Auto leveling/Auto tramming/ Automatic Compensation

This is not for beginners. If you don't know how to do it…don't. It's not enough documented for someone that does things like that for the first time.

The Wanhao Duplicator i3 is a very cool machine. Apart from burning down your house with the hotbed connector, it can really produce good prints in detail and in size. The bad thing about it is that until the version 2.1, it was difficult to level. So difficult that the community behind it made mods in order to make life easier. Although the scope of this mod is the same, there is one tiny difference: The mod does the leveling for you. This is a not new way of doing things, but a well proven one that we are going to apply to our beloved machine.

Things you will need:

- Print this thing: http://www.thingiverse.com/thing:1455918 It's the holder for our Z Probe.
- Some M3 screws to attach our holder to the fan mount.
- If you prefer to use the 12V voltage for the Probe (not necessary on my setup) then you will also need a 10K and a 15K resistor for a Voltage Divider. See this Video why you need one: https://www.youtube.com/watch?v=EcGFLwj0pnA&t=4s
- Arduino IDE Software https://www.arduino.cc/en/Main/Software for uploading the firmware or a Bootloader
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In order to do this mod, we will have to break it up on parts. I am going to explain why in the next few lines. There are two main questions you will have to ask yourself…

Question 1. I don't need a 12V for my probe. Do I have a 5v output somewhere I can use?

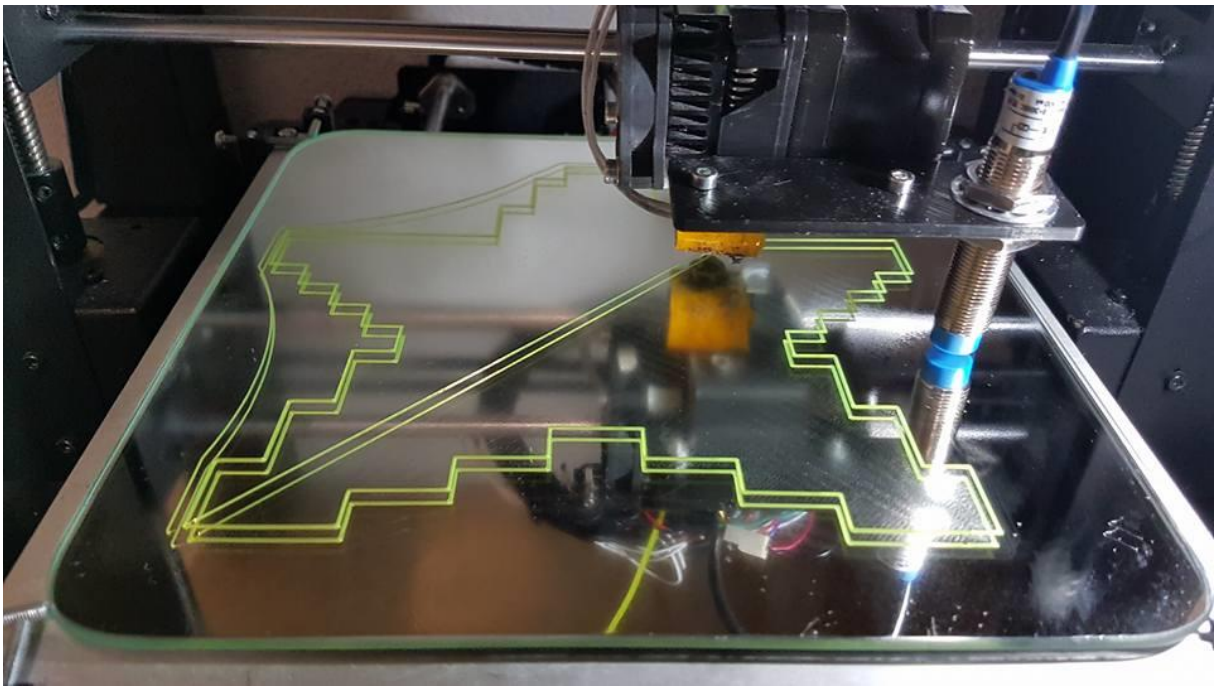
If you did the ATX PSU mod, then you should have plenty. Just use a multimeter and check which cable leads to a 5v source (should be a red cable on the ATX PSU). Mark that pin, that will be called our 5v source from now on.

