

Using v4 on the Morph 4K

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This guide walks through the new parts of v4 on the Morph 4K. It covers choosing a Processing Engine, getting a good first picture, the Retro FX menus, deinterlacing, and how settings and presets behave now. It is a practical companion to the v4 blog post, which explains the ideas behind the features.

Every setting in the v4 menus has a short description at the bottom of the screen. If you are ever unsure what a line does, highlight it and read the description. This guide shows where things are and how they fit together.

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1. Getting v4

v4 is on the **beta** update channel. Set the update channel to beta and check for an update as usual. After updating, you can find the update channel, the version check and the release notes under **System > Firmware**.

Keep the SD card in the Morph. v4 stores its Processing Engines on the SD card, and the update installs them there. If an engine shows **Not installed** on the Processing Engine page, the card is missing or its engine files are gone. Run the update again with the card inserted.

What carries over from v3. Your input, output resolution, HDMI and system settings are kept. Picture settings (zoom, scanlines, color and the rest) now start from v4's defaults (see section 9). Your presets stay on the SD card. Preset Auto-Load starts **Off** after the update, so an older Auto preset does not load into a v4 engine until you turn it back on.

2. Processing Engines

v4 can load a different FPGA design for each kind of job. Each design is called a **Processing Engine**. The Morph 4K has four:

Engine	Best for	Max input	Deinterlacing	Retro FX
Physical Display Model	240p and 480i consoles, with the full CRT and bezel simulation	1080p (progressive)	Seamless 240p/480i	Analog Path + CRT + Bezel
Universal Adaptive	Every source up to 1080p, including interlaced video	1080p	Film (Auto) and Motion Adaptive	CRT Simulation
Spatial Super Resolution	Crisp, smooth upscaling of progressive pixel art, 480p and above	1080p	None	None
Tate Mode	Vertical arcade games turned upright on a normal TV	720p; 2048x1024 custom progressive; 1080p with the Decimator	Basic (480i)	Scanlines + Masks

Choosing an engine. Open the **Processing Engine** page, the last row of the main menu. It lists the four engines:

- **[ACTIVE]** marks the engine that is running now.
- **[BEST]** marks the engine that suits the current input best.

Highlight an engine to read its description and limits, then press **OK** to load it. Loading an engine restarts the FPGA, so the picture goes black for a moment and the TV resyncs. The Morph remembers your engine across power cycles. If an engine fails to start twice in a row, the Morph starts Universal Adaptive instead.

When an input does not fit. If the source is beyond what the running engine can take, the Morph shows **Input Not Supported** and offers an engine that can show it.

Auto Rotation. The row under the engine list controls what happens when a vertical arcade game starts:

- **Off:** engines change only when you pick one.
- **Switch Engine:** Tate Mode loads when a vertical arcade core starts, and your own engine comes back when the core ends.
- **In Tate Mode:** Tate Mode stays loaded and shows horizontal cores as well, so it reloads less often.

Leave Auto Rotation Off if your TV is physically turned on its side. You can also set it per game or core.

Each engine has its own settings. Zoom, scanlines, color, Retro FX and the other picture settings are kept separately for each engine. The first time you load an engine, it starts from its defaults, not from the settings of the engine you came from. A look tuned for one engine therefore never confuses another.

3. Your first picture

Most of what shapes the basic picture is in the **Video** menu:

- **Decimator:** how many source samples reach the scaler.
- **Auto Sampling:** finds each mode's real pixel grid.
- **Deinterlacer:** how 480i and 576i become progressive frames.
- **Output Resolution**
- **Scaler:** zoom, aspect ratio, a custom size and interpolation.
- **Shift / Crop**
- **Smoothing**
- **Color Correction:** gamma, gain, lift, saturation and the SDR / HDR output.
- **Retro FX**
- **Advanced Video:** frame lock, buffering and the HDMI signal.

Output resolution. The Retro FX simulation looks its best at **4K**. Masks in particular need 4K output to show their full pattern. Bezel Art currently needs 4K output (see section 7). 1080p works for the rest, and Beam Scan needs 1080p at 120 Hz (see section 6).

Zoom

The **Scaler** page's **Zoom Mode** decides how big the picture is:

- **Under:** the largest whole-number zoom that fits the screen. Pixels stay even, with a border around the picture.
- **Fill** (the default): fills the screen exactly, recalculated whenever the source changes. For scanlines on 240p games, **Under** keeps every line the same width.
- **Over:** the smallest whole-number zoom that fills the screen. Pixels stay even, and the edges are cropped.
- **Manual:** a fixed zoom that you set, whatever the source.

The automatic modes follow the source. A 240p game and a 720p game both get a sensible size without any adjustment.

