

# RGBi to HDMI Video Processor

## Converts Tandy Graphics / CGA / EGA / MGA To HDMI / DVI or VGA Video

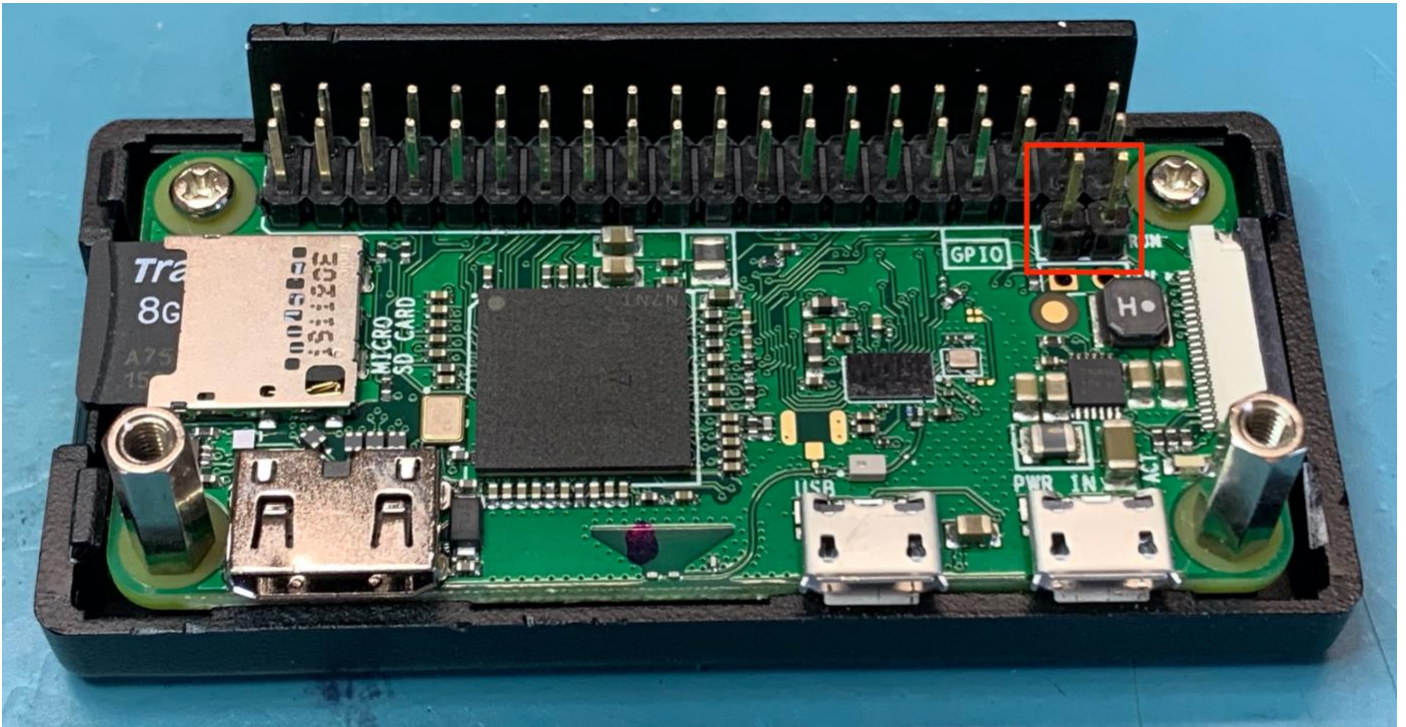
### Getting Started

This manual covers the assembly and software installation for the “RGBtoHDMI, 6-Bit Issue 3 + RGB TTL daughter board” sold by [Cybernetic Systems](#) on Tindie.

### Optional HW Reset Function:

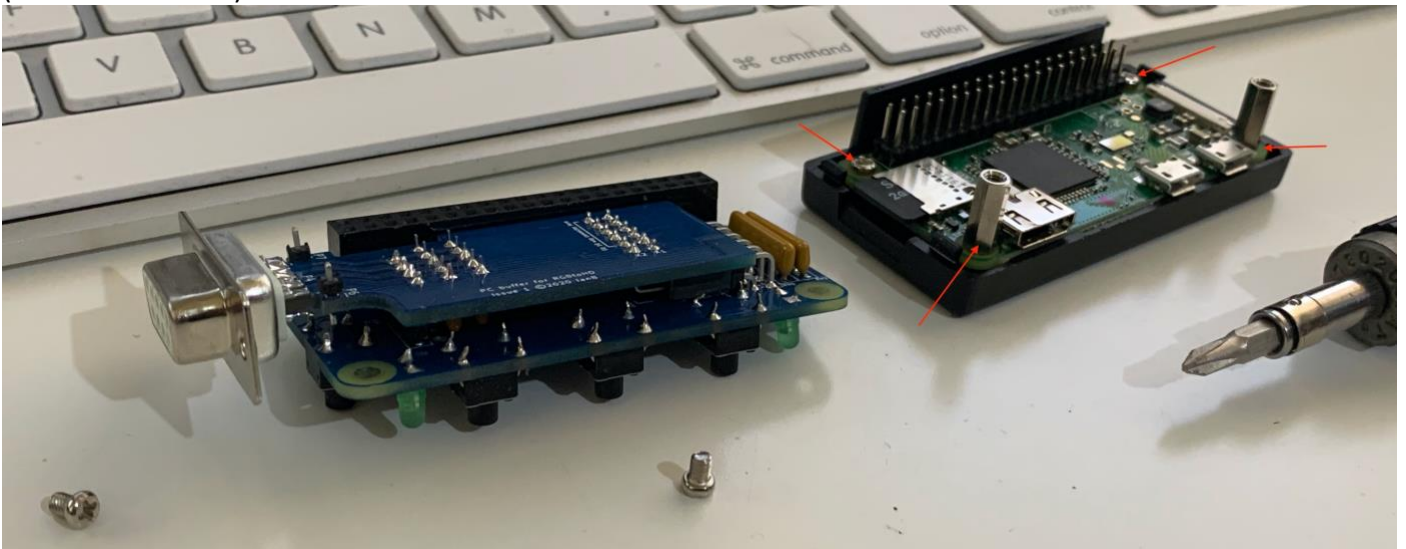
To allow easy rebooting of the RGBi to HDMI Video Processor, install the 2-pin header (supplied in the kit) as shown into your Pi Zero WH.

