

Setup Guide

SKR Mini E3 V3.0

TFT35-E3 V3.0

Written by Fredrik Brolin

Do not share without authorization.

WORK IN PROGRESS

Forewords by the author

Hi and welcome to this guide!

When I was setting up my first printer, I realized the absence of guides that were easy to read and follow. This guide is supposed to be just that!

Who am I? I am Fredrik! A tech nerd from Sweden who loves troubleshooting things. I am writing this guide to make it easier for newcomers to get up and running with the BTT hardware.

I hope you will benefit from this guide and that your printing career starts up with ease!

Best of luck,

Fredrik Brolin

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About this guide

This guide contains information on how to set up the SKR Mini E3 V3.0 and the TFT35-E3 V3.0 from BIGTREETECH (BIQU Technology Co., LTD).

This guide is aimed at newcomers to the 3D-printing world and is therefore very thorough with easy-to-understand terms and solutions. The guide contains both information on how to install hardware and software, troubleshooting, tips and tricks, and notable features.

Steps that are difficult for the unexperienced will be marked as such. Proper protection and tools together with sufficient experience and knowledge are recommended.

Disclaimer

The author takes no responsibility for damages, either to components or individuals which might be sustained from following this guide.

Use of this document

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Hardware and Software

SKR Mini E3 V3.0

Hardware

The SKR Mini E3 V3.0 is a drop-in replacement 32-bit controller board manufactured for the Ender 3 (E3). The board is compatible with Ender 3/Ender3-Pro/Ender 5/Ender 5-Plus/CR-10 (BIQU, 2022).

It features STMG0B0RET6/STM32G0B0RET6 ARM control chip and uses TMC2209 drivers for the steppers. The board can be supplied with both 12VDC and 24VDC.

With this board your printer will run quieter and with better thermal performance.

CR Touch (Probe)

The CR Touch is a bed leveling probe manufactured by Creality and enables automatic bed leveling by measuring differences in the bed's current leveling.

The SKR Mini E3 V3.0 supports different kinds of probes; this guide will focus on the CR Touch. Have in mind that it differs from the BL touch.

Software

The SKR Mini E3 V3.0 can run both Marlin and Klipper as its firmware. This guide will focus on Marlin due to it running directly on the board and does not require a separate unit for processing.

TFT35-E3 V3.0

Hardware

The TFT35-E3 V3.0 is a printer display featuring both "Touch mode" and "Marlin mode". It is compatible with multiple controller boards. This guide will focus on the use with SKR Mini E3 V3.0.

It is connected by two wires to the SKR Mini E3 V3.0. One wire for display, rotary encoder, and information, and one wire for the touch features.

Have in mind that this display is a controller board by itself. This allows it to run independent from the printer controller board.

Note: You cannot control the display from a PC/RPI with the USB port. This port is for USB Flash memory only.

Software

The software used in the TFT35-E3 V3.0 can run two different modes. It communicates with the printer control board via UART.

Touch mode (UART serial port screen mode) which uses the onboard processor to relay instructions to the printer controller board and display information returned. While in Touch mode it is relaying information that the SKR Mini E3 outputs and is running independently from the printer controller board.

Marlin mode (12864 screen mode) which passes on both inputs and is controlled by the printer controller board directly. In this mode it functions just as the stock screen on your printer.

The software used by the display is developed by BigTreeTech and contributors from the open-source community.

Marlin

About Marlin

Marlin is a printing software that increases customizability, printer performance, and introduces features unique to Marlin.

Configuration

Marlin can be configured to fit exactly your need. You can change movement speeds, acceleration and even which pins to use.

The easiest way to configure Marlin is by using Visual Studio Code.

How to compile

One way to compile Marlin is with the plugins Marlin Auto Builder and PlatformIO within Microsoft Visual Studio Code. The software is free to download from Microsoft and the plugins are downloadable inside it.

Due to the popularity and necessity to configure and compile Marlin by yourself there is a lot of guides on the internet. Therefore, this guide will not include how to do it. However, the troubleshooting section of this guide will contain Marlin related solutions.

Klipper

Klipper is another printing software that runs on a separate processing unit i.e., Raspberry Pi or Linux. Due to the complexity to run this software it will not be covered in any way.

