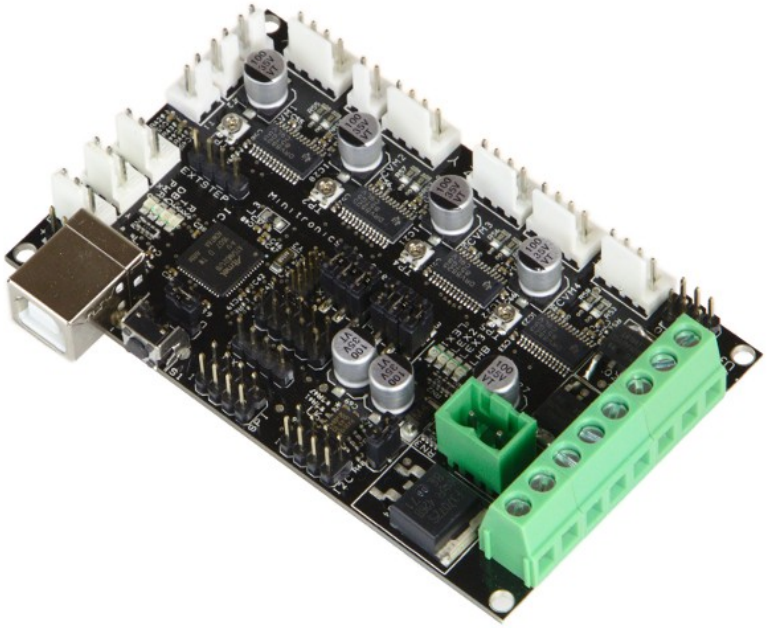
Minitronics v2.0
User Manual



Author Bart Meijer

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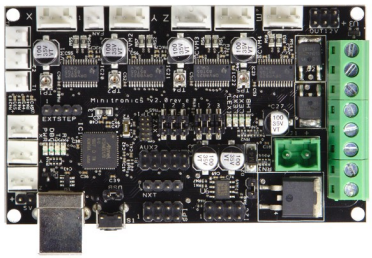
Document version 1.0

OVERVIEW



Thank you for purchasing Minitronics v2! This document will help you set up your new board and help you understand its basic functions. Target audience for this document is mainly the starting 3D printer enthusiast with basic knowledge of electronics. For more in-depth information the Microprocessor and I/O pin assignment the datasheet is the appropriate place to look.

Minitronics is the slim but powerful electronics line. It's designed to be an easy to use, compact and smart solution to fit 90% of the 3D-printers. Unlike the Megatronics, which targets at the advanced range of usages, the Minitronics is plug and play, which will fit the needs of the average user better.

Minitronics has a powerful SAMD21J18 32-bit microprocessor with 256KB memory, running at 48Mhz. The board can be connected to a PC using a normal USB cable and can run stand-alone from 12V power supply. The board is compatible with Arduino and will therefor be easily programmed from the Arduino IDE.

The board comes with four DRV8825 on-board stepper drivers, which can be configured to different micro-stepping settings. To enable dual-head support an external stepper driver may be hooked up to the EXTSTEP header.

Version 2.0 of the Minitronics gives you more features, while maintaining the same small form-factor of the version 1.1. Mounting hole positions, USB connector and reset button are placed at the same positions making an upgrade easy.

Warranty

Alls boards are tested on basic functions before shipping out, but however rare there may arise a problem with your board. We provide a three months limited warranty on the board. Common issues not covered by warranty include, but are not limited to, electronic shorts, over-voltage, reverse voltage polarization, insufficient cooling. You should verify the proper function of the board when it arrives, you may use the test firmware as described in the paragraph`Testing the board`. When you have determined that the board is not functioning properly, please provide a detailed description of the problem including pictures (if applicable) to techsupport@reprapworld.com. Make sure to include your order number for a quick solution.

Feedback

We love to hear feedback from our users. This way we can keep our boards the best option for the RepRap community. If you have ideas or comments, please feel free to drop an email to info@reprapworld.com.

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IMPORTANT STEPS

You are eager to start using the board, of course. But before you connect anything, make sure to follow at least these steps, to avoid damage to the board.

