

Camplayer OS Manual

Version 1.0

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Introduction

Camplayer OS is a Linux based operating system that uses a cheap Raspberry Pi as IP camera monitor. The list of supported IP cameras is endless as Camplayer OS makes use of the RTSP and HTTP streaming protocols. Especially the RTSP protocol is supported by nearly all big brands out there.

Grid like playback for up to 9 streams ([click here for details](#)), screen rotation, remote control navigation and CEC are some important features, check out the [full list in the next section](#).

Under the hood ‘Camplayer OS’ uses ‘Camplayer’ as actual media player, this software is open source and released under a GPL v2 license.

Check out the preview image below, for simplicity all four streams are identical.



Figure 1: Camplayer 2x2 grid

Features

- User friendly configuration and easy operation with a CEC remote and/or USB keyboard.
- Read-only operating system without the risk of corrupting the file system in case of an unexpected power down.
- H264, MJPEG and MPEG2 decoding support (MPEG2 is not supported on the Raspberry Pi 4).
- Video grid for up to 9 streams (H264 640x360@24FPS on Raspberry Pi Model B 3+). [click for details](#)
- Predefined screen layouts for easy configuration. [click for details](#)
- Substream/subchannel support with automatic or manual selection.
- Automatic recovery of broken streams.
- Display power management (automatic wake/sleep).
- Basic dual screen support for the Raspberry Pi 4.
- Automatic adaptation to changed IP addresses.
- Demo mode.
- ...

Limitations

- The maximum video resolution is 1920x1080.
- MPEG2 decoding is not supported on the Raspberry Pi 4.
- You need a to buy a separate license for MPEG2 decoding.
- No UHD/4K HDMI output at the moment.
- No static IP addresses at the moment.
- GUI is currently in English only.
- ...

Before you begin

License agreement

By using this software you implicitly agree to the end user license agreement. You can find the end user license agreements as attachment when you download the Camplayer OS software, these files are called 'LICENSE_system.txt' and 'LICENSE_camplayer.txt'. For existing installations, you can find these files on the 'boot' partition of the SD card or in the configuration menu.

Security warnings

The camera player software “Camplayer” uses RTSP/HTTP streams for playback, even with password protection these streams can not be considered as secure for the following reasons:

- RTSP/HTTP streams are not encrypted, only the login procedure is protected!
- Someone with physical access to this device can grab the SD card and read its content, including possible passwords!

For these reasons, CAMPLAYER OS is only intended to be used for harmless footage in protected and trusted home networks (domestic use).

Installation prerequisites

- At least a Raspberry Pi 2 model B or better.
Model 3+ or 4 is highly recommended because of the better video decoding capabilities.
- Micro SD card of at least 4 GB.

- Computer with a micro SD card reader.
- A USB keyboard connected to your Raspberry Pi, alternately you can use your television remote control, however this is less practical and does not work with all brands/models.
- Reliable network connection, either wired or wireless (WiFi).

Installation with keyboard or CEC remote

Please follow all installation steps in sequential order.

Prepare your SD card

1. Download 'CAMPLAYER OS'.
2. Unzip the .iso file.

For windows you can use the built-in ZIP extractor.

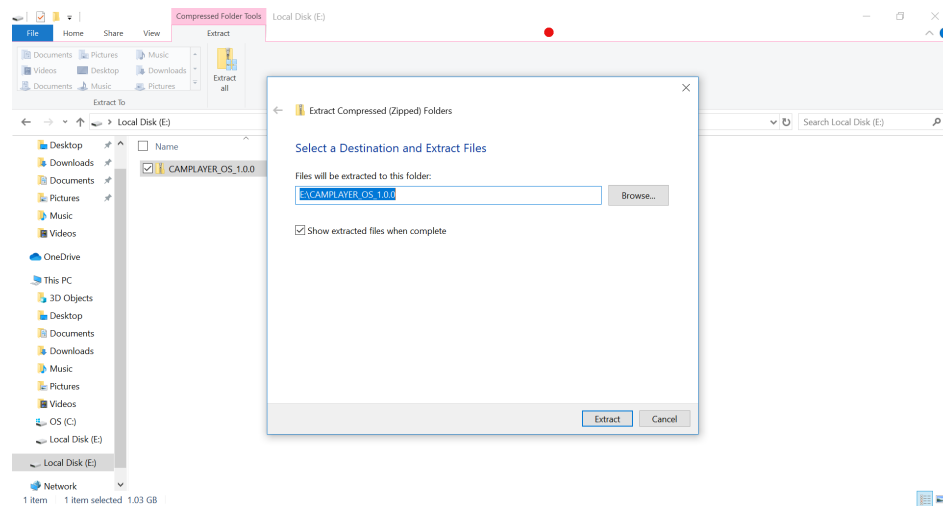


Figure 2: Extract image on Windows 10

3. Flash the 'CAMPLAYER OS' image (.iso file) on your SD card.

For windows you can use 'Win32DiskImager', you can download it from the SourceForge page here:

<https://sourceforge.net/projects/win32diskimager/>

1. Browse and select the unzipped .iso file (folder icon).
2. Select the correct SD card (drive letter/device), this is **VERY VERY important** as all data on this device will be overwritten!
3. Select 'Write'.

