

superOS-106

OWNER'S MANUAL

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PRECAUTIONS:

Installing this firmware means opening the instrument and changing chips. Do it at your own risk, with the power off and the mains cable unplugged. Keep the original assigner and voice EPROMs so the synth can always go back to stock. Version 1.16 needs the 8 KB F-RAM on IC3 and a wire on the module board (Introduction, section 3); do not run it without them. Back up your patches before you start.

INTRODUCTION

1 ABOUT SUPEROS-106

superOS-106 is replacement firmware for the Juno-106. It replaces the program in the two EPROMs, the assigner on the CPU board and the voice program on the module board, and adds a small block of program code kept in the patch memory. The sound engine, the 128 patches and the normal panel work as before: if you never use a new button combination, the synth behaves as it always did.

It adds a mono mode with note memory, unison and a dual-oscillator mode, chord memory, an arpeggiator with hold, per-voice velocity, a second envelope for the filter, a quarter-tone Arabic scale and four user scales, per-voice detune, vibrato, pulse-width movement and analog-style drift, all saved with each patch, a 64-step chord sequencer with three patterns, MIDI Local Off, MIDI control of every slider, an LFO that locks to MIDI clock, and sysex backup of the whole memory.

2 HOW TO USE THIS MANUAL

A. PANEL NAMES

Buttons are written as they are labelled on the panel: **POLY 1** **POLY 2** **MIDI CH** **KEY TRANSPOSE** **MANUAL** **WRITE** **BANK** (the group button, with the GROUP A and GROUP B lamps) and the tape buttons **LOAD** **SAVE** **VERIFY**. The eight bank number buttons are written **BANK NO. 1** **8** and the eight patch number buttons **PATCH NO. 1** **8**.

B. COMBINATIONS

WRITE + **SAVE** means: hold the first button, press the second, then let go of both. Combinations are taken by the firmware before the normal panel sees them, so they never write a patch by accident.

- The voice modes live on **POLY 1** and **POLY 2**.
- The sequencer and arpeggiator live on the three tape buttons, with **WRITE** and **MANUAL** as shift buttons.
- Everything else is a setting in the menu, opened with **MIDI CH**.

C. DISPLAY AND LAMPS

The two-digit display and its two decimal points show menu items, values and step numbers. Where this manual says a lamp blinks, it flashes steadily; solid means it stays on.

NOTE:

Switching any voice mode, the arpeggiator or a menu setting silences all voices first, so a change never leaves a note hanging.

INSTALLATION

superOS-106 runs in three parts: the assigner EPROM, the voice EPROM and the F-RAM code block, about 1.5 KB of program code installed over MIDI into the top of the patch memory. The assigner EPROM is full, so the newest functions run from there.

A. HARDWARE

- **8 KB F-RAM on IC3** (the IC3 F-RAM adapter), with address lines A11 and A12 connected. It replaces the battery-backed 2 KB RAM and holds the patches, the patterns, the settings and the code block with the power off. There is no check for it: on a stock 2 KB RAM the extra memory folds back onto the patches and overwrites them.
- **Module board A12 wire** from IC37 pin 2 to IC29 pin 51. The voice program uses the upper half of its EPROM; without the wire the voice board does not start.
- **Assigner board A12** must reach the EPROM socket. It does on standard boards. Units that run from the CPU's internal ROM with empty EPROM sockets cannot take this firmware without a different CPU.

B. EPROMS

Burn the assigner image into a 2764-type chip for the CPU board socket and the voice image for the module board socket. Both chips must come from the same release: the assigner sends the voice board commands the stock voice program does not know.

CHIP	NOTES
28C64 EEPROM	Recommended. Pin-compatible and reprogrammable.
27C64 windowed	UV-erasable, reusable.
27C64 plastic	One-time programmable.
27C256	Use the 32 KB images, which hold four copies of the program so the chip reads correctly in the 2764 socket.

1 Install the firmware and the F-RAM code block			
	Operation	Result	Notes
1	Back up your patches with a patch dump.		The patches survive the change to F-RAM only if you reload them.
2	Fit the F-RAM on IC3, the module board A12 wire and both EPROMs.		
3	Switch on.	The synth plays. Every setting starts at its default.	Defaults are listed in Reference, section 6.
4	Set the rear MIDI function switch to III and MEMORY PROTECT to off. Set the Juno to MIDI channel 1 unless your tool adjusts the channel.		Sysex is only received at III.
5	Send the F-RAM code file for version 1.16 into MIDI IN, from the SuperOS-106 web editor (F-RAM code, Install / update) or any sysex tool.		The web editor adjusts the MIDI channel for you. The plain file only works on channel 1.
6	Switch the Juno off and on again.	The code block is active.	On the first install, this start clears the three patterns and the per-patch records. Later updates keep them.
7	Reload your patches, then any patterns.		

The firmware is now fully installed.

The code block stays in the F-RAM with the power off. The firmware only runs it when it matches the EPROM version, so a block left over from another release is ignored. After every new EPROM burn, install the matching code block again. The web editor's Check button compares the installed block with the file.

CAUTION:

Do not send the code block's memory area back from an old memory dump: restore patches, patterns and per-patch records from the dump, and install the code from its own file. After updating from version 1.15, open the voice page and check the drift setting (Intermediate Course, section 4); it may hold a leftover value.

