

If you were sent here from Creality, EBay, Aliexpress, Amazon or any other site selling ABL kits be aware these are clones. They are NOT supported. Buying them will directly impact our ability to continue to provide for the 3D printing community and put food on our table.

Please click here to get a Genuine EZABL™ kit from our website.

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Before we start, we just wanted to thank you for choosing the TH3D EZABL™ kit. We've been working on perfecting the easiest, well documented, and supported ABL kit on the market. The V3 kit is the result of over a year 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 hand assembling all of them in our offices here in the USA. 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 sensor factory 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 emailing [Support@TH3DStudio.com](mailto:Support@TH3DStudio.com). If something is not up to our rigorous QC standards, please let us know so we can make our assembly guys aware of 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).

Thank you again for choosing TH3D and Happy Printing!

Sincerely,



~Tim Hoogland



# TH3D EZABL™ Installation Guide

**V1.8.2 - 4/17/2019**

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Re-distribution is NOT permitted and must be downloaded from our website  
**ONLY FOR USE WITH EZABL™ KITS**  
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# Getting Started

Welcome to the EZABL™ kit installation guide! This will walk through the steps to install the EZABL™ sensor on the printer.

There are 2 different versions of this kit so pay attention to which version you have. They both function the same but the wiring installation is slightly different.

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

**Direct Wire (EZABL™ on left, EZABL™ Mini on right) :**



**EZ-Connect (EZABL™ on left, EZABL™ Mini on right):**



# Preparation

If you are not comfortable flashing your printer's firmware, moving wires around, and/or taking your hotend mount apart you should NOT be attempting this upgrade as you could damage the printer. Contact us with any questions before hand if you are unsure of upgrading. Support covers the product itself. If you need assistance with your slicer, tuning your machine, or other non-product related issues please check out our communities.

Before you begin you should have the following:

- **TH3D EZABL™ Kit**
  - 1x EZABL™ Sensor w/ Module (this will be soldered to the EZABL™ Module)
  - Power Source – Varies on the module
    - Direct Wire has 3FT of 2 Conductor (red/black) wire included to go to the 2 pin terminal on the EZ ABL Module.
    - EZ-Connect has an included 12V AC/DC Adapter (US Plug) and Direct wire adapter plug (V3 kits only shipped after 7/2018).
- **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).
  - OR we offer printed parts if you do not want to print your own. Prices are about \$10-30 (depends on the mount) for an ABS printed mount. If you want one in your order please put a note on it and we can contact you. Small ones like the OEM are free of charge if noted in the EZABL™ order.
- **Latest copy of the firmware for your printer**
  - This is usually the Marlin source code – Varies by printer model
  - If you have a custom printer and need firmware help this is available at a discounted rate for EZABL™ customers.
  - **We have firmware for over 20 different machines on our website for customers**  
**– Check your order email for download info.**
- **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 [HERE](#) for flashing the bootloader.
- **A #2-#2.5 Regular Screwdriver to adjust the sensor sensitivity – Using too small on the EZABL™ Mini Adjustment may result in damage that is NOT covered under warranty.**

If you are missing anything from the TH3D EZABL™ kit then please email [Support@TH3DStudio.com](mailto:Support@TH3DStudio.com)

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

## 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™ 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 on page 24 of this guide.
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 an EZ-Connect model make sure the power 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 a M3 screw assortment from 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.

**Any of the models with the 1284p chips require a bootloader.**

**The CR-10, Ender 2, Ender 3, and Wanhao i3 all use the same process for the bootloader. There is a guide on our knowledgebase on how to load the bootloader.**

**The Anet uses the same process as the CR-10 but with different pin connections (also on our Knowledgebase but select Anet V1.0 from the board menu in the IDE).**

**We have an installation video here that goes along with this guide:**

**<http://EZABLVideo.TH3DStudio.com>**

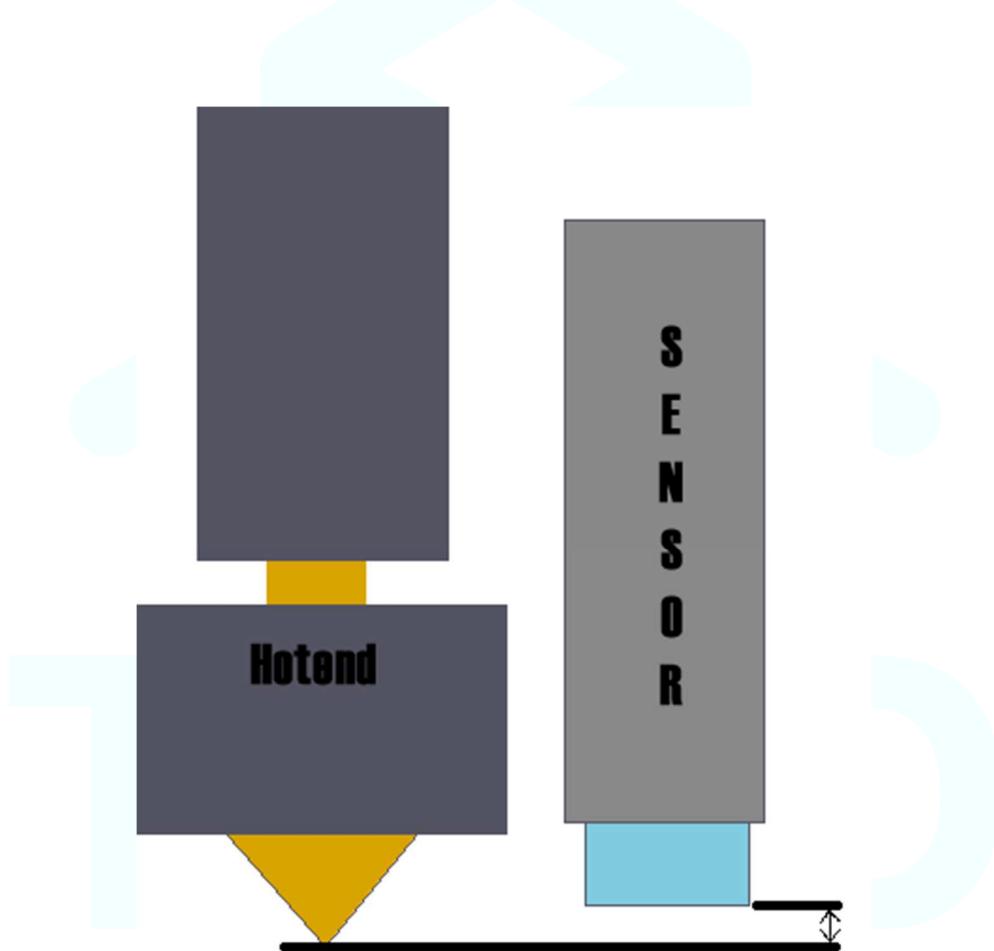
**ALL TROUBLESHOOTING INFORMATION IS TOWARDS THE END OF THIS GUIDE AND ON OUR KNOWLEDGEBASE HERE: <https://support.th3dstudio.com>**

# Installation

## 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 1mm ABOVE the tip of the nozzle for the EZABL™ Mini and 2mm ABOVE the tip of the nozzle for the EZABL™.** This does not have to be exact just higher than the nozzle but not too high.