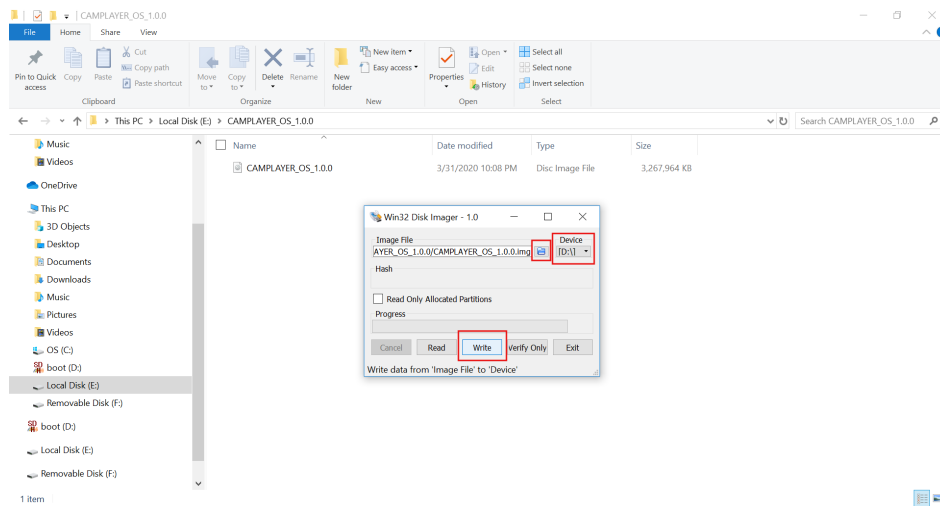


Figure 3: Write image on Windows 10 with Win32DiskImager

4. Safely remove your SD card, usually there is an icon for this in the taskbar.

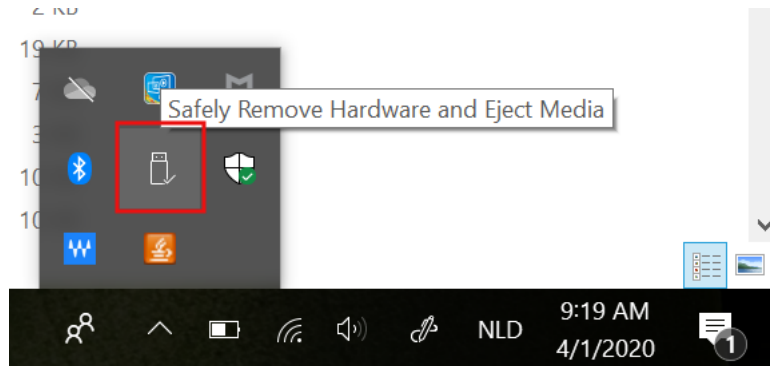


Figure 4: Safely remove SD card in Windows 10

Request license file

1. Startup your Raspberry Pi with the SD card you configured in the previous step.
2. You will be prompted to accept the end user agreement and some security warnings.
3. Follow the on screen instructions to request a license file and shutdown the system afterwards.
4. Once you received your license file by email, place this file on the 'boot' partition of your SD card.

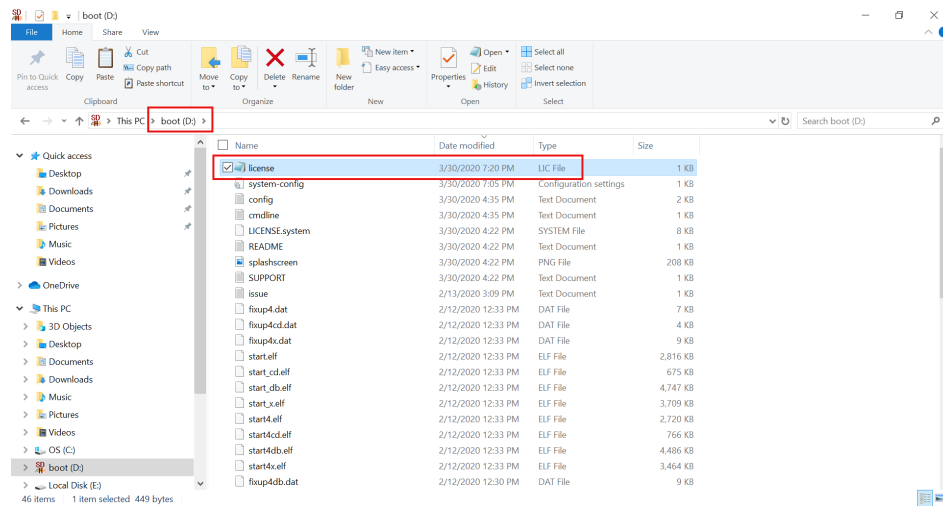


Figure 5: License file on Windows

- Startup your Raspberry Pi again and your system should be activated. You will be redirected to the configuration menu when no configuration file is found, this is usually the case.

Network configuration

Wired connection

Everything should be configured already by the DHCP client, you can skip to section *network verification* to verify the network status.

WiFi setup

This section will guide you through the WiFi setup procedure. Select 'WIFI SETUP WIZARD' in the configuration menu to start.

Example:

