QUICK START GUIDE

(FIRMWARE 1.09+)

OVERVIEW

The UltraHDMI video processor is an internal add-on to all retail Nintendo 64 game consoles.

It's very flexible – it can do as much processing as you want, or do the least amount possible. All of the options are accessible via the on-screen display (OSD) that can be brought up at any time.

USING THE ON-SCREEN DISPLAY

The OSD can be brought up on Controller 1

1. During a game, or
2. By itself if the N64 is powered on with no game inserted.

There are two possible combos so that you can press all the buttons no matter which left hand position you use with the controller.

OSD HOTKEY	***L/Z + Dpad right + C right + R trigger***
OSD MOVEMENT	***Either Dpad, Analog stick, or C-buttons***
Select item/menu	A, analog right, or C-right
Go back	B, analog left, or C-left

NOTE ON CONTROLLER POLLING

While a game is running, UltraHDMI watches Controller 1 hands-off. As the game sees which controller buttons are pressed – which is called "polling" – UltraHDMI peeks at sees if it should respond. As a result, there may be some times like loading screens where the OSD may appear frozen, which is normal.

HOW THE N64 GENERATES VIDEO

PROGRESSIVE	Each field comprises a complete frame of video, displayed at 50 or 60hz. On CRTs, the scanlines are located in the same spot every time, causing dark bands to appear between them. Vertical resolution is 240 lines on NTSC, and 288 lines for PAL.
INTERLACED	Each field makes up half of a complete frame of video, displayed at 25 or 30hz. The CRT slightly shifts up and down to scan each line, which increases perceived resolution at the cost of interlacing artifacts (called combing). Vertical resolution is 480 lines on NTSC, and 576 lines for PAL.

A game may have an opening title screen in interlaced for a higher resolution picture, then switch to progressive for gameplay. Some of the visual effects, like scanlines, appear differently depending on what mode the N64 is currently producing. All visual effects incur zero additional latency penalty.

MAIN MENU OPTIONS

FILL MODE	Changes how the source material is fitted onto the output area.

NORMAL	Fit while maintaining original aspect ratio.
STRETCH	Input material is stretched to cover output.
CINEMA	Input is enlarged so that the width matches the output, while cropping top and bottom. Used for watching letterboxed content.
PAL-FIX	Applies a 1.2x aspect ratio correction to remove black bars from some PAL titles. Only available in 50hz modes.

OVERSCAN	Enlarges the input content to better fit, if there is un-rendered black space around the image.
GAMMA BOOST	Applies a non-linear gamma boost that approximates the response of a CRT television. If applicable, analog out gamma is controlled separately.

1.0	Baseline, no change
1.3	Moderate gamma boost, recommended for most users
1.45	Extra brightness for dark games

Recommended to use 1.3 or 1.45 when **SCANLINES: HYBRID** is enabled.

SCANLINES	Adds one of two types of scanlines. Best seen in progressive input modes.

HYBRID	Approximates non-linear CRT phosphor response and brightness bleed. Recommended.
SIMPLE	Applies simple darkening which matches most existing implementations of fake scanlines. Darkness is controlled by advanced setting **SCAN SIMPLE DEPTH**.

[PICTURE…]	Enters the Picture Settings menu.
[OPTIONS…]	Enters the general options menu.
[HDMI SETUP…]	Enters the HDMI output setup menu.
[ABOUT…]	Shows About, Thanks, and Self-Test.
[LOAD PRESET…]	Replaces all possible settings with ones from a slot previously saved to.
[SAVE PRESET…]	Save a copy of all the current settings to a slot for later recall.

PICTURE SETTINGS

FEATURE AVAILABILITY

Many options are only available when the HDMI output resolution is 720p or greater.
Most features are not available when running at 480p/576p.

SCAN SERRATION	Adds an adjustable inter-line distortion to scanlines.
SCAN SIMPLE DEPTH	Adjust the percent darkness between scanlines when scanlines is set to **SIMPLE**
SCAN INTERLACED	Normally, scanlines are disabled in interlaced mode. This option adds scanlines that alternate every field like a real TV. Some displays may have trouble, especially ones with motion compensation.
TUBE CRT HV BLOOM	Simulates screen bloom exhibited by cheap CRT TVs. Inexpensive televisions typically had poor high voltage regulation, which means bright scenes cause the screen to "grow" subtly.
SHARP PIXELS	Disables upscaling filtering. Only applicable to 720p/1080p.

INTEGER	Displays the input centered in the screen at exactly 1x (720p) or 2x (1080p) with pixel doubling.
INTEGER+	Multiplies each pixel by 1.5x (720p) or 2.5x (1080p). When game uses 320x240 progressive mode, each pixel will be exactly 3x3 or 5x5 pixels. Produces visual artifacts on anything higher-res.
FRACTION	Allows the input to be scaled while filtering is still turned off. Produces visual artifacts, not recommended.

