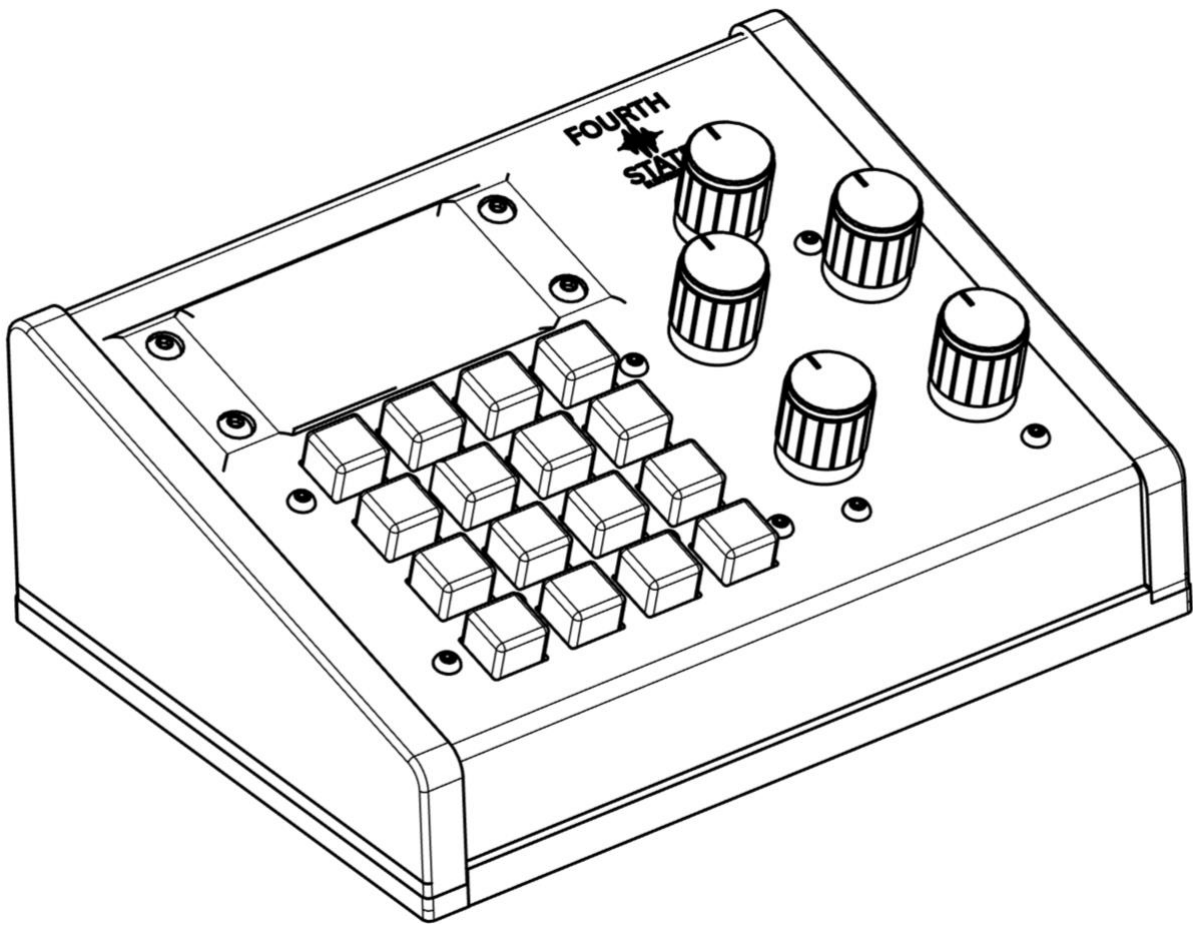




FSE 1

User Manual

Fourth State Electronics

Firmware v1.0

fourthstateelectronics.com

Contents

1	Welcome	4
2	What's in the Box	5
3	Hardware Overview	6
4	Quick Start	7
5	The Live Screen	9
6	Button Control	12
7	Editing Presets.....	14
7.1	Program	16
7.2	Color	17
7.3	Name.....	18
7.4	Knobs	19
7.5	Optional Features.....	21
8	System Configuration Screen.....	33
8.1	SD Card and Banks	34
8.2	Feature Editor	35
8.3	About Screen.....	37
9	Clock	39
10	Panic.....	41
11	Troubleshooting	42
12	Softload	44
13	Appendix.....	49
14	Specifications	51
15	Support.....	53

1 Welcome

The FSE 1 is a compact live-performance MIDI controller with three independent output ports, five assignable knobs, a 16-button pad, a color touchscreen, and an SD card for saving preset banks.

It is designed to sit on top of a synth, keyboard, or modular rack and give you one-hand control over patch changes, split zones, tempo and midi signal processing including velocity shaping, alternate tuning arpeggiation, midi filtering, chord generation, and latching; without the need for a computer.

Nothing on this device requires an app or a driver. Plug in power, connect and configure MIDI, play.

2 What's in the Box

- FSE 1 unit
- Quick-start card

3 Hardware Overview

Front Panel

1. Knobs K1–K5, five potentiometers. Each knob is assignable as a CC on a per-preset basis (which CC it sends, which port, its startup value). In edit and configuration screens, Knob 1 is used to change the value of the currently-selected field.
2. 4 × 4 pad, sixteen illuminated buttons. On the Live screen they are your presets (1–16); in edit and configuration screens they can be used to step values. In the clock screen they are also used to visualize and to tap the tempo.
3. TFT display, 320 × 172 IPS with capacitive touch. Shows the current preset in Live mode; editing happens here.

Rear Panel

1. MIDI OUT A / B / C, three independent 5-pin DIN MIDI outputs.
2. MIDI IN, 5-pin DIN MIDI input, used for external clock sync and for the Program editor's note-learn feature.
3. USB-C 5 V power.
4. Power on switch.

Side Panel

- MicroUSB, firmware updates, optional bank programming, backups and restores.

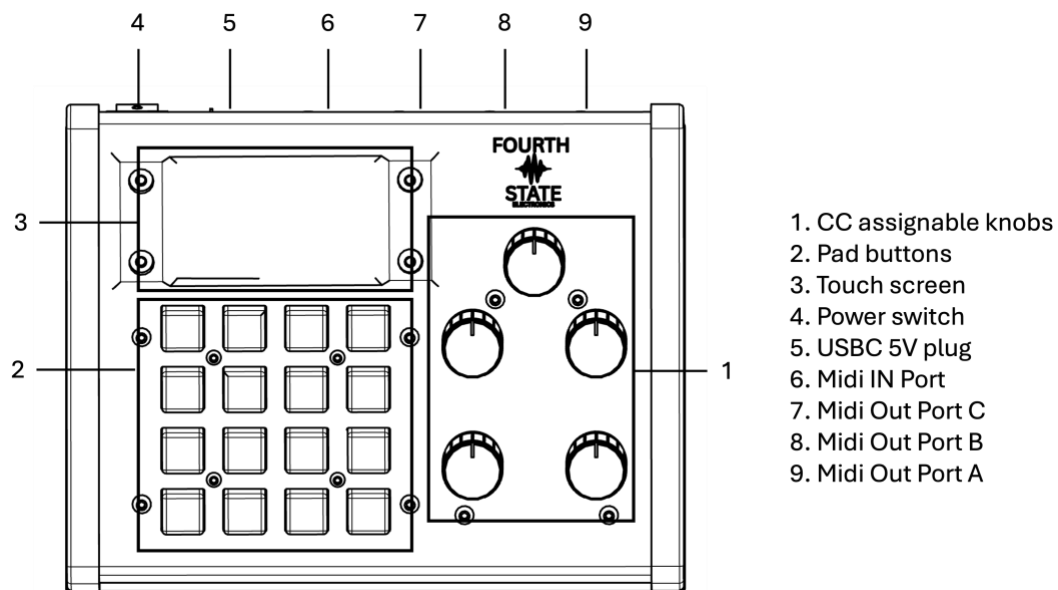
4 Quick Start

1. Plug in power. Connect any USB-C cable and 5 V USB power source (phone charger, powered hub, laptop USB port) to the POWER jack on the back.
2. Turn the unit on. Flip the rocker switch on the back to ON. The FSE splash logo appears for a moment, then the Live screen loads showing Preset 1.
3. Connect your master keyboard. Plug a 5-pin MIDI cable from your keyboard's MIDI OUT into the MIDI IN jack on the side of the FSE.
4. Connect your destination synths. Plug MIDI cables from MIDI OUT A / B / C on the back into the MIDI IN of each synth or effect you want to control.

Note. If MIDI from the FSE 1 is being routed back into your master keyboard's MIDI IN (so its onboard sounds get processed by the FSE 1), turn Local Control OFF on the master keyboard to prevent doubled notes.

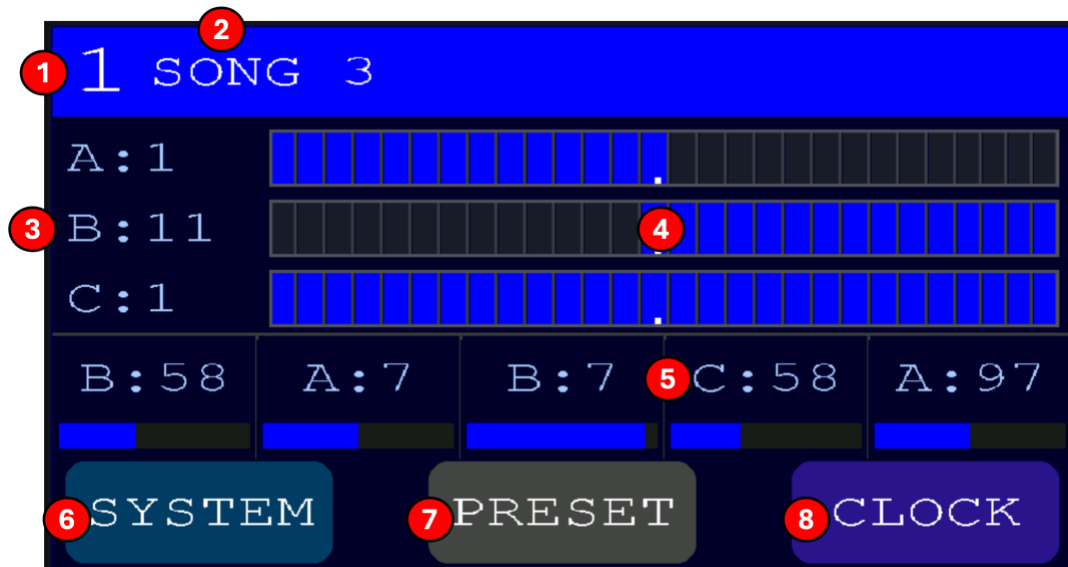
5. Set MIDI channels. On the Live screen, tap SYSTEM (bottom-left). Set the base MIDI channel for A, B, and C to match your synths (typically 1, 2, 3).
6. Play through Preset 1 to verify. Preset 1 sends every note through Port A. Knobs K1–K5 send CC 7 (volume) by default.
7. Switch presets. Tap any of the 16 pad buttons to load that preset.
8. Edit on-device. From Live, tap PRESET (center-bottom) to open the editor for the current pad, or KNOBS (right-bottom) for knob assignments. Edit optional features from the Features tab in the System screen.

