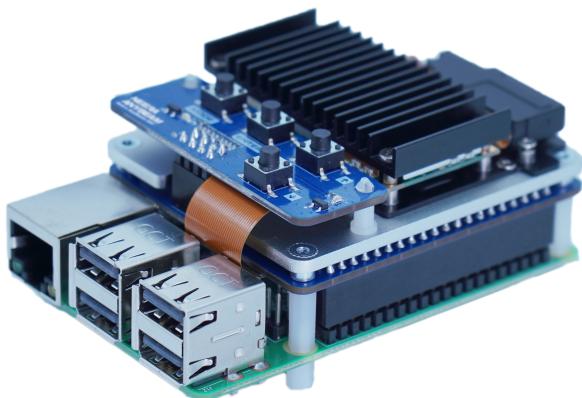


Nebra AnyBeam HAT User Guide

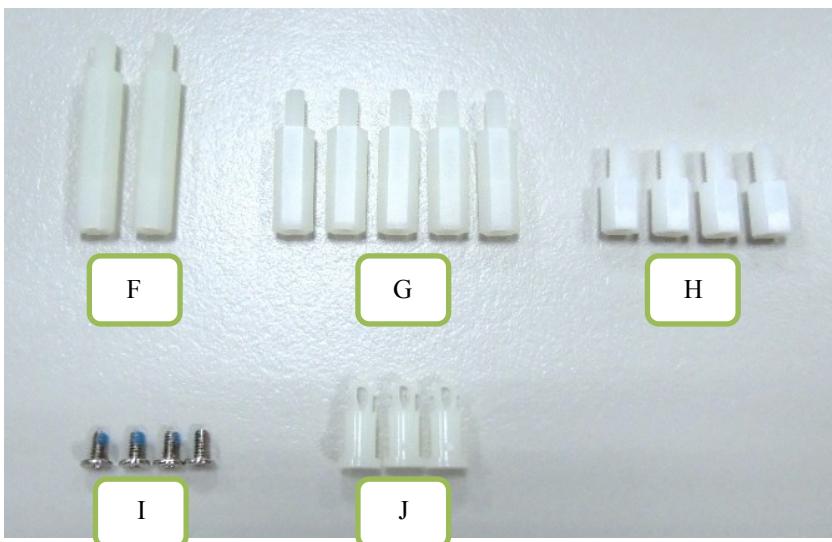
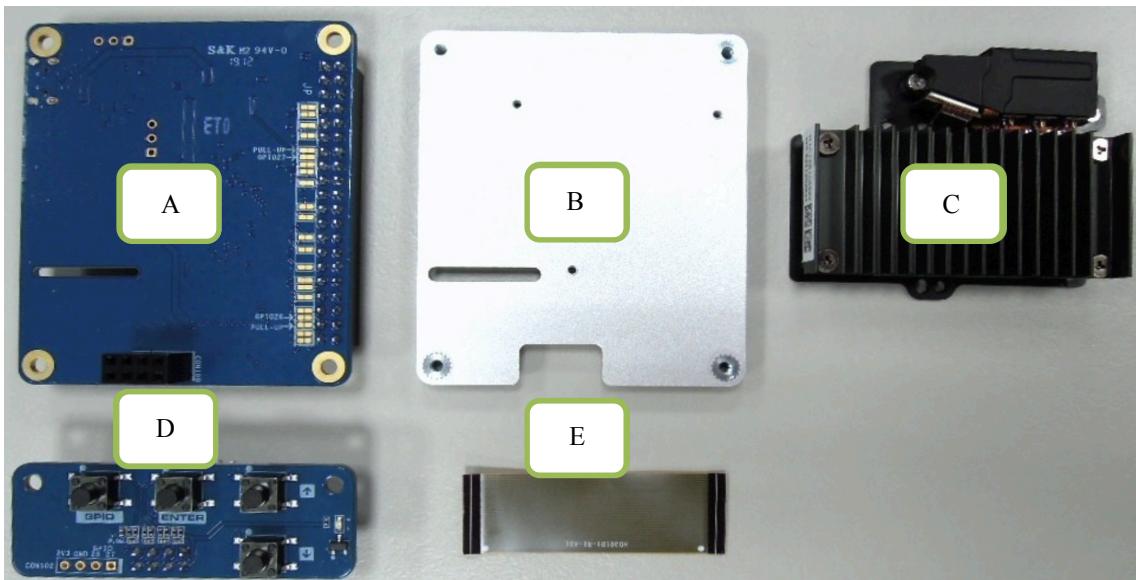


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Mechanical Specification

□ Package contents

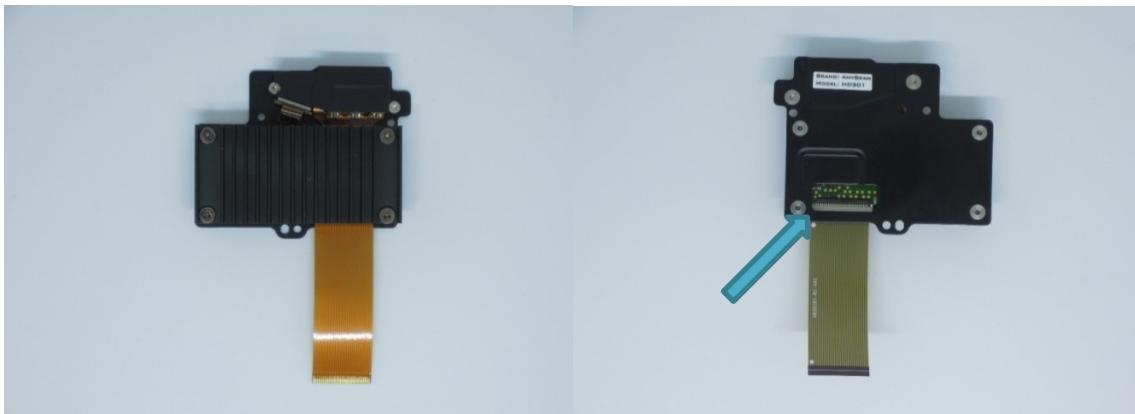


- A - 1 x Adapter Board
- B - 1 x Base Plater
- C - 1 x LSP Display Module
- D - 1 x Control Board
- E - 1 x FPC
- F - 2 x Spacers: M2.50 x 19L Spacer for the Raspberry Pi Zero and Pi Zero WH
- G - 5 x Spacers: M2.50 x 12L
- H - 4 x Spacers: M2.50 x 6L
- I - 4 x Screws: M1.60 x 3.50L
- J - 3 x Support Spacers

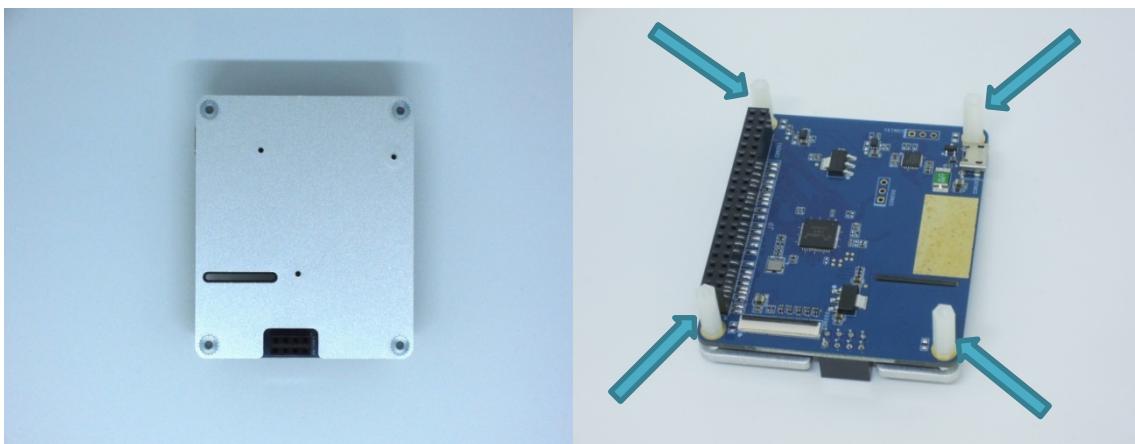
□ Assembly guide

Read “Precautions of use” carefully before you start to assemble.

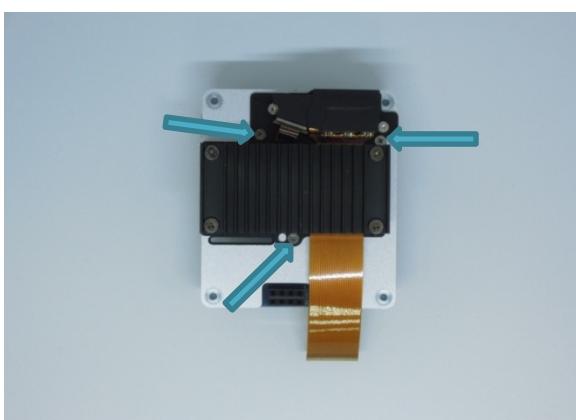
Step 1: Insert the FPC into the LSP Display Module connector and lock the actuator.



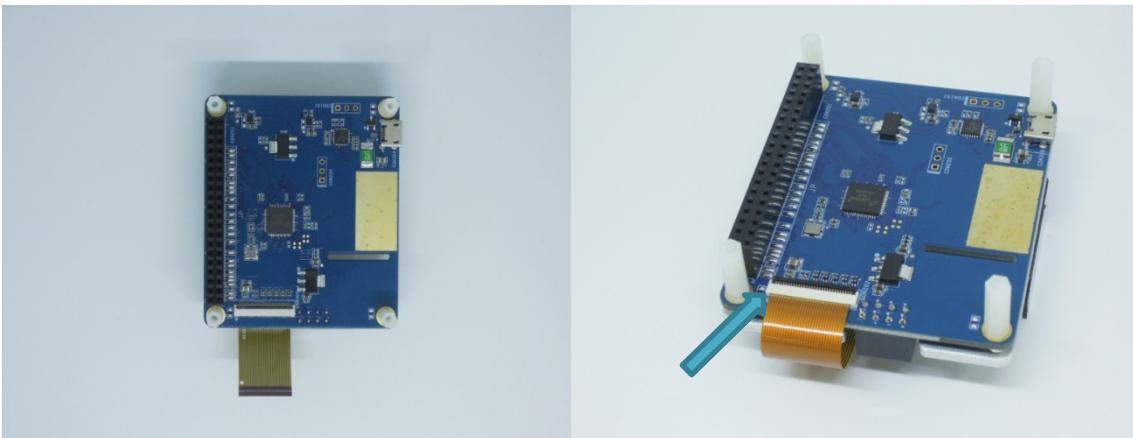
Step 2: Install 4 x 12L spacers by inserting one in each corner of the adapter board.



