STEP-BY-STEP TUTORIAL

RE7

The visual piano, explained line by line

The complete user guide to RE7, a software recreation of the Rutt-Etra Video Synthesizer: from the first image to MIDI control, from relief lifted by light to the waveform generators, from LFOs and ramps to the sequencer, from sound playing the picture to the final export.

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THE ORIGINAL MACHINE

In 1973, Steve Rutt and Bill Etra built an analog video synthesizer that deflects the scanning signals of a tube: the picture's brightness lifts the lines, oscillators and ramps distort them, and everything is played live like an instrument — “a visual piano”. This software takes up the principle, the controls from the RE-4 manual (Display Control Unit, waveform generators, ramp, audio interface) and the look of black-and-white images colorized afterwards. Throughout the guide, the box flags what comes from the period machine.

1 Getting started and a tour of the interface



Launching the software

Double-click **RE7.app**. At first launch, enter your licence key (one online activation, then nothing more). The window opens with the **sidebar** on the left and the **preview** on the right: the “Classic relief” preset already applies relief to the test generator's sphere pattern. The image moves: the sphere is lit as it rotates.

The sidebar

At the top: the **Presets** menu (13 built-in settings), the **Setting title** field + **Save**, and **My settings** (your JSON files) with **Delete**. Then five tabs that follow the signal order:

Tab	Modules
SOURCE	Video input · Signal · Mesh
RASTER	Relief · Display controls · Non-linear distortions
WAVES	Waveform generator 1 and 2
MOTION	LFO 1-3 · Ramp 1-2 · Audio interface · Sequencer · Gestures
OUTPUT	Colorizer · Phosphor · Re-scan camera

The transport bar



Fig. 1 — Open… (video), Image…, Camera, Play / Pause, ♪ Audio, ● REC, Export…, Output, MIDI; on the right ↶ ↷, Reset, About.



*Fig. 2 — The timeline of a loaded video: position, duration, **[In** and **Out]** points (playback loop and export range), ✕ to clear the range.*

Knob conventions — essential to know

Gesture	Effect
Drag the slider	Sets the value continuously.
Double-click the label	Back to the parameter's default value.
Click the number	Keyboard entry: `Return` confirms (clamped to the range), `Esc` cancels.
◎ **dot** left of the label	MIDI Learn: click, move a control on the controller, it's assigned (chap. 9).
`space` · `⌘Z` / `⇧⌘Z`	Play / pause · undo / redo (full snapshots).

> 💡 **Reset** brings back a flat raster, with no relief or modulation: the ideal starting point. Presets, on the other hand, *keep the loaded source*.

2 Source, signal and mesh

Video input — what goes into the machine

The **Video input** module (Source tab) offers four inputs:

- **Test**: six synthetic patterns — Bars, Sphere (lit while rotating), Checker, Ramp, Text (the field next to it), Circles. Perfect for understanding each control.
- **Video**: **Open a video…** (or the Open… button in the transport). Playback loops; the **[In** / **Out]** points on the timeline bound the loop and the export.
- **Image**: a photo, a logo, a title card — still, but everything else moves.
- **Camera**: the live webcam (macOS asks for permission).

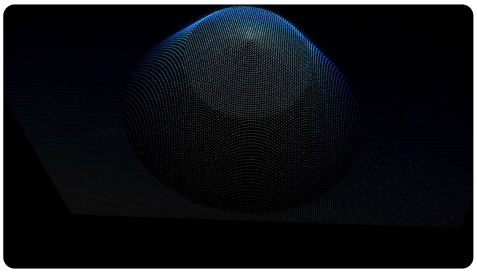
Framing: *Fit* keeps the whole image within the output format, *Fill* crops it, *Stretch* distorts it.

Signal — the RE-4's *Intensity*

Control	Effect
Gain	Amplifies luminance before the relief: more gain, more relief.
Threshold	Cuts the dark areas: below it, lines stay flat and unlit.
Invert (negative)	Dark areas lift, bright ones fade out.
Intensity	Brightness of the lines (the beam's light).
Base glow	Minimum brightness of the lines, even in black — the raster stays visible.

Mesh — the raster itself

Lines 0°: television's horizontal scan lines. **Lines 90°**: the scan turned a quarter turn, like the RE-4's *Scan Rate 0°/90°* switch. **Grid**: both at once. **Points**: every sample becomes a luminous dot — the point cloud.