C. WHAT NEEDS THE CODE BLOCK

NEEDS THE F-RAM CODE BLOCK	WORKS WITHOUT IT
Unison and dual (POLY 1 + POLY 2). Note memory in mono mode. The voice page (detune, LFO depth, PWM, drift). Per-patch extras. Patterns 2 and 3, pattern queue and chains. Settings sysex, CC 22 and CC 28. Sequencer steps that leave notes held over MIDI sounding (without it, each step cuts them).	Mono, chord memory, arpeggiator, the menu. Envelope 2 edit and CC 38–42. Per-voice detune and LFO from CC 102–114. The 16 slider CCs and CC 122. Patch, pattern, scale and memory sysex. The sequencer, on pattern 1.

BASIC COURSE

1 THE SETTINGS MENU

WORKS IN Press and release **MIDI CH**

All of the firmware's settings, the MIDI channel included, are items in a menu on the display. There are 16 items; the full list is in Reference, section 1. Settings are kept with the power off.

A. OPEN, CHOOSE, CHANGE

- **Open:** press and release **MIDI CH**. The KEY TRANSPOSE lamp blinks while the menu is open.
- **Choose an item:** **BANK NO. 1**–**8** are items 1 to 8, **PATCH NO. 1**–**8** items 9 to 16. The display shows the item number with one decimal point.
- **See its value:** press **BANK**. The display shows the value with two decimal points.
- **Change it:** press a number button. The value becomes the number minus one: **BANK NO. 1** = 0 ... **BANK NO. 8** = 7, **PATCH NO. 1** = 8 ... **PATCH NO. 8** = 15. On/off items are 0 = off, 1 = on. The MIDI channel and clock divide count from 1 instead (**BANK NO. 1** = 1). Numbers above an item's range are ignored.
- **Back to the items:** press **BANK** again.
- **Leave:** press and release **MIDI CH**. The display shows the patch number again.

While the menu is open the number buttons and **BANK** belong to it and do not change the patch.

1 Set the MIDI channel to 3			
	Operation	Result	Notes
1	Press and release MIDI CH .	KEY TRANSPOSE lamp blinks.	The menu is open.
2	Press BANK NO. 1 .	Display: item 1, one dot.	Item 1 is the MIDI channel.
3	Press BANK .	Display: the current channel, two dots.	
4	Press BANK NO. 3 .	Display: 3.	The channel counts from 1.
5	Press and release MIDI CH .	The patch number returns.	The channel is kept with the power off.

The Juno now receives and sends on MIDI channel 3.

NOTE:

Holding **MIDI CH** still blocks the other buttons, as on the stock firmware. The menu opens or closes each time **MIDI CH** is released.

2 VOICE MODES

Six voice modes share the two POLY buttons. The mode you are in is saved with the patch when you write it (Intermediate Course, section 5). The synth starts in Poly 1.

MODE	HOW TO SELECT	LAMPS
Poly 1	POLY 1	POLY 1 solid
Mono	POLY 1 again while in Poly 1	POLY 1 blinks
Poly 2	POLY 2	POLY 2 solid
Chord memory	POLY 2 again while in Poly 2	POLY 2 blinks
Unison	POLY 1 + POLY 2 together	Both solid
Dual	POLY 1 + POLY 2 again while in unison	Both blink

A further press of **POLY 1** in mono returns to Poly 1, and a further press of **POLY 2** in chord memory returns to Poly 2. **POLY 1** + **POLY 2** switches between unison and dual. Over MIDI the mode is CC 22 (Reference, section 2).

A. MONO

One note at a time on voice 1, like a mono synth. Overlapping keys change the pitch without starting the note from silence: the voice keeps sounding and its envelope climbs back to the peak from where it is. Release the newer key and the pitch returns to the highest key still held, from the keyboard or MIDI. Returning to a held key needs the F-RAM code block; without it, releasing the sounding key ends the note.

B. UNISON

All six voices play the same note, with the same note memory as mono. Menu item 10 (unison detune, 0–15) spreads the voices apart: voice 1 stays in tune, voices 2 and 3 go one step up and down, voices 4 and 5 two steps, voice 6 three steps up. The spread applies in every mode, so it also thickens poly chords. Needs the F-RAM code block.

C. DUAL

Three notes, each played by a pair of voices: the first note on voices 1 and 2, the second on 3 and 4, the third on 5 and 6. A fourth note held at the same time is not played. Each note now has two oscillators, so the voice page (Intermediate Course, section 4) can detune, vibrate or pulse-width-modulate the second voice of each pair

against the first. Set unison detune to 0 for a clean pair and use the voice page instead. Needs the F-RAM code block.

In unison and dual, a single POLY button acts when you let go of it: **POLY 1** goes to Poly 1, **POLY 2** to Poly 2. This lets you press the pair a moment apart without leaving the mode.

3

CHORD MEMORY

WORKS IN

POLY 2 twice (POLY 2 lamp blinks)

Chord memory stores a chord shape and plays the whole shape from any single key. Up to six notes are stored; the lowest is the root. Until a chord is stored, keys play single notes.

