

3D printer control board manual

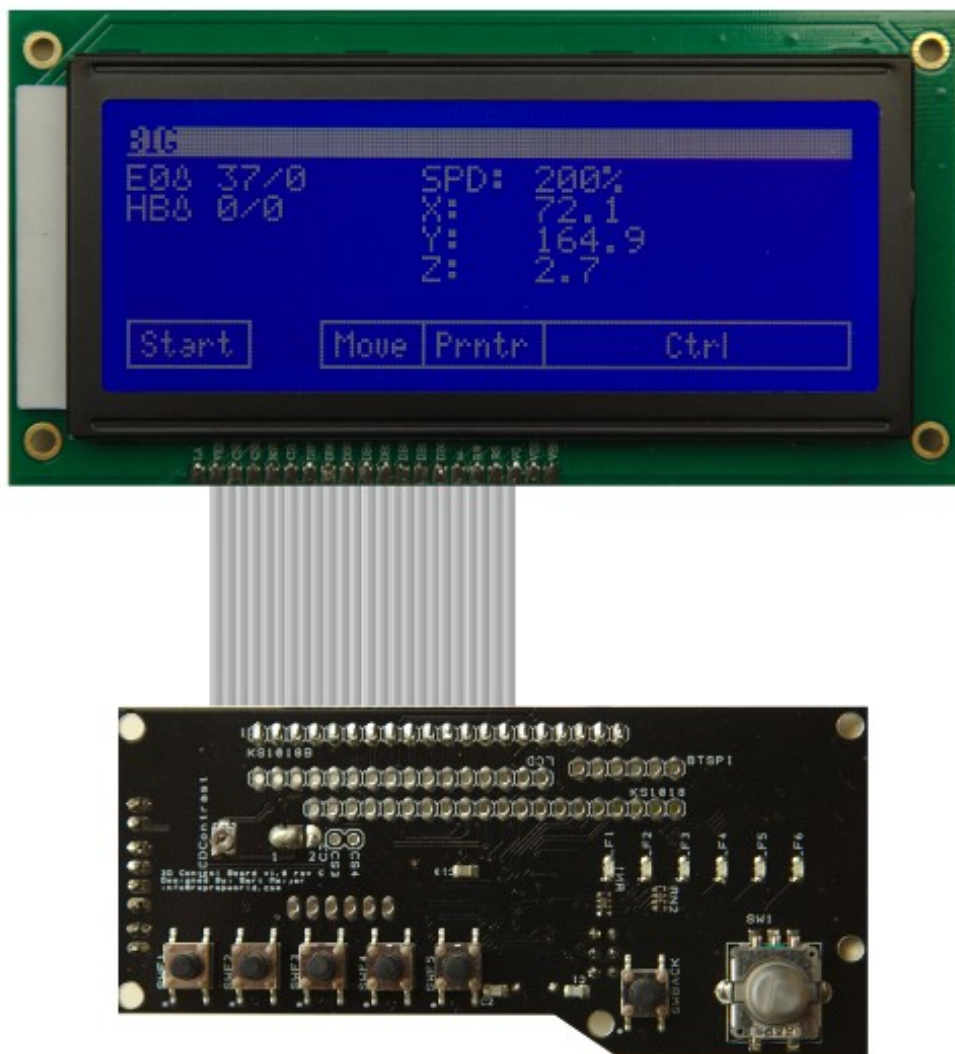


TABLE OF CONTENTS

Table of contents.....	2
About the 3d printer control board.....	3
Change history.....	3
Technical specification.....	4
Safety warnings.....	4
Major Features.....	5
Connectors.....	6
1 Setup.....	8
2 Setting up the printer.....	10
3 Using the board.....	11
3.1 Connecting.....	12
3.2 Dashboard.....	12
3.3 Printing.....	13
3.4 Selecting a printer.....	14
3.5 Controlling the printer.....	14
4 Uploading new firmware.....	17



ABOUT THE 3D PRINTER CONTROL BOARD

The control board allows you to control up to five 3D printers with one control board. It allows you to start print from SD card, but also heat up the extruder, move the axes and much more. The board gives you feedback on a large LCD screen and using several LEDs.