**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.

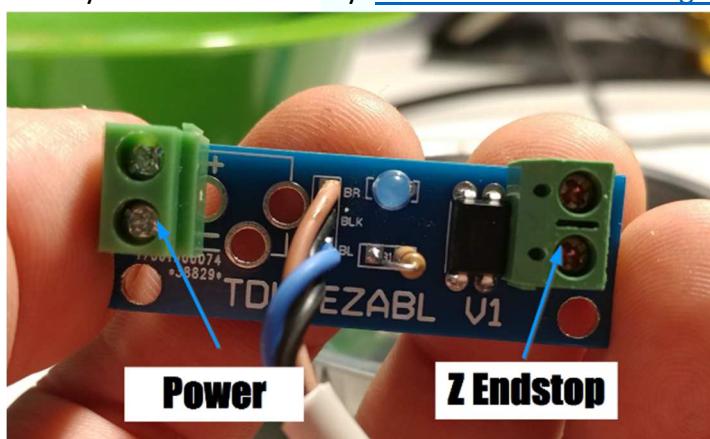


**1MM higher than nozzle for EZABL™ Mini | 2MM higher than nozzle for EZABL™**

## Wiring the sensor

Connect power to the EZABL™ Module

- If you are using the **direct wire** version then you will need to connect the module to the 12V OR 24V power that is on your printer. The **top pin is positive (+)** and bottom pin is negative (-). We recommend connecting direct to the power supply. Contact support with pictures if you are unsure if you wired it correctly. [Click here for PSU wiring info.](#)



**POLARITY MATTERS. BOARD WILL SHORT IF WIRED BACKWARDS ON V1 and V2 BOARDS. V3 BOARDS HAVE REVERSE VOLTAGE PROTECTION STANDARD. WIRING TO AC WILL KILL ALL KITS**

- If you are using the **EZ-Connect** version then simply plug in the power adapter and the other end into the DC jack on the EZABL™ module

## Connect your Z endstop to the EZABL™ Module

- If you are using the **direct wire** version then cut the leads going to your current Z endstop switch and connect them to the EZABL™ port labeled ZMIN
  - If you have the **EZ-Connect** version then unplug the 2/3 pin connector from your Z endstop and plug it into the EZABL™ port labeled ZMIN – **DO NOT USE JUMPER WIRES FOR THIS AS THEY DO NOT MAKE PROPER CONNECTION AND CAN DAMAGE OUR BOARD.**

If your printer has 3 wires going to the Z endstop connection, please contact our support BEFORE connecting. You can contact us at [Support@TH3DStudio.com](mailto:Support@TH3DStudio.com). For the Geeetech A10 with a 3 wire endstop see page 30 for wiring the Z endstop.

## Test the sensor for detection

Power on your printer and verify that the sensor is working by touching the sensor with your finger. The LED light on the Sensor AND the module should light up. If they do not light up adjust the screw clockwise on the sensor (top on EZABL™, white on the side of the EZABL™ Mini) until it lights up when you touch it.

**Firmware Setup – CLOSE ALL SLICERS BEFORE FLASHING**

If you have the CR-10 (all sizes), CR-10S (all sizes), Tornado, TAZ5, Anet (A2, A6, A8, E10 or E12), Ender 2, Ender 3, Wanhao (i3, i3 Mini, D6), Geeetech A10 we have already done all the firmware work for you. The pre-configured firmware is on our website here:

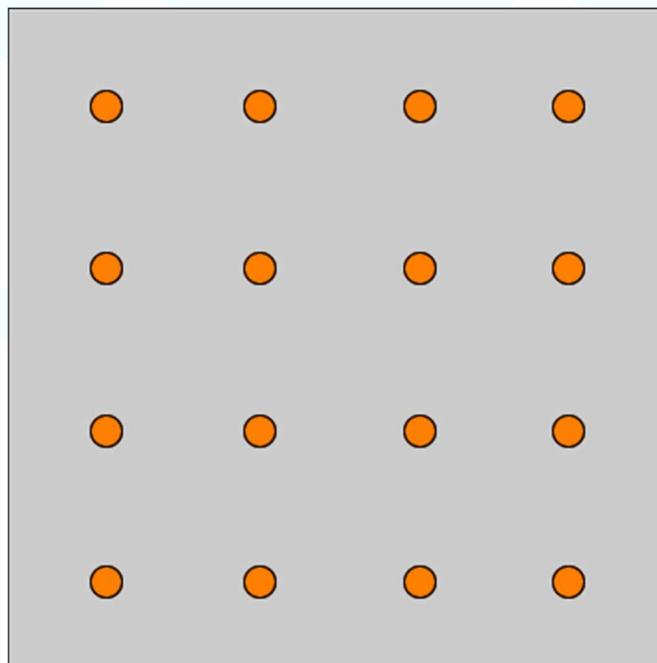
<https://www.th3dstudio.com/knowledge-base/th3d-unified-firmware/>

**If you have a printer that needs a bootloader this must be flashed. See the Unified Firmware page for details on this. Select Arduino as ISP for the programmer.**

In the Unified Firmware uncomment the printer model you have and the probe mount you are using. Probe mount STL files are included in the Unified Firmware package for every model we support.

Set the EZABL\_PROBE\_EDGE setting to 45-50mm for larger printer beds (300mm+ size beds) and 10-20mm for smaller printer beds. Check to make sure the probe is not probing over any binder clips and/or screw heads in the bed as this can affect the reading.

If you have a custom machine we can assist with setting up the firmware as long as you have the current firmware for the machine and it is working 100% without the EZABL™ installed already. We will need the full source code used to do these changes.



**Example of probing points on a bed**

## **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™ board.**

**DO NOT HOME YOUR Z UNTIL YOU VERIFY THAT THE FIRMWARE IS SEEING THE SENSOR CORRECTLY  
AND YOU HAVE CALIBRATED THE SENSOR (PAGE 9). YOU CAN DAMAGE YOUR HOTEND AND/OR  
PRINTER.**

Start by moving the Z up until the light on the sensor and the EZABL™ module 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.

