ARTIHIVE

Firmware 2.0.4 for M-Vave FM-1



Eight voices. Four interacting pairs. One nonlinear feedback network.
Created by KHAV with the assistance of Arena.ai Agent Mode.

English user and technical manual · November 2026

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This manual describes the stable ARTIHIVE 2.0.4 release. Version 2.0.4 has successfully started on physical FM-1 hardware and has passed the complete automated release suite.

1. Purpose, status and safety

ARTIHIVE is an experimental eight-voice drone synthesizer for the M-Vave FM-1. It was made to explore how far the device can be pushed as a sound instrument, a small real-time DSP platform and a graphic interface.

What has been physically confirmed

ARTIHIVE 2.0.4 has successfully started on a physical FM-1. Boot, display output and firmware operation are confirmed. Earlier hardware tests also confirmed sound, encoder response, MOD DEL operation and successful rollback to factory firmware.

Install responsibly

- Use a reliable data-capable USB cable and stable power.
- Do not disconnect power or USB while flash writing is in progress.
- Keep a known-good factory firmware package available.
- Begin audio testing at low volume, especially with short TIME and high feedback.

No absolute no-brick guarantee is possible. Interrupted writing remains the principal avoidable risk.

What is new in 2.0.4

POLY allocates notes in the order 1, 3, 5, 7, 2, 4, 6, 8. DRONE TUNE connects fixed note targets smoothly. In POLY the former MOD knob becomes a legato-only GLIDE control, while FM ROUTE MOD edits the selected pair. The indicators omit pair-name digits, retain numeric MOD amounts, and highlight the selected pair with a full frame: black on BLUSH VEIN and red on PORCELAIN. TIME 1/2 use queued 31.9 ms dual-head crossfades, and their MOD DEL bars reach the full rails at maximum TIME. ORGAN is the clean-install default; SELECT and ALGORITHM are finite while PRESETS remains cyclic.

On PORCELAIN, MOD DEL sliders, the HYPER LFO indication, LFO SPACE pair markers, the active arpeggiator step, the OUTPUT meter and only GR on OUT COMP are red; LFO SPACE tracks and the other compressor meters remain black. PORCELAIN SWARM also mixes red high-activity pixels with its black and white field. The DRONE oscilloscope trace is red while its baseline remains black.

FREEZE removes its loop-boundary click with a bounded 256-sample crossfade. SWARM now uses smooth independent roughly 10-second bidirectional sweeps, changes one discrete control per second, and draws a full-screen audio-reactive 30×30 cellular field in the selected colourway, shifted by Hyper LFO. OXIDE and BLACK RED are removed, and the solid dark ULTRAVIOLET theme is added, leaving twelve colourways. In DRONE, ENVELOPE and SHARP use black/white on standard colourways; PORCELAIN uses red/black, CARBON remains unchanged, and ULTRAVIOLET uses white for the selected pair with lavender text-colour ink for the others. In POLY every curve is black, red on PORCELAIN, or white on CARBON.

2. Installation and first boot

WebMIDI installation

Open the supplied self-contained install.html in a Chromium-based browser, connect the FM-1 by USB, choose the device and select artihive-2.0.4.fwsc. Keep the connection untouched until verification is complete.

Boot sequence

Stage	Expected result
Logo	Version at upper left, centred ARTIHIVE logo, and byKHAV in the saved colourway
Validation	Progress and status while all stored parameters are checked
READY	The interface opens after the staged boot hold
Before PLAY	Exact output silence; a preset is visible but not started
PLAY	The selected preset begins sounding

Update mode

Holding OCT− while powering on enters the hardware update path on supported FM-1 units. Recovery behaviour can vary by hardware revision; do not experiment with recovery unless ordinary installation or rollback has failed.