1. Make sure that all peripherals you want to connect work with 3.3V and NEVER put more than that to any of the headers.
2. After manufacturing the board the stepper driver current is set too high, so first set up the stepper driver current as per the paragraph `Connecting stepper motors`
3. The board can accept 24V, but you will need to REMOVE the jumper SRC12V (closest to the 12V input). Supply 5V from a different supply, for example USB and note that the board doesn’t down-convert 24V to 12V, so you need to have 24V peripherals as well.

HARDWARE SETUP

This chapter will guide you through the hardware setup of Minitronics. The flexible nature of the board allows for many additional setup options, therefor the scope of this document will be limited to basic setup only and a few examples of additional peripherals. More in-depth examples can be found in the knowledge base on our website.

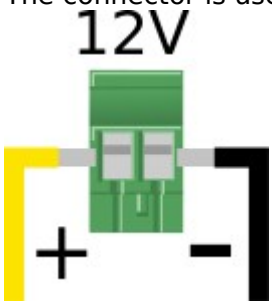
The following chapter will give an overview on peripherals that can be connected. First though, you should read the following paragraphs as they give specific instruction for this board to be used safely and correctly.

The microprocessor accepts 3.3V on I/O pins, do not put more than 3.3V on any pin unless specified otherwise.

Basic setup

The board comes with a connector for 12V and a 12V fan. Additional components can be sourced from our website too, as long as they fit within the specifications of the board. The fan is used to cool the board from the back. As the stepper drivers cool through the PCB, the board becomes hot. The heat dissipates through the back of the board, which therefor needs the most cooling.

The connector is used for 12V input, make sure to have the polarization correct. + goes to the left, - to the right.



Stepper motor current

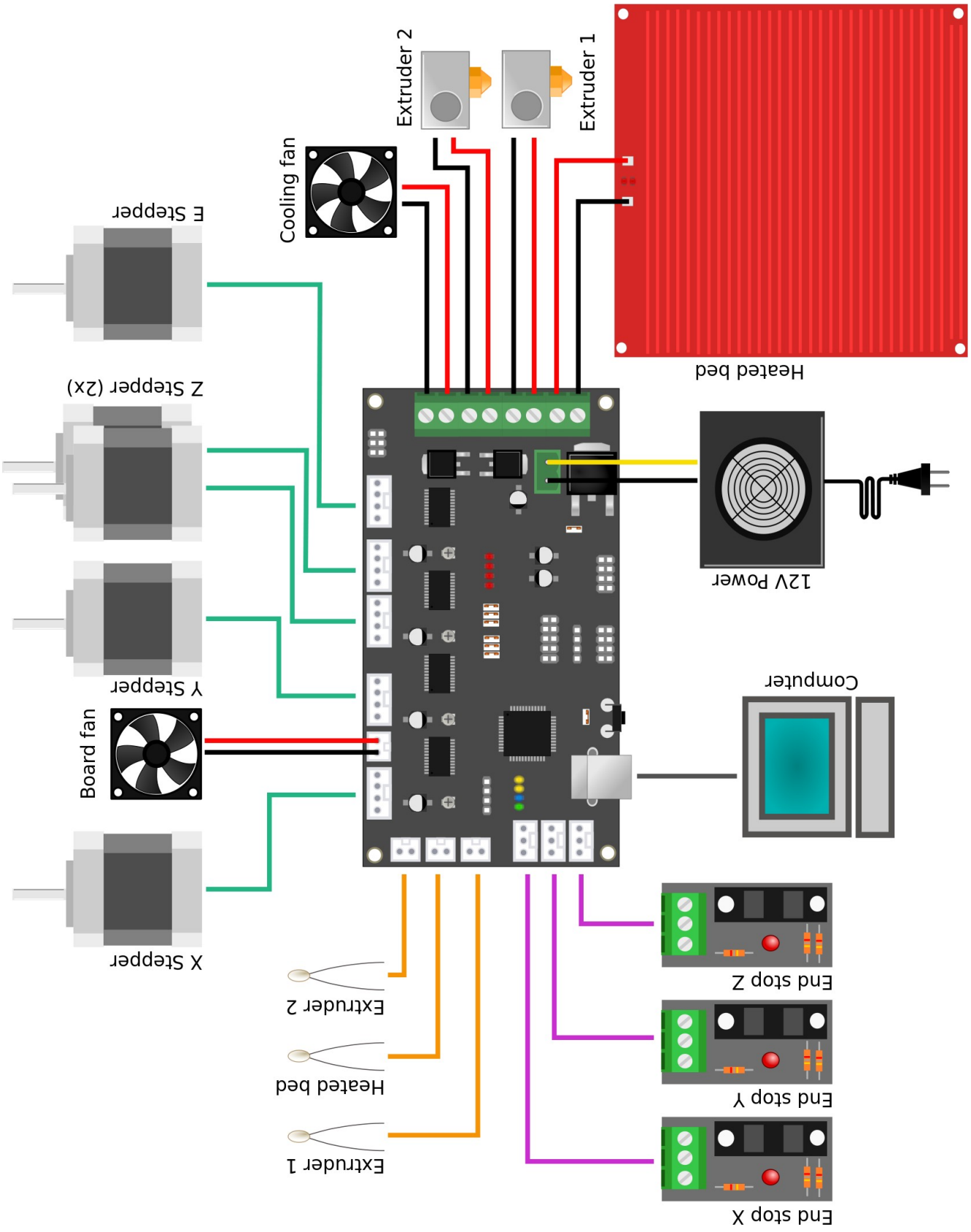
Before using the board, the stepper motor current must be adjusted. Use a small screwdriver to adjust the trimpots on the board. Turn the trimpots clockwise to **increase** current, counter-clockwise to **decrease** current. A too high current will result in loud noise and shutting thermal shutdown of the stepper driver (the axis on that stepper driver will stop moving). A too low current setting will cause the motor to skip steps in fast movements.

