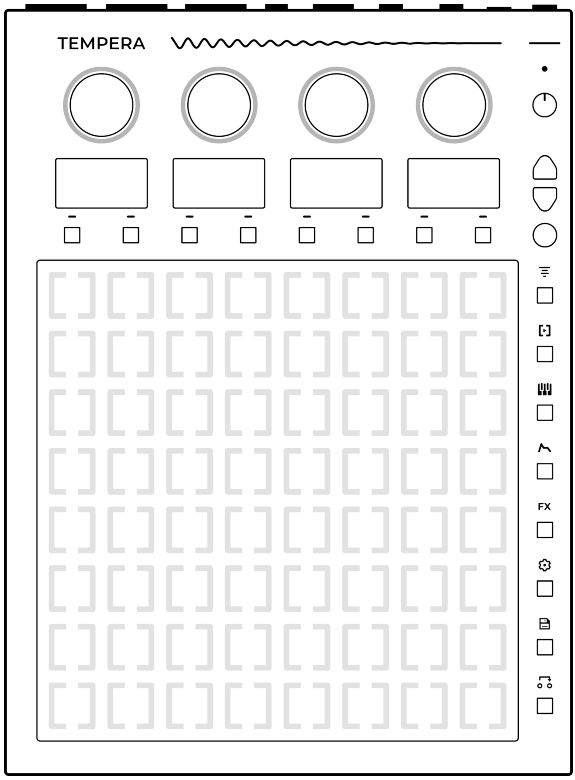
TEMPERA

Owner's Manual



beetlecrab.audio

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The most recent version is available at beetlecrab.audio.

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1 INTRODUCTION

Tempera is a multi-sample, 16-voice polyphonic granular synthesizer.

You can think of it as eight parallel stereo tape tracks, laid in columns next to each other, forming a kind of two-dimensional tape surface. Your fingers act as generators (known as *Emitters*) for one or many tape heads (referred to as *Grains*) riding across the audio surface.

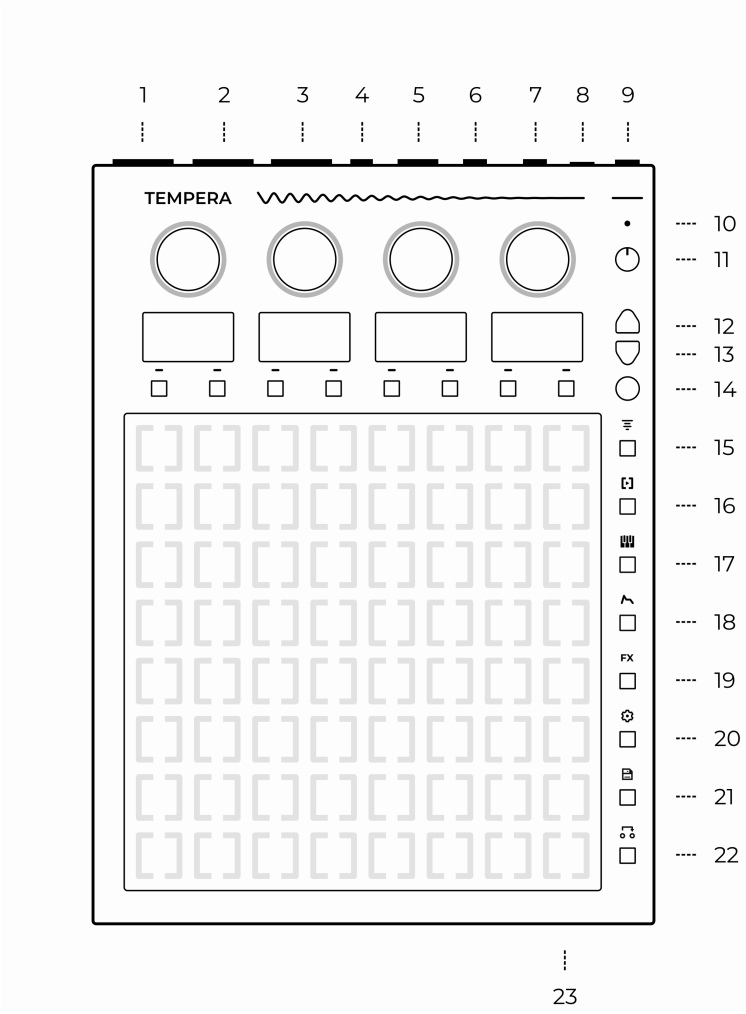
This main control interface – the touchgrid – is a fully polyphonic touch sensitive surface on which emitters are laid, which in turn produce streams of grains.

Tempera can be many things: a percussive drum bed, a pad station, sampler, granular cloud generator, an ambient machine, remix and sample-chopping instrument, recorder, an accompaniment to other instruments, a procedural composition tool, a sample wrangler, a tempo-synced live grain FX processor, an in-the-box resampler.

Above all, it can be the companion to wherever your music takes you.

This manual will walk you through Tempera's various functions and how to use them, as well as some tips and answers to frequently asked questions.

2 LAYOUT



1. 6.35 mm mono left audio or stereo headphones output – careful, the outputs can be very hot (up to 13 dBu or 10 Vpp)
2. 6.35 mm mono right audio output
3. 6.35 mm stereo audio input
4. USB host
5. USB device
6. TRS MIDI out
7. TRS MIDI in
8. Power input (12V/2.5A DC center positive) – please use the provided power supply for best performance
9. Power switch
10. Onboard microphone
11. Volume knob
12. Page up
13. Page down
14. Context switch (Round button)
15. Tracks (page 12)
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17. Overlay Keyboard (page 26)
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Each of the four main knobs' function is determined by menu navigation and associated with the display below it.

There are two buttons per each display, and their function changes depending on context. The function is always displayed above them.

The **Round button** serves several purposes:

1. Hold it to reveal an alternate context for buttons below the displays.
2. Hold it while turning a knob to move through the parameter faster.
3. When recording, press it to stop recording.

The column of buttons to the right of the touchgrid are navigation buttons that take you to various places inside Tempera, and the **Up** and **Down** arrows navigate across the menu pages. There are little dots on the right-most display showing the current page out of a total.

Tips

- Certain actions, like saving and loading canvases or detecting pitch on a sample are performed in the background. When the background task is busy, the knobs will light in a moving wave. This is always initiated by you and never spontaneously on its own. Tempera is fully usable during that time, however do not turn off the power when saving canvases or samples.
- Most parameter values are shown between 0.00 and 1.00. The internal resolution is however much higher and only the displayed value is truncated to two decimal places.

3 GETTING STARTED

When Tempera starts for the first time, you are greeted with the **Initial canvas**. Before making sound, check your **Output volume** and set it to around 25%. You can adjust as necessary later.

On the touchgrid, you can see that there are a few color cells, and two white rows at the bottom.

The color cells are **Emitters** that are already pre-placed in the canvas. Each placed emitter is one of the four primary colors. If a placed emitter is e.g. blue, then it behaves according to the *Blue emitter* settings.

The two white rows at the bottom are the **Overlay Keyboard**. In the initial canvas, it a single octave of a chromatic scale starting with C4.

Let's make some sound: place and hold your finger on any one cell in the Overlay Keyboard region. You are now playing a note and all emitters started triggering grains depending on their location on the grid and their configuration. Keep holding the note.