Lines (8 to 720) and **Points per line** (16 to 1024) set the mesh resolution. Few lines = an unapologetic Rutt-Etra look; many = an almost continuous surface. **Thickness** offsets copies of each line by one pixel: bolder, brighter strokes.

ON THE MACHINE

The RE-4 accepted any video signal: a studio camera, a tape deck, a test-pattern generator. The “hi-con camera” aimed at a high-contrast card was the favorite source: simple, very bright shapes give the most legible reliefs. The generator's *Text* pattern is its equivalent.

Exercise — the first mountain

Source → **Test**, **Sphere** pattern. Raster tab: **Vertical relief** at 0.6. Back in Source: raise **Gain** to 1.5 and watch the sphere rise; raise **Threshold** to 0.3 and the foot of the sphere flattens. Switch to **Points**, then **Grid**: same geometry, three ways of writing it.

3 Relief and display controls



Relief — the very principle of the Rutt-Etra

Vertical relief: each mesh point rises in proportion to the luminance it reads. **Depth relief**: it moves toward the camera. The two combine; with a **Tilt X** (high-angle view), depth relief becomes legible as a volume.

Display controls — the *Display Control Unit*

Control	Effect
Width / Height	Scale of the raster. **Negative** = inverted (mirrored) image. Height close to **0** = all lines squashed onto a single one: the RE-4's famous “single line”, where relief alone still draws the image.
Position X / Y	Moves the raster within the frame.
Depth (camera)	Distance of the virtual camera: small = strong perspective.
Tilt X / Y	Tilts the raster plane around the horizontal and vertical axes (the classic high-angle view = negative Tilt X).
Rotation Z	Rotates the raster in the screen plane.
Continuous rotation	Permanent rotation speed around the vertical axis.
Scroll X / Y	Slides the *source* under the mesh (the RE-4's *Horiz. Center*): the relief seems to travel across the image.

Non-linear distortions

Twist twists the raster around the vertical axis; **Bend** rolls it into a cylinder; **Spherize** inflates it into a ball. These are the non-linearities an operator got by patching multipliers — here, three knobs.

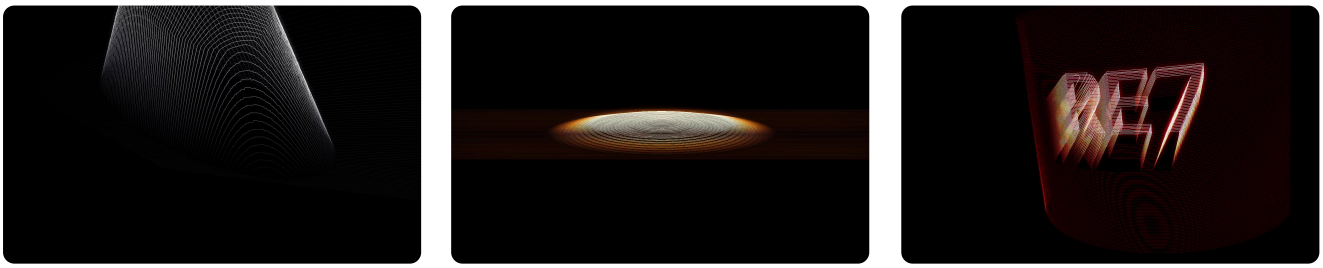


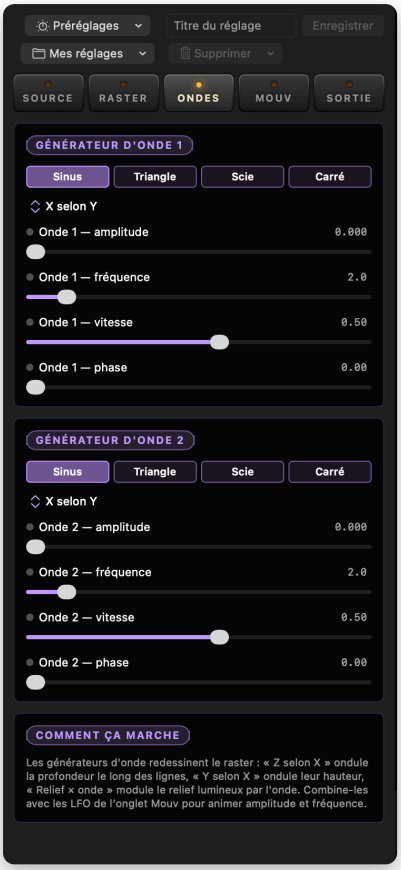
Fig. 3 — “P4 mountain” (strong relief, high angle), “A single line” (height ≈ 0), “Cylinder” (bend + text).

