CRTX - Installation & User Guide

CRTX is a step beyond CRT simulation. Built for Adobe After Effects and Premiere Pro, it does not just emulate a look, it reacts like a display system. Every frame is redrawn as if a real beam is painting it, with scan structure, mask patterns, bloom, glow, analog signal chaos, and controllable instability responding to your footage's motion, luminance, and edges. Forget static overlays. CRTX treats your image as a living signal, so highlights breathe, colors smear, and sync tears when you ask for them. The result feels like it was shot off a tube, not dragged from a preset.

AFTER EFFECTS | PREMIERE PRO | GPU ACCELERATED | 150+ PRESETS | PRESET WORKFLOW | SIGNAL + DISPLAY SIMULATION | EVERY EXPOSED PARAMETER

How to use this manual

Read the opening pages if you need installation, support, or workflow guidance. If you already know how to operate CRTX, jump directly to the topic reference pages. Each parameter entry gives the visible control name, what it does, and popup choices when the plugin exposes discrete modes.

Mental model: believable CRT looks usually come from choosing the signal path first, then the display structure, then beam and phosphor behavior, then glass/surface polish, and finally instability or destruction.

Manual map

01 Setup, installation, licensing, support, and workflow.
02 Import / export and style foundation controls.
03 Grade, beam, surface, and phosphor response.
04 Geometry, optics, masking, and convergence.
05 Quality, camera capture, and shutter simulation.
06 Glitch, wiring, sync failure, signal degradation, circuit bending, and audio.
07 Tube Physics: beam defocus, bandwidth, phosphor aging, pincushion, and electron-gun behavior.

Section index by plugin topic

Import / Export: Export CRTX, Load CRTX.

Style: CRT Curvature, Mask Type, Mask Model, Auto Mask Pitch, Mask Pitch, Mask Sharpness, Temporal Posterize.

Color Grading: Gain, Color, Color Temperature, Color Bleed, Vignette, Edge Brightness, CRT Gamma, Output Gamma, Signal Noise.

Electron Beam: Scanline Thickness, Scanline Opacity, Bloom, Glow, Peaking, Beam Spread Gain, Beam Skirt Gain.

Surface: Glass Dirt, Glass Scratches, Screen Reflection, Screen Glare, Reflection Map, Glass Reflectivity, Glass Tilt, Diffusion.

Phosphor: Persistence controls, phosphor type, per-channel decay, afterglow.

Geometry: Linearity, tube shape, keystone, rotation, connection type, convergence, purity, focus, aberration, jitter, masking, overscan, fit, tie wires.

Quality & Performance: quality preset, internal resolution, DRS, fast mode, voltage simulation, GPU rendering.

Camera: shutter model, readout, strength, flicker, ISO, sensor noise, white balance, exposure compensation.

Glitch & Instability: signal loss, glitch master controls, degauss, audio reactive modulation, wiring, sync failures, signal degradation, circuit bending.

Audio: generated hum, whine, distortion, filter, noise.

Tube Physics: focus breathing, vertical bandwidth, phosphor unevenness, pincushion, grid bias drift, beam diffraction, tube aging, magnetic ripple, dynamic gamma, channel sag.

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Installation

The easiest install and licensing path is the: aescripts + aeplugins manager. For manual installation, place **CRTX.aex** or **CRTX.plugin** in Adobe's shared **MediaCore** folder so compatible hosts can discover it on launch.

1. Navigate to the shared **MediaCore** folder for your operating system.

2. Create a folder named **Plugin LyfeX** if you want to keep the plugin organized with your other Plugin LyfeX tools.

3. Copy **CRTX.aex** on Windows or **CRTX.plugin** on macOS into that folder.

INSTALL CHECK

If installation is correct, CRTX should appear in the effect list after restarting After Effects or Premiere Pro.

IF UPDATING

Replace the older plugin file in the same location, then restart the host so the new binary is loaded.

