

# Ramps 1.4 Users Manual

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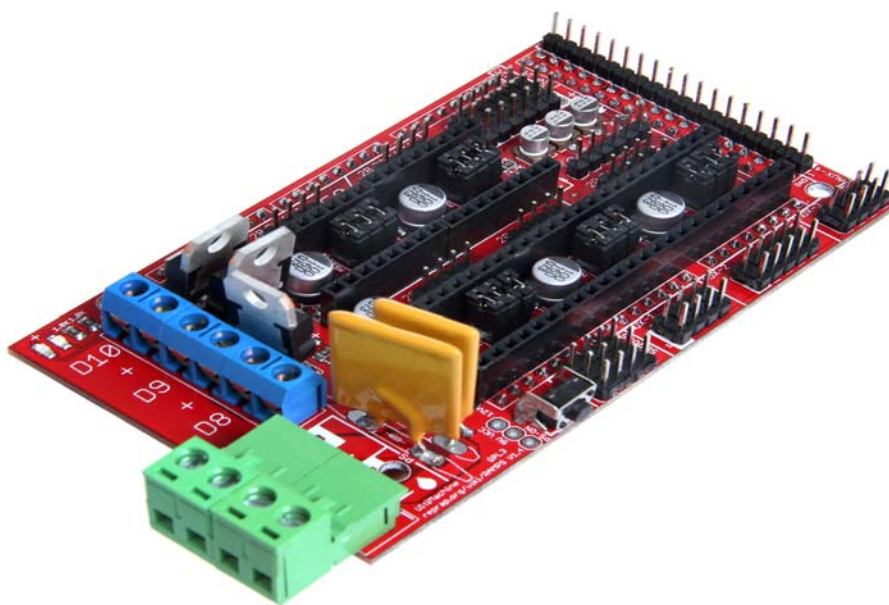
**Date:** Jun 25,2014

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**Date:** Jul 11,2014

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**Date:** Jul 15,2014



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## **1 Introduction**

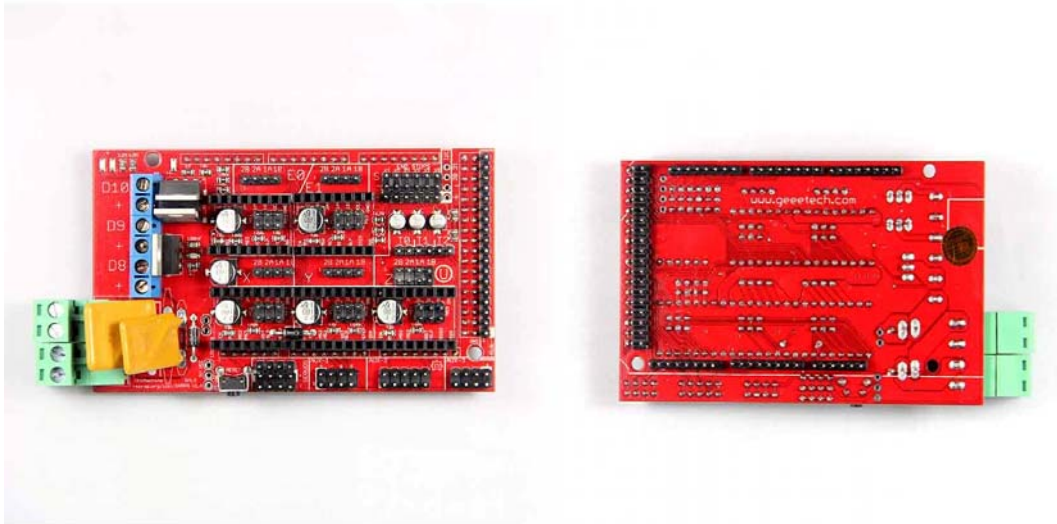
Ramps is short for reprop Arduino mega pololu shield, it is mainly designed for the purpose of using pololu stepper driven board (similar to 4988 driven board). Ramps can only work when connected to its mother board Mega 2560 and 4988/DRV8825.

Owing to its stability in operation and great compatibility with most 3Dprinter (all reprop-model such as pursa i2 and i3). The combination of Ramps1.4+MEGA2560+A4988/DRV8825 is becoming a mainstream of DIY 3D printer control board.

Features:

1. Standard interfaces (as that of extruder)
2. Reserved GCI like I2C and RS232
- 3 MOSFET 3 MOSFET are applied to the heater/ fan and thermistor circuit.
4. Adding another 5A to protect the component parts.
5. An 11A fuse is added to the hotbed
6. Support 5 stepper drive board
7. The adoption of Pin Header as pololu makes it more convenient to repair or change.
8. I2C and SPI are reserved for expanding
9. All the MOSFET can be controlled by PWM
10. Use the interface of servo motor to adjust the level of printing platform automatically.
11. Adding a SD module for SD ramps module.
12. LED can indicate the status of the heater (the open and close of MOS).
13. 2 stepper motor for Z axis in parallel.