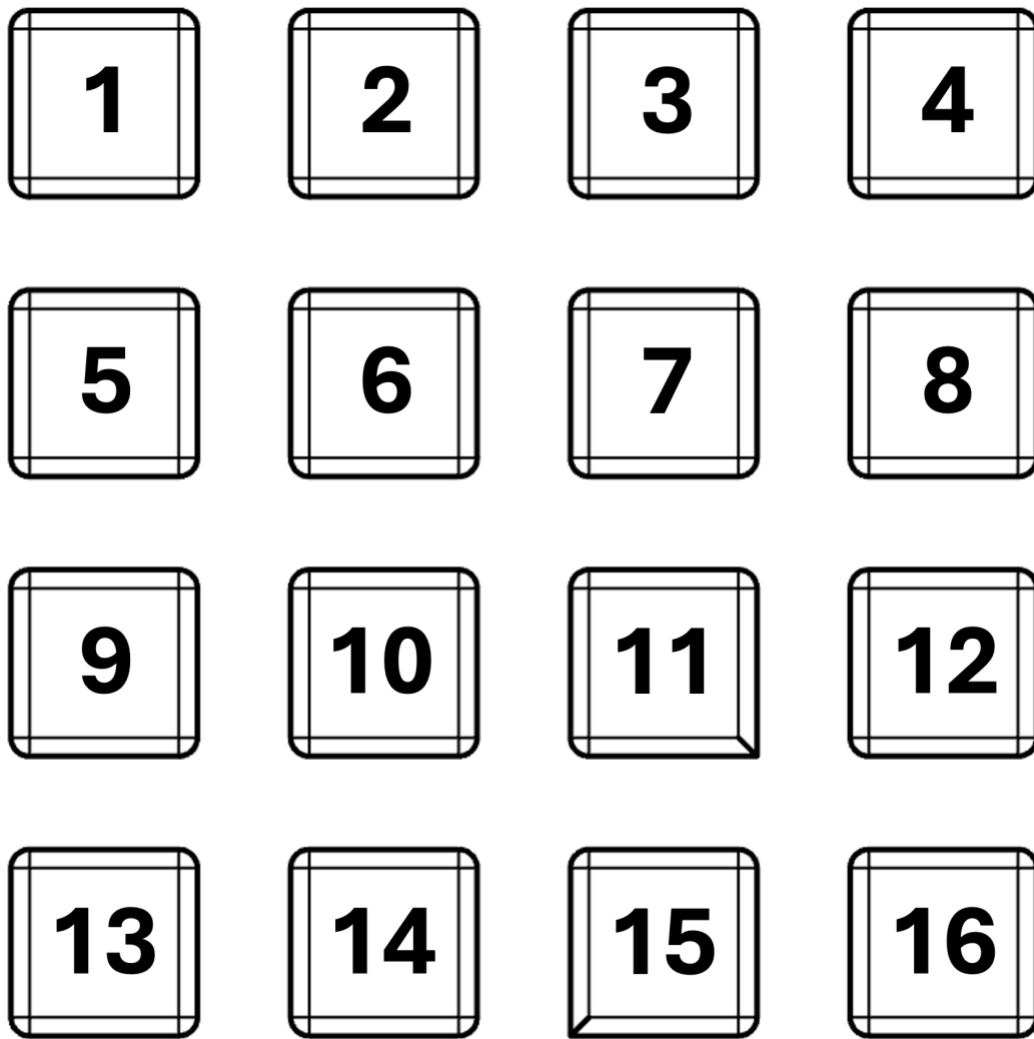
You're up and playing. Read on for the full walkthrough.



5 The Live Screen

The Live screen is the FSE 1's home base. This is the display you will see 99% of the time. It shows the currently active preset, real-time MIDI routing across all three output ports, and the current position of every physical knob. All navigation to other screens starts here.





Screen elements

(1) Preset number

The currently loaded preset (1–16). Changes instantly when you tap a different button.

(2) Preset name

The name assigned to this preset in the Name editor. Blank if the preset has not been named.

(3) Port zone bars (A, B, C)

One row per output port. The label shows the port letter and its Program Change number.

(4) Zone indicator

The bars are representations of a 128-key piano which help you visualize the zones of each device. Bright cells are notes that route through this port; dark cells are filtered out. A full bar means All

mode; a partial bar means Zone mode; a dark bar means the port is muted for this preset. The small dot inside each port bar marks Middle C (MIDI note 60). A fixed reference to help you read zone boundaries at a glance.

(5) Knob level bars (K1–K5)

Five compact bars showing each physical knob's port, CC number, and current MIDI value. Updates in real time as you turn each knob.

(6) SYSTEM button

Opens the Config screen; global settings, brightness, bank save/load, About, and Features. (See system configuration section)

(7) PRESET button

Opens the Preset Editor for the currently loaded preset. (See preset section)

(8) CLOCK button

Opens the Clock screen; sets internal BPM, chooses clock source, and selects which ports transmit MIDI clock. (See clock section)

Front-panel buttons (Fig. 2)

(0) Pads 1–16

The 16 backlit pads across the front of the unit map directly to the 16 presets in the current bank. Tap any pad to load that preset and the Live screen will update immediately. Pad color is the color assigned to that preset in the Color editor. (See color section)

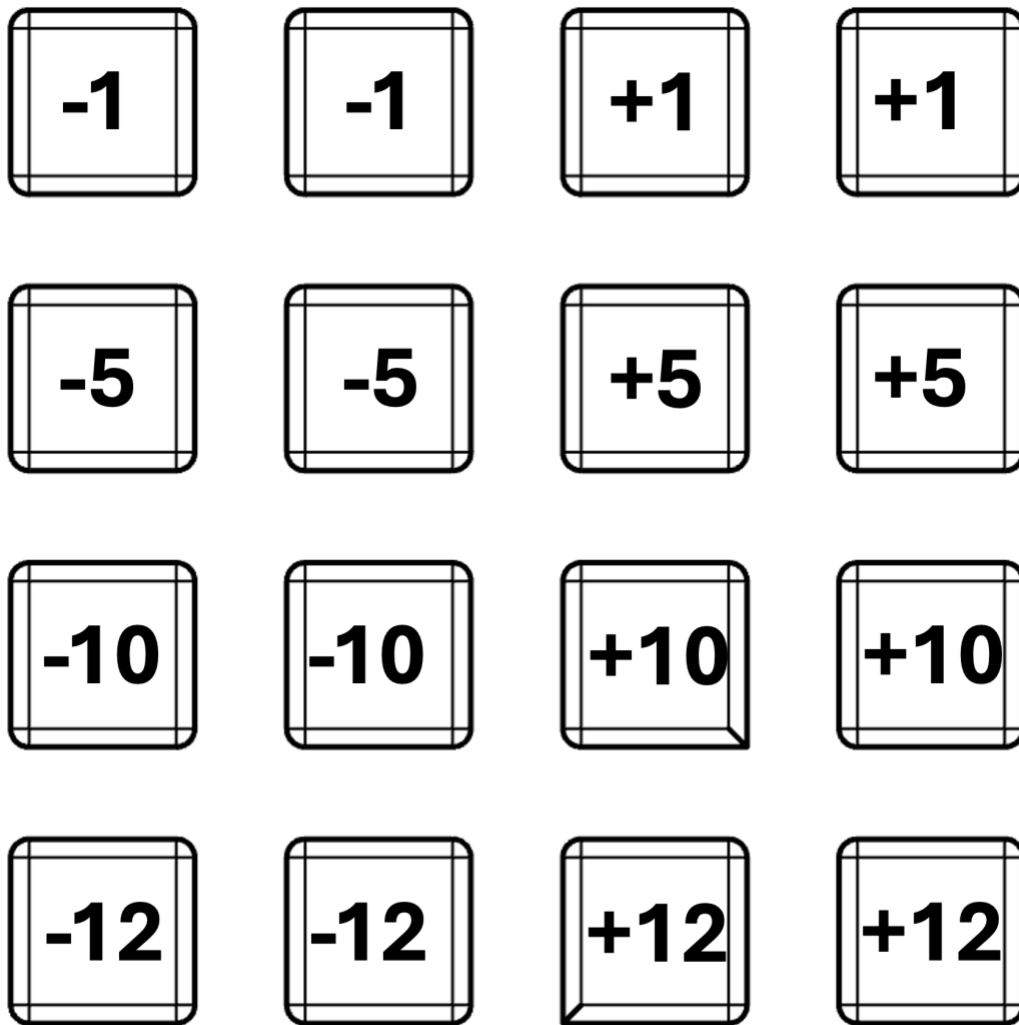
Notes

Note. Everything on the Live screen updates in real time: knob turns, incoming Program Changes, pad presses, and clock ticks all refresh the display within a few milliseconds.

Note. A completely dark port bar means the port is in None mode for this preset and any synth connected to that output will not sound but program changes will still occur which is still useful for effect control etc..

6 Button Control

Most edit and configuration screens on the FSE let you change values in two ways: Knob 1 gives fine control, and the 16 buttons become a colored nudge grid. The layout is the same on every screen that uses it, so the muscle memory transfers.



Reading the grid

Each row sets the magnitude; left half decreases, right half increases:

- Row 1 (top): ± 1
- Row 2: ± 5

- Row 3: ± 10
- Row 4 (bottom): ± 12

Every press has the same effect as turning Knob 1 by that many detents in the corresponding direction.

Where button control is active

The nudge grid lights up whenever you are on one of these screens:

- Program editor
- Knob editor
- Tuning editor
- Velocity editor
- Arp editor
- MIDI Filter editor
- Chord editor
- Config (System) screen
- Load Bank screen

Where button control is not active

Two screens deliberately re-use the buttons for a different purpose:

- Clock screen, the 16 buttons become a tap-tempo surface. Knob 1 still gives fine BPM control.
- Color and Name editors, the buttons are the color swatches or keyboard letters themselves, not nudge controls.

7 Editing Presets

Tap PRESET on the Live screen to open the Preset Editor, a grid of tiles for editing every aspect of the currently loaded preset. Each tile opens a dedicated editor. Tap CANCEL to return to Live.

The Preset Editor is a grid of tiles for editing every aspect of the currently loaded preset. Reach it by tapping the PRESET button on the Live screen. Each tile opens a dedicated editor for one facet of the preset from routing and knobs to optional features like tuning, arp, and chord. Tap CANCEL to return to Live without saving changes. Tuning, velocity, arp, filter and chord can be configured to not show up in this menu through the feature screen in the systems tab. This is useful if signal processing is not required for your setup and you would like to simplify your preset editing. (see feature section).



Tiles

(1) Header banner

Shows the preset number currently being edited and confirms you're in EDIT mode. All changes on the following screens apply to this preset only.

(2) PROGRAM

Opens the Program editor. This is where you define what each of the three output ports (A, B, C) does for this preset, routing mode, note zones, and the Program Change number sent when the preset loads.

(3) COLOR

Opens the Color picker. Sets the pad color for this preset, the swatch shown next to the label previews the current choice.

(4) NAME

Opens the on-screen keyboard for renaming this preset. The name is shown on Live and in the Bank Builder web app.

(5) KNOBS

Opens the Knob editor. Assigns each of the five physical knobs to a CC number, port, and initial value for this preset.

(6) TUNING

Opens the Tuning editor. Enables microtonal scales for this preset.

(7) VEL

Opens the Velocity Curve editor. Shapes how incoming keyboard velocity is mapped to outgoing note velocity for this preset. Only visible when the Velocity feature is on.

(8) ARP

Opens the Arpeggiator editor. Configures per-port arp pattern, rate, and octave range for this preset. Only visible when the Arp feature is on.

(9) FILTER

Opens the MIDI Filter editor. Blocks specific incoming CCs, PC, PB, or aftertouch messages per port. Only visible when the MIDI Filter feature is on.

(10) CHORD

Opens the Chord Generator editor. Turns single incoming notes into full chords per port. Only visible when the Chord Generator feature is on.

