

# Batocera 15kHz Video Output

## Foreword

This Guide would not have been possible without the following people to name a few.

- [jfroco](#)'s work to output Batocera on a Crts.
- [rtissera](#)'s knowledge, enthusiasm and willingness to add 15khz patches.
- Calamity for his knowledge, drivers, tools, GroovyMame.
- D0023R Doozer continued work at adding 15khz to the linux kernel.

## Pre-requisites

To achieve this on your setup, the following elements are needed :

- Wired Network Connection
- AMD/ATI/INTEL card with VGA or DVI-I connection
- Analog connection to your CRT/Monitor
- VGA → Scart/BNC/Component
- DVI-I → DVI-I to VGA adapter → Scart/BNC/Component
- Putty, WinScp and Notepad++ for editing or similar software.

## Connecting the PC to the CRT

The first step is to be able to connect your Batocera computer to the CRT itself.



During the boot process and resizing of the partition it will boot up in a non-supported resolution. Keep your Tv/Monitor off for the moment or on another AV channel so we don't send out **dangerous signals** to your Tv/Monitor. **This is very important.**

Also keep in mind that during the bios boot process the same rule applies. Have your TV/Monitor off or on another input when first booting up.

### To solve this we have 4 options

- Have your Tv/Monitor turned off, or on another channel during the boot.
- Have a look at gambaman's excellent solution [The ultimate VGA to SCART adapter](#) over at BYOAC (Build Your Own Arcade Controls Forum)
- Use buttersoft's passthrough dongle based on gambaman's design in the link above.
- Flash you AMD/ATI card with [ATOM-15](#).

## Editing the configuration files

### Change the main resolution

The first step will be to change the `syslinux` file to be able to use Batocera at a lower resolution. To achieve this, we need to be able to modify the boot partition:

1. Connect to Batocera using SSH. See : [Access Batocera Linux via ssh](#) for more informations.
2. Make the boot partition writable : While still connected to the Pc type `mount -o remount, rw /boot`

Then, we have to identify the video output we will be using

1. Get your graphics card DVI/VGA output using the following command : `ls /sys/class/drm/`
  - this will return something like

```
card0          card0-DP-1    card0-DVI-I-1  renderD128    ttm
version
```

- (In this example: **DVI-I-1**)
2. To make the next step a little bit easier for windows users, connect to Batocera using WinScp and install Notepad++
  3. Search for the `syslinux` file to enable booting in low resolution
    - If legacy, the file will be at `/boot/syslinux.cfg` or `/boot/boot/syslinux.cfg`
    - If UEFI, the file will be at `/boot/EFI/syslinux.cfg` or `/boot/EFI/BOOT/syslinux.cfg`
  4. Add the resolution for your graphic card output `video=YourCardOutput:640x480ieS`
    - In our example :

```
APPEND label=BATOCERA console=tty3 quiet loglevel=0
vt.global_cursor_default=0 video=DVI-I-1:640x480ieS
```

For other supported boot resolutions, see the documentation here:

[https://github.com/D0023R/linux\\_kernel\\_15khz](https://github.com/D0023R/linux_kernel_15khz)

### Disabling the other video output

Now we need to disable the displayport DP to get video exclusively out of the **VGA/DVI-I port**.

1. Get your graphics card DP output using the following command : `ls /sys/class/drm/`
  - this will return something like

```
card0          card0-DP-1    card0-DVI-I-1  renderD128    ttm
version
```

(in this example: **card0-DP-1**)

2. Get your display output using `xrandr : xrandr -display :0.0 | grep "connected"`

- this will return something like

```
DisplayPort-0 disconnected primary (normal left inverted right x
axis y axis)
DVI-0 connected 655x500+0+0 (normal left inverted right x axis y
axis) 0mm x 0mm
```

(in this example: **DisplayPort-0**)

3. We then need to create a config file in /etc/X11/xorg.conf.d/ named 10-monitor.conf
4. Paste these line in to the file (replace the Identifier by the values you found previously) and save.

```
◦ Section "Monitor"
    Identifier "card0-DP-1"
    Option "Ignore" "true"
EndSection

Section "Monitor"
    Identifier "DisplayPort-0"
    Option "Ignore" "true"
EndSection
```