🎛 Exercise — the tilting shot

Load a video. **Vertical relief** 0.5, **Tilt X** –35°, **Depth (camera)** 2.5: a landscape of lines seen from above. Bring **Height** down toward 0.05: only a horizon line animated by light remains. Push it to –1: the image flips over. Double-click the labels to set everything straight again.

💡 The **Visual piano** preset combines depth relief, continuous rotation and a depth colorizer; **Inversion** shows negative width and height.

4 Distortions and waveform generators

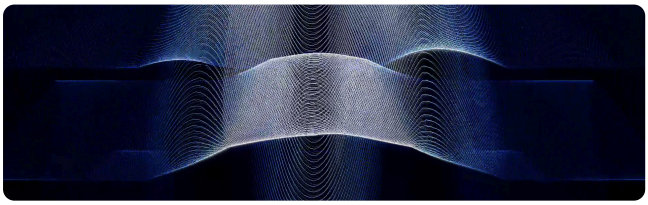


The **WAVES** tab holds two identical **waveform generators** — the RE-4's *Waveform Generators*: a periodic signal that *redraws the raster* along an axis.

Control	Effect
Shape	Sine (round), Triangle (folds), Saw (teeth), Square (steps).
Axis	What the wave moves, and according to what (table below).
Amplitude	Extent of the displacement (0 = wave inactive).
Frequency	Number of periods across the raster.
Speed	Travel of the wave over time (0 = frozen).
Phase	Starting offset — useful to desynchronize the two waves.

The nine axes

Axis	What moves
X along Y	Each line slides left / right according to its height: the raster ripples like a flag.
Y along X	Lines rise and fall along their length: waves.
Z along X / Z along Y	Depth ripple, legible when tilted: corrugated iron.
Radial Z	Ripples on water, from the center.
X / Y accordion	Lines or points bunch up and spread out periodically.
Swirl	Rotation increasing with distance from the center.
Relief × wave	The wave modulates the *relief* itself: light lifts more or less depending on position.



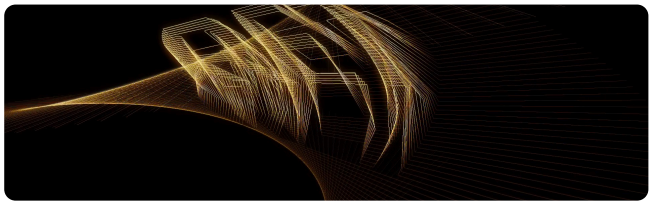


Fig. 4 — "Waves": Y along X + Z along Y, tilted; "Twist": distortion + wave on the text.

Exercise — the flag

Reset, Source Test → Checker. Wave 1: **X along Y**, Sine, Amplitude 0.15, Frequency 2, Speed 0.5. Wave 2: **Z along X**, Amplitude 0.3, Frequency 3, Speed 0.3. Raster: Tilt X –30°. The checker floats; Wave 1 in Square = a pleated flag.

The waves set the *shape*; to animate their amplitude over time, route an LFO onto it (chap. 5) — that is what the "Waves" preset does.

5 LFOs and ramps



The **MOTION** tab gathers the *Animation Control Modules*. They never modify your settings: they are applied to a copy at render time, live as well as on export. So you can switch them off and find your exact values again.

LFO 1, 2, 3

1. **On** switches the module on.
2. The **target** menu (◇) lists every knob of the instrument: pick one, for example *Tilt Y*.
3. Shape: **Sine**, **Triangle**, **Square** or **Random** (a new value every period).
4. Combination mode: **Add** (oscillates around your value), **Multiply** (your value × [0-1]: pulses from zero), **Replace** (sweeps the whole range, your value is ignored).
5. **Speed (Hz)** from 0.02 (one period every 50 s) to 8 Hz; **Depth**: the extent, as a fraction of the range.