Windows

```
C:\Program Files\Adobe\Common\Plug-ins\7.0\MediaCore\
```

```
CRTX.aex
```

macOS

```
/Library/Application Support/Adobe/Common/Plug-ins/7.0/MediaCore/
```

```
CRTX.plugin
```

Restart required

After installing the plugin file, you must **restart the host application** for the plugin to be loaded. Unlike scripts, plugins are loaded only during application startup, so a live file copy will not make CRTX appear immediately.

Startup expectation: after restart, search for **CRTX** in the effects list and apply it to a layer or clip.

If it does not appear: verify the file path, host restart, and that the correct binary was copied for your platform.

If replacing an older build: ensure the host was fully closed before relaunching so the previous binary is not still held in memory.

Licensing & support

Register from the effect's **Options** button and choose **Register**. For licensing or technical issues, open an aescripts ticket or email support@pluginlyfex.com. Include host version, OS, plugin version, and a concise reproduction note.

Best support data: mention whether the issue appears in preview only or final render, whether it changes with quality or GPU settings, and which control family seems involved. Premiere Pro support is new, so detailed reports help us tighten it up faster. Feature requests and workflow-change requests are also welcome by ticket or email.

Recommended workflow

1. Start with **CRTX Library** to get close to the target monitor family.
2. Set preview strategy first using **GPU Rendering**, **Quality Preset**, **Internal Resolution**, **Dynamic Resolution Scaling**, and **Fast Mode**.
3. Lock the display structure: mask, curvature, scanline feel, geometry, convergence, overscan, and connection type.
4. Shape beam response and phosphor energy with bloom, glow, peaking, persistence, and decay.
5. Set signal character with **Connection Type**, **Signal Noise**, **Color Bleed**, **Y/C Delay**, **Dot Crawl**, or **RF Stripes** as needed.
6. Finish with surface and persistence controls: **Glass Reflectivity**, **Screen Reflection**, **Diffusion**, and phosphor decay.
7. Add signal artifacts and instability last so the image breaks in a convincing way rather than starting broken.

Practical rule: use GPU whenever possible. It is the recommended path because it delivers more realistic results and much faster previews. Fine mask detail, phosphor structure, and subtle artifacts are easy to misjudge at low preview fidelity, so always validate hero shots at higher quality before export.

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LIBRARY

CRTX Library

CRTX Library opens the preset library for browsing and applying curated CRT starting points before you work through the per-topic controls.

IMPORT / EXPORT

Project state and preset controls

PARAMETER	WHAT IT DOES
Export CRTX	Saves the current state as a **.crtx** file so the look can be reused across shots or shared with collaborators.
Load CRTX	Loads a saved **.crtx** state and applies its stored parameter values to the current effect.

Import / Export note: only **Export CRTX** and **Load CRTX** belong to the actual topic rows in this section.

STYLE

Display structure foundation

PARAMETER	WHAT IT DOES
CRT Curvature	Simulates CRT barrel or pincushion curvature. Low values feel flatter; high values make the raster visibly tube-shaped.
Mask Type	Selects the CRT subpixel structure. `Dot Triad (Shadow) | Aperture Grille | Slot Mask`
Mask Model	Changes how the mask is reconstructed, ranging from cleaner overlay-like structure to more optical RGB behavior. `Classic (Overlay) | Realistic (RGB) | Grayscale`
Auto Mask Pitch	Auto-scales the subpixel pitch to the comp width for a more consistent physical-looking triad size.
Mask Pitch (px)	Sets the horizontal mask pitch in pixels. Smaller values create finer phosphor or stripe structure.
Mask Sharpness	Controls the crispness of subpixel weighting. Higher values make the mask pattern read more clearly.
Temporal Posterize (FPS)	Quantizes animation time to FPS steps for a stepped playback feel. Set it to 0 to disable the effect.

Style note: lock mask family and curvature before you chase artifact detail. The structure of the display is what makes later signal damage believable.