VI DE-BLUR	Attempts to remove horizontal filtering added by the final video processing stage in the N64. The vast majority of games render in 320x240 and can benefit from this functionality.

OFF	Video data is taken as-is from N64.
AUTO	Uses heuristics (educated guessing) to determine if the game uses a 320px wide framebuffer, and if so, reverses it. Only in progressive.
ALWAYS	Ignores heuristics and always reverses the filtering, again in progressive modes.
ALL +INT.	Always reverses filtering in all modes, even interlaced.

	If HDMI is not plugged in, the OSD hotkey instead only cycles through these deblur options. A small colored rectangle in the screen corner briefly indicates which option is selected.
FAST INTERLACED	Interlaced modes work by sending every other video line per field, taking up 2 fields to make a full frame. Normally de-interlacing works over a series of framebuffers, which eliminates any possible tearing artifacts, but introduces an additional 1 frame lag and stronger combing artifacts. When enabled, this option runs all interlaced content into a single working buffer, minimizing latency and visual artifacts.

GENERAL OPTIONS

SHOW VIDEO MODES	Shows the N64's current video mode for a few seconds in the left corner whenever it changes modes, or loses sync. Can be useful for debugging.
DISABLE HOTKEY	Prevents loading the OSD during gameplay for the rest of the power-on session, if the key combo is interfering with the game. If you SAVE SETTINGS after enabling this, the OSD will be locked out all the time. To get the OSD back, start the N64 with no game inserted, and use the hotkey to bring up the menu and disable the setting (remember to save!)
IN-GAME RESET	When enabled, the key combo Z+R+A+B+Start causes a soft reset, identical to pressing the console's own reset button. Please refer to your hardware revision:

HW1	Requires both firmware 1.06+ and an extra wire to be soldered in the console.
HW2	Available in all units.

PRESET MNEMONIC	Changes the list of presets in [SAVE/LOAD] to some more memorable names. Has no effect on functionality. All presets are initially blank and must be set by user. Available options:

GENERIC	Simplest –PRESET SLOT 1, 2, etc.
SCENARIO	Some possible use cases where some types of games may benefit from particular settings more than others.
CITIES	List of well-known cities
DOGS	List of popular dog breeds

ANALOG OUT	**HW2 only.**	
	OFF	No analog output is produced and DAC is powered off.
	COMPONENT	Analog component video is produced.
	RGB 0.7V	Analog RGB with separate CSYNC is produced. Standard 0.7V range recommended for all analog hardware.
	RGB 1.0V	Increases the analog for broadcast equipment designed for 1.0V range. Avoid using unless necessary, as some CRTs will be overdriven.
	RGB 0.7V SOG	Sync-on-green compatible with most PVMs and Multisyncs.
	In most cases, both RGB, RGsB, and Component can be used on the same PVM over the same cable. Make sure to select external sync on your PVM when using RGB.	
ANALOG GAMMA	**HW2 only.**	
	1.0	Baseline, recommended
	1.2	Moderate gamma boost
	1.3	Large gamma boost

*Analog capability, if installed, will be indicated on the [**ABOUT…**] screen.

HDMI OUTPUT SETUP

While the previous settings control the intermediate processing of the N64's video signal, the following options directly control the HDMI output used.

RESOLUTION	**480p**	VESA 640x480 mode. Compatible with all monitors. Perfect fit for NTSC video signals. Only available at 60hz.
	576p	DTV 720x576 video mode for PAL video signals. Only works at 50hz. Will have some horizontal fuzziness.
	720p	Standard baseline HDMI resolution. All visual effects enabled.
	1080p	Enhanced HDMI resolution. All visual effects enabled. Recommended.
	1200p	VESA 1600x1200 mode. Compatible with PC monitors and some displays. Do not use on 1080p displays!
REFRESH RATE	**50 Hz**	Best suited for if you play primarily PAL games (Europe, Australia)
	60 Hz	Best for NTSC games (North America, Brazil, Japan)
RGB RANGE	**FULL**	Recommended whenever possible. Confirm your TV options.
	LIMITED	Some displays may not be able to automatically switch black levels, or don't even have the option to manually change. Generally, if you see crushed blacks and clamped whites, you may want to run limited range RGB. Scanlines may appear slightly different.
ZERO LAG	Normally, UltraHDMI runs in buffered mode where all video data runs through a framebuffer with up to 1 frame (16ms) of latency, providing a consistent and stable video signal compatible with all displays. TEAR essentially turns off vertical sync, removing all lag, but also adding tearing artifacts. Display compatibility is the same as normal. SYNC is the best option, if your display supports it. This mode will lock onto the N64's sync rate and emit HDMI frames just as the N64 outputs them. There will be no tearing and instant progress-interlaced mode switching is supported. All display modes and effects are supported.	
	OFF	Buffered (normal mode). Recommended for most users.
	TEAR	Shows the received video frames immediately with no v-sync. Horizontal tearing will occur.
	SYNC	HDMI is locked to the N64. No lag or tearing.