CHANGE HISTORY

Document version	Changes
1.0 – 02/11/2015	Initial release



TECHNICAL SPECIFICATION

Microcontroller	Atmega2560-16AU
Operating Voltage Electronics	5V
Operating Voltage Input	12V
DC Current per I/O Pin	40mA
Clock Speed	16Mhz
LCD dimensions	78.67x26.19mm
LCD resolution	192x64 pixels

SAFETY WARNINGS

Do not power anything until all is set-up. Also, don't disconnect or modify anything while power is on. Make sure that everything is connected correctly and fixed adequately before powering the board.



MAJOR FEATURES

Features hardware:

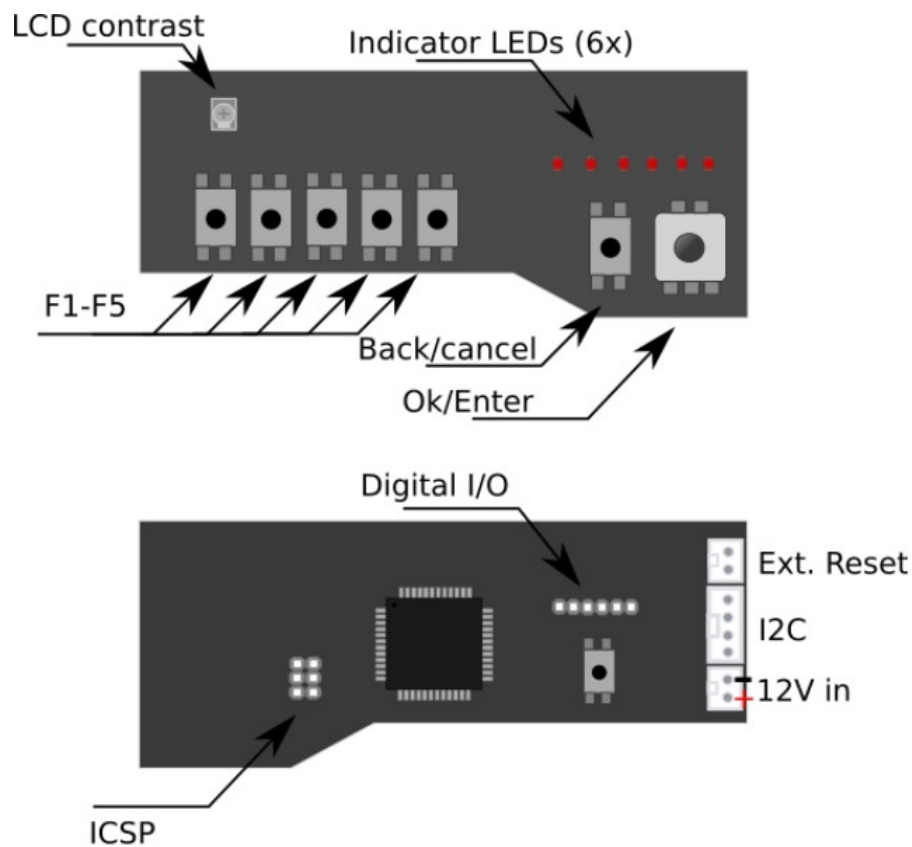
- Big LCD screen (78.67x26.19mm / 192x64 pixels)
- Includes a powerful atmega2560, programmable using ICSP
- 5 action buttons, a back button and a rotary encoder with push button
- six indicator LED's for extruders/heated bed
- control up to four extruders (if applicable)
- contrast trimpot to increase/decrease contrast
- communication over I2C with up to 5 printers
- compatible with RAMPS, Minitronics and Megatronics
- directly powered from 12V
- +/- 20cm wire between display and board, for customized placement in your printer
- software and hardware are open-source

Features software:

- Start prints from SD card (must have a separate SD card connected to the printer)
- Easy menu system, with different actions of the action buttons per menu item
- Dashboard with all necessary parameters in one view
- Move axis, control speed and temperature
- Switch between up to five printers