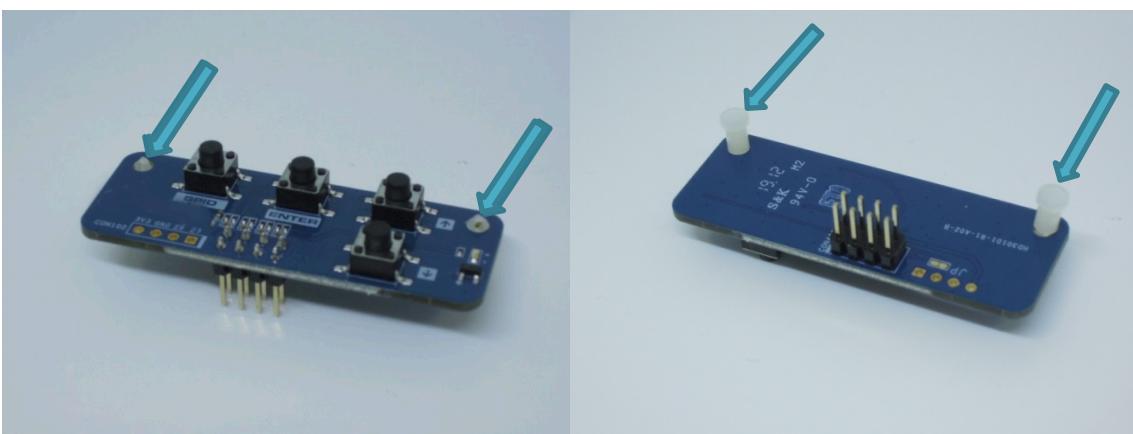
Step 3: Insert the three screws to secure the LSP Display Module to the base plate.



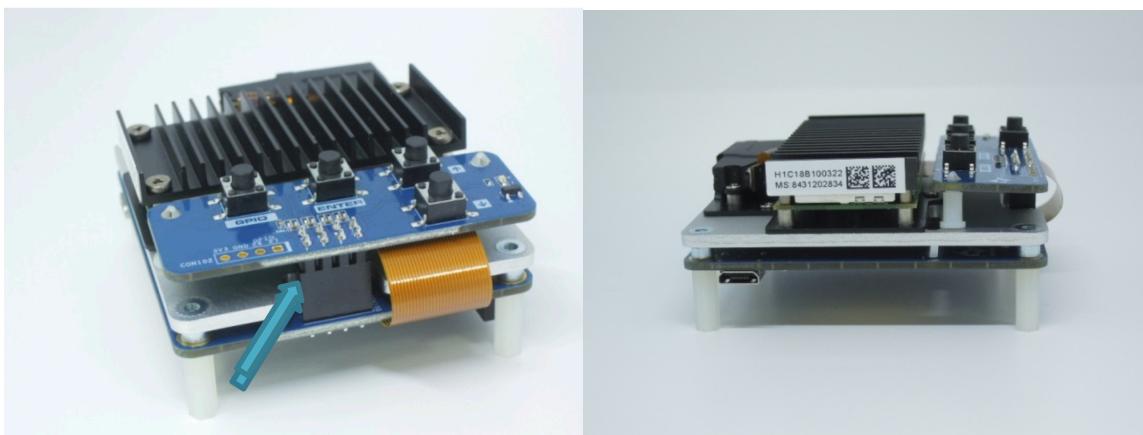
Step 4: Connect the FPC to the Adapter Board, and lock the actuator.



Step 5: Install the 2 pcs support spacers to the control board.

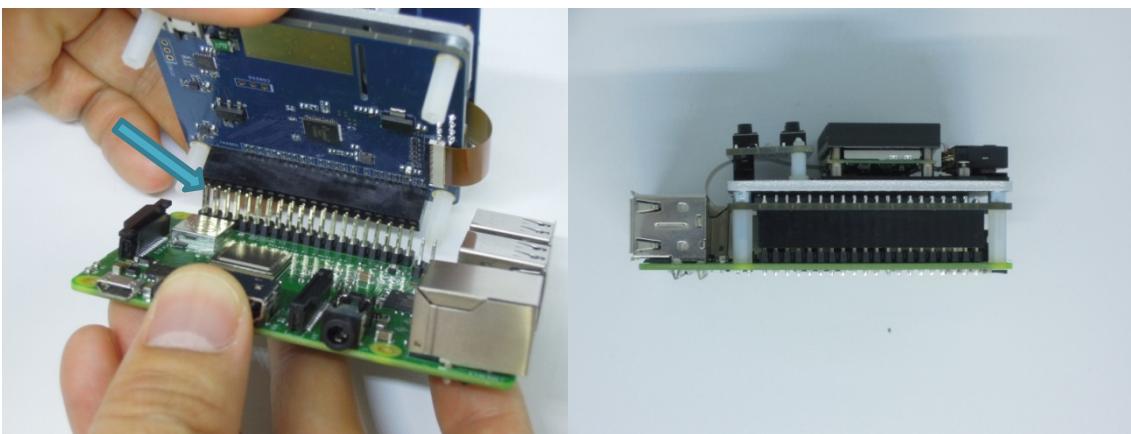


Step 6: Connect the control board to the adapter board via 2x4 header



Step 7: Connect the Nebra AnyBeam HAT to the Raspberry Pi via the 2x20 pin header.*

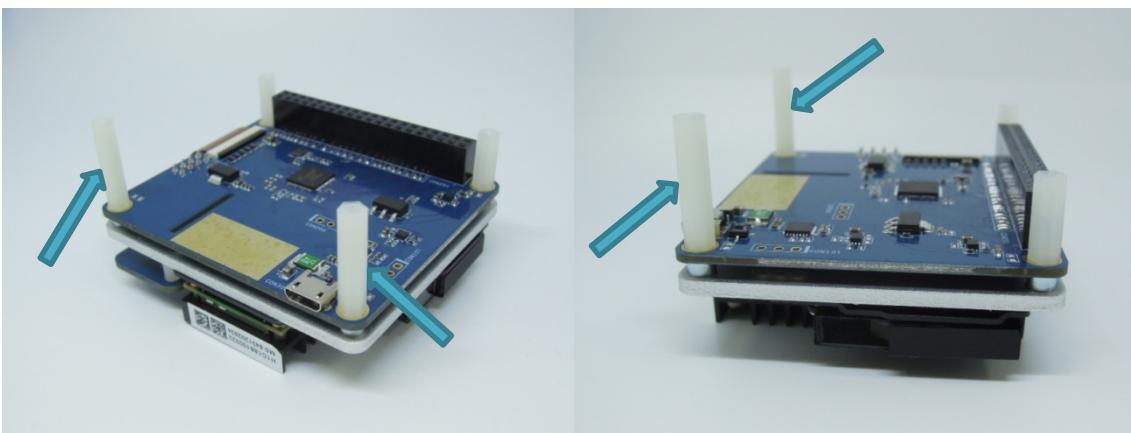
The Raspberry Pi and SD card are not included in Nebra AnyBeam HAT, it should be prepared by user.



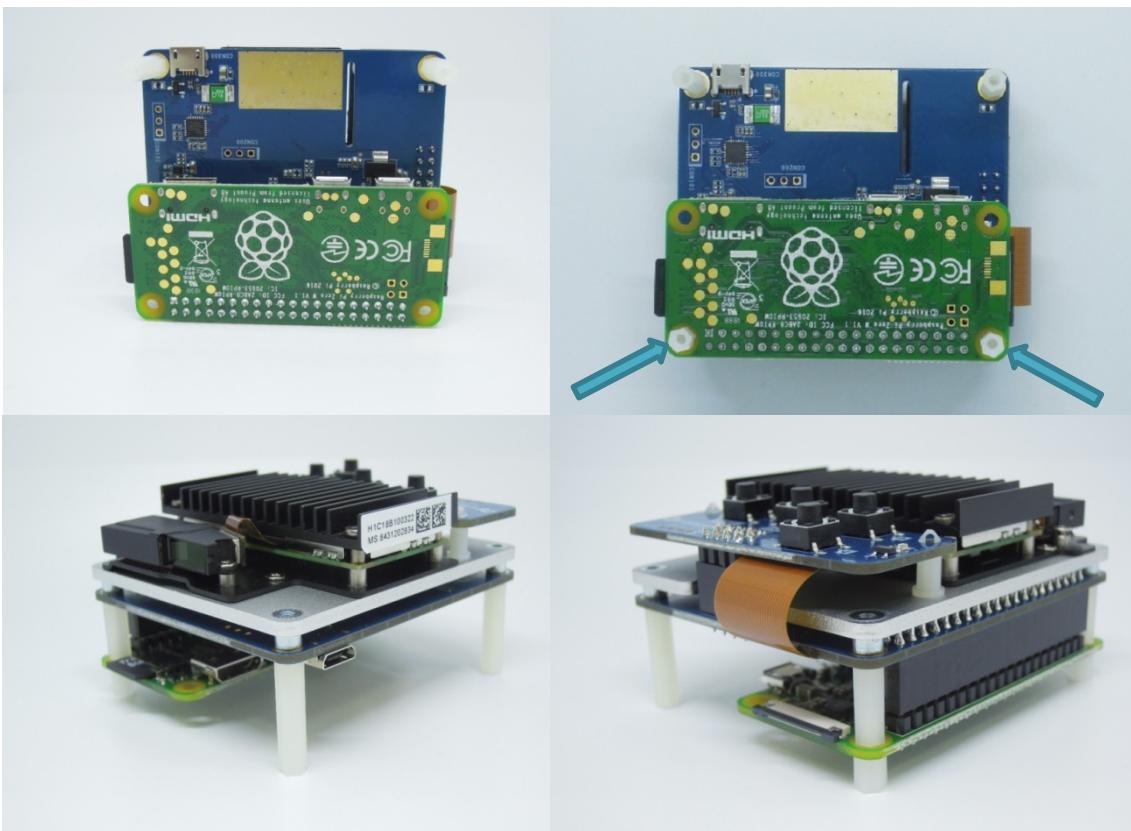
Step 8: Install 4 x 6L spacers by inserting one in each corner to secure the Nebra AnyBeam HAT to the Raspberry Pi.



Step 9: When connecting to the Raspberry Pi Zero or Zero WH, please change this from 2 x 12L spacers to 2 x 19L spacers.