## Add Boot Modeline

Now we need to add the modeline **"640x480i"**

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

**This will make the partition writable so we can make the changes.**

Edit

```
etc/X11/xinit/xinitrc
```

Go down to

```
#####
## CUSTOMISATIONS ###
```

Add

```
xrandr -display :0.0 --newmode "640x480i" 13.10 640 664 728 832 480 484 490
525 interlace -hsync -vsync
xrandr -display :0.0 --addmode DVI-0 "640x480i"
```

Example

```
<code>
```

```
# xrandr -s 640x480 -r 60
xrandr -display :0.0 --newmode "640x480i" 13.10 640 664 728 832 480 484 490
525 interlace -hsync -vsync
xrandr -display :0.0 --addmode DVI-0 "640x480i"
#####
#####
</code>
```

1. Save the changes you made to batocera so far with `batocera-save-overlay` : When you edit anything outside of the SHARE partition, the changes are lost when rebooting unless this command is used.
2. Reboot the system : You are now booting up in 640x480i
3. Set your default video output to **DVI-0** : **MAIN MENU**→**SYSTEM SETTINGS**→**HARDWARE**→**VIDEO OUTPUT**
4. Reboot again.

## Manage the EmulationStation Overscan and Centering

As you might have noticed there is some overscan and the picture in EmulationStation might not be centered. For this configuration you need to be able to look at your TV/Monitor directly to see the changes we are going to make.

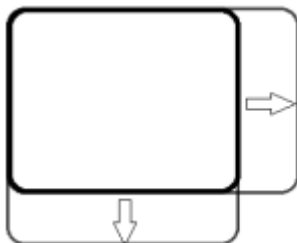
We are going to use `xrandr` and a function called `-scale-from wxh` `xrandr --scale-from`

Connect via SSH and from the terminal and type

```
xrandr -display :0.0 --output DVI-0 --scale-from 640x480
```

**Horizontal Resolution:** Increasing/Decreasing this will make the image shrink or expand to the left.

**Vertical Resolution:** Increasing/Decreasing this will make the image shrink or expand from the bottom.



When you are satisfied with your results we need to add this setting to `etc/X11/xinit/xinitrc`

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

**This will make the partition writable so we can make the changes.**

Edit

```
etc/X11/xinit/xinitrc
```

Go down to

```
#####
## CUSTOMISATIONS ###
```

Add `xrandr -display :0.0 -output DVI-0 -scale-from 640x480`

Example

```
# xrandr -s 640x480 -r 60
xrandr -display :0.0 --newmode "640x480i" 13.10 640 664 728 832 480 484 490
525 interlace -hsync -vsync
xrandr -display :0.0 --addmode DVI-0 "640x480i"
xrandr -display :0.0 --output DVI-0 --scale-from 640x480
#####
#####
```

We also need to make a script so this setting persists even after exiting an Emulator. Make a folder inside

```
/userdata/system/
```

called "scripts" and name it "first\_script.sh"

```
/userdata/system/scripts
/userdata/system/scripts/first_script.sh
```

[first\\_script.sh](#)

```
#!/bin/bash
#This is an example file how Events on START or STOP can be uses
#
#Set logfile location and filename
#logfile=/tmp/scriptlog.txt
#Case selection for first parameter parsed
case $1 in
#   gameStart)
#       echo "START" > $logfile
#       echo "$@" >> $logfile
#   ;;
#   gameStop)
```

```
xrandr -display :0.0 --output DVI-0 --mode "640x480i"  
xrandr -display :0.0 --output DVI-0 --scale-from "640x480i"  
;;  
esac
```

Make the script executable with `chmod +x /userdata/system/scripts/first_script.sh`

Explanation: When the game exit it will return to the boot resolution we set in `syslinux.cfg` and also recenter the image.

Finish with

```
batocera-save-overlay
```

**This will save the changes we made.**

```
reboot
```

## Advanced Fine Tuning

This will give you 1x pixel accuracy.