CONNECTORS

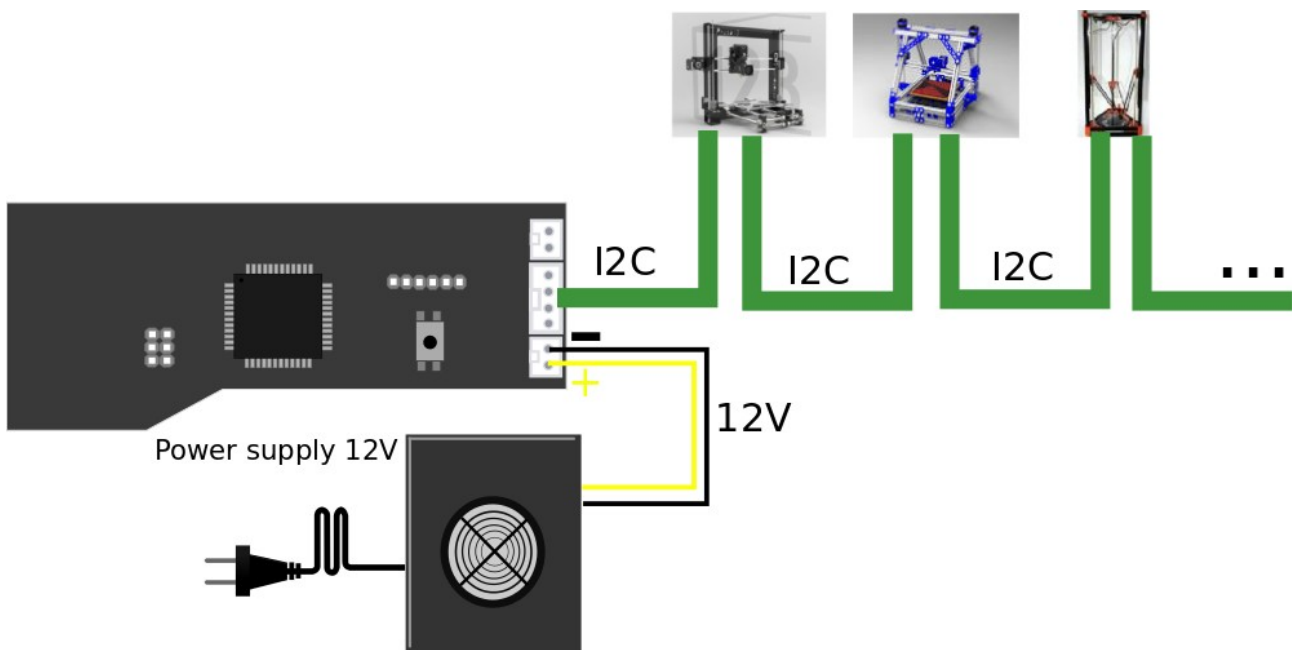


Name	Description
LCD contrast	Trimpot for controlling the display contrast.
Indicator LEDs	Red LEDs which by default show heating of extruders/heated bed
F1-F5	Five function buttons
Back/cancel	Back/cancel button
Ok/enter	Rotary encoder with enter button
ICSP	Program header
Digital I/O	Programmable I/O pins
Ext. Reset	Digital I/O for resetting slave board(s)
I2C	I2C header for connecting the slaves (pin 1 is bottom) 1. SCL 2. SDA 3. Not connected