**Note:** You can still reboot the RGBi to HDMI Video Processor via the menu without this header installed.

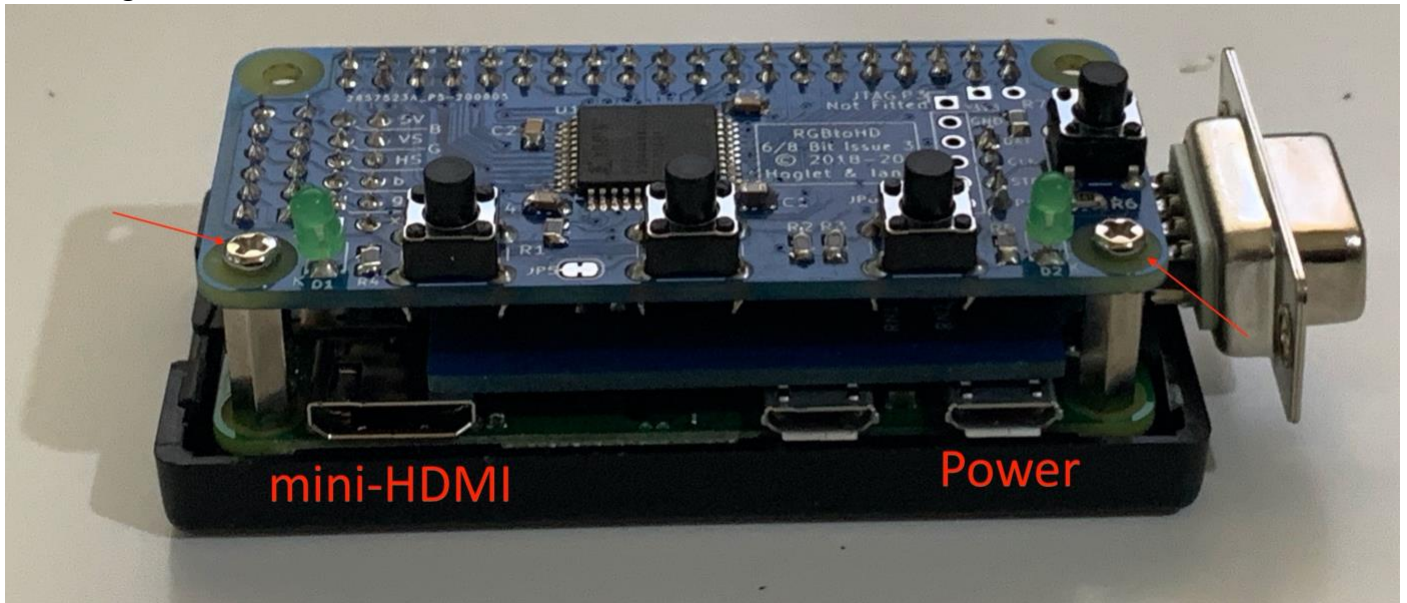


### Assembly:

Install your Pi Zero WH into the bottom half of the case using 2 screws and the 2 standoffs as shown (above and below).



Carefully align and install the RGBtoHDMI sandwich on top of the Pi Zero WH header - then install the remaining 2 screws as shown below.



**Note:** Please make sure you only power your RGBi to HDMI Video Processor via the Micro-B connector closest to the Video Input connector. Using the other port has been known to kill SD cards.

You can now clip on the top half of the case.



**Note:** The case clips can be fragile and break if taken apart multiple times.

## Installing the software

Using a PC or MAC:

- Start with a blank Micro SD Card (it should be FAT32 formatted)
- Download the latest release zip file from [here](#)  
(Click on the latest release “Name”, then download the [RGBtoHDMI](#) Zip file)  
I recommend version [RGBtoHDMI 20201010 4c8ca86](#) as it is stable & works on multiple platforms.
- Unzip this to the SD Card (so all the files are in the root directory of the SD Card)
- Safely remove the SD Card from the PC
- Insert the SD Card into the Raspberry Pi