## 1.1 Overview and Hardware Resources



1-1

Weight: 68g

Size: 102mm\*60mm

## 1.2 Software Resources

Compiling environment: Arduino IDE

Firmware: Marlin

PC software: Printron, Repetier-Host

## 1.3 Source

Arduino IDE : <http://arduino.cc/en/Main/Software>

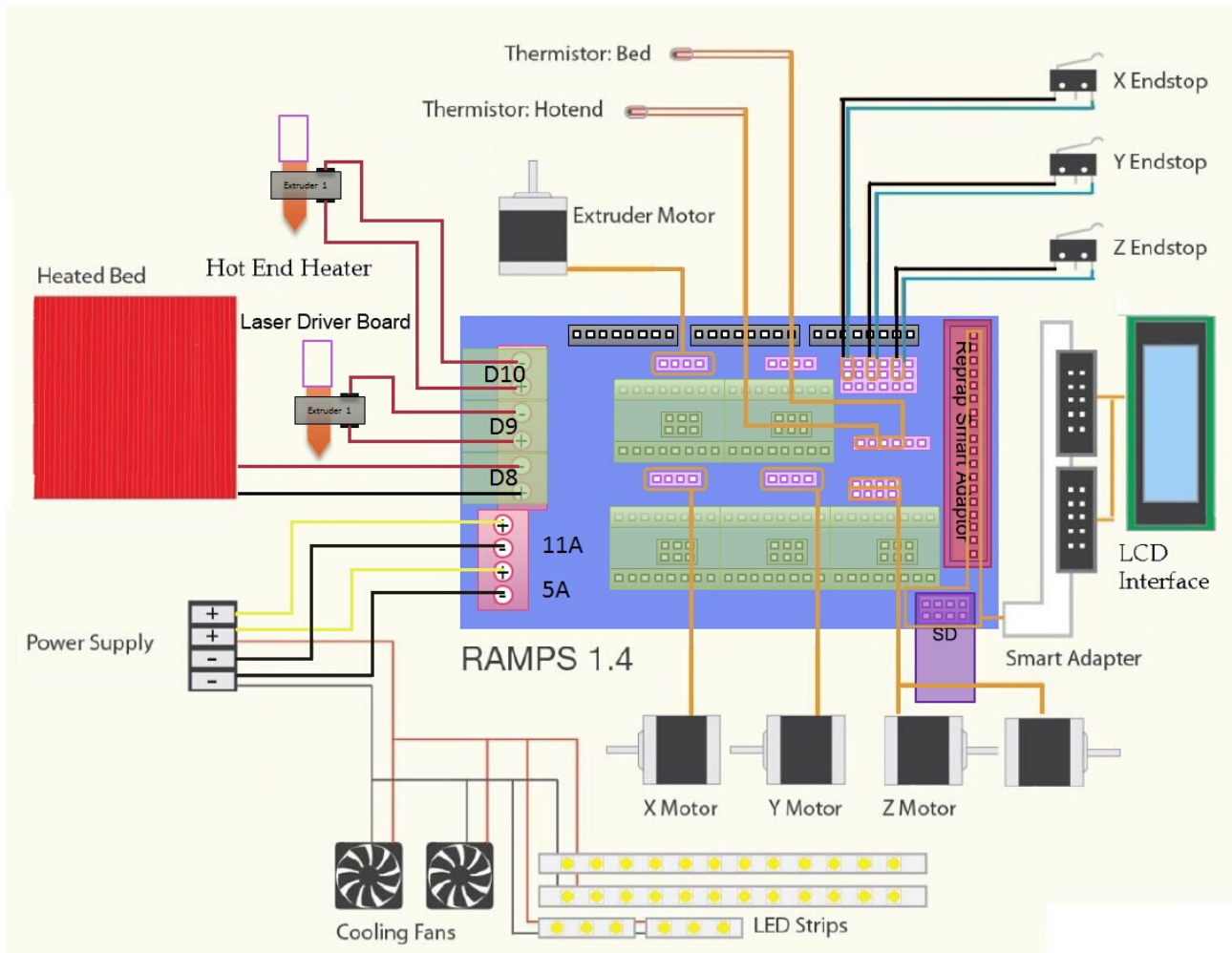
Marlin : [https://github.com/ErikZalm/Marlin/tree/Marlin\\_v1](https://github.com/ErikZalm/Marlin/tree/Marlin_v1)