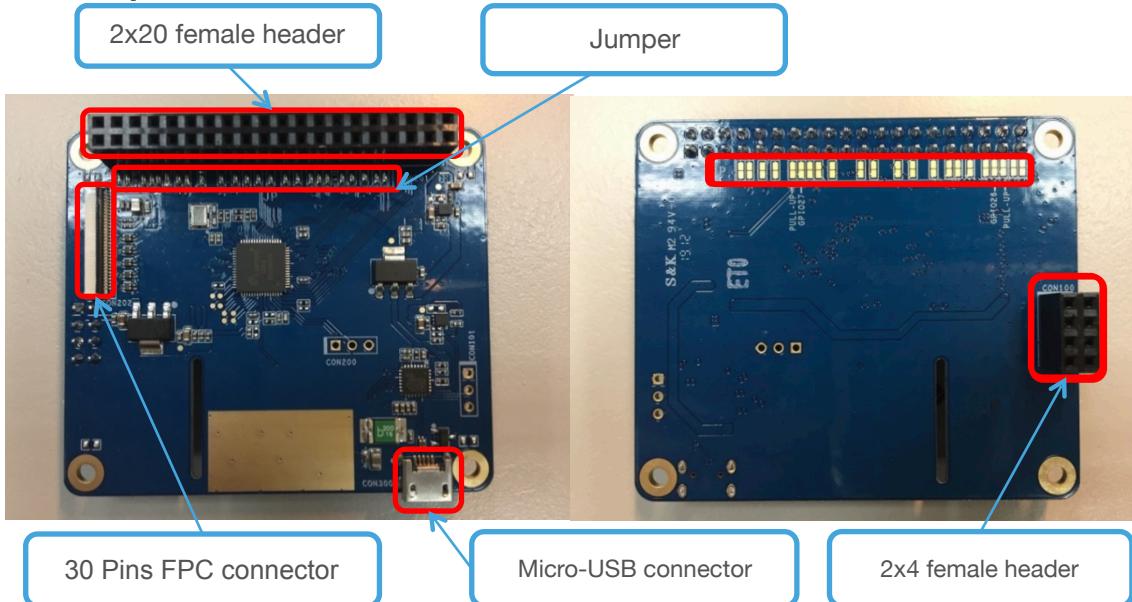


Step 10: Install 2 x 6L spacers to fix the Raspberry Pi Zero or Zero WH to the control board.



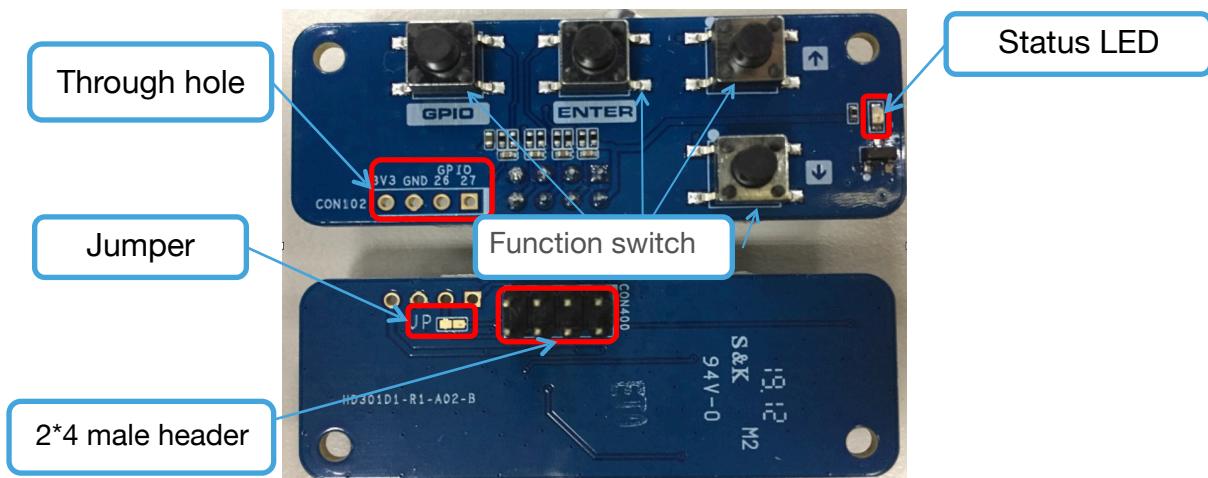
□ Configurations layout

▪ Adapter board:



- **Micro-USB connector** - deliver power via the onboard Micro-USB connector or the Raspberry Pi Micro-USB connector.
- **2x20 female header** - connect to the Raspberry Pi 2x20 male header.
- **2x4 female header** - connect to the Control Board 2x4 male header.
- **30 Pins FPC connector** - connect to the LSP Display Module.
- **Jumper**
JP - bridging this jumper for MODE selection.

- **Control board:**



➢ **2x4 male header** - connect to the Adapter Board female header.

➢ **STATUS LED**

Light up - when the Nebra AnyBeam HAT is powered up.

Flashing - error occurring.

➢ **Through hole pinout**

3V3 - this is the output from the onboard 3.3V regulator. It can provide at 100mA output.

GND - common ground for power and logic.

GPIO 26 - this is GPIO 26 from the Raspberry Pi.

GPIO 27 - this is GPIO 27 from the Raspberry Pi.

➢ **Function Switch**

ENTER - press and hold down this switch for 4~6 seconds to ENTER or EXIT the OSD mode.



- this switch is for up direction while entering the OSD mode.



- this switch is for down direction while entering the OSD mode.



- this user-defined switch is connected to GPIO 26 and only for MODE3.

- OFF – (ON)*

- **NOTES: (ON)* denotes function is momentary.**

➢ **Jumper**

JP - bridging this jumper for MODE 3 selection.

(Note: "JP" is open circuit in default)

Please note that this is not technically a HAT due to the lack of an onboard EEPROM.

You may need a soldering iron and desoldering braid to adjust the MODE by bridge or remove the solder pads on the PCBA(check the tutorial on this document).

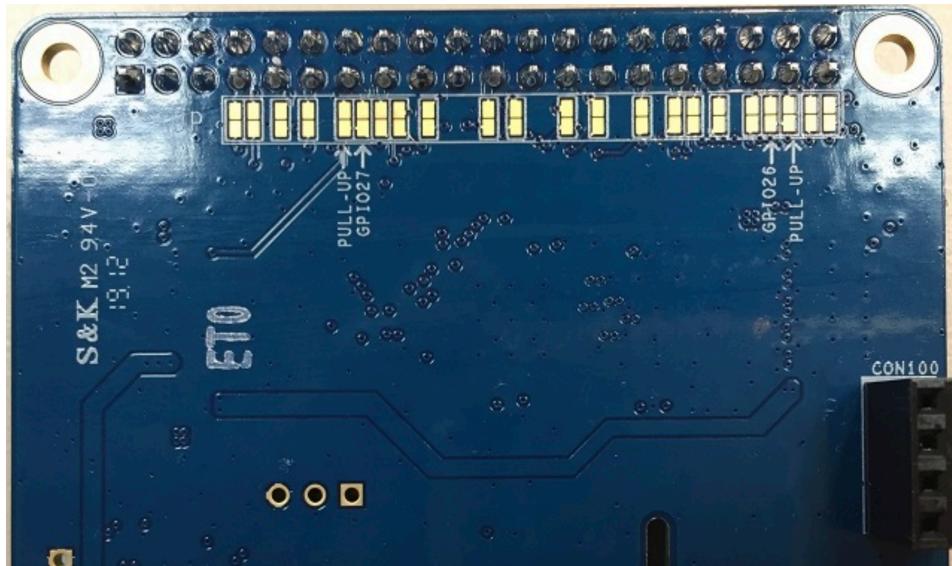
□ Four modes of Nebra AnyBeam HAT

➤ MODE 1: RGB 888(24 bits - 8 bits for red, green and blue)

In this mode, we use every pin available on the Raspberry Pi. That means you don't get the standard user I2C pins, the UART(TX/RX) pins, the EEPROM I2C pins and hardware SPI pins. Instead, you do get to use the USB ports, HDMI port, and CSI port.

The Nebra AnyBeam HAT is designed with Mode 1 in default (no jumpers required).

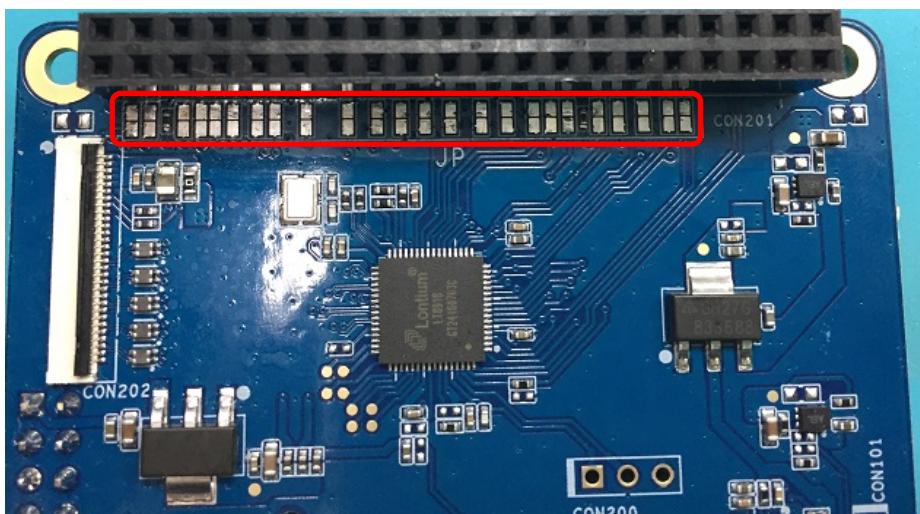
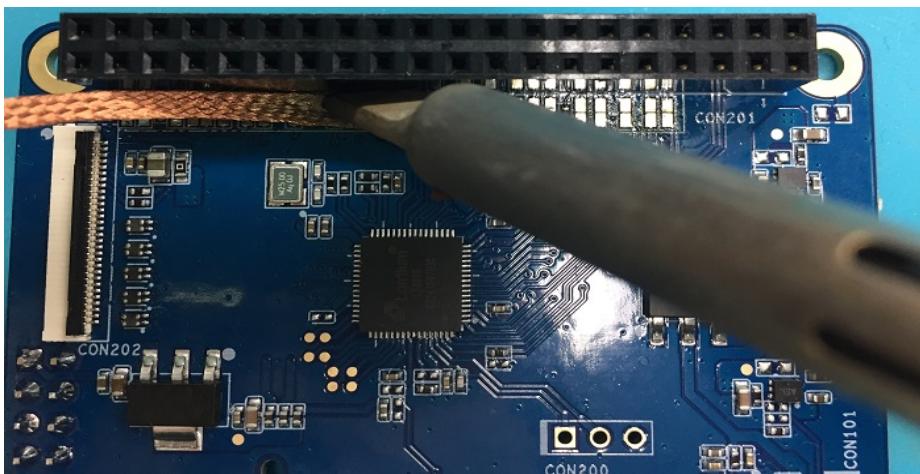




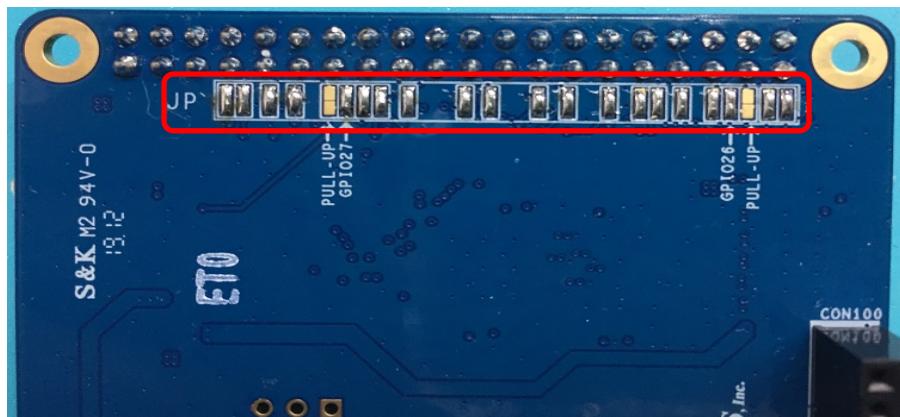
➤ **MODE 2: RGB 666(18 bits - 6 bits per color) + GPIO 26 and GPIO 27**

In this mode, you do get to use GPIO 26 and 27 from Raspberry Pi.