Interpolation and Anti-Ringing

Interpolation sets how the picture is smoothed when it is scaled, separately across and down:

Choice	Character
Off	Every pixel repeated exactly. The crispest, but uneven at some sizes.
Sharper Bilinear	Very crisp pixel edges with just enough smoothing to keep pixels even.
Sharp Bilinear	Crisp pixels with smooth, even edges. Best for 2D games.
Bilinear	Soft and even. Smooths pixel edges completely.
Mitchell	Smooth and natural, with fewer jagged edges. Good for 3D games.
Catmull-Rom	Sharp and detailed. Good for 3D games.
Lanczos	The sharpest detail. Best for 3D games and video.

Mitchell, Catmull-Rom and Lanczos are new in v4 on Universal Adaptive. Sharp filters like Lanczos can draw thin light or dark halos around hard edges. **Anti-Ringing** removes them:

- **Strong:** no halos. This is the recommended setting.
- **Light:** trims the strongest halos and keeps the most sharpness.

When scanlines are on, they shape the picture vertically, and the description on the Interpolation line says so.

Decimator

Some sources send far more samples per line than the game has pixels. HDMI from many devices pixel-repeats, and some cores and capture setups oversample. The **Decimator** reduces this back toward the game's real resolution before scaling, which gives sharper, more even pixels and lets the Retro FX simulation see the real pixel grid. **Auto** finds the factor by itself and shows what it found. **Fixed** and **Custom** are there for unusual sources.

The Decimator also applies when a source is wider than the running engine can take: the Morph raises the factor until the line fits.

Smoothing (Spatial Super Resolution)

On the Spatial Super Resolution engine, **Smoothing** rounds off the stair-steps of pixel art. Each game pixel becomes four, with smooth edges. The **Filter** line picks the style: **super-xBR**, **xBRZ** or **Super Eagle**.

4. Retro FX

Retro FX recreates a CRT television, from the console's analog signal to the tube, the bezel and the glass. In the Video menu, **Retro FX** is a switch and a page at the same time:

- **Left / right** on the Retro FX row turns all of Retro FX off or on. Off keeps every setting, and On brings them all back as they were. Use it to compare with and without.
- **OK** opens the Retro FX page.

The Retro FX page has three groups, each with its own switch:

- **Analog Path Simulation:** the console's signal and the TV's decoder (dot crawl, rainbows and color bleed).
- **CRT Simulation:** the tube's effects, from scanlines to curvature.
- **Bezel & Glass:** the TV set around the tube (bezel art, its reflection and room light).

Turning a group off keeps the settings inside it. Each engine shows only the rows it has. Physical Display Model has all three groups, Universal Adaptive has CRT Simulation, and Tate Mode has scanlines and masks.

Conventions on the Retro FX pages:

- Most effects have a **Look** or **Preset** line: a set of starting points. Changing any value below it marks the look with *.
- **Cyan** values differ from the chosen look. **Yellow** values were changed since you opened the page.
- **Reset to Defaults** puts the page's values back without changing its On/Off switch.
- **Undo Changes** puts everything back to how it was when you opened the page.

5. Analog Path Simulation

Physical Display Model

Analog Path Simulation models the signal path of a real console and TV: the console's video encoder, the cable or antenna, and the TV's decoder. This is where dot crawl, rainbow artifacts, dither blending and color bleed come from. They come out naturally, as they did on the original hardware, rather than as an overlay.

The main page:

- **Console:** sets the subcarrier timing, so dot crawl and artifact colors behave like that console's.
- **Connection:** Composite, S-Video, RF (Antenna), or **Blend Only**. Blend Only keeps dither blending and color smear without rainbows.
- **TV Decoder:** how the TV separates color from detail (Notch Filter, 2-Line Comb, 3-Line Comb or Adaptive Comb). Comb filters suit some consoles better than others; the description explains which. PAL sources get a **PAL Decoder** choice instead.
- **Dot Crawl:** Natural lets the dots move as the console's own timing makes them. Locked holds them still.
- **Sharpness, Luma Bandwidth, Color Bandwidth, Tint** and **Color:** the TV's own controls.

Deeper pages:

- **TV Character:** how the TV's circuits shape the picture (edge smear, chroma delay, black level and automatic color control).
- **RF Reception** (with RF): snow, ghosts, sound beat and tuning drift.
- **Cable:** softening and reflections from a long or poor cable.
- **Console Output:** how the console's own encoder produced the signal (setup level, chroma waveform, output clipping).

Reset to Console Defaults puts every setting back to the chosen console's defaults. A good way to start is to pick your console and connection, then reset.

APS Status shows what the simulation is doing. APS learns the lines of each source as the game shows each mode, so the first switch to a new mode may glitch once. If APS pauses, **Reason** says why, and it starts again by itself once the source suits it.