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COLOR GRADING

Tone, luminance, and color response

PARAMETER	WHAT IT DOES
Gain	Overall display brightness drive. It is a strong first stop because it influences beam energy, bloom, and glow.
Color	Overall color intensity / saturation applied to the decoded display response.
Color Temperature	Shifts the display white point. `Warm 5000K | Neutral 6500K | Cool 9300K`
Color Bleed	Simulates cross-channel smear and chroma bleeding, especially around contrast edges.
Vignette	Darkens the frame edges to emulate screen falloff and bezel shadowing.
Edge Brightness	Adjusts the brightness emphasis around edge regions of the image or screen response.
CRT Gamma	Sets the simulated CRT luminance gamma. Higher values darken midtones and steepen the response.
Output Gamma	Compensates the output for the target display or host color space.
Signal Noise	Adds analog noise and low-level interference character to the signal path.

ELECTRON BEAM

Scanline density and phosphor energy

PARAMETER	WHAT IT DOES
Scanline Thickness	Controls the relative vertical thickness of scanlines.
Scanline Opacity	Controls how dark the scanline separation becomes.
Bloom (Beam Spread)	Controls highlight bloom and glow halo around bright phosphor regions.
Glow	Adds a broader soft optical glow around bright regions.
Peaking (Sharpness)	Edge enhancement / sharpness shaping that can restore or exaggerate edge definition.
Beam Spread Gain	Increases blur radius with brightness to simulate phosphor halation on highlights.
Beam Skirt Gain	Adds a secondary wider glow contribution around bright phosphors.

Beam note: if the image feels too digital, lower peaking and raise bloom or beam spread slightly before adding instability.

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SURFACE

Glass, reflections, and presentation

PARAMETER	WHAT IT DOES
Glass Dirt	Adds faceplate grime, smudges, and accumulated screen dirt.
Glass Scratches	Adds fine wear and scratch detail to the display glass.
Screen Reflection	Controls the broad room-light reflection component across the screen.
Screen Glare	Adds a sharper glare highlight on top of the broader reflection feel.
Reflection Map	Uses a layer source to shape the reflection or mirrored fill response.
Glass Reflectivity	Sets the strength of the screen reflection highlight.
Glass Tilt	Adjusts the angle of the reflection gradient in degrees.
Diffusion (Glass Glow)	Adds broad soft diffusion from the face glass and surrounding optics.
Background Mode	Controls out-of-screen handling. `Transparent | Black Outside | Mirror (Reflection)`

PHOSPHOR

Persistence, decay, and phosphor family

PARAMETER	WHAT IT DOES
Phosphor Persistence	Primary persistence control for the phosphor response and glow trail character.
Phosphor Emulation	Selects the phosphor family and color/decay personality. `P22 (Standard) | P31 (Green) | P4 (B&W) | Amber | White (P4) | P22 Slow Green`
Phosphor Persistence (Trails)	Additional trail control that biases how strongly motion trails accumulate and persist.
Decay R (ms)	Red channel decay time in milliseconds.
Decay G (ms)	Green channel decay time in milliseconds.
Decay B (ms)	Blue channel decay time in milliseconds.
Afterglow Gain	Boosts the persistence trail contribution relative to the current frame.

Phosphor note: long persistence can feel powerful quickly. Use it carefully when the shot already contains motion blur or strong bloom.