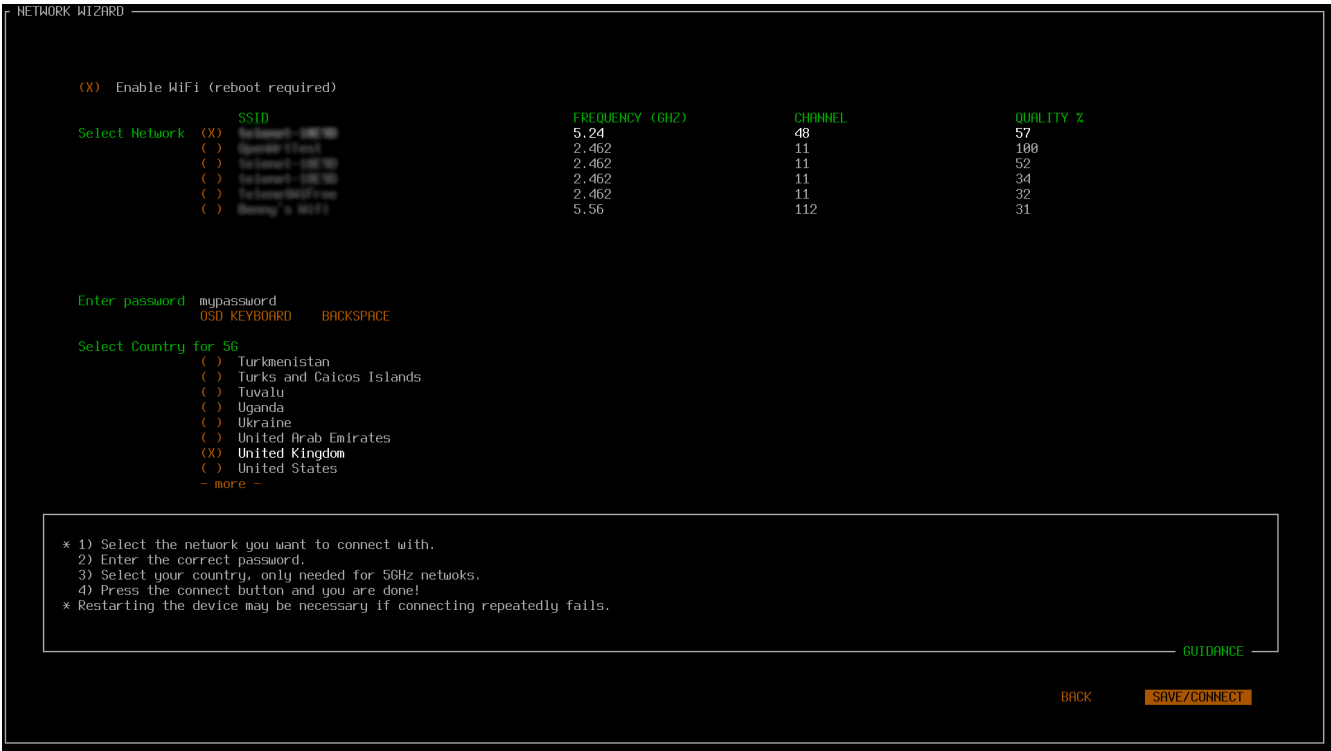


Figure 6: WiFi setup

Parameters:

Enable WiFi	Enables the onboard WiFi adapter. A reboot is required before it takes effect.
Select Network	A list of discovered networks, select the network you want to connect with.
Enter password	Enter your WiFi network password.
Select country..	Select your country, only required for 5GHz networks.
OSD KEYBOARD	Opens an OSD keyboard in case you are configuring without a connected keyboard (Television remote).
BACKSPACE	Sends a backspace in case you are configuring without a connected keyboard (Television remote).

Network verification

Network status

To view the current network status, open the configuration menu and select ‘NETWORK INFORMATION’. The network information will be shown in the output window. You have a valid network connection when the IP address and gateway fields are filled in. Please check your network cabling and/or configuration if this is not the case. In some cases, a full system restart is necessary.

Example:

```
OUTPUT WINDOW
Network connection : Wireless
IP Address         : 192.168.0.233
Network mask       : 255.255.255.0
Gateway            : 192.168.0.1
SSID               : 
Link speed         : 150.0 MBit/s
```

Figure 7: Network status

Network speedtest

Network problems can lead to interrupting and/or freezing video playback, therefore the speedtest tool comes in handy when you want to verify your network quality. The most important parameter is the download speed, at least 20Mbit/s is recommended and should be sufficient for most cases.

To start the speedtest, open the configuration menu and select ‘NETWORK SPEEDTEST’. The speedtest progress will be shown in the output window.

Example:

```
OUTPUT WINDOW
Running speedtest, this can take a few minutes, please be patient...
Retrieving speedtest.net configuration...
Testing from 
Retrieving speedtest.net server list...
Selecting best server based on ping...
Hosted by [34.59 km]: 30.369 ms
Testing download speed.....
Download: 60.70 Mbit/s
Testing upload speed.....
Upload: 3.59 Mbit/s
Done!
```

Figure 8: Network speedtest

Camplayer configuration

This section will guide you through the camplayer setup procedure. Before proceeding, please make sure your network connection is properly set up. You can verify this with the ‘**NETWORK INFORMATION**’ option in the **configuration menu**. Select ‘CAMPLAYER SETUP WIZARD’ in the configuration menu to start.

If an existing configuration is found, you will be prompted to edit this one or to create a new one.

The first page of the camplayer setup wizard is an overview of sources and streams listed in the current configuration file. Of course this list is empty if this is your initial setup or when you chose to create a new configuration file in the previous step. To add a new device (or other source), select ‘ADD DEVICE MANUALLY’.

Add devices and sources

One of the most important steps in the configuration progress is the adding of devices. You have to add at least one device, the maximum number of devices is currently limited to 64.

Each device can contain up to three substreams/subchannels, it is very important that the video content of all substreams is identical as the player software can automatically switch between them. Usually IP cameras support multi-quality streams e.g. one 1080p main stream, one 720p substream and one 360p substream.

Streams are composed semi-automatically by parameters like username, password and IP address. In most cases you have to append a camera specific path after the composed URL, you can probably find this information in the manual of your IP camera or on the internet.

I've made an attempt (without guarantee) to list this information for some of the most common brands.

Hikvision

```
/Streaming/Channels/<channel><subchannel>
/Streaming/Channels/101          # Channel 1 high quality stream.
/Streaming/Channels/102          # Channel 1 lower quality stream.
/Streaming/Channels/161          # Higher quality stream of channel 16,
                                only valid for multi-channel devices like NVRs.
```

Bosch

```
/?line=<channel>&inst=<subchannel>
/?line=1&inst=1                  # Channel 1 high quality stream.
/?line=1&inst=2                  # Channel 1 lower quality stream.
/?line=16&inst=1                 # Higher quality stream of channel 16,
                                only valid for multi-channel devices like NVRs.
```

Example:

CAMPLAYER WIZARD: ADD DEVICE MANUALLY

DEVICE NAME	Testcam	OSD KEYBOARD	BACKSPACE
TYPE	(X) RTSP () HTTP () FILE		
USERNAME	admin	OSD KEYBOARD	BACKSPACE
PASSWORD	Testcam1	OSD KEYBOARD	BACKSPACE
IP OR HOSTNAME	192.168.0.167	OSD KEYBOARD	IP KEYBOARD BACKSPACE
PORT	554	OSD KEYBOARD	BACKSPACE
SOURCE 1 URL	rtsp://admin:Testcam1@192.168.0.167:554/Streaming/Channels/101	OSD KEYBOARD	BACKSPACE PREVIEW
SOURCE 2 URL	rtsp://admin:Testcam1@192.168.0.167:554/Streaming/Channels/102	OSD KEYBOARD	BACKSPACE PREVIEW
SOURCE 3 URL	rtsp://admin:Testcam1@192.168.0.167:554/	OSD KEYBOARD	BACKSPACE PREVIEW

* You can add up to 3 sources (subchannels) for one main channel.
The content from the 3 sources should be identical but may vary in video quality.
The player software will automatically select the preferred source/subchannel.