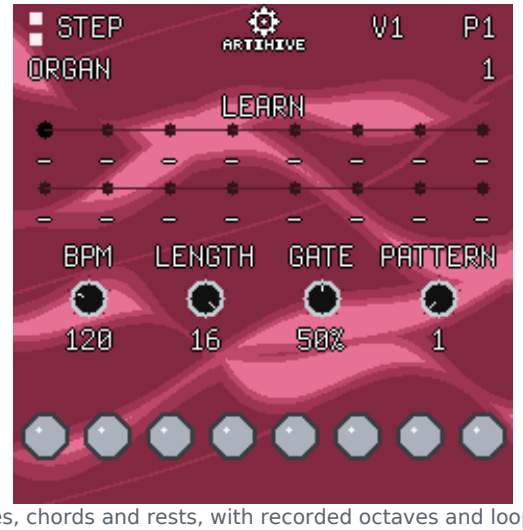
3. Panel and performance controls



VOICE page: one voice is selected while pair and global parameters remain visible.

Control	Action
HOME	Voice page; press again to switch DRONE/POLY
EDIT	FM ROUTE
BACK	ENVELOPE
LFO	HYPER LFO; press again for LFO SPACE
FX	MOD DEL; press again for modulation
SCL	Toggle delay FREEZE
ARP (short)	Open ARPEGGIO
ARP + HOME	Switch ARP DRONE/POLY
ARP (>0.7 s)	Select the next colourway
SEQ (short)	Open STEP
SEQ + HOME	Switch STEP DRONE/POLY
REC (>0.7 s)	Enter SWARM; release to return
SAVE + REC	Undo the latest SWARM session
PLAY	Start/stop ARP or STEP; all-drone action outside the sequencer
SAVE (short)	Select user slot outside STEP
SAVE (hold)	Store the patch, or the complete STEP bank on STEP

STEP sequencer



STEP provides ten patterns for notes, chords and rests, with recorded octaves and looping chains.

Press SEQ to open STEP. Hold SEQ and press one of the first ten black keys to select pattern 1–10. While stopped, play a note or chord to write the current step. In POLY, SEQ plus the rightmost black key writes REST. SEQ + OCT−/OCT+ navigates steps while stopped. Hold SAVE to store the complete bank.

Hold SEQ and press pattern keys in sequence to replace the current chain. The chain loops and follows the active pattern on-screen. Recorded octaves are retained. Changing the live POLY octave while transport runs does not transpose the sequence.

ARPEGGIO

Screenshot unavailable in this build.

ARP + HOME switches DRONE/POLY. PLAY always controls transport in POLY. Orders are UP, DOWN, PEND, RND, ALT UP, ALT DN, OUT-IN, IN-OUT and CHROM RND. CHROM RND is unavailable in DRONE. ARP and STEP use sample-accurate transport and preserve captured octaves.

Keys and octagonal contacts

The first eight white keys trigger envelopes for voices 1–8; they do not determine pitch. The next eight white keys independently toggle the same voices as drones. Each voice keeps its own TUNE value.

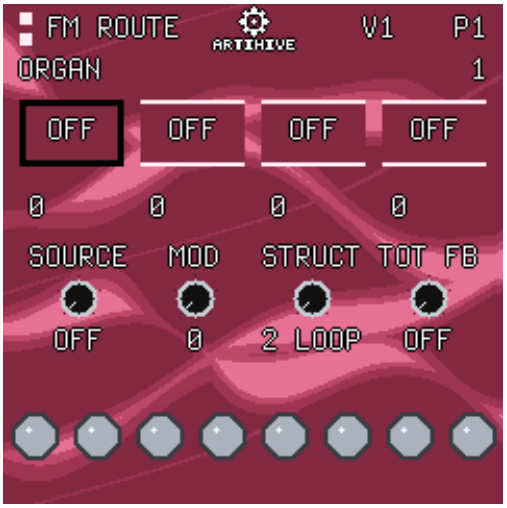
Each voice has one compact metal octagon with no backing pad. Its envelope appears at the centre and expands symmetrically towards all eight sides; ULTRAVIOLET uses black ink for this indication. The separate envelope bar and the former second contact are removed.

VOICE oscilloscope and vertical layout

DRONE places a real 128-sample output oscilloscope at the top. Its high-gain trace may escape the nominal amplitude field, but a protected gap prevents it from covering the four compact SHARP forms. Smaller knobs sit below; contacts remain at the bottom. Other pages use the larger field for enlarged LFO, routing, envelope, delay and Signal Web diagrams.