Let's start by using the same resolution in `xrand -scale-from` as show in the example above. In this case `640x480i`

We are going to manipulate the Screen Size X, Y & Screen Position X, Y of the Emulationstation window.

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

**This will make the partition writable so we can make the changes.**

Edit

```
etc/X11/xinit/xinitrc
```

Go down to

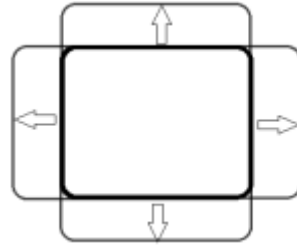
```
cd /userdata # es needs a PWD  
openbox --config-file /etc/openbox/rc.xml --startup "emulationstation --  
windowed ${EXTRA_OPTS}"
```

add and replace to this

```
cd /userdata # es needs a PWD  
openbox --config-file /etc/openbox/rc.xml --startup "emulationstation --  
windowed --screen-size 640 480 --screenoffset 00 00 ${EXTRA_OPTS}"
```

**-screen-size [width] [height] = For a canvas smaller than the full resolution.**

**-screenoffset [x] [y] = Move the canvas by x,y pixels.**



Start by looking at your picture to see if the image needs to be bigger or smaller. Change `-screensize 640 480` to a higher or lower value and change accordingly.

Finish with

```
batocera-save-overlay
```

**This will save the changes we made.**

```
reboot to see the changes.
```

When you are satisfied with the result do the same for Screen Position by changing the values `-screenoffset 00 00`

Finish with

```
batocera-save-overlay
```

**This will save the changes we made.**

```
reboot to see the changes.
```

## Configure Libretro Cores for use with Crt Switchres

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

Edit

```
/userdata/system/batocera.conf
```

Add this

```
## Configurations generated by Batocera.linux"
global.integerscale=1
global.smooth=0
global.retroarch.menu_driver=rgui
```

Finish with

## batocera-save-overlay

**This will save the changes we made.**

---

Make a backup of

```
/userdata/system/configs/retroarch/retroarchcustom.cfg  
/userdata/system/configs/retroarch/retroarchcustom.cfg.backup
```

Edit

```
/userdata/system/configs/retroarch/retroarchcustom.cfg
```

Add

```
menu_enable_widgets = "false"
```

**This will disable On-Screen Notifications and is optional**

```
menu_show_advanced_settings = "true"
```

---

Configure Libretro CRT switchres in RetroArch

Choose any libretro core and game inside Batocera using your gamepad or keyboard.

Example: Core: Atari 2600 Game: H.E.R.O.

Access the menu and configure (in this order):

```
Main Menu -- Settings -- Configuration -- Save Configuration on Quit [ON]  
Main Menu -- Video -- Bilinear Filtering [OFF]  
Main Menu -- Video -- Scaling --Integer Scaling [ON]  
Main Menu -- Video -- Scaling --Aspect ratio 4:3  
Main Menu -- Video -- CRT SwitchRes -- Use custom Refresh Rate [ON]  
Main Menu -- Video -- CRT SwitchRes -- CRT Super Resolution:  
1920/2560/3830/Native/Dynamic (Dynamic is preferred)  
Main Menu -- Video -- CRT SwitchRes -- CRT SwitchRes [ON]
```

It should change to 240p/480i

Now you can adjust your scaling

```
Main Menu -- Video -- Scaling
```

Finally, save the configuration for this core:

```
Quick Menu -- Overrides -- Save Core overrides
```

Do the same with the other libretro cores.

## Adding Modelines (Read Resolutions) for Emulators

Right now we only have one usable modeline and that is 640x480i.

We would like to add more modelines for external Emulators like for example PS2, PSP, GameCube, Wii, Wine (PC) and so on.

To do this we are going to use a program called [Switchres](#) made by Calamity that's now apart of Batocera as of v30.