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GEOMETRY

Tube shape, linearity, and optical misalignment

PARAMETER	WHAT IT DOES
Horizontal Linearity	Controls edge squeeze or stretch along the horizontal axis.
Vertical Linearity	Controls top/bottom squeeze or stretch along the vertical axis.
Tube Shape	Selects the base tube geometry. `Spherical` | `Cylindrical (Horizontal)` | `Cylindrical (Vertical)` | `Flat`
Barrel/Pincushion	Applies barrel or pincushion distortion to the raster shape.
Keystone Horizontal	Applies horizontal trapezoid distortion to mimic tilt correction or misalignment.
Keystone Vertical	Applies vertical trapezoid distortion to mimic tilt correction or misalignment.
Screen Rotation (deg)	Rotates the screen slightly to imitate yoke rotation.
Refresh Rate	Uses automatic or explicit refresh timing for television standards. `Auto (Recommended)` | `NTSC 60 Hz` | `PAL 50 Hz` | `SECAM 50 Hz`
Connection Type	Sets the transport class and baseline signal quality. `RF (Coaxial)` | `Composite (RCA)` | `S-Video (Y/C)` | `RGB (SCART/BNC)`
Manual Convergence X	Applies manual horizontal RGB beam offset.
Manual Convergence Y	Applies manual vertical RGB beam offset.
Manual Purity (Magnetism)	Introduces purity errors, corner tinting, or magnetized color contamination.
Dynamic Focus (Corner Softness)	Softens corners and edges to mimic focus limitations across the tube face.
Astigmatism (Directional Blur)	Adds directional focus error for asymmetric blur or beam smearing.
SVM Strength	Simulates scan velocity modulation edge enhancement.
Motion Blur	Simulates refresh trail or scanning blur along the beam path.
Chromatic Aberration	Offsets color channels horizontally to create RGB fringing.
Vertical Aberration Ratio	Adds a vertical component to the chromatic aberration response.
Fringe Strength	Focuses fringing on high-contrast edges for more edge-aware separation.

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GEOMETRY

Convergence, masking, overscan, and scan artifacts

PARAMETER	WHAT IT DOES
Scanline Jitter Amount	Sets the horizontal wobble amplitude per scanline for analog sync jitter.
Scanline Jitter Frequency	Controls how dense the wobble waves are over image height.
Dropout Rate	Sets how often scanlines intermittently darken like tape or signal dropouts.
Dropout Darken	Controls how dark the dropout lines become.
Convergence	Enables animated RGB convergence drift and beam misalignment.
Convergence Strength (px)	Sets the magnitude of RGB beam separation.
Convergence Angle (deg)	Sets the direction of RGB beam separation.
Convergence Drift Speed	Controls the rate of slow convergence drift over time.
Screen Mask	Enables an alpha or black mask around the screen area.
Mask Shape	Selects the screen silhouette. `Rectangle | Circle`
Mask Softness	Controls edge softness of the screen mask.
Mask Scale (%)	Sets the overall size of the screen mask relative to the layer.
Mask Mode	Controls what appears outside the screen mask. `Transparent Outside | Black Outside`
Mask Resampling HQ	Supersamples the mask edge for a smoother silhouette at higher cost.
Overscan (%)	Zooms content into the bezel region to emulate CRT overscan.
Fit to Comp	Scales the current geometry setup to fill the comp frame.
Tie Wire Count	Sets the number of aperture grille stabilizer wires.
Tie Wire Darkness	Darkens stabilizer wires as faint horizontal lines.

Display note: connection type, overscan, convergence, mask behavior, and geometry usually need to be judged together. Changing just one can make the rest feel wrong.

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QUALITY & PERFORMANCE

Sampling, speed, and stability

PARAMETER	WHAT IT DOES
Quality Preset	Controls the broad sampling cost and quality tier for the effect. `Low` | `Medium` | `High`
Internal Resolution	Sets internal processing resolution. `Full` | `Half` | `Third` | `Quarter`
Dynamic Resolution Scaling	Enables reduced internal processing resolution when you need faster previews while keeping the overall look responsive during setup.
DRS Scale (%)	Controls the internal resolution percentage used by dynamic resolution scaling.
Fast Mode	Reduces taps and sampling cost for more responsive look development.
Voltage Ripple Strength	Controls the strength of power-rail ripple in the picture response.
Voltage Ripple Frequency	Sets the frequency of power ripple or harmonics in the image behavior.
Voltage Sag Coupling	Controls how strongly content brightness drives voltage sag and related image response.

Performance guidance

`DRS` Use during exploration when structure matters more than micro-detail.

`INT` Lower **Internal Resolution** for previews, then restore for final judging.

Validation note: phosphor structure, mask pitch, and subtle beam shaping should always be rechecked at higher fidelity before export.

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GPU

GPU rendering and host acceleration

PARAMETER	WHAT IT DOES
GPU Rendering	Enables the high-fidelity GPU render path when available. Supported in both After Effects and Premiere Pro via CUDA. Premiere uses half-float (16f) during playback for real-time speed and full 32-bit float when paused for maximum quality.