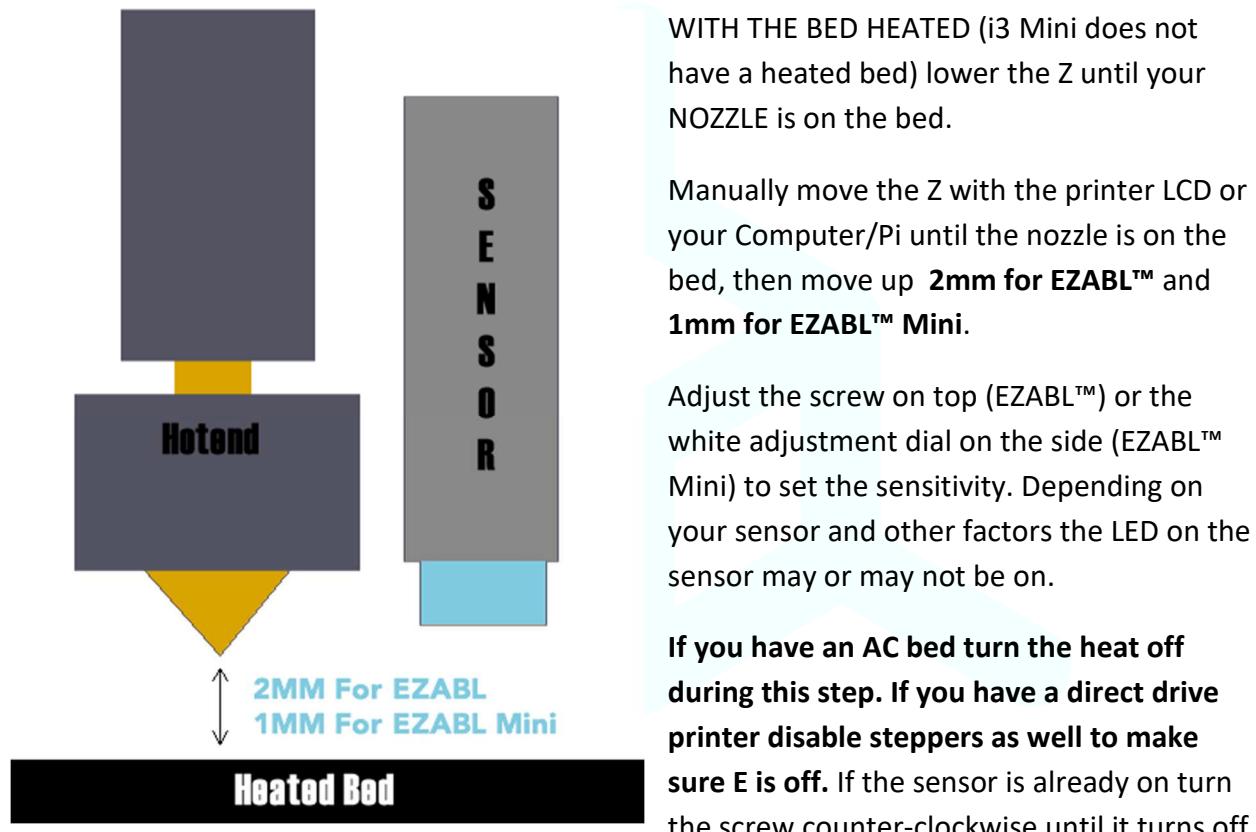
**If it does not then reverse the 2 endstop wires. We have a guide (with video) for this if you are using the EZ-Connect model on page 29.**

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.

```
> M119
< Reporting endstop status
< x_min: open
< y_min: open
< z_min: open
> M119
< Reporting endstop status
< x_min: open
< y_min: open
< z_min: TRIGGERED
```

## Setting the Sensor Sensitivity

The next step is setting the sensor sensitivity. To do this heat your bed to your normal print temperature. 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. **SEE PAGES 15 & 16 for adjusting the EZABL™ Mini correctly, damage may result if you do not.**



Now turn the screw clockwise slowly until the sensor LED turns on. Make sure the LED stays on when you remove your screw driver 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. Repeat the clockwise adjustment until the LED stays on when you remove your screwdriver and hand from the sensor. If you are having issues getting the LED to stay on check the grounding on your machine.

**Do NOT change the sensitivity if you are getting different heights between prints due to temperature changes. This should be handled by the ZOffset and/or BabyStepping the Z height. Under normal conditions at most you should only have to occasionally Babystep about 0.1-0.2mm. 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: <http://EZABLVideo.TH3DStudio.com>

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.

To set your Z Offset heat the bed to your normal print temp and do a G28 to home the sensor. Your **EZABL™ sensor** should be in the middle of the bed. Let it sit there for 5 minutes after the bed has reached its target printer temperature. After homing the Z will show 5mm. This is NOT included in the ZOffset. Move Z down 5mm before proceeding.

What you will do now is 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. That is what your Z Offset is.

Enter that number in the ZOffset section using your printer LCD, look for Z Offset or Probe Z offset. This is located under Menu>Control>Motion. Make sure you store your Z Offset by going to Menu>Control>Store Memory. If you do not store your memory the Z offset will be forgotten when you restart the printer.

Now do another G28 command. The Z should show 5mm still but if you notice it will actually be 5mm as the offset is taken into account when homing Z. This is new behavior in the U1.R2.X firmware.

You can now 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 below to fine-tune.

**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 “BabyStepping Z” menu. You can then turn the knob left to bring the nozzle closer to the bed in real time or right to move it further away. It is NORMAL to have to babystep a little especially when changing bed temps. If the resulting 1<sup>st</sup> layer is level after adjusting the 1<sup>st</sup> 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.**

## 1<sup>st</sup> Layer Recommended Settings

To get the best 1<sup>st</sup> layer and adhesion we recommend the following settings:

- 150% 1<sup>st</sup> layer width
- 0.3mm 1<sup>st</sup> layer height
- Print SLOW 25-30% speed or 20mm/s

## Update your Starting Code in your Slicer

If this will not copy correctly use the EZABL Starting Gcode.txt file in the Installation Guide Directory

---

M75 ; Start Print Timer and Engage Fil Sensor if USB Printing  
G92 E0 ; Reset Extruder distance to 0  
G1 E-2 ; Retracts filament to prevent blobs during probing  
M84 E ; Disable E Motor for probe accuracy on direct drive systems  
G28 ; home all axes  
G28 Z ; home Z to get more accurate Z position  
G29; EZABL mesh generation  
G4 S10; wait for heaters to recover

M117 Purge extruder  
G92 E0 ; reset extruder  
G1 Z1.0 F3000 ; move z up little  
G1 X0.1 Y20 Z0.3 F5000.0 ; move to start-line position  
G1 X0.1 Y100.0 Z0.3 F750.0 E15 ; draw 1st line  
G1 X0.4 Y100.0 Z0.3 F5000.0 ; move to side a little  
G1 X0.4 Y20 Z0.3 F750.0 E30 ; draw 2nd line  
G92 E0 ; reset extruder  
G1 Z1.0 F3000 ; move z up little

M117 Printing.....