1 Store a chord and play it			
	Operation	Result	Notes
1	Press POLY 2 , then POLY 2 again.	POLY 2 lamp blinks.	Chord memory is on.
2	Hold WRITE .	Display: -c. LOAD lamp blinks.	The synth is listening.
3	Play the chord, in any order, and let go of the keys.		The chord with the most keys held at once is stored. Let go of all keys and play again to replace it.
4	Release WRITE .	The patch number returns.	
5	Play single keys.	Each key plays the chord, transposed.	MIDI notes play it too.

The chord is kept with the power off until you store another.

Chord memory plays one chord at a time: a new key cuts the previous chord, release tails included, so chords never pile up. Chord notes that would land above the top of the range are left out. Writing a patch in chord memory stores the chord with it, so selecting that patch later brings its chord back.

Leave with **POLY 2** (to Poly 2) or **POLY 1**. Over MIDI, CC 22 value 3 selects chord memory; the chord itself can only be stored from the panel.

4 ARPEGGIATOR

WORKS IN

WRITE

+

SAVE

The arpeggiator plays the keys you hold, one after another, in a loop. Add or remove keys and the pattern follows. Each press of **WRITE** + **SAVE** steps on:

PRESS	STATE	VERIFY LAMP
1st	Arpeggiator on	Solid
2nd	Arpeggiator on with hold	Blinks
3rd	Off	Off

The SAVE lamp blinks the arpeggiator's clock the whole time it is on, keys held or not, so you can set the speed before you play. The arpeggiator is off at power-on and has no MIDI control.

A. SPEED AND CLOCK

With the internal clock the **LFO RATE** slider sets the speed, from about 2 to 32 steps per second (right = fast). The LFO still follows the slider as usual. Because the speed is the patch's LFO rate, a patch change or CC 76 changes it as well. The arpeggiator shares the clock source with the sequencer, menu item 2 (Advanced Course, section 5): on MIDI clock it always plays sixteenth notes; on a TAPE IN pulse or a trigger note it moves one step per pulse or note.

B. ORDER, RANGE AND FIRST NOTE

- **Order**, menu item 12: 0 up, 1 down, 2 up and down (without repeating the top and bottom note), 3 as played (the order you pressed the keys).
- **Range**, menu item 13: 0, 1, 2 = one, two or three octaves. The held keys play, then the same keys an octave up, and so on. Notes above the top of the range drop an octave.
- **First note**, menu item 14: 0–3. A chord played after all keys were up starts this many notes into the order.

A chord played after all keys were up always starts the pattern again. Up to 16 keys are followed; keys pressed beyond that are not played.

C. HOLD

With hold on, the arpeggio keeps playing after you let go. Play the next chord and it replaces the held one; keys added while others are still down join the chord.

D. WHICH VOICES PLAY

- Poly modes: each step takes a fresh voice, so release tails overlap.
- Mono and unison: every step plays on the mono voice and starts again.
- Chord memory: each step plays the stored chord.

The arpeggiator plays the keys of the Juno keyboard only. Notes received over MIDI are not arpeggiated, and the arpeggio's notes are not sent to MIDI OUT. It still sounds with Local Off.

5**LOCAL OFF****WORKS IN**

Menu item 9 · CC 122

Local Off disconnects the keyboard from the internal voices while its notes still go out over MIDI. Use the Juno keyboard to play another instrument, or play the Juno from a computer that echoes its keys back.

- Menu item 9: 0 = local on (normal), 1 = Local Off.
- CC 122: 0–63 = Local Off, 64–127 = local on.
- Notes received at MIDI IN play the voices normally. Bender, modulation and the hold pedal still act on the voices.
- The setting is kept with the power off.

INTERMEDIATE COURSE

1 VELOCITY

WORKS IN Menu items 4, 5 and 6

Each voice's envelope reaches its amplifier and its filter separately. superOS-106 scales these per voice by the note's velocity, so every sounding note keeps its own level and brightness.

- **Routing**, menu item 4: 0 off, 1 amp, 2 filter, 3 both.
- **Depth**, menu item 5: 0–15. At 0 velocity has no effect; at 15 a velocity of 1 is nearly silent (or nearly closes the filter envelope). A velocity of 127 always gives the full panel setting: velocity only takes away.
- **Keyboard velocity**, menu item 6: 0 (softest) to 15 (full, the default). The Juno keyboard has no velocity sensing, so its keys play at this fixed level.

NOTE:

Notes of a MIDI chord that arrive in the same instant share one velocity. A note whose key is held down on the Juno keyboard uses the keyboard velocity; other sequencer and arpeggiator notes use the last MIDI velocity received (full if none). In the VCA GATE position the amp path is not scaled; the filter path still is.

2 ENVELOPE 2 (FILTER)

WORKS IN Menu item 7 · **WRITE** + **VERIFY** · CC 38–42

A second ADSR envelope for every voice, for the filter only. When it is on, the filter follows envelope 2 and the amplifier keeps the panel envelope, so a slow pad with a snappy filter, or the reverse, fits in one patch. The VCF ENV slider, the envelope polarity switch and velocity to filter act on envelope 2.

A. ON AND OFF

Menu item 7: 0 off, 1 on. CC 42: 0 off, any other value on.