Graph ink adapts to the panel: black on Blush Vein and light themes, light on the remaining dark themes. Secondary lines use a separate intensity so overlapping modulation remains readable.

4. Voice and FM architecture



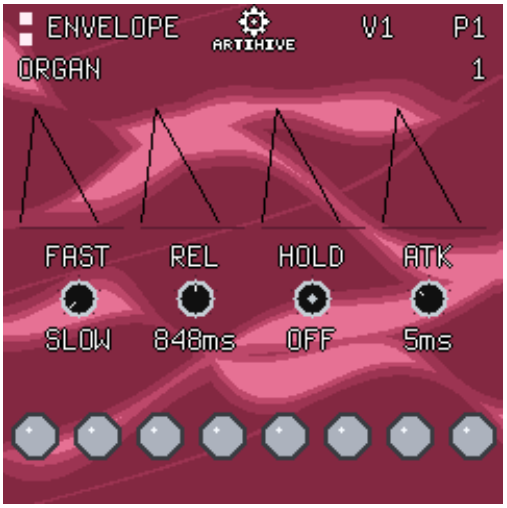
FM ROUTE shows pair source, structure and total-feedback state.

Eight oscillators are arranged as four permanent pairs: 12, 34, 56 and 78. TUNE and FINE belong to individual voices. SHARP, MOD and modulation routing belong to pairs.

Parameter	Scope	Meaning
TUNE	Voice	MIDI-note pitch, independently stored
FINE	Voice	Fine tuning up to approximately 98 cents
SHARP	Pair	Triangle-to-square waveshape
MOD	Pair	Frequency-modulation depth
SOURCE	Pair	OFF, another FM pair, or Hyper LFO
STRUCT	Global	Two loops or one four-pair ring
TOT FB	Global	Return total output into the modulation network

Strong modulation and total feedback intentionally create unstable, non-linear behaviour. Treat the instrument as an exploratory feedback system rather than a precision polysynth.

5. Envelope and Hyper LFO



ENVELOPE: FAST, REL and ATK follow the selected voice; HOLD follows its pair.

Parameter	Meaning
FAST	Per voice: selects the fast or slow release range
REL	Per voice, inverted: larger values produce a shorter decay
HOLD	Per pair: quadratic amplitude floor; high settings make that pair a drone
ATK	Per voice: attack approximately 2–743 ms



HYPER LFO combines two low-frequency oscillators.

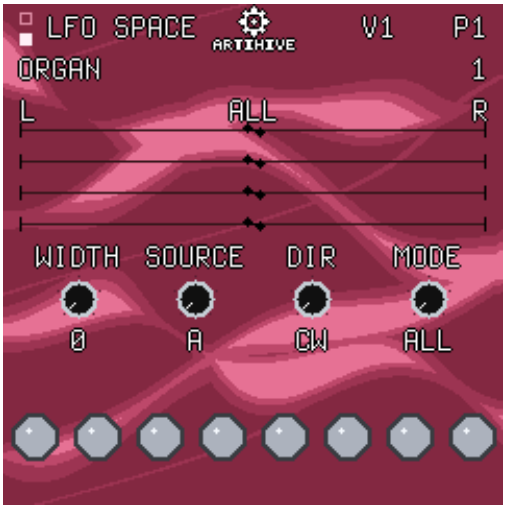
Parameter	Meaning
FREQ A / B	Approximately 0.08–21.6 Hz
MODE	OR for a broader contour; AND for gated intersections
LINK	A increasingly influences the rate of B

OR is the soft sum of the two triangle generators. AND retains its original stepped shape, clear plateaus and quick 1/8 response; the display shows that unsmoothed shape. With MOD DEL SOURCE=LFO and WAVE=SQR, only delay-head movement is smoothed: it crosses to the new delay time with an approximately 46 ms time constant while square plateaus stay flat.