PREVIOUS GUIDANCE ADD

Figure 9: Camplayer setup: add device

Parameters:

Device Name	Optional device name.
Type	Stream type, usually RTSP.
Username	Username for stream.
Password	Password for stream.
IP or Hostname	IP address or hostname of stream.
Port	RTSP or HTTP port, usually 554 for RTSP.
Stream 1 URL	Composed stream URL (mainstream/mainchannel) based on the previous settings, you probably have to append a specific path, check your IP camera stream URL documentation.
Stream 2 URL	Composed stream URL (substream1/subchannel1) based on the previous settings, you probably have to append a specific path, check your IP camera stream URL documentation. Optional in case your device doesn't support multiple streams.
Stream 3 URL	Composed stream URL (substream2/subchannel2) based on the previous settings, you probably have to append a specific path, check your IP camera stream URL documentation. Optional in case your device doesn't support multiple streams.
OSD KEYBOARD	Opens an OSD keyboard in case you are configuring without a physical keyboard (Television remote).
BACKSPACE	Sends a backspace in case you are configuring without a physical keyboard (Television remote).
PREVIEW	Opens the source URL in a video player, if you don't see anything your URL is probably wrong.

Devices and sources overview

After adding a device, you will return to the overview of sources and streams. Repeat this process until all devices are added.

Example:

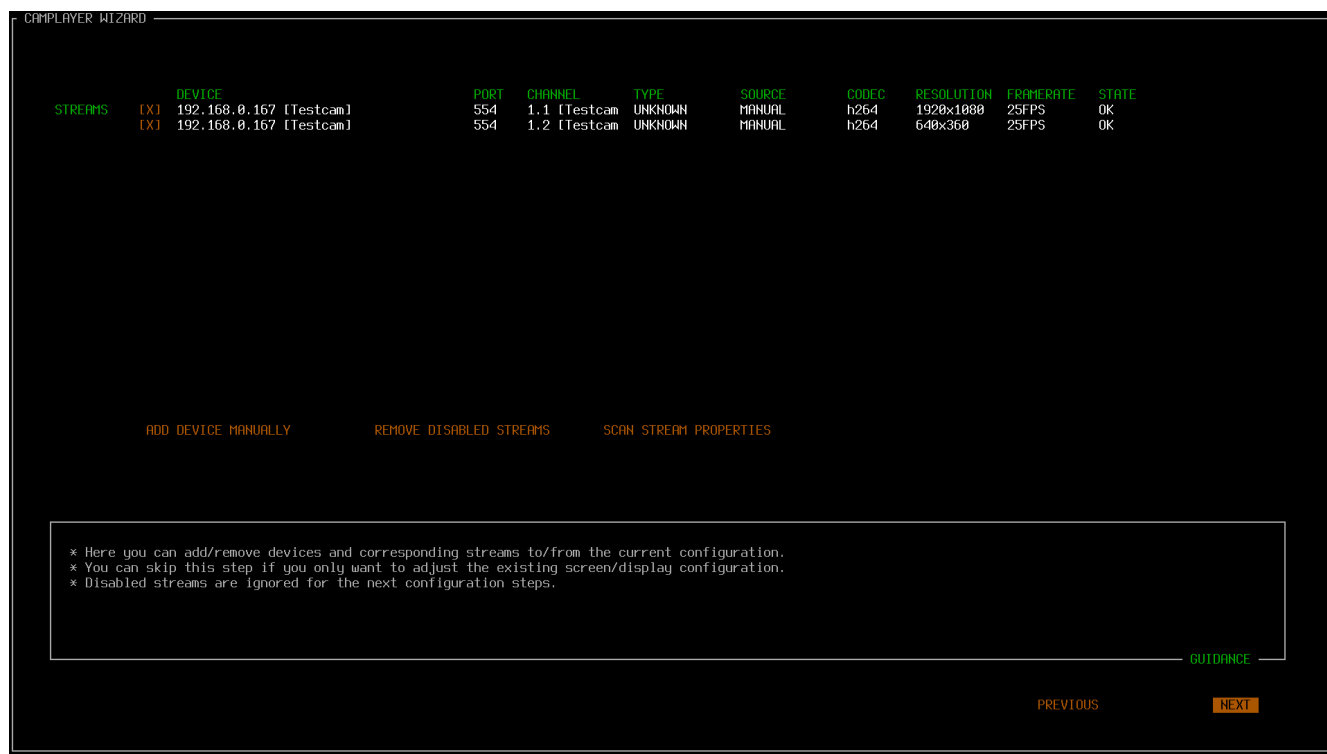


Figure 10: Camplayer setup: streams

Parameters:

Streams	The list of streams in the current configuration. Every device can contain up to 3 streams/subchannels.
ADD DEVICE MANUALLY	Add an IP camera device with up to three substreams/subchannels.
REMOVE DISABLED..	Remove unchecked streams from the configuration.
SCAN STREAM PROP..	Scan or rescan the stream properties like codec, resolution and frame rate.

Configure layout

In this step you can define the screen layout. i.e. how many windows per screens, order of streams/sources etc. If you are done, you have to select 'FINISH' and you will be prompted to enter a locking password. Saving the configuration with locking password is more secure and asks you to enter that password on every startup. After this step, the system is ready to use.