B. SETTING ITS SHAPE

1 Shape envelope 2 with the ENV sliders			
	Operation	Result	Notes
1	Set menu item 7 to 1.		Envelope 2 is on.
2	Hold WRITE and press VERIFY .	VERIFY lamp lights.	Envelope 2 edit. With the arpeggiator on, the lamp shows the arpeggiator instead.
3	Move the ENV A D S R sliders.	The filter envelope changes.	The patch's own envelope is left alone.
4	Hold WRITE and press VERIFY again.	VERIFY lamp goes out.	With the code block this opens the voice page; press the pair once more to leave it.

Write the patch to keep envelope 2 with it.

Over MIDI: CC 38 attack, CC 39 decay, CC 40 sustain, CC 41 release (0–127, in slider units). Envelope 2 is a global setting kept with the power off, and with the code block it is also saved with each patch. It follows the same gate, retrigger and hold pedal behaviour as the panel envelope.

3 ARABIC AND USER SCALES

WORKS IN Menu item 8

Menu item 8 retunes the whole instrument: 0 = equal temperament, 1 = Arabic, 2–5 = user scales 1–4. The tuning is applied exactly in the voice board's pitch calculation, and it retunes notes that are already sounding.

A. ARABIC

A maqam Rast tuning on C: E and B are lowered by a quarter tone (50 cents).

B. USER SCALES

Four scales of your own, loaded from the web editor or any sysex tool and kept with the power off. A scale is twelve values, one per note from C to B. 64 leaves the note unchanged; each step is 1/128 of a semitone (about 0.8 cent), so 0 lowers the note a quarter tone and 127 raises it by almost a quarter tone. That covers every maqam and any tuning whose offsets stay within ± 50 cents. The message is in Reference, section 3. Scales cannot be sent back on their own; they are part of the whole-memory dump.

4

THE VOICE PAGE

WORKS IN

WRITE

+

VERIFY

twice · needs the F-RAM code block

The voice page sets things the Juno panel has only one control for, separately for each of the six voices. Everything on it is saved with the patch on WRITE, so it is the patch's tuning page.

BUTTON	PARAMETER	RANGE	DISPLAY
PATCH NO. 1	Detune, per voice: a fixed pitch offset up to half a semitone either way, in 1/128 semitone steps.	centre ±64	1, voice
PATCH NO. 2	LFO depth, per voice: vibrato around the detuned pitch. Below the centre it moves the other way. Near the ends, with a full LFO, about one semitone.	centre ±64	2, voice
PATCH NO. 3	Detune LFO speed, all voices: 0 = the panel LFO with its rate and delay, above 0 = an LFO of its own at that speed, without delay.	0–63	3
PATCH NO. 4	PWM level, per voice: the detune LFO swings that voice's pulse width around the panel setting. At 7 about 37% to 59%.	0–7	4, voice
PATCH NO. 5	Drift, all voices (below).	0–15	5
PATCH NO. 6	Unison detune, the same setting as menu item 10.	0–15	6

1 Detune voice 2 against voice 1			
	Operation	Result	Notes
1	Hold WRITE and press VERIFY .	VERIFY lamp lights.	Envelope 2 edit.
2	Still holding WRITE , press VERIFY again.	Display: 1 1 with both decimal points.	The voice page: detune, voice 1.
3	Press BANK NO. 2 .	Display: 1 2.	BANK NO. 1 6 pick the voice.
4	Press PATCH NO. 1 .		PATCH NO. 1 6 pick the parameter. Nothing changes until the slider moves.
5	Move the LFO RATE slider a little above the centre.	The display shows the distance from the centre.	The right decimal point lights below the centre. About 12 is a gentle chorus.
6	Hold WRITE and press VERIFY once more.	The patch number returns.	Leaves the page.
7	Write the patch (WRITE + a patch number button).		The voice page settings are saved with it.

Voice 2 now plays slightly sharp of voice 1 in this patch.

On the voice page the bank and patch number buttons never change the patch, and every slider except **LFO RATE** plays as usual. After you leave, move **LFO RATE** to take it back for the patch. The page is closed at power-on.

A. DRIFT

Drift lets each voice's pitch wander slowly and at random around its note, as the oscillators of an older analog synth do, so held chords beat gently and no two voices stay exactly in tune. Each voice takes a small step every few seconds and stays within a narrow band. 0 is off; at 4 a voice wanders about ± 3 cents, at 15 up to about 12 cents flat or 10 cents sharp. It works in every voice mode.

B. OVER MIDI

CC 102–107 set the detune of voices 1–6, CC 108–113 their LFO depth, CC 114 the detune LFO speed (64 = centre for detune and depth). These work without the code block. PWM levels and drift have no CC; set them with the settings message (Reference, section 3).

5

PER-PATCH EXTRAS**WORKS IN**

Saved on WRITE, recalled on patch change · needs the F-RAM code block

A stock patch has no room for the new sound settings, so each of the 128 patches has an extras record beside it. Writing a patch (**WRITE** + a patch number button, MEMORY PROTECT off) saves:

- the voice mode, and in chord memory the chord itself;
- the unison detune;
- envelope 2: on/off, attack, decay, sustain, release;
- the voice page: six detunes, six LFO depths, the detune LFO speed, six PWM levels and drift.