Installation/Hardware

SKR Mini E3 V3.0

Installation

Note: Depending on your printer model the installation process might differ from the guide.

Use caution when handling the power supply unit. It can incapacitate a full-grown human even when powered off due to the lingering current inside it.

If you are unsure about handling the components, have someone with experience help you. Shorting a circuit can damage components both critically and partly but especially it can damage you.

Before starting, ensure you have the required tools. Schematic for pins can be found on the BigTreeTech Github under “BIGTREETECH-SKR-mini-E3/Hardware/...V3.0/Hardware/..._PIN.pdf”.

Tools needed:

1. Hex key in sizes (2mm, 2.5, 3mm, 3.5mm) or (5/64”, 3/32”, 7/64”, 1/8”)
2. Pincers
3. (Recommended) ESD-Bracelet

Steps 2, 3, 10, and 11 relevant to printers with a control box where access is obstructed by a power supply unit.

1. Disconnect the AC cord and move the power switch to “ON” then wait a few seconds
2. (Optional) Disconnect the control box from the printer
3. Disconnect and remove the Power supply unit (Note: You don’t need to remove the power supply unit completely)
4. Move the power switch back to “OFF”
5. (Optional) Take a picture of the stock controller board with all connectors still attached
6. (Optional) Label wires with a piece of painter’s tape (i.e., “HB” “Hot end fan”)
7. Disconnect everything from the stock controller board

8. Remove the stock controller board
9. Install the SKR Mini E3 V3.0 in the same direction as the stock controller board
- 10.(Ender 3 V2 screen only) Replace the display cable with the new one from BigTreeTech if purchased
11. Connect all plugs and cables in the correct places (see pin table and your picture from step 4 for reference)
12. Re-install the power supply unit and re-assemble the control box
13. Power it on and flash it with the preferred software (Marlin/Klipper)

Pins

Fan pins should be connected as follows (default pins in Marlin):

- Parts cooling fan = FAN0_PIN
- Extruder fan = FAN1_PIN
- Controller fan = FAN2_PIN

Note: Fan pins output the same current (12/24V) that is provided to the board. Ensure you have fans rated for your current.

CR-Touch:

The CR-Touch is plugged into the PROBE slot without any modifications.

Depending on software the need to have the Z-endstop plugged in varies. See troubleshooting for advice.

*Note: The **BL-Touch** might be wired differently from factory. Ensure you run the wires to the correct pin.*

TFT35-E3 V3.0

Installation

Use caution when handling the power supply unit. The power supply unit receives main line voltage in AC. It can incapacitate a full-grown human even when powered off due to the lingering current inside it.

If you are unsure about handling the components, have someone with experience help you. Shorting a circuit can damage components both critically and partly but especially it can hurt you.

Before starting, ensure you have the required tools.

Tools needed:

1. Hex key in sizes (2mm, 2.5, 3mm, 3.5mm) or (5/64", 3/32", 7/64", 1/8")
2. Pincers
3. (Recommended) ESD-Bracelet

Steps 2, 3, and 12 relevant to printers with a control box where access is obstructed by a power supply unit.

1. Disconnect the AC cord and move the power switch to "ON" then wait a few seconds
2. (Optional) Disconnect the control box from the printer
3. Disconnect and remove the Power supply unit (Note: You don't need to re-move the power supply unit completely)
4. Move the power switch back to "OFF"
5. (Optional) Remove the controller fan
6. Disconnect the display and remove the cables completely
7. Remove the rotary encoder plastic cap
8. Remove the stock display
9. Install the TFT35-E3 V3.0

10. Connect the serial cable into either EXP1, EXP2, or EXP3 depending on your controller board. (More info under Pins)
11. (Touch mode) If using Touch is wanted, connect the RS232 cable to TFT or AUX-1 on the board. (More info under Pins)
12. Re-install the power supply unit and re-assemble the control box
13. Power it on

Pins

Serial cable

Depending on what controller board you need to connect the display in different ways. Following text is from BigTreeTech TFT35-E3 V3.0 user guide:

“LCD12864 mode uses EXP1, EXP2 and EXP3. EXP1 and EXP2 are LCD screen port of normal motherboard. EXP3 is the LCD interface used by Ender 3 series motherboard (such as SKR MINI E3 V1.2, SKR E3 DIP V1.1, etc.)” (BIQU, 2019). More information can be found on the BigTreeTech Github under “BIGTREETECH-TouchScreenFirmware”.