6. CRT Simulation

The CRT Simulation page lists the effects in the order light travels through a real set: **Signal**, **Beam**, **Screen**, **Tube** and **Motion**. Each row is a switch. Left / right turns the effect on or off, and **OK** opens its page.

Amplifier Blur

Softens the picture the way a TV's video amplifiers did. Choose a **Look**, then scale it with **Amount**.

Scanlines

v4 has three kinds of scanlines:

- **Normal:** even lines, set by Beam Brightness, Depth and Thickness.
- **Adaptive:** bright lines widen, as on a tube. Start from a **Look** (Classic, Dark Detail or Deep), then adjust Depth, Width on Bright and Beam Brightness. More controls are under **Advanced**.
- **Dynamic:** lines widen with brightness *and* keep the light, so the picture stays as bright as it was without scanlines. Start from a **Beam Profile**, such as Gaussian, Soft, Sharp, PVM, Consumer TV or Arcade, then adjust the beam's width on dark and bright lines.

On interlaced sources, scanlines follow each field. True 480i scanlines show the interlaced line structure of a real tube.

A few useful controls on the Dynamic page:

- **Energy Conserving:** 100% keeps the picture as bright as without scanlines.
- **Highlight Knee:** above this level, highlights roll off so bright lines keep their gaps.
- **Width Growth:** Natural keeps dark and mid lines thin and widens them near white, as a tube does. Even widens steadily.

Convergence

Red and blue land a little apart from green, as on a real tube.

- **Horizontal Look:** shifts red and blue sideways across the whole screen, from a well-kept set to a tired one.
- **Vertical Look:** splits red and blue above and below green toward the edges, while the center stays clean.

Mask

The pattern of red, green and blue phosphors on the screen. **Type** lists the masks found on the SD card. **Intensity** sets how strong the mask is, and **Transform** turns or mirrors it for a rotated screen. Masks are best at 4K output. After adding masks to the card, use **Scan SD Card**.

Phosphor Glow

Light scattered in the tube's glass: a soft glow around bright areas.

- **Look:** a sharp consumer TV, a softer older tube, or a bright monitor in a dark room.
- **Strength:** how bright the glow is.
- **Glow Size:** how far it spreads.
- **Glow Tint:** warm glass glows redder, cool glass bluer.
- **Glow Stops At:** whether the glow can reach the dark band around the picture, as real glass does.

Edge Dimming is on this page too. It makes the picture darker toward the edges and corners, as on a real tube, with **Dimming Shape** Round or Wide.

Curvature

Bends the picture like the curved glass of a tube. Pick a **Preset**, from a flat studio monitor to a deep arcade tube, then adjust:

- **Horizontal Curve, Side Bow and Vertical Curve:** the shape. The scanlines follow the curve.
- **Corner Radius:** rounds the corners.

Without bezel art, **Bezel Sides** and **Bezel Top/Bottom** add a plain black frame. **Fit Bezel to Curve** sets the frame just deep enough to hide the curved edge, as on a TV that fills its screen.

Gamut & White Point

The colors of a real tube. Pick a **Look** for a US, PAL or Japanese TV, or a Japanese Sony PVM, then adjust:

- **White Point:** 6500K is the broadcast white. 9300K is bluer: Monitor for studios, TV for Japanese homes.
- **Phosphors:** the tube's red, green and blue.
- **Fit to Display:** pulls colors your display can't show just inside its range, so nothing clips.

Tube Sag

The picture swells a little on bright scenes, as a tube's power supply sags. Choose a strength from subtle to strong, or set **Picture Size**, **Line Width** and **Speed** yourself. With bezel art the growth is hidden behind the bezel. Without one, the edge grows into the black border.

Beam Scan

Beam Scan gives much sharper motion by drawing two output frames for every game frame:

- **BFI:** every other frame black.
- **Rolling Scan:** a rolling beam, like a CRT.
- **Bright Strobe:** a short, bright flash.

Persistence (BFI and Rolling Scan) and **Strobe Length** (Bright Strobe) set how long each pixel stays lit. Shorter gives sharper motion and a darker picture.

Beam Scan needs:

- output at **1080p120**, or **1080p100** for a 50 Hz game (Video > Output Resolution);
- **MagicLock2** buffering (Video > Advanced Video);
- a progressive game.

Until these are set, the row shows **Needs Setup**, and its page tells you which setting to change. Beam Scan runs on Universal Adaptive, Spatial Super Resolution and Tate Mode, and it is coming to Physical Display Model in a future update.

7. Bezel & Glass

Physical Display Model

Bezel Art

A TV or cabinet picture around the screen, from the SD card. Use left / right on **Bezel Art** to pick one.