Selecting the patch, from the panel or by MIDI program change, brings all of it back. A unison bass comes back in unison, a chord patch with its chord. If the voice mode already matches, sounding notes are not cut. A patch that was never written with the code block leaves the current settings as they are. Up to 31 different chords are kept; patches with the same chord share one.

NOTE:

A patch loaded by sysex does not bring its extras with it. To copy extras, use the web editor's Patch extras panel or the memory blocks for the records (Reference, section 3).

ADVANCED COURSE

1 THE STEP SEQUENCER

A 64-step sequencer in which every step holds up to six notes (any chord you can play), a tie or a rest. There are three patterns, kept in the F-RAM with the power off and separate from the 128 patches. While a pattern plays you can play along on the keyboard.

A. TRANSPORT

BUTTONS	ACTION	LAMP
SAVE	Play (always from step 1) / stop	SAVE blinks the clock
LOAD	Record (section 2)	LOAD blinks
WRITE + LOAD	Step edit (section 3)	LOAD solid
VERIFY + PATCH NO. 1 3	Pattern select and chains (section 4)	

Stopping silences the sequencer's notes at once. The sequencer is stopped at power-on. There is no CC or sysex for play and stop; with the MIDI clock source, MIDI Start and Stop run it (section 5).

B. STEPS, TIES AND RESTS

A step stores its notes exactly as played. A tie holds the previous step's notes on through this step; a rest is silent. A pattern ends where recording stopped and loops from step 1, so it can be 4 steps or 64. An empty pattern plays silence.

NOTE:

The stock tape load, save and verify functions are not in this firmware; sysex dump and load replace them (Reference, section 3). The rear TAPE IN jack works as a clock input.

2 RECORDING A PATTERN

WORKS IN

LOAD

Recording is step by step: each key or chord you play and release becomes the next step. Keys sound while you record. Recording writes into the selected pattern.

1 Record C, a C minor chord, a tie and a rest

	Operation	Result	Notes
1	Press LOAD .	LOAD lamp blinks. Display: 01.	The sequencer stops. The display shows the step being entered.
2	Play C and release it.	Display: 02.	A step is written when the last key comes up.
3	Play C, E $\flat$ and G together and release them.	Display: 03.	Keys pressed while the first is still down join the chord. Up to six.
4	Press SAVE .	Display: 04.	A tie: the chord holds on through step 3.
5	Press VERIFY .	Display: 05.	A rest.
6	Press LOAD .	The patch number returns.	The pattern ends here: it is 4 steps long.
7	Press SAVE .	The pattern plays and loops.	Press SAVE again to stop.

One 4-step pattern is now recorded.

To clear a pattern, press **LOAD** and then **LOAD** again straight away. After 64 steps recording accepts no more; press **LOAD** to leave.

3 STEP EDIT AND LIVE RECORD

WORKS IN **WRITE** + **LOAD**

Step edit lets you pick any step, hear it and change it, with the sequencer playing or stopped. It edits the selected pattern; while a chain runs, that is the pattern playing.

A. MOVING AROUND

- Hold **WRITE** and press **LOAD**. The LOAD lamp lights and the display shows the step number.
- Pick a step by number: **BANK NO. 1** **8** are steps 1–8 and **PATCH NO. 1** **8** steps 9–16 of the current page.
- **BANK** turns the page, shown on the group lamps: A solid = steps 1–16, B solid = 17–32, A blinking = 33–48, B blinking = 49–64. A step past the end of the pattern shows -- briefly and is not selected.
- **VERIFY** = next step, **SAVE** = previous step, wrapping around.
- The display shows one decimal point for a tie and two for a rest.

With the sequencer running you hear the pattern as usual. With it stopped, the step you land on sounds each time (audition).

B. CHANGING A STEP

OPERATION	RESULT
Play a key or chord and release	Rewrites the step. The position does not move.
WRITE + SAVE	Turns the step into a tie
WRITE + VERIFY	Turns the step into a rest
MANUAL + VERIFY	Inserts an empty step here; later steps move up. Up to 63 steps.
MANUAL + SAVE	Deletes this step; later steps move down
LOAD	Leaves step edit; the sequencer carries on if it was playing

C. LIVE RECORD

In step edit, press **WRITE** + **LOAD** once more. The LOAD lamp blinks and the two decimal points chase each other. Now every key or chord you play is written into the step that is playing at that moment, so you can play a part in over the running loop. The step edit buttons keep working. Leave with **WRITE** + **LOAD** or **LOAD**.

NOTE:

Record stops the sequencer; step edit does not. Inside record and step edit, **SAVE** and **VERIFY** are edit buttons, so playback cannot be started from the panel there; leave first.

4 PATTERNS, QUEUE AND CHAINS

WORKS IN Hold **VERIFY** + **PATCH NO. 1** - **3** · needs the F-RAM code block

A. SELECT A PATTERN

Hold **VERIFY**, press **PATCH NO. 1**, **2** or **3**, and release **VERIFY**. While **VERIFY** is held the display shows the playing pattern on the left and the last number pressed on the right. When the sequencer is stopped the choice is immediate. While it runs, the new pattern is queued and starts when the playing one reaches its end, so the change always lands on the downbeat.