Figure 11: Camplayer layout

Parameters:

SCREENx	Screen number, this defines the playing sequence.
Display Time	The active time of this screen in seconds before switching to the next screen (if multiple screens are configured), '0' will disable automatic rotation.
Screen Layout	The number of windows per screen. The more windows, the heavier the load on your Raspberry Pi, therefore please respect the 'Not recommended' warnings.
windowx	The source/stream that is currently mapped to this window, press select to change this mapping. Please also respect the 'Not recommended' warnings here.
DEVICE	The device mapped to this window.
CHANNEL	The channel/stream mapped to this window.
INFO	Please follow the suggestions given here.
MAPPING	Shows duplicate source/streams mappings when multiple screens are configured.
Numeric 0	Opens the source URL in a video player to verify the mapping location.

Advanced settings

Camplayer advanced settings

To adjust camplayer specific settings, select 'CAMPLAYER ADVANCED SETTINGS' in the configuration menu.

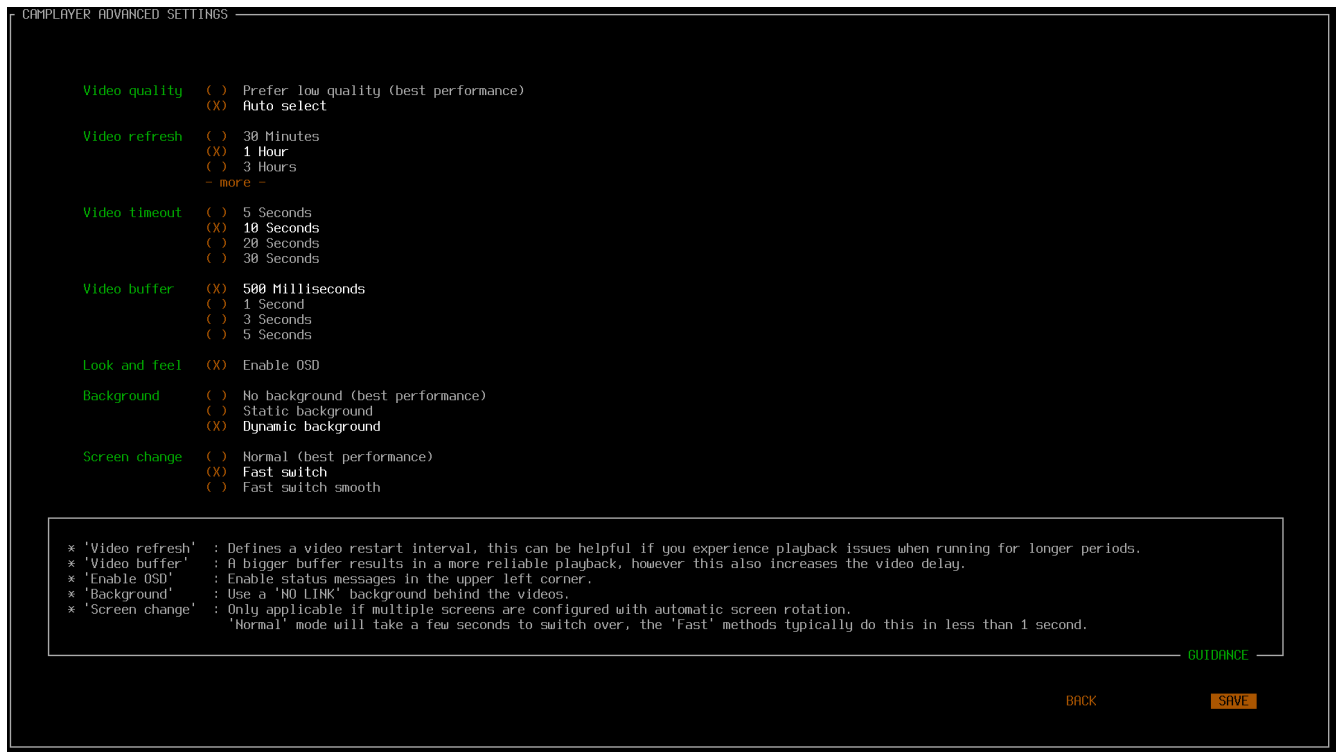


Figure 12: Camplayer settings

Parameters:

Video quality	Video source quality selection. Only valid if your devices have multiple subchannnels/substreams of a different quality. 'Auto select' is the preferred mode.
Video refresh	Refreshes all video players at this interval. Note that you will see a black screen for a few seconds every time this happens.
Video timeout	Video timeout when playback starts.
Video buffer	Video buffer time, you might need to increase this value when your video playback is unreliable (like a slow WAN connection). On the other side, increasing this value also increases the time delay.
Look and feel	'Enable OSD' enables status and action messages in the upper left corner.
Background	A background shows 'NO LINK' images behind every video. The dynamic mode changes this background in real-time.
Screen change	Only applicable if you have defined multiple screens. For the normal mode, there is a black screen period of a few seconds between the screen changeovers. The fast modes don't suffer from this but have a higher performance impact.

System settings

To adjust system specific settings, select 'SYSTEM SETTINGS' in the configuration menu.