Stepper driver microstepping

The on-board stepper driver chips support up to 1/32 microstepping modes. You can set the stepping mode dor the three movement axis (X,Y,Z) and separately for Extruder 1. Review the following table for the available microstepping modes.

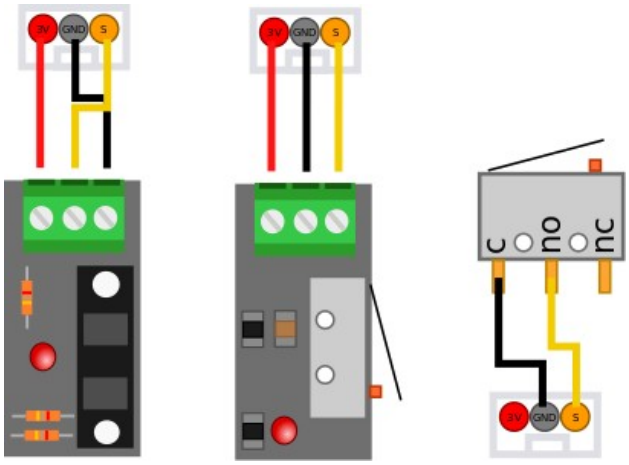
J1	J2	J3	Resolution
0	0	0	Full step
1	0	0	Half step
0	1	0	1/4 step
1	1	0	1/8 step
0	0	1	1/16 step
1	0	1	1/32 step
0	1	1	1/32 step
1	1	1	1/32 step

The following image will give an overview of the most common peripherals, attached to the board.



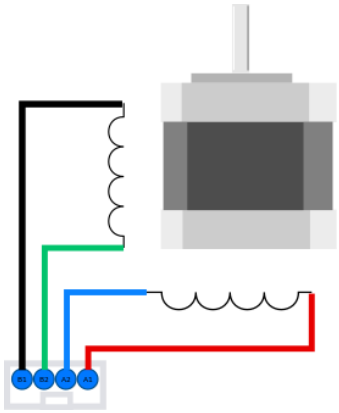
Connecting end stops

Minitronics provides three three-pin headers for connecting end-stops. You can use both our mechanical and optical end stops. The following image will show how to connect the end stops to each header. The Red wire is +3.3V, black is Ground (-), and Yellow is the signal line. For mechanical end-stops you need to enable the pull-up function in the firmware.