Ramp 1, 2 — the *Ramp Generator*

A ramp takes a parameter from a **Start** to an **End** (fractions of its range: 0 = minimum, 1 = maximum) over a **Duration** (0.1 to 60 s), with a *Linear*, *Smooth*, *Accelerate* or *Decelerate* curve. Three behaviors: **Once** (the ramp stays at the end), **Loop**, **Ping-pong**. ▶ **Trigger** starts it (or restarts it), **Release** stops it; a MIDI button can trigger it (chap. 9). On export, active ramps start at frame 0.

Exercise — breathing

"Classic relief" preset. LFO 1: On, target **Vertical relief**, Sine, **Multiply**, 0.25 Hz, depth 1: the relief breathes. LFO 2: target **Rotation Z**, Triangle, Add, 0.1 Hz, depth 0.1: a gentle sway. Ramp 1: target **Depth (camera)**, start 1, end 0.3, 12 s, Decelerate, Once → **Trigger**: a slow push-in.

ORDER OF APPLICATION

Sequencer → gestures → ramps → LFOs → audio. An LFO in *Replace* therefore overwrites what a ramp has put on the same target; in *Add*, they accumulate.

ON THE MACHINE

The RE-4 had only one ramp generator and two oscillators, hand-patched into a summing amplifier. RE7's three LFOs and two ramps, assignable to *any* knob, are the modern patch bay.

6 Sound plays the picture

The **Audio interface** module (Motion tab) analyzes a sound in four bands — overall **Level**, **Bass** (< 250 Hz), **Mids**, **Highs** (> 2 kHz) — and routes them to three parameters. Nothing is active until the ♪ button is lit.

Choosing the sound source

Source	When to use it
Mic	Live performance: voice, instrument, ambience. macOS asks for permission the first time.
Video sound	The loaded video's soundtrack drives its own relief. The sound keeps playing through the speakers.
Audio file	An mp3, m4a, wav or aiff (**Open…**) played in a loop, following Play / Pause. Ideal for a music video: it is the only source replayed *identically on export*, where the file is also mixed into the movie.

1. Choose the source, then click ♪ **Audio reactivity** (or ♪ **Audio** in the transport). The four meters come alive.
2. Set the **Sensitivity** so the meters rise without saturating on the loud beats.
3. **Routing 1**: On, **Bass** band, target **Vertical relief**, **Add**, amount 0.6. The kick drum lifts the landscape.
4. **Routing 2**: **Highs** → **Glow**, amount 0.4: the cymbals make the phosphor shine.
5. **Routing 3**: **Level** → **Tilt X**, **Multiply**: the plane tilts with the overall energy.

Amount is bipolar: negative, the sound *attenuates* the parameter. In *Multiply*, the knob's value is multiplied by the band's level (silence = 0).

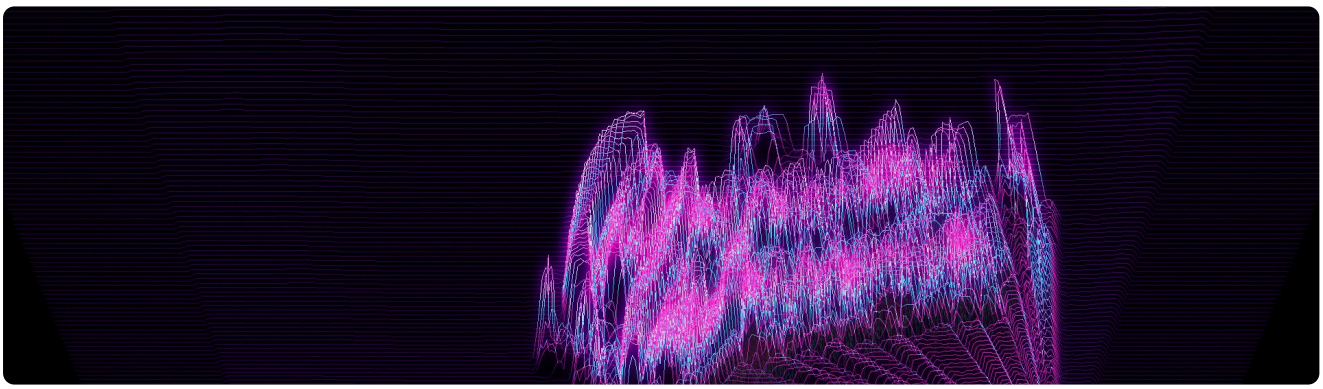


Fig. 5 — The “Audio reactive” preset on a video: relief and color driven by the bands.