## Powering On

Switch on the Monitor first and select the HDMI input

Switch on the Source Computer

If this is the first time powering up a newly built board, you will be presented with the CPLD recovery menu and you should select the correct CPLD for your board, clicking a second time to confirm programming:

```
CPLD Recovery Menu
CPLD is unprogrammed: Select correct CPLD
Return
3BIT_CPLD_v66
>6BIT_CPLD_v73<

IMPORTANT:

The CPLD type <3BIT/6BIT> must match
the RGBtoHDMI board type you have:

Use 3BIT_CPLD_vxx for Hoglet's
original RGBtoHD <c> 2018 board
Use 6BIT_CPLD_vxx for IanB's
6-bit Issue 2 <c> 2018-2019 board

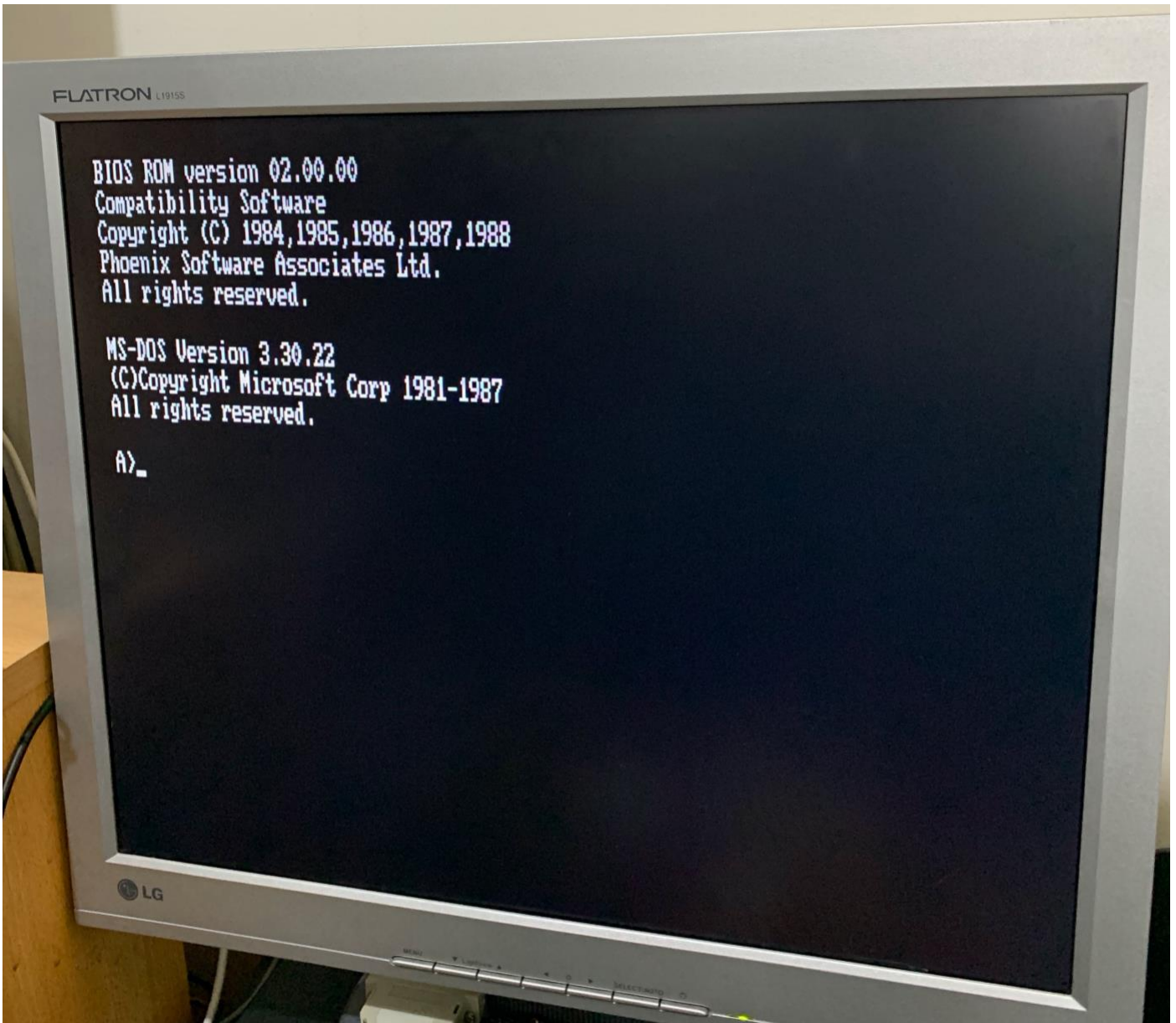
Programming the wrong CPLD type may
cause damage to your RGBtoHDMI board.
Please ask for help if you are not sure.

Hold 3 buttons during reset for this menu.
```

For more details see [CPLD Programming](#) (This should NOT be required, All Cybernetic Systems units come pre-programmed)



Once the CPLD has been programmed, after about two seconds you should see the normal start up screen of your computer:



Don't worry at this stage if the image is a bit fuzzy or jittery, we'll address that shortly.

**The first time RGBtoHDMI is used, it's necessary to configure a few settings:**

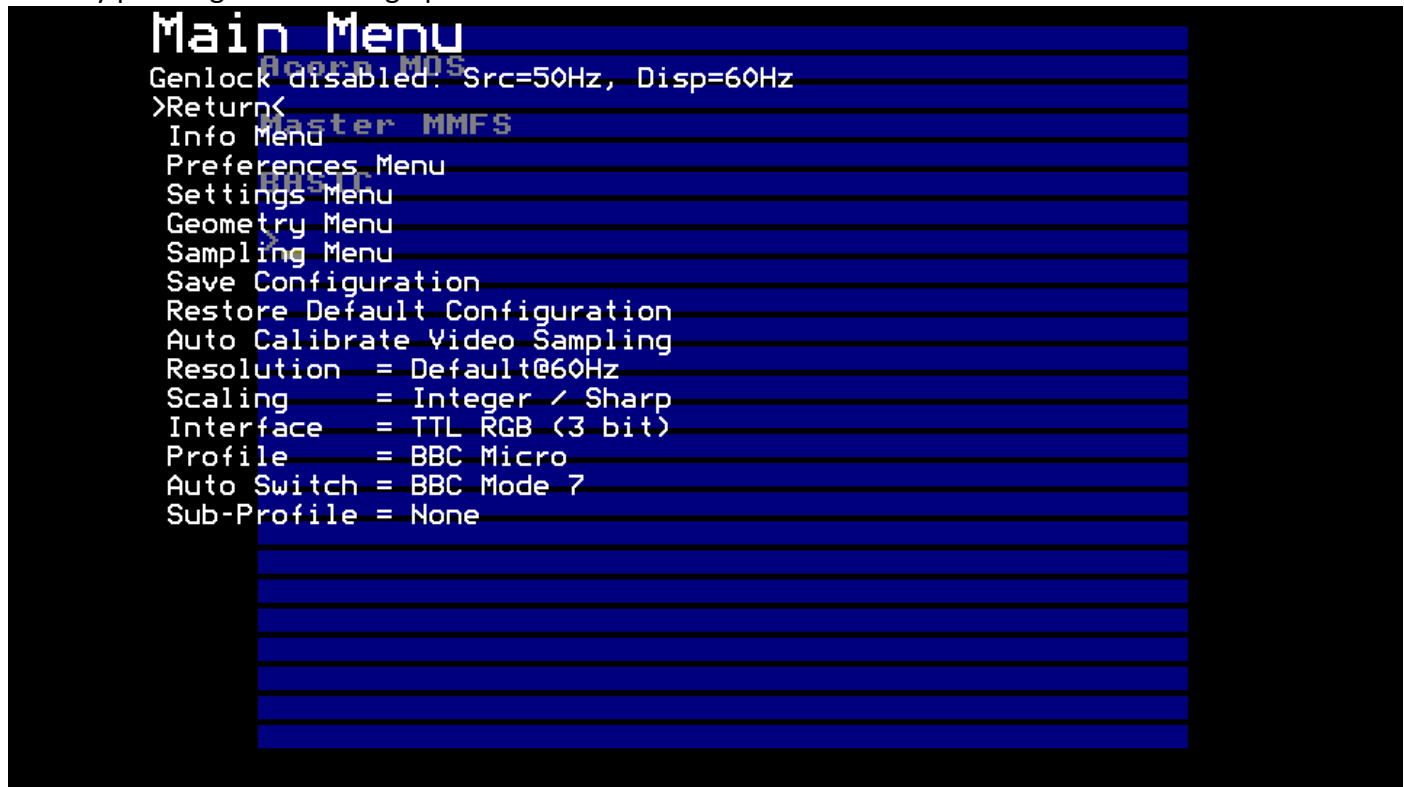
- the output Resolution that best matches the monitor you are using (**Now Automatic**)
- the Scaling option (this impacts image quality)
- the Profile for the source system (**the default is the BBC Micro profile**) for the Tandy 1000's, change this to "**Standard PC**"
- In the Geometry menu, Adjust the **H/V Pixel Aspect Ratio's**. The best starting point for Tandy 1000's is **H Pixel Aspect = 1** and **V Pixel Aspect = 2**