Step 1: Use a de-soldering braid to remove the “JP” on the Adapter Board here



Step 2: Use a soldering iron and heat it up, then grab some solder and melt it to short out the “JP” here:



➤ **MODE 3: RGB 666 + GPIO 27 + Button(GPIO 26)**

In this mode, you do get to use GPIO 27 and a user-defined switch which is connected to GPIO 26.

Step 1: Same as MODE 2.

Step 2: Use a soldering iron to short out the “JP” on the control board as shown in attached figure in red squared.



➤ **MODE 4: RGB 666 + GPIO26 with 4.7KΩ pull-up resistor +GPIO 27 with 4.7KΩ pull-up resistor**

In this mode, you do get to create an additional I2C bus on GPIO 26 as SDA and GPIO 27 as SCL.

Step 1: Follow MODE 2 steps (both of step 1 and step 2).

Step 2: Use a soldering iron to short out the “Pull-UP” on the Adapter Board here



Software Configuration

Preparation:

1. Raspberry Pi*
 2. 16GB SD Card with Raspbian*
 3. Nebra AnyBeam HAT
- There are 4 modes designed for Nebra AnyBeam HAT as listed below and the default is “MODE1” .
 - Hardware setting refer to “Nebra AnyBeam HAT user guide”
 - The Raspberry Pi and SD card aren't included

MODE 1: RGB 888(24 bits - 8 bits for red, green and blue)

MODE 2: RGB 666(18 bits - 6 bits per color) + GPIO 26 and GPIO 27

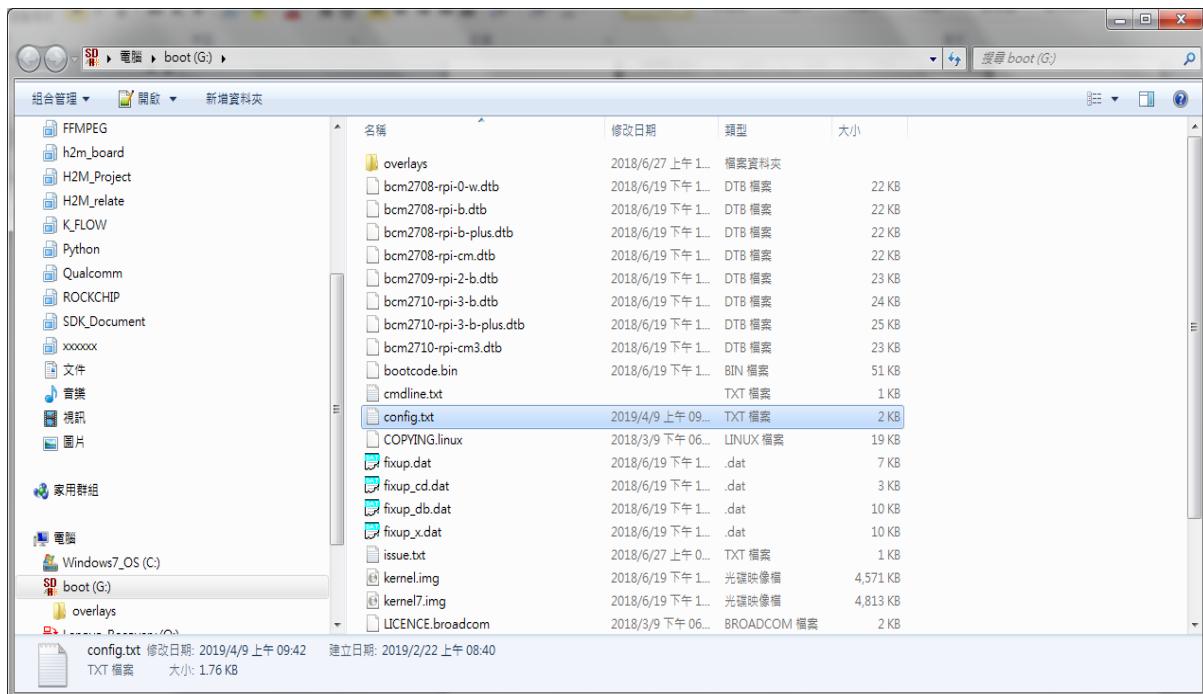
MODE 3: RGB 666 + GPIO 27 + Button (GPIO 26)

MODE 4: RGB 666 + GPIO26 with 4.7KΩ pull-up resistor +GPIO 27 with 4.7KΩ pull-up resistor

* Raspberry Pi and 16GB SD card are not included. You must purchase these yourself separately.

➤ MODE 1: RGB 888(24 bits - 8 bits for red, green and blue)

1. Go to SD Card with Raspbian and edit “config.txt”



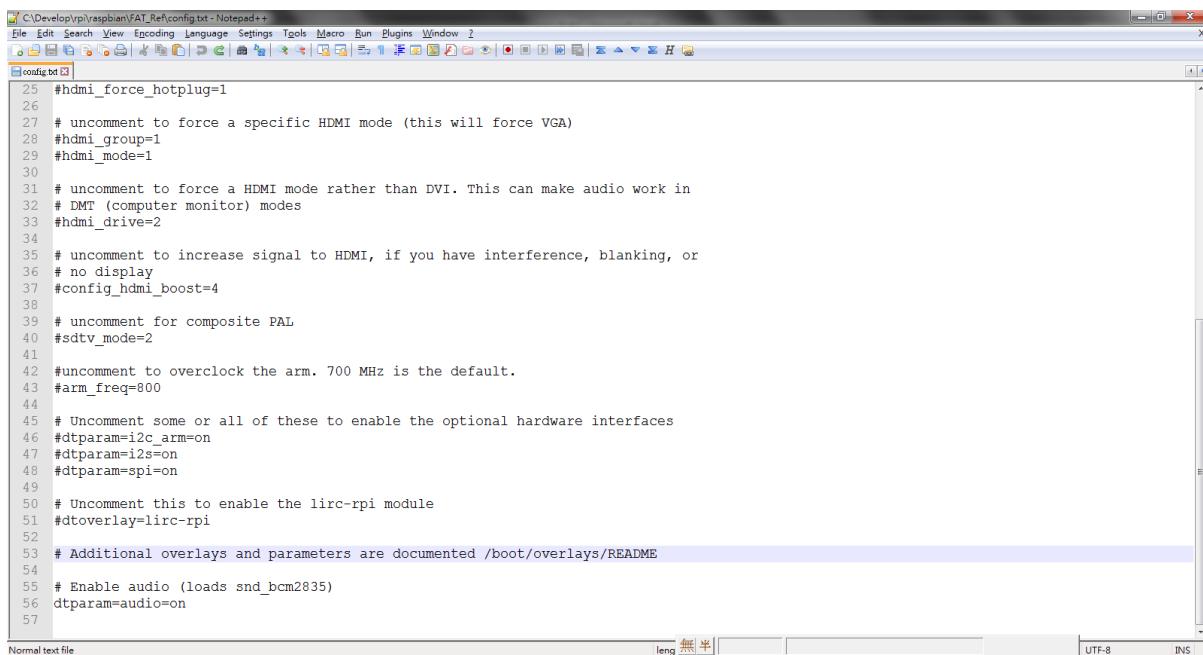
Open the “config.txt”, you will see the file as shown in attached figure below.

```

config.txt
1 # For more options and information see
2 # http://rpfi.io/configtxt
3 # Some settings may impact device functionality. See link above for details
4
5 # uncomment if you get no picture on HDMI for a default "safe" mode
6 #hdmi_safe=1
7
8 # uncomment this if your display has a black border of unused pixels visible
9 # and your display can output without overscan
10 #disable_overscan=1
11
12 # uncomment the following to adjust overscan. Use positive numbers if console
13 # goes off screen, and negative if there is too much border
14 #overscan_left=16
15 #overscan_right=16
16 #overscan_top=16
17 #overscan_bottom=16
18
19 # uncomment to force a console size. By default it will be display's size minus
20 # overscan.
21 #framebuffer_width=1280
22 #framebuffer_height=720
23
24 # uncomment if hdmi display is not detected and composite is being output
25 #hdmi_force_hotplug=1
26
27 # uncomment to force a specific HDMI mode (this will force VGA)
28 #hdmi_group=1
29 #hdmi_mode=1
30
31 # uncomment to force a HDMI mode rather than DVI. This can make audio work in
32 # DMT (computer monitor) modes
33 #hdmi_drive=2

```

2. Go to Line 53 (# Additional overlays and parameters are documented / boot/overlays/README)



```

25 #hdmi_force_hotplug=1
26
27 # uncomment to force a specific HDMI mode (this will force VGA)
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29 #hdmi_mode=1
30
31 # uncomment to force a HDMI mode rather than DVI. This can make audio work in
32 # DMT (computer monitor) modes
33 #hdmi_drive=2
34
35 # uncomment to increase signal to HDMI, if you have interference, blanking, or
36 # no display
37 #config_hdmi_boost=4
38
39 # uncomment for composite PAL
40 #sdtv_mode=2
41
42 #uncomment to overclock the arm. 700 MHz is the default.
43 #arm_freq=800
44
45 # Uncomment some or all of these to enable the optional hardware interfaces
46 #dtparam=i2c_arm=on
47 #dtparam=i2s=on
48 #dtparam=spi=on
49
50 # Uncomment this to enable the lirc-rpi module
51 #dtoverlay=lirc-rpi
52
53 # Additional overlays and parameters are documented /boot/overlays/README
54
55 # Enable audio (loads snd_bcm2835)
56 dtparam=audio=on
57

```

Fill the following comments into the next line of No.53 line (# Additional overlays and parameters are documented / boot / overlays / README) in the “config.txt” as shown in the following figure