**Make sure you replace your starting code with the one above. This will perform the auto bed leveling after Homing XYZ.**

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 help keep the sensor temperature consistent with every print and make sure everything is at the correct temp before it runs through the EZABL™ routine. Some say this is due to sensor drift and others say it's due to the machine flexing as it heats. Either way it's recommended to pre-heat your machine for the best experience possible.**

### Sensor Wire Routing

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.

We recommend using cloth or electrical tape (like Creality uses) to secure the wire to the existing hotend wiring close to the hotend (40mm or less). If you use Zip ties then leave about 1" of slack so the wire can freely move without being strained in the same place. **DO NOT USE THE REAR CABLE MOUNT WITH A PETSFANG. USE THE BOWDEN TUBE TO ROUTE THE WIRES.**

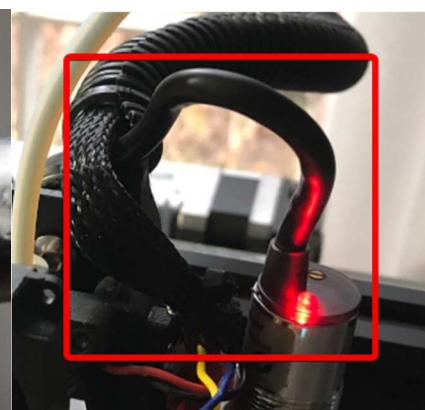
Damage to sensor cable due to zip ties and PETSFANG rear cable mount:



Zip Tie Damage

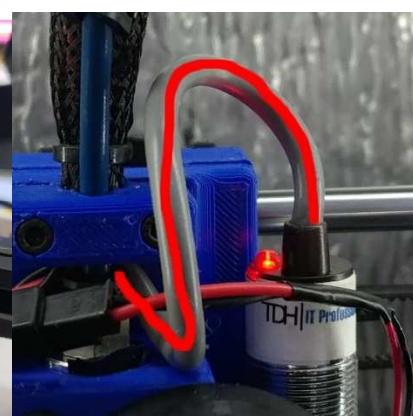
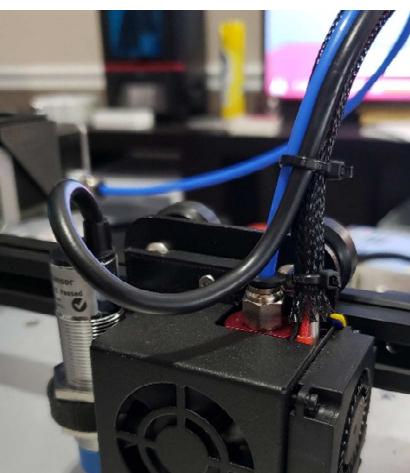
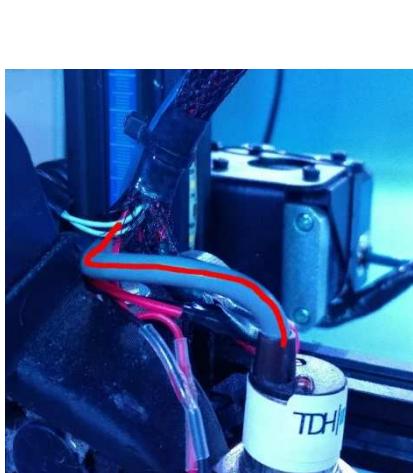


Zip Tie Damage



PETSFANG REAR CABLE MOUNT

Proper cable routing examples below. Notice there is slack on the cable and it is secured close to the hotend so it cannot be flexed by hotend movement.



### **Sensor Accuracy and Heat**

It is important to note that these sensors can be affected slightly by large temperature changes from the bed heat. Therefore, it is important that you must do all the calibration **with the bed heated**. If you do not do the steps with the bed heated then your calibration and Z Offset will be incorrect. This will result in the print either being too low or too high when you go to print.

### **Converting the EZ Connect to Direct Wire**

If you purchased the EZ connect version and want to do away with the wall wart to power the sensor you can simply cut the wire off the 12V AC/DC adapter and wire it to your 12V printer power supply. Doing this does void any support on the device but if you are comfortable with it you can do so. The center pin on the DC jack is the positive and the outer sleeve on the plug is negative. Verify this by testing the continuity on the wires to each of the parts of the plug.

All EZABL™ EZ-Connect kits shipped after June 2018 include an adapter plug to convert to direct wire for the power and are compatible with 12V and 24V input voltage.

If you wish to use another Z connection instead of the 3 pin plug you can simply pickup a JST-XH 3 pin connector and wire that to the ZMin port on the EZABL™ board.

### **OctoPrint Notes and Tips**

For those of you using OctoPrint I highly recommend installing 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:

<https://github.com/houseofbugs/OctoPrint-EEPROM-Marlin> <- USE OUR VERSION

### **Firmware Setup and Support**

Basic support for your 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 please send an email to [Support@TH3DStudio.com](mailto:Support@TH3DStudio.com) and check the Knowledgebase on <https://www.TH3DStudio.com>

**EZABL™ Mini Sensor Adjustment – MUST READ**

The adjustment in the EZABL™ Mini has a metal stop tab that prevents from overshooting the adjustment. If you are not careful and/or you use a screwdriver too larger (or too small) you can strip out the adjustment. Use a #2-#2.5 size screwdriver to adjust this adjustment and GO SLOW. The adjustment on the mini is more sensitive than the full size if you are used to adjusting that sensor.

**PICTURE SHOWING INCORRECT ADJUSTMENT**



PICTURE SHOWING CORRECT ADJUSTMENT



**DAMAGE TO THE ADJUSTMENT IS NOT COVERED UNDER WARRANTY.**

**ALL adjustments are tested by TH3D before shipment for movement.**

## Troubleshooting

**Please review the troubleshooting information below before submitting a ticket.**

**If you need to submit a ticket, please email  
[Support@TH3DStudio.com](mailto:Support@TH3DStudio.com).**

### Changing your print surface

ANY time you change your surface type (example: going from glass to BuildTak) you may have a different Z offset. This is because the sensors detect different materials at different sensitivities. Just repeat the “Setting your Z Offset” section of this guide.

You can also automate this if you know what your offset is for each surface type by putting it in your slicer starting code. M851 Z-X.XX sets the Z offset. This must be placed BEFORE all the other starting code.