You can see that some emitters are triggering rhythmically, while the blue emitter has some kind of rotating motion. You will learn how to configure emitters for different uses later in this manual in the **Emitters** and **Modulators** sections.

Release the note. You could see that one primary color, red, was not placed anywhere. Hold a note one more time, and this time with your other hand, place your finger somewhere in the right half of the grid. You can hear that the red emitter is configured to play a denser cloud of grains.

Move your emitter finger around to explore the sound at each location of the canvas. Try placing multiple fingers at different

places at once to find interesting blends. Try playing multiple notes as well.

Release the notes again.

Try moving the original placed emitters around, but in order to experiment with emitter placement, enable keyboard hold so you can use both hands for emitters: go to the **Overlay Keyboard** menu, and then press **Hold** below one of the displays. This activates a sustain pedal on the overlay keyboard.

To remove the pre-placed emitters, go to **Emitters** menu, and **Select** the blue emitter. Place your finger on a grid cell where the blue emitter is and it will be removed.

Play a note one more time, and this time release your finger from the overlay keyboard, the note will keep playing.

Place your finger on a grid cell where there isn't an emitter yet, a **Selected** (currently blue) emitter will be placed there.

Experiment with emitter placement for a while, play a few more notes and chords. Then go ahead with the rest of this manual.

Tips

- If you have a different canvas loaded after start up, you can find the initial canvas in System folder, at the very end (named **Initial.canvas**).
- You can play a note from the internal overlay keyboard, or from an external MIDI keyboard connected via MIDI TRS or USB.

Canvas

A full patch for Tempera is called a *canvas*. It contains eight audio samples (tracks), all emitters' and modulators' configuration, the configuration of the Overlay Keyboard, effects and macros, as well as optionally pre-placed emitters.

Tempera comes with a suite of canvases designed specifically for it, with its unique workflow. There is also an online gallery where you can share and download canvases, see **Sharing your canvas** (page 44) for more details.

When you load a canvas, try playing a note to get an idea of what it is, and then modify it to your liking. Some canvases are melodic, other are percussive, and the rest are anything in between.

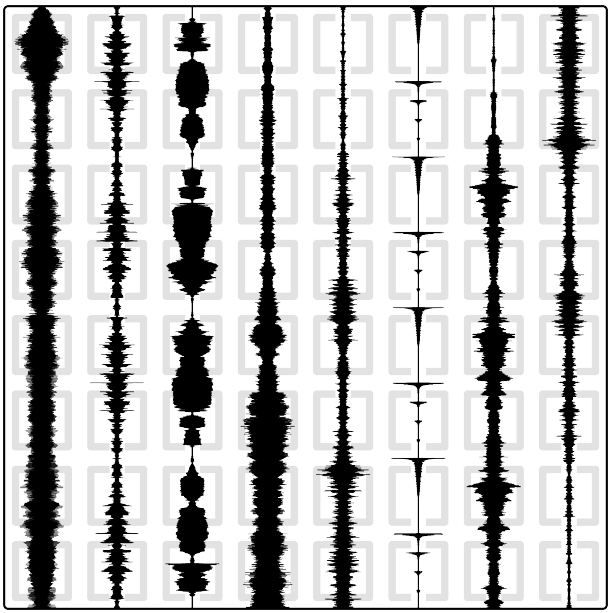
After you explore the built-in canvases, it's time to make your own!

Tips

- When you make your own canvas, save it directly onto an SD card and share it around!
- Try combining samples from different canvases.
- To start with a clean slate, load the **Empty.canvas** inside the **System** folder, near the end of the list.

4 TRACKS

Each column on Tempera's touchgrid represents a track, going from top to bottom.



Each track contains a loaded or recorded audio sample, which can be up to ~11 seconds long. When a longer audio sample is loaded, it is possible to select which slice of it to load.

Tempera supports many common audio formats as samples, stores them internally as 16-bit 48 kHz, and processes them with 32-bit floating point math.

When you play a note, all placed emitters start emitting grains which ride on the tracks and play audio from their locations. For the engine to know how fast or slow the playback of each sample needs to be in order to match the note being played, each track needs to have its tuning configured. This is the **Base frequency** of the sample when played at its original speed in the **Hz mode**.

For example, if a base frequency of a sample is 440 Hz and you play the A3 note, Tempera knows to play the grain at half speed, since A3 is at 220 Hz. If you don't know the tuning of the original sample, try using the **pitch detector**.

In addition to tuned samples, it is possible to load percussive ones. But in that case the sample playback needs to match not with your note played, but with your BPM tempo. For this, turn the track into **BPM mode**, and when any note is played, the track playback will slow down and tune down, or speed up and tune up, to match your global BPM. Each track in the BPM mode can have its **Base tempo** configured so it is possible to load percussive loops of different BPMs and they will be all synced perfectly.

Frequently Asked Questions

- *What is the exact maximum sample length?*
  The total track length is based on 2^{20} for programming convenience, resulting in 1048576 sample points.
  With 48 kHz stereo audio, this gives 10.92266667 seconds.

Tracks menu

In the main **Tracks** menu, the names and volumes of tracks are shown on the displays above them, in groups of two. Turning the corresponding knob tweaks the volume of the selected track.

Each display has two context actions:

- **Switch** which of the two tracks is selected for editing and volume change
- **Edit** the selected track

Holding the **Round button** reveals alternate context:

- **Rec** arms a track for recording. Recording begins the moment input audio crosses the **Threshold** set in **Settings** or on the next half note when **Cue rec** is activated. When recording, pressing the **Round button** again stops recording.

Tip

See **Recording** (page 48) and **Live grains** (page 50) for an overview of the recording workflow.

Editing a track

The **Edit** page of each track shows the track's details and waveform and has the following actions:

- **Load** a sample from the **Sample browser**. See **Loading a sample into track** (page 16) for details.
- **Rename** the track for display and exporting as a file.
- **To Hz** and **To BPM** toggles the tuning representation between the Hz mode with base frequency and the BPM mode with base tempo.
- **Snap** adjusts the tuning to the closest note (e.g. 441.3125 Hz becomes 440 Hz, 120.1 BPM becomes 120 BPM).
- **Play** previews or listens to the track.
- **Trim** allows to cut and normalize the sample in the **Waveform preview**. See **Trimming a sample** (page 18) for details.
- **Delete** discards the track contents.
- **Export** saves the audio as a new file in the Sample browser.

Holding the **Round button** reveals alternate context:

- **Detect** the pitch of the sample. It is possible to enter the note/frequency manually by turning the knob (turn faster by holding the round button).
- **Copy** and **Paste** the track to/from a clipboard.
- **< Swap** and **Swap >** moves the the track to the left or right.

Tips

- You can press the **Tracks** button twice to go quickly to last edited track.
- Press the **Up** and **Down** arrows to scroll between tracks.

Loading a sample into track

Tempera organizes audio samples in folders and files on the internal or external memory.

To load a sample into a track:

1. Go to **Tracks** .
2. Choose the track you want to load a sample into and press **Edit**.
3. Press **Load** to activate the **Sample browser**.
4. Choose a sample from either the internal or external memory and press **Load**.