Printron : <http://koti.kapsi.fi/~kliment/printron>

Repetier-Host : <http://www.repetier.com/download/>

## 2 Interfaces

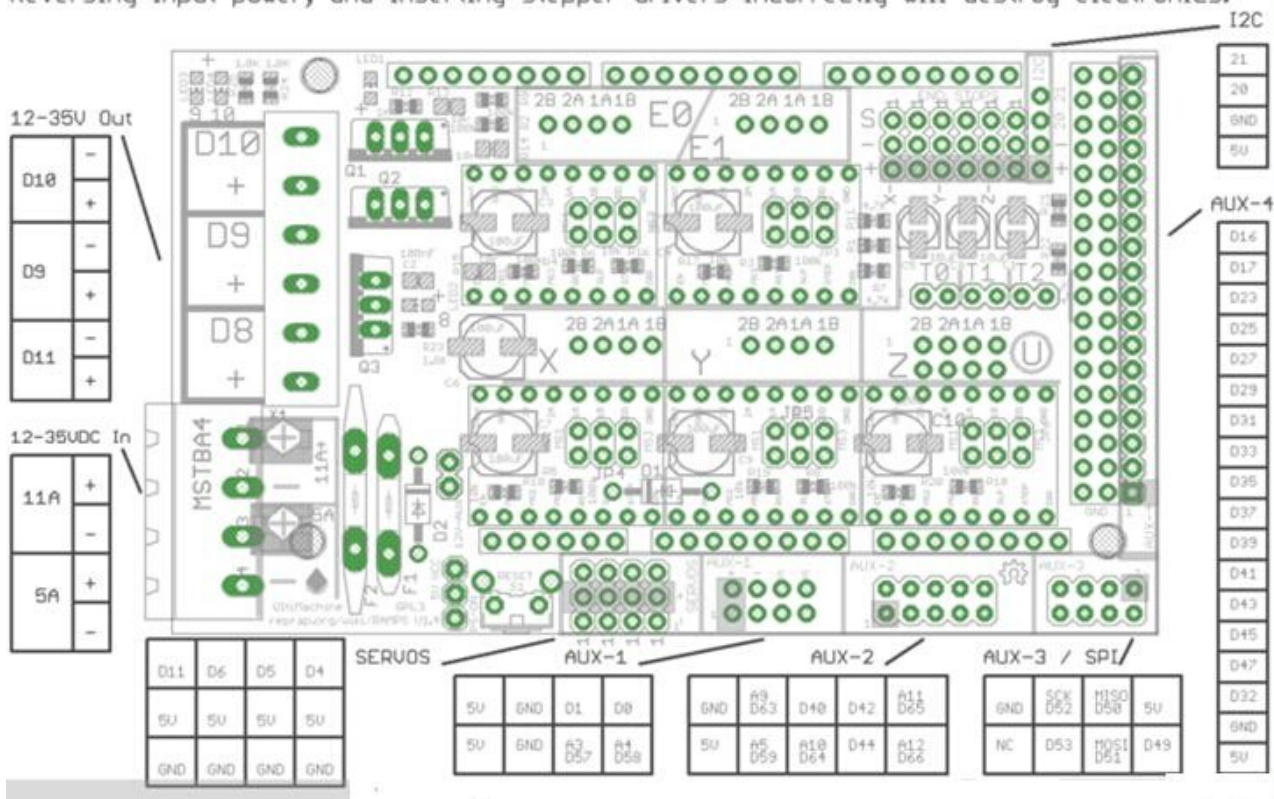
### 2.1 Interface Layout



2-1

## 2.2 Interface specifications

Reversing input power, and inserting stepper drivers incorrectly will destroy electronics.



2-2

2 power interfaces 12v 11a/12v 5a

6 motors (one for X axis, one for Y axis, 2 for Z axis, 2 for extruder)

2 interfaces for LCD&SD

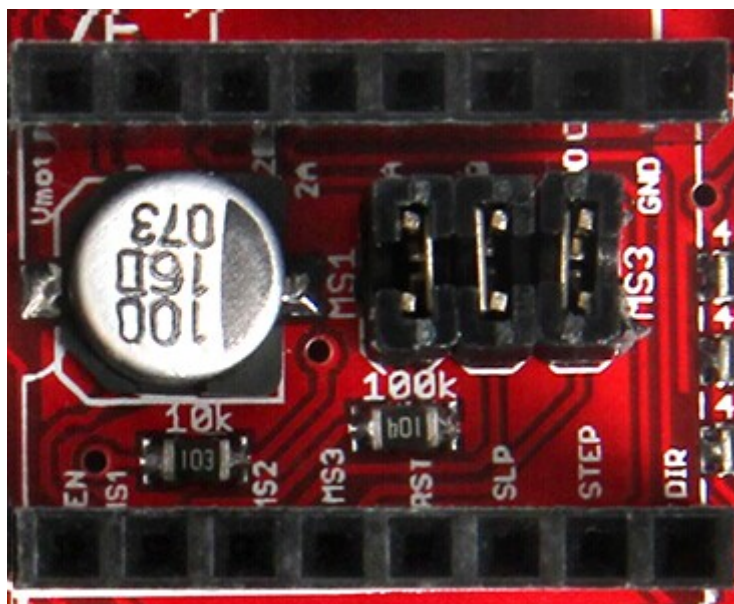
6 interfaces for end stop ( X/Y/Z min, X/Y/Z max )

3 interfaces for PWM (one for hotbed, one for fan and one for extruder)

3 interfaces for thermistor



## 2.3 Jumper Instruction



2-3

### Step size of stepper driver (A4988)

jumper	Yes/No		stepsize
ms1	ms2	ms3	
no	no	no	fullstep
yes	no	no	halfstep
no	yes	no	1/4step
yes	yes	no	1/8step
yes	yes	yes	1/16step

### Step size of stepper driver (Drv8825)

jumper	Yes/No		step size
ms1	ms2	ms3	
no	no	no	full step
yes	no	no	half step
no	yes	no	1/4 step
yes	yes	no	1/4 step
no	no	yes	1/16 step
yes	no	yes	1/32 step



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no	yes	yes	1/32step
yes	yes	yes	1/32step