Full-load stability: DRONE MASS calculates the PolyBLEP reciprocal only inside correction windows. Automatic flash persistence waits for complete silence instead of stopping an active drone. ARPEGGIO deadlines run from the 128-frame audio callback independently of LCD work. The panel

uses a stable approximately 10 Hz cadence with seven or eight active voices and approximately 16 Hz below that load, preserving predictable shared RAM-bus headroom for audio.

LFO SPACE



Press LFO again: pair motion is added to the existing stereo side signal.

Parameter	Meaning
WIDTH	0–127; zero is byte-identical to 1.3.3
SOURCE	LFO A, LFO B or combined OUT
DIR	Clockwise or counter-clockwise
MODE	ALL together, PAIR quarter-cycle offsets, or alternating ALT

Four full-width horizontal L/R lanes represent pairs 12, 34, 56 and 78 from top to bottom. Pair-number labels are deliberately omitted; every lane spans the safe x=8…231 field. Each joined double marker uses the actual audio pan coefficient and a small arrow shows direction. ALL aligns the lanes, PAIR applies quarter-cycle offsets and ALT mirrors adjacent pairs. No solid plate is drawn, so the procedural theme remains visible.

6. Modulation delay



MOD DEL: two cross-feedback delay lines.

SCL delay FREEZE

SCL stops writes to both delay rings while their read position keeps moving, looping the captured material without another buffer. The SCL LED and the persistent FREEZE status show the state. Loading a preset clears FREEZE.

Version 1.3.3 introduced the retained quadratic TIME law. The bottom of the knob is expanded for comb filtering and resonator effects, while the former 2039.4 ms maximum is retained.

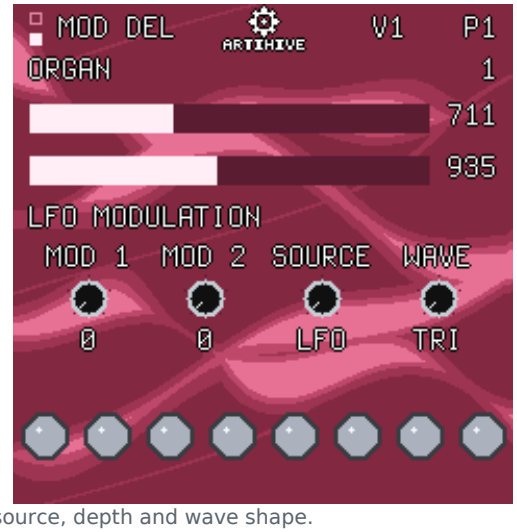
TIME value	Approximate delay
0	1 sample = 0.0227 ms
32	129 ms
64	518 ms
96	1165 ms
127	2039 ms

All thirteen retained factory presets preserve their migrated physical delay times, with no more than roughly 14 ms error. User slots remain structurally intact, but their saved numerical TIME values now follow the new curve.

Feedback caution

One-sample delay with high FB can become a loud high-frequency resonator. Start with FB and MIX low. Negative modulation is calculated as a signed value and safely clamped at one sample, so it can no longer wrap to the maximum end of the buffer.

MIX and FB use short per-sample smoothing, approximately 1/256 of the remaining difference per sample. Adding wet signal or feedback therefore does not inject an instantaneous level step into the audio path.



DELAY / MOD chooses modulation source, depth and wave shape.

SOURCE is directional rather than cyclic: turn KNOB 3 clockwise to select and hold SELF, or counter-clockwise to select and hold LFO. Continuing in the same direction never toggles to the other value.

7. Output, CPU and Signal Web



OUTPUT: drive, distortion mix, drift, pressure response and the Signal Web.

Parameter	Meaning
DRIVE	Gain into soft saturation, up to approximately 6.9×
D MIX	Blend between cleaner and distorted paths
DRIFT	Slow pitch instability, up to approximately ±5 cents
PRESS	Response level for panel-key sensor events

Signal Web

Eight activity-sensitive nodes represent the voices. Fixed pair colours are amber 12, cyan 34, magenta 56 and green 78. Inner links show modulation relationships, the outer ring shows TOTAL FB, and the retained bar displays output level.

CPU indicator

CPU 0–100% appears only in OUTPUT status. It is the smoothed audio-interrupt execution time divided by the full audio-block deadline. 100% means no processing budget remains. The host emulator reports 0% because it does not expose the JieLi hardware timer.

