



MULTIMEDIA CASE

for the Raspberry Pi 4

Expert manual

joy-it

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This is an expert manual and should only be used if you do want to use the Multimedia Case with another operating system or do not want to use our prepared LibreElec image. The basic manual can be found [here](#).

2. USAGE WITH RASPBERRY PI OS

The case has several functions, for example fan control and LED control, which can be used in conjunction with the Raspberry Pi. In this chapter you will find an exemplary application of these functions in Raspberry Pi OS and a more detailed explanation of the individual functions. For this purpose we offer you suitable code examples. You can download these code examples [here](#) and load them onto your Raspberry Pi using an SSH connection or you can enter the following command into the console of your Raspberry Pi:

```
wget https://joy-it.net/public/MultimediaCase.zip
```

If you have downloaded the sample codes, you must first unpack them with a command, and you can also remove the zip file in the same step. Please note, however, that the directory in which the file is located does not necessarily have to match the directory of the command. The command is the following:

```
unzip /home/pi/MultimediaCase.zip && rm /home/pi/MultimediaCase.zip
```

2.1 Setting up the serial interface

Using serial communication, the Raspberry Pi is able to communicate with the board of the multimedia case. This must be activated separately on the Raspberry Pi.

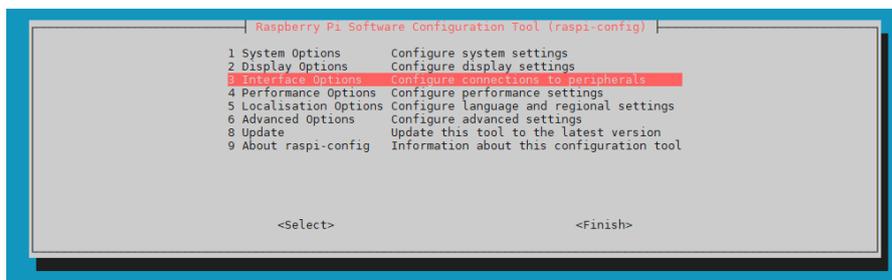


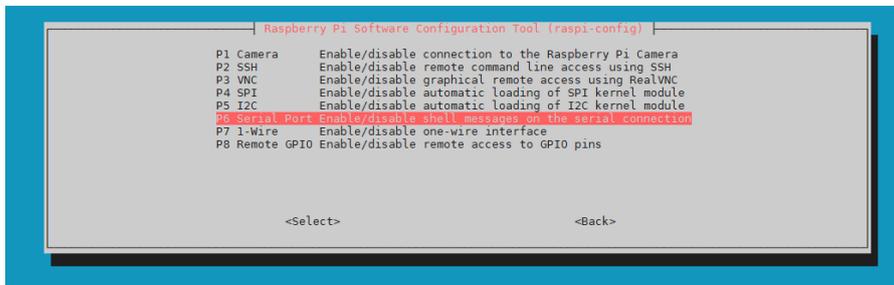
The serial interface is required for communication between the Raspberry Pi and the board. In some scripts (*learningMode* and *shutdown-function*) a string is sent from the Raspberry Pi to the board depending on the script. There, this string is used to execute a program specific to the script.

To enable this serial port, type the following command in the console to access the settings:

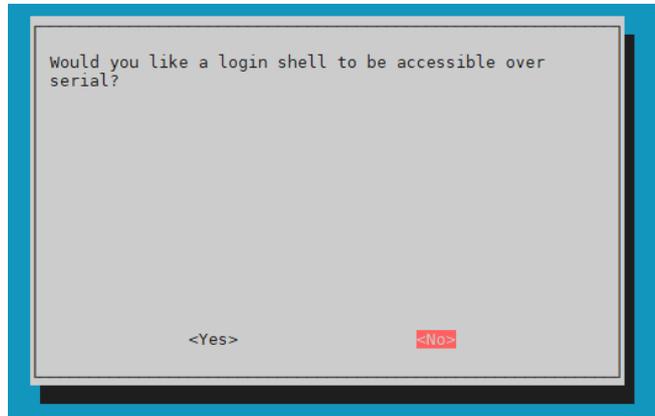
```
sudo raspi-config
```

There select **3 Interface Options** → **P6 Serial Port**.

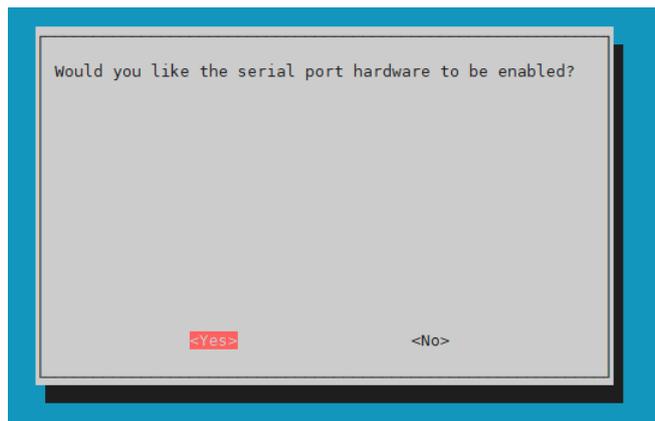




Now you are asked the question **Would you like a login shell to be accessible over serial?** which should be declined.



The next question **Would you like the serial port hardware to be enabled?** should be confirmed.



Exit the raspi-config configuration tool and do not restart your Raspberry Pi for now.

Add three lines in the `config.txt`. Open the file with the following command:

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

Add the following three lines to the file at the end:

```
dtoverlay=miniuart-bt
core_freq=250
```

Save the changes with CTRL + O and exit the editor with CTRL + X. Now restart the Raspberry Pi with the following command:

```
sudo reboot
```

2.2 Infrared-Receiver

An infrared receiver is built into the case, which is positioned in the front (opposite the connections). This allows, among other things, the control by a remote control, for example to switch the Raspberry Pi on and off. This also allows you to operate without mouse and keyboard. The infrared sensor TSOP4838 is connected to the GPIO 7.

2.2.1 learningMode

The script *learningMode.py* is a program that allows to set up a PowerOff button of any remote control. The PowerOff button serves as a button that switches the Multimedia Case on and off. This can be any button on a separate remote control or an unassigned button of a remote control you are already using with another device.

In the script, the string `\x0D X04 \x0D` is sent from the Raspberry Pi to the board of the multimedia case via serial communication (**see 2.1**). This string puts the board into the so-called *learningMode*.

The *learningMode* is used to declare the PowerOff button. In this mode you must press the desired button three times to set it. The LEDs will light up in different colors so that the *learningMode* can be recognized from outside.

Each time the button is pressed, the LEDs light up white to confirm that an infrared signal has been received.

If you should press any other key, the LEDs light up red and the program resets. Then you have to press a key three times again.

The LEDs will light up green when the PowerOff button has been set successfully.



The *learningMode* can be executed as often as desired, so the PowerOff button can be changed again.

You can run the *learningMode* with the following command:

```
sudo python3 /home/pi/MultimediaCase/learningMode.py
```

You get more information about the learningMode in relation to Kodi in **Chapter 3.1 Multimedia Case Configuration**, which is declared using this script.



The Multimedia Case indicates the startup with a green flashing of the LEDs. After 30s this blinking changes to a permanent light by default. The shutdown of the Multimedia Case is indicated by a red blinking of the LEDs. When the Multimedia Case has disconnected the power supply to the Raspberry Pi, the LEDs will be permanently red.