This is done through a series of on-screen menus operated by the three main buttons:

- a Menu/Select button (SW1)
- an Up button (SW2)
- a Down button (SW3)

**Note:** depending on which way you hold your RGBtoHDMI, the default button assignments may feel awkward. The [Reference Guide](#) explains how to change these assignments.

Start by pressing SW1 to bring up the Main Menu:



All of the settings you need to change are located on the Main Menu.

### Configuring the Resolution setting

The "Resolution" setting controls the video format (resolution and refresh rate) the Pi outputs to your monitor.

**Note:** On the latest Firmware, the RGBi to HDMI Video Processor will automatically detect your Monitors Native / Optimal resolution and adjust to use it.

Use SW2/SW3 to move the >< cursor down to the Resolution setting:



Press SW1 again to change the value (Default@60Hz).  
Use SW2/SW3 to cycle through the possible values:

- Default@60Hz
- 640x480@50Hz
- 640x480@60Hz
- 720x576@50Hz
- 800x480@50Hz
- 800x480@60Hz
- 800x600@50Hz
- 800x600@60Hz
- 1024x600@50Hz
- 1024x600@60Hz
- 1024x768@50Hz
- 1024x768@60Hz
- 1280x1024@50Hz
- 1280x1024@60Hz
- 1280x720@50Hz
- 1280x720@60Hz
- 1280x800@50Hz
- 1280x800@60Hz
- 1368x768@50Hz
- 1368x768@60Hz
- 1600x1200@50Hz
- 1600x1200@60Hz
- 1920x1080@50Hz
- 1920x1080@60Hz
- 1920x1200@50Hz
- 1920x1200@60Hz

Choose a resolution that matches your monitor's native physical resolution. For example, if you have a Full-HD monitor, pick 1920x1080. The refresh rate (@50Hz or @60Hz) should ideally match your source machine, so for a Tandy 1000 pick 60Hz. Then press SW1 to confirm the selection:

## Main Menu

New setting requires reboot on menu exit

Return

Info Menu

Preferences Menu

Settings Menu

Geometry Menu

Sampling Menu

Save Configuration

Restore Default Configuration

Auto Calibrate Video Sampling

>Resolution = 1920x1080@50Hz<

Scaling = Integer / Sharp

Interface = TTL RGB (3 bit)

Profile = BBC Micro

Auto Switch = BBC Mode 7

Sub-Profile = None

A message at the top will indicate a reboot is required, but first we need to configure the Scaling setting and choose the Profile to use.

NOTE: It is important to select the physical resolution of the lcd pixels on your monitor, not the claimed maximum resolution the monitor supports. e.g. on ebay you can find many small monitors that claim to display 1920x1080 but if you look at the specifications in detail, they will have a much lower physical resolution like 1024x600 or even 800x480 and it is this lower physical resolution you must select for the best quality results.

### Configuring the Scaling setting

The "Scaling" setting controls how the source image is up-scaled to the required output resolution.

A number of options are available:

- Integer / Sharp
- Integer / Soft
- Integer / Very Soft
- Fill 4:3 / Soft
- Fill 4:3 / Very Soft
- Fill All / Soft
- Fill All / Very Soft

"Integer" scaling will map each input pixel to an integer number of output pixels (e.g. 2x4) and this gives a very sharp image. It may, however, result in black borders around the source image. If there is no suitable integer relationship between the source resolution and the monitor resolution you may end up with a small or distorted image with very large black borders.

The best results for Integer scaling with PC computers are obtained with monitors of 1920x1080, 1920x1200 or 1600x1200 resolution. If you are using a monitor with a lower resolution the "Fill 4:3" options are recommended (see below).

Integer scaling may be suitable at lower monitor resolutions if you are using a source with a lower resolution like the Commodore 128.

"Fill 4:3" scaling reduces or eliminates any black borders by allowing scaling by a non-integer number of pixels using interpolation, while still preserving the source aspect ratio. However, if the source is 4:3 and the monitor is 16:9, there will still be vertical black bars on either side of the source image.