### 3 Development Environment setting

#### 3.1 Interface Connecting and Setting



3-1

### Precautions:

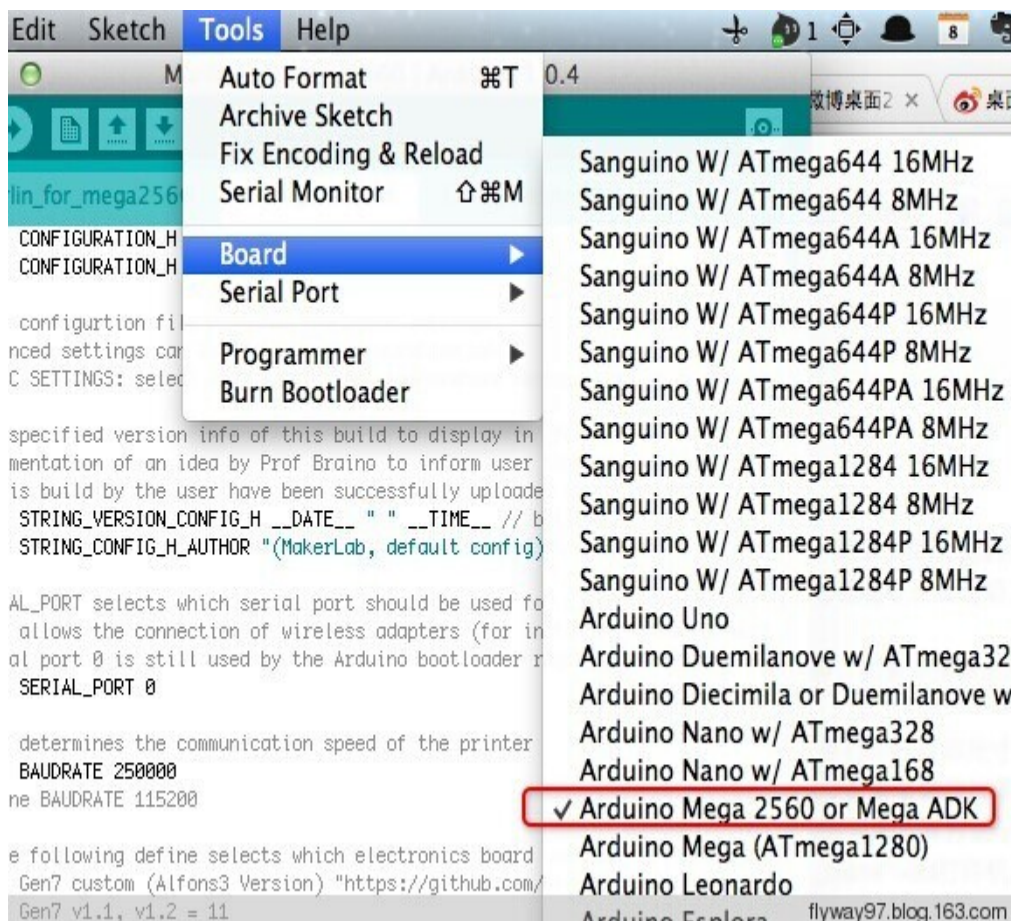
Like other electronics, the inverse connection of power supply can cause irreparable damage to the board (4988 included). You are advised to connect all the components before testing.

## 3.2 File Burning

As Ramps1.4 is just the shield board of Mega2560, the firmware must be burned into Mega2560.

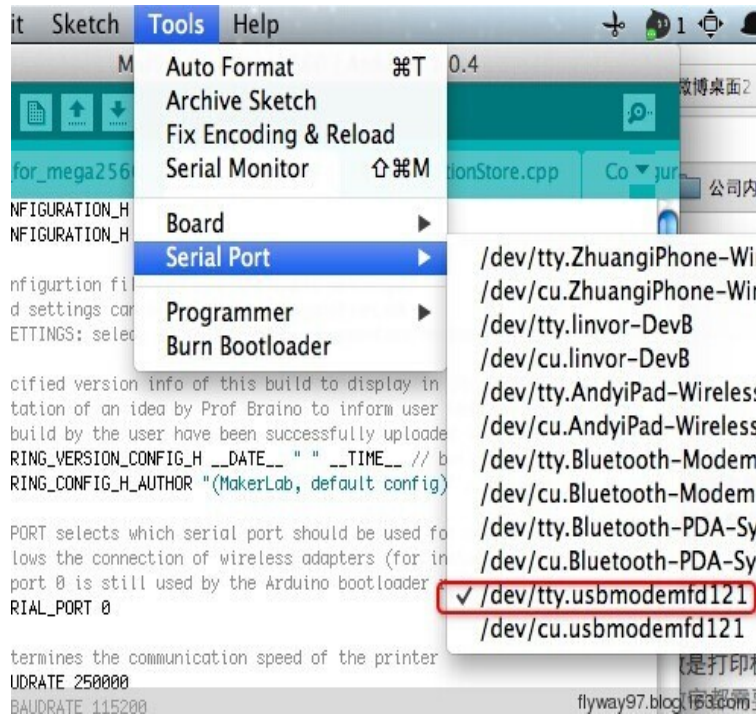
## 3.3 Software Setting

Before uploading, driver should be installed for windows. Then choose the type of board: Tools > Board > Arduino Mega 2560 or Mega ADK. (Picture below)