2.3 Shutdown script

You can shut down the Raspberry Pi using the Multimedia Case's circuit board. You can do this with a PowerOff button (**see 2.2.1 learningMode**) or with the button directly on the case. The shutdown script is needed to shut down the Raspberry Pi and not only to disconnect the power supply.

When the PowerOff button or the button on the Multimedia Case is pressed, the Multimedia Case serially sends the string `xxxShutdownRaspberrypixxx\n\r` to the Raspberry Pi. The following script then interprets the string as a command. This command is `sudo shutdown -h now` and shuts down the Raspberry Pi.



After starting the Multimedia Case, a green pulsation of the RGB LEDs indicates that the system is starting up - during this time the Raspberry Pi starts its operating system.

The displayed pulsation is preset to a time of 30s in the Multimedia Case and then changes to a permanent green light, which signals readiness for operation.

If the operating system of the Raspberry Pi has started up faster than in the 30s, the pulsation can be stopped by sending the string `\x0D X05 \x0D` via UART, so that the successful startup is displayed more directly. More about activating the serial interface can be found in **chapter 2.1**.

We have also integrated this method in our script of the shutdown function.



You can use the following command to run the program in the background so that the terminal is still available.

```
sudo python3 /home/pi/MultimediaCase/shutdown-function.py &
```

We recommend adding this program to the autostart, so that Raspberry Pi always automatically calls the script at startup and remains permanently activated in the background. To do this, open the file `rc.local` with the following command:

```
sudo nano /etc/rc.local
```

Insert the following line before **`exit 0`**. Note that the directory where the script is located may differ.

```
python3 /home/pi/MultimediaCase/shutdown-function.py &
exit 0
```

2.4 RGB-LEDs

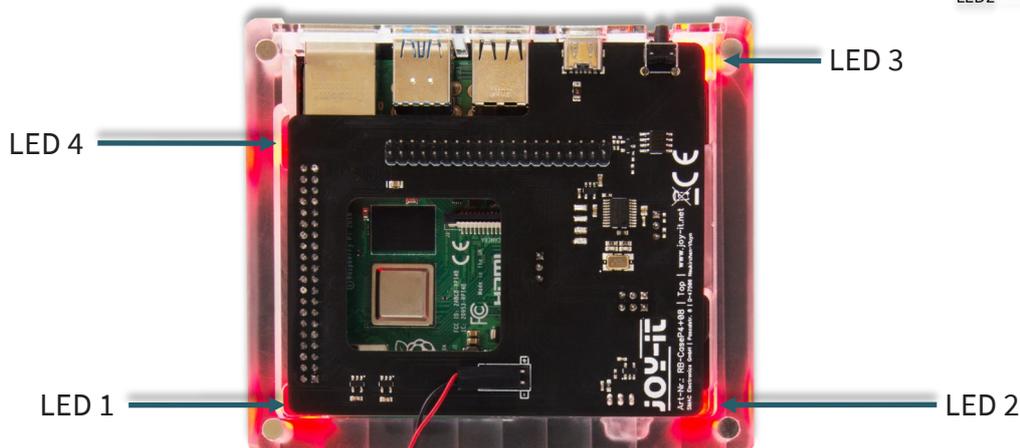
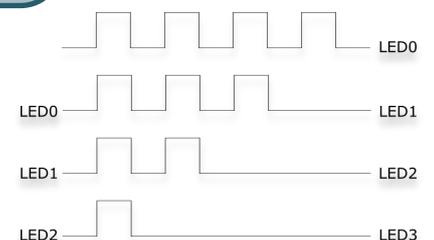
The case has a RGB LED on each corner. The WS2812B LEDs are connected in a row and can be color adjusted with GPIO 18. This pin is connected to the PWM module of the Raspberry Pi. It is mandatory to use time critical signals (PWM) for WS2812B LEDs, otherwise disturbances may occur.

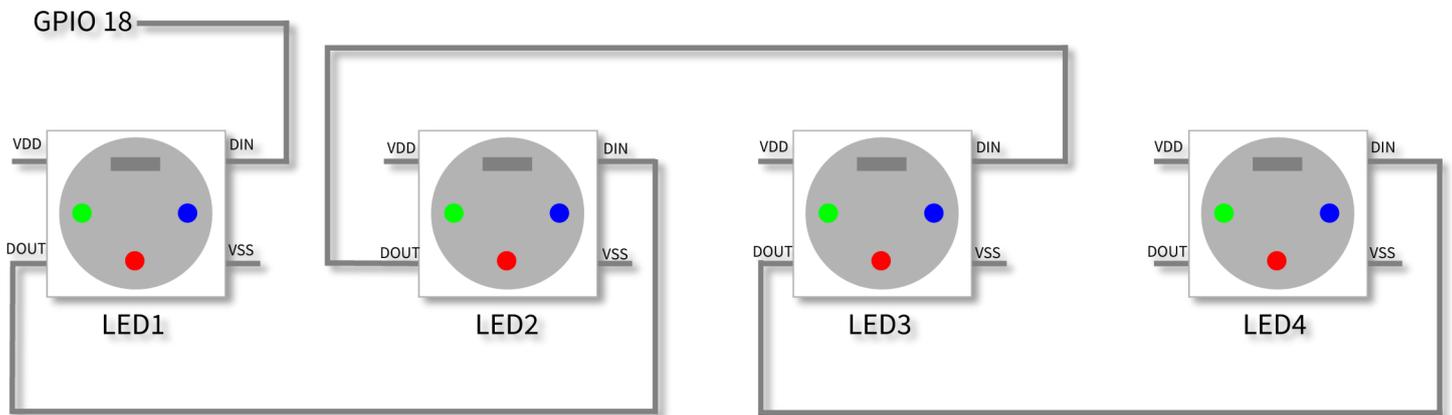
To set up the LEDs we recommend [Hyperion](#). Hyperion is an open source ambient light implementation which is compatible with many platforms. It also offers you the possibility to add more LEDs to add a backlight to your monitor and also allows you to play effects on your LEDs. You don't need any further knowledge about the data processing of LEDs.



Data processing of the LEDs

Because the WS2812B LEDs are arranged in a row / string, the signal passes through all the LEDs one after the other. Each LED takes one data package. Four data packages must always be sent so that all LEDs receive one data packet. These data packages contain values in GRB color space.





If you want to use the jack plug, you must first switch off the LEDs, otherwise malfunctions may occur. Both PWM0 pins are required for audio output via the jack plug.

2.4.1 LED colour mode

The firmware of the board supports different LED color modes starting with version 1.0.1. These modes also control the LEDs when the Raspberry Pi is shut down.

You set the LED mode by means of a string, which is transmitted serially to the board.

Mode 0 - Default colour mode

This is the default color mode, which is set in the factory default state. Here the LEDs are permanently red when the Raspberry Pi is powered off and green when it is active. Powering up and powering down is indicated by pulsing green or red. The string

`\x0D LM0 \x0D` sets this mode.



Mode 1 - Only pulsating

In this color mode only the startup and shutdown of the Raspberry Pi is indicated by pulsating. As soon as the Raspberry Pi is switched off or on, the LEDs are off. For this color mode you have to send this string `\x0D LM1 \x0D` serially to the board.



Mode 2 - Only confirming

In this color mode, only the startup and shutdown are acknowledged. The LEDs only light up briefly, when the signal for startup and shutdown has been received, to indicate that this signal has been acknowledged. The string `\x0D LM2 \x0D` is used to set the board.