   When the waveform is now shown across all 4 displays, gray vertical bars are hinting at where the cell boundaries will be. If you're loading a percussive sample, you will likely want to line the markers with sample transients.
5. Adjust the **< Start >** and **< End >** points using the first and last encoders and press **Load**. Scroll faster by holding the Round button.

Once the sample is loaded into the track, don't forget to adjust its **base frequency** or **base tempo**.

Batch loading of samples

In addition to loading individual sample files, you can load an entire folder at once by pressing **Load** at the folder level.

This loads alphabetically sorted samples from that folder into the currently edited and all subsequent tracks (up to eight tracks can be loaded at once). The batch-loaded samples are automatically trimmed to the maximum length.

Tips

- Tempera can set the sample tuning automatically if you include the base frequency or tempo in its file name, for example *Bells_533Hz.wav* or *DrumGroove130BPM.wav*.
- After you load a sample from the Sample browser but before it's committed into a track, you can press the **Up** and **Down** buttons to quickly load the next or previous audio files in the folder.
- While Tempera will accept and play any audio, here are a few general recommendations for making your own samples:
  - If you're making a harmonic sound (such as a synth waveform), try keeping the base sample to a lower tuning, such as 110 Hz or 220 Hz.
  - When making sequenced sounds, it's nice if the audio sample is neatly divisible in eight equal length slices. This will make it align well with the touchgrid cells.
  - When making a sample with an embedded melody that's meant to be played with a keyboard, it's usually a good choice to have the melody run in "safe" notes, such as octaves and fifths. For a bonus challenge: try making a sample melody more with its timbre and less with the pitch.

Trimming a sample

The **Waveform preview** allows to edit a sample which has been already loaded into a track:

1. Go to **Tracks** .
2. Choose the track you want to edit and press **Edit**.
3. Press **Trim** to enter the waveform preview.

Then, on the Trim page:

- Adjust the sample **< Start >** and **< End >** points by turning the first and last encoders.
- **Play** the sample between the start and end points.
- Normalize the sample by long-pressing the **Norm** button.

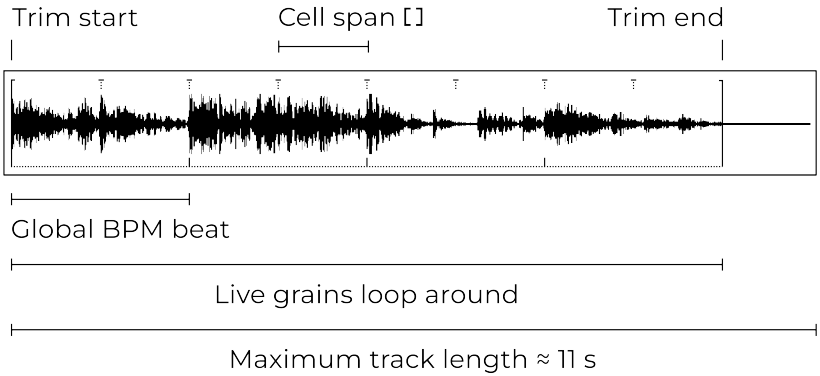
Holding the **Round button** reveals alternate context:

- **Rev** reverses the sample so it plays backwards.
- **Trim** cuts the sample contents before and after the start and end points.

Tip

The **Replace** recording mode in **Settings** has a switch to enable automatic **Trim** when **Recording** (page 48) into a track.

The Waveform preview shows vertical markers which move when changing the start and end points. Markers on the top correspond to the eight track cells' boundaries while markers on the bottom represent half notes. You can use them to align the track with tempo:



Frequently Asked Questions

- *Why does Tempera export audio files as .flac?*

  FLAC is an open lossless compression algorithm, which makes audio around 50% smaller at zero loss of quality. Think of it like a zip file, and not like an mp3.

- *After saving a canvas, can I move or delete the original audio files used as samples?*

  Yes, the saved .canvas file is fully self-contained.

- *When previewing/auditioning audio samples, the volume is too loud.*

  Adjust **Audition Volume** in **Settings** ⚙.

5 EMITTERS

To make sound, Tempera needs an emitter placed and voice played.

An emitter can be placed on any cell on the touchgrid, from where it will start emitting a stream of grains. All placed emitters are activated per each voice and can be one of four color-coded configurations.

Each display in the main **Emitters** menu corresponds to one emitter. Turning the corresponding knobs tweak the emitter's volume while the action buttons allow to:

- **Edit** the emitter parameters
- **Select** the emitter for placing on the touchgrid

Holding the **Round button** reveals alternate context:

- **Clear** all placed emitters
- **Pause** / **Unpause** emitter grain generation

> **Tip**
>
> The emitter primary colors can be changed globally in **Settings**.

Per-emitter parameters

Emitters have many parameters which determine their behavior in time an space. Some parameters can be modulated by **Modulators** ⌒, and some can be added an optional jitter (random variation for each emitted grain) by turning their encoder while holding the **Jitter** button.

The emitter parameters are available separately for each of the four color-coded configurations. When navigating through the parameter pages, the emitter under editing automatically changes to the next one when you cross the last page. This can be disabled in **Settings** ⚙ with **Emitter x-scroll**.

- **Grain length** controls how long the generated grains are. This can be measured as the number of grid cells from 0 to 8 (when in the **Cell** mode) or as note duration in time signature (when in the **Note** mode).
- **Grain density** determines how many grains are generated in time per note played and emitter placed. A density of 1.00 means there will be one grain played shoulder to shoulder.
- **Grain trigger** cross-fades between grain generation based on free length/density, and grain triggers synced to time.
- **Sync time** sets the note interval at which new grains are emitted when Grain trigger is synced to tempo.

  The screen is divided into three parameters **Active steps**, **Step duration** and **Total steps**, with the parameter under editing selectable using the **<>** buttons.

  The Total steps parameter activates an **Euclidean grain sequencer** (inspired by Godfried Toussaint's Euclidean rhythm algorithm), which distributes the number of Active steps across the available steps, conveniently generating various non-trivial rhythmical patterns.

  The resulting pattern can be further rotated when holding the **Round button**.

- **Spray X** and **Spray Y** set amount of randomness in grain spawning horizontally (across different tracks) and vertically (along a single track).
- **Relative X** and **Relative Y** manually scrub the grain trigger position away from its home base.

  An optional **Align** makes the emitted grain always start at the beginning of a cell. When not set, grains might be emitted from positions in between. Setting this on is useful for percussion tracks, where there's likely a transient at the beginning of each cell. When **Align** is off for **Relative X**, grains emitted in between tracks will be a weighted blend of the two.
- **Grain shape** determines how sharp the envelope of each grain is. Low value makes sharp transient grains, high value makes each grain smooth.

  When **Attack** is enabled, the first grain emitted by a note will have an instant ramp-up, overriding the grain shape (this is useful for playing long and smooth grains while having a distinct sharp attack, without which the ramp-up is slow even with a fast attack of the main ADSR envelope). The attack can be then controlled on the ADSR page of **Modulators** .
- **Grain reverse** controls the percentage of grains being played backwards. A value of 0% means all grains play in the standard forward direction, while 100% means all grains are reversed.