**dtoverlay=dpi24
overscan_left=0
overscan_right=0
overscan_top=0
overscan_bottom=0
framebuffer_width=1280
framebuffer_height=720
enable_dpi_lcd=1
display_default_lcd=1
dpi_group=2
dpi_mode=85
dpi_output_format=0x070027**



```

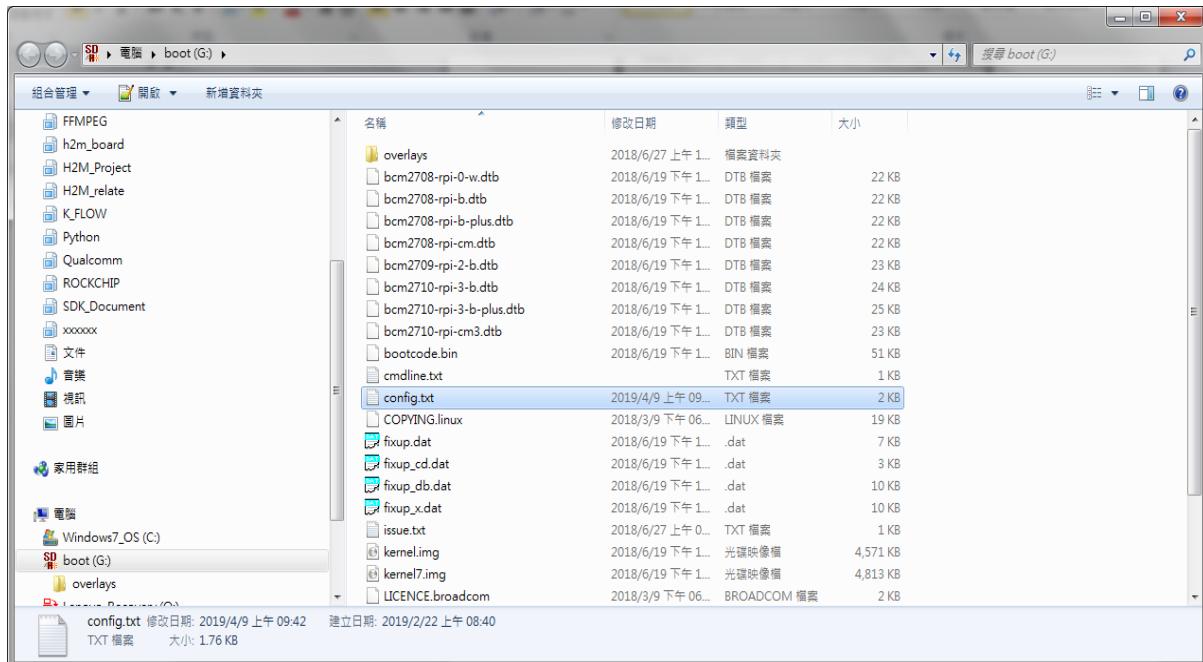
config.txt [3]
36 # no display
37 #config_hdmi_boost=4
38
39 # uncomment for composite PAL
40 #sdtv_mode=2
41
42 #uncomment to overclock the arm. 700 MHz is the default.
43 #arm_freq=800
44
45 # Uncomment some or all of these to enable the optional hardware interfaces
46 #dtoverlay=i2c_arm=on
47 #dtoverlay=i2s=on
48 #dtoverlay=spi=on
49
50 # Uncomment this to enable the lirc-rpi module
51 #dtoverlay=lirc-rpi
52
53 # Additional overlays and parameters are documented /boot/overlays/README
54 dtoverlay=dpi24
55 overscan_left=0
56 overscan_right=0
57 overscan_top=0
58 overscan_bottom=0
59 framebuffer_width=1280
60 framebuffer_height=720
61 enable_dpi_lcd=1
62 display_default_lcd=1
63 dpi_group=2
64 dpi_mode=85
65 dpi_output_format=0x070027
66 # Enable audio (loads snd_bcm2835)
67 dtoverlay=audio=on
68

```

3. Insert the SD card into your Raspberry Pi and plug in a power supply. Then, wait a few minutes to allow the system to boot.

➤ **MODE 2: RGB 666(18 bits - 6 bits per color) + GPIO 26 and GPIO 27**

1. Go to SD Card with Raspbian and edit “config.txt”



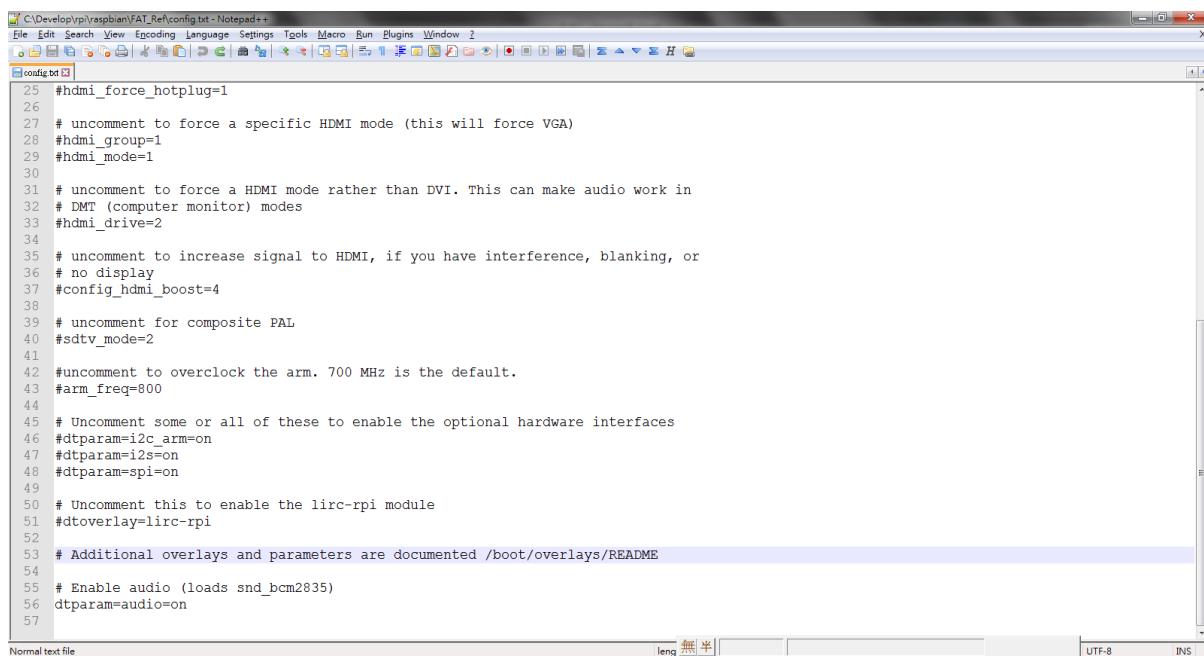
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2 # http://rpfi.io/configtxt
3 # Some settings may impact device functionality. See link above for details
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5 # uncomment if you get no picture on HDMI for a default "safe" mode
6 #hdmi_safe=1
7
8 # uncomment this if your display has a black border of unused pixels visible
9 # and your display can output without overscan
10 #disable_overscan=1
11
12 # uncomment the following to adjust overscan. Use positive numbers if console
13 # goes off screen, and negative if there is too much border
14 #overscan_left=16
15 #overscan_right=16
16 #overscan_top=16
17 #overscan_bottom=16
18
19 # uncomment to force a console size. By default it will be display's size minus
20 # overscan.
21 #framebuffer_width=1280
22 #framebuffer_height=720
23
24 # uncomment if hdmi display is not detected and composite is being output
25 #hdmi_force_hotplug=1
26
27 # uncomment to force a specific HDMI mode (this will force VGA)
28 #hdmi_group=1
29 #hdmi_mode=1
30
31 # uncomment to force a HDMI mode rather than DVI. This can make audio work in
32 # DMT (computer monitor) modes
33 #hdmi_drive=2

```

3. Go to Line 53 (# Additional overlays and parameters are documented / boot/overlays/README)



```

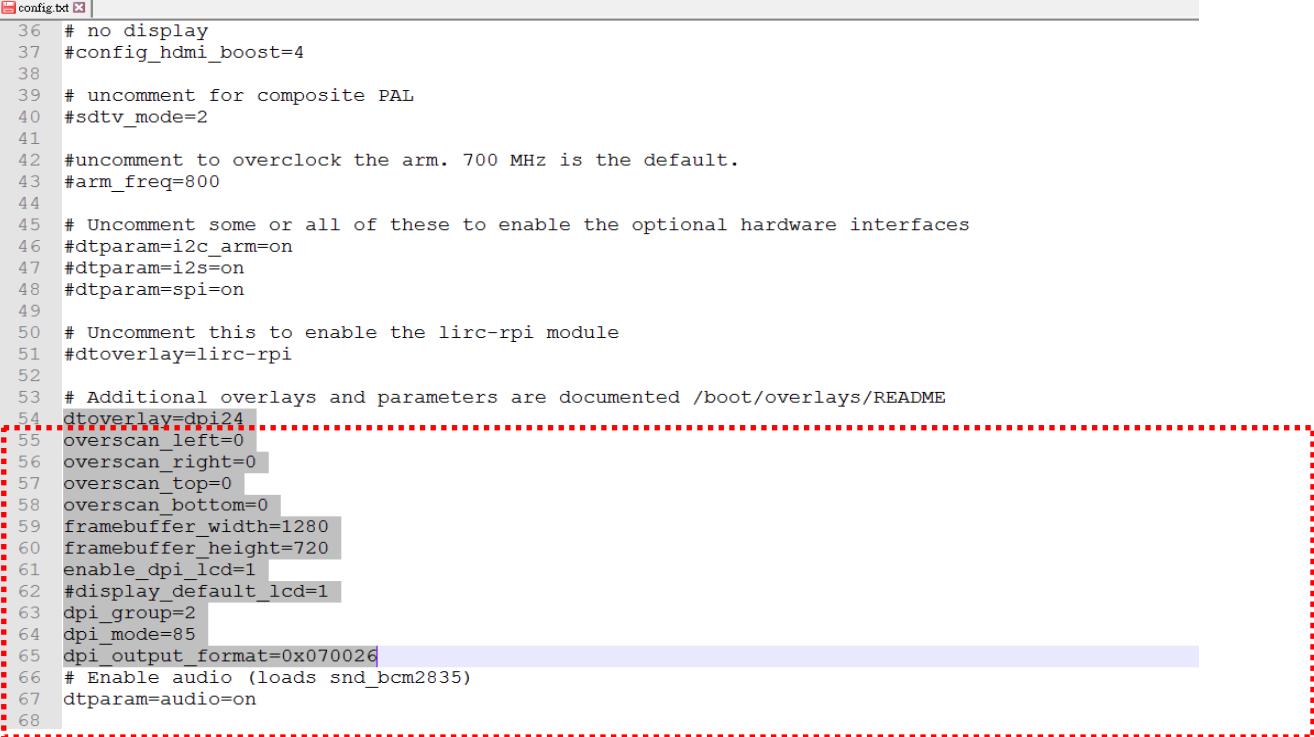
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36 # no display
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38
39 # uncomment for composite PAL
40 #sdtv_mode=2
41
42 #uncomment to overclock the arm. 700 MHz is the default.
43 #arm_freq=800
44
45 # Uncomment some or all of these to enable the optional hardware interfaces
46 #dtoparam-i2c_arm=on
47 #dtoparam-i2s=on
48 #dtoparam-spi=on
49
50 # Uncomment this to enable the lirc-rpi module
51 #dtoverlay=lirc-rpi
52
53 # Additional overlays and parameters are documented /boot/overlays/README
54
55 # Enable audio (loads snd_bcm2835)
56 dtoparam=audio=on
57

```

Fill the following comments into the next line of No.53 line (# Additional overlays and parameters are documented / boot / overlays / README) in the “config.txt” as shown in the following figure

dtoverlay=dpi24
 overscan_left=0
 overscan_right=0
 overscan_top=0
 overscan_bottom=0
 framebuffer_width=1280
 framebuffer_height=720
 enable_dpi_lcd=1
 display_default_lcd=1
 dpi_group=2
 dpi_mode=85
 dpi_output_format=0x070026