(11) CANCEL

Returns to the Live screen. Any preset changes made in the editors on this grid are saved as they are made

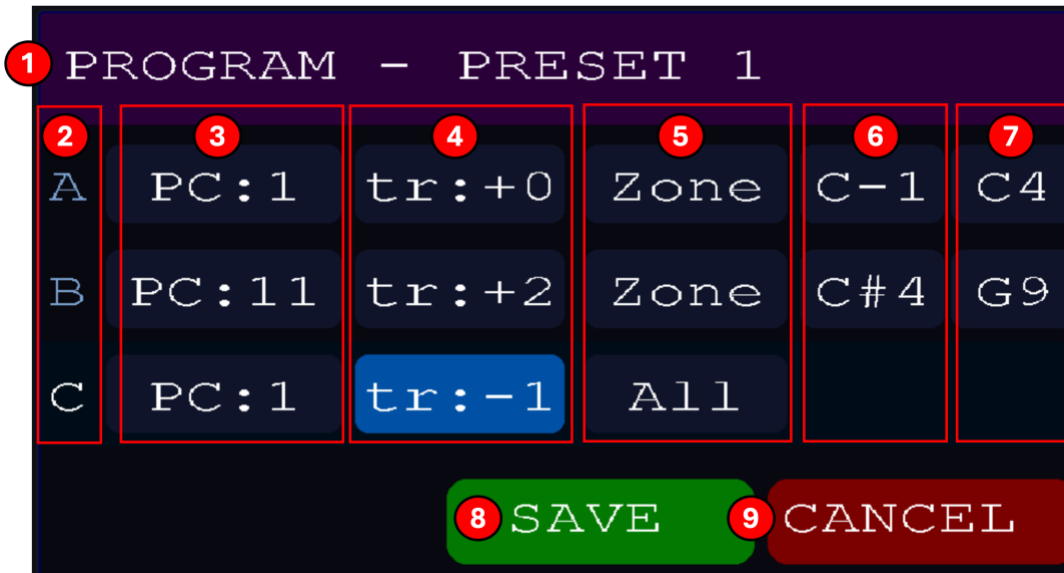
Notes

The grid is dynamic, tiles for optional features (Tuning, Velocity, Arp, Filter, Chord) only appear when their feature is enabled in the Features screen (SYSTEM → FEATURES). If a tile is missing, turn on its feature to reveal it. The layout automatically rearranges to fill the screen based on how many tiles are visible.

See the individual editor sections of this manual for detailed docs on each tile.

7.1 Program

The Program editor defines what each of the three output ports (A, B, C) does when this preset loads, the Program Change message sent, note transposition, note-range routing mode, and the zone boundaries.



Screen elements

(1) Header

Confirms which preset is being edited.

(2) Port column (A, B, C)

One row per output port. All settings on that row apply to that port only.

(3) PC (Program Change)

Program Change number transmitted on this port when the preset loads (1–128). Use this to auto-recall patches on your synths.

(4) Transpose (tr)

Number of semitones added to every note routed through this port. Negative values transpose down.

(5) Mode

How the port responds to notes from the master keyboard: All (every note passes), Zone (only notes within the range below pass), None (port is muted for this preset). If latch is enabled in the features window Alat and Zlat are enabled which allows either all keys (Alat) or a selected range (Zlat) to be passed and also latched (notes held down after physically released).

(6) Zone low note

In Zone mode, the lowest note (inclusive) that will route through this port. Not present in All and None modes.

(7) Zone high note

In Zone mode, the highest note (inclusive) that will route through this port. Not present in All and None modes.

(8) SAVE

Writes the changes to the preset and returns to the Preset Editor.

(9) CANCEL

Discards changes and returns to the Preset Editor.

Notes

Note. Zone mode is the basis of keyboard splits, set Port A to a bass range and Port B to a lead range on the same preset for an instant split.

7.2 Color

The Color editor sets the pad and screen palette color for each preset.



Screen elements

(1) Header

Confirms which preset is being edited.

(2) Current color preview

A large swatch showing the color currently selected for this preset.

(3) Color palette

20 preset color swatches. Tap any swatch to preview it, the current-color box updates immediately, and the front-panel pad for this preset lights up in the new color as well.

(4) SAVE

Writes the selected color to the preset and returns.

(5) BACK

Discards the color change and returns to the Preset Editor.

7.3 Name

The Name editor lets you assign a text label to the current preset. The name is shown on the Live screen and in the Bank Builder web app.



Screen elements

(1) Name display

The name being edited. Shows a cursor at the current insertion point.

(2) Keyboard

On-screen QWERTY keyboard. Tap any letter to insert it. Backspace (⇐) removes the last character; SPC inserts a space.

(3) NUM

Switches the keyboard between letters and a number/symbol layout for typing digits and punctuation.

(4) CANCEL

Discards changes and returns to the Preset Editor.

(5) CLEAR

Erases the entire name in one tap.

(6) DONE

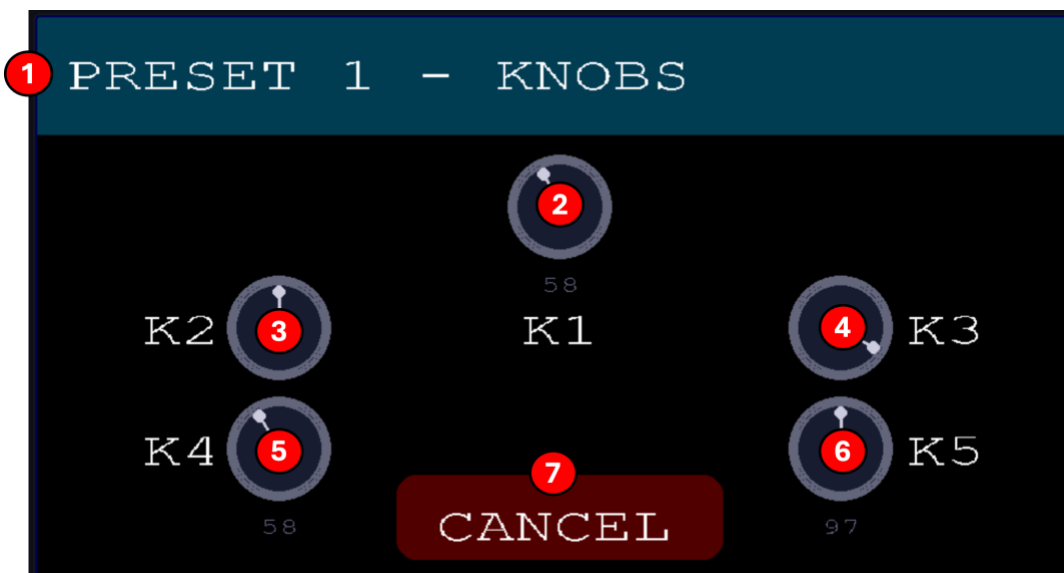
Saves the name to the preset and returns.

Notes

Note. Preset names are stored per-preset per-bank, renaming a preset in one bank does not affect its name in another bank.

7.4 Knobs

The Knobs editor is a two-step editor for assigning each of the five physical knobs to a MIDI CC number and output port for the current preset. First screen is a knob picker; second screen edits the picked knob.



Knob picker

(1) Header

Confirms which preset is being edited.

(2) K1 (top center)

Tap to open the edit screen for physical knob 1 (top-center on the front panel).

(3) K2 (upper left)

Tap to edit the assignment of physical knob 2.

(4) K3 (upper right)

Tap to edit the assignment of physical knob 3.

(5) K4 (lower left)

Tap to edit the assignment of physical knob 4.

(6) K5 (lower right)

Tap to edit the assignment of physical knob 5.

(7) CANCEL

Returns to the Preset Editor.



Knob edit screen

(1) Header

Shows which knob is being edited and which preset.

(2) Live position indicator

A visual dial showing the current physical position of this knob in real time. When saved, this will be the initial condition that the knob will go to when the preset is chosen. (5)

(3) CC

The MIDI CC number this knob transmits (0–127). Tap, use Knob 1 or buttons to change.

(4) Port

The output port this knob transmits on (A, B, or C). Tap, use Knob 1 or buttons to change.

(5) Value

The stored starting value the knob will transmit when the preset loads. Also shows the current live value being sent. This allows you to save a setting that is independent of the current position of the physical knob which allows you to reliably reset and restore preset initial sound

(6) SAVE

Writes the CC, port, and starting value to the preset and returns to the knob picker.

(7) CANCEL

Discards changes and returns to the knob picker.

Notes

Note. Knobs are direct — any wiggle past the deadband immediately becomes the new CC value. On preset load the stored Value is emitted once so the downstream synth starts at a known state; the next time you touch the knob, the CC jumps to wherever the physical knob happens to sit. No pickup-sweep step.

7.5 Optional Features

The following editors appear in the Preset Editor grid only when their corresponding toggle is enabled in the Features screen (SYSTEM → FEATURES). Turning a feature off hides its tile and bypasses the feature on every preset, but the underlying saved settings are preserved, so turning the feature back on restores everything.

7.5.1 Tuning

The Tuning editor assigns a microtonal or alternate scale to each output port for the current preset. Every port can run its own scale independently, for example, you can drive a synth on port A in standard 12-EDO while port B plays a Pythagorean bass and port C runs 19-EDO leads.



Screen elements

(1) Header

Confirms which preset is being edited.

(2) Port selector (A, B, C)

One row per output port. Each port can run its own independent tuning.

(3) Scale name

The scale currently assigned to this port. Tap to open a list of available scales.

(4) CANCEL

Discards changes and returns.

(5) SAVE

Writes the tunings to the preset and returns.

Available tunings

Nine built-in scales ship with the firmware. Each can be assigned per port, per preset. Standard is the default and bypasses the retuning engine entirely.

- **Standard**, 12-tone equal temperament. The default Western tuning, every note on a piano keyboard, octave split into 12 equal semitones (100 cents each). Use this when driving a synth that expects standard MIDI.
- **19-EDO**, Octave divided into 19 equal steps (~63 cents each). Major thirds sound noticeably purer than 12-EDO, and enharmonic pairs like C# and D $\flat$ become genuinely distinct notes. A staple of xenharmonic and experimental composition; comfortable to explore because familiar diatonic scales still work.

- **24-EDO**, Quartertones. The octave divided into 24 equal steps (50 cents apart), twice the resolution of standard tuning. Used in Arabic classical music, some contemporary classical works, and by anyone chasing blue notes between the keys.
- **Just Intonation**, 5-limit intervals built from simple integer ratios (3:2 fifths, 5:4 major thirds, etc.). Triads lock into place with no beating in the home key, giving chords an almost pre-recorded consonance. The trade-off: modulating away from the home key produces increasingly dissonant intervals. The classic tuning of unaccompanied vocal music.
- **Bohlen-Pierce**, A non-octave scale: the period is a tritave (3:1 frequency ratio, ~1902 cents) divided into 13 equal steps. There are no octaves at all, traditional major/minor harmony does not apply. Sounds alien and airy, and has been explored heavily in electronic and computer music since the 1970s.
- **Pythagorean**, 12 notes built entirely from stacked perfect fifths (3:2 ratios). Fifths and fourths are pure; major thirds are wider and more restless than in 12-EDO. Historically the tuning of medieval European chant and early Islamic music theory. Excellent for open-fifth and quartal harmony.
- **31-EDO**, Octave divided into 31 equal steps (~38.7 cents each). Approximates 5-limit just intonation exceptionally well, better than 19-EDO, making meantone-style harmony sound especially locked-in. Historically championed by Christian Huygens and, later, the Dutch composer Adriaan Fokker.
- **Slendro**, A 5-note tuning from Javanese and Balinese gamelan music, roughly equal steps of ~240 cents. No leading tones or dominant pull; melodies feel floating and cyclical rather than directional. This firmware uses a Wilson approximation; real gamelans vary tuning significantly by ensemble.
- **Pelog**, A 7-note gamelan scale with distinctly unequal spacing, small steps clustered together, then large leaps. Traditionally only 5 of the 7 notes are used in any given piece (via mode selections called *pathet*). Evocative and unresolved compared to Western tunings.