GPU note: the GPU path is recommended for all workflows because it produces the most realistic results and much faster previews. In Premiere Pro, CRTX automatically handles format conversion between the host's 16f playback pipeline and the 32f internal render. CPU fallback is available when GPU is disabled.

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CAMERA

Filmed-screen behavior and sensor response

PARAMETER	WHAT IT DOES
Camera Shutter	Enables a camera shutter layer on top of the CRT scan simulation.
Shutter Type	Selects the shutter model. `Global` | `Rolling`
Shutter Speed	Sets the exposure duration used by the camera shutter model. `1/60` | `1/90` | `1/120` | `1/180` | `1/250` | `1/320` | `1/500` | `1/1000` | `1/2000` | `1/4000` | `1/8000`
Readout Time (ms)	Controls rolling shutter readout duration across the frame.
Shutter Phase	Offsets shutter timing relative to the simulated frame timing.
Shutter Strength	Controls how strongly shutter sampling affects the final image.
Shutter Flicker	Adds temporal exposure or brightness flicker inside the shutter simulation layer.
ISO Gain	Adjusts virtual sensor gain, increasing both exposure and visible capture noise.
Sensor Noise (%)	Controls sensor-style capture noise scaled by ISO and luminance.
White Balance (K)	Sets the virtual camera white balance in Kelvin.
Exposure Compensation (EV)	Offsets exposure in EV / stop-like increments.

Camera note: use these controls when the CRT should feel recorded by a camera rather than purely generated inside the comp.

GLITCH & INSTABILITY

Global failure controls

PARAMETER	WHAT IT DOES
Signal Loss (Bad Wire)	Introduces signal-loss behavior or unstable feed conditions.
Blue Screen on Signal Loss	Shows a blue screen instead of pure loss when the signal disappears.
Glitch Intensity (Master)	Acts as a master multiplier for all glitch controls.
De-Gauss (Trigger)	Triggers a degauss-style disturbance with geometry and color instability.
Glitch Time Jitter	Adds temporal jitter to glitch effects for a less periodic feel.
Audio Reactive	Uses the selected layer to modulate glitch intensity.
Audio Layer	Selects the layer whose luminance drives audio-reactive glitch behavior.

BAD CONNECTION / WIRING

Bad wire simulation

PARAMETER	WHAT IT DOES
Bad Wire Strength	Controls the overall severity of wiring failure behavior.
Wire Noise (Snow)	Adds unstable noise and snow from poor connection quality.
Wire Loose Contact (Dropouts)	Creates intermittent contact loss and short-duration dropouts.
Wire Fluctuation Speed	Controls how quickly the bad connection behavior changes over time.
Wire Seed	Changes the random pattern used by the bad-wire simulation.

Glitch note: the strongest results usually come from building a stable CRT first and then layering one failure family at a time instead of maxing multiple unrelated modules immediately.

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SYNC FAILURES

Hold, tracking, and lock instability

PARAMETER	WHAT IT DOES
Sync Tear Enable	Quick toggle for tear band behavior.
Vertical Roll	Quick toggle for rolling vertical hold failure.
Field Shift	Quick toggle for alternate-line field offset behavior.
Hum Bars	Quick toggle for slow moving hum bars.
RF Stripes	Quick toggle for diagonal RF interference stripes.
Ghosting	Quick toggle for multipath ghost image behavior.
Sparkle Lines	Quick toggle for intermittent bright line sparkles.
Sync Tear Strength	Controls the horizontal phase offset of tear bands.
Sync Tear Density	Sets the number of tear bands across image height.
Sync Tear Speed	Controls animation speed of the tear pattern.
Roll Speed	Controls the speed of vertical roll drift.
Power Ripple Strength	Adds slow moving power-ripple bars to the picture.
Ripple Frequency	Controls the density of ripple bars.
Ripple Speed	Controls the movement speed of ripple bars.
RF Strength (%)	Controls diagonal RF stripe interference intensity.
RF Frequency	Controls RF stripe density.
RF Angle (deg)	Sets the angle of RF stripes.
Ghost Strength	Controls the weight of the offset ghost image.
Ghost Offset X	Sets the horizontal offset of the ghost image.
Ghost Offset Y	Sets the vertical offset of the ghost image.
Field Shift	Sets the amount of alternate-line horizontal shift when field shift is active.
Sparkle Rate	Sets the probability of bright line sparkles appearing.
Sparkle Gain	Controls how bright sparkle lines become.
Sync Edge Chew Strength (%)	Creates chew or jag at the left sync edge.
Sync Edge Width (%)	Controls the width of the chewed sync band.