> ⚠ **ON EXPORT**
>
> The mic and the video sound are not applied to the offline render (they cannot be reproduced frame by frame); record those performances with ● **REC**. The **audio file**, however, is analyzed frame by frame: the exported movie is strictly identical to the preview.

> **ON THE MACHINE**
>
> The RE-4's *Audio Interface* converted an audio signal into a control voltage sent into the summing amplifier: music deflected the scan. RE7's three per-band routings are the filtered version.

7 Sequencer and gestures

The step sequencer

Eight **steps** = eight complete states of the instrument (every knob except the source), played at tempo. Each step has two buttons: **Store** snapshots the current setting into the step, **Recall** loads it back into the knobs. A filled dot marks a stored step; an empty step is skipped.

1. Set a first state (for example Classic relief), **Store** on step 1.
2. Change the palette, the tilt, a wave… **Store** on step 2. Continue up to 4 steps.
3. **BPM** 120, **beats per step** 4: one step every two seconds.
4. **Glide** at 0.5: each step blends into the next over half its duration instead of jumping. Discrete values (palette, orientation) switch at the halfway point.
5. ▶ **Start the sequencer**. The active step lights up; ■ **Stop** hands control back without touching the knobs.

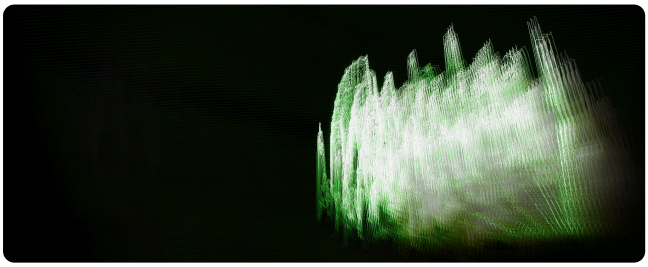
> 💡 **ON THE CONTROLLER**
>
> With the nanoKONTROL2 mapping (chap. 9), the **S** buttons recall steps 1-8 and the **M** buttons store them; **Cycle** starts / stops the sequencer. On export, the sequencer starts at step 1 on frame 0.

Gestures — automation by hand

The **Gestures — automation** module records everything you do to the knobs, at 30 Hz, and replays it in a loop.

1. • **Record**: play your movement — a tilt going up, a twist setting in, a palette changing. Click again to stop.
2. **Replay: on** replays the gesture in a loop on top of your settings; *off* keeps it in memory without applying it.
3. **Save to a file…** / **Load a file…**: gestures are JSON files in `~/Library/Application Support/RE7/Gestures/`. **Clear** empties the memory.

A replaying gesture is **applied on export**, from its beginning at frame 0: the most natural way to “play” a final render. In generative mode, the proposed export duration becomes that of the gesture.



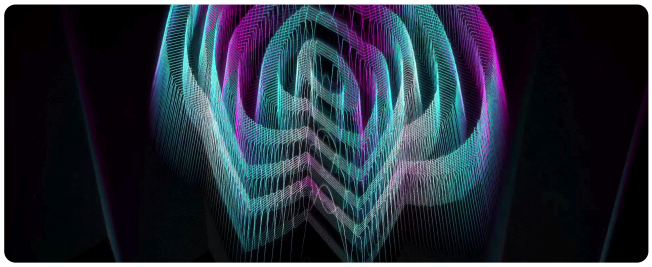


Fig. 6 — “Trails” (persistence) and “Visual piano” (depth colorizer): two steps of a possible sequence.

8 Colorizing — the Videolab, the phosphor, the camera



The Rutt-Etra produced black and white; color came afterwards, at the *Videolab*, through a colorizer that assigned a hue to each gray level. The **OUTPUT** tab reproduces that chain.

Colorizer (Videolab)

Control	Effect
Palette	Green phosphor, P4 white, Amber, Blue (the period tubes); Chrome, Rainbow, Neon, Fire, Ice, Peacock, Purple, TV pastel.
Color by	*Intensity*: color follows the light of the lines. *Depth*: it follows the depth relief — the volume reads in color.
Bands	Quantizes the palette into N steps (0 = continuous): the “poster” look.
Hue / Hue rotation	Shift of the palette, fixed or rotating over time.
Saturation / Brightness	Global output settings.