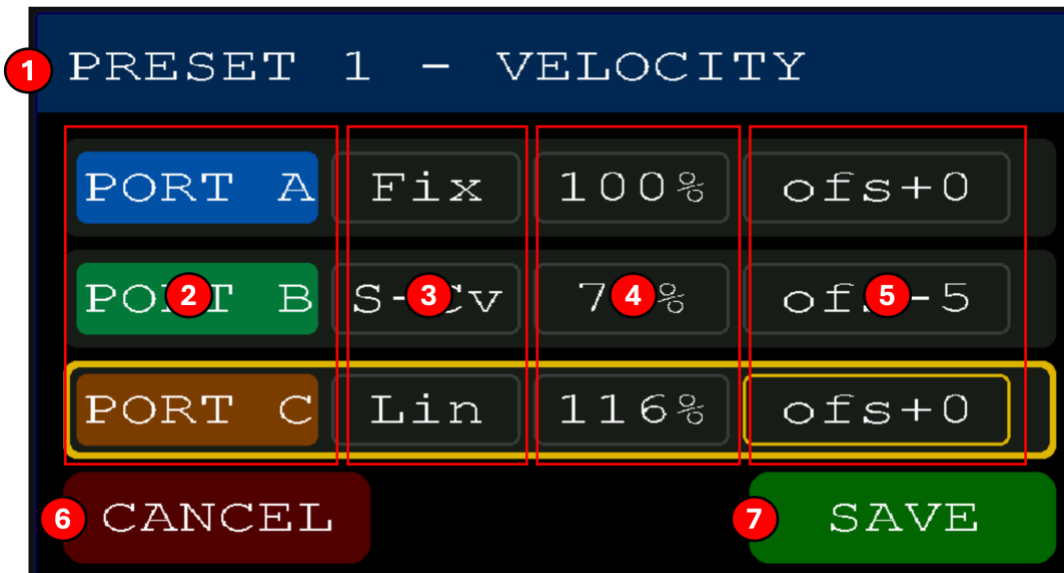
Notes

Note. Tuning is delivered as a pitch-bend paired with each note-on, so the receiving synth must respond to pitch-bend for the retuning to be audible. If microtonal intervals sound too small on the target synth, increase its pitch-bend range.

Note. Chord voicings in any non-standard tuning are approximate. MIDI tracks only one pitch-bend value per channel, so all sounding notes end up sharing whichever tuning offset the most-recently-played note used. Lead lines, melodic parts, and single-note phrases stay perfectly in tune. Standard (12-EDO) is not affected by this limitation because it sends no pitch-bend at all. Per-voice MPE routing is not currently supported.

7.5.2 Velocity

The Velocity editor reshapes how incoming keyboard velocity is mapped to outgoing note velocity, per output port. Useful for taming or exaggerating dynamics on a particular synth without changing your playing.



Screen elements

(1) Header

Confirms which preset is being edited.

(2) Port selector (A, B, C)

One row per output port. Each port has its own independent curve, gain, and offset.

(3) Curve type

The shape of the velocity mapping: Lin (linear pass-through), S-Cv (S-curve, compresses extremes), Fix (fixed output regardless of input), and additional curve types.

(4) Gain

Overall scaling percentage applied after the curve. 100% is unity.

(5) Offset

Constant added to the final velocity. Positive raises the floor, negative lowers the ceiling.

(6) CANCEL

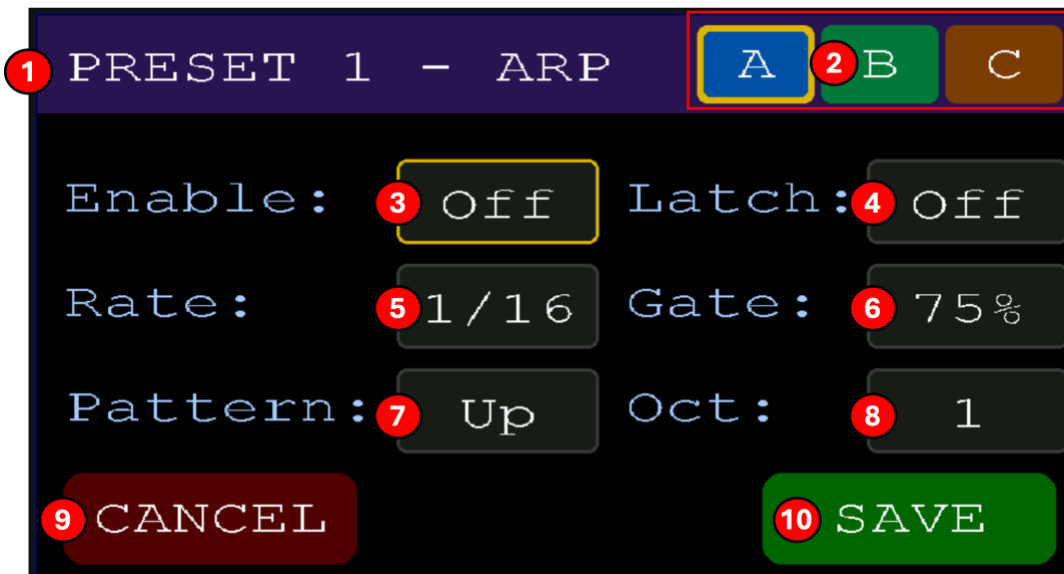
Discards changes and returns.

(7) SAVE

Writes the settings to the preset and returns.

7.5.3 Arpeggiator

The Arpeggiator editor configures a per-port arpeggiator for the current preset. Each of the three output ports can run its own independent arpeggiator, driven by internal clock or external MIDI clock. Internal or external clock mode is set through the clock screen. (see clock section)



Screen elements

(1) Header

Confirms which preset is being edited.

(2) Port tabs (A, B, C)

Tap to switch which output port's arpeggiator you're editing. The highlighted tab is active.

(3) Enable

Master on/off for the arp on this port. When off, notes pass through untouched.

(4) Latch

When on, held notes continue arpeggiating after you release them, until you play a new note or press CANCEL/PANIC.

(5) Rate

Step length as a musical note value (1/4, 1/8, 1/16, etc.) synced to the current clock.

(6) Gate

Percentage of each step during which the note sounds. Lower values are staccato, higher values are legato.

(7) Pattern

Note order, Up, Down, Up-Down, Random, and other pattern types.

(8) Octaves

How many octaves the pattern spans above the held notes.

(9) CANCEL

Discards changes and returns.

(10) SAVE

Writes the settings to the preset and returns.

Notes

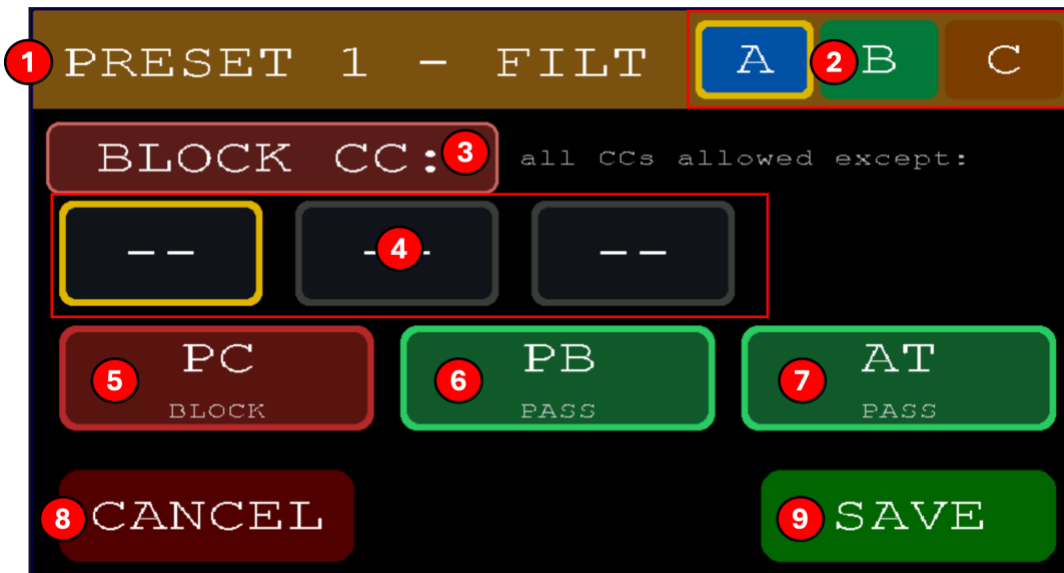
Note. The arpeggiator respects the port's tuning and velocity settings, enable a microtonal scale on Port A and its arp will play in that scale.

Note. Zoning gates which notes enter the arpeggiator buffer. Once a note is held and being arpeggiated, the octave-range expansion can carry the pattern above the zone, the only limit is MIDI 127.

Note. A running arp keeps time seamlessly while you navigate between edit screens. MIDI clock generation and arp step-firing run from hardware timer interrupts, so full-screen redraws never delay a step — you can jump into Chord, Tuning, or the arp editor itself and turn knobs live without the arp skipping a beat.

7.5.4 MIDI Filter

The MIDI Filter editor lets you shape which incoming MIDI messages from the master keyboard get forwarded through each output port. Useful when your keyboard sends CCs, program changes, or aftertouch that a downstream synth doesn't handle well — for example a sustain pedal (CC 64) you don't want translated to another instrument. Program Change is blocked by default because the FSE-1 already emits its own PC on preset activation; the filter only affects incoming PC from the keyboard, never the FSE-1's own preset PC.



Screen elements

(1) Header

Confirms which preset is being edited. The banner shows FILT (a shortened form of FILTER used to keep the port tabs on-screen).

(2) Port tabs (A, B, C)

Tap to switch which output port's filter you're editing.

(3) CC filter — mode toggle and 3 slots

The CC row has a BLOCK/ALLOW mode toggle (red for BLOCK, green for ALLOW) and three CC number slots. In ALLOW mode (the default on fresh presets) the caption reads "all CCs blocked except:" and the three slots list the only CCs allowed through; everything else is dropped. Tap the toggle to switch to BLOCK mode — the caption becomes "all CCs allowed except:" and the three slots now list the CCs to drop; everything else passes through. Slots left blank (--) are unused. In ALLOW mode with all three slots blank, every CC is blocked.

(4) PC

Whether Program Change messages from the master keyboard pass through this port. Default is BLOCK. This affects incoming keyboard PC only; the FSE-1's own preset-activation PC always sends. Tap to toggle PASS/BLOCK.

(5) PB

Whether Pitch Bend messages pass through this port. Tap to toggle PASS/BLOCK.

(6) AT

Whether Aftertouch (both channel and poly) passes through this port. Tap to toggle PASS/BLOCK.

(7) CANCEL

Discards changes and returns.

(8) SAVE

Writes the filter to the preset and returns.