SIGNAL DEGRADATION

Composite, RF, and tape-style failures

PARAMETER	WHAT IT DOES
Mains Hum Bars Strength (%)	Adds power-supply hum bars across the frame.
Mains Hum Bars Frequency	Controls the number of hum bars over screen height.
Mains Hum Bars Speed	Controls movement speed of the hum bars.
Dot Crawl Strength (%)	Adds colored edge crawl from chroma-luma crosstalk.
Dot Crawl Frequency	Sets the relative subcarrier frequency of the crawl pattern.
Dot Crawl Speed	Controls temporal motion of the crawl.
Head Switch Noise (%)	Adds a lower-image tracking or head-switch noise band.
Head Switch Height (%)	Controls the height of the head-switch band.
Warp Strength (Waves)	Controls horizontal line displacement amplitude for wavy instability.

Warp Frequency Y	Sets the number of warp ripple cycles down image height.
Warp Speed	Controls the temporal drift speed of warp phase.
Warp Stripes X	Sets horizontal stripe density that modulates ripple amplitude.
H-Blank (%)	Sets horizontal blanking percentage.
V-Blank (lines)	Sets vertical blanking line count.
Retrace Leak Rate	Controls how much retrace leakage becomes visible.
Retrace Leak Gain	Controls the brightness of the retrace leak.
Signal Decoding Standard	Selects the decoding family used for color and signal reconstruction. `NTSC | PAL | SECAM | Component`
Comb Filter Quality (Rainbows)	Controls how well chroma/luma separation is handled.
Y/C Delay (Chroma Shift)	Offsets chroma relative to luma to create classic color misregistration.
Phase Error (Hue Shift)	Simulates hue rotation or phase instability in the color decode.
Luminance Breathing (Geometry)	Changes geometry scale or behavior based on brightness-driven stress.

CIRCUIT BENDING

Experimental signal destruction

PARAMETER	WHAT IT DOES
Bend Mode	Selects the circuit-bending algorithm. `Off` | `Invert` | `Solarize` | `Sync Mash` | `Feedback` | `Luma Fold` | `Chroma Warp` | `Digital Trash` | `Analog Shred`
Bend Amount	Controls the overall strength of the selected bend mode.
DC Bias (Brightness)	Offsets the signal before bending, useful for pushing into clipping or threshold regions.
Frequency Scramble	Destabilizes the bend response over frequency content.
Bend Pattern	Selects the modulation texture used by the bend mode.
Feedback Decay	Controls how quickly feedback-type energy decays over time.
Bend Frequency	Controls the spatial frequency of the bend modulation.
Bend Speed	Controls temporal speed of the bend modulation.
Glitch Mod X	Additional X-axis modulation control for experimental glitch behavior.
Glitch Mod Y	Additional Y-axis modulation control for experimental glitch behavior.
Swap Color Channels	Swaps or scrambles channels for decoder-chaos and miswired color behavior.

AUDIO

Generated electrical sound layer

PARAMETER	WHAT IT DOES
Audio Effects	Master on/off toggle for the audio synthesis layer.
Audio Safety Warning	Provides safety guidance for high-frequency generated content.
Master Volume	Controls overall output level of the generated audio.
Master Pitch	Shifts the pitch of the generated audio bed.
Mains Hum	Adds low-frequency power hum.
Flyback Whine	Adds a high-frequency flyback-style tone.
Distortion	Adds clipping and analog-stage saturation.
Lowpass Filter	Rolls off harsh harmonics in the generated sound.
Static Noise	Adds broadband hiss or receiver noise.