```

36 # no display
37 #config_hdmi_boost=4
38
39 # uncomment for composite PAL
40 #sdtv_mode=2
41
42 #uncomment to overclock the arm. 700 MHz is the default.
43 #arm_freq=800
44
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52
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58 overscan_bottom=0
59 framebuffer_width=1280
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65 dpi_output_format=0x070026
66 # Enable audio (loads snd_bcm2835)
67 dtoparam=audio=on
68

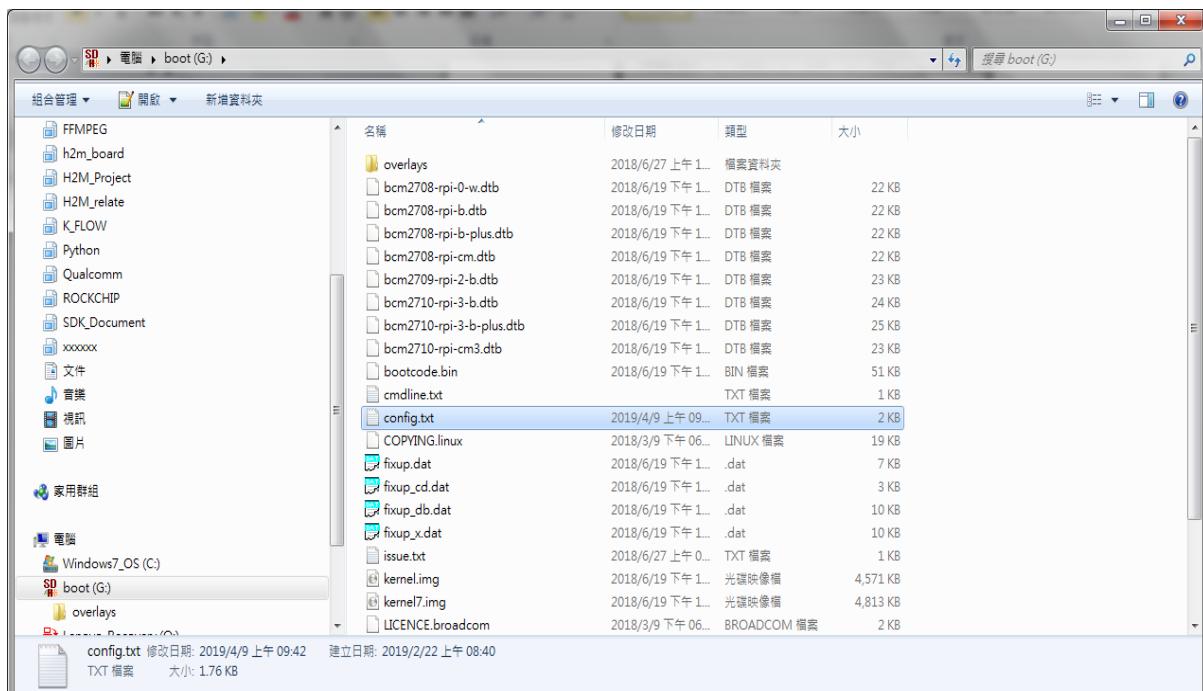
```

4. Insert the SD card into your Raspberry Pi and plug in a power supply. Then, wait a few minutes to allow the system to boot.

- **MODE 3: RGB 666 + GPIO 27 + Button (GPIO 26)**
The setting is same as MODE 2

- **MODE 4: RGB 666 + GPIO26 with 4.7KΩ pull-up resistor +GPIO 27 with 4.7KΩ pull-up resistor**

1. Go to SD Card with Raspbian and edit “config.txt”



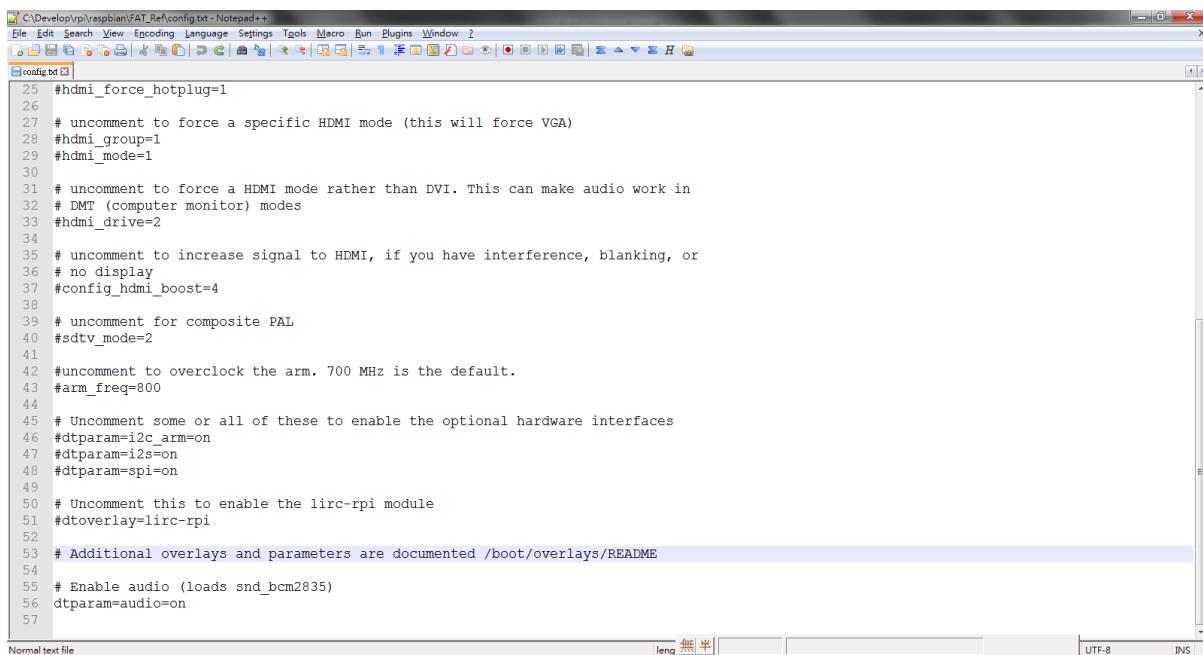
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```

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2 # http://rpf.io/configtxt
3 # Some settings may impact device functionality. See link above for details
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5 # uncomment if you get no picture on HDMI for a default "safe" mode
6 #hdmi_safe=1
7
8 # uncomment this if your display has a black border of unused pixels visible
9 # and your display can output without overscan
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12 # uncomment the following to adjust overscan. Use positive numbers if console
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20 # overscan.
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26
27 # uncomment to force a specific HDMI mode (this will force VGA)
28 #hdmi_group=1
29 #hdmi_mode=1
30
31 # uncomment to force a HDMI mode rather than DVI. This can make audio work in
32 # DMT (computer monitor) modes
33 #hdmi_drive=2

```

2. Go to Line 53 (# Additional overlays and parameters are documented / boot/overlays/README)



```

C:\Develop\py\raspbian\FAT_Ref\config.txt - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window 2
config.txt
25 #hdmi_force_hotplug=1
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52
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55 # Enable audio (loads snd_bcm2835)
56 dtoparam=audio=on
57

```

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Fill the following comments into the next line of No.53 line (# Additional overlays and parameters are documented / boot / overlays / README) in the “config.txt” as shown in the following figure

dtoverlay=dpi24
overscan_left=0
overscan_right=0
overscan_top=0
overscan_bottom=0
framebuffer_width=1280
framebuffer_height=720
enable_dpi_lcd=1
#display_default_lcd=1
dpi_group=2
dpi_mode=85
dpi_output_format=0x070026
dtoverlay=i2c-gpio,i2c_gpio_delay_us=1,i2c_gpio_sda=26,i2c_gpio_scl=27



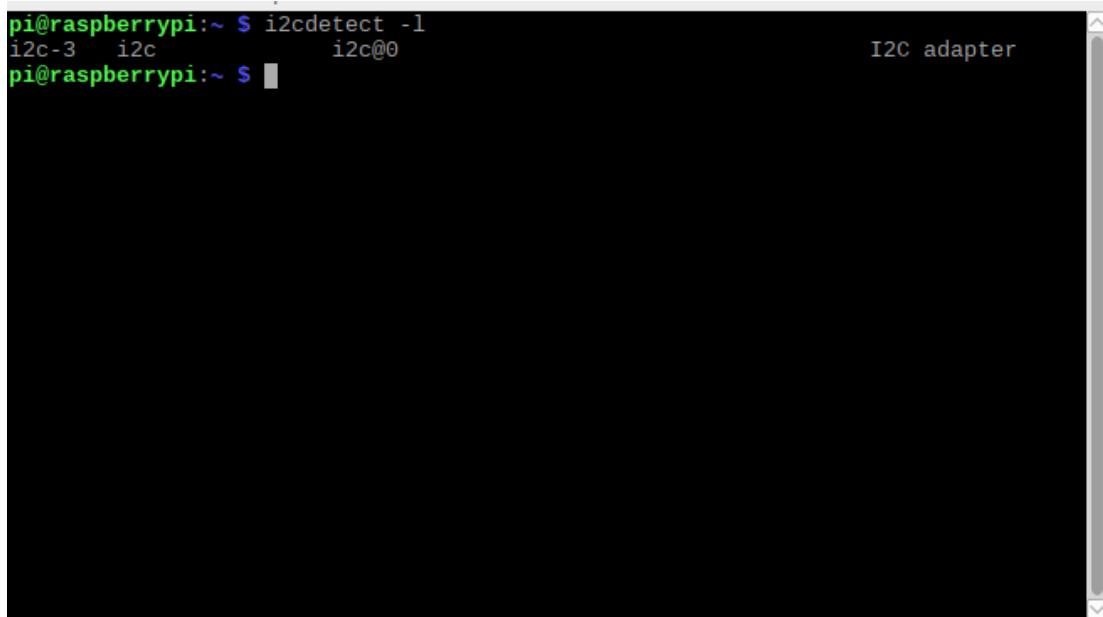
```

config.txt
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49
50 # Uncomment this to enable the lirc-rpi module
51 #dtoverlay=lirc-rpi
52
53 # Additional overlays and parameters are documented /boot/overlays/README
54 dtoverlay=dpi24
55 overscan_left=0
56 overscan_right=0
57 overscan_top=0
58 overscan_bottom=0
59 framebuffer_width=1280
60 framebuffer_height=720
61 enable_dpi_lcd=1
62 #display_default_lcd=1
63 dpi_group=2
64 dpi_mode=85
65 dpi_output_format=0x070026
66 dtoverlay=i2c-gpio,i2c_gpio_delay_us=1,i2c_gpio_sda=26,i2c_gpio_scl=27
67 # Enable audio (loads snd_bcm2835)
68 dtoparam=audio=on
69