  When a *reverse grain* is emitted, its starting position is where it would have ended if it were a forward grain. This ensures that both forward and reverse grains play the same chunk of audio regardless of grain length.
- **Grain pan** (**L/R**) or **Grain mid-side** (**M/S**) controls the spread of grains in the stereo space.
- **Tune spread** gives each grain a random tuning variation, in the range of ±1 octave. Apply this very gently for a thickening detune.

Snap 5 and **Snap 8** will quantize the grains random variation to fifths and/or octaves, in both directions.

- **Octave** transposes the generated grains in the range of up to ±3 octaves.
- **FX send** controls the amount of audio sent to global **Effects** FX chain (Chorus, Delay and Reverb) while **Filter send** controls audio input to the per-voice main filter.
- **Placement** changes the touchgrid behavior:
  - **Instant**: Touch to place and emitter, release to remove it.
  - **Toggle**: Touch to toggle the emitter placement.
  - **Latch**: Once all fingers are removed, all emitters are cleared at next placement.

  When **Lock** is enabled, the placed emitter is locked to prevent it from being replaced by another.

  If **2-lane** is active, the emitter gains exclusive access to the pair of tracks below it. For example, when activated for the blue emitter, anytime an emitter is placed on the first two tracks, it will be blue regardless of which emitter is selected for placement.
- **Channel** determines which MIDI channel the emitter listens to. When set to **Global**, it follows the MIDI channel set in **Settings** ⚙.
- **Fade in** and **Fade out** control the fading of grains after the emitter is placed or removed.
- **Tone** will apply a gentle low-pass and/or high-pass filter pair with **Center** frequency and band **Width** controllable. This is essentially a variable-width band-pass filter.
- **Name** of each emitter can be changed from the default *Emitter 1–4*.

- **Prefab** enables you to **Copy** and **Paste** emitter parameters from one emitter to another when in the **Clipboard** mode.

  Turning the knob reveals options to **Apply** one of several basic emitter configurations, which serve as starting points for common scenarios: **Pad**, **Rhythm**, and **Scatter**.

Tips

- Set **Grain density** to below 1.00 and try playing with a super short **Grain length**.
- Press the **Emitters** button twice to edit the last edited emitter.
- Once a grain is generated and already in flight, it will stop either when it runs its course, or if the *voice* playing it is released.
- Regardless of FX send setting, the per-voice ADSR amplitude envelope is always applied.
- **Octave** and **Grain detune** are not applied for tracks in **BPM mode**.
- When editing an emitter, holding the **Round button** and pressing the **Emitters** button will cycle to the next emitter for editing. This makes it easy to adjust the same parameter for multiple emitters quickly.
- Set various emitters to different MIDI **Channels** to achieve multi-timbrality.

  For example, Setting your percussive emitters to a separate MIDI channel can be useful.

Frequently Asked Questions

- *How can I scrub through a sample smoothly?*

  It is possible to modulate an emitter's **Rel X** and **Rel Y** (short for *relative*) positions with a modulator or MIDI input in the **Modulators** menu. Emitting short grains is recommended for smooth scrubbing, while with longer grains it is possible to do grain sequencing.

- *Can effects be applied to each emitter separately?*

  As of the current firmware this isn't possible.

- *My high-density short grain emitter sounds very metallic, as if glitched. Why?*

  When a lot of grains are emitted from exactly the same position periodically, for example 100 times per second, this will create an audible frequency component of 100 Hz. Add a tiny amount of unaligned Spray Y and grain trigger will no longer be harmonic.

6 OVERLAY KEYBOARD

While it's possible to use an external MIDI keyboard connected to Tempera, an overlay keyboard can be brought up which will occupy some potion of the touchgrid. This keyboard enables you to play Tempera as a stand-alone instrument or to complement your external MIDI controller for multi-timbral setups.

The **Overlay Keyboard** menu has the following options:

- **Base note** can be adjusted by semitones using the encoder or shifted by octaves using the associated buttons.
- **Channel** sets which MIDI channel the overlay keyboard plays at. This is useful to feed the notes to specific emitters.
- **Scale** determines the arrangement of notes on the grid with various scales available.
- **Overlay** selects which portion (horizontally or vertically) of the touchgrid the overlay keyboard will occupy.

  The context buttons allow to **Clear** all held notes or **Hold** them like a sustain pedal.

Pressure sensitivity

Tempera's keyboard is **pressure-sensitive** with polyphonic pressure (PolyAT) being available as per-voice modulation source for various targets, see **MIDI modulators** (page 31) for routing details.

When playing with PolyAT enabled, press the cell more with the pad of your finger rather than the tip, as this provides more contact surface and range for modulation.

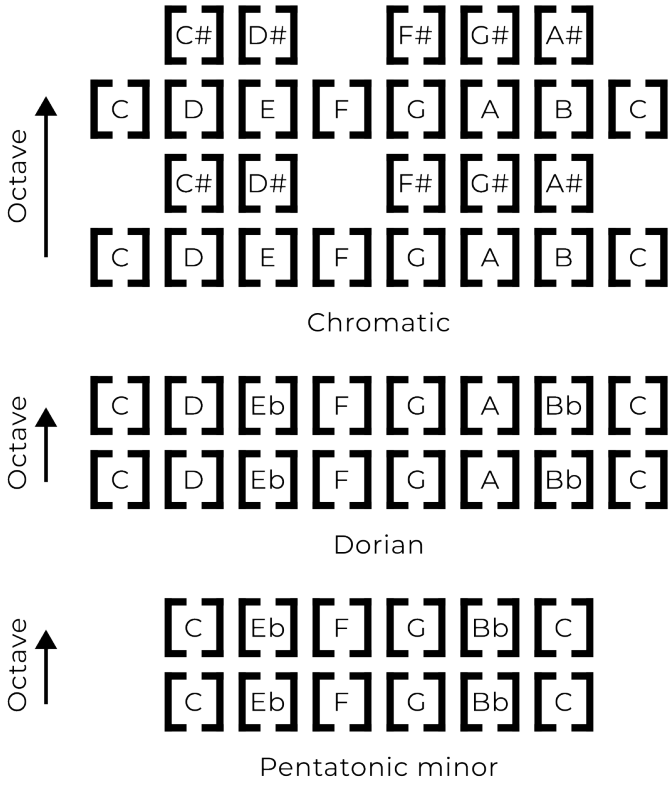
Tips

- Press a shortcut combo **Round button** and **Overlay Keyboard** to quickly show and hide the overlay keyboard even when a different menu is active.
- It is possible to have notes toggled on multiple MIDI channels at once. Useful for a held percussive or drone note on one channel, and playing along on a different channel.

Overlay keyboard scales

The overlay keyboard begins with a configurable **Base note** corresponding to the bottom-left cell.

Increasing the layout size will increase the keyboard range. Each row of the overlay keyboard is an octave except for the chromatic scale with two rows per octave.



7 MODULATORS

Modulators allow changing emitter or filter parameter values over time to produce a more complex and dynamic sound. Each modulator can be set to an envelope, a periodic wave, a slow randomized noise or even MIDI input. A modulator can be routed to one of the available targets. Multiple modulators can be routed to the same target.

On the Tempera, there are ten modulators per voice played, plus a a full ADSR amplitude envelope generator.

ADSR envelope

The first page of the **Modulators** menu is a main ADSR envelope with **Attack**, **Delay**, **Sustain** and **Release** parameters. This amplitude envelope applies to each voice played.