B. CHAIN

Press several numbers before releasing **VERIFY**: 1, 1, 2, 3 plays pattern 1 twice, then 2, then 3, and loops. Up to 8 entries. A new chain takes over at the end of the playing pattern; play and MIDI Start begin a chain from its first entry. Selecting a single number ends a chain.

Pattern select does not work during record, step edit, the voice page, the menu, or while **WRITE** is held. It is panel only: program change, CC and sysex do not select patterns. The selected pattern and chain are kept with the power off. Without the code block the sequencer uses pattern 1 only.

5 CLOCK SOURCES

WORKS IN Menu item 2 · CC 28

The sequencer and the arpeggiator share one clock source, kept with the power off.

VALUE	SOURCE	BEHAVIOUR
0	Internal	The LFO RATE slider sets the tempo, about 2 to 32 steps per second.
1	TAPE IN	Each rising pulse at the rear TAPE IN jack is one step. Feed it clean positive pulses, such as a drum machine's trigger out, not audio.
2	MIDI clock	Steps on MIDI clock; Start and Stop run the sequencer.
3	MIDI note	Each note-on of the trigger note is one step.
4	AUT	Internal until MIDI clock, Start or Continue arrives, then MIDI clock until the source is set again or the power is switched off.

A. MIDI CLOCK

- MIDI Start runs the sequencer from step 1; the first clock after Start plays step 1. No button press is needed.
- MIDI Stop stops it, rewinds to step 1 and silences its notes and any MIDI-held notes.
- MIDI Continue runs it on from where it stopped.
- Clock without a Start does not start the sequencer. **SAVE** still starts and stops it by hand; it then steps while the host is running.
- Menu item 3 sets the clocks per step, 1–16: 6 = sixteenths (default), 12 = eighths, 3 = thirty-seconds, 4 or 8 for triplets. The arpeggiator always plays sixteenths.

B. MIDI TRIGGER NOTE

With source 3, start the sequencer with **SAVE**. Each note-on of the trigger note on the Juno's MIDI channel then moves the sequencer and the arpeggiator one step, like a pulse at TAPE IN. Menu item 15 chooses the note: MIDI note 0 to 15 (default 0). The trigger note is never played; every other note plays normally. A drum machine or computer track that sends that note as a rhythm makes the sequence follow any groove, swing included. MIDI clock and transport are ignored by the sequencer in this mode.

6 LFO SYNC TO MIDI CLOCK

WORKS IN Menu item 16

The Juno-106's LFO is digital, and superOS-106 can lock it to MIDI clock, so vibrato, PWM sweeps and filter wobbles land on the beat at any tempo.

ITEM 16	ONE LFO CYCLE	MIDI CLOCKS
0	Off (LFO RATE slider)	
1	Sixteenth note	6
2	Eighth note	12
3	One beat	24
4	Two beats	48
5	One bar	96

The firmware measures the incoming clock every beat, sets the LFO rate to match and lines up the phase at each cycle and on MIDI Start and Continue. Tempo changes are followed within a beat. Sync follows MIDI clock whatever the clock source, and works down to about 30 BPM. Setting it to 0 returns the LFO to the slider at once.

NOTE:

The Juno has one LFO, so sync applies to everything it modulates. While sync is on, the **LFO RATE** slider and patch changes are overridden within a beat.

REFERENCE

1

MENU ITEMS

ITEM	BUTTON	SETTING	VALUES	DEFAULT
1	BANK NO. 1	MIDI channel	1–16	1
2	BANK NO. 2	Clock source	0 internal · 1 TAPE IN · 2 MIDI clock · 3 MIDI note · 4 AUT	0
3	BANK NO. 3	MIDI clocks per sequencer step	1–16	6
4	BANK NO. 4	Velocity routing	0 off · 1 amp · 2 filter · 3 both	0
5	BANK NO. 5	Velocity depth	0–15	0
6	BANK NO. 6	Keyboard velocity	0–15	15
7	BANK NO. 7	Envelope 2	0 off · 1 on	0
8	BANK NO. 8	Scale	0 equal · 1 Arabic · 2–5 user 1–4	0
9	PATCH NO. 1	Local control	0 on · 1 off	0
10	PATCH NO. 2	Unison detune	0–15	0
11	PATCH NO. 3	Send sysex dump	1 all 128 patches · 2 the three patterns · 3 identity reply	0
12	PATCH NO. 4	Arpeggiator order	0 up · 1 down · 2 up and down · 3 as played	0
13	PATCH NO. 5	Arpeggiator range	0–2 = one to three octaves	0
14	PATCH NO. 6	Arpeggiator first note	0–3	0
15	PATCH NO. 7	Trigger note (clock source 3)	MIDI note 0–15	0
16	PATCH NO. 8	LFO sync	0 off · 1 sixteenth · 2 eighth · 3 beat · 4 two beats · 5 bar	0

Item 11 sends the dump once and reads 0 again. Changing the MIDI channel also sends Omni Off and Poly On on the new channel. After power-on the Juno receives on the saved channel.

2 MIDI CONTROLLERS

A. SLIDER PARAMETERS

All 16 sliders can be played from MIDI controllers. A controller acts exactly like moving the slider: the change is immediate, sounding notes included, and the display's decimal point shows the patch is edited. Values use the full 0–127 range.