When using the SKR Mini E3 V3.0 connect ports EXP3 (display) to LCD (SKR Mini).

Touch cable

The cable provided from BigTreeTech has a connector on one side and pins on the other. The pins go to the controller board and are connected in the following way:

- +5V (Black) to +5V
- GND (Long dash) to GND
- PA2 (Cross) to TX2
- PA3 (Short dash) to RX2
- RST (Dots) to RST

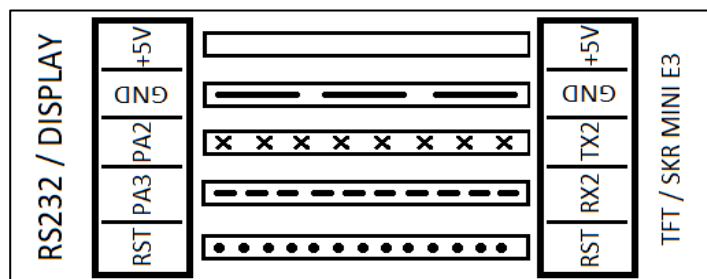


Figure 1: Markings on the cable when looking directly on the connector

Installation/Software

SKR Mini E3 V3.0

When you have successfully installed the hardware, the next step is to flash the controller board. This is done by putting a Marlin firmware file on a SD card, inserting it into the SKR Mini SD card slot, and powering on.

Steps to update/flash the firmware with downloaded firmware:

1. Download an already compiled firmware file (BIQU provides pre-compiled firmware for printers on their Github)
2. Rename the file "FIRMWARE.BIN"
3. Put the file on a SD card and insert it in the controller board SD card slot
4. Power on the printer
5. The status LED blinks red for around 10 seconds and then enters a solid state (Blink = firmware update, Solid = Board running normally)
6. The display should light up and display information
7. (TFT35-E3) The display should show the message "Printer Ready" in the message box
8. Initiate EEPROM to reset settings to the new ones

Steps to compile your own configuration into a firmware file:

Note: This requires Visual Code Studio (VCS) and the plugins referred to earlier to be installed. You should have some experience in making software modifications before trying this.

1. Download Marlin and the configuration examples from the Marlin website (marlinfw.org)

Description	Version	Download	Configurations
Current Marlin Release <small>Supports AVR and ARM Arduino and PlatformIO</small>	2.1.1	2.1.1.zip	View / Download

Figure 2: Marlin downloads page (Marlin, GPLv3, 2022)

2. Open the configuration folder and navigate to your printer.

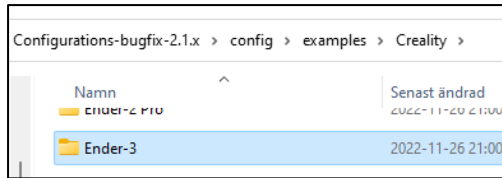


Figure 4: Example printer folder

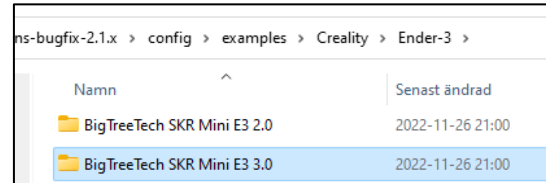


Figure 3: Example boards

3. Copy all files from the folder and paste them in Marlin firmware folder. Replace all identical files (Marlin-bugfix-2.1.x/Marlin)