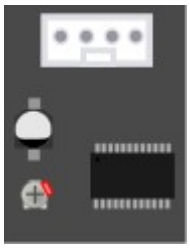


Connecting stepper motors

This is pretty straight forward. Most stepper motors have the red-blue and green-black wire pairs for connecting the motor. It doesn't matter if the polarization on any of the spool is revered, the motor will just run in a different direction. You can change the direction of the motor in the firmware as well.



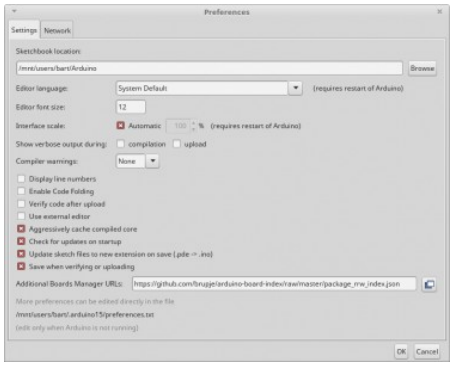
You will also need to change the current on the stepper drivers. We recommend setting the current as low as possible, to reduce noise an heat, increasing the lifespan of the electronics. Each stepper driver has a little trimpot, which controls the current. Rotating it clockwise increases current, while rotating it counter-clockwise reduces it. There is a voltage on the trimpot you can measure to determine the current. You can measure the voltage by using a multimeter and put one lead onto the trimpot and one on V-. A good setting to start is 0.4V, which can be obtained by setting the trimpot like the following image.



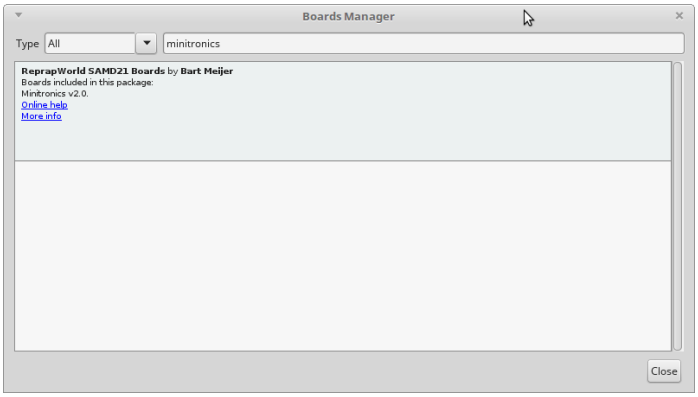
The board is only useful when loaded with appropriate software ‘firmware’ for your 3D printer. By default the board comes loaded with a generic firmware, but this needs to be updated for your specific needs. This chapter will help you understand the software components necessary to setup your board.

Arduino setup

The firmware needs to be uploaded to the board. The Arduino IDE is the preferred tool to use for this. It allows you to load a specific firmware, compile it for your your board and upload it. To be able to use Arduino with Minitronics, we need to install additional modules. First download the latest Arduino version from https://www.arduino.cc/ for your platform. Follow the installation instruction as per https://www.arduino.cc/en/Guide/HomePage.



After completion of the installation process we need to install the board. Go to *File > preferences*. The Arduino settings dialog will appear. Find the setting *Additional Boards Manager URL* and enter *https://github.com/brupje/arduino-board-index/raw/master/package_rrw_index.json.* Press OK to close the dialog.



Next go to *Tools -> Board: -> Board Manager*, the Board manager dialog will show. In the search bar, enter Minitronics. This should return one item, select it and press install.
After successful installation of the board, you can find the Minitronics 2.0 board in the Board: menu. You are now ready to start uploading firmware.

Selecting firmware

The firmware is software that runs on the Minitronics and will process command and translate them to actual movements. As Minitronics is open hardware, you are free to select your preferred firmware, or even write your own. There are a few free firmwares available, where each has its pros and cons. Configuration of the firmware is beyond the scope of this document, you can find more information in the knowledge base on our website.