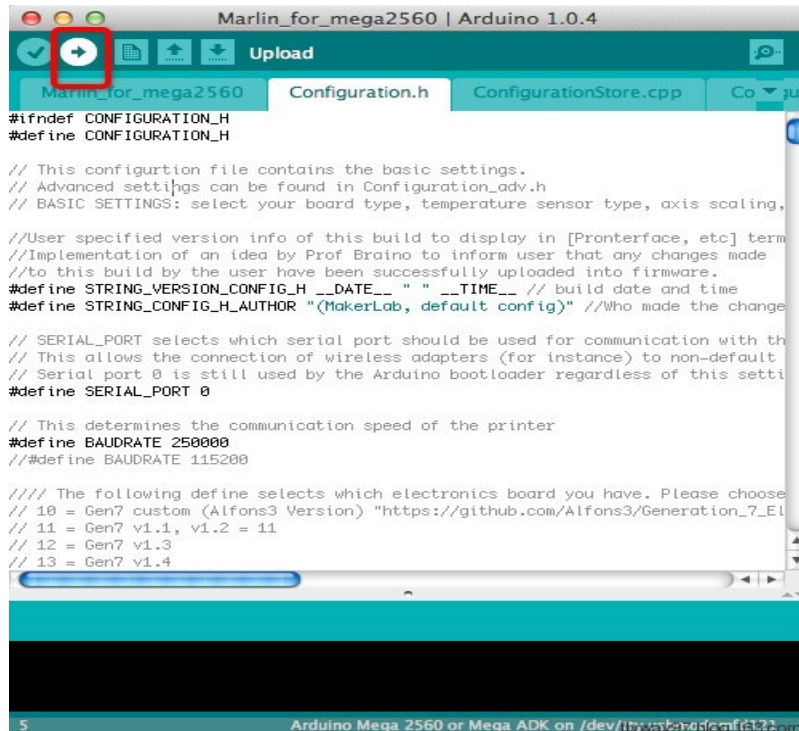
3-2

Select the serial port: Tools > Serial Port, the serial port for mega is usually the last one.



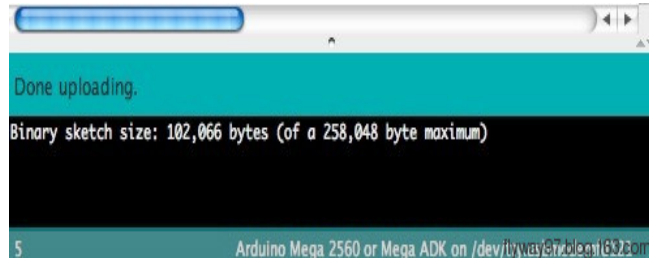
3-3

Click  to check if there is any mistake. If not, click  to upload.



3-4

During the process of uploading, the 3 LEDs corresponding to TX, RX and L on mega board will blink, if the blink stops, the uploading is done.



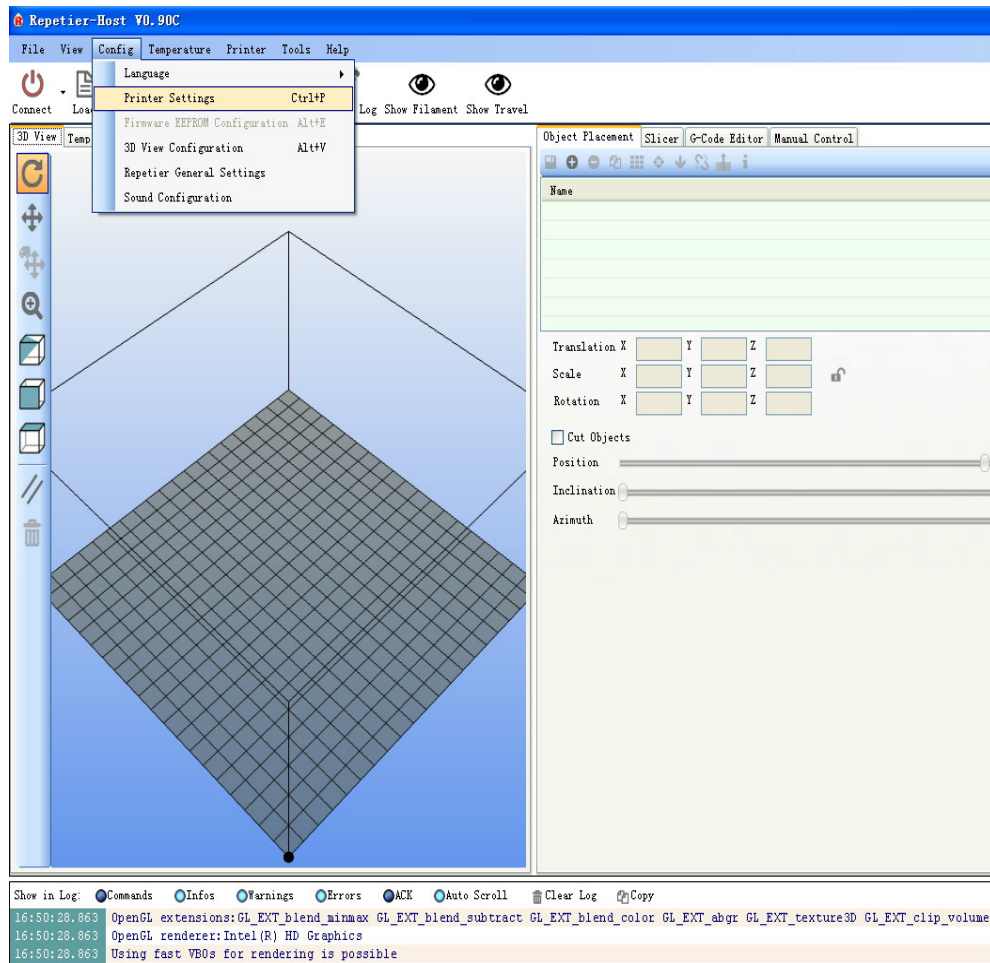
3-5

After the uploading, you can go on with the next step. If the uploading is unsuccessful, read the error report on IDE, figure out the problem, and then try again. some frequent errors are: a wrong select of board type and serial port.