Audio safety: start quietly and keep flyback-style tones conservative, especially on headphones.

Popup values and discrete option appendix

CONTROL	OPTIONS
Mask Type	Dot Triad (Shadow) | Aperture Grille | Slot Mask
Mask Model	Classic (Overlay) | Realistic (RGB) | Grayscale
Tube Shape	Spherical | Cylindrical (Horizontal) | Cylindrical (Vertical) | Flat
Refresh Rate	Auto (Recommended) | NTSC 60 Hz | PAL 50 Hz | SECAM 50 Hz
Quality Preset	Low | Medium | High
Connection Type	RF (Coaxial) | Composite (RCA) | S-Video (Y/C) | RGB (SCART/BNC)
Mask Shape	Rectangle | Circle
Mask Mode	Transparent Outside | Black Outside

Background Mode	Transparent | Black Outside | Mirror (Reflection)
Shutter Type	Global | Rolling
Shutter Speed	1/60 | 1/90 | 1/120 | 1/180 | 1/250 | 1/320 | 1/500 | 1/1000 | 1/2000 | 1/4000 | 1/8000
Internal Resolution	Full | Half | Third | Quarter
Signal Decoding Standard	NTSC | PAL | SECAM | Component
Phosphor Emulation	P22 (Standard) | P31 (Green) | P4 (B&W) | Amber | White (P4) | P22 Slow Green
Bend Mode	Off | Invert | Solarize | Sync Mash | Feedback | Luma Fold | Chroma Warp | Digital Trash | Analog Shred

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TUBE PHYSICS

Hardware-accurate CRT electron gun and display behavior

These controls model the real electrical and optical behavior of CRT electron guns, phosphor screens, and deflection systems. Each parameter targets a specific physical phenomenon that contributes to the look and feel of real tube displays.

PARAMETER	WHAT IT DOES
Focus Breathing	Beam defocus scales with brightness, simulating space-charge bloom where hot highlights cause the electron beam to spread. Brighter areas become softer while dark areas stay sharp.
Vertical Bandwidth	Kell-factor blur that softens vertical detail, matching a real CRT's limited vertical resolution due to scan line structure. Simulates the ~0.7 Kell factor of analog displays.
Phosphor Unevenness	Per-channel persistence asymmetry matching real P22 phosphor chemistry. Red lingers slightly longer while blue fades fastest, creating subtle color shifts in motion.
Pincushion	Geometric barrel/pincushion distortion from the CRT's curved electron gun optics. Creates the characteristic pillow-shaped distortion visible at screen edges.
Grid Bias Drift	Slow, organic brightness wander from cathode bias instability. Simulates the gradual voltage drift in aging CRT circuits that causes the image to slowly brighten and darken.
Beam Diffraction	Electron scatter halo around bright areas. Creates a soft glow proportional to luminance that simulates how electrons scatter when striking the phosphor screen.
Tube Aging	Phosphor wear pattern simulating center burn-in with warm discoloration. Blue channel degrades fastest, creating a warm yellowish tint in heavily-used screen areas.
Magnetic Ripple	Sinusoidal displacement at mains frequency (50/60 Hz) from deflection yoke interference. Amplitude increases toward screen edges where magnetic field non-uniformity is greatest.
Dynamic Gamma	Automatic gamma shift driven by average picture level (APL), matching real CRT automatic brightness limiting (ABL). Bright scenes compress while dark scenes expand.
Channel Sag	Per-gun gain asymmetry under high-brightness load. Red sags most (12%), green moderately (8%), and blue least (4%), matching real impedance differences between electron guns.

Tube Physics note: these effects are subtle by design. Start with Focus Breathing and Pincushion for the most visible impact, then layer in Tube Aging and Channel Sag for worn-hardware character. All parameters are GPU-accelerated and integrated into 22+ presets.

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