How to Install Klipper Firmware

From Scratch on a Raspberry Pi!

WARNING the commands listed here are powerful & if misused or misappropriated can cause harm, use with care! Any results are on you & you alone. Best efforts have been made to make sure they work & are good for your Rpi & printer.

These commands can & will work on a clone pi, like the BTT one & even the new Sovol SV07, but you will have a different initial image install process! Refer to your manual there. Also the extra features might be different too.

I have also included some additional files to help you. The demon_essentials.cfg is some extra function automation to add to your new system. Plus I have included boot-image.png for you to use with your custom boot screen as described in a link later in this document.

Ready, set, GO….!

Download Pi Imager
https://www.raspberrypi.com/software/
Click the cog & set network & location options & save
Select Raspberry Pi OS (Other)
Install Raspberry Pi OS Lite (64bit) image to your sd card

Install the sd card into your Pi & boot.

CLONE PI USERS START HERE!!!!

Follow your clone Pi's manual for OS image install…

Your Router…

Login to your wifi router & look at "Attached Devices" for your RPi, note down its IP address & then use the router's web interface to reserve that IP especially for your Pi. Your router's manual will tell you how to do that.

SSH - Remote Pi control via terminal!

Use a suitable SSH app on your computer
Then to login send…

EXAMPLE ADDRESS: ssh pi@192.168.x.xx

(Pi being the chosen user name & 192.168.x.x being the unique IP address you wrote down for your own RPi)

Enter the password you chose - it will not be displayed but will work. Press enter.

Then follow these steps….

CLONE PI USERS SKIP THIS SECTION, go down to "Log Back In'
sudo raspi-config
Interface options, enable spi & i2c
Advanced options, expand file system
Exit & reboot now

Now log in again & run

sudo apt-get update
sudo apt-get upgrade
sudo apt-get install git -y
sudo reboot now

FIX Possible Issue

A bug was introduced in Debian Bullseye (which includes current MainsailOS), which prevents the symlinks in /dev/serial/by-id/ from being created. If your printer can't connect to the MCU anymore after a system update, you can check if it is caused by that bug by checking the installed version of udev with
apt show udev

If your version is 247.3-7+deb11u2 or 247.3-7+rpi1+deb11u2 you have the broken package installed and should use one of the fixes below. Take special care about the last number ("u2").

As of May 20, this bug has spread to PiOS based systems as well.
Option A. Replace the corrupted udev file with one from upstream systemd

backup the existing rules file (just in case)
sudo cp /usr/lib/udev/rules.d/60-serial.rules /usr/lib/udev/rules.d/60-serial.old

download the rule from the systemd main repo.
sudo wget -O /usr/lib/udev/rules.d/60-serial.rules https://raw.githubusercontent.com/systemd/systemd/main/rules.d/60-serial.rules

Reboot
sudo reboot

IF THIS DOESN'T WORK TRY THIS THREAD:

https://klipper.discourse.group/t/debian-bullseye-bug-causing-klipper-to-no-longer-find-the-printer-board/8231

Log Back In....

sudo apt-get install git ffmpeg -y
sudo reboot now

cd ~ && git clone https://github.com/th33xitus/kiauh.git

To use Kiauh type this command…

./kiauh/kiauh.sh

Link.. https://github.com/th33xitus/kiauh

If your image is clean & empty, or if items are already installed you can manage & add more, or remove unwanted items.

Install:
Klipper
Moonraker
Mainsail
Any others you need

Use Kiauh to build your Klipper MCU firmware

Select option 4 “Advanced Options”

Then select option 2 “Build Only”

Now choose the correct options for your printer’s control board. They should be stated in the board’s manual, GitHub page or found online.

Use a FTP client like Cyber Duck to access the built firmware file on your Pi
Search how to use this software if needed.

The printer firmware file is found in: /home/pi/klipper/out
It will be called klipper.bin

Copy it to your computer & rename it firmware.bin

Then copy that to your printer’s sd card & flash your board.
Connect your Pi to your powered printer.

Use Kiauh options to get your MCU ID!

Option 4 “Advanced Options
Option 5 “Get MCU ID”
Option 1 “USB”

Copy the blue text next to “MCU 1” & paste it onto the end of the line in your printer.cfg

What you need will start “usb-Klipper_” then have a load of letters & numbers

In your printer.cfg look for…

[mcu]
serial: /dev/serial/by-id/ <<<(PASTE HERE)

USB cameras should automatically work

Camera setup in Crowsnest

You shouldn’t need these, but just incase…

USB cameras should automatically work but CSI cameras might need some tweaking

https://crowsnest.mainsail.xyz/faq-trouble-shoot/how-to-setup-a-raspicam

https://crowsnest.mainsail.xyz/faq/upgrade-from-v3-to-v4

For Klipperscreen…..