First we need to create a file named **switchres.ini** inside the folder **/usr/bin/**

From the terminal type

```
mount -o remount,rw /boot
nano /usr/bin/switchres.ini
```

Paste this into the file

```
#
# Switchres config
#

verbose                0
monitor                generic_15
crt_range0              auto
crt_range1              auto
crt_range2              auto
crt_range3              auto
crt_range4              auto
crt_range5              auto
crt_range6              auto
crt_range7              auto
crt_range8              auto
crt_range9              auto
lcd_range               auto
modeline                auto
user_mode               auto

#
# Display config
#

display                auto
```

```
api auto
lock_unsupported_modes 1
lock_system_modes 0
refresh_dont_care 0
keep_changes 0

#
# Modeline generation config
#
modeline_generation 1
interlace 1
doublescan 0
dotclock_min 0
sync_refresh_tolerance 2.0
super_width 2560
aspect 4:3
v_shift_correct 0
pixel_precision 1

#
# Custom video backend config
#
screen_compositing 0
screen_reordering 0
allow_hardware_refresh 0
custom_timing auto
```

then end with ctrl+x to save and type Y then enter.

Finish with

```
batocera-save-overlay
```

**This will save the changes we made.**

There are several types of Monitor types to choose from. Here is just a selected few. The one we are going to use is generic\_15 that works good for a standard crt. arcade\_15 is also a good alternative.

```
generic_15 = Generic 15.7 kHz
arcade_15 = Arcade 15.7 kHz - standard resolution
pal = PAL TV - 50 Hz/625
ntsc = NTSC TV - 60 Hz/525
arcade_15ex = Arcade 15.7-16.5 kHz - extended resolution
pc_31_120 = PC CRT 70kHz/120Hz
pc_70_120 = PC CRT 70kHz/120Hz
```

In this example we are going to generate the modeline **320x240@60hz**

```
switchres 320 240 60 -i switchres.ini -c
```

```
Switchres: Modeline "320x240_60 15.660000KHz 60.000000Hz" 6.514560 320 333 364 416 240 242 245 261 -hsync -vsync
```

We have now generated the modeline based on our monitor preset generic\_15.

Copy the modeline and save it temporarily to a text file.

```
Modeline "320x240_60 15.660000KHz 60.000000Hz" 6.514560 320 333 364 416 240 242 245 261 -hsync -vsync
```

Lets make it easier to read in EmulationStation and shorten the name.

```
Modeline "320x240_60" 6.514560 320 333 364 416 240 242 245 261 -hsync -vsync
```

Now we need to add the modeline to

etc/X11/xinit/xinitrc

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

**This will make the partition writable so we can make the changes.**

Edit

```
etc/X11/xinit/xinitrc
```

Go down to

```
#####  
## CUSTOMISATIONS ###
```

Example

```
# xrandr -s 640x480 -r 60  
xrandr -display :0.0 --newmode "320x240_60" 6.514560 320 333 364 416 240 242 245 261 -hsync -vsync  
xrandr -display :0.0 --addmode DVI-0 "320x240_60"  
xrandr -display :0.0 --newmode "640x480i" 13.10 640 664 728 832 480 484 490 525 interlace -hsync -vsync  
xrandr -display :0.0 --addmode DVI-0 "640x480i"  
xrandr -display :0.0 --output DVI-0 --scale-from 640x480  
#####  
#####
```

Finish with

```
batocera-save-overlay
```

**This will save the changes we made.**

reboot

## Creating you own Boot Resolution with Switchres

Let's say you have a PC Crt Monitor and like to add the boot resolution 1024x768@60hz. This can be done by using a custom **Extended Display Identification Data (EDID)**.

This will use the Monitor preset pc\_31\_120 **Pc Crt 31-120hz** at 1024x768@60hz

```
switchres 1024 768 60 -m pc_31_120 -e
```

The file will be named pc\_31\_120.bin.