```

3. Allow the system to boot.

4. Try to list i2c device by “i2cdetect -l”, you can find out i2c-3 (I2C adapter appear in the screen).



```

pi@raspberrypi:~ $ i2cdetect -l
i2c-3  i2c          i2c@0
pi@raspberrypi:~ $ I2C adapter

```

□ OSD Manual

▪ Operation Method

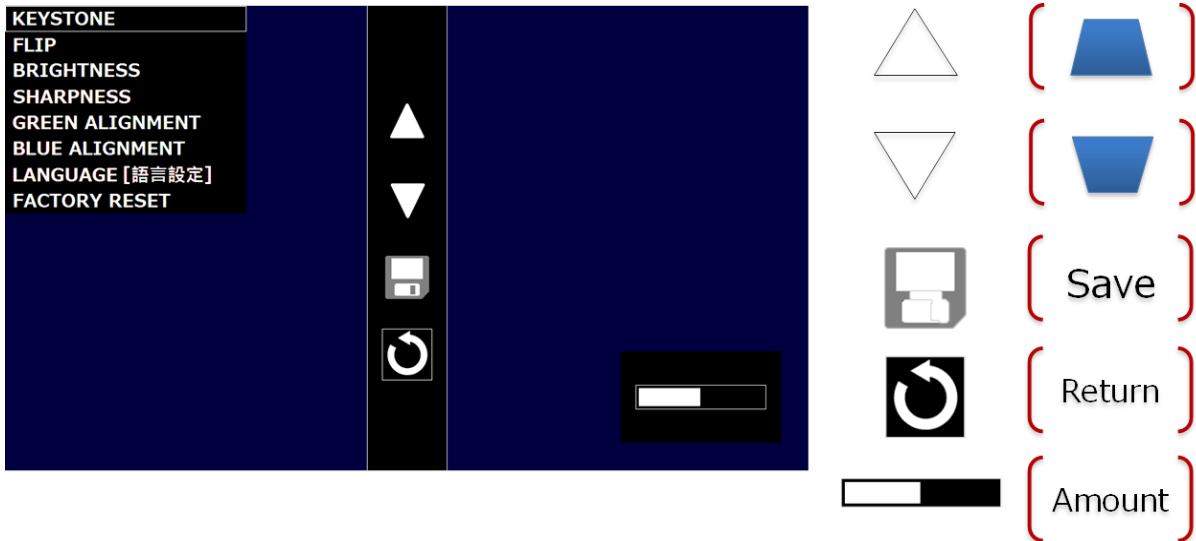
- Press and hold Function switch [Enter] for 3 to 5 seconds, you will see a On-Screen Display (OSD) menu.
- When the OSD menu is activated, these keys are used as directional arrows to select the desired menu items and to make adjustments.
Select the operation menu and select an item (press Function switch)
- Adjust the parameters according to the displayed adjustment items
- Select "Save" and save the setting.
- Press and hold Function switch [Enter] for 3 to 5 seconds to return display mode.

▪ Language

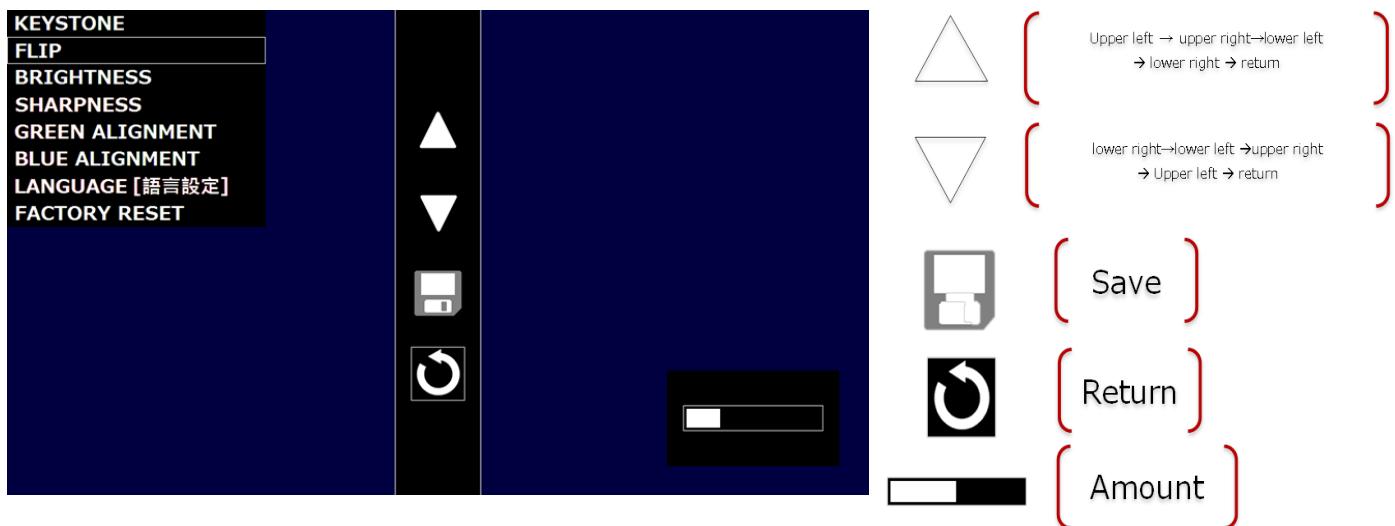
- There are eight languages for your selection:
English, 簡体中文(Simplified Chinese), 日本語(Japanese), French, German, Spanish, Italian, and Arabic.



- **KEYSTONE: Vertical directional distortion correction**
 - Corrects trapezoidal distortion that occurs when the projector is tilted up and down.

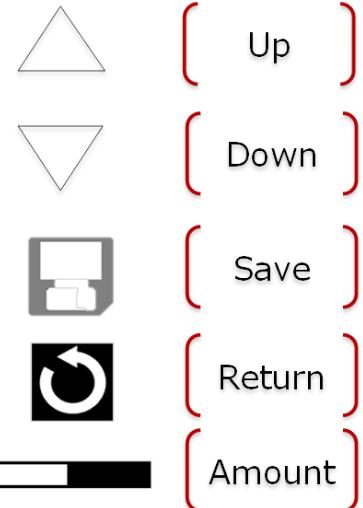


- **FLIP: Image flip**
 - You can flip the display image vertically and horizontally



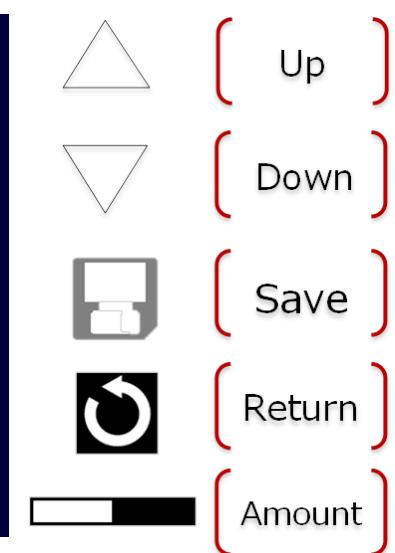
- **BRIGHTNESS**

➤ Adjust the screen brightness



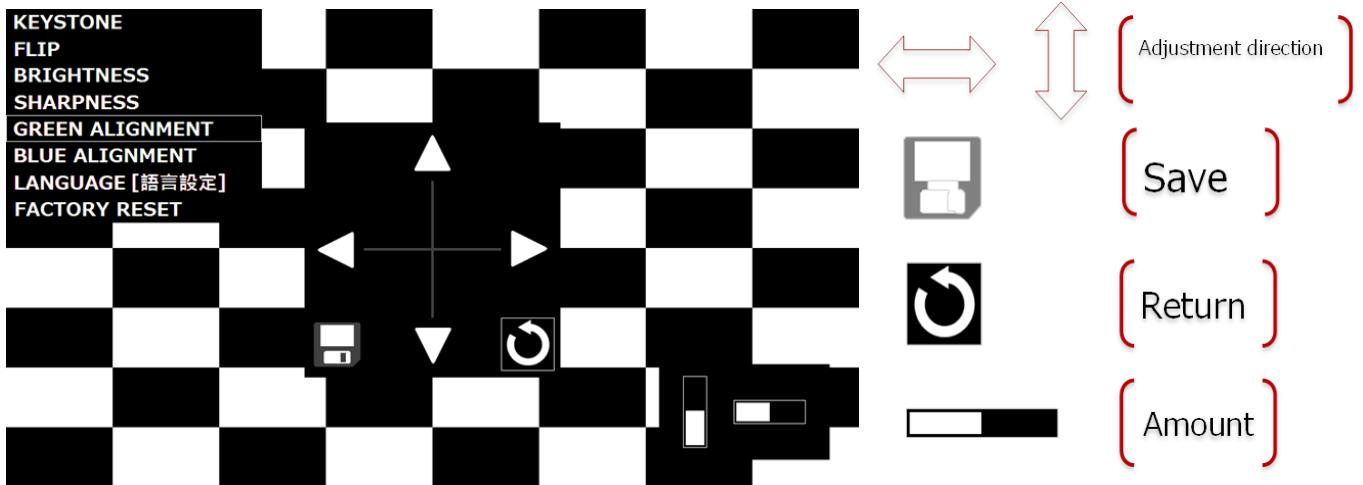
- **SHARPNESS : Fine adjustment for misalignment**

➤ Adjust the vertical double line at the center of the screen to one.