At the time of writing the following firmwares support Minitronics:

MK4DUO: https://github.com/MKFirmware/MK4duo

Download your preferred firmware and open it in Arduino. Make the changes to the settings as required, at the very least set Minitronics as board. Press the upload button to upload the firmware to the board.

AVAILABLE UPGRADES

The Minitronics is a versatile development board, allowing too many upgrades to discuss here. This document will limit the scope to the most common upgrades and pointing to resources on our website. More in depth information may be found in our knowledge base at https://reprapworld.com/customer/service/. Or you can contact Technical support (techsupport@reprapworld.com).

Using a LCD screen

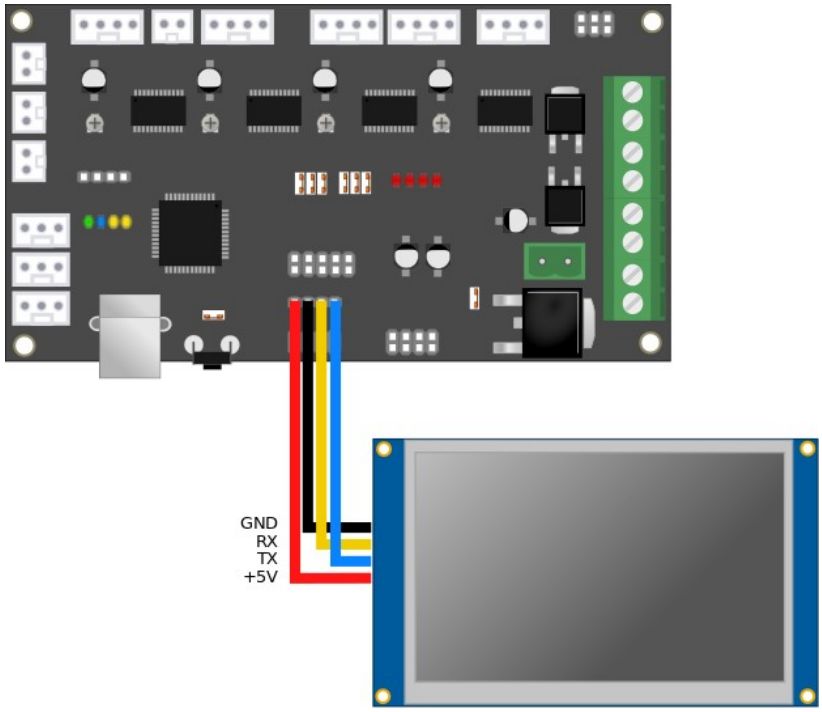
Minitronics has support for two LCD screens.

Nextion NX4832T035 LCD 3.5" with touch-screen

Nextion NX4832T035 full-color LCD, 3.5" touch screen. Has 16MB of flash memory, which can store graphics. This unloads the microprocessor of drawing the screen, avoiding interference with the 3D print.

You need to upload a graphic file to the screen too. Find instructions on how to do this on the Nextion product page.

You can easily hook up the Nextion screen to the Nextion header as follows. The screen is 3V3 tolerant, so it will work fine with the SAMD chip.



In the MK4Duo firmware, in the file Configuration_Feature.h, uncomment the line #define NEXTION and change the serial port to 2.