If you don't have a ATX PSU, then you will have to find a 5v source on the Melzi. This is not hard to do, since 5v is the main voltage used in the ATMEGA chip. The place we are going to draw our 5v is the X or Y endstop connector. Use a Multimeter to identify Positive +5V and GND. The +5V will be called our 5v source from now on.

So we have our answer to Question 1 answered and found a 5v source. Next thing to use is our inductive probe. I am using the model **LJ12a3-4-z/bx**. It has a 4mm sensing distance which is more than enough for our application. There is also a **LJ18a3-8-z/bx** that has a 8mm sensing distance, but is bulkier and add unnecessary weight to our x axis.

This sensor works with a voltage of 6v-36v. But wait? Why are we using 5v since our PSU has a 12V output 12v is well inside the working range of this sensor? The answer is simple. The ouput signal of this sensor is the same as the input voltage. If you supply it with 12v it will output 12v, which means bye bye dear Melzi. We could of course use a voltage divider to reduce it to 5v (link above) but we want to keep it as simple as possible. Also I found that the sensing distance on mine, didn't change by using either 5v or 12v.

The sensor has 3 cables, brown for V input, Blue for Ground and Black for Singal. Yours could differ so check it. Connect the Brown cable to your 5v source we discussed earlier. Remove the Z Endstop connector, unscrew the cables and connect the black and blue to the terminals. Check with a multimeter to connect the correct cable to the terminal. Signal should be connected to 5v and blue to GND. If you did that, your sensor should be working. Take a metal object and go near the sensor. If the red led light on the sensor lights up, you are good to go. Now mount so that it is 1mm higher than the nozzle.



Now from now on…do not use your printer since you actually have no real z endstop! You have been warned!!!

Question 2. Do I have a Bootloader on the Melzi board? If you have one of the new boards, then chances are you have a bootloader, that's the case if you have a 2.0 or 2.1 for instance. Some v1s also came with a Bootloader so you will have to check. How? Google it…. just kidding!

First make sure you have the FTDI Drivers installed. Follow this link:
http://forums.reprap.org/read.php?1,417199,418768#msg-418768

Now it's a good idea to make a Copy of you EEPROM with Repetier Host just in case you screw up :)

Fire up the Arduino IDE and go to File – Preferences – Additional Boards Manager URLs and add the following link to the input field:
https://raw.githubusercontent.com/Lauszus/Sanguino/master/package_lauszus_sanguino_index.json