If your touchscreen doesn’t recognise any touches do this…..

sudo nano /boot/config.txt

Scroll most of the way down in the now displayed text file, find & edit…
Change:
dtoverlay=vc4-kms-v3d

To:
dtoverlay=vc4-fkms-v3d

Save & exit - commands for this at bottom of the screen

Adding ADXL345 to GPIO pins

https://www.ifixit.com/Guide/Adding+ADXL345+Accelerometer/147745

https://www.klipper3d.org/Measuring_Resonances.html

~/klippy-env/bin/pip install -v numpy
sudo apt update
sudo apt install python3-numpy python3-matplotlib -y

Make sure this is done…. …we did it earlier.
sudo raspi-config
#3 Interface Options > P4 SPI > Yes > OK > Finish

 If using The FYSETC USB C Portable Input Shaper do this….

https://github.com/FYSETC/FYSETC-PortableInputShaper

Adding Host GPIO Pin Control

https://github.com/Klipper3d/klipper/blob/master/docs/RPi_microcontroller.md

cd ~/klipper/
sudo cp ./scripts/klipper-mcu.service /etc/systemd/system/
sudo systemctl enable klipper-mcu.service

To compile the Klipper micro-controller code, start by configuring it for the "Linux process":

cd ~/klipper/
make menuconfig

In the menu, set "Microcontroller Architecture" to "Linux process," then save and exit.

sudo service klipper stop
make flash
sudo service klipper start

If klippy.log reports a "Permission denied" error when attempting to connect to /tmp/klipper_host_mcu then you need to add your user to the tty group. The following command will add the "pi" user to the tty group:

sudo usermod -a -G tty pi

Make sure the Linux I2C driver is enabled by running sudo raspi-config and enabling I2C under the "Interfacing options" menu. If planning to use I2C for the MPU accelerometer, it is also required to set the baud rate to 400000 by: adding/uncommenting dtparam=i2c_arm=on,i2c_arm_baudrate=400000 in /boot/config.txt (or /boot/firmware/config.txt in some distros).

 **Custom Boot Screen Image** on Klipperscreen follow this guide….

https://docs.vorondesign.com/community/howto/samwiseg0/voron_rpi_bootscreen.html

Adding BME/BMP280 Sensor

They are great environmental sensors the BME280 measures temperature, air pressure & humidity. Whereas the BMP280 can only measure temperature & air pressure.

Connect the sensor to the correct GPIO pins on your Pi, they should be…
3v3 Power
BCM 2 (SDA)
BCM 3 (SCL)
Ground

Search RPi Pinout to find correct pinout.

Enable I2C as we did before & add the below section to your printer.cfg

[mcu host]
serial: /tmp/klipper_host_mcu

[temperature_sensor enclosure_temp]
sensor_type: BME280
i2c_address: 118
i2c_mcu: host
i2c_bus: i2c.1

```
[gcode_macro QUERY_BME280]
gcode:
    {% set sensor = printer["bme280 enclosure_temp"] %}
    {action_respond_info(
        "Temperature: %.2f C\n"
        "Pressure: %.2f hPa\n"
        "Humidity: %.2f%%" % (
            sensor.temperature,
            sensor.pressure,
            sensor.humidity))}
```

Adding A Integrated Power Control Device To The Moonraker.conf File

Word of warning! Adding a power control device like a power relay can sometimes involve working with & modifying your printer's wiring that runs on mains level voltage!
This can be extremely dangerous with a definite risk of serious injury, fire, loss of property & even death!

DO NOT mess with mains level wiring if you don't know what you're doing. I provide no instructions for installing such a device & I am not liable in any way shape or form for anything bad happening as mentioned due to you causing fire, death, injury, loss or accident linked directly or indirectly to you playing with mains voltage wiring while attempting anything you find here.

Example below for using the BTT Power Relay v1.2

See the install instructions for this product on the BTT Github! However search Youtube for…
"BTT Power Shutdown Relay V1.2 - Save your printer from idling all night. Full Tutorial."

It's far more helpful! Follow his instructions at your own risk.