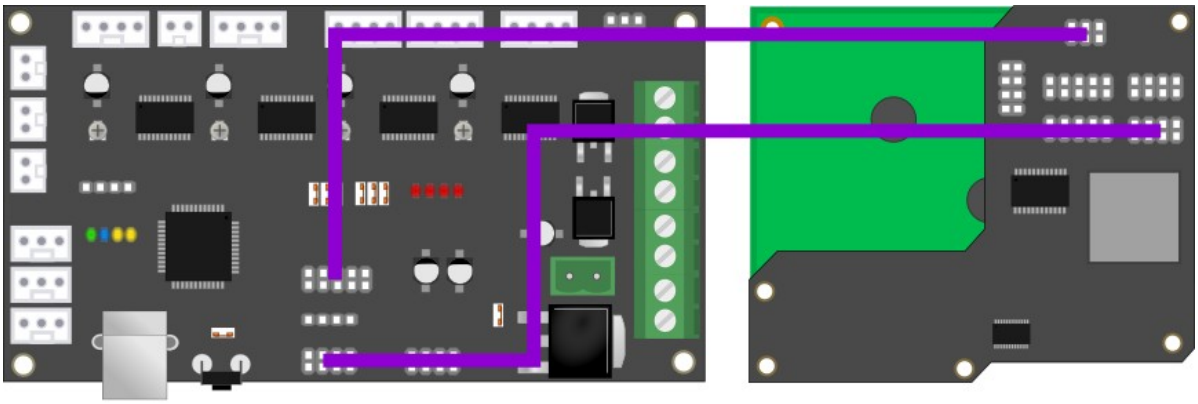
```
/**********************************************************************************************
***************************** LCD / Controller Selection *****************************
***************************** Other Controllers **************************************
**********************************************************************************************/
//
// Nextion 4.3" - 5" Enanched - 7" Enanched HMI panel
//
#define NEXTION
```

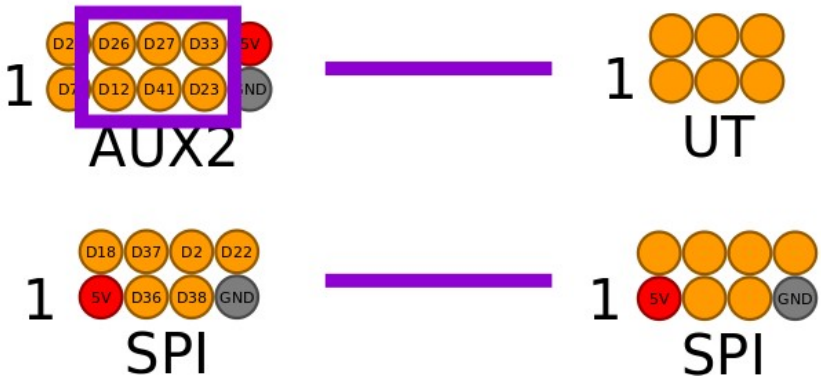
```
// Define Serial it use
#define NEXTION_SERIAL 2
// For GFX preview visualization enable NEXTION GFX
//#define NEXTION_GFX
// Define name firmware file for Nextion on SD
#define NEXTION_FIRMWARE_FILE "mk4duo.tft"
```

[Graphical LCD screen v1.0]

Cool 128x64 full graphical LCD (SPI) Not compatible with Megatronics 3.2

Hooking up the Graphical LCD is a bit difficult as the Graphical LCD headers don't match the new Minitronics headers yet. But by connecting the wires as follows, it should work fine. The SPI header should go 1-on-1 to the SPI header on the graphical LCD. Actually, the LCD should already work with this wire connected and the firmware adjusted. The second cable is for the encoder and push buttons.





In the MK4DUO firmware, in the file , find the line with REPRAPWORLD_GRAPHICAL_LCD and uncomment it, as well as the line SDSUPPORT.

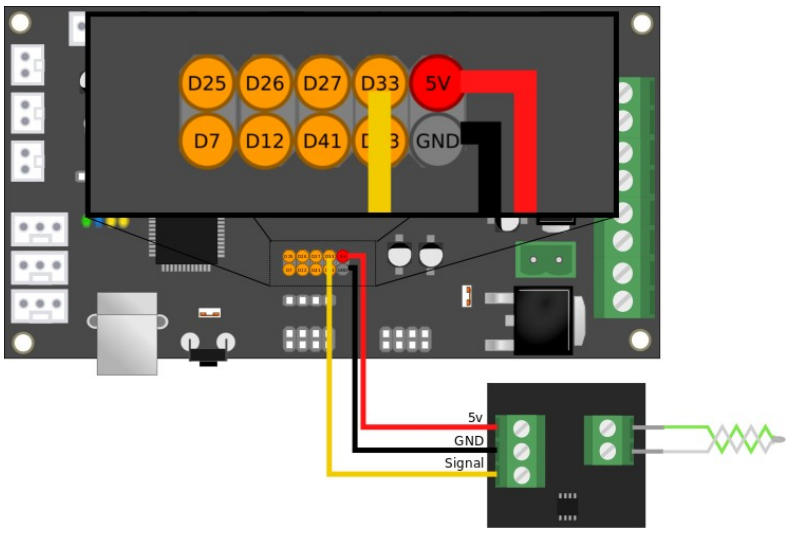
```
/****************************************************************************************
 ************************************* SDCARD ********************************************
 ****************************************************************************************/
#define SDSUPPORT

...

//
// ReprapWorld Graphical LCD
// https://reprapworld.com/?products_details&products_id/1218
//
#define REPRAPWORLD_GRAPHICAL_LCD
```