### Sensor Inconsistent Readings

If you are getting inconsistent readings with the sensor do a G28 and then G29 before you start printing. This will make sure the sensor is up to the temperature that you used to calibrate the sensor. If you are still having issues check your printer for mechanical issues and run the M48 test outlined on page 20 to rule that out before contacting support.

### My Z will not Home

You must home XY before you can home Z. Just use G28 to home all and your printer will home XYZ automatically.

## **Advanced EZABL™ and Printer Troubleshooting**

Read here: <https://www.th3dstudio.com/knowledge-base/ezabl-advanced-ezabl-and-printer-troubleshooting/>

This is on our website now as we add to it as we get updated information and things as new machines come out.

### **Is the bed level-ish?**

EZABL™ can't work miracles. You need to make sure your bed is as level as you can get it by adjusting the corner screws. When you have EZABL™ working well you may like to consider swapping the springs and screws for solid mounts. You can get the Solid Mounts we sell from the shop or just use aluminum spacers in place of the springs.

If you use printed parts for the bed mounts they MUST be in ABS and I recommend 3 outer walls with 75-90% infill. ABS will hold up to around 105C bed temps before it starts getting soft. We also offer hybrid aluminum/ABS mounts and ABS mounts for select models with extra features on the TH3DStudio.com store.

There's no magic number for how flat your bed needs to be, but you want any variations to be no more than 1mm across the entire bed. You can check it manually by laying a straight edge (such as a steel rule) across it or using your probe by increasing the number of probed points using the instructions under 'Measuring your bed flatness'.

You also want to make sure the X gantry is **level with the frame of the printer, not the bed**.

If you have a particularly warped bed try increasing the probe points in the firmware (located in the EZABL™ settings section towards the bottom of the Configuration.h file).

### **Are you using a plugin with OctoPrint?**

There are many plugins for OctoPrint that are great. However plugins like "ABL Expert" cause issues due to their poor coding and default options that are selected upon installation. Please disable any "ABL" plugins before contacting support.

Also make sure you are on the latest version of the "EEPROM Marlin Editor Plugin" or our version before contacting support. Older versions are known to break the EZABL™ from working correctly.

3<sup>rd</sup> Party Plugins for Octoprint are NOT supported in the included product support.



### **Is your probe working well?**

One of the first things you should do after installing your Z-probe is check how well it works using the M48 command to test it.

**In our latest firmware (TH3D Unified Firmware) M48 is enabled by default for ALL machines that we support. Please update to this one before contacting support as it addresses issues present in older firmware releases.**

Use commands like this to run 10 probes and get the measurements:

```
M48 P10 X100 Y100 V2
```

The output will look similar to this:

```
M48 Z-Probe Repeatability Test
Finished!
Mean: 3.450000 Min: 3.442 Max: 3.452 Range: 0.010
Standard Deviation: 0.004330
```

This shows the absolute maximum and minimum measurements the sensor took, the mean (average) of all the measurements, the range between the maximum and minimum, and the standard deviation.

The standard deviation is interesting because it tells us that 68% of all the measurements were within 0.00433mm (one standard deviation) of either side of the mean, and 95% of the measurements were within 0.00866 (two standard deviations) of the mean.

A good probe should consistently give a range in the hundredths of mm, e.g. 0.05mm. A very good probe will have a range in the thousandths. EZABL™ probes typically test UNDER 0.02mm on well setup machines with no mechanical or electrical issues.

If you get a very large range or standard deviation you should look for sources of movement in your Z-axis or the VREF on Z is set too low.

The motor couplers can contribute to excess play and you can consider upgrading them to better ones (like Upgraded Couplers, TH3D sells them), ESPECIALLY if yours are stretched out. Failing that, contact our support for more troubleshooting. If the probe is bad we will replace it under warranty.

### **Some tips for probe accuracy**

- The 'spring' type Z-motor couplers allow vertical play, which can affect the probe results. You can replace them with 'Plum' style couplers which have no vertical movement.
  - TH3D Shop link: <https://www.th3dstudio.com/product/upgraded-leadscrew-coupler-for-cr-10-cr-10s-tornado-ender-2-and-more/>
- Probe measurements will vary near the edge - ensure that your probe boundaries are far enough from the edge to avoid this, the entire probe cap needs to be ON the bed.

### **Are you probing enough points?**

If your bed is curved or particularly warped you can increase the number of points the probe measures in order to create a more detailed correction matrix (at the expense of time - more probes means G29 takes longer).

Try a 5×5 or 7×7 grid by changing this line:

```
#define EZABL_POINTS 5
```

TH3D

### **Are your X and Y offsets correct?**

For EZABL™ to work correctly it is **essential** that the printer knows the exact offset from the nozzle to the probe, otherwise any correction is not going to be applied in the right place, and it may look like the printer isn't correcting at all.

**If you downloaded the Unified Firmware and used one of the mounts we supply these are correct already as we have printed, mounted, and measured them all for you already.**

It is absolutely vital that you check the sensor offsets once your probe is installed, and update the values in configuration.h accordingly, you will need to uncomment #define CUSTOM\_PROBE and enter them in the configuration.h file.

These are the relevant lines:

```
#define X_PROBE_OFFSET_FROM_EXTRUDER 65 // X offset: -left +right [of the nozzle]  
#define Y_PROBE_OFFSET_FROM_EXTRUDER -36 // Y offset: -front +behind [the nozzle]
```

Typically, sensors are most sensitive in the center, so we need to know the offset from the tip of the nozzle to the center of the probe. Here is an approach you can use to measure it:

### **Measuring X and Y offsets**

1. Home X and Y then move your Z down until the nozzle is on the bed
2. Move the nozzle to roughly center on the bed and mark where the nozzle was
3. Cycle the power on the printer to reset the XY position, it should show 0 for each
4. Now move the head using the Prepare > Move Axis on the LCD (or you can also use your computer to move the axes) until the center of the probe is over where the nozzle was
5. Look at your X and Y position, these are your offsets.
  1. If the sensor is LEFT of the nozzle the offset is negative (Ex: -10). If it is to the right then the offset is positive (Ex: 10)
  2. If the sensor is in FRONT the nozzle on Y then the offset is negative (Ex: -5). If it is BEHIND the nozzle on Y then the offset is positive (Ex: 5).