Notes

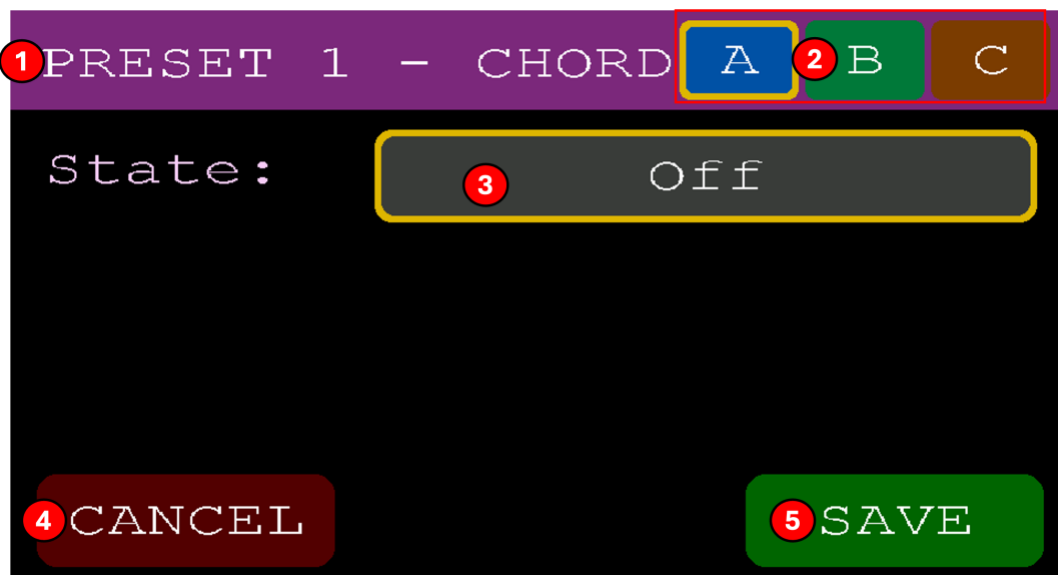
Note. The filter only shapes incoming keyboard messages. MIDI the FSE-1 generates itself — knob-driven CC and preset-activation PC — is never filtered, so setting the knob's CC in a block slot won't silence the knob. Note-on and note-off messages are always forwarded either way; the filter only affects CC, PC, PB, and aftertouch.

7.5.5 Chord Generation

Chord Generator Editor

The Chord Generator turns each single note you play into a full chord on the output. Each port has its own independent settings, so you can layer, for example, a Maj7 on Port A with a scale-locked diatonic 7th on Port B.

Every port has three top-level States. Only the fields that apply to the current State are drawn on the screen. Pick a State and the editor rearranges itself to show just what that State needs.



Screen elements

(1) Header

Confirms which preset is being edited.

(2) Port tabs (A, B, C)

Tap to switch which output port's chord settings you're editing. Each port keeps its own independent State, Type, Key, Mode, and Voicing.

(3) State

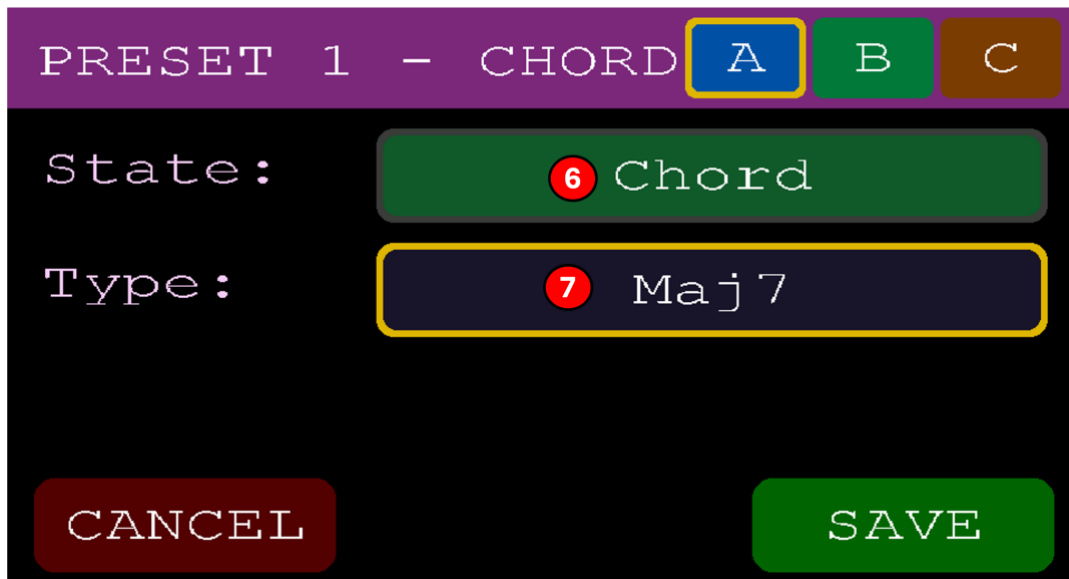
The top-level selector. Cycles through Off, Chord, and Diatonic when tapped. Rows below appear or disappear depending on the choice.

(4) CANCEL

Discards changes and returns.

(5) SAVE

Writes the settings to the preset and returns.

**(6) State (showing 'Chord')**

Tapped once from Off. A single Type row appears.

(7) Type

The fixed chord built above each played root. Thirteen types ship with the firmware — listed below. Numbers in parentheses list the intervals in semitones from the root.

- **Maj**, Major triad (0, 4, 7).
- **Min**, Minor triad (0, 3, 7).
- **Sus2**, Suspended 2nd (0, 2, 7).
- **Sus4**, Suspended 4th (0, 5, 7).
- **Dim**, Diminished triad (0, 3, 6).
- **Aug**, Augmented triad (0, 4, 8).

- **Maj7**, Major 7th (0, 4, 7, 11).
- **Min7**, Minor 7th (0, 3, 7, 10).
- **7**, Dominant 7 (0, 4, 7, 10).
- **Maj9**, Major 9th (0, 4, 7, 11, 14).
- **Min9**, Minor 9th (0, 3, 7, 10, 14).
- **Add9**, Major triad plus a 9, no 7th (0, 4, 7, 14).
- **5th**, Parallel fifth (0, 7) — just the root and a perfect fifth, two notes, useful for organum, power-chord, or bass doubling.



In Diatonic State, every played note is snapped to the nearest scale degree in the selected Key and Mode, then a chord is built by stacking the chosen Voicing's scale degrees above it. The result is textbook diatonic harmony: play white keys in C Major and you get I, ii, iii, IV, V, vi, vii° automatically. Play the same keys in C Dorian and you get i, ii, bIII, IV, v, vi°, bVII — same input, correct harmony for the mode.

(8) State (showing 'Diatonic')

Tapped once more from Chord. The Type row is replaced by the three Diatonic fields.

(9) Key

Root note of the scale — the 'do' of your key. Twelve options: C, C#, D, D#, E, F, F#, G, G#, A, A#, B.

(10) Mode

The scale that snaps every played note. Sixteen scales ship with the firmware:

- **Major**, Ionian — the standard I ii iii IV V vi vii° major scale.
- **Dorian**, Minor with a raised 6th (jazz and modal rock staple).
- **Phrygian**, Minor with a flat 2nd (Spanish, flamenco, dark rock).
- **Lydian**, Major with a raised 4th (dreamy, film-score bright).

- **Mixolydian**, Major with a flat 7th (rock, country, Celtic).
- **Minor**, Aeolian — the standard natural-minor scale.
- **Locrian**, Minor with flat 2nd and flat 5th (rarely used tonic).
- **HarmMinor**, Minor with a raised 7th (classical, Middle Eastern).
- **MeloMinor**, Minor with raised 6th and 7th, ascending (jazz).
- **PentaMajor**, 5-note major, no 4th or 7th (folk, blues, pop).
- **PentaMinor**, 5-note minor, no 2nd or 6th (blues, rock lead).
- **Blues**, Pentatonic minor plus a flat 5th 'blue note'.
- **WholeTone**, Six whole-step scale, no half-steps, dreamlike.
- **HalfWhole**, 8-note diminished scale, alternates half-whole steps.
- **PhrygDom**, Phrygian with a major 3rd (Spanish, flamenco, klezmer).
- **HungMinor**, Harmonic minor with a raised 4th, exotic tonic.

(11) Voicing

How many notes are stacked above the played root, always drawn from within the current Key and Mode. Eight voicings:

- **Triad**, Root + 3rd + 5th (three notes, the default).
- **3rd**, Root + 3rd (two-note parallel thirds).
- **5th**, Root + 5th (two-note parallel fifths, organum feel).
- **Sus**, Root + 4th + 5th (suspended, no third).
- **6th**, Root + 3rd + 5th + 6th (vintage jazz).
- **7th**, Root + 3rd + 5th + 7th (jazz / soul staple; play in Dorian for m7, Major for maj7, Mixolydian for dom7, etc.).
- **Add9**, Root + 3rd + 5th + 9th (airy modern voicing).
- **9th**, Root + 3rd + 5th + 7th + 9th (full ninth chord).

Notes

Note. Chord generation happens after tuning and velocity processing, so chord notes are retuned by the per-port scale. However, MIDI pitch-bend is applied per channel, not per note, so in a non-standard tuning all notes in a chord share one pitch-bend value, melodic lines will intonate perfectly, but stacked chord voicings only approximate.

Note. All chord voicings play in root position. The note you press is the lowest note of the chord; the intervals (Chord State) or scale degrees (Diatonic State) stack above it.

Note. Zoning gates the root note only. Once a note passes the port's zone check, the full chord expansion plays — chord notes that fall outside the zone still go out. The only limit on chord output is the 5-note maximum per played note (Maj9, Min9, and 9th).

7.5.6 Latch

Latch is a global on/off toggle, not a dedicated editor. When enabled, the port-mode picker in the Program editor gains two extra modes: All Latch and Zone Latch. In either latch mode, held notes drone until the next chord. Release the keys and the notes keep sounding; play a new chord to replace them.

Turn latch off from the Features screen and the picker limits itself to None, All, and Zone. Existing latched presets play with the latch behavior translated to their non-latch equivalent, so nothing hangs.

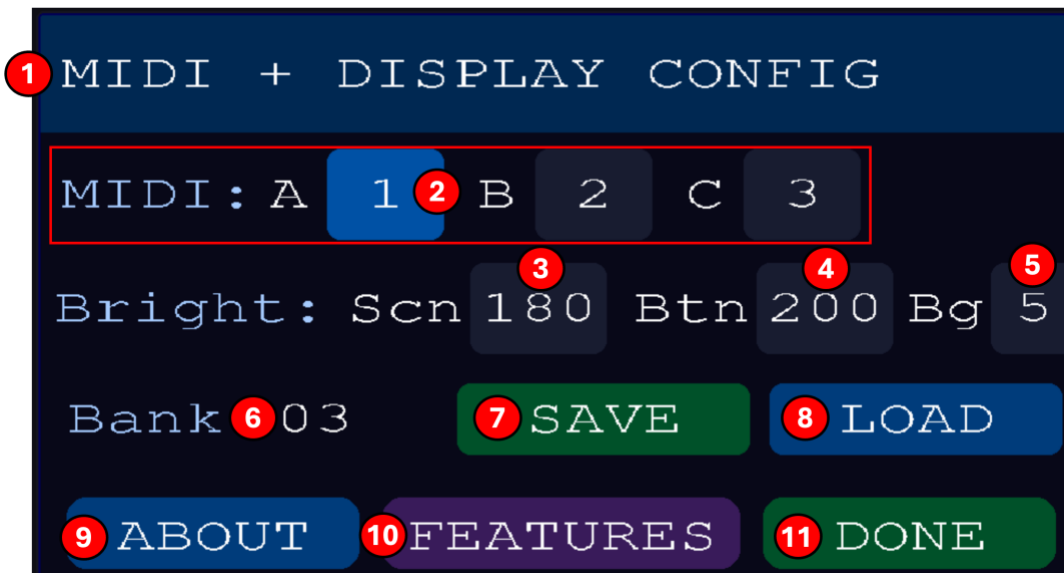
Notes

Note. Any latched chord releases automatically when you tap a preset button. Useful mid-set when you want a droning chord to stop without triggering Panic. The new preset loads normally with its own settings; only the previous latched notes are silenced.