CC	PARAMETER	CC	PARAMETER
76	LFO rate	74	VCF cutoff
78	LFO delay	71	VCF resonance
77	DCO LFO depth	16	VCF envelope amount
12	DCO PWM	17	VCF LFO amount
14	Sub oscillator level	18	VCF key follow
13	Noise level	7	VCA level
73	ENV attack	79	ENV sustain
75	ENV decay	72	ENV release

A slider you move owns its parameter: controllers for that one parameter are ignored while it moves and for half a second after it stops, so automation and a hand on the panel never fight. A controller value holds until you move the slider, change the patch or send a new value.

B. OTHER CONTROLLERS

CC	FUNCTION	VALUES
1, 64	Modulation, hold pedal	As stock
22	Voice mode*	0 Poly 1 · 1 Poly 2 · 2 mono · 3 chord memory · 4 unison · 5 dual
28	Clock source*	0–4, as menu item 2
38–41	Envelope 2 attack, decay, sustain, release	0–127
42	Envelope 2 on/off	0 off, other values on
102–107	Voice 1–6 detune	64 = none
108–113	Voice 1–6 LFO depth	64 = none, below 64 inverted
114	Detune LFO speed	0 = panel LFO, 1–127 own LFO
122	Local control	0–63 off, 64–127 on
123–127	Channel mode messages	As stock

* Needs the F-RAM code block; values out of range are ignored. All other controllers act at once and work without it. Controllers are received in every position of the rear MIDI function switch. The panel switches (range, waveforms, chorus and so on) have no controller; set them with the stock parameter sysex, as on an unmodified Juno-106.

3 SYSTEM EXCLUSIVE

All 128 patches, the three patterns, the user scales and the whole 8 KB memory can be sent to and loaded from a computer. The rear MIDI function switch must be at position III. Every superOS-106 message carries the MIDI channel in its fourth byte (ch = channel minus one); the Juno ignores messages for another channel. Every data byte travels as two 4-bit nibbles, high nibble first.

A. DUMP AND LOAD

- **Dump:** menu item 11 (1 patches, 2 patterns, 3 identity), or a dump request message. The panel pauses while a dump is sent.
- **Load:** play a dump back into MIDI IN. Each message is written into memory as it arrives.
- Patch, pattern, scale and memory loads are refused while MEMORY PROTECT is on. Switch it off before sending any superOS-106 sysex.

B. MESSAGE FORMATS

TYPE	MESSAGE
00 Patch	<code>F0 41 3D ch 00 nn [32 nibbles] F7</code> . nn = patch 0–127 (A-1-1 = 0, B-8-8 = 127), 16 patch bytes.
01 Pattern	<code>F0 41 3D ch 01 qq [256 nibbles] F7</code> . qq = part 0–11: pattern = qq / 4 + 1, quarter = qq mod 4 (steps 1–16, 17–32, 33–48, 49–64). 16 steps of 8 bytes: six notes (key 0–63, FF = empty), flags (bit 0 tie, bit 1 rest, bit 7 end), one reserved byte (send back what the dump gave).
02 User scale	<code>F0 41 3D ch 02 ss [24 nibbles] F7</code> . ss = scale 0–3, twelve values C to B, 64 = unchanged. Load only.
03 Memory block	<code>F0 41 3D ch 03 bb [256 nibbles] F7</code> . 128 bytes of memory block bb (table below). Blocks 18–63 can be loaded.
05 Setting	<code>F0 41 3D ch 05 ii vv F7</code> . Needs the F-RAM code block. ii 0–15 = menu items 1–16, vv = the value as the menu shows it, but counting from 0 for the MIDI channel and clock divide. ii 16–19 = envelope 2 A, D, S, R (0–127). ii 20 = voice mode (as CC 22). ii 21–26 = PWM level of voices 1–6, vv = level × 16. ii 27 = drift 0–15.
7E Request	<code>F0 41 3D ch 7E rr F7</code> . rr 01 = all patches, 02 = the three patterns, 03 = identity, 04 = the whole memory as 64 memory blocks (about 6 seconds).
7F Identity	<code>F0 41 3D ch 7F 00 F7</code> . Reply: <code>F0 41 3D ch 7F 00 01 10 F7</code> (version 1.16).

Setting messages and CC 22 and 28 wait in a queue (up to seven) and are applied one at a time. The stock patch and parameter sysex messages work as on an unmodified Juno-106; a patch loaded by any sysex does not change its per-patch extras.

C. MEMORY BLOCKS

BLOCKS	CONTENTS
0–15	The 128 patches (read only as blocks; load them as patches)
16–17	Settings, user scales, chord memory and working state (read only)
18–19	Voice page settings and the chord table
20–31	Patterns 1–3
32–51	Per-patch extras records
52–63	F-RAM code block

To restore from a whole-memory dump, send blocks 18–51 and the patches, and install the code block from its own file. A loaded block 18 is sent to the voice board at once.