The offset parameters are integers, so round your results to whole numbers before updating configuration.h

**Did you let it warm up?**

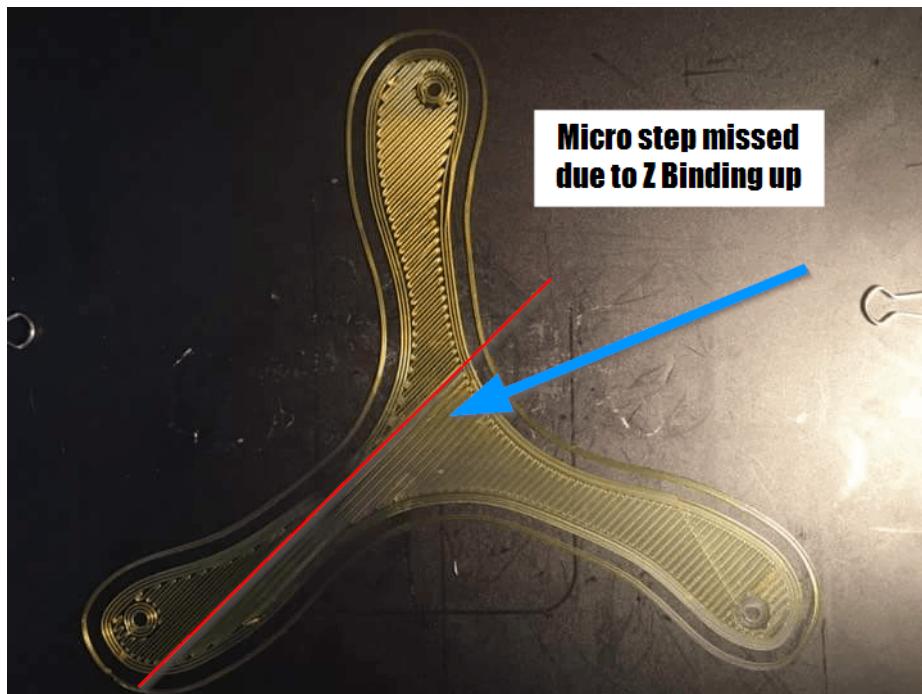
Before setting your Z-offset you need to make sure your printer is up to temperature and you've given it a few minutes for any thermal expansion to occur. Differences in nozzle height of around 0.2mm have been observed between a hot and a cold nozzle. If you set your Z-offset with the nozzle cold, you will most likely find it is too close to the bed when it is hot.

You should also ensure that the printer has had sufficient time at temperature before starting a print. Ideally give the printer 3-5 minutes after it reaches printing temperatures before you start to print. I typically issue a G28 so that the sensor is dead center on the bed while I am heating up the printer for calibration or a print. If you have a Pi setup you can add G28 to the starting scripts under the GCODE Scripts section in your OctoPrint settings.



**Is your Z Binding up (CR-10 images but applies to ALL printers)?**

ABL has sides that are lower and/or higher than the rest of the bed.

**Details**

After sending out multiple kits and getting feedback from customers that has issues there are many that had Z axes that were not working correctly and this throws off the probe. Before you move forward check that you can easily move your Z axis leadscrews. If there is a lot of resistance then you need to adjust and/or lube your Z axis (both sides if you have dual Z).

If you are getting inconsistent or odd behavior with the ABL then the likely culprit is a Z axis that is binding up in certain spots.

The Z leadscrews should be able to be turned by hand with minimal effort.

### Checks

With the motors DISABLED try moving the Z by grabbing the coupler (the silver piece that connects the leadscrew to the motor) and turning it. Your couplers should look like below and NOT be stretched out.



There should be little to no resistance when you do this. If you have resistance then proceed with the checks below. **You must check this by HAND. Just because it moves with the motors does NOT mean you do not have an issue.**

### Leadscrew Alignment

Your leadscrew should be the same distance from the extrusion from TOP to BOTTOM. Measure this. If yours is tilted try the “Z Motor is too close to the extrusion” solution below.



### Resolution/Possible Causes

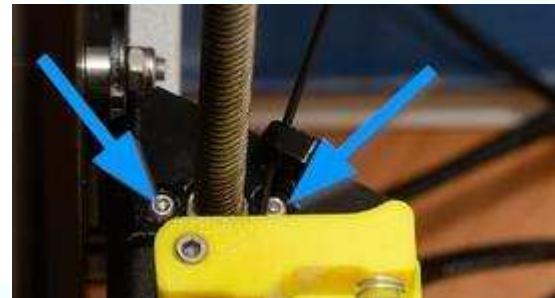
- **Z Motor is too close to the extrusion**

- Print a new Z mount: <https://www.thingiverse.com/thing:2158680>
- Add a washer to space it out from the extrusion



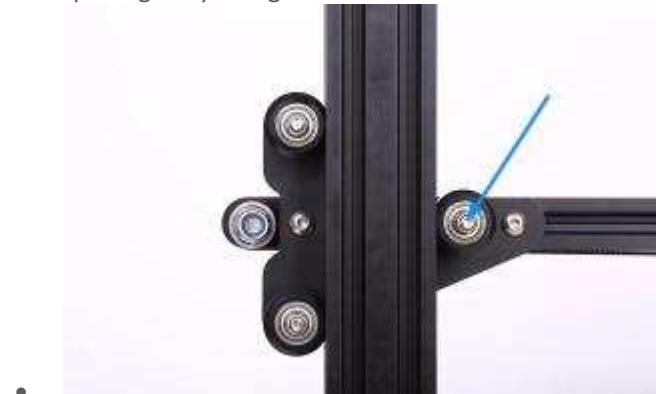
- **Z Leadscrew Brass Nut is Binding**

- Loosen the screws on the brass nut about 3/4 turn so it is slightly loose in the bracket. This applies to BOTH if you have Dual Z



- **Z Tension Bearings are too tight**

- On each of your Z axis/X Gantry brackets there is a single wheel. This wheel has an eccentric nut that is used to adjust tension. Use the included wrench and turn this nut until you are just able to move that wheel smoothly with your hand. It should NOT spin freely but it should just touch the extrusion enough to keep the gantry straight.