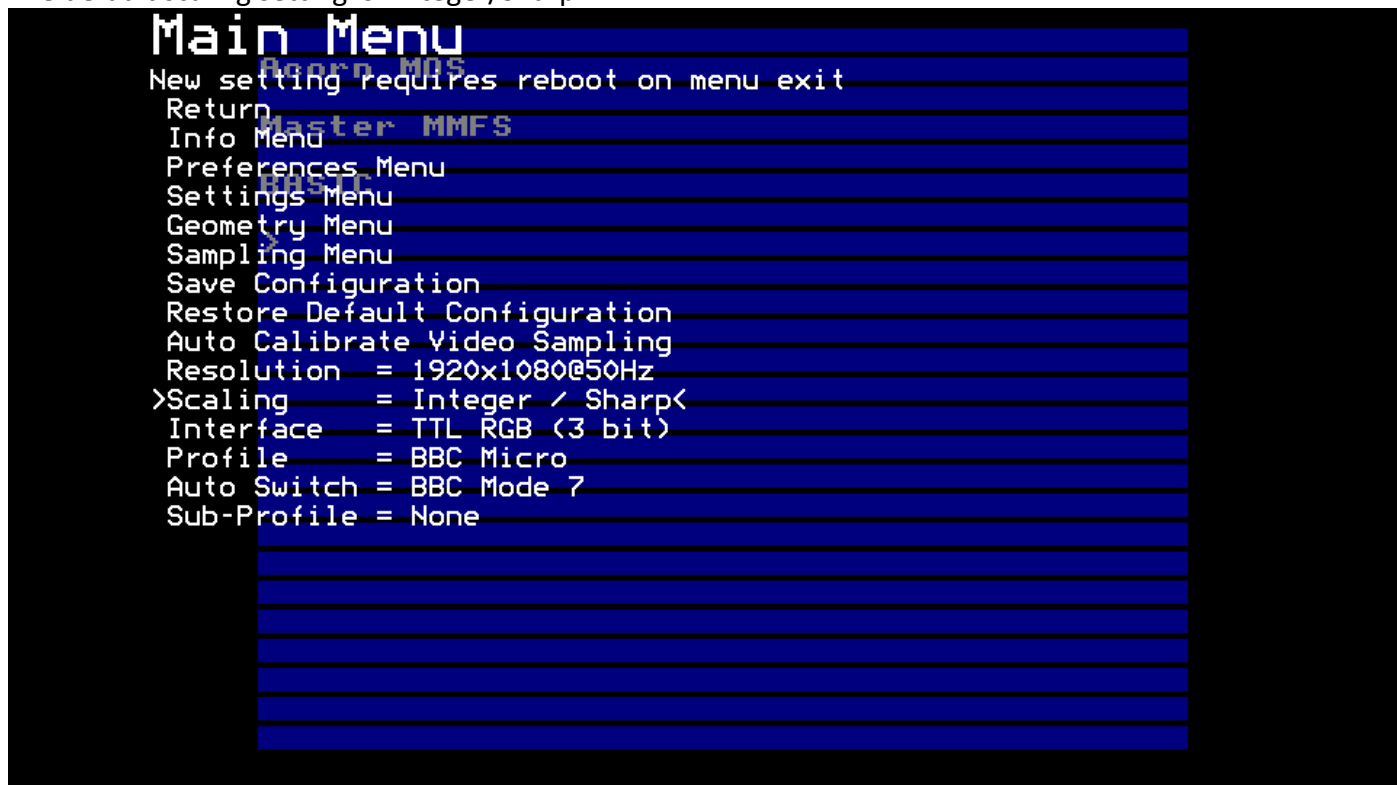
"Fill All" allows arbitrary scaling without any attempt to preserve aspect ratio. The source image will fill all of the display, but will likely appear too stretched if the monitor is not 4:3.

The above "Fill" scaling is the equivalent of the scaling that other converters and monitors themselves use when supplied with an image that is smaller than the monitor resolution.

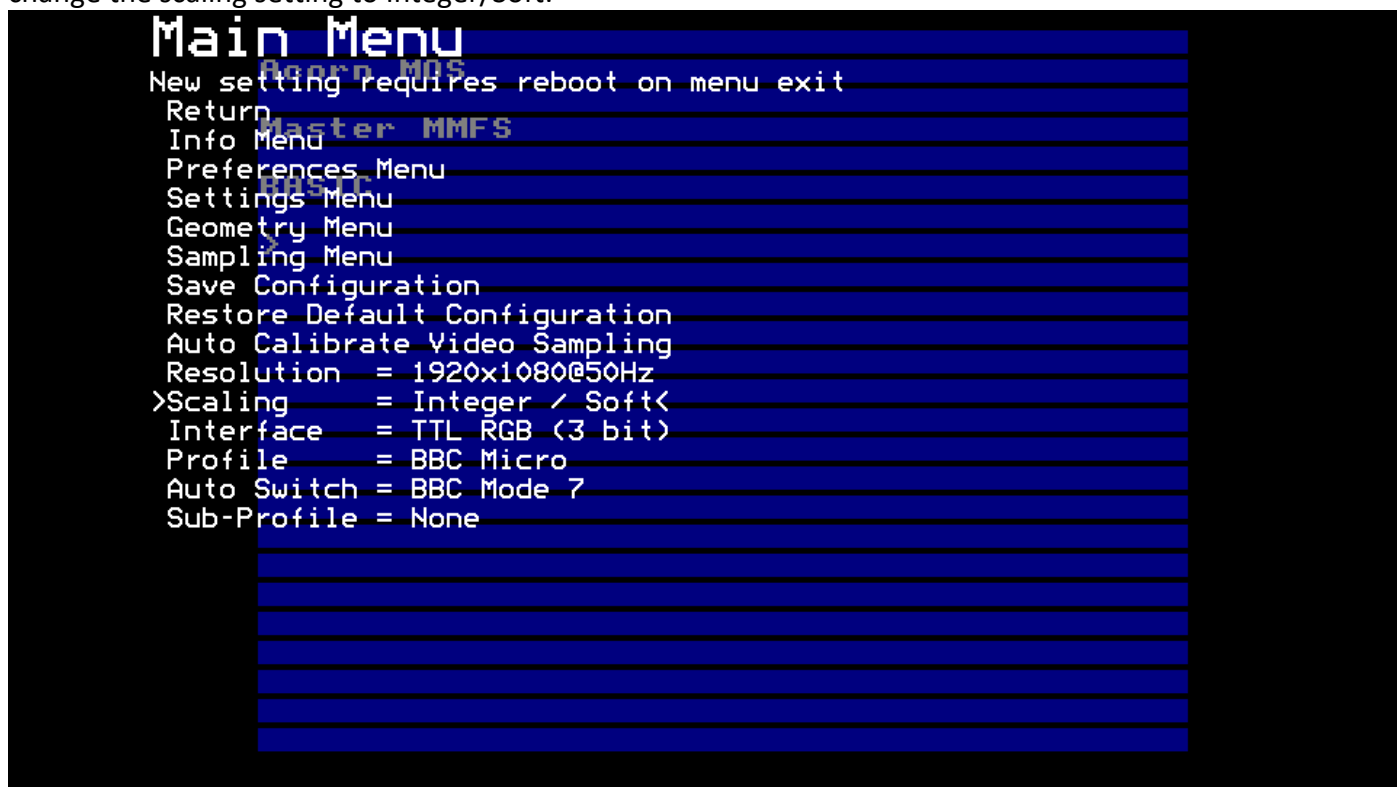
The actual re-scaling is performed by the GPU on the Pi, which supports several different algorithms. The "Sharp" / "Soft" / "Very Soft" refer to which algorithm is used by the GPU.