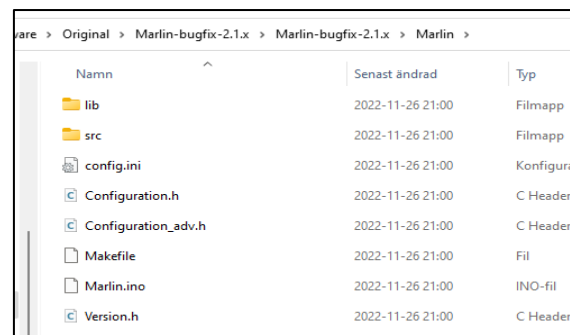


Figure 5: Marlin configuration folder

4. Launch Visual Code Studio
5. Access Marlin via the “Open Folder” function under “File”

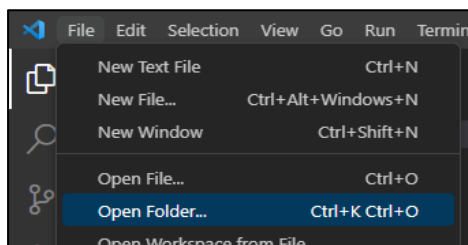


Figure 6: Open Folder in VCS

6. Open the main folder of the firmware named “Marlin-x.x.x”(Note: Mark the folder that contains all of the Marlin files. If you see folders named “.Github”, “Marlin”, “Docker” etc you need to go up one step.)
7. Go to “Auto Build Marlin” and confirm that “Board” and “Architectures” are correct. (SKR Mini E3 V3.0 should have “Board: BTT SKR MINI E3 V3.0” and “Architectures: STM32G0”)



Figure 7: Auto Build Marlin build page

8. Make desired changes in Configuration.h and Configuration_adv.h

9. Go back to “Auto Build Marlin” and press “Build”
10. Wait for the program to compile
11. If successful go to the next step, if the build failed read the log and correct issues
12. Copy the presented “Firmware.bin” file to a SD card and insert it into the controller board SD slot
13. Power on the printer and wait for it to update
14. Initiate EEPROM to reset settings to the new ones

TFT35-E3 V3.0

The TFT35-E3 V3.0 can be configured in two ways. Changing the Config.ini file in a word processor or changing the firmware config and compiling.

Config.ini

This is the easiest way to update firmware and settings in the display.

1. Download precompiled firmwares found in the “BIGTREE TECH-TouchScreen-Firmware” folder on the BigTreeTech Github. The folder is called “Copy to SD Card root directory to update”. To download press the green “<> Code” button and “Download ZIP”.
2. Copy the following folders/files to the SD card
 - a. BIGTREE_TFT35_V3.0_Vx.x.x.x.bin (Note: If your display uses a GigaDevices chip you must use the file containing “GD”. If unsure, put both files on the SD card and the display will pick the right one automatically)
 - b. Config.ini
 - c. TFT35-folder from the Theme folder of your choice
 - d. Preferred Language pack (Language_xx.ini)
3. Open the “Config.ini” file with a word processor and make desired changes (Especially if you have a CR-10. Then you must increase bed size in the config)

4. Put the SD-card in the slot on the display and wait. You should see the progress on the display
5. The display reports all issues that occurred and then return to the main menu

Modifying the firmware with Visual Code Studio

Note: This requires Visual Code Studio (VCS) and the plugins referred to earlier to be installed. You should have some experience in making software modifications before trying this.

This process differs from when compiling Marlin due to it not using Marlin Auto Builder.