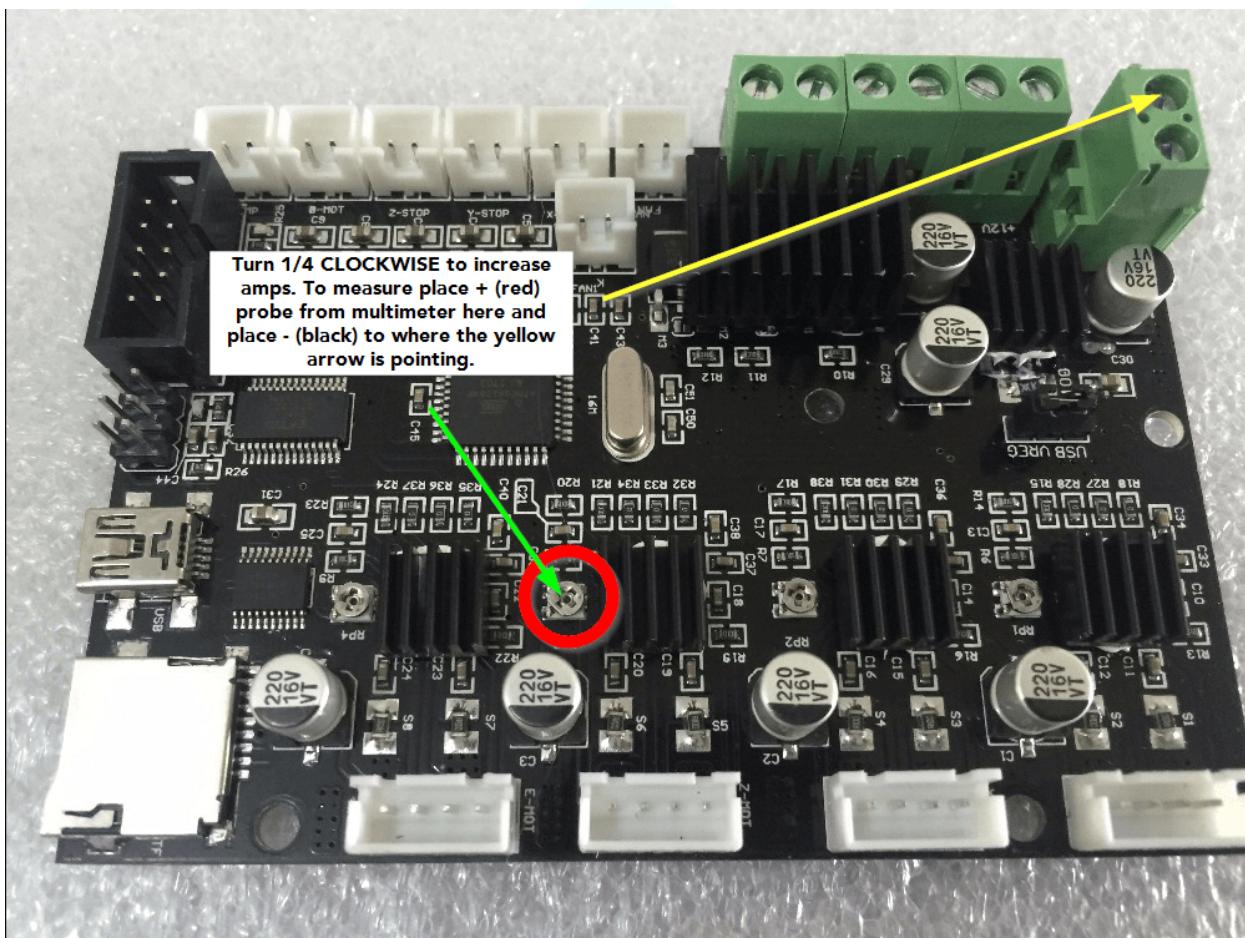
- **Z Leadscrew needs Lubrication**

- If the above fixes do not work try adding lubrication to the leadscrew from top to bottom. You just need a small amount and then move the z up and down completely a few times to spread the lube evenly. I recommend you do this anyways as it will help ensure smooth operation of the printer.
- Large Tube: <http://amzn.to/2uO244O>
- Small Tube: <http://amzn.to/2uO3Kvb>

### Z Axis Stepper Amperage is too Low

If your Z steppers are getting too little power you can verify by moving the Z up 100mm from your control box and then grabbing the Z leadscrews. The motors will be engaged and if you have proper amperage then they will be VERY hard to turn. If you can turn them easily and make the motor skip (you will feel it skipping a step) then you need to check the connections to the Z motor(s).

If your connections are good then you need to adjust the VREF on your Z axis by turning the small potentiometer about 1/4 turn CLOCKWISE to increase the amperage going to the Z motor. If you have a multi-meter (HIGHLY recommended) you can check the VREF voltage by placing the positive probe on TOP of the potentiometer and the negative to any negative coming from the power supply. The ideal VREF for dual Z is about 0.9-1.0V, single is 0.7-0.8V.



TH3D sells a low cost multimeter AND ceramic screwdriver kit for \$10 in the [TH3D Shop](#)

All Amazon links ARE affiliate links meaning if you purchase the product from the links we receive a referral fee for you purchasing them. This does NOT cost you anything and helps support us.

## Z Endstop Not Triggering

THIS ALSO APPLIES TO THE DIRECT WIRE. JUST SWAP THE 2 WIRES AND RUN THE M119 TEST AGAIN.

### Issue

If your Z Endstop is not triggering this could be due to a manufacturer wiring configuration on your Z endstop connector. The EZ-Connect has been setup based on testing of multiple CR-10 machines that we have in house. But after sending out many kits it appears that the wiring that Creality uses is not consistent and they reversed the wires in some Z Endstop connectors.

### Resolution

To fix this you need to use a small pin to carefully push out the wires from the Z Endstop pin and swap them around. This will make the Z Endstop trigger.