The connection of Repetier-Host

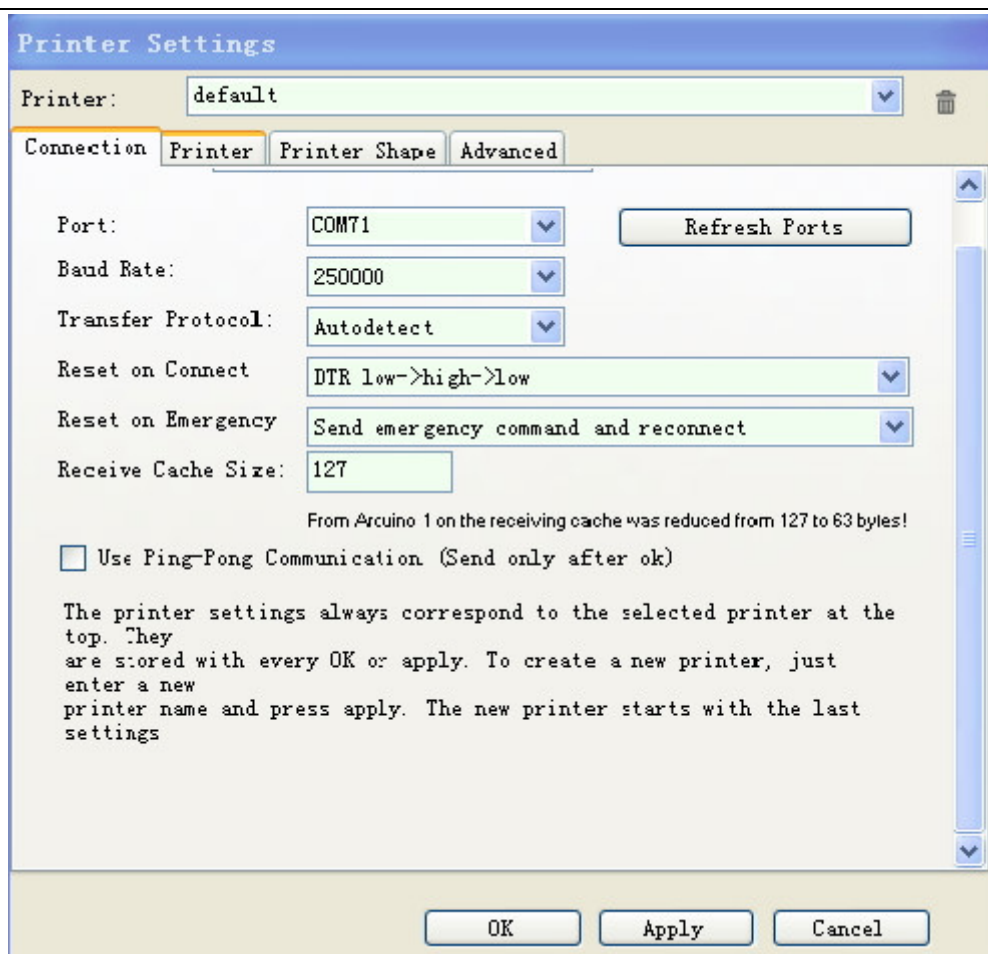
1. Click configuration> printer setting





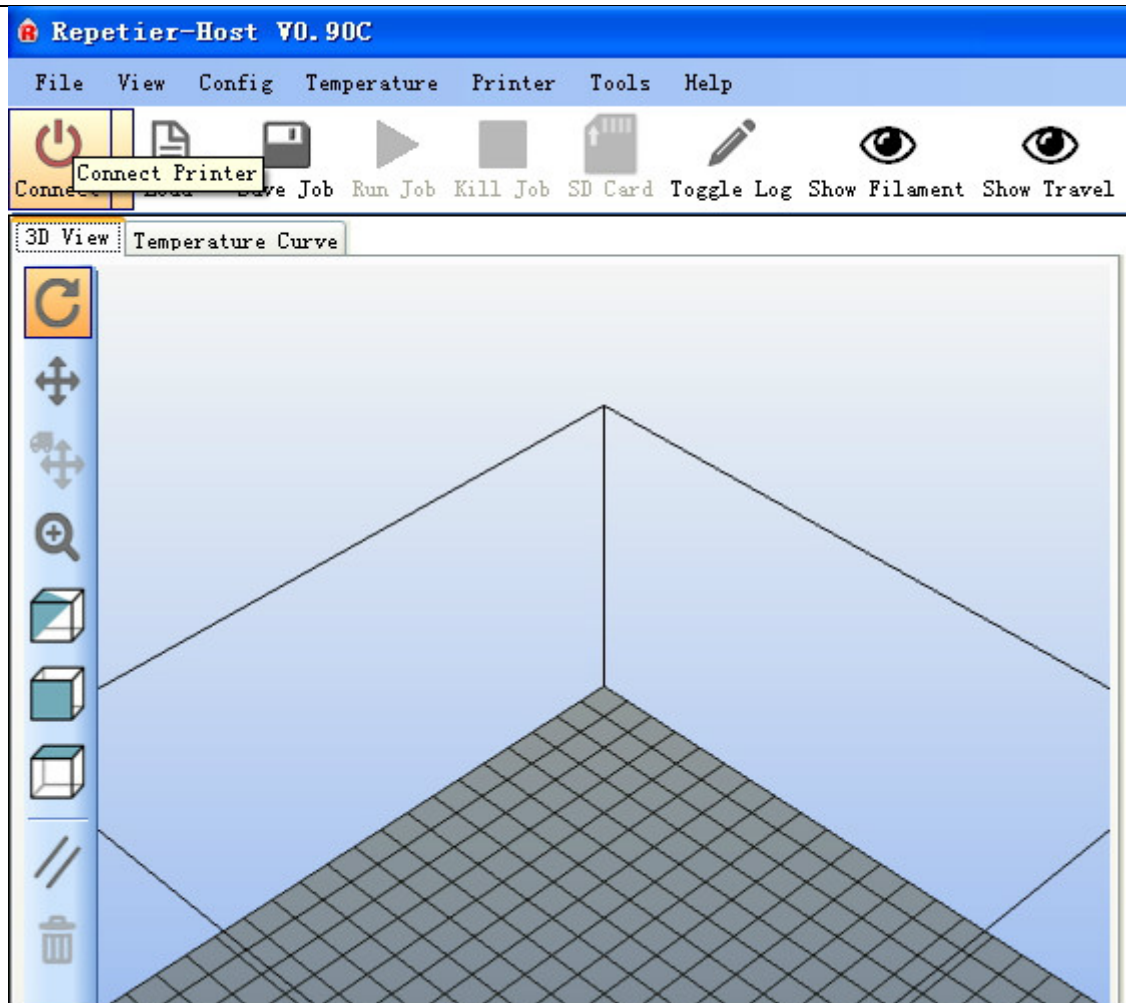
3-6

2. Set the communication port (the COM port for mega) and the Baud rate. Then click **ok**



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3. Click “connect”> upload. Choose the GCODE file you are printing.



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## 4 Get Started

Mega 2560 is the CPU of a 3d printer, manipulating the whole process of printing. Mega 2560 can't be put in use directly without uploading firmware.

1. Firmware uploading- marlin.
2. Setting parameters of the firmware
3. The parameters that need setting are as below, for those not mentioned just leave them as default.



`#define BAUDRATE 250000`

This parameter is for the baud rate of serial port. Note: a successful communication can be realized only when the Baud rate of upper computer is identical with that of Firmware. The Baud rate is not set in random. The common Baud rate are: 2400 , 9600 , 19200 , 38400 , 57600 , 115200 , 250000. The last three are frequently used for 3D Printer.

`#define MOTHERBOARD 33`

This parameter is set for board type. 3D Printer has many types of main board, and the setting of IOs is different, therefore, the parameter has to correspond to the type of your board, or it can't operate normally. The parameter of mega should be 33(single- nozzle) or 34 (dual-nozzle). For other board, you can refer to the annotation on the board.

`#define TEMP_SENSOR_0 3`

`#define TEMP_SENSOR_BED 3`

The two parameters are set for the type of temperature sensor respectively. They are the critical parameter to check if the sensor read temperature correctly. The printer can't operate normally, even has potential risk (damage the device and even worse). You must modify depending on the temperature sensor you use.

`#define EXTRUDE_MINTEMP 170`

This parameter is set to avoid the potential risks when the extruder operates before reaching the rated temperature. If you use other 3D Printer, such as printer to make Chocolates, 45°C is