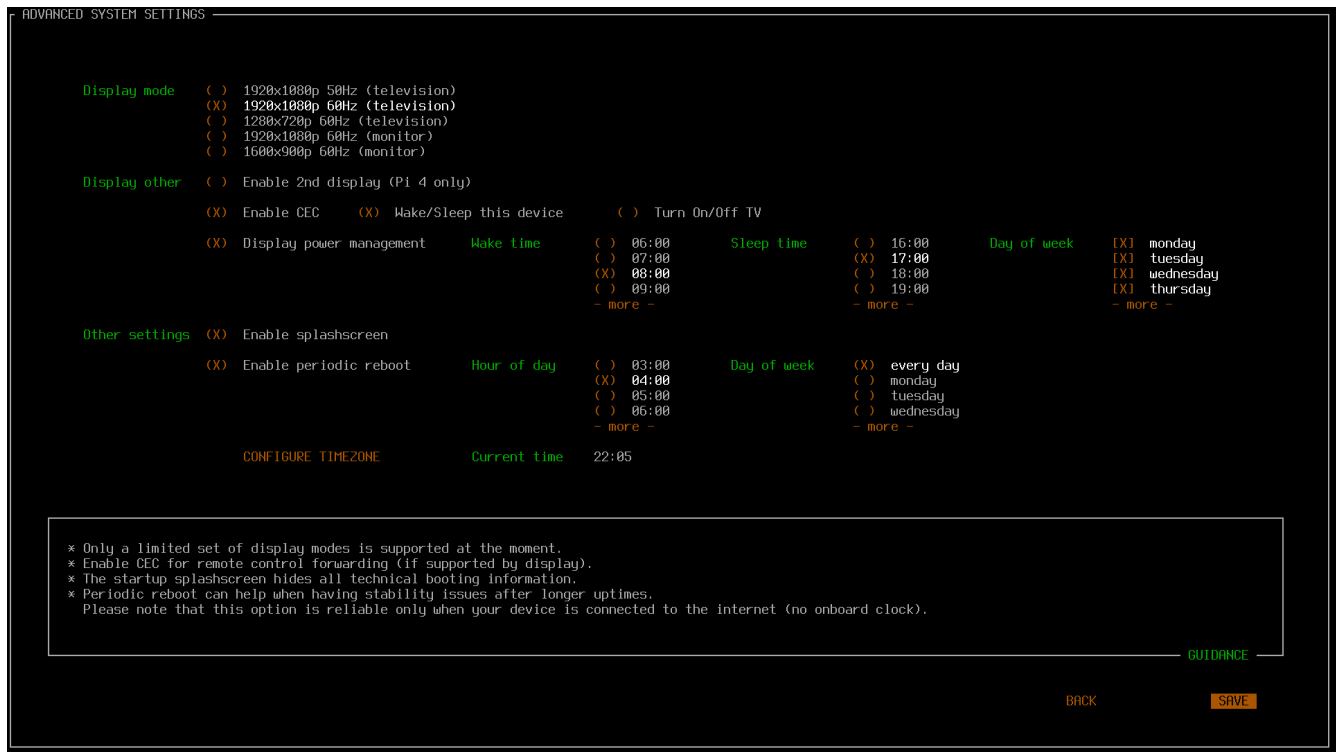


Figure 13: System settings

Parameters:

Display mode	Force a specific display mode. Some televisions also support monitor modes. Television modes use a limited HDMI color range while monitor modes use the full HDMI color range, this can affect the perceived black level.
Enable 2nd display	Enable the 2nd HDMI output (HDMI1) on the Raspberry Pi 4.
Enable CEC	Enable CEC, including Television remote control forwarding.
Wake/sleep..	Stop streaming when your television turns off and resume streaming when your television turns on again.
Turn On/Off TV	Wake television when this device resumes from sleep, sleep the television when this device goes to sleep.
Display pwr mngmnt	Wake and sleep the television or monitor at specific times.
Enable splash..	Hides technical information during startup.
Enable per. reboot	Reboot this device at specific times, this can help if you Experience stability issues after some longer uptimes.
Configure timezone	Configure the correct timezone especially when you have enabled periodic reboot or display power management.

Headless installation (for advanced users)

System configuration

The system configuration file 'system-config.ini' is stored on the 'boot' partition of the SD card and can be modified to your needs without the need for the configuration menu.

Actually, the configuration menu reads and edits this very same configuration file.

Display

Add a section named 'DISPLAY' to the system configuration file.

hdmi_ignore_update	{0/1}	Disables all HDMI settings from below, this is useful if you defined specific display settings in config.txt.
hdmi_group	{CEA/DMT}	Typically CEA are television modes and DMT are monitor modes.
hdmi_mode	{1..86}	Sets the actual resolution and refresh rate, check out raspberrypi.org/documentation/configuration/config-txt/video.md for an overview of supported modes.
hdmi_dual	{0/1}	Enable the 2nd HDMI output for the Raspberry Pi 4.
cec_enable	{0/1}	Enable CEC remotes (for HDMI) and the settings from below.
cec_pwr_tv	{0/1}	Send power up/down signal to television when starting/stopping camplayer.
cec_pwr_camplayer	{0/1}	Start/stop camplayer when the television powers up/down.

Network

Add a section named 'NETWORK' to the system configuration file.

wifi_ignore_update	{0/1}	Disables all WiFi settings from below, this is useful if you defined specific WiFi settings with a custom wpa_supplicant.conf.
wifi_enable	{0/1}	Enable the onboard WiFi adapter.
wifi_ssid	{any}	The WiFi network SSID you want to connect with.
wifi_password	{any}	The WiFi network password.
wifi_country	{any}	Two-letter WiFi country code (ISO 3166-1 alpha-2).

Power management

Add a section named 'POWER' to the system configuration file.

pwr_mgmt_enable	{0/1}	Enable the power management settings from below (= automatic startup and shutdown of system).
pwr_mgmt_wake_hour	{0..23}	Hour of day to wakeup device.
pwr_mgmt_sleep_hour	{0..23}	Hour of day to enter sleep mode.
pwr_mgmt_days	{1..127}	Sum of days where Monday = 1, Tuesday = 2, Wednesday = 4 etc. and 127 = all days of the week.

Advanced settings

Add a section named 'ADVANCED' to the system configuration file.

splashscreen	{0/1}	Enable boot splash screen (hides technical booting info).
periodic_reboot_enable	{0/1}	Enable the periodic reboot settings from below.
periodic_reboot_hour	{0..23}	Hour of day to reboot.
periodic_reboot_day	{0..7}	Day to reboot, 0 = every day, 1 = Monday, 2 = Tuesday, 3 = Wednesday etc.
		This is different from the power management settings!