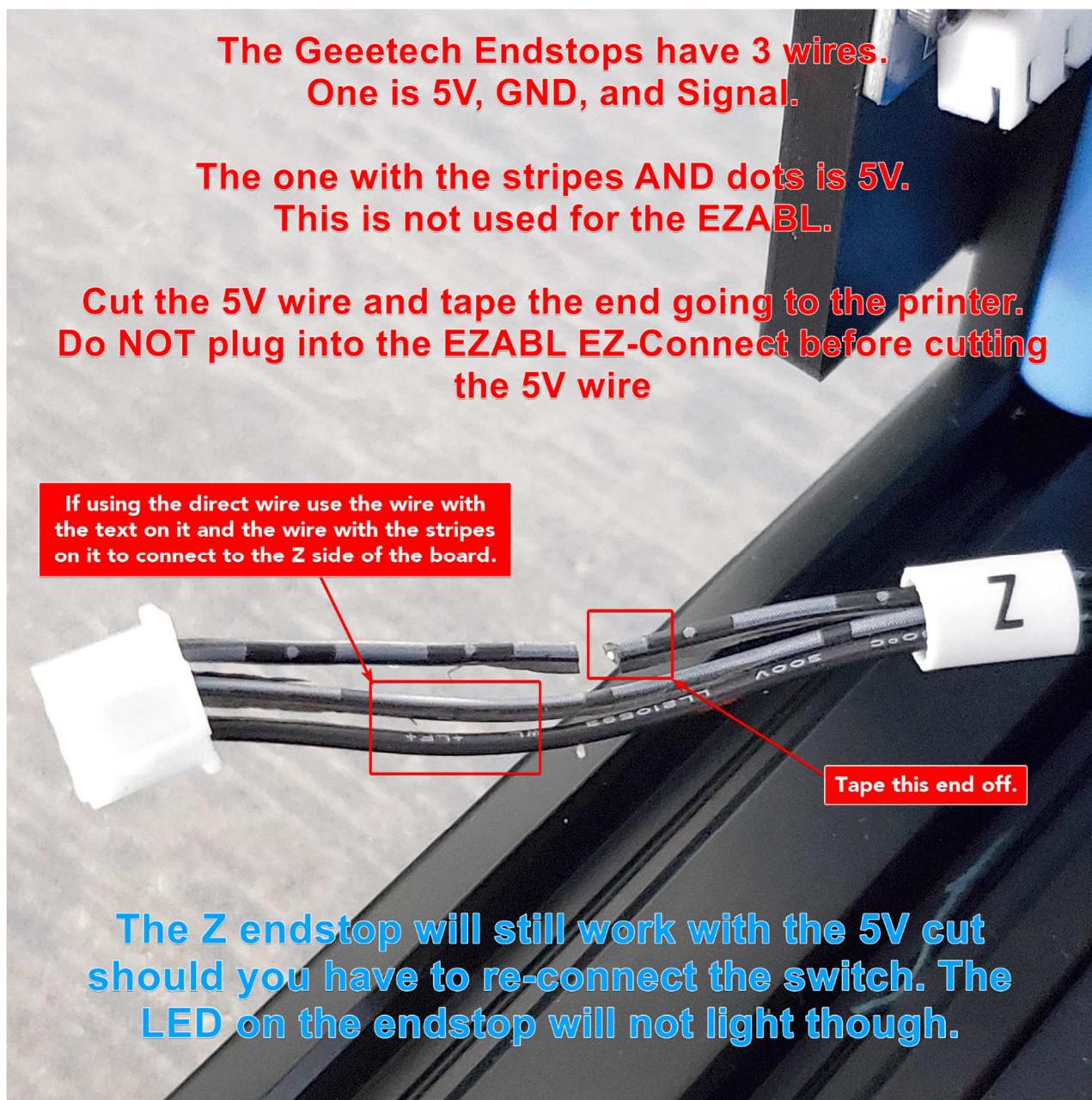
Here is a video showing how to do this. The connector in the video is slightly different than the CR-10 Z Endstop but this method works the same. <https://www.youtube.com/watch?v=TzF14MPu46I>

### But why do I need to do this when the stock Z switch works?

The EZABL™ module uses an IC chip that is what is similar to a diode. Diodes only allow electricity to flow one direction. Whereas a switch just connects 2 wires together no matter what way they are connected. If the wires are reversed from the baseline printers that we used for testing then the signal will not flow and reversing the wires will fix this.

### Will my stock Z Endstop still work if I want to go back to it?

Yes, this will not change how the stock switch works and you will not need to swap the wires back before installing the stock Z endstop switch.

**Geeetech A10 3 Pin Z Wiring Notes**

## Legal

By purchasing and install 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.

## Warranty

This kit comes with a full 90 day warranty against any failed component of the kit (board, AC/USB adapter, sensor, enclosure).

If you have a problem with the unit you can contact us at [Support@TH3DStudio.com](mailto:Support@TH3DStudio.com) and I will setup an RMA.

**\*\*International customers – Depending on the shipping cost you may be required to pay all or some of the shipping for RMA issues\*\*\***

STL files are on the website for download if you want to print your own for any reason (color, style, etc). **Older kits with the non-slanted case (with 2 screw holes on each tap) are secured with high strength hot melt.** New cases have the EZABL™ board press-fit into the case. If it pops out just push it back in, it will stay in the case unless you pull on the wires hard.

If you damage the module removing it from the case this is not covered under warranty. Do at your own risk or with guidance of our support team.

## Change Log

- V1.0.NO.PROTO – Initial Draft
- V1.1.NO.PROTO – Changed Setting Z Offset & Sensor Sensitivity Procedure
- V1.2.DR – Added in-depth troubleshooting and ABL information
- V1.0 – Retail Final Release
- V1.1 – Usability changes based on feedback from Prototype customers and retail kit customers.
- V1.2 – Added in Z Axis Step, Updated Images for Sensor calibration and mounting, Added new Direct Wire Diagram for 2 pin power version (current as of 6/1/17), updated M48 directions for CR-10 Use.
- V1.3 – Minor changes to text and changed branding to TH3DStudio
- V1.4 – Overhaul for new firmware and grammatical corrections
- V1.4.1 – Added note about sensor wire routing
- V1.5 – Added notes for Tornado endstop plug wire with EZ-Connect version.
- V1.5.1 – Grammar corrections and updates for the Unified Firmware
- V1.5.2 – Notes about 12/24V since Direct Supports both now
- V1.5.3 – Update for new firmware changes and notes about Anet printers.
- V1.6 – Major updates to installation process, rewrites to make things easier to understand. Changes to links to fix outdated ones.
- V1.6.1 - Added all troubleshooting to the guide for centralized information.
- V1.6.2 – Updated sensor distances for each version, updated video link for Z offset
- V1.6.3 – Page number corrections in guide
- V1.6.4 – 1<sup>st</sup> Layer setting recommendations
- V1.6.5 – Z Offset Updates
- V1.6.6 – Updated for notes about Wanhao D6 and other small notes. Updated starting scrip to slow purge speed and turn off E motor for direct drive systems
- V1.6.7 – Grammatical issue corrections
- V1.6.8 – Added Notes about new EZABL™ Installation Video, added welcome letter <3
- V1.6.9 – Added note about closing slicer before flashing firmware. Updated page numbers from being offset by 1 from adding welcome letter.
- V1.7 – Updated notes about where to download sensor mounts. Updated details about the new cases. Updated Z offset for new firmware (U1.R2.X) behavior.
- V1.7.1 – Added more info for Direct wire kits
- V1.7.2 – Added note about PETSFANG CABLE GUIDE ISSUES.
- V1.7.3 – Added note about making sure sensor nuts are tight. Added link to KB page.

- V1.7.4 – Updated EEPROM Plugin Link to our Version due to bugs with original authors version. Slowed starting code purge line speed.
- V1.7.5 – Added section about ABL Expert plugin and Marlin EEPROM Plugin version.
- V1.8 – Added section about EZABL™ Mini Adjustment
- V1.8.1 – Updated links to new support site. Added “™” for EZABL™ as this is a trademarked name owned by TH3D Studio LLC
- V1.8.2 – Added note about disabling E motor during calibration step, added 1 more example of correct sensor wiring routing to wiring page.

A large, semi-transparent watermark of the TH3D logo is centered on the page. The logo consists of the letters 'T', 'H', '3', and 'D' in a bold, blocky font. The '3' is positioned between the 'H' and the 'D'. The entire logo is rendered in a light blue color that is partially transparent, allowing the background content to be visible through it.