OUT COMP

Press GLO again on OUTPUT to open OUT COMP and switch between Signal Web and the lightweight stereo-linked compressor.

Control	Range
THRESH	−48…0 dB
RATIO	1:1…20:1
ATTACK	1…100 ms
RELEASE	20…2000 ms

IN, OUT and GR show the input, compressed output and gain reduction. One linked gain preserves the stereo image. At 1:1 the audio path is bypassed exactly.

8. POLY mode in ARTIHIVE 2.0

Press HOME a second time on DRONE to enter POLY; press HOME again to return to DRONE. All 27 physical keys play chromatically, including the black-key semitones. The default span is C3–D5.

Control	Action
ROOT	Chromatic root C through B
SHARP	One waveform-shape value for all eight voices
DETUNE	Voice spread; zero is equal temperament
MOD	One modulation-send value for all eight voices
OCT− / OCT+	Move POLY by octaves 1–7; DRONE retains semitone transpose

Eight voices can sound together. A ninth note steals the oldest active voice. Note level and outgoing velocity are fixed at 127. POLY has no drones or HOLD floor; PLAY controls ARP/STEP transport.

Global and held-voice envelopes

With no held key, FAST, RELEASE and ATTACK set all eight voices together. While notes are held, the controls edit only the newest still-held voice. HOLD displays OFF and remains inactive.

Display and textured themes

The eight voice contacts label only currently held notes. Voice numbers and permanent tuning labels are omitted. BLUSH VEIN uses white text and logos with black outlines; the four light vein themes use black text and logos with white outlines.

POLY 2.0 boundaries

POLY settings are not stored in presets. Incoming MIDI retains the compatible DRONE voice-address mapping; chromatic POLY allocation applies to the physical keyboard. Outgoing POLY key events use their true note numbers with velocity 127.

9. Presets and storage

There are thirteen factory presets and eight user slots. ACID SWARM, MACHINE and RUST were removed; the remaining factory bank is compactly numbered 1–13 and U1–U8 occupy positions 14–21. Loading never starts sound automatically after boot: press PLAY deliberately.

Operation	Result
Turn PRESETS	Choose one of 21 positions
Program Change 0–12	Load factory preset 1–13
Program Change 13–20	Load user slot U1–U8
Short SAVE	Choose a user destination
Hold SAVE >0.7 s	Write the current patch

Stored parameters are validated during boot. Out-of-range values are repaired before use. The saved colourway is also used by the startup screen. Transpose is a performance state and is not part of a patch.

Factory sound preservation

Legacy presets preserve their sound: each old pair FAST/REL value is copied to both voices, global ATK is copied to all eight voices, and each old four-voice HOLD value is copied to its two pairs. The inverted REL meaning is unchanged.

9. MIDI implementation

Message	Action
Note On, velocity 1–127	Enable DRONE voice (note mod 8)+1; velocity sets level
Note Off / Note On velocity 0	Release that DRONE voice
Program Change 0–12	Factory presets 1–13
Program Change 13–20	User slots U1–U8
CC 1	MOD for all four pairs
CC 20–23	MOD for pairs 1–4
CC 24–27	SHARP for pairs 1–4
CC 28 / 29	HOLD groups 1–4 / 5–8
CC 30 / 31	FREQ A / FREQ B
CC 32 / 33	Delay FB / MIX
CC 34 / 35	TIME 1 / TIME 2
CC 36 / 37	DRIVE / D MIX
CC 38 / 39	DRIFT / vibrato
CC 64	≥64 enable all drones; <64 release all
CC 120 / 123	Release all drones

Reception is OMNI. Panel sensor events transmit Note On/Off for notes 60–67 on MIDI channel 1. Other unsupported messages are ignored.

10. Colourways

The interface includes twelve original ARTIHIVE colourways. Every screen element follows the selected theme; sensor contacts remain consistently metallic.