	4. GND
12V in	12V input

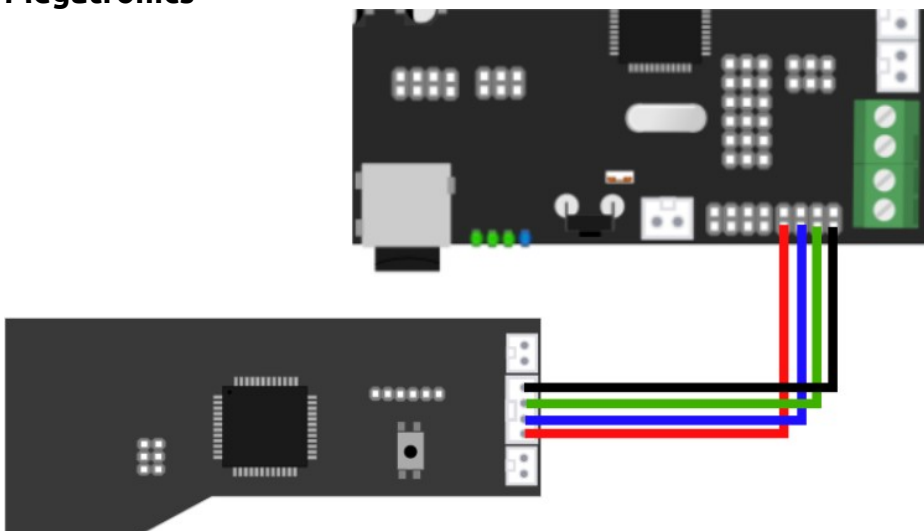


1 SETUP



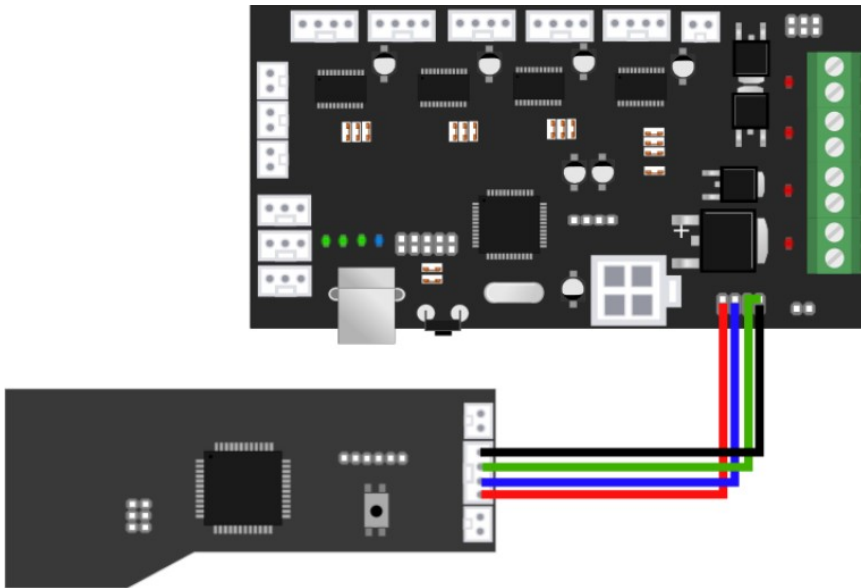
To start using the board, connect it to a 12V power supply. Make sure the polarization of the 12V matches between the power supply and the board. Connect the I2C header to the I2C header of the slave printer. You can daisy chain the slaves up to 5 printers. Depending on the type of wire used and the environment you can use at least 2m. The following pictures will show the wiring schema for multiple electronics.