You can send these strings serially to the board using a Python script. The following is an exemplary formulation of how this might look:

```
#!/usr/bin/env python
import serial
import os

ser = serial.Serial(
    port='/dev/serial0',
    baudrate = 38400,
    parity=serial.PARITY_NONE,
    stopbits=serial.STOPBITS_ONE,
    bytesize=serial.EIGHTBITS,
    timeout=1
)

ser.write(str.encode('\x0D'))
ser.write(str.encode('LM0')) # Mode 0
ser.write(str.encode('\x0D'))
```

2.4.1 Installation of Hyperion

Now follows a step by step installation of Hyperion in Raspberry Pi OS. The first step is to execute the following commands in your console to prepare the system for Hyperion:

```
sudo su
```

```
sudo apt-get update && sudo apt-get dist-upgrade
```

```
apt-get install scon
```

```
exit
```

Now restart the Raspberry Pi with the following command:

```
sudo reboot
```

After that, you can install Hyperion with the following command:

```
wget -q0- https://joy-it.net/public/installHyperion.sh | sh
```

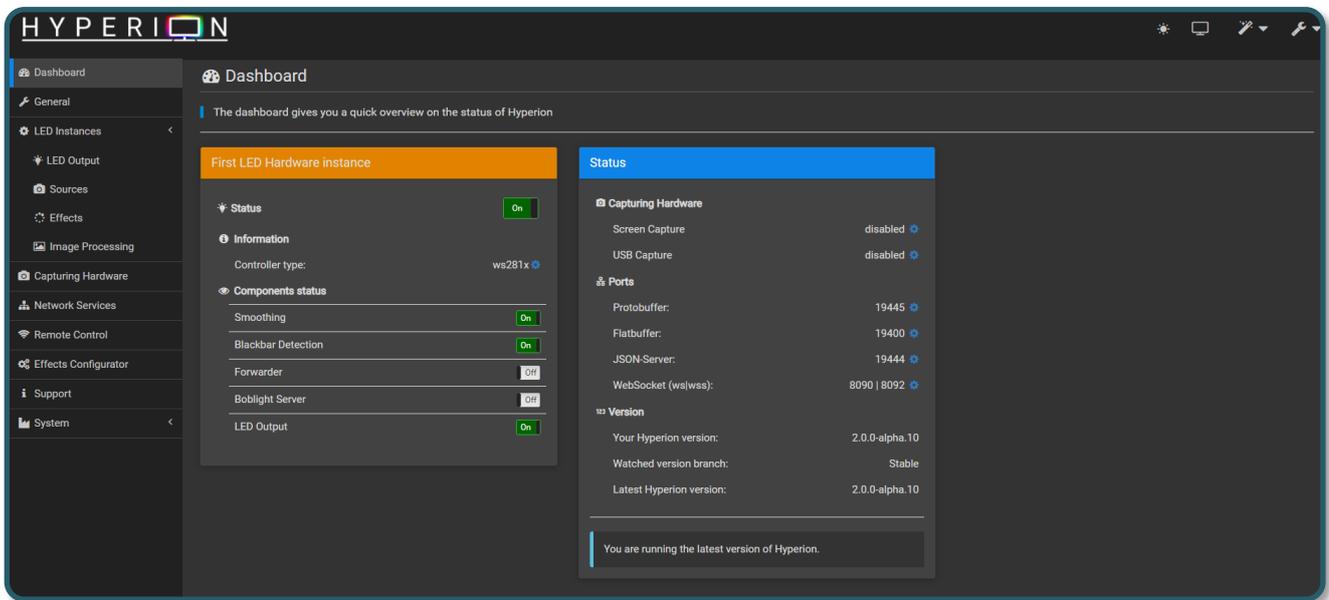
You have now successfully installed Hyperion on your Raspberry Pi OS. Hyperion can be run with the following command:

```
sudo hyperion/build/bin/hyperiond &
```

Now you can access Hyperion via web browser. To do so, enter your IP address of the Pi and attach a **:8090**. This could look like this, for example:

```
192.168.1.100:8090
```

Now the WebGUI of Hyperion is displayed.



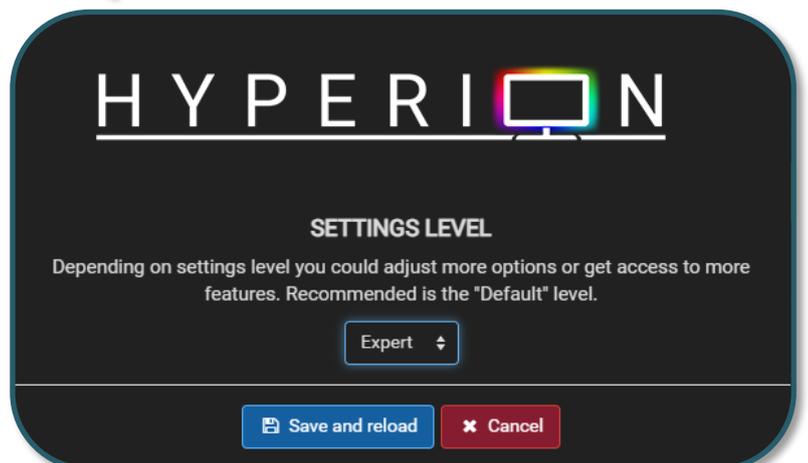
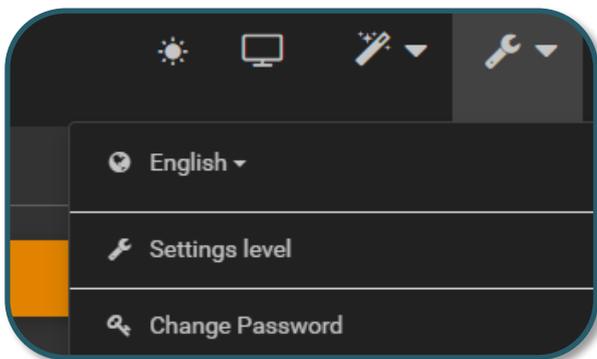
You can also open Hyperion automatically when starting the Raspberry Pi. To do this, open the `rc.local` file with the following command:

```
sudo nano /etc/rc.local
```

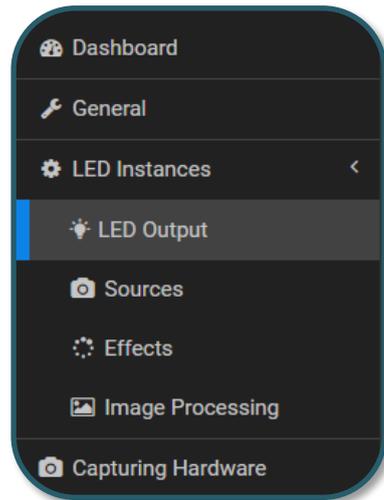
Add the following line before the `exit 0`. Note that your directory where the script is located may differ.

```
python3 /home/pi/MultimediaCase/shutdown-function.py &
sudo /home/pi/hyperion/build/bin/hyperiond &
exit 0
```