Note. If a latched chord ever refuses to release (a synth ignoring the note-off, a stuck sustain CC), Panic still works: hold buttons 1 and 16 for half a second to silence every port on every channel.

8 System Configuration Screen

The Config screen holds all global settings, MIDI channels, brightness, bank save/load, About, and Features. Reach it by tapping SYSTEM on the Live screen. Settings here apply to the whole unit, not to any single preset.



Screen elements

(1) Header

Titled MIDI + DISPLAY CONFIG.

(2) MIDI channels A/B/C

The base MIDI channel used on each output port (1–16). Match these to the receive channels on your connected synths.

(3) Scn (screen brightness)

LCD backlight brightness, 0–255.

(4) Btn (button brightness)

Pad LED brightness, 0–255. This sets the brightness of the selected presets and all other functionality (except background light)

(5) Bg (background brightness)

This sets the brightness of the buttons that are not the selected preset.

(6) Bank number

The bank slot currently loaded (1–16 or higher). Each bank contains its own 16 presets.

(7) SAVE

Saves the currently active in-memory bank to the numbered bank slot shown above.

(8) LOAD

Opens the Load Bank screen so you can pick a different bank slot to load into memory.

(9) ABOUT

Opens the About screen.

(10) FEATURES

Opens the Features screen and allows you to toggle optional per-preset features (Tuning, Vel, Arp, Latch, Filter, Chord) on or off globally.

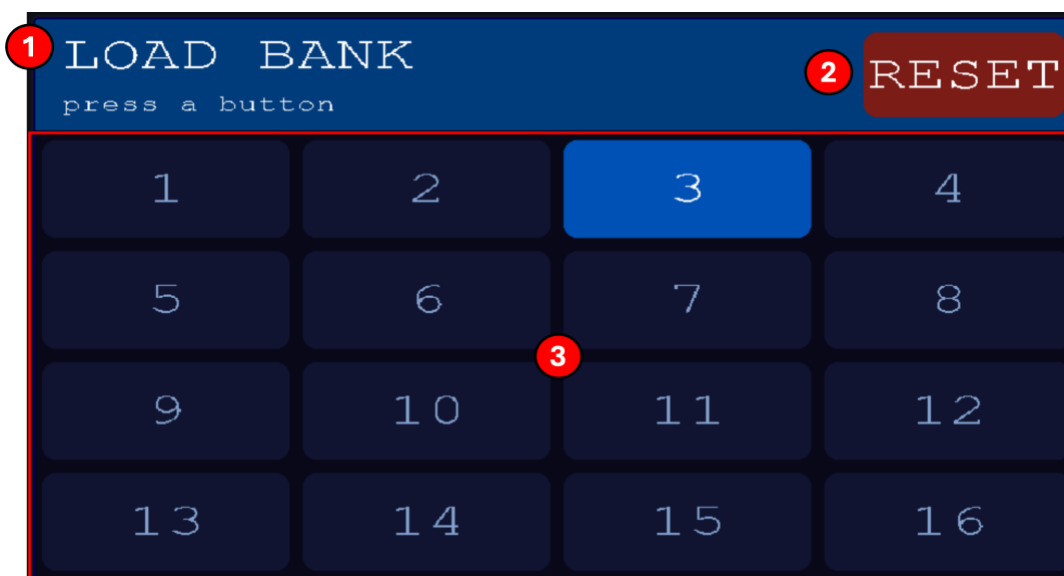
(11) DONE

Returns to the Live screen. Settings on this screen are saved immediately as you change them.

8.1 SD Card and Banks

The SD card stores up to 16 banks, each holding 16 presets and their names. Files are named BANK01.TTY ... BANK16.TTY. Saved in a bank: all 16 presets and their names. Not saved in a bank: MIDI channels, brightness, BPM, clock source, feature toggles, those live in EEPROM.

The Load Bank screen lets you pick a bank slot from the SD card and load its 16 presets into active memory. Reach it via SYSTEM → LOAD. Use either the button pads or the touch screen to load a bank.



Screen elements

(1) Header

Titled LOAD BANK with a prompt to press a numbered button.

(2) RESET

Restores the current bank slot to its factory-shipped state. Overwrites any user edits to that bank.
Confirm before tapping!

(3) Bank grid (1–16)

Tap any numbered pad on the touchscreen or the matching button on the front panel to load that bank slot.

Automatic migration

If you load a bank saved by an older firmware version, the FSE automatically converts it to the current format and re-saves. New fields fill in with pass-through defaults so the bank still plays the same, plus the new fields become editable normally.

SD card format

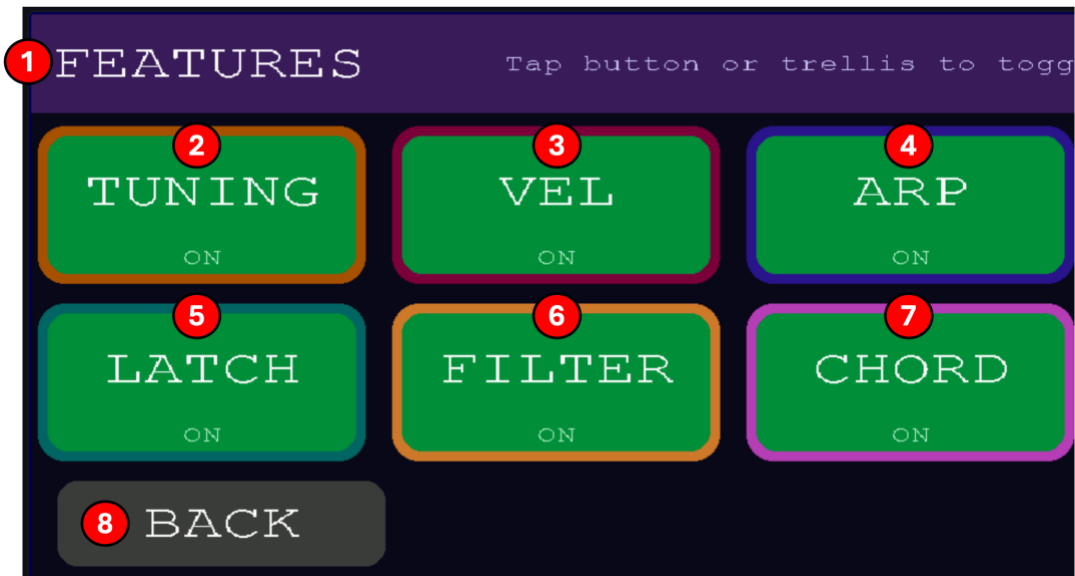
FAT32. Cards up to 32 GB are known good; larger cards should work but aren't tested. If a bank fails to load or save, the FSE tries to remount the card once before reporting an error.

Notes

Note. Loading a bank replaces every preset (1–16) with the ones stored in the chosen slot. If you have session edits in memory, the FSE always prompts before loading — an amber popup shows SAVE (writes your current state to a bank slot first, then loads the new one), DROP (proceeds and loses your edits), or BACK (cancels the load). SAVE targets the currently-active bank when there is one, or the destination slot as a fallback.

8.2 Feature Editor

The Features screen toggles optional per-preset features on and off globally. When a feature is on, its tile appears in the Preset Editor; when off, the tile is hidden and the feature is bypassed on every preset. Reach it via SYSTEM → FEATURES.



Screen elements

(1) Header

Titled FEATURES with a hint that features can be toggled from the touchscreen or from the front-panel buttons.

(2) TUNING

Enables the per-port microtonal Tuning editor across all presets.

(3) VEL

Enables the per-port Velocity curve editor across all presets.

(4) ARP

Enables the per-port Arpeggiator editor across all presets.

(5) LATCH

Enables the latch functionality that is set on the preset screen. If this functionality is enabled, the pressed notes on the master keyboard continue sounding after release until cleared if specified to do so in the mode select in the preset menu (Alat or Zlat)

(6) FILTER

Enables the per-port MIDI Filter editor across all presets.

(7) CHORD

Enables the per-port Chord Generator editor across all presets.

(8) BACK

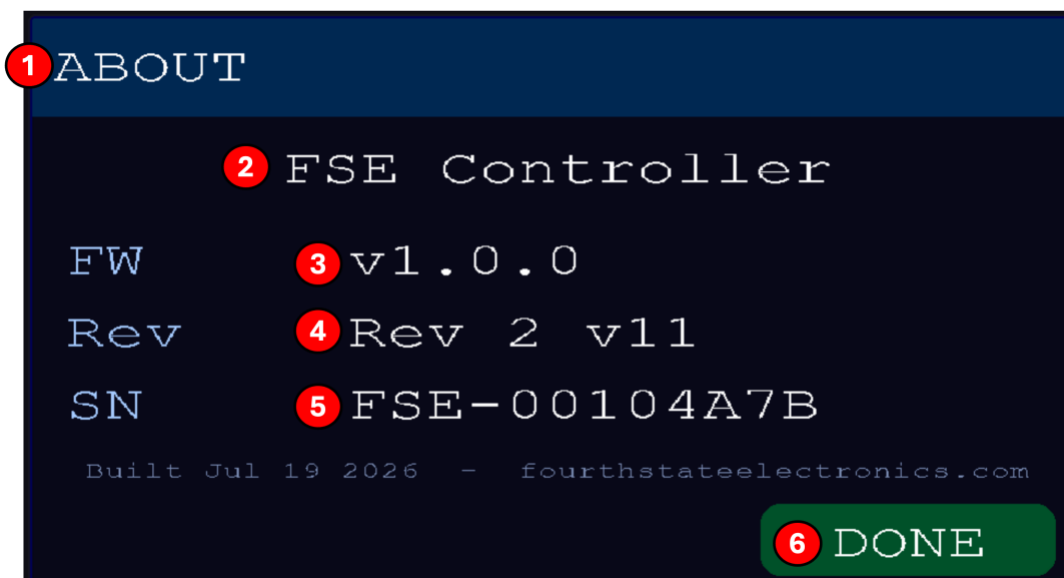
Returns to the Config screen.

Notes

Note. Turning a feature off hides its editor tile in the preset menu (except latch) but preserves the per-preset settings underneath, turning it back on restores your previous configuration.

8.3 About Screen

The About screen shows identifying information about your unit. This is useful when contacting support or checking that you're on the latest firmware. Reach it via SYSTEM → ABOUT.



Screen elements

(1) Header

Titled ABOUT.

(2) Model name

(3) FW (firmware version)

The firmware version currently running on the unit.

(4) Rev (hardware revision)

The hardware board revision.

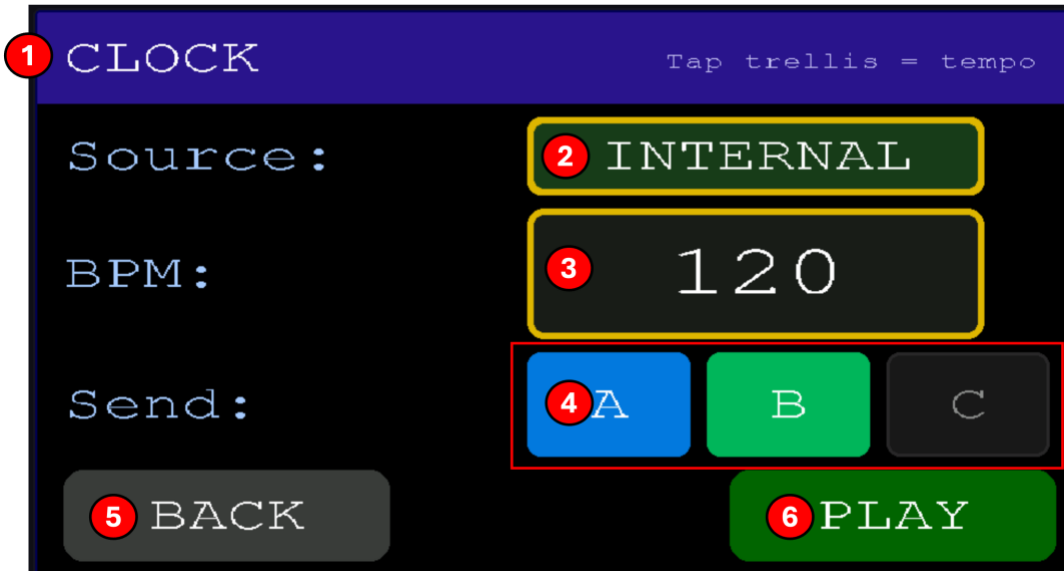
(5) SN (serial number)

(6) DONE

Returns to the Config screen.

