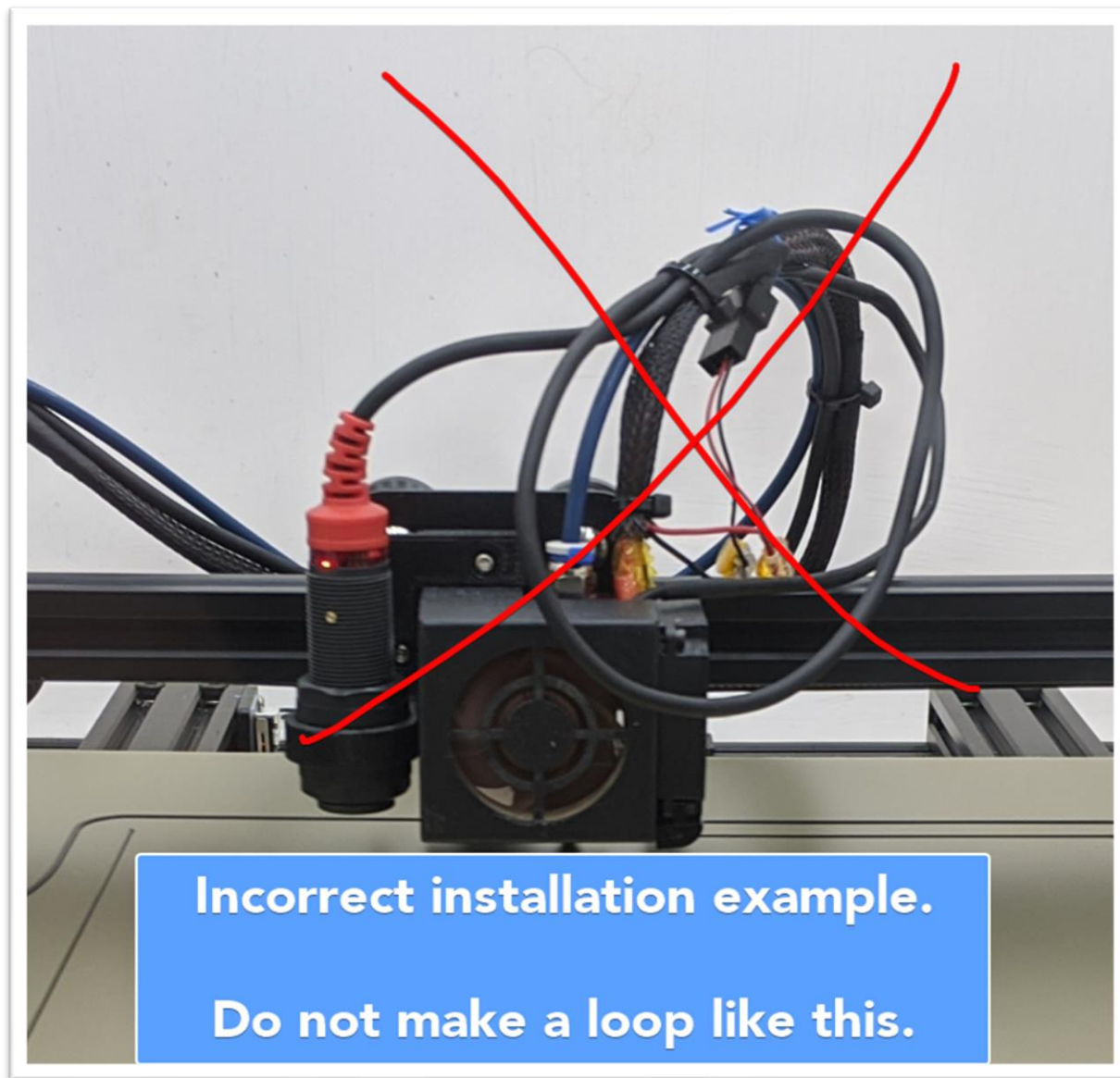
Sensor wire incorrect routing example.