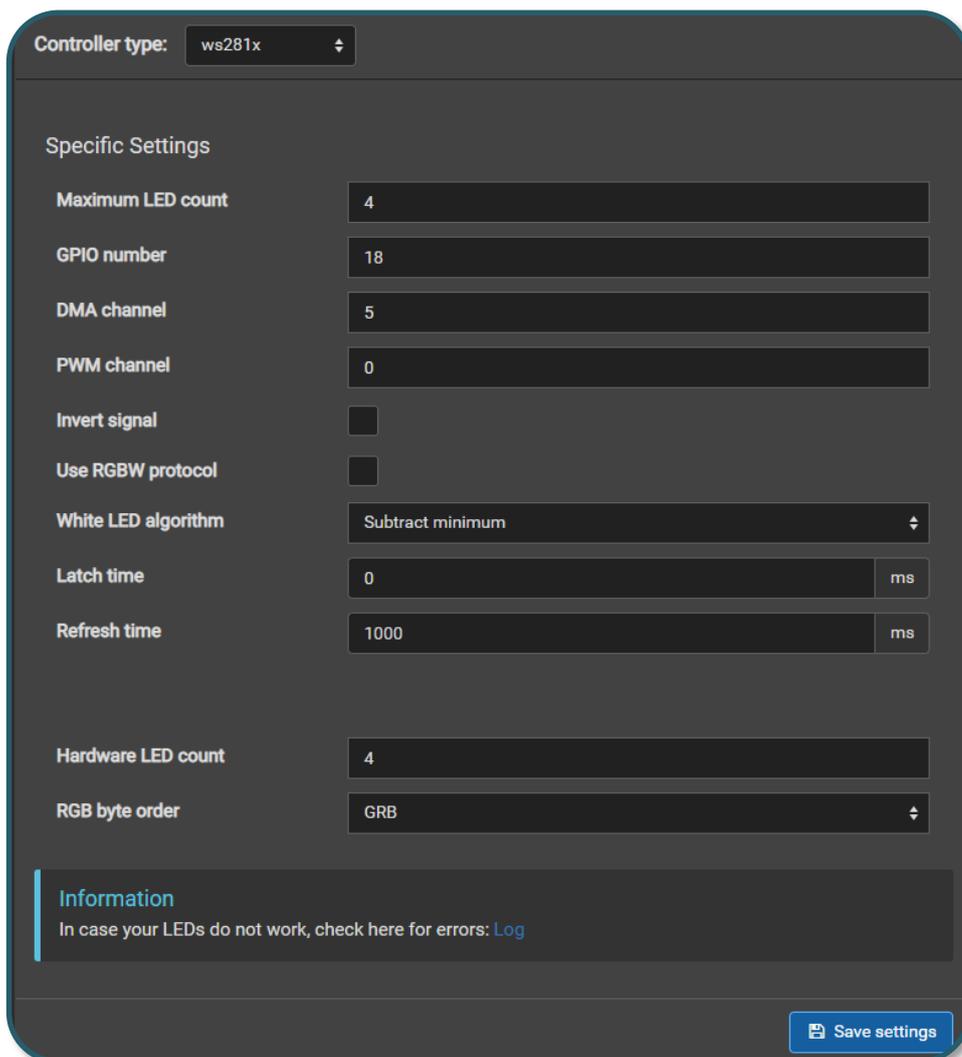
To be able to implement the following settings, you must set the **Setting level** from **Default** to **Expert**.



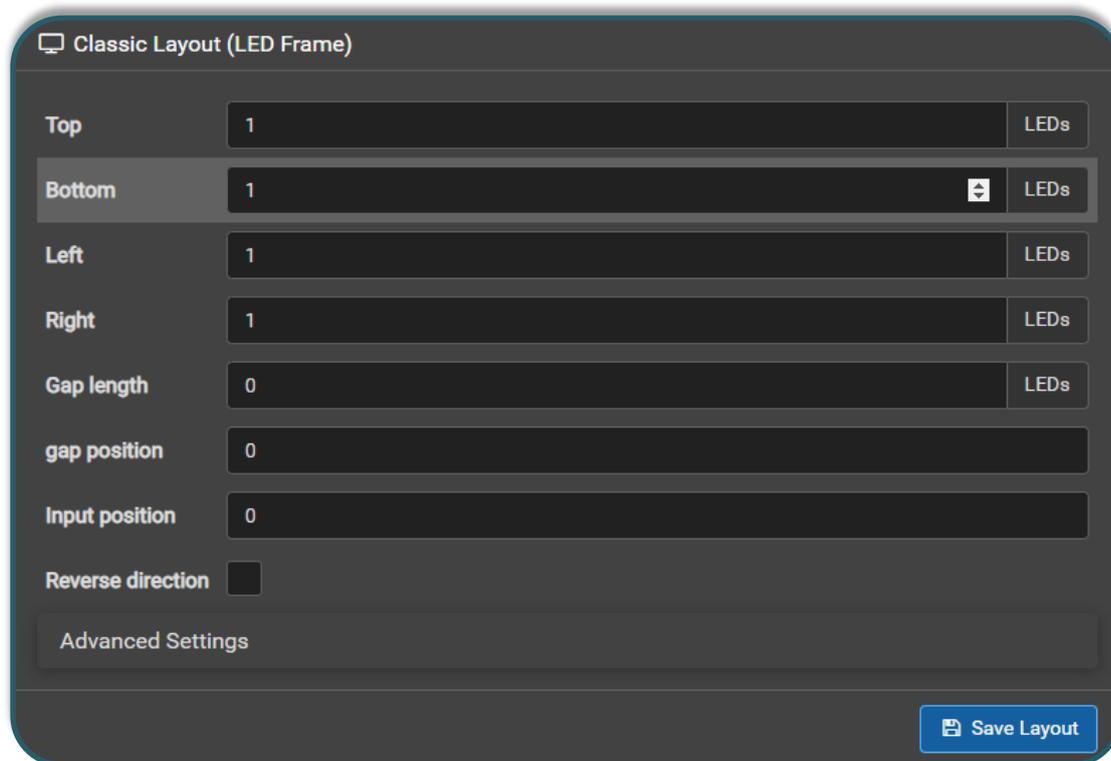
You first have to set up in the GUI which kind of LEDs are installed in the case. To do this go to **LED Instances** → **LED Output**.



There you make the following settings under **LED Controller**:



Under **LED Layout** → **Classic Layout (LED Frame)**, the following settings must also be made:



In Hyperion you can now apply a wide variety of effects to the LEDs, as well as connect and control additional LEDs.

2.5 Fan

A jumper with the inscription Fan Cntrl is attached to the back of the board of the Multimedia Case. This jumper allows to use the fan in two different modes.

When the jumper is set to OFF, the fan is supplied with 5 V voltage. This means that the fan will work at its full speed permanently.

But if it is set to ON, you can use a script to set the fan and even adjust it to the temperature of the Raspberry Pi.

By default, the jumper is set to ON, which allows programming of the fan. Without an active script, the fan will not run. Therefore, we provide you with a script where the speed of the fan is adjusted to the temperature of the CPU of the Raspberry Pi.

The transistor to control the fan is connected to the GPIO 17.



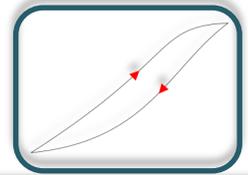
Customizable with the help of a script



Permanently at maximum speed



In the provided script a hysteresis is included. This means that if the maximum temperature of 60 °C is exceeded, the system will cool down to the set temperature of 50 °C.



Hysteresis curve

It is useful to start this program in the background or add it directly to the autostart. This way you can permanently check the temperature of the Raspberry Pi and if necessary cool the Raspberry Pi.

With the following command you can start the script in the background:

```
sudo python3 /home/pi/MultimediaCase/fan.py &
```

To run the program automatically when you start the Raspberry Pi, you must open a file with the following command:

```
sudo nano /etc/rc.local
```

Insert the following line before **exit 0**. Note that the directory where the script is located may differ.

```
python3 /home/pi/MultimediaCase/shutdown-function.py &  
sudo /home/pi/hyperion/build/bin/hyperiond &  
python3 /home/pi/MultimediaCase/fan.py &  
exit 0
```

2.6 Softwareupdates for the board

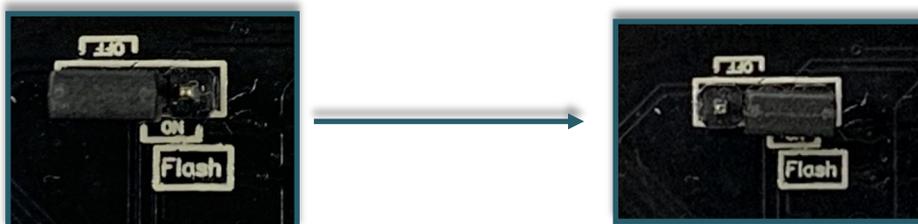
To keep the board always up to date with the latest software, it is useful to install software updates on the board. A new software version is written to the flash memory of the board.