Connecting a thermocouple

The board has no support for thermocouples directly, so you need a thermo couple converter like https://reprapworld.com/products/electronics/ramps/external_thermocouple_board_v1_0/. The thermistor outputs on the Minitronics have a pull-up resistor and cannot be used to connect to this board. Instead use the free analog pin (A5) in the AUX2 header, like this:



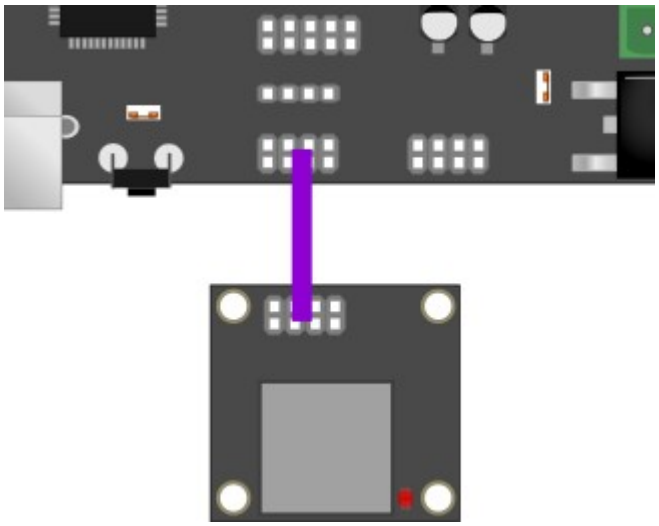
Adjust your firmware to use the AD575 Chip (Thermistor setting -1) and analog pin 5.

In the firmware, in the file , find the line SDSUPPORT and uncomment it

```
/****************************************************************************************
 ************************************* SDCARD ****************************************
 ****************************************************************************************/
#define SDSUPPORT
```