appropriate, so that the parameter configured to a lower value(such as 40°C).

```
const bool X_ENDSTOPS_INVERTING = true;  
const bool Y_ENDSTOPS_INVERTING = true;  
const bool Z_ENDSTOPS_INVERTING = true.
```

The three parameters are set for the end stops of three axes. If the configuration is true, the end stop outputs 1 in default condition, and outputs 0 when triggered. That is to say, mechanical end stop should connect to the NO (normally open) contactor. If it is connected to the NC (normally closed), true should be changed to false.

```
#define INVERT_X_DIR false  
#define INVERT_Y_DIR true
```

Mistakes are often made in the above two parameters. The parameters are different for different machinery. In principle, the origin should be at lower-left corner of the print platform (origin: [0, 0]), or at up-right corner (origin: [max, max]). Only in this way will the printing be correct, otherwise, the printing is the mirror image of one axis which is not what expected.

```
#define X_HOME_DIR -1  
#define Y_HOME_DIR -1  
#define Z_HOME_DIR -1
```

If the position of the origin is the minimum, the parameter is -1; if it is the maximum, the parameter is 1.

```
#define X_MAX_POS 205  
#define X_MIN_POS 0  
#define Y_MAX_POS 205
```

```
#define Y_MIN_POS 0
```

```
#define Z_MAX_POS 200
```

```
#define Z_MIN_POS 0
```

These parameters are crucial to the printing size. Fill in parameters by reference to the coordinate graphs. It is important to note that the origin is not the printing center and the real printing center usually lies at  $[(x.max - x.min)/2, (y.max - y.min)/2]$ . The coordinate of central will be used in the slice tool. The printing center's coordinate must correspond to the parameter configuration, or it will print to the outside of the platform.

```
#define HOMING_FEEDRATE {50*60, 50*60, 4*60, 0}
```

The parameter means the homing speeds (mm/min). This parameter can be set as default if you use the x-axis and y-axis adopt synchronous belt drive and z-axis adopts screw drive.

```
#define DEFAULT_AXIS_STEPS_PER_UNIT {85.3333, 85.3333, 2560, 158.8308}
```