Example

Example 'system-config.ini' file, please don't include the comments after the '#' in your ini file, this is only for clarification.

```

[DISPLAY]
hdmi_group = CEA                # Television mode.
hdmi_mode = 16                  # 1080p@60Hz
hdmi_dual = 0                   # Disable the 2nd HDMI output on the Pi 4.
cec_enable = 1                  # Enable CEC.
cec_pwr_tv = 0                  # Don't power off/on the television automatically.
cec_pwr_camplayer = 1           # Suspend/resume camplayer when the television turns off/on.

[NETWORK]
wifi_enable = 1                 # Enable WiFi.
wifi_ssid = myssid              # Connect to WiFi network 'myssid'.
wifi_password = mypass          # Set Wifi password to 'mypass'.
wifi_country = GB               # Set the WiFi country to The United Kingdom.

[POWER]
pwr_mgmt_enable = 0             # Disable display power management.

[ADVANCED]
splashscreen = 1                # Enable the bootup splashscreen.
periodic_reboot_enable = 0      # Disable automatic reboot.

```

Camplayer configuration

The camplayer configuration file ‘camplayer-config.ini’ is stored on the ‘boot’ partition of the SD card and can be modified to your needs without the need for the configuration tool. Actually, the configuration tool reads and edits this very same configuration file.

More information about options and syntax of this file can be found in the camplayer manual:

<https://github.com/raspicamplayer/camplayer>

Remote control mapping

space	Pause/unpause automatic screen rotation.
enter	Switch from grid to single view mode.
left/right arrow	Switch to previous/next screen (or window in single view mode).
up/down arrow	Increase/decrease stream quality
	when multiple subchannels/substreams are configured.
numeric keys 1..9	Switch from grid view mode to the relevant window in single view mode.
numeric key 0	Switch from single view to grid view mode and unpause rotation.
escape	Switch from single view to grid view mode and unpause rotation.
1234	Open configuration menu.
1638	Open configuration menu in expert mode.
←↓→↑	Open configuration menu with the arrow keys (CEC remote or keyboard).
9999	Power on/off display(s).
d/D	Select the display you want to control (for dual display setups).

Supported screen layouts

An overview of supported screen layouts.