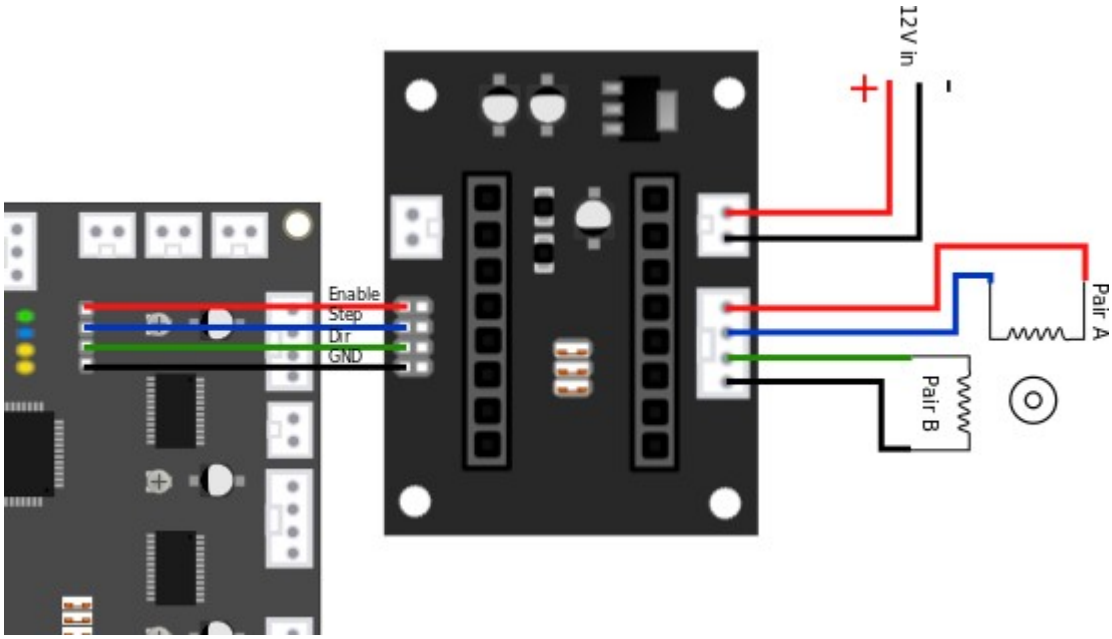
Using a SD-Card

You can use a SD card to store gcode and run that directly on the board. Or you can use the SD-card as a substitute for EEPROM and store settings. You can either use the https://reprapworld.com/products/electronics/ramps/external_sd_card_board_v1_1/ or the graphical LCD screen discussed in paragraph `Using a LCD screen`.



Connecting a external Stepper driver

For dual extrusion, you will need to use a fifth stepper driver. You can use an external stepper driver board (https://reprapworld.com/products/electronics/stepper_drivers/external_stepper_driver_v2_0/) with any Pololu compatible stepper driver to accomplish this. Connect the board like the following image and enable the second extruder in your firmware.



TROUBLESHOOTING

The following chapter provides a number of common problems and solutions. Before submitting a support request, make sure to test the board using the test firmware as outlined in the following paragraph.

Testing the board

To test the functionality of the board, a test firmware is available from https://github.com/brupje/minitronics_20/tree/master/Examples/minitronics20-test. This firmware will help you test the board. **Disconnect everything except the USB cable to your computer.** Upload the the test firmware to the board using Arduino, the blue debug LED should blink every second.

Open up the serial monitor in Arduino the board will show an output like:

AD values – T0: 1023 T1: 1023 T2: 1023

These values represent the resistance measured from t1, t2 and t3. When you connect a thermistor to the pins, the corresponding value in the serial monitor should change to about 890 for room temperature.

Endstops – S0: 1 S1: 1 S2: 1

This line reports the endstop status (1=open, 0=closed)

By connecting the 12V line, the MOSFETs should have power and their LEDs will blink in order. This verifies the MOSFETs and 12V power are OK. Also the stepper motors should turn when 12V is connected. They will rotate for a short time and switch direction.

These tests will verify the basic functionality of the board and help you diagnose the problem you have.

Common issues and solutions

Problem	**Solution**
- The print's layers shift during printing - My extruder is makes a clicking sound	- You are loosing steps. Increase the stepper motor current.
- The printer prints unexpectedly starts printing at a different position. - The extruders stops extruding, while the hot-end is still hot.	- The stepper driver(s) are becoming too hot. Decrease the current on the affected drivers.
- My stepper motor only vibrates	- The wiring of the stepper motor is loose/broken, try swapping the stepper motor with another one. - The current on the stepper motor is too low - The stepper driver is in error state, switch off voltage and wait a minute before turning it on again. - The stepper driver is broken, contact technical support
- The board does not run on (PWR LED off) while USB is connected	- Jumper USB (near the reset button) is missing - There is a short, fuse L1 on the bottom of the board near USB becomes (very) hot.
- The board turns on, but stepper motors and heaters don't work.	- The firmware is in protection mode (due to a temperature error). Try the testfirmware first - Fuse F1 (bottom of the board near 12V in) is blown due to a short. Verify using a multimeter. Replace the fuse with a compatible 10A one, remove all peripherals and check those first.
- I cannot upload code to the board	- Verify that the board is recognized by the computer. Press the reset button, the DBG LED should blink very fast for a few seconds and the computer should find the board - When Arduino show 'Uploading...', press the reset button - Try another PC to rule out a software problem