Megatronics



Minitronics



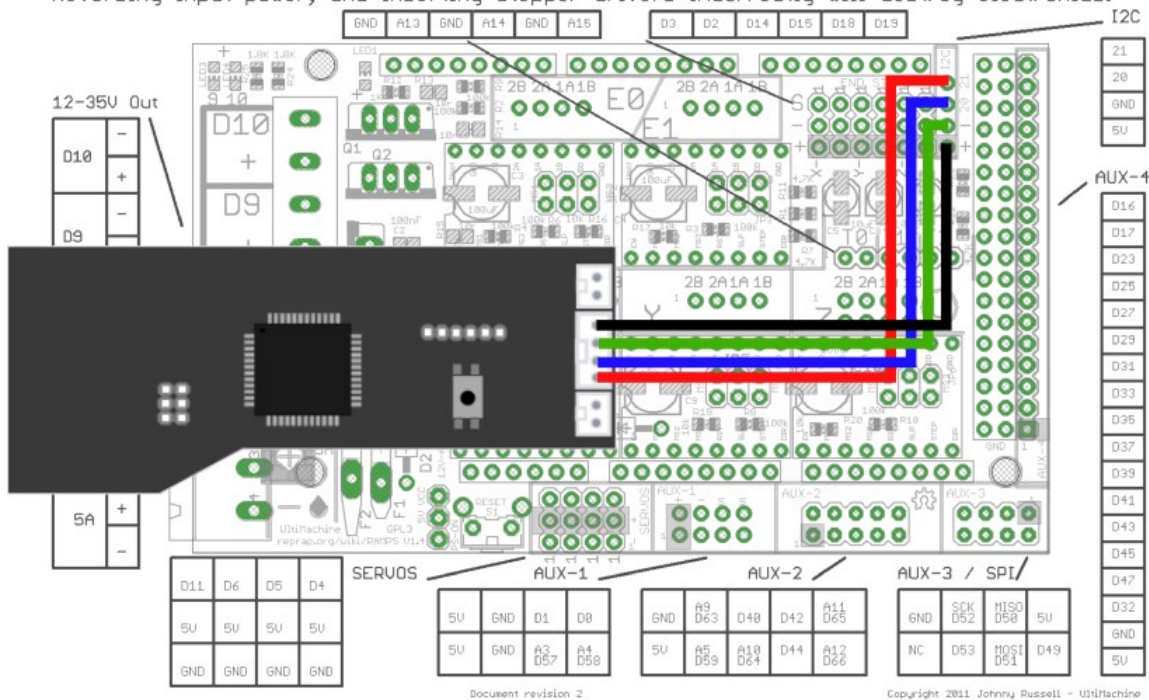


RAMPS

RAMPS 1.4 (RepRap Arduino MEGA Pololu Shield)
reprap.org/wiki/RAMPS1.4

GPL v3

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



Make sure the slaves are all powered or they will cause the I2C bus to be pulled to ground disabling any communication. We recommend to not connect the 5V wire (green in the above pictures) between the slaves as this will power all slaves through the I2C cable.



2 SETTING UP THE PRINTER

The control board connects to the printers using I2C. By default Marlin does not support this, so you need to upload a Marlin version which does and is available from our website. We will assume you are able to modify the Marlin version to your needs, the following settings are specific to the control board.

CUSTOM_MACHINE_NAME configuration.h

This setting sets the name shown in the LCD when the printer is selected. Make sure to take a good name, so you can easily recognize which printer is currently selected on the control board.

Example:

```
#define CUSTOM_MACHINE_NAME "My Machine"
```

CB_PRINTER_NR configuration.h

This is the slave number of the printer on the I2C bus. Make sure that every slave has a unique number.

Example:

```
#define CB_PRINTER_NR 2
```

CB_BUF_SIZE configuration.h

Number of commands buffered

Example:

```
#define CB_BUF_SIZE 5
```



3 USING THE BOARD

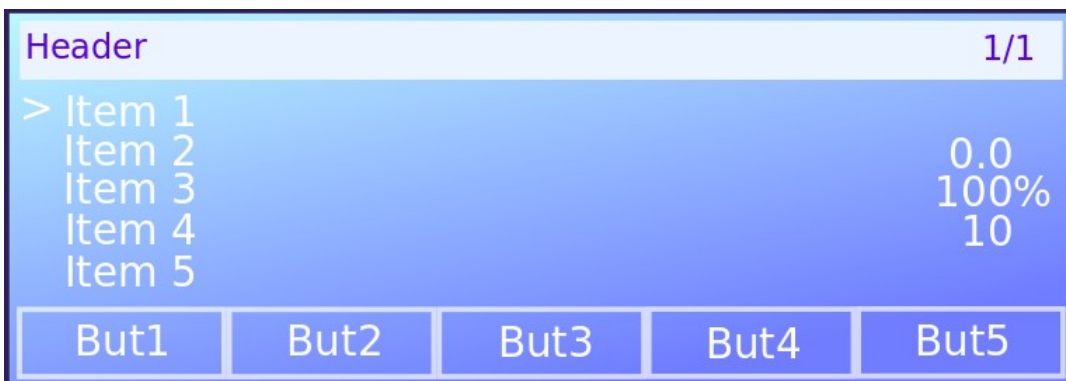
This chapter will go into detail on the functions of the board, while going through the whole menu system. To start, here is basic layout of the screen. The menu system is very consistent, so understanding the layout will help you navigate easily through the different options.



The header will show either the printer name or the current menu. Button 1 through 5 correspond to the function buttons on the control board. In other words, the LCD will show you what a button in the current context will do.