Newer software versions will be released over time to add newer features.

For a firmware update, the serial interface must be configured correctly (**see 2.1**).

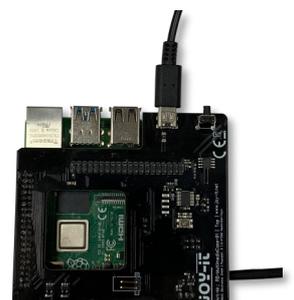
To perform a firmware update, the use of **Raspberry Pi OS** is recommended.

The Raspberry Pi and the circuit board must be removed from the case for the flash process. Furthermore the jumper marked with Flash has to be moved so that it is set to ON.



You can download the latest software version [here](#).

Once the board is plugged into the Raspberry Pi, you need to connect the Raspberry Pi and the board to the power supply using a USB-C cable. Please note that both boards must be powered to flash the board.



For flashing the program [stm32flash](#) is required. You can download and install it with the following commands.

```
sudo apt-get update -y
sudo apt-get install -y stm32flash
```

Make sure that you are in the same directory as the *.bin file*. There you can enter the following command to start the flash process:

```
sudo stm32flash /dev/serial0 -w MultimediaCase.bin -b 9600
```



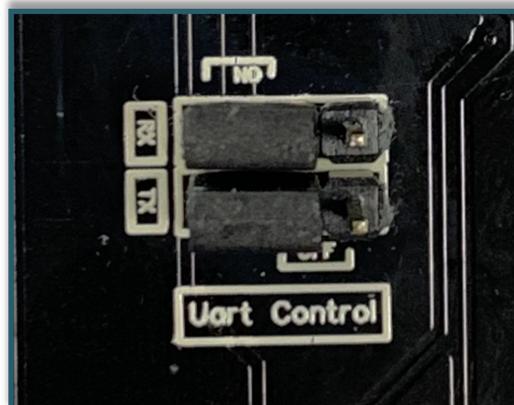
Please note that the name of the software may differ due to newer software versions.

When this process is successfully completed, the board is flashed. Before reassembling the case, put the jumper under the board back to its original position.



2.7 UART Control

Two jumpers for the UART connection are also attached to the bottom of the board. To change these jumpers is only useful if the Raspberry Pi and the Multimedia Case should not communicate with each other anymore. This occurs for example if the UART interface of the Raspberry Pi is needed to communicate with another device. This could be the case, for example, if you want to extend the Multimedia Case.

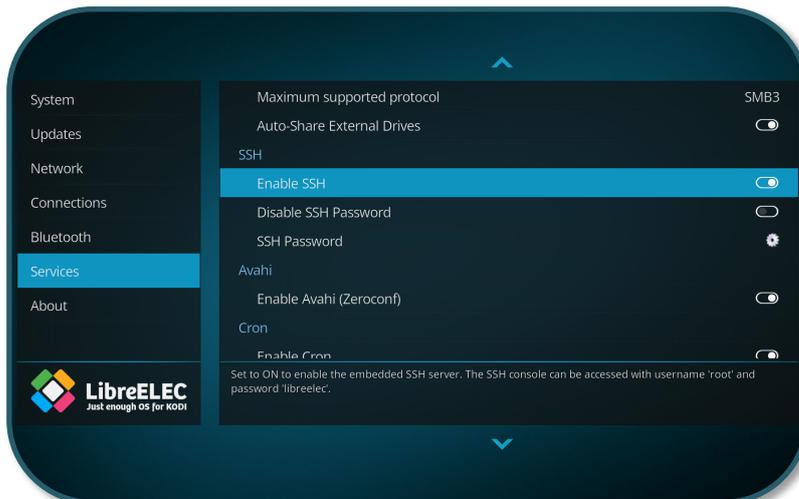


3. USAGE WITH KODI 19 MATRIX

We offer you a prepared image based on LibreElec 10, which you can download [here](#). In this image all necessary addons are already installed in Kodi for setting the Multimedia Case. If you don't want to use our prepared image, you can follow this chapter to use the full functionality of the Multimedia Case.

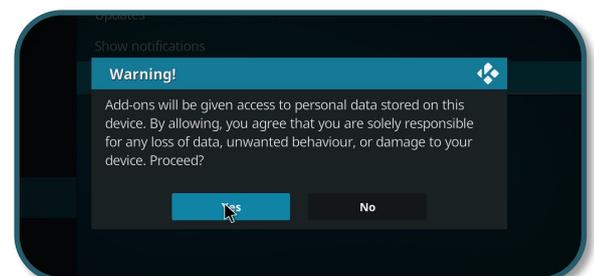
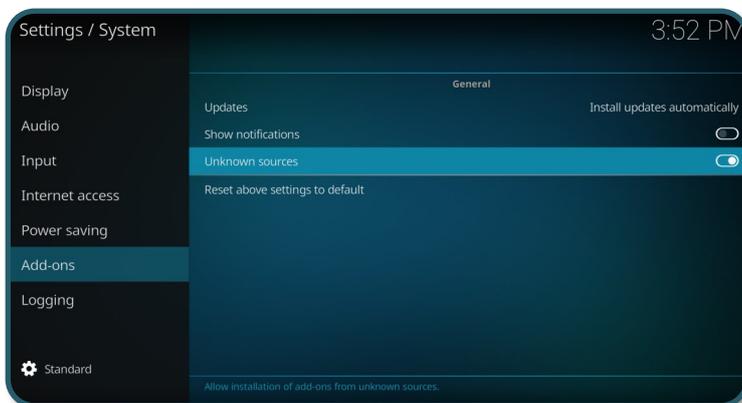
3.1 Installation

First you have to establish an SSH connection. We recommend MobaX-term, which you can download [here](#). You also need to enable SSH in LibreElec. You can enable SSH in the settings under **LibreELEC** → **Services** → **Enable SSH**.



To log in you also need the IP address, which you can read in the **system information** which is located in the settings. The username is *root* by default and the password is *libreelec* by default.