Apart from the main ADSR envelope, each emitter can have its distinct **Grain shape** (grain envelope) configured in the **Emitters** menu.

Modulator options

The second and following pages are dedicated to the individual modulators. These can be of different shape, destination, speed and scaling.

The **Target/Size** buttons switch between adjusting modulation target and modulation size.

Many per-voice modulation targets are available. The modulation Size controls how much the Target value is affected by the modulator.

Envelopes

The **AR** and **AD** modulators are two-stage simplified variants of the full ADSR envelope which can be controlled by **Attack**-**Decay** and **Attack**-**Release** parameters.

LFO modulators

The **Sine**, **Triangle**, **Square** and **Saw** modulators are periodic LFOs with controllable **Speed** and **Phase offset**.

The LFO **Speed** has options to enable tempo **Sync**, and to reset the modulator on each note with **Retrig**.

The **+-** button switches between bipolar and unipolar waveform.

Noise modulators

The **Noise S&H** and **Slow noise** modulators provide sampled and periodic randomized noise with adjustable **Speed** and **Phase offset** as well.

MIDI modulators

The MIDI modulators allow external MIDI input or keys played on Tempera to be used as modulation sources.

- **Modwheel** corresponds to MIDI CC 1.
- **Aftertouch** corresponds to MIDI Channel Pressure.
- **Key track** and **Velocity** correspond to the note number and velocity of keys played over MIDI or the Overlay Keyboard.
- **PolyAT** (polyphonic aftertouch) corresponds to the Key Pressure MIDI message, or to the polyphonic pressure of keys played on the Overlay Keyboard.

The MIDI input can be scaled with Size or toggled between bipolar and unipolar using the **+-** button.

Step modulator

The **Step** modulator is a stepped LFO with up to 16 steps whose entire cycle of steps runs at the rate defined by the Speed parameter. For example, if Speed is set to 1/4, the full sequence will take one quarter note to complete.

The number of steps can be adjusted using the encoder while holding the **Length** button, while the **Scroll** button selects the step currently being edited.

When no button is pressed, the encoder adjusts the amplitude of the selected step. The overall output is then scaled by the Size parameter.

Like other **LFO modulators** (page 31), the Step modulator can run in sync with tempo or freely. Holding the **Round button** reveals a **+-** polarity switch.

Tips

- If a parameter is modulated, a small vertical line will appear over its display for each voice played.
- The modulator shape is shown in real time on the first display for each voice played.
- You can freely grain-scrub through a track by modulating **Emitter Relative Y** with e.g. the Modwheel. Make sure the modulated emitter has enough grain density.

8 EFFECTS FX

Tempera has a carefully crafted effects suite: **Filter**, **Chorus**, **Delay**, **Reverb** and **Patina**. Apply them with a light touch!

Chorus, Delay, Reverb and Patina are processed in the order they are listed in the **Effects** FX menu and are applied on the master with the amount of the wet signal controllable through individual **Mix** parameters. The main Filter is processed per voice.

The amount of signal sent to the effects chain is controllable per emitter with **FX send** and **Filter send** in the **Emitters** menu.

Filter

Six different **Filter types** are available, each with **Cutoff** and **Emphasis** parameters:

- **Lowpass 12** and **Lowpass 24** attenuate signals below Cutoff at 12 dB/oct and 24 dB/oct with Emphasis controlling the amount of resonance.
- **Bandpass 12** passes signals within a band with its center frequency defined by Cutoff and resonance controlled by Emphasis.
- **Highpass 12** attenuates signals above Cutoff with Emphasis controlling the resonance.
- **Formant** emulates the resonance of different vowels. Cutoff aligns the filter with the U-E-O-I-A vowels while Emphasis acts as a blend between original and filtered signal.
- **Rake** is a comb filter configuration in which Cutoff controls the length of the feedback delay line, and Emphasis adds the feedback when its value is positive or subtracts it when negative.

  With Emphasis above or below ±0.5, the filter's feedback is amplitude-modulated by a sine wave with the same period length as the delay line.

For all filter types, the amount of **Key tracking** determines how much the cutoff frequency follows the played notes. When set to zero, the cutoff frequency is treated as an absolute value.

Chorus

Chorus mixes together sounds played back at different pitches, resembling the effect of a choir or an orchestra section.

Depth controls the amount of detuning while **Speed** determines the modulation speed. The Chorus **Flange** adjusts the amount of feedback.

Delay

Delay adds a delayed version of the signal to the final mix. **Feedback** controls the amount of output signal being fed into the delay while **Time** controls by how long the signal is delayed.

When **Pong** is enabled, the feedback signal is different for the left and right channels ("ping-pong"). The Delay time can be optionally **Dot**ted or have time signature **Sync** enabled.

Color adjusts the cutoff frequency of an optional bandpass filter at the feedback line which can be switched **On** or bypassed.

Reverb

Reverb simulates the reverberation of sound caused by reflections in a physical environment.

- **Size** increases the persistence of the signal. Setting this to 1.00 will essentially freeze the reflections.
- **Color** adjusts the cutoff frequency of a smooth band-pass filter at the effect's output.
- **Pre-delay** adjusts the time gap between the original sound and when the reverb effect begins, which helps separate the dry signal from the reverb tail for improved clarity.

Patina

Patina effects simulate various types of signal degradation in old and broken audio equipment.

Age reduces audio bandwidth and simulates a degraded speaker, while **Slip** emulates the behavior of a slippery driver motor and a loosened, mangled audio tape. You can also **Compress** the signal to mimic the effect of magnetic tape compression.

Frequently Asked Questions

- *How is the filter routed internally?*

  The filter is per-voice. That is, per each key played from a MIDI controller or the Overlay Keyboard, and per each note send from an external sequencer. This also means that when the Filter Cutoff parameter is modulated by e.g. sine LFO, it is applied to each voice separately. To apply filtering to an Emitter instead, use the Emitter's Tone filter.

- *The Formant filter doesn't seem to do anything.*

  Increase the amount of Emphasis, which works as a crossfade between original and formant-filtered signal.

- *Why does Delay Mix go above 1.00?*

  An active Color filter on the Delay will reduce the loudness of echos. To compensate for this, you can add some additional amplification with the Delay mix.

9 SETTINGS ⚙

It is possible to adjust many system-wide parameters. These are global (not linked to a specific canvas) and are saved automatically every time the **Settings** ⚙ menu is exited, such as going from Settings to **Emitters** or **Tracks** .

Recording options

- **Source** determines the audio input type, each with adjustable **Gain**. The recording source can be dry or wet signal from Tempera, external audio input signal (stereo, mono, external dynamic microphone, instrument input) or internal microphone.
- **Rec threshold** sets the input audio volume level for recording. When exceeded, Tempera will begin recording into armed tracks.
- **Rec monitor** adjusts how much of audio input is sent directly to audio output. This can be used to monitor while recording, or as audio pass-through.

  Holding the **Effects** button reveals **Effects send** which allows to route the audio input through Tempera's effects chain.
- Several **Recording modes** are available:
  - **Overdub** adds audio input to the original.
  - **Replace** substitutes existing audio in the track with the input audio, with an optional automatic **Trim**.
  - **Mix** audio input and original. This is similar to **Overdub** except after each recording the oldest audio is gradually decreased in volume.