Menus

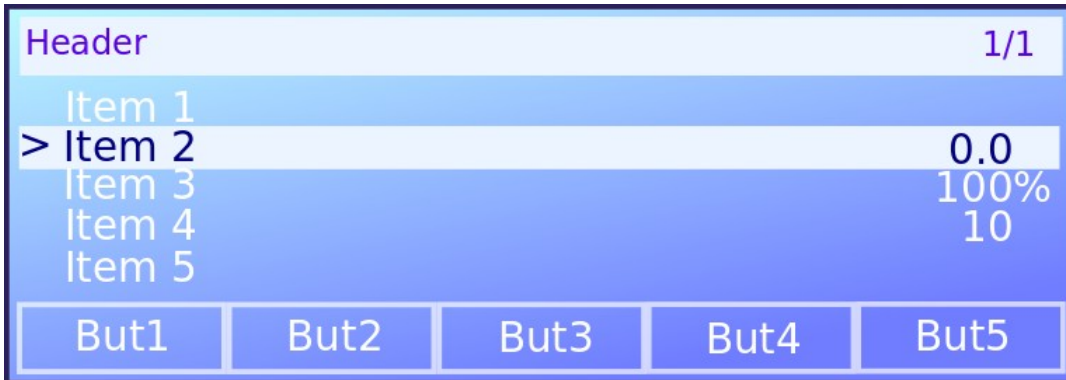
Within menus a list of available options is shown. In case a value can be set, the current value is shown on the right. You can navigate through the items using the rotary encoder. In the right-top corner of the screen the currently hovered menu item is displayed, as well as an arrow on the left of the menu item. The function buttons will apply a function to the hovered menu item. For example homing an axis when hovering an axis in the control menu and pressing the home function button. Pressing the rotary encoder will select the current menu item or enter a sub-menu. In case no value can be set, selecting an item will execute a command. Use the back button to return to the previous screen.



After selecting an item the item will be highlighted when a value can be set. The rotary encoder will no longer navigate through the menu, but instead change the value. Also the function buttons will change and give different options as compared to hovering the

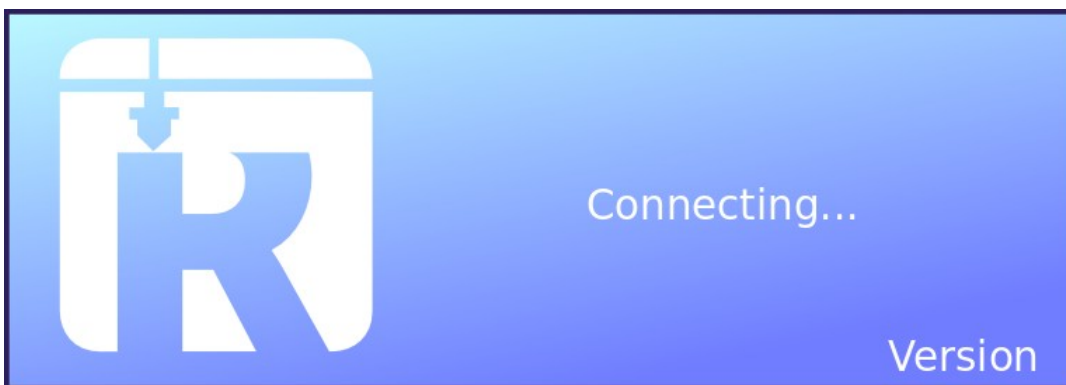


same item. Pressing the encoder button again will apply the value and send it to the printer. Pressing back will cancel all changes and unselect the item.



3.1 Connecting

After powering the control board, the board will try to connect to a slave. It will try to find the first slave on the I2C bus available. Until it does so, it will show the following screen:



The screens displays the software version on the board, the logo and "connecting...". If this screen appears for longer than 5 seconds, please check the wiring and software on the slave board.

3.2 Dashboard

After connecting to a slave the dashboard will be shown.