4 MIDI IMPLEMENTATION

MESSAGE	BEHAVIOUR
Note on / off	Received and sent on the Juno's MIDI channel. Mono, chord memory, unison and dual apply to received notes.
Velocity	Scales each voice's amp and filter envelope when velocity routing is on.
Controllers	Section 2.
Program change	0–127 selects A-1-1 to B-8-8 (rear switch II or III) and recalls the patch's extras. It does not select patterns.
Pitch bend	As stock.
Clock, Start, Continue, Stop	LFO sync; with the MIDI clock source (or AUT), they run and step the sequencer and arpeggiator.
Trigger note	With the MIDI note source, steps the sequencer and arpeggiator; never played.
Sysex	Stock patch and parameter messages, and the superOS-106 messages (section 3). Rear switch at III.

5 QUICK REFERENCE

BUTTONS	ACTION
VOICE MODES	
POLY 1 in Poly 1	Mono on / off (POLY 1 blinks)
POLY 2 in Poly 2	Chord memory on / off (POLY 2 blinks)
Hold WRITE in chord memory	Play a chord to store it (display -c, LOAD blinks)
POLY 1 + POLY 2	Unison (both solid); again: dual (both blink)
ARPEGGIATOR AND EDITING	
WRITE + SAVE	Arpeggiator on, on with hold, off (VERIFY solid, blinking)
WRITE + VERIFY	Envelope 2 edit; again: voice page; again: off
Voice page	BANK NO. 1–6 voice, PATCH NO. 1–6 parameter, LFO RATE sets the value
WRITE + patch number	Write the patch and its extras
SEQUENCER	
SAVE	Play from step 1 / stop
LOAD	Record: keys = step, SAVE tie, VERIFY rest, LOAD store and leave
WRITE + LOAD	Step edit: number buttons pick a step, BANK turns the page, VERIFY next, SAVE previous, keys rewrite, WRITE + SAVE tie, WRITE + VERIFY rest, MANUAL + VERIFY insert, MANUAL + SAVE delete, LOAD leave
WRITE + LOAD in step edit	Live record
Hold VERIFY + PATCH NO. 1 – 3	Select a pattern; several numbers make a chain
MENU	
Press and release MIDI CH	Open / close the menu (KEY TRANSPOSE blinks)
Number buttons	Item 1–16 (one dot); after BANK: value = number minus one (two dots)
BANK	Switch between item and value

6 LIMITATIONS

- Settings kept with the power off start at their defaults only on the very first start after installation: MIDI channel 1, internal clock, 6 clocks per step, velocity off with keyboard velocity full, envelope 2 off, equal temperament, local on, unison detune 0, arpeggiator up / one octave / first note 0, trigger note 0, LFO sync off, voice page centred with PWM and drift 0.
- Not kept with the power off: the arpeggiator, key transpose, the sequencer's run state and a queued pattern. The voice mode returns with a patch only when that patch is selected; the synth starts in Poly 1, so the first press of **POLY 1** after switching on goes to mono.
- MEMORY PROTECT covers the whole memory, including what the firmware itself works with. Keep it off while sending superOS-106 sysex.
- Chord memory's cut of the previous chord also shortens any note released within about 25 ms of it.
- While the arpeggiator is on, the VERIFY lamp shows the arpeggiator, not envelope 2 edit.
- Inserting and deleting steps takes a moment; the panel pauses meanwhile.
- A MIDI Start received during record or step edit starts the sequencer without leaving the edit display.
- Closing the menu turns the KEY TRANSPOSE lamp off even if transpose is active; the next transpose shows it again.
- The keyboard is not velocity sensitive; velocity comes from MIDI.
- The tape functions and the factory test mode (KEY TRANSPOSE held at power-on) are removed.
- The voice board has no clock of its own and the new features make its work longer. It measures its own timing and keeps envelope and LFO speeds matched to the stock firmware; the very shortest times and fastest LFO settings are drawn with fewer steps.

7 RETURNING TO STOCK

Fit the original assigner and voice EPROMs again, and the stock 2 KB RAM with its battery if you remove the F-RAM. All 128 patches are ordinary patches and stay valid on the stock firmware; the patterns, extras and code block above them are simply unused.

8 SPECIFICATIONS

■ VOICE MODES

Poly 1, Poly 2, mono with note memory, chord memory (up to six notes), unison with detune, dual (three notes on voice pairs).

■ ARPEGGIATOR

Up, down, up and down, as played; one to three octaves; first-note offset; hold. Clock from the LFO RATE slider, TAPE IN, MIDI clock or a trigger note.

■ SOUND

Per-voice velocity to amp and filter; envelope 2 for the filter; Arabic scale and four user scales; per-voice detune, LFO depth and PWM with their own LFO; drift. All saved per patch.

■ SEQUENCER

Three patterns of up to 64 steps, up to six notes a step, ties and rests; step record, step edit with audition, insert and delete, live record; pattern queue and chains of up to 8. Clock: internal, TAPE IN, MIDI clock (1–16 clocks per step) with Start / Stop / Continue, trigger note, or automatic.

■ MIDI

CC control of all 16 sliders, envelope 2, per-voice detune and LFO, voice mode, clock source and local control; LFO sync to MIDI clock; sysex dump and load of patches, patterns, scales and the whole memory; identity reply.

■ MEMORY

8 KB F-RAM: 128 patches, three patterns, per-patch extras, settings and the F-RAM code block, kept without a battery.

■ HARDWARE

Assigner and voice EPROMs (2764 type), 8 KB F-RAM on IC3, module board A12 wire.

superOS-106 Firmware Owner's Manual, version 1.16.