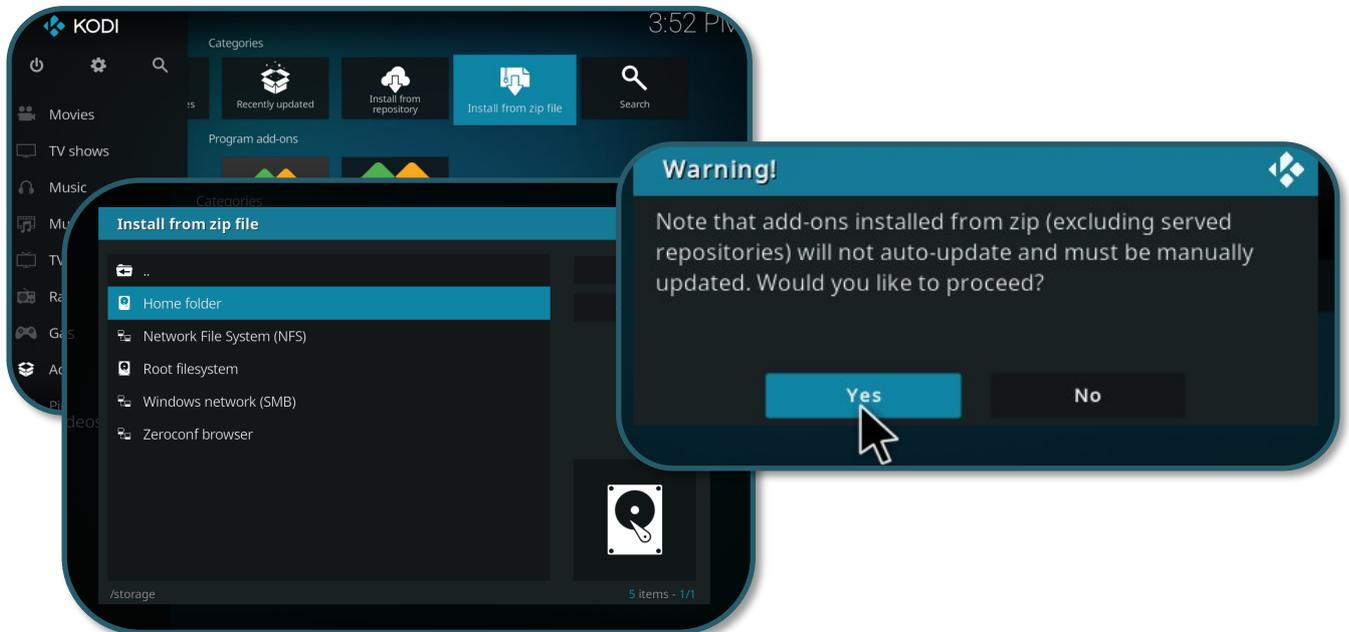
Now you have to download the necessary addons. First you have to allow that addons can be installed from zip files. To do so, go back to the settings on **System** → **Addons** and activate **Unknown Sources**.



First enter the following command to download the serial communication addon:

```
wget https://mirrors.kodi.tv/addons/krypton/script.module.pyserial/script.module.pyserial-3.4.0.zip
```

Now you can install **addons** with the help of the option **Install from Zip files**. If you click on this option, a warning message will be displayed, which you must confirm. After that, click on the home folder. From there you can find your directory where you downloaded the zip file.



If you select this, the addon should be installed. To enable serial communication with the Raspberry Pi completely, you also have to edit the *config.txt*. Open it with the following commands:

```
mount -o remount,rw /flash
```

```
nano /flash/config.txt
```

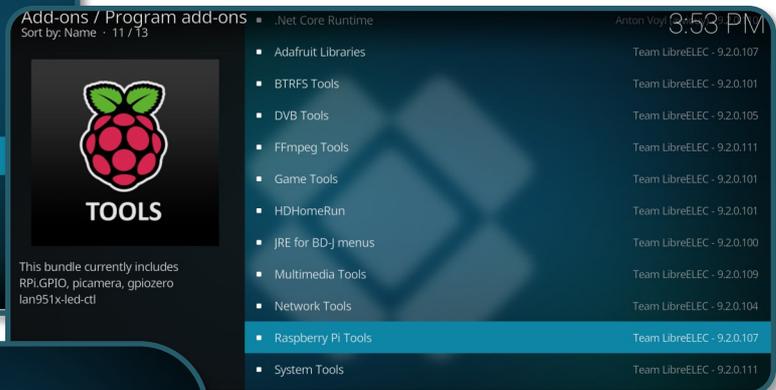
Add the following lines at the end of the file:

```
dtoverlay=pi3-miniuart-bt
enable_uart=1
core_freq=250
```

Save with CTRL + O and exit the editor again with CTRL + X. Restart the Raspberry Pi with the following command to allow the changes to take effect.

```
reboot
```

Now download another addon to use the GPIO functions of the Raspberry Pi. You can find the function **Download from Repository** in the menu **Addons**. There you can find under **LibreELEC Addons** → **Program Addons** → **Raspberry Pi Tools**, which you have to install.



Now open the config.txt again:

```
mount -o remount,rw /flash
```

```
nano /flash/config.txt
```

Now insert the following line at the end of the file again:

```
dtoverlay=gpio-ir,gpio_pin=7
```

To enable 4k at 60 Hz, add the following line to the file as well:

```
hdmi_enable_4kp60=1
```

Now restart the Raspberry Pi with the following command:

```
reboot
```

3.2 Multimedia Case Configuration

With this addon you can activate or modify certain functions of the Multimedia Case to personalize it. This addon contains the programs *fan.py*, *shutdown-function.py* and the *learningMode* (/storage/.kodi/addons/script.module.MultimediaCase/lib/).

fan.py

This is a script to control the fan automatically. By default it starts cooling at 60 °C and stops at 50 °C. Of course you can adjust this in the code to your needs. Make sure that the jumper on the bottom of the board is set to ON at Fan Cntrl, so that the fan can be controlled. This is the default position of the jumper. If the jumper is set to OFF, the fan will run permanently at 100% of its capacity. **See 2.5 Fan** for more information.

shutdown-function.py

This script shuts down your Raspberry Pi before the Multimedia Case disconnects the power supply, when the PowerOff button (*learningMode*) or the button on Multimedia Case was pressed. This script is automatically active after starting the Raspberry Pi, as soon as the addon was executed for the first time. For more information see **2.3 Shutdown script**.

learningMode

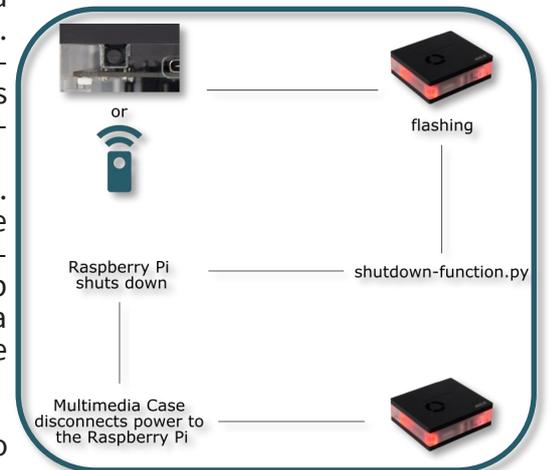
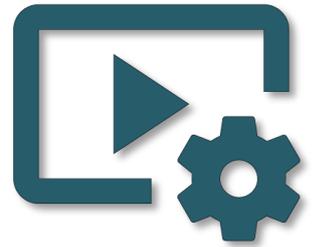
This function of the case puts the board into the so-called *learningMode*, where the board declares a PowerOff button. This means that you can shut down the Raspberry Pi properly by pressing any button on any remote control. This function is activated within the addon, whereby the two upper scripts are stored separately.

The board marks the learningMode with a colored flashing. You have to press the selected button three times. When the board has received an infrared signal, it flashes white. However, if you should press another key, the LEDs will light up red and you have to start again. The LEDs light green when a key has been successfully set as a PowerOff button. For more information see **2.2.1 learningMode**.

You can download the addon [here](#) or download it directly to the Raspberry Pi using the following command:

```
wget https://joy-it.net/public/script.module.MultimediaCase.zip
```

Now you can install **addons** with the help of the option **Install from Zip files**. If you click on this option, a warning message will be displayed, which you must confirm. After that, click on the home folder. From there you can find your directory where you downloaded the zip file.