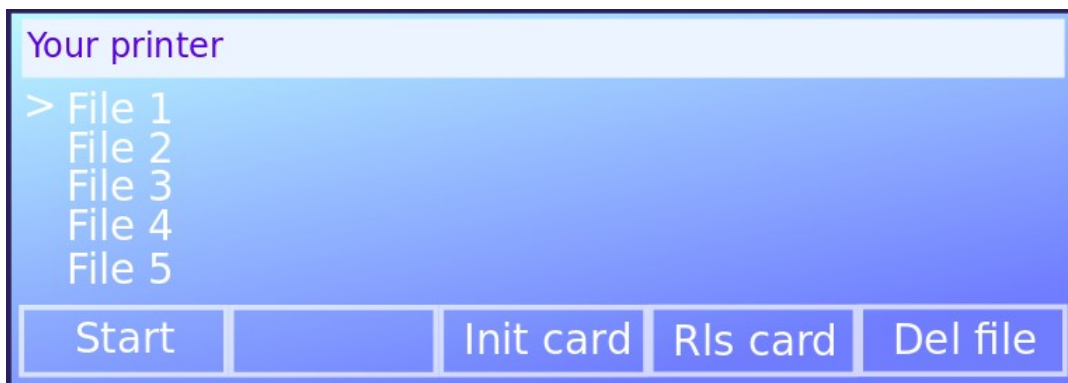
In the header the currently selected printer is displayed. Depending on the number of extruders reported by the slave electronics, it will show E0-E4 for each extruder. In case of a heated bed, the HB is also shown. The temperature is displayed on the right in the format of <current temperature>/<target temperature>. In case the target temperature is 0, the extruder or heated bed is off. Else it will show the target temperature and the corresponding LED will be lit.

In the second column from top to bottom is displayed: the printing speed factor (%), X, Y, Z positions and in case of a SD print, the progress of the print (%).

The buttons in the lower part of the screen will be discussed in the next paragraphs.

3.3 Printing

The control board allows the user to start a print from SD card. Make sure the SD card is inserted into the electronics before starting a print. From the dashboard, press start, which brings you to a list of files on the SD card.



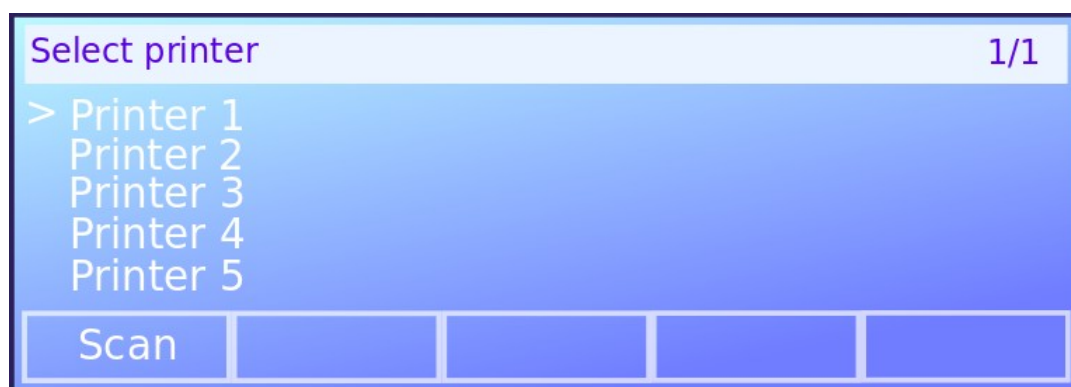
Button	Function
Start	Start a print using the selected file
Init card	Reinitialize the SD card. If this does not work, resetting the slave printer might.
Rls card	Cleanly close the SD card for removal
Del file	Delete the currently selected file



To start the print press Start again. The control board will return to the dashboard and the SD progress will be shown. Depending on the gcode also the extruder and heated bed temperature should be set. Also the Start button is replaced by a Pause button. Pressing this button will pause the printer (after executing a last few commands) and show a Resume and Stop button. Resume will continue the print as where Stop will abort the print.

3.4 Selecting a printer

You can control up to five printers using the control board. To change the current printer, press Pntr in the Dashboard menu. This will show a list of printers currently connected as slave to the I2C bus. If a printer does not appear here, check the wiring and software on the slave printer. Press scan to rescan the bus for printers.