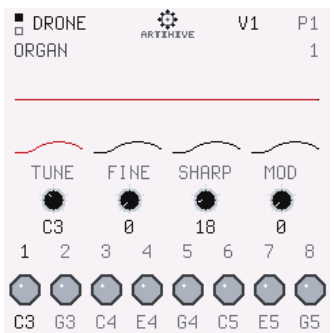
Colourway	Character
Blush Vein	Dark wine-red panel with flowing pink veins; factory default
Deep Blue	Blue industrial panel
Porcelain	High-contrast light panel
Rose	Warm light panel
Toxic Green	Acid green / dark contrast
Ember	Dense warm industrial palette
Carbon	Restrained dark panel
Ultraviolet	Solid deep blue-violet panel with cold white and electric violet printing
Lavender	Pastel violet with independent lilac veins
Lime Veil	Pastel lime with bent green veins
Vanilla	Warm cream with milk-and-gold veins
Pearl Grey	Pearl grey with a dense multi-direction steel vein field



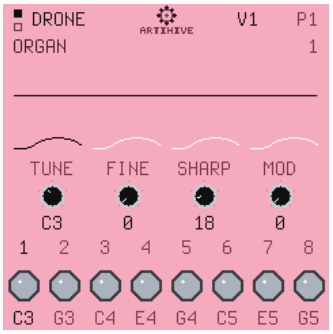
Blush-Vein



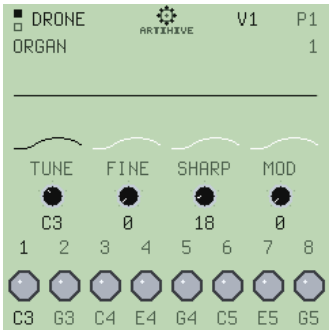
Deep-Blue



Porcelain



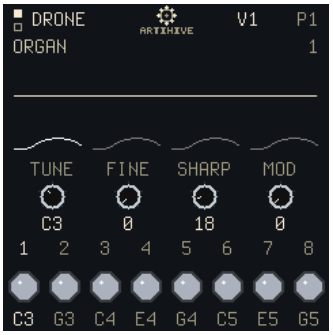
Rose



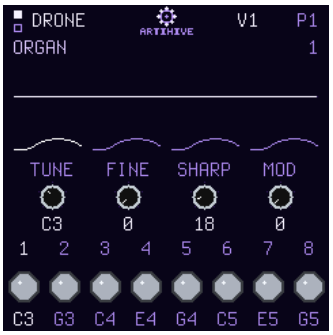
Toxic-Green



Ember



Carbon



Ultraviolet



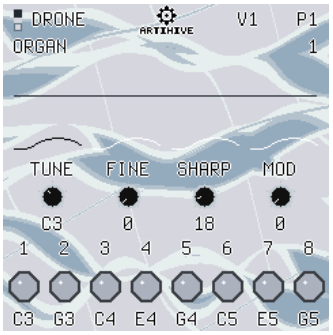
Lavender



Lime-Veil



Vanilla



Pearl-Grey

11. Troubleshooting and recovery

Symptom	First checks
No sound	Press PLAY; confirm MIX/output level; trigger or enable a drone voice
Sound only while holding a key	Raise HOLD or use the second bank of white keys as individual drone toggles
Very bright whistle at TIME=0	Lower FB, MIX and output volume; this can be expected resonator behaviour
Screen appears but controls do not react	Reconnect power and test encoders before attempting another flash
Installation interrupted	Do not repeatedly write blindly; first check whether normal USB/update mode still enumerates
Need factory firmware	Use the same known-good rollback procedure that has already worked on the tested FM-1

ARTIHIVE 2.0.4 startup on physical FM-1 hardware is confirmed. Continue to use cautious installation and rollback procedures across hardware revisions.

12. Technical notes

Item	Value
Target	JieLi AC791N / FM-1_9620
Audio	44.1 kHz, integer real-time DSP
Voices	8 oscillators in 4 pairs
Delay storage	Two packed 12-bit lines, 96,000 frames each
Delay capacity	2.1769 s per line; base TIME capped at 2.0394 s
Application size	166,496 bytes
RAM .data + .bss	21,696 bytes
Delay pool	330,240 of 344,064 bytes
Package	612,230 bytes
Firmware license	GPL-3.0-only

Build and verification

The release is built with the restored JieLi toolchain. Host DSP tests, OTA/package tests, layout audit, FM-1 compilation and SMK-37 pro/elite/mke compilations pass. The source-archive rebuild is byte-identical to the delivered .fwsc.