Note: changes to this setting will not be visible until after the system has rebooted.

The default scaling setting is "Integer/Sharp":



This can, however, make some systems look slightly jagged, so if you prefer a more authentic look, then change the scaling setting to Integer/Soft:



Note: the above description is somewhat simplified. In particular, there is interplay with the Overscan setting (Min/Half Way/Max/Auto) in the Preferences Menu, and the Min/Max Height/Width settings in Geometry Menu. For a more complete description, refer to the [Reference Guide](#) and the [Tutorial on Adding a New Profile](#).



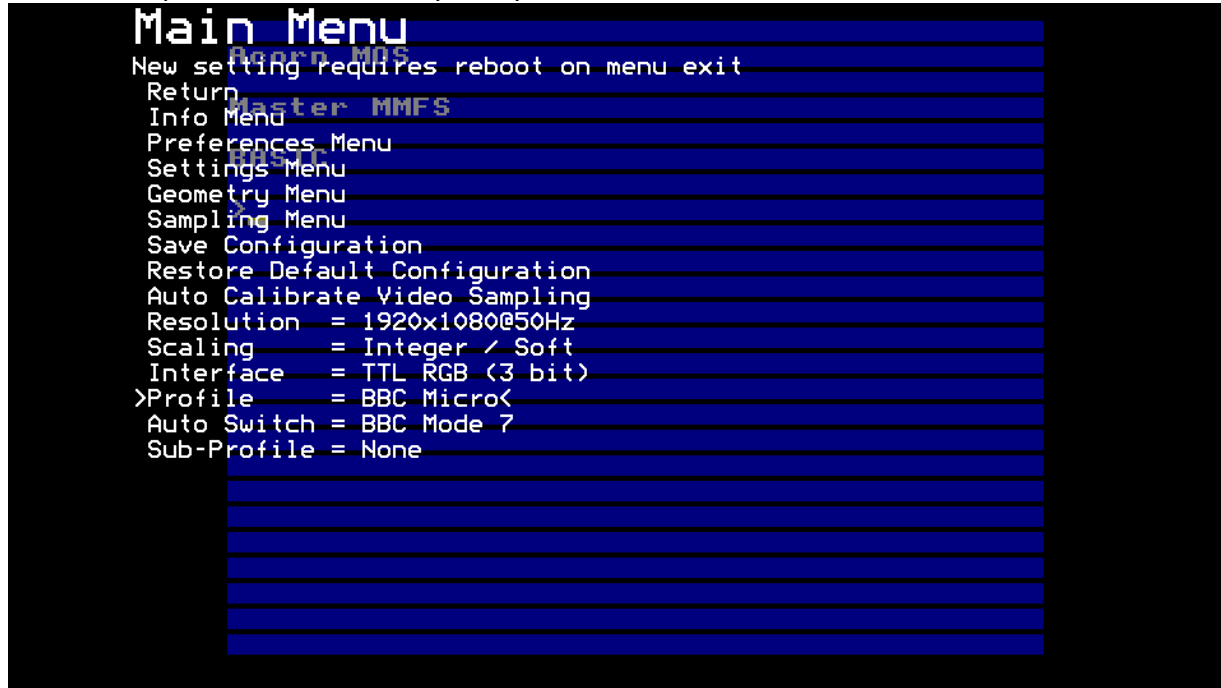
## Selecting a Profile

Each "Profile" optimises the system for a particular source (e.g. a CGA or EGA). When you select a Profile, many of the settings on the other menus (especially Geometry and Sampling) will change to reflect the video format of that source. This allows the user to quickly configure the system, without needing to understand the technical details of each system.

Currently we have profiles covering the following systems:

- IBM PC - MGA
- IBM PC – CGA (**including Tandy 1000's**)
- IBM PC - EGA (Also EGA+ VGA style resolutions)

Choose the profile that matches your system:



## Rebooting

After changing the Resolution and/or Scaling settings, you need to allow the system to reboot for these changes to take effect.