Phosphor

Control	Effect
Glow / Glow radius	Halo around the lines, like an overexposed tube.
Persistence	Previous frames fade slowly: trails.
Echo zoom	Each echo is slightly enlarged (> 1) or shrunk: tunnel.
Echo hue	The echoes drift in color.

Re-scan camera

The monitor was re-shot: the **Format** menu (1920×1080, 1280×720, 4:3, PAL, NTSC, square, vertical) sets the output size, used by the preview, REC and export. **Scanlines**, **Noise**, **Vignette**, **Tube curvature**, **Gamma** and **Background level** (a black that is never quite black) give the period image.

🎛 Exercise — the phosphor tunnel

“Wire grid” preset. Colorizer: **Color by Depth**, **Peacock** palette, Bands 6. Phosphor: Persistence 0.85, **Echo zoom** 1.02, Echo hue 0.03. Camera: Scanlines 0.3, Vignette 0.4. Start a slow Continuous rotation in Raster.

> ⚠ **CAUTION**
> High Persistence + strong Glow can run away toward white: lower one of the two, or reduce Intensity.

9 Playing with a MIDI controller

Plug in a USB-MIDI controller: the **MIDI** button in the transport shows a green dot and opens the configuration window. Hot-plugging is handled.

MIDI Learn

1. Click the ◎ dot to the left of a knob: it blinks, waiting.
2. Move a fader or knob on the controller: the assignment is made and saved immediately.
3. For an **action** (play, REC, trigger a ramp, recall / store a step, next preset, gestures, reset…), use the *Actions* list in the MIDI window and press a button on the controller.
4. **Pickup mode**: a fader only takes over when it *crosses* the current value — no jump when switching presets.

Mappings live in `~/Library/Application Support/RE7/midi-mappings.json`.

One-click Korg nanoKONTROL2 mapping

The **nanoKONTROL2** button in the MIDI window loads the factory mapping below (the controller's default CC mode):

Control	1	2	3	4	5	6	7	8
Faders	Vertical relief	Depth relief	Tilt X	Tilt Y	Width	Height	Intensity	Persistence
Knobs	Wave 1 ampl.	Wave 1 freq.	Wave 1 speed	Wave 2 ampl.	Wave 2 freq.	Wave 2 speed	Glow	Twist
S	Recall sequencer step 1 … 8							
M	Store step 1 … 8							
R	Ramp 1	Ramp 2						

Transport	Action	Transport	Action
▶ Play	Play / pause	● Rec	REC on / off
■ Stop	Gestures: record / stop	◀◀ Rewind	Reset (flat raster)
Cycle	Sequencer: start / stop	Track ◀ / ▶	Previous / next preset

> 💡 **PLAYING THE INSTRUMENT**
>
> Faders 1-2 (relief) and 3-4 (tilts) in the left hand, wave knobs in the right: that is the “visual piano”. Record the performance with ● **REC**, or capture it as a **gesture** (chap. 7) to export it later in ProRes.

> 📼 **ON THE MACHINE**
>
> The RE-4 was played from the panel knobs, and by “external control”: voltages from an audio synthesizer, a sequencer or a computer. MIDI is the 2026 version of those control cables.

10 Recording, exporting, saving

● REC — the live performance

● **REC** asks for a .mov file, then records the output as you see it — gestures, MIDI, mic included — at a constant frame rate. ■ **Stop** finalizes the file. It is the performance tool: what is played is kept, with no duration limit.

Export… — the frame-by-frame render

Export recomputes every frame offline, losing nothing, at the exact frame rate. LFOs, ramps (triggered at frame 0), sequencer (step 1 at frame 0), replaying gestures and audio file are replayed **identically**: two exports of the same setting give the same movie.

Situation	Frame rate and duration	Sound
A **video** is the source	Those of the video, **[In** / **Out]** range respected	Original sound copied
Test, image or camera (**generative** mode)	24 / 25 / 30 / 60 fps, free duration (that of the gesture if replay is on)	The audio interface's audio file, if active

Panel options: **Codec** H.264 (Low / Medium / High quality) or **ProRes 422 / 4444** for editing. Progress shows in the transport, with **Cancel**.

> 💡 **REC OR EXPORT?**
> Performance with mic or video sound → **REC**. Music video with an audio file, or a clean ProRes render → **Export**, after capturing the movements as a gesture.

The output window

Output opens a window with no interface, to drag onto a second display (projector, stage monitor) or capture in OBS; `^⌘F` makes it full screen. Preview and output share the same render.