Button	Function
Scan	Rescan the bus to find additional slaves

3.5 Controlling the printer

The control board can perform most basic maintenance commands from two menus, accessible from the dashboard: Move (Move) and Control (Ctrl). Move will enable the user to perform movements on all axis as where Control menu will contain more in-printing commands like speed and temperature.

Starting with the Move menu, we will see the following menu items:





Depending on the menu item function buttons will perform different actions. Also most items will be selectable to set a new value as were as the Home all button will just execute a command. We will discuss each items therefor seperatly.

Home all – Home all Axis

This item is not selectable and has no button. Pressing the rotary encoder will execute the G28 home all command.

Select button	Home all axis
Button	Function
N/A	

Move [X,Y,Z] – Move an axis

Moves an axis to a given point. You can set a specific position by selecting the item and use the rotary encoder. For convenience you can make bigger steps using the function buttons.

Button	Function
Home	Home axis
-10/-0.1	Do a small negative relative move
+10/+0.1	Do a small positive relative move
-100/-1	Do a large negative relative move
+100/+1	Do a large positive relative move

Extrude extruder N – perform movement on an extruder

Depending on the amount of extruders reported, multiple items are available. Selecting this item will allow you to do a specific relative extrusion.

Button	Function
Off	Disable extruder
Heat PLA	Heat the extruder up to PLA temperatures as defined by the slave printer
Heat ABS	Heat the extruder up to ABS temperatures as defined by the slave printer



Load	Perform the commands as defined by the slave printer for loading filament
Unload filament	Perform the commands as defined by the slave printer for unloading filament

The control menu will provide options useful while printing, like setting speed or adjusting temperature. Again the function buttons will have a different purpose per menu item.

Your printer		1/1
>	Set printing speed	100%
	Set extruder speed	100%
	Extruder 0 temp	0.0
	Heated bed temp	0.0
But1		But2
But3		But4
But5		

Set printing speed – Set the printing speed factor (%)

Sets a new speed factor, which will multiply the speed of the movements issued by this factor. The default is 100% speed, which is factor 1.

Button	Function
100%	Return to normal speed
50%	Half the printing speed
150%	Multiply the printing speed by 1.5
200%	Double the printing speed

Set extruder speed – Control the factor for flow rate

Sets a new speed factor for the flow rate, which will multiply the speed of the extruder by this factor. The default is 100% speed, which is factor 1.

Extruder N temp – Set the extruder temperature

Sets a new temperature for given extruder. Depending on the amount of extruders reported, multiple items are available.

Button	Function
Off	Disable the extruder temperature
Heat PLA	Heat the extruder up to PLA temperatures as defined by the slave printer
Heat ABS	Heat the extruder up to ABS temperatures as defined by the slave printer



4 UPLOADING NEW FIRMWARE

The control board has a programmable Atmega2560 on board, which by default is supplied with a current version of the software. To upload a new or custom firmware, please follow the following steps. Alternatively, if you have a ISCP programmer available, you can also upload the software using the ICSP header.

1. Upload an empty sketch to your Megatronics board. Make sure that you have a working copy of the firmware source, so you can upload that again to your Megatronics when you are done.

```
void setup() {  
    // put your setup code here, to run once:  
  
}  
  
void loop() {  
    // put your main code here, to run repeatedly:  
  
}
```

This will disable any interruption from the firmware on the electronics board.

2. Remove the reset-en jumper (near the reset button) from the Megatronics board. This will disable the upload functionality to the Megatronics board.

3. Open the new firmware in Arduino and press compile. You should get a white text which reports something like

```
Build options changed, rebuilding all  
  
Sketch uses 38,990 bytes (15%) of program storage space. Maximum is 253,952  
bytes.  
Global variables use 1,066 bytes (13%) of dynamic memory, leaving 7,126 bytes  
for local variables. Maximum is 8,192 bytes.
```

4. Connect a wire from the Megatronics board (AUX-1 header) to the control board D14 and D15 like this

5. Hold the reset button (RST) on the control board, while pressing upload in Arduino. Release when a white text appears (preferably just before actually). The RX / TX LEDs should start blinking very fast. If this does not happen, try pressing and releasing the reset button again. Repeat this until Arduino times out after which you need to press upload again.