HDMI & ANALOG CO-EXISTENCE

The optional analog output in HW2 units can function simultaneously with HDMI, but does not use its scaling engine.

Original sync position and signaling is preserved.

DE-BLUR

When adjusted, affects deblur operation with respect to both HDMI and analog.
Due to resource limitations, the menu will only show over HDMI.
However, when HDMI is disconnected, it's still possible to cycle through the de-blur options by pressing the OSD HOTKEY –

L/Z + Dpad right + C right + R trigger

A small square in the corner of the screen will briefly show which option was selected:

OFF	White
AUTO	Red
ALWAYS	Green
ALL+INT	Blue

GAMMA

Each output has an independently controlled gamma curve. For example, it's possible to have 1.3 on HDMI and 1.0 on component or RGB. In fact, this is recommended as normally the original video signal is considered optimal for the CRTs it was designed for.
HDMI must be plugged in to change this setting in the menu.

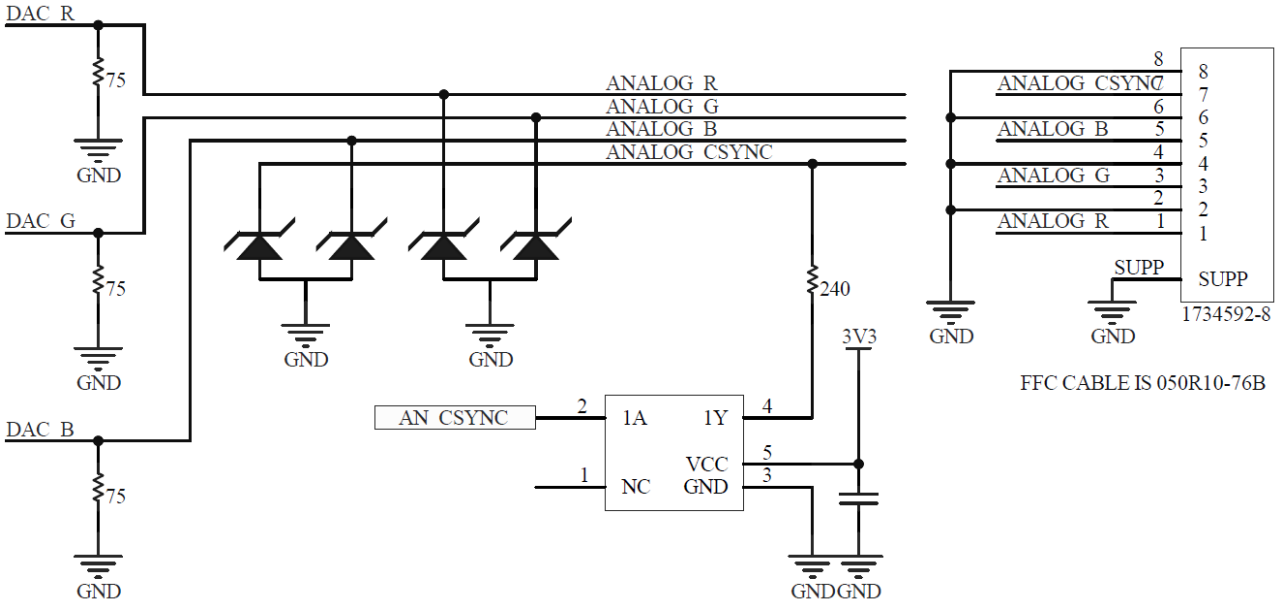
ANALOG OUTPUT STAGE

A wide variety of cables exist on the market. The exact cable and its components needed depends on your equipment, and there is no “one-size-fits-all”. Deciding what your setup needs is outside the scope of this document.

Generally speaking, the output stage is suitable for most devices and will sync correctly as well.

Some cables may not have C-sync connected in them and instead strip sync out of composite video or luma – in this case a horizontal shift of several pixels will be observed since the UltraHDMI’s analog stage has slightly less delay than the original N64 DAC.

Below are the exact components used:



END OF DOCUMENT

REVISION INFORMATION

September 13, 2015	First internal draft
November 03, 2015	Updated for 0.03
November 20, 2015	Updated for 1.00
December 2, 2015	Updated for 1.02
October 21, 2016	Updated for 1.05
December 11, 2016	Changed wording
March 13, 2017	Updated for 1.06
March 26, 2018	Updated for 1.07
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January 26, 2021	Updated for 1.08 HW2
July 4, 2021	Updated for 1.09

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