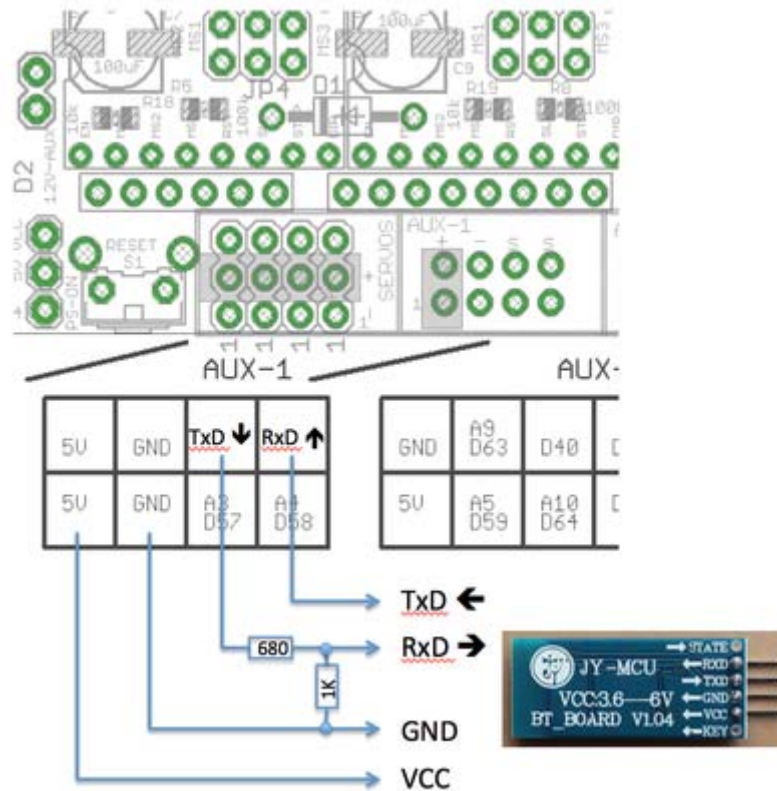
These parameters are crucial to the printing size. These parameters indicate the pulse the axis need when operating 1mm. they are corresponding to x, y, z axis and extruder respectively. In most cases these figure should be calculated by yourself, you can refer to:

<http://calculator.josefprusa.cz/#steppers>.

So far, the commonest parameters have been configured and the printer can work now. In addition, if the 2004 LCD needs verifying, you should delete the “//” from “//#define REPRAP\_DISCOUNT\_SMART\_CONTROLLER” to ensure the normal working.

## 5 Extensible Applications

Upload through Bluetooth



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The COM should be set as (9600, N, 8, 1)

The command for Bluetooth module

AT OK

AT+BAUD8 OK115200BAUD (set baud rate for RAMPS/Arduino Mega)

AT+NAMEPRUSAI3 OKsetname (optional set name, default: linvor)

AT+PIN0000 OKsetPIN (optional set pin, default: 1234)

## **6 FAQs**

### **1. How many extruders can ramps support?**

Ramps 1.4 support 5 A4988 driving boards, which are for X/Y/Z/axis and 2 extruders respectively, so the ramps can support at most 2 extruders.

### **2. What should I note when provide power for ramps?**

The recommended power supply for Ramps is 12V, especially for Mega2560. If supplied over 12v, Mega will over heat, resulting in instability of operation, the serial port communication is was at times strong and at other times weak. Do make sure the power is 12v, if you don't have switching power supply of 12v, please take down the diode D1 on Ramps if you use a greater power supply.

The current is decided by the use of hotbed. If you use a hotbed, an idea power supply is 12v 1 7A, 200W. If not, 5A is enough.

### **3. Can fan be added to Ramps?**

Yes. If you use only one extruder, you can connect the fan to the 2 pins in the middle of the 6 blue output pins. If you use two extruders, the fan cannot be connected to ramps directly; you should connect it to a power source that is controlled manually. Or you can build an external circuit, the pins of which should be set in the firmware.

### **4. What is the difference between ramps and ultimaker?**

In the respect of function, they are totally alike. But there are some difference, one lies in the configuration of I/O pins. Another lies in the way of reading temperature. Ultimaker uses thermocouple and temperature control board (AD597), ramps uses NTC thermistor 100K. If you want to use thermocouple and temperature control board for ramps, you should take down the pull-up resistor one the thermistor of hot end.

### **5. Can Ramps replace ultimaker to make an ultimaker printer?**

Yes, it can, but you need to pay attention to the points we've mentioned in chapter V .The

ultimaker printer is one kind of reprop, as well as standard three- axis rectangular coordinates.

**6. The temperature displayed is not normal?**

- A. you may select the wrong thermistor in marlin, we often choose 1.
- B. The thermistor is Broken or there is short-circuit occurred in the 2 pins of the thermistor.
- C. The electrolytic capacitor on ramps is broken.

**7. The motor jitters?**

- A. It is a matter of poor connection,
- B. A4988 has broke down,
- C, the VREF is not right.

**8. The scope of motor is too small?**

You may forget putting the jumper cap, or the parameter you set is wrong.

**9. The program uploading is not successful?**

The USB cable doesn't work; the version of Arduino IDE you use is not compatible; the select of COM is wrong.

**10. The hotbed and extruder can't heat?**

- A. The MOSFET is broken.
- B. The thermistor is not connected.

**11. The motor of extruder doesn't work?**

The thermistor is not connected; the temperature is not enough; A4988 broke down; ramps 1.4 broke down.