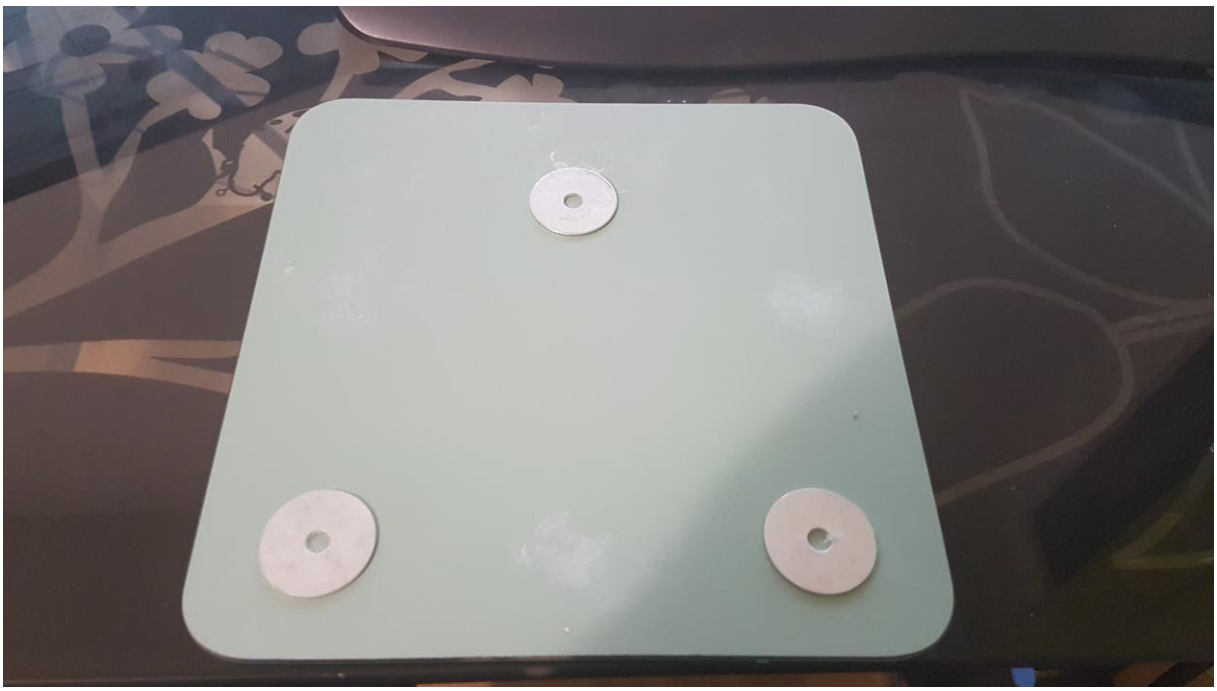
Then go to Tools – Board – Boards Manager. Search for Sanguino and Install it. Then again Tools – Board and select the Sanguino Board and the correct COM port, usually other than COM1. Restart the Arduino Software if necessary to show up the Sanguino.

Now we have selected our Board, we have selected our correct COM port, it is time to download the firmware. You can get it from the files section of the Facebook group. Unzip it and double click on the **Repetier_Autlevel – cpp from dev.ino** file. Now I know many of you have removed the Autoreset jumper. Now it's time to put it on again. The only thing left is uploading the firmware to the Wanhao Duplicator i3. Click on Ctrl+U and wait…. its uploading…wait…wait more…make coffee…and finally your Printer should Reboot.

So from now on you must be **VERY CAREFULL!!** Remember you don't have an Z endstop and the printer has no way of knowing the Z0 is. It would be a good idea to remove any glass from the build plate. The sensor will recognize the plate, but probably not with glass on it. You could always try though, by using the menu and slowly lowering the z position until a red light lights up on the sensor.

In the rar file of the firmware, I have included my EEPROM dump that works for me. Just import the file **eeprom.epr** with Repetier Host and type **M500** in the Terminal (you will have to close Arduino IDE)r

Now our firmware is set to probe 3 points. Bottom left, Bottom right and top middle to form a triangle like in the picture below:



I used 3 large metal washers because well you know what they say..3 points define a plane..ahmm.I hate this sentence! Anyways…Before you do this however, try this on the plain aluminium plate so you can see where the probe lowers in order to position the washers on the mirror. Use a G32 command in the terminal of Octoprint or Repetier Host….and Pray!!! Be ready however, to turn the printer off when needed.

If everything worked and you still have your printer in one piece, you can try it with the glass.

If you do this with, make sure that your z probe recognizes the metal before the nozzle hits the glass. Obvious isn't it? :)

Now the magic settings that make Autoleveling work is the configuration. I would suggest to use Reptier Host to make the test, since you will have to write your values to the EEPROM numerous times before you get the desired result.

Z-probe height [mm] The distance of the bed to the position the z probe is triggered. I suggest setting the value high and lowering it in steps of 1mm (not 0.1) and after getting close using 0.1 or even 0.05 steps

Z-probe bending correction A [mm] This value should be 0 but if the used to correct to value the probe returns. It's the Bottom left probe point.

Z-probe bending correction B [mm] This value should be 0 but if the used to correct to value the probe returns. It's the Bottom right probe point

Z-probe bending correction C [mm] This value should be 0 but if the used to correct to value the probe returns. It's the top middle probe point

Calibration is not easy and it's a frustrating process. Don't loose your hope. You are almost there. Whenever you start a print, do a G32 code first. Use it in your start Gcode script so that you wont need to do it manually every time. So that was it folks. You know where you can find me if you have trouble with this. Good Luck!