3.3 Multimedia Case LED Configuration

This add-on directly adjusts the LEDs of the case. You have to execute the following command to download Hyperion.

```
wget -qO- https://git.io/Jz5Qp | bash
```

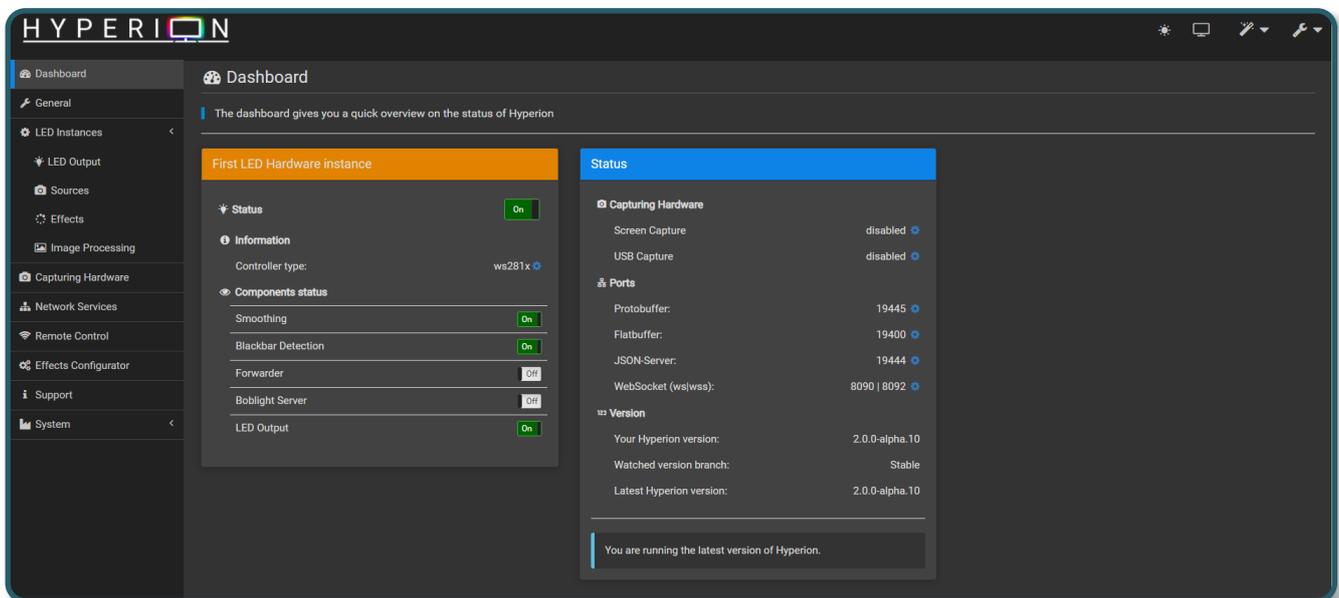
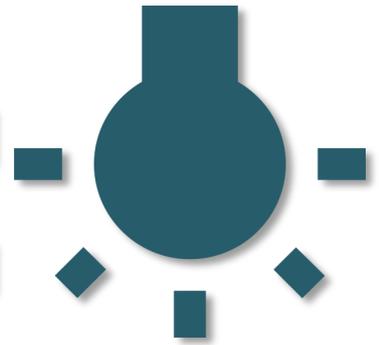
Now restart the Raspberry Pi with the following command:

```
reboot
```

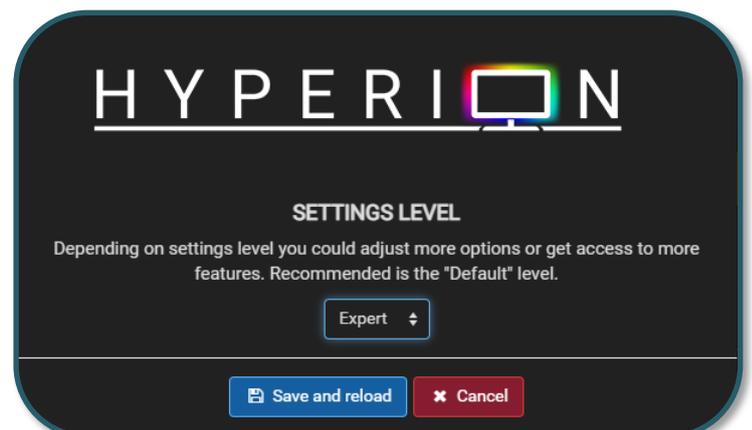
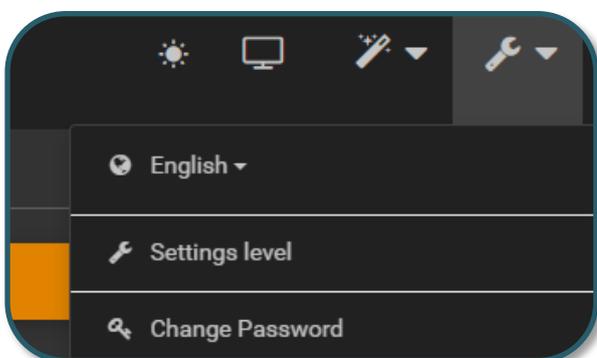
Now you can access Hyperion via web browser. To do so, enter your IP address of the Pi and attach a **:8090**. This could look like this, for example:

```
192.168.1.100:8090
```

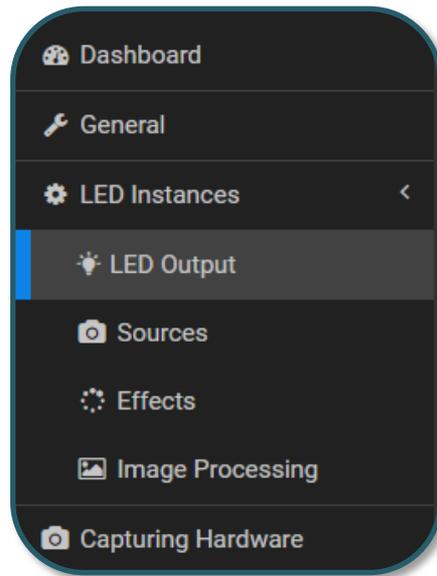
Now the WebGUI of Hyperion is displayed.



To be able to implement the following settings, you must set the **Setting level** from **Default** to **Expert**.



You first have to set up in the GUI which kind of LEDs are installed in the case. To do this go to **Configuration** → **LED Hardware**.



There you make the following settings under **LED Controller**:

A screenshot of the LED Controller settings page. At the top, 'Controller type' is set to 'ws281x'. Below this is a section titled 'Specific Settings' with the following fields: 'Maximum LED count' (4), 'GPIO number' (18), 'DMA channel' (5), 'PWM channel' (0), 'Invert signal' (checkbox), 'Use RGBW protocol' (checkbox), 'White LED algorithm' (dropdown menu set to 'Subtract minimum'), 'Latch time' (0 ms), 'Refresh time' (1000 ms), 'Hardware LED count' (4), and 'RGB byte order' (dropdown menu set to 'GRB'). At the bottom, there is an 'Information' section with a link to 'Log' and a 'Save settings' button.

Under **LED Layout** → **Classic Layout (Frame)**, the following settings must also be made:

The screenshot shows the 'Classic Layout (LED Frame)' settings panel. It features several input fields and a checkbox:

- Top:** Input field with value '1' and 'LEDs' label.
- Bottom:** Input field with value '1', a dropdown arrow, and 'LEDs' label.
- Left:** Input field with value '1' and 'LEDs' label.
- Right:** Input field with value '1' and 'LEDs' label.
- Gap length:** Input field with value '0' and 'LEDs' label.
- gap position:** Input field with value '0'.
- Input position:** Input field with value '0'.
- Reverse direction:** A checkbox that is currently unchecked.
- Advanced Settings:** A button at the bottom left.
- Save Layout:** A blue button at the bottom right.