- Create the folder `mkdir /lib/firmware/edid/`
- Move the file `mv pc_31_120.bin /lib/firmware/edid/`

### 1. Search for the syslinux file

- If legacy, the file will be at `/boot/syslinux.cfg` or `/boot/boot/syslinux.cfg`
- If UEFI, the file will be at `/boot/EFI/syslinux.cfg` or `/boot/EFI/BOOT/syslinux.cfg`

### 2. Replace the boot resolution with your edid file `video=YourCardOutput:e`

`drm.edid_firmware=YourCardOutput:edid/pc_31_120.bin`

- In our exemple :

```
APPEND label=BATOCERA console=tty3 quiet loglevel=0
vt.global_cursor_default=0 video=DVI-I-1:e drm.edid_firmware=DVI-I-1:edid/pc_31_120.bin
```

## Modelines

Here are some resolutions to use

- Calculate Resolution using Monitor generic\_15
  - `switchres 320 240 60 -m generic_15 -c`
- Calculate Resolution using setting in switchres.ini
  - `switchres 320 240 60 -i switchres.ini -c`
- Calculate Resolution using setting in switchres.ini and force the generation of the modeline
  - `switchres 854 480 60 -f 854x480@60 -i switchres.ini -c`
- Super Resolutions
  - 2560x240@60
  - 2560x248@58
  - 2560x256@57
  - 2560x264@55
  - 2560x272@54
  - 2560x280@52

- 2560×288@51
- 2560×448@60
- 2560×464@60
- 2560×480@60
- 2560×496@58
- 2560×512@57
- 2560×544@54
- 2560×560@52
- Emulator/Wine/PC
  - 240×240@60
  - 256×192@60
  - 288×224@60
  - 320×180@60
  - 320×200@60
  - 320×240@60
  - 320×240@60i
  - 320×256@55
  - 320×256@60
  - 352×240@60
  - 360×200@60
  - 360×240@60
  - 380×284@60
  - 384×216@60
  - 384×480@60i
  - 400×240@60
  - 416×240@60
  - 426×240@60
  - 428×240@60
  - 456×256@55
  - 460×200@60
  - 464@272@50
  - 480×270@50
  - 480×270@60
  - 480×272@60
  - 512×480@60i
  - 640×240@60
  - 640×360@60
  - 640×480@60
  - 640×480@60i
  - 854×480@60i (4:3 from 16:9)

## Configure GroovyMame

As of Batocera v30 we now have GroovyMame support.

We are now going to manually configure GroovyMame for use with a CRT.

- Go to the mame folder using the command `cd /usr/bin/mame`

- Generate the ini files needed `./mame -cc`
- this will create the following files

```
mame.ini
plugin.ini
ui.ini
```

(Now we need to move them)

- Create the folder `mkdir /userdata/system/.mame/`
- Move the files `mv /usr/bin/mame/*.ini /userdata/system/.mame/`

- 
- Making GroovyMame's Gui display correctly on a CRT.

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

- For this we need to download a Font called [Hack](#). (Place the folder TTF you just download in to `/usr/share/fonts` )

```
batocera-save-overlay
```

---

Now let's configure GroovyMame.

- Edit mame.ini using nano : `nano /userdata/system/.mame/mame.ini` or Notepad++ for example.
  - # CORE SEARCH PATH OPTIONS

```
fontpath .
```

- Change it to.

```
fontpath /usr/share/fonts/TTF/
```

- # CORE MISC OPTIONS

```
◦ skip_gameinfo 0
```

```
◦ uifont default
```

(Change to)

```
◦ skip_gameinfo 1
```

```
◦ uifont Hack-Regular.ttf
```

• # OSD FULL SCREEN OPTIONS

◦ modesetting 0

(Change to)

◦ modesetting 1

• Edit ui.ini using nano : nano /userdata/system/.mame/ui.ini or Notepad++ for example.

• # UI OPTIONS

infos\_text\_size 0.75

font\_rows 30

• Change it to.

◦ infos\_text\_size 1.00

font\_rows 19

Let's choose Mame (GroovyMame) as the default emulator for Mame roms in Batocera.

**MAIN MENU→GAMES SETTINGS→DEFAULT SETTINGS→PER SYSTEM ADVANCED CONFIGURATION→Mame**

- EMULATOR: MAME
- VIDEO MODE: AUTO
- DECORATION: NONE
- STRETCH BEZELS (4K & ULTRAWIDE): NONE
- GRAPHICS BACKEND: AUTO
- BGFX BACKEND: AUTO
- BGFX VIDEO FILTER: AUTO
- CRT SWITCHRES: ON
- TATE MODE: AUTO (Change if you are rotating your TV/Monitor when playing in Vertical TATE MODE)

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