– **Live grains** enable live processing and granularization of the input audio in real time.

See the **Recording** (page 48) section for a detailed overview of the recording workflow.

MIDI and tempo options

- **Pitchbend size** adjusts the sensitivity of pitchbend in the range from 0 to 12 semitones.
- **Velocity curve** of incoming MIDI notes can be set to **Linear**, **Exp** (exponential), **Rev exp** (reverse exponential) or **Fixed** (velocity is ignored).
- **Clock source** determines if Tempera will **Send** or **Receive** midi clock at 24 PPQN (pulses per quarter note), or run on **Internal** clock. It is possible to **Stop** the tempo or resume it again with **Play**.
- **BPM** controls the main tempo (global or inside the current canvas when **Canvas** is activated).

  The tempo can be changed manually with encoder or by tapping it on the **Tap** button. When **Clock source** is set to **Receive**, the value will change automatically once MIDI clock is detected.
- **MIDI TRS wiring** of the jacks is switchable between **Type A** and **Type B**.
- **TRS MIDI thru** enables direct passing of MIDI messages between MIDI TRS jack (IN to OUT).
- **MIDI channel** on which Tempera receives MIDI messages can be set to any of 1 to 16 or All.
- **Send MIDI notes** enables sending notes played on the **Overlay Keyboard** over MIDI. With this, you can use Tempera to play other instruments.

- **Control MIDI channel** enables placing emitters or arming a track for recording using MIDI notes on a specific channel. Messages can be received (**In**) or transmitted (**Out**), which is useful to record and play back a performance or to mirror emitter placements between two Temperas connected to each other.

  See **Placing and removing emitters with MIDI** (page 61) and **Arming a track for recording with MIDI** (page 62) for a detailed description.

Miscellaneous options

- **Audition volume** sets the volume of previewing (listening to) audio samples in the **Tracks** menu.
- **Max volume** amplifies or attenuates the volume of Tempera's main audio output. Careful, the outputs can be very hot (up to 13 dBu or 10 Vpp when maxed out).
- **LED light** adjusts the brightness of the touchgrid and encoder backlight.
- **Display light** dims the brightness of OLED displays.
- When **Micro SD card USB bridge** is activated, the micro SD card inserted into Tempera will be bridged over the USB cable to a computer as a mass storage device. See the **External storage** (page 52) section for more information.
- All global settings can be **Reset** to a default configuration.
- **Grid blanking** controls the touchgrid's behavior when Tempera is not touched for a while. The LEDs can remain on, display a splash animation, or turn off completely. The displays will go blank after inactivity in either case.

Emitter options

- **Emitter x-scroll** determines if cycling the pages of an emitter's configuration will scroll through to the next emitter after reaching the final page.
- When **Emitter edit selects** is enabled, pressing Edit under an emitter will also Select it for placement on the touchgrid.

Emitter primary colors

- The last settings page allows to adjust the primary colors of individual emitters.
- **LED color mode** on the previous page determines if emitter colors are set with hue and saturation (**Hue + Str**) or hue and strength or brightness (**Hue + Sat**).

10 LOAD AND SAVE CANVASES

The **Load and save** menu enables access to canvases, or the complete patches for Tempera.

The organizational structure for Tempera's saving and loading is files and folders. There are four top-level folders:

- **System** is read-only and contains factory canvases
- **User** for your samples and canvases
- **SD Card**
- **Flashdrive**

You can **Enter** a folder and navigate with **Up** and **Down** arrow buttons, and go one folder up at the top of each folder.

Loading a canvas

To load a canvas, navigate to its folder and press **Load**. Changing canvases can be seamless or jarring depending on how different the two canvases are.

Holding the **Round button** reveals options to **Delete** a canvas or **Merge** it with the current one. The merge function loads a new canvas without any audio samples and keeps the current track contents.

Saving a canvas

To save a canvas, navigate to where you want to save it and press **Save**. You will then be presented with a text input display:

- **Leftmost (blue) encoder** scrolls the text cursor
- **Rightmost (green) encoder** scrolls the selected character
- **OK** to confirm and save the canvas
- **Cancel** and go back to choosing where to save to
- **Insert** types the selected character
- **Delete** a character at the cursor
- **Random** generates a randomized name
- **Shift** toggles between upper and lower case characters

While holding the **Round button**, pressing **Alt** reveals numeric and special characters.

Placed emitters are saved along with a canvas, but played and held (latched) notes are not.

Tips

- Always use the **Eject** button before unplugging the external drive or SD card to prevent data loss.
- Organize your canvases and samples into folders. There can be as many levels of nesting as you need.
- When loading a canvas while the current one has playing and latched notes, these will be carried over to the newly loaded canvas. Since the new canvas may have a different Overlay Keyboard configuration, the played notes might appear outside of the overlay keyboard. It is possible to release all held notes by pressing the **Round button** and **Clear** in the **Overlay Keyboard** menu.

Sharing your canvas

When you make your own canvas, whether from scratch or by remixing parts of different canvases, it's time to share your creation with other Tempera players!

After you save the canvas onto a micro SD Card or USB flash-drive, upload it to the **Gallery** at gallery.beetlecrab.audio.

At the Gallery you can also download canvases others have created and get inspired, try them out!

Tips

- Pick a short, but descriptive and evocative name.
- It's nice to write a short commentary or tips on how to use your canvas.
- Other people will be interested to know how you made it, and what inspired you to create it!
- Give it a nice cover image that sets the right mood.

11 MACROS

Each canvas requires fast access to a different set of parameters. To make this happen, you can bind most parameters anywhere in the menus to one of the slots under **Macros**.

When you then navigate into Macros, all the parameters will be laid out for convenience during a performance.

For example, you might want to have these parameters handy: Filter cutoff, a Modulator speed, an Emitter grain length and a different Emitter grain density.

To assign the **Filter cutoff** to macro slot:

1. Find the **Filter cutoff** on the first page of **Effects** FX.
2. Hold the **Macros** button and keep holding.
3. Turn the **Filter cutoff** knob a little bit.
4. Release the **Macros** button.
5. Select which macro slot to place at.

Macro assignments are saved along with the canvas.

Shortcuts

To make common workflow quicker, Tempera has a handful of shortcuts as button combos.

While holding the **Round button**, the displays will reveal if there are any alternate context actions:

- The **Load and save** button will quicksave your current canvas into *User/Quicksave*. New quicksave will overwrite the old.
- When editing an emitter, pressing the **Emitters** button will cycle through emitters on the same page. For example, this allows to quickly adjust Grain length on all 4 emitters.
- The **Overlay Keyboard** button will toggle the Overlay Keyboard.

Moreover, turning any knob while holding the round button will increment the value faster.

There are a few shortcuts not involving the round button:

- Double-pressing the **Emitters** button will toggle between emitter overview and last edited emitter's settings.
- Double pressing the **Tracks** button will toggle between track overview and last edited track's settings.
- Pressing the **Load and save** button while already in file browser will bring you to the top-level folder.

Info screen

Holding the **Settings** button reveals a handy info screen, which reports the available space on internal and external storage, the name of the currently loaded canvas (with a button to **Save** and overwrite it), and the current firmware version.