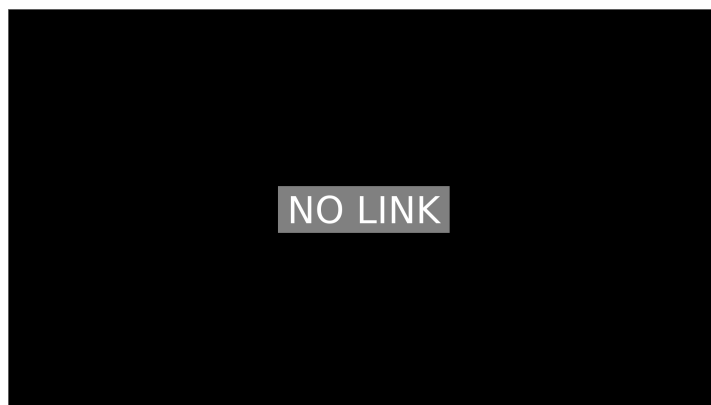


Figure 14: 1x1 grid layout



Figure 15: 2x2 grid layout

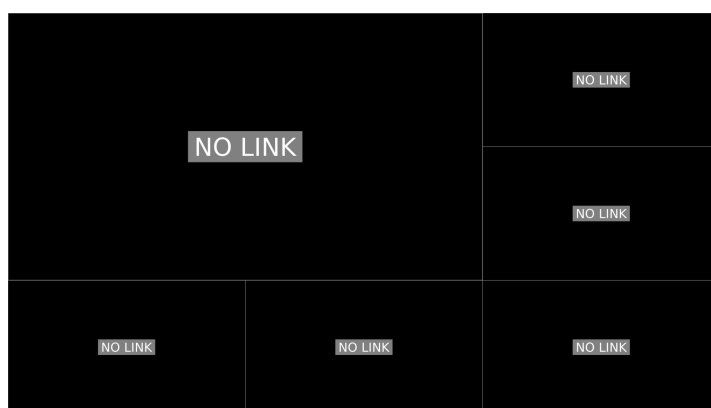


Figure 16: 1+5 grid layout



Figure 17: 3+4 grid layout

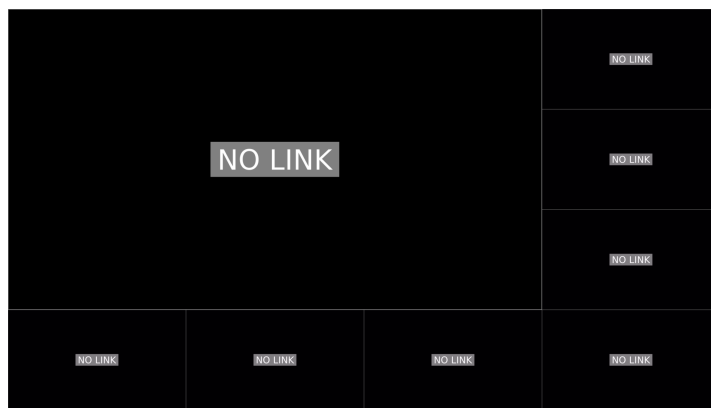


Figure 18: 1+7 grid layout

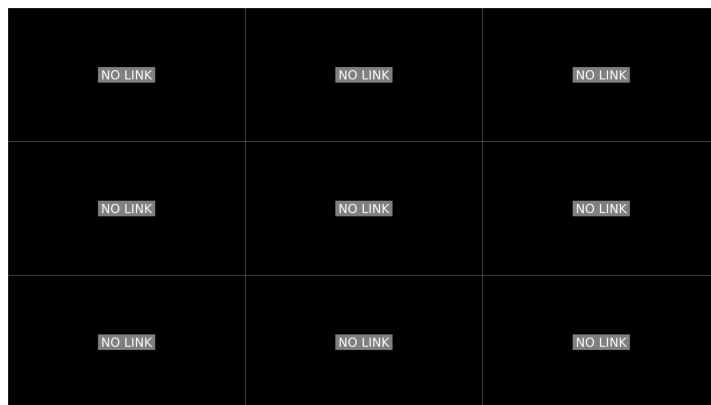


Figure 19: 3x3 grid layout

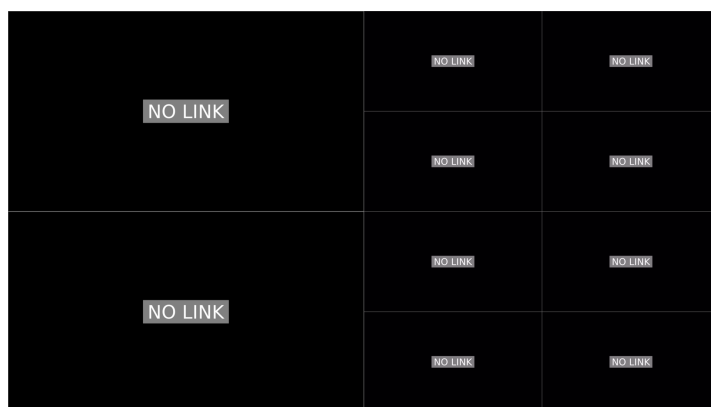


Figure 20: 2+8 grid layout

Performance indication

Single display 1920x1080@60Hz

	Raspberry Pi Zero	Raspberry Pi 2	Raspberry Pi 3/3+	Raspberry Pi 4
H264 640x360@24FPS	?	?	9	9
H264 854x480@24FPS	?	?	7	7
H264 1280x720@24FPS	?	?	4	4
H264 1920x1080@24FPS	1	1	1	1

NOTE: these results are indicative and can vary when using another display configuration, higher/lower quality streams etc.

Dual display 1920x1080@60Hz

	Raspberry Pi Zero	Raspberry Pi 2	Raspberry Pi 3/3+	Raspberry Pi 4
H264 640x360@24FPS	N/A	N/A	N/A	4 + 6
H264 854x480@24FPS	N/A	N/A	N/A	1 + 6

NOTE: these results are indicative and can vary when using another display configuration, higher/lower quality streams etc.

Import and export configuration

Export current configuration

To backup your current configuration, plug in the SD card in your computer and navigate to the ‘boot’ partition. Now, make a copy of the following 3 files to your backup location of choice.

1. ‘license.lic’, this is your license file.
2. ‘system-config.ini’, this is your system configuration file.
i.e. The file that holds your display mode, network configuration, automatic reboot etc.

3. ‘camplayer-config.ini’, this is your camplayer configuration file.
i.e. The file that holds your stream URLs, screen/window layout, playing and caching behavior etc.

NOTES

- * Always use the ‘safely remove’ option before you take out the SD card.

Import configuration

Copy the backed-up files ‘license.lic’, ‘system-config.ini’ and ‘camplayer-config.ini’ to the ‘boot’ partition of the SD card using your computer. It’s not absolutely necessary to copy all these 3 files if you are only interested in a partial recovery. e.g. copy only ‘camplayer-config.ini’ if you want to restore the camplayer configuration but not the system configuration.

You can also use this procedure to copy over the configuration from one device to another, the only limitation here is that the license file is linked to the SD card, which means you have to request a new license file.

NOTES

- * Always use the ‘safely remove’ option before you take out the SD card.
- * When you startup the Raspberry Pi, it might reboot a few times in order to restore its configuration.

Troubleshooting

Common problems and solutions.

No HDMI signal

- Switch your monitor/television to the correct source and check your cables.
- Switch on your monitor/television before you power up your Raspberry Pi.
- The configured HDMI mode is not supported by your display.
- In case of a dual display setup, your 2nd display has to support the same resolution/frame rate as your first display is set to. Also be sure your 2nd HDMI output is enabled in the system settings section of the configuration menu.
- For the Raspberry Pi 4, use HDMI0 for your primary display.

Video playback interruptions

- Unreliable network connection, low bandwidth. A wired connection is always better than a wireless connection. A minimum network speed of 20Mbit/s should be sufficient for 90% of the cases. Network speed is increasingly important when you configured multiple screens with automatic rotation as streams need to be pre-buffered in the background. You can verify this with the speedtest functionality in the configuration menu.
- Unsupported or experimental video codecs, the video codec should be h264, h265 (HEVC) and others are experimental.
- Your streams are exceeding the capabilities of your Raspberry Pi. Try reducing the number of windows per screen. Alter camplayer advanced settings to “best performance” in the configuration menu.

Corrupted video playback

- Is your stream playing correctly when you open it in VLC media player? If not, the problem lies somewhere in the provided stream, solve this first. As a hint, a possible cause can be that the stream is encrypted.
- Your streams are exceeding the capabilities of your Raspberry Pi. Try reducing the number of windows per screen. Alter camplayer advanced settings to “best performance” in the configuration menu.

CEC remote control not working

- Are you sure CEC is enabled on your Raspberry Pi? There is a ‘Enable CEC’ setting under the advanced system settings.
- Are you sure CEC is enabled on your Television? This can be named CEC, Anynet+ (Samsung), BRAVIA Link/sync (Sony), EasyLink (Philips), VIERA Link (Panasonic), SimpLink (LG) etc.
- Monitors usually don’t support CEC.
- Some televisions are just incompatible with the CEC standard.
- For the Raspberry Pi 4, only HDMI0 supports CEC.

Stream preview not working in the setup wizard

- Your stream URL is wrong.
- Your stream type is not supported.
The stream codec must be H264 or MJPEG.
MPEG2 is also supported on non RPI4 devices, but you need a separate license.
- You can check your stream URL and type with VLC media player on another computer.

My keyboard does not work correctly.

- Reconfigure your keyboard, the default mode is English (Qwerty). Open the configuration menu, navigate to system settings and then to ‘CONFIGURE KEYBOARD’. The first step is to select the correct model, usually ‘Generic 105-key PC (intl.)’ is fine. Then select your language, you might have to press ‘Other’ to get the full list. Now, select your keyboard layout and follow the on screen instructions. A full system restart is required before these changes take effect.