This will happen automatically when you exit the Main Menu by selecting the Return option:

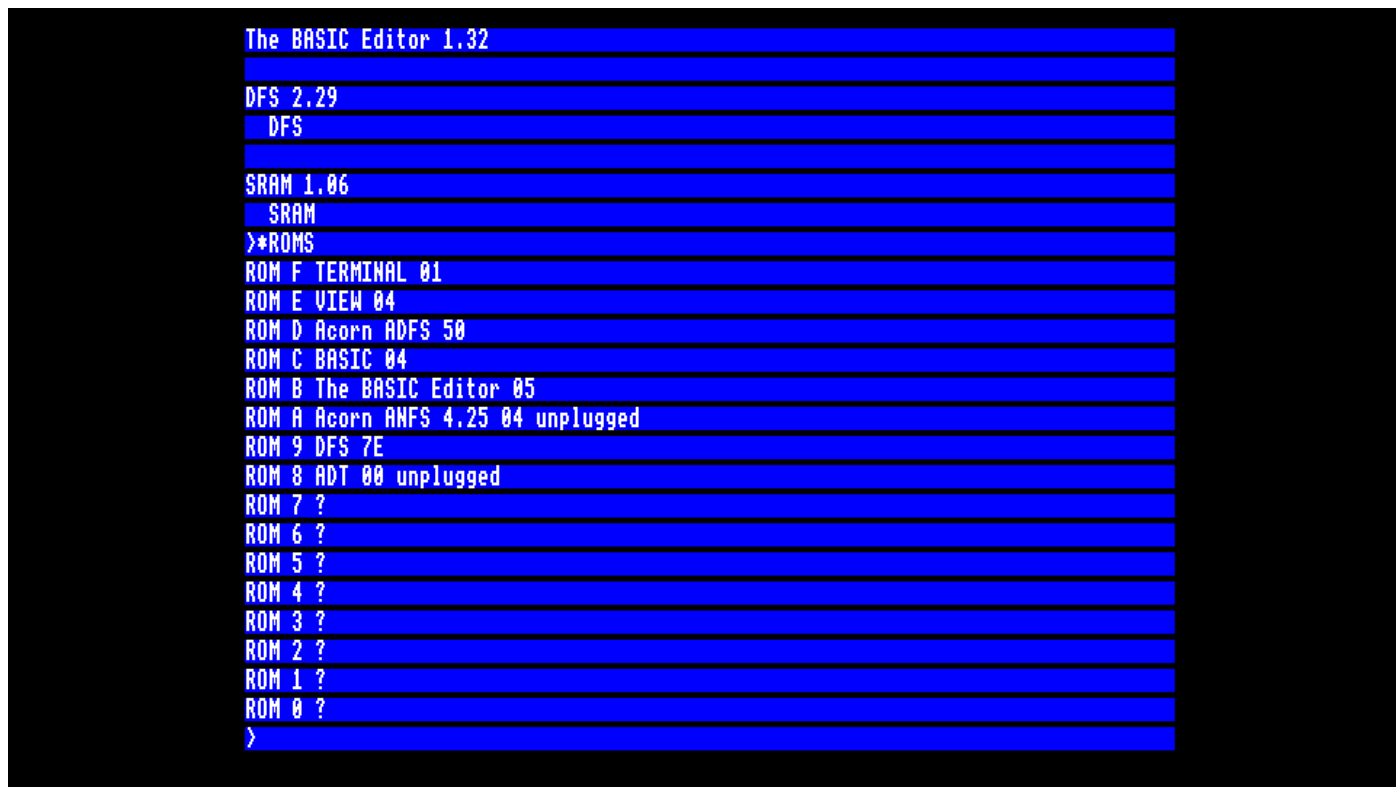


If for some reason you end up with a blank screen (because the resolution you chose was not compatible with your monitor), you can restore the default Resolution by holding down the Menu button (SW1) as the Pi boots. Hold the button down until the Pi's "Rainbow" screen appears, wait a couple more seconds, then release it.