Automated verification reduces software risk but does not replace listening, thermal observation and long-duration testing on physical hardware.

13. Licensing, authorship and acknowledgements

ARTIHIVE was created by KHAV with the assistance of Arena.ai Agent Mode.

The firmware was made for the experiment itself: to discover the sonic, visual and computational possibilities hidden in a small inexpensive device, and to learn what kind of instrument can emerge when feedback, instability and interface design are treated as one system.

KHAV is grateful to SOMA Laboratory for its aesthetics, its fearless approach to sound, and its culture of instruments that invite exploration rather than prescribe results. LYRA-8 provided the architectural and philosophical inspiration; ARTIHIVE is not a SOMA Laboratory product and is not endorsed by SOMA.

KHAV is also grateful to Mike Moreno for making his code accessible. The ability to read open work makes independent learning and experimentation possible. Mike Moreno’s code was not copied into ARTIHIVE.

Project / person	Contribution or acknowledgement
Dinghy / zvenson	Base firmware template
Felucca / Leo Kuroshita / Hügelton Instruments	Platform layer and WebMIDI update transport
felucca-bsp	Hardware support layer, MPL-2.0
SLOOP / isod89	Carrier of the platform layer
SOMA Laboratory	Aesthetic, sound approach and LYRA-8 architectural inspiration
Mike Moreno	Thanks for openness and accessible code as learning material
Arena.ai Agent Mode	Assistance to KHAV with design, implementation, testing and documentation

No SOMA code, samples or firmware are included. LYRA-8, M-Vave and FM-1 are names of their respective owners and are mentioned only to identify inspiration and compatibility.

Appendix — Complete parameter map

Parameter	Page	Scope	Range / meaning
TUNE	DRONE	Voice	MIDI note 8–127
FINE	DRONE	Voice	0–99, fine pitch
SHARP	DRONE	Pair	0–127, triangle → square
MOD	DRONE / FM	Pair	0–127
SOURCE	FM ROUTE	Pair	OFF / FM / LFO
STRUCT	FM ROUTE	Global	2 LOOP / RING
TOT FB	FM ROUTE	Global	OFF / ON
FAST	ENVELOPE	Voice	SLOW / FAST
REL	ENVELOPE	Voice	0–127, inverted
HOLD	ENVELOPE	Pair	0–127, quadratic floor
ATK	ENVELOPE	Voice	≈2–743 ms
FREQ A/B	HYPER LFO	Global	≈0.08–21.6 Hz
MODE	HYPER LFO	Global	OR / AND
LINK	HYPER LFO	Global	0–127
WIDTH	LFO SPACE	Global	0–127
SOURCE	LFO SPACE	Global	A / B / OUT
DIR	LFO SPACE	Global	CW / CCW
MODE	LFO SPACE	Global	ALL / PAIR / ALT
TIME 1/2	MOD DEL	Global	0–127, 0.023–2039 ms quadratic
FB	MOD DEL	Global	0–127; unity near 109
MIX	MOD DEL	Global	0–127
MOD 1/2	DELAY / MOD	Global	0–127, up to ±92 ms
SOURCE	DELAY / MOD	Global	LFO / SELF
WAVE	DELAY / MOD	Global	TRI / SQR
BPM	ARPEGGIO	Global	10–400 exact integer BPM
STEPS	ARPEGGIO	Global	1–8
GATE	ARPEGGIO	Global	1–100%
ORDER	ARPEGGIO	Global	9 modes including CHROM RND
DRIVE	OUTPUT	Global	0–127
D MIX	OUTPUT	Global	0–127
DRIFT	OUTPUT	Global	0–127, up to ≈±5 cents
PRESS	OUTPUT	Global	1–127

End of manual · ARTIHIVE 2.0.4 · FM-1_9620 · GPL-3.0-only