However, in order for the Addon to function correctly, you must deactivate under **LED Instances** → **Effects Boot Effect/Color**. It is necessary that you save these settings.

The screenshot shows the 'HYPERION' interface with the 'Effects' configuration page open. The left sidebar contains a menu with the following items: Dashboard, General, LED Instances, LED Output, Sources, Effects (highlighted), Image Processing, Capturing Hardware, Network Services, Remote Control, and Effects Configurator. The main content area is titled 'Effects' and shows the configuration for the 'First LED Hardware instance'. Under the 'Boot Effect/Color' section, there is an 'Explanation' box stating: 'Define a boot-effect or color, which is shown during Hyperion startup for the defined duration.' Below this, there is an 'Activate' label and an unchecked checkbox. A blue 'Save settings' button is located at the bottom right of the configuration area.

A close-up of the 'Save settings' button, which is a blue button with a white document icon and the text 'Save settings'.

If you want to use the addon to make settings, you must enter the following command. Because with the help of this command Hyperion itself can be switched off and on by using the addon.

```
systemctl disable hyperion.service --now
```

You can also undo this with the following command .

```
systemctl enable hyperion.service --now
```

Now you can download the addon [here](#) or download it directly to the Raspberry Pi with the following command:

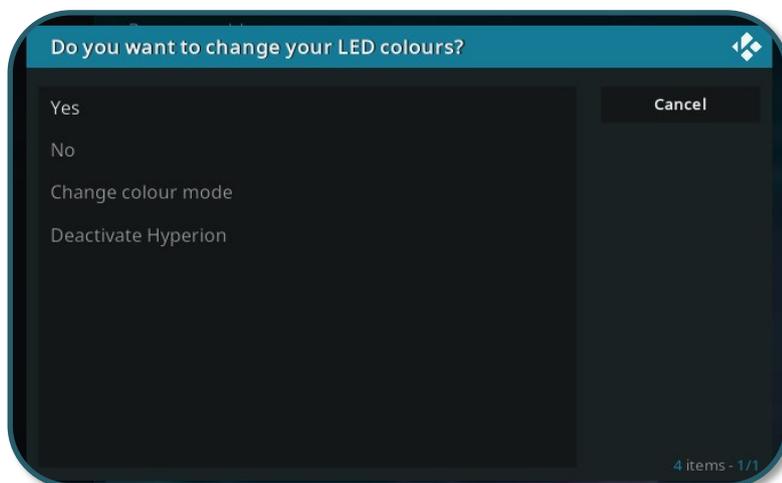
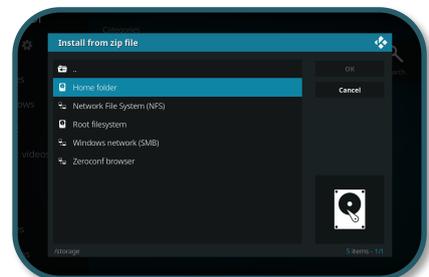
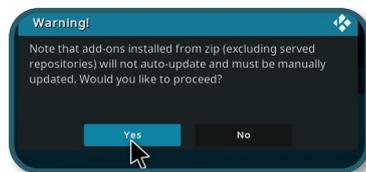
```
wget https://joy-it.net/public/script.module.MCHyperion.zip
```

You can install this, as already explained.

In the addon you can activate or deactivate Hyperion. More information can be found in **2.4 RGB-LEDs**.

In this addon, you can also set the LED colour modes. For more information about the LED color modes, see **2.4.1 LED color modes**.

Note that this addon is only compatible with firmware version 1.0.1 or higher. How to update the software can be found in **2.6 Software-updates for the board**.

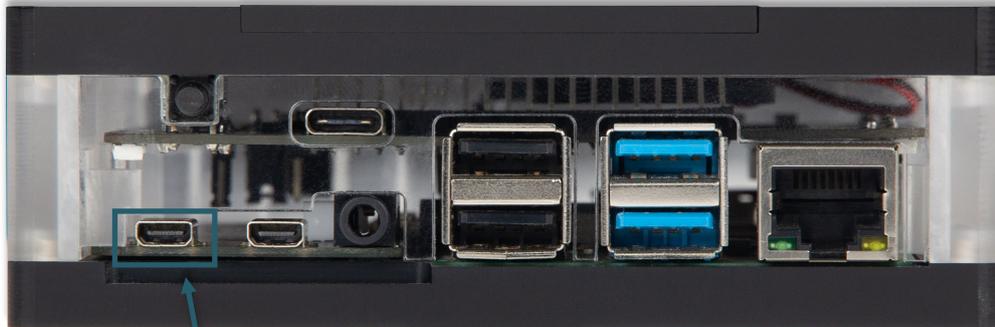


3.4 HDMI CEC

HDMI CEC is a function where the remote control of your TV can operate the Multimedia Case via the HDMI cable.

Kodi has already enabled this function by default. You can use the remote control with the Multimedia Case without further configuration.

The HDMI cable used must also support this function. The HDMI0 port must also be used. HDMI CEC offers an alternative to a separate remote control.



HDMI0



Note that the TV must also have HDMI CEC enabled. The name of this function may vary depending on the manufacturer.

3.5 IR Control Configuration

An alternative to HDMI CEC (**3.4 HDMI CEC**) is this addon, with which you can set up a remote control of your choice for the Multimedia Case. It will walk you through and save the individual keys of the remote control that are necessary to use Kodi, so you don't need to have a keyboard or mouse connected to the Raspberry Pi anymore.

Note that you don't get any feedback when you press a key, but only a message when it has been detected and continues with the next one.

You can download the addon [here](#) or download it directly to your Raspberry Pi with the following command:

```
wget https://joy-it.net/public/script.remote.config.zip
```

This addon must be installed like all other addons using the **Install from ZIP files**. More information can be found in **2.2 IR-Receiver**.



All addons can be configured as often as desired. With these addons the complete functionality of the Multimedia Case is covered and offers you an optimal experience.



4. FURTHER INFORMATION

Our Information and Take-back Obligations according to the German Electronic Law (ElektroG)



Symbol on Electrical and Electronic Products:

This crossed-out bin means that electrical and electronic products do not belong into the household waste. You must hand over your old appliance to a registration place. Before you can hand over the old appliance, you must remove used batteries and replacement batteries which are not enclosed by the device.

Return Options:

As the end user, you can hand over your old appliance (which has essentially the same functions as the new one bought with us) free of charge for disposal with the purchase of a new device.

Small devices, which do not have outer dimensions bigger than 25 cm can be handed in for disposal independently of the purchase of a new product in normal household quantities.

1. Possibility of return at our company location during our opening hours

Simac Electronics Handel GmbH, Pascalstr. 8, D-47506 Neukirchen-Vluyn

2. Possibility of return nearby

We will send you a parcel stamp with which you can send us your old appliance free of charge. For this possibility, please contact us via e-mail at service@joy-it.net or via telephone.

Information about Package:

Please package your old appliance safe for transport. Should you not have suitable packaging material or you do not want to use your own material, you can contact us and we will send you an appropriate package.

5. SUPPORT

If any questions remained open or problems may arise after your purchase, we are available by e-mail, telephone and ticket support system to answer these.

E-Mail: service@joy-it.net

Ticket-system: <http://support.joy-it.net>

Telephone: +49 (0)2845 98469 – 66 (10 - 17 o'clock)

For further information visit our website:

www.joy-it.net