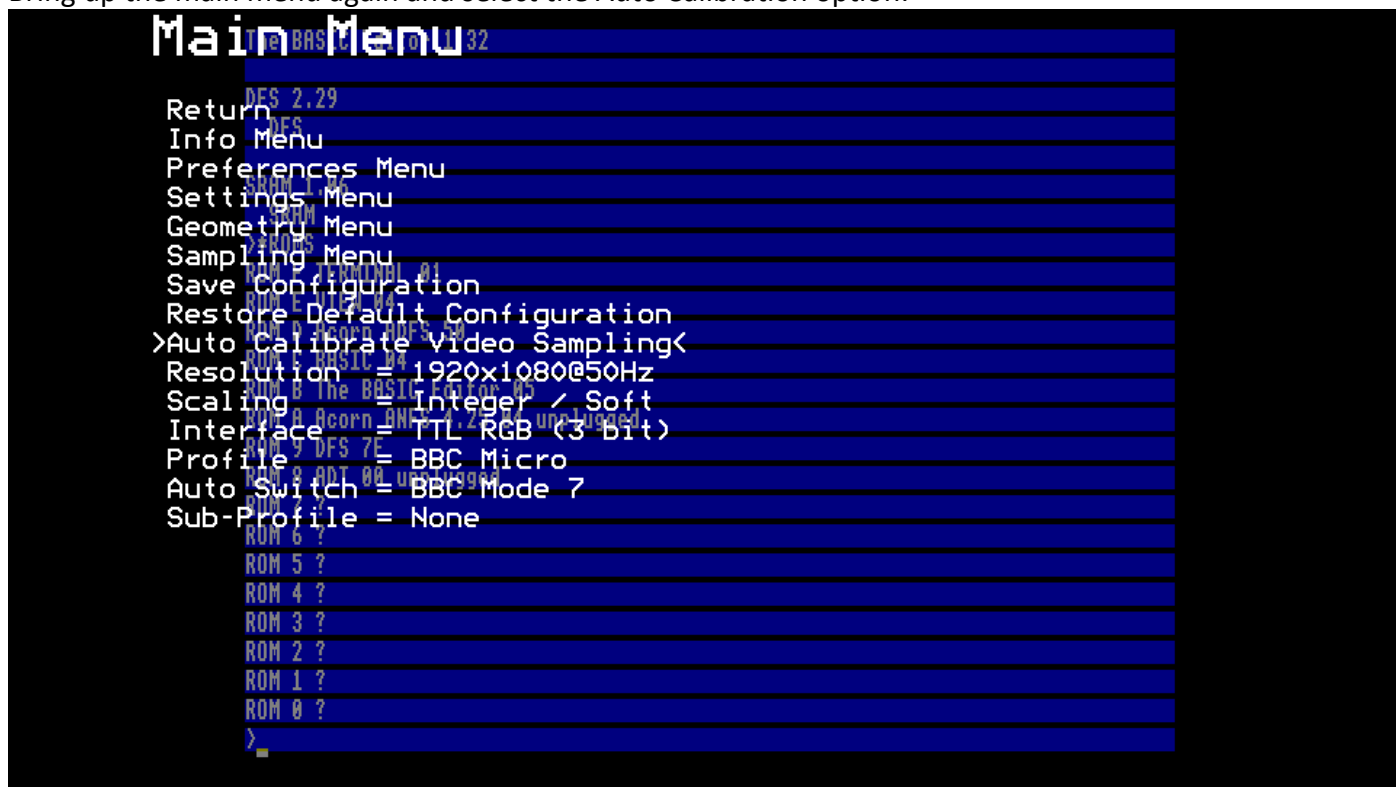
### Auto Calibration

Once the system has rebooted, there is one final step you should perform: Auto Calibration. This optimizes the pixel sampling for the exact timing of your particular computer.

This is best performed in the highest resolution mode, with a reasonable amount of text on the screen:



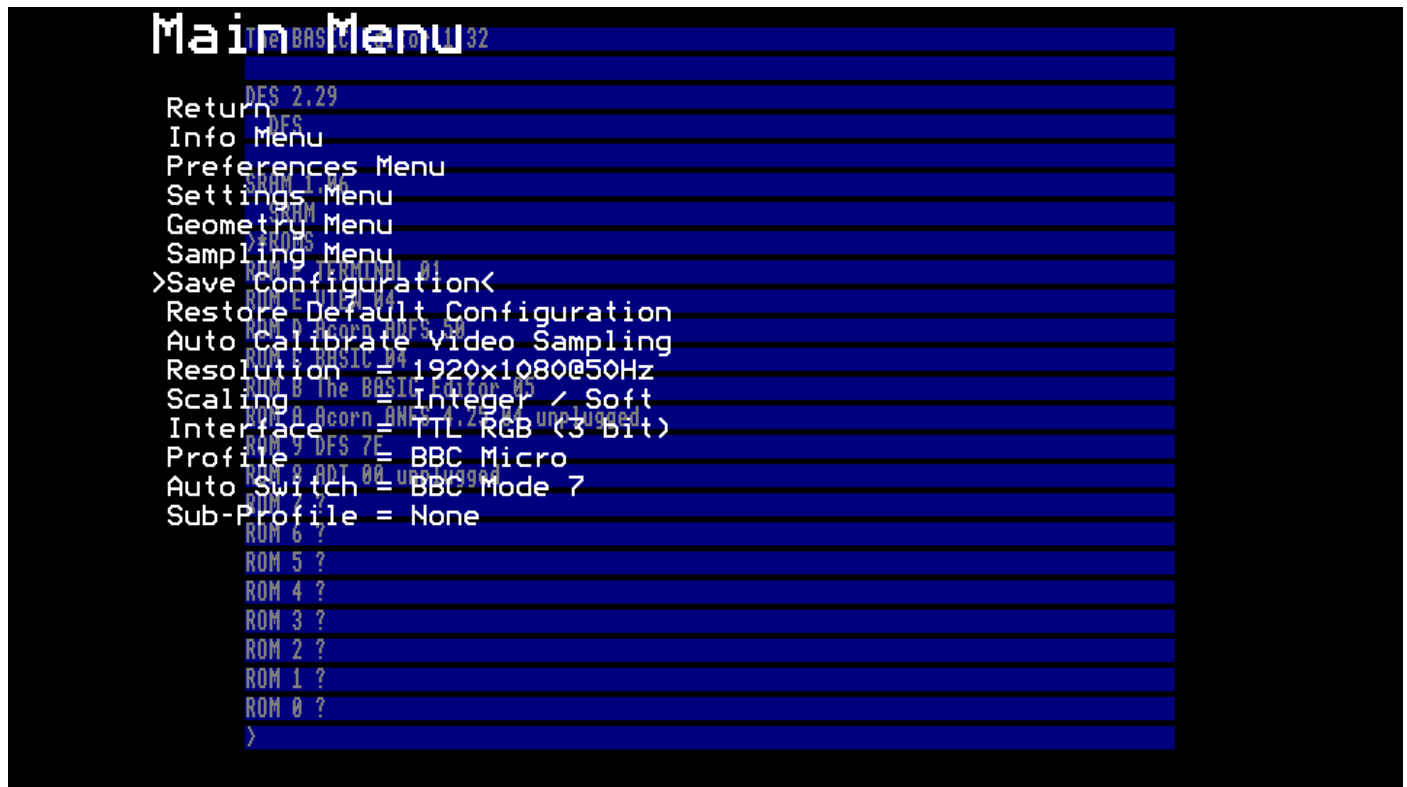
Bring up the main menu again and select the Auto Calibration option:



**Note:** On most systems you only need to perform Auto Calibration once. However, on the Beeb, you should perform Auto Calibration twice: once in MODE 0 (or 3), and again in MODE 7. This is because MODE 7 use different pixel clock to the other modes.

### Saving the Configuration

After performing Auto Calibration, or indeed after changing any other settings, you need to select the "Save Configuration" option to make the changes permanent:



Finally, select Return to close the menu:



## Further Customizations

Each Profile represents a reasonable starting point for that system type, but you may want to make further changes. For example, turning on visible scan lines, selecting a border colour, or changing the default palette.

If you make additional changes, and you want these to be permanent, then you need to repeat the "Save Configuration" action. This will update the current Profile to include these changes.

Note: The "Save Configuration" action applies only to the current profile. If you use several machines (with different profiles) and wanted to enable visible scan lines in all of them, you would need to make the change and repeat "Save Configuration" on each profile in turn.

If at any time you want to revert back to the original version of the current Profile (with all of your changes removed), then select the "Restore Default Configuration" action. Again, this affects only the current Profile.

## Additional Documentation

The following documentation is available online:

- [Quick Start Guide](#) (Similar to this document)
- [Hardware Guide](#)
- [Reference Guide](#)
- [Tutorial on Adding a New Profile](#)