9 Clock

The Clock screen configures the global tempo used by the arpeggiator, latching, and any downstream synth that syncs to MIDI clock. Reach it by tapping CLOCK on the Live screen.



Screen elements

(1) Header + tap tempo hint

The banner shows CLOCK and a reminder that you can tap the buttons in time to set BPM.

(2) Source

Where clock ticks come from. INTERNAL uses the built-in tempo. EXTERNAL slaves to MIDI clock arriving on the MIDI IN port.

(3) BPM

The internal tempo, in beats per minute. Edit with Knob 1 or by tapping. Ignored when Source is EXTERNAL.

(4) Send port toggles (A, B, C)

Which output ports transmit MIDI clock. Tap to toggle each port. Highlighted ports are transmitting.

(5) BACK

Returns to the Live screen. Clock changes are applied immediately as you make them.

(6) PLAY

Starts/stops MIDI transport (Start/Stop messages) on the selected send ports.

Notes

Note. Clock is a global setting, it applies to every preset. Only which features consume the clock (arp, latch timing) are per-preset.

Tap tempo

On the Clock screen when Source is Internal, the buttons become a tap surface and glow purple. Tap steadily at your target tempo, 2 taps set the BPM to the interval, 3–4 taps stabilize to the rolling average. Pause more than 2 seconds to start fresh. Taps outside 60–240 BPM are ignored.

10 Panic

If notes get stuck, a synth misses a note-off, a sustain CC hangs, a latched chord won't release, you can always recover without touching the display.

Hold buttons 1 and 16 (top-left and bottom-right corners) together for half a second. The buttons flash red briefly, then:

- All Notes Off (CC 123) is sent on all 16 channels of all 3 ports
- Reset All Controllers (CC 121) sweeps every channel
- Sustain (CC 64 = 0) explicitly clears every channel
- Explicit note-off 0–127 is sent on each port's active channel
- Any latched chord is cleared
- Any playing arp is silenced
- MIDI clock transport (if internal) is stopped so downstream sequencers reset cleanly

Note. Panic works from any screen. The visual state doesn't change, panic silences the audio without disturbing your workflow.

11 Troubleshooting

The SD card shows as missing at boot

The card was slow to enumerate on power-up. The firmware retries mount up to three times before giving up. If it still fails: reseal the card; reformat to FAT32 on a computer and copy your BANK*.TTY files back.

A bank won't load

The Config screen briefly shows one of these messages:

- No SD card, the card is genuinely absent or the socket has failed.
- SD error, a transient failure; try again.
- Load failed, the file failed twice.
- Bad file size, the file is from a firmware version outside the auto-migrate path, or is corrupted.

Notes hang after switching presets

Should not happen, every preset switch sends note-offs before the new preset's PCs. If you see it, hit the panic combo (buttons 1 and 16) and please report the reproduction steps via the support URL.

A knob doesn't do anything after switching presets

This is the knob-pickup feature working correctly. Sweep the knob through the current internal value (visible on the Live screen) and it will start sending again.

The arp keeps playing after I released the chord

The port's arp is in Latch mode. Tap the currently-active preset button to stop it, or turn Latch off for that port in the Arp editor.

I want to reset one preset without affecting the others

The RESET button on Config resets the entire bank (all 16 presets). To reset a single preset, load a fresh bank slot into the preset, or manually re-edit its PROGRAM, COLOR, and NAME back to defaults.

Firmware update

Connect the FSE to your computer using the micro-USB port. Then open Softload, either the standalone app from <https://www.fourthstateelectronics.com/downloads/> or the web version at <https://www.fourthstateelectronics.com/softload/>. Download the latest firmware .hex from the same

downloads page, click Upload Firmware in Softload, and select the file. The FSE reboots into the new firmware when the flash

completes.<https://www.fourthstateelectronics.com/downloads/https://www.fourthstateelectronics.com/softload/>

If Softload can't see the FSE

- Use Chrome or Edge. Web Serial isn't available in Safari or Firefox.
- Try a different USB cable. Some cables are power-only and can't carry data.
- Close any program that might be holding the serial port open, like Arduino IDE or another serial monitor.

12 Softload

Softload is the companion computer app for the FSE 1. It runs in your web browser, connects to the FSE over the microUSB on the side panel, and gives you a large-screen editor for banks and presets plus a one-click firmware updater. With the exception of firmware updates, everything softload does is also available on the FSE itself; softload just makes bulk editing, backups, and firmware updates much faster than doing it on the touchscreen.

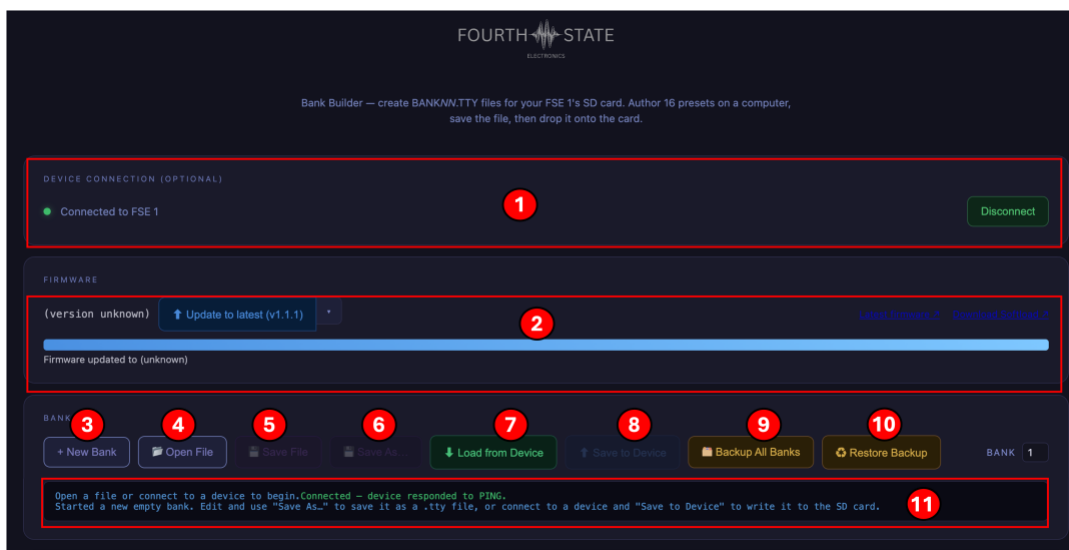
Note. Softload requires Chrome or Edge, Web Serial and File System Access aren't available in Safari or Firefox. It works fully offline; no install and no internet connection are needed once the page has loaded.

Getting Softload

There are two ways to run softload:

- Web version, open fourthstateelectronics.com/softload in Chrome or Edge. Nothing to install. This is the simplest option and always gives you the latest release.
- Standalone binary, download the .zip for your platform (macOS Apple Silicon, macOS Intel, or Windows) from the Downloads page — the tiles link to the latest GitHub Release. Unzip after download; on macOS the first launch needs a right-click → Open (the binary isn't Apple-signed, so a double-click shows "unidentified developer" right-click bypasses it just once). The binary starts a tiny local server, opens your browser to it, and shuts down when you close the terminal window.

Both versions are functionally identical.



The Softload Window

The top half of the softload page groups tasks into three cards, in the order you'll use them: Device Connection, Firmware, and Bank. Below those is the Preset Editor for whichever bank you have loaded.

(1) Device Connection

Click Connect to Device. Chrome pops a serial-port picker; pick the FSE 1. If successfully connected, softload shows a green status dot, and unlocks every other card. Softload bank creation can also work with no device connected. Open File / Save File let you edit .tty bank files offline.

(2) Firmware

Shows the version currently running on your FSE (auto-queried on connect). To install the current release, click Update to latest (vX.Y.Z) — softload fetches the .hex from fourthstateelectronics.com and flashes it in a single click. The version number on the button always matches whatever the site currently publishes, so there's nothing to hunt for. Use the ▼ dropdown next to it to install an older version, or Load local .hex file... to flash a file you already have on disk (useful offline, or when testing a private build). An amber UPDATING FIRMWARE banner appears on the FSE while the transfer runs; the unit reboots automatically when done and softload reconnects.

(3) New Bank

Start a fresh empty bank in the editor without needing a device connection or an existing file. All sixteen preset slots seed with default values, identical to what an empty SD slot on a fresh card would load. Pair with Save As... to write the bank to disk, or Save to Device to write it to the FSE's SD card.

(4) Open File

Load a .tty bank file from disk into the softload editor. Use this to work on an existing bank you previously downloaded or backed up.

(5) Save File

Write the currently-edited bank back to the same .tty file it was opened from. Disabled until you've either opened a file or done a Save As.

(6) Save As...

Write the currently-edited bank to a new .tty file. Use this to make a copy under a new name or save a bank you loaded from the device.

(7) Load from Device

Copy the numbered bank (see the BANK field on the right) from the FSE's SD card into the softload editor. Legacy banks from older firmware versions are auto-migrated on the first load.

(8) Save to Device

Write the bank currently open in the editor back to the FSE's SD card, overwriting the numbered bank slot. The FSE picks up the change immediately, no reboot needed.

(9) Backup All Banks

Pick a destination folder; softload downloads all sixteen banks from the FSE and writes them as BANK_01.tty ... BANK_16.tty into a dated folder (e.g. "FSE Backup 2026-07-24"). Your rescue for accidental overwrites, do this before major edits.