Then you will need to set your instance to be able to control your Pi's GPIO pins as mentioned previously in this document. You need to choose which 2 pins to use. Then you need to SSH into your pi & run:

```
sudo nano /boot/config.txt
```

Then at the bottom of the file at the end of the first section & in the space above the start of the [CM4] section paste in:

```
gpio=XX=op,dh # Replace “XX” with your chosen GPIO pin to control power device
```

Then use the commands at the bottom of the screen to exit & save the file.

This will make sure that the GPIO pin you will use for the relay’s PSon pin is automatically pulled “high” when the Pi is first turned on at the very beginning of the boot sequence. This in turn should keep your relay from opening & shutting the printer down while the Pi is booting. Trust me that is very annoying if you don’t do this!

Be very carful with the Moonraker.conf file! Its very important & you can break your instance if you ruin this file!

Then open your Moonraker.conf file on your Pi & paste in:

```
[power Printer Power]
type:gpio
#   The type of device.  Can be either gpio, klipper_device, rf,
#   tplink_smartplug, tasmota, shelly, homeseer, homeassistant, loxonev1,
#   smartthings, mqtt or hue.
#   This parameter must be provided.
pin:gpioXX # Replace XX with your GPIO PsOn pin
initial_state:on

off_when_shutdown: True
#   If set to True the device will be powered off when Klipper enters
#   the "shutdown" state.  This option applies to all device types.
#   The default is False.
#on_when_job_queued: False
#   If set to True the device will power on if a job is queued while the
#   device is off.  This allows for an automated "upload, power on, and
#   print" approach directly from the slicer, see the configuration example
#   below for details. The default is False.
locked_while_printing: False
#   If True, locks the device so that the power cannot be changed while the
#   printer is printing. This is useful to avert an accidental shutdown to
#   the printer's power.  The default is False.
restart_klipper_when_powered: True
#   If set to True, Moonraker will schedule a "FIRMWARE_RESTART" to command
#   after the device has been powered on. If it isn't possible to immediately
#   schedule a firmware restart (ie: Klippy is disconnected), the restart
#   will be postponed until Klippy reconnects and reports that startup is
```

```
#   complete.  Prior to scheduling the restart command the power device will
#   always check Klippy's state.  If Klippy reports that it is "ready", the
#   FIRMWARE_RESTART will be aborted as unnecessary.
#   The default is False.
restart_delay: 2
#   If "restart_klipper_when_powered" is set, this option specifies the amount
#   of time (in seconds) to delay the restart.  Default is 1 second.
bound_services:
#   A newline separated list of services that are "bound" to the state of this
#   device.  When the device is powered on all bound services will be started.
#   When the device is powered off all bound services are stopped.
#
#   The items in this list are limited to those specified in the allow list,
#   see the [machine] configuration documentation for details.  Additionally,
#   the Moonraker service can not be bound to a power device.  Note that
#   service names are case sensitive.
#
#   The default is no services are bound to the device.

[power Reset Power]
type:gpio
pin:gpioXX # Replace XX with your GPIO RESET pin
locked_while_printing: True
initial_state:off
restart_klipper_when_powered: True
restart_delay: 2
Timer:2
```

Be very careful with the Moonraker.conf file! Its very important & you can break your instance if you ruin this file!

Doing the above will give you two power devices in the Power menu in MainSail. Printer Power & Reset Power.

Now go to your macros.cfg file & paste in:

```
[gcode_macro M81]
gcode:
 {action_call_remote_method("set_device_power",device="Printer
Power”,state="off")}
```

This will give you macro control of the relay power unit by calling M81 & for use with the new End_Print macro using the Printer_Auto_off switch for fully automatic printer shutdown after a print has completed. This feature is enabled in the v1.1 macros, uncomment to activate.

NOTE: The BTT Power Relay v1.2 requires the PSon & reset connections. To keep the printer on the PSon must remain “high”, switching it off will shut the printer down after 8 seconds.

To turn it back on you must ensure the Printer Power switch is turned back on & then you click the Reset Power button. If you don’t do this the printer will turn back on but switch back off again. This is a quirk of the relay firmware & is normal.

You will also notice a new POWER icon in KlipperScreen. This will also control these functions.

Im not expecting any payment for putting this together, nor would I ask for any, but as people have requested a means to give a small gift or gratuity as a thank you I’ve included a links below. Please feel free to use them or don't, send any amount you feel is appropriate, if you so wish. Anything you send will be gratefully received & appreciated.

Thank you, & I hope this guide helps you!

https://ko-fi.com/3dprintdemon

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