- **Fit Picture to Opening:** sizes and places the picture inside the bezel's screen opening.
- **Window Shape: Fitted to Art** follows the bezel's opening with a smooth curve, so the edge shows no stair-steps.
- **Window Inset:** how far the black window sits inside the opening. Each bezel brings its own value.
- **Scan SD Card:** after copying new bezels to the card. Bezels are folders made with **Pixel FX Bezel Studio** (coming in a future update).

The Morph 4K comes with the PDM-20 bezel. Bezel Art currently works at 4K output only. Support for other output resolutions, and for Mega Bezel bezels, is coming in a future update.

Bezel Reflection

The picture lighting the bezel's angled plastic around the glass, as on a real set. Bezel Reflection needs a bezel made for it. Its **Look** is Subtle, Normal or Strong.

Cabinet Brightness and Room Light

Cabinet Brightness sets how bright the bezel art is: lower suits a dim room. **Room Light** is the light of your room falling on the screen: it lifts black to a soft gray, as on a real tube. Off is the deepest black. Room Light needs the color pipeline on (Color Correction > HDR set to anything but disabled).

8. Deinterlacing

The **Deinterlacer** page (Video menu) sets how 480i and 576i become progressive frames. Its **Method** line offers:

- **Film (Auto):** rebuilds the original frames of films and 30 fps games. Video, menus and 60 fps games use Motion Adaptive.

- **Motion Adaptive:** keeps full detail where the picture is still and rebuilds moving areas pixel by pixel. This is the default.
- **Weave, Blend and Bob:** the classic methods, for comparison.
- **Simulate CRT:** shows each field in its own scanline position, as a CRT does, with true interlaced motion and flicker.

When Film is active, **Detected** shows what it found. With a progressive source the page says it has nothing to do.

Other lines:

- **Latency:** Zero-Lag adds no field of delay. **+1 Field** gives cleaner motion and seamless film switching.
- **Edge Smoothing:** smooths jagged diagonals in moving areas. **Off, Low, Medium or High:** each level smooths shallower diagonals than the last, and **High** gives the cleanest edges. Low and Medium smooth less, if you prefer a lighter touch.
- **Source Noise:** Auto, Clean or Noisy. Tells the motion detection how much noise to expect.

Under **Advanced:**

- **Film Cadence:** forces 2:2 (30 fps sources such as many PS2 games) or 3:2 (24 fps films, as on DVD) when Auto falls back on slow scenes.
- **Field Order:** swap it if every interlaced source looks jittery.
- **I/P Change Blank:** hides the glitch when a source switches between interlaced and progressive.

The Physical Display Model engine handles 240p and 480i seamlessly as a CRT would. Tate Mode has a basic 480i deinterlacer. Spatial Super Resolution takes progressive sources only.

9. Settings, presets and per-game setups

The Morph starts fresh at every power-up. In v4, picture settings start from the defaults at each power-up, and nothing you experimented with in an earlier session comes back on its own. Your input, output resolution and system settings are kept. Settings you change during a session are kept until you power off, even if you switch engines or sources and come back.

To keep a setup, **save it as a preset.** Presets store the picture settings in a readable file on the SD card. Load a preset whenever you want that look back.

Preset Auto-Load loads the matching Auto preset by itself when a source mode is recognized. It is under **System > Behavior > Preset Auto-Load** and is set **for each engine separately.** After the v4 update it is Off on every engine. Turn it on for each engine where you want your Auto presets to load.

Per-game settings. **System > Game ID** picks settings by the game the console reports, for consoles and cores that send a game ID.

Restore defaults. If a picture ever looks wrong and you are not sure why, the page's **Reset to Defaults** or a power cycle brings back the defaults. Your presets are never changed by either.

10. Known issues and reporting a problem

This is a beta. These are the issues we know about:

- Rarely, the HDMI output shows red dots and drops audio. A power cycle recovers it.
- Some MiSTer cores tear in Triple Buffer and MagicLock.
- The OSD banner can draw over an open menu when the source changes from interlaced to progressive.
- Browsing Bezel Art loads each bezel in turn, so the picture changes as you browse.
- Beam Scan is not yet available on Physical Display Model.
- Analog Path Simulation can flicker and shake with the MiSTer PS1 core. Turn Analog Path Simulation off for that core for now.

Reporting a problem. Please tell us:

- the engine (Processing Engine page),
- the source and its resolution,
- the output resolution,
- what you changed just before it happened.

If you can, include a debug log. Turn on **System > Diagnostics > Write Debug Log**, restart the Morph, and make the problem happen again. The log is written to the SD card. A photo of the screen helps with picture problems.

Thank you for testing v4.

Pixel FX