12 RECORDING

Tempera can record audio into a track from one of several audio sources, including on-device resampling (record Tempera's dry or wet output).

Follow this example procedure to fill a track with recorded audio:

1. Set your desired audio input **Source** in **Settings** ⚙.
2. Make sure the meter is moving when audio streams in and adjust the **Gain**.
3. Set the **Record mode** to **Replace**.
4. Adjust recording **Threshold**. Once a track is later armed and audio input goes above this threshold, recording will start.
5. In the **Tracks** ⋮ menu, hold the **Round button** and press one of the context **Rec** buttons to arm the chosen track.
6. Release the **Round button** at which point the track is waiting for audio input.
7. Play audio into Tempera. After it triggers the recording threshold, all displays will go blank for the duration of recording to eliminate interference.
8. Press the **Round button** again to stop recording or wait until the track reaches the end.

Your audio is now recorded in the track. While in the **Tracks** ⋮ menu, you can press **Edit** and **Trim** the newly recorded track to your preference.

When the **Replace** recording mode selected, you can optionally toggle auto **Trim** in the **Settings** ⚙ menu. Instead of recording

into the trimmed portion of the track, this mode records from the beginning of the track, and after the recording is stopped, it automatically sets the trim to fit your recording.

Tips

- As an alternative to threshold-based triggering, you can enable **Cue rec** to make recording start instantaneously on the next half note after a track is armed.
- Tempera can record into a track while other tracks are playing. With this, you can record Tempera's dry or wet output and granularize it again. (And then maybe repeat the process!)
- Try recording random sounds around you with the internal microphone. Mangling them with granular processing will reveal many interesting facets of our environment.
- Have you recorded an interesting and unusual sample? Share it with others and see it used in a completely different way!
- Recording can also be started with MIDI, see **Arming a track for recording with MIDI** (page 62).

13 LIVE GRAINS

Besides recording into a *static* track, Tempera can also do live processing on incoming audio. This allows for subtle granularization or precisely synced rhythm chopping and re-sequencing in real time.

Similarly to standard recording, a *live* track is armed and incoming audio is streamed through it. New audio emerges at the bottom cell and travels to the top where it disappears into the void. Along the length of the eight cells, you can place emitters just like on a static track and play grains of the incoming audio directly.

Synced live grains

For the live grains to sync up well, a few things need to be set up in advance. While it's possible to do all kinds of experimentation, the basic scenario is this:

1. Tempera's **BPM** in **Settings** ⚙ should match the incoming audio BPM.
2. While in **Settings** ⚙, set **Record mode** to **Live grains** and enable **Cue rec** so the recording starts on the next half note.
3. In the **Tracks** ☰ menu, hold the **Round button** and press one of the **Rec** buttons to arm the chosen track for recording.

   The track which you wish to stream through should be trimmed with regards to the BPM. The easiest way is to align the top markers which indicate the cell spans with

the bottom markers which indicate the BPM half notes. See **Trimming a sample** (page 18) for details.

4. Have a note playing and place an emitter on the pulsating track. You can think of it as a tape moving under your finger.

Switching armed tracks

To stop the live grains mode, either disarm the track by pressing the **Round button** and **Rec** again, or turn off **Cue rec**. This will stop recording into the track which becomes static again. You can also re-arm into a different track, in which case the former will be retain its contents and recording will continue into the newly armed track.

Tips

- If things do not seem to sync up well, make sure that your clock is working correctly and that your track trim is set up.
- When trimming the track, top and bottom markers don't need to be aligned 1:1. Try experimenting with 6:4 or other ratios to introduce rhythm variations.

Frequently Asked Questions

- *Why is the Live grains track orientation reversed?*

  It may seem that while the static tracks go from the top to the bottom cell, the orientation of the live track is reversed. However, consider how audio is organized in the tracks: In both cases, the *most recent* audio is at the bottom cell while the *oldest* signal is at the top.

14 EXTERNAL STORAGE

Tempera has a total internal memory of 8 GB, and some of it is used for the firmware and built-in samples and canvases. The lossless internal conversion to FLAC happens seamlessly and more than doubles the amount of samples that will fit.

If you're a sample collector and this is not enough room, you can attach a micro SD card at the front, or a USB flashdrive at the back. On the external storage medium, create two folders, one named "samples" and another "programs" and place your samples and canvases there.

Micro SD card USB bridge

Tempera has a functionality to bridge the micro SD card contents over USB to a computer (using a cable connected to the USB Device port on Tempera). This option can be accessed in the **Settings** ⚙ menu.

When the bridge is activated, Tempera will act as a class-compliant USB mass storage device. This means that it appears as if the SD card was inserted directly into the computer and files and folders can be copied and moved to and from Tempera.

During the bridge, Tempera will not make sound or allow navigation in the menus, until it is deactivated again.

Firmware upgrade

After downloading a Tempera firmware file, place it onto a USB flashdrive or micro SD card (formatted with FAT32 or exFAT). When Tempera is off, insert it, and turn Tempera on while holding the **Round button**.

Tempera will then load the firmware upgrade file and provide further instructions on the displays.

Don't turn off power before the firmware update is finished.

Tips

- When a micro SD card is fully inserted into Tempera, it sits flush with the case. To insert it, push in a few millimeters with the pins facing up.
- Press and hold the **Settings** ⚙ button to reveal information about memory usage and firmware version.
- You can find the most recent firmware at beetlecrab.audio/tempera/support

15 MIDI INPUT

Tempera responds to standard MIDI messages with many internal parameters exposed. The implementation table below provides an overview while the following sections describe the workflow in detail.

Table 1: MIDI implementation table

Function	Transmitted	Recognized	Note
Channel	1–16	1–16	*1
Note: Number	1–127	1–127	*2,*3
Note: Velocity	1–127	1–127	*2,*3
Pitch Bend	–	Yes	*1
Channel Pressure (Aftertouch)	–	Yes	*3
Control Change (CC)	–	0–119	*4
Program Change	–	0–127	*5
Timing: Clock	Yes	Yes	*1
Timing: Start	Yes	Yes	*1
Timing: Stop	Yes	Yes	*1

Notes:

1. Configurable in **Settings**.
2. Transmitted are notes played on the **Overlay Keyboard**.
3. Also available as a source in **Modulators**.
4. See **Internal parameters** (page 55).
5. See **Changing canvases with MIDI** (page 62).