Presets and My settings

- The **Presets** menu loads one of the 13 built-in settings (Classic relief, P4 mountain, Visual piano, A single line, Inversion, Wire grid, Point cloud, Twist, Cylinder, Trails, Audio reactive, Waves, Flat raster) while *keeping your source*.
- Type a **Setting title** and **Save**: the complete state — knobs, LFOs, ramps, audio routings, sequencer steps — becomes a JSON file in `~/Library/Application Support/RE7/Presets/`, listed in **My settings**.
- A named setting appears in the sidebar; "· customized" flags that it has been modified since.

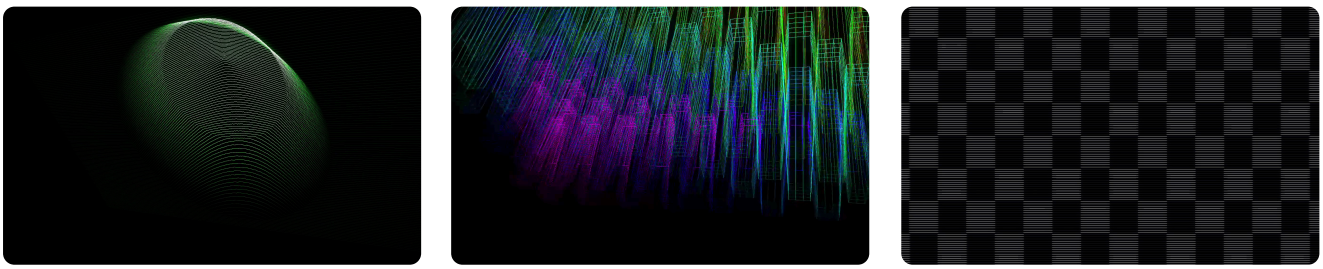


Fig. 7 — Three presets: "Classic relief", "Wire grid", "Flat raster" (the Reset).

A Appendices

Modulatable parameters (targets for LFOs, ramps, audio, MIDI)

Module	Parameters
Signal	Gain · Threshold · Intensity · Base glow
Mesh	Lines · Points per line · Thickness
Relief	Vertical relief · Depth relief
Display controls	Width · Height · Position X · Position Y · Depth (camera) · Tilt X · Tilt Y · Rotation Z · Continuous rotation · Scroll X · Scroll Y
Distortions	Twist · Bend · Spherize
Waves 1 and 2	Amplitude · Frequency · Speed · Phase
Colorizer	Bands · Hue · Hue rotation · Saturation · Brightness
Phosphor	Glow · Glow radius · Persistence · Echo zoom · Echo hue
Re-scan camera	Scanlines · Noise · Vignette · Tube curvature · Gamma · Background level

Command line

```
RE7 --render input.mp4 output.mov [preset]                  # video → RE7 movie, sound copied
RE7 --render-gen output.mov [seconds] [preset] [pattern]    # generative 60 fps, pattern 0-5
RE7 --open file.mp4 [preset]                                # interface with the video loaded
RE7 --presets | --licence "<key>" | --machine-id
```

Variables: `RE7_LANG=fr` (French interface; English by default), `RE7_AUDIO=file.mp3` (audio file applied to renders), `MESCALINA_LICENCE` (token for renders without the interface). The preset is given by number or by the start of its name.

Files on disk

Everything lives in `~/Library/Application Support/RE7/`: **Presets/** (My settings), **Gestures/** (gestures), **midi-mappings.json** (MIDI). Readable JSON files, copyable from one machine to another.

Troubleshooting

Symptom	Likely cause / fix
The image is flat, no relief	Vertical and depth relief at 0 (Reset), or Threshold too high, or Gain at 0.
A knob moves by itself	An LFO, a ramp, an audio routing or a replaying gesture is driving it (Motion tab). The modules do not overwrite your value: switch them off to get it back.
White screen that saturates	Persistence + Glow + Intensity too high; lower Persistence first.
Nothing reacts to sound	♪ button off, Sensitivity too low, or no routing On. With the “file” source, choose a file with Open….
The export has no audio reactivity	Normal for mic and video sound; use an audio file or record with REC.
The MIDI controller does not respond	No green dot on the MIDI button? Replug it. In pickup mode, cross the current value first.
The camera or mic stays black / silent	Permission denied: System Settings → Privacy & Security.