1. Open the main folder in VCS (BIGTREE TECH-TouchScreenFirmware-Master)

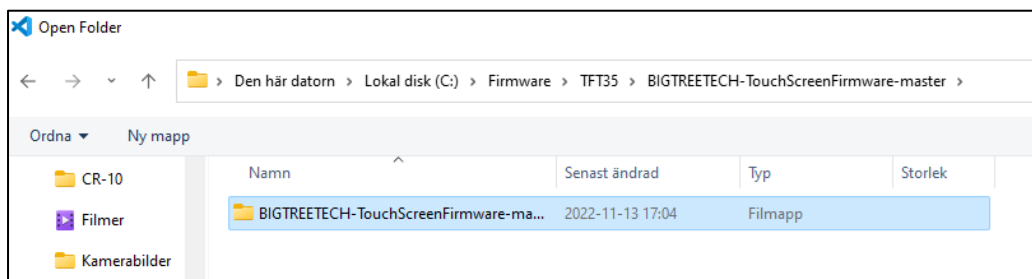


Figure 8: What folder to open in VCS

2. Make your desired change in "Configuration.h" and save
3. Open the Plugin "PlattformIO" and press "Open Project"

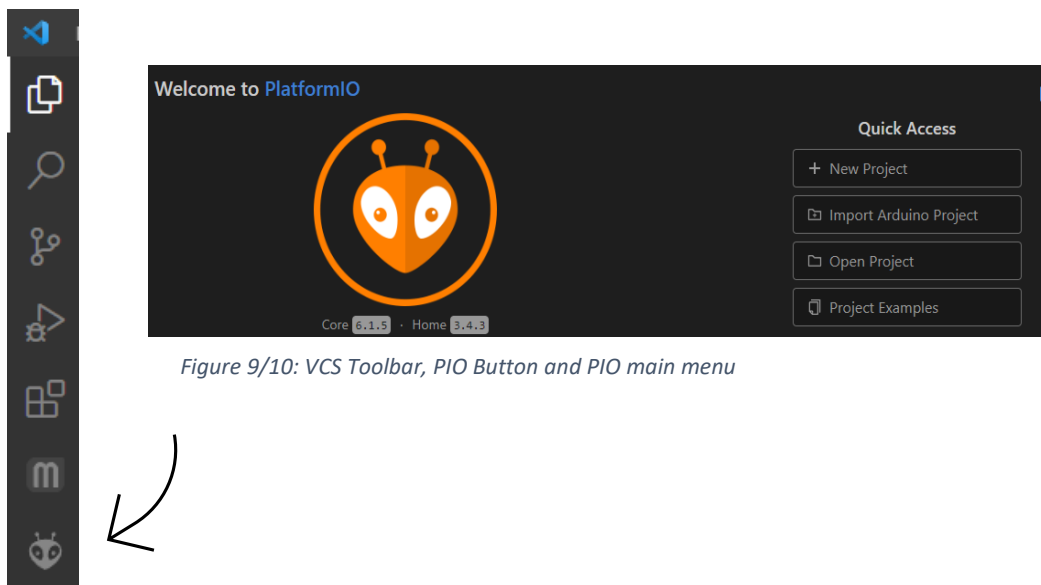
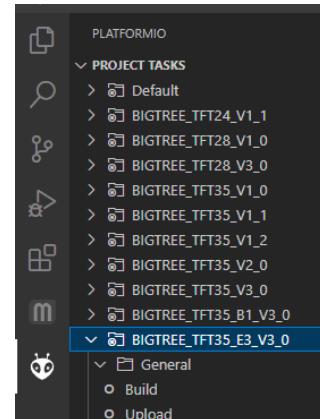


Figure 9/10: VCS Toolbar, PIO Button and PIO main menu

4. Open the same folder again
5. Press the PIO button again and navigate to the “BIGTREE_TFT35_E3_V3.0” folder under “Project Tasks”
6. Press “Build” and wait for it to compile
7. Open the file explorer and navigate to the folder “%/.pio/build/BIGTREE_TFT35_E3_V3.0”
8. Follow the steps in the “Config.ini” guide above but use the firmware file you just compiled instead
9. The display should update the firmware and boot into the main menu



Tips and Tricks/Features

Features found below are either run on the controller board or the display (in Touch mode). They are marked with “Marlin/gcode” or “Touch”.

SKR Mini E3 V3.0

Decreased temperature = Slower fans

Babystepping (Marlin/gcode)

Tramming (Marlin/gcode)

ABL speed/Restore or create mesh before print (Marlin/gcode)

TFT35-E3 V3.0

Independent operations

SD card and USB-Host

Modifying Marlin values directly in the printer

Injecting terminal G-codes into the controller board

Custom G-code buttons

Custom Start/End/Cancel G-codes

Using rotary encoder with touch mode

Creating new Preheat profiles

PID-Autotune (Touch)

Babystepping (Touch)

Tramming (Touch)

Troubleshooting

SKR Mini E3 V3.0

Software

PID-autotune timing out

Steps are wrong

Probing issues

Temperature problems (Thermal runaway,

Hardware

Temperature problems (Unstable, not heating up, thermistor not sending values)

Fans not running/Wrong fan running

Loud steppers

Extruder direction wrong

TFT35-E3 V3.0

Software

No printer Connected

Printer pauses momentarily then starts printing again

Rotary encoder problems

Touch calibration failing

PID-Autotune (Touch) Timeout

Hardware

Low sound from buzzer

No display

Sources