Internal parameters

Table 2: Control Change (CC) parameters

CC	Parameter
0	–
1	Modwheel (can be used as a modulator)
2–9	–
10	Active Emitter
11	Place emitter
12	Remove emitter
13	ADSR Attack
14	ADSR Decay
15	ADSR Sustain
16	ADSR Release
17	Reverb Size
18	Reverb Color
19	Reverb Mix
20	Delay Feedback
21	Delay Time
22	Delay Color
23	Delay Mix
24	Filter Cutoff
25	Filter Resonance
26	Chorus Depth
27	Chorus Speed

continues on next page

Table 2 – continued from previous page

CC	Parameter
28	Chorus Flange
29	Chorus Mix
30	Track 1 Volume
31	Track 2 Volume
32	–
33	Track 3 Volume
34	Track 4 Volume
35	Track 5 Volume
36	Track 6 Volume
37	Track 7 Volume
38	–
39	Track 8 Volume
40	Emitter 1 Volume
41	Emitter 1 Grain length Cell
42	Emitter 1 Grain length Note
43	Emitter 1 Grain density
44	Emitter 1 Grain shape
45	Emitter 1 Grain shape Attack
46	Emitter 1 Grain pan
47	Emitter 1 Grain tune spread
48	Emitter 1 Octave
49	Emitter 1 Relative X
50	Emitter 1 Relative Y

continues on next page

Table 2 – continued from previous page

CC	Parameter
51	Emitter 1 Spray X
52	Emitter 1 Spray Y
53	Emitter 1 Tone filter Width
54	Emitter 1 Tone filter Center
55	Emitter 1 Effects send
56	Emitter 2 Volume
57	Emitter 2 Grain length Cell
58	Emitter 2 Grain length Note
59	Emitter 2 Grain density
60	Emitter 2 Grain shape
61	Emitter 2 Grain shape Attack
62	Emitter 2 Grain pan
63	Emitter 2 Grain tune spread
64	Damper pedal
65	Emitter 2 Octave
66	–
67	Emitter 2 Relative X
68	Emitter 2 Relative Y
69	Emitter 2 Spray X
70	Emitter 2 Spray Y
71	–
72	Emitter 2 Tone filter Width
73	Emitter 2 Tone filter Center

continues on next page

Table 2 – continued from previous page

CC	Parameter
74	–
75	Emitter 2 Effects send
76	Emitter 3 Volume
77	Emitter 3 Grain length Cell
78	Emitter 3 Grain length Note
79	Emitter 3 Grain density
80	Emitter 3 Grain shape
81	Emitter 3 Grain shape Attack
82	Emitter 3 Grain pan
83	Emitter 3 Grain tune spread
84	Emitter 3 Octave
85	Emitter 3 Relative X
86	Emitter 3 Relative Y
87	Emitter 3 Spray X
88	Emitter 3 Spray Y
89	Emitter 3 Tone filter Width
90	Emitter 3 Tone filter Center
91	Emitter 3 Effects send
92	Emitter 4 Volume
93	Emitter 4 Grain length Cell
94	Emitter 4 Grain length Note
95	Emitter 4 Grain density
96	Emitter 4 Grain shape

continues on next page

Table 2 – continued from previous page

CC	Parameter
97	Emitter 4 Grain shape Attack
98	Emitter 4 Grain pan
99	Emitter 4 Grain tune spread
100	–
101	–
102	Emitter 4 Octave
103	Emitter 4 Relative X
104	Emitter 4 Relative Y
105	Emitter 4 Spray X
106	Emitter 4 Spray Y
107	Emitter 4 Tone filter Width
108	Emitter 4 Tone filter Center
109	Emitter 4 Effects send
110	Modulator 1 Size
111	Modulator 2 Size
112	Modulator 3 Size
113	Modulator 4 Size
114	Modulator 5 Size
115	Modulator 6 Size
116	Modulator 7 Size
117	Modulator 8 Size
118	Modulator 9 Size
119	Modulator 10 Size

Placing and removing emitters with MIDI

Using MIDI CC

Emitters can be placed or removed using the following commands:

- Set the **Active emitter** by sending CC 10 with value between 0 and 3. Value of 0 is the first (blue) emitter.
- **Place an emitter** by sending CC 11 with a value between 0 and 63. Grid cells for emitter placement are numbered starting at top left, column by column.
- **Remove an emitter** by sending CC 12 with a value between 0 and 63. Value of 64 clears all placed emitters.

For example, to place emitter 1 (blue) on the first cell of first track:

1. Fist send CC 10 with value 0 to set the active emitter to 1,
2. then send CC 11 with value of 0 to place the emitter.

Or to remove emitter 2 (red) from the second cell of the second track:

1. First send CC 10 with value 1 to set the active emitter to 2,
2. then send CC 12 with value 9 to remove the emitter.

In other words, cells in the first track are 0 to 7, second track are 8 to 15, third track are 16 to 23, and so on.

Using MIDI notes

When **Control MIDI channel** is enabled in **Settings** ⚙, Tempera can respond to or transmit MIDI Note On and Note Off messages corresponding to placing and removing emitters using the following commands:

- Set the **Active emitter** by sending Note On with a note between 96 and 99. Value of 96 or C7 is the first (blue) emitter.
- **Place an emitter** by sending Note On with a note between 0 and 91.

  The leftmost column starts with MIDI note 0 (C-1) at the top cell and ends with MIDI note 7 (G-1) at the bottom. Each subsequent column is shifted by an octave (the second column starts at note 12 or C0, etc.).
- **Remove an emitter** by sending Note Off.

For example, to place emitter 1 (blue) on the first cell of first track:

1. Fist send Note 96 On to set the active emitter to 1,
2. then send Note 0 On to place the emitter.

Or to remove emitter 2 (red) from the second cell of the second track:

1. First send Note 97 On to set the active emitter to 2,
2. then send Note 13 Off to remove the emitter.

Changing canvases with MIDI

Tempera can switch canvases using the Program Change MIDI message.

To change the current canvas, send a Program change message with the value between 0 and 127. Tempera will then load a canvas form the folder the current canvas is loaded from, with the program number corresponding to the canvas name sorted alphabetically.

To change the folder, load a different canvas from it in the **Load and save** menu.

Arming a track for recording with MIDI

The **Control MIDI channel** used to place and remove emitters with MIDI notes can be also utilized to control **recording** (page 48).

To arm or disarm a track for recording, send a MIDI Note between 100 and 107. Note 100 (E7) corresponds to track 1 while note 107 (B7) corresponds to track 8.

Recording on an armed track will start after the audio input crosses the recording **Threshold** or instantaneously with **Cue rec** (configurable in **Settings**).

16 SPECIFICATIONS

- ARM® Cortex™-A72 quad core with NEON™ DSP instructions
- 32-bit internal processing
- 16-voice polyphony with per-voice filters
- A global pool of 4096 stereo grains. This means that all the grains can be distributed to the 16 voices of polyphony, but also all into a single voice!
- Headphone amplifier
- 12V/2.5A DC power supply (5.5/2.1 mm, center-positive)
- Dual 6.35 mm jacks for audio output, up to 10 Vpp or 13 dBu (either headphone or separate left and right channels)
- 6.35 mm stereo jack for audio input, up to 5.9 Vpp or 8.6 dBu (line in or instrument switchable)
- Internal microphone
- MIDI TRS input and output ports (Type A and B switchable in settings)
- USB MIDI host and device ports (both capable of input and output)
- Micro SD card slot and USB flash drive support for storage and data transfer
- Firmware easily upgradable with a USB flash drive or micro SD card
- VESA-compatible mounting holes on the bottom panel (100×100 mm spacing, M4 screws. The absolute maximum thread depth inside Tempera is 5 mm)

Health and safety

Use common sense when handling Tempera. Standard guidelines for handling electronic devices apply, which, among others, are:

- Use only the supplied power supply (PSU-02).
- Do not expose the machine to any liquids or excessive levels of humidity.
- Do not use screws longer than 5 mm for the bottom panel mounting holes.

Tip

Found a bug or something is not working as you expect? Reach out to us at *makers@beetlecrab.audio* or on our Discord server.