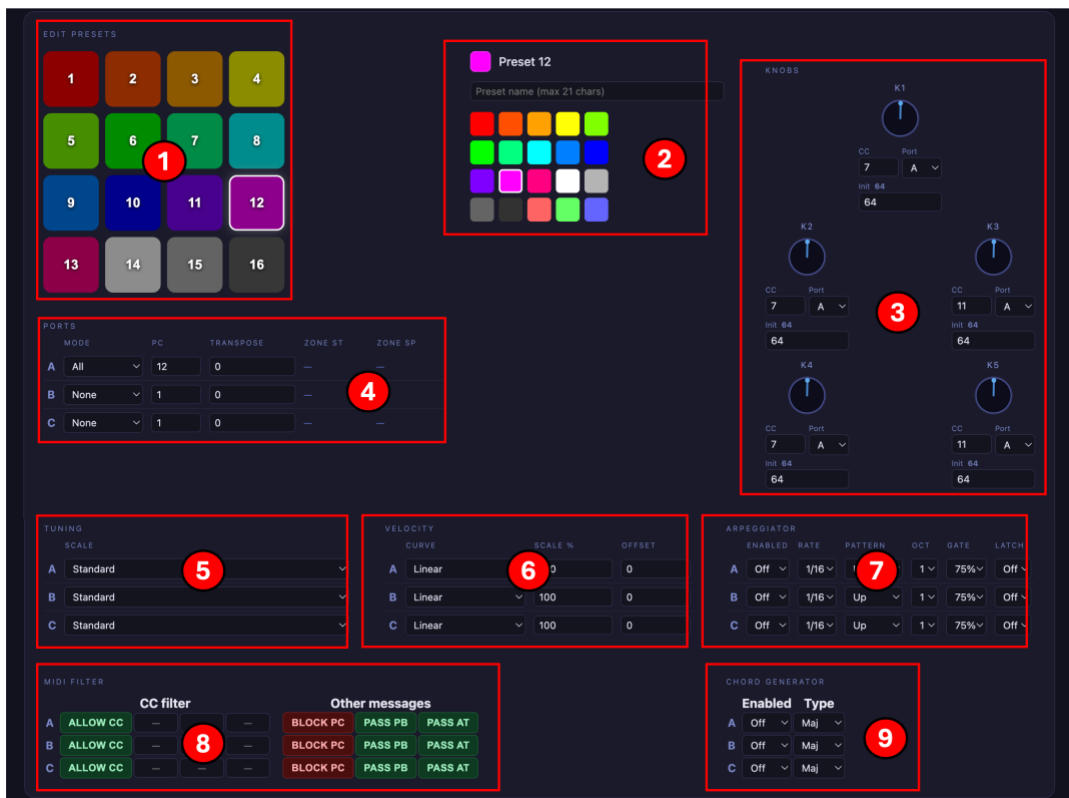
(10) Restore Backup

Pick a previously-created backup folder; softload uploads any BANK_NN.tty files it finds to the matching slots on the FSE. Missing banks in the folder are left alone.

(11) Activity Log

A running record of every action softload takes, connect, load, save, backup, restore. If something fails, this is where the error message shows up (e.g. ERR:CHECKSUM, ERR:BADSIZE). Includes per-bank success / failure detail during Backup All Banks.

Note. If your FSE isn't idle when you click a firmware update, softload shows an error such as ERR:BUSY_CLOCK. Stop the clock (CLOCK screen → STOP) and try again. If the update fails partway through, the FSE stays on the previous firmware, nothing is lost.



The Preset Editor

Once a bank is loaded, the Preset Editor at the bottom of the page is populated. Every setting the FSE exposes on-device is editable here, plus a few things much easier with a real keyboard and mouse (naming, color picking, bulk CC assignments).

Edits are held in softload's memory as you make them. Nothing is written back to the FSE until you click Save to Device (or Save File to save to disk).

(1) Preset selector

The sixteen buttons on the left mirror the physical buttons on the FSE. Each is colored with the preset's assigned color. The currently-selected preset is outlined in white. Click any button to switch to editing that preset, every field on the right updates to show that preset's data.

(2) Name and Color

Type up to 21 characters for the preset name in the text field. Below it, a 20-swatch palette; click any swatch to change the preset's pad color. Both the palette highlight and the preset selector button at left update instantly.

(3) Knobs

The five assignable knobs (K1–K5). For each knob, set the CC number it transmits, the output port (A, B, or C), and the startup value it sends when the preset loads. A live dial reflects the startup value.

(4) Ports

How each of the three output ports handles notes for this preset. Mode picks None / All / Zone / All Latch / Zone Latch. PC is the Program Change number transmitted on preset load. Transpose shifts every note by ± 2 octaves. Zone Start / Zone Sp only appear when the mode is Zone or Zone Latch.

(5) Tuning

Per-port microtonal scale. Standard is 12-TET (no re-tuning). Other options include various EDOs, historical temperaments, and world scales like Slendro and Pelog. See Appendix A for the full list.

(6) Velocity

Per-port velocity shaping. Curve chooses the response shape (Linear, Soft, Hard, S-Curve, Fixed). Scale % scales the result 0–200%; Offset adds ± 64 after the scale. See Appendix C for the curve reference.

(7) Arpeggiator

Per-port arpeggiator. Enabled turns it on. Rate is the note value (1/4 through 1/32). Pattern picks Up / Down / Up-Down / Random / As Played. Oct spans 1–4 octaves. Gate is the note length as a percent of the step. Latch keeps the arpeggiator running after you release the chord.

(8) MIDI Filter

Per-port MIDI event filter. Each row (A/B/C) has a BLOCK CC / ALLOW CC mode toggle plus three CC number slots. In BLOCK mode the three listed CCs are dropped and everything else passes; in ALLOW mode only the three listed CCs pass and everything else is dropped. Fresh banks default to ALLOW with no slots filled — nothing gets through until you list what to allow. To the right, PC / PB / AT toggle as explicit red BLOCK / green PASS buttons for Program Change, Pitch Bend, and Aftertouch. PC defaults to BLOCK because the FSE-1 emits its own PC on preset activation and keyboard-sent PC would fight it. The filter only shapes incoming keyboard messages — knob-driven CC and preset-activation PC that the FSE-1 sends itself are never gated.

(9) Chord Generator

Per-port chord expander. Enabled turns it on. Type picks the chord built above each played note, Maj, Min, Sus2, Sus4, Dim, Aug, Maj7, Min7, 7, Maj9, Min9, Add9. See Appendix B for the interval list.

Note. Softload's feature editors always show every field, even when the corresponding feature is disabled globally on the FSE. If a feature is off in SYSTEM → FEATURES on the device, softload will still let you edit its per-preset data, but the firmware silently ignores the settings until you turn the feature back on.

Saving your work

Nothing you do in the Preset Editor persists until you save. Two ways:

- Save to Device, writes the currently-edited bank back to the FSE's SD card, overwriting the numbered bank slot. The FSE picks up the change immediately.
- Save File / Save As, writes the bank to a .tty file on your disk. Good for making a backup before big edits or sharing banks with other FSE owners.

Closing the browser tab without saving still loses your edits, but Softload prompts before any in-app action that would discard them — + New Bank, Open File, or Load from Device. Click OK to proceed and lose the edits, or Cancel to go back and save first.

13 Appendix

A Tuning Scales

Available on the Tuning editor per output port. Standard (12-TET) is the default, notes pass through unchanged. Non-standard tunings retune each note by combining note-on with a per-voice pitch-bend on the port's channel.

- **Standard (12-EDO)**, Standard twelve-tone equal temperament. The default, no retuning applied.
- **19-EDO**, Nineteen equal divisions of the octave. Improved minor thirds; closer to just intonation for many triads.
- **24-EDO**, Quarter tones. Useful for Middle-Eastern and contemporary scales.
- **31-EDO**, Thirty-one equal divisions. Very close approximation to quarter-comma meantone temperament.
- **5-limit Just Intonation**, Chords built from small-integer frequency ratios. Pure thirds and fifths in the root key.
- **Pythagorean**, Fifth-based tuning. Perfect fifths at the expense of major thirds.
- **Slendro**, Traditional Indonesian five-note scale.
- **Pelog**, Traditional Indonesian seven-note scale.

B Chord Types

Available on the Chord Generator per output port. Intervals are semitones added to the played root note.

- **Maj**, Major triad, 0, 4, 7
- **Min**, Minor triad, 0, 3, 7
- **Sus2**, Suspended second, 0, 2, 7
- **Sus4**, Suspended fourth, 0, 5, 7
- **Dim**, Diminished, 0, 3, 6
- **Aug**, Augmented, 0, 4, 8
- **Maj7**, Major seventh, 0, 4, 7, 11
- **Min7**, Minor seventh, 0, 3, 7, 10
- **7**, Dominant seventh, 0, 4, 7, 10
- **Maj9**, Major ninth, 0, 4, 7, 11, 14
- **Min9**, Minor ninth, 0, 3, 7, 10, 14
- **Add9**, Add nine, 0, 4, 7, 14

C Velocity Curves

Available on the Velocity editor per output port. The curve shapes the response of the incoming velocity before gain and offset are applied.

- **Lin (Linear)**, No change, velocity passes through unmodified.
- **Soft**, Flatter response. Harder to reach top velocities; smooths an over-sensitive keyboard.
- **Hard**, Steeper response. Softer touches produce louder notes; useful for cutting through a mix.
- **S-Cv (S-Curve)**, Expressive middle range with compressed extremes, good default for keys players.
- **Fix (Fixed)**, Every note is transmitted at velocity 64 regardless of input.

14 Specifications

Preliminary specifications. Values marked TBD are placeholders, replace with final figures before printing.

Physical

- **Dimensions (L × W × H)**, 5.9 × 4.5 × 2.3 in (not including feet)
- **Weight**, 1.1 lb
- **Chassis**, anodized aluminum

Power

- **Input**, USB-C, 5 V DC
- **Current draw (typical)**, ~150 mA
- **Current draw (peak)**, 412 mA
- **Power consumption**, 0.75 W typical, 2.06 W peak

MIDI

- **Outputs**, 3 × 5-pin DIN (A, B, C)
- **Inputs**, 1 × 5-pin DIN
- **Clock**, 24 PPQ, sends / receives Start-Stop
- **Latency (in → out)**, TBD ms typical

USB

- **Rear USB-C**, 5 V power only
- **Side micro-USB**, Firmware update, softload, backup / restore
- **Data speed**, USB 2.0 High-Speed (480 Mbps)

Storage

- **Card slot**, microSD
- **Filesystem**, FAT32
- **Tested capacity**, 4 GB
- **Banks per card**, 16
- **Presets per bank**, 16

Controls & Display

- **Knobs**, 5 × 12 mm potentiometers
- **Buttons**, 16 × RGB backlit silicone buttons
- **Display**, 1.9" IPS TFT, 320 × 172, capacitive multi-touch
- **Power switch**, Rocker (rear)

15 Support

If you get stuck, you'll find help through one of the channels below. For any support request, please include your firmware version and serial number, both are shown on the ABOUT screen (SYSTEM → ABOUT).

Getting Help

- Email, support@fourthstateelectronics.com. Typical response within two business days.
- Website, fourthstateelectronics.com, knowledge base, tutorials, video walkthroughs, and the online version of this manual.

Firmware Updates

New firmware ships regularly, adding features and fixing bugs. Update at any time using the following steps:

- Connect your FSE 1 to your computer using the side micro-USB port, then open Softload — either the standalone app from fourthstateelectronics.com/downloads/ or the web version at fourthstateelectronics.com/softload/.
- In Softload, click Update to latest firmware. Softload downloads the latest .hex from the website and flashes it in one step. The FSE reboots into the new firmware automatically. To pick a specific version or load a local .hex file, use the version chooser next to the Update button.
- On next boot, check ABOUT to confirm the new firmware version.

Note. Your saved banks and settings survive firmware updates. Automatic migration handles bank files written by older firmware versions.

Softload

Bulk preset editing on a computer is done in Softload, our browser-based companion app. No install required: connect the side micro-USB port, open fourthstateelectronics.com/softload/ in Chrome or Edge, and click Connect. Edit every preset field (routing, tuning, chord generator, velocity, arpeggiator, MIDI filter), back up your whole bank set to a .tty file, and restore from a backup. A standalone desktop version is available on the downloads page for offline use.

Warranty

The Fourth State FSE 1 is covered by a one-year limited warranty from the date of original purchase, covering defects in materials and workmanship. Coverage extends to the original purchaser and is not transferable.

Not covered: physical damage, liquid damage, modifications outside firmware updates, and normal cosmetic wear.

If your unit is defective within the warranty period, email support@fourthstateelectronics.com with your serial number, order number, and a description of the fault. We'll repair or replace the unit at our option; if neither is practical, we'll issue a full refund. Shipping costs for warranty returns are covered by Fourth State Electronics within the continental United States; international customers are responsible for return shipping.

Fourth State Electronics

Designed and assembled in the USA

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