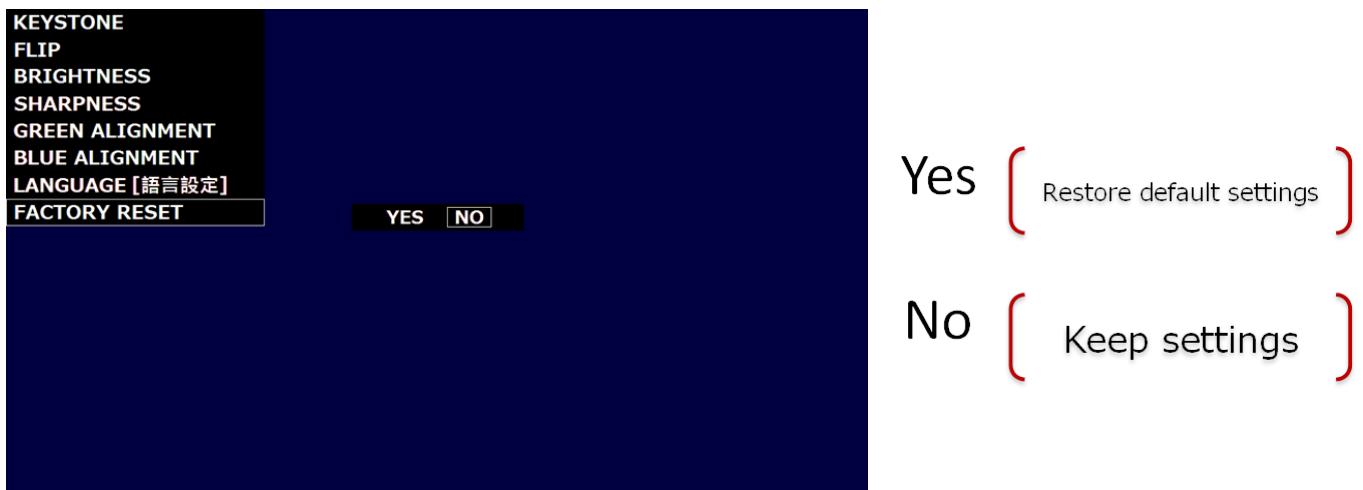
- **GREEN/BLUE ALIGNMENT: Color shift adjustment**

- The color shift (RGB) adjustment of this machine is adjusted by finely adjusting the positions of green and blue colors.



- **FACTORY RESET: Reset (return to initial settings)**

- Reset all settings items to default value



□ Troubleshooting

➤ STATUS LED does not light up or flash

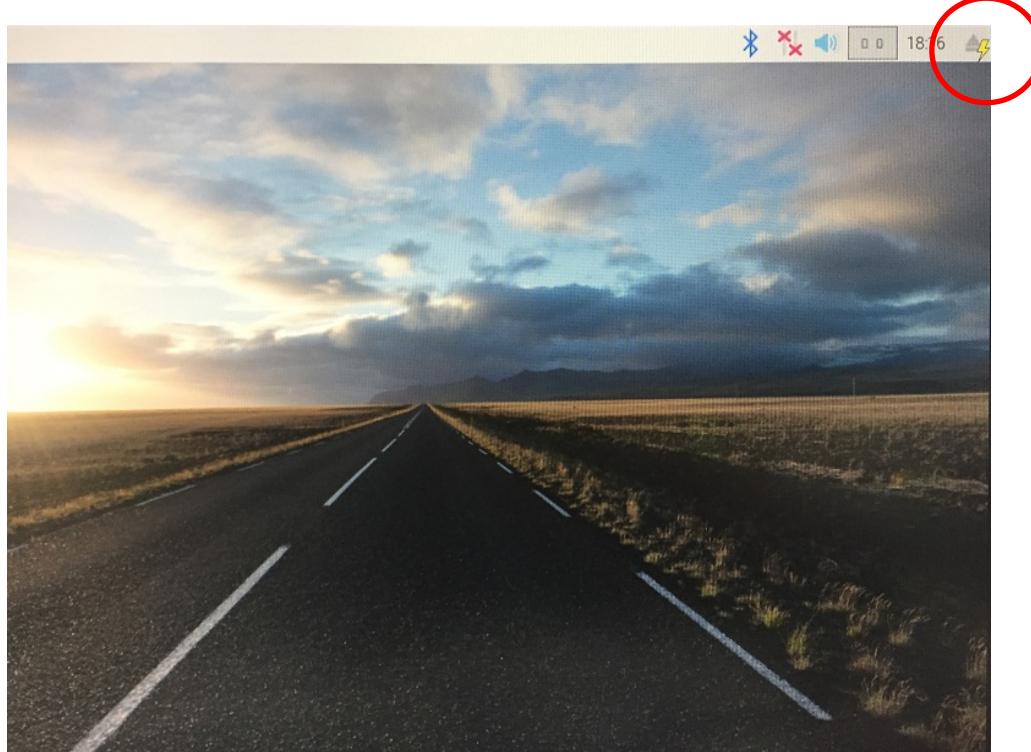
Step 1: Check the power supply shall be stable and meets all requirements.

Step 2: Check all connections between the Nebra AnyBeam HAT and the Raspberry Pi are correct.

Step 3: Unplug and plug the cable from the Micro-USB connector to restart.

➤ Under-Voltage Warning occurring

If a lightning bolt appears in the top-right corner of the Nebra AnyBeam HAT display, that means a voltage drop problem is causing the Raspberry Pi to not get enough voltage(4.65V↑ according to [the official forum post](#)). To prevent it from showing up, replace Power Supply and/or Cable, we recommend a 5.1~5.3V/2.0A↑ Power Supply with at least 20 AWG USB cable, that will provide you with enough power to run your Raspberry Pi with Nebra AnyBeam HAT for most applications, not including use of the 4 USB ports.



➤ **No image is displayed**

Step 1: Check the power supply shall be stable and meets all requirements.

Step 2: Check all connections between the Nebra AnyBeam HAT and the Raspberry Pi are correct.

Step 3: Check the Raspberry Pi ACT LED to determine if it is booting.

[If not booting, check for common boot problems from the official forum post](#)

Step 4: Check all “Software Configuration” steps are correct.

Step 5: Unplug and plug the cable from the Micro-USB connector to restart.

➤ **The display is showing an abnormal color (e.g. reddish.)**

Step 1: Check the power supply shall be stable and meets all requirements.

Step 2: Check all connections between the Nebra AnyBeam HAT and the Raspberry Pi are correct.

Step 3: Check whether the Raspberry Pi source image is outputting abnormally.

Step 4: Unplug and plug again the cable from the Micro-USB connector to restart.

➤ **Image jitter**

Step 1: Check the power supply shall be stable and meets all requirements.

Step 2: Check all connections between the Nebra AnyBeam HAT and the Raspberry Pi are correct.

Step 3: Remove any metal or magnetic material from the device, then unplug and plug again the cable from the Micro-USB connector to restart.

Step 4: Check whether there's any source of vibration (e.g. speaker, vibration may cause abnormal function of MEMS).

➤ **Image flickers or blurry**

Step 1: Press and hold down the “ENTER” switch for 4~6 seconds to enter the OSD mode.

Step 2: Select [Sharpness] to adjust.

➤ **Unexpected frame color (green, red or blue, etc.) shown in the Margin of the left/ right side of the display or word**

Step 1: Press and hold down the “ENTER” switch for 4~6 seconds to enter the OSD mode.

Step 2: Select [Green/ Blue Alignment] to adjust.

➤ **Partial area blurry or color fringing appeared in the display**

Make sure the lens is clean without particles and check again.
Please note that we recommended cleaning the lens with cleanroom wiper.

➤ **Image distortion appeared and could not project correctly**

Step 1: Check the power supply shall be stable and meets all requirements.

Step 2: Check all connections between the Nebra AnyBeam HAT and the Raspberry Pi are correct.

Step 3: Check “Software Configuration” steps are correct.

Step 4: Unplug and plug the cable from the Micro-USB connector to restart.

Please note that if you still cannot solve these problems, please contact us at sales@nebra.com.

□ Precautions of use

- Any Incorrect connection can damage the Nebra AnyBeam HAT and/or the Raspberry Pi, please follow the “Assembly Guide”.
- To minimize the potential for electrostatic discharge (ESD) damage, when assembling the Nebra AnyBeam HAT, please avoid touching any chips and circuitry, hold PCB boards by the edges wherever possible.
- Do not touch the Nebra AnyBeam HAT with wet hands.
- Do not apply any pulling force/tension on the FPC when it is inserted into the FPC connector, this can cause the actuator to be unlocked, the actuator to come off, cut the traces on the FPC, and/or damage the FPC.
- Do not pull the FPC vertically or twist the FPC back or force horizontally when it is inserted in the FPC connector.
- Do not open and close the FPC connector actuator under an active electrical circuit.
- Please ensure the FPC connector actuator is completely open during insertion.
- Please ensure the FPC is completely inserted until the end of the FPC touches the housing.
- Diagonal insertion of the FPC into the connector can cause a short circuit, deform the terminal and/or damage the FPC contact.
- Do not use a sharp-edged tool such as tweezers when opening and closing the FPC connector actuator. This may cause damage to the FPC, the connector or to the soldering area.
- When opening and closing the FPC connector actuator, please gently pull the center of the actuator by applying an even force across the actuator and rotating carefully. Please do not apply a force to only one side of actuator because it may cause damage to the connector.
- Do not connect dual power input in parallel at the same time.
- Do not drop, throw or try to bend the Nebra AnyBeam HAT.
- Do not expose the Nebra AnyBeam HAT to water or heat sources.
- Do not use near a strong magnetic field.
- Do not use or store the Nebra AnyBeam HAT in a place where the temperature is extremely high, such as near a fire, under direct sunlight, near a heater or in a car parked in the sun. Ensure that the ambient room temperature is within 0°C ~ 35°C.
- Children should only use the Nebra AnyBeam HAT under adult's supervision. Keep the Nebra AnyBeam HAT out of reach of infants.
- Do not disassemble or modify the Nebra AnyBeam HAT.
- Avoid continuous contact between your skin and Nebra AnyBeam HAT while in use.
- Nebra Ltd is not liable for damage or loss resulting from the use of the Nebra AnyBeam HAT, or for any claim from a third party.
- The Limited Warranty does not cover products purchased from sources other than Nebra Ltd or a Nebra Ltd authorized dealer (including non-authorized online auctions), or issues due to: (i) outdoor exposure and other acts of nature; (ii) power surges; (iii) accidental damage; (iv) abuse; (v) limitations of technology; (vi) contact with liquid, heat, humidity or perspiration, sand, smoke, or foreign materials; (vii) use of parts or supplies not sold or authorized by Nebra Ltd; (viii) servicing not authorized or performed by Nebra Ltd or a Nebra Ltd authorized service center; (ix) computer or internet viruses, bugs, worms (x) malfunctions due to peripherals/ accessories; (xi) any product where the factory-applied serial number has been altered or removed from the product.

□ Safety precautions

- The Nebra AnyBeam HAT is a Class 1 Laser Product (IEC/EN 60825-1:2014)
- Please do not look into the laser beam directly as it can damage your eyes.



Laser Color	Green		Red		Blue	
Max. CW Output	80 mW		120 mW		80 mW	
Wave Length	515 nm	530 nm	632 nm	642 nm	440 nm	460 nm